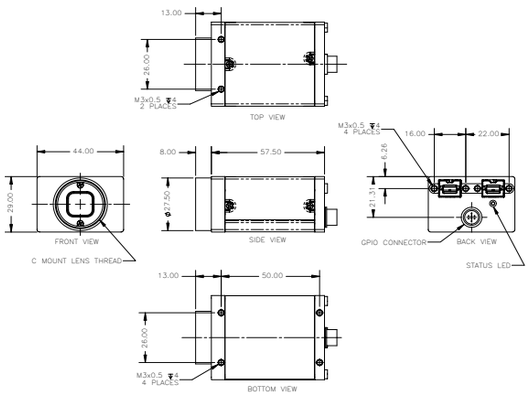
Development Kit Contents

First time *Grasshopper*® users are required to purchase this kit in addition to purchasing the initial camera:

- 4.5 meter, 9-pin to 9-pin locking IEEE-1394b cable for secure connection
- 4.5 meter, 6-pin to 9-pin locking IEEE-1394a to 1394b cable for secure connection
- IEEE-1394b OHCI PCI Host Adapter 3-port 800Mb/s card
- One (1) meter GPIO wiring harness with Hirose HR25 8-pin male connector
- *FlyCapture*® SDK (C/C++ API and device drivers) CD

Physical Dimensions



Camera Specifications

Specification	14S5	20S4	50S5
Overview	Compact case-enclosed IEEE-1394b digital camera		
Imaging Sensor	Sony® progressive scan CCDs		
Sensor Model	ICX285 2/3"	ICX274 1/1.8"	ICX625 2/3"
Sensor Max Pixels	1384x1036	1624x1224	2448x2048
Sensor Pixel Size	6.45 x 6.45µm	4.4 x 4.4µm	3.45 x 3.45µm
A/D Converter	Analog Devices 14-bit analog-to-digital converter		
Video Data Output	8, 16 and 24-bit digital data (see *Supported Data Formats*)		
Resolutions and FPS	See the *Supported Data Formats* section		
Partial Image Modes	Pixel binning and region of interest modes available via Format_7		
Interfaces	Dual 9-pin IEEE-1394b for camera control and video data transmission 4 general-purpose digital input/output (GPIO) pins.		
Power Requirements	Voltage: 8-32V via 1394 cable or GPIO. Power: less than 3.5W		
Gain	Automatic/Manual/One-Push Gain modes		
	0dB to 24dB		
Shutter	Automatic/Manual/One-Push Shutter modes		
	0.01ms to 66.63ms @ 15 FPS		
	Extended shutter modes for exposure times longer than 5 seconds		
Gamma	0.50 to 4.00		
Trigger Modes	DCAM v1.31 Trigger Modes 0, 1, 3, 14 and 15		
Dimensions	44mm x 29mm x 58mm (without optics)		
Mass	104 grams (without optics)		
Lens Mount	C-mount		
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 40°C		
Storage Temperature	-30° to 60°C		
Warranty	Two years (refer to the *Grasshopper Technical Reference* for full details)		

Standard Image Formats

14S5C 14S5M 20S4C 20S4M 50S5C 50S5M

Mode	Frames Per Second					
	1.875	3.75	7.5	15	30	60
160x120 YUV444			●	●	●	
320x240 YUV422	●●	●●	●●	●●	●	
640x480 YUV411	●●	●●	●●	●●	●	
640x480 YUV422	●●	●●	●●	●●	●	
640x480 RGB	●●	●●	●●	●●	●	
640x480 Y16	●●●●	●●●●	●●●●	●●●●	●●●●	●●
640x480 Y8	●●●●	●●●●	●●●●	●●●●	●●●●	●●
800x600 YUV422		●●	●●	●●	●	
800x600 RGB			●●	●●	●	
800x600 Y16		●●●●	●●●●	●●●●	●●	
800x600 Y8			●●●●	●●●●	●●	
1024x768 YUV422	●●●	●●●	●●●	●●●		
1024x768 RGB	●●●	●●●	●●●	●●		
1024x768 Y16	●●●●●●	●●●●●●	●●●●●●	●●●●●●	●●●●	
1024x768 Y8	●●●●●●	●●●●●●	●●●●●●	●●●●●●	●●●●	
1280x960 YUV422	●●	●●	●●	●●		
1280x960 RGB	●●	●●	●●	●●		
1280x960 Y16	●●●●	●●●●	●●●●	●●●●		
1280x960 Y8	●●●●	●●●●	●●●●	●●●●	●●	
1600x1200 YUV422	●●	●●	●●	●●		
1600x1200 RGB	●●	●●	●●			
1600x1200 Y16	●●●●	●●●●	●●●●	●●●●		
1600x1200 Y8	●●●●	●●●●	●●●●	●●●●		

Camera Features

Image Acquisition

Feature	Description
IEEE-1394b Bandwidth	800Mb/s transfer rates allow full color RGB output at high FPS
Automatic Synchronization	Multiple cameras on the same 1394b bus automatically sync
Fast Frame Rates	Faster standard frame rates, pixel binning and ROI support
Multiple Trigger Modes	Bulb-trigger mode, multiple triggered exposures before readout
Trigger at Full Frame Rate	Overlapped trigger input, image acquisition and transfer

Image Processing

Feature	Description
Color Conversion	On-camera conversion to YUV411, YUV422 and RGB formats
Image Processing	On-camera control of sharpness, hue, saturation, gamma, LUT
Embedded Image Info	Pixels contain frame-specific info (e.g. shutter, 1394 cycle time)

Camera and Device Control

Feature	Description
Auto White Balance	Auto and one-push white balance for easy color balancing
Frame Rate Control	Fine-tune frame rates for video conversion (e.g. PAL @ 24 FPS)
Improved Strobe Output	Increased drive strength, configurable strobe pattern output
Serial Port	Provides serial communication via GPIO TTL digital logic levels
Memory Channels	Non-volatile storage of camera default power-up settings
Camera Upgrades	Firmware upgradeable in field via IEEE-1394 interface.

Mechanics and Form Factor

Feature	Description
Industry Standard Design	ASA/ISO-compliant mounting bracket and C-mount lens holder
Jack Screw Connector	1394b cable jack screws provide secure connection

Spectral Response (QE)

For full sensor datasheets, including spectral response graphs, go to:
www.ptgrey.com/support/kb/index.asp?a=4&q=23

Status LED

The *Grasshopper* is equipped with a bi-color LED that can be red, green, or yellow (when both green and red are turned on). If the LED does not turn on at all when the camera is connected to the IEEE-1394b host adapter card, check that the camera is receiving adequate power. Refer to Knowledge Base Article 93 for a list of options to consider when running the camera off a laptop (notebook) computer.

FireWire activity: isochronous or asynchronous transmission of data on the IEEE-1394 bus
Configuration error: Bit [0] of VMODE_ERROR_STATUS register 0x628
Powered down: Power controlled via CAMERA_POWER register 0x610

LED Behaviour	Possible Causes
Maximum red (initial connection)	Initial startup. On until camera is being initialized
Maximum red (during operation)	Condition 1: Bus reset. On for 0.66s. Condition 2: Power failure. On until power-up via CAMERA_POWER 0x610.
Dull red	Configuration error.
Bright red	Configuration error.
Dull green	Camera is idle.
Bright green	FireWire activity. On for 0.5s during activity.
Dull yellow	Powered down.
Bright yellow	Powered down + FireWire activity. Bright for 0.5s during activity.
Red / green flashing	Camera firmware is being updated. Flashes at 5Hz.

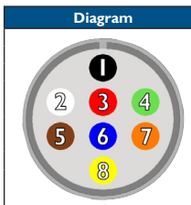
Camera Interface

IEEE-1394b Connector and Cables

The *Grasshopper* has two standard 9-pin IEEE-1394b connectors that can be used for data transmission, camera control and powering the camera. The maximum 1394b cable length between any 1394 node (e.g. camera to PCI card) is 4.5m, as specified by the IEEE-1394 standard. Use standard, shielded twisted pair copper cables. If the LED does not turn on at all when the camera is connected to the IEEE-1394b host adapter card, check that the camera is receiving adequate power. Refer to Knowledge Base Article 93 for a list of options to consider when running the camera off a laptop.

General Purpose I/O Connector

The *Grasshopper* has a Hirose HR25 8-pin general purpose input/output (GPIO) female connector on the back of the case (P/N: HR25-7TR-8SA). The development accessory kit includes a one (1) meter long wiring harness equipped with a male connector (P/N: HR25-7TP-8P, Digikey P/N: HR702-ND). Wires are color coded or labelled according to the table below to indicate functionality.

Diagram	Pin	Function	Description
	1	IO0	Input / Output (default Trigger_Src)
	2	IO1	Input / Output
	3	IO2	Input / Output / RS232 Transmit (TX)
	4	IO3	Input / Output / RS232 Receive (RX)
	5, 6	GND	
	7	Vext	Allows the camera to be powered externally. Voltage limit: 8 to 30V , Current limit: 1A
	8	+3.3V	Power external circuitry up to a total of 150mA
	To configure the GPIO pins, consult the "General Purpose Input / Output" section of the *PGR IEEE-1394 Digital Camera Register Reference*.		

Inputs can be configured to accept external trigger signals. **Outputs** can be configured to send an output signal or strobe pulse. Refer to the *Grasshopper Technical Reference* for detailed GPIO electrical characteristics.

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
- PCI Express slot and 1394b card (not included) (32-bit slot required)
- 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:
  - 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.
- 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-1394b PCI card

- Place the IEEE-1394b 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.

IMPORTANT NOTE for Windows XP Users
A dialog will appear prompting you to install the **PGRPRO** driver. We strongly recommend doing this in order to take full advantage of 1394b 800Mb/s speeds. 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 ASA and ISO-compliant tripod mounting bracket for the *Grasshopper* attaches to the camera using the included M2x5 screws.

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

- Plug the 4.5 meter, 9-pin to 9-pin, IEEE-1394b cable into the 1394b PCI card and either of the *Grasshopper's* 1394b connectors; the cable jack screws can be used for a secure connection. **NOTE:** The camera relies on the 9-pin 1394b 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

- Proceed to Step 8 if the PGRPRO driver has been installed.
- 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 (PGRCAM driver install only). Go to the *Start* menu, select *Run* and enter "devmgmt.msc".
- 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.

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

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Grasshopper™

IEEE-1394b Digital Camera

Getting Started Manual

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