TE16

UTILITY DRIVER

MD-11-DZTEF-A

EP-DZTEF-A-DL-A

FICHE 1 OF 1

JUN 1977

digital

MADE IN USA

EOF1DZTEERSE0	00010000	770608	PDP10 411	5:HDR1DZTEFASE0	00010000	770608

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1
                .REM    %
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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZTEF-A-D

PRODUCT NAME: TU16/TE16 UTILITY DRIVER

DATE CREATED: 21 APRIL 77

MAINTAINER: DIAGNOSTIC ENGINEERING

AUTHOR: J. G. ADAMS

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1. ABSTRACT

THIS PROGRAM IS INTENDED AS A BRUTE FORCE ROUTINE
TO EXECUTE AN OPERATION OR SERIES OF OPERATIONS, CONTINUOUSLY
REGARDLESS OF THE RESULTS OF THE OPERATION. BECAUSE
OF THE COMPLEXITY OF THE TU16/TE16 MAG TAPE SYSTEM AS
OPERATED ON THE MASSBUS, IT IS NOT ALWAYS POSSIBLE TO
PROVIDE FOR EVERY CONTINGENCY IN THE NORMAL PROGRAMS.
THEREFORE THIS UTILITY DRIVER WILL ALLOW AN OPERATOR
TO EXECUTE ANYTHING DESIRED IN ANY ORDER. THERE ARE
NO ERROR CHECKS OR PRINTOUTS MADE, AND ANY VARIATION
FROM PRESET SEQUENCES AND VALUES ARE MADE BY
CHANGING THE APPROPIATE MEMORY LOCATIONS.

2. REQUIREMENTS

2.1 HARDWARE:

A. ANY PDP-11 PROCESSOR - WITH OR WITHOUT HARDWARE SWITCH REGISTER.
B. RH MASSBUS CONTROLLER
C. TM02/TM03 MAG TAPE CONTROLLER
D. AT LEAST ONE (1) TU16/TE16 SLAVE

2.2 STORAGE:

THIS PROGRAM REQUIRES AT LEAST 3K OF CORE

3. LOADING PROCEDURE:

USE STANDARD BINARY LOADING PROCEDURE

4. STARTING PROCEDURE

THE PROGRAM IS ALWAYS STARTED AT LOCATION 200 (8)

***LOC. 176 (SWREG) IS DEFINED AS THE SOFTWARE SWITCH REGISTER
   (REFER TO SECTION 5 FOR MORE DETAIL)

***IF THE SOFTWARE SWITCH REGISTER IS USED THE DIAGNOSTIC TYPES OUT THE FOLLOWING
   MESSAGE; SWR=XXXXXX NEW= (REFER TO SECTION 5 FOR OPERATOR OPTIONS)
   AT THE START OF THE PROGRAM.

5. CONSOLE SWITCH SETTINGS

IF THE DIAGNOSTIC IS RUN ON A CPU WITHOUT A SWITCH REGISTER THEN A SOFTWARE SWITCH REGISTER IS USED WHICH ALLOWS THE USER THE SAME SWITCH OPTIONS AS THE HARDWARE SWITCH REGISTER. IF THE HARDWARE SWITCH REGISTER DOES NOT EXIST OR IF ONE DOES AND IT CONTAINS ALL ONES (177777) THEN THE SOFTWARE SWITCH REGISTER (LOC. 176) IS USED.

CONTROL:

THIS PROGRAM ALSO SUPPORTS THE DYNAMIC LOADING OF THE SOFTWARE SWITCH REGISTER (LOC. 176) FROM THE TTY. THIS CAN BE ACCOMPLISHED BY DOING THE FOLLOWING:

1) TYPE CONTROL G (↑G); THIS WILL ALLOW THE TTY TO ENTER DATA INTO LOC. 176 AT SELECTED POINTS WITHIN THE PROGRAM.

2) THE MACHINE WILL THEN TYPE: SWR=XXXXXXNEW= (XXXXXX IS THE OCTAL CONTENTS OF THE SOFTWARE SWITCH REGISTER.)

3) AFTER THE ''NEW='' HAS BEEN TYPED THEN THE OPERATOR CAN DO ONE OF THE FOLLOWING AT THE TTY:

   A) TYPE A NUMBER TO BE LOADED INTO LOC. 176 FOLLOWED BY A (CR). (ONLY NUMBERS BETWEEN 0-7 WILL BE ACCEPTED AND ONLY 6 NUMBERS WILL BE ALLOWED)
   IF A (CR) IS THE FIRST KEY DEPRESSED THE SOFTWARE SWITCH REGISTER CONTENTS WILL NOT BE CHANGED.

   B) IF A CONTROL U (↑U) IS DEPRESSED THEN THE PROGRAM WILL SEND YOU BACK TO STEP 2.

SW15(100000): 1=STOP AFTER EACH OPERATION
              0=PROCEED
SW14(040000): 1=STOP AT THE END OF THE OPERATION SEQUENCE
              0=PROCEED
SW13(020000): 1=IGNORE END OF TAPE (EOT)
              0=REWIND AT END OF TAPE (EOT)

5.1 HALT

TO CHANGE THE CONTENTS OF SWREG TYPE (↑G) BEFORE PRESSING CONTINUE AFTER A HALT.

6. OPERATION

THE PROGRAM OPERATION IS QUITE SIMPLE, BUT DOES REQUIRE THE OPERATOR TO HAVE KNOWLEDGE OF THE TU16/TE16 TAPE SYSTEM AS OPERATED ON THE RH MASSBUS CONTROLLER. THE OPERATOR MUST BE ABLE TO DECIDE WHICH SEQUENCE OF OPERATION IS REQUIRED, AND WHAT VALUES TO ASSIGN TO THE VARIOUS PARAMETERS REQUIRED TO EXECUTE THEM. THE OPERATION SEQUENCE IS SET UP BY LOADING A TABLE WITH THE FUNCTION CODES OF THE DESIRED OPERATIONS AND SETTING THE NUMBER OF OPERATIONS IN A COUNTER. THE PROGRAM IS SET UP TO DO A WRITE OF TEN (8) WORDS OF ALL ONES DATA TO SLAVE ZERO (0) ON DRIVE ZERO (0) IN PE (1600 BPI) WITH A NINE TRACK NORMAL DATA FORMAT. THE DATA ADDRESS IS 3000 (8). THE OPERATION SEQUENCE IS SET TO DO A SINGLE WRITE. IF LOADED AND STARTED AT 200 (8) WITH NO CHANGES MADE AND SWITCH 14 AND 15 SET TO A ZERO (0), THIS OPERATION WILL BE EXECUTED CONTINUOUSLY.
THE FOLLOWING IS THE LIST OF PARAMETERS WHICH MAY BE VARIED AND A DESCRIPTION OF EACH ALONG WITH THEIR CORE LOACATION:

PARAMETER	LOCATION	DESCRIPTION
RH ADDRESS	600	ADDRESS OF RH (THE FIRST REGISTER ADDRESS: CS1)
DRIVE NUMBER	700	SET TO SELECT TM02/TM03 NUMBER ADDRESS 0-7
UNIT DESCRIPTION	702	SET SELECTED SLAVE NUMBER (0-7) IN BITS 0,1,2 SELECT PARITY IN BIT 3 (0=ODD 1=EVEN) SELECT DATA FORMAT IN BITS 4,5,6,7 SELECT DENSITY IN BITS 8,9,10
FRAME COUNT	704	SET NUMBER OF FRAMES TO WRITE PER WORD COUNT AND FORMAT IN TWOS' COMPLIMENT
WORD COUNT	706	SET NUMBER OF WORDS TO BE TRANSFERRED IN TWOS' COMPLIMENT
READ ADDRESS	710	SET DESIRED ADDRESS FOR START OF READ BUFFER.
WRITE ADDRESS	712	SET DESIRED ADDRESS FOR START OF WRITE BUFFER.
READY DELAY	714	THIS DELAY VALUE IS USED BY THE PROGRAM TO ESTABLISH A MAXIMUM TIME TO AWAIT THE COMPLETION OF AN OPERATION BEFORE PROCEEDING TO THE NEXT. **(DEFAULT IS APPROX 435 MS FOR PDP-11/20)**
READY MULTIPLIER	716	IF THE VALUE SET INTO 714 DOES NOT ALLOW ENOUGH TIME, INCREASE THE SIZE OF THE MULTIPLIER. EACH INCREMENT OF THE MULTIPLIER WILL CAUSE THE 714 DELAY TO BE EXECUTED THAT MANY MORE TIMES.

OPERATION DELAY	720	THIS DELAY IS USED TO ALLOW FOR SOME AMOUNT OF TIME BETWEEN THE EXECUTION OF EACH OPERATION. IT IS LOADED AND USED JUST AS IN THE READY DELAY(714) **(DEFAULT IS APPROX 54 MS FOR PDP-11/20)**
OPER MULTIPLIER	722	THIS IS USED JUST AS THE READY DELAY MULTIPLIER(716)
OPERATION NUMBER	724	THIS IS THE NUMBER OF OPERATIONS TO BE PERFORMED IN A SEQUENCE AND SHOULD REFLECT THE NUMBERS OF OPERATIONS SET INTO THE OPERATION TABLE.
OPERATION TABLE	740-770	THIS TABLE (CONSISTING OF 15 LOCATIONS) IS TO BE LOADED WITH THE FUNCTION CODES FOR EACH OPERATION TO BE PERFORMED IN SEQUENCE. THE NUMBER OF ENTIRES MAY BE FROM ONE (1) TO FIFTEEN (15). MAKE SURE THAT THE NUMBER OF FUNCTION CODES SET IN THE TABLE IS REFLECTED BY THE NUMBER IN LOCATION 724 (OPNUM)

6.1 FUNCTION CODES

20=READ IN PRESET
02=REWIND-OFF LINE
06=REWIND
10=DRIVE CLEAR
26=WRITE TAPE MARK
24=ERASE
30=SPACE FORWARD
32=SPACE REVERSE
50=WRITE CHECK FORWARD
56=WRITE CHECK REVERSE
60=WRITE FORWARD
70=READ FORWARD
76=READ REVERSE

6.2 DATA FORMATS (BIT 7,6,5,4 OF UNIT DESCRIPTION)

14=NINE TRACK NORMAL: 2 FRAMES PER WORD
15=CORE DUMP: 4 FRAMES PER WORD

6.3 DENSITY (BITS 10,9,8 OF UNIT DESCRIPTION)

4=1600 BPI:PE (PE USES ONLY ODD PARITY)
3=800 BPI:NRZI
2=800 BPI:NRZI (TU16 ONLY)
1=556 BPI:NRZI (TU16 ONLY)
0=200 BPI:NRZI (TU16 ONLY)

6.4 PARITY (BIT 3 OF UNIT DESCRIPTION)

1=EVEN PARITY
0=ODD PARITY

6.5 SLAVE SELECT (BITS 2,1,0 OF UNIT DESCRIPTIONS)

SET TO DEVICE SLAVE ADDRESS (0-7)

JO1

7. PROGRAM DESCRIPTION

IN ORDER TO MAINTAIN THE CONTINUOUS EXECUTION OF
THE OPERATIONS DESCRIBED THE PROGRAM IS ORGANIZED AS
FOLLOWS:

```
START
INITIALIZE THE RH
SET UP TAPE PARAMETERS (DENSITY, PARITY, FORMAT: WORD COUNT, FRAME COUNT, BUS ADDRESS)
SELECT DEVICE TO TEST  (DRIVE NUMBER, SLAVE NUMBER)
EXECUTE OPERATION  (SET FUNCTION AND FROM OP TABLE AND SET GO=1)
AWAIT END OF OPERATION (READY DELAY)
STOP IF SWITCH 15=1
DO OPERATION DELAY (OP DELAY)
STOP IF LAST OPERATION IN SEQUENCE AND SWITCH 14=1
POINT TO NEXT FUNCTION CODE IN OP TABLE
JUMP BACK TO START
```

7.1 FLOW:

```
START:          HOUSEKEEPING
INIT:           CLEAR MASSBUS AND TM02/TM03
SET UP:         SET UP REQUIRED REGISTERS
EXECUTE:        SET FUNCTION AND GO=1
AWAIT END:      LOOP ON DRY=1 AS LONG AS ALLOWED BY READY DELAY
STOP:           IF SWITCH 15=1
DELAY:          PER OP DELAY
END OF RSEQUENCE? IF NOT JUMP TO START
STOP:           IF SWITCH 14=1
JUMP TO START   RESTART SEQUENCE
```

7.2 VARIATIONS: THERE ARE TWO VARIATIONS MADE FROM THIS FLOW.
BOTH ARE CAUSED BY A PARITCULAR FUNCTION CODE.
IF A READ REVERSE IS TO BE EXECUTED, THEN THE
BUS ADDRESS IS INCREMENTED BY THE SIZE OF THE
RECORD BECAUSE THE DATA IS LOADED INTO MEMORY
IN REVERSE (I.E: HIGH ADDRESS TO LOW ADDRESS)
THE SECOND VARIATION IS CAUSED BY A SPACE (FORWARD OR REVERSE)
OPERATION AND IT IS THAT THE FRAME COUNTER IS SET TO A -1
SO THAT ONLY ONE (1) RECORD IS SPACED OVER. IF YOU WISH
TO SPACE OVER MORE THAT ONE (1) RECORD, SET LOCATION 1100 (8)
TO THE TWOS' COMPLIMENT OF THE NUMBER OF RECORDS DESIRED.

8. LISTING

```
%
310                                     .LIST   BIN,LOC,SEQ
```

```
                                        .TITLE TU16/TE16 UTILITY DRIVER
                                        ;MAINDEC-11-DZTUE-E-D
                                        ;15 APR 77
                                        ;J. G. ADAMS
                                        ;REVISED APRIL ,1976 BY S. CARPENTER
                                        ;       1) SUPPORTS SOFTWARE SWITCH REGISTER
                                        ;       2) SUPPORTS THE DYNAMIC LOADING OF THE SOFTWARE SWITCH REGISTER
                                        ;REVISED APRI 1977 BY J. G.  ADAMS

                                        ;       1)DOCUMENTATION CHANGES TO REFLECT TM03/TE16 CAPABILITY
                                        .ABS

                                    ;CONSOLE SWITCHES

                                    ;SW 15=1(100000) STOP ON EACH OPERATION
                                    ;                0 CONTINUE
                                    ;SW 14=1(040000) STOP AT END OF SEQUENCE
                                    ;                0 CONTINUE
                                    ;SW 13=1(020000) IGNORE END OF TAPE (EOT)
                                    ;                0 REWIND AT END OF TAPE (EOT)

                                    ;REGISTER EQUIVES

    000000                          R0=%0
    000001                          R1=%1
    000002                          R2=%2
    000003                          R3=%3
    000004                          R4=%4
    000005                          R5=%5
    000006                          SP=%6
    000007                          PC=%7

    000046                          .=46
000046  000170                      RESTART:        170             ;ALLOW RESTART WHEN (LF) IS PRESSED
                                                                    ;DURING CHANGING OF SWREG IF SOFTWARE SWITCH
                                                                    ;REGISTER IS USED.


                                    ;SOFTWARE SWITCH REGISTER**********

    000176                          .=176
000176  000000                      SWREG:  0               ;SOFTWARE SWITCH REGISTER


                                    ;*********************************************************************

                                    ;THIS PROGRAM SUPPORTS THE SOFTWARE SWITCH REGISTER LOC.176.
                                    ;REFER TO SECTION 5 OF DOCUMENT FOR DESCRIPTION

                                    ;*********************************************************************

                                    ;STARTING ADDRESS

    000200                          .=200
000200  000167  001110              JMP     SETUP
```

```
                        000600                          .=600
                                                        ;TM02/TM03 REGISTERS
                                                        
000600  172440                        C1:     172440
000602  172442                        WC:     172442
000604  172444                        BA:     172444
000606  172446                        FC:     172446
000610  172450                        CS:     172450
000612  172452                        DS:     172452
000614  172454                        ER:     172454
000616  172456                        AS:     172456
000620  172460                        CC:     172460
000622  172462                        DB:     172462
000624  172464                        MR:     172464
000626  172466                        DT:     172466
000630  172470                        SN:     172470
000632  172472                        C2:     172472
                                                        
                                                        ;PROCESSOR ADDRESSES
                                                        
000634  177776                        PSW:    177776          ;PROCESSOR STATUS
000636  177570                        SWR:    177570          ;SWITCH REGISTER
                                                        
                                                        ;TTY REGISTERS
                                                        
000640  177560                        TKS:    177560          ;TTY READER STATUS
000642  177562                        TKB:    177562          ;TTY READ BUFFER
000644  177564                        TPS:    177564          ;TTY PUNCH STATUS
000646  177566                        TPB:    177566          ;TTY PUNCH BUFFER
```

```
                        000700                          .=700
                                                        ;SET PARAMETERS DESIRED FOR UNIT UNDER TEST******
                                                        
000700  000000                        DRVN:   0       ;DRIVE NUMBER
000702  002300                        UDES:   2300    ;SLAVE DESCRIPTION
000704  177760                        FCNT:   -20     ;FRAME COUNT
000706  177770                        WCNT:   -10     ;WORD COUNT
000710  004000                        RADDR:  4000    ;READ ADDRESS
000712  005000                        WADDR:  5000    ;WRITE ADDRESS
000714  100000                        RDYDLY: 100000  ;READY DELAY
000716  000001                        RDYDX:  1       ;READY DELAY MULTIPLIER
000720  010000                        OPDLY:  10000   ;OPERATION DELAY
000722  000001                        OPDX:   1       ;OPERATION DELAY MULTIPLIER
000724  000001                        OPNUM:  1       ;NUMBER OF OPERATION (1 TO 15)
000726  000000                        TIB:    0
000730  000000                        TOB:    0
000732  000000                        COUNT:  0
000734  000000                        RDSW:   0
000736  000000                        TEMPST: 0

                                                        ;OPERATION TABLE**********
                                                        ;ENTER OPERATION SEQUENCE DESIRED.
                                                        ;MUST HAVE AT LEAST 1 OPERATION, AND
                                                        ;MAY HAVE UP TO 15(8).
                                                        ;SET THE OPERATION COUNTER EQUAL
                                                        ;TO THE NUMBER OF OPERATIONS IN
                                                        ;THE SEQUENCE.
                                                        ;
                                                        ;20 = READ IN PRESET
                                                        ;02 = REWIND-OFFLINE
                                                        ;06 = REWIND
                                                        ;10 = DRIVE CLEAR
                                                        ;26 = WRITE TAPE MARK
                                                        ;24 = ERASE
                                                        ;30 = SPACE FORWARD
                                                        ;32 = SPACE REVERSE
                                                        ;50 = WRITE CHECK FORWARD
                                                        ;56 = WRITE CHECK REVERSE
                                                        ;60 = WRITE FORWARD
                                                        ;70 = READ FORWARD
                                                        ;76 = READ REVERSE

000740  000060                        OPTBL:  60
000742  000000                                0
000744  000000                                0
000746  000000                                0
000750  000000                                0
000752  000000                                0
000754  000000                                0       ;FILL WITH OPERATION SEQUENCE
000756  000000                                0
000760  000000                                0
000762  000000                                0
000764  000000                                0
000766  000000                                0
000770  000000                                0
```

```
                001000                          .=1000
                                                ;START OF PROGRAM**********

001000  012706  000500          START:  MOV     #500,SP
001004  012777  000340  177622          MOV     #340,@PSW

001012  016700  177706                  MOV     OPNUM,R0        ;SET COUNTER
001016  012701  000740                  MOV     #OPTBL,R1       ;SET POINTER
001022  012777  000040  177560  A:      MOV     #40,@CS         ;INIT
001030  016777  177644  177552          MOV     DRVN,@CS        ;DRIVE NUMBER
001036  016777  177640  177566          MOV     UDES,@C2        ;UNIT DESCRIPTION
001044  016777  177636  177530          MOV     WCNT,@C         ;WORD COUNT
001052  016777  177626  177526          MOV     FCNT,@FC        ;FRAME COUNT
001060  012102                          MOV     (R1)+,R2        ;SET OP CODE
001062  022702  000030                  CMP     #30,R2          ;SEE IF SPACE FORWARD
001066  001403                          BEQ     AA              ;IF SO: BR
001070  022702  000032                  CMP     #32,R2          ;SEE IF SPACE REVERSE
001074  001003                          BNE     A0              ;IF NOT: BR
001076  012777  177777  177502  AA:     MOV     #-1,@FC         ;SET TO SPACE ONE RECORD
001104  022702  000060          A0:     CMP     #60,R2          ;SEE IF READ OP
001110  103404                          BLO     A1              ;IF SO: BR
001112  016777  177574  177464          MOV     WADDR,@BA       ;SET WRITE ADDRESS
001120  000413                          BR      A3
001122  016777  177562  177454  A1:     MOV     RADDR,@BA       ;SET READ ADDRESS
001130  022702  000070                  CMP     #70,R2          ;SEE IF READ OPERATION
001134  001405                          BEQ     A3              ;IF SO: BR
001136  016703  177542                  MOV     FCNT,R3         ;GET FRAME COUNT
001142  005403                          NEG     R3
001144  060377  177434                  ADD     R3,@BA          ;SET BUS ADDRESS FOR READ REVERSE
001150  052702  000001          A3:     BIS     #1,R2           ;SET GO BIT
001154  000240                          NOP
001156  000240                          NOP
001160  010277  177414                  MOV     R2,@C1          ;START OPERATION
001164  000240                          NOP
001166  000240                          NOP
001170  016704  177522                  MOV     RDYDX,R4        ;SET DELAY MULTIPLIER
001174  016703  177514          B0:     MOV     RDYDLY,R3       ;SET READY DELAY
001200  032777  000200  177404  B:      BIT     #200,@S
001206  001005                          BNE     C               ;IF DRY: BR
001210  005303                          DEC     R3
001212  001372                          BNE     B
001214  005304                          DEC     R4
001216  001366                          BNE     B0              ;DELAY FOR DRIVE READY
001220  000240                          NOP
001222  005777  177410          C:      TST     @SWR            ;SEE IF STOP ON OPERATION
001226  100001                          BPL     D               ;IF NOT: BR
001230  000000                          HALT
001232  004767  000302          D:      JSR     PC,CKSWR        ;CHECK FOR CNTL G
001236  000240                          NOP
001240  000240                          NOP
001242  016704  177454                  MOV     OPDX,R4         ;SET DELAY MULTIPLIER
001246  016703  177446          E0:     MOV     OPDLY,R3        ;SET OPERATION DELAY
001252  005303                  E:      DEC     R3
001254  001376                          BNE     E
001256  005304                          DEC     R4
001260  001372                          BNE     E0              ;DELAY BETWEEN OPERATIONS
```

```
                                ;GO SEE IF REWIND
001262  004767  000152          JSR     PC,RWND
001266  005300                  DEC     R0
001270  001254                  BNE     A               ;IF SEQUENCE NOT DONE: BR
                                ;SEE IF HALT ON SEQUENCE
001272  032777  040000  177336  BIT     #40000,@SWR
001300  001401                  BEQ     1$
001302  000000                  HALT
001304  004767  000230  1$:     JSR     PC,CKSWR        ;CHECK FOR CNTL G
001310  000167  177464          JMP     START

                                ;RH REGISTER SETUP**********

001314  000240          SETUP:  NOP
001316  016701  177256          MOV     C1,R1           ;GET ADDRESS OF CS1
001322  012700  000015          MOV     #15,R0          ;SET NUMBER OF REGISTERS
001326  012702  000602          MOV     #WC,R2          ;GET FIRST ADDRESS
001332  062701  000002  SETA:   ADD     #2,R1           ;INCREMENT
001336  010122                  MOV     R1,(R2)+        ;LOAD ADDRESS
001340  005300                  DEC     R0              ;SEE IF DONE
001342  001373                  BNE     SETA            ;IF NOT: BR
001344  012706  000500          MOV     #500,SP
001350  013746  000006  SUSWR:  MOV     @#6,-(SP)               ;SAVE VECTORS
001354  013746  000004          MOV     @#4,-(SP)
001360  012737  001400  000004  MOV     #1$,@#4                 ;SET UP FOR TIMEOUT
001366  022777  177777  177242  CMP     #-1,@SWR                ;REFERENCE HARDWARE SWITCH REGISTER
001374  001402                  BEQ     2$
001376  000404                  BR      3$
001400  022626          1$:     CMP     (SP)+,(SP)+             ;ADJUST STACK
001402  012767  000176  177226  2$:     MOV     #SWREG,SWR      ;POINT TO SOFTWARE SWITCH REG
001410  012637  000004          3$:     MOV     (SP)+,@#4       ;RESTORE VECTORS
001414  012637  000006          MOV     (SP)+,@#6
001420  023727  000636  000176  CMP     @#SWR,#SWREG            ;IS SOFTWARE REG USED
001426  001002                  BNE     GO                      ;BRANCH IF NO
001430  004767  000156          JSR     PC,CNTLU                ;ALLOW SOFTARE SWITCH REGISTER TO BE CHANGED
001434  000167  177340  GO:     JMP     START           ;ELSE GO START EXECUTION

                                ;REWIND FROM EOT (PER SW13)

001440  032777  020000  177170  RWND:   BIT     #20000,@SWR     ;SEE IF IGNORE EOT
001446  001033                  BNE     RWNDX           ;IF SO: BR
001450  032777  002000  177134          BIT     #2000,@DS       ;SEE IF AT EOT
001456  001427                  BEQ     RWNDX           ;IF NOT: BR
001460  012777  000040  177122          MOV     #40,@CS         ;INIT
001466  016777  177206  177114          MOV     DRVN,@CS        ;SET DRIVE NUMBER
001474  016777  177202  177130          MOV     UDES,@C2        ;SET SLAVE NUMBER
001502  012777  000007  177070          MOV     #7,@C1          ;START REWIND
001510  032777  000200  177074  RWNDA:  BIT     #200,@DS        ;SEE IF DRY
001516  001774                  BEQ     RWNDA           ;IF NOT: BR
001520  032777  020000  177064  RWNDB:  BIT     #20000,@DS      ;SEE IF PIP RESET
001526  001374                  BNE     RWNDB           ;IF NOT: BR
001530  005726                  TST     (SP)+           ;RESET STACK
001532  000167  177242          JMP     START           ;RESTART SEQUENCE
001536  000207          RWNDX:  RTS     PC              ;RETURN
```

```
                                                ;CKSWR ROUTINE THAT ALLOWS THE LOADING OF LOC.176, SWREG**********
                                                ;FROM THE TTY AT SELECTED POINTS WITHIN THE PROGRAM**********

001540  022767  000176  177070  CKSWR:  CMP     #SWREG,SWR              ;SOFTWARE SWITCH REG PRESENT
001546  001041                          BNE     OUT                     ;NO, GET OUT
001550  105777  177064                  TSTB    @TKS                    ;YES,WAIT FOR
001554  100036                          BPL     OUT                     ;READY, GET CHARACTER
001556  017767  177060  177142          MOV     @TKB,TIB                ;AND STRIP OFF
001564  042767  177600  177134          BIC     #177600,TIB             ;THE GARBAGE
001572  022767  000007  177126          CMP     #7,TIB          ;IS IT A ^G
001600  001024                          BNE     OUT
001602  012704  002512                  MOV     #SCNTG,R4
001606  004767  000242                  JSR     PC,TTOUT
001612  012704  002516          CNTLU:  MOV     #SWSWR,R4
001616  004767  000232                  JSR     PC,TTOUT
001622  017703  177010                  MOV     @SWR,R3
001626  004767  000354                  JSR     PC,OCTPE
001632  012704  002525                  MOV     #SWNEW,R4
001636  004767  000212                  JSR     PC,TTOUT
001642  005037  000736                  CLR     @#TEMPST
001646  004767  000002                  JSR     PC,$READ                ;GO READ A LINE
001652  000207                  OUT:    RTS     PC                      ;RETURN TO MAIN BODY OF PROGRAM

001654  005067  177056          $READ:  CLR     TEMPST
001660  012767  000007  177044          MOV     #7,COUNT
001666  004767  000546          1$:     JSR     PC,TTIN         ;GO  READ A CHARACTER
001672  042767  177600  177026          BIC     #177600,TIB     ;STRIP OFF GARBAGE
001700  122767  000025  177020          CMPB    #25,TIB         ;IS IT A ^U?
001706  001002                          BNE     2$              ;BRANCH IF NOT
001710  005726                  3$:     TST     (SP)+           ;POP THE STACK
001712  000737                          BR CNTLU                ;START OVER
001714  122767  000015  177004  2$:     CMPB    #15,TIB         ;IS IT A <CR>?
001722  001013                          BNE     4$              ;BRANCH IF NOT
001724  012767  000200  177002          MOV     #200,RDSW
001732  004767  000150                  JSR     PC,TCRLF        ;ECHO IT WITH <LF>
001736  022767  000007  176766          CMP     #7,COUNT        ;WAS IT FIRST CHARACTER
001744  001037                          BNE     7$              ;CHANGE SWR IF NOT FIRST ONE
001746  005726                  8$:     TST     (SP)+           ;POP THE STACK
001750  000740                          BR      OUT             ;GET OUT
001752  122767  000060  176746  4$:     CMPB    #60,TIB
001760  003004                          BGT     5$
001762  122767  000067  176736          CMPB    #67,TIB
001770  003005                          BGT     6$
001772  012704  002535          5$:     MOV     #$QUEST, R4
001776  004767  000052                  JSR     PC,TTOUT
002002  000742                          BR      3$              ;START OVER IF NOT LEGAL CHARACTER
002004  006367  176726          6$:     ASL     TEMPST
002010  006367  176722                  ASL     TEMPST
002014  006367  176716                  ASL     TEMPST
002020  142767  000060  176700          BICB    #60,TIB         ;GET NITTY-GRITTY
002026  156767  176674  176702          BISB    TIB,TEMPST
002034  005367  176672                  DEC     COUNT           ;ONLY WANT 6   DIGITS
002040  001754                          BEQ     5$
002042  000711                          BR      1$
002044  016777  176666  176564  7$:     MOV     TEMPST,@SWR     ;CHANGE SWITCH REGISTER CONTENTS
```

```
  617  002052  000735                          BR      8$
  618
  619
  620                                          ;TTY OUTPUT SUBROUTINE************
  621
  622  002054  112467  176650          TTOUT:  MOVB    (R4)+,TOB
  623  002060  122767  000043  176642          CMPB    #43,TOB
  624  002066  001446                          BEQ     TEX
  625  002070  122767  000045  176632          CMPB    #45,TOB
  626  002076  001403                          BEQ     TCRLF
  627  002100  004767  000064                  JSR     PC,TOG
  628  002104  000763                          BR      TTOUT
  629  002106  112767  000015  176614  TCRLF:  MOVB    #15,TOB
  630  002114  004767  000050                  JSR     PC,TOG
  631  002120  012703  000004                  MOV     #4,R3
  632  002124  005067  176600          TCRLFA: CLR     TOB
  633  002130  004767  000034                  JSR     PC,TOG
  634  002134  005303                          DEC     R3
  635  002136  001372                          BNE     TCRLFA          ;DO FILLERS
  636  002140  112767  000012  176562          MOVB    #12,TOB
  637  002146  004767  000016                  JSR     PC,TOG
  638  002152  105767  176556                  TSTB    RDSW
  639  002156  100401                          BMI     1$
  640  002160  000735                          BR      TTOUT
  641  002162  005067  176546          1$:     CLR     RDSW
  642  002166  000406                          BR      TEX
  643  002170  105777  176450          TOG:    TSTB    @TPS
  644  002174  100375                          BPL     TOG
  645  002176  116777  176526  176442          MOVB    TOB,@TPB
  646  002204  000207                  TEX:    RTS     PC
  647
  648                                          ;OCTAL OUTPUT SUBROUTINE************
  649
  650  002206  012767  000001  000222  OCTPE:  MOV     #1,OFL
  651  002214  010304                          MOV     R3,R4
  652  002216  000410                          BR      OCTPO
  653  002220  005067  000212          OCTP:   CLR     OFL             ;CLEAR FLAG FOR LEADING ZERO
  654  002224  010304                  OCTPE1: MOV     R3,R4           ;SEE IF NUMBER IS ZERO
  655  002226  001004                          BNE     OCTPO           ;IF NOT ZERO: BR
  656  002230  004767  000162                  JSR     PC,OCTPG1       ;ELSE PRINT ZERO
  657  002234  000167  000120                  JMP     OCTP3           ;SPACE AND EXIT
  658  002240  032704  100000          OCTPO:  BIT     #100000,R4      ;SEE IF MSD = 1
  659  002244  001406                          BEQ     OCTP1           ;IF NOT: BR
  660  002246  012704  000001                  MOV     #1,R4
  661  002252  004767  000116                  JSR     PC,OCTPG        ;PRINT 1
  662  002256  000167  000006                  JMP     OCTP2
  663  002262  005004                  OCTP1:  CLR     R4
  664  002264  004767  000104                  JSR     PC,OCTPG        ;PRINT 0
  665  002270  010304                  OCTP2:  MOV     R3,R4
  666  002272  006004                          ROR     R4
  667  002274  006004                          ROR     R4
  668  002276  006004                          ROR     R4              ;POSITION DIGIT
  669  002300  006004                          ROR     R4
  670  002302  000304                          SWAB    R4
  671  002304  004767  000064                  JSR     PC,OCTPG        ;PRINT DIGIT 2
  672  002310  010304                          MOV     R3,R4
```

```
                                                ROR     R4
                                                SWAB    R4
                                                JSR     PC,OCTPG        ;PRINT DIGIT 3
                                                MOV     R3,R4
                                                ROL     R4
                                                ROL     R4
                                                SWAB    R4
                                                JSR     PC,OCTPG        ;PRINT DIGIT 4
                                                MOV     R3,R4
                                                ROR     R4
                                                ROR     R4
                                                ROR     R4
                                                JSR     PC,OCTPG
                                                MOV     R3,R4
                                                JSR     PC,OCTPG        ;PRINT DIGIT 5
176342  OCTP3:                                  MOV     #240,TOB
                                                JSR     PC,TOG          ;PRINT SPACE
                                                RTS     PC              ;EXIT
177770          OCTPG:                          BIC     #177770,R4
                                                BNE     OCTPGO
                                                TST     OFL
                                                BNE     OCTPGO
                                                RTS     PC
                OCTPGO: INC     OFL
                OCTPG1: BIS     #260,R4
                                                MOV     R4,TOB
                                                JSR     PC,TOG
                                                MOV     R3,R4
                                                RTS     PC
                OFL:    0                       ;FIRST CHAR FLAG

                        ;TTY READ SUBROUTINE**********

                TTIN:   CLR     @TKS
                        CLR     @TKB
                        CLR     TIB
                        INC     @TKS
                TTIN1:  TSTB    @TKS
                        BPL     TTIN1
176232                  MOV     @TKB,TIB
                TTIN2:  TSTB    @TPS
                        BPL     TTIN2
176136                  MOVB    TIB,@TPB
                        RTS     PC

021507          SCNTG:  .ASCII  /%1G#/
051127  020075  SMSWR:  .ASCII  /%SWR= #/
    043
    040 047040  053505  SMNEW:  .ASCII  /  NEW= #/
020075      043
    077 021445          SQUEST: .ASCII  /?%#/
004000                          .=4000
000100                          .REPT   100
                                0
                                .ENDR
```

```
729          005000                    .=5000
730          000100                    .REPT   100
731                                    i177777
732                                    .ENDR
733
734          000001                    .END
```

```
TU16/TE16 UTILITY DRIVER       MACY11 27(1006)  06-APR-77  09:56  PAGE 19
DZTEFA.P11    06-APR-77 09:55          SYMBOL TABLE

A       001022          DB      000622          OCTP1   002262          RWNDX   001536          TPS     000644
AA      001076          DRVN    000700          OCTP2   002270          SETA    001332          TTIN    002440
AS      000616          DS      000612          OCTP3   002360          SETUP   001314          TTIN1   002460
AC      001104          DT      000626          OFL     002436          SN      000630          TTIN2   002474
A1      001122          E       001252          OPDLY   000720          START   001000          TTOUT   002054
A3      001150          ER      000614          OPDX    000722          SUSWR   001350          UDES    000702
B       001200          ED      001246          OPNUM   000724          SWR     000636          WRDDR   000712
BA      000604          FC      000606          OPTBL   000740          SWREG   000176          WC      000602
BD      001174          FCNT    000704          OUT     001652          TCRLF   002106          WCNT    000706
C       001222          GO      001434          PSW     000634          TCRLFA  002124          WCNTG   002512
CC      000620          MR      000624          RADDR   000710          TEMPST  000736          WMNEM   002525
CKSWR   001540          OCTP    002220          RDSW    000734          TEX     002204          WMSWR   002516
CNTLU   001612          OCTPE   002206          RDYDLY  000714          TIB     000726          WQUEST  002535
COUNT   000732          OCTPE1  002224          RDYDX   000716          TKB     000642          WREAD   001654
CS      000610          OCTPG   002374          RESTAR  000046          TKS     000640          .       = 005200
C1      000600          OCTPGD  002412          RWND    001440          TOB     000730
C2      000632          OCTPG1  002416          RWNDA   001510          TOG     002170
D       001232          OCTPO   002240          RWNDB   001520          TPB     000646

. ABS.  005200      000

 ERRORS DETECTED:  0
 DEFAULT GLOBALS GENERATED:  0

 DZTEFA,DZTEFA/SOL=DZTEFA.P11
 RUN-TIME:  .6 1 0 SECONDS
 RUN-TIME RATIO: 32/1=17.3
 CORE USED:  5K  (9 PAGES)
```