CLV-412 CAMERA LINK VIDEO SPLITTER

User's Manual

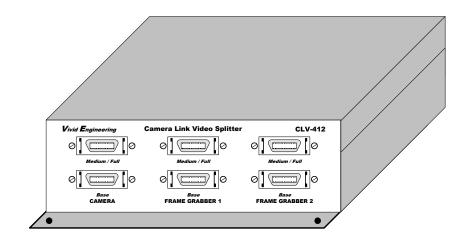# Table of Contents

1. Introduction

1.1. Overview

The CLV-412 Camera Link[1] Video Splitter interfaces one Camera Link camera of any configuration (base, medium, full, 80-bit) to up-to four frame grabbers using standard Camera Link cables. This enables the use of multiple frame grabbers for applications requiring parallel or distributed processing, camera sharing, etc. One frame grabber acts as master and provides control and communications to the camera. The remaining frame grabbers receive camera video data only. The master frame grabber is selectable and may be dynamically changed for applications requiring camera control sharing.

The CLV-412 incorporates high-speed 85 MHz interfaces and supports all Camera Link cameras. Multiple CLV-412s may be cascaded for large parallel processing systems.

The CLV-412 Camera Link Video Splitter is housed in a sturdy, compact aluminum enclosure.

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[1] The Camera Link interface standard enables the interoperability of cameras and frame grabbers, regardless of vendor. The Automated Imaging Association (AIA) sponsors the Camera Link program including the oversight Camera Link Committee, the self-certification program, and the product registry. The Camera Link specification may be downloaded from the AIA website, found at www.machinevisiononline.org

Camera Link is a trademark of the Automated Imaging Association

Vivid Engineering   Camera Link Video Splitter   CLV-412

Medium / Full   Medium / Full   Medium / Full

Base
CAMERA

Base
FRAME GRABBER 1

Base
FRAME GRABBER 2

1.2. Features

- Interfaces one camera to up-to four frame grabbers

- Supports all Camera Link configurations (base, medium, full), including 80-bit

- Supports parallel or distributed processing, camera sharing, etc

- High-speed (85 MHz) design supports all Camera Link cameras

- Uses standard Camera Link cables (not included)

- May be cascaded for large parallel processing systems

- Dynamic master frame grabber selection via opto-isolated control inputs

- Minimal video data pass-through latency: 5 camera pixel clocks

- Minimal control/communication pass-through latency: under 15 nS

- Rear panel LEDs identify master frame grabber

- Flow-through connector positioning

- Sturdy, compact aluminum enclosure w/ mounting flange

- Multi-nation power supply included

- 3-year warrantee

1.3.   Functional Description

A block diagram of the CLV-412 is provided in Figure 1-1. The CLV-412 interfaces one camera of any configuration (base, medium, full, 80-bit) to up-to four frame grabbers using standard Camera Link cables.

One frame grabber acts as the master (primary). The master frame grabber receives video data from the camera, and can also control and communicate with the camera. The interface between the camera and the *master* frame grabber utilizes the entire Camera Link signal set defined in the Camera Link Specification. This consists of video data, camera control, and serial communications.

The remaining frame grabbers act as slaves (secondary). The interface between the camera and the *slave* frame grabbers utilizes video data only. The slave frame grabbers receive video data, but cannot control or communicate with the camera.

Some applications require the ability to share control of the camera between the frame grabbers (i.e. share the master role). CLV-412 allows any of the four frame grabbers to act as the master. Selection of the master frame grabber is made via the opto-isolated master select inputs. When the select inputs change, the master frame grabber is immediately reassigned accordingly. This enables dynamic (i.e. real-time) selection of the master frame grabber for applications requiring this capability. Frame grabber 1 is the default master frame grabber whenever the opt-isolated inputs are not being used. Rear-panel LED indicators identify the current master frame grabber.

The CLV-412 camera and frame grabber interfaces incorporate the connector, signals, pinout, and chipset in compliance with the Camera Link specification. The CLV-412 incorporates the "full" (i.e. dual cable) configuration signal set, consisting of video data, camera control, and serial communications. The CLV-412 also works with 80-bit, medium configuration and base configuration (single cable) configuration cameras. The CLV-412 incorporates high-speed (85 MHz) interfaces.

The CLV-412 adds minimal delay (i.e. latency) to the video data path. This is an important criterion for time-critical applications. The latency through the CLV-412 is a fixed 5 pixel-clock delay. The pixel clock is established by the camera and can range from 20-85 MHz. Therefore, the CLV-412 fixed delay can range from 59 to 250 nS, depending on camera. The delay added by the CLV-412 for the camera control and serial communication signals is under 15 nS.

Multiple CLV-412s may be cascaded for large parallel processing systems.

The CLV-412 Camera Link Video Splitter is housed in a sturdy, compact aluminum enclosure.

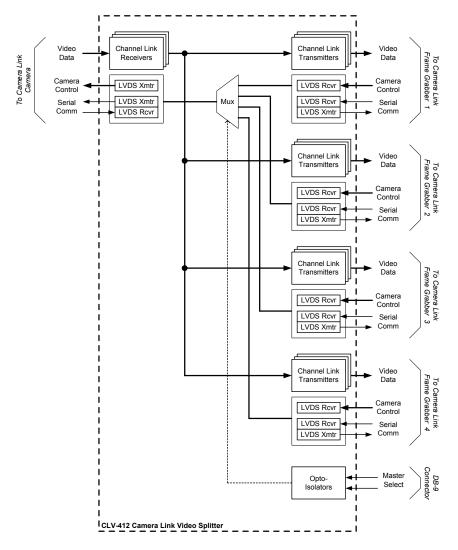The CLV-412 is powered by an external wall plug-in power supply.

Figure 1-1: CLV-412 Block Diagram

1.3.1. Master Frame Grabber Selection

Master frame grabber selection is supported via the master select port. Note that the use of this port is optional.

Two opto-isolated control inputs are provided via a DB9 connector on the rear panel. Voltage levels applied to these inputs select the master frame grabber. Master reassignment occurs instantaneously, enabling real-time master selection. When no connection is made to the DB9, Frame Grabber 1 is master (default). See Section 2.2.1 for connector pin assignments and signal characteristics.

The rear-panel indicator LEDs identify the current master frame grabber.

Table 1-1: Master Frame Grabber Select Inputs

SEL1	SEL0	Master Frame Grabber
0	0	Frame Grabber 1
0	1	Frame Grabber 2
1	0	Frame Grabber 3
1	1	Frame Grabber 4
No Connection		Frame Grabber 1

1.4.   Typical Application

A typical CLV-412 application is shown in Figure 1-2. A Camera Link full configuration camera is connected to a single CLV-412 via a pair of standard Camera Link cables. Additional Camera Link cable pairs are then used to connect the CLV-412 to up-to four Camera Link frame grabbers.

Since the master select port is not being used in this example, frame grabber 1 (bottom) is the default master. The master frame grabber provides camera control and communication, as well as performing processing functions. The slave frame grabbers cannot control or communicate with the camera, but are used for parallel or distributed processing, monitoring, etc.
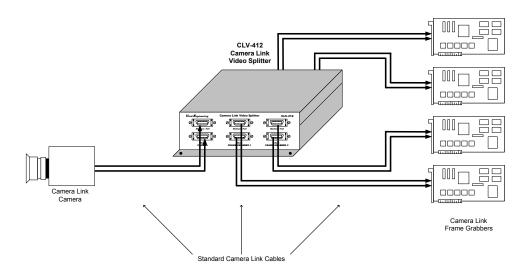

Figure 1-2: CLV-412 Standard Application

1.5. Specifications

Table 1-1: CLV-412 Specifications

Feature	Specification
Video Interfaces	Camera Link Spec "full" configuration + 80-bit modes
Video Connectors	26-pin MDR type
Camera Frequency	20-85 MHz
Latency	Video path: 5 camera pixel clock cycles Control & communication: 15ns max
Chipset	National Semiconductor DS90CR287 / 288A
Select Connector	Female 9-pin D-Sub (DB9), opto-isolated inputs
Power Supply	Universal wall style w/ outlet plug set
Power Jack	2.1 x 5.5 mm, center-positive
Power Requirements	5-7 VDC,480 mA (typical)
Cabinet Dimensions	6.14" (L) x 2.10" (H) x 7.02" (D)
Weight	26 oz
Operating Temperature Range	0 to 50° C
Storage Temperature Range	-25 to 75° C
Relative Humidity	0 to 90%, non-condensing

2. Interface

2.1.   Front Panel Connections

The CLV-412 Camera Link Video Splitter front panel is shown in Figure 2-1. The front panel contains six 26-pin MDR video connectors; two for the camera, two for frame grabber 1, and two for frame grabber 2.

The video connectors are 3M MDR-26 types as specified in the Camera Link Spec. Figure 2-2 identifies the MDR-26 pin positions.
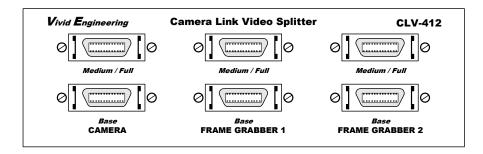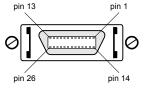

Figure 2-1: CLV-412 Front Panel

Figure 2-2: MDR-26 Connector Pin Positions

2.2.   Rear Panel Connections

The CLV-412 Camera Link Video Splitter rear panel is shown in Figure 2-3. The rear panel contains two 26-pin MDR video connectors for connecting to frame grabber 3, two 26-pin MDR video connectors for connecting to frame grabber 4, the master select connector, LEDs for identifying the master frame grabber, and a DC power jack.

The MDR-26 connector is a 3M device as specified in the Camera Link Spec.

The master select connector is a standard 9-pin female D-Sub type (DB9). Figure 2-4 identifies the DB9 pin positions.

The four LEDs identify which frame grabber is "master" as discussed in prior sections.

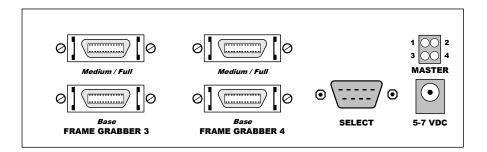DC power jack accepts 5-7 volts DC. Polarity is center-positive.
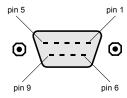

Figure 2-3: CLV-412 Rear Panel

Figure 2-4: Female DB9 Connector Positions

2.2.1. Master Select Connector

A standard female DB9 connector is located on the rear panel for master frame grabber selection. Use of this connector is optional. The CLV-412 will default to frame grabber 1 as master when no connection is made. Table 2-1 identifies the DB9 signal assignments.

Table 2-1: Master Select DB9 Connector

Signal Name	DB9 Pin#	Notes
SEL0 +	1	*Master Select 0*
n/c	2	*no connection*
n/c	3	*no connection*
SEL1 +	4	*Master Select 1*
n/c	5	*no connection*
SEL0 -	6	*Master Select 0 Return*
n/c	7	*no connection*
n/c	8	*no connection*
SEL1 -	9	*Master Select 1 Return*

Two control inputs (SEL0+/- & SEL1+/-) are used to select the master frame grabber. The control inputs are received by opto-isolator devices for system electrical isolation.

SEL0 is logic "1" when 5-10 VDC is applied between SEL0+ and SEL0-. SEL0 is logic "0" when 0 VDC is applied. Similarly, SEL1 is logic "1" when 5-10 VDC is applied between SEL1+ and SEL1-. SEL1 is logic "0" when 0 VDC is applied.

2.3. Camera Connector Signals

The MDR-26 video connector signal assignments comply with the Camera Link "full" configuration, providing compatibility with all Camera Link cameras and frame grabbers (base, medium, full, 80-bit). The *camera* connector signal assignments correspond to the frame grabber interface defined in the Camera Link Specification. Conversely, the *frame grabber* connector assignments are as defined for the camera interface in the Camera Link Specification. This arrangement provides compatibility with standard Camera Link cables.

Tables 2-2 and 2-3 identify the signal assignments for the CLV-412 "Base" and "Medium/Full" MDR-26 video connectors, respectively.

2.3.1. Cable Shield Grounding

Camera <u>and</u> frame grabber cable "outer" shields are connected to the CLV-412 aluminum case. The case is isolated from the CLV-412 circuitry and the cable "inner" shields.

The frame grabber cable "inner" shield connects to circuit digital ground, maintaining signal reference levels between the CLV-412 and the frame grabber.

Table 2-2: MDR-26 "Base" Connector Assignments

Camera Link Signal Name	Camera Connector Pin # (frame grabber pinout)	Frame Grabber Connectors Pin # (camera pinout)	Signal Direction
Inner shield	1	1	N/A
Inner shield	14	14	N/A
X0-	25	2	CAM → FG
X0+	12	15	CAM → FG
X1-	24	3	CAM → FG
X1+	11	16	CAM → FG
X2-	23	4	CAM → FG
X2+	10	17	CAM → FG
Xclk-	22	5	CAM → FG
Xclk+	9	18	CAM → FG
X3-	21	6	CAM → FG
X3+	8	19	CAM → FG
SerTC+	20	7	FG → CAM
SerTC-	7	20	FG → CAM
SerTFG-	19	8	CAM → FG
SerTFG+	6	21	CAM → FG
CC1-	18	9	FG → CAM
CC1+	5	22	FG → CAM
CC2+	17	10	FG → CAM
CC2-	4	23	FG → CAM
CC3-	16	11	FG → CAM
CC3+	3	24	FG → CAM
CC4+	15	12	FG → CAM
CC4-	2	25	FG → CAM
Inner shield	13	13	N/A
Inner shield	26	26	N/A

"FG" = Frame Grabber, "CAM" = Camera

Table 2-2: MDR-26 "Medium/Full" Connector Assignments

Camera Link Signal Name	Camera Connector Pin # (frame grabber pinout)	Frame Grabber Connectors Pin # (camera pinout)	Signal Direction
Inner shield	1	1	N/A
Inner shield	14	14	N/A
Y0-	25	2	CAM → FG
Y0+	12	15	CAM → FG
Y1-	24	3	CAM → FG
Y1+	11	16	CAM → FG
Y2-	23	4	CAM → FG
Y2+	10	17	CAM → FG
Yclk-	22	5	CAM → FG
Yclk+	9	18	CAM → FG
Y3-	21	6	CAM → FG
Y3+	8	19	CAM → FG
100 Ω	20	7	N/A
terminated	7	20	N/A
Z0-	19	8	CAM → FG
Z0+	6	21	CAM → FG
Z1-	18	9	CAM → FG
Z1+	5	22	CAM → FG
Z2-	17	10	CAM → FG
Z2+	4	23	CAM → FG
Zclk-	16	11	CAM → FG
Zclk+	3	24	CAM → FG
Z3-	15	12	CAM → FG
Z3+	2	25	CAM → FG
Inner shield	13	13	N/A
Inner shield	26	26	N/A

"FG" = Frame Grabber, "CAM" = Camera

3. Mechanical

3.1. Dimensions

The CLV-412 Camera Link Video splitter cabinet dimensions are shown in Figure 3-1.

The CLV-412 is housed in a sturdy aluminum enclosure. The body is extruded aluminum, with detachable front and rear endplates. The enclosure incorporates a mounting flange. The flange contains four predrilled holes (0.15" diameter) for convenient equipment mounting. A mounting footprint drawing is provided in Figure 3-2.
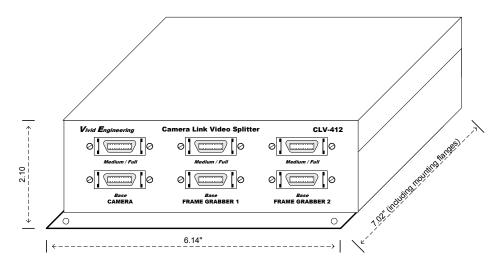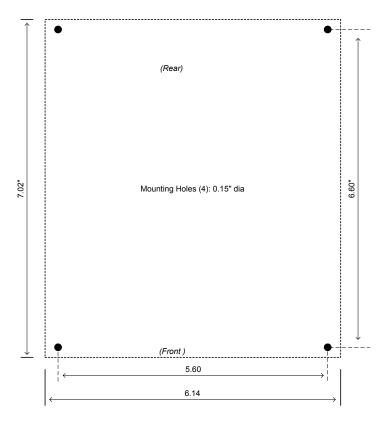

Figure 3-1: CLV-412 Cabinet Dimensions

Figure 3-2: Mounting Footprint Drawing

3.2.   External Power Supply

The CLV-412 is powered by 5-7 VDC and incorporates a 2.1 x 5.5 mm DC power jack that accepts a standard barrel-style power plug. Power plug polarity is center-positive.

The CLV-412 includes a multi-nation wall-mount power supply that handles a wide power range (90-264 VAC, 47-63 Hz) and comes with a set of outlet plugs suitable for most countries (US, Europe, UK, etc). The CLV-412 may also be purchased without a power supply.

The CLV-412 is protected by an internal resetable fuse.

4. Revision History

Table 5-1: CLV-412 User's Manual Revision History

Document ID #	Date	Changes
200666-0.1	12/3/2010	**Preliminary** release of manual