
Technical Application Note TAN2006001

Transitioning from the Dragonfly® to the Dragonfly2®: A How-To Guide
Revised March 31, 2006

1.1. Subject

Technical Application Note (TAN2006001): Transitioning from the Dragonfly to the Dragonfly2: A How-To Guide.

1.2. Applicable Product(s)

- **Dragonfly** (all models) with firmware v2.1 Release 16 or later
- **Dragonfly2** (all models)

Consult [Knowledge Base Article 94](#) for information on how to determine camera firmware versions. The most recent firmware versions can be downloaded at www.ptgrey.com/support/downloads/.

1.3. Application Note Description

The *Dragonfly2* (DR2) was developed for easy design transition from the original *Dragonfly* camera. It supports many of the features of the *Dragonfly*, yet also offers a significant number of additional features such as faster standard frame rates, auto-iris lens control and on-board color processing. While some *Dragonfly*-specific functionality has been removed or changed in the *Dragonfly2*, PGR has designed the DR2 to be backward-compatible with most core *Dragonfly* features.

The purpose of this Technical Application Note is to:

1. Outline the primary similarities and differences between the two cameras; and
2. Offer suggestions and pointers to end users for migrating their custom applications from the *Dragonfly* to the *Dragonfly2*.

NOTE: PGR strongly encourages users to put the *Dragonfly2* through a full requalification process before deciding to fully migrate from the *Dragonfly*.

Given the vast number of mechanical, hardware and firmware feature enhancements included in the *Dragonfly2*, this document will limit its discussion to similarities and differences that could directly impact current *Dragonfly* users interested in transitioning to the DR2, such as:

- **Mechanics:** dimensions, lens systems, case and brackets, physical and I/O connectors
- **Hardware:** printed circuit board (PCB), 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:

- [PGR IEEE-1394 Digital Camera Register Reference](#)
- [Dragonfly Technical Reference](#)
- [Dragonfly2 Technical Reference](#)
- [PGR 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 *PGR FlyCapture SDK*. For register definitions and individual bit descriptions, please refer to the *PGR IEEE-1394 Digital Camera Register Reference*.

1.3.1.3. Camera Orientation

For the purposes of this document, the “*left side*” of the camera refers to the side where the IEEE-1394 connector is mounted i.e. the left side if you were looking out of the camera through the CCD.

1.3.1.4. Acronyms

- A/D converter: analog-to-digital converter
- DCAM: IIDC 1394-based Digital Camera specification
- GPIO: general purpose input / output
- PCB: printed circuit board
- SDK: software development kit

1.3.2. Mechanics

Description	Same?	Dragonfly	Dragonfly2
Overall dimensions	Y	<p>The exterior dimensions of the PCB¹ and aluminum case are 63.5mm x 50.8mm x 13.15mm, and 75mm x 65mm x 25.5mm, respectively.</p> <p>NOTES:</p> <ol style="list-style-type: none"> 1. The CCD chip has moved (see <i>CCD sensor placement</i> below) 2. PCB components have changed and heights and positions may be different; users should requalify fit with existing jigs or enclosures 3. The <i>Dragonfly</i> will not fit in the <i>Dragonfly2</i> case, and vice versa 	
IR filter properties	Y	The infrared cut-off filter used with color versions of the cameras is the same and has the same transmittance properties.	
C/CS-mount lens holder dimensions	Y	While the actual part used on the cameras is different, the overall dimensions (footprint, height, etc.) are the same.	
C/CS-mount lens holder set screw	N	One set screw hole in the top of the lens holder	Adds a second set screw on the left side of the lens holder. PGR assembles the <i>DR2</i> with the set screw in the left hole
Removable glass / IR filter system ²	N	<ul style="list-style-type: none"> • No glass on monochrome models • IR filter on color models is glued into place 	<ul style="list-style-type: none"> • Protective dust glass on monochrome models • IR filter on color models • Glass / IR filter screwed into place to allow easy removal
		<p>NOTE: Due to the placement of the <i>DR2</i> glass/IR filter, the minimum distance from the CCD imaging plane to the lens may be greater than the <i>Dragonfly</i>. However, lenses adhering to the CS back flange distance standard should not be affected.</p>	
Mounting holes	N	<ul style="list-style-type: none"> • One (1) ¼-20 mounting hole on the bottom face of the aluminum case. 	<ul style="list-style-type: none"> • One (1) ¼-20 mounting hole on each of the faces of the aluminum case (except back). • Additional M3 mounting holes on all faces (except back)
CCD sensor placement on PCB	N	The physical CCD chip and lens holder mounting holes are off-centered horizontally (0.25mm).	The chip and lens holder mounting holes are centered relative to the four corner mounting holes.
GPIO connector	N	<ul style="list-style-type: none"> • 6-pin 2mm header on the back of the camera, oriented horizontally on the left side. • Unlike the <i>DR2</i>, the <i>Dragonfly</i> aluminum case does not have a hole for access to the GPIO. 	<ul style="list-style-type: none"> • 8-pin connector on the back of the camera, oriented vertically on the right side, makes wiring easier • <i>Dragonfly2</i> aluminum case provides access to the GPIO • Boxed and board level <i>DR2</i>'s use different connectors.

¹ PCB dimensions of the *DR2* are without the auto iris connector, lens holder, or green GPIO connector

² C/CS-mount lens holders and aluminum case only

<i>Auto iris connector</i>	N	None	Some <i>Dragonfly2</i> models (e.g. DR2-xxxx-CSBOX) are equipped with a DC auto-iris connector.
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1.3.3. Hardware and Electronics

Description	Same?	Dragonfly	Dragonfly2
<i>IEEE-1394 connector</i>	Y	Both cameras use the same 1394 connector, which is in the same position and oriented in the same direction on both.	
<i>CCD imaging sensors</i>	Y ³	Sony 1/3" progressive scan CCD ICX424AL (Mono) / AK (Color) ICX204AL (Mono) / AK (Color)	
<i>RoHS compliant</i>	Y	The <i>DR2</i> and <i>Dragonfly</i> will both be compliant in the future. See www.ptgrey.com/support/kb/index.asp?a=4&q=232 for more details.	
<i>GPIO pin configuration</i>	N	6-pins: four (4) I/O, one (1) GND, one (1) +3.3V.	8-pins: four (4) I/O, two (2) GND, one (1) +3.3V, one (1) V _{EXT} .
<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. IO2 has a weak pull-up resistor. 	<ul style="list-style-type: none"> Pin 1 (+3.3V) is capable of powering external circuitry up to a total of 200mA. Pin 8 (V_{EXT}) allows the camera to be powered externally. Voltage limit: 8-30V. Current limit: 1A. When configured as output, each of the four I/O lines can sink 10mA of current.
<i>A/D converter</i>	N	Analog Devices AD9841A Resolution: 10-bit	Analog Devices AD9949A Resolution: 12-bit

1.3.4. Firmware and Software

Due to the significant number of operational features available in the *Dragonfly* and *Dragonfly2*, this section only focuses on the differences in functionality between the two cameras. 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 Dragonfly2. However, PGR has implemented memory channels on the DR2 that can be used for creating new default settings. Refer to the Dragonfly2 Technical Reference for more detailed information.

³ New *Dragonfly* cameras only; some older models used the Sony ICX084 CCD instead of the ICX424



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	Dragonfly	Dragonfly2
DCAM compliance	v1.30	v1.31
	Many functional differences are a result of differences between the DCAM versions supported. For example, numerous <i>Dragonfly</i> -specific features (coincidentally) became part of the DCAM v1.31 standard, such as: trigger (shutter) delay; parallel input/output; frame rate control; extended shutter; and software trigger.	
Default power configuration	Always powered up	Can be powered up or down Default: power off
	<p>Recommendation: Power the <i>Dragonfly2</i> up via the CAMERA_POWER register 0x610 or by enabling isochronous transmit, which causes the camera to automatically write <i>Cam_Pwr_Ctrl</i> = 1 to power itself up.</p> <p>Recommendation: Use the <i>Dragonfly2</i> memory channel feature to change the default setting to power on.</p>	
Color processing	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>Dragonfly2</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>Dragonfly2</i> memory channel feature to change the default video mode to Format_7, as described above.</p>	
GPIO modes	<ul style="list-style-type: none"> • PGR-specific modes: 0, (input), 1 (output), 2 (trigger input) and 3 (strobe output) 	<ul style="list-style-type: none"> • PGR-specific modes 0 (input), 1 (output), 2 (trigger input), 3 (strobe output) and 4 (PWM) • DCAM parallel input/output (PIO) • DCAM serial input/output (SIO)
External trigger	<ul style="list-style-type: none"> • Default trigger pin: Not defined • Time between trigger and start of shutter: less than 10us 	<ul style="list-style-type: none"> • Default trigger pin: IO0 • Time between trigger and start of shutter: less than 10us
	Recommendation: Use the <i>Dragonfly2</i> memory channel feature to change the default trigger input via the appropriate GPIO_CTRL_PIN_x register.	
Trigger modes	0, 1, 3	0, 1, 3, 4, 5, 14
Software trigger	<ul style="list-style-type: none"> • PGR-specific SOFT_ASYNC_TRIGGER register 0x102C 	<ul style="list-style-type: none"> • PGR-specific SOFT_ASYNC_TRIGGER register 0x102C

		<ul style="list-style-type: none"> • DCAM SOFTWARE_TRIGGER register 0x62C
	Recommendation: Review the <i>AsyncTriggerEx</i> sample program for pointers on using the different software trigger methods.	
<i>Trigger / shutter delay</i>	<ul style="list-style-type: none"> • Delay time defined in SHUTTER_DELAY register 0x1108 • Value is ticks of a 49.152MHz clock • Maximum delay: 64 seconds using Strobe_Divider in GPIO_XTRA register 0x1104 • Controls the sync offset when in free-running (continuous shot) mode • Controls delay between trigger event and start of shutter when in trigger mode 	<ul style="list-style-type: none"> • Delay time defined in TRIGGER_DELAY register 0x834 • Value is ticks of a 24.576MHz clock • Maximum delay: 64 seconds (refer to TRIGGER_DELAY register definition) • Controls the sync offset when in free-running (continuous shot) mode • Controls delay between trigger event and start of shutter when in trigger mode
<i>Strobe output</i>	<ul style="list-style-type: none"> • PGR-specific GPIO Mode_3 • Delay / duration specified in GPIO_XTRA_PIN_x registers, in ticks of a 49.152MHz clock 	<ul style="list-style-type: none"> • PGR-specific GPIO Mode_3 • Delay / duration specified in GPIO_XTRA_PIN_x registers, in ticks of a 1.024MHz clock
<i>Extended shutter</i>	<ul style="list-style-type: none"> • PGR-specific EXTENDED_SHUTTER register 0x1028 	<ul style="list-style-type: none"> • DCAM FRAME_RATE register 0x83C
	Recommendation: Review the <i>ExtendedShutterEx</i> sample program for pointers on using the different extended shutter methods.	
<i>Configurable frame rate (e.g. PAL / NTSC)</i>	<ul style="list-style-type: none"> • PGR-specific FRAME_TIME register 0x1240 	<ul style="list-style-type: none"> • DCAM FRAME_RATE register 0x83C
<i>Pixel clock frequency</i>	Same pixel clock frequency for all formats and frame rates	Different pixel clock frequencies, depending on the format/frame rate.
<i>Gain and shutter values</i>	Gain and shutter value fixed-to-floating point conversion formulas provided	Conversion formulas not provided
	Recommendation: Use the absolute value registers for both <i>Dragonfly</i> and <i>Dragonfly2</i> . Using the absolute values contained in the ABS_VAL_x camera registers is easier and more efficient than applying complex conversion formulas to the information in the Value field of the associated Control and Status Register (CSR). In addition, conversion formulas can change between firmware versions.	
<i>White balance setting</i>	<ul style="list-style-type: none"> • Red / Blue range: 0 to 63 • Implements PGR-specific BAYER_TILE_GAIN register 0x1044 	<ul style="list-style-type: none"> • Red / Blue range: 1 to 1023 • Auto white balance (default on)
<i>Format_7 custom image modes</i>	<ul style="list-style-type: none"> • Mode_0: ROI (no frame rate speedup) • Mode_1: 1x2 and 2x2 binning with frame rate speedup 	<ul style="list-style-type: none"> • Mode_0: ROI with frame rate speedup • Mode_1: 2x2 binning with speedup • Mode_2: 1x2 binning with speedup
<i>Maximum resolution using Format_7</i>	<ul style="list-style-type: none"> • 640x480 (DRAG-xx) • 1024x768 (DRAG-HIxx) 	<ul style="list-style-type: none"> • 648x488 (DR2-xx): standard 640x480 image is centered by default • 1024x768 (DR2-HIxx)

1.4. Additional Downloads and Support

Access more PGR 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/.