1. IDENTIFICATION

1.2 Digital-7-10-O

1.3 Teletype Output Package

1.3 January 7, 1965

2. ABSTRACT

This package includes subroutines which allow the user to type characters on line represented by 1, 3, or a string of codes. Routines are included to facilitate formating by the user. The user must supply his own subroutine, OTY, to type out one Teletype character.

3. REQUIREMENTS

3.3 Equipment

Teleprinter

4. USAGE

4.1 Loading

The Teletype Output Package source tape should be assembled with the program which refers to it, or assembled using a symbol punch which contains the required subroutine calls (see Digital-7-3-S). In either case, the operation of the routines are independent of their position in memory. The user must supply a type-out routine, OTY, which is referred to by the package (see below).

4.2 Calling Sequence

The following calling sequences may be used to call the Teletype output subroutines.

Format Routines

TCR Type a carriage return and line feed.

TSP Type a space.

TYT Type a tab. Tab stops are located every TTAB spaces. This value is initially 10, but may be altered by the user. The subroutine counts the number of characters being printed on a line so that a TYT call will generate the proper number of spaces for a consistant format. TCR resets the character count to 0.

TIN Initialize the teleprinter. Type a carriage return, line feed, lower case, and set the character count to 0. TIN should be called before any other subroutines in the package.

Character Type-out Routines

TDIGIT Type the digit (code value from 0 to 9) in the right four bits of the AC.

TY1 Type the character represented by the code in the right six bits of the AC.

TY3 Type the three characters represented by the codes in left, middle, and right six bits of the AC, respectively.

LAW A
TSR Type the string of characters represented by the codes stored beginning in register A. A code having zeros in the leftmost five bits terminates the string.

All characters are typed by calling the subroutine OTY, which must be defined by the user. Two sequences are suggested, one for use with programs which use program interrupt for I/O service, and one for programs which do not.

NOTE: When using a Type 28 Teletype, TLS will type characters represented by 5-bit codes; when using a Type 33 Teletype, TLS will type from 8-bit codes.

The following subroutine works very well with interrupt programs where buffering is not needed:

```
OTY,    0
        TLS
        JMP.
        JMP I OTY
TYINT,  TCF
        ISZ 0
        DISMISS
```

When using the associated program interrupt routine, an interrupt from the teleprinter should execute the command:

JMP TYINT

In addition, the symbol DISMIS should be defined as a JMP to the section of the interrupt routine which restores the AC and link and dismisses the program interrupt.

The following subroutine is suggested for noninterrupt programs:

```
OTY     0
        TLS
        TSF
        JMP .-1
        JMP I OTY
```

6. DESCRIPTION

6.1 Discussion

These routines assume that the codes which represent the characters to be typed consist of six bits. The leftmost five bits are the Baudot code for the character; the rightmost bit indicates the case of the character (1 for upper case, 0 for lower case). This format is generated by the PDP-7 Assember's character input operations in Teletype mode (see Digital-7-3-S). The case of the Type 28 Teletype is automatically checked (and adjusted if necessary) when each character is typed. A code whose leftmost five bits are 0 is not printed.

When using a PDP-7 with KSR33 teleprinter, the 5-bit Teletype codes are translated to 8- bit Type 33 codes (ASCII plus 200) before printing. Case shifts on the KSR33 are nonexistent. References to case in this document may be ignored when using the KSR33.

WARNING

When using a Type 28 Teletype the routine keeps track of keyboard case and assumes it knows the case at all times. However, if the user is also using the keyboard for input, he may change the case without the routines knowing it, possibly causing hash at the next type-out. For this reason and also for convenience, it is suggested that the user keep track of case by using the same indicators the package uses.

The contents of the register OCS indicates the case of the teleprinter, 33_8 for upper case and 37_8 for lower case. If this is changed whenever a case shift is typed upon input, no problems of this type will be encountered.

10. PROGRAM

10.4 Program Listing

PDP-7 BTA

```
/TELETYPE OUTPUT PACKAGE 8-13-63
XIT=CAC-JMS  TTAB=1Ø
/TYPE  1 CHARACTER FROM AC BITS 12-17
```

```
TY1=JMS .
                0
                DAC TY→SVAC
                RAR
                JMS TY1A
                XIT TY1
                TYEXIT
/TYPE 1 CHARACTER (5 BIT), LINK INDICATES CASE
TY1A,           0
                DAC T→EMY
                AND (37
                SNA
                JMP TY2
                703301
                SKP
                JMP TY1B
                LAC OCL
                SZL
                LAC OCU
                SAD OCS
                JMP . 3
                JMS OTY
                DAC OCS
                LAC TEMY
                JMS OTY
                ISZ T→BC
TY2,            LAC TEMY
                JMP I TY1A
/TYPE 3 CHARACTERS FROM AC 0-5, 6-11,12-17 RESPECTIVELY
TY3=JMS .
                0
                DAC TYSVAC
                JMS RL6
                JMS TY1A
                JMS RL6
                JMS TY1A
                JMS RL6
                JMS TY1A
                XIT TY3
                TYEXIT

/TELETYPE OUTPACKAGE PAGE 2
/TYPE A CARRIAGE RETURN, AND LINE FEED
TCR=JMS .
                0
                DAC TYSVAC
                703301
                SKP
                JMP TCRA
                LAW 2
                JMS OTY
```

```
                LAW 10
                JMS OTY
                DZM TBC
                XIT TCR
                TYEXIT
/TYPE A SPACE
TSP=JMS .
                0
                DAC TYSVAC
                LAW 4
                703301
                SKP
                LAW 240
                JMS OTY
                ISZ TBC
                XIT TSP
                TYEXIT
/TYPE A TABULATION
TYT=JMS .
                0
                DAC TYSVAC
                LAC TBC
                ADD (1
                TAD (-TTAB
                SMA
                JMP .-2
                TAD (-1
                DAC TEMY1
                LAC TYSVAC
                TSP
                ISZ TEMY1
                JMP .-2
                XIT TYT
                TYEXIT

/TELETYPE OUTPUT PACKAGE - PAGE 3
/TYPEWRITER INITIALIZE
TIN=JMS .
                0
                DAC TYSVAC
                LAC OCL
                DAC OCS
                703301
                SKP
                JMP . 3
                TLS
```

```
                JMS OTY
                LAC TYSVAC
                TCR
                JMP I TIN-JMS
/TYPE THE DIGIT IN THE AC
TDIGIT=JMS .
                0
                DAC TEMY1
                AND (17
                ADD (LAC NCT
                DAC . 1
                XX
                TY1
                LAC TEMY1

                JMP TDIGIT-JMS
/TYPE A STRING OF CHARACTERS
TSR=JMS .
                0
                DAC T→EMY1
                LAC I TEMY1
                TY3
                AND (76
                ISZ TEMY1
                SZA
                JMP TSR+2-JMS
                LAC TEMY1
                JMP I TSR-JMS
/EXIT AFTER RESTORING AC AND LINK
                TYEXIT JMP .
                DAC TEMY
                RAL
                LAC TYSVAC
                JMP I TEMY
/TELETYPE OUTPUT PACKAGE - PAGE 4
/ROTATE LEFT 6
RL6,            0
                RTL
                RTL
                RTL
                JMP I RL6
/TABLE OF DIGITS
NCT,            33      73      63      41      25
                3       53      71      31      7
/CASE STORAGE
OCU,            33
OCL,            37
OCS,            0
/END OF TELETYPE OUTPUT PACKAGE
```

```
/PDP-4/7 ADDENDUM
TY1B,       ADD (LAC BTATAB-1
            DAC . 1
            XX
            SZL
            JMP TY1C
TY1D,       JMS OTY
            JMP TY2-1
TY1C,       JMS RL6
            RTL
            RTL
            JMP TY1D
TCRA,       LAW 215
            JMS OTY
            LAW 212
            JMP TCR-JMS 10

BTATAB,   265324    /5,T
          215215    /CARRIAGE RETURN
          271317    /9,O
          240240    /SPACE
          243310    /x,H
          254316    /,,N
          256315    /.,M
          212212    /LINE FEED
          251314    /),L
          264322    /4,R
          246307    /+,G
          270311    /8,I
          260320    /0,P
          272303    /:,C
          273326    /',V
          263305    /3,E
          242332    /$,Z
          244304    /ɔD
          277302    /?,B
          211323    /BELL,S
          266331    /6,Y
          241306    /↑,F
          257330    ///,X
          255301    /-,A
          262327    /2,W
          247312    /→,J
          377377    /FIGURES
          267325    /7,U
          261321    /1,Q
          250313    /(,K
          377377    /LETTERS
START
```