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## Technical Application Note TAN2005002

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*Setting a GPIO pin to strobe using DCAM 1.31 Strobe Signal Output registers*  
*Revised March 6, 2006*

### 1.1. Subject

Technical Application Note (TAN2005002): Setting a GPIO pin to strobe using DCAM 1.31 Strobe Signal Output registers.

### 1.2. Applicable Product(s)

The following PGR Imaging Products support this functionality:

- **Flea** (all models) with firmware v0.9.2.10 or later
- **Scorpion** (all models except SCOR-03NS and SCOR-13SM) with firmware v0.9.2.10 or later
- **Dragonfly EXPRESS** (all models and all firmware versions)

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 output a strobe signal output pulse on one of its general purpose input/output (GPIO) pins using the DCAM 1.31 parallel input/output (PIO) functionality. For a full explanation of the DCAM v1.31-specific input/output modes, please consult the “GPIO Control Using DCAM v1.31 Functionality” section of the *PGR IEEE-1394 Digital Camera Register Reference*.

In addition to summarizing some of the general considerations the user must take into account before setting up a strobe signal output, this document also explains how to:

- Determine which GPIO pins are, by default, configured as outputs.
- Set one or more GPIO pins as outputs.
- Determine if DCAM 1.31 strobe output functionality is supported.
- Configure one or more GPIO pins to output a strobe output pulse.

#### 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

To configure and test the information presented in this TAN:

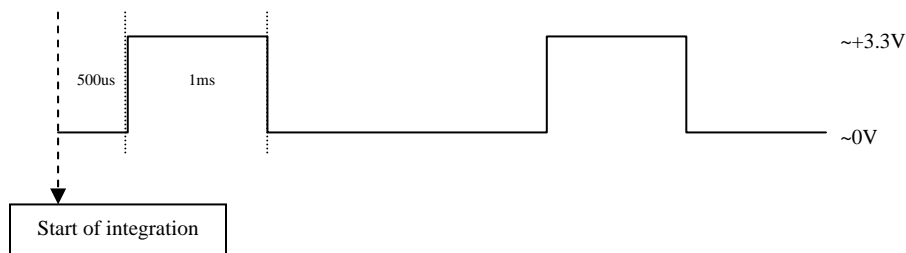
1. **Connect the camera's GPIO pins to an oscilloscope or external device.** External devices can include an external light source or LED or other triggerable device. By connecting the appropriate GPIO pins to an external device or oscilloscope, you can verify that the camera is outputting a strobe pulse of the correct delay and duration. Consult your camera's *Technical Reference* or *Getting Started* manual for:
  - a. GPIO connector pin layouts; and
  - b. GPIO electrical characteristics.
2. **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 "Strobe Signal Output Registers" section of the *PGR IEEE-1394 Digital Camera Register Reference*. 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. Example Overview

For the purposes of this Technical Application Note we will work through the following example strobe scenario:

- Desired strobe output pin: GPIO0
- Strobe output characteristics: 500us delay from start of shutter, 1ms high duration (see below)



### 1.3.2.2. Determine the Default Output Pins

Electrically, general purpose input/output pins are in one of two states: input or output. In order for a GPIO pin to act as a strobe output source, it must be configured as an output. To determine which of the GPIO pins are outputs by default, get the value of the PIO\_DIRECTION register 0x11F8. The *IOx\_Mode* fields (bits 0-3) report the current state of the corresponding pin. For example:

0x11F8 = 0x6000 0000

6	0	0	0	0	0	0	0	Hex
0110	0000	0000	0000	0000	0000	0000	0000	Binary
0-7		8-15		16-23		24-31		Bits

Each of the first four bits represents the current state of its associated GPIO pin: ‘0’ indicates it is an input/trigger, and ‘1’ indicates it is an output/strobe. In the example above, 0x6 = 0110 in binary, so GPIO1 and GPIO2 are configured as outputs and GPIO0 and GPIO3 are inputs. Therefore, GPIO1 and GPIO2 can be configured as strobe output signal sources.

### 1.3.2.3. Set the Desired Pin as an Output

Following the example above, assume we want to configure GPIO0 to be an output. To do this, set the appropriate bit of the PIO\_DIRECTION register 0x11F8 (in this case bit 0) to ‘1’. In the example above, we would therefore do the following register write:

0x11F8 = 0xE000 0000

### 1.3.2.4. Determine DCAM 1.31 Strobe Support

Using the previous steps we determined which GPIO pins are currently “outputs”. The next step is to determine whether our desired strobe pin, GPIO0, is capable of outputting a strobe signal. To do this, get the value of the appropriate STROBE\_x\_INQ register; in this case, the STROBE\_0\_INQ register 0x1400. Assuming we have correctly configured GPIO0 to be an output, we should get a value of:

0x1400 = 0x8E00 0FFF

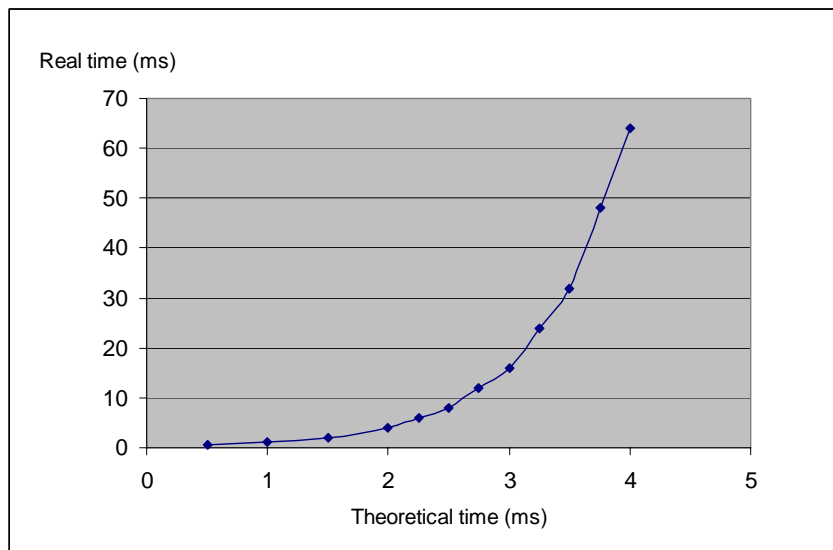
8	E	0	0	0	F	F	F	Hex
1000	1110	0000	0000	0000	1111	1111	1111	Binary
0-7	8-15		16-23		24-31		Bits	

Bit 0 is a ‘1’, which confirms that the strobe functionality is present on this GPIO pin. Bit 4 points to the ability to read the value of this feature. Bit 5 indicates the ability to turn the strobe on and off, and bit 6 indicates that we can change the strobe signal polarity. Bits 8-19 are ‘0’, which means the minimum strobe duration is zero. Bits 20-31 are ‘0xFFF’ or 4096 in decimal, so the maximum strobe delay and duration is 4096.

### 1.3.2.5. Configure the Desired Pin to Output a Strobe

At this point, GPIO0 is set as an output pin and we know it can be a strobe signal source. Now, we need to enable it as a strobe source by “turning it on” using the GPIO pin’s STROBE\_x\_CNT register.

Continuing our example, the desired strobe pin is GPIO0. Therefore, we want to look at the STROBE\_0\_CNT register 0x1500. The values that we enter in the *Delay\_Value* and *Duration\_Value* fields of this register are determined as follows: for values up to approximately 0x400 (1024 decimal), each value increment is a tick of a 1.024MHz clock. Values between 0x401 and 0xFF become non-linear in the manner shown in the figure below:



Duration_Value / Delay_Value	Real Time (ms)
0x050	0.078
0x200	0.5
0x400	1
0x600	2
0x800	4
0x900	6
0xA00	8
0xB00	12
0xC00	16
0xD00	24
0xE00	32
0xF00	48
0xFFF	63.93

For example, to achieve a 500us delay and 1ms duration we calculate:

$$\text{Delay\_Value} = 0.0005\text{s} * 1024000\text{Hz} = 512 = 0x200$$

$$\text{Duration\_Value} = 0.001\text{s} * 1024000\text{Hz} = 1024 = 0x400$$

To finish configuring GPIO0 to output a strobe pulse of 500us delay from the start of integration and 1ms high duration (high active output), we make the following final register write:

$$0x1500 = 0x8320 \ 0400$$