



FrameLink™

User's Manual

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Revision History

Revision History			
RA01	Dec-9-2003	J. Egri	Initial Release
RA02	Feb-10-2004	J. Egri	Added Bayer-to-RGB support. Added RGB Gain Control. Updated 8-bit packing. Added “Freeze preview window while capturing” to Series of Frames and AVI dialogs. Added DirectX installation instructions.
RA03	Aug-25-2004	J. Egri	Changed Multiple Frame Settings dialog in Series of Frames per software release v2.10
RA04	Dec-7-2004	J. Egri	Added strobe inversion options to Camera Configuration dialog per software release v2.11. Modified software installation instructions to support Install Shield.
RA05	May-05-2005	G. Angelone	Updated Chapter 4 to reflect v2.12 application GUI. Updated software installation instructions for new driver install.
RA06	Jun-08-2005	J. Egri	Added CC Control dialog to Chapter 4 to reflect v2.13 of application GUI.
RA07	Jun-22-2005	J. Egri	Updated software installation instructions. Added Appendix A – Serial Communications.

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Chapter **1**



Introduction

This chapter outlines the key features of the Imperx FrameLink card.

FrameLink

The FrameLink frame grabber is a TYPE II PC Card with both a Camera Link and Cardbus interface. It provides the ability to capture digital video data from a 'base configuration' Camera Link interface and transfer that data to host memory via a Cardbus (PCI) interface.

Functionality

- Captures video data from the Camera Link interface, formats this data and stores it into local SDRAM.
- Retrieves the formatted data from the SDRAM and transfers it into host memory via DMA over the Cardbus.
- Provides a full-duplex asynchronous interface (UART) to/from an attached device on the Camera Link's serial interface.
- Provides the host processor with the ability to configure the four discrete Camera Control signals on the Camera Link interface.

Interfaces

Camera Link interface

The FrameLink provides a Camera Link interface that follows the 'base configuration', as defined in the Camera Link standard, requiring a single 26 conductor connector/cable (refer to Figure 2). The base configuration consists of multiplexing 28 bits of video data into 4 LVDS data streams. This data consists of 24 bits of pixel data along with 4 pixel qualifier signals: 'line valid' strobe, 'frame valid' strobe, 'data valid' strobe and a spare strobe (for future use). A phased-locked transmit clock is transmitted in parallel with the data streams over a fifth LVDS link. Additionally, four RS-644 LVDS streams are included for general purpose camera control. These 'camera control' signals allow the frame grabber to manipulate discrete controls within an attached camera. A bi-directional asynchronous communications channel between the frame grabber and an attached camera is also provided by means of two RS-644 LVDS pairs.

PCMCIA/CardBus interface

The FrameLink card complies with the TYPE II PC Card package dimensions as defined in the PC Card Release 8.0 Standard. It includes a 30mm x 10mm extension area, used to house the CameraLink connector.

The FrameLink provides a 33 MHz 32 bit PCI Master/Target interface

(Cardbus) compliant with the PC Card Release 8.0 specification. This interface provides a single 'function', as defined in the Cardbus specification. The design does not support any memory mapped or I/O mapped peripherals on card. Access to the FrameLink's SDRAM devices is achieved through DMA operations that move the data from the SDRAM into host memory. The host cannot directly access the contents of the SDRAM. The design supports host access into configuration registers, DMA registers, local registers and CIS data via configuration space accesses.

A functional block diagram of the FrameLink card is illustrated in Figure 1.

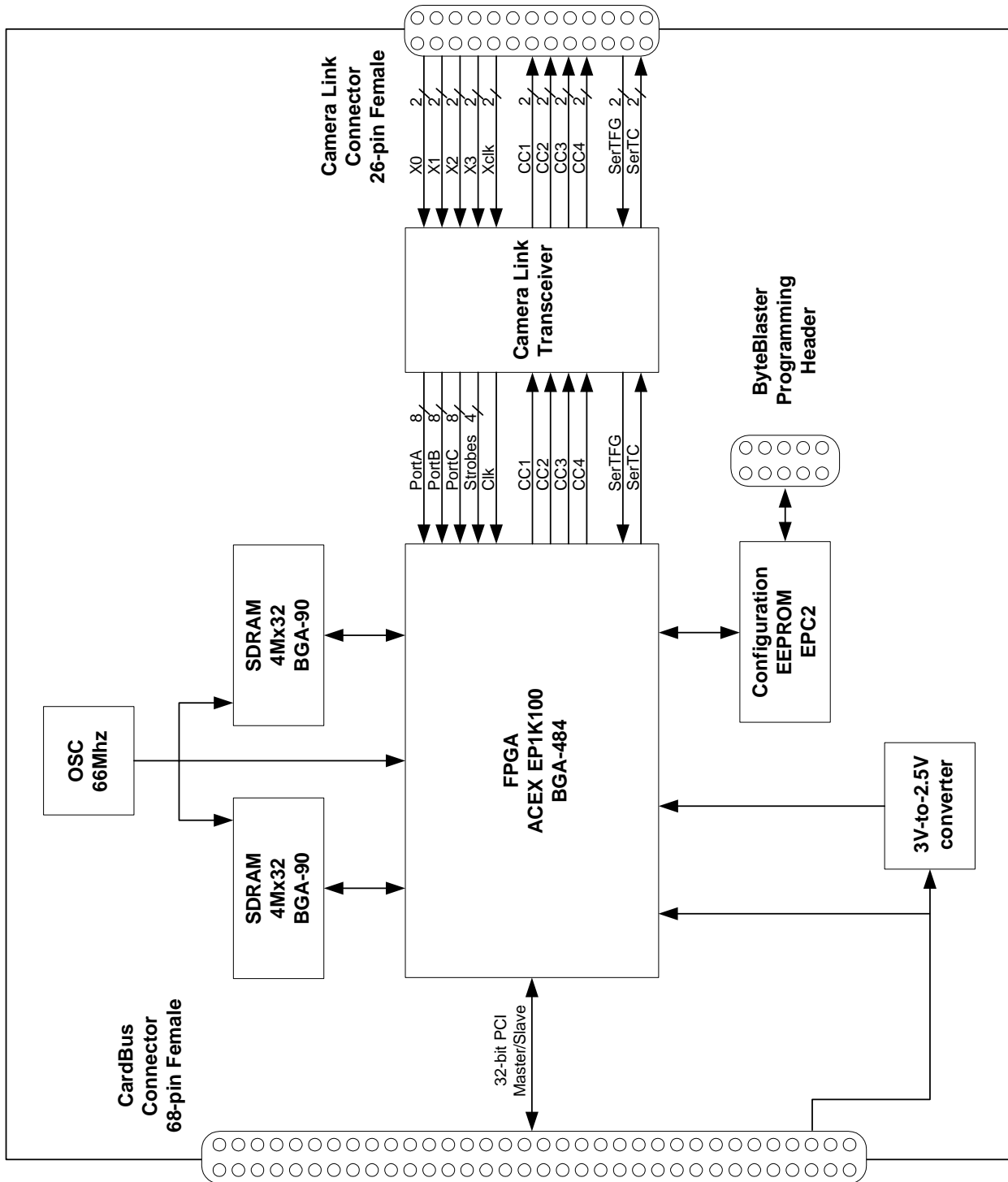


Figure 1 – FrameLink Block Diagram

A functional block diagram of the Camera Link interface is illustrated in Figure 2.

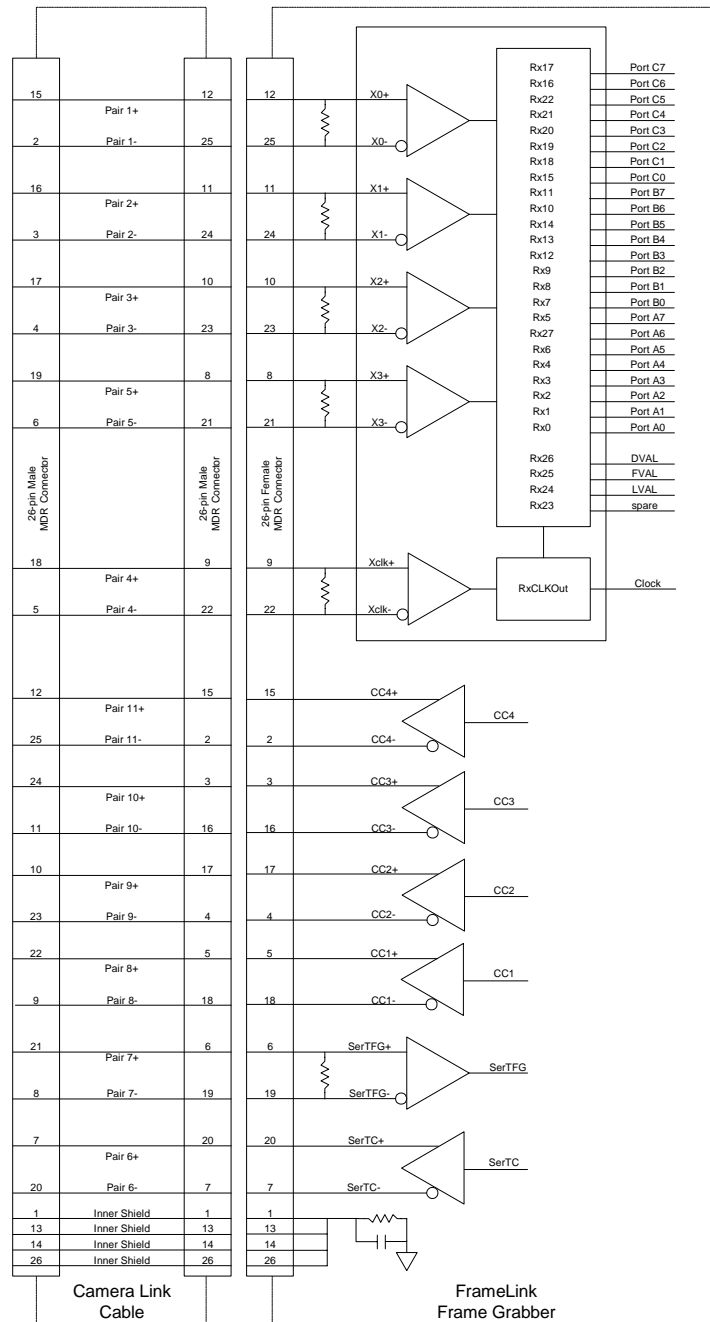


Figure 2 – Camera Link Interface

Video Capture

The video capture engine is responsible for receiving video pixel data and qualifiers from the Camera Link transceivers, formatting the data and transferring it into on-board memory. The data that it receives from the Camera Link transceivers is formatted per Table 1. Ten different modes of operation are supported as indicated in the table. The video capture engine translates this data into longwords (32 bits), as defined in Table 2, in order to use the Cardbus bandwidth more efficiently and conserve memory space. Table 2 reflects how the data will appear in host memory. In the case of the single tap and dual tap 8 bit modes, the module packs four pixels into each longword. In the case of the other modes, excluding 3x8 and RGB, the module packs two pixels into each longword.

Port C								Port B								Port A								MODE						
c7	c6	c5	c4	C3	c2	c1	c0	b7	b6	b5	b4	b3	b2	b1	b0	a7	a6	a5	a4	a3	a2	a1	a0							
																A7	A6	A5	A4	A3	A2	A1	A0	1x8						
								B7	B6	B5	B4	B3	B2	B1	B0	A7	A6	A5	A4	A3	A2	A1	A0	2x8						
C7	C6	C5	C4	C3	C2	C1	C0	B7	B6	B5	B4	B3	B2	B1	B0	A7	A6	A5	A4	A3	A2	A1	A0	3x8						
																A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x10				
																A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	2x10				
B7	B6	B5	B4	B3	B2	B1	B0																							
																A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x12		
B7	B6	B5	B4	B3	B2	B1	B0	B11	B10	B9	B8	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	2x12						
																A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x14
								A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x16						
BL7	BL6	BL5	BL4	BL3	BL2	BL1	BL0	GR7	GR6	GR5	GR4	GR5	GR2	GR1	GR0	RD7	RD6	RD5	RD4	RD3	RD2	RD1	RD0	RGB (1x24)						

Table 1 – Image data bit-to-port assignments per the Camera Link specification

d31	d30	d29	d28	d27	d26	d25	d24	d23	d22	d21	d20	d19	d18	d17	d16	d15	d14	d13	d12	d11	d10	d9	d8	d7	d6	d5	d4	d3	d2	d1	d0	MODE						
A7	A6	A5	A4	A3	A2	A1	A0	A7	A6	A5	A4	A3	A2	A1	A0	A7	A6	A5	A4	A3	A2	A1	A0	A7	A6	A5	A4	A3	A2	A1	A0	1x8						
B7	B6	B5	B4	B3	B2	B1	B0	A7	A6	A5	A4	A3	A2	A1	A0	B7	B6	B5	B4	B3	B2	B1	B0	A7	A6	A5	A4	A3	A2	A1	A0	2x8						
								C7	C6	C5	C4	C3	C2	C1	C0	B7	B6	B5	B4	B3	B2	B1	B0	A7	A6	A5	A4	A3	A2	A1	A0	3x8						
																								A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x10				
																								A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	2x10				
																A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x12										
																B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0	2x12										
																								A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x14
								A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0	1x16														
																								RD7	RD6	RD5	RD4	RD3	RD2	RD1	RD0	RGB						

Table 2 – FrameLink Image data mapping into memory

Pixel Buffering

The pixel data formatted by the video capture engine is stored into two

on-board 4Mx32 SDRAM devices. This memory serves as a local store for formatted video pixel data. Each SDRAM will buffer a single frame's worth of data, supporting a maximum frame size of 8 million pixels/frame in all modes except RGB. In the RGB mode, the maximum frame size supported is 4 million pixels. The SDRAMs are managed by an independent pair of controllers, implemented in the FPGA, supporting concurrent operation. The two SDRAMs are utilized in a ping-pong fashion such that while one is being filled with new pixel data, the other is being emptied via DMA into host memory.

DMA

The DMA engine is responsible for reading formatted pixel data from the on-board SDRAM devices and transferring them into host memory via the Cardbus interface. An intelligent scatter-gather method is utilized, providing for an efficient use of the Cardbus bandwidth. The use of non-contiguous 4Kbyte buffers provides support for the Windows operating system's memory allocation model.

Serial Interface

A bi-directional Universal Asynchronous Receiver Transmitter (UART) is provided for the Camera Link serial interface. It transmits and receives ASYNC formatted characters with 1 Start bit, 8 data bits, no parity and 1 Stop bit. The baud rate of this interface can be configured by the user to be any one of a set of standard bit rates ranging from 4800 to 115.2K bits per second. A software interface to the UART is provided by means of a Camera Link compliant '*clservce.dll*' file.

Camera Control

The FrameLink card provides four discrete camera control bits per the Camera Link specification. These bits can be configured by the user via the FrameLink application GUI.

FPGA

The heart of the FrameLink is a dense Field Programmable Gate Array (FPGA). This FPGA implements all of the functions related to video data capture, storage and DMA. The firmware contents of the FPGA can be upgraded while in the field by following the instruction outlined in Section 3 of this document entitled 'Firmware Upgrade from Web Site'.

In System Programming:

The FrameLink design supports ISP programming during operation. This capability is useful when the FPGA code needs to be upgraded and the unit is at a remote customer location. The programming is accomplished using a JamPlayer utility, which runs on the host PC. The JamPlayer utility downloads a new FPGA image into the EEPROM via the Cardbus interface. The FPGA provides a set of I/O pins which are connected to the EEPROM's JTAG interface. The JamPlayer utility toggles these I/O pins, which are mapped into a register in configuration space, and thus can communicate with the EEPROM's JTAG controller and affect a programming operation.

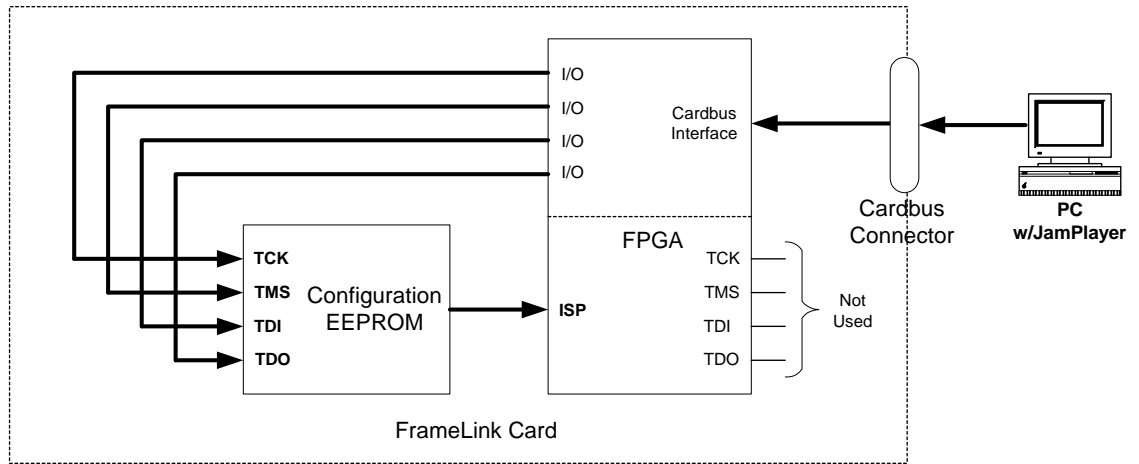


Figure 3 – EEPROM Programming In System

What you need to get started

To begin using the FrameLink card, you need the following:

- A computer with a PCMCIA slot that is Cardbus compliant.
- Microsoft Windows XP or 2000 software.
- A computer with a relatively up to date Cardbus-to-PCI chipset (sometimes referred to as a 'Cardbus Controller'). You can determine which chipset your laptop uses by looking in:

Control Panel – System – Hardware – Device Manager – PCMCIA Adapters

These chipsets are recommended because they generally offer better performance in terms of DMA transfer rates:

TI PCI-1520
TI PCI-4510

These chipsets are discouraged because of their poor DMA performance:

O2 Micro OZ6912
TI PCI-1225

- A computer with at least 256M bytes of RAM.
- A CD drive, and a hard disk on which to install the FrameLink software.

Inspecting the FrameLink package

When you unpack your FrameLink package, you should visually inspect all of its contents. If something is missing or damaged, contact your Imperx representative.

Package contents

You should have received the following items:

- The FrameLink PCMCIA card
- A metal 'strain relief' bracket
- A CD with the FrameLink software suite
- A 'Quick Start' installation guide
- A 'User's Manual' (this document)

Chapter 2

Hardware Installation

Installing the FrameLink card is as simple as plugging it into an available PCMCIA slot on your computer. Note that the card should be plugged in with the CameraLink connector facing up and away from the computer.

Chapter

3

Software Installation

This chapter explains how to install the FrameLink software.

Software Suite

The FrameLink software suite consists of the following files:

Windows XP and 2000 application files:

(located in c:\Program_Files\ImperX\Framelink\)

AMCap.exe	- DirectX sample application
clservice.dll	- CameraLink serial interface library
console.exe	- console program (for debug purposes)
ijl20.dll	- Intel JPEG encoding/decoding library
VCECLB.dll	- FrameLink library
VCECLB_app.chm	- FrameLink help file
VCECLB_app.exe	- FrameLink Area Scan application
VCECLB-LS_app.exe	- FrameLink Line Scan application
VceComX.exe	- Virtual COM port emulator

Windows XP and 2000 driver files:

(located in c:\Program_Files\ImperX\Framelink\Drivers\WDM\)

vceclb.sys	- FrameLink WinXP/2000 driver file
vceclb.inf	- FrameLink WinXP/2000 driver info file
ipxinstdrv.exe	- WDM Streaming installation program

Streaming Kernel Driver (DirectX) files:

(located in c:\Program_Files\ImperX\FrameLink\Drivers\DirectX\)

Vceclbks.sys	- FrameLink WDM Streaming driver
Vceclbks.inf	- FrameLink WDM Streaming info file
VceClbKs.ax	- WDM Streaming driver's properties plugin

Documentation files:

(located in c:\Program_Files\ImperX\FrameLink\Doc\)

FrameLink_Users_Manual.pdf	- User manual document
FrameLinkSpec.pdf	- Technical datasheet
History_drv.txt	- WDM driver change description file
History_ks.txt	- KS driver change description file
History_app.txt	- Application change description file

Cam Files:

(located in c:\Program_Files\ImperX\FrameLink\Cam_Files\)

IPX folder	- FrameLink configuration files for Imperx' IPX series of cameras
MDC folder	- FrameLink configuration files for Imperx' MDC series of cameras
LYNX folder	- FrameLink configuration files for Imperx' LYNX series of cameras

Note that our FrameLink application program was created using our SDK (software developers kit). Our SDK is a separately purchased product and is not included in the standard FrameLink software suite that comes with the card. For more information on the SDK, please visit our web site at <http://www.imperx.com/sdk/index.php> or call us toll free at 1-877-863-1654.

Software Installation from CD

Use the following steps to install the FrameLink software supplied on a CD:

1. If a version of FrameLink was previously installed on this machine, then you must first remove it:

To remove the application files:

- 1.1 Left mouse click on “*Start*”
- 1.2 Left mouse click on “*Settings*”.
- 1.3 Left mouse click on “*Control Panel*”.
- 1.4 Double left mouse click on “*Add or Remove Programs*”.
- 1.5 Left mouse click on “*FrameLink*”.
- 1.6 Left mouse click on “*Remove*”.
- 1.7 **If the ‘FrameLink – InstallShield Wizard’ pops-up, do the following:
If not, go to step 1.8**
 - Left mouse click on ‘*Remove*’.
 - Click ‘*Next*’.
 - Click ‘*Yes*’.
 - Click ‘*Finish*’.
- 1.8 Left mouse click on “*Yes*”.
- 1.9 Left mouse click on “*Close*”.

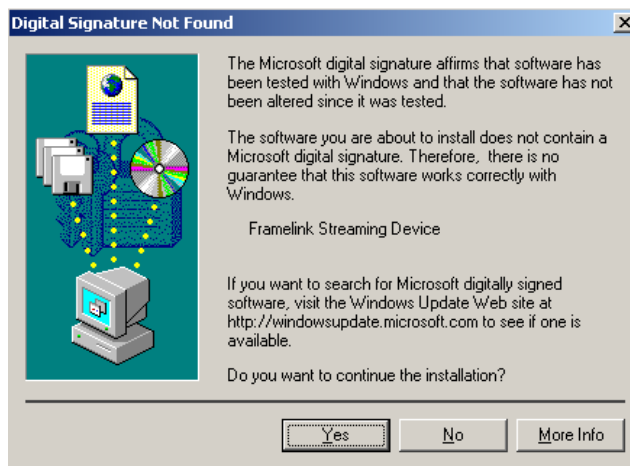
2. After having removed a previous version or if a version of FrameLink was NOT previously installed on this machine then:

The first step is to install the application files:

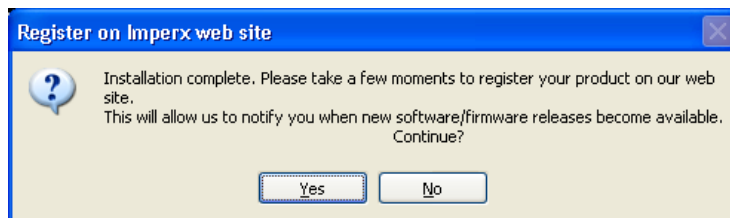
- 2.1 Insert the FrameLink CD into the appropriate drive; the setup.exe file will run automatically. Note: If it does not start automatically, left mouse click on to “*Start*”, “*Run*”, enter or browse to “*(CD drive): setup.exe*” and click “*OK*”.
- 2.2 Wait for the “FrameLink - InstallShield Wizard” screen to appear.
- 2.3 Follow the on-screen instructions.
- 2.4 For Windows XP, the following message will appear:



For Windows 2000, the following message will appear:



- 2.5 Click "Continue Anyway" for XP, "Yes" for 2000.
- 2.6 When the following message appears, choose if you would like to register online by left clicking on "Yes" or "No".



If you choose "Yes", follow the on-screen instructions.

2.7 When prompted, select *"Yes, I will restart my computer now"*.

After restarting the computer a New Hardware Found screen will come up: (the FrameLink card must be installed to perform the following steps)

Steps 2.8 through 2.14 are for Windows XP. For Windows 2000, go to Step 2.15

- 2.8 Wait for the system to prompt you with a "Found New Hardware Wizard" dialog box.
- 2.9 Under certain conditions, the following message may appear:



If this message appears, click *"No, not this time"*, then *"Next"*.

- 2.10 When the following message appears, select “*Install the software automatically (Recommended)*”, then left click “*Next*”.



- 2.11 For Windows XP, the following message will appear:



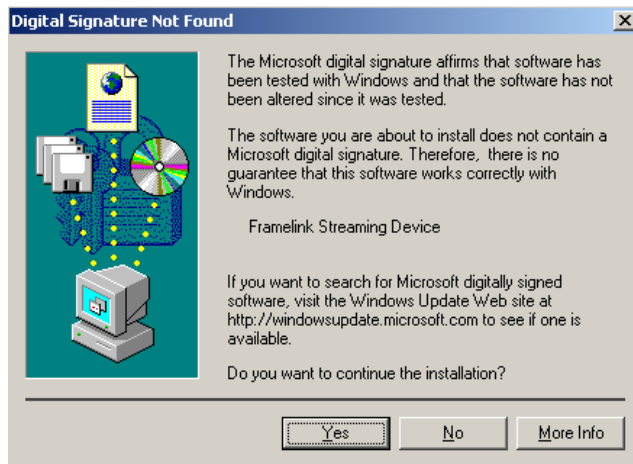
- 2.12 Click “*Continue Anyway*” to continue.
2.13 When “Click Finish to close the wizard” appears, Left click on “*Finish*”.
2.14 This completes the installation for Windows XP.

To install the WDM driver for Windows 2000:

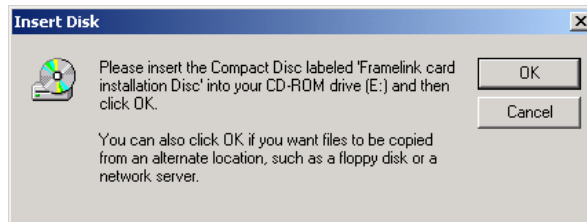
- 2.15 Wait for the system to prompt you with a “Found New Hardware Wizard” dialog box.



2.16 Left click “Next” to continue. The following message will appear:



Click “Yes” to continue.



- 2.17 Click “OK” , then either enter or browse to:
C:\Program Files\ImperX\Framelink\Drivers\WDM
- 2.18 Click “OK”
- 2.19 This completes the installation for Windows 2000.

Software Upgrade from Web Site

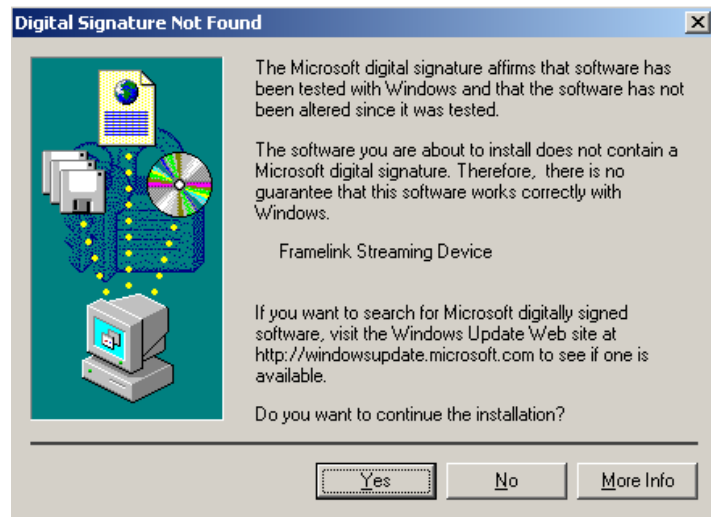
New application and/or driver software may be released periodically to reflect improvements and/or functionality added to the FrameLink. You can retrieve these updates by visiting the download page of our web site at http://www.imperx.com/frame_grabbers/camera_link/FrameLink_downloads.php

Use the following steps to install newly released application software:

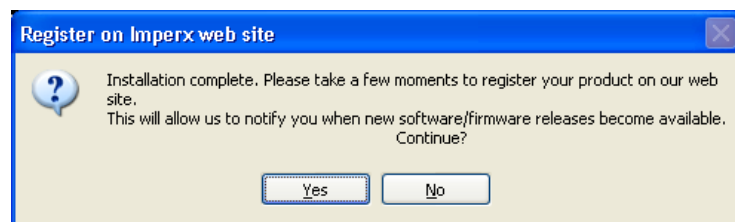
- 3.1 Uninstall all application files by following the instructions in step 1. of the ‘Software Installation from CD’ section.
- 3.2 Download the FrameLink_Installer.exe file from the Imperx web site to a new folder on your PC (we will use the folder C:\new_FrameLink as an example).
- 3.3 Left mouse click on “Start”, “Run”, enter or browse to “C:\new_FrameLink\Framelink_Installer.exe”.
- 3.4 Left mouse click on “Open”, then “OK”.
- 3.5 Follow the on-screen instructions.
- 3.6 For XP, when the following message appears, left click “Continue Anyway”



For Windows 2000, when the following message appears, click “Yes”.



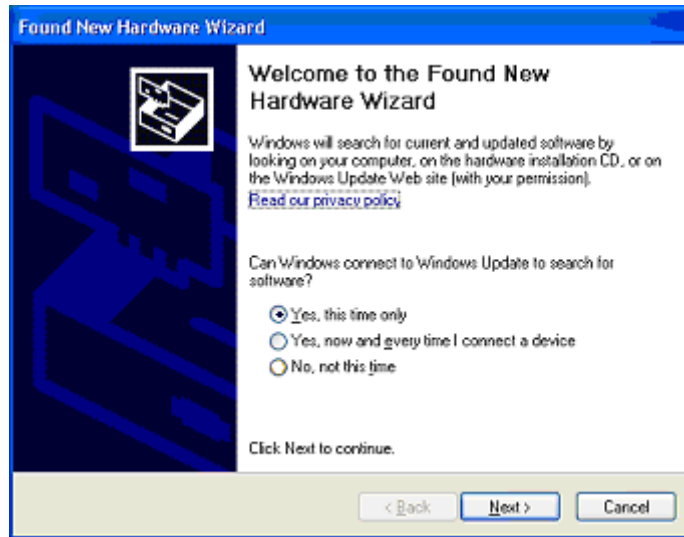
- 3.7 When the following message appears, choose if you would like to register online by left clicking on “Yes” or “No”.



If you choose “Yes”, follow the on-screen instructions.

- 3.8 When prompted, select “Yes, I want to restart my computer now” and left click “Finish”.
4. After having successfully installed the newly released application software, use the following steps to install a newly released WDM driver for Windows XP (for Windows 2000 go to step 5.):
- 4.1 Wait for the system to prompt you with a “New Hardware Found” dialog box.

4.2 Under certain conditions, the following message may appear:



If this message appears, click “*No, not this time*”, then “*Next*”.

4.3 When the following message appears, select “*Install the software automatically (Recommended)*”, then left click “*Next*”.



- 4.4 For XP, when the following message appears, left click “Continue Anyway”.



- 4.5 When “Click Finish to close the wizard” appears, Left click on “Finish”.

- 4.6 This completes the installation for Windows XP.

5. After having successfully installed the newly released application software, use the following steps to install a newly released WDM driver for Windows 2000:

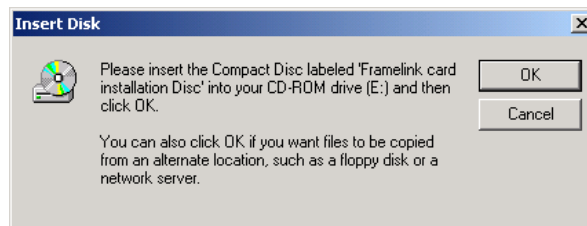
- 5.1 Wait for the system to prompt you with a “Found New Hardware Wizard” dialog box.



- 5.2 Left click “Next” to continue. The following message will appear:



5.3 Click “Yes” to continue.



- 5.4 Click “OK”, then either enter or browse to:
C:\Program Files\ImperX\Framelink\Drivers\WDM
- 5.5 Click “OK”.
- 5.6 This completes the installation for Windows 2000.

Firmware Upgrade from Web Site

Your newly received FrameLink card has been programmed in the factory with the latest firmware prior to shipping. New firmware, however, may be released periodically to reflect improvements and/or functionality added to the FrameLink FPGA. You can retrieve these updates by visiting the download page of our web site at

http://www.imperx.com/frame_grabbers/camera_link/FrameLink_downloads.php

Use the following steps to install newly released firmware:

1. Download and unzip the firmware patch (.zip) file to a folder on your PC (we will use C:\fw_patch as an example).
2. If you haven't previously installed the JamPCI drivers then:
 - 2.1 Left mouse click on to “*Start*”, “*Run*”, enter “*C:/fw_patch/loadsys.bat*” and click “*OK*”.
 - 2.2 Wait until "Press any key to continue . . ." message appears.
 - 2.3 Press any key to exit batch file.
3. Insert the FrameLink card into the laptop. Note that if your system has two PCMCIA slots, then you must insert the card into the slot in which it was placed during the original driver installation.
4. If the system prompts you with a “New Hardware Found” dialog box, press “*Cancel*”.
5. **Note: DO NOT POWER DOWN OR REMOVE CARD WHILE PROGRAMMING IS IN PROGRESS!**
6. Left mouse click on “*Start*”, “*Run*”, enter “*C:/fw_patch/FrameLink_patch_x_y.bat*” and click “*OK*”. Note that ‘*x_y*’ refers to the revision number (i.e. 2.0).
7. Wait until "Press any key to continue . . ." message appears.
8. If line above it reads "Exit code = 0...Success" then proceed with installation, otherwise contact techsupport@imperx.com.
9. Press any key to exit batch file.
10. You must either reboot the PC or remove and then reinsert the FrameLink card in order for the changes to take effect

Chapter **4**



Using the FrameLink

This chapter contains information on how to configure and use the FrameLink card.

Running the FrameLink Application

The VCECLB_app.exe program supplied with the FrameLink card is a stand-alone Windows based application. It provides an easy to use graphical user interface (GUI), allowing the user to configure the FrameLink card and to view, record and playback video data received from the CameraLink interface. The application consists of a main window as well as 'Camera Configuration', 'Control Panel' and 'Player' dialog windows.

Launching Application

To launch the FrameLink application, simply double left mouse click on the 'FrameLink application' icon on the desktop.

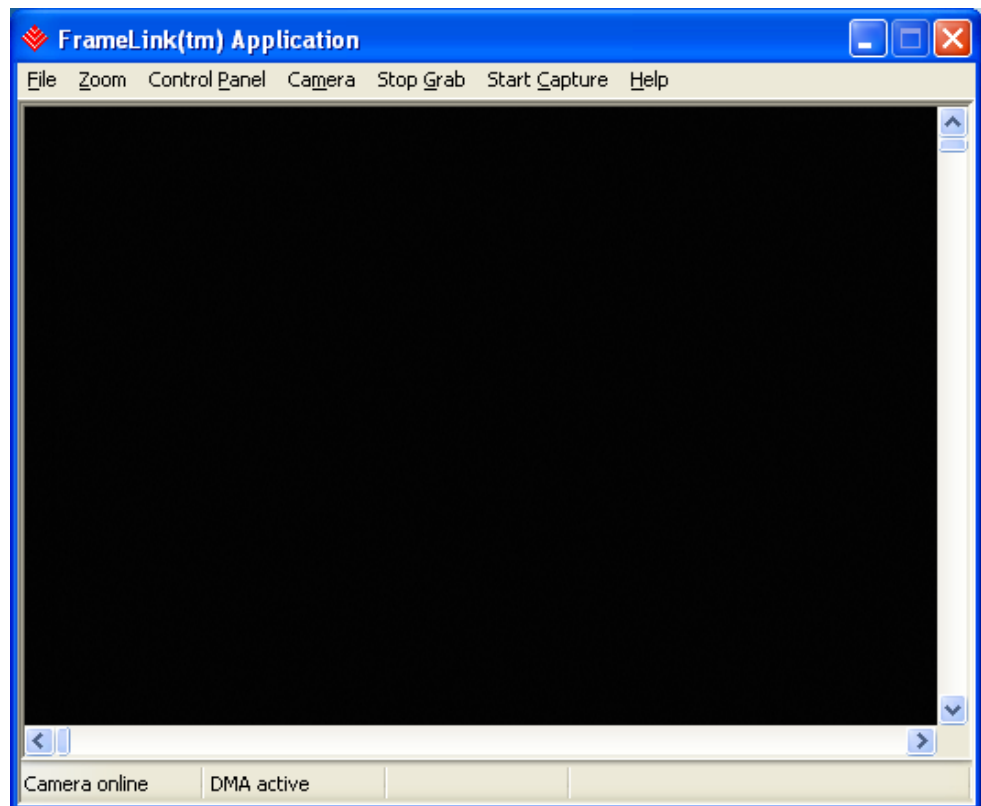


Note

In the remainder of this chapter, references to 'clicking' on objects in the GUI refers to the left mouse button.

Main Window

When the VCECLB_app.exe program is executed, a main window titled 'FrameLink™ Application' will appear. The main window provides the primary area for viewing real-time images received from the camera. This window can be sized and moved to suit your needs. When image viewing is active, the size of this window will be automatically scaled as a function of the camera parameters (i.e. pixels/ line and lines/frame) specified in the 'Camera Parameters' dialog.



File Clicking on this item reveals a pull-down menu with two options: 'Player' and 'Exit'.

Player This option opens the 'Player Dialog' and 'Player Control' windows.

Exit Clicking on this option causes the program to terminate.

Zoom Reveals a pull-down menu which allow the user to select the image scaling factor. The image scaling factor determines the size of the display window and the captured image. Changing from one scale to another scale automatically updates the display window and image size.

Control Panel

Clicking on this item reveals a pull-down menu with the following options:

Capture Settings

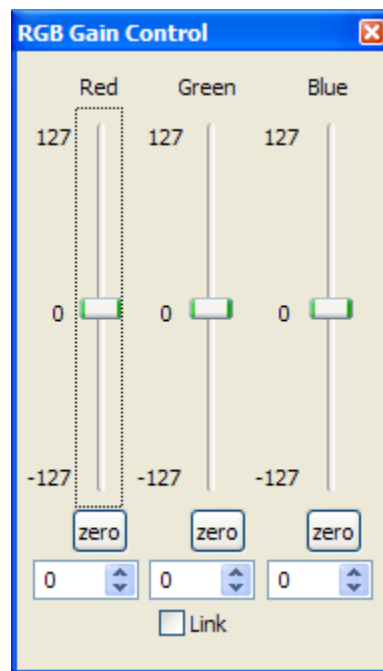
Selecting this item causes the 'Capture Settings' dialog to appear. Alternatively, Ctrl-S can be used to open/close this dialog.

Camera Parameters

Selecting this item causes the 'Camera Parameters' dialog to appear. Alternatively, Ctrl-P can be used to open/close this dialog.

RGB Gain

Select this option when you wish to adjust each of the RGB color components. This option is only available if 'Bayer' or 'RGB' is selected in the 'video type' field of the 'Camera Parameters' dialog. Clicking on this button causes the 'RGB Gain Control' dialog window to open. Alternatively, Ctrl-R can be used to open/close this dialog.



CC Control

Selecting this item causes the 'CC Control' dialog to appear. Alternatively, Ctrl-C can be used to open/close this dialog.

Camera

This button lets you choose which camera you would like to use. Note that this option is only viable for the FrameLink-JFLEX dual port card. It has no effect for the standard FrameLink.

Start/Stop Grab

This button will toggle between 'Start Grab' and 'Stop Grab' every time the user clicks on it. Clicking on 'Start Grab' enables the FrameLink's DMA engine and causes the main window to display live images received from the camera. Clicking on 'Stop Grab' disables the DMA engine and causes the display to freeze.

Start/Stop Capture

This button will toggle between **‘Start Capture’** and **‘Stop Capture’** every time the user clicks on it. Clicking on **‘Start Capture’** starts the process of recording the images to disk. The options set in the **‘Capture Options’** field determine what, how and when actual recording is performed. Clicking on **‘Stop Capture’** causes recording to stop.

Help

Clicking on this item reveals a pull-down menu with two options: **‘About’** and **‘Help Manual’**.

About

Clicking on this option causes version information to be displayed including release identifiers for the application software, library, driver and firmware. This information should be provided to Imperx technical support personnel during a service call.

Help Manual

Clicking on this option causes an interactive point-and-click style help manual to be displayed. The help manual provides a summary description of all GUI controls and fields.

Status Indicators

On the bottom of the window are two status indicators: **‘Camera’** status and **‘DMA’** status.

Camera Status

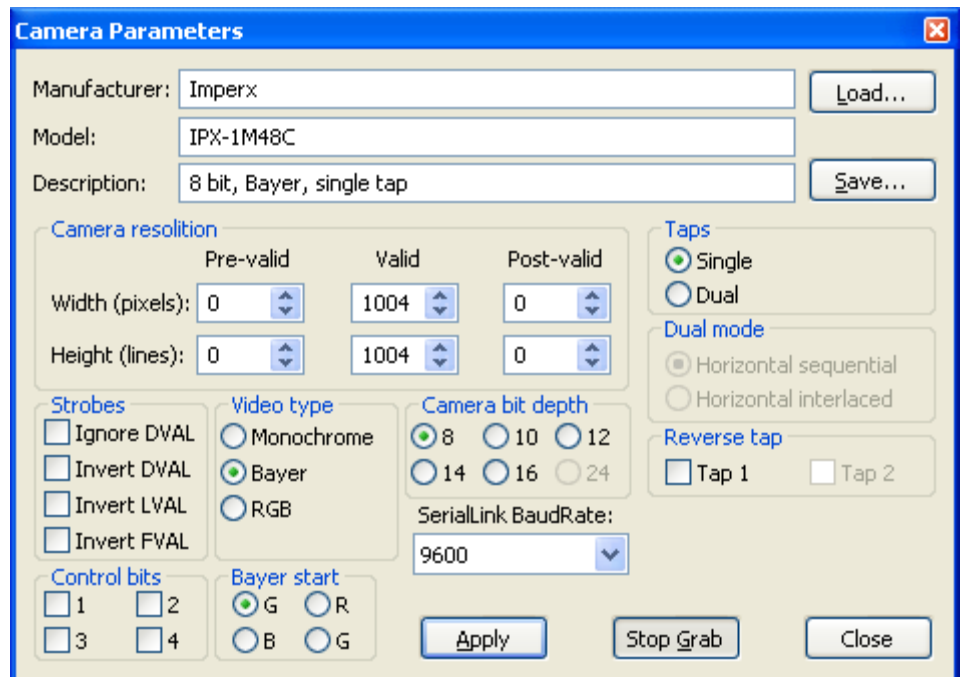
Displays the real-time status of the attached camera as being either **‘online’** or **‘offline’**. **‘Online’** indicates that the camera is powered on, attached and providing a video clock via the CameraLink interface. **‘Offline’** indicates that the FrameLink card is not receiving a video clock from the camera either because the camera is powered off or the CameraLink cable is disconnected.

DMA Status

Displays the real-time status of the DMA process as being either **‘active’** or **‘inactive’**. **‘Active’** indicates that the user has commanded the FrameLink to acquire video data by clicking on the **‘start grab’** button and that the camera is providing valid framing (FVAL signal toggling). **‘Inactive’** indicates that either the user has commanded the FrameLink to stop acquiring video data by clicking on the **‘stop grab’** button or that grabbing is enabled but the camera is not providing valid framing (no FVAL signal)

Camera Parameters Dialog

When the VCECLB_app.exe program is executed, a 'Camera Parameters' dialog will appear. The Camera Parameters screen allows the user to program the FrameLink card with the operating parameters of the attached camera. For the FrameLink card to be able to properly acquire and display images from an attached camera, the settings entered into this screen must match the parameters of the camera.



**Manufacturer
Model
Description** These text fields allow the user to record the vendor and part number of the attached camera. This text, along with all of the other settings, can then be saved as a .CAM file on the PC for later retrieval.

Load Loads a previously saved camera configuration file. Clicking on this box will cause a Windows 'browse' box to appear. The user can then browse to the folder and file he wishes to open. The program will then open the selected file, parse it and populate the fields in the GUI.

Save Saves the current GUI fields as a camera configuration file. Clicking on this box will cause a Windows 'browse' box to appear. The user can then browse to a folder and enter a file name. The program will then create a .CAM file using the values in the GUI's fields and write it to the disk.

Dimension

These fields specify the geometry of the attached camera and instruct the FrameLink on how to reconstruct a received image.

Width (pixels): These fields specify the total number of pixels per line. The Camera Link standard defines a line as being a series of pixels enveloped by the LVAL strobe and qualified by the DVAL strobe. Cameras generally provide some leading and trailing dummy pixels before and after a set of valid pixels. Most cameras can disqualify these dummy pixels by negating the DVAL signal. For cameras that do not disqualify the dummy pixels, the FrameLink has to be told the number of pre-valid, valid and post-valid pixels in order to properly construct an image.

Pre-valid Specifies the number of leading pixels prior to any valid pixels. The FrameLink will exclude these pixels from the displayed/captured image.

Valid Specifies the number of valid pixels. The FrameLink will include these pixels in the displayed/captured image.

Post-valid Specifies the number of trailing pixels following any valid pixels. The FrameLink will exclude these pixels from the displayed/captured image.

Height (lines): These fields specify the total number of lines per frame. The Camera Link standard defines a frame as being a series of lines enveloped by the FVAL strobe. Cameras can sometimes provide some leading and trailing dummy lines before and after a set of valid lines. Most cameras can disqualify these dummy lines by negating the FVAL signal. For cameras that do not disqualify the dummy lines, the FrameLink has to be told the number of pre-valid, valid and post-valid lines in order to properly construct an image.

Pre-valid Specifies the number of leading lines prior to any valid lines. The FrameLink will exclude these lines from the displayed/captured image.

Valid Specifies the number of valid lines. The FrameLink will include these lines in the displayed/captured image.

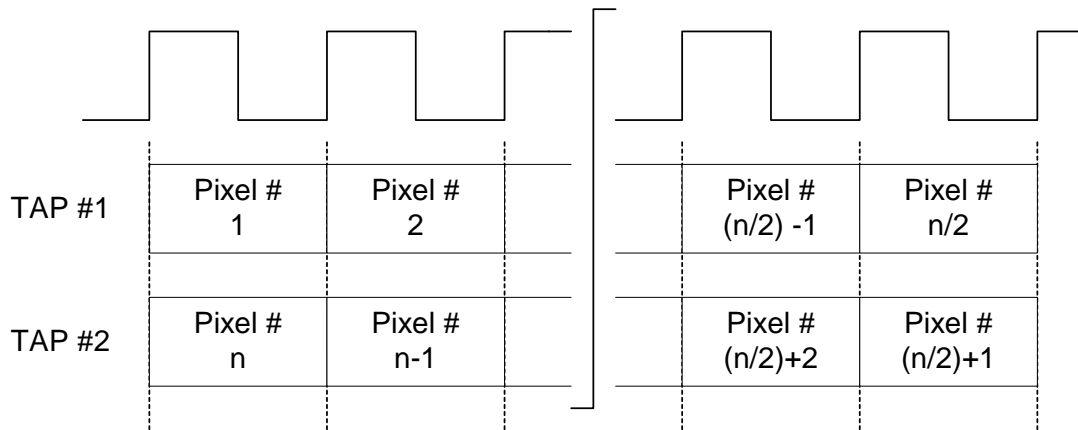
Post-valid Specifies the number of trailing lines following any valid lines. The FrameLink will exclude these

lines from the displayed/captured image.

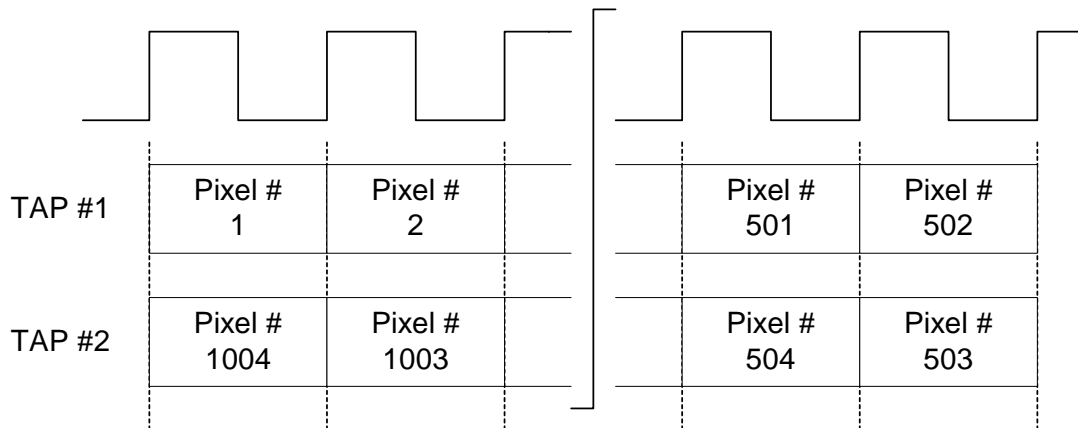
Taps Specifies the number of taps (channels) of video data provided by the attached camera.

Dual Mode This field specifies the order in which the pixels are received from the Camera when operating in the dual tap mode. Two formats are supported: 'Horizontal sequential' and 'Horizontal interlaced'.

Horizontal Sequential This should be selected when the camera delivers pixels in the following order (where n = total number of pixels in the line):

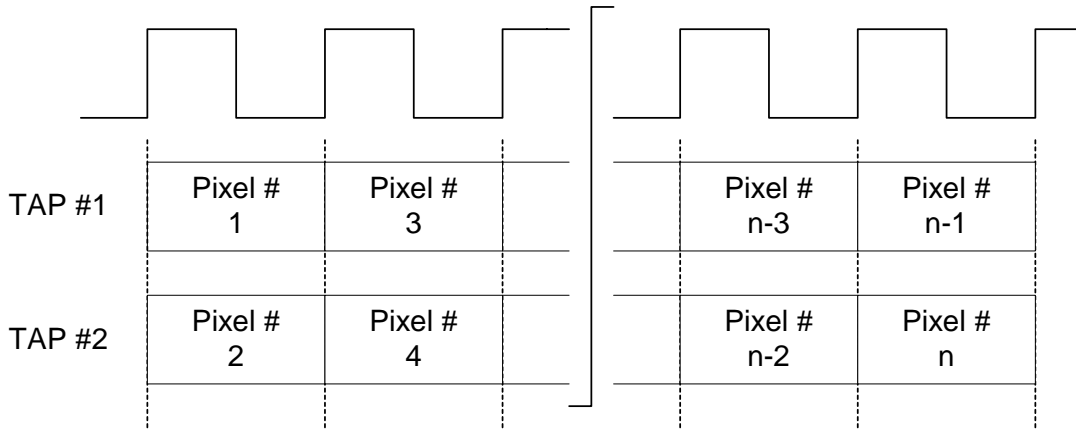


For example: For a camera with 1004 pixels/line in Horizontal Sequential dual progressive mode:

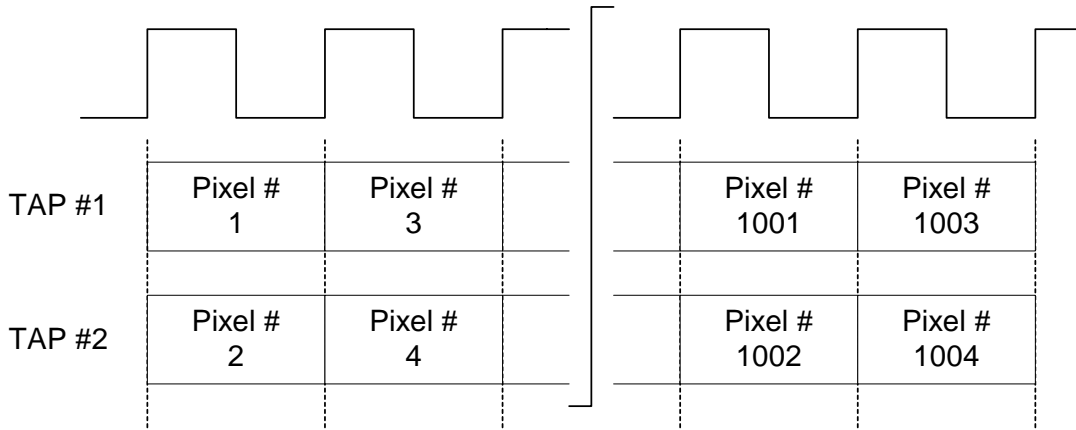


Horizontal Interlaced

This should be selected when the camera delivers pixels in the following order (where n = total number of pixels in the line)



For example: For a camera with 1004 pixels/line in Horizontal Interlaced dual progressive mode:



Reverse Tap

Configures the FrameLink to reverse the pixel order of the displayed image (mirror left-to-right or right-to-left) of either Tap #1 , Tap #2 or both taps.

Strobes Specifies how to treat the Camera Link strobes, where ‘DVAL’ is data valid, ‘LVAL’ is line valid and ‘FVAL’ is frame valid.

Ignore DVAL Instructs the FrameLink card to ignore the ‘DVAL’ signal received from the CameraLink interface. Pixel capture will be qualified with the ‘FVAL’ and ‘LVAL’ signals only.

Invert DVAL Instructs the FrameLink card to invert the ‘DVAL’ signal received from the CameraLink interface prior to processing it.

Invert LVAL Instructs the FrameLink card to invert the ‘LVAL’ signal received from the CameraLink interface prior to processing it.

Invert FVAL Instructs the FrameLink card to invert the ‘FVAL’ signal received from the CameraLink interface prior to processing it.

Video Type Specifies the video mode as either or monochrome, Bayer or RGB (24 bit).

Camera Bit Depth Specifies the number of bits per pixel when the video type is monochrome. When the video type is RGB, the depth is fixed at 24 bits.

Control Bits Specifies the state of the four camera control signals (CC1 – CC4) of the CameraLink interface. An unchecked box represents a negated signal (logic-0), while a checked box represents an asserted signal (logic-1)

Bayer Start Specifies the starting pixel in the bayer pattern as provided by the camera. This selection is typically required when a camera is operated with an ‘area of interest’ feature enabled. For the following examples, assume that ‘n = number of pixels/line’ and ‘m = number of lines’ then:

Pattern #1 Use this selection when the camera provides the following pattern:

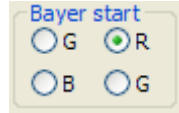


		Pixel						
		1	2	3	4	...	n-1	n
Line	1	G	R	G	R		G	R
	2	B	G	B	G		B	G
	3	G	R	G	R		G	R
	4	B	G	B	G		B	G
	:							
	m-1	G	R	G	R		G	R
	m	B	G	B	G		B	G

An example of this is when the camera is operated in a normal

mode or when its horizontal window starts on an odd pixel and its vertical window starts on an odd line.

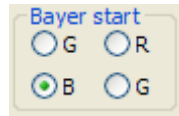
Pattern #2 Use this selection when the camera provides the following pattern:



		Pixel						
		1	2	3	4	...	n-1	n
Line	1	R	G	R	G		R	G
	2	G	B	G	B		G	B
	3	R	G	R	G		R	G
	4	G	B	G	B		G	B
	:							
	m-1	R	G	R	G		R	G
	m	G	B	G	B		G	B

An example of this is when the camera's horizontal window starts on an even pixel and its vertical window starts on an odd line.

Pattern #3 Use this selection when the camera provides the following pattern:



		Pixel						
		1	2	3	4	...	n-1	n
Line	1	B	G	B	G		B	G
	2	G	R	G	R		G	R
	3	B	G	B	G		B	G
	4	G	R	G	R		G	R
	:							
	m-1	B	G	B	G		B	G
	m	G	R	G	R		G	R

An example of this is when the camera's horizontal window starts on an odd pixel and its vertical window starts on an even line.

Pattern #4 Use this selection when the camera provides the following pattern:



		Pixel						
		1	2	3	4	...	n-1	n
Line	1	G	B	G	B		G	B
	2	R	G	R	G		R	G
	3	G	B	G	B		G	B
	4	R	G	R	G		R	G
	:							
	m-1	G	B	G	B		G	B
	m	R	G	R	G		R	G

An example of this is when the camera's horizontal window starts

on an even pixel and its vertical window starts on an even line.

**SerialLink
BaudRate**

Specifies the data transfer speed of the CameraLink's serial interface. Clicking on this box causes a pull-down menu to appear. The user can then select the desired baud rate from among the choices presented, ranging from 9600 to 115,200 bits per second. This setting must match the camera's requirements.

Apply

Causes the application to apply the current settings to the FrameLink card.

**Start/Stop
Grab**

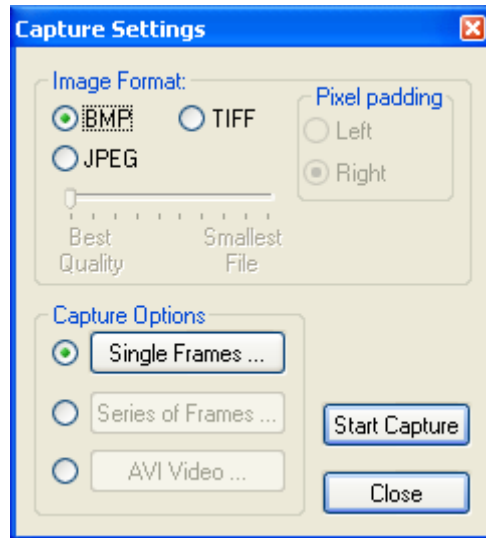
This button will toggle between '**Start Grab**' and '**Stop Grab**' every time the user clicks on it. Clicking on 'Start Grab' enables the FrameLink's DMA engine and causes the main window to display live images received from the camera. Clicking on 'Stop Grab' disables the DMA engine and causes the display to freeze.

Close

This button will hide the Camera Parameters dialog screen. You can invoke it again by either hitting Ctrl-P or by selecting it from the Control Panel pull-down menu.

Capture Settings Dialog

This dialog can be invoked by either hitting Ctrl-S or by selecting it from the Control Panel pull-down menu. This dialog gives the user complete control over image storage. The window can be moved anywhere around the screen to suit your needs.



Start/Stop Capture

This button will toggle between **'Start Capture'** and **'Stop Capture'** every time the user clicks on it. Clicking on **'Start Capture'** starts the process of recording the images to disk. The options set in the **'Capture Options'** field determine what, how and when actual recording is performed. Clicking on **'Stop Capture'** causes recording to stop.

Close

This button will hide the Capture Settings Dialog screen. You can invoke it again by either hitting Ctrl-S or by selecting it from the Control Panel pull-down menu.

Image Format

When recording images to disk, this option selects the format, **'BMP'**, **'JPEG'** or **'TIFF'**, that the image will be saved in. Selecting **'JPEG'** activates a compression slider. **'Best Quality'** provides the least compression while **'Smallest File'** provides the most compression.

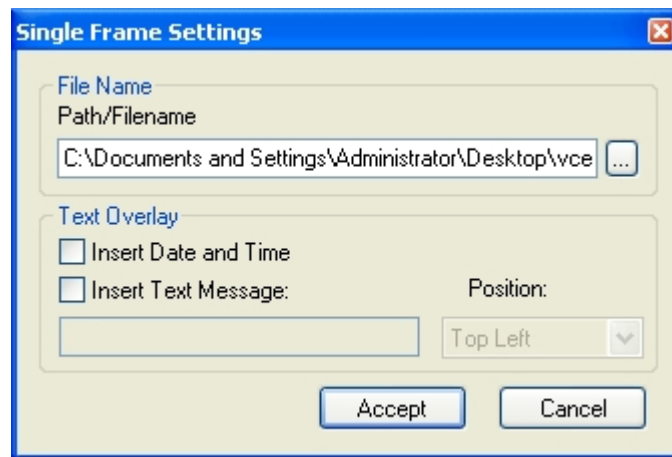
Pixel Padding

Pixel padding defines the way in which TIFF files are created. Since a TIFF file uses 16 bits to represent each pixel and cameras can produce less than 16 bit pixels, the pixel padding option is provided. **'Left'** pixel padding means that 16 bit TIFF data is produced by appending zeros to the MSB bits of the pixel data. For example, for a 12 bit pixel the resultant 16 bit TIFF data is "0,0,0,0,p12, p11...p2,p1" where p12..p1 represent the 12

bit pixel. Left padding is useful when the user wishes to post-process the TIFF data. 'Right' pixel padding means that 16 bit TIFF data is produced by shifting the pixel data left and appending zeros to the LSB bits of the pixel data. For example, for a 12 bit pixel the resultant 16 bit TIFF data is "p12, p11...p2,p1,0,0,0,0". Right padding is useful when the user wishes to view the TIFF data using a standard TIFF viewer program.

Capture Options Determines how, when and where images are recorded to disk. Three choices are provided: 'Single Frames', 'Series of Frames' and 'AVI Video'. Clicking on each option opens a new dialog window providing additional options.

Single Frames Select this option when you wish to record one frame only. Clicking on this button causes the 'Single Frame Settings' dialog window to open.



Path/Filename This text field allows you to provide a path and filename for the recorded image file. Clicking on the '...' box will cause a Windows 'browse' box to appear. The user can then browse to a folder and enter a file name. The filename extension, .BMP or .JPG, will automatically be added depending on the image format chosen and therefore you do not need to include the filename extension.

Text Overlay Enabling '**Insert Date and Time**' automatically places the date and time on each image recorded. Date and time formats are the same as those used on your computer. Enabling '**Insert Text Message**' allows you to enter a text string to be automatically overlaid on each image recorded. Clicking on '**Position**' causes a pull-down menu to appear

which defines the placement position of the date/time/text message within the image. Available options include: Top-Left, Top-Center, Top-Right, Bottom-Left, Bottom-Center and Bottom-Right.

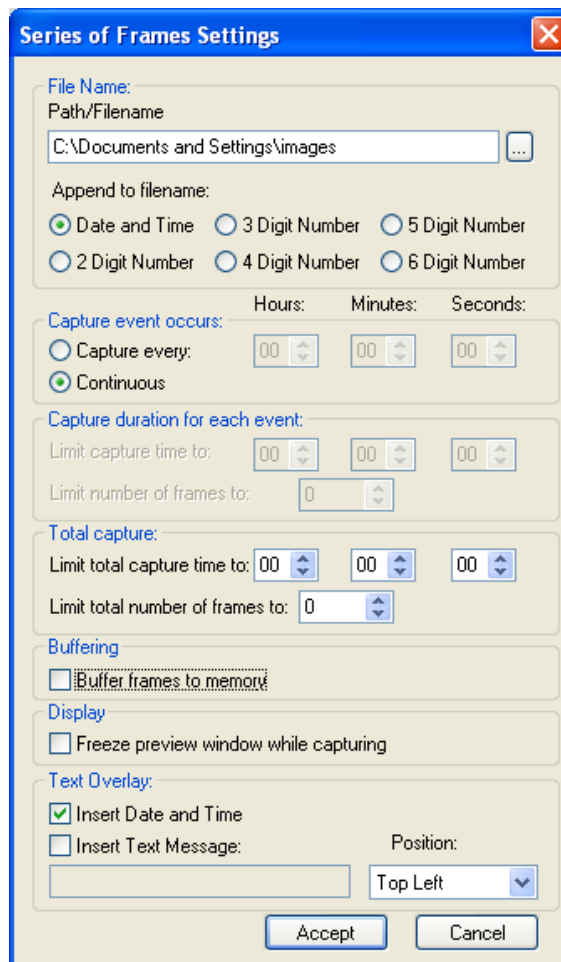
Accept

Clicking on this causes the entries made to the various fields to be accepted and then closes the 'Single Frame Settings' dialog window.

Cancel

Clicking on this causes the entries made to the various fields to be rejected and then closes the 'Single Frame Settings' dialog window.

Series of Frames Select this option when you wish to record multiple frames. Clicking on this button causes the 'Series of Frames Settings' dialog window to open.



Path/Filename

This text field allows you to provide a path to a folder where the recorded image files will be saved

to. Clicking on the '...' box will cause a Windows 'browse' box to appear. The user can then browse to a folder. The filename will automatically be created based on the choice made in the 'Append to filename' option. The filename extension, .BMP or .JPG, will automatically be added depending on the image format chosen.

Append to filename

Allows the user to choose the format of the text filename to be created. Every time a recording file is created, the filename suffix will automatically be updated (for the 'Date and Time' option) or incremented (for the 'N Digit Number' option).

Date and Time

This option will create files named as YYYYMMDDhhmmssnnn where:

- Y - year (4 digits)
- M - month (2 digits)
- D - day (2 digits)
- h - hour (2 digits)
- m - minute (2 digits)
- s - second (2 digits)
- n - millisecond (3 digits)

'N' Digit Number

This option will create numerically named files. The filename starts at 0 and is incremented by one after each frame is captured. If the number of frames captured exceeds the number of digits selected then the filename will continue to increment.

For example:

If '2 Digit Number' is selected then the files will be named as:

- '00.bmp', '01.bmp' ... '99.bmp',
- '100.bmp', '101.bmp', etc.

If '4 Digit Number' is selected then the files will be named as:

- '0000.bmp', '0001.bmp' ... '9999.bmp',
- '10000.bmp', '10001.bmp', etc.

Capture event occurs:

Allows you to control how often to start capturing images.

Capture every

Specifies how often, in time, to start

capturing images. Use this feature to take snapshots at regular intervals in order to create a time-lapse series of images. This option is mutually exclusive with the 'Continuous' option.

Continuous Specifies that image capture is free-running.

Capture duration for each event: Allows you to control how much to capture with each capture event specified above. Limits can be specified by either time or number of frames, whichever occurs first.

Limit capture time to Allows you to limit the duration of the recording by the amount of time specified.

Limit number of frames to Allows you to limit the duration of the recording by the number of frames specified.

Total capture: Allows you to control how much to capture over all events specified above. Limits can be specified by either time or number of frames, whichever occurs first.

Limit total capture time to Allows you to limit the duration of the total recording by the amount of time specified.

Limit total number of frames to Allows you to limit the duration of the total recording by the number of frames specified

Examples of how to use Capture timers and counters:

Example #1: To capture 5 frames, every 1.5 hours, over a 12 hour period.

Capture event occurs:

Capture every: 01 Hr 30 Min 00 Sec

Capture duration for each event:

Limit number of frames to: 5

Total capture:

Limit total capture time to: 12 Hr 00 Min 00 Sec

Example #2: To capture 5 minutes worth of images, every 15 minutes and not to exceed a total of 250 images.

Capture event occurs:

Capture every: 00 Hr 15 Min 00 Sec

Capture duration for each event:

Limit capture time to: 00 Hr 05 Min 00 Sec

Total capture:

Limit total number of frames to: 250

Example #3: To capture 10 frames, every 1 hour, over a 6 hour period and not to exceed a total of 300 images.

Capture event occurs:

Capture every: 01 Hr 00 Min 00 Sec

Capture duration for each event:

Limit number of frames to: 10

Total capture:

Limit total capture time to: 06 Hr 00 Min 00 Sec

Limit total number of frames to: 300

Example #4: To capture continuously for a period of 2 hours and not to exceed a total of 100 images.

Capture event occurs:

Continuous

Total capture:

Limit total capture time to: 02 Hr 00 Min 00 Sec

Limit total number of frames to: 100

Buffer frames to memory

When selected will store images in system memory during capturing. When capturing is complete, the images in memory will be flushed to the disk drive. Select this option to improve capture performance (i.e. the number of frames per second stored to disk). If this option is not selected, images will be stored

directly to disk and therefore capture performance will be limited by the disk's transfer rate.

Freeze preview window while capturing

When selected will stop the live image in the main window from updating during capture, otherwise the image will remain live. Selecting this option improves capture performance (i.e. the number of frames per second stored to disk).

Text Overlay

Same as in 'Single Frames'.

Accept

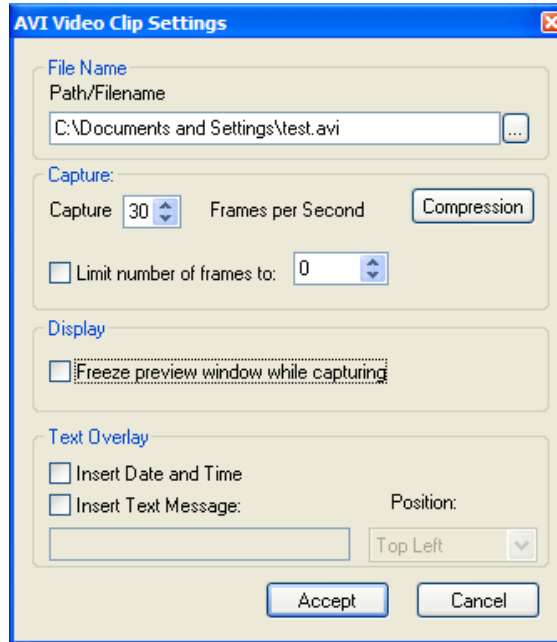
Same as in 'Single Frames'.

Cancel

Same as in 'Single Frames'.

AVI Video

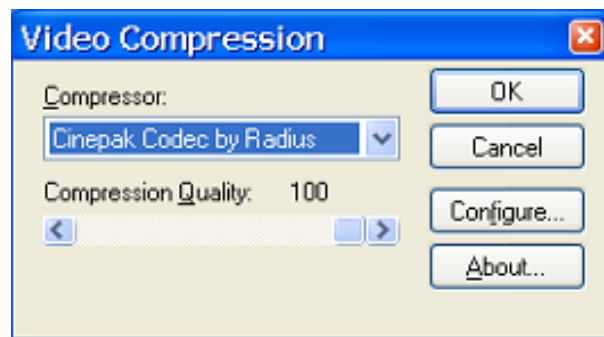
Select this option when you wish to create an AVI movie file. An AVI movie is a series of BMP files assembled into a single AVI file. This choice is not available if JPEG was chosen as the 'Image Format'. Clicking on this button causes the 'AVI Video Clip Settings' dialog window to open.



Path/Filename Same as in 'Single Frames'.

**Capture []
Frames per
Second** Limits the frame rate of the recorded movie.

Compression Allows you to choose between a variety of compressor implementations and options. Clicking on this button causes the 'Video Compression' dialog window to open.



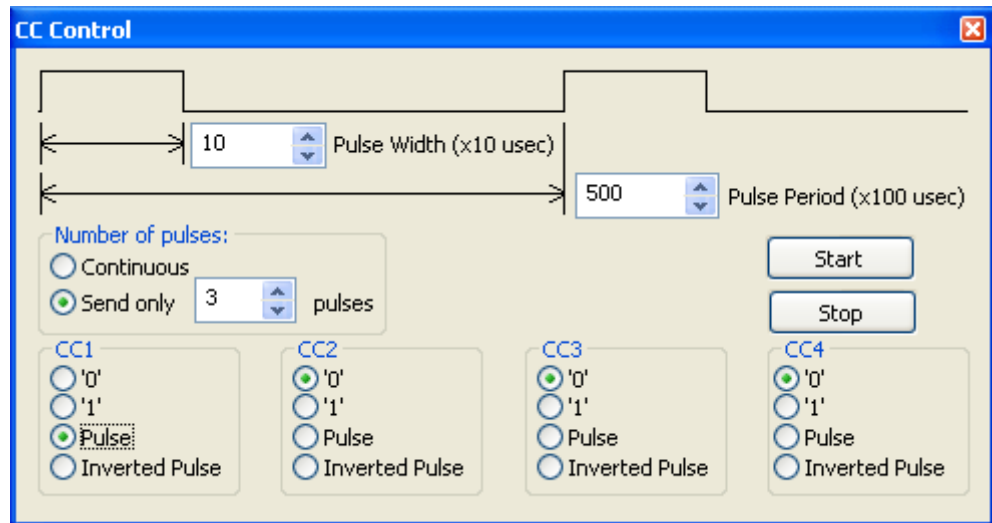
Compressor This pull-down menu lists several different

implementations of AVI compressors. Each has its own set of configuration options.

Compression Quality	Lets you trade off quality versus file size. The higher the quality, the larger the file size and the lower the quality, the smaller the file size.
OK	Clicking on this causes the entries made to the various fields to be accepted and then closes the 'Video Compression' dialog window.
Cancel	Clicking on this causes the entries made to the various fields to be rejected and then closes the 'Video Compression' dialog window.
Configure...	Provides additional configuration options that are specific to the type of compressor chosen.
About...	Provides version number information for the chosen compressor.
Limit number of frames to	Allows you to limit the duration of the recording by the number of frames specified.
Freeze preview window while capturing	Same as in 'Series of Frames'.
Text Overlay	Same as in 'Single Frames'.
Accept	Same as in 'Single Frames'.
Cancel	Same as in 'Single Frames'.

CC Control Dialog

The CC Control screen allows the user to program the FrameLink card to generate signals on the Camera Link CC1-CC4 signals. These signals are often used by cameras to control triggering and exposure via the host computer.



- | | |
|--------------------------|---|
| Pulse Width | Sets the width of the CC pulse generator in 10 uSec increments. |
| Pulse Period | Sets the period (repetition rate) of the CC pulse generator in 100 uSec increments. |
| Number of pulses: | Determines how often to send CC pulses: |
| Continuous | Configures the FrameLink to send a continuous stream of CC pulses. Clicking on the 'Start' button causes the pulses to begin. Clicking on the 'Stop' button causes the pulses to cease. |
| Send only | Configures the FrameLink to send a programmed number of pulses. Clicking on the 'Start' button causes the sequence to begin. Every click of the 'Start' button will cause a new sequence to be generated. |
| CC1 – CC4 | Configures the behavior of each of the four CC signals: |
| '0' | Drive the selected CC signal to a logic '0'. |
| '1' | Drive the selected CC signal to a logic '1'. |
| Pulse | Drive the selected CC signal with the output of the CC pulse |

generator.

**Inverted
Pulse**

Drive the selected CC signal with the inverted output of the CC pulse generator.

Start

Causes the CC pulse generator to start running.

Stop

Causes the CC pulse generator to stop running.

Player Control

Clicking on the 'Player' item under the 'File' pull-down menu at the top of the FrameLink main window causes two windows to appear: the 'Player Control' and 'Player Dialog' windows. These windows can be moved anywhere around the screen to suit your needs.

The Player Control window is used to select the pre-recorded image or movie files that you wish to view.

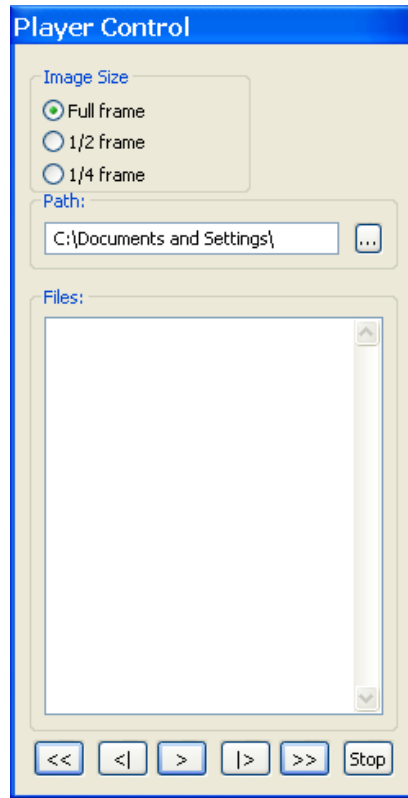


Image Size

Determines the size of the Player Dialog window and the playback image. Changing from one scale to another automatically updates the Player Dialog window and image size.

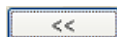
Path

This text field allows you to enter the name of the folder or directory containing the image or movie files. Clicking on the '...' box will cause a Windows 'browse' box to appear.

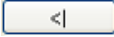
Files


This box lists all of the image or movie files that are in the folder selected under 'Path'.

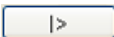
Rewind




Displays the first image in the series.

Step Backwards  Displays the previous frame or image. Use this button to back through individual frames of an AVI Movie. Play must be paused for this button to work on AVI Movies.

Play  Begins playing the AVI movie. If you are viewing JPEG or BMP images, clicking this button displays a series of images (one after another) starting from the current file selected in the Player Control dialog.

Step Forward  Displays the next frame or image. Use this button to advance through individual frames of an AVI Movie. Play must be paused for this button to work on AVI Movies.

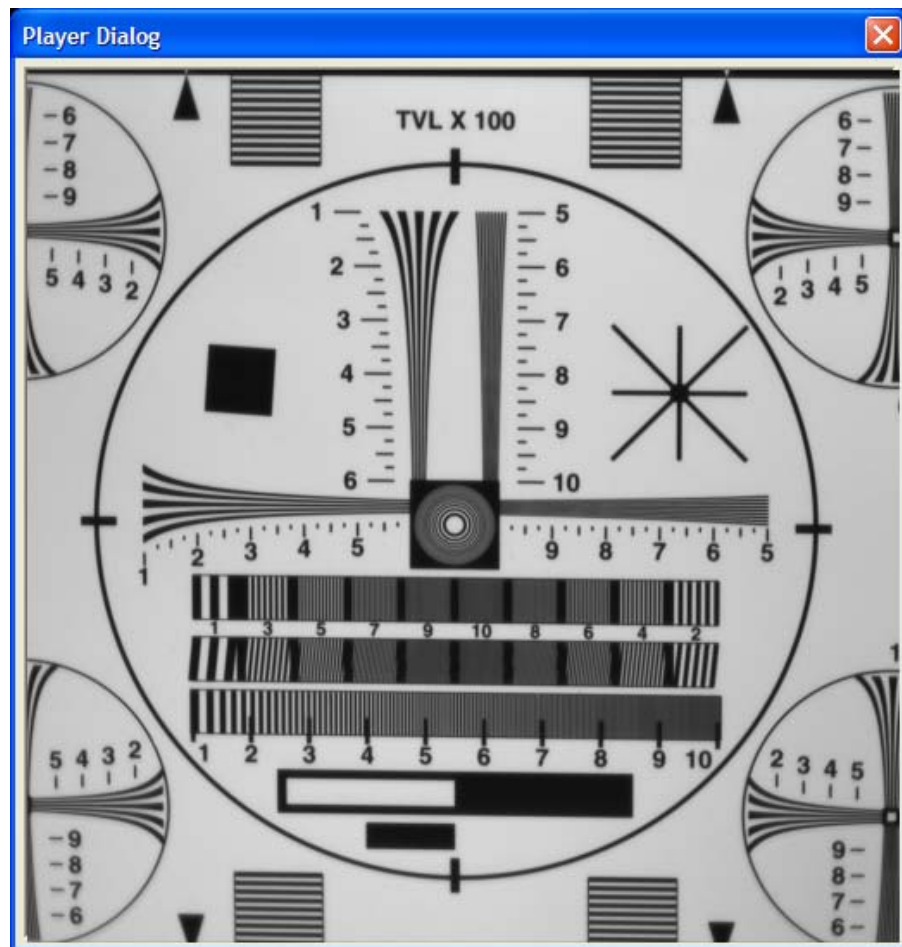
Fast Forward  Displays the last image in the series.

Stop  Halts current playback.

Player Dialog

The Player Dialog window appears when the user selects the 'Player' item under the 'File' pull-down menu at the top of the FrameLink main window. The Player Dialog window provides the primary area for viewing playback of pre-recorded images or movies. This window can be moved anywhere around the screen to suit your needs.

The size of the window (and image) is determined by the size of the image file selected in the 'Player Control' window and can be scaled using the 'Image Size' option. For example, if the user selects an image file that was produced by a 1004x1004 resolution camera, then the 'Full frame' window size will be 1004x1004. In this example, selecting '½ frame' produces a window size of 502x502 and selecting '¼ frame' produces a size of 251x251.



Chapter **5**



Electrical Interfaces

This chapter contains information on the FrameLink's connectors.

Camera Link Connector

The Camera Link connector is a shielded, surface mount, vertical, 26 position, female, MDR (mini-D ribbon) style connector.

Pin #	Cable name	Signal name
1	Inner Shield	Inner Shield
2	PAIR11-	CC4-
3	PAIR10+	CC3+
4	PAIR9-	CC2-
5	PAIR8+	CC1+
6	PAIR7+	SerTFG+
7	PAIR6-	SerTC-
8	PAIR5+	X3+
9	PAIR4+	Xclk+
10	PAIR3+	X2+
11	PAIR2+	X1+
12	PAIR1+	X0+
13	Inner Shield	Inner Shield
14	Inner Shield	Inner Shield
15	PAIR11+	CC4+
16	PAIR10-	CC3-
17	PAIR9+	CC2+
18	PAIR8-	CC1-
19	PAIR7-	SerTFG-
20	PAIR6+	SerTC+
21	PAIR5-	X3-
22	PAIR4-	Xclk-
23	PAIR3-	X2-
24	PAIR2-	X1-
25	PAIR1-	X0-
26	Inner Shield	Inner Shield

Table 3 – Camera Link Connector Pin-out

Note that the Camera Link connector pin-out for the frame grabber is 180 degrees rotated from the pin-out for the camera.

PCMCIA/Cardbus Connector

The Cardbus connector is a surface mount, right angle, 68 position, female connector.

Pin #	Signal	Pin #	Signal
1	GND	35	GND
2	ad0	36	cd1#
3	ad1	37	ad2
4	ad3	38	ad4
5	ad5	39	ad6
6	ad7	40	rfu
7	c/be0#	41	ad8
8	ad9	42	ad10
9	ad11	43	vs1
10	ad12	44	ad13
11	ad14	45	ad15
12	c/be1#	46	ad16
13	par	47	rfu
14	perr#	48	block#
15	gnt#	49	stop#
16	int#	50	devsel#
17	VCC	51	VCC
18	VPP1	52	VPP2
19	clk	53	trdy#
20	irdy#	54	frame#
21	c/be2#	55	ad17
22	ad18	56	ad19
23	ad20	57	vs2
24	ad21	58	rst
25	ad22	59	serr#
26	ad23	60	req#
27	ad24	61	c/be3#
28	ad25	62	audio#
29	ad26	63	stschg
30	ad27	64	ad28
31	ad29	65	ad30
32	rfu	66	ad31
33	clkrun#	67	cd2#
34	GND	68	GND

Table 4 – Cardbus Connector Pin-out

Chapter

6

Specifications

Video Source

Camera Link interface (Base configuration using a single 26 pin connector).

Supports 1x8, 2x8, 1x10, 2x10, 1x12, 2x12, 1x14, 1x16 and RGB (3x8) modes of operation.

Camera Link clock rates up to 66 MHz.

RS232 Serial interface for configuring & monitoring camera.

Four discrete camera control LVDS differential outputs to camera (CC1 to CC4)

Physical Dimensions

PCMCIA Type II: 115.6mm(4.55in) x 54mm(2.1in) x 5mm(.2in) with a 30mm x 10mm extension.

Weight

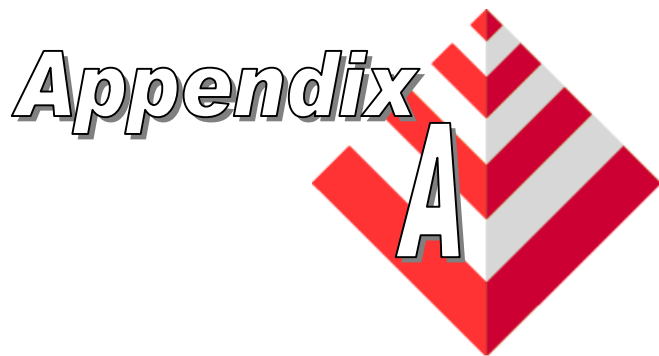
35 grams (1.25 oz)

Electrical Characteristics

Operating voltage: 3.3V +/- 5%
Operating current: 160mA
Inrush current: 360mA

Operating Environment

Operating temperature: 0°C to 65°C
Relative humidity: 90% non-condensing



Serial Communications

The FrameLink provides a Camera Link compliant serial communications channel. This is an ASYNC interface operating at a user selectable BAUD rate (set via the Camera Parameters dialog), with 1 start bit, 8 data bits, 1 stop bit, no parity and no handshake.

Clservice.dll

Any standard camera configuration software can access this serial interface by using the FrameLink's clservice.dll file (located in the c:/WINDOWS/system32 folder for WinXP or c:/WINNT/system32 folder for Win2000). The clservice.dll is fully compliant with v1.0 of the Camera Link specification.

COM port emulation

Alternatively, if the camera configuration software does not provide an interface to the Camera Link clser***.dll but only supports standard COM ports, then the user can invoke our VceComX.exe COM port emulator. This software will emulate a PC COM port allowing any terminal emulator or camera configuration tool to access the FrameLink serial interface.

To create a virtual COM port, simply run the VceComX.exe program. Then select the port number from the pull-down list and click on 'Create Port'. You can now begin using the virtual COM port in you terminal or camera configuration software. **NOTE: You must not exit the VceComX program while it is in use.** When you are done using the COM port, then click on 'Delete Port' and 'Exit'.

