

CLB-501 CAMERA LINK™ BREAKOUT BOX

User's Manual

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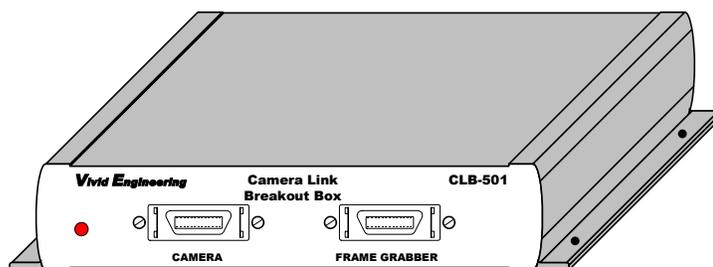
1. Introduction

1.1. Overview

The CLB-501 Camera Link™ Breakout Box provides convenient access to the data transferred between camera and frame grabber over a Camera Link connection. All video, control, and communication data can be monitored and/or sourced via a standard header connector located on the rear panel.

The CLB-501 supports the Camera Link “base” configuration. “Medium” configuration applications are supported using two CLB-501s.

The CLB-501 Camera Link Breakout Box is extremely useful during the development, test, and integration of Camera Link products and systems. Housed in a sturdy aluminum enclosure, the CLB-501 is well suited for industrial environments.



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

1.2. Features

- Provides access to all data (video, camera control, serial comm.)
- Standard 0.1” pitch dual-row header-style breakout connector
- Removable header jumpers (shunts) enable external data sourcing
- Standard LVTTTL signal levels
- Power, ground, and buffered clock pins aide interfacing
- Uses standard Camera Link cables (not included)
- Supports Camera Link “base” configurations
- “Medium” configuration support using two CLB-501s
- Also acts as a repeater, doubling max distance between camera and frame grabber
- Sturdy, compact aluminum enclosure w/ mounting flange
- External power supply included
- 3-year warrantee

1.3. Functional Description

A block diagram of the CLB-501 is provided in Figure 1-1. The CLB-501 provides access to the data transferred between camera and frame grabber over a Camera Link connection. All video, control, and communication data can be monitored and/or sourced via a header-style breakout connector located on the rear panel.

The CLB-501 incorporates the connectors, signals, pinouts, and chipset in compliance with the Camera Link™ specification for the “base” configuration.

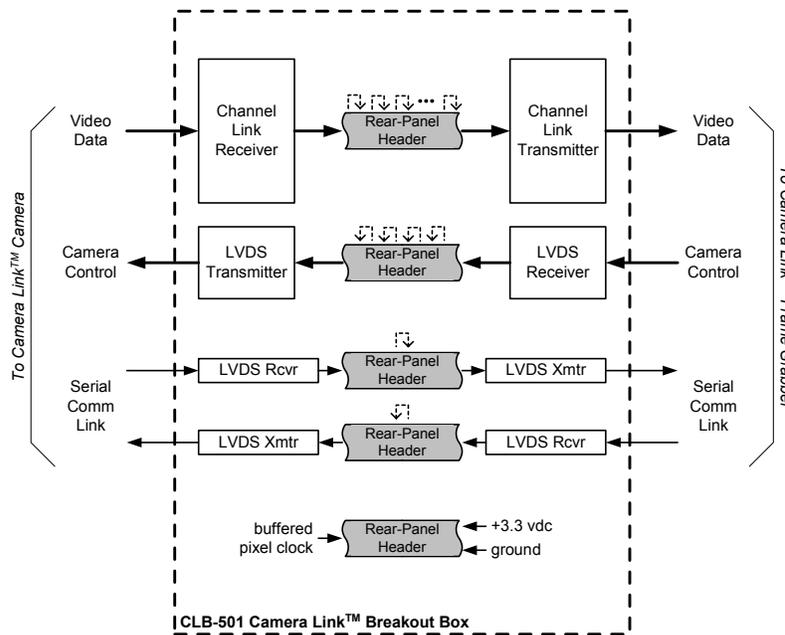


Figure 1-1: CLB-501 Block Diagram

The CLB-501 breakout connector is a standard dual-row header for easy connection to external test equipment and is located on the rear panel. The unit comes with a complete set of shorting blocks (shunts) installed on the header. The shunts may be removed to break the connection between camera and frame grabber in order to insert an external data source (i.e. for camera control, serial comm., etc.). Since all video data is available at the header, the CLB-501 may also be used to remap/realign video and control information between camera and frame grabber.

To aid in interfacing to external equipment, the CLB-501 incorporates an auxiliary header that provides 3.3VDC power, ground, and a buffered version of the pixel clock. The buffered clock enables access to the reference clock without the risk of degradation of the raw clock signal which could cause a malfunction. The raw (unbuffered) pixel clock is also available on the header, but care should be taken in its use. The buffered clock is sourced from the output (frame grabber) side of the breakout header.

All signals on the header utilize standard LVTTTL levels. Care must be taken when interfacing to the header to avoid damage to the internal components.

The CLB-501 also acts as a repeater, doubling the maximum distance between camera and frame grabber.

Camera Link “medium” applications are supported using a pair of CLB-501’s in parallel. The CLB-501 does not support the Camera Link “full” configuration.

The CLB-501 is powered by an external wall plug-in power supply (included).

1.3.1. Breakout Header Pixel Assignments

Tables 1-1 through 1-6 identify the assignment of camera pixel data to the breakout header pins for the Camera Link™ “base” configuration modes.

Table 1-1: Pixel Assignment, 8-bit x 1~3 Modes

Camera Link™ Pixel Assignment	CLB-501 Breakout Pin
A0	D0
A1	D1
A2	D2
A3	D3
A4	D4
A5	D6
A6	D27
A7	D5
B0	D7
B1	D8
B2	D9
B3	D12
B4	D13
B5	D14
B6	D10
B7	D11
C0	D15
C1	D18
C2	D19
C3	D20
C4	D21
C5	D22
C6	D16
C7	D17

Table 1-2: Pixel Assignment, 10-bit x 1~2 Modes

Camera Link™ Pixel Assignment	CLB-501 Breakout Pin
A0	D0
A1	D1
A2	D2
A3	D3
A4	D4
A5	D6
A6	D27
A7	D5
A8	D7
A9	D8
B0	D15
B1	D18
B2	D19
B3	D20
B4	D21
B5	D22
B6	D16
B7	D17
B8	D13
B9	D14

Table 1-3: Pixel Assignment, 12-bit x 1~2 Modes

Camera Link™ Pixel Assignment	CLB-501 Breakout Pin
A0	D0
A1	D1
A2	D2
A3	D3
A4	D4
A5	D6
A6	D27
A7	D5
A8	D7
A9	D8
A10	D9
A11	D12
B0	D15
B1	D18
B2	D19
B3	D20
B4	D21
B5	D22
B6	D16
B7	D17
B8	D13
B9	D14
B10	D10
B11	D11

Table 1-4: Pixel Assignment, 14-bit x 1 Mode

Camera Link™ Pixel Assignment	CLB-501 Breakout Pin
A0	D0
A1	D1
A2	D2
A3	D3
A4	D4
A5	D6
A6	D27
A7	D5
A8	D7
A9	D8
A10	D9
A11	D12
A12	D13
A13	D14

Table 1-5: Pixel Assignment, 16-bit x 1 Mode

Camera Link™ Pixel Assignment	CLB-501 Breakout Pin
A0	D0
A1	D1
A2	D2
A3	D3
A4	D4
A5	D6
A6	D27
A7	D5
A8	D7
A9	D8
A10	D9
A11	D12
A12	D13
A13	D14
A14	D10
A15	D11

Table 1-6: Pixel Assignment, 24-bit RGB Mode

Camera Link™ Pixel Assignment	CLB-501 Breakout Pin
R0	D0
R1	D1
R2	D2
R3	D3
R4	D4
R5	D6
R6	D27
R7	D5
G0	D7
G1	D8
G2	D9
G3	D12
G4	D13
G5	D14
G6	D10
G7	D11
B0	D15
B1	D18
B2	D19
B3	D20
B4	D21
B5	D22
B6	D16
B7	D17

1.4. Typical Application

A typical CLB-501 application is shown in Figure 1-2. A Camera Link™ “base” configuration camera is connected to the CLB-501 via a standard Camera Link™ cable. A second cable is then connected from the CLB-501 to a Camera Link™ frame grabber. External test equipment, signal sources, etc may then be connected via the rear panel breakout header to monitor and/or source the desired Camera Link interface signals.

To “monitor” signals the shorting blocks (shunts) are installed on the breakout header, allowing data to transfer between camera and frame grabber. The header posts are double-height, allowing connection to external equipment even when the shunts are present.

To “source” signals (i.e. serial comm, camera control, etc), the corresponding shunt is removed to isolate the desired signal(s). The external signal source is then connected on the appropriate side (“to camera” or “to frame grabber”) of the breakout header connector.

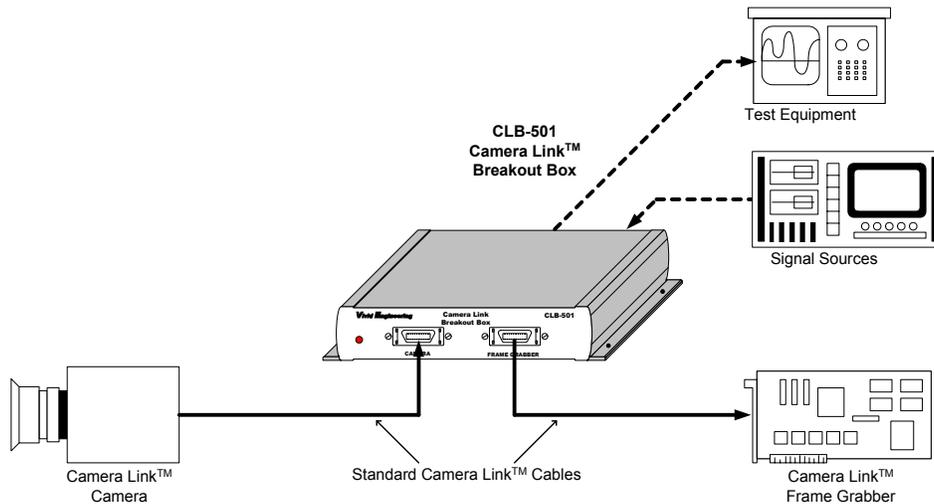


Figure 1-2: CLB-501 Application

1.5. Specifications

Table 1-7: CLB-501 Specifications

Feature	Specification
Video Interfaces	Camera Link Spec "base" configuration
Video Connectors	26-pin MDR type
Breakout Connector	70-pin dual-row 0.1" pitch header w/ removable shunts
Auxiliary Connector	4-pin dual-row 0.1" pitch header
Frequency Range	20 - 66 MHz
Chipset	National Semi. DS90CR285 / DS90CR286A
Power Supply	US/Europe Wall Transformer w/ Outlet Plug Set (included)
Power Jack	2.1 x 5.5 mm, center-positive
Power Requirements	5-7 VDC, 230 mA (typical)
Cabinet Dimensions	6.25" (L) x 1.14" (H) 4.16" (D)
Weight	11 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 CLB-501 Camera Link™ Breakout Box front panel is shown in Figure 2-1. The front panel contains two 26-pin MDR video connectors; one for connecting to the camera and one for connecting to the frame grabber. The MDR-26 connectors are 3M p/n 10226-55G3VC as specified in the Camera Link Spec. Figure 2-2 identifies the MDR-26 pin positions. The front panel also includes a power-on indicator.

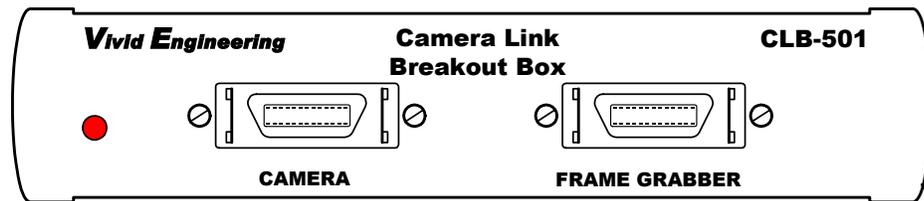


Figure 2-1: CLB-501 Front Panel

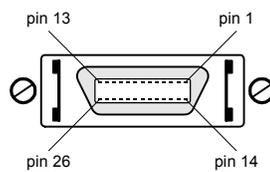


Figure 2-2: MDR-26 Connector Pin Positions

2.1.1. Video Connector Signals

The front panel MDR-26 video connector signal assignments comply with the Camera Link™ “base” configuration. 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.

Table 2-1 identifies the signal assignments for the MDR-26 video connectors.

2.1.2. Cable Shield Grounding

Camera and frame grabber cable “outer” shields are connected to the CLB-501 aluminum case. Case and endplate contacting surfaces are unpainted, providing a Faraday cage to shield internal circuitry. The case is isolated from the CLB-501 circuitry and the cable “inner” shields, avoiding possible safety concerns.

The frame grabber cable “inner” shield connects to circuit digital ground, maintaining signal reference levels between the CLB-501 and the frame grabber.

The Camera Link™ Specification recommends that a provision be incorporated into frame grabbers that enable the inner shields be tied to digital ground either directly, or through a parallel R/C network. In CLB-501, the *camera connector* represents the Camera Link™ frame grabber interface. To incorporate this flexibility, the CLB-501 ties the inner shields from the camera connector to digital ground through 0-ohm resistors. If necessary, the 0-ohm resistors may be replaced with a parallel RC network.

Table 2-1: MDR-26 Connector Assignments

Camera Link Signal Name	Camera Connector Pin # (frame grabber pinout)	Frame Grabber Connector 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

2.2. Rear Panel Connections

The CLB-501 Camera Link™ Breakout Box rear panel is shown in Figure 2-3. The rear panel contains a 70-pin dual-row breakout header, a 4-pin dual-row auxiliary header, and a DC power jack. The headers are standard 0.1” pitch w/ 0.025” gold-plated square posts. The 70-pin breakout header is double-height, enabling connection to external equipment while the shunts are installed. DC power jack accepts 5-7 volts DC. Polarity is center-positive.

The 70-pin breakout header provides access to all data transferred between camera and frame grabber for the Camera Link “base” configuration. The breakout header also incorporates the raw (unbuffered) pixel clock. A buffered version which is recommended for use as a clock reference is provided on the 4-pin auxiliary header. Removable shunts (jumpers) are factory installed on the 70-pin breakout header. All output signals are LVTTTL level and are 33-ohm series terminated at the source.

The 4-pin auxiliary header aides in interfacing to the CLB-501. Two reference ground pins are provided as well as +3.3 VDC power and an output clock signal. 3.3 VDC power is limited to 500mA by an internal resettable fuse. The output clock is a buffered version of the camera’s pixel clock. A 0-delay buffer is utilized and the signal is LVTTTL level with 33-ohm series terminated at the source. **NOTE: DO NOT INSTALL SHUNTS ON THE 4-PIN AUXILIARY HEADER.**

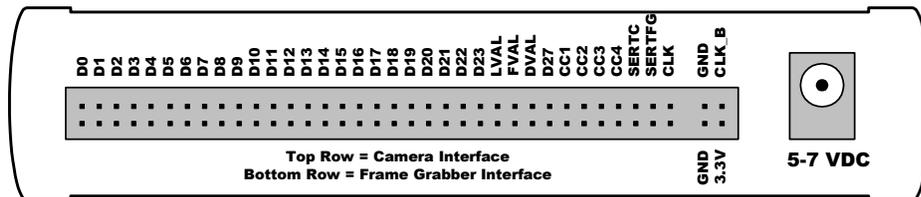


Figure 2-3: CLB-501 Rear Panel

2.2.1. Breakout Header Signals

The breakout header is organized as two 35-pin rows. The top row contains the signals to/from the camera interface, and the bottom row contains the corresponding signals to/from the frame grabber. Table 2-2 identifies the breakout header signals. The corresponding signal name per the Camera Link Specification is also provided.

Table 2-2: Breakout Header Signals

Breakout Header Pin Name	Camera Link Spec Name	Signal Type	Signal Direction
D0	TX/RX 0	Pixel Data	CAM → FG
D1	TX/RX 1	Pixel Data	CAM → FG
D2	TX/RX 2	Pixel Data	CAM → FG
D3	TX/RX 3	Pixel Data	CAM → FG
D4	TX/RX 4	Pixel Data	CAM → FG
D5	TX/RX 5	Pixel Data	CAM → FG
D6	TX/RX 6	Pixel Data	CAM → FG
D7	TX/RX 7	Pixel Data	CAM → FG
D8	TX/RX 8	Pixel Data	CAM → FG
D9	TX/RX 9	Pixel Data	CAM → FG
D10	TX/RX 10	Pixel Data	CAM → FG
D11	TX/RX 11	Pixel Data	CAM → FG
D12	TX/RX 12	Pixel Data	CAM → FG
D13	TX/RX 13	Pixel Data	CAM → FG
D14	TX/RX 14	Pixel Data	CAM → FG
D15	TX/RX 15	Pixel Data	CAM → FG
D16	TX/RX 16	Pixel Data	CAM → FG
D17	TX/RX 17	Pixel Data	CAM → FG
D18	TX/RX 18	Pixel Data	CAM → FG
D19	TX/RX 19	Pixel Data	CAM → FG
D20	TX/RX 20	Pixel Data	CAM → FG
D21	TX/RX 21	Pixel Data	CAM → FG
D22	TX/RX 22	Pixel Data	CAM → FG
D23	TX/RX 23	Spare	FG → CAM
LVAL	TX/RX 24	Line Valid	CAM → FG
FVAL	TX/RX 25	Frame Valid	CAM → FG
DVAL	TX/RX 26	Data Valid	CAM → FG

D27	TX/RX 27	Pixel Data	CAM → FG
CC1	CC1	Camera Control 1	FG → CAM
CC2	CC2	Camera Control 2	FG → CAM
CC3	CC3	Camera Control 3	FG → CAM
CC4	CC4	Camera Control 4	FG → CAM
SERTC	SERTC	Serial Comm to CAM	FG → CAM
SERTFG	SERTFG	Serial Comm to FG	CAM → FG
CLK	STROBE	Pixel Clock	CAM → FG

NOTE: - Top row breakout header pins are to/from camera.
- Bottom row breakout header pins are to/from frame grabber.
- "FG" = Frame Grabber
- "CAM" = Camera

2.2.2. Auxiliary Header Signals

The auxiliary header is organized as two 2-pin rows. The auxiliary header provides power, ground, and clock signals to aide in interfacing to the CLB-501.

Table 2-2: Breakout Header Signals

Auxiliary Header Pin Name	Characteristics
GND	Ground
GND	Ground
3.3V	+3.3 VDC Power Output (500 mA max)
CLK_B	Buffered Pixel Clock Output

3. Mechanical

3.1. Dimensions

The CLB-501 Camera Link™ Breakout Box cabinet dimensions are shown in Figure 3-1.

The CLB-501 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 for convenient equipment mounting. The mounting holes are 11/64" diameter and are suitable for #8 machine screws. A mounting hole template drawing is provided in Figure 3-2.

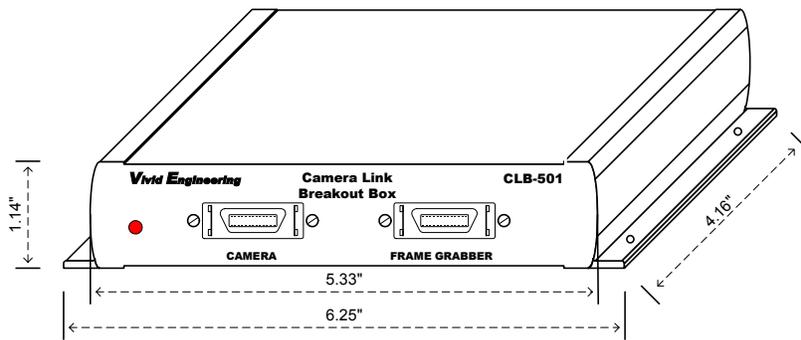


Figure 3-1: CLB-501 Cabinet Dimensions

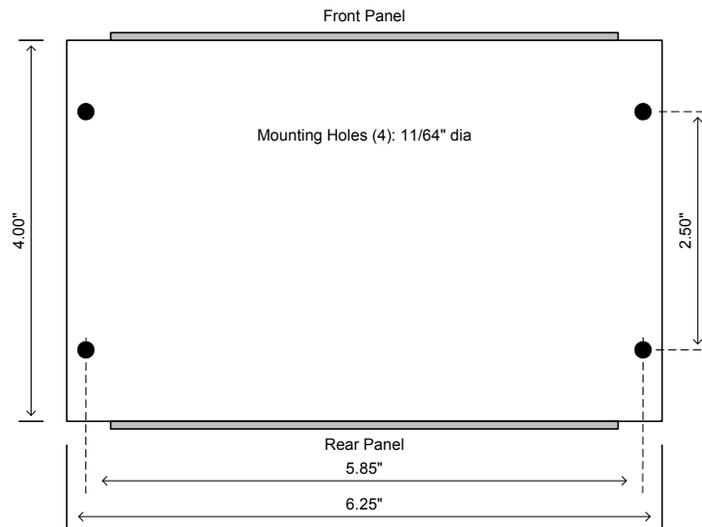


Figure 3-2: Mounting Hole Template

3.2. External Power Supply

The CLB-501 is powered by 5-7 VDC and incorporates a standard 2.1 x 5.5 mm DC power jack. Power plug polarity is center-positive.

The optional multi-nation wall-mount power supply 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 CLB-501 is protected by an internal resettable fuse.

4. Revision History

Table 5-1: CLB-501 User’s Manual Revision History

Document ID #	Date	Changes
200318-1.0	11/18/04	Initial release of manual