ANSI MEZZANINE MODULES PROVIDE INSTRUMENT DESIGN/REPLACEMENT FLEXIBILITY

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Abstract - This document examines the growing trend towards more modular forms of instrumentation and how they may be used across multiple instrument platforms. The multi-vendor support for this trend is shown as is its application to reconfigurable and legacy applications. Ongoing activity and future directions are briefly enumerated.

INTRODUCTION

The mezzanine approach to placing multiple functions in a single card slot has been around for a long time both in proprietary and open standard forms and valid arguments can be put forth for both of these approaches. One open standard that is gaining increasing popularity for instrument applications is the M-Module. This standard, which was originally developed in Europe for VME applications, has been embraced as ANSI/VITA 12-1996. The basic form of these modules is shown by Figure 1.

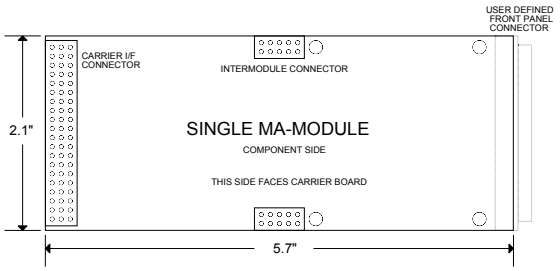

Figure 1. Single Wide M-Module

In addition to the single wide form shown, M-Modules can be developed in double, triple and quadruple wide configurations. Because of the standard's genesis in the VME world it is sized such that 4 fit in a 6U module and 2 in a 3U module. Conveniently, because of the way other backplane standards have evolved, 4 units easily fit the front panel space in VXI and 6U cPCI/PXI while 2 will fit in the front panel space of 3U cPCI/PXI and up to 8 will fit in a 1U LXI rack mount carrier.

At the present time a number of instruments are available in the M-Module form factor. A representative sampling of these is shown by Table 1. A complete listing of over 100 M-Modules from all vendors may be found on the C&H web site.

- Pulse Generators
- Function Generator
- Arbitrary Waveform Generators
- Digital Word Generator
- Digital Multi-meter
- Counter Timer
- Rubidium Source
- OCXO
- GPS Timing Receiver
- Distribution Amplifier
- Precision Voltage Source
- Mil-Std-1553, CAN, ARINC429
- Switching
- Plus numerous serial and analog/digital I/O

Table 1. M-Modules Currently Available

A further significant advantage to the M-Module is that it has a relatively straight forward set of electrical and mechanical specifications. This enables an engineer to design a function that might be required without having to become and expert on VXI, PXI or LXI as carriers are available to allow the design to be ported to the backplane or bus of the test system in use. In fact, C&H has several customers that have taken this approach for their unique requirements. One of these customers has six (6) of his own proprietary design M-Modules.

SUPPORTING THE STANDARD

As with any mezzanine card, a means must be provided through which the card may be adapted to a backplane or higher level interface. Such a device is generally referred to as a carrier. These come in two types: Non-intelligent and Intelligent. The functions preformed by the former include the simpler functions such as mounting and providing power as well as the more complex such as providing translation between bus types, protocols, routing of triggers and interrupts and making each mezzanine appear as a separate instrument to the host backplane. Intelligent carriers will generally perform all of the functions of the non-intelligent plus perform pre or post processing of data, allow the combination of multiple instruments into composite instruments that then may be controlled at a higher level, and perform translation of commands from older instruments so as to facilitate replacement of Legacy instruments. Figure 2 shows a typical VXI carrier and Figure 3 an LXI carrier.

Figure 2. VXI M-Module Carrier

Figure 3. LXI M-Module Carrier

Of equal or greater importance in the support of the mezzanine is the software. The majority of the M-Module Instrument types referenced above come with VXI/PXI P&P or IVI drivers. However, a number of the more control oriented M-Modules are supported only with C drivers. Actions are underway that are described below which allow application of the P&P drivers across multiple platforms.

BENEFITS OF MODULARITY

Perhaps the greatest advantage of an M-Module mezzanine instrument is the ability of both the vendor and the user to become “Platform Agnostic”. From the vendors perspective, it is only necessary to develop one instrument, say a Pulse Generator, and with the use of carriers he can sell the same product into VXI, PXI, VME, LXI and other applications. This greatly reduces development costs when compared to the development of PGs for multiple busses. Figure 4 depicts the platforms where M-Modules are currently supported.

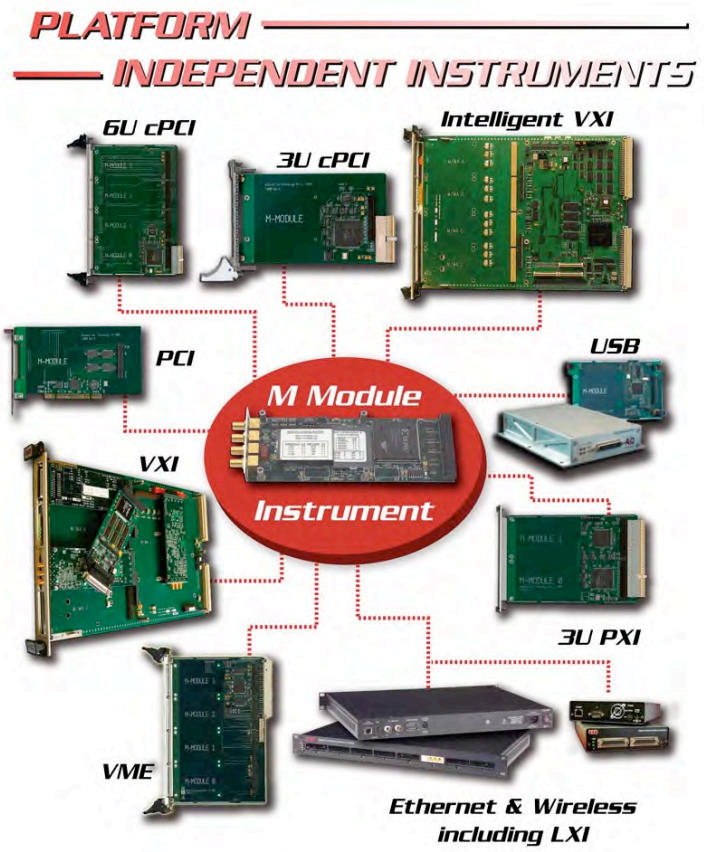

Figure 4. Platforms where M-Module support is Available

From the users perspective it is now possible through the use of M-Modules to use that same PG in say a factory test set that is VXI based and a field test set that is PXI based, thereby reducing the chances of CND (can not duplicate) problems which invariably occur when two different PGs are used. In the long term the user will also derive cost benefits because the vendor has not had to develop as many instruments to serve the different bus environments.

A further benefit to both parties occurs when a great new backplane or bus catches on (as VXI and PXI have in the past), because it is only necessary to develop a new carrier to allow migration of the M-Module to the new environment. C&H was a recent beneficiary of this phenomena when the LXI standard was approved. It simply developed its intelligent LXI carrier and immediately its 25 M-Module products were supported in the LXI environment.

In parallel with its M-Module development effort, C&H has developed a driver architecture that allows a splitting of platform functions (bus and OS) from instrument functions. This allows a driver for a new instrument to be developed one time yet run on all 10 platforms depicted in Figure 4. A white paper is available on the C&H web site that describes this in detail.

SUPPORTING LEGACY REQUIREMENTS

A further advantage of the modularity and re-configurability gained with M-Modules can be seen when replacing legacy instruments that require amplifiers and buffers which are not a part of a newer instrument. A recent case occurred with one customer that had to replace two different BCD controlled PGs, circa 1965 – 1970, which had very specialized signal generation capabilites (25V, floating, interlocks etc.). The general nature of the signal could be met with an MA204 PG, however this PG could not provide the necessary output levels and isolation. Working with the customer, who did the driver software

for the new composite instruments, two amplifier M-Modules were developed. This enabled the customer to replace two different PGs with common carriers and M-Module PGs, but with unique amplifiers, thereby placing all the unique signal amplification and isolation on a single M-Module. Figure 5 shows the old and new PG units.

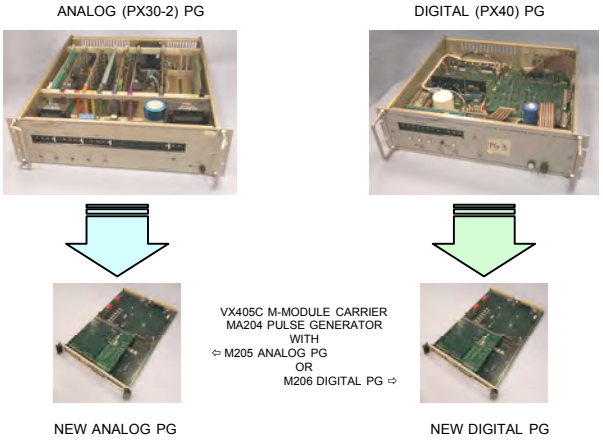

Figure 5. PG Replacement Examples

The above approach has been taken a step further on a number of legacy projects where intelligent VXI carriers have allowed users to port command translation software directly on a carrier to facilitate replacement of an old instrument. Composite instruments may also be created by mounting multiple instruments on an intelligent carrier and embedding their drivers and application code on the carrier's processor and then writing a much higher level driver (eg. An SMU) that runs on the host with much less primary bus traffic. This same approach may be used with intelligent LXI carriers as well.

FUTURE DIRECTION

In general, we will continue to see increasing functionality and performance in M-Module form factors as the semiconductor technology allows these gains to be practical. Further, the availability of Power PC cores within devices such a Xilinx Gate Arrays is going to add a level of flexibility and power that will make viable Synthetic Instruments in M-Module form factor a reality.

These capabilities, both existing and planned, along with the ability to quickly migrate M-Module instruments to new platforms when necessary bode well for the increasing utilization of the ANSI/VITA 12-1996 standard for future instrument development and applications.

REFERENCES

[1] **ANSI/VITA 12-1996** "American National Standard for The Mezzanine Concept M-Module Specification", *VMEbus International Trade Association,* http://www.vita.com

[2] **Gary Guilbeaux, et. al.,** "Use of Intelligent VXI Carriers for Legacy Instrument Replacement In VXI Systems", Autotestcon, Anaheim, CA, September 2003