

EZ-USB™ FX20 DVK (KIT_FX20_FMC_001) kit guide

About this document

Scope and purpose

The EZ-USB™ FX20 DVK (KIT_FX20_FMC_001) kit enables the development of applications based on EZ-USB™ FX20 USB 3.2 Gen 2x2 device controller (CYUSB4024-BZXI) for streaming video and audio seamlessly to the USB host using the off-the-shelf FPGA add-on board and camera modules.

Intended audience

This document is intended for the EZ-USB™ FX20 DVK (KIT_FX20_FMC_001) kit users.

Important notice

Important notice

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Safety precautions

Safety precautions

Note: Please note the following warnings regarding the hazards associated with development systems.

Table 1 Safety precautions


	Caution: <i>The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.</i>
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Introduction

1 Introduction

The EZ-USB™ FX20 DVK (KIT_FX20_FMC_001) kit is based on the EZ-USB™ FX20 product family of Infineon's USB 20 Gbps device controllers.

EZ-USB™ FX20 is a family of USB 20 Gbps peripheral controllers targeting the next-generation USB applications in camera, video, imaging, and data acquisition markets. EZ-USB™ FX20 consists of dual Arm® Cortex®-M4 and M0+ core CPUs, 512 KB flash, 128 KB SRAM, 128 KB ROM, seven Serial Communication Blocks (SCBs), cryptography accelerator, and high-bandwidth data subsystem providing DMA data transfers between LVDS and USB ports at speeds up to 20 Gbps. An additional 1 MB SRAM is included in the high-bandwidth data subsystem to provide buffering for the USB data. EZ-USB™ FX20 also supports USB Type-C plug orientation detection and flip-mux function without the need for external logic. This kit is intended to be a solution demo kit for video and audio streaming applications from block camera to a PC via USB-C interface.

See the device [datasheet](#) to understand and compare the various features supported by EZ-USB™ FX20 controllers.

The EZ-USB™ FX20 DVK (KIT_FX20_FMC_001) supports the following key features:

- Stream video and audio seamlessly to a USB host
- USB bus-powered and self-powered operation
- Onboard regulators

For EZ-USB™ FX20 controller details, see the [EZ-USB™ FX20 kit webpage](#).

1.1 DVK contents

[Table 2](#) lists the EZ-USB™ FX20 DVK (KIT_FX20_FMC_001) contents.

Table 2 DVK contents

Item	Type	Comments
EZ-USB™ FX20 baseboard	Hardware	–
USB-C cable	Cable	This cable supports 10 Gbps in each lane. Hence it can be used for USB 3.2 Gen 2x2 applications
Hard copy of the quick-start guide (QSG)	Documentation	–
Kit casing	Package	–
Foam	Package	To protect and maintain proper placement in the kit container

Introduction

1.2 Download kit documents and hardware design files

Download the KIT_FX20_FMC_001 kit documents and the hardware design files from the [EZ-USB™ FX20 kit webpage](#). The documents include a quick start guide (QSG), kit user guide (this document), and release notes. The hardware design files include schematics, bill of materials (BOM), and layout files.

1.3 EZ-USB™ FX20 baseboard details

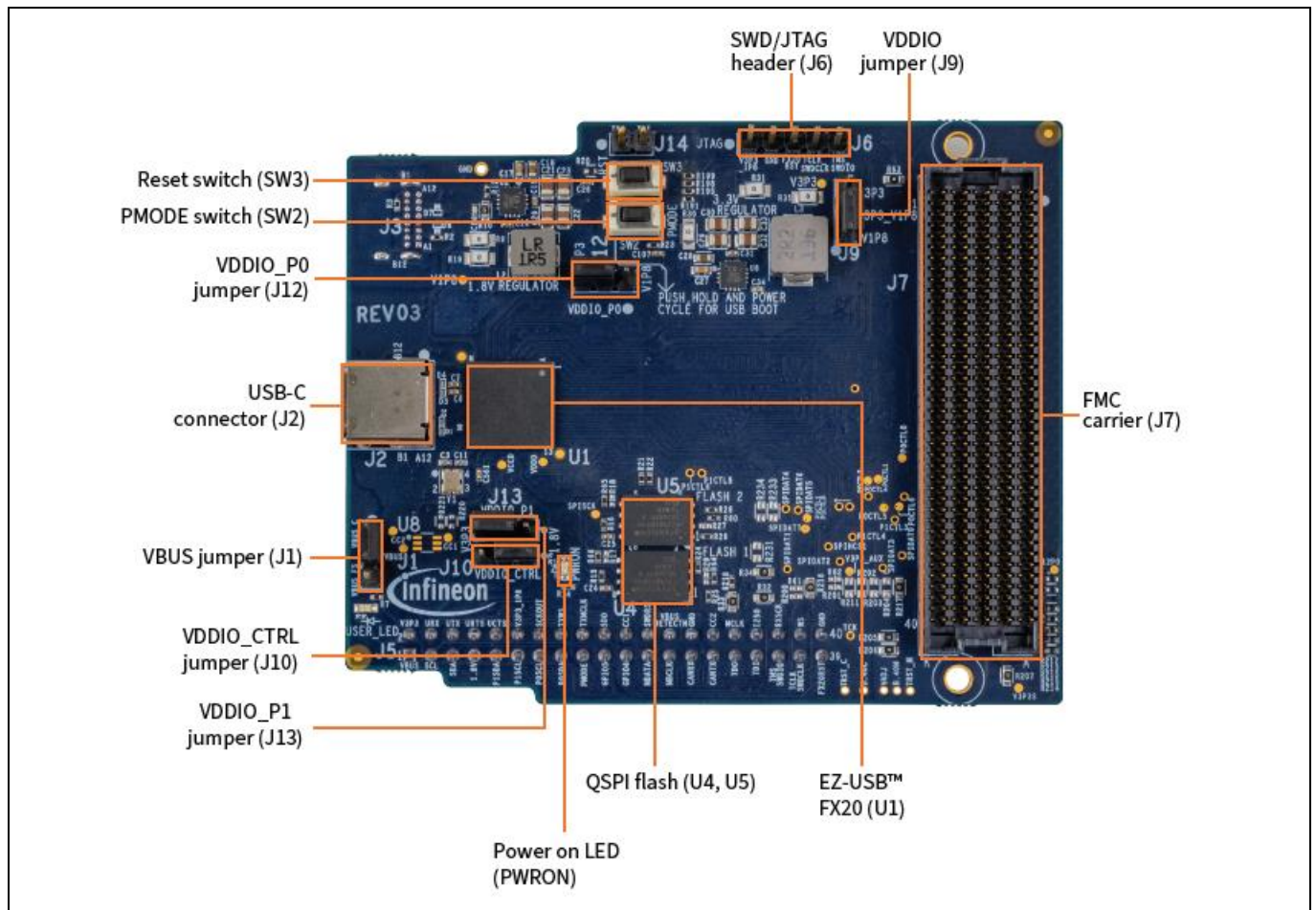


Figure 1 EZ-USB™ FX20 baseboard – top view

Introduction

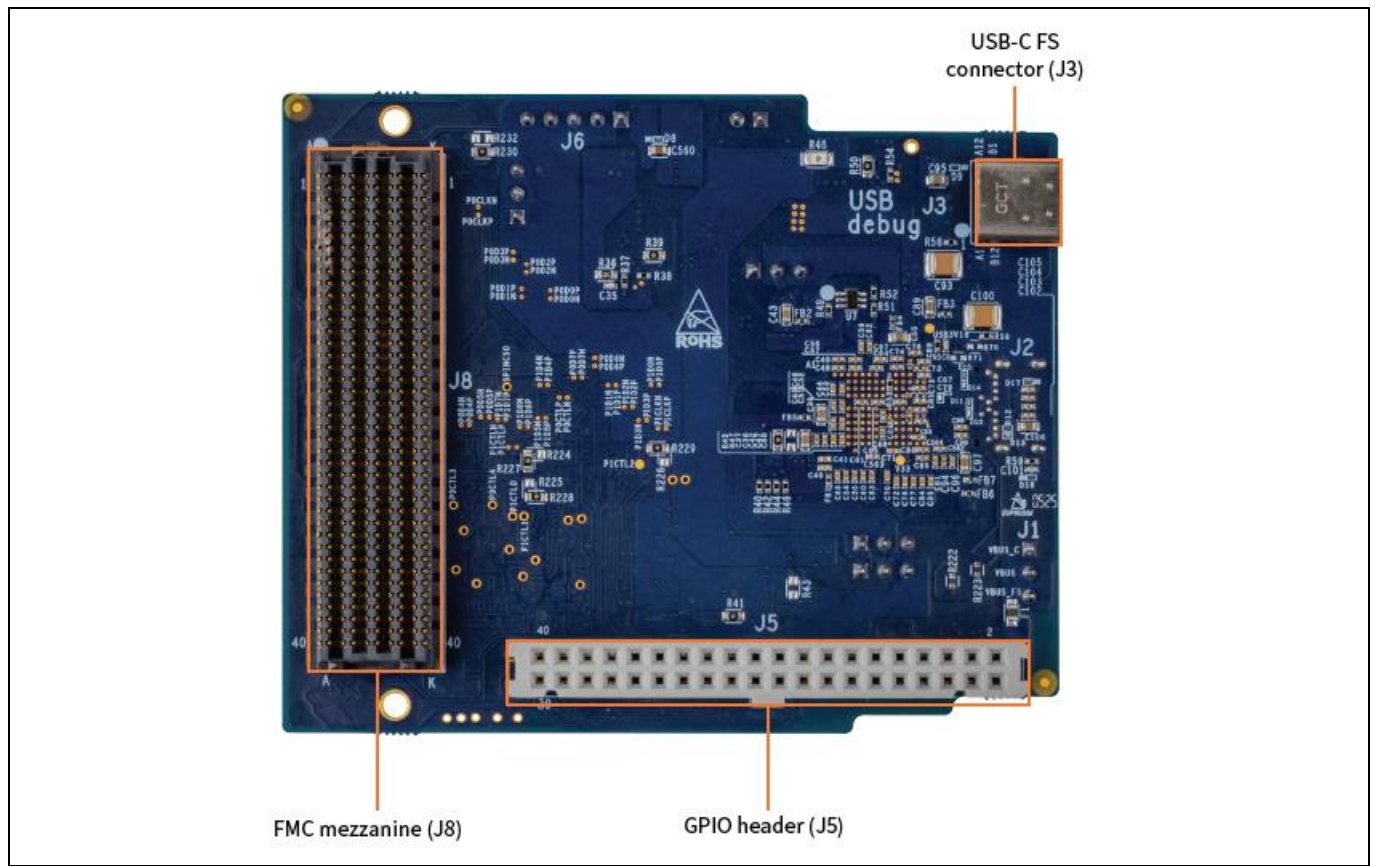


Figure 2 EZ-USB™ FX20 baseboard – bottom view

1.4 EZ-USB™ FX20 baseboard features

- EZ-USB™ FX20 controller
- Two QSPI SPI flash
- Onboard regulators: 1.8 V and 3.3 V DC-DC switching regulators
- Boot mode switch for selecting USB boot or SPI boot
- FMC-HPC mezzanine connector to interface EZ-USB™ FX20 DVK with FPGA boards
- FMC-HPC carrier connector to interface other carrier boards with FPGA boards
- 40-pin GPIO header for interfacing the GPIO accessory board (ASSY_GPIO_001)
- SS USB port for data transfers at speeds up to 20 Gbps
- FS USB port for data logging

Installing the kit software

2 Installing the kit software

Download the EZ-USB™ FX20 SDK from the [EZ-USB™ FX20](#) kit webpage.

Install the following software. The installation of the following software may require administrator privileges.

EZ-USB™ Control Center

Download and install the EZ-USB FX Control Center application from the [webpage](#).

Pleora eBUS Player

For USB3Vision (U3V) video streaming, download and install Pleora eBUS Player:

- For [Windows 64-bit](#)
- For [Windows 32-bit](#)

KIT_FX20_FMC_001 system design

3 KIT_FX20_FMC_001 system design

The EZ-USB™ FX20 baseboard is bus-powered and needs a USB-C cable to connect to the PC. To demonstrate the full functionality of the kit and FPGA, the add-on board must be connected to the EZ-USB™ FX20 DVK.

3.1 Top-level hardware design

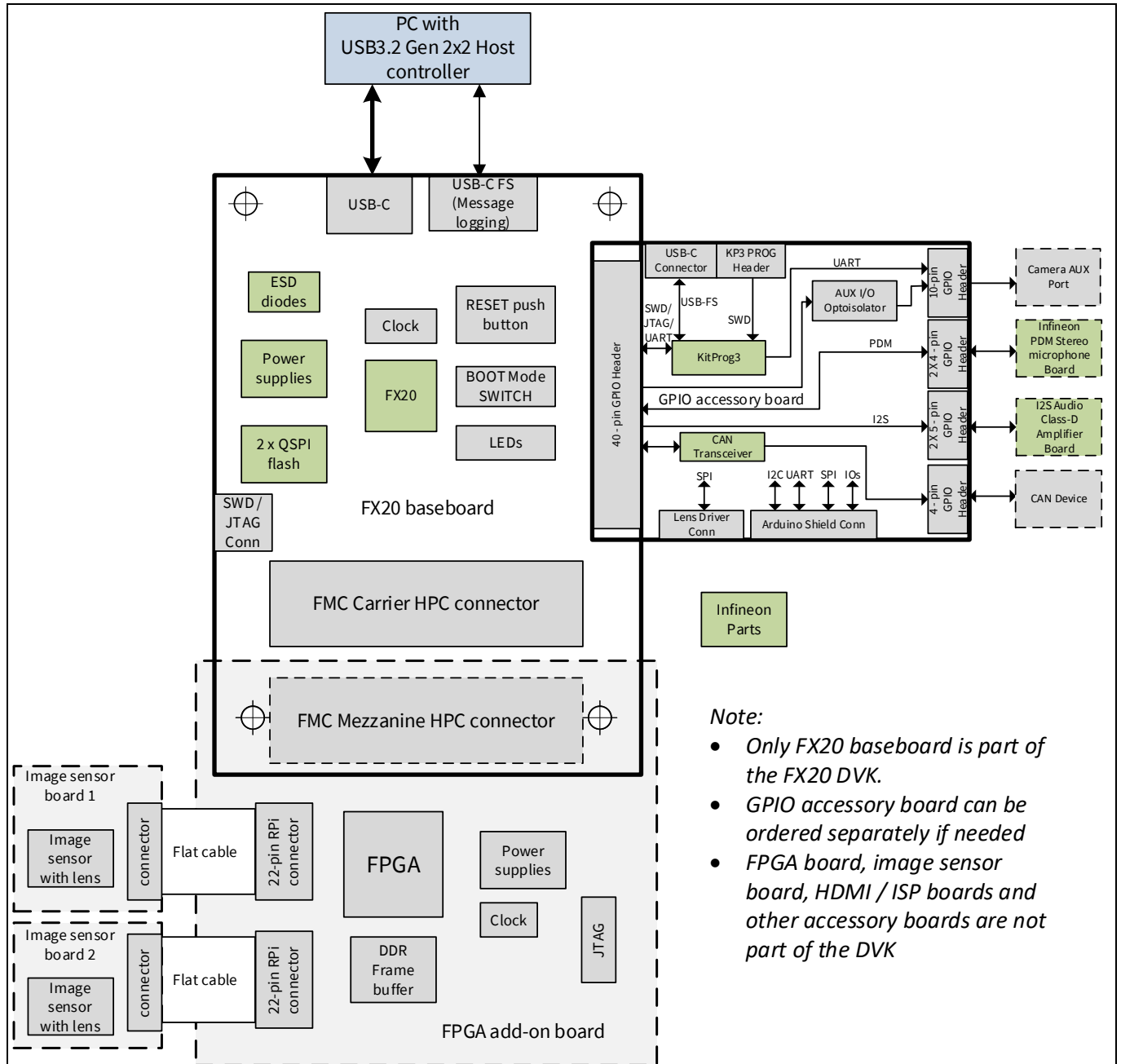


Figure 3 EZ-USB™ FX20 DVK block diagram

KIT_FX20_FMC_001 system design

3.2 KIT_FX20_FMC_001 EZ-USB™ FX20 DVK design details

The KIT_FX20_FMC_001 EZ-USB™ FX20 DVK consists of the following:

- EZ-USB™ FX20 silicon (CYUSB4024-BZXI)
- Two external QSPI Flash modules
- Power supplies
- 24 MHz crystal
- USB-C SS connector
- USB-C FS connector
- FMC HPC mezzanine connector to connect with the add-on FPGA board
- GPIO interface connector for GPIO accessory board
- FMC HPC carrier connector to provide access to the pins of the FPGA board that are not used by FX20 DVK

3.2.1 EZ-USB™ FX20 DVK

3.2.1.1 USB-C SS connector (J2)

The KIT_FX20_FMC_001 kit is bus-powered and uses a USB-C SS connector to interface with the PC through the USB-C cable provided with the kit. The USB3 port of the PC will be able to source a maximum of 5 V at 3 A power through VBUS. The connector used in the DVK is USB-IF certified. This interface has TVS diodes for protection against ESD.

3.2.1.2 Mode selection switch (SW2)

This switch selects the mode in which EZ-USB™ FX20 must boot upon power-on. The kit can boot in two modes based on the position of this switch.

Table 3 Boot modes

Boot mode	SW2	Description
USB	ON	Hold the push button (SW2) and power cycle the KIT either by pressing and releasing the RESET button (SW3) or removing and reconnecting the USB-C cable
Internal flash memory	OFF	Default

KIT_FX20_FMC_001 system design

3.2.1.3 Power supply

The kit is bus-powered. VBUS supply from the host PC can be disconnected from the kit by removing the jumper from connector J1 pin 1-2.

The board consists of two IR3883MTRPBF regulators from Infineon Technologies. It is a DC-DC buck switching regulator rated for 3 A. With a 16PQFN package, the regulator features overvoltage protection, overcurrent protection, and overtemperature protection. The following voltages are generated from VBUS (i.e., $5\text{ V} \pm 0.25\text{ V}$) and the rating of each regulator is:

- U6: $3.3\text{ V} \pm 5\%$ at 3 A
- U2: $1.8\text{ V} \pm 5\%$ at 3 A

Jumpers J9, J10, J12, and J13 are 3-pin headers that can be used to switch the VDDIO supply between 1.8 V and 3.3 V. Shorting the pins 1-2 in these jumpers will set the voltage at respective supply pin to 1.8 V. Similarly, shorting the pins 2-3 in these jumpers will set the voltage at respective supply pin to 3.3 V.

Table 4 DVK jumper settings

Name	Jumper	Short 1-2	Short 2-3
V3P3_1P8	J9	1.8 V	3.3 V
VDDIO_CTRL	J10	1.8 V	3.3 V
VDDIO_P0	J12	1.8 V	3.3 V
VDDIO_P1	J13	1.8 V	3.3 V

Note: For LVDS operation, VDDIO_P0 and VDDIO_P1 must be kept at 3.3 V. VDDIO_P0_CTRL and VDDIO_P1_CTRL can be at either 1.8 V or 3.3 V depending on the desired CTRL signal logic level.

3.2.1.4 EZ-USB™ FX20 (U1)

EZ-USB™ FX20 is a 20 Gbps device controller with a bandwidth to support USB 3.2 Gen 2x2 based host systems. It supports UVC, UAC, U3V, and USB Vendor Class protocols. The EZ-USB™ FX20 DVK is designed to stream video and audio seamlessly to USB host using off-the-shelf FPGA add-on boards and camera modules. It is a 169-ball, $10\text{ mm} \times 10\text{ mm} \times 1.2\text{ mm}$, 13×13 ball array, 0.75 mm pitch FBGA. See the [datasheet](#) for more details on EZ-USB™ FX20.

3.2.1.5 QSPI flash (U6, U7)

The kit has two Infineon S25FS256SDSNFI000 256 Mb QSPI flash devices. When the DVK is interface with an FPGA board, it is necessary to store the FPGA bin file in a flash memory. The DVK on-board flash modules can be used for this purpose.

3.2.1.6 FMC HPC mezzanine connector (J8)

The kit uses an ASP-134488-01 FMC-HPC mezzanine connector to interface with off-the-shelf FPGA boards. It is a 400-pin, 1.27 mm pitch connector that supports ANSI/VITA 57 standard. All the high bandwidth subsystem interfaces are brought to the FMC connector.

3.2.1.7 FMC HPC carrier connector (J7)

The kit has an onboard ASP-134486-01 FMC HPC carrier connector that allows you to connect the FMC carrier boards. All unused signals of FMC mezzanine connectors are brought to the FMC carrier connector. FPGA boards can use these signals to communicate with the FMC carrier boards.

3.2.1.8 GPIO interface connector (J5)

The kit has a 2x20-pin GPIO connector to interface with GPIO accessory board. All the low-speed peripheral signals of EZ-USB™ FX20 are brought to this connector. Using the GPIO accessory board, you can interface with external add-on modules such as CAN transceivers, PDM microphones, UART devices, KitProg3 programmer for programming EZ-USB™ FX20 bootloader, Arduino shield boards, and I2S devices.

3.2.1.9 USB-C Full-Speed connector (J3)

EZ-USB™ FX20 has a debug access port (DAP) that acts as the interface for device programming and debugging. An external programmer or debugger (the “host”) communicates with the DAP through the device Serial Wire Debug (SWD) or JTAG interface pins through the USB-C Full-Speed connector.

3.2.1.10 SWD header (J6)

This DVK provides a SWD header interface that can be used to program the EZ-USB™ FX20 device. J6 along with J14 can be used for JTAG operation. This interface can also be used for boundary scan operations.

3.2.1.11 Crystal (Y1)

EZ-USB™ FX20 needs a 24 MHz crystal to generate the clock for its operation having tolerance ± 10 ppm and drive level 100 μ W.

3.2.1.12 LED (USER_LED, PWRON)

- LED1 (user LED): Green LED connected to GPIO5 of EZ-USB™ FX20. It is an application/firmware-controlled LED used for the FW debug purpose
- LED2 (PWR ON): With power-on, this LED glows green, indicating the 3.3 V power supply is ON

Programming the kit

4 Programming the kit

The KIT_FX20_FMC_001 kit is preprogrammed with the internal colorbar firmware to stream 4K UVC color bar video generated internally inside EZ-USB™ FX20. This allows you to stream the color bar video without the need of an FPGA board. Do the following steps if you need to change the firmware.

4.1 Program the user application

1. Following the SDK user guide, build the code example project which you want to program on the kit
2. Open EZ-USB™ FX Control Center application from the installed directory

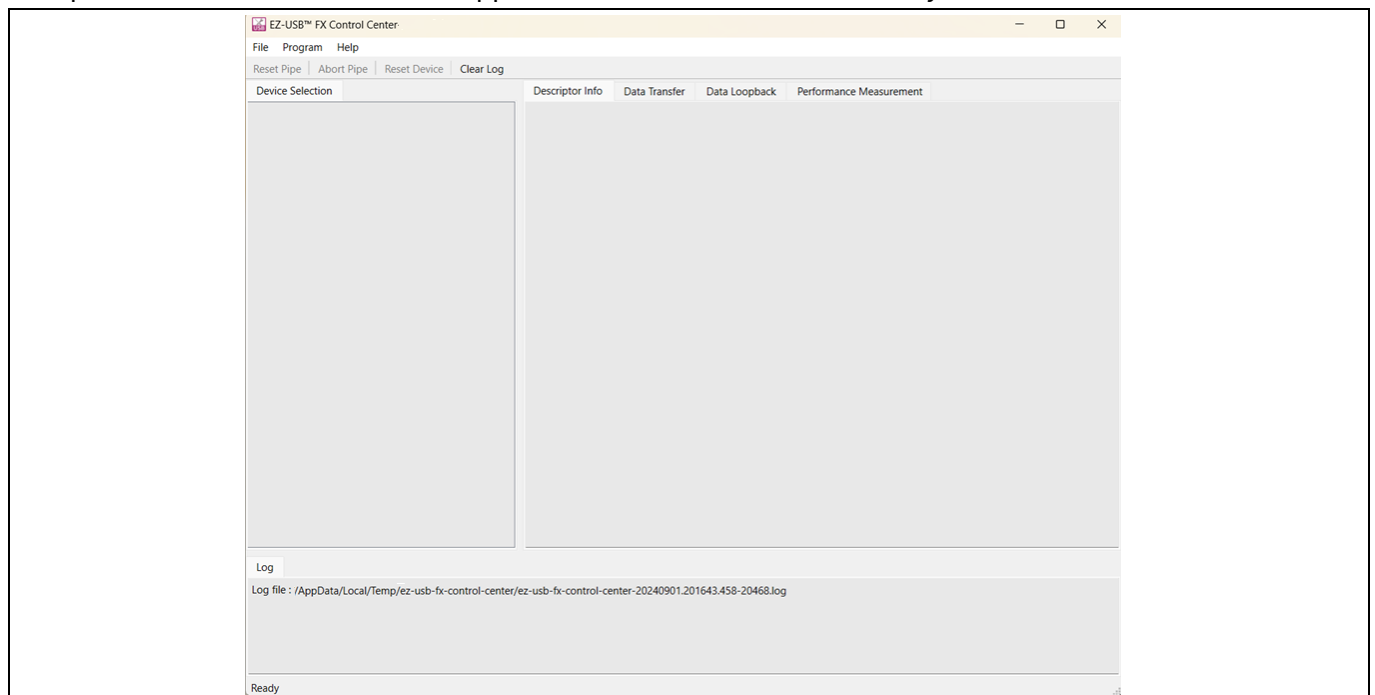


Figure 4 EZ-USB™ FX Control Center

3. Connect the EZ-USB™ FX20 DVK to the PC via the USB-C cable provided with the kit
4. Press and hold the PMODE switch (SW2) and reset the device by pressing the RESET switch (SW3). Release the PMODE switch (SW2)
5. Wait for the **EZ-USB™ FX Control Center utility** tool to detect the bootloader

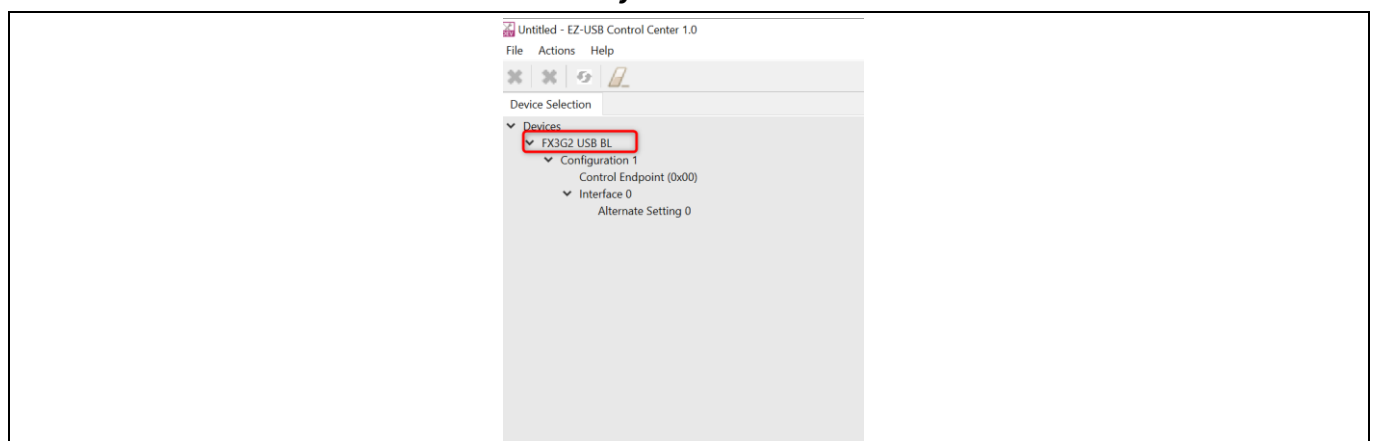


Figure 5 Bootloader detection in EZ-USB™ FX Control Center application

Programming the kit

6. Do the following to program the device:

Click **FX3G2 USB BL** > Click **Program** > Click **Internal Flash**

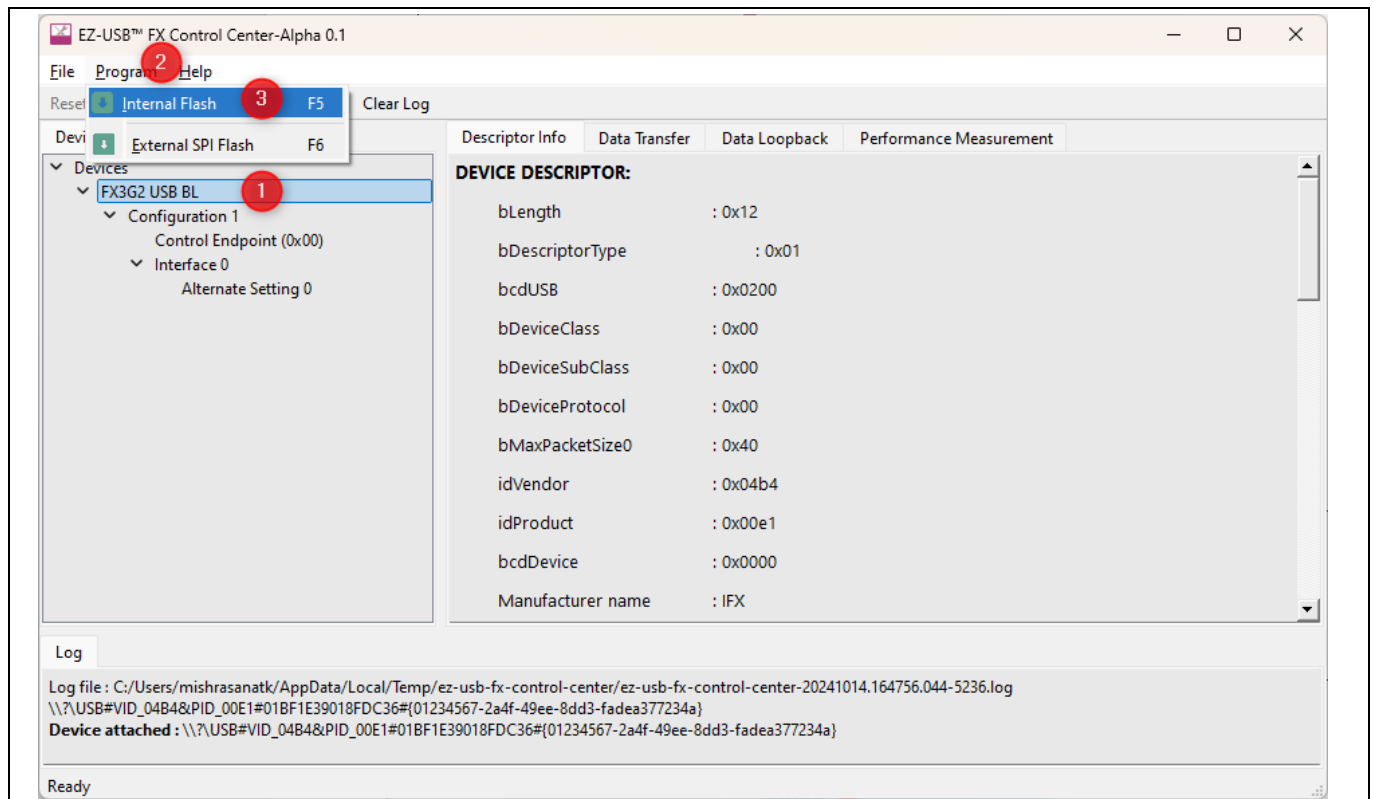


Figure 6 Program in Control Center application

7. Navigate to the <Drive>\EZ-USB FX20 Release Package\SDK\<project folder>\out folder based on the code example project. Select the hex file to program and click **Open**

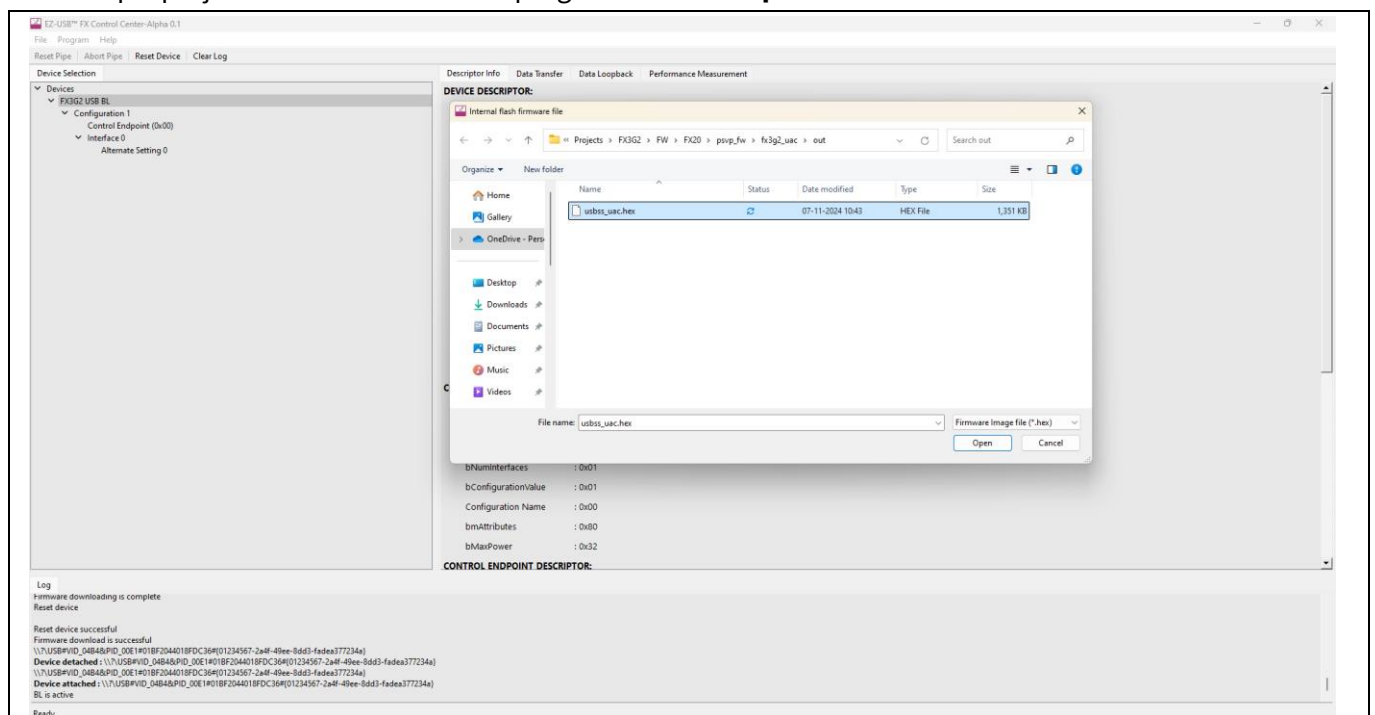


Figure 7 Programming EZ-USB™ FX20

Programming the kit

8. Wait for programming to complete. Observe the EZ-USB™ FX20 device detach message in the **Log** window.

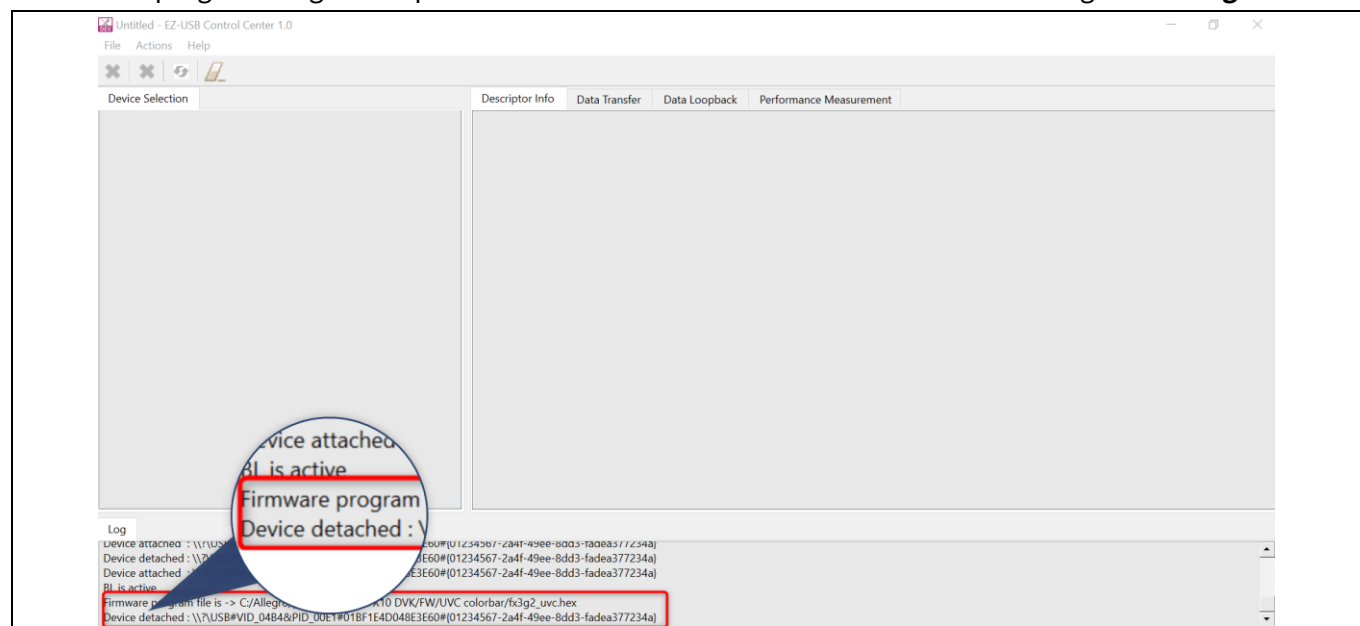


Figure 8 **Programming successful Log window**

Run the application (internal color bar)

5 Run the application (internal color bar)

5.1 Viewing the UVC output using windows camera application

1. Follow the instructions in the SDK user guide to build the `uvc_inmem` project
2. Program EZ-USB™ FX20 with the generated `.hex` file by following the steps mentioned in the [Program the user application](#) section
3. Open Windows **Device Manager** and verify that the EZ-USB™ FX20 camera is listed



Figure 9 Board enumerated as FX3G2 device in Windows Device Manager

Note: The enumeration name can vary based on the latest FW available.

4. Open the Windows Camera application and click the flip camera option. Ensure the resolution selected is 3840X2160 in the settings window. Observe the video streaming

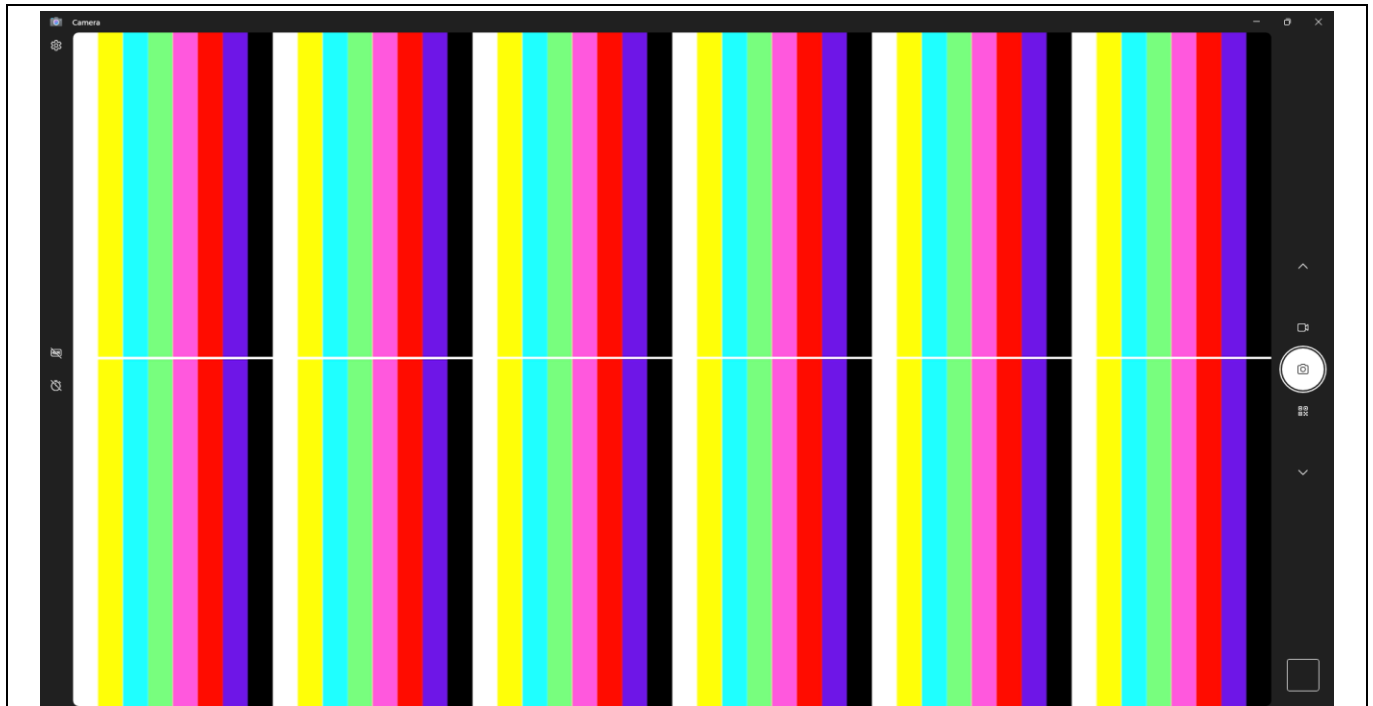


Figure 10 Streaming on Windows Camera application

Run the application (internal color bar)

5. On a USB 3.2 Gen 2x2 host, the frame rate will be ~124 fps. This can be viewed on the serial terminal such as Tera Term. Take a USB-C FS cable and connect its one end to J3 and the other end to a PC. Open any serial terminal application such as Tera Term. Select the correct COM port and you see the debug logs printing ~124 fps.

5.2 Viewing the U3V output (color bar) using eBus Player application

1. Follow the instructions in the SDK user guide to build the *u3v_inmem* project
2. Program EZ-USB™ FX20 with the generated *.hex* file by following the steps mentioned in the [Program the user application](#) section
3. Check the **Device Manager** for USB enumeration

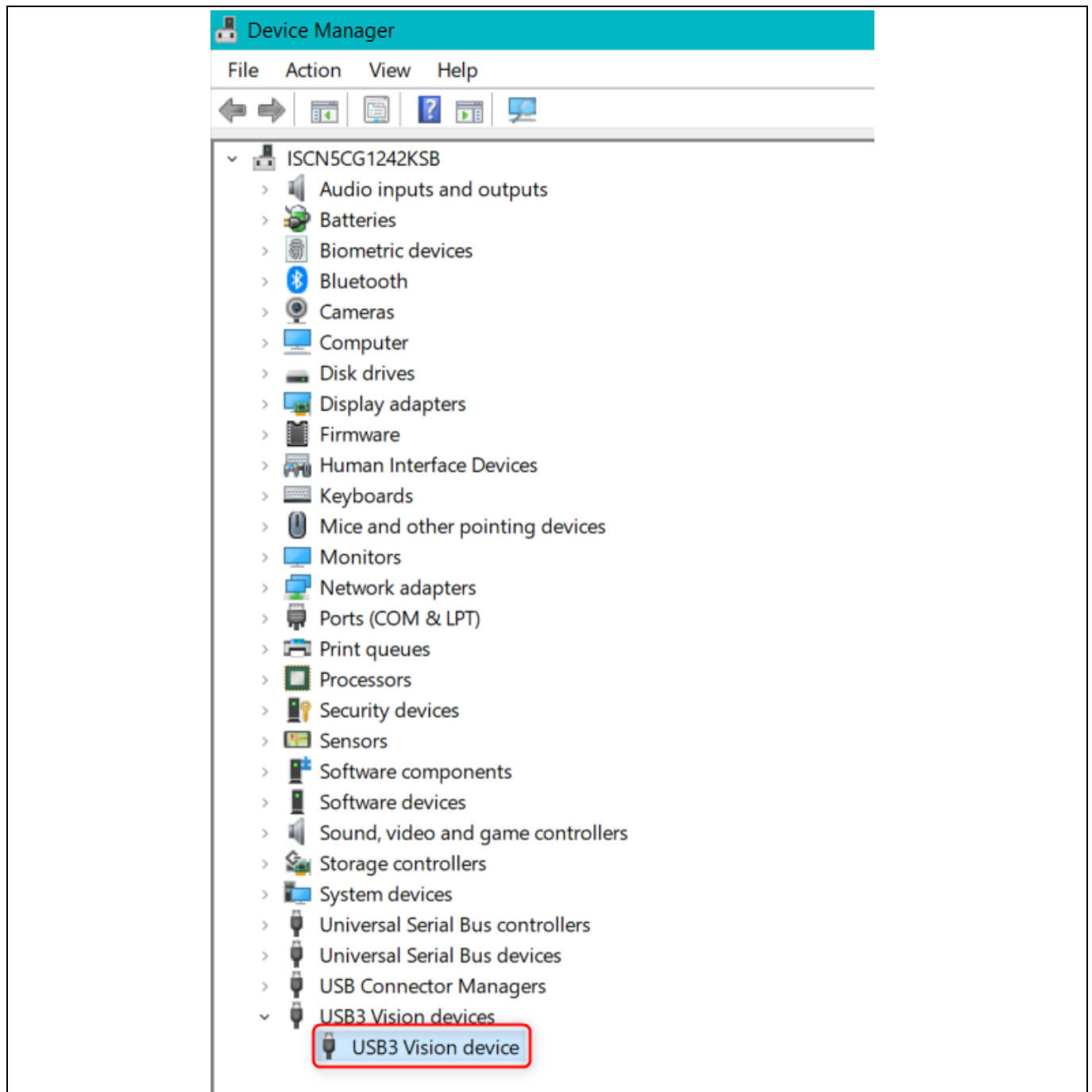


Figure 11 U3V device enumeration

Run the application (internal color bar)

4. Open eBus Player application and do the following:
 - a) Go to **Select/Connect**
 - b) Select the available device. For example, **FX3G2**
 - c) Press **OK**

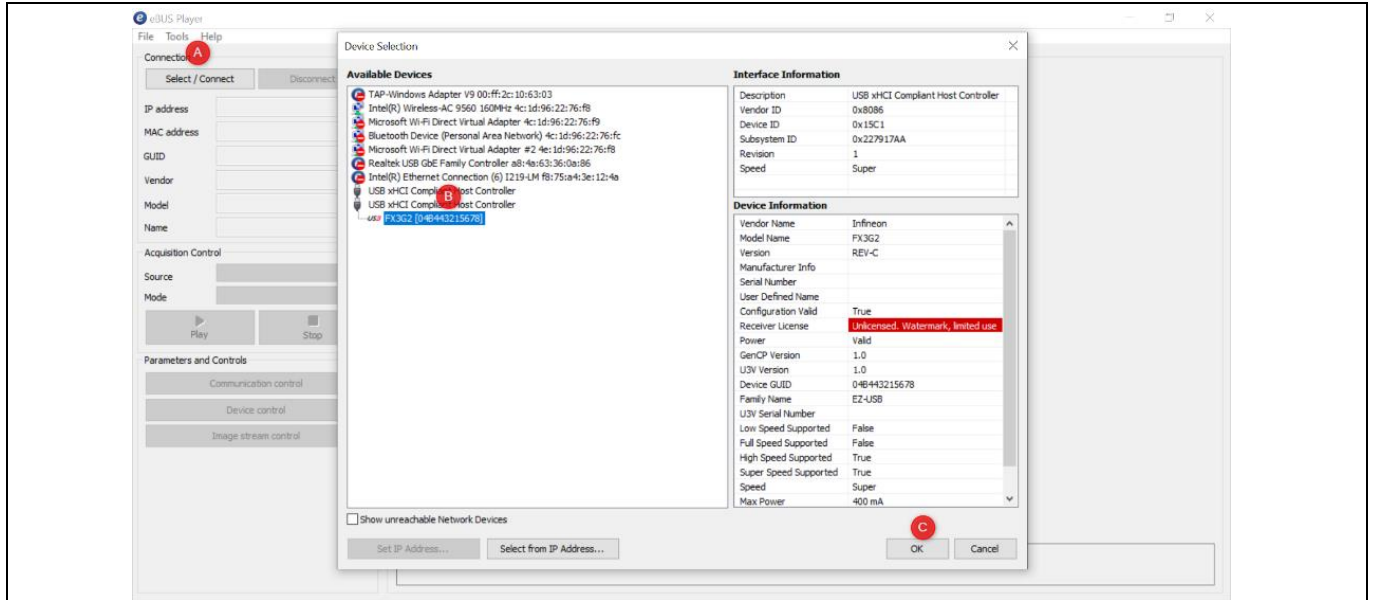


Figure 12 eBus Player settings

5. Click on **Play** button and observe the video streaming



Figure 13 U3V colorbar streaming

Note: Internal color bar can stream at up to ~124 fps.

6 Troubleshooting

6.1 EZ-USB™ FX20 programming test

1. If EZ-FX™ Control Center is not detecting the EZ-USB™ FX20 device:
 - a) Press and hold the PMODE switch (SW2)
 - b) RESET EZ-USB™ FX20: (Either press the RESET switch SW1 and release or power cycle the kit)
 - c) Release the PMODE switch after a delay

If you have any questions, create a support request on the Infineon [Technical Support](#) page.

References

References

- [1] Infineon Technologies AG: *EZ-USB™ FX20 kit webpage*; [Available online](#)
- [2] Infineon Technologies AG: *EZ-USB™ FX20 datasheet*; [Available online](#)

Glossary

Glossary

DMA

active authentication (AA)

DAP

debug access port

EMC

Electromagnetic Compatibility

ESD

Electrostatic discharge

FW

Firmware

JTAG

Joint test action group

LVDS

Low-voltage differential signaling

PDM

Pulse density modulation

QSPI

Quad serial peripheral interface

SDK

Software development kit

SPI

Serial peripheral interface

SWD

Serial Wire Debug

Revision history**Revision history**

Document revision	Date	Description of changes
**	2024-11-08	Initial release
*A	2025-02-21	Updated FX20-related changes
*B	2025-03-21	Updated FX20 webpage url
*C	2025-03-25	Released to Web

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