

# Matrox **FDK** for Matrox **Rapixo Pro** **>>**

Harness the full power and flexibility of FPGAs  
for image processing



# Overview

## Image processing offload and acceleration

Matrox® FPGA Development Kit (FDK) provides a library of components that enable development of custom field-programmable gate array (FPGA) configurations for [Matrox Rapixo CXP Pro](#) frame grabbers, based on Xilinx Kintex® UltraScale™ devices, and the [Matrox Rapixo CL Pro](#) frame grabbers, based on Xilinx Kintex™-7 devices. In both instances, the Matrox FDK is used in combination with Xilinx Vivado® Design suite to create FPGA configurations that offload and accelerate image processing functions from the host system.

## Focus on custom image processing functions

Developers with software backgrounds can use the Vivado High-Level Synthesis (HLS) tool to write custom image processing functions as FPGA design components using the C or C++ languages. With the Matrox FDK, developers can focus on creating custom FPGA design components vital to their application rather than the peripheral logic.

## Quick assembly of FPGA design components

Custom- and ready-made Matrox FPGA design components are graphically combined within the Xilinx Vivado IP Integrator tool to easily create custom FPGA configurations. In addition, Xilinx provides over 50 image-processing functions within their library with their source code. These can be compiled using Vivado HLS into building blocks compatible with the components provided by the Matrox FDK.

## Xilinx Vivado HLS

The Vivado HLS tool is designed for software application developers and FPGA designers seeking a more direct path to FPGA hardware. The Vivado HLS compiler is a high-level synthesis tool that lets developers compile C/C++ algorithms directly into optimized logic, ready for use with FPGA devices found on both models of the Matrox Rapixo Pro. The Vivado HLS tools enable highly iterative, software-oriented design methods for quick development of FPGA hardware modules from C/C++ source code. Several example functions are provided with the FDK; those can be used as-is or as a model for creating custom processing units.

## Matrox FDK at a glance

**Build custom FPGA configurations** for Matrox Rapixo Pro frame grabbers

**Code custom FPGA design components** in C/C++ with Xilinx Vivado HLS tool

**Accelerate creation of custom FPGA configurations** using Matrox Imaging's library of ready-made FPGA design components

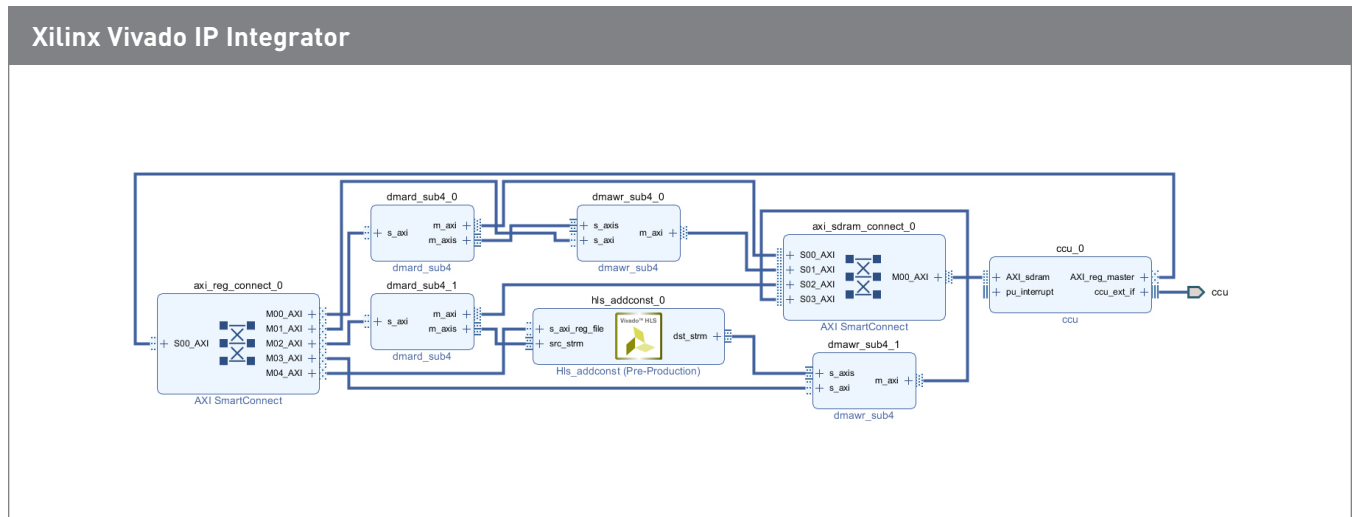
**Leverage more than 50 optimized image-processing functions** from the Xilinx IP library

**Assemble FPGA configurations quickly** with the graphical Xilinx Vivado IP Integrator

# Overview (cont.)

## Xilinx Vivado IP Integrator

Custom- and ready-made Matrix FPGA design components are graphically combined within the Xilinx Vivado IP Integrator tool to easily create custom FPGA configurations.



## Xilinx Vivado HLS

Developers with software backgrounds can use the Xilinx Vivado HLS tool to write custom image processing functions as FPGA design components using C or C++ languages.

### Xilinx Vivado HLS

The screenshot shows the Xilinx Vivado HLS 2018.1 interface. The main window displays the C++ source code for the `hls_addconst` block. The code defines a function `void hls_addconst` that takes a stream of source data (`src_strm`), a stream of destination data (`dst_strm`), and control parameters (`ctrl`, `int_val`, `int_numpix`). The function processes the data in parallel, reading `N` pixels from the source stream and adding a constant value (`int_val`) to each pixel. The output is written to the destination stream. The code includes pragmas for HLS interfaces and pipeline control.

```
10 void hls_addconst(fdc_stream& src_strm, fdc_stream& dst_strm, int ctrl, int val, int numpix)
11 {
12     #pragma HLS INTERFACE axis port=src_strm
13     #pragma HLS INTERFACE axis port=dst_strm
14     #pragma HLS INTERFACE s_axilite port=ctrl bundle=Regfile
15     #pragma HLS INTERFACE s_axilite port=val bundle=Regfile
16     #pragma HLS INTERFACE s_axilite port=numpix bundle=Regfile
17     #pragma HLS INTERFACE s_axilite port=return bundle=Regfile
18
19     int i, n;
20     unsigned char src, optype, dest;
21     short dst, valshort;
22     FDC_STREAM_TYPE srch, dsth;
23
24     // Pick up parameters
25     optype = ctrl & 0x3;
26     src = (ctrl >> 2) & 0xff;
27     dest = (ctrl >> 8) & 0xff;
28     valshort = (short)val;
29
30     // Process one frame
31     for (i = 0; i < numpix; i += NPIX)
32     {
33         #pragma HLS pipeline
34
35         // Read N pixels
36         srch = src_strm.read();
37
38         // Process N pixels in parallel
39         for (n = 0; n < NPIX; n++)
40         {
41             if (optype == 0) // sign extend each byte
42                 dst = (char)(PIX8(srch, n));
43             else
44                 dst = (unsigned char)(PIX8(srch, n));
45
46             // Add as 16-bit to avoid overflow
47             dst += valshort;
48         }
49     }
50 }
```

The console window at the bottom shows the output of the simulation, indicating that the CSDM (Control Signal Data Memory) is finished and the simulation is complete.

# Specifications

## Supported environment

- 64-bit Microsoft® Windows® 7 and 10

# Ordering Information

| Part number                               | Description   |
|---|---|
| Hardware                                  |   |
| RAPPROFDK                                 | Matrox FDK for Matrox Rapixo Pro. Must be ordered with 6x IMGPROSERV for personalized training and/or support. Requires Xilinx Vivado Design suite. |
| Additional requirements (sold separately) |   |
| Compatible hardware                       | <a href="#">Matrox Rapixo CXP Pro</a>   |
|   | <a href="#">Matrox Rapixo CL Pro</a>  |
| Compatible software                       | <a href="#">Matrox Imaging Library (MIL) X</a> or <a href="#">MIL-Lite X</a>  |
|   | <a href="#">Xilinx Vivado Design Suite – HLx Editions</a> <sup>1</sup>  |
| Operating system support                  | Windows 7 (64-bit)  |
|   | Windows 10 (64-bit)   |

Endnotes:

1. Purchased from Xilinx Inc.

## 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.



## About Matrox Imaging

Founded in 1976, Matrox is a privately held company based in Montreal, Canada. Imaging, Graphics, and Video divisions provide leading component-level solutions, leveraging the others' expertise and industry relations to provide innovative, timely products.

Matrox Imaging 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.

## Contact Matrox

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