PTZOPTICS

1/30/2017

Recommendations and System Setup

of a two (2) camera solution

for Streaming and Recording

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General Overview

There are many ways to design a multi-camera system; this article will focus on building a system that is easy to deploy and provides reliable results.

We will cover set up of the cameras for both video and control.

This guide will assume that there is an existing audio system, mixing board or microphone(s) available.

We will also add redundancy into the system. This will allow the video feed from each of the cameras to be accessed in two (2) unique ways, just in case there is an issue during a recording or stream.

Understanding the Camera's Connections

Let's take a look at the different connections the camera has to offer and how you can use them. The PTZOptics line has (2) models, an SDI model and a USB model.

For this article and system build we will be using the SDI model of the PTZOptics cameras.

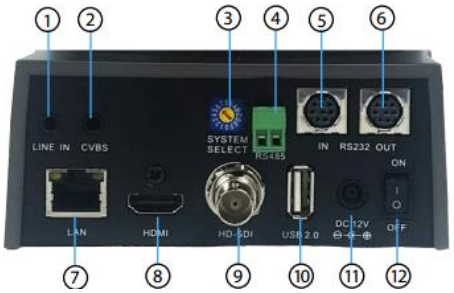
The SDI model of the camera has three (3) simultaneous outputs: 3G-SDI [9], HDMI [8], and RTSP / RTMP streaming via a Network [7].

For control, the camera features RS-232, in [5] and out [6], as well as RS-485 [4] and network [7] options.

The Rotary Dial [3] changes the resolution and framerate of your camera for the HDMI and SDI outputs but not for the RTSP / RTMP streaming or USB.

The Line In [1] allows for embedding true line-level audio over an RTSP / RTMP stream.

For the purposes of this design, we will be using the Network [7], SDI [9], RS-232 in [5] and out [6] as well as the power connection [11].



1. Audio Line In *(For embedding true line level audio over an RTSP or RTMP stream)*
2. CVBS - Composite Video *(Systems Select Dial must be on D or E / Only non-simultaneous output)*
3. Rotary / Systems Select Dial *(Allows for changing the HDMI and SDI output resolution and frame rate)*
4. RS-485 Control Port
5. RS-232 In Control Port
6. RS-232 Out Control Port *(Used for daisy chaining camera for multiple camera control)*
7. Ethernet / RJ45 Port (Web Interface, Control and RTSP / RTMP streaming)
8. HDMI Output
9. 3G-SDI Output
10. USB 2.0 Port *(Future Applications)*
11. 12VDC Power Connection
12. On / Off Power Switch

For a flexible two (2) camera setup, we'll use a PTZOptics 20X-SDI camera and a PTZOptics 12X-SDI camera, since these cameras have different capabilities, such as zoom ranges and fields of view, to serve different needs.

The PTZOptics 20X-SDI camera can be placed on the back wall of your room (to zoom in on the presenter) while the PTZOptics 12X-SDI can be used for other shots such as an audience or choir, as it provides a wider field of view *(The PTZOptics 12X-SDI has a 72.5° HFOV versus the PTZOptics 20X-SDI with a 61° HFOV)*

Camera Control Options and using RS-232

To control the P/T/Z functionality of the cameras, we will use the HC-JOY-G2.

The HC-JOY-G2 is a small affordable joystick controller (well-suited for a variety of camera control applications)

A PTZOptics camera has three (3) different ways to gain remote control of the camera

- IP Control
- Serial Control
    - RS-232
    - RS-485
- IR control (IR remote included with camera)

We will be using serial control solely because it provides the most reliable and flexible method of controlling your camera.

> *IP control works by putting a PTZOptics camera on a network; once setup properly you are able to control it from anywhere on your network using an IP Joystick (PT-JOY), Software (Rocosoft or ONVIF Device Manager) or even the web interface of the camera. The downside to IP control is there is usually a small degree of latency when controlling the camera that can make it harder to get smooth panning shots.*

This system will be using serial control so now we must decide if RS-485 or RS-232 is better for this scenario. A majority of people will use RS-232 to control a camera, as it is a familiar industry standard. Unfortunately, RS-232 by spec does not travel far (around 100’ / 30m). If you will have runs longer than 100’ you may want to consider RS-485, which is capable of being run over 4000 feet (depending on the quality of the cable and the set baud rate).

This system will use RS-232 for control of the PTZOptics cameras because RS-232 is by far the easiest and most reliable method of control when less than 100 feet of cable is needed. Using RS-232 for control of two (2) PTZOptics cameras will involve two (2) different cables. The first cable is for connecting the joystick to the first camera and the second cable is for daisy-chaining from the first camera to the second camera to achieve control of both cameras. It is worth noting that, when using RS-485, you can run a separate cable to each camera directly from the joystick for multi-camera control.

Camera Locations and Installation

Now, we need to examine the mounting options for the PTZOptics camera. If you would like to use the PTZOptics camera on a camera tripod, they feature a standard 1/4 -20 threaded insert on the bottom of the camera. If a more permanent solution is needed, you can mount the PTZOptics cameras to the ceiling using our ceiling mount *(PT-CM-1-BK)* or to the wall using our wall mount *(HCM-1-BK or HCM-1-WH)*. As mentioned earlier, the PTZOptics 12X camera has a wider field of view so it is better suited for wider shots, such as an audience or multiple presenters. A PTZOptics 20X has a narrower field of view, so it would be better suited for tight shots, such as that of a presenter at a podium or individuals on a stage.

> Let's put the field of view information into some real-world examples…
>
> When the PTZOptics 12X camera is placed 40' away from its subject, it will provide a view approximately 57' wide when completely zoomed out and covering only a 4.9' wide when completely zoomed in.
>
> The PTZOptics 20x camera from the same 40' distance will cover a 48' wide area when zoomed out and will cover a 2.8' wide area when zoomed in.
>
> Based on these viewing areas, you can see why using the PTZOptics 20X for the presenter / on-stage talent and using the PTZOptics 12X for capturing the crowd, choir or another complex scene is an ideal setup.

Now we need to examine running signal cables back to our production PC. The SDI models of the cameras will make working in any larger venue a non-issue as you can make extremely long SDI cable runs without any noticeable loss of quality or reliability. At the PC side of this system, we will suggest the use of high quality SDI frame grabbers, such as those made by Magewell. These will allow you to take that SDI signal and convert it to USB 3.0 for use on your production PC in high quality.

Some people might ask at this point why we wouldn't recommend use of our USB models instead. It is solely a matter of USB 3.0 extension being extremely difficult and ultimately unreliable at the distances needed by a typical large venue installation. This recommended solution, with SDI cameras and frame grabbers will end up being very similar in cost to the USB cameras with USB 3.0 extension solutions but will prove to be far more reliable.

Now to get the video into your production PC, you will need to run 3G-SDI cables from each camera location to your production PC. 3G-SDI cabling has maximum length limitations ranging from 81' – 393' (depending on the quality of the cable used). PTZOptics offers 3G-SDI cabling in varying lengths up to 100' (with anything longer requiring a custom quote). Once the 3G-SDI cable(s) have been routed to the production PC, a SDI frame grabber, per camera, will be required to convert the 3G-SDI signal(s) into USB 3.0 signal(s). If you are using a production PC with available PCIe slots, the use of a PCIe SDI capture card is a nice option. Keep in mind that, if you are doing a two (2) camera system, it is typically less expensive to use the two (2) USB based SDI frame grabbers than their big brother, the PCIe option.

The “Production PC” – Hardware

We’ve talked about a lot of the pieces that will attach to your production PC; however, we have yet to discuss the capabilities that your production PC will require to handle pulling in two (2) live video streams in addition to recording or streaming back out to Facebook, YouTube or another CDN. Two (2) HD (1080P@60) feeds, as well as audio and any other processing that needs to happen on the computer will require a powerful production PC. To best answer what would really be needed we reached out to Tom Sinclair, an expert in this field, from Eastern Shore Broadcasting to help recommend a PC that someone could rely on.

> Tom recommended using current generation “Kaby Lake” i7-Quad Core CPUs, a gamer's motherboard, a minimum of 16GB of high speed RAM, Windows 10/64-bit as the Operating Systems and an NVidia GeForce GTX 750 (or better graphics card). These are pretty hefty specs, meaning it can easily cost thousands of dollars for a high performance PC. The PC is going to be the heart of this system; responsible for recoding, streaming, editing, overlays, and audio for your whole show… so get it right the first time.

The Production PC – Software

Now that we have examined the hardware required for a high quality and reliable show, we'll look into what software you will need on the production PC.

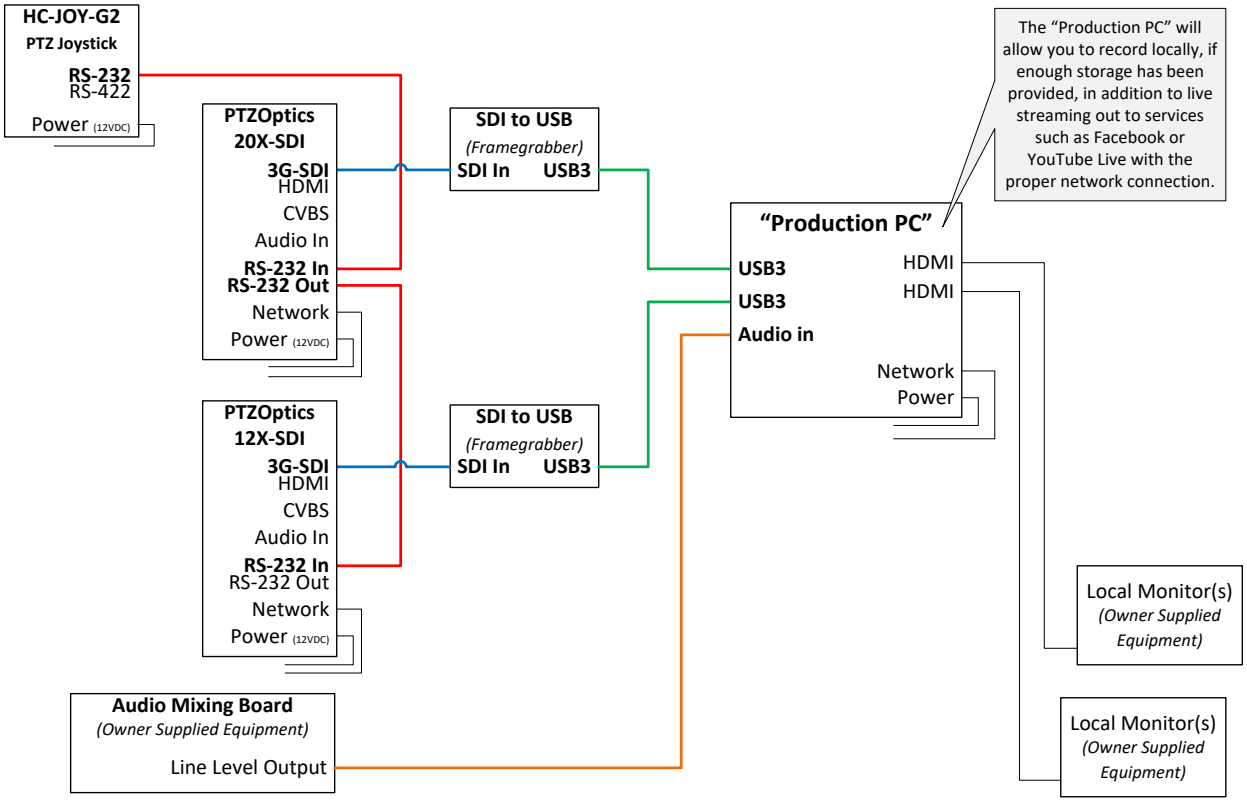
VMix is a high quality and affordable option for professional video production with their "HD Edition" coming in at only $350. The "HD Edition" is the minimum of what would be ***recommended*** for a modern-day production, as it allows for HD resolutions in addition to multiple video / audio inputs. The more affordable options have a maximum resolution of 768 x 576 for content, which is not enough for a modern HD presentation that we have all come to expect. For alternatives to VMix, please research the following software options: Wirecast, X-Split or Open Broadcaster Software (OBS).

Integrating Existing Audio

So far we've examined the cameras, signal cabling, control (with its associated cabling) and finally the hardware and software necessary for a reliable and high quality production system - but we have yet to discuss audio. At the start of this article we mentioned an assumption that the venue already has some form of an audio system in place - with great likelihood the audio system will be an audio mixing board. Most audio boards / mixers will be able to accommodate a single audio output that will be connected to the production PC using a 3.5mm input (available on most standard PCs). A balanced signal from a mixing board may require custom termination of the cables. These types of adaptors and custom cables are readily available from Amazon once you know what signal you're mixing board will be able to output. The PC audio input generally requires an unbalanced, line level signal.

Full Systems Review – Wiring Diagram

Using the wiring diagram provided below, let's take a look at how all of these parts connect to each other. Of note is the fact that we have not yet shown power or network directly plugging into outlets or network switches, which will be required for a successful system.



This may be a bit hard to read if you are not used to looking at wiring diagrams, so let's try to break it down piece by piece.

We're looking at two (2) PTZOptics cameras, each with the connections populated as follows: 3G-SDI, Network, RS-232 Control, and last but certainly not least, is Power.

The joystick controller (HC-JOY-G2) is connected to the first camera using a DB9 cable and then the first camera is connected to the second camera using a "VISCA cascade" cable.

The SDI signal out of each camera runs back to its own SDI to USB 3.0 frame grabber, present at the production PC, with the USB 3.0 connected directly to the production PC **without** the use of USB hubs or extension cables. USB Hubs and extension cables can reduce performance and reliability of the system.

The audio content from the audio mixing board is acquired from a spare output on the board and then is connected to the production PC input, which is typically a 3.5mm input.

Equipment List

Below you will find an equipment and cabling lists based on everything that has been discussed so far.

Equipment

- Quantity one (1) PTZOptics 12X-SDI-XX-G2 *(White or Gray)* $1,599.00 *(MAP)*
- Quantity one (1) PTZOptics 20X-SDI-XX-G2 *(White or Gray)* $1,699.00 *(MAP)*
- Quantity two (2) Magewell SDI to USB 3.0 Frame Grabbers $598.00 *(Both)*
- Quantity one (1) "GOOD" production PC $1,799.00 *(Pricing can vary depending on overall needs)*
- Quantity one (1) VMix "HD Edition," or better, License $350.00
- Quantity one (1) HC-JOY-G2 Serial Control PTZ Joystick $299.00
- Quantity one (1) PTZOptics Wall Mount(s) $90.00 *(Depending on installation needs)*
- Quantity one (1) PTZOptics Ceiling Mount(s) $60.00 *(Depending on installation needs)*

Cabling

- Quantity two (2) 3G-SDI cables (various lengths available) $69.00 - $189.00
- Quantity one (1) DB9 Extension Cable – Male to Female (various lengths available) $59.00 - $109.00
- Quantity one (1) VISCA Cascade Cable (various lengths available) $59.00 - $109.00
- Quantity three (3) CAT-6 Patch cables (various lengths available) for network $5.00 - $26.00
  (Note that these are optional and per this guide are only providing redundancy to your system)

Audio Cables & Adapters *(May be needed)*

- Quantity two (2) XLR Cable Extensions to extend audio to PC $12.99 *(Accommodates L&R audio channels)*
- Quantity one (1) Dual XLR to 3.5mm for connection to PC $8.99

All the equipment listed, costs a little over $7,100 for a new and complete two (2) camera production system (with the assumption that there is an existing audio system). This cost can be lowered even further if the facility decides to use a single camera or that they don't require control of the cameras from an RS-232 joystick. Make sure to only order what is needed to accomplish the job.

Setting “EVERYTHING” up

This is the hard part… as there are a lot of components and connections to account for.

Hiring a professional A/V contractor in your area is a good option for proper installation. You can provide the contractor with this guide, and the equipment recommended, and the contractor should have no issues installing the system for you.

If you would like to do this yourself, you will need to be comfortable running cables and installing camera mounts in addition to having some spare patience in the event there is a problem. This guide will cover the installation process in a step by step method; when in doubt about a step, it is best to reference the wiring-diagram provided above on page 9.

1. Identify the ideal locations for your cameras based on the coverages we discussed in the “Camera Locations and Installation” section on Page 9.
    a. Note the cable lengths to reach each location, from Point A (Camera) to Point B, the production PC.
        i. Pay special attention to adding length for any cable that may be running up and or down a wall
        ii. Always plan for the cable to be run vertically or horizontally, **do not** estimate cable lengths using diagonals to transverse walls or ceilings.
        iii. When planning your cables runs always add extra cabling, within distance limitations, to allow for reconfiguration and maintenance of the equipment with ease
    b. The cameras will need power at each camera location
    c. We highly recommend connecting the cameras to a network, if one exists, and if not it is still ideal to run network cables to your production PC location for future use.
2. Mount the cameras
    a. If you are using a ceiling mount, you should be able to anchor / install the mount using the hardware provided.
    b. If you are using a wall mount, you should be able to anchor / install the mount using the hardware provided.
3. Cabling will need to be installed once the cameras have been installed in their locations. You will need to run the following cables to each camera for the system we have described. It is worth noting that labeling your cables on both ends to identify the equipment connected makes setup on the production PC side much easier (ex. SDI1, SDI2, etc…)
    a. 3G-SDI Cabling from each camera’s SDI output to the input on an SDI frame grabber at the production PC location
    b. RS-232 Extension Cabling for first camera
        i. With the PTZ joystick situated at the production PC location you would run the first cable (DB9-Male to Female) with the female end at the joystick and the male end at the camera.

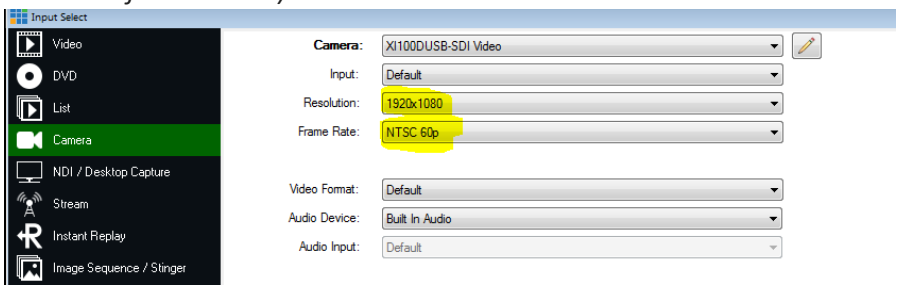
ii. Using the supplied DB9 Female – MiniDin8 adaptor cable, pictured below, connect the DB9-Female end to the DB9 extension cable

iii. Connect the MiniDin8 RS232 cable end to the cameras "RS232 IN" as shown below

c. RS-232 Cascade cabling will be run from the "RS232 OUT" port of the first camera to the "RS232 IN" port of the secondary camera for daisy-chain control.

4. To setup the production PC, start by plugging in power and setting up the Windows OS, per your needs
    a. This is also a good time to get the PC on the same network as the cameras, if one is available.
    b. Install VMix on the production PC.
    c. Connect the USB 3.0 outputs of the SDI frame grabbers to available USB 3.0 ports on the production PC.
        i. If possible, try to spread the USB connections between multiple USB Host Chipsets or a bottleneck in USB bandwidth may occur
        ii. When connecting the frame grabbers to the production PC please use USB cables that adhere to the specification for maximum cable length of USB 3.0 at 3 meters.
5. As a quick review, we now have the control cabling connected from the PTZ joystick to the first cameras RS-232 IN port, the RS-232 OUT port of the first camera is connected to the RS-232 IN port on the second camera. We have the SDI outputs of each camera connected the SDI inputs on the frame grabbers and then the frame grabbers are connected to the production PC using the supplied USB 3.0 cables. Finally, we have the cameras and production PC live on the same network and VMix has been installed.
6. Launch VMix on the production PC
    a. Select the "Add Input" button in the bottom left of the application windows.
        i. You should see two (2) selectable devices called "XI100DUSB-SDI" which are your two (2) cameras / frame grabbers.
        ii. Please select one camera at a time and bring both cameras into VMix as separate inputs per the instructions provided below
            1. When you add your cameras in VMix you need to tell VMix what resolution and framerate which the cameras are currently operating at. By default, the cameras should be set as follows *(note that the resolution and frame rate can be changed using the yellow rotary dial on*

the back of the camera)



a. A default resolution and frame rate of 1080P60
b. This equates to a VMix resolution setting of 1920 x 1080
c. This equates to a VMix frame rate setting of NTSC 60

2. If everything worked for each input, you should now be seeing two (2) live inputs, one from each of the cameras

7. Make sure the DB9 Extension cable, that has been run for control from the RS-232 IN port on the first camera to the production PC location, is connected to the DB9 Male port on the PTZ joystick controller. Make sure the PTZ joystick controller is connected to power.
    a. Now we need to configure each camera for control by the PTZ joystick controller, using the IR remote to assign unique IR IDs and then adjust the protocol, baud rate and Camera ID of each camera in our system.
        i. Start by turning the power to "Camera 1" to the Off position
        ii. This leaves only "Camera 2" available to respond to the IR remote
            1. Enter the following key sequence: *** # [F2]** *(Star, Pound, Green F2)*
            2. "Camera 2" will now be assigned an IR ID of 2 that can be selected using the "Camera Select" buttons at the top of the remote
        iii. Turn "Camera 1" back to the On position
            1. To control "Camera 1" from the IR Remote you need to push the "Camera Select" 1 button
            2. To control "Camera 2" from the IR remote you need to push the "Camera Select" 2 button
        iv. Now that we have discrete control of each camera from the IR remote we will proceed with adjusting the RS-232 control settings for each camera via their OSD (On Screen Display)
    b. With power restored to "Camera 1" point the IR remote at the camera and press the "MENU" button
        i. At the production PC, in VMix you should now see the OSD of "Camera 1" in the preview window
        ii. Navigate using the directional controls on the IR remote to the title of "Setup" or "Communication Setup" depending on the generation of PTZOptics camera you are using
            1. Set "**Protocol**" to "**VISCA**"
            2. Set "**Baud rate**" to "**9600**"
            3. Set "**V_AddrFix**" to "**On**"
            4. Set "**V addr**" to "**1**" for "Camera 1"
            5. Exit the "Setup" section

iii. Note that if you have mounted the camera in an inverted position this is a good time to flip the image under the "**Image**" section in the OSD; the option should be titled "**Flip V**"

c. The steps listed above, **7) b)**, should be repeated for "Camera 2" with the only exception being on step **7) b) ii) 4)** where we want to set "**V addr**" to "**2**" for "Camera 2"

d. The cameras are now setup to be controlled from the PTZ joystick controller but we have not setup the joystick controller. It is likely at this point, with the joystick controller in its default state, that the adjustments made to the cameras will allow for full control of the cameras. Let's walk through the setup procedure in case there are any issues.

i. On the PTZ joystick controller (**HC-JOY-G2**) press and hold the setup button until prompted for a password… the default password is "**8888**"

1. Select "**CAM 1**" and press "**Enter**"
2. Press "**Enter**" again with the cursor flashing on the number "**001**"
3. Press "**Enter**" again to be able to adjust the "**Protocol**" using the left and right directions, of the joystick, to set the protocol to "**VISCA**"
4. Using the joystick navigate down to "**Baud rate**" and use the left and right directions to set the "**Baud rate**" to "**9600**"
5. Once completed click the "ESC" button to return one menu level

ii. The blinking cursor is now over a new number that should read "**002**" for the address (This is for our secondary camera "Camera 2")

1. Press "**Enter**" and you will be able to adjust the "**Protocol**" and "**Baud rate**" as we did in steps **7) d) i) 3) – 7) d) i) 5)** for "**Camera 2**"
2. Once completed hit the "ESC" button until you are returned to the main screen

e. There should now be complete control over "Camera 1" and "Camera 2" from the PTZ joystick controller.

8. Now we will examine bringing audio into the production PC

a. From the existing audio mixing board identify an available audio output

b. If you look at this affordable Mackie Mixer as an example, it has two (2) sets of connectors labeled as "MAIN OUT," dual ¼" connectors on the top right and dual XLR connectors on the rear of the unit.

i. Each set has two (2) connectors because the mixing board is providing a balanced stereo connection with one connector serving the left channel and the other serving the right channel.

ii. Depending on your specific mixing board you may only have XLR or ¼" connections available for connection to the production PC

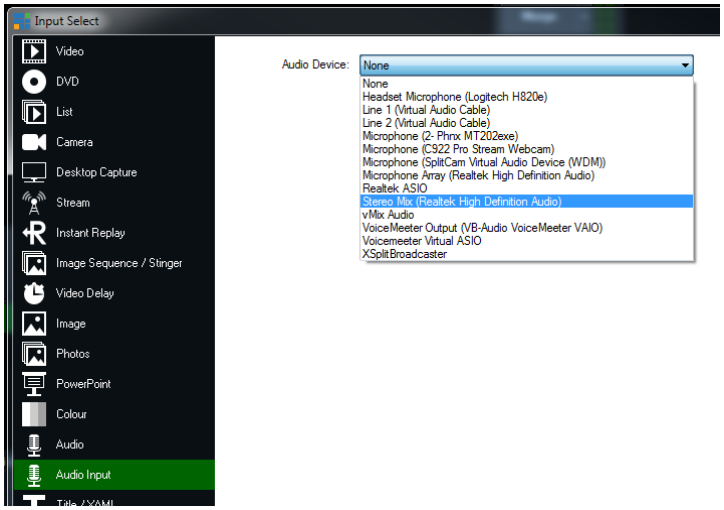
iii. If there is someone who regularly operates the audio mixing board it is worthwhile to ask them about an available output to connect to the input on the production PC.

c. Connect an available output from the audio mixing board to an available input, typically 3.5mm, on the production PC. Use an adaptor if necessary to bring both channels into the single 3.5mm plug.

d. In VMix click on the “Add Input” button and select “Audio Input”

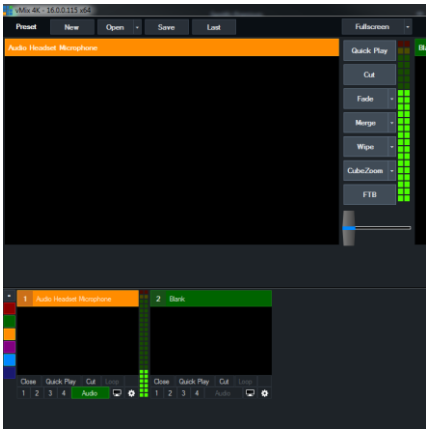
i. From the available drop-down list select the audio input device, on the production PC, that has the audio mixing output brought in.

ii. A lot of PCs utilize a Realtek Audio solution, but note that may not be the case for your specific PC, as we are showing in the image below



iii. Click the “OK” button

e. We now have audio brought into VMix from the mixing board, as can be seen by the VU Level meters showing incoming audio



9. As another quick review, we have so-far gained control over the cameras using the hardwired RS-232 PTZ joystick controller, we have live video feeds from each camera in VMix and finally we have audio from the audio mixing board in VMix.

10. The next goal is setting up the cameras on the network for redundant control and video feeds. *(Please only follow the steps below if you have an available network and the cameras are able to be connected to the same network as the production PC)*

a. The PTZOptics cameras, per the previous instructions, are hopefully already connected to the same network as your production PC.
b. To access the cameras, we will need to assign each of the cameras a static IP address, if you have someone who manages the network this is a good time to request a static IP for each camera in your system.
c. The easiest way to set the static IPs for each camera is using the "IP Address Setting Tool" available for download from the PTZOptics.com website. Detailed instructions on how to use the tool can be found in our Knowledge Base or by clicking the following link "How do I setup the network stream of my PTZOptics?"
    i. If for some reason the "IP Address Setting Tool" is unable to locate your cameras on the network, please follow these instructions to manually update the IP addresses of the PTZOptics cameras – "How do I connect the Camera to my computer or Network?"
    ii. If you are using a Macintosh computer, please follow these instructions for manually updating the IP addresses of the cameras – "Is there an IP Address Setting Tool for Mac?"
d. If you run into any issues, please feel free to put in a support request on PTZOptics.com

11. The cameras are now accessible via your network using a web browser, such as the Firefox browser (recommended due to the best feature compatibilities).
    a. Enter the static IP address assigned to each camera into a separate browser window or tab to see the control and setup pages built directly into the camera.
    b. Via the web interface you have camera control available but controlling via two (2) separate interfaces can get messy very quickly so we will look at setting up "ONVIF Device Manager" to make this easier.
        i. With the browser windows / tabs still open navigate the web interface of each camera to the "Network" section
        ii. Scroll down to the section titled "ONVIF Settings"
            1. Set "**ONVIF**" radio button to "**On**"
            2. Set "**ONVIF Auth**" radio button to "**Off**"
            3. Click the "**Apply**" button
            4. To ensure all settings have committed click on the "**System**" section
                a. Click the "**Reboot**" button
                b. Wait for camera to finish the reboot / calibration cycle
            5. Make sure to do this for ALL PTZOptics cameras on the network
        iii. Launch the "ONVIF Device Manager" application
            1. In the top left enter the following credentials
                a. Name – "admin"
                b. Password – "admin"
            2. Click the "**Log in**" button
            3. You should now see both of your cameras available for control and live viewing via one simple interface that provides a backup to the hardwired RS-232 PTZ joystick controller.
12. To setup redundancy for the video feeds we will bring an RTSP video stream from each camera into VMix now that they are operating properly on the network

a. In VMix click on the “Add Input” button and select “Stream”
    i. From the drop down menu select “**RTSP over UDP**”
    ii. In the “**URL**” field enter the following string, replacing <ip address> with the static IP address from each camera, “**rtsp://<ip address>:554/1**” as an example if my camera has a static IP address of “192.168.100.88” I would use “rtsp://192.168.100.88:554/1”
    iii. Click the “**OK**” button
        1. Repeat these steps for each PTZOptics camera that has a static IP address on your network
b. You should now be seeing live video from the cameras setup for RTSP streaming to VMix via your network
c. This is just a redundant video feed from the cameras. In the event your direct SDI signal is lost, you can minimize downtime by switching to the IP video feeds and adjusting the audio delay in VMix to match the new video feeds.

13. As a quick review, we now have the live video from two (2) cameras in VMix on the production PC via a direct SDI to frame grabber connection as well as a backup RTSP / IP feed from each camera. We also have control of the cameras via the hardwired RS-232 PTZ joystick as well as redundant control via IP using “ONVIF Device Manager.” Finally, we have the audio output from the audio mixing board connected to the production PC and pulled into VMix as an audio input. From a system setup standpoint, this is everything needed to accomplish a live show.
14. Now we will focus on setting up VMix to stream live to a service such as YouTube Live and enable local recording of the content *(Note that the production PC MUST have live access to the public internet for live streaming)*
    a. For “**YouTube Live**” log in to a valid Google / YouTube account on the YouTube website
        i. Once fully logged in go to “**My Channel**” on the left side of the page
        ii. Click on “**Video Manager**” near the top in the middle of the page
        iii. Select “**Live Streaming**” to collect two (2) pieces of information necessary for a live stream to YouTube
            1. Your streaming tab should show a “**Server URL**”. Save this address for later use.
            2. Your streaming tab should also show a “**Stream Name / Key**”
                a. Click on the “**Reveal**” button next to the “**Stream Name / Key**”
                b. Copy the “**Stream Name / Key**” before it is hidden again
    b. Open VMix and click on the “**gear**” icon next to the “Stream” button near the bottom of the application window to bring up the Streaming Setup window.
        i. Select “**YouTube Live**” as your “**Destination**”
            1. If “YouTube Live” is not available, select “**Custom RTMP Server**”
            2. In the URL enter the URL identified from the YouTube page from step **14) a) 1)**
        ii. Paste the “**Stream Name / Key**” copied above from the YouTube website into the “**Stream Name or Key**” field
        iii. For “**Input Size**” select the resolution you want your content streamed to YouTube Live in, we highly recommend **1280x720** for a reliable but high quality streaming experience.

iv. For "**Frame Rate**" this would be the refresh rate you want sent to YouTube Live. We recommend using **30** for a reliable but high quality streaming experience.
v. Click the "**Save and Close**" button

c. Click the "**Stream**" button at the bottom of the VMix application window to initiate the live RTMP stream to YouTube Live from your production PC.
d. Navigate back to your YouTube page and you should see the stream status change from "**Offline**" to "**Live**" and a delayed, approximately 20 – 60 seconds, video preview should present itself.
e. To share the live stream with other people, copy and share the link provided in the bottom right of the YouTube Live via e-mail, messengers or social media.
f. To turn the Live Stream "Off" click the "**Stream**" button again, located at the bottom of the VMix application window.

15. To setup a local recording using VMix click the "**gear**" icon next to the "**Record**" button to bring up the Recording Setup window
    a. Please set the characteristics of the recording as needed for resolution, frame rate, encoding format as well as the file destination.
    b. Click the "**OK**" button
    c. To begin recording simply click the "Record" button and to stop recording click the "Record" button again
16. That is a complete overview of setting up and configuring a two (2) camera production system using PTZOptics cameras and accessories. We hope that you find this document helpful and informative but if you have any additional questions, please feel free to submit a support request via the PTZOptics.com website with your questions.