

A Guide to Transitioning from the Flea3 FireWire to the Flea3 GigE Camera

Technical Application Note TAN2011004

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1.1. Subject

Technical Application Note (TAN2010004): A Guide to Transitioning from the Flea3 FireWire to the Flea3 GigE Camera

1.2. Applicable Product(s)

- Flea3 FL3-FW
- Flea3 FL3-GE

1.3. Application Note Description

The *Flea3* FL3-GE features a 1000 Mbps Gigabit Ethernet digital interface packaged in the same housing and dimensions as the *Flea3* FireWire camera. Camera firmware supports version 1.32 of the Instrumentation & Industrial Digital Camera (IIDC) specification, making it easy for existing *Flea3* applications to migrate their applications. Alternatively, GenICam-compliant applications can interface with the pre-loaded XML device description file.

The purpose of this Technical Application Note is to:

- Answer some frequently-asked questions about transitioning from the *Flea3* FireWire to the *Flea3* GigE camera.
- Outline the primary similarities and differences between the two cameras; and
- Offer suggestions and pointers to end users for migrating their custom applications from the *Flea3* FireWire to the *Flea3* GigE.



For customers upgrading from a Flea3 FireWire camera, Point Grey strongly encourages putting the Flea3 GigE camera through a full requalification process. The [Point Grey Evaluation Program](#) offers qualified customers an excellent opportunity to evaluate the Flea3 GigE camera.

1.4. Frequently-Asked Questions About Upgrading from the Flea3 FireWire to the Flea3 GigE

Is the Flea3 FireWire camera being discontinued?

No, there are no plans to discontinue Flea3 FireWire models at this time. The new GigE Vision models are intended to give customers an alternative to address issues such as cable length, as well as provide next-generation functionality.

What other new hardware do I need to use the Flea3 GigE?

Cable—Category 5, 5e or 6 cables up to 100 meters in length can be used (a significant improvement in distance over the FireWire standard). A 5-meter Category 5e cable can be purchased directly from Point Grey (**Part No. ACC-01-2100**)

Interface Card—The camera will require a Gigabit Ethernet network interface card (NIC) with support for “jumbo packets” to run at full 1 Gbit/s transfer rates. We strongly recommend customers use PCI Express NICs with Intel PRO 1000 chipsets. An Intel PRO 1000CT-based card can be purchased directly from Point Grey (**Part No. ACC-01-1100**). GigE network interface cards are also widely available at consumer electronics stores, or supported on board existing hardware.

Power Supply—Power must be provided through the HR25 8-pin GPIO interface. The required input voltage is 12-24 V DC. A compatible 12 V wall-mount power supply and wiring harness can be purchased directly from Point Grey (**Part No. ACC-01-9006**).

For more information, see Point Grey’s [GigE accessories data sheet](#).

A tripod adapter is included with the *Flea3* at no extra charge.

Can I run the Flea3 GigE with my existing FlyCapture-based application?

FlyCapture version 2.1 or later is required to control the Flea3 GigE and acquire images. Earlier versions do not support the GigE Vision-specific functionality that the camera implements.

How easy will it be to migrate my FireWire-based application for Flea3 FireWire to the Flea3 GigE?

The *Flea3* FireWire is an IIDC-1394 (FireWire) camera, while the *Flea3* GigE is a GigE Vision camera. However, the IIDC-based control and status registers in the camera firmware, which are accessed by Point Grey’s FlyCapture API, remain mostly the same between the two cameras. As a result, upgrading an application from the *Flea3* FireWire to the *Flea3* GigE should be fairly straightforward. Among the factors to consider are supported pixel formats and modes (*Flea3* GigE supports Format_7 only), and network management requirements for GigE Vision cameras. These differences, and others, are outlined in the following sections of this application note. Additionally, the FlyCapture SDK includes a GigEGrabEx sample program to show developers the basics of getting started in grabbing images with a GigE camera.

Can I use a GenICam-compliant application with the Flea3 GigE?

Yes. The camera is loaded with a GenICam-compliant XML device description file. For a list of supported features or to access the file, consult the *Flea3 FL3-GE Technical Reference*.

How does performance of the GigE network compare to that of the FireWire bus?

Data throughput on the IIDC-1394b bus is 800 Mb/s, while on the GigE network it is 1000 Mb/s. In practice, there is little measurable difference in performance, as approximately 15% of the GigE bandwidth is reserved for communications control data. Performance differences may be more noticeable in terms of load on the host CPU. GigE Vision applications may consume more resources because the CPU must process both data packet handling and image processing tasks. The CPU in FireWire systems handles only image processing tasks because data packets are delivered directly to main memory using direct memory access (DMA). To reduce GigE packet load on the CPU, Point Grey provides an Image Filter Driver, which is installed and enabled by default as part of downloading and installing the FlyCapture SDK. This driver works by isolating GigE Vision Streaming Protocol (GVSP) packets, and is recommended for improved image streaming performance on Windows systems. (On Linux systems, GigE Vision cameras communicate directly with native Ubuntu drivers.)

How does bandwidth management differ between GigE and FireWire in multiple-camera configurations?

The FireWire bus provides dedicated bandwidth and guaranteed timing for data packets, which guarantees packet delivery, particularly on systems with multiple cameras on the bus. In contrast, the User Datagram Protocol (UDP) used by the GigE Vision standard provides no guaranteed transmission or fixed timing mechanism. Bandwidth must be managed by adjusting packet size and packet delay, based on desired resolution and frame rate. These parameters are configurable using Point Grey's FlyCapture API or the FlyCap demo program. Additional information about GigE bandwidth management is available in the *Flea3 FL3-GE Technical Reference*.

How do I enumerate the Flea3 GigE camera on the GigE network?

Point Grey's FlyCapture SDK includes an easy-to-use graphical interface tool for configuring the IP address of the camera and interface card. The Point Grey GigE Configurator provides IP configuration options based on the DHCP protocol, a persistent IP, or a link-local address (LLA). The IP address can also be configured programmatically using the FlyCapture SDK.

Does the Flea3 GigE support automatic inter-camera synchronization?

Not at this time. However, like all Point Grey cameras, the *Flea3* provides a GPIO connector and trigger functionality, which allows the start of exposure to be synchronized between multiple cameras using an external electrical signal.

1.5. General Considerations

1.5.1. Other Reference Documentation

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

[Flea3 FireWire Getting Started Manual](#)

[Flea3 GigE Getting Started Manual](#)

[Flea3 FireWire and Flea3 GigE Technical Reference Manuals](#)

1.5.2. Testing Tools

To configure and test the information presented in this TAN:

Connect the camera's GPIO pins to an oscilloscope or external trigger source. By connecting the appropriate GPIO pins to an external trigger source or oscilloscope, you can observe the differences in general purpose input/output capability of the Applicable Product(s). Consult your camera's *Technical Reference* or *Getting Started* manual for GPIO connector pin layouts and electrical characteristics.

Download the FlyCapture SDK. The SDK includes numerous [example programs](#) that demonstrate various camera features. Specific examples that relate to this TAN include *CustomImageEx*, *AsyncTriggerEx* and *GigEGrabEx*.

Access the camera's register space. The easiest way to try this is using the FlyCap demo software included with the *FlyCapture SDK*. For register definitions and individual bit descriptions, please refer to your camera's *Technical Reference* manual.

1.6. Detailed Comparison Between Flea3 FireWire and Flea3 GigE

1.6.1. Mechanics

The Flea3 FireWire and Flea3 GigE share many of the same form factor and general mechanical properties.

Description	Flea3 FireWire	Flea3 GigE
<i>Data transfer and camera control connectors</i>	One standard 9-pin IEEE-1394b connector for data transfer, camera control and powering the camera	One RJ-45 Ethernet jack for data transfer and camera control (power must be provided via the GPIO)
<i>Host adapter card requirements</i>	IEEE-1394b PCI, PCIe or ExpressCard	Gigabit Ethernet network interface
<i>GPIO connector</i>	Hirose HR25 8 pin connector	
<i>IR cut filter</i>	The infrared cut-off filter used with color versions of the cameras is the same	

<i>properties</i>	and has the same transmittance properties.	
<i>CCD sensor placement on PCB</i>	The chip and lens holder mounting holes are centered relative to the four corner mounting holes.	
<i>Overall dimensions</i>	Industry standard 44mm x 29mm x 58mm (excluding lens holder, 1394/GigE and GPIO connector)	
<i>Lens holder</i>	C-mount	
<i>Case description</i>	Black zinc (casted) with black aluminum top and Point Grey logo	
<i>Mass</i>	Approximately 85 g, depending on sensor (excluding optics)	
<i>Tripod mounting bracket</i>	Secured by four (4) M2x2mm screws Meets ISO and ASA standards Included free of charge with every camera.	
<i>Mounting holes</i>	Three (3) M3x2.5mm holes on the bottom face Four (4) M2x2mm holes on the bottom face (for mounting bracket) Two (2) M2 holes on the top face	
<i>Removable glass / IR filter system</i>	BW models: protective dust glass between sensor and optics COL models: IR filter between sensor and optics Glass / IR filter screwed into place to allow easy removal	
<i>Development kit</i>	Includes cable, 1394 interface card, software CD and Getting Started Manual.	Not available. NIC, cable and power supply available for purchase separately. Software and Getting Started Manual available for download.

1.6.2. GPIO Properties

The cameras have the same 8-pin GPIO connector with the same properties. Consult either the *Flea3 FL3-FW* or *Flea3 FL3-GE Technical Reference* for pin assignments.

1.6.3. Other Hardware and Electronics

Description	Flea3 FireWire	Flea3 GigE
<i>CCD imaging sensors</i>	648x488 Sony ICX618 ¼" CCD 648x488 Sony ICX414 ½" CCD 1384x1032 Sony ICX267 ½" CCD 1624x1224 Sony ICX274 1/1.8" CCD	1288x964 Sony ICX445 1/3" EXview HAD CCD
<i>Data transfer and camera control interface</i>	2X 9-pin IEEE-1394b (800Mb/s) Connector flush with case Secure jack screw connector	1X RJ-45 Ethernet connector (1000 Mb/s) Connector flush with case

		Secure jack screw connector
<i>Power interfaces</i>	Via IEEE-1394b bus or GPIO connector	Via GPIO connector only
<i>Power consumption</i>	Less than 2.5 W	Less than 4.7 W
<i>Cable length/type supported</i>	10-meter FireWire	100-meter Cat5, 5e, 6
<i>A/D converter</i>	Analog Devices, 12-bit resolution	
<i>Temperature Sensor</i>	On-board, accessible via control and status registers (CSRs)	
<i>Voltage Sensor</i>		
<i>Current Sensor</i>		
<i>Case Temperature/Heat Dissipation</i>	Camera runs warm in high data rate video modes. Heat dissipation is encouraged but not required in normal operating environments.	Camera runs at a higher temperature than Flea3 FireWire and may require heat dissipation and active monitoring of ambient temperature.
<i>LED Behavior</i>	One general purpose status LED for monitoring camera power, initialization and FireWire activity.	
<i>Automatic inter-camera image synchronization</i>	Cameras operating on the same FireWire bus are automatically synchronized.	Not supported; requires external trigger.

1.6.4. Firmware

This section does not address the significant number of firmware enhancements that have been added in the *Flea3 GigE*, but focuses on functional differences between the two cameras that could affect integration of the *Flea3 GigE* in existing *Flea3 FireWire*-based applications. Users are encouraged to download the documents listed in Section 1.5.1: Other Reference Documentation for assistance with terms, camera specifications, and register definitions.



Many default startup (power-up) parameters, such as resolution, frame rate, and ROI have changed in the Flea3 GigE. The memory channels on the Flea3 GigE can be used for creating new default settings.



Point Grey cannot predict if or how all of the following differences may affect user applications. This section provides recommendations on how to address some of the most obvious differences in functionality.

1.6.4.1. Format_7

Description	Flea3 FireWire	Flea3 GigE
<i>Pixel Formats</i>	Mono8, Mono12, Mono16, Raw8, Raw12, Raw16, YUV411, YUV422, YUV444, RGB8	
<i>Max frame rates at max resolution</i>		
<i>648x488 Sony ICX618</i>	120 FPS	Not applicable
<i>648x488 Sony ICX414</i>	76 FPS	Not applicable
<i>1288x964 Sony ICX445</i>	Not applicable	32 FPS
<i>1384x1032 Sony ICX267</i>	16	Not applicable
<i>1624x1224 Sony ICX274</i>	15	Not applicable
<i>Packet Size</i>	User-configurable	By default, Format_7 packet size auto-adjusts to GigE Vision Stream Channel Packet Size setting, Stream Channel Packet Delay setting, and GigE link speed. Alternatively, packet size is programmable via FlyCapture API (not recommended).
<i>Modes</i>		
<i>Mode_0</i>	Region of interest only. Smear reduction supported on select models	Region of interest only.
<i>Mode_1</i>	2X vertical binning and 2X horizontal subsampling (monochrome models) or 2X vertical and 2x horizontal subsampling (color models); values are aggregated without averaging; increased intensity, improved SNR.	

<i>Mode_4</i>	2X vertical binning and 2X horizontal subsampling; increased frame rate; available on color models only	
<i>Mode_5</i>	4X vertical binning and 4X horizontal subsampling (monochrome models) or 4X vertical and 4x horizontal subsampling (color models); values are aggregated without averaging; increased intensity, improved SNR.	Not available
<i>Mode_7</i>	Region of interest only. Slower pixel clock, recommended for longer extended shutter times and/or improved imaging performance. Frame rate increase may not be possible with reduced ROI.	

1.6.4.2. Other Firmware Changes

Description	Flea3 FireWire	Flea3 GigE
<i>IIDC Version</i>	1.32	
<i>GigE Vision Bootstrap Registers</i>	Not applicable	Stream channel packet size, stream channel packet delay, heartbeat, and others. For a complete list of all supported GigE Vision registers, see the Flea3 GigE Technical Reference.
<i>Pixel Format Standards</i>	Standard (Format_0 or Format_1) and customizable (Format_7)	Customizable (Format_7) only
<i>Color processing</i>	Color models output greyscale information when run in standard (Format_0 or Format_1) Y8/Y16 modes. The conversion from raw Bayer information to greyscale is done on-board the camera.	On color models, conversion from raw Bayer information to greyscale is done on-board the camera.
<i>Extended Shutter/Exposure Times</i>	Supported	Up to 32 s in Format_7 Mode_7 only. Not available in other modes.
<i>Trigger Modes</i>	Supports multiple exposure modes. IIDC modes 0, 1, 3, 4, 5, 14, 15: Supported on all models	
<i>Memory Channels</i>	Two (2) channels for user-defined configuration sets; one (1) channel for restoring to factory default settings	
<i>Frame Buffer</i>	32 MB for temporary image storage and re-transmission	

<i>Non-Volatile Flash Memory</i>	1 MB for data storage
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1.6.5. Software and Driver Support

Description	Flea3 FireWire	Flea3 GigE
<i>Driver options</i>	Point Grey FirePRO driver Point Grey PGRCAM driver (for S800, requires Windows XP SP1 or Windows 7 drivers)	Point Grey Image Filter driver (recommended on Windows) or Microsoft/Linux native drivers
<i>Bandwidth Management</i>	Guaranteed bandwidth for all cameras on bus	Packet size and packet delay user configurable
<i>Camera Enumeration</i>	Enumeration on the FireWire bus is supported natively by the OS	Point Grey GigE Configurator tool for camera enumeration; configuring MTU/IP address for camera and NIC
<i>FlyCapture 2.x Applications</i>	Supported	Supported on v2.1 or later
<i>FlyCapture 1.x Applications</i>	Supported	Not supported
<i>GenICam Applications</i>	Not supported	Supported via on-board device description file. For a list of all supported features, see the Flea3 GigE Technical Reference.
<i>Supported Operating Systems</i>	Windows 2000 (PGRCAM driver only) Windows XP 32-bit Windows XP 64-bit (FIREPRO driver only) Windows Vista 32/64-bit (FIREPRO driver only) Windows 7 32/64-bit Linux Ubuntu 8.04	Windows XP 32/64-bit Windows Vista 32/64-bit Windows 7 32/64-bit Linux Ubuntu 8.04
<i>Software Requirements with FlyCapture 2.1</i>	MS Visual Studio 6.0 SP5 (to compile and run example code on Windows XP 32-bit) MS Visual Studio 2005 SP1 (to compile and run example code on Windows XP 64-bit) MS Visual Studio 2005 SP1 and SP1 Update for Vista (to compile and run example code on Windows Vista or Windows 7)	

1.7. Additional Downloads and Support

Access more Technical Application Notes on the web at www.ptgrey.com/support/downloads.

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 Product Support section of our website: www.ptgrey.com/support.

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, e-mail address, and camera serial number. To apply for a Customer Login Account go to www.ptgrey.com/support/downloads/.

Knowledge Base

Our on-line knowledge base at www.ptgrey.com/support/kb/ 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 site at www.ptgrey.com/support/downloads. 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 at www.ptgrey.com/support/contact/.