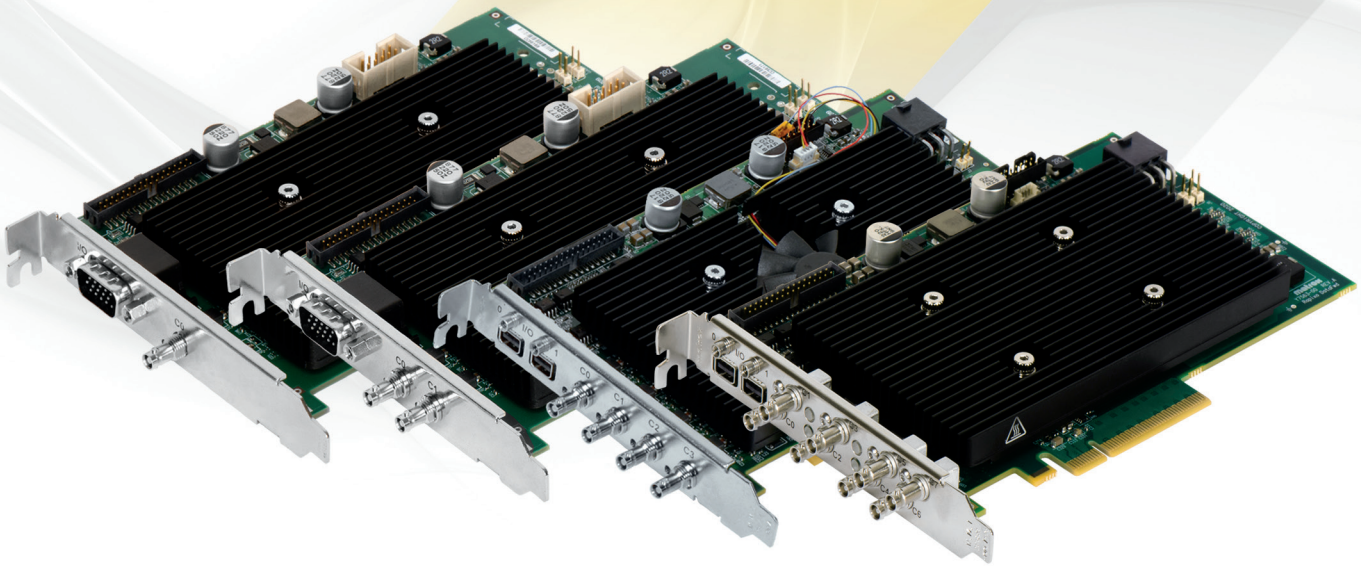

Matrox **Rapixo CXP** »

Single- to quad-input CoaXPress 2.0 frame grabbers with optional data forwarding and FPGA-based image processing offload

ZEBRA | MATROX IMAGING

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Overview

Interface cards for high-speed imaging

Matrox® Rapixo CXP is a new generation of frame grabbers, supporting version 2.0 of the CoaXPress® digital interface standard for machine vision applications. The Matrox Rapixo CXP series supports data rates of either up to 6.25 Gbps (CXP-6) or up to 12.5 Gbps (CXP-12) per connection. The PCIe® host interface comfortably matches the maximum input bandwidth from the CoaXPress links. The CoaXPress links are accessed through high-density BNC connectors allowing for a homogenous interconnection with new cameras. Power-over-CoaXPress (PoCXP) support on each connection simplifies system configurations, combining the camera's power interface with its command- and data-interface onto the same coaxial cable.

The Matrox Rapixo CXP series of frame grabbers feature one, two, or four connections for interfacing to independent cameras. Matrox Rapixo CXP Dual and Quad models can also handle higher data rates through connection aggregation. The Matrox Rapixo CXP series possesses sufficient onboard memory to buffer incoming image data in situations where the host computer is temporarily unable to accept data. The fanless design for select models ensures extended use without maintenance.

FPGA-based image processing offload

The Matrox Rapixo CXP Pro makes use of an FPGA device from the Xilinx Kintex® UltraScale™ family for not only integrating the controlling, formatting, and streaming logic of the various interfaces, but also allowing developers to incorporate Matrox Imaging- or user-developed custom image pre-processing operations to offload from the host computer. A variety of FPGA sizes are available for the Matrox Rapixo CXP Pro, providing a range of solutions tailored to a given application. Operations performed on-board are controlled through MIL X application-development software. Within MIL X, an existing FPGA configuration can be rearranged to perform a required sequence of operations without necessarily having to generate a new FPGA configuration. Using the Matrox FDK, developers generate their own FPGA configurations with custom operations written in C/C++.

Data forwarding for distributed processing

The Matrox Rapixo CXP series also offers the possibility of distributing image processing across multiple computers using the data forwarding option. This feature enables the relaying of images to another computer using four output connections running at either up to 6.25 Gbps (CXP-6) or up to 12.5 Gbps (CXP-12). The data forwarding is accomplished without host computer involvement as image data is re-transmitted prior to also being stored in onboard memory, thus minimizing latency. Images can be retransmitted to multiple computers in a daisy chain fashion by equipping each PC with a Matrox Rapixo CXP board with data forwarding option.

Matrox Rapixo CXP at a glance

Support for the highest speeds available in CoaXPress 2.0

Connect to and capture from up to four cameras or combine connections for even higher data rates

Simplify cabling with PoCXP support between cameras and vision computer

Offload host computer of custom image processing using a field-programmable gate array (FPGA) device

Distribute image processing workload across multiple computers through data forwarding capability

Synchronize with sensors, encoders, and controllers with ample auxiliary I/Os for each CoaXPress connection

Use license fingerprint for Matrox Imaging Library (MIL) X software and avoid the need for a separate hardware key

Monitor and troubleshoot acquisition performance in detail using Matrox Gecho event-logging tool

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Software Environment

Pairs with MIL X[1] software

Boards from the Matrox Rapixo CXP series support 64-bit Windows® and Linux® through the latest MIL X software. The card also acts as a license fingerprint and can store a supplemental license for Matrox Imaging software, avoiding the need for a separate hardware key.

Field-proven application development software

Matrox Rapixo CXP is supported by both MIL X and Matrox Design Assistant® X software[1]. Each software offers developers a different environment with the same underlying vision tools.

MIL X[1] is a comprehensive software development kit (SDK) with a 25-year history of reliable performance. This toolkit features interactive software and programming functions for image capture, processing, analysis, annotation, display, and archiving operations, with the accuracy and robustness needed to tackle the most demanding applications. Refer to the MIL X datasheet for more information.

Matrox Design Assistant X[1] is an integrated development environment (IDE) for Windows where vision applications are created by constructing an intuitive flowchart instead of writing traditional program code. Matrox Design Assistant X's IDE also enables users to design a graphical web-based operator interface for the application. Refer to the Matrox Design Assistant X datasheet for more information.

Camera configuration and test utility

Matrox Capture Works is a utility that allows users to rapidly evaluate the performance and functionality of virtually any CoaXPress camera. Matrox Capture Works will list all detected CoaXPress devices connected to each allocated board. It can start or stop capturing images, display acquired images, save the last grabbed image, send a software trigger, as well as browse and control the selected device's features. Users can view and change acquisition properties, as well as view acquisition statistics. Matrox Capture Works is distributed with MIL X and Matrox Design Assistant X software; it is also available with MIL-Lite X.

Thorough acquisition monitoring utility

Offered with the above-mentioned software is Matrox Gecho, a logging utility that records events generated by the Matrox CXP device driver and saves these to a JSON or CSV file. The utility is made to run concurrently with the application to log acquisition activity for the purpose of troubleshooting capture errors as well as measuring latencies and execution times to identify performance bottlenecks. Resulting trace files can be loaded into Google Perfetto for viewing on an interactively navigable graphical timeline. Matrox Gecho helps developers optimize image capture and make sure it runs as intended.

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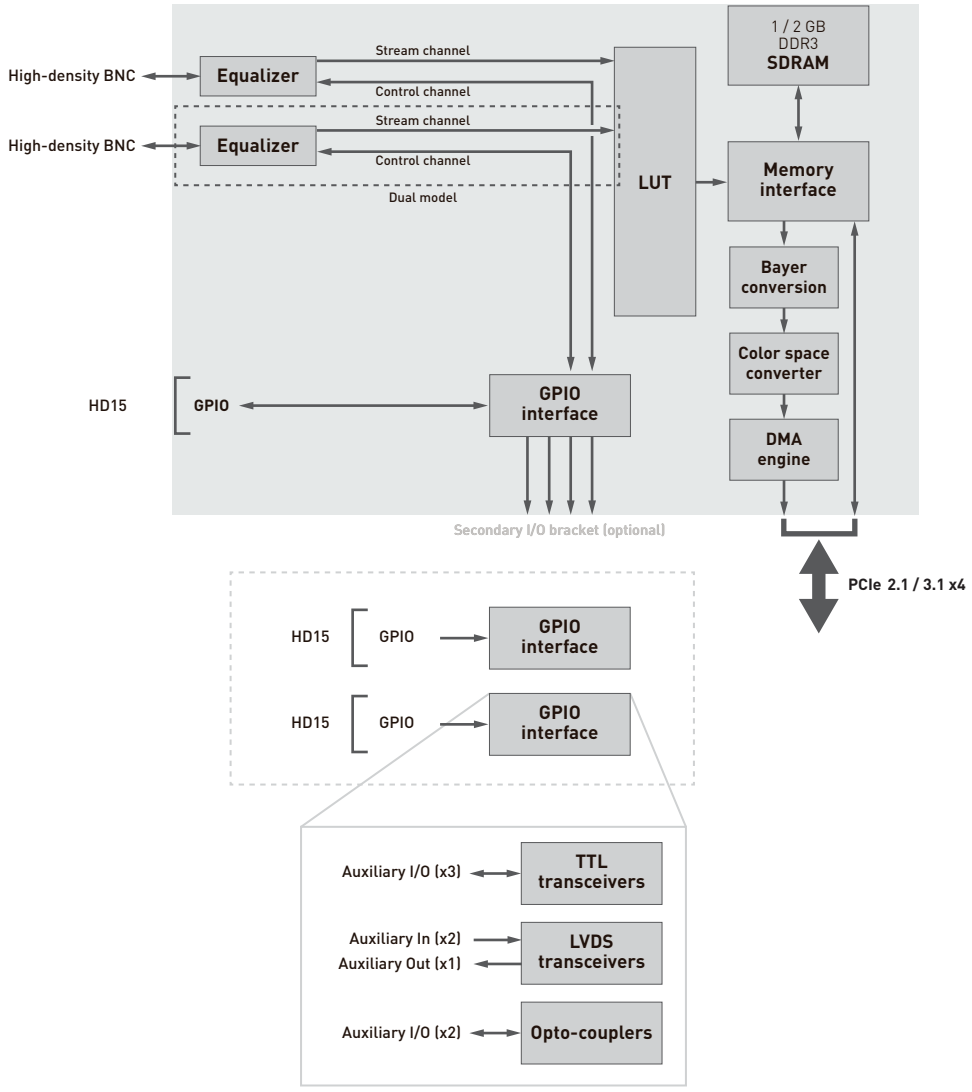
Connectivity

Matrox Rapixo CXP Single/Dual block diagram



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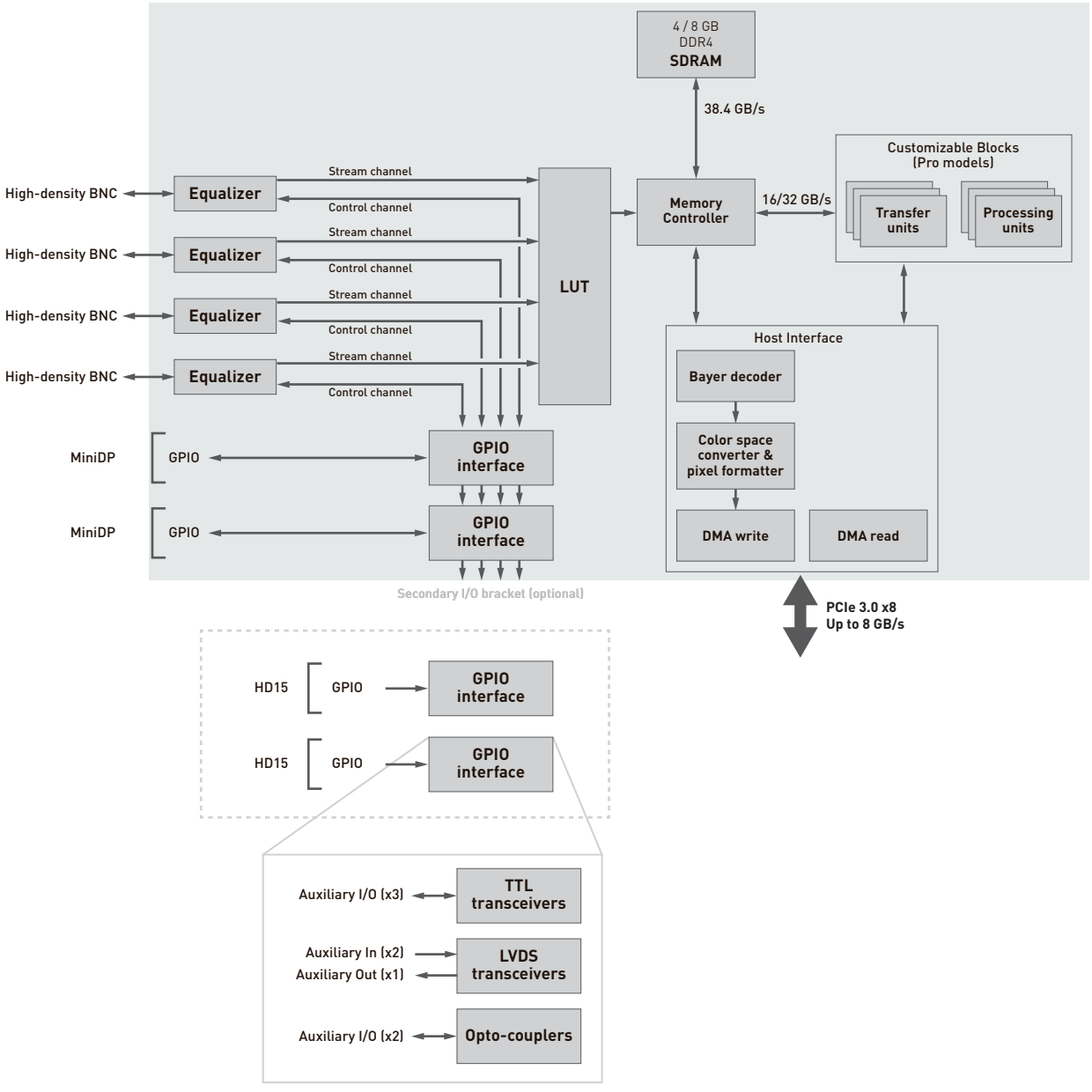
Connectivity (cont.)

Matrox Rapixo CXP Quad block diagram



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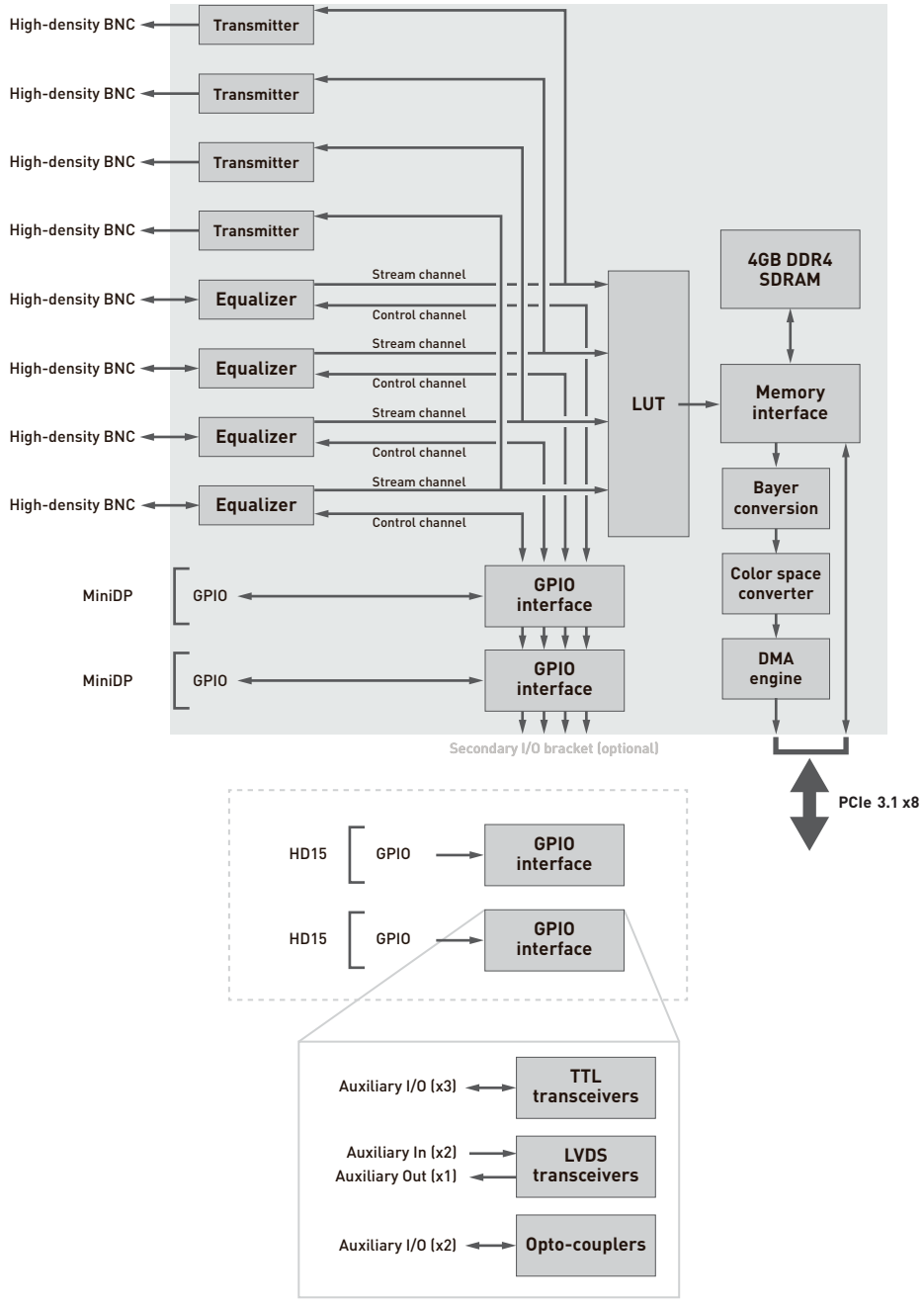
Connectivity (cont.)

Matrox Rapixo CXP Quad Data Forwarding block diagram



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Specifications

Matrox Rapixo CXP			
Hardware			
Model	Matrox Rapixo CXP Single/Dual	Matrox Rapixo CXP Quad	Matrox Rapixo CXP Quad Data Forwarding
Host interface			
Interconnect	PCIe 2.1/3.1 x4	PCIe 2.1/3.1 x8	PCIe 3.1 x8
Camera/video interface			
Standard	CXP version 2.0		
Configuration	One (1) or two (2) input connection(s)	Four (4) input connections	Four (4) input connections and four (4) output connections
Speeds	1.25 / 2.5 / 3.125 / 5 / 6.25 / 10 / 12.5 Gbps (CXP-1, 2, 3, 5, 6, 10, and 12 respectively)		
Streams	Up to eight (8) total		
Connectors	High-density BNC		
Power output	PoCXP		
Miscellaneous	Connection-status indicator LEDs for inputs		
Memory			
Type	DDR3 SDRAM	DDR4 SDRAM	
Quantity	1 or 2 GB	4 or 8 GB	4 GB
Purpose	Image buffering and processing		
Image processing capabilities			
Onboard look-up tables	8-/10-/12-bit support		
Onboard Bayer interpolation	GB, BG, GR, and RG pattern support		
Onboard color space conversion	Input formats: 8-/16-bit mono/Bayer, 24-/48-bit packed BGR		
	Output formats: 8-/16-bit mono, 24-/48-bit packed/planar BGR, 16-bit YUV, 16-bit YCbCr, 32-bit BGRa		
Custom processing	N/A	Matrox Imaging- or user-developed using Xilinx Vivado® Design Suite and Matrox FDK	N/A
I/Os			
Types	Three (3) TTL I/Os per connector		
	Two (2) LVDS inputs per connector		
	One (1) LVDS output per connector		
	Two (2) opto-isolated inputs per connector		
Connectors	One (1) HD15 connector on main I/O bracket	Two (2) mDP connectors on main I/O bracket accessed through a mDP-to-HD15 adaptor	
	Two (2) HD15 connectors on secondary I/O bracket		
Physical			
Form factor	Half-length, full-height, PCIe add-in card		
Dimensions (L x W x H)	16.76 x 11.12 x 1.871 cm (6.6 x 4.376 x 0.737 in)		
Environmental			
Operating temperature	0°C to 55°C (32°F to 131°F)[2]		
Relative humidity	Up to 95% (non-condensing)		

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Specifications (cont.)

Matrox Rapixo CXP	
Certifications	
Electromagnetic compatibility	FCC Class A
	CE Class A (EN55032, EN55024)
	ICES-003 / NMB-003 Class A
	RCM Class A
	KC Class A
Software	
Compatible software	MIL X
	Matrox Design Assistant X
	GenICam™ GenTL version 1.5
Operating system support	Windows 7 (64-bit)
	Windows 10 (64-bit)
	Linux (64-bit) Note: MIL X only.
Licensing provisions	MIL X license fingerprint and storage

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Ordering Information

Part number	Description
Hardware	
RAP 1G 1C12	Matrox Rapixo CXP Single CXP-12 PCIe 2.1 x4 frame grabber with 1 GB DDR3 SDRAM and passive heatsink. Note: Cable adaptors for second and third GPIO sets sold separately.
RAP 2G 2C12	Matrox Rapixo CXP Dual CXP-12 PCIe 3.1 x4 frame grabber with 2 GB DDR3 SDRAM and passive heatsink. Note: Cable adaptors for second and third GPIO sets sold separately.
RAP 4G 4C6	Matrox Rapixo CXP Quad CXP-6 PCIe 2.1 x8 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
RAP 4G 4C12	Matrox Rapixo CXP Quad CXP-12 PCIe 3.1 x8 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
RAP 8G 4C12 P352	Matrox Rapixo CXP Pro Quad CXP-12 PCIe 3.1 x8 frame grabber with 8 GB DDR4 SDRAM, Xilinx Kintex Ultrascale KU035 FPGA, and active heatsink (fansink). Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
RAP 8G 4C12 P602	Matrox Rapixo CXP Pro Quad CXP-12 PCIe 3.1 x8 frame grabber with 8 GB DDR4 SDRAM, Xilinx Kintex Ultrasacale KU060 FPGA, and active heatsink (fansink). Includes one (1) mDP-toHD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIOs sold separately.
RAP 4G 4C6 DF	Matrox Rapixo CXP Quad Data Forwarding CXP-6 PCIe 3.1 x8 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
RAP 4G 4C12 DF[3] Verify for availability	Matrox Rapixo CXP Quad Data Forwarding CXP-12 PCIe 3.1 x8 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
Software	
Refer to MIL X datasheet and Matrox FDK datasheet.	
Refer to Matrox Design Assistant X datasheet.	
Accessories	
RAPACCKIT02	Accessory kit for Matrox Rapixo CXP Single/Dual. Includes one (1) secondary dual HD15 I/O bracket with ribbon cable.
RAPACCKIT01	Accessory kit for Matrox Rapixo CXP Quad. Includes one (1) additional mDP-to-HD15 GPIO cable adaptor and one (1) secondary dual HD15 I/O bracket with ribbon cable.
HDBNC2BNC	One (1) 12 in or 30 cm HDBNC-male-to-BNC-female adaptor cable.

Endnotes:
1. The software may be protected by one or more patents; see www.matrox.com/patents for more information.
2. Models with passive heatsink require a minimum ventilation of 150 LFM (linear feet per minute) in a single board configuration. Contact a Matrox Imaging sales representative for ventilation requirement for multiple board configurations.
3. Certification pending.

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The Matrox Imaging advantage

Assured quality & longevity
Adhering to industry best practices in all hardware manufacturing and software development, product designs pay careful attention to component selection to secure consistent long-term availability. Matrox Imaging is able to meet Copy Exact and Revision Change Control procurement requirements in particular circumstances, backed by a dedicated team of QA specialists.

Trusted industry standards
Matrox Imaging champions industry standards in its design and production. Leveraging these standards to deliver quality compatible products, Matrox Imaging protects its customers' best interests by ensuring hardware and software components work with as many third-party products as possible.

Comprehensive customer support
Devoted front-line support and applications teams are on call to offer timely product installation, usage, and integration assistance. Matrox Professional Services delivers deep technical assistance to help customers develop their particular applications in a timely fashion. Services include personalized training and device interfacing as well as application feasibility, prototyping, troubleshooting, and debugging.

Tailored customer training
Matrox Vision Academy comprises online and on-premises training for Matrox Imaging vision software tools. On-premises intensive training courses are regularly held at Matrox headquarters, and can also be customized for onsite delivery. The Matrox Vision Academy online training platform hosts a comprehensive set of on-demand videos available when and where needed.

Long-standing global network
Matrox Imaging customers benefit from a global network of distributors who offer complementary products and support, and integrators who build customized vision systems. These relationships are built on years of mutual trust and span the globe, ensuring customer access to only the best assistance in the industry.

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ABOUT MATROX IMAGING
Matrox Imaging, now a part of Zebra Technologies, is an established and trusted supplier to top OEMs and integrators involved in machine vision, image analysis, and medical imaging industries. The components consist of smart cameras, 3D sensors, vision controllers, I/O cards, and frame grabbers, all designed to provide optimum price-performance within a common software environment. For more information, visit www.matrox.com/imaging

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