A PC BASED VME TO CAMAC LINK

P.J. Yogendran, E. Klassen, K.S. Lee, M.M. Mouat, J.J. Pon, TRIUMF, Vancouver, B.C., Canada

Abstract

A PC based link connecting a VME crate and a CAMAC crate has been configured. This setup is used to provide control and data acquisition between CAMAC in the Central Control System and specialized VME-based hardware used with multi-wire monitors. Commercial hardware and software drivers together with in-house written software have been assembled to provide a bi-directional link. The hardware and software configurations, performance, and other aspects are described.

1 INTRODUCTION

The TRIUMF Central Control System (CCS) primarily uses CAMAC executive crates with parallel and serial branch couplers connecting the CAMAC crates for data acquisition and device control. Multiple computers, mainly Alpha CPUs running OpenVMS, are connected to this system of approximately 80 crates.

One of the functions of the CCS is the data acquisition, display and control of the multi-wire chamber (MWC) monitors' signals, used for beam tuning. To handle lower wire currents for several existing MWCs, new VME-based amplifiers and digitizers have been added. Previously, the signals from these monitors were handled in two ways simultaneously. In one case, for computer monitor displays, the signals were digitized and presented graphically using an X Window application. In the second case, the wire signals were sent to an oscilloscope for display. The update rate was determined in part by the integration time, with lower beam currents producing lower wire currents, which need longer integration times. The Operations Group were accustomed to getting an effectively instantaneous update on the oscilloscope, which allowed them to steer the beam and see the beam profile move without delay.

The design of the new amplifier/digitizer has no oscilloscope display capability, and is housed in a standalone VME crate. The task was to transfer real-time data between the VME electronics and the CCS multi-computer system, and to display the data for tuning. To accomplish this project in the required time, the choice was made to use some existing commercial hardware available at TRIUMF, the readily available commercial software drivers, the existing X Window display application, and to develop some Windows 2000 code to transfer the data. This setup is definitely not state-of-the-art but does demonstrate that even using older equipment in a new configuration, a reliable solution with acceptable performance can be quickly assembled. This configuration was a PC based VME to CAMAC link. The hardware consists of a PC, a PCI to VME adapter, a PCI SCSI board, and SCSI CAMAC L2 controller. The data is read out of the VME by the PC and then written out to a CAMAC memory. Information is also read from the CAMAC memory and transferred to the VME.

An alternate approach using a VME microprocessor and ethernet to the CCS computers was considered. This implementation time would have been longer (given the initial starting conditions), the initial cost greater, and the distributed resource locking more complex. The perceived reliability and performance of the two approaches was deemed to be similar.

2 COMMERCIAL SYSTEMS INTEGRATION

2.1 Hardware

As previously mentioned, the hardware required to configure a prototype link already existed at TRIUMF. This included a PC running Windows 2000, an SBS Technologies Model 617 PCI to VME bus adapter, and a Jorway Corporation Model 73A SCSI bus CAMAC L2 crate controller (see Fig. 1).
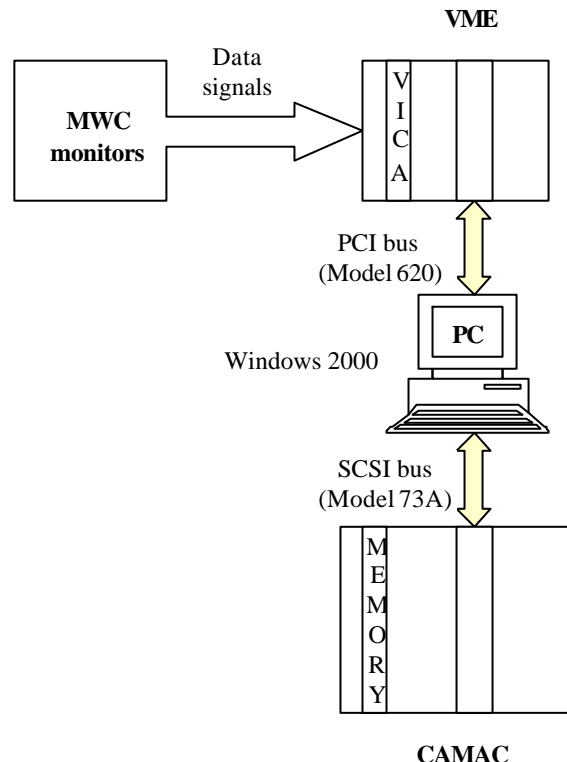

Figure 1: Hardware Configuration

In prototyping this link, all of the hardware could be assembled in close proximity but in the final configuration the VME crate was located in a separate

building that required an isolated ground. For the in-service implementation, a new PC running Windows 2000 and fiber optic version of the Model 620 PCI to VME adapter were envisioned.

2.2 Software

Software drivers for these commercial devices were readily available and easily integrated in the PC. They included Model 983 support software and device driver for PCI bus computers, running under Windows NT (works on Windows 2000 as well), and IEEE CAMAC interface routines and device driver software for Jorway 73A SCSI bus CAMAC controller.

3 CONTROL AND DATA ACQUISITION TRANSFER

The software to transfer the necessary data between VME and CAMAC was developed in-house, using Visual C++, and runs on the PC continuously. The data gathered from the VME electronics consists of 96 channels of current integration signals from a MWC monitor, as well as other related data for this monitor. A group of VME cards, one per MWC monitor, make up the VME electronics. Each VME card, known as VICA 96, consists of 96 channels of 16-bit data signals of which 64 channels are connected to one MWC monitor and the other 32 channels of data are left for diagnostics. Additional cards using unique base address selections are used for accessing multiple MWC monitors. The VME interface is a 128-word address space, consisting of the 96 channels of data signals, and an additional 32 words of related data such as monitor gain selection and channel update pointers. The necessary data is read from the VME crate and written to the CAMAC memory, where the CCS can access this data from multiple computers. In addition to the wire monitor data, a diagnostic counter is written out to the CAMAC system to indicate that the PC is still running the transfer process software.

The CCS computers access the data in the CAMAC memory and display the MWC monitor profiles graphically using an X Windows application interface. Modifications to the original software application were made to simulate the oscilloscope function that was lost in the new VME electronics. This GUI application is also capable of controlling the MWC parameters from the CCS by sending commands to the CAMAC memory, which are then transferred to the VME crate via the PC transfer process software. Commands sent from the CCS include gain settings for the MWC monitors, and the monitor selection to determine which VICA card data to transfer. The Operations Group only tunes one beamline at a time and only use one MWC monitor at a time so data for one MWC monitor is transferred at any time.

4 PERFORMANCE

The transfer rate of a set of 96 channel data words from the VME electronics to the CAMAC memory is around 60 times per second, even though the end user display only requires the graph to update 10 times per second.

The timing on individual read and write cycles for VME and CAMAC were tested on two different PCs, a Pentium II, and a Pentium 4. The results are shown in Table 1. The Pentium 4 showed an improvement of about 30% over the Pentium II.

A VME memory read of the entire 128 words of data can be achieved with a single call to read, which significantly improved the VME read time, over doing 128 single cycles to the VME.

The CAMAC performance could be enhanced using different PCI to CAMAC hardware.

Table 1: CAMAC and VME read and write cycles per second

Cycles per second	Pentium II (Windows NT)	Pentium 4 (Windows 2000)
CAMAC reads (3 byte)	5,409	7,341
CAMAC writes (3 byte)	5,413	7,226
VME reads (2 byte)	30,074	36,787
VME writes (1 byte)	32,305	38,900
VME memory reads (128 words)	2,985	2,619

5 SUMMARY

The VME to CAMAC link established with commercial equipment, and the in-house developed PC software to transfer MWC monitor data between the CAMAC and the VME crates has been completed successfully, and is running reliably. The required performance has been achieved with some existing equipment, and within a limited time.

6 REFERENCES

[1] PCI to VME adapter manual for SBS Adapters.
[2] Jorway 73A SCSI CAMAC Crate Controller manual.