

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

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1. MODULE DESCRIPTION

"MULSLU" IS A DEC/X8 SOFTWARE MODULE WHICH EXERCISES 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 SEQUENTIALLY (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" MODULE.

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	S1-5	S1-7	S1-1	S3-3	S3-5	S3-7	S3-1
S1-4	S1-6	S1-8	S1-2	S3-4	S3-6	S3-8	S3-2

NOTE THAT THE SWITCHES FOR 20 MA LOOP-BACK MUST BE THROWN IN PAIRS (I.E. ALL 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 TYI/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	RECEIVE BRANCH,

6. LISTING

ATTACHED

/DEC/X8 EXTERNAL SYMBOL TABLE "EXTSYM"
 /FOR USE IN ASSEMBLING DEC/X8 SOFTWARE MODULES.
 /COPYRIGHT 1972, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
 PAUSE

PAL10 V142A 17-FEB-76 11104 PAGE 2

/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 SLOTS: 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 TEXT "DIKLC-A"
0205 0411
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 INHRET
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 ERFP
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, MBRD /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
0261 5264 JMP ,+3 /ACTIVE?
0262 1644 TAD I SRVIN /LINE IS ACTIVE.
0263 7402 ERHLT1, HLT /LOAD LINE NUMBER TO AC.
0264 1372 TAD M2 /NO, THIS LINE SHOULDNT INTERRUPT.
0265 7440 SZA
0266 5272 JMP ,+6 /TERMINAL MODE?
/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 DEFERRED 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 MASK1
0343 0644 AND I SRVIN /MASK LEVEL1
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 0
0354 3774 DCA SAVLNK /SAVE LINK.
0355 1777 TAD CNTPLG /GET LATCH INDICATOR.
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 1775 TAD LINPLG
0363 3777 DCA CNTPLG /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 1037
0377 0563
0400 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 FLGRTO, 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 TTOBND /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 FLGRTO, 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 TTOBND /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 1777 JMS SRVIN /SERVICE TTI, COMPARE DATA
0440 0001 FLGRTO, 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 TTOBND /SEND TTO CHARACTER.
0445 5236 JMP RUNGO3 /DEFERRED, SEND AND START NEXT TTO!
0446 1104 LINE3T, TAD K400 /LATCH BIT 6, LINE 3.
0447 4260 JMS TTOBAK /EXIT.
0450 1102 LINE3R, TAD K200 /LATCH BIT 7, LINE 3.
0451 4777 JMS SRVIN /SERVICE TTI, COMPARE DATA
0452 0001 FLGRTO, 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 TTOBND /SEND TTO CHARACTER.
0457 5004 SERVEX /EXIT TO MONITOR

0460 0000 TTOBAK, 0
0461 7004 AND K7760
0462 0133 AND CNTPLG /SETUP UP BIT FOR MASK.
0463 0363 AND CNTPLG /SET INTERRUPT LATCH.
0464 3363 DCA CNTPLG
0465 2260 ISZ TTOBAK
0466 2260 ISZ TTOBAK
0467 1660 TAD I TTOBAK
0470 2260 ISZ TTOBAK
0471 2260 ISZ TTOBAK
0472 7400 SZA
0473 5276 JMP *3
0474 1660 TAD I TTOBAK
0475 7402 ERHLT2, HLT
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 UPCTR /CHECK FOR UPDATE CNTR.
0516 1137 TAD MS
0517 1314 TAD TTOSND
0520 3260 DCA TTOBAK /SAVE INDICATOR POINTER.
0521 1141 TAD M3
0522 1314 TAD TTOSND
0523 3362 DCA SAVADS /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 SAVADS /GET CHARACTER.
0540 2362 ISZ SAVADS
0541 0762 AND I SAVADS /MASK CHARACTER.
0542 3362 DCA SAVADS /SAVE REDUCED CHARACTER.
0543 2260 ISZ TTOBAK
0544 1660 TAD I TTOBAK /GET CHARACTER.
0545 0766 AND K1400 /MASK LINE NO.
0546 1362 TAD SAVADS /ADD IN THE REST.
0547 5352 JMP +3
0550 2260 TRANS, ISZ TTOBAK
0551 1660 TAD I TTOBAK /TRANSMIT UPDATED CHARACTER.
0552 6404 IOTF, MSXD /TRANSMIT!
0553 7200 CLA
0554 1361 TAD SAVLNK
0555 7110 CLL RAR
0556 7620 SNL CLA /INT. OR DEFERRED 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 SAVADS, 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 4054 INIT, CRLF /CR LF
0601 1377 TAD (TEXT1
0602 3204 DCA +2
0603 4444 MESSAGE /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.

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0652 4450 TYPE /PRINT IT.
0653 4455 SPACE2 /SPACE AND WAIT.
0654 1327 TAO SAVAD2
0655 1332 TAO 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 TAO I SAVAD2 /GET TYPE INDICATOR.
0666 7600 S20 CLA K20 /BOLY TERMINAL?
0667 3325 TAO K48
0670 1330 DCA SAVINT /SAVE LATCH MAKER.
0671 7106 TAO LINFLG
0672 3330 CLL RTL
0673 2326 DCA LINFLG /ROTATE AND SAVE INTERRUPT LATCH.
0676 7600 ISZ SAVCNT
0677 1327 S20 CLA SAVAD2 /TEST THIS LINE?
0678 5242 JMP NTLOOP /NO
0679 3204 TAO SAVAD2
0680 1330 DCA SAVAD4 /SAVE ADDRESS POINTER
0681 1325 TAO LINFLG
0682 3330 TAO SAVINT /SET INT. LATCH.
0683 4455 DCA LINFLG
0684 2204 SPACE2
0685 2331 ISZ SAVAD4
0686 4442 ISZ TTYCNT /UPDATE LINE COUNTER.
0687 5200 ONEOCT /GET FIRST PART OF LEVEL.
0688 2204 JMP INIT /ERROR, TRY AGAIN.
0689 2204 ISZ SAVAD4
0690 7106 ISZ SAVAD4
0691 7006 CLL RTL
0692 7006 RTL
0693 3604 DCA I SAVAD4 /SAVE FIRST OF LEVEL
0694 4441 TWOOCT /GET REMAINING LEVEL.
0695 5200 JMP INIT /ERROR, TRY AGAIN.
0696 1604 TAO I SAVAD4 /ADD IN OTHER PART.
0697 3604 DCA I SAVAD4 /SAVE COMPLETE LEVEL.
0698 5242 JMP NTLOOP /CHECK NEXT.

0724 0000 EVcnt, 0
0725 0000 SAVINT, 0
0726 0000 SAVCNT, 0
0727 0000 SAVAD2, 0
0730 7760 LINFLG, 7760
0731 0004 TTYCNT, 4
0732 0012 K12, 0012
/
/RETURN HERE AFTER AN INTERRUPT
/
0733 0000 INT, 0
0734 6214 ROP /MAKE CIF CDF FOR EXIT TO

```

```

0735 1020 TAD Z KCIFDF /MONITOR CHAIN.
0736 3353 DCA INT1
0737 4770 JMS HOMEDF /SETUP DF
0740 1767 TAD KILLED /JOB KILLED?
0741 7640 S2A CLA
0742 5353 JMP INT1 /BACK TO MONITOR
0743 1357 TAD BASEAD /GET BASE ADDRESS.
0744 6412 IOTA, MSLB /LOAD BRANCH ADDRESS.
0745 6402 IOTB, MSRA /READ STATUS.
0746 3355 DCA SAVEA /SAVE STATUS A.
0747 6417 IOTH, MSRB /READ STATUS B.
0750 3356 DCA SAVES /SAVE IT.
0751 6401 IOTC, MSAB /BRANCH IF FLAG1
0752 7300 CLA CLL /YOU DIDN'T BRANCH!
0753 7402 HLT /EXIT TO MONITOR CHAIN.
0754 5733 JMP I INT
/
0755 0000 SAVEA, 0
0756 0000 SAVES, 0
0757 0400 BASEAD, TABLE
/
/
0767 0220
0770 0211
0771 0452
0772 0440
0773 0426
0774 0414
0775 1135
0776 0402
0777 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 S2A CLA /0=WAIT FOR STATUS REPORTER!
1002 4776 JMS ERROR
1003 7301 CLA CLL IAC
1004 1017 TAD AUTO
1005 7640 S2A 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 MONITOR.
1014	5234	JMP	RESTRY	/RESTART LINES.
1015	3774	DCA	CNTR	/CLEAR INTERRUPT INDICATOR
1016	6002	IOF		/SHUT HIM 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, HSLC		/SET LOOP BACK MODE.
1034	7300	RESTRY, CLA CLL		
1035	6002	IOF		/SHUT HIM 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	1700	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	RUNGOB	/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	CHA	
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	CHA	
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 RYL	
1130	3747	DCA	CODE	/CODE IS A 2 FOR STATUS ERRORS.
1131	7344	STASKP, CLA CLL	CHA 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 11111111 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
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 3700

4000
4100

4200
4300

4400
4500

4600
4700

5000
5100

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5300

5400
5500

5600
5700

6000
6100

6200
6300

6400
6500
6600
6700

7000
7100

7200
7300

7400
7500

7600
7700

1200	0600	/BUILDER CALL
1201	1015	INIT/RUN/INT
1202	0733	
1203	0801	1/HLT/HLT/HLT/HLT/HLT
1204	7402	
1205	7402	
1206	7402	
1209	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

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2100

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6700

7000
7100

7200
7300

7400
7500

7600
7700

ASBUFF	4460	IOTE	1042	K7760	0135	MSSR	6403
ASBUFF	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	IO TJ	1072	KCDF	0064	NOSKP	1110
AUTOLP	1135	IO TK	1075	KCIF	0005	NTLOOP	0642
BASEAD	0757	IO TL	1100	KCIFDF	0020	NUDATA	0335
CHAR0	0416	IO TM	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
CRLF	0054	K1400	0370	LINE3R	0450	REPORT	0324
DEVCON	0724	K17	0101	LINE3T	0446	RESTRY	1034
DNREC	0330	K177	0130	LINFLG	0730	RLBUFF	4457
DWAIT	0371	K20	0102	LISN	4440	RLBUFP	0057
ERHLT1	0263	K200	0110	LISNP	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
ERRKP	1105	K3	0072	M3	0141	SAVAD4	0004
EXINIT	0020	K30	0103	M30	0134	SAVAD5	0562
EXSERV	0004	K301	0117	M4	0140	SAVAD6	0367
EXTMEM	0161	K32	0067	M40	0133	SAVCNT	0726
FLGRTO	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
IMHETP	0026	K5402	0003	MESSAGE	4444	SRVIN	0244
INIT	0600	K64	0070	MESAGP	0044	STASKP	1131
INITEX	0020	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
IOFB	0745	K7735	0132	MSRD	6405	TT0BAK	0460
IOFC	0751	K7740	0133	MSRB	6413	TT0SND	0514
IODD	0251	K7750	0134	MSRC	6415	TTYCNT	0731

TWOCP 0041
TWOCT 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