BitFlow™

Vision Research S990
Revision 1.0 2019-07-29

Purpose

This document explains how to interface the Vision Research S990 to the BitFlow Cyton-CXP frame grabber. The S990 is very high speed camera running 4K x 2k at 1000 FPS. This data rate exceeds the speed of a single frame grabber so the camera has 16 outputs and requires four Cyton-CXP4 frame grabbers. The camera will, however run with two or even one frame grabber, with a proportional reduction in the maximum frame rate.

When this camera is running in two or four frame grabber mode, the camera outputs interleaved "chunks" lines simultaneously to each connected frame grabber. These lines must be re-interleaved in the host PC. The Cyton's DMA engine in powerful and flexible enough to perform this re-interleaving task on the fly, with no CPU usage. This re-interleaving works in both two and four frame grabber modes. Then end result is fully raster-scan images ready for processing.

Requirements

> One Vision Research S990
> Four Cyton-CXP4 frame grabbers
> Sixteen coax cables (DIN to DIN)
> One PC with at least four PCIe x8 or x16 Gen 2 or Gen 3 slots
> BitFlow SDK 6.40 or later
> BitFlow's Ximilon GenTL Consumer Camera Control application

System Setup

Install the BitFlow SDK

Follow the instructions in the "Getting Started with SDK X.XX.pdf" document

Install Ximilon

Simply run the installer

Test the System with One Cyton

Install one Cyton in to the PC

Install one Cyton into one PCIe x8 or x16 Gen 2 or Gen 3 slot

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Connect Four CXP Cables

Connect the cables as shown in the following table:

Cyton	S990
1	1
2	2
3	3
4	4

It is recommended that cables are connected when the camera is off.

Configure the system for Single Frame Grabber Mode

Run SysReg, click on Bd(0), hit the "Configure" button. The "Board Details" dialog will show up. Click the "Add" button to attach a configuration file. Select the following file:

Make: Vision Research > Model: Phantom S990 > Mode: One Frame Grabber, Freerun. Click on the mode name and hit "OK", then click "OK" two more times to close SysReg.
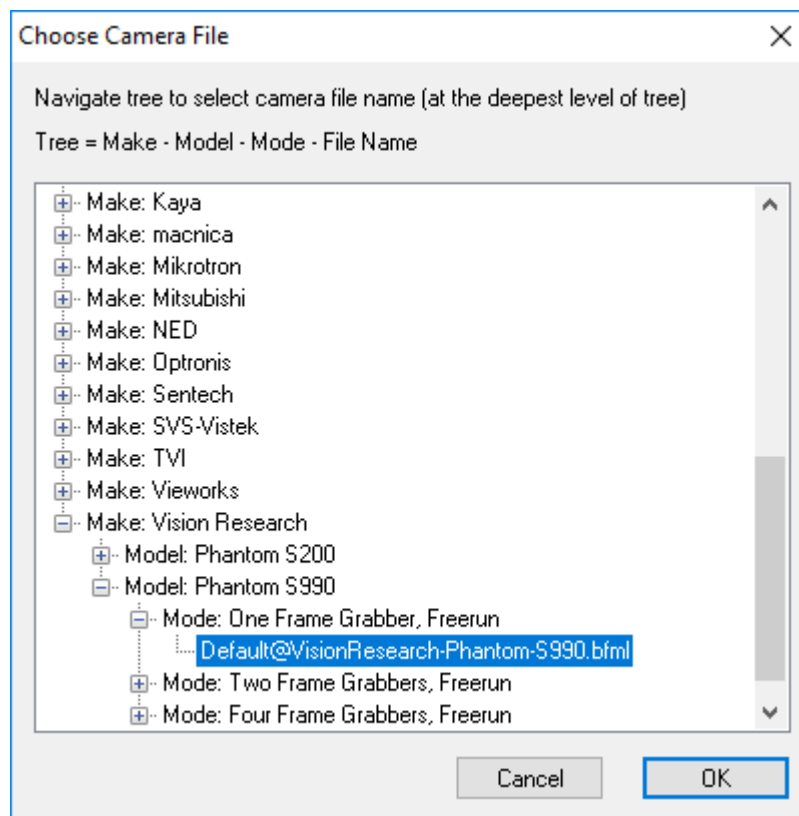
Test the System

Next run "BitFlow Preview" to see live video from the camera in single frame grabber mode. The maximum frame rate in this mode will be about one fourth of the camera's maximum in four frame grabber mode.

It's helpful to use this mode to get the camera set up and focused.

Test the System with Four Cytons
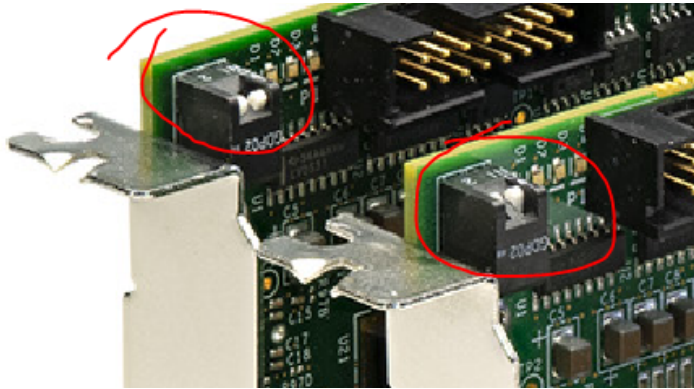
Install Four Cytons in the PC.

Install the four Cytons in four PCIe x8 or x16 slots.

Each physical Cyton is seen by the operation system as four Virtual Frame Grabbers (VFGs). Each Cyton will exposure VFG0, VFG1, VFG2 and VFG3. When using a quad link CXP camera, only the first VFG (VFG0) is used on the Cyton. All of the VFGs in the system are accessed by selecting their board numbers. Thus the system will look like this:

Cyton	VFG	Connector	Board
0	VFG0	1	0
0	VFG1	2	1
0	VFG2	3	2
0	VFG3	4	3
1	VFG0	1	4
1	VFG1	2	5
1	VFG2	3	6
1	VFG3	4	7
2	VFG0	1	8
2	VFG1	2	9
2	VFG2	3	10
2	VFG3	4	11
3	VFG0	1	12
3	VFG1	2	13
3	VFG2	3	14
3	VFG3	4	15

Because the S990 requires four Cytons, the operating system will see 16 VFGs. You will only be using the first VFG on each Cyton. This means that you will be working with VFG0 on each board.

It is important to establish which physical board corresponds to which VFG. To help with this each boards has a small switch on the top of the board near the CXP connectors. You an set this switch to a different value on each physical board.

You can then use SysReg to determine the switch value of each VFG.
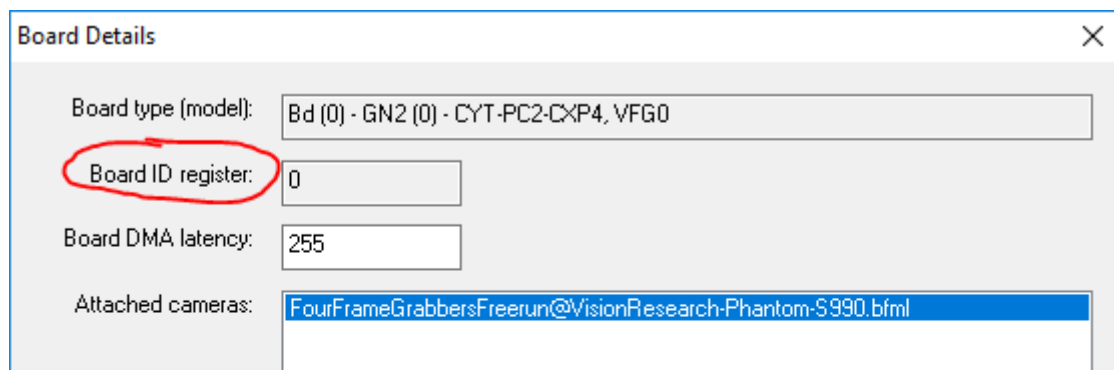
Discover order of the Cytons in the PC

We recommend setting the switches on the four Cytons so that the board switch setting are in the same order as the VFGs. This will make connecting cables less confusing.

Board	Switch
0, 1, 2, 3	0
4, 5, 6, 7	1
8, 9, 10, 11	2
12, 13, 14, 15	3

The procedure goes something like this:

Set the switch on each board to a unique value
Run SysReg, click on VFG0, Click on "Configure", then look at the "Board ID register".
If VFG0 does not have ID = 0, swap the board's switch settings around so that VFG0 has ID = 0
Repeat this process with VFG4, VFG8 and VFG12

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Connect the 16 CXP cables from the camera to the Cytons in the correct order

Now that you know the order of the Cytons, connected this 16 cables between the camera and the Cyton as shown in the table below:

Cyton	Connector	Board	Camera Connector
0	1	0	1
0	2	1	2
0	3	2	3
0	4	3	4
1	1	4	5
1	2	5	6
1	3	6	7
1	4	7	8
2	1	8	9
2	2	9	10
2	3	10	11
2	4	11	12
3	1	12	13
3	2	13	14
3	3	14	15
3	4	15	16

Configure the system for Four Frame Grabber Mode

Run SysReg, click on Bd(0), hit the "Configure" button. The "Board Details" dialog will show up. Click the "Change" button to attach a configuration file. Select the following file:

Make: Vision Research > Model: Phanton S990 > Mode: Four Frame Grabbers, Freerun. Click on the mode name and hit "OK". Repeat this process for Bd(4), Bd(8) and Bd(12). You do not need to attach a configuration file to any of the other VFGs.

Test the system in four frame grabber mode

You can now run "BitFlow Preview" four times. Each time it will ask you which board to open. Select Bd(0), Bd(4), Bd(8) then Bd(12) in that order. When the system is in four board mode, each frame grabbers gets 1/4 of the lines. The result of this is that the images in each "BitFlow Preview" window will look squished vertically. The image width will be correct, but the image height will be one fourth of what it should be. If you zoom in you will see that 3/4's of the lines are missing from each copy of "BitFlow Preview".

Test the system using BiFlow2x

BiFlow2x is an application that is designed to acquire images from two our four Cyton frame grabbers simultaneously and re-interleave the image lines from each Cyton so that the images in memory look exactly like they do on the image sensor.

Images are recorded to host memory. After they are captured, they can be played back using the VCR style controls (or menu commands). Images sequences can also be saved to disk for off-line processing.

Run "\BitFlow SDK X.XX\BinXX\BiFlow2x.exe"

Click "NO" to run the application in four board mode

The "Open which board?" dialog will appear four times in a row. Select Bd(0) the first time, Bd(4) second time, Bd(8) then third time then Bd(12) hit "Open Initialized" each time. After the last time it will take a little while to open and configure all four boards.

Next the "Memory Allocation" dialog will pop us. This lets you select the number of frames that can be captured in a sequence, to start with we recommend setting a smaller number of frames, maybe 100 to 1000. Click "OK" to close this dialog an open the application.

When the main application window opens up, select Acquisition > Setup to set up the boards for acquisition.

To start acquisition, select Process > Start Acquisition, click "OK" to the frame selector, the "OK" to the acquisition start dialog. After the last "OK" acquisition will start and quickly end when all frames are acquired.

Once acquisition is complete, a dialog will popup indicating is it done. Click "OK" to this dialog. You can now look at the frames in the display window. You can step through them or play them back using the VCR style controls. Frames can be saved using the File > Save menu command.

Note that the camera's default power up frame rate is 100 FPS. You can modify this rate by running our Ximilon application and navigating to the Acquisition settings where you can set the frame rate. Ximilon also provides controls for all of the other camera settings.