JVC

# New PTZ Cameras Empower Video Communications

## – A JVC White Paper –


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# Introduction

## New PTZ Cameras Empower Video Communications

A new generation of compact professional PTZ camera is enabling powerful video applications in broadcast, education, sports, house of worship, science, government, and teleproduction.

Innovative features such as IP Control, Live Streaming, production quality video, and in-camera recording with support for FTP make it easier to capture, transmit, process and view high-resolution video in a wide range of environments. These features expand the reach of video communications while simultaneously reducing the cost and difficulty of achieving great results.

Whether you need to capture a lecture, record a congressional hearing, coach a football team, stream a worship service, or automate newsroom production, these camera systems can almost certainly improve your results, and make your job easier, more productive, and less stressful.

This white paper describes how the new capabilities expand the reach of video communications while simultaneously reducing the cost and difficulty of achieving great results. It also provides tips and tools for selecting and deploying the best camera system for your application.

# A New Generation of PTZs

## What makes this new class of cameras different from previous models is the combination of professional performance features with much lower cost and smaller size.

In the not too distant past, PTZ cameras suitable for professional production and IMAG (image magnification) use were large, heavy, difficult to install, and cost more than $20,000 each. Despite these disadvantages, tens of thousands of PTZ cameras were deployed in TV stations, churches, ballparks, concert venues, and legislative chambers around the country.

On the lower end, small, low cost CCTV-derived PTZ cameras were available for $2,000 to $4,000, but lacked production quality video, smooth/precise control, and many other features required for professional use. Due to growing needs and limited budgets, many of these cameras still found use in videoconferencing, distance learning, and even remote production—despite the many problems their use engendered. Video/AV professionals are a resourceful bunch, and found ways to make do with the available tools.

Rapidly developing sensor, digital signal processing, electromechanical, and other technologies—combined with the enthusiastic response from the market that greeted each incremental improvement with increased sales—have brought forth a new generation of PTZ cameras with true production quality performance, for less than $4,000 each. Many of these compact PTZs also incorporate features barely dreamed of in the hay day of "heavy iron" PTZs. These features include IP control, Web-based live preview, integrated live streaming, and internal recording with remote FTP capability.

# Choosing a PTZ Camera

There are several pan/tilt/zoom cameras now available that produce good video at a much lower cost than just few years ago. How can you choose the most appropriate camera for your application?

***The answer is twofold:***

**1. You need to decide what is "adequate" performance for your application.**

For example, what may be considered good low-light performance in a TV studio may not be adequate for use in a smaller house of worship.

**2. You need to determine which camera fits best into your entire system.**

The key word here is "system" because, in even the simplest installation, a PTZ camera is just one part of a synergetic system, and is worthless if it can't operate in harmony with the required controller, transmission, decoding, and other sub-systems.

Fortunately, it's not that difficult to step through a logical camera selection process. We'll look at both the conventional and advanced features incorporated into newer PTZ cameras, help you determine the importance of each to your application, and provide some tips on evaluating the relative quality and usefulness of these features as implemented in different camera systems.

Hopefully, this process will provide you with additional knowledge that will help you choose the most appropriate camera for your system, application, and budget.

# Key Features & Advantages

Here are some of the key features available in the latest generation of compact PTZ cameras designed for professional use:

- Production-quality video and audio
- Smooth pan/tilt/zoom operation suitable for "On-Air" use
- IP Control and Web-based live preview
- Live Streaming over IP networks
- Internal Recording and Remote FTP Delivery
- Wide-range, high-quality zoom lenses
- Power over Ethernet for Single Cable Solutions
- Low Power Consumption and light weight

Each of these features, in different combinations, provide unique benefits for different applications. For example, precise IP control, smooth pan/tilt/zoom operation, long, sharp zoom lenses, low power consumption, and standards-based video streaming make some of these systems ideal for remote TV production of sports, news, and special events.

For use in education, good low-light performance, wide-angle lens coverage, internal recording with simple record and forward FTP capabilities, and ease of operation make it simpler and more cost-effective to deploy high-quality lecture capture across an entire campus.

For houses of worship, ease of operation by volunteer staff, good video in high contrast environments, low noise and crisp video reproduction for IMAG, and simple installation may be most important.

To better understand these new features and how they can help enhance your application, it may be helpful to take a closer look at each one, and at some simple ways you can evaluate a PTZs performance.

# Production-quality Video & Audio

## While video quality can be objectively measured in a lab, deciding what represents good video for a particular application is a complex, subjective process.

Although a specified signal-to-noise ratio (e.g., > 45dB) horizontal resolution (e.g., > 600 lines) might seem to indicate a compact PTZ camera of good quality, there are many other factors that strongly influence the actual video quality you can expect in your real-world application.

Even though there are no universally accepted standards for measuring the video performance of compact PTZ cameras, signal-to-noise ratio is typically measured at a very high illumination level (e.g., 2000 lux), and cameras with similar S/N ratio specs may react very differently to the lower light levels (e.g., <100 lux) sometimes found in non-studio environments. The video processing DSP firmware and software in these cameras is very smart, but it is also non-linear. This means that cameras with similar specs and sensors may perform very differently in your specific shooting conditions. Low light, high or low contrast, saturated colors, lighting with mixed color temperatures—all of these are handled differently by different cameras. For example, some cameras drastically reduce color saturation at low light levels, perhaps to mask increased chroma noise as the cameras increase gain to compensate for a lack of light. One quick way to check a camera's image quality is to see how well it reproduces colors, particularly properly saturated shades of red, in low light situations.

# Evaluating Video Quality

Probably the best way to evaluate the video quality of a PTZ camera for your application is to try out the camera in your actual shooting conditions. If that's not practical, at least try to simulate the following conditions during your test:

1. **Similar light levels**—both foreground and background.
2. **Similar color temperature(s) and spectra: i**ncandescent, fluorescent, daylight, LED, mixed lighting.
3. **Similar subject colors, pattern, and contrast levels:** (e.g., pale skin, dark suit, fine pinstripe shirt, bright foreground, dark red background).
4. **Similar distance to the subject:** some camera lens combos are more tolerant of certain difficult lighting environments with wide angle shots, or reproduce differently while zooming in or out.

One cannot reasonably expect a compact PTZ camera to respond as uniformly as a much more expensive unit to dynamic shooting situations, but you can insist that your shots are free of excessive video noise, disturbing color shifts, fringing and other artifacts.

The latest compact PTZs from major Japanese manufacturers, such as JVC's KY-PZ100, are generally more tolerant of difficult lighting and shooting situations than previous generations of cameras and those from other sources. This might be due to these companies' long history developing professional video cameras, and their willingness to invest lots of expensive man-power in the difficult process of developing and testing video processing DSP software.

**Note about Video Formats:** *Although most high-quality compact PTZ cameras output a full range of video formats (e.g., 720p, 1080i, 1080p), some models are more limited. Make sure that the camera you select outputs all the video formats you expect to need for the next few years.*

# A Lens on the World

## Choosing a lens with optimal balance is key.

Several of the better cameras in this class have good quality, 30X zoom lenses (approx. 4.3-129mm), with a reasonable balance between wide-angle and telephoto field of view for their 1/2.8" MOS sensors. Cameras with 15X or 20X lenses usually sacrifice either extreme wide angle or long telephoto capabilities. You might want to actually measure a prospective camera's field of view for your most important shots. For example, if you will be using the camera in a meeting room, small newsroom or other similar environment, measure the camera's horizontal field of view at the distance you expect to use with the zoom at its widest angle setting.

On the other hand, if you will be shooting concerts or sports, the telephoto coverage is almost certainly the top priority. Due to the carefully balanced mechanisms in these cameras, they don't usually perform well with add-on tele or wide-angle extender lenses. Also, built-in "digital zoom" functions introduce too much noise and other artifacts to be of use in most professional video applications. For these reasons, it's doubly important to select a PTZ with a lens that will give you good coverage for your most important shots.

Powerful 30x Optical Zoom

# Audio Capabilities

## Until very recently, professional compact PTZ cameras had no audio capabilities at all.

Today, with the spread of in-camera recording and the increasing importance of embedded audio in remote production, all of the better quality compact PTZs include some audio functionality.

Most common in this class of cameras is a 3.5mm miniature jack on the back of the camera for use with an external microphone or input feed from a local audio mixer. While some cameras offer stereo unbalanced mic/line input, others such as the KY-PZ100 provide a balanced mic/line in.

The balanced input is generally more desirable because it will often reduce electronic noise and interference, which can be a particular problem when using small mics with long, thin connecting wires. While stereo capability is useful, it's not a big plus, especially in situations where audio from multiple cameras will be sent to a switcher/mixer.

Some security-type PTZ cameras include a built-in microphone. However, this kind of mic is not suitable for production purposes, because they inevitably pickup the sound of the camera's pan/tilt/zoom mechanism.

# Camera Control

## Even the best PTZ camera is useless if it cannot be controlled in a way that meets the needs of the chosen application.

For example, if the slow pan movement of the camera/controller combination is not smooth enough for slow "on air" moves between two musicians, it would be a poor choice for concert hall use.

***There are at least four important aspects of control for small PTZ cameras:***

- Smooth and accurate pan/tilt/zoom control and performance
- IP Control capability
- Available Control functions, including Presets
- Controller compatibility


**RM-LP100 Remote Control w/Touch Screen**

# Smooth and accurate PTZ control and performance

## How does one easily evaluate the smoothness and accuracy of a compact PTZ camera?

The first criteria is to look at the camera with both its "native" controller and, if applicable, with an intended third-party controller. Even though a camera may generally work well with third-party controllers, there may be differences in performance, particularly at very slow pan speeds. The size, sensitivity, and quality of the native controller's joystick can also have a significant effect on smoothness of operation.

# Testing PTZ Smoothness

## *After setting up the camera on a level surface in a well lit room:*

1. Zoom in very slowly on a stationary, high contrast subject (e.g., a can of soda). Notice if the picture tends to jump or stutter slightly, especially near extreme telephoto. If possible, make sure image stabilizer and all other automatic adjustments (other than auto-focus and auto-iris) are turned off in the camera's on-screen menus.
2. After zooming in, pan as slowly as possible to the right and then to the left. Look for any unevenness in motion, such as jumping, stuttering, or vibration.
3. Now pan as quickly as possible left to right and right to left, stopping as quickly as the control system will allow. Does the camera come to a smooth stop, without "bounce" or vibration? If the stop is too abrupt, look in the PTZ setup menus for Ramp Curve, Ballistics, or a similar term. This function, when turned on lets the camera stop (or start) a pan move gradually. This produces a smoother looking movement, and is easier on the eye. It is sometimes turned off for most rapid access to presets in fast moving situations, such as ice hockey.
4. Zoom out slowly, and watch carefully for any uneven motion or artifacts. This test can also reveal shortcomings in the camera's autofocus tracking.

If one camera outperforms another in these tests, it can be a clear indication that that camera's PTZ mechanism and control software is superior. However, super-smooth PTZ operation may not be a critical factor if you plan to primarily use presets in your application. Cameras intended for use in lower-end videoconferencing systems for example, often use less expensive PTZ mechanisms—since vendors expect users to employ presets for established seating positions, and camera cost is a major factor in packaged videoconferencing system.

However, if you plan to use "live" camera moves, such as tracking a professor, minister, or athlete in real time, then PTZ smoothness become a major gating factor.

Tip: Most PTZ controllers have several ways to adjust movement speed and sensitivity, including proportional joystick movement, sensitivity/speed knobs or switches, and menu settings.

# Cost: Value of High-end PTZ Cameras

Even the best compact PTZ camera is no match for a high-end, full servo, interchangeable lens system in terms of smoothness, accuracy and often speed of operation.

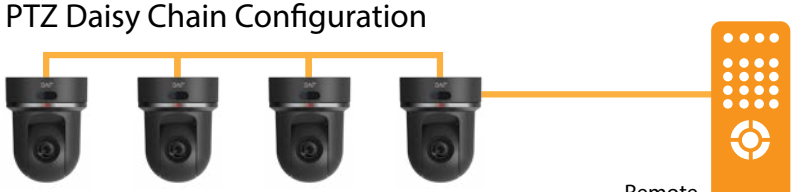
But, the lens alone for one of these cameras typically costs two to five times as much as an entire compact PTZ camera system. This type of lens/camera/PTZ system, sometimes still used for back of house in concert venues or for a center field camera in MLB, costs from $35K to $50K or more, and lacks native IP-control and autofocus. For the 95% percent of deployments that don't require such high-end performance, it's very hard to justify a cost differential of more than 10:1. Additionally, IP-control and autofocus are both important factors for many institutional and remote broadcast applications.

# IP Control Capabilities and Infrastructure

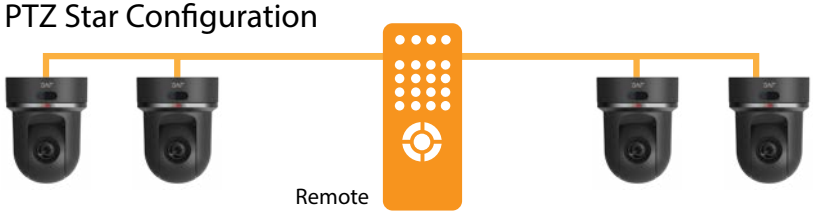
Although serial control via RS-422 or RS-232C has been the conventional means of control for PTZ cameras for decades, the latest systems also include control via IP over Ethernet. For most locally controlled systems, the latest IP-based controllers, such as the IP equipped JVC RM-LP100, work as well as those using serial connections, and are much easier and less expensive to install.

While IP control works over most wired or wireless data networks, and therefore has virtually no distance limitations, serial control runs over dedicated cabling, with a direct physical connection required between the controller and camera. This connection can use either a direct (Star or "Home Run") or a daisy chain configuration. In a daisy chain configuration, only the first camera in the chain needs to be directly wired to the controller, with the rest of the cameras wired from one to another in a series. In either chain or star configurations, there are limits for the maximum distance between the camera(s) and controller. For RS-422, this varies between 500 and 1000 meters over Cat5e/6 cabling, while RS-232C typically maxes out at around 70 meters (200') to the first camera in the chain, depending on the type of cable and controller used. Third-party extenders are also available to extend RS-232C control over Cat5e/6 cabling.

PTZ Daisy Chain Configuration




PTZ Star Configuration



# IP and Web Control
# — Pluses and Minuses —

As mentioned earlier, IP control has no distance limitations when properly configured, and, because it uses the existing LAN (and WAN) connectivity, IP control greatly simplifies the physical installation of a system.

Some of the most advanced systems also incorporate Web interfaces that enable remote preview, setup, monitoring, and even control of remote recording and FTP function.

***This is particularly useful for several applications:***

- Remote Production: sports, entertainment, reporter/pundit-cams, tower-cams, and reality show production
- Education: lecture capture, distance learning, and campus-wide system management
- Social-media Communications: multi-channel marketing and remote location cams

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The common functionality required in all these applications is the ability to separate the shooting location from the camera operation and support—without the need for expensive baseband monitoring systems. A single engineer/operator can, for instance, set-up, preview, control, record, and retrieve content from a dozen classrooms or lecture halls.

In a news environment, reporters or pundits in St. Louis or Cairo can live stream or record-and-forward production quality video and audio, all under the watchful eye of an engineer or producer in New York.


**Web Interface— Camera Control and Monitoring using Web Browser**

# IP Control Limitations

## There are, however, a few potential limitations with IP control, particularly over very long distances or on public networks.

The most likely challenge is a result of latency or delay of the video signal being monitored by the person operating the controls. In the most challenging deployments, latency can manifest as a visible delay between command and action. For example, the camera video might continue to pan, even though the joystick has been returned to its center position. To address this problem, the KY-PZ100 provides a low latency video signal when monitored through the camera's web interface. In situations where control latency is critical, the use of preset positions may offer a viable solution.

But, even in challenging, limited through-put communications environments, the remote record and FTP capabilities available in more advanced PTZ systems can still deliver the message.

# IP Control Advantages for Sports and Mobile Uses

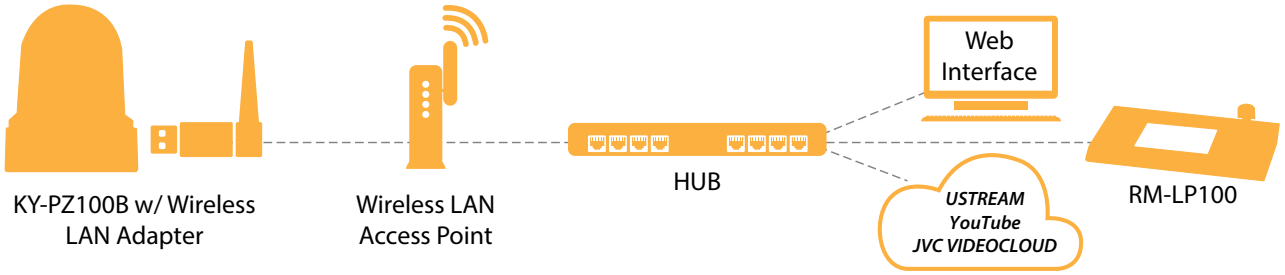
## Using IP controlled PTZ cameras for mobile applications, such as sports or out-of–classroom events, is easier than using serial controlled units.

There are no giant rolls of serial cable to deploy. Typically you only need to plug into the nearest LAN outlet, re-establish communication between camera(s) and controller(s), and shoot!

IP control is also much easier to deploy for campus or venue-wide systems, or in any system where long distances or multiple control rooms are involved. Larger educational, governmental, and broadcast systems typically require the ability to control cameras in multiple classrooms, meeting rooms, or studios from different control rooms. This kind of operational flexibility is nearly impossible with serial controlled systems, but is routine with well-engineered IP-based controllers such as the RM-LP100.

# Wireless PTZ Systems Rock!

Many IP controllable PTZ cameras can be adapted for wireless use with a separately powered Wi-Fi access point connected to the camera's RJ-45 Ethernet port. At least one new camera, the JVC KY-PZ100, takes the next step with the inclusion of built-in USB host connectivity. This capability enables wireless control (and streaming) through the use of small wireless USB network adapter, such as the Hawking Technology HD65U, and requires no separate power supply or wiring.



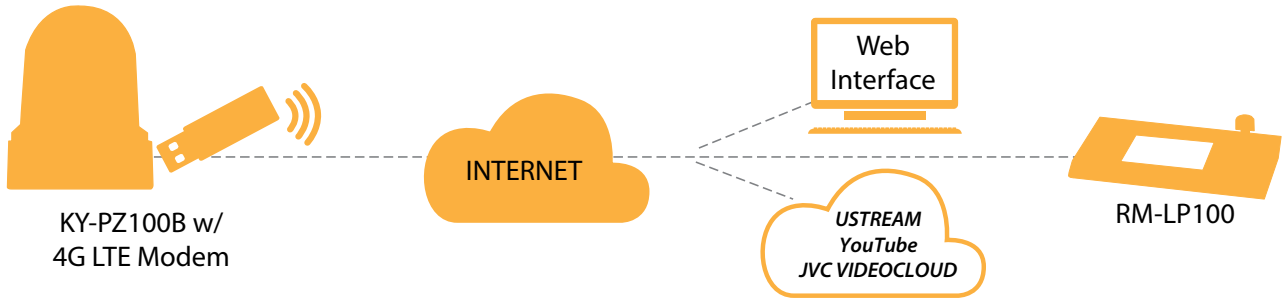

Wireless PTZ with IP control, plus streaming video and audio, open up great possibilities for both everyday uses in classrooms and conference centers, and advanced applications in sports, staging, and broadcast remote production. In a wireless remote production application, a portable streaming switcher system such as a TriCaster or Streamstar CASE may be combined with Wi-Fi enable PTZ cameras to provide an extremely flexible "studio without wires." Mixed content can be stored on a local hard drive and/or streamed live via USTREAM or another reflector service provider.

Whether you plan to use wired or wireless connectivity for IP control and streaming from an IP-enabled PTZ, it's always a good idea to check planned network connectivity, system setup, and device compatibility for glitch-free operation before finalizing system design, and again before any scheduled use. This helps assure that cameras, controllers, switchers, servers, services, and networks are properly configured, and that there are no issues (e.g., VLAN setup, Firewalls, wireless interference) that could prevent proper operation.

# Beyond Wi-Fi

## There are a variety of wireless wide area network (WAN) video transmission systems available for cameras from Teradek, Livestream and other vendors.

JVC handheld ENG cameras have been available for a few years with built-in USB host adapters and software capable of directly interfacing with portable 4G-LTE USB modems. Recently, JVC introduced the KY-PZ100, a PTZ with this same capability. This makes wireless remote controlled production over distances practical where wired networking is not available or extremely expensive, for example with bridge-cams, tower-cams, mountain sports, and in other difficult locations.



# Humble IR Controllers Shine

## Most modern PTZ systems also have handheld IR controllers available, either as standard equipment or as optional accessories.

It is highly recommended that these be deployed with most systems, and that everyone responsible for one of these systems carry one in their toolkit or backpack. Though these units have limited range and are not precise enough to use for manual on-air PTZ control, they are invaluable for set-up, last minute tweaks from camera locations, preset setting and recall, and the inevitable emergencies.

Some newer IR controllers offer additional features including very slow pan/tilt and zoom. The handheld remote for the KY-PZ100, for example, has a dedicated button to trigger in-camera recording.

# A Word About Presets

## Virtually all compact PTZ cameras include "preset" functionality, allowing the instant recall of memorized shot positions and setting (pan, tilt, zoom, etc.).

Where they differ most significantly is in the number of presets and the accuracy of preset recall. Other related features, such as the grouping of presets and selection of parameters remembered (e.g., white balance) also varies between camera systems.

***The two most important camera selection criteria regarding presets are the available number, and the accuracy with which a preset reproduces the precise framing of the memorized shot.***

Many compact PTZs, including the KY-PZ100 have up to 100 presets. While this may be overkill for small classroom or conference room use, it is in the right ballpark for sports, staging, and even lecture hall use.

Most current systems offer a limited number of presets (5 to 10) using "direct access" from buttons on the controller, requiring extra button pushes to access additional presets in banks or groups of 5-10. The JVC RM-LP100 provides 10 direct cameras selection buttons, with up to a total of 100 in 10 banks of 10. Larger, custom programmable system controllers, such as AMX or Crestron, can also be mapped to recall up to 100 presets for complex, large venue or multi-room applications. Some PTZ camera system with built-in Web interfaces, including the KY-PZ100, also offer direct access to all 100 presets through a drop-down menu or similar means.

# Testing Preset Accuracy

## Test preset accuracy using the following simple steps:

1. Power the camera off, then on to calibrate the pan-tilt mechanism.
2. Set up a preset (e.g., #1) after zooming in all the way on a small object and panning slowly until that object appears to touch the side of the monitor screen.
3. Set up another preset (e.g., #2) that is a wide-angle shot pointed at a different part of the room.
4. Alternately recall presets #1 and #2, noting how closely the position of the object in preset #1 is, after three repetitions, compared to its position in the original shot.
5. If the final position of the object after three recall of the preset is closer to the original than 1 degree (or approximately 1/100th of the screen width), the camera probably has very accurate PTZ operation.

Even though they do not employ the full-servo technology used in very expensive P/T heads, some of the latest compact PTZ cameras achieve great preset accuracy, as good as +/- .0.03 degrees in the JVC KY-PZ100.

# Compatibility with Third-Party Controllers

## There are many popular third-party control systems.

The most widely deployed are Crestron and AMX, but many other high-level vendors, including Extron, Vaddio, and Pelco, offer systems with specific advantages. The benefits of a properly programmed third-party control system might include a customized graphical user interface (GUI) that allows simple touch-control and automation of both cameras and other system equipment, ranging from video switchers and audio mixers to lighting and projectors. One of the most common uses of custom GUIs is to provide both a simplified user interface for executive or volunteer users, as well as a protected engineering level interface for setup, adjustment, and expert system operation.

PTZ controllers employ a variety of control protocols or command languages/tables to communicate with PTZ cameras. The most common of these involve a serial and IP control system made popular by Sony. Another common system, particularly in weather-cam, traffic-cam, or broadcast system, is Pelco-D, created by the CCTV equipment manufacturer of the same name. Some camera manufacturers also have their own highly developed control protocols, either serial, direct-IP, or Web-based, which they may share with qualified control system programmers. The KY-PZ100 supports serial and IP control protocol made popular by Sony (serial or IP), and Pelco-D, as well as JVC's own direct IP control and Web API. The NewTek Tricaster is compatible with KY-PZ100.

As mentioned above, touch panel-enabled and other third-party controllers offer many advantages, but it's important to recognize the potential limitations and challenges associated with deploying these complex sub-systems.

# Selecting a Third-Party Controller

After identifying a third-party control system that can add desired functions to your system, such as programmable touch-screen control, room control, conference system "dialing", or integrated video monitoring, these simple steps will help to assure that your system will perform as expected:

1. Confirm that your selected camera(s) can be controlled by the selected control system. This may seem obvious, but it should be authoritatively confirmed to avoid the possibility of a rude awakening.
2. Confirm that all the camera functions required for your application are available from a prospective control system. Again, this may seem obvious, but many third-party control systems that offer basic PTZ control of specific cameras are unable to access more advanced features such as streaming, or in-camera recording control. Overlooking this simple step can result in delays, increased cost, and some embarrassment.
3. If all the functions you require are not native to the chosen control system, and custom programming is required for their use, make sure that both the selected controller and prospective programmer are up to the job of providing the desired custom functions.

Even after you have decided to deploy a third-party controller, it is a good idea to have the cameras' native (OEM) controller on hand for backup and for precise control during key events.

# Streaming On

Perhaps the most exciting development in PTZ cameras over the past few years has been the availability of in-camera, production quality streaming.

This makes it easy and affordable to capture and deliver high quality live video and audio from a remote location without the need for complex and expensive streaming systems. It also simplifies staffing for a remote capture or feed.

Related features, such as Web-based preview and control, wireless operation, and in-camera recording with FTP capabilities, further multiply the usefulness of this new generation of network-able PTZs for remote production and event capture.

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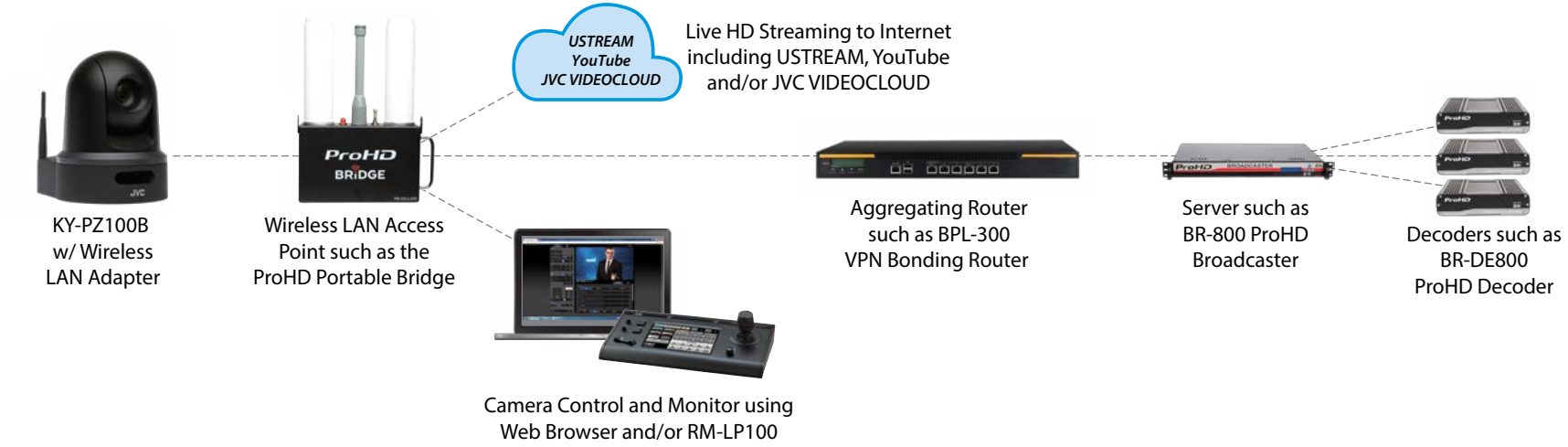
While these innovative functions may not be essential for some more conventional applications, they make creative new solutions practical, as well as making complex or advanced systems more economical and easier to manage. Some of the new applications these features make possible may be obvious, such as the use of portable "pundit-cams" for remote newsgathering. Not so obvious are the reduced manpower, infrastructure, bandwidth, and support costs of networked PTZ systems, whether these are used for campus-wide lecture capture, or for large venue, special event, or sports applications.




Live streaming video from a PTZ is not recommended for applications in which latency or delay is a major issue. Because of the delay involved in processing and compressing a signal for streaming, the signal (video and audio) from the streamed camera(s) will be delayed. This means that in an auditorium, house of worship, or stadium where the audience can see both the live subject and their projected image on a large screen, there will be an unacceptable delay between these two.

# More than CCTV

## The new connected-PTZ cameras are not simply CCTV or security cameras on steroids, though there are some similarities.

The new PTZ cameras generally provide much higher networked quality audio and video, with transmission rates of up to 70Mb/Sec and content quality suitable for broadcast news, reality show production, and even large screen projection (IMAG).

In addition to uncompressed local outputs (3G/HD-SDI and/or HDMI), the new PTZs provide standards-based live streaming, critical for professional deployments. Though the quality of high-end security cameras has risen over the past few years, even the best still fall far short in picture quality and smoothness of live PTZ operation for video production and A/V system use.

# Standards-based Streaming

## The key to useful streaming deployments is standards-based compatibility between a streaming PTZ camera and the selected decoder, IRD (integrated receiver decoder), or server.

This may seem simple. After all, a standard is a standard, right? And—interoperability should be as simple as matching standards and specs. Though this might be true in some rosy future, interoperability for remote streaming systems still requires planning, attention to detail, and a healthy skepticism regarding claims of "plug-and-play" operation.

The surest method to maximize a simple and successful deployment is to employ encoder/decoder pairs from the same manufacturer, designed for your application, and certified to be interoperable.

For example, JVC offers the ProHD BR-DE800 hardware decoder, certified to operate with the company's KY-PZ100 camera system. While Panasonic does not manufacture a decoder that pairs with its streaming professional PTZ cameras, it offers Teradek hardware decoders certified for use with its cameras.

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If you are planning to employ servers from Zixi, Wowza, or other popular vendors in your streaming system, you can also rely on published statements of compatibility from well known PTZ manufacturers.

It is important to keep in mind that an MPEG-2 or MPEG-4 stream from one device will not necessarily be decoded properly by another device using the same "standards," even if both devices are the same brand. Even if you manually match settings between devices (MPEG-2, RTMP, etc.) you still may have connectivity issues that require troubleshooting.

In the recent past, when professional video camera outputs were primarily encoded for streaming via external devices, it was relatively simple to assure interoperability. You just had to buy a matching pair of encoder/decoders—of the same model line from the same manufacturer, and follow the included instructions.

Although matching specs do not guarantee interoperability, mismatched specs should be a red flag. For example, many decoders already in use at broadcast facilities, as well as streaming services such as USTREAM and YouTube, require that incoming streams be RTMP (Real-time Messaging Protocol) compliant. On the other hand, some PTZ cameras with built-in streaming encoders only output streams in RTSP (Real Time Streaming Protocol), and therefore will not work directly with those decoders or services.

# Caution, Software Update Ahead

## Unfortunately even matching the basic specs on encoders, decoders, and servers is not enough to assure successful interoperability.

In this dynamic product segment, new software/firmware updates to improve interoperability and fix bugs are often issued several times a year, if not more often, so it's a good idea to check vendors' Websites for updated info before making a choice. This being said, updates sometimes are just as likely to reveal new issues as they are to resolve old ones.

If a vendor does not specify on their Website that their camera or decoder is compatible with another device, it's best to communicate with the company's technical support staff, and seek written confirmation of interoperability before making a final purchase decision. If you have a post-purchase problem, your communication, and/or their confirmation, should include not only model numbers, but firmware and software versions as well, as version changes sometimes effect compatibility.

# Software versus Hardware Decoders

Though widely available software decoders such as VLC can do a good job decoding  many video streams, the resulting image is not typically of "production quality."

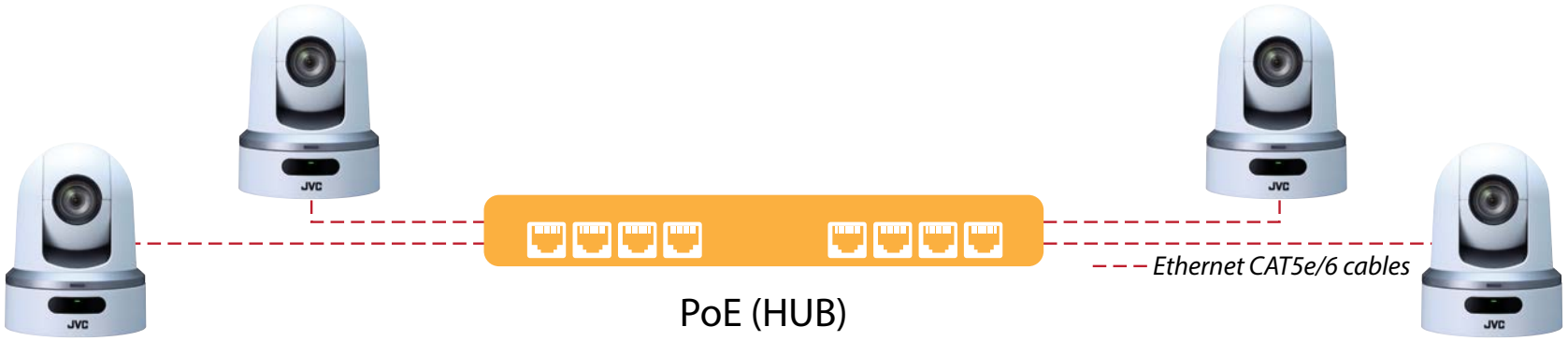
This is often true even if the decoding software is running on a reasonably powerful dedicated computer.  That being said, software decoders are excellent for remote monitoring and, in some applications, may function well enough for the intended end use.

Since the cost of powerful hardware decoders is falling almost as fast as the price of 4K TV's, you're likely to have a wide range of choices when selecting a decoder.  But a bargain is no bargain if doesn't work (and continue to work.) So in addition to absolute confirmation of interoperability with your PTZ, you'll probably want to base your decoder selection, at least in part, on the device's reported reliability and the established reputation of the decoder's manufacturer.

# What is POE+ and Why You Should Care

System integration and deployment issues are big factors in determining the expense and feasibility of a planned solution. Including POE+ (Power Over Ethernet Plus) capabilities in compact PTZ cameras is one way camera designers have made it easier and less expensive to deploy high performance systems.

In a nutshell, POE+ lets you run power to small PTZ cameras over Cat5e/6 cabling, eliminating the need to provide power outlets at every camera position. This is particularly useful for remote applications, such as staging or sports , and for installations in architecturally sensitive spaces, such as churches or museums. Cost reductions (and time savings) can be very substantial—in many US cities, the cost of installing a wall mounted "clock outlet" to provide power to each camera position can range from $500 to $1,000 per camera, or more.



# Single Cable Solutions

## In addition to providing power over Cat5e/6 cabling, POE+ can carry IP control, Web control and preview, and streaming content over the same, common Cat5e/6 cable.

This enables what is called a "Single Cable Solution." This is particularly useful when cameras are placed in a difficult location such as the roof of a building, out standing in a field, or when cameras need to be set up very quickly for remote sports, or special events.

**Note:** Make sure that the selected POE+ Ethernet switch, power inserter, or other POE+ device can provide more than the total rated power consumption of all cameras on that segment combined.

A Single Cable Solution can only deliver program content when your video is already encoded for streaming by the camera. When 3G/HD-SDI video is required, a second cable will be needed, but even this two-cable solution will still save money and installation time compared with separate power supplies and 120 VAC wiring.

# Other Solution Enablers

**Time Code:** If you are operating in a production or broadcast environment, you'll be familiar with the advantages of camera Time Code for postproduction.

Time Code accurately tracks the time of each video recording and enables subsequent accurate synchronizing of video from different cameras and other recording devices used during the same shoot for editing purposes. User Bits allow you to embed identifying information in the video at the time of recording. These are tools that would be particularly useful for remote controlled multi-camera production using PTZ cameras equipped with in-camera recording.

Until recently, time code and PTZs only co-existed in high-end studio automation systems. With the development of a new generation of more advanced compact PTZ cameras, most notably the JVC KY-PZ100, fully configurable Time Code with User Bits is now available for use in a wide range of remote production environments. Time Code can be recorded in the camera, along with the video on micro-SD cards, and is also embedded in the live camera output. For the purposes of multi-camera remote production, the Time Code allows recordings from all the cameras to be easily synchronized during editing for seamless transitions between video shot from different points of view. The KY-PZ100 can also display the time and date on a video overlay--very useful when recording interrogations or depositions.

In-camera Time Code is also useful in other common production scenarios. For example, when a ceiling-mounted PTZ camera is used in conjunction with handheld cameras in reality show production, the video captured on the PTZ's microSD card can be easily and accurately time-matched with "footage" from the handheld cameras for editing.

# In-camera Recording and Remote FTP Delivery

In-camera recording with remote access via streaming or FTP is a very useful function that has migrated from broadcast camcorders the latest PTZs.

***In-camera recording offers several advantages for connected PTZ cameras, including:***

- Remote video recording and retrieval from unattended locations
- Bandwidth conservation through FTP retrieval
- Backup recording for Iso-Cam use or to ensure against lost content due to network problems
- Iso-Cam recording in PTZs for creative flexibility and backup
- Efficient staffing and workflow

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The basic advantage of PTZ in-camera recording is the ability to record video and audio from a remote location at any time, without the need to dispatch a camera operator and camcorder. The additional capabilities of remote control and preview, live streaming, and content retrieval via FTP further extend the reach and productivity of these systems. Whether you need to know if surf's up or record an impromptu lecture, you're covered. The few new PTZ cameras with this capability typically use a Web interface to preview shots and activate recording. Some offer other ways to start remote "taping." The JVC RM-LP100 controller for example, also includes REC function control for any one of up to 100 cameras selected for control.

**Control PTZ recording functions remotely with the Web Interface**


**Control PTZ recording functions with Remote Control with RM-LP100**

# Bandwidth Conservation

Although a single camera streaming production quality video over a modern LAN is not likely to slow data traffic to a crawl, 40 cameras simultaneously spitting out 20Mb/sec streams from as many classrooms or remote locations is more likely to inspire murderous thought in the most mild mannered IT manager. By recording events in-camera, and using FTP for content retrieval, you can minimize network load and delay any load to a time when network usage is lighter. FTP'd files are also less subject to interference and quality loss than live streamed content.

# Backup Iso-Cam Recording

With PTZ cameras that allow simultaneous streaming and recording, you can prepare a backup "Iso-Cam" recording for each camera location. This provides insurance in case of network problems, and enriches post-production possibilities in a live-switched environment using a Tricaster or similar system for recording or Webcasting sports, news, or live performances.

# Efficient Staffing and Workflow

The flexibility provided by an integrated PTZ system, such as the KY-PZ100, that is capable of live 3G/HD-SDI output, live streaming, in-camera recording, FTP content delivery, and even 4G-LTE communication provides extraordinary opportunities to improve the efficient use of skilled staff, and optimize workflow to maximize productivity and creative possibilities.

Just one of countless possible scenarios involves covering a remote event with a single skilled camera operator running several PTZ cameras with iso-cam recording followed by FTP retrieval. With no lost time for setup, moving equipment, or sneaker-net retrieval of content, even a small staff will be able to output maximum quality content with minimum delay. And, with time-code/user-bit enabled PTZ cameras like the JVC KY-PZ100, post–production of multi-camera remote controlled shoots can move even more smoothly.

# Into the Future

Finally, it's important to realize that the potential of these compact, connected PTZ systems is not limited by the creative restrictions and workflow constraints of previous generations of cameras.

It's up to the imagination of system designers, production managers, and programmers to combine the advanced capabilities of these cameras with new streaming switchers, smart phones, and other evolved technologies to create innovative applications and experiences for the brave new world of video communications.

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