# Development Kit Contents

- 2 meter, 6-pin to 6-pin, super slim and flexible IEEE-1394 cable
- IEEE-1394 OHCI PCI Host Adapter 3-port 400Mb/s card
- Two (2) microlens holders (with and without IR filter) and one (1) 6mm microlens
- Male GPIO connector pre-wired for quick and easy access
- Tripod mounting adapter
- FlyCapture® SDK (C/C++ API and device drivers) CD

Physical Dimensions

Dimensions are in millimeters (mm)
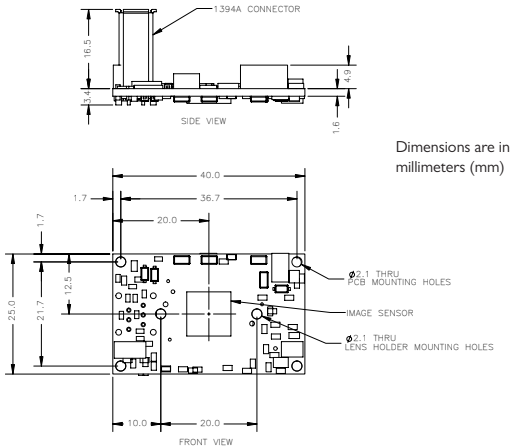
Camera Specifications

Specification	Description
Overview	Small format OEM board level IEEE-1394 digital camera
Imaging Sensor	Micron MT9V022 1/3" progressive scan CMOS
Active Pixels	Wide-VGA 752x480
Shutter Type	Global shutter using Micron TrueSNAP™ technology
A/D Converter	On-chip 10-bit analog-to-digital converter
Video Data Output	8 and 16-bit digital data (see *Supported Data Formats* below)
Standard Resolutions	640x480
Frame Rates	60, 30, 15, 7.5 FPS
Partial Image Modes	Pixel binning and region of interest modes available via Format_7
Interfaces	6-pin IEEE-1394 for camera control and video data transmission 2 general-purpose digital input/output (GPIO) pins
Voltage Requirements	8-32V
Power Consumption	Less than one (1) Watt
Gain	Automatic/Manual Gain modes
	0 to 12dB
Shutter	Automatic/Manual Shutter modes
	0.12ms to 66.6ms @15 FPS
Gamma	0 (linear) or 1 (12-bit to 10-bit companding mode)
Trigger Modes	DCAM v1.31 Trigger Modes 0 and 3
Signal To Noise Ratio	Greater than 50dB at minimum gain
Dimensions	25mm x 40mm (without lens holder or optics)
Mass	14 grams (with microlens)
Camera Specification	IIDC 1394-based Digital Camera Specification v1.31
Emissions Compliance	Complies with CE rules and Part 15 Class B of FCC Rules
Operating Temperature	Commercial grade electronics rated from 0° to 45°C
Storage Temperature	-30° to 60°C

Spectral Response (QE)
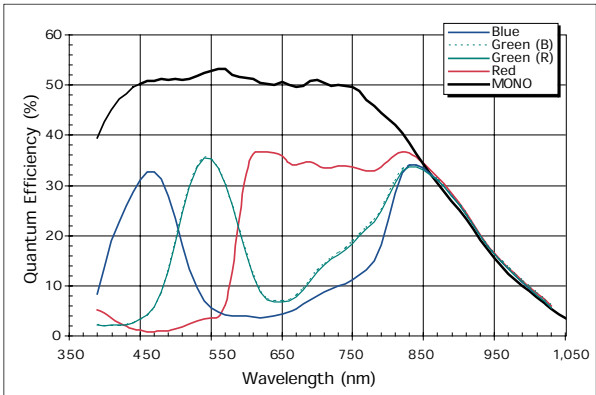
Status LED

LED Status	Description
Steady on	Camera receiving power and initialized
Steady on and very bright	Camera acquiring and transmitting images
Flashing bright, then brighter	Camera registers being accessed
Steady or slow flashing on and off	Firmware updated, or possible camera problem (power cycle)

Camera Features

Image Acquisition

Feature	Description
Global Shutter	Photodiode pixels with simultaneous integration and readout
Near-IR Performance	Enhanced performance provides NIR QE greater than 35%
Auto Exposure Control	Ensures optimal auto settings of shutter and gain for each image
Fast Frame Rates	Faster standard frame rates up to 60 FPS
Partial Image Modes	Format_7 modes for fast frame rates and higher signal-to-noise
Multiple Trigger Modes	Standard external trigger mode, skip frames mode
Gain and Brightness	Adjust gain and black clamp via a 10-bit A/D converter

Image Processing

Feature	Description
ADC On-Chip	10-bit linear or 12-bit to 10-bit companding mode via Gamma
Image Flip	Horizontal image flipping (mirror image)
Embedded Image Info	Pixels contain image timestamp (1394 cycle time)

Camera and Device Control

| Feature	Description
Memory Channels	Non-volatile storage of camera default power-up settings
Strobe Output	Strobe output with configurable delay and duration
Absolute Value Controls	Shutter and gain reported in real-world units (seconds and dB)
Broadcast Properties	Camera responds to broadcast register writes on the same bus
Camera Upgrades	Firmware upgradeable in field via IEEE-1394 interface.

Image Formats

Standard Modes	Frames Per Second					
	1.875	3.75	7.5	15	30	60
640x480 Y8 (8bpp)			•	•	•	•
640x480 Y16 (16bpp)			•	•	•	

(Format_7 Partial Image Modes)

Mode	Pixel Format	Size	FPS	Description
0	Mono8 (8bpp)	752x480	63	Region of interest (ROI)
0	Mono8 (8bpp)	320x240	125	Region of interest (ROI)
0	Mono8 (8bpp)	160x120	210	Region of interest (ROI)
1	Mono8 (8bpp)	320x240	135	2x2 pixel binning
2	Mono8 (8bpp)	640x240	135	1x2 pixel binning

12-bit to 10-bit Companding

A gamma value of 0 yields a linear response; a value of 1 puts the camera into 12-bit to 10-bit mode. This mode allows higher ADC resolution (12 bits) for low-level signals (shadow details) and lower ADC resolution (9 bits) for high-level signals (highlight details).
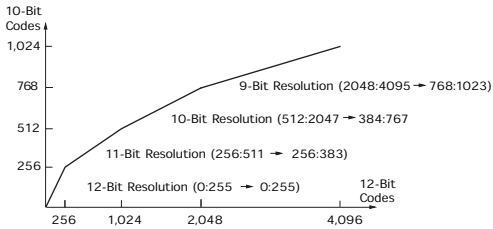
Camera Interface

IEEE-1394 Connector

The *Firefly® MV* has a standard 6-pin IEEE-1394 connector that is used for data transmission, camera control and powering the camera.

Cables

The maximum 1394 cable length between any 1394 node (e.g. camera to PCI card, card to hub, etc.) is 4.5m, as specified by the IEEE-1394 standard. Use standard, shielded twisted pair copper cables.

General Purpose I/O Connector

The *Firefly MV* has a 7-pin GPIO connector on the back of the board. The connector is made by JST (Mfg P/N: BM07B-SRSS-TB). The Development Kit contents include a pre-wired female connector; refer to the diagram below for wire color-coding. Additional female connectors (Mfg P/N: SHR-07V-S-B) can be purchased from Digikey (P/N: 455-1382-ND).

Diagram	Pin	Function	Description
	1	Vext	Allows the camera to be powered externally. Voltage limit: 8 to 30V , Current limit: 1A
	2	+3.3V	Power external circuitry up to a total of 150mA
	3	IO0	Input / Output (Default Trigger_Src)
	4	IO1	Input / Output
	5, 6		Not connected
	7	GND	
			To configure the GPIO pins, consult the "General Purpose Input / Output" section of the *PGR IEEE-1394 Digital Camera Register Reference*.

The *Firefly MV* GPIO pins are TTL 3.3V pins. **Inputs** can be configured to accept external trigger signals. When configured as inputs, the pins are internally pulled high using weak pull-up resistors to allow easy triggering of the camera by simply shorting the pin to ground (GND). Inputs can also be directly driven from a 3.3V or 5V logic output. The inputs are protected from both over and under voltage. It is recommended, however, that they only be connected to 5V or 3.3V digital logic signals. **Outputs** can be configured to send an output signal or strobe pulse. When configured as outputs, each line can sink 10mA of current.

1 Installation

1. Recommended System Configuration

- Windows XP Service Pack 1
- 512MB of RAM
- Intel Pentium 4 2.0GHz or compatible processor
- AGP video card with 128MB video memory
- 32-bit PCI slot for IEEE-1394 card
- Microsoft Visual C++ 6.0 (to compile and run example code)

2. Electrostatic Precautions and Camera Care

- Users who have purchased a bare board camera should:
    o   Either handle bare handed or use non-chargeable gloves, clothes or material. Also use conductive shoes.
    o   Install a conductive mat on the floor or working table to prevent the generation of static electricity.
- When handling the camera unit, avoid touching the lenses. To clean the lenses, use a standard camera lens cleaning kit or a clean dry cotton cloth. Do not apply excessive force.
- To clean the imaging surface of your CCD, follow the steps outlined in www.ptgrey.com/support/kb/index.asp?a=4&q=66.
- Extended exposure to bright sunlight, rain, dusty environments, etc. may cause problems with the electronics and the optics of the system.
- Avoid excessive shaking, dropping or mishandling of the device.

2 Installation

3. Install the IEEE-1394 PCI card

- Place the IEEE-1394 PCI card in an open PCI slot.
- Connect the 4-pin connector on the card to the PC power supply.
- Turn the computer back on and log into Windows.
- In most cases, the Windows IEEE-1394 drivers will be automatically installed for the card, with no user input required. However, in some cases the *Found New Hardware Wizard* will appear. Follow the prompts given by the Wizard to install the card.
- Open Windows Device Manager by going to the Control Panel > *System* > *Hardware* tab > *Device Manager*. Ensure that the PCI card is properly installed as an *IEEE 1394 Bus host controller*.

4. Install the FlyCapture® Software and Drivers

- Insert the software CD-ROM. If the Installation Wizard does not automatically run, browse to your CD-ROM directory and run *setup.exe*.
- Follow the installation instructions to install the software.
- A dialog will appear asking if you want to downgrade your Windows XP drivers. If you have installed Service Pack 2, we encourage users to do this. See this Knowledge Base article for further information: www.ptgrey.com/support/kb/index.asp?a=4&q=171

3 Installation

5. Installing the Tripod Mounting Bracket (optional)

- The mounting bracket for the *Firefly® MV* attaches to the camera using the included M2 screws.

6. Connect the 1394 PCI Card and Cable to the Camera

- Plug the 4.5 meter, 6-pin to 6-pin, IEEE-1394 cable into the 1394 PCI card and the *Firefly MV* 1394 Connector.
    NOTE: The camera relies on the 6-pin 1394 cable to provide power. If using an interface card other than that provided, ensure that adequate power is provided.
- If the Microsoft Windows *"Found New Hardware Wizard"* appears, proceed to Step 7. Otherwise, proceed to Step 8.

7. Install the PGRCAM Driver

- Click *"Install from a list or specific location"* and click *"Next"*.
- Select *"Don't search. I will choose the driver to install"* and *"Next"*.
- Click *"Have Disk"* and browse to *C:\Program Files\Point Grey Research\PGR FlyCapture\driver*, click *"Open"*, then *"OK"*.
- Select the camera model and click *"Next"*.
- You will be prompted to continue installation - click *"Continue Anyway"* then *"Finish"* to complete installation.

4 Installation

8. Confirm Successful Installation

- Check the Device Manager to confirm that installation was successful. Go to the *Start* menu, select *Run* and enter "devmgmt.msc". Verify the camera is listed under "Point Grey Research Devices".
- To test the camera's image acquisition capabilities, run the FlyCap demo program. From the *Start* menu, select *All Programs > Point Grey Research > PGR FlyCapture > FlyCap.exe*.

5 Troubleshooting

The FlyCapture® User Guide and other technical references can be found in the *Programs > Point Grey Research > PGR FlyCapture > Documentation* directory. Our on-line Knowledge Base (www.ptgrey.com/support/kb/) also addresses the following problems:

- Article 21: Troublesome hardware configurations
- Article 88: Vertical bleeding or smearing from a saturated portion of an image
- Article 91: PGR camera not recognized by system and not listed in Device Manager
- Article 93: My laptop's IEEE-1394 port or PCMCIA card doesn't supply power to my camera
- Article 145: Image discontinuities or horizontal tearing of images when displayed on monitor
- Article 171: Performance of 1394 devices may decrease after installing Windows XP SP2
- Article 188: Image data acquired by my camera is corrupt and displayed images are broken
- Article 189: Image capture freezes after a period of successful image capture.

Contacting Point Grey Research

Email: For all general questions about Point Grey Research please contact us at info@ptgrey.com.

For technical support (existing customers only) contact us at www.ptgrey.com/support/contact/.

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Knowledge Base: Find answers to commonly asked questions in our knowledge base at www.ptgrey.com/support/kb/.

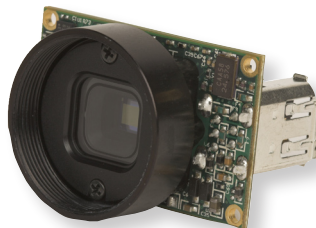**Downloads:** Users can download the latest manuals and software from www.ptgrey.com/support/downloads/.

POINT GREY
R E S E A R C H

Firefly® MV

IEEE-1394 Digital Camera System

Getting Started
Manual