Technical Application Note TAN2007004

Accessing the On-Camera Frame Buffer
Revised September 24, 2010

1.1. Subject

Technical Application Note (TAN2007004): *Accessing the On-Camera Frame Buffer*

1.2. Applicable Product(s)

- ***All models of Grasshopper cameras***
- ***Flea2 models FL2G-13S2 and FL2G-50S5***
- ***Flea3***
- ***Grasshopper2***

1.3. Overview

The purpose of this Technical Application Note is to describe how users can directly interact with the on-board frame buffer of a supported camera through the registry.

The frame buffer can also be accessed using the FlyCap Demo software. For more information, refer to the FlyCapture SDK online Help.

The frame buffer has been shown to be useful in a number of different scenarios. Most of these scenarios fall into one of two categories:

1) Cases where retransmission of an image is required due to data loss or corruption
2) Multiple camera configurations where there is not enough bandwidth to capture sequences in the desired configuration.

The Grasshopper, Grasshopper2, Flea2 FL2G-13S2, Flea2 FL2G-50S5 and Flea3 have 32MB of memory that can be used for temporary image storage.

Please refer to the *Point Grey Digital Camera Register Reference* for more details on accessing and the format of any registers referred to in this document.

1.4. Register Description

IMAGE_RETRANSMIT: 12E8h

This register provides the user with an interface to the camera's frame buffer functionality.

Format:

Field	Bit	Description
Presence_Inq	[0]	Indicates the presence of this feature (read only)
Reserved	[1-5]	Reserved
HoldImg	[6]	0: disable hold image 1: store images to frame buffer rather than transmitting.
Reserved	[7-15]	Reserved
BufferSize	[16-23]	Maximum number of images in the current configuration.
NumOfImages	[24-31]	Read: Number of images currently in buffer. Write: When HoldImg is enabled, transmit a single image and delete the specified number of images from the buffer.

1.5. Using the Frame Buffer

All images pass through the frame buffer mechanism. This introduces relatively little delay in the system because of the fact that the camera does not wait for a full image to arrive in the buffer before starting transmission over the 1394 interface but rather lags only a few lines behind.

The user can cause images to accumulate in the frame buffer by enabling the HoldImg bit of register 12E8h. This effectively disables the transmission of images over the 1394 interface in favor of accumulating them in the frame buffer. The user is then required to use the remaining elements of the interface to cause the transmission of the images.

The buffer system is circular in nature, storing only the last 32MB worth of image data. The number of images that this amounts to depends on the currently configured image size.

The standard user interaction involves the following steps:

1) **Configure the imaging mode.**
   This first step involves configuring the format, mode and frame rate in which the camera will acquire images. This can be done by either directly manipulating the DCAM registers or using the higher level functionality associated with the software library being used. Depending on the software package, this may involve going so far as to configure the camera, perform bandwidth negotiation and grab an image. In cases where bandwidth is restricted, the user will want to disable transmission and free the bandwidth after the camera is configured.

2) **Enable frame buffer accumulation**
The second step involves enabling the `HoldImg` bit of register 12E8h. Enabling this bit results in images being accumulated in the frame buffer rather than immediately being transmitted out over the 1394 interface.

3) **Negotiate bandwidth with the camera**
Having accumulated some number of images on the camera, bandwidth will have to be renegotiated if it has not been done already. In most cases, this will involve effectively starting the camera in the imaging mode configured in step (1).

4) **Transmit images off of the camera.**
The final step involves poking bits [24-31] of register 12E8h in order to cause the camera to transmit images from the frame buffer over the 1394 interface. Every write to the register will cause a single image to be transmitted.

A couple of items to note are:

- Although it is possible to repeatedly transmit the same image, there is no way to access images that are older than the last image transmitted.
- Whether by enabling trigger or disabling isochronous data, switching out of a free running mode will leave the last image transmitted in an undefined state.
- The frame buffer is volatile memory that is erased after power cycling. If you want to store images on the camera after power cycling, use flash memory. Accessing flash memory is significantly slower than accessing the frame buffer, and storage is limited. To determine if your camera supports flash memory, and the amount of storage available, consult your camera's technical reference manual, or query the DATA_FLASH_CTRL register 1240h, described in the *Point Grey Digital Camera Register Reference*. For example code, refer to the *SaveImageToFlashEx* example program, included with the FlyCapture SDK, or from www.ptgrey.com/products/pgrflycapture/examples/SaveImageToFlash.html.

There are two basic scenarios in which a customer may want to use the frame buffer system. These scenarios are outlined below.

1.5.1. Retransmitting an Image in External Trigger Mode

There are occasions where it might be beneficial to retransmit an image when in an external trigger mode. Having configured the camera to be running in an external trigger mode, the user can cause the camera to retransmit an image by doing the following:

1) **Read the current state of the IMAGE_RETRANSMIT register 12E8h:**

Read	12E8h	80 00 07 00

Reading register 12E8h indicates that the camera supports the frame buffer mechanism, the feature is currently disabled and in the current imaging mode, the system is capable of storing up to 7 images.

2) Enable image hold:

Write	12E8h	8**2** 00 07 00

Setting bit 6 of register 12E8 enables access to the frame buffer.

3) Retransmit the last image:

Write	12E8h	82 00 07 **00**

Writing a value of **00** to bits 24-31 will cause the last image to be retransmitted.

4) Disable the hold image bit to return to normal operation

Write	12E8h	8**0** 00 07 00

Writing a 0 to bit 6 of register 12E8 disables access to the frame buffer and returns the camera to normal operation.

1.5.2. Storing images for later transmission

A second scenario where this functionality is useful involves the storage of images for transmission at a later time. In this case, having configured the camera to be running in the desired imaging mode, enabling the hold image bit will stop images from being transmitted out over the 1394 interface in favor of accumulating in the frame buffer. Again, assuming the camera is configured to run in an external trigger mode:

1) Read the current state of register 12E8h:

Read	12E8h	80 00 07 00

Again, this value indicates that the camera supports the frame buffer mechanism, the feature is currently disabled and in the current imaging mode, the system is capable of storing up to 7 images.

2) Enable hold image mode:

Write	12E8h	8**2** 00 07 00

Setting bit 6 of 12E8h enables hold image mode, resulting in images being accumulated in the frame buffer rather than being immediately transmitted.

3) Aquire 4 images:

Write	62Ch	80 00 00 00
Write	62Ch	80 00 00 00
Write	62Ch	80 00 00 00
Write	62Ch	80 00 00 00
Read	12E8h	82 00 07 **04**

Writing the software trigger register 4 times results in 4 images being accumulated in the frame buffer. The last 8 bits of 12E8h will now indicate that there are 4 images in the frame buffer.

4) Transmit two images:

Write	12E8h	82 00 07 **01**
Write	12E8h	82 00 07 **01**
Read	12E8h	82 00 07 **02**

Writing **01** to bits 24-31 of 12E8h results in a single image being transmitted and the number of images available being decremented by one. After transmitting two images, a subsequent read of the register indicates that there are two images left.

5) Skip one image and transmit the next image:

Write	12E8h	82 00 07 **02**
Read	12E8h	82 00 07 **00**

Writing **02** to bits 24-31 of 12E8h causes the camera to skip one image and transmit the second image from the buffer. A subsequent read of the register indicates that there are no un-transmitted images left in the buffer.

6) Retransmit the last image:

Write	12E8h	82 00 07 **00**

Finally, writing **00** to bits [24-31] of 12E8h causes the retransmission of the last image.

1.6. Additional References

- *Point Grey Digital Camera Register Reference*
- Knowledge Base Article 239: *External trigger modes supported by Point Grey cameras*

1.7. 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/.