Dragonfly Express™ Kit Contents
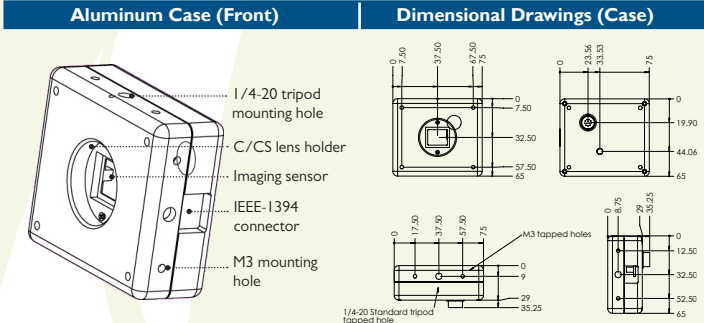
The following items are included in all *Dragonfly Express*™ camera kits:

- *Dragonfly Express* IEEE-1394 digital camera unit
- Anodized aluminum case w/CS-mount lens holder (DX-xx-CSBX only)
- 4.5 meter, 9-pin to 9-pin, IEEE-1394b cable
- IEEE-1394b OHCI PCI Host Adapter 3-port 800Mb/s card
- 5mm spacer for use with C-mount lens
- Hirose 12-pin male GPIO connector
- PGR FlyCapture SDK (C/C++ API and device drivers) CD

Camera Specifications

Specification	Description
Overview	OEM board-level camera (anodized aluminum case available)
Imaging Sensor	Kodak 1/3" progressive scan interline CCD (dual output)
	KAI-0340DM / KAI-0340DC
Max Pixels / Pixel Size	648 (H) x 484 (V) effective pixels / 7.4μm (H) x 7.4μm (V)
Sensor Datasheet	http://www.ptgrey.com/support/kb/index.asp?a=4&q=23
A/D Converter	Two (2) Analog Devices AD9847 10-bit analog-to-digital converters
Video Data Output	8 and 16-bit digital data (see *Standard Image Formats* below)
Standard Frame Rates	120, 60, 30, 15, 7.5, 3.75, 1.875 FPS (200 FPS using Format_7)
Partial Image Modes	Format_7 Modes 0 to 5 (region of interest and pixel binning)
Interfaces	9-pin IEEE-1394b for camera control and video data transmission 4 general-purpose digital input/output (GPIO) pins
Voltage Requirements	8 to 32V
Power Consumption	Less than 4W
Gain	Automatic / Manual / One-Push Gain modes
	-6dB to 30dB
Shutter	Automatic / Manual / One-Push Shutter modes
	0.02ms to 8.3ms @ 120 FPS / Extended shutter up to 63s
Gamma	0.50 to 4.00
Trigger Modes	DCAM v1.31 Trigger Modes 0, 1, 3 and 14 (overlapped trigger)
Signal To Noise Ratio	Greater than 60dB
Dimensions	63.5mm x 50.8mm x 13.15mm (bare board w/o case or lens holder)
Mass	25 grams (bare board w/o case or optics)
Camera Specification	IIDC 1394-based Digital Camera Specification v1.31
Emissions Compliance	Complies with CE rules and Part 15 Class B of FCC Rules (in aluminum case only).
Operating Temperature	Commercial grade electronics rated from 0° to 45°C
Storage Temperature	-30° to 60°C
Camera Upgrades	Firmware upgradeable in field via IEEE-1394b interface

Physical Description

Aluminum Case (Front)	Dimensional Drawings (Case)

- 1/4-20 tripod mounting hole
- C/CS lens holder
- Imaging sensor
- IEEE-1394 connector
- M3 mounting hole

The large mounting holes on the case are 1/4-20 tapped holes. The smaller mounting holes are M3 tapped holes. The lens set screw hole is 2mm and the set screw requires a 0.035-inch hex driver. The set screw is used to hold the adjustable C/CS lens holder ring in place once the lens is focused. The camera comes pre-focused to the standard CS-mount lens focal length (12.52mm).

The case is designed to prevent dust from falling directly onto the CCD's protective glass surface. This is achieved by placing a piece of glass above the surface of the CCD's glass.

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
Automatic Synchronization	Multiple DX's on the same 1394 bus automatically sync
Fast Frame Rates	Faster standard frame rates up to 120 FPS
Partial Image Modes	Format_7 modes for fast frame rates (640x480 @ 200 FPS)
Multiple Trigger Modes	Bulb-trigger mode, overlapped trigger at full frame rate
Dual Output Sensor	Dual output to two A/D converters for 640x480 @ 200 FPS
Gain and Brightness	Adjust gain and black clamp via a pair of 10-bit A/D converters

Image Processing

Feature	Description
Image Processing	On-camera control of gamma and lookup table
Embedded Image Info	Pixels contain frame-specific info (e.g. shutter, 1394 cycle time)
Test Pattern	Continuous static image for testing and development

Camera and Device Control

Feature	Description
Broadcast Properties	Apply settings (e.g. shutter, gain) to all cameras on the same bus
Auto White Balance	Auto and one-push white balance for easy color balancing
Voltage Sensor	Monitors sensor voltages to ensure optimal image quality
Frame Rate Control	Fine-tune frame rates for video conversion (e.g. PAL @ 24 FPS)
Improved Strobe Output	Configurable strobe pattern output, pulse width modulation
RS-232 Serial Port	Provides serial communication via GPIO TTL digital logic levels
Camera Upgrades	Firmware upgradeable in field via IEEE-1394b interface.

Standard Image Formats

Dragonfly Express™ 640x480 (Format_0)

Mode Description	Frames Per Second						
	1.875	3.75	7.5	15	30	60	120
640x480 Y8 (8bpp)	•	•	•	•	•	•	•
640x480 Y16 (16bpp)	•	•	•	•	•	•	

Partial Image Formats (Format_7)

Mode_0: Region of interest (ROI) mode, single output or dual output, fast shutter
Mode_1: 2x2 pixel binning with dual output
Mode_2: 1x2 pixel binning with dual output
Mode_3: Region of interest (ROI) mode, single output
Mode_4: 2x2 pixel binning with single output
Mode_5: 1x2 pixel binning with single output

Mode	Pixel Format	Size	FPS
0	Mono8 (8bpp)	640x480	200
0	Mono16 (16bpp)	640x480	100
0	Mono8	320x240	320
0	Mono8	160x120	450
1	Mono8	320x240	350
2	Mono8	640x240	350

To achieve 200 FPS using the FlyCap demo program, consult the following Knowledge Base article:
www.ptgrey.com/support/kb/index.asp?a=4&q=236

Camera Interface

IEEE-1394b Connector

The *Dragonfly Express*™ has a standard 9-pin IEEE-1394b connector that is used for data transmission, camera control and powering the camera.

Cables

The maximum 1394b 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 *Dragonfly Express* has a 12-pin Hirose HR10 (Mfg P/N: HR10A-10R-12SB) female circular connector on the back of the case. Camera KIT contents include a pre-wired male connector; refer to the diagram below for wire color-coding. Additional male counterparts (Mfg P/N: HR10A-10P-12P) can be purchased from Digi-Key (P/N: HR112-ND).

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, 7, 8	n/a	Not connected
	9, 10	GND	
	11, 12	+3.3V	Power external circuitry up to a total of 50mA

To configure the GPIO pins, consult the "General Purpose Input / Output" section of the *PGR IEEE-1394 Digital Camera Register Reference*.

The GPIO pins are TTL 3.3V pins protected by two diodes to +3.3V and GND in parallel. There is also a 10K resistor in series to limit current. **Inputs** can be configured to accept external trigger signals. **Outputs** can be configured to send an output signal, strobe, or PWM signal; however, the pins have almost no drive strength (they are high impedance) and need to be buffered with a transistor or driver.

To use the **RS232** functionality, a level converter must be used to convert the TTL digital logic levels to RS232 voltage levels. See B&B Electronics (http://www.bb-elec.com/) P/N: 232LPTTL for an example.

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:
    - 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-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.
- A dialog will appear asking if you want to install the PGR1394b-PRO driver. Please read the instructions in this dialog carefully before deciding to do this. If you have installed Service Pack 2 and will be using FlyCapture for application development, we encourage users to do this. Refer to www.ptgrey.com/support/kb/index.asp?a=4&q=171 for further details.

3 Installation

5. Installing the Tripod Mounting Bracket (optional)

- The mounting bracket for DX-xx-CS models attaches to the bare board camera using the included M3x14 screws and nylon spacers.

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 the *Dragonfly Express* 1394 Connector; 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 PGR1394b-PRO 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. To begin capturing at 200 FPS, follow the instructions at www.ptgrey.com/support/kb/index.asp?a=4&q=236.

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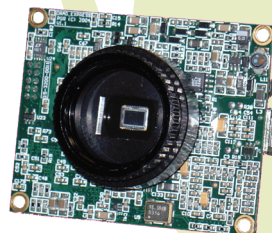
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Downloads: Users can download the latest manuals and software from http://www.ptgrey.com/support/downloads/.

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Dragonfly Express™

IEEE-1394b Digital Camera System

Getting Started
Manual