

Technical Application Note TAN2007006

A Guide to Transitioning from Scorpion® to Grasshopper™
Revised January 9, 2008

1.1. Subject

Technical Application Note (TAN2007006): A Guide to Transitioning from Scorpion to Grasshopper.

1.2. Applicable Product(s)

- *Scorpion* SCOR-03SO, SCOR-14SO and SCOR-20SO models
- *Grasshopper* (all models)

1.3. Application Note Description

The *Grasshopper* was developed as the next generation replacement for the popular *Scorpion* camera. It supports all the features of the *Scorpion*, yet also offers a significant number of additional features such as an IEEE-1394b interface for greater 1394 bus bandwidth, on-board color processing and an even smaller form factor. While the most significant change is, perhaps, the new 1394b interface, PGR has designed the *Grasshopper* to be backward-compatible with the IEEE-1394a standard used by the *Scorpion*.

The purpose of this Technical Application Note is to:

1. Outline the primary similarities and differences between the two cameras; and
2. Assist end users who wish to migrate from the *Grasshopper* to the *Scorpion*.

NOTE: PGR strongly encourages users to put the *Grasshopper* through a full requalification process before deciding to fully migrate from the *Scorpion*. The [Point Grey Research Evaluation Program](#) offers qualified customers an excellent opportunity to evaluate the *Grasshopper*.

Given the significant number of mechanical, hardware and firmware feature enhancements included in the *Grasshopper*, this document will limit its discussion to similarities and differences that could directly impact current *Scorpion* users interested in transitioning to the *Grasshopper*, such as:

- **Mechanics:** dimensions, lens systems, case and brackets, physical and I/O connectors
- **Hardware:** 1394 interface, I/O electrical characteristics, imaging sensors
- **Firmware:** IIDC 1394-based Digital Camera compliance, camera properties

1.3.1. General Considerations

1.3.1.1. Other Reference Documentation

Other useful sources of information regarding specific features of the Applicable Product(s) include:

- [Point Grey Digital Camera Register Reference](#)
- [Scorpion Getting Started Manual](#)
- [Grasshopper Getting Started Manual](#)
- [Point Grey Imaging Products Comparison Chart](#)

1.3.1.2. Testing Tools

To configure and test the information presented in this TAN:

1. **Connect the camera's GPIO pins to an oscilloscope or external trigger source.** By connecting the appropriate GPIO pins to an external trigger source or oscilloscope, you can observe the differences in general purpose input/output capability of the Applicable Product(s). Consult your camera's *Technical Reference* or *Getting Started* manual for:
 - a. GPIO connector pin layouts; and
 - b. GPIO electrical characteristics
2. **Download the FlyCapture SDK.** The SDK includes numerous example programs that demonstrate various camera features. Specific examples that relate to this TAN include *AsyncTriggerEx* and *ExtendedShutterEx*.
3. **Access the camera's register space.** The easiest way to try this is using the FlyCap demo software included with the *FlyCapture SDK*. For register definitions and individual bit descriptions, please refer to the *Point Grey Digital Camera Register Reference*.

1.3.1.3. Camera Orientation

For the purposes of this document, the “*left side*” of the camera is from the point of view of looking out of the camera through the CCD.

1.3.2. Mechanics

Description	Same?	Scorpion	Grasshopper
<i>IR cut filter properties</i>	Y	The infrared cut-off filter used with color versions of the cameras is the same and has the same transmittance properties.	
<i>GPIO connector</i>	N	<ul style="list-style-type: none"> • Hirose HR10 12-pin male connector • 4 pins for trigger and strobe • 4 pins for RS232 serial port 	<ul style="list-style-type: none"> • Hirose HR25 8-pin male connector • 4 pins for trigger, strobe and logic-level serial port
<i>CCD sensor placement</i>	Y	The CCD is centered relative to the lens mount.	
<i>Overall dimensions</i>	N	50x50x37mm	44x29x58mm
		NOTE: Dimensions do not include lens holder or GPIO connector	
<i>Lens holder</i>	N	CS-mount	C-mount
<i>Case description</i>	N	Silver machined aluminum with logo on the top	Black cast zinc with black aluminum top, logo on both sides
<i>Mass</i>	N	125g	104g
		NOTE: Not including lens or C-mount lens adapter (Scorpion)	
<i>Tripod mounting bracket</i>	N	<ul style="list-style-type: none"> • Secured by two (2) M2 screws 	<ul style="list-style-type: none"> • Secured by four (4) M3x8mm screws • Meets ISO and ASA standards
<i>Mounting holes</i>	N	<ul style="list-style-type: none"> • Two (2) M3 on both the top and bottom (4 holes total) • Four (4) M3 on the front 	<ul style="list-style-type: none"> • Four (3) M3x0.5mm on the bottom • Two (2) M3x0.5mm on the top
<i>Removable glass / IR filter system</i>	Y	<ul style="list-style-type: none"> • BW models: protective dust glass between sensor and optics • COL models: IR filter between sensor and optics • Glass / IR filter screwed into place to allow easy removal 	

1.3.3. Hardware and Electronics

Description	Same?	Scorpion	Grasshopper
<i>CCD imaging sensors</i>	N	The Grasshopper incorporates many of the same sensors as the Scorpion, such as the 2MP Sony ICX274, in addition to a range of new sensors, such as the 5MP Sony ICx625.	
<i>RoHS compliance</i>	Y	Both products are RoHS compliant.	
<i>CE/FCC compliance</i>	T	Both products have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules.	
<i>GPIO pin mapping</i>	N	Different GPIO connectors. Refer to camera Getting Started Manual.	
<i>IEEE-1394 interface</i>	N	• 6-pin IEEE-1394a (400Mb/s)	• 9-pin IEEE-1394b (800Mb/s) • Dual locking connectors
		The <i>Grasshopper</i> is backward compatible with standard 1394a OHCI host adapters. To connect the <i>Grasshopper</i> to a 1394a card, such as those provided with <i>Scorpion</i> camera kits, use a 6-pin to 9-pin 1394 cable. However, bus speed will be limited to S400.	
<i>Power consumption</i>	Y	Power consumption is approximately the same at less than 3.5W at 12V	
<i>GPIO electrical characteristics</i>	N	<ul style="list-style-type: none"> • Pin 1 (+3.3V) is capable of powering external circuitry up to a total of 50mA. • When configured as outputs each of the four I/O lines have almost no drive strength. 	<ul style="list-style-type: none"> • Pin 1 (+3.3V) is capable of powering external circuitry up to a total of 150mA. • When configured as outputs, each of the four I/O lines can sink 10mA of current.
<i>A/D converter</i>	N	Analog Devices 12-bit A/D	Analog Devices 14-bit A/D

1.3.4. Firmware and Software

This section does not address the significant number of features that have been added in the *Grasshopper*, but focuses on functional differences between the two cameras that could affect integration of the *Grasshopper* in existing *Scorpion*-based applications. Users are encouraged to download the documents listed in Section 1.3.1.1: Other Reference Documentation for assistance with terms, camera specifications, and register definitions.



Many default startup (power-up) parameters, such as resolution, frame rate, gain, and shutter, have changed in the Grasshopper. However, PGR has implemented memory channels on the Grasshopper that can be used for creating new default settings.



PGR cannot predict if or how all of the following differences may affect user applications. This section provides recommendations on how to address some of the most obvious differences in functionality.

Description	Scorpion	Grasshopper
<i>Color processing</i>	Color models output raw Bayer information when run in standard (Format_0 or Format_1) Y8/Y16 modes. This raw data is then color processed in software by the PC.	Color models output greyscale information when run in standard (Format_0 or Format_1) Y8/Y16 modes. The conversion from raw Bayer information to greyscale is done on-board the camera.
	<p>Recommendation: To access raw data from the <i>Grasshopper</i> for color processing in software by the PC, users should configure the camera to acquire images using one of the Format_7 video modes that support Raw8 or Raw16 pixel encoding e.g. using flycaptureStartCustomImage(). Users can then apply any of the standard FlyCapture color processing algorithms to the image data.</p> <p>Recommendation: Use the <i>Grasshopper</i> memory channel feature to change the default video mode to Format_7, as described above.</p>	
<i>Lookup table</i>	<ul style="list-style-type: none"> • 11-bit to 8-bit mapping • One (1) LUT for raw Bayer data 	<ul style="list-style-type: none"> • 11-bit to 9-bit mapping • Three (3) LUT's for RGB
<i>White balance setting</i>	<ul style="list-style-type: none"> • Red / Blue range: 0 to 127 	<ul style="list-style-type: none"> • Red / Blue range: 1 to 1023 • Auto white balance (default on)

1.4. Glossary

Term	Definition
<i>Absolute Values</i>	Real-world values, such as milliseconds (ms), decibels (dB) or percent (%). Using the absolute values is easier and more efficient than applying complex conversion formulas to integer values.
<i>Analog-to-Digital Converter</i>	Often abbreviated as ADC or A/D converted, it is a device that converts a voltage to a digital number.
<i>API</i>	Application Programming Interface. Essentially a library of software functions.
<i>Auto Exposure (EV)</i>	This is the average intensity of the image. It will use other available (non-manually adjustable) controls to adjust the image.
<i>BPP</i>	Bytes per packet. An image is broken into multiple packets of data, which are then streamed isochronously to the host system. Each packet is made up of multiple bytes of data.
<i>Brightness (%)</i>	This is essentially the level of black in an image. A high brightness will result in a low amount of black in the image. In the absence of noise, the minimum pixel value in an image acquired with a brightness setting of 1% should be 1% of the A/D converter's minimum value.
<i>DCAM</i>	Abbreviation for the <i>IIDC 1394-based Digital Camera (DCAM) Specification</i> , which is the standard used for building FireWire-based cameras.
<i>Firmware</i>	Programming that is inserted into programmable read-only memory, thus becoming a permanent part of a computing device. Firmware is created and tested like software and can be loaded onto the camera.
<i>Format_7</i>	Encompasses partial or custom image video formats and modes, such as region of interest of pixel binned modes. Format_7 modes and frame rates are defined by the camera manufacturer, as opposed to the DCAM specification.
<i>FPS</i>	Frames Per Second.
<i>Frame Rate</i>	Often defined in terms of number of frames per second (FPS) or frequency (Hz). This is the speed at which the camera is streaming images to the host system. It basically defines the interval between consecutive image transfers.
<i>Gain (dB)</i>	The amount of amplification that is applied to a pixel by the A/D converter. An increase in gain can result in a brighter image and an increase in noise.
<i>Gamma</i>	Gamma defines the function between incoming light level and output picture level. Gamma can also be useful in emphasizing details in the darkest and/or brightest regions of the image.
<i>GPIO</i>	General Purpose Input/Output.
<i>Hz</i>	Hertz. A unit of frequency; one Hertz has a periodic interval of one second. Often used interchangeably with FPS as a measure of frame rate.
<i>Quadlet</i>	A 4 byte (32-bit) value.
<i>Quadlet Offset</i>	The number of quadlets separating a base address and the desired CSR address. For example, if the base address is 0xFFFFF0F00000 and the value of the quadlet offset is 0x100, then the actual address offset is 0x400 and the actual address 0xFFFFF0F00400.
<i>Saturation</i>	This is how far a color is from a gray image of the same intensity. For example, red is highly saturated, whereas a pale pink is not.
<i>Sharpness</i>	This works by filtering the image to reduce blurred edges in an image.
<i>Signal-to-Noise Ratio (dB)</i>	The difference between the ideal signal that you expect and the real-world signal that you actually see is usually called noise. The relationship between signal and noise is called the signal-to-noise ratio (SNR). SNR is calculated using the general methodology outlined in KB Article 142.
<i>Shutter (ms)</i>	This is the amount of time that the camera's electronic shutter stays open for; also known as the <i>exposure</i> or <i>integration</i> time. The shutter time defines the start and end point of when light falls on the imaging sensor. At the end of the exposure period, all charges are simultaneously transferred to light-shielded areas of the sensor. The charges are then shifted out of the light shielded areas of the sensor and read out.

1.5. Additional Downloads and Support

Access more Technical Application Notes on the web at www.ptgrey.com/support/downloads.

Point Grey Research Inc. endeavors to provide the highest level of technical support possible to our customers. Most support resources can be accessed through the Product Support section of our website: www.ptgrey.com/support.

Creating a Customer Login Account

The first step in accessing our technical support resources is to obtain a Customer Login Account. This requires a valid name, e-mail address, and camera serial number. To apply for a Customer Login Account go to www.ptgrey.com/support/downloads/.

Knowledge Base

Our on-line knowledge base at www.ptgrey.com/support/kb/ contains answers to some of the most common support questions. It is constantly updated, expanded, and refined to ensure that our customers have access to the latest information.

Product Downloads

Customers with a Customer Login Account can access the latest software and firmware for their cameras from our downloads site at www.ptgrey.com/support/downloads. We encourage our customers to keep their software and firmware up-to-date by downloading and installing the latest versions.

Contacting Technical Support

Before contacting Technical Support, have you:

1. *Read the product documentation and user manual?*
2. *Searched the Knowledge Base?*
3. *Downloaded and installed the latest version of software and/or firmware?*

If you have done all the above and still can't find an answer to your question, contact our Technical Support team at www.ptgrey.com/support/contact/.