



SightLine

APPLICATIONS

EAN-USB Cameras

PN: EAN-USB-Cameras

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The following notifications are used throughout the document to help identify important safety and setup information to the user:

 **CAUTION:** Alerts to a potential hazard that may result in personal injury, or an unsafe practice that causes damage to the equipment if not avoided.

 **IMPORTANT:** Identifies crucial information that is important to setup and configuration procedures.

 *Used to emphasize points or reminds the user of something. Supplementary information that aids in the use or understanding of the equipment or subject that is not critical to system use.*



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1 Overview

This document describes how to configure the 4000-OEM to receive video from USB Video Class Cameras (UVC) and USB3 Vision cameras.

 *Before configuring the camera, it is important to know the type of USB camera you are using. Check the camera specification supplied by the manufacturer to determine the camera type.*

This document covers the following topics:

- Determining supported camera resolutions, formats and frame rates.
- Configuring basic acquisition settings.
- Example settings from supported cameras.
- Troubleshooting tips and additional support.
- USB3 max supported data rates.

1.1 Associated Documents

[EAN-Camera Compatibility](#): Lists third-party cameras that are currently supported by SightLine software. Lists camera adapter board kits for the SightLine OEM video processing boards.

[EAN-Digital Video Configuration](#): Describes how to configure the SightLine hardware for digital video input.

[EAN-Ethernet-and-Serial-Communication](#): Describes how to set up serial communications for cameras or other payload devices from SightLine hardware.


[Interface Command and Control \(IDD\)](#): Describes the native communications protocol used by the SightLine Applications product line. The IDD is also available as a PDF download on the [Software Download](#) page.

[Panel Plus User Guide](#): A complete overview of settings and dialog windows located in the Help menu of the Panel Plus application.

Additional support documentation EANs can be found on the Documentation pages of the SightLine Applications [website](#).

1.2 SightLine Software Requirements

The 4000-OEM requires firmware 3.00.xx and higher.

 **IMPORTANT:** The Panel Plus software version should match the firmware version running on the board. Firmware and Panel Plus software versions are available on the [Software Download](#) page.

1.3 Third Party Software

[Tera Term](#) (recommended) or [PuTTY](#): Terminal emulator programs used for debug output, or to issue commands on SLA hardware.

[Aravis Project](#): Used in conjunction with Tera Term for USB3 Vision cameras.

Additional information and links to third party software can be found on the SightLine [website](#).



2 4000-OEM USB Camera Bench Setup

USB adapters:

- USB C to USB 3.0 Adapter: Connects the USB-C port on the 4000-OEM to the USB 3.0 cable.

Cable connections:

- USB cable (camera specific): Connects to J8 on the 4000-OEM interface board and the USB camera.
- SLA-CAB-0403: Connects to J4 on 4000-OEM board. Provides an RJ45 Ethernet connection.
- SLA-CAB-1504 / SLA-PWR-B12V-36W: Connects to J50 on the 4000-OEM board and AC power source.

Power and network connectivity LEDs:

A green light (D1) on the 4000-OEM board indicates that all boards are powered on. An amber light (D5) verifies network connection.

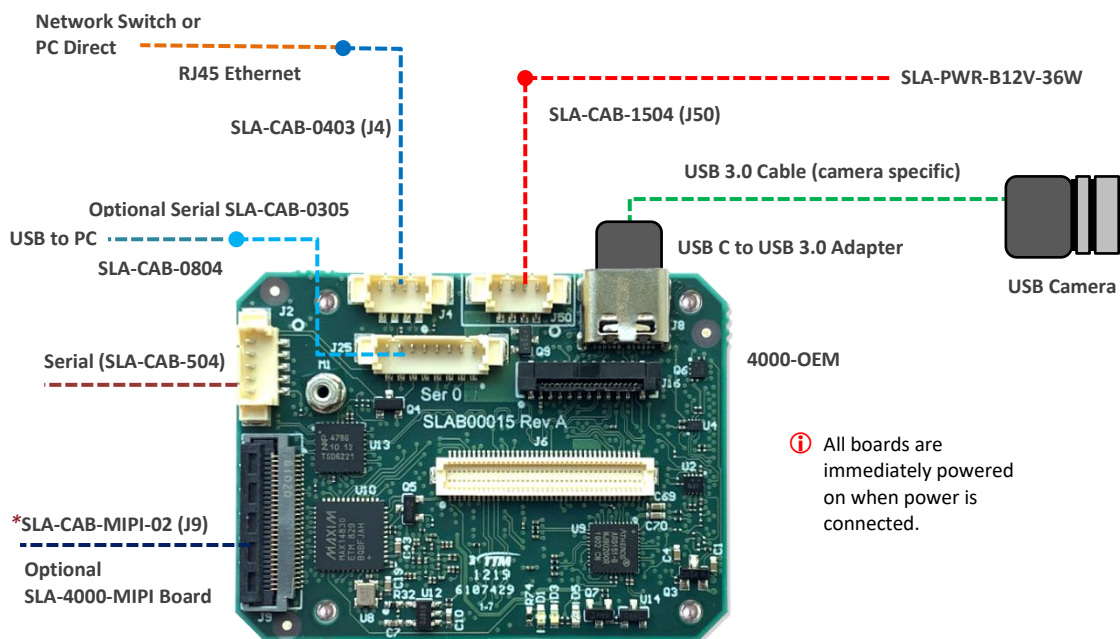


Figure 1: 4000-OEM HDMI Camera Bench Setup

*SLA-CAB-MIPI-02 is an FFC cable and must be oriented and connected correctly. See [FFC cable](#) instructions and precautions before connecting the SLA-4000-MIPI board.

Additional non-USB cameras can be connected to the 4000-OEM on J6 and using the SLA-4000-MIPI board on J9. See the [ICD-3000-4000 Adapter Boards](#) for more information.

ⓘ IMPORTANT: To connect the 640 USB Boson camera to the 4000-OEM use the [RHP-BOSON](#) interface module from RHP International. See Appendix A in [EAN-FLIR-Cameras](#) document for more information.



3 Configuration Settings

This section covers the basic camera configuration settings in Panel Plus for the SightLine OEM video processing boards.

Before connecting with the Panel Plus software, the OEM board should be powered up and connected through:

- a network switch or directly to the host PC (preferred) or,
- Direct serial connection (for troubleshooting or if a network connection cannot be established).

See the [EAN-Startup Guide 4000-OEM](#) for connection and video streaming instructions:

ⓘ IMPORTANT: This procedure makes the assumption that the customer has read the OEM startup guide(s) and has a basic understanding of the following fundamentals:

- Completed a functional connection between the SightLine video processing board and Panel Plus application
- Familiar with Panel Plus controls
- Successfully streamed video in Panel Plus

If you ***do not*** have a strong basic system setup and familiarity, we recommend reviewing the OEM startup guide(s) and work with our support team to establish basic connection and streaming fundamentals.

3.1 Acquisition Settings

From the main menu in Panel Plus go to *Configure » Acquisition Settings*.

If available, use the *Auto Fill* drop down menu in the *Acquisition Settings* dialog to automatically populate the relevant fields with the correct settings. The settings can also be manually entered as shown in [Table 1](#) and [Table 2](#).

ⓘ IMPROTANT: If the camera is not available in Panel Plus *Auto Fill* see the [Camera Discovery](#) section to verify and modify camera resolutions, formats and frame rates that are available for a selected camera.

For information about Acquisition fields in Panel Plus see [EAN-Digital Video Configuration](#).

Save parameters and reset the board when changing parameters. Cycle system power when changing resolution.

If video does not display, try saving and activating the settings again. Check the encoding settings on the Compression tab and review the network addresses for the destination video.



Table 1: 4000-OEM Panel Plus Basic Acquisition Settings - USB UVC Cameras

USB Cameras	Camera Index = 2	Camera Type = USB Webcam										
Acquisition Settings	Auto Fill	Height	Width	VFP	HFP	Bits	Input	Invert VSync	Invert HSync	Sync/Crop	Init Code	Flags
USB Webcam 720p	USB Webcam 720p	720	1280	0	0	8	YUV	None	None	None	None	0x1
USB Webcam 1080p	USB Webcam 1080p	1080	1920	0	0	8	YUV	None	None	None	None	0x1
<i>Configuration notes: Requires software version 3.01.xx and above. Use Cam 2.</i>												
e-con Systems												
See3Cam_CU30	USB Webcam 1080p	1080	1920	0	0	8	YUV	None	None	None	None	0x1
	USB Webcam 1080p	1536	1920	0	0	8	YUV	None	None	None	None	0x1
<i>Configuration notes: Requires software version 3.00.04 and above. 1080@30, 1536x2304@24, 1080in/720out@59</i>												
ELP												
SUSB1080P01-LC1100	No	1080	1920	0	0	8	YUV	None	None	None	None	0x1
<i>Configuration notes: Requires software version 3.00.06 and above. Use Cam 2. Enter flag <fmt=YUYV,fps=60> in the Options field.</i>												
FLIR												
Boson 640 USB	FLIR Boson 640 USB	512	640	0	0	16	Gray	None	None	None	None	0x0
<i>Configuration notes: Requires software version 3.00.04 and above. Enter flag <fmt=G16> in the Options field. Requires the RHP-BOSON interface module see Appendix A in the EAN-FLIR document.</i>												
Kayeton												
KYT-U200-SL01MCSF	USB Webcam 1080p	1080	1920	0	0	8	YUV	None	None	None	None	0x1
<i>Configuration notes: Requires software version 3.01.xx and above. Use Cam 2.</i>												
Logitech												
C615	USB Webcam 720p	720	1280	0	0	8	YUV	None	None	None	None	0x1
C920	USB Webcam 1080p	1080	1920	0	0	8	YUV	None	None	None	None	0x1
<i>Configuration notes: Requires software version 3.00.04 and above. Use Cam 2.</i>												

Table 2: 4000-OEM Panel Plus Basic Acquisition Settings - USB3 Vision Cameras

USB3 Vision	Camera Index = 2	Camera Type = USB3 Vision										
Acquisition Settings	Auto Fill	Height	Width	VFP	HFP	Bits	Input	Invert VSync	Invert HSync	Sync/Crop	Init Code	Flags
FLIR												
Blackfly S USB3	USB3V FLIR BFS-U3-120S4C	3040	4064	0	0	8	Bayer	None	None	None	None	0x3
<i>Configuration notes: USB3 Vision camera. Requires software version 3.00.04 and above. ROI recommended.</i>												
Smartek Vision												
UCC4113C	USB3V Smartek UCC4113C	3008	4112	0	0	8	Bayer	None	None	None	None	0x3
<i>Configuration notes: USB3 Vision camera. Requires software version 3.00.04 and above. ROI recommended.</i>												

3.1.1 Optional Supported Formats - USB UVC Cameras

For optional supported formats see message ID 0x37 in the [IDD](#).

In the *Acquisition Settings Options* field, enter the format options in lower case. Use comma separated values, e.g., `fmt=yuyv,fps=30`.

Make sure the selected values are in the formats shown after completing the steps shown in the [List Available Formats](#) section.

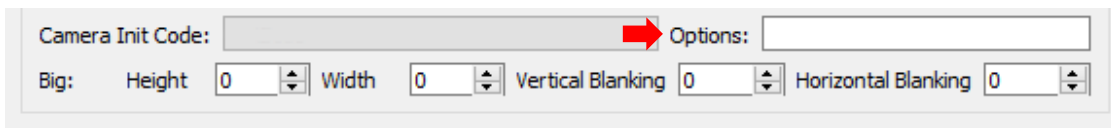


Figure 2: Optional Formats



4 Camera Discovery

This section describes how to determine, camera resolutions, formats and frame rates that are available for USB Video Class Cameras (UVC) and USB3 Vision cameras that are not preconfigured in Panel Plus *Auto Fill*.

IMPORTANT: These steps should be done before configuring the camera through Panel Plus or the discovery commands will fail.

Use [Tera Term](#) (recommended) or another SSH client to connect to the OEM board.

Use [Aravis Project](#) in conjunction with Tera Term for USB3 Vision cameras.

4.1 USB UVC Cameras

1. Establish an SSH session to the OEM hardware with Tera Term. There can be multiple media devices enabled. The default is `/dev/media0`.
2. Discover camera and device node name:

- a. From the `root@sla-alip:~#` prompt type:
`media-ctl -p`
 Tera Term displays the device node name and camera name.

The device node name can change between power cycles.

```
Media device information
-----
driver          uvcvideo
model           HD Pro Webcam C920
serial          8EBCEE4F
bus info        1
hw revision     0x11
driver version  4.14.90
Device topology
- entity 1: HD Pro Webcam C920 (1 pad,1 link)
  type Node subtype V4L flags 1
  device node name/dev/video8
  pad0: Sink
    <- "Processing 3":1 [ENABLED,IMMUTABLE]
```

If the above command does not show the connected USB camera type:

```
media-ctl -p -d /dev/mediaX (mediaX is media1 or media2)
```

- b. An alternate option to find the device node name:
 From the `root@sla-alip:~#` prompt type:
`v4l2-ctl --list-devices`

```
Qualcomm Camera Subsystem (platform:a34000.camss):
/dev/video0
/dev/video1
/dev/video2
/dev/video3
/dev/video4
/dev/video5
/dev/video6
/dev/video7
Qualcomm Venus video decoder (platform:qcom-venus):
/dev/video9
/dev/video10
HD Pro Webcam C920 (usb-xhci-hcd.1.auto-1.4):
/dev/video8
```




3. List available formats.

From the root@sla-alip:~# prompt type:

```
v4l2-ctl --list-formats-ext -d /dev/video8
```

The resultant listing will show video format, resolution, and FPS support.

```
ioctl: VIDIOC_ENUM_FMT
Type: Video Capture
[0]: 'YUYV' (YUYV 4:2:2) ←

Size: Discrete 640x480
Interval: Discrete 0.033s (30.000 fps) ←
Interval: Discrete 0.042s (24.000 fps)
Interval: Discrete 0.050s (20.000 fps)
Interval: Discrete 0.067s (15.000 fps)
Interval: Discrete 0.100s (10.000 fps)
Interval: Discrete 0.133s (7.500 fps)
Interval: Discrete 0.200s (5.000 fps)
Size: Discrete 160x90
Interval: Discrete 0.033s (30.000 fps)
Interval: Discrete 0.042s (24.000 fps)
Interval: Discrete 0.050s (20.000 fps)
Interval: Discrete 0.067s (15.000 fps)
Interval: Discrete 0.100s (10.000 fps)
Interval: Discrete 0.133s (7.500 fps)
Interval: Discrete 0.200s (5.000 fps)
```

4. Show current format:

From the root@sla-alip:~# prompt type:

```
v4l2-ctl --all -d /dev/video8
```

```
Priority: 2
Video input : 0 (Camera 1: ok)
Format Video Capture:
Width/Height      : 1920/1080 ←
Pixel Format       : 'YUYV' (YUYV 4:2:2) ←
Field              : None
Bytes per Line    : 3840
Size Image        : 4147200
Colorspace        : sRGB
Transfer Function  : Default (maps to sRGB)
YCbCr/HSV Encoding: Default (maps to ITU-R 601)
Quantization      : Default (maps to Limited Range)
Flags              :
Crop Capability Video Capture:
Bounds            : Left 0, Top 0, Width 1920, Height 1080
Default           : Left 0, Top 0, Width 1920, Height 1080
Pixel Aspect: 1/1
Selection: crop_default, Left 0, Top 0, Width 1920, Height 1080, Flags:
Selection: crop_bounds, Left 0, Top 0, Width 1920, Height 1080, Flags:
Streaming Parameters Video Capture:
Capabilities       : timeperframe
Frames per second : 5.000 (5/1) ←
Read buffers       : 0
```



4.2 USB3 Vision Cameras

Use [Aravis Project](#) in conjunction with Tera Term for USB3 Vision cameras.

1. Establish an SSH session to the OEM hardware with Tera Term.
2. Discover camera:

From the SD> prompt type:

```
arv-tool-0.6
```

Tera Term displays the device name. In this example the device manufacturer and the device serial number

```
SD> arv-tool-0.6
FLIR-0119E709 <USB3>

!slroot @ ~
SD> █
```

If the above command does not show the connected camera type continue to the next section.

4.2.1 Alternative Camera Discover Method

1. From the SD> prompt type:

```
lsusb
```

Find the device and bus number of your device. In this example it is *Bus 002* and *Device 002*.

```
SD> lsusb
Bus 002 Device 002: ID 1e10:4000 Point Grey Research, Inc.
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

2. From the SD> prompt type:

```
lsusb -D
/dev/bus/usb/<<bus
#>>/<<device #>>
```

Find the value for idVendor. In this example it is *0x1e10*.

```
SD> lsusb -D /dev/bus/usb/002/002
Device: ID 1e10:4000 Point Grey Research, Inc.
Device Descriptor:
  bLength                18
  bDescriptorType        1
  bcdUSB                  3.10
  bDeviceClass            239 Miscellaneous Device
  bDeviceSubClass         2
  bDeviceProtocol         1 Interface Association
  bMaxPacketSize0         9
  idVendor                0x1e10 Point Grey Research, Inc.
  idProduct               0x4000
  bcdDevice                0.00
  iManufacturer          1 FLIR
  iProduct                2 Blackfly S BFS-U3-120S4C
  iSerial                 3 0119E709
```

3. Add the following lines to this file: `/etc/udev/rules.d/aravis.rules`

```
SUBSYSTEM=="usb", ATTRS {idVendor}=="<<idVendor from lsusb>>",
MODE=="0666", TAG+="uaccess", TAG+="udev-acl"
```

```
# Point Grey Research
SUBSYSTEM=="usb", ATTRS{idVendor}=="1e10", MODE=="0666", TAG+="uaccess", TAG+="udev-acl"
```

4. From the main menu in Panel Plus » *Parameters* » *Save to Board*.
5. Main menu » *Reset* » *Board*.
6. To verify that the device is enabled, from the SD> prompt type:

```
arv-tool-0.6
```



5 USB3 Vision Camera Passthrough Options

This section describes how to control advanced camera features, and requires SightLine software version 3.01.xx.

This process should be completed before configuring the camera through Panel Plus or the commands to `arv-tool-0.6` will fail.

1. Establish an SSH session to the OEM hardware with Tera Term.
2. Query the device for a list of all the available features and their settings type. From the SD> prompt type:

```
arv-tool-0.6 features
```

or

```
arv-tool-0.6 description
```

```
SD> arv-tool-0.6 features
FLIR-0119E709 (USB3)
Category: 'Root'
  Category: 'AcquisitionControl'
    Enumeration: 'AcquisitionMode'
      EnumEntry: 'MultiFrame'
      EnumEntry: 'SingleFrame'
      EnumEntry: 'Continuous'
    Command: 'AcquisitionStart'
    Command: 'AcquisitionStop'
    Integer: 'AcquisitionFrameCount'
    Integer: 'AcquisitionBurstFrameCount'
    Enumeration: 'ExposureMode'
      EnumEntry: 'TriggerWidth'
      EnumEntry: 'Timed'
    Float: 'ExposureTime'
    Enumeration: 'ExposureAuto'
      EnumEntry: 'Continuous'
      EnumEntry: 'Once'
      EnumEntry: 'Off'
    Float: 'AcquisitionFrameRate'
```

Available features can be accessed when the camera is connected to VT through the FIP command **SetUsb3VisionFeature (0xA6)**. This command assumes a camera index, which must be set to the index that the USB3 Vision camera is configured.

Enumeration types are accessed with the string type by passing the label of the requested enumeration entry in the *Value* field. Integer and float types are passed in as strings. Values that do not parse to valid floats or integers are set to 0.

For Boolean types the first character of the value string is checked. If the character is 0 the feature is set to false, if it set to 1 it is true. Send this message in Panel Plus. From the main menu *File » USB3 Vision Passthrough*.

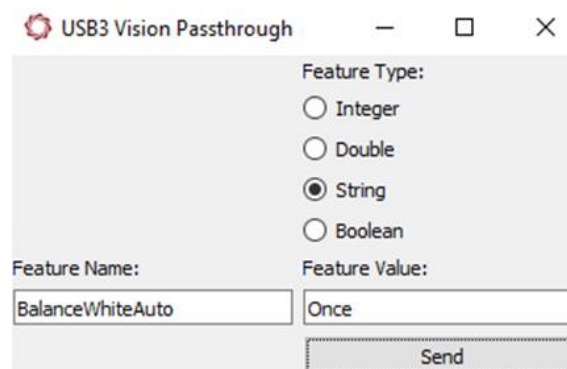


Figure 3: USB3 Vision Passthrough Dialog

Changing features that affect the frame size received from the camera will break the connection between VT and the camera. Set up frame size using Acquisition Settings in Panel Plus.

Changing features that affect framerate, e.g., ExposureTime, etc., may impact performance.



5.1 Configuration Example: ELP-SUSB1080P01-LC1100 Camera

This example describes how to determine camera resolutions, frame rates and resolutions for the ELP-SUSB1080P01-LC1100 USB webcam.

1. Establish an SSH session to the OEM hardware with Tera Term.
2. Verify the camera is operating correctly using the Windows camera app.

Connect the camera to a desktop running Windows, run the camera app. If video is being displayed the camera is working.

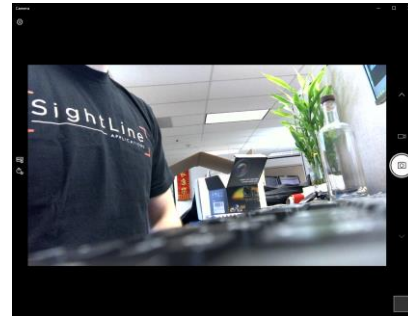


Figure 4: Video in Windows Camera App

3. Verify the camera is detected and properly connected to the 4000-OEM. Since the USB port on the 4000-OEM is a USB-C, a USB 3.0 to USB-C adaptor is required to connect the camera to the board.
4. Apply power to the board.
5. Use Tera Term to establish an SSH session to the OEM board.
6. From the root@sla-alip:~# prompt type:

```
lsusb
```

```
Bus 002 Device 004: ID 15aa:1555 Gearway Electronics (Dong Guan) Co., Ltd.
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

This step verifies that the device is connected and detected. The camera is on the same bus as the USB 3.0 root hub. This enables the camera to reach USB 3.0 speeds.

7. Find the camera and device node name shown in [USB UVC Cameras](#) section.

The camera is available on /dev/video8.

```
Media controller API version 4.14.90

Media device information
-----
driver          uvcvideo
model           3.0 USB Camera: 3.0 USB Camera
serial
bus info       1
hw revision    0x1002
driver version 4.14.90

Device topology
- entity 1: 3.0 USB Camera: 3.0 USB Camera (1 pad, 1 link)
  type Node subtype V4L flags 1
  device node name /dev/video8
  pad0: Sink
    <- "Extension 4":1 [ENABLED,IMMUTABLE]
```

Figure 5: Camera and Device Node Name



8. Follow the steps in [USB UVC Cameras](#) section to list available formats for this device.

This camera supports MJPEG and YUYV output formats, at 1920x1080, 1280x720, and 640x480 shown in [Figure 6](#). While the list suggests a maximum framerate of 60fps, the manufacturer advertises the camera as reaching a framerate of 50fps. In this example 50fps will be the frame rate target.

```
ioctl: VIDIOC_ENUM_FMT
      Type: Video Capture
      [0]: 'MJPG' (Motion-JPEG, compressed)
          Size: Discrete 1920x1080
              Interval: Discrete 0.017s (60.000 fps)
          Size: Discrete 1280x720
              Interval: Discrete 0.017s (60.000 fps)
          Size: Discrete 640x480
              Interval: Discrete 0.017s (60.000 fps)
      [1]: 'YUYV' (YUYV 4:2:2)
          Size: Discrete 1920x1080
              Interval: Discrete 0.017s (60.000 fps)
          Size: Discrete 1280x720
              Interval: Discrete 0.017s (60.000 fps)
          Size: Discrete 640x480
              Interval: Discrete 0.017s (60.000 fps)
```

Figure 6: Available Formats

9. Configure *Acquisition Settings* through Panel Plus as shown in [Table 1](#) for the ELP-SUSB1080P01-LC1100 camera:
 - a. Set *Camera Index* to *Cam 2*.
 - b. Set *Camera Type* to *USB Webcam*.
 - c. Set *Auto Fill* to *USB Webcam 1080P*.
 - d. Click *Apply*.
 - e. From the main menu in Panel Plus » *Parameters* » *Save to Board*.
 - f. Main menu » *Reset* » *Board*.
 - g. From the *Connect* tab reconnect to the board. Select *Video Output* » *Cam 2*.
 - h. Click *Stream Network Video to This PC* to see output video.
10. Check the frame rate at the bottom of the Panel Plus window. In this configuration the frame rate only reaches ~20fps.

➔ Commanded Camera: 2
 Frame Rate: 22.86[frames/sec]. Data rate: 5667.38[Kb/sec]

11. Test available output formats for increasing the frame rate.

In the *Acquisition Settings* dialog add a format specifier to the *Options* field. For more info on this field see [SetAcquisitionParameters](#) in the IDD. In this example the MPEG output is tested.

- a. In the *Options* field type the options string: *fmt=MJPEG*.
- b. Click *Apply*.
- c. Main menu » *Parameters* » *Save to Board*.
- d. Main menu » *Reset* » *Board*.



12. Check the frame rate at the bottom of the Panel Plus window. In this configuration the frame rate only reaches ~20fps.

→ Commanded Camera: 2
Frame Rate: 20.05[frames/sec]. Data rate: 5368.76[Kb/sec]

13. Repeat the above steps and use the option string *fmt=YUYV* to test the YUYV format. Check the frame rate at the bottom of the Panel Plus window. In this configuration the frame rate reaches ~50fps.

→ Commanded Camera: 2
Frame Rate: 48.38[frames/sec]. Data rate: 5714.73[Kb/sec]

6 Troubleshooting

Check device is connected and enumerated.

1. Apply power to the board.
2. Use Tera Term to establish an SSH session to the OEM board.
3. From the `root@sla-alip:~#` prompt type:

`Lsusb`

```
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 002: ID 044d:072d HD Pro Webcam (Camera is detected)
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```

No Video, video quality is bad, video artifacts.

Connect the camera to a Windows desktop and test the camera using the Windows camera app. If any issues exist when the camera is connected to a Windows desktop and 4000-OEM, the issue is likely the camera.

Check multiple input modes.

If the camera supports multiple output formats, it can be valuable to test all available formats for changes in performance and video quality. Follow the steps in [USB UVC Cameras](#) section to list available formats for this device.

Check supported USB version of cables.

Verify that any cables or adaptors used to connect the camera to the 4000-OEM support the necessary USB version for your camera. If an adaptor or hub that only supports USB 2.0 is used with a USB 3.0 camera, the camera will likely not reach full framerate. You can verify that the USB 3.0 camera can reach USB 3.0 speeds by ensuring the camera is on the same bus as the USB 3.0 root hub.

1. Apply power to the board.
2. Use Tera Term to establish an SSH session to the OEM board.
3. From the `root@sla-alip:~#` prompt type:

`lsusb`

```
Bus 002 Device 004: ID 155a:1515 HD Pro Webcam
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
```



6.1 Questions and Additional Support

For questions and additional support, please contact [Technical Support](#). Additional support documentation and Engineering Application Notes (EANs) can be found on the Support pages of the SightLine Applications [website](#).

Appendix - USB Max Supported Data Rates

The USB 3.0 Superspeed port on the 4000-OEM supports USB 3.1 Gen 1.

USB Speed Comparison and Driver Benchmark rates can be found at [Everything USB](#).

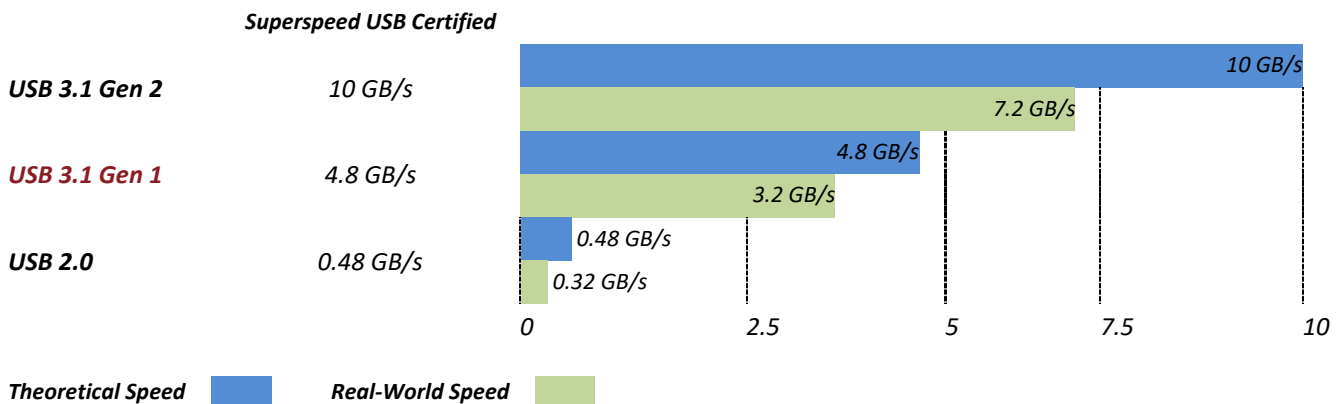


Figure A1: USB 3.1 Speed Comparison and Drive Benchmark