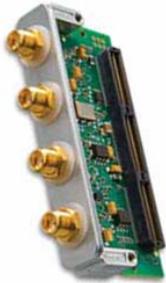


## Reducing Costs with Customized I/O on COTS FPGA Modules



**Analog Input: AXM-A30**



**CMOS & RS485 I/O: AXM-D03**



**TRANS-C5200**  
6U cPCI Transition  
Module providing  
Rear I/O through TTL  
Transceivers then to  
SCSI-3 Connectors

It is now common to deploy COTS FPGA modules to help speed development cycles and reduce overall project costs. However, to maximize savings when FPGAs are used to perform custom I/O functions, it is very important to first determine the suitability of a particular FPGA module for the application. This determination is dependent upon several factors:

1. The size of the FPGA: Does the FPGA have the resources to meet the requirements of the application?
2. The performance of the FPGA: Based upon the architecture and clock rates of the FPGA module, is there sufficient processing power and information throughput capacity to meet the application requirements?
3. The I/O interface of the FPGA module: Does the FPGA module meet the application's I/O interface requirements or can it be quickly and easily adapted?

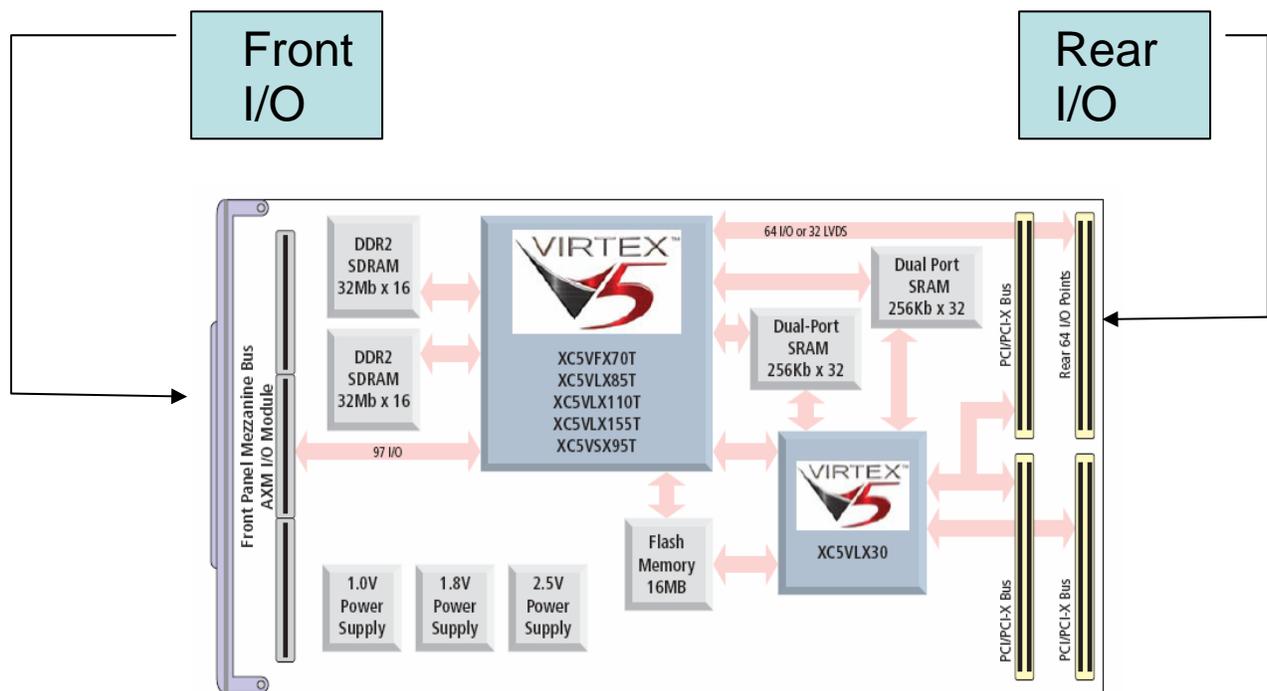
Acromag offers a broad family of FPGA modules employing Xilinx Virtex-4 and Virtex-5 class devices to address the concerns of size and performance. But for this article, our discussion will focus on meeting the I/O interface requirements.

After selecting an FPGA module of sufficient resources, it is the I/O interface requirement that will determine whether the platform will solve the application at hand. As FPGA modules are more frequently used to build bridges between various sub-systems, it is necessary for an FPGA

module to quickly and easily adapt to the sub-system's I/O interface requirements. Based upon experience in FPGA module applications, Acromag offers several standardized methods to customize the front and rear I/O interface on many of their PMC FPGA modules.

Acromag's Virtex-4 and Virtex-5 FPGA PMC modules feature both front and rear I/O. See Figure 1 below. Rear I/O consists of 64 I/O points accessible through the PMC JN4 connector. These I/O points are directly interfaced to the FPGA device and offer the configurability defined by the constraints file of the FPGA. Definable I/O types include: LVTTTL, LVCMOS, LVDS, ELVDS, and Hyper-transport. Typically, rear I/O points are routed to the backplane. They are then routed through the backplane connector and can be used either directly as configured or further routed to a rear transition module (RTM) where additional signal conditioning may occur.

**Figure 1: Block diagram of Acromag Virtex-5 FPGA PMC Module**



Acromag offers simple pass-through type rear transition modules and RTMs with signal conditioning capabilities. Some pass-through examples are the Compact PCI Model [TRANS-C4510](#) and Model [TRANS-C4620](#). Models with signal conditioning include the [TRANS-C5200](#) (TTL) and [TRANS-C5201](#) (RS422). For applications with other I/O interface requirements, Acromag can design custom transition modules to meet specific needs.

**Figure 2: Acromag rear transition modules**

**Available rear transition modules**



TRANS-C4620  
6U cPCI Transition Module  
providing Direct Connection  
of Rear I/O to SCSI-3  
Connectors



TRANS-C5200  
6U cPCI Transition  
Module providing  
Rear I/O through TTL  
Transceivers then to  
SCSI-3 Connectors

**Custom design**



TRANS-Possibilities  
6U cPCI Transition  
Module providing:  
-Analog  
-Digital  
-Combos

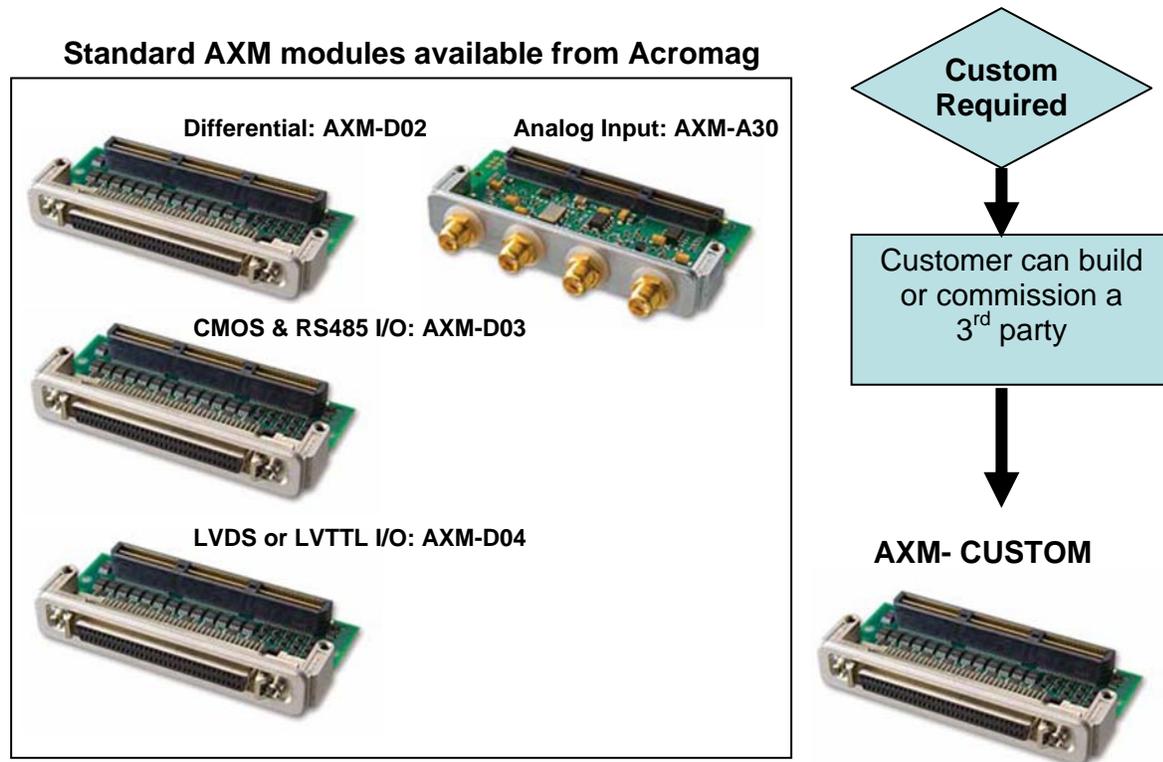
Front I/O is accessible using the FPGA module's front panel mezzanine bus (see Figure 1). By simply attaching an Acromag extension module (AXM) to the front mezzanine connector (see Figure 3), the COTS FPGA module can now implement a variety of standard or custom I/O configurations. Standard [AXM I/O modules](#) include the AXM-D02 (RS485), AXM-D03 (CMOS & RS485), AXM-D04 (TTL & RS485), and the AXM-A30 (analog input).

**Figure 3: Connecting a front-panel I/O mezzanine module**



Custom AXM modules can also be developed by Acromag or on your own. Acromag provides an AXM Design Guide to assist with the development.

**Figure 4: Acromag front-panel I/O mezzanine AXM modules**



Having access to both customizable front and rear I/O on a COTS FPGA module can be a real asset to engineers facing real-world interface challenges. Utilizing the front/rear combination vastly increases the I/O count and mix available. The simplicity and flexibility of this design facilitates the re-use of developed logic. Taken together, these factors increase overall productivity when developing FPGA solutions.

### ***The bottom line ... reducing costs!***

The advantages of using a custom AXM module and/or a custom rear transition module in conjunction with a COTS FPGA module include:

1. Re-use of logic developed for a COTS FPGA module in a multiplicity of applications.
2. Reduced learning curve for the hardware and software development environment.
3. Use of a commercial product which is off-the-shelf from Acromag at any time. There is no need to run special builds of the most costly component of the custom FPGA solution ... the FPGA module itself. AXM modules and custom rear transition modules are comparatively inexpensive to build and consequently result in minimal, if any, inventory costs. Having access to inexpensive custom I/O on COTS FPGA modules opens doors to diverse applications.

4. Quick project development and deployment, even when custom I/O interfaces are required. It is not necessary to re-design and re-qualify the PMC FPGA module, just the interface.
5. More project bid wins as a result of lower project development costs and shorter delivery times compared to the competition.

For more information on how customizing front and rear I/O on COTS PMC FPGA modules can save you time, money, and increase your project bid wins, please contact Acromag.