ADCE-1021, ADCE-1121, ADCE-2021, and ADCE-2121 Evaluation Kit

AVAGO TECHNOLOGIES

User's Guide

Introduction

The ADCE-1021, ADCE-1121, ADCE-2021 and ADCE-2121 are Avago evaluation kits for customers to test and evaluate the performance capabilities of a USB PC camera system based on Avago's CMOS image sensors and image processors.

There are four types of evaluation kits, each containing a CMOS image sensor and an image processor:

1. ADCE-1021/1121:
   - ADCS-1021/1121 - Color / Mono

   CIF (352 x 288 pixels)
   CMOS Image Sensor
   - HDCP-2000 - USB Camera

   Image Processor

2. ADCE-2021/2121:
   - ADCS-2021/2121 - Color / Mono

   VGA (640 x 480 pixels)
   CMOS Image Sensor
   - HDCP-2000 - USB Camera

   Image Processor

ADCE-1021/1121/2021/2121 System Architecture

Avago CMOS sensor and Image Processor

ADCS-2021/2121 (VGA) and ADCS-1021/1121 (CIF) are CMOS active pixel image sensors with integrated A/D conversion and full timing control. They provide random access of sensor pixels, which allows windowing and panning capabilities. The sensor is designed for video conferencing applications and still image capabilities.

Programmable Features

- Programmable window size ranging from the full array down to a 4 x 4 pixel window.
- Programmable panning capability which allows a specified window (minimum 4 x 4 pixels) to be located anywhere on the sensor array.
- Integrated programmable gain amplifiers with independent gain control for each color (R, G, B).
- Internal register set programmable via either the UART or synchronous serial interface.
- Integrated timing controller with rolling electronic shutter, row/column addressing, and operating mode selection with programmable exposure control, frame rate, and data rate.
- Programmable horizontal, vertical, and shutter synchronization signals.
- Programmable horizontal and vertical blanking intervals.

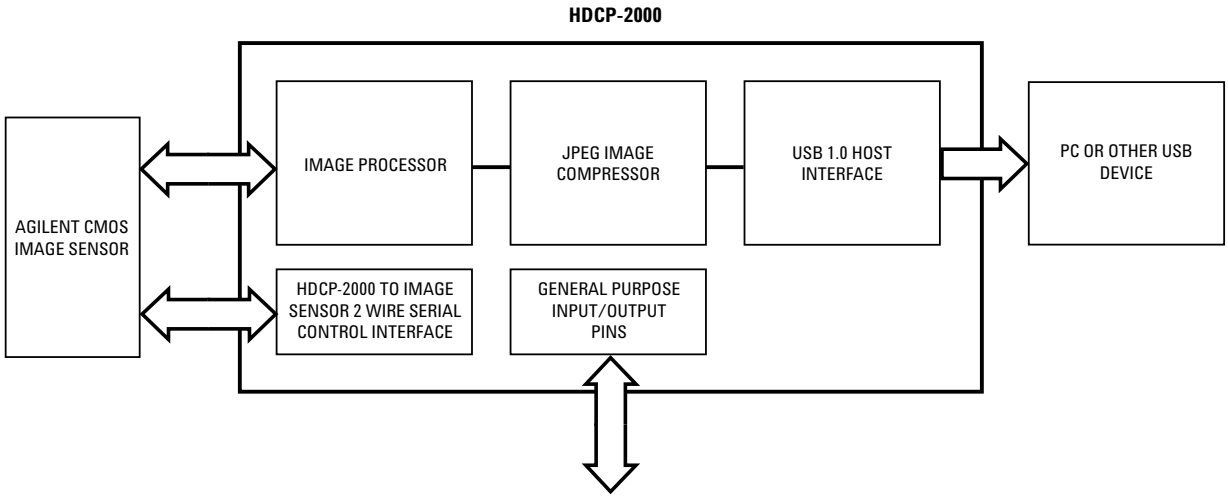

Figure 1. USB PC camera system block diagram for ADCE-1021/1121/2021/2121 Evaluation Kit

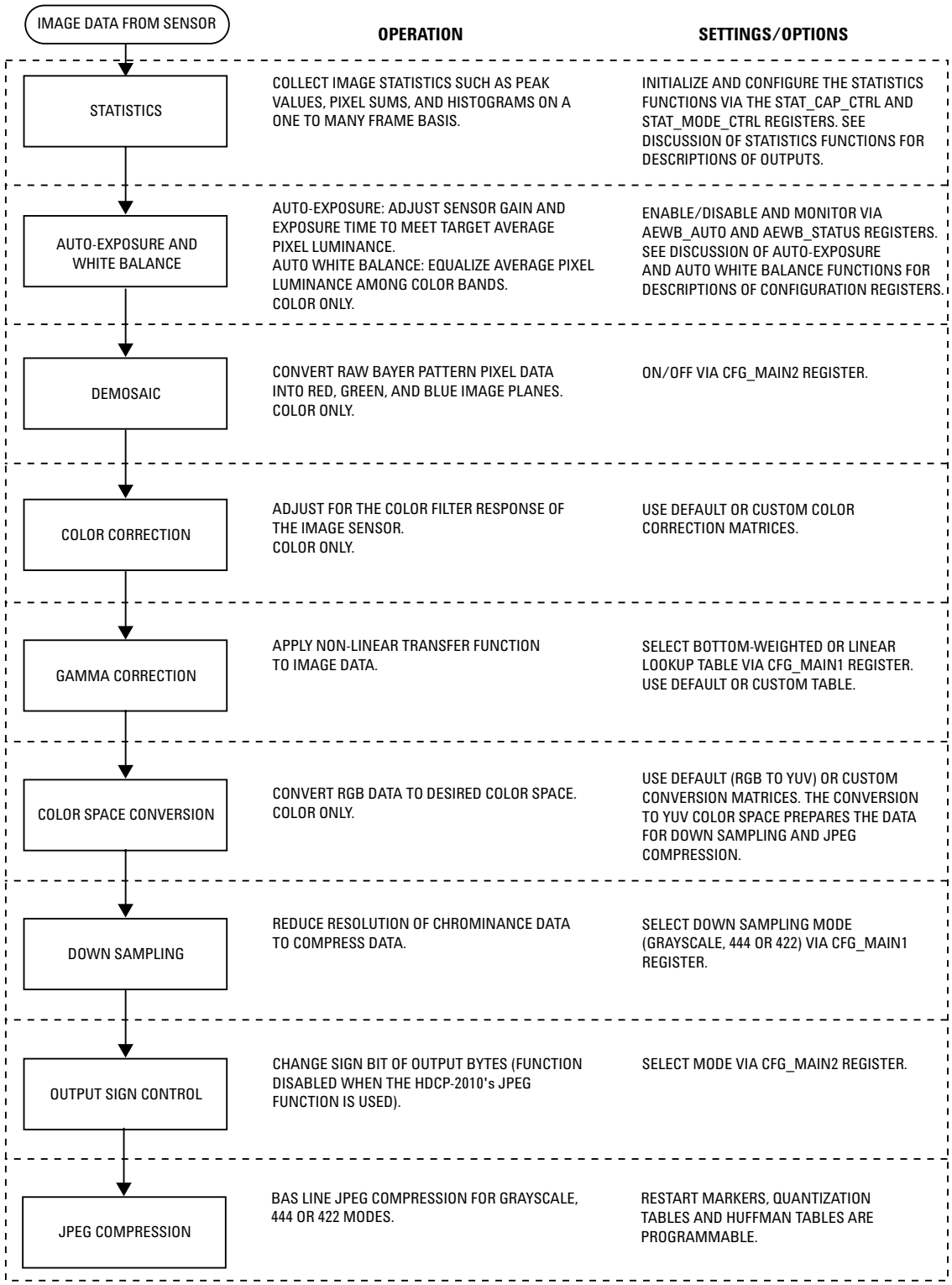

Figure 2. Overview of image processing operations.

The HDCP-2000 image processing chip operates in conjunction with the Avago ADCS family of CMOS image sensors. Together, the two chips provide a complete solution for a USB PC Camera. The HDCP provides all necessary image processing to transform the raw Bayer pixel data output from the ADCS sensors into a standard video stream and communicate it over a USB bus. The HDCP-2000 includes complete auto-exposure and auto white balance capability to assure optimal image quality in any lighting environment.

This image processor component enables the direct interface of Avago CMOS image sensors to the USB bus for a mainstream USB PC Camera. The combination of an ADCS sensor with the HDCP-2000 image processor yields a complete image capture solution.

User Guide

Required Equipment:
- PC running Microsoft® Windows® 98 or Windows® 2000
- USB Cable
- Evaluation Kit
- Software Diskette

The diskette contains the following files:

- **Avago USB Camera.exe** –– This is a program that allows for viewing and capturing images. Any video-enabled application should be able to view images from this camera.
- **HDCP.exe** – This program allows for register access to the HDCP-2000 Image Processor. For definitions of the registers, refer to the HDCP-20x0 Product Guide.
- **Atusbcam.inf** – Windows INF file for the driver
- **Atusbcam.sys** – Windows Driver for the Avago USB Camera
- **HDCP-2000 evaluation users guide.pdf** –User guide in Adobe PDF format.

Installation Instructions

1. Create a new directory in your computer's hard disk.

2. Copy the files from the diskette to the new directory.

3. Connect the camera with the provided USB cable to the PC's USB port.

4. When prompted to install the driver, point the Hardware manager to the new directory created in step 1.

Operating Instructions

1. Plug the USB cable into the camera if it is not already.

2. The green LED will illuminate indicating that the driver was loaded properly and able to communicate with the camera.*

3. Start the **Avago USB Camera.exe** program. The following screen will appear:

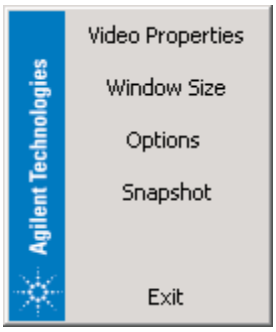

Figure 3. Avago USB Camera Main Screen

By clicking on the *Video Properties* a screen will pop up that enables the user to change the brightness, contrast, hue, saturation and others. The window size option allows the user to change the window's resolution to the following:

- 640 x 480 (max. for Avago ADCS-2021/2121 CMOS image sensor)
- 352 x 288 (max. for Avago ADCS-1021/1121 CMOS image sensor)
- 320 x 240
- 240 x 176
- 176 x 144
- 160 x 120

4. A window will also appear with live video, providing information on the window size and camera frame rate (frames per second). See Figure 4**:

Figure 4. PC Window showing the resolution and frame rate of image sample in the upper-left corner of the frame.

5. Pressing the *Preview* button will open and close the video window.

6. Press *Stream Format* to adjust the window size. The other features on this screen are not enabled.

7. Press *Video Properties* to adjust the video characteristics such as brightness, hue, and back-light compensation.

8. The *Snapshot* button will capture one frame to a file in the same directory where the **Avago USB Camera.exe** file resides. It will automatically increment the filename so that numerous images can be captured without having to be relabeled manually or the previous files being accidentally overwritten by the new ones.

9. Depending on the type of images being viewed, the *Auto Exposure & Color Balance* and *Auto Compression Manager* should be enabled with the following procedures:

- Configuring Auto-Exposure and Auto Color Balance
- Configuring the Image Sensor
- Shutting down and disconnecting the camera

Notes:
* In step # 2, if the Green LED is not lighted up, unplug the cable, wait a few seconds, and re-plug again.

** In step #4, if you do not get a video window, close the application, unplug the camera. Wait a few seconds, then plug back the camera and make sure the green LED comes on. This will indicate the driver is operational. If you still have problems, try reloading the driver.

Do not unplug the camera while any of the programs are still running.

Configuring Auto-Exposure and Auto Color Balance

1. Start the program **HDCP.exe** Sensor Register Access Program

2. Check the box labeled *Auto Quantization*

3. Check the box labeled *Auto White Balance*

4. Check the box labeled *Auto Exposure*

5. Check the box labeled *Enable Temporary AEWB Fix*

The camera is now set for automatic mode.

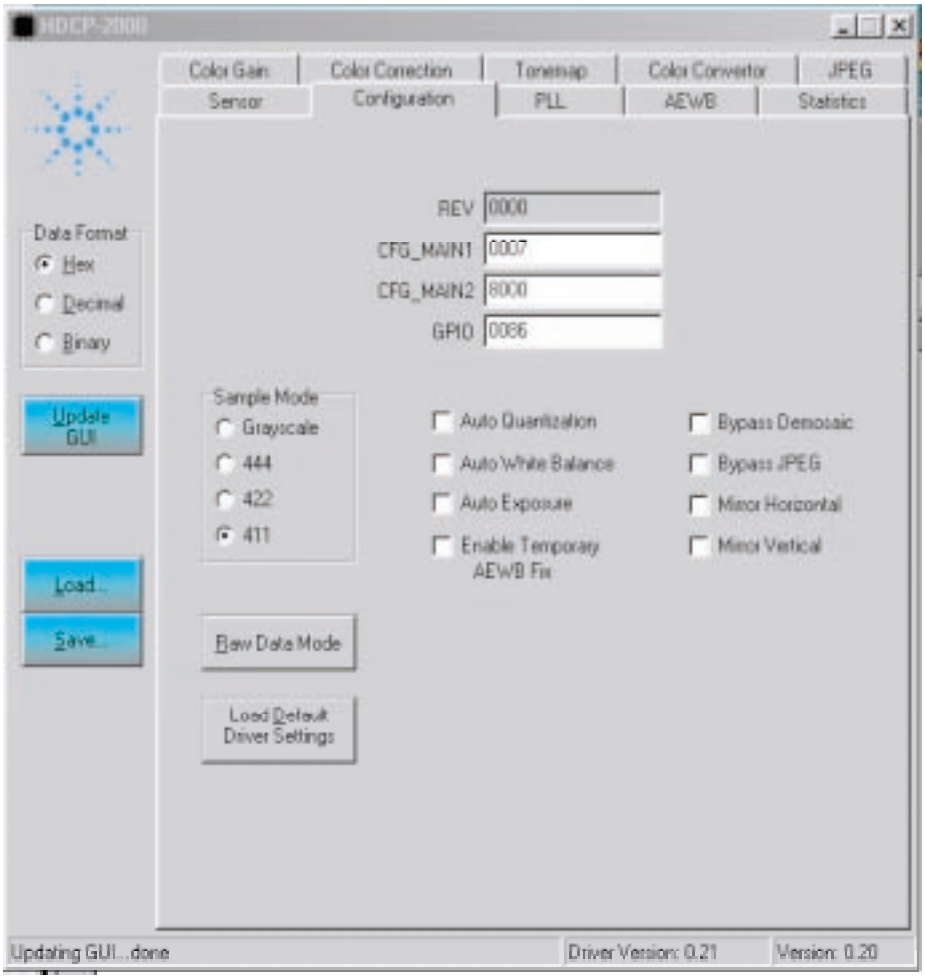

Figure 5. Example of HDCP main screen of HDCP controls

Configuring the Image Sensor

Figure 6 shows the default sensor screen. This screen identifies the type of sensor used and also allows the user to adjust the exposure time and gain. By clicking on the view registers, this allows the user to have a greater control on the sensor setting.

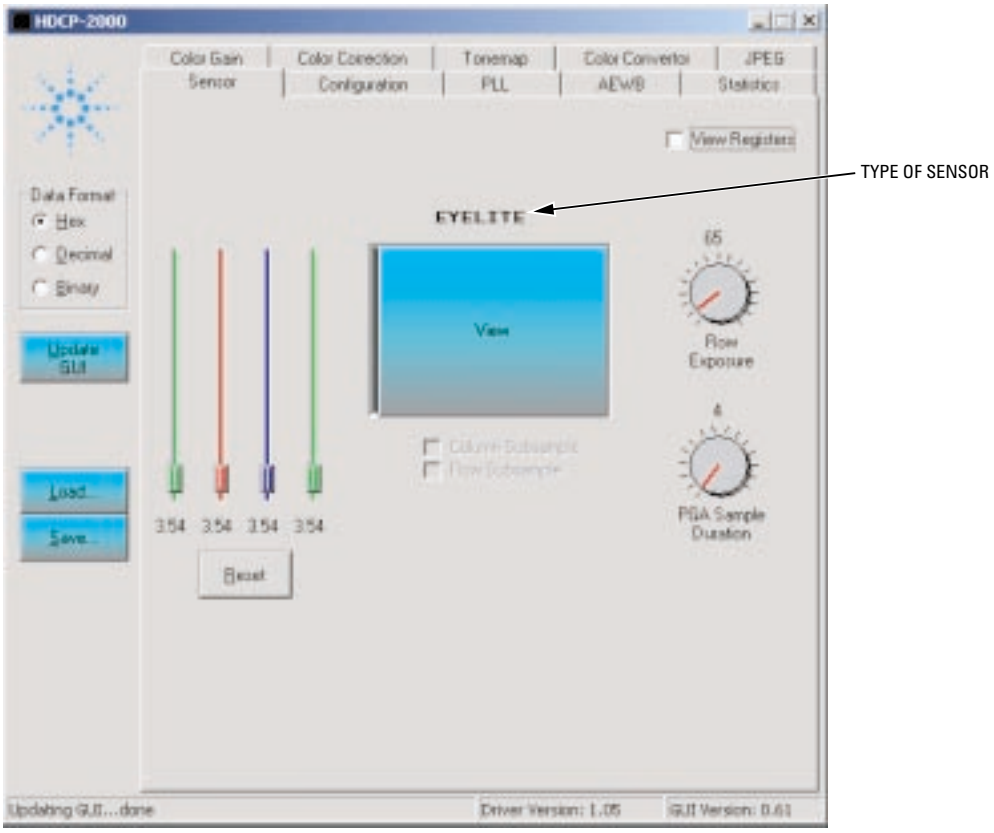

Figure 6. Sensor configuration screen

Figure 7 shows the sensor register screen. For more details about the registers, please refer to ADCS-1021/1121/2021/2121 register specifications.

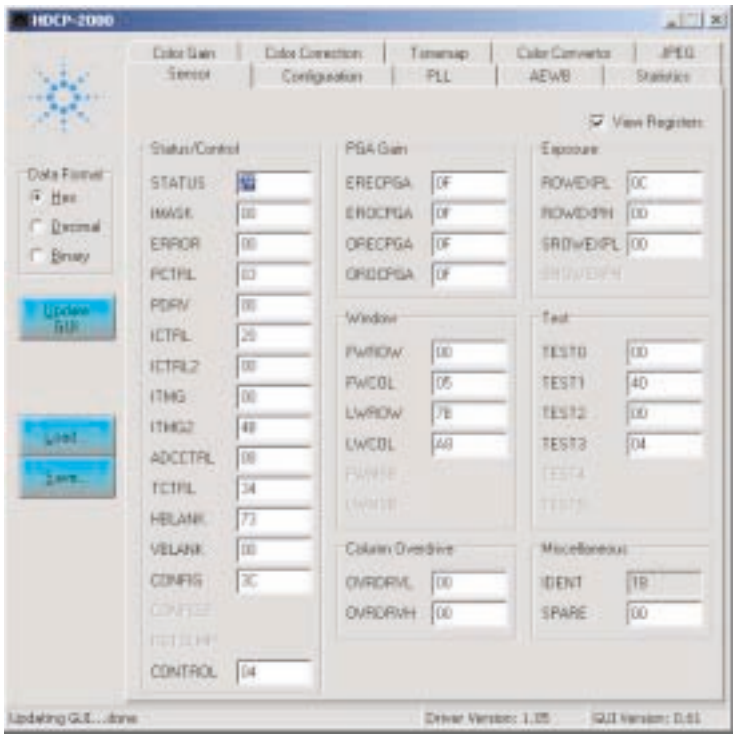

Figure 7. Sensor register setting screen.

Shutting Down and Disconnecting the Camera

1. Close the **HDCP.exe** program.

2. Close the **Avago USB Camera.exe**, the video window will also close automatically.

3. The camera can now be disconnected.

For the ADCE-1021/1121/2021/2121 evaluation kit schematics and BOM, please refer to the ADCE-2020.pdf document.

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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