IDENTIFICATION
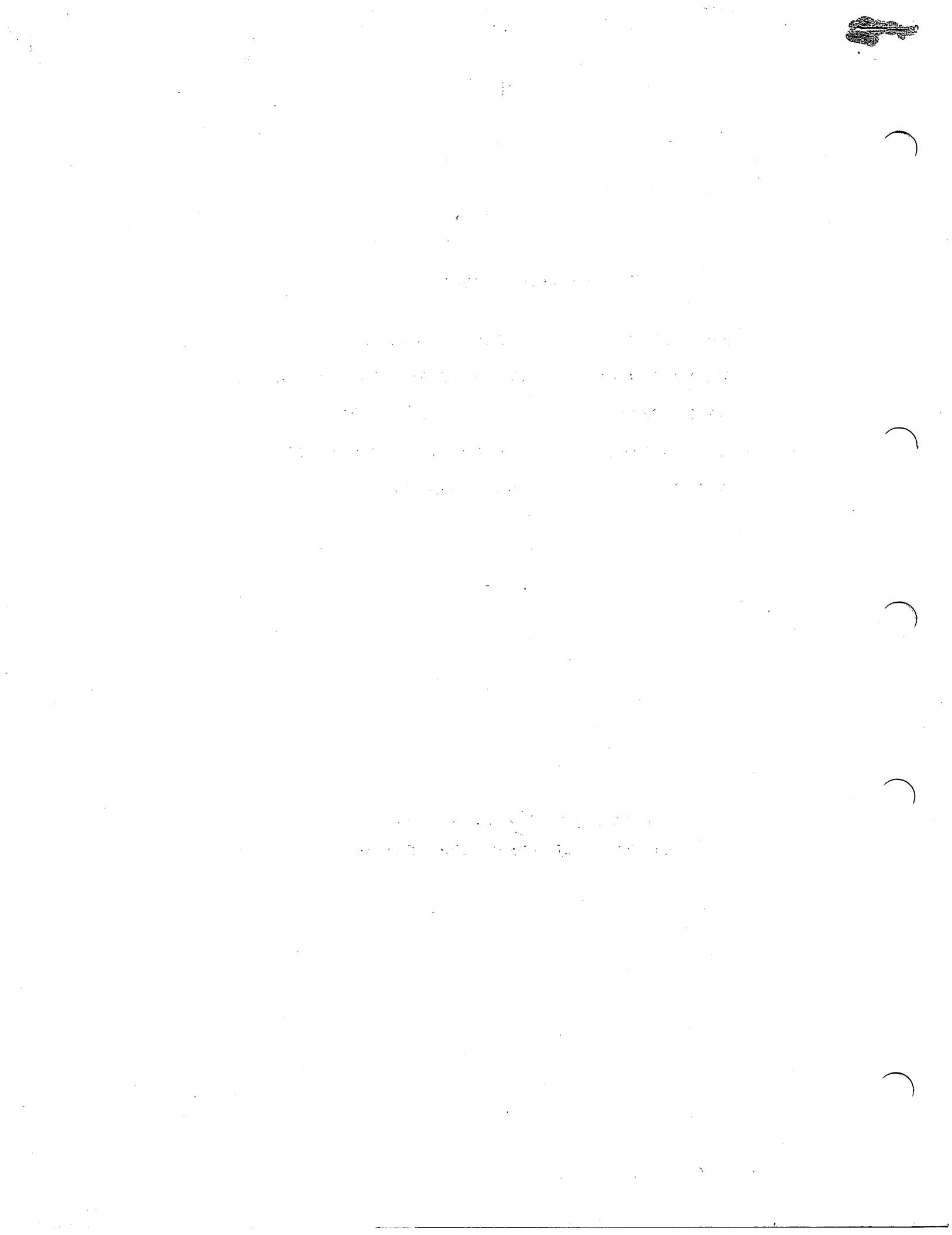
PRODUCT CODE   MAINDEC-08-DHVTA-B-D

PRODUCT NAME   VT8-E VIDEO DISPLAY TEST 1

DATE CREATED   FEBRUARY 26, 1973

MAINTAINER   DIAGNOSTIC PROGRAMMING

AUTHOR   BRUCE HANSEN

1. ABSTRACT

VT8-E VIDEO DISPLAY TEST 1 IS A TEST OF THE VT8-E
DISPLAY, CONTROL, AND KEYBOARD. THIS PROGRAM TESTS THE
BASIC FUNCTIONS OF THE CONTROL AS WELL AS CHECKING THE
ABILITY TO DISPLAY IN THE ALPHA-NUMERIC MODE. WHILE
WAITING FOR INTERRUPTS DURING THE VISUAL TESTS A SIMPLE
PROCESSOR TEST IS BEING EXECUTED IN THE BACKGROUND.

W A R N I N G - THIS PROGRAM SHOULD ONLY BE HALTED
                 WHEN IN MAINTENANCE AND VISUAL TESTS
                 BY SETTING SRØ TO THE "1" POSITION.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP8-E, -F, OR -M PROCESSOR
TELETYPE OR HIGH SPEED READER TO READ IN THE PROGRAM
VT8-E

2.2 STORAGE

LOCATIONS 0000 THROUGH 7577.

2.3 PRELIMINARY PROGRAMS

ALL PROCESSOR AND MEMORY TEST PROGRAMS MUST HAVE BEEN
RUN SUCCESSFULLY.

3. LOADING PROCEDURE

THE BINARY LOADER IS USED TO LOAD THE PROGRAM INTO ANY
MEMORY FIELD. REFER TO BINARY LOADER DOCUMENTATION IF
UNFAMILIAR WITH ITS USE.

4. TEST PROCEDURE

4.1 STANDARD TEST PROCEDURE

USE OF THE STANDARD TEST PROCEDURE RESULTS IN ANY ERROR
OCCURENCE THAT CAN BE DETECTED BY THE SOFTWARE TO BE INDICATED
BY A HALT. CONSULT THE LISTING WHERE THE HALT OCCURRED TO
DETERMINE THE NATURE OF THE ERROR. IF AN ERROR OCCURS, REFER
TO PARAGRAPHS 5.1 AND 6.0 FOR SWITCH SETTINGS, ERROR EXPLANATIONS, AND
ERROR RECOVERIES. THERE ARE SPECIAL STARTING ADDRESSES WHICH ALLOW
THE USER TO CHANGE DEVICE CODES, DISPLAY SELECTED CHARACTERS,
DO DATA BREAKS USING THE DATA IN THE SR, OR START AT A PARTICULAR
SECTION OF THE PROGRAM. REFER TO PARAGRAPH 5.2 FOR THESE
SPECIAL STARTING ADDRESSES AND A DESCRIPTION OF EACH.

4.2 ALTERNATE VT8-E'S

IN ORDER TO RUN UP TO 8 VT8-E'S SEQUENTIALLY USING THE DIAGNOSTIC,
THE IOT CODES FOR THE DEVICES MUST BE DEPOSITED INTO AN IOT
TABLE IN MEMORY. THE TABLE IS NORMALLY SETUP TO RUN ONLY ONE
VT8-E AND APPEARS IN MEMORY AS FOLLOWS:

LOCATION	CONTENTS
0020	0503
0021	0000
0022	0000
0023	0000
0024	0000
0025	0000
0026	0000
0027	0000
0030	0000

THE CONTENTS OF LOCATION 0020 CONTAINS THE DEVICE CODES OF ONE
VT8-E. BITS 0-5 ARE THE DEVICE CODE OF THE DISPLAY (05) AND
BITS 6-11 ARE THE DEVICE OF THE KEYBOARD (03). TO TERMINATE
THE TABLE, ZEROES MUST BE DEPOSITED INTO THE LOCATION FOLLOWING
THE LAST DEVICE CODE DEPOSITED. BELOW IS AN EXAMPLE OF A TABLE
SETUP TO RUN SIX CONSECUTIVE VT8-E'S.

LOCATION	CONTENTS	
0020	0503	
0021	1513	
0022	2523	
0023	3533	
0024	4543	
0025	5553	
0026	0000	TERMINATOR
0027	0000	UNUSED
0030	0000	UNUSED

WARNING! IF THE PROGRAM IS HALTED WHILE RUNNING ALTERNATE VT8-E'S
AND THE PROGRAM IS RESTARTED AT ANY OTHER ADDRESS THEN
200,71,72 OR 75 THE PROGRAM WILL RUN THE CURRENT VT8-E SELECTED.

4.3 MAINTAINENCE AND ALPHA-NUMERIC TESTS

1. CHECK THE VT8-E CLOCK WITH A SCOPE AND VERIFY THAT FOR 60 HZ A TICK OCCURS EVERY 16 2/3 MS, OR FOR 50 HZ A TICK OCCURRS EVERY 20 MS.

2. TURN THE VIDEO TERMINAL ON.

3. LOAD THE PROGRAM INTO ANY DESIRED MEMORY FIELD USING THE BINARY LOADER.

4. SET THE SENSE SWITCH TO A "1".

5. IF IT IS DESIRED TO RUN MORE THEN ONE VT8-E, REFER TO PARAGRAPH 4.2 FOR IOT TABLE SETUP AND THEN GO TO STEP 6 IN THIS PARAGRAPH.

6. LOAD ADDRESS 0200 WITH THE IF AND DF SET TO THE PROGRAM FIELD.

7. CLEAR ALL SWITCHES.

8. IF 50 HZ, SET SR4 = 1.

9. IF 32 CHARACTERS PER LINE, SET SR6 = 1.

10. PLACE THE VALUE OF THE HIGHEST MEMORY FIELD IN SR9-11.

11. DEPRESS CLEAR AND CONTINUE.

12. THE DISPLAY WILL HAVE A BLANK SCREEN FOR THE DURATION OF THE MAINTENANCE TESTS WHICH IS APPROXIMATELY 17 SECONDS.

13. IF RUNNING MORE THEN ONE VT8-E, THE NEXT VT8-E IN THE IOT TABLE WILL BE SELECTED TO RUN THE MAINTENANCE TEST UNTIL ALL VT8-E'S IN THE IOT TABLE ARE TESTED.

14. REFER TO PARAGRAPH 8.2 FOR A DESCRIPTION OF THE PATTERNS DISPLAYED.

15. AT THE CONCLUSION OF THE VISUAL TESTS, "DONE" WILL BE DISPLAYED ON THE SCREEN AND THE TEST WILL THEN LOOP BACK TO THE BEGINNING. IF MORE THAN ONE VT8-E IS BEING TESTED, "DONE" WILL NOT BE DISPLAYED UNTIL THE LAST VT8-E IS TESTED.

16. FOR SYSTEMS WITH MULTIPLE VT8-E'S, REFER TO PARAGRAPH 5.2.6 TO RUN UP TO 4 VT8-E'S SIMULTANEOUSLY.

4.4 KEYBOARD TEST PROCEDURE

1. THE MAINTAINENCE AND VISUAL TESTS SHOULD HAVE BEEN RUN PRIOR TO THIS TEST.

2. MAKE SURE THE VIDEO TERMINAL IS ON.

3. IF IT IS DESIRED TO RUN MORE THEN ONE VT8-E, REFER TO PARAGRAPH 4.2 OR IF THE IOT TABLE HAS ALREADY BEEN SETUP GO TO STEP 4 IN THIS PARAGRAPH.

4. LOAD ADDRESS 0072 WITH THE "IF" AND "DF" SET TO THE PROGRAM FIELD.

5. CLEAR ALL SWITCHES.

6. IF 32 CHARACTERS PER LINE SET SR6 = 1.

7. DEPRESS CLEAR AND CONTINUE.

4.5 KEYBOARD TEST 1 (STANDARD KEYS ONLY)

1. A "CURSOR 1" WILL BE DISPLAYED IN THE TOP LEFT OF THE SCREEN.

2. CARRIAGE RETURN ENDS THIS TEST AND ENTERS KEYBOARD TEST 2.

3. TO VERIFY THAT ALL KEYS, (EXCEPT SPECIAL FUNCTION KEYS), ARE FUNCTIONING EACH ONE SHOULD BE STRUCK SEVERAL TIMES VERIFYING THAT THE CORRECT CHARACTER APPEARS ON THE SCREEN.

4. IF TOO MANY LINE FEEDS ARE TYPED THE SCREEN WILL BE BLANK.

5. RUBOUT WILL BACK THE CURSOR UP ONE POSITION.

4.6 KEYBOARD TEST 2 (SPECIAL FUNCTION KEYS)

1. THIS TEST IS ENTERED BY TYPING CARRIAGE RETURN WHILE IN KEYBOARD TEST 1, OR BY STARTING AT ADDRESS 3000.

2. A "CURSOR 2" WILL BE DISPLAYED IN THE TOP LEFT OF THE SCREEN.

3. CARRIAGE RETURN ENDS THIS TEST AND ENTERS KEYBOARD TEST 3.

4. TO VERIFY THAT ALL KEYS FUNCTION CORRECTLY EACH ONE SHOULD BE STRUCK SEVERAL TIMES. THIS ONLY APPLIES TO THE SPECIAL FUNCTION KEYS.

4,7   KEYBOARD TEST 3 (ALL KEYS)
       ━━━━━━━━━━━━━━━━━━━━━━━━━━

       1, THIS TEST IS ENTERED BY TYPING CARRIAGE RETURN
           IN TEST 2 OR BY STARTING AT ADDRESS 3200,

       2, A "CURSOR 3" WILL BE DISPLAYED IN THE TOP LEFT OF THE SCREEN.

       3, CARRIAGE RETURN ENDS THIS TEST AND STARTS THE PROGRAM AT
           ADDRESS 0200 UNLESS SR OPTIONS PREVENT IT, IF MORE THAN
           ONE VT8-E IS BEING TESTED, THE PROGRAM WILL GO TO KEYBOARD
           TEST 1 ON THE NEXT DEVICE (PARAGRAPH 4,5) AND THEN
           CONTINUE THROUGH UNTIL ALL DEVICES ARE TESTED,

       4, ALL KEYS SHOULD BE STRUCK SEVERAL TIMES WITH THE SENSE
           SWITCH IN BOTH POSITIONS, CHECK THAT THE POSITION OF THE
           SWITCH IS THE SAME AS THE ONE DISPLAYED ON THE SCREEN,

5,   OPERATING PROCEDURE
       ━━━━━━━━━━━━━━━━━━━

5,1   SWITCH REGISTER CONTROL
       ━━━━━━━━━━━━━━━━━━━━━━━

       SR0 = 0   NORMAL RUN,
       SR0 = 1   HALT PROGRAM,

       SR1 = 0   HALT ON ERROR,
       SR1 = 1   NO HALT ON ERROR,

       SR2 = 0   NO LOOP,
       SR2 = 1   REPEAT PATTERN, (SCOPE LOOP)

       SR3 = 0   NORMAL RUN,
       SR3 = 1   REMAIN IN CURRENT TEST,

       SR4 = 0   60 HERTZ
       SR4 = 1   50 HERTZ

       SR5 = 0   ENABLE BACKGROUND JOB,
       SR5 = 1   DISABLE BACKGROUND JOB,

       SR6 = 0   64 CHARACTERS PER LINE,
       SR6 = 1   32 CHARACTERS PER LINE,

       SR7 = 0   NORMAL,
       SR7 = 1   ENABLE MANUAL INCREMENT FOR VISUAL TESTS

       SR8   WITH SR7 = 1 A CHANGE IN SR8 CHANGES THE
                        PATTERN ON THE SCREEN

                        WITH SR7 = 0 AND SR8 = 1 REMAIN IN CURRENT
                        SECTION, (MAINTENANCE, DISPLAY, OR KEYBOARD)

       SR9-11   PLACE VALUE OF HIGHEST MEMORY FIELD IN
                        THE SR 9-11, (EG, 0 FOR 4K, 1 FOR 8K, AND UP
                        TO 7 FOR 32K),

5.2   STARTING ADDRESSES

5.2.1   0070 - DEVICE CODE MODIFICATION:

                 A. SET SR TO 0070, PRESS "LOAD ADDRESS".
                 B. SET SR0-5 TO THE DEVICE CODE OF THE DISPLAY.
                 C. SET SR6-11 TO THE DEVICE CODE OF THE KEYBOARD.
                 D. PRESS "CLEAR" THEN "CONTINUE".
                 E. THE PROGRAM WILL MAKE THE DEVICE CODE CHANGES AND
                     MODIFY THE IOT TABLE TO RUN ONLY ONE VT8-E AND THEN
                     THE PROGRAM WILL HALT.

5.2.2   0071 - ENTER AT THE VISUAL SECTION.

5.2.3   0072 - ENTER AT THE KEYBOARD SECTION.

5.2.4   0073 - STARTING AT THIS ADDRESS ENTERS A TEST WHICH DOES
                  DATA BREAKS USING THE DATA IN THE SR TO PUT IN THE
                  BUFFER AND DISPLAYS THE OUTPUT IN THE MQ.

5.2.5   0074 - DISPLAY SELECTED CHARACTER.

                 A. SET SR TO 0074, PRESS "LOAD ADDRESS".
                 B. SET THE CHARACTER CODE IN SR5-11.
                 C. SET CONTROL BITS FOR CB1,CB2,CB3 AND CB4 IN SR1-4 RESPECTIVELY AS DESCRIBED BELOW:

                        SR1   SR2   SR3   SR4
                         0   0   NOP   0   0   NORMAL
                         0   1   EBF   0   1   BLINK
                         1   0   BBF   1   0   BOLD
                         1   1   EOS   1   1   CURSOR

                 D. PRESS "CLEAR AND CONTINUE".
                 E. PROGRAMS HALTS, CLEAR ALL SWITCHES.
                 F. SET SR2 IF A LOOP ON THIS CHARACTER IS DESIRED
                     OTHERWISE CONSULT THE SR OPTIONS.
                 G. PRESS CONTINUE.

5.2.6   0075 - MULTIPLE VT8-E'S. THIS TEST IS SETUP TO RUN 4 VT8-E'S
                  SIMULTANEOUSLY TO INSURE THAT THE VT8-E'S DO NOT COMPETE
                  FOR DATA BREAKS. A STABLE SWIRL PATTERN SHOULD BE
                  DISPLAYED ON ALL 20 LINES OF ALL VT8-E'S. THE FIRST
                  VT8-E SHOULD HAVE A SWIRL PATTERN STARTING OFF WITH
                  A NUMBER 1 AND THE NEXT WITH A NUMBER 2,ETC..IF 64 CHAR/LINE THERE WILL BE
                  N SPACES AT THE END OF THE LAST LINE,WHERE N IS THE VT8-E NUMBER.

                  IN ORDER TO RUN 4 VT8-E'S SIMULTANEOUSLY, A TABLE HAS
                  BEEN SETUP IN MEMORY AS SHOWN BELOW:

                     LOCATION   CONTENTS
                        1517   0503
                        1520   1513
                        1521   2523
                        1522   3533
                        1523   0000   TERMINATOR

LOCATION 1517 CONTAINS THE DEVICE CODES OF A VT8=E
WITH A DISPLAY DEVICE CODE OF 05 AND A KEYBOARD DEVICE
CODE OF 03, THE NEXT THREE LOCATIONS CONTAINS DEVICE
CODES FOR THREE OTHER VT8=E'S,AND THE LAST LOCATION
CONTAINS ZEROES WHICH IS A TERMINATOR TO THE PROGRAM,
THESE LOCATIONS MAY BE CHANGED TO ANY OTHER DEVICE
CODES BUT A ZERO LOCATION MUST FOLLOW THE LAST DEVICE
CODE INSERTED. A ZERO LOCATION TERMINATES THE TABLE.

5,2,7   0200 = STANDARD STARTING ADDRESS

6,   ERROR INFORMATION
         ~~~~~~~~~~~~~~~~~

ALL ERRORS THAT ARE SOFTWARE DETECTABLE WILL
RESULT IN A PROGRAM HALT UNLESS PREVENTED BY THE SR,
REFER TO THE PROGRAM LISTING FOR A DESCRIPTION OF
THE ERRORS AND UNLESS OTHERWISE STATED IN THE LISTING THE
SR MAY BE USED FOR SETTING UP A SCOPE LOOP,

IF THERE IS A FAILURE WHILE RUNNING ALTERNATE VT8=E'S,
EXAMINE LOCATION 0031 TO OBTAIN THE POINTER ADDRESS TO
THE IOT TABLE FOR THE DEVICE CODES OF THE FAILING VT8=E, IF
LOCATION 0031 CONTAINED A 0024 AND LOCATION 0024 CONTAINED
A 4543 AS IN THE LAST TABLE IN PARAGRAPH 4,2, THIS WOULD MEAN
THAT A VT8=E FAILED WITH A DISPLAY DEVICE CODE OF 45 AND A
KEYBOARD DEVICE CODE OF 43,

7,   EXECUTION TIME
         ~~~~~~~~~~~~~~

THE EXECUTION TIME OF THE MAINTENANCE AND VISUAL TESTS
IS APPROXIMATELY 17,5 MINUTES,

8,   PROGRAM DESCRIPTION
         ~~~~~~~~~~~~~~~~~~~

8,1   MAINTENANCE TESTS
         ~~~~~~~~~~~~~~~~~

    1,   CHECK THAT KCC WILL CLEAR THE AC, (CKCC)

         THE AC IS SET TO 7777 AND THE KCC IS ISSUED
         AND THE AC IS CHECKED TO BE 0,

    2,   CHECK THAT KRB WILL CLEAR THE AC, (CKRB)

         THE AC IS SET TO 7777 AND THEN KRB IS ISSUED
         AND AC0=3 IS CHECKED TO BE CLEAR,

    3,   CHECK THAT KRS WILL "INCLUSIVE OR", (CKRS)

         THE AC IS SET TO 7777 AND THEN KRS IS ISSUED
         AND THE AC IS CHECKED TO BE 7777,

4, CHECK FOR SENSE SWITCH IN THE "1" POSITION, (SENSE)

WITH A CLEAR AC, DPMS IS ISSUED TO READ THE STATE OF THE
SENSE SWITCH INTO AC0 AND A CHECK IS MADE TO
VERIFY IT WAS READ BACK,

5, CHECK THAT DPLA WILL CLEAR THE AC, (CDPLA)

THE AC IS SET TO 7777 AND THEN DPLA IS ISSUED, THEN
THE AC IS THEN CHECKED TO BE 0,

6, CHECK THAT DPSM WILL CLEAR THE AC, (CDPSM)

THE AC IS SET TO 7777 AND THEN DPSM IS ISSUED, THEN
THE AC IS CHECKED TO BE 0,

7, TEST THAT DPCL DOES NOT AFFECT THE AC, (CDPCL)

DPCL IS ISSUED WITH THE AC = 7777 AND THEN 0000,
CHECKING EACH TIME THAT THE AC REMAINS UNCHANGED,

8, CHECK THAT DPGO WILL CLEAR THE AC, (CDPGO)

THE AC IS SET TO 7777 AND THEN DPGO IS ISSUED,
THE AC IS THEN CHECKED TO BE 0,

9, CHECK OF THE REAL TIME CLOCK, (CLOCK)

WAIT FOR THE CLOCK FLAG TO SET AND THEN ONCE
IT'S SET CHECK THAT DPCL CLEARED THE FLAG AND
THAT DPCL WILL NOT SKIP WITH THE FLAG 0, NOW CHECK
THAT A CLOCK FLAG WILL OCCUR WITHIN APPROXIMATELY 40 MSEC,

10, CHECK THAT DPGO CAN ENABLE THE CLOCK INTERRUPT ENABLE, (INT1)

DPGO IS ISSUED WITH THE AC=0001 WHICH SHOULD ENABLE
THE CLOCK INTERRUPT ENABLE, THE INTERRUPT IS TURNED
ON AND THE PROGRAM ENTERS A 30 MS, TIME-OUT LOOP
DURING WHICH TIME AN INTERRUPT FROM THE CLOCK SHOULD
TAKE PLACE,

11, CHECK THAT DPGO CAN DISABLE THE CLOCK INTERRUPT ENABLE, (INT2)

DPGO IS ISSUED WITH THE AC=0001 WHICH ENBALES THE
CLOCK INTERRUPT, NOW DPGO IS ISSUED AGAIN ONLY THIS TIME
THE AC IS ZERO SO THE CLOCK INTERRUPT SHOULD BE DISABLED,
THE INTERRUPT IS TURNED ON AND THE PROGRAM ENTERS A
30 MSEC TIME-OUT LOOP WHICH SHOULD TIME-OUT SINCE
THE CLOCK IS DISABLED,

12, CHECK THAT INITIALIZE CAN DISABLE THE CLOCK INTERRUPT ENABLE, (INT3)

DPGO IS ISSUED WITH THE AC=0001 WHICH ENABLES
THE CLOCK INTERRUPT ENABLE, CAF IS NOW ISSUED WHICH
GENERATES INITIALIZE AND SHOULD CLEAR THE CLOCK
INTERRUPT ENABLE, THE INTERRUPT IS NOW TURNED ON AND
THE PROGRAM ENTERS A 30 MSEC TIME-OUT LOOP WHICH
SHOULD TIME-OUT SINCE THE CLOCK IS DISABLED,

13. CHECK THAT THE EXTENDED ADDRESS REGISTER AND COUNTER
    CAN BE LOADED AND READ BACK. (EXTA)

        DPSM IS ISSUED WITH THE AC CONTAINING THE DATA PATTERN
        TO BE USED TO TEST THE EXTENDED STARTING ADDRESS REGISTERS
        AND AC11 SET WHICH PLACES AC6-8 INTO THE EXTENDED
        STARTING ADDRESS REGISTER. DPSM IS ISSUED AGAIN ONLY
        THIS TIME WITH AC=0 WHICH LOADS THE CONTENTS OF THE
        EXTENDED STARTING ADDRESS REGISTER INTO THE ADDRESS
        COUNTER. DPMS IS THEN ISSUED TO READ THE CONTENTS
        OF THE EXTENDED ADDRESS COUNTER INTO THE AC. AN
        INCREMENTING PATTERN IS USED STARTING WITH 0.

14. CHECK THAT THE EXTENDED ADDRESS COUNTER WILL ONLY INCREMENT
    WHEN THE ADDRESS COUNTER GOES FROM 7777 TO 0000. (EXTIN)

        ISSUE DPLA WITH THE AC=0 WHICH LOADS THE STARTING
        ADDRESS REGISTER WITH 0. NOW ISSUE DPSM WITH THE
        AC=0001 WHICH SETS THE EXTENDED STARTING ADDRESS
        REGISTER TO 0. DPSM IS NOW ISSUED WHICH LOADS THE
        STARTING ADDRESS REGISTERS INTO THE ADDRESS
        COUNTER. ISSUE DPMB WHICH DOES A BREAK AND
        CAUSES THE ADDRESS COUNTER TO INCREMENT. THE
        EXTENDED ADDRESS COUNTER IS READ BACK USING DPMS.
        THE ONLY TIME DPMB SHOULD READ ANYTHING BACK INTO
        AC6-8 IS WHEN THE ADDRESS COUNTER OVERFLOWED.

15. CHECK THAT THE EXTENDED ADDRESS COUNTER WILL
    INCREMENT CORRECTLY. (EXT)

        USING DPLA SET THE STARTING ADDRESS REGISTER TO
        7777. NOW LOAD THE EXTENDED STARTING ADDRESS
        REGISTER (STARTING WITH 0) USING DPSM WITH AC11=1.
        NOW LOAD THE ADDRESS COUNTERS BY ISSUING DPSM
        WITH THE AC=0. DO A BREAK BY ISSUING DPMB WHICH
        WILL OVERFLOW THE ADDRESS COUNTER INTO
        THE EXTENDED ADDRESS COUNTER. NOW READ BACK THE
        EXTENDED ADDRESS COUNTER AND CHECK THAT IT WAS
        PROPERLY INCREMENTED. UPDATE THE TEST PATTERN
        BY 1 AND REPEAT THE TEST AGAIN UNTIL THE
        EXTENDED ADDRESS COUNTER INCREMENTS FROM
        0 THROUGH 7 TO 0.

16. CHECK THAT DPGO CAN LOAD THE EXTENDED STARTING
    ADDRESS REGISTER. (EDPGO)

        THE AC IS LOADED WITH 0001 AND DPSM IS ISSUED WHICH
        CLEARS THE EXTENDED STARTING ADDRESS REGISTER AND
        DPSM IS ISSUED AGAIN WITH THE AC ZERO WHICH NOW
        LOADS 0 INTO THE EXTENDED STARTING ADDRESS COUNTER.
        DPGO IS ISSUED WITH THE AC=70 WHICH SHOULD SET THE
        EXTENDED STARTING ADDRESS REGISTER TO 7. IN ORDER TO
        VERIFY THAT IT HAPPENED, DPSM IS ISSUED WHICH LOADS THE
        EXTENDED STARTING ADDRESS REGISTER INTO THE EXTENDED
        ADDRESS COUNTER WHICH IS READ INTO THE AC WITH DPMS.
        THE AC SHOULD BE 0070.

17. CHECK THE VT8-E BUFFER USING CONSTANT DATA. (DATA1)

     OBTAIN THE DATA PATTERN AND DO 31 OR 63 BREAKS TO
     PRIME THE BUFFER. NOW DO 1 MORE BREAK AND VERIFY THAT
     THE DATA PATTERN RECEIVED IS THE SAME ONE THAT WAS SENT.
     EACH PATTERN IS DONE 4096 TIMES.
     DATA PATTERNS USED: 7777! 0000! 7777! 5252! 2525!
                          7700! 0077! 7007! 0770.

18. CHECK THE VT8-E BUFFER USING A SPECIAL BINARY COUNT
    PATTERN. (DATA2)

     A SPECIAL BINARY COUNT PATTERN IS THE BINARY COUNT
     AND THEN THE 1'S COMPLEMENT. EG: (0000! 7777!
     0001! 7776! 0002! 7775! ETC.)

     A. GET THE PATTERN.
     B. DO A SINGLE BREAK.
     C. 32ND OR 64TH BREAK?
     D. NO - GO TO G! YES - GO TO E.
     E. SIMULATE THE CORRECT OUTPUT AND CHECK THE
         ACTUAL AGAINST THE SIMULATED.
     F. IF ERROR - HALT (SEE THE LISTING).
     G. UPDATA DATA PATTERN (EG: IF 0000 THEN 7777!
         IF 7777 THEN 0001! IF 0001 THEN 7776! ETC)
     H. ALL PATTERNS BEEN OUTPUT?
     I. NO - GO TO A! YES - GO TO NEXT TEST.

19. ADDRESS TEST (ADDR1)

     THIS TEST STARTS AT ADDRESS 0 OF FIELD 0 AND CHECKS
     EVERY ADDRESS IN EVERY FIELD FOR AS MANY FIELDS AS
     SELECTED IN SR9-11. THE ADDRESS AND ITS COMPLEMENT ARE
     THE DATA PATTERNS USED.

     A. GET THE ADDRESS AND SAVE THE CONTENTS IN THE MQ.
     B. GET THE DATA PATTERN AND PLACE IT IN THE ADDRESS.
         (ADDRESS OR ITS COMPLEMENT)
     C. DO 32 OR 64 BREAKS ON THE SAME ADDRESS.
     D. SAVE THE OUTPUT OF THE BUFFER.
     E. RESTORE THE ADDRESS WITH THE CONTENTS OF THE MQ.
     F. CHECK THE EXPECTED AGAINST THE ACTUAL.
     G. IF ERROR - HALT. (SEE LISTING).
     H. UPDATA PATTERN AND ADDRESS.
     I. ALL ADDRESSES CHECKED?
     J. NO - GO TO A! YES - GO TO NEXT TEST.

20. CURRENT ADDRESS INCREMENT TEST. (CAINC)

THIS TEST CHECKS THAT THE ADDRESS COUNTER INCREMENTS
CORRECTLY.

A. LOAD ADDRESS 0000 INTO STARTING ADDRESS REGISTER.
B. SAVE THE CONTENTS OF THE ADDRESS TO BE TESTED
   IN THE MQ.
C. PLACE A VALUE EQUIVALENT TO THE ADDRESS IN THE ADDRESS.
D. DO 1 BREAK.
E. RESTORE THE ADDRESS AND SAVE THE OUTPUT OF THE BUFFER.
F. HAVE 32 OR 64 BREAKS BEEN PERFORMED?
G. NO - GO TO J; YES - NEXT.
H. IS THE OUTPUT THE SAME AS WHAT WAS EXPECTED?
I. NO - HALT. (SEE LISTING)
J. +1 TO THE DATA.
K. HAS ADDRESS 7777 BEEN OUTPUT YET?
L. NO - GO TO C; YES - GO TO NEXT TEST.

8.2   VISUAL DISPLAY TESTS
      ----

1. DISPLAY A FULL SCREEN OF A SINGLE CHARACTER. (DSCHAR)

THIS TEST DISPLAYS A FULL SCREEN OF A SINGLE CHARACTER
FOR 2 SECONDS STARTING WITH CODE 0040 (SPACE) AND INCREMENTING
UP TO CODE 0137 (+). EACH COMPLETE CHARACTER SET IS
DISPLAYED IN NORMAL, BLINK, BRIGHT, AND THEN FINALLY
CURSOR MODE.

A. SET UP SO SPACE (0040) IS FIRST CHARACTER DISPLAYED.
B. LOAD BUFFER WITH CHARACTER AND CB2+CB3 CONTROL BITS.
C. SET TIMER FOR 2 SECONDS.
D. DISPLAY CHARACTER FOR DURATION OF TIMER.
E. MANUAL INCREMENT?
F. NO - NEXT; YES - GO TO D.
G. +1 TO CHARACTER.
H. CODE 137 "+" BEEN DISPLAYED YET?
I. NO - GO TO B; YES - NEXT.
J. INCREMENT CB2+CB3 CONTROL WORD
K. CURSOR CONTROL BEEN SEEN YET?
L. NO - GO TO B; YES - GO TO NEXT TEST.

2. DISPLAY A RIPPLE PATTERN. (DISRIP)

        THIS TEST DISPLAYS A RIPPLE OR INCREMENTING PATTERN
        OF THE CHARACTER SET ON EACH LINE STARTING WITH CODE
        0040 (SPACE) AND ENDING WITH CODE 0137 (*) IF JUMPERED
        FOR 64 CHARACTERS PER LINE, HOWEVER IF SET FOR 32
        CHARACTERS PER LINE IT WILL REQUIRE 2 LINES TO DISPLAY
        THE CHARACTER SET.

        EG|
        64| !"#$%&'()**,-./0123456789;|<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[/]+*
        32| !"#$%&'()**,-./0123456789;|<=>?
           @ABCDEFGHIJKLMNOPQRSTUVWXYZ[/]+*

        THE PATTERN IS DISPLAYED IN NORMAL, BLINK, BRIGHT,
        AND FINALLY CURSOR MODE.

        A. SET TIMER FOR 5 SECONDS.
        B. LOAD RIPPLE PATTERN.
        C. DISPLAY RIPPLE PATTERN FOR DURATION OF TIMER.
        D. STOP DISPLAY.
        E. INCREMENT THE CB2CB3 CONTROL WORD
        F. CURSOR CONTROL DISPLAYED YET?
        G. NO - GO TO B; YES - GO TO NEXT TEST.

3. DISPLAY A SWIRL PATTERN (DISSWL)

        THIS TEST DISPLAYS A SWIRL PATTERN.

        EG| !"#$%
                 !"#$%&
                 "#$%&'

        IN THE CASE OF 64 CHARACTERS PER LINE EACH LINE WILL
        CONTAIN THE ENTIRE CHARACTER SET AND IF 32 CHARACTERS
        PER LINE IT WILL REQUIRE 2 LINES TO DISPLAY THE SET.
        THIS TEST IS RUN WITH CB2CB3 IN THE NORMAL MODE. THE
        SWIRL IS MOVED OR UPDATED EVERY SECOND.

4. DISPLAY A RIPPLE PATTERN WITH ALL CONTROL BITS SEEN. (ALL)

        THIS TEST IS SIMILAR TO 8.2(2.) EXCEPT EACH COMPLETE
        CHARACTER SET IS SHOWN WITH A DIFFERENT CB2CB3 CONTROL
        BIT SET.

                EG| ABC   (NORMAL)
                        ABC   (BLINK)
                        ABC   (BRIGHT)
                        ABC   (CURSOR)
                        ABC   (NORMAL) - REPEAT

        THE PATTERN IS DISPLAYED FOR 10 SECONDS.

5. LINE FEED TEST. (LFTST)

THE ENTIRE BUFFER IS FILLED WITH "CURSOR ?". A
VERTICAL COLUMN OF "BRIGHT *" IS FORMED WITH ","
ON THE LEFT AND LINE FEEDS ON THE RIGHT WHICH
SHOULD PRODUCE A HORIZONTAL MOVEMENT OF THE VERTICAL
COLUMN OF "BRIGHT *'S" WITH NOTHING VISUAL TO THE RIGHT
OF IT. A LINE FEED FAILURE WILL MOST LIKELY DISRUPT
THE VERTICAL COLUMN AND "CURSOR ?" WILL BE SEEN. IF
AT ANY TIME "CURSOR ?" IS SEEN THERE HAS BEEN A FAILURE.

EG: (L=LINE FEED)   ,,,,,,*L???   --)
                      ,,,,,,*L???   --)
                      ,,,,,,*L???   --)

THE COLUMN IS MOVED TO THE RIGHT EVERY .5 SECONDS.

6. TEST OF "BEGIN BLANK FIELD" AND "END BLANK FIELD". (FLDTST)

THE ENTIRE BUFFER IS FILLED WITH "<'S". SET BBF IN THE
FIRST CHARACTER WHICH WILL BE A "CURSOR ?" AND MOVE EBF
WHICH WILL BE A "BRIGHT E". THE "BRIGHT ?'S" WHICH
ARE LOADED BETWEEN BBF AND EFB SHOULD NEVER BE SEEN. IF
"CURSOR ?" AND/OR "BRIGHT ?" ARE SEEN THIS CONSTITUTES
AN ERROR. EBF IS MOVED RIGHT AND DOWN, AND WHEN IT REACHES
THE LOWER RIGHT THE SCREEN SHOULD BE EMPTY. NOW MOVE
BBF RIGHT AND DOWN EACH TIME PLACING A "BRIGHT B"
ON THE LEFT OF IT AND ">'S" BEHIND IT. THE TEST IS
COMPLETE WHEN THE SCREEN IS FULL OF ">'S". THE BBF OR
EBF MOVEMENT TAKES PLACE EVERY .1 SECONDS.

7. END OF SCREEN TEST. (EOSTST)

THIS TEST CHECKS THAT NOTHING PAST THE "END OF SCREEN"
CONTROL BIT SHOULD BE SEEN. LOAD THE BUFFER WITH
"BRIGHT ?". START AT THE UPPER LEFT WITH EOS WHICH WILL
BE A "CURSOR ?". ON THE LEFT PLACE A "BRIGHT O" AND BEHIND
THAT "X'S". STARTING AT THE UPPER LEFT THE USER SHOULD SEE
THE SCREEN BEING FILLED WITH "X'S" WITH A "BRIGHT O" PRECEEDING
THEM. TEST IS COMPLETE WHEN "EOS" IS AT THE BOTTOM RIGHT
OF THE SCREEN AND THE SCREEN IS FULL OF "X'S". IF AT
ANY TIME A "?" IS SEEN THIS CONSTITUTES A FAILURE.
EOS IS MOVED EVERY .1 SECONDS.

8. SHRINKAGE TEST. (SHRINK)

PERIODS ARE PLACED IN EACH CORNER OF THE SCREEN WITH
"CURSOR SPACE" FILLING THE REST OF THE SCREEN. AT
ALL TIMES THE "PERIODS" SHOULD REMAIN ALMOST MOTIONLESS.
THE DURATION OF THE TEST IS 10 SECONDS.

1. KEYBOARD TEST 1 (KEYTST)

        THIS TEST ECHOES THE CHARACTER TYPED ON THE KEYBOARD
        ON THE SCREEN AND CHECKS THAT KIE CAN DISABLE AND
        ENABLE THE KEYBOARD INTERRUPT. KRB IS TESTED FOR READING
        THE KEYBOARD BUFFER AND THAT IT CAN CLEAR THE KEYBOARD
        FLAG. THIS TEST IS ONLY FOR ECHOING CHARACTERS FROM
        THE STANDARD KEYBOARD.

        A. CHECK KEYBOARD FLAG TO BE CLEAR AFTER INITIALIZATION.
        B. KEYBOARD FLAG CLEAR?
        C. NO = HALT (SEE LISTING); YES = NEXT.
        D. FILL BUFFER WITH "CURSOR ?".
        E. DISPLAY "CURSOR 1".
        F. WAIT FOR INPUT FROM THE KEYBOARD.
        G. KEYBOARD FLAG SET YET? NO = GO TO F; YES = NEXT.
        H. ENABLE THE KEYBOARD INTERRUPT AND TURN THE INTERRUPT ON.
        I. DID AN INTERRUPT OCCUR?
        J. NO = HALT (SEE LISTING); YES = NEXT.
        K. DISABLE THE KEYBOARD INTERRUPT AND TURN THE INTERRUPT ON.
        L. DID AN INTERRUPT OCCUR?
        M. NO = NEXT; YES = HALT (SEE LISTING)
        N. ENABLE THE KEYBOARD INTERRUPT AND TURN THE INTERUPT ON.
        O. DID AN INTERRUPT OCCUR?
        P. NO = HALT (SEE LISTING); YES = NEXT.
        Q. SET AC=7777.
        R. READ THE KEYBOARD BUFFER AND CLEAR THE FLAG (KRB).
        S. SAVE THE 7-BIT CODE.
        T. IS THE KEYBOARD FLAG SET?
        U. NO = NEXT; YES = HALT (SEE LISTING).
        V. IF A "RUBOUT" DELETE A CHARACTER ON THE SCREEN.
        W. IF A "CARRIAGE RETURN" = GO TO THE NEXT TEST.
        X. MOVE CURSOR RIGHT ONE AND INSERT THE NEW CHARACTER.
        Y. IF THE SCREEN IS FILLED WITH CHARACTERS GO TO A
        Z. GO TO B.

2. KEYBOARD TEST 2. (CURTST)

        THIS TEST WILL DISPLAY IN "ENGLISH" THE DEFINITION OF THE
        SPECIAL FUNCTION KEY TYPED.
        EG: UP, DOWN, HOME, EOS, EOL, LEFT, RIGHT.
        AN ILLEGAL CODE WILL DISPLAY "WHAT ?".
        KCF IS CHECKED THAT IT CAN CLEAR THE KEYBOARD FLAG.
        CARRIAGE RETURN ENDS THIS TEST.

        A. INITIALIZE AND DISPLAY "CURSOR 2".
        B. WAIT FOR KEYBOARD INPUT.
        C. IS THE KEYBOARD FLAG SET?
        D. NO = GO TO C; YES = NEXT.
        E. CLEAR THE KEYBOARD FLAG WITH KCF.
        F. IS THE KEYBOARD FLAG SET?
        G. NO = NEXT; YES = HALT (SEE LISTING).
        H. SAVE THE 7 BIT CODE.
        I. IF A CARRIAGE RETURN = GO TO THE NEXT TEST.
        J. IF "CURSOR LEFT" DISPLAY "LEFT".
        K. IF "CURSOR RIGHT" DISPLAY "RIGHT".

```
            L,  IF "CURSOR UP" DISPLAY "UP",
            M,  IF "CURSOR DOWN" DISPLAY "DOWN",
            N,  IF "EOL" DISPLAY "EOL",
            O,  IF "EOS" DISPLAY "EOS",
            P,  IF "HOME" DISPLAY "HOME",
            Q,  IF NOT I = P| DISPLAY "WHAT ?",
            R,  GO TO B,

    3,  KEYBOARD TEST 3,  (OCT)

            THIS TEST DISPLAYS THE CHARACTER, ASCII CODE, AND
            SENSE SWITCH POSITION,  CAF IS CHECKED THAT IT CAN
            CLEAR THE KEYBOARD KEYBOARD FLAG,

            EG|  A = 0301  SW = 1
                 A = 0301  SW = 0

            A,  INITIALIZE
            B,  DISABLE THE KEYBOARD INTERRUPT WITH KIE,
            C,  ISSUE CAF WHICH SHOULD ENABLE THE KEYBOARD INTERRUPT,
            D,  DISPLAY "CURSOR 3",
            E,  WAIT FOR INPUT FROM THE KEYBOARD,
            F,  KEYBOARD FLAG SET?  NO - GO TO E|  YES - NEXT,
            G,  READ CHARACTER FROM THE KEYBOARD BUFFER WITH KRS,
            H,  TURN THE INTERRUPT ON,
            I,  DID AN INTERRUPT OCCUR?
            J,  NO - ERROR (SEE LISTING)|  YES - NEXT,
            K,  IS THE KEYBOARD FLAG SET?
            L,  NO - NEXT|  YES - HALT (SEE LISTING),
            M,  RESTART DISPLAY,
            N,  IF CARRIAGE RETURN WAS TYPED - GO TO NEXT TEST,
            O,  READ THE SWITCH STATUS FROM THE TERMINAL,
            P,  IF CODE "XX40" TO CODE "X137" DISPLAY
                "CHARACTER" = AND ASCII CODE, AND
                SWITCH POSITION,  EG|  A = 0301  SW = 1
            Q,  IF CODE <0040 OR >0137 DISPLAY THE ASCII
                CODE AND SWITCH POSITON,  EG| (RUBOUT)  0377  SW = 1
            R,  GO TO E,

9,     LISTING
       -------
```

```
                         /VT8-E  VIDEO DISPLAY TEST 1   MAINDEC-08-DHVTA-B-L
                         /
                         /ALPHA-NUMERIC
                         /
                         /COPYRIGHT 1972, 1973, DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASS, 01754,
                         /
                         /PROGRAMMER!  ED FORTHILLER
                         /
                         /VT8-E EQUATE STATEMENTS!
        6050    DPLA=6050                /LOAD STARTING ADDRESS OF DATA BUFFER,
                                         /AC0-11 --->STARTING ADDRESS REGISTER, 0-->AC,

        6051    DPGO=6051                /LOAD STARTING EXTENDED ADDRESS OF DATA BUFFER,
                                         /AC6-8 -->EXTENDED ADDRESS REGISTER,
                                         /GO - START DISPLAY AFTER NEXT VERTICAL RETRACE IN
                                         /ONE OF FOUR MODES SPECIFIED BY AC10,11,
                                         /AC10  AC11
                                         /  0     0      ALPHA-NUMERIC; INTERRUPT DISABLED
                                         /  0     1      ALPHA-NUMERIC; INTERRUPT ENABLED
                                         /  1     0      GRAPHIC; INTERRUPT DISABLED,
                                         /  1     1      GRAPHIC; INTERRUPT ENABLED,
                                         /
                                         /0 --> AC,

        6052    DPSM=6052                /STOP DISPLAY, INHIBIT VIDEO AND FURTHER
                                         /DEVICE INITIATED BREAKS,
                                         /ENTER MAINTENANCE MODE AND IF AC11=1,
                                         /AC6-8 -->EXT, STARTING ADDRESS REGISTER;
                                         /IF AC11=0, PREPARE FOR SINGLE DATA BREAK,
                                         /(STARTING ADDR REG)-->ADDR COUNTER(CA),
                                         /0 --> AC,

        6053    DPMB=6053                /MAINTENANCE INSTRUCTION,
                                         /PERFORM A SINGLE ONE-CYCLE DATA BREAK,
                                         /C(BREAK ADDRESS)-->INTERFACE DATA BUFFER,
                                         /BREAK ADDR+1 --> BREAK ADDR REGISTER,

        6054    DPMD=6054                /MAINTENANCE INSTRUCTION,
                                         /READ DATA BUFFER (DATA BUFFER)--> AC0-11,

        6055    DPMS=6055                /MAINTENANCE INSTRUCTION,
                                         /READ EXTENDED BREAK ADDRESS REGISTER
                                         /AND SENSE SWITCH (EXT ADDR REG)--> AC6-8,

        6056    DPCL=6056                /SKIP ON REAL TIME CLOCK FLAG AND CLEAR IF SET,

        6057    DPBELL=6057              /GENERATE A ,5 SECOND BURST OF 1,56 KHZ TONE,


                /EQUATE STATEMENTS FOR CREF LISTING!

        7402    HLT=7402                 /HALT,
        7604    LAS=7604                 /READ SWITCHES,
```

```
        7404    OSR=7404                 /INCLUSIVE "OR" SWITCHES TO AC,
        7002    BSW=7002                 /SWAP BYTES IN AC,

                /EQUATE STATEMENTS FOR THE MQ,

        7421    MQL=7421                 /LOAD MQ FROM AC THEN CLEAR AC,
        7501    MQA=7501                 /INCLUSIVE "OR" THE MQ WITH THE AC,
        7621    CAM=7621                 /CLEAR AC AND MQ,
        7521    SWP=7521                 /SWAP AC AND MQ,
        7701    ACL=7701                 /LOAD MQ IN TO AC,
        7721    CLASWP=7721              /LOAD AC FROM MQ THEN CLEAR MQ,

                /MISCELLANEOUS EQUATE STATEMENTS!

        0000    OPEN=0000                /PROGRAM MODIFIABLE,
        7000    FUTURE=NOP               /PATCH SPACE,

                /EQUATE STATEMENTS FOR PROCESSOR IOT'S!

        6000    SKON=6000                /SKIP IF INTERRUPT ON, AND TURN OFF,
        6001    ION=6001                 /TURN INTERRUPT ON,
        6002    IOF=6002                 /TURN INTERRUPT OFF,
        6003    SRQ=6003                 /SKIP ON INTERRUPT REQUEST,
        6004    GTF=6004                 /GET INTERRUPT FLAGS,
        6005    RTF=6005                 /RESTORE INTERRUPT FLAGS,
        6007    CAF=6007                 /CLEAR ALL FLAGS, AC AND LINK,

                /EQUATE STATEMENTS FOR MEMORY EXTENSION!

        6214    RDF=6214                 /READ DATA FIELD,
        6224    RIF=6224                 /READ INSTRUCTION FIELD,
        6234    RIB=6234                 /READ INTERRUPT BUFFER,
        6244    RMF=6244                 /RESTORE MEMORY FIELD,
        6201    CDF=CDF                  /CHANGE DATA FIELD,

                /EQUATE STATEMENTS FOR KEYBOARD!

        6030    KCF=6030                 /CLEAR KEYBOARD FLAG,
        6031    KSF=6031                 /SKIP ON KEYBOARD FLAG,
        6032    KCC=6032                 /CLEAR KEYBOARD FLAG AND AC,
        6034    KRS=6034                 /"OR" KEYBOARD BUFFER WITH AC 5-11
                                         /1-->AC4; 0-->AC0-3,
        6035    KIE=6035                 /ENABLE INTERRUPT IF AC 11 = 1,
                                         /DISABLE INTERRUPT IF AC 11 = 0,
        6036    KRB=KCC KRS              /SEE "KCC" AND "KRS",


                /DEFINES!

        4577    UDPLA=JMS I      C=DPLA
        4576    UDPGO=JMS I      C=DPGO
        4575    UDPSM=JMS I      C=DPSM
        4574    UDPMB=JMS I      C=DPMB
        4573    UDPMD=JMS I      C=DPMD
        4572    UDPMS=JMS I      C=DPMS
```

```
        4571    UDPCL=JMS I     [ZDPCL
        4570    UDPBEL=JMS I    [ZDPBEL
        4567    XDPGO=JMS I     [DPGOX
        4566    SETUP=JMS I     [SETUPX
        4565    SHOW=JMS I      [SHOWX
        4564    LOOP=JMS I      [XLOOP
        4060    HOMEDF=JMS      HOME
        4563    SR1=JMS I       [SW1
        4562    SR1A=JMS I      [SW1A
        4561    SR2=JMS I       [SW2
        4560    SR3=JMS I       [SW3
        4557    SR6=JMS I       [SW6
        4556    SR7=JMS I       [SW7

                /CONTROL WORD DEFINES!

        1000    EBF=1000
        2000    BBF=2000
        3000    EOS=3000
        0000    NORMAL=0000
        0200    BLINK=0200
        0400    BRIGHT=0400
        0600    CURSOR=0600

                /OTHER DEFINES!

        0036    LFADD=TEMP2
        0037    LFEND=TEMP3
        0040    LENGTH=TEMP4
        0041    ISTORE=TEMP5
        0177    BIT7=177
        0200    BEGIN=0200
        4700    BUFFER=4700
        7400    BWA=BUFFER+100+2400
        0375    ALTMOD=375
        0377    RUBOUT=377
        0212    LINEFD=212
        0215    CARRET=215
        0010    CURLFT=10
        0030    CURRHT=30
        0032    CURUP=32
        0013    CURDWN=13
        0035    CURHME=35
        0036    EOL=36
        0037    EOS=37

                /MACRO!

                DEFINE  NPAGE
                <       JMP I   (.+200&7600    /GO TO NEXT PAGE>


                /STARTING ADDRESS!
                /
                /       0200
```

```
                /
                /SWITCH REGISTER SETTINGS!
                /
                /       SR0 = 0                 NORMAL RUN,
                /       SR0 = 1                 HALT PROGRAM,
                /
                /       SR1 = 0                 HALT ON ERROR,
                /       SR1 = 1                 NO HALT ON ERROR,
                /
                /       SR2 = 0                 NO LOOP,
                /       SR2 = 1                 REPEAT PATTERN,
                /
                /       SR3 = 0                 NORMAL RUN,
                /       SR3 = 1                 REMAIN IN TEST,
                /
                /       SR4 = 0                 60 CYCLE,
                /       SR4 = 1                 50 CYCLE,
                /
                /       SR5 = 0                 ENABLE BACKGROUND JOB,
                /       SR5 = 1                 DISABLE BACKGROUND JOB,
                /
                /       SR6 = 0                 64 CHARACTER,
                /       SR6 = 1                 32 CHARACTER,
                /
                /       SR7 = 0                 NORMAL,
                /       SR7 = 1                 ENABLE MANUAL INCREMENT,
                /
                /       SR8                     WITH SR7 = 1 A CHANGE IN SR8 INCREMENTS
                /                               THE PATTERN.  (VISUAL TESTS ONLY)
                /
                /                               WITH SR7 = 0 AND SR8 = 1  REMAIN IN
                /                               SECTION.
                /
                /       SR9=11                  PLACE VALUE OF HIGHEST MEMORY FIELD.
                /                               (E.G. 0 FOR 4K, 1 FOR 8K, AND UP TO
                /                               7 FOR 32K),
                /
                /REQUIRED BUFFER SIZES!
                /       32 CHAR ALPHA-NUMERIC   20 LINES * 32 CHAR PER LINE = 0640 (DECIMAL)
                /       64 CHAR ALPHA-NUMERIC   20 LINES * 64 CHAR PER LINE = 1280 (DECIMAL)
                /       GRAPHICS                192 DOTS (=3) PERLINE * 200 LINES = 3200 (DECIMAL)

        0000            *0

0000    0000    ZERO,   OPEN
0001    0000    ONE,    OPEN
0002    0000    TWO,    OPEN
0003    0000    THREE,  OPEN
0004    0000    FOUR,   OPEN
0005    0000    FIVE,   OPEN
0006    0000    SIX,    OPEN
0007    0000    SEVEN,  OPEN

        0010            *10
```

```
0010  0000   AI10,   OPEN
0011  0000   AI11,   OPEN
0012  0000   AI12,   OPEN
0013  0000   AI13,   OPEN
0014  0000   AI14,   OPEN
0015  0000   AI15,   OPEN
0016  0000   AI16,   OPEN
0017  0000   AI17,   OPEN

      0020           *20

0020  0503   IOTTAB, 0503
0021  0000           OPEN
0022  0000           OPEN
0023  0000           OPEN
0024  0000           OPEN
0025  0000           OPEN
0026  0000           OPEN
0027  0000           OPEN
0030  0000           0

0031  0000   WORKVT, OPEN
```

/THESE LOCATIONS ARE CLEARED AT THE START OF EACH TEST;

```
0032  0000   GDATA,  OPEN
0033  0000   BDATA,  OPEN
0034  0000   ADATA,  OPEN
0035  0000   TEMP1,  OPEN
0036  0000   TEMP2,  OPEN
0037  0000   TEMP3,  OPEN
0040  0000   TEMP4,  OPEN
0041  0000   TEMP5,  OPEN
0042  0000   COUNT1, OPEN
0043  0000   COUNT2, OPEN
0044  0000   COUNT3, OPEN
0045  0000   TIME,   OPEN
0046  0000   TIMEX,  OPEN
0047  0000   CB2CB3, OPEN
0050  0000   CHAR,   OPEN
0051  0000   PSET,   OPEN
0052  0000   FLO,    OPEN
0053  0000   AC,     OPEN
0054  0000   MQ,     OPEN
0055  0000   LINK,   OPEN
0056  0000   RETUJM, OPEN

0057  0000   IDPSM,  OPEN                      /CONTAINS A "DPSM" OR A "NOP";
```

/THIS ROUTINE SETS THE DF=IF,

```
0060  0000   HOME,   OPEN
0061  6224           RIF                /
0062  1155           TAD     (CDF    00  /
```

```
0063  3064   DCA     ,+1                /
0064  0000   OPEN                       /CHANGE DF;
0065  5460   JMP I   HOME               /EXIT OF NOW =/S IF,

      0070   *70
```

/SPECIAL STARTING ADDRESSES;

```
0070  5754'  JMP     DVCOD              /THIS SPECIAL STARTING ADDRESS IS USED TO
                                        /CHANGE DEVICE CODES;
                                        /SR0 = 5;  DISPLAY
                                        /SR6 =11;  KEYBOARD
0071  5753'  JMP     DSCHAR-1           /THIS STARTS THE PROGRAM AT THE VISUAL SECTION;
0072  5752'  JMP     KEYTST-1           /THIS STARTS THE PROGRAM AT THE KEYBOARD SECTION,
0073  5751'  JMP     DP                 /THIS TEST DOES CONTINUOUS MAINTENANCE BREAKS
                                        /USING THE DATA PATTERN IN THE SR AND
                                        /DISPLAYS THE OUTPUT IN THE MQ;

0074  5750'  JMP     SETCHR             /THIS TEST WILL DISPLAY A FULL SCREEN OF
                                        /THE CHARACTER PLACED IN THE SR,  AFTER
                                        /PRESSING CONTINUE, SELECT DESIRED SR OPTIONS;

0075  5747'  JMP     MULVT8             /THIS SPECIAL STARTING ADDRESS IS USED
                                        /TO RUN A SWIRL PATTERN ON 4 VT8E'S
                                        /SIMULTANEOUSLY;

      0200   *200

0200  4355   JMS     INITDC             /INITALIZE TO THE FIRST DEVICE CODE
```

/TEST THAT KCC WILL CLEAR THE AC,

```
0201  4566   CKCC,   SETUP              /INIT
0202  7240           CLA CMA            /7777
0203  6032   KEYI7,  KCC                /CLEAR KBRD FLAG AND AC
0204  7450           SNA                /IS AC CLEAR?
0205  5210           JMP     ,+3        /YES, KCC OK
0206  4562           SR1A               /HALT?
0207  7402           HLT                /KCC FAILED TO CLEAR THE AC;
                                        /AC SHOULD BE 0;
0210  4564           LOOP               /
0211  0202           KEYI7-1            /RETURN POINTER
0212  5201           JMP     CKCC       /YES,
```

/CHECK THAT KRB WILL CLEAR THE AC;

```
0213  4566   CKRB,   SETUP              /INIT
0214  7240           CLA CMA            /7777
0215  6036   KEYI8,  KRB                /TRY TO CLEAR AC
0216  0146           AND     (7400      /JUST CHECK 0-3
0217  7450           SNA                /CLEAR?
0220  5223           JMP     ,+3        /OK
0221  4562           SR1A               /HALT?
```

```
        0222  7402          HLT                       /KRB FAILED TO CLEAR THE AC0-3
                                                      /AC CONTAINS THE RESULT OF KRB,
                                                      /AC SHOULD BE 0 AT THIS TIME,
        0223  4564          LOOP                      /
        0224  0214          KEYI8-1                   /RETURN POINTER
        0225  5213          JMP       CKRB            /YES,

                    /CHECK THAT KRS WILL NOT CLEAR THE AC,

        0226  4566   CKRS,  SETUP                     /INIT
        0227  7240          CLA CMA                   /7777
        0230  6034   KEYI9, KRS                       /INCLUSIVE OR TO AC,
        0231  7421          MQL                       /SAVE AC
        0232  7501          MQA                       /RESTORE AC
        0233  7101          CLL IAC                   /+1 TO MAKE AC 0 IF OK
        0234  7650          SNA CLA                   /AC NOW 0?
        0235  5241          JMP       ,+4             /YES, KRS OK
        0236  4563          SR1                       /HALT?
        0237  7501          MQA                       /RESTORE BAD AC
        0240  7402          HLT                       /KRS DID NO INCLUSIVE OR WITH AC
                                                      /AC SHOULD BE 7777,
        0241  4564          LOOP                      /
        0242  0227          CKRS+1                    /RETURN POINTER
        0243  5226          JMP       CKRS            /YES



                    /CHECK FOR THE SENSE SWITCH ON DISPLAY TO BE SET,

        0244  4566   SENSE, SETUP                     /INIT
        0245  4572          UDPMS                     /READ SWITCH
        0246  7104          CLL RAL                   /PUT IN LINK
        0247  7210          CLA RAR                   /PUT IT BACK IN AC WITH REST OF AC CLEAR,
        0250  7440          SZA                       /SENSE SWITCH IN THE "1" POSITION?
        0251  5254          JMP       ,+3             /YES,
        0252  4562          SR1A                      /HALT?
        0253  7402          HLT                       /SENSE SWITCH IN THE "0" POSITION
                                                      /OR DPMS CANNOT READ IT BACK,
                                                      /AC CONTAINS WHAT WAS READ FROM
                                                      /THE STATUS REGISTER,  AC SHOULD
                                                      /BE 4000,
        0254  4564          LOOP                      /
        0255  0245          SENSE+1                   /RETURN POINTER
        0256  5244          JMP       SENSE           /YES,

                    /TEST THAT DPLA WILL CLEAR THE AC,

        0257  4566   CDPLA, SETUP                     /INITIALIZE
        0260  7340          CLA CLL CMA               /7777
        0261  4577          UDPLA                     /ISSUE DPLA
        0262  7450          SNA                       /DID THE AC GET CLEARED?
        0263  5266          JMP       ,+3             /YES, A-OKAY
        0264  4562          SR1A                      /SHALL WE HALT?
        0265  7402          HLT                       /DPLA FAILED TO CLEAR THE AC,
```

```
                                                      /AC SHOULD BE 0,
        0266  4564          LOOP                      /
        0267  0260          CDPLA+1                   /RETURN POINTER
        0270  5257          JMP       CDPLA           /YES,

                    /TEST THAT DPSM WILL CLEAR THE AC

        0271  4566   CDPSM, SETUP                     /INITIALIZE,
        0272  7340          CLA CLL CMA               /7777
        0273  4575          UDPSM                     /ISSUE DPSM
        0274  7450          SNA                       /DID THE AC GET CLEARED?
        0275  5300          JMP       ,+3             /YES, A-OKAY
        0276  4562          SR1A                      /HALT?
        0277  7402          HLT                       /DPSM FAILED TO CLEAR THE AC,
                                                      /AC SHOULD BE 0,
        0300  4564          LOOP                      /
        0301  0272          CDPSM+1                   /RETURN POINTER
        0302  5271          JMP       CDPSM           /YES,



                    /TEST THAT DPCL WILL NOT AFFECT THE AC,

        0303  4566   CDPCL, SETUP                     /INITIALIZE
        0304  7340          CLA CLL CMA               /7777
        0305  4571          UDPCL                     /ISSUE DPCL
        0306  7000          NOP                       /COVERS NO SKIP CONDITION
        0307  7421          MQL                       /SAVE AC
        0310  7501          MQA                       /RESTORE AC
        0311  7001          IAC                       /+1 TO MAKE AC 0 FOR CHECK,
        0312  7450          SNA                       /WAS AC 7777 AFTER DPCL?
        0313  5317          JMP       ,+4             /YES,
        0314  7501          MQA                       /GET AC BACK
        0315  4562          SR1A                      /HALT?
        0316  7402          HLT                       /DPCL DID SOMETHING TO THE AC,
                                                      /AC SHOULD BE 7777,
        0317  4561          SR2                       /LOOP?
        0320  5304          JMP       CDPCL+1         /YES,
        0321  7300   CDPCL1,CLA CLL                   /0
        0322  4571          UDPCL                     /ISSUE DPCL
        0323  7000          NOP                       /IN CASE OF SKIP
        0324  7450          SNA                       /WAS AC STILL 0?
        0325  5330          JMP       ,+3             /YES,
        0326  4562          SR1A                      /HALT?
        0327  7402          HLT                       /DPCL SET SOMETHING IN THE AC,
                                                      /AC SHOULD BE 0,
        0330  4561          SR2                       /LOOP?
        0331  5321          JMP       CDPCL1          /YES,
        0332  2035          ISZ       TEMP1           /DONE 4096 TIMES?
        0333  5304          JMP       CDPCL+1         /NO,
        0334  4560          SR3                       /REMAIN IN THIS TEST?
        0335  5303          JMP       CDPCL           /YES,

                    /TEST THAT DPGO WILL CLEAR THE AC,
```

```
0336  4566    CDPGO,  SETUP                   /INITIALIZE,
0337  7340            CLA CLL CMA             /SET AC TO 7777
0340  4576            UDPGO                   /GO, THIS SHOULD ALSO 0 THE AC,
0341  7421            MQL                     /SAVE THE AC IN THE MQ,
0342  4575            UDPSM                   /STOP
0343  7501            MQA                     /MQ TO AC,
0344  7650            SNA CLA                 /WAS AC 0?
0345  5351            JMP     .+4             /YES, A-OKAY,
0346  4563            SR1                     /HALT?
0347  7501            MQA                     /BAD AC TO THE AC,
0350  7402            HLT                     /DPGO FAILED TO CLEAR THE AC,
                                              /CONTENTS OF AC AFTER DPGO ARE
                                              /IN THE AC AT THIS TIME,
                                              /AC SHOULD BE 0,
0351  4564            LOOP                    /
0352  0337            CDPGO+1                 /RETURN POINTER
0353  5336            JMP     CDPGO           /YES,
              NPAGE
0354  5777            JMP I   (.+2000&7600   /GO TO NEXT PAGE

0355  0000    INITDC, 0
0356  1376            TAD     (IOTTAB
0357  3031            DCA     WORKVT
0360  4775'           JMS     DEVCOD
0361  5755            JMP  I  INITDC


0375  4123
0376  0020
0377  0400
      0400            PAGE
              /TEST OF THE REAL TIME CLOCK,

0400  4566    CLOCK,  SETUP                   /INITIALIZE
0401  3035            DCA     TEMP1           /0 --> TEMP1 FOR TIMER,
0402  6056    CLOCK1, DPCL                    /WAIT FOR THE FLAG TO SET
0403  5202            JMP     .-1             /GO WAIT SOME MORE,
0404  6056    CLOCK2, DPCL                    /IS IT SET BY ANY CHANCE?
0405  5210            JMP     .+3             /NO, FLAG OK,
0406  4562            SR1A                    /HALT?
0407  7402            HLT                     /THE CLOCK FLAG SET IMMMEDIATELY
                                              /AFTER BEING SET OR DPCL DID NOT
                                              /CLEAR THE CLOCK FLAG OR SKIPPED ON NO FLAG,
0410  4561            SR2                     /LOOP?
0411  5202            JMP     CLOCK1          /YES,
0412  4571    CLOCK3, UDPCL                   /MAKE SURE IT SETS BY ABOUT 40 MSEC,
0413  7410            SKP                     /NOT SET YET,
0414  5221            JMP     .+5             /SET, OK,
0415  2035            ISZ     TEMP1           /"GROSS" TIMER,
0416  5212            JMP     CLOCK3          /GO TIME SOME MORE,
0417  4562            SR1A                    /FLAG NOT SET, SHALL WE HALT?
```

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0420  7402            HLT                     /FLAG NOT SET IN ABOUT 40 MSEC,
                                              /OR DPCL FAILED,
                                              /FLAG SHOUD SET IN 16,67 MSEC FOR 60 HZ,
                                              /FLAG SHOULD SET IN 20,0 MSEC FOR 50 HZ,
0421  4561            SR2                     /LOOP?
0422  5201            JMP     CLOCK1-1        /YES,
0423  4560            SR3                     /REMAIN IN THIS TEST?
0424  5200            JMP     CLOCK           /YES,


              /TEST THAT THE INTERRUPT ENABLE CAN BE SET
              /USING DPGO WITH AC11 = 1,

0425  4566    INT1,   SETUP                   /GENERAL INITIALIZE,
              DECIMAL                         /
0426  1145            TAD     (-10            /NUMBER OF PASSES AS MINUS
              OCTAL                           /
0427  3042            DCA     COUNT1          /SAVE
0430  4777'           JMS     INTLD           /SET UP FOR INTERRUPT,
0431  0440            INT1B                   /INT RETURN ADDRESS
0432  7301    INT1A,  CLA CLL IAC             /ENABLE INT, BIT
0433  4576            UDPGO                   /START DISPLAY
0434  4575            UDPSM                   /STOP
0435  6001            ION                     /TURN INTERRUPT SYSTEM ON,
0436  4776            JMS I   (WAIT           /WAIT ABOUT 30 MSEC,
0437  5243            JMP     INT1C           /NO INTERRUPT,
0440  4571    INT1B,  UDPCL                   /WAS IT THE CLOCK FLAG?
0441  7402            HLT                     /NO, ILLEGAL INTERRUPT
                                              /NO SCOPE LOOPING PROVIDED,
                                              /NO ATTEMPT WILL BE MADE TO
                                              /CLEAR THE ILLEGAL INTERRUPT,
                                              /RESTART AT BEGINNING OF TEST OR PROGRAM,
0442  5246            JMP     INT1D           /CORRECT INTERRUPT
0443  4563    INT1C,  SR1                     /HALT?
0444  7402            HLT                     /WITH CLOCK INTERRUPT ENABLED
                                              /THE CLOCK FLAG FAILED TO INTERRUPT,
0445  6002            IOF                     /
0446  4564    INT1D,  LOOP                    /
0447  0432            INT1A                   /RETURN POINTER
0450  5225            JMP     INT1            /YES,

              /TEST THAT THE INTERRUPT ENABLE CAN BE DISABLED
              /BY ISSUING DPGO WITH A 0 AC,

0451  4566    INT2,   SETUP                   /GENERAL INITIALIZE,
              DECIMAL                         /
0452  1145            TAD     (-10            /NUMBER OF PASSES AS MINUS,
              OCTAL                           /
0453  3042            DCA     COUNT1          /SAVE,
0454  4777'           JMS     INTLD           /SET UP FOR INTERRUPTS,
0455  0466            INT2B                   /RETURN ADDRESS
0456  7301    INT2A,  CLA CLL IAC             /UDPGO
0457  4576            UDPGO                   /GO
0460  4576            UDPGO                   /DISABLE INT,
```

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        0461  4575              UDPSM                      /STOP
        0462  6001              ION                        /ENABLE INTERRUPT SYSTEM,
        0463  4776              JMS I   (WAIT              /WAIT ABOUT 30 MSEC,
        0464  6002              IOF                        /DISABLE INT, SYSTEM, /
        0465  5272              JMP     INT2C              /DISABLE FUNCTIONED OK
        0466  4571      INT2B,  UDPCL                      /CLOCK FLAG CAUSE INT?
        0467  7402              HLT                        /NO,  ILLEGAL INTERRUPT,
                                                           /NO SCOPE LOOP PROVIDED OR NO ATTEMPT
                                                           /WILL BE MADE BY THIS PROGRAM TO LOCATE IT,
                                                           /RESTART PROGRAM OR TEST FOR RECOVERY,
        0470  4562              SR1A                       /HALT?
        0471  7402              HLT                        /DPGO FAILED TO DISABLE THE
                                                           /CLOCK INTERRUPT FACILITY,
        0472  4564      INT2C,  LOOP                       /
        0473  0456              INT2A                      /RETURN POINTER
        0474  5251              JMP     INT2              /YES,


                        /TEST THAT INITIALIZE CAN DISABLE THE INTERRUPT ENABLE,

        0475  4566      INT3,   SETUP                      /GENERAL INITIALIZE,
        0476  1375              TAD     (" &BIT7 EOS       /LOAD THE BUFFER WITH
        0477  4544              JMS I   CLDBUFF            /INVISABLE CHARACTERS,
        0500  4777'             JMS     INTLD             /SETUP FOR INTERRUPTS,
        0501  0511              INT3B                      /RETURN ADDRESS
        0502  7301      INT3A,  CLA CLL IAC               /ENABLE BIT
        0503  4576              UDPGO                      /GO,
        0504  6007              CAF                        /DISABLE THE INT ENABLE
        0505  6001              ION                        /ENABLE INTERRUPTS
        0506  4776              JMS I   (WAIT              /WAIT ABOUT 30 MSEC,
        0507  6002              IOF                        /TURN INT OFF
        0510  5313              JMP     INT3C             /CAF FUNCTIONED OK,
        0511  4562      INT3B,  SR1A                       /HALT?
        0512  7402              HLT                        /INITIALIZE FAILED TO DISABLE
                                                           /THE CLOCK INTERRUPT ENABLE F,F, OR AN
                                                           /ILLEGAL INTERRUPT OCCURRED,
        0513  4561      INT3C,  SR2                        /LOOP?
        0514  5302              JMP     INT3A             /YES,
        0515  4560              SR3                        /REMAIN IN TEST?
        0516  5275              JMP     INT3              /YES,

                        /THIS TEST CHECKS THAT THE "EXTENDED STARTING ADDRESS REGISTER"
                        /CAN BE LOADED AND READ BACK,  AN INCREMENTING PATTERN IS USED
                        /DOING EACH PATTERN 4096 TIMES,

        0517  4566      EXTA,   SETUP                      /INITIALIZE,
                                DECIMAL                    /
        0520  1143              TAD     C-8                /
                                OCTAL                      /
        0521  3036              DCA     TEMP2             /ALL 8 PATTERNS OF THE EXT REG,
        0522  1032      EXTA2,  TAD     GDATA             /GET PATTERN
        0523  7421              MQL                        /SAVE IT IN THE "MQ"
        0524  7501      EXTA3,  MQA                        /MQ --> AC
        0525  7101              CLL IAC                    /SET AC11 SO THE -
```

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        0526  4575              UDPSM                      /EXT STARTING REG  WILL BE LOADED,
        0527  4575              UDPSM                      /EXT STARTING REG --> ADDR COUNTER
        0530  4572              UDPMS                      /READ BACK THE EXT STARTING REG,
        0531  0142              AND     C1777             /ONLY THE EXT BITS,
        0532  3033              DCA     BDATA             /SAVE THE PATTERN,
        0533  7501              MQA                        /"SHOULD BE" TO THE AC,
        0534  7041              CMA IAC                    /NEGATE IT
        0535  1033              TAD     BDATA             /AND ADD BDATA TO AC
        0536  7650              SNA CLA                    /DID WE RECEIVE WHAT WE SENT?
        0537  5343              JMP     .+4               /YES,  A=OKAY,
        0540  4563              SR1                        /HALT?
        0541  1033              TAD     BDATA             /"RECEIVED" FROM THE EXT REG TO THE AC
        0542  7402              HLT                        /EXTENDED STARTING ADDRESS REGISTER
                                                           /NOT BEING LOADED OR IT CANNOT BE
                                                           /READ BACK,
                                                           /MQ=SENT,  AC=RECEIVED,
        0543  4561              SR2                        /LOOP ON SAME DATA?
        0544  5324              JMP     EXTA3             /YES,
        0545  2035              ISZ     TEMP1             /DONE THIS PATTERN 4096 TIMES?
        0546  5324              JMP     EXTA3             /NO, REPEAT
        0547  7501              MQA                        /UPDATE THE -
        0550  1141              TAD     C10               /PATTERN,
        0551  2036              ISZ     TEMP2             /ALL PATTERNS DONE?
        0552  5322              JMP     EXTA2             /NO,
        0553  4560              SR3                        /YES, REMAIN IN THIS TEST?
        0554  5317              JMP     EXTA              /YES,
                                NPAGE
        0555  5774              JMP I   (,+200&7600       /GO TO NEXT PAGE


        0574  0600
        0575  3040
        0576  4400
        0577  4163
              0600              PAGE

                        /TEST THAT +1 TO THE EXTENDED ADDRESS COUNTER
                        /WILL ONLY OCCUR WHEN THE ADDRESS COUNTER
                        /INCREMENTS FROM 7777 --> 0000,

              0034      ADDR=ADATA
              0032      EXTADR=GDATA

        0600  4566      EXTIN,  SETUP                      /INITIALIZE,
        0601  1034      EXTIN1, TAD     ADDR              /LOAD THE "ADDRESS REGISTER" -
        0602  4577              UDPLA                      /IN THE VT8-E,
        0603  7101              CLL IAC                    /SET "EXT ADDRESS REGISTER" -
        0604  4575              UDPSM                      /TO 0,
        0605  4575              UDPSM                      /ADDRESS REGISTERS --> ADDRESS COUNTERS,
        0606  1034      EXTIN2, TAD     ADDR              /SIMULATE +1 TO -
        0607  7101              CLL IAC                    /THE ADDRESS COUNTER AND -
        0610  7421              MQL                        /KEEP IT IN THE MQ,
        0611  7430              SZL                        /IS IT GOING TO BE 7777 --> 0000,
        0612  7103              CLL IAC BSW                /YES,  100 TO "EXTADR" FOR -
```

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        0613  3032          DCA     EXTADR      /SIMULATED ANSWER,
        0614  4574          UDPMB               /BREAK,
        0615  4572          UDPMS               /READ THE EXTENDED ADDRESS COUNTER,
        0616  0377          AND     (70         /KEEP ONLY THE EXTENDED BITS,
        0617  3033          DCA     BDATA       /SAVE THEM,
        0620  7501          MQA                 /WAS A +1 TO THE -
        0621  7650          SNA CLA             /EXTENDED ADDRESS COUNTER GENERATED?
        0622  1143          TAD     C-10        /YES, IT WAS SUPPOSED TO,
        0623  1033          TAD     BDATA       /NO,
        0624  7650          SNA CLA             /IS THE EXTENDED ADDRESS COUNTER CORRECT?
        0625  5235          JMP     EXTIN3      /YES, OK,
        0626  7604          LAS                 /HALT?
        0627  7104          CLL RAL             /
        0630  7710          SPA CLA             /
        0631  5235          JMP     EXTIN3      /NO HALT,
        0632  1033          TAD     BDATA       /COMBINE "EXPECTED" AND "RECEIVED" -
        0633  1032          TAD     EXTADR      /INTO ONE WORD,
        0634  7402          HLT                 /EXTENDED ADDRESS COUNTER ERROR,
                                                /THE EXTENDED ADDRESS COUNTER WAS
                                                /INCREMENTED AT SOME OTHER TIME THEN
                                                /WHEN THE ADDRESS COUNTER INCREMENTED
                                                /FROM 7777 TO 0000,
                                                /AC 3-5 CONTAINS "SHOULD BE",
                                                /AC 6-8 CONTAINS "RECEIVED",
                                                /MQ CONTAINS WHAT THE ADDRESS COUNTER
                                                /SHOULD CONTAIN,
        0635  4561  EXTIN3, SR2                 /LOOP?
        0636  5201          JMP     EXTIN1      /YES,
        0637  2034          ISZ     ADDR        /SETUP FOR NEXT,
        0640  5206          JMP     EXTIN2      /DO ANOTHER,
        0641  7501          MQA                 /
        0642  7640          SZA CLA             /
        0643  7402          HLT                 /
        0644  4560          SR3                 /REMAIN IN THIS TEST?
        0645  5200          JMP     EXTIN       /YES,


                    /TEST THAT THE EXTENDED ADDRESS COUNTER
                    /WILL INCREMENT CORRECTLY,
                    /LOAD THE STARTING ADDRESS REGISTER
                    /WITH 7777 AND DO A BREAK,  THE EXTENDED ADDRESS
                    /REGISTER SHOULD BE +1 AFTER THE BREAK,

        0646  4566  EXT,    SETUP               /INITIALIZE,
                            DECIMAL             /
        0647  1143  EXT1,   TAD     C-8         /COUNTER FOR INCREMENTING
                            OCTAL               /
        0650  3042          DCA     COUNT1      /SAVE THE END COUNT,
        0651  7340          CLA CLL CMA         /7777
        0652  4577          UDPLA               /LOAD THE ADDRESS REGISTER WITH 7777,
        0653  1032  EXT2,   TAD     EXTADR      /GET THE EXTENDED ADDRESS,
        0654  1141          TAD     C10         /ADD 10 FOR THE SIMULATED,
        0655  0377          AND     (70         /MASK FOR OVERFLOW
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        0656  7421          MQL                 /SAVE AS THE SIMULATED,
        0657  1032  EXT3,   TAD     EXTADR      /EXTENDED ADDRESS
        0660  7101          CLL IAC             /+1 SO MAINTENANCE WILL LOAD THE CORRECT
                                                /REGISTER,
        0661  4575          UDPSH               /AC 6-8 --> EXT STARTING ADD, REG,
        0662  4575          UDPSH               /EXT STARTING ADD, REGS, --> ADD COUNTERS,
        0663  4574          UDPMB               /BREAK, WHICH WILL INCREMENT ADD, COUNTER,
        0664  4572          UDPMS               /READ THE EXT ADD, COUNTER BACK,
        0665  0377          AND     (70         /ONLY EXT BITS,
        0666  3033          DCA     BDATA       /SAVE IT,
        0667  7501          MQA                 /SIMULATED TO AC,
        0670  7041          CMA IAC             /NEGATE FOR CHECKING,
        0671  1033          TAD     BDATA       /ADD RECEIVED,
        0672  7650          SNA CLA             /SIMULATED SAME AS RECEIVED?
        0673  5277          JMP     EXT4        /YES, OK,
        0674  4563          SR1                 /HALT?
        0675  1033          TAD     BDATA       /RECEIVED TO THE AC,
        0676  7402          HLT                 /EXTENDED ADDRESS COUNTER ERROR,
                                                /THE EXTENDED ADDRESS COUNTER FAILED
                                                /TO INCREMENT CORRECTLY WHEN
                                                /THE ADDRESS COUNTER INCREMENTED FROM
                                                /7777 TO 0000,
                                                /AC CONTAINS THE EXTENDED ADDRESS COUNTER,
                                                /MQ CONTAINS WHAT THE EXT, ADD, COUNTER SHOULD BE,
        0677  4561  EXT4,   SR2                 /LOOP?
        0700  5257          JMP     EXT3        /YES,
        0701  1032          TAD     EXTADR      /UPDATE EXTADR FOR NEXT PATTERN
        0702  1141          TAD     C10         /
        0703  3032          DCA     EXTADR      /UPDATE DONE,
        0704  2042          ISZ     COUNT1      /ALL PATTERNS DONE?
        0705  5253          JMP     EXT2        /NO,
        0706  2043          ISZ     COUNT2      /HAS THIS TEST MADE 4096 PASSES?
        0707  5247          JMP     EXT1        /NO,
        0710  4560          SR3                 /REMAIN IN THIS TEST?
        0711  5246          JMP     EXT         /YES,


                    /TEST THAT DPGO CAN LOAD THE
                    /EXTENDED STARTING ADDRESS REGISTER,

        0712  4566  EDPGO,  SETUP               /INITIALIZE,
                            DECIMAL             /
        0713  1376          TAD     (-100       /DO TEST THIS NUMBER OF TIMES,
                            OCTAL               /
        0714  3044          DCA     COUNT3      /SAVE COUNT
        0715  4577          UDPLA               /STARTING ADDRESS OF 0
        0716  7301  EDPGO1, CLA CLL IAC         /SET MAINT AND, 0 --> EXT ADDR REG,
        0717  4575          UDPSH               /DO ABOVE,
        0720  4575          UDPSH               /ADDR REG --> COUNTERS
        0721  1377          TAD     (70         /LOAD FOR FIELD7
        0722  7421          MQL                 /SAVE IN MQ,
        0723  7501          MQA                 /70
        0724  4576          UDPGO               /TEST
        0725  4575          UDPSH               /ADDR REG --> COUNTERS
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0726  4572           UDPMS              /READ BACK EXT ADDR COUNTER,
0727  0377           AND     (70        /SAVE ONLY FIELD BITS,
0730  3033           DCA     BDATA      /SAVE ALWAYS
0731  7501           MQA                /GOOD TO AC FOR CHECK
0732  7041           CMA IAC            /NEGATE GOOD
0733  1033           TAD     BDATA      /ADD RECEIVED TO CHECK IF SAME
0734  7650           SNA CLA            /EXPECTED OK
0735  5341           JMP     EDPG02     /OK
0736  4563           SR1                /HALT?
0737  1033           TAD     BDATA      /BAD TO AC
0740  7402           HLT                /DPGO FAILED TO LOAD THE EXT
                                        /STARTING REG, AC SHOULD = 70,
                                        /AC CONTAINS THE VALUE OF THE EXT, ADDRESS COUNTER,
0741  4561  EDPG02,  SR2                /LOOP?
0742  5316           JMP     EDPG01     /YES,
0743  4560           SR3                /REMAIN IN THIS TEST?
0744  5312           JMP     EDPGO      /YES,
                     NPAGE
0745  5775           JMP I   (,+200&7600  /GO TO NEXT PAGE



0775  1000
0776  7634
0777  0070
      1000           PAGE

                /TEST OF THE VT8=E BUFFER USING CONSTANT DATA
                /PATTERNS, 7777, 0000, 7777, 5252, 2525, 7700, 0077, 7007, 0770,
                /GET THE DATA AND DO 31 OR 63 BREAKS TO PRIME THE BUFFER
                /NOW DO 4096 BREAKS ON THE DATA CHECKING AFTER EACH BREAK,

1000  4566  DATA1,   SETUP              /INITIALIZE
1001  1140           TAD     [GDATA     /ADDRESS OF DATA
1002  3034           DCA     ADATA      /STORE FOR ERROR DISPLAY,
1003  7201           CLA IAC            /0001
1004  6214           RDF                /GET FIELD
1005  4575           UDPSM              /SET MAINTENANCE MODE
1006  6214           RDF                /FIELD TO AC
1007  3052           DCA     FLD        /FOR ERROR REPORTING
1010  1397           TAD     (FDATAB=1  /SET AUTO=INDEX FOR =
1011  3010           DCA     AI10       /OBTAINING COUNT AND DATA,
1012  1410           TAD I   AI10       /GET NUMBER OF PATTERNS,
1013  3035           DCA     TEMP1      /SAVE,
1014  1410  DATA1A,  TAD I   AI10       /GET DATA,
1015  3032           DCA     GDATA      /SAVE,
1016  3042           DCA     COUNT1     /SET FOR 4096 COUNT,
1017  7201           CLA IAC            /1
1020  4537           JMS I   CPRIME     /PRIME THE BUFFER =
1021  0032           GDATA              /
1022  1140           TAD     [GDATA     /SET BUFFER =
1023  4577           UDPLA              /ADDRESS,
1024  4575  DATA1B,  UDPSM              /START ADDR REGS ==> ADDR COUNTER,
1025  4574           UDPMB              /SINGLE BREAK,
```

```
1026  4573           UDPMD              /LOAD AC FROM DATA BUFFER,
1027  3033           DCA     BDATA      /SAVE RECEIVED DATA,
1030  1032           TAD     GDATA      /TAKE THE EXPECTED DATA AND =
1031  7041           CMA IAC            /NEGATE IT, NOW ADD =
1032  1033           TAD     BDATA      /THE RECEIVED DATA AND SEE =
1033  7650           SNA CLA            /IF THEY ARE THE SAME,
1034  5240           JMP     ,+4        /DATA A=OKAY,
1035  4563           SR1                /SHALL WE HALT?
1036  7402           HLT                /RECEIVED NOT SAME AS EXPECTED, PRESS CONTINUE
1037  4565           SHOW               /TO DISPLAY DATA, AC=RECEIVED; MQ=EXPECTED,
1040  4561           SR2                /SHALL WE LOOP?
1041  5224           JMP     DATA1B     /YES,
1042  2042           ISZ     COUNT1     /DONE 4096 TIMES?
1043  5224           JMP     DATA1B     /NO,
1044  2035           ISZ     TEMP1      /ALL PATTERNS DONE?
1045  5214           JMP     DATA1A     /NO,
1046  4560           SR3                /REMAIN IN THIS TEST?
1047  5200           JMP     DATA1      /YES,
                     NPAGE              /
1050  5776           JMP I   (,+200&7600  /GO TO NEXT PAGE

                /MANUAL INCREMENT ROUTINE
                /SR7 SET ENABLES THE ROUTINE,
                /A CHANGE IN SR8 MANUALLY STEPS
                /DISPLAY SINGLE STEP,

1051  0000  BUMP,    OPEN
1052  7604           LAS                /READ SWITCHES,
1053  0136           AND     [20        /MASK FOR SR7,
1054  7454           SNA OSR            /WAS SR7 SET?  ALSO READ SW,
1055  5270           JMP     BUMP1      /SR7 NOT SET,
1056  0141           AND     [10        /MASK FOR SR8,
1057  7640           SZA CLA            /IF SET: AC=7777; IF NOT, AC=0
1060  7040           CMA                /SR8 SET,
1061  1051           TAD     PSET       /ADD THIS
1062  7001           IAC                /+1
1063  7640           SZA CLA            /
1064  5651           JMP I   BUMP       /
1065  1051           TAD     PSET       /COMPLEMENT =
1066  7140           CLL CMA            /THE CHANGE =
1067  3051           DCA     PSET       /INDICATOR,
1070  2251  BUMP1,   ISZ     BUMP       /+1 FOR EXIT,
1071  7300           CLA CLL            /AC+L=0,
1072  5651           JMP I   BUMP       /EXIT,

                /INITIALIZATION ROUTINE,

1073  0000  SETUPX,  OPEN
1074  6007           CAF                /CLEAR ALL,
1075  4560           SR3                /
1076  7610           SKP CLA            /NO TUNE IF SR3 IS SET,
1077  4570           UDPBEL             /SOUND A TUNE AT THE BEGINNING OF
                                        /EACH TEST,
1100  7621           CAM                /0 ==> AC+MQ,
1101  1375           TAD     (RMF       /RMF INSTRUCTION
```

```
1102  6201           CDF     00               /DF 0
1103  3774           DCA I   (ONE             /PUT IN 1 OF FIELD 0
1104  1373           TAD     (JMP     ONE      /JMP 1
1105  3772           DCA I   (TWO             /PUT IN 2 OF FIELD 0
1106  4060           HOMEDF                   /DF = IF,
1107  1135           TAD     (JMP I  TWO      /PUT IN PROGRAM FIELD,
1110  3001           DCA     ONE              /LOCATION 1,
1111  1371           TAD     (-LINK+GDATA-1   /SETUP TO ZERO PAGE ZERO STORAGE,
1112  3007           DCA     SEVEN            /SAVE COUNT OF LOCATIONS
1113  1370           TAD     (GDATA-1         /SET AUTO-INDEX
1114  3010           DCA     AI10             /SAVE
1115  3410           DCA I   AI10             /0 --> STORAGE LOCATION
1116  2007           ISZ     SEVEN            /DONE?
1117  5315           JMP     .-2              /NO, GO ZERO ANOTHER,
1120  1134           TAD     (ISZTST          /SET UP BACKGROUND JOB
1121  3533           DCA I   (BACKST          /
1122  3532           DCA I   (BUFFER          /0 --> FIRST LOCATION IN THE BUFFER,
1123  5673           JMP I   SETUPX           /EXIT, AC+L+FLAGS=0


1170  0031
1171  7754
1172  0002
1173  5001
1174  0001
1175  6244
1176  1200
1177  4547
      1200           PAGE

               /THIS IS A TEST OF THE VT8-E DATA BUFFER
               /USING A SPECIAL BINARY COUNT PATTERN,
               /(THE BINARY COUNT AND ITS COMPLEMENT)
               /THE DATA APPLIED TO THE INPUT IS DELAYED 32 OR
               /64 BREAKS BEFORE SEEN ON THE OUTPUT,   IF
               /SR2 IS SET TO LOOP THEN AFTER 32 OR 64 BREAKS THE SAME
               /DATA AS APPLIED WILL CONTINUOUSLY BE SEEN,   WHEN SR2 IS
               /LOWERED THE PROGRAM WILL PICK UP WHERE IT LEFT OFF +1,
               /[THE BUFFER HOLDS THE SPECIAL BINARY COUNT INSTEAD OF BEING
               /FILLED WITH THE SAME DATA AS IN "DATA1",]

               /DEFINES:

      0035           NOCNT=TEMP1
      0036           LOOPFL=TEMP2
      0037           INDATA=TEMP3
      0040           FILBUF=TEMP4
      0043           UPDOWN=COUNT2

1200  4566   DATA2,  SETUP                    /INITIALIZE,
1201  1132           TAD     (BUFFER          /ADDRESS OF DATA
1202  3034           DCA     ADATA            /STORE FOR ERROR DISPLAY
1203  7201           CLA IAC                  /0001
1204  6214           RDF                      /GET FIELD
1205  4575           UDPSM                    /SET MAINT, AND FIELD,
```

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1206  6214           RDF                      /FIELD TO AC
1207  3052           DCA     FLD              /FOR ERROR REPORTING,
1210  1132           TAD     (BUFFER          /
1211  4577           UDPLA                    /AC --> STARTING ADDR REG,
1212  7344           CLA CLL CMA RAL          /-2,
1213  3043           DCA     UPDOWN           /-2 --> UPDOWN,
1214  4557   DATA2A, SR6                      /32 FOR 64?
               DECIMAL                        /
1215  1131           TAD     (32              /SET A COUNTER SO A FULL -
1216  1130           TAD     (-64             /BUFFER CAN BE DETERMINDED,
               OCTAL                          /
1217  1036           TAD     LOOPFL           /IF LOOP WAS SET, THEN 1 MORE BREAK,
1220  3040           DCA     FILBUF           /SAVE THE COUNT,
1221  1036           TAD     LOOPFL           /
1222  7650           SNA CLA                  /IF LOOP FLAG SET THEN ZERO IT,
1223  5237           JMP     DATA2B           /ITS ZERO,
1224  1043           TAD     UPDOWN           /LOOK AT THE WAY WE WERE COUNTING
1225  7130           CLL CML RAR              /IF 7776 THEN MAKE IT 7777,
1226  7430           SZL                      /IF 7777 THEN MAKE IT 7776,
1227  7344           CLA CLL CMA RAL          /7776
1230  3043           DCA     UPDOWN           /DIRECTION OF COUNT NOW RESET,
1231  7630           SZL CLA                  /CHECK IF DOWN,
1232  5236           JMP     DATA2B-1         /UP,
1233  2042           ISZ     COUNT1           /UPDATE COUNT1 SINCE LOOP BYPASSED IT,
1234  7610           SKP CLA                  /COUNT DID NOT GO TO ZERO,
1235  5352           JMP     DATA2K           /COUNT1 OVERFLOWED SO LOOK AT SR3 TO DECIDED WHAT TO DO,
1236  3036           DCA     LOOPFL           /0 --> LOOPFL,
1237  1037   DATA2B, TAD     INDATA           /GET THE DATA TO BE PUT IN THE -
1240  3532           DCA I   (BUFFER          /BUFFER NEXT AND SAVE IT,
1241  4575           UDPSM                    /START ADDR REG --> ADDR COUNTER,
1242  4574           UDPMB                    /SINGLE BREAK,
1243  4573           UDPMD                    /READ VT8-E BUFFER,
1244  3033           DCA     BDATA            /AND SAVE IT,
1245  1040           TAD     FILBUF           /IF VT8-E BUFFER IS CLEAR OF GARBAGE
1246  7650           SNA CLA                  /THEN  CHECKS CAN BE MADE,
1247  5252           JMP     .+3              /OK TO CHECK,
1250  2040           ISZ     FILBUF           /CLEAR OF JUNK YET?
1251  5331           JMP     DATA2H           /NO,
1252  1036           TAD     LOOPFL           /IF LOOPFL IS 0 THEN WE MUST -
1253  7640           SZA CLA                  /CALCULATE THE OUTPUT OF THE BUFFER,
1254  5301           JMP     DATA2E           /LOOPFL=1,
1255  1043           TAD     UPDOWN           /COUNTING UP OR DOWN?
1256  7110           CLL RAR                  /CHECK AC11
1257  7630           SZL CLA                  /SKIP IF "UP"
1260  5270           JMP     DATA2C           /"DOWN"
1261  1037           TAD     INDATA           /FROM AN "UP" -
1262  7040           CMA                      /CALCULATE THE "DOWN" -
1263  3041           DCA     TEMP5            /DATA,
1264  4557           SR6                      /32 OR 64?
               DECIMAL                        /
1265  1377           TAD     (-16             /32
1266  1131           TAD     (32              /64
               OCTAL                          /
1267  5276           JMP     DATA2D           /
1270  1037   DATA2C, TAD     INDATA           /FROM A "DOWN" -
```

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1271  7041          CMA IAC            /CALCULATE THE -
1272  3041          DCA      TEMP5      /"UP" DATA,
1273  4557          SR6                 /32 OR 64?
                    DECIMAL            /
1274  1376          TAD      (16        /32
1275  1375          TAD      (-32       /64
                    OCTAL              /
1276  1041  DATA2D, TAD      TEMP5      /ADD TO TEMP5
1277  3032          DCA      GDATA      /SAVE AS THE EXPECTED DATA
1300  3035          DCA      NOCNT      /ALWAYS 0 NOCNT,
1301  1032  DATA2E, TAD      GDATA      /TAKE THE "EXPECTED" DATA -
1302  7041          CMA IAC            /AND NEGATE IT, NOW ADD -
1303  1033          TAD      BDATA      /THE RECEIVED DATA AND SEE IF -
1304  7650          SNA CLA            /ITS THE SAME,
1305  5311          JMP      DATA2F     /DATA A-OKAY,
1306  4563          SR1                 /HALT ON ERROR?
1307  7402          HLT                 /YES, DATA RECEIVED IS INCORRECT,
                                        /PRESS CONTINUE TO DISPLAY THE -
                                        /"BAD" DATA IN THE "AC" AND THE
                                        /"GOOD" IN THE "MQ",
1310  4565          SHOW               /SHOW THE DATA,
1311  4561  DATA2F, SR2                 /LOOP ON DATA ON OUTPUT?
1312  5317          JMP      DATA2G     /YES,
1313  1036          TAD      LOOPFL     /WERE WE LOOPING?
1314  7640          SZA CLA            /CHECK?
1315  5214          JMP      DATA2A     /YES, MUST RESET,
1316  5333          JMP      DATA2I     /NO,
1317  1036  DATA2G, TAD      LOOPFL     /ARE WE ALL READY LOOPING?
1320  7640          SZA CLA            /CHECK?
1321  5237          JMP      DATA2B     /YES,
1322  1032          TAD      GDATA      /SET THE DATA SO WE'RE -
1323  3037          DCA      INDATA     /CONSTANT INSTEAD OF COUNTING,
1324  4537          JMS I    CPRIME     /PRIME THE BUFFER,
1325  0037          INDATA             /WITH CONSTANT DATA,
1326  7340          CLA CLL CMA        /SET LOOP FLAG,
1327  3036          DCA      LOOPFL     /7777 --> LOOPFL,
1330  5237          JMP      DATA2B     /TEST,
1331  7340  DATA2H, CLA CLL CMA        /SET NOCNT SO A COUNT -
1332  3035          DCA      NOCNT      /ISN'T STARTED UNTIL JUNK IS CLEARED,
1333  1037  DATA2I, TAD      INDATA     /GET LAST DATA TO ENTER BUFFER,
1334  7040          CMA                /COMPLEMENT IT,
1335  2043          ISZ      UPDOWN     /NEXT DATA TO BE UP OR DOWN?
1336  5344          JMP      DATA2J     /"DOWN"
1337  7001          IAC                /+1 TO MAKE NEW "UP" DATA
1340  3037          DCA      INDATA     /STORE,
1341  7344          CLA CLL CMA RAL    /RESET COUNT,
1342  3043          DCA      UPDOWN     /SAVE,
1343  5237          JMP      DATA2B     /GO LOAD BUFFER WITH NEW,
1344  3037  DATA2J, DCA      INDATA     /SAVE NEW "DOWN",
1345  1035          TAD      NOCNT      /SHALL THE COUNT BE UPDATED?
1346  7640          SZA CLA            /CHECK?
1347  5237          JMP      DATA2B     /NO,
1350  2042          ISZ      COUNT1     /YES, DONE TEST?
1351  5237          JMP      DATA2B     /NO,
1352  4560  DATA2K, SR3                 /REMAIN IN THIS TEST?
```

```
1353  5200          JMP      DATA2      /YES,
                    NPAGE              /
1354  5774          JMP I    (.-200&7600 /GO TO NEXT PAGE


1374  1400
1375  7740
1376  0020
1377  7760
      1400          PAGE

                    /ADDRESS TEST
                    /BREAK FROM EVERY ADDRESS USING THE ADDRESS
                    /AND ITS COMPLEMENT FOR DATA,
                    /THE ADDRESS SELECTED TO BE TESTED HAS ITS CONTENTS
                    /SAVED IN THE "MQ", THE VALUE OF THE ADDRESS IS PLACED IN
                    /THE ADDRESS AND AFTER 32 OR 64 BREAKS ITS READ BACK AND
                    /CHECKED, ADDRESS IS THEN RESTORED AND THE COMPLEMENT OF THE
                    /ADDRESS IS CALCULATED AND AGAIN THE ADDRESS IS SAVED IN THE
                    /"MQ", THE COMPLEMENT PATTERN IS PLACED IN THE ADDRESS AND
                    /32 OR 64 BREAKS ARE DONE AND THE DATA CHECKED,
                    /THIS TEST STARTS AT FIELD 0 ADDRESS 0000 AND CHECKS EVERY ADDRESS
                    /IN EVERY FIELD FOR AS MANY FIELDS AS SELECTED IN SR 9-11,

1400  4566  ADDR1,  SETUP              /INITIALIZE,
1401  1777'         TAD      DDPSM      /GET A "DPSM" INSTRUCTION
1402  3057          DCA      IDPSM      /AND STORE IT SO BREAK ROUTINE
                                        /CAN GET THE INSTRUCTION,
1403  4557          SR6                 /32 OR 64?
                    DECIMAL            /
1404  1131          TAD      [32        /32
1405  1130          TAD      [-64       /64
                    OCTAL              /
1406  3042          DCA      COUNT1     /SAVE
1407  7604          LAS                /READ FIELD FROM SW,
1410  0376          AND      (7         /KEEP ONLY FIELD BITS,
1411  7040          CMA                /CHANGE FOR A COUNT
1412  3044          DCA      COUNT3     /SAVE COUNT,
1413  7344  ADDR1A, CLA CLL CMA RAL    /-2
1414  3043          DCA      COUNT2     /THIS COUNT SERVES TO DETERMINE
                                        /WHETHER ITS THE ADDRESS OR ITS
                                        /COMPLEMENT,
1415  1034          TAD      ADATA      /GET ADDRESS TO BE TESTED
1416  4577          UDPLA              /ADDRESS --> STARTING ADDR REG
1417  7301          CLA CLL IAC        /0001,
1420  1052          TAD      FLD        /GET FIELD
1421  4575          UDPSM              /SET MAINTENANCE
1422  7100          CLL                /
1423  1034  ADDR1B, TAD      ADATA      /GET ADDRESS TO BE TESTED,
1424  1375          TAD      (-LOADDB    /ADD THE ADDRESS TO THE ROUTINE
                                        /TO STORE DATA IN THE ADDRESS AND
                                        /DO THE BREAKS, IF THE ADDRESS EQUALS
                                        /THE ROUTINE ADDRESS, ROUTINE "LOADDA"
                                        /IS THEN USED TO PERFORM THE SAME FUNCTION,
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              1425  7630          SEL CLA                /ADDRESS EQUAL TO LDADDB?
              1426  4774'         JMS       LDADDA       /YES,
              1427  4773'         JMS       LDADDB       /
              1430  6054    I1,   DPMD                   /READ BACK BUFFER,
              1431  3033          DCA       BDATA        /SAVE THE DATA
              1432  1037          TAD       INDATA       /GET WHAT SHOULD HAVE COME BACK
              1433  7041          CMA IAC                /NEGATE IT,
              1434  1033          TAD       BDATA        /ADD RECEIVED AND SEE IF ITS OK
              1435  7650          SNA CLA                /WAS IT OK?
              1436  5244          JMP       ADDR1D       /YES, OK,
              1437  1037          TAD       INDATA       /SET THE EXPECTED FOR ERROR REPORTING,
              1440  3032          DCA       GDATA        /SAVE EXPECTED,
              1441  4563          SR1                    /HALT?
              1442  7402          HLT                    /YES,   RECEIVED THE INCORRECT DATA FROM
                                                         /THE VT8-E DATA BUFFER,  PRESS CONTINUE
                                                         /TO DISPLAY THE GOOD AND BAD DATA
                                                         /AND THE ADDRESS BEING TESTED,
              1443  4565          SHOW                   /DISPLAY INFORMATION,
                                                         /SEE THE LISTING AT THE HALT ADDRESS,
              1444  4561   ADDR1D, SR2                   /LOOP?
              1445  5222          JMP       ADDR1B-1     /YES,
              1446  1037          TAD       INDATA       /GET THE DATA
              1447  7140          CLL CMA                /COMPLEMENT IT,
              1450  2043          ISZ       COUNT2       /COMPLEMENT OR ADDRESS?
              1451  5266          JMP       ADDR1C       /COMPLEMENT OF ADDRESS,
              1452  7001          IAC                    /+1 TO MAKE DATA FOR NEXT ADDRESS,
              1453  3037          DCA       INDATA       /SAVE NEW DATA
              1454  2034          ISZ       ADATA        /MAKE NEW ADDRESS,  DONE ALL?
              1455  5213          JMP       ADDR1A       /NOT ALL DONE,
              1456  1052          TAD       FLD          /GET PRESENT FIELD
              1457  1141          TAD       C10          /ADD 10 FOR UPDATE
              1460  3052          DCA       FLD          /SAVE NEW FIELD TO BE TESTED,
              1461  2044          ISZ       COUNT3       /ALL FIELDS DONE?
              1462  5213          JMP       ADDR1A       /NO, DO NEXT,
              1463  4560          SR3                    /REMAIN IN THIS TEST?
              1464  5200          JMP       ADDR1        /YES,
                                  NPAGE                  /GO TO NEXT TEST
              1465  5772          JMP I     (,+200&7600  /GO TO NEXT PAGE
              1466  3037   ADDR1C, DCA      INDATA       /SAVE COMPLEMENT DATA
              1467  5222          JMP       ADDR1B-1     /DO IT,

                                  /THIS ROUTINE RUNS A SWIRL PATTERN SIMULTANEOUSLY ON 4 VT8E'S

              1470  4566   MULVT8, SETUP
              1471  1127          TAD       C"1&BIT7 NORMAL
              1472  3050          DCA       CHAR
              1473  4771'         JMS       LDSWL
              1474  1370          TAD       (3000
              1475  3767          DCA  I    (23+100+BUFFER+100-1
              1476  1132          TAD       CBUFFER
              1477  3316          DCA       BUFCA
              1500  1366          TAD       (MULTAB
              1501  3031          DCA       WORKVT
              1502  4765'  MULV1, JMS       DEVCOD
              1503  1316          TAD       BUFCA
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              1504  4577          UDPLA
              1505  6214          RDF
              1506  4576          UDPGO
              1507  2316          ISZ       BUFCA
              1510  2031          ISZ       WORKVT
              1511  1431          TAD  I    WORKVT
              1512  7640          SZA  CLA
              1513  5302          JMP       MULV1
              1514  7001          IAC
              1515  5314          JMP       ,-1

              1516  0000   BUFCA, OPEN

              1517  0503   MULTAB, 0503
              1520  1513          1513
              1521  2523          2523
              1522  3533          3533
              1523  0000          0


              1565  4123
              1566  1517
              1567  7277
              1570  3000
              1571  3054
              1572  1600
              1573  4453
              1574  4424
              1575  3325
              1576  0007
              1577  4011
                    1600          PAGE

                                  /CURRENT ADDRESS INCREMENT TEST,
                                  /THIS TEST PLACES THE VALUE OF THE ADDRESS IN THE ADDRESS
                                  /AND DOES A BREAK STARTING AT ADDRESS 0 CURRENT FIELD AND PERFORMES
                                  /THIS PROCEDURE FOR EVERY ADDRESS IN THE CURRENT FIELD,  THE DATA
                                  /COMING OUT OF THE BUFFER IS LAGGING THE INPUT BY 32 OR 64 BREAKS,
                                  /IF LOOP IS SET, BREAKS USING THE SAME ADDRESS AND DATA WILL BE
                                  /DONE,  RESETTING LOOP RESUMES THE PROGRAM FROM WHERE
                                  /IT LEFT OFF +1,

              1600  4566   CAINC, SETUP                  /INITIALIZE
              1601  7201          CLA IAC                /SET I1 SO THE EXTENDED
              1602  6214          RDF                    /ADDRESS WILL BE LOADED,
              1603  4575          UDPSM                  /LOAD EXT ADDRESS REGISTER,
              1604  6214          RDF                    /FIELD TO AC
              1605  3052          DCA       FLD          /SAVE FOR ERROR REPORTING
              1606  4557          SR6                    /32 OR 64?
                                  DECIMAL                /
              1607  1377          TAD       (-32         /32
              1610  1376          TAD       (64          /64
                                  OCTAL                  /
              1611  7041          CMA IAC                /NEGATE FOR COUNT
```

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        1612  3041          DCA     TEMP5       /SAVE SIMULATED FACTOR
        1613  1041  CAINC1, TAD     TEMP5       /GET IT BACK
        1614  1036          TAD     LOOPFL      /IF LOOPFL IS SET THIS ALLOWS 1 MORE BREAK,
        1615  3040          DCA     FILBUF      /SAVE NUMBER OF BREAKS,
        1616  1036          TAD     LOOPFL      /IS FLAG FOR LOOPING SET?
        1617  7650          SNA CLA             /CHECK,
        1620  5225          JMP     CAINC2      /NOT SET,
        1621  2044          ISZ     COUNT3      /YES, UPDATE COUNT MISSED BY LOOP
        1622  7610          SKP CLA             /DONE?
        1623  5340          JMP     CAINCA      /YES, CHECK SR3,
        1624  3036          DCA     LOOPFL      /0 --> LOOP FLAG,
        1625  1375  CAINC2, TAD     (NOP        /NOP TO BREAK ROUTINE SO ADDRESS
        1626  3057          DCA     IDPSM       /COUNTER WILL INCREMENT,
        1627  1034          TAD     ADATA       /GET ADDRESS
        1630  4577          UDPLA               /LOAD STARTING ADDRESS REGISTER,
        1631  4575          UDPSM               /STARTING ADDR REG --> ADDR COUNTER,
        1632  7240  CAINC3, CLA CMA             /7777
        1633  3042          DCA     COUNT1      /ONLY ONE BREAK
        1634  7100  CAINC4, CLL                 /LINK 0
        1635  1034          TAD     ADATA       /GET ADDRESS TO BE TESTED,
        1636  1374          TAD     (-LDADDB    /ADD THE ADDRESS TO THE ROUTINE
                                                /TO STORE DATA IN THE ADDRESS AND
                                                /DO THE BREAKS,  IF THE ADDRESS
                                                /EQUALS THE ROUTINE ADDRESS, ANOTHER
                                                /ROUTINE IS USED TO PREVENT WIPE-OUT,
        1637  7630          SZL CLA             /ADDRESS EQUAL TO LDADDB?
        1640  4773'         JMS     LDADDA      /YES, THEN USE THIS ROUTINE,
        1641  4772'         JMS     LDADDB      /
        1642  4573          UDPMD               /READ BACK DATA BUFFER,
        1643  3033          DCA     BDATA       /SAVE IT REGARDLESS,
        1644  1040          TAD     FILBUF      /CHECK TO SEE IF DATA BUFFER IS FULL,
        1645  7650          SNA CLA             /CLEAR OF JUNK?
        1646  5251          JMP     .+3         /YES,
        1647  2040          ISZ     FILBUF      /BUFFER FULL?
        1650  5325          JMP     CAINC8      /NO, NO CHECK CAN BE MADE YET,
        1651  1036          TAD     LOOPFL      /IS LOOP FLAG SET?
        1652  7640          SZA CLA             /CHECK
        1653  5261          JMP     CAINC5      /YES,
        1654  3035          DCA     NOCNT       /ALWAYS 0 NO COUNT
        1655  1037          TAD     INDATA      /GET DATA -
        1656  1041          TAD     TEMP5       /ADD SIMULATED FACTOR -
        1657  7101          IAC CLL             /+1 FOR SIMULATED
        1660  3032          DCA     GDATA       /AND SAVE AS EXPECTED DATA,
        1661  1032  CAINC5, TAD     GDATA       /GET EXPECTED,
        1662  7041          CMA IAC             /NEGATE
        1663  1033          TAD     BDATA       /ADD RECEIVED
        1664  7650          SNA CLA             /SAME?
        1665  5271          JMP     CAINC6      /YES,
        1666  4563          SR1                 /NO,  HALT?
        1667  7402          HLT                 /DATA RECEIVED OUT OF THE BUFFER
                                                /IS NOT THE SAME AS THAT PUT IN
                                                /THE BUFFER,  PRESS CONTINUE TO REPORT ERROR DATA,
                                                /C A U T I O N
                                                /THE ADDRESS DISPLAYED WILL BE THE LAST
                                                /ONE THAT A BREAK WAS EXECUTED ON,  THEREFORE
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                                                /TO FIND THE ADDRESS OF THE INCORRECT DATA
                                                /SET SR2=1 AND PRESS CONTINUE 3 TIMES,
                                                /AT THIS POINT THE AC + MQ CONTAIN THE
                                                /DATA AND PRESSING CONTINUE ONCE MORE
                                                /WILL RESULT IN THE ADDRESS AND FIELD
                                                /TO BE DISPLAYED IN THE AC + MQ,  THIS
                                                /PROCEDURE ONLY APPLIES WHEN A HALT
                                                /OCCURS WHEN SR2 IS NOT SET,
        1670  4565          SHOW                /REPORT ERROR DATA,  SEE ABOVE
        1671  4561  CAINC6, SR2                 /LOOP?
        1672  5277          JMP     CAINC7      /YES,
        1673  1036          TAD     LOOPFL      /WERE WE LOOPING?
        1674  7640          SZA CLA             /CHECK,
        1675  5213          JMP     CAINC1      /YES,  THINGS MUST BE RESET,
        1676  5327          JMP     CAINC9      /NO,
        1677  1036  CAINC7, TAD     LOOPFL      /LOOP FLAG SET?
        1700  7640          SZA CLA             /CHECK
        1701  5234          JMP     CAINC4      /YES,
        1702  1032          TAD     GDATA       /USE THE EXPECTED DATA,
        1703  3037          DCA     INDATA      /TO BREAK WITH SINCE IT ERRORED ON IT,
        1704  1037          TAD     INDATA      /
        1705  3034          DCA     ADATA       /
        1706  1771'         TAD     DOPSM       /SET BREAK ROUTINE TO -
        1707  3057          DCA     IDPSM       /ALWAYS BREAK FROM THE SAME ADDRESS,
        1710  7040          CMA                 /7777 TO SUBTRACT 1
        1711  1041          TAD     TEMP5       /
        1712  3042          DCA     COUNT1      /SAVE,
        1713  1034          TAD     ADATA       /SET ADDRESS,
        1714  4577          UDPLA               /
        1715  7340          CLL CLA CMA         /
        1716  3036          DCA     LOOPFL      /SET LOOP FLAG
        1717  1037          TAD     INDATA      /
        1720  1374          TAD     (-LDADDB    /
        1721  7630          SZL CLA             /
        1722  4773'         JMS     LDADDA      /
        1723  4772'         JMS     LDADDB      /
        1724  5232          JMP     CAINC3      /
        1725  7340  CAINC8, CLA CLL CMA         /SET NO COUNT FLAG BECAUSE BUFFER
        1726  3035          DCA     NOCNT       /IS NOT FULL,
        1727  2037  CAINC9, ISZ     INDATA      /UPDATE DATA,
        1730  7000          NOP                 /
        1731  1037          TAD     INDATA      /
        1732  3034          DCA     ADATA       /
        1733  1035          TAD     NOCNT       /COUNT?
        1734  7640          SZA CLA             /CHECK
        1735  5234          JMP     CAINC4      /NO
        1736  2044          ISZ     COUNT3      /YES, DONE?
        1737  5234          JMP     CAINC4      /NO
        1740  4560  CAINCA, SR3                 /REMAIN IN THIS TEST?
        1741  5200          JMP     CAINC       /YES,
        1742  2031          ISZ     WORKVT
        1743  1431          TAD   I WORKVT
        1744  7650          SNA     CLA
        1745  5350          JMP     .+3
        1746  4770'         JMS     DEVCOD
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```
        1747  5767'            JMP      CKCC
        1750  4766'            JMS      SR7SR8              /
        1751  5526             JMP I    CBEGIN              /
                               NPAGE                       /
        1752  5765             JMP I    (,+200&7600         /GO TO NEXT PAGE


        1765  2000
        1766  3747
        1767  0201
        1770  4123
        1771  4011
        1772  4453
        1773  4424
        1774  3325
        1775  7000
        1776  0100
        1777  7740
              2000             PAGE

                      /DISPLAY FULL SCREEN OF A SINGLE CHARACTER
                      /FOR A PERIOD OF 2 SECONDS,  STARTING WITH
                      /7 BIT CODE 40,  WHILE DISPLAYING A
                      /BACKGROUND JOB IS BEING RUN UNLESS THE
                      /SR PREVENTS IT,

        2000  4777'            JMS      INITDC              /INITIALIZE THE DEVICE CODE
        2001  4566    DSCHAR,  SETUP                        /INITIALIZE,
        2002  1131             TAD      C" &BIT7 NORMAL     /7-BIT CODE FOR SPACE,
        2003  3050             DCA      CHAR                /START WITH SPACE,
        2004  1050    DSCHA1,  TAD      CHAR                /COMBINE CHARACTER,
        2005  1047             TAD      CB2CB3              /AND CONTROL BITS,
        2006  4544             JMS I    CLDBUFF             /LOAD THE BUFFER,
        2007  4525    DSCHA2,  JMS I    CSETTIM             /SET TIME TO DISPLAY
                               DECIMAL
        2010  0024             2+10                         /2 SECONDS,
                               OCTAL
        2011  4556             SR7                          /MANUAL INCREMENT?
        2012  5215             JMP      ,+3                 /NO, SELF TIMED
        2013  7344    DSCHA3,  CLA CLL  CMA RAL             /-2
        2014  3046             DCA      TIMEX               /
        2015  1132             TAD      CBUFFER             /BEGINING OF BUFFER
        2016  4567             XDPGO                        /GO DISPLAY
        2017  4524             JMS I    CBUMP               /CHECK FOR MANUAL INCREMENT,
        2020  5213             JMP      DSCHA3              /DISPLAY SAME,
        2021  4523             JMS I    CINCBUF             /INCREMENT ENTIRE BUFFER,
        2022  5207             JMP      DSCHA2              /DISPLAY
        2023  4522             JMS I    CCB3CB2             /INCREMENT CONTROL BITS,
        2024  5204             JMP      DSCHA1              /GO DISPLAY
        2025  4575             UDPSH                        /STOP DISPLAY,
        2026  4560             SR3                          /REMAIN IN THIS TEST?
        2027  5201             JMP      DSCHAR              /YES,

                      /THIS TEST DISPLAYS A RIPPLE PATTERN CHANGING
```

```
                      /THE CONTROL BIT EVERY 5 SECONDS,

        2030  4566    DISRIP,  SETUP                        /INITIALIZE,
        2031  4525    DISRI1,  JMS I    CSETTIM             /SET TIMER FOR-
                               DECIMAL
        2032  0062             5+10                         /TIME
                               OCTAL
        2033  4776'            JMS      LDINC               /LOAD BUFFER WITH A RIPPLE PATTERN
        2034  1132             TAD      CBUFFER             /STARTING ADDRESS OF BUFFER
        2035  4567             XDPGO                        /GO DISPLAY
        2036  4575             UDPSH                        /STOP WHILE CHANGING DATA,
        2037  4522             JMS I    CCB3CB2             /INCREMENT CONTROL BIT,
        2040  5231             JMP      DISRI1              /REPEAT TEST WITH NEW CONTROL BIT
        2041  4560             SR3                          /REMAIN IN TEST?
        2042  5230             JMP      DISRIP              /YES,

                      /TEST TO DISPLAY A SWIRL PATTERN

        2043  4566    DISSWL,  SETUP                        /INITIALIZE,
        2044  1131             TAD      C" &BIT7 NORMAL     /INITIALIZE "CHAR" -
        2045  3050             DCA      CHAR                /WITH 7 BIT CODE FOR SPACE,
        2046  1130             TAD      C-100               /COUNTER TO DISPLAY -
        2047  3036             DCA      TEMP2               /1 PASS OF A SWIRL,
        2050  4775'    DISSW1,  JMS      LDSWL               /LOAD BUFFER WITH SWIRL PATTERN,
        2051  4525             JMS I    CSETTIM             /SET TIMER,
                               DECIMAL                      /
        2052  0012             10+1                         /TIME,
                               OCTAL                        /
        2053  4556             SR7                          /MANUAL INCREMENT,
        2054  5257             JMP      ,+3                 /NO, SELF TIMED,
        2055  7344    DISSW2,  CLA CLL  CMA RAL             /-2
        2056  3046             DCA      TIMEX               /
        2057  1132             TAD      CBUFFER             /STARTING ADDRESS OF BUFFER,
        2060  4567             XDPGO                        /GO DISPLAY,
        2061  4524             JMS I    CBUMP               /CHECK FOR MANUAL INCREMENT,
        2062  5255             JMP      DISSW2              /DISPLAY SAME,
        2063  2050             ISZ      CHAR                /UPDATE CHARACTER,
        2064  2036             ISZ      TEMP2               /DONE YET?
        2065  5250             JMP      DISSW1              /NO,
        2066  5271             JMP      ,+3                 /FORGET OTHER PATTERNS,
        2067  4522             JMS I    CCB3CB2             /INCREMENT CONTROL BITS,
        2070  5244             JMP      DISSWL+1            /RELOAD,
        2071  4575             UDPSH                        /STOP DISPLAY,
        2072  4560             SR3                          /REMAIN IN THIS TEST?
        2073  5243             JMP      DISSWL              /YES,

                      /THIS TEST DISPLAYS A RIPPLE PATTERN WITH
                      /EACH ROW OF 64 CHARACTERS HAVING THE CB2-CB3 CONTROL
                      /BIT INCREMENTED,

        2074  4566    ALL,     SETUP                        /INIT
                               DECIMAL                      /
        2075  4525             JMS I    CSETTIM             /SET TIME FOR DURATION OF TEST
        2076  0144             10+10
        2077  1121             TAD      CBUFFER-1           /SET AUTO INDEX
```

```
        2100  3010          DCA     AI10            /
        2101  4557          SR6                     /32 OR 64?
        2102  1374          TAD     (10             /32
        2103  1373          TAD     (-20            /64
        2104  3043          DCA     COUNT2          /COUNT TO DETERMINE END OF SCREEN,
        2105  1130  ALL1,   TAD     [-64            /NUMBER OF PATTERNS
                            OCTAL                   /
        2106  3044          DCA     COUNT3          /SAVE
        2107  1372          TAD     (" &BIT7        /START WITH 40
        2110  3035          DCA     TEMP1           /
        2111  1035  ALL2,   TAD     TEMP1           /GET CODE FOR CHARACTER
        2112  1036          TAD     TEMP2           /ADD CONTROL CODE
        2113  3410          DCA I   AI10            /STORE
        2114  2035          ISZ     TEMP1           /UPDATE FOR NEXT CHAR
        2115  2044          ISZ     COUNT3          /DONE 64 YET?
        2116  5311          JMP     ALL2            /NO
        2117  2043          ISZ     COUNT2          /DONE SCREEN?
        2120  7410          SKP                     /NO
        2121  5327          JMP     ALL3            /YES,
        2122  1036          TAD     TEMP2           /GET CONTROL CODE
        2123  1126          TAD     [200            /UPDATE FOR NEXT 64
        2124  0371          AND     (700            /KEEP ONLY CONTROL BITS
        2125  3036          DCA     TEMP2           /SAVE
        2126  5305          JMP     ALL1            /DO ANOTHER 64
        2127  1132  ALL3,   TAD     [BUFFER         /ADDRESS OF DATA
        2130  4567          XDPGO                   /GO DISPLAY
        2131  4575          UDPSM                   /STOP FOR EXIT
        2132  4560          SR3                     /REMAIN IN THIS TEST?
        2133  5274          JMP     ALL             /YES,
                            NPAGE                   /
        2134  5770          JMP I   (,+200&7600     /GO TO NEXT PAGE

                    /ROUTINE TO INCREMENT 7 BIT CODE
                    /IN THE ENTIRE BUFFER BY ONE,
                    /EXIT +1 IF CODE 137,

        2135  0000  INCBUF, OPEN
        2136  7300          CLA CLL
        2137  1767'         TAD     BUFFER          /IS CODE 137 -
        2140  0120          AND     [BIT7           /
        2141  1366          TAD     (-137           /BEEN DISPLAYED -
        2142  7640          SZA CLA                 /YET?
        2143  5350          JMP     ,+5             /NO,
        2144  1131          TAD     [" &BIT7 NORMAL /
        2145  3050          DCA     CHAR            /YES, 0 CHAR,
        2146  2335          ISZ     INCBUF          /+1 FOR EXIT,
        2147  5735          JMP I   INCBUF          /EXIT, AC=0,
        2150  4557          SR6                     /32 OR 64 CHARACTER?
                            DECIMAL                 /
        2151  1117          TAD     [32+20          /32
        2152  1116          TAD     [-64+20         /64
                            OCTAL                   /
        2153  3035          DCA     TEMP1           /
        2154  1121          TAD     [BUFFER-1       /
        2155  3010          DCA     AI10            /BUFFER-1-->AI10
```

```
        2156  2410          ISZ I   AI10            /INCREMENT CHARACTER
        2157  2035          ISZ     TEMP1           /DONE ENTIRE BUFFER
        2160  5356          JMP     ,-2             /NO, REPEAT,
        2161  5735          JMP I   INCBUF          /YES, EXIT, AC=0,


        2166  7641
        2167  4700
        2170  2200
        2171  0700
        2172  0040
        2173  7754
        2174  0012
        2175  3054
        2176  3507
        2177  0355
        2200                PAGE


                    /TEST OF LINE FEED,
                    /THE ENTIRE BUFFER IS FILLED WITH "CURSOR ?"
                    /A VERTICAL COLUMN OF "BRIGHT *" IS FORMED WITH ",,"
                    /ON THE LEFT AND LINE FEEDS ON THE RIGHT, WHICH SHOULD
                    /PRODUCE A HORIZONTAL MOVEMENT OF THE VERTICAL COLUMN
                    /OF "*" WITH NOTHING VISUAL TO THE RIGHT OF IT,  A LINE
                    /FEED FAILURE WILL MOST LIKELY DISRUPT THE VERTICAL COLUMN
                    /AND "CURSOR ?" WILL BE SEEN,

        2200  4566  LFTST,  SETUP                   /INITIALIZE,
        2201  4557          SR6                     /32 OR 64
                            DECIMAL                 /
        2202  1131          TAD     [32             /32
        2203  1130          TAD     [-64            /64
                            OCTAL                   /
        2204  3040          DCA     LENGTH          /
        2205  1377          TAD     ("?&BIT7 CURSOR /FILL ENTIRE DISPLAY BUFFER
        2206  4544          JMS I   [LDBUFF         /WITH "CURSOR ?",
        2207  7201          CLA IAC                 /1
        2210  3036          DCA     LFADD           /NUMBER TO DETERMINE POSITION,
        2211  4525  LFTST1, JMS I   [SETTIM         /SET TIMER,
                            DECIMAL                 /
        2212  0005          5                       /TIME,
        2213  1376          TAD     (-20            /NUMBER OF LINES AS NEGATIVE
                            OCTAL                   /
        2214  1037          TAD     LFEND           /ADD ACTIVE BUFFER
        2215  3037          DCA     LFEND           /AND SAVE FOR COUNTER,
        2216  7346          CLA CLL CMA RTL         /-3
        2217  1036          TAD     LFADD           /
        2220  7710          SPA CLA                 /READY FOR PERIODS YET?
        2221  5236          JMP     LFTST2          /NO, CHECK "*"
        2222  1037          TAD     LFEND           /LF BUFFER LENGTH-->TEMP1
        2223  3035          DCA     TEMP1           /COUNTER,
        2224  1121          TAD     [BUFFER-1       /SET AUTO INDEX
        2225  3010          DCA     AI10            /FOR LOADING ",,"
        2226  1375          TAD     (",&BIT7 NORMAL /ALWAYS LOAD ENTIRE LF BUFFER WITH
```

```
2227  3410            DCA I   AI10            /"."
2230  2035            ISZ     TEMP1           /DONE YET?
2231  5226            JMP     .=3             /NO.
2232  7344            CLA CLL CMA RAL         /=2
2233  1036            TAD     LFADD           /
2234  7710            SPA CLA                 /READY FOR "*" YET?
2235  5251            JMP     LFTST3          /NO, GO LOAD THE LF'S.
2236  1115    LFTST2, TAD     CBUFFER=2       /SET "ISTORE"
2237  3041            DCA     ISTORE          /FOR LOADING "*"
              DECIMAL                         /
2240  1376            TAD     (=20            /NUMBER OF LF TO LOAD.
              OCTAL                           /
2241  3035            DCA     TEMP1           /COUNTER.
2242  1036            TAD     LFADD           /ADD POSITION INDICATOR =
2243  1041            TAD     ISTORE          /ADDRESS.
2244  3041            DCA     ISTORE          /AND SAVE.
2245  1374            TAD     ("*&BIT7 BRIGHT /LOAD "BRIGHT *"
2246  3441            DCA I   ISTORE          /LOAD.
2247  2035            ·ISZ    TEMP1           /DONE?
2250  5242            JMP     .=6             /NO.
2251  1121    LFTST3, TAD     CBUFFER=1       /SET "ISTORE" =
2252  3041            DCA     ISTORE          /LOADING "LF".
              DECIMAL                         /
2253  1376            TAD     (=20            /
              OCTAL                           /
2254  3035            DCA     TEMP1           /COUNTER.
2255  1036            TAD     LFADD           /ADD POSITION INDICATOR =
2256  1041            TAD     ISTORE          /AND MAKE AN ADDRESS.
2257  3041            DCA     ISTORE          /SAVE FOR INDIRECT.
2260  1373            TAD     (LINEFD&BIT7    /7 BIT FOR LF.
2261  3441            DCA I   ISTORE          /PUT IN BUFFER.
2262  2035            ISZ     TEMP1           /DONE?
2263  5255            JMP     .=6             /NO.
2264  4556    LFTST4, SR7                     /MANUAL INCREMENT?
2265  5270            JMP     .+3             /NO, AUTO.
2266  7344            CLA CLL CMA RAL         /=2 FOR TIME.
2267  3046            DCA     TIMEX           /SET TIMEX FOR MANUAL INCREMENT.
2270  1132    LFTST5, TAD     CBUFFER         /STARTING ADDRESS OF BUFFER.
2271  4567            XDPGO                   /GO DISPLAY.
2272  4524            JMS I   CBUMP           /CHECK MANUAL INCREMENT.
2273  5270            JMP     LFTST5          /YES, REPEAT.
2274  4575            UDPSM                   /STOP DISPLAY.
2275  2036            ISZ     LFADD           /UPDATE POSITION INDICATOR.
2276  2040            ISZ     LENGTH          /DONE YET?
2277  5211            JMP     LFTST1          /NO.
2300  4560            SR3                     /REMAIN IN THIS TEST?
2301  5200            JMP     LFTST           /YES.
```

```
/TEST TO CHECK "BBF AND EBF".
/FILL ENTIRE BUFFER WITH "<".
/SET "BBF" IN FIRST CHARACTER ("CURSOR ?") AND MOVE
/"EBF" WHICH WILL BE A BRIGHT E".  BETWEEN THE "BBF" AND
/"EBF" THE CHARACTERS ARE "BRIGHT ?".  MOVE "EBF" UNTIL ITS AT
/THE LOWER RIGHT AT WHICH TIME THE SCREEN SHOULD BE EMPTY.
```

```
                      /NOW MOVE "BBF" ONE POSITION PLACING A "B" ON THE LEFT
                      /OF IT AND ">'S" BEHIND IT.  TEST IS COMPLETE WHEN THE SCREEN
                      /IS FULL OF ">'S".

2302  4566    FLDTST, SETUP                   /INITIALIZE.
2303  4525            JMS I   CSETTIM         /SET TIMER FOR =
              DECIMAL
2304  0001            1                       /TIME.
              OCTAL
2305  1372            TAD     ("<&BIT7 NORMAL /LOAD ENTIRE BUFFER WITH "<".
2306  4544            JMS I   CLDBUFF         /
2307  4557            SR6                     /32 OR 64?
              DECIMAL                         /
2310  1117            TAD     [32+20          /32
2311  1116            TAD     [=64+20         /64
              OCTAL                           /
2312  3035            DCA     TEMP1           /SAVE AS A COUNTER
2313  7001            IAC                     /
2314  1035            TAD     TEMP1           /
2315  3036            DCA     TEMP2           /TEMP2 = TEMP1 + 1
2316  1121            TAD     CBUFFER=1       /
2317  3010            DCA     AI10            /BBF
2320  1132            TAD     CBUFFER         /
2321  3011            DCA     AI11            /INBETWEEN BBF+EBF
2322  1132            TAD     CBUFFER         /
2323  3012            DCA     AI12            /EBF
2324  1371            TAD     (BUFFER=2       /2 CHARACTERS BEFORE BBF
2325  3013            DCA     AI13            /JUST BEFORE BBF
2326  1121            TAD     CBUFFER=1       /
2327  3014            DCA     AI14            /
2330  1370            TAD     ("?&BIT7 CURSOR BBF   /
2331  3410            DCA I   AI10            /LOAD FIRST BBF.
2332  5335            JMP     .+3             /DO NOT DO IN BETWEEN THE FIRST TIME.
2333  1367    FLDTS1, TAD     ("?&BIT7 BRIGHT /
2334  3411            DCA I   AI11            /LOAD IN BETWEEN
2335  1366            TAD     ("E&BIT7 BRIGHT EBF   /
2336  3412            DCA I   AI12            /LOAD EBF
2337  1132    FLDTS4, TAD     CBUFFER         /
2340  4567            XDPGO                   /GO DISPLAY
2341  4524            JMS I   CBUMP           /CHECK MANUAL INCREMENT.
2342  5337            JMP     FLDTS4          /AUTOMATIC
2343  2035            ISZ     TEMP1           /EBF AT LOWER RIGHT YET?
2344  5333            JMP     FLDTS1          /NO.
2345  4570            UDPBEL                  /SOUND A TUNE DO TO END OF THIS TEST
2346  1370    FLDTS2, TAD     ("?&BIT7 CURSOR BBF   /
2347  3410            DCA I   AI10            /LOAD BBF
2350  1365            TAD     (">&BIT7 NORMAL /
2351  3413            DCA I   AI13            /POSITIONS 2 CHARACTER BEFORE BBF
2352  1364            TAD     ("B&BIT7 BRIGHT /
2353  3414            DCA I   AI14            /THE CHARACTER BEFORE BBF.
              NPAGE
2354  5763            JMP I   (.=200&7600     /GO TO NEXT PAGE

2363  2400
2364  0502
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2365  0076
2366  1505
2367  0477
2370  2677
2371  4676
2372  0074
2373  0012
2374  0452
2375  0056
2376  7754
2377  0677
      2400              PAGE

2400  1132   FLDTS3, TAD    CBUFFER          /
2401  4567           XDPGO                   /GO DISPLAY,
2402  4524           JMS I   CBUMP           /CHECK MANUAL INCREMENT,
2403  5200           JMP     FLDTS3          /AUTOMATIC
2404  2036           ISZ     TEMP2           /BBF AT LOWER RIGHT-1?
2405  5777'          JMP     FLDTS2          /NO,
2406  4575           UDPSM                   /STOP THE DISPLAY,
2407  4560           SR3                     /REMAIN IN ENTIRE TEST?
2410  5776'          JMP     FLDTST          /YES,

             /TEST TO CHECK "EOS" (END OF SCREEN)
             /LOAD ENTIRE BUFFER WITH "BRIGHT ?"
             /START AT THE UPPER LEFT WITH EOS
             /WHICH WILL BE A "CURSOR ?",  ON THE LEFT PUT
             /A "BRIGHT 0" AND BEHIND THE "X'S",  STARTING AT THE
             /UPPER LEFT THE USER SHOULD SEE THE SCREEN BEING
             /FILLED WITH X'S WITH A "0" PRECEDEING THEM,  TEST
             /IS COMPLETE WHEN "EOS" IS AT THE BOTTOM RIGHT AND
             /THE SCREEN IS FULL OF X'S,

2411  4566   EOSTST, SETUP                   /INITIALIZE,
2412  4557           SR6                     /32 OR 64?
                     DECIMAL                 /
2413  1117           TAD     C32+20          /32
2414  1116           TAD     C-64+20         /64
                     OCTAL                   /
2415  3037           DCA     TEMP3           /SAVE TO DETERMINE END OF SCREEN
2416  4525           JMS I   CSETTIM         /SET THE TIMER FOR -
                     DECIMAL
2417  0001           1                       /TIME
                     OCTAL
2420  1375           TAD     ("?&BIT7 BRIGHT /LOAD ENTIRE BUFFER -
2421  4544           JMS I   CLDBUFF         /WITH "BRIGHT ?",
2422  1121           TAD     CBUFFER-1       /INIT, AI10,
2423  3010           DCA     AI10            /
2424  1374           TAD     (BUFFER-2       /INIT AI11,
2425  3011           DCA     AI11            /
2426  1373           TAD     (BUFFER-3       /INIT, AI12,
2427  3012           DCA     AI12            /
2430  1372   EOSTS1, TAD     ("?&BIT7 CURSOR EOS    /LOAD EOS,
2431  3410           DCA I   AI10            /
2432  1371           TAD     ("0&BIT7 BRIGHT /LOAD LAST VISIBLE CHARACTER,
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2433  3411           DCA I   AI11            /
2434  1370           TAD     ("X&BIT7 NORMAL /LOAD A "NORMAL X",
2435  3412           DCA I   AI12            /
2436  1132   EOSTS2, TAD     CBUFFER         /STARTING ADDRESS OF BUFFER
2437  4567           XDPGO                   /GO, DISPLAY
2440  4524           JMS I   CBUMP           /CHECK MANUAL INCREMENT
2441  5236           JMP     EOSTS2          /AUTOMATIC
2442  2037           ISZ     TEMP3           /FULL SCREEN COMPLETE?
2443  5230           JMP     EOSTS1          /NO,
2444  4575           UDPSM                   /STOP THE DISPLAY,
2445  4560           SR3                     /REMAIN IN TEST?
2446  5211           JMP     EOSTST          /YES,

             /TEST FOR SHRINKAGE
             /PERIODS ARE PLACED IN EACH CORNOR
             /OF THE SCREEN WITH "CURSOR SPACE" FILLING
             /THE REST OF THE SCREEN,  THE PERIODS
             /SHOULD REMAIN RATHER MOTIONLESS AT ALL
             /TIMES,

2447  4566   SHRINK, SETUP                   /INITIALIZE,
2450  1367           TAD     (" &BIT7 CURSOR /SPACE WITH CURSOR SET,
2451  4544           JMS I   CLDBUFF         /LOAD BUFFER
2452  1366           TAD     (",&BIT7 BRIGHT /PLACE A BRIGHT PERIOD
2453  3532           DCA I   CBUFFER         /IN UPPER LEFT,
2454  4557           SR6                     /32 OR 64 CHAR?
2455  5265           JMP     SHR32           /32
2456  1366           TAD     (",&BIT7 BRIGHT /64
2457  3765           DCA I   (BUFFER+100-1   /PLACE "PERIOD" IN UPPER RIGHT
2460  1366           TAD     (",&BIT7 BRIGHT /
2461  3764           DCA I   (23+100+BUFFER  /PLACE "PERIOD" IN LOWER LEFT
2462  1366           TAD     (",&BIT7 BRIGHT /
2463  3763           DCA I   (23+100+BUFFER+100-1   /PLACE "PERIOD" IN LOWER RIGHT,
2464  5273           JMP     SHRIN1          /
2465  1366   SHR32,  TAD     (",&BIT7 BRIGHT /32 CHAR SETUP,
2466  3762           DCA I   (BUFFER+40-1    /PLACE "PERIOD" IN UPPER RIGHT
2467  1366           TAD     (",&BIT7 BRIGHT /
2470  3761           DCA I   (23+40+BUFFER   /PLACE "PERIOD" IN LOWER LEFT,
2471  1366           TAD     (",&BIT7 BRIGHT /
2472  3760           DCA I   (23+40+BUFFER+40-1     /PLACE "PERIOD" IN LOWER RIGHT
2473  4525   SHRIN1, JMS I   CSETTIM         /SET TEST TIMER FOR-
                     DECIMAL
2474  0144           10+10                   /TIME
                     OCTAL
2475  1132           TAD     CBUFFER         /OBTAIN BUFFER STARTING ADDRESS
2476  4567           XDPGO                   /GO DISPLAY
2477  4575           UDPSM                   /STOP DISPLAY
2500  4560           SR3                     /REMAIN IN THIS TEST?
2501  5247           JMP     SHRINK          /YES,
2502  2031           ISZ     WORKVT
2503  1431           TAD I   WORKVT
2504  7650           SNA     CLA
2505  5310           JMP     ,+3
2506  4757'          JMS     DEVCOD
2507  5756'          JMP     DSCHAR
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2510  4755'          JMS    SR7SR8           /LOOK AT SR7 AND SR8
2511  5754           JMP I  (DSCHAR-1        /

                     /REPORT END OF TEST,

2512  4566    DONE,  SETUP                   /INITIALIZE,
2513  7604           LAS                      /READ SR
2514  0353           AND    (1430            /LOOK FOR CERTAIN SW SET,
2515  7640           SZA CLA                  /ANY SET?
2516  5526           JMP I  (BEGIN           /YES, DON'T REPORT END,
2517  4557           SR6                      /
                     DECIMAL                  /
2520  1117           TAD    C32+20           /32
2521  1116           TAD    C-64+20          /64
2522  3042           DCA    COUNT1           /
2523  4525           JMS I  (SETTIM          /
2524  0062           5+10                     /
                     OCTAL                    /
2525  1121           TAD    (BUFFER-1        /
2526  3011           DCA    AI11             /
2527  1352    DONE1, TAD    (MDONE-1         /
2530  3010           DCA    AI10             /
2531  1410    DONE2, TAD I  AI10             /
2532  7450           SNA                      /
2533  5327           JMP    DONE1            /
2534  3411           DCA I  AI11             /
2535  2042           ISZ    COUNT1           /BUFFER FILLED WITH "DONE"?
2536  5331           JMP    DONE2            /NO
2537  1132           TAD    (BUFFER          /
2540  4567           XDPGO                    /GO
2541  4575           UDPSM                    /STOP
2542  5526           JMP I  (BEGIN           /


2552  4647
2553  1430
2554  2000
2555  3747
2556  2001
2557  4123
2560  6077
2561  6040
2562  4737
2563  7277
2564  7200
2565  4777
2566  0456
2567  0640
2570  0130
2571  0517
2572  3677
2573  4675
2574  4676
2575  0477
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2576  2302
2577  2346
      2600          PAGE


                    /KEYBOARD TEST 1
                    /CARRIAGE RETURN ENDS TEST
                    /RUBOUT IS ACTIVE
                    /TEST THAT KIE WILL DISABLE AND ENABLE KBRD INTERRUPTS,
                    /TEST THAT KRB CAN READ THE BUFFER AND THAT IT CAN CLEAR THE FLAG,

2600  4777'          JMS    INITDC
2601  4566    KEYTST, SETUP                  /INIT
2602  6030    KEYI1, KCF                     /CLEAR FLAG
2603  6031    KEYI1A, KSF                    /FLAG SET?
2604  5207           JMP    ,+3              /NO, OK,
2605  4562           SR1A                     /HALT?
2606  7402           HLT                      /KBRD FLAG NO CLEAR OR KSF SKIPPED
                                              /ON NO KBRD FLAG,
2607  4561           SR2                      /LOOP?
2610  5202           JMP    KEYI1            /YES,
2611  1376           TAD    ("7&BIT7 CURSOR /FILL ENTIRE BUFFER WITH
2612  4544           JMS I  (LDBUFF          /"CURSOR 7" INCASE "EOS" FAILS,
2613  1121           TAD    (BUFFER-1        /SET AI10 FOR =
2614  3010           DCA    AI10             /STORING CHARACTERS,
2615  1132           TAD    (BUFFER          /SET AI11 FOR =
2616  3011           DCA    AI11             /SETTING "EOS",
2617  1121           TAD    (BUFFER-1        /SET AI12 FOR =
2620  3012           DCA    AI12             /SETTING "CURSOR",
2621  1375           TAD    ("X&BIT7 CURSOR EOS     /
2622  3411           DCA I  AI11             /SET "EOS",
2623  1374           TAD    ("1&BIT7 CURSOR /SET "CURSOR",
2624  3412           DCA I  AI12             /PUT IN THE BUFFER,
2625  4557           SR6                      /32 OR 64?
                     DECIMAL                  /
2626  1117           TAD    C32+20           /32
2627  1116           TAD    C-64+20          /64
                     OCTAL                    /
2630  3035           DCA    TEMP1            /SAVE SO END OF SCREEN CAN BE DETERMINED,
2631  4357           JMS    GO               /GO DISPLAY
2632  6031    KEY1,  KSF                     /KBRD FLAG SET?
2633  5232           JMP    ,-1              /NO, THEN WAIT,
2634  4773'   KEY3,  JMS    INTLD            /SET UP FOR INTERRUPT RETURN
2635  2644           KEY4                     /
2636  7201           CLA IAC                  /0001
2637  6035    KEYI10, KIE                     /ENABLE TTY INTERRUPT
2640  6001           ION                      /TURN INTERRUPT ON
2641  4563           SR1                      /INTERRUPT SHOULD OCCUR DURING THIS JMS
2642  6002           IOF                      /NO INTERRUPT, TURN INT OFF,
2643  7402           HLT                      /WITH KBRD FLAG SET AND TTY INT ENABLED
                                              /NO INTERRUPT OCCURRED,
2644  6002    KEY4,  IOF                      /
2645  4561           SR2                      /LOOP?
2646  5232           JMP    KEY1             /YES,
2647  4773'   KEY5,  JMS    INTLD            /SET UP RETURN FROM INTERRUPT,
```

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2650  2656          KEY6
2651  6035   KEYI11, KIE                          /DISABLE TTY INTERRUPT,
2652  6001          ION                           /INTERRUPT ON
2653  7000          NOP                           /GIVE INTERRUPT A CHANCE TO INT
2654  6002          IOF                           /TURN IT OFF
2655  5261          JMP      .+4                   /INT ENABLE OK
2656  6002   KEY6,  IOF                           /
2657  4562          SRIA                          /HALT?
2660  7402          HLT                           /KIE WITH AC=0 FAILED TO DISABLE TTY INT,
                                                  /OR AN EXTRA KEY WAS HIT ON ANOTHER DEVICE
2661  4561          SR2                           /LOOP?
2662  5247          JMP      KEY5                  /
2663  4773   KEY7,  JMS      INTLD                 /SET UP FOR INT
2664  2673          KEY8                          /
2665  7201          CLA IAC                        /0001
2666  6035   KEYI12, KIE                          /ENABLE TTY INT
2667  6001          ION                           /TURN INT ON
2670  4563          SR1                           /HALT
2671  6002          IOF                           /
2672  7402          HLT                           /KIE WITH AC11=1 FAILED TO ENABLE TTY INT,
2673  4561   KEY8,  SR2                           /LOOP?
2674  5263          JMP      KEY7                  /YES,
2675  7240   KEY9,  CLA CMA                        /7777
2676  6036   KEYI16, KRB                          /CLEAR FLAG AND READ BUFFER
2677  0120          AND      [BIT7                 /7 BIT CODE
2700  7421          MQL                           /SAVE IN MQ
2701  6031   KEYI13, KSF                          /FLAG SET?
2702  5305          JMP      .+3                   /NO OK,
2703  4562          SRIA                          /HALT?
2704  7402          HLT                           /KRB FAILED TO CLEAR THE KBRD FLAG,
2705  4561          SR2                           /LOOP?
2706  5275          JMP      KEY9                  /
2707  7501          MQA                           /MQ --> AC,
2710  1372          TAD      (=RUBOUT+200          /
2711  7650          SNA CLA                        /WAS IT A RUBOUT?
2712  5333          JMP      RUB                   /YES,
2713  7501          MQA                           /
2714  1371          TAD      (=CARRET+200          /
2715  7650          SNA CLA                        /WAS IT A CR?
2716  5327          JMP      KEY2                  /YES, END OF TEST,
2717  1375          TAD      ("X&BIT7 CURSOR EOS   /MOVE EOS -
2720  3411          DCA I    AI11                  /IN BUFFER,
2721  1374          TAD      ("I&BIT7 CURSOR       /SET "CURSOR",
2722  3412          DCA I    AI12                  /
2723  7501          MQA                           /CHARACTER TO AC,
2724  3410          DCA I    AI10                  /STORE TO BE DISPLAYED,
2725  2035          ISZ      TEMP1                 /END OF BUFFER?
2726  5232          JMP      KEY1                  /NO,
2727  4560   KEY2,  SR3                           /YES, REMAIN IN THIS TEST?
2730  5201          JMP      KEYTST                /YES,
2731  4575          UDPSM                         /STOP FOR EXIT,
2732  5770          JMP      CURTST                /GO TO NEXT TEST,
2733  1367   RUB,   TAD      (=BUFFER+1            /WILL RUBOUT MOVE CHARACTER -
2734  1010          TAD      AI10                  /BEHIND BUFFER?
2735  7650          SNA CLA                        /
```

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2736  5232          JMP      KEY1                  /YES,
2737  7240          CLA CMA                        /
2740  1010          TAD      AI10                  /
2741  3010          DCA      AI10                  /DECREMENT AI10 FOR RUBOUT
2742  1010          TAD      AI10                  /
2743  3012          DCA      AI12                  /
2744  1374          TAD      ("I&BIT7 CURSOR       /
2745  3412          DCA I    AI12                  /
2746  1012          TAD      AI12                  /
2747  3011          DCA      AI11                  /RESET AI11
2750  1375          TAD      ("X&BIT7 CURSOR EOS   /
2751  3411          DCA I    AI11                  /RESET EOS
2752  7240          CLA CMA                        /
2753  1035          TAD      TEMP1                 /RESET TEMP1
2754  3035          DCA      TEMP1                 /
2755  5232          JMP      KEY1                  /
             NPAGE
2756  5770          JMP I    (.+200&7600           /GO TO NEXT PAGE

             /ROUTINE TO GO DISPLAY WITH OUT BACKGROUND
             /USED ONLY IN KBRD TESTS,

2757  0000   GO,    OPEN
2760  1132          TAD      [BUFFER               /ADDRESS OF DATA
2761  4577          UDPLA                         /AC --> STARTING ADDR REG
2762  6214          RDF                           /GET FIELD
2763  4576          UDPGO                         /GO DISPLAY
2764  5757          JMP I    GO                    /EXIT,


2767  3101
2770  3000
2771  7763
2772  7601
2773  4163
2774  0661
2775  3730
2776  0677
2777  0355
             PAGE
3000

             /KEYBOARD TEST 2
             /TEST OF SPECIAL KEYS,
             /TEST THAT KCF WILL CLEAR THE KBRD FLAG,

3000  4566   CURTST, SETUP                        /INITIALIZE,
3001  1377          TAD      ("I&BIT7 CURSOR /
3002  4544          JMS I    [LDBUFF               /LOAD BUFFER WITH CONTENTS OF AC,
3003  1376          TAD      ("2&BIT7 CURSOR /
3004  3532          DCA I    [BUFFER               /
3005  1375          TAD      ("I&BIT7 CURSOR EOS   /
3006  3514          DCA I    [BUFFER+1             /
3007  1132          TAD      [BUFFER               /
```

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3010  4577    CUR1,   UDPLA                   /AC --> STARTING ADDR REG,
3011  6214            RDF                     /GET FIELD,
3012  4576            UDPGO                   /GO DISPLAY,
3013  6031    KEY14,  KSF                     /WAIT FOR KBRD FLAG,
3014  5213            JMP      .-1            /WAIT
3015  6030    KEY15,  KCF                     /CLEAR FLAG
3016  6031    KEY114, KSF                     /FLAG SET?
3017  5222            JMP      .+3            /NO OK
3020  4562            SR1A                    /HALT?
3021  7402            HLT                     /KCF FAILED TO CLEAR THE KBRD FLAG
3022  4561            SR2                     /LOOP?
3023  5215            JMP      KEY15          /YES,
3024  6034    KEY115, KRS                     /READ BUFFER
3025  0120            AND      CBIT7          /7 BIT
3026  3035            DCA      TEMP1          /SAVE CHARACTER,
3027  1035            TAD      TEMP1          /GET  CHAR BACK
3030  1374            TAD      (=CARRET+200   /CHECK FOR CARRIAGE RET,
3031  7650            SNA CLA                 /WAS IT ONE?
3032  5250            JMP      CUR2           /YES, END OF TEST,
3033  1373            TAD      (CURPOS-1      /ADDRESS-1 OF TABLE  FOR CHECKING CODE,
3034  3010            DCA      AI10           /TO AUTO INDEX,
3035  1372            TAD      (CURMSG-1      /FOR DETERMINING ADDRESS OF MSG,
3036  3042            DCA      COUNT1         /
3037  1410            TAD I    AI10           /
3040  2042            ISZ      COUNT1         /+1 TO ADDRESS OF MSG,
3041  7450            SNA                     /WAS THE CODE FOUND?
3042  5246            JMP      .+4            /NO,  DISPLAY "WHAT?",
3043  1035            TAD      TEMP1          /GET CHARACTER CODE,
3044  7640            SZA CLA                 /DOES TABLE MATCH CHARACTER,
3045  5237            JMP      .-6            /NO, TRY NEXT CODE IN TABLE,
3046  1442            TAD I    COUNT1         /
3047  5210            JMP      CUR1           /ADDRESS OF MSG  IN AC,
3050  4575    CUR2,   UDPSH                   /STOP
3051  4560            SR3                     /REMAIN IN THIS TEST,
3052  5200            JMP      CURTST         /YES,
              NPAGE                           /GO TO NEXT TEST,
3053  5771            JMP I    (.+200&7600    /GO TO NEXT PAGE


              /ROUTINE TO LOAD BUFFER WITH A SWIRL PATTERN,

3054  0000    LDSWL,  OPEN
3055  7300            CLA CLL                 /
3056  1050            TAD      CHAR           /GET CHARACTER
3057  3037            DCA      TEMP3          /SAVE IT,
3060  1121            TAD      CBUFFER-1      /BUFFER-1 FOR USE IN-
3061  3010            DCA      AI10           /AUTO INDEX,
              DECIMAL
3062  1130            TAD      C-64           /
              OCTAL
3063  3370            DCA      ("L            /COUNTER FOR LINE LENGTH,
3064  4557            SR6                     /32 OR 64 CHARACTER?
3065  5324            JMP      SWL32          /32 CHAR
              DECIMAL
3066  1116            TAD      C-64+20        /
```

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              OCTAL                           /
3067  3367            DCA      ("C            /BUFFER SIZE COUNTER,
3070  1370    LDSWL1, TAD      ("L            /
3071  3040            DCA      TEMP4          /
3072  1037            TAD      TEMP3          /GET A NUMBER AND
3073  0120            AND      CBIT7          /MAKE A 7 BIT CHARACTER OUT OF IT,
3074  3035            DCA      TEMP1          /SAVE CHARACTER
3075  1047    LDSWL2, TAD      CB2CB3         /ADD CONTROL BITS TO -
3076  1035            TAD      TEMP1          /CHARACTER AND -
3077  3410            DCA I    AI10           /STORE IN THE BUFFER,
3100  2367            ISZ      ("C            /BUFFER FILLED?
3101  7610            SKP CLA                 /NO,
3102  5654            JMP I    LDSWL          /YES, EXIT,
3103  2035            ISZ      TEMP1          /INCREMENT FUTURE CHARACTER,
3104  1035            TAD      TEMP1          /
3105  1366            TAD      (-140          /IF CODE 140 SET TO 40
3106  7640            SZA CLA                 /
3107  5312            JMP      .+3            /
3110  1131            TAD      (" &BIT7 NORMAL /
3111  3035            DCA      TEMP1          /
3112  2040            ISZ      TEMP4          /LINE COMPLETE
3113  5275            JMP      LDSWL2         /NO,
3114  2037            ISZ      TEMP3          /YES, INCREMENT FUTURE CHARACTER,
3115  1037            TAD      TEMP3          /
3116  1366            TAD      (-140          /IF CODE 140 SET TO 40,
3117  7640            SZA CLA                 /IS IT 140?
3120  5270            JMP      LDSWL1         /NO, OK,
3121  1131            TAD      (" &BIT7 NORMAL /RESET TEMP3 TO 40
3122  3037            DCA      TEMP3          /STORE IT,
3123  5270            JMP      LDSWL1         /
              DECIMAL
3124  1365    SWL32,  TAD      (-32           /SET LINE LENGTH FOR
              OCTAL
3125  3370            DCA      ("L            /32 CHARACTERS,
              DECIMAL
3126  1117            TAD      C32+20         /
              OCTAL
3127  5266            JMP      LDSWL1-2       /

3165  7740
3166  7640
3167  0303
3170  0314
3171  3200
3172  4571
3173  4561
3174  7763
3175  3677
3176  0662
3177  0677
3200          PAGE
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/KEYBOARD TEST 3,
/TEST TO PRINT OUT THE LETTER AND OCTAL VALUE
/AND POSITION OF SWITCH,

```
                    /TEST THAT CAF WILL ENABLE THE KBRD INTERRUPT
                    /AND THAT IT CAN CLEAR THE FLAG,

       3200  4566   OCT,    SETUP                   /GENERAL INITIALIZE,
       3201  4777'          JMS     INTLD           /SET UP FOR INTERRUPT
       3202  3222           OCT4                    /
       3203  6035   KEYI17, KIE                     /DISABLE INT
       3204  6007           CAF                     /ENABLE INTERRUPT FOR KBRD
       3205  1376           TAD     ("3&BIT7 CURSOR /CURSOR CHARACTER,
       3206  3532           DCA I   CBUFFER         /STORE
       3207  1375           TAD     ("7&BIT7 CURSOR EOS     /
       3210  3774           DCA I   (BUFFER+1       /
       3211  4773'          JMS     GO              /DISPLAY
       3212  6031   OCT1,   KSF                     /FLAG FROM KBRD SET?
       3213  5212           JMP     .-1             /NO, THEN WAIT FOR A CHARACTER,
       3214  6034   KEYI6,  KRS                     /READ CHARACTER,
       3215  7421           MQL                     /SAVE IN THE MQ,
       3216  6001           ION                     /
       3217  4563           SR1                     /INTERRUPT SHOULD OCCUR DURING THIS JMS
       3220  6002           IOF                     /
       3221  7402           HLT                     /INITIALIZE FAILED TO SET KBRD INTERRUPT
                                                    /ENABLE,
       3222  6002   OCT4,   IOF                     /
       3223  4561           SR2                     /LOOP?
       3224  5201           JMP     OCT+1           /YES,
       3225  6007   OCT5,   CAF                     /INIT  =CLEAR FLAG
       3226  6031   KEYI18, KSF                     /FLAG SET?
       3227  5232           JMP     .+3             /NO, OK
       3230  4563           SR1                     /HALT?
       3231  7402           HLT                     /INITIALIZE FAILED TO CLEAR KBRD FLAG
       3232  7000           NOP                     /MUST BE HERE ON ACCOUNT OF SCOPE LOOP,
       3233  4561           SR2                     /LOOP?
       3234  5225           JMP     OCT5            /YES,
       3235  4773'          JMS     GO              /RESTART DISPLAY
       3236  7501           MQA                     /GET IT BACK
       3237  0120           AND     CBIT7           /MAKE IT A 7 BIT,
       3240  3035           DCA     TEMP1           /SAVE THE 7 BIT CODE,
       3241  1035           TAD     TEMP1           /GET THE CHARACTER JUST TYPED
       3242  1372           TAD     (-CARRET+200    /
       3243  7650           SNA CLA                 /IS IT A CARRIAGE RETURN?
       3244  5314           JMP     OCT3            /YES IT WAS,
       3245  4572           UDPMS                   /READ STATUS FOR SENSE SWITCH
       3246  7104           CLL RAL                 /PUT IT IN THE LINK,
       3247  7204           CLA RAL                 /BACK TO AC11
       3250  1371           TAD     ("0&BIT7        /EITHER 0 OR 1,
       3251  3341           DCA     MOCT2           /
       3252  1035           TAD     TEMP1           /GET CODE,
       3253  7041           CMA IAC                 /NEGATE
       3254  1131           TAD     C40             /
       3255  7540           SMA SZA                 /CODE LESS THAN 40?
       3256  5262           JMP     .+4             /NO,
       3257  1370           TAD     ("-&BIT7-40     /
       3260  7700           SMA CLA                 /IS IT MORE THAN 137?
       3261  5266           JMP     .+5             /NO, ITS IN THE RANGE OF 40-137
       3262  7300           CLA CLL                 /0
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       3263  1367           TAD     ("7&BIT7 BBF    /BLANK FIRST PART BECAUSE OF NON-PRINT TYPE,
       3264  3322           DCA     MOCT            /SET BBF
       3265  5270           JMP     .+3             /GO SET OCTAL
       3266  1035           TAD     TEMP1           /GET 7 BIT CODE
       3267  3322           DCA     MOCT            /STORE PRINTABLE CHARACTER,
       3270  1366           TAD     (-4             /
       3271  3042           DCA     COUNT1          /
       3272  1365           TAD     (MOCT1-1        /SET AUTO INDEX
       3273  3010           DCA     AI10            /FOR STORING OCTAL
       3274  7501           MQA                     /GET 7-8 BIT CODE,
       3275  7104           CLL RAL                 /LEFT ONE ON ACCOUNT OF LINK
       3276  7004   OCT2,   RAL                     /LEFT 1
       3277  7006           RTL                     /LEFT 2) SHOULD POSITION FIRST TO STORE,
       3300  7421           MQL                     /SAVE IN MQ,
       3301  7501           MQA                     /MQ --> AC,
       3302  0364           AND     (7              /SAVE 9-11
       3303  1371           TAD     ("0-200         /ADD TO MAKE 7 BIT NUMBER,
       3304  3410           DCA I   AI10            /PUT IN MESSAGE BUFFER,
       3305  7501           MQA                     /
       3306  2042           ISZ     COUNT1          /DONE ALL 4
       3307  5276           JMP     OCT2            /NO
       3310  7300           CLA CLL                 /0
       3311  1363           TAD     (MOCT           /ADDRESS OF MESSAGE
       3312  4577           UDPLA                   /LOAD ADDRESS
       3313  5212           JMP     OCT1            /GO WAIT FOR ANOTHER CHARACTER,
       3314  4560   OCT3,   SR3                     /REMAIN IN THIS TEST?
       3315  5200           JMP     OCT             /YES,
       3316  5762'          JMP     MOREVT          /MORE VT'S TO DO
       3317  4761'          JMS     SR7SR8          /LOOK AT SR7 AND SR8 TO SEE
                                                    /IF WE REMAIN IN THIS SECTION,
       3320  5760'          JMP     KEYTST-1        /REMAIN IN KBRD SECTION
       3321  5526           JMP I   CBEGIN          /DO TEST FROM BEGINNING,

       3322  0077   MOCT,   "7&BIT7
       3323  0040           " &BIT7
       3324  0275           "-&BIT7 BLINK
       3325  1040           " &BIT7 EBF
       3326  0077   MOCT1,  "7&BIT7
       3327  0077           "7&BIT7
       3330  0077           "7&BIT7
       3331  0077           "7&BIT7
       3332  0040           " &BIT7
       3333  0040           " &BIT7
       3334  0123           "S&BIT7
       3335  0127           "W&BIT7
       3336  0040           " &BIT7
       3337  0275           "-&BIT7 BLINK
       3340  0040           " &BIT7
       3341  0077   MOCT2,  "7&BIT7
       3342  3330           "X&BIT7 BLINK EOS

                    /ROUTINE FOR LOOPING,

       3343  0000   XLOOP,  OPEN
       3344  7200           CLA                     /MAKE SURE THE AC IS 0,
```

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3345  1743            TAD I    XLOOP          /GET THE RETURN POINTER,
3346  3006            DCA      SIX            /SAVE THE POINTER,
3347  4561            SR2                     /LOOP?
3350  5406            JMP I    SIX            /YES, LOOP ON TEST,
3351  2042            ISZ      COUNT1         /DONE YET?
3352  5406            JMP I    SIX            /NO, DO TEST AGAIN,
3353  2343            ISZ      XLOOP          /+1 FOR RETURN
3354  4560            SR3                     /REMAIN IN CURRENT TEST?
3355  5743            JMP I    XLOOP          /YES,
3356  2343            ISZ      XLOOP          /+1 TO EXIT TEST
3357  5743            JMP I    XLOOP          /EXIT CURRENT TEST,


3360  2600
3361  3747
3362  3547
3363  3322
3364  0007
3365  3325
3366  7774
3367  2077
3370  0077
3371  0060
3372  7763
3373  2757
3374  4701
3375  3677
3376  0663
3377  4163
      3400            PAGE

                /STARTS DISPLAY AND BACKGROUND JOB,

3400  0000   DPGOX,  OPEN
3401  4577            UDPLA                   /LOAD STARTING ADDRESS OF DATA BUFFER,
3402  4777            JMS I    (CALTIM        /IF "BLINK" IS SET THEN THE TIME
                                              /MUST BE CHANGED,
3403  6035   KEYI19,  KIE                     /ALWAYS DISABLE CONSOLE TTY INTERRUPT,
3404  7604            LAS                     /LOOK AT BACKGROUND SW,
3405  0113            AND      [100           /AND ONLY KEEP THAT ONE,
3406  7640            SZA CLA                 /IS BACKGROUND ALLOWED?
3407  5265            JMP      NOBACK         /NO,
3410  4776'           JMS      INTLD          /SET UP FOR INTERRUPT
3411  3426            XDPG01                  /RETURN ADDRESS,
             DECIMAL                          /
3412  1145            TAD      C-10           /SET UP TO COUNT BACKGROUND PASSES
             OCTAL                            /
3413  3775'           DCA      BACKPA         /FOR NO INTERRUPT DETECTION,
3414  7301   XDPG04,  CLA CLL IAC            /0001,
3415  6214            RDF                     /GET FIELD,
3416  4576            UDPGO                   /ALPHA-NUMERIC INT, ENABLED GO,
3417  1055   FLSET,   TAD      LINK           /RESTORE LINK,
3420  7104            CLL RAL                 /
3421  1054            TAD      MQ             /
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3422  7421            MQL                     /RESTORE MQ,
3423  1053            TAD      AC             /RESTORE AC,
3424  6001            ION                     /INTERRUPT ENABLED,
3425  5706            JMP I    BACKST         /START BACKGROUND
3426  4571   XDPG01,  UDPCL                   /CLOCK FLAG SET?
3427  7402            HLT                     /NO, ILLEGAL INTERRUPT,
                                              /NO SCOPE LOOPING PROVIDED,
                                              /PROGRAM MUST BE RESTARTED,
3430  3053            DCA      AC             /SAVE THE AC,
             DECIMAL                          /
3431  1145            TAD      C-10           /SET UP TO COUNT BACKGROUND PASSES
             OCTAL                            /
3432  3775'           DCA      BACKPA         /FOR NO INTERRUPT DETECTION,
3433  2045            ISZ      TIME           /DONE DISPLAYING REQUIRED TIME?
3434  5245            JMP      XDPG02         /
3435  7604            LAS                     /LOOK AT LOOP SWITCH,
3436  7510            SPA                     /CHECK HALT SWITCH
3437  7402            HLT                     /SR0 WAS SET TO HALT PROGRAM,
3440  0112            AND      [1000          /
3441  7650            SNA CLA                 /LOOP SWITCH SET?
3442  5254            JMP      XDPG03         /NO
             DECIMAL                          /
3443  1145            TAD      C-10+1         /RESET TIME -
             OCTAL                            /
3444  3045            DCA      TIME           /COUNTER FOR 1 SECOND
3445  6201   XDPG02,  CDF      00             /CHANGE TO DF 0
3446  1774            TAD I    (ZERO          /GET CONTENTS OF 0 OF FIELD 0 -
3447  3000            DCA      ZERO           /AND PLACE IT IN PROGRAM FIELD,
3450  4060            HOMEDF                  /CHANGE BACK TO PROGRAM DF,
3451  1053            TAD      AC             /RESTORE AC,
3452  6001            ION                     /INTERRUPT ON,
3453  5400            JMP I    ZERO           /CONTINUE BACKGROUND,
3454  7010   XDPG03,  RAR                     /L --> AC0,
3455  3055            DCA      LINK           /SAVE THE LINK,
3456  6201            CDF      00             /GO TO DF 0
3457  1774            TAD I    (ZERO          /GET CONTENTS OF FIELD 0 -
3460  3306            DCA      BACKST         /AND SAVE IN PROGRAM FIELD,
3461  4060            HOMEDF                  /RESTORE DF,
3462  7701            ACL                     /LOAD MQ INTO AC,
3463  3054            DCA      MQ             /SAVE MQ,
3464  5600            JMP I    DPGOX          /EXIT, AC+L=0
3465  6214   NOBACK,  RDF                     /GET FIELD,
3466  4576            UDPGO                   /ALPHA-NUMERIC INTERRUPT DISABLED,
3467  1373   NBACK2,  TAD      ("E            /OBTAIN LAST "AC" FROM THIS NON-BACK JOB,
3470  4571            UDPCL                   /CLOCK FLAG?
3471  5275            JMP      ,+4            /NO,
3472  2045            ISZ      TIME           /YES, DONE TIME?
3473  5270            JMP      ,-3            /NO, WAIT,
3474  5277            JMP      ,+3            /
3475  7001            IAC                     /INCREMENT THE AC SO THE PROGRAM LOOKS -
3476  5270            JMP      ,-6            /LIKE SOMETHING IS RUNNING,
3477  3373            DCA      ("E            /SAVE THE "AC",
3500  4561            SR2                     /LOOP?
3501  7610            SKP CLA                 /YES,
3502  5600            JMP I    DPGOX          /NO, EXIT, AC=0,
```

```
                              DECIMAL                       /
        3503  1145            TAD       C-10+1              /SET TIMER FOR
                              OCTAL                         /
        3504  3045            DCA       TIME                /1 SECOND;
        3505  5267            JMP       NBACK2              /

        3506  4205    BACKST, JSZTST                        /THIS LOCATION GETS MODIFIED!


                      /ROUTINE TO LOAD A BUFFER WITH
                      /AN INCREMENTING 7 BIT PATTERN;
                      /PLUS CONTROL BITS;

        3507  0000    LDINC,  OPEN
        3510  7300            CLA CLL                       /
        3511  4597            SR6                           /32 OR 64 CHARACTER,
                              DECIMAL                       /
        3512  1117            TAD       C32+20              /32,
        3513  1116            TAD       C-64+20             /64,
                              OCTAL                         /
        3514  3035            DCA       TEMP1               /SAVE COUNT,
        3515  1121            TAD       CBUFFER-1           /BUFFER-1 FOR =
        3516  3010            DCA       AI10                /AUTO-INDEX USE,
        3517  1131    LDINC1, TAD       C" &BIT7 NORMAL     /7-BIT CODE FOR SPACE;
        3520  3050            DCA       CHAR                /0--> CHAR,
                              DECIMAL                       /
        3521  1130            TAD       C-64                /
                              OCTAL                         /
        3522  3372            DCA       ("C                 /COUNTER,
        3523  1050    LDINC2, TAD       CHAR                /CONTENTS OF CHAR AND
        3524  0120            AND       CBIT7               /MASK A 177 FOR A 7-BIT CODE,
        3525  1047            TAD       CB2CB3              /NOW ADD THE CONTROL BITS TO IT,
        3526  3410            DCA I     AI10                /STORE IN THE BUFFER,
        3527  2050            ISZ       CHAR                /UPDATE FUTURE CHARACTER
        3530  7000            NOP                           /
        3531  2035            ISZ       TEMP1               /COMPLETED BUFFER YET?
        3532  7610            SKP CLA                       /NO
        3533  5707            JMP I     LDINC               /YES, EXIT, AC=0,
        3534  2372            ISZ       ("C                 /
        3535  5323            JMP       LDINC2              /
        3536  5317            JMP       LDINC1              /

        3537  7604    DVCOD,  LAS
        3540  3020            DCA       IOTTAB
        3541  3021            DCA       IOTTAB+1
        3542  1371            TAD       (IOTTAB
        3543  3031            DCA       WORKVT
        3544  4770'           JMS       DEVCOD
        3545  7402            HLT
        3546  5526            JMP I     CBEGIN

        3547  2031    MOREVT, ISZ       WORKVT
        3550  1431            TAD I     WORKVT
        3551  7650            SNA       CLA
        3552  5767'           JMP       OCT3+3
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        3553  4770'           JMS       DEVCOD
        3554  5766'           JHP       KEYTST




        3566  2601
        3567  3317
        3570  4123
        3571  0020
        3572  0303
        3573  0332
        3574  0000
        3575  4364
        3576  4163
        3577  3720
        3600                  PAGE
                      3600

                      /ROUTINE TO INCREMENT CB2+CB3

        3600  0000    CB3CB2, OPEN
        3601  7300            CLA CLL                       /
        3602  1047            TAD       CB2CB3              /CONTROL BITS -
        3603  1377            TAD       (-600               /2 AND 3 BEEN -
        3604  7640            SZA CLA                       /DISPLAYED YET?
        3605  5211            JMP       .+4                 /NO,
        3606  2200            ISZ       CB3CB2              /YES, +1 FOR EXIT,
        3607  3047            DCA       CB2CB3              /0-->CB2CB3,
        3610  5600            JMP I     CB3CB2              /EXIT, AC=0,
        3611  1047            TAD       CB2CB3              /ADD 200 -
        3612  1126            TAD       C200                /TO THE CONTROL -
        3613  3047            DCA       CB2CB3              /WORD,
        3614  5600            JMP I     CB3CB2              /EXIT, AC=0,

                      /ROUTINE TO SET THE AMOUNT OF TIME;

        3615  0000    SETTIM, OPEN                          /
        3616  7300            CLA CLL                       /0
        3617  3046            DCA       TIMEX               /0-->TIMEX,
        3620  1615            TAD I     SETTIM              /GET AMOUNT OF TIME (SECONDS)
        3621  7041            CMA IAC                       /NEGATE SECONDS,
        3622  3376            DCA       ("A                 /SAVE IT,
        3623  7604            LAS                           /LOOK FOR 50-60 CYCLE SW,
        3624  0126            AND       C200                /
        3625  7640            SZA CLA                       /SKIP IF 60 CYCLE
        3626  7001            IAC                           /1 (50 CYCLE),
        3627  1375            TAD       (-6                 /60 CYCLE
        3630  3374    SETTI,  DCA       ("B                 /SAVE AS COUNT REQUIRED FOR ,1 SECOND,
        3631  1046            TAD       TIMEX               /ADD ACCUMULATED TIME -
        3632  1374            TAD       ("B                 /PLUS ,1 SECOND AND -
        3633  3046            DCA       TIMEX               /SAVE,
        3634  2376            ISZ       ("A                 /TIMEX SET FOR AMOUNT OF TIME?
        3635  5231            JMP       .-4                 /NO,
        3636  2215            ISZ       SETTIM              /+1 FOR EXIT,
        3637  5615            JMP I     SETTIM              /EXIT, AC=0,
```

```
                        /SPECIAL ENTRANCE TO DISPLAY DESIRED CHARACTER.

3640  4566    SETCHR, SETUP
3641  7604            LAS                      /READ SWITCHES FOR CHARACTER
3642  0120            AND       CBIT7          /KEEP 7-BIT CODE
3643  3050            DCA       CHAR           /SAVE FOR THE CHARACTER.
3644  7604            LAS                      /READ SWITCHES FOR CONTROL BIT.
3645  0373            AND       (3600          /SAVE CONTROL BITS.
3646  3047            DCA       CB2CB3         /
3647  7402            HLT                      /SET SR OPTIONS
3650  5772'           JMP       DSCHA1         /GO DISPLAY

                        /ROUTINE TO PRIME THE VT8-E DATA BUFFER WITH
                        /THE DATA THAT IS IN THE LOCATION DEFINED
                        /AFTER THE CALL.

3651  0000    PRIME,  OPEN
3652  4557            SRS                      /32 OR 64?
                      DECIMAL                  /
3653  1131            TAD       (32            /32
3654  1371            TAD       (-64+1         /64
                      OCTAL                    /
3655  3044            DCA       COUNT3
3656  1651            TAD I     PRIME          /ADDRESS OF DATA
3657  4577            UDPLA                    /
3660  4575            UDPSH                    /MAINTENANCE MODE
3661  4574            UDPMB                    /SINGLE BREAK.
3662  2044            ISZ COUNT3               /BUFFER FILLED -1?
3663  5260            JMP       .-3            /NO.
3664  2251            ISZ       PRIME          /+1 FOR EXIT.
3665  5651            JMP I     PRIME          /EXIT, AC=0.

                        /ROUTINE TO DISPLAY THE RECEIVED AND
                        /EXPECTED DATA IN THE AC AND MQ.

3666  0000    SHOWX,  OPEN
3667  7300            CLA CLL                  /0
3670  1032            TAD       GDATA          /EXPECTED DATA TO MQ
3671  7421            MQL                       /
3672  1033            TAD       BDATA          /RECEIVED DATA TO AC
3673  7402            HLT                      /MQ CONTAINS EXPECTED.
                                               /AC CONTAINS RECEIVED.
3674  7621            CAM                      /0 --> AC+MQ.
3675  1052            TAD       FLD            /GET FIELD TESTED
3676  7421            MQL                      /SAVE IN THE MQ FOR VIEWING
3677  1034            TAD       ADATA          /
3700  7402            HLT                      /AC = ADDRESS OF DATA.
                                               /MQ = MEMORY FIELD.
3701  7300            CLA CLL                  /0
3702  5666            JMP I     SHOWX          /EXIT, AC+L+MQ=0.

                        /ROUTINE TO LOAD THE DATA BUFFER
                        /WITH THE DATA IN THE SR.   THE
```

```
                        /DATA READ FROM THE DATA BUFFER
                        /IS LOADED INTO THE MQ.

3703  4566    DP,     SETUP                    /INITIALIZE.
3704  7604            LAS                      /READ DATA PATTERN
3705  3532            DCA I     CBUFFER        /STORE.
3706  1132            TAD       CBUFFER        /BUFFER ADDRESS -->
3707  4577            UDPLA                    /STARTING ADDRESS REGISTER.
3710  7301            CLA CLL IAC              /SET EXT. STARTING ADDRESS REGISER.
3711  6214            RDF                      /FIELD.
3712  4575            UDPSM                    /
3713  4575            UDPSM                    /STARTING ADDR REGS --> ADDRESS COUNTER.
3714  4574            UDPMB                    /BREAK
3715  4573            UDPMD                    /READ DATA
3716  7421            MQL                      /STORE OUTPUT FROM BUFFER IN THE "MQ"
3717  5304            JMP       DP+1           /REPEAT UNTIL STOPPED.

                        /ROUTINE TO ADJUST "TIME" FOR SYNCHROZATION WITH
                        /THE BLINK FREQUENCY.
                        /FOR EVERY 15 TICKS AN ADDITIONAL 1 IS ADDED.

3720  0000    CALTIM, OPEN
3721  1770'           TAD       BUFFER         /LOOK AT A CHARACTER IN THE BUFFER
3722  0367            AND       (CURSOR        /KEEP ONLY THESE CONTROL BITS.
3723  1366            TAD       (-BLINK        /ADD -BLINK TO SEE IF
3724  7650            SNA CLA                  /IF BLINK IS SET.
3725  5330            JMP       .+3            /BLINK IS SET.
3726  1046            TAD       TIMEX          /GET CALCULATED TIME COUNT
3727  5345            JMP       CAL3           /AND PUT IT IN TIME.
3730  1046            TAD       TIMEX          /GET ORGINAL TIME COUNT.
3731  7041            CMA IAC                  /NEGATE IT
3732  7421            MQL                      /STORE IN MQ
3733  7501            MQA                      /MQ --> AC
                      DECIMAL                  /
3734  1365    CAL1,   TAD       (-15           /SUBTRACT 15.
                      OCTAL                    /
3735  7510            SPA                      /CAN WE SUBTRACT ANOTHER 15?
3736  5343            JMP       CAL2           /NO
3737  7521            SWP                      /AC --> MQ;  MQ --> AC.
3740  7001            IAC                      /+1 ON TIME.
3741  7521            SWP                      /AC --> MQ;  MQ --> AC.
3742  5334            JMP       CAL1           /GO DO ANOTHER SUBTRACTION.
3743  7721    CAL2,   CLASWP                   /MQ --> AC;  0 --> MQ.
3744  7041            CMA IAC                  /NEGATE NEW TIME
3745  3045    CAL3,   DCA       TIME           /SAVE.
3746  5720            JMP I     CALTIM         /EXIT.

                        /ROUTINE TO EXIT +1 IF SR7 AND SR8 ARE
                        /NOT 0 AND 1 RESPECTIVELY.

3747  0000    SR7SR8, OPEN
3750  7604            LAS                      /LOOK AT SR
3751  7102            CLL BSW                  /POSITION 7+8 FOR TESTING
3752  7006            RTL                      /GET INTO LINK AND AC0
3753  7040            CMA                      /CHANGE AC0
```

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        3754  7720        SNL SMA CLA          /SR7=0 AND SR8=1?
        3755  5747        JMP I    SR7SR8      /YES,
        3756  2347        ISZ      SR7SR8      /NO, THEN +1,
        3757  5747        JMP I    SR7SR8      /EXIT +1,


        3765  7761
        3766  7600
        3767  0600
        3770  4700
        3771  7701
        3772  2004
        3773  3600
        3774  0302
        3775  7772
        3776  0301
        3777  7200
              4000              PAGE

                        /IOT SUBROUTINES,

        4000  0000   ZDPLA,  OPEN
        4001  6050   DDPLA,  DPLA
        4002  5600           JMP I    ZDPLA
        4003  7402           HLT                 /DPLA SKIPPED,
                                                 /NO SCOPE LOOP PROVIDED
                                                 /SR SETTINGS DO NOT APPLY,

        4004  0000   ZDPGO,  OPEN
        4005  6051   DDPGO,  DPGO
        4006  5604           JMP I    ZDPGO
        4007  7402           HLT                 /DPGO SKIPPED,
                                                 /NO SCOPE LOOP PROVIDED
                                                 /SR SETTINGS DO NOT APPLY,

        4010  0000   ZDPSM,  OPEN
        4011  6052   DDPSM,  DPSM
        4012  5610           JMP I    ZDPSM
        4013  7402           HLT                 /DPSM SKIPPED,
                                                 /NO SCOPE LOOP PROVIDED
                                                 /SR SETTINGS DO NOT APPLY,

        4014  0000   ZDPMB,  OPEN
        4015  6053   DDPMB,  DPMB
        4016  5614           JMP I    ZDPMB
        4017  7402           HLT                 /DPMB SKIPPED,
                                                 /NO SCOPE LOOP PROVIDED
                                                 /SR SETTINGS DO NOT APPLY,

        4020  0000   ZDPMD,  OPEN
        4021  6054   DDPMD,  DPMD
        4022  5620           JMP I    ZDPMD
        4023  7402           HLT                 /DPMD SKIPPED,
                                                 /NO SCOPE LOOP PROVIDED
                                                 /SR SETTINGS DO NOT APPLY,
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        4024  0000   ZDPMS,  OPEN
        4025  6055   DDPMS,  DPMS
        4026  5624           JMP I    ZDPMS
        4027  7402           HLT                 /DPMS SKIPPED,
                                                 /NO SCOPE LOOP PROVIDED
                                                 /SR SETTINGS DO NOT APPLY,

        4030  0000   ZDPCL,  OPEN
        4031  6056   DDPCL,  DPCL
        4032  5630           JMP I    ZDPCL      /DPCL NO SKIP,
        4033  2230           ISZ      ZDPCL
        4034  5630           JMP I    ZDPCL      /DPCL SKIPPED,

        4035  0000   ZDPBEL, OPEN
        4036  6057   DDPBEL, DPBELL
        4037  5635           JMP I    ZDPBEL
        4040  7402           HLT                 /DPBELL SKIPPED,
                                                 /NO SCOPE LOOP PROVIDED
                                                 /SR SETTINGS DO NOT APPLY,


                        /ROUTINE TO EXIT +2 IF SR1=1,

        4041  0000   SW1,    OPEN
        4042  7604           LAS
        4043  7104           RAL CLL
        4044  7700           SMA CLA
        4045  5641           JMP I    SW1
        4046  2241           ISZ      SW1
        4047  2241           ISZ      SW1
        4050  5641           JMP I    SW1

                        /ROUTINE TO EXIT +1 IF SR1=1,

        4051  0000   SW1A,   OPEN
        4052  7421           MQL
        4053  7604           LAS
        4054  7106           CLL RTL
        4055  7200           CLA
        4056  7501           MQA
        4057  7420           SNL
        4060  5651           JMP I    SW1A
        4061  2251           ISZ      SW1A
        4062  5651           JMP I    SW1A

                        /ROUTINE TO EXIT +1 IF SR2=0,

        4063  0000   SW2,    OPEN
        4064  7604           LAS
        4065  7510           SPA
        4066  7402           HLT                 /SR0 WAS SET TO HALT THE PROGRAM,
        4067  7106           RTL CLL
```

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4070  7710            SPA CLA
4071  5663            JMP I    SW2
4072  2263            ISZ      SW2
4073  5663            JMP I    SW2

         /ROUTINE TO EXIT +1 IF SR3=0,

4074  0000    SW3,    OPEN
4075  7604            LAS
4076  7106            RTL CLL
4077  7104            RAL CLL
4100  7710            SPA CLA
4101  5674            JMP I    SW3
4102  2274            ISZ      SW3
4103  5674            JMP I    SW3

         /ROUTINE TO EXIT+1 IF SR6=0,

4104  0000    SW6,    OPEN
4105  7604            LAS
4106  7102            BSW CLL
4107  7710            SPA CLA
4110  5704            JMP I    SW6
4111  2304            ISZ      SW6
4112  5704            JMP I    SW6

         /ROUTINE TO EXIT +1 IF SR7=1,

4113  0000    SW7,    OPEN
4114  7604            LAS
4115  7102            CLL BSW
4116  7104            CLL RAL
4117  7700            SMA CLA
4120  5713            JMP I    SW7
4121  2313            ISZ      SW7
4122  5713            JMP I    SW7

         /ROUTINE TO CHANGE IOT DEVICE CODE!
         /AC 0-5  DISPLAY IOT
         /AC 6-11 KEYBOARD IOT,

4123  0000    DEVCOD, 0
4124  4060            HOMEDF
4125  1431            TAD  I   WORKVT        /GET NEW DEVICE CODE FROM TABLE
4126  3035            DCA      TEMP1         /IOT CODE'S,
4127  1111            TAD      CDISIOT       /SET STARTING ADDRESS OF DISPLAY IOT TABLE,
4130  3036            DCA      TEMP2         /SAVE AT TEMP2,
4131  1035            TAD      TEMP1         /OBTAIN NEW IOT-
4132  7012            RTR                    /AND STORE AT TEMP3,
4133  7010            RAR                    /
4134  0110            AND      C0770         /
4135  3037            DCA      TEMP3         /
4136  4350            JMS      DVCOM         /PERFORM IOT SELECTION
4137  1107            TAD      CKEYIOT       /GET STARTING ADDRESS OF KEYBOARD IOT TABLE,
4140  3036            DCA      TEMP2         /AND SAVE
```

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4141  1035            TAD      TEMP1         /OBTAIN NEW IOT CODE-
4142  7006            RTL                    /
4143  7004            RAL                    /
4144  0110            AND      C0770         /
4145  3037            DCA      TEMP3         /AND STORE AT TEMP3,
4146  4350            JMS      DVCOM         /PERFORM IOT SELECTION
4147  5723            JMP  I   DEVCOD        /RETURN
4150  0000    DVCOM,  OPEN                   /COMMON SUBROUTINE TO SELECT IOT,
4151  1436            TAD  I   TEMP2         /
4152  7450            SNA                    /0?
4153  5750            JMP  I   DVCOM         /YES, EXIT,
4154  3040            DCA      TEMP4         /
4155  1440            TAD  I   TEMP4         /
4156  0377            AND      (7007         /REMOVE OLD CODE,
4157  1037            TAD      TEMP3         /INSERT NEW CODE,
4160  3440            DCA  I   TEMP4         /PUT BACK NEW ITO,
4161  2036            ISZ      TEMP2         /SET UP FOR NEXT IOT CODE,
4162  5351            JMP      DVCOM+1

         /ROUTINE TO LOAD ADDRESS "ONE + TWO" FOR INTERRUPTS

4163  0000    INTLD,  OPEN
4164  1135            TAD      CJMP I   TWO  /
4165  3001            DCA      ONE           /
4166  1763            TAD  I   INTLD         /
4167  3002            DCA      TWO           /
4170  2363            ISZ      INTLD         /
4171  6035  KEYI20, KIE                      /
4172  5763            JMP  I   INTLD         /


4177  7007
      4200            PAGE

      4205            *,*5

         /BACKGROUND PROCESSOR TEST!
         /TESTS ARE RUN WHILE WAITING FOR INTERRUPT

         /ISZ TEST!

4205  7040  ISZTST, CMA
4206  3355            DCA      XTEMP5
4207  3352            DCA      XTEMP2
4210  3351            DCA      XTEMP1
4211  2351            ISZ      XTEMP1
4212  2352            ISZ      XTEMP2
4213  5211            JMP      .-2
4214  1352            TAD      XTEMP2
4215  7440            SZA
4216  7402            HLT                    /ISZ FAILURE,
```

```
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,
        4217  7240           CLA CMA
        4220  1351           TAD     XTEMP1
        4221  7440           SZA
        4222  7402           HLT                        /ISZ FAILURE,
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,

        4223  2355           ISZ     XTEMP5
        4224  7410           SKP
        4225  5210           JMP     ISZTST+3

                     /ROTATE 1 TEST,

        4226  1352   ROT1TS, TAD     XTEMP2
        4227  7130           STL RAR
        4230  7004           RAL
        4231  7420           SNL
        4232  7402           HLT                        /ROTATE FAILURE,
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,

        4233  7041           CMA IAC
        4234  1352           TAD     XTEMP2
        4235  7440           SZA
        4236  7402           HLT                        /ROTATE FAILURE,
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,

        4237  2352           ISZ     XTEMP2
        4240  5226           JMP     ROT1TS

                     /ROTATE 2 TEST,

        4241  1352   ROT2TS, TAD     XTEMP2
        4242  7106           CLL RTL
        4243  7012           RTR
        4244  7430           SZL
        4245  7402           HLT                        /ROTATE FAILURE,
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,

        4246  7041           CMA IAC
        4247  1352           TAD     XTEMP2
        4250  7440           SZA
        4251  7402           HLT                        /ROTATE FAILURE,
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,

        4252  2352           ISZ     XTEMP2
        4253  5241           JMP     ROT2TS

                     /TAD TEST ADD EVERY COM TO RAN NO,

        4254  3353   TADTST, DCA     XTEMP3
        4255  1356           TAD     PRAN1
        4256  7104           CLL RAL
        4257  7430           SZL
        4260  7001           IAC
```

```
        4261  3356           DCA     PRAN1
        4262  1357           TAD     PRAN2
        4263  1356           TAD     PRAN1
        4264  3357           DCA     PRAN2
        4265  1357           TAD     PRAN2
        4266  3354           DCA     XTEMP4
        4267  1357           TAD     PRAN2
        4270  1353           TAD     XTEMP3
        4271  7041           CMA IAC
        4272  1354           TAD     XTEMP4
        4273  7440           SZA
        4274  7402           HLT                        /TAD FAILURE,
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,

        4275  2354           ISZ     XTEMP4
        4276  7000           NOP
        4277  2353           ISZ     XTEMP3
        4300  5267           JMP     ,-11

                     /JMS TEST MAKE 13 PASSES OF 128 CONSECUTIVE JMS,
                     /AND COMPARE RESULTS,

        4301  1363   JMSTST, TAD     K7763X
        4302  3351           DCA     XTEMP1
        4303  1362           TAD     K7600X
        4304  3352           DCA     XTEMP2
        4305  1360           TAD     JMSLOC
        4306  3353           DCA     XTEMP3
        4307  1361           TAD     JMSKON
        4310  3354           DCA     XTEMP4
        4311  1377           TAD     (JMRETU
        4312  3056           DCA     RETUJM
        4313  1354           TAD     XTEMP4
        4314  3753           DCA I   XTEMP3
        4315  2354           ISZ     XTEMP4
        4316  2353           ISZ     XTEMP3
        4317  2352           ISZ     XTEMP2
        4320  5313           JMP     ,-5
        4321  1106           TAD     (JMP I  RETUJM
        4322  3753           DCA I   XTEMP3
        4323  5760           JMP I   JMSLOC

        4324  1362   JMRETU, TAD     K7600X
        4325  3352           DCA     XTEMP2
        4326  1360           TAD     JMSLOC
        4327  3353           DCA     XTEMP3
        4330  1353           TAD     XTEMP3
        4331  7040           CMA
        4332  1753           TAD I   XTEMP3
        4333  7440           SZA
        4334  7402           HLT                        /JMS FAILURE,
                                                        /NO SCOPE LOOP PROVIDED
                                                        /SR SETTINGS DO NOT APPLY,

        4335  2353           ISZ     XTEMP3
        4336  2352           ISZ     XTEMP2
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          4337  5330          JMP     JMRETU+4
          4340  2351          ISZ     XTEMP1
          4341  5303          JMP     JMSTST+2
          4342  7501          MQA
          4343  7001          IAC
          4344  7421          MQL
          4345  2364          ISZ     BACKPA          /COUNT TEN PASSES,
          4346  5205          JMP     ISBTST
          4347  7402          HLT                     /NO INTERRUPT OCCURRED WITHIN 1Ø
                                                      /PASSES OF THE BACKGROUND JOB,
                                                      /CLOCK RUNNING SLOW OR INTERRUPT
                                                      /FAILING,
                                                      /NO SCOPE LOOP PROVIDED
                                                      /SR SETTINGS DO NOT APPLY,
          4350  5776'         JMP     BEGIN           /START TEST FROM BEGINNING,

          4351  0000  XTEMP1, OPEN
          4352  0000  XTEMP2, OPEN
          4353  0000  XTEMP3, OPEN
          4354  0000  XTEMP4, OPEN
          4355  0000  XTEMP5, OPEN
          4356  4263  PRAN1,  4263
          4357  2634  PRAN2,  2634

          4360  7400  JMSLOC, BWA
          4361  4200  JMSKON, 4200
          4362  7600  K7600X, 7600
          4363  7763  K7763X, 7763
          4364  0000  BACKPA, OPEN                    /BACKGROUND PASS COUNT

          4376  0200
          4377  4324
                4400          PAGE

                /ROUTINE TO WAIT THE DURATION OF 2 "ISZ" LOOPS,

          4400  0000  WAIT,   OPEN
          4401  3252          DCA     LDA             /
          4402  2252          ISZ     LDA             /
          4403  5202          JMP     ,-1             /
          4404  2252          ISZ     LDA             /
          4405  5204          JMP     ,-1             /
          4406  5600          JMP I   WAIT            /

                /ROUTINE TO LOAD BUFFER WITH THE
                /CONTENTS OF THE AC,

          4407  0000  LDBUFF, OPEN
          4410  3252          DCA     LDA             /SAVE THE CHARACTER,
          4411  1121          TAD     [BUFFER-1       /BUFFER-1-=>A11Ø,
          4412  3010          DCA     AI1Ø            /
          4413  4557          SR6                     /32 OR 64 CHARACTER?
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```
                        DECIMAL                       /
          4414  1117          TAD     [32+20          /32,
          4415  1116          TAD     [-64+20         /64,
                        OCTAL                         /
          4416  3302          DCA     LDB             /
          4417  1252          TAD     LDA             /CHARACTER BUFFER,
          4420  3410          DCA I   AI1Ø            /
          4421  2302          ISZ     LDB             /BUFFER FILLED?
          4422  5217          JMP     ,-3             /NO,
          4423  5607          JMP I   LDBUFF          /YES, EXIT,

                /THIS ROUTINE SAVES THE CONTENTS OF THE ADDRESS
                /SPECIFIED BY LOCATION "ADATA" IN THE MQ,  THE ADDRESS
                /IS THEN LOADED WITH THE DATA IN LOCATION "GDATA"
                /EITHER 32 OR 64 BREAKS ARE THEN PERFORMED DEPENDING ON THE
                /SETTING OF THE SR,  THE ORGINAL CONTENTS OF THE ADDRESS ARE
                /RESTORED BEFORE EXIT,

          4424  0000  LDADDA, OPEN
          4425  2224          ISZ     LDADDA          /+1 FOR EXIT,
          4426  1042          TAD     COUNT1          /GET THE NUMBER OF BREAKS
          4427  3252          DCA     LDA             /SAVE THIS NUMBER,
          4430  1057          TAD     IDPSM           /GET EITHER A "NOP" OR "DPSM"
          4431  3242          DCA     LDAI            /STORE INSTRUCTION
          4432  1052          TAD     FLD             /GET FIELD
          4433  1155          TAD     [CDF    ØØ      /CDF Ø INST,
          4434  3235          DCA     ,+1             /STORE CDF INST,
          4435  0000          OPEN                    /EXECUTE CDF XX
          4436  1434          TAD I   ADATA           /GET THE INFORMATION IN THE ADDRESS,
          4437  7421          MQL                     /SAVE IT,
          4440  1037          TAD     INDATA          /GET TEST DATA
          4441  3434          DCA I   ADATA           /PUT TEST DATA IN THE ADDRESS,
          4442  0000  LDAI,   OPEN                    /WILL CONTAIN A "NOP" OR "DPSM"
          4443  6053  15,     DPMB                    /DO A SINGLE BREAK,
          4444  2252          ISZ     LDA             /ENOUGH BREAKS TO FILL BUFFER?
          4445  5242          JMP     ,-3             /NO, DO SOME MORE,
          4446  7501          MQA                     /RESTORE THE ADDRESS WITH -
          4447  3434          DCA I   ADATA           /ITS ORGINAL CONTENTS,
          4450  4060          HOMEDF                  /BACK TO PROGRAM DF,
          4451  5624          JMP I   LDADDA          /EXIT,
          4452  0000  LDA,    OPEN                    /COUNT LOCATION,

          4453  0000  LDADDB, OPEN
          4454  1042          TAD     COUNT1          /GET THE NUMBER OF BREAKS
          4455  3302          DCA     LDB             /SAVE THIS NUMBER,
          4456  1057          TAD     IDPSM           /GET INSTRUCTION
          4457  3272          DCA     LDBI            /SAVE
          4460  1034          TAD     ADATA           /
          4461  3303          DCA     LDB1            /
          4462  1052          TAD     FLD             /FIELD
          4463  1155          TAD     [CDF 00         /CDF Ø INST,
          4464  3265          DCA     ,+1             /STORE CDF INSTRUCTION,
          4465  0000          OPEN                    /EXECUTE CDF XX INSTRUCTION,
          4466  1703          TAD I   LDB1            /GET THE INFORMATION IN THE ADDRESS,
          4467  7421          MQL                     /SAVE IT,
```

```
          4470  1037            TAD    INDATA       /GET TEST DATA
          4471  3703            DCA I  LDB1         /PUT TEST DATA IN THE ADDRESS,
          4472  0000     LDBI,  OPEN                /WILL CONTAIN A "NOP" OR "DPSM"
          4473  6053     I3,    DPMB                /DO A SINGLE BREAK,
          4474  2302            ISZ    LDB          /ENOUGH BREAKS TO FILL BUFFER?
          4475  5272            JMP    .-3          /NO, DO SOME MORE,
          4476  7501            MQA                 /RESTORE THE ADDRESS WITH -
          4477  3703            DCA I  LDB1         /ITS ORGINAL CONTENTS,
          4500  4060            HOMEDF              /RESTORE PROGRAM DF,
          4501  5653            JMP I  LDADDB       /EXIT,
          4502  0000     LDB,   OPEN                /COUNT LOCATION,
          4503  0000     LDB1,  OPEN

          4504  4001     DISIOT, DDPLA
          4505  4005             DDPGO
          4506  4011             DDPSM
          4507  4015             DDPMB
          4510  4021             DDPMD
          4511  4025             DDPMS
          4512  4031             DDPCL
          4513  4036             DDPBEL
          4514  0402             CLOCK1
          4515  0404             CLOCK2
          4516  1430             I1
          4517  4473             I3
          4520  4443             I5
          4521  0000             0
          4522  2602     KEYIOT, KEYI1
          4523  2603             KEYI1A
          4524  2632             KEYI
          4525  3013             KEYI4
          4526  3015             KEYI5
          4527  3214             KEYI6
          4530  0203             KEYI7
          4531  0215             KEYI8
          4532  0230             KEYI9
          4533  2637             KEYI10
          4534  2651             KEYI11
          4535  2666             KEYI12
          4536  2701             KEYI13
          4537  3016             KEYI14
          4540  3024             KEYI15
          4541  2676             KEYI16
          4542  3203             KEYI17
          4543  3226             KEYI18
          4544  3212             OCTI
          4545  3403             KEYI19
          4546  4171             KEYI20
          4547  0000             0

                           /DATA FOR CONSTANT DATA TEST,

          4550  7767     FDATAB, =FDATAE+FDATAB
          4551  7777             7777
          4552  0000             0000
```

```
          4553  7777            7777
          4554  5252            5252
          4555  2525            2525
          4556  7700            7700
          4557  0077            0077
          4560  7007            7007
          4561  0770     FDATAE, 0770

          4562  7770     CURPOS, -CURLFT
          4563  7750             -CURRHT
          4564  7746             -CURUP
          4565  7765             -CURDWN
          4566  7743             -CURHME
          4567  7742             -EOL
          4570  7741             -EOS
          4571  0000             0

          4572  4602     CURMSG, MLEFT
          4573  4607             MRIGHT
          4574  4615             MUP
          4575  4620             MDOWN
          4576  4625             MHOME
          4577  4636             MEOL
          4600  4632             MEOS
          4601  4642             MWHAT

          4602  0114     MLEFT,  "L&BIT7I"E&BIT7I"F&BIT7I"T&BIT7I"?&BIT7 BLINK EOS
          4603  0105
          4604  0106
          4605  0124
          4606  3277
          4607  0122     MRIGHT, "R&BIT7I"I&BIT7I"G&BIT7I"H&BIT7I"T&BIT7I"?&BIT7 BLINK EOS
          4610  0111
          4611  0107
          4612  0110
          4613  0124
          4614  3277
          4615  0125     MUP,    "U&BIT7I"P&BIT7I"?&BIT7 BLINK EOS
          4616  0120
          4617  3277
          4620  0104     MDOWN,  "D&BIT7I"O&BIT7I"W&BIT7I"N&BIT7I"?&BIT7 BLINK EOS
          4621  0117
          4622  0127
          4623  0116
          4624  3277
          4625  0110     MHOME,  "H&BIT7I"O&BIT7I"M&BIT7I"E&BIT7I"?&BIT7 BLINK EOS
          4626  0117
          4627  0115
          4630  0105
          4631  3277
          4632  0105     MEOS,   "E&BIT7I"O&BIT7I"S&BIT7I"?&BIT7 BLINK EOS
          4633  0117
          4634  0123
          4635  3277
          4636  0105     MEOL,   "E&BIT7I"O&BIT7I"L&BIT7I"?&BIT7 BLINK EOS
```

```
         4637  0117
         4640  0114
         4641  3277
         4642  0127    MWHAT,   "H&BIT7I"H&BIT7I"A&BIT7I"T&BIT7I"7&BIT7 BLINKI"?&BIT7 BLINK EOS
         4643  0110
         4644  0101
         4645  0124
         4646  0277
         4647  3277
         4650  0304    MDONE,   "O&BIT7 BLINKI"O&BIT7 BLINKI"N&BIT7 BLINKI"E&BIT7 BLINKIO
         4651  0317
         4652  0316
         4653  0305
         4654  0000


                     /DISPLAY BUFFER USES LOCATIONS 4670-7377,
                     /BACKGROUND WORKING AREA USES LOCATIONS 7400-7577,

         4670          *4670

                       XLIST

                       S

         0106  5456
         0107  4522
         0110  0770
         0111  4504
         0112  1000
         0113  0100
         0114  4701
         0115  4676
         0116  5400
         0117  1200
         0120  0177
         0121  4677
         0122  3600
         0123  2135
         0124  1051
         0125  3615
         0126  0200
         0127  0061
         0130  7700
         0131  0040
         0132  4700
         0133  3506
         0134  4205
         0135  5402
         0136  0020
         0137  3651
         0140  0032
         0141  0010
         0142  1777
```

```
         0143  7770
         0144  4407
         0145  7766
         0146  7400
         0147  1470
         0150  3640
         0151  3703
         0152  2600
         0153  2000
         0154  3537
         0155  6201
         0156  4113
         0157  4104
         0160  4074
         0161  4063
         0162  4051
         0163  4041
         0164  3343
         0165  3666
         0166  1073
         0167  3400
         0170  4035
         0171  4030
         0172  4024
         0173  4020
         0174  4014
         0175  4010
         0176  4004
         0177  4000
```

```
0000  11111111  11111111  11111111  11111111  11111111  11111111  11111100  11111100
0100  00000011  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0300  11111111  11111111  11111111  11111111  11111111  11111111  11000000  00000111

0400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0500  11111111  11111111  11111111  11111111  11111111  11111100  00000000  00001111

0600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0700  11111111  11111111  11111111  11111111  11111100  00000000  00000000  00000111

1000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1100  11111111  11111111  11110000  00000000  00000000  00000000  00000000  11111111

1200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1300  11111111  11111111  11111111  11111111  11111111  11111000  00000000  00001111

1400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1500  11111111  11111111  11110000  00000000  00000000  00000000  00000111  11111111

1600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1700  11111111  11111111  11111111  11111111  11111111  11100000  00000111  11111111

2000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2100  11111111  11111111  11111111  11111111  11111111  11111111  11000011  11111111

2200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2300  11111111  11111111  11111111  11111111  11111111  11111000  00011111  11111111

2400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2500  11111111  11111111  11111111  11111111  11100000  00111111  11111111  11111111

2600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2700  11111111  11111111  11111111  11111111  11111111  11111111  11110001  11111111

3000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3100  11111111  11111111  11111111  00000000  00000000  00000000  00000111  11111111

3200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

3400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3500  11111111  11111111  11111111  11111111  11111111  11111000  00000011  11111111

3600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3700  11111111  11111111  11111111  11111111  11111111  11111111  00000111  11111111
```

```
4000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11000001

4200  00000111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4300  11111111  11111111  11111111  11111111  11111111  11111111  11111000  00000011

4400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

4600  11111111  11111111  11111111  11111111  11111111  11111000  00000000  11111111
4700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

5000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

5200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

5400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

5600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
5700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

6000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

6200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

6400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

6600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
6700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

7000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
7100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

7200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
7300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

7400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
7500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

7600
7700
```

Symbol	Value	Symbol	Value	Symbol	Value	Symbol	Value
AC	0053	CAM	7621	DDPMB	4015	EXTIN3	0635
ACL	7701	CARRET	0215	DDPMD	4021	FDATAB	4550
ADATA	0034	CB2CB3	0047	DDPMS	4025	FDATAE	4561
ADDR	0034	CB3CB2	3600	DDPSM	4011	FILBUF	4040
ADDR1	1400	CDF	6201	DEVCOD	4123	FIVE	0005
ADDR1A	1413	CDPCL	0303	DISIOT	4504	FLD	0052
ADDR1B	1423	CDPCL1	0321	DISRI1	2031	FLDTS1	2333
ADDR1C	1466	CDPGO	0336	DISRIP	2030	FLDTS2	2346
ADDR1D	1444	CDPLA	0257	DISSW1	2050	FLDTS3	2400
AI10	0010	CDPSM	0271	DISSW2	2055	FLDTS4	2337
AI11	0011	CHAR	0050	DISSWL	2043	FLDTST	2302
AI12	0012	CKCC	0201	DONE	2512	FLSET	3417
AI13	0013	CKRB	0213	DONE1	2527	FOUR	0004
AI14	0014	CKRS	0226	DONE2	2531	FUTURE	7000
AI15	0015	CLASWP	7721	DP	3703	GDATA	0032
AI16	0016	CLOCK	0400	DPBELL	6057	GO	2727
AI17	0017	CLOCK1	0402	DPCL	6056	GTF	6004
ALL	2074	CLOCK2	0404	DPGO	6051	HLT	7402
ALL1	2105	CLOCK3	0412	DPGOX	3400	HOME	0060
ALL2	2111	COUNT1	0042	DPLA	6050	HOMEDF	4060
ALL3	2127	COUNT2	0043	DPMB	6053	I1	1430
ALTMOD	0375	COUNT3	0044	DPMD	6054	I3	4473
BACKPA	4364	CUR1	3010	DPMS	6055	I5	4443
BACKST	3506	CUR2	3050	DPSM	6052	IDPSM	0057
BBF	2000	CURDWN	0013	DSCHA1	2004	INCBUF	2135
BDATA	0033	CURHME	0035	DSCHA2	2007	INDATA	0037
BEGIN	0200	CURLFT	0010	DSCHA3	2013	INITDC	0355
BIT7	0177	CURMSG	4572	DSCHAR	2001	INT1	0425
BLINK	0200	CURPOS	4562	OVCOD	3537	INT1A	0432
BRIGHT	0400	CURRHT	0030	DVCOM	4150	INT1B	0150
BSW	7002	CURSOR	0600	EOS	0037	INT1C	0443
BUFCA	1516	CURTST	3000	EBF	1000	INT1D	0446
BUFFER	4700	CURUP	0032	EDPGO	0712	INT2	0451
BUMP	1051	DATA1	1000	EDPGO1	0716	INT2A	0456
BUMP1	1070	DATA1A	1014	EDPGO2	0741	INT2B	0466
BWA	7400	DATA1B	1024	EOL	0036	INT2C	0472
CAF	6007	DATA2	1200	EOS	3000	INT3	0475
CAINC	1600	DATA2A	1214	EOSTS1	2430	INT3A	0502
CAINC1	1613	DATA2B	1237	EOSTS2	2436	INT3B	0511
CAINC2	1625	DATA2C	1270	EOSTST	2411	INT3C	0513
CAINC3	1632	DATA2D	1276	EXT	0646	INTLD	4163
CAINC4	1634	DATA2E	1301	EXT1	0647	IOF	6002
CAINC5	1661	DATA2F	1311	EXT2	0653	ION	6001
CAINC6	1671	DATA2G	1317	EXT3	0657	IOTTAB	0020
CAINC7	1677	DATA2H	1331	EXT4	0677	ISTORE	0041
CAINC8	1725	DATA2I	1333	EXTA	0517	ISZTST	4205
CAINC9	1727	DATA2J	1344	EXTA2	0522	JMRETU	4324
CAINCA	1740	DATA2K	1352	EXTA3	0524	JMSKON	4361
CAL1	3734	DDPBEL	4036	EXTADR	0032	JMSLOC	4360
CAL2	3743	DDPCL	4031	EXTIN	0600	JMSTST	4301
CAL3	3745	DDPGO	4005	EXTIN1	0601	K7600X	4362
CALTIM	3720	DDPLA	4001	EXTIN2	0606	K7763X	4363

Symbol	Value	Symbol	Value	Symbol	Value	Symbol	Value
KCC	6032	LFADD	0036	RMF	6244	UDPMS	4572
KCF	6030	LFEND	0037	ROT1TS	4226	UDPSM	4575
KEY1	2632	LFTST	2200	ROT2TS	4241	UPDOWN	0043
KEY2	2727	LFTST1	2211	RTF	6005	WAIT	4400
KEY3	2634	LFTST2	2236	RUB	2733	WORKVT	0031
KEY4	2644	LFTST3	2251	RUBOUT	0377	XDPGO	4567
KEY5	2647	LFTST4	2264	SENSE	0244	XDPGO1	3426
KEY6	2656	LFTST5	2270	SETCHR	3640	XDPGO2	3445
KEY7	2663	LINEFD	0212	SETTI	3630	XDPGO3	3454
KEY8	2673	LINK	0055	SETTIM	3615	XDPGO4	3414
KEY9	2675	LOOP	4564	SETUP	4566	XLOOP	3343
KEY11	2602	LOOPFL	0036	SETUPX	1073	XTEMP1	4351
KEY110	2637	MDONE	4650	SEVEN	0007	XTEMP2	4352
KEY111	2651	MDOWN	4620	SHOW	4545	XTEMP3	4353
KEY112	2666	MEOL	4636	SHOWX	3666	XTEMP4	4354
KEY113	2701	MEOS	4632	SHR32	2465	XTEMP5	4355
KEY114	3016	MHOME	4625	SHRIN1	2473	ZDPBEL	4035
KEY115	3024	MLEFT	4602	SHRINK	2447	ZDPCL	4030
KEY116	2676	MOCT	3322	SIX	0006	ZDPGO	4004
KEY117	3203	MOCT1	3326	SKON	6000	ZDPLA	4000
KEY118	3226	MOCT2	3341	SR1	4563	ZDPMB	4014
KEY119	3403	MOREVT	3547	SR1A	4562	ZDPMD	4020
KEY11A	2603	MQ	0054	SR2	4561	ZDPMS	4024
KEY120	4171	MQA	7501	SR3	4560	ZDPSM	4010
KEY14	3013	MQL	7421	SR6	4557	ZERO	0000
KEY15	3015	MRIGHT	4607	SR7	4556		
KEY16	3214	MULTAB	1517	SR7SR8	3747		
KEY17	0203	MULV1	1502	SRQ	6003		
KEY18	0215	MULVT8	1470	SW1	4041		
KEY19	0230	MUP	4615	SW1A	4051		
KEYIOT	4522	MWHAT	4642	SW2	4063		
KEYTST	2601	NBACK2	3467	SW3	4074		
KIE	6035	NOBACK	3465	SW6	4104		
KRB	6036	NOCNT	0035	SW7	4113		
KRS	6034	NORMAL	0000	SWL32	3124		
KSF	6031	OCT	3200	SWP	7521		
LAS	7604	OCT1	3212	TADTST	4254		
LDA	4452	OCT2	3276	TEMP1	0035		
LOADOA	4424	OCT3	3314	TEMP2	0036		
LDADDB	4453	OCT4	3222	TEMP3	0037		
LDAI	4442	OCT5	3225	TEMP4	0040		
LDB	4502	ONE	0001	TEMP5	0041		
LDB1	4503	OPEN	0000	THREE	0003		
LDBI	4472	OSR	7404	TIME	0045		
LDBUFF	4407	PRAN1	4356	TIMEX	0046		
LDINC	3507	PRAN2	4357	TWO	0002		
LDINC1	3517	PRIME	3651	UDPBEL	4570		
LDINC2	3523	PSET	0051	UDPCL	4571		
LDSWL	3054	RDF	6214	UDPGO	4576		
LDSWL1	3070	RETUJM	0056	UDPLA	4577		
LDSWL2	3075	RIB	6234	UDPMB	4574		
LENGTH	0040	RIF	6224	UDPMD	4573		

ERRORS DETECTED: 0
LINKS GENERATED: 53
RUN-TIME: 24 SECONDS
3K CORE USED