Technical Application Note TAN2004004

Synchronizing to an external signal using DCAM 1.31 Trigger Mode_0
Revised July 30, 2004

1.1. Subject

Technical Application Note (TAN2004004): Synchronizing to an external device using DCAM 1.31 Trigger Mode_0.

1.2. Applicable Product(s)

PGR *Flea* (all models) and *Scorpion* (all models except SCOR-03NS) IEEE-1394 digital cameras with firmware version 0.9.1.8 or higher. Consult Knowledge Base Article 94 to determine camera firmware versions. The most recent firmware versions can be downloaded from the PGR website at http://www.ptgrey.com/support/downloads/.

1.3. Application Note Description

The purpose of this Technical Application Note is to provide the user with a set of basic instructions on how to configure one of the Applicable Product(s) above to acquire images synchronized to an external electrical signal using the DCAM 1.31 parallel input/output (PIO) functionality. This process is often known as "externally triggering" a camera. For a full explanation of the DCAM v1.31-specific input modes, please consult the "General Purpose Input/Output" section of the *PGR IEEE-1394 Digital Camera Register Reference*.

1.3.1. General Considerations

1.3.1.1. General Purpose Input/Output Pins

The Applicable Product(s) is/are equipped with a set of general purpose input/output (GPIO) pins that can be accessed via the Hirose connector on the back of the camera. Different products may use different Hirose connectors; consult your camera's *Technical Reference* or *Getting Started* manual for part numbers and specifications, GPIO connector pin layouts, and GPIO electrical characteristics.

1.3.1.2. Testing Tools

For basic testing and configuration, we recommend using the FlyCap demo program (included with all versions of the PGR FlyCapture SDK) in conjunction with the *PGR IEEE-1394 Digital Camera Register Reference*. FlyCap allows easy access to camera trigger functionality and camera registers, and the *PGR IEEE-1394 Digital Camera Register Reference* is a source of general information pertaining to all PGR IEEE-1394 cameras. The latest versions of PGR FlyCapture and the Register Reference can be downloaded from http://www.ptgrey.com/support/downloads/.

1.3.2. Configuring the Camera

1.3.2.1. Determine the Default External Trigger Pin

One of the camera GPIO pins is configured as the default trigger. To determine which pin is the default input/trigger pin either:

1. Consult the Technical Reference or Getting Started manual for the camera; or
2. Get the value of the TRIGGER_MODE register 0x830. The *Trigger_Source* field (bits 8-10) is the current trigger source e.g. if the value represented by the *Trigger_Source* field is 0, the default trigger source is GPIO0.

For example:

```
0x830 = 0x80100000
```

8	0	1	0	0	0	0	0	Hex
1000	00**0**0	**000**1	0000	0000	0000	0000	0000	Binary
0-7		8-15		16-23		24-31		Bits

This indicates that a Trigger Mode is available (bit 0 = 1) but not currently enabled (bit 6 = 0). It also indicates that GPIO0 is the default trigger pin (bits 8-10 = 0), and the default polarity of the pin is active low (bit 7 = 0), which means the camera trigger on the falling edge of a pulse.

We recommend using method '2' to determine the default trigger pin in order to avoid possible documentation errors.

1.3.2.2. Configure a Different GPIO Pin to be an External Trigger

If you wish to use a different GPIO pin as the external trigger instead of the default trigger, you will need to configure the specific pin to be an input trigger, then configure the camera to use this newly allocated trigger pin.

> **NOTE**: *Only one GPIO pin can be configured as a trigger source using this method. To have multiple pins acting as a trigger sources, use the GPIO_MODE_2 method via the GPIO_CTRL_PIN_x registers (see the* PGR Register Reference *for more information).*

For example, to configure the camera to use GPIO2 as the external trigger pin:

1. Get the value of the PIO_DIRECTION register 0x11F8 to determine the current states of each GPIO pin. For example:

```
0x11F8 = 0x20000000
```

2	0	0	0	0	0	0	0	Hex
0010	0000	0000	0000	0000	0000	0000	0000	Binary
0-8		9-15		16-23		24-31		Bits

Each of the first four bits represents the current state of its associated GPIO pin: '0' indicates it is a input/trigger, and '1' indicates it is an output/strobe. In the example above, 0x2 = 0010 in binary, so GPIO0, GPIO1 and GPIO 3 are all configured as inputs and GPIO2 is an output.

2. To set GPIO2 in the example above to be an input/trigger, and all other GPIO pins as outputs:

```
                      0x11F8 = 0xD0000000
```

D	0	0	0	0	0	0	0	Hex
1101	0000	0000	0000	0000	0000	0000	0000	Binary
0-8		9-15		16-23		24-31		Bits

3. Configure the camera to use GPIO2 as the external trigger source by setting bits 8-10 of the TRIGGER_MODE register:

```
           0x11F8 = 0x8040000000 (assumes bits 11-31 are zero)
```

8	0	4	0	0	0	0	0	Hex
1000	0000	**0010**	0000	0000	0000	0000	0000	Binary
0-8		9-15		16-23		24-31		Bits

1.3.2.3.   Enable Trigger Mode

The camera must be put into Trigger Mode_0 to allow it to be externally triggered.

To do this in the FlyCap graphical user interface:

1. Open the Camera Control Dialog (F11)
2. Select the "Trigger" tab (or "Extended" tab in older versions)
3. Check the "Trigger Mode On/Off" checkbox

To do this by directly accessing the camera's TRIGGER_MODE register:

1. Get register 0x830
2. Turn trigger Mode_0 ON by setting bit 6 to one (1) and setting bits 12-15 to zero (0)

1.3.3.   Externally Trigger the Camera

At this point, one of the camera's GPIO pins should be configured as the external trigger source, and the camera should be in Trigger Mode_0. To acquire an image, connect the external TTL synchronization signal to the GPIO pin. Once the trigger signal is received, an image will be grabbed. For specific external trigger timing information, consult your camera's *Technical Reference* or *Getting Started Manual*.