

THSEU101 User Manual

Vision System Starter Kit

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V-by-One® HS Vision System Starter Kit overview

The THine Evaluation System for Industrial and Automotive (V-by-One® HS based Image Evaluation System) USB starter kit allows designers to evaluate features of the THCV241A, SerDes transmitter with bi-directional transceiver, for vision solutions working in pair with THCV242A, SerDes receiver with bi-directional transceiver, to increase the distance between an image sensor and a video processing system up to 15 meters using V-by-One® HS. The V-by-One® HS Vision System Starter Kit allows evaluating a number of cable and connector types, such as FAKRA and SMA. The goal of the V-by-One® HS Vision System Starter Kit is to allow maximum flexibility for evaluating THCV241A and THCV242A, and serving as a design aid.

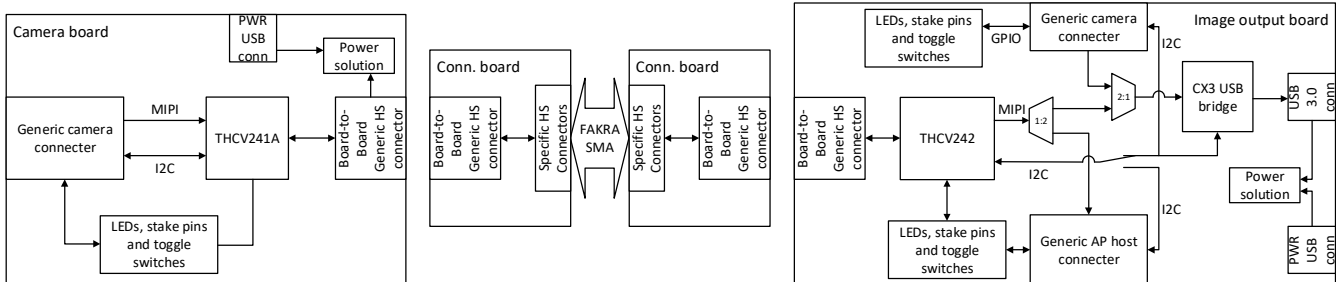
This User's Guide will help in understanding the boards' functions and how to use them. The QUICK START GUIDE provides instructions for the out-of-the-box setup and demonstration. With the out-of-the-box demonstration, user will be able to confirm the hardware/software functionality.

V-by-One® HS based Image Evaluation System evaluation kit supports all features of the THCV241A and THCV242A, and is designed to provide maximum flexibility in terms of options and video path configurations.

The diagram below shows a high level architecture of the V-by-One® HS Vision System Starter Kit.

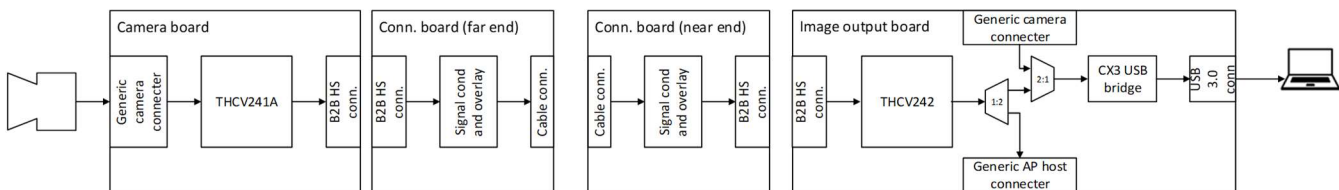
The full kit consists of seven boards and a camera module. The following table provides high level description of these boards.

Board name	Description
Camera board	Designed for maximum flexibility for THCV241A via toggle switches, LEDs, and test points. May be powered from either board-to-board high speed connector or an external power supply.
Connector boards	These boards are responsible for adopting the generic board-to-board interface of the Camera board and Image Output board to a specific cable interface. This includes circuitry for power over V-by-One® HS and Sub-Link overlay. Connector boards are designed to work in pairs, with each pair featuring a specific connector type.
Image Output Board	Designed for maximum flexibility for THCV242A via toggle switches, LEDs, and test points. The Image Output Board allows for receiving video via THCV242A or inputting video from a camera directly via a dedicated connector. The Image Output board allows for outputting video to a host PC via USB3.0 interface or to an external MIPI CSI-2 receiver.

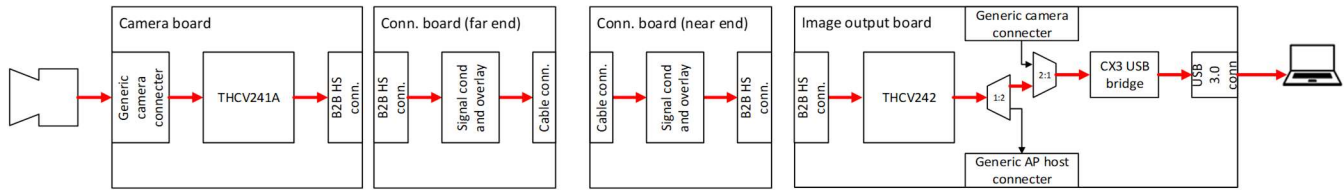


Video path overview

The following simplified block diagram shows V-by-One® HS Vision System Starter Kit video path:

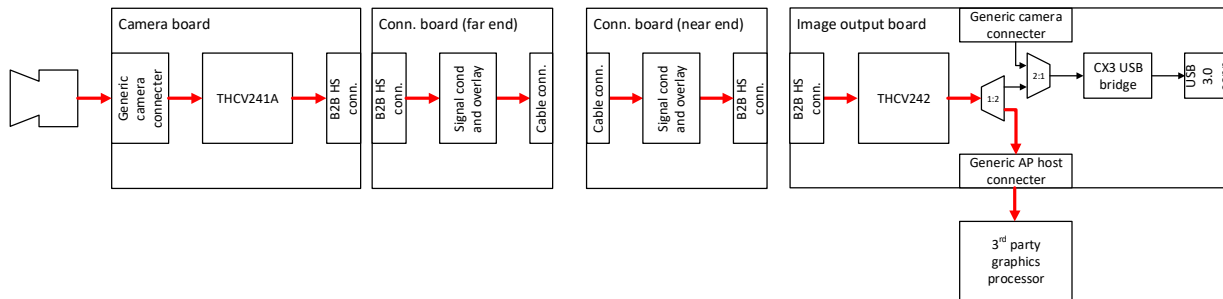


Far-End camera to USB host



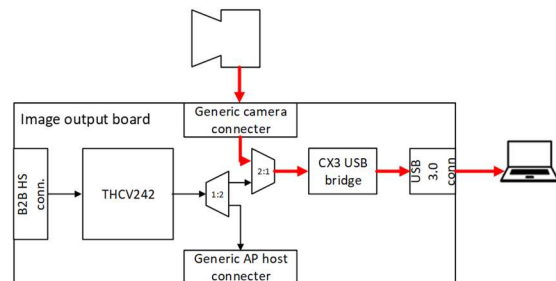
Note: The "no cable" option is NOT supported.

Far-End camera to external processor



Note: the "no cable" option is NOT supported

Near-End camera to USB host



Configuration, control, and status options overview

V-by-One® HS Vision System Starter Kit is designed to be flexible and allows for various configuration and control options:

- *Full control of all options built into the THCV241A and THCV242A via discrete pins and 2-WIRE interface are supported. Discrete pins are controlled via onboard switches. 2-WIRE communication is implemented via V-by-One® HS Sub-Link.*
- *Multiple video path configurations as shown in section below.*

V-by-One® HS Vision System Starter Kit also allows to observe current system state, configuration, and signal quality via:

- *Onboard LEDs*
- *Test points provided on all key signals throughout the entire video path*
- *2-WIRE based I/O expanders monitoring control and status signals throughout the entire design and making it available to the host application*

Kit contents

V-by-One® HS Vision System Starter Kit includes:

- *Camera module*
- *Camera board*
- *Image Output Board*
- *One pair of connector boards for each of the following connector types: FAKRA and SMA*
- *Eight 1.2 meter SMA cable*
- *One USB 3.0 cable*
- *Quick Start Guide*

Out of the box setup and operation

- 1. Connect Image Output Board to FAKRA Near End Board.*
- 2. Connect FAKRA Far End Board to Camera Board to the camera.*
- 3. Connect the 10m FAKRA cable From the Far-End board to RX0 (J300) of the Near-End Board..*
- 4. Configure DIP switches on Camera Board and Image Output Board as shown on the diagram*
- 5. Connect the USB3.0 cable from the Image Output Board to a Host PC. In Windows Device Manager this device will appear under a list of Imaging Devices as THEIA*
- 6. If not already installed, install the latest version of Microsoft Visual C++ 2015 Redistributable.*
- 7. Obtain VSSK PC Software Suite from THine Solutions.*
- 8. Extract package contents into a directory the application will run from and launch the host application.*

In host application, under Devices menu select the THEIA camera.

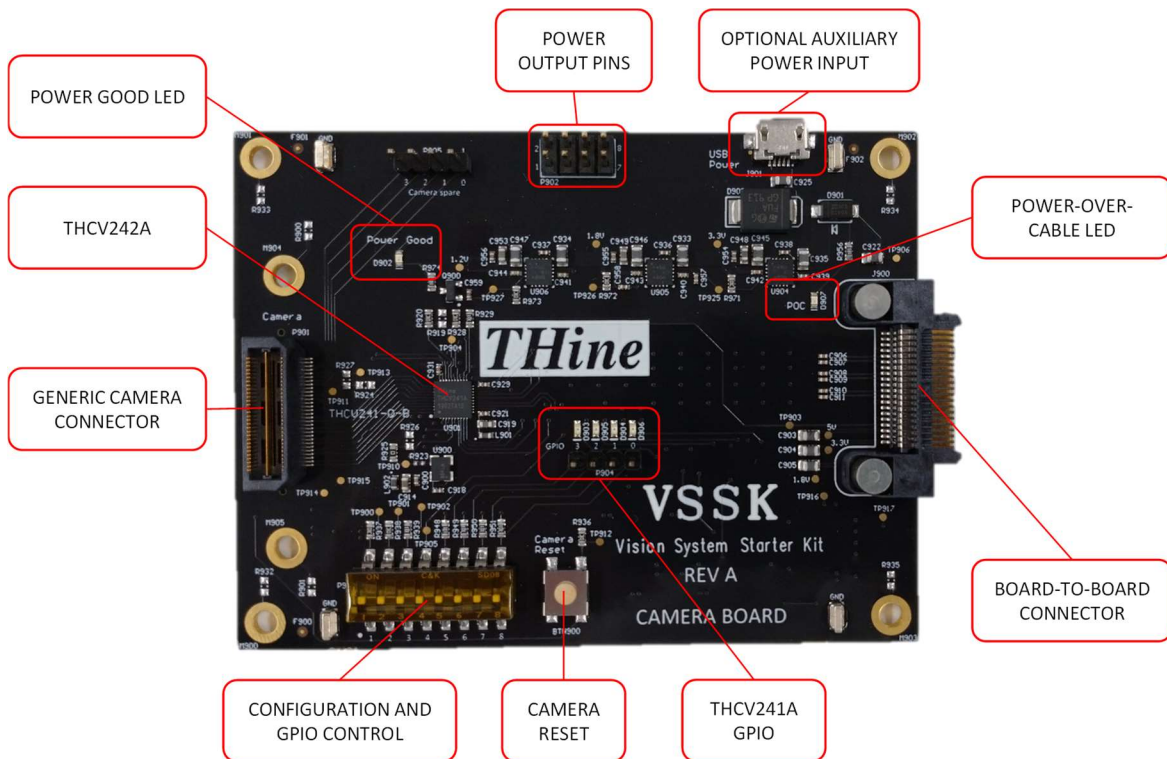
Observe video from the camera in Vby1Viewer application window

Reference and support

V-by-One® HS Vision System Starter Kit design data, programming files, and other support data can be found at <https://www.thinesolutions.com/vision-system-starter-kit>

Camera board

The Camera board hosts the THCV241A bi-directional transceiver receiving MIPI CSI-2 data from an image sensor. Camera configuration is controlled via 2-WIRE interface supported by the CML Sub-Link. Camera board also contains a complete clocking and power solutions. Test points and status indicators are available on the board for all key signals. Camera board may be powered independently by a standard 5V power supply or from the Image Output board through connector boards.



Features

Generic camera connector

V-by-One® HS Vision System Starter Kit utilizes camera adapter boards for interfacing to specific camera modules. V-by-One® HS Vision System Starter Kit is supplied with VSSK Camera. The generic camera connector is implemented with Samtec QTH-030-02-L-D-A. Refer to schematics for pinout and other details.

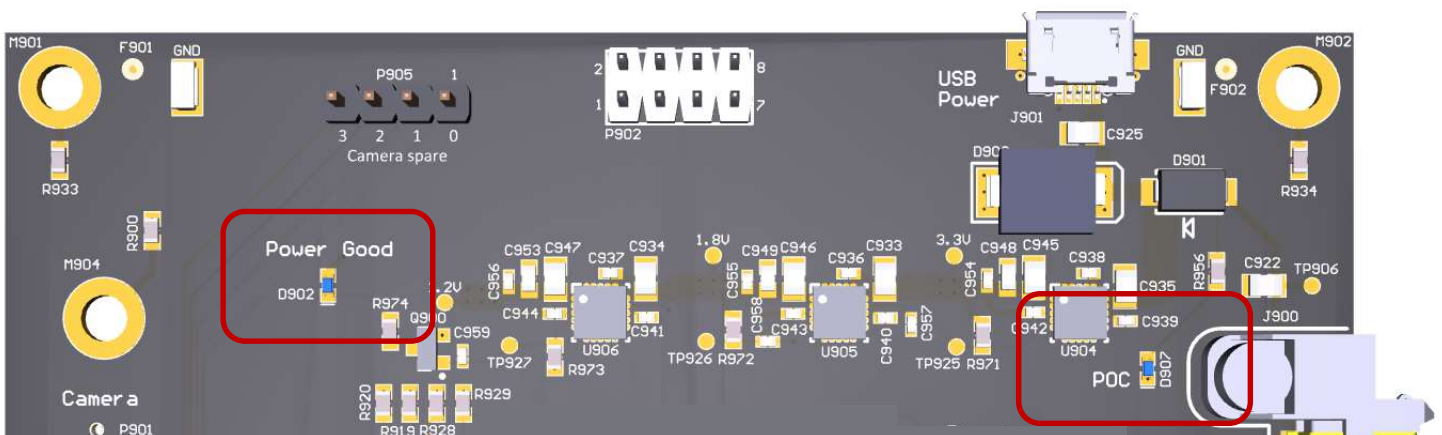
THCV241A-B bi-directional transceiver

THCV241A is designed to support 1080p60 2Mpixel uncompressed video data over 15m 100 Ohm differential STP or single-end 50 Ohm Coaxial cable with 4 in-line connectors between camera and processor via V-by-One® HS. THCV241A supports a MIPI CSI-2. Each CSI-2 data lane can transmit up to 1.2Gbps/lane. Virtual channel is supported. One high-speed V-by-One® HS lane can transmit up to 1080p60fps. The maximum serial data rate is 4Gbps/lane. 2nd output lane supports HDR large amount of data or data copy-and-distribution experience.

Power solution

The camera board can be powered from an external source or from the board-to-board connector. Powering from the board-to-board connector requires the use of a connector board that supports power over V-by-One® HS or proper cable connection in the case of the SMA connector board. When powering the camera board externally via the optional auxiliary power input, connect a 5V adapter via the micro USB connector.

When power is applied to the board from either external adapter or from the board-to-board connector, the LED, D902, labeled Power Good will be illuminated. When power is present from the board-to-board connector, the LED, D907, labeled POC (Power-Over-Cable) will also be illuminated.



Power output pins

Header P902 makes all on-board voltage rails available for the user.

Board-to-board HS connector

Generic high-speed connector is used to transmit all THCV241A signaling to Far-End connector board.

All applicable signal conditioning, CML Sub-Link overlay/extraction, power overlay/extraction, number of links selection is done on connector boards. This approach makes the board-to-board connector completely generic across all of the boards in V-by-One® HS Vision System Starter Kit.

The board to board connector is implemented with Samtec ERM8-020-01-S-D-RA-L-TR. Refer to schematics for pinout and other details.

THCV241A GPIO

THCV241A GPIO signals are routed to LEDs and to a generic header making these signals available for the user. These signals are also routed to the DIP switches described below.

There are four LEDs connected to the four GPIO signals. Each LED will illuminate when there is a logic high present on the signal.



Reset button

The reset button is connected to camera reset signal.

Configuration and GPIO control DIP switches

The block of eight DIP switches P903 allows to control THCV241A configuration pins as well as THCV241A GPIO signals. As it applies to DIP switches: position “down”/ “Off” / “0” means the switch is open, position “up” / “On” / “1” means that switch is closed.

Switch 1 and 2 directly control the THCV241A PDN0 and PDN1 respectively.

Switch 3 and 4, control the value and connection to MSSEL and HTPDN on the THCV241A and used in combination. The MSEL is a dual function signal based on the value of PDN1. Please see datasheet for more details.

Switches 5, 6, 7, 8 are connected to GPIO pins of the THCV241A. Since these pins can be input or output the Switched can control a pull up or pull down value for each signal.

Pin Name	SW#	IC Pin #	Description	Default
PDN0	1	24	Whole IC Power Down SW = 0 (Off) = Logic 1 to THCV241A : Normal Operation SW = 1 (On) = Logic 0 to THCV241A : Power Down	SW = 0 (Off)
PDN1	2	12	Sub-Link Power Down SW = 0 (Off) = Logic 1 to THCV241A : Sub-Link Normal Operation SW = 1 (On) = Logic 0 to THCV241A : Sub-Link Power Down	SW = 0 (Off)
MSSEL	3	22	MSSEL (PDN1=1): Sub-Link Controller/Peripheral Select SW = 0 (Off) = Logic 1 to THCV241A : Sub-Link Peripheral Side SW = 1 (On) = Logic 0 to THCV241A : Sub-Link Controller Side HTPDN (PDN1=0): Hot Plug Detect input Negative polarity.	SW = 0 (Off)
MSSEL/ HTPDN connection	4	N/A	When MSSEL function is HTPDN (PDN1=0), this switch can make the connection of HTPDN to MSSEL pin on THCV241A	SW = 0 (Off)
GPIO3	5	10	GPIO[3] SW = 0 (Off) = Pull down on THCV241A GPIO pin SW = 1 (On) = Pull up on THCV241A GPIO pin	SW = 0 (Off)
GPIO2	6	9	GPIO[2] SW = 0 (Off) = Pull down on THCV241A GPIO pin SW = 1 (On) = Pull up on THCV241A GPIO pin	SW = 0 (Off)
GPIO1	7	8	GPIO[1] SW = 0 (Off) = Pull down on THCV241A GPIO pin SW = 1 (On) = Pull up on THCV241A GPIO pin	SW = 0 (Off)

Pin Name	SW#	IC Pin #	Description	Default
GPIO0	8	7	GPIO[0] SW = 0 (Off) = Pull down on THC241A GPIO pin SW = 1 (On) = Pull up on THC241A GPIO pin	SW = 0 (Off)

THCV241A 2-wire Address

To change the 2-wire device address find the resistors, R919 and R920 and reference the table below.



Pin Name	Pin #	Description	Default
A1N	27	Select Peripheral Address R919 (DNP) / R920 (Populated) = 0 : 2wire serial address = 7'b000_1011 R919 (Populated) / R919 (DNP) = 1 : 2wire serial address = 7'b011_0100	0: 7'b000_1011

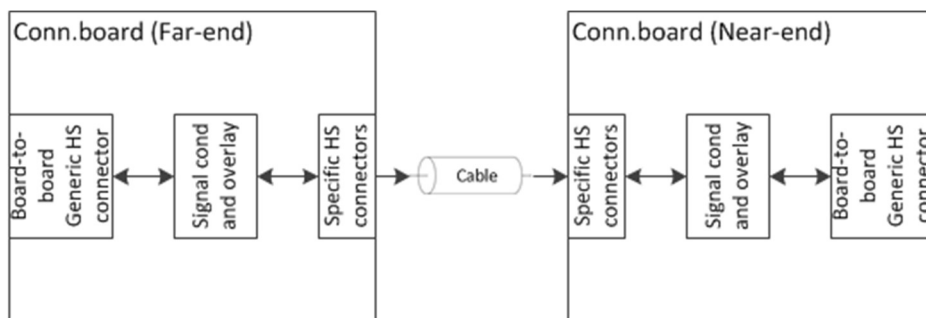
Connector boards

Overview

V-by-One® HS Vision System Starter Kit allows to evaluate four cable/connector options:

- SMA
- FAKRA

Each of these interfaces is implemented via a pair of connector boards. Each pair consists of "Far-End" and "Near-End" connector boards. The "Far-End" connector board connects to the camera board, and the "Near-End" connector board connects to the Image Output board. Functionally, these boards are mirror image of each other. Physically, these boards are different in terms of board-to-board connector gender and its placement.



Connector boards contain all signals conditioning circuitry and corresponding configuration options as it applies to Sub-Link overlay, power overlay, number of links, etc.

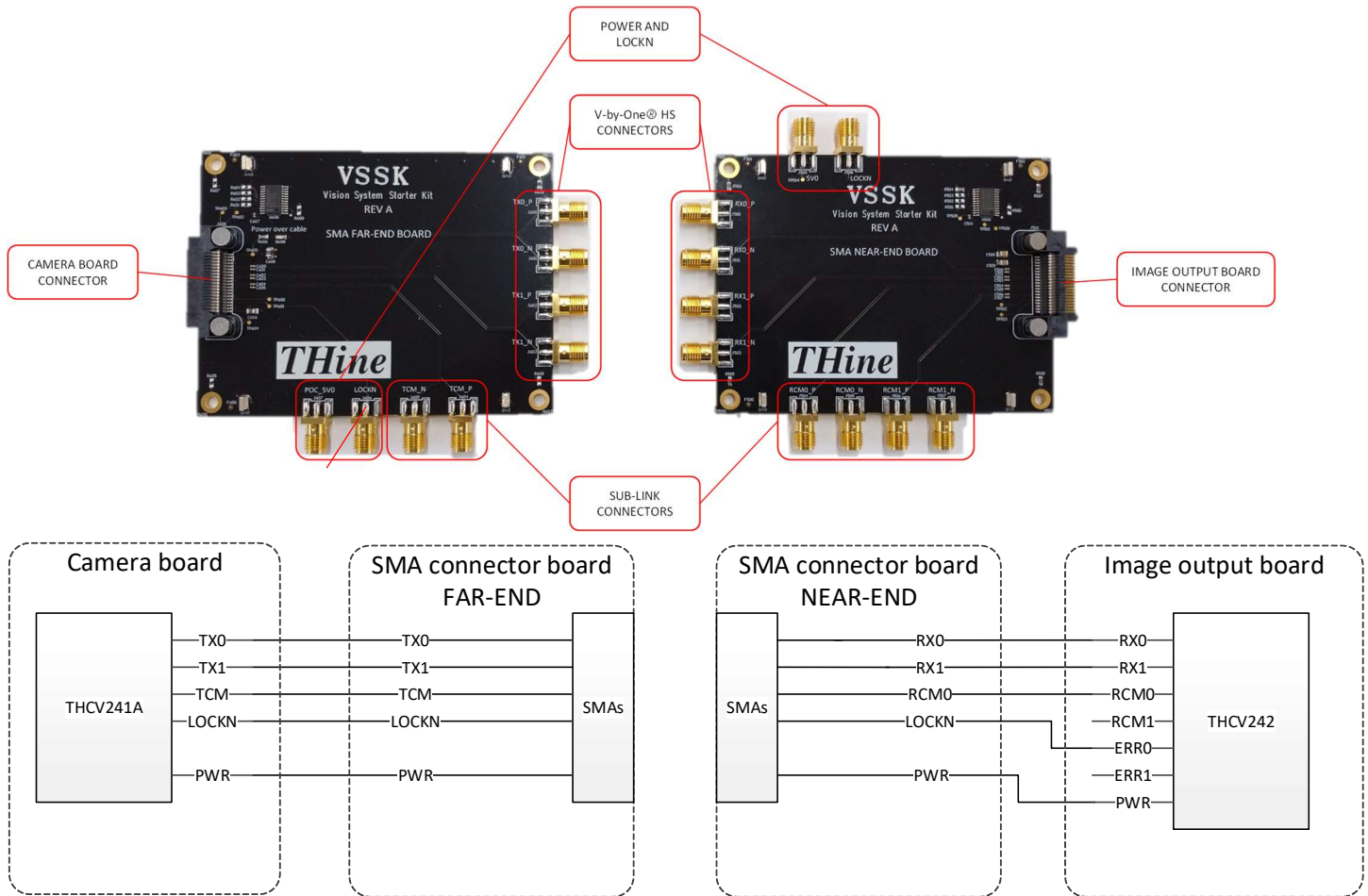
Connector boards serve two purposes:

1. Adapt generic board-to-board interface to a specific cable/connector option.
2. Contain all conditioning circuitry needed for CML Sub-Link overlay, power over V-by-One® HS, and other options (where applicable).

Connector boards also have circuitry that allows the host application to identify which connector cards are used in V-by-One® HS Vision System Starter Kit. This sensing capability is used by the host application to evaluate current configuration and identify configuration related problems.

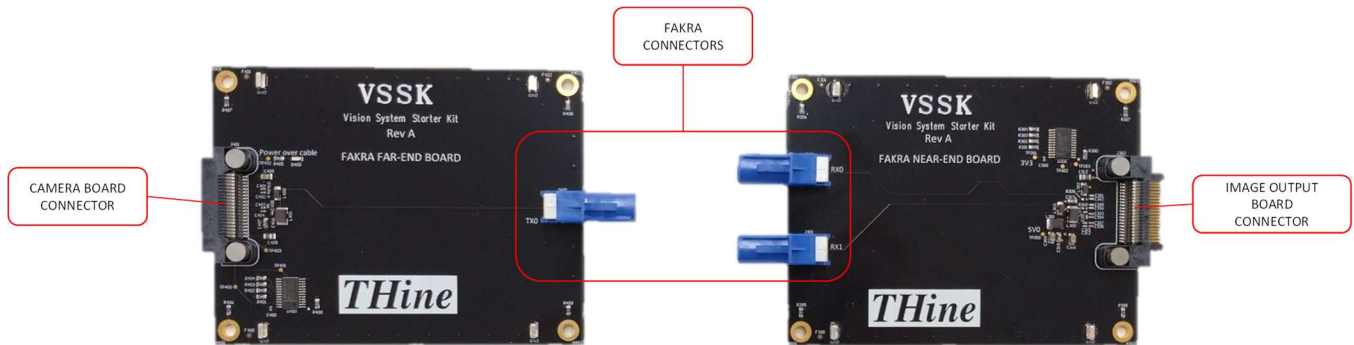
SMA

SMA connectors utilize a single coaxial cable. SMA connector boards allow to connect all signals directly, and do not feature signal overlay.



FAKRA

FAKRA connector boards utilize signal overlay techniques to transmit high-speed, low-speed, and power over a single coaxial cable.



The following functional diagram shows configuration options:

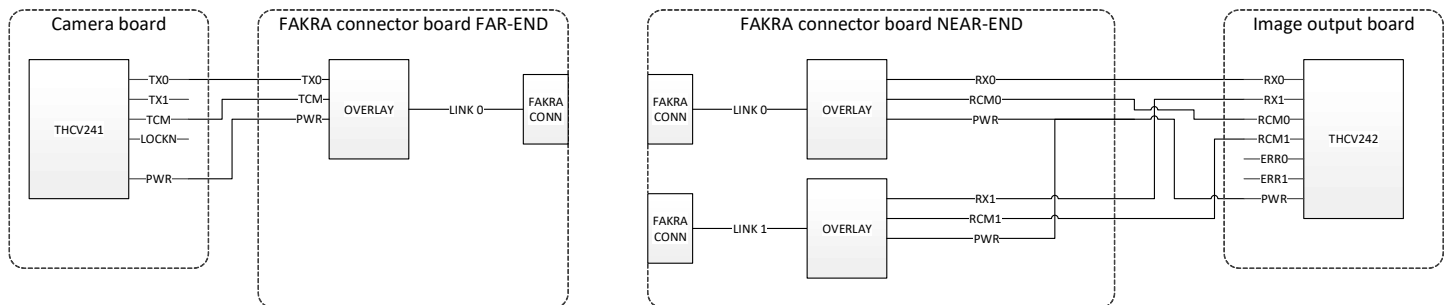
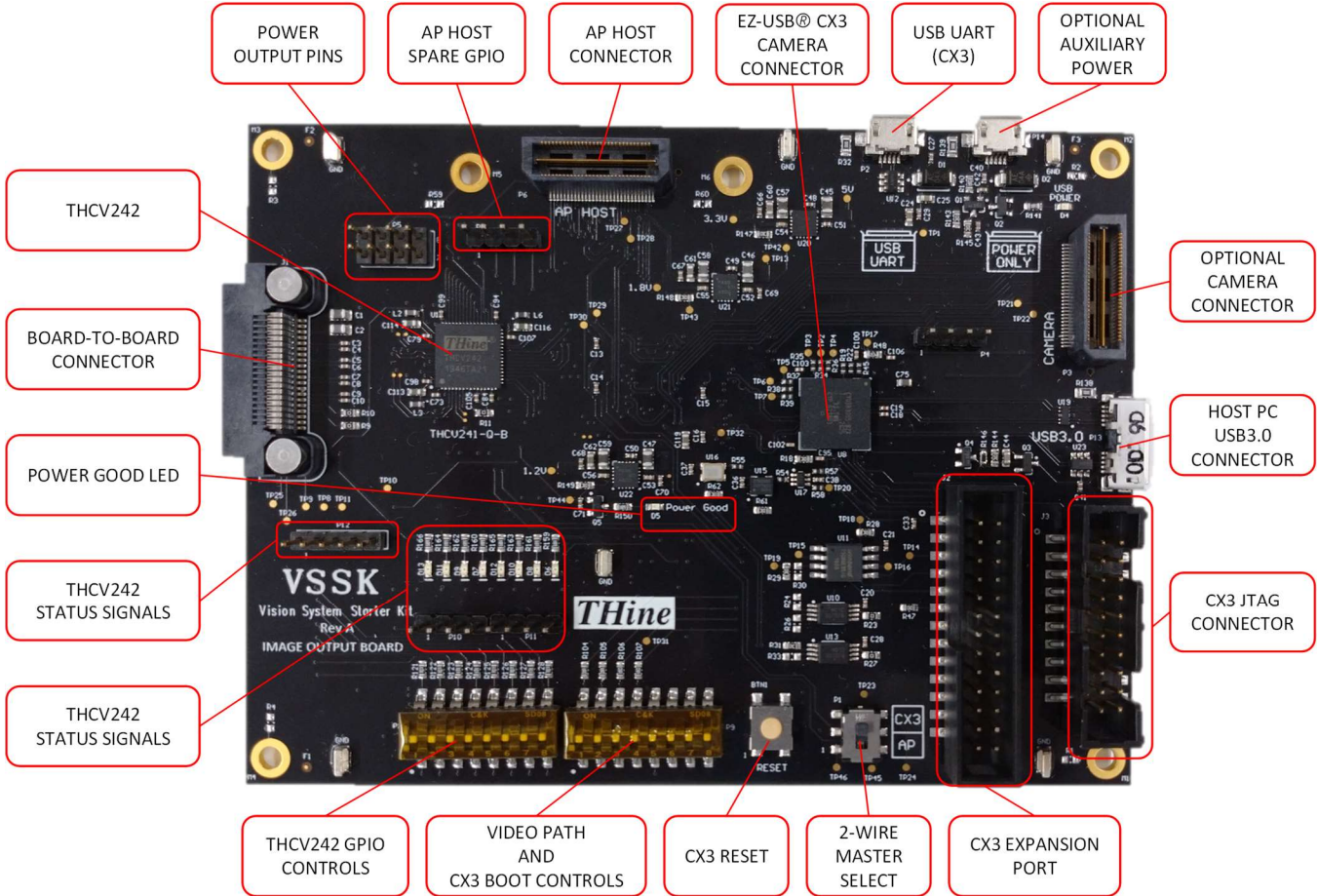
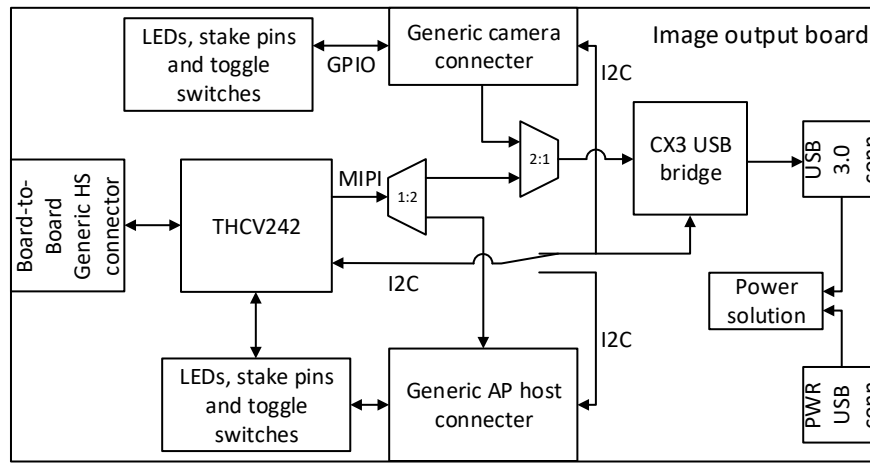


Image Output board

The Image Output board is responsible for receiving V-by-One® HS data from the Camera board via THC242A. The received MIPI data then can be routed to the host PC via the Cypress EZ-USB® CX3 Programmable MIPI CSI-2 to USB 3.0 Camera Controller. User control and status is implemented via toggle switches, LEDs, and test points.



The functional block diagram for the Image Output Board is as shown below:



In addition, the Image Output board features:

1. *Auxiliary Processor (AP) host connector. An external processing system can be connected via this interface. The AP connector is not specific to any particular processing system. MIPI stream from the THCv242A can be routed to the AP host via MIPI de-multiplexer.*
2. *Camera connector which allows to connect camera module directly to the Cypress EZ-USB® CX3 Programmable MIPI CSI-2 to USB 3.0 Camera Controller, which may be useful for debug purposes.*

Features

Board-to-board HS connector

This board-to-board connector is designed to mate with Near-End connector board.

THCV242A

THCV242A is designed to support 1080p60 2Mpixel uncompressed video data over 15m 100ohm differential STP or single-end 50ohm Coaxial cable with 4 in-line connectors between camera and processor via V-by-One® HS. THCV242A supports a MIPI CSI-2. Each CSI-2 data lane can transmit up to 1Gbps/lane. Virtual channel is supported. The second output lane supports data copy and distribution.

One high-speed V-by-One® HS lane can transmit up to 1080p60fps. The maximum serial data rate is 3Gbps/lane. The second input lane supports HDR or camera switch experience.

The GPIO available on the THCV242A is connected to toggle switches, as well as LEDs and stake-pins for easy troubleshooting and development. THCV242A status signals are also routed to stake-pins.

MIPI multiplexer/de-multiplexer

The MIPI MUX/DEMUX is implemented in two stages. The first stage is a de-multiplexer stage that allows to re-direct the MIPI signaling to either CX3 MIPI CSI-2 to SuperSpeed USB Bridge Controller or to the AP host connector allowing for use of an external image processor. The second stage multiplexer allows connecting CX3 MIPI CSI-2 to SuperSpeed USB Bridge Controller to either MIPI stream from the THCV242A or MIPI stream from the onboard generic camera connector.

EZ-USB® CX3 MIPI CSI-2 to USB Bridge

Cypress CYUSB3065 EZ-USB® CX3: MIPI CSI-2 to SuperSpeed USB Bridge Controller is used to receive and process MIPI signaling on the Image Output board. The USB3.0 interface is implemented by this chip connects to host PC. The EZ-USB® CX3 MIPI CSI-2 to USB Bridge also serves as 2-WIRE controller for all 2-WIRE peripherals in the system. Additionally, board features USB UART connected to the CX3 controller, CX3 expansion port, and CX3 JTAG connectors. CX3 reset button is also available on the board. Refer to schematics for details on these interfaces.

AP host connector

The AP host connector is intended to expand V-by-One® HS Vision System Starter Kit processing capabilities beyond the EZ-USB® CX3 MIPI CSI-2 to USB Bridge. It allows redirecting the MIPI video stream to an external processing system. Additionally, Spare Camera GPIO is available on the board. Refer to schematics for details on these interfaces.

2-WIRE controller select

In the case when an external processor is used to receive MIPI signaling, the external processor also serves as a 2-WIRE controller. In order to allow for that a mechanical DIP switch is placed on Image Output board, controlling which 2-WIRE controller is connected to the THCV242A and the rest of the system.

Optional camera connector

The camera connector on Image Output board allows to connect a camera module directly to the Image Output board, bypassing the entire video path, and feeding MIPI signaling from the camera directly into the EZ-USB® CX3 MIPI CSI-2 to USB Bridge. This functionality is intended as a troubleshooting tool, helping to isolate a potential problem. Additionally, Spare Camera GPIO is available on the board. Refer to schematics for details on these interfaces.

Power output pins

While Image Output Board was not designed to power external devices, the voltage rails present on the board are made available on connector P5. Refer to schematics for details on these interfaces.

Optional auxiliary power

Image Output Board can be optionally powered via a dedicated Micro-USB connector (marked "POWER ONLY"). The "USB POWER" LED is lit when power is supplied from an auxiliary source.

Power Good LED

A "power good" LED is placed in the middle of the board, indicating that all power rails are correct.

Signal quality test points

Image Output boards provides test points for measuring signals quality of all high speed signals throughout the entire video path.

Power solution

Image Output board will be powered from the host PC. If host PC is not available, or its power is inadequate, an additional auxiliary USB power connector is provided as well. Image Output board will contain status LEDs indicating the state of the power system.

Host PC USB3.0 connector

The USB3.0 connector is designed to interface with host application running on host PC, as well as to provide power to the V-by-One® HS Vision System Starter Kit.

Switches and LEDs

Image Output Board contains two 8bit DIP switches (P9 and P15), CX3 reset button, and 2-wire controller select switch.

DIP switch P9

Pin Name	SW#	Description	Default
MIPI_MUX_THCV_SEL	1	MIPI de-multiplexer. Controls MIPI path from THCV-242-Q-B. SW = 0 (Off) = MIPI is routed to MIPI multiplexer SW = 1 (On) = MIPI is routed to AP host	SW = 0 (Off)
MIPI_MUX_THCV_OE_N	2	MIPI de-multiplexer output enable. Active low. SW = 0 (Off) = MIPI de-multiplexer is enabled SW = 1 (On) = MIPI de-multiplexer is disabled	SW = 0 (Off)
MIPI_MUX_CX3_SEL	3	CX-3 MIPI multiplexer. Controls which MIPI stream is routed to the CX-3. SW = 0 (Off) = Camera connector MIPI is routed to the CX-3 SW = 1 (On) = THCV-242 MIPI is routed to the CX-3	SW = 1 (On)
MIPI_MUX_CX3_OE_N	4	MIPI multiplexer output enable. Active low. SW = 0 (Off) = MIPI multiplexer is enabled SW = 1 (On) = MIPI multiplexer is disabled	SW = 0 (Off)
CX3_PMODE_2	5	Controls CX-3 boot options. Refer to schematic and/or CX-3 documentation for details. SW = 0 (Off) = PMODE_2 pin is floating SW = 1 (On) = PMODE_2 pin is low	SW = 0 (Off)
CX3_PMODE_1	6	Controls CX-3 boot options. Refer to schematic and/or CX-3 documentation for details. SW = 0 (Off) = PMODE_2 pin is floating SW = 1 (On) = PMODE_2 pin is high	SW = 0 (Off)
CX3_PMODE_0	7	Controls CX-3 boot options. Refer to schematic and/or CX-3 documentation for details. SW = 0 (Off) = PMODE_2 pin is floating SW = 1 (On) = PMODE_2 pin is high	SW = 0 (Off)
Not used	8	Not used	SW = 0 (Off)

Supported CX-3 boot modes are as follows:

PMODE2	PMODE1	PMODE0	BOOT OPTION
FLOAT	1	1	USB
FLOAT	1	FLOAT	I2C
0	FLOAT	1	SPI

DIP switch P15: THCV242A GPIO

Pin Name	SW#	Description	Default
THCV_GPIO0	1	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 0 (Off)
THCV_GPIO1	2	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 0 (Off)
THCV_GPIO2	3	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 1 (On)
THCV_GPIO3	4	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 0 (Off)
THCV_GPIO4	5	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 0 (Off)
THCV_GPIO5	6	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 0 (Off)
THCV_GPIO6	7	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 0 (Off)
THCV_GPIO7	8	SW = 0 (Off) = logic 0 SW = 1 (On) = logic 1	SW = 0 (Off)

THCV242A GPIO signals are also routed to stake-pin headers (P10 and P11), as well as to LEDs. Logic '1' on GPIO signal turns on the corresponding LED.

2-wire controller select

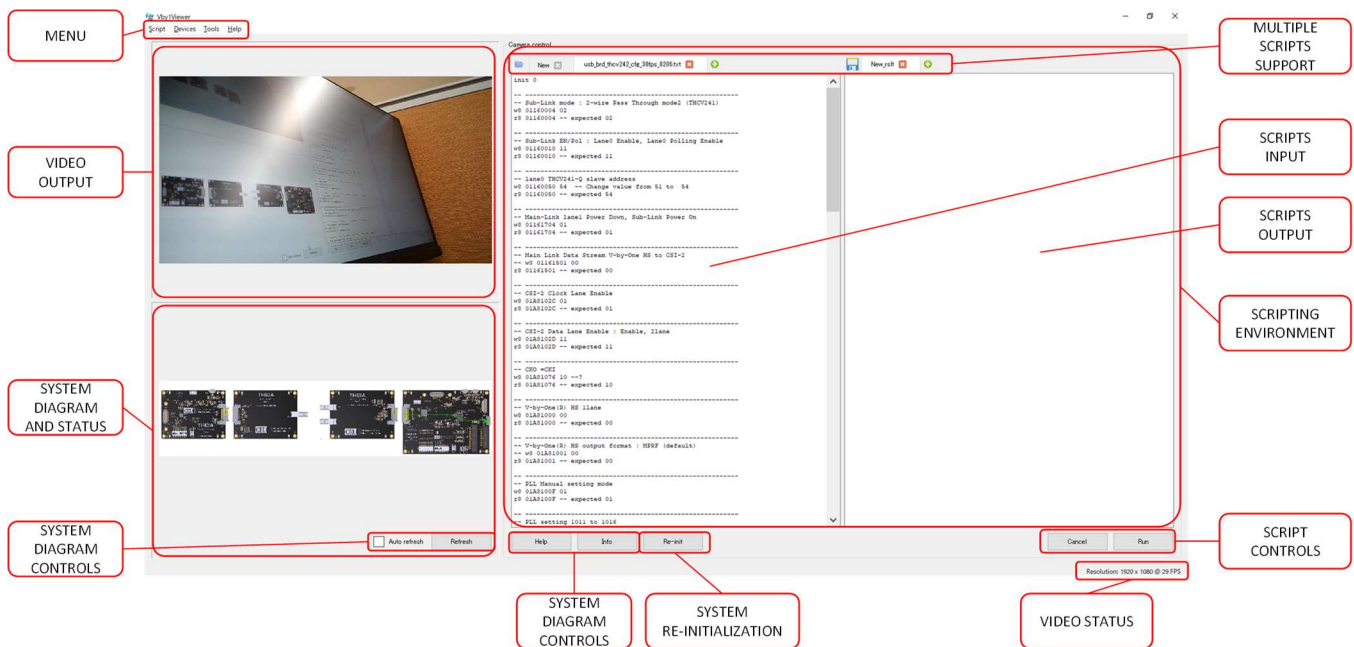
Image Output Board allows to select 2-wire bus controller. Normally, CX-3 is a 2-wire bus controller. Optionally, the AP can serve as 2-wire controller.

Host software application

The host application aims to achieve several goals:

- Display camera data stream and its status
- Enable user to access/modify register settings of various devices connected via 2-WIRE
- Provide real time status of the system state and configuration
- Provide user with simple and useful interface

Host application layout is shown on the figure below:



Menu bar

“Script” enables basic script file operations

“Devices” lists all connected camera devices. Allows to re-scan to identify newly added camera devices, select specific camera, start/stop camera video.

“Tools” allows to update CX-3 firmware

“Help” shows application revision

Menu bar provides a set of commands, such as open or close video stream. The complete list of these commands will be determined later, however the key is to keep it simple.

Video output

This area contains rendering of the MIPI video data. The video is scaled to fit this area regardless of its native resolution. Double-clicking this area puts video into full screen mode. Double-clicking again returns video mode to its previous state.

System diagram

The lower left portion of the application window is allocated for the system diagram. Host application detects the connected boards by periodically polling 2-wire bus, and renders the detected boards on the system diagram. User can clear the “Auto refresh” check box to prevent application from periodic polling, therefore removing periodic 2-wire transactions on the bus. The diagram can also be updated on demand, by clicking “Refresh” button.

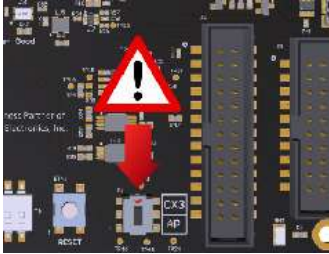
Double-clicking on the system diagram puts it into full screen mode. Double-clicking again returns the diagram to its previous state.

In addition to rendering the boards connected to host, the system diagram features overlay, indicating MIPI stream routing and position of the key DIP switches.

Also, system diagram reflects the state of the key switches. DIP switches position overlay example:



When AP is selected as a controller of 2-wire bus, the CX-3 has no connection to the 2-wire bus, which inhibits any of the host application functionality. In this case, a special overlay will be displayed indicating to the user that CX-3 has no connection to the 2-wire bus, as shown below:



Scripting environment

One of the main features of the host application is enabling the user to read/write via text based scripts. For detailed description of the scripting syntax refer to Appendix A: Scripting syntax.

There are five control buttons related to scripting environment:

“Help” - outputs scripting syntax and list of expected 2-wire devices and their addresses

“Info” - output list of camera devices and their indexes

“Re-init” - executes system re-initialization

“Run” - run script from the currently active script tab

“Cancel” - cancels script execution currently in progress

The scripting environment consists of two vertical panels: script input on the left, and script output on the right. Scripts can be entered manually, as well as loaded from or saved into a text file. Using multiple tabs is helpful when multiple scripts need to be staged.

Status panel

The status panel has two goals:

Provide real time status of the video being received. This status includes: resolution, frame rate, and other applicable parameters of the video stream.

Display real time status of the V-by-One® HS Vision System Starter Kit state and settings. (while this is early in the project) this status will be provided in form of system block diagram. The block diagram will have current video path highlighted. State of all settings will be displayed near corresponding blocks, simplifying navigation through all configuration settings available in the system.

Some error checking is possible as well. For example, if there are two DIP switches which should always be in specific position at the same time (disconnecting Vx1 diff pair, for example), host application could detect it and notify the user.

Video status

Shows current video resolution and frame rate.

Appendix A: Scripting syntax

NOTE: all numbers in scripts are in hexadecimal format unless specified otherwise.

Initialization

Before working with a specific device, it needs to be initialized. The initialization is done via “init” command:

`init <device#>`

where <device#> equals to device index as displayed in the list of devices, or in output of the help button

Read commands

Reads can be 8, 16, and 32 bits wide.

`{r8, r16, r32, r} <addr> [addr_1 ... addr_N]`

Read command is followed by one or more addresses separated by spaces. Note: “r” and “r32” are the same.

Write commands

Writes can be 8, 16, and 32 bits wide.

`{w8, w16, w32, w} <addr> <val> [<addr_1> <val_1> ... <addr_N> <val_N>]`

Write command is followed by one or more address/data pairs by spaces. Note: “w” and “w32” are the same.

Dump commands

Dump commands allow to read blocks of consecutive registers. Just like read commands these transactions can be 8, 16, and 32 bits wide.

`{dump8, dump16, dump32, dump} <count_hex> <addr>`

Filed “count_hex” specifies the number of reads in hexadecimal format.

Fill commands

Fill commands allow writing the same value into multiple registers.

`{fill8, fill16, fill32, fill} <count_hex> <addr> <val>`

Filed "count_hex" specifies the number of reads in hexadecimal format.

Delay

Delay command allows to insert a delay during script execution. The delay value is provided in milliseconds.

`dly <val>`

Release

Release command allows to "disconnect" from the currently initialized device. This command needs to be executed before initializing a different device.

`release`

Info

Outputs a list of imaging devices available on host PC with short descriptions

`info`

Help

Outputs help content including scripting commands and expected 2-wire devices and their addresses.

`help`

Appendix B: 2-WIRE devices and addressing

<i>Board</i>	<i>Device</i>	<i>8-bit (shifted) 2-wire address</i>
<i>Image output board</i>	<i>CX3 MIPI controller</i>	<i>0x0E</i>
<i>Image output board</i>	<i>U10 I2C EEPROM</i>	<i>0xA0</i>
<i>Image output board</i>	<i>U13 I2C EEPROM</i>	<i>0xA2</i>
<i>Image output board</i>	<i>THCV242A chip</i>	<i>0x16</i>
<i>Image output board</i>	<i>I/O expander</i>	<i>0x40</i>
<i>SMA near end</i>	<i>I/O expander</i>	<i>0x46</i>
<i>SMA far end</i>	<i>I/O expander</i>	<i>0x48</i>
<i>FAKRA near end</i>	<i>I/O expander</i>	<i>0x4A</i>
<i>FAKRA far end</i>	<i>I/O expander</i>	<i>0x4C</i>
<i>Camera board</i>	<i>I/O expander</i>	<i>0x58</i>

Appendix C: Cypress CX3 firmware update procedure

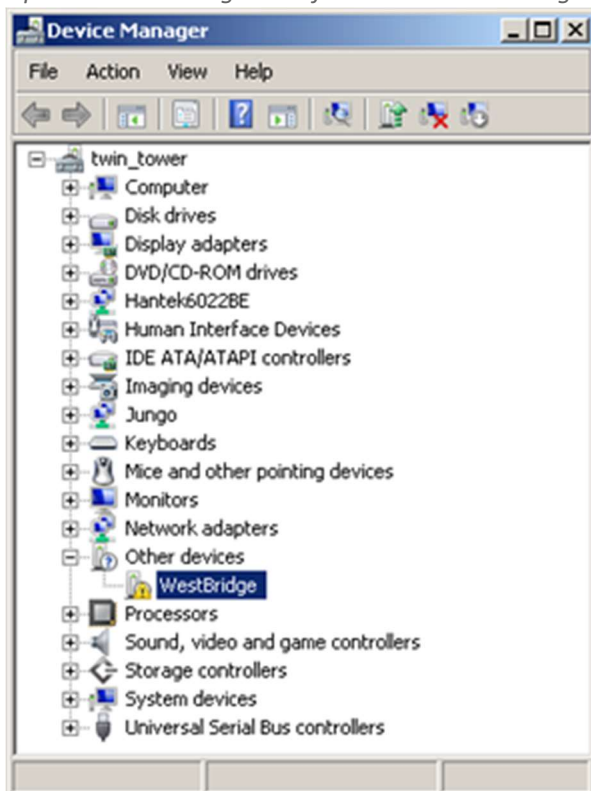
There are two use cases for the CX3 firmware upgrade:

First time programming. CX3 configuration memory is blank or corrupted. This may case may occur if user erases or overwrites the configuration memory.

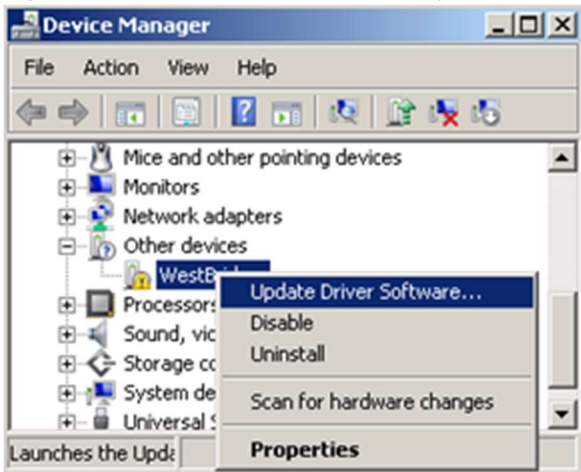
V-by-One® HS based Image Evaluation System firmware update. V-by-One® HS based Image Evaluation System CX3 configuration memory is intact, however CX3 needs to be updated to a new firmware revision.

First time programming procedure

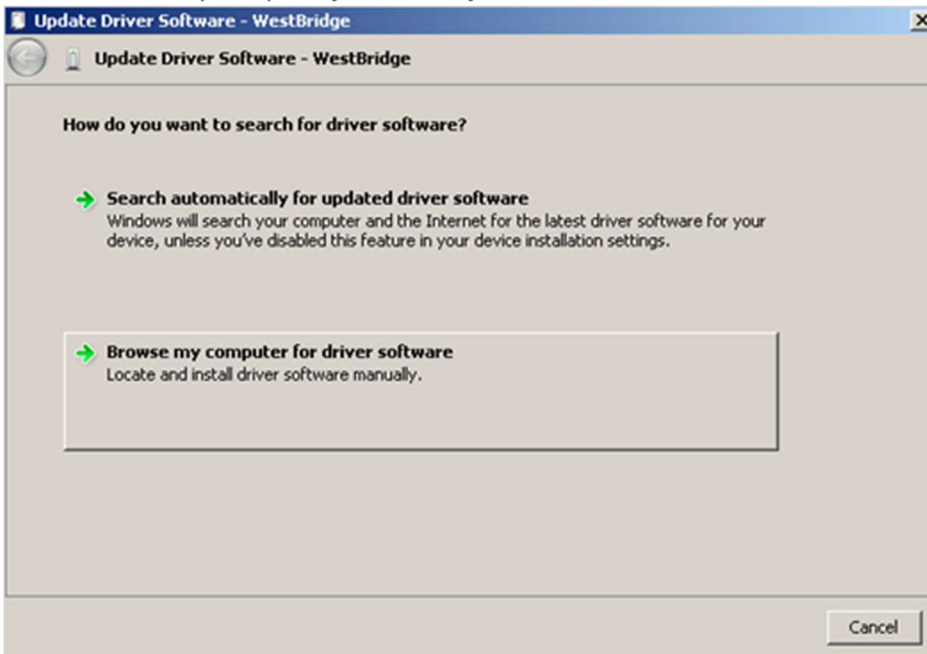
1. Download Cypress EZ-USB FX3 Software Development Kit from Cypress website and install it.
2. Connect Image Output Board (IOB) to host PC via USB 3.0 port. Make sure the board is powered up.
3. Open Device Manager and find device “WestBridge” in “Other devices” list:



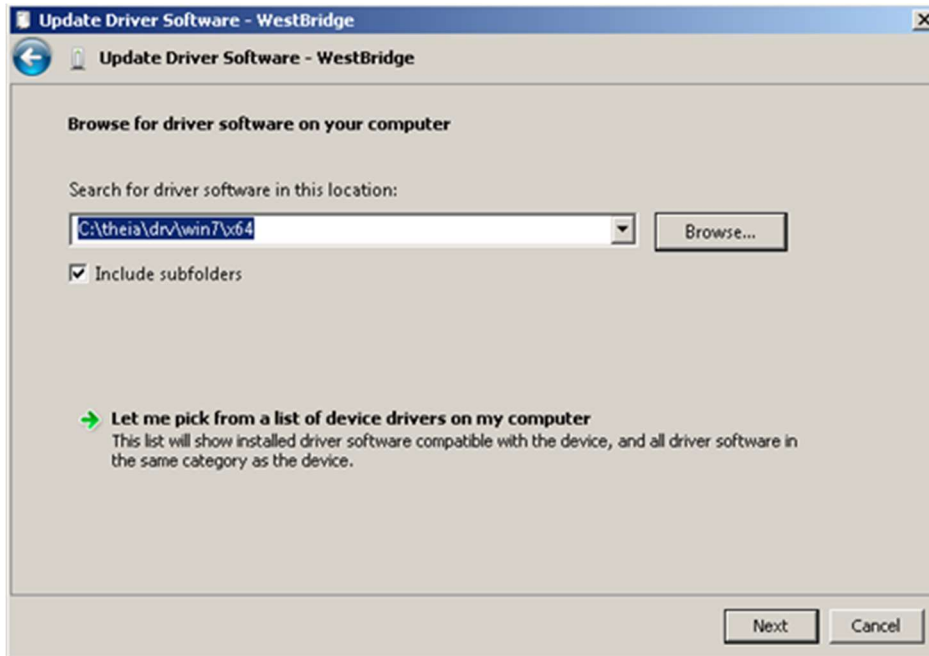
4. Right-click on this device and select "Update Driver Software ..."



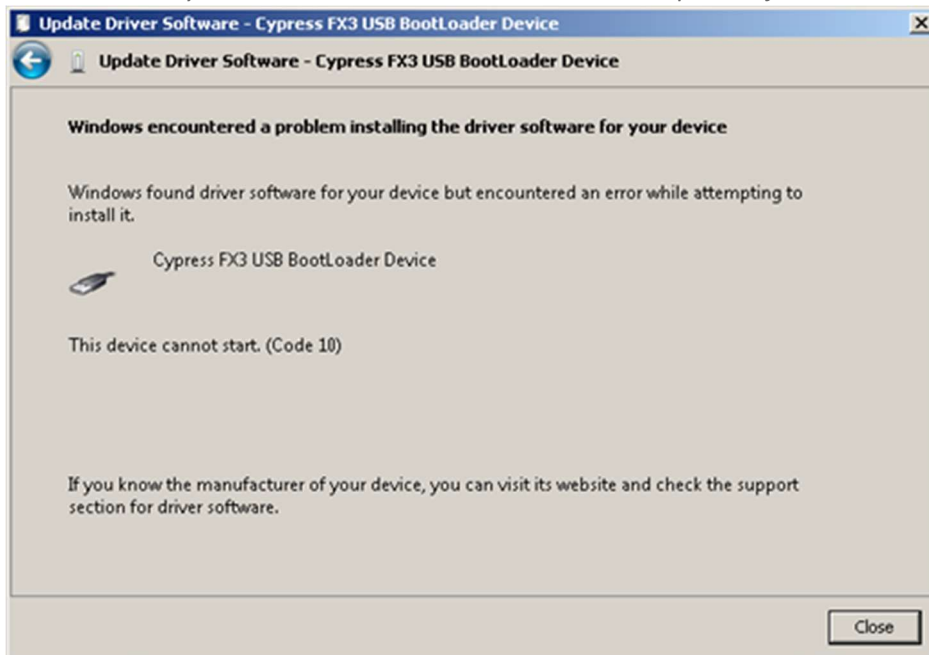
5. Select "Browse my computer for driver software":



6. Select path to the appropriate driver in <V-by-One® HS based Image Evaluation System install dir>/drv dir and click "Next":

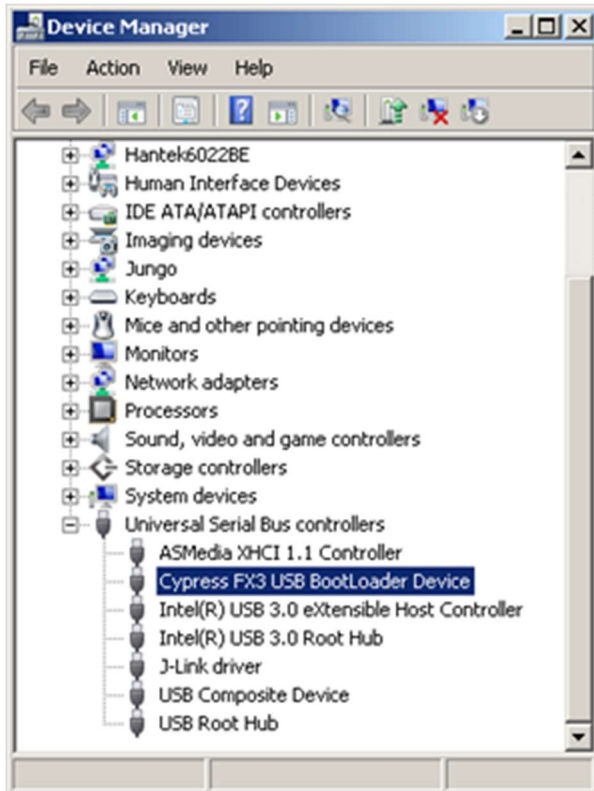


7. After installing the selected driver click "Close".
Note: status may indicate "This device cannot start". It is expected, just close this dialog.



8. Disconnect and reconnect USB board to the PC.

After that “Cypress FX3 USB BootLoader Device” device should appear in Device Manager:



9. Run `theia_firmware_upgrade.bat` (you may need to run it as administrator).
10. Disconnect and reconnect USB board to the host PC. First time programming is complete.

Firmware upgrade from V-by-One® HS based Image Evaluation System application

1. Connect USB board to the USB 3.0 port on the host PC using USB3.0 cable. Make sure the board is powered up.
2. Run V-by-One® HS based Image Evaluation System application
3. Select V-by-One® HS based Image Evaluation System device for firmware upgrade from user application “Devices” menu. The correct devices are named “V-by-One® HS based Image Evaluation System”.
4. Select firmware upgrade operation from user application “Tools” menu. It runs firmware file selection dialog.
5. Select valid firmware file from `<V-by-One® HS based Image Evaluation System install dir>/firmware dir` (`theia_fw.img` for example). This will run firmware upgrade process and progress bar will appear in status bar.
6. If invalid device was selected in “Devices” menu “Unable to connect to device ...” string appear in output window. “invalid” here means any device other than this kit.

7. *After upgrade is finished "Firmware updated successfully" string appear in output window. If firmware file was not write to the boot flash correctly "Error in firmware upgrade" string appear in output window.*

Revision History

<i>Previous Versions</i>	<i>Changes to Current Version</i>	<i>Page(s)</i>
<i>Document Issue No: Rev. 0.01 January 28, 2021</i>	<i>Preliminary Release</i>	<i>N/A</i>
<i>Rev. 1.00 June 24, 2021</i>	<i>First Release</i>	<i>N/A</i>
<i>Rev. 1.01 January 14, 2023</i>	<i>Format Update</i>	<i>All pages</i>
<i>Rev. 1.02 March 7, 2023</i>	<i>I2C Terminology Correction</i>	<i>12, 13, 19-22, 25</i>

Important Notice

1. The product specifications described in this document are subject to change without prior notice.
2. The circuit diagrams described in this document are examples of the application. THine Solution, Inc. (“THine”) assumes no responsibility for any losses incurred by you or third parties from the use of these circuit diagrams.
3. Testing and other quality control techniques are used to this product to the extent THine deems necessary to support warranty for performance of this product. Except where mandated by applicable law or deemed necessary by THine based on the user’s request, testing of all functions and performance of the product is not necessarily performed.
4. This product is presumed to be used for general electric device, not for applications which require extremely high reliability/safety.

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