DG0849
Demo Guide
PolarFire Dual Camera Video Kit

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1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision 2.0

Added the image panning feature in Running the Demo, page 9.

1.2 Revision 1.0

The first publication of this document.

2 PolarFire Dual Camera Video Kit

This document describes how to run the imaging and video demo using the PolarFire Video Kit, Dual Camera sensor module, and a HDMI monitor. The demo design features a fully integrated solution created using Microsemi Libero SoC to help customers build prototypes quickly.

The demo demonstrates the following functions:

- MIPI CSI-2 RX to read the camera input
- CFA (Color filter array) to RGB (red, green, blue) conversion
- Display controller
- Picture in picture (PIP)
- Image Panning
- Edge detection
- Image enhancements such as contrast, brightness, color balance

Note: The solution includes a user-friendly GUI used to control these image/video settings.

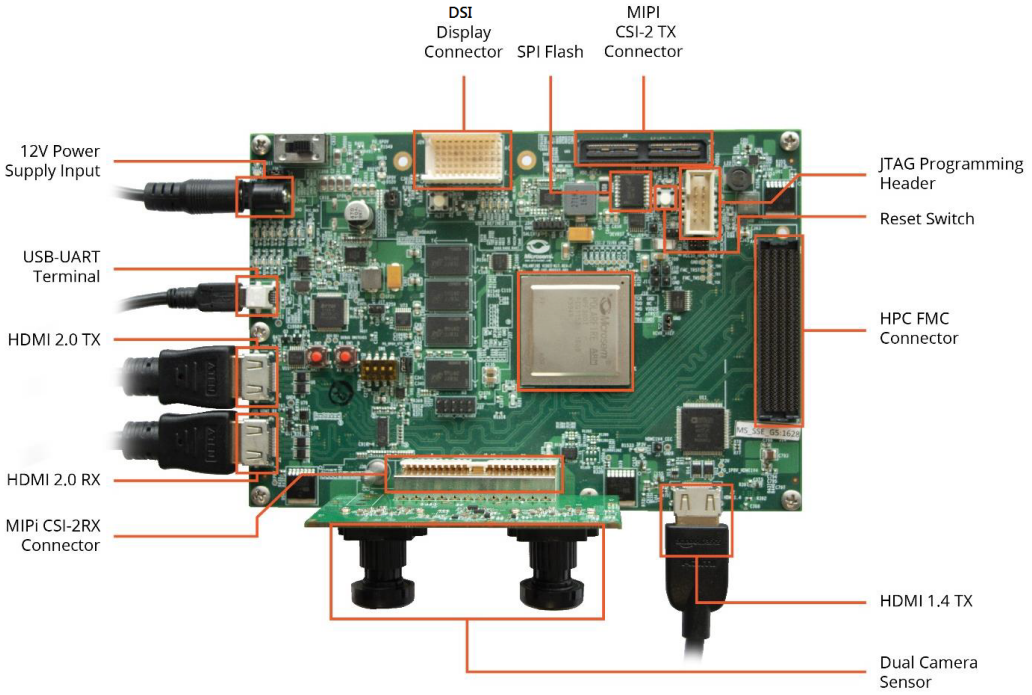
The PolarFire Video Kit (DVP-102-000512-001) features:

- A 300K LE FPGA (MPF300T, FCG1152)
- HDMI 1.4 transmitter (ADV7511) chipset and corresponding connector
- HDMI 2.0 with rail clamps and redrivers and corresponding connectors
- Dual camera sensor featuring IMX334 Sony image sensor
- Image sensor interface to support upto two MIPI CSI-2 cameras
- DSI Interface
- NVIDIA Jetson Interface
- A high pin count (HPC) FMC connector to connect to high-speed interfaces (like HDSDI)

For more information about this video kit, see https://www.microsemi.com/existing-parts/parts/150747.

The following figure highlights the various features of the PolarFire Video Kit.

Figure 1 • **PolarFire Video Kit (DVP-102-000512-001)**



2.1 Design Requirements

The following table lists the hardware and software required to run the demo.

Table 1 • **Design Requirements**

Design Requirement	Description
Hardware	
-PolarFire VIDEO KIT	DVP-102-000512-001 REV 1.0
-Image Sensor module	LI-IMX334-MIPI-MICRO v1.0
-USB A to mini-B cable	
-HDMI cable	HDMI A Male to Male cable
-HDMI monitor	Any display with HDMI input
-Power Adapter	12V, 5A
-Host PC	OS: Windows 7 or later, with HDMI TX port
Software	
-Program_Debug_v2.3_win.exe	This executable installs FlashPro used to program the FPGA

Note: For HDMI 2.0, do not use a HDMI converter with the monitor or the Host PC.

2.2 Prerequisites

Before you start:

1. Download the programming files and the TCL script from: *http://soc.microsemi.com/download/rsc/?f=mpf_dg0849_liberosoc_pf*
2. Download the GUI from: *http://soc.microsemi.com/download/rsc/?f=mpf_dg0849_liberosoc_gui*
3. Download and install the program and Debug software from: https://www.microsemi.com/document-portal/doc_download/1243650-download-programming-and-debug-polarfire-v2-3-for-windows

Note: On this web page, you are prompted to download the `Program_Debug_PolarFire_v2.3_win.exe` binary file. Installation of this executable installs FlashPro and SmartDebug used for FPGA programming and debugging. FlashPro is used in this demo.

Note: The Program and Debug Software also installs the drivers on the Host PC to detect the COM port for running the demo. Hence, install this software whenever you run the demo on a different Host PC.

2.3 Demo Resources

The `mpf_dg0849_liberosoc_pf` folder contains the following resources:

- **A programming file (STP file)**: This file is the FPGA bitstream to be programmed.
- **A binary file (BIN file) for the on-board SPI flash**: This file is the user application that is executed by the Mi-V soft processor in the FPGA. The file is stored in SPI flash and is used to initialize the fabric RAMs at device power-up.
- **A TCL script file**: This script stores the TCL instructions to program the PolarFire device and the SPI Flash.

Follow these steps to make the TCL file compatible with your setup.

1. Unzip the <programming files>.zip file.
2. Open the TCL file using a text editor like notepad++.
3. Update the location of the STP and BIN files as per your file system paths.
4. Replace the path separator '\' with '/' when copying the Windows file paths.
5. Save and close the TCL file.

2.4 Installing the Demo GUI

To install the GUI:

1. Extract the contents of the `mpf_dg0849_liberosoc_gui.rar` file and run the `setup.exe` file.
2. Click Yes for any message from User Account Control.
   The **Video Control GUI** installation wizard is displayed.
3. Confirm the installation directory locations for the GUI and the National Instruments products and click **Next**.
4. Accept the license agreement, and click **Next**.
5. Review the summary and click **Next**.
   The installation proceeds with a progress bar. After the installation, a confirmation message is displayed.
6. Click **Next** to exit the installation wizard.
7. Restart the host PC when prompted.

The Video_Control GUI is installed.

2.5 Setting Up the Demo

Setting up the demo involves the following steps:

1. Setting Up the Hardware, page 4
2. Programming the PolarFire Device, page 5

2.5.1 Setting Up the Hardware

Setting up the hardware involves interfacing the dual camera sensor module with the PolarFire Video Kit and verifying the jumper settings. The following steps describe how to connect the camera module to video kit.

1. Connect the **J1** connector of the dual camera sensor module to **J38** interface of the video kit.
2. Connect the video kit and the HDMI monitor through **J2** (HDMI 1.4) of the video kit using the HDMI cable.
3. Connect the Host PC and the video kit through **J12** of the video kit using the USB mini cable.
4. Connect the power supply cable to **J20** of the video kit.
5. Ensure that the following jumper settings are set on the video kit.

Table 2 • **Jumper Settings**

Jumper	Default Position	Functionality
J15	Open	SPI Slave and Master mode selection. By Default SPI master
J17	Open	100K PD for TRSTn, by default 1K PD is connected.
J19	Pin 1&2	Default: XCVR_VREF is connected to GND
J28	Pin 1&2	Default: Programming through the FTDI
J24	Pin 2&4	Default: VDDAUX4 voltage is set to 3V3
J25	Pin 5&6	Default: Bank4 voltage is set to 1V8
J36	Pin 1&2	Default: Board power up through the SW4
SW4	OFF (Pin 2-3,5-6 Positions)	Power ON\OFF switch
SW6	OFF position	user slide switch, Default OFF position
J20	12Volts Input	12V input to the board

6. Power-up the HDMI monitor.
7. Power-up the board using the **SW4** slide switch.

The PolarFire dual camera video and imaging hardware is set up. See the next section to program the PolarFire device.

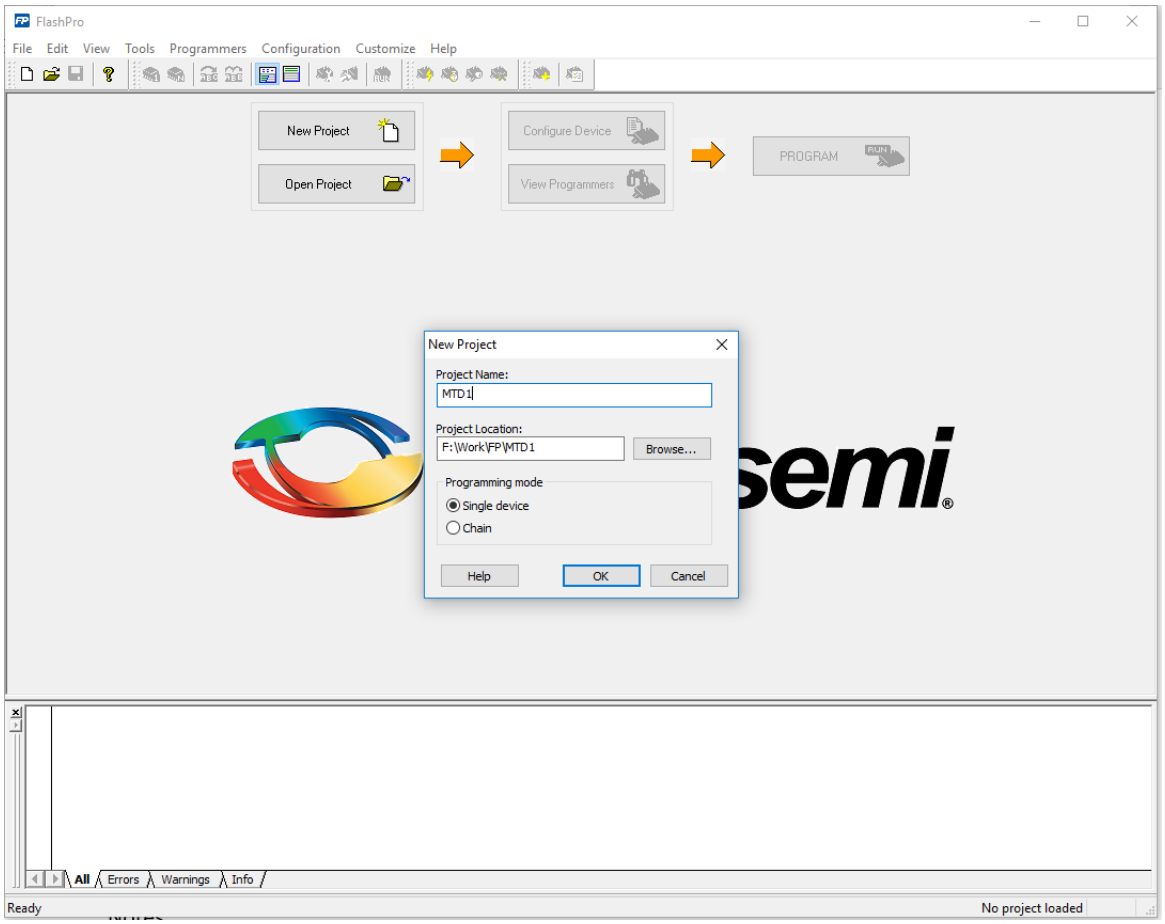
2.5.2 Programming the PolarFire Device

The TCL script is used to program the PolarFire device. The FlashPro software can execute the TCL script file.

Follow these steps:

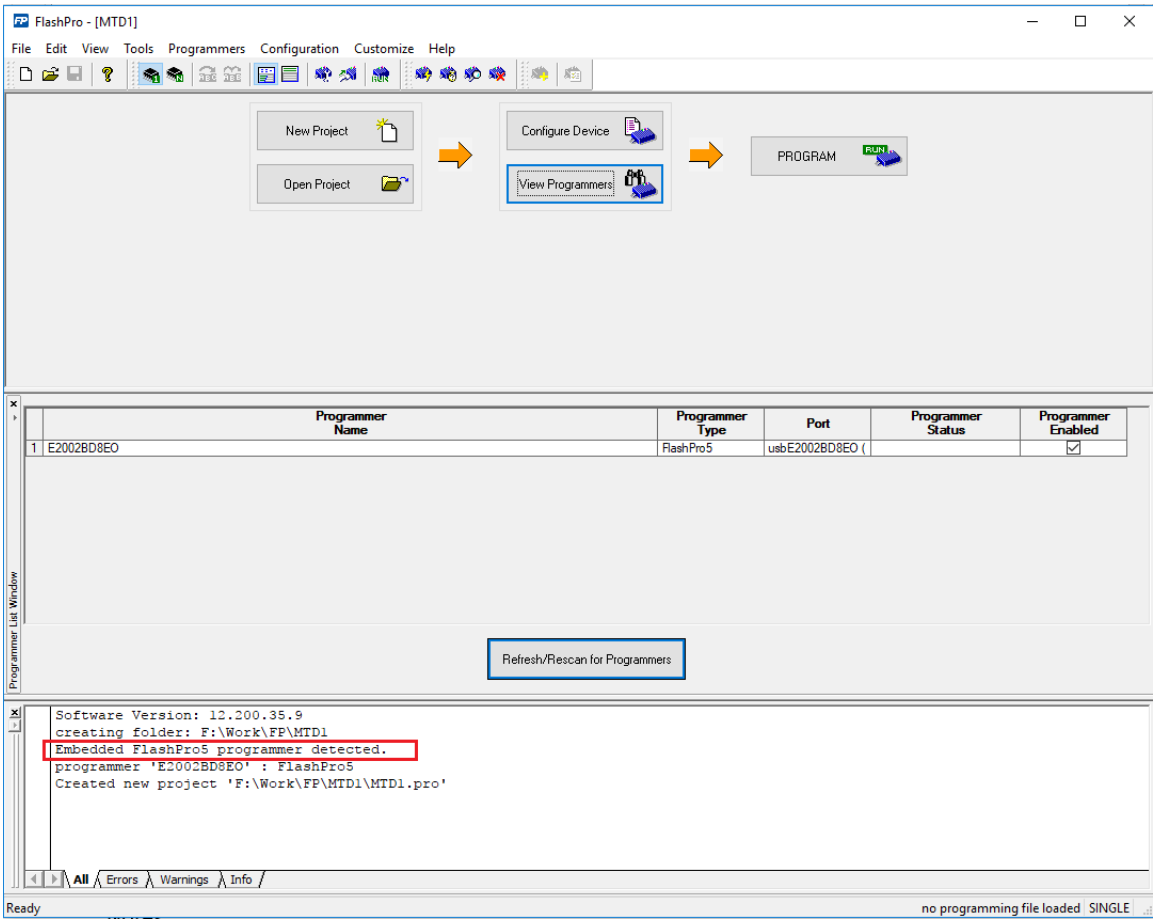
1. Open FlashPro and create a new project as shown in the following figure.

Figure 2 • **Creating New Project**



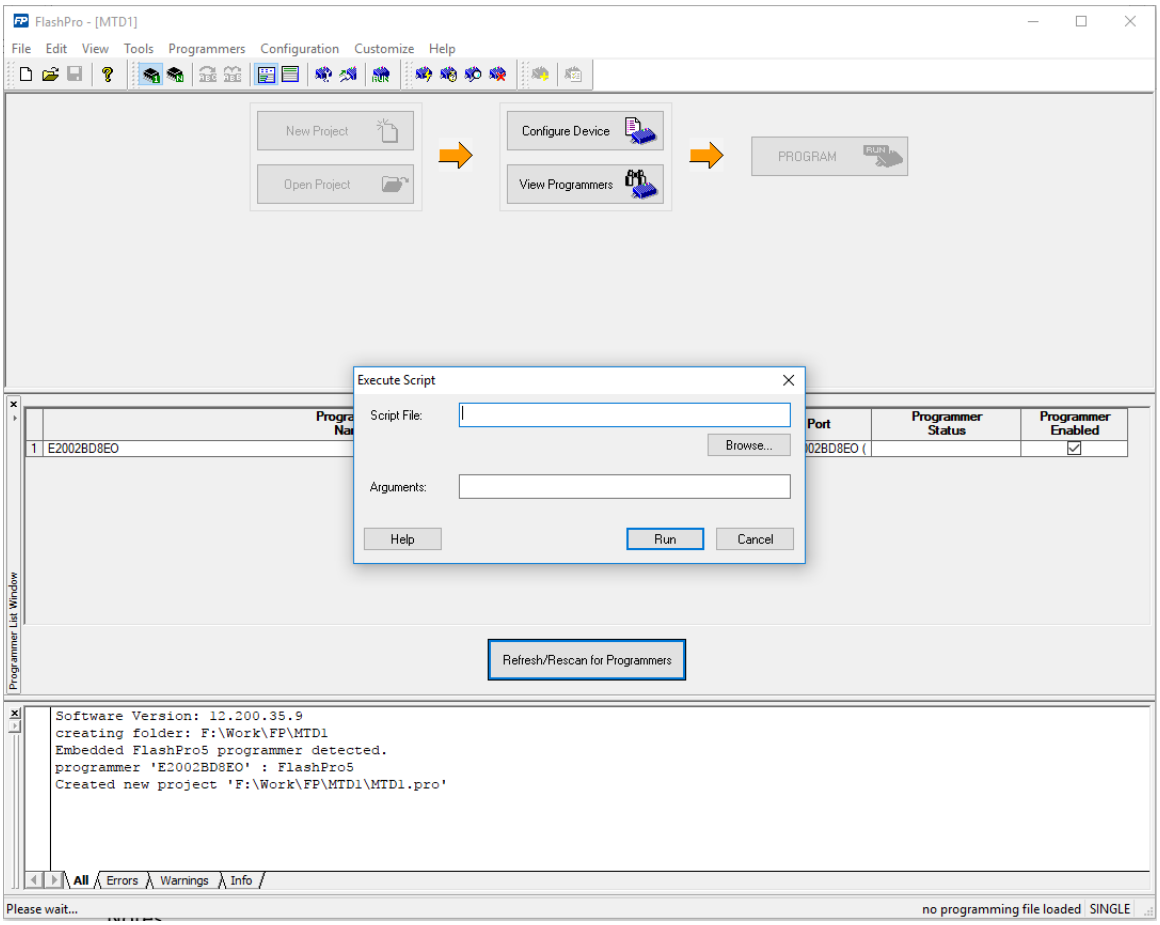
2. Verify that the FlashPro5 programmer is detected and displayed as shown in the following figure.

Figure 3 • **View Programmer**



3. Select **File** -> **Run script**. The Execute Script dialog box opens as shown in the following figure.

Figure 4 • **Running Script**

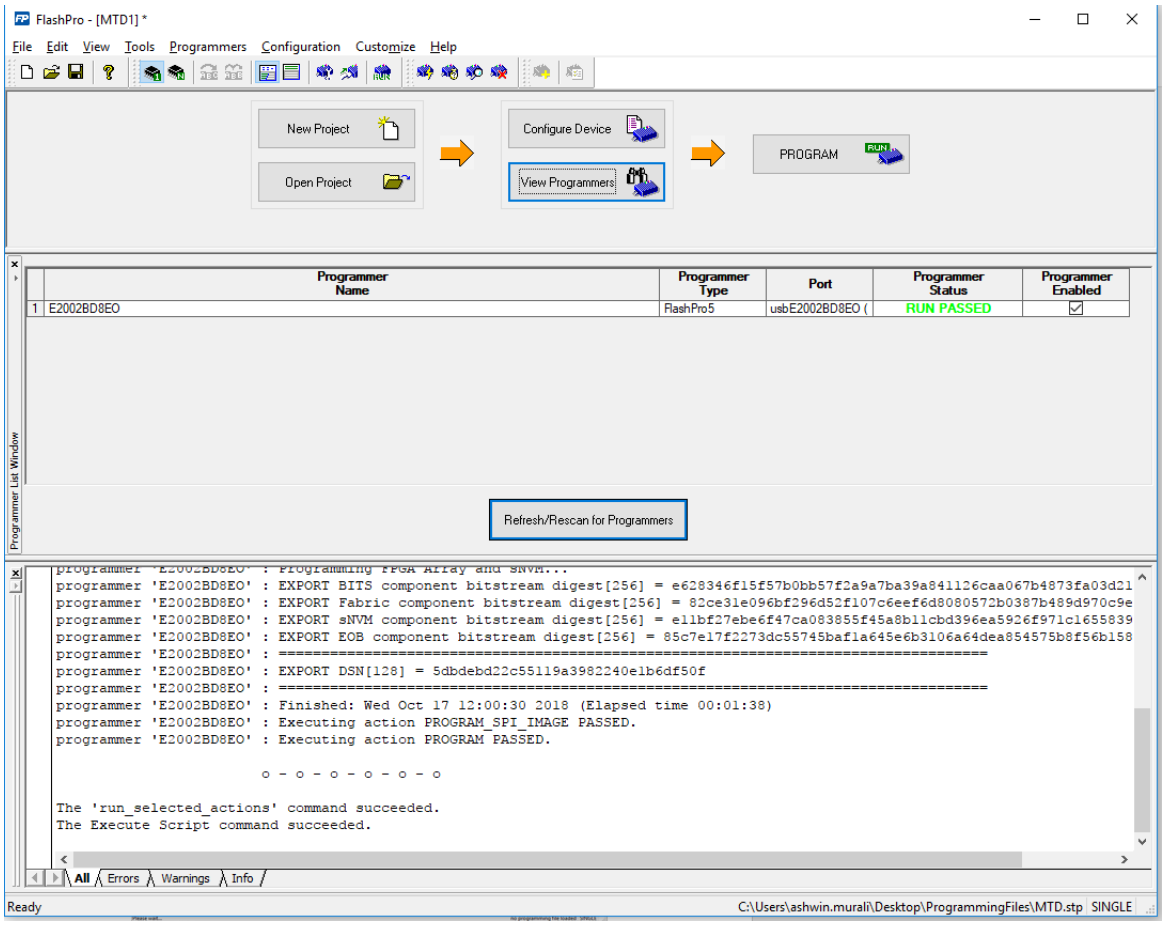


4. Use the Browse option to select the Script.tcl file from the following design files folder: <script file location>

Note: In the TCL file, ensure that the path separator '\' is replaced with '/' when using a Windows PC.

5. Select **Run** to run the script. Once complete, a message appears in the log as shown in the following figure.

Figure 5 • **Run Passed-Notification**



The PolarFire device and SPI Flash are programmed.

Power cycle the board using switch SW4. The camera feed from the 2 cameras is displayed on the HDMI monitor as Picture in Picture.

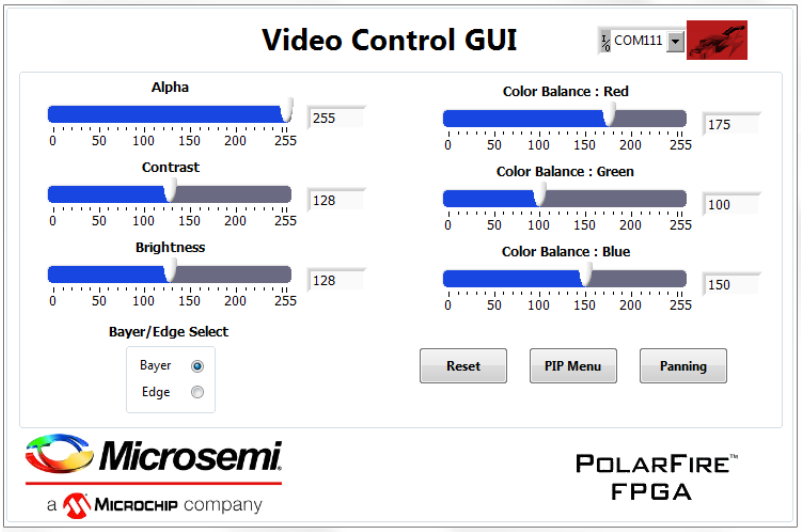
2.6 Running the Demo

Running the demo involves verifying the imaging and video settings using the Video_Control GUI and then observing the result on the HDMI monitor.

To use the demo GUI:

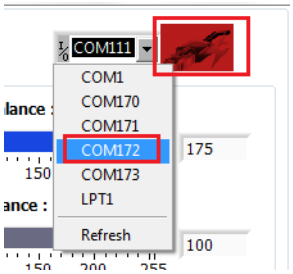
1. Start the Video_Control GUI from the installation directory.
   The GUI is displayed as shown in the following figure.

Figure 6 • **Video_Contol GUI**



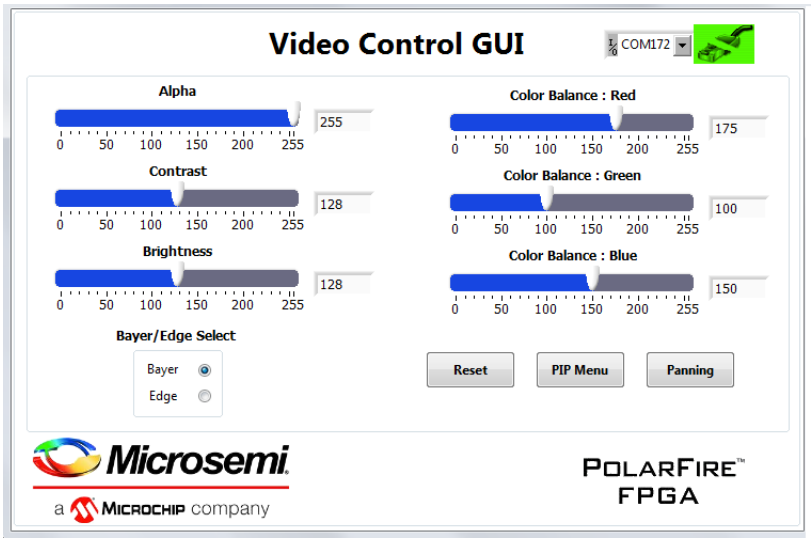
2. Select the second largest COM port on the GUI and select the Connect option.

Figure 7 • **Connecting the GUI and Video kit**



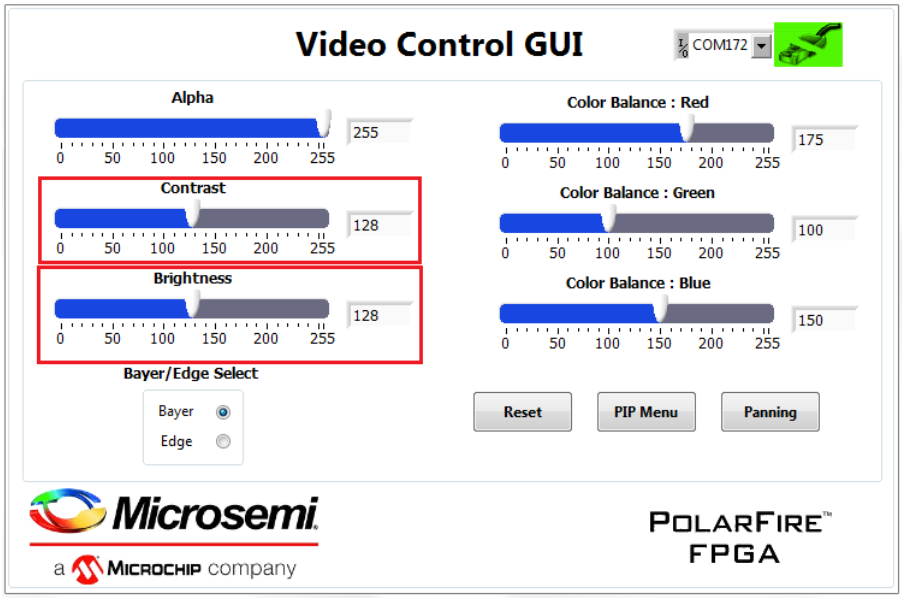
3. The connect button turns green which indicates that the connection was successful.

Figure 8 • **Connection Successful**



4. Use the Contrast and Brightness sliders to adjust the contrast and brightness and observe the change on the HDMI monitor. These sliders are highlighted in the following figure.

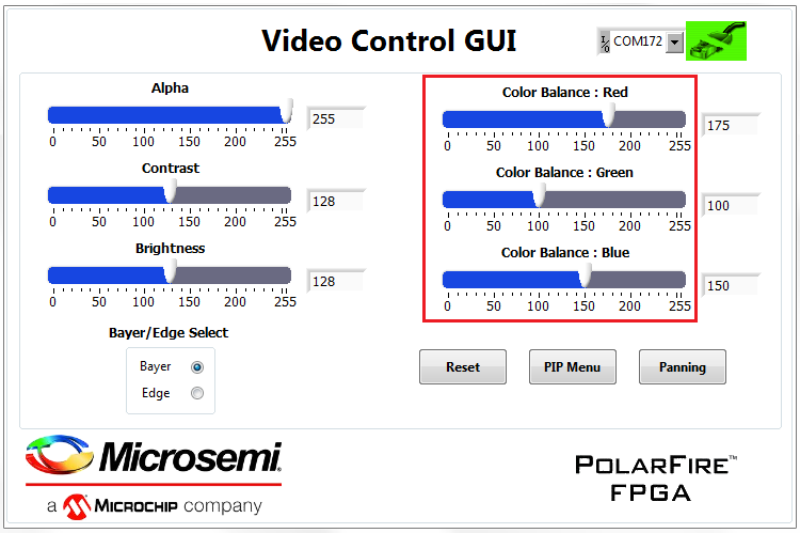
Figure 9 • **Adjusting Contrast and Brightness**



5. Similarly, adjust the color balance of the image using the color balance sliders.

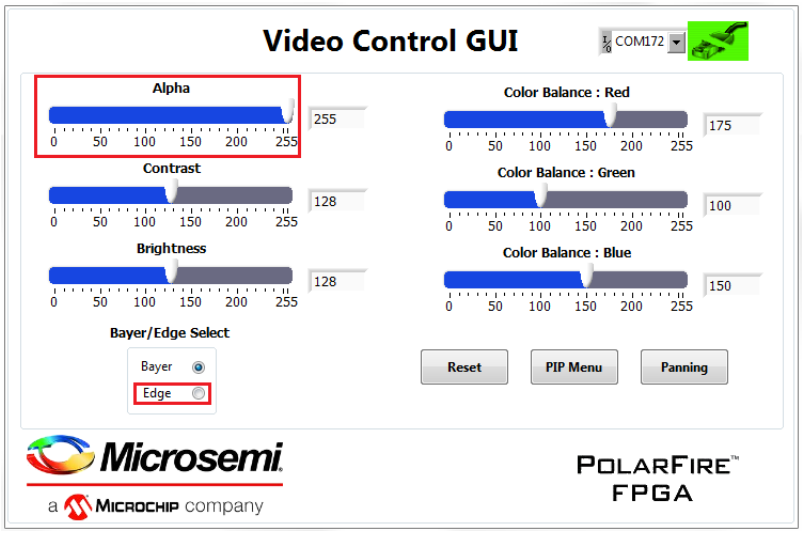
Note: You can revert to default image settings by using the Reset option.

Figure 10 • **Adjusting Colors**



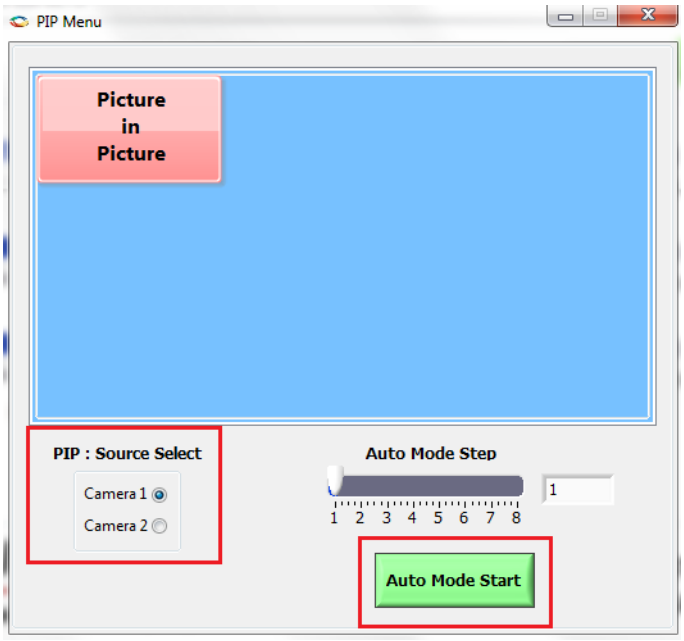
6. Similarly, adjust the Alpha slider. The alpha blending feature enables adjusting the transparency of the PIP image. When the alpha value is adjusted to minimum (0), the image disappears.
7. Switch to edge detection mode using the Edge option.

Figure 11 • **Edge Detection Option**



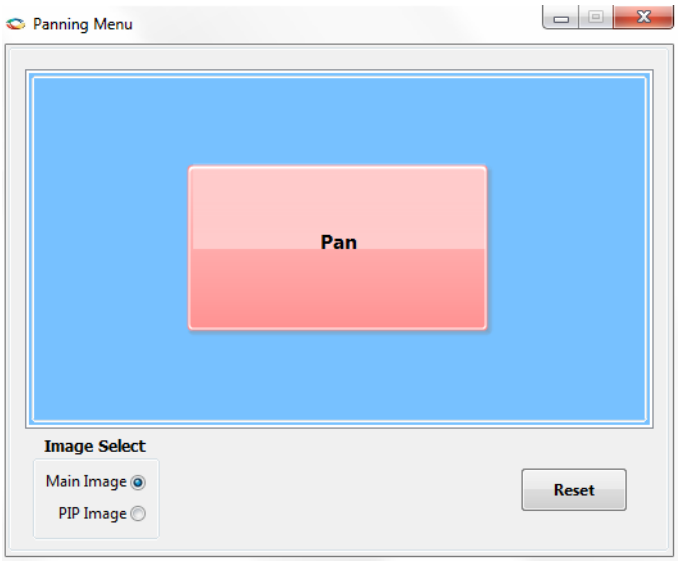
8. Select **PIP Menu** to change the PIP settings.
9. In the PIP Menu, the source of the PIP window can be selected between Camera 1 and Camera 2 using **PIP: Source Select**. The position of the PIP window can be moved anywhere within the screen by dragging the pink **Picture In Picture** box. The Auto Mode Start option moves the PIP window automatically. The speed of this movement can be controlled using the Auto Mode Step slider.

Figure 12 • **PIP Menu**



10. Close the PIP Menu.
11. Select the Panning option to view a particular area of the main or PIP image.
12. In the Panning Menu, the image to be panned can be selected between Main image and PIP image using **Image Select**. You can view any area of the camera feed by dragging the pink box horizontally or vertically. The Reset option sets the view of the Main image and PIP image in its default center position.

Figure 13 • **Panning Menu**



13. Close Panning Menu to return to the main GUI.
14. Close the GUI.

This concludes the demo.