



CoaXPress™ Range Extender over Fiber

User Manual 2014

International Distributors



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Revision History

Version	Date	Notes
1.0	25.12.13	Initial Release
1.1	21.2.14	Minor change in Part Number
1.2	19.11.14	CWDM options were added
1.3	26.07.15	BIDI option were added
1.4	26.7.16	Updated commands at Table 4

2.1 Safety Precautions

With your CoaXPress™ Range Extender over Fiber (KY_FXT) in hand, please take a minute to read carefully the precautions listed below in order to prevent unnecessary injuries to you or other personnel or cause damage to property.

- **Before using the product, read these safety precautions carefully to assure correct use.**
- **These precautions contain serious safety instructions that must be observed.**
- **After reading through this manual, be sure to act upon it to prevent misuse of product.**



Caution

<p>In the event of a failure, disconnect the power supply. If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately and contact our sales personnel for repair.</p>
<p>If an unpleasant smell or smoking occurs, disconnect the power supply. If the product is used as is, a fire or electric shock may occur. Disconnect the power supply immediately. After verifying that no smoking is observed, contact our sales personnel for repair.</p>
<p>Do not disassemble, repair or modify the product. Otherwise, a fire or electric shock may occur due to a short circuit or heat generation. For inspection, modification or repair, contact our sales personnel.</p>
<p>Do not touch a cooling fan. As a cooling fan rotates in high speed, do not put your hand close to it. Otherwise, it may cause injury to persons. Never touch a rotating cooling fan.</p>
<p>Do not place the product on unstable locations. Otherwise, it may drop or fall, resulting in injury to persons or failure.</p>
<p>If the product is dropped or damaged, do not use it as is. Otherwise, a fire or electric shock may occur.</p>
<p>Do not touch the product with a metallic object. Otherwise, a fire or electric shock may occur.</p>
<p>Do not place the product in dusty or humid locations or where water may splash. Otherwise, a fire or electric shock may occur.</p>
<p>Do not get the product wet or touch it with a wet hand. Otherwise, the product may break down or it may cause a fire, smoking or electric shock.</p>
<p>Do not touch a connector on the product (gold-plated portion). Otherwise, the surface of a connector may be contaminated with sweat or skin oil, resulting in contact failure of a connector or it may cause a malfunction, fire or electric shock due to static</p>

electricity.
Do not use or place the product in the following locations. <ul style="list-style-type: none">● Humid and dusty locations● Airless locations such as closet or bookshelf● Locations which receive oily smoke or steam● Locations close to heating equipment● Closed inside of a car where the temperature becomes high● Static electricity replete locations● Locations close to 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 things on the product. <p>Otherwise, the product may be damaged.</p>
Do not look into the fiber optic cable or the panel mounted SFP connectors. <p>In order to avoid possible exposure to (Class 1) laser energy.</p>

2.2 Disclaimer

This product should be used for increasing the CoaXPress video transmission distance. It also can be used for transmitting CoaXPress video over fiber in environments where standard coaxial cable is not applicable. KAYA Instruments assumes no responsibility for any damages resulting from the use of this product for purposes other than those stated.

Even if the product is used properly, KAYA Instruments assumes no responsibility for any damages caused by the following:

- Earthquake, thunder, natural disaster or fire resulting from the use beyond our responsibility, acts caused by a third party or other accidents, the customer's willful or accidental misuse or use under other abnormal conditions.
- Secondary impact arising from use of this product or its unusable state (business interruption or others).
- Use of this product against the instructions given in this manual or malfunctions due to connection to other devices.

KAYA Instruments assumes no responsibility or liability for:

- Erasure or corruption of data arising from use of this product.
- Any consequences or other abnormalities arising from use of this product, or damage of this product not due to our responsibility or failure due to modification.

This product is covered with one year limited warranty. The customer is responsible for all shipping charges to return the faulty device to KAYA Instruments and back.

Repair of this product, out of warranty period, is carried out by replacing it on a chargeable basis, not repairing the faulty devices.

3.1 Overview

KAYA Instruments' *CoaXPress Range Extender over Fiber (KY_FEXT)* provides a high resolution stream interface for distances of up to 10km over single-mode optic fiber and up to 300m over multi-mode optic fiber. Optic fiber is electrically isolated, hence it does not radiate nor is it susceptible to electromagnetic interference, also eliminates the problems associated with grounding. The fiber cable is not easily tapped, providing more secure communication. The system is constructed of two converters, one on the camera side (*KY_FEXT_D*) and one on the frame grabber side (*KY_FEXT_H*). The camera side converter can provide power to the camera over CoaXPress link, while the host side converter can sink power from the frame grabber. The converters use flexible SFP+ modules for optical connection that can be easily changed. The range extender is able to provide a downlink of up to 6.25Gbps (CXP6) and uplink of 20.83Mbps per each link.

3.2 Features

- CoaXPress V1.1 compatible
- Both ends of CXP6 is supported with up to 6.25 Gbps downlink, 20.83 Mbps uplink
- Extension for distances up to 10km with single-mode optic fiber and up to 300m with multi-mode optic fiber
- Bidirectional CoaXPress communication
- Flexible SFP+ module for optic fiber connection
- DIN 1.0/2.3 Connector for CoaXPress link
- Plug and Play , no need to configure
- Power over CoaXPress (PoCXP) support
- 0°C to 50°C operating environment temperature

3.3 Product Applications

- ✓ High speed cameras
- ✓ High definition cameras
- ✓ Panoramic cameras
- ✓ Defense remote systems
- ✓ Surveillance
- ✓ Robotic Vision

3.4 Related documents and accessories

Documents:

- Japan Industrial Imaging Association (JIIA NIF-001-2010)

Optional accessories:

- 24V 72W power supply

4.1 External View of the KY_FEXT

Each *KY_FEXT* unit is housed in a compact, metal enclosure. Each unit has a power connector, 4 coax connectors, 4 SFP+ cages and a Mini USB Terminal interface, as shown in Figure 1.

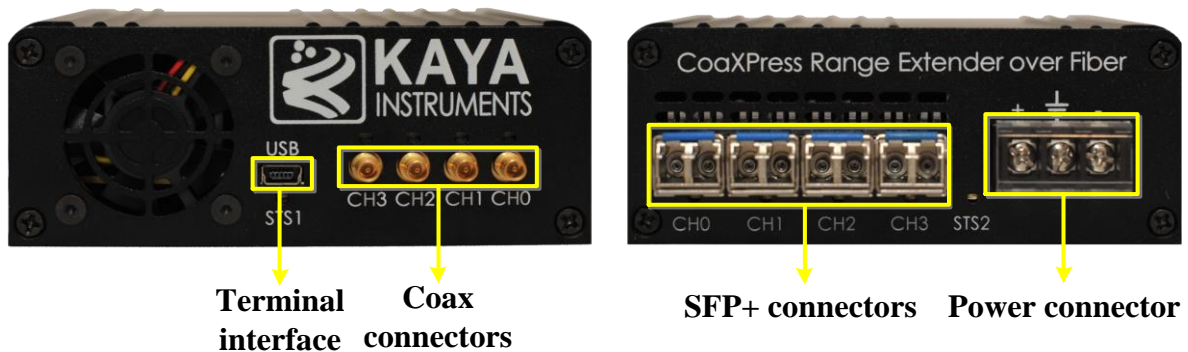


Figure 1 : KY_FEXT external view

Each of the 4 coax and SFP+ connector is paired with a status LED and there is a system status LED (see Table 1 and Table 2 describing the LED's behavior).

Each unit also has mount ears for an easy and secure installation on any flat surface.

4.2 Power supply

This device requires 24V power supply for proper function. The Host side of the extender is compatible with PoCXP standard and therefore doesn't require external power supply, once the Frame Grabber supports this feature too.

At the Device side, external power supply must be used. Please, refer to Electrical specification section of this document for exact Power Supply requirements.

Below is shown the power supply connector of the *KY_FEXT* unit. An optional power supply or user selectable must be connected to this on the device side extender box.

Connect the positive wire from the power supply to the "+" connector, connect the GND pin of connector to the ground wire and the negative wire to the "-" connector, as seen in Figure 2.

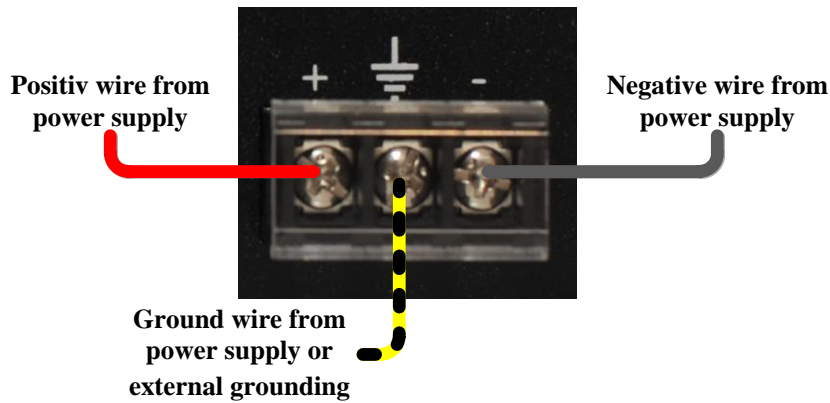


Figure 2 : KY_FEXT power connector

Each unit has several status LEDs, as seen in Figure 3 and Figure 4.

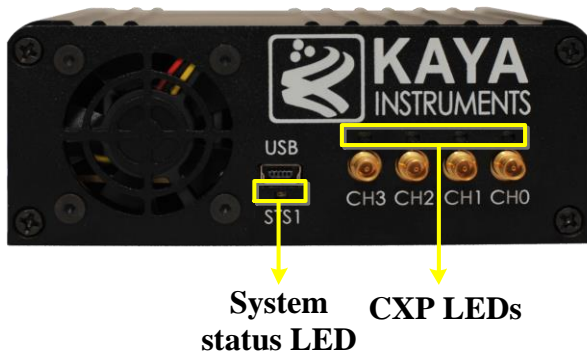


Figure 3 : KY_FEXT coax side LEDs

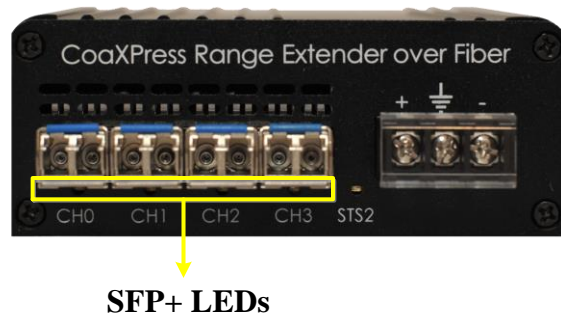


Figure 4 : KY_FEXT fiber side LEDs

The System status LED, located on the coax side, always slow pulses in green while the system is ON. While in firmware update mode, this LED slow pulses orange. In any case of system failure, the LED will constantly light orange.

The CXP LED's behavior is described in Table 1:

LED state	Condition
Slow pulse red	No valid CoaXPress low speed link detected
Solid red	PoCXP failure (Overcurrent/Under voltage/Overvoltage)
Fast flash green	CoaXPress link speed is being negotiated
Solid green	CoaXPress link is active

Table 1 : CXP status LEDs behavior

The SFP+ LED's behavior is described in Table 2:

LED state	Condition
Fast flash red	SFP+ is unplugged
Solid red	SFP is not compatible
Slow pulse red	No signal detected on optic fiber
Fast flash green	CoaXPress link speed is being negotiated
Solid green	CoaXPress link is active

Table 2 : SFP+ status LEDs behavior

5.1 Installation procedure

The *KY_FEXT* system, on the host side (*KY_FEXT_H* unit), is connected to the frame grabber. On the device side (*KY_FEXT_D* unit), the system is connected to the camera, as described in Figure 5:

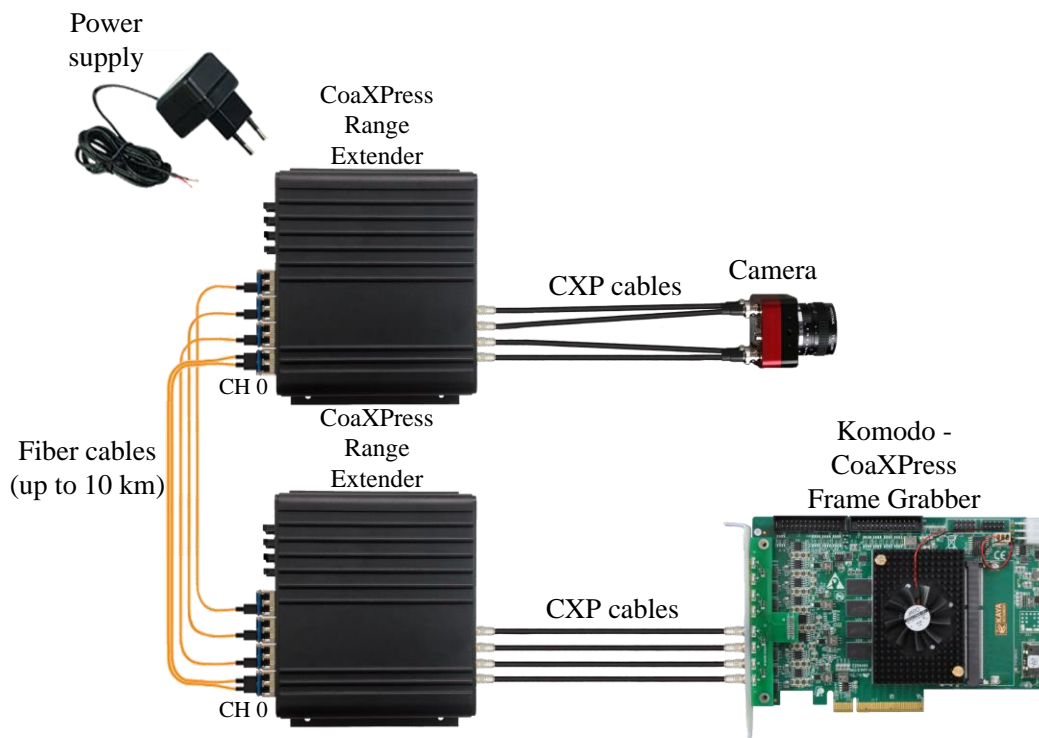


Figure 5 : KY_FEXT connection diagram

In order to properly use the *KY_FEXT* system, the following steps must be taken for initial power up:

1. Make sure there is no dirt or any other foreign matter inside the SFP+ module, or blocking any of the connectors.
2. Make sure that the male connectors on the SFP+ module will align with the female connectors inside the cage.
3. Insert the module(s) into the *KY_FEXT* and close the locking mechanism (*).
4. Connect the fiber cables using one of the configurations available:

4.1. Single connectivity, as described in Figure 6:

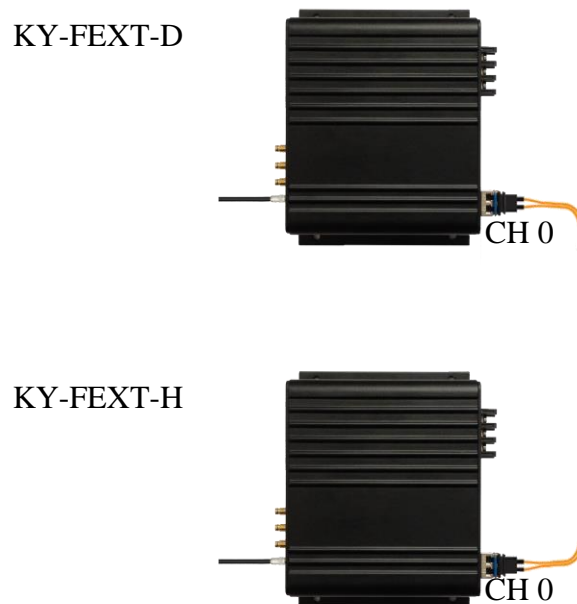


Figure 6 : Single connectivity order

4.2. Dual connectivity, as described in Figure 7:

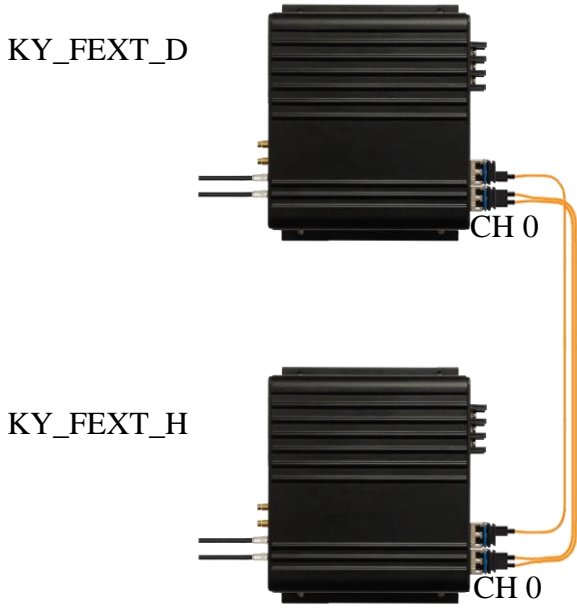


Figure 7 : Dual connectivity order

4.3. Quad connectivity, as described in Figure 8:

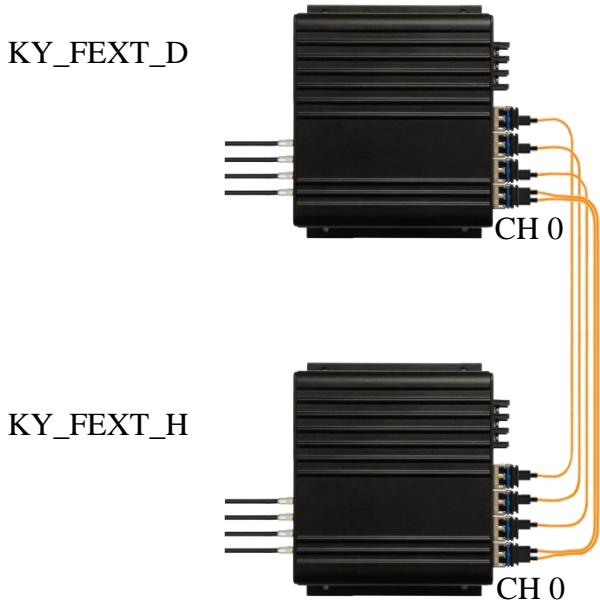


Figure 8 : Quad connectivity order

5. Connect the Coax cables in the right order, as shown in Figure 6, Figure 7 or Figure 8.
6. Connect the Power Adaptors to the 2 *KY_FEXT* units (connecting the power supply to the *KY_FEXT* unit is optional; if the unit is connected to a frame grabber with a PoCXP option available).
7. Turn the camera and the frame grabber on and start your application software.

(*) The *KY_FEXT* system supports the following SFP+ modules:

1. KY-SFP-10G31-10 – Allows of up to 10Km connection over single mode fiber cable
2. KY-SFP-10G85-3M – Allows of up to 300m connection over multi-mode fiber cable

Note: to remove the SFP+ module, first remove the fiber cable connected to it, then open the SFP+ module's locking mechanism (see Figure 9 and Figure 10) and remove module.



Figure 9 : Module with locking mechanism closed

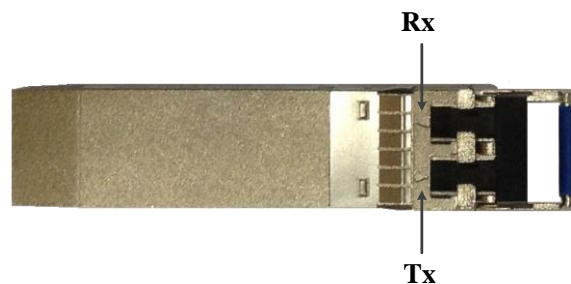


Figure 10 : Module with locking mechanism open

NOTES :

1. Link 0 of the extender must always be connected as power and controls are delivered with this port
2. A Fiber connection and CoaXPRESS connection must be done to the same port number all over the way from camera to frame grabber.
3. 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.
4. 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 device unit and RX input (Marked with RX or Arrow inwards the SFP) on host unit.

5.2 Bidirectional (BIDI) SFP option

This option allows reducing one fiber optic cable from the system. The total required number of cables will be as number of CoaxPress cables. For example 4 link cameras will require 4 fiber cables.

The *KY_FEXT* bidirectional system supports the following SFP+ modules simultaneously:

1. KY-BSFP-10G33-10 and KY-BSFP-10G23-10 – Allows of up to 10Km bidirectional connection over single fiber cable.

In this option the SFP in link 0 is replaced by bidirectional (BIDI) SFP that transmits and receives on the same fiber cable. Example connection for four link camera is described in Figure 11.

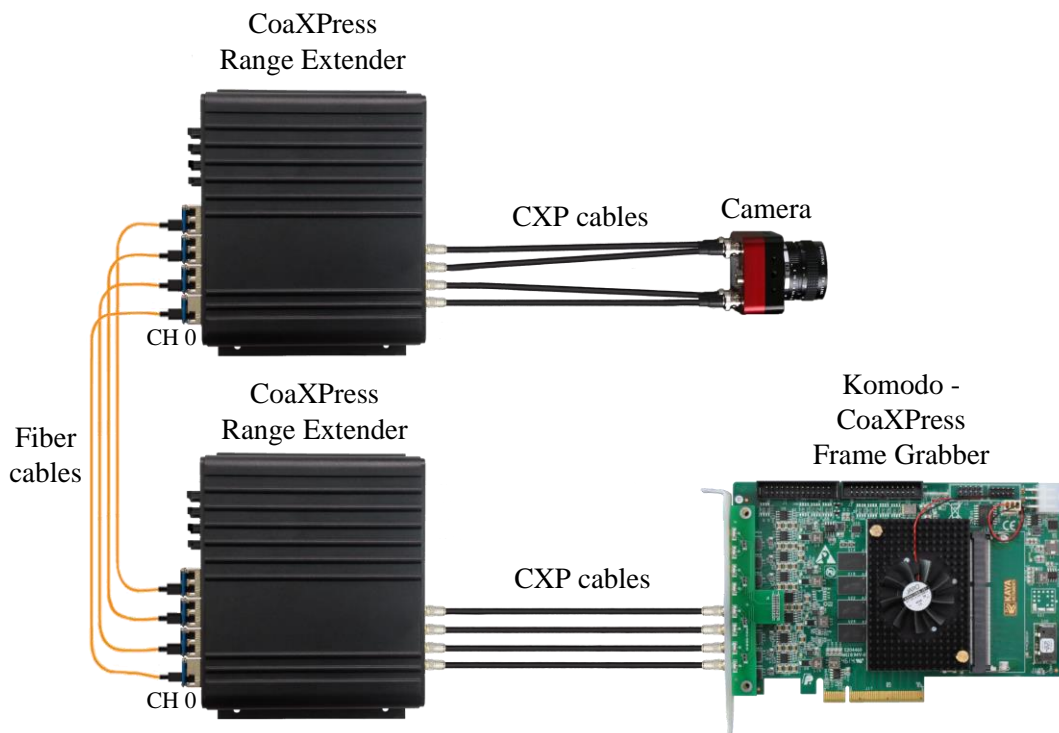


Figure 11 : Bidirectional camera link connection

5.3 CWDM Option

In CWDM each optical SFP module operates at different wavelength and then an optical multiplexer is used to mix all the signals into a single fiber. In this mode the number of cables required in the infrastructure can be reduced from 5 down to two cables or even single cable. The CWDM also can be used to use the CoaXPress over existing infrastructure, sharing the same fiber cables with other applications.

Two available CWDM modes (for single or dual fibers) are described in Figure 12 and Figure 13. For assignment of CWDM wavelengths please contact KAYA Instruments representative.

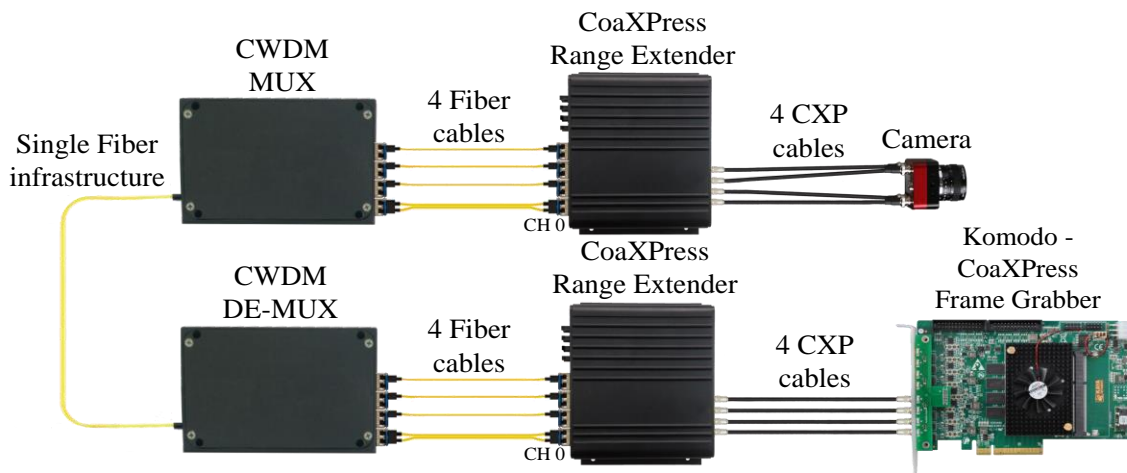


Figure 12 : CWDM mode for single fiber

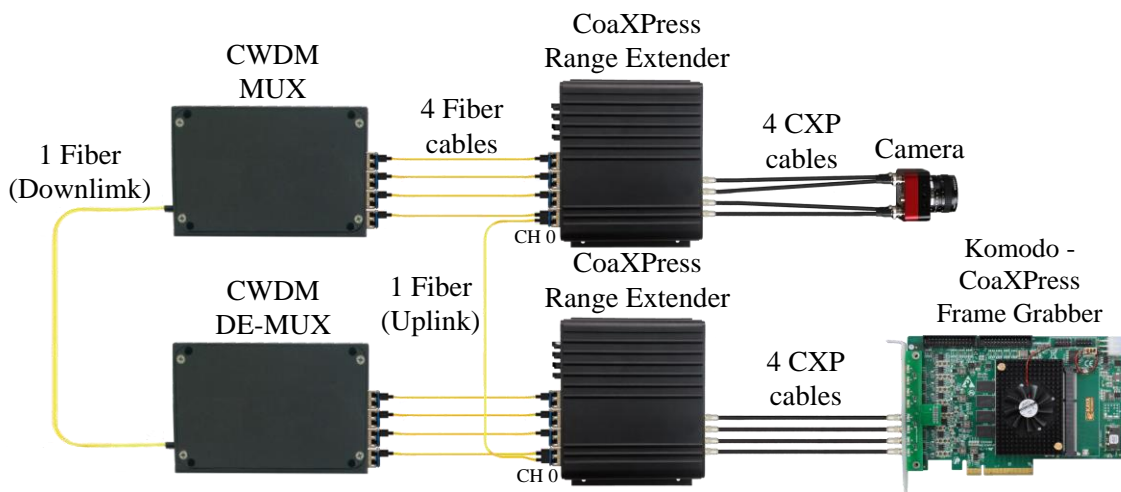


Figure 13 : CWDM mode for dual fiber

6.1 Terminal control

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: <http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpcdrivers.aspx>

After driver installation and USB connection is acquired a serial emulated terminal (i.e. Tera Term use is recommended) can be used with the following configurations, described in Table 3:

Parameter	Value
Baud rate	115200
Start bits	1
Stop bits	1
Parity	None
Flow Control	None

Table 3 : Serial emulated terminal configurations

The following commands are supported by the terminal; each command must be followed by carriage return (Enter) in order to execute:

Command	Description
firmware	Sets the system to firmware update mode. See 6.2 chapter for firmware update information
status	Prints the system and individual link status and general information
pwr <x>	Sets the PoCXP state of the device unit according to <x>: 0. Off - No power is provided to CXP 1. Auto – Connection of PoCXP compatible device is automatically detected 2. On – power is always provided to CXP
save	Saves the configured parameters to unit nonvolatile memory
default	Resets the unit to default configuration

Table 4 : Terminal commands

NOTE: The commands are not case sensitive.

6.2 Firmware update

1. The extender supports firmware update via USB using a serial emulated terminal. To initiate firmware update the following steps should be taken:
2. Connect the USB cable to the extender and acquire connection using Silabs drivers (drivers need to be downloaded manually if an automatic download isn't initiated).
3. Open serial emulated terminal (usage of Tera Term terminal is recommended) and set serial communication protocol as described in Table 3.
4. In the terminal window type "status" followed by carriage return and checks the current firmware version.
5. Choose the firmware update option by entering "firmware" followed by carriage return and wait for the following message: "Now starting firmware update, please start file transfer using XMODEM:"
6. At this point all the LEDs will turn off and the "System status LED" will slow pulse orange indicating the extender is ready to receive the firmware binary file. Under "File" tab use the terminal "transfer" capability using the XMODEM protocol to initiate the firmware update. Choose "Send" and the firmware version: CXP_EXT_x_xx.rbf, when x_xx is the version number.
7. If no firmware will be sent during 1 minute, or in case of an error the firmware update will fail and return to previous operation mode.
8. A successful update will result in appropriate message and a reboot of the extender to new firmware.
9. Check the firmware version by typing "status" followed by carriage return. Make sure that the firmware version matches the version on the firmware update package supplied; that would insure the success of the firmware update operation.

7.1 Absolute maximum ratings

Specification	Values
Power supply voltage	0V to 30V
Storage Temperature	-40°C to 85°C
Operating Temperature	0°C to 50°C

Table 5 : Absolute maximum ratings

7.2 Operating conditions

Parameter	Description	Minimum	Typical	Maximum
V _{cc}	Supply voltage	20.3V	24V	26 V
I _{cc} (Host)	Supply Current from PoCXP or external power supply (4 active channels)	-	0.25A	0.33A
I _{cc} (Device)	Supply Current from external power supply (4 active channels)	-	0.25A	2.61A ⁽¹⁾
I _{PoCXP}	PoCXP Output current per link	0A	-	0.57A

Table 6 : Operating conditions

(1) In case all the 4 CXP channels supply 13.5W of power to connected camera

8.1 Dimensions

Each *KY_FEXT* unit is housed in a metal enclosure as shown in Figure 14:

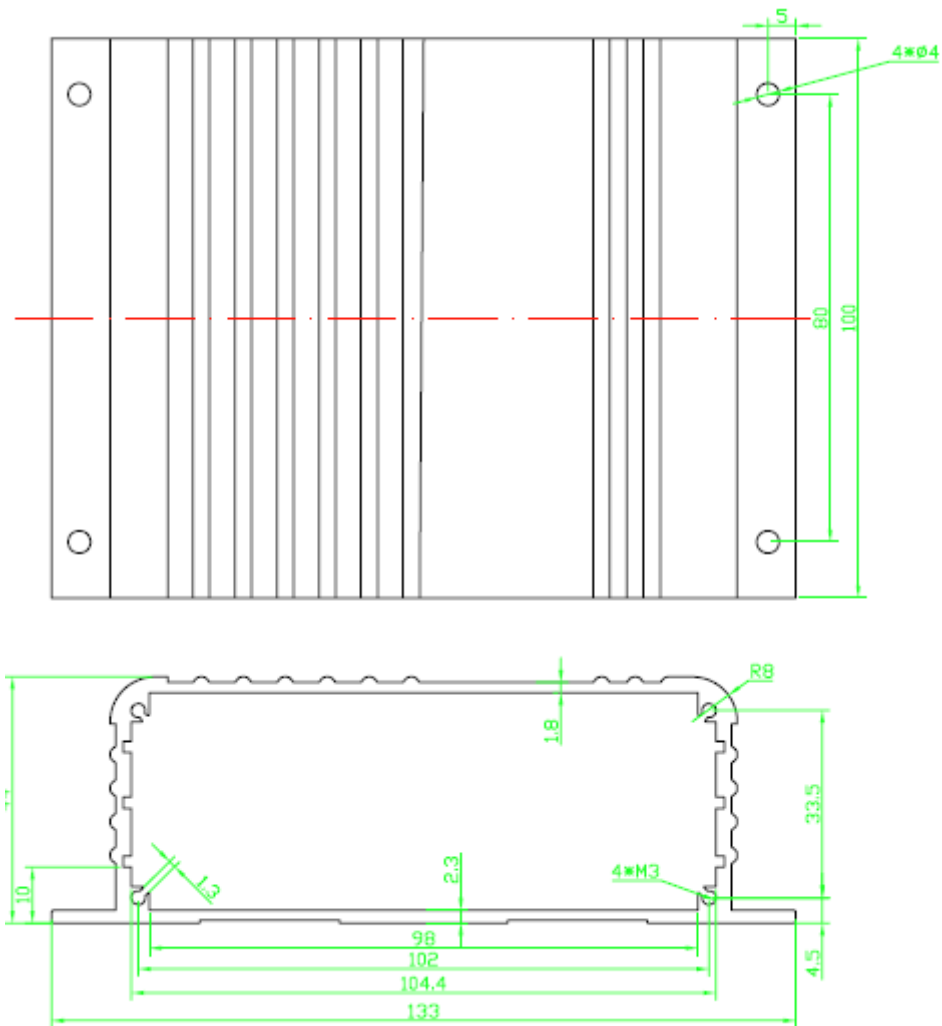


Figure 14 : External dimensions of the KY_FEXT enclosure box

9.1 CoaXPress cables

CoaXPress is a new digital transmission standard that allows high speed data from a device, such as a camera, to be transferred to a host, such as a frame grabber. Each CoaXPress link supports up to 6.25 Gbps data rates, along with device power up to 13W and device control at 20 Mbps – all on a single coax cable. For very fast devices, the links can be aggregated to provide multiples of the single coax bandwidth. Long cable lengths are supported – up to 40 meters at 6.25 Gbps and over 100 meters at 3.125 Gbps.



9.2 Fiber cables

Optical fibers are widely used to permits transmission over longer distances and at higher bandwidths than other forms of communication. Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference.

Fibers that support many propagation paths or transverse modes are called multi-mode fibers (MMF), while those that only support a single mode are called single-mode fibers (SMF). Multi-mode fibers generally are used for short-distance communication links and for applications where high power must be transmitted. Single-mode fibers are used for most communication links longer than 300 meters (1,200 ft.).

10.1 Ordering information

Item name	Item part number
CoaXPress Range Extender over Fiber – Host and Device units	KY_FEXT
CoaXPress Range Extender over Fiber – Host unit only	KY_FEXT_H
CoaXPress Range Extender over Fiber – device unit only	KY_FEXT_D
SFP+ single-mode module	KY-SFP-10G31-10
SFP+ multi-mode module	KY-SFP-10G85-3M
SFP+ bidirectional connection module	KY-BSFP-10G33-10
SFP+ bidirectional connection module	KY-BSFP-10G23-10
Fiber cable - single-mode x meter	KY-FCA-S-SM-LC-LC-XXX.X
Fiber cable - multi-mode x meter	KY-FCA-S-MM-LC-LC-XXX.X
Coaxial cable x meter	KY-FCC-000-XXX.X
Power supply 24V , 72W	KY-PWR-24

Table 7 : Ordering Information

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