

CLT-302R & CLT-302L CAMERA LINK  
TRANSLATOR

**User's Manual**

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# 1. Introduction

## 1.1. Overview

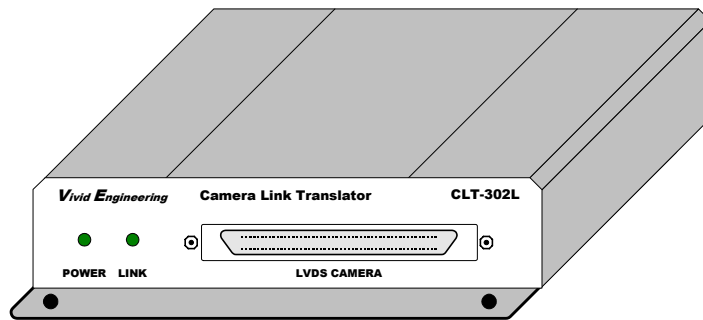
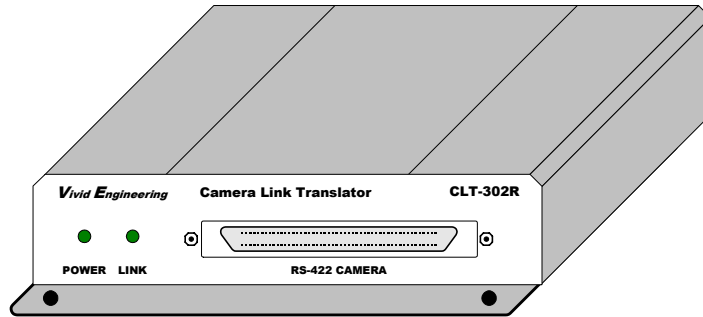
The CLT-302R and CLT-302L Camera Link<sup>1</sup> Translators enable the use of traditional RS-422 and LVDS digital cameras with Camera Link frame grabbers. The “R” and “L” versions support parallel RS-422 and LVDS digital camera data, respectively. The CLT-302’s are extremely flexible and can convert a wide range of cameras from parallel digital output to Camera Link base configuration with up-to 24-bit data.

Cameras with pixel clock rates as low as 2.5 MHz and as high as 85 MHz are supported. Features include RS-232 communication support, a camera signal detect indicator, and isolated DC power input.

The CLT-302’s are housed in sturdy, compact aluminum enclosures. A locking power supply plug is optional.

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<sup>1</sup> 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](http://www.machinevisiononline.org)



## **1.2. Features**

- Enable use of RS-422 and LVDS cameras with Camera Link frame grabbers
- Also useful for converting parallel video from FPGA and imaging development boards
- Camera Link “base” configuration interface, supports up-to 24-bit data
- “R” version supports RS-422 cameras
- “L” version supports LVDS cameras
- 2.5 MHz to 85 MHz camera pixel clock range for “L” version
- 2.5 MHz to 32 MHz camera pixel clock range for “R” version
- RS-232 camera communication support
- Selectable camera clock and timing signal polarities
- Link indicator identifies an active camera connection
- Isolated DC power input
- Minimal data pass-through latency
- Flow-through connector placement
- Sturdy, compact aluminum enclosure with mounting flange
- Multi-nation power supply included, locking power plug optional
- 3-year warrantee

### 1.3. Functional Description

The CLT-302L & CLT-302R Camera Link Translators enable the use of traditional RS-422 and LVDS digital cameras with Camera Link frame grabbers. Block diagrams of the CLT-302R and CLT-302L are provided in Figures 1-1 and 1-2, respectively. The CLT-302R is intended for use with RS-422 digital cameras and the CLT-302L for use with LVDS (EIA-644) digital cameras.

The camera interface receives video data in parallel digital format using RS-422 or LVDS, depending on CLT-302 version. The camera interface incorporates a 100-pin SCSI-style connector.

The CLT-302 frame grabber interfaces incorporates the connector, signals, pinout, and chipset in compliance with the Camera Link specification. The CLT-302 incorporates the “base” configuration signal set, consisting of video data, camera control, and serial communications.

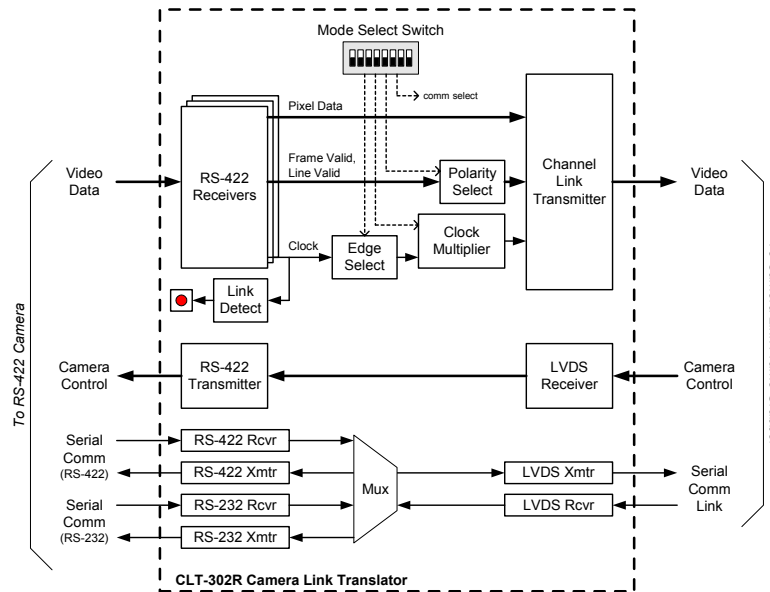
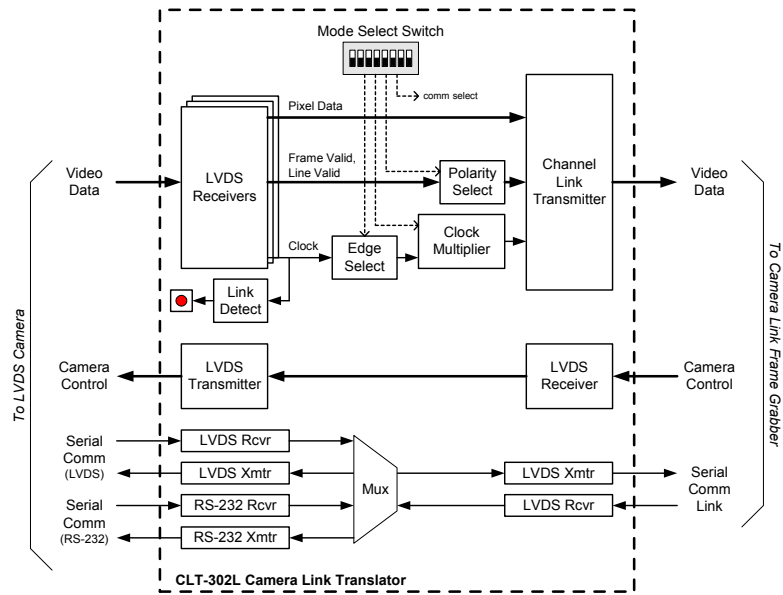


Figure 1-1: CLT-302R Block Diagram



**Figure 1-2: CLT-302L Block Diagram**



The CLT-302 receives parallel digital camera data on the 100-pin camera connector and maps the pixel data into the corresponding Camera Link “base” configuration format. The CLT supports single-channel (monochrome) cameras with 8/10/12/14/16-bit pixels, dual-channel 8/10/12-bit cameras, and 8-bit color cameras.

The latency (i.e. delay) of the video, control, and communication signals passing through the CLT-302 is minimal. This is an important criteria in some time-critical application. The delay for the camera video through the CLT-302 is only a few pixel clock periods. See Table 1.1 for CLT-302 latency specifications.

Camera 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.

Camera Link incorporates a data valid signal which is used to qualify the video data. This signal is generated by the CLT-302 and sent to the Camera Link frame grabber. Most LVDS and RS-422 digital cameras do not incorporate a *data valid* type signal. The CLT-302 incorporates a provision for the rare cases in which a data valid *is* provided by the camera. When the data valid pass-through dip switch position is raised, the CLT-302 passes the data valid signal from the camera to the frame grabber. The Camera Link data valid input is active-high, qualifying the incoming video data when the signal is high. A second dipswitch position, data valid polarity, supports either active-high or active-low data valid signals from the camera. When the data valid pass-through dipswitch is in the normal (low) position, the CLT-302 maintains the data valid signal sent to the frame grabber in the high position. The only exception is when the clock multiplier is being used which is discussed next.

Camera pixel clock characteristics are selected using the rear-panel mode switch. One switch position is used to select which pixel clock edge, rising or falling, is used to sample the data and timing signals received from the camera. Two additional switch positions are used to enable the CLT-302 clock multiplier circuit. The clock multiplier supports the use of camera with pixel clock frequency below the Camera Link 20MHz minimum by “multiplying” the camera clock frequency before it is sent to the Camera Link frame grabber.. For cameras with pixel clocks in the 10-19.99 MHz range, the clock multiplier is used to 2x (i.e. double) the clock frequency. For cameras with pixel clocks in the 5-9.99 MHz range, the clock multiplier is used to 4x (i.e. quadruple) the clock frequency. For cameras with pixel clocks in the 2.5-4.99 MHz range, the clock multiplier is used to 8x the clock frequency.

The result of using the clock multiplier is a 2x/4x/8x oversampling of camera data and timing signals sent to the Camera Link frame grabber. When in 2x/4x/8x mode, the CLT-302L & CLT-302R toggles the “data valid” signal defined in the Camera Link Specification accordingly. If the frame grabber supports the data valid signal, the oversampling affect is removed automatically. Otherwise, the oversampling is easily removed in the frame grabber by adjusting the line timing (multiply by 2/4/8) and decimating (divide by 2/4/8) the pixels in the “X” dimension. Two switch positions are used to select camera clock characteristics. Switch settings are defined in Section 1.3.1.

The CLT-302 receives four LVDS camera control signals from the Camera Link frame grabber and retransmits all four signals to the camera using LVDS or RS-422 signaling, depending on CLT-302 version. These signals are often used to externally synchronize the camera (i.e. EXSYNC). The camera may or may not require any or all of these signals.

The CLT-302 routes the serial communication signals between the LVDS/RS-422 digital camera and the Camera Link frame grabber. This supports host computer access to mode control and status registers in the camera via the serial port included in the Camera Link frame grabber. The camera may or may not incorporate a serial port. The CLT-302 supports differential signaling (LVDS or RS-422, depending on CLT-302 version) for the camera serial port as well as RS-232 single-ended signaling which is used with some LVDS/RS-422 cameras. A rear-panel dipswitch is used to select the camera serial port signaling standard (RS-422/LVDS or RS-232). Note that the LVDS/RS-422 and RS-232 serial ports use different pins on the 100-pin camera connector. The camera cable must be correctly wired for the desired serial port signaling standard.

The CLT-302L & CLT-302R *frame grabber* interface incorporates LVDS devices for the serial communication signals (per Camera Link). The *camera* interface serial signals are implemented using LVDS or RS-422 devices, depending on CLT-302 version.

The CLT-302 detects the presence of an active Camera Link camera. When an active (i.e. powered) camera is detected, the front-panel “link” indicator illuminates. The front panel also includes a power indicator to show that the CLT-302 is powered.

The CLT-302 is powered by an external wall plug-in power supply. A multi-nation power supply is standard. Optionally, the CLT-302 is available with a locking power supply connector. The locking power supply connector reduces the risk of accidental disconnection. The CLT-302 is also available without any power supply for customers who want to provide their own power source.

**Note: The CLT-302 requires a steady, continuous pixel clock from the camera.**

### 1.3.1. Mode Switch Settings

The CLT-302 incorporates a rear-panel mode select switch. The switch allows the user to identify camera timing signal, serial communication, and clock characteristics. The mode switch has eight positions. The functional assignments are defined in Figure 1-3.

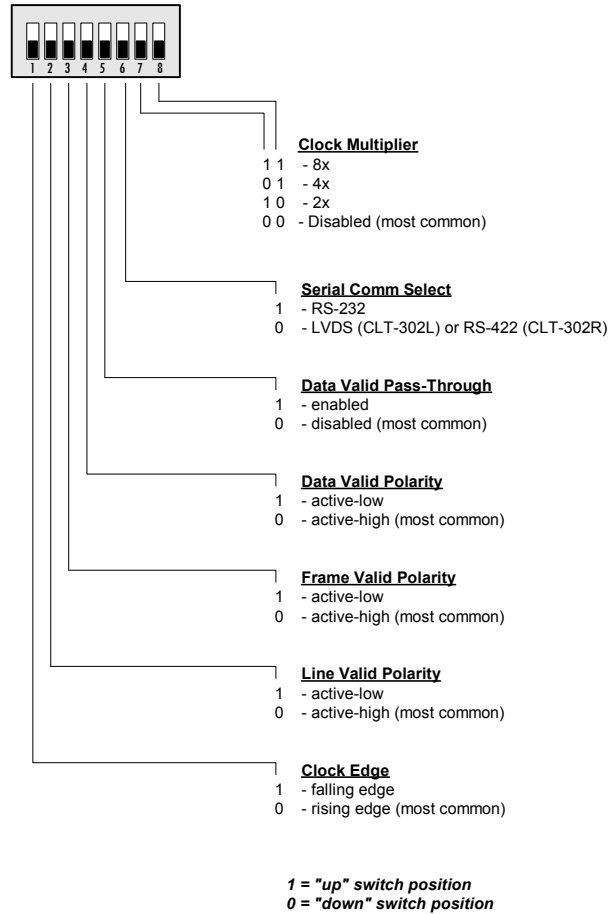


Figure 1-3: CLT-302 Mode Switch Definition

Note: Normal (default) dipswitch settings are "all-low" as shown above

## 1.4. Typical Application

A typical CLT-302 application is shown in Figure 1-4. An LVDS camera is connected to the CLT-302L using a camera cable that incorporates a 100-pin connector and pin assignments for use with the CLT-302L and RS-232 camera communication. The CLT-302L is connected to the frame grabber using a standard Camera Link cable.

The camera in this example is 8-bit, dual-channel, area-scan with a 20MHz pixel clock and LVDS signaling. The frame enable and line enable timing signals are conventional active-high. The camera does not generate a data valid signal. Data sampling was found to be best performed using the falling edge of the camera pixel clock, which is sometimes the case. In addition, the serial control port on the camera is RS-232. The corresponding mode switch settings are shown in Figure 1-5. Note that the clock multiplier feature is not required in this example since the pixel clock is within the 20-85 MHz range required by Camera Link.

The Camera Link frame grabber is programmed for area-scan, base-configuration, dual-channel, 8-bit mode. 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-302L, to the camera for use as an EXSYNC pulse, exposure control, etc.

The serial port in the Camera Link frame grabber is used to control and monitor camera functions.

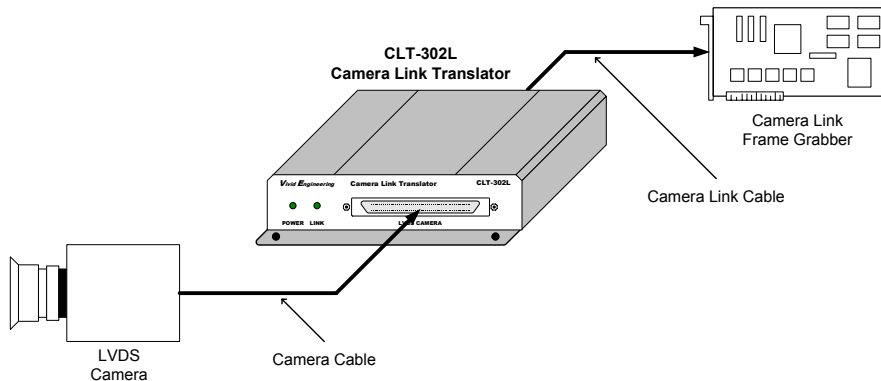
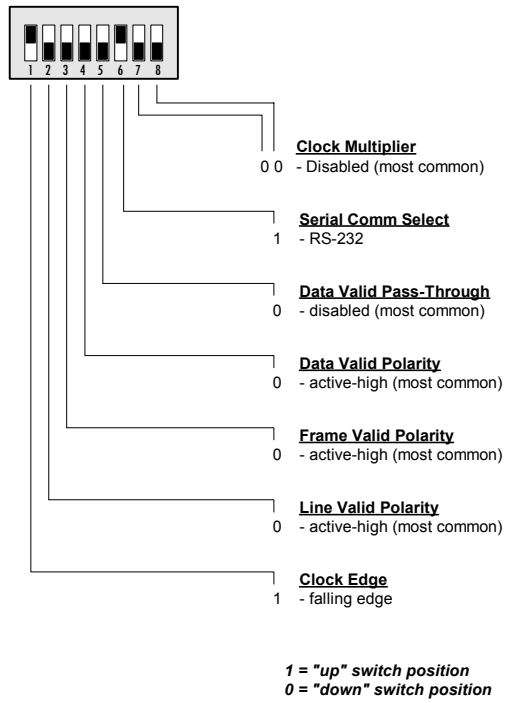


Figure 1-4: CLT-302 Typical Application



**Figure 1-5: Example Mode Settings**

## 1.5. Specifications

Table 1-1: CLT-302L & CLT-302R Specifications

Feature	Specification
Camera Interface	- "R" version = Parallel RS-422 - "L" version = Parallel LVDS (EIA-644)
Camera Connector	100-pin SCSI-style
Frame Grabber Interface	Camera Link "base" configuration
Frame Grabber Connector	26-pin MDR type
Camera Frequency	- "R" version: 2.5 - 32 MHz - "L" version: 2.5 - 85 MHz
Mode Selection	Rear-panel 8-position DIP switch
Latency	Video path: 3 camera pixel clock cycles Control signals: 20 ns max
Power Supply	Universal wall style w/ outlet plug set
Power Jack	2.1 x 5.5 mm, center-positive. Locking style optional
Power Requirements	4.5 – 6.0 VDC, internally isolated - 300 mA @ 5 VDC (typical)
Cabinet Dimensions	5.28" (L) x 1.12" (H) x 6.13" (D)
Weight	13 oz
Operating Temperature Range	0 to 50° C
Storage Temperature Range	-25 to 75° C
Relative Humidity	0 to 90%, non-condensing
Compliance	FCC Class A, ROHS, CE EN55024 pending

## 2. Interface

### 2.1. Front Panel Connections

A CLT-302L & CLT-302R Camera Link Translator front panel is shown in Figure 2-1 (CLT-302L shown). The front panel contains a 100-pin video connector for connecting to the camera, an LED power indicator, and an LED link indicator. The camera connector is a 100-pin SCSI-style, TE Connectivity p/n 5787170-9. Included are two jackscrew sockets (TE Connectivity p/n 749087-2) that mate with camera cable 2-56 thread jackscrews. Figure 2-2 identifies the pin positions.

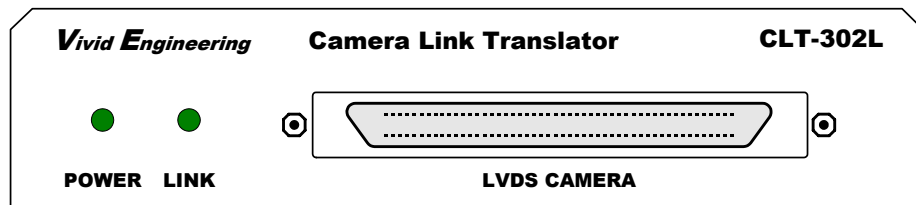


Figure 2-1: CLT-302L Front Panel

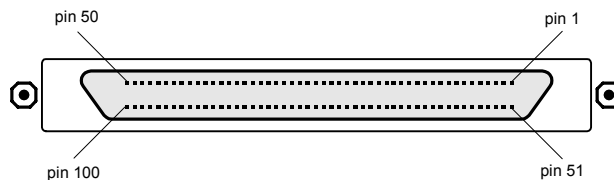


Figure 2-2: 100-pin Camera Connector Pin Positions



### **2.1.1. Camera Connector Signals**

Tables 2-1 through 2-5 identify the 100-pin camera connector signal assignments for single-channel pixel data modes (1x8, 1x10, 1x12, 1x14, and 1x16). Tables 2-6 through 2-8 identify the signal assignment for dual-channel modes (2x8, 2x10, 2x12), and Table 2-9 identifies the signal assignment for color mode (3x8). **The appropriate table must be used when making a camera cable for use with the CLT-302.**

### **2.1.2. Camera Cable Shielding and Grounding**

At a minimum, one digital ground pin at the camera connector must be connected to one of the digital ground pins on the CLT-302 connector in order to maintaining signal reference levels between camera and CLT-302. Camera cable “inner” shields (if present) should connect to CLT-302 digital ground pins.

Camera cable “outer” shields should attach to the metallic connector shell, which contacts the CLT-302 aluminum enclosure. CLT-302 enclosure body and endplate contacting surfaces are unpainted, providing a Faraday cage to shield the internal circuitry. The enclosure is isolated from the CLT-302 circuitry, avoiding possible safety concerns.

### **2.1.3. Camera Cable Recommended Connectors**

The camera connector used in the CLT-302 is made by TE Connectivity ([www.te.com](http://www.te.com), formerly Tyco and originally Amp). The connector part number is identified in Section 2.1. The following is a list of recommended mating connectors and hardware for use in camera cables:

- Plug, TE Connectivity p/n 1-5750913-9
- Plug, TE Connectivity p/n 5749111-8
- Plug, TE Connectivity p/n 5749621-9
- Backshell, TE Connectivity p/n 5749854-1
- Backshell, TE Connectivity p/n 5749081-1

**Table 2-1: Camera Connector, 8-bit Single-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 + <sup>1</sup>	15	CAM → CLT-302	
A7 - <sup>1</sup>	16	CAM → CLT-302	
<i>Unused Input</i>	17	CAM → CLT-302	
<i>Unused Input</i>	18	CAM → CLT-302	
<i>Unused Input</i>	19	CAM → CLT-302	
<i>Unused Input</i>	20	CAM → CLT-302	
<i>Unused Input</i>	21	CAM → CLT-302	
<i>Unused Input</i>	22	CAM → CLT-302	
<i>Unused Input</i>	23	CAM → CLT-302	
<i>Unused Input</i>	24	CAM → CLT-302	
<i>Unused Input</i>	25	CAM → CLT-302	
<i>Unused Input</i>	26	CAM → CLT-302	
<i>Unused Input</i>	27	CAM → CLT-302	
<i>Unused Input</i>	28	CAM → CLT-302	
<i>Unused Input</i>	29	CAM → CLT-302	
<i>Unused Input</i>	30	CAM → CLT-302	

<i>Unused Input</i>	31	CAM → CLT-302	
<i>Unused Input</i>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
<i>Unused Input</i>	51	CAM → CLT-302	
<i>Unused Input</i>	52	CAM → CLT-302	
<i>Unused Input</i>	53	CAM → CLT-302	
<i>Unused Input</i>	54	CAM → CLT-302	
<i>Unused Input</i>	55	CAM → CLT-302	
<i>Unused Input</i>	56	CAM → CLT-302	
<i>Unused Input</i>	57	CAM → CLT-302	
<i>Unused Input</i>	58	CAM → CLT-302	
<i>Unused Input</i>	59	CAM → CLT-302	
<i>Unused Input</i>	60	CAM → CLT-302	
<i>Unused Input</i>	61	CAM → CLT-302	
<i>Unused Input</i>	62	CAM → CLT-302	
<i>Unused Input</i>	63	CAM → CLT-302	
<i>Unused Input</i>	64	CAM → CLT-302	
<i>Unused Input</i>	65	CAM → CLT-302	
<i>Unused Input</i>	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>

RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>†</sup> Pixel "A" MSB  
 "FG" = Frame Grabber  
 "cam" = Camera

**Table 2-2: Camera Connector, 10-bit Single-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 +	15	CAM → CLT-302	
A7 -	16	CAM → CLT-302	
A8 +	17	CAM → CLT-302	
A8 -	18	CAM → CLT-302	
A9 + <sup>1</sup>	19	CAM → CLT-302	
A9 - <sup>1</sup>	20	CAM → CLT-302	
<i>Unused Input</i>	21	CAM → CLT-302	
<i>Unused Input</i>	22	CAM → CLT-302	
<i>Unused Input</i>	23	CAM → CLT-302	
<i>Unused Input</i>	24	CAM → CLT-302	
<i>Unused Input</i>	25	CAM → CLT-302	
<i>Unused Input</i>	26	CAM → CLT-302	
<i>Unused Input</i>	27	CAM → CLT-302	
<i>Unused Input</i>	28	CAM → CLT-302	
<i>Unused Input</i>	29	CAM → CLT-302	
<i>Unused Input</i>	30	CAM → CLT-302	

<i>Unused Input</i>	31	CAM → CLT-302	
<i>Unused Input</i>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
<i>Unused Input</i>	51	CAM → CLT-302	
<i>Unused Input</i>	52	CAM → CLT-302	
<i>Unused Input</i>	53	CAM → CLT-302	
<i>Unused Input</i>	54	CAM → CLT-302	
<i>Unused Input</i>	55	CAM → CLT-302	
<i>Unused Input</i>	56	CAM → CLT-302	
<i>Unused Input</i>	57	CAM → CLT-302	
<i>Unused Input</i>	58	CAM → CLT-302	
<i>Unused Input</i>	59	CAM → CLT-302	
<i>Unused Input</i>	60	CAM → CLT-302	
<i>Unused Input</i>	61	CAM → CLT-302	
<i>Unused Input</i>	62	CAM → CLT-302	
<i>Unused Input</i>	63	CAM → CLT-302	
<i>Unused Input</i>	64	CAM → CLT-302	
<i>Unused Input</i>	65	CAM → CLT-302	
<i>Unused Input</i>	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>



RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>†</sup> Pixel "A" MSB  
 "FG" = Frame Grabber  
 "cam" = Camera

**Table 2-3: Camera Connector, 12-bit Single-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 +	15	CAM → CLT-302	
A7 -	16	CAM → CLT-302	
A8 +	17	CAM → CLT-302	
A8 -	18	CAM → CLT-302	
A9 +	19	CAM → CLT-302	
A9 -	20	CAM → CLT-302	
A10 +	21	CAM → CLT-302	
A10 -	22	CAM → CLT-302	
A11 + <sup>1</sup>	23	CAM → CLT-302	
A11 - <sup>1</sup>	24	CAM → CLT-302	
<i>Unused Input</i>	25	CAM → CLT-302	
<i>Unused Input</i>	26	CAM → CLT-302	
<i>Unused Input</i>	27	CAM → CLT-302	
<i>Unused Input</i>	28	CAM → CLT-302	
<i>Unused Input</i>	29	CAM → CLT-302	
<i>Unused Input</i>	30	CAM → CLT-302	

<i>Unused Input</i>	31	CAM → CLT-302	
<i>Unused Input</i>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
<i>Unused Input</i>	51	CAM → CLT-302	
<i>Unused Input</i>	52	CAM → CLT-302	
<i>Unused Input</i>	53	CAM → CLT-302	
<i>Unused Input</i>	54	CAM → CLT-302	
<i>Unused Input</i>	55	CAM → CLT-302	
<i>Unused Input</i>	56	CAM → CLT-302	
<i>Unused Input</i>	57	CAM → CLT-302	
<i>Unused Input</i>	58	CAM → CLT-302	
<i>Unused Input</i>	59	CAM → CLT-302	
<i>Unused Input</i>	60	CAM → CLT-302	
<i>Unused Input</i>	61	CAM → CLT-302	
<i>Unused Input</i>	62	CAM → CLT-302	
<i>Unused Input</i>	63	CAM → CLT-302	
<i>Unused Input</i>	64	CAM → CLT-302	
<i>Unused Input</i>	65	CAM → CLT-302	
<i>Unused Input</i>	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>

RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>†</sup> Pixel "A" MSB  
 "FG" = Frame Grabber  
 "cam" = Camera

**Table 2-4: Camera Connector, 14-bit Single-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 +	15	CAM → CLT-302	
A7 -	16	CAM → CLT-302	
A8 +	17	CAM → CLT-302	
A8 -	18	CAM → CLT-302	
A9 +	19	CAM → CLT-302	
A9 -	20	CAM → CLT-302	
A10 +	21	CAM → CLT-302	
A10 -	22	CAM → CLT-302	
A11 +	23	CAM → CLT-302	
A11 -	24	CAM → CLT-302	
A12 +	25	CAM → CLT-302	
A12 -	26	CAM → CLT-302	
A13 + <sup>1</sup>	27	CAM → CLT-302	
A13 - <sup>1</sup>	28	CAM → CLT-302	
<i>Unused Input</i>	29	CAM → CLT-302	
<i>Unused Input</i>	30	CAM → CLT-302	

<i>Unused Input</i>	31	CAM → CLT-302	
<i>Unused Input</i>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
<i>Unused Input</i>	51	CAM → CLT-302	
<i>Unused Input</i>	52	CAM → CLT-302	
<i>Unused Input</i>	53	CAM → CLT-302	
<i>Unused Input</i>	54	CAM → CLT-302	
<i>Unused Input</i>	55	CAM → CLT-302	
<i>Unused Input</i>	56	CAM → CLT-302	
<i>Unused Input</i>	57	CAM → CLT-302	
<i>Unused Input</i>	58	CAM → CLT-302	
<i>Unused Input</i>	59	CAM → CLT-302	
<i>Unused Input</i>	60	CAM → CLT-302	
<i>Unused Input</i>	61	CAM → CLT-302	
<i>Unused Input</i>	62	CAM → CLT-302	
<i>Unused Input</i>	63	CAM → CLT-302	
<i>Unused Input</i>	64	CAM → CLT-302	
<i>Unused Input</i>	65	CAM → CLT-302	
<i>Unused Input</i>	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>



RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>†</sup> Pixel "A" MSB  
 "FG" = Frame Grabber  
 "cam" = Camera

**Table 2-5: Camera Connector, 16-bit Single-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 +	15	CAM → CLT-302	
A7 -	16	CAM → CLT-302	
A8 +	17	CAM → CLT-302	
A8 -	18	CAM → CLT-302	
A9 +	19	CAM → CLT-302	
A9 -	20	CAM → CLT-302	
A10 +	21	CAM → CLT-302	
A10 -	22	CAM → CLT-302	
A11 +	23	CAM → CLT-302	
A11 -	24	CAM → CLT-302	
A12 +	25	CAM → CLT-302	
A12 -	26	CAM → CLT-302	
A13 +	27	CAM → CLT-302	
A13 -	28	CAM → CLT-302	
A14 +	29	CAM → CLT-302	
A14 -	30	CAM → CLT-302	

A15 + <sup>1</sup>	31	CAM → CLT-302	
A15 - <sup>1</sup>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
<i>Unused Input</i>	51	CAM → CLT-302	
<i>Unused Input</i>	52	CAM → CLT-302	
<i>Unused Input</i>	53	CAM → CLT-302	
<i>Unused Input</i>	54	CAM → CLT-302	
<i>Unused Input</i>	55	CAM → CLT-302	
<i>Unused Input</i>	56	CAM → CLT-302	
<i>Unused Input</i>	57	CAM → CLT-302	
<i>Unused Input</i>	58	CAM → CLT-302	
<i>Unused Input</i>	59	CAM → CLT-302	
<i>Unused Input</i>	60	CAM → CLT-302	
<i>Unused Input</i>	61	CAM → CLT-302	
<i>Unused Input</i>	62	CAM → CLT-302	
<i>Unused Input</i>	63	CAM → CLT-302	
<i>Unused Input</i>	64	CAM → CLT-302	
<i>Unused Input</i>	65	CAM → CLT-302	
<i>Unused Input</i>	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>

RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>†</sup> Pixel "A" MSB  
 "FG" = Frame Grabber  
 "cam" = Camera

**Table 2-6: Camera Connector, 8-bit Dual-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 + <sup>1</sup>	15	CAM → CLT-302	
A7 - <sup>1</sup>	16	CAM → CLT-302	
B0 +	17	CAM → CLT-302	
B0 -	18	CAM → CLT-302	
B1 +	19	CAM → CLT-302	
B1 -	20	CAM → CLT-302	
B2 +	21	CAM → CLT-302	
B2 -	22	CAM → CLT-302	
B3 +	23	CAM → CLT-302	
B3 -	24	CAM → CLT-302	
B4 +	25	CAM → CLT-302	
B4 -	26	CAM → CLT-302	
B5 +	27	CAM → CLT-302	
B5 -	28	CAM → CLT-302	
B6 +	29	CAM → CLT-302	
B6 -	30	CAM → CLT-302	

B7 + <sup>2</sup>	31	CAM → CLT-302	
B7 - <sup>2</sup>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
<i>Unused Input</i>	51	CAM → CLT-302	
<i>Unused Input</i>	52	CAM → CLT-302	
<i>Unused Input</i>	53	CAM → CLT-302	
<i>Unused Input</i>	54	CAM → CLT-302	
<i>Unused Input</i>	55	CAM → CLT-302	
<i>Unused Input</i>	56	CAM → CLT-302	
<i>Unused Input</i>	57	CAM → CLT-302	
<i>Unused Input</i>	58	CAM → CLT-302	
<i>Unused Input</i>	59	CAM → CLT-302	
<i>Unused Input</i>	60	CAM → CLT-302	
<i>Unused Input</i>	61	CAM → CLT-302	
<i>Unused Input</i>	62	CAM → CLT-302	
<i>Unused Input</i>	63	CAM → CLT-302	
<i>Unused Input</i>	64	CAM → CLT-302	
<i>Unused Input</i>	65	CAM → CLT-302	
<i>Unused Input</i>	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>



RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>1</sup> Pixel "A" MSB

<sup>2</sup> Pixel "B" MSB

"FG" = Frame Grabber

"cam" = Camera

**Table 2-7: Camera Connector, 10-bit Dual-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 +	15	CAM → CLT-302	
A7 -	16	CAM → CLT-302	
A8 +	17	CAM → CLT-302	
A8 -	18	CAM → CLT-302	
A9 + <sup>1</sup>	19	CAM → CLT-302	
A9 - <sup>1</sup>	20	CAM → CLT-302	
<i>Unused Input</i>	21	CAM → CLT-302	
<i>Unused Input</i>	22	CAM → CLT-302	
<i>Unused Input</i>	23	CAM → CLT-302	
<i>Unused Input</i>	24	CAM → CLT-302	
B8 +	25	CAM → CLT-302	
B8 -	26	CAM → CLT-302	
B9 + <sup>2</sup>	27	CAM → CLT-302	
B9 - <sup>2</sup>	28	CAM → CLT-302	
<i>Unused Input</i>	29	CAM → CLT-302	
<i>Unused Input</i>	30	CAM → CLT-302	

<i>Unused Input</i>	31	CAM → CLT-302	
<i>Unused Input</i>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
B0 +	51	CAM → CLT-302	
B0 -	52	CAM → CLT-302	
B1 +	53	CAM → CLT-302	
B1 -	54	CAM → CLT-302	
B2 +	55	CAM → CLT-302	
B2 -	56	CAM → CLT-302	
B3 +	57	CAM → CLT-302	
B3 -	58	CAM → CLT-302	
B4 +	59	CAM → CLT-302	
B4 -	60	CAM → CLT-302	
B5 +	61	CAM → CLT-302	
B5 -	62	CAM → CLT-302	
B6 +	63	CAM → CLT-302	
B6 -	64	CAM → CLT-302	
B7 +	65	CAM → CLT-302	
B7 -	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>

RS-232 Comm In	94	CAM → CLT-302	RS-232 comm, cam to FG
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>1</sup> Pixel "A" MSB

<sup>2</sup> Pixel "B" MSB

"FG" = Frame Grabber

"cam" = Camera

**Table 2-8: Camera Connector, 12-bit Dual-Channel Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
A0 +	1	CAM → CLT-302	
A0 -	2	CAM → CLT-302	
A1 +	3	CAM → CLT-302	
A1 -	4	CAM → CLT-302	
A2 +	5	CAM → CLT-302	
A2 -	6	CAM → CLT-302	
A3 +	7	CAM → CLT-302	
A3 -	8	CAM → CLT-302	
A4 +	9	CAM → CLT-302	
A4 -	10	CAM → CLT-302	
A5 +	11	CAM → CLT-302	
A5 -	12	CAM → CLT-302	
A6 +	13	CAM → CLT-302	
A6 -	14	CAM → CLT-302	
A7 +	15	CAM → CLT-302	
A7 -	16	CAM → CLT-302	
A8 +	17	CAM → CLT-302	
A8 -	18	CAM → CLT-302	
A9 +	19	CAM → CLT-302	
A9 -	20	CAM → CLT-302	
A10 +	21	CAM → CLT-302	
A10 -	22	CAM → CLT-302	
A11 + <sup>1</sup>	23	CAM → CLT-302	
A11 - <sup>1</sup>	24	CAM → CLT-302	
B8 +	25	CAM → CLT-302	
B8 -	26	CAM → CLT-302	
B9 +	27	CAM → CLT-302	
B9 -	28	CAM → CLT-302	
B10 +	29	CAM → CLT-302	
B10 -	30	CAM → CLT-302	

B11 + <sup>2</sup>	31	CAM → CLT-302	
B11 - <sup>2</sup>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
B0 +	51	CAM → CLT-302	
B0 -	52	CAM → CLT-302	
B1 +	53	CAM → CLT-302	
B1 -	54	CAM → CLT-302	
B2 +	55	CAM → CLT-302	
B2 -	56	CAM → CLT-302	
B3 +	57	CAM → CLT-302	
B3 -	58	CAM → CLT-302	
B4 +	59	CAM → CLT-302	
B4 -	60	CAM → CLT-302	
B5 +	61	CAM → CLT-302	
B5 -	62	CAM → CLT-302	
B6 +	63	CAM → CLT-302	
B6 -	64	CAM → CLT-302	
B7 +	65	CAM → CLT-302	
B7 -	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>



RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>1</sup> Pixel "A" MSB

<sup>2</sup> Pixel "B" MSB

"FG" = Frame Grabber

"cam" = Camera

**Table 2-9: Camera Connector, Color Mode**

Camera Interface Signal Name	Camera Interface Connector Pin	Signal Direction	Notes
R0 +	1	CAM → CLT-302	
R0 -	2	CAM → CLT-302	
R1 +	3	CAM → CLT-302	
R1 -	4	CAM → CLT-302	
R2 +	5	CAM → CLT-302	
R2 -	6	CAM → CLT-302	
R3 +	7	CAM → CLT-302	
R3 -	8	CAM → CLT-302	
R4 +	9	CAM → CLT-302	
R4 -	10	CAM → CLT-302	
R5 +	11	CAM → CLT-302	
R5 -	12	CAM → CLT-302	
R6 +	13	CAM → CLT-302	
R6 -	14	CAM → CLT-302	
R7 + <sup>1</sup>	15	CAM → CLT-302	
R7 - <sup>1</sup>	16	CAM → CLT-302	
G0 +	17	CAM → CLT-302	
G0 -	18	CAM → CLT-302	
G1 +	19	CAM → CLT-302	
G1 -	20	CAM → CLT-302	
G2 +	21	CAM → CLT-302	
G2 -	22	CAM → CLT-302	
G3 +	23	CAM → CLT-302	
G3 -	24	CAM → CLT-302	
G4 +	25	CAM → CLT-302	
G4 -	26	CAM → CLT-302	
G5 +	27	CAM → CLT-302	
G5 -	28	CAM → CLT-302	
G6 +	29	CAM → CLT-302	
G6 -	30	CAM → CLT-302	

G7 + <sup>2</sup>	31	CAM → CLT-302	
G7 - <sup>2</sup>	32	CAM → CLT-302	
Mode Control 0 +	33	CLT-302 → CAM	<i>CC1 from FG</i>
Mode Control 0 -	34	CLT-302 → CAM	"
Mode Control 1 +	35	CLT-302 → CAM	<i>CC2 from FG</i>
Mode Control 1 -	36	CLT-302 → CAM	"
Mode Control 2 +	37	CLT-302 → CAM	<i>CC3 from FG</i>
Mode Control 2 -	38	CLT-302 → CAM	"
Mode Control 3 +	39	CLT-302 → CAM	<i>CC4 from FG</i>
Mode Control 3 -	40	CLT-302 → CAM	"
Frame Enable +	41	CAM → CLT-302	<i>"frame valid"</i>
Frame Enable -	42	CAM → CLT-302	"
Line Enable +	43	CAM → CLT-302	<i>"line valid"</i>
Line Enable -	44	CAM → CLT-302	"
Data Valid +	45	CAM → CLT-302	<i>"data valid"</i>
Data Valid -	46	CAM → CLT-302	"
Ground	47	N/A	<i>tied to digital ground</i>
Ground	48	N/A	<i>tied to digital ground</i>
Pixel Strobe +	49	CAM → CLT-302	<i>"pixel clock"</i>
Pixel Strobe -	50	CAM → CLT-302	"
B0 +	51	CAM → CLT-302	
B0 -	52	CAM → CLT-302	
B1 +	53	CAM → CLT-302	
B1 -	54	CAM → CLT-302	
B2 +	55	CAM → CLT-302	
B2 -	56	CAM → CLT-302	
B3 +	57	CAM → CLT-302	
B3 -	58	CAM → CLT-302	
B4 +	59	CAM → CLT-302	
B4 -	60	CAM → CLT-302	
B5 +	61	CAM → CLT-302	
B5 -	62	CAM → CLT-302	
B6 +	63	CAM → CLT-302	
B6 -	64	CAM → CLT-302	
B7 + <sup>3</sup>	65	CAM → CLT-302	
B7 - <sup>3</sup>	66	CAM → CLT-302	

<i>Not Used</i>	67	N/A	
<i>Not Used</i>	68	N/A	
<i>Not Used</i>	69	N/A	
<i>Not Used</i>	70	N/A	
<i>Not Used</i>	71	N/A	
<i>Not Used</i>	72	N/A	
<i>Not Used</i>	73	N/A	
<i>Not Used</i>	74	N/A	
<i>Not Used</i>	75	N/A	
<i>Not Used</i>	76	N/A	
<i>Not Used</i>	77	N/A	
<i>Not Used</i>	78	N/A	
<i>Not Used</i>	79	N/A	
<i>Not Used</i>	80	N/A	
<i>Not Used</i>	81	N/A	
<i>Not Used</i>	82	N/A	
<i>Not Used</i>	83	N/A	
<i>Not Used</i>	84	N/A	
<i>Not Used</i>	85	N/A	
<i>Not Used</i>	86	N/A	
<i>Not Used</i>	87	N/A	
<i>Not Used</i>	88	N/A	
Serial Control Out +	89	CLT-302 → CAM	<i>serial comm, FG to cam</i>
Serial Control Out -	90	CLT-302 → CAM	"
Serial Control In +	91	CAM → CLT-302	<i>serial comm, cam to FG</i>
Serial Control In -	92	CAM → CLT-302	"
RS-232 Comm Out	93	CLT-302 → CAM	<i>RS-232 comm, FG to cam</i>

RS-232 Comm In	94	CAM → CLT-302	<i>RS-232 comm, cam to FG</i>
<i>Not Used</i>	95	N/A	
<i>Not Used</i>	96	N/A	
<i>Not Used</i>	97	N/A	
<i>Not Used</i>	98	N/A	
Ground	99	N/A	<i>tied to digital ground</i>
Ground	100	N/A	<i>tied to digital ground</i>

<sup>1</sup> Pixel "R" MSB (red)  
<sup>2</sup> Pixel "G" MSB (green)  
<sup>3</sup> Pixel "B" MSB (blue)  
"FG" = Frame Grabber  
"cam" = Camera

## 2.2. Rear Panel

The CLT-302 Camera Link Translator rear panel is shown in Figure 2-3. The rear panel contains a 26-pin MDR video connectors for connecting to the frame grabber, an 8-position mode select DIP switch, and a DC power jack. The MDR-26 connector is a 3M device as specified in the Camera Link Spec. Figure 2-4 identifies the MDR-26 pin positions

The DC power jack accepts either a standard 2.1 x 5.5 mm barrel-style power plug, or a special locking version plug. The locking plug has bayonet-style “ears” on the barrel. Once inserted, the barrel may be turned  $\frac{1}{4}$  turn clockwise. This locks the connector in place and provides retention. The locking plug is removed by first turning the barrel  $\frac{1}{4}$  turn counterclockwise, and then pulling out the plug from the unit. Plug polarity is center-positive. The locking power plug is Philmore p/n 2150.

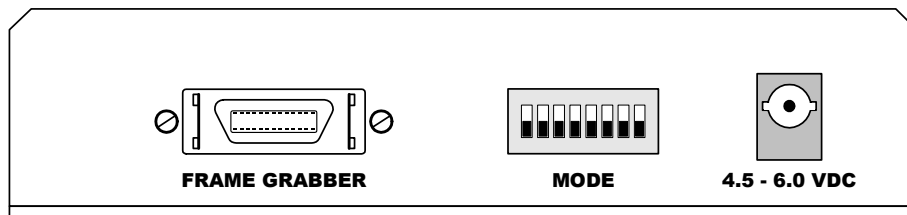


Figure 2-3: CLT-302 Rear Panel

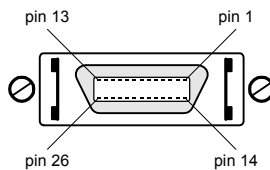


Figure 2-4: MDR-26 Connector Pin Positions

### **2.2.1. Video Connector Signals**

The MDR-26 video connector signal assignments comply with the Camera Link “base” configuration. The connector signal assignments correspond to the *camera* interface defined in the Camera Link Specification. This provides compatibility with standard Camera Link cables.

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

**Table 2-10: MDR-26 Connector Assignments**

Camera Link Signal Name	MDR-26 Connector Pin # (camera pinout)	Signal Direction
Inner shield	1	N/A
Inner shield	14	N/A
X0-	2	CLT-302 → FG
X0+	15	CLT-302 → FG
X1-	3	CLT-302 → FG
X1+	16	CLT-302 → FG
X2-	4	CLT-302 → FG
X2+	17	CLT-302 → FG
Xclk-	5	CLT-302 → FG
Xclk+	18	CLT-302 → FG
X3-	6	CLT-302 → FG
X3+	19	CLT-302 → FG
SerTC+	7	FG → CLT-302
SerTC-	20	FG → CLT-302
SerTFG-	8	CLT-302 → FG
SerTFG+	21	CLT-302 → FG
CC1-	9	FG → CLT-302
CC1+	22	FG → CLT-302
CC2+	10	FG → CLT-302
CC2-	23	FG → CLT-302
CC3-	11	FG → CLT-302
CC3+	24	FG → CLT-302
CC4+	12	FG → CLT-302
CC4-	25	FG → CLT-302
Inner shield	13	N/A
Inner shield	26	N/A

"FG" = Frame Grabber

"CAM" = Camera



## 3. Mechanical

### 3.1. Dimensions

The CLT-302 Camera Link Translator cabinet dimensions are shown in Figure 3-1 (CLT-302L shown).

The CLT-302 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.

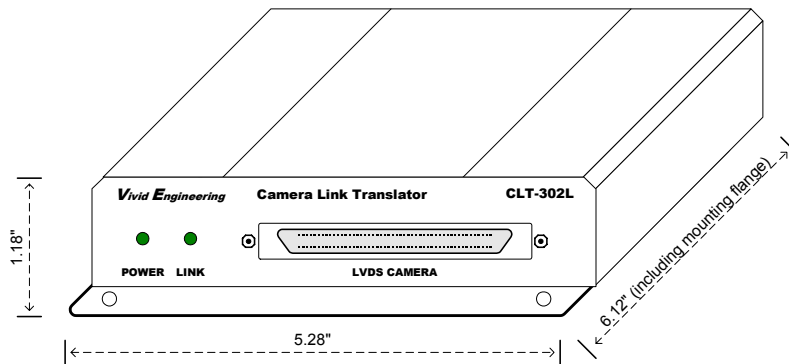
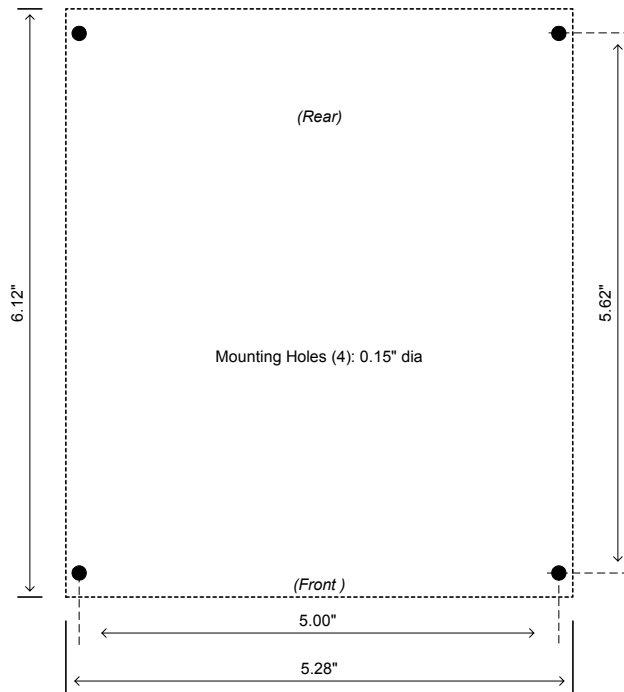


Figure 3-1: CLT-302L & CLT-302R Cabinet Dimensions



**Figure 3-2: Mounting Footprint Drawing**

### **3.2. External Power Supply**

The CLT-302 is powered by 4.5 – 6.0 VDC and incorporates a 2.1 x 5.5 mm DC power jack that accepts either a standard barrel-style power plug, or a special locking version (see Section 2.2). Power plug polarity is center-positive.

The CLT-302 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 CLT-302 may also be purchased with the locking power supply plug, or without a power supply.

## 4. Revision History

Table 5-1: CLT-302L & CLT-302R User's Manual Revision History

Document ID #	Date	Changes
201034-0.1	6/23/11	Preliminary release of manual
201034-0.2	7/15/11	Updates mating connector list