

IDENTIFICATION

PRODUCT CODE: Digital-8-18-U-Sym
PRODUCT NAME: Alphanumeric Message Typeout
DATE CREATED: February 16, 1967
MAINTAINER: Software Service Group

Digital-8-18-U-Sym

1. ABSTRACT

A basic subroutine to type messages packed in computer words. Two 6-bit characters are packed internally in a single word. All ASR-33 codes from 301 to 337 and from 240 to 277 (excepting 243 and 245) can be typed. The typing of line-feed (code 212) and carriage-return (code 215) are made possible by arbitrarily assigning internal codes of 43 and 45, respectively, to represent these characters, thus preventing the output of ASCII codes 243 (#) and 245 (%).

2. REQUIREMENTS

Storage

This subroutine occupies 48 (decimal) storage locations in core plus autoindex register 10 (octal) on page 0.

Equipment

Basic PDP-8

3. USAGE

3.1 Loading

This subroutine may be placed in memory by the use of the Binary Loader. The library tape supplied is symbolic.

3.2 Calling Sequence

The calling sequence is designed so that the user may easily incorporate messages in his program. The following example illustrates a simple usage of this program.

```
/TEST 8-18-U
/START ADDRESS IS 400
/PRINTS AB HI E.R. DOW AND HALTS AT LOC. 407
*400          /ORIGIN AT 400
START,        JMS I ADDR/  JMS TO MESSAGE SUBR
               0102        /AB
               1011        /HI
               0556        /E.
               2256        /R.
               0417        /DO
               2700        /W+ END CHAR
END,          HLT          /END OF PROGRAM
ADDR,        MESSAGE      /ADDRESS OF MESSAGE TYPEOUT SUBROUTINE
```

4. RESTRICTIONS

The end-of-message code consists of 00_8 or (000000_2) , of course, only an end-of-message code may appear in the most significant six bits of location at the end of the message if the message consists of an even number of characters.

5. DESCRIPTION

The ASCII code breaks down into two main groups: first, the set of codes from 301 to 337 inclusive; and second, the set of codes from 240 to 277 inclusive. Combined, these two sets represent 63 characters. It is not necessary to store the most significant octal digit of the code for these characters, 2 or 3, internally since it may be computed from a knowledge of the least two significant digits, in other words from a "stripped" code.

Codes 3XX where digits XX are greater than 37 and codes 2XX where XX is less than 40 do not fit into this scheme and must be handled by special means. Only two such codes are necessary to accomplish the purposes of this subroutine. These are line-feed (code 212) and carriage-return (code 215) which are assigned "stripped" code representations of 43 and 45, respectively, making the actual codes 243 (#) and 245 (%) illegal for this subroutine; e.g., when an internal code of 43 is found, it is discarded and a 212 is sent to the ASR-33.

Section 7 contains a complete table of internal and external codes legal and illegal for this subroutine.

6. METHOD

Upon entry MESSAGE will hold the address of the first message word. One is subtracted from this and the result deposited in autoindex register 10. The main loop is then entered.

The message word is deposited in MSRGHT, then rotated six bits to the right. A jump to the minor subroutine TYPECH causes the character now contained in the six least significant bits of C(AC) to be typed. A second jump to TYPECH causes the character contained in the least significant six bits of MSRGHT to be typed.

If at any time TYPECH finds the least significant six bits of its current data word to be 0 (the end-of-message code), MESSAGE will return to the calling program.

After each two passes through TYPECH (if an end-of-message code is not encountered), the next message word is picked up by an indirect TAD instruction referencing location 0010 (octal) and the main loop repeats.

7. FORMAT

For this program external (ASCII) and internal core formats may best be illustrated by the following tables.

LEGAL CHARACTERS

Internal (Stripped)	ASCII	Character	Internal (Stripped)	ASCII	Character
01	301	A	12	312	J
02	302	B	13	313	K
03	303	C	14	314	L
04	304	D	15	315	M
05	305	E	16	316	N
06	306	F	17	317	O
07	307	G	20	320	P
10	310	H	21	321	Q
11	311	I	22	322	R

LEGAL CHARACTERS (continued)

Internal (Stripped)	ASCII	Character	Internal (Stripped)	ASCII	Character
23	323	S	52	252	*
24	324	T	53	253	+
25	325	U	54	254	,
26	326	V	55	255	-
27	327	W	56	256	.
30	330	X	57	257	\
31	331	Y	60	260	0
32	332	Z	61	261	1
33	333	[62	262	2
34	334	/	63	263	3
35	335]	64	264	4
36	336	↑	65	265	5
37	337	→	66	266	6
40	240	space	67	267	7
41	241	:	70	270	8
42	242	"	71	271	9
43	243	line feed	72	272	:
44	244	\$	73	273	;
45	245	carriage return	74	274	<
46	246	&	75	275	=
47	247	'	76	276	>
50	250	(77	277	?
51	251)			

Illegal codes, that is codes that will never be sent to the ASR-33 by this subroutine, are shown in the next table. The characters represented by these ASCII codes cannot be typed by this subroutine.

ILLEGAL CODES

ASCII	Character	Reason for Illegality
300	@	Stripped code 00 needed for end-of-message code
374	ACK	Greater than 37 internally
375	ALT MODE	Greater than 37 internally
377	RUB OUT	Greater than 37 internally
204	EOT	Less than 40 internally
205	W RU	Less than 40 internally
206	RU	Less than 40 internally
207	BELL	Less than 40 internally
243	#	Arbitrarily used in stripped form for FORM FEED
245	%	Arbitrarily used in stripped form for CAR. RETURN

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Note that there are only ten illegal codes. The illegal codes are not frequently necessary in alphanumeric messages. Furthermore, in cases where they might be useful they can be represented by simple combinations of legal characters. For example @ may be represented by "AT" while # may commonly be represented by "NO."

8. EXECUTION TIME

This subroutine is output limited.

9. PROGRAM LISTING

```

/DIGITAL 8-18-U
/MESSAGE TYPE-OUT
/CALL WITH A JMS MESSAGE
/WITH DATA FOLLOWING
/RETURN FOLLOWING END OF MESSAGE
/COE(00)

```

0200	0000	MESSAGE,	0	
0201	7240		CLA CMA	/SET C(AC)=-1
0202	1200		TAD MESSAGE	/ADD LOCATION
0203	3010		DCA 10	/AUTO-INDEX REGISTER
0204	1410		TAD I 10	/FETCH FIRST WORD
0205	3216		DCA MSRGHT	/SAVE IT
0206	1216		TAD MSRGHT	
0207	7012		RTR	
0210	7012		RTR	/ROTATE 6 BITS RIGHT
0211	7012		RTR	
0212	4217		JMS TYPECH	/TYPE IT
0213	1216		TAD MSRGHT	/GET DATA AGAIN
0214	4217		JMS TYPECH	/TYPE RIGHT HALF
0215	5204		JMP MESSAGE+4	/CONTINUE
0216	0000	MSRGHT,	0	/TEMPORARY STORAGE
0217	0000	TYPECH,	0	/TYPE CHARACTER IN C(AC)6-11
0220	0250		AND MASK77	
0221	7450		SNA	/IS IT END OF MESSAGE?
0222	5410		JMP I 10	/YES: EXIT
0223	1251		TAD M40	/SUBTRACT 40
0224	7500		SMA	/<40?
0225	5230		JMP .+3	/NO
0226	1252		TAD C340	/YES: ADD 300
0227	5243		JMP MTP	/TO CODES <40
0230	1253		TAD M3	/SUBTRACT 3
0231	7440		SZA	/IS IT ZERO?
0232	5235		JMP .+3	/NO
0233	1254		TAD C212	/YES: CODE 43 IS
0234	5243		JMP MTP	/LINE-FEED (212)
0235	1255		TAD M2	/SUBTRACT 2
0236	7440		SZA	/IS IT ZERO?
0237	5242		JMP .+3	/NO
0240	1256		TAD C215	/YES: CODE 45 IS
0241	5243		JMP MTP	/CARRIAGE-RETURN (215)

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0242	1257		TAD C245	/ADD 200 TO OTHERS >40
0243	6046	MTP,	TLS	/TRANSMIT CHARACTER
0244	6041		TSF	/WAIT FOR FLAG
0245	5244		JMP .-1	/NOT SET YET
0246	7200		CLA	/SET: CLEAR C(AC)
0247	5617		JMP I TYPECH	/RETURN

/CONSTANTS			
0250	0077	MASK77,	77
0251	7740	M40,	-40
0252	0340	C340,	340
0253	7775	M3,	-3
0254	0212	C212,	212
0255	7776	M2,	-2
0256	0215	C215,	215
0257	0245	C245,	245

C212	0254
C215	0256
C245	0257
C340	0252
MASK77	0250
MESSAGE	0200
MSRGHT	0216
MTP	0243
M2	0255
M3	0253
M40	0251
TYPECH	0217

10. REFERENCES

Digital-8-19-U (Teletype Output Subroutines) and Digital-8-20-U (Character String Typeout).

