Product Catalog–Stereo

POINT GREY

PRODUCT CATALOG – STEREO

POINT GREY

PRODUCT CATALOG – STEREO

Stereo Vision Cameras for Superior 3D Imaging

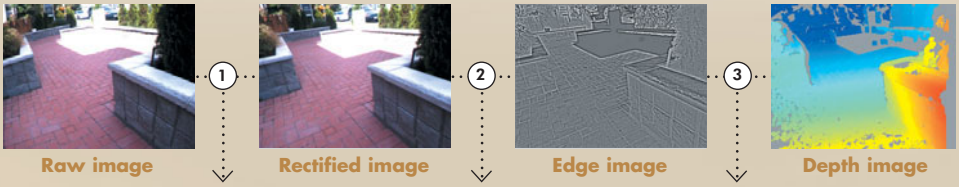
Point Grey has made stereo vision practical for a variety of research areas by providing hardware and software packages that include complete stereo processing support – from image correction and alignment to dense correlation-based stereo mapping.

Stereo vision works in a similar way to 3D sensing in human vision. It begins with identifying image pixels that correspond to the same point in a physical scene observed by multiple cameras. The 3D position of a point can then be established by triangulation using a ray from each camera. The more corresponding pixels identified, the more 3D points that can be determined with a single set of images. Correlation stereo methods attempt to obtain correspondences for every pixel in the stereo image, resulting in tens of thousands of 3D values generated with every stereo image.

POINT GREY'S STEREO VISION TECHNOLOGY DELIVERS:

- Full field-of-view depth measurements from a single image set
- Real time transformation of images to 3D data – cameras can easily generate one million 3D points per second
- Easy integration with other machine vision techniques – the images and 3D data are perfectly registered
- Passive 3D sensing – no lasers or projectors required
- Pre-calibration for lens distortion and camera misalignments, no manual adjustments or in-field calibration required
- High quality CCD sensors and IIDC 1.31 compliant high speed 1394 interface
- Flexible software environment that provides access to all levels of the stereo processing pipeline

STEREO IMAGE PROCESSING PIPELINE



Stage 1: Rectification
After the images are transmitted to the PC over the IEEE-1394 bus, they are corrected and aligned to remove lens distortion.

Stage 2: Laplacian of Gaussian
The Laplacian of Gaussian filter is applied to create edge images that are not biased by image brightness.

Stage 3: Correlation Stereo
For each pixel in the right image, a corresponding pixel in the left image is obtained via correlation using the Sum of Absolute Differences criteria.

CALIBRATION QUALITY & IMAGE RECTIFICATION

Point Grey Stereo Vision cameras are factory-calibrated for lens distortion and camera misalignments, to ensure consistency of calibration across all cameras and eliminate the need for in-field calibration. During the rectification process, epipolar lines are aligned to within 0.1* pixels RMS error. Calibration results are stored on the camera, allowing the software to retrieve image correction information without requiring camera-specific files on the host computer. This allows seamless swapping of cameras and easy use of multi-camera systems. The camera case is also specially designed to protect the calibration against mechanical shock and vibration.

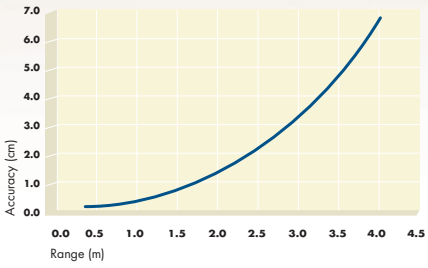
Images can be rectified to any image size, making it easy to change the resolution of stereo results depending on speed and accuracy requirements. Camera calibration and rectification are key to getting high quality disparity images from a stereo camera.

Raw Image
This image shows the lens distortion for a wide angle lens.

Rectified Image
Same image corrected with lens distortion removed.

RANGE VS ACCURACY

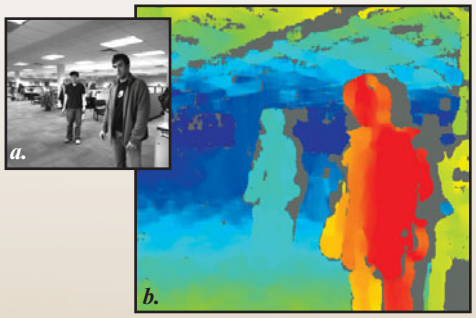
This chart shows the accuracy of 3D point calculations versus the range to the point. Results are heavily dependent on camera model and parameters, such as image resolution, lens focal length and calibration accuracy. This chart was generated for a 3.8mm Bumblebee2 camera with a stereo resolution of 512x384 and typical calibration accuracy.



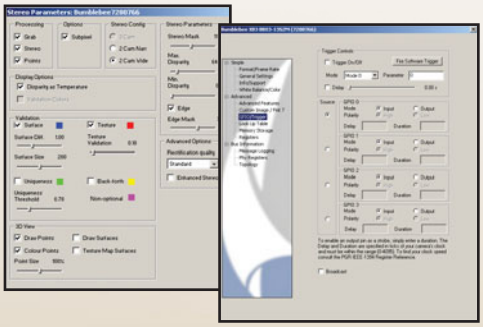
* This figure is based on a stereo resolution of 640x480 and is valid for all camera models. Calibration accuracy will vary from camera to camera.

Software

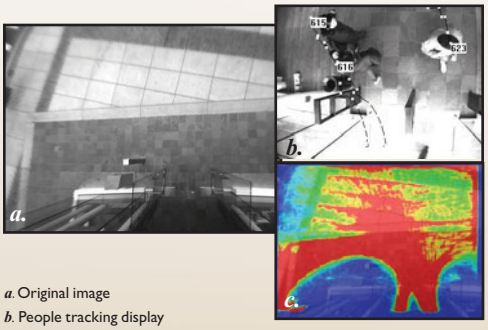
Point Grey's IEEE-1394 (FireWire) Stereo Vision camera systems are provided as complete hardware and software packages. Every Point Grey Stereo Vision camera system includes a free license of the FlyCapture SDK, which is used for image acquisition and camera control, and the Triclops SDK, which performs image rectification and stereo processing. Additional stereo vision software components are available at no extra cost such as the Censys3D SDK, which is ideal for people tracking.



a. Original Image *b*. Depth Image



Triclops SDK Stereo & Camera Settings Dialog Boxes



a. Original image
b. People tracking display
c. Trajectory information over one day

TRICLOPS™ STEREO SDK

The Triclops SDK provides flexible access to all image stages in the stereo processing pipeline, making it ideal for custom stereo processing approaches. For example, users can track features in the distorted images, rectify feature locations only, use rectified locations to perform epipolar validation on the features, and then determine their locations in 3D. Or users can rectify images and implement a user-supplied stereo algorithm, or perform correlation stereo only in regions of interest in the image, to speed up stereo processing. This flexibility enables innovation in a wide range of stereo vision research and application.

Triclops SDK features include:

- Distance Measurement for every pixel in view
- Over1,000,000 measurements per second*
- Removes lens distortions and misalignments
- Extensive example programs and source code
- Free unlimited upgrades to the latest versions

FLYCAPTURE® SDK

The FlyCapture Software Development Kit that comes with every camera provides a common software interface to control all Point Grey FireWire and USB 2.0 cameras using the same API. FlyCapture supports ActiveX, TWAIN and DirectShow interfaces, and includes the FirePRO low-level 1394b interface driver, which enables users to grab images at full 800Mb/s transfer rates. A complete software API library, ready-to-use demo programs, and comprehensive source code examples enable users to easily build custom imaging applications.

FlyCapture SDK features include:

- Resolution and frame rate control
- Control settings like shutter and gain
- Get information about the camera and software
- HDR, image flip, and other advanced features
- Pixel binning and region of interest control
- GPIO control for trigger and strobe

CENSYS3D® SDK

The Censys3D SDK is designed to provide users with accurate, online, people tracking information in challenging environments. The SDK requires a Point Grey Research Stereo Vision camera and allows users to easily integrate robust tracking functionality into their own custom applications. Stereo Vision camera owners can download this SDK for free from our download page.

Key features include:

- Up to 6m x 4m coverage area
- Tracks people even in crowded conditions
- Can be used indoors or outdoors
- Unaffected by shadows and changes in lighting

Sample Tracking Applications include:

- Track shopper movement in retail environments
- Secure a restricted area by monitoring its traffic
- Guard against personnel entering hazardous areas

* Computations are performed on host computer.

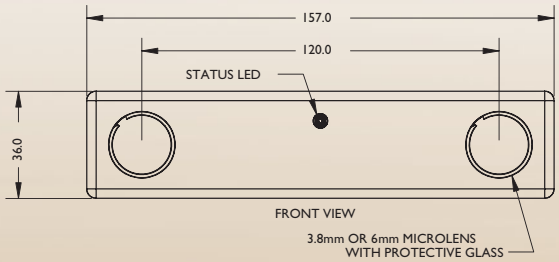
Recommended System Configuration:
- Windows® XP Service Pack 1
- 512MB of RAM
- Intel® Pentium 4 2.0GHz or compatible processor
- AGP video card with 128MB video memory
- PCI slot for the IEEE-1394 OHCI card (PCI Express recommended)
- Microsoft® Visual C++ 6.0 (to compile and run example code)

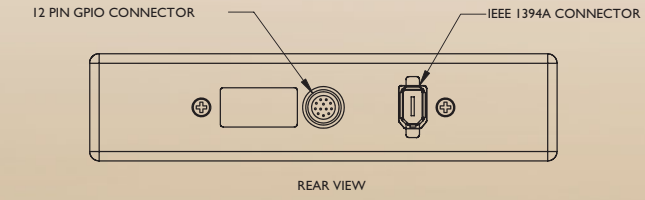
Bumblebee® 2

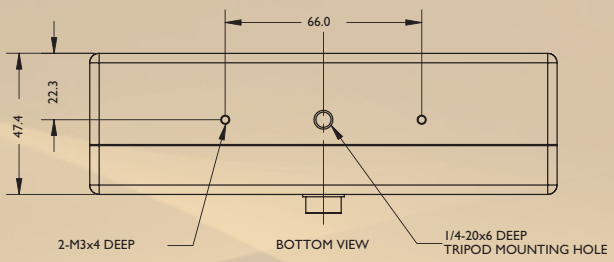
0.3MP	Sony 0.3 MP 1/3" ICX424	648x488 at 48 fps
0.8MP	Sony 0.8 MP 1/3" ICX204	1032x 776 at 20 fps

Baseline	12 cm
Focal Lengths	2.5 mm with 97° HFOV, 3.8 mm with 66° HFOV, 6 mm with 43° HFOV
A/D Converter	12-bit analog-to-digital converter
White Balance	Automatic / Manual (Color model)
Video Data Output	8, 16, 24-bit digital data
Interfaces	6-pin IEEE-1394a for camera control and video data transmission / 4 general-purpose digital input/output (GPIO) pins
Voltage Requirements	8-32V via IEEE-1394 interface or GPIO connector
Power Consumption	2.5W at 12V
Gain	Automatic/Manual
Shutter	Automatic/Manual, 0.01ms to 66.63ms at 15 FPS
Trigger Modes	DCAM v1.31 Trigger Modes 0, 1, 3, and 14
Signal To Noise Ratio	60dB
Dimensions	157 x 36 x 47.4 mm
Mass	342 grams
Camera Specification	IIDC 1394-based Digital Camera Specification v1.31
Lens mount	2 x M12 microlens mount
Emissions Compliance	Complies with CE rules and Part 15 Class A of FCC Rules
Operating Temp.	Commercial grade electronics rated from 0° to 45°C

The Bumblebee2 is the second generation Bumblebee stereo vision camera. It provides a balance between 3D data quality, processing speed, size and price. Developed as a drop-in replacement for the original Bumblebee camera, the Bumblebee2 also features double the frame rate and a GPIO connector for external trigger and strobe functionality.







Who We Are

Point Grey Research, Inc. is a worldwide leader in the development of advanced digital camera technology products for machine vision, industrial imaging, and computer vision applications. Based in Richmond, BC, Canada, Point Grey designs, manufactures and distributes IEEE-1394 (FireWire) and USB 2.0 cameras that are known for their excellent quality, performance, and ease of use.

A broad range of hardware, software, and mechanical engineering skills has allowed Point Grey to successfully bring innovative and ground-breaking products to market. This drive for innovation has led to many industry firsts, including both the first and the world's smallest 1394b digital camera.

Since its founding in January of 1997, the company's approach to product pricing, quality control, and customer service has attracted thousands of customers worldwide, and its organic growth through product sales has enabled the company to expand significantly without any outside investment. Point Grey currently employs more than 90 people worldwide, and has a German subsidiary that provides sales and support services to customers in Europe, Africa and Israel. The company has also established a strong network of distributors in Japan, Korea, China, Singapore, and Taiwan.

All Point Grey cameras and FirePRO products are built using state-of-the-art manufacturing facilities, located in the company's 41,000 square-foot (3,800 sq m) corporate headquarters. These facilities include a dedicated SMT line, AOI and X-ray machines, industrial clean room, and automated test stations.

The "Seal of Quality" label that is applied to each Point Grey camera cannot be printed until the camera has been 100% inspected and tested. This rigorous quality testing, together with hassle-free product warranties, ensures that customers can rely on Point Grey cameras for their demanding vision applications.

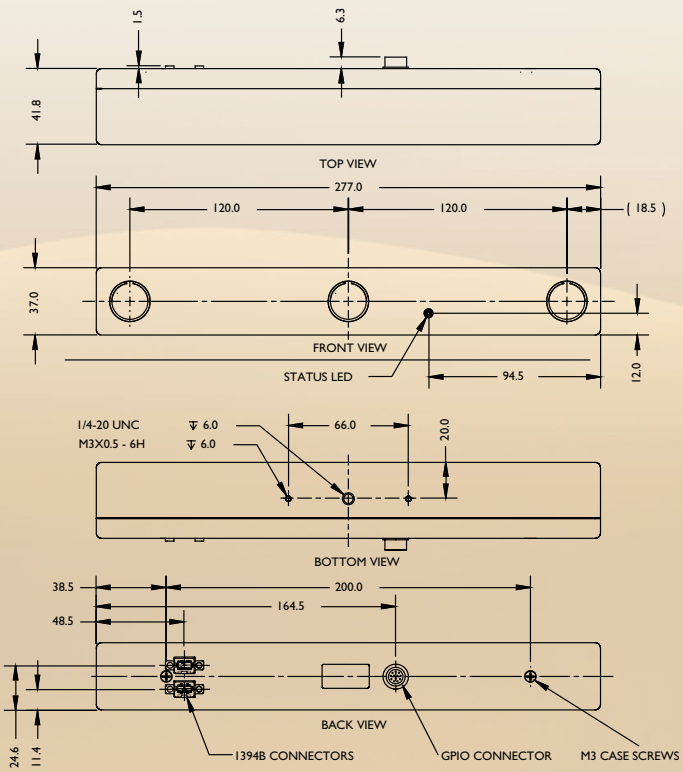
Point Grey is also proud to offer world-class support on installation, configuration, customization and troubleshooting, so that all customers derive significant value from their camera systems. Quick response e-mail and phone support, online user manuals and knowledge base articles, and regular software and firmware updates are designed to deliver a superior ownership experience.

Bumblebee® XB3

1.3MP	Sony 1.3 MP 1/3" ICX445	1280x960 at 16 fps

Baseline	12 cm and 24 cm
Focal Lengths	3.8 mm with 66° HFOV, 6 mm with 43° HFOV
A/D Converter	12-bit analog-to-digital converter
White Balance	Manual (Color model)
Video Data Output	8 and 16-bit digital data
Interfaces	2 x 9-pin IEEE-1394b for camera control and video data transmit; 4 general-purpose digital input/output (GPIO) pins
Voltage Requirements	8-32V via IEEE-1394 interface or GPIO connector
Power Consumption	4W at 12V
Gain	Automatic/Manual
Shutter	Automatic/Manual, 0.01ms to 66.63ms at 15 FPS
Trigger Modes	DCAM v1.31 Trigger Modes 0, 1, 3, and 14
Signal To Noise Ratio	54dB
Dimensions	277 x 37 x 41.8 mm
Mass	505 grams
Camera Specification	IIDC 1394-based Digital Camera Specification v1.31
Lens mount	3 x M12 microlens mount
Emissions Compliance	Complies with CE rules and Part 15 Class A of FCC Rules
Operating Temp.	Commercial grade electronics rated from 0° to 45°C

The Bumblebee XB3 is a 3-sensor multi-baseline IEEE-1394b (800Mb/s) stereo camera designed for improved flexibility and accuracy. It features 1.3 megapixel sensors and has two baselines available for stereo processing. The extended baseline and high resolution provide more precision at longer ranges, while the narrow baseline improves close range matching and minimum-range limitations.



1997 Company Incorporation

1998 First analog stereo vision camera Triclops

2000 First IEEE 1394 stereo vision camera Digiclops

2001 First IEEE 1394 imaging camera Firefly

2002 First spherical vision camera Ladybug

2004 First IEEE 1394b camera Dragonfly Express

2005 Headquarters expansion
New products Dragonfly2 Ladybug2

2006 Office opens in Germany
New products Flea2 Firefly MV

2007 New products Grasshopper FirePRO

2008 Headquarters expansion
First USB 2.0 camera Chameleon
New product Ladybug3

2009 World's first USB 3.0 Camera

POINT GREY

PRODUCT CATALOG – STEREO

CANADA (Headquarters)

Point Grey Research, Inc.

12051 Riverside Way
Richmond, BC, Canada
V6W 1K7

T: +1 866.765.0827 (toll free)
T: +1 604.242.9937
F: +1 604.242.9938
E: sales@ptgrey.com

USA

T: +1 866.765.0827 (toll free)
E: na-sales@ptgrey.com

EUROPE

T: +49 7141 488817-0
F: +49 7141 488817-99
E: eu-sales@ptgrey.com

DISTRIBUTORS

JAPAN–ViewPLUS Inc. (www.viewplus.co.jp)
KOREA–CYLOD Co., Ltd. (www.cylod.com)
CHINA–LUSTER LightVision (www.lusterlighttech.com)
SINGAPORE–Voltrium Systems (www.voltrium.com.sg)
TAIWAN–Apo Star Co., Ltd. (www.apostar.com.tw)