1. IDENTIFICATION

1.1 Digital-8-20-U-Sym

1.2 Character String Typeout

1.3 October 22, 1965

2. ABSTRACT

A basic subroutine to type messages stored internally as a string of coded characters. All ASR-33 characters are legal.

3. REQUIREMENTS

3.1 Storage

This subroutine uses 59 (decimal) core memory locations.

3.3 EQUIPMENT

Basic PDP-8

4. USAGE

4.1 Loading

This subroutine may be placed in core through the use of the Binary Loader, which is completely described in Digital-8-2-Rim. The library tape supplied is symbolic.

4.2 Calling Sequence

Call with a JMS with the starting address of the character string in the AC. Return will be to the instruction following the calling JMS.

5. RESTRICTIONS (Not Applicable)

6. DESCRIPTION

6.1 Discussion

The ASCII character set breaks naturally into two major groupings: characters represented by codes 240 through 277; and characters represented by codes 301 through 337. Characters with these codes may readily be handled by representing them internally as stripped 6-bit codes. See Digital-8-18-U-Sym and Digital-8-19-U-Sym for a complete discussion of how this is done.

The following are special characters:

Character	Code
EOT	204
WRU	205
RU	206
BELL	207
Line Feed	212
Return	215
@	300
ACK	374
ALT MODE	375
RUBOUT	377

These special characters are represented by codes which conflict with the groupings from 240 to 277 and 301 to 337. Consequently when these characters must be output, they are treated as exceptions and

developed by special methods as described in Digital-8-18-U-Sym and Digital-8-19-U-Sym. Neither of these programs permits the development of all the codes listed above. This program does.

7. METHODS

7.1 Discussion

Internally characters are represented as 6-bit stripped characters and are packed two to a word. The stripped character 00 is used to indicate that the following character is a special character. For example, @ may be developed by packing 0000.

Since the appearance of 00 indicates that the next 6-bit group is to receive special treatment, 64 special characters are possible. This is many more than necessary to accommodate the ten special characters listed above that are required for ASCII typeout. The 6-bit group 000001 is therefore used to indicate the end of a given character string since it is not needed for regular ASCII output.

The method is straightforward. The first message word is picked up and the two trimmed codes masked out. Two jumps to the subroutine tagged TSCC2 are made in order to type the two characters. TSCC2 tests first to determine if the special character flag is set indicating that the current character is special. If so, a JMP to TYPSP is executed. If not, a test is made to see if the current code is 00. If so, the special character flag is set but no typeout ensues. If not, a regular character is being processed and is typed.

The TYPSP section of coding processes special characters. The special characters may be classified as:

Special Character	Comments
300	Logically the lowest element of extended group 301 through 337.
374,375,377	Least significant two digits similar to those in group 240 to 277.
204,205,206 207,212,215	Least significant two digits similar to those in group 301 through 337.

In order to develop the correct output, TYPSP changes the SPA command in SWITCH to a SMA command for all special characters but 300.

8. FORMAT

8.4 Miscellaneous

Refer to Digital-8-18-U-Sym and Digital-8-19-U-Sym for further format and code description.

9. EXECUTION TIME (Not applicable)

10. PROGRAM

10.4 Program Listing

```
                /DIGITAL 8-20-U
                /CHARACTER STRING TYPE-OUT
                /CALL WITH STRING ADDRESS IN
                /C(AC); ALL CODES MAY BE DEVELOPED
                /RETURN FOLLOWING THE JMS

0200  0000  TYPSTG,   0
0201  3262            DCA TEMQ            /STORE INITIAL ADDRESS
0202  3264            DCA FLAG            /CLEAR FLAG
0203  1662  TSCC1,    TAD I TEMQ          /PICK UP DATA
0204  7012            RTR                 /ROTATE 6 BITS RIGHT
0205  7012            RTR
0206  7012            RTR
0207  4214            JMS TSCC2           /TYPE FIRST CHARACTER
0210  1662            TAD I TEMQ          /PICK UP DATA
0211  4214            JMS TSCC2           /TYPE SECOND CHARACTER
0212  2262            ISZ TEMQ            /INCREMENT STORAGE ADDRESS
0213  5203            JMP TSCC1           /GO BACK FOR MORE

0214  0000  TSCC2,    0
0215  0265            AND K77             /MASK OFF 6 BITS
0216  3263            DCA TEMR            /SAVE CHARACTER
0217  1264            TAD FLAG            /TEST "SPECIAL" FLAG
0220  7640            SZA CLA
0221  5231            JMP TYPSP           /SET: TYPE SPECIAL
0222  1263            TAD TEMR            /NO: REGULAR CHARACTER
0223  7450            SNA                 /IS IT ZERO?
0224  5227            JMP .+3             /YES: SET FLAG
0225  4250  TYPAT,    JMS PRINT           /NO: PRINT IT
0226  5614            JMP I TSCC2         /RETURN
0227  2264            ISZ FLAG            /SET "SPECIAL" FLAG
0230  5614            JMP I TSCC2         /EXIT

0231  3264  TYPSP,    DCA FLAG            /CLEAR "SPECIAL" FLAG
0232  1263            TAD TEMR            /TEST FOR "0"
0233  7041            CIA
0234  7450            SNA
0235  5225            JMP TYPAT           /0: TYPE "@"
0236  7001            IAC                 /TEST FOR 01
0237  7650            SNA CLA
0240  5600            JMP I TYPSTG      /YES: EXIT CODE
0241  1271            TAD SKIPMA          /ALTER INSTRUCTION
0242  3252            DCA SWITCH          /TO BE "SMA"
0243  1263            TAD TEMR            /TYPE CHARACTER
0244  4250            JMS PRINT
0245  1272            TAD SKIPPA          /ALTER INSTRUCTION
0246  3252            DCA SWITCH          /TO BE "SPA"
0247  5614            JMP I TSCC2         /RETURN

0250  0000  PRINT,    0
0251  1266            TAD M40             /COMPARE WITH 40
0252  7510  SWITCH,   SPA                 /OR SMA FOR SPECIAL CODES
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```
0253  1267            TAD C100
0254  1270            TAD C240
0255  6046            TLS
0256  6041            TSF
0257  5256            JMP .-1
0260  7200            CLA
0261  5650            JMP I PRINT

                /CONSTANTS AND TEMPORARY REGISTERS
0262  0000  TEMQ,     0                    /CONTAINS STRING ADDRESS
0263  0000  TEMR,     0                    /CONTAINS 6 BIT CHARACTER
0264  0000  FLAG,     0                    /"SPECIAL" FLAG
0265  0077  K77,      77
0266  7740  M40,      -40
0267  0100  C100,     100
0270  0240  C240,     240
0271  7500  SKIPMA,   SMA
0272  7510  SKIPPA,   SPA


C100    0267
C240    0270
FLAG    0264
K77     0265
M40     0266
PRINT   0250
SKIPMA  0271
SKIPPA  0272
SWITCH  0252
TEMQ    0262
TEMR    0263
TSCC1   0203
TSCC2   0214
TYPAT   0225
TYPSP   0231
TYPSTG  0200
```

11. DIAGRAMS (Not Applicable)

12. REFERENCES

12.1 Other Library Programs

Digital-8-18-U-Sym and Digital-8-19-U-Sym