FXCL II and FXCL III Acquisition system Hardware Reference & Installation Guide

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KAYA INSTRUMENTS

20283 State Road 7, Suite 350
Boca Raton, FL 33498
USA
+1 (561) 689-2899

info@kayainstruments.com
support@kayainstruments.com

www.kayainstruments.com

+1 (561) 689-2899
info@kayainstruments.com
www.kayainstruments.com

1 Revision History

Version	Date	Notes
1.0	05.2024	Initial Release
1.1	12.2025	FXCL III Acquisition System added

Table 1 – Revision History

+1 (561) 689-2899
info@kayainstruments.com
www.kayainstruments.com

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4 Introduction

4.1 Safety precautions

With your **FXCL Acquisition system** in hand, please take the time to read through the precautions listed below to prevent preventable and unnecessary injuries and damage to you, other personnel, or property. Read these safety instructions carefully before your first use of the product, as these precautions contain safety instructions that must be observed. Be sure to follow this manual to prevent misuse of the product.

⚠ Caution! Read Carefully and do not disregard these instructions.
In the event of a failure, disconnect the power supply. Disconnect the power supply immediately and contact our sales personnel for repair. Continuing to use the product in this state may result in a fire or electric shock.
If an unpleasant smell or smoking occurs, disconnect the power supply. Disconnect the power supply immediately! Continuing to use the product in this state may result in a fire or electric shock. After verifying that no smoking is observed, contact our sales personnel for repair.
Do not disassemble, repair or modify the product. This may result in a fire or electric shock due to a circuit shortage or heat generation. Contact our sales personnel before inspection, modification, or repair.
Do not place the product on unstable surfaces. Otherwise, it may drop or fall, resulting in injury to persons or the camera.
Do not use the product if dropped or damaged. Otherwise, a fire or electric shock may occur.
Do not touch the product with metallic objects. Otherwise, a fire or electric shock may occur.
Do not place the product in dusty or humid environments, nor where water may splash. Otherwise, a fire or electric shock may occur.
Do not wet the product or touch it with wet hands. Otherwise, the product may fail or it may cause a fire, smoking, or electric shock.
Do not touch the gold-plated sections of the connectors on the product. Otherwise, the surface of the connector may be contaminated by sweat or skin oil, resulting in contact failure of a connector, malfunction, fire or electric shock due to static electricity discharge.
Do not use or place the product in the following locations. ▪ Unventilated areas such as closets or bookshelves. ▪ Near oils, smoke or steam. ▪ Next to heat sources. ▪ A closed (and not running) car where the temperature becomes high. ▪ Static electricity replete locations ▪ Near water or chemicals. Otherwise, a fire, electric shock, accident or deformation may occur due to a short circuit or heat generation.
Do not place heavy objects on the product. Otherwise, the product may be damaged.
Do not look into the fiber optic cable or the panel mounted SFP+ connectors. In order to avoid possible exposure to (Class 1) laser energy.
Be sure to discharge static electricity from the body before touching any sensitive electronic components. The electronic circuits in your computer and the circuits on the ***KY-FXCL-III*** device are sensitive to static electricity and surges. Improper handling may seriously damage the circuits. In addition, do not let your clothing come in contact with the circuit boards or components. Otherwise, the product may be damaged.

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4.2 Disclaimer

KAYA Instruments will assume no responsibility for any damage that may ensue by the use of this product for any purpose other than intended, as previously stated. Without detracting from what was previously written, please be advised that the company will take no responsibility for any damages caused by:

- Earthquake, thunderstrike, natural disasters, a fire caused by use beyond our control, willful and/or accidental misuse and/or use under other abnormal and/or unreasonable conditions.
- Secondary damages caused by the use of this product or its unusable state (business interruption or others).
- Use of this product in any manner that contradicts this manual or malfunctions that may occur due to connection to other devices. Damage to this product that is out of our control or failure due to modification.
- Accidents and/or third parties that may be involved.

Additionally, KAYA Instruments assumes no responsibility or liability for:

- Erasure or corruption of data caused by the use of this product.
- Any consequences or other abnormalities following the use of this product.

Repairs to this product are carried out by replacing it on a chargeable basis and not by repairing the faulty device. Non-chargeable replacement is offered for the initial failure, as long as it is reported no later than two weeks post-delivery of the product.

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info@kayainstruments.com
www.kayainstruments.com

5 Key Features

5.1 Overview

FXCL Acquisition system is the industry most advanced Camera Link image acquisition system without range limitations. The system uses fiber optic cables to provide high resolution image acquisition interface for distances up to 80 km in single-mode and up to 300 m in multi-mode, while each Camera Link Full interface translated to single fiber cable.
The FXCL Acquisition system is capable of receiving video streams from Camera Link Full camera while such interface supports standard Camera Link bitrates up to 85 MHz. This system is ideally suited for industrial, defense and aerospace Machine Vision Systems and applications.

The FXCL Acquisition system uses a high performance flow through DMA to transmit video streams to computer memory through PCIe interface with minimal latency. This product also provides GPIO for machine control signals, such as triggers, shaft encoders, exposure control and general I/O, which can be control aside video stream acquisition.

Depending on the Frame Grabber used, KAYA Instruments offers FXCL II and FXCL III Acquisition System.
The FXCL II Acquisition System consists of Komodo II Quad CLHS compatible Frame Grabber and CameraLink to Fiber remote unit. Accordingly, the FXCL III Acquisition System consists of Komodo III Quad CLHS compatible Frame Grabber and CameraLink to Fiber remote unit.
The remote unit converts CameraLink interface to fiber optic interface.
The Frame Grabber utilizes PCIe Gen3 x8 links for communication with Host PC for video uploading and configuration.

6 System Description

6.1 System structure

The **FXCL Acquisition system** consists of an extender device unit (KY-CL2F-D) that translates the CameraLink interface to fiber optic interface and a Komodo II / Komodo III Quad CLHS compatible Frame Grabber that is able to acquire video directly from fiber optic cables.
The Komodo II / Komodo III CLHS compatible Frame Grabber support multiple modes of configuration and system topology. Few of these are presented in following diagrams.

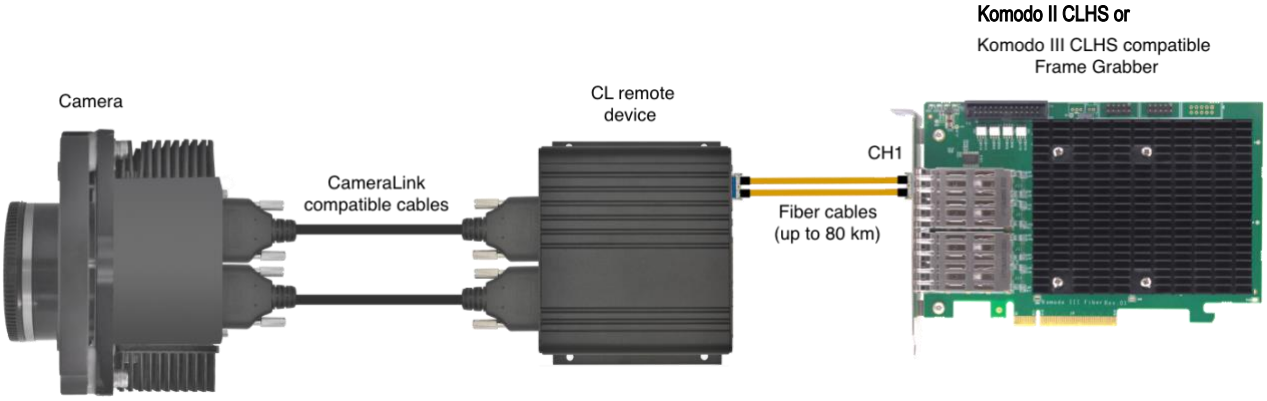

Figure 1 – Single camera topology block diagram

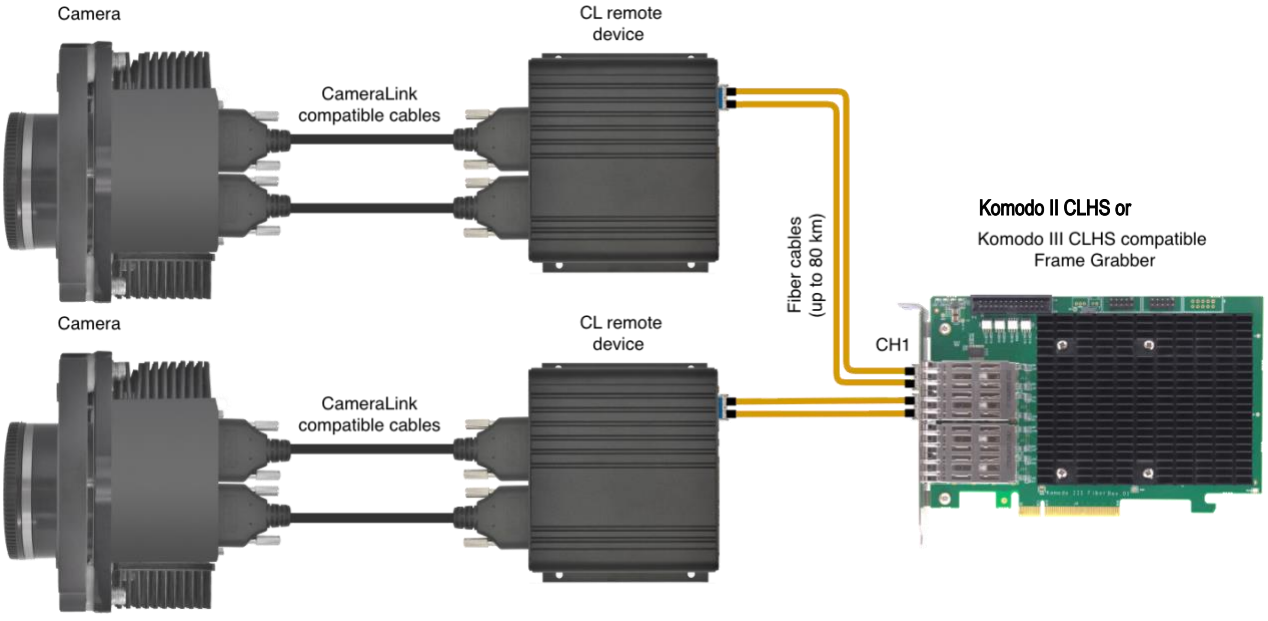

Figure 2 –Dual camera topology block diagram

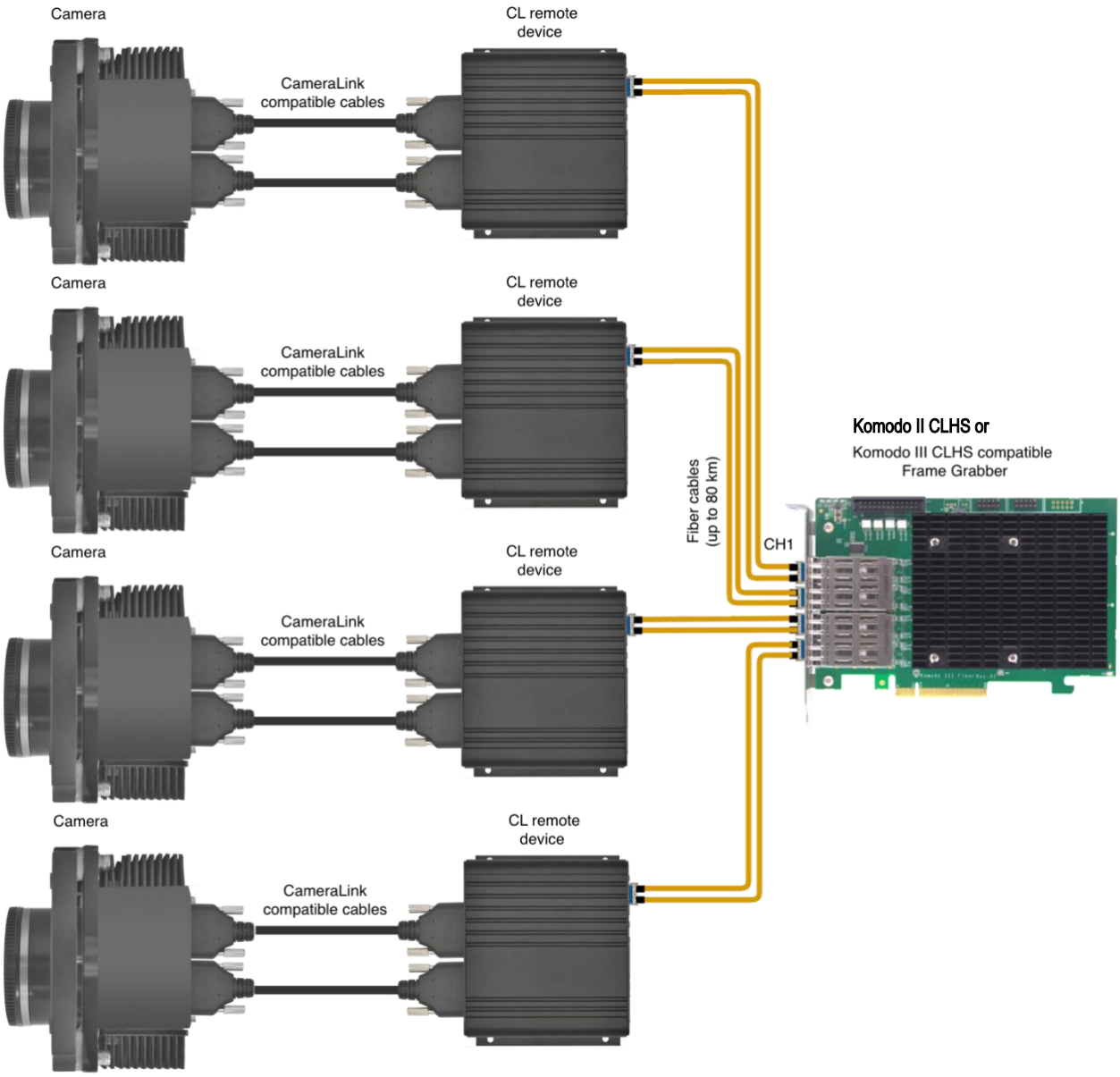

Figure 3 – Quad camera topology block diagram

7 Installation and Configuration

7.1 Installation procedure

The typical FXCL Acquisition system is connected as described in Figure 4:

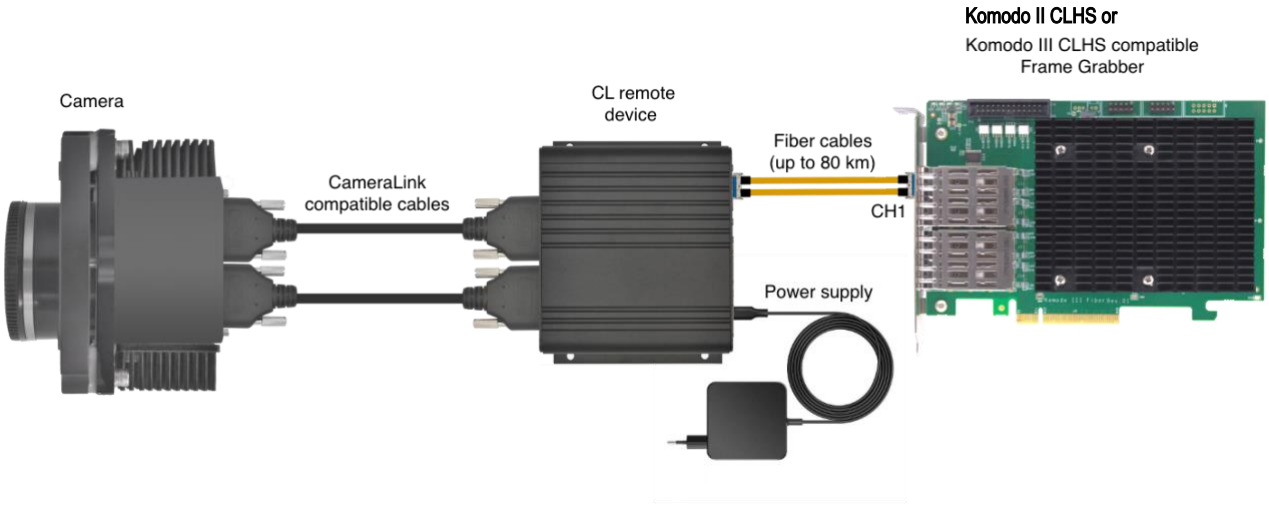

Figure 4 – KY-EXT-CL connection diagram

The first stage of the system installation is Komodo II / Komodo III CLHS compatible Frame Grabber board installation as described in section 7.3. The second stage is installation of the SFP+ modules and fiber cable allowing the connection between the Camera Link compatible Extender Device (KY-CL2F-D) and the Komodo II / Komodo III CLHS compatible Frame Grabber, described in section 7.3.2. The third stage is connection of KY-CL2F-D unit and Camera Link compatible camera as described in section 7.3.5.

7.2 Power Supply

This device requires 12 V power supply for proper function. The positive pin of the power supply connected to the bottom pin of the connector, shown as “12V”, the negative pin connected to the upper right pin of the connector, shown as “GND”. The power connector shown in Figure 5. The power connector used in KY- CL2F-D (device) unit is Tini-QG RA PC 3 pin (TRA3M SERIES). The mating connector of the power connector is TA3FX.

Figure 5 – KY-CL2F-D power connector

7.3 Frame Grabber installation

Before system installation the Komodo II / Komodo III CLHS compatible Frame Grabber board should be installed into host computer. Komodo II / Komodo III CLHS compatible board is standard PCIe card with 8 lanes connector.
It can be installed in any PCIe connector of the motherboard with 8 lanes and up.
Note: The Komodo II / Komodo III CLHS compatible board should be installed before the software installation.

1. Before installing, turn off the power of the computer and its peripherals.
2. Use an ESD-preventive glove, wrist or ankle strap and follow its instructions for use.
3. Make sure there is no dust or any other foreign matter inside the PCIe slot and the Frame Grabbers PCIe connector or blocking any of the connectors.
4. Firmly insert the board to PCIe connector of the motherboard.
5. Anchor the PCIe bracket to the computer chassis using M3 screw.
6. Verify the board inserted correctly to the PCIe slot.
7. Power up the computer.
8. Once the operating system has fully loaded, a request to install a driver for a newly detected multimedia device will be displayed. Cancel the installation at this stage.

Under Windows and Linux OS, the compatible drivers for Komodo II / Komodo III CLHS compatible board will be installed during installation of Vision Point II app.

Multiple Komodo II / Komodo III CLHS compatible frame grabbers can be installed and used in a single computer. The number of Komodo boards that can be installed in a computer depends on the number of available PCIe slots.

7.3.1 Installing and Removing SFP+ Modules

The purpose of this section is to demonstrate how to install SFP+ transceiver module, attach an optical network cable and remove an SFP+ transceiver module. It is necessary to understand the correct way of installing and removing an SFP+ transceiver, as correct operation can protect the module from being damaged and ensure its stable performance. Before removing or installing an SFP+ module, please follow the precautions and installation instructions.

7.3.1.1 Precautions

1. Use an ESD-preventive wrist or ankle strap and follow its instructions for use.
2. Make sure there is no dust or any other foreign matter inside the SFP+ module or blocking any of the connectors.
3. Clean the optic surfaces of the fiber cables before plugging them into the optical ports of an SFP+ module.
4. Removing and inserting a module can shorten its useful life, therefore do not remove and insert the module any more often than is absolutely necessary.
5. Insert clean dust covers into the module after the cables are removed. Do not remove the dust plugs until the network interface cable is ready to be attached.
6. Do not install or remove the SFP+ module with fiber-optic cables attached to it because of the potential of damaging the cable, the cable connector, or the optical interfaces in the module.
7. Disconnect all cables before removing or installing a module.
8. Place the removed module on an antistatic mat or a static shielding bag If the module is to be returned to the factory.
9. Protect the line card by inserting clean module cage covers into the optical module cage when there is no module installed.
10. Keep the protective dust plugs installed in the unplugged fiber-optic cable connectors and in the transceiver optical bores until a connection is ready to be made.

7.3.2 Installing the SFP+ Module

In order to install the SFP+ module, follow these steps:

1. Remove the dust plugs from the module as shown in Figure 6 (a).
2. The SFP+ module has a bale clasp that used to remove or install the SFP+ module.
3. Close the bale clasp before inserting the SFP+ module.
4. Line up the module with the port and slide it into the port as shown in Figure 6 (b).
5. Make sure that the male connectors on the module will align with the female connectors inside the cage.
6. Verify that the modules are completely seated and secured in their assigned receptacles on the line card by firmly pushing on each module. If the module is not fully seated, a click will be heard when the triangular pin on the bottom of the module engages with the receptacle hole.
7. Follow the exact steps to insert additional module into the KY-CL2F-D fiber interface.

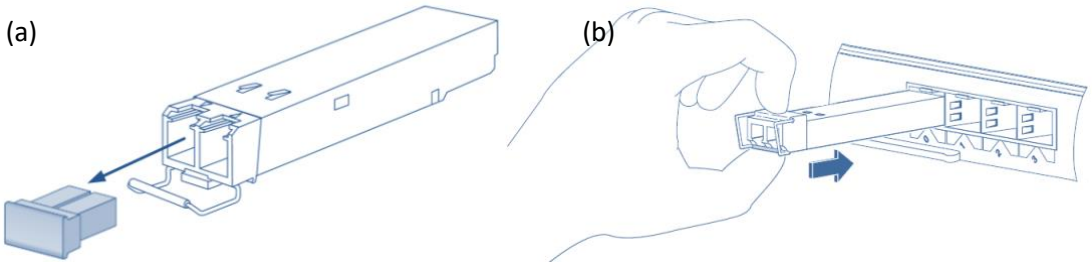

Figure 6 – SFP+ Module Installation.
(a) Cable clasp open and dust plug removed, (b) Installing an SFP+ Module into a port

7.3.3 Connecting the interface Cable to SFP+ Module

In order to properly connect the fiber optic cables, the following steps must be taken:

1. Remove the protective dust plugs from the fiber-optic cable connectors.
2. Perform the connection according to the instructions below:
   a) Channel 0 of the system must be always connected as controls are delivered with this port.
   b) A Fiber connection must be done to the same port number all over the way from KY-CL2F-D to Komodo II /Komodo III CLHS compatible Frame Grabber.
   c) A fiber cable should match an SFP+ type. If a single mode SFP+ is used a single mode fiber (yellow) should be attached to it. If a multi-mode SFP+ is used a multi-mode fiber (orange) should be attached.
   d) On Fiber channel 0 both the TX and RX fiber cables must be connected. On channels 1 through 3 only one fiber cable should be connected. This cable is connected between TX output (Marked with TX or Arrow outwards the SFP+) on the KY-CL2F-D and RX input (Marked with RX or Arrow inwards the SFP+) on the Frame Grabber, as shown in Figure 7 (a).
3. Insert the fiber cable into the module, as shown in Figure 7 (b).
4. Firmly push on each cable, until a click.
5. Connect the other side of the fiber cable to the KY-CL2F-D.

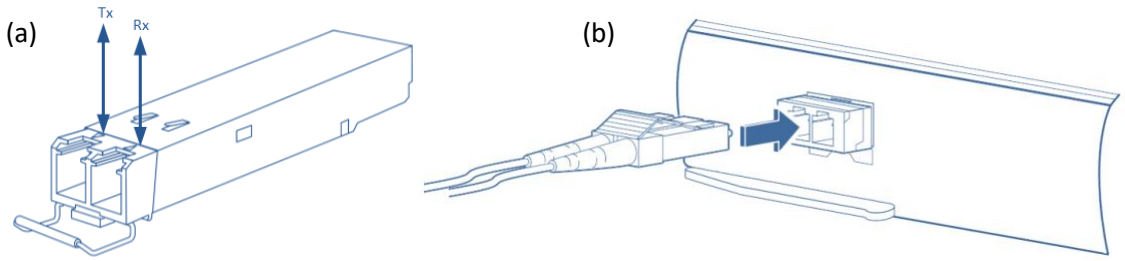

Figure 7 – Interface connecting to the SFP+ Module
(a) SFP+ module with TX output and RX input marked, b) Connecting the cable to SFP+ Module

7.3.4 Removing the SFP+ Module

In order to remove the SFP+ module, follow these steps:

1. Turn the KY-CL2F-D and the computer off.
2. Disconnect and remove all interface cables from the ports.
3. Open the bale clasp on the SFP+ module with the index finger, or a small flat-blade screwdriver, in a downward direction, as shown in Figure 8 (a).
4. Grasp the module between the thumb and index finger and carefully remove it from the port, as shown in Figure 8 (b).
5. Insert the clean dust covers into the module, as shown in Figure 8 (c).

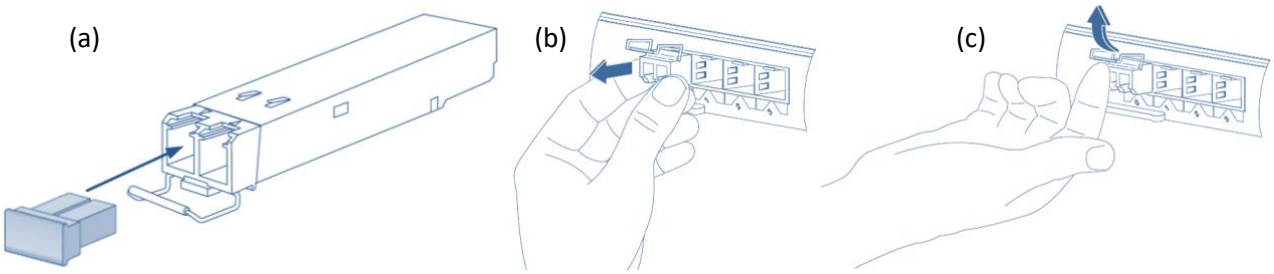

Figure 8 – Removing the SFP+ Module

(a) Opening the bale clasp of an SFP+ Module, (b) Removing an SFP+ Module from the port, (c) SFP+ Module dust plug placement

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7.3.5 Completing the system installation

In order to properly complete the system installation, the following steps must be taken:

1. Connect the CameraLink cables between the camera and KY-CL2F-D unit.
2. Connect the Power Adaptor to the KY-CL2F-D unit.
   The KY-CL2F-D requires 12 V power supply for proper function of the camera.
3. The power supply connector of the KY-CL2F-D unit shown in Figure 4.
4. Connect the camera to a power supply (Regardless of the supported camera's communication cable).
5. Turn the KY-CL2F-D, the CameraLink camera and the computer on and start Vision Point II app.

7.4 Reducing the fiber optic cable count

The system requires duplex fiber optical cable in order to properly operate, but sometimes it required transferring the data over simplex fiber cable or installing the system into existing CWDM infrastructure. Several options listed in the sections below exist in order to achieve the above. Please note that these options are available for single mode fiber infrastructure only.
Please contact KAYA representative for details of those options.

7.4.1 CWDM SFP+ option

In CWDM option the SFP+ is replaced by CWDM SFP+ that is able to transmit and receive the data on specific wavelength. By using these SFP+ modules, the system can be integrated into existing CWDM infrastructure by usage of external CWDM MUX.
Please contact KAYA representative for details.

7.4.2 Bidirectional (BIDI) SFP+ option

This option allows using a simplex fiber cable in the system. In this option the SFP+ is replaced by bidirectional (BIDI) SFP+ that transmits and receives on the same fiber core. Example connection is described in Figure 9.

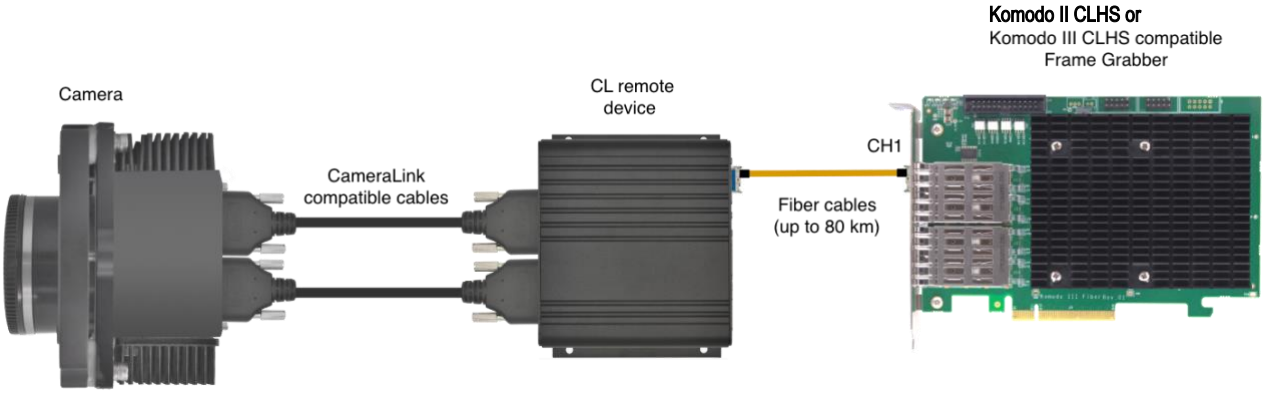

Figure 9 – Bidirectional Camera link connection

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8 Firmware

8.1 Frame Grabber Firmware Update process

It is recommended to perform firmware update after factory FPGA Programming. The KAYA Instruments devices support firmware update via Vision Point II GUI.
The process applies to both Windows and Linux operating systems.

For full information about firmware update, please refer to the Vision_Point_II_API_Data_Book.

8.2 Remote device firmware

A Mini USB port is available for individual link & general information status and firmware update. The port uses a Silabs CP2101 chip. A driver from the Silabs website might have to be installed on certain PCs to gain access to the terminal port.
Free supporting driver can be found at: https://storage.kayainstruments.com/s/Silabs_usb_driver.

For full information about configurations, commands and firmware update, please refer to the CameraLink_range_extender_over_fiber_user_manual.

9 Ordering information

Item name	Item part number
FXCL II Acquisition System	KY-FXCL-II
FXCL III Acquisition System	KY-FXCL-III
Camera Link compatible Range Extender over Fiber – Device unit	KY-CL2F-D
Komodo II Quad CLHS compatible Frame Grabber	KY-FGF-II-CLHS
Komodo III Quad CLHS compatible Frame Grabber	KY-FGF-III-CLHS
SFP+ single-mode module	KY-SFP-10GLR-31
SFP+ multi-mode module	KY-SFP-10GSR-85
SFP+ single-mode bidirectional module	KY-SFP-BD-10G-10
Fiber cable	KY-FCA-X
Camera Link Cable	KY-CCL-X
Power supply 12 V, 60 W	KY_PWR12_60

Table 2 – Ordering Information

Please contact KAYA Instruments for exact cables Part Number or refer to our website at: https://kayainstruments.com/product-category/accessories/.
We are offering variety of modules and customized cable assembly, to fit your application exact needs.
Please, Contact KAYA Instruments representative for any question and services.
We have the expertise and experiences to develop a suitable solution dedicated to customer's application, prototypes or production.

REFERENCES

Supported vision standards:

CoaXPress GEN<i>CAM

Vision Point documentation:

Vision Point

TECHNICAL SUPPORT AND PROFESSIONAL SERVICE

If you searched the documents and could not find the answers you need, contact KAYA Instruments support service:

- Create a support request on the web: support.kayainstruments.com
- Our knowledge base is available on: kb.kayainstruments.com

Visit us at kayainstruments.com for comprehensive information.

SUBMITTING A SUPPORT REQUEST

When opening a support request, please provide the following information when applicable:

• Vision Point Diagnostic Info* • Serial number of Frame Grabber • Camera model • SFP+ module model • CoaXPress/Fiber cable model and length • External power or PoCXP • PC motherboard model *In the Vision Point app, use menu option Help > Collect diagnostic info.	• Vision Point Diagnostic Info (or frame grabber being utilized) • Serial Number of Camera • XML dump and/or description of how the camera is being utilized • Description of issue • SFP+ module model • CoaXPress/Fiber cable model and length • External power or PoCXP	• Range Extender Model • Serial Number of Range Extender • SFP+ module model • CoaXPress/Fiber Cable model and length • PC configuration • Operating System • Software Revision • Camera and Frame Grabber Manufacturer and Model

お問い合わせは立野電脳（株） sales@dsp-tdi.com

立野電脳 EXT営業部
E-mail : sales@dsp-tdi.com
〒198-0063 東京都青梅市梅郷5-955 TEL.0428-77-7000

URL https : //www.dsp-tdi.com/

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Please feel free to contact our sales team for pricing, availability, documentation or customization through our e-mail or phone, we will be happy to provide assistance and consultation.

Sales Inquiries: info@kayainstruments.com

www.KAYAInstruments.com

KAYA Instruments, Inc.
20283 State Road 7, Suite 350
Boca Raton, FL 33498
USA

+1 561 698-2899

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