PDP-8 MORSE CODE SENDER

DECUS Program Library Write-up

DECUS No. 8-308

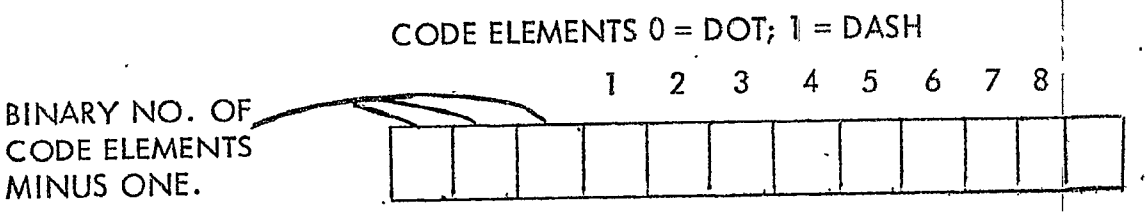
STORAGE

6000 - 6347 (octal)

DESCRIPTION

The program reads input from the ASR keyboard or tape reader and translates all valid characters into Morse code. Output in the form of a square audio wave is taken from D to A converter #1 and fed into an audio amplifier. Invalid input characters are ignored by the program.

Translation into Morse code is by a table look-up method. Each character is coded into a single computer word as illustrated below:



Determination of the validity of an input character is also accomplished by table look-up. The code speed is variable over its entire useful range.

HARDWARE

4K PDP-8, D to A converter, audio amplifier with speaker.

RESTRICTIONS

There is no input buffer in the program. Keyboard input must not be at a faster rate than code output.

OPERATION

Load with the binary loader. Starting address is 6000. The code speed is determined by the setting of the switch register and may be changed at any time.

The valid input characters are:

A thru Z	← (error)
0 thru 9	↑ (understood)
. , ? - ( ) ; : " ' /	! (attention)
+ (double dash)	(space)
@ (end of message)	(line feed)
$ (end of work)	(carriage return)
# (wait)	

A carriage return-line feed combination is timed as a space. The output audio frequency may be changed by changing the contents of address 6150. A different D to A converter may be selected by the appropriate output command in address 6120.

```
                DAL=6551  /D-A #1
                NEG=7330  /SET AC=4000
                *6000  /START ADR
6000    6032    KCC  /CLEAR FLAGS
6001    6046    TLS  -PRINT NULL
6002    7300    ST, CLA CLL  /READ INPUT CHARACTER
6003    6031    KSF
6004    5203    JMP .-1
6005    6036    KRB
6006    3337    DCA TEMP  - CHAR READ IN
6007    1340    TAD STEST  /BEGINNING OF VALID CHARACTER TABLE
6010    3346    DCA CHAR
6011    7300    CHECK, CLA CLL
6012    1746    TAD I CHAR  /FROM "VALID" TABLE
6013    2346    ISZ CHAR
6014    7450    SNA  /END OF TABLE?
6015    5202    JMP ST  /YES, TRY ANOTHER INPUT
6016    7041    CIA
6017    1337    TAD TEMP
6020    7440    SZA  /INPUT VALID?
6021    5211    JMP CHECK  /NO, TRY NEXT ON LIST
6022    1337    TAD TEMP  /YES, ECHO
6023    6041    TSF
6024    5223    JMP .-1
6025    6046    TLS
6026    1341    TAD MODIFY
6027    3346    DCA CHAR      CHAR ← LOC OF ENCODED CHAR
6030    3337    DCA TEMP      TEMP ← 0
6031    1346    TAD CHAR
6032    1342    TAD SP  /SPACE?
6033    7650    SNA CLA
6034    5277    JMP SPACE
6035    1346    TAD CHAR
6036    1343    TAD LF  /LINE FEED?
6037    7650    SNA CLA
6040    5300    JMP LINF
6041    1346    TAD CHAR
6042    1344    TAD CR  /CAR RET?
6043    7650    SNA CLA
6044    5302    JMP CARET
6045    7100    CLL
6046    1746    TAD I CHAR  /GET DATA FROM TABLE
6047    3346    DCA CHAR      CHAR ← ENCODED CHAR
6050    4327    JMS ROT  /DETERMINE # OF CODE ELEMENTS
6051    4327    JMS ROT
6052    4327    JMS ROT
6053    1337    TAD TEMP  - number of code elements - 1
6054    7040    CMA
6055    3337    DCA TEMP      TEMP ← -(# OF CODE ELEMENTS - 1)
6056    7300    NEXT, CLA CLL  /DOT OR DASH?
6057    1346    TAD CHAR
```

000 000 000 100
111 111 111 011

```
6Ø6Ø  7ØØ4  RAL
6Ø61  3346  DCA CHAR
6Ø62  1211  TAD CHECK
6Ø63  331Ø  DCA AGAIN   AGAIN ← 7300
6Ø64  742Ø  SNL /SKP IF DASH   LINK CONTAINS PRESENT CODE ELEMT
6Ø65  527Ø  JMP DOT
6Ø66  43Ø4  JMS COUNT
6Ø67  43Ø4  JMS COUNT
6Ø7Ø  43Ø4  DOT, JMS COUNT
6Ø71  1312  TAD INST
6Ø72  331Ø  DCA AGAIN   AGAIN ← 7330
6Ø73  43Ø4  JMS COUNT /SEND A SPACE
6Ø74  2337  ISZ TEMP /LAST ELEMENT FOR INPUT?
6Ø75  5256  JMP NEXT /SEND MORE
6Ø76  53Ø1  JMP WDSP /SEND MORE SPACE & GET NEW INPUT
6Ø77  43Ø4  SPACE, JMS COUNT
61ØØ  43Ø4  LINF, JMS COUNT
61Ø1  43Ø4  WDSP, JMS COUNT ←
61Ø2  43Ø4  CARET, JMS COUNT
61Ø3  52Ø2  JMP ST
61Ø4  ØØØØ  COUNT, ØØØØ
61Ø5  76Ø4  LAS /GET SENDING SPEED
61Ø6  7Ø4Ø  CMA
61Ø7  3345  DCA CLOCK
611Ø  ØØØØ  AGAIN,ØØØØ /SEND IF CLA, SPACE IF NEG -will contain 7300 CLA
                                                    or 7330 LDA (-3777)
6111  4317  JMS CONV   SNA CLA
6112  733Ø  INST, NEG   INST, TAD RELY
6113  4317  JMS CONV
6114  2345  ISZ CLOCK
6115  531Ø  JMP AGAIN
6116  57Ø4  JMP I COUNT   ENTER CONV WITH AC = 0
6117  ØØØØ  CONV,ØØØØ      OR 7 = 4000 (-3777)
612Ø  6551  DAL ——— - 6653 (LOAD RELAYS)
6121  73ØØ  CLA CLL
6122  135Ø  TAD PITCH
6123  3347  DCA DELAY
6124  2347  ISZ DELAY
6125  5324  JMP .-1
6126  5717  JMP I CONV
6127  ØØØØ  ROT, ØØØØ
613Ø  1346  TAD CHAR   AC ← CHAR
6131  7ØØ4  RAL
6132  3346  DCA CHAR   CHAR ← CHAR, RAL(1)
6133  1337  TAD TEMP   AC ←
6134  7ØØ4  RAL
6135  3337  DCA TEMP
6136  5727  JMP I ROT
6137  ØØØØ  TEMP,ØØØØ
614Ø  6156  STEST,6156
6141  6Ø1Ø  MODIFY,6Ø1Ø
6142  153Ø  SP,153Ø
6143  1556  LF,1556
```

```
6144  1553  CR,1553
6145  ØØØØ  CLOCK,ØØØØ
6146  ØØØØ  CHAR,ØØØØ
6147  ØØØØ  DELAY,ØØØØ
615Ø  7464  PITCH,7464
                        *6156 /START OF "VALID" TABLE
6156  Ø3Ø1  3Ø1 A
6157  Ø3Ø2  3Ø2
616Ø  Ø3Ø3  3Ø3
6161  Ø3Ø4  3Ø4
6162  0305  305
6163  Ø3Ø6  3Ø6
6164  Ø3Ø7  3Ø7
6165  Ø31Ø  31Ø
6166  Ø311  311
6167  Ø312  312
617Ø  Ø313  313
6171  Ø314  314
6172  Ø315  315
6173  Ø316  316
6174  Ø317  317
6175  Ø32Ø  32Ø
6176  Ø321  321
6177  Ø322  322
62ØØ  Ø323  323
62Ø1  Ø324  324
62Ø2  Ø325  325
62Ø3  Ø326  326
62Ø4  Ø327  327
62Ø5  Ø33Ø  33Ø
62Ø6  Ø331  331
62Ø7  Ø332  332 Z
621Ø  Ø26Ø  26Ø O
6211  Ø261  261
6212  Ø262  262
6213  Ø263  263
6214  Ø264  264
6215  Ø265  265
6216  Ø266  266
6217  Ø267  267
622Ø  Ø27Ø  27Ø
6221  Ø271  271 9
6222  Ø256  256 8
6223  Ø254  254 7
6224  Ø277  277 ?
6225  Ø253  253 +
6226  Ø3ØØ  3ØØ @
6227  Ø244  244 $
623Ø  Ø243  243 #
6231  Ø241  241 )
```

6151 RELY, 0077

```
6232  Ø336  336  ↑
6233  Ø257  257  !
6234  Ø247  247  '
6235  Ø255  255  "
6236  Ø25Ø  25Ø  (
6237  Ø251  251  )
624Ø  Ø272  272  :
6241  Ø273  273  ;
6242  Ø242  242  "
6243  Ø337  337  ←
6244  Ø212  212  LF
6245  Ø215  215  CR
6246  Ø24Ø  24Ø  SF
6247  ØØØØ  ØØØ  /END OF VALID TABLE
625Ø  ØØØØ  ØØØ
6251  452Ø  452Ø  /START DATA TABLE

6252  522Ø  522Ø
6253  42ØØ  42ØØ
6254  5Ø5Ø  5Ø5Ø
            *6257
6257  536Ø  536Ø
626Ø  555Ø  555Ø
6261  555Ø  555Ø
6262  ØØØØ  ØØØØ
6263  442Ø  442Ø
6264  563Ø  563Ø
6265  541Ø  541Ø
6266  525Ø  525Ø
6267  444Ø  444Ø
627Ø  476Ø  476Ø
6271  436Ø  436Ø
6272  416Ø  416Ø
6273  4Ø6Ø  4Ø6Ø  3
6274  4Ø2Ø  4Ø2Ø
6275  4ØØØ  4ØØØ
6276  44ØØ  44ØØ
6277  46ØØ  46ØØ
63ØØ  47ØØ  47ØØ
63Ø1  474Ø  474Ø
63Ø2  57ØØ  57ØØ
63Ø3  552Ø  552Ø
            *63Ø7
63Ø7  514Ø  514Ø
631Ø  424Ø  424Ø
6311  12ØØ  12ØØ  A
6312  34ØØ  34ØØ  B
6313  35ØØ  35ØØ  C
6314  24ØØ  24ØØ  D
6315  ØØØØ  ØØØØ  E
```

WAIT SK

BT +

- (minus)

4066

```
6316  31ØØ  31ØØ  F
6317  26ØØ  26ØØ  G
632Ø  3ØØØ  3ØØØ  H
6321  1ØØØ  1ØØØ  I
6322  334Ø  334Ø  J
6323  25ØØ  25ØØ  K
6324  32ØØ  32ØØ  L
6325  16ØØ  16ØØ  M
6326  14ØØ  14ØØ  N
6327  27ØØ  27ØØ  O
633Ø  33ØØ  33ØØ  P
6331  364Ø  364Ø  Q
6332  22ØØ  22ØØ  R
6333  2ØØØ  2ØØØ  S
6334  Ø4ØØ  Ø4ØØ  T
6335  21ØØ  21ØØ  U
6336  3Ø4Ø  3Ø4Ø  V
6337  23ØØ  23ØØ  W
634Ø  344Ø  344Ø  X
6341  354Ø  354Ø  Y
6342  36ØØ  36ØØ  Z
              *6346
6346  4Ø4Ø  4Ø4Ø
6347  7ØØØ  7ØØØ

AGAIN    611Ø
CARET    61Ø2
CHAR     6146
CHECK    6Ø11
CLOCK    6145
CONV     6117
COUNT    61Ø4
CR       6144
DAL      6551
DELAY    6147
DOT      6Ø7Ø
INST     6112
LF       6143
LINF     61ØØ
MODIFY   6141
NEG      733Ø
NEXT     6Ø56
PITCH    615Ø
ROT      6127
SP       6142
SPACE    6Ø77
ST       6ØØ2
STEST    614Ø
TEMP     6137
WDSP     61Ø1
```