PLEORA TECHNOLOGIES INC.

iPORT™ CL-Ten Dual Medium External Frame Grabber

User Guide

Pleora Technologies

Document Number

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Table of Contents

Chapter 1

About this Guide

This chapter describes the purpose and scope of this guide, and provides a list of complimentary 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 iPORT CL-Ten Dual Medium External Frame Grabber to two Camera Link® Medium cameras. In this guide you can find a product overview, instructions for connecting the cables, installing the Pleora eBUS™ SDK, establishing an Ethernet connection, performing general configuration tasks, and configuring the settings to properly capture and display images from Camera Link cameras.

The last chapter of this guide provides Technical Support contact information for Pleora Technologies.

Related Documents

The *iPORT CL-Ten Dual Medium External Frame Grabber User Guide* is complemented by the following guides:

- *eBUS Player Quick Start Guide*
- *eBUS SDK C++ API SDK Help File*
- *eBUS SDK .NET API Help File*
- *eBUS SDK Programmer's Guide*
- *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*, available from the Automated Imaging Association (AIA) at www.visiononline.org
- *iPORT Advanced Features User Guide*

Chapter 2

About the iPORT CL-Ten Dual Medium External Frame Grabber

This chapter describes the external frame grabber, including the product variants and key features.

The following topics are covered in this chapter:

The iPORT CL-Ten Dual Medium External Frame Grabber

Pleora's iPORT™ CL-Ten External Frame Grabbers use a high performance GigE Vision® over 10 Gigabit Ethernet (10 GigE) link to transmit video simultaneously from two Camera Link Base or Medium cameras at their maximum data rates, with low, predictable latency. These external frame grabbers allow designers to extend and aggregate system cabling, and integrate Camera Link cameras into a networked environment.

CL-Ten External Frame Grabbers interact seamlessly with Pleora's other products in networked or point-to-point digital video systems. The frame grabbers also comply fully with the GigE Vision and GenICam™ standards, enabling interoperation with third-party equipment in multi-vendor environments. The GigE Vision and GenICam standards are agnostic to Ethernet link speed, which means the CL-Ten can be designed into multi-speed systems alongside GigE Vision cameras operating at 1 Gb/s, with no software modifications. With these benefits, manufacturers and integrators can use the CL-Ten to shorten time-to-market, reduce development and deployment risk, and lower design and system costs.

The CL-Ten converts video data to packets and sends them over a 10 GigE link to receiving software or hardware. The CL-Ten is compatible with industry-standard copper or fiber-based links via an SFP+ (small form-factor pluggable) connector, and can be easily connected to off-the-shelf 10 GigE components such as network cards and switches.

The CL-Ten is bundled with Pleora's feature-rich application toolkit, eBUS™ SDK.

Model Variants

The iPORT CL-Ten Dual Medium External Frame Grabber is supplied in these variants and is equipped with these parts, as listed in the following table.

Table 1: Model Variants

iPORT CL-Ten Dual Medium Enclosed	Quantity
iPORT CL-Ten Dual Medium Enclosed	**Quantity**
iPORT CL-Ten Dual Medium enclosed unit	1

iPORT CL-Ten Dual Medium Evaluation Kit Fiber	Quantity
iPORT CL-Ten Dual Medium External Frame Grabber enclosed unit	1
10 gigabit Ethernet network interface card (NIC)	1
10 gigabit enhanced small form-factor pluggable (SFP+) module, short range	2
Multimode fiber optic cable, 2 meters	1
12V power supply	1
Pleora eBUS SDK, provided on CD or USB stick (includes eBUS Player sample application)	1

iPORT CL-Ten Dual Medium Evaluation Kit Copper	Quantity
iPORT CL-Ten Dual Medium External Frame Grabber enclosed unit	1
10 gigabit Ethernet NIC	1
SFP+ Direct-Attach cable (passive), 2 meters	1
12V power supply	1
Pleora eBUS SDK, provided on CD or USB stick (includes eBUS Player sample application)	1

*Before assembly, ensure that all components are included in the selected package.

Feature Set

Key features
10 gigabit Ethernet-based. Supports IGMPv2 and ICMP.
Aggregation of two Camera Link Medium cameras over a single 10 gigabit Ethernet link*
Camera Link support: • Compatible with Base and Medium mode cameras up to 85 MHz* • Supports Power over Camera Link (PoCL) • Supports CLProtocol
• Supports 10GBASE-SR, -LR, and -LRM using linear or limiting SFP+ modules • Supports SFP+ Direct-Attach copper (passive, 12m maximum length)
Supports key non-interlaced tap configurations
Supports interleaved 2-tap and 4-tap configurations
Supports 1, 2, or 4 tap configurations**
Software-controlled GPIO: • 4 TTL (5V) general purpose inputs • 2 TTL (5V) general purpose outputs
3 UARTs (2 LVDS on Camera Link interface and 1 RS-232 on GPIO connector) allow serial control of cameras and other devices using a computer application over the network link
Compatible with *GigE Vision Standard*, version 2.0. Operates with GigE Vision and GenICam compatible applications.
Environmental and Physical
Storage temperature: -40° to 85°C
Operating temperature: 0° to 45°C
Dimensions (L x W x H): • 117 mm x 100 mm x 83.5 mm

* Two Base mode cameras can be connected (using the Medium 1A and Medium 2A connectors).

** When using Base mode cameras, 1 and 2 tap configurations are available.

Selected GenICam Features

The iPORT CL-Ten Dual Medium External Frame Grabber supports the mandatory GenICam features along with additional features, some of which are shown in the following table. The full list of features can be seen in the Device Control dialog box of Pleora's eBUS Player application.

Table 2: Selected GenICam Features

Feature	Description
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 pixel provided by the device. Available pixel formats are: • Monochrome pixel formats, 8 to 16 bits • Bayer pixel formats, 8 to 16 bits • RGB pixel formats, 8 to 12 bits per component
DeviceReset	Resets the external frame grabber to its power up state.
ActionUnconditionalMode**	Enables the unconditional action command mode where action commands are processed even when the primary control channel is closed.
ActionDeviceKey**	Provides the device key that allows the device to check the validity of action commands.
ActionQueueSize**	Indicates the size of the scheduled action commands queue. This number represents the maximum number of scheduled action commands that can be pending at a given point in time.
ActionSelector**	Selects to which Action Signal further Action settings apply.
ActionGroupMask**	Provides the mask that the device will use to validate the action on reception of the action protocol message.
ActionGroupKey**	Provides the key that the device will use to validate the action on reception of the action protocol message.
ClConnectorSelector	Selects the Camera Link interface to configure.
ClSafePowerActive	Controls whether the SafePower protocol is active. SafePower is a protocol to prevent the External Frame Grabber from attempting to supply power to a conventional (non-PoCL) cable or camera.
ClSafePowerStatus	Reports the status of the SafePower controller.
SourceCount*	Controls the number of sources supported by the device.
DeviceScanType*	Specifies the sensor scan type, such as areascan or linescan.

Table 2: Selected GenICam Features (Continued)

Feature	Description
DeviceTapGeometry*	Describes the geometrical properties characterizing the taps of a Camera Link camera as seen from the frame grabber or acquisition card. This device tap geometry feature is specific to Camera Link. Available tap geometries are: • Geometry_1X_1Y • Geometry_1X2_1Y • Geometry_1X • Geometry_1X2 • Geometry_1X4_1Y • Geometry_1X4 • Geometry_1X8 • Geometry_2X2E
GevIEEE1588**	Enables the IEEE 1588 Precision Time Protocol to control the timestamp register.
GevIEEE1588ClockAccuracy**	Indicates the expected accuracy of the device clock when it is the grandmaster, or in the event it becomes the grandmaster. This feature maps to the IEEE 1588 clockAccuracy attribute.
GevIEEE1588Status**	Provides the state of the IEEE 1588 clock.
SensorDigitizationTaps*	Specifies the number of digitized samples that are simultaneously output by the camera A/D conversion stage.
DigitizedImageWidth*	Width of the image provided by the Camera Link camera (in pixels).
DigitizedImageHeight*	Height of the image provided by the Camera Link camera (in pixels).

* These features are interrelated. When you change any of these values, the external frame grabber may automatically adjust the other values to ensure the configuration is valid.

** For information about using the action command and IEEE1588 features, see the *iPORT Advanced Features User Guide*, available on the Pleora Support Center at www.pleora.com.

Chapter 3

iPORT CL-Ten Dual Medium External Frame Grabber Connections

This chapter describes the external frame grabber connections. It also includes pinouts for the GPIO, serial, and power connector.

The following topics are covered in this chapter:

Connector Locations

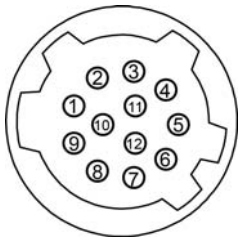
The following figure and table describe the external frame grabber connectors.

Table 3: External Frame Grabber Connectors

Connector	Type	Description
Medium	Mini Camera Link	Transmits images from a Camera Link camera to the external frame grabber through a Camera Link cable. You can connect two Medium mode cameras to the external frame grabber (connect one camera to the connectors labeled **Medium 1** and connect the other camera to the connectors labeled **Medium 2**). If PoCL is enabled, 4W at 12V is supplied to the camera, as outlined in the PoCL specification. **Note:** To use the external frame grabber in a Base Camera Link configuration, you can connect two Base mode cameras to the external frame grabber (connect one camera to the **Medium 1A** connector and connect the other camera to the **Medium 2A** connector).
Power	6-pin connector	Receives 12V of unfiltered DC input. The power consumption of the external frame grabber is approximately 11.5W (when using fiber optic cabling) and approximately 10W (when using Direct-Attach copper cabling). Values exclude PoCL power consumption.
Ethernet	SFP+ cage	Interfaces the external frame grabber to Ethernet networks, as specified in IEEE 802.3. The Ethernet interface operates at 10 gigabits per second (Gbps), and supports Internet Protocol Version 4 (IPv4).
GPIO/Serial	12-pin connector	Provides external signals, such as serial communication and GPIO, to the external frame grabber.

GPIO and Serial Connector Pinouts

The GPIO and serial pinout descriptions on the 12-pin female connector are listed in the following table.



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

Table 4: 12-Pin Connector — Pinout Descriptions

Pin	Type	Notes
1	GPIO output	Protected by ESD suppressors to IEC61000-4-2, Level 4 (+/-8 kV contact, +/-15 kV air discharge)
2	GPIO input	ESD information is the same as pin 1. This pin is mapped to CC2 on the Medium1A connector. See Table 6 on page 13 for the mapping of camera control and GPIO pins.
3	GPIO output	ESD information is the same as pin 1.
4	GPIO input/ output	ESD information is the same as pin 1. This pin is mapped to CC1 on the Medium2A connector. See Table 6 on page 13 for the mapping of camera control and GPIO pins.
5	Ground	Ferrite bead 0.3A, 600 Ohm @ 100 MHz to DGND of the daughter card.
6	GPIO input/ output	ESD information is the same as pin 1. This pin is mapped to CC2 on the Medium2A connector. See Table 6 on page 13 for the mapping of camera control and GPIO pins.
7	GPIO input/ output	ESD information is the same as pin 1. For second generation CL-Ten External Frame Grabber models, this pin is reserved.
8	GPIO input/ output	ESD information is the same as pin 1. For second generation CL-Ten External Frame Grabber models, this pin is reserved.
9	3.3 V power output	Maximum 100 mA, protected by 0.2A resettable fuse.
10	GPIO input	ESD information is the same as pin 1. This pin is mapped to CC1 on the Medium1A connector. See Table 6 on page 13 for the mapping of camera control and GPIO pins.

Table 4: 12-Pin Connector — Pinout Descriptions (Continued)

Pin	Type	Notes
11	RS232_RX0 (BULK4 Rx)	Protected by ESD suppressors to IEC61000-4-2, Level 4 (+/-8 kV contact, +/-15 kV air discharge)
12	RS232_TX0 (BULK4 Tx)	ESD information is the same as pin 1.

The GPIO pins on the 12-pin connector are mapped to GpioIn0 through GpioIn3 and GpioOut0 through GpioOut1 of the DigitalIOControl\LineSelector feature in the device's XML file. For information about configuring the external frame grabber with eBUS Player, see "Connecting to the External Frame Grabber and Configuring General Settings" on page 27.

Mapping of Serial Communication Interfaces and Connectors

The mapping of the signals from the Camera Link connector to the bulk interfaces of the camera is provided in the following table.

Table 5: Mapping of Serial Communication Interfaces and Connectors

Connector	Serial communication interface
Medium 1A	Bulk0
Medium1B	N/A
Medium 2A	Bulk1
Medium2B	N/A
GPIO	Bulk4

When using a Base mode configuration, the camera connected to the **Medium 1A** connector is mapped to Bulk0. The camera connected to the **Medium 2A** connector is mapped to Bulk1.

Mapping of Camera Link Connector and GPIO Pinouts

This section only applies to earlier releases of the external frame grabber. With the introduction of our next generation PLC, the CC and GPIO signals are no longer linked. The CC signals are now outputs to the PLC and the GPIO_In signals are inputs to the PLC. If you have upgraded your external frame grabber to version 2.0.0 (or later) and you want to drive the CC lines with the GPIO_In lines, you must program the PLC to perform this task. For more information about the PLC, see the *iPORT Advanced Features User Guide*, available at the Pleora Support Center. Embedded camera interfaces with version 2.0.0 (or later) firmware have the next generation PLC.

The GPIO pins on the 12-pin circular connector allow an external signal to control a Camera Link camera (typically, to trigger a camera). For example, triggers can be used to synchronize image capture from multiple cameras or to synchronize image capture with an external device.

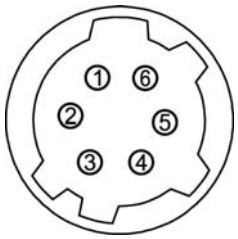
The mapping of the GPIO signals from the 12-pin circular connector to the Camera Link connector are provided in the following table.

Table 6: Mapping of Camera Link Connector and GPIO Pinouts

Camera Control (CC) Pin	GPIO Pin
Base 1/Medium 1A	
CC4	0/unused
CC3	0/unused
CC2	Line1 (GPIO_IN1)
CC1	Line0 (GPIO_IN0)
Base 2/Medium 2A	
CC4	0/unused
CC3	0/unused
CC2	Line3 (GPIO_INOUT1)
CC1	Line2 (GPIO_INOUT0)

Power Connector Pinouts

The power connector receives 12V of unfiltered DC input. The external frame grabber's power consumption is approximately 11.5W (when using fiber optic cabling) and approximately 10W (when using Direct-Attach copper cabling). Values exclude PoCL power consumption.



The power connector is a Hirose 6-pin connector, part number HR10A-7R-6P(73).

Table 7: Power Connector Pinout Descriptions

Pin	Name
1	V_{in} 11V to 13V regulated
2	V_{in} 11V to 13V regulated
3	V_{in} 11V to 13V regulated
4	Ground
5	Ground
6	Ground

Chapter 4

Signal Handling

The CL-Ten Dual Medium External Frame Grabber 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.

The PLC in the iPORT CL-Ten Dual Medium External Frame Grabber routes signals through a sophisticated PLC control block.

PLC Programming Signals

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 www.pleora.com.

The following table lists the PLC input and output programming signals that are specific to the iPORT CL-Ten Dual Medium External Frame Grabber, and indicates the pins on which they are available.

Table 8: PLC Signal Usage

Signal name	PLC equation usage
Pb0Fval	Input
Pb0Lval	Input
Pb0Dval	Input
Pb0Spare	Input
Pb1Fval	Input
Pb1Lval	Input
Pb1Dval	Input
Pb1Spare	Input
GpioIn0	Input
GpioIn1	Input
GpioIn2	Input
GpioIn3	Input
BufferWM0	Input
BufferWM1	Input
Grb0AcqActive	Input
Grb1AcqActive	Input
PlcCtrl0	Input
PlcCtrl1	Input
PlcCtrl2	Input
PlcCtrl3	Input
Pb0CC0	Input, output
Pb0CC1	Input, output
Pb0CC2	Input, output
Pb0CC3	Input, output
Pb1CC0	Input, output

Table 8: PLC Signal Usage (Continued)

Signal name	PLC equation usage
Pb1CC1	Input, output
Pb1CC2	Input, output
Pb1CC3	Input, output
GpioOut0	Input, output
GpioOut1	Input, output
PlcFval0	Input, output
PlcFval1	Input, output
PlcLval0	Input, output
PlcLval1	Input, output
PlcMval0	Input, output
PlcMval1	Input, output
PlcTrig0	Input, output
PlcTrig1	Input, output
PlcTimestampCtrl	Input, output
Timer0Trig	Input, output
Timer0Out	Input
Timer1Trig	Input, output
Timer1Out	Input
Counter0Reset	Input, output
Counter0Inc	Input, output
Counter0Dec	Input, output
Counter0Eq	Input
Counter0Gt	Input
Counter1Reset	Input, output
Counter1Inc	Input, output
Counter1Dec	Input, output
Counter1Eq	Input
Counter1Gt	Input
Rescaler0In	Input, output
Rescaler0Out	Input
Delayer0In	Input, output
Delayer0Out	Input

Table 8: PLC Signal Usage (Continued)

Signal name	PLC equation usage
Event0	Input, output
Event1	Input, output
Event2	Input, output
Event3	Input, output
ActionTrig0	Input
ActionTrig1	Input

Chapter 5

Status LEDs

The status LEDs indicate the operating status of the external frame grabber's network connection and firmware. The following figure and table describe the status LEDs.

Table 9: Status LEDs

LED	Description
Power/FPGA	**Off.** No power. **Green.** Power on. **Orange.** Main firmware load is corrupted. Contact Pleora support.
Link	**Green (solid).** Network connection. **Green (blinking).** Data receive/transmit. **Off.** No connection.
1, 2, 3, and 4	**Green (solid).** Power over Camera Link (PoCL) is active for the associated connector. **Off.** PoCL is not active.

Chapter 6

Installing the eBUS SDK

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

Before you can configure and control your external frame grabber, you must install the eBUS SDK and GigE Vision driver.

The following topics are covered in this chapter:

Installing the eBUS SDK

You can install the Pleora eBUS SDK on your computer to configure and control your external frame grabber. Consult the *eBUS Player Quick Start Guide* or *eBUS Player User Guide* for information about setting up and configuring your camera for connection to the external frame grabber.

The Pleora Technologies eBUS SDK contains 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.

It is possible for you to configure the external frame grabber 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.

To learn more about the features that are available in the eBUS SDK, along with details on creating applications for device configuration and control, image and data acquisition, and image display and diagnostics, see the *eBUS SDK Programmer's Guide* on the Pleora Support Center (www.pleora.com).

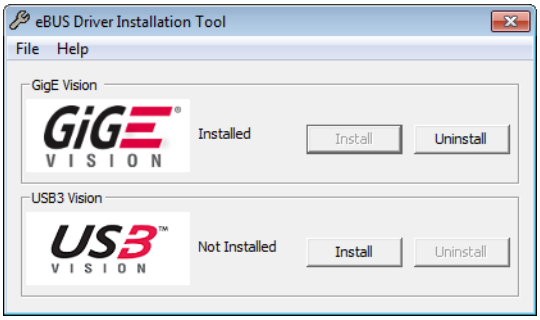
Installing the Driver and Configuring the NIC

Before you can configure the external frame grabber, use the Driver Installation Tool (included with the eBUS SDK) to install the correct driver. Then, set up your NIC.

To install a Pleora driver

1. Click **Start** > **All Programs** > **Pleora Technologies Inc** > **eBUS SDK** > **Tools** > **eBUS Driver Installation Tool**.
2. Under **GigE Vision**, click **Install**.

   After a moment the driver installs and the driver status changes to **Installed**. 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**.

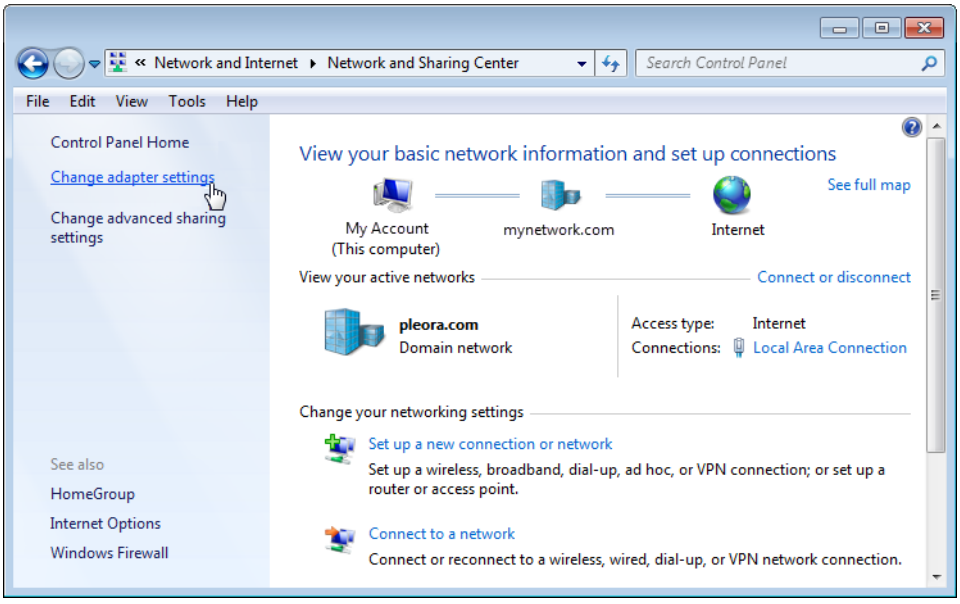
To configure an IP address for the NIC

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

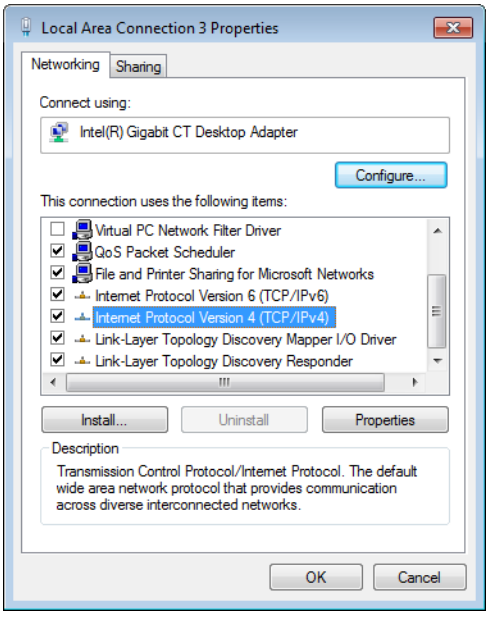
The instructions in this procedure are based on the Windows 7 operating system. The steps may vary depending on your computer's operating system.

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

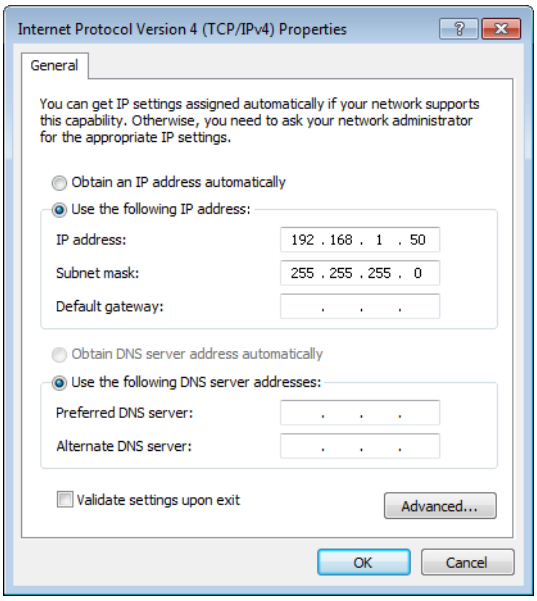
3. In the left-hand panel, click **Change adapter settings**.



4. Right-click the NIC and then click **Properties**.
5. Click **Internet Protocol Version 4 (TCP/IPv4)** and then click **Properties**.

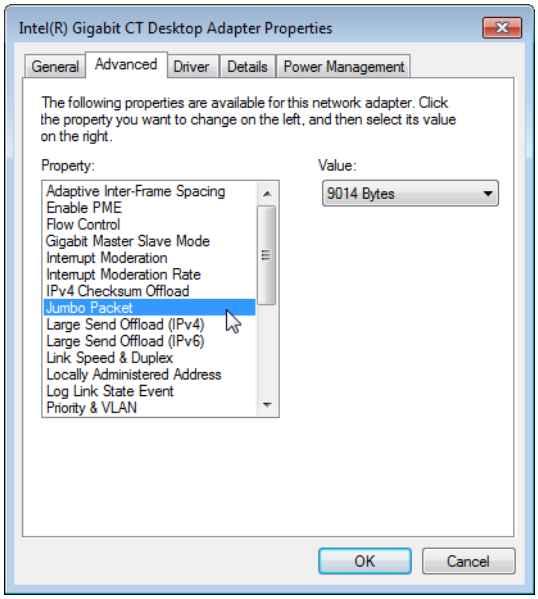


6. Select **Obtain an IP address automatically** or **Use the following IP address** to give the NIC an IP address.
7. Close the open dialog boxes to apply the changes and close the Control Panel.



8. Configure the NIC for jumbo packets (more often referred to as jumbo frames) and set the NIC's Rx Descriptor 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.



While not mandatory, you may wish to disable the network firewall and anti-virus software to improve system performance.

Chapter 7

Connecting to the External Frame Grabber and Configuring General Settings

After you have connected to the external frame grabber, you can provide it with a unique IP address on your network. When a connection is established, start eBUS Player and connect to the external frame grabber. Then you can configure its image and Camera Link settings to ensure images are received and displayed properly. You can also configure the buffer options to reduce the likelihood of lost packets.

eBUS Player is documented in more detail in the *eBUS Player Quick Start Guide* and the *eBUS Player User Guide*. The *iPORT CL-Ten Dual Medium External Frame Grabber User Guide* provides you with the eBUS Player instructions and overviews required to set up and configure the external frame grabber.

The following topics are covered in this chapter:

Connecting the Ethernet Cables and Confirming Image Streaming

The external frame grabber can communicate with your computer using either a direct connection or by connecting to a 10 GigE switch. This section explains how to connect the external frame grabber to a 10 GigE switch to confirm that images are streaming.

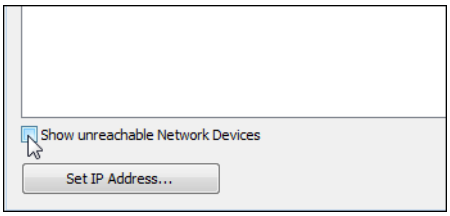
To connect the Ethernet cables and apply power

1. Connect the external frame grabber to the RJ-45 Ethernet connector on your computer's NIC.
2. Apply external power (if required).

To start eBUS Player and connect to a device

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

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



3. In the **Device Selection** dialog box, click the external frame grabber.

If the IP address is not valid, a warning ( ) appears in the **Device Selection** dialog box. Provide the device with an IP address, as outlined in "Providing the External Frame Grabber with an IP Address" on page 30.

4. Click **OK**.

   eBUS Player is now connected to the device.

To confirm image streaming

1. Under **Acquisition Control**, click the source to which a camera is connected.
2. Click **Play** to stream live images.
3. After you confirm that images are streaming, click **Stop**.

If images do not stream, see the tips provided in "System Troubleshooting" on page 53.

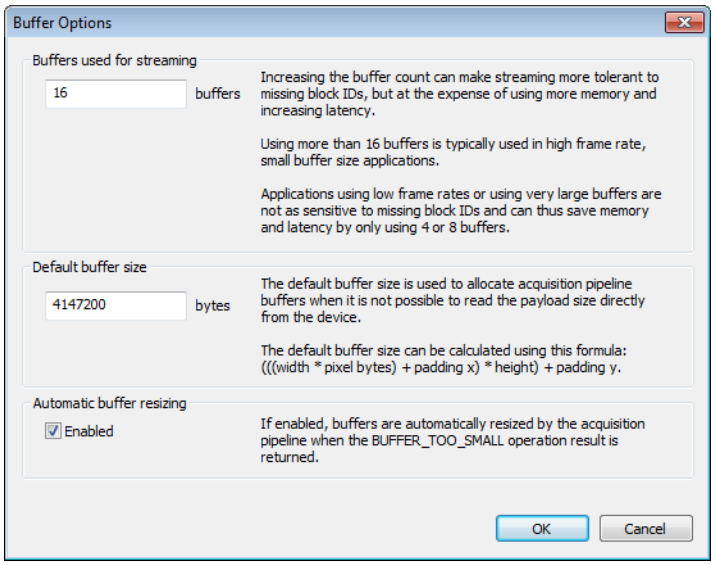
Configuring the Buffers

You can increase the buffer count in eBUS Player to reduce the impact and likelihood of lost and out-of-order packets, and 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. Applications using a high number of buffers might experience greater latency.

To configure the buffers

1. Start eBUS Player and connect to the external frame grabber.
   For more information, see "To start eBUS Player and connect to a device" on page 28.
2. Click **Tools** > **Buffer Options**.
3. Click the buffer option that suits your requirements.
4. Click **OK**.

Default size for streaming is 16 buffers.



Providing the External Frame Grabber with an IP Address

The external frame grabber 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 external frame grabber with an IP address

1. Start eBUS Player.
2. Click **Select/Connect**.
3. Click the external frame grabber.
4. Click **Set IP Address**.
5. Provide the external frame grabber with a valid IP address and subnet mask. You can optionally provide a default gateway.

If you are using a unicast network configuration, the management entity/data receiver and the external frame grabber must be on the same subnet. The unicast network configuration is outlined in "Unicast Network Configuration" on page 44.

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 device.

Configuring an Automatic/Persistent IP Address

The Device Control dialog box allows you to configure a persistent IP address for the external frame grabber. Alternatively, the external frame grabber can be configured to automatically obtain an IP address using Dynamic Host Configuration Protocol (DHCP) or Link Local Addressing (LLA). The external frame grabber 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**.

To configure a persistent IP address

1. Start eBUS Player and connect to the external frame grabber.
   For more information, see "To start eBUS Player and connect to a device" on page 28.
2. Under **Parameters and Controls**, click **Device control**.
3. Under **TransportLayerControl**, set the **GevCurrentIPConfigurationPersistentIP** feature to **True**.
4. Set the **GevPersistentIPAddress** feature to a valid IP address in the **GevPersistentIPAddress** field.
5. Set the **GevPersistentSubnetMask** feature to a valid subnet mask address.
6. Optionally, enter a valid default gateway in the **GevPersistentDefaultGateway** field.
7. Close the **Device Control** dialog box.
8. Power cycle the external frame grabber.

To automatically configure an IP address

1. Start eBUS Player and connect to the external frame grabber.

   For more information, see "To start eBUS Player and connect to a device" on page 28.
2. Under **Parameters and Controls**, click **Device control**.
3. Under **TransportLayerControl**, 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. Power cycle the external frame grabber.

Configuring the External Frame Grabber's Image Settings

You can configure the external frame grabber's image settings, which provide the external frame grabber with information about the image coming from the camera. These settings allow the images to appear correctly.

The image settings are located under **ImageFormatControl** in the **Device Control** dialog box.

For information about configuring the external frame grabber to send serial commands to a Camera Link camera that uses a CLProtocol DLL, see the *Establishing a Serial Bridge eBUS SDK Application Note* available on the Pleora Technologies Support Center.

To turn the test pattern on or off

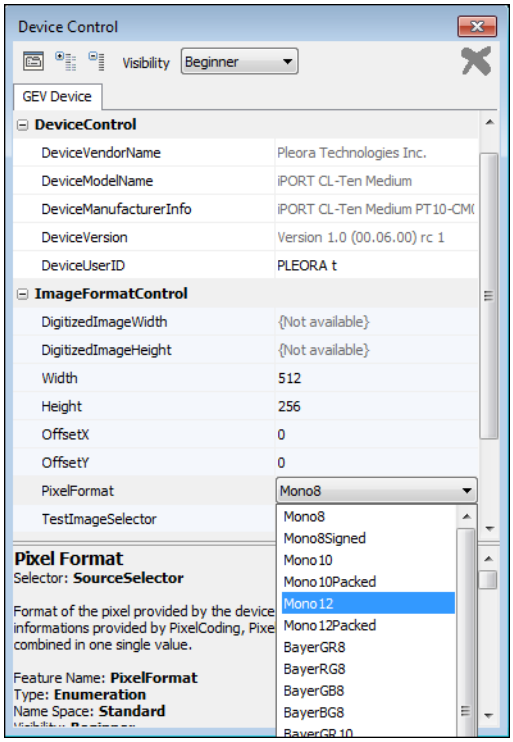
1. Start eBUS Player and connect to the external frame grabber.

   For more information, see "To start eBUS Player and connect to a device" on page 28.
1. Under **Parameters and Controls**, click **Device control**.
2. Under **ImageFormatControl**, click a test pattern option in the **TestImageSelector** list.
3. Close the **Device Control** dialog box.

To change the pixel format

1. Start eBUS Player and connect to the external frame grabber.

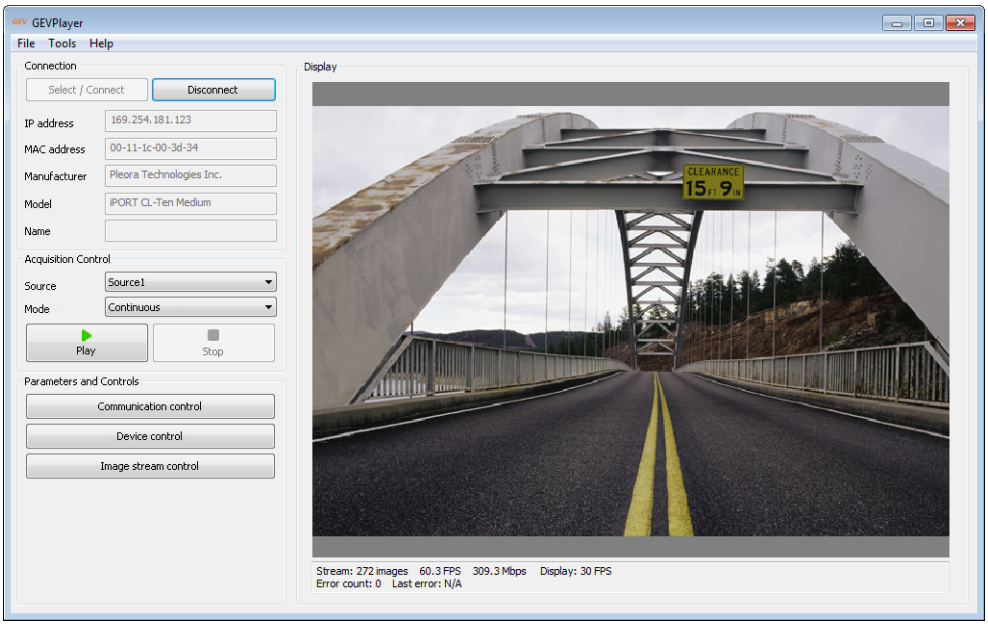
   For more information, see "To start eBUS Player and connect to a device" on page 28.
2. If images are streaming, click the **Stop** button.
3. Under **Parameters and Controls**, click **Device control**.
4. Under **SourceControl**, click the source that you want to configure.
5. Under **ImageFormatControl**, set the **PixelFormat** feature to a color format, such as **Bayer**, or **RGB** (by default the **PixelFormat** is set to **Mono8**).



Changes to the **PixelFormat** may affect the **DeviceScanType**, **SensorDigitizationTaps**, **DeviceTapGeometry**, **Width**, **Height**, **DigitizedImageWidth**, and **DigitizedImageHeight** features. When you change the PixelFormat, the external frame grabber may automatically adjust the other values to ensure the configuration is valid. For information about these settings, see "Configuring Camera Link Settings" on page 35.

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

7. Under **Acquisition Control**, click the source to which the camera you want to view is connected.
8. Click **Play** to see the changes.



To configure the image width and height

1. Start eBUS Player and connect to the external frame grabber.

   For more information, see "To start eBUS Player and connect to a device" on page 28.
2. If images are streaming, click the **Stop** button.
3. Under **Parameters and Controls**, click **Device control**.
4. Under **SourceControl**, click the source that you want to configure.
5. Under **ImageFormatControl**, change the **Width** and **Height** to suit your camera.
   - If the external frame grabber does not perform tap reconstruction (as specified in Table 12 on page 37), configure the **Width** and **Height**.
   - If the external frame grabber does perform tap reconstruction, configure the **Width**, **Height**, **DigitizedImageWidth**, and **DigitizedImageHeight**.

Changes to the **Width**, **Height**, **DigitizedImageWidth**, and **DigitizedImageHeight** may affect the **DeviceScanType**, **SensorDigitizationTaps**, **DeviceTapGeometry**, and **PixelFormat** features. When you change these features, the external frame grabber may automatically adjust the other values to ensure the configuration is valid. For information about these settings, see "Configuring Camera Link Settings" on page 35.

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

Configuring a Camera Link Camera

To configure a Camera Link camera, you can use one of the methods outlined in the following table.

Table 10: Connection Methods for Configuring Camera Link Cameras

Connection Method	Use this Method When...
Direct serial connection	You want to manually type commands that are directly sent to the camera. This method uses the **Serial Communications** dialog box in eBUS Player.
Serial Communication Bridge, Camera Link serial DLL connection	You are using a third-party camera configuration application that requires that you use a Camera Link serial DLL to send serial commands to the camera.
Serial Communication Bridge, CLProtocol DLL and GenICam CLProtocol connection	The camera manufacturer has provided a CLProtocol DLL that allows you to configure and monitor settings within the camera using GenICam.

For more information about the Serial Communication Bridge methods, see the *Establishing a Serial Bridge Application Note* available on the Pleora Support Center.

Configuring Camera Link Settings

The CL-Ten Dual Medium External Frame Grabber supports up to two Camera Link Medium cameras, which stream image data to the external frame grabber using four standard Camera Link cables (two cables for each camera, as outlined by the Camera Link standard). Optionally, the external frame grabber can supply power to the cameras using PoCL.

To ensure images are received properly, you must configure the general Camera Link settings, which include specifying the sensor scan type (either areascan or linescan), selecting the number of taps for your camera, and selecting your camera's tap geometry. All of this information is provided by the camera manufacturer.

You can optionally enable the SafePower protocol, which prevents the external frame grabber from attempting to supply power to a non-PoCL cable or camera.

If you are using Camera Link Base cameras, you can connect two Camera Link Base cameras to the CL-Ten Dual Medium External Frame Grabber (using the **Medium 1A** and **Medium 2A** connectors).

Supported Camera Link Modes

The following table lists the supported Camera Link modes and sub-modes. All Camera Link Medium modes are supported, with the exception of the 3-tap modes. For detailed information about bit assignment for each mode, see the Camera Link standard (available from the Automated Imaging Association (AIA) at www.visiononline.org).

Table 11: Supported Camera Link Modes

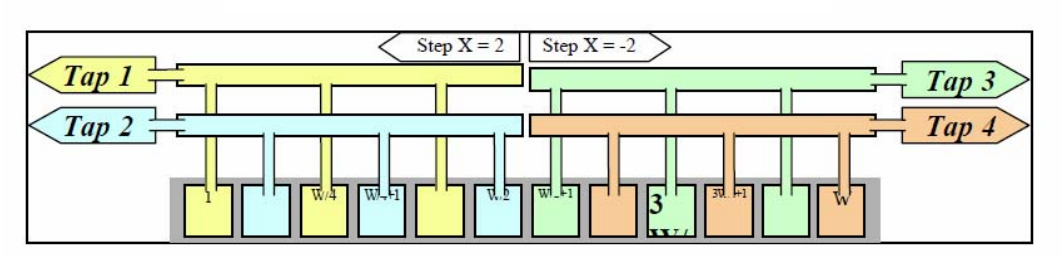
Camera Link configuration	Taps	Pixel depth
Base	1	8-bit, 10-bit, 12-bit, 14-bit, 16-bit, 24-bit RGB
	2	8-bit, 10-bit, 12-bit
Medium	1	8-bit, 10-bit, 12-bit, 14-bit, 16-bit, 24-bit RGB, 30-bit RGB, 32-bit RGB, 36-bit RGB
	4	8-bit, 10-bit, 12-bit
Single source dual medium*	8	12-bit

*Single Source Dual Medium mode enables the transmission of video data coming from four Camera Link connectors on one GigE Vision stream channel. When **SourceCount** is set to **1**, the external frame grabber is using Single Source Dual Medium mode.

About Tap Reconstruction

For multi-tap cameras, pixels may not be received in order from the Camera Link camera, depending on the camera's tap configuration. Using the DeviceTapGeometry GenICam feature, you can specify the device tap geometry that corresponds to your camera, which allows the external frame grabber to reconstruct the pixel order. The following figure provides an example of a tap geometry that requires reconstruction.

Figure 1: 2X2E (Linescan) Tap Geometry



When you select a tap geometry for which the external frame grabber performs tap reconstruction, you must provide the external frame grabber with information about the size of the image coming from the camera. This information allows the external frame grabber to send a portion of the image (an area of interest) to the receiver, when required.

Supported Device Tap Geometries

The following table lists the supported device tap geometries. Please note that the external frame grabber does not need to perform tap reconstruction for most of the supported tap geometries (that is, the taps are received in order from the camera and the external frame grabber does not need to reconstruct the order).

Table 12: Supported Camera Link Tap Geometries

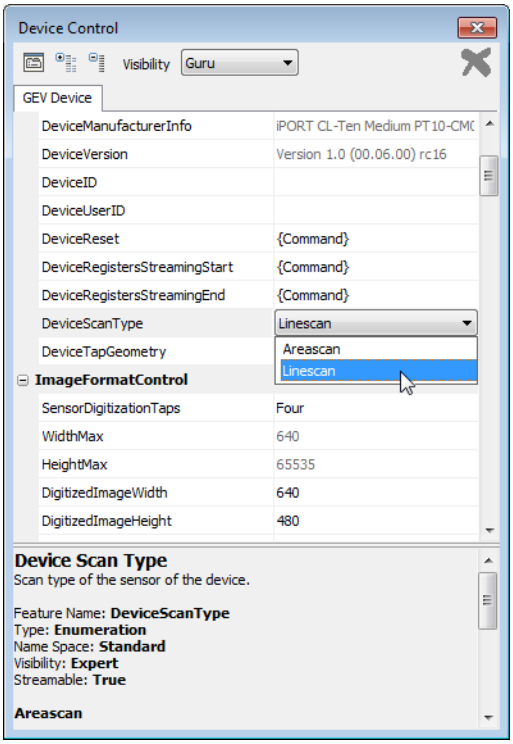
Tap geometry	Number of taps	Tap reconstruction performed?	Scan type
Geometry_1X_1Y	1	Not required	Areascan
Geometry_1X2_1Y	2	Not required	Areascan
Geometry_1X	1	Not required	Linescan
Geometry_1X2	2	Not required	Linescan
Geometry_1X4_1Y	4	Not required	Areascan
Geometry_1X4	4	Not required	Linescan
Geometry_1X8_1Y	8	Not required	Areascan
Geometry_1X8	8	Not required	Linescan
Geometry_2X2E	2	Yes	Linescan

If your camera outputs a tap geometry that is not listed in Table 12 on page 37, you may need to perform tap reconstruction using your software application. For more information about tap geometry, refer to the *GenICam Standard Features Naming Convention* (Version 1.5.1 or later), available from the European Machine Vision Association at http://www.emva.org.

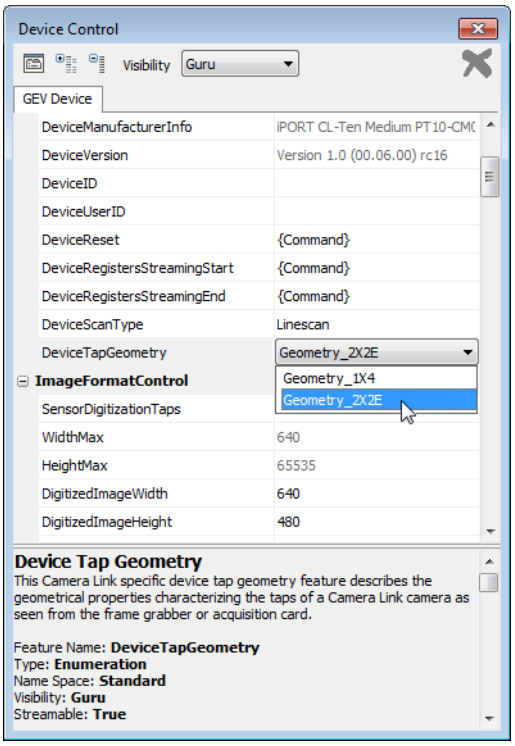
To configure general Camera Link settings

1. Start eBUS Player and connect to the external frame grabber.

   For more information, see "To start eBUS Player and connect to a device" on page 28.
2. If images are streaming, click the **Stop** button.
3. Under **Parameters and Controls**, click **Device control**.
4. Click **Expert** in the **Visibility** list.
5. Under **DeviceControl**, select a sensor scan type (areascan or linescan) in the **DeviceScanType** list.



6. Under **ImageFormatControl**, select the number of taps in the **SensorDigitizationTaps** list.
7. Under **DeviceControl**, select your camera's tap geometry in the **DeviceTapGeometry** list.



DeviceScanType, **SensorDigitizationTaps**, and **DeviceTapGeometry** are interrelated. When you change any of these values, the external frame grabber may automatically adjust the other values to ensure the configuration is valid.

These values are also affected by changes to the **Width**, **Height**, **DigitizedImageWidth**, **DigitizedImageHeight**, **SourceCount**, and **PixelFormat** features.

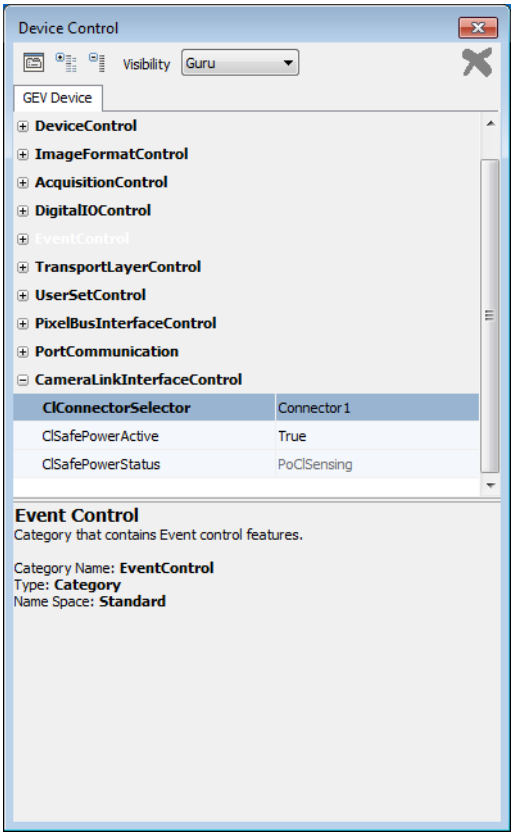
8. Close the **Device Control** dialog box.

To configure the Camera Link SafePower settings

1. Under **CameraLinkInterfaceControl**, select the connector that you want to configure for SafePower in the **ClConnectorSelector** list.

   Note: Connector1, **Connector2**, **Connector3**, and **Connector4** correspond to the **Medium 1A**, **Medium 1B, Medium 2A**, and **Medium 2B** connectors, respectively.

2. To enable SafePower, set **ClSafePowerActive** to **True**. When this option is set to **False**, SafePower is disabled and the external frame grabber does not attempt to supply power to the selected connector.



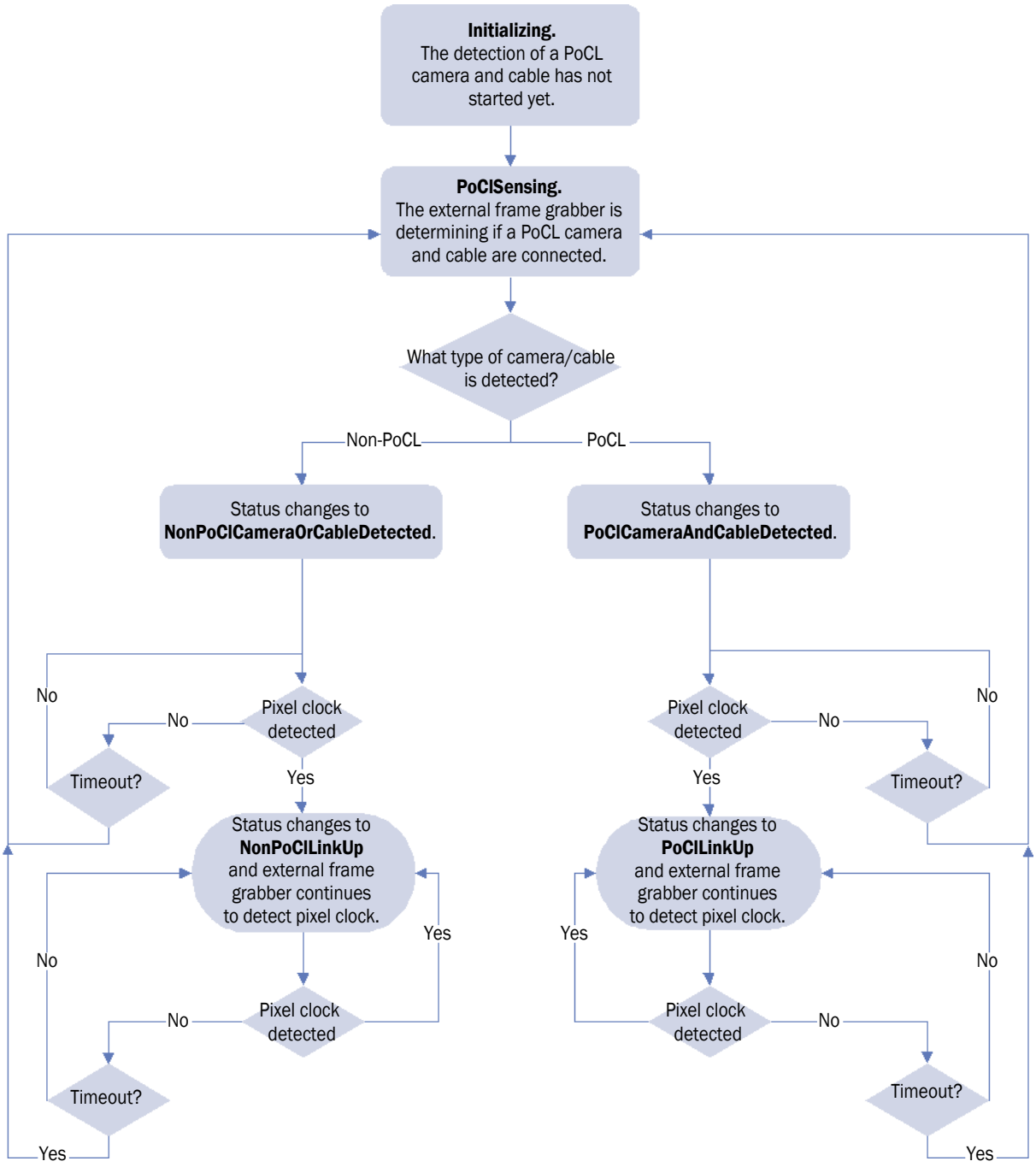
3. Repeat steps 1 and 2 as required for the other connectors.
4. Close the **Device Control** dialog box.

To view the Camera Link SafePower status

1. Under **CameraLinkInterfaceControl**, select a connector in the **ClConnectorSelector** list.

   Note: Connector1, **Connector2**, **Connector3**, and **Connector4** correspond to the **Medium 1A**, **Medium 1B**, **Medium 2A**, and **Medium 2B** connectors, respectively

2. Review the status that appears under **ClSafePowerStatus**. The following flowchart explains the status changes. Please note that each connector performs this process independently.



Implementing the eBUS SDK

You can create your own image acquisition software for the external frame grabber. Consult the *eBUS SDK Programmer's Guide*, the *eBUS SDK C++ API Help file,* and the *eBUS SDK .NET API Help file* for information about creating custom image acquisition software.

Chapter 8

Network Configurations

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

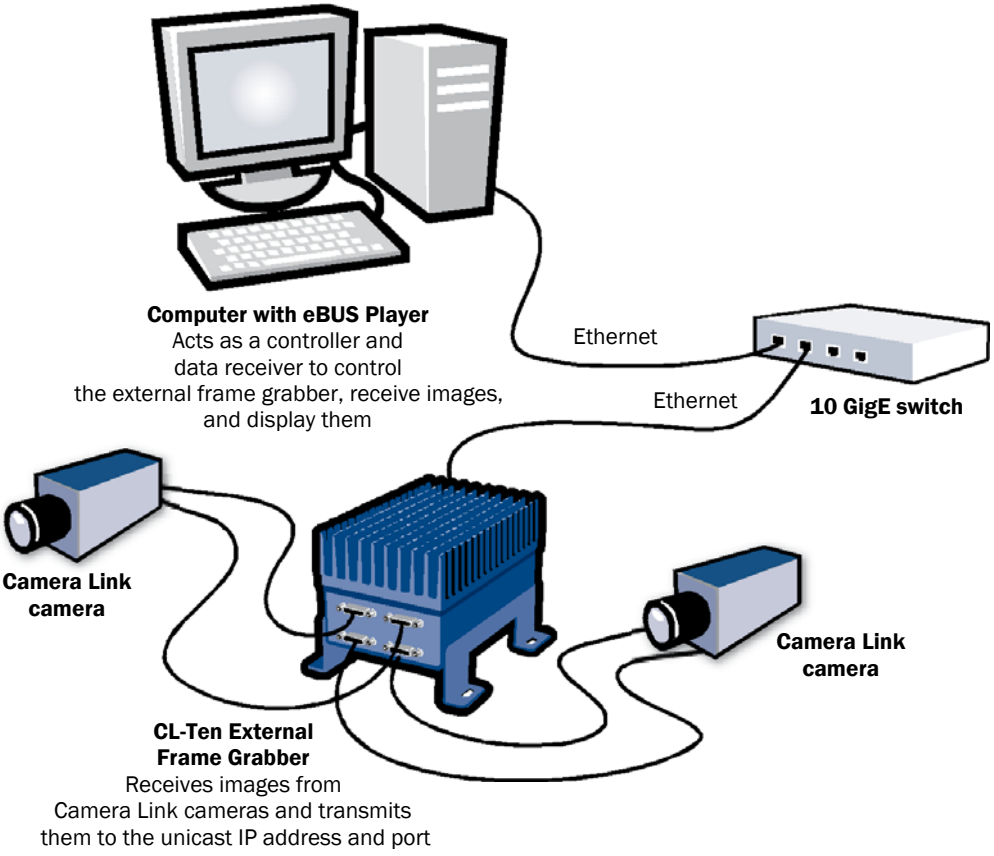
The following topics are covered in this chapter:

Unicast Network Configuration

In a unicast configuration, an external frame grabber is connected to a 10 GigE switch that sends a stream of images over Ethernet to the computer. Alternatively, the external frame grabber 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 external frame grabber.

Figure 2: Unicast Network Configuration



Required Items — Unicast Network Configuration

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

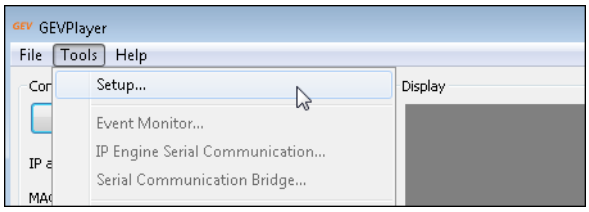
- iPORT CL-Ten Dual Medium External Frame Grabber and corresponding power supply
- Copper or fiber cable with SFP connectors (quantity: 1)
- 10 GigE switch and an additional copper or fiber cable (optional)
- Desktop computer with eBUS SDK, version 2.2 (or later) installed
- Camera and cables

External Frame Grabber Configuration — Unicast Network Configuration

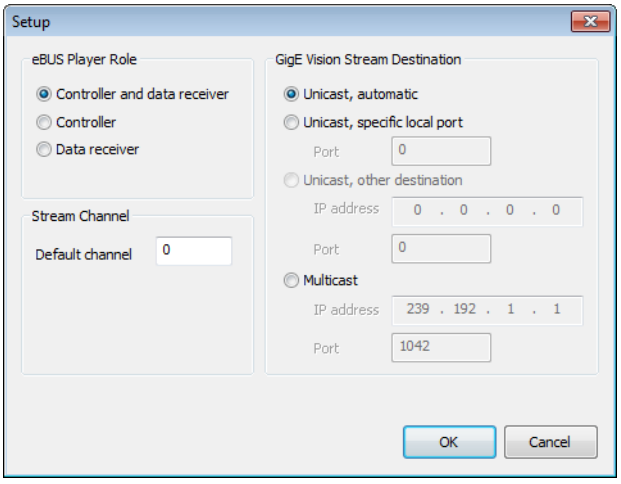
After you have connected and applied power to the hardware components, use eBUS Player to configure the external frame grabber.

To configure the external frame grabber for a unicast network configuration

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



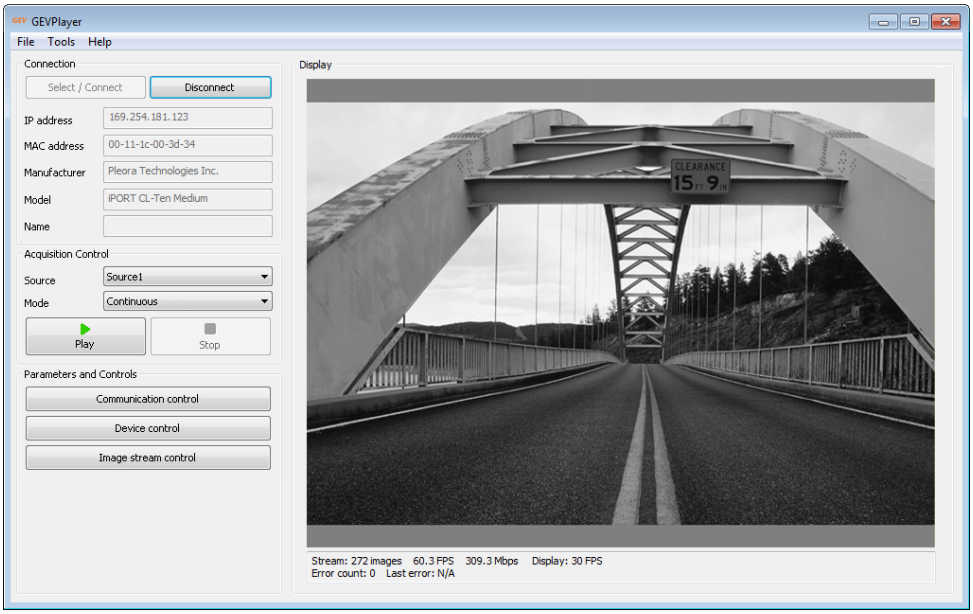
3. Under **eBUS Player Role**, click **Controller and data receiver**.



4. Under **GigE Vision Stream Destination**, click **Unicast, automatic**.
5. Click **OK**.
6. Connect to the external frame grabber.

   For more information, see "To start eBUS Player and connect to a device" on page 28.

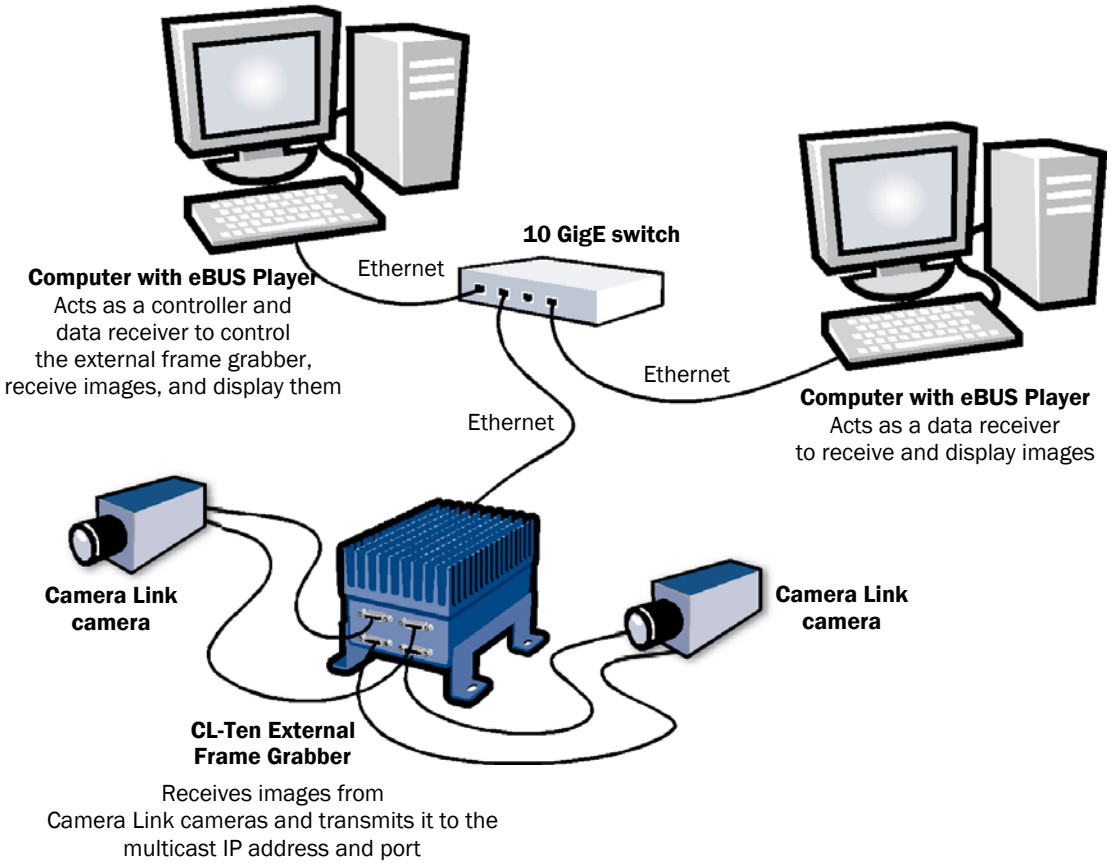
7. Click **Play** to view a live image stream.



Multicast Network Configuration

In a multicast network configuration, the iPORT CL-Ten Dual Medium External Frame Grabber is connected to a 10 GigE switch, and sends a stream of images over Ethernet simultaneously to two computers running eBUS Player (or an application created with the eBUS SDK).

Figure 3: Multicast Network Configuration



Required Items — Multicast Network Configuration

You require the following components to set up a multicast network configuration:

- iPORT CL-Ten Dual Medium External Frame Grabber and corresponding power supply
- Copper or fiber cable with SFP connectors (quantity: 3)
- 10 GigE switch (IGMP v2-compatible)
- Desktop computer (quantity:2) with eBUS SDK, version 2.2 (or later) installed
- Camera and cables

Connecting the Hardware and Power

The following procedure explains how to connect the power, network, and data cables to the computers running eBUS Player and CL-Ten Dual Medium external frame grabber.

To connect the network cables and apply power

1. On the computer that is acting as a controller and data receiver with eBUS Player, connect a 10 GigE port on your NIC to a 10 GigE port on your 10 GigE switch. Repeat this step for the computer that is acting as a video receiver with eBUS Player.
2. Connect one end of a direct attach copper cable to the CL-Ten Dual Medium external frame grabber Ethernet connector. Attach the other end to an available 10 GigE port on the 10 GigE switch.

   - Or -

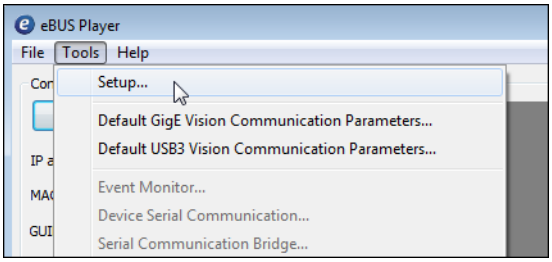
   Insert a fiber SFP+ module into the SFP+ Ethernet connector on the external frame grabber and connect the fiber cable to the module. Attach the other end to an available 10 GigE port on the 10 GigE switch.
3. Apply power to the devices.

Configuring the CL-Ten Dual Medium External Frame Grabber for a Multicast Network Configuration

After you have connected and applied power to the hardware components, use eBUS Player to configure the iPORT CL-Ten Dual Medium external frame grabber for multicast configuration. Begin by configuring one instance of eBUS Player to act as a data receiver. Then, configure the external frame grabber to transmit images to a multicast IP address and port.

To configure eBUS Player as a data receiver

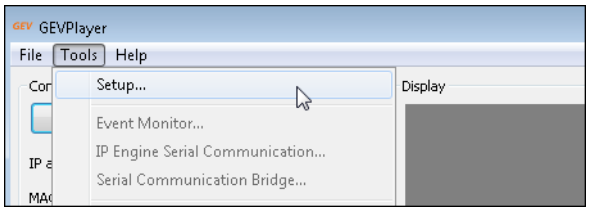
1. On the computer that is acting as a data receiver with eBUS Player, start **eBUS Player**.
2. Click **Tools > Setup**.



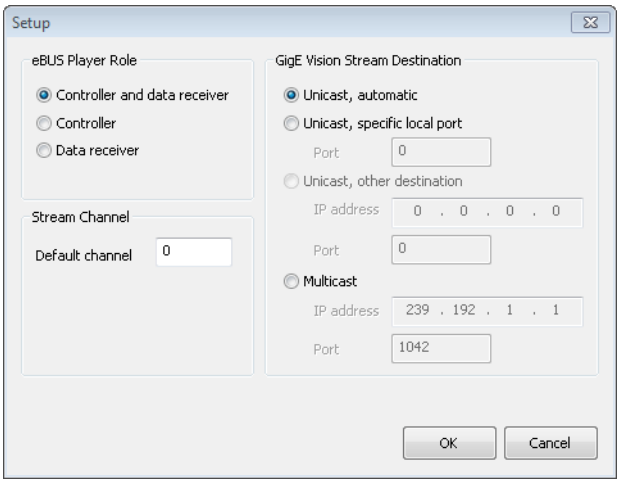
3. Under **eBUS Player Role**, click **Data receiver**.
4. Under **Stream Destination**, click **Multicast** and then specify a multicast address (for example, 239.192.1.1) and a streaming channel port (for example, 1042).
5. Click **OK**.
6. Now, configure the iPORT CL-Ten Dual Medium External Frame Grabber, as outlined in "To configure the iPORT CL-Ten Dual Medium External Frame Grabber for a multicast network configuration" on page 50.

To configure the iPORT CL-Ten Dual Medium External Frame Grabber for a multicast network configuration

1. On the computer that is acting as a controller and data receiver with eBUS Player, start eBUS Player.
2. Click **Tools** > **Setup**.



3. Under **eBUS Player Role**, click **Controller and data receiver**.

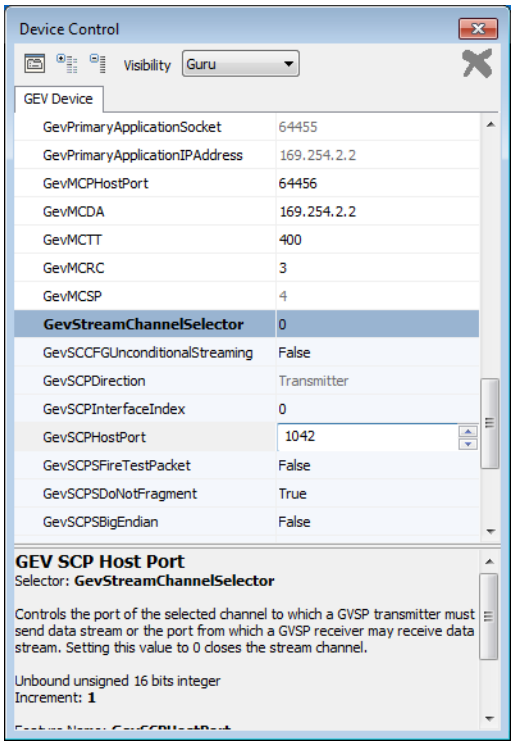


4. Under **GigE Vision Stream Destination**, click **Multicast** and enter the **IP address** and **Port** number.

   The address and port must be identical to that configured for the receiver in step 4 of "To configure eBUS Player as a data receiver" on page 49.
5. Click **OK**.
6. Connect to the iPORT CL-Ten Dual Medium External Frame Grabber.

   For more information, see "To start eBUS Player and connect to a device" on page 28.
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.

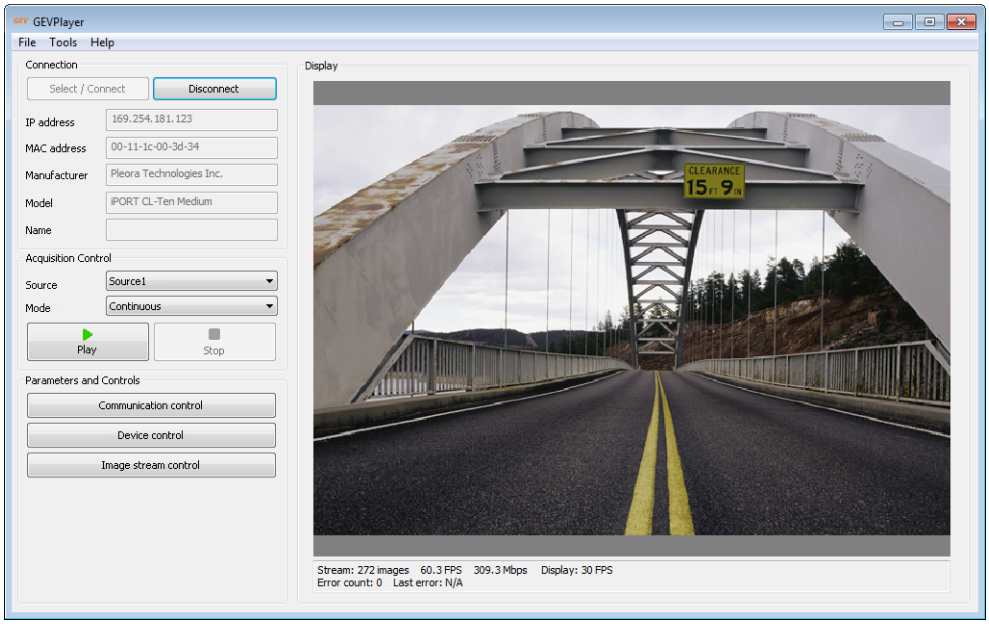


10. When you follow the instructions in this section, eBUS Player automatically configures the external frame grabber to send images from **Source1** to the default multicast group. To send images from a particular source to a specific multicast group, select the stream you want to configure in the **GevStreamChannelSelector**. Then, specify the multicast group information in the **GevSCPHostPort** and **GevSCDA** fields. In the **GevStreamChannelSelector**, **0** corresponds to **Source1** and **1** corresponds to **Source2**.

- **Source1** corresponds to the camera connected to the **Medium 1** connectors.
- **Source2** corresponds to the camera connected to the **Medium 2** connectors.

11. Close the **Device Control** dialog box.
12. Under **Acquisition Control**, click the source to which the camera you want to view is connected.
13. Click **Play** to view the source image stream on the computer.

The multicast image is shown on the receiver, as shown below.



Chapter 9

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-Ten Dual Medium External Frame Grabber.

Not all scenarios and solutions are listed here. You can refer to the Pleora Technologies Support Center at www.pleora.com for additional support and assistance.

The Pleora Technologies Support Center can help you to learn more about integrating Pleora Technologies products. Use keywords to search the Pleora Technologies knowledge database for solutions and suggestions to optimize and troubleshoot Pleora Technologies products. The knowledge database includes a description of the issue and the suggested solution for your search results.

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 the following table are those that you might encounter during the setup and operation of your external frame grabber. Not all possible scenarios and errors are presented. The symptoms, possible causes, and resolutions depend upon your particular network, 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 13: Troubleshooting Tips

Symptom	Possible cause	Resolution
SDK cannot detect or connect to the external frame grabber	Power not supplied to the external frame grabber	Both the detection and connection to the external frame grabber will fail if power is not supplied to the device. Verify the power connection and ensure 12V is present at the connector. Verify that the Link LED is active. For information about the LEDs, see "Status LEDs" on page 19. Re-try the connection to the external frame grabber with eBUS Player.
	The external frame grabber is not connected to the network	Verify that the Link LED is active. If this LED is illuminated, check the LEDs on your network switch to ensure the switch is functioning properly. If the problem continues, connect the external frame grabber directly to the computer to verify its operation. For information about the LEDs, see the documentation accompanying the external frame grabber.
	The external frame grabber and computer are not on the same subnet	Images might not appear in eBUS Player if the external frame grabber and the computer running eBUS Player are not on the same subnet. Ensure that these devices are on the same subnet. In addition, ensure that these devices are connected using valid gateway and subnet mask information. You can view the external frame grabber IP address information in the **Available Devices** list in eBUS Player. A red icon appears beside the device if there is an invalid IP configuration.

Table 13: Troubleshooting Tips (Continued)

Symptom	Possible cause	Resolution
SDK is able to connect, but no images appear in eBUS Player.	In a multicast configuration, the external frame grabber may not be configured correctly	Images might not appear on the display if you have not configured the external frame grabber for a multicast network configuration. The external frame grabber and all multicast receivers must have identical values for both the **GevSCDA** and **GevSCPHostPort** features in the **TransportLayerControl** section. For more information, see "Multicast Network Configuration" on page 47.
	In a multicast configuration, your computer's firewall may be blocking eBUS Player	Ensure that eBUS Player is allowed to communicate through the firewall.
	Anti-virus software or firewalls blocking transmission	Images might not appear in eBUS Player because of anti-virus software or firewalls on your network. Disable all virus scanning software and firewalls, and re-attempt a connection to the external frame grabber with eBUS Player.
Dropped packets: eBUS Player, NetCommand, or applications created using the eBUS SDK	Insufficient computer performance	The computer being used to receive images from the external frame grabber 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. For more information about installing the driver, see "Installing the Driver and Configuring the NIC" on page 22.
	Insufficient NIC performance	The NIC being used to receive images from the external frame grabber 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 Application Note*, available on the Pleora Support Center.
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**, **DigitizedImageWidth**, **DigitizedImageHeight**, and image offset features until the black bars no longer appear.

Table 13: Troubleshooting Tips (Continued)

Symptom	Possible cause	Resolution
Images are not properly sized or are not properly positioned in the window	Image width, height, or offset not set correctly, based on the **InputVideoFormat** feature	In eBUS Player, adjust the **Width**, **Height**, **DigitizedImageWidth**, **DigitizedImageHeight**, **OffsetX**, and **OffsetY** to the correct value, based on the **InputVideoFormat** settings that you configured.
Exclamation marks  appear beside the **Width**, **Height**, **DigitizedImageWidth**, **DigitizedImageHeight**, **OffsetX**, or **OffsetY** features in eBUS Player		

Chapter 10

Reference: Mechanical Drawings and Material List

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

Three-dimensional (3-D) mechanical drawings 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 external frame grabber's dimensions, features, and attributes. All dimensions are in millimeters.

Figure 4: Enclosure — Top View

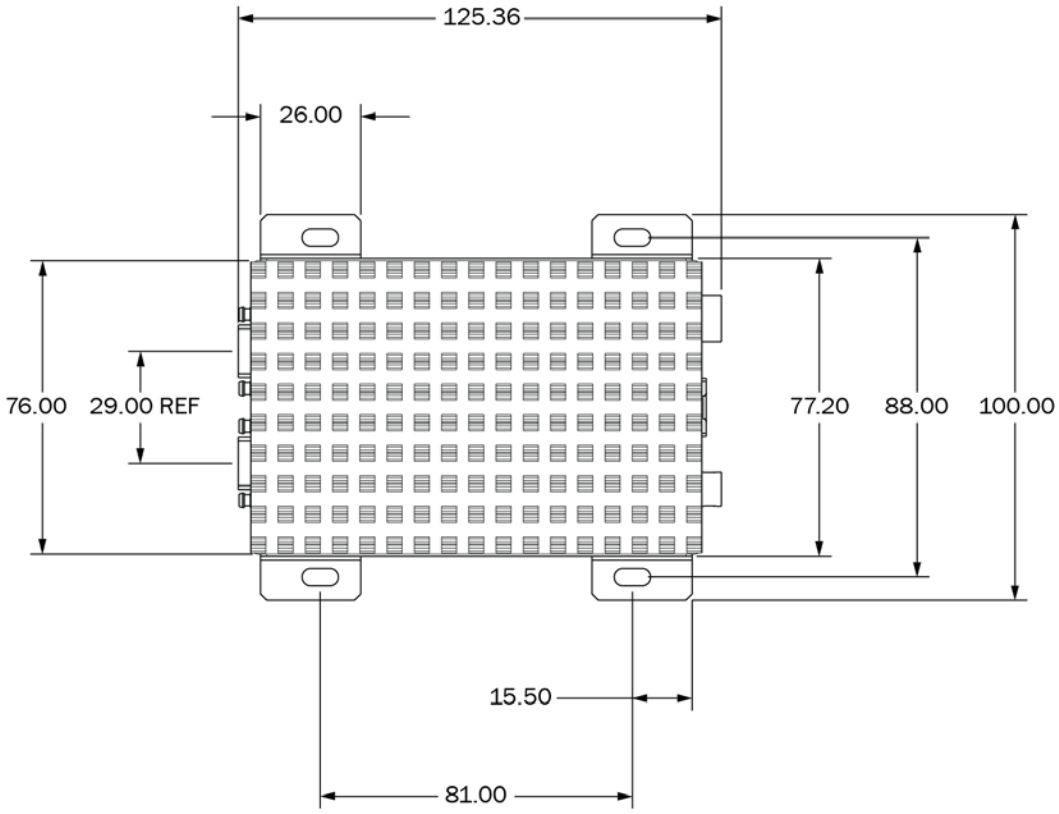


Figure 5: Enclosure — Side View

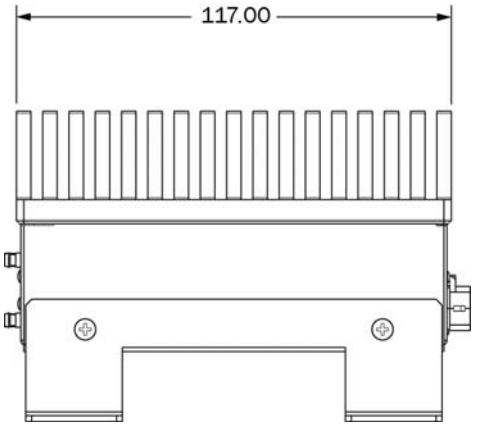


Figure 6: Enclosure — Back View

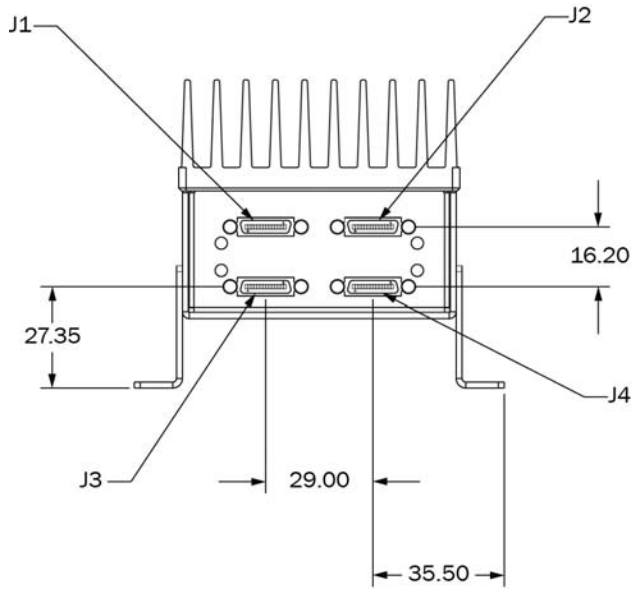
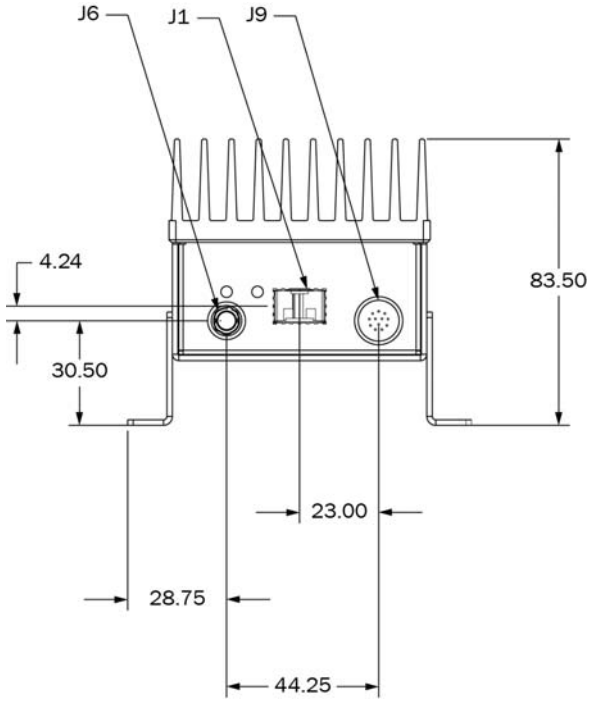


Figure 7: Enclosure — Front View



Material List

The connector and accessory summary for the external frame grabber is provided in the following table.

Table 14: Connector Summary

Description	Manufacturer part number	Manufacturer
6-pin circular connector, male	HR10A-7R-6P(73)	Hirose
12-pin circular connector, female	HR10A-10R-12SB(71)	Hirose
Camera Link SDR connector (x4)	12226-8250-00FR	3M
Accessories		
SFP+ module	Example: E10GSFPSR	Intel
10 GigE NIC	Example: E10G42BTDA	Intel

When purchasing fiber cables, ensure you purchase cables that are rated for 10GigE.

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

Chapter 11

Technical Support

On the Pleora Support Center, you can:

- Download the latest software.
- Log a support issue.
- View documentation for current and past releases.
- Browse for solutions to problems other customers have encountered.
- Get presentations and application notes.
- Get the latest news and information about our products.
- Decide which of Pleora's products work best for you.

To visit the Pleora Support Center

- Go to www.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.

If you have difficulty finding an existing solution in the knowledge base, post a question by clicking **Log a Case**. Provide as many specific details about your system and the nature of the issue as possible.