



# MONSSTR<sup>®</sup>

**MODular Non-volatile  
Solid STate Recorders**

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## MONSSTR Recorders

Harsh environments encountered in many military and aerospace programs often preclude the use of magnetic tape or disk for instrumentation data recording. Furthermore, today's ever-increasing demands for higher data recording rates often exceed the capability of magnetic recording technology. The CALCULEX<sup>®</sup> **MODular Non-volatile Solid STate Recorder** (MONSSTR) overcomes all of the limitations associated with magnetic recording technology by utilizing high-density, non-volatile flash memory in an innovative

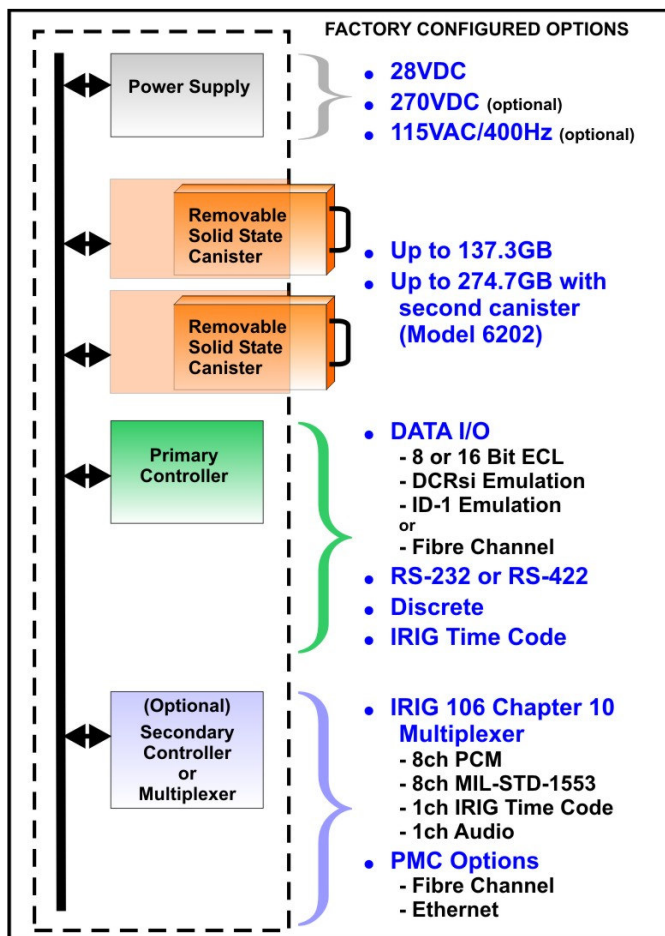


Figure 1: Model 6000 Block Diagram

### Product Highlights:

- Up to one gigabit per second sustained data transfer rate
- Up to 274.7 gigabytes of storage in modular increments
- Generic parallel ECL or Fibre Channel user equipment interfaces
- High-speed digital cassette tape recorder emulation for DCRsi<sup>™</sup>, VLDS<sup>™</sup> and ID-1<sup>™</sup>
- Full-duplex user equipment data ports support simultaneous read and write
- Read-after-write with re-write error detection and correction
- Optional multiple-channel input multiplexer for PCM and MIL-STD-1553
- MONSSTR recorders may be daisy-chained for increased capacity
- Extensive built-in-test, diagnostic and status reporting software

# MODular Non-volatile Solid STate Recorder

system architecture enclosed in modular rugged packaging. Featuring sustained data rates up to one gigabit per second, storage capacities over 274.7 gigabytes, and a wealth of features only possible with solid-state, random-access devices, MONSSTR is the answer to the stringent requirements of the next generation of instrumentation data recorders.

## System Architecture

A minimum Model 6000 MONSSTR recorder configuration consists of an enclosure with a power module, one controller and one memory canister. An optional second controller may be included to provide full dual-recorder operation. A data multiplexer, either similar to the CALCULEX ARMOR system or IRIG 106 Chapter 10 compliant, may be installed in the secondary controller slot to combine multiple analog and digital data channels into a single composite data stream for input to the primary controller. Figure 1 is a high-level block diagram of a two canister MONSSTR 6000.

Model 5000 recorders accommodate one controller plus an optional multiplexer board and contain fixed, non-removable memory.

Power modules are available for use with AC or DC power sources. Standard power modules for ruggedized units are 115VAC/400Hz, 28VDC and 270VDC.

## Storage Capacity

Model 6000 memory canisters have a storage capacity of 274.7 gigabytes. Approximately two percent additional memory is held in reserve for internal housekeeping and error recovery. Partially populated memory canisters are available. The MONSSTR system architecture is designed to accommodate higher memory densities as they become available.

Model 5000 MONSSTR recorders do not utilize removable canisters. Model 5000 recorders contain up to 90.1 gigabytes of non-removable memory.

## Data Rates

The maximum sustained data rate of a MONSSTR recorder is determined by the speed of the internal bus, the mode of operation and the I/O controllers installed. Model 6000 internal busses are capable of sustained data rates of up to 128 megabytes per second, while Model

5000 busses are capable of sustained data rates of up to 64 megabytes per second.

The user equipment interface data transfer rate of a MONSSTR recorder may not always be equal to the maximum data rate of the internal bus. If one controller is active and operating in basic read or write mode, the maximum user interface transfer rate will be equal to the maximum sustained data rate of the internal bus or the user equipment, whichever is less. However, if the controller is operating in record mode with read-after-write enabled, the maximum net throughput will be one-half of the maximum data rate of the internal bus.

## I/O Controllers

MONSSTR I/O controller design is organized into three "layers" of internal hardware and firmware: a physical layer, a logical layer and virtual layer. The physical layer interfaces to the system bus and performs basic memory read and write operations. The logical layer performs error detection and correction operations and memory management. The virtual layer defines the "personality" of the controller for the user equipment interface. All MONSSTR I/O controllers are identical at the physical and logical layers. However, different controller models have different virtual layer firmware and hardware to accommodate a variety of user equipment data communication protocols.

## CSR-6121 and -5121 Controllers

These controllers feature a generic parallel I/O user equipment interface with maximum data transfer rates equal to that of the internal system bus. The user equipment interface is either differential ECL or differential PECL, and may be configured for 8-bit (all models) or 16-bit (6000) parallel data transfers. On-board time code reader/generators are used to append time stamps to user data. Host control is asserted by means of a serial control port that may be configured for standard RS-232 or RS-422 operation.

## CSR-6123 and -5123 Controllers

These controllers emulate the Ampex DCRsi tape recorder. Data rates of up to 64 megabytes per second are attainable across the user equipment interface. In read-after-write mode, up to 128 megabytes per second of internal bus bandwidth is used (64 MB/s write and 64 MB/s read).

# MODular Non-volatile Solid STate Recorder

## CSR-6124 and -5124 Controllers

These controllers feature ANSI Standard Fibre Channel fiber optic interfaces. Bit-serial I/O is supported at user equipment data transfer rates equal to that of the internal system bus on the Model 5000 version and at the maximum Fibre Channel data rate on Model 6000. The user equipment interface features ANSI standard Fibre Channel hardware. On-board IRIG time code reader/generators are used to append time stamps to user data. No separate control port is necessary; system control is asserted via the Fibre Channel interface.

## CSR-6125 and -5125 Controllers

These controllers feature Enertec™ ID-1 emulation. This interface is based on 8-bit ECL logic and supports the interface protocol for ID-1 tape recorders. Host control is accomplished through a separate serial connection.

## CSR-6031, -6032 & -5032 Multiplexers

A Model 6000-series multi-channel input multiplexer may be installed in the secondary controller slot of the Model 6000 MONSSTR. CSR-6031 multiplexers feature eight PCM inputs with bit rates up to 20Mbps each and two analog inputs suitable for IRIG time code or voice. The format of the data recorded from 6031 multiplexers is compatible with the IRIG 106-98 ARMOR standard. The CSR-6032 multiplexers format the data from up to eight PCM channels, eight MIL-STD-1553 channels, one time code channel, and one voice channel into IRIG 106 Chapter 10 Format 1 packets. A CSR-5032 packet multiplexer with two PCM channels, two 1553 channels, one time code channel and one voice channel may be installed in the multiplexer slot of a Model 5000 MONSSTR.

## Read-After-Write

All MONSSTR controllers incorporate data buffer memory that preserves user input data until it has been successfully stored in the memory canister. When read-after-write mode is enabled, the controller will read each data word after it is written to verify that it was written correctly. This feature may be enabled or disabled by the user equipment. Since two bus transfers are required for each word recorded in this mode of operation, the maximum net throughput is limited to one-half of the

maximum internal bus data rate of the MONSSTR recorder.

## Special Memory Operations

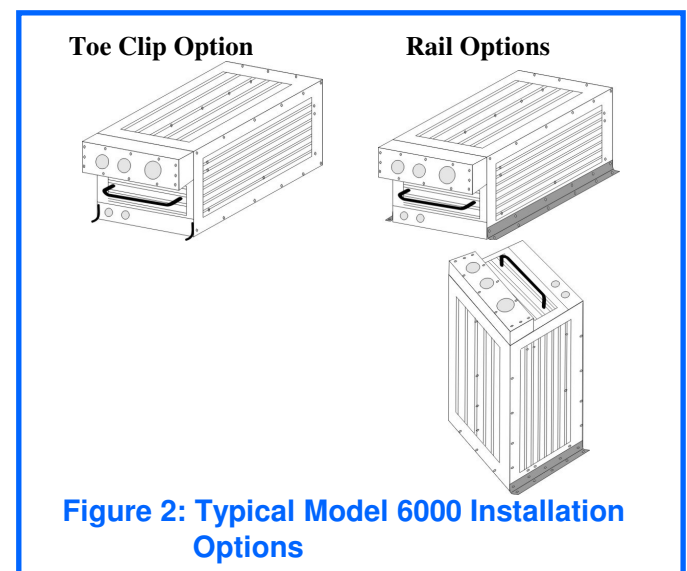
Special memory operations may be enabled or disabled by the user equipment. Enabling erase-before-write mode allows the MONSSTR recorder to operate in circular buffer mode. Once the memory is filled, oldest data is erased and re-written with new data. A daisy-chain mode allows multiple MONSSTR recorders to be connected together such that when the memory in one is full, the next one in the chain will begin recording.

## Hot-Swap Memory Canisters

The power circuits in Model 6000 MONSSTR recorders feature separate power busses to each memory canister, allowing one or more canisters to be powered down without affecting ongoing operations with other canisters in multi-canister recorders. This feature makes memory capacity virtually limitless, since full canisters may be replaced without interrupting recording.

## Momentary Power Outage

MONSSTR power modules incorporate sufficient capacitance to support full-up operation of the recorder during power losses of up to 50 milliseconds. Loss of power for more than 50 milliseconds will result in a clean power-down sequence with no loss of previously recorded data.



**MONSSTR**

**MODular Non-volatile Solid State Recorder**

SPECIFICATIONS

Model	CSR-5000	CSR-6201	CSR-6202
Capacity:	Up to 90.1GB	Up to 137.3GB	Up to 274.7GB
Size (Inches):	4.5 x 4.9 x 12.1	7.6 x 6.2 x 12.9	7.6 x 8.5 x 12.9
Weight (Pounds):	Up to 18	Up to 25	Up to 33
Bandwidth:	512Mbps	1,024 Mbps	1,024 Mbps
Maximum Power:	2.0 Amp @ 28VDC Per MIL-STD-704A/D	2.58 Amp @ 28VDC Per MIL-STD-704A/D	3.52 Amp @ 28VDC Per MIL-STD-704A/D



ENVIRONMENTAL

<b>Temperature:</b>	-40°C to +72°C (operational) -55°C to +95°C, storage
<b>Humidity:</b>	10% to 90%, non-condensing
<b>Cooling:</b>	Conduction
<b>Shock:</b>	25Gs, any axis
<b>Acceleration:</b>	15Gs, any axis
<b>Vibration:</b>	16.75 gRMS, any axis
<b>Altitude:</b>	80,000 ft. (operational) 100,000 ft. (non operational)
<b>Explosive Atmosphere:</b>	Per MIL-STD-810F
<b>Salt Fog:</b>	Per MIL-STD-810F
<b>Sand &amp; Dust:</b>	Per MIL-STD-810F
<b>Fungus:</b>	Per MIL-STD-810F
<b>EMI:</b>	Per MIL-STD-461E

CONTACT

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