



Datasheet

FXCL II Acquisition system

Innovative Approach

The **FXCL II Acquisition system** is the industry most advanced Camera Link compatible 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 II Acquisition system** is capable of receiving video streams from Camera Link Full camera while such interface supports standard Camera Link bitrates up to 100 MHz. This system is ideally suited for industrial, defense and aerospace Machine Vision Systems and applications.

The system consists of Komodo II CLHS compatible frame grabber and CameraLink to CLHS converter unit. The remote unit converts CameraLink interface to fiber optic interface. The FXCL II 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.

Key Features:

- Solves distance limitation of Camera Link
- Extension for distances up to 80 km in single-mode and up to 300 m in multi-mode
- Camera Link Full (Decca) support
- Up to 4 CL Full cameras with single Frame Grabber
- Camera Link Full (Decca) over single fiber cable
- PCIe Gen3 x8 Half-length card
- Camera controls and triggers
 - Camera Link 2.0 compliant
 - Power over Camera Link support
 - Multiple Camera synchronization
 - Multiple Frame Grabbers synchronization
 - MDR connectors for camera interface
 - GUI interface
 - Supporting Windows, Linux OS and Nvidia Jetpack
 - API for developing custom applications
 - Plug-ins modules for Matlab, HALCON and Labview
- GenTL support
- -40°C to +70°C operating environment temperature

TECHNICAL DATA

General	
Form factor	PCI Express card + remote device
Format	Standard profile, half-length, 8-lane PCI Express card
Cooling method	Air cooling, fan-cooled heatsink (Optional passive heatsink)
Mounting	For insertion in a standard height, 8-lane or higher, PCI Express card slot
Dimensions	Frame Grabber: 167.65 mm x 111.15 mm (6.6" x 4.4") Remote device: 133 x 103 x 43 mm (5.23" x 4.05" x 1.7")
Weight	Frame grabber: 183 g (6.5 oz) Remote device: 348 g (12,275 oz)

Host bus	
Standard	PCI Express 3.0
Link width	8 lanes 1, 2 or 4 lanes with reduced performance
Link speed	8.0 GT/s (PCIe 3.0) 5.0 GT/s (PCIe 2.0) with reduced performance
Maximum payload size	2,048 bytes
DMA	64-bit addressing support - Scatter gather support - Physical address support (GPU transfers)
Peak delivery bandwidth	7,877 MB/s
Effective (sustained), delivery bandwidth	6,695 MB/s (Host PC dependent)
Power consumption	Frame grabber: 16.8 W Remote device: 10.8 W

Camera / video inputs	
Interface standard(s)	Camera Link compatible v2.0
Status LEDs	1 bicolor status LED per connector 4 System status LEDs
Number of cameras	Up to 4
Synchronization between cameras	Yes
Line-scan cameras supported	Yes
Maximum aggregated camera data transfer rate	63.8 Gbit/s
Maximum stream packet size	8,192 bytes
Camera types	Area-scan cameras: - Gray-scale and color (RGB and Bayer CFA) Line-scan cameras: - Gray-scale and color RGB

General Purpose Inputs and Outputs	
Number of lines	20 I/O lines: 2 differential inputs 2 differential outputs 4 singled-ended TTL inputs/outputs 4 single-ended LVTTTL inputs/outputs 4 opto-isolated inputs 4 opto-isolated outputs
Usage	- Any System I/O input lines can be connected to any I/O output line - Any I/O input line can be used to decode A/B and Z signals of a motion encoder - Any I/O input line can generate any trigger event - Any I/O input line can trigger a timer

Electrical specifications	- Differential lines - LVDS compatible - TTL lines - 5V TTL compliant - LVTTL lines - 3.3V LVTTL compliant - Isolated lines - opto isolated lines with voltage range up to 30 V
Filter control	- Glitch removal filter for Encoders and Triggers - Configurable filter time between 0 μs and 34 ms - Filter time resolution of 8 ns - Glitch removal filter for Encoders and Triggers
Polarity control	Yes
Encoders	4 quadrature encoders with A/B and Z inputs 32bit position counter - Forward and backward counting - Position trigger support - Noise filtering
Timers	4 general-purpose timers - Configurable delay and duration 32-bit accumulator
Event reporting	64-bit system timestamp event reporting - Each I/O line can generate an event on a configurable edge - Each Timer can generate an event - Each encoder can generate an event
Frame Grabber synchronization	
Synchronization	Precise area and line-scan cameras synchronization across different frame grabbers
Area-scan camera control	
Trigger	- Precise control of asynchronous reset cameras, with exposure control - Support of camera exposure/readout overlap - Support of triggering from encoder or timer - Support of external hardware trigger, with optional delay, filtering and trigger decimation
Strobe	Accurate control of the strobe position for strobe light sources. Support of early and late strobe pulses
Line-scan camera control	
Scan/page trigger	- Precise control of start-of-scan and end-of-scan triggers - Support of external hardware trigger, with optional delay and filtering - Support of triggering from an encoder - Support of infinite acquisition, without missing lines
Line trigger	Support for quadrature motion encoders, with programmable filters, selection of acquisition direction and backward motion compensation
Line strobe	Accurate control of the strobe position for strobe light sources
On-board processing	
On-board memory	4 GByte DDR4
Bayer de-mosaic	- Full 16-bit resolution - Bilinear 3x3 - Bilinear 3x2 for linescan with gradient correction
Color transformation	- Full 16bit resolution 18bit coefficients table: - Color space conversion - Gain and Offset
Decimation	Line skip
Additional features	Unpacking of 10-/12-/14-bit to 16-bit LSB aligned
Frame timestamp	64-bit with 8 ns precision
Data stream statistics	Measurement of: Frame rate

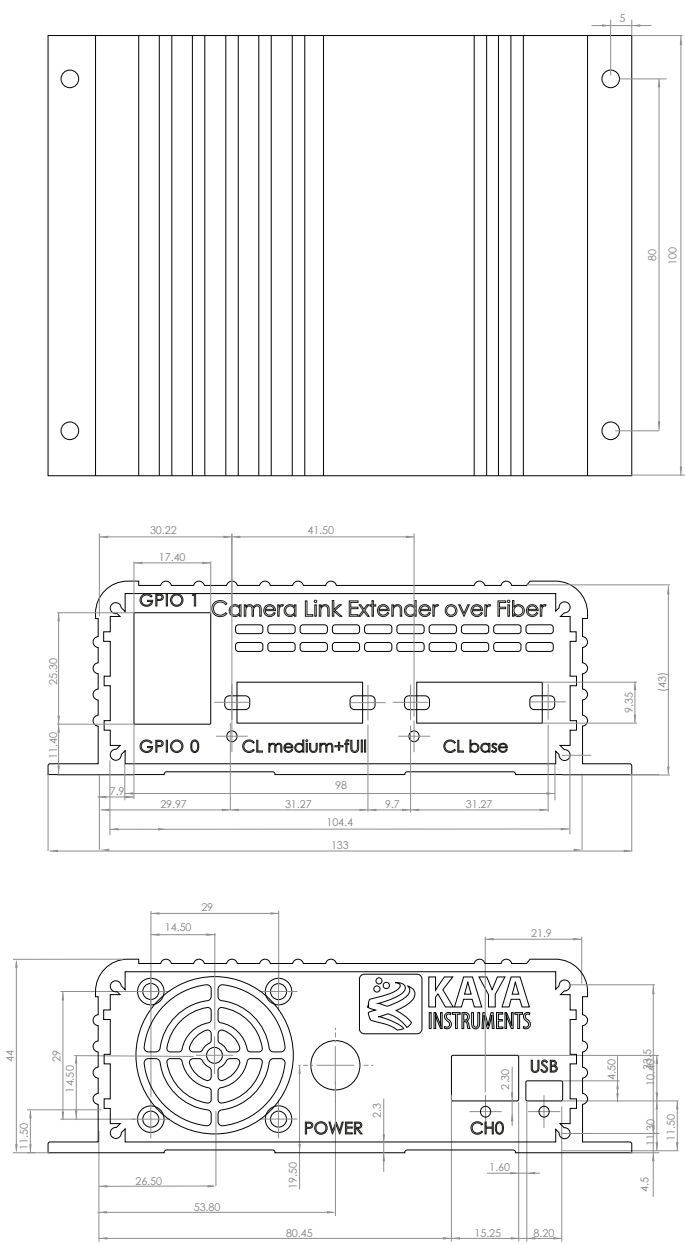
	• CRC Errors • Received/Dropped frames • Received/Dropped packets • Test packets
Event signaling and counting	The application software can be notified of the occurrence of various events: • Newly acquired buffers • Camera and Illumination control events • I/O events • Timer events • Encoder events
Software	
Host PC operating system	• Microsoft Windows 10 64-bit version • Microsoft Windows 11 64-bit version • Signed and certified kernel driver supporting Windows 10 and 11 • Source code Linux kernel driver (Automatically compiled during installation) • Tested for Ubuntu 18.04, 20.04 and 22.04 versions • Nvidia Xavier AGX (Jetpack 5.1.1 and 4.6.1) • Nvidia Orin AGX (Jetpack 5.1.1)
Gen<i>Cam	• Support of Gen<i>Cam 3.2 • Full camera and Frame Grabber parameters configuration
Buffer management	• Circular buffer support • Accumulation of several frames/lines to single buffer to reduce CPU load • Flexible buffer queuing • DMA Buffer filling directly to system memory
GUI	• Supported for Windows and Linux OS • Multi camera display and configuration • Image/video recording and playback
Debugging capabilities	• Event logging • Statistics counters
APIs	• Gen<i>Cam, GenTL producer libraries, ANSI C, Python and NET bindings • x86 64 dynamic library designed to be used with ISO-compliant C runtime • Allows for development of x86 64 applications • Plug-in modules for Matlab, HALCON, Cognex and Labview • Export straightforward, unified and easy-to-use API across all Grabber types • Include practical examples based on API functions, for supported language wrappers • Documentation include sample snippets for API usage
Environmental conditions	
Operating ambient air temperature	-40 °C to +70 °C (-40 °F to +158 °F)
Operating ambient air humidity	10% to 90% RH non-condensing
Storage ambient air temperature	-40 °C to +70 °C (-40 °F to +158 °F)
Storage ambient air humidity	10% to 90% RH non-condensing
Certifications	
Electromagnetic - EMC standards	• The European Council EMC Directive 2004/108/EC • The Unites States FCC rule 47 CFR 15
EMC - emission	• EN 55022:2010 Class B • FCC 47 Part 15 Class B
EMC - immunity	• EN 55024:2010 Class B • EN 61000-4-3 • EN 61000-4-4 • EN 61000-4-6
Flammability	PCB compliant with UL 94 V-0

RoHS	Compliant with the European Union Directive 2011/65/EU (ROHS2)
REACH	Compliant with the European Union Regulation No 1907/2006
WEEE	Must be disposed of separately from normal household waste and must be recycled according to local regulations

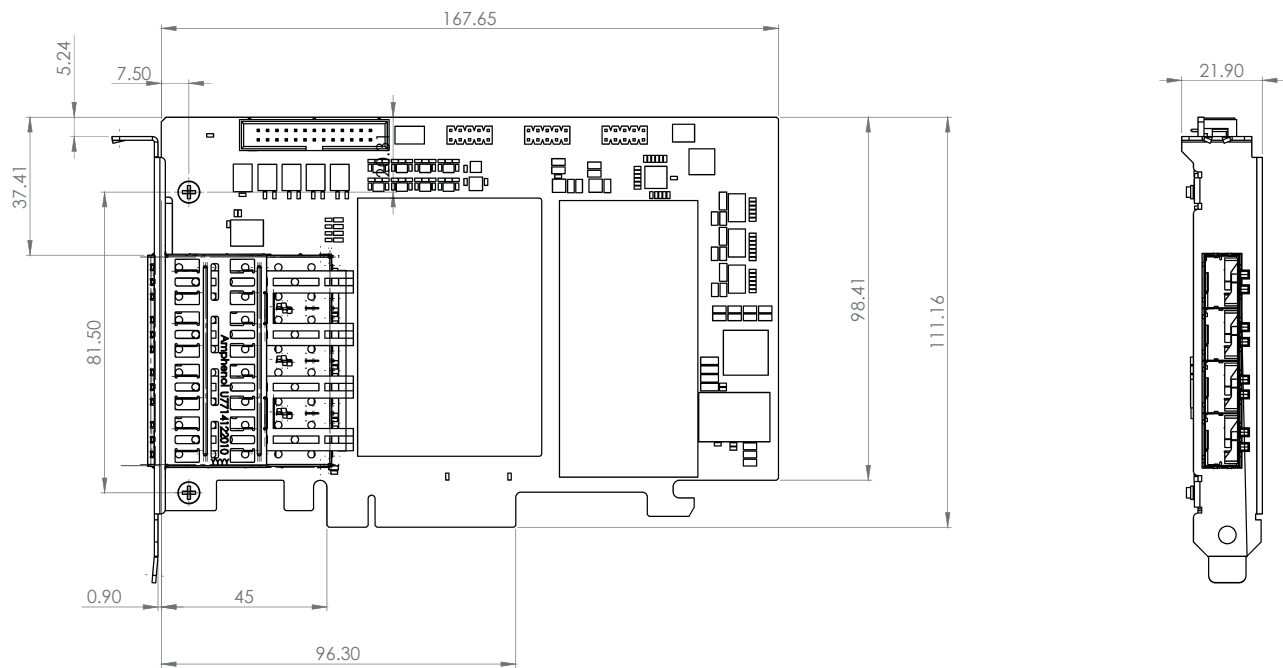
Ordering information	
FXCL II Acquisition system	KY-FXCL-II
Camera Link compatible Range Extender over Fiber – Device unit	KY-CL2F-D
Komodo II CLHS compatible Frame Grabber	KY-FGF-II-CLHS
SFP+ single-mode module, 10 km	KY-SFP-10GLR-31
SFP+ multi-mode module, 300 m	KY-SFP-10GSR-85
SFP+ single-mode bidirectional 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

MECHANICAL DRAWINGS

Camera Link compatible remote device:



Komodo II CLHS compatible frame grabber:



SYSTEM STRUCTURE

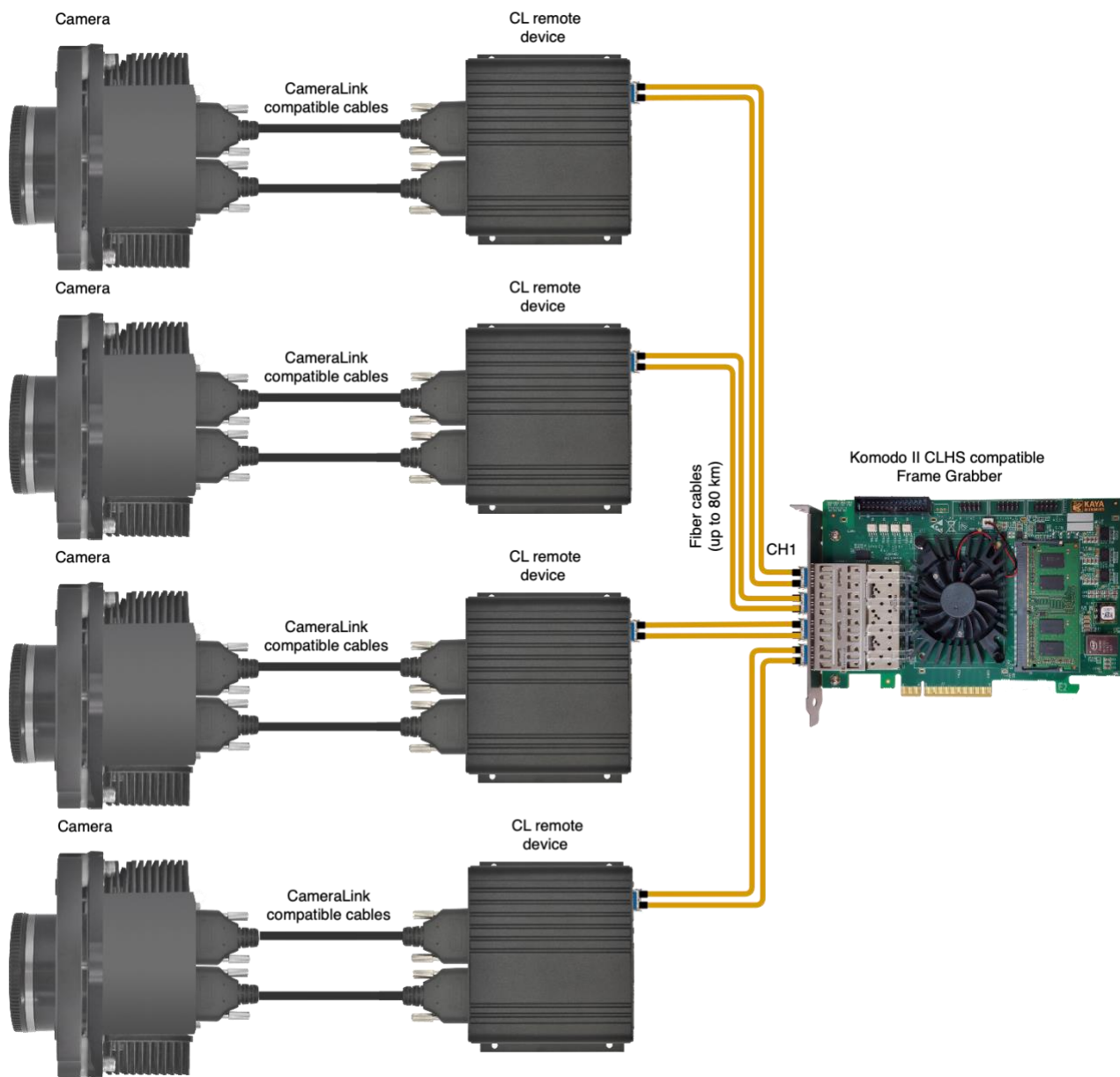


Figure 1 – KY-FXCL-II quad camera topology

COMPATIBILITY

KAYA Instruments creates and maintains compatibility and interfaces for the most common and advanced vision image processing libraries and applications. Major support is available for **MVTec Halcon**, **National Instruments' LabVIEW** and **MathWorks' MATLAB**.

Supported vision standards:



Supported vision libraries:



Supported operating systems:



Please check our website for an up-to-date list of other supported libraries and software package

International Distributor



Sky Blue Microsystems GmbH
Geisenhausenerstr. 18
81379 Munich, Germany
+49 89 780 2970, info@skyblue.de
www.skyblue.de

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