CLT-351R/L CAMERA LINK™ TRANSLATOR
User's Manual

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Table of Contents

1. Introduction

1.1. Overview

The CLT-351R and CLT-351L Camera Link^{TM} [1] Translators enable the use of newer Camera Link^{TM} cameras with frame grabbers incorporating traditional RS-422 and LVDS digital interfaces. The "R" and "L" versions support RS-422 and LVDS frame grabbers, respectively.

The CLT-351's incorporate an AIA standard 68-pin frame grabber interface[2] to maximize the use of standard and existing cables. The CLT-351's are extremely flexible and can translate a wide range of single-channel, dual-channel, and color "base" configuration Camera Link^{TM} cameras to AIA-standard parallel digital format using rear-panel mode switch settings.
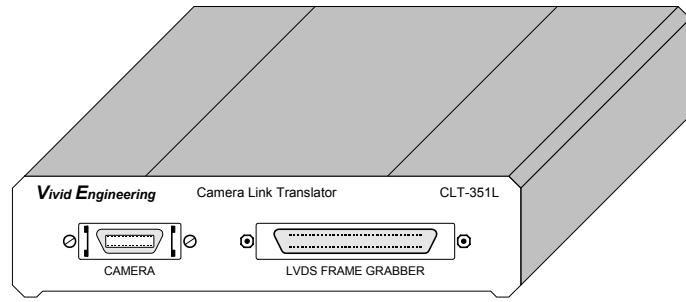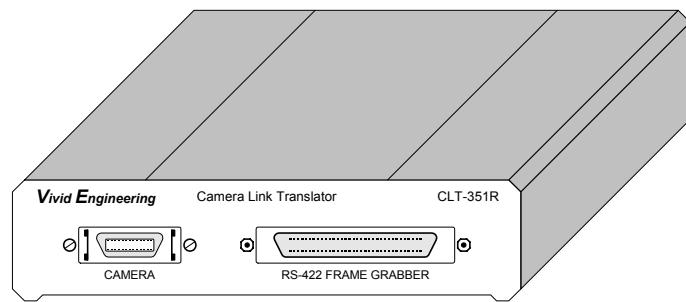
Housed in sturdy, compact aluminum enclosures, the CLT-351R/L Camera Link^{TM} Translators are well suited for industrial environments.

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

[2] Standard BSR/AIA A15.08/3-199X "Automated Vision Components - Cameras - AIA Monochrome Digital Interface Specification". Available from Automated Imaging Association P.O. Box 3724, Ann Arbor, MI 48106

Camera Link^{TM} is a trademark of the Automated Imaging Association

Vivid Engineering   Camera Link Translator   CLT-351R

CAMERA   RS-422 FRAME GRABBER

Vivid Engineering   Camera Link Translator   CLT-351L

CAMERA   LVDS FRAME GRABBER

1.2. Features

- Enable use of Camera Link^{TM} cameras with RS-422 and LVDS frame grabbers

- Interfaces to a wide range of single-channel, dual-channel, and color Camera Link^{TM} cameras

- AIA standard 68-pin frame grabber interface to maximize reuse of existing/standard cables

- "R" version supports RS-422 frame grabbers

- "L" version supports LVDS frame grabbers

- 66 MHz max pixel clock rate for "L" version

- 32 MHz max pixel clock rate for "R" version

- Rear-panel switch mode selection

- Programmable frame grabber pixel clock phase

- Selectable frame grabber timing signal polarities

- Sturdy, compact aluminum enclosure

- External power supply included

- 3-year warrantee

1.3. Functional Description

The CLT-351R/L Camera Link^{TM} Translators enable the use of Camera Link^{TM} cameras with frame grabbers incorporating traditional parallel RS-422 and LVDS digital interfaces. Block diagrams of the CLT-351R and CLT-351L are provided in Figures 1-1 and 1-2, respectively. The CLT-351R is intended for use with RS-422 frame grabbers, and the CLT-351L for use with LVDS (EIA-644) frame grabbers.

The CLT-351R/L camera interface incorporates the connector, signals, pinout, and chipset in compliance with the Camera Link^{TM} specification. The CLT-351R/L incorporates the "base" configuration signal set, consisting of video data, camera control, and serial communications.

The frame grabber interface outputs video data in parallel digital format using RS-422 or LVDS, depending on CLT351 version. The interface incorporates a 68-pin SCSI-style connector and is compatible with the AIA digital interface standard. This feature supports the use of existing AIA camera cables to connect the CLT351R/L to the frame grabber. In some cases, a low cost off-the-shelf SCSI cable can be used
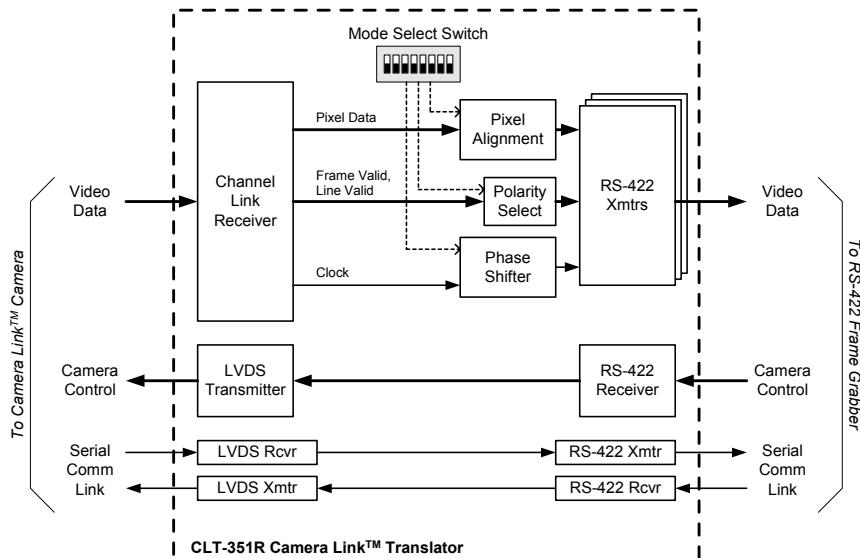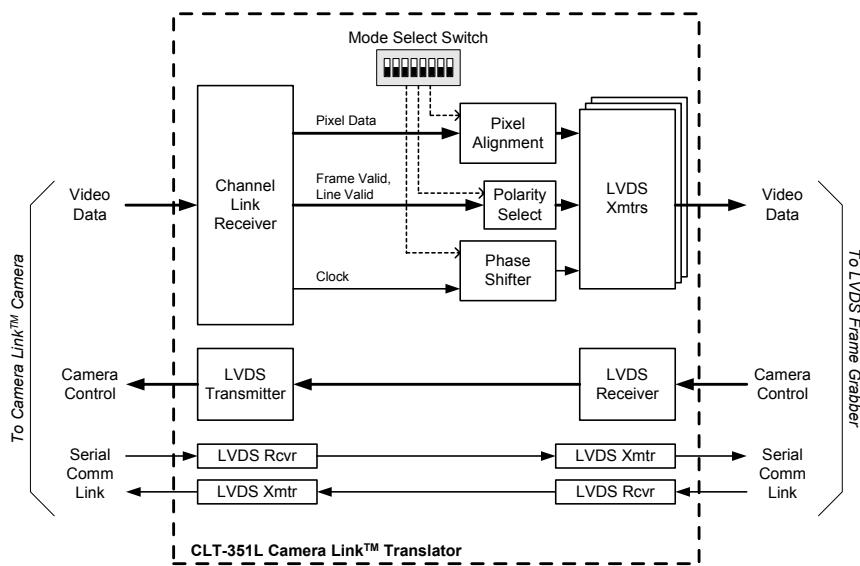

Figure 1-1: CLT-351R Block Diagram
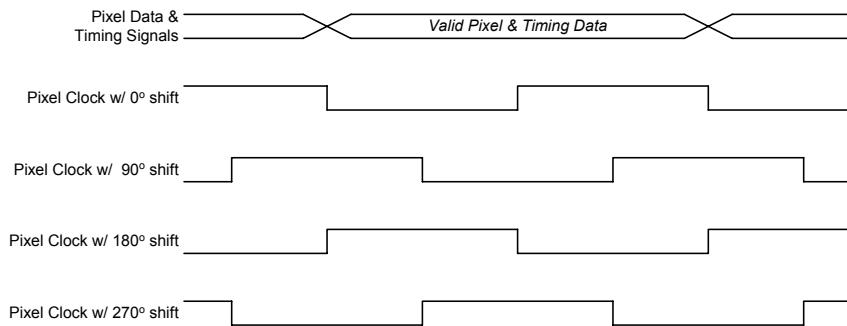
Figure 1-2: CLT-351L: Block Diagram

A mode switch on the CLT-351R/L rear-panel is used to identify camera data format. The CLT-351R/L receives Camera Link^{TM} camera data and maps the pixels into the corresponding parallel format per the 68-pin AIA digital interface standard. The CLT-351R/L supports 8/10/12/14/16-bit single-channel, 8/10/12-bit dual-channel, and 8-bit color Camera Link^{TM} "base" configuration cameras. Four mode switch positions are used to indicate camera data format. Switch settings are defined in Section 1.3.1.

Frame grabber timing signal characteristics are selected using the rear-panel mode switch. One switch position is used to select the polarity of the line valid signal, and a second switch position is used to select the polarity of the frame valid signal. In most cases, a "high" state on the line enable and frame enable signals is used to envelope valid lines and frames of video data, respectively. The settings enable the user to select either active-high or active-low polarities for each timing signal. Note that the frame enable signal is not used in line scan applications. Switch settings are defined in Section 1.3.1.

Frame grabber pixel clock characteristics are selected using the rear-panel mode switch. The CLT-351R/L incorporates a phase shifter to optimize the clock /data timing relationship for the frame grabber being used. Two switch positions are used to select pixel clock phase shift. In most cases, the 0 degree phase shift setting is used which centers the rising edge of the pixel clock within the valid pixel/timing data interval. Alternatively, clock phase shifts of 90, 180, and 270 degrees are supported. The pixel clock phase shifter characteristics are illustrated in Figure 1-3. Switch settings are defined in Section 1.3.1.

Figure 1-3: Pixel Clock Phase Options

The CLT-351R/L receives up-to four camera control signals from the frame grabber in RS-422 or LVDS, depending on CLT-351 version. The camera control signals are then

retransmitted to the Camera Link^{TM} camera using LVDS signaling. When the CLT-351R/L is operated in one of the single-channel modes (1x8, 1x10, 1x12, 1x14, 1x16), all four camera control signals are received from the frame grabber and routed to the camera. In the dual-channel (2x8, 2x10, 2x12) and color (3x8) modes, the number of camera control lines in the frame grabber's AIA interface is reduced to allow for added pixel data. In dual-channel and color modes, only one camera control signal (CC1) is supported.

The CLT-351R/L routes the serial communication signals between the camera and the frame grabber. This supports host computer access to mode control and status registers in the Camera Link^{TM} camera via the serial link built-into the AIA interface. The CLT-351R/L camera interface incorporates LVDS devices for the serial communication signals. The frame grabber interface serial signals are implemented using LVDS or RS-422 devices, depending on CLT-351 version.

The CLT-351R/L is powered by an external wall plug-in power supply (included).

1.3.1. Mode Switch Settings

The CLT-351R/L incorporates a rear-panel mode select switch. The switch allows the user to identify pixel data, timing signal, and clock characteristics. The mode switch has eight positions. The functional assignments are defined in Figure 1-4.

Clock Phase Shifter

0 0	-	0° (most common)
0 1	-	90°
1 1	-	180°
1 0	-	270°

Frame Valid Polarity

0	-	active-high (most common)
1	-	active-low

Line Valid Polarity

0	-	active-high (most common)
1	-	active-low

Pixel Data Format

0 0 0 0	-	8-bit, single-channel
0 0 0 1	-	10-bit, single-channel
0 0 1 0	-	12-bit, single-channel
0 0 1 1	-	14-bit, single-channel
0 1 0 0	-	16-bit, single-channel
1 0 0 0	-	8-bit, dual-channel
1 0 0 1	-	10-bit, dual-channel
1 1 0 1	-	12-bit, dual-channel
1 1 0 1	-	8-bit, color (8x3)

*0 = "down" switch position*
1 = "up" switch position

Figure 1-4: CLT-351R/L Mode Switch Definition

1.4.   Typical Application

A typical CLT-351R/L application is shown in Figure 1-5. A Camera Link^{TM} camera is connected to the CLT-351R using a standard Camera Link^{TM} cable. The CLT-351R is then connected to the frame grabber using an existing camera cable incorporating the AIA-standard 68-pin connector.

Note: If the frame grabber incorporates the AIA interface and supports the serial link, a standard low-cost SCSI cable may be used between the camera and the CLT-351R

The Camera Link^{TM} "base" configuration camera in this example is, 8-bit, dual-channel, area-scan with a 20MHz pixel clock.

The RS-422 frame grabber is programmed for area-scan, dual-channel, 8-bit mode. The frame enable and line enable timing signals are conventional active-high, and data is sampled using the rising clock edge. The pixel clock rate is set at 20MHz and video timing is set to match camera characteristics.

Camera control signal CC1 is routed from the frame grabber, through the CLT-351R, to the camera for use as an EXSYNC pulse, exposure control, etc. If a serial port is built-into the frame grabber, it may be used to control and monitor camera functions. In some cases, the camera cable between the frame grabber and the CLT-351R may break-out the serial signals for connection to a separate serial communications port in the PC.

CLT-351R
Camera Link^{TM} Translator

Vivid Engineering   Camera Link Translator   CLT-351R

CAMERA   RS-422 FRAME GRABBER

Camera Link^{TM}
Camera

Camera Link^{TM} Cable

Existing Camera Cable
or
Standard SCSI Cable

RS-422
Frame Grabber
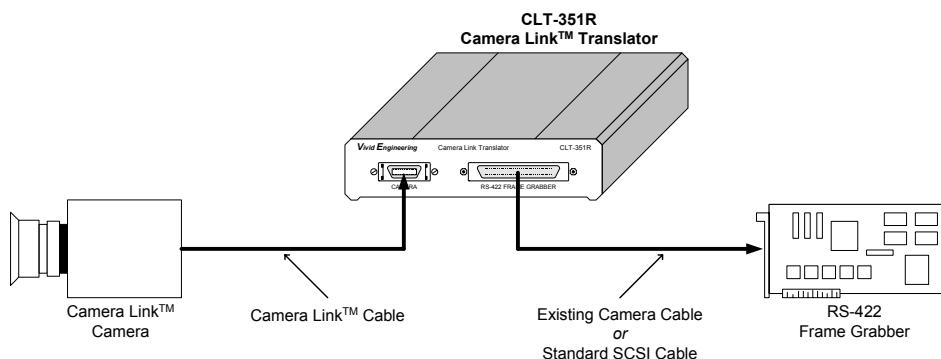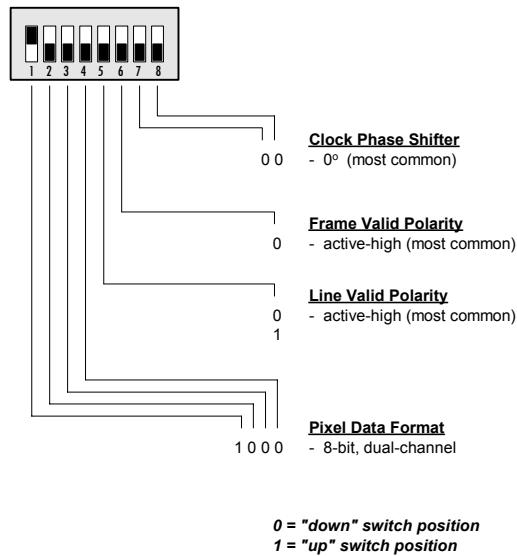
Figure 1-5: CLT-351R/L Typical Application

Clock Phase Shifter
0 0   - 0° (most common)

Frame Valid Polarity
0   - active-high (most common)

Line Valid Polarity
0   - active-high (most common)
1

Pixel Data Format
1 0 0 0   - 8-bit, dual-channel

0 = "down" switch position
1 = "up" switch position

Figure 1-6: Example Mode Settings

1.5. Specifications

Table 1-1: CLT-351R/L Specifications

Feature	Specification
Camera Interface	Camera Link™ Spec "base" configuration
Camera Connector	26-pin MDR type
Frame Grabber Interface	AIA digital interface standard - "R" version = RS-422 - "L" version = LVDS (EIA-644)
Frame Grabber Connector	68-pin HD type (SCSI-3)
Frequency Range	20 - 66 MHz ("L" version) 20 - 32 MHz ("R" version)
Mode Selection	Rear-panel 8-position DIP switch
Chipset	National Semi. DS90CR286A
Power Supply	External 6 VDC Wall Transformer
Power Jack	2.1 x 5.5 mm, center-positive
Power Requirements	- "R" version = 1100 mA at 6 VDC (typical) - "L" version = 400 mA at 6 VDC (typical)
Cabinet Dimensions	5.28" (L) x 1.12" (H) x 6.13" (D)
Weight	14 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

A CLT-351R/L Camera Link^{TM} Translator front panel is shown in Figure 2-1 (CLT-351R shown). The front panel contains two video connectors; one for connecting to the camera and one for connecting to the frame grabber.

The camera connector is a 26-pin MDR type (MDR-26), 3M p/n 10226-55G3PC as specified in the Camera Link^{TM} Spec. Figure 2-2 identifies the MDR-26 pin positions.

The frame grabber connector is a 68-pin SCSI-3 type (HD68), Tyco p/n 5787170-7. Figure 2-3 identifies the HD68 pin positions.
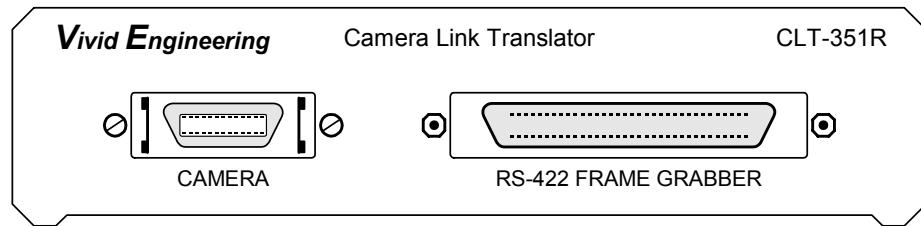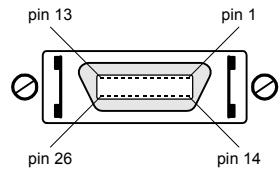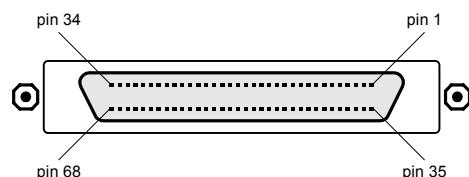

Figure 2-1: CLT-351R Front Panel

Figure 2-2: MDR-26 Connector Pin Positions

Figure 2-3: HD68 Connector Pin Positions

2.1.1. Camera Connector Signals

The MDR-26 camera connector signal assignment is compliant with the Camera Link^{TM} Specification for the "base" configuration.

Table 2-1 identifies the signal assignment for the MDR-26 camera connector.

Note that the connector pin assignments are as defined for the <u>frame grabber interface</u> in the Camera Link^{TM} Specification. This provides compatibility with standard Camera Link^{TM} cables

2.1.2. Frame Grabber Connector Signals

The HD68 frame grabber connector signal assignments are compatible with the AIA digital interface standard. The signal assignment is determined by the pixel data format, indicated with the mode switch.

Tables 2-2 through 2-6 identify the HD68 frame grabber connector signal assignment for single-channel pixel data modes (1x8, 1x10, 1x12, 1x14, and 1x16). Tables 2-7 through 2-9 identify the signal assignment for dual-channel modes (2x8, 2x10, 2x12), and Table 2-10 identifies the signal assignment for color mode (3x8).

Note that in the single channel modes, the CLT-351R/L receives four camera control signals from the frame grabber (CC1, CC2, CC3, CC4) and retransmits the signals to the camera. In the dual-channel and color modes, the CLT-351R/L only receives and retransmits CC1.

2.1.3. Cable Shield Grounding

Camera <u>and</u> frame grabber cable "outer" shields are connected to the CLT-351R/L aluminum case. Case and endplate contacting surfaces are unpainted, providing a Faraday cage to shield internal circuitry. The case is isolated from the CLT-351R/L 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 CLT-351R/L and the frame grabber.

The Camera Link^{TM} 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 the CLT-351R/L, the *camera connector* represents the Camera Link^{TM} frame grabber interface. To incorporate this flexibility, the CLT-351R/L 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: Camera Connector

Camera Link™ Signal Name	Camera Connector Pin # (frame grabber pinout)	Signal Direction	Notes
Inner shield	1	N/A	*tied to digital ground[1]*
Inner shield	14	N/A	*tied to digital ground[1]*
X0-	25	CAM → CLT351	
X0+	12	CAM → CLT351	
X1-	24	CAM → CLT351	
X1+	11	CAM → CLT351	
X2-	23	CAM → CLT351	
X2+	10	CAM → CLT351	
Xclk-	22	CAM → CLT351	
Xclk+	9	CAM → CLT351	
X3-	21	CAM → CLT351	
X3+	8	CAM → CLT351	
SerTC+	20	CLT351 → CAM	*serial comm, FG to cam*
SerTC-	7	CLT351 → CAM	"
SerTFG-	19	CAM → CLT351	*serial comm, cam to FG*
SerTFG+	6	CAM → CLT351	"
CC1-	18	CLT351 → CAM	
CC1+	5	CLT351 → CAM	
CC2+	17	CLT351 → CAM	*single-channel modes only*
CC2-	4	CLT351 → CAM	"
CC3-	16	CLT351 → CAM	*single-channel modes only*
CC3+	3	CLT351 → CAM	"
CC4+	15	CLT351 → CAM	*single-channel modes only*
CC4-	2	CLT351 → CAM	"
Inner shield	13	N/A	*tied to digital ground[1]*
Inner shield	26	N/A	*tied to digital ground[1]*

"FG" = Frame Grabber
[1] See Section 2.1.3

Table 2-2: Frame Grabber Connector, 8-bit Single-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A7 +[1]	2	CLT351 → FG	
A7 -[1]	36	CLT351 → FG	
A6 +	3	CLT351 → FG	
A6 -	37	CLT351 → FG	
A5 +	4	CLT351 → FG	
A5 -	38	CLT351 → FG	
A4 +	5	CLT351 → FG	
A4 -	39	CLT351 → FG	
A3 +	6	CLT351 → FG	
A3 -	40	CLT351 → FG	
A2 +	7	CLT351 → FG	
A2 -	41	CLT351 → FG	
A1 +	8	CLT351 → FG	
A1 -	42	CLT351 → FG	
A0 +	9	CLT351 → FG	
A0 -	43	CLT351 → FG	
Unused Output	10	CLT351 → FG	
Unused Output	44	CLT351 → FG	
Unused Output	11	CLT351 → FG	
Unused Output	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
Unused Output	13	CLT351 → FG	
Unused Output	47	CLT351 → FG	
Unused Output	14	CLT351 → FG	
Unused Output	48	CLT351 → FG	
Unused Output	15	CLT351 → FG	
Unused Output	49	CLT351 → FG	
Unused Output	16	CLT351 → FG	

Unused Output	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
Unused Output	18	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	52	CLT351 → FG	*"*
Unused Output	19	CLT351 → FG	
Unused Output	53	CLT351 → FG	
Unused Output	20	CLT351 → FG	
Unused Output	54	CLT351 → FG	
Unused Output	21	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	55	CLT351 → FG	*"*
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	*"*
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	*"*
Unused Output	24	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	58	CLT351 → FG	*"*
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	*"*
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	*"*
Unused Output	27	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	61	CLT351 → FG	*"*
Unused Output	28	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	62	CLT351 → FG	*"*
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	*"*
Mode Control 0 +	30	FG → CLT351	*CC1 from FG*
Mode Control 0 -	64	FG → CLT351	*"*
Mode Control 1 +	31	FG → CLT351	*CC2 from FG*
Mode Control 1 -	65	FG → CLT351	*"*
Mode Control 2 +	32	FG → CLT351	*CC3 from FG*
Mode Control 2 -	66	FG → CLT351	*"*
Mode Control 3 +	33	FG → CLT351	*CC4 from FG*
Mode Control 3 -	67	FG → CLT351	*"*
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*

[1] Pixel Data MSB
"FG" = Frame Grabber

Table 2-3: Frame Grabber Connector, 10-bit Single-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A9 +[1]	2	CLT351 → FG	
A9 -[1]	36	CLT351 → FG	
A8 +	3	CLT351 → FG	
A8 -	37	CLT351 → FG	
A7 +	4	CLT351 → FG	
A7 -	38	CLT351 → FG	
A6 +	5	CLT351 → FG	
A6 -	39	CLT351 → FG	
A5 +	6	CLT351 → FG	
A5 -	40	CLT351 → FG	
A4 +	7	CLT351 → FG	
A4 -	41	CLT351 → FG	
A3 +	8	CLT351 → FG	
A3 -	42	CLT351 → FG	
A2 +	9	CLT351 → FG	
A2 -	43	CLT351 → FG	
A1 +	10	CLT351 → FG	
A1 -	44	CLT351 → FG	
A0 +	11	CLT351 → FG	
A0 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
Unused Output	13	CLT351 → FG	
Unused Output	47	CLT351 → FG	
Unused Output	14	CLT351 → FG	
Unused Output	48	CLT351 → FG	
Unused Output	15	CLT351 → FG	
Unused Output	49	CLT351 → FG	
Unused Output	16	CLT351 → FG	

Unused Output	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
Unused Output	18	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	52	CLT351 → FG	*"*
Unused Output	19	CLT351 → FG	
Unused Output	53	CLT351 → FG	
Unused Output	20	CLT351 → FG	
Unused Output	54	CLT351 → FG	
Unused Output	21	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	55	CLT351 → FG	*"*
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	*"*
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	*"*
Unused Output	24	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	58	CLT351 → FG	*"*
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	*"*
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	*"*
Unused Output	27	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	61	CLT351 → FG	*"*
Unused Output	28	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	62	CLT351 → FG	*"*
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	*"*
Mode Control 0 +	30	FG → CLT351	*CC1 from FG*
Mode Control 0 -	64	FG → CLT351	*"*
Mode Control 1 +	31	FG → CLT351	*CC2 from FG*
Mode Control 1 -	65	FG → CLT351	*"*
Mode Control 2 +	32	FG → CLT351	*CC3 from FG*
Mode Control 2 -	66	FG → CLT351	*"*
Mode Control 3 +	33	FG → CLT351	*CC4 from FG*
Mode Control 3 -	67	FG → CLT351	*"*
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*

[1] Pixel Data MSB
"FG" = Frame Grabber

Table 2-4: Frame Grabber Connector, 12-bit Single-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A11 +[1]	2	CLT351 → FG	
A11 -[1]	36	CLT351 → FG	
A10 +	3	CLT351 → FG	
A10 -	37	CLT351 → FG	
A9 +	4	CLT351 → FG	
A9 -	38	CLT351 → FG	
A8 +	5	CLT351 → FG	
A8 -	39	CLT351 → FG	
A7 +	6	CLT351 → FG	
A7 -	40	CLT351 → FG	
A6 +	7	CLT351 → FG	
A6 -	41	CLT351 → FG	
A5 +	8	CLT351 → FG	
A5 -	42	CLT351 → FG	
A4 +	9	CLT351 → FG	
A4 -	43	CLT351 → FG	
A3 +	10	CLT351 → FG	
A3 -	44	CLT351 → FG	
A2 +	11	CLT351 → FG	
A2 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
A1 +	13	CLT351 → FG	
A1 -	47	CLT351 → FG	
A0 +	14	CLT351 → FG	
A0 -	48	CLT351 → FG	
Unused Output	15	CLT351 → FG	
Unused Output	49	CLT351 → FG	
Unused Output	16	CLT351 → FG	

Unused Output	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
Unused Output	18	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	52	CLT351 → FG	"
Unused Output	19	CLT351 → FG	
Unused Output	53	CLT351 → FG	
Unused Output	20	CLT351 → FG	
Unused Output	54	CLT351 → FG	
Unused Output	21	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	55	CLT351 → FG	"
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	"
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	"
Unused Output	24	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	58	CLT351 → FG	"
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	"
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	"
Unused Output	27	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	61	CLT351 → FG	"
Unused Output	28	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	62	CLT351 → FG	"
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	"
Mode Control 0 +	30	FG → CLT351	*CC1 from FG*
Mode Control 0 -	64	FG → CLT351	"
Mode Control 1 +	31	FG → CLT351	*CC2 from FG*
Mode Control 1 -	65	FG → CLT351	"
Mode Control 2 +	32	FG → CLT351	*CC3 from FG*
Mode Control 2 -	66	FG → CLT351	"
Mode Control 3 +	33	FG → CLT351	*CC4 from FG*
Mode Control 3 -	67	FG → CLT351	"
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*

[1] Pixel Data MSB
"FG" = Frame Grabber

Table 2-5: Frame Grabber Connector, 14-bit Single-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A13 +[1]	2	CLT351 → FG	
A13 -[1]	36	CLT351 → FG	
A12 +	3	CLT351 → FG	
A12 -	37	CLT351 → FG	
A11 +	4	CLT351 → FG	
A11 -	38	CLT351 → FG	
A10 +	5	CLT351 → FG	
A10 -	39	CLT351 → FG	
A9 +	6	CLT351 → FG	
A9 -	40	CLT351 → FG	
A8 +	7	CLT351 → FG	
A8 -	41	CLT351 → FG	
A7 +	8	CLT351 → FG	
A7 -	42	CLT351 → FG	
A6 +	9	CLT351 → FG	
A6 -	43	CLT351 → FG	
A5 +	10	CLT351 → FG	
A5 -	44	CLT351 → FG	
A4 +	11	CLT351 → FG	
A4 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
A3 +	13	CLT351 → FG	
A3 -	47	CLT351 → FG	
A2 +	14	CLT351 → FG	
A2 -	48	CLT351 → FG	
A1 +	15	CLT351 → FG	
A1 -	49	CLT351 → FG	
A0 +	16	CLT351 → FG	

A0 -	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
Unused Output	18	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	52	CLT351 → FG	*"*
Unused Output	19	CLT351 → FG	
Unused Output	53	CLT351 → FG	
Unused Output	20	CLT351 → FG	
Unused Output	54	CLT351 → FG	
Unused Output	21	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	55	CLT351 → FG	*"*
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	*"*
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	*"*
Unused Output	24	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	58	CLT351 → FG	*"*
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	*"*
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	*"*
Unused Output	27	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	61	CLT351 → FG	*"*
Unused Output	28	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	62	CLT351 → FG	*"*
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	*"*
Mode Control 0 +	30	FG → CLT351	*CC1 from FG*
Mode Control 0 -	64	FG → CLT351	*"*
Mode Control 1 +	31	FG → CLT351	*CC2 from FG*
Mode Control 1 -	65	FG → CLT351	*"*
Mode Control 2 +	32	FG → CLT351	*CC3 from FG*
Mode Control 2 -	66	FG → CLT351	*"*
Mode Control 3 +	33	FG → CLT351	*CC4 from FG*
Mode Control 3 -	67	FG → CLT351	*"*
Ground	34	N/A	*tied to digital ground*

| Ground | 68 | N/A | *tied to digital ground* |

[1] Pixel Data MSB
"FG" = Frame Grabber

Table 2-6: Frame Grabber Connector, 16-bit Single-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A15 +[1]	2	CLT351 → FG	
A15 -[1]	36	CLT351 → FG	
A14 +	3	CLT351 → FG	
A14 -	37	CLT351 → FG	
A13 +	4	CLT351 → FG	
A13 -	38	CLT351 → FG	
A12 +	5	CLT351 → FG	
A12 -	39	CLT351 → FG	
A11 +	6	CLT351 → FG	
A11 -	40	CLT351 → FG	
A10 +	7	CLT351 → FG	
A10 -	41	CLT351 → FG	
A69 +	8	CLT351 → FG	
A9 -	42	CLT351 → FG	
A8 +	9	CLT351 → FG	
A8 -	43	CLT351 → FG	
A7 +	10	CLT351 → FG	
A7 -	44	CLT351 → FG	
A6 +	11	CLT351 → FG	
A6 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
A5 +	13	CLT351 → FG	
A5 -	47	CLT351 → FG	
A4 +	14	CLT351 → FG	
A4 -	48	CLT351 → FG	
A3 +	15	CLT351 → FG	
A3 -	49	CLT351 → FG	
A2 +	16	CLT351 → FG	

A2 -	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
Unused Output	18	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	52	CLT351 → FG	*"*
A1 +	19	CLT351 → FG	
A1 -	53	CLT351 → FG	
A0 +	20	CLT351 → FG	
A0 -	54	CLT351 → FG	
Unused Output	21	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	55	CLT351 → FG	*"*
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	*"*
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	*"*
Unused Output	24	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	58	CLT351 → FG	*"*
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	*"*
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	*"*
Unused Output	27	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	61	CLT351 → FG	*"*
Unused Output	28	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	62	CLT351 → FG	*"*
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	*"*
Mode Control 0 +	30	FG → CLT351	*CC1 from FG*
Mode Control 0 -	64	FG → CLT351	*"*
Mode Control 1 +	31	FG → CLT351	*CC2 from FG*
Mode Control 1 -	65	FG → CLT351	*"*
Mode Control 2 +	32	FG → CLT351	*CC3 from FG*
Mode Control 2 -	66	FG → CLT351	*"*
Mode Control 3 +	33	FG → CLT351	*CC4 from FG*
Mode Control 3 -	67	FG → CLT351	*"*
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*

[1] Pixel Data MSB
"FG" = Frame Grabber

Table 2-7: Frame Grabber Connector, 8-bit Dual-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A7 +[1]	2	CLT351 → FG	
A7 -[1]	36	CLT351 → FG	
A6 +	3	CLT351 → FG	
A6 -	37	CLT351 → FG	
A5 +	4	CLT351 → FG	
A5 -	38	CLT351 → FG	
A4 +	5	CLT351 → FG	
A4 -	39	CLT351 → FG	
A3 +	6	CLT351 → FG	
A3 -	40	CLT351 → FG	
A2 +	7	CLT351 → FG	
A2 -	41	CLT351 → FG	
A1 +	8	CLT351 → FG	
A1 -	42	CLT351 → FG	
A0 +	9	CLT351 → FG	
A0 -	43	CLT351 → FG	
B7 +[2]	10	CLT351 → FG	
B7 -[2]	44	CLT351 → FG	
B6 +	11	CLT351 → FG	
B6 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
B5 +	13	CLT351 → FG	
B5 -	47	CLT351 → FG	
B4 +	14	CLT351 → FG	
B4 -	48	CLT351 → FG	
B3 +	15	CLT351 → FG	
B3 -	49	CLT351 → FG	
B2 +	16	CLT351 → FG	

B2 -	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
Unused Output	18	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	52	CLT351 → FG	*"*
B1 +	19	CLT351 → FG	
B1 -	53	CLT351 → FG	
B0 +	20	CLT351 → FG	
B0 -	54	CLT351 → FG	
Unused Output	21	CLT351 → FG	
Unused Output	55	CLT351 → FG	
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	*"*
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	*"*
Unused Output	24	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	58	CLT351 → FG	*"*
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	*"*
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	*"*
Unused Output	27	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	61	CLT351 → FG	*"*
Unused Output	28	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	62	CLT351 → FG	*"*
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	*"*
Expose +	30	FG → CLT351	*CC1 from FG*
Expose -	64	FG → CLT351	*"*
Unused Output	31	CLT351 → FG	
Unused Output	65	CLT351 → FG	
Unused Output	32	CLT351 → FG	
Unused Output	66	CLT351 → FG	
Unused Output	33	CLT351 → FG	
Unused Output	67	CLT351 → FG	
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*

[1] Pixel "A" MSB
[2] Pixel "B" MSB
"FG" = Frame Grabber

Table 2-8: Frame Grabber Connector, 10-bit Dual-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A9 +[1]	2	CLT351 → FG	
A9 -[1]	36	CLT351 → FG	
A8 +	3	CLT351 → FG	
A8 -	37	CLT351 → FG	
A7 +	4	CLT351 → FG	
A7 -	38	CLT351 → FG	
A6 +	5	CLT351 → FG	
A6 -	39	CLT351 → FG	
A5 +	6	CLT351 → FG	
A5 -	40	CLT351 → FG	
A4 +	7	CLT351 → FG	
A4 -	41	CLT351 → FG	
A3 +	8	CLT351 → FG	
A3 -	42	CLT351 → FG	
A2 +	9	CLT351 → FG	
A2 -	43	CLT351 → FG	
B9 +[2]	10	CLT351 → FG	
B9 -[2]	44	CLT351 → FG	
B8 +	11	CLT351 → FG	
B8 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
B7 +	13	CLT351 → FG	
B7 -	47	CLT351 → FG	
B6 +	14	CLT351 → FG	
B6 -	48	CLT351 → FG	
B5 +	15	CLT351 → FG	
B5 -	49	CLT351 → FG	
B4 +	16	CLT351 → FG	

B4 -	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
Unused Output	18	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	52	CLT351 → FG	*"*
B3 +	19	CLT351 → FG	
B3 -	53	CLT351 → FG	
B2 +	20	CLT351 → FG	
B2 -	54	CLT351 → FG	
A1 +	21	CLT351 → FG	
A1 -	55	CLT351 → FG	
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	*"*
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	*"*
Unused Output	24	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	58	CLT351 → FG	*"*
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	*"*
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	*"*
Unused Output	27	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	61	CLT351 → FG	*"*
Unused Output	28	CLT351 → FG	*CLT351 outputs logic "0"*
Unused Output	62	CLT351 → FG	*"*
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	*"*
Expose +	30	FG → CLT351	*CC1 from FG*
Expose -	64	FG → CLT351	*"*
A0 +	31	CLT351 → FG	
A0 -	65	CLT351 → FG	
B1 +	32	CLT351 → FG	
B1 -	66	CLT351 → FG	
B0 +	33	CLT351 → FG	
B0 -	67	CLT351 → FG	
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*

[1] Pixel "A" MSB
[2] Pixel "B" MSB
"FG" = Frame Grabber

Table 2-9: Frame Grabber Connector, 12-bit Dual-Channel Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
A7 +	2	CLT351 → FG	
A7 -	36	CLT351 → FG	
A6 +	3	CLT351 → FG	
A6 -	37	CLT351 → FG	
A5 +	4	CLT351 → FG	
A5 -	38	CLT351 → FG	
A4 +	5	CLT351 → FG	
A4 -	39	CLT351 → FG	
A3 +	6	CLT351 → FG	
A3 -	40	CLT351 → FG	
A2 +	7	CLT351 → FG	
A2 -	41	CLT351 → FG	
A1 +	8	CLT351 → FG	
A1 -	42	CLT351 → FG	
A0 +	9	CLT351 → FG	
A0 -	43	CLT351 → FG	
B11 +[2]	10	CLT351 → FG	
B11 -[2]	44	CLT351 → FG	
B10 +	11	CLT351 → FG	
B10 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
B9 +	13	CLT351 → FG	
B9 -	47	CLT351 → FG	
B8 +	14	CLT351 → FG	
B8 -	48	CLT351 → FG	
A11 +[1]	15	CLT351 → FG	
A11 -[1]	49	CLT351 → FG	
A10 +	16	CLT351 → FG	

A10 -	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
B3 +	18	CLT351 → FG	*CLT351 outputs logic "0"*
B3 -	52	CLT351 → FG	*"*
A9 +	19	CLT351 → FG	
A9 -	53	CLT351 → FG	
A8 +	20	CLT351 → FG	
A8 -	54	CLT351 → FG	
B7 +	21	CLT351 → FG	
B7 -	55	CLT351 → FG	
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	*"*
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	*"*
B2 +	24	CLT351 → FG	*CLT351 outputs logic "0"*
B2 -	58	CLT351 → FG	*"*
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	*"*
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	*"*
B1 +	27	CLT351 → FG	*CLT351 outputs logic "0"*
B1 -	61	CLT351 → FG	*"*
B0 +	28	CLT351 → FG	*CLT351 outputs logic "0"*
B0 -	62	CLT351 → FG	*"*
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	*"*
Expose +	30	FG → CLT351	*CC1 from FG*
Expose -	64	FG → CLT351	*"*
B6 +	31	CLT351 → FG	
B6 -	65	CLT351 → FG	
B5 +	32	CLT351 → FG	
B5 -	66	CLT351 → FG	
B4 +	33	CLT351 → FG	
B4 -	67	CLT351 → FG	
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*

[1] Pixel "A" MSB
[2] Pixel "B" MSB
"FG" = Frame Grabber

Table 2-10: Frame Grabber Connector, Color Mode

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
Ground	1	N/A	*tied to digital ground*
Ground	35	N/A	*tied to digital ground*
R7 +[1]	2	CLT351 → FG	
R7 -[1]	36	CLT351 → FG	
R6 +	3	CLT351 → FG	
R6 -	37	CLT351 → FG	
R5 +	4	CLT351 → FG	
R5 -	38	CLT351 → FG	
R4 +	5	CLT351 → FG	
R4 -	39	CLT351 → FG	
R3 +	6	CLT351 → FG	
R3 -	40	CLT351 → FG	
R2 +	7	CLT351 → FG	
R2 -	41	CLT351 → FG	
R1 +	8	CLT351 → FG	
R1 -	42	CLT351 → FG	
R0 +	9	CLT351 → FG	
R0 -	43	CLT351 → FG	
G7 +[2]	10	CLT351 → FG	
G7 -[2]	44	CLT351 → FG	
G6 +	11	CLT351 → FG	
G6 -	45	CLT351 → FG	
Ground	12	N/A	*tied to digital ground*
Ground	46	N/A	*tied to digital ground*
G5 +	13	CLT351 → FG	
G5 -	47	CLT351 → FG	
G4 +	14	CLT351 → FG	
G4 -	48	CLT351 → FG	
G3 +	15	CLT351 → FG	
G3 -	49	CLT351 → FG	
G2 +	16	CLT351 → FG	

G2 -	50	CLT351 → FG	
Not Used	17	N/A	
Not Used	51	N/A	
B3 +	18	CLT351 → FG	
B3 -	52	CLT351 → FG	
G1 +	19	CLT351 → FG	
G1 -	53	CLT351 → FG	
G0 +	20	CLT351 → FG	
G0 -	54	CLT351 → FG	
B7 +[3]	21	CLT351 → FG	
B7 -[3]	55	CLT351 → FG	
Serial Control Out +	22	CLT351 → FG	*serial comm, cam to FG*
Serial Control Out -	56	CLT351 → FG	"
Serial Control In +	23	FG → CLT351	*serial comm, FG to cam*
Serial Control In -	57	FG → CLT351	"
B2 +	24	CLT351 → FG	
B2 -	58	CLT351 → FG	
Frame Enable +	25	CLT351 → FG	*"frame valid"*
Frame Enable -	59	CLT351 → FG	"
Line Enable +	26	CLT351 → FG	*"line valid"*
Line Enable -	60	CLT351 → FG	"
B1 +	27	CLT351 → FG	
B1 -	61	CLT351 → FG	
B0 +	28	CLT351 → FG	
B0 -	62	CLT351 → FG	
Pixel Strobe +	29	CLT351 → FG	*"pixel clock"*
Pixel Strobe -	63	CLT351 → FG	"
Expose +	30	FG → CLT351	*CC1 from FG*
Expose -	64	FG → CLT351	"
B6 +	31	CLT351 → FG	
B6 -	65	CLT351 → FG	
B5 +	32	CLT351 → FG	
B5 -	66	CLT351 → FG	
B4 +	33	CLT351 → FG	
B4 -	67	CLT351 → FG	
Ground	34	N/A	*tied to digital ground*

Ground	68	N/A	*tied to digital ground*
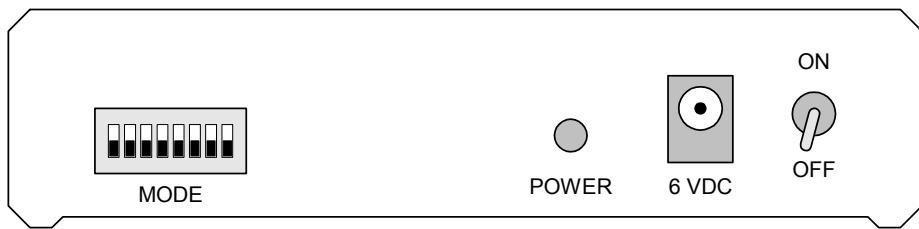
[1] Pixel "R" MSB (red)
[2] Pixel "G" MSB (green)
[3] Pixel "B" MSB (blue)
"FG" = Frame Grabber

2.2.   Rear Panel

The CLT-351R/L Camera Link^{TM} Translator rear panel is shown in Figure 2-4. The rear panel contains an 8-position mode select DIP switch, power on indicator, on-off switch, and DC power jack. Mode select switch settings are defined in Section 1.3.1. The DC power jack accepts 6 volts DC, center-positive.


Figure 2-4: CLT-351R/L Rear Panel

3. Mechanical

3.1. Dimensions

The CLT-351R/L Camera Link^{TM} Translator cabinet dimensions are shown in Figure 3-1 (CLT-351R shown). Note that the dimensions are for the cabinet only. Connectors, switch, hardware, etc are not included in the measurements.

The CLT-351R/L is housed in a sturdy aluminum enclosure. The body is extruded aluminum, with detachable front and rear endplates.
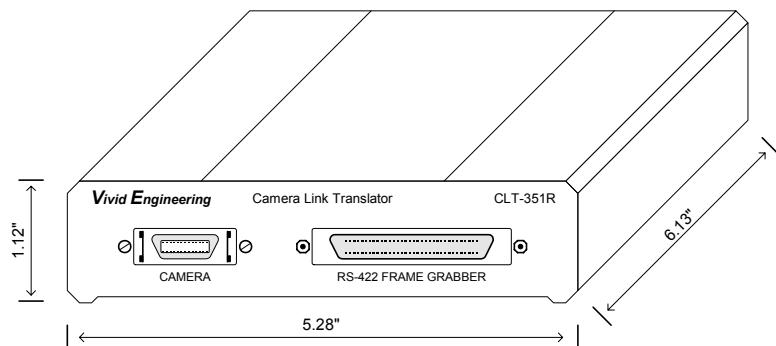

Figure 3-1: CLT-351R/L Cabinet Dimensions

3.2. External Power Supply

The CLT-351R/L is powered by an external wall-mount 6 VDC power supply (included). The power supply incorporates a standard 2.1 x 5.5 mm DC power plug. Power plug polarity is center-positive. The power supply is UL and CSA listed.

An EMI filter is located on the power cord near the DC power plug. The filter suppresses EMI emissions, ensuring regulatory limits are not exceeded. **Do not remove the EMI filter.**

The CLT-351R/L is protected by an internal resettable fuse.

4. Regulatory Compliance

4.1. FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

4.2. Canadian Compliance Statement

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

5. Revision History

Table 5-1: CLT-351R/L User's Manual Revision History

Document ID #	Date	Changes
200162-1.0	5/29/03	Initial release of manual
200162-1.1	8/10/10	Clarifies connector pin assignments