```
;       RCSL:   44-018n

;       VERSION:  10.11.71   JEP


;               PROGRAM
;               *******
;
;       RC 3600 -  POWER SHUT DOWN TEST
;
;               TAPES
;
;       BINARY: RCSL  44-T5.1/0
;
;1.     ABSTRACT.
;       POWER SHUT DOWN TEST IS A MAINTENANCE PROGRAM DESIGNED
;       TO TEST THE POWER MONITOR AND AUTORESTART OPTION. THE
;       PROGRAM ALSO TEST FOR MEMORY RETENTION UPON POWER SHUT
;       DOWN. IT IS TO BE USED WITH OR WITHOUT THE POWER MONITOR
;       OPTION.

;2.     MACHINE REQUIREMENTS.
;2.1    CPU: NOVA, SUPERNOVA, SUPER SC, 1200 OR 800.
;2.2    4K READ/WRITE MEMORY. (SEE 7. FOR 1-2K)
;2.3    TELETYPE OR DISPLAY FOR ERROR MESSAGE
;2.4    OPTIONAL EQUIPMENT
;2.4.1  POWER MONITOR AUTORESTART OPTION

;5.     SWITCH SETTINGS
;5.1    STARTING ADDRESS  = 000002
;5.2    RESTART  ADDRESS  = 000040


;4.     OPERATING PROCEDURE/OPERATOR INPUT
;4.1    LOAD THE PROGRAM VIA THE BINARY LOADER.
;4.2    SET THE SWITCHES TO 000002
;4.3    PRESS START
;
;4.4    OPERATION WITHOUT THE POWER MONITOR.
;4.4.1  THE PROGRAM WILL REQUEST THE OPERATOR TO TURN THE
;       COMPUTER OFF,ON AND TO RESTART IT. (SW = 40, PRESS START).
;       DISPLAY: OFF,ON,REST.
;4.4.2  UPON RESTART THE PROGRAM WILL RING THE
;       TELETYPE BELL 3 TIMES AND SOUND THE AUDIO ALARM
;       DISPLAY: BBB
;4.4.3  THE OPERATOR SHOULD REPEATLY PERFORM THE POWER
;       OFF-RESTART SEQUENCE. AFTER EACH RESTART ALLOW
;       2-3 SECONDS FOR A POSSIABLE ERROR MESSAGE.
;
;4.5    OPERATION WITH THE POWER MONITOR OPTION.
;4.5.1  THE PROGRAM WILL REQUEST THE OPERATOR TO TURN THE
;       COMPUTER OFF, ON AND TO RESTART IT. (SW = 40, PRESS START).
;       DISPLAY: OFF,ON,REST.
;4.5.2  UPON RESTART THE PROGRAM WILL RING THE
;       TELETYPE BELL 3 TIMES AND SOUND THE AUDIO ALARM
;       DISPLAY: BBB
;4.5.3  AFTER SEVERAL RESTARTS LOCK THE CONSOLE
;       AND REMOVE THE WALL PLUG.
;4.5.4  WHEN COMPUTER POWER IS RESTORED THE PROGRAM
;       WILL BE RESTARTED WITHOUT OPERATOR INTERVENTION.
;       THE TELETYPE BELL WILL BE RUNG 3 TIMES
;       AND THE AUDIO ALARM WILL SOUND EACH TIME
;       POWER IS RESTORED. DISPLAY: - B B B -.
;4.5.5  THE OPERATOR SHOULD REPEATLY REMOVE AND RESTORE
;       POWER. AT EACH RESTORATION OF POWER ALLOW 2-3
;       SECONDS FOR POSSIABLE ERROR MESSAGES.
```

```
;5.      PROGRAM OUTPUT/ERROR DESCRIPTION.
;5.1     MESSAGE: -THE PROCESSOR DID NOT RUN FOR 2 MS
;        AFTER THE POWER FAIL FLAG-  AFTER THE POWER
;        FAIL FLAG IS SET A MEMORY LOCATION IS COUNTED
;        TO ZERO. IF THE PROCESSOR STOPPED BEFORE THE
;        COUNT REACHED ZERO, THE PROCESSOR DID NOT RUN
;        THE REQUIRED 2 MS.
;        DISPLAY MESSAGE: -5.1 MILLI-
;5.2     MESSAGE: - NO INTERRUPT DETECTED ON POWER SHUT
;        DOWN -  WHEN POWER WAS REMOVED THE POWER FAIL
;        FLAG DID NOT SET, OR IT DID NOT CAUSE A INTER-
;        RUPT. THIS IS A NORMAL MESSAGE ON E. G. NOVA
;        MACHINES WITHOUT THE POWER MONITOR OPTION.
;        SOME NEW TYPES OF CPU'S, E. G. 1200 HAVE
;        INTERRUPT FACILITY EVEN WITHOUT OPTION.
;        DISPLAY MESSAGE: - 5.2 NOINT -.
;5.3     MESSAGE: - COMPUTER WAS RESTARTED WITHOUT A POWER
;        FAIL INTERRUPT -  THIS MESSAGE WILL OCCURE ANYTIME
;        THE PROCESSUR IS STARTED AT LOCATION 0 WITHOUT
;        FIRST BEING PROCEEDED BY A POWER FAIL INTERRUPT.
;        DISPLAY MESSAGE:  - 5.3 FUNNE -.
;5.4     MESSAGE: - PROGRAM SUM CHECK. EXAMINE THE CHECK
;        ROUTINE -  THE PROGRAM HAS BEEN MODIFIED BY THE
;        POWER UP-DOWN SEQUENCE. EXAMINE LOCATION CHECK
;        AND THE NEXT 20 INSTRUCTIONS.  MANUALLY CORRECT
;        THE PROGRAM. CHECK MEM-OK AND +5 OK.
;        DISPLAY MESSAGE: - 5.4 MSUM -.
;5.5     IF LOCATION IN THE MEMORY ADDRESS PATTERN ARE
;        MODIFIED THE PROGRAM WILL TYPE:
;        C(ADDRESS)=XXXXX.  THIS MESSAGE INDICATES MEMORY
;        DATA IS BEING LOST ON POWER SHUT DOWN.
;        DISPLAY MESSAGE: - THE SAME.
;5.6     MESSAGE: - A INTERRUPT BUT NO POWER FAIL DONE FLAG
;            XX-.  XX IS OCTAL DEVICE CODE REQUESTING INTERR.
;        DISPLAY MESSAGE: -5.6 NODONE    XX-.
;5.7     MESSAGE: - POWER TURN ON FAILED TO CLEAR ACCUMULATORS.
;        DISPLAY MESSAGE: -5.7 MZERO -
;
;6.      PROGRAM DESCRIPTION/THEORY OF OPERATION.
;        THE MEMORY IS FILLED WITH A ADDRESS PATTERN, THIS
;        PATTERN IS CONTINUALLY CHECKED DURING THE POWER
;        UP-DOWN SEQUENSE PERFORMED BY THE OPERATOR. ANY
;        LOSS OF DATA IS DETECTED AND PRINTED AS A ERROR.
;        THE ADDRESS PATTERN IS NOT REWRITTEN UNLESS A
;        ERROR IS DETECTED.
;
;7.      LIMITATIONS/MISC.
;        THE FINAL LOCATION USED BY THE ADDRESS PATTERN
;        MAY BE MODIFIED BY CHANGING LOCATION -FADR-.
;
;8.      AUDIO ALARM.
;        1 TOOT:   DISPLAY MESSAGE FOR 3 SECONDS.
;        IF YOU PRESS STOP WITHIN THESE 3 SECONDS
;        THE DISPLAY WILL KEEP THE MESSAGE. PRESS
;        CONTINUE WHEN MESSAGE NO LONGER NEEDED.
;        2 TOOTS:  HARD ERROR, PROGRAM WILL HALT.
;        3 TOOTS:  MACINE RUNS AFTER POWER UP.
```

```
        000001  .LOC 1
00001 000172            INIR
00002 000221            JMP     STEP1

                                ;INDIRECT ADDRESSES
00003 001124    ICRLF:  CRLF
00004 000766    IMESS:  MESS
00005 001005    IZUCT:  ZUCT
00006 001007    IPUCT:  PUCT
00007 001244    IKINC:  KINC
00010 001274    INIRET: NIRET
00011 001212    IDISATT:        DISATT
00012 000401    INODN:  NODN
00013 001245    IWTYP:  NWTYP
00014 001325    IWAIT:  XWAIT
00015 001217    IHAATT: HAATT
00016 001201    IDCL:   DDCL
00017 001155    IDISP:  DDISP

                        ;DEFINITIONS
        000032   FUN=32
        000035   DIS=35
        000011  .TTO=TTO
        006016  CDCL=JSR @IDCL
        006017  CDISP=JSR @IDISP
        006011  CDISATT=JSR @IDISATT
        006015  CHAATT=JSR @IHAATT
        006014  WAIT=JSR @IWAIT
        006013  WTYP=JSR @IWTYP

        000040  .LOC 40

00040 102415    REST:   SUB#    0,0,SNR
00041 126414            SUB#    1,1,SZR
00042 000047            JMP     ZERR
00043 152415            SUB#    2,2,SNR
00044 176414            SUB#    3,3,SZR
00045 000047            JMP     ZERR
00046 000056            JMP     BELL

00047 006003    ZERR:   JSR     @ICRLF
00050 006004            JSR     @IMESS
00051 000662            MZERO
00052 006016            JSR     @IDCL
00053 006017            JSR     @IDISP
00054 000747            MZ
00055 006011            CDISATT

00056 006004    BELL:   JSR     @IMESS
00057 000710            MBELL
00060 006016            CDCL
00061 006015            CHAATT
00062 006014            WAIT
00063 000303            SEC15
00064 006015            CHAATT
00065 006014            WAIT
00066 000303            SEC15
00067 006015            CHAATT
00070 006017            JSR     @IDISP
00071 000764            MB
```

```
00072 034316  SUMCH:  LDA     3,CKSUM ;PERFORM A SUM CHECK
00073 030317          LDA     2,CKWC  ;ON THE PROGRAM
00074 020320          LDA     0,SUM
00075 025400          LDA     1,0,3
00076 123000          ADD     1,0
00077 175400          INC     3,3
00100 151404          INC     2,2,SZR
00101 000075          JMP     .-4
00102 101004          MOV     0,0,SZR
00103 000123          JMP     SUMER   ;ERROR
00104 010321          ISZ     NDF
00105 102401          SUB     0,0,SKP
00106 002012          JMP     @INODN  ;NO DONE FLAG
00107 040321          STA     0,NDF
00110 020272          LDA     0,IFLAG ;RESTART HERE
00111 101005          MOV     0,0,SNR
00112 000137          JMP     REST1
00113 006003          JSR     @ICRLF  ;MESSAGE NO INTERRUPT,
00114 006004          JSR     @IMESS  ;PRINTER
00115 000551          NOINT
00116 006016          JSR     @IDCL
00117 006017          JSR     @IDISP
00120 000720          NOI
00121 006011          CDISATT
00122 000253          JMP     STEP2

00123 006003  SUMER:  JSR     @ICRLF
00124 006004          JSR     @IMESS
00125 000633          MSUM
00126 006016          JSR     @IDCL
00127 006015          CHAATT
00130 006014          WAIT
00131 000303          SEC15
00132 006015          CHAATT
00133 006017          JSR     @IDISP
00134 000734          MS
00135 063077          HALT            ;PROGRAM SUM CHECK
00136 000135          JMP     .-1

00137 022007  REST1:  LDA     0,@IKINC ;ONLY MONITOR
00140 101004          MOV     0,0,SZR
00141 000145          JMP     TERR
00142 022010          LDA     0,@INIRET
00143 101005          MOV     0,0,SNR
00144 000154          JMP     REST2
00145 006003  TERR:   JSR     @ICRLF  ;DID NOT RUN FOR 2MS
00146 006004          JSR     @IMESS
00147 000513          MILLI
00150 006016          JSR     @IDCL
00151 006017          JSR     @IDISP
00152 000712          MI
00153 006011          CDISATT

00154 020273  REST2:  LDA     0,CNG   ;ONLY MONITOR
00155 040000          STA     0,0     ;SET LOC 0 FOR PHONEY RESTART
00156 062677          IORST
00157 102000          ADC     0,0
00160 062077          MSKO    0
00161 040272          STA     0,IFLAG
00162 020300          LDA     0,SAVC
00163 101100          MOVL    0,0
00164 020274          LDA     0,SAV0  ;RESTORE MACHINE STATE
00165 024275          LDA     1,SAV1
00166 030276          LDA     2,SAV2
00167 034277          LDA     3,SAV3
00170 060177          INTEN
00171 002301          JMP     @SAVPC  ;EXIT
```

```
00172 063677  INTR:   SKPDN   CPU
00173 000214          JMP     INTQ     ;INTERRUPT BUT NOT POWERFAIL
00174 040274          STA     0,SAV0
00175 044275          STA     1,SAV1
00176 050276          STA     2,SAV2
00177 054277          STA     3,SAV3
00200 101200          MOVR    0,0
00201 040300          STA     0,SAVC
00202 020000          LDA     0,0
00203 040301          STA     0,SAVPC

00204 102400  INTR1:  SUB     0,0      ;SET A FLAG
00205 040272          STA     0,IFLAG  ;TO INDICATE INTERRUPTS.
00206 020302          LDA     0,CREST
00207 040000          STA     0,0      ;SETUP 0 FOR AUTO RESTART.
00210 006014          WAIT
00211 000304          CONST
00212 004341          JSR     FILL
00213 000212          JMP     .-1

00214 102000  INTQ:   ADC     0,0
00215 040321          STA     0,NDF
00216 061477          INTA    0
00217 040311          STA     0,ACK
00220 002012          JMP     @INODN

00221 006013  STEP1:  WTYP             ;START HERE
00222 034316          LDA     3,CKSUM  ;CALCULATE
00223 030317          LDA     2,CKWC   ;SUM FOR
00224 102400          SUB     0,0      ;LATER SUM CHECK
00225 025400          LDA     1,0,3
00226 123000          ADD     1,0
00227 175400          INC     3,3
00230 151404          INC     2,2,SZR
00231 000225          JMP     .-4
00232 100400          NEG     0,0
00233 040320          STA     0,SUM
00234 020273          LDA     0,CNG
00235 040000          STA     0,0      ;SETUP FOR PHONEY RESTART
00236 040321          STA     0,NDF
00237 062677          IORST
00240 102000          ADC     0,0
00241 062077          MSKO    0
00242 040272          STA     0,IFLAG  ;SET INTERRUPTED FLAG
00243 060177          INTEN
00244 004341          JSR     FILL
00245 006003          JSR     @ICRLF
00246 006004          JSR     @IMESS
00247 000450          ONOFF
00250 006016          JSR     @IDCL
00251 006017          JSR     @IDISP
00252 000755          ON

00253 004322  STEP2:  JSR     CHECK    ;CHECK THE ADDRESS PATTERN
00254 004341          JSR     FILL     ;RETURN+2 IF NO ERROR
00255 000253          JMP     STEP2
```

```
00256 006003   NG:     JSR     @ICRLF  ;A RESTART OCCURED
00257 006004           JSR     @IMESS  ;WITHOUT A INTERRUPT
00260 000576           FUNNE
00261 006016           JSR     @IDCL
00262 006015           CHAATT
00263 006014           WAIT
00264 000303           SEC15
00265 006015           CHAATT
00266 006017           JSR     @IDISP
00267 000726           FU
00270 063077           HALT
00271 000270           JMP     .-1

00272 000000   IFLAG:  0
00273 000256   CNG:    JMP NG
00274 000000   SAV0:   0
00275 000000   SAV1:   0
00276 000000   SAV2:   0
00277 000000   SAV3:   0
00300 000000   SAVC:   0
00301 000000   SAVPC:  0
00302 000040   CREST:  REST
      000012   .RDX 10
00303 000226   SEC15:  150
00304 000002   CONST:  2
      000010   .RDX 8
00305 007600   FADR:   7600
00306 001353   IADR:   FDU+10
00307 000000   CKRET:  0
00310 000000   ESWT:   0
00311 000000   ACK:    0
00312 000000   ER0:    0
00313 000000   ER1:    0
00314 000000   ER2:    0
00315 000000   ER3:    0
00316 000322   CKSUM:  CHECK
00317 177752   CKWC:   -26
00320 000000   SUM:    0               ;PUT HERE BY PROGRAM
00321 000000   NUF:    0
```

```
00322 020305  CHECK:  LDA     0,FADR  ;CHECK CONTENTS OF MEMORY
00323 030306          LDA     2,IADR
00324 054307          STA     3,CKRET
00325 126520          SUBZL   1,1
00326 044310          STA     1,ESWT
00327 025000  CK1:    LDA     1,0,2   ;WORD FROM MEMORY
00330 132414          SUB#    1,2,SZR
00331 004350          JSR     CKEXX   ;ERROR
00332 151400          INC     2,2
00333 142414          SUB#    2,0,SZR
00334 000327          JMP     CK1
00335 030310          LDA     2,ESWT  ;RETURN+2 IF NO ERR
00336 034307          LDA     3,CKRET
00337 157000          ADD     2,3
00340 001400          JMP     0,3

00341 020305  FILL:   LDA     0,FADR  ;WRITE THE ADDRESS PATTERN.
00342 030306          LDA     2,IADR
00343 051000          STA     2,0,2
00344 151400          INC     2,2
00345 112414          SUB#    0,2,SZR
00346 000343          JMP     FILL+2
00347 001400          JMP     0,3

00350 040312  CKEXX:  STA     0,ER0   ;ERROR PRINTER
00351 044313          STA     1,ER1
00352 050314          STA     2,ER2
00353 054315          STA     3,ER3
00354 006003          JSR     @ICRLF
00355 006004          JSR     @IMESS  ;MESSAGE  C(
00356 000444          CC
00357 006016          JSR     @IDCL
00360 006017          JSR     @IDISP
00361 000444          CC
00362 024314          LDA     1,ER2   ;MEMORY ADDRESS
00363 006005          JSR     @IZOCT
00364 006004          JSR     @IMESS
00365 000446          CCX             ;MESSAGE  )=
00366 006017          JSR     @IDISP
00367 000446          CCX
00370 024313          LDA     1,ER1   ;MEMORY VALUE
00371 006006          JSR     @IPOCT
00372 006011          CDISATT
00373 126400          SUB     1,1
00374 044310          STA     1,ESWT
00375 020312          LDA     0,ER0
00376 024313          LDA     1,ER1
00377 030314          LDA     2,ER2
00400 002315          JMP     @ER3

00401 006003  NODN:   JSR     @ICRLF
00402 006004          JSR     @IMESS
00403 000417          NODONE
00404 006016          JSR     @IDCL
00405 006015          CHAATT
00406 006014          WAIT
00407 000303          SEC15
00410 006015          CHAATT
00411 006017          JSR     @IDISP
00412 000741          NOD
00413 024311          LDA     1,ACK
00414 006005          JSR     @IZOCT
00415 063077          HALT
00416 000777          JMP     .-1
```

```
00417 020101   NODONE: .TXT =A
00420 047111   LN
00421 042524   IE
00422 051122   RR
00423 050125   UP
00424 020124   I
00425 052502   BU
00426 020124   I
00427 047516   NO
00430 050040    P
00431 053517   UW
00432 051105   ER
00433 043040    F
00434 044501   AI
00435 020114   L
00436 047504   UU
00437 042516   NE
00440 043040    F
00441 040514   LA
00442 020107   G
00443 000000   =        ;A INTERRUPT BUT NO POWER FAIL DONE FLAG
00444 024103   CC:  .TXT =C(
00445 000000   =        ;C(
00446 036451   CCX:  .TXT =)=
00447 000000   =        ;)=
00450 052524   UNOFF:  .TXT =TU
00451 047122   RN
00452 052040    T
00453 042510   HE
00454 041440    C
00455 046517   UM
00456 052520   PU
00457 042524   IE
00460 020122   R
00461 043117   OF
00462 027106   F.
00463 052524   TU
00464 047122   RN
00465 052040    T
00466 042510   HE
00467 041440    C
00470 046517   UM
00471 052520   PU
00472 042524   IE
00473 020122   R
00474 047117   ON
00475 040440    A
00476 042116   ND
00477 051440    S
00500 040524   IA
00501 052122   RT
00502 040440    A
00503 020124   I
00504 047514   LO
00505 040503   CA
00506 044524   TI
00507 047117   ON
00510 032040    4
00511 027060   0.
00512 000040   =        ;TURN THE COMPUTER OFF.
               ;TURN THE COMPUTER ON AND START AT LOCATION 40.
```

```
00513 044124   MILLI: .TXT -TH
00514 020105   E
00515 051120   PR
00516 041517   OC
00517 051505   ES
00520 047523   SO
00521 020122   R
00522 044504   DI
00523 020104   D
00524 047516   NO
00525 020124   T
00526 052522   RU
00527 020116   N
00530 047506   FO
00531 020122   R
00532 046462   2M
00533 020123   S
00534 043101   AF
00535 042524   TE
00536 020122   R
00537 044124   TH
00540 020105   E
00541 047520   PO
00542 042527   WE
00543 020122   R
00544 040506   FA
00545 046111   IL
00546 043040    F
00547 040514   LA
00550 000107   G-        ;THE PROCESSOR DID NOT RUN
               ;FOR 2MS AFTER THE POWER FAIL FLAG
00551 047516   NOINT: .TXT -NO
00552 044440    I
00553 052116   NT
00554 051105   ER
00555 052522   RU
00556 052120   PT
00557 042040    D
00560 052105   ET
00561 041505   EC
00562 042524   TE
00563 020104   D
00564 047117   ON
00565 050040    P
00566 053517   OW
00567 051105   ER
00570 051440    S
00571 052510   HU
00572 020124   T
00573 047504   DO
00574 047127   WN
00575 000000   -         ;NO INTERRUPT DETECTED ON POWER SHUT DOWN
```

```
00576 044124  FUNNE: .TXT -TH
00577 020105  E
00600 040515  MA
00601 044103  CH
00602 047111  IN
00603 020105  E
00604 040527  WA
00605 020123  S
00606 042522  RE
00607 052123  ST
00610 051101  AR
00611 042524  TE
00612 020104  D
00613 044527  WI
00614 044124  TH
00615 052517  UU
00616 020124  T
00617 020101  A
00620 047520  PU
00621 042527  WE
00622 020122  R
00623 040506  FA
00624 046111  IL
00625 044440   I
00626 052116  NT
00627 051105  ER
00630 052522  RU
00631 052120  PT
00632 000056  .=      ;THE MACHINE WAS RESTARTED
              ;WITHOUT A POWER FAIL INTERRUPT
00633 051120  MSUM: .TXT -PR
00634 043517  OG
00635 040522  RA
00636 020115  M
00637 052523  SU
00640 020115  M
00641 044103  CH
00642 041505  EC
00643 027113  K.
00644 042440   E
00645 040530  XA
00646 044515  MI
00647 042516  NE
00650 052040   T
00651 042510  HE
00652 041440   C
00653 042510  HE
00654 045503  CK
00655 051040   K
00656 052517  UU
00657 044524  TI
00660 042516  NE
00661 000056  .=      ;PROGRAM SUM CHECK.
              ;EXAMINE THE CHECK ROUTINE
```

```
00662 147520   MZERO: .TXTE -PD
00663 142727   WE
00664 120322   R
00665 052724   TU
00666 047322   RN
00667 147640    U
00670 120116   N
00671 040706   FA
00672 146311   IL
00673 042305   ED
00674 152240    T
00675 120317   U
00676 146303   CL
00677 040705   EA
00700 120322   R
00701 141501   AC
00702 052703   CU
00703 052515   MU
00704 040714   LA
00705 147724   TU
00706 051722   RS
00707 000000   -          ;POWER TURN ON
               ;FAILED TO CLEAR ACCUMULATORS
00710 103607   MBELL: .TXTE -<207><207>
00711 000207   <207>-  ;<207><207><207>(BELL)
```

```
00712 027065  MI:   .TXT -5.
00713 020061  1
00714 044515  MI
00715 046114  LL
00716 020111  I
00717 000000  -         ;5.1 MILLI
00720 027065  NUI:  .TXT -5.
00721 020062  2
00722 047516  NU
00723 047111  IN
00724 020124  T
00725 000000  -         ;5.2 NUINT
00726 027065  FU:   .TXT -5.
00727 020063  3
00730 052506  FU
00731 047116  NN
00732 020105  E
00733 000000  -         ;5.3 FUNNE
00734 027065  MS:   .TXT -5.
00735 020064  4
00736 051515  MS
00737 046525  UM
00740 000040  -         ;5.4 MSUM
00741 027065  NOD:  .TXT -5.
00742 020066  6
00743 047516  NO
00744 047504  DO
00745 042516  NE
00746 000000  -         ;5.6 NODONE
00747 027065  MZ:   .TXT -5.
00750 020067  7
00751 055115  MZ
00752 051105  ER
00753 020117  O
00754 000000  -         ;5.7 MZERO
00755 043117  ON:   .TXT -OF
00756 026106  F,
00757 047117  ON
00760 051054  ,R
00761 051505  ES
00762 027124  T,
00763 000000  -;OFF,ON,REST.
00764 041102  MB:   .TXT -BB
00765 000102  B-                ;BBB
```

```
                ;TTO AND DIS NON INTERRUPT PACKAGE
                ;IF THE DEVICE(S) ARE NOT PRESENT THE ROUTINES CONTINUES.
                ;DEFINE .TTO AND DIS AND FUN. WAIT ROUTINE USED.

                ;TTO ROUTINES:
                ;>MESS< PRINTS ASCII MESSAGES AS SPECIFIED BY ASSEMBLER.
                ;>CHAR< PRINTS ASCII CHARACTOR, AC0=R.
                ;AC0=L MUST BE 0. CORRECTS THE PARITY, 11 SIMULATE TAB.
                ;>TYPE< PRINTS AC0=R. MUST HAVE PROPER PARITY. RETURN IS
                ;TO CALL+1.REPLACE THIS ROUTINE WITH INTERRUPT TYPE IF DESIRED.
                ;>CRLF< PRINTS A CARRIAGE RETURN.

                ;DIS ROUTINES:
                ;>DDISP< PRINTS ACSII MESSAGES AS SPECIFIED BY ASSEMBLER.
                ;>DDOUT< PRINTS ASSII CHARACTOR, AC0=R. AC0=L MUST BE 0. RETURN IS
                ; TO CALL+1. REPLACE THIS ROUTINE WITH INTERRUPT TYPE IF DESIRED.
                ;>DDCL< CLEARS THE DISPLAY.
                ;>DISATT< ATTENTION DISPLAY, SEE ROUTINE
                ;>HAATT<  ATTENTION HALT, SEE ROUTINE

                ;TTO AND DIS ROUTINES:
                ;>POCT< PRINTS AC1 IN OCTAL, 6 DIGITS.
                ;>PDEC< PRINTS AC1 IN DECIMAL, LEADING ZEROES SUPPRESSED, 5 DIGITS.
                ;>ZOCT< PRINTS AC1 IN OCTAL, LEADING ZEROES SUPPRESSED, 6 DIGITS.
                ;THE ROUTINES ARE FOLLOWED BY A TAB ON .TTO.

00766 054563    MESS:   STA     3,MESSR ;PRINT A TEXT MESSAGE
00767 010562            ISZ     MESSR
00770 031400            LDA     2,0,3   ;AC2 POINTS TO MESSAGE
00771 024551            LDA     1,CMASK ;A 8 BIT MASK
00772 021000            LDA     0,0,2   ;AC0=DATA WORD
00773 125112            MOVL#   1,1,SZC
00774 123701            ANDS    1,0,SKP
00775 123401            AND     1,0,SKP ;AC0=DATA CHARACTOR RIGHT
00776 151400            INC     2,2     ;INC TO NEXT WORD
00777 124000            COM     1,1     ;FLIP MASK
01000 004465            JSR     MESCH   ;PRINT
01001 000771            JMP     MESS+4  ;ANOTHER
01002 063511            SKPBZ   .TTO
01003 000777            JMP     .-1
01004 002545            JMP     @MESSR  ;LAST

01005 020533    ZOCT:   LDA     0,CMSP
01006 101001            MOV     0,0,SKP

01007 020530    POCT:   LDA     0,CHAR0
01010 030434            LDA     2,OCTAB ;PRINT AC1 IN OCTAL
01011 000403            JMP     .+3
01012 030442    PDEC:   LDA     2,DECTB ;PRINT AC1 IN DECIMAL
01013 020525            LDA     0,CMSP  ;SUPPRESS LEADING ZEROS
01014 054450            STA     3,RADRET;BOTH ENTRYS PRINT NUMBER
01015 040446            STA     0,ZSUPP ;THEN TAB TO NEXT POSITION
01016 050401            STA     2,.+1
01017 000000    DECOCT: 0               ;A LDA 2,TABLE INSTRUCTION
01020 010777            ISZ     .-1
01021 034443            LDA     3,RADRET
01022 020514            LDA     0,CHTAB ;SETUP TAB AT END
01023 151005            MOV     2,2,SNR ;IF TABLE ENTRY=0 THEN
01024 000443            JMP     CHAR    ;EXIT WITH TAB
01025 034436            LDA     3,ZSUPP ;ZEROS SUPPRESS STUF
01026 102400            SUB     0,0
```

```
01027 146512  DECOT:  SUBL#   2,1,SZC
01030 000405          JMP     DECP
01031 146400          SUB     2,1       ;FORM THE DIGIT
01032 034505          LDA     3,CHAR0
01033 101400          INC     0,0
01034 000773          JMP     DECOT
01035 151235  DECP:   MOVZR#  2,2,SNR
01036 034501          LDA     3,CHAR0
01037 054424          STA     3,ZSUPP   ;AC0=DIGIT
01040 163000          ADD     3,0       ;MAKE ASCII
01041 004426          JSR     CHAR      ;PRINT
01042 004540          JSR     DDOUT     ;DISPLAY
01043 000754          JMP     DECOCT    ;GET NEXT DIGIT

01044 030426  OCTAB:  LDA 2,.+1+.-DECOCT
01045 100000          100000
01046 010000          10000
01047 001000          1000
01050 000100          100
01051 000010          10
01052 000001          1
01053 000000          0

01054 030436  DECTB:  LDA 2,.+1+.-DECOCT
      000012  .RDX 10
01055 023420          10000
01056 001750          1000
01057 000144          100
01060 000012          10
01061 000001          1
01062 000000          0
      000010  .RDX 8

01063 000000  ZSUPP:  0
01064 000000  RADRET: 0

01065 101015  MESCH:  MOV#     0,0,SNR
01066 001401          JMP     1,3       ;RETURN +2 IF NULL

01067 054455  CHAR:   STA      3,CHRET ;PRINT AC0 RIGHT
01070 101320          MOVZS    0,0
01071 040454          STA      0,CHSAV
01072 176000          ADC      3,3      ;COMPUTE THE PARITY
01073 117000          ADD      0,3
01074 163404          AND      3,0,SZR
01075 000775          JMP      .-3
01076 176660          SUBCR    3,3      ;COMBIND PARITY WITH CHAR
01077 020446          LDA      0,CHSAV
01100 163300          ADDS     3,0
```

```
01101 034435  CHAR1:  LDA     3,CHTAB ;IS THIS A TAB
01102 116405          SUB     0,3,SNR
01103 000403          JMP     .+3     ;YES
01104 004413          JSR     TYPE    ;NO PRINT IT
01105 002437          JMP     @CHRET  ;EXIT
01106 020440          LDA     0,CHORZ ;SIMULATE A TAB
01107 034440          LDA     3,CHAR7 ;VIA 1 TO 8 SPACES
01110 117404          AND     0,3,SZR
01111 000403          JMP     .+3
01112 102460          SUBC    0,0
01113 002431          JMP     @CHRET
01114 020424          LDA     0,CHSP
01115 004402          JSR     TYPE
01116 000772          JMP     .-6

01117 010427  TYPE:   ISZ     CHORZ   ;INC HORIZIONAL POSITION
01120 063511          SKPBZ   .TTO    ;WAIT IF TTO BUSY
01121 000777          JMP     .-1
01122 061111          DOAS    0,.TTO  ;SEND CHAR
01123 001400          JMP     0,3     ;EXIT

01124 054424  CRLF:   STA     3,CRLFR ;SAVE RETURN
01125 020410          LDA     0,CHCR
01126 004741          JSR     CHAR    ;PRINT CARIAGE AND LF
01127 020405          LDA     0,CHLF
01130 004737          JSR     CHAR
01131 102400          SUB     0,0
01132 040414          STA     0,CHORZ ;CLEAR HORZ POSITION
01133 002415          JMP     @CRLFR  ;EXIT

01134 000012  CHLF:   12
01135 000215  CHCR:   215
01136 000011  CHTAB:  11
01137 000060  CHAR0:  60
01140 000240  CHSP:   240
01141 000000  CHNUL:  0
01142 000377  CMASK:  377
01143 000177  CDMASK: 177
01144 000000  CHRET:  0
01145 000000  CHSAV:  0
01146 000000  CHORZ:  0
01147 000007  CHAR7:  7
01150 000000  CRLFR:  0
01151 000000  MESSR:  0
```

```
01152 000000  DDIR:   0
01153 000000  DDIC:   0
01154 000000  DDOR:   0

01155 054775  DDISP:  STA     3,DDIR  ;DISPLAY MESSAGE
01156 010774          ISZ     DDIR
01157 031400          LDA     2,0,3   ;AC2=POINTS TO MESSAGE
01160 024762          LDA     1,CMASK
01161 021000          LDA     0,0,2   ;AC0=DATAWORD
01162 125112          MOVL#   1,1,SZC
01163 123701          ANDS    1,0,SKP
01164 123401          AND     1,0,SKP ;AC0=CHAR. RIGHT
01165 151400          INC     2,2     ;INC TO NEXT WORD
01166 124000          COM     1,1     ;FLIP MASK
01167 004405          JSR     DDICH   ;GO DISPLAY
01170 000771          JMP     DDISP+4 ;ANOTHER
01171 063535          SKPBZ.  DIS
01172 000777          JMP     .-1
01173 002757          JMP     @DDIR   ;RETURN

01174 054757  DDICH:  STA     3,DDIC  ;DISPLAYER AC0 RIGHT
01175 101005          MOV     0,0,SNR
01176 001401          JMP     1,3     ;RETURN +2 IF NULL
01177 004403          JSR     DDOUT
01200 002753          JMP     @DDIC

01201 020733  DDCL:   LDA     0,CHLF

01202 054752  DDOUT:  STA     3,DDOR  ;CHAR OUT
01203 034740          LDA     3,CDMASK
01204 163405          AND     3,0,SNR ;MASK
01205 002747          JMP     @DDOR
01206 063535          SKPBZ   DIS     ;WAIT IF DISPLAY BUSY
01207 000777          JMP     .-1
01210 061135          DOAS    0,DIS   ;SEND CHAR
01211 002743          JMP     @DDOR   ;EXIT
```

```
                        ;RC 3600, ATTENTION DISPLAY OUTPUT
                        ;BY MEANS OF ACOUSTIC ALARM FOR 50 MS
                        ;AND WAIT FOR 3 SECONDS TO ALLOW
                        ;THE OPERATOR TO READ THE MESSAGE.
                        ;
                        ;       (DISATT)
                        ;
                        ;RC 3600, ATTENTION HALT BY MEANS OF
                        ;ACOUSTIC ALARM FOR 50 MS BEFORE HALT.
                        ;
                        ;       (HAATT)
                        ;
01212 054421  DISATT:   STA     3,OUTRE
01213 004404            JSR     HAATT
01214 006014            WAIT
01215 001227            SEC3
01216 002415            JMP     @OUTRE
01217 054413  HAATT:    STA     3,PIPRE
01220 020411            LDA     0,SEC4K
01221 061032            DOA     0,FUN
01222 006014            WAIT
01223 001230            SECM5
01224 102400            SUB     0,0
01225 061032            DOA     0,FUN
01226 002404            JMP     @PIPRE
      000012            .RDX 10
01227 005670  SEC3:     3000
01230 000062  SECM5:    50
      000010            .RDX 8
01231 004000  SEC4K:    4000
01232 000000  PIPRE:    0
01233 000000  OUTRE:    0

                        ;FIND TYPE OF CPU
                        ;USES RTC. PUTS TYPE TO CPUNO
                        ;DEFINE CDCL,CDISP,CHAATT,WTYP
                        ;
                        ;       WTYP    NWTYP
                        ;
                        ;DELAY SUBROUTINE
                        ;ARGUMENT FOLLOWING CALL IS ADDRESS
                        ;OF DELAY CONSTANT.
                        ;DELAY IN INCREMENTS OF 1 MS
                        ;AC2 & 3 ARE USED, DEFINE WAIT,ARG
                        ;
                        ;       WAIT    XWAIT
                        ;       ARG
                        ;
01234 001235  KINDI:    .+1     ;ADDRESS OF KNOVA
      000012            .RDX 10
01235 000175  KNOVA:    125             ;0=NOVA=12.6 US
01236 000000  KNON1:    0
01237 000341  K1200:    225             ;2=1200=5.25US
01240 000567  KSU:      375             ;3=SUPER=4.5US
01241 000764  KSUSC:    500             ;4=SUSC=3.7US
01242 000567  K800:     375             ;5=800=3.2US
01243 000000  KNON2:    0
      000010            .RDX 8
01244 000000  KINC:     0
```

```
01245 054427  NWTYP:  STA     3,NIRET ;SAVE RETURN
01246 102520          SUBZL   0,0
01247 101120          MOVZL   0,0     ;SET RTC FREQUENCY
01250 126400          SUB     1,1
01251 061114          DOAS    0,RTC   ;SYNCHRONIZE RTC
01252 063614          SKPDN   RTC
01253 000777          JMP     .-1
01254 060114          NIOS    RTC     ;START RTC
01255 125400          INC     1,1     ;COUNTS
01256 063614          SKPDN   RTC
01257 000776          JMP     .-2     ;LOOP FOR 10 MS
01260 030416          LDA     2,NN500 ;STEP -500
01261 034416          LDA     3,NN8   ;7 TIMES
01262 141000          MOV     2,0     ;STARTING AT -500=SPEED
01263 175405  NXTYP:  INC     3,3,SNR ;NEXT STEP OR
01264 004416          JSR     NOTYP   ;TYPE OF NOVA NOT FOUND
01265 143020          ADDZ    2,0     ;SPEED:=SPEED-500
01266 107013          ADD#    0,1,SNC ;NO. OF COUNTS<SPEED
01267 000774          JMP     NXTYP   ;THEN GO TO NXTYP ELSE
01270 030410          LDA     2,NC7   ;CONVERT TIMES TO
01271 173000          ADD     3,2     ;CPUNO AS MENTIONED
01272 050403          STA     2,CPUNO ;AT K-LABELS
01273 002401          JMP     @NIRET  ;RETURN
01274 000000  NIRET:  0
01275 000000  CPUNO:  0
      000012          .RDX 10
01276 177014  NN500:  -500
01277 177770  NN8:    -8
01300 000007  NC7:    7
      000010          .RDX 8
01301 000005  NC5:    5
01302 020777  NOTYP:  LDA     0,NC5   ;COMPUTE RETURN
01303 117000          ADD     0,3     ;ADDRESS
01304 054407          STA     3,NOTRE
01305 006016          CDCL            ;CLEAR DIS
01306 006017          CDISP           ;DIS = MESSAGE
01307 001314          NOTYM
01310 006015          CMAATT
01311 063077          HALT            ;PUT CPUNO INTO AC2
01312 002401          JMP     @NOTRE  ;CONTINUE
01313 000000  NOTRE:  0
01314 042523  NOTYM:  .TXTISE
01315 020124  !
01316 050103  CP
01317 047125  UN
01320 020117  U
01321 020076  >
01322 041501  AC
01323 020062  2
01324 000000  !       ;SET CPUNO > AC2

01325 054766  XWAIT:  STA     3,NOTRE ;SAVE RETURN
01326 010765          ISZ     NOTRE   ;PASS ARG
01327 033400          LDA     2,@0,3  ;FETCH ARG
01330 050744          STA     2,NIRET ;STORE ARG
01331 030703          LDA     2,KINDI ;FETCH KNOVA ADDRESS
01332 034743          LDA     3,CPUNO ;FETCH CPUNO
01333 157000          ADD     2,3     ;COMPUTE KADDRESS
01334 031400          LDA     2,0,3   ;FETCH CPU CONSTANT
01335 050707  NWAIT:  STA     2,KINC  ;STORE IT FOR INC
01336 014706          DSZ     KINC    ;1 MS
01337 000777          JMP     .-1     ;INC LOOP
01340 014734          DSZ     NIRET   ;NO. OF MS =
01341 000774          JMP     NWAIT   ;COUNT ARG NOT ENDED
01342 002751          JMP     @NOTRE  ;COUNT ARG ENDED, RETURN
```

```
01543 000000  FOO:     0
01544 000000  LASTPR:  0

              .END
```

```
ACK       000311
BELL      000056
CC        000444
CCX       000446
CDCL      006016
CDISA     006011
CDISP     006017
CDMAS     001143
CHAAI     006015
CHAR      001067
CHAR0     001137
CHAR1     001101
CHAR7     001147
CHCR      001135
CHECK     000322
CHLF      001134
CHNUL     001141
CHOR6     001146
CHREI     001144
CHSAV     001145
CHSP      001140
CHTAB     001136
CK1       000327
CKEXA     000350
CKRET     000307
CKSUM     000316
CKWC      000317
CMASK     001142
CNG       000273
CONSI     000304
CPUNO     001275
CRESI     000302
CRLF      001124
CRLFR     001150
CDCL      001201
CDIC      001153
CDICH     001174
CDIR      001152
CDISP     001155
CDOR      001154
CDOUI     001202
CECOL     001017
CECOI     001027
CECP      001035
CECTB     001054
CIS       000035
CISAI     001212
CR0       000312
CR1       000313
CR2       000314
CR3       000315
CSWT      000310
CADR      000305
CELL      000341
CDO       001343
CJ        000726
CON       000032
CONNE     000576
CPATT     001217
CPDR      000306
```

```
ICRLF   000003
IDCL    000016
IDISA   000011
IDISF   000017
IFLAG   000272
IHAAI   000015
IKING   000007
IMESS   000004
INIRE   000010
INODN   000012
INTG    000214
INTR    000172
INTR1   000204
IPOCI   000006
IWAII   000014
IWTYF   000013
IZOCI   000005
K1200   001237
K800    001242
KINC    001244
KIND1   001234
KNON1   001236
KNON2   001243
KNOVA   001235
KSU     001240
KSUSC   001241
LASTF   001344
MB      000764
MBELL   000710
MESCH   001065
MESS    000766
MESSR   001151
MI      000712
MILL1   000513
MS      000734
MSUM    000633
MZ      000747
MZERO   000662
NC5     001301
NC7     001300
NDF     000321
NG      000256
NIREI   001274
NN500   001276
NN8     001277
NOD     000741
NODN    000401
NODON   000417
NOI     000720
NOINI   000551
NOTRE   001313
NOTYM   001314
NOTYF   001302
NWAII   001335
NWTYF   001245
NXTYF   001263
OCTAB   001044
ON      000755
ONOFF   000450
OUTRE   001233
```

```
DEC     001012
IPRE    001232
OCT     001007
ADRE    001064
EST     000040
EST1    000137
EST2    000154
AV0     000274
AV1     000275
AV2     000276
AV3     000277
AVC     000300
AVPC    000301
EC15    000303
EC3     001227
EC4K    001231
ECMS    001230
TEP1    000221
TEP2    000255
UM      000320
UMCM    000072
UMER    000123
ERR     000145
YPE     001117
AIT     006014
TYP     006015
WAIT    001325
ERR     000047
OCT     001005
SUPR    001063
TTO     000011


ND OF SYMBOL LIST
```