PLEORA TECHNOLOGIES INC.

iPORT CL-GigE External Frame Grabber User Guide

Pleora Technologies

Document Number

EX001-025-0002 Version 3.0, 09/22/20

Important Power Information

To avoid damage to the CL-GigE (and in some cases the connected equipment), it is important that you follow the correct power sequence:

- If you are using GPIO inputs, set the **Differential Type** switch and **I/O Level** switch BEFORE you connect equipment and BEFORE you apply power to the CL-GigE.
- Always power up the CL-GigE BEFORE the camera:
  - Power up the CL-GigE and wait until it is fully powered (the Power/FPGA status LED is green).
  - Connect the camera to the CL-GigE.
  - Apply power to the camera.
- Always power down the camera BEFORE you power down the CL-GigE.

Complete Power Information and Instructions

For complete power information and instructions, refer to the following sections of this guide:

Important Overview: "Powering the CL-GigE" on page 23

- "Differential Type and I/O Level Switches" on page 19
- "Powering the CL-GigE Using PoE" on page 23
- "Powering the CL-GigE Using an External Power Supply" on page 24

Ensuring Proper Image Streaming From a Camera Link Camera

Important: Before you attempt to stream images, you must know the image settings of your Camera Link camera, and then configure the CL-GigE with matching image settings.

Steps to Ensure Proper Image Streaming

1. Ensure you have installed the latest release of Pleora's eBUS SDK and supporting drivers on your computer. For more information, see "Installing the eBUS SDK" on page 41.
2. Physically connect the camera, CL-GigE, and computer. Power up the system. For more information, see "CL-GigE Connections" on page 11.
3. Test the connection between the CL-GigE and the computer using the test pattern. For more information, see "Confirming Image Streaming" on page 50.
4. If you want to configure your camera's settings or if your camera requires that you send a serial command to start image acquisition, you can set up Camera Link serial communications. For more information, see "Accessing your Camera Settings through Camera Link Serial Communications" on page 54.
5. After you have configured the image settings on the camera, you must then configure matching image settings on the CL-GigE. For more information about configuring CL-GigE settings, see "Configuring CL-GigE Image Settings Using eBUS Player" on page 55.

The changes that you make to your CL-GigE are temporary and WILL NOT PERSIST ACROSS POWER CYCLES. Save your settings using the steps outlined in "Saving eBUS Player and CL-GigE Settings" on page 67 to avoid losing changes when the CL-GigE is power-cycled.

Table of Contents

Chapter 1

About this Guide

This chapter describes the purpose and scope of this guide, and provides a list of complementary guides.

The following topics are covered in this chapter:

What this Guide Provides

This guide provides you with the information you need to connect the CL-GigE to a Base Camera Link camera.

In this guide you can find product overviews, instructions for connecting the cables, installing the Pleora eBUS™ SDK, establishing connections, performing general configuration tasks, and configuring the settings to properly capture and display images from a Camera Link camera. The last chapter of this guide provides Technical Support contact information for Pleora Technologies.

Documented Product Versions

This guide covers the following product versions. The features and functionality documented in this guide may vary if you are using an earlier or later version of the product.

Table 1: Documented Product Versions

Product	Release/version documented in this guide...
iPORT CL-GigE External Frame Grabber	1.3.2
eBUS SDK and eBUS Player	6.1

Related Documents

The *iPORT CL-GigE External Frame Grabber User Guide* is complemented by the following Pleora Technologies documents, which are available on the Pleora Technologies Support Center (supportcenter.pleora.com):

- *eBUS Player Quick Start Guide* and *eBUS Player User Guide*, available for Windows, Linux, and macOS
- *eBUS SDK API Quick Start Guides*, available for C++, .NET, Linux, and macOS
- *iPORT Advanced Features User Guide*
- *Configuring Your Computer and Network Adapters for Best Performance* knowledge base article
- *Stream Control Application Note*
- *Introduction: Establishing a Serial Bridge* knowledge base article
- *Updating Pleora Firmware* knowledge base article

You can also consult the *eBUS SDK API Help Files*, which are installed on your computer during the installation of the eBUS SDK. You can access this documentation from the Windows Start menu under **eBUS SDK**.

Further Reading

Although not required in order to successfully use the CL-GigE, you can find details about industry-related standards and naming conventions in the following documents:

- *GigE Vision Standard, version 2.0* available from the Automated Imaging Association (AIA) at www.visiononline.org.
- *GenICam Standard Features Naming Convention* available from the European Machine Vision Association (EMVA) at www.emva.org.
- *Camera Link Standard, version 2.0* available from the Automated Imaging Association (AIA) at www.visiononline.org.
- *Pixel Format Naming Convention*, available from the European Machine Vision Association (EMVA) at www.emva.org.

Chapter 2

About the iPORT CL-GigE External Frame Grabber

This chapter describes the CL-GigE External Frame Grabber, including the models and key features.

The following topics are covered in this chapter:

Models

The CL-GigE is available in several models and is equipped with the parts listed in the following tables. Before assembly, ensure that all components are included in the selected package.

Table 2: Models

Order code	Model	Quantity
900-6010	**iPORT CL-GigEB-IND in mountable enclosure** *Device Model Name: iPORT CL-GigE-PT01-CLOIP01-128x*	
	iPORT CL-GigEB-IND External Frame Grabber **in mountable enclosure** for Camera Link Base mode (industrial use).*	1
900-6009	**iPORT CL-GigEB-IND OEM board set** *Device Model Name: iPORT CL-GigE-PT01-CLOIP01-128x*	
	iPORT CL-GigEB-IND External Frame Grabber **OEM board set** for Camera Link Base mode (industrial use).* • Includes a GPIO board assembly, flat flex cable, unsoldered 12-pin GPIO connector, and SDR-26 jack socket screws**	1
900-6011	**iPORT CL-GigEB-IND Development Kit**	
	iPORT CL-GigEB-IND External Frame Grabber (900-6010)	1
	Gigabit Ethernet desktop NIC	1
	Ethernet cables	2
	PoE injector (power supply)	1
	eBUS SDK USB Stick	1

* We recommend that you use a PoE power injector, PoE-enabled GigE switch, or an external power supply such as the one supplied by Pleora, part number 904-3905.

** If you will be powering the CL-GigE using PoE and do not plan on using the CL-GigE's GPIO signals, you do not need to solder the 12-pin GPIO connector to the board.

Feature Set

	CL-GigEB-IND	CL-GigEB-IND
Order code	900-6010	900-6009
Device Model Name	iPORT CL-GigE-PT01-CL0IP01-128x	
Description	Enclosed, industrial use	OEM board set, industrial use
Camera Link mode	**Base**	**Base**
Channels	Single	Single
MiniCL connectors	1	1
External or PoE powered	Yes	Yes
PoCL	Yes	Yes
Operating temperature	• **External powered:** -40°C to 60°C • **PoE powered with PoCL off:** -40°C to 55°C • **PoE powered with PoCL on:** -40°C to 50°C	See note*
Storage temperature	-40°C to 85°C	
Dimensions (L x W x H) (mm)**	38 x 83 x 51	48.2 x 52 x 37
Weight (grams)	161	47
GPIO		
LVDS/RS-422/HVTTL/±24V/±30V differential or TTL/LVCMOS single-ended inputs	2	2
TTL/LVCMOS single-ended inputs	2	2
TTL/LVCMOS single-ended outputs	3	3
MTBF at 40°C (hours)	1,014,151	1,014,151
Interface and transfer rate	GigE interface with 1 Gb/s transfer rate	
Standards compliance	Compliant with Camera Link version 2.0 and GigE Vision version 2.0	
Regulatory compliance	RoHS2; REACH	
Tap support	1 and 2 tap (dependent on selected pixel format)	
Pixel clock	20 MHz to 85 MHz	
Frame buffer	128 MB (120 MB is used for the frame buffer, 8 MB is used for the CL-GigE firmware)	
Serial communication	1 UART on Camera Link interface allows serial control of cameras using a computer application over the GigE connection	

*Case and junction temperature limits vary by IC device. For more information, see "Ambient and Junction Temperatures" on page 27.

**Approximate, excluding 12-pin GPIO connector.

Key GenICam Features

The CL-GigE supports the seven features mandated by the GigE Vision standard, along with many additional features. The following table lists these mandatory features along with some of the key GenICam features. The full list of features can be seen in the Device Control dialog box of Pleora's eBUS Player application.

Table 3: Key GenICam Features

Feature	Description
DeviceScanType	Specifies the sensor scan type, such as areascan or linescan.
SensorDigitizationTaps	Specifies the number of digitized samples output simultaneously by the camera.
WidthMax	Specifies the maximum width of the image (in pixels).
HeightMax	Specifies the maximum height of the image (in pixels).
Width	Specifies the width of the image (in pixels).
Height	Specifies the height of the image (in pixels).
OffsetX	Specifies the horizontal image offset (in pixels).
OffsetY	Specifies the vertical image offset (in pixels).
PixelFormat	Specifies the format of the pixels provided by the camera.
ClConnectorSelector	Selects the Camera Link interface to configure.
ClSafePowerActive	Controls whether the SafePower protocol is active. SafePower is a protocol to prevent the CL-GigE from attempting to supply power to a conventional (non-PoCL) cable or camera.
ClSafePowerStatus	Reports the status of the SafePower controller.

Available Pixel Formats

The following table lists the pixel formats available on the CL-GigE.

Table 4: Available Pixel Formats

Taps	Pixel Formats
1, 2 taps	Mono8 (Default), Mono8s, Mono10, Mono10Packed, Mono12, Mono12Packed
1 tap	Mono14, Mono16
1, 2 taps	BayerGR8, BayerRG8, BayerGB8, BayerBG8
1, 2 taps	BayerGR10, BayerRG10, BayerGB10, BayerBG10
1, 2 taps	BayerGR12, BayerRG12, BayerGB12, BayerBG12
1, 2 taps	BayerGR10Packed, BayerRG10Packed, BayerGB10Packed, BayerBG10Packed
1, 2 taps	BayerGR12Packed, BayerRG12Packed, BayerGB12Packed, BayerBG12Packed
1 tap	BayerGR16, BayerRG16, BayerGB16, BayerBG16
1 tap	RGB8, BGR8
1, 2 taps	SCF1WGWR8
1, 2 taps	SCF1WGWR10
1, 2 taps	SCF1WGWR12
1 tap	SCF1WGWR14
1, 2 taps	YUV411_8_UYYVYY
1 tap	YUV422_8_UYVY
1 tap	YUV8_UYV
1 tap	YCbCr422_8_CbYCrY
1 tap	YCbCr709_422_8_CbYCrY
1, 2 taps	YCbCr709_411_8_CbYYCrYY

Chapter 3

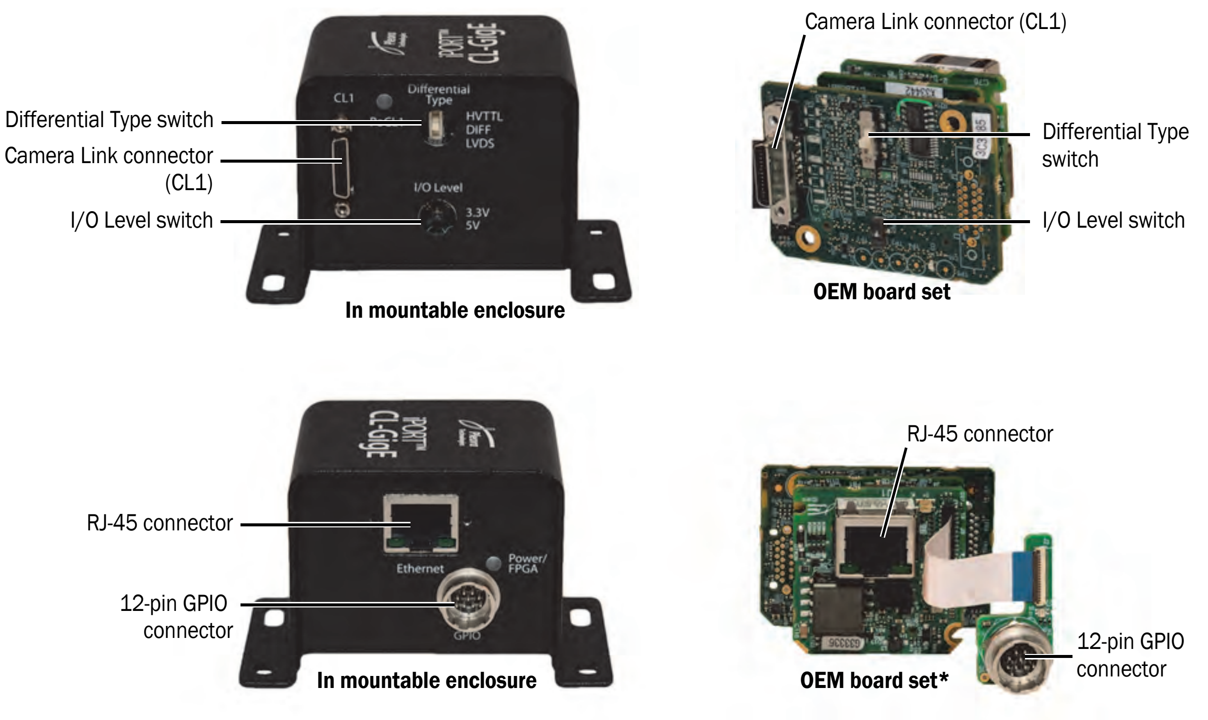
CL-GigE Connections

This chapter describes the CL-GigE connections, including connector details and pinout information. When the CL-GigE is powered, you can observe the status LEDs.

The following topics are covered in this chapter:

Connector and Switch Locations

The following figures and table describe the CL-GigE connectors and switches.



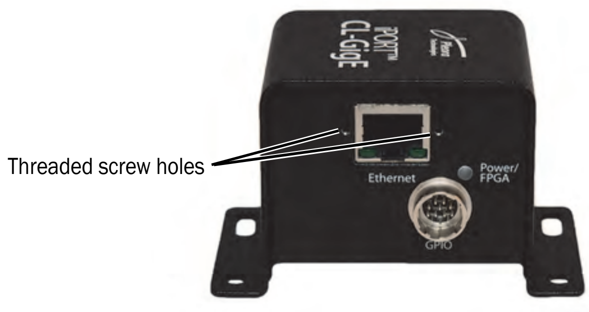
*GPIO board assembly with soldered 12-pin connector and flat flex cable shown.

Table 5: Connectors and Switches

Component	Type	Description
CL1 connector	Miniature Camera Link (MiniCL) connector	Provides connection to a Camera Link Base camera. Serial communication on this connector is mapped to the Bulk0 serial communication interface of the CL-GigE. When PoCL is enabled, the CL-GigE can supply 4 W at 12 V to the Camera Link connector, as outlined in the *Camera Link Standard*. For more information, see "Camera Link Connector" on page 13.
GPIO connector	12-pin circular connector	Provides power and I/O signals to the CL-GigE. For more information, see "12-Pin GPIO Connector" on page 16.
RJ-45 connector	RJ-45 Ethernet connector	Interfaces the CL-GigE to Ethernet networks, as specified in IEEE 802.3. The Ethernet interface can operate at 100 or 1000 Mbps, and supports Internet Protocol Version 4 (IPv4).
Differential Type switch	3-position DIP switch	Selects the termination type for differential inputs. For more information, see "Differential Type and I/O Level Switches" on page 19.
I/O Level switch	2-position DIP switch	Selects the voltage for single-ended GPIO inputs and outputs (3.3 V or 5 V). For more information, see "Differential Type and I/O Level Switches" on page 19.

RJ-45 Locking Connectors

The CL-GigE supports the Type 090 RJ-45 locking connectors specified by the *GigE Vision Standard, Mechanical Supplement, version 1.0 draft A*. The enclosure includes threaded screw holes that comply with the connectors specified in the standard.



Camera Link Connector

The CL-GigE supports one Base Camera Link camera, which streams image data to the CL-GigE. The CL1 connector is used to connect a Camera Link camera to the CL-GigE using one standard Camera Link cable, as outlined in the *Camera Link Standard*. This connector can process up to 24 bits of data from the camera and provides the following Camera Link control signals, as outlined in the *Camera Link Standard*: CC1, CC2, CC3, and CC4.

Powering a Camera using Power Over Camera Link (PoCL)

The CL-GigE can optionally supply power to a camera using PoCL, in accordance to the *Camera Link Standard*. When powered using PoCL, 4 W at 12 V is supplied to the Camera Link connector for compatible cameras.

To enable PoCL and to prevent the CL-GigE from attempting to supply power to a non-PoCL cable or camera, you must enable the **ClSafePowerActive** feature using eBUS Player (or an application created with the eBUS SDK). For more information, see "Enabling SafePower and PoCL" on page 58.

When power is being supplied to the camera using PoCL, the **PoCL1** status LED will be on. For more information about the status LEDs, see "Status LEDs" on page 26.

Voltage Drop Monitoring

The CL-GigE includes a **Voltage Dropped** state that monitors a voltage drop from 12 V to a voltage below 10.5 V for cameras using PoCL. If the voltage drops below 10.5 V for more than 20 ms, the CL-GigE returns to the **PoCL Sensing** state.

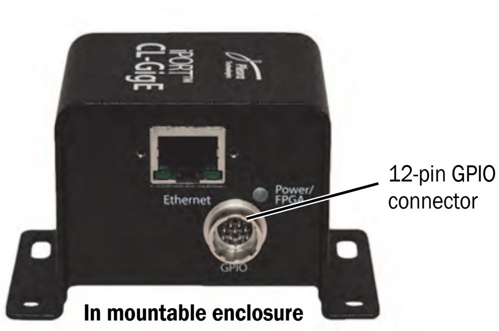
For information about viewing the SafePower status and the status changes that occur, including **PoCL Sensing**, see "Enabling SafePower and PoCL" on page 58.

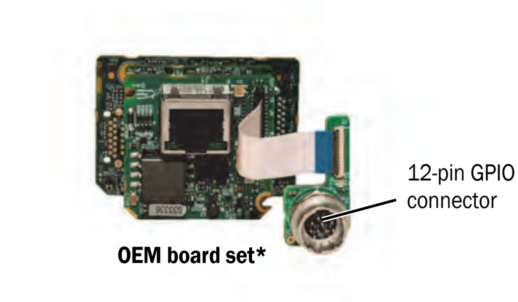
Mapping to the Serial Communication Interface

The CL1 Camera Link connector is mapped to the Bulk0 serial communication interface on the CL-GigE.

Mapping of Camera Link Connector and 12-Pin GPIO Connector Inputs

The GPIO pins on the 12-pin GPIO connector allow an external signal to control a Camera Link camera, and are typically used for triggering. For example, you can use a trigger to synchronize image capture from multiple cameras or to synchronize image capture with an external device.





*GPIO board assembly with soldered 12-pin connector and flat flex cable shown.

Using the Programmable Logic Controller (PLC), you can map and modify the GPIO input signals (GPIO_IN3, GPIO_IN2, GPIO_IN1, and GPIO_IN0) to:

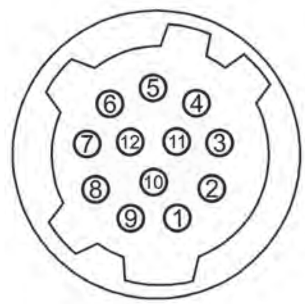
- the camera control output signals (CC1, CC2, CC3, CC4) on the CL1 connector; and
- the GPIO output signals (GPIO_OUT2, GPIO_OUT1, GPIO_OUT0) on the 12-pin GPIO connector.

There are 16 possible mappings of the GPIO signals. For more information, see "Handling GPIO, Camera Control, and PLC Input and Output Programming Signals" on page 29.

12-Pin GPIO Connector

The GPIO inputs and outputs on the 12-pin GPIO connector support a variety of differential and single-ended inputs and outputs, such as HVTTL, LVDS, and LVCMOS.

The pinouts for the 12-pin GPIO connector are listed in the following table.



The manufacturer and part number are provided in "Material List" on page 100.

The mating connector is a Hirose 12-pin circular connector, part number HR10A-10P-12S(73).

Table 6: 12-Pin GPIO Connector Pinouts

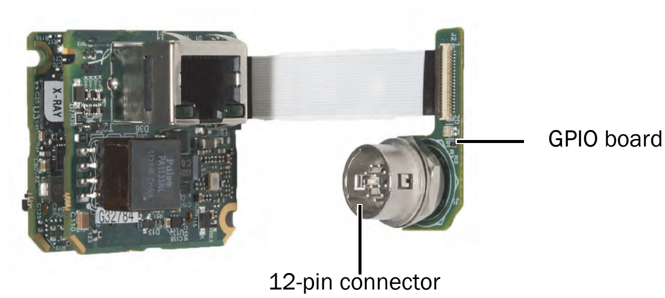
Pin	Function	Type	PLC signal	Notes
1	RET	Power return	N/A	Ground
2	VIN	Power input	N/A	Protected by 600 W @ 1.0 ms PP Zener TVS, +/- 30 kV per KBM. Receives 11.7 V to 13 V unfiltered DC input, up to 0.7 A.
3	GPIO_IN1-	Differential input1 negative	GpioIn1	Do not connect for single-ended operation. Pin 6 provides the single-ended connection.
4	GPIO_OUT2	Single-ended output	GpioOut2	
5	GND/EMI_GND	Ground		Signal ground
6	GPIO_IN1+	Differential input1 positive	GpioIn1	Can be used as a single-ended input (optional).
7	GPIO_OUT1	Single-ended output	GpioOut1	
8	GPIO_IN0-	Differential input0 negative	GpioIn0	Do not connect for single-ended operation. Pin 10 provides the single-ended connection.
9	GPIO_OUT0	Single-ended output	GpioOut0	
10	GPIO_IN0+	Differential input0 positive	GpioIn0	Can be used as a single-ended input (optional).

Table 6: 12-Pin GPIO Connector Pinouts (Continued)

Pin	Function	Type	PLC signal	Notes
11	GPIO_IN3	Single-ended input	GpioIn3	
12	GPIO_IN2	Single-ended input	GpioIn2	

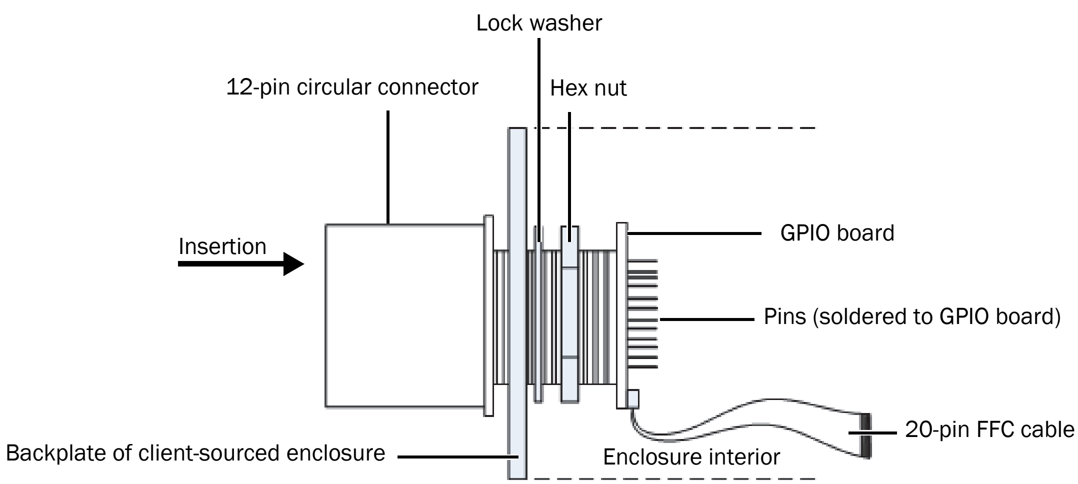
Mounting the 12-Pin GPIO Connector to an Enclosure Backplate

The CL-GigE is optionally available with a removable 12-pin GPIO connector and the corresponding GPIO board that are suitable for mounting to a client-sourced enclosure.



To mount the 12-pin GPIO connector to an enclosure backplate

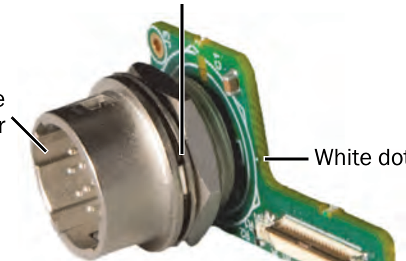
1. Insert the 12-pin connector through the external side of the backplate.
2. Secure with washer and hex nut.
3. Connect the GPIO board (12 holes) to the base pins of the 12-pin connector through the internal side of the backplate.



4. Assemble the 12-pin GPIO connector to the GPIO board by lining up the pins with the GPIO board.

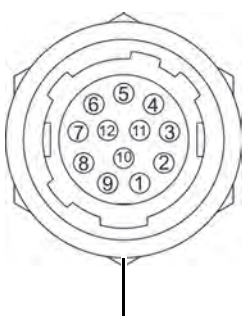
> When oriented correctly, the tab on the 12-pin connector is aligned with the small white dot on the GPIO board, as shown in the following figure. Please disregard the white numbering on the back of the GPIO board, as the pin numbers are labeled incorrectly in early versions of the product.

5. Solder the pins of the connector to the GPIO board for a secure connection.

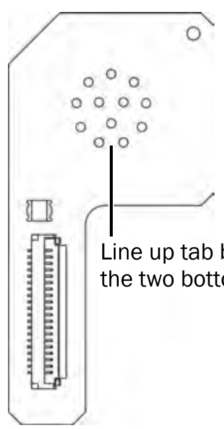


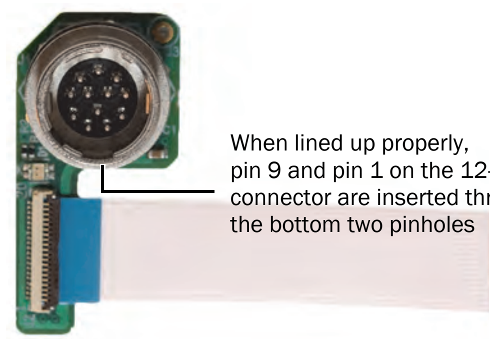
GPIO board and 12-pin male connector (assembled)

12-pin male connector



GPIO board

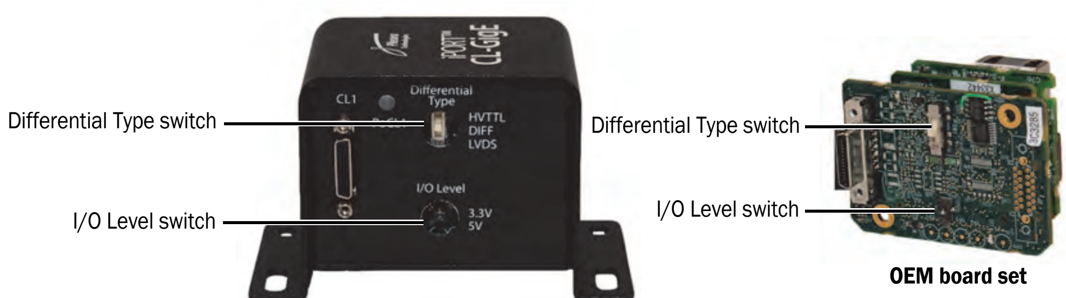




GPIO board and 12-pin male connector (assembled)

Differential Type and I/O Level Switches

The Differential Type and I/O Level switches are used to configure the CL-GigE to work with single-ended and differential inputs.



In mountable enclosure

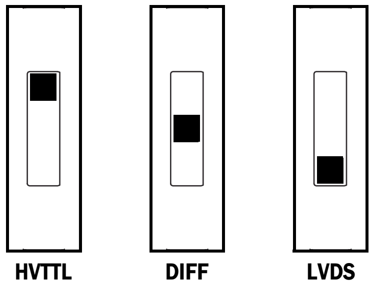
OEM board set

Warning:

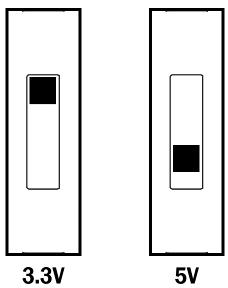
To avoid damage to the CL-GigE and connected equipment (or reduced lifetime of the **Differential Type** switch), ensure you observe the following precautions:

- Set the **Differential Type** and **I/O Level** switches <u>BEFORE</u> you connect equipment and apply power to the CL-GigE.
- Do not set the **Differential Type** switch to **HVTTL** when you are using LVDS equipment.
- Do not change the **Differential Type** switch setting while the CL-GigE is powered or while devices are connected.

The **Differential Type** switch is used to select the differential and single-ended signal levels.



The **I/O Level** switch is used to select either 3.3 V LVCMOS or 5 V TTL operation, and is used with single-ended inputs and outputs.



The following table shows how the **Differential Type** and **I/O Level** switches can be set, based on the input type.

Table 7: Switch Settings Based on Input Type

	Input/output type	Set the Differential Type switch to...	Set the I/O Level switch to...
Single-ended inputs and outputs	LVCMOS	DIFF	3.3 V
	TTL	DIFF	5 V
	HVTTL/HVCMOS/HTL	HVTTL	N/A
Differential inputs	LVDS	LVDS	N/A
	RS-422	LVDS or DIFF	N/A
	+/-24 V or +/-30 V	DIFF	N/A

Differential and Single-Ended Input/Output Specifications

The input and output specifications vary, depending on how the **Differential Type** and **I/O Level** switches are set, as listed in the following tables.

Warning:

To avoid damage to the CL-GigE and connected equipment (or reduced lifetime of the **Differential Type** switch), ensure you observe the following precautions:

- Set the **Differential Type** and **I/O Level** switches BEFORE you connect equipment and apply power to the CL-GigE.
- Do not set the **Differential Type** switch to **HVTTL** when you are using LVDS equipment.
- Do not change the **Differential Type** switch setting while the CL-GigE is powered or while devices are connected.

Table 8: GPIO Differential Input Specifications

Specifications	**Input type**				
	Differential +/-24 V, +/-30 V, RS-422	**Differential LVDS, RS-422 with 100 Ohm termination**	**Differential used as single-ended HVTTL/ HVCMOS**	**Differential used as single-ended LVCMOS**	**Differential used as single-ended TTL**
Differential input termination	10 K and 50 pF in series	100 Ohm	N/A	N/A	N/A
Single-ended input termination Negative (-) input	47 K to 1/3 of I/O level (1.1 V for 3.3 V I/O level or 1.7 V for 5 V I/O level)		Do not connect to negative (-) input		
Positive (+) input	100 K to CL-GigE GND				
Input thresholds Low	-200 mV (minimum), differential -50 mV (typical), differential 0 mV (maximum), differential		<6.5 V	<0.9 V	<1.5 V
High	+200 mV (maximum), differential +50 mV (typical), differential 0 mV (minimum), differential		>9.5 V	>1.3 V	>1.9 V
Hysteresis	150 mV (typical)				
Maximum delay	100 nsec	65 nsec	100 nsec	100 nsec	100 nsec
Minimum operation voltage	-30 V				
Maximum operation voltage	+30 V				

Table 8: GPIO Differential Input Specifications (Continued)

Specifications	Input type				
	Differential +/-24 V, +/-30 V, RS-422	Differential LVDS, RS-422 with 100 Ohm termination	Differential used as single-ended HVTTL/ HVCMOS	Differential used as single-ended LVCMOS	Differential used as single-ended TTL
Clamping voltage	Below -42 V, over +42 V				
ESD protection	Up to class -4 (+/-15 kV)				
EMI filtering	Serial ferrite bead 120 Ohm @ 100 MHz				

Table 9: GPIO Single-Ended Input Specifications

Specifications	Input type	
	LVCMOS	TTL
Termination	100 K to CL-GigE GND	
Low threshold	<0.8 V	<1.5 V
High threshold	>2.0 V	>3.5 V
Maximum delay	8 nsec	
Minimum voltage	-0.5 V (absolute)	
Maximum voltage	6.5 V (absolute)	
ESD protection	Up to class -4 (+/-15 kV)	
EMI filtering	Serial ferrite bead 120 Ohm @ 100 MHz	

Table 10: GPIO Output Specifications

Specifications	Output type	
	LVCMOS	TTL
High level output current	+/-24 mA	+/-32 mA
Output Voltage		
High minimum	2.4 V (@24 mA)	3.8 V (@ 32 mA)
High maximum	3.5 V	5.3 V
Low maximum	0.55 V (@24 mA)	0.55 V (@ 32 mA)
Maximum delay	6.4 nsec	
ESD protection	Up to class -4 (+/-15 kV)	
EMI filtering	Serial ferrite bead 120 Ohm @ 100 MHz	

Powering the CL-GigE

The CL-GigE can be powered using Power over Ethernet (PoE) which uses isolated PoE circuitry or through an external power supply.

Powering the CL-GigE Using PoE

One of the ways that you can power the CL-GigE is with PoE. When you power the CL-GigE this way, the PoE power source can be either a PoE power injector or a PoE-enabled GigE switch.

Important Power Sequence Information

To avoid damage to the CL-GigE (and in some cases the connected equipment):

- If you are using single-ended and differential inputs, set the **Differential Type** and **I/O Level** switches BEFORE you connect equipment and BEFORE you apply power to the CL-GigE.
- Always power up the CL-GigE BEFORE the camera.
- Always power down the camera BEFORE the CL-GigE.

To power the CL-GigE using PoE

1. Ensure that the Camera Link camera and the CL-GigE are NOT receiving power.
2. Securely connect the Camera Link cable to the camera and the CL-GigE.

   Ensure that you tighten the screws to prevent the camera from being disconnected accidentally.

   Important: Do not disconnect the Camera Link cable while the camera or CL-GigE are receiving power.
3. Connect the CL-GigE to a PoE power injector or a PoE-enabled GigE switch. Then, connect your computer to the PoE power injector or GigE switch.
4. Apply power to the camera:
   - If you plan on powering the camera using PoCL, use eBUS Player to enable PoCL (using the **ClSafePowerActive** feature). For more information, see "Enabling SafePower and PoCL" on page 58.
   - If you are not powering the camera using PoCL, connect the camera to a power supply.

Powering the CL-GigE Using an External Power Supply

Another way to power the CL-GigE is with a 12 V external power supply through the 12-pin GPIO connector. Optionally, you can purchase an external power supply from Pleora (part number 904-3905).

The CL-GigE can optionally supply power to a camera using PoCL. If the CL-GigE is powered by an external power supply and you supply power to the camera using PoCL, VIN must be in the range of 11.7 V to 13 V to meet the requirements of the *Camera Link Standard*.

External Power Supply — Input Signals

The following table lists the input power signals for the CL-GigE from an external power supply using the 12-pin GPIO connector.

Table 11: Input Signals from the 12-Pin GPIO Connector

Name	Volts (V)	Notes
VIN	11.7-13V	Efficiency of power circuitry (including drops on Schottky diodes) is flat in this range. Unfiltered DC power from an external power supply through the 12-pin GPIO connector. Reverse voltage protected, up to -30 VDC. The CL-GigE generates all internal power rails from the VIN signal. A resident common mode filter allows the input to be unfiltered, directly from a switching wall plug power supply.
RET	Ground	Ground for VIN.
GND	Ground	0 V relative to other voltages on the CL-GigE.

To power the CL-GigE using an external power supply

Important Power Sequence Information

To avoid damage to the CL-GigE (and in some cases the connected equipment):

- If you are using GPIO inputs, set the **Differential Type** and **I/O Level** switches BEFORE you connect equipment and BEFORE you apply power to the CL-GigE.
- Always power up the CL-GigE BEFORE the camera.
- Always power down the camera BEFORE the CL-GigE.

1. Ensure that the Camera Link camera and the CL-GigE are NOT receiving power.
2. Securely connect the Camera Link cable to the camera and to the CL-GigE.

   Ensure that you tighten the screws to prevent the camera from being disconnected accidentally.

   Important: Do not disconnect the Camera Link cable while the camera or CL-GigE are receiving power.

   Tip: We recommend that you connect the CL-GigE to your computer's NIC or a GigE switch before you apply power.
3. Supply 12 V power to the 12-pin GPIO connector on the CL-GigE.

4. Apply power to the camera:
   - If you plan on powering the camera using PoCL, use eBUS Player to enable PoCL (using the **ClSafePowerActive** feature). For more information, see "Enabling SafePower and PoCL" on page 58.
   - If you are not powering the camera using PoCL, connect the camera to a power supply.

If you are not using PoCL, the camera's ground must be electrically floating or attached to the 12 V external power supply ground.

Power Consumption

Power consumption at room temperature using a BK Precision DC Regulated external power supply.

Table 12: Power Consumption Using External Power Supply

Streaming	PoCL enabled	Pixel clock frequency (MHz)	Sensor digitization taps	Width	Height	Pixel format	Data rate (Mbps)	Power (W)
No	No	20	N/A	N/A	N/A	N/A	Idle	2.1
No	No	42	N/A	N/A	N/A	N/A	Idle	2.1
No	No	85	N/A	N/A	N/A	N/A	Idle	2.2
Yes	No	20	1	1024	1024	Mono12	319	2.2
Yes	No	42	1	1024	1024	Mono12	670	2.3
Yes	No	85	1	1024	1024	Mono12	990	2.4

Power consumption at room temperature using PoE and a Cisco SG200-08P Ethernet switch.

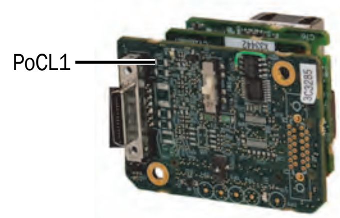
Table 13: Power Consumption Using PoE

								Switch reading
Streaming	PoCL enabled	Pixel clock frequency (MHz)	Sensor digitization taps	Width	Height	Pixel format	Data rate (Mbps)	Power (W)
No	No	20	N/A	N/A	N/A	N/A	Idle	2.3
No	No	42	N/A	N/A	N/A	N/A	Idle	2.3
No	No	85	N/A	N/A	N/A	N/A	Idle	2.4
Yes	No	20	2	1024	1024	Mono12	638	2.4
Yes	No	42	2	1024	1024	Mono12	990	2.6
Yes	No	85	2	1024	1024	Mono12	990	2.7

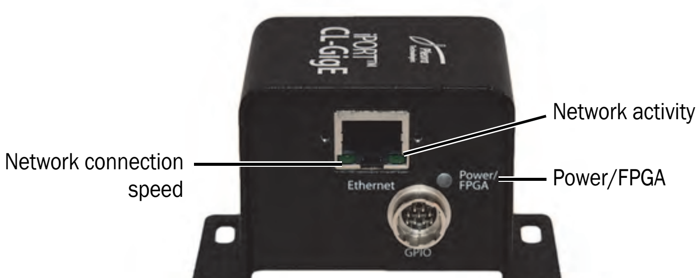
Status LEDs

The CL-GigE has status LEDs that indicate the operating status of the network connection, PoCL, power, and firmware, as described in the following table.

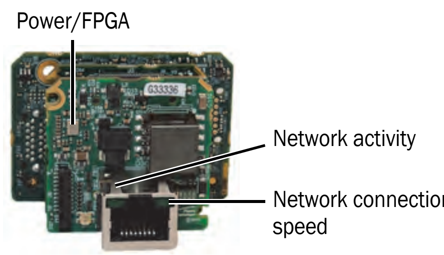
In mountable enclosure



OEM board set



In mountable enclosure



OEM board set

Table 14: Status LEDs

LED	Description
Power/FPGA	**Green:** The CL-GigE is receiving power and the main firmware load is being used. **Yellow:** The CL-GigE is receiving power and the backup firmware load is being used. **Off:** The CL-GigE is not receiving power.
Network activity	**Off:** No Ethernet connection. **Green:** Ethernet link. **Green, flashing:** Data is being transmitted or received.
Network connection speed	**Off:** No connection, 10 Mbps connection, or 100 Mbps connection. **Green:** 1 Gbps connection.
PoCL1	**Green:** Power over Camera Link (PoCL) is active and the camera is being powered using PoCL. **Off:** The camera is not receiving power through PoCL.

Chapter 4

Ambient and Junction Temperatures

This chapter provides you with the information you need to ensure the optimal operating temperature for your CL-GigE OEM board set.

> You should store the CL-GigE at temperatures between -40°C to +85°C.

This chapter lists the components that consume the largest amount of power on the CL-GigE OEM board set, and will therefore be most affected by high temperatures. You must provide a method to cool these components using a heat sink or thermal pad.

Table 15: Thermal Guidelines, OEM Board Set

Reference designator and location	Component and manufacturer part number	Rating for component on standard Pleora product*
U2, GigE PHY board	Marvell PHY **Part number:** 88E1510-A0-NNB2I000	**Ambient:** -40°C to +85°C **Junction:** -40°C to +125°C **Case:** Not specified **Junction-to-case thermal resistance ΘJC:** 18.6 (°C/W) **Junction-to-ambient thermal resistance ΘJA:** • **Still air:** 35.2 (°C/W) • **1 m/sec:** 30.5 (°C/W) • **2 m/sec:** 29.3 (°C/W) • **3 m/sec:** 28.4 (°C/W) **Power consumption:** ~ 450 mW

Table 15: Thermal Guidelines, OEM Board Set (Continued)

Reference designator and location	Component and manufacturer part number	Rating for component on standard Pleora product*
U2, FPGA board	ISSI DDR3 **Part number:** IS43TR16640A-15GBLI	**Ambient:** Not specified **Junction:** Not specified **Case:** -40°C to +95°C **Junction-to-case thermal resistance ΘJC:** Not specified **Junction-to-ambient thermal resistance ΘJA:** Not specified **Power consumption:** ~ 130 mW at 1Gbps streaming.
U1, FPGA board	Altera FPGA **Part number:** 5CEFA4U19I7N	**Ambient:** Not specified **Junction:** -40°C to +100°C **Case:** Not specified **Junction-to-case thermal resistance ΘJC:** 5 (°C/W) **Junction-to-ambient thermal resistance ΘJA:** • **Still air:** 23.6 (° C/W) • **100 ft./min:** 19.5 (°C/W) • **200 ft./min:** 17.5 (°C/W) • **400 ft./min:** 15.9 (°C/W) **Power consumption:** • ~ 980 mW

* ΘJC = (Tj - Ta)/Ptop, where Ptop = Power dissipation from the top of the package.

ΘJA = (Tc - Ta)/P, where P = Total power dissipation.

Chapter 5

Handling GPIO, Camera Control, and PLC Input and Output Programming Signals

The CL-GigE includes a programmable logic controller (PLC) that lets you control external machines and react to inputs. By controlling your system using the PLC, you can make functional changes, adjust timing, or add features without having to add new hardware.

If your system includes a quadrature encoder, you can process its signals and produce trigger signals for the camera using the CL-GigE's PLC, as described later in this chapter.

> For an introduction to the PLC and for detailed information about how PLC signals are handled, see the *iPORT Advanced Features User Guide*, available on the Pleora Support Center at supportcenter.pleora.com.

The following topics are covered in this chapter:

PLC Input and Output Programming Signals

The following table lists the PLC input and output programming signals and indicates the pins on which they are available.

Table 16: PLC Signal Usage

Signal name	PLC equation usage	Associated pin on the 12-pin GPIO connector	Camera Link connector
Pb0Fval	In	No associated pin	
Pb0Lval	In	No associated pin	
Pb0Dval	In	No associated pin	
Pb0Spare	In	No associated pin	
GpioIn0	In	Pin 10 (GPIO_IN0+), 8 (GPIO_IN0-)	
GpioIn1	In	Pin 6 (GPIO_IN1+), 3 (GPIO_IN1-)	
GpioIn2	In	Pin 12 (GPIO_IN2)	
GpioIn3	In	Pin 11 (GPIO_IN3)	
BufferWM0	In	No associated pin	
Grb0AcqActive	In	No associated pin	
PlcCtrl0	In	No associated pin	
PlcCtrl1	In	No associated pin	
PlcCtrl2	In	No associated pin	
PlcCtrl3	In	No associated pin	
Pb0CC0	In, out	No associated pin	CC1
Pb0CC1	In, out	No associated pin	CC2
Pb0CC2	In, out	No associated pin	CC3
Pb0CC3	In, out	No associated pin	CC4
GpioOut0	In, out	Pin 9 (GPIO_OUT0)	
GpioOut1	In, out	Pin 7 (GPIO_OUT1)	
GpioOut2	In, out	Pin 4 (GPIO_OUT2)	
PlcFval0	In, out	No associated pin	
PlcLval0	In, out	No associated pin	
PlcMval0	In, out	No associated pin	
PlcTrig0	In, out	No associated pin	
PlcTimestampCtrl	In, out	No associated pin	
Timer0Trig	In, out	No associated pin	

Table 16: PLC Signal Usage (Continued)

Signal name	PLC equation usage	Associated pin on the 12-pin GPIO connector	Camera Link connector
Timer0Out	In	No associated pin	
Timer1Trig	In, out	No associated pin	
Timer1Out	In	No associated pin	
Timer2Trig*	In, out	No associated pin	
Timer2Out*	In	No associated pin	
Timer3Trig*	In, out	No associated pin	
Timer3Out*	In	No associated pin	
Counter0Reset	In, out	No associated pin	
Counter0Inc	In, out	No associated pin	
Counter0Dec	In, out	No associated pin	
Counter0Eq	In	No associated pin	
Counter0Gt	In	No associated pin	
Counter1Reset	In, out	No associated pin	
Counter1Inc	In, out	No associated pin	
Counter1Dec	In, out	No associated pin	
Counter1Eq	In	No associated pin	
Counter1Gt	In	No associated pin	
Rescaler0In	In, out	No associated pin	
Rescaler0Out	In	No associated pin	
Delayer0In	In, out	No associated pin	
Delayer0Out	In	No associated pin	
Event0	In, out	No associated pin	
Event1	In, out	No associated pin	
Event2	In, out	No associated pin	
Event3	In, out	No associated pin	
ActionTrig0	In	No associated pin	
ActionTrig1	In	No associated pin	

* Available in release 1.3.1 (and later) of the CL-GigE firmware.

Using Quadrature Encoders

Quadrature encoder sensors produce electrical signals that indicate the direction, speed, and motion of the processed material on the web or conveyor systems. These signals are often used to control camera triggering to provide uniform images under varying load conditions. The quadrature encoder's signals are typically processed by an external frame grabber that produces a trigger signal for the camera.

Quadrature encoders have a solid or hollow shaft that is mechanically connected to a motor or rotating apparatus on the web or conveyor system. Two-phase quadrature encoders have two outputs labeled **A** and **B**, which produce square wave signals when the shaft is rotating. These signals are 90° out-of-phase. When the shaft changes rotation between clockwise and counter-clockwise directions, these signals change phasing between +90° and -90°.

Figure 1: Two-Phase Quadrature Encoder Signals

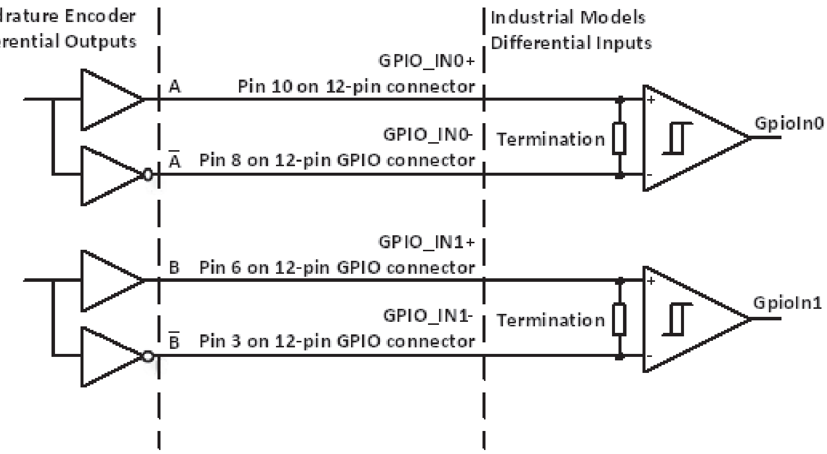
This change is used to detect direction of motion. The rate of the square wave signals is proportional to the rotation speed of the shaft. This change is also used for detecting speed of motion. When these signals are steady-state, and are not producing square wave signals, the motion has stopped.

For information about the electrical interface on the CL-GigE, see "Differential Type and I/O Level Switches" on page 19.

Differential Connection

The following diagram illustrates a typical differential connection to a quadrature encoder.

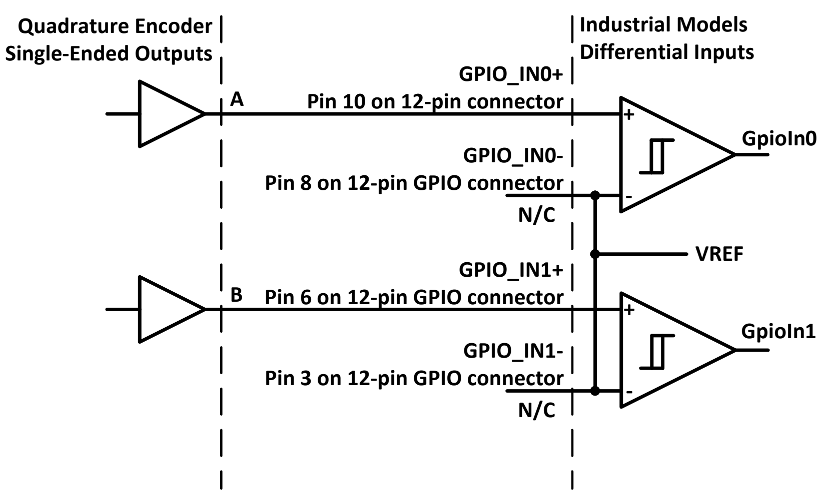
Figure 2: Typical Differential Connection to Quadrature Encoder



Single-Ended Connection

The following diagram illustrates a typical single-ended connection to a quadrature encoder.

Figure 3: Typical Single-Ended Differential Connection to Quadrature Encoder



Timer0 is configured with the following settings to generate a trigger pulse. These values may need to be adjusted depending on the selected camera model and system requirements.

Table 17: PLC Timer Equations

Equation	Description
TimerTriggerSource = TriggerInput	Sets the triggering source for the Timer to be its external trigger input.
TimerTriggerActivation = FallingEdge	Sets the Timer to trigger on the external source's falling edge.
TimerGranularityFactor = Granularity30ns	Sets the interval of the Timer's internal clock tick. For this example, we recommend that the selected factor be at least 8x smaller than the period of the highest frequency expected from the quadrature encoder.
TimerDelayRaw = 1	Sets the delay time before the pulse can start. This is the low period of the pulse after the trigger. This value represents the number of Timer internal clock ticks.
TimerDurationRaw = 6	Sets the duration or high time of the pulse. This value represents the number of internal clock ticks.

The signal routing block in the PLC is configured using the Boolean expressions below. **GpioIn0** is signal **A** and **GpioIn1** is signal **B**. Note that "!" in the Boolean expressions represents *not* or inverted.

Table 18: Signal Routing Block Equations

Equation	Description
Timer0Trig = GpioIn0 & !GpioIn1	Generates the trigger signal for **Timer0** from signals **A** and **B**.
Pb0CC0 = !(Timer0Out & GpioIn0)	Masks the trigger for the camera when the conveyor belt or web moves in the reverse direction.

Processing Quadrature Encoder Signals

This section provides an example of how you can using the CL-GigE's PLC to process signals from a quadrature encoder.

Example: Connect **GpioIn0** and **GpioIn1** to quadrature encoder outputs **A** and **B**, respectively.

In this example, images are captured only when the conveyor belt or web is moving in the forward direction. When the conveyor belt or web moves in the forward direction, signal **A** leads signal **B** by 90°. When the conveyor belt moves in the reverse direction, signal **A** lags signal **B** by 90°. The PLC provides a trigger signal on the Camera Link control line **Pb0CC**0 only when signal **A** leads signal **B** by 90°.

The **Timer0** function in the PLC is used to generate the trigger pulse **Timer0Out**. **Timer0** itself is triggered by the falling edge of a Boolean combination of **A** and **B** signals, which obtains the correct quadrature phase for the forward direction. Another Boolean combination is used to produce the trigger signal **Pb0CC0** from signal **B** and **Timer0Out**; when the conveyor belt or web moves in the reverse direction, signal **B** masks the trigger pulse **Timer0Out**.

The following table provides recommendations for using quadrature encoders.

Table 19: Quadrature Encoder Recommendations

Encoder output type	Encoder output	GPIO input	Notes
Differential	A	Differential Input0 positive, pin 10 on the 12-pin connector	PLC signal name: GpioIn0
	$\overline{A}$	Differential Input0 negative, pin 8 on the 12-pin connector	
	B	Differential Input1 positive, pin 6 on the 12-pin connector	PLC signal name: GpioIn1
	$\overline{B}$	Differential Input1 negative, pin 3 on the 12-pin connector	
Single-ended	A	Differential Input0 positive, pin 10 on the 12-pin connector	PLC signal name: GpioIn0 Differential Input0 negative, pin 8 is not connected
	B	Differential Input1 negative, pin 6 on the 12-pin connector	PLC signal name: GpioIn0 Differential Input1 negative, pin 3 is not connected

Chapter 6

Bulk Interfaces

The CL-GigE has one UART interface for serial communication with a connected Camera Link camera.

The following topics are covered in this chapter:

- "GenICam Interface for Serial Communication Configuration" on page 38
- "UART Timing" on page 38

GenICam Interface for Serial Communication Configuration

The following GenICam features are available for serial communication configuration.

Table 20: GenICam Features Available for Serial Communication

Feature	Description
BulkSelector	Selects Bulk0 for configuration.
BulkBaudRate	Selects a predefined Baud rate or programmable option.
BulkBaudRateFactor	Programs a user-defined Baud rate.
BulkLoopback	Loops back downstream data to upstream direction (loops the data back to the computer).
BulkNumOfStopBits	Selects a stop bit option (either 1 or 2).
BulkParity	Selects a parity option (None, Even, or Odd).
BulkUpstreamFifoWatermark	Controls the number of bytes to accumulate in the Bulk interface upstream FIFO before the CL-GigE delivers them to the host using an event type packet.

UART Timing

The UART interface supports:

- 8-bit data transfer
- 1 start bit
- Programmable stop bit(s): 1 or 2 stop bits
- Parity: None, Even, or Odd
- Baud rates:
  - Predefined rates: 9600, 14 400, 19 200, 28 800, 38 400, 57 600, 115 200, 230400*, 460800*, and 921,600*
  - Programmable
- Loop back mode from downstream to upstream

*Available in release 1.3.1 (and later) of the CL-GigE firmware.

Figure 4: UART Timing

A number of preset baud rates can be used. If you require a baud rate that is not covered by the presets, you can specify your own baud rate. To specify your own baud rate:

1. In the **Device Control** dialog box, under **Port Communication**, choose **Programmable** in the **BulkBaudRate** list.
2. In the **BulkBaudRateFactor** field, enter a baud rate between 1 and 511.

   The CL-GigE calculates the baud rate using the following equation:
   (66.666666 MHz * 1000000)/(BulkBaudRateFactor * 16)

*Available in release 1.3.1 (and later) of the CL-GigE.

Table 21: UART Baud Rates

Baud rate (BR) [bps]	Notes
9,600	Preset 0 (default)
14,400	Preset 1
19,200	Preset 2
28,800	Preset 3
38,400	Preset 4
57,600	Preset 5
115,200	Preset 6
230,400*	Preset 7
460,800*	Preset 8
921,600*	Preset 9
Maximum BulkBaudRateValue (when BulkBaudRateFactor is set to 1): 4,166,667 **Minimum BulkBaudRateValue (when BulkBaudRateFactor is set to 511):** 8,154	Programmable baud rate

*Available in release 1.3.1 (and later) of the CL-GigE.

The following table provides the A.C. operating characteristics of the UART interface.

Table 22: A.C. Operating Characteristics of the UART Interfaces

Parameter	Symbol	Min	Max	Units	Notes
Data period	t_{UART}	0.240	122.64	µs	
Baud rate	BR	8 154	4 166 667	bps	$1/t_{UART}$

Chapter 7

Installing the eBUS SDK

This chapter describes how to install the eBUS SDK, and also provides information about installing the GigE Vision driver.

The following topics are covered in this chapter:

Installing the eBUS SDK

You can install the Pleora Technologies eBUS SDK on your computer to configure and control your CL-GigE.

The eBUS SDK includes:

- Pleora's eBUS Player application, which allows you to control the CL-GigE parameters and view video from a video source connected to the CL-GigE.
- An extensive library of sample applications, with source code, to create working applications for device configuration and control, image and data acquisition, and image display and diagnostics.
- Drivers that optimize the performance of your system.

It is possible for you to configure the CL-GigE and GigE Vision compliant video sources using other GenICam compliant software, however, this guide provides you with the instructions you need to use the Pleora eBUS Player application.

Installing the eBUS Universal Pro Driver

The eBUS SDK includes a GigE Vision driver that enhances existing general-purpose drivers shipped with NICs, increases image acquisition throughput and performance, decreases latency and jitter, and minimizes CPU utilization.

The USB3 Vision driver, which is available during the installation of the eBUS SDK, is for use with USB3 Vision compliant devices, such as the Pleora CL-U3 External Frame Grabber.

The drivers are selected for installation by default during the eBUS SDK installation process. If you choose not to install the drivers (or want to uninstall either driver), you can use the eBUS Driver Installation Tool.

To use the eBUS Driver Installation Tool

1. Click **Start** > **All Programs** > **eBUS SDK** > **eBUS Driver Installation Tool**.
2. Under **GigE Vision**, click **Install** or **Uninstall**.

   After a moment the driver status changes. If you are installing a driver, the driver is installed across all network adapters on your computer.

3. Close the eBUS Driver Installation Tool.

   You may be required to restart your computer.

To see the versions of the installed drivers, click **Help** > **About**.

Chapter 8

Configuring Your Computer’s NIC for use with the CL-GigE

When using the CL-GigE and connected Camera Link camera, you may observe high data rates (above 800 Mb/s) that are close to the physical limit of Gigabit Ethernet (1000 Mb/s). This chapter provides guidance on how to configure your CL-GigE to maximize the performance of your system.

The following topics are covered in this chapter:

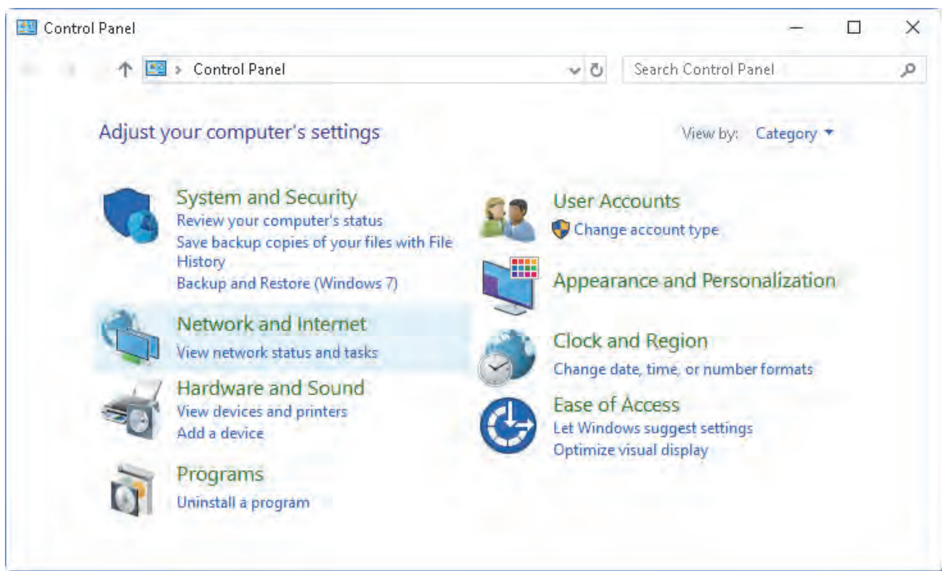
Configuring the NIC for Communication with the CL-GigE

For optimal performance, we recommend that you enable jumbo packets (also known as jumbo frames) and set the receive descriptors to the maximum available value.

The instructions in this section are based on the Windows 10 operating system. The steps may vary depending on your computer's operating system.

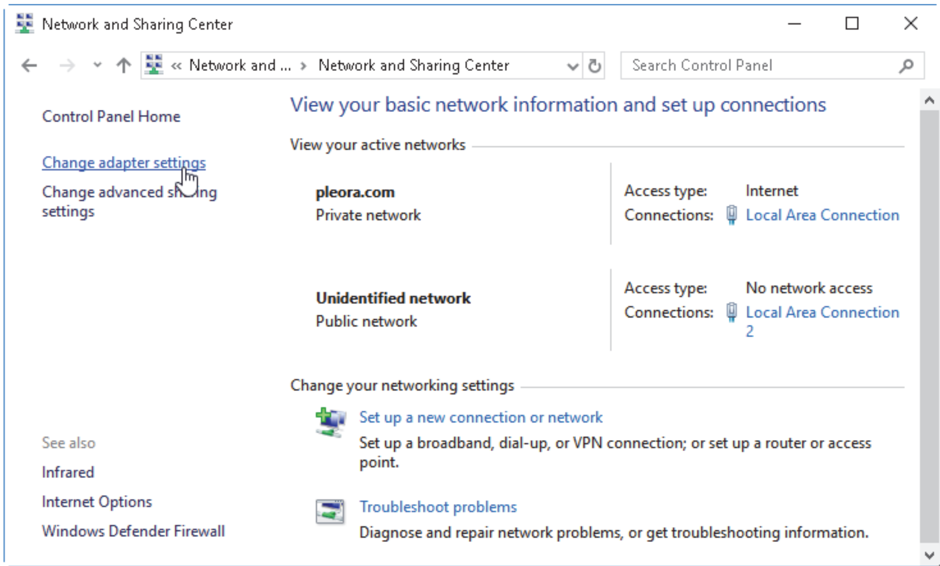
To configure the NIC for optimal performance

1. In the Windows Control Panel, click **Network and Internet**.



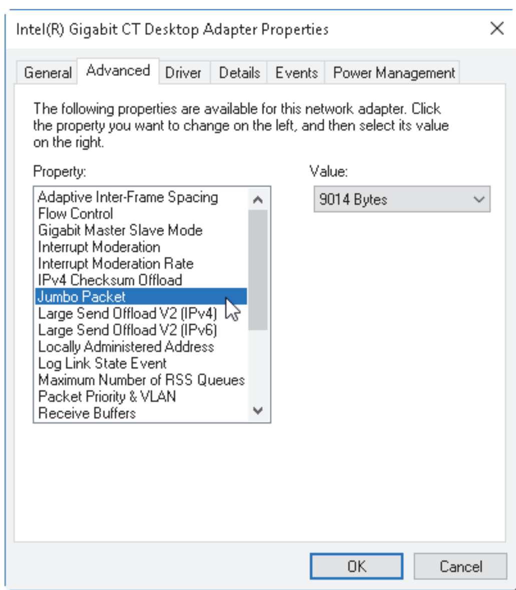
2. Click **Network and Sharing Center**.

3. In the left-hand panel, click **Change adapter settings**.



4. Configure the NIC for jumbo packets (more often referred to as jumbo frames) and set the NIC's **Receive Buffers** (**Receive Descriptors**) to the maximum available value. Using jumbo packets allows you to increase system performance. However, you must ensure your NIC and GigE switch (if applicable) support jumbo packets.

   To complete this task, right-click the NIC and click **Properties**. Then, click **Configure**. The exact configuration procedure, as well as the jumbo packet size limit, depends on the NIC.



5. Close the open dialog boxes to apply the changes and close the Control Panel.

Calculating the Required Bandwidth

To calculate the approximate bandwidth that is required, use the following formula. Keep in mind that this calculation results in an approximate value, and does not take into account Ethernet, IP, UDP, and GigE Vision overhead. Note that each image is broken up into many packets, which should be considered when determining overhead.

PayloadSize (MB) x 8 x Frames Per Second = Bandwidth (Mbps)

PayloadSize is automatically calculated by the CL-GigE, based on the selected image settings, which include **Width**, **Height**, **OffsetX**, **OffsetY**, **PixelSize**, and any padding that has to be added to the image payload. To see the **PayloadSize**, open eBUS Player, connect to the CL-GigE, and then click **Device control**. **PayloadSize** appears in the **TransportLayerControl** category.

For example, for a CL-GigE configured with 1280 x 720, a 16-bit pixel format, and a **PayloadSize** of 1.84 MB at 60 frames per second, the equation would look like this:

1.84 MB x 8 x 60 Hz = 883.2 Mbps

Understanding the Factors that can Effect Bandwidth and Performance

This section provides a summary of the features that you can adjust to maximize the bandwidth and performance of your system. For detailed information, see the *Configuring Your Computer and Network Adapters for Best Performance* knowledge base article, available on the Pleora Support Center at supportcenter.pleora.com.

If you experience streaming errors or warnings, such as AUTO_ABORTED, MISSING_PACKETS, or BlocksDropped, see the *Stream Control Application Note*, available on the Pleora Support Center.

Width, Height, and Pixel Format

The **Width**, **Height**, and **PixelSize** have a direct effect on the bandwidth that is used between the CL-GigE and the computer. Increasing the width and the height of the image will result in larger frames being streamed from the CL-GigE.

Acquisition Frame to Skip

If the CL-GigE drops frames because of high bandwidth usage (close to 1 gigabit), you can reduce the bandwidth by adjusting the **AcquisitionControl\AcquisitionFrameToSkip** feature.

You can set this feature to **2** to skip two frames and then send one frame, resulting in one out of every three frames being sent, for example.

Packet Size

To decrease the CPU resources required to reassemble full frames, you can increase the **GevSCPSPacketSize**. Doing so increases the size of each packet, resulting in fewer packets, thereby reducing the amount of CPU resources that are used for packet reassembling. Depending on the **GevSCPSPacketSize** you choose, you may need a NIC that supports jumbo packets.

You can also set the **AutoNegotiation** feature to **True**, which allows the eBUS SDK to negotiate the largest packet size that the computer can receive. When acquisition starts, you can see the value that was negotiated for the **GevSCPSPacketSize** feature.

On some occasions, your computer may display a **Connection Lost** error. This can occur when a NIC does not properly support jumbo packets. If this occurs, you can either disable jumbo packets on the NIC or disable the **AutoNegotiation** feature and set the **DefaultPacketSize** manually.

Please note that if you execute the **DeviceReset** command, the **GevSCPSPacketSize** is reset to **576**. To avoid this limitation, you can set the **GevSCPSPacketSize** manually or override this feature using the User Set. The User Set is a feature that lets you save the changes you make to your CL-GigE settings. For more information, see "Saving eBUS Player and CL-GigE Settings" on page 67.

Chapter 9

Connecting to the CL-GigE and Configuring General Settings Using eBUS Player

After you have set up the physical connections to the CL-GigE, you can start eBUS Player to configure image settings, which will help ensure that images are received and displayed properly. You can also configure the buffer options to reduce the likelihood of lost packets.

BEFORE you attempt to stream images, you must know the image settings of your Camera Link camera, and then configure the CL-GigE with matching image settings.

The following topics are covered in this chapter:

Confirming Image Streaming

After the CL-GigE is physically connected to the computer, use eBUS Player with the test pattern feature enabled to verify that the CL-GigE can stream properly to the computer.

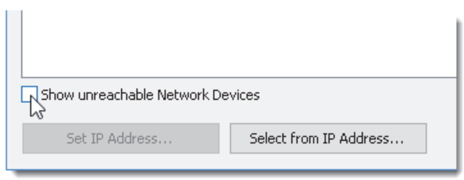
After you have confirmed that eBUS Player is receiving the test pattern from the CL-GigE, disable the test pattern so that the CL-GigE can stream images from the camera.

For detailed instructions about how to use eBUS Player, see the *eBUS Player for Windows and Linux User Guide* available on the Pleora Support Center at supportcenter.pleora.com.

To start eBUS Player and connect to the CL-GigE

1. Start eBUS Player from the Windows Start menu.
2. Click **Select/Connect**.

   If the CL-GigE does not appear in the list that appears, click the **Show unreachable Network Devices** check box to show all devices.



3. In the **Device Selection** dialog box, click the CL-GigE and then click **OK**.

If the IP address is not compatible with the NIC, a warning ( ) appears in the **Device Selection** dialog box. Provide the CL-GigE with an IP address, as outlined in "Providing the CL-GigE with an IP Address" on page 52.

4. In the **Camera Control** dialog box that appears, click **Manual** (other communication methods for the camera include CL Protocol library and GenCP).
5. Under **How is your camera powered**, choose one of the following options:
   - **My camera has an external power supply.** Selecting this option sets the **ClSafePowerActive** feature* to **False**.
   - **Power is provided by the frame grabber Camera Link cable (PoCL)**. Selecting this option sets the **ClSafePowerActive** feature* to **True**.

   * The **ClSafePowerActive** feature enables the SafePower protocol on the CL-GigE so it can supply power using PoCL. This protocol also prevents the CL-GigE from attempting to supply power to a camera that does not support PoCL.
6. Click **OK**.

   eBUS Player is now connected to the CL-GigE.

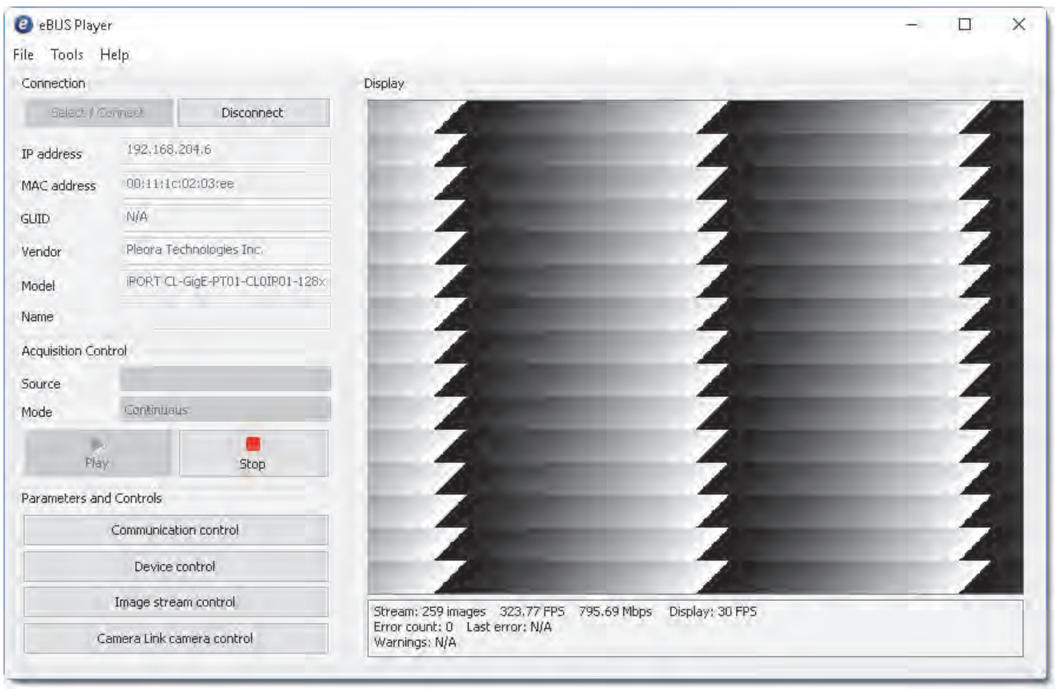
To turn the test pattern on or off

1. Start eBUS Player and connect to the CL-GigE.

   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.

2. Under **Parameters and Controls**, click **Device control**.
3. Under **ImageFormatControl**, click a test pattern option in the **TestPattern** list.
4. Close the **Device Control** dialog box.

   When the test pattern is enabled and you click **Play**, you will see an image similar to this (the pattern and colors may vary, depending on the image settings).



Providing the CL-GigE with an IP Address

The CL-GigE requires an IP address to communicate on a video network. This address must be on the same subnet as the computer that is performing the configuration and receiving the image stream.

To provide the CL-GigE with an IP address

1. Start eBUS Player.
2. Click **Select/Connect**.
3. Click the CL-GigE.

   If the CL-GigE does not appear in the list, click the **Show unreachable Network Devices** check box to show all devices.

   If the IP address is not compatible with the NIC, a warning ( ) appears in the **Device Selection** dialog box.
4. Click **Set IP Address**.
5. Provide the CL-GigE with a compatible IP address and subnet mask. You can optionally provide a default gateway.

   Note that this information is temporary and is reset when you power down the CL-GigE. To set an IP address that is used permanently, see the next procedure in this guide.

If you are using a unicast network configuration, the management entity/data receiver and the CL-GigE must be on the same subnet. The unicast network configuration is outlined in "Unicast Network Configuration" on page 74.

6. Click **OK** to close the **Set IP Address** dialog box.
7. Click **OK** to close the **Device Selection** dialog box and connect to the CL-GigE.

Configuring the CL-GigE with an Automatic/Persistent IP Address

The Device Control dialog box allows you to configure a persistent IP address for the CL-GigE. Alternatively, the CL-GigE can be configured to automatically obtain an IP address using Dynamic Host Configuration Protocol (DHCP) or Link Local Addressing (LLA). The CL-GigE uses its persistent IP address first, but if this option is set to **False**, it can be configured to attempt to obtain an address from a DHCP server. If this fails, it will use LLA to find an available IP address. LLA cannot be disabled and is always set to **True**.

The CL-GigE can use the persistent IP address each time it is powered up as long as the IP address is valid and there are no IP address conflicts

To configure a persistent IP address

1. Start eBUS Player and connect to the CL-GigE.

   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.
2. Under **Parameters and Controls**, click **Device control**.

3. Under **TransportLayerControl\GigEVision**, set the **GevCurrentIPConfigurationPersistentIP** feature to **True**.
4. Set the **GevPersistentIPAddress** feature to an IP address that is compatible with your computer's NIC.
5. Set the **GevPersistentSubnetMask** feature to a compatible subnet mask address.
6. Optionally, enter a compatible default gateway in the **GevPersistentDefaultGateway** field.
7. Close the **Device Control** dialog box.
8. Disconnect the camera from the CL-GigE, power cycle the CL-GigE, and reconnect the camera.

To automatically configure an IP address

1. Start eBUS Player and connect to the CL-GigE.

   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.
2. Under **Parameters and Controls**, click **Device control**.
3. Under **TransportLayerControl\GigEVision**, set the **GevCurrentIPConfigurationPersistentIP** feature to **False**.
4. Set the **GevCurrentIPConfigurationLLA** and/or **GevCurrentIPConfigurationDHCP** values to **True**, depending on the type of automatic addressing you require.
5. Close the **Device Control** dialog box.
6. Disconnect the camera from the CL-GigE, power cycle the CL-GigE, and reconnect the camera.

Accessing your Camera Settings through Camera Link Serial Communications

You can use eBUS Player to send serial commands between the CL-GigE and the Camera Link camera. For a list of commands that can be sent to the camera, consult the camera's technical documentation.

This section explains how to send serial commands between the CL-GigE and the camera. Alternatively, you can establish a serial bridge or camera bridge to communicate with your camera using serial communication.

The following options are available:

- GenCP communication, for cameras that are GenCP compliant.
- Serial port (COM port) communication, which you will use if your camera manufacturer has provided a software application that assumes that you use a serial port on your computer to send serial commands to the camera.
- Camera Link DLL, which you will use if your camera manufacturer has provided a software application that uses a Camera Link DLL to send serial commands to the camera.
- GenICam CLProtocol library, which you will use if you have a CLProtocol DLL (provided by the camera manufacturer).

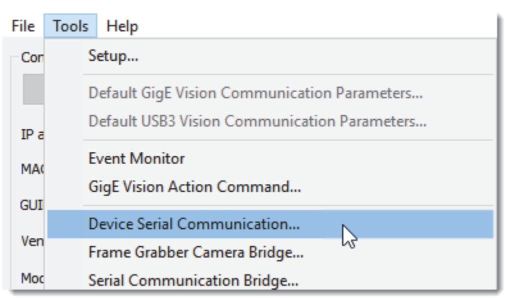
For information about using these serial communication methods, see the knowledge base article titled *Introduction: Establishing a Serial Bridge* on the Pleora Support Center at supportcenter.pleora.com.

To send serial commands to your camera using eBUS Player

1. Start eBUS Player and connect to the CL-GigE.

   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.

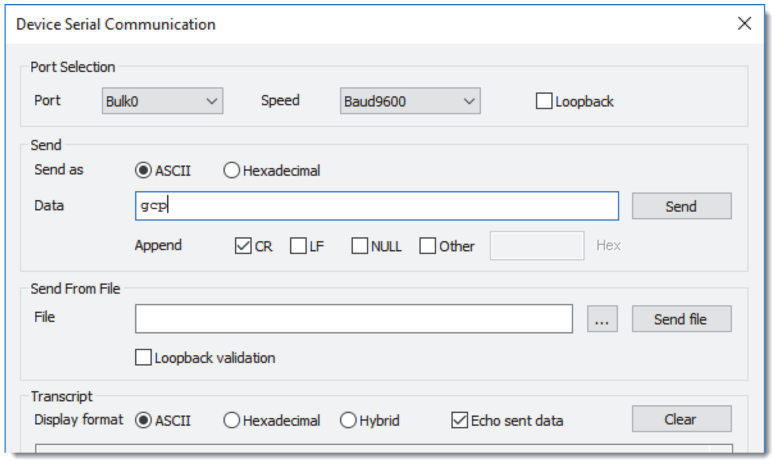
2. On the **Tools** menu, click **Device Serial Communication**.



3. In the **Port Selection** list, ensure the bulk port is selected.
4. In the **Speed** list, select the baud rate that matches your camera.

   Tip: If you need to set the parity and stop bits, click **Device control** on the main page of eBUS Player. In the **Visibility** list, click **Guru**. Under **IP Engine** > **PortCommunication**, set the values for these options.

5. Under **Send as**, select the data transmission sequence format by clicking either **ASCII** (text only) or **Hexadecimal**.



6. Type the data string in the **Data** box.

   For hexadecimal, enter a pair of hexadecimal digits for each byte, separated by spaces. For example, 01 23 45 67 89 AB CD EF.

7. Select one of the trailer options beside **Append**.

   Trailer options are not mutually exclusive; they append in the order shown.

   Select **Other** for ASCII and hexadecimal sequences in custom trailers for devices that do not use the trailer options in the order shown, for example, CR and LF.

8. Click **Send** to transmit the data sequence.
9. Wait for the device to reply.
10. Close the **Device Serial Communication** dialog box.

Configuring CL-GigE Image Settings Using eBUS Player

After you have configured your Camera Link Camera with optimal image settings, you must configure matching image settings on the CL-GigE.

The changes that you make to your CL-GigE are temporary and will not persist across power cycles. To understand more about how to save your settings, see “Saving eBUS Player and CL-GigE Settings” on page 67.

Take note of the camera’s image settings

Take note of the camera’s image settings. You can find this information by consulting the camera’s technical documentation or by using the camera configuration software that accompanies your camera.

- Scan type (area scan or line scan)
- Number of taps (sometimes referred to as tap geometry or sensor digitization taps)
- Image width

- Image height
- Pixel bit depth (8, 10, 12 bits, or more)
- Pixel format

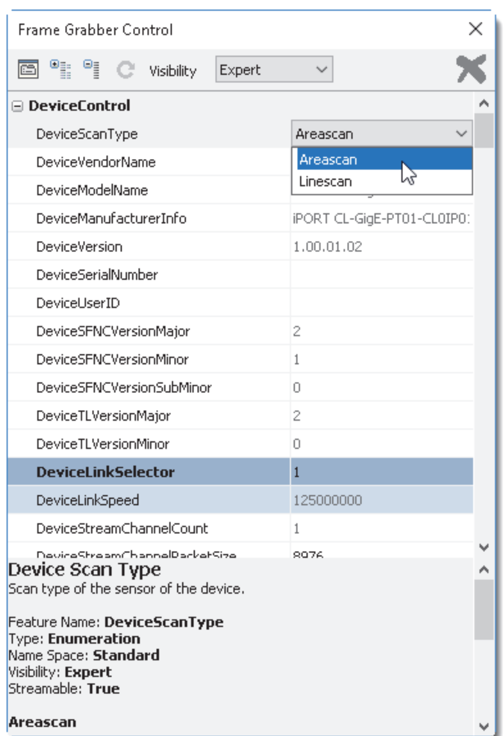
  These settings may not be available in the software; you may need to use the camera's technical documentation to find this information. If you cannot find the pixel format, you should start by configuring the CL-GigE to use a Mono (monochrome) setting.
- Power source (from a power supply or PoCL)

To ensure the CL-GigE is streaming images properly, you must configure the CL-GigE's image settings to match those previously configured on the camera.

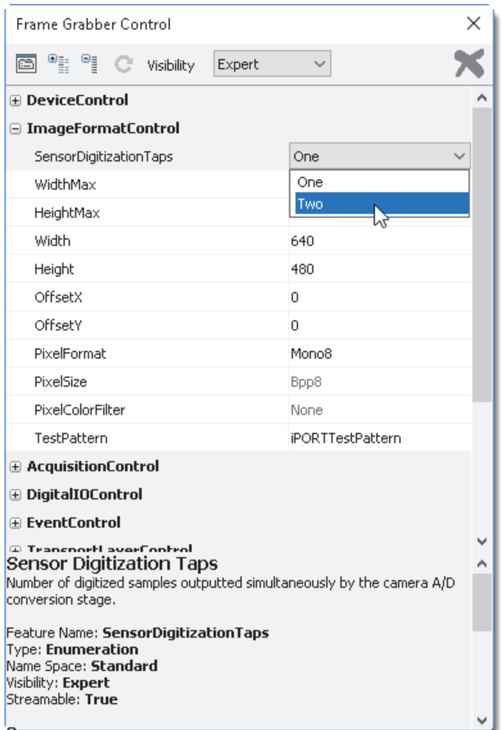
To configure image settings on the CL-GigE

1. Start eBUS Player and connect to the CL-GigE.

   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.
2. In the **Visibility** list, click **Expert**.
3. Under **DeviceControl**, select a sensor scan type (areascan or linescan) in the **DeviceScanType** list.



4. Under **ImageFormatControl**, select the number of taps in the **SensorDigitizationTaps** list.



DeviceScanType, **SensorDigitizationTaps**, **PixelFormat**, and **TestPattern** are interrelated. When you change any of these values, the CL-GigE may automatically adjust the other values to ensure the configuration is valid.

5. Under **ImageFormatControl**, enter the image width and height, and select a pixel format from the **PixelFormat** list.
6. Close the **Device Control** dialog box.
7. Click **Play** to see the changes.

Enabling SafePower and PoCL

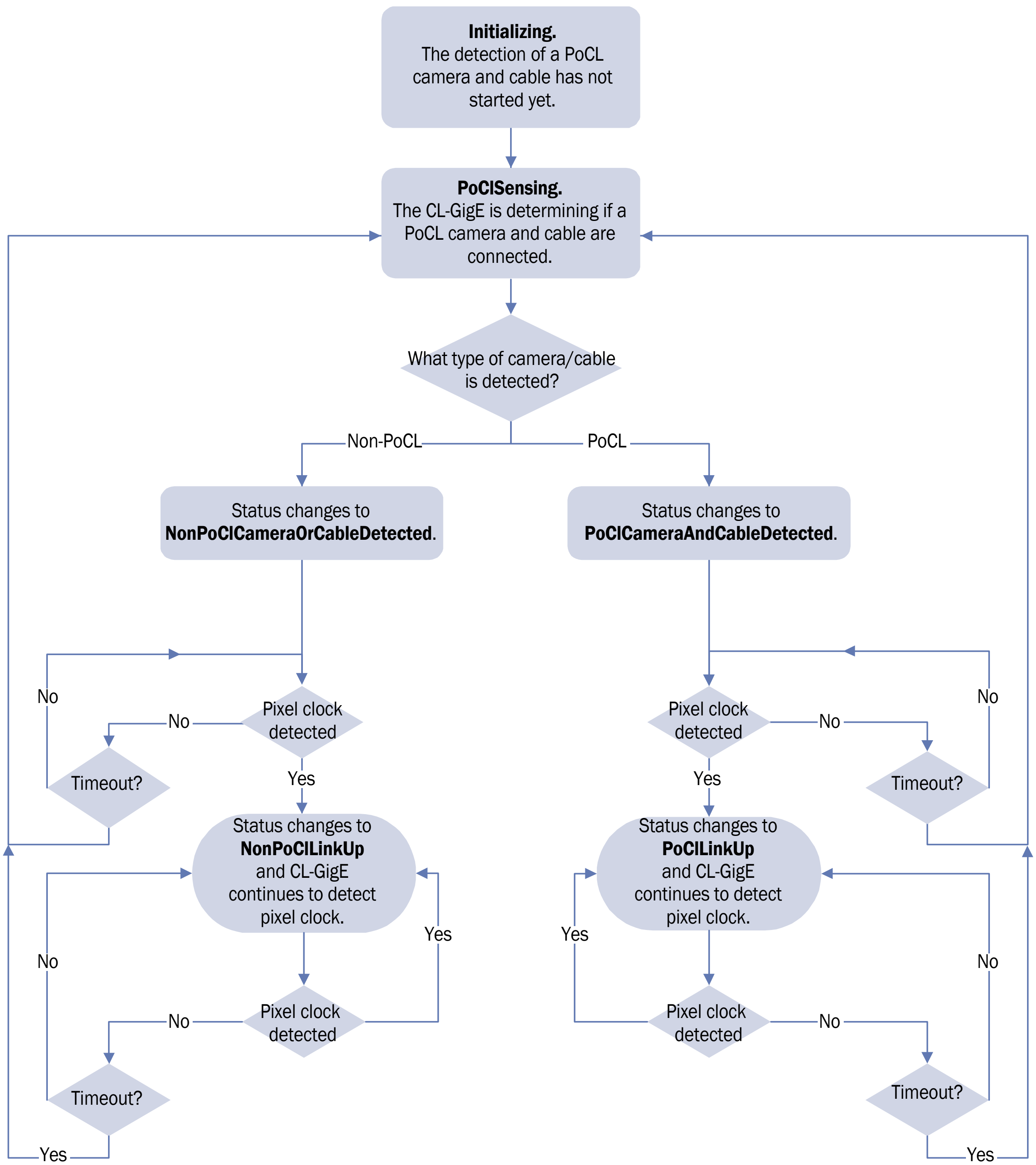
To allow the CL-GigE to supply power to a Camera Link camera using PoCL, enable the **ClSafePowerActive** feature. When this feature is enabled, PoCL is active and the SafePower protocol is used, which prevents the CL-GigE from attempting to supply power to a non-PoCL cable or camera.

To enable SafePower and PoCL and to view the PoCL status

1. Start eBUS Player and connect to the CL-GigE.

   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.
2. In the **Visibility** list, click **Expert** or **Guru**.
3. Under **CameraLinkInterfaceControl**, select **Connector1** in the **ClConnectorSelector** list.
4. In the **ClSafePowerActive** list, click **True** to enable SafePower and PoCL.

5. Review the status that appears under **ClSafePowerStatus**. The following flowchart explains the status changes.



Viewing and Testing Streaming Images

You can view and test your image settings using eBUS Player.

To view images from the camera, the test pattern must be disabled. For more information, see "To turn the test pattern on or off" on page 51.

To view streaming images in eBUS Player

1. Start eBUS Player and connect to the CL-GigE.

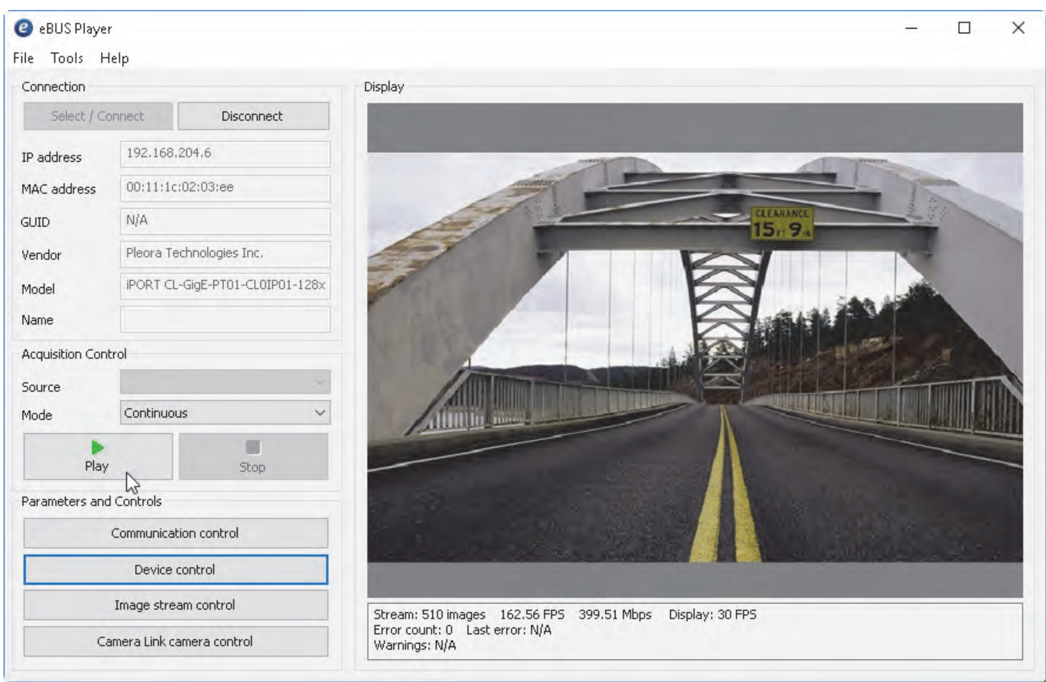
   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.

2. Under **Acquisition Control**, select the acquisition mode you want to use to acquire images. By default, images are streamed in **Continuous** mode (the CL-GigE sends a stream of continuous images instead of a single image).

   For other acquisition modes, see "Specifying How Images are Acquired" on page 62.

3. Click **Play**.

   The images appear in the **Display** section of eBUS Player.



Example image. When the test pattern is enabled for the CL-GigE, a stream of moving lines will appear (often black, gray, and white) instead of video from your camera.

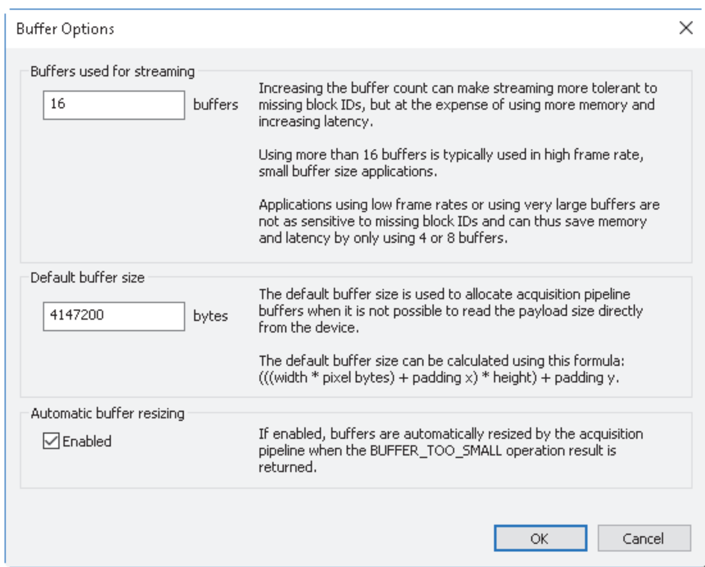
If images or the test pattern do not stream, see the tips provided in "System Troubleshooting" on page 83.

Configuring the Buffers

You can increase the buffer count using eBUS Player to make streaming more robust. A high number of buffers are needed in high frame rate applications, while a small number of buffers are needed for lower frame rates. Latency increases as the number of buffers increases.

To configure the buffers

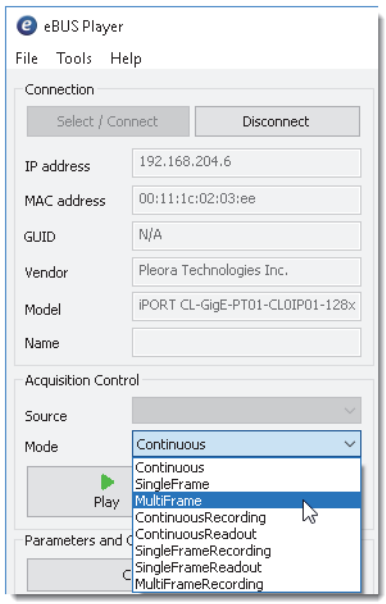
1. Start eBUS Player.
2. Click **Tools** > **Buffer Options**.
3. Click the buffer option that suits your requirements.
4. Click **OK**.



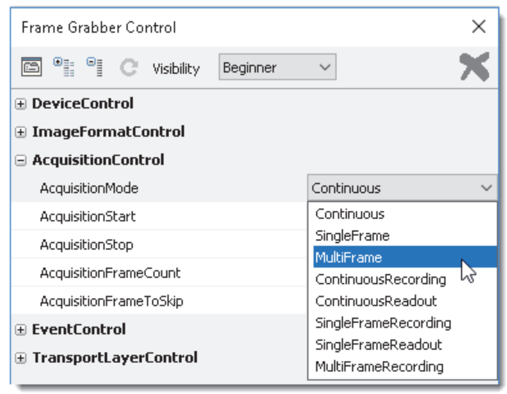
Default size for streaming is 16 buffers.

Specifying How Images are Acquired

Continuous, **SingleFrame**, and **MultiFrame** modes are usually standard for external frame grabbers. Acquisition starts when the **Play** button is pressed (the **AcquisitionStart** command is executed).



eBUS Player Main Page



Device Control Dialog Box

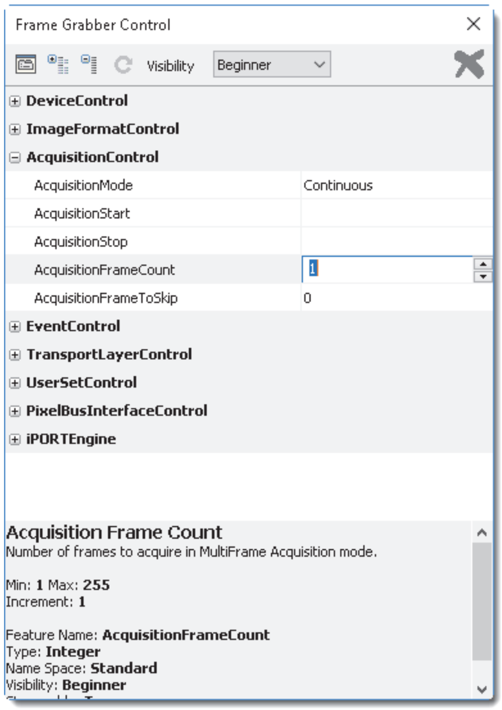
Continuous Mode

This mode allows you to acquire images continuously and is the default mode for most external frame grabbers.

Mulitframe Mode

This mode allows you to acquire a fixed number of images. To configure the number of images, set the CL-GigE's **AcquisitionControl** > **AcquisitionFrameCount** feature.

You can set the **AcquisitionControl** > **AcquisitionFrameCount** feature in the **Device Control** dialog box, as shown in the following image.



SingleFrame Mode

This mode allows you to acquire a single image.

Recording and Retrieving Images in the Onboard Memory

The **recording** acquisition modes allow you to capture images from a camera and store them in the CL-GigE's onboard memory. The **readout** acquisition modes allow images to be acquired from the CL-GigE's memory at a slower rate, ensuring images are not lost.

These modes are helpful when you are working with a camera that transmits images at a rate that exceeds the connection between the CL-GigE and the computer, resulting in dropped images. For example, a Base Configuration Camera Link camera transmits images at up to 2.04 Gbps (2 taps, 12 bits) but the connection to the computer might be only 1 Gbps. By using the recording and readout modes in this example, you can capture and stream images from the camera without losing any images (as long as there is space in the onboard memory).

The recording acquisition modes support back-to-back recording, which allows you to click the **Stop** and **Play** buttons multiple consecutive times without clearing the onboard memory.

Acquisition starts when the **Play** button is pressed (the **AcquisitionStart** command is executed) when one of the recording modes is selected.

Images can be stored in the CL-GigE's onboard memory as long as there is space or until there are 512 images in memory. For information about calculating how many images you can store, see "Calculating How Many Images Can be Stored in Onboard Memory" on page 66.

ContinuousRecording Mode

With this mode, images are acquired continuously and are stored in the CL-GigE's onboard memory until the memory is full (or 512 images are stored in onboard memory). When this limit is reached, the CL-GigE stops acquiring new images from the camera.

We recommend that you observe **AcquisitionControl** > **BlockBufferCount** (**Expert** or **Guru** visibility level is required). When the value for this feature stops increasing, the memory is full. For information about the actions that clear the images from onboard memory, see "Understanding When Images are Removed from the Onboard Memory" on page 66.

To determine how many images can be stored in memory, see "Calculating How Many Images Can be Stored in Onboard Memory" on page 66.

ContinuousReadout Mode

With this mode, images are continuously read (and removed) from the CL-GigE's onboard memory. The readout begins at the first image in memory. To see the number of images stored in onboard memory, see **AcquisitionControl** > **BlockBufferCount** in the **Device Control** dialog box (**Expert** or **Guru** visibility level is required).

Readout continues until the **Stop** button is pressed (**AcquisitionStop** command is executed) or until the last image has been sent by the device (**BlockBufferCount** will be **0**).

MultiFrameRecording Mode

With this mode, a fixed number of images are stored in the CL-GigE's onboard memory. To configure the number of images, set the **AcquisitionControl** > **AcquisitionFrameCount** feature in the **Device Control** dialog box. Images can be read out from memory using **ContinuousReadout** mode.

A maximum of 512 images can be acquired at one time in MultiFrameRecording mode.

To determine how many images can be stored in memory, see "Calculating How Many Images Can be Stored in Onboard Memory" on page 66.

If **AcquisitionControl** > **AcquisitionFrameCount** is set to a value that exceeds the amount of available memory, the CL-GigE stops acquiring new images when the onboard memory is full (or 512 images are stored in onboard memory).

BlockBufferCount shows the number of images currently in memory. In MultiFrameRecording mode, this number is cumulative: If the memory is empty and you acquire an image, **BlockBufferCount** will match the **AcquisitionFrameCount**. If you stop and restart recording, **BlockBufferCount** will increment (to a maximum of 512 images, depending on the image size) and will no longer match the **AcquisitionFrameCount**.

For information about the actions that clear the images from onboard memory, see "ContinuousReadout Mode" on page 65.

SingleFrameRecording Mode

With this mode, a single image is saved in the CL-GigE's onboard memory after each **AcquisitionStart** command.

For information about the actions that clear the images from onboard memory, see "Understanding When Images are Removed from the Onboard Memory" on page 66.

SingleFrameReadout Mode

With this mode, a single image is acquired from the CL-GigE's onboard memory.

Understanding When Images are Removed from the Onboard Memory

The following actions remove the images from the CL-GigE's onboard memory:

- Streaming images from the onboard memory using one of the readout acquisition modes (**ContinuousReadout** or **SingleFrameReadout**).
- Power cycling the CL-GigE, which clears all images from the onboard memory.
- Making any of the following **AcquisitionMode** changes and then clicking the **Play** button (**AcquisitionStart** command):

Table 23: Changes that Clear Images from the Onboard Memory

First you acquire images with...	And then you change the Acquisition mode to...
ContinuousRecording, MultiFrameRecording, or SingleFrameRecording	Continuous, MultiFrame, or SingleFrame
SingleFrameReadout or ContinuousReadout	SingleFrame, MultiFrame, or Continuous
SingleFrameReadout or ContinuousReadout	ContinuousRecording, MultiFrameRecording, or SingleFrameRecording

Calculating How Many Images Can be Stored in Onboard Memory

First, take note of the **PayloadSize**, which appears under **TransportLayerControl** in the **Device Control** dialog box. Expert or Guru visibility level is required to access this feature.

The **PayloadSize** is automatically calculated by the CL-GigE based on the selected image settings, which include Width, Height, OffsetX, OffsetY, PixelSize, any chunk data, as well as any padding that has to be added to the image payload.

For example, for a CL-GigE configured to use Mono10p with images that are 1920 x 1080, the **PayloadSize** is equal to 2 592 000 bytes per image or 2.472 MB (2 592 000 / 1 048 576).

You can use the following equation to determine the number of images that can be saved in onboard memory:

Available onboard memory MB / PayloadSize MB = Number of images that can be saved

Using our example, the equation is:

120 MB / 2.472 MB = 48 images

Implementing the eBUS SDK

You can create your own image acquisition software for the CL-GigE. Consult the following guides for information about creating custom image acquisition software:

- *eBUS SDK API Quick Start Guides*, available for C++, .NET, Linux, and macOS, which are available on the Pleora Support Center at supportcenter.pleora.com.
- *eBUS SDK API Help Files*, which are installed on your computer during the installation of the eBUS SDK. You can access this documentation from the Windows Start menu under **eBUS SDK**.

Chapter 10

Saving eBUS Player and CL-GigE Settings

This chapter describes the various ways to save your eBUS Player and CL-GigE settings.

The changes that you make to your CL-GigE are temporary and WILL NOT PERSIST ACROSS POWER CYCLES unless you save the changes to the flash memory of the CL-GigE or to a .pvcfg file on your computer.

The following topics are covered in this chapter:

Choosing the Best Method for Saving eBUS Player and CL-GigE Settings

eBUS Player offers several ways to save your eBUS Player and CL-GigE settings. Each method saves different settings, as outlined in the following table.

Table 24: eBUS Player and CL-GigE Settings Saving Options

	Format and location of saved settings:		
	Saves to a .pvcfg file on your computer	**Saves to your computer's user profile**	**Saves to the CL-GigE flash memory**
	eBUS Player procedure for saving:		
	File > Save	**Tools > Save preferences**	**Device Control > Usersets**
	Settings saved:		
Default GigE Vision host-side communication parameters. These parameters are set using the **Default GigE Vision Communication Parameters** dialog box, accessed from the **Tools** menu in eBUS Player.	Yes	Yes	No
GigE Vision host-side communication parameters. These parameters are set using the **Communication Control** dialog box (click the **Communication control** button on the main page of eBUS Player).	Yes	No	No
CL-GigE parameters. These parameters are set using the **Device Control** dialog box (click the **Device control** button on the main page of eBUS Player).	Yes	No	Yes
Image stream parameters. These parameters are set using the **Image Stream Control** dialog box (click the **Image stream control** button on the main page of eBUS Player).	Yes	No	No

Table 24: eBUS Player and CL-GigE Settings Saving Options (Continued)

	Format and location of saved settings:		
	Saves to a .pvcfg file on your computer	**Saves to your computer's user profile**	**Saves to the CL-GigE flash memory**
	eBUS Player procedure for saving:		
	File > Save	**Tools > Save preferences**	**Device Control > Usersets**
	Settings saved:		
1. eBUS Player settings accessed from the **Tools** menu: • Setup: eBUS Player role and stream destination • Image filtering • Image saving • Event monitor • Buffer options • Display options **2.** GenICam browser settings configured using the **Device Control** dialog box: Parameter visibility level, browser options, expanded or collapsed feature lists.	Yes	Yes	No
Serial communication bridge settings. These parameters are set using the **Serial Communications Bridge** dialog box, accessed from the **Tools** menu.	Yes	No	No
Camera bridge configuration settings.	Yes	Yes	No
Identification (MAC address) of devices to which you are connected.	Yes	No	No
CL-GigE serial communication settings. These parameters are set using the **Device Serial Communication** dialog box accessed from the **Tools** menu.	No	No	No

For more information about the settings and parameters shown in the table above, see the *eBUS Player For Windows and Linux User Guide*.

Using File > Save

When you select **Save As** on the eBUS Player **File** menu, the changes you have made to the eBUS Player application settings, along with most of the settings configured on the CL-GigE to which eBUS Player is connected, are saved to a .pvcfg file on your computer. When you are next connected to the CL-GigE using eBUS Player, you can apply the saved .pvcfg file to restore all of your previously configured settings.

The settings saved to the .pvcfg file include the MAC address for the NIC in the computer on which eBUS Player is installed and the MAC address of the connected CL-GigE. This enables you to connect to the device automatically and restore the CL-GigE and eBUS Player application settings. For more information about the eBUS Player settings saved using this method, see "eBUS Player and CL-GigE Settings Saving Options" on page 68.

To save CL-GigE settings to a .pvcfg file on your computer

1. After you have changed settings on the CL-GigE using eBUS Player, click **File** > **Save As**.
2. Choose a file name and location on your computer to save the .pvcfg file.
3. Click **Save**.

To apply a saved .pvcfg file to the CL-GigE

1. Connect to the CL-GigE using eBUS Player.
2. Click **File** > **Open**.
3. Navigate to the saved .pvcfg file and click **Open**.

You can apply the settings in the saved .pvcfg file to a CL-GigE with a different MAC address.

Using Tools > Save Preferences

When you select **Save Preferences** on the eBUS Player **Tools** menu, specific eBUS Player application settings along with **Communication control** options, such as a specific heartbeat interval and answer timeout value, are saved to your Windows/Linux/macOS operating system user profile. When you next open eBUS Player, your preferences are the same as when you closed the application. For more information about the eBUS Player settings saved using this method, see "eBUS Player and CL-GigE Settings Saving Options" on page 68.

The **Device control** settings and the **Image stream** control settings are not saved when you click **Save Preferences**.

To save eBUS Player preferences

- Click **Tools** > **Save Preferences**.

  The eBUS Player preferences, including the **Communication control** options such as a specific heartbeat interval and answer timeout value, are saved.

To restore default eBUS Player settings

- Click **Tools** > **Restore Default Preferences**.

  Settings are restored to the values set on the CL-GigE before it was first used.

Using User Sets: Saving Settings to the CL-GigE's Flash Memory

When you use the **UserSetSave** feature available in the **UserSetControl** section of the eBUS Player **Device Control** dialog box, you are saving configuration changes to the flash memory of the CL-GigE. These settings persist across power cycles. A User Set can be configured to be the default settings for the CL-GigE so that each time you start the CL-GigE it starts with these settings applied, or you can start the CL-GigE and then apply User Set configurations.

Most Pleora external frame grabbers support two User Sets: **UserSet1**, which consists of the user-configured settings, and **Default**, which consists of the pre-configured settings, to which you can always revert. Settings identified as **Default** in the **Device Control** dialog box cannot be changed.

Not all CL-GigE configuration changes can be saved to a User Set. Features in the **Device Control** dialog box that can be saved to the CL-GigE's flash memory have **Streamable: True** in the Help section at the bottom of the **Device Control** dialog box.

The following table describes the options available in **UserSetControl**.

Table 25: Saving Configuration Settings to the CL-GigE

Setting	Description
UserSetSelector	Selects the User Set to load or save.
UserSetLoad	Loads the User Set (specified by **UserSetSelector**) to the CL-GigE and makes it active.
UserSetSave	Saves configuration data to the User Set specified by **UserSetSelector**, which is part of the non-volatile memory of the CL-GigE.
UserSetDefaultSelector	Specifies the User Set to load and make active when the CL-GigE is reset or power-cycled.
UserSetLoadLastUserSet	Shows the last User Set executed by the CL-GigE from a **UserSetLoad** command, or as a result of a reset (or power cycle) of the CL-GigE.
UserSetLoadStatus	Indicates the success or failure of the last User Set applied. The User Set can be applied through a power cycle or through user selection.

To save a configuration change to UserSet1

1. In the **Device Control** dialog box, make the required configuration changes.
2. Scroll to the **UserSetControl** section and change the **UserSetSelector** setting to **UserSet1**.
3. Click **UserSetSave**.

To load the default configuration settings (one-time)

1. In the **UserSetControl** section of the **Device Control** dialog box, select **Default** in the **UserSetSelector** box.
2. Click the **UserSetLoad** setting and then click the **UserSetLoad** button that appears to the right.

   The default settings are applied to the CL-GigE.

To specify the persistent settings that are loaded every time the CL-GigE is reset

- In the **UserSetControl** section of the **Device Control** dialog box, select a User Set in the **UserSetDefaultSelector** box and then close the **Device Control** dialog box.

  The next time the CL-GigE is reset or power cycled, the User Set that you selected is loaded.

Ensuring Configuration Settings are not Overwritten

When you choose a method to save eBUS Player and CL-GigE settings, you could overwrite previously configured settings. You should consider the following when saving settings.

- Each newly applied .pvcfg file overwrites all settings configured by a previously applied .pvcfg file.
- Each newly applied .pvcfg file overwrites the settings from a previously applied User Set.
- When you apply CL-GigE settings from a User Set, device settings configured by a previously applied .pvcfg are overwritten.

Saving the CL-GigE XML File to your Computer

You can save the CL-GigE XML file to your computer.

This allows you to view the CL-GigE's GenICam XML file; it does not save your eBUS Player or camera settings.

To save your camera's XML file

1. Click **Tools** > **Save GenICam XML**.
2. Navigate to the location in which you want to save the XML file.
3. Click **Save**.

Chapter 11

Network Configurations for the CL-GigE

After you have connected to the CL-GigE and provided it with a unique IP address on your network, you can configure the CL-GigE for either unicast or multicast.

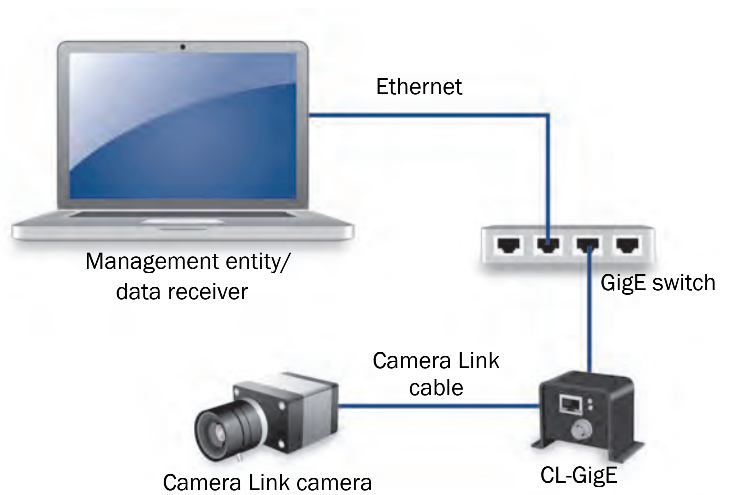
The following topics are covered in this chapter:

Unicast Network Configuration

In the following unicast configuration, a Camera Link camera is connected to a CL-GigE and then a GigE switch that sends a stream of images over Ethernet to the computer. Alternatively, the CL-GigE can be connected directly to the computer.

The computer is configured as both a data receiver and controller, and serves as a management entity for the CL-GigE.

Figure 5: Unicast Network Configuration



Required Items — Unicast Network Configuration

You require the following items to set up a unicast network configuration:

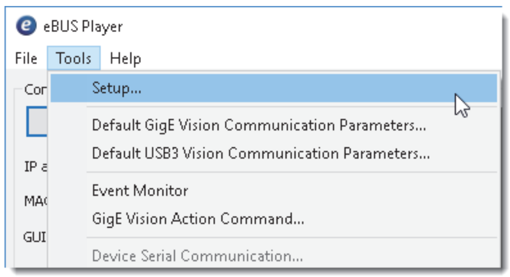
- Camera Link camera
- CL-GigE and cables
- Power supply or, if using PoE, a PoE power injector or PoE-enabled GigE switch
- GigE switch (optional)
- CAT5e or CAT6 Ethernet cables
- Desktop computer or laptop with eBUS SDK installed

CL-GigE Configuration — Unicast Network Configuration

After you have connected and applied power to the hardware components, use eBUS Player to configure the CL-GigE.

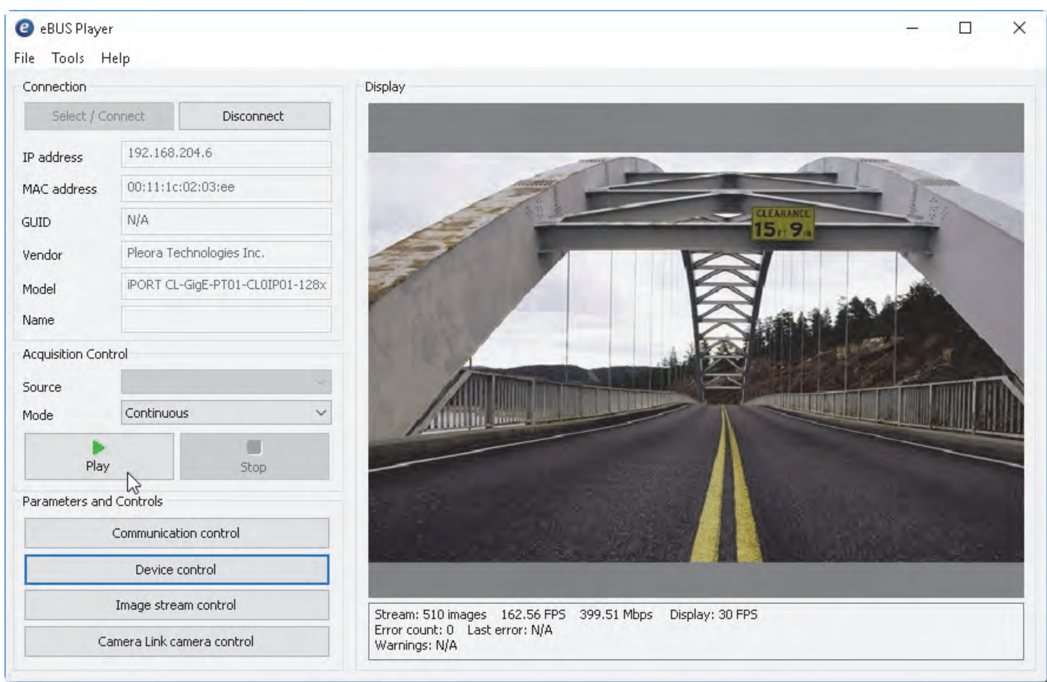
To configure the CL-GigE for a unicast network configuration

1. Start eBUS Player.
2. Click **Tools** > **Setup**.



3. Under **eBUS Player Role**, click **Controller and data receiver**.
4. Under **GigE Vision Stream Destination**, click **Unicast, automatic**.
5. Click **OK**.
6. Connect to the CL-GigE.

   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.
7. Click **Play** to view a live image stream.

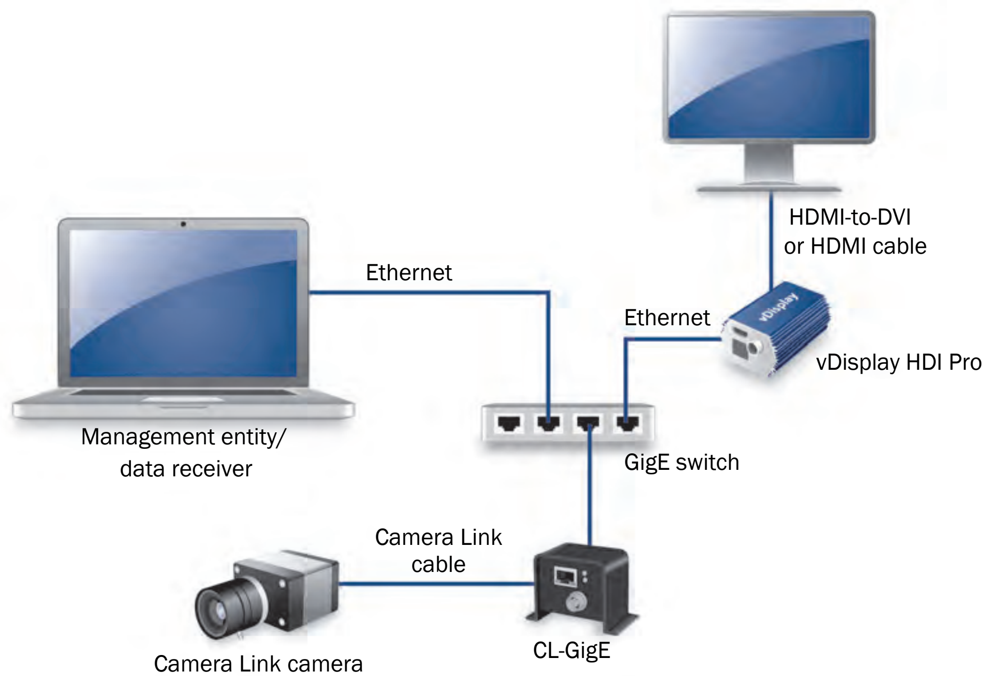


Example image. When the test pattern is enabled for the CL-GigE, a stream of moving lines will appear (often black, gray, and white) instead of video from your camera.

Multicast Network Configuration

In the following example of a multicast network configuration, the CL-GigE is connected to a GigE switch, and sends a stream of images over Ethernet simultaneously to both a computer and to a vDisplay HDI-Pro External Frame Grabber. Then, the vDisplay HDI-Pro External Frame Grabber converts it to an image stream for display on a monitor.

Figure 6: Multicast Network Configuration



Required Items — Multicast Network Configuration

You require the following items to set up the multicast network configuration example above:

- Camera Link camera
- CL-GigE and cables
- Power supply or, if you are using PoE, a PoE power injector or PoE-enabled GigE switch
- vDisplay HDI-Pro External Frame Grabber and corresponding power supply
- Compatible display monitor
- Cable to connect the vDisplay HDI-Pro External Frame Grabber to the display monitor
- GigE switch
- CAT5e or CAT6 Ethernet cables
- Desktop computer or laptop with eBUS SDK installed

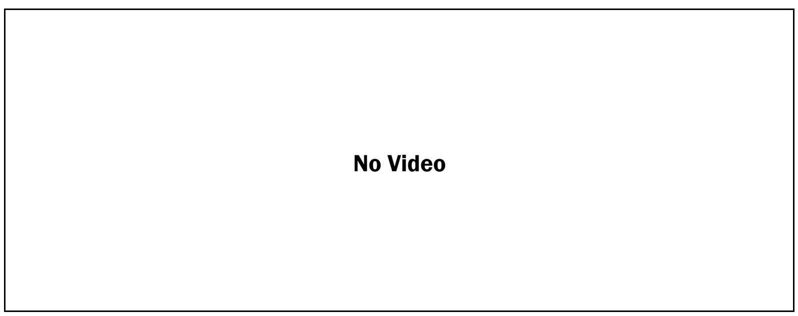
Connecting the Hardware and Power

The following procedure explains how to connect the power, network, and data cables to the vDisplay HDI-Pro External Frame Grabber and CL-GigE.

To connect the network cables and apply power

1. Connect one end of a CAT5e/CAT6 cable to the Ethernet connector on your computer's NIC. Attach the other end to an available port on the GigE switch.
2. Attach one end of the video cable to the display monitor. Attach the other end to the HDI connector on the vDisplay HDI-Pro External Frame Grabber.
3. Connect one end of a CAT5e/CAT6 cable to the vDisplay HDI-Pro External Frame Grabber Ethernet connector. Attach the other end to an available port on the GigE switch.
4. Connect one end of a CAT5e/CAT6 cable to the CL-GigE Ethernet connector. Attach the other end to an available port on the GigE switch.
5. Apply power to the devices.

   The message **No Video** appears on the display monitor.

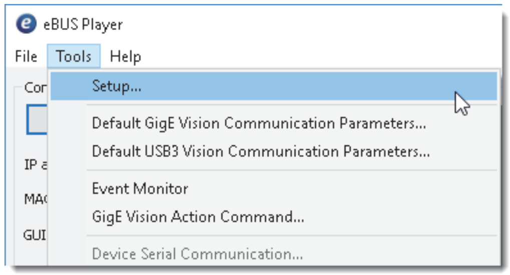


Configuring the Devices for a Multicast Network Configuration

After you have connected and applied power to the hardware components, use eBUS Player to configure the vDisplay HDI-Pro External Frame Grabber and CL-GigE for multicast configuration. You may want to launch two instances of eBUS Player to perform both configurations. Begin by configuring the vDisplay HDI-Pro External Frame Grabber. Then, configure the CL-GigE to transmit images to a multicast IP address and port.

To configure the vDisplay HDI-Pro External Frame Grabber for a multicast network configuration

1. Start eBUS Player.
2. Click **Tools** > **Setup**.



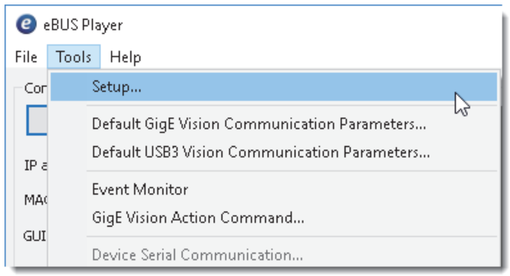
3. Under **eBUS Player Role**, click **Controller**.

   You do not need to specify the **GigE Vision Stream Destination**, as the stream destination is not applicable to a video receiver.
4. Click **OK**.
5. Connect to the vDisplay HDI-Pro External Frame Grabber.

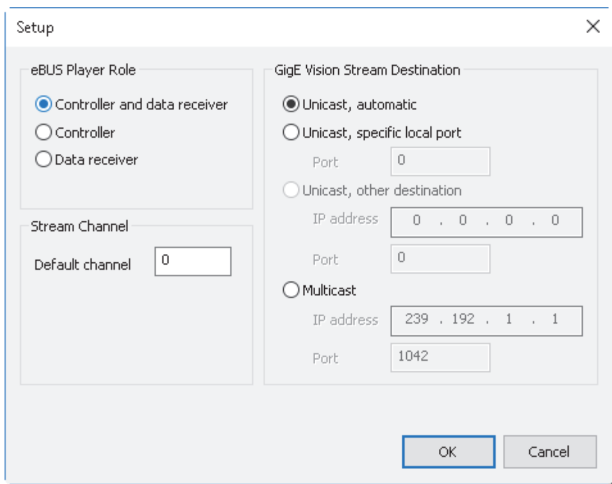
   For more information, see "To configure image settings on the CL-GigE" on page 56.
6. Click **Device control**.
7. Click **Guru** in the **Visibility** list.
8. In the **TransportLayerControl** > **GigEVision** category, set **GevSCPHostPort** to a streaming channel port (for example, 1042).
9. Set **GevSCDA** to a multicast address (for example, 239.192.1.1).
10. Close the **Device Control** dialog box.
11. Now, configure the CL-GigE, as outlined in "To configure the CL-GigE for a multicast network configuration" on page 79.

To configure the CL-GigE for a multicast network configuration

1. Start an additional instance of eBUS Player.
2. Click **Tools** > **Setup**.



3. Under **eBUS Player Role**, click **Controller and data receiver**, as shown in the following image.

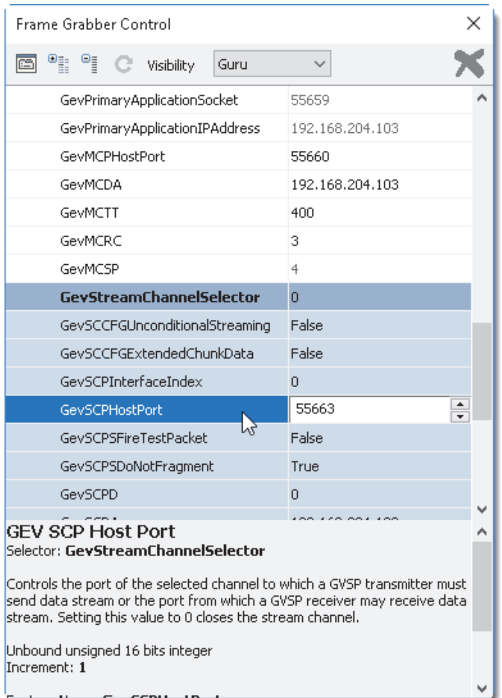


4. Under **GigE Vision Stream Destination**, click **Multicast** and enter the IP address and port number.

   The address and port must be identical to that configured for the vDisplay HDI-Pro External Frame Grabber in step 8 and 9 of "To configure the vDisplay HDI-Pro External Frame Grabber for a multicast network configuration" on page 78.
5. Click **OK**.
6. Connect to the CL-GigE.

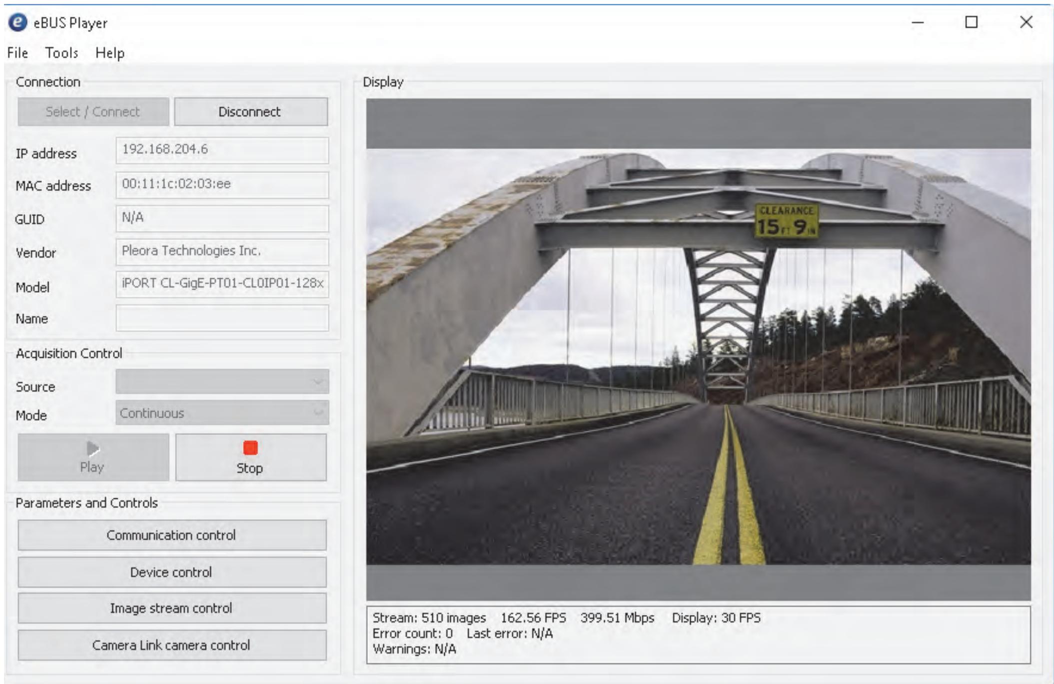
   For more information, see "To start eBUS Player and connect to the CL-GigE" on page 50.
7. Under **Parameters and Controls**, click **Device control**.
8. Click **Guru** in the **Visibility** list.

9. Under **TransportLayerControl** > **GigEVision**, ensure that the port in the **GevSCPHostPort** field and the multicast IP address in the **GevSCDA** field are correct. They are configured automatically to the values set in step 4 of this procedure.



10. Close the **Device Control** dialog box.

11. Click **Play** to view the source image stream both on the computer and the display monitor.



Example image. When the test pattern is enabled for the CL-GigE, a stream of moving lines will appear (often black, gray, and white) instead of video from your camera.

Chapter 12

System Troubleshooting

This chapter provides you with troubleshooting tips and recommended solutions for issues that can occur during configuration, setup, and operation of the CL-GigE. It also shows you how to switch between the backup and main firmware loads.

Not all scenarios and solutions are listed here. You can refer to the Pleora Technologies Support Center at supportcenter.pleora.com for additional support and assistance. Details for creating a customer account are available on the Pleora Technologies Support Center.

Refer to the product release notes that are available on the Pleora Technologies Support Center for known issues and other product features.

Troubleshooting Tips

The scenarios and known issues listed in this chapter are those that you might encounter during the setup and operation of your CL-GigE. Not all possible scenarios and errors are presented. The symptoms, possible causes, and resolutions depend upon your particular setup and operation.

If you perform the resolution for your issue and the issue is not corrected, we recommend you review the other resolutions listed in this table. Some symptoms may be interrelated.

Table 26: Troubleshooting Tips

Symptom	Possible cause	Resolution
SDK cannot detect or connect to the CL-GigE	Power not supplied to the CL-GigE or inadequate power supplied	Both the detection and connection to the CL-GigE will fail if adequate power is not supplied to the device. Re-try the connection to the device with eBUS Player. Verify that the Power/FPGA LED is green (power on). For information about the LEDs, see "Status LEDs" on page 26. Verify the power connection and ensure 5.2 V to 16 V is present at the connector.
	Device is not connected to the network	Verify that the network activity LED and network connection speed LED are active. If these LEDs are illuminated, check the LEDs on your network switch to ensure the switch is functioning properly. If the problem continues, connect the CL-GigE directly to the computer to verify its operation. For information about the LEDs, see "Status LEDs" on page 26.
	The CL-GigE and computer are not on the same subnet	Ensure that the CL-GigE and the computer running eBUS Player are on the same subnet. In addition, ensure that these devices are connected using compatible gateway and subnet mask information. You can view the CL-GigE IP address information in the **Available Devices** list in eBUS Player. A red icon appears beside the device if there is an incompatible IP configuration.

Table 26: Troubleshooting Tips (Continued)

Symptom	Possible cause	Resolution
SDK is able to connect, but no images appear in eBUS Player. In a multicast configuration, images appear on a display monitor connected to a vDisplay HDI-Pro External Frame Grabber but do not appear in eBUS Player.	In a multicast configuration, the CL-GigE may not be configured correctly	Images might not appear on the display if you have not configured the CL-GigE for a multicast network configuration. The CL-GigE and all multicast receivers (for example, a vDisplay HDI-Pro External Frame Grabber) must have identical values for both the GevSCDA and GevSCPHostPort features in the TransportLayerControl section. For more information, see "Multicast Network Configuration" on page 76.
	Your computer's firewall may be blocking eBUS Player	Ensure that eBUS Player is allowed to communicate through the firewall.
	Anti-virus software blocking transmission	Images might not appear in eBUS Player because of anti-virus software on your network. Disable all virus scanning software and re-attempt a connection to the CL-GigE with eBUS Player.
	A non-Pleora GigE Vision driver is blocking the connection	Disable or uninstall the non-Pleora GigE Vision driver and install the Pleora eBUS Universal Pro Driver. For more information, see "Installing the eBUS Universal Pro Driver" on page 42.

Table 26: Troubleshooting Tips (Continued)

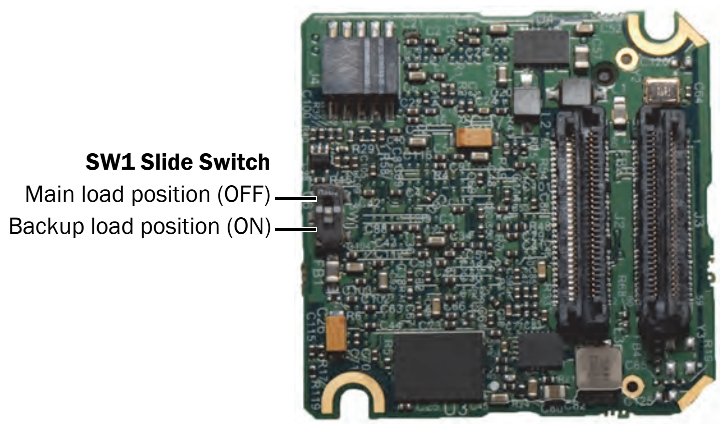
Symptom	Possible cause	Resolution
Dropped packets: eBUS Player or applications created using the eBUS SDK	Insufficient computer performance	The computer being used to receive images from the device may not perform well enough to handle the data rate of the image stream. The GigE Vision driver reduces the amount of computer resources required to receive images and is recommended for applications that require high throughput. Should the application continue to drop packets even after the installation of the GigE Vision driver, a computer with better performance may be required.
	Insufficient NIC performance	The NIC being used to receive images from the GigE Vision device may not perform well enough to handle the data rate of the image stream. For example, the bus connecting the NIC to the CPU may not be fast enough, or certain default settings on the NIC may not be appropriate for reception of a high-throughput image stream. Examples of NIC settings that may need to be reconfigured include the number of Rx Descriptors and the maximum size of Ethernet packets (jumbo packets). Additionally, some NICs are known to not work well in high-throughput applications. For information about maximizing the performance of your system, see the *Configuring Your Computer and Network Adapters for Best Performance* knowledge base article, available on the Pleora Support Center. Also see "Configuring Your Computer's NIC for use with the CL-GigE" on page 43.
Black bars appear on the sides of the images	Camera does not output images using the full image size	In eBUS Player, adjust the **Width**, **Height**, and image offset features until the black bars no longer appear.

Changing to the Backup Firmware Load

In the event that the main firmware load fails to start, the CL-GigE will start up using the backup firmware load when it is restarted or power cycled.

In the rare event that the backup load is not used automatically (as indicated by the fact that eBUS Player will not be able to detect the CL-GigE), you can use the slide switch to change to the backup load.

After the CL-GigE starts up using the backup load, you can apply a firmware update to the CL-GigE to recover the main load. For more information see the *Updating Pleora Firmware* knowledge base article on the Pleora Support Center (supportcenter.pleora.com).



FPGA Board (Back View)

Chapter 13

Reference: Mechanical Drawings and Material List

This chapter provides mechanical drawings and also provides a list of connectors with corresponding manufacturer details.

Three-dimensional (3-D) mechanical models are available at the Pleora Technologies Support Center.

The following topics are covered in this chapter:

Mechanical Drawings

The mechanical drawings in this section provide the CL-GigE's dimensions, features, and attributes. All dimensions are in millimeters. Connectors are dimensioned to the center.

Enclosed Model

Figure 7: Enclosed Model — Camera Link Connector View

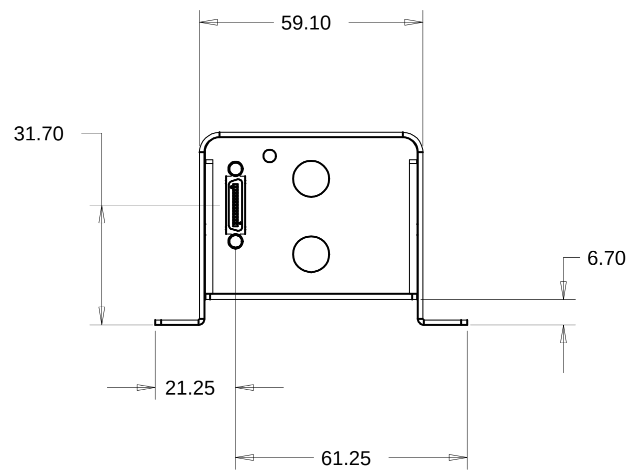


Figure 8: Enclosed Model — Side View

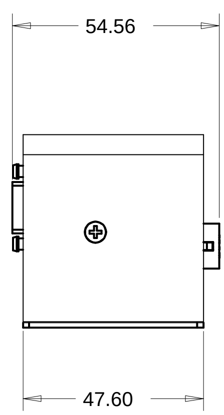


Figure 9: Enclosed Model — GPIO Connector View

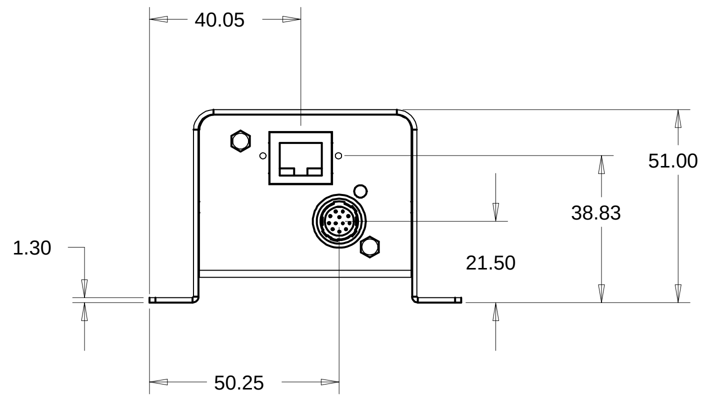
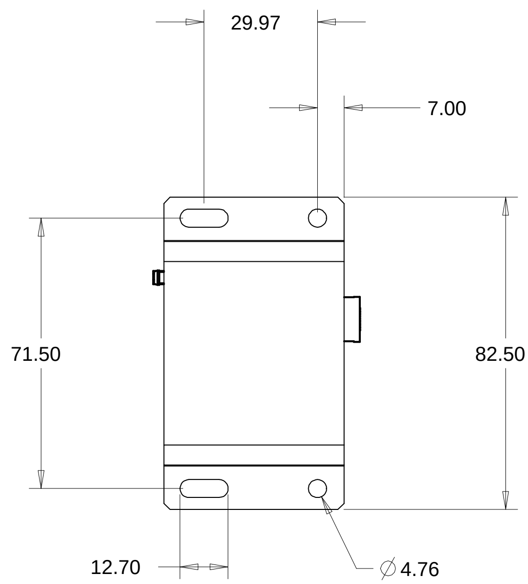


Figure 10: Enclosed Model — Bottom View



CL-GigE OEM Board Set with 12-Pin GPIO Connector

When you purchase the CL-GigEB-IND OEM board set (order code 900-6009), the 12-pin GPIO connector is not soldered to the board. If you plan on soldering the connector to the board, the following drawings show the dimensions with the 12-pin GPIO connector.

Figure 11: OEM Board Set with GPIO: Maximum Component Height

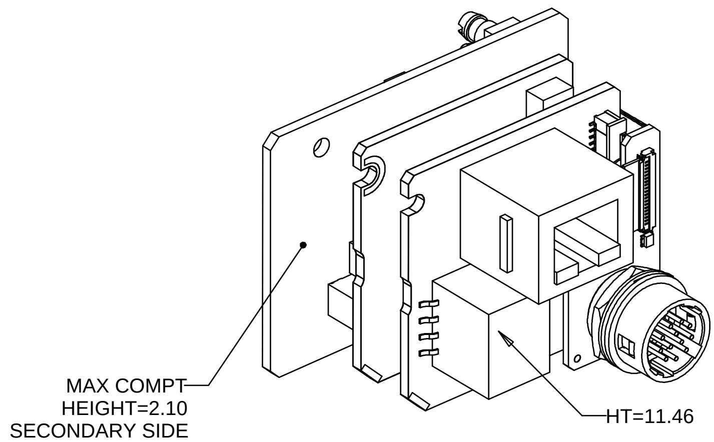


Figure 12: OEM Board Set with GPIO: Component Height Adapter Board

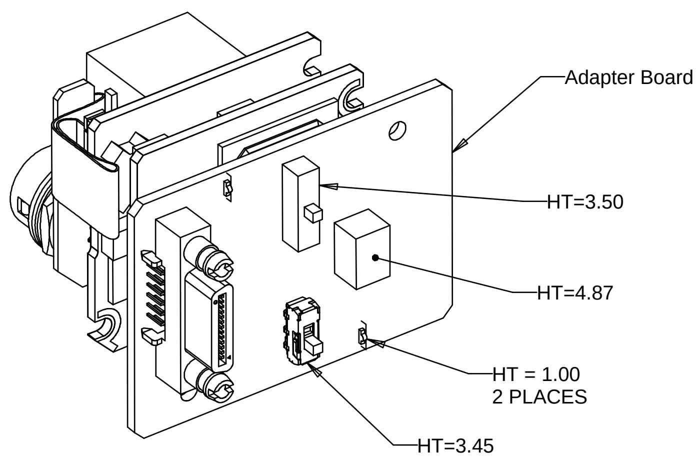


Figure 13: OEM with GPIO: Adapter Board Detailed Measurements

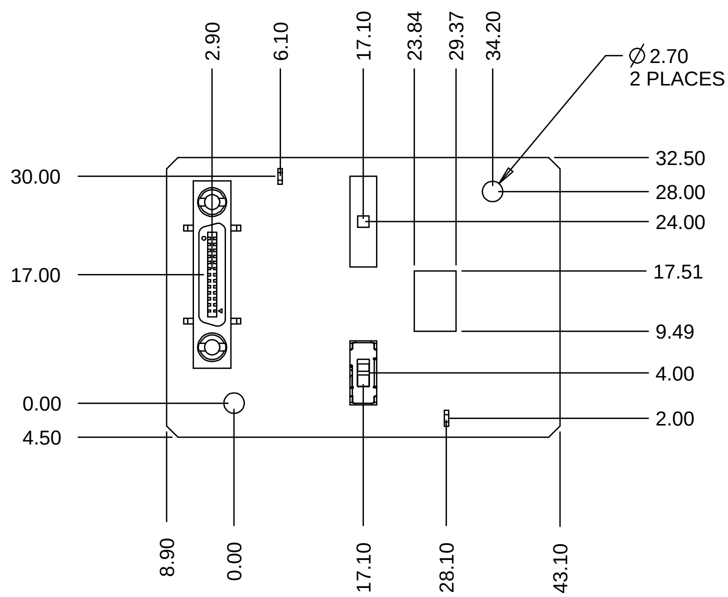


Figure 14: OEM Board Set with GPIO: GigE PHY Board Detailed Measurements

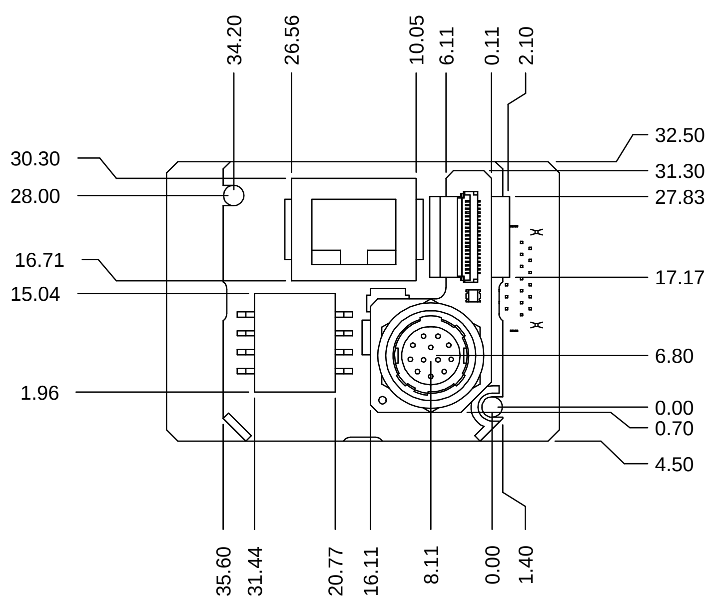
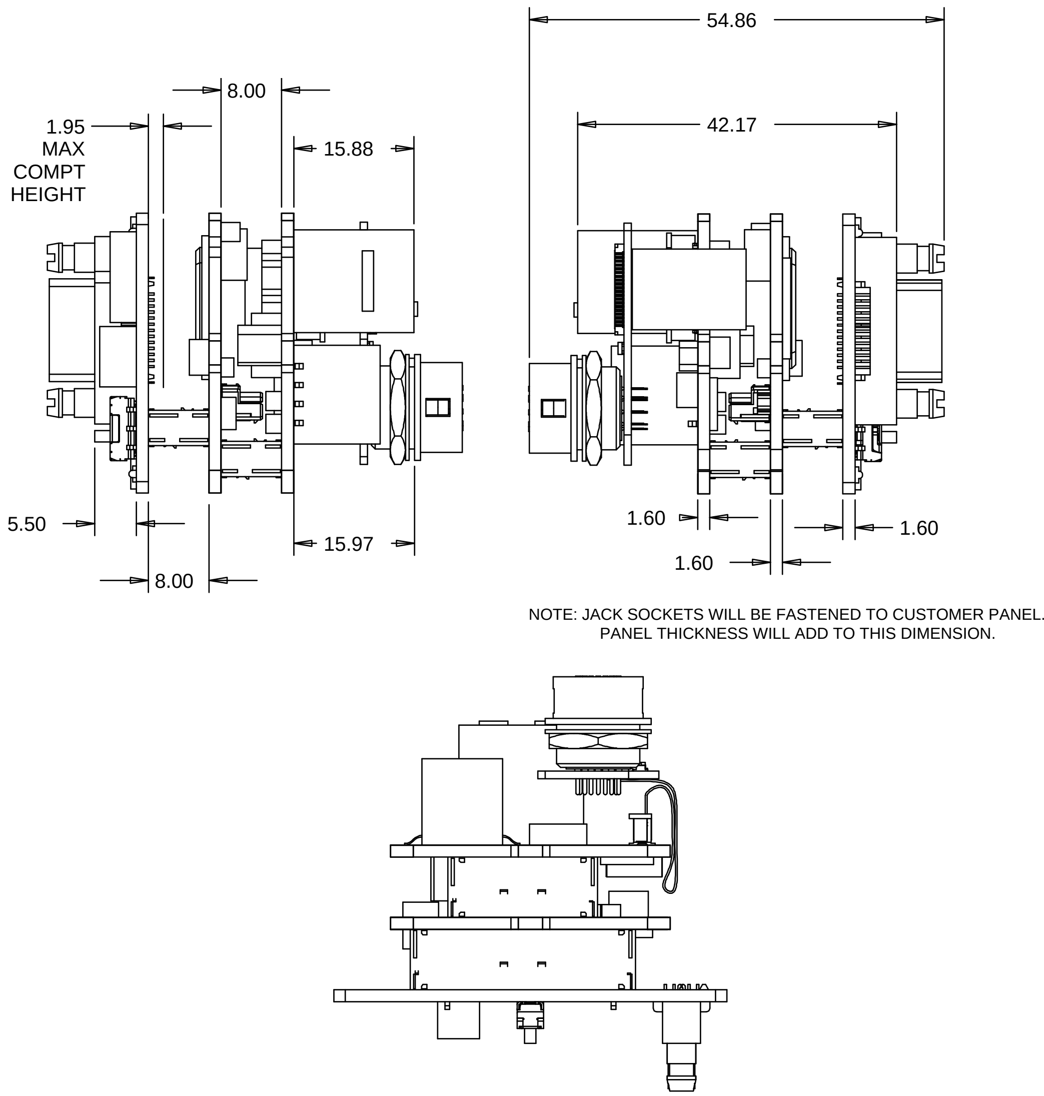


Figure 15: OEM Board Set with GPIO: Maximum Component Height



CL-GigE OEM Board Set with no 12-Pin GPIO Connector

The drawings in this section show the CL-GigEB-IND OEM board set (order code 900-6009) without the 12-pin GPIO connector soldered to the board.

Figure 16: OEM Board Set No GPIO Connector: Maximum Component Height

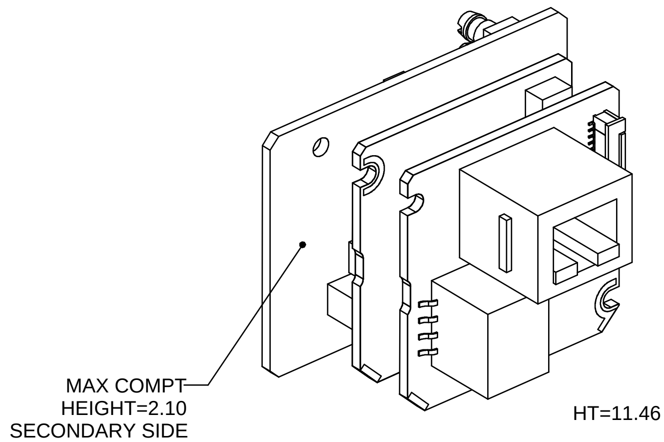


Figure 17: OEM Board Set No GPIO Connector: Component Height Adapter Board

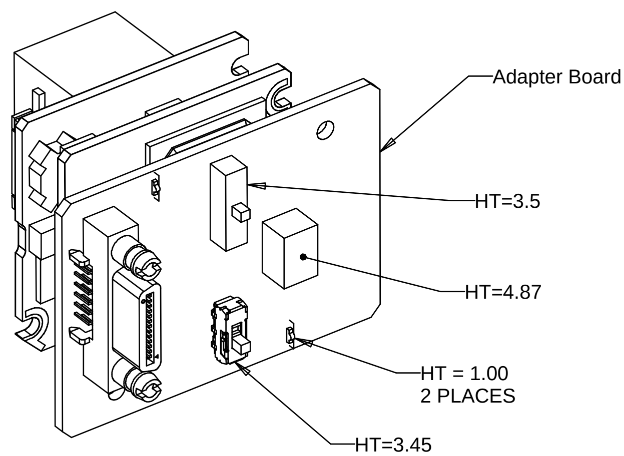


Figure 18: OEM Board Set No GPIO Connector: Adapter Board Detailed Measurements

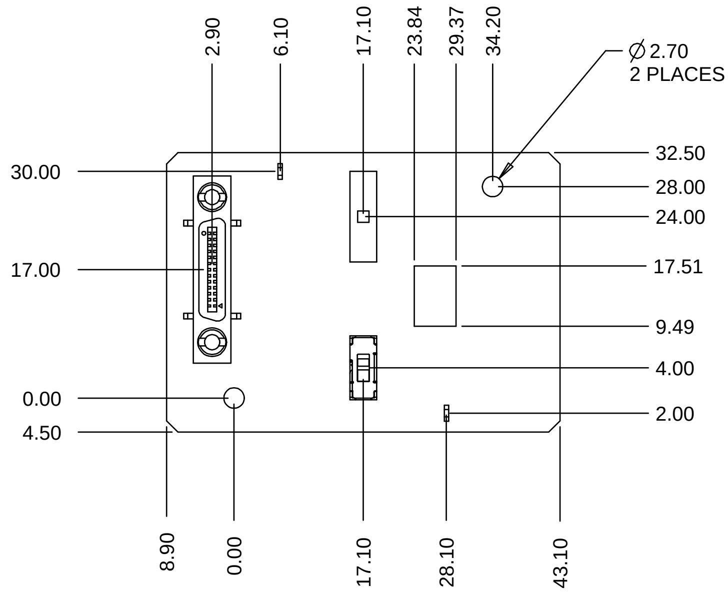


Figure 19: OEM Board Set No GPIO Connector: GigE PHY Board Detailed Measurements

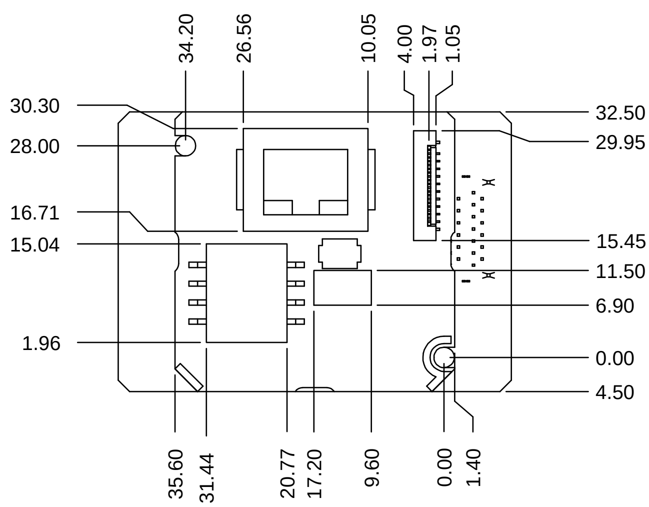
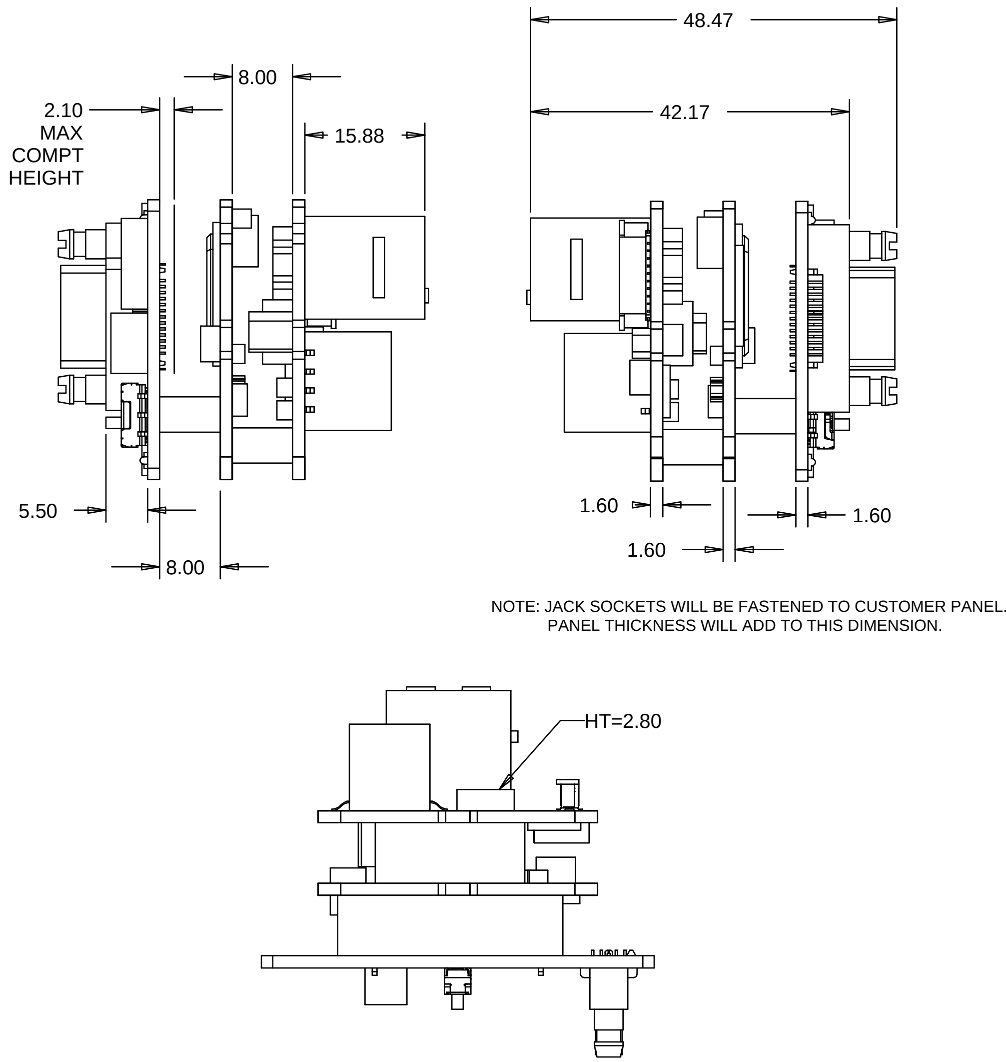


Figure 20: OEM Board Set No GPIO Connector: Maximum Component Height



GPIO Board Assembly

The drawings in this section show the GPIO board assembly that is included with the CL-GigEB-IND Development Kit (the development kit order code is 900-6011).

Figure 21: GPIO Board — Front and Back Views

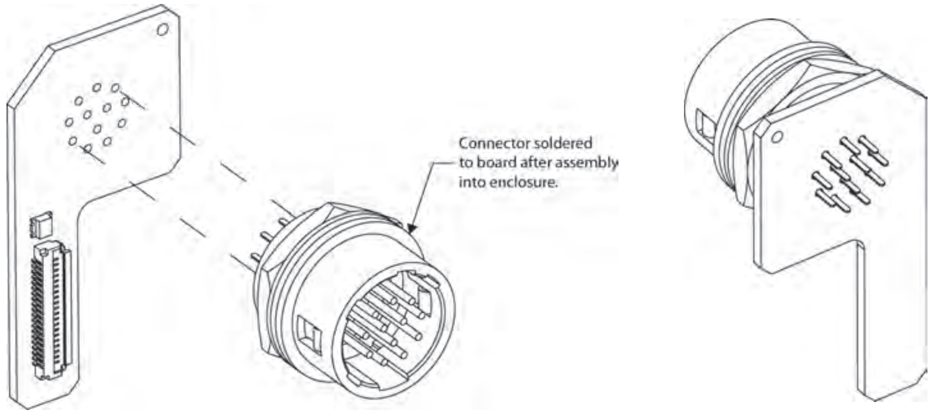


Figure 22: GPIO Board — Dimensions

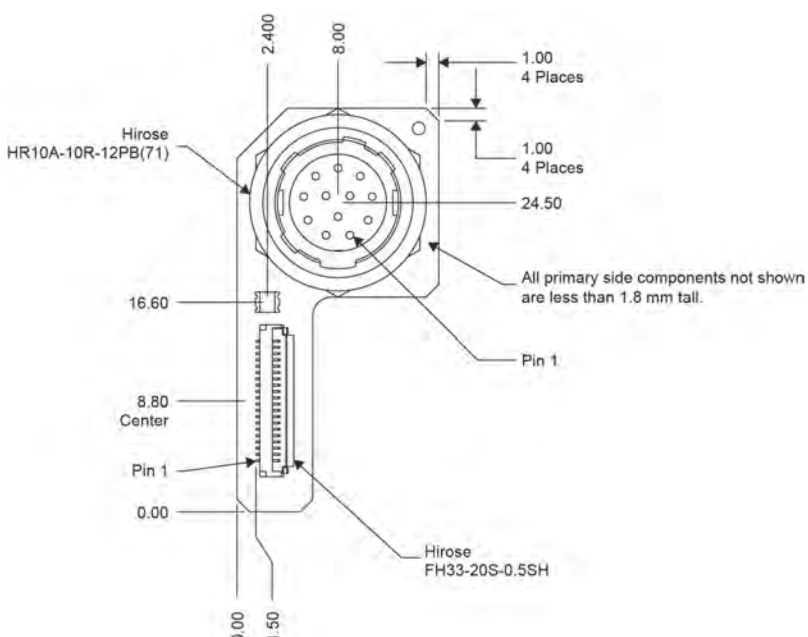


Figure 23: GPIO Board — Dimensions (Continued)

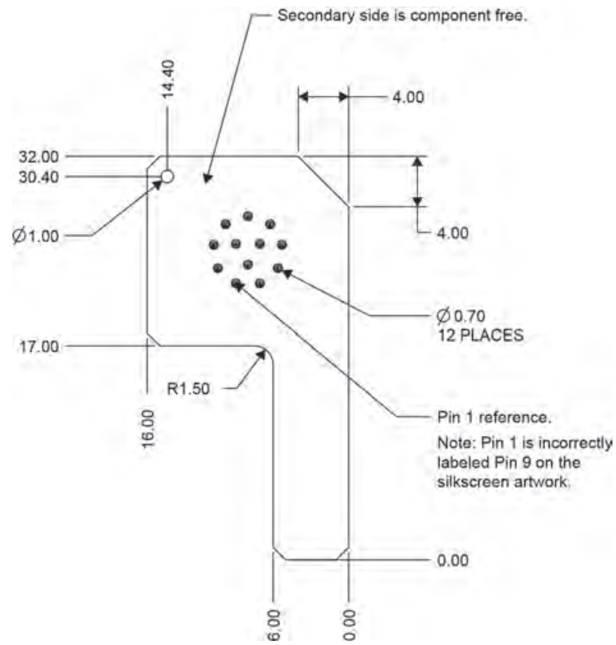
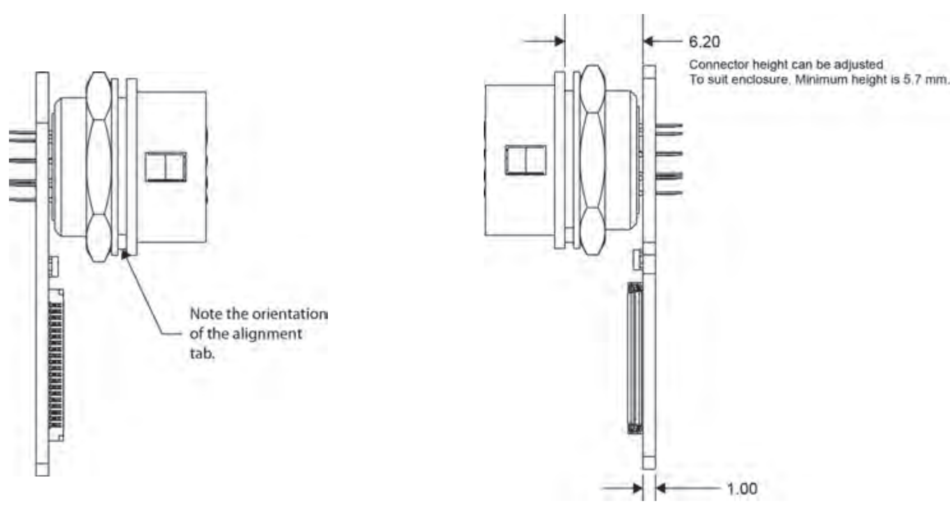


Figure 24: GPIO Board — Side Views



Material List

The connector summaries for the CL-GigE are listed in the following table.

Table 27: Connector Summary

Description	Manufacturer part number	Manufacturer
RJ-45 connector	RJHSE-3P85	Amphenol
12-pin circular connector	HR10A-10R-12PB(71)	Hirose Electric Co. Ltd.
Miniature Camera Link	12226-1100-00FR	3M

Source manufacturer, description, and identification may vary for each connector.

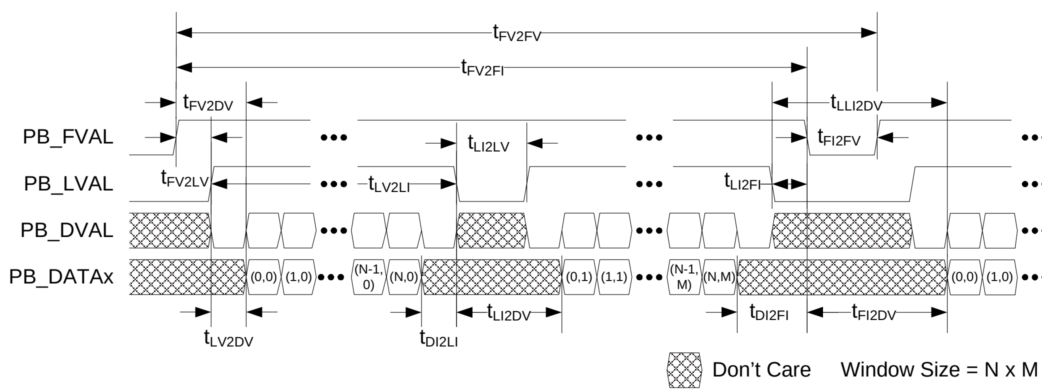
Chapter 14

Appendix: Timing for Camera Link Signals

The output of the camera must match the format of the CL-GigE. You should select a case for your application and then refer to “Timing Values for All Cases” on page 103. The stated timing restrictions are minimum values.

Camera Link Signals

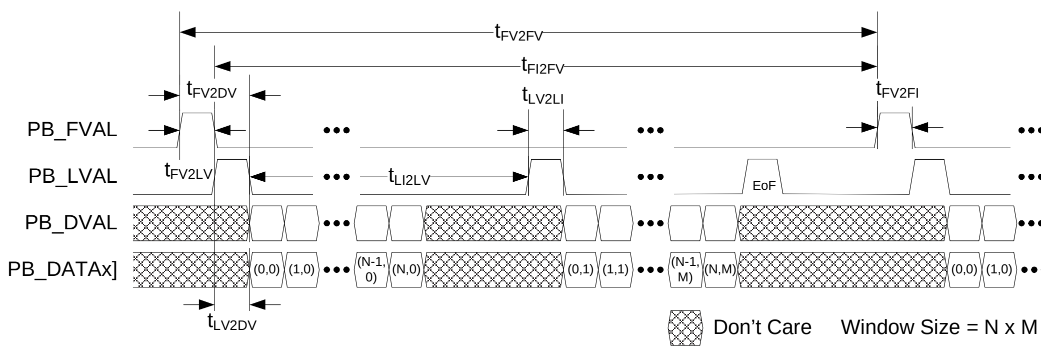
Case 1: FVAL and LVAL are Level-Sensitive



Case 2: FVAL and LVAL are Edge-Sensitive

In this case, FVAL and LVAL are edge-sensitive.

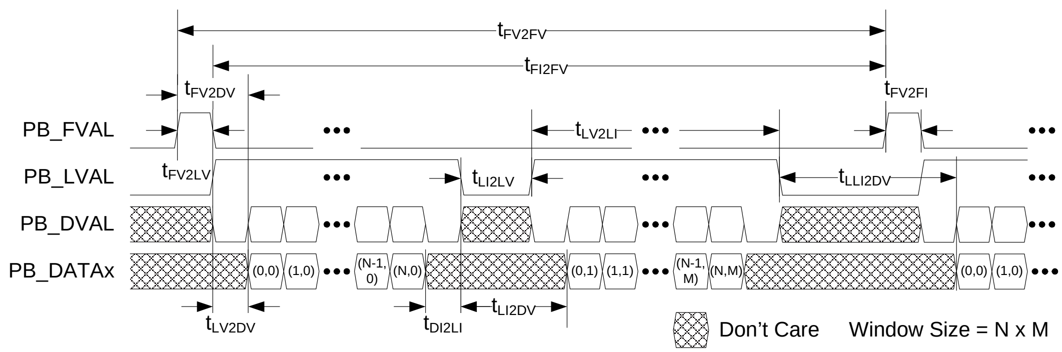
- **Start of frame/line is signaled by:** A rising (or falling) edge on FVAL, which signals the start of a *frame*. A rising (or falling) edge on LVAL, which signals the start of a *line*.
- **End of frame is signaled by:**
  - The next FVAL valid edge (rising edge when rising-edge sensitive or falling edge when falling-edge sensitive) occurs.
  - Or, when all of the pixels have been acquired (as set in the image height and width settings) **AND** an end-of-frame (EOF) occurs.
    Note: EOF occurs at LVAL rising edge (when rising-edge sensitive) or LVAL falling edge (when falling-edge sensitive). This is an additional LVAL edge, in addition to the configured/expected number of lines. See the EOF indicator in the illustration below.
- **Line Missing status and Partial Line Missing errors:** Partial Line Missing indicates lines are ending early (the next LVAL valid edge occurs before all of the pixels have been acquired). Full Line Missing indicates that the frame is ending early (the next FVAL edge occurs before all of the lines have been acquired).



Case 3: FVAL is Edge-Sensitive and LVAL is Level-Sensitive

In this case, FVAL is edge-sensitive and LVAL is level-sensitive.

- **Start of frame/line is signaled by:** A rising (or falling) edge on FVAL, which signals start of *frame*. The line is valid when LVAL is active (high or low depending on settings).
- **End of frame is signaled by:**
  - The next FVAL valid edge (rising edge when rising-edge sensitive or falling edge when falling-edge sensitive) occurs.
  - Or when all of the lines have been acquired (as set in the image height settings) **AND** the last LVAL with valid data is de-asserted (low when high level sensitive or high when low level sensitive).
- **Line Missing status or a Partial Line Missing error generated:**
  - Full Line Missing indicates that the frame is ending early (the next FVAL edge occurs before all of the lines have been acquired). Partial Line Missing indicates that lines are ending early (in this case, LVAL is de-asserted before all pixels in a line are captured).



Timing Values for All Cases

The timing values stated in the following table are minimum values only.

Table 28: Timing Values for All Cases

From	To	Symbol	Case 1 (level) (tcp)	Case 2 (edge) (tcp)	Case 3 (both) (tcp)
FVAL valid	LVAL valid [a]	tFV2LV	0 [b]	0	1
FVAL valid	Data valid [a, c, d]	tFV2DV	0 [b]	16	1
LVAL valid	Data valid [a, c, d]	tLV2DV	0	1	0
LVAL valid	LVAL invalid [a]	tLV2LI	1	1	1
LVAL invalid	LVAL valid [a]	tLI2LV	1	1	1

Table 28: Timing Values for All Cases

From	To	Symbol	Case 1 (level) (^{t}cp)	Case 2 (edge) (^{t}cp)	Case 3 (both) (^{t}cp)
LVAL invalid (Automatic Internal Retrigger disabled)	Data valid [a, c, d]	^{t}LI2DV	1	N/A	1
LVAL invalid (Automatic Internal Re-trigger enabled)	Data valid	^{t}LI2DV	16	N/A	16
Data invalid	LVAL invalid [a, c, d]	^{t}DI2LI	0	N/A	0
LVAL invalid	FVAL invalid [a]	^{t}LI2FI	0 [e]	N/A	N/A
Data invalid	FVAL invalid [a, c, d]	^{t}DI2FI	0 [e]	N/A	N/A
FVAL invalid	FVAL valid [a]	^{t}FI2FV	1	1	1
FVAL invalid	Data valid [a, c, d]	^{t}FI2DV	1	N/A	N/A
Last LVAL invalid	Data valid	^{t}LLI2DV	16	N/A	16
FVAL valid	FVAL invalid	^{t}FV2FI	16	1	1
FVAL valid	FVAL valid	^{t}2FV2FV	17	17	17

a. The valid state of FVAL and LVAL is high when they are set as level-high sensitive or rising-edge sensitive. Their valid state is low when they are set as level-low sensitive or falling-edge sensitive.

b. If LVAL is valid before FVAL becomes valid, the grabber drops the full line.

c. Data valid is defined by FVAL valid (note a), LVAL valid (note a), and DVAL valid (note d).

d. The valid state of DVAL is high when it is set as level-high sensitive, and low when set as level-low sensitive. DVAL is always valid in the grabber when the parameter PixelBusDataValidEnabled is off.

e. If FVAL becomes invalid and LVAL is still valid, the line is truncated.

Chapter 15

Reference: Mean Time Between Failures (MTBF) Data

The following table provides MTBF data.

Table 29: MTBF Data

Model	MTBF @ 40 °C
CL-GigE External Frame Grabber	1,014,151 hours

Assumptions:

1. The calculation is performed using the *RelCalc for Windows V5.1-TELC3* software, which implements Telcordia SR-332 (Issue 3) failure rate models.
2. The operating internal chassis temperature is 40°C. The calculation assumes the temperature across the boards is relatively constant.
3. The Telcordia environment is GB.
4. Each part's operating current/voltage/power stress is 50%.
5. The typical operating power value (as specified in the component's datasheet) is used for each IC and semiconductor.
6. The calculation uses the 90% UCL (Upper Confidence Level) Telcordia Issue 3 model.
7. Each part's Telcordia Quality Level is I.

Chapter 16

Technical Support

On the Pleora Support Center, you can:

- Download the latest software and firmware.
- Log a support issue.
- View documentation for current and past releases.
- Browse for solutions to problems other customers have encountered.
- Read knowledge base articles for information about common tasks.

To visit the Pleora Support Center

- Go to supportcenter.pleora.com and click **Support Center**.

  If you have not registered yet, you are prompted to register.

  Accounts are usually validated within one business day.