Transitioning from the Chameleon USB 2.0 to the Chameleon3 USB 3.0 Camera
Technical Application Note TAN2015003
Revised January 29, 2015

1.1. Subject

Technical Application Note (TAN2015003): Transitioning from the Chameleon USB 2.0 to the Chameleon3 USB 3.0 Camera

1.2. Applicable Product(s)

- Chameleon USB 2.0
- Chameleon3 USB 3.0

1.3. Application Note Description

The Chameleon3 camera offers existing Chameleon users an upgrade path to enable new features and improvements enabled by the USB 3.0 interface and the Chameleon3 camera platform. The purpose of this Technical Application Note is to:

- Describe the improvements and benefits of *Chameleon3 USB 3.0 (CM3)*
- Compare the specifications between *Chameleon3* and *Chameleon USB 2.0 (CMLN)*
- Answer some frequently-asked questions about transitioning from the *Chameleon* to the *Chameleon3* camera.

Improvements and Benefits
Camera Specifications
Mechanical Specifications
GPIO Specifications
Software and Driver Support
Frequently Asked Questions About Upgrading
Reference Documentation
Additional Downloads and Support

1.4. Improvements and Benefits

The Chameleon3 USB 3.0 camera brings improvements in areas of product performance, reliability and user experience.

Performance

USB 2.0 employs a communication architecture where the data transaction must be initiated by the host. The host frequently polls the device to ask for data, and the device may only transmit the data once it has been requested by the host. The high polling frequency not only increases power consumption, it also increases CPU usage and transmission latency because the data can only be transmitted when the device is polled by the host.

USB 3.0 improves upon this communication model and reduces transmission latency by minimizing polling, lowering CPU usage, and allowing devices to transmit data as soon as it is ready. The increase in bus bandwidth also enables color interpolation to be done on the camera, saving host resources and enabling the frame rate of ICX445 to reach 30 FPS.

For more information about the benefits of USB 3.0, please refer to the whitepaper USB 3.0: Improvements over USB 2.0.

In addition to the improved performance afforded by the USB 3.0 interface, a plethora of new camera features has been added to the Chameleon3, including look up table, sharpness controls and multi shot trigger.

Reliability

Chameleon3 uses USB 3.0 bulk transfer as the transmission mechanism. Bulk transfer supports error recovery and data retransmission. In addition, Chameleon3 is equipped with a 16 MB frame buffer. A frame buffer is critical to improve data communication and reduce image corruption. The addition of a frame buffer allows the camera to utilize the error correction built in to bulk transfer and retransmit the corrupt data packets. The Chameleon3 also comes with screw locking USB3 connectors and a positive latch GPIO connector to secure cable connections and prevent disconnects. The camera comes with a robust metal housing, improving heat dissipation.

User Experience

While no camera control standard exists for USB 2.0 cameras, a standard called USB3 Vision was ratified in 2013 for USB 3.0 cameras. USB3 Vision builds upon the popular GeniCam standard and defines USB 3.0 related requirements, device identification and control interfaces, data streaming mechanisms, mechanical requirements, and testing frameworks. Chameleon3 supports USB3 Vision protocol, enabling the camera to be used with any USB3 Vision software. Customers are able to choose from a wide variety of image processing libraries and tools that are available commercially and save on development cost and reduce time to market.

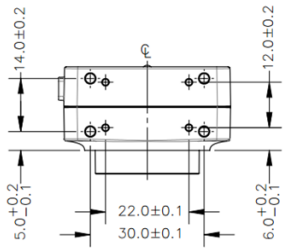
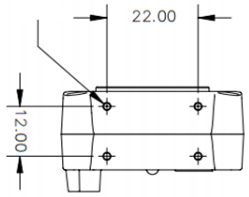
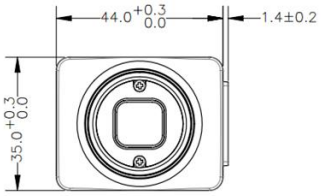
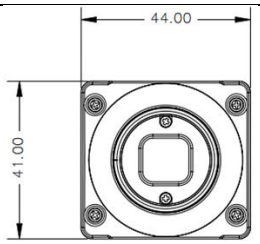
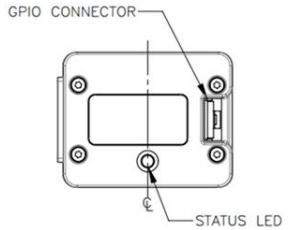
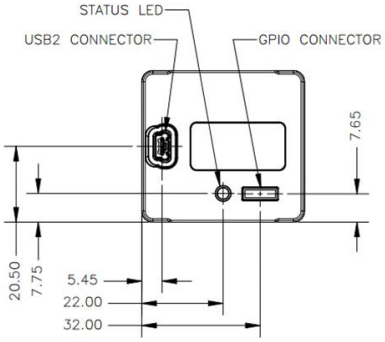
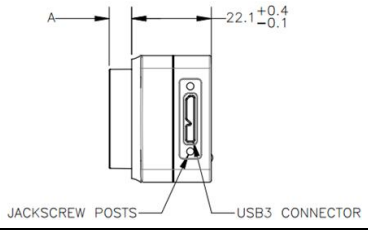
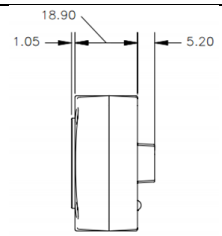
1.5. Camera Specifications

	CM3-U3-13S2	CMLN-13S2
Resolution	1288 x 964	1296 x 964
Frame Rate	30 FPS*	18 FPS
Megapixels	1.3 MP	1.3 MP
Chroma	Mono/Color	Mono/Color
Sensor	Sony ICX445, CCD, 1/3"	Sony ICX445, CCD, 1/3"
Readout Method	Global shutter	Global shutter
Pixel Size	3.75 µm	3.75 µm
Lens Mount	CS-mount	CS-mount
ADC	12-bit	12-bit
Gain Range	-11 dB to 23.991 dB	0 dB to 24 dB
Exposure Range	0.046 ms to 31.9 seconds	0.01 ms to 10 seconds
Trigger Modes	Standard, bulb, low smear, overlapped, multi-shot	Standard, bulb, skip frames, overlapped
Partial Image Modes	Pixel binning, ROI	Pixel binning, ROI
Image Processing	Gamma, lookup table, hue, saturation, and sharpness	Color/Greyscale conversion, gamma, lookup table, white balance
Image Buffer	16 MB	N/A
User Sets	2 memory channels for custom camera settings	2 memory channels for custom camera settings
Flash Memory	1 MB non-volatile memory	256 KB non-volatile memory
Opto-isolated I/O Ports	1 input, 1 output	N/A
Non-isolated I/O	2 bi-directional	2 bi-directional
Serial Port	Unsupported	1 (over non-isolated I/O)
Auxiliary Output	3.3 V, 150 mA maximum	3.3 V, 150 mA maximum
Interface	USB 3.0	USB 2.0
Power Requirements	5 - 24 V via GPIO or 5 V via USB 3.0 interface	4.745 to 5.25 V via Mini-B USB 2.0 interface or JST 7-pin GPIO connector
Power Consumption	2.5W maximum	2 W maximum
Dimensions/Mass	44 mm x 35 mm x 19.5 mm (case enclosed); 40 mm x 31 mm (board level) /36 grams	25.5 mm x 44 mm x 41 mm/37 grams
Machine Vision Standard	USB3 Vision v1.0	IIDC v1.31
Compliance	CE, FCC, KCC, RoHS	CE, FCC, KCC, RoHS
Temperature	Operating: 0° to 45°C Storage: -30° to 60°C	Operating: 0° to 45°C Storage: -30° to 60°C
Humidity	Operating: 20% to 80% (no condensation) Storage: 20% to 95% (no condensation)	Operating: 20% to 80% (no condensation) Storage: 20% to 95% (no condensation)
Warranty	3 years	1 year

*Supported under USB 2.0 using 8 bit pixel formats

1.6. Mechanical Specifications

Chameleon3 has a side USB 3.0 connector, which reduces the overall depth of the camera when installed. For more information, please refer to Chameleon3 USB3 Dimensional Drawings and CAD Models and Chameleon Dimensional Drawings and CAD Models.

Description	CM3	CMLN
Top/ Bottom		
Front		
Back		
Side		

1.7. GPIO Specifications

	CM3	CMLN
Camera Side Connector	JST BM09B-NSHSS-TBT	JST BM07B-SRSS-TB
Cable Side Connector	JST NSHR-09V-S	JST SHR-07V-S-B
Number of Pins	9	7
Opto-isolated I/O Ports	1 input, 1 output	N/A
Non-isolated I/O	2 bi-directional	2 bi-directional
Serial Port	Unsupported	1 (over non-isolated I/O)

1.8. Software and Driver Support

Description	CM3	CMLN
Driver Options	Point Grey PGRxHCI driver Point Grey PGRUSBCAM driver	Point Grey PGRUSBCAM driver
USB3 Vision Support	Yes	No

For more information on using third party USB3Vision software with Chameleon3, please refer to the following application notes:

Using Point Grey USB3 Vision cameras with A&B Software's ActiveUSB
Using Point Grey USB3 Vision cameras with Matrox Imaging Library
Using Point Grey USB3 Vision cameras with MVTec HALCON 11
Using Point Grey USB3 Vision cameras with National Instruments' Vision Acquisition software

1.9. Frequently Asked Questions About Upgrading

What new hardware do I need to use the Chameleon3?

Cable—The Chameleon3 camera requires USB 3.0 Micro-B cables. USB 3.0 cables can also be purchased directly from Point Grey.

- ACC-01-2300 - 3 Meter USB 3.0 Cable, Type-A to Micro-B (Locking)
- ACC-01-2301 - 5 Meter USB 3.0 Cable, Type-A to Micro-B (Locking)
- ACC-01-2302 - 5 Meter USB 3.0 Cable, Type-A to Micro-B (Locking), Extended Temp

While a USB 2.0 cable can be used, it will cause the camera to run at USB 2.0 speeds (slower frame rate and less bandwidth).

Interface Card—The Chameleon3 camera requires a USB 3.0 port. Point Grey strongly recommends Intel, Fresco, or Renesas host controllers. For motherboards without a USB 3.0 port, users can purchase a PCI express adapter card. These adapter cards can also be purchased from directly from Point Grey.

- U3-PCIE2-2P01X - USB 3.0 PCI Express 2.0 x1 Host Adapter Card, 1 Channel, 2 Port, FL1100
- ACC-01-1201 - USB 3.0 PCI Express 2.0 x1 Host Adapter Card, 1 Channel, 2 Port, uPD720202
- ACC-01-1202 - USB 3.0 PCI Express 2.0 x1 Host Adapter Card, 1 Channel, 4 Port, FL1100

Accessories—Tripod mounts and CS-C lens mount adapters are not included with Chameleon3. These can be purchased separately from Point Grey.

- ACC-01-0003 - Tripod mount
- ACC-01-5004 - CS to C-mount adapter

For more USB 3.0 system components, please refer to the application note Recommended USB 3.0 System Components.

Can I connect the Chameleon3 to a USB 2.0 port?

Yes, although connecting the Chameleon3 to a USB 2.0 port reduces interface bandwidth to USB 2.0. However, the camera can still maintain 30 FPS in 8-bit pixel formats. Users are still able to take advantage of the on-camera color processing as long as the frame rate and pixel format chosen is within the bandwidth limit of USB 2.0. Users can also use the Chameleon3 with USB3Vision software over a USB 2.0 bus.

Can I run the *Chameleon3* with my existing FlyCapture-based application?

Yes, FlyCapture version 2.7 or later is recommended to control the *Chameleon3* and acquire images.

What is the max cable length I can use with Chameleon3?

The standard maximum cable length is 5 meters for USB 2.0 devices. The USB 3.0 standard does not specify a standard length. However, Point Grey recommends using passive cables of 5 meters or less. The increasing demand for USB 3.0 cameras has also created a market for many type of cable solutions designed to solve challenges from extending cable distance to high flex USB 3.0 cables targeted for machine vision applications.

For more information on extending USB 3.0 cable distance, please refer to the application note Extending the Working Distance of Point Grey USB 3.0 Cameras.

How can I use the *Chameleon3* with non-USB3 Vision software?

The Chameleon3 can be used with other software via DirectShow, open source libraries, or software adapters. For more information, please refer to the following application notes.

Using Point Grey USB3/USB2 Cameras with Cognex VisionPro
Streaming Point Grey USB 3.0 Cameras on Embedded Systems
Using Linux with USB 3.0

How does bandwidth management differ between USB 3.0 and USB 2.0 in multiple-camera configurations?

When using multiple Chameleon3 cameras, users need to manage the bandwidth of each camera to ensure the total bandwidth does not exceed the maximum allowed by the USB 3.0 bus.

To manage bandwidth, users can use the packet size control in FlyCapture2 or the DeviceLinkThroughput control in any USB3Vision software. Users are able to limit the data output of the camera and ensure it doesn't exceed the user set limit.

For more information on how to setup multiple USB 3.0 cameras, please refer to the application note USB 3.0 Multiple Camera Setup.

Is the Chameleon USB 2.0 camera being discontinued?

No, there are no plans to discontinue Chameleon models at this time. The new Chameleon3 models are intended to give customers an alternative and provide additional features such as higher bandwidth, frame buffer selection, USB3 Vision control and more sensor selection.

1.10. Reference Documentation

Other useful sources of information regarding specific features of the Applicable Product(s) include:

Chameleon Getting Started Manual
Chameleon3 Getting Started Manual
Chameleon Technical Reference Manual
Chameleon3 Technical Reference Manual

1.11. 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.

