MONSSTR
MOdular Non-volatile Solid STate Recorder
Solid State Recording...

Model 8000

Super-Scalar Digital Recorder

INTRODUCTION

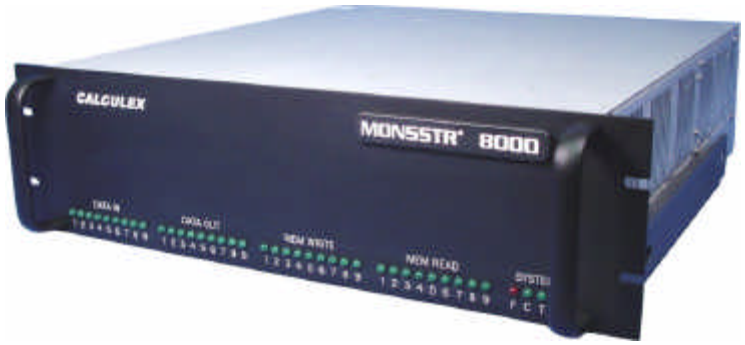
CALCULEX® introduced the MONSSTR® (MOdular Non-volatile Solid STate Recorder) in 1999 and it quickly became the de facto industry standard for high-performance solid-state recorders due to its superior performance and configurable I/O. Model 5000 & 6000 series MONSSTRs are in use worldwide and satisfy a broad spectrum of data rate, storage capacity, I/O, and environmental requirements.

The introduction of the MONSSTR Model 8000 continues the tradition at CALCULEX of leading the industry in state-of-the-art systems. With the Model 8000, CALCULEX can now provide users a solid-state recorder that has the bandwidth and storage capacity for virtually any application.

SUPER-SCALAR ARCHITECTURE

The MONSSTR 8000 "super-scalar" architecture supports unlimited scalability in bandwidth and storage capacity. At the heart of each Model 8000 are two M8Bus™ (pronounced "MateBus") data paths, one for I/O and one for memory write/read. Each M8Bus supports a maximum sustained user data rate of ten gigabits per second. The unique design of the M8Bus makes it extensible to virtually any number of I/O or memory module "slots." M8Bus repeaters can extend an I/O or memory bus across two or more chassis if required to support the necessary complement of I/O or memory modules.

With solid-state memory as the recording media, virtually unlimited throughput can be obtained by striping multiple Model 8000 MONSSTRs in parallel. Distributed timing signals are provided for interconnection of parallel MONSSTR 8000's, and command and control of a striped system configuration is implemented via the Ethernet interface on each controller. Figure 1 shows a single Model 8000 "stripe set."



Product Highlights:

- **Super-scalar Architecture for Unlimited Growth**
- **Bandwidth Scaled by Striping 10Gbit/s Modules**
- **Capacity Scaled via Extensible Memory Bus**
- **Configurable I/O via Extensible I/O Bus**
- **Fibre Channel, Infiniband, SONET I/O**
- **Network Appliance Command and Control Capable**
- **Laboratory and Airborne Packaging and Power**

MONSSTR VIRTUAL FRAMING

As with all MONSSTR systems, the memory appears to the user as a linear sequence of virtual frames. The virtual frame size is programmed by the user during the system setup and can be reprogrammed any time the memory is empty. The virtual frame size may be selected to coincide with the granularity of the user's data such that user data records are aligned on virtual frame boundaries. Often the virtual frame size is set to be a convenient value, such as 16384 (16K) or 65536 (64K). File table entries and user playback queries specify virtual frame numbers.

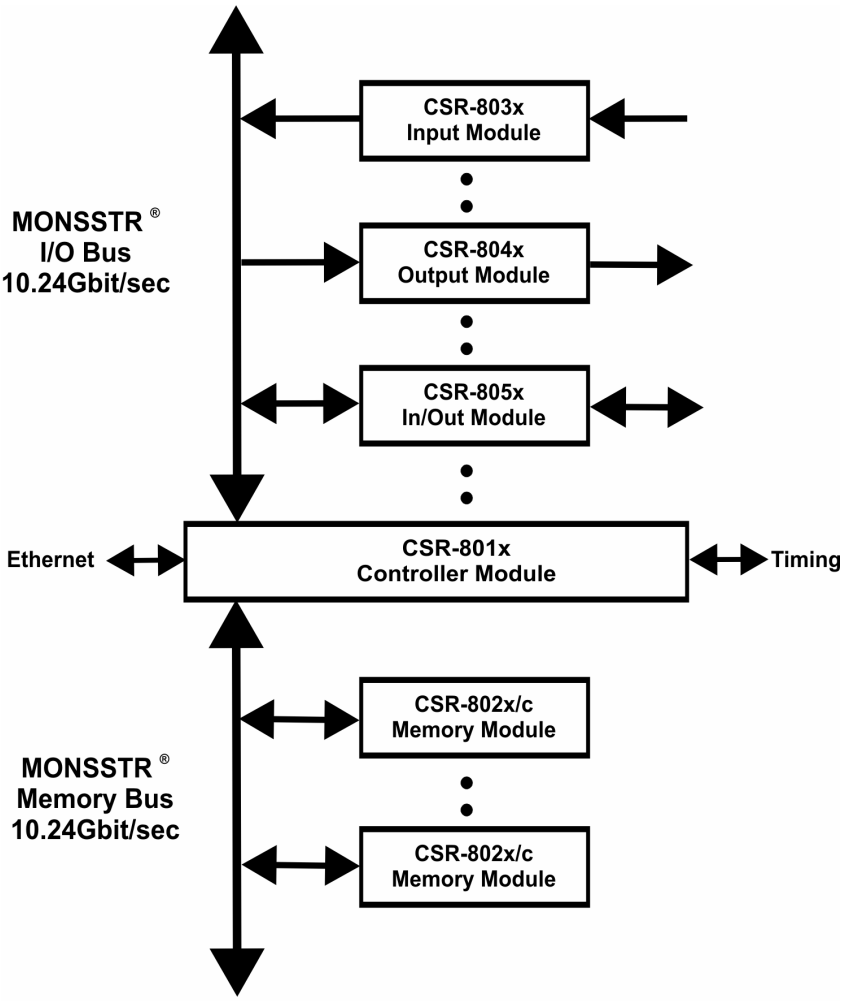


Figure 1: MONSSTR Series 8000 Single Stripe Block Diagram

MONSSTR controllers add a small "header" to each virtual frame. These headers contain a time stamp generated internally during data recording to enable time-indexed access to the data during playback. For typical virtual frame sizes, these headers represent less than one tenth of one percent of the recorded data.

MEMORY M8BUS

The memory M8bus provides a 10Gbit/s path in and out of memory. The controller manages the available bandwidth of the memory M8Bus by interleaving block writes to memory with block reads from memory. The granularity of the blocking used for these internal writes and reads is transparent to the user and is implemented to optimize M8Bus performance. The default mode, which can be overridden, gives priority to memory writes and allocates any remaining bus bandwidth after all write requests are satisfied to memory reads. This priority feature assures that read-while-write data playback does not interfere with realtime data acquisition.

Memory modules are available with either DRAM or Flash memory. Each DRAM module has a 320MB/s sustained user data bandwidth (write + read). Four DRAM modules are required on a single M8Bus to achieve the maximum 10Gbit/s sustained user data rate. Each Flash module has an 80MB/s sustained user data bandwidth (write + read). Sixteen Flash modules are required on a single M8Bus to achieve the 10Gbit/s sustained user data rate. DRAM modules are available with 2, 4, 6, or 8 gigabytes. Flash modules are available in 4GB increments from 4GB to 32GB. These storage capacity numbers do not include additional memory in each module that is reserved for forward error correction code bits and for spare blocks that are used to dynamically replace any failed blocks.

I/O M8BUS

The Input/Output M8Bus provides a 10Gbit/s path from and to input and output devices. The controller manages the available bandwidth of the I/O M8Bus by interleaving block reads from input devices with block writes to output devices. The granularity of the blocking used for these internal reads and writes is transparent to the user and is implemented to optimize M8Bus performance. The default mode, which can be overridden, gives priority to input device reads and allocates any remaining bus bandwidth after all input read requests are satisfied to output device writes. This feature assures that read-while-write data playback does not interfere with realtime data acquisition.

I/O modules can be input only, output only or both input and output. Table 1 lists the currently supported module types. Other module types in planning or development are Infiniband (2500Hz), SONET OC-48 (2488.32MHz) and OC-192 (9953.28MHz), and 10GBit Ethernet (10000MHz.)

Protocol	MHz	Copper	Fibre
SCSI Fibre Channel	1062.5	X	X
SCSI Fibre Channel	2125		X
FibreXtreme* Fibre Channel	1062.5	X	X
FibreXtreme* Fibre Channel	2500		X
1Gbit Ethernet	1250	X	X
2Gbit Ethernet	2500		X
*FibreXtreme is a trademerk of Systran Corporation			

Table 1. I/O Modules

SERIAL ACCESS CONTROLLER

The Serial Access Controller (SAC) manages the data flow from input devices on the I/O bus to the memory modules on the memory bus and from the memory back to output devices on the I/O bus. The SAC always writes new data at the current logical end-of-data point (an append operation.) Any recorded data must be explicitly erased before the memory can be reused for a new recording. Each time a recording is started, an entry is made in a file table with a user-specified or default file name, a starting virtual frame number and a time-of-day. When recording is stopped, a virtual frame length and an end time are inserted in the file table entry. The SAC has an on-board time code reader that flywheels in the absence of a valid external time code signal and may be set to a user-specified starting time.

The SAC supports indexed sequential access to the recorded data simultaneously and asynchronously with an on-going recording. The user specifies the starting point of the playback as a file name and frame offset into the file, an absolute virtual frame number, or a time-of-day. The high bandwidth of the bus, combined with the user-transparent input and output block interleaving managed by the SAC, provides a full-duplex data flow, even though an M8Bus can only be writing or reading, but not both, during a single bus cycle.

The SAC has an extensive built-in test capability and performs a Power-On Self Test every time the system is powered on. The microprocessor on the SAC can test over 97% of the system circuitry when cabled in a typical operating configuration. Attaching external loopback test cables to the various I/O ports enables the SAC to test 100% of the system.

RANDOM ACCESS CONTROLLER

The Random Access Controller (RAC) has all the features of a SAC with the addition of a hardware (gate array) File Access Controller (FAC). The FAC dynamically maintains a File Allocation Table (FAT) that links the multiple non-contiguous extents in each file and links all of the (potentially non-contiguous) unused extents into a free space chain. With the addition of the FAC, a MONSSTR 8000 can overwrite previously recorded data and can delete selected files to reclaim their storage space.

Model 8000

Super-Scalar Digital Recorder

ETHERNET COMMAND AND CONTROL

Each Model 8000 controller has a 10/100T Ethernet port that provides a user-friendly command and control facility. Network appliance software provided with each Model 8000 MONSSTR enables the user to control the unit and monitor status during recording and playback operations. When multiple Model 8000's are connected in parallel (striped) for bandwidth expansion, the software supports single-command operation of all parallel units. Asynchronous serial ports and multiple discrete inputs and output on each controller may also be used for command and control.

LABORATORY AND RUGGED PACKAGING

The Model 8000 MONSSTR is available in both rugged, flight-qualified and standard laboratory configuration. The airborne units come in a variety of ARINC-standard ATR sizes and utilize either 28VDC or 115VAC 400Hz input power. Laboratory units are standard 19-inch rack mount enclosures with a 3U (5.25 inch) front panel height. The specific chassis or multi-chassis configuration depends on the number of required I/O modules, memory modules, and M8Bus controllers. Please contact CALCULEX for the specific configuration that supports your data acquisition and processing requirements.

CONTACT:

CALCULEX, Inc.
132 W. Las Cruces Ave.
Las Cruces, NM 88001 USA
TEL: (505) 525-0131
FAX: (505) 524-4744
www.calculex.com

182003-0180-C 0504