

Achieving Maximum Frame Rate with GS3-U3

Technical Application Note TAN2013010

Revised August 23, 2013

1.1 Subject

Technical Application Note (TAN2013010): Achieving Maximum Frame Rate with GS3-U3

1.2 Applicable Product(s)

- Grasshopper3 USB 3.0, specifically:
 - GS3-U3-41C6

1.3 Application Note Description

This application note describes the configuration and settings needed to achieve the maximum potential from Point Grey USB 3.0 cameras. The capabilities of Point Grey USB 3.0 cameras, and in particular the GS3-U3, push the boundaries of USB 3.0 technology and thus may require extra consideration with respect to system configuration.

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1.4 Preparing for Use

Before you use your Point Grey USB 3.0 camera, we recommend that you are aware of the following resources:

Getting Started Manual for the camera—provides information on installing components and software needed to run the camera. The Getting Started manuals can be downloaded from the [Point Grey Website](#).

Technical Reference for the camera—provides information on the camera's specifications, features and operations, as well as imaging and acquisition controls. The technical references can be downloaded from the [Point Grey Downloads](#) page.

FlyCapture2 SDK—contains utilities to configure the camera such as Driver Control GUI, update firmware and drivers, and check setup. As well, contains the FlyCapture2 API for use in creating your own applications. FlyCapture2 can be downloaded from the [Point Grey Downloads](#) page.

Firmware updates—ensure you are using to most up-to-date firmware for the camera to take advantage of improvements and fixes. The latest firmware can be downloaded from the [Point Grey Downloads](#) page.

Knowledge Base Articles—provide additional information on the setup and function of the camera.

[Knowledge Base Article 368](#): Recommended System Components for USB 3.0 Cameras

[Knowledge Base Article 389](#): Setting up Multiple USB 3.0 Cameras

[Knowledge Base Article 405](#): How can I power my Point Grey USB 3.0 camera?

1.5 System Components and Configuration

For detailed information on system components for Point Grey USB 3.0 cameras, see [Knowledge Base Article 368](#).

To optimally support the Grasshopper3, recommended system components are:

Component	Description
CPU	Intel(R) Core(TM) i7-2600K or equivalent
RAM	4 GB
Host Adapter	Renesas Electronics μ PD720202 (Part Number ACC-01-1201 sold by Point Grey)
Cabling	3 meter (Part Number ACC-01-2300 sold by Point Grey)
Operating System	Windows 7 SP1 x86
Driver	PGRxHCI 2.3.3.54 or later
Software	FlyCapture 2.5.2.3 or later
Firmware	v1.10.3.0 or later



We recommend using the latest versions of the driver, FlyCapture SDK, and camera firmware.

When configuring your USB 3.0 camera, recommended best practices are:

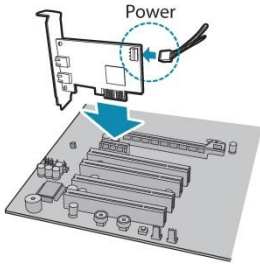
- Minimize or avoid asynchronous calls to the camera while streaming
- Dedicate sufficient CPU resources for image acquisition
- Limit one camera per USB 3.0 controller

1.6 Supplying Power

Generally speaking USB 3.0 cameras draw adequate power through the USB 3.0 interface. However, the Grasshopper3 power consumption is higher than the Flea3-U3 due to its large format sensors and bigger FPGA. The power consumption can therefore reach as high as 4.5 W; the upper limit of USB 3.0 power supply. This may be too much for some laptops to supply.

To troubleshoot power issues:

- Ensure that your interface card is connected to the computer's power supply.



- Or, connect the camera via a powered USB hub.
- Or, use an external GPIO power source. Laptop users in particular are encouraged to purchase a GPIO power supply for the GS3-U3. ([Part Number ACC-01-9009](#) sold by Point Grey)

1.7 Frame Rate Values in FlyCap2

The FlyCap2 program main window reports four frame rate values for the camera. The variance in these rates is affected by the memory and resources available to process images from the camera.

- **Requested**—the target frame rate for the camera to output to the PC
- **Received**—the frame rate that has arrived at the PC and is in memory
- **Processed**—the frame rate passed to FlyCapture and converted for display
- **Displayed**—the frame rate displayed on the screen by the FlyCap program

To view the frame rate information:

1. Open the FlyCap program.

Start→All Programs→Point Grey FlyCapture2 SDK→Point Grey FlyCap2

2. Select the camera and click OK. The main window opens.



1.8 Test Configuration

Point Grey tested the GS3-U3-41C6 using the following configuration.

1.8.1 System Components

Component	Description
CPU	Intel(R) Core(TM) i7-2600K
RAM	4 GB
Host Adapter	Renesas Electronics μ PD720202 (Part Number ACC-01-1201 sold by Point Grey)
Cabling	3 meter (Part Number ACC-01-2300 sold by Point Grey)
Operating System	Windows 7 SP1 x86
Driver	PGRxHCI 2.3.3.54
Software	FlyCapture 2.5.3.4
Firmware	v1.11.3.0

1.8.2 FlyCapture Settings

Camera Information

The screenshot displays the FlyCapture 2.5.3.4 software interface. The main window shows a live video feed of a camera. On the left, a sidebar contains a tree view with the following categories expanded:

- Frame rate**
 - Processed: 97.36 fps
 - Displayed: 106.14 fps
 - Requested: 90.00 fps
 - Received: 90.01 fps
- Timestamp**
 - Seconds: Wed Jul 10 15:27:29 2013
 - Microseconds: 22207
 - Camera timestamp seconds: 110
 - Camera timestamp count: 5439
 - Camera timestamp offset: 0905
- Image**
 - Width: 2048
 - Height: 2048
 - Pixel format: Raw 8
 - Bits per pixel: 8
- Embedded image information**
- Diagnostics**

At the bottom of the sidebar, a status bar shows "OK" and "Frame Rate (Proc/Disp/Req): 97.36".

The main window has a menu bar (File, View, Settings, Help) and a toolbar. A "Camera Information" dialog box is open, showing the following details:

- Camera Settings**
 - Standard Video Modes
 - Custom Video Modes
 - Camera Information** (selected)
 - Camera Registers
 - Trigger / Strobe
 - Advanced Camera Settings
- Camera Information**
 - Basic**
 - Serial Number: 13185974
 - Model: Grasshopper3 GS3-U3-41C6C
 - Vendor: Point Grey Research
 - Sensor: CMOSIS CMV4000 (1" 2048x2048 CMOS)
 - Resolution: 2048x2048
 - Interface: USB 3.0
 - Bus Speed: S5000
 - PCIe Bus Speed: 5.0 GT/s
 - IIDC Version: 1.32
 - Firmware Version: 1.11.3.0
 - Firmware Build Time: Fri Jul 12 19:47:17 2013
 - Driver: USB Host Controller Driver (PGRxHCI.sys) - 2.3.3.59
 - Advanced**
 - Time since initialization: 0h 21m 4s
 - Time since last bus reset: 0h 21m 4s
 - Transmit failures: 0
 - Pixel clock frequency: 384.00000 MHz
 - Horizontal line frequency: 186046.5 Hz

A "Copy to Clipboard" button is located below the Basic information section. A "Reset" button is located next to the Transmit failures value in the Advanced section.

Camera Settings

FlyCap2 2.5.3.4 - Point Grey Research Grasshopper3 GS3-U3-41C6C (13185974)

File View Settings Help

Camera Information

- Frame rate**
 - Processed: 88.54 fps
 - Displayed: 42.72 fps
 - Requested: 90.00 fps
 - Received: 90.01 fps
- Timestamp**
 - Seconds: Wed Jul 10 15:26:34 2013
 - Microseconds: 234911
 - Camera timestamp seconds: 55
 - Camera timestamp count: 7108
 - Camera timestamp offset: 0213
- Image**
 - Width: 2048
 - Height: 2048
 - Pixel format: Raw 8
 - Bits per pixel: 8
- Embedded image information**
- Diagnostics**

OK Frame Rate (Proc/Disp/Req): 88.54

Camera Settings

Standard Video Modes Custom Video Modes Camera Information Camera Registers Trigger / Strobe Advanced Camera Settings High Dynamic Range Look Up Table Frame Buffer Data Flash System Information Bus Topology Help / Support

Camera Settings

☒ Absolute Mode

Brightness: 0.879 %

Exposure: 1.070 EV

Sharpness: 1024

Hue: 0.000 deg

Saturation: 100.000 %

Gamma: 1.250

Iris: [Slider]

Focus: [Slider]

Zoom: [Slider]

Pan: [Slider]

Tilt: [Slider]

Shutter: 11.032 ms

Gain: 1.584 dB

FrameRate: 90.000 fps

W.B. (Red): 482

W.B. (Blue): 762

Power: ☒

Temperature: 318.9K / 45.75°C / 114.35°F

Custom Video Settings

FlyCap2 2.5.3.4 - Point Grey Research Grasshopper3 GS3-U3-41C6C (13185974)

File View Settings Help

Camera Information

- Frame rate**
 - Processed: 88.57 fps
 - Displayed: 90.48 fps
 - Requested: 90.00 fps
 - Received: 90.01 fps
- Timestamp**
 - Seconds: Wed Jul 10 15:25:54 2013
 - Microseconds: 517241
 - Camera timestamp seconds: 16
 - Camera timestamp count: 1470
 - Camera timestamp offset: 0543
- Image**
 - Width: 2048
 - Height: 2048
 - Pixel format: Raw 8
 - Bits per pixel: 8
- Embedded image information**
- Diagnostics**

OK Frame Rate (Proc/Disp/Req): 90.19

Custom Video Modes

Start: (0,0) End: (2048,2048)
Dimensions: 2048 x 2048
Cursors: (1629, 343)

Mode
Mode: 0

Pixel Format
Pixel Format: Raw 8

Image
Left: 0 Width: 2048
Top: 0 Height: 2048
Center ROI Max Image Size

Binning (GigE Only)
1 by 1
Horizontal Vertical

Packet Size
528 48048

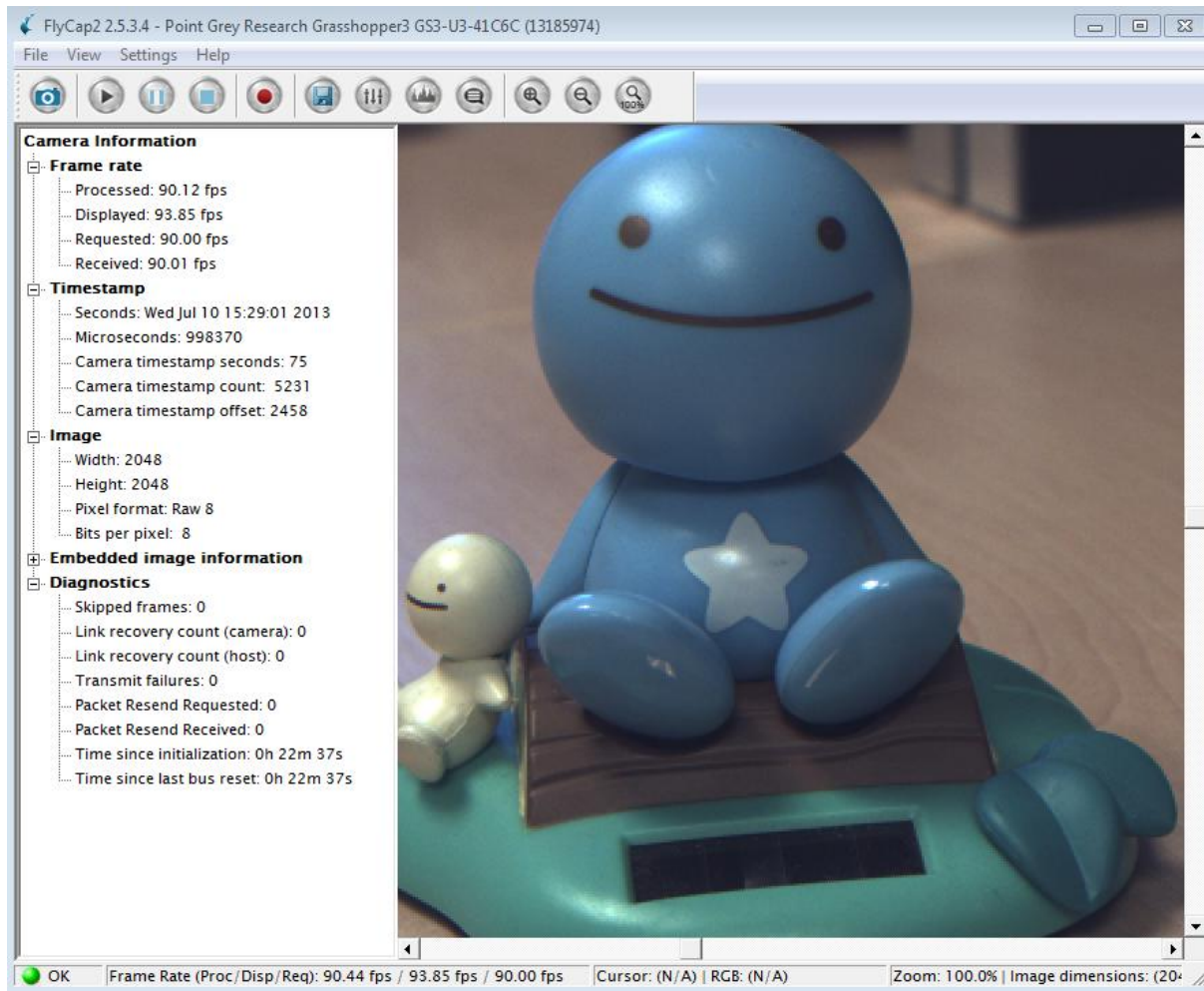
Packet Delay
Min Max
Packet Delay: 0

Apply

Image Information
Maximum image size: 2048x2048
Image size units: 16(H), 2(V)
Image offset units: 2(H), 2(V)
Pre color processing subsampling: N/A
Post color processing subsampling: N/A
Standard binning: Unknown
Bayer binning: Unknown
Cols: N/A Rows: N/A

Bandwidth Information
Image Size: 4194 KB
Estimated Bandwidth: -- MB/s

Main Window



1.9 Troubleshooting Skipped Frames

By default, the GS3-U3-41C6 is configured to Format 7, Mode 0, 8-bit pixel format, 2048 x 2048 (maximum resolution). This configuration uses an estimated 350 MB/s bandwidth which may be too high for some systems to process.

If your camera is skipping frames, lower the bandwidth until the camera is able to stream without errors. This can be achieved by reducing the packet size. A smaller packet size means lower bandwidth which results in a lower frame rate.

Resolution (Maximum)	Packet Size	Bandwidth (MB/s)	Frame Rate (FPS)
2048 x 2048	48048	378	90
2048 x 2048	44880	357	85
2048 x 2048	43824*	350	82
2048 x 2048	41712	332	78
2048 x 2048	39072	311	74
2048 x 2048	37488	300	70

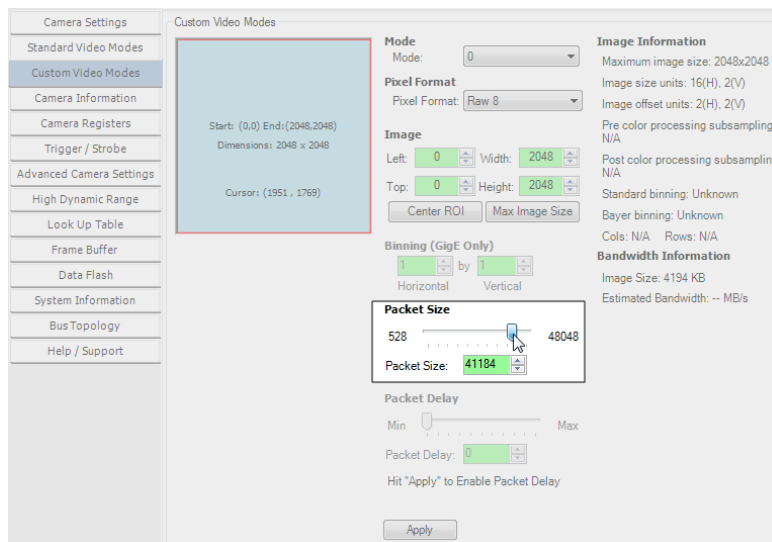
*Default Setting

To lower the packet size:

1. Open the FlyCap program.
Start→All Programs→Point Grey FlyCapture2 SDK→Point Grey FlyCap2
2. Select the camera and click OK.
3. On the Main window toolbar, click the Camera Control dialog button.



4. Click on the Custom Video tab.
5. Adjust the packet size with the slider or enter a value in the textbox.



6. Click the Apply button.

1.10 Additional Downloads and Support

Point Grey Research Inc. endeavors to provide the highest level of technical support possible to our customers. Most support resources can be accessed through the [Support](#) section of our website.

Creating a Customer Login Account

The first step in accessing our technical support resources is to obtain a Customer Login Account. This requires a valid name and email address. To apply for a Customer Login Account go to the [Downloads](#) page.

Knowledge Base

Our [Knowledge Base](#) contains answers to some of the most common support questions. It is constantly updated, expanded, and refined to ensure that our customers have access to the latest information.

Product Downloads

Customers with a Customer Login Account can access the latest software and firmware for their cameras from our [Downloads](#) page. We encourage our customers to keep their software and firmware up-to-date by downloading and installing the latest versions.

Contacting Technical Support

Before contacting Technical Support, have you:

1. *Read the product documentation and user manual?*
2. *Searched the Knowledge Base?*
3. *Downloaded and installed the latest version of software and/or firmware?*

If you have done all the above and still can't find an answer to your question, contact our [Technical Support](#) team.