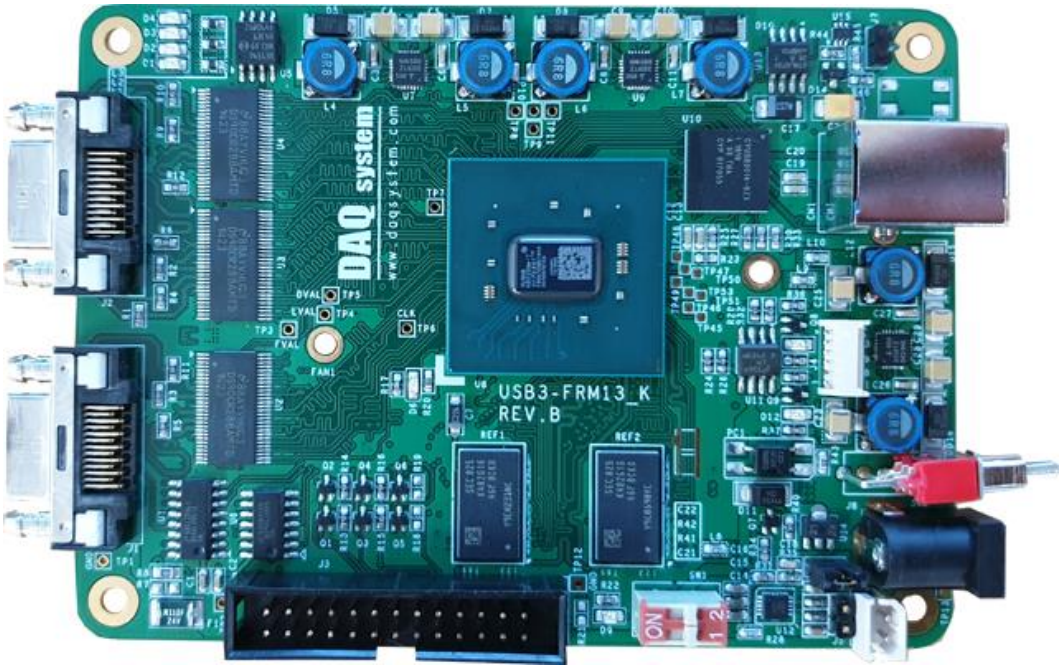
USB3-FRM13_K

User Manual

Version 1.1



DAQ SYSTEM
Measurement & Automation

Contents

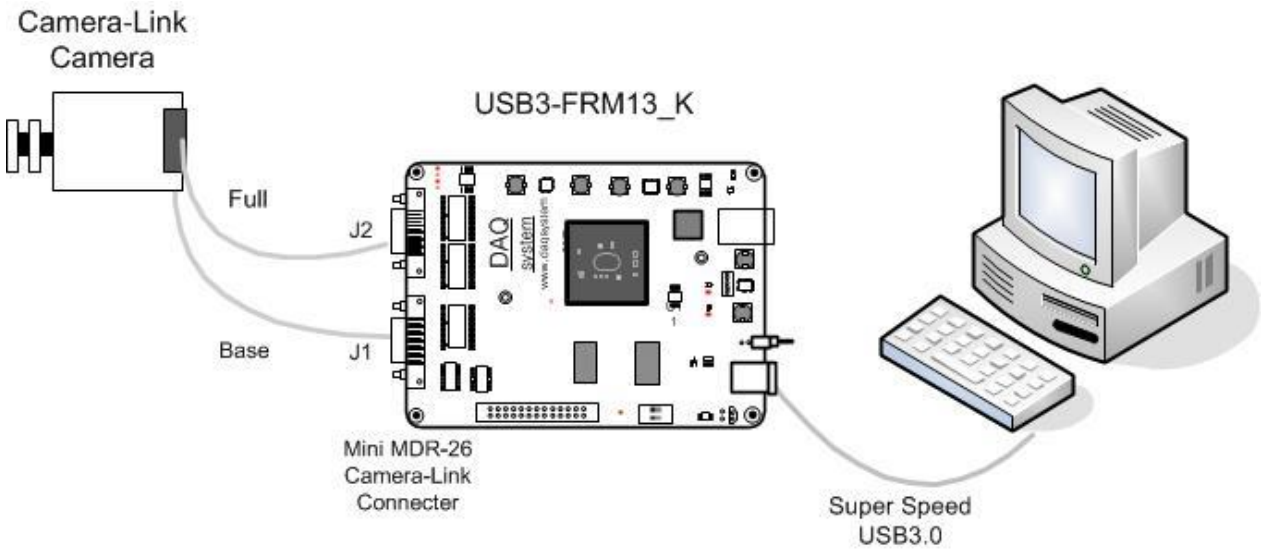
1. Introduction

USB3-FRM13_K is an image acquisition board to support Full configuration camera Link compatible cameras. Acquire images in real time and directly transferred to the system memory. Easy installation and fast image transfer is a suitable device to meet the needs of the industry's low-cost, high-efficiency.

The sample program provided by the DQ system is provided in the form of a source so that the API provided to use the board can be tested briefly, so the user can modify it and use it. Refer to Chapter 5 Sample Program for detailed explanation.

The Mini MDR 26-pin connector can connect with Camera Link compatible cameras, the bottom connector (J8) supports Base Camera Link Configuration, and the top (J4) connector supports Full/Medium Camera Link Configuration with the bottom connector. In addition, it has the function of external control by providing 4 pairs of RS-422 signal lines and 6 TTL level Line/Area Trigger signals. Please refer to 3-3 Connector Pin-Out for detailed explanation.

This is a board that transmits the captured image frame to the PC through the PCI Express 1x interface method in conjunction with the standard Camera-link camera. The operation of the board is controlled by the program API, and the figure below shows the interlocking operation of the board.



[Figure 1-1. USB3-FRM13_K Board Usage]

1-1 Product Features

Items	Description	Remark
Hardware		
PC Interface	USB 3.0	B-Type
Operation Power	+12VDC/650mA	External 12V DC Power (A6-Type : 5.5x2.1mm)
Video Interface	Base/Medium/Full Camera Link	
Feature	Area/Line Scan Camera Pixel Clock : 20 ~ 85MHz 1 ~ 10tap 85MHz PoCL	 12V (333mA)
Interface	4TTL Digital I/O 2TTL Trigger I/O 4-pair Differential Encoder Signal	 Isolated Photo Coupler
On-board Memory	256MB (DDR3) x2	
Communication	UART(Data bit 8, 1 start, 1 stop, No parity, 9600/19200/38400/57600 /115200bps)	
Simultaneous use of boards	Max. 4	
Software		
OS	Windows 2000/XP/7/8/10 (32/64bit)	
API	Windows Client DLL API	
Development		
Support	Sample Program	VC++
Environmental conditions		
Operating temperature range	0 ~ 60℃	
Storage temperature range	-20 ~ 80℃	
Humidity range	5 ~ 95%	Non-condensing
Board size	80mm X 110mm	PCB Board Size

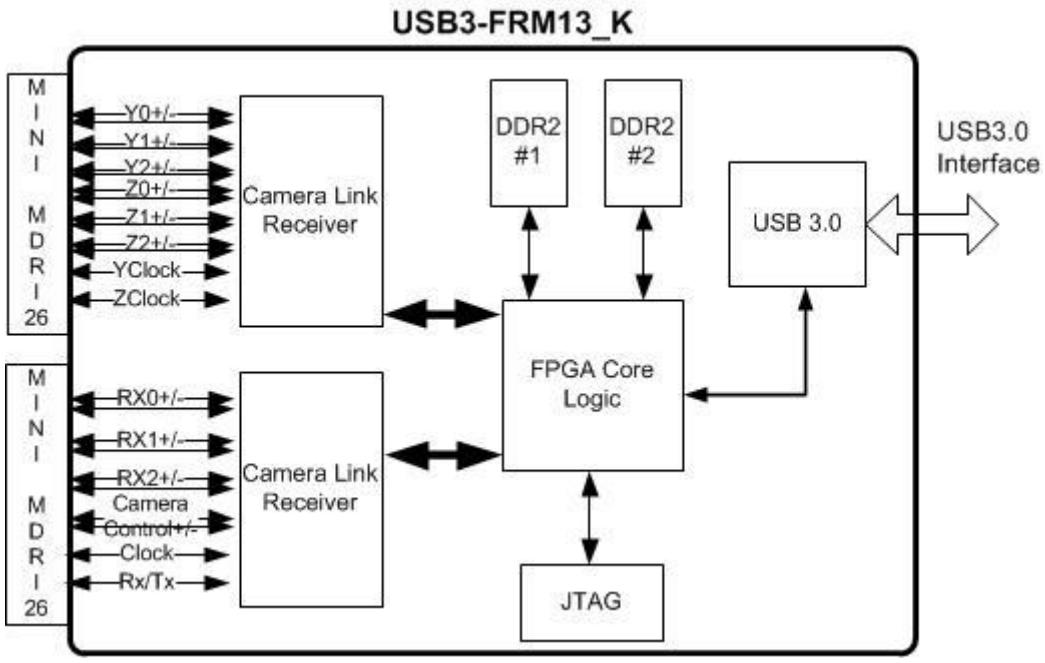
1-2 Product Applications

- Image recognition (Pattern, particle, etc.)
- Inspection equipment (Sensor, Semiconductor, Device etc.)
- Security Solution
- Black and White, Color Image Display
- Medical Image Capture (X-ray, Supersonic etc.)

2. USB3-FRM13_K Board Function

2-1 Block Diagram

As shown in the figure below, in the case of USB3-FRM13_K, FPGA Core Logic is in charge of overall control. Its main function is to receive Image Frame Data through two Mini MDR-26 connectors, write it to DDR#1 and DDR#2 first, and transmit it to the PC upon request. These functions are performed using API in PC through USB 3.0 interface.



[Figure 2-1. USB3-FRM13_K Block Diagram]

Programming FPGA Core Logic is performed via the JTAG interface. The logic program of the FPGA is saved in a flash ROM, it is located on the board and loaded at the power-up time.

2-2 Camera Link

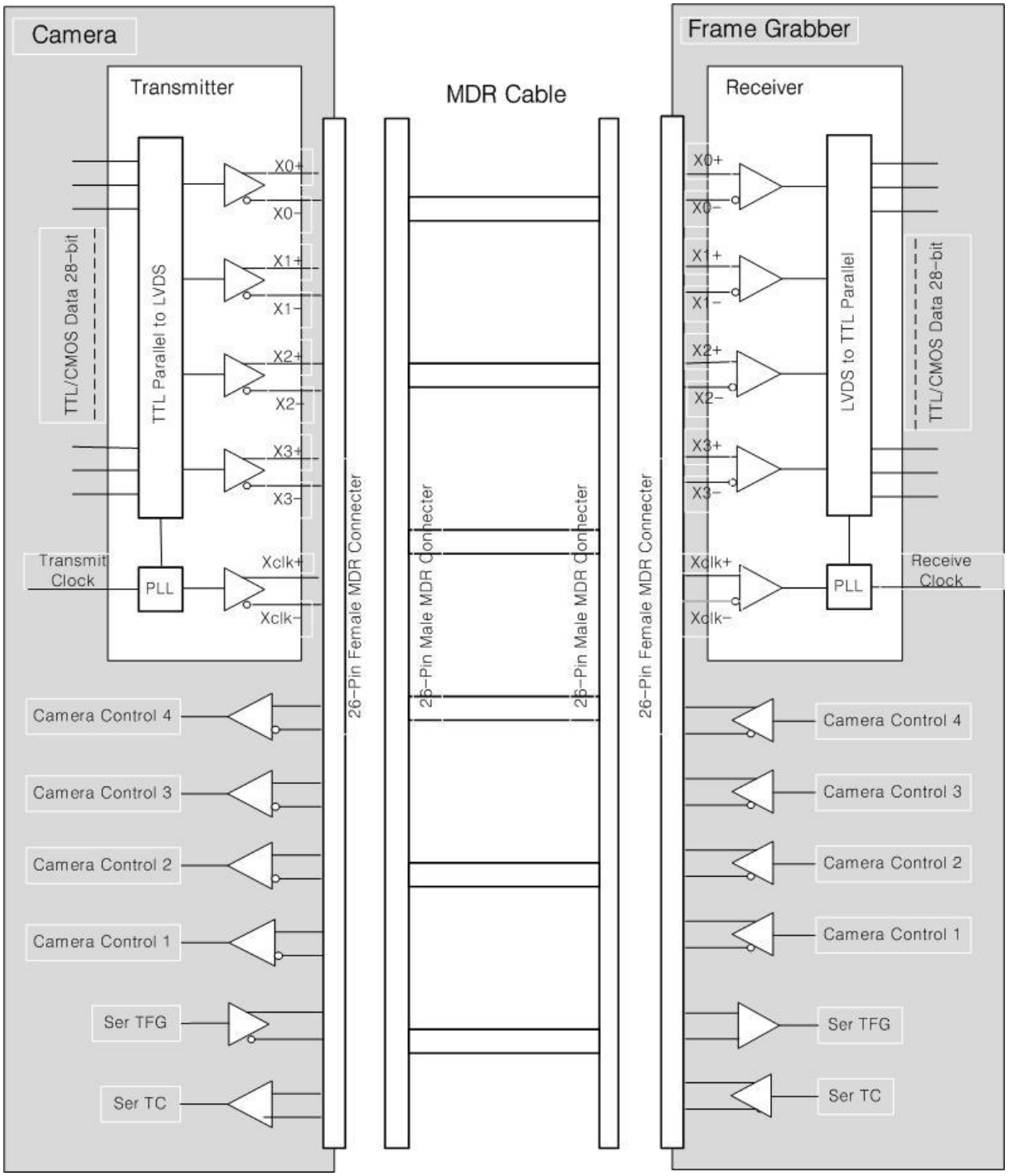
Camera Link is a communication interface for use in a vision application development. In the past, the camera manufacturer and Frame Grabber manufacturers use their own standard connectors and cables. This has caused a lot of confusion and increased costs to users. In order to eliminate this confusion and increase the data rate and data transmission trouble, the specifications of Camera Link interface have been made to the regulations of cable or connector assembly specifications, transfer speed, transfer method at the meeting of camera makers and Frame grabber manufacturers.

Currently, many digital video solution use the LVDS (Low Voltage Differential Signal) communication as defined RS-644. LVDS is a way to improve the existing RS-422 that had intractable cable and transmission speed limit. RS-644 LVDS was the Camera Link standard. The LVDS can be transferred the data at high speed using low voltage swing differential signal Differential Signal. This is compared with the existing single-ended signal (Single-ended Signal) using one of the lines, the differential signal transmits the signal using two complementary lines. Such a transfer is characterized by excellent noise immunity, low power consumption, large in-phase voltage transmission to refer only to the data transfer on the ground, however Single-ended system is impossible.

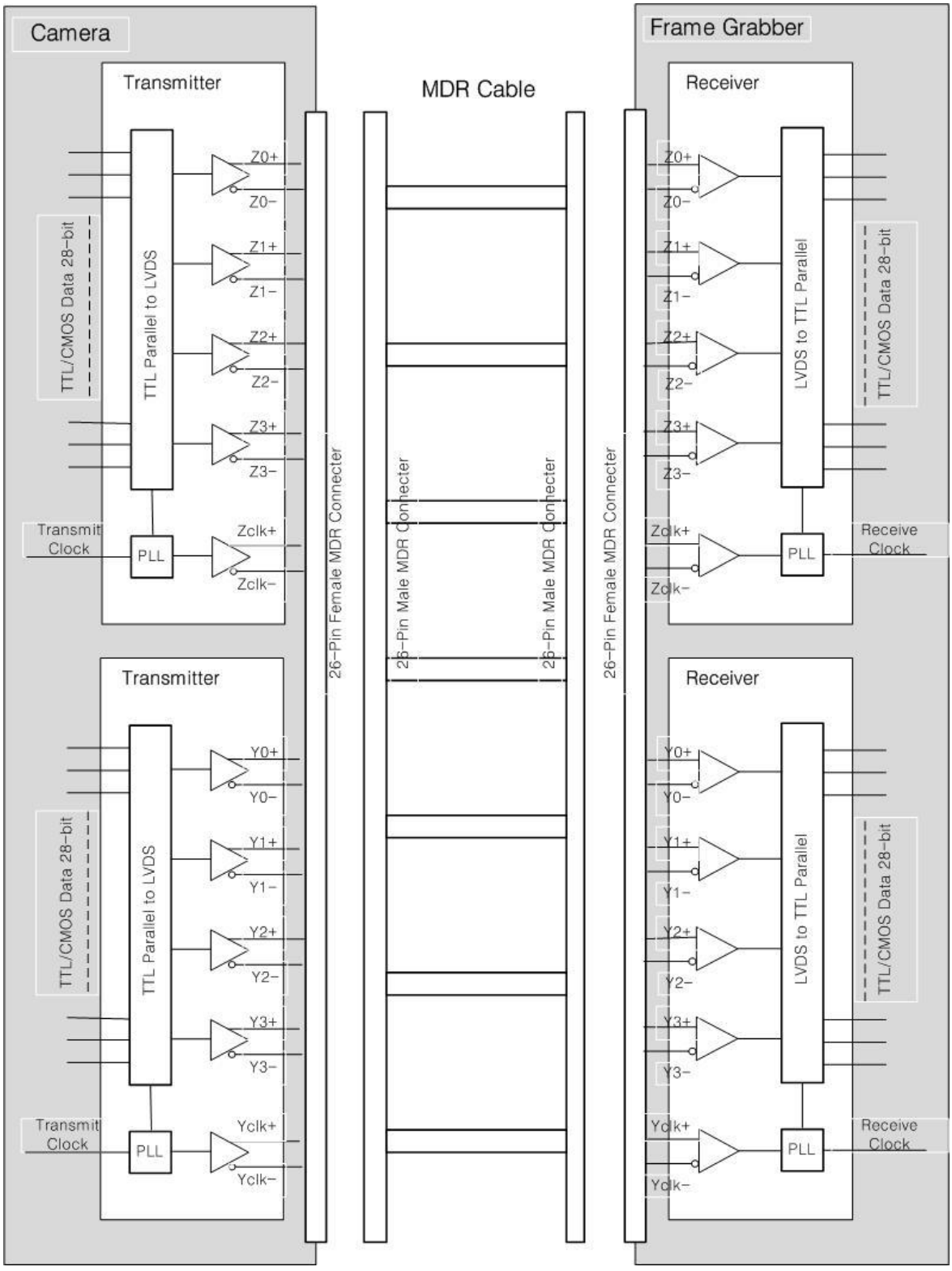
Camera Link has multiple configuration with depending on the amount of data to be transferred. Base Configuration consists of 28 bits, including a 24-bit pixel data and 3-bit video sync signal lines of the Data Valid, Frame Line Valid, Line Valid, one reserved signal line, and can transmit 2.04Gbit / s (256MB / s). Medium Configuration can be transmitted the 48bit video signal to 4.08Gbit/s(510Mb/s), Full Configuration can be transmitted the 64bit video signal to 5.44Gbit/s(680MB/s). Camera Link requires two cables to transfer more than Medium Specifications.

Transmitter part is converted to LVDS data stem's 4/8/12 from 28/48/64 bit CMOS / TTL data only. Converted signal is transmitted to MDR Cable in accordance with the Transmit Clock signal, the opposite Receiver will be converted into parallel LVDS data of 28/48/64 bits of CMOS / TTL according to the Receive Clock signal from 4/8/12 LVDS data. This Channel Link technology can immediately take advantage of the low cost chip-set because easy to learn and easy to transplant.

Camera Link Interface includes Base Configuration, Medium Configuration, Full Configuration. Base Configuration is used 4 RS-644 LVDS pairs for controlling the Transmitter/Receiver and Camera like [Figure 2-2], is used for communication between the camera and the frame grabber. Transferred the data from serial 26-Pin MDR Cable, is used to change 28-bit parallel image data at the Receiver part of Frame Grabber.



[Figure 2-2. Base Camera Link Block Diagram]

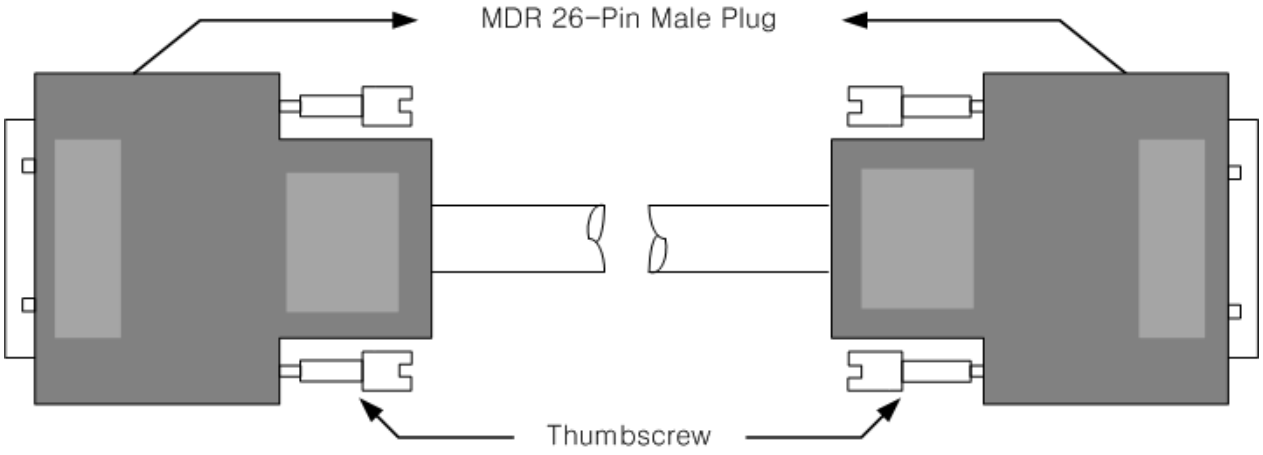


[Figure 2-3. Full Camera Link Block Diagram]

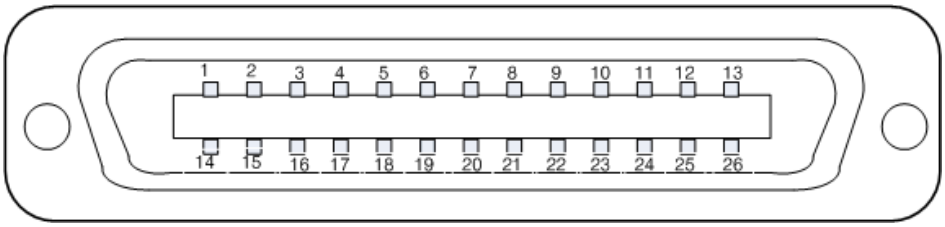
2-3 Camera Link Cable & Connector

The connection between the camera link cameras and USB3-FRM13_K board uses the 26 Pin Mini MDR (Mini D Ribbon) cable. Camera Link cable consists of twin-axial shielded cable and 2 Mini MDR 26-male plug. The bottom of [Figure 2-4] Camera Link cable is typically used.

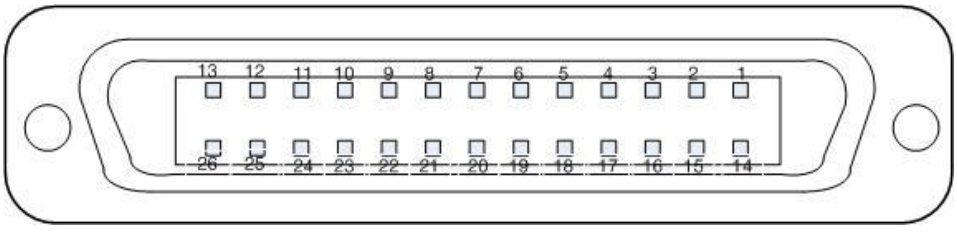
26-Pin Mini MDR Connecter is located at the end of the cable as like [Figure 2-5], [Figure 2-6] is 26-Pin Mini MDR Connecter, placed at the Camera or Frame Grabber. As shown in the figure, Pin numbers are cross-linked to each other, Transmitter and Receiver of Camera and Frame Grabber signals are connected cross each other.



[Figure 2-4. Mini MDR-26 Camera Link Straight Cable]



[Figure 2-5. Mini MDR-26 Cable Pin Map]

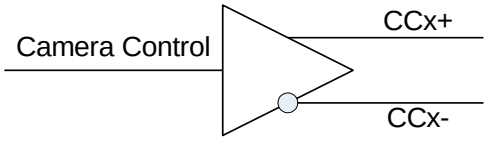


[Figure 2-6. Mini MDR-26 Connector Pin Map(Opposite Connector)]

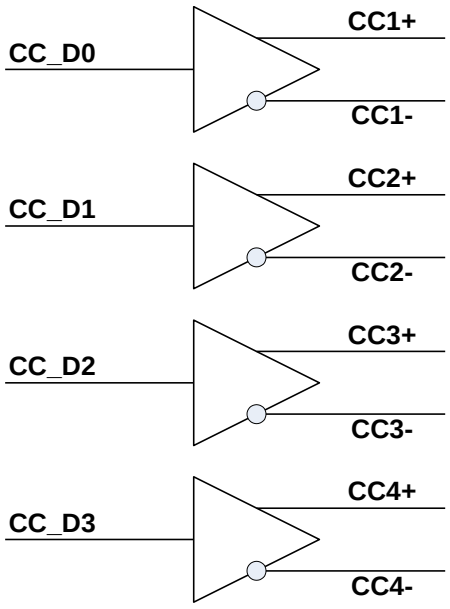
2-4 Camera Link and USB3-FRM13_K

USB3-FRM13_K supports Camera Link Base/Medium/Full Configuration. Base Configuration, 24 data bits and four enable signals Frame Valid, Line Valid, Data Valid and a spare, including 28-bit parallel signals serialized four LVDS signal lines and one LVDS signal line to fit the camera and synchronous LVDS signal lines including four CC (Camera Control) signal and full 11 includes two asynchronous serial communication to communicate with the camera LVDS lines, is transmitted through one MDR cable. In order to use the MDR Medium / Full Configuration is used other cable and has a total 64bit wide video path.

The transmitted signal parallelizes 12 video LVDS serial signals into 64-bit parallel video signals and control signals for each specification (Frame Valid, Line Valid, Data Valid, and a spare) through the Channel Link chip in USB3-FRM13_K. In addition, one LVDS to synchronize the signal between the camera and the USB3-FRM13_K makes a clock signal, and the remaining cameras control signals and communication signals are converted into general TTL signal levels and used.

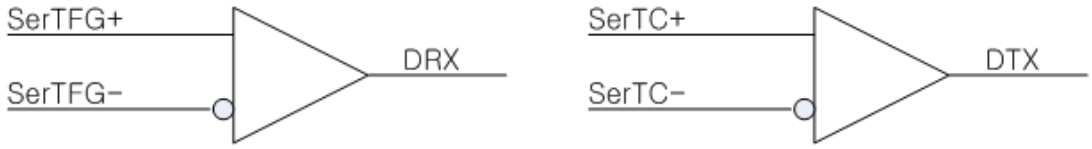


Above picture is a Camera Control output circuit from USB3-FRM13_K board to Camera for the specific control of the Camera-link Cable. The USB3-FRM13+K board has four differential digital outputs. Each output is mapped by Digital output. Below picture [Figure 2-7] display that each bit position set.



[Figure 2-7. Camera Control LVDS Digital Output Circuit]

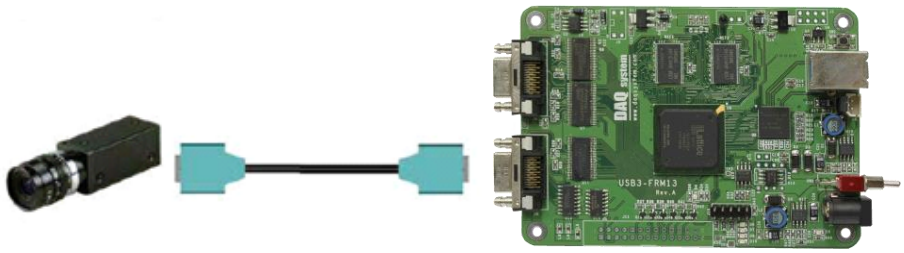
The serial input signal through the Camera-link cable is used for general input circuit from USB3-FRM13_K board.



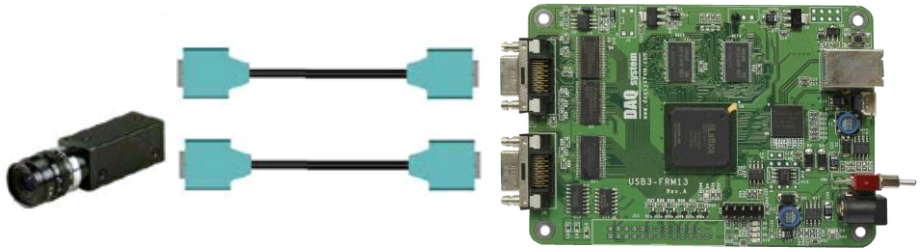
[Figure 2-8. Serial Communication LVDS Digital Output Circuit]

2-5 PoCL Function

PoCL (Power over Camera Link) is to transmit the power to the cable such as the data transfer cable to the camera. [Figure 2-9] shows the connection with theUSB3-FRM13_K and the camera.



(a) Base Configuration PoCL Connection



(b) Full Configuration PoCL Connection

Camera Link Signals → ← Power, Other Control Signal

[Figure 2-9. PoCL Connections]

This concept is similar the USB-powered devices to receive power from a power source such as a Repeater or Frame Grabber. PoCL has an advantage of reducing the number of interfaces required by the back of the camera. That is, using the four drain of the Camera Link cable wires (4 ground), the power cable can be removed from the camera. Not only it does not have any effect the quality of data from the camera, but also it is very helpful in reducing the cost and size of the system to remove the power source terminal.

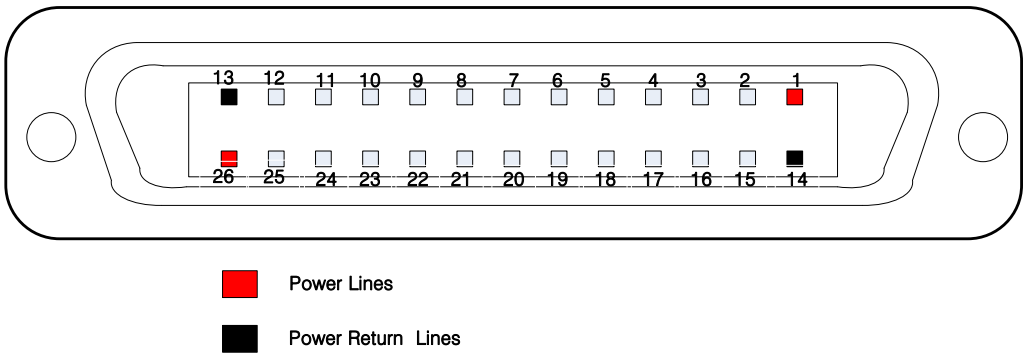
[Figure 2-10. Connection without Power Cable]

Implementation of PoCL that is, power transfer is used by setting the Camera Link 1, 13, 14, 26 pins as [table 1] and 1 and 26pins are used as the power(+ 12V). It can supply current of 330mA for 12V, it can supply current of 400mA for 10V as standard on 4W (watt),

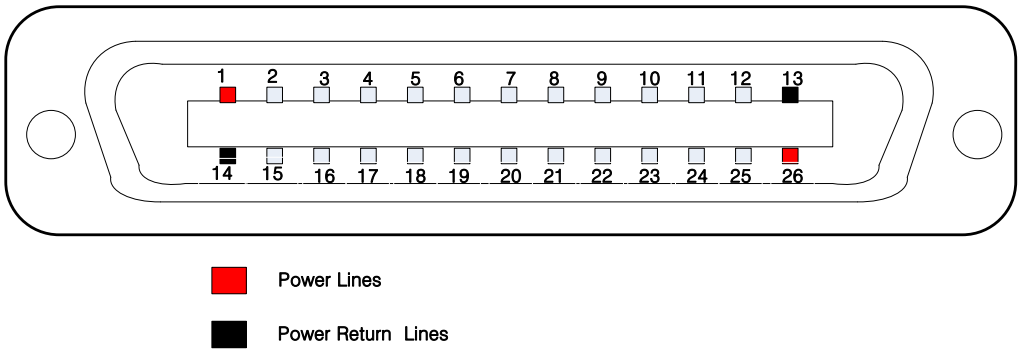
For USB3-FRM13_K, PoCL function can be implemented in the Base Configuration Connector. It is available for Base / Full Configuration camera.

[Table 1. Camera Link Connection for PoCL]

Pin	Existing Camera Link Connector	PoCL Connector
1	Inner Shield	Power (nominal 12V DC)
26	Inner Shield	Power (nominal 12V DC)
13	Inner Shield	Power Return
14	Inner Shield	Power Return



[Figure 2-11. PoCL Connector Pin Out]



[Figure 2-12. PoCL Cable Pin out]

In order to use a PoCL, generally it requires a transformation of the Frame Grabber (power supply section) or a dedicated cable. Frame Grabber conversion is divided into the power by changing the design of the product to include a power supply "safe power" or "dedicated power". Difference between the two, in the case of of "safe power" is to add some of the sensor circuit in order to detect the possible PoCL camera – it does not detect the camera and cable, there is no power supply. "Dedicated power" is always supplied a power, but use a fuse in order to supply the equipment that do not receive support.

USB3-FRM13_K supports dedicated power. It is only available if the camera supports PoCL and uses PoCL cables. If either the camera or the cable does not support PoCL, PoCL does not work. If you do not want to use the PoCL of the camera while using the PoCL cable, disconnect the fuse (F1) on the board.

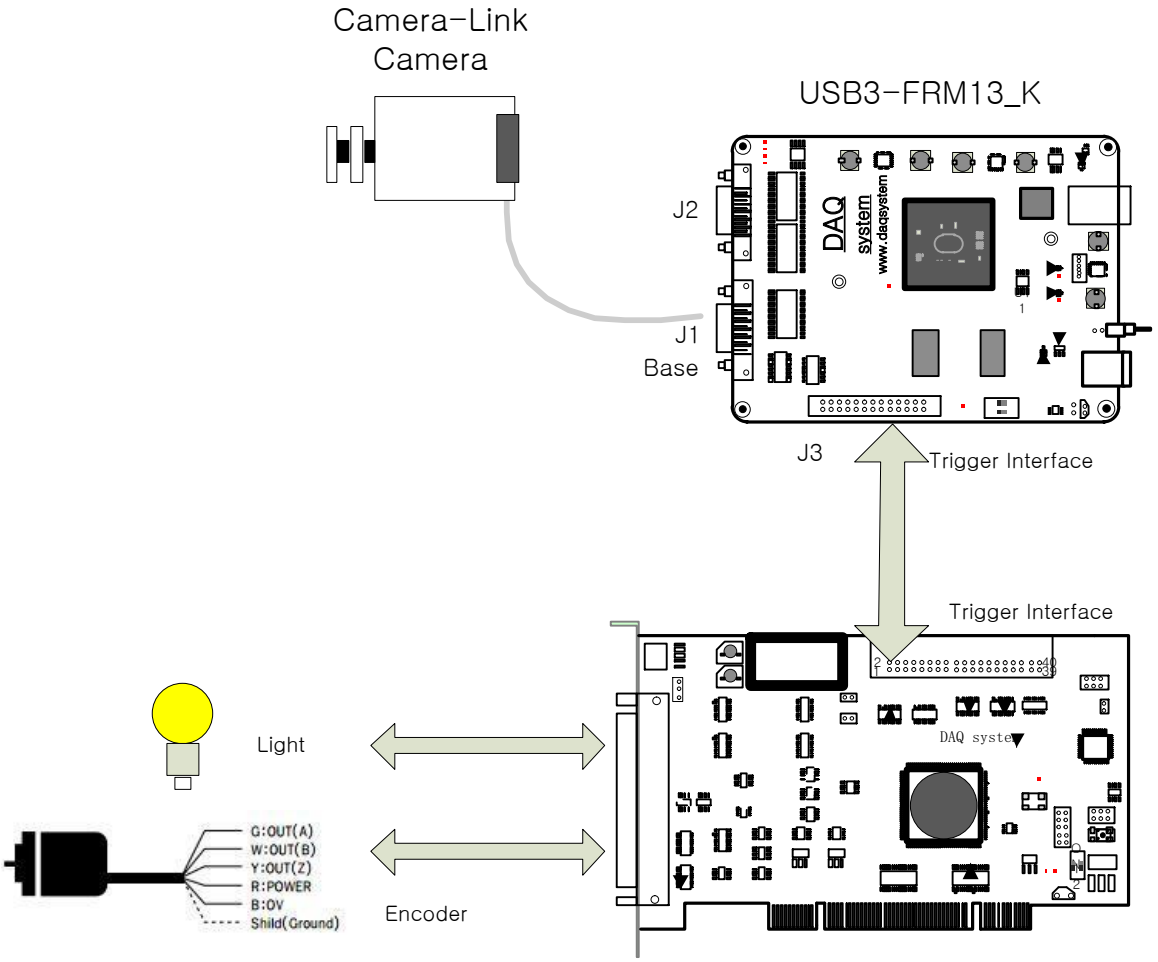
[Table 2. Compatibility Table]

Frame Grabber	Camera	Cable	Operability
Switchable PoCL Frame Grabber	Conventional	Conventional	OK
		PoCL	OK
	PoCL	Conventional	NOK
		PoCL	OK
Dedicated PoCL Frame Grabber	Conventional	Conventional	NOK
		PoCL	NOK
	PoCL	Conventional	NOK
		PoCL	OK
Conventional Frame Grabber	Conventional	Conventional	OK
		PoCL	OK
	PoCL	Conventional	NOK
		PoCL	NOK

Caution) When using a camera with PoCL applied and connecting a camera without PoCL applied (when used at the same time), it is recommended to turn the board power off and then on.

2-6 Encoder Trigger Controller

USB3-FRM13_K has 4 pair isolated photo-coupler and 6 TTL level signal lines for external digital I/O (Motion Controller, Digital I/O board etc.) and it can control a camera. For detailed signal line description, refer to section 3-3-6.

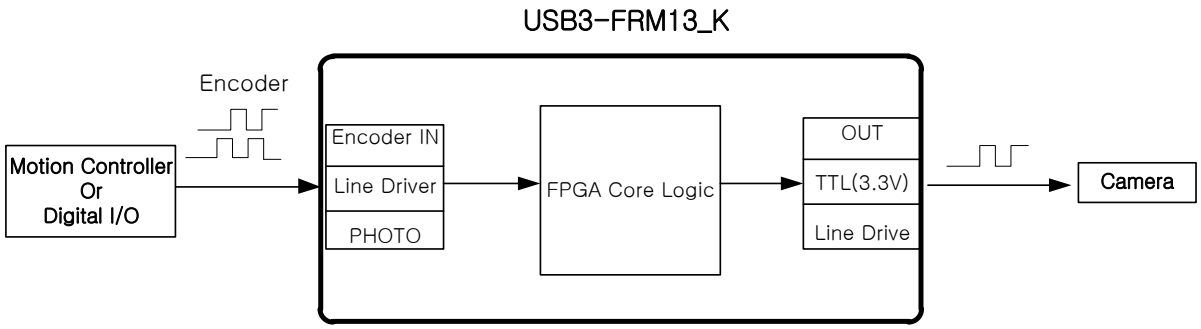


[그림 2-13. Encoder Trigger Control]

2-6-1 Trigger Mode

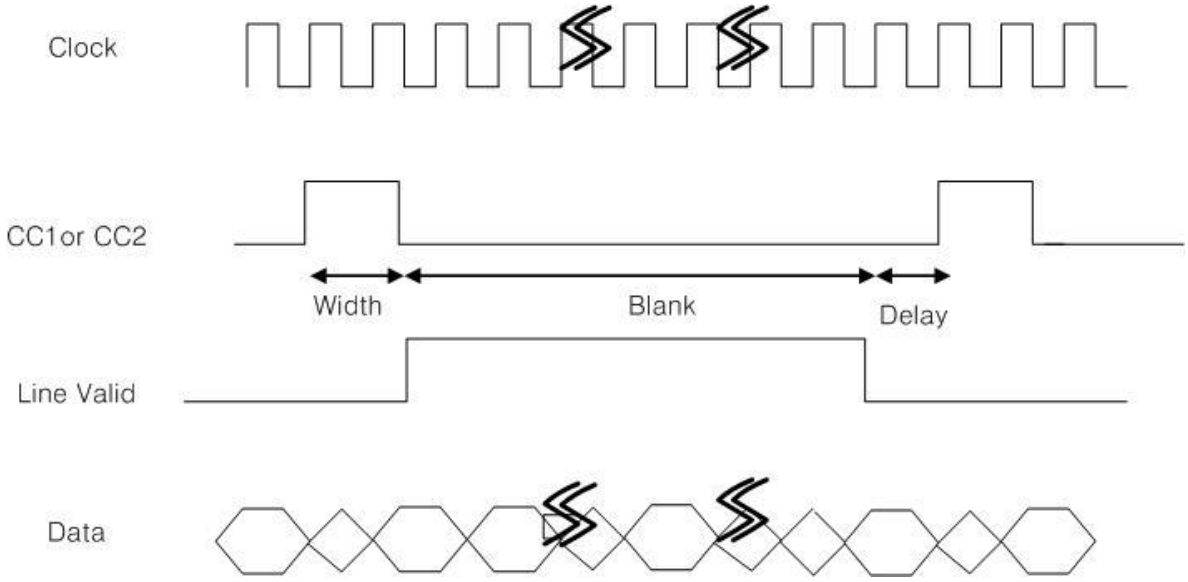
USB3-FRM13_K can be used for an external trigger.

The figure below shows a circuit that trigger signal inputs through the connector J3 are used to the general board input/output. This signals - are converted the CC (Camera Control) signal of Camera Link inside FPGA logic - will send to the camera. Currently set to CC1 ~ CC4 is shown below.



bit0(CC1 configure) = "0" : digital out1 / "1": alternate (Trigger1 output)
bit1(CC2 configure) = "0" : digital out2 / "1": alternate (Trigger2 output)
bit2(CC3 configure) = "0" : digital out3 / "1": (Digital output)
bit3(CC4 configure) = "0" : digital out4 / "1": alternate (Reference clock output)

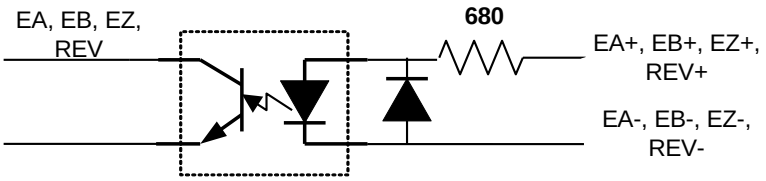
The Line Scan Camera is less time to transfer the information rather than Area Scan Camera because the outputs are a single line of pixels per exposure. However, the Line Scan Camera will be required moving objects in order to obtain images. Synchronization between the movements of the camera and the object is required. This synchronization is a little difference according to the manufacture's cameras and is performed by the trigger pulse which most of the triggering signal of an external camera or the camera's itself. The trigger pulse is initiated by the application. A thickness, width, delay of the trigger can be gave a value (Blank, Width, Delay) by the program.



[Figure 2-14. Trigger Timing]

2-6-2 A, B, Z Encoder

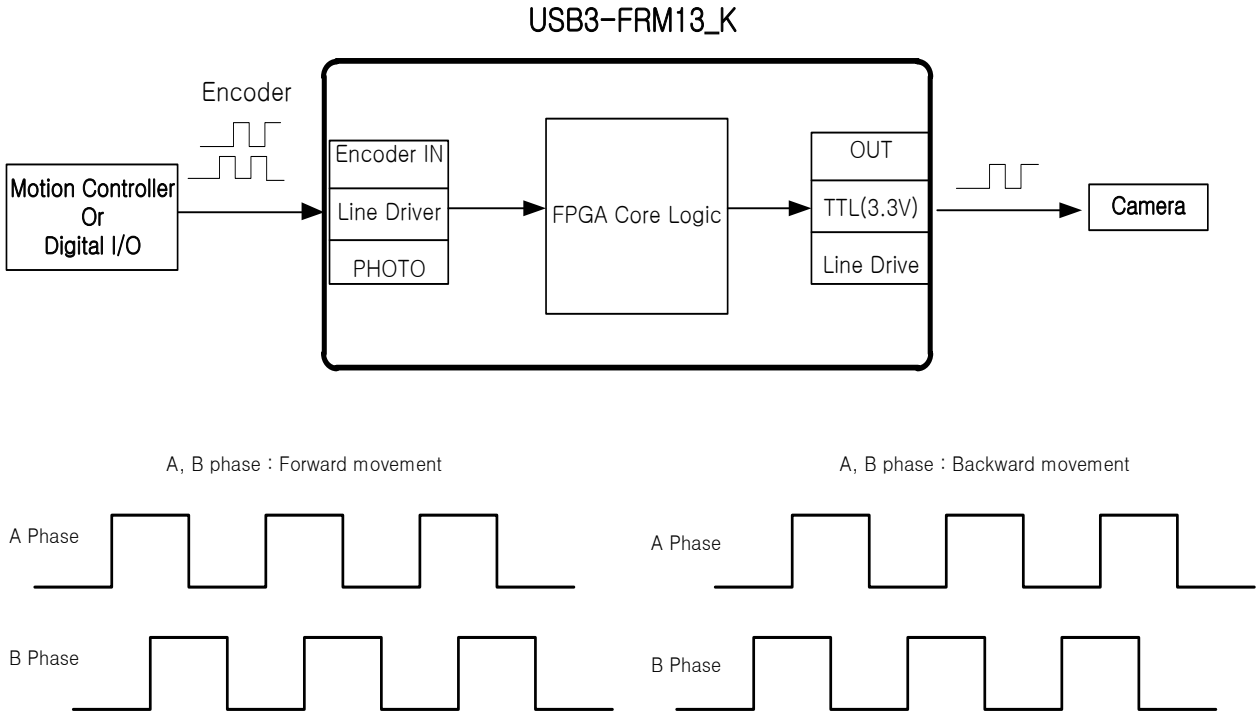
USB3-FRM13_K board can be controlled with using four pair Isolated Photo coupler input signals. Photo-coupler circuit is shown below. Output current should be used less than 10mA.



[Figure 2-15. Photo-coupler Circuit]

Caution) As Trigger Control can change according to kinds of Motion Controller or Camera, when you want use this function, contact to DAQ system

Rotary Encoder is used to detect a speed and turn direction of the electric volume or Motor. When turning the axis of rotation, two pulse signals that are able to distinguish between left and right, come out proportional to the speed. A single phase, A / B phase, A / B / Z phase are separated, the resolution can be determined according to the A / B pulse number by one turn.



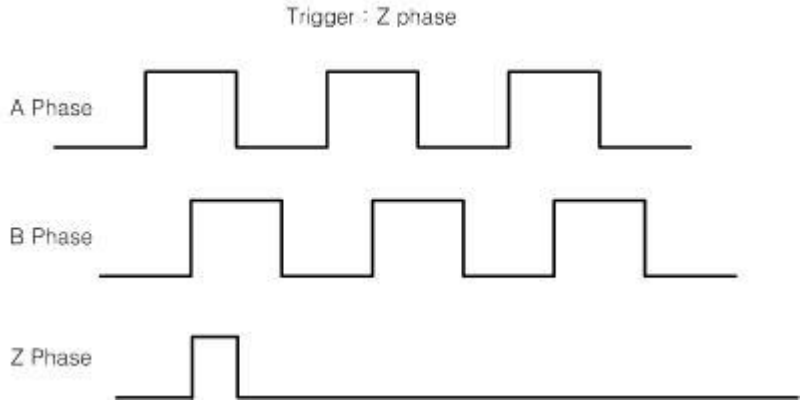
[Figure 2-16. Encoder A/B Phase Clockwise/Counter Clockwise]

A and B operates the difference of 90 degree as shown in the figure above.

When "B" is low and "A" is high, it move counter-wise direction

When "B" is high and "A" is high, it move count counter-wise direction.

Z also used as a trigger because Z shows the one on the wheel once.

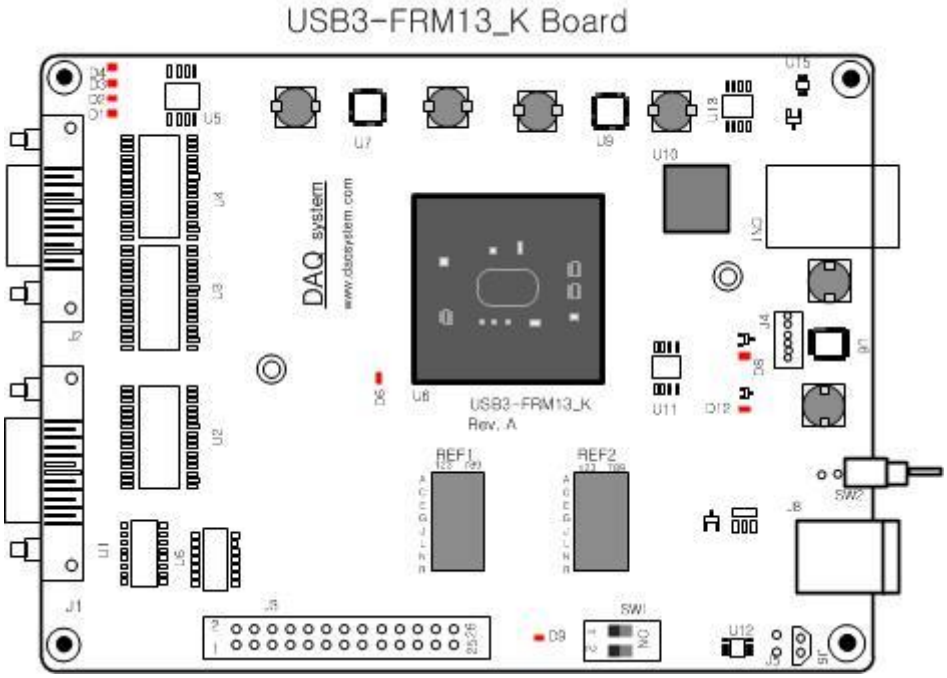


[Figure 2-17. Encoder Z Phase]

3. USB3-FRM13_K Board Description

Each important board function is briefly described. For detailed function information, please refer to the parts specification

3-1 USB3-FRM13_K Board Layout



[Figure 3-1. USB3-FRM13_K Layout]

There are a total of seven LEDs on the board, and the description of each is as follows.

D1 : Lights up when the board finishes configuration and ready for operation.
D2 : Horizontal Synchronization signal line (Hsync) is connected.
This is a sign for visually confirming Hsync.
D3 : Displays the value obtained by dividing Vertical Synchronization (Vsync) by 1/16.
This is a mark to visually confirm Vsync.
D4 : Lights up when 3.3V power is applied.
D6, 9, 12 : for testing

3-2 Device Features

(1) **MDR-26 Connector : J1, J2**

Camera Link Base (J1), medium/Full (J2) Signal Connector

(2) **LVDS Link : U2, U3, U4**

It is protected a circuit that the interface of high voltage higher than 3.3V CMOS Logic is exchanged to normal 3.3V Logic Level

(3) **FPGA : U6**

All of the functions are controlled by the logic program of the FPGA.

(4) **Regulator : U14, U20, U21**

The Regulator is for supplying the power (3.3V) to the board.

(5) **USB 3.0 Interface Chipset : U10**

This block supports USB3.0 Super Speed interface.

(6) **DDR Memory : REF1, REF2**

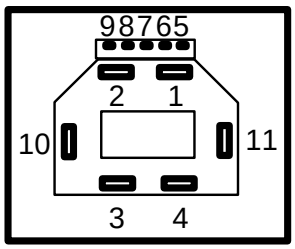
After save the data in a frame unit, transfer to PC through FPGA.

3-3 Connector Pin-out

This section describes the connectors and jumpers used in USB3-FRM13_K. The main connectors are CN1 for USB 3.0 connection, Mini MDR 26pin connectors J4 and J8 connectors for Camera Link connection, and 26pin Box Header connector J11 for external trigger I/O connection.

3-3-1 CN1 Connector

The USB3-FRM13 has a USB-B type connector for high speed USB connection.
[Figure 3-2] and [Table 1] shows the CN1 connector and its pin description.



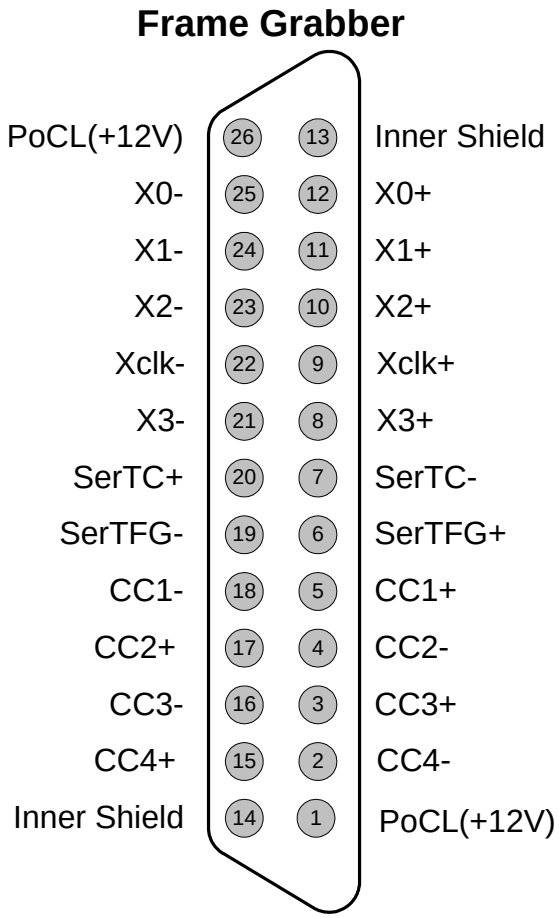
[Figure 3-2. CN1 Connecter (USB3.0 standard powered-B type Front View)]

[Table 3. USB3.0 Standard Powered-B Connecter]

Pin	Signal Name	Description	Remark
1	VBus	+5V Power	+5V Power
2	USB D-	USB2.0 data (Negative)	USB2.0 Signal
3	USB D+	USB2.0 data (Positive)	USB2.0 Signal
4	GND	Ground for Power Return	USB Power GND
5	StdA_SSTX-	Super Speed Transmitter (Negative)	USB3.0 Signal
6	StdA_SSTX+	Super Speed Transmitter (Positive)	USB3.0 Signal
7	GND_DRAIN	Ground for Signal Return	USB Power GND
8	StdA_SSRX+	Super Speed Receiver (Positive)	USB3.0 Signal
9	StdA_SSRX-	Super Speed Receiver (Negative)	USB3.0 Signal
10	DPWR	Power Provided by Device	USB Power GND
11	DGND	Ground return for DPWR	USB Power GND

3-3-2 J1(MDR26) Connector

The figure below shows the pin map of the J1 connector of the board used when using the Base Configuration Camera Link. All pin specifications are input/output based on the Camera Link standard, so please refer to the Camera Link standard document for details.



[Figure 3-3. J1 Connector Pin-out]

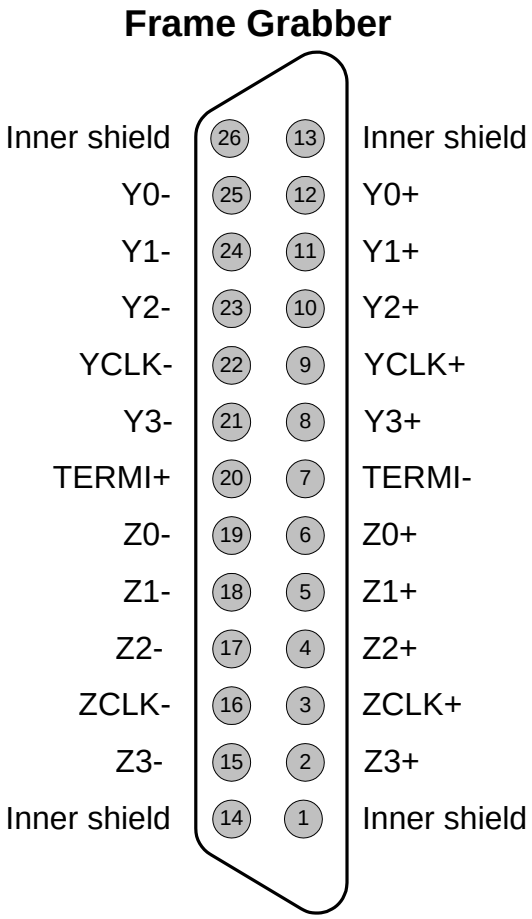
[Table 4. J1 Connector]

Pin No	Name	Description	Remark
1	PoCL_Pin	Power over Camera Link(+12V)	
2	CC4-	Camera Control output 4-	
3	CC3+	Camera Control output 3+	
4	CC2--	Camera Control output 2-	
5	CC1+	Camera Control output 1+	
6	SerTFG+	Serial to Frame grabber +	
7	SerTC-	Serial to Camera-	
8	X3+	Camera link LVDS receive data3 +	
9	Xclk+	Camera link LVDS receive clock +	
10	X2+	Camera link LVDS receive data2 +	
11	X1+	Camera link LVDS receive data1 +	
12	X0+	Camera link LVDS receive data0 +	
13	Inner Shield	Ground	
14	Inner Shield	Ground	
15	CC4+	Camera Control output 4+	
16	CC3-	Camera Control output 3-	
17	CC2+	Camera Control output 2+	
18	CC1-	Camera Control output 1-	
19	SerTFG-	Serial to Frame grabber-	
20	SerTC+	Serial to Camera+	
21	X3-	Camera link LVDS receive data3-	
22	Xclk-	Camera link LVDS receive clock-	
23	X2-	Camera link LVDS receive data2-	
24	X1-	Camera link LVDS receive data1-	
25	X0-	Camera link LVDS receive data0-	
26	PoCL_Pin	Power over Camera Link(+12V)	

(Note) For more information, refer to Camera Link Standard Specification.

3-3-3 J2(MDR26) Connector

The figure below shows the pin map of the J2 connector of the board used when Medium/Full Configuration Camera Link is used. All pin specifications are input/output based on the Camera Link standard, so please refer to the Camera Link standard document for details.



[Figure 3-4. J2 Connector Pin-out]

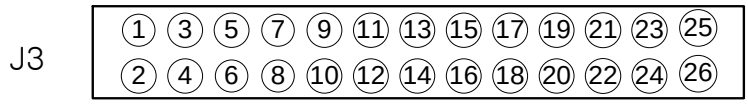
[Table 5. J2 Connector]

Pin No	Name	Description	Remark
1	Inner Shield	Cable shield	
2	Z3+-	Camera link LVDS receive data11+	
3	ZCLK+	Camera link LVDS receive clock+	
4	Z2+-	Camera link LVDS receive data10+	
5	Z1-	Camera link LVDS receive data9+	
6	Z0+	Camera link LVDS receive data8+	
7	TERMI-	Serial to Camera-	
8	Y3+	Camera link LVDS receive data7 +	
9	YCLK+	Camera link LVDS receive clock +	
10	Y2+	Camera link LVDS receive data6 +	
11	Y1+	Camera link LVDS receive data5 +	
12	Y0+	Camera link LVDS receive data4 +	
13	Inner Shield		
14	Inner Shield		
15	Z3-	Camera link LVDS receive data11-	
16	ZCLK-	Camera link LVDS receive clock-	
17	Z2-	Camera link LVDS receive data10-	
18	Z1-	Camera link LVDS receive data9-	
19	Z0-	Camera link LVDS receive data8-	
20	TERMI+	Serial to Camera+	
21	Y3-	Camera link LVDS receive data7-	
22	YCLK-	Camera link LVDS receive clock-	
23	Y2-	Camera link LVDS receive data6-	
24	Y1-	Camera link LVDS receive data5-	
25	Y0-	Camera link LVDS receive data4-	
26	Inner Shield		

(Note) For more information, refer to Camera Link Standard Specification.

3-3-4 J3 Connector

J3 of the input and output connectors support the Isolated Photo-coupler input signals of four pairs and four TTL Input, two TTL Output signal line.



[Figure 3-5. J3 Connector (Top View)]

[Table 6. J3 PIN-OUT]

Pin	Signal Name	Description
1	N.C.	No Connection
2	N.C.	No Connection
3	EA+	Encoder A+ (Positive) Phase
4	EA-	Encoder A- (Negative) Phase
5	EB-	Encoder B- (Negative) Phase
6	EB+	Encoder B+ (Positive) Phase
7	EZ+	Encoder Z+ (Positive) Phase
8	EZ-	Encoder Z- (Negative) Phase
9	REV-	External Clock Negative
10	REV+	External Clock Positive
11	TRIGGER_IN	TTL Input
12	N.C.	No Connection
13	LINE_TRIGGER_START	TTL Input
14	N.C.	No Connection
15	DIGITAL_OUT	Open Collector Output
16	N.C.	No Connection
17	DIGITAL_IN	TTL Input
18	N.C.	No Connection
19	LINE_TRIGGER_IN	TTL Input
20	GND	Board Ground
21	LINE_TRIGGER_OUT	Open Collector Output
22	GND	Board Ground
23	N.C.	No Connection
24	GND	Board Ground
25	+3.3V	Board Power(+3.3V)
26	GND	Board Ground

3-3-5 J8 Connecter

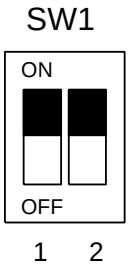
It is an external 12V DC Jack power connector DC-005 (2.0) standard. If the USB power is insufficient, you can program does not come out video or down.

If the power is insufficient, it will use this connector.

[Figure 3-6. Rated Output]

3-3-6 SW1 Switch

The USB3-FRM13_K board is designed of four maximum USB3-FRM13_K boards at the same time so as usable. Distribution of each board sets it up through 4 pin switch in a board.



[Figure 3-7. SW1 switch (Top View)]

[Table 7. SW1 PIN-OUT]

1	2	Description
OFF	OFF	Board No. 0
ON	OFF	Board No. 1
OFF	ON	Board No. 2
ON	ON	Board No. 3

4. Installation

After unpacking, inspect the board to make sure there are no damages on the package.

4-1 Package Contents

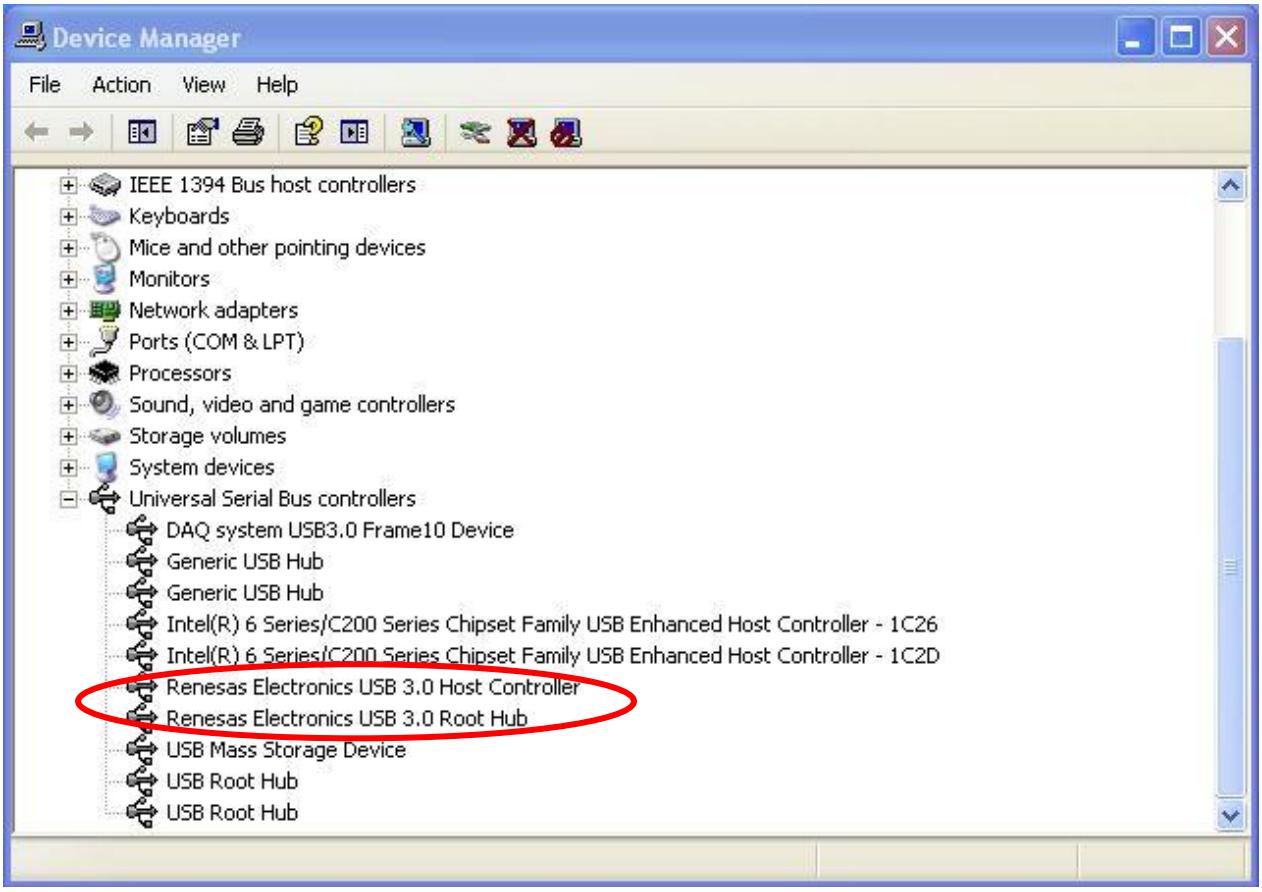
Product Contents

1. USB3-FRM13_K Board
2. USB3(A-B) Cable
3. CD (Driver/Manual/API/Samples etc.)

4-2 Installation Sequence

To install USB3-FRM13 board in your environment, do the following steps. The USB3-FRM13 board is completely Hot-Plug and Plug & Play. Therefore, you can install it easily.

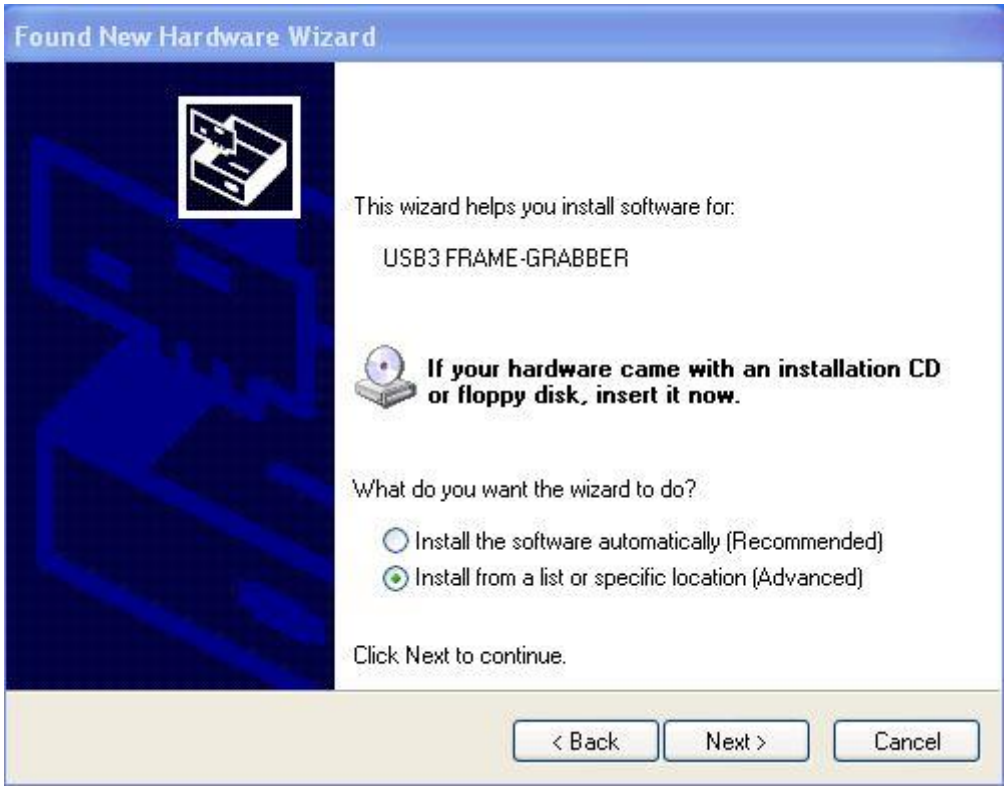
The required PC operating system for the USB3-FRM13 is Windows 2000 SP4 or Windows XP SP1 higher. The USB3-FRM13 uses USB Super Speed interface thus "xxx **USB 3.0 Root Hub**" should be installed in your PC. You can check this condition by doing the following steps.



[Figure 4-1. "Device Manager" window]

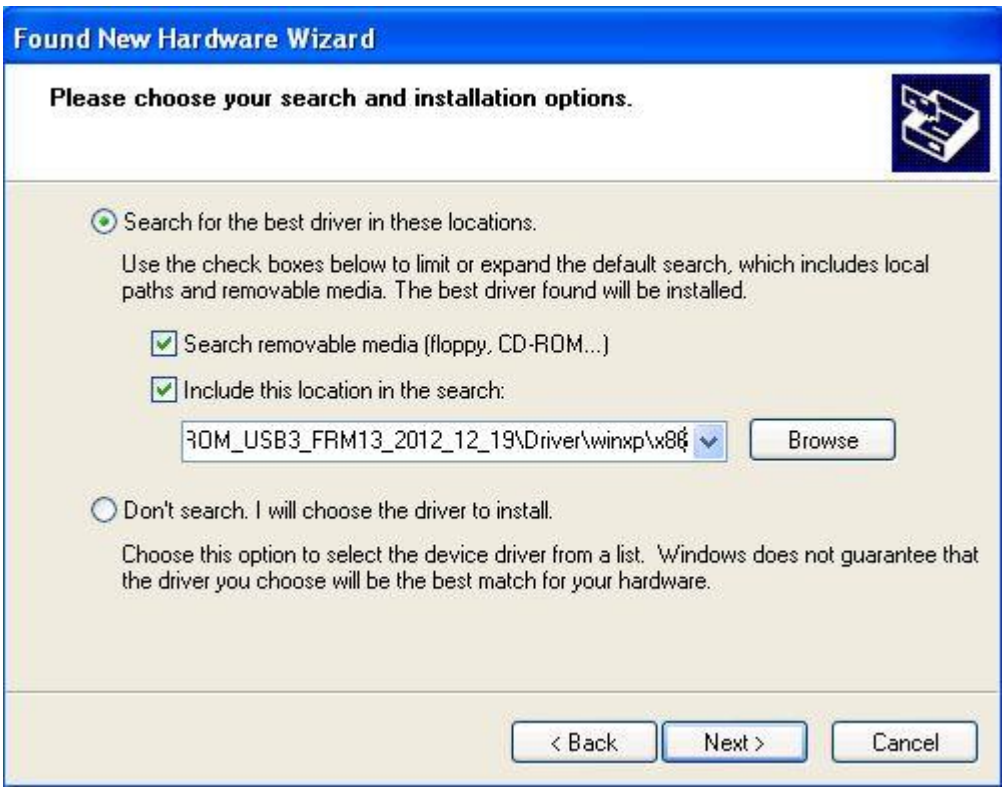
The item "USB 3.0 Root Hub" should be shown in the "Device Manager" window as shown in [Figure 4-1]. After checking the PC environmental conditions for USB3-FRM13, do the following steps to install the board

(1) Install the USB3-FRM13 board into your system.
(2) Power on the frame grabber.
(3) Confirm the LED(D4) on the USB3-FRM13 board turns on.
(4) Connect USB3 A-B cable between the case and your PC.
The Add New Hardware Wizard will appear in order to install the driver for new hardware.
(5) The Add new Hardware Wizard will install the driver in the following process. The following install process is explained based on Windows XP operating system.



[Figure 4-2. "Hardware Wizard" window]

If new hardware is found, Wizard will ask you to install the corresponding driver, For installation of the driver, select item "Install from a list or specific location(Advanced)" and click "Next" as in the [Figure 4-3].



[Figure 4-3. Specify the driver folder]

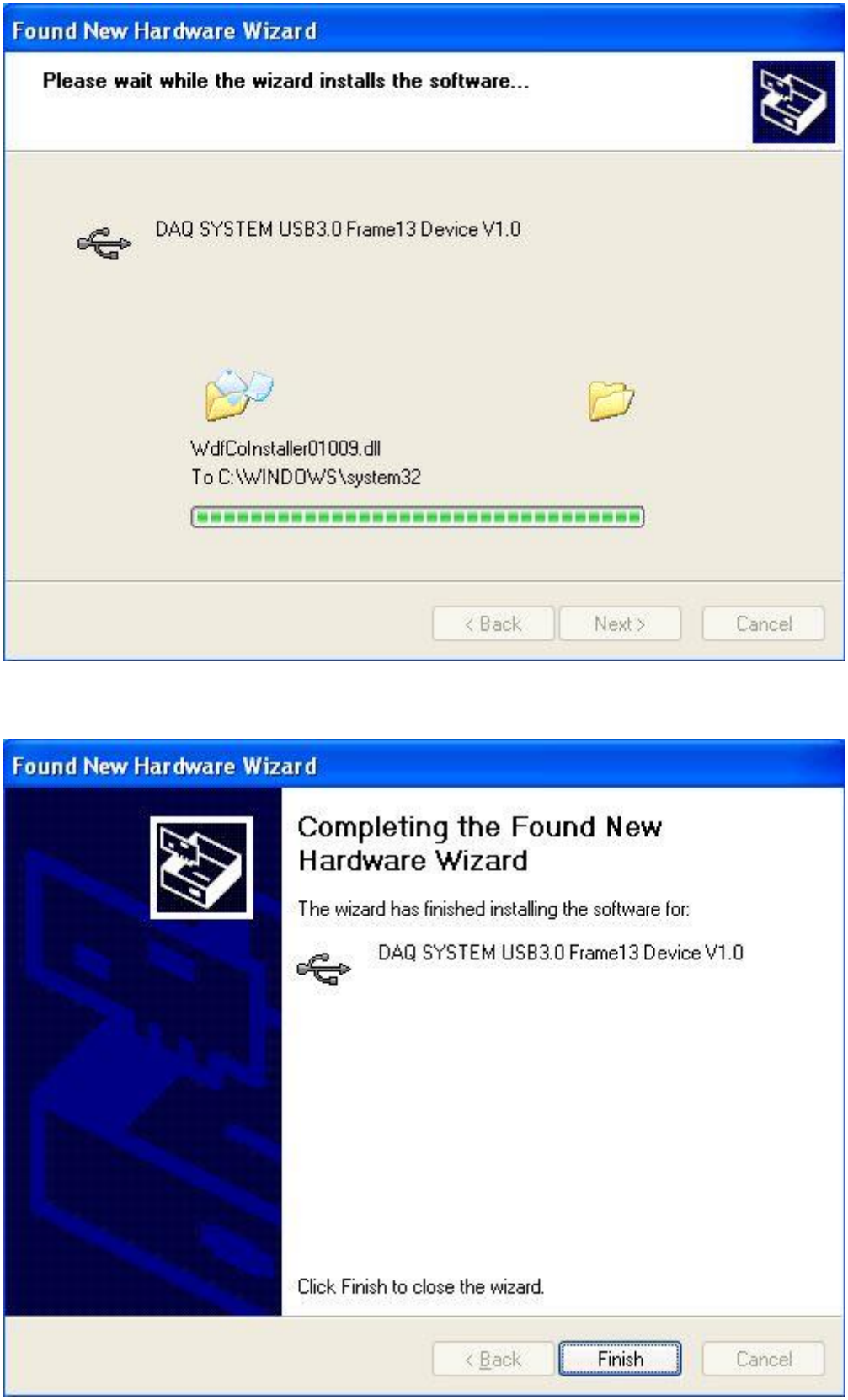
Select "Search for the best driver in these locations". Check "Search removable media (floppy, CD-ROM)". Check "include this location in the search". Click "Browse" button. Select the folder where the drivers are located. Click "OK". Click "Next".

The necessary files are **"cyusb3.inf"** and **"cyusb3.sys"** in the driver polder.

[Figure 4-4. Warning window]

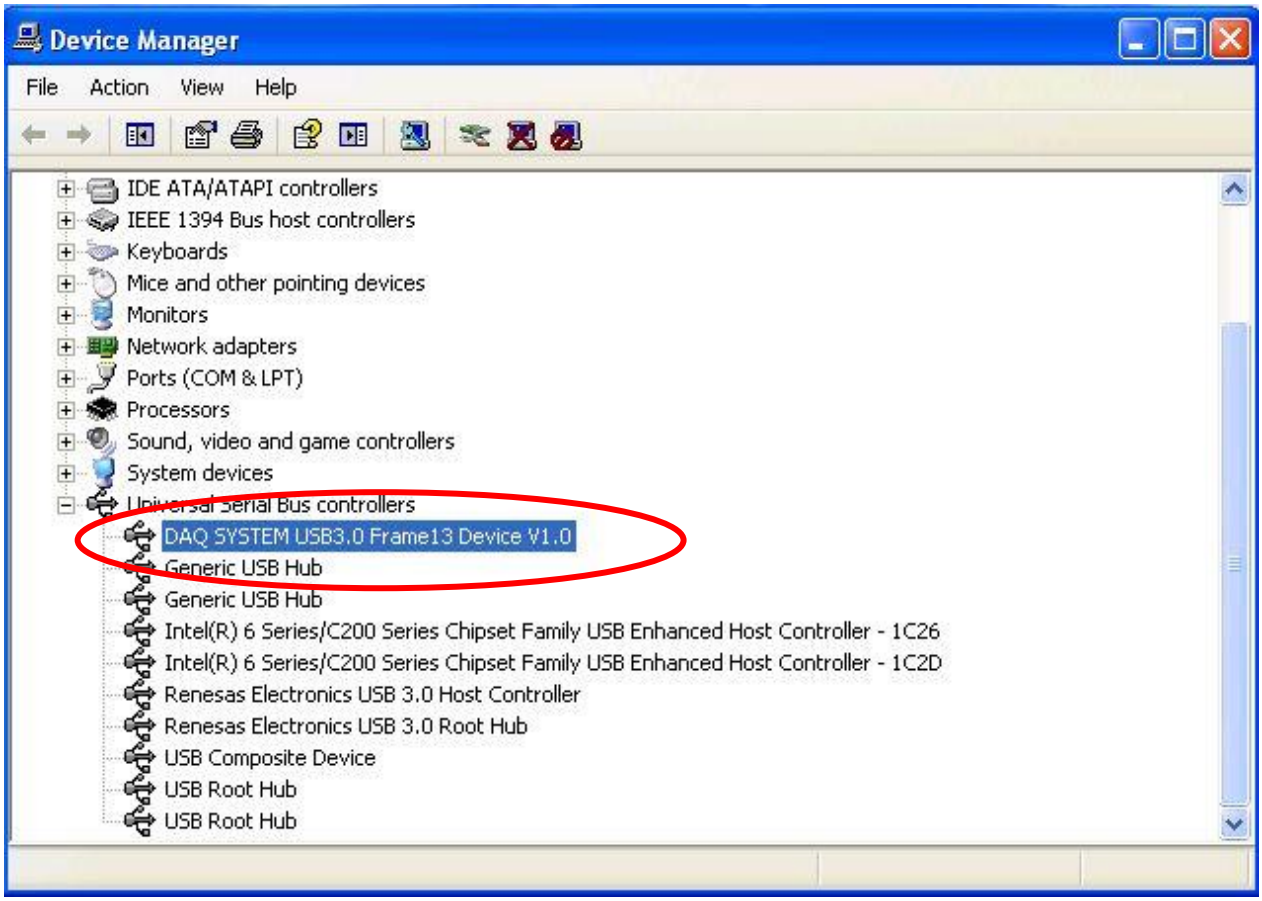
When you across a window's warning message regarding to the compatibility problem as shown the [Figure 4-4] during the installation process, just click "Continue" button and go on the installation.

If the installation is completely finished, a completion window message shall be shown as in [Figure 4-5]. Click "Finish".



[Figure 4-5. "Completion" message window]

If you successfully complete the wizard, you can find the item **"DAQ system USB3.0 Frame 13 Device"** in the "Device Manager" window as shown in [Figure 4-6].



[Figure 4-6. "Device Manager" window]

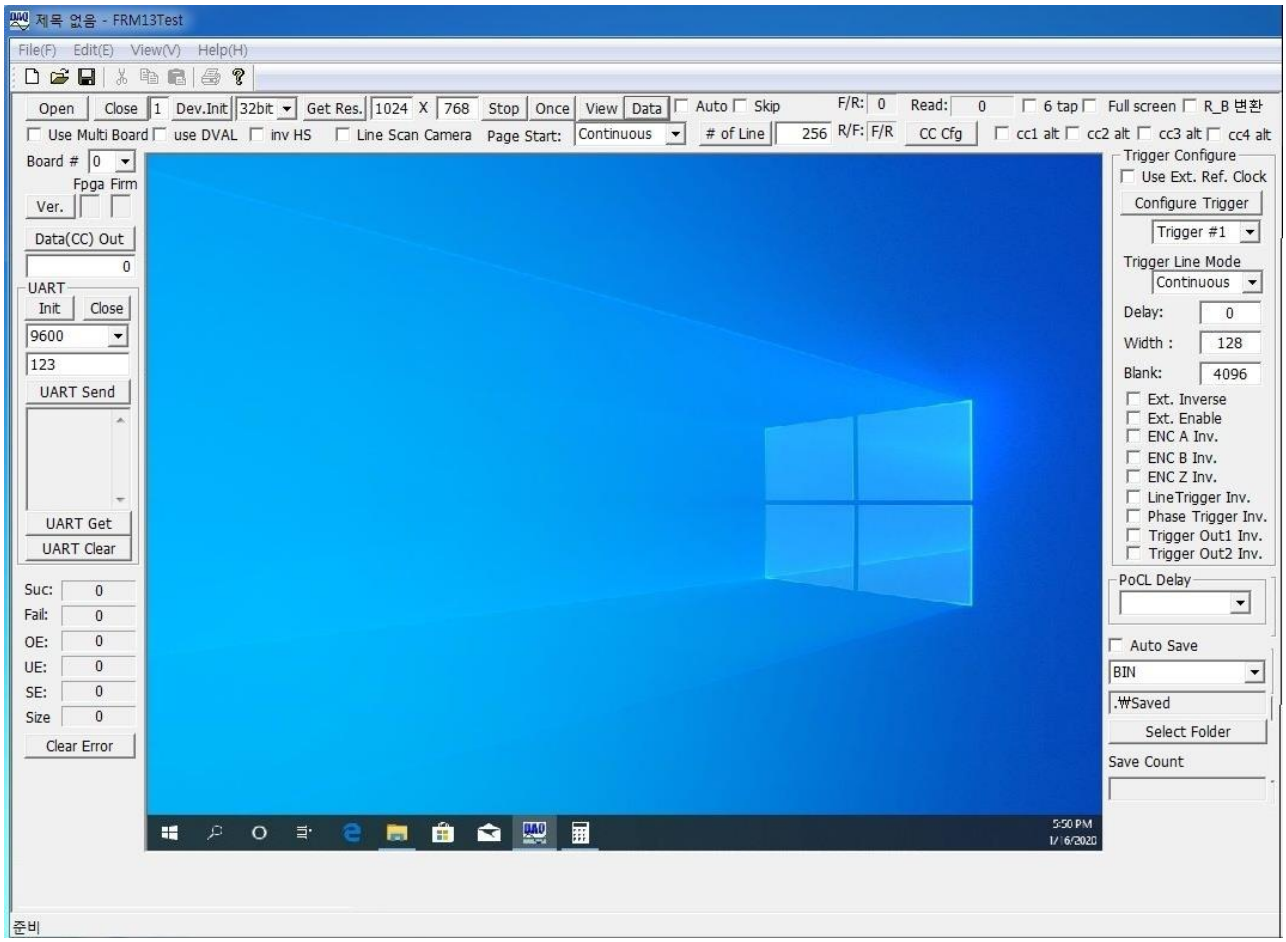
If you can see the "DAQ system USB3.0 Frame 13 Device" at the Universal Serial Bus controllers, the driver installation is to have been over. (Check the red circle)

(Note) After initial installation, the PC must be rebooted for normal operation.

5. Sample Program

In the Exe folder of the CDROM provided with the board, a sample program "FrameTest.exe" is provided for easy use of the board. By displaying Frame Data as hexadecimal values, it is stored in memory or hard disk so that developers can utilize the frame data needed. In order to test the sample program, the driver of the board must be installed first.

The sample program is provided in the form of a source so that the API provided to use the board can be tested briefly, so the user can modify it and use it.



[Figure 5-1. Sample Program "FrmTest.exe"]

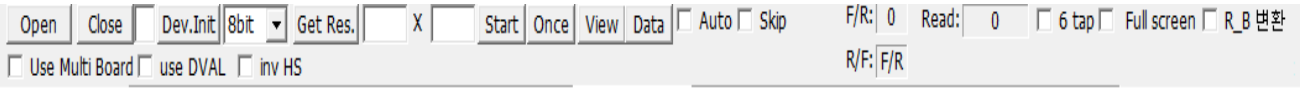
The above executable file is a test screen using our DVI-CL1 (DVI to Camera Link) board and is different from the actual Camera Link camera connection. API (Application Programming Interface) is required to use the above sample program. API is provided in the form of "DLL", and import library and header file are required for compilation.

All files specified above are included on the supplied CDROM. In order to run the sample program normally, the API DLL (USB3-FRM13_K.DLL) must be in the folder of the executable file or in the Windows system folder or the folder specified by the Path environment variable.

(Notice) The running order for the sample program as

Device "Open" click ➔ "Dev. Init" click ➔ Select Mode "8, 16, 32, 64"
➔ Get. Res. (Get Resolution) ➔ "Start" click ➔ "View" Click or "Auto" check

5-1 Image Function



(1) **"Open" button**

It starts a selected board device.

(2) **"Close" button**

It stops a selected board device.

(3) **"Device Init" button**

Press this button to initialize the function of receiving image frame data. It is performed only once after power is applied to the board.

(4) **"Mode" Selection**

It selects a Video Data Mode of 8bit, 16bit, 32bit, 64bit, 80bit.

Ex) Base Configuration : 8bit, 16bit, 32bit(MSB 8bit ignored)

Full Configuration : 64bit, 80bit

(5) **"Get Res." button**

It shows the image resolution.

(6) **"Start" button**

It starts the image transfer. It is a Toggle button, press again stop the image transferring.

(7) **"Once" button**

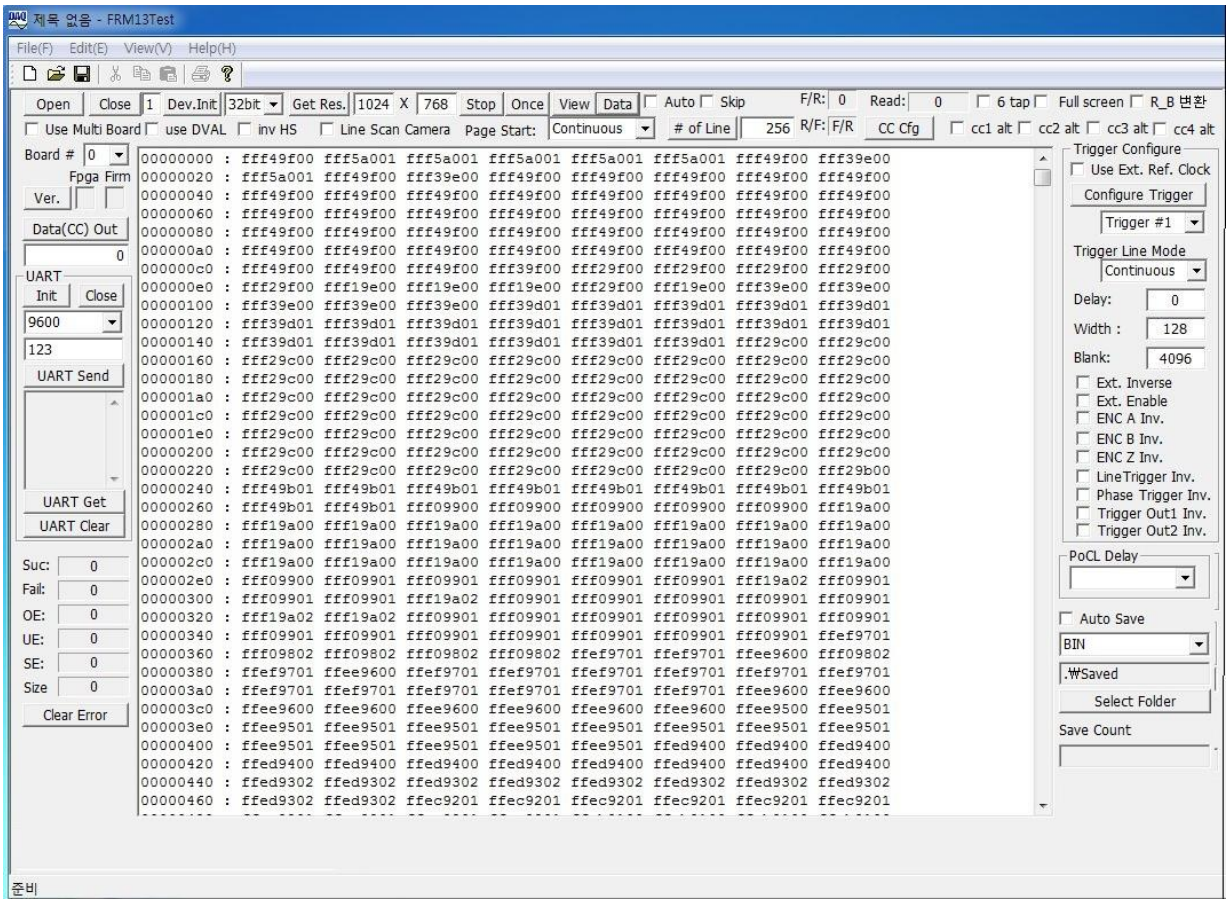
When press this button, it displays a freeze-frame.

(8) **"View" button**

Start the image transmission.

(9) **"Data" button**

Press this button to read the image frame data of the board to your PC(Hex Value). If image frame data is not saved on the board, you must wait until the end of data collection.



(10) **"Auto" toggle**

When check this box, it displays a video

(11) **"Skip" toggle**

When press this button, it displays a freeze-frame.

(12) **"F/R : "/ "R/F"**

F/R: We show the frame rate per second shown in the program.

R/F: We show the frame rate per second from the actual sensor.

(13) **"Read : "**

We show the total cumulative number of frames shown in F/R.

(14) **"6 tap" toggle**

Test function for DAQ system.

(15) **"Full screen" toggle**

It shows full screen.

(16) **"R/B Change" toggle**

The image color can be changed (Red <-> Blue).

(17) **"use DVAL" toggle**

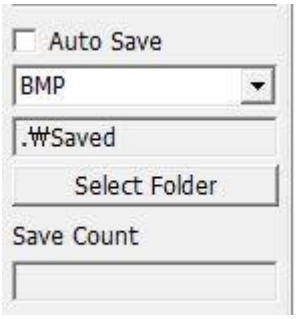
If the box clicks, you use the Data Valid signal.

If the box don't click, you use the HSYNC(Horizontal Synchronization) signal.

(18) **"inv HS" toggle**

If the box clicks, you use the inverse HSYNC signal.

If the box doesn't click, you use the HSYNC signal.

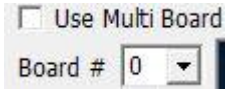


(21) **"Auto Save" toggle**

If you click the box, the video data is saved as a BMP, JPG (x86), Binary (Hexa value) file in the frame unit in Saved (or the folder selected by the user: Select Folder) specified below. In the case of JPEG, it does not work in 64-bit O.S.

The number of saved frames is shown in the Save Count column below..

5-2 Multi-board Function



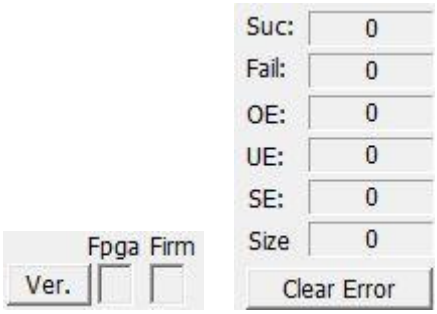
(1) **"Use Multi Board" toggle**

Select a multi-USB3.0 board.

(2) **"Board # :"**

It selects a board number in case of the multi USB3.0 boards. It can select 0 ~ 4 at currently.

5-3 Status Function



(1) **"Ver."**

It shows the version of FPGA and Firmware.

(2) **Clear Error**

Error number is initialized to "0".

"Suce: Success" : It shows good image transfer state.

"Fail" : It shows bad image transfer state.

OE : Overflow Error

UE : UnRead Error

SE : Size Error

Size

5-4 UART Read/Write Function

(1) **"Init" button**

Initialize the I2C registers.

(2) **"Close" Button**

Close the I2C function.

(3) **"UART" toggle**

Select the Baud Rate (9600, 19200, 38400, 57600, 115200 Baud Rate).

(4) **"UART Send" button**

Send the UART data.

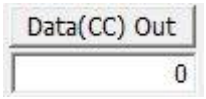
(5) **"UART Get" button**

Get the data from UART buffer.

(6) **"UART Clear" button**

Clear the UART Receiver buffer.

5-5 Line Scan Camera Trigger Configure Function



(1) **"Data(CC)Out" button**

Make the CC (Camera Control) signal to be used from Low to High Active. It is from CC1 to CC4. To make the signal of CC1 high active, write 1, CC2 write 2, CC3 write 4, CC4 write 8. Write "F" to make them all high active.

(2) **"Line Scan Camera" toggle**

If the box clicks, you can use a Line Scan Camera. Otherwise, you can use an Area Scan Camera.

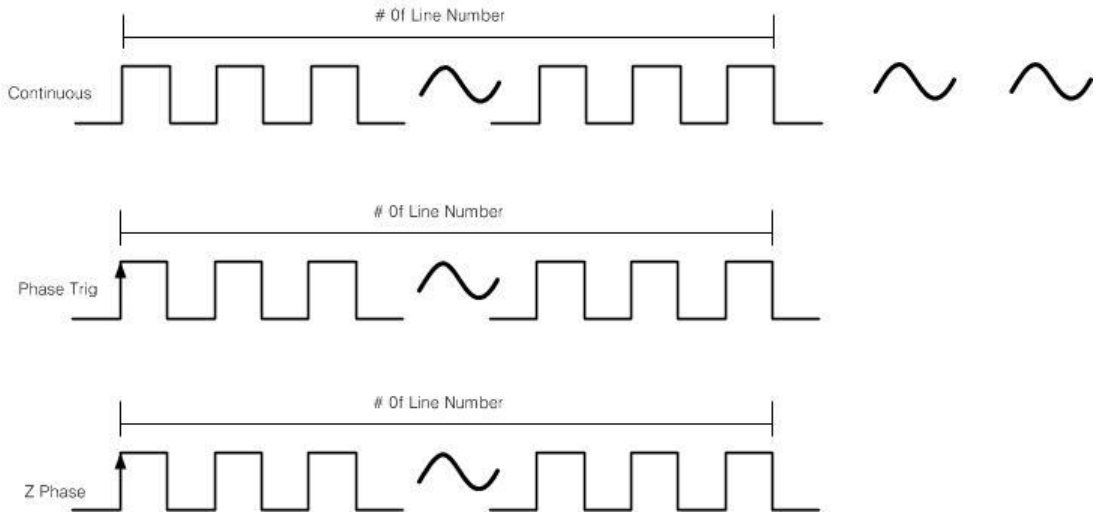
(3) **"Page Start" button**

You can select Continuous, Page Trig, Z Phase modes.

Continuous --- The vertical resolution (Vsync) is repeatedly generated as many times as the number set in # of Line.

Page Trig --- When the external trigger starts, vertical resolution (Vsync) is created once as many as the number set in # of Line.

Z Phase --- When the Z-Phase (Z-Phase) of an external motor or encoder starts, vertical resolution (Vsync) is generated once as much as the number set in # of Line.



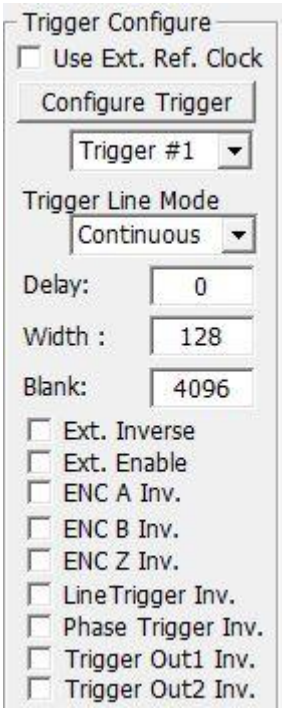
(4) **"# of Line" button**

It is a Line number, you can select 1 ~ 65536.

(5) **"CC Cfg" button**

You can select a CC(camera control) signal among CC1 ~ CC4.

Camera Option can be selected from Camera Control signal lines (cc1 alt ~ cc4 alt). If you select "cc1 alt" or "cc2 alt" and click the "CC Cfg" button, the trigger cycle set as Delay, Width, and Blank is output as CC1. The "cc3 alt" mode does not currently implement the trigger mode, and when "cc4 alt" is selected, it operates at internal 50MHz. Ref. When "Clock" is selected, it operates with a signal from REV+/- (refer to Section 2.3.4 J3 connector) instead of 50MHz.



(6) **"Use Ext, Ref, Clock" toggle**

If the button clicks, you can use an external reference clock.

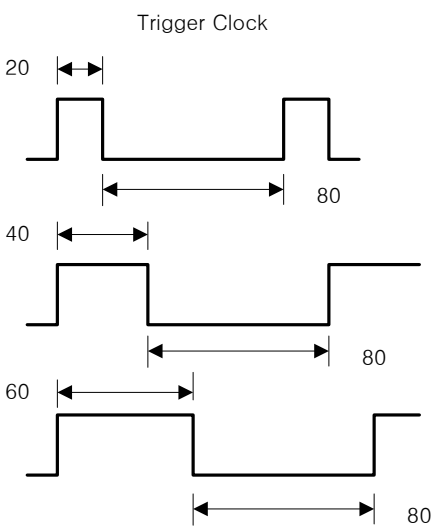
(7) **"Configure Trigger" button**

Trigger # 1 (CC1), Trigger # 2 (CC2) of the following conditions, is set depending on the selected trigger Delay, Width, Blank. The default setting frequency is based on 50MHz (1 clock period: 20ns). When Ext Out Trig is selected, the frequency of the external Reference (REV+/-) signal is used as the default frequency. Trigger Delay, Width, Blank values are different, and CC4 output is changed to this signal.

Delay : 0 ~ 4095, Width & Blank : 0 ~ 65535

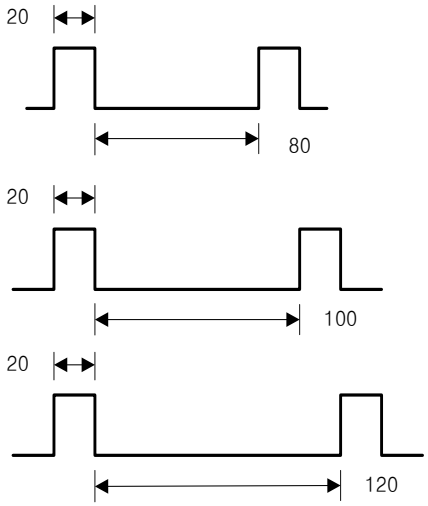
Minimum frequency can be set f=1/T , so 1 / ((4095 + 65535 + 65535) * 20ns) = 369.8Hz.

Reference) If the default settings is Delay / Width / Blank of 0/0/0 100ns (20 +80), so the output is 10Mhz as shown in the figure below.



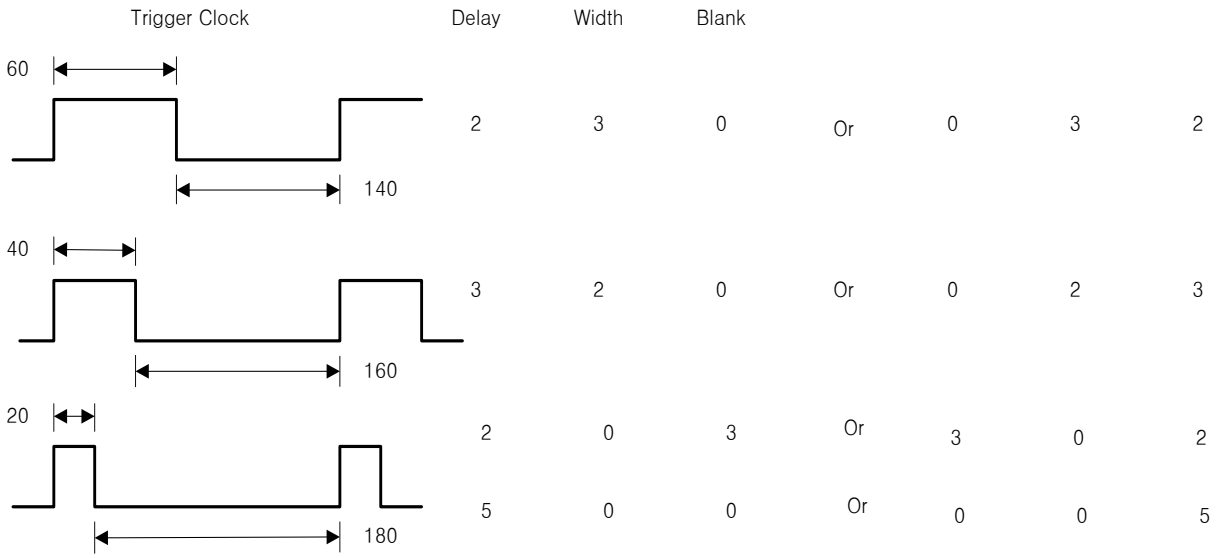
Delay	Width	Blank
0	0	0
0	1	0
0	2	0

Increasing the Width increases the width of the pulse, and increasing the Blank increases the gap.



Delay	Width	Blank				
0	0	0				
1	0	0	Or	0	0	1
2	0	0	Or	0	0	2
1	0	1				

For example, if you want 5MHz trigger clock at the CC1 or CC2 , you set the CC that you want at the **"CC Cfg"** button**.** Delay/Width/Blank setting is as follows.



(8) **Trigger Line Mode Selection**

Start the CC1 to CC4 (except CC3) trigger selected as "CC Cfg" by the method selected below.

Continuous --- Free Run Mode starts triggering with the value set below based on the internal clock 50 MHz.

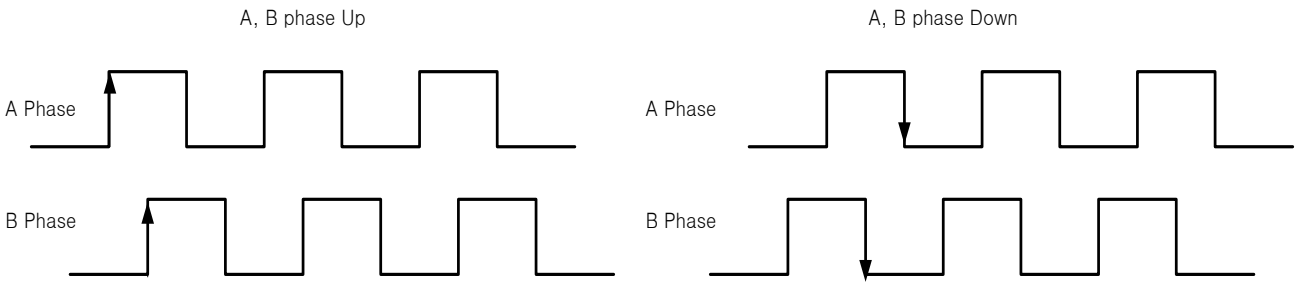
Line trigger --- Start triggering with the value set below when Line trigger detects Rising Edge.

When A Phase --- A-Phase (A-Phase) detects a Rising Edge, it starts triggering with the value set below.

When B Phase --- B-Phase (A-phase) detects a Rising Edge, it starts triggering with the value set below.

AB Phase up --- starts triggering with the value set below when the Rising Edge is detected on the AB-Phase (AB-phase) rising edge.

AB Phase dn --- starts triggering with the value set below when the Rising Edge is detected on the AB-Phase (AB-phase) falling edge.



(9) **"Ext. Inverse"**: When selected, the external trigger waveform is inversely converted and input.

"Ext. Enable": When selected, external trigger mode On/Off is executed.

"ENC A Inv." : When selected, the waveform of encoder A is converted and input.

"ENC B Inv." : When selected, inversely converts the waveform of encoder B and inputs it.

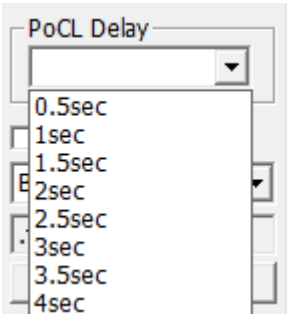
"ENC Z Inv." : When selected, the waveform of encoder Z is inverted and input.

"Line Trigger Inv." : When selected, the waveform of the Line Trigger is inversely converted and input.

"Phase Trigger Inv." : When selected, the waveform of the Page Trigger is inverted and input.

"Trigger Out1 Inv." : When selected, inversely converts the waveform of Trigger output 1 (CC1).

"Trigger Out2 Inv." : When selected, inversely converts the waveform of Trigger output 2 (CC2).



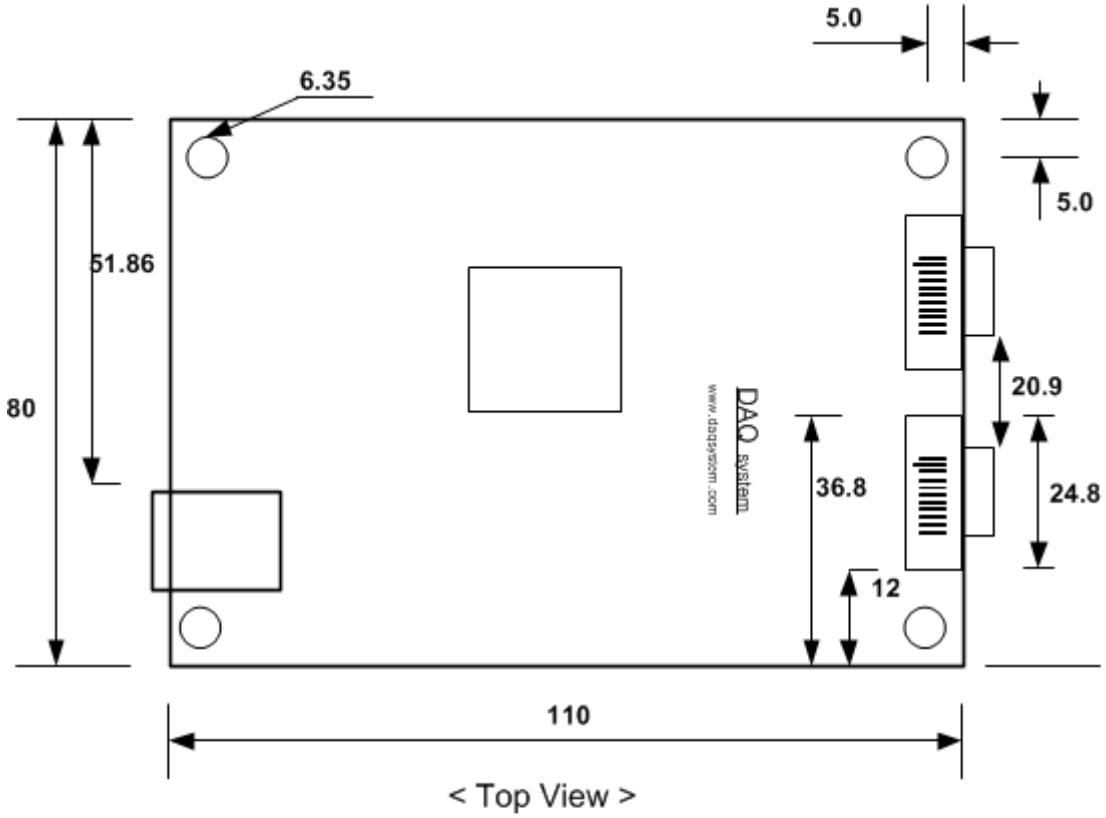
(10) **PoCL Delay**

The delay time can be set when powering a camera using PoCL (Power over Camera Link). It selects from 0.5 sec to 4 sec. The default value is 0.5 sec.

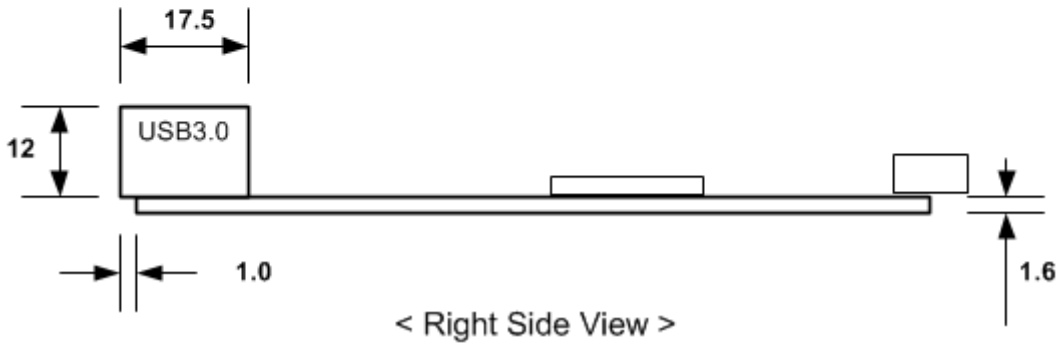
Appendix

A-1 Board Size

The external dimensions of the board are as follows.
(For detailed dimensions, please ask the person in charge.)



< Top View >



< Right Side View >

A-2 Repair Regulations

Thank you for purchasing a DAQSYSTEM product. Please refer to the following regarding Customer Service regulated by DAQSYSTEM.

(1) Read the user manual before using the DAQSYSTEM product and follow the instructions..

(2) When returning the product to be repaired, please write down the symptoms of the failure and send it to the head office.

(3) The warranty period for all DAQSYSTEM products is one year.
-. Warranty period counts from the date the product is shipped from DAQSYSTEM.
-. Peripherals and third-party products not manufactured by DAQ SYSTEM are covered by the manufacturer's warranty.
-. If you need repairs, please contact the Contact Point below.

(4) Even during the warranty period, repairs will be charged in the following cases.
① Failure or damage caused by use without following the user's manual
② Breakdown or damage caused by customer's negligence during product transportation after purchase
③ Failure or damage due to natural phenomena such as fire, earthquake, flood, lightning, pollution, or power supply exceeding the recommended range
④ Failure or damage caused by inappropriate storage environment (eg, high temperature, high humidity, volatile chemicals, etc.)
⑤ Breakdown or damage due to unfair repair or modification
⑥ Products whose serial number has been changed or deliberately removed
⑦ If DAQ SYSTEM determines that it is the customer's fault due to other reasons

(5) Customer is responsible for shipping costs for returning the repaired product to DAQSYSTEM.

(6) The manufacturer is not responsible for any problems caused by incorrect use, regardless of our warranty terms.

References

1. USB 3.0 System Architecture

-- Don Anderson, USB SIG(www.usb.org)

2. Universal Serial Bus Specification

-- Compaq/Intel/Microsoft/NEC, MindShare Inc. (Addison Wesley)

3. AN201 How to build application using API

-- DAQ system

4. AN342 USB3-FRM13_K API ver1.2

-- DAQ system

MEMO

Contact Point

Web sit : https://www.daqsystem.com

Email : postmaster@daqsystem.com

DAQ SYSTEM
Measurement & Automation