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TITLE

INTERRUPT DUPLICATOR FOR BINARY OBJECT TAPES

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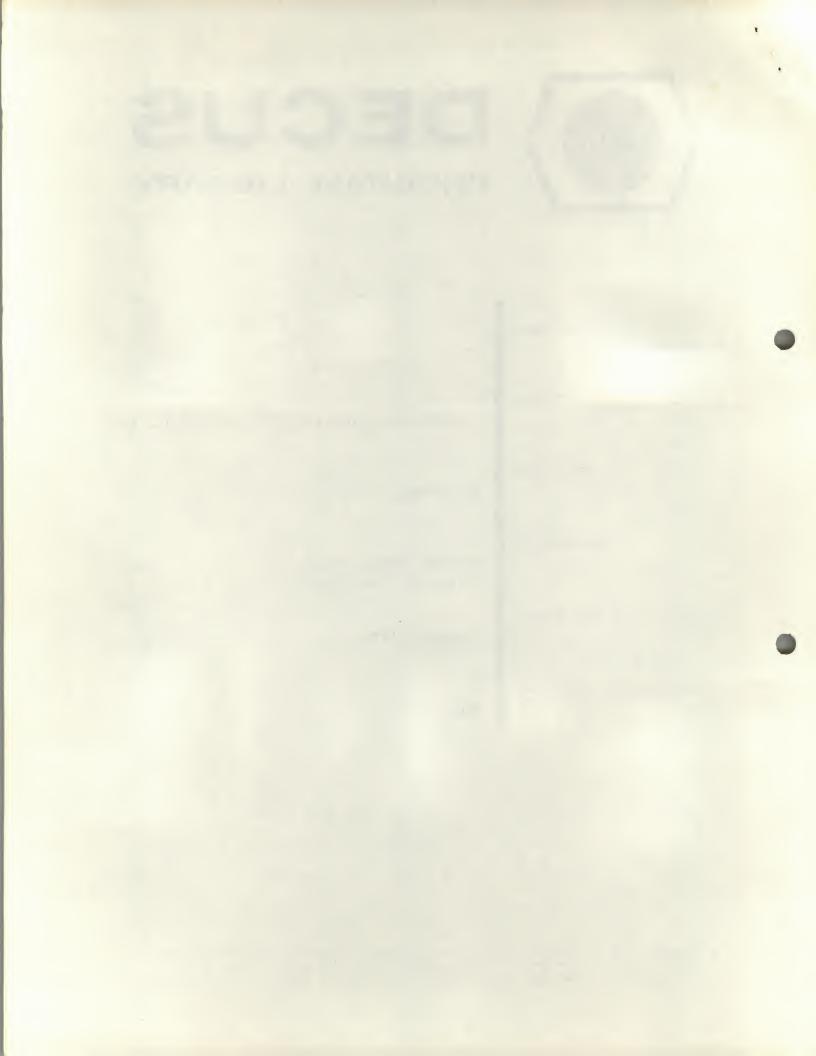Portsmouth, Rhode Island

DATE

January 5, 1972

SOURCE LANGUAGE

PAL III

INTERRUPT DUPLICATOR FOR BINARY OBJECT TAPES

Hardware: 4-K PDP-8 series computer with one or more on-line Teletypes, optional high speed reader and/or punch.

Function: Copies absolute binary tapes (produced by PAL, MACRO, ODT, etc.) from any of three readers onto any one of three punches. The routine will not copy SABR or other relocatable binaries.

Core required: Main program, locations 10-306, in any core field
                    Storage buffer, locns. 307-4000 in the same field
                    Interrupt, locations 0-7 in field 0.

To use: Load the duplicator binary into the core field of your choice. Set instruction and data field switches (in a multi-field machine) to that field. Load address=0200. Now set the switch register for:

	Teletype punch:	TTY punch, code 41:	High spd. punch:
	6046	6416	6026
[PDP-8/E:	6040	6410	6026]

Load the tape to be duplicated into the reader of your choice and turn the reader on (if a Teletype reader, turn TTY to LINE). Turn on the punch chosen above. Turn off all other devices capable of causing interrupts. Start the central processor at the console.

Brief outline of operation: The reader and punch run asychronously until the source tape is read or the storage buffer filled. The reader then halts until the punch has caught up. If necessary, the storage buffer is filled and emptied many times over. When duplication is complete, the computer halts with the computed checksum displayed in the AC lights; this should agree with the punched checksum on both tapes. The user can restart the duplicator by pressing CONTINUE; the routine skips the initial 6046 (or whatever), thus avoiding a blank between the trailer of one program on a segmented binary tape and the leader of the next.

Premature halts: The duplicator halts if it detects error in high-order bits. Check the listing for the exact error made.

Ascii text: Ascii text, e.g. diagnostics from the assembler, is ignored if enclosed in rubouts. Stray Ascii is flagged as an error.

/ROUTINE TO COPY BINARY OBJECT TAPES ON ANY
/OF THREE DEVICES, USING PROGRAM INTERRUPT.

/MAIN PROGRAM: MAY BE LOADED INTO ANY CORE FIELD

                    /LOAD ADDRESS=200. SET SWITCH REGISTER TO THE
                    /INITIALIZATION CODE OF THE PUNCH IN USE:
                    /6046, 6026, ETC. NOW START.

```
0200   7410   START,  SKP
0201   5205           JMP .+4           /RESTART AFTER 'CONTINUE'
0202   7604           LAS               /READ INIT. CODE FROM S.R.
0203   3204           DCA .+1
0204   0000           0                 /EXECUTE IT

0205   4216   RESTRT, JMS SETUP
0206   3154           DCA CKSUM
0207   3107           DCA LDR+1         /INITIAL MODE, CODE 200=LEADER
0210   3155           DCA FLAG1         /FLAG1=-1 WHEN RDNG. EVEN FRAMES,
                      /                   =0 WHEN RDNG. ODD FRAMES
0211   3156           DCA FLAG2         /FLAG2=-1 IN ASCII MODE,
                      /                   =0 WHEN READING PROGRAM DATA
0212   4141           JMS TRAILR
0213   6001   WAIT,   ION
0214   5214           JMP .             /WAIT LOOP
0215   5213           JMP .-2           /RETURN FROM INTERRUPT
0216   0000   SETUP,  0
0217   6032           KCC               /START READERS
0220   6402           KCC2
0221   6014           RFC
0222   1177           TAD SKIP          /DO NOT SKIP READER FLAGS
0223   3237           DCA STEER         /  (CF. 'FLAGS', BELOW)
0224   1306           TAD KBOTM
0225   3010           DCA 10            /SET POINTERS TO STOR. BUFFER
0226   1010           TAD 10
0227   3011           DCA 11
0230   5616           JMP I SETUP

0231   3020   FLAGS,  DCA ADRS
0232   6011           RSF
0233   5237           JMP .+4
0234   6012           RRB
0235   4021           JMS TEST
0236   6014           RFC
              /LOW-SPEED DEVICES:
0237   7410   STEER,  SKP
0240   5253           JMP PUNCH         /IGNORE READER FLAGS
                      /                  IF BUFFER IS FILLED
0241   6031           KSF
0242   5246           JMP .+4
0243   6034           KRS
0244   4021           JMS TEST
0245   6032           KCC
0246   6401           KSF2
0247   5253           JMP .+4
0250   6404           KRS2
0251   4021           JMS TEST
0252   6402           KCC2
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0253    6021    PUNCH,    PSF
0254    5257              JMP .+3
0255    4270              JMS FETCH
0256    6026              PLS
0257    6041              TSF
0260    5263              JMP .+3
0261    4270              JMS FETCH
0262    6046              TLS
0263    6411              TSF2
0264    5267              JMP .+3
0265    4270              JMS FETCH
0266    6416              TLS2
0267    5016              JMP BACK

0270    0000    FETCH,    0
0271    1162              TAD AC          /ZERO?
0272    7450              SNA
0273    5277              JMP .+4
                          /               NO, 7600.  DO TRAILER.
0274    2153              ISZ COUNT
0275    5670              JMP I FETCH
0276    5016              JMP BACK
                          /
0277    1010              TAD 10          /YES, ANY DATA READY?
0300    7041              CIA
0301    1011              TAD 11
0302    7700              SMA CLA
0303    5016              JMP BACK        /NO DATA READY; RETURN
0304    1411              TAD I 11        /READY: FETCH DATUM FROM STOR.
0305    5670              JMP I FETCH
0306    0306    KBOTM,    .               /BOTTOM OF STORAGE BUFFER

                *16

                BACK,
0016    7600    M200,     CLA 400
0017    5420              JMP I .+1
0020    0000    ADRS,     0
0021    0000    TEST,     0
0022    3014              DCA 14
0023    1014              TAD 14
0024    1047              TAD M376
0025    7750              SPA SNA CLA
0026    5034              JMP NONRBT
0027    2156    RBT,      ISZ FLAG2       /CHANGE STATE OF FLAG2
0030    7040              CMA
0031    3156              DCA FLAG2
0032    3155              DCA FLAG1
0033    5421              JMP I TEST
0034    2156    NONRBT,   ISZ FLAG2
0035    5041              JMP NONASC
0036    7040    ASCII,    CMA
0037    3156              DCA FLAG2       /RESTORE -1
0040    5421              JMP I TEST
0041    3156    NONASC,   DCA FLAG2       /CLEAR FLAG
0042    2155              ISZ FLAG1       /EVEN OR ODD FRAME?
0043    5100              JMP ODD
0044    1014    EVEN,     TAD 14
0045    1133              TAD M100
0046    7700              SMA CLA
0047    7402    M376,     HLT             /CODE>77, AN ERROR
0050    1014              TAD 14
0051    3160              DCA LEVEN
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0052    1014    CHECK,    TAD 14
0053    1154              TAD CKSUM
0054    3154              DCA CKSUM
0055    1014    STORE,    TAD 14
0056    3410              DCA I 10
0057    1177              TAD SKIP
0060    3107              DCA LDR+1         /TREAT CODE 200 AS TRAILER
                         /                   (END OF BIN. TAPE)
0061    1010              TAD 10
0062    7700              SMA CLA
0063    5421              JMP I TEST        /STORAGE NOT FILLED;
                         /                   CONTINUE READ-IN.
0064    3540              DCA I PSTEER      /FULL UP, STOP INPUT
0065    6001              ION
0066    5066              JMP .             /WAIT FOR PUNCH TO CATCH UP
0067    1010              TAD 10
0070    7041              CIA
0071    1011              TAD 11
0072    7710              SPA CLA           /CAUGHT UP YET?
0073    5065              JMP .-6           /NO
0074    4477              JMS I PSETUP      /YES
0075    5476              JMP I .+1
0076    0213              WAIT
0077    0216    PSETUP,   SETUP

0100    1014    ODD,      TAD 14
0101    1016              TAD M200
0102    7510              SPA
0103    5122              JMP DATA
0104    7440              SZA
0105    5112              JMP FLD
0106    3155    LDR,      DCA FLAG1         /NEXT FRAME IS ODD
0107    0000              0                 /(0 OR SKP)
0110    5421              JMP I TEST        /AFTER LEADER
0111    5127              JMP END           /AFTER TRAILER

0112    1133    FLD,      TAD M100
0113    7510              SPA
0114    7602              CLA HLT           /200<CODE<300, AN ERROR
0115    0157              AND K7
0116    7640              SZA CLA
0117    7402              HLT               /FLD. OP. SHOULD END IN 0
0120    3155              DCA FLAG1
0121    5055              JMP STORE

0122    7240    DATA,     CLA CMA
0123    3155              DCA FLAG1         /NEXT FRAME WILL BE EVEN
0124    1014              TAD 14
0125    3161              DCA LODD
0126    5052              JMP CHECK

0127    3540    END,      DCA I PSTEER      /SKIP READER FLAGS
0130    1010              TAD 10
0131    7041              CIA
0132    1011              TAD 11
0133    7700    M100,     SMA CLA
0134    5170              JMP EXIT
0135    6001              ION
0136    5136              JMP .
0137    5127              JMP END
0140    0237    PSTEER,   STEER
```

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```
0141    0000    TRAILR,  0
0142    1133             TAD M100
0143    3153             DCA COUNT
0144    1016             TAD M200           /7600; PUNCH READS 200
0145    6001             ION
0146    5146             JMP .
0147    1153             TAD COUNT
0150    7640             SZA CLA
0151    5144             JMP .-5
0152    5541             JMP I TRAILR
0153    0000    COUNT,   0
0154    0000    CKSUM,   0
0155    0000    FLAG1,   0
0156    0000    FLAG2,   0
0157    0007    K7,      7
0160    0000    LEVEN,   0
0161    0000    LODD,    0          /LAST EVEN & ODD FRAMES
0162    0000    AC,      0

                *167

0167    0030    K30,     30
0170    1167    EXIT,    TAD K30
0171    4141             JMS TRAILR
0172    1160             TAD LEVEN
0173    1161             TAD LODD
0174    7041             CIA                /SUBTRACT TAPE CKSUM FRAMES
                         /                   FROM TOTAL COMPUTED CKSUM
0175    1154             TAD CKSUM          /TRUE COMPUTED CKSUM
0176    7402             HLT                /USER CHECKS AC LIGHTS
                         /                   AGAINST PUNCHED CKSUM
0177    7610    SKIP,    CLA SKP            /RESTART BY 'CONTINUE'


                FIELD 0

                *0
0000    0000             0                  /FOR INTERRUPT RTRN. ADRS.
0001    6244             RMF
0002    3407             DCA I POINTR       /STORE AC IN 'AC'
0003    1000             TAD 0
0004    7001             IAC                /RETURN TO 'JMP .' PLUS 1
0005    5406             JMP I .+1
0006    0231             FLAGS
0007    0162    POINTR,  AC


                KCC2=6402
                KRS2=6404
                KSF2=6401
                TSF2=6411
                TLS2=6416
```

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```
AC       0162
ADRS     0020
ASCII    0036
BACK     0016
CHECK    0052
CKSUM    0154
COUNT    0153
DATA     0122
END      0127
EVEN     0044
EXIT     0170
FETCH    0270
FLAGS    0231
FLAG1    0155
FLAG2    0156
FLD      0112
KBOTM    0306
KCC2     6402
KRS2     6404
KSF2     6401
K30      0167
K7       0157
LDR      0106
LEVEN    0160
LODD     0161
M100     0133
M200     0016
M376     0047
NONASC   0041
NONRBT   0034
ODD      0100
POINTR   0007
PSETUP   0077
PSTEER   0140
PUNCH    0253
RBT      0027
RESTRT   0205
SETUP    0216
SKIP     0177
START    0200
STEER    0237
STORE    0055
TEST     0021
TLS2     6416
TRAILR   0141
TSF2     6411
WAIT     0213
```