TR79F

TR79F UTILITY TIMING

MD-11-DZRTB-B

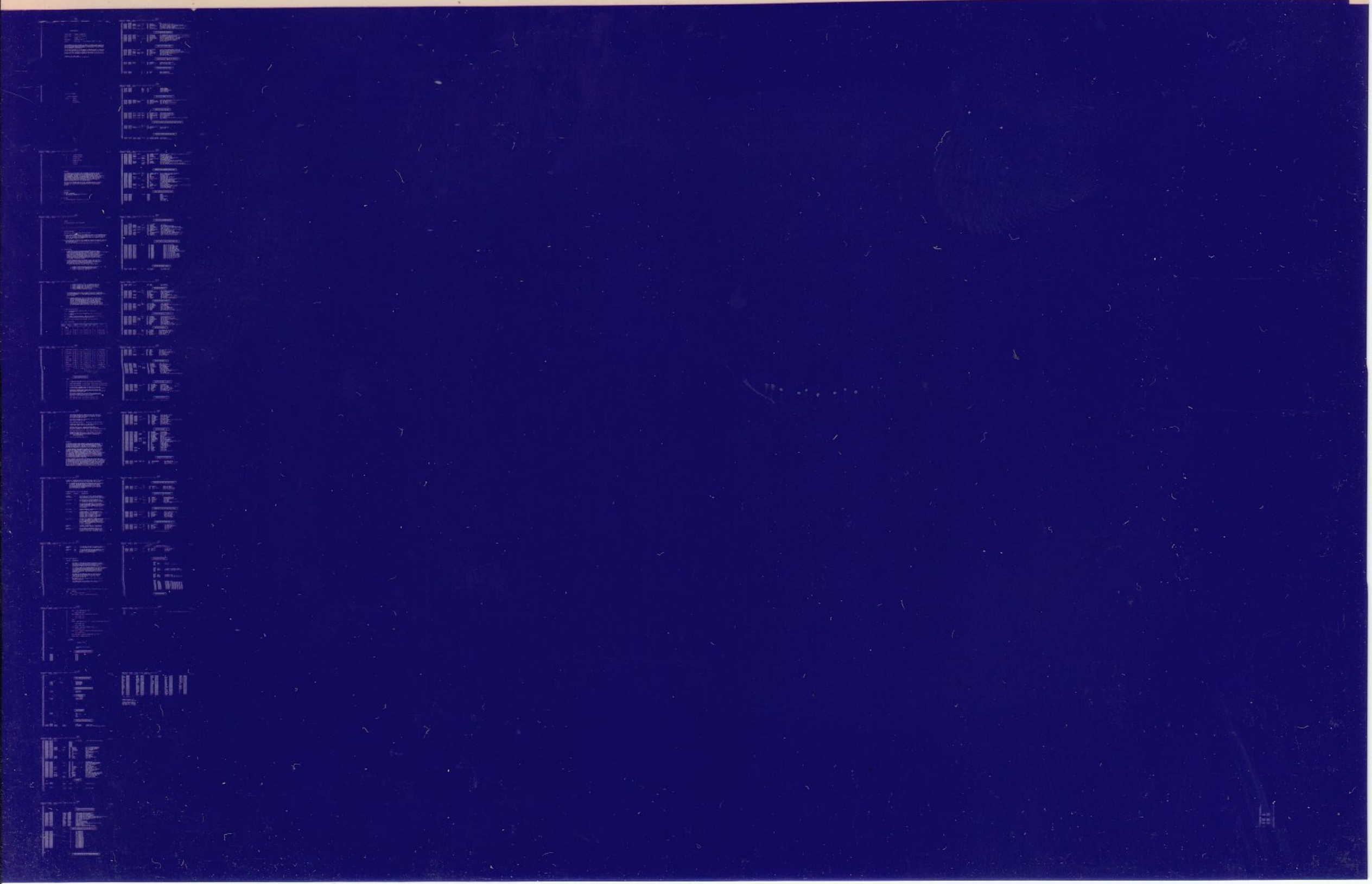
EP DZTRB B DL B

FICHE 1 OF 1

MAR 1977

digital

MADE IN USA



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                        .REM %
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IDENTIFICATION

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

PRODUCT NAME: TR79 UTILITY PROGRAMS

DATE: JANUARY 1977

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 COMMANDS 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.

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

++

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.

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 CAN RECOVER FRO 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 (CDD PARITY) IS ALW

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 TO 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						

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

6.2 DELAY

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 204,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 AMO OF TAPE TO BE ERASED. THIS NUMBER IS LOADED INTO THE WORD COUNT REGISTER PRIOR TO AN ERASE COMMAND BIENG 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 WAS 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              **** ILLEGAL ****
                                17        WRITE TAPE MARK (ILLEGAL IF ISSUED FROM LOAD POINT)
                                20        CONTROL RESET ( PROGRAM PSEUDO OP )

                            %
                                .ENABLE ABS
                            ;
                            ;
                            ;                       8.  PROGRAM LISTING
                            ;
                            ;
                            ;
                            ;
                                                .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
```

```
                                                    JMP @#CORBIL        ;START HERE FOR DELAY ROUTINES
                                                    000777
                                                    000777
                                                    000400
                                                    000777
                                                    000525
                                                    000652
                        CORBIL:     MOV   #214,R1           ;SET UP PATTERN GENERATOR
                                    MOV   #216,R3           ;SET UP PATTERN GENERATOR
                        X1:         MOV   #2700,R2          ;SET UP ADRESS POINTER
                        X2:         MOV   #177400,R0        ;SET UP COUNTER
                        X3:         MOV   (R1),(R2)+        ;DO IT
                                    INC   R0                ;KEEP TRACK OF HOW MANY
                                    BEQ   X4                ;CHECK FOR DONE
                                    MOV   (R3),(R2)+        ;DO IT
                                    INC   R0                ;KEEP COUNTING
                                    BNE   X3                ;LOOP HERE
                        X4:         ADD   #4,R1             ;NEXT PATTERN
                                    ADD   #4,R3             ;GO TO NEXT PATTERN
                                    CMP   #230,R1           ;DONE YET

                        ;
                        ;
                                    BNE   X2                ;NOT DONE YET
                        SLB:        CLR   R0                ;CLEAR THE PATTERN GENERATOR
                                    CLR   R1                ;CLEAR THE PATTERN COUNTER
                                    INC   R0                ;SET BIT IN PATTERN
                        SLB1:       INC   R1                ;KEEP COUNT
                                    MOV   R0,(R2)+          ;PUT IT IN CORE
                                    CMP   #6700,R2          ;SEE IF WERE FINISHED
                                    BEQ   SLBDON            ;YES JUMP OUT
                                    CMP   #11,R1            ;CHECK ON THE BIT POSITION
                                    BEQ   SLB               ;RESET THE SLIDING BIT
                                    ASL   R0                ;SHIFT THE BIT
                                    BR    SLB1              ;LOOP AGAIN
                        SLBDON:     TST   @#NORST           ;SEE WHERE THE START CAME FROM
                                    BEQ   ALD               ;IF = 0 MUST HAVE BEEN START 200
                                    CLR   @#NORST           ;CLEAR IT OUTFOR NEXT TIME
                                    JMP   @#DRTN            ;NOT = GO TO 204 START
                        ALD:        JMP   @#START           ;GO TO A 200 START
                        NORST:      000000                  ;TEMPORARY LOCATION

                        ;
                        ;                   **************
                        ;                   *   STACKS   *
                        ;                   **************
                        ;
                                       .=500
                        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   *
                                ;       ****************************************************
```

```
                001000                                          .=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$:     CMP  @#TEMP2,(R3)+      ;CHECK IT AGAINST THE LEGAL FUNCTIONS
001062  001422                          BEQ  CLINH              ;IF ITS LEGAL CONTINUE TO EXECUTE IT
001064  005367  177604                  DEC  TEMP1              ;WASN'T THAT OPERATION SUBTRACT 1
001070  001372                          BNE  2$                 ;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  052767  004000  162664  CRES:   BIS  #4000,TRCOM        ;MUST BE A POWER CLEAR SO DO IT TAKES 900 MILI SECONDS
001114  032767  004000  162656  3$:     BIT  #4000,TRCOM        ;SEE IF DONE WITH POWER CLEAR YET
001122  001374                          BNE  3$                 ;WAIT UNTILL DONE
001124  000167  000134                  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
```

```
                        ER:     BR   ERSE              ;ERASE COMMAND
                        REWD:   NOP                    ;REWIND COMMAND
                        FFOR:   NOP                    ;FAST FORWARD COMMAND
                        IDB:    NOP                    ;WRITE ID BURST
                        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
```

```
                                BIT   #40000,@#COMTEM   ;WAS IT AN ILLEGAL COMMAND DUE TO SEQUENCE OR TAPE POSI
                                BEQ   ERDONE           ;NO ERROR HERE
                    ILLCOM:     ASR   @#TEMP2          ;STRIP OFF THE GO BIT
                                MOV   @#TEMP2,R0       ;PUT BAD COMMAND IN R0
                    ERR14:      HALT                   ; STOP WITH BAD COMMAND DISPLAYED
                    ERDONE:     BIT   #100000,@#COMTEM ;SEE IF ERROR BIT IS SET
                                BEQ   OPDEL            ;NO ERRORS CONTINUE
                    ERR15:      HALT                   ;GOT AN ARROR NOP THIS HALT TO CONTINUE
                                JMP   @#CRES           ;IF YOU GOT AN ERROR ONLY RECOVERY IS WITH A CONTROL RE
                    ILLFUN:     ASR   @#TEMP2          ;STRIP OFF GO BIT
                    ILFUT:      MOV   @#TEMP2,R0       ;PUT THE BAD CODE IN R0 TO DISPLAY WHEN HALTED
                    ERRIF:      HALT                   ;GOT AN ILLEGAL FUNCTION CHECK YOUR PROGRAM LOCATION 72
                    ;
                    ;
                    ;
                    ;
                    ;       ********************************************
                    ;       *   OPERATION DELAY BETWEEN INSTRUCTIONS   *
                    ;       ********************************************
                    ;
                    OPDEL:      MOV   @#OPDLX,@#TIMMUL ;SET OP OPERATIONS DELAY MULTIPLIER
                                MOV   @#OPDLY,R0       ;SET UP OPERATIONS DELAY TIMER
                    8$:         DEC   R0               ;TIMER IS TICKING
                                BNE   8$               ;GET MORE TIME
                                DEC   @#TIMMUL         ;COUNT DOWN THE MULTIPLIER
                                BNE   8$               ;GET MORE TIME
                                BIT   #100000,@#SWR    ;TIMES UP CHECK SWITCHES TO SEE IF WE HALT OR CONTINUE
                                BEQ   .+4              ;DONT STOP NOW SKIP THE HALT
                    INSHLT:     HALT                   ;STOP BETWEEN INSTRUCTIONS
                                DEC   R1               ;-1 FROM THE NUMBER OF OPERATIONS IN R1
                                BNE   9$               ;GO AND DO THE NEXT INSTRUCTION
                                BR    .+4              ;SKIP THE JUMP
                    9$:         JMP   @#LOOP           ;DO THE LOOP AGAIN
                                BIT   #40000,@#SWR     ;CHECK SWITCHES TO SEE IF WE WANT TO STOP AT END OF PAS
                                BEQ   REST             ;DO THE NEXT PASS SKIP THE HALT
                    PASHLT:     HALT                   ;STOP BETWEEN PASSES
                    REST:       JMP   @#START          ;GO DO IT AGAIN (NEXT PASS)
                    ;
                    ;
                    ;       ****************************************
                    ;       *   LEGAL OPERATIONS COMPARITOR TABLE  *
                    ;       ****************************************
                    ;
                    LEGOPS:     00001                  ;WRITE
                                00002                  ;READ
                                00004                  ;SPACE REVERSE
                                00007                  ;ERASE
                                00010                  ;REWIND
                                00013                  ;FAST FORWARD
                                00015                  ;WRITE IDB
                                00017                  ;WRITE TAPE MARK
                    ;
                    ;
                    ;
```

```
                                ;
                                ;               ************************************
                                ;               *   DELAY SET-UP PROGRAM ROUTINES  *
                                ;               ************************************
                                ;
                                ;
                    001460                          .=1460
001460  012706  000600          DRTN:   MOV  #600,SP            ;SET STACK
001464  012705  000500                  MOV  #500,R5            ;SET UP SUBROUTINE STACK
001470  012737  000340  177776          MOV  #340,@#PSW         ;SET PRIORITY 7 NO INTERRUPTS ALLOWED
001476  032737  004000  164000  DROUTS:  BIT  #4000,@#TRCOM    ;CHECK FOR INITIAL POWER CLEAR TO SUBSIDE
001504  001774                          BEQ  DROUTS             ;WAIT TILL DONE
001506  013737  177570  000664  BR1:    MOV  @#SWR,@#SWRTEM     ;GET SWITCHES AND PUT THEM IN STORAGE
001514  105737  000664                  TSTB @#SWRTEM           ;SEE IF ENABLE IS UP YET
001520  100372                          BPL  BR1                ;LOOP UNTILL ENABLE IS UP
001522  042737  177760  000664          BIC  #177760,@#SWRTEM   ;MASK BITS AND GET A NUMBER BETWEEN 0-16
001530  006337  000664                  ASL  @#SWRTEM           ;SHIFT IT LEFT TO MULTIPLY BY 2
001534  006337  000664                  ASL  @#SWRTEM           ;SHIFT AGAIN MULTIPLY BY 2 TO GET OFFSET
001540  063707  000664                  ADD  @#SWRTEM,PC        ;ADD IT TO THE PC AND GO THERE
                                ;
                                ;
                                ;
                                ;               ************************************************
                                ;               *   INDEX TABLE OF DELAY PROGRAM DIRECTIVES    *
                                ;               ************************************************
                                ;
                                ;
001544  000137  001506  TABLE:          JMP  @#BR1              ;DELAY 0 IS A NO-OP
001550  000137  001644                  JMP  @#BR2              ;DELAY 1 IS FOR POWER CLEAR
001554  000137  001644                  JMP  @#BR2              ;DELAY 2 IS FOR POWER CLEAR
001560  000137  001662                  JMP  @#BR3              ;DELAY 3 IS FOR ERROR CLK
001564  000137  001722                  JMP  @#BR4              ;DELAY 4 IS FOR WRITE ENABLE
001570  000137  001764                  JMP  @#BR5              ;DELAY 5 IS FOR OUT BUFF FLAG
001574  000137  001764                  JMP  @#BR5              ;DELAY 6 IS FOR END WRITE DATA
001600  000137  001764                  JMP  @#BR5              ;DELAY 7 IS FOR FIRST WORD WRITE REQUEST
001604  000137  002120                  JMP  @#BR10             ;DELAY 10 IS FOR ERASE
001610  000137  002174                  JMP  @#BR11             ;DELAY 11 IS FOR WRITE I.D.B.
001614  000137  002174                  JMP  @#BR11             ;DELAY 12 IS FOR I.D.B. TIMING
001620  000137  002314                  JMP  @#BR16             ;DELAY 13 IS FOR ABORT WINDOW
001624  000137  002040                  JMP  @#BR6              ;DELAY 14 IS FOR LD CTRL + BUSY
001630  000137  001722                  JMP  @#BR4              ;DELAY 15 IS FOR GO PULSE DELAY
001634  000137  002234                  JMP  @#BR14             ;DELAY 16 IS FOR M.S.D. DELAY
001640  000137  001506                  JMP  @#BR1              ;DELAY 17 IS A NO-OP
                                ;
                                ;
                                ;
                                ;
                                ;               ************************************
                                ;               *   ROUTINE FOR DELAYS 1 AND 2     *
                                ;               ************************************
                                ;
001644  004537  002442  BR2:    JSR  R5,@#PCL           ;DO A POWER CLEAR
001650  105737  177570          TSTB @#SWR              ;CKECK FOR A LOOP
```

```
001654  100773                          BMI  BR2              ;DO IT AGAIN
001656  000137  001506                  JMP  @#BR1            ;GET NEXT TEST

                                ;
                                ;       ****************************
                                ;       *   ROUTINE FOR DELAY 3    *
                                ;       ****************************
                                ;
001662  012700  000070          BR3:    MOV #70,R0            ;SET UP DELAY MULTIPLIER
001666  052737  004000  164002          BIS #4000,@#TRSTAT    ;FORCE AN ERROR WITH B.G.L. BIT
001674  005300                  13$:    DEC R0                ;TIMER IS TICKING
001676  001376                          BNE 13$               ;CHECK TIMER
001700  005037  164002                  CLR @#TRSTAT          ;OK NOW CLEAR THE BIT
001704  105737  177570                  TSTB @#SWR            ;SEE IF WE WANT TO DO IT AGAIN
001710  100764                          BMI  BR3              ;OK LOOP BACK
001712  004537  002442                  JSR  R5,@#PCL         ;DONE HERE DO A POWER CLEAR AND GET THE NEXT ONE
001716  000137  001506                  JMP  @#BR1            ;GET THE NEXT DELAY DIRECTIVE

                                ;
                                ;       ********************************
                                ;       *   ROUTINE FOR DELAY 4 AND 15 *
                                ;       ********************************
                                ;
001722  004537  002462          BR4:    JSR  R5,@#RDY         ;CHECK FOR READY
001726  012737  177777  164004  BR4A:   MOV  #-1,@#TRWC       ;THIS NUMBER IS USED FOR AN ERASE COUNT
001734  012737  000017  164000          MOV  #17,@#TRCOM      ;DO THE ERASE
001742  004537  002462                  JSR  R5,@#RDY         ;WAIT TILL DONE
001746  004537  002500                  JSR  R5,@#ERCK        ;SEE IF WE ERRORED OUT
001752  105737  177570                  TSTB @#SWR            ;SEE IF WE LOOPON TEST
001756  100763                          BMI  BR4A             ;LOOP HERE AND DO IT AGAIN
001760  000137  001506                  JMP  @#BR1            ;GET OUT AND GET NEXT DELAY DIRECTIVE

                                ;
                                ;       ************************************
                                ;       *   ROUTINE FOR DELAY 5 , 6 AND 7  *
                                ;       ************************************
                                ;
001764  004537  002530          BR5:    JSR  R5,@#OFLP        ;SEE IF WE ARE AT LOAD POINT
001770  005037  164002                  CLR   @#TRSTAT        ;CLEAR INHIBIT BIT
001774  012737  177774  164004  BR5A:   MOV  #-4,@#TRWC       ;SET UP FOR A 10 BYTE WRITE
002002  013737  000710  164006          MOV  @#WADDR,@#TRBA   ;SET UP THE WRITE ADRESS BUFFER
002010  012737  000003  164000          MOV  #3,@#TRCOM       ;DO THE WRITE
002016  004537  002462                  JSR  R5,@#RDY         ;WAIT FOR READY
002022  004537  002500                  JSR  R5,@#ERCK        ;CHECK FOR ERRORS
002026  105737  177570                  TSTB @#SWR            ;SEE IF WE WANT TO LOOP
002032  100760                          BMI  BR5A             ;LOOP HERE AND DO IT AGAIN
002034  000137  001506                  JMP  @#BR1            ;GET OUT AND GET NEXT DELAY DIRECTIVE

                                ;
                                ;       ****************************
                                ;       *   ROUTINE FOR DELAY 14   *
                                ;       ****************************
                                ;
002040  004537  002564          BR6:    JSR   R5,@#REW        ;DO A REWIND GET TO B.O.T.
002044  004537  002614          BR6C:   JSR   R5,@#ETS        ;CHECK FOR END OF TAPE ANYWAY
002050  005037  164002                  CLR   @#TRSTAT        ;CLEAR THE INHIBIT BIT
002054  005037  164004                  CLR   @#TRWC          ;CLEAR THE WORD COUNT
002060  012737  000017  164000          MOV   #17,@#TRCOM     ;DO AN ERASE
002066  005037  164000          BR6A:   CLR   @#TRCOM         ;FORCE A LOAD PULSE
```

```
                                TSTB    @#SWR           ;SEE IF WE WANT TO LOOP
                                BPL     BR6B            ;ALL DONE
                                TSTB    @#TRCOM         ;SEE IF ERASE IS DONE YET
                                BPL     BR6A            ;NOT DONE DO ANOTHER LOAD PULSE
                                BR      BR6C            ;DO IT AGAIN
                        BR6B:   JSR     R5,@#PCL        ;DO A CLEAR AND EXIT
                                JMP     @#BR1           ;GO BACK TO MAIN
                        ;
                        ;
                        ;
                        ;                       ******************************
                        ;                       *   ROUTINE FOR DELAY  10    *
                        ;                       ******************************
                        ;
                        BR10:   JSR     R5,@#ETS        ;CHECT FOR E.O.T.
                                JSR     R5,@#OFLP       ;GET US OFF LOAD POINT
                                CLR     @#TRSTAT        ;CLEAR INHIBIT
                                MOV     #17,@#TRCOM     ;DO A MAXIMUM ERASE
                        BR10A:  MOV     #5000,R0        ;SET UP COUNTER
                        BR10B:  DEC     R0              ;START COUNTDOWN
                                BNE     BR10B           ;TIMER IS TICKING
                                CLR     @#TRWC          ;RE ESTABLISH THE ERASE COUNT TO 0
                                TSTB    @#SWR           ;SEE IF WE LOOP HERE
                                BMI     BR10A           ;DO IT AGAIN
                                JSR     R5,@#PCL        ;DO A POWER CLEAR
                                JMP     @#BR1           ;GET OUT AND GET THE NEXT DELAY DIRECTIVE
                        ;
                        ;
                        ;
                        ;
                        ;
                        ;
                        ;                       ************************************
                        ;                       *   ROUTINE FOR DELAY 11 AND 12    *
                        ;                       ************************************
                        ;
                        BR11:   JSR     R5,@#REW        ;DO A REWIND
                                MOV     #33,@#TRCOM     ;WRITE AN I.D.B.
                                JSR     R5,@#RDY        ;CHECK FOR DONE
                                JSR     R5,@#ERCK       ;SEE IF ANY ERRORS UP
                                TSTB    @#SWR           ;SEE IF WE WANT TO LOOP
                                BMI     BR11            ;LOOP BACK DO IT AGAIN
                                JSR     R5,@#PCL        ;DO A POWER CLEAR
                                JMP     @#BR1           ;GET OUT AND GET NEXT DELAY DIRECTIVE
                        ;
                        ;
                        ;
                        ;
                        ;
                        ;
                        ;                       ******************************
                        ;                       *   ROUTINE FOR DELAY  16    *
                        ;                       ******************************
                        ;
                        BR14:   TSTB    @#TRSTAT        ;CHECK FOR EOT UP
```

```
1009  002240  100407                        BMI   BR14A          ;SKIP THE FAST FORWARD
1010  002242  005037  164002                CLR   @#TRSTAT       ;CLEAR INHIBIT
1011  002246  012737  000027  164000        MOV   #27,@#TRCOM    ;DO A FAST FORWARD
1012  002254  004537  002462                JSR   R5,@#RDY       ;WAIT TILL DONE
1013  002260  005037  164002        BR14A:  CLR   @#TRSTAT       ;CLEAR INHIBIT
1014  002264  012737  000027  164000        MOV   #27,@#TRCOM    ;TRY A FAST FORWARD ,SHOULD PRODUCE ERROR
1015  002272  004537  002462                JSR   R5,@#RDY       ;WAIT TILL DONE
1016  002276  105737  177570                TSTB  @#SWR          ;SEE IF WE LOOP HERE
1017  002302  100766                        BMI   BR14A          ;YES LOOP HERE
1018  002304  004537  002442                JSR   R5,@#PCL       ;DO A POWER CLEAR
1019  002310  000137  001506                JMP   @#BR1          ;GET OUT DO NEXT DELAY
1020                          ;
1021                          ;
1022                          ;
1023                          ;                ******************************
1024                          ;                *   ROUTINE FOR DELAY  13    *
1025                          ;                ******************************
1026                          ;
1027  002314  004537  002564        BR16:   JSR   R5,@#REW       ;DO A REWIND
1028  002320  005037  164002                CLR   @#TRSTAT       ;CLEAR INHIBIT
1029  002324  012737  177000  164004        MOV   #177000,@#TRWC ;SET UP ERASE COUNT
1030  002332  012737  000017  164000        MOV   #17,@#TRCOM    ;DO AN ERASE
1031  002340  004537  002462                JSR   R5,@#RDY       ;WAIT FOR IT
1032  002344  004537  002564                JSR   R5,@#REW       ;REWIND IT
1033  002350  004537  002530                JSR   R5,@#OFLP      ;GET OFF LOAD POINT LEGALLY
1034  002354  012737  177760  164004  BR16A:MOV   #-20,@#TRWC     ;SET UP W.C.
1035  002362  012737  003600  164006        MOV   #3600,@#TRBA   ;SET UP CORE ADDRESS
1036  002370  005037  164002                CLR   @#TRSTAT       ;CLEAR THE INHIBIT
1037  002374  012737  000003  164000        MOV   #3,@#TRCOM     ;NOW TRY TO WRITE NOTHING,SHOULD ABORT
1038  002402  012701  000010        BR16B:  MOV   #10,R1         ;SET UP TIME MULTIPLIER
1039  002406  005000                BR16D:  CLR   R0             ;CLEAR TIMER
1040  002410  005200                BR16C:  INC   R0             ;TIMES WAISTING
1041  002412  001376                        BNE   BR16C          ;TIMER RUNNING
1042  002414  005301                        DEC   R1             ;-1 FROM MULTIPLIER
1043  002416  001373                        BNE   BR16D          ;SEE IF DONE YET
1044  002420  004537  002442                JSR   R5,@#PCL       ;CLEAR ERRORS
1045  002424  105737  177570                TSTB  @#SWR          ; LOOP ???
1046  002430  100751                        BMI   BR16A          ;DO IT AGAIN
1047  002432  004537  002442                JSR   R5,@#PCL       ;POWER CLEAR
1048  002436  000137  001506                JMP   @#BR1          ;ALL DONE GET SOME MORE
1049                          ;
1050                          ;
1051                          ;
1052                          ;
1053                          ;
1054                          ;                ***********************************
1055                          ;                *   SUBROUTINE FOR POWER CLEAR    *
1056                          ;                ***********************************
1057                          ;
1058                          ;
1059  002442  052737  004000  164000  PCL:    BIS   #4000,@#TRCOM      ;SET POWER CLEAR
1060  002450  032737  004000  164000  PCL1:   BIT   #4000,@#TRCOM      ;WAIT FOR 900 MILI SECONDS
1061  002456  001374                        BNE   PCL1               ;STILL WAITING
1062  002460  000205                        RTS   R5                 ;RETURN TO MAIN ROUTINE
1063                          ;
1064                          ;
```

```
                        ;
                        ;       **********************************************
                        ;       *   SUBROUTINE FOR READY AND CLEAR INHIBIT   *
                        ;       **********************************************
                        ;
002462  105737  164000  RDY:    TSTB  @#TRCOM          ;CHECK ON DONE BIT
002466  100375                  BPL   RDY              ;WAIT TILL DONE
002470  042737  000001  164002 IHB:    BIC   #1,@#TRSTAT      ;CLEAR THE INHIBIT BIT
002476  000205                  RTS   R5               ;RETUN TO MAIN ROUTINE
                        ;
                        ;       **************************************
                        ;       *   SUBROUTINE TO CHECK FOR ERRORS   *
                        ;       **************************************
                        ;
002500  005737  164000  ERCK:   TST   @#TRCOM          ;SEE IF ERROR IS UP
002504  100010                  BPL   ERCK2            ;NO ERRORS JUMP OUT
002506  012737  000007  177566  MOV   #7,@#TTBUF       ;GOT AN ERROR RING A BELL
002514  105737  177564  ERCK1:  TSTB  @#TTSTAT         ;WAIT HERE
002520  100375                  BPL   ERCK1            ;WAIT HERE
002522  004537  002442          JSR   R5,@#PCL         ;CLEAR THE ERROR WITH A POWER CLEAR
002526  000205          ERCK2:  RTS   R5               ;GO BACK TO MAIN
                        ;
                        ;       **********************************************
                        ;       *   SUBROUTINE TO GET OFF LOAD POINT LEGALLY   *
                        ;       **********************************************
                        ;
002530  032737  000040  164002 OFLP:   BIT   #40,@#TRSTAT      ;SEE IF LOAD POINT IS UP
002536  001411                  BEQ   OFLP1            ;NO LP JUMP OUT
002540  005037  164002          CLR   @#TRSTAT         ;CLEAR THE INHIBIT
002544  012737  000033  164000  MOV   #33,@#TRCOM      ;WRITE AN I.D.B.
002552  004537  002462          JSR   R5,@#RDY         ;WAIT FOR READY
002556  004567  177716          JSR   R5,ERCK          ;CHECK FOR ERRORS
002562  000205          OFLP1:  RTS   R5               ;GO BACK TO MAIN
                        ;
                        ;       **************************************
                        ;       *   SUBROUTUNE FOR REWIND AND L.P.   *
                        ;       **************************************
                        ;
002564  032737  000040  164002 REW:    BIT   #40,@#TRSTAT      ;AT LOAD POINT??
002572  001007                  BNE   REW2             ;YES DON'T NEED REWIND
002574  005037  164002  REW1:   CLR   @#TRSTAT         ;CLR THE INHIBIT
002600  012737  000021  164000  MOV   #21,@#TRCOM      ;DO A REWIND
002606  004537  002462          JSR   R5,@#RDY         ;WAIT TILL DONE
002612  000205          REW2:   RTS   R5               ;GO BACK
                        ;
                        ;       ******************************
```

```
1121                                ;                    *   SUBROUTINE FOR E.O.T.   *
1122                                ;                    *****************************
1123                                ;
1124  002614  105737  164002       ETS:     TSTB  @#TRSTAT              ;IS END OF TAPE UP ?
1125  002620  100002                        BPL   ETS1                  ;NOT AT E.O.T.
1126  002622  004537  002564              JSR   R5,@#REW              ;DO A REWIND
1127  002626  000205                ETS1:    RTS   R5                    ;GET BACK
1128                                ;
1129                                ;
1130                                ;
1131
1132                                ;
1133                                ;
1134                                ;              ******************************
1135                                ;              *   WRITE BUFFER PATTERNS    *
1136                                ;              ******************************
1137                                ;
1138                                ;
1139                                ;                 .=2700
1140                                ;                 .REPT   1000          ;ALL 1'S
1141                                ;                 .WORD   000777        ;PATTERN = 0 000 000 111 111 111
1142                                ;                 .ENDR
1143                                ;
1144                                ;
1145                                ;                 .=3700
1146                                ;                 .REPT   1000          ;1'S AND 0'S ALTERNATE WORDS
1147                                ;                 .WORD   000400        ;PATTERN = 0 000 000 100 000 000
1148                                ;                 .WORD   000777        ;PATTERN = 0 000 000 111 111 111
1149                                ;                 .ENDR
1150                                ;
1151
1152                                ;                 .=4700
1153                                ;                 .REPT   1000          ;ALTERNATE BITS
1154                                ;                 .WORD   000525        ;PATTERN = 0 000 000 101 010 101
1155                                ;                 .WORD   000652        ;PATTERN = 0 000 000 110 101 010
1156                                ;                 .ENDR
1157
1158                                ;
1159                                ;                 .=5700
1160                                ;                 .REPT   1000          ;SLIDING 1 BIT
1161                                ;                 .WORD   000001        ;PATTERN = 0 000 000 000 000 001
1162                                ;                 .WORD   000002        ;PATTERN = 0 000 000 000 000 010
1163                                ;                 .WORD   000004        ;PATTERN = 0 000 000 000 000 100
1164                                ;                 .WORD   000010        ;PATTERN = 0 000 000 000 001 000
1165                                ;                 .WORD   000020        ;PATTERN = 0 000 000 000 010 000
1166                                ;                 .WORD   000040        ;PATTERN = 0 000 000 000 100 000
1167                                ;                 .WORD   000100        ;PATTERN = 0 000 000 001 000 000
1168                                ;                 .WORD   000200        ;PATTERN = 0 000 000 010 000 000
1169                                ;                 .WORD   000400        ;PATTERN = 0 000 000 100 000 000
1170                                ;                 .ENDR
1171
1172                                ;
1173                                ;              ************************
1174                                ;              *   READ BUFFER AREA   *
1175                                ;              ************************
1176                                ;
```

```
1177                                    ;
1178                                    ;               .=6700          ;1000 WORD LOCATIONS RESERVED FOR READ BUFFER
1179                                    ;
1180                                    ;
1181            000001                                  .END
```

L02


```
ALD     000352          BR6A    002066          EXTCOR  000700          PSW    = 177776          TEMP2   000676
BEGIN   000200          BR6B    002110          FFOR    001154          R      001144          TIMMUL  000666
BEGIN2  000204          BR6C    002044          FUDONE  001264          RADDR  000706          TRBA   = 164006
BR1     001506          CLINH   001130          IDB     001156          RDY    002462          TRCOM  = 164000
BR10    002120          COMTEM  000670          IHB     002470          READ   001220          TRSTAT= 164002
BR10A   002142          CORBIL  000230          ILFUT   001344          REST   001434          TRWC   = 164004
BR10B   002146          CRES    001106          ILLCOM  001310          REW    002564          TTBUF  = 177566
BR11    002174          DROUTS  001476          ILLFUN  001340          REWD   001152          TTSTAT= 177564
BR14    002234          DRTN    001460          INSHLT  001406          REW1   002574          UNIT    000702
BR14A   002260          ER      001150          LEGOPS  001440          REW2   002612          UNUM    001026
BR16    002314          ERCK    002500          LOOP    001040          SGOB   001162          W       001142
BR16A   002354          ERCK1   002514          NORST   000356          SLB    000302          WADDR   000710
BR16B   002402          ERCK2   002526          OFLP    002530          SLBDON 000334          WCNT    000704
BR16C   002410          ERDONE  001322          OFLP1   002562          SLB1   000310          WRITE   001210
BR16D   002406          ERRIF   001350          OPDEL   001352          SR     001146          WR1WC   001226
BR2     001644          ERR14   001320          OPDLX   000716          START  001000          WTM     001160
BR3     001662          ERR15   001332          OPDLY   000714          STTEM  000672          X1      000240
BR4     001722          ERSCNT  000712          OPNUM   000720          SUBSTK 000500          X2      000244
BR4A    001726          ERSE    001236          OPTBL   000722          SWR    = 177570        X3      000250
BR5     001764          ETS     002614          PASHLT  001432          SWRTEM 000664          X4      000264
BR5A    001774          ETS1    002626          PCL     002442          TABLE  001544          .      = 002630
BR6     002040          EXECUT  001246          PCL1    002450          TEMP1  000674

. ABS.  002630      000

ERRORS DETECTED:  0
DEFAULT GLOBALS GENERATED:  0

DZTRBB,DZTRBB=DZTRBB.M11
RUN-TIME:  4  9  .3 SECONDS
RUN-TIME RATIO: 53/14=3.6
CORE USED:  5K  (9 PAGES)
```

M02