



CrossLink-NX Human Counting Using VGG on EVDK Demonstration User Guide

User Guide

FPGA-UG-02111-1.0

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Acronyms in This Document

A list of acronyms used in this document.

Acronym	Definition
EVDK	Embedded Vision Development Kit
FPGA	Field-Programmable Gate Array
ML	Machine Learning
SD	Secure Digital
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
VIP	Video Interface Platform
USB	Universal Serial Bus

1. Introduction

This document provides technical information and instructions on setting up and running the CrossLink™-NX EVDK Based Human Counting Demo.

Refer to the following documents for detailed information on Lattice development boards and kit:

- [Lattice Embedded Vision Development Kit User Guide \(FPGA-UG-02015\)](#)
- [ECP5 VIP Processor Board Evaluation Board User Guide \(FPGA-EB-02001\)](#)
- [HDMI VIP Output Bridge Board Evaluation Board User Guide \(FPGA-EB-02003\)](#)
- [CrossLink-NX VIP Sensor Input Board User Guide \(FPGA-EB-02029\)](#)
- [4 to 1 Image Aggregation with CrossLink-NX VIP Sensor Input Board User Guide \(FPGA-UG-02095\)](#)

2. Functional Description

The EVDK Based Human Counting Demo is designed to utilize the Lattice Embedded Vision Development Kit, as shown in [Figure 2.1](#).



Figure 2.1. Lattice CrossLink-NX EVDK

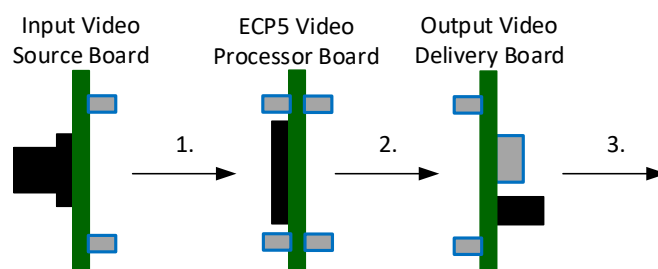


Figure 2.2. Lattice EVDK Stack

The Lattice Embedded Vision Development Kit features a stackable modular architecture consisting of three boards:

- CrossLink-NX Video Interface Platform (VIP) Input Bridge Board
- ECP5™ VIP Processor Board
- HDMI VIP Output Bridge Board

3. Demo Setup

This section describes the demo setup.

3.1. Hardware Requirements

- Lattice Embedded Vision Development Kit
 - Mini-USB Cable
 - 12 V Power Supply
- HDMI Cable
- HDMI Monitor (1080p30)

3.2. Software Requirements

- Lattice Radiant® Programmer (refer to <http://www.latticesemi.com/Products/DesignSoftwareAndIP/FPGAandLDS/Radiant>)
- Lattice Diamond® Programmer (refer to <http://www.latticesemi.com/programmer>)

4. Programming the Demo

4.1. Programming the CrossLink-NX SPI Flash

4.1.1. Erasing the CrossLink-NX SRAM Prior to Reprogramming

If the CrossLink-NX device is already programmed (either directly, or loaded from SPI Flash), follow this procedure to first erase the CrossLink-NX SRAM memory before re-programming the CrossLink-NX's SPI Flash. If you are doing this, keep the board powered when re-programming the SPI Flash (so it does not reload on reboot).

To erase the CrossLink-NX Device SRAM:

1. Launch Lattice Radiant Programmer with **Create a new blank project**.

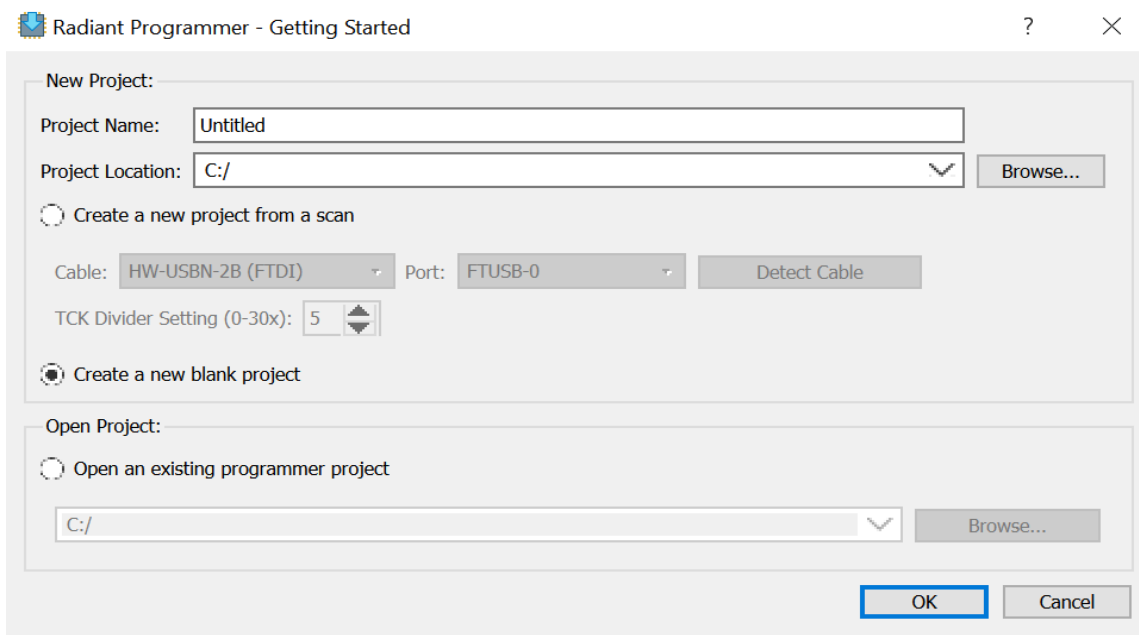


Figure 4.1. Radiant Programmer – Default Screen

2. Select **LIFMD** for **Device Family**, **LIFCL** for **Device Vendor**, and **LIFCL-40** for **Device** as shown in Figure 4.2.

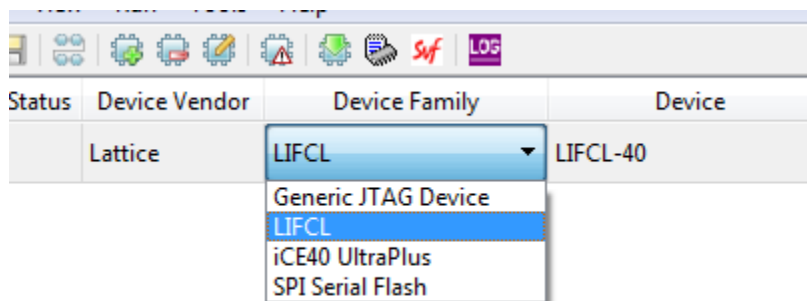


Figure 4.2. Radiant Programmer – Device Selection

3. Right-click and select **Device Properties** dialog box.
4. Select **JTAG** for **Port Interface**, **Direct Programming** for **Access Mode**, and **Erase Only** for **Operation** as shown in Figure 4.3.

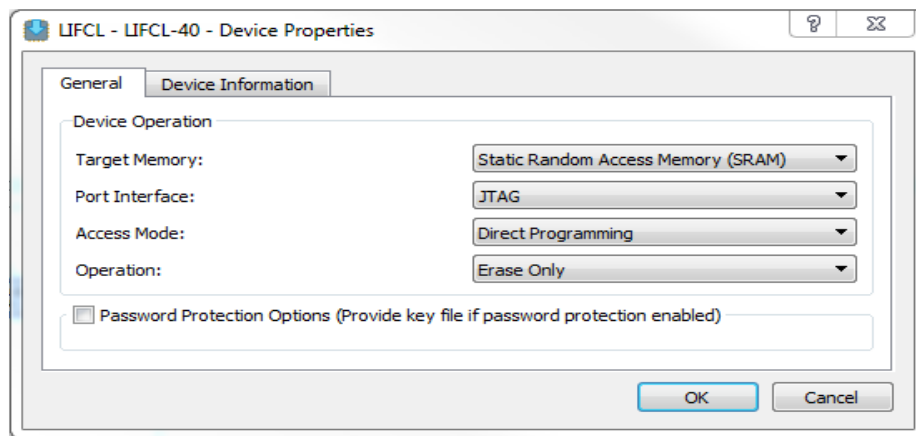


Figure 4.3. Radiant Programmer – Device Operation

5. Click **OK** to close the **Device Properties** dialog box.
6. Click the **Program** button  to start the erase operation.

4.1.2. Programming the CrossLink-NX VIP Input Bridge Board

To program the SPI flash on the CrossLink-NX Input Bridge board:

1. Ensure that the CrossLink-NX device SRAM is erased by performing the steps in [Erasing the CrossLink-NX SRAM Prior to Reprogramming](#).
2. In the Radiant Programmer main interface, right-click the CrossLink-NX row and select **Device Properties**.
3. Select SPI FLASH for Access mode, JTAG2SPI for Port Interface, and Direct Programming for Access Mode.
 - a. For Programming File, browse and select the CrossLink-NX bitfile (*.bit).
 - b. For SPI Flash Options, make the selections as shown in [Figure 4.4](#).

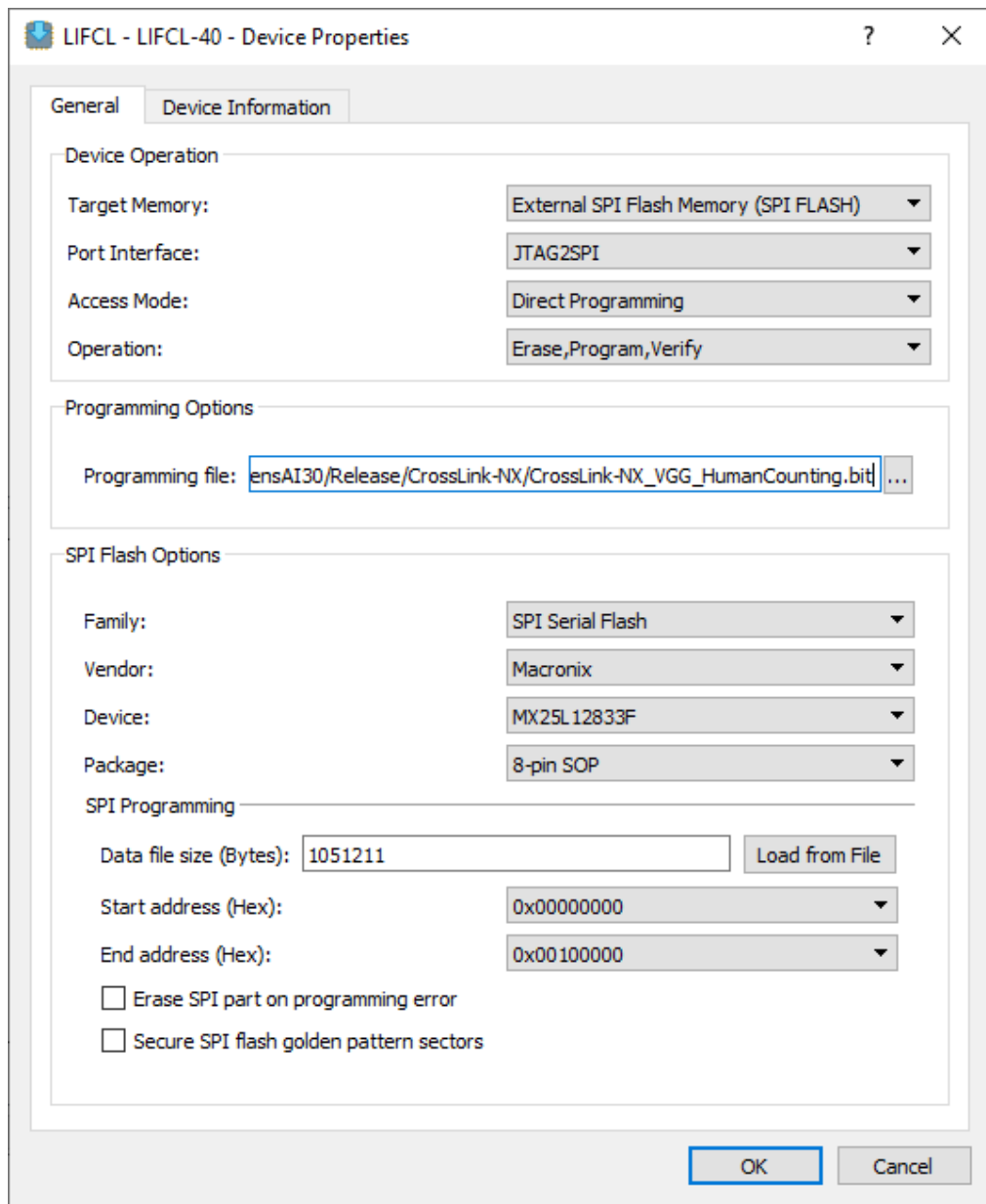


Figure 4.4. Radiant Programmer – Selecting Device Properties Options for CrossLink-NX Flashing

4. Click **Load from File** to update the Data file size (Bytes) value.
5. Ensure that the following addresses are correct:
 - **Start Address (Hex) – 0x00000000**
 - **End Address (Hex) – 0x00100000**
6. Click **OK**.
7. Press the **SW4** push button switch before clicking the **PROGRAMN** button as shown in Figure 4.5. Keep it pressed until you see the *Successful* message in the Radiant log window.

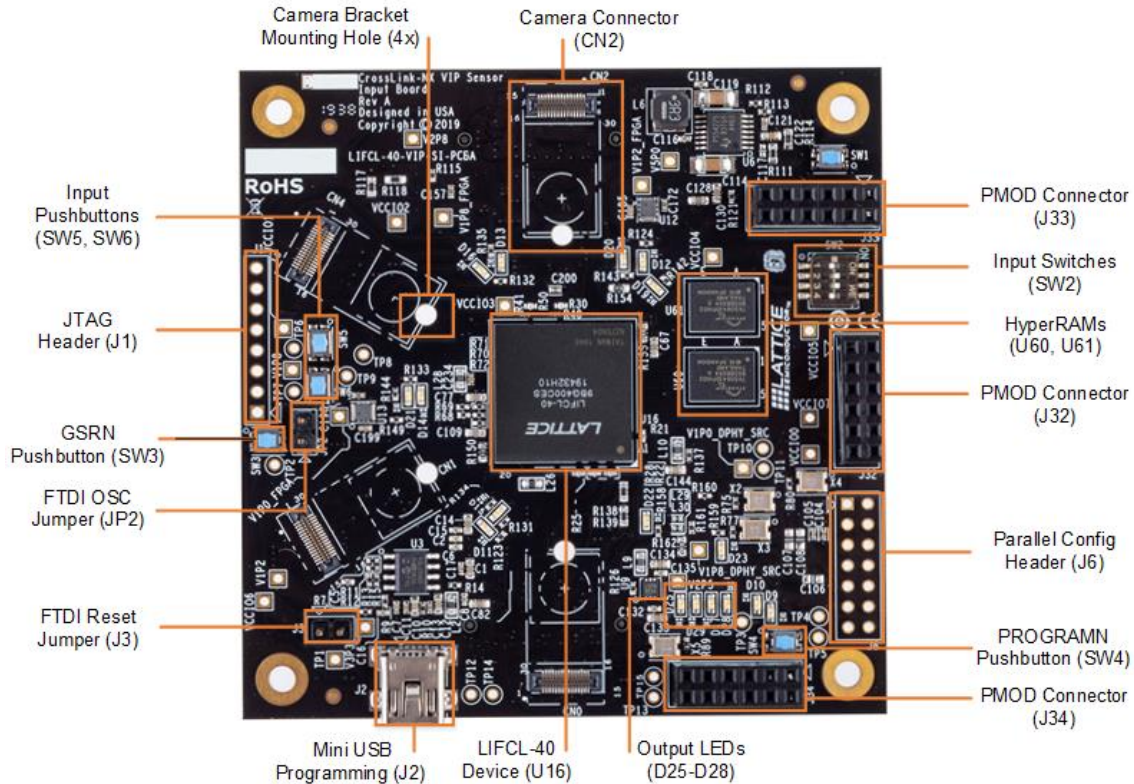


Figure 4.5. CrossLink-NX Flashing Switch – SW4 Push Button

8. Click the **Program** button  to start the programming sequence.
9. After successful programming, the **Output** console displays the results as shown in Figure 4.6.



Figure 4.6. Radiant Programmer – Output Console

4.1.3. Programming SensAI Firmware Binary to the CrossLink-NX SPI Flash

4.1.3.1. Convert SensAI Firmware Binary to Hex

To program CrossLink-NX SPI flash:

1. Use **bin2hex.exe** to convert the SensAI firmware binary file to hex format using the command shown in [Figure 4.7](#).
2. Make sure you do not have the target **.mcs** file present in the directory. If the target **.mcs** file is already present at the specified path, utility does not perform anything.

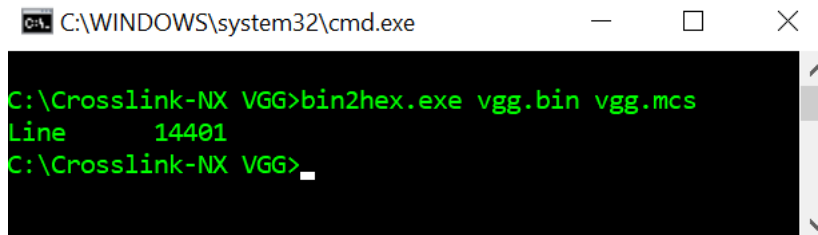


Figure 4.7. SensAI BIN to HEX – Convert SensAI Binary to Hex Format

4.1.3.2. Convert Flash SensAI Firmware Hex to Crosslink-NX SPI Flash

To program the CrossLink-NX SPI flash:

1. For Programming File, browse and select the CrossLink-NX SensAI firmware binary file after converting it to hex (*.mcs).
2. For SPI Flash Options, follow the configurations in [Figure 4.8](#).

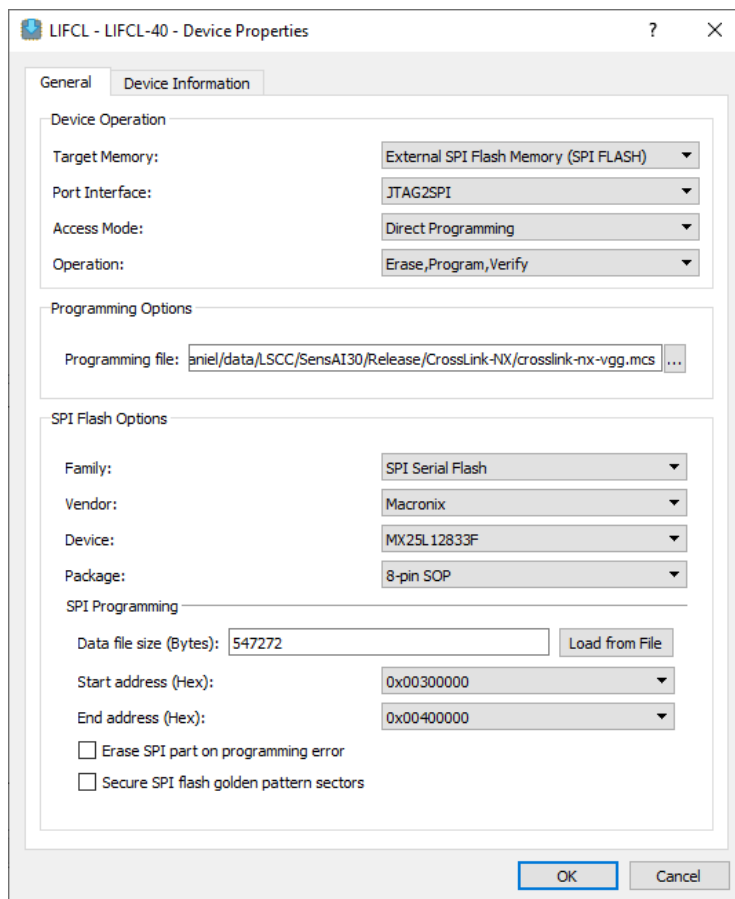


Figure 4.8. Radiant Programmer – Selecting Device Properties Options for CrossLink-NX Flashing

3. Click **Load from File** to update the Data file size (Bytes) value.
4. Ensure that the following addresses are correct:
 - **Start Address (Hex) – 0x00300000**
 - **End Address (Hex) – 0x00400000**
5. Click **OK**.
6. Press the **SW4** push button switch and click the **PROGAMN** button. Keep it pressed until you see the *Successful* message in the Radiant log window.

4.2. Programming ECP5 VIP Board

4.2.1. Erasing the ECP5 Prior to Reprogramming

If the ECP5 device is already programmed (either directly or loaded from SPI Flash), erase the ECP5 SRAM before reprogramming the ECP5 SPI Flash. Keep the board powered on to prevent reloading on reboot.

To erase the ECP5 device SRAM:

1. Start Diamond Programmer. In the Getting Started dialog box, select **Create a new blank project**.

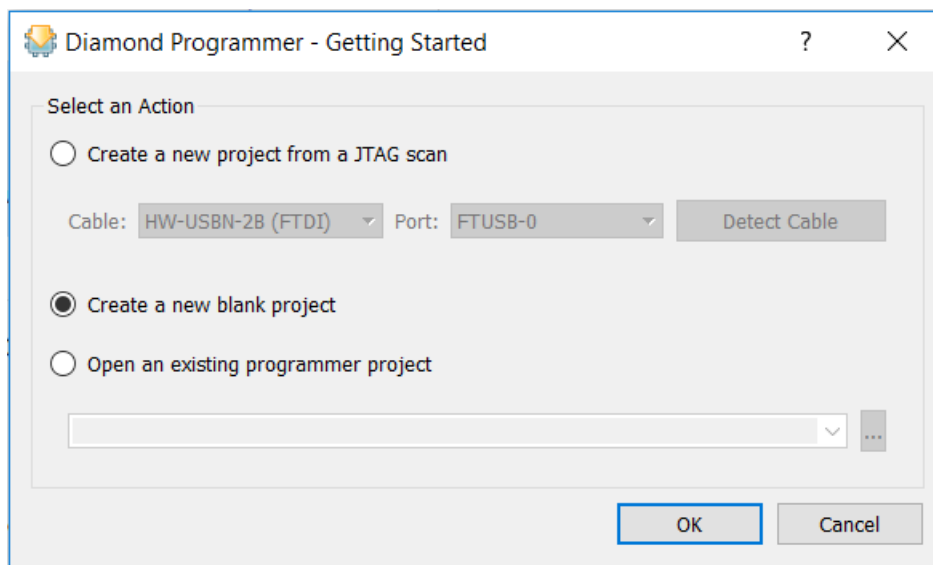


Figure 4.9. Diamond Programmer – Default Screen

2. Click **OK**.
3. In the Diamond Programmer main interface, select **ECP5UM** in Device Family and **LFE5UM-85F** in Device as shown in Figure 4.10.

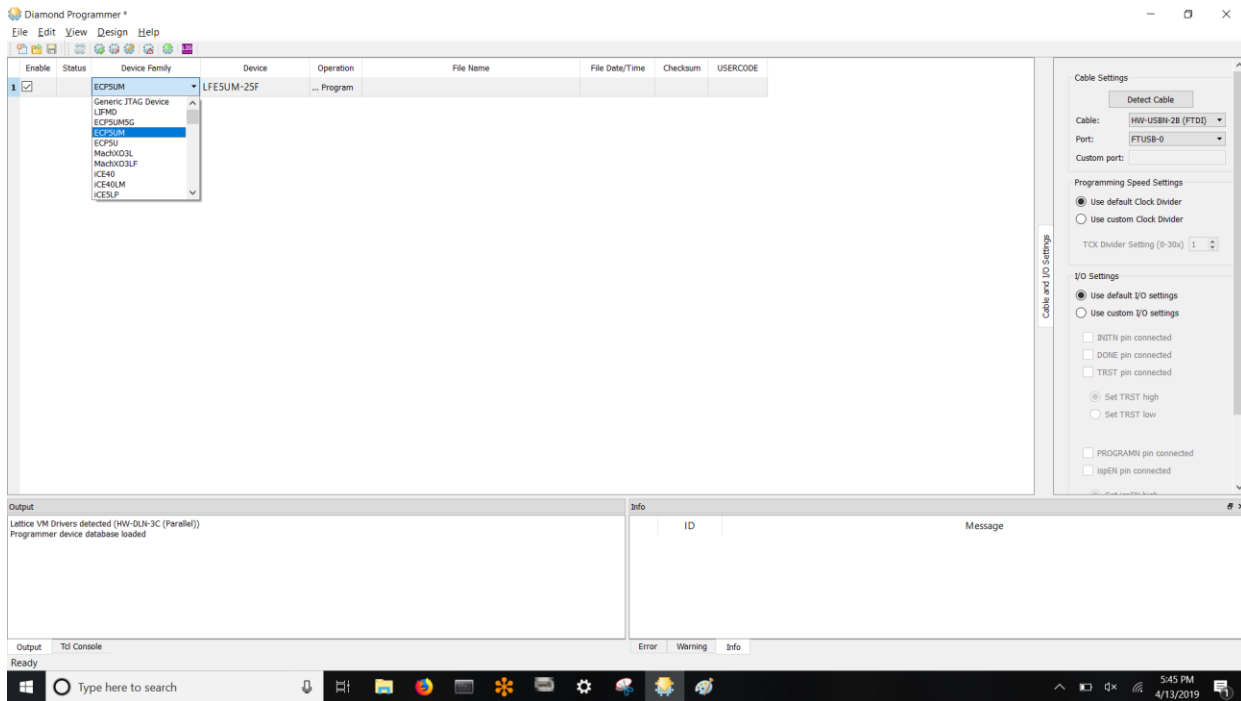


Figure 4.10. Diamond Programmer – Device Family Selection

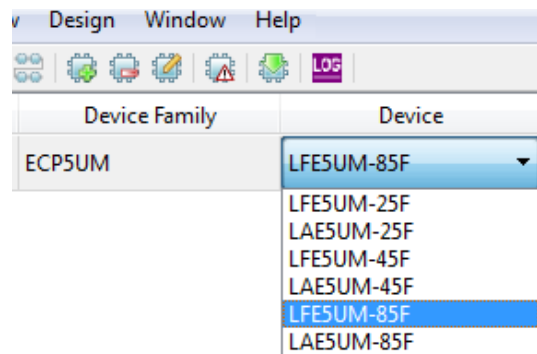


Figure 4.11. Diamond Programmer – Device Selection

4. Right-click and select **Edit > Device Properties**.
5. Select **JTAG 1532 Mode** for **Access mode** and **Erase Only** for **Operation** as shown in Figure 4.12.

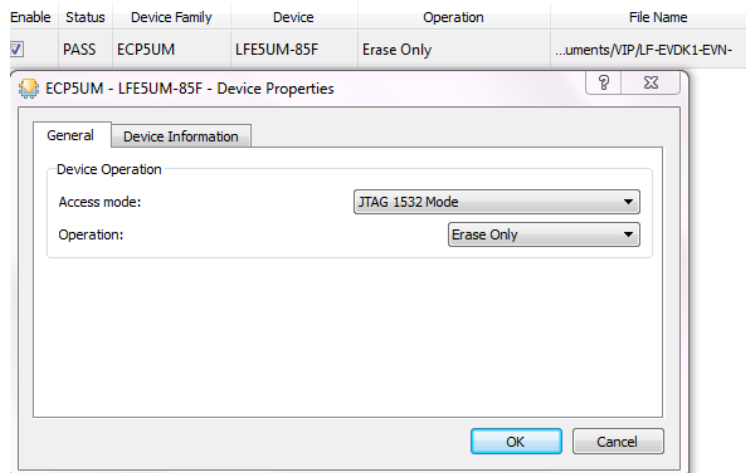


Figure 4.12. Diamond Programmer – Device Operation

6. Click **OK** to close the Device Properties dialog box.

7. Click the Program button  to start the erase operation.

Note: If you power OFF/ON the board, the SPI Flash reprograms the ECP5 device. In this case, you must repeat all the steps.

4.2.2. Programming the ECP5 VIP Processor Board

To program the ECP5 VIP Processor Board:

1. Ensure that the ECP5 device is erased by performing the steps in [Erasing the ECP5 Prior to Reprogramming](#).
2. Right-click and select **Edit > Device Properties**.
3. Apply the following settings:
 - a. Under Device Operation, select the options below:
 - **Access Mode – SPI Flash Background Programming**
 - **Operation – Erase, Program, Verify**
 - b. Under **Programming Options**, select the bitstream file *Raw10toParallel_75MHZ.bit* in **Programming** file.
 - c. For **SPI Flash Options**, refer to [Table 4.1](#):

Table 4.1. Diamond Programmer – SPI Flash Options

Item	Rev B	Rev C - Option 1
Family	SPI Serial Flash	SPI Serial Flash
Vendor	Micron	Macronix
Device	SPI-N25Q128A	MX25L12835F
Package	8-pin SO8	8-Land WSON

- d. Click **Load from File** to update the Data file size (Bytes) value.
- e. Ensure that the following addresses are correct:
 - **Start Address (Hex) – 0x00000000**
 - **End Address (Hex) – 0x001D0000**

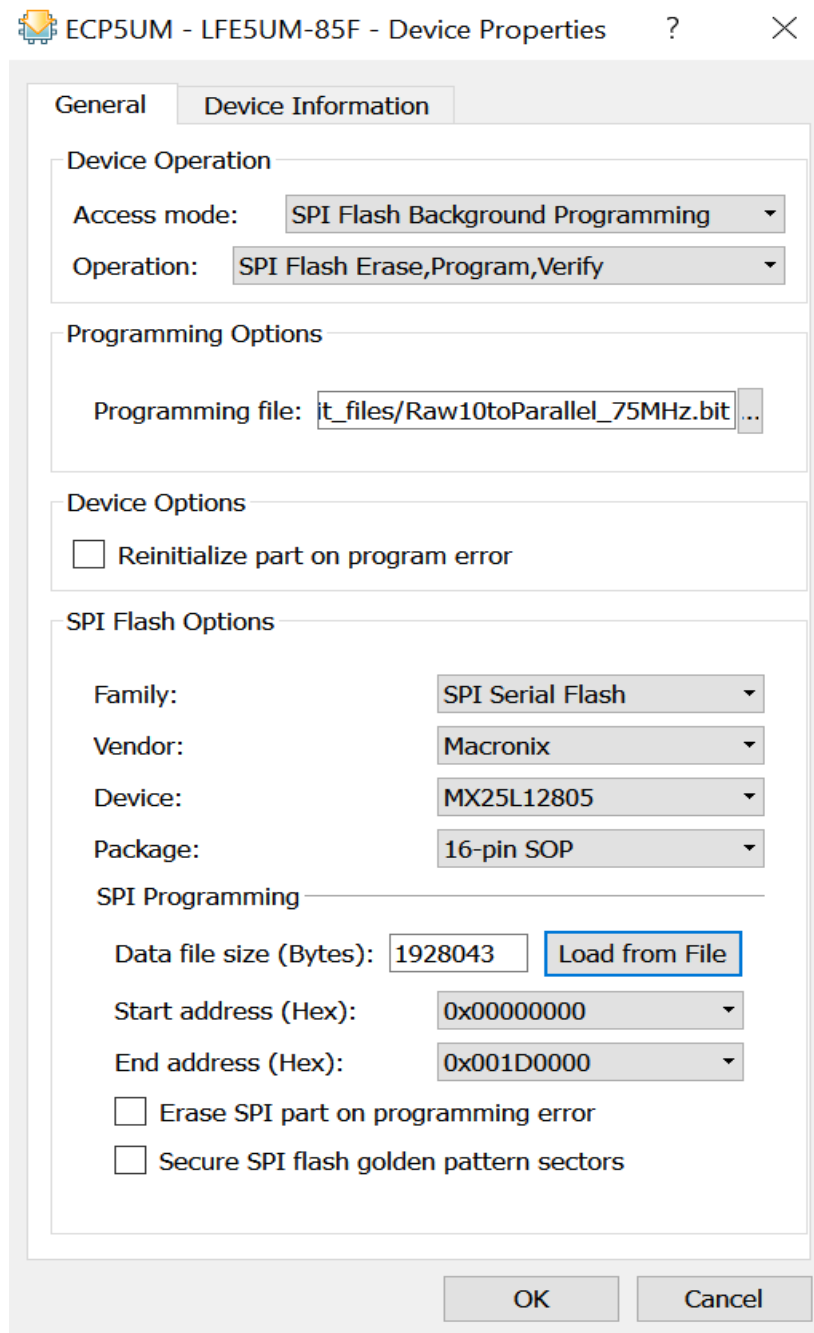


Figure 4.13. Diamond Programmer – Selecting Device Properties Options for ECP5 Flashing

4. Click **OK**.
5. Click the **Program** button  to start the programming operation.
6. After successful programming, the **Output** console displays the result as shown in [Figure 4.14](#).



Figure 4.14. Diamond Programmer – Output Console

5. Running the Demo

To run the demo:

1. Cycle the power on the Embedded Vision Development Kit to allow the ECP5 and CrossLink-NX devices to be reconfigured from Flash.
2. Connect the Embedded Vision Development Kit to the HDMI monitor. The camera image is displayed on monitors as shown in [Figure 5.1](#).

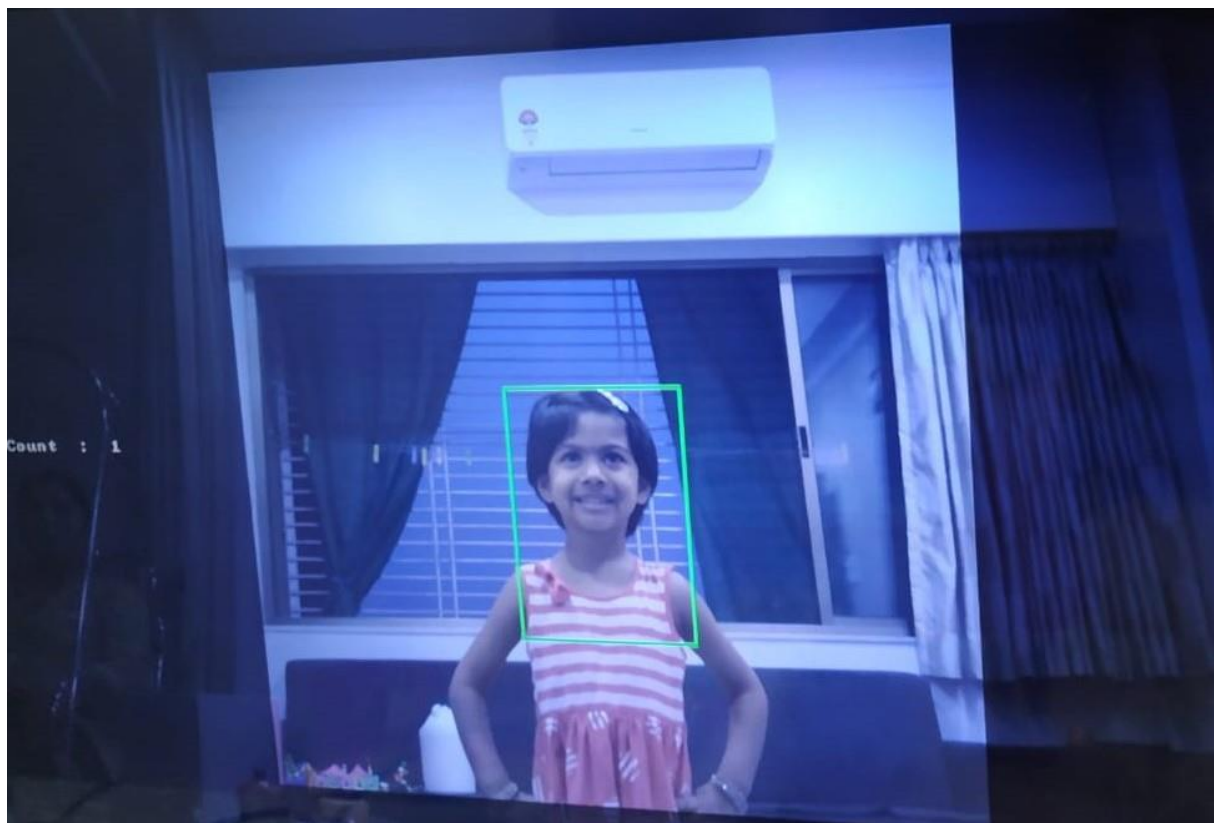


Figure 5.1. Running the Demo

3. The demo output contains bounding boxes for detected humans in a given frame. It also displays the total number of detected humans in a given frame on HDMI output.

6. Preparing the Hardware

To prepare the hardware:

1. Order the LF-EVDK1-EVN and CrossLink-NX VIP Sensor Input Board.
2. Remove the top board of the CrossLink VIP from the LF-EVDK1-EVN. Figure 6.1 shows the EVDK Three-Board Stack.

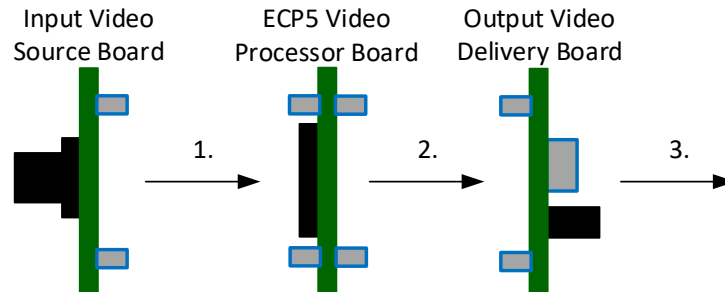


Figure 6.1. EVDK Three-Board Stack

The top board is the CrossLink-NX VIP Sensor Bridge Board with 2 pieces of the IMX214 camera modules.

3. Pop the IMX214 camera module from the CrossLink-NX VIP Sensor Bridge Board carefully.

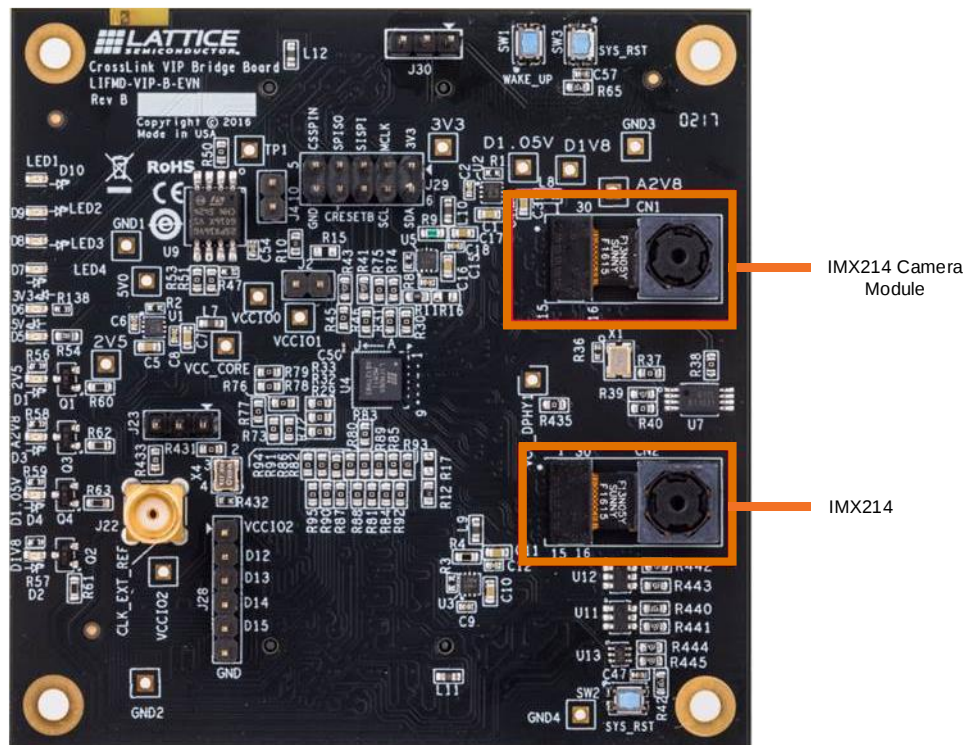


Figure 6.2. CrossLink VIP and IMX214 Camera Modules

4. Remove the four IMX258 Camera modules from the CrossLink-NX VIP Sensor Board.
5. Install one IMX214 Camera module on the CN2 of the CrossLink-NX VIP Sensor Board.
6. Connect the CrossLink-NX VIP Board to ECP5 Video Processor Board and make a CrossLink-NX EVDK as shown in Figure 6.3.



Figure 6.3. CrossLink-NX EVDK Board

Technical Support Assistance

Submit a technical support case through www.latticesemi.com/techsupport.

Revision History

Revision 1.0, May 2020

Section	Change Summary
All	Initial release



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