

CLR-101C CAMERA LINK REPEATER

User's Manual

Document # 200624, Rev 0.1, 11/17/2010 (**preliminary**)

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1. Introduction

1.1. Overview

The CLR-101C Camera Link¹ Repeater supports applications requiring separation between camera and frame grabber in excess of the maximum Camera Link cable length (10 meters).

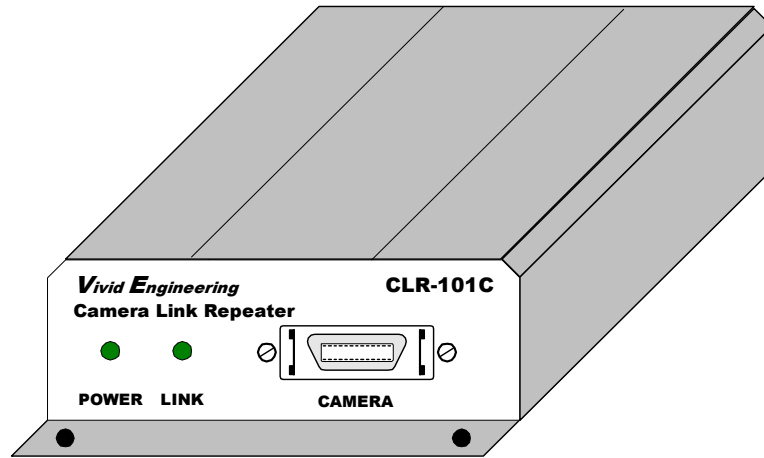
One Camera Link cable connects the camera to the CLR-101C, and a second cable connects the CLR-101C to the frame grabber. This solution provides a 20 meter reach between camera and frame grabber using a pair of standard 10m Camera Link cables. Up to three repeaters may be cascaded to support greater distances. CLR-101C incorporates high-speed 85MHz interfaces and is compatible with any Camera Link “Base” configuration camera. A front-panel link status indicator identifies an active connection.

Replacing a long Camera Link cable with the combination of a CLR-101C and two shorter cables can eliminate performance problems sometimes encountered using high clock-rate cameras and long cables.

Featuring a sturdy compact enclosure with mounting flange and optional locking power supply connector, the CLR-101C is well suited for OEM and industrial applications.

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

- Doubles max distance between camera and frame grabber
- Combines with shorter cables to improve performance in high clock-rate applications
- Uses standard Camera Link cables (not included)
- Supports Camera Link “base” configuration
- “Medium” configuration support using two CLR-101C’s in parallel
- High-speed 85 MHz interface chipset, works with any base camera
- Minimal video data pass-through latency: 3 camera pixel clocks
- Minimal control/communication pass-through latency: under 5 nS
- Front-panel link status indicator
- Up-to three CLR-101C’s may be cascaded, supporting a 40m reach
- Flow-through connector positioning
- Multi-nation power supply included
- Optional locking power supply connector
- Sturdy, compact aluminum enclosure w/ mounting flange
- 3-year warrantee
- Well suited for industrial and OEM applications
- Cost-effective solution

1.3. Functional Description

A block diagram of the CLR-101C is provided in Figure 1-1. The CLR-101C regenerates the “base” configuration signal set defined in the Camera Link Specification. The regenerated signals may then be transmitted an additional distance up-to 10 meters over standard Camera Link cables. The CLR-101C can also improve performance in high clock-rate long-cable applications by replacing a long cable with the combination of the CLR-101C and two shorter cables.

The CLR-101C incorporates the connectors, signals, pinouts, and chipset in compliance with the Camera Link specification. The CLR-101C regenerates all the “base” configuration signals, consisting of video data, camera control, and serial communications.

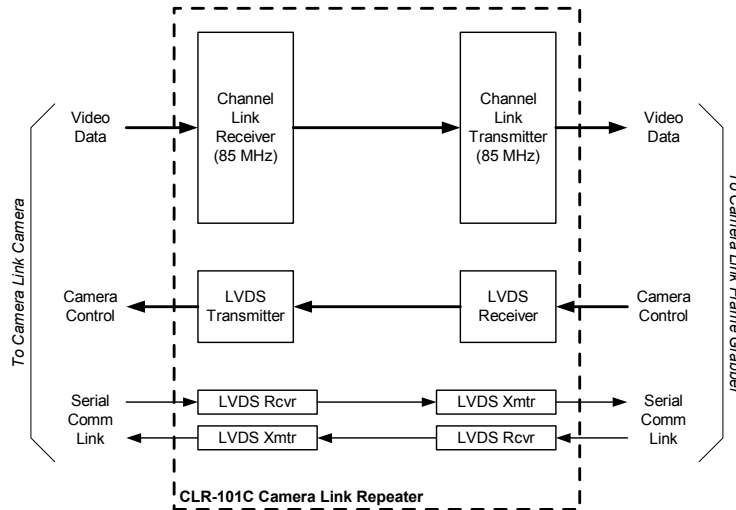


Figure 1-1: CLR-101C Block Diagram

The CLR-101C incorporates high-speed (85MHz) interfaces and is compatible with any “base” configuration camera. “Medium” configuration applications are supported using a pair of CLR-101C’s in parallel. The CLR-101C does not support the Camera Link “full” configuration.

The CLR-101C adds minimal delay (i.e. latency) to the video data path. This is an important criterion for time-critical applications. The latency through the CLR-101C is a fixed 3 pixel-clock delay. The pixel clock is established by the camera and can range from 20-85 MHz. Therefore, the CLR-101C fixed delay can range from 35 to 150 nS, depending on camera. The delay added by the CLR-101C for the camera control and serial communication signals is under 5 nS.

The CLR-101C 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 CLR-101C is powered.

The CLR-101C is powered by an external wall plug-in power supply. A multi-nation power supply is standard. Optionally, the CLR-101C is available with a locking power supply connector. The locking power supply connector reduces the risk of accidental disconnection. The CLR-101C is also available without any power supply for customers who want to provide their own power source.

1.4. Typical Applications

1.4.1. Standard Base Application

A typical CLR-101C application is shown in Figure 1-2. A Camera Link “base” configuration camera is connected to the CLR-101C via a standard 10m Camera Link cable. A second 10m Camera Link cable is then connected from the CLR-101C to a Camera Link frame grabber. This provides a 20 meter reach between camera and frame grabber. Note that the use of 10m cables is not recommended in applications where the camera pixel clock-rate exceeds 60 MHz (see Section 1.4.2).

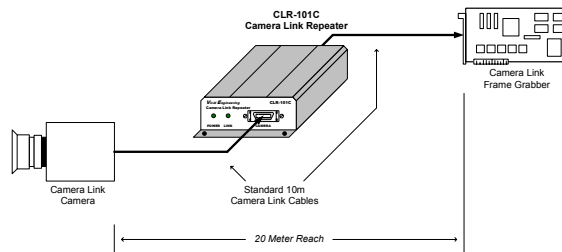


Figure 1-2: CLR-101C Standard Application

1.4.2. Performance Improvement Application

The pixel clock rate for Camera Link cameras ranges from 20-85 MHz. High-performance applications in which the camera clock rate is at the high-end of the range (i.e. 60-85 MHz) are often problematic when longer cables are used. A solution to this problem is to replace the long Camera Link cable with the combination of the CLR-101C and two shorter cables. Problem and solution examples are illustrated in Figures 1-3 and 1-4, respectively.

Testing has verified that a 10m reach at the Camera Link maximum 85 MHz clock-rate is reliably achieved using the combination of the CLR-101C and two high-quality 5m Camera Link cables as shown in Figure 1-3. Testing has also shown that longer 7m cables can be utilized reliably in the example shown in Figure 1-3 for cameras with clock rates up-to 80 MHz.

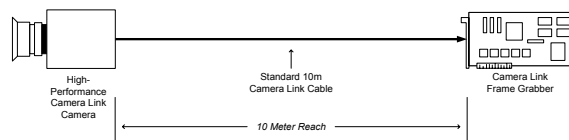


Figure 1-3: Problematic High-Performance Example

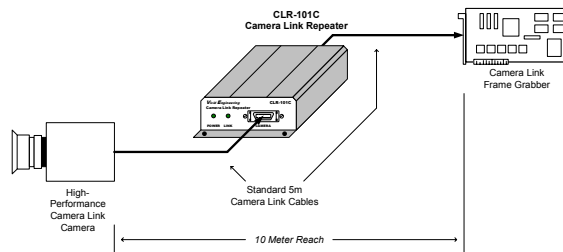


Figure 1-4: Reliable High-Performance Example Using CLR-101C

1.4.3. 40 Meter Application

Figure 1-5 shows an application in which multiple CLR-101Cs and standard cables are cascaded to provide a 40 meter separation between camera and frame grabber. In this example, a 40 meter reach is achieved using three CLR-101Cs and four standard 10m Camera Link cables. Note that the use of 10m cables is not recommended in applications where the camera pixel clock-rate exceeds 60 MHz (see Section 1.4.2).

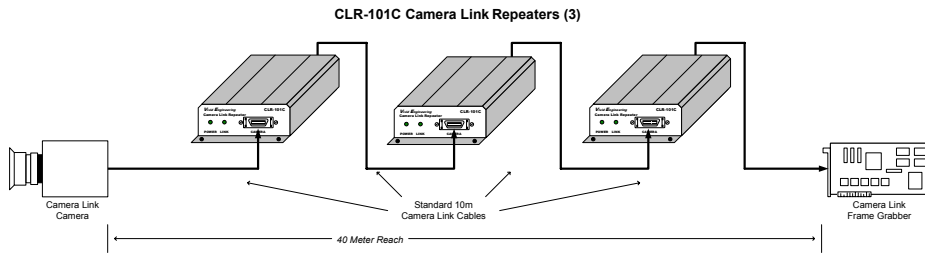


Figure 1-5: CLR-101C 40m Application

1.4.4. Medium Application

CLR-101C medium application is shown in Figure 1-6. Medium configuration, in which two cables connect the camera to the frame grabber, is supported using two CLR-101C's in parallel. A Camera Link medium configuration camera is connected to two CLR-101Cs via a pair of standard Camera Link cables. A second pair of cables is then used to connect the CLR-101Cs to the Camera Link frame grabber. Note that the use of 10m cables is not recommended in applications where the camera pixel clock-rate exceeds 60 MHz (see Section 1.4.2).

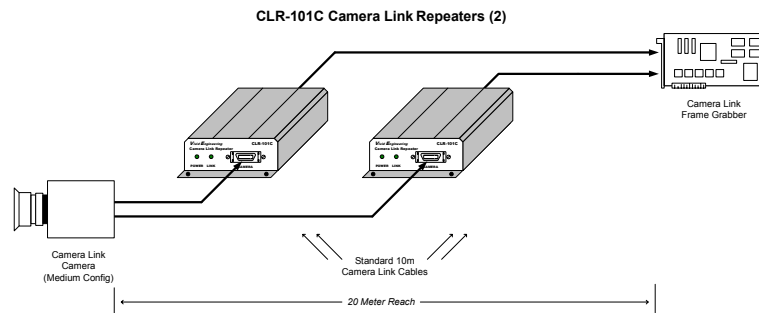


Figure 1-6: CLR-101C “Medium” Application

1.5. Specifications

Table 1-1: CLR-101C Specifications

Feature	Specification
Video Interfaces	Camera Link Spec "base" configuration
Video Connectors	26-pin MDR type
Frequency Range	20 - 85 MHz
Latency	Video path: 3 camera pixel clock cycles Control & communication: 5ns max
Chipset	National Semiconductor DS90CR287 / 288A
Power Supply	Universal wall style w/ outlet plug set
Power Plug	2.1 x 5.5 mm, center-positive. Locking style optional.
Power Requirements	5-7 VDC, 150 mA (typical)
Cabinet Dimensions	3.28" (L) x 1.14" (H) x 4.37" (D), including mounting flange
Weight	6 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 CLR-101C Camera Link Repeater front panel is shown in Figure 2-1. The front panel contains a 26-pin MDR video connector for connecting to the camera, an LED power indicator, and an LED link indicator. The MDR-26 connector is a 3M device as specified in the Camera Link Spec. Figure 2-2 identifies the MDR-26 pin positions.

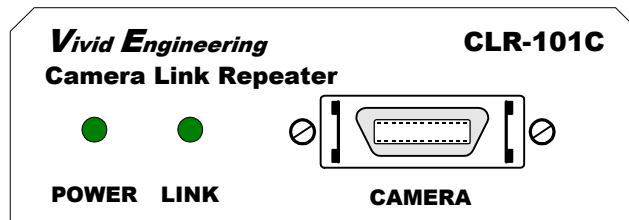


Figure 2-1: CLR-101C Front Panel

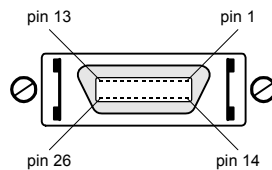


Figure 2-2: MDR-26 Connector Pin Positions

2.2. Rear Panel Connections

The CLR-101C Camera Link Repeater rear panel is shown in Figure 2-3. The rear panel contains a 26-pin MDR video connectors for connecting to the frame grabber and a DC power jack. The MDR-26 connector is a 3M device as specified in the Camera Link Spec.

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.

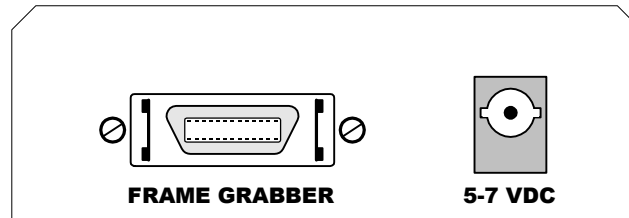


Figure 2-3: CLR-101C Rear Panel

2.2.1. Video Connector Signals

The 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.

2.2.2. Cable Shield Grounding

Camera and frame grabber cable “outer” shields are connected to the CLR-101C aluminum case. Case and endplate contacting surfaces are unpainted, providing a Faraday cage to shield internal circuitry. The case is isolated from the CLR-101C 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 CLR-101C and the frame grabber.

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

3. Mechanical

3.1. Dimensions

The CLR-101C Camera Link Repeater cabinet dimensions are shown in Figure 3-1.

The CLR-101C 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.

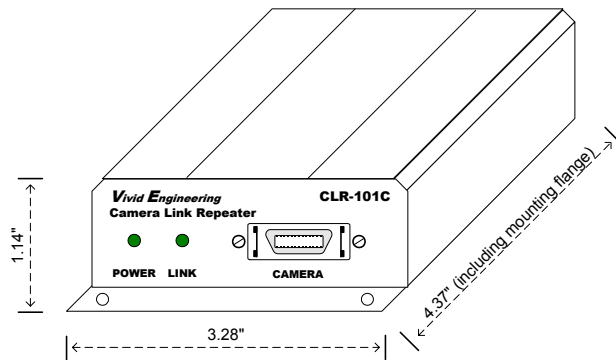


Figure 3-1: CLR-101C Cabinet Dimensions

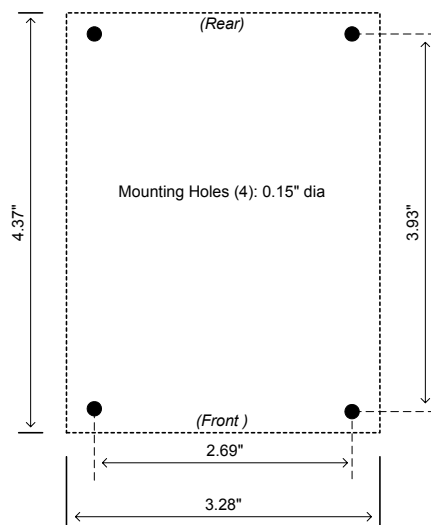


Figure 3-2: Mounting Footprint Drawing

3.2. External Power Supply

The CLR-101C is powered by 5-7 VDC and incorporates a special 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 CLR-101C 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 CLR-101C may also be purchased with the locking power supply plug, or without a power supply.

The CLR-101C is protected by an internal resettable fuse.

4. Revision History

Table 4-1: CLR-101C User's Manual Revision History

Document ID #	Date	Changes
200624-0.1	11/17/2010	Preliminary release of manual