Choosing the right CompactPCI board for your MIL-STD-1553 applications

By Rich Wade

The telecom market was, and remains to a degree, the initial impetus for the success of CompactPCI. Despite the downturn in the telecom market it continues to be a mainstay in computer telephony, real-time machine control, data acquisition, industrial automation, and commercial and military avionics. CompactPCI is well suited for other applications that require high-speed computing, a robust package design, and long-term manufacturer support as well. It's no wonder that CompactPCI is rapidly becoming an alternative to VME as the preferred interface for many applications.

One of the reasons for this migration is primarily because VME equipment is often more expensive and more likely to become obsolete. In addition to being cost effective over the long haul, CompactPCI's rugged, modular design comes in 3U and 6U sizes, identical to the VME form factor and provides the advantage of the faster, plug-and-play PCI bus. Likewise, CompactPCI and PXI offer a viable alternative to VXI for test and instrumentation applications. This could be the reason that the avionics industry is integrating CompactPCI for both laboratory and flight applications.

Military applications rely heavily on the MIL-STD-1553 databus for communication between the pieces of equipment that make up an avionics system. Although the specific requirements needed for a MIL-STD-1553 interface vary by application, there are a number of key items to take into consideration when determining an optimal CompactPCI board for a military avionics databus application. These include:

- Channel density: Since aircraft avionics normally have multiple databuses, it's desirable to have multiple channels on a single board. This reduces board count, overall system cost, and power requirements.
- Memory: Avionics designers prefer interfaces that include more memory per channel providing greater flexibility for the application software, while increasing data buffering capabilities.
- Single and multiple function options: Single function (remote terminal ONLY, bus controller ONLY, or bus monitor ONLY) interfaces are satisfactory for simple applications, but the more complex the application or system simulation, the more there is a need for a multiple-function interface. Ideally, multiple function interfaces should not only monitor simultaneously, they also need to be able to simulate all remote terminals and the bus controller. Additionally, the board's application programming interface (API) should allow operation with either single or multiple function interfaces from the same software. This allows development and testing using multiple function interfaces for system integration, while at the same time offering the advantage of using lower cost single function interfaces in the final system, eliminating the need to change the software.

Also, in determining the optimal MIL-STD-1553 CompactPCI board, engineers should consider the following Bus Controller, remote terminal, and Bus Monitor features.

Bus Controller features

Look for the following in Bus Controller applications:

- Frame timer: The interface should have an internal timer to manage message frame times relieving the controlling software from performing this task on timing.
- Conditional branching: Based on user-defined conditions, the Bus Controller should have the capability to branch to different message lists. This should be done on the board rather than requiring the controlling software to detect the condition and manually change the message list.
- Aperiodic messages: The Bus Controller should be able to inject aperiodic messages into the frame while running, allowing easy insertion of one time events on the bus.

Remote terminal features

Look for the following in remote terminal applications:

- Message legalization: The remote terminal should support message legalization down to the word-count level. Many MIL-STD-1553 interfaces only support legalization to the sub-address level, while others do not support it at all. The benefit of message legalization is that it allows the device to block out unimplemented sub-addresses and word counts.
- Multiple data buffers per sub-address: The remote terminal should define as many message buffers per sub-address as desired (limited by available memory). The interface should also provide the ability to set interrupts on specific message buffers that will significantly reduce the demands on the controlling software for servicing the message buffers.

Bus Monitor features

Look for the following in Bus Monitor applications:

- Sequential monitor: The Bus Monitor should provide the option to record messages sequentially as they are seen on the bus, including error information. This should include options for filtering in order to capture only the desired messages. The sequential monitor should also have the ability to define trigger events to start and stop monitoring.
- RT Monitor: The Bus Monitor should provide an option to record messages by remote terminal and sub-address.

This is useful for current value monitoring where one is interested in the most current data for a specific remote terminal and sub-address.

- Message Time: All messages that the Bus Monitor captures should record the time that the message occurred. High resolution (1 microsecond LSB) is desired for accurate time correlation of data.

Condor Engineering provides CompactPCI interfaces for a variety of avionics databus protocols, including MIL-STD-1553, the new emerging MMSI protocol, ARINC-429, and other ARINC protocols (573, 575, 717, and more). The cPCI-1553 MIL-STD-1553 interface board from Condor Engineering is suited for military avionics applications. This product offers options for multiple channels, 1 Mbyte of memory per channel, single and multiple function configurations with common software, and includes the BC, RT, and BM features discussed previously.

Rich Wade *joined Condor Engineering in 2001 and is one of the developers of the CORE-1553 and CORE-MMSI products. He works closely with Condor Engineering customers for system integration and application development. Rich has avionics engineering and management experience since 1995. He has a BSEE from New Mexico State University and is a Captain in the US Army.*

For further information, contact Rich at:

Condor Engineering
101 West Anapamu
Santa Barbara, CA 93101
Tel: 805-965-8000
Fax: 805-963-9630
E-mail: richw@condoreng.com
Web site: www.condoreng.com