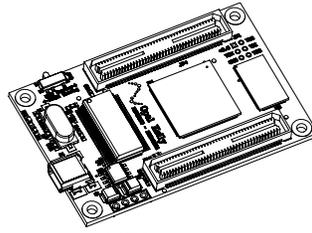
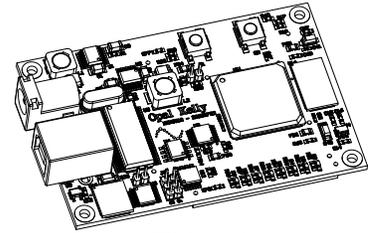


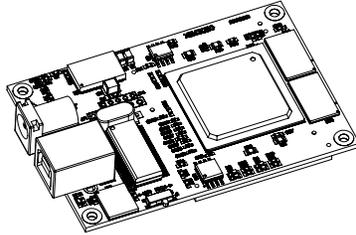
XEM3001



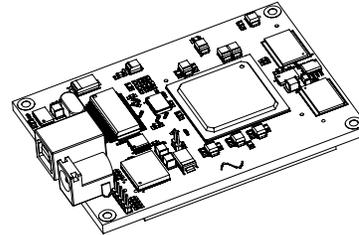
XEM3005



XEM3010



XEM3050



XEM5010

## Thank You!

Thank you for purchasing an Opal Kelly XEM product. We've included this printed guide to help you start using the XEM and FrontPanel software. Much more documentation is available on the included CD-ROM. In addition, several examples are included which illustrate how to add FrontPanel support to your own FPGA designs. Finally, source code to several programs in both C/C++, Python, and Java show how easy it is to add FPGA communication to your own software.

If you have any questions or just want to chat, please visit our community forums online at:

<http://forums.opalkelly.com>

For technical answers from our support staff, email us at:

[support@opalkelly.com](mailto:support@opalkelly.com)

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## Contents

Your XEM package should have arrived with the following items. If anything is missing, please contact us as soon as possible so we may replace the item.

- XEM - Xilinx Integration Module
- USB Cable
- Software CD-ROM
- Printed Getting Started Guide

## Installation and Setup

This section will guide you through the software installation. The XEM is a USB device which requires a special driver to be installed on your system. You should install this driver before connecting the XEM to your system.

### System Requirements

- Microsoft Windows (XP 32- or 64-bit, or Vista 32- or 64-bit)
- USB (version 1.1 or 2.0)
- 256 MB RAM
- Approximately 30 MB free disk space

### CD-ROM Contents

The CD-ROM contains the following items in the root directory:

| File / Folder        | Description                                                                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Documentation</b> | This folder contains the Adobe PDF documentation for FrontPanel and the XEM. Also included in this directory is the HTML documentation for the FrontPanel API.                  |
| <b>Extras</b>        | This folder contains items that are not directly related to FrontPanel development, but may be of interest to programmers.                                                      |
| <b>FrontPanel</b>    | This folder contains the installer files for Linux and Mac versions as well as a Windows "Driver-Only" installer that OEMs can use when distributing products that use the XEM. |
| Setup-Win-Win32.exe  | The 32-bit Windows installation executable for FrontPanel, the USB driver and several samples to get you started.                                                               |
| Setup-Win-x64.exe    | The 64-bit Windows installation executable for FrontPanel, the USB driver and several samples to get you started.                                                               |
| GettingStarted.pdf   | This guide in Adobe PDF format.                                                                                                                                                 |

### Software Installation

The software included with the XEM includes the following components:

- Universal USB driver for all XEMs.
- Opal Kelly's FrontPanel™ virtual instrumentation software.
- FrontPanel API for C, C++, Python, and Java.

- Sample Verilog and VHDL projects.
- Sample FrontPanel projects.

To start installation, run the Setup.exe application in the root directory of the included CD. The installation wizard will guide you through the installation and should only take a minute or two. We suggest installing everything available -- it won't take up much space. By default, the installation procedure will copy files to the following directory:

**C:\Program Files\Opal Kelly\FrontPanel**

When installation is complete, a two new entry will be made in your Start Menu:

**Start Menu → All Programs → Opal Kelly**

The folder (**Opal Kelly**) contains shortcuts to the documentation as well as a shortcut to the Samples folder. The shortcut (**Opal Kelly FrontPanel**) will start FrontPanel.

## Powering the XEM3001

The XEM3001 is configured by default to use USB bus power. No external supply is required.

## Powering the XEM3005

The XEM3005 has been designed to be a low-cost USB/FPGA interface to your own hardware. As such, it has been designed without the necessary 3.3v or 1.2v power supplies. The intent is that you provide these voltages from your design. To make the XEM3005 usable in evaluation situations, we have included the necessary power supply circuitry on our BRK3005 breakout board. The BRK3005 has on-board 3.3v and 1.2v regulators and may be used to power the XEM3005 in bus-powered or self-powered mode (using an external supply).

## Powering the XEM3010, XEM3050, and XEM5010

The XEM3010 has a large FPGA and an SDRAM device. Together, these parts may consume more power than the USB provides to bus-powered devices. Therefore, in its default configuration, the XEM3010 is a self-powered device. You will need to attach a power source with the following specifications:

- Voltage: 4.5-5.5VDC (must be well-regulated)
- DC connector: 2.1mm center / 5.5mm ring, Ring is DGND

Alternatively, the XEM3010 may be bus-powered by soldering across the J3 solder-jumper on the bottom side of the PCB. NOTE: This requires USB power and you should be aware of the limitations that the Universal Serial Bus can provide to bus-powered devices.

## IMPORTANT - Heat Dissipation

Care should be taken to provide proper cooling for the XEM and components on the board. The devices can potentially generate more heat than can be dissipated in still air. Passive or active cooling should be considered. Cooling requirements must be determined by the end-user using empirical data or simulation information from the Xilinx tools.

## Connecting the XEM

Once the software is installed on your system, connect the XEM to a USB port which can provide bus power. Windows will recognize that a new device has been attached and will display a notice (example shown at the right) near the taskbar.



Windows will then display the following dialog:



Allow Windows to install the software automatically and click **Next**. Windows should then properly locate the driver installed previously and complete the installation. Your XEM is now ready to be used and will be recognized in FrontPanel.

Note that different XEM boards have different USB serial numbers. Windows recognizes them as different devices and therefore performs the "Found New Hardware" procedure for each board. If you have multiple XEM boards, you'll need to go through this short procedure for each one. Each time, Windows should find the appropriate driver automatically.

## An Introductory Project

A few examples have been installed with the FrontPanel software. These can be found at the following location under the Start Menu:

**Opal Kelly → FrontPanel → Samples**

Browse to this location and open the **First** example to find the following:

| File / Folder       | Description                                         |
|---------------------|-----------------------------------------------------|
| XEMxxxx-Verilog     | Project source folder for the XEMxxxx in Verilog.   |
| XEMxxxx-VHDL        | Project source folder for the XEMxxxx in VHDL.      |
| ...                 | Project source folders for other Opal Kelly boards. |
| First.xfp           | The FrontPanel XML interface description.           |
| first-xxxx-yyyy.bit | Pre-built FPGA bitfile for each board model.        |

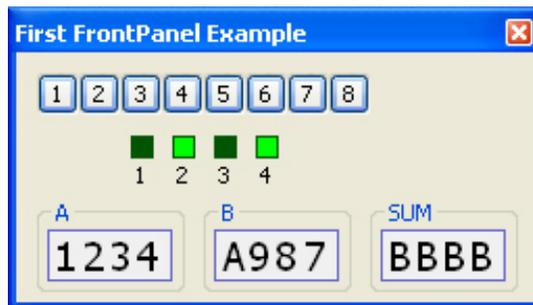
## Download the Configuration File

Start FrontPanel and click the download button to open a file selector dialog. Browse to the appropriate bitfile (e.g. **first-xem3005-1200.bit**) and click **Ok**. FrontPanel will then download the configuration file to the FPGA. Download time typically varies between 50 ms and 300 ms.

Note: Instead of using the file selector dialog to browse for the bitfile, you can drag the **First.bit** file onto the FPGA Download button.

## Load the FrontPanel Profile

When the download is complete, click the “Load Profile” button to open another file selector dialog. This time, select the First.xfp file and click Ok. FrontPanel will load the profile and open the first (and only) panel in the profile. It should look like this:



The panel contains eight `okToggleButtons` which are connected to the physical LEDs on the XEM3001 as well as four `okLEDs` which are connected to the physical pushbuttons. You can click on the toggle buttons and observe that the LEDs change state. You can also press the pushbuttons and observe the virtual LEDs in FrontPanel echo their state. At the bottom are the inputs (A and B) and the output (SUM) of a 16-bit adder designed into the FPGA. Using the mousewheel or keyboard, you can change the inputs and observe the output.

Note that the functionality varies slightly depending on what LEDs and buttons are available on your specific hardware. For example, the XEM3010 only has two pushbuttons.

Congratulations! You’ve just been introduced to the simplicity and power of FrontPanel. More elaborate examples are available in the **Samples** directory. Please see the FrontPanel User’s Manual for a short tutorial on FrontPanel.

## What’s Next?

You’re ready to start using the XEM. A few documents will help get you going quickly. These documents are located on the installation CD, and, if you elected to do so, were installed with the Opal Kelly FrontPanel software.

**FrontPanel User’s Manual** - This manual describes FrontPanel and describes how to add FrontPanel support to new or existing FPGA designs.

**XEM User’s Manual** - This manual describes the design and function of the XEM. Look here to find details about the XEM such as FPGA pin mappings.

**FrontPanel API Documentation** - This HTML documentation is a browsable description of the FrontPanel programmer's interface. Although specifically written for the C++ API, it readily translates to the Python API except in noted areas.

**Samples** - Several sample projects provide a great starting point to developing your own project. These are installed with FrontPanel in the installation directory.

## Extras

Included on the installation CD-ROM are several packages that you may find useful in conjunction with the XEM. You may want to check the respective websites to see if a more recent version of any of this software is available.

### Xilinx ISE WebPack and latest Service Pack [NOT INCLUDED]

This is a free download from Xilinx's website and provides the tools necessary to design and implement a complete project on the XEM3001, XEM3005, and XEM3010. The XEM3050 requires a license of ISE Foundation which is not free. Xilinx provides several tutorial examples and a lot of design assistance on their website: <http://www.xilinx.com>

### Python 2.6 for Windows

Python is an object-oriented, multi-platform interpreted language with a simple syntax. Together with extensive libraries, application development with Python is quick, easy, and robust. FrontPanel Python extensions allow you to configure and communicate with the XEM within any Python program. More information on Python can be found at their official website: <http://www.python.org>

### wxWidgets 2.8

wxWidgets is an Open Source C++ class library designed to make GUI design fast and portable. Applications designed with wxWidgets can easily be ported between Windows, Linux, and Apple operating systems. wxWidgets is often favorably compared to the Microsoft Foundation Classes (MFC). More information can be found at the website: <http://www.wxwidgets.org>

### wxPython 2.8

This is an implementation of the wxWidgets library for use under Python. This diverse library makes it very easy to build graphical applications quickly. In addition to the FrontPanel Python extensions, a complete GUI interface to your project can be built quickly and easily. The official website for wxPython is at: <http://www.wxpython.org>