FIREFLY®MV SPECIFICATIONS

SPECIFICATION	FFMU-03MTM/C (BW or Color)	FMVU-13S2C (Color)
Image Sensor Type	1/3" progressive scan CMOS	
Shutter Type	Global shutter (Micron TrueSNAP™)	Rolling shutter
Image Sensor Model	Micron MT9V022	Sony IMX035LQR-C
Maximum Resolution	752 (H) x 480 (V)	1328 (H) x 1048 (V)
Pixel Size	6.0 μm x 6.0 μm	3.63 μm x 3.63 μm
Analog-to-Digital Converter	On-chip 10-bit ADC	On-chip 10 / 12-bit ADC
Video Data Output	8 and 16-bit digital data	
Image Data Formats	Y8, Y16 (monochrome), 8-bit and 16-bit raw Bayer data (color models)	
Digital Interface	5-pin Mini-B USB 2.0 for camera control, video data, power	
Transfer Rates	480 Mb/s	
Maximum Frame Rate*	752x480 at 61 FPS 320x240 at 112 FPS (ROI) 320x240 at 122 FPS (2 x 2 pixel binning)	Free-running acquisition: 1328x1048 at 23FPS, 664x524 at 60 FPS (2x2 pixel binning) 640x480 at 60 FPS (center cut-out mode) Triggered acquisition: Frame rate is half the specified rate. Maximum frame rate in external trigger mode: 30FPS
Partial Image Modes	pixel binning and region of interest modes via Format_7	pixel binning or center cut-out (640x480) mode via Format_7
General Purpose I/O Ports	7-pin JST GPIO connector, 4 pins for trigger and strobe, 1 pin +3.3 V, 1 Vext pin for external power	
Gain Control	automatic / manual, 0 dB to 12 dB	automatic / manual, 0 dB to 18 dB
Shutter Speed	auto / manual, 0.12 ms to 512 ms	auto / manual, 0.12 ms to 8000 ms
Gamma	0 to 1 (enables 12-bit to 10-bit companding)	
Synchronization	via external trigger	
External Trigger Modes	IIDC v1.31 Trigger Modes 0 and 3	
Power Requirements	4.745 to 5.25 V via the Mini-B USB 2.0 or GPIO connector, less than one (1) Watt	
Dimensions (L x W x H)	24.4 x 44 x 34 mm	
Mass	37 g (including tripod adapter)	
Camera Specifications	IIDC 1394-based Digital Camera Specification v1.31	
Memory Storage	three memory channels for user configurable power-up settings	
Lens Mount	CS-mount (5mm C-mount adapter included) • M12 microlens mount**	
Compliance	CE, FCC Class B, RoHS	

* Using standard Format 7 modes and ROI ** Board level only

CAMERA AND DEVICE CONTROL

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 PROCESSING

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)

IMAGE ACQUISITION

Global Shutter[3]	Photodiode pixels with simultaneous integration and readout
Near-IR Performance[3]	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

[3] FMVU-03MTM/C only

CAMERA INTERFACE

USB 2.0 CONNECTOR
The Firefly® MV has a standard USB 2.0 connector that is used for data transmission, camera control and powering the camera.

CABLES
The maximum USB 2.0 cable length between any USB node (e.g. camera to PCI card, card to hub, etc.) is 5.0 m, as specified by the USB 2.0 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 case. The connector is made by JST (Mfg P/N: BM07B-SRSS-TB). The Development Kit contents include a pre-wired female connector (Point Grey P/N: ACC-01-3002); refer to the diagram below for wire color-coding. Additional female connectors (JST Mfg P/N: SHR-07V-S-B) can be purchased from Digikey (P/N: 455-1382-ND).

Diagram	Pin	Function	Description
7 6 5 4 3 2 1	1	Vext	Power camera externally
	2	+3.3V	Power external circuitry up to a total of 150mA
	3	IO0	Input / Output (Default Trigger_Src)
	4	IO1	Input / Output
black green green green green red white	5	IO2	Input / Output / RS232 Transmit (TX)
	6	IO3	Input / Output / RS232 Receive (RX)
Pre-wired GPIO cable	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.

Getting Started

Firefly®MV USB 2.0 Digital Camera

The following items are included with your Firefly MV Development Accessory Kit

- 2 meter USB 2.0 cable (Type A to Mini-B 5 pin)
- ACC-01-3002: GPIO wiring harness
- Firefly MV Getting Started Manual
- FlyCapture® SDK (C/C++ API and device drivers) CD

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POINT GREY
Innovation in Imaging

STANDARD IMAGE FORMATS

Mode Description	Frames Per Second					
	1.875	3.75	7.5	15	30	60
640x480 Y8 (8bpp)			•	•	•	•
640x480 Y16 (16bpp)			•	•	•	
1280x960 Y8 (8bpp)*			•	•		
1280x960 Y16 (16bpp)*			•			

* FMVU-13S2C Only

PARTIAL IMAGE FORMATS (FORMAT_7)
FMVU-03MTM/C

Mode	Pixel Format	Size	FPS	Description
0	Mono8 (8bpp)	752x480	61	Region of interest (ROI)
1	Mono8 (8bpp)	320x240	122*	2x2 pixel binning
2	Mono8 (8bpp)	320x240	122*	1x2 pixel binning

* Black and white output only. Color data is removed due to pixel binning.

FMVU-13S2C

Mode	Pixel Format	Size	FPS	Description
0	Mono8 (8bpp)	1328x1048	23	Region of interest (ROI)
0	Mono8 (8bpp)	640x480	60	Center cut-out mode**
1	Mono8 (8bpp)	664x524	60	2x2 pixel binning**

**This is the only ROI size available in this Format 7 Mode.

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).

STATUS LED

Steady on	Receiving power and successful camera initialization
Steady on and very bright	Acquiring / transmitting images
Flashing bright, then brighter	Camera registers being accessed (no image acquisition)
Steady or slow flashing on and off	Camera firmware updated (requires power cycle), or possible camera problem

SPECTRAL RESPONSE (QE)

FFMV-03MT / FMVU-03MT

FMVU-13S2C
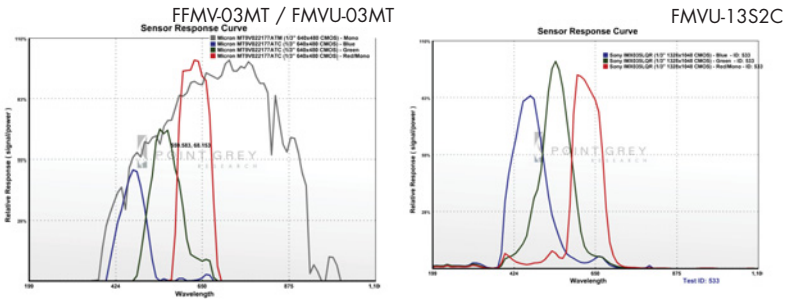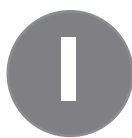
1 Installation

1. Recommended System Configuration

OS	CPU	RAM	VIDEO	PORTS
Windows XP SP1	2.0GHz or equivalent	512mb	AGP 128mb	USB 2.0

- Windows XP Service Pack 1
- 512MB of RAM
- Intel Pentium 4 2.0GHz or compatible processor
- AGP video card with 128MB video memory
- FlyCapture SDK v1.8 or later
- 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:

- This product is not intended for use in residential environments.
- Either handle bare handed or use non-chargeable gloves, clothes or material. Also use conductive shoes.
- 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.
- This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable operation. This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

- 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.

3. Install the FlyCapture® Software and Drivers

FLYCAPTURE
Software and Drivers
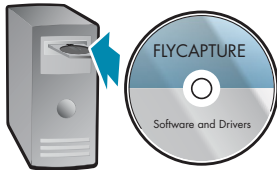
- Insert the software CD-ROM. If the Installation Wizard does not automatically run, browse to your CD-ROM directory and run setup.exe.
- Follow the installation instructions to install the software.

4. Installing the Tripod Adapter (optional)
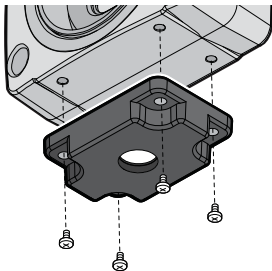
- The ASA and ISO-compliant tripod adapter for the Firefly MV USB 2.0 models attaches to the camera using the included M2x3.5 screws.

5. Connect the Camera to the USB 2.0 port
- Plug the 2-meter USB 2.0 cable (Type A to Mini-B 5-pin) into the host machine's USB 2.0 port and the Firefly MV USB 2.0 connector.
- If the Microsoft Windows "Found New Hardware Wizard" appears, proceed to Step 6. Otherwise, proceed to Step 7.

USB 2.0
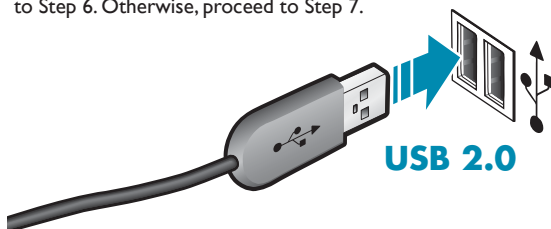
6. Install the PGRUSBCam Driver

- 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.

7. Confirm Successful Installation

- Check the Device Manager to confirm that installation was successful (PGRUSBCam driver install only). 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.**

2 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 145: Image discontinuities or horizontal tearing of images when displayed on monitor
- 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.
- Article 197: Extending the distance between a PGR camera and the controlling host system.
- Article 309: Use USB 2.0 PCI host adapter cards with USB cameras

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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/.

TECHNICAL DRAWINGS