Smart Vision Development Kit (SVDK)  
GigE Vision Getting Started Guide  
Version 1.5
## Document Control

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1 Getting Started with the Smart Vision Development Kit

The Smart Vision Development Kit builds on the PicoZed SOM by providing a carrier card for machine vision applications. This kit provides all the necessary components to start development of embedded vision applications.

It features a low cost all-in one-package with 5 minutes out of box experience and is equipped with all the industry vision connectivity such as GigE Vision (GEV), USB3 Vision (U3V), and CoaXPress (CXP). The kit includes an Aptina 1.2MP camera module.

In addition, industry leading software tools are offered and supported on this kit to provide an accelerated development cycle.

This Getting Started Guide will outline the steps to setup the Smart Vision Development Kit (SVDK), and run the plug-and-play GigE Vision demonstration with the Aptina camera module.

The SVDK carrier card is hardware compatible with the PicoZed 7015 SOM, as well as the PicoZed 7010/7020 SOMs.

NOTE: When the SVDK carrier card is used with the PicoZed 7010 SOM, the PMOD, HDMI and CoaXPress (CXP) interfaces are not available.

NOTE: When the SVDK carrier card is used with the PicoZed 7020 SOM, the HDMI and CoaXPress (CXP) interfaces are not available.

NOTE: The SVDK carrier card IS NOT COMPATIBLE with the PicoZed 7030 SOM! Attempting to mate the PicoZed 7030 SOM to the SVDK will permanently damage the SOM !!!
2 What’s Inside the Box?

2.1 Smart Vision Development Kit
- PicoZed (Zynq-7015) SOM module
- Machine Vision Carrier Board
- Aptina 1.2MP camera module
- Universal Power Adapters
- mini-USB-B to USB-A cable
- Ethernet cable
- Vivado Design Edition entitlement voucher – Device Locked
- Quick Start Card
- Downloadable documentation and reference designs
3 What’s on the Web?
PicoZed is a community-oriented kit, with all materials being made available through the www.picozed.org community website.

3.1 Official Documentation:
- Available on www.picozed.org
  - Getting started guides
  - Hardware user guide
- Available from Sensor to Image after kit registration
  - Schematics
  - Layout (Gerber files)

3.2 Tutorials and Reference Designs:
- Design examples, including:
  - GigE Vision (GEV)
  - USB3 Vision (U3V)
  - CoaXPress (CXP)
- Community projects

For the latest collateral for the kit, including documentation and getting started designs:
1. Go to www.picozed.org
2. Select Products → Smart Vision Development Kit
3. Click on image

3.3 Training and Videos:
- Overview of PicoZed
- Introduction to Zynq
- Implementing Linux on the Zynq-7000 SoC

For the latest training and videos:
1. Go to www.picozed.org
2. Click Support → Trainings and Videos
4 Smart Vision Development Kit - Key Features

- PicoZed (Zynq-7015) SOM module
- Machine Vision Carrier Board, including:
  - GigE Vision (GEV)
    - 10/100/1000 Ethernet interface
    - Evaluation version of GigE Vision IP from Sensor to Image
  - CoaXPress (CXP)
    - Featuring MicroChip CoaXPress transmitter and receiver devices
    - Evaluation version of CoaXPress IP from Sensor to Image
  - USB3 Vision (U3V)
    - Featuring Cypress EZ-USB FX3 SuperSpeed USB 3.0 peripheral interface
    - Evaluation version of USB3 Vision IP from Sensor to Image
  - HDMI Output Interface
    - Featuring Analog Devices ADV7511 HDMI output transmitter
  - Camera Interface, supporting optional camera modules
- Camera Module
  - Aptina 1.2MP camera module, featuring Aptina AR0134 image sensor

![Smart Vision Development Kit - Block Diagram](image-url)

**Figure 2** – Smart Vision Development Kit (SVDK) - Block Diagram
5 Smart Vision Development Kit – Basic Setup and Operation

In addition to the items included in the kit, you will also need the following to run the out of box example on your SVDK.

- **PC, running SphinxGEVViewer application**  
  (provided in the SVDK_GigE_Vision_Getting_Started_{version}.zip archive)
- **JTAG Programming Cable (Platform Cable, Digilent HS1 or HS2 cable)**  
  (optional, to re-program firmware)

An image of the SVDK in its expected out-of-box configuration is shown below along with the locations of several key components.

![Smart Vision Development Kit (SVDK) – Topology](image.png)
5.1 Example Design

The SVDK is shipped with the **SVDK GigE Vision Reference Design** (for Aptina camera) programmed in the PicoZed SOM’s QSPI flash device. The pre-built getting started design is available at [http://www.picozed.org](http://www.picozed.org), in the Reference Design/Tutorials section for the Smart Vision Development Kit. For more information on how to build this design please review the tutorial document and full reference design that is available from Sensor to Image after product registration. Details on how to register with Sensor to Image are included at the end of the Hardware Setup section.

The example design uses the Aptina 1.2MP Camera Module, as well as the Sensor to Image GigE Vision (GEV) IP, to implement a GigE Vision camera. The RJ45 Ethernet connector of interest is highlighted in the photo below.

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Figure 4 – RJ45 Ethernet connector of interest for Example Design
5.2 Hardware Setup

1. A terminal program is required. Windows 7 does not come pre-installed with a terminal program. Tera Term was used in this example which can be downloaded from the Tera Term project on the SourceForge Japan page: ttssh2.sourceforge.jp. Install Tera Term or another terminal program of your choice.

2. If not previously installed, go to www.microzed.org to download and install the Silicon Labs CP2104 USB-to-UART driver. http://www.microzed.org/support/documentation/1519 Silicon Labs CP210x USB-to-UART Setup Guide

3. Set the PicoZed boot mode DIP switches (SW1) to QSPI mode as described in the PicoZed SOM's Hardware Users Guide. http://www.picozed.org/support/documentation/4736

Figure 5 – QSPI Boot Settings
4. Verify the following default SVDK jumper settings:
   - FX3 Boot Jumper => boot from SPI
     - JP6 (1-2, 5-6 closed)
   - USB OTG Configuration => HOST
     - JP7 (2-3 closed)
     - JP8 (2-3 closed)
     - JP9 (2-3 closed)
     - JP10 (1-2 closed)
   - UART Selector => PS UART
     - JP12 (5-6, 7-8 closed)

**Figure 6 – SVDK – Default Jumper Configuration**
5. Make sure the SVDK power switch is in the OFF position.
6. Insert the PicoZed module onto the SVDK (if not already mounted).
7. Insert the Aptina 1.2MP camera module onto the SVDK.
8. Insert the appropriate country plug into the 5V DC Power Supply AC/DC adapter. Plug it into the 5V DC Power Supply Connector.
9. Connect the SVDK to an Ethernet network (RJ45 connector close to Camera connector), either directly to local network card or to DHCP enabled public network.
10. We will be using a mini-USB cable to communicate through a terminal, but this will be plugged in a bit later.

5.3 Programming the Firmware
The SVDK kit is shipped with the GigE Vision design pre-programmed on the PicoZed 7015T SOM’s QSPI Flash device. If you have not changed this firmware, you can proceed to the next section.

If you have changed the GigE Vision firmware (for example, with the USB3 Vision or CoaXPress design firmware), you will need to re-program, as described below.

1. Connect a JTAG Programming Cable (Platform Cable, Digilent HS1 or HS2 cable), not included with the kit, to the PC using a USB cable and then plug the 14-Pin PC4 header or cable into the PC4 connector on the SVDK carrier card.
2. Launch Vivado 2014.4 (or greater)
3. Click the Open Hardware Manager icon
4. In the Vivado menu, select Tools, then Auto Connect
   You should see the xc7z015_1 device in the JTAG chain, as shown in the following screen capture.

![Figure 7 – Hardware JTAG Chain](image)
5. In the Vivado menu, select **Tools**, then **Add Configuration Memory Device**, then **xc7z015_1**
   a. Specify the following **Filters**:
      i. **Manufacturer** = **Spansion**
      ii. **Density (Mb)** = **128**
      iii. **Type** = **qspi**
      iv. **Width** = **x4-single**
   b. Specify the following **Configuration Memory Part**:
      i. **S25FL128S-3.3V-QSPI-X4-Single**
   c. Click **OK**
6. Click **OK** if asked if you want to program the configuration memory device now.
7. In the Program Configuration Memory Device dialog, specify the following:
   a. **Configuration file**: **SVDK_1.2_GEV_Firmware/BOOT.bin**
   b. Make sure the **Erase**, **Program**, and **Verify** options are enabled
   c. Click **OK** to program the QSPI device.
8. When done, close Vivado
5.4 Running the Example

1. Turn the power switch on the SVDK to the ON position. After 1-2 seconds, you will notice several LEDs that are lit, including the FPGA DONE LED (DS1).

2. Now plug in the mini-USB-B to USB-A cable between the PC and the USB Serial (J17) connector on SVDK.

3. On the PC, open a serial terminal program. Tera Term is used to show the example output for this lab document. Follow the instructions in the CP210x Setup Guide to set the terminal as shown in Figure 8, using the appropriate COM port that you discover on your own machine.

4. Cycle power on the SVDK. The terminal output displays feedback from the bare-metal example application.

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[00] GigE Vision IP core, v2.0.3 (2014-04-03)
[00] S2I GigE library, v4.7.1m (Aug 6 2014, 09:51:29)

0x04000000 bytes starting at 0x0013F800, alignment 64 bytes
5. If connected properly, the SVDK’s serial output should indicate “Connected at: 1Gbps”, as well as the IP address.

6. Using a Command Prompt (Start Menu => All Programs => Accessories => Command Prompt), verify Ethernet connectivity between SVDK and PC by trying to ping IP address from the PC

```plaintext
C:\> ping 192.168.0.105

Pinging 192.168.0.105 with 32 bytes of data:
Reply from 192.168.0.105: bytes=32 time=2ms TTL=128
Reply from 192.168.0.105: bytes=32 time=1ms TTL=128
Reply from 192.168.0.105: bytes=32 time=2ms TTL=128
Reply from 192.168.0.105: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.0.105:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Round trip time min/avg/max = 1ms
```

Figure 9 – SVDK – Serial Console Output

Figure 10 – Verifying Ethernet connectivity with ping from PC
7. Start the **SphinxGEVViewer.exe** GigE Vision Viewer application
8. Press the **Discovery** button

![Discovery window](image)

**Figure 12 – Sphinx GigE Vision (GEV) Viewer – Discovery**

9. Select the SVDK in the Discovered Devices list
10. Click on the **Open** button to open it

**NOTE:** If you get a message box indicating “SphinxLib: Evaluation period expired”, the hardware evaluation has expired. Cycle power on the SVDK, and re-start the Discovery process.
11. Click the Grab checkbox to start streaming video to the PC

![Figure 13 – Sphinx GigE Vision (GEV) Viewer – Click Grab checkbox](image)

12. Click the Grab checkbox to start streaming video to the PC

You should see capture images in the Image section of the SphinxGEVViewer. If the image is out of focus, adjust the focus by turning the lens on the Aptina camera module.

**NOTE:** The firewall setting on the PC could cause an issue with the demos running. Being able to ping the hardware is not enough as ping, discovery and control channel works regardless the firewall settings, but streaming (runs on different port) is usually blocked by the firewall. The software included adds itself to firewall, but it needs administrator privileges.
To further examine this reference design, please contact Sensor to Image whom, upon registering, can provide access to the tutorial document included in the **SVDK GigE Vision Reference Design for Aptina camera**. A link to contact is provided below:

http://www.sensor-to-image.de/index.php/products-mainmenu-33/registration

To complete this tutorial, you will need to install the correct version of the Xilinx development tools as indicated in the tutorial documentation. For instructions on installing the Xilinx software, please refer to **Appendix A: Installing and Licensing Xilinx Software**.
6 Getting Help and Support

6.1 Avnet Support

PicoZed is a versatile development kit and a SOM ready to be adopted into your next design. All technical support is offered through the PicoZed.org website support forums. PicoZed users are encouraged to participate in the forums and offer help to others when possible.

For questions regarding the PicoZed community website, please direct any questions to:

PicoZed.org Web Master – webmaster@picozed.org

To access the most current collateral for PicoZed please visit the community support page at:

http://www.picozed.org/content/support

Once on the PicoZed.org support page:

To access the latest PicoZed documentation, click on the Documentation link:

![Documentation](http://www.picozed.org/content/support)

To access the latest reference designs for PicoZed, click on the following link:

![Reference Designs](http://www.picozed.org/content/support)

To access the PicoZed technical forums, click on the following link:

![Support Forums](http://www.picozed.org/content/support)
6.2 **Xilinx Support**

For questions regarding products within the Product Entitlement Account, send an e-mail message to the Customer Service Representative in your region:

- **Canada, USA and South America** – isscs_cases@xilinx.com
- **Europe, Middle East, and Africa** – eucases@xilinx.com
- **Asia Pacific including Japan** – apaccase@xilinx.com

For technical support including the installation and use of the product license file, contact Xilinx Online Technical Support at [www.xilinx.com/support](http://www.xilinx.com/support). The following assistance resources are also available on the website:

- Software, IP and documentation updates
- Access to technical support web tools
- Searchable answer database with over 4,000 solutions
- User forums
Appendix A: Installing and Licensing Xilinx Software

7.1 Install Vivado Design Edition
The PicoZed Zynq-7000 AP SoC device development is supported by Vivado WebPACK licensing. The SVDK also comes with an entitlement voucher to a seat of Vivado Design Edition which is device locked to a XC7Z015-1SBG485 Zynq-7000 AP SoC device. The Design Edition software is an advantage over WebPACK as it adds the Logic Analyzer capability. See http://www.xilinx.com/products/design_tools/vivado/vivado-webpack.htm

This software can be downloaded online at: www.xilinx.com/support/download/index.htm

You can also request a free DVD from www.xilinx.com/onlinestore/dvd_fulfillment_request.htm

If a full seat of Vivado System Edition has already been installed, then no further software will be needed. Please check online for any updates at: www.xilinx.com/support/download/index.htm