OMNIBUS MAGNETIC TAPE OPTIONS

The OMNIBUS Magnetic Tape Options include:

a. The TD8-EM Dual DECtape Transport Control and TU56 Dual DECtape Transport
b. The TM8-E DECmagtape Transport Control and TU10 DECmagtape transport

DECtapes

The DECtape unit can interface directly with the OMNIBUS via the TD8-E or to the External Bus via the TC08. The configurations are defined in the following table. For information on the TC08 Controller, refer to section 4 of this chapter.

Four basic DECtape configurations are identified in the following table.

SYSTEM DESIGNATION	DECtape	CONTROL	PREREQUISITE	REMARKS
None	TU56 (Dual Drive)	TC08	KA8-E* KD8-E PDP-8/E	Up to 4 Dual TU56's per control. (8 drive units)
None	TU56H (Single Drive)	TC08	KA8-E* KD8-E PDP-8/E	Up to 4 single DECtape drive units.
TD8-EM	TU56-M (Dual Drive)	TD8-E	PDP-8/E	Control plugs into OMNIBUS.
TD8-EH	TU56-MH (Single Drive)	TD8-E	PDP-8/E	Control plugs into OMNIBUS.

TD8-E DECtape Option

The DECtape system is a standard option for the PDP-8/E that serves as an auxiliary magnetic tape data storage facility. The DECtape system stores information at fixed positions on magnetic tape, as in magnetic disk or drum storage devices, rather than at unknown or variable positions, as in conventional magnetic tape systems. This feature allows replacement of blocks of data on tape in a random fashion without disturbing other previously recorded information. In particular, during the writing of information on tape, the system reads format (mark) and timing information from the tape and uses this information to determine the exact position at which to record the information to be written. Similarly, in reading, the same mark and timing information has a number of features to improve its reliability and make it exceptionally useful for program updating and program editing applications. These features are: phase or polarity sensed recording on redundant tracks, bidirectional reading and writing, and a simple mechanical mechanism utilizing hydrodynamically lubricated tape guiding (the tape floats on air over the tape guides while in motion).

* Magnetic tape options operated on the external bus of the PDP-8/E require the use of the KA8-E Positive I/O Bus Interface module and the KD8-E Data Break Interface module as prerequisites.

Specifications

Tape Characteristics	Capacity—260 feet of ¾ inch, 1 mil Mylar sandwich tape, coated both sides. Reel diameter—3.9 inches Tape Handling—direct drive hubs and specially designed guides float the tape over the head. No capstans or pinch rollers are used. Speed—97 ± 14 ips Density—350 ± 55 bpi Information capacity—2702_8 Blocks with 201_8 12-bit words per block (188,672 12-bit words) Tape Motion—bi-directional
Word Transfer Rate	33,300 3-bit characters per second
Addressing	Mark and timing tracks allow searching for a particular block by number in a forward or backward direction.
Tape Motion Timing	Start Time—150 msec ± 15 msec Stop time—100 msec ± 10 msec Turn around time—200 msec ± 20 msec
Mounting	TU56 Drive mounts in a standard 19 inch equipment rack
Size	10 ½ inches high 19 inches wide 9 ¾ inches deep } TU56 Drive 1 Quad Module } TD8-E Control plugs into OMNIBUS
Cooling	Internally mounted fan provided for TU56
Environmental Conditions	Temperature—40°F to 90°F Note: The magnetic tape manufacturer recommends 40-60% relative humidity and 60° to 80° as an acceptable operating environment for DECtape.

Tape Compatibility

Tapes may be certified, programmed, read, modified, and rewritten interchangeably on either the larger automatic DECtape units (TC08/TC01) or on the TD8-E. DEC provides all the necessary subroutines and MAINDECs for the TD8-E; for example:

- Read/Write Subroutines
- Tape Certification Routine
- MAINDEC Maintenance Programs

- PS/8 Programming System (12K Minimum Configuration)
- A new 4K Keyboard Operating System with Program Directory, Line Editor, and PAL III* Assembler.
- A DECtape Copy Program

* (A Paper Tape Device is required; either ASR-33 or PC8-E, for input and output with PAL-III.)

TD8-E DECTAPE CONTROL

The TD8-E is a low cost interface for the TU56 DECtape units. A TD8-EM consists of a TD8-E and one TU56-M Dual DECtape drive. The TD8-EH consists of a TD8-E and one TU56-MH Single DECtape drive.

The TD8-E is contained on a single quad Flip-Chip module which plugs directly into the OMNIBUS of the PDP-8/E. It is connected to the TU56 by a special interface cable (P.N. 7008447). It uses a standard TU56 with no modifications. The Read/Write Amplifiers (G888) must be plugged into the TU56 drives.

When reading, writing, or searching, the PDP-8/E acts as a controller for the DECtape. That is, all data transfers to and from the 8/E are through the AC in non-interrupt, non-data break mode. The PDP-8/E is completely committed to the tape operation and cannot perform any other functions until the tape operations have been completed.

Up to four TD8-E interfaces can be used with a PDP-8/E. Each TD8-E can drive either a single or dual transport. It is therefore possible to have eight DECtape drives connected to the PDP-8/E through four TD8-E's. When a dual transport is used on the TD8-E's, the first TD8-E will control units 0 and 1; the second TD8-E will control units 2 and 3; the third, units 4 and 5; and the fourth, units 6 and 7.

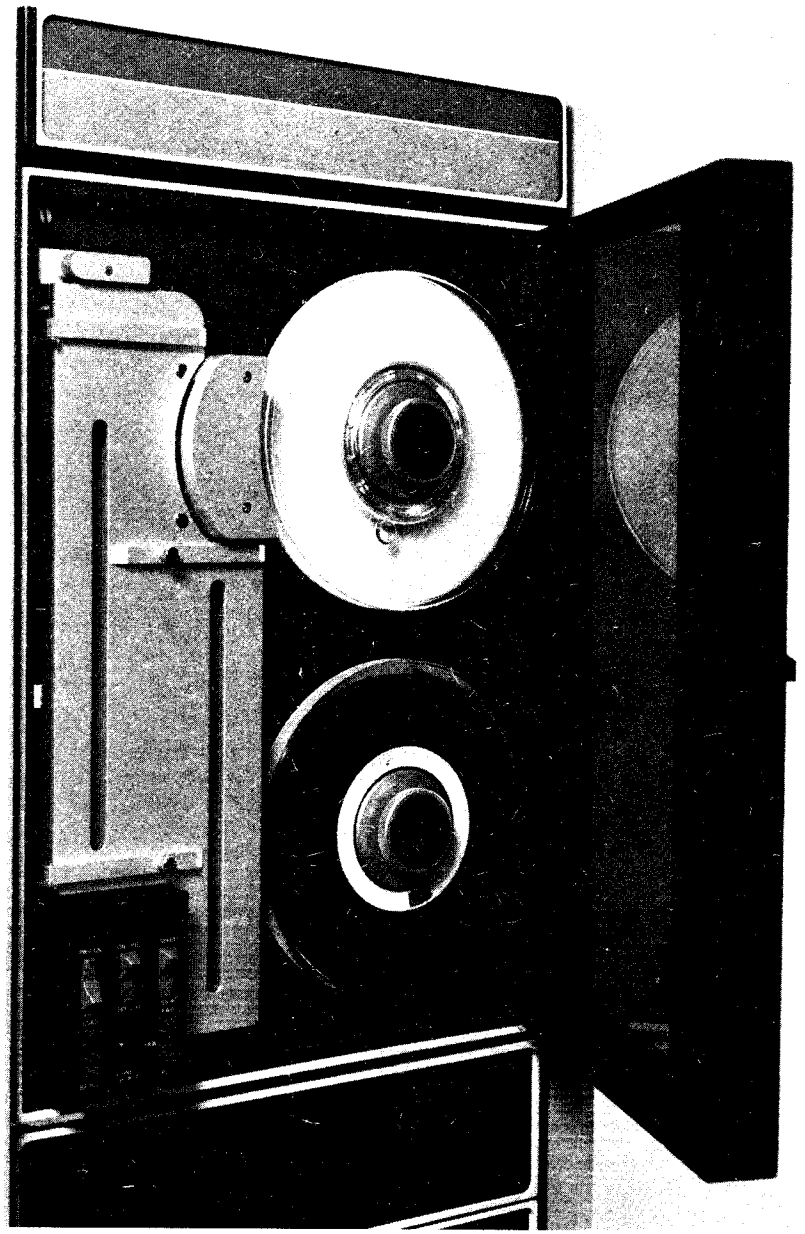
A comprehensive set of diagnostic routines is included with the TD8-E which checks all of its functions. The TD8-E is also supplied with subroutine software which search, read, and write PDP-8 compatible DECtapes. DECtapes written with the TC01 or TC08 control can be read with the TD8-E using this software and vice versa. Because of the close dependency of the hardware with the software, Digital Equipment Corporation will not guarantee operation of the TD8-E with any software other than that which is supplied by Digital Equipment Corporation.

The TD8-E was designed as a low-cost DECtape interface with limited functions. It is not a replacement for the TC08 which makes transfers of data direct to memory concurrent with CP operations. Its primary use is for library storage of programs and blocks of data. The TD8-E will, however, like the TC08, certify DECtapes by writing and verifying the mark and time tracks and block numbers.

Refer to Section 4 of this chapter for a detailed discussion of TU56.

TU10 DECmagnetic Tapes

The DECmagtape can interface directly with the OMNIBUS via the TM8-E, or to the EXTERNAL BUS via the TC58. The configurations of both categories are defined in the following table. For information on the TC58 controller, refer to section 4.



TU10 DECmagtape

DECmagtape Configurations

SYSTEM OPTION	EQUIPMENT	NO. OF CHANNELS	DENSITIES (BPI)	TAPE SPEED (IPS)	OTHER INFORMATION
TM8-EA	TM8-E Control & TU10-EA(master)	9	800	45	Control plugs into OMNIBUS. TU10-EA contains a master and one slave. Up to 7 additional TU10 slaves may be added. 7 and 9 track TU10's can be mixed on the same system. For example, a 7 track master can be operated with a 9 track slave etc. The master consists of logic modules which plug into the TU-10 electronics.
TM8-FA	TM8-E Control & TU10-FA(master)	7	800/556/200	45	Same as above.
TC58 *	TC58 Control(master) & TU10-EE(slave)	9	800	45	DW08A I/O conversion panel, KA8-E Positive I/O Bus and KD8-E Data Break Interface are prerequisites. The master is contained with the TC58 controller. Up to 7 additional TU10 slaves may be added. 7 and 9 track TU10's can be mixed on the same system.
TC58 *	TC58 Control(master) & TU10-FE(slave)	7	800/556/200	45	Same as above.

* Refer to Section 4 for TC58 Description

OMNIBUS DECmagtape Unit and Control Type TM8-E/F

NOTE

The following information is preliminary and is subject to change without notice. The reader should consult with the local DEC sales office.

The TM8E control provides the interface between the PDP-8/E and the TU10 master-slave magnetic tape transport system. The TU10 master can control 7 slaves; therefore the TM8-E is capable of controlling 8 transports.

The data transfer is via single cycle data break with a transfer rate of 36 KHZ. The transport operates at 45 ips and uses 7 channel formats at 200, 556 or 800 bpi or 9 channel format at 800 bpi.

The TM8-E contains six registers which are used to control the transports and report the status of the transports to the computer. The registers are loaded and read using IOT instructions which require no data break.

PROGRAMMING

The following Instructions are used to program the TM8-E:

Load Word Count Register (LWCR)

Octal Code: 6701
Operation: Load Word Count Register and Clear the AC
AC → WC, 0 → AC

Clear Word Count Register (CWCR)

Octal Code: 6702
Operation: Clear Word Count Register

Load Current Address Register (LCAR)

Octal Code: 6703
Operation: Load Current Address Register and Clear the AC
AC → CA, 0 → AC

Clear Current Address (CCAR)

Octal Code: 6704
Operation: Clear Current Address

Load Command Register (LCMR)

Octal Code: 6705
Operation: Load Command Register and Clear the AC
AC → CM, 0 → AC

Load Function Register (LFGR)

Octal Code: 6706
Operation: Load Function Register (GO bit) and Clear AC
AC → Function Register 0 → AC

Load Data Buffer Register (LDBR)

Octal Code: 6707
Operation: Load Data Buffer Register and Clear AC
AC → DB, 0 → AC

Read Word Count Register (RWCR)

Octal Code: 6711
Operation: Clear AC and Read Word Count Register
0 → AC, WC → AC

Clear Transport (CLT)

Octal Code: 6712
Operation: Clear Transport

Read Current Address Register (RCAR)

Octal Code: 6713
Operation: Clear AC and Read Current Address Register
0 → AC, then CA → AC

Read Main Status Register (RMSR)

Octal Code: 6714
Operation: Clear AC and Read Main Status Register
0 → AC, then MS → AC

Read Command Register (RCMR)

Octal Code: 6715
Operation: Clear AC and Read Command Register
0 → AC, then CM → AC

Read Function Register & Status (RFSR)

Octal Code: 6716
Operation: Clear AC Read Function Register and Status 1
0 → AC, then Function and Status 1 → AC

Read Data Buffer (RDBR)

Octal Code: 6717
Operation: Clear AC and Read Data Buffer
0 → AC, then DB → AC

Skip if Error Flag (SKEF)

Octal Code: 6721
Operation: Skip if error flag is set.

Skip if Control not Busy (SKCB)

Octal Code: 6722
Operation: Skip if the control is not busy. The TM8-E becomes busy when a go is given to the transport and becomes not busy at MTTF.

Skip When Job Done (SKJD)

Octal Code: 6723
Operation: Skip if the job is done (MTTF is set). The job done flag (MTTF) sets at the end (LRCS) of a Read, Read/Compare, Write File Mark, or Write operation, and at the end of a record, if an EOT, EOF or BOT was encountered or the WC overflowed during a space operation.
MTTF sets when a transport begins to do a rewind and a new transport may be selected, when a transport goes off-line following an off-line operation, and when a rewinding transport has reached BOT and is ready.

Skip When Tape Ready (SKTR)

Octal Code: 6724
Operation: Skip if tape unit is ready (TUR is true).

Clear Controller and Master (CLF)

Octal Code: 6725
Operation: Clear the Controller and Transport Master if TUR, if not clear MTTF, EF and Status Registers.
0 → Control Registers

Octal Code: 6726
Reserved for Maintenance

Octal Code: 6727
Reserved for Maintenance

Description of Registers

6701 LWCR — The 12 bit Word Count Register may be loaded from AC 0—11 any time the control is not busy. If the register is loaded during Control Busy, data reliability and tape compatibility cannot be assured. The Word Count must be loaded to the 2's complement of the number of words to be transferred or blocks to be spaced. The Word Count is incremented at TPI of the break cycle during Data Transfers and at LPCS during a space forward, and at the first word of a block during a Space Reverse.

Recommended block length is per USA Standards, Document USAS X3.22-1967. Recorded Magnetic Tape for information interchange (800 cpi, NRZ1).

6702 CWCR — This IOT clears the Word Count Register and is essentially for maintenance use. It should not be used during Control Busy.

6703 LCAR — The 12 bit Current Address Register may be *loaded from AC 0–11 any time the control is not* busy. It must be loaded to one less the Memory Address where the first data is taken or placed. If the Register is loaded during Control Busy, the following occurs:

1). In wrap around mode, function bit 6 = 0, location of the data transfer can not be assured within the selected memory field.

2). In EMA INC Enable mode, function bit 6 = 1, location of the data transfer can not be assured within the memory.

The Current Address Register is incremented at Break Request prior to the break cycle.

6704 CCAR — This IOT clears the Current Address Register and is essentially for maintenance use. It should not be used during Control Busy.

6705 LCMR — The Command Register can only be loaded from AC 0—11 during Control Not Busy. If the IOT is issued during Control Busy, an illegal function will be indicated and the current operation aborted. The transport may have to be rewound.

Bits

0, 1, 2	Unit selection: These determine which of the eight transports will be used.
0 0 0	Transport 0
0 0 1	Transport 1
0 1 0	Transport 2
0 1 1	Transport 3
1 0 0	Transport 4
1 0 1	Transport 5
1 1 0	Transport 6
1 1 1	Transport 7
Bit 3	Parity: 0 = Even 1 = Odd
Bit 4	Enable Interrupt on Error Flag
Bit 5	Enable Interrupt on MTTF (job done flag)
Bits 6, 7, 8	Extended Memory Address: These three bits determine which memory field the controller uses. The manner in which these bits are loaded depends upon the setting of the EMA Enable bit, Function Register bit 6.

Bits

6 7 8	
0 0 0	Field 0
0 0 1	Field 1
0 1 0	Field 2
0 1 1	Field 3
1 0 0	Field 4
1 0 1	Field 5
1 1 0	Field 6
1 1 1	Field 7
Bit 9	Reserved for Future Use
Bits 10, 11	Density: These bits select the density for the transports operation.

10 11		
0 0	200 bpi	7 channel
0 1	556 bpi	7 channel
1 0	800 bpi	7 channel

This also serves as a core dump mode. When issued to a 9 channel transport, data is written in 7 channel format and zero's are written in channels 0 and 1 on the tape.

1 1	800 bpi	9 channel

6706 LFGR — The function register must be the last register to be loaded, since this register contains the GO bit.

Bit 0	Bit 1	Bit 2	
0	0	0	Off Line: The selected transport is taken off-line and rewound to BOT. The MTTF is set when the transport responds to the function, the controller may then select and use another transport. The transport must be manually reset to the on-line state. The Word Count and Current Address Registers need not be loaded.
0	0	1	*Rewind: The transport rewinds at high speed (150 ips) to BOT and stops. The MTTF is set when the transport responds to the function. The controller may then select and use another transport. Should the rewinding*