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## IDENTIFICATION

PRODUCT CODE: AC-E509A-MC

PRODUCT NAME: CZRXCA0 RX02 UTIL DRVR

DATE CREATED: DEC 1978

MAINTAINER: DIAGNOSTIC ENGINEERING

AUTHOR: L.S. PRUCHA

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## 1.0 ABSTRACT

THIS PROGRAM IS INTENDED AS A BRUTE FORCE ROUTINE TO EXECUTE AN OPERATION OR SERIES OF OPERATIONS, CONTINUOUSLY REGARDLESS OF THE RESULTS OF THE OPERATION. BECAUSE OF THE COMPLEXITY OF THE RX01,02 FLOPPY DISK SYSTEM AS OPERATED ON THE UNIBUS, IT IS NOT ALWAYS POSSIBLE TO PROVIDE FOR EVERY CONTINGENCY IN THE NORMAL PROGRAMS THEREFORE THIS UTILITY DRIVER WILL ALLOW AN OPERATOR TO EXECUTE ANYTHING DESIRED IN ANY ORDER. THERE ARE NO ERROR CHECKS OR PRINTOUTS MADE, AND ANY VARIATION FROM PRESET SEQUENCES AND VALUES ARE MADE BY CHANGING THE APPROPIATE MEMORY LOCATIONS.

## 2.0 REQUIREMENTS

### 2.1 HARDWARE

1. ANY PDP-11 PROCESSOR
2. RX11, RXV11, RX211, OR RXV21 BUS INTERFACE
3. RX01 OR RX02 DEVICE

### 2.2 STORAGE

THIS PROGRAM REQUIRES AT LEAST 2K OF CORE

## 3.0 LOADING PROCEDURE

USE STANDARD BINARY LOADING PROCEDURE

## 4.0 STARTING PROCEDURE

THE PROGRAM IS ALWAYS STARTED AT LOCATION 200(8)

## 5.0 CONSOLE SWITCH SETTINGS <SEE NOTE BELOW>

HARDWARE SWITCH REG OR IF SOFTWARE SWITCH REG --> (SFSWR LOC:760)

SW 15=1 (100000) - STOP ON EACH OPERATION
=0 - CONTINUE

SW 14=1 (040000) - STOP ON END OF SEQUENCE
=0 - CONTINUE

SW 13=1 (020000) - INTIALIZE DEVICE BEFORE EACH OPERATION
=0 - NO INTALIZATION BETWEEN OPERATIONS

SW 12-6 (6-0,RXTA) - TRACK ADDRESS

SW 5-0 (4-0,RXSA) - SECTOR ADDRESS

****** SOFTWARE OR HARDWARE SWITCH REGISTER ******

| | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SWR | OP HLT | SEQ HLT | OP INT | TRACK ADDRESS | | | | | | | SECTOR ADDRESS | | | | | |

NOTE: IF PROCESSOR DOES NOT HAVE HARDWARE SWITCH REGISTER AT LOCATION 177570 THEN THE PROGRAM WILL USE ITS OWN INTERNAL SOFTWARE SWITCH REGISTER AT 760. THE PROGRAM WILL DETECT THE NON-EXISTENCE OF A HARDWARE SWITCH REGISTER.

## 6.0 OPERATION

THE PROGRAM OPERATION IS QUITE SIMPLE, BUT DOES REQUIRE THE OPERATOR TO HAVE KNOWLEDGE OF THE RX01,02 FLOPPY DISK SYSTEM AS OPERATED BY RX11,RX211 UNIBUS INTERFACE. THE OPERATOR MUST BE ABLE TO DECIDE WHICH SEQUENCE OF OPERATIONS IS REQUIRED, AND WHAT VALUES TO ASSIGN TO THE VARIOUS PARAMETERS REQUIRED TO EXECUTE THEM. THE OPERATION SEQUENCE IS SET UP BY LOADING A TABLE WITH THE FUNCTION CODES OF THE DESIRED OPERATIONS AND SETTING THE NUMBER OF OPERATIONS IN A COUNTER. THE PROGRAM IS SET UP TO OPERATE IN SIGNLE DENSITY MODE, WITH UNIT 0 PRESELECTED, AND TO DO AN EMPTY BUFFER OPERATION. THE OPERATION SEQUENCE WILL BE EXECUTED CONTINUOSLY IF LOADED AND STARTED AT 200(8) WITH NO CHANGES MADE AND SWITCHES 14 AND 15 SET AT ZERO(0). THE FOLLOWING IS THE LIST OF PARAMETERS WHICH MAY BE VARIED AND A DESCRIPTION OF EACH ALONG WITH THEIR CORE LOCATION:

| PARAMETER | LOCATION | DESCRIPTION |
|---|---|---|
| RXCS | 600 | ADDRESS OF RX CONTROL + STATUS REG |
| RXDB | 602 | ADDRESS OF RX DATA BUFFER REG |
| PSW | 604 | ADDRESS OF PROCESSOR STATUS WORDS |
| SWR | 606 | ADDRESS OF SWITCH REGISTER WORD |
| SETCS | 700 | SET PART OF RXCS WORD -<br>BIT#4 UNIT SELECT<br>BIT#6 INTERRUPT ENABLE<br>BIT#8 DENSITY SELECT (RX02,XX ONLY)<br>BIT#9 SIDE SELECT (RXXX ONLY) |
| WRDCNT | 702 | WORD COUNT- SET NUMBER OF WORDS TO BE TRANS-FERRED RX02,XX (RX01-N/A) |
| RDYDLY | 70 | READY DELAY- THIS DELAY VALUE IS USED BY THE PROGRAM TO ESTABLISH A MAXIMUM TIME TO AWAIT THE COMPLETION OF AN OPERATION BEFORE PROCEEDING TO THE NEXT.<br>**(DEFAULT IS APPROX 435 MS FOR PDP-11/20)** |
| RDYDX | 706 | READY MULTIPLIER- IF THE VALUE SET INTO 704 DOES NOT ALLOW ENOUGH TIME, INCREASE THE SIZE OF THE MULTIPLIER. EACH INCREMENT OF THE MULTIPLIER WILL CAUSE THE 704 DELAY TO BE EXECUTED THAT MANY MORE TIMES. |
| OPNUM | 710 | OPERATION NUMBER- THIS IS THE NUMBER OF OPER-ATIONS TO BE PERFORMED IN A SEQUENCE AND SHOULD REFLECT THE NUMBER OF OPERATIONS SET INTO THE FUNCTION TABLE. (16 MAXIMUM) |

```
                                FUNTAB      712-750   FUNCTION TABLE-
                                                      THIS TABLE (CONSISTING OF 16 WORD LOCATIONS) IS TO
                                                      BE LOADED WITH THE FUNCTION CODES FOR EACH
                                                      OPERATION TO BE PERFORMED IN SEQUENCE.  THE
                                                      NUMBER OF ENTERIES MAY BE FROM ONE(1) TO
                                                      SIXTEEN(16).  MAKE SURE THAT THE NUMBER OF
                                                      FUNCTION CODES SET IN THE TABLE IS REFLECTED
                                                      BY THE NUMBER IN LOCATION 710 (OPNUM).

                                SOFTSR      760       SOFTWARE SWITCH REGISTER - USED FOR
                                                      SWITCHLESS PROCESSORS.

                                ERRTAB      3700      ERROR TABLE- ERROR REG FOR RESP. FUCTIONS
                                INTAB       4000      INPUT TABLE- RX DATA BUFFER INTO TABLE
                                OUTAB       5000      OUTPUT TABLE- TABLE INTO RX DATA BUFFER

                                XETBA       4400      EXTENDED ERROR TABLE - THIS TABLE CONTAINS
                                                      RESULTS OF READ ERROR CODE OPERATION IN
                                                      FUNCTION TABLE - SEE TABLE DESCRIPTIONS BELOW.

                                NOTE:  RXXX + XX ARE REFERENCES TO DEVICE FUTURE EXPANSION.
```

## 6.1 FUNCTION CODES

0 = FILL BUFFER
1 = EMPTY BUFFER
2 = WRITE SECTOR
3 = READ SECTOR
4 = SET DENSITY(RX02 ONLY)
5 = READ STATUS
6 = WRITE SECTOR WITH DELETED DATA
7 = READ ERROR CODE

## 6.2 DATA FORMATS (RELATIVE TO DENSITY)

SINGLE DENSITY:  64 WORD/SECTOR RX01,02,XX
DOUBLE DENSITY:  128 WORDS/SECTOR RX02,XX ONLY

## 6.3 DENSITY (BIT 8 OF CONTROL STATUS WORD, RX02,XX ONLY)

0 = DOUBLE FREQUENCY (OR FM) SINGLE DENSITY
1 = MILLER CODE (OR MCM) DOUBLE DENSITY

## 6.4 UNIT SELECT (BIT 4 OF CONTROL STATUS WORD)

SET TO DEVICE UNIT ADDRESS (0-1)

## 6.5 SIDE SELECT (BIT9 OF CONTROL STATUS WORD, RXXX ONLY)

SET TO SIDE ADDRESS (0-1)

## 6.6 HARDWARE REGISTERS

| | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RXCS: | ERR | INT | XM | XM | RX2 | | | SID | DEN | TR | IE | DON | DRV | FUN | FUN | FUN | GO |
| RXWC: | WORD COUNT | | | | | | | | | | | | | | | | (RX02) |
| RXBA: | BUS ADDRESS REGISTER | | | | | | | | | | | | | | | | (RX02) |
| RXES: | | | | | NXM | WC OVF | SID #1 | DRV #1 | DRV RDY | DEL DAT | DSK DEN | DEN ERR | AC LOW | INT DON | SID RDY | CRC | |
| RXDB: | DATA BUFFER | | | | | | | | | | | | | | | | |
| RXTA: | | | | | | | | 0 | TRACK ADDRESS | | | | | | | | |
| RXSA: | | | | | | | | 0 | 0 | 0 | SECTOR ADDRESS | | | | | | |

NOTE:  RXXX + XX ARE REFERENCES TO DEVICE FUTURE EXPANSION.

```
                        6.7     DEVICE ERROR CODES
                                ------------------


                                KNXDV0=10       /DRIVE 0 FAILED TO SEE HOME ON INITIALIZE.  NO ERROR BIT
                                KNXDV1=20       /DRIVE 1 FAILED TO SEE HOME ON INITIALIZE.  NO ERROR BIT
                                KERTRK=40       /TRIED TO ACCESS A TRACK GREATER THAN 76.
                                KHOMERR=50      /HOME WAS FOUND BEFORE DESIRED TRACK WAS REACHED.
                                KSELFER=60      /SELF DIAGNOSTIC ERROR.
                                KNXHDR=70       /DESIRED SECTOR COULD NOT BE FOUND AFTER LOOKING AT 52 HEADERS.
                                KWPROT=100      /WRITE FUNCTION ATTEMPTED ON A WRITE PROTECTED DISK.
                                KTIMERR=110     /MORE THAN 40 MICROSECONDS AND NO SEPCLOCK SEEN.
                                KNXPRAM=120     /A PREAMBLE COULD NOT BE FOUND.
                                KNXIDAM=130     /PREAMBLE FOUND BUT NO ID MARK FOUND WITHIN ALLOWABLE TIME.
                                KNCHCER=140     /CRC ERROR ON WHAT APPEARED TO BE A HEADER.  ERROR IS NOT ASSERT
                                KTKSKER=150     /THE TRACK ADDRESS OF A GOOD HEADER DOES NOT COMPARE WITH THE DE
                                KXSTRYS=160     /TOO MANY TRIES FOR AN IDAM.
                                KNODAM=170      /DATA AM NOT FOUND IN ALLOTTED TIME.
                                KDCRCER=200     /CRC ERROR ON READING THE SECTOR FROM THE DISK.
                                KMANER=220      /R/W ELECTRONICS FAILED MAINTENANCE MODE TEST.
                                KWCNOV=230      /WORD COUNT OVERFLOW.
                                KSTDER=240      /WRONG KEY WORD FOR SET MEDIA DENSITY COMMAND.

                        7.0     PROGRAM DESCRIPTION
                                -------------------

                                IN ORDER TO MAINTAIN THE CONTINUOUS EXECUTION OF THE
                                OPERATIONS DESCRIBED THE PROGRAM IS ORGANIZED AS FOLLOWS:

                                        START
                                        DETERMINE IF SWITCHLESS PROCESSOR
                                        DETERMINE IF LSI PROCESSOR
                                        INITIALIZE THE RX
                                        GET RX STATUS WORD                  (WORD COUNT, UNIT SELECT)
                                        GET SWITCH REGISTER
                                        INITIALIZE RX IF SWITCH 13=1
                                        EXECUTE OPERATION (SET FUNCTION AND FROM OP TABLE AND SET GO=1)
                                        AWAIT END OF OPERATION (READY DELAY)
                                        STOP IF SWITCH 15=1
                                        STOP IF LAST OPERATION IN SEQUENCE AND SWITCH 14=1
                                        POINT TO NEXT FUNCTION CODE IN OP TABLE
                                        JUMP BACK TO GET SWITCH REGISTER.


                        7.1     FLOW
                                ----

                                ;BEGINROUTINE [MOD 0.0 CONTROL]
                                ;   INITIALIZE STACK
                                ;   IF HARDWARE REG
                                ;   :   THEN
                                ;   :       SET SWITCH_REG ADDRESS=HARDWARE SWITCH REG ADDRESS
                                ;   :   ELSE
                                ;   :       SET SWITCH_REG ADDRESS=SOFTWARE SWITCH REG ADDRESS
                                ;   ENDIF
                                ;   IF NOT LSI_PROCESSOR
                                ;   :   THEN
```

```
364                                     ;  :     SET NORMAL PROCESSOR PRI
365                                     ;  :  ELSE
366                                     ;  :     SET LSI PROCESSOR PRI + SET LSI_FLAG
367                                     ;  ENDIF
368                                     ;  CALL OUTPUT [MOD 3.0]-OUTPUT INITIALIZE TO RX (INTWD,CSAD)
369                                     ;  CALL INPUT [MOD 1.0]-GET RX CSR (DNWD,CSAD,TYIN,CSWD)
370                                     ;  BEGINDO
371                                     ;  :  CALL INPUT [MOD 1.0]-GET SWITCH REG (SWAD,TYIN,SWWD)
372                                     ;  :  CALL PROCESS [MOD 7.0]-FORMAT TABLE ENTRY (TE,SETFW,FNWD)
373                                     ;  :  IF SWR_BIT8=1
374                                     ;  :  :  THEN
375                                     ;  :  :     CALL OUTPUT [MOD 3.0]-INITIALIZE RX (CSAD,INITWD)
376                                     ;  :  ENDIF
377                                     ;  :  CALL OUTPUT [MOD 3.0]-SEND FUNCTION WORD TO RX (CSAD,FW,CSWD,WC,SWWD,ETAD,TE)
378                                     ;  :  IF FW [FUNCTION WORD]=EMPTY BUFFER
379                                     ;  :  :  THEN
380                                     ;  :  :     IF DEVICE=RX02 <RXCS BIT11=0>
381                                     ;  :  :     :  THEN
382                                     ;  :  :     :     SET TYIN=64
383                                     ;  :  :     :     CALL INPUT [MOD 1.0]-GET RX01 INPUT BUFFER (DBAD,TYIN)
384                                     ;  :  :     ENDIF
385                                     ;  :  ENDIF
386                                     ;  :  CALCULATE ERROR TABLE ADDRESS <ETAD=ETBA+2TE>
387                                     ;  :  IF ERROR_STATUS_FLAG=1 <ERSTAT=1>
388                                     ;  :  :  THEN
389                                     ;  :  :     CALL INPUT [MOD 1.0]-GET ERROR WORD (DBAD,TYIN,ERWD)
390                                     ;  :  :     SAVE ERROR WORD (ERWD) IN ERROR TABLE AT (ERAD)
391                                     ;  :  :  ELSE
392                                     ;  :  :     CALL INPUT [MOD 1.0]-GET STATUS WORD (CSAD,CSWD,TYIN)
393                                     ;  :  :     IF RX CSR BIT15=1 [ERROR BIT]
394                                     ;  :  :     :  THEN
395                                     ;  :  :     :     CALL INPUT [MOD 1.0]-GET ERROR WORD (DBAD,TYIN,ERWD)
396                                     ;  :  :     :     SAVE ERROR WORD (ERWD) IN ERROR TABLE AT (ERAD)
397                                     ;  :  :     ENDIF
398                                     ;  :  ENDIF
399                                     ;  :  CLEAR ERROR_STATUS_FLAG <ERSTAT>
400                                     ;  :  ADVANCE TABLE ENTRY <TE=TE+1>
401                                     ;  :  IF SWR BIT15=1
402                                     ;  :  :  THEN
403                                     ;  :  :     HALT
404                                     ;  :  :     IF TABLE ENTRY=TABLE LENGTH <TE=TL>
405                                     ;  :  :     :  THEN
406                                     ;  :  :     :     SET TABLE ENTRY=0
407                                     ;  :  :     ENDIF
408                                     ;  :  :  ELSE
409                                     ;  :  :     IF TABLE ENTRY=TABLE LENGTH <TE=TL>
410                                     ;  :  :     :  THEN
411                                     ;  :  :     :     IF SWR BIT14=1
412                                     ;  :  :     :     :  THEN
413                                     ;  :  :     :     :     HALT
414                                     ;  :  :     :     ENDIF
415                                     ;  :  :     :     SET TABLE ENTRY=0 <TE=0>
416                                     ;  :  :     ENDIF
417                                     ;  :  ENDIF
418                                     ;  ENDDO
419                                     ;ENDROUTINE
```

## 7.2 TABLES

1. THE DATA INPUT (FROM RX) TABLE IS AT LOCATION 4000.

2. THE DATA OUTPUT (TO RX) TABLE IS AT LOCATION 5000.

3. THE ERROR TABLE IS AT LOCATION 3700.

   - ERRORS ARE STORED IN THIS TABLE, ONE WORD FOR ONE WORD IN SEQUENCE CORRESPONDING WITH FUNCTION CODE TABLE. (SEE FUNCTION TABLE BELOW)

   - OPERATION-ERRORS ARE STORED FOR EACH MAINT READ STATUS FUNCTION SELECTED OR ON ANY OTHER FUNCTION IF AN ERROR OCCURRED. THE LOCATION IS ZEROED IF THESE TWO CONDITIONS ARE NOT MET.

4. THE EXTENDED ERROR CODE TABLE IS AT LOCATION 4400.

   - THE RESULTS OF A READ ERROR CODE ARE STORED IN THIS TABLE.

   - OPERATION - IF A READ ERROR CODE FUNCTION IS USED THEN THE RESULTS ARE STORED IN THIS TABLE WITH A STARTING ADDRESS AS SHOWN IN THE FUNCTION TABLE BELOW. THE NEXT 8 BYTES CONTAIN RESULTS OF THE FUNCTION.

5. THE FUNCTION TABLE IS AT LOCATION 712.

## 8.0 LISTING INDEX



## 8.1 LISTING

&

```
                                        .NLIST TTM
                                        .TITLE  RX01,2,X UTILITY DRIVER
                                        ;MAINDEC-11-
                                        ;7 FEB 77   UPDATE: 18-APR-78
                                        ;L.PRUCHA  V: 3
                                        ;THIS SOURCE TAKEN FROM BRUT2.LSI
                                        .ENABLE ABS.AMA
                                        .MCALL ..V2..,.REGDEF

        000000                          .=0
000000  000000                          .WORD   0
000002  000000                          .WORD   0
000004  000000                          .WORD   0
000006  000000                          .WORD   0
000010  000000                          .WORD   0
000012  000000                          .WORD   0
000014  000000                          .WORD   0
000016  000000                          .WORD   0
000020  000000                          .WORD   0
000022  000000                          .WORD   0

        000200                          .=200
000200  000167  000574                  JMP     START

                                ;***** RX INTERRUPT VECTOR *****

        000264                          .=264                   ;RX INTERRUPT HANDLER ADDRESS
000264  003452                          RXINTR                  ;IF INTERRUPTS ARE USED AND VECTOR ADDRESS
000266  000340                          340                     ;IS NOT 264, THEN THIS MUST BE MODIFIED.

        000600                          .=600
                                ;***** RX01,2,X REGISTERS *****

000600  177170                  RXCS:   177170
000602  177172                  RXDB:   177172

                                ;***** PROCESSOR ADDRESSES *****

000604  177776                  PSW:    177776
000606  000760                  SWR:    760

                                ;***** CONTSTANTS *****

000610  177570                  HDSWR:  177570                  ;HARDWARE SWITCH REG ADDRESS
000612  000760                  SFSWR:  760                     ;SOFTWARE SWITCH REG ADDRESS
000614  000004                  BTRP:   4                       ;BUS TRAP ADDRESS
000616  000006                  BTRP2:  6                       ;BUS TRAP PRI LEVEL
```

```
                        000700                  .=700
                                        ;***** SET PARAMETERS DESIRED FOR UNIT UNDER TEST *****

000700  000000          SETCS:  0               ;SET RXCS-USED TO SET: DRV#,SIDE#,DENSITY BIT,INTERRUPT
000702  000001          WRDCNT: 1               ;WORD COUNT-FOR FILL OR EMPTY BUFFER OPERATIONS
000704  100000          RDYDLY: 100000          ;READY DELAY            : TIME OUT
000706  000001          RDYDX:  1               ;READY MULTIPLIER       :      DELAYS
000710  000001          OPNUM:  1               ;NUMBER OF OPERATIONS (1 TO 15 DECIMAL)
                        ;-------------------------------------------------------------------
                        ;
                        ;       ***** FUNCTION TABLE *****
                        ;
                        ;ENTER FUNCTIONS IN SEQUENCE DESIRED.  MUST HAVE AT LEAST 1 FUNCTION
                        ;ENTERED, AND MAY HAVE UP TO 16 OPERATIONS.  SET THE OPERATION COUNTER
                        ;(OPNUM) ABOVE EQUAL TO THE NUMBER OF FUNCTIONS IN THE SEQUENCE.
                        ;
                        ;       CODE            FUNCTION
                        ;       ----            --------
                        ;        0      =       FILL BUFFER
                        ;        1      =       EMPTY BUFFER
                        ;        2      =       WRITE SECTOR
                        ;        3      =       READ SECTOR
                        ;        4      =       SET DENSITY (RX02,XX) ** BE CAREFUL  TAKES 15 SECONDS **
                        ;        5      =       READ MAINTENANCE STATUS  ** MAINTENANCE MODE **
                        ;        6      =       WRITE SECTOR WITH DELETED DATA
                        ;        7      =       READ ERROR CODE
                        ;-------------------------------------------------------------------
                        ;       !--< FILL WITH SEQUENCE OF FUNCTIONS
                        ;       !
                        ;       !               ETAD            XETAD (RX02,XX ONLY)
                        ;       !               ----            -----
000712  000000          FUNTAB: 0       ;       3700            4400
000714  000000                  0       ;       3702            4420
000716  000000                  0       ;       3704            4440
000720  000000                  0       ;       3706            4460
000722  000000                  0       ;       3710            4500
000724  000000                  0       ;       3712            4520
000726  000000                  0       ;       3714            4540
000730  000000                  0       ;       3716            4560
000732  000000                  0       ;       3720            4600
000734  000000                  0       ;       3722            4620
000736  000000                  0       ;       3724            4640
000740  000000                  0       ;       3726            4660
000742  000000                  0       ;       3730            4700
000744  000000                  0       ;       3732            4720
000746  000000                  0       ;       3734            4740
000750  000000                  0       ;       3736            4760
                        ;-------------------------------------------------------------------
                          INTAB=4000                    ;ADDRESS OF INPUT TABLE, RX TO TABLE
                          OUTAB=5000                    ;ADDRESS OF OUTPUT TABLE, TABLE TO RX
                           ETBA=3700                    ;ADDRESS OF ERROR TABLE (16 WORDS)
                          XETBA=4400                    ;ADDRESS OF EXTENDED ERROR CODE TABLE
                        ;-------------------------------------------------------------------
                                .=760
000760  000000          SOFTSR: 0                       ;SOFTWARE SWITCH REG
                        ;-------------------------------------------------------------------
```

```
                        001000                          .=1000
                                                        ;START OF PROGRAM
                                                .SBTTL  MODULE 0.0 - CONTROL
                                                        ;-------------------------------------------------------------

001000  012706  000500          START:  MOV     #500,SP         ;INTIALIZE STACK PIONTER
001004  012777  001042  177602          MOV     #SSWTRP,@BTRP   ;SET BUS TRAP FOR SWITCHLESS ADR TRAP
001012  012777  000200  177576          MOV     #200,@BTRP2     ;SET PROCESSOR PRI FOR TRAP
001020  005777  177564                  TST     @HDSWR          ;CAUSE SWITCHLESS PROCESSOR TRAP
001024  016767  177560  177554          MOV     HDSWR,SWR       ;SET UP FOR HARDWARE SWITCH REG.
001032  016767  177552  002272          MOV     HDSWR,DISPLY    ;SET DISPLAY REG
001040  000403                          BR      START0          ;NO SWITCHLESS PROCESSOR TRAP BRANCH
001042  016767  177544  177536  SSWTRP: MOV     SFSWR,SWR       ;SET UP SOFTWARE SWITCH REG.
001050  012777  001074  177536  START0: MOV     #LSITRP,@BTRP   ;SET BUS TRAP FOR LSI TRAP
001056  012777  000200  177532          MOV     #200,@BTRP2     ;SET PROCESS
001064  012777  000340  177512          MOV     #340,@PSW       ;CAUSE LSI TRAP
001072  000405                          BR      START1          ;BR IF NO TRAP
001074  012767  000001  000740  LSITRP: MOV     #1,LSIFLG       ;SET SWITCHLESS PROCESSOR FLAG
001102  106427  000200                  MTPS    #200            ;SET LSI PRIORITY
001106  005077  177502          START1: CLR     @BTRP           ;RESET BUS TRAP
001112  005077  177500                  CLR     @BTRP2          ;RESET BUS TRAP
001116  012767  000001  000642          MOV     #1,TR           ;INTIALIZE INPUT TYPE
001124  012767  000000  000632          MOV     #0,TE           ;INTIALIZE TABLE ENTR
001132  012767  000000  000660          MOV     #0,DNWD         ;SET DONE BIT TO ZERO
001140  016767  177734  000636          MOV     CSAD,ADOT       ;ADDRESS OF OUTPUT WORD (PASS TO 3.0)
001146  016767  000652  000632          MOV     INTWD,WDOT      ;INTIALIZE WORD         (PASS TO 3.0)
001154  004767  001076                  JSR     PC,OUTPUT       ;INTIALIZE DEVICE       DO 3.0
001160  012767  000040  000632          MOV     #40,DNWD        ;SET DONE BIT TO ONE
001166  016767  177406  000576          MOV     CSAD,ADIN       ;ADDRESS OF INPUT WORD  (PASS TO 1.0
001174  016767  000566  000574          MOV     TR,TYIN         ;INPUT TYPE             (PASS TO 1.0)
001202  004767  000640                  JSR     PC,INPUT        ;INPUT DEVICE CS REG    DO 1.0
001206  016767  000562  000612          MOV     WDIN,CSWD       ;SAVE DEVICE CS REG     (FROM  1.0)
001214  016767  177366  000550  DO0:    MOV     SWR,ADIN        ;ADDRESS OF WORD INPUT  (PASS TO 1.0)
001222  012767  000000  000570          MOV     #0,DNWD         ;SET DONE BIT TO ZERO   (PASS TO 1.0)
001230  012767  000001  000530          MOV     #1,TR           ;SET INPUT TYPE         (PASS TO 1.0)
001236  016767  000524  000532          MOV     TR,TYIN         ;INPUT TYPE             (PASS TO 1.0)
001244  004767  000576                  JSR     PC,INPUT        ;INPUT SWITCH REG       DO 1.0
001250  016767  000520  000552          MOV     WDIN,SWWD       ;SAVE SWITCH REG        (FROM    1.0)
001256  016767  000502  000514          MOV     TE,TABENT       ;TABLE ENTRY            (PASS TO 2.0)
001264  016767  177410  000524          MOV     SETFW,STWD      ;SET FUNCTION WORD      (PASS TO 2.0)
001272  004767  000706                  JSR     PC,PROCES       ;PROCESS TABLE ENTRY    DO 2.0
001276  016767  000500  000456          MOV     FNWD,FW         ;SAVE FUNCTION WORD     (FROM 2.0)
001304  032767  020000  000516  IFA0:   BIT     #20000,SWWD     ;IF SR BIT#13
001312  001413                          BEQ     EA10            ;EQUALS ONE, THEN
001314  012767  000040  000476          MOV     #40,DNWD        ;SET DONE BIT                   (PASS TO 3.0)
001322  016767  177252  000454          MOV     CSAD,ADOT       ;AND SET ADDRESS OF OUTPUT      (PASS TO 3.0)
001330  016767  000470  000450          MOV     INTWD,WDOT      ;AND SET INTIALIZE WORD         (PASS TO 3.0)
001336  004767  000714                  JSR     PC,OUTPUT       ;AND INTIALIZE DEVICE           DO 3.0
001342  012767  000040  000450  EA10:   MOV     #40,DNWD        ;SET DONE BIT TO ONE            (PASS TO 3.0
001350  016767  000410  000460          MOV     TE,TBEN         ;TABLE ENTRY                    (PASS TO 3.0)
001356  016767  000400  000422          MOV     FW,WDOT         ;FUNCTION WORD FOR OUTPUT       (PASS TO 3.0)
001364  016767  000436  000376          MOV     CSWD,STATWD     ;DEVICE STATUS WORD             (PASS TO 3.0)
001372  016767  177304  000410          MOV     WC,WDCT         ;BUFFER WORD COUNT (RX02)       (PASS TO 3.0)
001400  016767  000424  000404          MOV     SWWD,TASA       ;TA AND SA (IN SWITCH WORD)     (PASS TO 3.0)
001406  004767  000644                  JSR     PC,OUTPUT       ;OUTPUT FUNCTION WORD           DO 3.0
001412  016701  000344                  MOV     FW,R1           ;MOVE FUNCTION WORD TO R1
```

```
                                        BIC     #177761,R1      ;MASK ALL BUT FUNCTION
                                IFB0:   CMP     #2,R1           ;IF FUNCTION IS (FW BITS#3,2,1)
                                        BNE     ELB0            ;"EMPTY BUFFER" (         0,0,1)
                                        MOV     CSWD,R1         ;THEN MOVE CS WORD TO R1
                                IFC0:   BIT     #4000,R1        ;IF DEVICE IS
                                        BNE     ELB0            ;RX01  (RXCS BIT#11=0)
                                        MOV     #64,TR          ;THEN SET TYPE TRANSFER
                                        MOV     TR,TYIN         ;INPUT TRANSFER          (PASS TO 1.0)
                                        MOV     #0,DNWD         ;SET DONE BIT TO ZERO    (PASS TO 1.0)
                                        MOV     DBAD,ADIN       ;ADDRESS OF INPUT        (PASS TO 1.0)
                                        JSR     PC,INPUT        ;INPUT RX01 "EMPTY BUFF" DO 1.0
                                ELB0:   MOV     TE,MULTE        ;SET UP TABLE ENTRY
                                        ASL     MULTE           ;MULTIPLY TABLE ENTRY (*2)
                                        MOV     #ETBA,ETAD      ;SET UP ERROR TABLE BASE ADDRESS
                                        ADD     MULTE,ETAD      ;CALCULATE ERROR TABLE ADDRESS
                                        MOV     #40,RDYWD       ;SET DONE BIT TEST    (PASS TO 1/3.1)
                                        JSR     PC,DELAY        ;DELAY FOR DONE        DO 1/3.1
                                IFD0:   BIT     #1,ERSTAT       ;IF ERROR STATUS
                                        BEQ     ELD0            ;EQUALS 1 THEN
                                        BR      EID0            ;PROCEED TO END IF 'D'
                                ELD0:   MOV     #1,TYIN         ;SET INPUT TYPE -SINGLE WD (PASS TO 1.0)
                                        MOV     #40,DNWD        ;SET DONE BIT -COMPARE WD  (PASS TO 1.0)
                                        MOV     CSAD,ADIN       ;SET ADRESS OF INPUT WD    (PASS TO 1.0)
                                        JSR     PC,INPUT        ;GET DEVICE STATUS WD       DO 1.0
                                IFE0:   BIT     #100000,WDIN    ;IF DEVICE ERROR BIT (RXCS BIT#15=1)
                                        BEQ     ELE0            ;EQUALS 1
                                EID0:   MOV     #1,TYIN         ;SET INPUT TYPE -SINGLE WD (PASS TO 1.0)
                                        MOV     DBAD,ADIN       ;SET ADDRESS OF INPUT WD   (PASS TO 1.0)
                                        MOV     #40,DNWD        ;SET DONE BIT -COMPARE WD  (PASS TO 1.0)
                                        JSR     PC,INPUT        ;GET DEVICE ERROR WD (RXES) DO 1.0
                                        MOV     WDIN,ERWD       ;SAVE ERROR WD
                                        MOV     ERWD,@ETAD      ;STORE ERROR WORD IN TABLE
                                        BR      EIE0            ;PROCEED TO END IF 'E'
                                ELE0:   MOV     #0,@ETAD        ;ZERO ERROR TABLE LOCATION
                                        CLR     ERSTAT          ;CLEAR ERROR STATUS (SET BY 3.0)
                                EIE0:   INC     TE              ;INCREMENT TABLE ENTRY
                                IFF0:   BIT     #100000,SWWD    ;IF SR BIT#15 IS
                                        BEQ     IFH0            ;EQUAL TO ONE
                                        HALT                    ;THEN HALT
                                IFG0:   CMP     TL,TE           ;IF      (TL-TE)
                                        BNE     EIG0            ;TE=TL
                                        MOV     #0,TE           ;THEN SET TE=0
                                EIG0:   BR      EIF0
                                IFH0:   CMP     TL,TE           ;IF      (TL-TE)
                                        BNE     EIH0            ;TE=TL
                                IFI0:   BIT     #40000,SWWD     ;THEN IF SR BIT#14 IS
                                        BEQ     EII0            ;EQUAL TO ONE
                                        HALT                    ;THEN HALT
                                EII0:   MOV     #0,TE           ;SET TABLE ENTRY TO ZERO
                                EIH0:   NOP
                                EIF0:   NOP
                                        JMP     D00             ;GET NEXT TABLE ENTRY
                                ;-----------------------------------------------------------------
```

```
                                ;MODULE 0.0 - REGISTERS AND PARAMETERS ----------------------------------
000606                             SWAD=SWR                ;EXTERNAL, SWITCH REG ADDRESS
000600                             CSAD=RXCS               ;EXTERNAL, RXCS ADDRESS
000602                             DBAD=RXDB               ;EXTERNAL, RXDB ADDRESS
000710                               TL=OPNUM              ;EXTERNAL,SET FUNCTION TABLE LENGTH
000702                               WC=WRDCNT             ;EXTERNAL, WORD COUNT
000700                           SETFW=SETCS               ;EXTERNAL, SET PART OF FUNCTION WORD
001762  000000                FW:      0                  ;INTERNAL, FUNCTION WORD
001764  000000                TE:      0                  ;INTERNAL, TABLE ENTRY
001766  000000                TR:      0                  ;INTERNAL, TRANSFER TYPE
001770  000000                STATWD:  0                  ;MODULE 3.0 DEVICE STATUS WORD
001772  000000                ADIN:    0                  ;MODULE 1.0 INPUT ADDRESS
001774  000000                WDIN:    0                  ;MODULE 1.0 INPUT WORD
001776  000000                TYIN:    0                  ;MODULE 1.0 TYPE TRANSFER
002000  000000                TABENT:  0                  ;MODULE 2.0 TABLE ENTRY
002002  000000                FNWD:    0                  ;MODULE 2.0 FUNCTION WORD
002004  000000                ADOT:    0                  ;MODULE 3.0 OUTPUT ADDRESS
002006  000000                WDOT:    0                  ;MODULE 3.0 OUTPUT WORD
002010  000000                WDCT:    0                  ;MODULE 3.0 WORD COUNT (RX02)
002012  000000                TASA:    0                  ;MODULE 3.0 TRACK AND SECTOR ADDRESS
002014  000000                DATAD:   0                  ;MODULE 3.0 DATA ADDRESS
002016  000000                STWD:    0                  ;MODULE 2.0 PRESET FUNCTION WORD
002020  000000                DNWD:    0                  ;MODULE 0.0 DONE READY TEST WORD
002022  000000                RDYWD:   0                  ;MODULE 1/3.1 READY WORD
002024  040000                INTWD:   40000              ;INTERNAL,INITIALIZE DEVICE WORD
002026  000000                CSWD:    0                  ;INTERNAL,DEVICE CS REG
002030  000000                SWWD:    0                  ;INTERNAL,SWITCH REG WORD
002032  000000                MULTE:   0                  ;INTERNAL,MULTIPLY TABLE ENTRY PARAM.
002034  000000                ETAD:    0                  ;INTERNAL,ADDRESS OF ERROR WORD
002036  000000                TBEN:    0                  ;MODULE 3.0 CURRENT TABLE ENTRY
002040  000000                ERWD:    0                  ;INTERNAL, TEMP STORAGE ERROR WORD
002042  000000                LSIFLG:  0                  ;EXTERNAL, LSI PROCESSOR/SWITCHLESS PROCESSOR FLAG
002044  000000                INTRFG:  0                  ;EXTERNAL, INTERRUPT FLAG


                                ;MODULE 0.0 ----- END MODULE ----------------------------------------
```

```
                                        .SBTTL  MODULE 1.0 - INPUT
                                        ;-------------------------------------------------------------------

002046  000240                  INPUT:  NOP
002050  032767  000001  177720  IFA1:   BIT     #1,TYIN         ;IF WORD TRANSFER
002056  001413                          BEQ     ELA1            ;EQUALS ONE
002060  016767  177734  177734        MOV     DNWD,RDYWD      ;SET READY WORD (PASS TO 1/3.1)
002066  004767  001156                JSR     PC,DELAY        ;DELAY FOR READY   DO 1/3.1
002072  000240                        NOP
002074  017767  177672  177672        MOV     @ADIN,WDIN      ;THEN TRANSFER WORD (PASS TO 0.0)
002102  000240                        NOP
002104  000431                        BR      EIA1            ;BRANCH TO ENDIF 'A'
002106  012767  000000  000062  ELA1:   MOV     #0,BYCNT        ;INTIALIZE BYTE COUNT
002114  016701  000056          BDA1:   MOV     BYCNT,R1        ;MOVE BYTE COUNT
002120  062701  004000                  ADD     #BAINTB,R1      ;ADD DATA BASE ADDRESS TO BYTE COUNT
002124  010167  000050                  MOV     R1,DAINAD       ;MOVE RESULT TO DATA ADDRESS
002130  016767  000046  177664        MOV     INTR,RDYWD      ;SET READY WORD  (PASS TO 1/3.1)
002136  004767  001106                JSR     PC,DELAY        ;DELAY FOR READY  DO 1/3.1
002142  117777  177624  000030        MOVB    @ADIN,@DAINAD   ;MOV DATA BYTE TO INPUT DATA TABLE
002150  005267  000022                INC     BYCNT           ;INCREMENT BYTE COUNT
002154  000240                        NOP
002156  000240                        NOP
002160  032767  000200  000010        BIT     #200,BYCNT      ;TEST BYCNT
002166  001752                DUA3:   BEQ     BDA1            ;DOUNTIL BYCNT=128 BYTES
002170  000240                EIA1:   NOP
002172  000240                        NOP
002174  000207                        RTS     PC              ;RETURN TO MOD 0.0


                                        ;MODULE 1.0 REGISTERS ----------------------------------------------

002176  000000                BYCNT:  0                       ;INTERNAL, BYTE COUNTER
002200  000000                DAINAD: 0                       ;INTERNAL, CURRENT ADDRESS DATA INPUT TABLE
002202  000200                INTR:   200                     ;INTERNAL, TRANSFER READY, INPUT
        004000                 BAINTB=INTAB                   ;EXTERNAL, INPUT DATA TABLE BEGIN ADDRESS
                                ;MODULE 1.0 ----- END MODULE ----------------------------------------------
```

```
                                        .SBTTL  MODULE 2.0 - PROCESS
                                        ;-------------------------------------------------------------------

002204  000240                  PROCES: NOP
002206  006167  177566                  ROL     TABENT          ;DOUBLE ENTRY FOR TABLE ADDRESS
002212  016705  177562                  MOV     TABENT,R5       ;ENTRY FUNCTION CODE TABLE
002216  012704  000712                  MOV     #TBA,R4         ;BASE ADDRESS FUNCTION CODE TABLE
002222  060405                          ADD     R4,R5           ;FORM ADDRESS OF FUNCTION CODE
002224  010567  000024                  MOV     R5,FUNCAD       ;SAVE ADDRESS OF FUNCTION CODE
002230  011501                          MOV     (R5),R1         ;GET FUNCTION CODE
002232  000261                          SEC                     ;SET CARRY BIT
002234  006101                          ROL     R1              ;FORMAT FUNCTION CODE + GO BIT
002236  016702  177554                  MOV     STWD,R2         ;GET SET FUNCTION WORD
002242  050102                          BIS     R1,R2           ;MASK FUNCTION CODE ONTO SET FUNCTION WORD
002244  010267  177532                  MOV     R2,FNWD         ;FUNCTION WORD  (PASS TO 0.0)
002250  000240                          NOP
002252  000207                          RTS     PC              ;RETURN TO MOD 0.0
                                        ;MODULE 2.0 REGISTERS ----------------------------------------------

                        000712              TBA=FUNTAB          ;BEGIN ADDRESS FUNCTION CODE TABLE
002254  000000                  FUNCAD: 0                       ;CURRENT FUNCTION CODE ADDRESS
                                        ;MODULE 2.0 ----- END MODULE ------------------  ------------------
```

```
                                        .SBTTL  MODULE 3.0 - OUTPUT
                                        ;-------------------------------------------------------------------

002256  000240                  OUTPUT: NOP
002260  016767  177534  177534         MOV     DNWD,RDYWD      ;READY TEST WD          (PASS TO 3.1)
002266  016767  177514  000604         MOV     WDOT,WRDS       ;WORD FOR OUTPUT        (PASS TO 3.1)
002274  016767  176300  000600         MOV     CSADR,ADRS      ;ADDRESS OF OUTPUT      (PASS TO 3.1)
002302  004767  000614                 JSR     PC,OUTSWD       ;OUTPUT FUNCTION WD (FW) DO 3.1
002306  032767  040000  177472  IFA3:  BIT     #40000,WDOT     ;IF FUNCTION IS
002314  001001                         BNE     ELA3            ;NOT AN ''INTIALIZE'' (FW BIT#14=0)
002316  000402                         BR      THA3            ;THEN 'A'
002320  000167  000520         ELA3:  JMP     END3            ;ENDIF 'A' -DONE
002324  032767  000010  177454  THA3:  BIT     #10,WDOT        ;THEN, IF FUNCTION IS
002332  001073                         BNE     IFC3            ;''READ,WRITE,FILL,EMPTY'' (FW BIT#3=0)
002334  032767  000004  177444  IFH3:  BIT     #4,WDOT         ;AND THEN IF FUNCTION IS
002342  001077                         BNE     ELH3            ;''EMPTY,FILL''   (FW BIT#2=0)
002344  032767  004000  177416  IFI3:  BIT     #4000,STATWD    ;THEN IF DEVICE IS
002352  001443                         BEQ     IFJ3            ;RX02     (RXCS BIT#11=1)
002354  016767  000516  177440         MOV     OTTR,RDYWD      ;THEN SET OUTPUT READY TEST WORD (PASS TO 3.1)
002362  016767  177422  000510         MOV     WDCT,WRDS       ;AND SET WORD FOR OUTPUT        (PASS TO 3.1)
002370  016767  176206  000504         MOV     DBADR,ADRS      ;AND SET ADDRESS OF OUTPUT      (PASS TO 3.1)
002376  004767  000520                 JSR     PC,OUTSWD       ;OUTPUT WORD  COUNT  WORD        DO 3.1
002402  032767  000002  177376  IFK3:  BIT     #2,WDOT         ;IF FUNCTION IS
002410  001004                         BNE     ELK3            ;''FILL BUFFER''      (FW BIT#1=0)
002412  012767  005000  000474         MOV     #BAOUTB,BA      ;SET BASE ADDRESS FOR FILL
002420  000403                         BR      EIK3            ;BRANCH TO ENDIF 'K'
002422  012767  004000  000464  ELK3:  MOV     #BAINTB,BA      ;SET BASE ADDRESS FOR EMPTY
002430  016767  000442  177364  EIK3:  MOV     OTTR,RDYWD      ;SET OUTPUT READY TEST WORD  (PASS TO 3.1)
002436  016767  000452  000434         MOV     BA,WRDS         ;WORD FOR OUTPUT             (PASS TO 3.1)
002444  016767  176132  000430         MOV     DBADR,ADRS      ;ADDRESS OF OUTPUT           (PASS TO 3.1)
002452  004767  000444                 JSR     PC,OUTSWD       ;OUTPUT BASE ADDRESS WORD     DO 3.1
002456  000167  000362                 JMP     END3            ;DONE
002462  032767  000002  177316  IFJ3:  BIT     #2,WDOT         ;IF FUNCTION IS
002470  001013                         BNE     EII3            ;''FILL BUFFER -RX01'' (FW BIT#1=0)
002472  016767  000400  177322         MOV     OTTR,RDYWD      ;THEN SET OUTPUT READY TEST WORD (PASS TO 3.2)
002500  016767  002274  000376         MOV     BAOUTB,WRDM     ;WORD TABLE FOR OUTPUT           (PASS TO 3.2)
002506  016767  176070  000372         MOV     DBAD,ADRM       ;ADDRESS OF OUTPUT               (PASS TO 3.2)
002514  004767  000432                 JSR     PC,OUTMWD       ;OUTPUT WORD TABLE                DO 3.2
002520  000460                 EII3:   BR      EIH3            ;BRANCH TO ENDIF 'H'
002522  032767  000004  177256  IFC3:  BIT     #4,WDOT         ;IF FUNCTION WORD IS
002530  001516                         BEQ     IFE3            ;''WRITE D.D.'' OR 'READ E.C.''(FW BIT#2=1)
002532  032767  000002  177246  IFD3:  BIT     #2,WDOT         ;THEN, IF FUNCTION IS
002540  001051                         BNE     IFF3            ;''WRITE D.D.'', THEN          (FW BIT#1=0)
002542  016767  000330  177252  ELH3:  MOV     OTTR,RDYWD      ;SET OUTPUT READY TEST WORD     (PASS TO 3.1)
002550  016767  177236  000322         MOV     TASA,WRDS       ;MOVE TRACK AND SECTOR ADDRESS  (PASS TO 3.1)
002556  042767  177700  000314         BIC     #177700,WRDS    ;FORMAT TO SECTOR ADDRESS       (PASS TO 3.1)
002564  016767  176012  000310         MOV     DBAD,ADRS       ;ADDRESS OF OUTPUT              (PASS TO 3.1)
002572  004767  000324                 JSR     PC,OUTSWD       ;OUTPUT SECTOR ADDRESS           DO 3.1
002576  016767  177210  000274         MOV     TASA,WRDS       ;MOVE TRACK AND SECTOR ADDRESS
002604  006067  000270                 ROR     WRDS            ;FORMAT
002610  006067  000264                 ROR     WRDS            ;FORMAT
002614  006067  000260                 ROR     WRDS            ;FORMAT
002620  006067  000254                 ROR     WRDS            ;FORMAT
002624  006067  000250                 ROR     WRDS            ;FORMAT
002630  006067  000244                 ROR     WRDS            ;FORMAT
002634  042767  177600  000236         BIC     #177600,WRDS    ;FORMAT TRACK ADDRESS       (PASS TO 3.1)
```

```
                                                ;SET OUTPUT READY TEST WORD (PASS TO 3.1)
                                                ;ADDRESS OF OUTPUT          (PASS TO 3.1)
                                                ;OUTPUT TRACK ADDRESS        DO 3.1
                                                ;ENDIF H -DONE
                                                ;IF DEVICE IS
                                                ;RX02, THEN          (RXCS BIT#11=1)
                                                ;SET UP TABLE ENTRY FOR MULT.
                                                ;-MULTIPLY
                                                ; TABLE ENTRY (TE)
                                                ; BY
                                                ; 20(8)
                                                ;SET UP TO CAL. ADDRESS
                                                ;EXTENDED ERROR TABLE ADDRESS
                                                ;SET READY WD TO TR MODE     (PASS TO 3.1)
                                                ;EXT ERR. CODE TABLE ADD     (PASS TO 3.1)
                                                ;ADDRESS OF OUTPUT, RXDB     (PASS TO 3.1)
                                                ;O/P BASE ADD FOR ERR. CODE   DO 3.1
                                                ;DONE
                                                ;IF FUNCTION IS
                                                ;'READ STATUS''      (FW BIT#1=1)
                                                ;THEN-SET ERR STATUS FLAG  (CLEAR BY 0.0)
                                                ;DONE
                                                ;IF DEVICE IS
                                                ;RX02, THEN                  (RXCS BIT#11=1)
                                                ;SET  OUTPUT READY TEST WD (PASS TO 3.1)
                                                ;VALIDATION WORD            (PASS TO 3.1)
                                                ;ADDRESS OF OUTPUT ,RXDB    (PASS TO 3.1)
                                                ;OUTPUT VALIDATION WORD      DO 3.1
                                                ;IF INTERRUPT BIT
                                                ;IS SET, THEN
                                                ;CALL MOD U.2 - WATCH DOG
                                                ;BR TO END
                                                ;SET DELAY FOR DONE
                                                ;DELAY FOR DONE BIT
                                                ;RETURN TO MOD 0.0
                                                ;MODULE 3.0 REGISTERS ----------
                                                ;MODULE 1/3.1 TRANSFER READY, OUTPUT
                                                ;MODULE 3.1 OUTPUT WORD
                                                ;MODULE 3.1 OUTPUT ADDRESS
                                                ;MODULE 3.2 OUTPUT WORD
                                                ;MODULE 3.2 OUTPUT ADDRESS
                                                ;MODULE 0.0 ERR STATUS READ FLAG
                                                ;EXTERNAL, VALIDATION WD (SET DENS.) ASCII ''I''
                                                ;INTERNAL, TEMP BASE ADDRESS
                                                ;INTERNAL, MULTIPLY PARAMETER
                                                ;MODULE 3.1 EXT. ERR. TABLE ADDR.
                                                ;MODULE 0.0 RX DATA BUFFER ADDRESS
                                                ;MODULE 0.0 RX CONT/STATUS ADDRESS
                                                ;EXTERNAL, BASE ADDRESS OUTPUT TABLE
                                                ;MODULE 3.0 ----- END MODULE ----------
```

H 2

MODULE 3.1 - OUTPUT SINGLE WORD

SEQ 0020

```
                                        .SBTTL  MODULE 3.1 - OUTPUT SINGLE WORD
                                        ;-------------------------------------------------------------

003122  000240                  OUTSWD: NOP
003124  016767  176672  176670        MOV     RDYWD,RDYWD     ;OUTPUT READY WORD      (PASS TO 1/3.1)
003132  004767  000112                JSR     PC,DELAY        ;DELAY FOR READY        DO 1/3.1
003136  000240                        NOP
003140  016777  177734  177734        MOV     WRDS,@ADRS      ;MOVE WORD TO ADDRESS
003146  000240                        NOP
003150  000207                        RTS     PC              ;RETURN TO MOD 3.0
                                    ;MODULE 3.1 ----- END MODULE ----------------------------------

                                        .SBTTL  MODULE 3.2 - OUTPUT MULTIPLE WORDS
                                        ;-------------------------------------------------------------

003152  000240                  OUTMWD: NOP
003154  012767  000000  000062        MOV     #0,BTCNT        ;INTIALIZE BYTE COUNT
003162  016767  176634  176632  BDA32: MOV     RDYWD,RDYWD     ;OUTPUT READY WORD      (PASS TO 1/3.1)
003170  004767  000054                JSR     PC,DELAY        ;DELAY FOR READY        DO 1/3.1
003174  000240                        NOP
003176  016701  000042                MOV     BTCNT,R1        ;MOVE BYTE COUNT
003202  062701  005000                ADD     #BAOUTB,R1      ;ADD DATA BASS ADDRESS TO BYTE COUNT
003206  010167  000034                MOV     R1,DAOTAD       ;MOV RESULT TO OUTPUT DATA ADDRESS
003212  117777  000030  177666        MOVB    @DAOTAD,@ADRM   ;MOV DATA BYTE TO OUTPUT
003220  000240                        NOP
003222  005267  000016                INC     BTCNT           ;INCREMENT BYTE COUNT
003226  000240                        NOP
003230  032767  000200  000006  DUA32: BIT     #200,BTCNT      ;TEST BYCNT
003236  001751                        BEQ     BDA32           ;DO UNTIL BTCNT=128 BYTES
003240  000240                        NOP
003242  000207                        RTS     PC              ;RETURN TO MOD 3.0
                                    ;MODULE 3.2 REGISTERS ----------------------------------------

003244  000000                  BTCNT:  0                       ;INTERNAL, BYTE COUNTER
        005000                   BAOUTB=OUTAB                   ;EXTERNAL, BASE ADDRESS OF OUTPUT TABLE
003246  000000                  DAOTAD: 0                       ;INTERNAL, CURRENT ADDRESS IN OUTPUT TABLE
                                    ;MODULE 3.2 ----- END MODULE  ----------------------------------
```

```
                                        .SBTTL  MODULE 1/3.1 - DELAY
                                        ;-----------------------------------------------------------------
                                        DELAY:  NOP
003252  026727  176544  000000        IFA13:  CMP     RDYWD,#0        ;IF READY WORD
003260  001423                                BEQ     EIA13           ;EQUALS ZERO THEN BRANCH TO ENDIF 'A'
003262  016704  175420                        MOV     RYDX,R4         ;SET READY DELAY MULT
003266  016703  175412                BDA13:  MOV     RYDLY,R3        ;SET READY DELAY
003272  036777  176524  175300        BDB13:  BIT     RDYWD,@CSAD     ;IF READY
003300  001012                                BNE     EIB13           ;EQUAL TO ONE THEN BRANCH TO ENDIF 'B'
003302  005303                                DEC     R3              ;ELSE DECREMENT DELAY
003304  010377  000022                        MOV     R3,@DISPLY      ;DISPLAY R3
003310  010377  000016                        MOV     R3,@DISPLY      ;DISPLAY R3
003314  010377  000012                        MOV     R3,@DISPLY      ;DISPLAY R3
003320  001364                                BNE     BDB13           ;DOUNTIL R3=0
003322  005304                                DEC     R4              ;DECREMENT DELAY MULT.
003324  001360                                BNE     BDA13           ;DOUNTIL R4=0
003326  000240                        EIB13:  NOP
003330  000207                        EIA13:  RTS     PC              ;RETURN TO CALLING MODULE
                                        ;MODULE 1/3.1 REGISTERS ----------------------------------------
                                        
                                          RYDX=RDYDX                    ;EXTERNAL, READY MULTIPLIER
                                         RYDLY=RDYDLY                   ;EXTERNAL, READY DELAY
003332  000762                        DISPLY: 762                       ;INTERNAL, ADDRESS OF LIGHTS
                                        ;MODULE 1/3.1 ----- END MODULE ---------------------------------
```

```
                                        .SBTTL  MOD U.2.1  - WATCH DOG TIMER
                                        ;-------------------------------------------------------------
                                        ;
003334  000240                  WATCH:  NOP                     ;
003336  012767  000000  000104          MOV     #PR0,NEWPRI     ;SET PROCESSOR PRI=0
003344  004767  000054                  JSR     PC,SETPRI       ;SET PROCESSOR PRI
003350  016704  000044                  MOV     DX,R4           ;SET DELAY MULT
003354  016703  000042          BDAU21: MOV     DLY,R3          ;SET DELAY
003360  005767  176460          BDBU21: TST     INTRFG          ;IF INTERRUPT FLAG
003364  001007                          BNE     ENDU21          ;EQUALS ZERO, THEN
003366  005303                          DEC     R3              ;DECREMENT DELAY CNT
003370  001373                          BNE     BDBU21          ;IF IT EQUALS ZERO
003372  005304                          DEC     R4              ;THEN DECREMENT DELAY MULT
003374  001367                          BNE     BDAU21          ;IF IT EQUALS ZERO, THEN
003376  052767  000001  177504          BIS     #1,ERSTAT       ;SET ERROR
003404  012767  000340  000036  ENDU21: MOV     #PR7,NEWPRI     ;SET PROCESSOR PRI=7
003412  004767  000006                  JSR     PC,SETPRI       ;SET PROCESSOR PRI
003416  000207                          RTS     PC              ;RETURN TO MOD 2.3.4
                                        ;-------------------------------------------------------------
                                        PR0=0                           ;PRIORITY 0
                                        PR7=340                         ;PRIORITY 7
003420  000010                  DX:     10                      ;DELAY MULT
003422  100000                  DLY:    100000                  ;DELAY
                                        ;MOD U.2.1 ---- END MODULE ------------------------------------
                                        .SBTTL  SET PROCESSOR PRI
                                        ;-------------------------------------------------------------
                                        ;
003424  005767  176412          SETPRI: TST     LSIFLG          ;IF PROCESSOR IS
003430  001403                          BEQ     1$              ;LSI, THEN
003432  106467  000012                  MTPS    NEWPRI          ;SET PROCESSOR PRI
003436  000403                          BR      SETPIX          ;BR TO END
003440  016777  000004  175136  1$:     MOV     NEWPRI,@PSW     ;SET PROCESSOR PRI
003446  000207                  SETPIX: RTS     PC              ;RETURN
                                        ;-------------------------------------------------------------
003450  000000                  NEWPRI: 0                       ;NEW PROCESSOR PRIORITY
                                        ;-------------------------------------------------------------
                                        .SBTTL  RX INTERRUPT HANDLER
                                        ;-------------------------------------------------------------
                                        ;
003452  000240                  RXINTR: NOP                     ;
003454  005267  176364                  INC     INTRFG          ;INCREMENT INTERRUPT FLAG
003460  000240                          NOP                     ;
003462  000002                          RTI                     ;RETURN TO PROGRAM
                                        ;-------------------------------------------------------------
```

```
1006                                    .SBTTL  DATA TABLES
1007                                    ;-----------------------------------------------------------------------
1008            003700                  .=3700                  ;ERROR TABLE (CODE=5 OR RXES IF ERR OCCURRED)
1009            000020                  .REPT 16.
1010                                    .WORD 0
1011                                    .ENDR
1012
1013                                    ;-----------------------------------------------------------------------
1014            004000                  .=4000                  ;INPUT TABLE -- RX TO TABLE
1015            000400                  .REPT   256.
1016                                    .BYTE   0
1017                                    .ENDR
1018
1019                                    ;-----------------------------------------------------------------------
1020            004400                  .=4400                  ;EXTENDED ERROR CODE TABLE (CODE=7)
1021            000200                  .REPT 128.
1022                                    .WORD 0
1023                                    .ENDR
1024
1025                                    ;-----------------------------------------------------------------------
1026            005000                  .=5000                  ;OUTPUT TABLE -- TABLE TO RX
1027            000400                  .REPT   256.
1028                                    .BYTE   377
1029                                    .ENDR
1030                                    ;-----------------------------------------------------------------------
1031    005400  000000                  PATCH:  0               ;PATCH AREA
1032            006000                  .=6000
1033                                    ;-----------------------------------------------------------------------
1034
1035                                    ;---------- BOOT RX01 ----------------------------------------------------
1036    006000  005000                  BOOTRX: CLR     R0
1037    006002  012701  177170                  MOV     #177170,R1      ;LOAD RXCS ADR
1038    006006  105711                  1$:     TSTB    (R1)            ;TEST RXCS
1039    006010  001776                          BEQ     1$
1040    006012  012711  000003                  MOV     #3,(R1)         ;SEND COMMAND
1041    006016  005711                  2$:     TST     (R1)            ;TEST RXCS
1042    006020  001776                          BEQ     2$              ;WAIT FOR TR, DONE, OR ERROR
1043    006022  100405                          BMI     3$              ;ERROR - HALT!
1044    006024  105711                          TSTB    (R1)            ;SEE IF 'TR'
1045    006026  100004                          BPL     4$              ;NOT 'TR', BUT 'DONE'
1046    006030  116120  000002                  MOVB    2(R1),(R0)+     ;MOVE BYTE
1047    006034  000770                          BR      2$              ;NEXT
1048    006036  000000                  3$:     HALT
1049    006040  005000                  4$:     CLR     R0
1050    006042  000110                          JMP     (R0)
1051    006044  000000                          HALT
1052    006046  000000                          HALT
1053    006050  000000                          HALT
1054                                    ;-----------------------------------------------------------------------
1055
1056
1057            000001                          .END
```

```
ADIN     001772  606* 610* 643* 656* 661* 699# 736  745
ADOT     002004  602* 623* 704#
ADRM     003106  823* 884# 918*
ADRS     003102  793* 807* 816* 833* 844* 858* 869* 882# 902*
BA       003114  811* 813* 815  887#
BAINTB=  004000  741  761# 813
BAOUTB=  005000  811  822  892# 916  929#
BDAU21   003354  966# 972
BDA1     002114  740# 750
BDA13    003266  940# 949
BDA32    003162  912# 923
BDBU21   003360  967# 970
BDB13    003272  941# 947
BOOTRX   006000  1036#
BTCNT    003244  911* 915  920* 922  928#
BTRP     000614  518# 584* 591* 597*
BTRP2    000616  519# 585* 592* 598*
BYCNT    002176  739* 740  746* 749  758#
CSAD   = 000600  602  606  623  656  690# 891  941
CSADR  = 000600  793  891#
CSWD     002026  609* 629  637  713#
DAINAD   002200  742* 745* 759#
DAOTAD   003246  917* 918  930#
DATAD    002014  708#
DBAD   = 000602  643  661  691# 823  833  858  869  890
DBADR  = 000602  807  816  844  890#
DELAY    003250  650  734  744  876  900  913  936#
DISPLY   003332  588* 944* 945* 946* 956#
DLY      003422  966  981#
DNWD     002020  601* 605* 611* 622* 626* 642* 655* 662* 710# 733  791
DO0      001214  610# 685
DUA3     002166  750#
DUA32    003230  922#
DX       003420  965  980#
EA10     001342  621  626#
EIA1     002170  738  751#
EIA13    003330  938  951#
EIB13    003326  942  950#
EID0     001606  653  660#
EIE0     001664  666  669#
EIF0     001754  676  684#
EIG0     001720  674  676#
EIH0     001752  678  683#
EIH3     002662  825  846#
EII0     001744  680  682#
EII3     002520  820  825#
EIK3     002430  812  814#
ELA1     002106  732  739#
ELA3     002320  796  798#
ELB0     001476  636  639  645#
ELD0     001550  652  654#
ELE0     001652  659  667#
ELE3     003006  862  865#
ELH3     002542  802  830#
ELK3     002422  810  813#
ENDU21   003404  968  974#
```

```
END3    003044              798     818     846     860     864     866     871#
ERSTAT  003110              651     668*    863*    885#    973*
ERWD    002040              664*    665     718#
ETAD    002034              647*    648*    665*    667*    716#
ETBA  = 003700              571#    647
FNWD    002002              619     703#    778*
FUNCAD  002254              772*    784#
FUNTAB  000712              552#    783
FW      001762              619*    628     633     695#
HDSWR   000610              516#    586     587     588
IFA0    001304              620#
IFA1    002050              731#
IFA13   003252              937#
IFA3    002306              795#
IFB0    001422              635#
IFC0    001434              638#
IFC3    002522              800     826#
IFD0    001536              651#
IFD3    002532              828#
IFE0    001576              658#
IFE3    002766              827     861#
IFF0    001670              670#
IFF3    002664              829     847#
IFG0    001702              673#
IFH0    001722              671     677#
IFH3    002334              801#
IFI0    001732              679#
IFI3    002344              803#
IFJ3    002462              804     819#
IFK3    002402              809#
INPUT   002046              608     614     644     657     663     730#
INTAB = 004000              569#    761
INTR    002202              743     760#
INTRFG  002044              720#    967     1001*
INTWD   002024              603     624     712#
LSIFLG  002042              595*    719#    987
LSITRP  001074              591     595#
MULT    003116              849*    850*    851*    852*    853*    855     888#
MULTE   002032              645*    646*    648     715#
NEWPRI  003450              963*    974*    989*    991     994#
OPNUM   000710              528#    692
OTTR    003076              805     814     821     830     843     856     867     880#
OUTAB = 005000              570#    892     929
OUTMWD  003152              824     910#
OUTPUT  002256              604     625     632     790#
OUTSWD  003122              794     808     817     834     845     859     870     898#
PATCH   005400              1031#
PROCES  002204              618     767#
PR0   = 000000              963     978#
PR7   = 000340              974     979#
PSW     000604              511#    593*    991*
RDYDLY  000704              526#    955
RDYDX   000706              527#    954
RDYWD   002022              649*    711#    733*    743*    791*    805*    814*    821*    830*    843*    856*    867*    875*
                            899*    912*    937     941
RXCS    000600              506#    690
```

```
RXDB    000602          507#    691
RXINTR  003452          500     1000#
RYDLY = 000704          940     955#
RYDX  = 000706          939     954#
SETCS   000700          524#    694
SETFW = 000700          617     694#
SETPIX  003446          990     992#
SETPRI  003424          964     975     987#
SFSWR   000612          517#    590
SOFTSR  000760          575#
SSWTRP  001042          584     590#
START   001000          495     583#
STARTO  001050          589     591#
START1  001106          594     597#
STATWD  001770          629*    698#    803     847     865
STWD    002016          617*    709#    776
SWAD  = 000606          689#
SWR     000606          512#    587*    590*    610     689
SWWD    002030          615*    620     631     670     679     714#
TABENT  002000          616*    702#    768*    769
TASA    002012          631*    707#    831     835
TBA   = 000712          770     783#
TBEN    002036          627*    717#    849
TE      001764          600*    616     627     645     669*    673     675*    677     682*    696#
THA3    002324          797     799#
THE3    002776          848     863#
TL    = 000710          673     677     692#
TR      001766          599*    607     612*    613     640*    641     697#
TYIN    001776          607*    613*    641*    657*    660*    701#    731
VALWD   003112          868     886#
WATCH   003334          873*    962#
WC    = 000702          630     693#
WDCT    002010          630*    706#    806
WDIN    001774          609     615     658     664     700#    736*
WDOT    002006          603*    624*    628*    705#    792     795     799     801     809     819     826     828     861
                        871
WRDCNT  000702          525#    693
WRDM    003104          822*    883#
WRDS    003100          792*    806*    815*    831*    832*    835*    836*    837*    838*    839*    840*    841*    842*
                        857*    868*    881#    902
XETAD   003120          854*    855*    857     889#
XETBA = 004400          572#    854
.     = 006052          482#    494#    499#    503#    521#    574#    578#    1008#   1014#   1020#   1026#   1032#
```

```
.REGDE    480#
..V2..    480#


. ABS.  006052      000


 ERRORS DETECTED:  0

 CZRXCA,CZRXCA/CRF=CZRXCA.P11
 RUN-TIME:  4  2  .3 SECONDS
 RUN-TIME RATIO: 10/7=1.3
 CORE USED:  9K  (18 PAGES)
```