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USERS MANUAL FOR THE ACROAMATICS REAL TIME DATA STORAGE SYSTEM

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ACROAMATICS DOCUMENT HISTORY

The following table indicates major changes made to

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TABLE OF CONTENTS

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CHAPTER 1
INTRODUCTION

DESCRIPTION

The Real-time Data Storage System records data input from either the processed telemetry data bus (the TDP A-bus) or the VMEbus. Recording is initiated by commands from the TDP internal computer to VMEbus-addressable registers on the *521VA Real Time Data Storage (RTDS)* VMEbus card. The recording operation archives data at sustained rates up to 20 MBytes/sec without intervention from the host processor. This rate is consistent with the maximum data message rate that the VME TDP can generate. Although higher rates can be achieved with much more complex hardware, the higher rates would not be beneficial in typical applications.

A single drive cannot sustain the 20 Mbyte carry-away rate the Fast SCSI bus supports for synchronous transfers. Disk drives have overhead that offsets their instantaneous transfer rates so that the sustainable rate is a fraction of the instantaneous rate. To achieve higher transfer rates typically requires a system to operate with four drives per SCSI bus, filling these buffers at the 10 Mbyte rate, then moving to the next drive and filling its buffer, and so-on. This process is called *striping of the data* and it is a conventional method for improving sustained disk transfer rates.

The basic Real-time Data Storage System consists of the 521VA RTDS card and internal cabling for an appropriate Acroamatics TDP. You can use this base system in your TDP with two internal disk drives (for systems requiring only limited storage) or with external disks in an expansion unit.

Data Storage & Expansion Unit

The Data Storage System *Expansion Unit* is an expansion chassis with power supply, internal cabling and up to eight removable hard disk drives. The removable disk drives are industry standard disk drives installed in the carrier assembly in the Expansion unit. The recording system provides storage up to eight times the capacity of a single drive (all drives must be the same capacity) when configured with either six external and two internal drives - or with eight external drives. For instance, using 9GB drives will provide 72GB of storage. The upper storage limit per eight drives (per controller) is one Terabyte.

The rack mountable expansion chassis is a seven inch high rack mountable chassis, and includes the pair of SCSI cables required to connect the expansion chassis to the TDP.

You can configure this system to meet particular recording needs. For field operations requiring lower total bandwidth and less recording capacity you can use the system with only the two drives installed in the TDP. For use with systems that have no room in the TDP for the two drives, you can use the external chassis alone with all eight drives installed there.

521VA A-Bus Recording

During a telemetry data acquisition the 521VA RTDS card buffers data received from the A-bus stream into a hardware-managed 1MB memory. An option is available to expand the buffer memory to 4MB. The memory is divided into four memory pages (two for input message formation and two for completed data records) which are transferred to or from the two SCSI controllers to the disk drives. The card divides the incoming data stream into frame buffer messages, usually containing a fixed number of telemetry samples, proceeded by a time header. The number of words in the buffer is determined by the frame buffer size, which is a programmable number of 16-bit sequential data stream data words. The maximum transfer rate block size is a function of the disk drives used, and should be as large as the disk cache memory. The disk is addressed as clusters of sectors, and maximum disk utilization occurs when the buffer size is evenly divisible by the cluster size. Block sizes up to 256kB are supported with the 1MB memory, and up to 1MB with the optional 4MB memory. There is a separate transfer path for each of the two SCSI busses. When you select dual bus operation the memory manager hardware directs the data blocks alternately between the two busses. The embedded processor controlling this operation receives an interrupt at the completion of each new block, at which time it issues the commands that cause the record to be output on the appropriate SCSI bus. If the associated disk drive on the selected SCSI bus is ready, it will initiate the transfer to that SCSI bus and disk drive. The processor then commands the memory control hardware to transfer the block of data to the selected SCSI bus. When a SCSI transfer completes, the processor determines whether another buffer is complete and, if so, selects the next disk drive or alternate SCSI bus to receive data, and initiates the transfer. Each SCSI bus will service one to four high performance 3.5 inch disk drives, depending on the system configuration. SCSI Bus One feeds disk drives 1-3-5-7, and SCSI Bus Two feeds drives 2-4-6-8. A sequence of block transfers is as follows: first block to SCSI 1, drive 1, second block to SCSI 2 drive 2, third to SCSI 1 drive 3, fourth to SCSI 2 drive 4, etc. If you do not require high transfer rates, you can configure the controller to operate with a single SCSI bus.

VMEBUS Data Recording

You can also record data from the VME bus. The system supports two methods of data transfer: conventional double-buffered DMA, and a memory mapped data transfer path. Both methods require the recording block length to be the same as the length of the record being transferred. The host processor controls DMA transfers by loading Starting and Backup address registers and Transfer Length counters. The host is interrupted at the end of each DMA transfer and controls the rate of transfer by reloading the Word Length register. The embedded 386EX processor is interrupted at the finish of each DMA so that it may transfer the block of data to the appropriate disk drive. The first complete record following

the Record ON will be the first record recorded. Record OFF works similarly in that the last complete buffer following a Record OFF will be recorded and if the DMA channel is left enabled the data will be transferred to the frame buffer memory but will not be recorded on the disk drive.

When the data record memory is selected as memory mapped, the DMA starting address register specifies the VME address at which the input record page (256k bytes) starts. The DMA record length register defines the number of 32-bit words in the data record. Once the current memory page has been written with the number of words in a record, the memory page is rotated to provide a new empty page (assuming an empty page is available). The completed record is transferred to disk via the SCSI bus if the Record ON command has been received.

The recorded data is read back via the VME bus using either DMA or memory mapped operations. The host first asks for the file directly. You recover data by reading the records from programmable *START* and *STOP* times.

SYSTEM APPLICATION SOFTWARE

The RTDS card contains an embedded processor that automatically detects the number of disk drives attached to each of the SCSI busses and controls the data recording strategy to maximize the recording bandwidth. It also initiates the transfer of data to and from the SCSI channels, and it keeps records of the relationship between IRIG time and data record blocks. This feature enables a rapid search of large volumes of recorded data. You can start and stop data recording using either IRIG times or Start/Stop Immediate commands. The Host processor can read the recorded data through a dual-ported memory (memory-mapped into the VME address space) and also addressable by the disk recording logic.

TDP software running on the PC VME Host in the TDP supports the following tasks:

1. Initiate and stop data recording independently of the TDP running and stopping.

   Data recording on a Real Time Data Storage Device (RDSD) uses an entirely different data path from data recording on the local hard disk drive and you can continue to record data there as well as on the RDSD. Recording on the RDSD does not use the VME Host DMA channel but connects to a different A-bus device address. This means that anything you want to record on the RDSD requires additional Distribution programming. For example, to record on both the local disk drive and the RDSD you need to have the programming:

   ```
   idtag:  PAS
           PAS DV2
   ```

   That sends the data to both ports. On the other hand, to send data only to the RDSD, you can just add the command

   ```
   OUT DV2
   ```

   At the start of your distribution program and all data you output will go

there.

2. Recover data from the disk system and transfer it to a file on the Host computer disk drive.

   Software also transfers data from the RDSD, selected according to a time window, to a file on the VME host computer. From there, you can use existing software to analyze or transmit the data to other systems by way of the Ethernet link. This software moves the data from the RDSD to any file accessible device on the VME host, including tape drives, optical disk recorders, and network files on other systems. There are also library functions that user-written software can use to access data on the RDSD.

3. Reconstruct recorded data

   Software also accesses data on the RDSD selected by the time window. This transmits to the reconstructor section, allowing you to play back recorded data through the TDP front end for real-time display, output to DACs, and further pre-processing. To use this feature you must format the data in a form acceptable to the reconstructor.