QuickCam User's Manual

30-Aug-06
03-032-10187-04
www.dalsa.com

Contents

1

DALSA QuickCam

Welcome.The DALSA QuickCam application allows you to quickly control and view output from a DALSA camera. Among the many available options are controlling camera exposure, sensor readout and performing flat field correction.

Getting Help

The QuickCam application provides context-sensitive help on all dialog boxes, providing descriptions of specific fields as well as conceptual information related to those fields.

You can find help from the accompanying user guide or directly from the QuickCam Help.

- For context sensitive help, place your cursor in the field where you want more help and press **F1**.

  or

- Click the **Help** button on the tab in QuickCam where you want more information.
- For the complete Help, select **Help→QuickCam Help** on the QuickCam menu bar. You can find topics from the Help by using the table of contents and search tool.

Customer Feedback and Support

For additional information or support, contact us at:

Address	605 McMurray Road Waterloo, Ontario Canada N2V 2E9
Voice	(519) 886-6000
Fax	(519) 886-2230
E-mail	Customer Support (support@dalsa.com) Sales (sales.americas@dalsa.com)
Web	http://www.dalsa.com/

2

Installing, Connecting, Detecting, and Saving

2.1 Installing QuickCam and Camera Drivers

To install QuickCam:

1. Insert the camera CD into your CD-ROM drive.

   If the installation wizard does not start automatically, click **Start** on the Windows taskbar, and click **Run**. Type **D:\Setup**, where **D** is the letter that corresponds to your CD drive.

2. Click **Install QuickCam** and follow the online instructions to complete the installation.

Installing Drivers for Your Camera

If you are using a **Spyder3 GigE** camera, you must install drivers before running QuickCam.

Before installing drivers, ensure that your PC is equipped with a GigE network interface (also referred to as a network adapter) based on Intel's 82540 chip. Many motherboard manufacturers are designing this chip directly into their board in "LAN on the motherboard (LOM)" implementations. Alternately, an Intel 82540-based network adapter, also known as a network interface card, can be slotted into a PC.

To install Spyder3 GigE drivers:

1. Open the **Driver Installation Tool**. On the Windows task bar click Start, point to **Programs → DALSA QuickCam → Tools → Launch Driver Installation Tool**.

   If you are using an **Intel PRO/1000 adapter**:

   a) On the **Pro 1000 Adapters tab**, right click on an Intel PRO/1000 network interface card adapter with no installed driver (i.e. when the Device Class is Ethernet Controller).

   The following context menu appears:

b) Choose **Install High Performance IP Device Driver** to install the QuickCam High Performance IP Device Driver.

If you are **NOT** using an **Intel PRO/1000 adapter**:

a) On the **Universal IP Filter Driver tab**, click, **Install Filter Driver…**. This button installs the QuickCam Universal IP Filter Driver on ALL network adapters installed on the system that are using a network driver. This excludes PRO/1000 adapters on which the QuickCam High Performance Driver has been installed.

2.2 Running QuickCam

To run QuickCam:

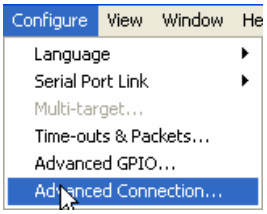
1. On the Windows task bar, click the **Start** button, point to **Programs → DALSA QuickCam → DALSA QuickCam**

2.3 Connecting, Detecting and Acquiring Images

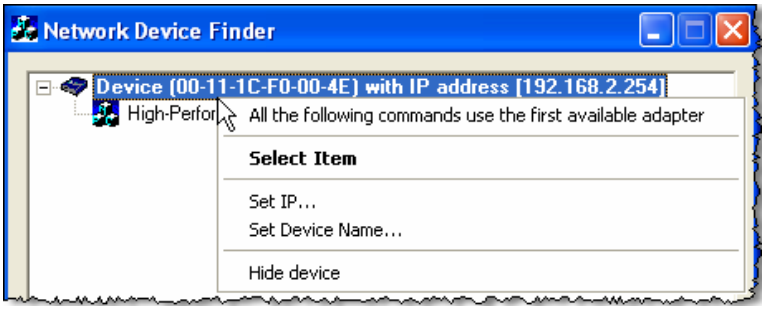
Detecting a Camera

When you first open the QuickCam application, and after powering up the camera, QuickCam automatically detects all cameras on the network and asks you to set an IP address for each (or accept the suggested default). If you have multiple cameras on your network, ensure you give each one of them a unique IP address.

If you need to change the device's IP or name after initial setup, use the Network Device Finder dialog box (menu bar: **Configure → Advanced Connection…**).



To access the advanced controls, right click on the device you want to configure.



To manually detect a camera:

1. If your camera is not already connected, click the Detect icon  on the toolbar.

The connection to the camera should now be established. If you are having problems detecting your camera, see section 8.1 Troubleshooting: Cannot Detect the Camera on page 59.

Disconnecting and Reconnecting a Camera

To disconnect a camera:

1. Open the **Connection** tab in the **Camera Configuration Window**.

   On the **Connection** tab:
2. Click **Disconnect**.

The camera should now be disconnected

Toolbar equivalent: 

To reconnect a camera after a disconnection:

1. Open the **Connection** tab in the **Camera Configuration Window**.

   On the **Connection** tab:
2. Click **Connect**.

The camera should now be connected

Toolbar equivalent: 

Acquiring Images

After QuickCam has detected your camera, you can begin grabbing images.

To begin grabbing images:

1. Open the **Connection** tab in the **Camera Configuration Window**.

Under **Acquisition Control**:

2. Click the **Start** button.

The camera is now grabbing images in continuous mode.

From here you can also select whether or not to allow bad and/or incomplete images to be acquired by selecting the **Bad image passthrough** and **Ignore Missing Packets** options.

To switch between continuous mode and snapshot mode:

1. Click the  button to continuously grab images

   or

   Click the  button to take a snap shot of the image.

Stopping Image Acquisition

To stop acquiring images:

1. Open the **Connection** tab in the **Camera Configuration Window**.

   Under **Device Actions**:

2. Click the **Stop** button.

Toolbar equivalent: 

Rebooting a Camera

To reboot the camera:

1. Open the Connection tab in the Camera Configuration Window.

   On the Connect/Detect tab:

2. Click the **Reset Camera** button.

Toolbar equivalent: 

2.4 Saving and Restoring Camera Settings

Saving Camera Settings

You can save the current camera settings to the camera's non-volatile memory, allowing you to use them again after a camera reboot.

Note: Pixel coefficients are saved separately from other settings.

To save camera settings to the camera's non-volatile memory:

1. Open the **Save/Restore** tab in the **Camera Configuration Window**.

   Beside **User Settings**:
2. Click **Save to Camera**.

Toolbar equivalent: 

With the exception of pixel coefficients, the current camera settings are saved to the camera's non-volatile memory.

Restoring Camera Settings

You can quickly restore the last saved camera settings from non-volatile memory through the Save/Restore tab.

To restore user settings from the camera's non-volatile memory:

1. Open the **Save/Restore** tab in the **Camera Configuration Window**.

   Beside **User Settings**:
2. Click **Restore from Camera**.

With the exception of pixel coefficients, the last saved camera settings are restored.

Restoring Factory Settings

On first initialization, the camera operates using the factory settings. You can restore the camera's original factory settings at any time through the Save/Restore tab.

To restore the camera's factory settings:

1. Open the **Save/Restore** tab in the **Camera Configuration Window**.

   Beside **Factory Settings**:
2. Click **Restore from Camera**.

Saving Camera Configuration to an XML File

You can save the current camera Ethernet configuration to an XML file, allowing you to reload and re-use the settings at a later time.

To save the camera Ethernet configuration to an XML file:

1. Choose **File → Save XML File…**.

   In the **Save As** dialog box:
2. Select the location on your computer to save the file.
3. In the File name text box, enter a name for the settings script file.
4. Click **Save**.

Toolbar equivalent: 

A camera script file is created with the specified file properties.

Loading Camera Configuration from an XML File

You can load camera system settings from a previously saved XML file. This is useful when you want to load the same settings on multiple cameras.

To load Ethernet configuration settings from an XML file:

1. Choose **File → Load XML File…**.

   In the Open dialog box:

2. In the **Look in** list, click the drive, folder, or Internet location that contains the file you want to open.
3. In the folder list, locate and open the folder that contains the file.
4. Click the file, and then click **Open**.

Toolbar equivalent: 

Saving, Loading, and Resetting Pixel Coefficients

You can save the current FPN and PRNU coefficients to the camera's non-volatile memory, allowing you to reload and re-use the coefficients again at a later time. You can also reset pixel coefficients to zero at any time.

To save or load pixel coefficients:

1. Open the **Save/Restore** tab in the **Camera Configuration Window**.

   Under **Pixel Coefficients**:

2. Select the pixel coefficient set number from the **Set Number** drop down box. You can save or load up to four different sets of pixel coefficients.
3. Click **Save** or **Load**.

The selected pixel coefficient set is now saved or loaded.

 Remember that pixel coefficients must be enabled in order to see their effect on your image. Refer to 7.7 Enabling and Disabling Coefficients for details.

To reset pixel coefficients to zero:

1. Open the **Save/Restore** in the **Camera Configuration Window**.

   Under **Pixel Coefficients**:

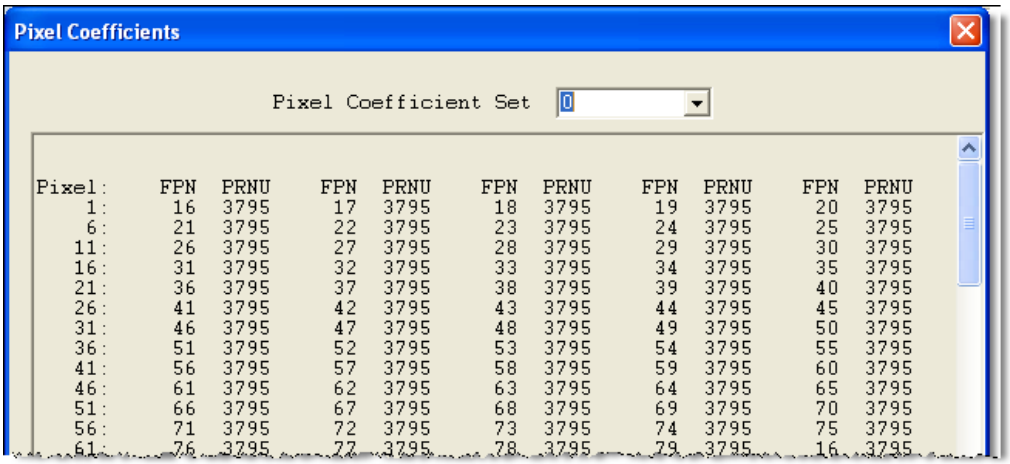
2. Select the pixel coefficient set number from the **Set Number** drop down box. You can save or load up to four different sets of pixel coefficients.
3. Click **Reset**.

The selected pixel coefficient set is now set to zero.

To display pixel coefficients:

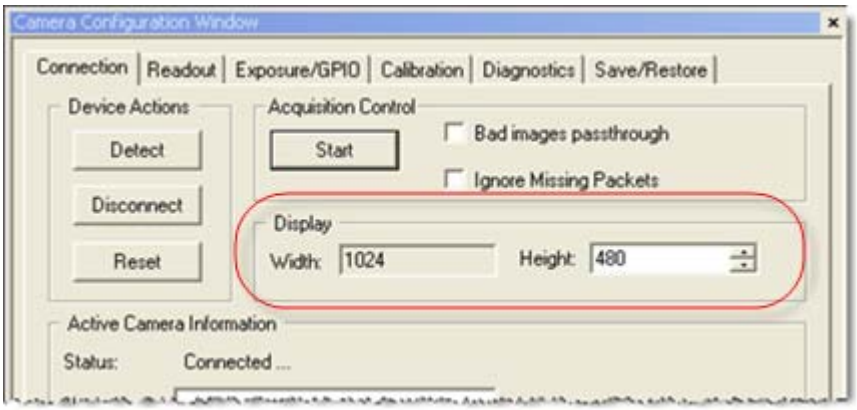
1. Choose **View** → **Pixel Coefficients** on the menu bar.
2. Select the pixel coefficient set number from the drop down box.

The pixel coefficient set displays.



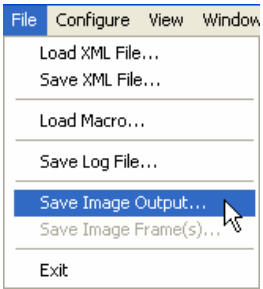
Saving Images

You can save the contents of the Image Output Window in TIFF format, either as a single frame, or as a series of frames. You can control the size of the frame using the Width and Height controls in the Display section of the Connection tab.



Saving a Single Image

To save a single image you must stop acquiring images first (for example, with the  button). What you save will be either the last image acquired when you stopped acquiring (in continuous mode), or an image acquired when you take a snapshot with the  button. To save a single image:



1. From the File menu, select **Save Image Output**. If this menu option is not available, you are likely still in continuous acquisition mode; stop acquiring (use the Stop button in the Connection tab) and the menu option will be enabled.
2. In the **Save As** file browser, select the location on your computer to save the image.
3. Click **Ok**.

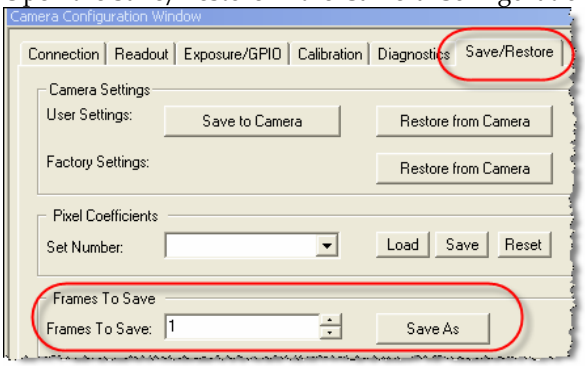
The image will now be saved to your computer.

Saving Multiple Image Frames:

You must be acquiring images in continuous mode save multiple image frames. If you have not already done so, click Start in the Connection window or use the  button. To save multiple images:

Method 1:

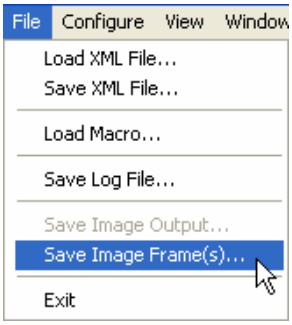
1. Open the Save/Restore in the Camera Configuration Window.



2. In the **Frames to Save** spin box, select the number of frames to save.
3. Click **Save As**.
4. In the **Save As** file browser, select the location on your computer to save the frames.
5. Click **Ok**.

The selected number of frames will now be saved to your computer.

Method 2:



1. From the File menu, select Save Image Frame(s).
2. From the **Frames to Save** spin box, select the number of frames to save.
3. Click **Save**.
4. In the file browser, Select the location on your computer to save the frames.
5. Click **Ok**.

The selected number of frames will now be saved to your computer.

3

Viewing, Resizing, and Moving the Image

3.1 Viewing an Image

After you have detected your camera and started grabbing images, you can view the images in the Image Output Window. Refer to Chapter 1 if you need more information on how to detect a camera and begin grabbing images.

To view what the camera is currently imaging:

1. Select **Window → Image Output Window** to show the **Image Output Window**.

The image should now be displayed in the **Image Output Window**.

3.2 Viewing a Saved Image

Method 1:

1. From the Camera Display Window, select the file the images were saved to. By default this will be the "Images" file.
2. Double click the name of the image you want to view.

The image will display in the Image Output Window.

Method 2:

1. From the File menu, select Load Image Output.
2. In the file browser, locate the file the image was saved to and select the image.
3. Click Open.

The image will display in the Image Output Window.

3.3 Resizing the Image

You can adjust the image size in the Image Output Window to either fit to the window size or display the image at actual size.

To resize the image:

1. Click the  button on the toolbar to fit the image to the size of the Image Output Window.

   or

   Click the  button on the toolbar to view image at its actual size.

3.4 Zooming In or Out of an Image

You can "zoom in" to get a close-up view of your image or "zoom out" to see more of the image at a reduced size.

To change the zoom level:

1. Click the  button to zoom in on the image.

   or

   Click the  button zoom out on the image.

3.5 Moving the Image in the Window

You can “unlock” an image in order to move it around the Image Output Window. This feature is useful when viewing areas of an image that has been zoomed in on.

1. Open the image you want to move in the Image Output Window.
2. Right click on the image and uncheck the “Lock on center” option.
3. You can now left-click-and-hold on the image in order to drag it around the window.

Note that the ROI feature, as well as features dependent on set X & Y coordinates, will be affected if the image is moved.

4

Configuring Image Readout

4.1 Overview: Configuring Image Readout

To configure image readout:

1. Open the **Readout** tab in the **Camera Configuration Window**.

   Under **Readout**:

2. Select the sensitivity mode to use from the **Sensitivity Mode** dropdown box. For details, see Setting the Camera's Sensitivity Mode.
3. Select the bit depth to use from the **Bit Depth** dropdown box. For details, see Selecting the Camera's Bit Depth.
4. Select the camera's CCD shift direction from the **Direction** dropdown box. For details, see Changing the Camera's CCD Shift Direction.

   Under **Binning**:

5. Select the horizontal binning value from the **Horizontal Binning** dropdown box. For details, see Using Horizontal Binning.
6. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

4.2 Setting the Camera's Sensitivity Mode

You can operate the camera in high sensitivity, low sensitivity, or tall pixel mode.

To set the camera's sensitivity mode:

1. Open the **Readout** tab in the **Camera Configuration Window**.

   Under **Readout**:

2. Select the sensitivity mode to use from the list in the **Sensitivity Mode** dropdown box where:

   High Sensitivity: The camera uses both line scan sensors and its responsivity increases accordingly

Low Sensitivity: The camera uses a single line scan sensor.

Tall Pixel: The camera operates using both sensors, creating a 28µm x 14µm pixel.

3. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

4.3 Selecting the Camera's Bit Depth

You can output either 8 or 12 bits.

To set the camera's bit depth:

1. Open the **Readout** tab in the **Camera Configuration Window**.

   Under **Readout**:

2. Select the bit depth to use from the list in the **Bit Depth** dropdown box.
3. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

4.4 Changing the Camera's CCD Shift Direction

When in high sensitivity mode, you can select either forward or reverse CCD shift direction or external direction control. This accommodates object direction change on a web and allows you to mount the camera "upside down".

To set the camera's readout direction:

1. Open the Readout tab in the Camera Configuration Window.

   Under **Readout**:

2. Select the direction to use from the list in the **Direction** dropdown box.
3. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

 Available only in high sensitivity mode.

4.5 Using Horizontal Binning

Horizontal binning increases the horizontal pixel pitch and light sensitivity by decreasing horizontal resolution. The amount of data being sent from the camera is reduced by the horizontal binning factor.

To set the horizontal binning factor:

1. Open the **Readout** tab in the **Camera Configuration Window**.

   Under **Binning**:

2. Select the horizontal binning factor to use from the list in the **Horizontal Binning** dropdown box.

3. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

Notes on Binning

- For optimal flat field correction, you should rerun the flat field correction after changing binning values.
- Changing binning values does not automatically alter gain, frame rate generation, or other functions of the camera. You may, however, have to re-enter the camera's frame rate after changing binning values.

5

Exposure Control

5.1 Exposure Control

Overview: Exposure Control

Using the **Exposure/GPIO tab** in the **Camera Configuration Window**, you can control the camera's exposure mode, line rate, and exposure time.

To select how you want the camera's line/frame rate to be generated:

1. In the **Exposure Mode** dropdown box, first select the camera's exposure mode. For details, refer to Setting the Camera's Exposure Mode.
2. Next, if using an internally generated sync, you must set the camera's line rate in the **Line Rate (Hz)** text box. This option is grayed out and not available when using an external sync. For details, refer to Setting the Camera's Line Rate and Exposure Time.
3. Finally, if applicable to your exposure mode, set the exposure time in the **Exposure Time (µs)** text box. This option is not available in some exposure modes and is grayed out. For details, refer to Setting the Camera's Line Rate and Exposure Time.

Setting the Camera's Exposure Mode

You have a choice of operating the camera in one of the multiple exposure modes. Depending on your mode of operation, the camera's line/frame rate (synchronization) can be generated internally or set externally with an EXSYNC signal (CC1).

To select the camera's exposure mode:

1. Open the **Exposure/GPIO** tab in the **Camera Configuration Window**.

   Under **Exposure**:
2. Select the exposure mode to use from the list in the **Exposure Mode** dropdown box.
3. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

Note: Refer to the camera user's manual for detailed timing diagrams.

Setting the Camera's Line Rate and Exposure Time

Depending on the camera's exposure mode, you can set the camera's line rate and/or exposure time. These options are grayed out when you are operating the camera in an exposure mode that does not allow you to set these programmatically.

Please note that *the exposure time range is calculated based on the current line rate*. For example, in exposure mode 2, a line rate of 5000 Hz allows for a maximum exposure time of 197.50 µs; whereas, a line rate of 4000 Hz allows for a maximum exposure time of 247.50 µs.

Use the command **get ger** in order to have the camera return the maximum exposure time for the current line rate.

To set the camera's line rate:

1. Open the **Exposure/GPIO** tab in the **Camera Configuration Window**.

   Under **Exposure**:
2. Enter the line rate to use by sliding the slider or typing the value in the **Line Rate(Hz)** textbox.
3. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.


This option is available only when operating in exposure modes 2 or 7.

To set the camera's exposure time:

1. Open the **Exposure /GPIO** tab in the **Camera Configuration Window**.

   Under **Exposure**:
2. Enter the exposure time to use by sliding the slider or typing the value in the **Exposure Time(µs)** textbox.
3. To save the settings to the camera's nonvolatile memory, click **Save Camera User Settings**.


This option is available only when operating in exposure mode 2

6

GPIO Control

The GPIO connector allows the camera to receive (and in some cases output) direct, real-time control signals that are independent of Ethernet communications. Ethernet network protocols introduce a small but measurable and unpredictable lag that does not allow extremely precise and reliable control of camera behavior such as line rate, integration time, and readout direction.

For example, the GPIO connector can be used to control EXSYNC, PRIN (pixel reset), and direction signals.

In general, to configure the GPIO, you need to accomplish three main tasks:

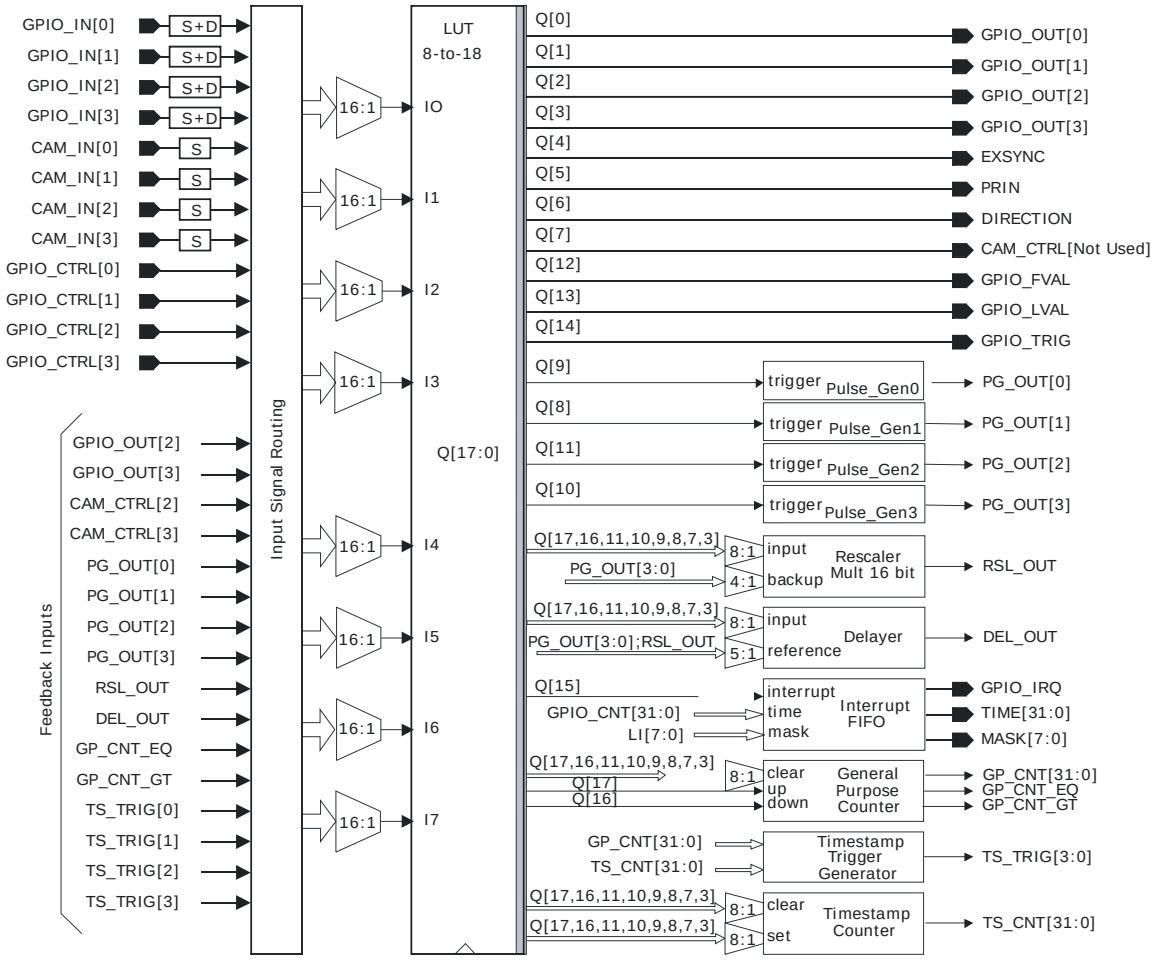
1. Assign a physical camera pin and signal to a GPIO Input number.
2. Map the GPIO Input or Output from the Exposure/GPIO tab to the corresponding GPIO Look-Up Input Configuration.
3. Using the LUT programming language, map the GPIO Input Configuration to the GPIO Output Configuration.

The following sections provide details on the LUT control block, the LUT programming language and the advanced features of the GPIO.

6.1 The GPIO Control Block

All signals pass through the GPIO Control Block. Depending on its programming, the GPIO Control Block generates output signals that can be redirected to various camera outputs.

The GPIO control block uses a look up table (LUT) to generate the outputs. This LUT contains eight different inputs, each of which can generate 18 different outputs, resulting in 256 entries of 18 bits.



Note that all external inputs (from the camera, TTL inputs, and GPIO controls) are resynchronized. The outputs from the look-up table are synchronous.

The LUT is programmed using a simple language. This language allows you to create logical equations that specify the conditions that set particular outputs. See also: GPIO Control Block Programming Language

Note: There is a delay of two clock cycles between the inputs of the LUT and its outputs. A clock cycle has a period of 30 nanoseconds, so the delay is 60 nanoseconds.

The signals in the GPIO Control Block are defined in the tables below.

Inputs to QuickCam are labeled I*n* (where n is an integer from 0 to 7) and outputs are labeled Q*n* (where n is an integer from 0 to 15).

GPIO Input Labels

Input Signal	Label	Description
GPIO_IN[0]	*	GPIO 0 input
GPIO_IN[1]		GPIO 1 input
GPIO_IN[2]		GPIO 2 input

Input Signal	Label	Description
GPIO_IN[3]		GPIO 3 input
CAM_IN[0]		Camera input 0
CAM_IN[1]		Camera input 1
CAM_IN[2]		Camera input 2
CAM_IN[3]		Camera input 3
GPIO_CTRL[0]		GPIO 0 control bit. The control bits are internal to QuickCam and can be controlled by the SDK.
GPIO_CTRL[1]		GPIO 1 control bit. The control bits are internal to QuickCam and can be controlled by the SDK.
GPIO_CTRL[2]		GPIO 2 control bit. The control bits are internal to QuickCam and can be controlled by the SDK.
GPIO_CTRL[3]		GPIO 3 control bit. The control bits are internal to QuickCam and can be controlled by the SDK.
PULSE_OUT0		Output from pulse generator 0
PULSE_OUT1		Output from pulse generator 1
PULSE_OUT2		Output from pulse generator 2
PULSE_OUT3		Output from pulse generator 3
GPIO_OUT[2]		Direct feedback from the LUT output assigned to GPIO_OUT[2]
GPIO_OUT[3]		Direct feedback from the LUT output assigned to GPIO_OUT[3]
CAM_CTRL[3]		Direct feedback from the LUT output assigned to CAM_CTRL[3]
CAM_CTRL[4]		Direct feedback from the LUT output assigned to CAM_CTRL[4]
RSL_OUT		Output from rescaler 0
DEL_OUT		Output from delayer 0
GP_CNT_EQ		Output of counter 0. Low when the counter's value is lower than or greater than a specified comparison value. High when the value is equal to the specified comparison value.
GP_CNT_GT		Output of counter 0. Low when the counter's value is lower than a specified comparison value. High when the value is equal to or greater than the specified comparison value.

GPIO Output Labels

Input Signal	Label	Description
GPIO OUTPUT 0	Q0	GPIO output 0
GPIO OUTPUT 1	Q1	GPIO output 1
GPIO OUTPUT 2	Q2	GPIO output 2
GPIO OUTPUT 3	Q3	GPIO output 3
EXSYNC	Q4	EXSYNC
PRIN	Q5	PRIN
DIRECTION	Q6	Camera forward and reverse control.
CAM_CTRL (NOT USED_	Q7	CC4 signal. Not used.
PULSE_TRIG1	Q8	Trigger for pulse generator 1. Used only when

Input Signal	Label	Description
		the pulse generator is in triggered mode. If available, can be used by one of the following modules: • Rescaler 0 input • Delayer 0 reference signal • Counter 0 clear event input • Timestamp counter set event input • Timestamp counter clear event input
PULSE_TRIG0	Q9	Trigger for pulse generator 0. Used only when the pulse generator is in triggered mode. If available, can be used by one of the following modules: • Rescaler 0 input • Delayer 0 reference signal • Counter 0 clear event input • Timestamp counter set event input Timestamp counter clear event input
PULSE_TRIG3	Q10	Trigger for pulse generator 3. Used only when the pulse generator is in triggered mode. If available, can be used by one of the following modules: • Rescaler 0 input • Delayer 0 reference signal • Counter 0 clear event input • Timestamp counter set event input Timestamp counter clear event input
PULSE_TRIG2	Q11	Trigger for pulse generator 2. Used only when the pulse generator is in triggered mode. If available, can be used by one of the following modules: • Rescaler 0 input • Delayer 0 reference signal • Counter 0 clear event input • Timestamp counter set event input Timestamp counter clear event input
GPIO_FVAL	Q12	Output to the internal grabber to replace or mix with the camera's FVAL signal. Depending on the camera, the FVAL signal can be replaced or combined with the signal of this output.
GPIO_LVAL	Q13	Output to the internal grabber to replace or mix with the camera's LVAL signal. Depending on the cameral, the LVAL signal can be replaced or combined with the signal of this output.
GPIO_TRIG	Q14	Trigger of image grabber when configured to use hardware trigger.

Input Signal	Label	Description
GPIO_IRQ	Q15	Trigger for an application callback. When the callback is invoked, it provides the following information: • A bit mask of the 8 LUT inputs at the time the interrupt was generated. • The timestamp value at the time of the interrupt.
CNT_DOWN	Q16	Trigger for the down event of counter 0. If available, can be used by one of the following modules: • Rescaler 0 input • Delayer 0 references signal • Counter 0 clear event input • Timestamp counter set event input • Timestamp counter clear event input
CNT_UP	Q17	Trigger for the up event of counter 0. If available, can be used by one of the following modules: • Rescaler 0 input • Delayer 0 references signal • Counter 0 clear event input • Timestamp counter set event input • Timestamp counter clear event input

6.2 GPIO Control Block Programming Language

The GPIO Control Block is programmed using a simple, yet very flexible language.

By default, the GPIO Control Block will not generate output signals, regardless of the state of the input signals. The program consists of zero or more lines that specify how an output signal is generated based on the input signals. Basically each line of the program has the following format:

Q*n* = <logical expression of inputs: I*n*>

Therefore, a program line can range from a simple redirection from one input to one output, to a complex logical expression of two or more input signals.

The language uses generic labels for inputs and outputs.

To configure the GPIO Look-Up Table from the user interface or SDK functions, the following language is used:

```
language                *( line )

line                    eol | output '=' combined_expression [ eol ]

eol                     '\r' | '\n' | "\r\n" | "\n\r"

output                  "Q0" | "Q1" | "Q2" | "Q3" | "Q4" | "Q5" |
                        "Q6" | "Q7" | "Q8" | "Q9" | "Q10" | "Q11" |
                        "Q12" | "Q13" | "Q14" | "Q15"

group                   '(' combined_expression ')'

not_group               '!' group

and                     '&' expression

or                      '|' expression

xor                     '^' expression

combined_expression     expression *( and | or | xor )

expression              input | not_input |
                        false | true |
                        group | not_group

false                   '0' | "false" | "FALSE"

true                    '1' | "true" | "TRUE"

input                   "I0" | "I1" | "I2" | "I3" | "I4" |
                        "I5" | "I6" | "I7"

not_input               '!' input
```

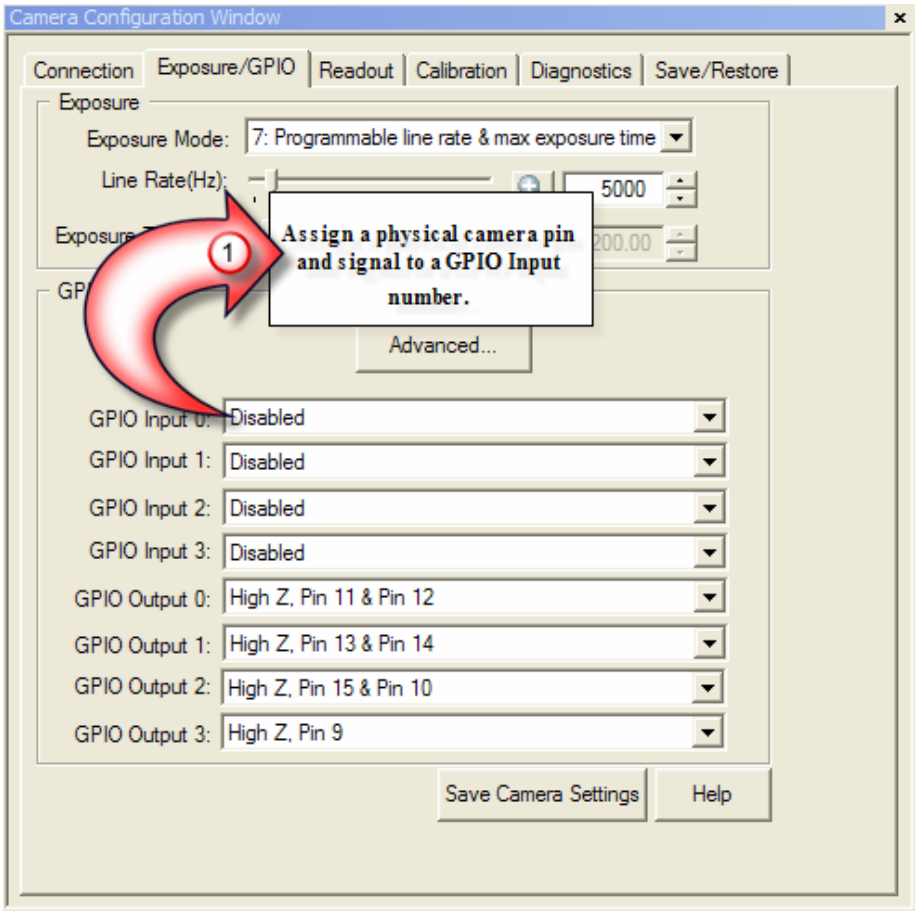
6. 3 Configuring the GPIO (With Examples)

Overview

As was mentioned in the introduction of this chapter, to configure the GPIO, you need to accomplish three main tasks:

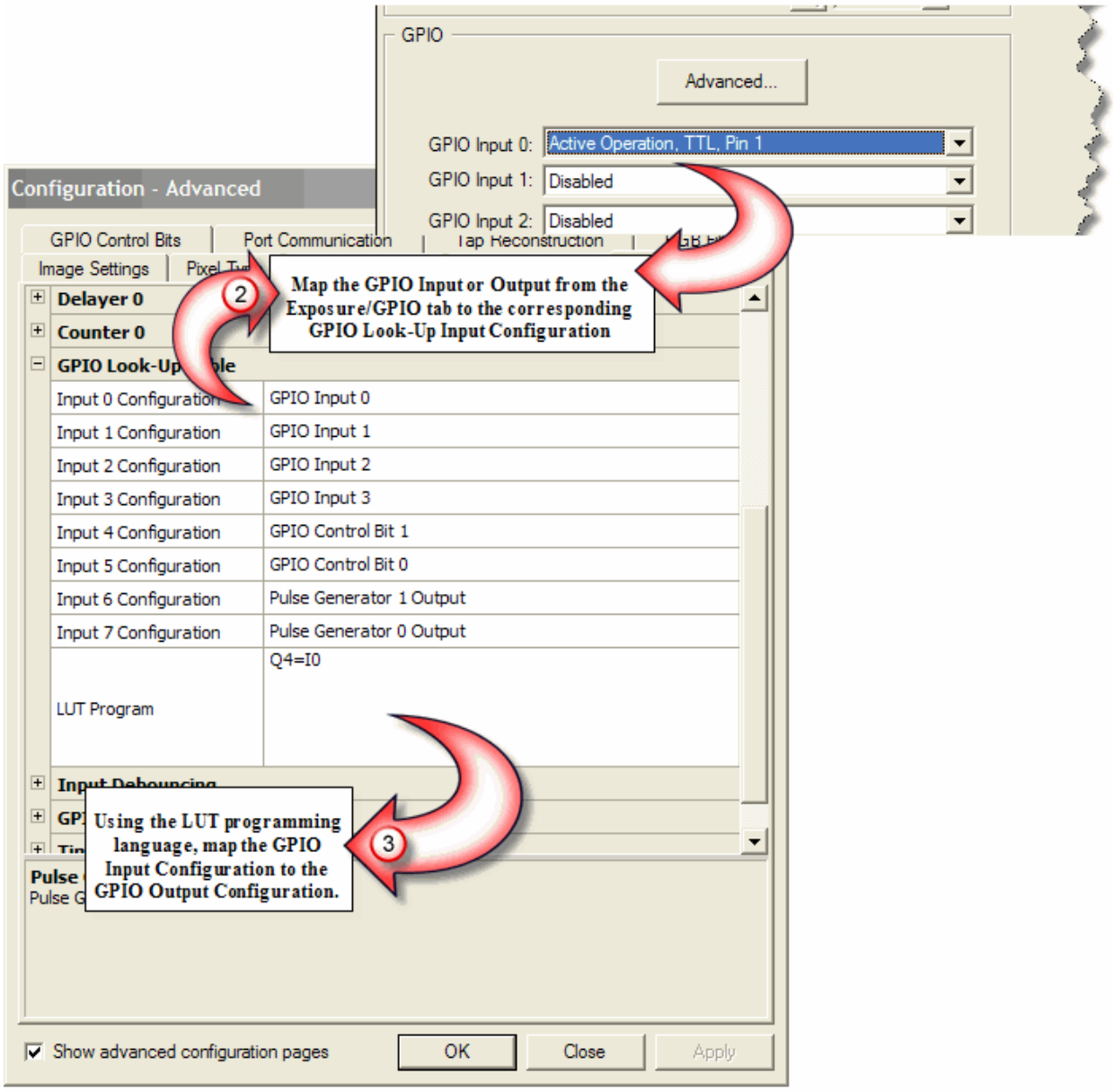
Step 1

The first step is to select and assign the GPIO connector pins and signal type to use for any necessary inputs or outputs.



Step 2

Next you must map the GPIO input number and signal type set on the Exposure/GPIO tab to a GPIO Look-Up Table Input Configuration Label.

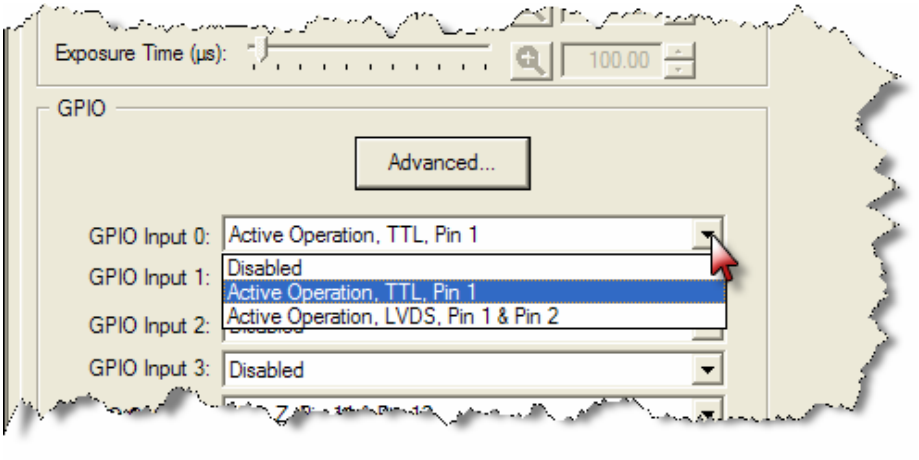


Step 3

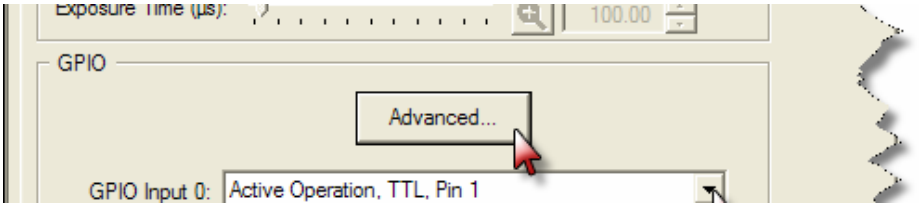
The final step maps the GPIO Look-Up Input Configuration Label to a GPIO Output Configuration Label.

Example: Setting a Simple EXSYNC

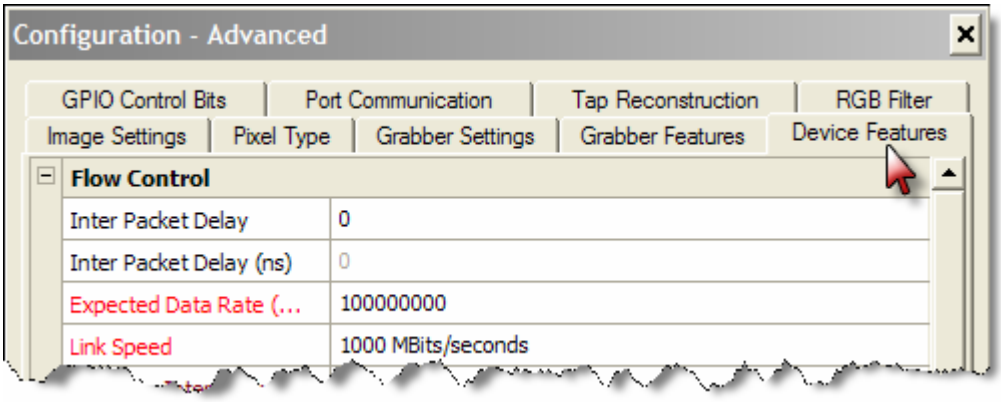
1. Assuming you are using a TTL signal, assign **GPIO Input 0** to **Active Operation, TTL, Pin 1**.



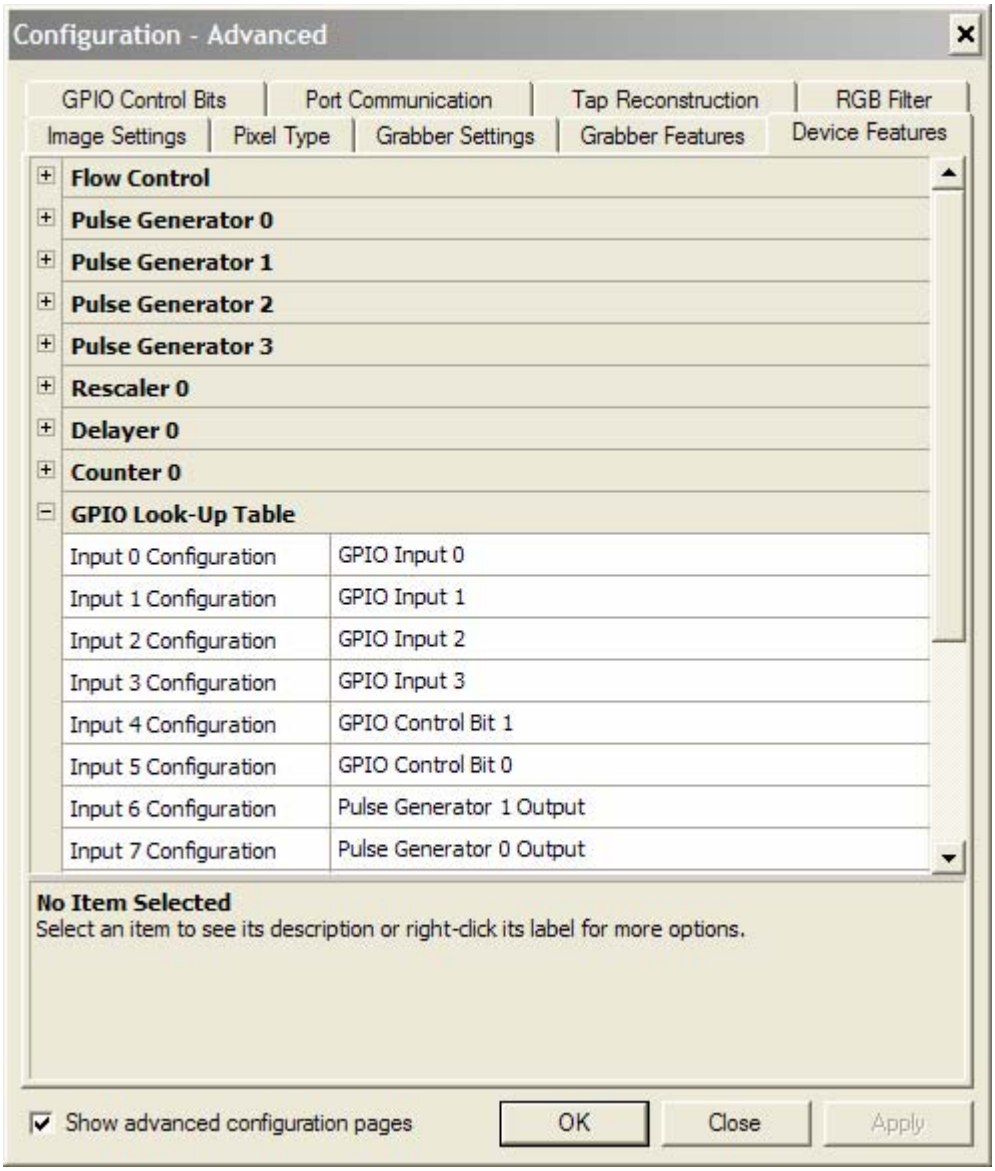
2. Click **Advanced** to open the **Configuration dialog box**.



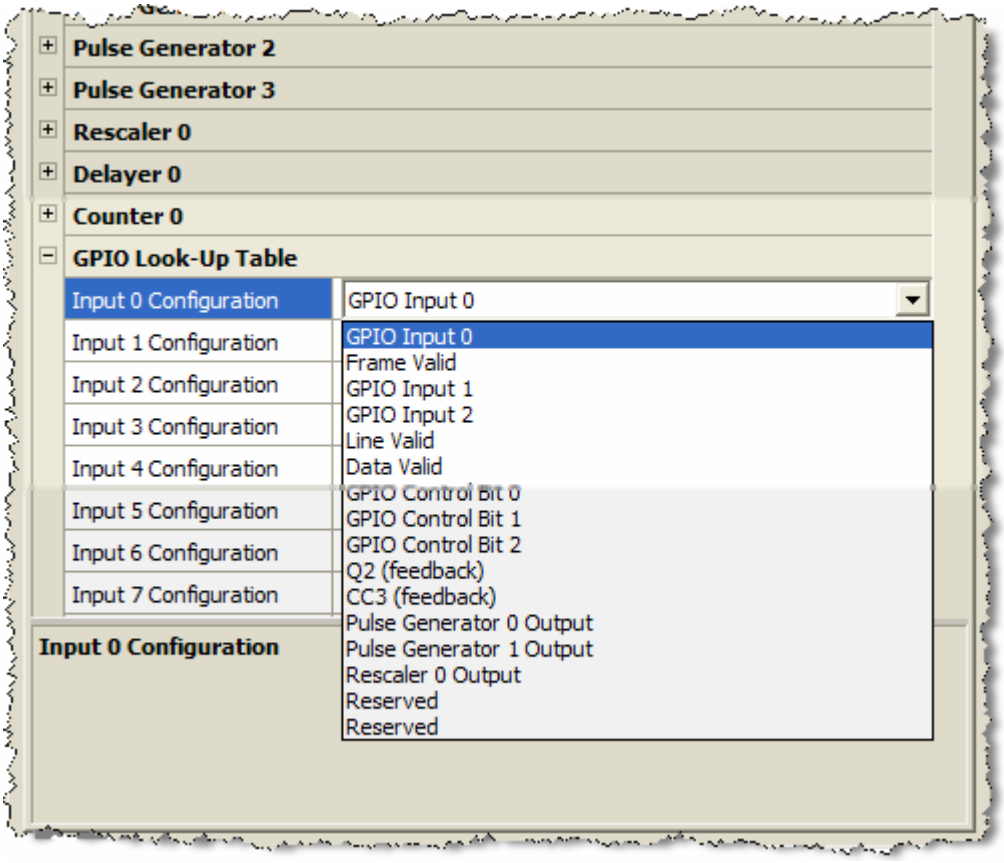
3. In the **Configuration dialog box**, open the **Device Features tab**.



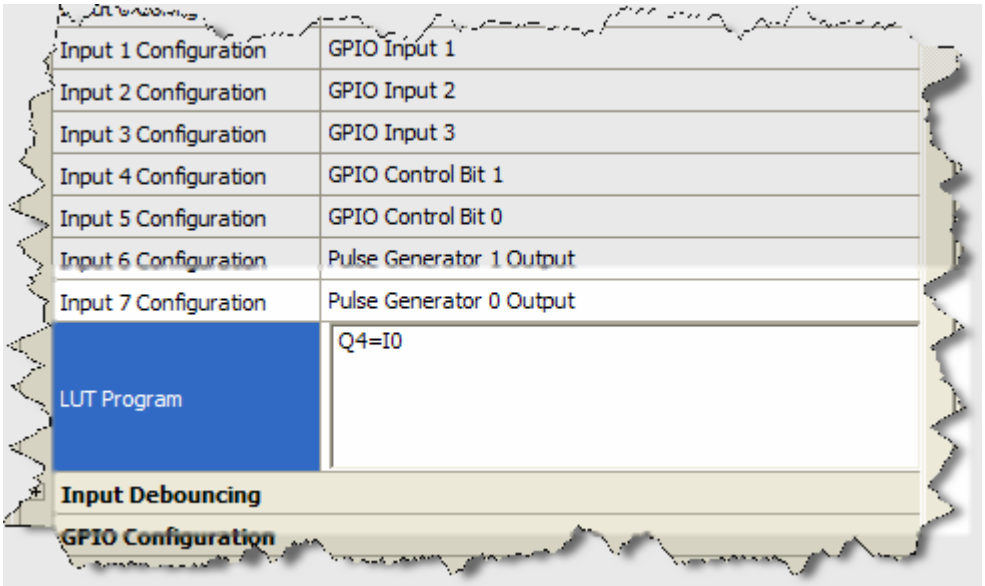
4. On the Device Features tab, open the GPIO Look-Up tree.



5. In the Input 0 Configuration, map GPIO Input 0 to the Input 0 Configuration label.



6. In the LUT Program text box, enter the equation to map Input 0 Configuration (I0) to Output 4 (Q4) where *Output Label* = *Input Configuration Label*. If you refer to the GPIO Output Label table on page 25, you'll see that Output 4 is the LUT label for EXSYNC.



7. Click Apply.

Example: External Sync with Pulse Generator

In this example, a variation on the previous one, pulse generators are used to provide a periodic trigger to the camera.

The camera uses the signal to receive both the frame rate and the exposure time. The frame rate varies, depending on the period of the signal and the exposure time on the width of the signal.

To get a rate of 10 frames per second, the signal needs to have a period of 100 ms. The desired exposure time is 21 ms.

First the pulse generator 0 needs to be configured to the correct value. In the pulse generator section of the Device Features tab, shown in the following figure, the following values would be specified:

- Delay: 12530
- Width: 3334
- Granularity: 209
- Periodic: TRUE
- Trigger Mode: irrelevant in periodic mode

With the pulse generator 0 correctly set up, its output simply needs to be redirected to the camera.

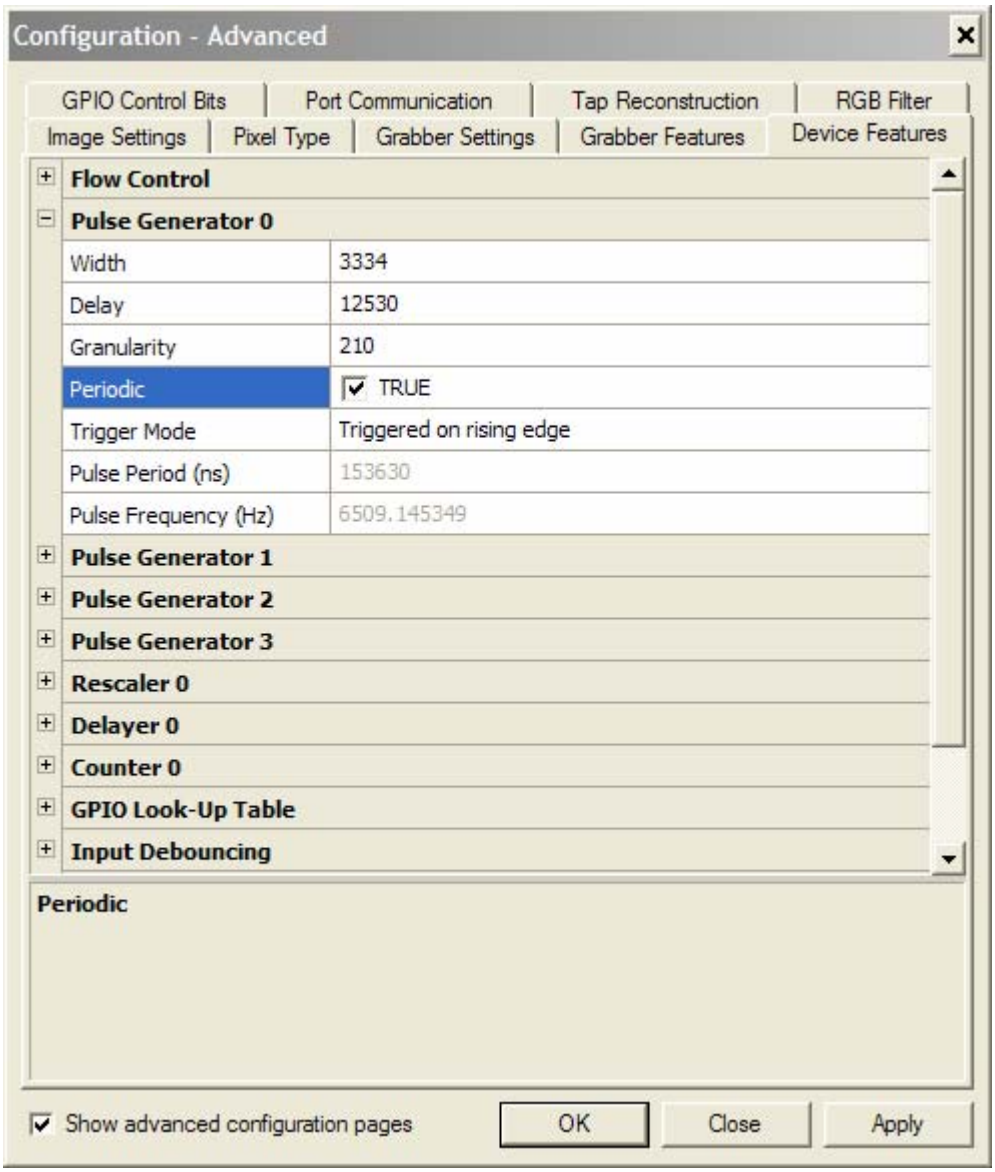
Here is a short summary of the outputs and inputs that would be used:

- Periodic Pulse Generator 0: I7
- EXSYNC label: Q4

The resulting program would look like this:

- Q4=I7

Example: Pulse Generator Configuration for 100 ms Period and 21 ms Exposure Time



With the pulse generator 0 correctly set up, its output simply needs to be redirected to the camera.

Here is a short summary of the outputs and inputs that would be used:

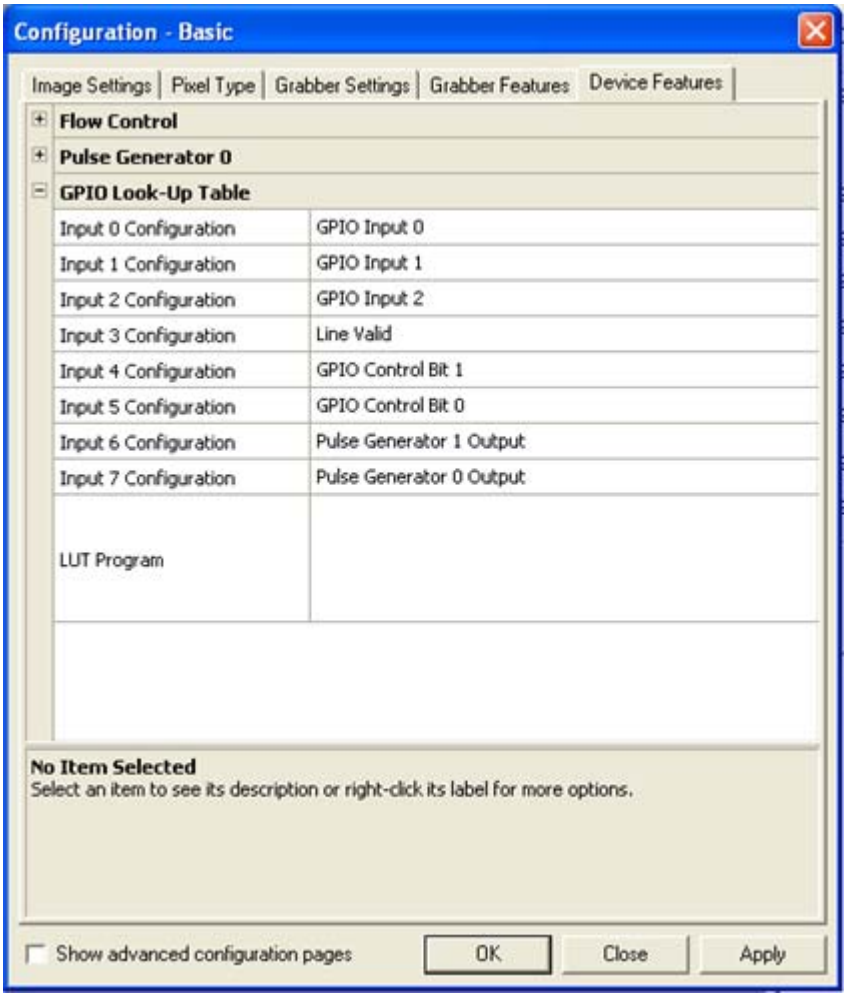
- Periodic Pulse Generator 0: I7
- Camera Control 1 (output): Q4
- The resulting program would look like this:

```
Q4 = I7
```

6.4 GPIO Look-Up Table

The GPIO Look-Up Table tab is used to configure how the QuickCam software handles and redirects inputs and outputs. (This differs from the signals set on

Exposure/GPIO tab where you are setting how the camera handles it physical inputs and outputs.)



Input 0 Configuration

Selects the input associated with the label IO. This should match the input setting for Input 1 on the Exposure/GPIO tab.

Input 1 Configuration

Selects the input associated with the label I1. This should match the input setting for Input 2 on the Exposure/GPIO tab.

Input 2 Configuration

Selects the input associated with the label I2. This should match the input setting for Input 3 on the Exposure/GPIO tab.

Input 3 Configuration

Selects the input associated with the label I3. This should match the input setting for Input 4 on the Exposure/GPIO tab.

Input 4 Configuration

Selects the input associated with the label I4.

Input 5 Configuration

Selects the input associated with the label I5.

Input 6 Configuration

Selects the input associated with the label I6.

Input 7 Configuration

Selects the input associated with the label I7.

LUT Program

The GPIO Control Block is programmed using a simple, yet very flexible language.

By default, the GPIO Control Block will not generate output signals, regardless of the state of the input signals. The program consists of zero or more lines that specify how an output signal is generated based on the input signals. Basically each line of the program has the following format:

Q*n* = <logical expression of inputs: I*n*>

Therefore, a program line can range from a simple redirection from one input to one output, to a complex logical expression of two or more input signals.

The language uses generic labels for inputs and outputs.

To configure the GPIO Look-Up Table from the user interface or SDK functions, use the language described in GPIO Control Block Programming Language.

6.5 Pulse Generator

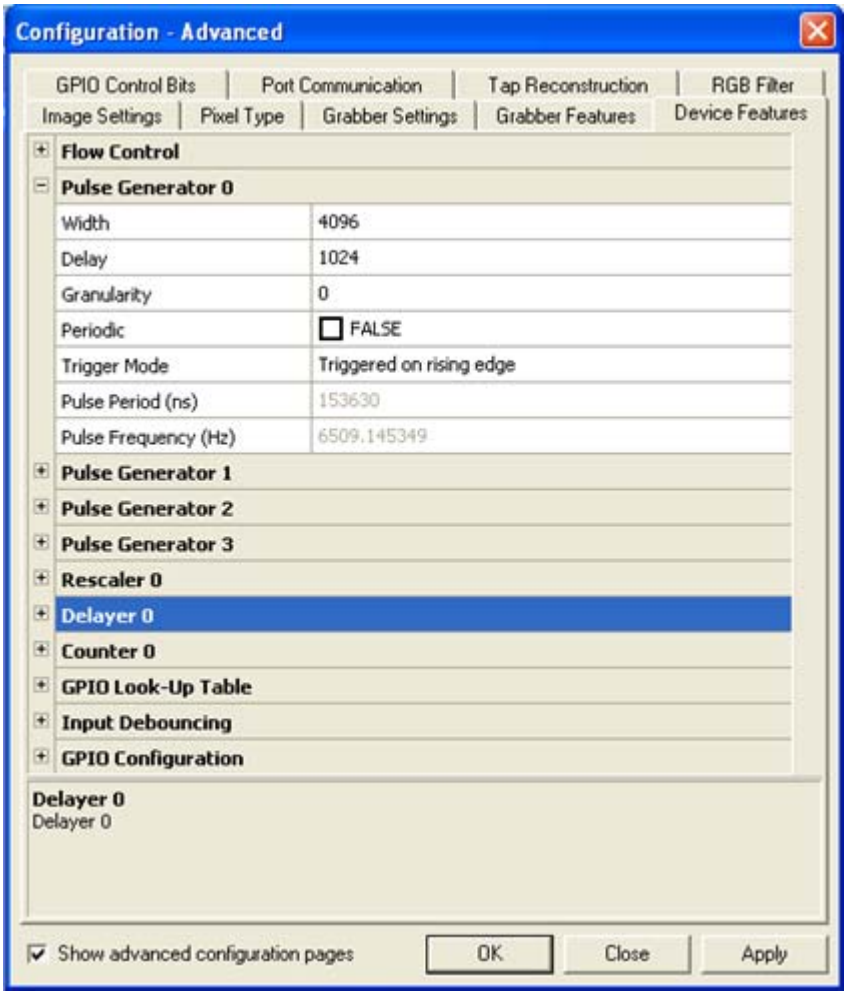
To configure the Pulse Generator, click the **Advanced…** button on the **Exposure/GPIO** tab in the **Camera Configuration** dialog box and open the **Device Features** tab.

The **Pulse Generators** are located on the **Device Features** tab.

The behavior of the Pulse Generator is defined by their delay and width. The delay is the amount of time the pulse is inactive prior to the pulse, and the width is the amount of time the pulse is active.

The Pulse Generator signals can be set in either triggered or periodic mode. In triggered mode, the pulse generator is triggered by either the rising edge or high level of the input signal. When triggered, the pulse generator is inactive for the duration of the delay, then active for the duration of the width. After that, it will become inactive until the next trigger occurs. If a trigger occurs while pulse generator is already handling a previous trigger, the new trigger is ignored.

In periodic mode, the trigger continuously generates a signal that is based on the configured delay and width. The period of the pulse is therefore the delay time plus the width time.



Pulse Generator 0 to 3

Selects which pulse generator to configure. To view the pulse generator properties, open the directory

Width

Indicates the number of cycles (also determined by the granularity) that the pulse remains at a high level before falling to a low level.

Delay

Indicates the number of cycles (also determined by the granularity) that the pulse remains at a low level before rising to a high level.

Granularity

Indicates the number of PCI clock cycles that are used for each increment of the delay and width. The amount specified in the granularity is multiplied by 30 nanoseconds.

Trigger Mode

Indicates how a triggered pulse generator will handle its triggers. The possible settings are:

- **Triggered on rising edge**: Indicates if a triggered pulse generator is triggered on the rising edge of an input
- **Triggered on high level**: Indicates is a triggered pulse generator is triggered on the high level of an input
- **Triggered on falling edge**: Indicates if a triggered pulse generator is triggered on the falling edge of an input
- **Triggered on rising AND falling edges**: Indicates if a triggered pulse generator is triggered on the rising edge of an input and on the falling edge of an input
- **Triggered on low level**: Indicates if a triggered pulse generator is triggered on the low level of an input

Pulse Period (ns)

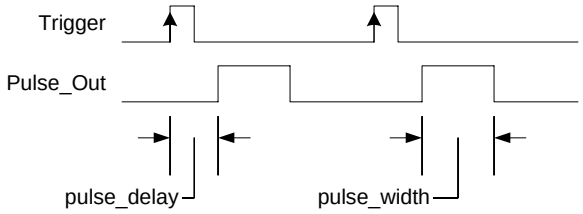
Displays the value of the parameter, in nanoseconds, of a complete delay-width cycle of the pulse generator. This value is computed every time the delay, width or granularity is modified and is available regardless of the periodic mode.

Pulse Frequency (Hz)

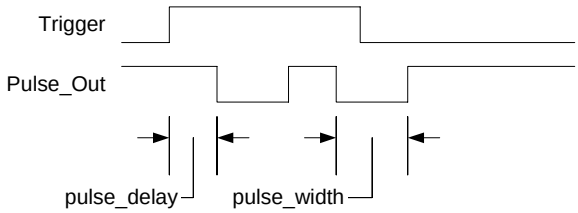
Displays the frequency of the pulse generator. This value is computed every time the delay, width or granularity is modified and is available regardless of the periodic mode.

Pulse Generator Timing

Positive Pulse Generated from a Rising Edge Trigger



Negative Pulse Generated from a Level High Trigger



QuickCam can generate two internal signals using the internal pulse generators. The behavior of each of these two pulse generators is defined by a delay and a width. As shown in the accompanying diagrams, the delay is the time between the trigger and the pulse transitions. The width is the time the pulse stays at the active level before transitioning. The periodic mode, the delay determines the low time of the pulse.

Each pulse generator generates a signal that can be used as an input to the GPIO Control Block. A triggered pulse generator needs an input signal that comes from an output of the GPIO Control Block.

Note: There is one clock cycle between the output signal of a pulse generator and the outputs of the GPIO Control Block.

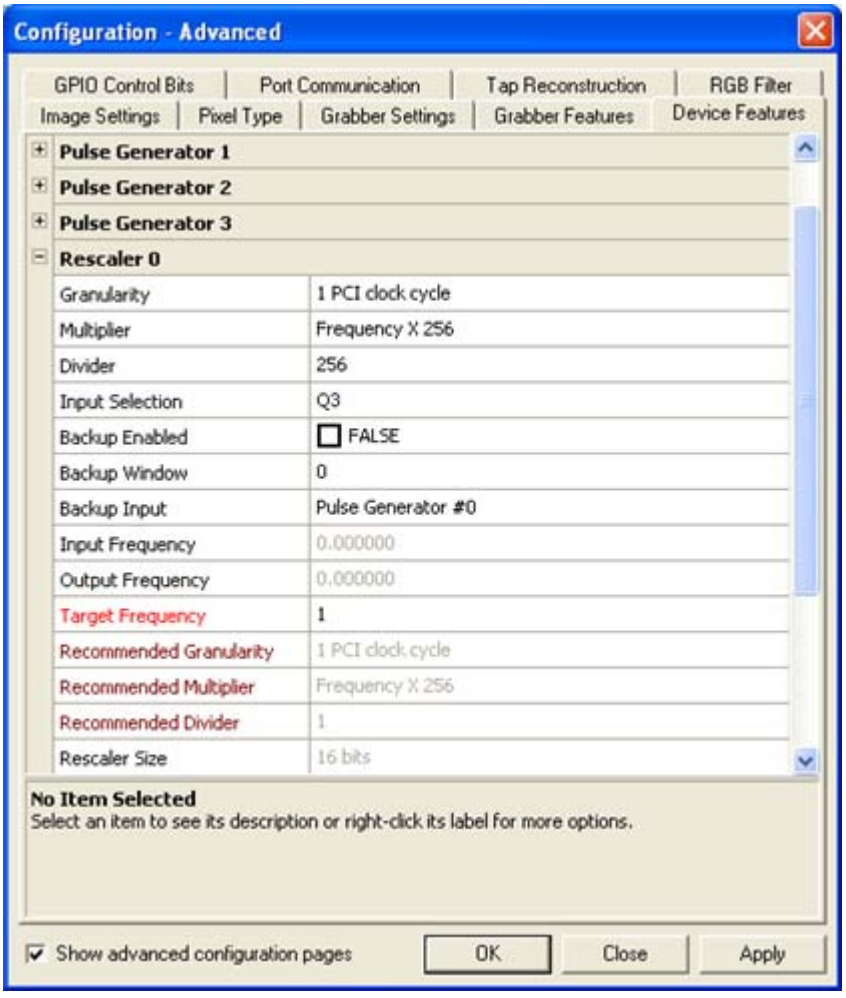
The labels for the inputs from the pulse generators in the GPIO Control Block programming languages are:

- I7, for pulse generator 0
- I6, for pulse generator 1

6.6 Rescaler

To configure the Rescaler, click the **Advanced...** button on the Exposure/GPIO tab in the Camera Configuration dialog box and open the **Device Features** tab.

QuickCam has a rescaler module that can be used to rescale a periodic input signal. The signal output is resynchronized based on the rescaler settings.



The rescaler is defined by the following settings:

Granularity

The granularity is the number of clock cycles during which the rescaler checks for activity on its input. The value to use depends on the period/frequency of the

input signal. If a frequency lies between two different granularity settings, the lowest setting will yield a better precision. The possible values are:

1 PCI clock cycles: The frequency of the input signal is between 509Hz and 33.3MHz.

4 PCI clock cycles: The frequency of the input signal is between 128Hz and 8.3MHz.

16 PCI clock cycles: The frequency of the input signal is between 32Hz and 2.08Mhz

256 PCI clock cycles: The frequency of the input signal is between 2Hz and 130.2kHz

Multiplicator

The multiplier applied to the input frequency. The possible values are:

- Frequency is multiplied by 256
- Frequency is multiplied by 16
- Frequency is multiplied by 4096

Divider

The divider applied to the input frequency. The resulting frequency is computed as follows:

$$output\_frequency = \frac{input\_frequencyxmultiplicator}{divider}$$

Input Selection

Indicates which label in the GPIO LUT will be associated with the rescaler. Make sure you select an input label that is not being used for its default behavior. For example, Q9 is used to send a trigger to pulse generator 0. If pulse generator 0 is used in triggered mode, then it will be triggered by Q9 and cannot be used as the input for the rescaler. The possible values are: Q3, Q7, Q8. Q9, Q10, Q11, Q16, and Q17.

Backup Enabled

Indicates if the rescaler will use a back-up input source if its main source stops its activity.

Backup Window

Specifies the window of time during which there can be no activity from the main input source before the rescaler switches to the back-up source. As soon as activity is detected, the rescaler returns to its main input source.

Backup Input

Same as the main input source

Target Frequency

Helper parameter that computes the best rescaler value of a given target frequency.

Recommended Granularity

Provides the recommended granularity for the value specified in the Target Frequency

Recommended Multiplier

Provides the recommended multiplier for the value specified in the Target Frequency

Recommended Divider

Provides the recommended divider for the value specified in the Target Frequency

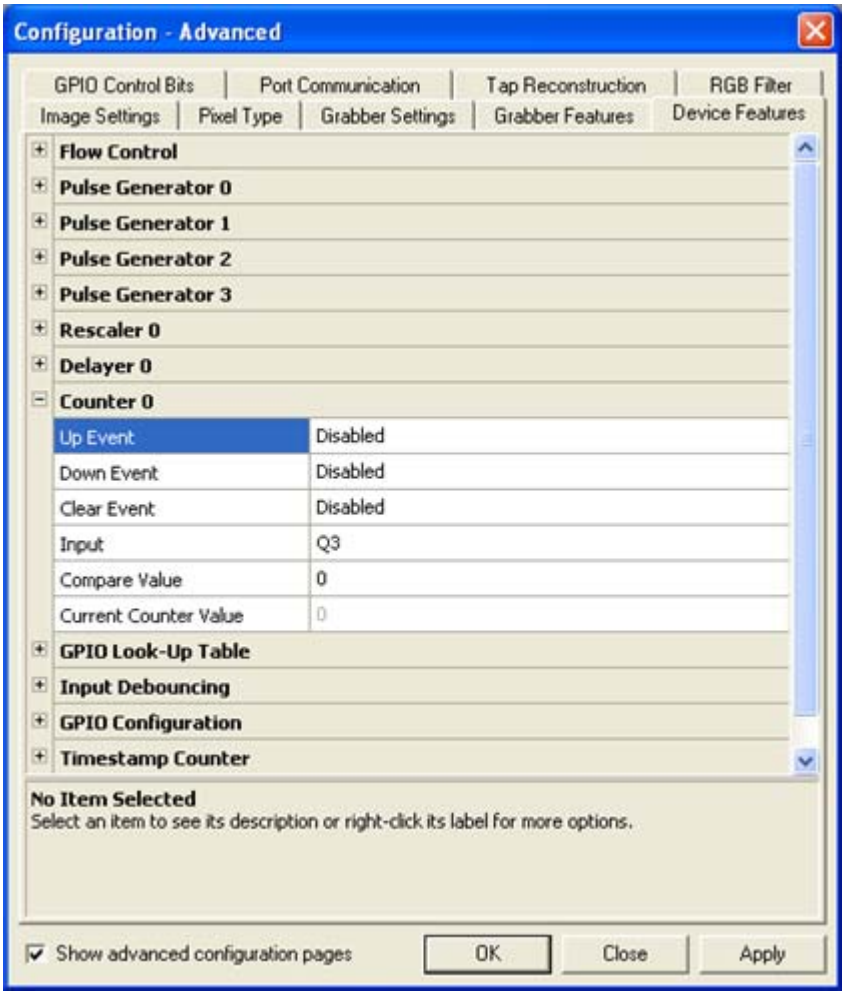
The output of the rescaler is considered an input for the GPIO LUT.

The labels for the output from the rescaler in the GPIO Control Block programming languages depend on the LUT input configuration.

6.7 Counter

To configure the Counter, click the **Advanced…** button on the **Exposure/GPIO** tab in the **Camera Configuration** dialog box and open the **Device Features** tab.

QuickCam has general purpose counter module. It simply maintains a count value that can be increased, decreased, or cleared based on input signals. The counter outputs two signals (which are inputs to the GPIO LUT)



Up Event

Specifies how the input for incrementing the count is handled. The counter's up event uses the Q17 label in the LUT. It can be one of the following settings:

- Disabled
- On the rising edge
- On the falling edge
- On both edges
- On the high level
- On the low level

Down Event

Same as above but for the down event, but uses the Q16 label in the GPIO LUT.

Clear Event

Same as above but for the clear event. The clear event input of the counter does not have a predefined label on the GPIO LUT.

Input

Indicates which label from the GPIO LUT that will be associated with the clear event input of the counter. Make sure you select an input label that is not being used for its default behavior. The possible values are: Q3, Q7, Q8, Q9, Q10, Q11, Q16, and Q17.

Compare value

Indicates the value against which to compare to the current value of the counter. The counter module uses this value to generate both its "equal to" and "greater than" outputs.

Current Counter Value

Displays the current counter value

6.8 Input Debouncing

To configure Input Debouncing, click the **Advanced...** button on the **Exposure/GPIO** tab in the **Camera Configuration** dialog box and open the **Device Features** tab.

The Debouncers tab is used to configure the debouncers of the camera. The debouncers are associated with the first and second PHYSICAL inputs of QuickCam, usually Input 1 and Input 2.

The debouncers make sure that their corresponding inputs filter out bouncing effects. Bouncing is when there are a few very short pulses when the input signal transitions from low to high. Without debouncing, QuickCam may see these small pulses as real signals.

The debouncers make sure that the signal is truly high for the specified amount of time before it is declared as high. The same applies to the falling edge.

Input 0 Value

Indicates the debouncing value for input 0. Each unit is equal to 16 clock cycles (30ns each), or 480ns.

Input 1 Value

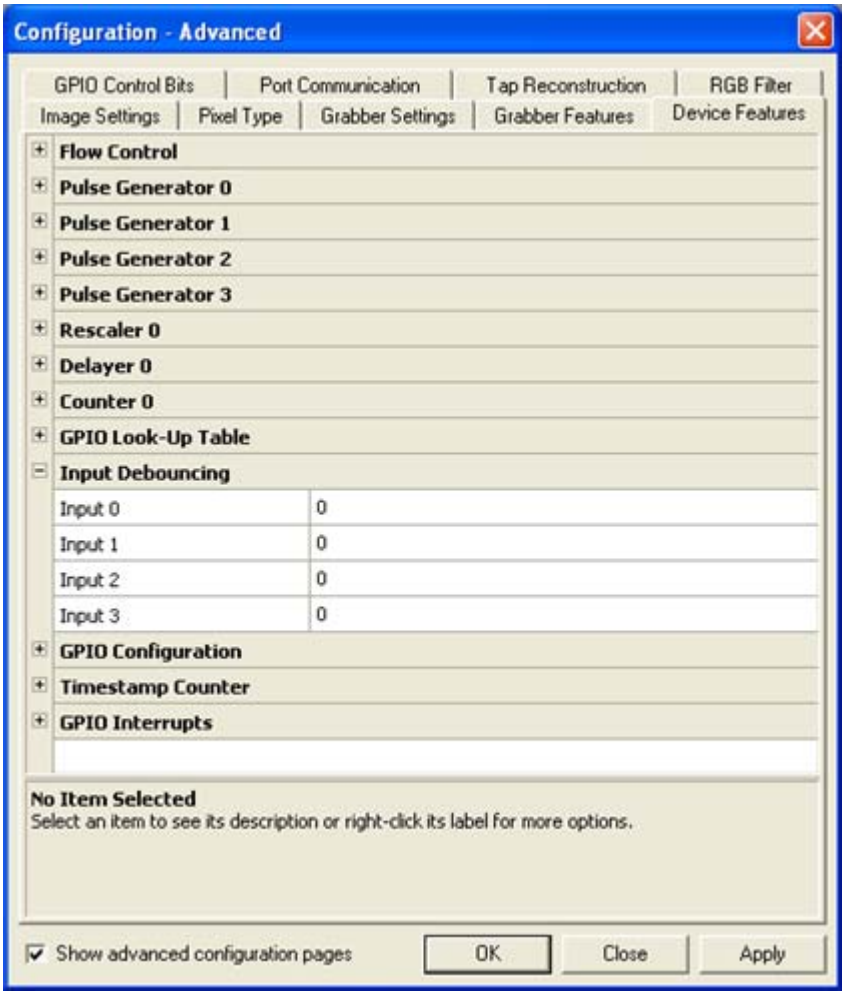
Indicates the debouncing value for input 1. Each unit is equal to 16 clock cycles (30ns each), or 480ns.

Input 2 Value

Indicates the debouncing value for input 2. Each unit is equal to 16 clock cycles (30ns each), or 480ns.

Input 3 Value

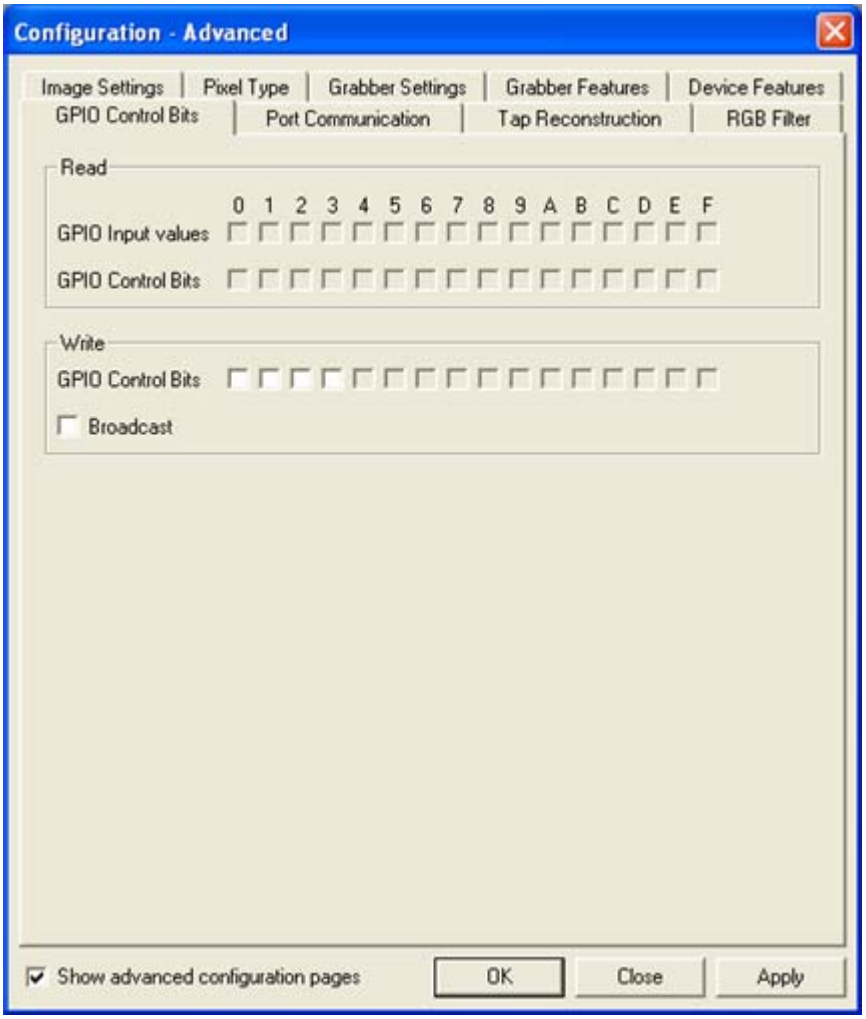
Indicates the debouncing value for input 3. Each unit is equal to 16 clock cycles (30ns each), or 480ns.



6.9 GPIO Control Bits

The GPIO Control Bits tab is used to read and change the values of the GPIO Control Bits of QuickCam. The QuickCam protocol and the SDK functions permit up to 16 GPIO Control Bits, but only 4 are used at the moment.

Note that this panel is not meant to be a real-time display of the control bits. The panel uses an internal timer that reads the actual values from QuickCam.



Broadcast

When this is enabled, the command to set or clear a GPIO will be broadcast to all cameras on the same network as the currently selected camera.

GPIO Control Bits (Write)

These check boxes allow the values of the GPIO Control Bits to be modified.

GPIO Control Bits (Read)

These read-only check boxes represent the actual value that is set on the software-controlled GPIO Control Bits.

GPIO Input Values

These read-only check boxes represent the actual values from the GPIO connector in GPIO Inputs 1, 2, 3, and 4. Refer to Configuring the GPIO Pinout for details on how to set the GPIO actual values.

6.10 GPIO Configuration

Input 0 Configuration

Function selection of Input 0

Input 1 Configuration

Function selection of Input 1

Input 2 Configuration

Function selection of Input 2

Input 3 Configuration

Function selection of Input 3

Output 0 Configuration

Function selection of Output 0

Output 1 Configuration

Function selection of Output 1

Output 2 Configuration

Function selection of Output 2

Output 3 Configuration

Function selection of Output 3

GPIO Synchronization

Synchronizes GPIO inputs using either 2 flip flops or 1 flip flop. Using one flip flop may cause synchronization glitches, so it is recommended that you use two flip flops.

CC1 Configuration

Function selection of the Camera Control Signal 1

CC2 Configuration

Function selection of the Camera Control Signal 2

CC3 Configuration

Function selection of the Camera Control Signal 3

CC4 Configuration

Function selection of the Camera Control Signal 4

To configure the Timestamp Counter, click the **Advanced…** button on the Exposure/GPIO tab in the Camera Configuration dialog box and open the Device Features tab.

6.11 Timestamp Counter

Counter Select

Timestamp Counter (default), General Purpose Counter

Granularity

Indicates the value of each timestamp unit of the timestamp counter. Available values are:480 nanoseconds, 1 microsecond, 100 microseconds, 10 milliseconds

Set Mode

Indicates how the timestamp module handles the “set event”. Possible values are:

Disabled

On Apply-The specified value is set when the user clicks the Apply button.

Rising edge input signal-When the signal on the “set event” input rises, the timestamp module applies the specified value

Set Input

Indicates which label from the GPIO LUT that is associated with the “set event” input of the timestamp module. Make sure you select an input label that is not being used for its default behavior. The possible values are:

- 0: Q3
- 1: Q7
- 2: Q8
- 3: Q9
- 4: Q10
- 5: Q11
- 6: Q16
- 7: Q17

Clear Mode

Indicates how the timestamp module handles the “clear event”. The possible values are:

Disabled

On Apply: The timestamp count is cleared when the user clicks the Apply button

Rising edge input signal: Then the signal on the clear event input rises, the timestamp module clears the timestamp counter value

Clear Input

Indicates which label from the GPIO LUT that is associated with the “clear event” input of the timestamp module. Make sure you select an input that is not being used for its default behavior. The possible values are:

- 0: Q3
- 1: Q7

- 2: Q8
- 3: Q9
- 4: Q10
- 5: Q11
- 6: Q16
- 7: Q17

Broadcast

When set to true, the operation is broadcasted to all other devices on the same network as the current device.

Set Value

The value assigned is used when the "set event" of the counter occurs.

Current Value

Displays the timestamp counter's current value

6.12 GPIO Interrupts

You can disable or enable the following interrupts:

Q15 Enabled

Enable or disable interrupts on the Q15 output of the GPIO LUT

Q3 Enabled

Enable or disable interrupts on the Q3 output of the GPIO LUT

Q7 Enabled

Enable or disable interrupts on the Q7 output of the GPIO LUT

Q10 Enabled

Enable or disable interrupts on the Q10 output of the GPIO LUT

6.13 Delayer

The delayer is used to delay an input signal. The output of the delayer is the delayed version of the input signal. A delayer is defined by:

- **Delay**: The delay is a value expressed in the number of rising edges from the reference signal.
- **Reference Signal**: A periodic input signal that is used to generate the delay from the input source. It is important that this reference signal be periodic. Also note that the pulse width of the signal you want to delay must be greater than the period of the reference signal.

- **Input** Source Selection: The delayer does not have a pre-assigned label in the GPIO Look-Up Table (Qn). This parameter is used to select a label that **is not used** by another GPIO module.

The output of the delayer is considered an input for the GPIO Look-Up Table.

The labels for the output from the delayer in the GPIO Control Block programming languages depend on the LUT input configuration.

7

Performing Image Processing

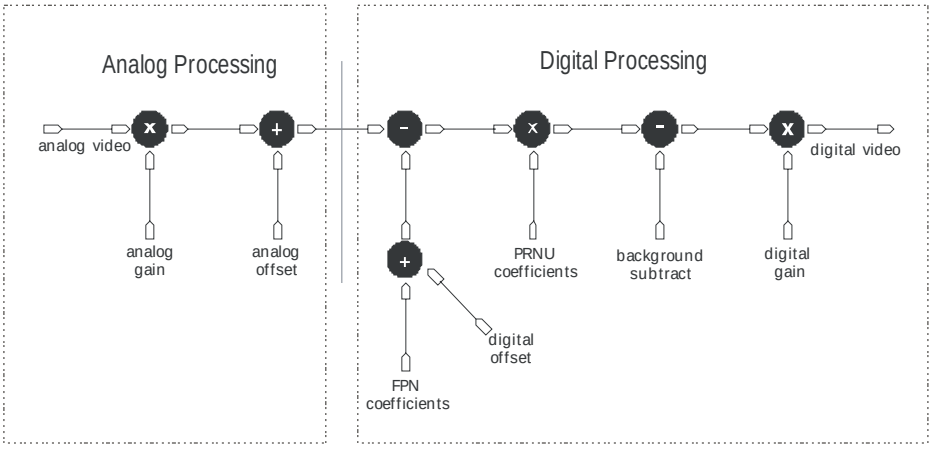
7.1 Processing Chain Description

The following diagram shows a simplified block diagram of the camera's analog and digital processing chain. The analog processing chain begins with an analog gain adjustment, followed by an analog offset adjustment. These adjustments are applied to the video analog signal prior to its digitization by an A/D converter.

The digital processing chain contains the FPN correction, the PRNU correction, the background subtract, and the digital gain and offset.

All of these elements can be set on the Image Processing tab of the Spyder3 GigE Camera Control application.

Figure 1: Analog and Digital Processing Chain



All of these elements can be set on the Calibration tab of the QuickCam application.

Analog Processing

Optimizing offset performance and gain in the analog domain allows you to achieve a better signal-to-noise ratio and dynamic range than you would achieve by trying to optimize the offset in the digital domain. As a result, perform all analog adjustments prior to any digital adjustments.

1. Analog gain is multiplied by the analog signal to increase the signal strength before the A/D conversion. It is used to take advantage of the full dynamic range of the A/D converter. For example, in a low light situation the brightest part of the image may be consistently coming in at only 50% of the DN. An analog gain of 6 dB (2x) will ensure full use of the dynamic range of the A/D converter. Of course the noise is also increased.
2. The analog offset or black level is an "artificial" offset introduced into the video path to ensure that the A/D is functioning properly. The analog offset should be set so that it is at least 3 times the rms noise value at the current gain.

Digital Processing

To optimize camera performance, digital signal processing should be completed after any analog adjustments.

1. Fixed pattern noise (FPN) calibration is used to subtract away individual pixel dark current.
2. The digital offset enables the subtraction of the "artificial" A/D offset (the analog offset) so that application of the PRNU coefficient doesn't result in artifacts at low light levels due to the offset value.
3. Photo-Response Non-Uniformity (PRNU) coefficients are used to correct the difference in responsivity of individual pixels (i.e. given the same amount of light different pixels will charge up at different rates) and the change in light intensity across the image either because of the light source or due to optical aberrations (e.g. there many be more light in the center of the image). PRNU coefficients are multipliers and are defined to be of a value greater than or equal to 1. This ensures that all pixels will saturate together. When using PRNU correction, it is important that the A/D offset and Fixed Pattern Noise (FPN) or per pixel offsets are subtracted prior to the multiplication by the PRNU coefficient. The subtraction of these 2 components ensure that the video supplied to the PRNU multiplier is nominally zero and zero multiplied by anything is still zero resulting in no PRNU coefficient induced FPN. If the offset is not subtracted from the video then there will be artifacts in the video at low light caused by the multiplication of the offset value by the PRNU coefficients.
4. Background subtract and digital gain are used to increase image contrast after FPN and PRNU calibration. It is useful for systems that process 8-bit data but want to take advantage of the camera's 12-bit digital processing chain. For example, if you find that your image is consistently between 128 and 255DN(8-bit), you can subtract off 128 and then multiply by 2 (by setting the digital gain to 8192) to get an output range from 0 to 255.

7.2 Setting a Region of Interest

The region of interest is your desired calibration region. The region of interest determines the pixel range used when calibrating gains, offsets and pixel coefficients.

In most applications, the field of view exceeds the required object size and these extraneous areas can be ignored. It is recommended that you set the region of interest a few pixels inside the actual useable image.

To set the camera's region of interest:

1. Open the **Calibration** tab in the **Camera Configuration Window**.

   Under **Region of Interest**:
2. Enter the region of interest to use in the **X1** and **X2** text boxes.
3. Click **Apply**.
4. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

7.3 Viewing a Region of Interest

You can view the region of interest in the **Image Output Window**.

To view the region of interest:

1. If the camera is currently grabbing images, stop grabbing images by clicking the  button on the toolbar.
2. Open the **Calibration** tab in the **Camera Configuration** window.

   Under **Region of Interest**:
3. Enter the region of interest to use in the **X1** and **X2** text boxes.
4. Click **Apply**.
5. On the QuickCam toolbar, click the  to view the area defined by the region of interest.

The line disappears when you begin imaging again.

7.4 Performing Flat Field Correction

The QuickCam application has the ability to calculate correction coefficients in order to remove non-uniformity in the image. This video correction operates on a pixel-by-pixel basis and implements a two point correction for each pixel. This correction can reduce or eliminate image distortion caused by the following factors:

- Fixed Pattern Noise (FPN)
- Photo Response Non Uniformity (PRNU)
- Lens and light source non-uniformity

The QuickCam application allows you to perform flat field correction easily using the Flat Field Correction Wizard. The wizard steps you through the entire flat field process including setting gains and offsets, as well as calibrating pixel coefficients.

To perform flat field correction:

1. Open the Calibration tab in the Camera Configuration Window.
2. Click the **Flat Field Correction Wizard…** button to invoke the correction wizard.
3. Follow the on-screen instructions.

Toolbar equivalent: 

7.5 Adjusting Analog Gain and Offset

If you are performing flat field correction, you should adjust the analog gain and offset using the Flat Field Correction Wizard. See Performing Flat Field Correction for details.

If necessary, you can set the analog gain and offset separately from other processes. Refer to the Processing Chain Description for an explanation on why you would want to use these commands.

To adjust the analog gain:

1. Open the **Calibration** tab in the **Camera Configuration Window**.
2. Beside **Taps to Calibrate**, select the tap number to adjust, either **Tap 1**, **Tap 2**, or **All Taps**.
3. Enter the analog gain value(s) in decibels in the **Analog Gain (dB)** text box

   or

   Click the **Auto Calibration…** button to invoke the analog gain calibration wizard.
4. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

To adjust the analog offset:

1. Open the **Calibration** tab in the **Camera Configuration Window**.
2. Beside **Taps to Calibrate**, select the tap number to adjust, either **Tap 1**, **Tap 2**, or **All Taps**.
3. Enter the analog gain value(s) to use in the **Analog Offset (DN)** text box

   or

   Click the **Auto Calibration…** button to invoke the analog offset calibration wizard.
4. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

7.6 Adjusting Digital Gain, Offset, and Background Subtract

If you are performing flat field correction, you should adjust digital settings using the Flat Field Correction Wizard. See Performing Flat Field Correction for details.

If necessary, you can set the digital gain, offset, or background separately from other processes. Refer to the Processing Chain Description for an explanation on why you would want to use these commands.

To adjust the digital gain:

1. Open the Calibration tab in the Camera Configuration Window.
2. Beside **Taps to Calibrate**, select the tap number to adjust, either **Tap 1**, **Tap 2**, or **All Taps**.
3. Type the value or use the slider to enter the digital gain value to use in the **Digital Gain (DN)** text box.
4. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

To adjust the analog offset:

1. Open the Calibration tab in the Camera Configuration Window.
2. Beside **Taps to Calibrate**, select the tap number to adjust, either Tap 1, Tap 2, or All Taps.
3. Type the value or use the slider to enter the desired digital offset value to use in the **Digital Offset (DN)** text box.
4. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

To adjust the background subtract:

1. Open the Calibration tab in the Camera Configuration Window.
2. Beside **Taps to Calibrate**, select the tap number to adjust, either **Tap 1**, **Tap 2**, or **All Taps**.
3. Type the value or use the slider to enter the desired background subtract value to use in the **Background Subtraction(DN)** text box.
4. To save the settings to the camera's nonvolatile memory, click **Save Camera Settings**.

7.7 Enabling and Disabling Coefficients

You can enable or disable FPN and PRNU coefficients.

To enable or disable FPN and PRNU coefficients:

1. Open the **Calibration tab** in the **Camera Configuration Window**.

Under **Pixel Coefficients**:

2. Beside **FPN Coefficients**, check the checkbox to enable coefficients or uncheck the checkbox to disable coefficients.
3. Click **Apply**.
4. Beside **PRNU Coefficients**, check the checkbox to enable coefficients or uncheck the checkbox to disable coefficients.
5. Click **Apply**.
6. To save the pixel coefficients to the camera's non-volatile memory, open the **Save/Restore** in the **Camera Configuration Window**.

   Under **Pixel Coefficients**:

7. Select the pixel coefficient set number from the **Set Number** drop down box. You can save or load up to four different sets of pixel coefficients.
8. Click **Save**.

7.8 Setting Individual Pixel Coefficients

To set an individual pixel's FPN and PRNU coefficient:

1. Open the **Calibration tab** in the **Camera Configuration Window**.

   Under **Pixel Coefficients**:

2. Beside **FPN Coefficients**, enter the pixel number to set.
3. Enter the FPN coefficients to use in DN in the **FPN Coefficient (DN)** text box.
4. Click **Apply**.
5. Beside **PRNU Coefficients**, enter the pixel number to set.
6. Enter the PRNU coefficients to use in DN in the **PRNU Coefficients (DN)** text box.
7. Click **Apply**.
8. To save the pixel coefficients to the camera's non-volatile memory, open the **Save/Restore** tab in the **Camera Configuration Window**.

   Under **Pixel Coefficients**:

9. Select the pixel coefficient set number from the **Set Number** drop down box. You can save or load up to four different sets of pixel coefficients.
10. Click **Save**.

7.9 Using Calibration Macros

Recording a Camera Calibration Macro

You can record a camera calibration macro to record a sequence of calibration actions. You can then reload the macro at a later time to repeat the sequence of actions.

To record a macro:

1. On the toolbar, click 
2. Perform the actions you want to include in the macro.

   Note: You can pause the recording at anytime by clicking the  . To resume recording, click the pause button again.
3. To stop recording your macro, click  .
4. In the **File name** box, type a name for the macro. It is recommended that you save the macro in the default location and use the default extension of .scp.
5. In the **Save in** box, browse to the location where you want to save the macro.
6. Click **Save**.

Loading a Camera Calibration Macro

You can load a previously recorded camera calibration macro at a later time to repeat the sequence of actions.

To load a macro:

1. On the toolbar, click 

   In the Open dialog box:
2. In the **Look in** list, click the drive, folder, or Internet location that contains the file you want to open.
3. In the folder list, locate and open the folder that contains the file.
4. Click the file, and then click **Open**.

8

Troubleshooting

8.1 Troubleshooting: Cannot Detect the Camera

- Verify that the camera is powered on and the LED is lit correctly. Refer to your camera's user's manual for details on power settings and LED states.
- Verify that your camera has all the correct connections. Refer to your camera's user's manual for cabling details.
- Verify that your driver is installed properly. To install drivers, follow the procedure described in DALSA QuickCam→Documentation→DALSA Driver Installation Tool Manual.pdf.
- Your Windows Firewall or Personal Firewall may be filtering out packets sent by the camera. Try turning off the firewall.
- Check that your network adapter is enabled.
- Your network adapter may not have an IP address. Typically, when a system is not connected to a network with a DHCP server, the network interfaces assign an address to themselves in the form of 169.254.XXX.YYY. This is called a zeroconf (or autoconf) IP address. For the PC to detect/communicate with the IP engine, it must reside in the same sub-network as the IP engine. Moreover, the Windows Firewall will discard packets from "unknown" sources, and the IP engine will not show up in your detection window. You may also want to set up a static IP address on that network adapter, such as 192.168.2.1, so that you always know what it is.

8.2 High Performance Driver is Missing in Device Manager

Symptom: The software was installed, but I don't see a "Pro/1000 Grabber Devices" in the Device Manager.

Scenario #1: You do not have an Intel Pro/1000 network adapter installed on the PC.

Solution: Install an Intel Pro/1000 network adapter and follow the High Performance Driver installation procedure described in DALSA QuickCam→Documentation→DALSA Driver Installation Tool Manual.pdf.

Scenario #2: You have not installed the Pro/1000 Grabber Device driver on the Intel Pro/1000 adapter, in lieu of the Intel driver.

Solution: Uninstall the Intel Pro/1000 network driver from the adapter and follow the High Performance Driver installation procedure described in DALSA QuickCam→Documentation→DALSA Driver Installation Tool Manual.pdf.

Scenario #3: Windows does not allow you to choose which driver to install; it just automatically picks the regular Intel Pro/1000 driver.

Solution: Use the Driver Installation Tool to install your preferred driver. Alternately, for manual driver installation, follow the instructions from

http://support.microsoft.com/?scid=kb;en-us;306584

to remove the Intel Pro/1000 Network driver from your PC, and then follow the Pro/1000 Grabber Device driver installation procedure described in DALSA QuickCam→Documentation→DALSA Driver Installation Tool Manual.pdf.

8.3 My Frame Rate is Lower than Expected

Possible Cause#1: Your network adapter is configured to run at 10/100 Mb/s instead of 1 Gb/s.

Solution: Verify the network adapter settings to ensure it is set to operate at 1 Gb/s.

Possible Cause #2: Your network is not properly wired.

Solution #1: Check your cable wiring for conformance with the EIA/TIA 568A or 568B wiring diagrams.

Solution #2: Check the length and type of your cable. For GigE speeds, cable spans cannot exceed 100 meters, and cables must conform to the Cat5e cable specification.

8.4 Troubleshooting: Creating an Error Report

You can create an error report in order to review test patterns, settings, and all messages sent from the camera. This is useful for your own information as well as when you have to contact Product Support.

To view the test and video images, you require QuickTime. To download QuickTime, go to http://www.apple.com/quicktime/download/win.html

To create an error report

1. Click the  button on QuickCam toolbar.

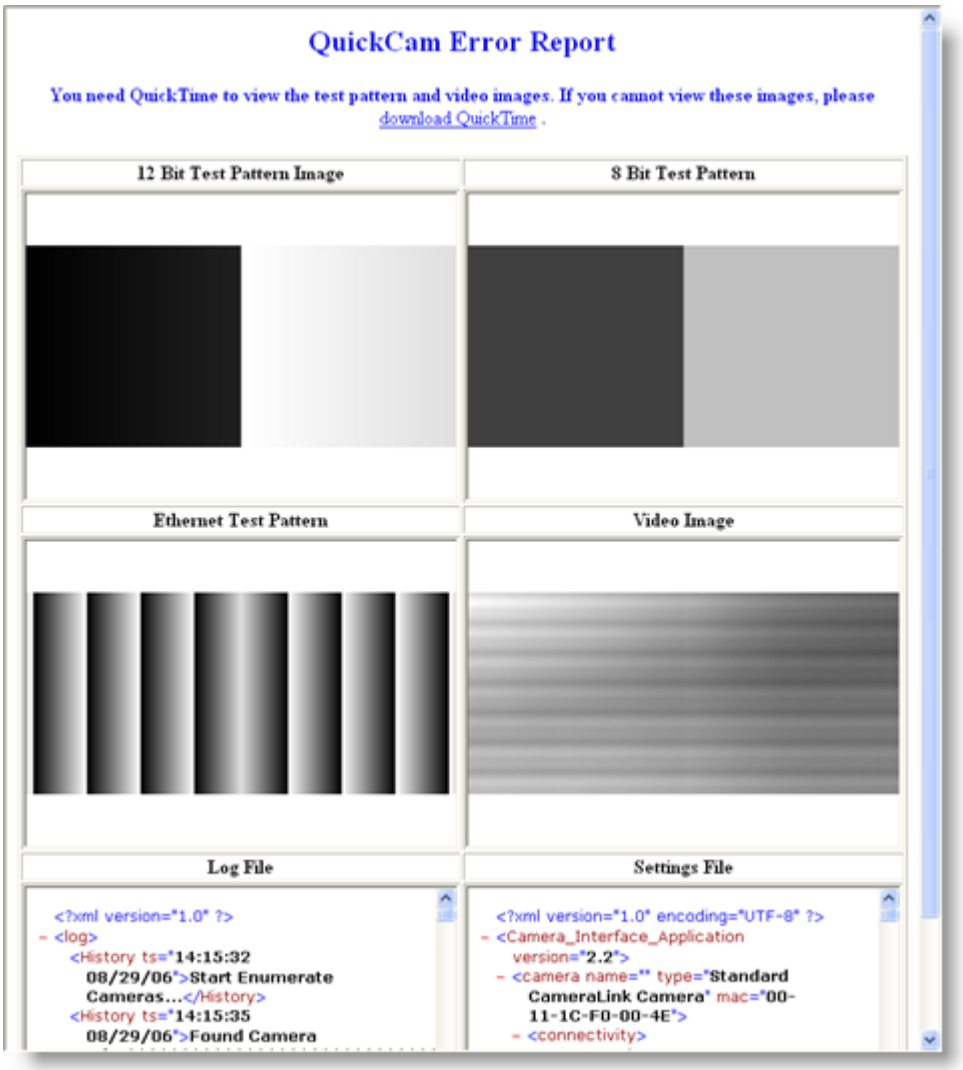
   In the **Save As** dialog box:

2. Select the location on your computer to save the file.

3. In the **File name** text box, enter a name for the error report.
4. Click **Save**.

After QuickCam creates and saves the error report, the error report is displayed on-screen.

Example Error Report



8.5 Troubleshooting: Switching Between Video and Test Patterns

You can generate a test pattern to aid in system debugging. The camera test patterns are useful for verifying camera timing and connections. The Ethernet test patterns are useful for testing your Ethernet connection.

To set the camera's video mode:

1. Open the **Diagnostics tab** in the **Camera Configuration Window**.

Under **Test Pattern**:

2. Select the video mode to use from the list in the **Camera** dropdown box or the **Ethernet** dropdown box.

8.6 Troubleshooting: Using the Diagnostics Tab

Communications and Verify Parameters

To quickly verify serial communications, check the Diagnostics tab. Communication is working properly if the camera settings are properly displayed in the **Camera Settings** section.

Verify Voltage

To check the camera's input voltage, refer to the **Temperature/Voltage** section on the **Diagnostics** tab. If it is within the proper range, the camera returns OK> and the voltage value. Otherwise the camera returns an error message.

Verify Temperature

To check the internal temperature of the camera, refer to the **Temperature/Voltage** section on the **Diagnostics** tab. The camera will shut itself down if the internal temperature exceeds 75°C.

Verify Signal Frequency

To verify the signal frequency, refer to the **Signal Frequency** section on the **Diagnostics** tab. Use the drop down list to select the control signal and review the signal frequency. The control signals available for measuring are: CC1 (EXSYNC), CC2 (PRIN), CC3 (CCD Direction), and CC4 (Spare).

Appendix A

Workspace Tour

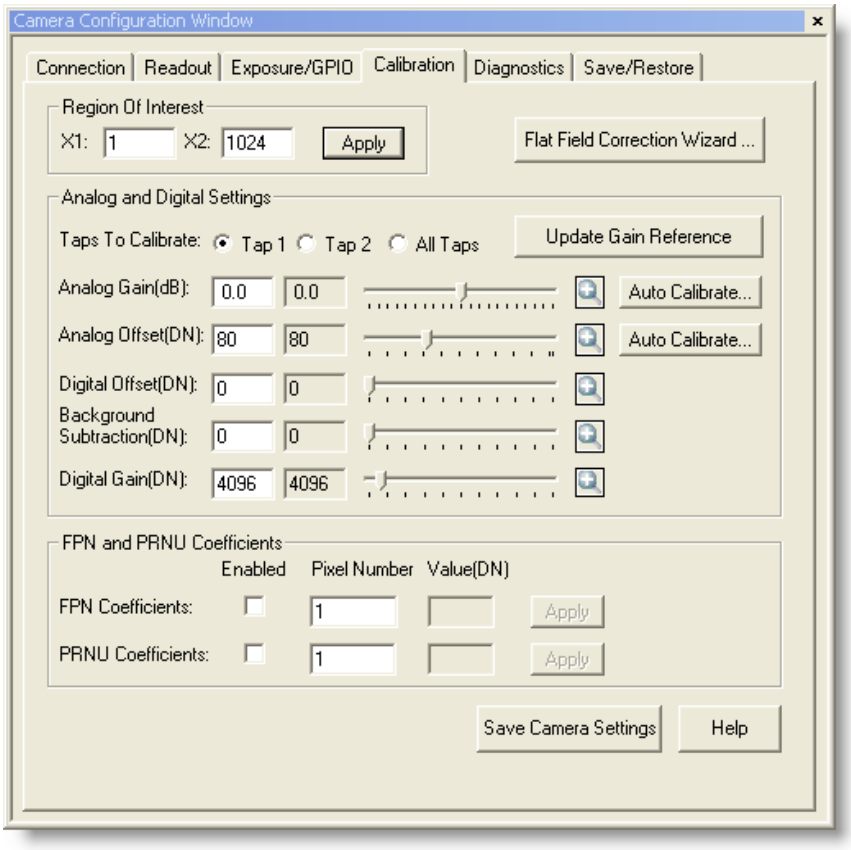
QuickCam Application Windows

When you first launch QuickCam, the application window opens with the following default windows. You can move and resize these windows as desired. To toggle between displaying and hiding a window, Click **Window** → ***Window Name***.

Camera Configuration Window

The Camera Configuration Window contains all of the tabs for controlling the camera.

Figure 2: Camera Configuration Window showing the Calibration Tab



Connection Tab

The Connection tab contains all of the functions for controlling camera connections and acquisition control.

Command	Purpose	Reference Page Number
Detect	Detects all cameras currently connected.	8
Start	Begins the process of acquiring images. Button text changes to **Stop** during image acquisition and allows you to stop acquiring images.	9
Bad images passthrough	When selected, allows "bad" images (images containing missing lines or pixels) to be transmitted as good images.	
Ignore Missing Packets	When selected, missing packets will not be requested. The resulting image may be incomplete.	
Disconnect	Disconnects the camera currently selected in the Camera Detection window.	9
Reset Camera	Reboots camera. After reboot, the camera operates using the last saved user settings.	9
Status	Displays the camera's current connection status.	
Name	Displays and sets the current camera's name.	
Model No.	Displays the model number of the currently selected camera. This information is useful if you require product support.	
Serial No.	Displays the serial number of the currently active camera.	
Width	Displays and sets the number of columns being imaged in the Image Output window. This is not selectable in a line scan camera.	
Height	Displays and sets the number of lines being imaged in the Image Output window.	
Display Rate	Shows the current rate of display in frames per second. The display rate is a cumulative display from the time the Start button was last pressed, rather than a current dynamic acquisition rate.	
Grabbing	Displays the current image acquisition rate in frames per second. The display rate is a cumulative display from the time the Start button was last pressed, rather than a	

	current dynamic acquisition rate.	
Status	Displays the number of acquired images as well as the number of bad images. A large number of bad images is indicative of a set-up or cable problem.	
Last Error	Displays the last error that occurred while acquiring images.	

Readout Tab

The readout tab sets the sensor's readout configuration.

Command	Purpose	Reference Page Number
Sensitivity Mode	Displays and sets the camera's sensitivity mode.	17
Bit Depth	Displays and sets the camera's bit depth.	18
Direction	Displays and sets the camera's CCD shift direction.	18
Horizontal Binning	Displays and sets the camera's horizontal binning value.	18
Save User Settings	Saves the current settings to the camera's non-volatile memory.	10

Exposure/GPIO Tab

The Exposure/GPIO tab configures the camera's exposure mode and settings. It also configures the GPIO inputs and outputs.

Command	Purpose	Reference Page Number
Exposure Mode	Displays and sets the camera's exposure mode.	21
Line Rate (Hz)	Displays and sets the camera's line rate in Hertz.	22
Exposure Time (µs)	Displays and sets the camera's exposure time in microseconds.	22
Advanced…	Opens the Configuration Dialog box allowing you to configure how the camera handles and redirects its internal and external signals through the GPIO connector.	23
Input and Output dropdowns	Configure the physical pins and signals types to use for GPIO control.	

Save Camera Settings	Saves the current settings to the camera's non-volatile memory.	10

Calibration Tab

The Calibration tab controls all of the camera's analog and digital settings.

Command	Purpose	Reference Page Number
Region of Interest	Displays and sets the camera's region of interest.	53
X1	Sets the region of interest's starting pixel value.	53
X2	Sets the region of interest's ending pixel value.	53
Apply	Applies the region of interest specified in **X1** and **X2** to the image.	53
Flat Field Correction Wizard…	Invokes the Flat Field Correction Wizard. When used, the camera calculates appropriate analog and digital settings, as well as, appropriate FPN and PRNU coefficients.	53
Update Gain Reference	Sets the current analog gain value to be the nominal gain setting.	
Taps to Calibrate	Sets which taps to calibrate when performing an analog or digital adjustment.	54
Analog Gain (dB)	Displays and sets the camera's analog gain value in decibels. You can enter the value directly or use the scroll bar to choose the gain setting.	54
Analog Offset (DN)	Displays and sets the camera's analog offset value in digital numbers. You can enter the value directly or use the scroll bar to choose the offset setting.	54
Auto Calibrate…	Invokes the Auto Calibration wizard. When used, the camera calculates appropriate analog settings.	54
Digital Offset (DN)	Displays and sets the camera's digital offset in digital numbers. You can enter the value directly or use the scroll bar to choose the gain setting.	55
Background Subtract (DN)	Displays and sets the camera's background subtract value in digital numbers.	55
Digital Gain (DN)	Displays and sets the camera's digital gain in digital numbers. You can enter the value directly or use the scroll bar to	55

	choose the gain setting.	
Enabled	Enables or disables PRNU coefficients.	55
Pixel Number	The pixel number to set.	56
Coefficient Value (DN)	Sets the PRNU coefficient for the pixel specified in the Pixel Number field.	56
Apply	Applies the PRNU coefficient to the image output.	56
Save Camera Settings	Saves the current settings to the camera's non-volatile memory.	10

Diagnostics Tab

Command	Purpose	Reference Page Number
Temperature/Voltage	Displays the camera's last measured temperature and voltage.	62
Test Pattern	Selects the test pattern to view.	61
Camera Settings	Displays the camera's current settings.	62
IP Information	Displays the camera's IP information.	62
Timeouts and Packets	Displays timeout and packet information.	62
Pixel Coefficients	Displays the pixel coefficients for the coefficient set selected from the dropdown list.	62
Signal Frequency	Displays the signal frequency for the camera control signal selected from the dropdown list.	62
Refresh Settings	Refreshes the Diagnostics tab and displays the latest camera settings.	62

Save/Restore Tab

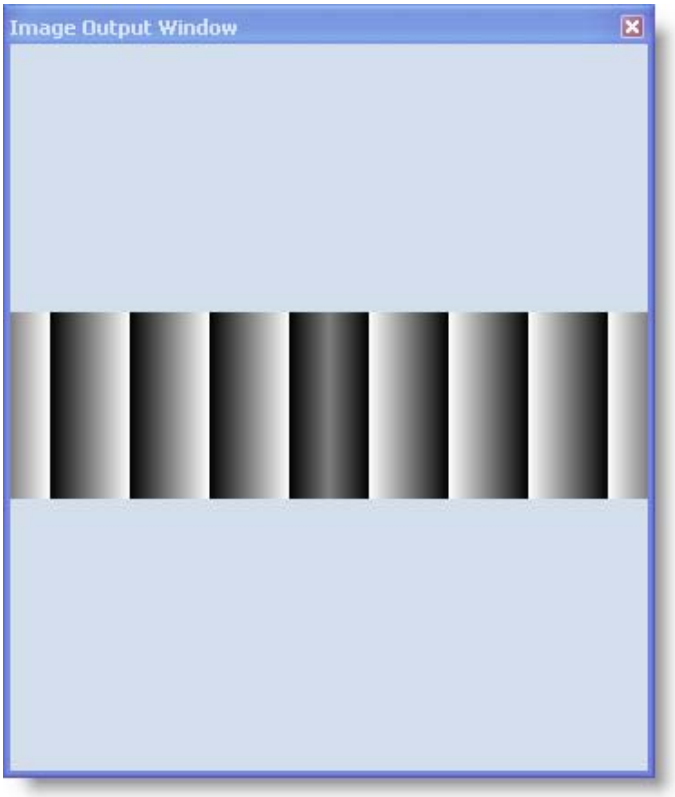
Command	Purpose	Reference Page Number
Save to Camera	Saves the current user settings to the camera's non-volatile memory. On reboot, the camera operates using the last saved user settings.	10
(User Settings) Restore from Camera	Returns the current camera operating conditions to the last saved user settings.	11
(Factory Settings)	Returns the current camera operating conditions to the camera's factory settings.	11

Restore from Camera		
Set Number	Selects the pixel coefficient set to load, save, or reset.	12
Load	When clicked, loads the pixel coefficient set displayed in the Set Number dropdown box.	12
Save	When clicked, saves the current pixel coefficients to the pixel coefficient set displayed in the Set Number dropdown box.	12
Reset	When clicked, returns the pixel coefficient set displayed in the Set Number dropdown box to zero.	12
Frames to Save	Sets the number of frames to save to file. It is enabled only when image acquisition is continuous and you are not using the Image Output Window.	**Error! Bookmark not defined.**
Save As	Invokes the Save As dialog box, allowing you to name the frames.	**Error! Bookmark not defined.**

Image Output Window

The Camera Output Window displays the camera's image output. You can move the Camera Output Window anywhere within the program window.

Figure 3: Image Output Window displaying 8 Bit Test Pattern



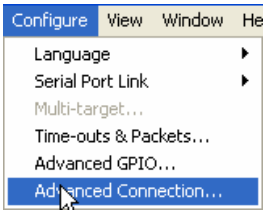
Message Window

The Message Window provides camera feedback in the following forms:

Command	Purpose
Message	Provides a list of all command responses from the camera to the Spyder3 GigE Camera Control application.
History	Provides a list of all camera messages.
Command	Provides a list of all commands sent to the camera. You can also send ASCII commands through the Command window. Refer to your camera's user's manual for a list of the available ASCII commands.
Error/Warning	Provides a list of all error or warning messages sent from the camera to the Spyder3 GigE Camera Control application.

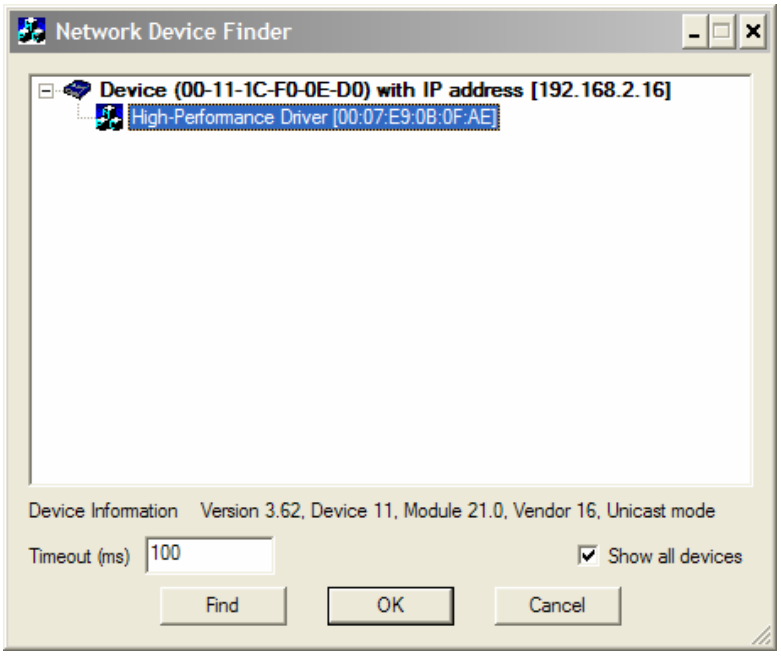
Network Device Finder

The Network Device Finder Window displays all detected cameras on the same sub-network.



1. To display the Network Device Finder, choose **Configure→Advanced Connection.**

Figure 4: Network Device Finder

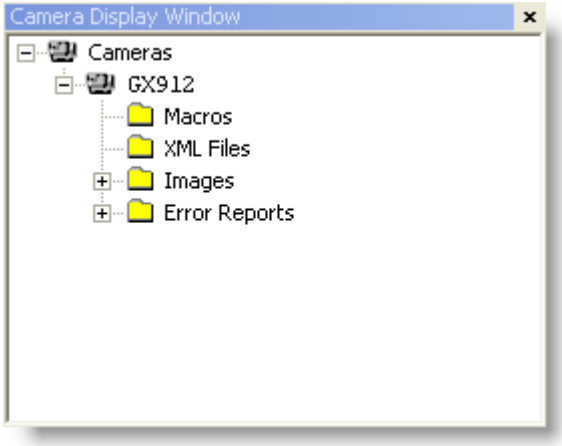


Camera Display Window

The Camera Display window lists all of the detected cameras on the network. You can also load macros, XML files, acquired images, and other associated files for the currently connected camera.

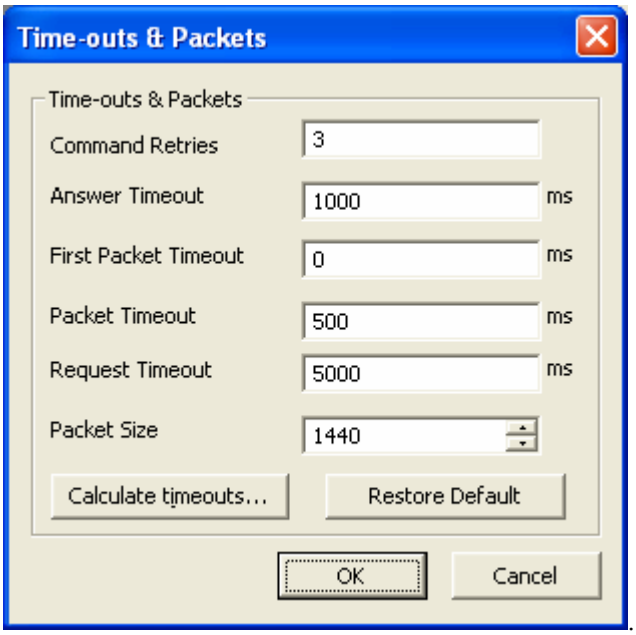
You can also connect to any camera listed in the Camera Display window by double clicking on the camera name.

Note: deleting images from the Camera Display Window only removes them from this list and will not delete them from where they are stored.



Time-outs & Packets Dialog Box

Use **Configure → Advanced Ethernet** to open the Time-outs & Packets dialog box.



Command	Purpose
Command Retries	Indicates the maximum number of retries to perform when a command is sent from the PC to camera. A command consists of a single command packet from the PC and an acknowledge packet from the camera. If either of these packets is lost, the behavior of QuickCam remains the same because it does not receive the acknowledge packet. Before issuing a time out error, however, the software will resend the command packet. The value of this parameter indicates the maximum number of tries (including the original command) that the underlying communication layer will attempt.
Answer Timeout	Indicates the maximum time, in milliseconds, that the camera can take to respond to a command from QuickCam.
First Packet Timeout	Indicates the maximum time, in milliseconds, that the camera can take to send the first packet of image data to the application. When it is zero, the timeout is calculated automatically from the request timeout.
Packet Timeout	Indicates the maximum time, in milliseconds, the camera can take to send subsequent packets of image data to QuickCam. When it is zero, the timeout is calculated automatically from the request timeout.
Request Timeout	Indicates the maximum time, in milliseconds, the camera can take to send all the packets of image data to QuickCam.

Packet Size	Indicates the maximum packet size, in bytes, that the camera can use to send image data to the application. When connected point-to-point with the QuickCam High Performance Driver, the maximum value is 8128 bytes. In networked applications, the value depends on the maximum packet size that can be accepted by the switches between the camera and the host PC. If the switches can be configured to support jumbo packets, it is recommended to use the jumbo packet configuration to reduce packet overhead in the application. A packet size of 1440 bytes will work with all networking equipment.
Calculate Timeouts	Invokes the Timeout Calculator dialog box, which provides estimates of timeouts to use, based on image size, link type, the maximum total request time, and packet size.
Restore Default	Restores default values from factory configuration.

Virtual Serial Port

Use **Configure→Serial Port Link→Enable/Disable** to enable or disable the virtual serial port.

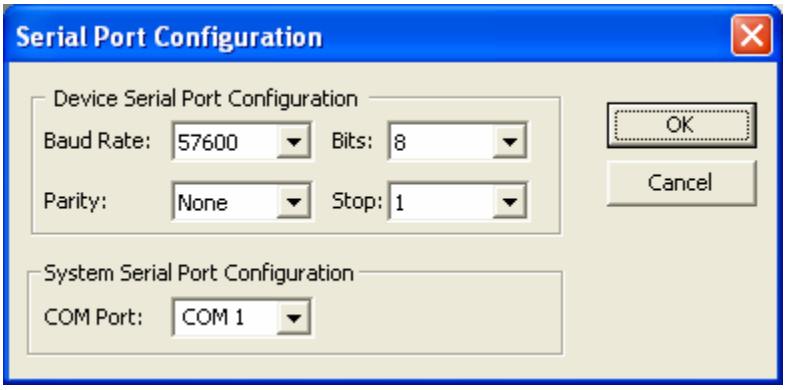
Some camera control tools can connect only to a Windows system serial port. To avoid asking for changes from camera manufacturers, two serial COM ports in the PC can be linked together to share the serial channel to the IP engine. Through their linkage, data written to one port can be read by the other port, and vice-versa.

These linked serial COM ports can be either "virtual" or physical. To set up virtual ports, use a virtual serial port driver. Some good virtual serial port drivers are available at: http://www.softinfinity.com/ or http://www.virtual-serial-port.com/.

Alternatively, if a PC has two free physical serial ports, they can be connected together and used as a pair, in the same manner as a virtual serial port driver.

The Serial Port Configuration dialog box allows you to attach the serial channel in QuickCam to one port in a serial port pair, whether a physical pair or virtual pair. Therefore, an external application needs simply to connect to the other serial port of the pair to communicate with the camera.

Note that while the virtual serial port is enabled, not all GUI controls will be available. This is because the camera expects to take commands through the virtual serial interface instead of the GUI. To regain use of all GUI controls, disable the virtual serial port.



Command	Purpose
Baud Rate	Specifies the speed of the serial communication between the COM port and the camera. Default: 57600.
Bits	Specifies the data size for the COM port.
Parity	Specifies the parity of the serial communication between the COM port and the camera. Can be set at "None," "Odd," or "Even."
Stop	Specifies the number of stop bits for the COM port.
COM Port	Specifies which serial COM port to monitor for activity.

Appendix B

Menus

Menu Bar Commands

File Menu Commands

Load XML File …	Opens the selected camera settings script file.
Save XML File …	Saves the current camera settings to a script file under the selected name and location.
Load Macro…	Load the selected camera macro file.
Save Log File…	Saves the current camera log file under the selected name and location. The log file contains a record of all camera activity, including camera messages, camera settings, and a history of commands sent to the camera.
Load Image Output	Opens the selected image file in the Image Output Winow.
Save Image Output	Saves the contents of the Image Output Window as a single TIFF file to the selected location.
Save Image Frame(s)	Saves the number frames indicated in the Frames to Save dialog box in TIFF format to the selected location.
Exit	Closes the program.

Configure Menu Commands

Language	Changes the interface language. Currently, English is the only supported language.	
Serial Port Link	Enable	Invokes the Serial Port Configuration dialog box.
	Disable	Disables serial port configuration.
Time-outs & Packets…	Invokes the Time-outs & Packets dialog box.	
Advanced GPIO…	Invokes the Configuration dialog box.	
Advanced Connection…	Invokes the Network Device Finder dialog	

View Menu Commands

Camera Settings	Displays all camera settings in text format.
Pixel Coefficients	Displays all pixel coefficients in text format.
Error Report	Opens the selected error report.
Get Line(s)s	Displays average pixel values for selected number of lines and calculates line statistics, including Min, Max, and Mean values for the sample and for each sensor tap.

Window Menu Commands

Camera Display Window	Opens or hides the Camera Display Window.	
Camera Configuration Window	Opens or hides the Camera Configuration Window.	
Camera Output Window	Opens or hides the Camera Output Window.	
Message Window	Opens or hides the Message Window	
Tool Bar	Displays or hides the tool bar buttons.	
Clear Message Window		
	All	Clear the output on all message tabs.
	History	Clear the output on the History tab.
	Commands	Clear the output on the Commands tab.
	Message	Clear the output on the Message tab.
	Error/Warning	Clear the output on the Error/Warning tab.
Restore Default Window Setting	Returns window displays to default state.	

Help Menu Commands

DALSA QuickCam Help	F1	leads to the "Help Topics" window that contains the Contents, Index, and Find tabs.
Error Report		Generates an error report.
Contact Us		Displays contact information for Product Support, Sales, or Technical Communication.
About		Displays the About dialog box, with registration and copyright information.

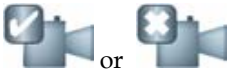
Toolbar Commands


Open an XML camera settings file


Save current settings to an XML script file


Save current settings to camera's non-volatile memory


Detects all camera's currently connected to the network


Connect or connect currently selected camera


Reboot currently selected camera


Invoke the flat field correction wizard


Begin recording a camera settings macro


Load camera settings macro


Stop recording camera settings macro


Pause camera settings macro


Start continuous image grab


Snap a single image


Display the current region of interest.


Fit image to window

View image actual size


Zoom in on image


Zoom out of image

Index

Z