CONTROL DATA® 9730
MINI MODULE DRIVE FAMILY

Designed for Original Equipment Manufacturers (OEM)

CONTROL DATA

5/79

Control Data Mini Module Drives (MMDs) are random-access storage devices which use fixed, sealed modules as the storage medium. This drive family consists of the 9730-12 (12 megabytes), 9730-24 (24 megabytes), 9730-80 (80 megabytes) and 9730-160 (160 megabytes).

The basic drive includes the following frame-mounted components: drive motor, power supply, electronics, front panel and sealed module. The sealed module contains the spindle, media, rotary actuator, heads and optional head-per-track shoes.

The 9730 Mini Module Drive family is designed for applications which demand high reliability and low maintenance. A sealed module protects the entire recording environment from external contaminants. The fixed media concept significantly improves device reliability and eliminates the need for costly head alignments. In addition, drive unit circuitry is easily accessible for fast troubleshooting.

Options

- Head-per-track shoe
- Dual channel unit
- Rack mount slides

Features

- Interface and format compatibility with the Control Data Storage Module Drive (SMD) family
- No scheduled maintenance required
- Fixed, sealed media
- Write protect
- Daisy chaining of up to 15 drives
- Power sequencing (local and remote)
- Power supply
- Flat input/output cable
- Variable or fixed sectoring
- Phase-locked oscillator (PLO)/ data separator
- NRZ to MFM data encoder with write compensation
- Prewired for dual channel field kit

Interface Signals

Input Signals From Controller

Unit Select Tag — Leading edge samples the unit select bit lines for storage. The remaining true level enables the unit to stay selected.

Unit Select 2^0-2^3 — Carry binary logical address of the unit to be selected.

Cylinder Select Tag 1 — Leading edge loads the absolute address from the 10-bit bus lines, and the trailing edge initiates the seek.

Head Select Tag 2 — Leading edge loads the head address from the 10-bit lines.

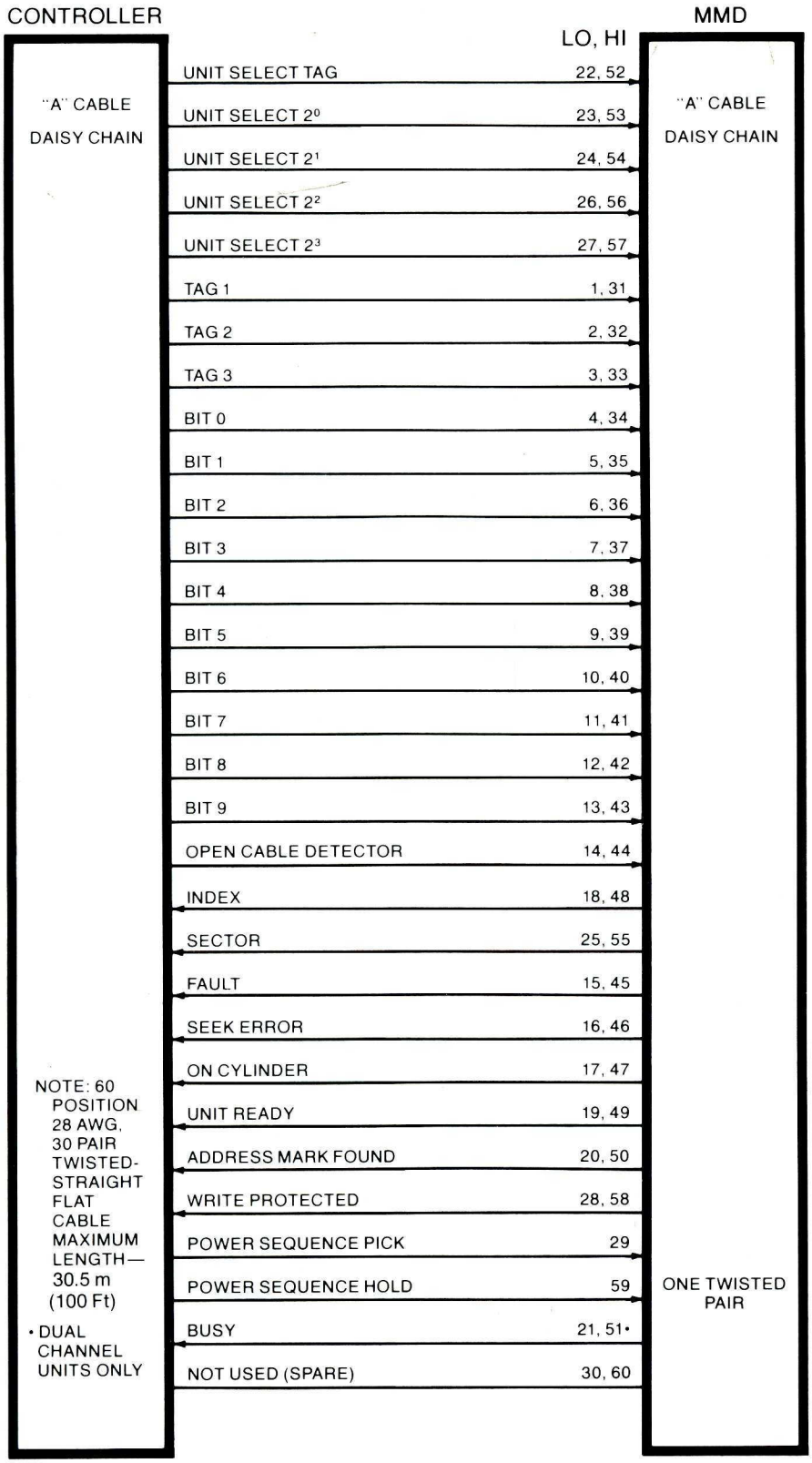
Control Select Tag 3 — Used as gate enable which provides control information from the 10-bit bus lines and must be true for the entire control operation. Bus lines contain the following control information:

Bit 0 Write Gate — Enables the write driver.

Bit 1 Read Gate — Enables digital read data on the transmission lines.

Leading edge of Read Gate triggers the read chain to synchronize on all-zeros pattern.

NOTE: The heads in the drive do not physically move. Signals are provided to meet the timing requirements of the SMD family.



Bit 2 Servo Offset Plus

Bit 3 Servo Offset Minus

Bit 4 Fault Clear — Clears the fault flip-flop if the fault condition no longer exists.

Bit 5 AM Enable — Address Mark Enable line, in conjunction with Write Gate or Read Gate, allows write or recovery of Address Marks.

Bit 6 RTZ — Pulse sent to the MMD will cause the actuator to seek to Track 0, reset the Head Register, and clear the Seek Error flip-flop. This seek is significantly longer than a normal seek to Track 0 and should only be used for recalibration, not data acquisition.

Bit 7 Data Strobe Early — SMD PLO Data Separator will strobe data at a time earlier than nominal.

Bit 8 Data Strobe Late — SMD PLO Data Separator will strobe data at a time later than nominal.

Bit 9 Release (dual channel only) — Will release channel priority reserve in the MMD, making alternate channel access possible after selection by the other channel ceases. If the unit is to function with "Reserve Timer" feature, release will occur from 500 ns to 10 seconds (customer selectable), following the last selection of the MMD. Enabling Release will always clear Reserve and allow alternate channel access independent of the Reserve Timer feature. The Reserve Timer is enabled by means of a switch on the I/O board. Inhibiting the Reserve Timer causes the MMD to stay Reserved until specifically released by the operating channel. By using switches on the I/O board, it is also possible to absolutely reserve an MMD to one channel or the other.

Power Sequencing

Power sequencing is an internal switch-selectable feature. When a ground is applied to the P.S. pick line, the MMD is allowed to power-up in the daisy-chain order. When one unit is up to speed, it applies ground to the next unit to continue the sequence. This method is used after a power interruption of the first power-up.

Open Cable Detector

This detector inhibits control functions when a true signal does not exist, as in the case of a disconnected "A" cable.

Output Signals to Controller

Unit Ready — Heads are loaded, no faults exist, and unit is up to speed.

On Cylinder — Indicates that heads are on track. The Unit is ready to seek, read or write.

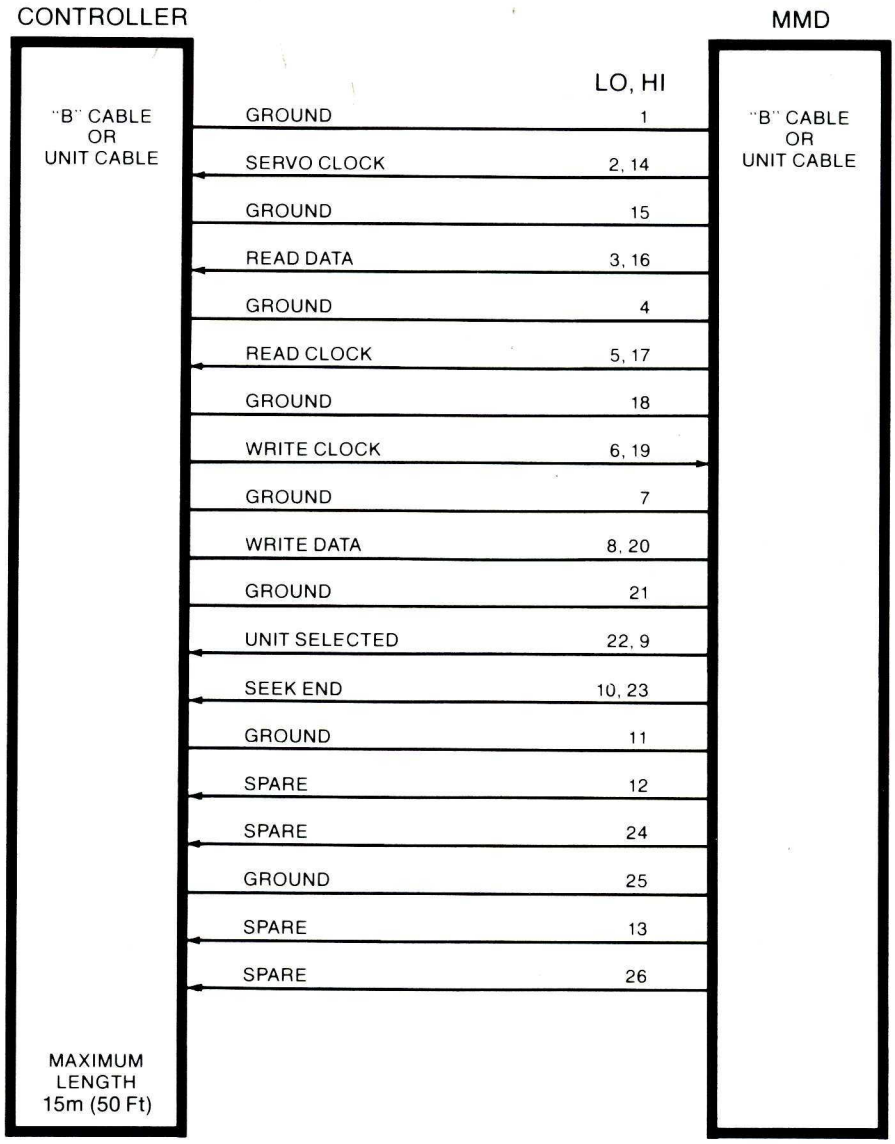
Fault — One of the following faults exists: dc power fault, head select fault, write fault, attempt to write or read when unit is not On Cylinder, or attempt to read and write at the same time. The fault inhibits the writer. If the fault was transient, this status may be cleared by control select clear, operator panel clear or master clear in the logic chassis.

Seek Error — Unit was not able to complete a seek within 500 ms, carriage has moved off position or illegal seek was attempted. A return-to-zero (RTZ) will clear the Seek Error status and return heads to Track 0.

Index — This pulse occurs once per revolution. Its leading edge defines the start of each track or sector zero.

Sector — Sector marks as well as the index mark are derived from the servo track. Number of sectors is switch selectable within the MMD.

Address Mark Found — Sent during Address Mark Search, when at least 16 missing transitions are detected on the disk. After receipt, AM Enable should be dropped and valid data will be present on the I/O.



Write Protected — Status which indicates the writer is inhibited because of operator panel switch status, head alignment card installed or a fault condition.

Busy (dual channel only) — If the MMD is already reserved and/or selected, or disabled, a busy signal will be issued to the "A" cable and sent to the channel attempting the select.

Seek End — On Cylinder or Seek Error. Indicates when a seek operation has ended.

Unit Selected — Occurs when the four unit select lines compare with the logic plus decode on the control panel, and the unit select tag is true. Allows physical identification of logical unit.

Read Clock —9.67 MHz clock derived from the MFM data recorded on the disk. The leading edge is used by the controller to sample the Read Data line.

Read Data — PLO separated NRZ data with 103 ns cell time.

Servo Clock — Phase-locked 9.67 MHz clock, generated from the servo track digits.

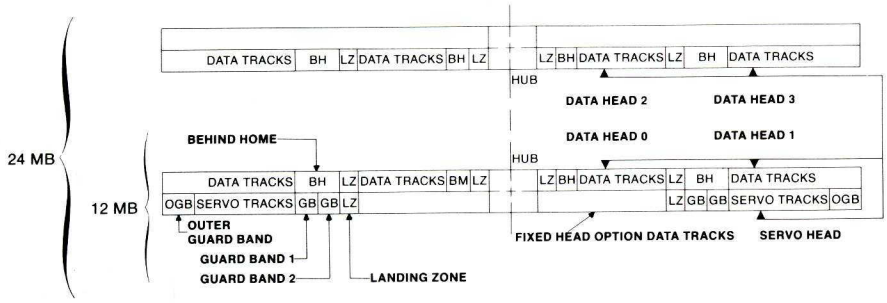
Write Data — NRZ data with 103 ns cell time to be converted within the drive to MFM and written on the disk.

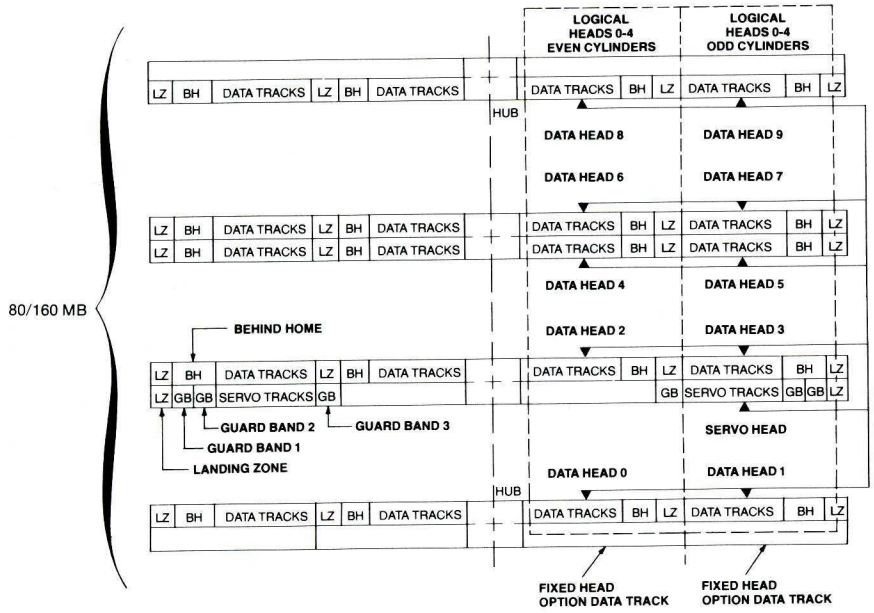
Write Clock — 9.67 MHz clock, which is Servo Clock turned around at controller and in phase such that the leading edge falls in the center of the 103 ns cell of write data.

Addressing Configuration

	9730-12	9730-12F	9730-24	9730-24F	9730-80	9730-80F	9730-160	9730-160F
Data Surfaces/Module:	1	1	2	2	5	5	5	5
Movable Heads/Surface:	2	2	2	2	2	2	2	2
Fixed Heads/Module:	—	48	—	48	—	48/96	—	48/96
Movable Cylinders/Module:	320	320	320	320	823	823	823	823
Fixed Cylinders/Module:	—	12	—	12	—	10/20	—	5/10
Movable Heads/Logical Cylinder:	2	2	4	4	5	5	10	10
Fixed Heads/Logical Cylinder:	—	4	—	4	—	5	—	10
Movable Cylinder Addresses:	0-319	0-319	0-319	0-319	0-822	0-822	0-822	0-822
Fixed Cylinder Addresses:	—	896-907	—	896-907	—	896-905-915	—	896-900-905

Head and Media Configuration

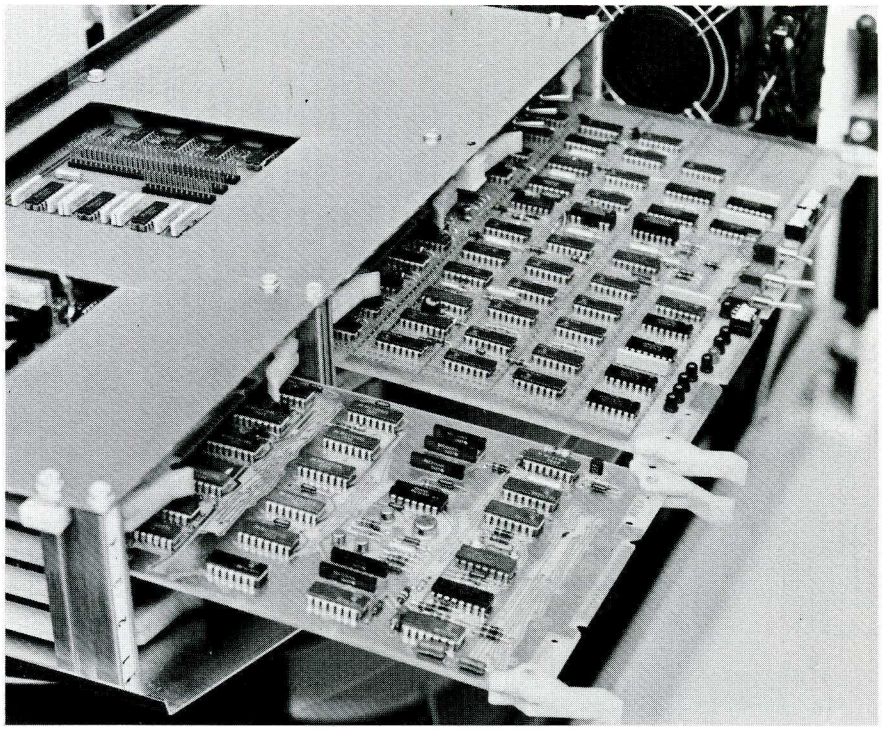




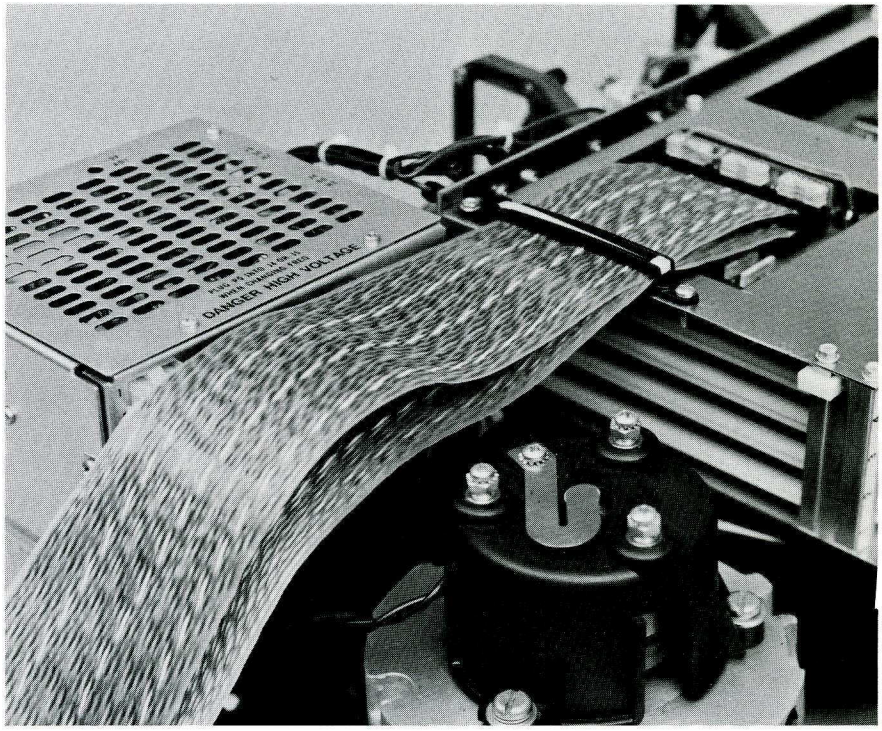
Represents the cylinder and head addressing for the 80-megabyte MMD

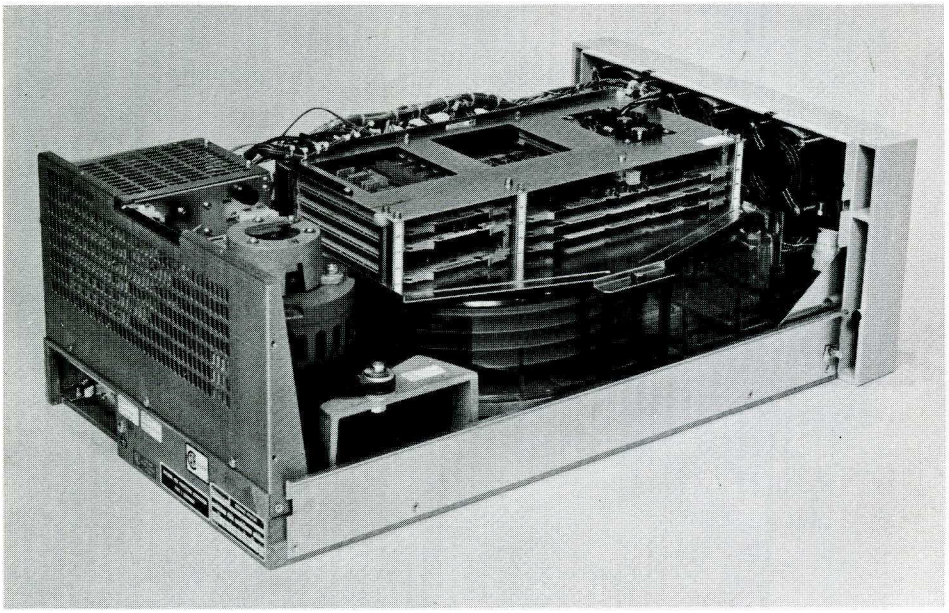
Maintainability

- Pluggable circuit cards
- No electrical adjustments
- Fault trap indicators
- Logic card extenders are the only special tools required

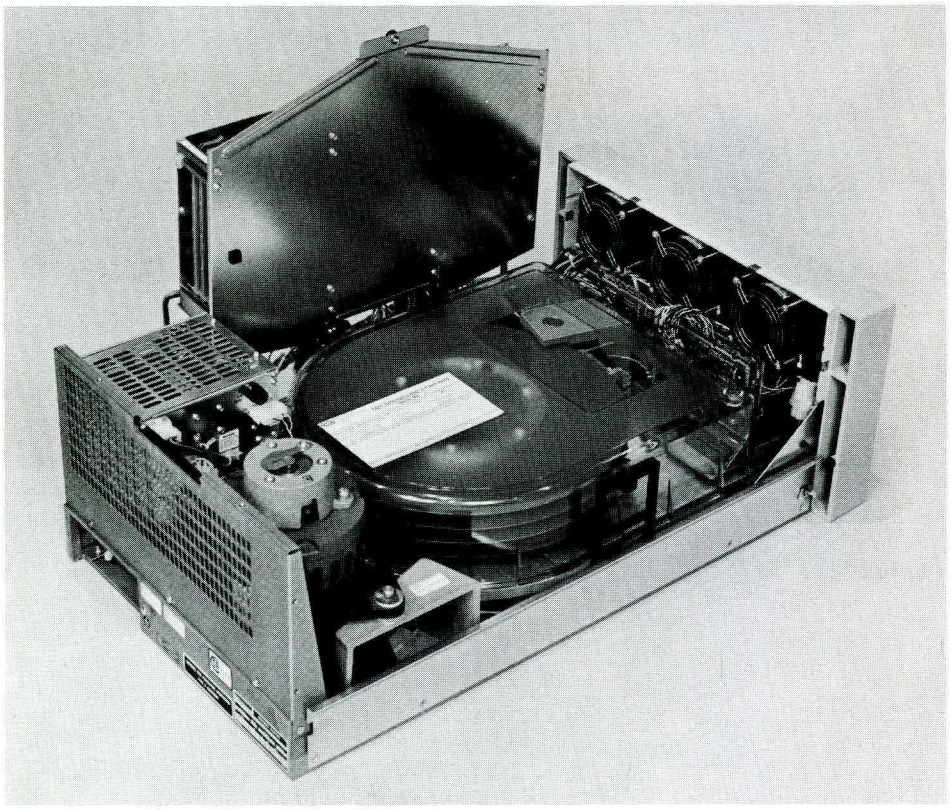


- Flat cable interface is ideal for intracabinet routing
- Optional dual channel field kit requires only pluggable cards
- All drives are prewired for dual channel kit
- Field Exerciser (9967) is common with SMD and CMD





24 MB



160 MB

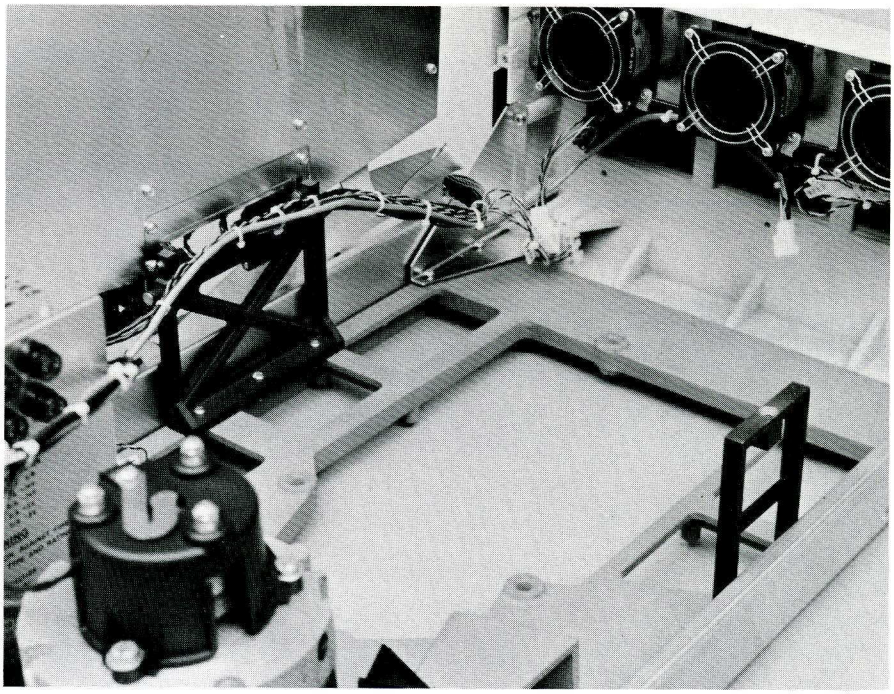
Accessibility

- Coarse filter is located behind the cooling fans and is operator replaceable
- Slides are available which permit mounting in standard 483-millimeter (19-inch) rack
- All major components are accessible from the top of unit.

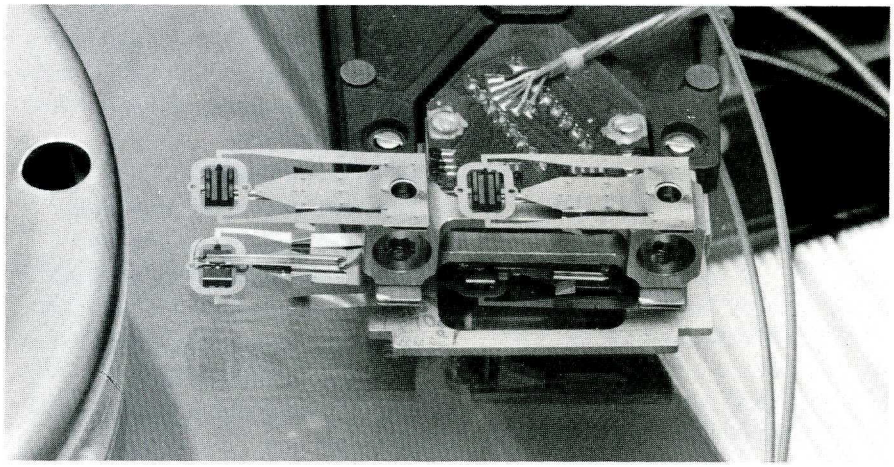
- Logic chassis swings upward to provide access to module
- There are three easily accessible shipping locks for motor, actuator and spindle

Upgradability

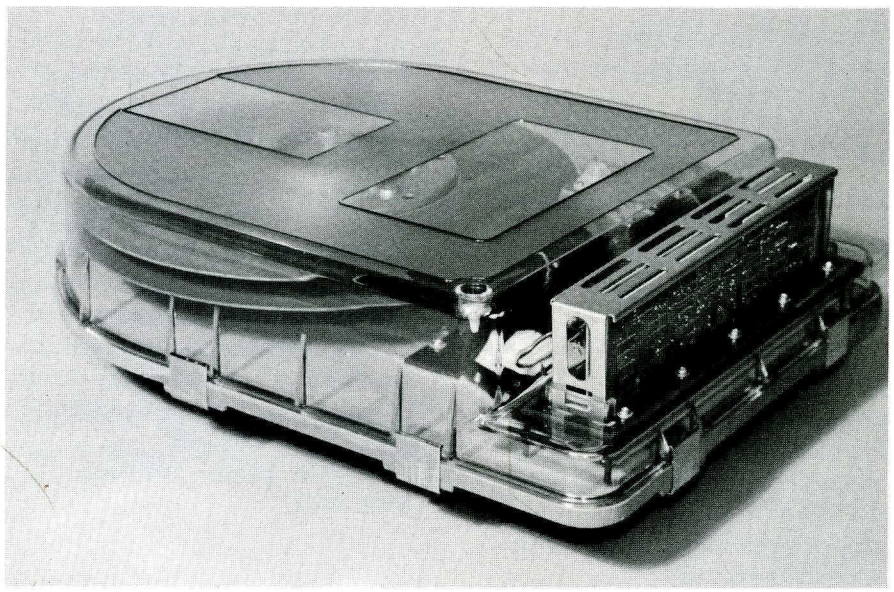
- Front panel slides out to aid module removal
- Three bolts fasten module to frame
- Module can be removed in five minutes



- Write driver read preamp and servo preamp are mounted on module
- MMD is field upgradable
  - — 12 megabytes to 24 megabytes only, with module change
  - — 80 megabytes to 160 megabytes only, with module change and three card changes



- Contact start/stop head design
- Mechanical gimbling
- Head arms operate on lubricated media
- Module weighs 16 to 21 kilograms (35 to 47 pounds) with two to four disks and head-per-track option



Specifications

Data Organization (unformatted capacities given)

	9730-12	9730-24	9730-80	9730-160
Eight-Bit Bytes/Spindle:	12.9 M	25.8 M	82.9 M	165.9 M
Optional Fixed Heads-Per-Track (Bytes/Spindle):	0.96 M	0.96 M	0.96/1.93 M	0.96/1.93 M
Cylinders/Drive:	320	320	823	823
Bytes/Track:	20,160	20,160	20,160	20,160
Bytes/Cylinder:	40,320	80,640	100,800	201,600
Data Heads/Surface:	2	2	2	2
Optional Fixed Heads-Per-Track:	48	48	48/96	48/96
Data Surfaces:	1	2	5	5
Disks:	1	2	4	4
Servo and Head-Per-Track Surface:	1	1	2	2
Track Density (tracks/in):	296	296	340	680

Performance

Data Transfer Rate: 1.2 MB/s
Spindle Speed: 3600 r/min
Bit Density: 6220 bpi (inner radius)
Access Time
- Maximum Full Stroke: (65 ms 12/24 MB) (55 ms 80 MB)
- Average: (40 ms 12/24 MB) (30 ms 80 MB)
- Minimum (one track): (10 ms 12/24 MB) (7 ms 80 MB)

Latency Time
- Maximum: 16.7 ms
- Average: 8.3 ms

Media: 356 mm (14-in) diameter, magnetic-oxide coated, lubricated
Heads: Contact during start/stop

Power Requirements

Frequency	Voltage
60 Hz	120
50 Hz	220 and 240

Phase: Single
Maximum Inrush Current: 14 A
Heat Dissipation: 508 Wh (1050 Btu/h)
Power Input: 300 W
Input Power Conn: Nema, type 5-15 P for 110 V, 60 Hz

Physical Characteristics

Height: 259.1 mm (10.2 in)
Width: 425.5 mm (16.75 in), fits 482.6 mm (19 in) rack
Depth: 762 mm (30 in)
Weight: 38.6 kg (85 lb)

Environmental

Operating Temperature: 10° C to 40° C (50° F to 104° F)
Nonoperating Temperature: 4.4° C to 70° C (40° F to 158° F)
Operating Humidity: 20 to 80% RH
Nonoperating Humidity: 5 to 95% RH

Reliability and Service

MTBF: 8000 hours
MTTR: Less than 1.0 hour
Service Life: Five years
Data Error Rate
- Recoverable: Not more than one error in 10^{10} bits transferred

Maintenance: No scheduled maintenance required other than periodic cleaning of coarse filter or replacement

Maintenance Features

- No head alignment required
- No read/write adjustments
- Fault trap indicators to isolate problems quickly
- Field test unit available for off-line maintenance
- Module is easily removed as a sealed unit
- Functionally organized logic modules with easy access

Operator Control Panel

- Ready indicator
- Fault clear switch with fault status indicator

Interface Hardware

I/O Circuits: Industry Standard 75110 differential line drivers or equivalent
Industry Standard 75108 differential line receivers or equivalent
I/O Connectors: "A" Cable (60 pin), Berg Part 65043-12
"B" Cable (26 pin), 3M Part 3399-3000
"A" Cable: 30 twisted pair, flat cable, 100 (±10) ohms characteristic impedance, 30.5 m (100 ft) maximum length. Used in daisy-chain mode. Spectra Strip 3CT-6028-7B-05-100
"B" Cable: 26 conductor, flat cable with ground plane, 130 (±15) ohms characteristic impedance, 15.2 m (50 ft) maximum length, 3M Part 3476/26. Used in radial mode as unit cable.

Data Integrity of Media

Maximum media errors per drive:
- 10 (9730-12 MMD)
- 20 (9730-24 MMD)
- 30 (9730-80 MMD)
- 250 (9730-160 MMD)

Fixed heads-per-track: Media error free

Specifications subject to change without notice

CONTROL DATA SALES OFFICES ARE LOCATED IN PRINCIPAL CITIES THROUGHOUT THE WORLD

CONTROL DATA CORPORATION
OEM PRODUCT SALES
BOX 0, MINNEAPOLIS, MINNESOTA 55440

201,405D LITHO IN U.S.A. 5/79