IDENTIFICATION

PRODUCT CODE: MAINDEC-X8-DIKLC-A-D
(KL8-A EXERCISER)

PRODUCT NAME: DEC/X8 MODULE "MULSLU"

DATE: MARCH 1976

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: JOHN VROBEL

1. MODULE DESCRIPTION

"MULSLU" IS A DE/X8 SOFTWARE MODULE WHICH EXERCISERS THE KL8-A MULTIPLE SERIAL LINE UNIT IN THE "EIA" OR "CURRENT" LOOPBACK MODE, WITH TERMINALS, OR WITH COMPUTER TO COMPUTER OPERATION. AS MANY "MULSLU" SOFTWARE MODULES AS DESIRED MAY BE BUILT INTO A CUSTOMIZED EXERCISER.

THE PATTERN USED IN LOOP-BACK MODE AND COMPUTER TO COMPUTER MODE IS THE STANDARD BINARY UP COUNT SEQUENCE (I.E. 0,1,2,3,4 ETC.), EACH KL8-A LINE IS OPERATED INDEPENDENTLY OF THE OTHER, THEREFORE, DATA PATTERNS WILL VARY BETWEEN LINES. ANY STANDARD LEVEL CONFIGURATION (001-377) IS HANDLED AND CHANGABLE VIA INITIALIZATION (IJXX<CR>).

THE PATTERN USED IN TERMINAL MODE IS THE STANDARD BINARY UP COUNT SEQUENCE (I.E. 0,1,2,3,4 ETC.) RESULTING IN TYPING ALL CHARACTERS SEQUENCIALLY (I.E. A, B, C, D, ETC.). ANY CHARACTER VIA THE KEYBOARD OR READER IMMEDIATELY WILL BE REPLACED BY THAT CHARACTER OR THAT CHARACTER +1 AND THE PATTERN WILL CONTINUE FROM THAT POINT. EACH TERMINAL IS OPERATED INDEPENDENTLY OF THE OTHER, THEREFORE, DATA PATTERNS WILL VARY BETWEEN UNITS. ANY STANDARD LEVEL CONFIGURATION (001-377) IS HANDLED AND CHANGABLE VIA INITIALIZATION.

2. REQUIREMENTS

1. PROCESSORS: PDP-8/E, 8/M, AND 8/A.

2. OPTIONS: KL8-A MULTIPLE SERIAL LINE UNIT

3. SPECIAL: H326 PATCH PANEL

3. RESTRICTIONS

WHEN OPERATING IN COMPUTER TO COMPUTER MODE, EACH DEC/X8 MONITOR IN EACH COMPUTER MUST BE STARTED PRIOR TO RUNNING EITHER "MULSLU" ODULE.

4. OPERATING INFORMATION

4.1 SPECIAL CONSIDERATIONS

WHEN OPERATING IN COMPUTER TO COMPUTER MODE, ONE "MULSLU" COMPUTER MUST BE ASSIGNED AS THE MASTER (3) AND THE OTHER "MULSLU" COMPUTER MUST BE ASSIGNED AS A SLAVE (4).

4.2 BUILDING

1. JOB TYPE: INTERRUPT DRIVE

2. PRIORITY: NON-CRITICAL ; MAY HAVE RAPID INTERRUPT FREQUENCY.

3. JOB SLOTS: JOB SLOTS JX1 AND JX2; 4 PAGES REQUIRED.

4. STANDARD DEVICE CODES: X40X AND X41X.

4.3 INITIALIZING

THE MODULE IS NORMALLY INITIALIZED TO RUN 8 LEVEL, IN AUTO LOOP-BACK MODE. THE MODULE CAN BE INITIALIZED VIA IJXX(CR). AFTER THE MODULE NAME "MULSLU" IS PRINTED, THE TTY WILL SPACE OUT AND WAIT FOR THE OPERATOR TO INPUT THE DESIRED OPERATION (A "0" FOR AUTO INTERNAL LOOPBACK OR A "1" FOR A COMBINATION OF PATCH PANEL LOOPBACK, TERMINALS, OR COMPUTER TO COMPUTER OPERATION. IF A 0 IS THE INPUT THE INITIALIZE ROUTINE WILL IMMEDIATELY BE TERMINATED AND INTERNAL LOOPBACK MODE ASSUMED. IF A 1 IS THE INPUT THE TTY WILL DO A CARRIAGE RETURN/LINE FEED AND TYPE A LINE NUMBER, THEN WAIT FOR THE OPERATOR TO INPUT MORE PARAMETERS.

AFTER THE LINE NUMBER IS TYPED, THE OPERATOR SHOULD RESPOND WITH THE DESIRED MODE AND LEVEL AS SHOWN BELOW:

LINE	MODE	LEVEL
X	Y	ZZZ

X IS THE LINE NUMBER IN QUESTION.
Y IS THE DESIRED MODE OF OPERATION(0 FOR DEACTIVATE, 1 FOR PATCH PANEL LOOPBACK, 2 FOR TERMINAL, 3 FOR COMPUTER TO COMPUTER MASTER, OR 4 FOR COMPUTER TO COMPUTER SLAVE.

ZZZ IS THE LEVEL OR DATA LENGTH 000-377.

4.4 DEVICE SETUP

SWITCHES HAVE BEEN PROVIDED TO ALLOW EIA OR 20 MA LOOP-BACK MODE. ON IS LOOP-BACK AND OFF IS NORMAL:

EIA LOOP-BACK SWITCHES

A L0	A L1	A L2	A L3	B L0	B L1	B L2	B L3
S2-4	S2-3	S2-1	S2-2	S4-4	S4-3	S4-1	S4-2

NOTE THAT THE "A" IN L0, FOR EXAMPLE, REPRESENTS THE "A" HALF OF THE PATCH PANEL WHILE THE "B" REPRESENTS "B" OR THE OTHER HALF OF THE PATCH PANEL. THIS IS BECAUSE ONE H326 PATCH PANEL CAN BE CONNECTED TO TWO KL8-A MODULES.

20 MA LOOP-BACK SWITCHES

A L0	A L1	A L2	A L3	B L0	B L1	B L2	B L3
S1-3 S1-4	S1-5 S1-6	S1-7 1-8	S1-1 S1-2	S3-3 S3-4	S3-5 S3-6	S3-7 S3-8	S3-1 S3-2

NOTE THAT THE SWITCHES FOR 20 MA LOOP-BACK MUST BE THROWN IN PAIRS(I.E. AL1 LOOP-BACK, THROW S1-5 AND S1-6 ON).

WHEN RUNNING INTERNAL LOOP-BACK MODE S1 1, 2, 3, AND 4 MUST BE ON.

WHEN RUNNING PATCH PANEL LOOP-BACK, SET THESE SWITCHES DETERMINED BY THE WAY THE LOOP-BACK SWITCHES ARE SELECTED ON THE H326 (PATCH PANEL).

S1 1 - 2 - 3 - 4 ON = EIA RECEIVER CONNECTED TO UART.
OFF = 20 MA RECEIVER CONNECTED TO UART.

4.5 RUNNING

1. CNTR: UPDATED EACH TIME ALL INITIALIZED TTI/TTO LINES PROCESS A CHARACTER (INTERRUPT)

2. SR10: NO EFFECT
3. SR11: NO EFFECT

5. ERROR INFORMATION

ERRORS ARE INDICATED IN THE FOLLOWING MANNER:

1. DATA ERRORS, STATUS ERRORS, AND SKIP ERRORS ARE REPORTED IN THE STANDARD STATUS ERROR FORMAT.

2. ERROR HALTS INDICATING "UNDEFINED OR UNEXPECTED INTERRUPTS".
3. BY THE UPDATE OF "CNTR" INDICATING NO INTERRUPTS.

5.1 ERROR SYMBOL DEFINITIONS

1. CODE: INDICATES TYPE OF ERROR, 0 FOR DATA ERROR, A 1 FOR SKIP ERROR (ONE OF THE IOTS MSSB, MSSS, MSSC, OR MSSV CAUSED A SKIP), OR A 2 FOR STATUS ERROR (STATUS A OR STATUS B).

2. ERRSA: STATUS REGISTER A.

3. ERRSB: STATUS REGISTER B.

4. ERRSC: LINE NUMBER EXPECTED BITS 2-3
CHARACTER EXPECTED BITS 4-11

5. ERRSD: LINE NUMBER READ BITS 2-3
CHARACTER READ BITS 4-11

SPECIAL: THE LOCATION "CNTR" WILL NOT UPDATE IF ANY LINE TTI/TTO FAIL TO INTERRUPT.TO DETERMINE WHICH LINE FAILED TO INTERRUPT, EXAMINE LOCATION "CNTFLG" BITS 0-7. BITS SET TO A 1 ARE THE PARTICULAR TTI/TTO LINES FAILING TO INTERRUPT. BIT 0=1 FOR LINE 0 TTO, BIT 1=1 FOR LINE 0 TTI, BIT 2=1 FOR LINE 1 TTO, BIT 3=1 FOR LINE 1 TTI, BIT 4=1 FOR LINE 2 TTO, BIT 5=1 FOR LINE 2 TTI, BIT 6=1 FOR LINE 3 TTO, BIT 7=1 FOR LINE 3 TTI.

LOCATION	RELATIVE	PURPOSE
CNTFLG	0563	INTERRUPT INDICATOR

SPECIAL: AN ERROR HALT WILL OCCUR AT THE FOLLOWING RELATIVE LOCATIONS IF A DEACTIVE LINE CAUSES AN INTERRUPT OR BRANCH; THE AC (BITS 2 AND 3) WILL CONTAIN THE LINE NUMBER OF THE LINE IN QUESTION:

LOCATION	RELATIVE	PURPOSE
ERHLT1	0263	TRANSMIT BRANCH.
ERHLT2	0475	ECEIVE BRANCH.

6. LISTING

ATTACHED

^A^C^G

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                        /

                        /DEC/X8 EXTERNAL SYMBOL TABLE  "EXTSYM"
                        /FOR USE IN ASSEMBLING DEC/X8 SOFTWARE MODULES.

                        /COPYRIGHT 1972, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
                                PAUSE
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                        /MAINDEC-X8-DIKLC-A-L "DEC/X8" MULSLU

                        /KL8-A MULTIPLE SERIAL LINE UNIT EXERCISER FOR DEC/X8

                        /COPYRIGHT 1976, DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASS.

                        /THIS MODULE OPERATION A S/E, S/M, AND S/A.

                                /PRG.   JOHN VROBEL
                        /

                        /HARDWARE LOOP BACK SETUP

                                /THE MODULE CAN BE RUN IN THE LOOP-BACK MODE, WITH TERMINALS,
                        /OR WITH COMPUTER TO COMPUTER OPERATION.

                        /BUILDER INSTRUCTIONS:

                                /1. PRIORITY:  NON-CRITICAL; MAY HAVE RAPID INTERRUPT FREQUENCY
                                /4. JOB SLOT:  4 PAGES REQUIRED; JX1 AND JX2 ONLY.
                                /3. ANY AMOUNT OF "MULSLU" MODULES MAY BE BUILT INTO A
                        /CUSTOMIZED EXERCISER. THE ONLY LIMITATION IS THE MEMORY AVAILABLE.

                        /INITIALIZER INSTRUCTIONS

                                /THIS MODULE MAY BE INITIALIZED PRIOR TO RUNNING.
                        /SEE DOCUMENT FOR MORE INFORMATION.
                        /
                        /IOT DEFINITIONS
                        /
                6400    MSIE=6400
                6401    MSAB=6401
                6402    MSRA=6402
                6403    MSSR=6403
                6404    MSXD=6404
                6405    MSRD=6405
                6410    MSCD=6410
                6411    MSLC=6411
                6412    MSLB=6412
                6413    MSSB=6413
                6414    MSSS=6414
                6415    MSSC=6415
                6416    MSSV=6416
                6417    MSRB=6417
                        /
                0200    *200

                        /MODULE INTERFACE TABLE

0200  0000              0
0201  1525    TEXT1,  TEXT    "MULSLU"
0202  1423
0203  1425
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0204  0000
0205  0411            TEXT    "DIKLC-A"
0206  1314
0207  0355
0210  0100
0211  0000    HOMEDF, 0
0212  7402            HLT
0213  5611            JMP I   HOMEDF
0214  6202    INTACK, CIF     00
0215  4426            JMS I   IHRETP
0216  7777            -1
0217  7777    KILL,   -1
0220  7777    KILLED, -1
0221  0000    CNTR,   0
                /
0222  0000    ERROR,  0
0223  3234            DCA     .+11
0224  7604            LAS
0225  0073            AND Z   K4
0226  7440            SZA
0227  3217            DCA     KILL
0230  4211            JMS     HOMEDF
0231  6002            IOF
0232  6202            CIF     00
0233  4461            JMS I   ERRP
0234  0000            0
0235  5622            JMP I   ERROR
0236  0000    CODE,   0                       /STATUS OF MODULE.
0237  7774            -4
0240  0000    ERRSA,  0                       /STATUS A.
0241  0000    ERRSB,  0                       /STATUS B.
0242  0000    ERRSC,  0                       /DATA EXPECTED.
0243  0000    ERRSD,  0                       /DATA READ.
                /
                /ROUTINE TO SERVICE RECEIVE INTERRUPTS.
0244  0000    SRVIN,  0
0245  7040            CMA
0246  0135            AND     K7760
0247  0777'           AND     CNTFLG          /SETUP BIT FOR MASK.
0250  3777'           DCA     CNTFLG          /SET INTERRUPT LATCH.
0251  6405    IOTD,   MSRD                    /READ DATA.
0252  3366            DCA     SAVAD3          /SAVE DATA.
0253  1244            TAD     SRVIN
0254  3365            DCA     SAVAD1          /SAVE ADDRESS POINTER.
0255  1765            TAD I   SAVAD1          /GET TYPE FLAG.
0256  2244            ISZ     SRVIN
0257  2244            ISZ     SRVIN
0260  7440            SZA                     /ACTIVE?
0261  5264            JMP     .+3             /LINE IS ACTIVE.
0262  1644            TAD I   SRVIN           /LOAD LINE NUMBER TO AC.
0263  7402    ERMLT1, HLT                     /NO, THIS LINE SHOULDNT INTERRUPT.
0264  1372            TAD     M2
0265  7440            SZA                     /TERMINAL MODE?
0266  5272            JMP     .+4             /NO, CONTINUE.
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0267  1366            TAD     SAVAD3          /GET CHARACTER READ.
0270  3644            DCA I   SRVIN           /RESET CHARACTER
0271  5214            JMP     INTACK          /EXIT
0272  1372            TAD     M2
0273  7640            SZA CLA                 /COMP. TO COMP.?
0274  5300            JMP     .+4             /NO, OTHER.
0275  7340            CLA CLL CMA
0276  2365            ISZ     SAVAD1
0277  3765            DCA I   SAVAD1          /RESET FIRST TIME TRANSMIT POINTER.
0300  1644            TAD I   SRVIN           /GET EXPECTED DATA.
0301  3352            DCA     UPCNT           /SAVE FOR FUTURE USE.
0302  4335            JMS     NUDATA          /UPDATE PATTERN.
                /
0303  4776'           JMS     CHKAB           /CHECK STATUS A, B, AND SKIPS.
                /
0304  1366            TAD     SAVAD3          /GET DATA READ.
0305  3243            DCA     ERRSD           /SAVE CHARACTER.
0306  1352            TAD     UPCNT           /GET SAVED CHARACTER.
0307  3242            DCA     ERRSC           /SAVE EXPECTED DATA
0310  1243            TAD     ERRSD
0311  7041            CIA
0312  1242            TAD     ERRSC
0313  7640            SZA CLA                 /DATA THE SAME?
0314  5321            JMP     WAIT            /NO, ERROR.
0315  1217            TAD     KILL            /YES, CHECK FOR KILL.
0316  7650            SNA CLA                 /TIME TO KILL JOB?
0317  5330            JMP     DNREC           /NO, CHECK FOR NEXT TRANSMIT.
0320  3371            DCA     DWAIT           /YES, STOP FLAG.
0321  1140    WAIT,   TAD     M4
0322  3237            DCA     ERRSA-1         /SETUP FOR DATA REPORT.
0323  3236            DCA     CODE            /CODE IS 0 FOR DATA REPORT.
0324  7340    REPORT, CLA CLL CMA
0325  3222            DCA     ERROR           /SET ERROR FLAG.
0326  1375          TAD     (PNTR1
0327  5214            JMP     INTACK          /ENTER DEFFERED SERVICE.
0330  2371    DNREC,  ISZ     DWAIT           /TIME TO WAIT?
0331  7610            SKP CLA                 /NO, CONTINUE SERVICE.
0332  5321            JMP     WAIT            /YES, WAIT FOR ALL LINES.
0333  2244    UPDATE, ISZ     SRVIN           /UPDATE FOR RETURN
0334  5644            JMP I   SRVIN           /NO, RETURN AND START TRANSMITTER.
                /
                /ROUTINE TO UPDATE DATA PATTERN.
                /
0335  0000    NUDATA, 0
0336  1244            TAD     SRVIN
0337  3367            DCA     SAVAD6          /SAVE RETURN POINTER.
0340  7301            CLA CLL IAC             /UPDATE FOR CHARACTER.
0341  1644            TAD I   SRVIN           /GET CHARACTER.
0342  2244            ISZ     SRVIN           /UPDATE TO MASK!
0343  0644            AND I   SRVIN           /MASK LEVEL!
0344  3365            DCA     SAVAD1          /SAVE IT.
0345  1767            TAD I   SAVAD6          /GET LINE NUMBER.
0346  0370            AND     K1400           /MASK IT.
0347  1365            TAD     SAVAD1          /ADD IN CHARACTER.
0350  3767            DCA I   SAVAD6          /SAVE CHARACTER.
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0351  5735            JMP I   NUDATA
                      /
                      /
                      /ROUTINE TO UPDATE COUNTER.
                      /
0352  0000    UPCNT,  0
0353  7004            RAL
0354  3774'           DCA     SAVLNK          /SAVE LINK.
0355  1777'           TAD     CNTFLG          /GET LATCH INCICATOR.
0356  7640            SZA CLA                 /ALL INTERRUPTS RECEIVED?
0357  5752            JMP I   UPCNT           /NO, DON'T UPDATE CNTR.
0360  2221            ISZ     CNTR            /YES, UPDATE CNTR.
0361  7000            NOP
0362  1773'           TAD     LINFLG
0363  3777'           DCA     CNTFLG          /RESET LATCH.
0364  5752            JMP I   UPCNT           /EXIT
                      /
0365  0000    SAVAD1, 0
0366  0000    SAVAD3, 0
0367  0000    SAVAD6, 0
0370  1400    K1400,  1400
0371  0000    DWAIT,  0
0372  7776    M2,     7776
                      /
      0373    *.
                      /
                      /
0373  0730
0374  0561
0375  1000
0376  1057
0377  0563
      0400    *400
                      /
                      /BRANCH TABLE.
                      /
0400  5210    TABLE,  JMP     LINE0T
0401  5222            JMP     LINE1T
0402  5234            JMP     LINE2T
0403  5246            JMP     LINE3T
0404  5212            JMP     LINE0R
0405  5224            JMP     LINE1R
0406  5236            JMP     LINE2R
0407  5250            JMP     LINE3R
                      /
                      /ROUTINE TO CHECK AND SERVICE THE INTERRUPTS
                      /
0410  7330    LINE0T, CLA CLL CML RAR         /LATCH BIT 0, LINE 0.
0411  4260            JMS     TTOBAK          /EXIT.
0412  7332    LINE0R, CLA CLL CML RTR         /MASK BIT 1, LINE 0.
0413  4777'           JMS     SRVIN           /SERVICE TTI, COMPARE DATA
0414  0001    FLGRT0, 0001                    /TERMINAL/LOOPBACK FLAG.
0415  0000    TCNT0,  0                       /POINTER FOR FIRST TRANSMIT.
0416  0000    CHAR0,  0000                    /CHARACTER FOR LINE 0.
0417  0377    MASK0,  0377                    /MASK FOR LINE 0
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0420  4314    RUNGO0, JMS     TTOSND          /SEND TTO CHARACTER.
0421  5232            JMP     RUNGO1          /DEFERRED, SEND AND START NEXT TTO!
0422  1776'   LINE1T, TAD     K1000           /LATCH BIT 2, LINE 1.
0423  4260            JMS     TTOBAK          /EXIT.
0424  1121    LINE1R, TAD     K400            /LATCH BIT 3, LINE 1.
0425  4777'           JMS     SRVIN           /SERVICE TTI, COMPARE DATA
0426  0001    FLGRT1, 0001                    /TERMINAL/LOOPBACK FLAG.
0427  0000    TCNT1,  0                       /POINTER FOR FIRST TRANSMIT.
0430  0400    CHAR1,  0400                    /CHARACTER FOR LINE 1.
0431  0377    MASK1,  0377                    /MASK LEVEL FOR LINE 1.
0432  4314    RUNGO1, JMS     TTOSND          /SEND TTO CHARACTER.
0433  5244            JMP     RUNGO2          /DEFERRED SERVICE.
                      /
0434  1110    LINE2T, TAD     K200            /LATCH BIT 4, LINE 2.
0435  4260            JMS     TTOBAK          /EXIT.
0436  1107    LINE2R, TAD     K100            /LATCH BIT 5, LINE 2.
0437  4777'           JMS     SRVIN           /SERVICE TTI, COMPARE DATA
0440  0001    FLGRT2, 0001                    /TERMINAL/LOOPBACK FLAG.
0441  0000    TCNT2,  0                       /POINTER FOR FIRST TRANSMIT.
0442  1000    CHAR2,  1000                    /CHARACTER FOR LINE 2.
0443  0377    MASK2,  0377                    /MASK FOR LINE 2
0444  4314    RUNGO2, JMS     TTOSND          /SEND TTO CHARACTER.
0445  5256            JMP     RUNGO3          /DEFERRED, SEND AND START NEXT TTO!
0446  1104    LINE3T, TAD     K40             /LATCH BIT 6, LINE 3.
0447  4260            JMS     TTOBAK          /EXIT.
0450  1102    LINE3R, TAD     K20             /LATCH BIT 7, LINE 3.
0451  4777'           JMS     SRVIN           /SERVICE TTI, COMPARE DATA
0452  0001    FLGRT3, 0001                    /TERMINAL/LOOPBACK FLAG.
0453  0000    TCNT3,  0                       /POINTER FOR FIRST TRANSMIT.
0454  1400    CHAR3,  1400                    /CHARACTER FOR LINE 3.
0455  0377    MASK3,  0377                    /MASK LEVEL FOR LINE 3.
0456  4314    RUNGO3, JMS     TTOSND          /SEND TTO CHARACTER.
0457  5004            SERVEX                  /EXIT TO MONITOR
                      /
0460  0000    TTOBAK, 0
0461  7040            CMA
0462  0135            AND     K7760
0463  0363            AND     CNTFLG          /SETUP UP BIT FOR MASK.
0464  3363            DCA     CNTFLG          /SET INTERRUPT LATCH.
0465  2260            ISZ     TTOBAK
0466  2260            ISZ     TTOBAK          /UPDATE ADDRESS POINTER.
0467  1660            TAD I   TTOBAK
0470  2260            ISZ     TTOBAK
0471  2260            ISZ     TTOBAK          /UPDATE ADDRESS POINTER.
0472  7440            SZA                     /ERROR?
0473  5276            JMP     .+3             /LINE IS ACTIVE.
0474  1660            TAD I   TTOBAK          /LOAD LINE NUMBER TO AC.
0475  7402    ERHLT2, HLT                     /YES, THIS LINE SHOULDN'T INTERRUPT.
0476  1775'           TAD     M2
0477  7640            SZA CLA                 /TERMINAL OR OTHER?
0500  5774'           JMP     INTACK          /OTHER.
0501  1260            TAD     TTOBAK
0502  3777'           DCA     SRVIN
0503  4773'           JMS     NUDATA          /UPDATE PATTERN.
0504  4772'           JMS     CHKAB           /CHECK STATUS A, B, AND SKIPS.
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0505  1660            TAD I   TTOBAK          /GET LAST CHARACTER.
0506  0130            AND     K177
0507  1364            TAD     M16
0510  7650            SNA CLA                 /WAS IT IN NEED OF FILLERS?
0511  5771'           JMP     WAIT-1          /EXIT.
0512  7100            CLL                     /I AM IN INTERRUPT MODE!!!!
0513  5770'           JMP     UPDATE          /TRANSMIT CHARACTER.
                      /
0514  0000    TTOSND, 0
0515  4767'           JMS     UPCNT           /CHECK FOR UPDATE CNTR.
0516  1137            TAD     M5
0517  1314            TAD     TTOSND
0520  3260            DCA     TTOBAK         /SAVE INDICATOR POINTER.
0521  1141            TAD     M3
0522  1314            TAD     TTOSND
0523  3362            DCA     SAVAD5          /SAVE CHARACTER POINTER.
0524  1660            TAD I   TTOBAK          /GET TYPE INDICATOR.
0525  7450            SNA                     /RUN THIS LINE?
0526  5353            JMP     IOTF+1          /NO, DON'T TRANSMIT.
0527  1140            TAD     M4
0530  2260            ISZ     TTOBAK          /UPDATE POINTER.
0531  7640            SZA CLA                 /COMP. TO COMP. RECEIVER?
0532  5350            JMP     TRANS           /NO TRANSMIT.
0533  1660            TAD I   TTOBAK
0534  7650            SNA CLA                 /FIRST TIME TRANSMIT INHIBIT?
0535  5353            JMP     IOTF+1          /YES, DON'T TRANSMIT.
0536  7240            CLA CMA
0537  1762            TAD I   SAVAD5          /GET CHARACTER.
0540  2362            ISZ     SAVAD5
0541  0762            AND I   SAVAD5          /MASK CHARACTER.
0542  3362            DCA     SAVAD5          /SAVE REDUCED CHARACTER.
0543  2260            ISZ     TTOBAK
0544  1660            TAD I   TTOBAK          /GET CHARACTER.
0545  0766'           AND     K1400           /MASK LINE NO.
0546  1362            TAD     SAVAD5          /ADD IN THE REST.
0547  5352            JMP     .+3
0550  2260    TRANS,  ISZ     TTOBAK
0551  1660            TAD I   TTOBAK          /TRANSMIT UPDATED CHARACTER.
0552  6404    IOTF,   MSKD                    /TRANSMIT!
0553  7200            CLA
0554  1361            TAD     SAVLNK
0555  7110            CLL RAR
0556  7620            SNL CLA                 /INT. OR DEFERED SERVICE?
0557  5774'           JMP     INTACK          /INTERRUPT, EXIT TO MONITOR.
0560  5714            JMP I   TTOSND          /DEFERRED, EXIT TO NEXT LINE.
                      /
0561  0000    SAVLNK, 0
0562  0000    SAVAD5, 0
0563  7760    CNTFLG, 7760
0564  7762    M16,    7762
                      /
      0565    *.
                      /
                      /
0566  0370
```



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0567  0352
0570  0333
0571  0320
0572  1057
0573  0335
0574  0214
0575  0372
0576  1134
0577  0244
      0600    *0600
              /
              ROUTINE TO INITIALIZE MODULE.
              /
0600  4454    INIT,   CRLF                    /CR LF
0601  1377            TAD     (TEXT1
0602  3204            DCA     .+2
0603  4444            MESAGE                  /TYPE MESSAGE ROUTINE.
0604  0000    SAVAD4, 0
0605  1114            TAD     K260
0606  3326            DCA     SAVCNT          /SAVE LINE COUNTER.
0607  1376            TAD     (FLGRT0-12
0610  3327            DCA     SAVAD2          /SAVE INDICATOR POINTER.
0611  3330            DCA     LINFLG          /SAVE INTERRUPT INDICATOR.
0612  1137            TAD     M5
0613  3324            DCA     DEVCNT          /SETUP LINE COUNTER.
0614  3331            DCA     TTYCNT          /CLEAR LINE COUNTER.
0615  4455    INITLP, SPACE2                  /SPACE AND WAIT.
0616  4442            ONEOCT                  /GET OCTAL.
0617  5200            JMP     INIT            /ERROR.
0620  7640            SZA CLA                 /INTERNAL LOOPBACK?
0621  5241            JMP     NTLOOP-1                /NO.
0622  1135            TAD     K7760           /YES, SETUP.
0623  3330            DCA     LINFLG
0624  7330            CLA CLL CML RAR
0625  3775'           DCA     AUTOLP
0626  1073            TAD     K4
0627  3331            DCA     TTYCNT
0630  7301            CLA CLL IAC
0631  3774'           DCA     FLGRT0
0632  7301            CLA CLL IAC
0633  3773'           DCA     FLGRT1
0634  7301            CLA CLL IAC
0635  3772'           DCA     FLGRT2
0636  7301            CLA CLL IAC
0637  3771'           DCA     FLGRT3
0640  5020            INITEX
0641  3775'           DCA     AUTOLP          /CLEAR AUTO LOOP.
0642  2324    NTLOOP, ISZ     DEVCNT          /COUNT TIMES?
0643  5250            JMP     .+5             /MORE TO CHECK.
0644  1331            TAD     TTYCNT          /CHECK FOR SOMETHING.
0645  7640            SZA CLA                 /ANY LINES?
0646  5020            INITEX                  /YES, EXIT.
0647  5200            JMP     INIT            /NO, TRY AGAIN.
0650  4454            CRLF                    /CR LF.
0651  1326            TAD     SAVCNT          /GET LINE NUMBER.
```

```
0652  4450          TYPE                    /PRINT IT.
0653  4455          SPACE2                  /SPACE AND WAIT.
0654  1327          TAD     SAVAD2
0655  1332          TAD     K12
0656  3327          DCA     SAVAD2          /ADVANCE TO LINE TYPE INDICATOR.
0657  4442          ONEOCT                  /GET ONE IN OCTAL.
0660  5200          JMP     INIT            /ERROR, TRY AGAIN.
0661  3727          DCA I   SAVAD2          /SAVE FLAG.
0662  7344          CLA CLL CMA RAL
0663  1727          TAD I   SAVAD2          /GET TYPE INDICATOR.
0664  7650          SZA CLA K20             /88LY TERMINAL?
0665  1104          TAD     K40
0666  3325          DCA     SAVINT         /SAVE LATCH MAKER.
0667  1330          TAD     LINFLG
0670  7106          CLL RTL
0671  3330          DCA     LINFLG          /ROTATE AND SAVE INTERRUPT LATCH.
0672  2326          ISZ     SAVCNT
0673  7650          SNA CLA SAVAD2          /TEST THIS LINE?
0674  5242          JMP     NTLOOP          /NO
0675  1327          TAD     SAVAD2
0676  3324          DCA     SAVAD4          /SAVE ADDRESS POINTER
0677  1330          TAD     LINFLG
0700  1325          TAD     SAVINT          /SET INT. LATCH.
0701  3330          DCA     LINFLG
0702  4455          SPACE2
0703  2324          ISZ     SAVAD4
0704  2331          ISZ     TTYCNT          /UPDATE LINE COUNTER.
0705  4442          ONEOCT                  /GET FIRST PART OF LEVEL.
0706  5200          JMP     INIT            /ERROR, TRY AGAIN.
0707  2324          ISZ     SAVAD4
0710  2324          ISZ     SAVAD4
0711  7106          CLL RTL
0712  7006          RTL
0713  7006          RTL
0714  3604          DCA I   SAVAD4          /SAVE FIRST OF LEVEL
0715  4441          TWOOCT                  /GET REMAINING LEVEL.
0716  5200          JMP     INIT            /ERROR, TRY AGAIN.
0717  1604          TAD I   SAVAD4          /ADD IN OTHER PART.
0720  3604          DCA I   SAVAD4          /SAVE COMPLETE LEVEL.
0721  5242          JMP     NTLOOP          /CHECK NEXT.

0722  0000    EVCNT, 0
0723  0000    SAVINT, 0
0724  0000    SAVCNT, 0
0725  0000    SAVAD2, 0
0726  7760    LINFLG, 7760
0727  0004    TTYCNT, 4
0730  0012    K12,    0012
                /
                /RETURN HERE AFTER AN INTERRUPT
                /
0731  0000    INT,    0
0732  6214            RDF                     /MAKE CIF CDF FOR EXIT TO
```



```
0733  1020            TAD Z   KCIFDF          /MONITOR CHAIN.
0734  3353            DCA     INT1
0735  4770'           JMS     HOMEDF          /SETUP DF
0736  1767'           TAD     KILLED          /JOB KILLED?
0737  7640            SZA CLA
0740  5353            JMP     INT1            /BACK TO MONITOR
0741  1357            TAD     BASEAD          /GET BASE ADDRESS.
0742  6412    IOTA,   MSLB                    /LOAD BRANCH ADDRESS.
0743  6402    IOTB,   MSRA                   /READ STATUS.
0744  3355            DCA     SAVEA          /SAVE STATUS A.
0745  6417    IOTH,   MSRB                    /READ STATUS B.
0746  3356            DCA     SAVEB           /SAVE IT.
0747  6401    IOTC,   MSAB                    /BRANCH IF FLAG!
0750  7300            CLA CLL                 /YOU DIDN'T BRANCH!
0751  7402    INT1,   HLT                     /EXIT TO MONITOR CHAIN.
0752  5733            JMP I   INT
                /
0753  0000    SAVEA,  0
0754  0000    SAVEB,  0
      0755    *.
                /
0755  0400    BASEAD, TABLE
                /
                /
0765  0220
0766  0211
0767  0452
0770  0440
0771  0426
0772  0414
0773  1135
0774  0402
0775  0201
      1000    *1000
                /
                /
                /PROGRAM COMES HERE ON AN ERROR, AFTER EVERY 4000
                /CHARACTERS IN LOOP-BACK MODE, OR WHEN A 15 CHARACTER
                /IS DETECTED IN TERMINAL MODE TO HANDLE CR TIME.
                /
1000  1777'   PNTR1,  TAD     DWAIT           /GET WAIT FLAG
1001  7640            SZA CLA                 /0=WAIT FOR STATUS REPORTER!
1002  4776'           JMS     ERROR
1003  7381            CLA CLL IAC
1004  1017    AUA,    TAD     AUTO
1005  7640            SZA CLA
1006  5203            JMP     .+3
1007  1136            TAD     K7771
1010  3777'           DCA     DWAIT           /SET TIME COUNTER.
                /
                /PROGRAM COMES HERE ON INITIAL START OF JOB
                /OR FOR RESTART AFTER AN ERROR REPORT OR DELAY WAIT.
                /
1011  1375    WATLOP, TAD     (WATLOP         /GET RETURN POINTER.
```

```
1012  2777'          ISZ     DWAIT           /UPDATE TIME INDICATOR.
1013  5004           SERVEX                  /EXIT BACK TO MOITOR.
1014  5234           JMP     RESTRT          /RESTART LINES.
1015  3774'  RUN,    DCA     CNTR            /CLEAR INTERRUPT INDICATOR
1016  6002           IOF                     /SHUT MIM DOWN.
1017  3773'          DCA     CHAR0           /START LINE 0 AT 0.
1020  1121           TAD     K400
1021  3772'          DCA     CHAR1           /START LINE 1 AT 0.
1022  1334           TAD     K1000
1023  3771'          DCA     CHAR2           /START LINE 2 AT 0.
1024  1770'          TAD     K1400
1025  3767'          DCA     CHAR3           /START LINE 3 AT 0.
1026  3766'          DCA     TCNT0           /SETUP COMP. TO COMP. COUNT.
1027  3765'          DCA     TCNT1           /SETUP COMP. TO COMP. COUNT.
1030  3764'          DCA     TCNT2           /SETUP COMP. TO COMP. COUNT.
1031  3763'          DCA     TCNT3           /SETUP COMP. TO COMP. COUNT.
1032  1335           TAD     AUTOLP          /GET AUTOLOOPBACK FLAG.
1033  6411   OTI,    MSLC                    /SET LOOP BACK MODE.
1034  7300   RESTRT, CLA CLL
1035  6002           IOF                     /SHUT MIM DOWN.
1036  1762'          TAD     KILL            /GET KILL FLAG.
1037  7450           SNA                     /TIME TO KILL JOB.
1040  5244           JMP     .+4             /NO, CONTINUE TEST.
1041  3761'          DCA     KILLED          /YES, SET FLAG.
1042  6400   IOTE,   MSIE                    /CLEAR INT. ENABLE.
1043  5004           SERVEX                  /EXIT.
1044  7330           CLA CLL CML RAR
1045  3777'          DCA     DWAIT           /SETUP WAIT COUNTER.
1046  7321           CLA CLL CML IAC
1047  6400   IOTG,   MSIE                    /ENABLE INTERRUPT.
1050  1760'          TAD     LINFLG
1051  3757'          DCA     CNTFLG          /SETUP INT. BIT LATCH
1052  1756'          TAD     TTYCNT
1053  7041           CIA
1054  3017   AUD,    DCA     AUTO            /CLEAR LINE COUNTER.
1055  3776'          DCA     ERROR           /CLEAR ERROR INDICATOR.
1056  5755'          JMP     RUNG0B          /START UP LINES
                     /
                     /CHECK STATUS A, B, AND SKIPS.
                     /
1057  0000   CHKAB,  0
1060  1776'          TAD     ERROR           /GET ERROR POINTER.
1061  7650           SNA CLA                 /SOMETHING ERROR REPORT?
1062  5266           JMP     .+4             /NO, THEN CHECK FOR ERRORS.
1063  2017   AUB,    ISZ     AUTO            /YES, UPDATE COUNT THEN WAIT.
1064  7000           NOP
1065  5754'          JMP     INTACK          /TO MONITOR.
1066  1753'          TAD     SAVEA
1067  3752'          DCA     ERRSA           /SAVE STATUS A FOR ERROR PRINTER.
1070  1751'          TAD     SAVEB
1071  3750'          DCA     ERRSB           /SAVE STATUS B FOR PRINTER.
1072  6413   IOTJ,   MSSB                    /SKIP ON RING?
1073  7610           SKP CLA                 /O.K. NO SKIP!
1074  5305           JMP     ERSKP           /ERROR MSSB SKIPPED.
1075  6414   IOTK,   MSSS                    /SKIP ON CLEAR TO SEND?
```



```
1076  7610           SKP CLA                 /O.K. NO SKIP!
1077  5305           JMP     ERSKP           /ERROR, MSSS SKIPPED.
1100  6415   IOTL,   MSSC                    /SKIP ON CARRIER.
1101  7610           SKP CLA
1102  5305           JMP     ERSKP           /ERROR, MSSC SKIPPED.
1103  6416   IOTM,   MSSV                    /SKIP ON SECONDARY RECEIVE?
1104  5310           JMP     NOSKP           /NO SKIP ERRORS!!!!
1105  7301   ERSKP,  CLA CLL IAC
1106  3747'          DCA     CODE            /CODE IS A 1 FOR SKIP ERRORS.
1107  5331           JMP     STASKP          /EXIT TO ERROR REPORTER.
1110  7340   NOSKP,  CLA CLL CMA
1111  1750'          TAD     ERRSB           /GET STATUS B READ.
1112  7640           SZA CLA                 /B O.K.?
1113  5327           JMP     STASKP-2                /STATUS ERROR
1114  7340           CLA CLL CMA
1115  1752'          TAD     ERRSA           /GET STATUS A.
1116  7420           SNL                     /GREATER THAN 0.
1117  5327           JMP     STASKP-2                /NO, ERROR.
1120  1136           TAD     M7
1121  7620           SNL CLA                 /LESS THAN 10?
1122  5327           JMP     STASKP-2                /NO, ERROR.
1123  1752'          TAD     ERRSA           /GET STATUS A.
1124  7010           RAR
1125  7630           SZL CLA                 /EVEN?
1126  5657           JMP I   CHKAB           /NO, ALL O.K.
1127  7326           CLA CLL CML RTL
1130  3747'          DCA     CODE            /CODE IS A 2 FOR STATUS ERRORS.
1131  7344   STASKP, CLA CLL CMA RAL
1132  3746'          DCA     ERRSA-1
1133  5745'          JMP     REPORT          /REPORT ERROR.
                     /
1134  1000   K1000,  1000
1135  4000   AUTOLP, 4000
                     /
      1136   *.
                     /
1145  0324
1146  0237
1147  0236
1150  0241
1151  0756
1152  0240
1153  0755
1154  0214
1155  0420
1156  0731
1157  0563
1160  0730
1161  0220
1162  0217
1163  0453
1164  0441
1165  0427
1166  0415
1167  0454
```

```
1170  0370
1171  0442
1172  0430
1173  0416
1174  0221
1175  1011
1176  0222
1177  0371
      0001    FIELD 1
```



```
0000
0100

0200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0500  11111111  11111111  11111111  11111111  11111111  11111111  11111011  11111111

0600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0700  11111111  11111111  11111111  11111111  11111111  11111111  00000001  11111111

1000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1100  11111111  11111111  11111111  11111100  00000111  11111111  11111111  11111111

1200
1300

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700
```

```
4000
4100

4200
4300

4400
4500

4600
4700


5000
5100

5200
5300

5400
5500

5600
5700


6000
6100

6200
6300

6400
6500
6600
6700


7000
7100

7200
7300

7400
7500

7600
7700
```



```
                    /BUILDER CALL
          1200  0600            INIT;RUN;INT
          1201  1015
          1202  0733
          1203  0001            1;HLT;HLT;HLT;HLT;HLT
          1204  7402
          1205  7402
          1206  7402
          1207  7402
          1211  7775            -3
          1212  1004            AUA
          1213  1063            AUB
          1214  1054            AUD
          1215  7776            -2
          1216  0400            0400
          1217  7772            -6
          1220  0745            IOTB
          1221  0751            IOTC
          1222  0251            IOTD
          1223  1042            IOTE
          1224  0552            IOTF
          1225  1047            IOTG
          1226  0410            0410
          1227  7771            -7
          1230  0744            IOTA
          1231  0747            IOTH
          1232  1033            IOTI
          1233  1072            IOTJ
          1234  1075            IOTK
          1235  1100            IOTL
          1236  1103            IOTM
          1237  0000            0
          1240  0000            0
                    $$$
```

```
0000
0100

0200
0300

0400
0500

0600
0700


1000
1100

1200  11111111  11111111  11111111  11111111  10000000  00000000  00000000  00000000
1300  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500
2600
2700

3000
3100

3200
3300

3400
3500

3600
3700
```



```
4000
4100

4200
4300

4400
4500

4600
4700

5000
5100

5200
5300

5400
5500

5600
5700

6000
6100

6200
6300

6400
6500

6600
6700

7000
7100

7200
7300

7400
7500

7600
7700
```

ASBUFF	4460	IOTE	1042	K7760	0135	MSSR	6403
ASBUFP	0060	IOTF	0552	K7771	0136	MSSS	6414
AUA	1004	IOTG	1047	K7773	0137	MSSV	6416
AUB	1063	IOTH	0747	K7774	0140	MSXD	6404
AUD	1054	IOTI	1033	K7775	0141	MUL26P	0065
AUTO	0017	IOTJ	1072	KCDF	0064	NOSKP	1110
AUTOLP	1135	IOTK	1075	KCIF	0005	NTLOOP	0642
BASEAD	0757	IOTL	1100	KCIFDF	0020	NUDATA	0335
CHAR0	0416	IOTM	1103	KILL	0217	ONEOCP	0042
CHAR1	0430	K0	0066	KILLED	0220	ONEOCT	4442
CHAR2	0442	K10	0076	KIOF	0004	PNTR1	1000
CHAR3	0454	K100	0107	LINE0R	0412	PRNT1	4451
CHKAB	1057	K1000	1134	LINE0T	0410	PRNT1P	0051
CNTFLG	0563	K11	0077	LINE1R	0424	PRNT2	4452
CNTR	0221	K116	0071	LINE1T	0422	PRNT2P	0052
CODE	0236	K12	0732	LINE2R	0436	PRNT4	4453
CRLF	4454	K13	0100	LINE2T	0434	PRNT4P	0053
CRLFP	0054	K1400	0370	LINE3R	0450	REPORT	0324
DEVCNT	0724	K17	0101	LINE3T	0446	RESTRT	1034
DNREC	0330	K177	0130	LINFLG	0730	RLBUFF	4457
DWAIT	0371	K20	0102	LI8N	4440	RLBUFP	0057
ERHLT1	0263	K200	0110	LI8NP	0040	RUN	1015
ERHLT2	0475	K2000	0122	M16	0564	RUNG00	0420
ERROR	0222	K212	0111	M2	0372	RUNG01	0432
ERRP	0061	K215	0112	M20	0135	RUNG02	0444
ERRSA	0240	K240	0113	M200	0131	RUNG03	0456
ERRSB	0241	K260	0114	M240	0127	SAVAD1	0365
ERRSC	0242	K272	0115	M260	0126	SAVAD2	0727
ERRSD	0243	K277	0116	M270	0125	SAVAD3	0366
ERSKP	1105	K3	0072	M3	0141	SAVAD4	0604
EXINIT	0020	K30	0103	M30	0134	SAVAD5	0562
EXSERV	0004	K301	0117	M4	0140	SAVAD6	0367
EXTMEM	0161	K32	0067	M40	0133	SAVCNT	0726
FLGRT0	0414	K323	0120	M43	0132	SAVEA	0755
FLGRT1	0426	K4	0073	M5	0137	SAVEB	0756
FLGRT2	0440	K40	0104	M7	0136	SAVINT	0725
FLGRT3	0452	K400	0121	MASK0	0417	SAVLNK	0561
FOROCP	0043	K5	0074	MASK1	0431	SERVEX	5004
FOROCT	4443	K5200	0123	MASK2	0443	SPACE2	4455
HOMEDF	0211	K540	0124	MASK3	0455	SPACEP	0055
IHRETP	0026	K5402	0003	MESAGE	4444	SRVIN	0244
INIT	0600	K64	0070	MESAGP	0044	STASKP	1131
INITEX	5020	K7	0075	MSAB	6401	TABLE	0400
INITLP	0615	K70	0105	MSCD	6410	TCNT0	0415
INT	0733	K7510	0125	MSIE	6400	TCNT1	0427
INT1	0753	K7520	0126	MSLB	6412	TCNT2	0441
INTACK	0214	K7540	0127	MSLC	6411	TCNT3	0453
IOFMSP	0056	K7600	0131	MSRA	6402	TEXT1	0201
IOTA	0744	K77	0106	MSRB	6417	TRANS	0550
IOTB	0745	K7735	0132	MSRD	6405	TTOBAK	0460
IOTC	0751	K7740	0133	MSSB	6413	TTOSND	0514
IOTD	0251	K7750	0134	MSSC	6415	TTYCNT	0731

TWOOCP	0041
TWOOCT	4441
TYPE	4450
TYPEP	0050
UPCNT	0352
UPDATE	0333
WAIT	0321
WATLOP	1011

ERRORS DETECTED: 0

LINKS GENERATED: 65

RUN-TIME: 4 SECONDS

2K CORE USED