NCV11

NCV-11 EXER

CZNCDB0

AH-E777B-MC

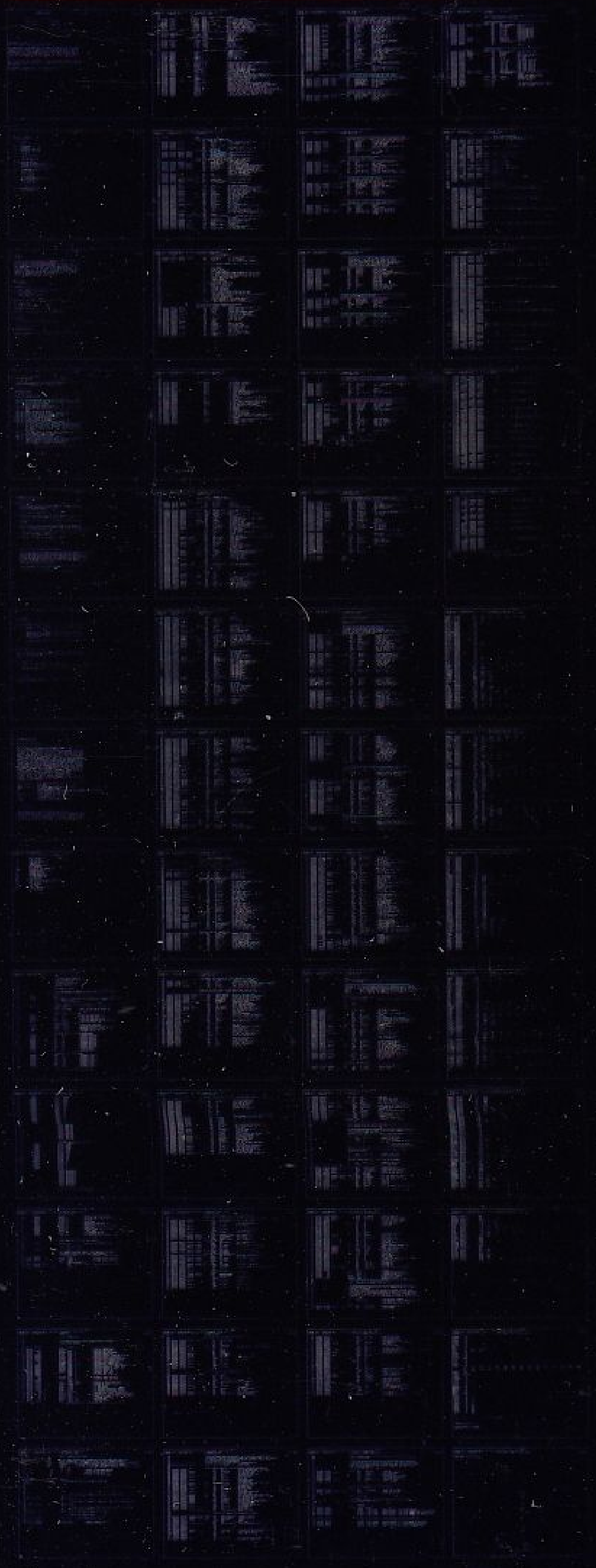
COPYRIGHT 78-80

FICHE 1 OF 1

JAN 1980

digital

MADE IN USA



IDENTIFICATION

Product Code:	AC-E776B-MC
Product Name:	CZNCDBO NCV-11 EXERCISER
Date:	AUGUST 1979
MAintainer:	Diagnostic Engineering

0.0 TABLE OF CONTENTS

1.0 ABSTRACT

The 'B'' version corrected the 'O'' command. It also corrected problems when no VSV01 display was present.
This is a self contained program designed to convert data from the GAMMA camera via the NCV11 interface and display it on a VSV01 display. It can be used for camera/interface and joystick setup or for practice in image manipulation. It is meant as a exerciser rather than a diagnostic. TOTAL PROGRAM CONTROL IS ACCOMPLISHED THRU THE CONSOLE KEYBOARD. THE PROGRAM IS NOT CHAINABLE/SCRIPTABLE UNDER XXDP/APT.

2.0 REQUIREMENTS

2.1 Equipment

1. PDP-11 FAMILY OR LSI-11 FAMILY Computer
2. I/O Terminal (i.e., LA36)
3. NCV11 Interface
4. Gamma Camera (OR SUBSTITUTE)

2.2 Equipment - Optional

1. H3060 Joystick
2. VSV01 DISPLAY

2.3 PRELIMINARY PROGRAMS

MAINDEC-11-CZNCC SHOULD HAVE PREVIOUSLY BEEN RUN

2.4 Storage

This program uses all of lower 12K of memory.

3.0 LOADING PROCEDURE

Normal procedure for loading a binary program into memory SHOULD BE followed.

4.0 STARTING PROCEDURE

Loading address 200 and starting will initialize the system, IDENTIFY THE PROGRAM and wait a keyboARd command.

5.0 OPERATOR OPTIONS

5.1 OPERATOR KEYBOARD OPTIONS

```
TYPE 'H'- HELP OPERATOR AND DISPLAY OR TYPE THIS LIST
Type 'N'- Collect new data from camera - clears core matrix FIRST
Type 'C'- Collect data from camera - starts NCV11, previous core
          matrix data not cleared
TYPE 'X'- SELECT ANOTHER CAMERA CHANNEL
Type 'S'- Stop NCV11 data coLLection - also terminates free RUN
          MODE
Type 'Z'- Zoom - Set NCV11 TO GAIN 2
Type 'R'- Regular - SET NCV11 TO GAIN 1 (DEFAULT COND)
Type 'W'- Select VSV01 display using 1st bit map
Type 'M'- Select VSV01 display USING 2nd bit map
Type 'A'- Display ISOTOPE A (default cond)
Type 'B'- Display ISOTOPE B (B GAMMA)
Type 'D'- Display data - display selected ISOTOPE
Type 'L'- Get lower threshold from keyboard (default=0) - all
          matrix values less than typed value are not displayed
Type 'U'- Get upper threshold from KEYBOARD (default=177777) -
          All matrix values greater than typed value are NOT
          DISPLAYED
Type 'F'- Free run mode - coLLect and display new data
          continuously - Type 'S' to terminate this mode
TYPE 'X'- SELECT ANOTHER CAMERA CHANNEL
Type 'G'- Initialize everything - start fresh
Type 'J'- Joystick calibration NCV11 - use "Cntrl C" to terminate mode
TYPE 'T'- DISPLAY INTENSITY TEST PATTERN ON SELECTED DISPLAY -
          THIS FEATURE IS FOR DISPLAY VERIFCATION ONLY
TYPE 'O'- OTHER TERMINAL TO CONTROL THE PROGRAM

Type "Cntrl & C" - Abort whatever - back to keyboard monitor
```

5.2 OPERATOR SWITCH REGISTER OPTION(S)

NONE

6.0 RECOMMENDED OPERATOR ACTION

6.1 Camera/A017 Setup

1. Place radioactive flood source IN FRONT OF CAMERA DETECTOR, OR USE A WEAK RADIOACTIVE SAMPLE ABOUT 3 FEET FROM A DETECTOR WITH THE COLLIMATOR REMOVED.

2. Collect data (C) and display (D)

3. Adjust the X and Y gain controls ON THE A017 until a round circle* IS SEEN and centered within the box on screen.

4. Increase the circle* size until the edges just begin to TOUCH THE BOX.

5. Collect data for a 3 minute period and observe the image. If there is an artifact on the center of the screen that looks like a right angle bracket, the "Z" delay circuit should be adjusted.

6. IF THE MATRIX AND Z COUNTS EQUAL 0 THEN NO DATA WAS COLLECTED, THEREFORE, NO DISPLAY.

* THIS MAY BE A HEXAGON FOR SOME MAKES OF CAMERA.

6.2 Joystick Setup

1. Select Joystick configration by typing "J".

2. Adjust the Y Pot on the H3060 Joystick so that the HORIZONTAL cross hair provide UNIFORM access within the box drawn on the screen.
   ADJUST THE X POT ON THE H3060 SO THAT THE VERTICAL CROSS HAIR WILL ALSO BE UNIFORM EXCEPT THAT DUE TO A HARDWARE OFFSET WILL NOT REACH THE RIGHT EDGE AND EXCEED THE LEFT EDGE BY THE SAME AMOUNT.
   Ideally, a physcial center of the Joystick will provide a point approximately centered in the box.

3. Check that when the Joystick interrupt SWITCH is depressed the CROSS HAIRS DO not follow the Joystick.

4. A "Cntrl C" will return user back to the keyboard monitor.

7.0 MISCELLANEOUS

7.1 Device Bus Address Modifications

NCV11	Modify location "NCVADR" if base bus address is not 772760
VSV01	Modify location "VTVADR" if base bus address (CHARACTER GENERATOR) IS NOT 772600 MODIFY LOCATION "VTMADR" IF BASE BUS ADDRESS (BIT MAP) IS NOT 772620
Note:	A restart is required after any of the above address modifications.

7.2 Free Run Mode (Type "F")

Modification of location "TIME" will alter the data collection time in the free run mode. The default value of 20(8) provides about 10 SECONDS ON AN LSI-11 CPU.

7.3 Error Reporting

1. INCORRECT KEYBOARD COMMANDS ARE RESPONDED WITH '?'
2. A MESSAGE WILL BE REPORTED IF ANY SELECTED DEVICE (SEE SECTION 7.1) DOES NOT RESPOND.

7.4 Execution Time

The EXECUTION TIME is completely dependent upon the user for whatever option selected.

8.0 PROGRAM DESCRIPTION

8.1 Data Collection & Display

The user may collect data from the gamma camera system via the NCV11 interface and display this data on the VSV01 (bitmap) display. All functions are ENTERED thru the keyboard as defined in section 5.1. When the data collection mode is selected the NCV11 is receiving X & Y data from the gamma camera (looking AT a radioactive source). This information is transformed via THE address maker LOGIC which forms a unique address within a defined matrix relative to the scan position of the camera. The NCV11 preforms an NPR increment to memory to this UNIQUE address. The program selects the address MATRIX 64x64x16 (RESOLUTION 2) OFFSET TO address 20000(8) FOR THE 'A' Isotope, AND FOR THE 'B' ISOTOPE, (CAMERAS EQUIPPED WITH THE DUAL ISOTOPE ATTACHMENT) INFORMATION VIA B GAMMA LOGIC IS STORED STARTING AT ADDRESS 40000 (8). The intensity of each cell (memory location) of the image in memory is adjusted with the upper and lower thresholds and scaled to ONE OF 16 intensity levelS. The cell with the highest count represents THE HIGHEST intensity level, therefore appears brightest on the display. At the completion of the image display, the following parameters are displayed:

Lower Threshold	-	All values greater than this value are displayed
Upper Threshold	-	All values above this value are omitted
CAMERA	-	SELECTED CAMERA CHANNEL
PB	-	UP/DN INDICATOR OF THE PUSH BUTTON STATE DURING LAST COLLECTION
JB	-	UP/DN INDICATOR OF THE JOY BUTTON STATE DURING LAST COLLECTION
Z Count	-	32 bit counter of EVENT pulses
MatRix Count	-	Total count of the contents of each cell in the 64x64 matrix
Zoom	-	Displayed if gain was selected
B-Gamma	-	Displayed if 'B' Isotope selected

8.2 Joystick Mode

Selecting the TEST takes advantage of the Joystick mode provided by the NCV11. This mode selects the JOYSTICK inputs and the NCV11 performs like aN A/D with the X & Y CONVERTED values available in X-Y holding register. The X and Y data is applied to the display and should conform to the requirements in section 6.2. HE VSV01 uses the X & Y cross hairs as the DISPLAY indicator.

9.0 LISTING

```
                        ;DEVELOPED USING SYSMAC.C3
                        .TITLE  CZNCDB  NCV11 EXERCISER
                        ;*COPYRIGHT (C) 1979
                        ;*DIGITAL EQUIPMENT CORP.
                        ;*MAYNARD, MASS. 01754
                        ;*
                        ;*PROGRAM BY R.SHOOP
                        ;*
                        ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                        ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
                        ;*
        000001          $TN=1
        160000          $SWR=160000      ;;HALT ON ERROR, LOOP ON TEST, INHIBIT ERROR TYPOUT
        172760                  ABASE=172760            ;DEFAULT NCV11 ADDRESS
                        .SBTTL  BASIC DEFINITIONS

                        ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
        001100          STACK=  1100
                        .EQUIV  EMT,ERROR        ;;BASIC DEFINITION OF ERROR CALL
                        .EQUIV  IOT,SCOPE        ;;BASIC DEFINITION OF SCOPE CALL

                        ;*MISCELLANEOUS DEFINITIONS
        000011          HT=     11               ;;CODE FOR HORIZONTAL TAB
        000012          LF=     12               ;;CODE FOR LINE FEED
        000015          CR=     15               ;;CODE FOR CARRIAGE RETURN
        000200          CRLF=   200              ;;CODE FOR CARRIAGE RETURN-LINE FEED
        177776          PS=     177776           ;;PROCESSOR STATUS WORD
                        .EQUIV  PS,PSW
        177774          STKLMT= 177774           ;;STACK LIMIT REGISTER
        177772          PIRQ=   177772           ;;PROGRAM INTERRUPT REQUEST REGISTER
        177570          DSWR=   177570           ;;HARDWARE SWITCH REGISTER
        177570          DDISP=  177570           ;;HARDWARE DISPLAY REGISTER

                        ;*GENERAL PURPOSE REGISTER DEFINITIONS
        000000          R0=     %0               ;;GENERAL REGISTER
        000001          R1=     %1               ;;GENERAL REGISTER
        000002          R2=     %2               ;;GENERAL REGISTER
        000003          R3=     %3               ;;GENERAL REGISTER
        000004          R4=     %4               ;;GENERAL REGISTER
        000005          R5=     %5               ;;GENERAL REGISTER
        000006          R6=     %6               ;;GENERAL REGISTER
        000007          R7=     %7               ;;GENERAL REGISTER
        000006          SP=     %6               ;;STACK POINTER
        000007          PC=     %7               ;;PROGRAM COUNTER

                        ;*PRIORITY LEVEL DEFINITIONS
        000000          PR0=    0                ;;PRIORITY LEVEL 0
        000040          PR1=    40               ;;PRIORITY LEVEL 1
        000100          PR2=    100              ;;PRIORITY LEVEL 2
        000140          PR3=    140              ;;PRIORITY LEVEL 3
        000200          PR4=    200              ;;PRIORITY LEVEL 4
        000240          PR5=    240              ;;PRIORITY LEVEL 5
        000300          PR6=    300              ;;PRIORITY LEVEL 6
        000340          PR7=    340              ;;PRIORITY LEVEL 7

                        ;*''SWITCH REGISTER'' SWITCH DEFINITIONS
```

```
    (1)          100000                 SW15=   100000
    (1)          040000                 SW14=   40000
    (1)          020000                 SW13=   20000
    (1)          010000                 SW12=   10000
    (1)          004000                 SW11=   4000
    (1)          002000                 SW10=   2000
    (1)          001000                 SW09=   1000
    (1)          000400                 SW08=   400
    (1)          000200                 SW07=   200
    (1)          000100                 SW06=   100
    (1)          000040                 SW05=   40
    (1)          000020                 SW04=   20
    (1)          000010                 SW03=   10
    (1)          000004                 SW02=   4
    (1)          000002                 SW01=   2
    (1)          000001                 SW00=   1
    (1)                                 .EQUIV  SW09,SW9
    (1)                                 .EQUIV  SW08,SW8
    (1)                                 .EQUIV  SW07,SW7
    (1)                                 .EQUIV  SW06,SW6
    (1)                                 .EQUIV  SW05,SW5
    (1)                                 .EQUIV  SW04,SW4
    (1)                                 .EQUIV  SW03,SW3
    (1)                                 .EQUIV  SW02,SW2
    (1)                                 .EQUIV  SW01,SW1
    (1)                                 .EQUIV  SW00,SW0
    (1)
    (1)                                 ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
    (1)          100000                 BIT15=  100000
    (1)          040000                 BIT14=  40000
    (1)          020000                 BIT13=  20000
    (1)          010000                 BIT12=  10000
    (1)          004000                 BIT11=  4000
    (1)          002000                 BIT10=  2000
    (1)          001000                 BIT09=  1000
    (1)          000400                 BIT08=  400
    (1)          000200                 BIT07=  200
    (1)          000100                 BIT06=  100
    (1)          000040                 BIT05=  40
    (1)          000020                 BIT04=  20
    (1)          000010                 BIT03=  10
    (1)          000004                 BIT02=  4
    (1)          000002                 BIT01=  2
    (1)          000001                 BIT00=  1
    (1)                                 .EQUIV  BIT09,BIT9
    (1)                                 .EQUIV  BIT08,BIT8
    (1)                                 .EQUIV  BIT07,BIT7
    (1)                                 .EQUIV  BIT06,BIT6
    (1)                                 .EQUIV  BIT05,BIT5
    (1)                                 .EQUIV  BIT04,BIT4
    (1)                                 .EQUIV  BIT03,BIT3
    (1)                                 .EQUIV  BIT02,BIT2
    (1)                                 .EQUIV  BIT01,BIT1
    (1)                                 .EQUIV  BIT00,BIT0
    (1)
    (1)                                 ;*BASIC "CPU" TRAP VECTOR ADDRESSES
```

```
 (1)          000004                    ERRVEC= 4                  ;;TIME OUT AND OTHER ERRORS
 (1)          000010                    RESVEC= 10                 ;;RESERVED AND ILLEGAL INSTRUCTIONS
 (1)          000014                    TBITVEC=14                 ;;'T'' BIT
 (1)          000014                    TRTVEC= 14                 ;;TRACE TRAP
 (1)          000014                    BPTVEC= 14                 ;;BREAKPOINT TRAP (BPT)
 (1)          000020                    IOTVEC= 20                 ;;INPUT/OUTPUT TRAP (IOT) **SCOPE**
 (1)          000024                    PWRVEC= 24                 ;;POWER FAIL
 (1)          000030                    EMTVEC= 30                 ;;EMULATOR TRAP (EMT) **ERROR**
 (1)          000034                    TRAPVEC=34                 ;;''TRAP'' TRAP
 (1)          000060                    TKVEC=  60                 ;;TTY KEYBOARD VECTOR
 (1)          000064                    TPVEC=  64                 ;;TTY PRINTER VECTOR
 (1)          000240                    PIRQVEC=240                ;;PROGRAM INTERRUPT REQUEST VECTOR
 12
 13
 14                                     ;SOME COMMON PROGRAM VALUES AND EQUATES
 15
 16           020000                    MATRIX=20000               ;STARTING ADRS OF MATRIX DATA
 17
 18                                     .SBTTL  TRAP CATCHER
 (1)
 (1)          000000                            .=0
 (1)                                    ;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ''.+2,HALT''
 (1)                                    ;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
 (1)                                    ;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS
 (1)          000174                            .=174
 (1)  000174  000000                    DISPREG: .WORD  0                   ;;SOFTWARE DISPLAY REGISTER
 (1)  000176  000000                    SWREG:   .WORD  0                   ;;SOFTWARE SWITCH REGISTER
 (1)                                    .SBTTL  STARTING ADDRESS(ES)
 (1)  000200  000137  001326                    JMP     @#START ;;JUMP TO STARTING ADDRESS OF PROGRAM
 19           000100                            .=100
 20   000100  000104  000340  000002            104,340,RTI         ;LSI-11 B EVENT
```

```
   21                                     .SBTTL  COMMON TAGS
  (1)
  (2)                                     ;;*************************************************************************
  (1)                                     ;*THIS TABLE CONTAINS VARIOUS COMMON STORAGE LOCATIONS
  (1)                                     ;*USED IN THE PROGRAM.
  (1)
  (1)           001100                            .=1100
  (1)   001100                            $CMTAG:                              ;;START OF COMMON TAGS
  (1)   001100  000000                    $PASS:   .WORD   0                   ;;CONTAINS PASS COUNT
  (1)   001102     000                    $TSTNM:  .BYTE   0                   ;;CONTAINS THE TEST NUMBER
  (1)   001103     000                    $ERFLG:  .BYTE   0                   ;;CONTAINS ERROR FLAG
  (1)   001104  000000                    $ICNT:   .WORD   0                   ;;CONTAINS SUBTEST ITERATION COUNT
  (1)   001106  000000                    $LPADR:  .WORD   0                   ;;CONTAINS SCOPE LOOP ADDRESS
  (1)   001110  000000                    $LPERR:  .WORD   0                   ;;CONTAINS SCOPE RETURN FOR ERRORS
  (1)   001112  000000                    $ERTTL:  .WORD   0                   ;;CONTAINS TOTAL ERRORS DETECTED
  (1)   001114     000                    $ITEMB:  .BYTE   0                   ;;CONTAINS ITEM CONTROL BYTE
  (1)   001115     001                    $ERMAX:  .BYTE   1                   ;;CONTAINS MAX. ERRORS PER TEST
  (1)   001116  000000                    $ERRPC:  .WORD   0                   ;;CONTAINS PC OF LAST ERROR INSTRUCTION
  (1)   001120  000000                    $GDADR:  .WORD   0                   ;;CONTAINS ADDRESS OF 'GOOD' DATA
  (1)   001122  000000                    $BDADR:  .WORD   0                   ;;CONTAINS ADDRESS OF 'BAD' DATA
  (1)   001124  000000                    $GDDAT:  .WORD   0                   ;;CONTAINS 'GOOD' DATA
  (1)   001126  000000                    $BDDAT:  .WORD   0                   ;;CONTAINS 'BAD' DATA
  (1)   001130  000000                             .WORD   0                   ;;RESERVED--NOT TO BE USED
  (1)   001132  000000                             .WORD   0
  (1)   001134     000                    $AUTOB:  .BYTE   0                   ;;AUTOMATIC MODE INDICATOR
  (1)   001135     000                    $INTAG:  .BYTE   0                   ;;INTERRUPT MODE INDICATOR
  (1)   001136  000000                             .WORD   0
  (1)   001140  177570                    SWR:     .WORD   DSWR                ;;ADDRESS OF SWITCH REGISTER
  (1)   001142  177570                    DISPLAY: .WORD   DDISP               ;;ADDRESS OF DISPLAY REGISTER
  (1)   001144  177560                    $TKS:    177560                      ;;TTY KBD STATUS
  (1)   001146  177562                    $TKB:    177562                      ;;TTY KBD BUFFER
  (1)   001150  177564                    $TPS:    177564                      ;;TTY PRINTER STATUS REG. ADDRESS
  (1)   001152  177566                    $TPB:    177566                      ;;TTY PRINTER BUFFER REG. ADDRESS
  (1)   001154     000                    $NULL:   .BYTE   0                   ;;CONTAINS NULL CHARACTER FOR FILLS
  (1)   001155     002                    $FILLS:  .BYTE   2                   ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
  (1)   001156     012                    $FILLC:  .BYTE   12                  ;;INSERT FILL CHARS. AFTER A "LINE FEED"
  (1)   001157     000                    $TPFLG:  .BYTE   0                   ;;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
  (1)   001160     077                    $QUES:   .ASCII  /?/                 ;;QUESTION MARK
  (1)   001161     015                    $CRLF:   .ASCII  <15>                ;;CARRIAGE RETURN
  (1)   001162  000012                    $LF:     .ASCIZ  <12>                ;;LINE FEED
  (2)                                     ;;*************************************************************************
```

```
   (1)                                .SBTTL  ERROR POINTER TABLE
   (1)
   (1)                                ;*THIS TABLE CONTAINS THE INFORMATION FOR EACH ERROR THAT CAN OCCUR.
   (1)                                ;*THE INFORMATION IS OBTAINED BY USING THE INDEX NUMBER FOUND IN
   (1)                                ;*LOCATION $ITEMB. THIS NUMBER INDICATES WHICH ITEM IN THE TABLE IS PERTINENT.
   (1)                                ;*NOTE1:        IF $ITEMB IS 0 THE ONLY PERTINENT DATA IS ($ERRPC).
   (1)                                ;*NOTE2:        EACH ITEM IN THE TABLE CONTAINS 4 POINTERS EXPLAINED AS FOLLOWS:
   (1)
   (1)                                ;*      EM              ;;POINTS TO THE ERROR MESSAGE
   (1)                                ;*      DH              ;;POINTS TO THE DATA HEADER
   (1)                                ;*      DT              ;;POINTS TO THE DATA
   (1)                                ;*      DF              ;;POINTS TO THE DATA FORMAT
   (1)
   (1)
   (1)  001164                        $ERRTB:
    22                                ;THIS PROGRAM DOES NOT USE THE ABOVE ERROR TABLE
    23
    24
    25
    26
    27
    28
    29
    30                                        ;NCV11 BUS ADRS ASSIGNMENTS - MODS ARE TO BE MADE HERE
    31
    32  001164  172760                NCADR:  ABASE
    33
    34                                        ;VSV01 BUS ADRS ASSIGNMENTS (CHAR GEN) - MODS ARE TO BE MADE HERE
    35
    36  001166  172600                VTVADR: 172600
    37
    38                                        ;VSV01 BUS ADRS ASSIGNMENTS (BIT MAP) - MODS ARE TO BE MADE HERE
    39
    40  001170  172620                VTMADR: 172620  ;FIRST MAP  2ND MAP IS 20 HIGHER
    41
    42                                        ;COUNTER FOR FREE RUN MODE
    43
    44  001172  000024                TIME:   20.     ;LOOP COUNTER FOR 'F' MODE
    45
    46  001174  000060                TKVEC0: TKVEC           ;CONSOLE TERMINAL VECTOR
    47  001176  000062                TKVEC1: TKVEC+2         ; ADDRESS AN PRIORITY
    49                                             ;NCV11 REGISTER ADDRESS POINTERS
    50  001200  172760           NCCSR:  ABASE                     ;NCV11 STATUS CONTROL REGISTER
    51  001202  172762           NCOFF:  ABASE+2                   ;NCV11 OFFSET REGISTER
    52  001204  172764           NCWCR:  ABASE+4                   ;NCV11 WORD COUNT REGISTER
    53  001206  172766           NCBAR:  ABASE+6                   ;NCV11 BUS ADDRESS REGISTER / LOW Z COUNT
    54  001210  172770           NCSFR:  ABASE+10                  ;NCV11 SPECIAL FUNCTION / JOYSTICK STATUS REGISTER
    55  001212  172772           NCADM:  ABASE+12                  ;NCV11 ADDRESS MAKER REGISTER
    56  001214  172774           NCJOY:  ABASE+14                  ;NCV11 JOYSTICK DATA REGISTER
    57  001216  172776           NCBAR1: ABASE+16                  ;NCV11 SPARE <SAME AS NCBAR>
    58                                   ;VSV01 REGISTER ADDRESS POINTERS (CHARACTER GENERATOR)
    59  001220  172600           VTVCRG: 172600                    ;CHAR/STATUS
    60  001222  172602           VTVCHP: 172602                    ;CROSS HAIR POS
    61  001224  172604           VTVPOS: 172604                    ;CHAR POS
    62                                   ;VSV01 REGISTER ADDRESS POINTERS (BIT MAP)
    63  001226  172620           VTVCSR: 172620                    ;COMMAND/STATUS
    64  001230  172622           VTVMAP: 172622                    ;MAP ADRS
    65  001232  172624           VTVPX:  172624                    ;PIXEL WD
    66  001234  172626           VTVPX1: 172626                    ;PIXEL BYTE
    67  001236  172630           VTVINT: 172630                    ;INTENSITY LOOK UP
    68
    69                                   ;COMMON PROGRAM TAGS AND STORAGE LOCATIONS
    70  001240  000000           TEMP0:  0                         ;COMMON UTILITY LOC
    71  001242  000000           TEMP1:  0                         ;COMMON UTILITY LOC
    72  001244  000000           TEMP2:  0                         ;COMMON UTILITY LOC
    73  001246  000000           DUMMY1: 0                         ;OCTAL TEMP LOC.
    74  001250  000000           DUMMY2: 0                         ;OCTAL TEMP LOC.
    75  001252  000000           INTLUT: 0
    76  001254  006400           VTVSAV: 6400                      ;VSV01 SET UP - FULL SCREEN, MONO(BLK/WHT), ENA DISPLAY
    77  001256  000000           MRXADR: 0                         ;CURRENT CORE ADRS OF CELL BEING DISPLAYED
    78  001260  000000           MAPADR: 0                         ;CURRENT ADRS OF BIT MAP LD
    79  001262  000003           PIXCNT: 3                         ;CURRENT PIXEL BYTE COUNT
    80  001264  000000           PIXASM: 0                         ;4 PIXELS ASSEMBLED HERE BEFORE BIT MAP LD
    81  001266  000000           KBUFF:  0                         ;CONTAINS KEYBOARD CHAR TYPED
    82  001270  000000           TTYOUT: 0                         ;OUTPUT CHAR TO PRINTER
    83  001272  000000           THLO:   0                         ;LOW THRESHOLD VALUE APPLIED TO MATRIX CELLS
    84  001274  177777           THHI:   177777                    ;HIGH THRESHOLD VALUE APPLIED TO MATRIX CELLS
    85  001276  000000           COMSAV: 0                         ;SAVED NCV11 CSR CONTENTS WHEN DISPLAYING
    86  001300  000000           CAMERA: 0                         ;CAMERA SELECTION IN BITS 8-9
    87  001302  000000           GAIN:   0                         ;GAIN 1=0, GAIN 2=BIT10
    88  001304  010000           TOTSIZ: 4096.                     ;TOTAL # OF CELLS IN MATRIX (ISTOPE A OR B)
    89  001306  000000           CHARCT: 0                         ;COUNTS TOTAL # OF CELLS IN MATRIX (ISOTOPE A OR B)
    90  001310  000000           CPERL:  0                         ;CONTAINS LARGEST CELL OF MATRIX WITHIN THRESHOLDS
    91  001312  000000           ROWCNT: 0                         ;COUNTS 64 CELLS EACH ROW OF CORE MATRIX
    92  001314  020000           TABLEX: MATRIX                    ;CONTAINS STARTING ADRS OF MATRIX OF SELECTED ISOTOPE
    93  001316  000000           FREERN: 0                         ;NON-ZERO SAYS COLLECT NEW DATA & DISPLAY IN FREE RUN MO
    94  001320  000000           MSELCT: 0                         ;0 SAYS 1ST BIT MAP, -1 SAYS 2ND BIT MAP(VSV01)
    95  001322  000000           BELLEN: 0                         ;0 SAYS RING BELL ON NO CONVERT, -1 SAYS DON'T
    96  001324  000000           NOVSV:  0                         ;NON-ZERO INDICATES NO VSV01 DISPLAY
```

```
      001326                         START:
(1)                                  .SBTTL  INITIALIZE THE COMMON TAGS
(1)                                  ;;CLEAR THE COMMON TAGS ($CMTAG) AREA
(1)   001326  012706  001100                 MOV     #$CMTAG,R6        ;;FIRST LOCATION TO BE CLEARED
(1)   001332  005026                         CLR     (R6)+             ;;CLEAR MEMORY LOCATION
(1)   001334  022706  001140                 CMP     #SWR,R6 ;;DONE?
(1)   001340  001374                         BNE     .-6               ;;LOOP BACK IF NO
(1)   001342  012706  001100                 MOV     #STACK,SP         ;;SETUP THE STACK POINTER
(1)                                  ;;INITIALIZE A FEW VECTORS
(1)   001346  012737  007432  000034         MOV     #$TRAP,@#TRAPVEC ;;TRAP VECTOR FOR TRAP CALLS
(1)   001354  012737  000340  000036         MOV     #340,@#TRAPVEC+2;LEVEL 7
(1)   001362  012737  007512  000024         MOV     #$PWRDN,@#PWRVEC ;;POWER FAILURE VECTOR
(1)   001370  012737  000340  000026         MOV     #340,@#PWRVEC+2 ;;LEVEL 7
(2)                                  ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
(2)                                  ;;EQUAL TO A "-1", SETUP FOR A SOFTWARE SWITCH REGISTER.
(2)   001376  013746  000004                 MOV     @#ERRVEC,-(SP)   ;;SAVE ERROR VECTOR
(2)   001402  012737  001436  000004         MOV     #64$,@#ERRVEC    ;;SET UP ERROR VECTOR
(2)   001410  012737  177570  001140         MOV     #DSWR,SWR        ;;SETUP FOR A HARDWARE SWICH REGISTER
(2)   001416  012737  177570  001142         MOV     #DDISP,DISPLAY   ;;AND A HARDWARE DISPLAY REGISTER
(2)   001424  022777  177777  177506         CMP     #-1,@SWR         ;;TRY TO REFERENCE HARDWARE SWR
(2)   001432  001012                         BNE     66$              ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
(2)                                                                   ;;AND  THE HARDWARE SWR IS NOT = -1
(2)   001434  000403                         BR      65$              ;;BRANCH IF NO TIMEOUT
(2)   001436  012716  001444         64$:    MOV     #65$,(SP)        ;;SET UP FOR TRAP RETURN
(2)   001442  000002                         RTI
(2)   001444  012737  000176  001140 65$:    MOV     #SWREG,SWR       ;;POINT TO SOFTWARE SWR
(2)   001452  012737  000174  001142         MOV     #DISPREG,DISPLAY
(2)   001460  012637  000004         66$:    MOV     (SP)+,@#ERRVEC   ;;RESTORE ERROR VECTOR
(1)
      001464  104401  010120                 TYPE    ,MSG1            ;GO IDENTIFY PROGRAM
      001470  004737  004546                 JSR     PC,SELCTA        ;DEFAULT TO VSV01 DISPLAY IF THERE
      001474  103004                         BCC     3$               ;BR IF DISPLAY VSV01 IS THERE
      001476  005237  001324                 INC     NOVSV            ;SAVE THE FACT NO VSV01 CONNECTED
      001502  104401  010242                 TYPE    ,MSG3            ;GO TYPE 'BUS TIMEOUT ER - VSV01 DISPLAY'
      001506  013700  001164         3$:     MOV     NCADR,R0         ;GET NCV11 BASE ADRS
      001512  012701  001200                 MOV     #NCCSR,R1        ;GET POINTER ADRS
      001516  010021                 NCSET:  MOV     R0,(R1)+         ;SET UP NCV11 REG ADRS PTRS
      001520  062700  000002                 ADD     #2,R0            ;BUMP REG ADRS
      001524  022701  001220                 CMP     #VTVCRG,R1       ;ALL SET UP?
      001530  001372                         BNE     NCSET            ;BR IF NOT
      001532  012737  001546  000004         MOV     #1$,ERRVEC       ;SET UP TIMEOUT ADRS
      001540  005777  177434                 TST     @NCCSR           ;WILL TRAP TO LOC 4 IF NOT THERE
      001544  000406                         BR      START1           ;BR IF THERE
      001546  022626                 1$:     CMP     (SP)+,(SP)+      ;FIX STACK SINCE NO RTI
      001550  104401  010400                 TYPE    ,MSG5            ;GO TYPE 'BUS TIMEOUT ER - NCV11'
      001554  000000                         HALT                     ;NCV11 NOT SEEN AT ASSIGNED BUS ADRS
      001556  000137  001326                 JMP     START
      001562  012737  000006  000004 START1: MOV     #ERRVEC+2,@#ERRVEC      ;RESTORE ERR TRAP LOC TO PT TO 6
      001570  000005                         RESET                    ;CLR WORLD
      001572  004737  004766                 JSR     PC,NCSTP1        ;GO STOP NCV11 & CLR CORE MATRIX
      001576  012777  020000  177376         MOV     #MATRIX,@NCOFF   ;SET OFFSET(ADRS 20000)
      001604  005037  001302                 CLR     GAIN             ;REGULAR GAIN
      001610  012737  020000  001314         MOV     #MATRIX,TABLEX   ;ISOTOPE A
      001616  005037  001272                 CLR     THLO             ;CLEAR LOWER THRESHOLD
      001622  012737  177777  001274         MOV     #177777,THHI     ;CEILING THRESHOLD
      001630  012777  005220  177336         MOV     #KBINT,@TKVECO   ;SET KEYBOARD INTR RETURN ADRS
```

```
001636  012777  000340  177332          MOV     #340,@TKVEC1      ;SET UP NEW PRIORTY ON INTR
001644  012777  000100  177272          MOV     #100,@$TKS        ;SET INTR ENABLE
001652  104401  010434                  TYPE    ,MSG6             ;GO ASK FOR KEYBOARD COMMAND(S)

                                ;THIS IS A LIST OF KEYBOARD COMMANDS FOR THE NCV11/DISPLAY/JOYSTICK

                                        ;H      HELP FRAME
                                        ;D      DISPLAY DATA
                                        ;E      ERASE THE SCOPE
                                        ;L      GET LOWER THRESHOLD FROM KEYBOARD & DISPLAY DATA
                                        ;U      GET UPPER THRESHOLD FROM KEYBOARD & DISPLAY DATA
                                        ;N      COLLECT NEW DATA FROM CAMERA (CLEAR CORE MATRIX)
                                        ;C      COLLECT DATA FROM CAMERA
                                        ;X      CHANGE CAMERA
                                        ;S      STOP COLLECTION
                                        ;G      INITIALIZE EVERYTHING
                                        ;Z      ZOOM - SET GAIN TO 2
                                        ;R      REGULAR - SET GAIN TO 1
                                        ;A      DISPLAY ISOTOPE A
                                        ;B      DISPLAY ISOTOPE B
                                        ;W      SELECT VSV01 DISPLAY USING 1ST BIT MAP
                                        ;M      SELECT VSV01 DISPLAY USING 2ND BIT MAP
                                        ;F      FREE RUN MODE - COLLECT & DISPLAY NEW DATA CONTINUALLY
                                        ;J      JOYSTICK CALIBRATION
                                        ;T      DISPLAY INTENSITY TEST IMAGE ON SELECTED DISPLAY
                                        ;O      OTHER TERMINAL TO CONTROL PROGRAM
                                        ;CNTRL C  ABORT WHATEVER - BACK TO KEYBOARD MONITOR

                                ;THIS CODE WILL DISPATCH PROGRAM TO THE PROPER
                                ;ROUTINE VIA THE DISPATCH TABLE 'RTABLE'
001656  005037  001316          LISEN:  CLR     FREERN            ;KNOCK DOWN FREE RUN MODE IF SET
001662  012706  001100                  MOV     #STACK,SP         ;RESET STACK PTR
001666  005037  001266                  CLR     KBUFF             ;INSURE NO KEYBOARD GARBAGE
001672  005046                          CLR     -(SP)             ;PUSH LEVEL 0 ONTO STACK
001674  012746  001702                  MOV     #LISN,-(SP)       ;TO BE LSI-11 COMPATABLE
001700  000002                          RTI                       ;FAKE RTI TO LOWER PRIORITY
001702  013700  001266          LISN:   MOV     KBUFF,R0          ;LOOK FOR CHAR
001706  001775                          BEQ     LISN              ;WAIT FOR ONE
001710  005037  001266                  CLR     KBUFF             ;
001714  020027  000101                  CMP     R0,#101           ;WAS IT A CHAR?
001720  103445                          BCS     B00B00            ;NOT A GOOD CHAR
001722  042700  177740                  BIC     #177740,R0        ;ELIMINATE LOWER CASE
001726  020027  000033                  CMP     R0,#33            ;IS IT AN ALPHA CHAR?
001732  103040                          BCC     B00B00            ;BR IF NOT
001734  006300                          ASL     R0                ;MAKE UP WORD OFFSET
001736  005760  001746                  TST     RTABLE-2(R0)      ;IS IT A LEGAL COMMAND?
001742  001434                          BEQ     B00B00            ;BR IF NOT
001744  000170  001746                  JMP     @RTABLE-2(R0)     ;GO DO IT
```

```


                                       .SBTTL  KEYBOARD DISPATCH TABLE

 001750  002054                RTABLE: ROUTA                  ;'A' DISPLAY ISOTOPE A
 001752  002066                        ROUTB                  ;'B' DISPLAY ISOTOPE B
 001754  002100                        ROUTC                  ;'C' COLLECT DATA
 001756  002110                        ROUTD                  ;'D' DISPLAY DATA
 001760  002114                        ROUTE                  ;'E' ERASE SCOPE
 001762  002124                        ROUTF                  ;'F' FREE RUN MODE(COLLECT NEW DATA & DISPLAY CONTINOUSL
 001764  002220                        ROUTG                  ;'G' INITIALIZE EVERYTHING
 001766  002230                        ROUTH                  ;'H' HELP THE OPERATOR
 001770  000000                        0                      ;'I' BOOBOO
 001772  002302                        ROUTJ                  ;'J' GO TO NCV11 JOYSTICK CALIBRATION
 001774  000000                        0                      ;'K' BOOBOO
 001776  002320                        ROUTL                  ;'L' GET LOWER THRESHOLD FROM KEYBOARD
 002000  002360                        ROUTM                  ;'M' SELECT VSV01 DISPLAY USING 2ND BIT MAP
 002002  002420                        ROUTN                  ;'N' GET NEW DATA FROM CAMERA
 002004  002434                        ROUTO                  ;'O' GET ADDRESS OF OTHER TERMINAL
 002006  000000                        0                      ;'P' BOOBOO
 002010  000000                        0                      ;'Q' BOOBOO
 002012  002614                        ROUTR                  ;'R' REGULAR GAIN =1
 002014  002632                        ROUTS                  ;'S' STOP COLLECTION
 002016  002650                        ROUTT                  ;'T' DISPLAY INTENSITY TEST IMAGE ON SELECTED DISPLAY
 002020  002664                        ROUTU                  ;'U' GET UPPER THRESHOLD FROM KEYBOARD
 002022  000000                        0                      ;'V' BOOBOO
 002024  002724                        ROUTW                  ;'W' SELECT VSV01 DISPLAY USING 1ST BIT MAP
 002026  002762                        ROUTX                  ;'X' CHANGE CAMERA CHANNEL
 002030  000000                        0                      ;'Y' BOOBOO
 002032  003102                        ROUTZ                  ;'Z' ZOOM - GAIN = 2
```

```
                                            .SBTTL  COMMAND DECODER
                                  ;REPORTS ILLEGAL KEYBOARD CHARACTERS

002034  012737  000077  001270  BOOBOO: MOV     #77,TTYOUT          ;SET UP '?'
002042  004737  005300                  JSR     PC,TYPO             ;TYPE IT
002046  004737  005260                  JSR     PC,TYPCR            ;DO A 'CR'
002052  000713                          BR      LISN                ;GO LOOK FOR GOOD CHAR

002054  012737  020000  001314  ROUTA:  MOV     #MATRIX,TABLEX      ;WILL DISPLAY ISOTOPE A
002062  000137  003122                  JMP     CHANGE              ;GO DO IT
002066  012737  040000  001314  ROUTB:  MOV     #MATRIX+20000,TABLEX     ;WILL DISPLAY ISOTOPE B
002074  000137  003122                  JMP     CHANGE              ;GO DO IT
002100  004737  004704          ROUTC:  JSR     PC,NCSTRT           ;GO START NCV11
002104  000137  001702                  JMP     LISN                ;COLLECT DATA UNTIL KEYBRD COMMAND
002110  000137  003122          ROUTD:  JMP     CHANGE              ;GO DISPLAY DATA
002114  004737  005020          ROUTE:  JSR     PC,ERASE            ;GO ERASE SCOPE
002120  000137  001702                  JMP     LISN                ;GO WAIT ON NEXT COMMAND
002124  012737  177777  001316  ROUTF:  MOV     #-1,FREERN          ;SELECT FREE RUN MODE
002132  004737  004766                  JSR     PC,NCSTP1           ;GO STOP NCV11 & CLR CORE MATRIX AREA
002136  004737  004704                  JSR     PC,NCSTRT           ;GO START NCV11
002142  005000                          CLR     R0                  ;SET UP TIMER
002144  013701  001172                  MOV     TIME,R1             ;SET UP GROSS TIMER VALUE
002150  005300                  1$:     DEC     R0                  ;COUNT
002152  001376                          BNE     1$                  ;WAIT FOR ZERO
002154  042737  000040  001266          BIC     #BIT5,KBUFF         ;LOOK FOR POSSIBLE STOP KEY - RID LOWER CASE
002162  022737  000123  001266          CMP     #123,KBUFF          ;STOP BEEN STRUCK?
002170  001007                          BNE     2$                  ;BR IF NOT
002172  052777  000400  177010          BIS     #BIT8,@NCSFR        ;STOP NCV11
002200  005077  176774                  CLR     @NCCSR              ;ZERO NCV CSR
002204  000137  001656                  JMP     LISEN               ;GO AWAIT NEXT COMMAND
002210  005301                  2$:     DEC     R1                  ;DO LOOP AGAIN?
002212  001356                          BNE     1$                  ;BR IF SO
002214  000137  003122                  JMP     CHANGE              ;NOW GO DISPLAY DATA JUST COLLECTED
002220  004737  005020          ROUTG:  JSR     PC,ERASE            ;GO ERASE SELECTED DISPLAY
002224  000137  001562                  JMP     START1              ;INITIALIZE AND START FRESH
002230  005737  001324          ROUTH:  TST     NOVSV               ;CHECK IF DISPLAY
002234  001016                          BNE     1$                  ;BR IF NO VSV01
002236  004737  005020                  JSR     PC,ERASE            ;CLEAR THE SCREEN
002242  000240                          NOP
002244  000240                          NOP
002246  012777  002000  176750          MOV     #2000,@VTVPOS       ;POSITION THE READ-OUT
002254  004537  005316                  JSR     R5,VTWRIT           ;TELL THE OPERATOR VIA VSV01
002260  010640                          HELP0
002262  004537  005316                  JSR     R5,VTWRIT
002266  011336                          HELP1
002270  000402                          BR      2$
002272  104401  011336          1$:     TYPE,   HELP1               ;NO VSV01 - TELL OPERATOR SHORT LIST
002276  000137  001702          2$:     JMP     LISN
002302  005737  001324          ROUTJ:  TST     NOVSV               ;CHECK IF VSV01 PRESENT
002306  001402                          BEQ     1$                  ;BR IF PRESENT
002310  000137  001702                  JMP     LISN                ;FORGET IF NO DISPLAY
002314  000137  004332          1$:     JMP     TJOY                ;CALB. THE JOYSTICK GO TO IT
002320  012746  000340          ROUTL:  MOV     #340,-(SP)          ;PUSH HIGH PSW ON STACK
002324  012746  002332                  MOV     #1$,-(SP)           ;PUSH RETURN ADDRESS
002330  000002                          RTI                         ;FAKE RTI TO RAISE PSW
002332  104401  010161          1$:     TYPE    ,MSG2               ;ASK FOR OCTAL DATA
```

```
    002336  104411                          RDOCT                           ;GO GET IT
    002340  012637  001272                  MOV     (SP)+,THLO              ;SAVE IT
    002344  005046                          CLR     -(SP)                   ;PUSH LOW PSW
    002346  012746  002354                  MOV     #2$,-(SP)
    002352  000002                          RTI
    002354  000137  003122          2$:     JMP     CHANGE                  ;GO DISPLAY
    002360  005737  001324          ROUTM:  TST     NOVSV                   ;TEST IF VSV01 DETECTED ?
    002364  001013                          BNE     1$                      ;BR IF NOT
    002366  012737  177777  001320          MOV     #-1,MSELCT              ;SELECT 2ND BIT MAP
    002374  004737  004546                  JSR     PC,SELCTA               ;RELOAD ADDRESSES
    002400  000240                          NOP
    002402  013700  001226                  MOV     VTVCSR,R0               ;GET 2ND BIT MAP ADRS
    002406  042760  000400  177760          BIC     #BIT8,-20(R0)           ;TURN OFF 1ST BIT MAP
    002414  000137  001702          1$:     JMP     LISN                    ;GO AWAIT NEXT COMMAND
    002420  004737  004766          ROUTN:  JSR     PC,NCSTP1               ;GO STOP NCV11 & CLR CORE MATRIX
    002424  004737  004704                  JSR     PC,NCSTRT               ;START THE NCV11
    002430  000137  001702                  JMP     LISN                    ;COLLECT DATA & AWAIT NEXT KEYBRD COMMAND
    002434  012746  000340          ROUTO:  MOV     #340,-(SP)              ;RAISE PS
    002440  012746  002446                  MOV     #1$,-(SP)
    002444  000002                          RTI
    002446  104401  010324          1$:     TYPE,   MSG4                    ;ASK OPR FOR ADDRESS
    002452  104411                          RDOCT                           ;GET HIS INPUT
    002454  012600                          MOV     (SP)+,R0                ;GET ADDRESS
    002456  001002                          BNE     2$                      ;BR IF NOT ''CR'' OR 0
    002460  000137  002034                  JMP     BOOBOO                  ;FAT FINGER OPERATOR
    002464  013746  000004          2$:     MOV     @#ERRVEC,-(SP)          ;SAVE LOC 4
    002470  012737  002576  000004          MOV     #4$,@#ERRVEC            ;SAVE IF WRONG ADDRESS BY OPR.
    002476  005710                          TST     (R0)                    ;REF. THE NEW CONSOLE ADDR.
    002500  012701  001144                  MOV     #$TKS,R1                ;GET OLD ADDR. POINTER
    002504  010021                          MOV     R0,(R1)+                ;LOAD NEW ADDRESS
    002506  005720                          TST     (R0)+                   ;BUMP ADDRESS
(1) 002510  010021                          MOV     R0,(R1)+                ;LOAD NEW ADDRESS
(1) 002512  005720                          TST     (R0)+                   ;BUMP ADDRESS
(1) 002514  010021                          MOV     R0,(R1)+                ;LOAD NEW ADDRESS
(1) 002516  005720                          TST     (R0)+                   ;BUMP ADDRESS
(1) 002520  010021                          MOV     R0,(R1)+                ;LOAD NEW ADDRESS
    002522  012637  000004                  MOV     (SP)+,@#ERRVEC          ;RESTORE LOC 4.
    002526  104401  010555                  TYPE,   MSG8                    ;ASK OPR FOR ADDRESS
    002532  104411                          RDOCT
    002534  012600                          MOV     (SP)+,R0                ;GET VALUE
    002536  001002                          BNE     3$                      ;BR IF VALID
    002540  000137  002034                  JMP     BOOBOO                  ;BR IF NOT GOOD NUMBER
    002544  042700  177003          3$:     BIC     #177003,R0              ;MASK OFF OTHER BITS
    002550  010037  001174                  MOV     R0,TKVEC0               ;SAVE THE VECTOR
    002554  010037  001176                  MOV     R0,TKVEC1               ;SAVE THE BR LEVEL
    002560  062737  000002  001176          ADD     #2,TKVEC1               ; ADDRESS
    002566  005046                          CLR     -(SP)
    002570  012746  001326                  MOV     #START,-(SP)            ;LOWER PS AND START PROG AGAIN
    002574  000002                          RTI
    002576  022626                  4$:     CMP     (SP)+,(SP)+             ;CLEAN STACK
    002600  012637  000004                  MOV     (SP)+,@#ERRVEC          ;RESTORE LOC. 4
    002604  005046                          CLR     -(SP)                   ;LOWER PS
    002606  012746  002034                  MOV     #BOOBOO,-(SP)           ;RETURN
    002612  000002                          RTI
```

```

002614  005037  001302           ROUTR:  CLR     GAIN               ;WANT REGULAR GAIN
002620  042777  002000  176352           BIC     #BIT10,@NCCSR      ;INSURE REGULAR GAIN
002626  000137  001702                   JMP     LISN               ;LOOK FOR NEXT COMMAND
002632  052777  000400  176350   ROUTS:  BIS     #BIT8,@NCSFR       ;STOP NCV11
002640  005077  176334                   CLR     @NCCSR             ;ZERO NCV CSR
002644  000137  001702                   JMP     LISN               ;LOOK FOR NEXT COMMAND
002650  004737  004744           ROUTT:  JSR     PC,NCSTP           ;GO STOP THE NCV11 IF RUNNING
002654  004737  005152                   JSR     PC,LDIMGE          ;GO SET UP TEST CORE IMAGE
002660  000137  003122                   JMP     CHANGE             ;GO DISPLAY IT
002664  012746  000340           ROUTU:  MOV     #340,-(SP)
002670  012746  002676                   MOV     #1$,-(SP)
002674  000002                           RTI
002676  104401  010161           1$:     TYPE    ,MSG2              ;ASK FOR OCTAL DATA
002702  104411                           RDOCT                      ;GO GET IT
002704  012637  001274                   MOV     (SP)+,THHI         ;SAVE IT
002710  005046                           CLR     -(SP)
002712  012746  002720                   MOV     #2$,-(SP)
002716  000002                           RTI
002720  000137  003122           2$:     JMP     CHANGE             ;GO DISPLAY
002724  005737  001324           ROUTW:  TST     NOVSV              ;TEST IF VSV01 DETECTED
002730  001012                           BNE     1$                 ;BR IF NOT
002732  005037  001320                   CLR     MSELCT             ;SELECT 1ST BIT MAP
002736  004737  004546                   JSR     PC,SELCTA          ;CHANGE ADDRESSES
002742  000240                           NOP
002744  013700  001226                   MOV     VTVCSR,R0          ;GET 1ST BIT MAP ADRS
002750  042760  000400  000020           BIC     #BIT8,20(R0)       ;TURN OFF 2ND BIT MAP
002756  000137  001702           1$:     JMP     LISN               ;GO AWAIT NEXT COMMAND
002762  012746  000340           ROUTX:  MOV     #340,-(SP)
002766  012746  002774                   MOV     #1$,-(SP)
002772  000002                           RTI
002774  104401  010520           1$:     TYPE,   MSG7               ;TELL OPERATOR TO SELECT CAMERA
003000  104411                           RDOCT                      ;WAIT FOR HIS INPUT
003002  012637  003076                   MOV     (SP)+,10$          ;GET CHAR.
003006  000240                           NOP
003010  000240                           NOP
003012  000240                           NOP
003014  042737  177774  003076           BIC     #177774,10$        ;MASK OFF BITS
003022  005237  003076                   INC     10$
003026  005037  003100                   CLR     11$                ;CLEAR ACTUAL VALUE
003032  005337  003076           2$:     DEC     10$
003036  001403                           BEQ     3$
003040  005237  003100                   INC     11$                ;UPDATE ACUTAL
003044  000772                           BR      2$
003046  110737  003100  001301   3$:     MOVB    11$,CAMERA+1       ;UPDATE CAMERA SAVE LOC.
003054  053777  001300  176116           BIS     CAMERA,@NCCSR      ;AND SELECT THAT CAMERA
003062  005046                           CLR     -(SP)
003064  012746  003072                   MOV     #4$,-(SP)
003070  000002                           RTI
003072  000137  003122           4$:     JMP     CHANGE             ;RETURN
003076  000000                   10$:    0
003100  000000                   11$:    0
003102  012737  002000  001302   ROUTZ:  MOV     #BIT10,GAIN        ;ENABLE GAIN
003110  053777  001302  176062           BIS     GAIN,@NCCSR        ;SET IT AT NCV CSR
003116  000137  001702                   JMP     LISN               ;GO AWAIT NEXT COMMAND
```

```
                                                        .SBTTL  PROGRAM ROUTINES
                                                ;GO CLEAR SCREEN OF SELECTED DISPLAY

 003122  004737  005020                         CHANGE: JSR     PC,ERASE        ;GO ERASE SCOPE

                                                ;STOP NCV11 AND GET SET TO DISPLAY

 003126  004737  004744                                 JSR     PC,NCSTP        ;GO STOP NCV11

 003132  005737  001324                                 TST     NOVSV           ;TEST IF VSV01 DETECTED
 003136  001402                                         BEQ     BOX             ;BR IF YES
 003140  000137  001702                                 JMP     LISN            ;RETURN IF NOT
                                                ;NOW DRAW A BOX AROUND POTENTIAL MATRIX DISPLAY
                                                ;AREA ON THE SELECTED DISPLAY
 003144  012700  001750                         BOX:    MOV     #1750,R0        ;SET UP BIT MAP ADRS - TOP LINE
 003150  012701  073567                                 MOV     #73567,R1       ;SET UP PIXEL DATA IN R1 - INT 7
 003154  004737  005060                                 JSR     PC,DISPY        ;GO LOAD BIT MAP
 003160  005200                                 1$:     INC     R0              ;ADVANCE ADRS
 003162  022700  001770                                 CMP     #1770,R0        ;TOP LINE DONE?
 003166  001403                                         BEQ     2$              ;BR IF SO
 003170  004737  005072                                 JSR     PC,DCONT        ;LOAD NEXT PIXEL WD
 003174  000771                                         BR      1$              ;NEXT MAP LOAD
 003176  012700  006010                         2$:     MOV     #6010,R0        ;SET UP BIT MAP ADRS - BOT LINE
 003202  004737  005060                                 JSR     PC,DISPY        ;GO LOAD BIT MAP
 003206  005200                                 3$:     INC     R0              ;ADVANCE ADRS
 003210  022700  006030                                 CMP     #6030,R0        ;BOT LINE DONE?
 003214  001403                                         BEQ     4$              ;BR IF SO
 003216  004737  005072                                 JSR     PC,DCONT        ;LOAD NEXT PIXEL WD
 003222  000771                                         BR      3$              ;NEXT MAP LOAD
 003224  012700  001730                         4$:     MOV     #1730,R0        ;SET UP BIT MAP ADRS SIDE LINES
 003230  062700  000017                         5$:     ADD     #17,R0          ;OFFSET NEXT ROW
 003234  012701  070000                                 MOV     #70000,R1       ;SET UP PIXEL 3 DATA IN R1 - INT 7
 003240  022700  006047                                 CMP     #6047,R0        ;AT BOTTOM OF SCREEN?
 003244  001411                                         BEQ     6$              ;GO START VSV01 DISPLAY
 003246  004737  005060                                 JSR     PC,DISPY        ;GO LOAD BIT MAP
 003252  012701  000007                                 MOV     #7,R1           ;SET UP PIXEL 0 DATA IN R1 - INT 7
 003256  062700  000021                                 ADD     #21,R0          ;OFFSET TO RIGHT LINE
 003262  004737  005060                                 JSR     PC,DISPY        ;GO LOAD BIT MAP
 003266  000760                                         BR      5$              ;DO NEXT ROW
 003270  013777  001254  175730                 6$:     MOV     VTVSAV,@VTVCSR  ;START DISPLAY
 003276  012737  002010  001260                         MOV     #2010,MAPADR    ;OFFSET BIT MAP ADRS
 003304  012737  000003  001262                         MOV     #3,PIXCNT       ;SET UP PIXEL BYTE COUNT
 003312  005037  001264                                 CLR     PIXASM          ;CLR PIXEL ASSEMBLY WORD

                                                ;NOW LETS FIND THE LARGEST CELL
 003316  013737  001304  001306                 LARGES: MOV     TOTSIZ,CHARCT   ;NUMBER OF ELEMENTS TO CONSIDER
 003324  017700  175764                                 MOV     @TABLEX,R0      ;THIS IS FIRST GUESS
 003330  013701  001314                                 MOV     TABLEX,R1       ;R1 POINTS TO TABLE
 003334  020021                                 1$:     CMP     R0,(R1)+        ;COMPARE GUESS AGAINST NEW
 003336  103005                                         BHIS    3$              ;GUESS STILL GOOD
 003340  024137  001274                                 CMP     -(R1),THHI      ;GUESS SMALLER BUT CHECK NEW
 003344  101001                                         BHI     2$              ;HI AGAINST UPPER THESHOLD
 003346  011100                                         MOV     (R1),R0         ;WITHIN BOUNDS. MAKE THIS NEW HI
 003350  005721                                 2$:     TST     (R1)+           ;INCREASE REGISTER BY 2
 003352  005337  001306                         3$:     DEC     CHARCT          ;COUNT THIS LAST COMPARISON
 003356  001366                                         BNE     1$
```

```
                                        ;THE LARGEST CELL WITHIN THE UPPER THRESHOLD IS NOW IN R0
                                        ;NOW ACCOUNT FOR LOWER THRESHOLD - BOW OUT IF TOO SMALL
003360  163700  001272                          SUB     THLO,R0         ;SUBTRACT LOWER THRESHOLD
003364  101002                                  BHI     4$              ;BR IF CELL VALUE GREATER THAN LO THRESHOLD
003366  000137  003720                          JMP     PATWRT          ;DON'T DISPLAY-ALL VALUES BELOW LO THRESHOLD
003372  010037  001310                  4$:     MOV     R0,CPERL        ;SAVE LARGEST CELL OF MATRIX

                                        ;NOW PICK OUT EACH VALUE IN CORE MATRIX AND SCALE TO THE
                                        ;PROPER INTENSITY LEVEL.  THEN DISPLAY IT ON THE SELECTED DISPLAY

003376  013737  001314  001256  DMATRX: MOV     TABLEX,MRXADR   ;BEGIN AT TOP LEFT ROW
003404  062737  017600  001256          ADD     #8064.,MRXADR   ;OFFSET TO BOTTOM OF CORE MATRIX
003412  012737  000100  001312          MOV     #64.,ROWCNT     ;THERE ARE 64 CELLS PER ROW
003420  017702  175632          DISLOP: MOV     @MRXADR,R2      ;GET A CELL VALUE FROM MATRIX
003424  062737  000002  001256          ADD     #2,MRXADR       ;BUMP MATRIX ADRS
003432  005337  001312                  DEC     ROWCNT          ;COUNT CELL THIS ROW
003436  001006                          BNE     1$              ;BR IF ROW NOT FINISHED
003440  012737  000100  001312          MOV     #64.,ROWCNT     ;RESET NEXT ROW COUNT
003446  162737  000400  001256          SUB     #256.,MRXADR    ;SET UP FOR NEXT ROW IN MATRIX
003454  020237  001274          1$:     CMP     R2,THHI         ;CELL WITHIN HI THRESHOLD?
003460  101003                          BHI     2$              ;BR IF NOT
003462  163702  001272                  SUB     THLO,R2         ;SUB LOW THRESHOLD
003466  101002                          BHI     SCLCEL          ;BR IF CELL ABOVE LOW THRESHOLD
003470  005004                  2$:     CLR     R4              ;SET CELL TO LOWEST INTENSITY
003472  000423                          BR      MAPLD
003474  013701  001310          SCLCEL: MOV     CPERL,R1        ;NOW ESTABLISH THE INTENSITY LEVEL
003500  012703  000005                  MOV     #5,R3           ;SCALE TO 16 LEVELS
003504  005004                          CLR     R4
003506  006304                  2$:     ASL     R4              ;MUL BY 2
003510  020201                          CMP     R2,R1           ;COMPARE THIS CELL TO LARGEST
003512  103404                          BLO     4$              ;BR IF SMALLER
003514  005701                          TST     R1              ;CHECK CASE WHERE 0 DEVISOR
003516  001401                          BEQ     3$              ;BR IF SO
003520  005204                          INC     R4              ;ACCOUNT FOR GOOD SUBTRACTION
003522  160102                  3$:     SUB     R1,R2           ;NO DO THE SUBTRACTION
003524  000241                  4$:     CLC
003526  006001                          ROR     R1              ;MAKE DEVISOR SMALLER
003530  005303                          DEC     R3              ;COUNT POSITION
003532  001365                          BNE     2$              ;AGAIN IF NOT SCALLED TO 16 LEVELS YET
003534  160102                          SUB     R1,R2           ;ACCOUNT FOR REMAINDER
003536  101401                          BLOS    MAPLD           ;BR IF TOO SMALL
003540  005204                          INC     R4              ;ROUND UP
```

```
                                        ;THIS CODE DISPLAYS EACH SCALED CELL ON THE VSV01 (ONE OF 16 LEVELS)

003542  013700  001260          MAPLD:  MOV     MAPADR,R0       ;SET UP BIT MAP ADRS
003546  005704                          TST     R4              ;LOOK FOR NO INTENSITY
003550  001401                          BEQ     1$              ;BR IF NO INTENSITY
003552  005304                          DEC     R4              ;OFFSET TO 0-17
003554  000304                  1$:     SWAB    R4              ;PREPARE FOR PIXEL LOC
003556  006304                          ASL     R4              ;MOVE TO TOP 4 BITS
003560  006304                          ASL     R4              ;
003562  006304                          ASL     R4              ;
003564  006304                          ASL     R4              ;
003566  000241                          CLC                     ;NOW ASSEMBLE THIS PIXEL INTO PIXEL WORD
003570  006037  001264                  ROR     PIXASM          ;NOW MAKE ROOM IN PIXEL WORD
003574  006037  001264                  ROR     PIXASM          ;
003600  006037  001264                  ROR     PIXASM          ;
003604  006037  001264                  ROR     PIXASM          ;
003610  060437  001264                  ADD     R4,PIXASM       ;ADD THIS PIXEL TO OTHERS
003614  005737  001262                  TST     PIXCNT          ;ALL 4 PIXELS DONE FOR THIS WORD?
003620  001004                          BNE     2$              ;BR IF NOT
003622  013701  001264                  MOV     PIXASM,R1       ;LD PIXEL WORD INTO R1
003626  004737  005060                  JSR     PC,DISPY        ;LOAD BIT MAP
003632  005337  001262          2$:     DEC     PIXCNT          ;COUNT PIXEL
003636  100270                          BPL     DISLOP          ;BR IF 4 PIXELS NOT ASSEMBLED YET
003640  005037  001264                  CLR     PIXASM          ;CLR PIXEL ASSEMBLY WORD
003644  012737  000003  001262          MOV     #3,PIXCNT       ;RESET PIXEL COUNT
003652  005237  001260                  INC     MAPADR          ;ADVANCE MAP ADRS
003656  013700  001260                  MOV     MAPADR,R0       ;LOAD INTO R0
003662  022700  005770                  CMP     #5770,R0        ;HAVE ALL 64 ROWS BEEN DONE?
003666  001002                          BNE     3$              ;BR IF NOT
003670  000137  003720                  JMP     PATWRT          ;NOW GO DISPLAY PARAMETERS
003674  042700  177740          3$:     BIC     #177740,R0      ;SAVE ROW POSITION BITS
003700  022700  000030                  CMP     #30,R0          ;NOW LOOK FOR END OF ROW
003704  001003                          BNE     4$              ;BR IF NOT AT END
003706  062737  000020  001260          ADD     #20,MAPADR      ;ADVANCE MAP ADRS TO NEXT ROW
003714  000137  003420          4$:     JMP     DISLOP          ;GO GET NEXT MATRIX DATUM
```

```
                                        ;CODE TO WRITE PARAMETER DATA AT BOTTOM OF SCREEN

 003720  012777  012000  175276  PATWRT: MOV     #12000,@VTVPOS  ;VSV01 - SET CHAR POS,LINE 20, LEFT MARGIN
 003726  004537  005316                  JSR     R5,VTWRIT
 003732  007664                          WD001                   ;''CR,LOWER THRESHOLD''
 003734  004537  005342                  JSR     R5,AWRIT        ;DISPAY OCTAL
 003740  001272                          THLO
 003742  004537  005316                  JSR     R5,VTWRIT
 003746  007707                          WD002                   ;''CR, UPPER THRESHOLD''
 003750  004537  005342                  JSR     R5,AWRIT        ;DISPAY OCTAL
 003754  001274                          THHI
 003756  113737  001301  001246          MOVB    CAMERA+1,DUMMY1 ;GET CAMERA VALUE
 003764  062737  000060  001246          ADD     #60,DUMMY1      ;MAKE ASCII
 003772  113737  001246  010022          MOVB    DUMMY1,CAMOUT   ;SAVE FOR READOUT
                                 ;TEST THE ''PB'' FLAG
 004000  032777  000040  175202          BIT     #BIT5,@NCSFR    ;TEST FOR ''PB'' FLAG
 004006  001007                          BNE     1$              ;BR IF SET
 004010  112737  000125  010036          MOVB    #'U,PBUP        ;NO- TELL OPER. IT WAS UP
 004016  112737  000120  010037          MOVB    #'P,PBUP+1
 004024  000406                          BR      2$
 004026  112737  000104  010036  1$:     MOVB    #'D,PBUP        ;TELL OPER. IT WAS DN
 004034  112737  000116  010037          MOVB    #'N,PBUP+1
                                 ;TEST FOR JOY-STICK BUTTON FLAG
 004042  032777  000100  175140  2$:     BIT     #BIT6,@NCSFR    ;TEST FOR ''JOY-BUTTON'' FLAG
 004050  001007                          BNE     3$              ;BR IF SET
 004052  112737  000125  010053          MOVB    #'U,JBUP        ;TELL OPER. IT WAS UP
 004060  112737  000120  010054          MOVB    #'P,JBUP+1
 004066  000406                          BR      4$
 004070  112737  000104  010053  3$:     MOVB    #'D,JBUP        ;TELL OPER. IT WAS DN
 004076  112737  000116  010054          MOVB    #'N,JBUP+1
 004104  004537  005316          4$:     JSR     R5,VTWRIT       ;DISPLAY CAMERA VALUE AND BUTTON STATUS
 004110  010007                          WD007
 004112  004537  005316                  JSR     R5,VTWRIT
 004116  007735                          WD003                   ;''Z COUNT =''
 004120  017737  175062  001246          MOV     @NCBAR,DUMMY1
 004126  017737  175052  001250          MOV     @NCWCR,DUMMY2
 004134  004537  005342                  JSR     R5,AWRIT        ;DISPALY OCTAL
 004140  001250                          DUMMY2
 004142  004537  005316                  JSR     R5,VTWRIT       ;INSERT ''-''
 004146  010634                          DASH
 004150  004537  005342                  JSR     R5,AWRIT        ;DISPLAY OCTAL
 004154  001246                          DUMMY1
 004156  004537  005316                  JSR     R5,VTWRIT
 004162  007750                          WD004                   ;''MATRIX COUNT=''

```

```
                                          ;DETERMINE THE # OF COUNTS IN THE MATRIX

004164  013737  001304  001240                    MOV     TOTSIZ,TEMPO
004172  005002                                    CLR     R2
004174  005003                                    CLR     R3
004176  013701  001314                            MOV     TABLEX,R1
004202  062103                           MXSML:   ADD     (R1)+,R3          ;NOW ADD UP ALL VALUES IN MATRIX
004204  005502                                    ADC     R2
004206  005337  001240                            DEC     TEMPO
004212  001373                                    BNE     MXSML
004214  010337  001246                            MOV     R3,DUMMY1
004220  010237  001250                            MOV     R2,DUMMY2
004224  004537  005342                            JSR     R5,AWRIT          ;TELL OPER. OCTAL
004230  001250                                    DUMMY2
004232  004537  005316                            JSR     R5,VTWRIT         ;INSERT DASH
004236  010634                                    DASH
004240  004537  005342                            JSR     R5,AWRIT
004244  001246                                    DUMMY1
004246  004537  005316                            JSR     R5,VTWRIT
004252  011716                                    BCRLF

                                          ;TEST FOR GAIN = 2 AND B GAMMA STATES

004254  005737  001302                            TST     GAIN
004260  001403                                    BEQ     1$
004262  004537  005316                            JSR     R5,VTWRIT
004266  007767                                    WD005                     ;''ZOOM''
004270  023727  001314  040000   1$:      CMP     TABLEX,#MATRIX+20000 ;ISOTOPE B?
004276  001003                                    BNE     2$                        ;NO
004300  004537  005316                            JSR     R5,VTWRIT                 ;YES
004304  007776                                    WD006                     ;''B-GAMMA''
004306  005737  001316           2$:      TST     FREERN            ;IN FREE RUN MODE?
004312  001402                                    BEQ     3$                ;BR IF NOT
004314  000137  002124                            JMP     ROUTF             ;YES, GO GET NEW DATA
004320  013777  001276  174652   3$:      MOV     COMSAV,@NCCSR     ;RESUME THE NCV11
004326  000137  001702                            JMP     LISN              ;DONE WITH MESSAGES
```

```
                                        ;THIS CODE DRAWS CROSS HAIRS(VSV01) WITH THE X & Y JOYSTICK DATA
                                        ;THE BUG WILL FOLLOW THE JOYSTICK WHEN THE INTERRUPT BAR IS NOT DEPRESSED -
                                        ;ALL PARTS WITHIN THE DISPLAYED BOX ON THE SELECTED DISPLAY SHOULD
                                        ;BE ACCESSIBLE IN A UNIFORM MANNER
                                        ;A CNTRL 'C' WILL GET USER BACK TO KEYBOARD MONITOR
 004332 004737  005020                  TJOY:   JSR     PC,ERASE        ;START FRESH

                                        ;DRAW A BOX UP ON VSV01 SCREEN FOR NCV11 JOYSTICK CALIBRATION
 004336 005000                                  CLR     R0              ;SET UP BIT MAP ADRS - TOP LINE
 004340 012701  073567                          MOV     #73567,R1       ;SET UP PIXEL DATA IN R1 - INT 7
 004344 004737  005060                          JSR     PC,DISPY        ;GO LOAD BIT MAP
 004350 005200                          1$:     INC     R0              ;ADVANCE BIT MAP ADRS
 004352 022700  000040                          CMP     #40,R0          ;TOP LINE DONE?
 004356 001403                                  BEQ     2$              ;BR IF SO
 004360 004737  005072                          JSR     PC,DCONT        ;LOAD NEXT PIXEL
 004364 000771                                  BR      1$              ;NEXT MAP LOAD
 004366 012700  007740                  2$:     MOV     #7740,R0        ;SET UP BIT MAP ADRS - BOT LINE
 004372 004737  005060                          JSR     PC,DISPY        ;GO LOAD BIT MAP
 004376 005200                          3$:     INC     R0              ;ADVANCE ADRS
 004400 022700  010000                          CMP     #10000,R0       ;BOT LINE DONE?
 004404 001403                                  BEQ     4$              ;BR IF SO
 004406 004737  005072                          JSR     PC,DCONT        ;LOAD NEXT PIXEL WORD
 004412 000771                                  BR      3$              ;NEXT MAP LOAD
 004414 012700  000040                  4$:     MOV     #40,R0          ;SET UP BIT MAP ADRS SIDE LINES
 004420 012701  000007                  5$:     MOV     #7,R1           ;SET UP PIXEL 0 DATA IN R1 - INT 7
 004424 004737  005060                          JSR     PC,DISPY        ;GO LOAD BIT MAP
 004430 012701  070000                          MOV     #70000,R1       ;SET UP PIXEL 3 DATA IN R1 - INT 7
 004434 062700  000037                          ADD     #37,R0          ;OFFSET TO RIGHT SIDE LINE
 004440 004737  005060                          JSR     PC,DISPY        ;GO LOAD BIT MAP
 004444 005200                                  INC     R0              ;GO TO NEXT ROW ON LEFT
 004446 022700  007740                          CMP     #7740,R0        ;TO BOTTOM YET?
 004452 001362                                  BNE     5$              ;BR IF NOT
 004454 013777  001254  174544                  MOV     VTVSAV,@VTVCSR  ;ENABLE BIT MAP

                                                ;NOW COLLECT ANALOG DATA FROM NCV11 JOYSTICK

 004462 012777  004000  174520          DISBG:  MOV     #BIT11,@NCSFR   ;CLEAR THE DEVICE
 004470 052777  000001  174512          1$:     BIS     #BIT0,@NCSFR    ;CONVERT JOYSTICK
 004476 105777  174506                  2$:     TSTB    @NCSFR          ;DONE?
 004502 100375                                  BPL     2$              ;BR IF NOT
 004504 017737  174504  001240                  MOV     @NCJOY,TEMP0    ;STORE CONVERSION VALUES
 004512 000240                                  NOP
 004514 000240                                  NOP
 004516 000240                                  NOP
 004520 004737  005472                          JSR     PC,XYAVE        ;GO AVG LAST 32. X-Y JOYSTICK VALUES
 004524 032777  000040  174456                  BIT     #BIT5,@NCSFR    ;LOOK FOR JOY BOTTON DOWN
 004532 001356                                  BNE     1$              ;DON'T MOVE THE BUG
 004534 000240                                  NOP
 004536 000240                                  NOP
 004540 004737  005122                          JSR     PC,DISPY2       ;GO DISPLAY CROSS HAIRS - VSV01
 004544 000751                                  BR      1$              ;DO ANOTHER CONVERSION
```

```
                                     ;;*******************************************************************
                                             ;ROUTINE SELECTS VSV01 DISPLAY - SETS UP BUS ADRS AND INTENSITY LEVEL
                                             ;AND INTENSITY LOOK-UP TABLE - THE CARRY BIT IS SET ON EXIT IF THE
                                             ;VSV01 IS NOT SEEN AT THE ASSIGNED BUS ADDRESS
                                     ;;*******************************************************************
004546  013700  001166               SELCTA: MOV     VTVADR,R0          ;GET VSV01 BASE ADRS
004552  012701  001220                       MOV     #VTVCRG,R1         ;GET PTR ADRS
004556  010021                       1$:     MOV     R0,(R1)+           ;SET UP REG ADRS PTRS
004560  062700  000002                       ADD     #2,R0              ;BUMP REG ADRS
004564  022701  001226                       CMP     #VTVCSR,R1         ;CHAR GEN REGS ALL SET UP?
004570  001372                               BNE     1$                 ;BR IF NOT
004572  013700  001170                       MOV     VTMADR,R0          ;GET BASE ADRS OF BIT MAP
004576  005737  001320                       TST     MSELCT             ;USING SECOND MAP?
004602  001402                               BEQ     2$                 ;BR IF NOT
004604  062700  000020                       ADD     #20,R0             ;POINT TO 2ND BIT MAP ADRS'S
004610  010021                       2$:     MOV     R0,(R1)+           ;CONTINUE TO BIT MAP ADRS'S
004612  062700  000002                       ADD     #2,R0              ;BUMP REG ADRS
004616  022701  001240                       CMP     #VTVINT+2,R1       ;ALL SET UP?
004622  001372                               BNE     2$                 ;BR IF NOT
004624  012737  004676  000004               MOV     #5$,@#ERRVEC       ;SET UP BUS TIMEOUT RETURN ADRS IF NO VSV01
004632  005777  174362                       TST     @VTVCRG            ;IS CHARACTER GENERATOR THERE?
004636  005777  174364                       TST     @VTVCSR            ;IS BIT MAP THERE?
004642  013700  001252                       MOV     INTLUT,R0          ;SET UP ADRS & DATA OF INTENSITY LOOK-UP TABLE
004646  010077  174364               3$:     MOV     R0,@VTVINT         ;SET UP TABLE
004652  062700  000401                       ADD     #401,R0            ;ADVANCE ADRS & INTENSITY
004656  032700  010000                       BIT     #10000,R0          ;TABLE LOADED?
004662  001771                               BEQ     3$                 ;BR IF NOT
004664  000241                               CLC                        ;ZERO CARRY SAYS VSV01 THERE
004666  012737  000006  000004       4$:     MOV     #ERRVEC+2,@#ERRVEC       ;RESTORE ER TRAP LOC TO PT TO 6
004674  000207                               RTS     PC                 ;EXIT
004676  022626                       5$:     CMP     (SP)+,(SP)+        ;FIX STACK SINCE NO RTI
004700  000261                               SEC                        ;CARRY ON EXIT SAYS NO VSV01
004702  000771                               BR      4$                 ;GO EXIT

                                     ;;*******************************************************************
                                             ;ROUTINE STARTS NCV11 AT SELECTED GAIN AND CAMERA
                                     ;;*******************************************************************
004704  012777  004030  174266       NCSTRT: MOV     #4030,@NCCSR       ;SET UP ZB ENABLE AND 64*64 WORD MATRIX
004712  012777  020000  174262               MOV     #MATRIX,@NCOFF     ;ENSURE OFFSET REG. IS SET
004720  053777  001302  174252               BIS     GAIN,@NCCSR        ;SET UP GAIN
004726  053777  001300  174244               BIS     CAMERA,@NCCSR      ;SET UP CAMERA
004734  052777  000001  174236               BIS     #BIT0,@NCCSR       ;SET GO BIT
004742  000207                               RTS     PC                 ;RETURN

                                     ;;*******************************************************************
                                             ;ROUTINE STOPS NCV11 AND SAVES NCV11 STATUS
                                     ;;*******************************************************************
004744  017737  174230  001276       NCSTP:  MOV     @NCCSR,COMSAV      ;SAVE THE INTERFACE ACTION
004752  052777  000400  174230               BIS     #BIT8,@NCSFR       ;DISABLE NPR'S
004760  005077  174214                       CLR     @NCCSR             ;ZERO ALL STATUS
004764  000207                               RTS     PC                 ;RETURN
```

```
                                        ;;*******************************************************************
                                                ;ROUTINE STOPS NCV11, SAVES STATUS AND CLEARS MATRIX CORE AREA
                                        ;;*******************************************************************
004766  004737  004744                  NCSTP1: JSR     PC,NCSTP                ;GO STOP NCV11 AND SAVE STATUS
004772  005077  174206                          CLR     @NCWCR                  ;CLEAR HIGH WORD
004776  005077  174204                          CLR     @NCBAR                  ;CLEAR LOW WORD
005002  012700  020000                          MOV     #MATRIX,R0              ;GET SET TO ZERO CORE MATRIX AREA
005006  005020                          1$:     CLR     (R0)+                   ;ZERO LOC
005010  020027  060000                          CMP     R0,#MATRIX+40000                ;ALL DONE?
005014  001374                                  BNE     1$                      ;BR IF MORE
005016  000207                                  RTS     PC                      ;RETURN


                                        ;;*******************************************************************
                                                ;ROUTINE WILL ERASE DISPLAY
                                        ;;*******************************************************************
005020  005737  001324                  ERASE:  TST     NOVSV                   ;TEST IF VSV01 DETECTED
005024  001014                                  BNE     2$                      ;BR IF NOT
005026  052777  001000  174172                  BIS     #1000,@VTVCSR           ;ERASE DISPLAY (CLR BIT MAP)
005034  105777  174166                  1$:     TSTB    @VTVCSR                 ;LOOK FOR READY
005040  100375                                  BPL     1$                      ;WAIT FOR IT
005042  042777  001000  174156                  BIC     #1000,@VTVCSR           ;TURN OFF ERASE DISPLAY
005050  012777  002035  174142                  MOV     #2035,@VTVCRG           ;CLR CHAR SCREEN & DISABLE CURSOR
005056  000207                          2$:     RTS     PC                      ;EXIT


                                        ;;*******************************************************************
                                                ;ROUTINE WILL LOAD BIT MAP (VSV01)
                                                ;R0 CONTAINS BIT MAP ADRS AND R1 THE BIT MAP DATA
                                        ;;*******************************************************************
005060  042777  000400  174140          DISPY:  BIC     #400,@VTVCSR            ;STOP DISPLAY
005066  010077  174136                          MOV     R0,@VTVMAP              ;LOAD BIT MAP ADRS
005072  042777  000400  174126          DCONT:  BIC     #400,@VTVCSR            ;AGAIN IF ENTERING HERE
005100  105777  174122                  1$:     TSTB    @VTVCSR                 ;READY?
005104  100375                                  BPL     1$                      ;WAIT THEN
005106  010177  174120                          MOV     R1,@VTVPX               ;LOAD BIT MAP
005112  052777  000400  174106                  BIS     #400,@VTVCSR            ;RESUME DISPLAY
005120  000207                                  RTS     PC                      ;RETURN



                                        ;;*******************************************************************
                                                ;ROUTINE WILL DISPLAY X & Y CROSS HAIRS ON VSV01
                                        ;;*******************************************************************
005122  005777  174072                  DISPY2: TST     @VTVCRG                 ;READY?
005126  100375                                  BPL     DISPY2                  ;WAIT IF NOT
005130  105137  001241                          COMB    TEMP0+1                 ;X NEEDS TO BE INVERTED
005134  013777  001240  174060                  MOV     TEMP0,@VTVCHP           ;LOAD X & Y CROSS HAIRS
005142  052777  016000  174050                  BIS     #16000,@VTVCRG          ;ENABLE THE CROSS HAIRS
005150  000207                                  RTS     PC                      ;RETURN
```

```
                                ;;*************************************************************
                                                ;ROUTINE WIIL FILL CORE WITH AN IMAGE THAT WHEN
                                                ;DISPLAYED WILL CONTAIN ALL THE INTENSITY LEVELS -
                                                ;ROWS AT THE BOTTOM OF THE SCREEN WILL APPEAR BRIGHTEST -
                                                ;NOTE THAT THIS IS ONLY A DISPLAY TEST PATTERN FOR
                                                ;POSSIBLE DISPLAY ADJUSTMENTS BY THE USER
                                ;;*************************************************************
005152  012700  000100          LDIMGE: MOV     #100,R0         ;COUNT 64 ROWS
005156  013701  001314                  MOV     TABLEX,R1       ;GET SELECTED ISOTOPE
005162  012702  000100                  MOV     #100,R2         ;COUNT 64 DATA POINTS PER ROW
005166  012703  000100                  MOV     #100,R3         ;100 WILL REPRESENT HIGHEST INTENSITY LEVEL(100-0)
005172  010321                  1$:     MOV     R3,(R1)+        ;LOAD CORE IMAGE
005174  005302                          DEC     R2              ;DONE ROW?
005176  001375                          BNE     1$              ;BR IF NOT
005200  005300                          DEC     R0              ;DONE ROWS?
005202  001405                          BEQ     2$              ;BR IF SO
005204  162703  000001                  SUB     #1,R3           ;LOWER NEXT CELL VALUE
005210  012702  000100                  MOV     #100,R2         ;RESET ROW LENGTH COUNTER
005214  000766                          BR      1$              ;LOAD THIS ROW IMAGE
005216  000207                  2$:     RTS     PC              ;RETURN FOR DISPLAY



                                ;;*************************************************************
                                ;KEYBOARD INTERRUPT SERVICE ROUTINE
                                ;;*************************************************************
005220  017737  173722  001266  KBINT:  MOV     @$TKB,KBUFF     ;READ KEY BOARD
005226  013777  001266  173716          MOV     KBUFF,@$TPB     ;ECHO CHAR.
005234  042737  177600  001266          BIC     #177600,KBUFF   ;RID PARITY
005242  022737  000003  001266          CMP     #3,KBUFF        ;CNTRL 'C'?
005250  001002                          BNE     1$              ;BR IF NOT
005252  000137  001656                  JMP     LISEN           ;ABORT WHATEVER & LOOK FOR NEXT COMMAND
005256  000002                  1$:     RTI

                                ;;*************************************************************
                                ;ROUTINE TYPES 'CR' AND 'LF' OR CHAR IN TTYOUT
                                ;;*************************************************************
005260  012737  000015  001270  TYPCR:  MOV     #15,TTYOUT      ;SET UP FOR A 'CR'
005266  004737  005300                  JSR     PC,TYPO
005272  012737  000012  001270          MOV     #12,TTYOUT      ;SET UP FOR LF
005300  105777  173644          TYPO:   TSTB    @$TPS           ;WAIT FOR LAST CHARACTER
005304  100375                          BPL     TYPO
005306  013777  001270  173636          MOV     TTYOUT,@$TPB    ;SEND IT OUT
005314  000207                          RTS     PC
```

```
                                         ;;*********************************************************************
                                         ;THIS SUBROUTINE IS CALLED WITH THE ADDRESS OF A MESSAGE TERM WITH A 0 BYTE
                                         ;;*********************************************************************

005316  012504                          VTWRIT: MOV     (R5)+,R4                ;GET ADDRESS OF MESSAGE IN R4
005320  005777  173674                  1$:     TST     @VTVCRG         ;WAIT FOR READY
005324  100375                                  BPL     1$
005326  105714                                  TSTB    (R4)            ;TERM ?
005330  001403                                  BEQ     2$              ;BR IF YES
005332  112477  173662                          MOVB    (R4)+,@VTVCRG   ;LOAD THE CHARACTER
005336  000770                                  BR      1$
005340  000205                          2$:     RTS     R5              ;EXIT

                                         ;;*********************************************************************
                                         ;THIS ROUTINE CONVERTS OCTAL INTO ASCII FOR DISPLAY
                                         ;;*********************************************************************
005342  012537  005454                  AWRIT:  MOV     (R5)+,10$       ;GET VALUE'S ADDRESS
005346  017737  000102  005454                  MOV     @10$,10$        ;GET ACTUAL VALUE
005354  010046                                  MOV     R0,-(SP)        ;SAVE R0
005356  012700  005470                          MOV     #NUMEND,R0      ;LOAD LAST ADDRESS OF OCTAL TYPEOUT
005362  012737  000006  005460                  MOV     #6,12$          ;LOAD LOOP COUNTER
005370  000406                                  BR      2$
005372  006237  005454                  1$:     ASR     10$             ;SHIFT DATA
005376  006237  005454                          ASR     10$
005402  006237  005454                          ASR     10$
005406  013737  005454  005456          2$:     MOV     10$,11$         ;COPY THE VALUE
005414  042737  177770  005456                  BIC     #177770,11$     ;MASK OFF UNWANTED BITS
005422  062737  000060  005456                  ADD     #60,11$         ;MAKE ASCII OCTAL
005430  113740  005456                          MOVB    11$,-(R0)       ;SAVE THE CHAR.
005434  005337  005460                          DEC     12$             ;FINISHED ?
005440  001354                                  BNE     1$
005442  012600                                  MOV     (SP)+,R0
005444  004537  005316                          JSR     R5,VTWRIT       ;DISPAY THE OCTAL #
005450  005462                                  NUMBEG
005452  000205                                  RTS     R5              ;EXIT
005454  000000                          10$:    0
005456  000000                          11$:    0
005460  000005                          12$:    5
005462     060     060     060          NUMBEG: .BYTE   60,60,60,60,60,60
005465     060     060     060
005470     000                          NUMEND: .BYTE   0
        005472                                  .EVEN
```

```
                                      ;;*************************************************************
                                      ;THIS ROUTINE AVERAGES THE LAST 32. X-Y JOYSTICK VALUES
                                      ;;*************************************************************
005472  010046                        XYAVE:  MOV     R0,-(SP)        ;SAVE R0
005474  013700  001240                        MOV     TEMPO,R0        ;GET X & Y
005500  013702  005720                        MOV     XYBUFP,R2       ;GET CURRENT BUFFER POINTER
005504  010022                                MOV     R0,(R2)+        ;SAVE NEW X-Y VALUE
005506  020227  005720                        CMP     R2,#XYBUFE      ;END OF BUFFER?
005512  103402                                BLO     1$              ;NO
005514  012702  005620                        MOV     #XYBUF,R2       ;YES, GO BACK TO BEGINING OF BUFFER
005520  010237  005720                1$:     MOV     R2,XYBUFP       ;SAVE NEW BUFFER POINTER
005524  012702  005620                        MOV     #XYBUF,R2       ;CALC AVE X
005530  004737  005562                        JSR     PC,10$
005534  110046                                MOVB    R0,-(SP)        ;SAVE IT
005536  012702  005621                        MOV     #XYBUF+1,R2     ;CALC AVE Y
005542  004737  005562                        JSR     PC,10$          ;GO DO IT
005546  000300                                SWAB    R0              ;GET X-Y IN R0
005550  152600                                BISB    (SP)+,R0        ;GET SAVED X
005552  010037  001240                        MOV     R0,TEMPO        ;PUT IN TEMPO
005556  012600                                MOV     (SP)+,R0        ;RESTORE R0
005560  000207                                RTS     PC              ;EXIT WITH AVE X-Y IN TEMPO

005562  005000                        10$:    CLR     R0              ;ZERO SUM
005564  005005                        11$:    CLR     R5              ;DO A MOVB TO A REG (UNSIGNED)
005566  152205                                BISB    (R2)+,R5
005570  060500                                ADD     R5,R0           ;ADD IT IN
005572  005202                                INC     R2              ;SKIP OTHER VALUE
005574  020227  005720                        CMP     R2,#XYBUFE      ;END OF BUFFER?
005600  103771                                BLO     11$             ;NO
005602  006300                                ASL     R0              ;DIVIDE BY 32.
005604  006300                                ASL     R0
005606  006300                                ASL     R0
005610  000300                                SWAB    R0
005612  042700  177400                        BIC     #177400,R0      ;CLR HI BYTE
005616  000207                                RTS     PC

005620  000040                        XYBUF:
        005720                        XYBUFE=.
005720  005620                        XYBUFP: XYBUF
```

```
 878                                          ;;*****************************************************************
 879                                          .SBTTL  TTY INPUT ROUTINE
 (1)
 (2)                                          ;;*****************************************************************
 (1)                                          .ENABL  LSB
 (1)
 (2)                                          ;;*****************************************************************
 (1)                                          ;*SOFTWARE SWITCH REGISTER CHANGE ROUTINE.
 (1)                                          ;*ROUTINE IS ENTERED FROM THE TRAP HANDLER, AND WILL
 (1)                                          ;*SERVICE THE TEST FOR CHANGE IN SOFTWARE SWITCH REGISTER TRAP CALL
 (1)                                          ;*WHEN OPERATING IN TTY FLAG MODE.
 (1)  005722  022737  000176  001140  $CKSWR: CMP     #SWREG,SWR          ;;IS THE SOFT-SWR SELECTED?
 (1)  005730  001074                          BNE     15$                 ;;BRANCH IF NO
 (1)  005732  105777  173206                  TSTB    @$TKS               ;;CHAR THERE?
 (1)  005736  100071                          BPL     15$                 ;;IF NO, DON'T WAIT AROUND
 (1)  005740  117746  173202                  MOVB    @$TKB,-(SP)         ;;SAVE THE CHAR
 (1)  005744  042716  177600                  BIC     #^C177,(SP)         ;;STRIP-OFF THE ASCII
 (1)  005750  022726  000007                  CMP     #7,(SP)+            ;;IS IT A CONTROL G?
 (1)  005754  001062                          BNE     15$                 ;;NO, RETURN TO USER
 (1)  005756  123727  001134  000001          CMPB    $AUTOB,#1           ;;ARE WE RUNNING IN AUTO-MODE?
 (1)  005764  001456                          BEQ     15$                 ;;BRANCH IF YES
 (1)
 (1)  005766  104401  006574                  TYPE    ,$CNTLG             ;;ECHO THE CONTROL-G (^G)
 (1)  005772  104401  006601          $GTSWR: TYPE    ,$MSWR              ;;TYPE CURRENT CONTENTS
 (2)  005776  013746  000176                  MOV     SWREG,-(SP)         ;;SAVE SWREG FOR TYPEOUT
 (2)  006002  104402                          TYPOC                       ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
 (1)  006004  104401  006612                  TYPE    ,$MNEW              ;;PROMPT FOR NEW SWR
 (1)  006010  005046                  19$:    CLR     -(SP)               ;;CLEAR COUNTER
 (1)  006012  005046                          CLR     -(SP)               ;;THE NEW SWR
 (1)  006014  105777  173124          7$:     TSTB    @$TKS               ;;CHAR THERE?
 (1)  006020  100375                          BPL     7$                  ;;IF NOT TRY AGAIN
 (1)
 (1)  006022  117746  173120                  MOVB    @$TKB,-(SP)         ;;PICK UP CHAR
 (1)  006026  042716  177600                  BIC     #^C177,(SP)         ;;MAKE IT 7-BIT ASCII
 (1)
 (1)
 (1)
 (1)  006032  021627  000025          9$:     CMP     (SP),#25            ;;IS IT A CONTROL-U?
 (1)  006036  001005                          BNE     10$                 ;;BRANCH IF NOT
 (1)  006040  104401  006567                  TYPE    ,$CNTLU             ;;YES, ECHO CONTROL-U (^U)
 (1)  006044  062706  000006          20$:    ADD     #6,SP               ;;IGNORE PREVIOUS INPUT
 (1)  006050  000757                          BR      19$                 ;;LET'S TRY IT AGAIN
 (1)
 (1)
 (1)  006052  021627  000015          10$:    CMP     (SP),#15            ;;IS IT A <CR>?
 (1)  006056  001022                          BNE     16$                 ;;BRANCH IF NO
 (1)  006060  005766  000004                  TST     4(SP)               ;;YES, IS IT THE FIRST CHAR?
 (1)  006064  001403                          BEQ     11$                 ;;BRANCH IF YES
 (1)  006066  016677  000002  173044          MOV     2(SP),@SWR          ;;SAVE NEW SWR
 (1)  006074  062706  000006          11$:    ADD     #6,SP               ;;CLEAR UP STACK
 (1)  006100  104401  001161          14$:    TYPE    ,$CRLF              ;;ECHO <CR> AND <LF>
 (1)  006104  123727  001135  000001          CMPB    $INTAG,#1           ;;RE-ENABLE TTY KBD INTERRUPTS?
 (1)  006112  001003                          BNE     15$                 ;;BRANCH IF NOT
 (1)  006114  012777  000100  173022          MOV     #100,@$TKS          ;;RE-ENABLE TTY KBD INTERRUPTS
 (1)  006122  000002                  15$:    RTI                         ;;RETURN
 (1)  006124  004737  006774          16$:    JSR     PC,$TYPEC           ;;ECHO CHAR
```

```
(1)  006130  021627  000060                      CMP     (SP),#60            ;;CHAR < 0?
(1)  006134  002420                              BLT     18$                 ;;BRANCH IF YES
(1)  006136  021627  000067                      CMP     (SP),#67            ;;CHAR > 7?
(1)  006142  003015                              BGT     18$                 ;;BRANCH IF YES
(1)  006144  042726  000060                      BIC     #60,(SP)+           ;;STRIP-OFF ASCII
(1)  006150  005766  000002                      TST     2(SP)               ;;IS THIS THE FIRST CHAR
(1)  006154  001403                              BEQ     17$                 ;;BRANCH IF YES
(1)  006156  006316                              ASL     (SP)                ;;NO, SHIFT PRESENT
(1)  006160  006316                              ASL     (SP)                ;;   CHAR OVER TO MAKE
(1)  006162  006316                              ASL     (SP)                ;;   ROOM FOR NEW ONE.
(1)  006164  005266  000002              17$:    INC     2(SP)               ;;KEEP COUNT OF CHAR
(1)  006170  056616  177776                      BIS     -2(SP),(SP)         ;;SET IN NEW CHAR
(1)  006174  000707                              BR      7$                  ;;GET THE NEXT ONE
(1)  006176  104401  001160              18$:    TYPE    ,$QUES              ;;TYPE ?<CR><LF>
(1)  006202  000720                              BR      20$                 ;;SIMULATE CONTROL-U
(1)                                      .DSABL  LSB
(1)
(1)
(2)                                      ;;*************************************************************
(1)                                      ;*THIS ROUTINE WILL INPUT A SINGLE CHARACTER FROM THE TTY
(1)                                      ;*CALL:
(1)                                      ;*      RDCHR                       ;;INPUT A SINGLE CHARACTER FROM THE TTY
(1)                                      ;*      RETURN HERE                 ;;CHARACTER IS ON THE STACK
(1)                                      ;*                                  ;;WITH PARITY BIT STRIPPED OFF
(1)                                      ;
(1)
(1)  006204  011646                      $RDCHR: MOV     (SP),-(SP)          ;;PUSH DOWN THE PC
(1)  006206  016666  000004  000002              MOV     4(SP),2(SP)         ;;SAVE THE PS
(1)  006214  105777  172724              1$:     TSTB    @$TKS               ;;WAIT FOR
(1)  006220  100375                              BPL     1$                  ;;A CHARACTER
(1)  006222  117766  172720  000004              MOVB    @$TKB,4(SP)         ;;READ THE TTY
(1)  006230  042766  177600  000004              BIC     #^C<177>,4(SP)      ;;GET RID OF JUNK IF ANY
(1)  006236  026627  000004  000023              CMP     4(SP),#23           ;;IS IT A CONTROL-S?
(1)  006244  001013                              BNE     3$                  ;;BRANCH IF NO
(1)  006246  105777  172672              2$:     TSTB    @$TKS               ;;WAIT FOR A CHARACTER
(1)  006252  100375                              BPL     2$                  ;;LOOP UNTIL ITS THERE
(1)  006254  117746  172666                      MOVB    @$TKB,-(SP)         ;;GET CHARACTER
(1)  006260  042716  177600                      BIC     #^C177,(SP)         ;;MAKE IT 7-BIT ASCII
(1)  006264  022627  000021                      CMP     (SP)+,#21           ;;IS IT A CONTROL-Q?
(1)  006270  001366                              BNE     2$                  ;;IF NOT DISCARD IT
(1)  006272  000750                              BR      1$                  ;;YES, RESUME
(1)  006274  026627  000004  000140      3$:     CMP     4(SP),#140          ;;IS IT UPPER CASE?
(1)  006302  002407                              BLT     4$                  ;;BRANCH IF YES
(1)  006304  026627  000004  000175              CMP     4(SP),#175          ;;IS IT A SPECIAL CHAR?
(1)  006312  003003                              BGT     4$                  ;;BRANCH IF YES
(1)  006314  042766  000040  000004              BIC     #40,4(SP)           ;;MAKE IT UPPER CASE
(1)  006322  000002                      4$:     RTI                         ;;GO BACK TO USER
(2)                                      ;;*************************************************************
(1)                                      ;*THIS ROUTINE WILL INPUT A STRING FROM THE TTY
(1)                                      ;*CALL:
(1)                                      ;*      RDLIN                       ;;INPUT A STRING FROM THE TTY
(1)                                      ;*      RETURN HERE                 ;;ADDRESS OF FIRST CHARACTER WILL BE ON THE STACK
(1)                                      ;*                                  ;;TERMINATOR WILL BE A BYTE OF ALL 0'S
(1)
(1)  006324  010346                      $RDLIN: MOV     R3,-(SP)            ;;SAVE R3
(1)  006326  005046                              CLR     -(SP)               ;;CLEAR THE RUBOUT KEY
```

```
(1) 006330 012703 006560         1$:      MOV     #$TTYIN,R3        ;;GET ADDRESS
(1) 006334 022703 006567         2$:      CMP     #$TTYIN+7,R3      ;;BUFFER FULL?
(1) 006340 101456                         BLOS    4$                ;;BR IF YES
(1) 006342 104407                         RDCHR                     ;;GO READ ONE CHARACTER FROM THE TTY
(1) 006344 112613                         MOVB    (SP)+,(R3)        ;;GET CHARACTER
(1) 006346 122713 000177         10$:     CMPB    #177,(R3)         ;;IS IT A RUBOUT
(1) 006352 001022                         BNE     5$                ;;BR IF NO
(1) 006354 005716                         TST     (SP)              ;;IS THIS THE FIRST RUBOUT?
(1) 006356 001007                         BNE     6$                ;;BR IF NO
(1) 006360 112737 000134 006556           MOVB    #'\,9$            ;;TYPE A BACK SLASH
(1) 006366 104401 006556                  TYPE    ,9$
(1) 006372 012716 177777                  MOV     #-1,(SP)          ;;SET THE RUBOUT KEY
(1) 006376 005303                6$:      DEC     R3                ;;BACKUP BY ONE
(1) 006400 020327 006560                  CMP     R3,#$TTYIN        ;;STACK EMPTY?
(1) 006404 103434                         BLO     4$                ;;BR IF YES
(1) 006406 111337 006556                  MOVB    (R3),9$           ;;SETUP TO TYPEOUT THE DELETED CHAR.
(1) 006412 104401 006556                  TYPE    ,9$               ;;GO TYPE
(1) 006416 000746                         BR      2$                ;;GO READ ANOTHER CHAR.
(1) 006420 005716                5$:      TST     (SP)              ;;RUBOUT KEY SET?
(1) 006422 001406                         BEQ     7$                ;;BR IF NO
(1) 006424 112737 000134 006556           MOVB    #'\,9$            ;;TYPE A BACK SLASH
(1) 006432 104401 006556                  TYPE    ,9$
(1) 006436 005016                         CLR     (SP)              ;;CLEAR THE RUBOUT KEY
(1) 006440 122713 000025         7$:      CMPB    #25,(R3)          ;;IS CHARACTER A CTRL U?
(1) 006444 001003                         BNE     8$                ;;BR IF NO
(1) 006446 104401 006567                  TYPE    ,$CNTLU           ;;TYPE A CONTROL ''U''
(1) 006452 000726                         BR      1$                ;;GO START OVER
(1) 006454 122713 000022         8$:      CMPB    #22,(R3)          ;;IS CHARACTER A ''^R''?
(1) 006460 001011                         BNE     3$                ;;BRANCH IF NO
(1) 006462 105013                         CLRB    (R3)              ;;CLEAR THE CHARACTER
(1) 006464 104401 001161                  TYPE    ,$CRLF            ;;TYPE A ''CR'' & ''LF''
(1) 006470 104401 006560                  TYPE    ,$TTYIN           ;;TYPE THE INPUT STRING
(1) 006474 000717                         BR      2$                ;;GO PICKUP ANOTHER CHACTER
(1) 006476 104401 001160         4$:      TYPE    ,$QUES            ;;TYPE A '?'
(1) 006502 000712                         BR      1$                ;;CLEAR THE BUFFER AND LOOP
(1) 006504 111337 006556         3$:      MOVB    (R3),9$           ;;ECHO THE CHARACTER
(1) 006510 104401 006556                  TYPE    ,9$
(1) 006514 122723 000015                  CMPB    #15,(R3)+         ;;CHECK FOR RETURN
(1) 006520 001305                         BNE     2$                ;;LOOP IF NOT RETURN
(1) 006522 105063 177777                  CLRB    -1(R3)            ;;CLEAR RETURN (THE 15)
(1) 006526 104401 001162                  TYPE    ,$LF              ;;TYPE A LINE FEED
(1) 006532 005726                         TST     (SP)+             ;;CLEAN RUBOUT KEY FROM THE STACK
(1) 006534 012603                         MOV     (SP)+,R3          ;;RESTORE R3
(1) 006536 011646                         MOV     (SP),-(SP)        ;;ADJUST THE STACK AND PUT ADDRESS OF THE
(1) 006540 016666 000004 000002           MOV     4(SP),2(SP)       ;;       FIRST ASCII CHARACTER ON IT
(1) 006546 012766 006560 000004           MOV     #$TTYIN,4(SP)
(1) 006554 000002                         RTI                       ;;RETURN
(1) 006556    000                9$:      .BYTE   0                 ;;STORAGE FOR ASCII CHAR. TO TYPE
(1) 006557    000                         .BYTE   0                 ;;TERMINATOR
(1) 006560 000007                $TTYIN:  .BLKB   7                 ;;RESERVE 7 BYTES FOR TTY INPUT
(1) 006567    136 006525 000012  $CNTLU:  .ASCIZ  /^U/<15><12>      ;;CONTROL ''U''
(1) 006574 043536 005015    000  $CNTLG:  .ASCIZ  /^G/<15><12>      ;;CONTROL ''G''
(1) 006601    015 051412 051127  $MSWR:   .ASCIZ  <15><12>/SWR = /
(1) 006606 036440 000040
(1) 006612 020040 042516 020127  $MNEW:   .ASCIZ  /  NEW = /
(1) 006620 020075    000
```

```
  (1)            006624                       .EVEN
  880                                         ;;********************************************************************
  881                                         .SBTTL  TYPE ROUTINE
  (1)
  (2)                                         ;;********************************************************************
  (1)                                         ;*ROUTINE TO TYPE ASCIZ MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
  (1)                                         ;*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
  (1)                                         ;*NOTE1:        $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
  (1)                                         ;*NOTE2:        $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
  (1)                                         ;*NOTE3:        $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
  (1)                                         ;*
  (1)                                         ;*CALL:
  (1)                                         ;*1) USING A TRAP INSTRUCTION
  (1)                                         ;*        TYPE     ,MESADR          ;;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
  (1)                                         ;*OR
  (1)                                         ;*        TYPE
  (1)                                         ;*        MESADR
  (1)                                         ;*
  (1)
  (1)   006624   105737   001157              $TYPE:  TSTB     $TPFLG           ;;IS THERE A TERMINAL?
  (1)   006630   100002                               BPL      1$               ;;BR IF YES
  (1)   006632   000000                               HALT                      ;;HALT HERE IF NO TERMINAL
  (1)   006634   000407                               BR       3$               ;;LEAVE
  (1)   006636   010046                       1$:     MOV      R0,-(SP)         ;;SAVE R0
  (1)   006640   017600   000002                      MOV      @2(SP),R0        ;;GET ADDRESS OF ASCIZ STRING
  (1)   006644   112046                       2$:     MOVB     (R0)+,-(SP)      ;;PUSH CHARACTER TO BE TYPED ONTO STACK
  (1)   006646   001005                               BNE      4$               ;;BR IF IT ISN'T THE TERMINATOR
  (1)   006650   005726                               TST      (SP)+            ;;IF TERMINATOR POP IT OFF THE STACK
  (1)   006652   012600                       60$:    MOV      (SP)+,R0         ;;RESTORE R0
  (1)   006654   062716   000002              3$:     ADD      #2,(SP)          ;;ADJUST RETURN PC
  (1)   006660   000002                               RTI                       ;;RETURN
  (1)   006662   122716   000011              4$:     CMPB     #HT,(SP)         ;;BRANCH IF <HT>
  (1)   006666   001430                               BEQ      8$
  (1)   006670   122716   000200                      CMPB     #CRLF,(SP)       ;;BRANCH IF NOT <CRLF>
  (1)   006674   001006                               BNE      5$
  (1)   006676   005726                               TST      (SP)+            ;;POP  <CR><LF> EQUIV
  (1)   006700   104401                               TYPE                      ;;TYPE A CR AND LF
  (1)   006702   001161                               $CRLF
  (1)   006704   105037   007040                      CLRB     $CHARCNT         ;;CLEAR CHARACTER COUNT
  (1)   006710   000755                               BR       2$               ;;GET NEXT CHARACTER
  (1)   006712   004737   006774              5$:     JSR      PC,$TYPEC        ;;GO TYPE THIS CHARACTER
  (1)   006716   123726   001156              6$:     CMPB     $FILLC,(SP)+     ;;IS IT TIME FOR FILLER CHARS.?
  (1)   006722   001350                               BNE      2$               ;;IF NO GO GET NEXT CHAR.
  (1)   006724   013746   001154                      MOV      $NULL,-(SP)      ;;GET # OF FILLER CHARS. NEEDED
  (1)                                                                           ;;AND THE NULL CHAR.
  (1)   006730   105366   000001              7$:     DECB     1(SP)            ;;DOES A NULL NEED TO BE TYPED?
  (1)   006734   002770                               BLT      6$               ;;BR IF NO--GO POP THE NULL OFF OF STACK
  (1)   006736   004737   006774                      JSR      PC,$TYPEC        ;;GO TYPE A NULL
  (1)   006742   105337   007040                      DECB     $CHARCNT         ;;DO NOT COUNT AS A COUNT
  (1)   006746   000770                               BR       7$               ;;LOOP
  (1)
  (1)                                         ;HORIZONTAL TAB PROCESSOR
  (1)
  (1)   006750   112716   000040              8$:     MOVB     #' ,(SP)         ;;REPLACE TAB WITH SPACE
  (1)   006754   004737   006774              9$:     JSR      PC,$TYPEC        ;;TYPE A SPACE
  (1)   006760   132737   000007   007040              BITB     #7,$CHARCNT      ;;BRANCH IF NOT AT
```

```
   (1)  006766  001372                          BNE     9$                  ;;TAB STOP
   (1)  006770  005726                          TST     (SP)+               ;;POP SPACE OFF STACK
   (1)  006772  000724                          BR      2$                  ;;GET NEXT CHARACTER
   (1)  006774  105777  172150          $TYPEC: TSTB    @$TPS               ;;WAIT UNTIL PRINTER IS READY
   (1)  007000  100375                          BPL     $TYPEC
   (1)  007002  116677  000002  172142          MOVB    2(SP),@$TPB         ;;LOAD CHAR TO BE TYPED INTO DATA REG.
   (1)  007010  122766  000015  000002          CMPB    #CR,2(SP)           ;;IS CHARACTER A CARRIAGE RETURN?
   (1)  007016  001003                          BNE     1$                  ;;BRANCH IF NO
   (1)  007020  105037  007040                  CLRB    $CHARCNT            ;;YES--CLEAR CHARACTER COUNT
   (1)  007024  000406                          BR      $TYPEX              ;;EXIT
   (1)  007026  122766  000012  000002  1$:     CMPB    #LF,2(SP)           ;;IS CHARACTER A LINE FEED?
   (1)  007034  001402                          BEQ     $TYPEX              ;;BRANCH IF YES
   (1)  007036  105227                          INCB    (PC)+               ;;COUNT THE CHARACTER
   (1)  007040  000000                  $CHARCNT:.WORD  0                   ;;CHARACTER COUNT STORAGE
   (1)  007042  000207                  $TYPEX: RTS     PC
   (1)
  882                                   ;;*************************************************************
  883                                   .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE
   (1)
   (2)                                  ;;*************************************************************
   (1)                                  ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 6-DIGIT
   (1)                                  ;*OCTAL (ASCII) NUMBER AND TYPE IT.
   (1)                                  ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
   (1)                                  ;*CALL:
   (1)                                  ;*      MOV     NUM,-(SP)           ;;NUMBER TO BE TYPED
   (1)                                  ;*      TYPOS                       ;;CALL FOR TYPEOUT
   (1)                                  ;*      .BYTE   N                   ;;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE
   (1)                                  ;*      .BYTE   M                   ;;M=1 OR 0
   (1)                                  ;*                                          ;;1=TYPE LEADING ZEROS
   (1)                                  ;*                                          ;;0=SUPPRESS LEADING ZEROS
   (1)                                  ;*
   (1)                                  ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
   (1)                                  ;*$TYPOS OR $TYPOC
   (1)                                  ;*CALL:
   (1)                                  ;*      MOV     NUM,-(SP)           ;;NUMBER TO BE TYPED
   (1)                                  ;*      TYPON                       ;;CALL FOR TYPEOUT
   (1)                                  ;*
   (1)                                  ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
   (1)                                  ;*CALL:
   (1)                                  ;*      MOV     NUM,-(SP)           ;;NUMBER TO BE TYPED
   (1)                                  ;*      TYPOC                       ;;CALL FOR TYPEOUT
   (1)
   (1)  007044  017646  000000          $TYPOS: MOV     @(SP),-(SP)         ;;PICKUP THE MODE
   (1)  007050  116637  000001  007267          MOVB    1(SP),$OFILL        ;;LOAD ZERO FILL SWITCH
   (1)  007056  112637  007271                  MOVB    (SP)+,$OMODE+1      ;;NUMBER OF DIGITS TO TYPE
   (1)  007062  062716  000002                  ADD     #2,(SP)             ;;ADJUST RETURN ADDRESS
   (1)  007066  000406                          BR      $TYPON
   (1)  007070  112737  000001  007267  $TYPOC: MOVB    #1,$OFILL           ;;SET THE ZERO FILL SWITCH
   (1)  007076  112737  000006  007271          MOVB    #6,$OMODE+1         ;;SET FOR SIX(6) DIGITS
   (1)  007104  112737  000005  007266  $TYPON: MOVB    #5,$OCNT            ;;SET THE ITERATION COUNT
   (1)  007112  010346                          MOV     R3,-(SP)            ;;SAVE R3
   (1)  007114  010446                          MOV     R4,-(SP)            ;;SAVE R4
   (1)  007116  010546                          MOV     R5,-(SP)            ;;SAVE R5
   (1)  007120  113704  007271                  MOVB    $OMODE+1,R4         ;;GET THE NUMBER OF DIGITS TO TYPE
   (1)  007124  005404                          NEG     R4
   (1)  007126  062704  000006                  ADD     #6,R4               ;;SUBTRACT IT FOR MAX. ALLOWED
```

```
    (1)  007132  110437  007270                  MOVB    R4,$OMODE          ;;SAVE IT FOR USE
    (1)  007136  113704  007267                  MOVB    $OFILL,R4          ;;GET THE ZERO FILL SWITCH
    (1)  007142  016605  000012                  MOV     12(SP),R5          ;;PICKUP THE INPUT NUMBER
    (1)  007146  005003                          CLR     R3                 ;;CLEAR THE OUTPUT WORD
    (1)  007150  006105                  1$:     ROL     R5                 ;;ROTATE MSB INTO ''C''
    (1)  007152  000404                          BR      3$                 ;;GO DO MSB
    (1)  007154  006105                  2$:     ROL     R5                 ;;FORM THIS DIGIT
    (1)  007156  006105                          ROL     R5
    (1)  007160  006105                          ROL     R5
    (1)  007162  010503                          MOV     R5,R3
    (1)  007164  006103                  3$:     ROL     R3                 ;;GET LSB OF THIS DIGIT
    (1)  007166  105337  007270                  DECB    $OMODE             ;;TYPE THIS DIGIT?
    (1)  007172  100016                          BPL     7$                 ;;BR IF NO
    (1)  007174  042703  177770                  BIC     #177770,R3         ;;GET RID OF JUNK
    (1)  007200  001002                          BNE     4$                 ;;TEST FOR 0
    (1)  007202  005704                          TST     R4                 ;;SUPPRESS THIS 0?
    (1)  007204  001403                          BEQ     5$                 ;;BR IF YES
    (1)  007206  005204                  4$:     INC     R4                 ;;DON'T SUPPRESS ANYMORE 0'S
    (1)  007210  052703  000060                  BIS     #'0,R3             ;;MAKE THIS DIGIT ASCII
    (1)  007214  052703  000040          5$:     BIS     #' ,R3             ;;MAKE ASCII IF NOT ALREADY
    (1)  007220  110337  007264                  MOVB    R3,8$              ;;SAVE FOR TYPING
    (1)  007224  104401  007264                  TYPE    ,8$                ;;GO TYPE THIS DIGIT
    (1)  007230  105337  007266          7$:     DECB    $OCNT              ;;COUNT BY 1
    (1)  007234  003347                          BGT     2$                 ;;BR IF MORE TO DO
    (1)  007236  002402                          BLT     6$                 ;;BR IF DONE
    (1)  007240  005204                          INC     R4                 ;;INSURE LAST DIGIT ISN'T A BLANK
    (1)  007242  000744                          BR      2$                 ;;GO DO THE LAST DIGIT
    (1)  007244  012605                  6$:     MOV     (SP)+,R5           ;;RESTORE R5
    (1)  007246  012604                          MOV     (SP)+,R4           ;;RESTORE R4
    (1)  007250  012603                          MOV     (SP)+,R3           ;;RESTORE R3
    (1)  007252  016666  000002  000004          MOV     2(SP),4(SP)        ;;SET THE STACK FOR RETURNING
    (1)  007260  012616                          MOV     (SP)+,(SP)
    (1)  007262  000002                          RTI                        ;;RETURN
    (1)  007264     000                  8$:     .BYTE   0                  ;;STORAGE FOR ASCII DIGIT
    (1)  007265     000                          .BYTE   0                  ;;TERMINATOR FOR TYPE ROUTINE
    (1)  007266     000                  $OCNT:  .BYTE   0                  ;;OCTAL DIGIT COUNTER
    (1)  007267     000                  $OFILL: .BYTE   0                  ;;ZERO FILL SWITCH
    (1)  007270  000000                  $OMODE: .WORD   0                  ;;NUMBER OF DIGITS TO TYPE
    884                                  ;;*************************************************************
    885                                  .SBTTL  READ AN OCTAL NUMBER FROM THE TTY
    (1)
    (2)                                  ;;*************************************************************
    (1)                                  ;*THIS ROUTINE WILL READ AN OCTAL (ASCII) NUMBER FROM THE TTY AND
    (1)                                  ;*CHANGE IT TO BINARY.
    (1)                                  ;*THE INPUT CHARACTERS WILL BE CHECKED TO INSURED THEY ARE LEGAL
    (1)                                  ;*OCTAL DIGITS. IF AN ILLEGAL CHARACTER IS READ A ''?'' WILL BE TYPED
    (1)                                  ;*FOLLOWED BY A CARRIAGE RETURN-LINE FEED. THE COMPLETE NUMBER MUST
    (1)                                  ;*THEN BE RETYPED. THE INPUT IS TERMINATED BY TYPING A CARRIAGE RETURN.
    (1)                                  ;*CALL:
    (1)                                  ;*      RDOCT                      ;;READ AN OCTAL NUMBER
    (1)                                  ;*      RETURN HERE                ;;LOW ORDER BITS ARE ON TOP OF THE STACK
    (1)                                  ;*                                 ;;HIGH ORDER BITS ARE IN $HIOCT
    (1)
    (1)  007272  011646                  $RDOCT: MOV     (SP),-(SP)         ;;PROVIDE SPACE FOR THE
    (1)  007274  016666  000004  000002          MOV     4(SP),2(SP)        ;;INPUT NUMBER
    (3)  007302  010046                          MOV     R0,-(SP)           ;;PUSH R0 ON STACK
```

```
   (3)  007304  010146                         MOV     R1,-(SP)          ;;PUSH R1 ON STACK
   (3)  007306  010246                         MOV     R2,-(SP)          ;;PUSH R2 ON STACK
   (1)  007310  104410              1$:        RDLIN                     ;;READ AN ASCIZ LINE
   (1)  007312  012600                         MOV     (SP)+,R0          ;;GET ADDRESS OF 1ST CHARACTER
   (1)  007314  010037  007420                 MOV     R0,5$             ;;AND SAVE IT
   (1)  007320  005001                         CLR     R1                ;;CLEAR DATA WORD
   (1)  007322  005002                         CLR     R2
   (1)  007324  112046              2$:        MOVB    (R0)+,-(SP)       ;;PICKUP THIS CHARACTER
   (1)  007326  001420                         BEQ     3$                ;;IF ZERO GET OUT
   (1)  007330  122716  000060                 CMPB    #'0,(SP)          ;;MAKE SURE THIS CHARACTER
   (1)  007334  003026                         BGT     4$                ;;IS AN OCTAL DIGIT
   (1)  007336  122716  000067                 CMPB    #'7,(SP)
   (1)  007342  002423                         BLT     4$
   (1)  007344  006301                         ASL     R1                ;;*2
   (1)  007346  006102                         ROL     R2
   (1)  007350  006301                         ASL     R1                ;;*4
   (1)  007352  006102                         ROL     R2
   (1)  007354  006301                         ASL     R1                ;;*8
   (1)  007356  006102                         ROL     R2
   (1)  007360  042716  177770                 BIC     #^C7,(SP)         ;;STRIP THE ASCII JUNK
   (1)  007364  062601                         ADD     (SP)+,R1          ;;ADD IN THIS DIGIT
   (1)  007366  000756                         BR      2$                ;;LOOP
   (1)  007370  005726              3$:        TST     (SP)+             ;;CLEAN TERMINATOR FROM STACK
   (1)  007372  010166  000012                 MOV     R1,12(SP)         ;;SAVE THE RESULT
   (1)  007376  010237  007430                 MOV     R2,$HIOCT
   (3)  007402  012602                         MOV     (SP)+,R2          ;;POP STACK INTO R2
   (3)  007404  012601                         MOV     (SP)+,R1          ;;POP STACK INTO R1
   (3)  007406  012600                         MOV     (SP)+,R0          ;;POP STACK INTO R0
   (1)  007410  000002                         RTI                       ;;RETURN
   (1)  007412  005726              4$:        TST     (SP)+             ;;CLEAN PARTIAL FROM STACK
   (1)  007414  105010                         CLRB    (R0)              ;;SET A TERMINATOR
   (1)  007416  104401                         TYPE                      ;;TYPE UP THRU THE BAD CHAR.
   (1)  007420  000000              5$:        .WORD   0
   (1)  007422  104401  001160                 TYPE    ,$QUES            ;;"?" "CR" & "LF"
   (1)  007426  000730                         BR      1$                ;;TRY AGAIN
   (1)  007430  000000              $HIOCT:    .WORD   0                 ;;HIGH ORDER BITS GO HERE
```

```
  887                                         ;;*****************************************************************
  888                                         .SBTTL  TRAP DECODER
  (1)
  (2)                                         ;;*****************************************************************
  (1)                                         ;*THIS ROUTINE WILL PICKUP THE LOWER BYTE OF THE ''TRAP'' INSTRUCTION
  (1)                                         ;*AND USE IT TO INDEX THROUGH THE TRAP TABLE FOR THE STARTING ADDRESS
  (1)                                         ;*OF THE DESIRED ROUTINE. THEN USING THE ADDRESS OBTAINED IT WILL
  (1)                                         ;*GO TO THAT ROUTINE.
  (1)
  (1)  007432  010046                         $TRAP:  MOV     R0,-(SP)          ;;SAVE R0
  (1)  007434  016600  000002                         MOV     2(SP),R0          ;;GET TRAP ADDRESS
  (1)  007440  005740                                 TST     -(R0)             ;;BACKUP BY 2
  (1)  007442  111000                                 MOVB    (R0),R0           ;;GET RIGHT BYTE OF TRAP
  (1)  007444  006300                                 ASL     R0                ;;POSITION FOR INDEXING
  (1)  007446  016000  007466                         MOV     $TRPAD(R0),R0     ;;INDEX TO TABLE
  (1)  007452  000200                                 RTS     R0                ;;GO TO ROUTINE
  (1)
  (1)
  (1)                                         ;;THIS IS USE TO HANDLE THE ''GETPRI'' MACRO
  (1)
  (1)  007454  011646                         $TRAP2: MOV     (SP),-(SP)        ;;MOVE THE PC DOWN
  (1)  007456  016666  000004  000002                 MOV     4(SP),2(SP)       ;;MOVE THE PSW DOWN
  (1)  007464  000002                                 RTI                       ;;RESTORE THE PSW
  (1)
  (3)                                         .SBTTL  TRAP TABLE
  (3)
  (3)                                         ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
  (3)                                         ;*BY THE ''TRAP'' INSTRUCTION.
  (3)
  (3)                                         ;       ROUTINE
  (3)                                         ;       -------
  (3)  007466  007454                         $TRPAD: .WORD   $TRAP2
  (3)  007470  006624                                 $TYPE   ;;CALL=TYPE      TRAP+1(104401)  TTY TYPEOUT ROUTINE
  (3)  007472  007070                                 $TYPOC  ;;CALL=TYPOC     TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING ZEROS)
  (3)  007474  007044                                 $TYPOS  ;;CALL=TYPOS     TRAP+3(104403)  TYPE OCTAL NUMBER (NO LEADING ZEROS)
  (3)  007476  007104                                 $TYPON  ;;CALL=TYPON     TRAP+4(104404)  TYPE OCTAL NUMBER (AS PER LAST CALL)
  (1)
  (3)  007500  005772                                 $GTSWR  ;;CALL=GTSWR     TRAP+5(104405)  GET SOFT-SWR SETTING
  (1)
  (3)  007502  005722                                 $CKSWR  ;;CALL=CKSWR     TRAP+6(104406)  TEST FOR CHANGE IN SOFT-SWR
  (3)  007504  006204                                 $RDCHR  ;;CALL=RDCHR     TRAP+7(104407)  TTY TYPEIN CHARACTER ROUTINE
  (3)  007506  006324                                 $RDLIN  ;;CALL=RDLIN     TRAP+10(104410) TTY TYPEIN STRING ROUTINE
  (3)  007510  007272                                 $RDOCT  ;;CALL=RDOCT     TRAP+11(104411) READ AN OCTAL NUMBER FROM TTY
```

```
                                        ;;*****************************************************************
                                        .SBTTL  POWER DOWN AND UP ROUTINES
 (1)
 (2)                                    ;;*****************************************************************
 (1)                                    ;POWER DOWN ROUTINE
 (1)  007512  012737  007656  000024    $PWRDN: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST UP
 (1)  007520  012737  000340  000026            MOV     #340,@#PWRVEC+2 ;;PRIO:7
 (3)  007526  010046                            MOV     R0,-(SP)        ;;PUSH R0 ON STACK
 (3)  007530  010146                            MOV     R1,-(SP)        ;;PUSH R1 ON STACK
 (3)  007532  010246                            MOV     R2,-(SP)        ;;PUSH R2 ON STACK
 (3)  007534  010346                            MOV     R3,-(SP)        ;;PUSH R3 ON STACK
 (3)  007536  010446                            MOV     R4,-(SP)        ;;PUSH R4 ON STACK
 (3)  007540  010546                            MOV     R5,-(SP)        ;;PUSH R5 ON STACK
 (3)  007542  017746  171372                    MOV     @SWR,-(SP)      ;;PUSH @SWR ON STACK
 (1)  007546  010637  007662                    MOV     SP,$SAVR6       ;;SAVE SP
 (1)  007552  012737  007564  000024            MOV     #$PWRUP,@#PWRVEC ;;SET UP VECTOR
 (1)  007560  000000                            HALT
 (1)  007562  000776                            BR      .-2             ;;HANG UP
 (1)
 (2)                                    ;;*****************************************************************
 (1)                                    ;POWER UP ROUTINE
 (1)  007564  012737  007656  000024    $PWRUP: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST DOWN
 (1)  007572  013706  007662                    MOV     $SAVR6,SP       ;;GET SP
 (1)  007576  005037  007662                    CLR     $SAVR6          ;;WAIT LOOP FOR THE TTY
 (1)  007602  005237  007662            1$:     INC     $SAVR6          ;;WAIT FOR THE INC
 (1)  007606  001375                            BNE     1$              ;;OF  WORD
 (3)  007610  012677  171324                    MOV     (SP)+,@SWR      ;;POP STACK INTO @SWR
 (3)  007614  012605                            MOV     (SP)+,R5        ;;POP STACK INTO R5
 (3)  007616  012604                            MOV     (SP)+,R4        ;;POP STACK INTO R4
 (3)  007620  012603                            MOV     (SP)+,R3        ;;POP STACK INTO R3
 (3)  007622  012602                            MOV     (SP)+,R2        ;;POP STACK INTO R2
 (3)  007624  012601                            MOV     (SP)+,R1        ;;POP STACK INTO R1
 (3)  007626  012600                            MOV     (SP)+,R0        ;;POP STACK INTO R0
 (1)  007630  012737  007512  000024            MOV     #$PWRDN,@#PWRVEC ;;SET UP THE POWER DOWN VECTOR
 (1)  007636  012737  000340  000026            MOV     #340,@#PWRVEC+2 ;;PRIO:7
 (1)  007644  104401                            TYPE                    ;;REPORT THE POWER FAILURE
 (1)  007646  010056                    $PWRMG: .WORD   PWRMSG          ;;POWER FAIL MESSAGE POINTER
 (1)  007650  012716                            MOV     (PC)+,(SP)      ;;RESTART AT START1
 (1)  007652  001562                    $PWRAD: .WORD   START1          ;;RESTART ADDRESS
 (1)  007654  000002                            RTI
 (1)  007656  000000                    $ILLUP: HALT                    ;;THE POWER UP SEQUENCE WAS STARTED
 (1)  007660  000776                            BR      .-2             ;; BEFORE THE POWER DOWN WAS COMPLETE
 (1)  007662  000000                    $SAVR6: 0                       ;;PUT THE SP HERE
```

```
                                           .SBTTL  DISPLAY MESSAGES
                                  ;THIS IS THE MESSAGE FOR THE BOTTOM OF THE SCOPE
 007664  005015  047514  042527   WD001:  .ASCIZ  <15><12>/LOWER THRESHOLD /
 007672  020122  044124  042522
 007700  044123  046117  020104
 007706     000
 007707     040  020040  020040   WD002:  .ASCIZ  /      UPPER THRESHOLD /
 007714  050125  042520  020122
 007722  044124  042522  044123
 007730  046117  020104     000
 007735     015  055012  041440   WD003:  .ASCIZ  <15><12>/Z COUNT=/
 007742  052517  052116  000075
 007750  046440  052101  044522   WD004:  .ASCIZ  / MATRIX COUNT=/
 007756  020130  047503  047125
 007764  036524     000
 007767     040  055040  047517   WD005:  .ASCIZ  /  ZOOM/
 007774  000115
 007776  041040  043455  046501   WD006:  .ASCIZ  / B-GAMMA/
 010004  040515     000
 010007     015  041412  046501   WD007:  .ASCII  <15><12>/CAMERA # /
 010014  051105  020101  020043
 010022     060                   CAMOUT: .BYTE   60
 010023     040  020040  020040           .ASCII  /     PB IS /
 010030  041120  044440  020123
 010036  050125  020040  020040   PBUP:   .ASCII  /UP     JB IS /
 010044  045040  020102  051511
 010052     040
 010053     125  000120           JBUP:   .ASCIZ  /UP/

                                  .SBTTL  ASCII MESSAGES

 010056  005015  051012  051505   PWRMSG: .ASCIZ  <15><12><12>/RESTARTED AFTER POWER FAILURE /
 010064  040524  052122  042105
 010072  040440  052106  051105
 010100  050040  053517  051105
 010106  043040  044501  052514
 010114  042522  000040
 010120  005015  041412  047132   MSG1:   .ASCIZ  <15><12><12>/CZNCDB   NCV-11 EXERCISER    /
 010126  042103  020102  020040
 010134  041516  026526  030461
 010142  042440  042530  041522
 010150  051511  051105  020040
 010156  020040     000
 010161     015  042412  052116   MSG2:   .ASCIZ  <15><12>/ENTER THRESHOLD VALUE IN OCTAL - THEN RETURN =/
 010166  051105  052040  051110
 010174  051505  047510  042114
 010202  053040  046101  042525
 010210  044440  020116  041517
 010216  040524  020114  020055
 010224  044124  047105  051040
 010232  052105  051125  020116
 010240  000075
 010242  005015  052502  020123   MSG3:   .ASCIZ  <15><12>/BUS TIMEOUT ERROR - NO VSV01 DISPLAY DETECTED  /
 010250  044524  042515  052517
 010256  020124  051105  047522
 010264  020122  020055  047516
```

```
        010272  053040  053123  030460
        010300  042040  051511  046120
        010306  054501  042040  052105
        010314  041505  042524  020104
        010322  000040
        010324  005015  047105  042524  MSG4:   .ASCIZ  <15><12>/ENTER CONSOLE BUS ADDRESS - THEN RETURN =/
        010332  020122  047503  051516
        010340  046117  020105  052502
        010346  020123  042101  051104
        010354  051505  020123  020055
        010362  044124  047105  051040
        010370  052105  051125  020116
        010376  000075
        010400  005015  052502  020123  MSG5:   .ASCIZ  <15><12>/BUS TIMEOUT ERROR - NCV11/
        010406  044524  042515  052517
        010414  020124  051105  047522
        010422  020122  020055  041516
        010430  030526  000061
        010434  005015  054524  042520  MSG6:   .ASCIZ  <15><12>/TYPE 'H' FOR HELP INFO  ENTER KEYBOARD COMMAND(S)/
        010442  021040  021110  043040
        010450  051117  044040  046105
        010456  020120  047111  047506
        010464  020040  047105  042524
        010472  020122  042513  041131
        010500  040517  042122  041440
        010506  046517  040515  042116
        010514  051450  000051
        010520  005015  047105  042524  MSG7:   .ASCIZ  <15><12>/ENTER CAMERA NUMBER 0-3 ? /
        010526  020122  040503  042515
        010534  040522  047040  046525
        010542  042502  020122  026460
        010550  020063  020077     000
        010555     015  042412  052116  MSG8:   .ASCIZ  <15><12>/ENTER CONSOLE VECTOR ADDRESS - THEN RETURN =/
        010562  051105  041440  047117
        010570  047523  042514  053040
        010576  041505  047524  020122
        010604  042101  051104  051505
        010612  020123  020055  044124
        010620  047105  051040  052105
        010626  051125  020116  000075
        010634  026440  000040          DASH:   .ASCIZ  / - /
        010640  005015  042115  030455  HELP0:  .ASCII  <15><12>/MD-11-CZNCD-B NCV11 EXERCISER/<15><12><12>
        010646  026461  055103  041516
        010654  026504  020102  041516
        010662  030526  020061  054105
        010670  051105  044503  042523
        010676  006522  005012
        010702  020104  020040  020040          .ASCII  /D       DISPLAY DATA/<15><12>
        010710  042040  051511  046120
        010716  054501  042040  052101
        010724  006501     012
        010727     105  020040  020040          .ASCII  /E       ERASE SCOPE/<15><12>
        010734  020040  051105  051501
        010742  020105  041523  050117
        010750  006505     012
        010753     114  020040  020040          .ASCII  /L       GET LOWER THRESHOLD/<15><12>
        010760  020040  042507  020124
        010766  047514  042527  020122
        010774  044124  042522  044123
        011002  046117  006504     012
   923  011007     125  020040  020040                .ASCII  /U      GET UPPER THRESHOLD/<15><12>
        011014  020040  042507  020124
        011022  050125  042520  020122
        011030  044124  042522  044123
        011036  046117  006504     012
   924  011043     101  020040  020040                .ASCII  /A      DISPLAY ISOTOPE A/<15><12>
        011050  020040  044504  050123
        011056  040514  020131  051511
        011064  052117  050117  020105
        011072  006501     012
   925  011075     102  020040  020040                .ASCII  /B      DISPLAY ISOTOPE B/<15><12>
        011102  020040  044504  050123
        011110  040514  020131  051511
        011116  052117  050117  020105
        011124  006502     012
   926  011127     127  020040  020040                .ASCII  /W      SELECT FIRST BIT MAP/<15><12>
        011134  020040  042523  042514
        011142  052103  043040  051111
        011150  052123  041040  052111
        011156  046440  050101  005015
   927  011164  020115  020040  020040                .ASCII  /M      SELECT SECOND BIT MAP/<15><12>
        011172  051440  046105  041505
        011200  020124  042523  047503
        011206  042116  041040  052111
        011214  046440  050101  005015
   928  011222  020106  020040  020040                .ASCII  /F      FREE RUN MODE/<15><12>
        011230  043040  042522  020105
        011236  052522  020116  047515
        011244  042504  005015
   929  011250  020112  020040  020040                .ASCII  /J      JOYSTICK CALIB./<15><12>
        011256  045040  054517  052123
        011264  041511  020113  040503
        011272  044514  027102  005015
   930  011300  020124  020040  020040                .ASCIZ  /T      DISPLAY INTENSITY TEST/
        011306  042040  051511  046120
        011314  054501  044440  052116
        011322  047105  044523  054524
        011330  052040  051505  000124
   931  011336  005015  020116  020040      HELP1:    .ASCII  <15><12>/N       COLLECT NEW DATA/<15><12>
        011344  020040  041440  046117
        011352  042514  052103  047040
        011360  053505  042040  052101
        011366  006501     012
   932  011371     103  020040  020040                .ASCII  /C      COLLECT MORE DATA/<15><12>
        011376  020040  047503  046114
        011404  041505  020124  047515
        011412  042522  042040  052101
        011420  006501     012
   933  011423     130  020040  020040                .ASCII  /X      CHANGE CAMERA CHANNEL/<15><12>
        011430  020040  044103  047101
        011436  042507  041440  046501
        011444  051105  020101  044103
        011452  047101  042516  006514
        011460     012
   934  011461     123  020040  020040          .ASCII  /S      STOP COLLECTION/<15><12>
        011466  020040  052123  050117
        011474  041440  046117  042514
        011502  052103  047511  006516
        011510     012
   935  011511     107  020040  020040          .ASCII  /G      INITILIZE/<15><12>
        011516  020040  047111  052111
        011524  046111  055111  006505
        011532     012
   936  011533     132  020040  020040          .ASCII  /Z      ZOOM GAIN/<15><12>
        011540  020040  047532  046517
        011546  043440  044501  006516
        011554     012
   937  011555     122  020040  020040          .ASCII  /R      REGULAR GAIN/<15><12>
        011562  020040  042522  052507
        011570  040514  020122  040507
        011576  047111  005015
   938  011602  020117  020040  020040          .ASCII  /O      OTHER CONSOLE TERMINAL/<15><12>
        011610  047440  044124  051105
        011616  041440  047117  047523
        011624  042514  052040  051105
        011632  044515  040516  006514
        011640     012
   939  011641     110  020040  020040          .ASCII  /H      HELP THE OPERATOR AND REPEAT THIS LIST/
        011646  020040  042510  050114
        011654  052040  042510  047440
        011662  042520  040522  047524
        011670  020122  047101  020104
        011676  042522  042520  052101
        011704  052040  044510  020123
        011712  044514  052123
   940  011716     015     012     000  BCRLF:  .BYTE   15,12,0
   941
   942                                  ;LOC. 20000 THRU 57776 ARE BUFFER AREA
   943
   944          000001                          .END
```

```
                                                                                G  4
CZNCDB  NCV11 EXERCISER MACY11 30G(1063)  31-AUG-79  13:08  PAGE 19
CZNCDB.P11     31-AUG-79 11:21              CROSS REFERENCE TABLE -- USER SYMBOLS                                          SEQ 0045

ABASE = 172760              10#     32      50      51      52      53      54      55      56      57
AWRIT   005342             515     519     546     550     568     572     808#
BCRLF   011716             575     940#
BELLEN  001322              95#
BIT0  = 000001              11#    630     689
BIT00 = 000001              11#
BIT01 = 000002              11#
BIT02 = 000004              11#
BIT03 = 000010              11#
BIT04 = 000020              11#
BIT05 = 000040              11#
BIT06 = 000100              11#
BIT07 = 000200              11#
BIT08 = 000400              11#
BIT09 = 001000              11#
BIT1  = 000002              11#
BIT10 = 002000              11#    320     370
BIT11 = 004000              11#    629
BIT12 = 010000              11#
BIT13 = 020000              11#
BIT14 = 040000              11#
BIT15 = 100000              11#
BIT2  = 000004              11#
BIT3  = 000010              11#
BIT4  = 000020              11#
BIT5  = 000040              11#    233     525     638
BIT6  = 000100              11#    533
BIT7  = 000200              11#
BIT8  = 000400              11#    236     277     322     344     696
BIT9  = 001000              11#
BOOBOO  002034             170     173     176     212#    289     304     315
BOX     003144             384     388#
BPTVEC= 000014              11#
CAMERA  001300              86#    362*    363     521     688
CAMOUT  010022             523*    902#
CHANGE  003122             218     220     223     241     270     327     337     367     377#
CHARCT  001306              89#    419*    428*
CKSWR = 104406             888#
COMSAV  001276              85#    590     695*
CPERL   001310              90#    436*    456
CR    = 000015              11#    881
CRLF  = 000200              11#    881
DASH    010634             549     571     918#
DCONT   005072             394     401     607     614     730#
DDISP = 177570              11#     21     102
DISBG   004462             629#
DISLOP  003420             444#    496     508
DISPLA  001142              21#    102*
DISPRE  000174              18#    102
DISPY   005060             390     397     408     411     494     603     610     618     621     728#
DISPY2  005122             642     741#    742
DMATRX  003376             441#
DSWR  = 177570              11#     21     102
DUMMY1  001246              73#    521*    522*    523     544*    551     566*    573
DUMMY2  001250              74#    545*    547     567*    569
EMTVEC= 000030              11#
```

```
                                                                 H  4
CZNCDB  NCV11 EXERCISER MACY11 30G(1063)  31-AUG-79  13:08  PAGE 19-1
CZNCDB.P11     31-AUG-79 11:21            CROSS REFERENCE TABLE -- USER SYMBOLS                                   SEQ 0046

ERASE    005020          224     242     246     377     598     715#
ERRVEC=  000004           11#    102*    114*    121*    290     291*    299*    313*    667*    676*
FREERN   001316           93#    160*    226*    587
GAIN     001302           87#    125*    319*    370*    371     579     687
GNS   =  ****** U         18     888
GTSWR =  104405          888#
HELP0    010640          251     919#
HELP1    011336          253     255     931#
HT    =  000011           11#    881
INTLUT   001252           75#    670
IOTVEC=  000020           11#
JBUP     010053          535*    536*    538*    539*    905#
KBINT    005220          129     773#
KBUFF    001266           81#    162*    166     168*    233*    234     773*    774     775*    776
LARGES   003316          419#
LDIMGE   005152          326     755#
LF    =  000012           11#    881
LISEN    001656          160#    238     778
LISN     001702          164     166#    167     215     222     225     256     259     278     281     321     324     345
                         372     385     591
MAPADR   001260           78#    414*    476     499*    500     507*
MAPLD    003542          455     471     476#
MATRIX=  020000           16#     92     124     126     217     219     583     686     706     708
MRXADR   001256           77#    441*    442*    444     445*    449*
MSELCT   001320           94#    273*    340*    660
MSG1     010120          103     910#
MSG2     010161          264     331     911#
MSG3     010242          107     912#
MSG4     010324          285     913#
MSG5     010400          118     914#
MSG6     010434          132     915#
MSG7     010520          349     916#
MSG8     010555          300     917#
MXSML    004202          562#    565
NCADM    001212           55#
NCADR    001164           32#    108
NCBAR    001206           53#    544     705*
NCBAR1   001216           57#
NCCSR    001200           50#    109     115     237*    320*    323*    363*    371*    590*    685*    687*    688*    689*
                         695     697*
NCJOY    001214           56#    633
NCOFF    001202           51#    124*    686*
NCSET    001516          110#    113
NCSFR    001210           54#    236*    322*    525     533     629*    630*    631     638     696*
NCSTP    004744          325     381     695#    703
NCSTP1   004766          123     227     279     703#
NCSTRT   004704          221     228     280     685#
NCWCR    001204           52#    545     704*
NOVSV    001324           96#    106*    244     257     271     338     383     715
NUMBEG   005462          825     830#
NUMEND   005470          811     831#
PATWRT   003720          435     503     512#
PBUP     010036          527*    528*    530*    531*    904#
PIRQ  =  177772           11#
PIRQVE=  000240           11#
PIXASM   001264           80#    416*    486*    487*    488*    489*    490*    493     497*
```

```
PIXCNT  001262           79#     415*     491      495*     498*
PR0    = 000000          11#
PR1    = 000040          11#
PR2    = 000100          11#
PR3    = 000140          11#
PR4    = 000200          11#
PR5    = 000240          11#
PR6    = 000300          11#
PR7    = 000340          11#
PS     = 177776          11#
PSW    = 177776          11#
PWRMSG  010056          891      909#
PWRVEC= 000024           11#     102*     891*
RDCHR = 104407          879      888#
RDLIN = 104410          885      888#
RDOCT = 104411          265      286      301      332      350      888#
RESVEC= 000010           11#
ROUTA   002054          182      217#
ROUTB   002066          183      219#
ROUTC   002100          184      221#
ROUTD   002110          185      223#
ROUTE   002114          186      224#
ROUTF   002124          187      226#     589
ROUTG   002220          188      242#
ROUTH   002230          189      244#
ROUTJ   002302          191      257#
ROUTL   002320          193      261#
ROUTM   002360          194      271#
ROUTN   002420          195      279#
ROUTO   002434          196      282#
ROUTR   002614          199      319#
ROUTS   002632          200      322#
ROUTT   002650          201      325#
ROUTU   002664          202      328#
ROUTW   002724          204      338#
ROUTX   002762          205      346#
ROUTZ   003102          207      370#
ROWCNT  001312           91#     443*     446*     448*
RTABLE  001750          175      177      182#
SCLCEL  003474          453      456#
SELCTA  004546          104      274      341      653#
STACK = 001100           11#     102      161
START   001326           18      102#     120      310
START1  001562          116      121#     243      891
STKLMT= 177774           11#
SWR     001140           21#     102*     879*     891*
SWREG   000176           18#     102      879
SW0    = 000001          11#
SW00   = 000001          11#
SW01   = 000002          11#
SW02   = 000004          11#
SW03   = 000010          11#
SW04   = 000020          11#
SW05   = 000040          11#
SW06   = 000100          11#
SW07   = 000200          11#
```

```
SW08   = 000400         11#
SW09   = 001000         11#
SW1    = 000002         11#
SW10   = 002000         11#
SW11   = 004000         11#
SW12   = 010000         11#
SW13   = 020000         11#
SW14   = 040000         11#
SW15   = 100000         11#
SW2    = 000004         11#
SW3    = 000010         11#
SW4    = 000020         11#
SW5    = 000040         11#
SW6    = 000100         11#
SW7    = 000200         11#
SW8    = 000400         11#
SW9    = 001000         11#
TABLEX   001314         92#     126*    217*    219*    420     421     441     561     583     756
TBITVE=  000014         11#
TEMP0    001240         70#     558*    564*    633*    743*    744     838     852*
TEMP1    001242         71#
TEMP2    001244         72#
THHI     001274         84#     128*    333*    424     450     520
THLO     001272         83#     127*    266*    433     452     516
TIME     001172         44#     230
TJOY     004332        260      598#
TKVEC  = 000060         11#      46      47
TKVEC0   001174         46#     129*    306*
TKVEC1   001176         47#     130*    307*    308*
TOTSIZ   001304         88#     419     558
TPVEC  = 000064         11#
TRAPVE=  000034         11#     102*
TRTVEC=  000014         11#
TTYOUT   001270         82#     212*    784*    786*    789
TYPCR    005260        214      784#
TYPE   = 104401        103      107     118     132     255     264     285     300     331     349     879     881     883
                       885      888#    891
TYPO     005300        213      785     787#    788
TYPOC  = 104402        879      888#
TYPON  = 104404        888#
TYPOS  = 104403        888#
VTMADR   001170         40#     659
VTVADR   001166         36#     653
VTVCHP   001222         60#     744*
VTVCRG   001220         59#     112     654     668     721*    741     745*    797     801*
VTVCSR   001226         63#     276     343     413*    625*    657     669     717*    718     720*    728*    730*    731
                       734*
VTVINT   001236         67#     665     671*
VTVMAP   001230         64#     729*
VTVPOS   001224         61#     249*    512*
VTVPX    001232         65#     733*
VTVPX1   001234         66#
VTVSAV   001254         76#     413     625
VTWRIT   005316        250      252     513     517     540     542     548     552     570     574     581     585     796#
                       824
WD001    007664        514      895#
```

```
WD002    007707          518      896#
WD003    007735          543      897#
WD004    007750          553      898#
WD005    007767          582      899#
WD006    007776          586      900#
WD007    010007          541      901#
XYAVE    005472          637      837#
XYBUF    005620          843      845      848      870#     876
XYBUFE=  005720          841      861      875#
XYBUFP   005720          839      844*     876#
$AUTOB   001134           21#     879
$BDADR   001122           21#
$BDDAT   001126           21#
$CHARC   007040          881#*
$CKSWR   005722          879#     888
$CMTAG   001100           21#     102
$CM3   = 000000           21#
$CNTLG   006574          879#
$CNTLU   006567          879#
$CRLF    001161           21#     879      881      885
$ERFLG   001103           21#
$ERMAX   001115           21#
$ERRPC   001116           21#
$ERRTB   001164           21#
$ERTTL   001112           21#
$FILLC   001156           21#     881
$FILLS   001155           21#     881
$GDADR   001120           21#
$GDDAT   001124           21#
$GTSWR   005772          879#     888
$HD    = 000003            9
$HIOCT   007430          885#*
$ICNT    001104           21#
$ILLUP   007656          891#
$INTAG   001135           21#     879
$ITEMB   001114           21#
$LF      001162           21#     879      881      885
$LPADR   001106           21#
$LPERR   001110           21#
$MAIL  = ****** U        102      881
$MNEW    006612          879#
$MSWR    006601          879#
$NULL    001154           21#     881
$OCNT    007266          883#*
$OMODE   007270          883#*
$PASS    001100           21#
$PWRAD   007652          891#
$PWRDN   007512          102      891#
$PWRMG   007646          891#
$PWRUP   007564          891#
$QUES    001160           21#     879      881      885
$RDCHR   006204          879#     888
$RDDEC=  ****** U        888
$RDLIN   006324          879#     888
$RDOCT   007272          885#     888
$RDSZ  = 000007          879#
```

```
$R2A   = ****** U          888
$SAVRE= ****** U           888
$SAVR6  007662             891#*
$SETUP= 000114             101#     102      879
$STUP  = 177777            101#
$SWR   = 160000              9#      21      891
$TKB    001146              21#     773      879
$TKS    001144              21#     131*     293      879*
$TN    = 000001              9#
$TPB    001152              21#     774*     789*     881*
$TPFLG  001157              21#     881
$TPS    001150              21#     787      881
$TRAP   007432             102      888#
$TRAP2  007454             888#
$TRP   = 000012            888#
$TRPAD  007466             888#
$TSTNM  001102              21#
$TTYIN  006560             879#
$TYPBN= ****** U           888
$TYPDS= ****** U           888
$TYPE   006624             881#     888
$TYPEC  006774             879      881#
$TYPEX  007042             881#
$TYPOC  007070             883#     888
$TYPON  007104             883#     888
$TYPOS  007044             883#     888
$OFILL  007267             883#*
.      = 011721             18#      19#      21#     102      832#     875      879#     881      885      891
```

```
CZNCDB  NCV11 EXERCISER MACY11 30G(1063)  31-AUG-79  13:08  PAGE 20
CZNCDB.P11     31-AUG-79 11:21            CROSS REFERENCE TABLE -- MACRO NAMES                                        SEQ 0051

COMMEN     11#
ENDCOM     11#
ERROR      11#
ESCAPE     11#
GETPRI     11#
GETSWR     11#
MULT       11#
NEWTST     11#
POP        11#     885     891
PUSH       11#     885     891
REPORT     11#
SCOPE      11#
SETPRI     11#
SETTRA    888#
SETUP      11#     102
SKIP       11#
SLASH      11#
SPACE      11#
STARS      11#      21     648     652     682     684     692     694     700     702     712     714     724     727     738
          740      748     754     770     772     781     783     792     794     805     807     834     836     878     879
          880      881     882     883     884     885     887     888     890     891
SWRSU      11#     102#
TRMTRP    888#
TYPBIN     11#
TYPDEC     11#
TYPNAM     11#
TYPNUM     11#
TYPOCS     11#
TYPOCT     11#     879
TYPTXT     11#
$$CMRE     21#
$$CMTM     21#
$$ESCA     11#
$$NEWT     11#
$$SET     888#
$$SKIP     11#
.EQUAT      6#      11
.HEADE      6#       9
.SETUP      6#     101
.$CATC      6#      18
.$CMTA      6#      21
.$POWE      7#     891
.$RDOC      7#     885
.$READ      7#     879
.$TRAP      7#     888
.$TYPE      7#     881
.$TYPO      7#     883


. ABS.   011721     000     CON    RO    ABS    GBL    D


 ERRORS DETECTED:  0

 CZNCDB,CZNCDB/CRF=CZNCDB
 RUN-TIME: 13 6 .7 SECONDS
```

```
RUN-TIME RATIO: 30/20=1.4
CORE USED:  18K  (35 PAGES)
```