TR79F

TIMING PROGRAM

MD-11-DZTRB-C

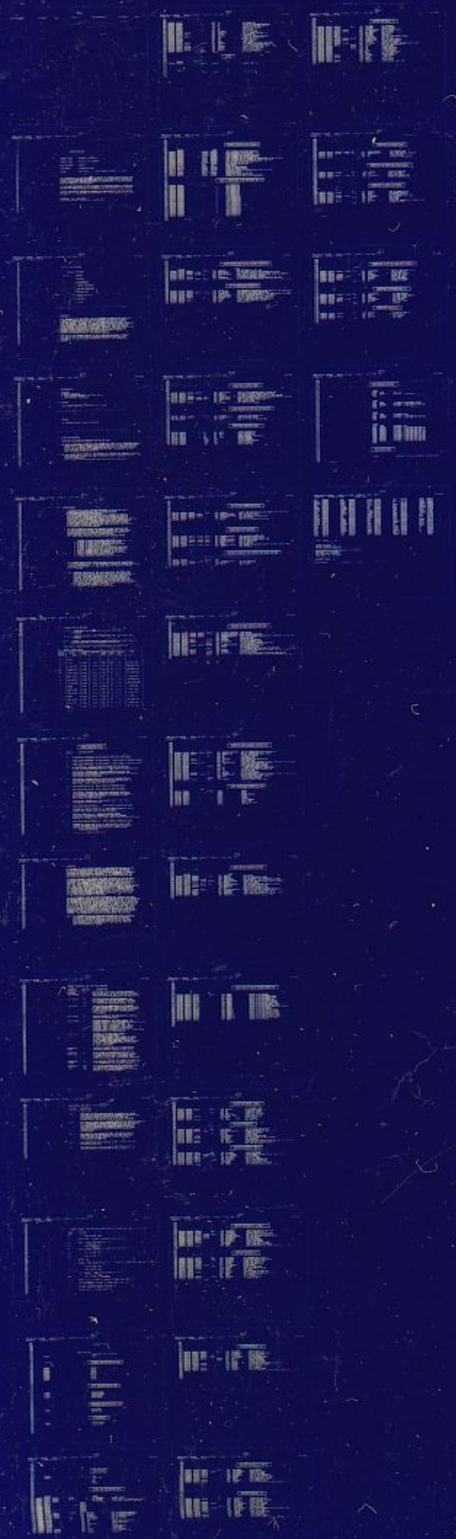
EP-DZTRB-C-DL-C

FICHE 1 OF 1

JUN 1977

digital

MADE IN USA



B01

EOF1DZTEDASEQ	00010000	770526	PDP10 411	HDR1DZTRBCSEQ	00010000	770526

IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZTRB-C-D

PRODUCT NAME: TR79 UTILITY PROGRAMS

DATE RELEASED: 1-APR-77

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: JOHN YASKO TELCO PRODUCT SUPPORT (EX 3922)

TR79 UTILITY PROGRAM

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1. ABSTRACT

THIS PROGRAM IS IN TWO PARTS, AND IS INTENDED TO PROVIDE THE USER WITH A TOOL FOR TROUBLE-SHOOTING THE TR79 MAGTAPE SUBSYSTEM ON A PDP-11 COMPUTER SYSTEM. THE FIRST PART OF THE PROGRAM ALLOWS THE USER TO GIVE THE MAGTAPE, COMMANDS, TO SIMULATE USER ROUTINES BY MERELY INSERTING THESE CODES IN THE CORE LOCATIONS PROVIDED. THE USER MAY EXECUTE ONE OR SEVERAL INSTRUCTIONS IN ANY LEGAL SEQUENCE. WHILE THE CODE FOR THE DRIVER IS SIMPLE AND USES NO INTERRUPTS, DUE TO THE DESIGN OF THE HARDWARE CERTAIN ERROR CONDITIONS MUST BE IDENTIFIED IN ORDER TO PREVENT MISINTERPRITATION OF THE DESIRED RESULTS.

PART TWO OF THE PROGRAM CONSIST OF SELF CONTAINED ROUTINES TO PERMIT THE USER TO SET UP AND CHECK THE DELAYS CONTAINED WITHIN THE TR79 CONTROLLER, BY USING THE SWITCH REGISTER TO SELECT THE APPROPRIATE ROUTINE.

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                    2.   REQUIREMENTS

                    2.1  HARDWARE
                         A. PDP-11 PROCESSOR
                         B. TR79 MAGTAPE TRANSPORT (HP-7970E DRIVE)
                         C. TR79F MAGTAPE CONTROLLER

                    2.2  STORAGE

                         THIS PROGRAM REQUIRES A MINIMUM OF 4K OF CORE

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                    3.   LOADING

                         USE STANDARD BINARY LOADING PROCEDURE



                    ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++


                    4.0  STARTING PROCEDURE

                         THERE ARE TWO STARTING ADRESSES THAT MAY BE USED

                    4.1  200 (8): LA 200 SR=0 A START AT THIS ADRESS WILL RESULT IN A PROGRAMMED DEFAULT
                            OPERATION OF A WRITE FORWARD WITH A WORD COUNT OF -20 AND A DATA PATTERN
                            OF ALL 1'S. TO MODIFY THESE PARAMETERS SEE SECTION 7.1 PROGRAM OPERATION
                            NOTE: ALSO SEE SECTION 5.0 PROGRAM RESTRICTIONS, THE DEFAULT OF WRITE
                            WILL NOT WORK IF TAPE IS AT B.O.T..

                    4.2  204 (8) LA 204 SR=0 A START AT THIS ADRESS WILL EXECUTE THE SPECIALLY DESIGNED
                            SETUP ROUTINES TO ALLOW THE USER TO SETUP OR VERIFY THE DELAYS WITHIN
                            THE TR79 CONTROLLER.
                            NOTE: ALLWAYS USE SCRATCH TAPES WHEN TAPE MOTION IS INDICATED.
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5.0 RESTRICTIONS

5.1 A. A PSEUDO-OP OF A 20(8) HAS BEEN PROVIDED TO ALLOW THE USER TO POWER CLEAR BETWEEN OPERATIONS IF DESIRED, HOWEVER THE PROGRAM CANNOT RECOVER FROM ERRORS.
THIS IS A POWER CLEAR AND TAKES 900 MILI SECONDS TO COMPLETE
ANY ATTEMPTS TO ISSUE INSTRUCTIONS TO THE CONTROLLER WHILE A
POWER CLEAR IS IN PROGRESS WILL RESULT IN ILLEGAL COMMAND BIT SETTING
WHICH WILL INHIBIT ANY FURTHER INSTRUCTIONS FROM BIENG EXECUTED.
A POWER CLEAR IS ALSO GENERATED FROM A BUS INIT WHICH OCCURS
FROM A RESET INSTRUCTION, THE DRIVER USES NO RESETS, (USE CAUTION
IF YOU MODIFY THE DRIVER PACKAGE)

B. THE TR79 CONTROLLER CHECKS FOR CERTAIN ILLEGAL FUNCTIONS DUE TO TAPE POSITION OR STATUS, THE DRIVER PACKAGE WILL CHECK THESE CONDITIONS AND HALT AT APPROPRIATE LOCATIONS WITH MEANINGFULL DATA DISPLAYED (SEE SECTION 7.2 ERROR CHECKS).
THE LISTED CONDITIONS WILL PRODUCE ILLEGAL COMMAND ERRORS:

1. ATTEMPT TO WRITE DATA FROM LOAD POINT WITHOUT AN I.D.B.
2. ATTEMPT TO WRITE A TAPE MARK FROM LOAD POINT
3. ATTEMPT TO MOVE TAPE IN REVERSE FROM LOAD POINT
4. ATTEMPT TO REWIND FROM LOAD POINT
5. ATTEMPT TO WRITE AN I.D.B. AT OTHERTHAN LOAD POINT
6. ATTEMPT TO WRITE DATA WITH THE WRITE RING REMOVED
7. ISSUE A COMMAND WHILE THE MAGTAPE IS NOT READY
8. ISSUE A COMMAND WHILE THE CONTROLLER IS NOT READY
9. ISSUE A COMMAND WITH INHIBIT BIT SET
10. ILLEGAL FUNCTION CODES 00,03,05,06,11,12,14

C. THE PROGRAM DOES NO DATA CHECKS ON READ OR WRITE DATA TRANSFERRED. IT IS THE RESPONSIBILITY OF THE OPERATOR TO MANUALLY EXAMINE THE BUFFER LOCATIONS TO DETERMINE IF THERE HAVE BEEN ANY PICKED OR DROPPED BITS IF DESIRED.

D. NOTE: HARDWARE OPERATION OF THE TR-79 SPECIFIES THAT EACH CORE WORD LOCATION CONTAIN ONE BYTE (BITS 0-7) OF DATA AND PARITY (BIT 8). THEREFORE WHEN CALCULATING THE WORD COUNT FOR A TRANSFER THE ACTUAL NUMBER OF CORE LOCATIONS ACCESED IS EQUAL TO 2X THE NUMBER LOADED IN THE WORD COUNT REGISTER.
ALSO NOTE THAT THE CONTROLLER DOES NOT APPEND PARITY TO THE BYTE BEFORE DOING A WRITE OPERATION. PARITY MUST BE CORRECT IN CORE OTHERWISE ERRORS WILL OCCUR ON
THE TRANSFER (ODD PARITY) IS ALWAYS USED.

6.0 CONSOLE SWITCH SETTINGS

SW 15 = 1 STOP AFTER EACH OPERATION (ONLY WITH START 200)
0 PROCEED

SW 14 = 1 STOP AT THE END OF EACH PROGRAM PASS (ONLY WITH START 200)
0 PROCEED

SW 7 = 1 ENABLE FOR DELAY ROUTINES (EXECUTE ROUTINE ONLY WITH START 204)
0 ALLOW SELECTION OF DELAY ROUTINES WITH SW 0-3

SW 0 THU 3 = DELAY ROUTINE) BE EXECUTED (ONLY WITH START 204)

6.1 DELAY SETUP TABLE

SWITCH SETING	DELAY NAME	MODULE TYPE	LOCATION	PRINT PAGE	INPUT PIN	OUTPUT PIN	TIME
00	NO-OP						
01	P CLR	M-302	C-06	T02-2	H2	F2	20 MILI SEC.
02	P CLR OFF	M-306	D-09	T04-1	H2	T2	900 MILI SEC.
03	ERROR CLK	M-302	C-10	T04-2	H2	F2	200 NANO SEC.
04	WRITE ENAB	M-302	C-10	T09-3	M2	T2	40 MICRO SEC.
05	BUFF CONT	M-304	B-18	T11-1	E1	J1	1 MICRO SEC.
06	END WR DAT	M-302	A-16	T11-1	M2	T2	18 MICRO SEC.
07	1ST WD REQ	M-302	A-22	T11-2	H2	F2	100 MICRO SEC.
10	ERASE	M-304	B-18	T09-3	S1	M1	1 MICRO SEC.
11	WRITE IDB	M-302	A-16	T09-1	H2	F2	17 MILI SEC.
12	IDB TIMING	M-302	D-13	T09-1	H2	F2	75 MILI SEC.
13	ABORT	M-306	A-25	T09-3	H2	T2	1.5 SEC.
14	BUSY DELAY	M-304	B-18	T05-1	R1	P1	100 NANO SEC.
15	GO BIT DEL	M-304	B-18	T06-1	D1	H1	1 MICRO SEC.
16	M.S.D.	M-302	A-22	T09-2	M2	T2	900 MILI SEC.
17	NO-OP						

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                                    ****************************
                                    *   DELAY CONDITION NOTES  *
                                    ****************************

6.2   DELAY        $$=FIXED DELAYS
      -----

          00    NO OPERATION PERFORMED WAITING SWITCH SELECTION AND ENABLE

          01    POWER CLEAR PERFORMED  NO TAPE MOTION   DELAY PULSE IS POSITIVE GOING

          02    POWER CLEAR PERFORMED  NO TAPE MOTION   DELAY PULSE IS POSITIVE GOING

          03    NO TAPE MOTION, PROGRAM FORCES AN ERROR WITH THE BGL BIT
                IN THE TR STATUS REGISTER (BIT 11)  DELAY PULSE IS POSITIVE GOING

          04    TAPE MOTION, PROGRAM DOES A SHORT ERASE WHILE MOVING TAPE
                TAPE MOTION IS NOT READILY NOTICIBLE WHILE EXECUTING THIS ROUTINE
                DELAY PULSE IS POSITIVE GOING

    $$    05    TAPE MOTION, PROGRAM DOES A 10 BYTE WRITE, PROGRAM CHECKS
                FOR LOAD POINT AND WILL WRITE AN I.D.B. BEFORE ENTERING THE
                DELAY LOOP.  DELAY PULSE IS POSITIVE GOING

          06    SAME CONDITIONS AS 05  DELAY PULSE IS POSITIVE GOING

          07    SAME CONDITIONS AS 05  DELAY PULSE IS POSITIVE GOING

    $$    10    TAPE MOTION, PROGRAM WILL CHECK FOR LOAD POINT THEN DO A
                MAXIMUM ERASE TO MAKE THE OPERATION CONTINIOUS THE PROGRAM
                WILL CLEAR THE ERASE COUNT BEFORE THE OPERATION IS DONE.
                DELAY PULSE IS NEGATIVE GOING

          11    TAPE MOTION, PROGRAM WILL CONTINIOUSLY WRITE  THE I.D.B.
                DELAY PULSE IS POSITIVE GOING

          12    SAME CONDITIONS AS DELAY 11.  DELAY PULSE IS POSITIVE GOING

          13    PROGRAM WILL REWIND TAPE TO L.P. AND FORCE AN ERROR BY DOING
                A WRITE DATA. DELAY PULSE IS POSITIVE GOING.

    $$    14    TAPE WILL MOVE TO L.P. , AND DO A MAXIMUM ERASE.
                WHILE THIS IS HAPPENING PROGRAM WILL LOAD THE COMMAND
                REGISTER TO PRODUCE A LD CTRL PULSE. DELAY PULSE IS POSITIVE GOING

    $$    15    SAME CONDITIONS AS DELAY 04.  DELAY PULSE IS NEGATIVE GOING

          16    PROGRAM WILL MOVE TAPE TO E.O.T. AND ATTEMPT TO DO A FAST
                FORWARD TO PRODUCE THE MOTION STOP DELAY. DELAY IS POSITIVE.
                NOTE: AFTER COMPLETION OF THIS ROUTINE A MANUAL REWIND
                      SHOULD BE PERFORMED.

          17    THIS IS A NO OPERATION SAME AS 00
```

7.0 OPERATION

THE PROGRAM IS QUITE SIMPLE HOWEVER IT DOES REQUIRE KNOWLEGE OF THE
OF THE TR-79 MAGTAPE SYSTEM AND AN UNDERSTANDING OF THE PROGRAM
FUNCTIONS AND RESTRICTIONS. THE CODE HAS BEEN ASSEMBLED IN IMMEDIATE
AND ABSOLUTE MODES USING PC ADRESSING. IT IS RECOMMENDED THAT THE
USER READ AND UNDERSTAND THE RESTRICTIONS AND OPERATIONS SECTIONS.

THE DRIVER PROGRAM (LOAD ADRESS 200,START SWITCHES =0) CAN BE MADEB
TO EXECUTE ANY LEGAL SEQUENCE OF OPERATIONS (SEE SECTION 7.3) BY
INSERTING THE COMMANDS IN THE OPERATIONS TABLE, (CORE LOCATIONS 722
THRU 766). EACH COMMAND SHOULD OCCUPY ONE CORE LOCATION BITS 0-4
ONLY. THE TOTAL NUMBER OF COMMANDS TO BE EXECUTED SHOULD THEN BE ENTERED
IN LOCATION 720. THE PROGRAM PARAMETERS MAY BE ALTERED BY CHANGING
THE APPROPRIATE CORE LOCATIONS (SEE SECTION 7.1). PROGRAM DEFAULT
IS A SINGLE WRITE COMMAND OF 20 WORDS OF ALL 1'S FROM LOCATION 2700
WITH MINIMUM DELAY BETWEEN OPERATIONS. THIS DEFAULT WILL NOT WORK
IF THE TAPE IS POSITIONED AT LOAD POINT.

THE DELAY PROGRAM (LOAD 20H,START SWITCHES=0) WILL EXECUTE THE DELAY
SET-UP ROUTINES TO ALLOW SET-UP OF ALL THE DELAYS IN THE TR-79 CONTROLLER
THE PROGRAM HAS AN ACTIVE SWITCH REGISTER AFTER STARTING. BY SELECTING
THE DESIRED DELAY ROUTINE IN SWITCH REGISTER 0 THRU 3, AND THEN SETTING
BIT 7 =1 THE ROUTINE WILL BEGIN EXECUTION. TO CHANGE THE DELAY ROUTINE
SET BIT 7=0, WAIT A FEW SECONDS FOR COMPLETION OF THE ROUTINE, THEN
ENTER THE NEW ROUTINE NUMBER IN BITS 0-3 AND SET BIT 7=1. THE DELAY
PROGRAM CONTAINS NO ERROR HALTS, HOWEVER IF ERRORS ARE DETECTED THE
PROGRAM WILL INFORM THE USER BY OUTPUTTING A BELL CODE TO THE CONSOLE
TERMINAL. THE PROGRAM WILL THEN DO A CONTROL RESET AND CONTINUE.

NOTE: THE PROGRAM BUILDS THE CORE DATA BUFFERS EACH TIME THE PROGRAM
IS STARTED. THE PROGRAM DEFAULT IS LOCATION 2700 HOWEVER
THIS MAY BE CHANGED BY MODIFYING LOCATION 242 IN THE CORE
BUILD ROUTINE TO PUT THE BUFFERS ANYPLACE IN THE LOWER 28K.
THIS PROGRAM DOES NOT PROGRAM THE KT AND DOES NOT RELOCATE
ABOVE THE LOWER 28K OF MEMORY.

7.1 PROGRAM PARAMETER LIST AND CORE ADRESSES

PARAMETER	LOCATION	DESCRIPTION
EXTENDED CORE ADDRESS	700	BITS 12 AND 13 OF THIS LOCATION REPRESENT XBA 16 AND XBA 17 OF THE TR CONTROL REGISTER THESE BITS ALLOW RELOCATION OF THE DATA BUFFER.
UNIT SELECT	702	BITS 8+9 IN THIS LOCATION REPRESENT THE UNIT NUMBERS OF THE TAPE DRIVES. A MAXIMUM OF 4 DRIVES PER CONTROLLER DEFAULT IS UNIT 0.
WORD COUNT	704	THIS IS THE 2'S COMPLIMENT OF THE NUMBER OF WORDS TRANSFERRED. SINCE EACH BYTE OCCUPIES A WORD LOCATION THE NUMBER OF CORE LOCATIONS USED IS 2X THE WORD COUNT. PROGRAM DEFAULT IS -20 WORDS.
READ ADRESS	706	CONTAINS ADRESS OF THE READ BUFFER. PROGRAM DEFAULT IS LOCATION 6700.
WRITE ADRESS	710	CONTAINS ADRESS OF THE WRITE BUFFER. THE PROGRAM CONTAINS 4 WRITE PATTERNS CONTIGIOUS IN CORE. LOCATION 2700 = ALL 1'S PATTERN LOCATION 3700 = ALTERNATE 1 AND 0 BYTES LOCATION 4700 = ALTERNATE 1 AND 0 BITS LOCATION 5700 = SLIDING 1 BIT PATTERN PROGRAM DEFAULT IS LOCATION 2700
ERASE COUNT	712	CONTAINS A 2'S COMPLIMENT NUMBER PROPORTIONAL TO THE AMOUNT OF TAPE TO BE ERASED. THIS NUMBER IS LOADED INTO THE WORD COUNT REGISTER PRIOR TO AN ERASE COMMAND BEING PERFORMED. PROGRAM DEFAULT IS 77777 . EACH INCREMENT CAUSES .02 INCHES OF TAPE TO BE ERASED.
OPERATION DELAY	714	CONTAINS A NUMBER USED IN A TIMER BETWEEN OPERATIONS DEFAULT =000001 MINIMUM DELAY
OPERATION DELAY MULT.	716	THIS IS USED IN CONJUNCTION WITH LOC. 714 AS A MULTIPLIER IN THE DELAY TIMER. DEFAULT IS 000001 MINIMUM DELAY. INCREASING THIS NUMBER WILL ALLOW MORE TIME BETWEEN OPERATIONS.
OPERATIONS NUMBER	720	THIS LOCATION CONTAINS THE NUMBER OF OPERATIONS TO BE PERFORMED IN THE OP TABLE. DEFAULT = 1 .
OPERATIONS TABLE	722 THRU 766	THIS IS THE BEGINNING OF THE OPERATIONS TABLE. ALL OPERATIONS TO BE PERFORMED SHOULD BE ENTERED IN THE DESIRED SEQUENCE IN THIS TABLE. DEFAULT IS A WRITE OPERATION.

7.2 ERROR CHECKS AND HALTS

LOCATION	DESCRIPTION
1320	HALT HERE IF THERE HAS AN ATTEMPT TO EXECUTE AN ILLEGAL FUNCTION, DUE TO TAPE POSITION OR SEQUENCE OF INSTRUCTIONS. THE ILLEGAL COMMAND IS DISPLAYED IN R0 WHEN THE PROGRAM HALTS. SEE SECTION 5.1B FOR ILLEGAL FUNCTIONS
1332	HALT HERE IF THERE WAS A HARDWARE ERROR ON THE PREVIOUS OPERATION IF IT IS DESIRED TO BYPASS THE ERROR FLAG NOP THIS LOCATION. THE COMMAND AND STATUS REGISTER SHOULD BE EXAMINED AT THIS TIME TO DETERMINE THE PROBABLE CAUSE OF THE ERROR. PRESSING CONTINUE WILL CLEAR THE ERROR BY EXECUTING A CONTROL RESET.
1350	HALT HERE IF YOUR OPERATION TABLE LOC.722-766 HAS AN OPERATION THAT IS NOT DEFINED IN THE LEGAL FUNCTION CODES. R0 HAS THE BAD CODE IN IT, CHECK YOUR TABLE IN LOCATIONS 722 THRU 766.
1406	HALT HERE IF BIT 15 OF THE SWR IS SET. THIS IS THE HALT BETWEEN INSTRUCTIONS.
1432	HALT HERE IF BIT 14 OF THE SWR IS SET. THIS IS THE HALT BETWEEN PASSES OF INSTRUCTIONS IN THE OP TABLE.

7.3 TABLE OF LEGAL FUNCTIONS AND CODES FOR USE IN OPERATIONS TABLE (LOC 722-766)

CODE	FUNCTION
00	**** ILLEGAL ****
01	WRITE DATA (ILLEGAL IF EXECUTED FROM LOAD POINT)
02	READ (DATA, TAPE MARK OR I.D.B.)
03	**** ILLEGAL ****
04	SPACE REVERSE (ILLEGAL IF ISSUED FROM LOAD POINT)
05	**** ILLEGAL ****
06	**** ILLEGAL ****
07	ERASE
10	REWIND (TAPE MOVES AT 160 I.P.S.) ILLEGAL IF ISSUED FROM LOAD POINT.
11	**** ILLEGAL ****
12	**** ILLEGAL ****
13	FAST FORWARD (TAPE MOVES FORWARD AT 160 I.P.S.)
14	**** ILLEGAL ****
15	WRITE I.D.B. (ILLEGAL IF ISSUED AT OTHER THAN LOAD POINT)
16	WRITE TAPE MARK (ILLEGAL IF ISSUED FROM LOAD POINT)
17	OFFLINE (REQUIRES MANUAL INTERVENTION)
20	CONTROL RESET (PROGRAM PSEUDO OP)

```
                                ;
                                ;               8.  PROGRAM LISTING
                                ;
                                ;
                                ;
                                ;
                                        .ENABLE ABS,AMA
                                                .TITLE TR79 UTILITY DRIVER
        000000                                  .ASECT
                                ;
                                ;               ***********************************
                                ;               *   GENERAL REGISTER DEFINITIONS  *
                                ;               ***********************************
                                ;
        000000                                  R0=%0
        000001                                  R1=%1
        000002                                  R2=%2
        000003                                  R3=%3
        000004                                  R4=%4
        000005                                  R5=%5
        000006                                  SP=%6
        000007                                  PC=%7
                                ;
                                ;               ******************************
                                ;               *  TR79  REGISTER DEFINITIONS  *
                                ;               ******************************
                                ;
                                ;
        164000                                  TRCOM=164000
        164002                                  TRSTAT=164002
        164004                                  TRWC=164004
        164006                                  TRBA=164006
                                ;
                                ;               ***********************************
                                ;               *  PROCESSOR REGISTER DEFINITIONS *
                                ;               ***********************************
                                ;
                                ;
        177776                                  PSW=177776
        177570                                  SWR=177570
                                ;
                                ;               *******************
                                ;               *   TTY REGISTERS   *
                                ;               *******************
                                ;
                                ;
        177564                                  TTSTAT=177564
        177566                                  TTBUF=177566
                                ;
                                ;
                                ;
                                ;
                                ;
```

```
                                ;
                                ;
                                ;       ******************
                                ;       *  TRAP CATCHERS *
                                ;       ******************
                                ;
000000                                    .=0
000200                                    .REPT  200
                                          .+2
                                          HALT
                                          .ENDR
                                ;
                                ;       ************************************
                                ;       *   STARTS AND CORE BUFFER BUILD   *
                                ;       ************************************
                                ;
000200                                    .=200
000200  000137  000230          BEGIN:    JMP @#CORBIL        ;NORMAL START
000204  005237  000356          BEGIN2:   INC @#NORST         ;SETS FLAG TO DETERMINE WHO STARTED
000210  000137  000230                    JMP @#CORBIL        ;START HERE FOR DELAY ROUTINES
000214  000777                  000777
000216  000777                  000777
000220  000400                  000400
000222  000777                  000777
000224  000525                  000525
000226  000652                  000652
000230  012701  000214          CORBIL:   MOV   #214,R1       ;SET UP PATTERN GENERATOR
000234  012703  000216                    MOV   #216,R3       ;SET UP PATTERN GENERATOR
000240  012702  002700          X1:       MOV   #2700,R2      ;SET UP ADRESS POINTER
000244  012700  177400          X2:       MOV   #177400,R0    ;SET UP COUNTER
000250  011122                  X3:       MOV   (R1),(R2)+    ;DO IT
000252  005200                            INC   R0            ;KEEP TRACK OF HOW MANY
000254  001403                            BEQ   X4            ;CHECK FOR DONE
000256  011322                            MOV   (R3),(R2)+    ;DO IT
000260  005200                            INC   R0            ;KEEP COUNTING
000262  001372                            BNE   X3            ;LOOP HERE
000264  062701  000004          X4:       ADD   #4,R1         ;NEXT PATTERN
000270  062703  000004                    ADD   #4,R3         ;GO TO NEXT PATTERN
000274  022701  000230                    CMP   #230,R1       ;DONE YET
```

```
                                        ;
                                        ;
000300  001361                 BNE     X2                      ;NOT DONE YET
000302  005000                 CLR     R0                      ;CLEAR THE PATTERN GENERATOR
000304  005001                 CLR     R1                      ;CLEAR THE PATTERN COUNTER
000306  005200                 INC     R0                      ;SET BIT IN PATTERN
000310  005201         SLB1:   INC     R1                      ;KEEP COUNT
000312  010022                 MOV     R0,(R2)+                ;PUT IT IN CORE
000314  022702  006700         CMP     #6700,R2                ;SEE IF WERE FINISHED
000320  001405                 BEQ     SLBDON                  ;YES JUMP OUT
000322  022701  000011         CMP     #11,R1                  ;CHECK ON THE BIT POSITION
000326  001765                 BEQ     SLB                     ;RESET THE SLIDING BIT
000330  006300                 ASL     R0                      ;SHIFT THE BIT
000332  000766                 BR      SLB1                    ;LOOP AGAIN
000334  005737  000356 SLBDON: TST     @#NORST                 ;SEE WHERE THE START CAME FROM
000340  001404                 BEQ     ALD                     ;IF = 0 MUST HAVE BEEN START 200
000342  005037  000356         CLR     @#NORST                 ;CLEAR IT OUTFOR NEXT TIME
000346  000137  001462         JMP     @#DRTN                  ;NOT = GO TO 204 START
000352  000137  001000 ALD:    JMP     @#START                 ;GO TO A 200 START
000356  000000 NORST:          000000                          ;TEMPORARY LOCATION
                                        ;
                                        ;               **************
                                        ;               *   STACKS   *
                                        ;               **************
                                        ;
                                                .=500
000500  000000 SUBSTK:          000000                          ;SUBROUTINE STACK
                                        ;
                                        ;
                                        ;
                                                .=600
                                ;STACK:  000000                 ;SET STACK HERE
                                        ;
                                        ;
                                        ;
```

```
                                        ;
                                        ;
                                        ;*************************************
                                        ;* PROGRAM CONSTANTS AND VARIABLES *
                                        ;*************************************
                                        ;
                    000664              .=664
000664  000000      SWRTEM:  000000       ;TEMP STORAGE FOR SWITCH REGISTER
000666  000000      TIMMUL:  000000       ;CONTAINS DELAY MULTIPLIERS
000670  000000      COMTEM:  000000       ;TEMP STORAGE FOR COMMAND REGISTER
000672  000000      STTEM:   000000       ;TEMP STORAGE FOR STATUS REGISTER
000674  000000      TEMP1:   000000       ;TEMP STORAGE FOR THE NUMBER OF OPERATIONS TO BE PERFORMED
000676  000000      TEMP2:   000000       ;TEMP STORAGE FOR THE OPERATION BIENG PERFORMED
000700  000000      EXTCOR:  000000       ;BITS 12 AND 13 ARE XBA 16AND XBA 17
000702  000000      UNIT:    000000       ;UNIT SELECT BITS 8 AND 9
000704  177760      WCNT:    -20          ;WORD COUNT
000706  006700      RADDR:   006700       ;START OF READ BUFFER
000710  002700      WADDR:   002700       ;START OF WRITE BUFFER
000712  177777      ERSCNT:  177777       ;CONTAINS LENGTH OF ERASURE WHEN DOING AN ERASE
000714  000001      OPDLY:   000001       ;OPERATION DELAY
000716  000001      OPDLX:   000001       ;OPERATION DELAY MULTIPLIER
000720  000001      OPNUM:   000001       ;NUMBER OF OPERATIONS TO BE PERFORMED
                                        ;
                                        ;*************************************************
                                        ;*  TABLE OF OPERATIONS TO BE PERFORMED MAX =23 *
                                        ;*************************************************
                                        ;
000722  000001      OPTBL:     1          ;1ST OPERATION
000724  000000                 0          ;2ND OPERATION
000726  000000                 0          ;3RD OPERATION
000730  000000                 0          ;4TH OPERATION
000732  000000                 0          ;5TH OPERATION
000734  000000                 0          ;6TH OPERATION
000736  000000                 0          ;7TH OPERATION
000740  000000                 0          ;10TH OPERATION
000742  000000                 0          ;11TH OPERATION
000744  000000                 0          ;12TH OPERATION
000746  000000                 0          ;13TH OPERATION
000750  000000                 0          ;14TH OPERATION
000752  000000                 0          ;15TH OPERATION
000754  000000                 0          ;16TH OPERATION
000756  000000                 0          ;17TH OPERATION
000760  000000                 0          ;20TH OPERATION
000762  000000                 0          ;21ST OPERATION
000764  000000                 0          ;22ND OPERATION
000766  000000                 0          ;23RD OPERATION
                                        ;
                                        ;
                                        ;
```

```
                                ;
                                ;               ************************************************
                                ;               *   HOUSE KEEPING AND INITIAL PROGRAM PARAMETERS  *
                                ;               ************************************************
                                ;
                                ;                                .=1000
001000  012706  000600          ;START:  MOV  #600,SP           ;SET UP STACK AT LOC, 600
001004  012737  000340  177776  ;        MOV  #340,@#PSW        ;SET PRIORITY LEVEL 7 NO INTERRUPTS ALLOWED
001012  032737  004000  164000  ;1$:     BIT  #4000,@#TRCOM     ;WAIT FOR THE INITIAL 900 MS.POWER CLEAR TO SUBSIDE
001020  001374                  ;        BNE  1$                ;LOOP UNTILL CONTROL IS READY
001022  013701  000720          ;        MOV  @#OPNUM,R1        ;R1 CONTAINS HOW MANY OPERATIONS WILL BE DONE
001026  042737  176377  000702  ;UNUM:   BIC  #176377,@#UNIT   ;STRIP OFF EVERYTHING EXCEPT BITS 8 AND 9 TO SET UP UNI
                                ;
                                ;               ************************************
                                ;               *   SET UP OPERATIONS COMPARITOR  *
                                ;               ************************************
                                ;
001034  012702  000722          ;        MOV  #OPTBL,R2         ;R2 CONTAINS THE POINTER TO THE START OF THE OPERATINS
001040  012737  000011  000674  ;LOOP:   MOV  #9.,@#TEMP1       ;THE NUMBER OF LEAGAL OPERATIONS
001046  012703  001440          ;        MOV  #LEGOPS,R3        ;POINTER TO THE BEGINNING OF THE LEGAL OPERATIONS COMPA
001052  012237  000676          ;        MOV  (R2)+,@#TEMP2     ;GET THE OPERATION AND PUT IT IN TEMP 2
001056  023723  000676          ;2$:     CMP  @#TEMP2,(R3)+     ;CHECK IT AGAINST THE LEGAL FUNCTIONS
001062  001422                  ;        BEQ  CLINH             ;IF ITS LEGAL CONTINUE TO EXECUTE IT
001064  005337  000674          ;        DEC  TEMP1             ;WASN'T THAT OPERATION SUBTRACT 1
001070  001372                  ;        BNE  2$                ;TRY NEXT ONE
```

```
                                ;
                                ;
                                ;
                                ;                       ***********************************
                                ;                       *   CHECK FOR A CONTROL RESET   *
                                ;                       ***********************************
                                ;
001072  022737  000020  000676          CMP   #20,@#TEMP2       ;SEE IF ITS A CONTROL RESET (PSEUDO OP)
001100  001402                         BEQ   CRES              ;MUST BE A CONTROL RESET JUMP TO CRES
001102  000137  001344                 JMP   @#ILFUT           ;IT MUST BE ILLEGAL FUNCTION STOP THE PROGRAM
001106  052737  004000  164000  CRES:  BIS   #4000,TRCOM       ;MUST BE A POWER CLEAR SO DO IT TAKES 900 MILI SECONDS
001114  032737  004000  164000  3$:    BIT   #4000,TRCOM       ;SEE IF DONE WITH POWER CLEAR YET
001122  001374                         BNE   3$                ;WAIT UNTILL DONE
001124  000137  001264                 JMP   FUDONE            ;GET BACK INTO PROGRAM
                                ;
                                ;                       ************************************************
                                ;                       *   CLEAR INHIBIT BIT AND SET UP OPERATION   *
                                ;                       ************************************************
                                ;
001130  005037  164002          CLINH: CLR   @#TRSTAT           ;CLEAR OUT THE INHIBIT BIT
001134  162703  001442                 SUB   #LEGOPS+2,R3       ;GET AN OFFSET VALUE
001140  060307                         ADD   R3,PC              ;ADD IT TO THE PC AND GO THERE
                                ;
                                ;                       ***********************************
                                ;                       *   OPERATIONS DIRECTORY TABLE    *
                                ;                       ***********************************
                                ;
001142  000422          W:     BR    WRITE              ;WRITE INSTRUCTION
001144  000425          R:     BR    READ               ;READ INSTRUCTION
001146  000401          SR:    BR    .+4                ;SPACE REVERSE INSTRUCTION
001150  000432          ER:    BR    ERSE               ;ERASE COMMAND
001152  000240          REWD:  NOP                      ;REWIND COMMAND
001154  000240          FFOR:  NOP                      ;FAST FORWARD COMMAND
001156  000240          IDB:   NOP                      ;WRITE ID BURST
001160  000240          WTM:   NOP                      ;WRITE TAPE MARK
```

```
                                ;
                                ;
                                ;                       ************************************
                                ;                       *   SET UP UNIT NUMBER AND GO BIT  *
                                ;                       ************************************
                                ;
001162  006337  000676          ;SGOB:      ASL  @#TEMP2            ;SHIFT THE FUNCTION INTO THE PROPER BIT POSITIONS
001166  053737  000702  000676  ;           BIS  @#UNIT,@#TEMP2     ;SET THE UNIT # BITS
001174  053737  000700  000676  ;           BIS  @#EXTCOR,@#TEMP2   ;SET THE MEMORY EXTENSION BITS
001202  005237  000676          ;           INC  @#TEMP2            ;SET THE GO BIT
001206  000417                  ;           BR   EXECUT             ;JUMP TO THE EXECUTION ROUTINE
                                ;
                                ;
                                ;
                                ;                     ***********************************
                                ;                     *   OPERATIONS SETUP ROUTINES   *
                                ;                     ***********************************
                                ;
001210  013737  000710  164006  ;WRITE:    MOV  @#WADDR,@#TRBA     ;SET UP WRITE BUFFER AREA
001216  000403                  ;           BR   WR1WC              ;CONTINUE ON TO SET UP W.C.
001220  013737  000706  164006  ;READ:     MOV  @#RADDR,@#TRBA     ;SET UP READ BUFFER ADRESS
001226  013737  000704  164004  ;WR1WC:    MOV  @#WCNT,@#TRWC      ;SET UP WORD COUNT
001234  000752                  ;           BR   SGOB               ;SET UP GO BIT
001236  013737  000712  164004  ;ERSE:     MOV  @#ERSCNT,@#TRWC    ;SET NUMBER TO INDICATE AMOUNT OF TAPE TO BE ERASED
001244  000746                  ;           BR   SGOB               ;SET UP GO BIT
                                ;
                                ;
                                ;                  ***************************************************************
                                ;                  *   ROUTINE TO EXECUTE THE FUNCTION AND CHECK FOR DONE  *
                                ;                  ***************************************************************
                                ;
001246  000240                  ;EXECUT:    NOP
001250  013737  000676  164000  ;           MOV  @#TEMP2,@#TRCOM    ;DO THE FUNCTION
001256  105737  164000          ;7$:        TSTB @#TRCOM            ;SEE IF DONE YET
001262  100375                  ;           BPL  7$                 ;WAIT FOR IT
                                ;
```

```
                                ;
                                ;                    ********************************************
                                ;                    *   ROUTINE TO CHECK FUNCTION WHEN DONE    *
                                ;                    ********************************************
                                ;
001264  013737  164002  000672 FUDONE:  MOV  @#TRSTAT,@#STTEM  ;SAVE STATUS
001272  013737  164000  000670          MOV  @#TRCOM,@#COMTEM  ;SAVE COMMAND REGISTER
001300  032737  040000  000670          BIT  #40000,@#COMTEM   ;WAS IT AN ILLEGAL COMMAND DUE TO SEQUENCE OR TAPE POSI
001306  001405                          BEQ  ERDONE            ;NO ERROR HERE
001310  006237  000676        ILLCOM:   ASR  @#TEMP2           ;STRIP OFF THE GO BIT
001314  013700  000676                  MOV  @#TEMP2,R0        ;PUT BAD COMMAND IN R0
001320  000000                ERR14:    HALT                   ; STOP WITH BAD COMMAND DISPLAYED
001322  032737  100000  000670 ERDONE:  BIT  #100000,@#COMTEM  ;SEE IF ERROR BIT IS SET
001330  001410                          BEQ  OPDEL             ;NO ERRORS CONTINUE
001332  000000                ERR15:    HALT                   ;GOT AN ARROR NOP THIS HALT TO CONTINUE
001334  000137  001106                  JMP  @#CRES            ;IF YOU GOT AN ERROR ONLY RECOVERY IS WITH A CONTROL RE
001340  006237  000676        ILLFUN:   ASR  @#TEMP2           ;STRIP OFF GO BIT
001344  013700  000676        ILFUT:    MOV  @#TEMP2,R0        ;PUT THE BAD CODE IN R0 TO DISPLAY WHEN HALTED
001350  000000                ERRIF:    HALT                   ;GOT AN ILLEGAL FUNCTION CHECK YOUR PROGRAM LOCATION 72
                                ;
                                ;
```

```
                        ;
                        ;               ********************************************
                        ;               *   OPERATION DELAY BETWEEN INSTRUCTIONS   *
                        ;               ********************************************
                        ;
001352  013737  000716  000666 OPDEL:   MOV   @#OPDLX,@#TIMMUL ;SET OP OPERATIONS DELAY MULTIPLIER
001360  013700  000714         MOV   @#OPDLY,R0        ;SET UP OPERATIONS DELAY TIMER
001364  005300         8$:     DEC   R0                ;TIMER IS TICKING
001366  001376                 BNE   8$                ;GET MORE TIME
001370  005337  000666         DEC   @#TIMMUL          ;COUNT DOWN THE MULTIPLIER
001374  001373                 BNE   8$                ;GET MORE TIME
001376  032737  100000  177570 BIT   #100000,@#SWR     ;TIMES UP CHECK SWITCHES TO SEE IF WE HALT OR CONTINUE
001404  001401                 BEQ   .+4               ;DONT STOP NOW SKIP THE HALT
001406  000000         INSHLT: HALT                    ;STOP BETWEEN INSTRUCTIONS
001410  005301                 DEC   R1                ;-1 FROM THE NUMBER OF OPERATIONS IN R1
001412  001001                 BNE   9$                ;GO AND DO THE NEXT INSTRUCTION
001414  000401                 BR    .+4               ;SKIP THE JUMP
001416  000137  001040 9$:     JMP   @#LOOP            ;DO THE LOOP AGAIN
001422  032737  040000  177570 BIT   #40000,@#SWR      ;CHECK SWITCHES TO SEE IF WE WANT TO STOP AT END OF PAS
001430  001401                 BEQ   REST              ;DO THE NEXT PASS SKIP THE HALT
001432  000000         PASHLT: HALT                    ;STOP BETWEEN PASSES
001434  000137  001000 REST:   JMP   @#START           ;GO DO IT AGAIN (NEXT PASS)
                        ;
                        ;               ****************************************
                        ;               *   LEGAL OPERATIONS COMPARITOR TABLE  *
                        ;               ****************************************
                        ;
001440  000001 LEGOPS:  00001                   ;WRITE
001442  000002          00002                   ;READ
001444  000004          00004                   ;SPACE REVERSE
001446  000007          00007                   ;ERASE
001450  000010          00010                   ;REWIND
001452  000013          00013                   ;FAST FORWARD
001454  000015          00015                   ;WRITE ID B
001456  000016          00016                   ;WRITE TAPE MARK
001460  000017          00017                   ;OFFLINE
                        ;
```

```
                                ;
                                ;                    ************************************
                                ;                    *   DELAY SET-UP PROGRAM ROUTINES  *
                                ;                    ************************************
                                ;
                    001462                              .=1462
001462  012706  000600          DRTN:       MOV   #600,SP           ;SET STACK
001466  012705  000500                      MOV   #500,R5           ;SET UP SUBROUTINE STACK
001472  012737  000340  177776              MOV   #340,@#PSW        ;SET PRIORITY 7 NO INTERRUPTS ALLOWED
001500  032737  004000  164000  DROUTS:     BIT   #4000,@#TRCOM     ;CHECK FOR INITIAL POWER CLEAR TO SUBSIDE
001506  001774                              BEQ   DROUTS            ;WAIT TILL DONE
001510  013737  177570  000664  BR1:        MOV   @#SWR,@#SWRTEM    ;GET SWITCHES AND PUT THEM IN STORAGE
001516  105737  000664                      TSTB  @#SWRTEM          ;SEE IF ENABLE IS UP YET
001522  100372                              BPL   BR1               ;LOOP UNTILL ENABLE IS UP
001524  042737  177760  000664              BIC   #177760,@#SWRTEM  ;MASK BITS AND GET A NUMBER BETWEEN 0-16
001532  006337  000664                      ASL   @#SWRTEM          ;SHIFT IT LEFT TO MULTIPLY BY 2
001536  006337  000664                      ASL   @#SWRTEM          ;SHIFT AGAIN MULTIPLY BY 2 TO GET OFFSET
001542  063707  000664                      ADD   @#SWRTEM,PC       ;ADD IT TO THE PC AND GO THERE
                                ;
                                ;
```

```
                                        ;
                                        ;
                                        ;                               ***********************************************
                                        ;                               *   INDEX TABLE OF DELAY PROGRAM DIRECTIVES   *
                                        ;                               ***********************************************
                                        ;
                                        ;
001546  000137  001510                  TABLE:          JMP     @#BR1                   ;DELAY 0 IS A NO-OP
001552  000137  001646                                  JMP     @#[illegible]R2         ;DELAY 1 IS FOR POWER CLEAR
001[illegible]6  000137  001646                         JMP     @#BR2                   ;DELAY 2 IS FOR POWER CLEAR
001[illegible]2  0[illegible]0137  001672               JMP     @[illegible]R3          ;DELAY 3 IS FOR E[illegible]OR CLK
001[illegible]6  000137  001732                         JMP     @#[illegible]R4         ;DELAY 4 IS FOR WRITE ENABLE
001572  000137  001774                                  JMP     @#[illegible]R5         ;DELAY 5 IS FOR OUT BUFF FLAG
001576  000137  001774                                  JMP     @#BR5                   ;DELAY 6 IS FOR END WRITE DATA
001602  000137  001774                                  JMP     @#BR5                   ;DELAY 7 IS FOR FIRST WORD WRITE REQUEST
001606  000137  002130                                  JMP     @#BR10                  ;DELAY 10 IS FOR ERASE
001612  000137  002204                                  JMP     @#BR11                  ;DELAY 11 IS FOR WRITE I.D.B.
001616  000137  002204                                  JMP     @#BR11                  ;DELAY 12 IS FOR I.D.B. TIMING
001622  000137  002324                                  JMP     @#BR16                  ;DELAY 13 IS FOR ABORT WINDOW
001626  000137  002050                                  JMP     @#BR6                   ;DELAY 14 IS FOR LD CTRL + BUSY
001632  000137  001732                                  JMP     @#BR4                   ;DELAY 15 IS FOR GO PULSE DELAY
001636  000137  002244                                  JMP     @#BR14                  ;DELAY 16 IS FOR M.S.D. DELAY
001642  000137  001510                                  JMP     @#BR1                   ;DELAY 17 IS A NO-OP
                                        ;
                                        ;
                                        ;
                                        ;
```

```
                                ;                ************************************
                                ;                *   ROUTINE FOR DELAYS 1 AND 2   *
                                ;                ************************************
                                ;
001646  004537  002452          ;BR2:      JSR  R5,@#PCL          ;DO A POWER CLEAR
001652  005000                  ;          CLR  R0                ;CLEAR THE TIMER
001654  005300                  ;BR2A:     DEC  R0                ;TIMER IS TICKING
001656  001376                  ;          BNE  BR2A              ;WAIT TILL ITS DONE
001660  105737  177570          ;          TSTB @#SWR             ;CKECK FOR A LOOP
001664  100770                  ;          BMI  BR2               ;DO IT AGAIN
001666  000137  001510          ;          JMP  @#BR1             ;GET NEXT TEST
                                ;
                                ;                ****************************
                                ;                *   ROUTINE FOR DELAY 3    *
                                ;                ****************************
                                ;
001672  012700  000070          ;BR3:      MOV #70,R0             ;SET UP DELAY MULTIPLIER
001676  052737  004000  164002  ;          BIS #4000,@#TRSTAT     ;FORCE AN ERROR WITH B.G.L. BIT
001704  005300                  ;13$:      DEC R0                 ;TIMER IS TICKING
001706  001376                  ;          BNE 13$                ;CHECK TIMER
001710  005037  164002          ;          CLR @#TRSTAT           ;OK NOW CLEAR THE BIT
001714  105737  177570          ;          TSTB @#SWR             ;SEE IF WE WANT TO DO IT AGAIN
001720  100764                  ;          BMI  BR3               ;OK LOOP BACK
001722  004537  002452          ;          JSR  R5,@#PCL          ;DONE HERE DO A POWER CLEAR AND GET THE NEXT ONE
001726  000137  001510          ;          JMP  @#BR1             ;GET THE NEXT DELAY DIRECTIVE
                                ;
                                ;                ************************************
                                ;                *   ROUTINE FOR DELAY 4 AND 15   *
                                ;                ************************************
                                ;
001732  004537  002472          ;BR4:      JSR  R5,@#RDY          ;CHECK FOR READY
001736  012737  177777  164004  ;BR4A:     MOV  #-1,@#TRWC        ;THIS NUMBER IS USED FOR AN ERASE COUNT
001744  012737  000017  164000  ;          MOV  #17,@#TRCOM       ;DO THE ERASE
001752  004537  002472          ;          JSR  R5,@#RDY          ;WAIT TILL DONE
001756  004537  002510          ;          JSR  R5,@#ERCK         ;SEE IF WE ERRORED OUT
001762  105737  177570          ;          TSTB @#SWR             ;SEE IF WE LOOPON TEST
001766  100763                  ;          BMI  BR4A              ;LOOP HERE AND DO IT AGAIN
001770  000137  001510          ;          JMP  @#BR1             ;GET OUT AND GET NEXT DELAY DIRECTIVE
```

```
                                ;
                                ;               ****************************************
                                ;               *   ROUTINE FOR DELAY 5 , 6 AND 7      *
                                ;               ****************************************
                                ;
001774  004537  002540          BR5:    JSR   R5,@#OFLP         ;SEE IF WE ARE AT LOAD POINT
002000  005037  164002                  CLR   @#TRSTAT          ;CLEAR INHIBIT BIT
002004  012737  177774  164004  BR5A:   MOV   #-4,@#TRWC        ;SET UP FOR A 10 BYTE WRITE
002012  013737  000710  164006          MOV   @#WADDR,@#TRBA    ;SET UP THE WRITE ADRESS BUFFER
002020  012737  000003  164000          MOV   #3,@#TRCOM        ;DO THE WRITE
002026  004537  002472                  JSR   R5,@#RDY          ;WAIT FOR READY
002032  004537  002510                  JSR   R5,@#CRCK         ;CHECK FOR ERRORS
002036  105737  177570                  TSTB  @#SWR             ;SEE IF WE WANT TO LOOP
002042  100760                          BMI   BR5A              ;LOOP HERE AND DO IT AGAIN
002044  000137  001510                  JMP   @#BR1             ;GET OUT AND GET NEXT DELAY DIRECTIVE
                                ;
                                ;               ******************************
                                ;               *   ROUTINE FOR DELAY 14     *
                                ;               ******************************
                                ;
002050  004537  002574          BR6:    JSR   R5,@#REW          ;DO A REWIND GET TO B.O.T.
002054  004537  002624          BR6C:   JSR   R5,@#ETS          ;CHECK FOR END OF TAPE ANYWAY
002060  005037  164002                  CLR   @#TRSTAT          ;CLEAR THE INHIBIT BIT
002064  005037  164004                  CLR   @#TRWC            ;CLEAR THE WORD COUNT
002070  012737  000017  164000          MOV   #17,@#TRCOM       ;DO AN ERASE
002076  005037  164000  BR6A:   CLR   @#TRCOM          ;FORCE A LOAD PULSE
002102  105737  177570                  TSTB  @#SWR             ;SEE IF WE WANT TO LOOP
002106  100004                          BPL   BR6B              ;ALL DONE
002110  105737  164000                  TSTB  @#TRCOM           ;SEE IF ERASE IS DONE YET
002114  100370                          BPL   BR6A              ;NOT DONE DO ANOTHER LOAD PULSE
002116  000756                          BR    BR6C              ;DO IT AGAIN
002120  004537  002452  BR6B:   JSR   R5,@#PCL          ;DO A CLEAR AND EXIT
002124  000137  001510                  JMP   @#BR1             ;GO BACK TO MAIN
```

```
                                        ;
                                        ;
                                        ;                    ******************************
                                        ;                    *   ROUTINE FOR DELAY  10    *
                                        ;                    ******************************
                                        ;
002130  004537  002624          BR10:   JSR     R5,@#ETS        ;CHECT FOR E.O.T.
002134  004537  002540                  JSR     R5,@#OFLP       ;GET US OFF LOAD POINT
002140  005037  164002                  CLR     @#TRSTAT        ;CLEAR INHIBIT
002144  012737  000017  164000          MOV     #17,@#TRCOM     ;DO A MAXIMUM ERASE
002152  012700  005000          BR10A:  MOV     #5000,R0        ;SET UP COUNTER
002156  005300                  BR10B:  DEC     R0              ;START COUNTDOWN
002160  001376                          BNE     BR10B           ;TIMER IS TICKING
002162  005037  164004                  CLR     @#TRWC          ;RE ESTABLISH THE ERASE COUNT TO 0
002166  105737  177570                  TSTB    @#SWR           ;SEE IF WE LOOP HERE
002172  100767                          BMI     BR10A           ;DO IT AGAIN
002174  004537  002452                  JSR     R5,@#PCL        ;DO A POWER CLEAR
002200  000137  001510                  JMP     @#BR1           ;GET OUT AND GET THE NEXT DELAY DIRECTIVE
                                        ;
                                        ;
                                        ;
                                        ;
                                        ;
```

```
                                ;
                                ;               ************************************
                                ;               *   ROUTINE FOR DELAY 11 AND 12    *
                                ;               ************************************
                                ;
 002204  004537  002574         BR11:   JSR     R5,@#REW        ;DO A REWIND
 002210  012737  000033  164000         MOV     #33,@#TRCOM     ;WRITE AN I.D.B.
 002216  004537  002472                 JSR     R5,@#RDY        ;CHECK FOR DONE
 002222  004537  002510                 JSR     R5,@#ERCK       ;SEE IF ANY ERRORS UP
 002226  105737  177570                 TSTB    @#SWR           ;SEE IF WE WANT TO LOOP
 002232  100764                         BMI     BR11            ;LOOP BACK DO IT AGAIN
 002234  004537  002452                 JSR     R5,@#PCL        ;DO A POWER CLEAR
 002240  000137  001510                 JMP     @#BR1           ;GET OUT AND GET NEXT DELAY DIRECTIVE
                                ;
                                ;
                                ;
                                ;
                                ;               ******************************
                                ;               *   ROUTINE FOR DELAY  16    *
                                ;               ******************************
                                ;
 002244  105737  164002         BR14:   TSTB    @#TRSTAT        ;CHECK FOR EOT UP
 002250  100407                         BMI     BR14A           ;SKIP THE FAST FORWARD
 002252  005037  164002                 CLR     @#TRSTAT        ;CLEAR INHIBIT
 002256  012737  000027  164000         MOV     #27,@#TRCOM     ;DO A FAST FORWARD
 002264  004537  002472                 JSR     R5,@#RDY        ;WAIT TILL DONE
 002270  005037  164002         BR14A:  CLR     @#TRSTAT        ;CLEAR INHIBIT
 002274  012737  000027  164000         MOV     #27,@#TRCOM     ;TRY A FAST FORWARD ,SHOULD PRODUCE ERROR
 002302  004537  002472                 JSR     R5,@#RDY        ;WAIT TILL DONE
 002306  105737  177570                 TSTB    @#SWR           ;SEE IF WE LOOP HERE
 002312  100766                         BMI     BR14A           ;YES LOOP HERE
 002314  004537  002452                 JSR     R5,@#PCL        ;DO A POWER CLEAR
 002320  000137  001510                 JMP     @#BR1           ;GET OUT DO NEXT DELAY
                                ;
```

```
1028                                    ;
1029                                    ;              ****************************
1030                                    ;              *   ROUTINE FOR DELAY  13  *
1031                                    ;              ****************************
1032                                    ;
1033  002324  004537  002574           BR16:   JSR   R5,@#REW          ;DO A REWIND
1034  002330  005037  164002                   CLR   @#TRSTAT          ;CLEAR INHIBIT
1035  002334  012737  177000  164004           MOV   #177000,@#TRWC    ;SET UP ERASE COUNT
1036  002342  012737  000017  164000           MOV   #17,@#TRCOM       ;DO AN ERASE
1037  002350  004537  002472                   JSR   R5,@#RDY          ;WAIT FOR IT
1038  002354  004537  002574                   JSR   R5,@#REW          ;REWIND IT
1039  002360  004537  002540                   JSR   R5,@#OFLP         ;GET OFF LOAD POINT LEGALLY
1040  002364  012737  177760  164004  BR16A:   MOV   #-20,@#TRWC      ;SET UP W.C.
1041  002372  012737  003600  164006           MOV   #3600,@#TRBA      ;SET UP CORE ADDRESS
1042  002400  005037  164002                   CLR   @#TRSTAT          ;CLEAR THE INHIBIT
1043  002404  012737  000003  164000           MOV   #3,@#TRCOM        ;NOW TRY TO WRITE NOTHING,SHOULD ABORT
1044  002412  012701  000010           BR16B:  MOV   #10,R1            ;SET UP TIME MULTIPLIER
1045  002416  005000                   BR16D:  CLR   R0                ;CLEAR TIMER
1046  002420  005200                   BR16C:  INC   R0                ;TIMES WAISTING
1047  002422  001376                           BNE   BR16C             ;TIMER RUNNING
1048  002424  005301                           DEC   R1                ;-1 FROM MULTIPLIER
1049  002426  001373                           BNE   BR16D             ;SEE IF DONE YET
1050  002430  004537  002452                   JSR   R5,@#PCL          ;CLEAR ERRORS
1051  002434  105737  177570                   TSTB  @#SWR             ; LOOP ???
1052  002440  100751                           BMI   BR16A             ;DO IT AGAIN
1053  002442  004537  002452                   JSR   R5,@#PCL          ;POWER CLEAR
1054  002446  000137  001510                   JMP   @#BR1             ;ALL DONE GET SOME MORE
1055                                    ;
```

```
                                ;
                                ;
                                ;
                                ;                       ***********************************
                                ;                       *   SUBROUTINE FOR POWER CLEAR    *
                                ;                       ***********************************
                                ;
002452  052737  004000  164000  PCL:    BIS   #4000,@#TRCOM       ;SET POWER CLEAR
002460  032737  004000  164000  PCL1:   BIT   #4000,@#TRCOM       ;WAIT FOR 900 MILI SECONDS
002466  001374                        BNE   PCL1                  ;STILL WAITING
002470  000205                        RTS   R5                    ;RETURN TO MAIN ROUTINE
                                ;
                                ;
                                ;           ***********************************************
                                ;           *   SUBROUTINE FOR READY AND CLEAR INHIBIT    *
                                ;           ***********************************************
                                ;
002472  105737  164000          RDY:    TSTB  @#TRCOM             ;CHECK ON DONE BIT
002476  100375                        BPL   RDY                   ;WAIT TILL DONE
002500  042737  000001  164002  INB:    BIC   #1,@#TRSTAT         ;CLEAR THE INHIBIT BIT
002506  000205                        RTS   R5                    ;RETURN TO MAIN ROUTINE
                                ;
                                ;
                                ;
                                ;           ***************************************
                                ;           *   SUBROUTINE TO CHECK FOR ERRORS    *
                                ;           ***************************************
                                ;
002510  005737  164000          ERCK:   TST   @#TRCOM             ;SEE IF ERROR IS UP
002514  100010                        BPL   ERCK2                 ;NO ERRORS JUMP OUT
002516  012737  000007  177566        MOV   #7,@#TTBUF            ;GOT AN ERROR RING A BELL
002524  105737  177564          ERCK1:  TSTB  @#TTSTAT            ;WAIT HERE
002530  100375                        BPL   ERCK1                 ;WAIT HERE
002532  004537  002452                JSR   R5,@#PCL              ;CLEAR THE ERROR WITH A POWER CLEAR
002536  000205                  ERCK2:  RTS   R5                    ;GO BACK TO MAIN
                                ;
```

```
1098
1099
1100                            ;*************************************************
1101                            ;*   SUBROUTINE TO GET OFF LOAD POINT LEGALLY    *
1102                            ;*************************************************
1103
1104
1105  002540  032737  000040  164002  OFLP:   BIT   #40,@#TRSTAT          ;SEE IF LOAD POINT IS UP
1106  002546  001411                  BEQ   OFLP1                     ;NO LP JUMP OUT
1107  002550  005037  164002          CLR   @#TRSTAT                  ;CLEAR THE INHIBIT
1108  002554  012737  000033  164000  MOV   #33,@#TRCOM               ;WRITE AN I.D.B.
1109  002562  004537  002472          JSR   R5,@#RDY                  ;WAIT FOR READY
1110  002566  004537  002510          JSR   R5,ERCK                   ;CHECK FOR ERRORS
1111  002572  000205                  OFLP1:  RTS   R5                ;GO BACK TO MAIN
1112
1113
1114
1115                                    ;*************************************
1116                                    ;*   SUBROUTINE FOR REWIND AND L.P.  *
1117                                    ;*************************************
1118
1119  002574  032737  000040  164002  REW:    BIT   #40,@#TRSTAT          ;AT LOAD POINT??
1120  002602  001007                  BNE   REW2                      ;YES DON'T NEED REWIND
1121  002604  005037  164002          REW1:   CLR   @#TRSTAT          ;CLR THE INHIBIT
1122  002610  012737  000021  164000  MOV   #21,@#TRCOM               ;DO A REWIND
1123  002616  004537  002472          JSR   R5,@#RDY                  ;WAIT TILL DONE
1124  002622  000205                  REW2:   RTS   R5                ;GO BACK
1125
1126                                    ;*****************************
1127                                    ;*   SUBROUTINE FOR E.O.T.   *
1128                                    ;*****************************
1129
1130  002624  105737  164002  ETS:    TSTB  @#TRSTAT                  ;IS END OF TAPE UP ?
1131  002630  100002                  BPL   ETS1                      ;NOT AT E.O.T.
1132  002632  004537  002574          JSR   R5,@#REW                  ;DO A REWIND
1133  002636  000205                  ETS1:   RTS   R5                ;GET BACK
1134
1135
1136
```

```
                        ;
                        ;       ******************************
                        ;       *   WRITE BUFFER PATTERNS    *
                        ;       ******************************
                        ;
                        ;
                        ;         .=2700
                        ;         .REPT   1000          ;ALL 1'S
                        ;         .WORD   000777        ;PATTERN = 0 000 000 111 111 111
                        ;         .ENDR
                        ;
                        ;
                        ;         .=3700
                        ;         .REPT   1000          ;1'S AND 0'S ALTERNATE WORDS
                        ;         .WORD   000400        ;PATTERN = 0 000 000 100 000 000
                        ;         .WORD   000777        ;PATTERN = 0 000 000 111 111 111
                        ;         .ENDR
                        ;
                        ;
                        ;         .=4700
                        ;         .REPT   1000          ;ALTERNATE BITS
                        ;         .WORD   000525        ;PATTERN = 0 000 000 101 010 101
                        ;         .WORD   000652        ;PATTERN = 0 000 000 110 101 010
                        ;         .ENDR
                        ;
                        ;
                        ;         .=5700
                        ;         .REPT   1000          ;SLIDING 1 BIT
                        ;         .WORD   000001        ;PATTERN = 0 000 000 000 000 001
                        ;         .WORD   000002        ;PATTERN = 0 000 000 000 000 010
                        ;         .WORD   000004        ;PATTERN = 0 000 000 000 000 100
                        ;         .WORD   000010        ;PATTERN = 0 000 000 000 001 000
                        ;         .WORD   000020        ;PATTERN = 0 000 000 000 010 000
                        ;         .WORD   000040        ;PATTERN = 0 000 000 000 100 000
                        ;         .WORD   000100        ;PATTERN = 0 000 000 001 000 000
                        ;         .WORD   000200        ;PATTERN = 0 000 000 010 000 000
                        ;         .WORD   000400        ;PATTERN = 0 000 000 100 000 000
                        ;         .ENDR
                        ;
                        ;       ************************
                        ;       *   READ BUFFER AREA   *
                        ;       ************************
                        ;
                        ;         .=6700                ;1000 WORD LOCATIONS RESERVED FOR READ BUFFER
                        ;
000001                  ;         .END
```

```
TR79 UTILITY DRIVER     MACY11 27(1006)  12-APR-77  13:25  PAGE 2                                                    SEQ 0030
DZTRBC.P11    29-MAR-77 07:58          SYMBOL TABLE

ALD     000352          BR6     002050          EXECUT  001246          PCL1    002460          TEMP1   000674
BEGIN   000200          BR6A    002076          EXTCOR  000700          PSW   = 177776          TEMP2   000676
BEGIN2  000204          BR6B    002120          FFOR    001154          R       001144          TIMMUL  000666
BR1     001510          BR6C    002054          FUDONE  001264          RADDR   000706          TRBA  = 164006
BR10    002130          CLINH   001130          IDB     001156          RDY     002472          TRCOM = 164000
BR10A   002152          COMTEM  000670          IHB     002500          READ    001220          TRSTAT= 164002
BR10B   002156          CORBIL  000230          ILFUT   001344          REST    001434          TRWC  = 164004
BR11    002204          CRES    001106          ILLCOM  001310          REW     002574          TTBUF = 177566
BR14    002244          DROUTS  001500          ILLFUN  001340          REWD    001152          TTSTAT= 177564
BR14A   002270          DRTN    001462          INSHLT  001406          REWI    002604          UNIT    000702
BR16    002324          ER      001150          LEGOPS  001440          REWZ    002622          UNUM    001026
BR16A   002364          ERCK    002510          LOOP    001040          SGOB    001162          W       001142
BR16B   002412          ERCK1   002524          NORST   000356          SLB     000302          WADDR   000710
BR16C   002420          ERCK2   002536          OFLP    002540          SLBDON  000334          WCNT    000704
BR16D   002416          ERDONE  001322          OFLP1   002572          SLB1    000310          WRITE   001210
BR2     001646          ERRIF   001350          OPDEL   001352          SR      001146          WRIWC   001226
BR2A    001654          ERR14   001320          OPDLX   000716          START   001000          WTM     001160
BR3     001672          ERR15   001332          OPDLY   000714          STTEM   000672          X1      000240
BR4     001732          ERSCNT  000712          OPNUM   000720          SUBSTK  000500          X2      000244
BR4A    001736          ERSE    001236          OPTBL   000722          SWR   = 177570          X3      000250
BR5     001774          ETS     002624          PASHLT  001432          SWRTEM  000664          X4      000264
BR5A    002004          ETS1    002636          PCL     002452          TABLE   001546          .     = 002640

. ABS.  002640     000

  ERRORS DETECTED:  0
  DEFAULT GLOBALS GENERATED:  0

  DSKZ:DZTRBC.BIN,DZTRBC.SEQ/DOC/NL:TOC=DZTRBC.P11
  RUN-TIME:  1  2  0 SECONDS
  RUN-TIME RATIO: 89/4=20.5
  CORE USED:  4K  (8 PAGES)

  DOCUMENT PAGES:  30

EOF1DZTRBCSEQ               00010000       770526              PDP10 411          0
```