



DISC AND DRUM MEMORIES



High Speed,
Random-Access
Storage Capability for
Computer Operations

FEATURES

ON-LINE STORAGE –

Provides additional mass storage for high speed input/output of data, user programs, and standard software. Adds versatility and greater problem solving power to your computer.

HIGH STORAGE CAPACITY –

Available with storage capacities of 262K, 393K, 524K, 786K or 1,048K 16-bit words in a single unit – especially advantageous in applications where data or software must be rapidly swapped in or out of computer memory during program execution.

FAST STORAGE/RETRIEVAL –

Data may be stored and retrieved at a rate of 118K 16-bit words per second with an average access time of only 8.7 milliseconds. Along with bulk storage you can now have the speed you need to realize even greater operational efficiencies from your computer.

EASY TO PROGRAM –

Programming all units is easily done by using HP Assembly language software which means the stored data is readily available for immediate use.

SIMPLE TO INSTALL –

Supplied complete – simply rack mount, plug in two interface input/output cards, and connect cables – no expensive and time consuming installation or computer down-time required.



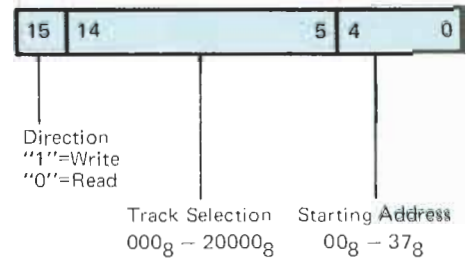
PROGRAMMING

Programming the disc (or drum) memory using direct memory access (DMA) is easily accomplished with HP Assembly language. Before an input or output operation is initiated, communication must be established between a DMA channel and the Data channel of the disc memory. Once this has been done, the disc memory may be programmed with an OTA or OTB instruction. The general form is:

OTA or OTB nn Output A- or B-Register contents to I/O channel nn.

(where nn is the octal Select Code of the Command Channel)

The A- or B-Register must contain a 16-bit word which defines track selection, starting sector address, and whether a Read or Write operation is to be performed, as follows:



The following program illustrates the ease of programming the disc (or drum) memory. This example transfers a block of 4096 words, located at track 8 (10₈), sectors 21 (25₈) through 84 (124₈), to core memory and stores them in addresses 10000₈ through 17677₈. DMA channel 2 is used and the disc memory interface cards are in I/O slots 10 (Data) and 11 (Command).

Initialize DMA	LDA	CW1	Output control word (CW1) to DMA specifying that a CLC is automatically issued by DMA after the last word has been transferred (bit 13 = "1") and the I/O address of the disc memory (bits 0-5 = 10 ₈).
	OTA	7	
	CLC	3	
Initialize Disc Memory	LDA	CW2	Output control word (CW2) to DMA specifying an input operation (bit 15 = "1") and the starting memory address (bits 0-4 = 10000 ₈).
	OTA	3	
	STC	3	
Initialize Disc Memory	LDA	CW3	Output control word (CW3) to DMA specifying the 2's complement of the number of words to be transferred (4096).
	OTA	3	
	LDA	CW4	
OTA	11B		
STC	7,C	Activate DMA channel 2.	
	STC	10	Initiate data transfer.
	CW1	OCT	20010
	CW2	OCT	110000
	CW3	DEC	-4096
	CW4	OCT	2025

NOTE: For further information on programming with DMA refer to publication no. 5950-8718, "A Pocket Guide to Interfacing HP Computers," available from your Hewlett-Packard Field Sales Office.

2773A/2774A DRUM MEMORY SPECIFICATIONS

(Disc specifications shown on back page)

SYSTEM TRACKS

2773A: 48 tracks (expandable)
 2773A-003: 64 tracks (expandable)
 2774A: 96 tracks (expandable)
 2774A-003: 128 tracks (non-expandable)

WORD SIZE

16 bit plus parity bit

WORDS PER SECTOR

64

SECTORS PER SYSTEM TRACK

128

WORDS PER SYSTEM TRACK

8192

(Note: One system track is equivalent to four hardware tracks.)

STORAGE CAPACITY

2773A: 393,216 words (expandable)
 2773A-003: 524,288 words (expandable)
 2774A: 786,432 words (expandable)
 2774A-003: 1,048,576 words (non-expandable)

HEAD CONFIGURATION

One fixed head per track

ROTATIONAL SPEED

60 Hz operation: 3450 rpm nominal
 50 Hz operation: 2875 rpm nominal

DATA TRANSFER RATE

60 Hz operation: 118,000 16-bit words per second
 50 Hz operation: 98,000 16-bit words per second

ACCESS TIME

60 Hz operation: 8.7 ms average
 50 Hz operation: 10.4 ms average

READ ERROR PROBABILITY

1 in 10^{10} bits

PRIMARY VOLTAGES REQUIRED (Fully implemented drum)

115V \pm 10%, 60 Hz \pm 5%, single phase (230V, 50 Hz operation available, specify when ordering), 8.5A starting, 14.5A for 4 sec when heads are actuated, 3.1A running (all heads down)

DRUM DIAMETER

10-inches nominal

POWER FAILURE

No recorded data is affected by AC or DC power loss in any sequence other than the write mode. In the write mode, only the sector being written may be affected. The drum will automatically restart when power is restored.

INTERFACE CURRENT SUPPLIED BY COMPUTER

2.40A (+4.5V); 0.24A (-2V); No other voltages required

(Note: An auxiliary Power Supply Extender may be necessary for installations which use several I/O devices with high-current requirements. Consult the HP Field Sales Office.)

ENVIRONMENTAL CONDITIONS

Operating Temperature Range: 5° to 40°C (41° to 104°F)
 Non-Operating Temperature Range: -18° to +60°C (0° to +140°F)
 Relative Humidity (with no condensation): 0% to 95% (25° to 40°C)

DIMENSIONS

Front Panel Height: 40-1/4 inches (1022 mm)
 Unit Depth: 23-1/2 inches (597 mm) (including front panel and heat exchanger)
 Rack Mount Width: 19 inches (483 mm)

2776A DRUM MEMORY POWER SUPPLY

Front Panel Height: 8-3/4 inches (222 mm)
 Unit Depth: 14 inches (356 mm)
 Rack Mount Width: 19 inches (483 mm)

WEIGHT (fully implemented)

Net Weight: 2773/2774 - 200 lbs (90.8 kg)
 Shipping Weight: 2773/2774 - 300 lbs (136.2 kg)

2776A Drum Memory Power Supply

Net Weight: 50 lbs (22.7 kg)
 Shipping Weight: 65 lbs (29.5 kg)

12610B Drum Interface Kit

Net Weight: 17 oz. (482 g)
 Shipping Weight: 4 lbs. (1.82 kg)

EQUIPMENT SUPPLIED*

HP 2773A Drum Memory (393,216 words, expandable) or HP 2773A-003 Drum Memory (524,288 words, expandable) or HP 2774A Drum Memory (786,432 words, expandable) or HP 2774A-003 Drum Memory (1,048,576 words, non-expandable) HP 2776A Drum Memory Power Supply which includes all necessary AC and DC Power Cables.

*Drum memories ordered with HP equipment enclosures include all necessary rack mounting hardware.

HP 12610B Drum Memory Interface Kit, which includes:

Data Channel Interface Card, HP Part No. 12610-6001
 Command Channel Interface Card, HP Part No. 12610-6002
 Interface Cable, 10 feet, HP Part No. 12610-6004
 Drum Memory Binary Diagnostic Tape

Model No.	Expansion Kit No.	Storage Added by Kit	Total Storage with Expansion Kit
2773A		Minimum Unit	393,216 words
2773A	12553A-001	393,216 words	786,432 words**
2773A	12553A-002	131,072 words	524,288 words
2773A (with 12553A-002)	12553A	262,144 words	786,432 words**
2774A			786,432 words
2774A	12553A	262,144 words	1,048,576 words

** This unit is physically and electrically identical with the 2774A.

ROTATING MEMORY STORAGE SYSTEMS

DESCRIPTION

HP Disc and Drum Memories serve as a high capacity, random-access memory extension for HP computers. The memory device consists of either a disc (2766) or a drum (2773/2774) driven by a directly-coupled AC motor. A modular system of plug-in circuit cards and heads allows capacity to be tailored to individual requirements. Fast access time is accomplished by head-per-track construction combined with a rotational speed of 3450 RPM. Average access time of all units is 8.7 milliseconds (60 Hz operation). The number of head assemblies for the desired capacity are installed initially. Additional heads may be added to expandable units, permitting future expansion of disc or drum storage.

System tracks are divided into 128 sectors, each sector containing 64 words. The sector is the basic addressable unit. Sectors may be addressed individually or in blocks of up to 128 contiguous sectors equal to one full track or 8,192 words. Contiguous sectors may be accessed without re-initialization of the DMA (Direct Memory Access) channel or the memory control circuits. Re-initialization is re-

quired upon crossing track origin of the programming track currently addressed. Write data is transferred to computer memory serially in NRZ format at a nominal transfer rate of 3MHz.

RECORDING HEADS

Magnetic heads never touch the disc or drum recording surface at any time. When lowered to their operating position, the heads fly at a nominal spacing of 100 microinches from the recording surface. All surface wear is eliminated. Each memory is mounted in a rugged and massive frame that is shock-mounted in a protective cover providing complete protection from contaminating elements.

TRACK PROTECT

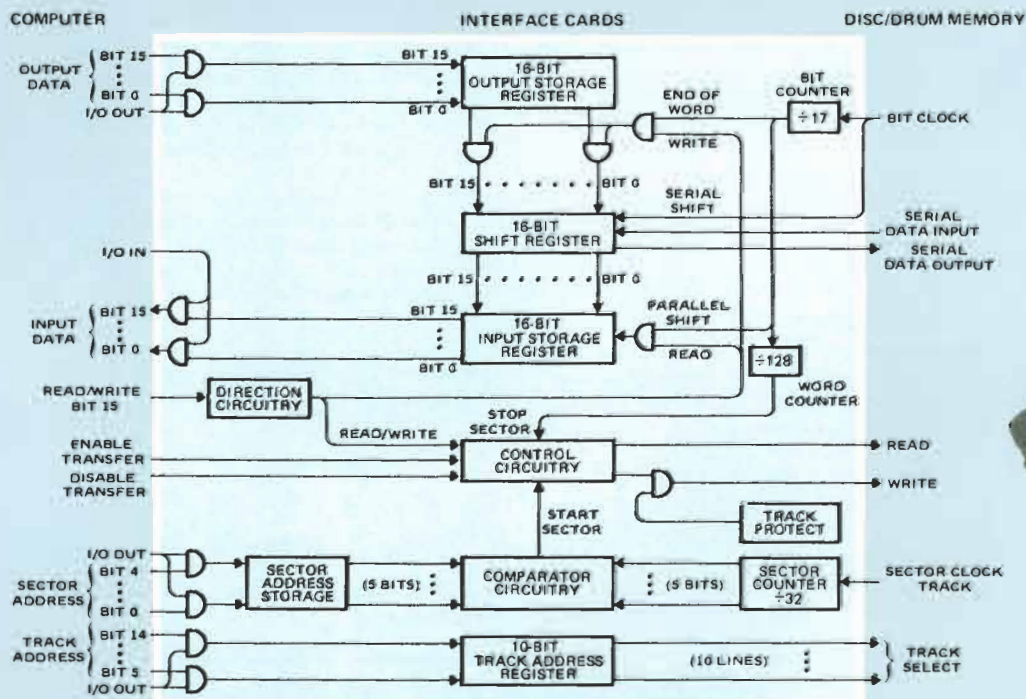
Selected disc or drum tracks can be protected from being over-written by use of the track-protect feature. Enabling the track-protect switch provides a read-only capability for the selected number of tracks. The number of tracks protected can be selected in multiples of two up to the maximum number of tracks contained in the unit.

PARITY AND STATUS CHECKS

Parity is generated for the data during write and checked during read. Results of the parity check are available from the disc/drum memory interface cards. The interface can also be interrogated for disc/drum status, which includes rotational position (sector under head). The desired sector or the following ones may then be accessed on the same revolution with a predictable delay between the time of address detection and the initiation of data transfer. A simplified logic diagram of the disc/drum memory interface card is shown below.

BASIC SYSTEM REQUIREMENTS

A basic rotating memory system for an HP Computer consists of the selected Disc or Drum Memory, a Disc or Drum Memory Interface Kit and the corresponding Memory Power Supply. The computer must be equipped with Direct Memory Access which permits data to be transferred directly between the disc or drum memory and the computer memory in either direction. With the computer under DMA control, rather than program control, the data transfer rate is increased more than twelve times, taking advantage of the fast data transfer rate.



SIMPLIFIED LOGIC DIAGRAM FOR INTERFACE CARDS



2766A DISC MEMORY SPECIFICATIONS

(Drum specifications shown on inside)

SYSTEM TRACKS

2766A: 32 tracks (expandable)
2766A-002: 64 tracks (expandable)
2766A-003: 96 tracks (expandable)
2766A-004: 128 tracks (non-expandable)

WORD SIZE

16 bits plus parity bit

WORDS PER SECTOR

64

SECTORS PER SYSTEM TRACK

128

WORDS PER SYSTEM TRACK

8192

(Note: One system track is equivalent to four hardware tracks.)

STORAGE CAPACITY

2766A: 262,144 words (expandable)
2766A-002: 524,288 words (expandable)
2766A-003: 786,432 words (expandable)
2766A-004: 1,048,576 words (non-expandable)

HEAD CONFIGURATION

One fixed head per hardware track

ROTATIONAL SPEED

60 Hz operation: 3450 rpm nominal
50 Hz operation: 2875 rpm nominal

DATA TRANSFER RATE

60 Hz operation: 118,000 16-bit words per second
50 Hz operation: 98,000 16-bit words per second

ACCESS TIME

60 Hz operation: 8.7 ms (average)
50 Hz operation: 10.4 ms (average)

READ ERROR PROBABILITY

1 in 10^{10} bits

PRIMARY VOLTAGES REQUIRED

(fully implemented disc)

115V \pm 10%, 60 Hz \pm 3% (230V, 50 Hz operation available, specify when ordering), 2.9A Starting, 1.9A Running

DISCS

Diameter: 12 inches
Track Length: 30 inches nominal (shortest track)
Coating: Nickel-cobalt plating

POWER FAILURE

No recorded data is affected by AC or DC power loss in any sequence other than the write mode. In the write mode, only the sector being written may be affected.

INTERFACE CURRENT SUPPLIED BY THE COMPUTER

2.4A (+4.5V); 0.24A (-2V)

No other voltages required

(Note: An auxiliary Power Supply Extender may be necessary for installations which use several I/O devices with high-current requirements. Consult the HP Field Sales Office.)

OPERATING CONDITIONS

Ambient Temperature: 0° to 48°C (32° to 118°F)
Non-Operating Temperature: -18° to +60°C (0° to +140°F)
Relative Humidity (with no condensation): 5% to 95%
(25° to 40°C)

DIMENSIONS

Front panel height: 21 inches (533 mm)
Unit depth: 20 inches (508 mm)
Rack mount width: 19 inches (483 mm)

2772A DISC MEMORY POWER SUPPLY

Front panel height: 7-inches (184 mm)
Unit depth: 18-3/4 inches (476 mm)
Rack mount width: 19 inches (483 mm)

WEIGHT

Disc Memory
Net Weight: 170 lbs. (77,2 kg)
Shipping Weight: 259 lbs. (117,6 kg)

2772A Disc Memory Power Supply

Net Weight: 33 lbs (15 kg)
Shipping Weight: 37 lbs. (16,8 kg)

HP 12610C Disc Interface Kit

Net Weight: 17 oz. (482 g)
Shipping Weight: 4 lbs. (1,82 kg)

EQUIPMENT SUPPLIED*

HP 2766A Disc Memory (262,144 words, expandable) or
HP 2766A-002 Disc Memory (524,288 words, expandable) or
HP 2766A-003 Disc Memory (786,432 words, expandable)
HP 2776A-004 Disc Memory (1,048,576 words, non-expandable)
HP 2772A Disc Memory Power Supply which includes all necessary AC and DC Power Cables.

HP 12610C Disc Memory Interface Kit, which includes:
Data Channel Interface Card, HP Part No. 12610-6001
Command Channel Interface Card, HP Part No. 12610-6002
Interface Cable, 10 feet, HP Part No. 12610-6004
Disc Memory Binary Diagnostic Tape

DISC EXPANSION

Model No.	Expansion Kit No.	Storage Added by Kit	Total Storage with Expansion Kit
2766A	Minimum Unit		262,144 words
2766A-002	12865A	262,144 words	524,288 words
2766A-003	12865A	262,144 words	786,432 words
2766A-004	12865A	262,144 words	1,048,576 words

*Disc memories ordered with HP equipment enclosures include all necessary rack mounting hardware.

