Cypress Demo Kit User Guide

Star-1000 sensor
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1. ABOUT THIS DOCUMENT

This document describes the installation and basic operation of the Cypress Image sensor demo application. You'll learn how to connect to the demo system and how to extract images from it using customized settings. The first part of the document gives a general overview of the demo-software whereas the last paragraph provides sensor-specific information.

<table>
<thead>
<tr>
<th>Issue</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>Remarks</td>
<td>Original document</td>
<td>Sensor specific information added</td>
</tr>
</tbody>
</table>

2. REQUIREMENTS


- The application requires some permissions that are by default allowed for local applications, but may have been revoked. These include:
  - Broadcast ping (required in the Net scanner tool to scan the network for connected controllers)
  - .NET Reflection (required in the scripting engine).

- Local Ethernet connection to a running demo system (using controller core 1.0e)
3. SOFTWARE INSTALLATION / REMOVAL
The application is packaged in an MSI (Microsoft Installer) file. You can install it by double clicking the file. After installation, a shortcut to the application appears on the desktop and in the Windows start menu.
Un-installation can be performed through the Windows control panel (Add/Remove Programs).

4. HARDWARE INSTALLATION
Make sure that the cross cable that is delivered with the system is used to connect the PC and evaluation kit! When the software is installed properly the demo kit’s power supply can be switched on.

By default the board is configured not to use a DHCP-server. The default IP settings for the system are:

- IP-address: 192.168.2.10
- Netmask: 255.255.255.0
- Gateway: 192.168.2.254

When you change the IP settings of the PC to make sure it is connected to the same subnet, http://192.168.2.10 gives you a configuration/status pages. The system can be used on a standard network environment or standalone with a cross-cable to a PC (default).

**Important note:** If you power on the system and connect it using the cross cable to the PC but you are unable to get to the status page http://192.168.2.10 on the PC, please contact your network administrator to make sure your PC is in the same subnet. After the power is switched on or the reset button is pushed it takes approximately 10 sec before the FPGA is configured. The reset button is the little black button on the side of the demo kit.

**NOTE:**
1. Verify if there is communication between the board and the PC by surfing to the web-interface.
2. Do not unplug the ethernet cable or power down the demo kit when the software is running to avoid any software failures. When this install sequence is followed strictly the software can be started.
5. PROGRAM LAYOUT

The program is divided into four main parts:

- An image viewer in the center, where grabbed images can be studied.
- A sensor status panel on the right (Controller status panel available through a tab at the bottom).
- A command console at the bottom for performing scripting operations (Net scanner panel available through a tab at the bottom).
- A Sensor properties panel at the left, expandable by clicking it.

![Figure 1: The main layout of the demo software](image-url)
6. CONNECTING TO THE DEMO SYSTEM

To connect to the demo system, activate the "Net scanner" tab at the bottom of the application. Using the "Search controllers" button, you can search the local (Ethernet) network for compatible controller boards.

Searching the local subnet for controllers is done by means of a broadcast ping. By default this feature is disabled in Windows XP. You should enable it (e.g. by shutting down your local firewall).

Double click on the presented controller to connect to it, or alternatively, type in its IP address and click the "Connect" button. Using this last method, the use of a broadcast ping can be avoided.
7. ACQUIRING IMAGES FROM THE SENSOR

After the connection has been established, the controller has to be initialized by clicking the "Init" button on the "Sensor status" panel (see image 3).

Grabbing images from the sensors is done by simply clicking the "Grab frame" button. You can also grab frames continuously, by checking the "Loop" checkbox right below this button. The PSU control provides information on power-consumption of the imager. This control can also be used to adjust the power supply settings.

Figure 3: The Sensor status panel
8. ALTERING SENSOR PARAMETERS

All sensor parameters are centralized in the "Sensor properties" panel at the left, which you should expand first.

Some important notes about this panel:

- Some parameters are derived parameters. This means that they are calculated on-the-fly based on other parameters in the table. Typically these are setting bits or parameters that require some more complicated calculation like integration times. Changing these parameters will also automatically update other parameters.

- A change in any of these parameters is not automatically mirrored in the controller’s memory. A manual ‘Upload parameters’ is needed.

![Figure 4: The Sensor properties panel (left)]

Using the menu of the application (“File → Save Sensor settings”), you can write the currently active sensor settings to a text file. Later on, these same settings can be read back in using “File → Load Sensor settings”.

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9. VIEWING AND PROCESSING IMAGES

You can use the following controls on the grabbed image.

<table>
<thead>
<tr>
<th>Control</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panning</td>
<td>Left-click and drag the mouse</td>
</tr>
<tr>
<td>Zooming</td>
<td>Move scroll wheel or use context menu (right click)</td>
</tr>
<tr>
<td>Altering interpolation mode</td>
<td>The sub-pixel interpolation mode can be changed using the context menu (right click). By default there is no sub-pixel interpolation.</td>
</tr>
<tr>
<td>Save Image</td>
<td>Context menu (right click). Save as 16 bit grayscale TIFF.</td>
</tr>
<tr>
<td>New Widget</td>
<td>Context menu (right click). See sensor specific information.</td>
</tr>
</tbody>
</table>

You can use the color picker tool (the red rectangle) to view the value of a certain pixel. You can drag this widget around by click-and-drag; the currently selected pixel is located in the small inner square. The can range from 0 to 65535 (16 bit).

![Image of the color picker widget]

**Figure 5: The color picker widget**
10. SENSOR SPECIFIC INFORMATION

1. Altering sensor parameters

1. SysMode: Controller system mode
   - INT_MODE: Integration mode: 0=Lines, 1=Frames
   - PIX_TRIG: Pixelsample: 0=disable, 1=enable
   - ADC_OEN: ADC-outputenable: 0=enable, 1=disable
   - BITINVERT: ADC-Bitinvert: 0=none, 1=inverted
   - PSU_MEASURE_EN: enable psu (power supply unit) measurement during frame readout
   - USE_EXT_ADC: Int./Ext. ADC select: 0=internal, 1=External
   - INT_ADC_OEN: Enable Outputs of internal ADC: 0=enable, 1=disable
   - TRISTATE: Tritate sensor control signals: 0=enable, 1=tristate
   - SHUTDOWN: Shutdown sensor signals: 0=normal, 1=shutdown
   - INVERT_INTADC_CLK: Invert internal adc_clk: 0=invert, 1=normal

2. Sensor Registers
   - SEL: Selection of analog channel: 0 = ImageSensor, 1 = A_IN1, 2 = A_IN2, 3 = A_IN3
   - XSTART: Column Start address
   - Xlength: Number of consecutive columns to read out in the current window
   - YSTART: Row Start address

2 = x4, 3 = x8
• **Ylength**: Number of consecutive rows to read out in the current window
• **Exposure**: Exposure delay specified in number of cycles (lines/frames)
• **NROF_Frames**: Number of frames to grab and store in memory
• **Xsample**: At which pixel PIX_TRIG will assert
• **Ysample**: At which line PIX_TRIG will assert
• **XRdInitInt**: X-address counter, similar to XStart, but with pipedelay for internal ADC
• **XrdInitExt**: X-address counter, similar to XStart, but with pipedelay for external ADC
• **DataValidPipe**: Pipeline length to compensate ADC delay
• **TA**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz
• **TB**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz
• **TC**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz
• **TD**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz
• **TF**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz
• **TG**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz
• **TH**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz
• **TI**: Timing parameter (cfr. Datasheet p10): Value times 1/20MHz

### 2. Viewing and processing images

By accessing the context menu (right click on the image and choose new widget), the following features are available on top of the features mentioned in paragraph 8:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color picker</td>
<td>Creates a widget and gives the pixel value (16-bit)</td>
</tr>
<tr>
<td>ROI selector</td>
<td>Possibility to see the live histogram of a certain region</td>
</tr>
<tr>
<td>Row profile selector</td>
<td>View the live row profile of a row</td>
</tr>
<tr>
<td>MacBeth checker</td>
<td>N/A</td>
</tr>
<tr>
<td>Grid</td>
<td>Put a grid on the image</td>
</tr>
</tbody>
</table>

To access the widget-options and to remove the widget: right-click on the widget.
In addition to this, the demo-software has some extra features, which are accessible by using the function-keys:

- **F2:** FPN correction
- **F3:** Equalize (Auto-levels)
- **F4:** PRNU correction
- **F5:** DeMosaic (N/A)
- **F6:** Get Calibration Frames (Grab black and grey frames for FPN and PRNU correction)

**Note:**

First grab calibration frames before calibration. Use the following sequence to grab the calibration frames:

- Connect to the sensor as specified above (start grabbing images)
- Cover the sensor and use a short integration time (1 line)
- Push F6
- Enter “1” and press enter
- Press enter to grab the dark frame
- Apply the correct settings to obtain a uniform grey image (85% of swing)
- Press enter