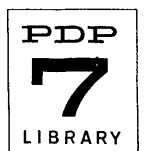


- 1. IDENTIFICATION
- 1.1 Digital-7-94-U
- 1.2 DECtape Copy Program
- 1.3 January 21, 1966



2. ABSTRACT

The program is designed to copy all or part of any DECtape onto any other DECtape. The program reads a series of blocks, writes them on the second DECtape, and then rereads them checking for an accurate checksum and comparing the information just read with the information originally read. Any DECtape or comparison error will cause an identifiable halt. To keep the programming simple and to allow maximum space for copying purposes, block number references are entered using the console ACCUMULATOR switches. The program operates on either a 4K or 8K PDP-7. It is not designed for operation on a PDP-4.

3. REQUIREMENTS

3.1 Storage

The program occupies approximately the first 1400 locations of core memory but uses the remainder of memory through location (1) 7377 for copying and comparison areas.

3.2 Subprograms

The program makes use of the PDP-7 Bidirectional DECtape Subroutines (Digital-7-22A-I/O), with which the symbolic tape must be assembled. The subroutines are included in the binary tape used for running the program.

3.3 Equipment

Two DECtape drives attached to a PDP-7 DECtape control are required. The PDP-7 can have a 4K or larger memory.

4. USAGE

4.1 Loading

4.1.1 Mount the tape to be copied on a DECtape drive dialed to unit 1. The drive can be kept in WRITE LOCK position.

4.1.2 Mount the tape to be copied on a DECtape drive dialed to unit 2. The drive must be write enabled.

4.1.3 Read in the binary tape by starting at location (1) 7770.

4.1.4 Set bits 8-17 of the ACCUMULATOR switches to the first block to be copied (numbers 1-1100 only); then start at location 22.

4.1.5 When the computer halts, set bits 8-17 of the ACCUMULATOR switches to the last block number to be copied, and press CONTINUE.

4.1.6 When the computer stops at location 134 with the accumulator and link set to all 1's, copying has been completed. To copy another section, repeat the steps beginning at paragraph 4.1.4 using the required set of block numbers. Do not press CONTINUE.

4.2 Calling Sequence (Not Applicable)

4.3 Switch Settings

The ACCUMULATOR switches must be set to the starting block number before starting at 22, and to the final block number after the halt, which occurs immediately. Bits 6-17 are examined even though block numbers 1-1100 only are accepted.

4.4 The program can be restarted any time by setting the ACCUMULATOR switches to the first block to be copied and pressing START with the ADDRESS switches set to 22.

4.5 Errors in Usage

The following errors can occur:

Halt Location	Meaning	Procedure
21	Illegal CAL instruction. Probable machine malfunction.	Reload the program and start over. If condition persists, the computer requires maintenance.
57	HALT to allow putting final block number in the ACCUMULATOR switches. Not an error.	Set ACCUMULATOR switches to final block number to be copied, and press CONTINUE.
134	Final halt. Accumulator and link should be all 1's.	Repeat program for additional areas to be copied, as necessary.
202	Interrupt occurred from other than DECTape, or a DECTape skip command did not function correctly. The ACCUMULATOR displays the result of an IORS command.	Start over. If error persists, maintenance should be performed to eliminate the spurious flag.
217	DECTape error during reading of original tape. The contents of the ACCUMULATOR lights indicate the type of error as follows: LAW 100 - Format error (should never occur) LAW 200 - Block number cannot be found LAW 300 - Non-end-of-tape error during searching	Press CONTINUE to try operation again. If the error is persistent, either the DECTape cannot be copied or the DECTape system itself is malfunctioning. Try copying another tape or section of tape, if possible.

Halt Location	Meaning	Procedure
217 (cont)	LAW 400 - Error flag during reading LAW 500 - Sumcheck error during reading LAW 600 - Error flag during writing LAW 700 - Block-mark number error during reading or writing	
221	DEctape error during writing of new tape. See HLT 217 for decoding of error.	Same as above
223	DEctape error during reread of second tape. See HLT 217 for decoding of error.	Same as above
225	Comparison error.	Press CONTINUE to reread and rewrite the last section. If error persists, maintenance is required.

5. RESTRICTIONS

The tapes copied must be in the standard DEC format of 1100_g blocks of 400_g words each. Note that block 0 cannot be copied.

6. DESCRIPTION

6.1 Discussion

The program first determines whether or not a 4K machine is used and allocates core locations accordingly. If a 4K machine is being used, 3000_g locations (6 blocks) are allocated for reading and an additional 3000_g locations are allocated for checking. If an 8K machine is used, 7000_g locations (16_g blocks) are allocated for each area.

The copying procedure is as follows:

1. Read (1)6 blocks from the original tape, in either direction.
2. Write the (1)6 blocks on the second tape, in either direction.
3. Reread the (1)6 blocks from the second tape, in either direction, into another core area and compare the two areas.
4. Repeat steps 1-3 until all requested blocks have been transferred, then halt.

6.2 Applications

The program can be used to copy any standard type of PDP-4, PDP-6, or PDP-7 DECtape without reference to the contents or data format on the tape providing only that the standard block format is used. It is, therefore, a fairly fast procedure for copying system tapes or other work tapes. This allows duplication of tapes for backup or for distribution to more than one user.

7. METHODS

(See Discussion, Section 6)

8. FORMAT

Standard PDP-4, PDP-6, and PDP-7 DECtape block format of 1100₈ addressable blocks of 400₈ (18-bit) words each.

9. Execution Time

Measurements indicate that a complete reel of tape can be copied and checked in almost exactly 3 minutes using an 8K computer, or about 4 minutes and 20 seconds on a 4K computer.

10. PROGRAM

Program Listing is attached. See Digital-7-22A-I/O for a complete listing of the PDP-7 Bidirectional Subroutines which are not included with the listing of the Copy program itself.

10.1 Core Map (None)

10.2 Dimension List (None)

10.3 Parameter List (None)

10.4 Program Listing

```
/TAPE COPY PROGRAM
/LMM 1=21=66
```

```
21/
```

```

G00,          HLT
              CAF                /CLEAR FLAGS
              LAC (JMP INTERR)
              DAC 1                /SPT UP INTERRUPT
              LAC (NOP)
              DAC SW1              /SPT SW1
              DZM 7777
              DZM 17777
              DAC 17777
              SAD 7777            /SKIP IF 8K MACHINE
              JMP G03             /4K MACHINE
              LAC (16)            /NUMBER OF BLOCKS PER PASS
              DAC K1
              LAC (7000)          /NUMBER OF WORDS PER PASS
G02,          DAC K2
              LAC K1
              CMA

```

	DAC 0	/BLOCK DISTANCE
	LAC R1=1	/START OF 1ST READ AREA
	ADD K2	/3000 OR 7000
	DAC R3=1	/START OF 2ND READ AREA
	TAD (=0)	/SUBTRACT 1
	DAC R1	/END OF 1ST READ AREA
	DAC R2	
	ADD K2	/3000 OR 7000
	DAC R3	/END OF 2ND READ AREA
	LAS	/STARTING BLOCK
	AND (7777)	
	ADD 0	
	DAC BN	/STARTING BLOCK-BLOCK DISTANCE
	HLT	/PUT IN FINAL BLOCK
	LAS	/LAST BLOCK
	AND (7777)	
	DAC K2	
	JMP SW1+1	
G03,	LAC (6)	
	DAC K1	
	LAC (3000)	
	JMP G02	
/READ DATA		
R0,	JMS MMRDS	/READ
	LAC B=N	/BLOCK NUMBER
	JMP ERR1	/ERROR RETURN
	10000	/UNIT
	RA1	/FIRST ADDRESS
R1,	RA1	/LAST ADDRESS, MODIFIED
	JMS WAIT	
R1A,	JMS MMWRS	/WRITE
	LAC BN	/BLOCK NUMBER
	JMP ERR2	/ERROR RETURN
	20000	/UNIT
	RA1	/FIRST ADDRESS,
R2,	RA1	/LAST ADDRESS, MODIFIED
	JMS WAIT	
R2A,	JMS MMRDS	/READ AGAIN
	LAC BN	/BLOCK NUMBER
	JMP ERR3	/ERROR RETURN
	20000	/UNIT
	RA2	/FIRST ADDRESS, MODIFIED
R3,	RA2	/LAST ADDRESS, MODIFIED
	JMS WAIT	
/COMPARE THE TWO AREAS		
	LAW RA1=1	
	DAC AX1	/START OF FIRST AREA
	LAM	
	TAD R3=1	
	DAC AX2	/START OF 2ND AREA
	LAC R3	
	CMA	
	ADD R3=1	
	DAC C1	/COUNTER

R4,	LAC I AX1	
	SAD I AX2	
	SKP	
	JMP ERR4	/ERROR
	ISZ C=1	
	JMP R4	
SW1,	NOP	/OR HLT
	LAC BN	
	ADD K=1	/CONSTANT BLOCK AMOUNT
	DAC BN	
	ADD K1	/CONSTANT BLOCK AMOUNT
	CMA	
	ADD K=2	/FINAL BLOCK
	ADD (1)	
	SMAVCLL	/LAST SECTION TO TRANSFER
	JMP R0	/TRANSFER NEXT
	ADD K1	/CONSTANT BLOCK AMOUNT
	RTL	/MULTIPLY BY 400
	RTL	
	RTL	
	RTL	
	TAD (=0)	/SUBTRACT 1
	DAC K1	/TEMPORARY STORAGE
	LAC R1=1	
	ADD K1	
	DAC R1	
	DAC R2	
	LAC R3=1	
	ADD K1	
	DAC R3	
	LAC (STLVCLCVHLT)	
	DAC SW1	
	JMP R0	
INTERR,	DAC ACS=AVE	
	MMEF	
	SKP	
	JMP I MMERR	
	M MDF	
	SKP	
	JMP I MM DATA	
	M MBF	
	SKP	
	JMP I MMBLF	
	IORS	
I1,	HLT	/INTERRUPT ERROR
DISMIS=JMP .	CAF	
	LAC 0	
	RAL	
	LAC ACSAVE	
	ION	
	JMP I 0	
MMAPII,	0	

```
WAIT,      0  
            LAC I MMWA1  
            ISZ MMDONE  
            JMP .+2  
            JMP I WAIT  
  
ERR1,      HLT                /ERR DURING INITIAL READ  
            JMP R0  
ERR2,      HLT                /ERR DURING WRITING  
            JMP R1A  
ERR3,      HLT                /ERR DURING 2ND READ  
            JMP R2A  
ERR4,      HLT                /COMPARISON ERROR  
            JMP R0
```

```
AX1=10  
AX2=AX1+1  
RA1=1400  
RA2=RA1+3000
```

START

11. DIAGRAM (None)
12. REFERENCES (None)