# STORM 25

## single board
## RM 02/05
## emulation

Two considerations of major importance when selecting an alternative to DEC's mass storage disk system are software compatibility and media compatibility. Advanced Electronics Design's STORM™ disk controller answers the first concern with on-board firmware that is specially dedicated to the emulation of DEC's RM02 and RM05 disk systems. The STORM 25 is transparent to DEC's operating system and all pertinent diagnostics.

Media compatibility is ensured because the STORM 25's pack format is identical to that of DEC's RM02 (80MB) or RM05 (300MB). This allows complete interchangeability of media between the respective DEC systems.

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## STORM 25 PROVIDES IMMEDIATE MASS STORAGE CAPABILITY FOR PDP-11 USERS

The STORM 25 controller has been designed using an advanced architecture based on state-of-the-art bipolar microprocessor technology. This technology enables it to be packaged on a single HEX printed circuit board with UNIBUS® compatibility. The board plugs directly into the standard SPC slots of DEC's PDP-11/04 thru 11/60 Series, thus providing your system with immediate mass storage capability.

Furthurmore, your PDP-11 system performance will be enhanced by the implementation of the STORM's unique DMA transfer optimization circuitry and on-board, multi-sector data buffer. These two STORM features, in conjunction, significantly increase the efficiency of your system's I/O throughput capability.

The use of a STORM 25 allows integration of up-to-four industry standard SMDs (Storage Module Drives) with your PDP-11 Series computer. This provides the best cost/performance ratio available.

## THE HIDDEN BENEFITS OF THE STORM 25 CONTROLLER

The innovative design of the STORM 25's board architecture provides user benefits that are not at once apparent. Using just one PC board for disk system control reduces the amount of board space generally allocated for mass storage requirements. This provides the opportunity for system expansion in the future without incurring the cost of backplane expansion.

Add to this the fact that the AED design minimizes controller component count. This means greater reliability and lower power consumption. Both these factors have a positive impact on your system's cost/performance ratio.

## USER-SELECTABLE DRIVE CAPACITY

The STORM 25 disk controller accommodates both 80MB and 300MB capacity drives. On-board jumpers allow you to select use of either 80MB or 300MB SMD drives according to the needs of your system configuration. One-to-four SMD drives in any combination of 80MB and/or 300MB can be accommodated. This feature provides the optimum system configuration flexibility. And the 80MB and 300MB drives both have direct DEC equivalents and offer the best performance in their respective storage classes.

## DMA TRANSFER OPTIMIZATION CIRCUITRY BOOSTS THROUGHPUT

The unique DMA transfer optimization circuitry, designed into the STORM 25 controller, provides maximum disk data transfer efficiency for a PDP-11 system. The controller automatically regulates disk buffer data transfer, thereby preventing 'bus hogging' by the mass storage disk while other DMA devices require bus access. This eliminates impact, such as 'data late' errors, etc., on other DMA devices.

Because of its ability to compensate for the different asynchronous data transfer rates of disk drive versus UNIBUS® and main memory, the AED controller performs as a large disk data

buffer. This intelligent buffering allows use of drives operating at 3600 RPM (1.2 MB data rate) vs DEC's 2400 RPM (806KB data rate) to provide maximum disk throughput to the system user.

## ERROR CORRECTION CODE FEATURE

Error detection and correction capability is provided for in the STORM 25 hardware. A 32-bit code is appended to the data field of each sector to assure integrity of all data read. This provides an error syndrome allowing correction of single errors up to 11 contiguous bits.

A 16-bit Cycle Redundancy Code (CRC), also hardware generated, is appended to the address field of each sector.

## THE STORM 25's SELF-DIAGNOSTIC CAPABILITY REDUCES NEED FOR FIELD MAINTENANCE

To enhance maintainability, the STORM 25 includes a unique self-test feature that automatically tests all major function blocks of the controller, 'in system'. If an error should be detected, a code is instantly displayed on the controller's on-board LED array.

Power-up diagnostics and diagnostics run during normal system operations

are both performed by the STORM's on-board microprocessor. If a problem develops on the STORM 25 board it is immediately detected, keeping downtime to a minimum. In this way, the diagnostic capability of the STORM 25 facilitates easier maintenance.

In addition, the STORM 25 Controller can accommodate an external Writeable Control Store (WCS) which allows the system user to functionally replace firmware control store memory. This external WCS facilitates the execution of a special diagnostic package designed specifically to test the unique architecture of the STORM 25.

## WARRANTY

All AED computer peripherals carry a 90-day warranty against defects due to workmanship and design. Within the 48 contiguous States and Canada, the customer sends the malfunctioning unit freight collect, AED repairs it at no cost to the customer and returns it freight collect. Outside this area the customer pays the round-trip freight costs.
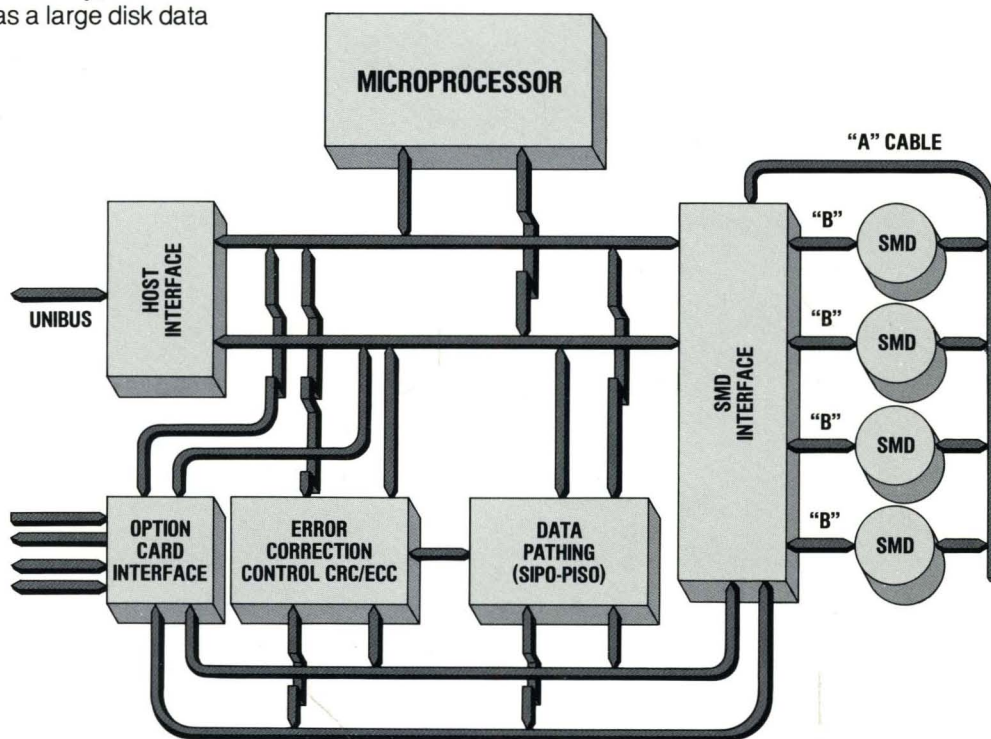


**STORM 25 FUNCTIONAL BLOCK DIAGRAM**

# Drive Characteristics

The drives are direct access, 80 megabyte or 300 megabyte storage module devices consisting of a single spindle and drive motor, voice coil head positioning motor, carriage and head assembly, read/write heads, absolute air filter, positive pressure air supply system, logic chassis, electronics and DC power supply.
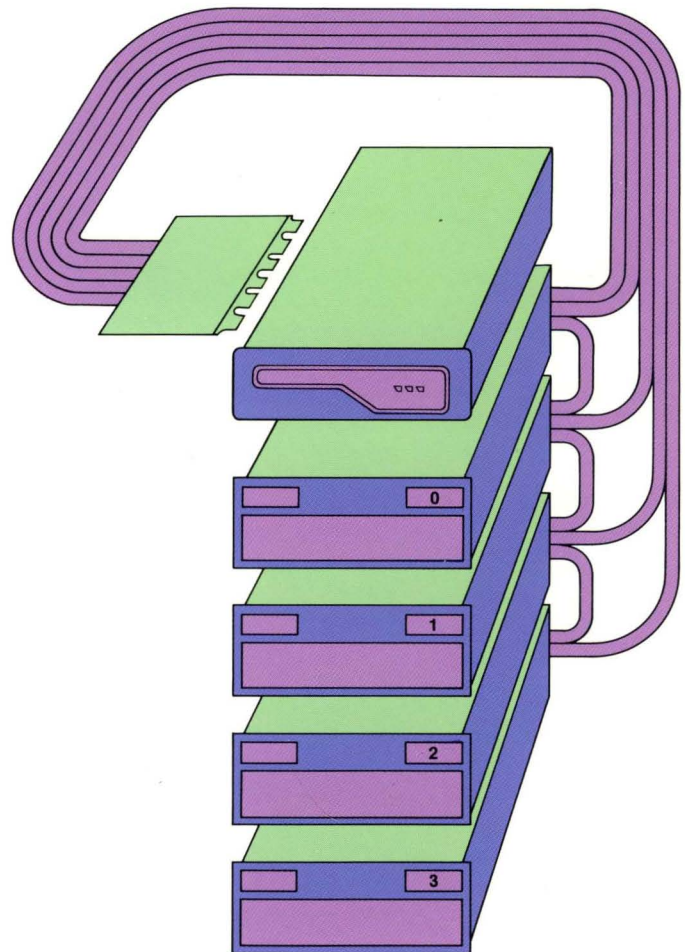
## Standard Specifications:

*Start Time*      *Access Time*
   22 seconds      6 Milliseconds (1 cylinder movement)
*Stop Time*      28 Milliseconds average
   15 seconds      55 Milliseconds (823 cylinder movements)

*Average Rotation Latency*
   8.35 Milliseconds @ 3600 rpm

*Pack Capacity*
   RM02: 82.9 Megabytes (41.4 mega words), unformatted
   RM05: 315.2 Megabytes (157.6 mega words), unformatted

*Data Transfer Rate*
   3600 rpm: 1.209 megabytes/sec
             9.67 megabits/sec

*Recording Method*
   Modified Frequency Modulation (MFM)

# System Specifications

| | |
|---|---|
| Computer Interface | Standard UNIBUS® protocol, one unit load per bus signal with line drives/receivers complying to DEC specifications. |
| Bus Address Range | 0-128K words |
| Bus Register Base Address | Selectable: $760000_8$-7777777 |
| Vector Address | Selectable: $0$-$774_8$ |
| Priority Level | Selectable: BR4-BR7 |
| Compatibility—*Software* | Functional equivalent of RH11/RM02/RM05 provides transparency with RM02/RM05 supported operating system. User selectable emulation mode (RM02/RM05) on a per drive basis, permitting any combination of RM02 or RM05 drives on a single controller. |
| *Media* | Maintains complete 16 bit format compatibility with RM02/RM05. Pack interchangeable. |
| Buffer Memory | High speed RAM, 1536 bytes for data buffering. |
| Error Detection | Hardware generated data validity check character appended to both header and data field; a 16 bit CRC for header and a 32 bit ECC for data. |
| Testability | LED's used to indicate sequential state of controller and detection of error condition within any state. |
| Disk Interface | Standard Storage Module Drive (SMD) bus utilizing differential line drivers/receivers. |
| Cable Connection | 60 and 26 pin flat cable, daisy chain configuration for A cable, radial for B cable. |
| Physical Drives | 1-4 per controller |
| Packaging | One standard HEX printed circuit board inserting in SPC slot. |
| Power Req. | −15V      .9AMP max<br>+5V      9.8AMP max |