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QANDA

**AN INTERACTIVE SUBROUTINE USING THE
VR12 DISPLAY**

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Specification for QANDA Subroutine.

ABSTRACT

QANDA is a PDP-12 subroutine written in LINC mode which allows a user to display textual information on the scope, ask questions of the viewer, allow editing of the input, and receive responses thereto.

PRELIMINARY REQUIREMENTS

QANDA will operate on a PDP-12 computer equipped with a VC12 LINCscope control and VR12 CRT display, and Teletype.

The subroutine is called by the following format:

.	JMP QAINIT	
.+1	TXTSTR	/POINTER TO TEXT STRING (HALF WORD ADDRESS)
.+2	ANSWER	/POINTER TO ANSWER BUFFER (HALF WORD ADDRESS)
.+3	REFRESH	return
.+4	DONE	return

The calling sequence must be in LINC mode.

.	A JMP to QAINIT will initialize the subroutine and fill the answer buffer with the underline character (_). The subroutine must be initialized at least once. QAINIT is located at the relative address 0 with respect to the beginning of the routine.
.+1	Points to the first character of the textual information to be displayed on the scope.

Characters in the text string which have special meaning are:

<u>Character</u>	<u>Code</u>	<u>Meaning</u>
RETURN	43	End of a line of display. Place next character on next line.
<	74	Interpret the decimal number immediately following < as the number of characters in the question field (Range 1-9).
\	34	End of text string
F	06	Treated as a special character only if it appears at the beginning of a line. If present, the entire line will be displayed in full-size character format. F will not appear on the scope.

<u>Character</u>	<u>Code</u>	<u>Meaning</u>
H	10	Treated as a special character only if it appears at the beginning of a line. If present, the entire line will be displayed in half-size character format. H will not appear on the scope. If neither F nor H is present at the beginning of a line, half-size is assumed, and the first character of the line will appear on the scope. Intermixing of half and full-size characters between lines is legal.

The 6-bit character string must conform to the character set accepted by DIAL. (See Table I.)

The "TEXT" pseudo-op in DIAL may be used to create the text string. For example, to display the following message on the scope in full-size character format:

```
DATA AT BLOCK _ _ _
UNIT _
```

the text string may be coded as:

```
TXSTR, TEXT ← ZFDATA AT BLOCK <3
FUNIT <1 \Z
```

and would be assembled as:

```
TEXT,      0604
            0124
            0140
            0124
            4002
            1417
            0313
            7463
            4306
            2516
            1124
            7461
            3400
```

NOTE that the character "Z" before and after the text string is a delimiter for the assembler and does not appear in the assembled text string. (Any character not appearing in the text string may be used as a delimiter).

Note also that the character "TAB", if typed within the text string, will appear in the assembled string and will not be interpreted as a special character by DIAL. The use of "TAB" within the text string should, therefore, be avoided.

The subroutine will automatically place a space before all question fields on the scope. The text string will not be changed.

.+2

Points to the first character of the answer buffer. The answer buffer need not be set up in any special way; it must be in length at least the number of half words equal to the sum of the number of characters in each question field plus one for each question field plus one. In the example above, 7 half-words long: 4 for the total number of characters in all question fields plus 2 for the number of question fields ~~plus 2 for the number of question fields~~ plus 1 for the terminator.

Upon entry, QANDA will initialize the answer buffer as follows (see example above). All characters in each answer field are initialized to the underline character (00):

```
ANSWER,  7400
          0000
          7400
          3400
```

Code 74 precedes each answer field. Code 34 is the terminator. These codes are placed in the answer buffer by QANDA upon initialization.

Characters, as they are received by QANDA from the Teletype, replace code 00 from left to right in each answer field.

Conditions will always be such that the presence of a null value (00) in an answer field will guarantee that all remaining characters in that field will be set to 00. Note that an all-null field is possible.

If the typist responds to the questions with the block number 43 and the unit 1, when the "DONE" return is taken, the buffer will show:

```
ANSWER,  7464
          6300
          7461
          3400
```

If the responses to questions are dealt with as received, the same answer buffer may be used with various text strings in sundry calls to QANDA, since it will be initialized by QANDA upon each initialization entry; the area reserved must, of course, be of sufficient length to accommodate the requirement among the text strings.

.+3

QANDA will refresh the scope once and then will return to this address, provided a LINE FEED has not been typed. This return is provided so that the calling program may periodically check external conditions: e.g., a sense switch may be checked or; the program may display a message while awaiting completion of a tape instruction which it may check following each refresh. Examining a partial answer buffer, however, is not recommended, because the answer buffer can be edited at any time by the typist.

To maintain the display on the scope, QANDA has another entry point, QARFSH, which will not re-initialize the answer buffer. QANDA must be entered at this point each time it is to be refreshed. It is located at the relative address QAINIT +53.

QANDA will always return to .+3 or .+4 following the instruction JMP QAINIT, regardless of the address of the instruction JMP QARFSH. A common situation is to place the instruction JMP QARFSH at .+3 following JMP QAINIT.

.+4

QANDA will return to this location only if either

1. LINE FEED is struck, or
2. RETURN is struck and no question fields exist.

A return to this address signals that the typist has completed his input.

INPUT

Input is received from the Teletype keyboard. Legal keyboard characters are converted to their 6-bit equivalent and displayed on the scope. Legal characters are shown in Table I. The following input characters are not displayed, but are treated as special characters.

<u>Character</u>	<u>Code</u>	<u>Meaning</u>
\	34	Ignored on input
ALT MODE	36	The scope display is reinitialized. All answer fields are reinitialized to the underline character (_).
RUBOUT	37	A cursor will always appear on the scope in front of the next character to be typed (unless there are no question fields).

<u>Character</u>	<u>Code</u>	<u>Meaning</u>
		Typing RUBOUT will delete the character preceding the cursor and will move all characters following the cursor one character to the left, unless the cursor is initially at the beginning of a question field.
RETURN	43	The cursor is moved to the beginning of the next question field. If the cursor is currently in the last field, it will be moved to the beginning of the first field when RETURN is typed.
		If there are no question fields, RETURN will have the same effect as LINE FEED.
LINE FEED	45	Causes QANDA to exit to the "DONE" return.
TAB	47	Ignored on input.
<	74	Moves the cursor left one position. Subsequent typing of another legal character will cause the present character on the scope to the right of the cursor to be replaced by the character just typed.
>	76	Moves the cursor right one position unless that character is the underline character (<u> </u>).

OUTPUT

All output is to the scope, as described above.

USAGE

QANDA is written in LINC code. Along with the keyboard input subroutine, GETKBD, it occupies two blocks (512 words) of binary LINC tape. It may be assembled with the calling program by adding the source to the program. If this is done, remove *1000 at the beginning of the subroutine.

It may also be called by reading the binary of the program into LINC location 1000 (memory blocks 2 and 3) and executing an effective JMP 1000 and JMP 1053 to refresh. Two blocks of the binary must be read into core memory.

PROGRAMS CALLED

A LINC Teletype input subroutine, GETKBD, is called by QANDA and begins at location 121 of the second block of the binary.

It can be used independently of QANDA. GETKBD will accept ASCII input from the Teletype and convert it to 6-bit code as shown in Table I.

Its calling sequence is:

```
JMP GETKBD
RETURN address
```

GETKBD returns with the 6-bit code in the accumulator. If the accumulator equals zero, a key was not struck, and no input was received; or an illegal character was typed.

GETKBD uses the LINC instruction IOB followed by a PDP-8 Teletype IOT instruction to perform the Teletype input/output functions. The following instruction sequence is issued in the subroutine QATPE to echo a character:

```
QATPE,   IOB
          QATLS   /EQUATED TO PDP-8 IOT TLS
          LDA
          0
          STC     .+4/SAVE RETURN
          IOB
          QATSF   /WAIT FOR FLAG. PDP-8 IOT TSF
          JMP     .-2
          JMP     /EXIT
```

This routine prints the ASCII character in the accumulator then waits for the printer flag to rise. The routine can be made more efficient by first waiting for the flag, then printing the character by changing the above routine as shown below:

```
QATPE,   STC QAACUM   /SAVE AC
          ADD 0
          STC QARETR   /SAVE RETURN
          IOB
          QATSF       /WAIT FOR FLAG
          JMP .-2
          LDA I        /GET CHAR
QAACUM,  0
          IOB
```

```

QATLS          /PRINT IT
CLR
QARETR,JMP     /EXIT, AC=0

```

Subsequently, less flicker will appear on the scope while characters are being typed. However, the calling program must initially cause the Teletype flag to raise when the program is first started. This may be accomplished by the following instruction sequence at the beginning of the program:

```

IOB
6032          /PDP-8 IOT KCC
IOB
6046          /PDP-8 IOT TLS
:

```

Whatever method is used, the calling program must, of course, also conform to the same convention throughout the program whenever it is driving the Teletype.

RESTRICTIONS

QANDA must reside in the same LINC lower memory segment as the calling sequence.

It uses, without restoring, index registers 1, 2, 3, 4, 5, 6. Further, these registers cannot be used by the calling program between the refresh return and the next call to the refresh entry unless they are first saved and then restored.

The text string and answer buffer are separate from each other and from the calling sequence and may therefore be in upper memory. However, the text string may not start in the left half of LINC location 2000 (e.g. the left half of the first word of the upper memory segment) unless the pointer to the text string is coded as 2\2000, or 2\TAG, where TAG=2000.

QANDA will display a maximum of 44_{10} half-size characters horizontally on a line before scope "wrap-around" will occur. Likewise, a maximum of 22_{10} full-size characters per line may be displayed.

A maximum of 13_{10} lines of text (either half-size or full-size) may be displayed vertically on the scope without wraparound. The initial Y-coordinate setting is coded as 277_8 at location QARFSH+1. This initial Y-coordinate setting may be changed by incrementing or decrementing this number by a

number which is a multiple of 40_8 . Thus, to raise the initial Y-coordinate one line and therefore increase the maximum number of lines to 14_{10} , the number 277_8 may be changed to 337_8 at location QARFSH+1.

Table I
PDP-12 Character Set

<u>Character</u>	<u>6-bit Code</u>	<u>Comments</u>
@	00	Illegal
A	01	
B	02	
C	03	
D	04	
E	05	
F	06	
G	07	
H	10	
I	11	
J	12	
K	13	
L	14	
M	15	
N	16	
O	17	
P	20	
Q	21	
R	22	
S	23	
T	24	
U	25	
V	26	
W	27	
X	30	
Y	31	
Z	32	
[	33	Shift/K
\	34	Shift/M
]	35	
ALT MODE	36	Illegal
RUBOUT	37	
SPACE	40	
!	41	
"	42	
RETURN	43	
\$	44	Illegal
LINE FEED	45	
&	46	

Table I (Cont)
PDP-12 Character Set

<u>Character</u>	<u>6-bit Code</u>	<u>Comments</u>
TAB	47	Control/1
(	50	
)	51	
*	52	
+	53	
,	54	
-	55	
.	56	
/	57	
0	60	
1	61	
2	62	
3	63	
4	64	
5	65	
6	66	
7	67	
8	70	
9	71	
:	72	
;	73	
<	74	
=	75	
>	76	
?	77	

LI QANDA,1

```

0000          *20
0001          /QANDA SUBROUTINE FOR THE
0002          /PDP-12
0003          /REMOVE *1000 BELOW IF
0004          /INSERTING SOURCE DIRECTLY
0005          /INTO YOUR PROGRAM SOURCE
0006          *1000 /REMOVE,IF DESIRED
0007          /
0010          /TO HERE TO INITIALIZE THE ROUTINE
0011          /
0012          1000 1020 QAINIT, LDA I          /SAVE JMP RETURN
0013          1001 0002          2
0014          1002 2000          ADD 0
0015          1003 1060          STA I
0016          1004 0000 QAB, 0          /JMP +3
0017          1005 3200          ADD QAL+3
0020          1006 4001          STC 1          /PTR TO FIRST PARAM
0021          1007 1001          LDA 1          /GET FIRST PARAM
0022          1010 3264          ADD QAO+1      /PTR TO HALFWORD-1
0023          1011 5057          STC QAG-3
0024          1012 1021          LDA I 1
0025          1013 5052          STC QARFSH-1
0026          1014 4006          STC 6          /XR6 USED AS A SWITCH. =0
0027          1015 0043          IELD, =1777 IF YES
0030          1016 1052 QACA, SET 3          /XR3 TO PTR TO ANSWERS
0031          1017 0044          QARFSH-1
0032          1020 1057          SET 4          /XR4 TO PTR TO QUESTIONS
0033          1020 1057          QAG-3
0033          /TO HERE IF FIRST TIME TH
CR
0034          1021 0041          SET 1
0035          1022 0004          4
0036          1023 7270          JMP QAT
0037          1024 0016          NOP          /F
0040          1025 1324          LDH I 4          /H. BUMP PTR IF H OR F
0041          1026 7231 QAD, JMP QAO
0042          1027 7035          JMP .+6          /74
0043          1030 7050          JMP QAE          /34
0044          1031 1460          SAE I          /CR?
0045          1032 0043          43
0046          1033 7026          JMP QAD          /NO
0047          1034 7021          JMP QACA+4 /EXAMINE NEXT CHAR
0050          /INITIALIZE ANSWER BUFR
0051          1035 1343          STH 3          /74 TO ANSWERS
0052          1036 1324          LDH I 4          /NEXT HALFWORD
0053          1037 1120          ADA I
0054          1040 7717          -60
0055          1041 0017          COM
0056          1042 4006          STC 6
0057          1043 1363          STH I 3          /0 IN AC
0060          1044 0226          XSK I 6
0061          1045 7043          JMP .-2
0062          1046 1323          LDH I 3          /BUMP PTR TO ANSWERS
0063          1047 7026          JMP QAD
0064          /ANSWER BUFR IS INITIATED
0065          1050 1343 QAE, STH 3
0066          1051 0064          SET I 4          /XR4 TO PTR TO LAST TYPED
0067          1052 0000          ER BUFR 0
0070          /----RE-ENTER HERE TO REFB
0071          1053 1020 QARFSH, LDA I          /INITIAL Y POSITION

```

0072	1054	0277	277		
0073	1055	5113		STC QAH-1	
0074	1056	0063		SET I 3	/XR3 TO PTR TO HALFWORD 00
0075	1057	0000		0	
0076	1060	0045		SET 5	/XR5 TO PTR TO LAST DISPL
				SWER BUFR	
0077	1061	1052		QARFSH-1	
0100	1062	0041	QAG,	SET I	
0101	1063	0003		3	
0102	1064	7270		JMP QAT	
0103	1065	7074		JMP .+7	/F
0104	1066	1323		LDH I 3	/H. BUMP PTR
0105	1067	1020		LDA I	/NEITHER. ASSUME HALF SIZE
0106	1070	1560		BCL I	
0107	1071	5103		STC QAM+2	/SET INSTR TO CLEAR FF FOR
0110	1072	3512		ADD QAW	/NOP IN AC
0111	1073	7101		JMP QAM	
0112	1074	1323		LDH I 3	/BUMP PTR
0113	1075	1020		LDA I	
0114	1076	1620		BSE I	
0115	1077	5103		STC QAM+2	/SET INSTR TO SET FF FOR
0116	1100	3513		ADD QAW+1	/ADD 9U IN AC
0117	1101	5245	QAM,	STC QAP+3	
0120	1102	0024		MSC I 4	/EAD CONTROL REGISTER
0121	1103	1620		BSE I	/THIS INSTR CHANGES. EITHER
				&	
0122	1104	0200		200	
0123	1105	0004		MSC 4	/AC TO CONTROL REGISTER
0124	1106	0061		SET I 1	/XR1 TO INITIAL X POSITION
0125	1107	0100		100	
0126	1110	1020		LDA I	/Y COORDINATE MULTIPLE
0127	1111	7737		-40	
0130	1112	1160		ADM I	/Y COORDINATE
0131	1113	0000		0	
0132	1114	1323	QAH,	LDH I 3	
0133	1115	7232		JMP QAO+1	
0134	1116	7301		JMP QAZ	/74 BUMP PTR TO NEXT CHAR
				C	
0135	1117	7136		JMP QAJ	/34
0136	1120	1420		SHD I	/NEITHER
0137	1121	4300		4300	
0140	1122	7062		JMP QAG	/CR. MOVE X AND Y COORDINATE
0141	1123	7242		JMP QAP	/ISPLAY CHAR
0142	1124	7114		JMP QAH	/PICK UP NEXT CHAR
0143	1125	7242		JMP QAP	/TO HERE IF DISPLAYING AN
0144	1126	1520		SRO I	/SWITCH TO DISPLAY CURSOR. EITHER
				7777	
0145	1127	0000		0	/IFXR4=XR5, THEN SWITCH=77
0146	1130	7516		JMP QAF	
0147					/QUESTION MODE
0150	1131	1325	QAI,	LDH I 5	
0151	1132	7232		JMP QAO+1	
0152	1133	7114		JMP QAH	/74
0153	1134	7114		JMP QAH	/34
0154	1135	7125		JMP QAI-4	/NEITHER. DISPLAY IT
0155	1136	7521	QAJ,	JMP GETKBD	/TO HERE IF DISPLAYED BUFR
0156	1137	0470		AZE I	
0157	1140	7004		JMP QAR	/NOTHING TYPED. EXIT
0160	1141	0060		SET I 2	
0161	1142	1412		QAY	
0162	1143	1402		SHD 2	/LF?
0163	1144	7311		JMP QAK+4	/YES. EXIT
0164	1145	1422		SHD I 2	/CR?

0165	1146	7223	JMP QAN	
0166	1147	0206		/IS THERE AN ANSWER FIELD?
0167	1150	7053	JMP QARFSH	
0170	1151	1422	SHD I 2	/<?
0171	1152	7175	JMP QAL	
0172	1153	1422	SHD I 2	/>?
0173	1154	7305	JMP QAK	
0174	1155	1422	SHD I 2	/ALT?
0175	1156	7015	JMP QACA /REINITIALIZE	
0176	1157	1422	SHD I 2	/BACK SLASH?
0177	1160	7053	JMP QARFSH	/IGNORE
0200	1161	1422	SHD I 2	/RUBOUT?
0201	1162	7175	JMP QAL	/IGNORE
0202	1163	1422	SHD I 2	/TAB?
0203	1164	7053	JMP QARFSH	/IGNORE
0204	1165	5172	STC .+5	/ACCEPTABLE CHAR
0205	1166	7231	JMP QAO	/TEST NEXT CHAR
0206	1167	7263	JMP QAO	/74 BACK PTR UP BY 1
0207	1170	7263	JMP QAO	/34 ↑
0210	1171	1020	LDA I	/OK. STORE IT
0211	1172	0000	0	
0212	1173	1344	STH 4	
0213	1174	7053	JMP QARFSH	/REDISPLAY
0214	1175	1304	LDH 4	/TO HERE IF RUBBOUT OR <
0215	1176	7232	JMP QAO+1	
0216	1177	7053	JMP QARFSH	/74 IGNORE
0217	1200	1775	-6002	
0220	1201	1302	LDH 2	/TEST THE CHAR
0221	1202	1460	SAE I	/RUBOUT?
0222	1203	0037	37	
0223	1204	7263	JMP QAO	/NO. BACK PTR UP BY 1
0224	1205	0045	SET 5	
0225	1206	0004	4	
0226	1207	0043	SET 3	
0227	1210	0004	4	
0230	1211	7213	JMP .+2	
0231	1212	1325	LDH I 5	/BUMP PTR
0232	1213	1323	LDH I 3	/GET NEXT CHAR
0233	1214	7232	JMP QAO+1	
0234	1215	0016	NOP	/IF 74 OR 34, REPLACE CUR
0235	1216	0011	CLR	
0236	1217	1345	STH 5	
0237	1220	0450	AZE	/WAS IT 74 OR 34?
0240	1221	7212	JMP .-7	/NO. CONTINUE
0241	1222	7263	JMP QAO	/BACK PTR UP BY 1
0242				/TO HERE IF CR
0243	1223	0206	QAN, XSK 6	
0244	1224	7311	JMP QAK+4	/EXIT ROUTINE IF NO ANSWER
0245	1225	7231	JMP QAO	
0246	1226	7053	JMP QARFSH	/74 MOVE PTR TO NEXT QUES
0247	1227	7051	JMP QAE+1	/34 END OF BUFR. MOVE PTR
0250	1230	7225	ESTION FIELD JMP QAN+2	
0251				
0252	1231	1324	QAO, LDH I 4	/S\R
0253	1232	1420	SHD I	/ +1 74 BEGIN FIELD
0254	1233	7400	7400	/ +2 34 END BUFR
0255	1234	6000	JMP 0	/ +3 NEITHER 74 NOR
0256	1235	1460	SAE I	
0257	1236	0034	34	
0260	1237	022	XSK I 0	
0261	1240	022	XSK I 0	
0262	1241	6000	JMP 0	

0263					/SVR TO DISP LINC CHAR IN0
0264	1242	0241	QAP, ABLE	ROL 1	/MULT BY 2 FOR INDEX TO A0
0265	1243	3430		ADD QAX+4	
0266	1244	4002		STC 2	/ADDRESS OF CHAR TO DISP 0
0267	1245	3506		ADD QAU	/THIS INSTR CHANGES. EITHER
			9U		
0270	1246	3506		ADD QAU	
0271	1247	2001		ADD 1	/ADD 4 TO XRI TO SPACE CHA
0272	1250	4001		STC 1	
0273	1251	2005		ADD 5	/GET ADDRESS OF ANSWER BUR
0274	1252	0017		COM	
0275	1253	2004		ADD 4	
0276	1254	0450		AZE	
0277	1255	0011		CLR	
0300	1256	5127		STC QAI-2	/SWITCH=0 OR 7777
0301	1257	3113		ADD QAH-1	/Y COORDINATE IN AC
0302	1260	1742		DSC 2	
0303	1261	1762		DSC I 2	/DISPLAY CHAR
0304	1262	6000		JMP 0	
0305	1263	1020	QAO,	LDA I	/BACK UP PTR BY 1
0306	1264	3777		-4000	
0307	1265	1140		ADM	
0310	1266	0004		4	
0311	1267	7053		JMP QARFSH	/REDISPLAY
0312					/
0313	1270	1321	QAT,	LDH I 1	/SVR
0314	1271	1420		SHD I	/
0315	1272	0600		0600	+1 F
0316	1273	6000		JMP 0	+2 H
0317	1274	1460		SAE I	+3 NEITHER
0320	1275	0010		10	
0321	1276	0220		XSK I 0	
0322	1277	0220		XSK I 0	
0323	1300	6000		JMP 0	
0324					/
0325	1301	1323	QAZ,	LDH I 3	
0326	1302	1020		LDA I	
0327	1303	0040		40	
0330	1304	7125		JMP QAI-4	
0331					/TO HERE IF >
0332	1305	1324	QAK,	LDH I 4	
0333	1306	0470		AZE I	/IS CURRENT CHAR BLANK?
0334	1307	7263		JMP QAO	/YES. IGNORE
0335	1310	7424		JMP QAX	/MOVE DOT FORWARD
0336					/TO HERE TO EXIT WITH SKIP
0337	1311	1020		LDA I	
0340	1312	0001		1	
0341	1313	1140		ADM	
0342	1314	1004		QAB	
0343	1315	7004		JMP QAB	
0344					
0345	1316	0101	QAV,	0101	/CHARACTER PATTERNS
0346	1317	0101		0101	/KRD 0, ILLEGAL. USED AS 0
0347	1320	4477		4477	/1:A
0350	1321	7744		7744	
0351	1322	5177		5177	/2:B
0352	1323	2651		2651	
0353	1324	4136		4136	/3:C
0354	1325	2241		2241	
0355	1326	4177		4177	/4:D
0356	1327	3641		3641	
0357	1330	4577		4577	/5:E

0360	1331	4145	4145	
0361	1332	4477	4477	/6:F
0362	1333	4044	4044	
0363	1334	4136	4136	/7:G
0364	1335	2645	2645	
0365	1336	1077	1077	/10:H
0366	1337	7710	7710	
0367	1340	7741	7741	/11:I
0370	1341	0041	0041	
0371	1342	4142	4142	/12:J
0372	1343	4076	4076	
0373	1344	1077	1077	/13:K
0374	1345	4324	4324	
0375	1346	0177	0177	/14:L
0376	1347	0301	0301	
0377	1350	3077	3077	/15:M
0400	1351	7730	7730	
0401	1352	3077	3077	/16:N
0402	1353	7706	7706	
0403	1354	4177	4177	/17:O
0404	1355	7741	7741	
0405	1356	4477	4477	/20:P
0406	1357	3044	3044	
0407	1360	4276	4276	/21:Q
0410	1361	0376	0376	
0411	1362	4477	4477	/22:R
0412	1363	3146	3146	
0413	1364	5121	5121	/23:S
0414	1365	4651	4651	
0415	1366	4040	4040	/24:T
0416	1367	4077	4077	
0417	1370	0177	0177	/25:U
0420	1371	7701	7701	
0421	1372	0176	0176	/26:V
0422	1373	7402	7402	
0423	1374	0677	0677	/27:W
0424	1375	7701	7701	
0425	1376	1463	1463	/30:X
0426	1377	6314	6314	
0427	1400	0770	0770	/31:Y
0430	1401	7007	7007	
0431	1402	4543	4543	/32:Z
0432	1403	6151	6151	
0433	1404	4177	4177	/33:/
0434	1405	0000	0000	
0435				/34:BACKSLASH IGNORED ON ■
0436	1406	0000	0	/NOT USED
0437	1407	0000	0	/NOT USED
0440	1410	0000	0000	/35:]
0441	1411	7741	7741	
0442				/CODES 36:ALT, 37:RUBOUT ■
0443	1412	4543	4543	/LF,CR
0444	1413	7476	7476	/,<,>
0445	1414	3634	3634	/ALT, BACKSLASH
0446	1415	3747	3747	/RUBOUT, TAB
0447	1416	0000	0000	/40:SPACE
0450	1417	0000	0000	
0451	1420	7500	7500	/41:X!
0452	1421	0000	0000	
0453	1422	7000	7000	/42:"
0454	1423	0070	0070	
0455				/CODES 43:, 44:, 45:LF NO■
0456	1424	7232	QAX, JMP QA0+1	

0457	1425	7263	JMP QAO	
0460	1426	7263	JMP QAO	
0461	1427	7053	JMP QARFSH	
0462	1430	1316	QAV	
0463	1431	0000	0	/NOT USED
0464	1432	5166	5166	/46: &
0465	1433	0526	0526	
0466				/CODE 47: TAB NOT DISPLAYED
0467	1434	0000	0	/NOT USED
0470	1435	0000	0	/NOT USED
0471	1436	3600	3600	/50:(
0472	1437	0041	0041	
0473	1440	4100	4100	/51:)
0474	1441	0036	0036	
0475	1442	2050	2050	/52:*
0476	1443	0050	0050	
0477	1444	0404	0404	/53:+
0500	1445	0437	0437	
0501	1446	0500	0500	/54:.
0502	1447	0006	0006	
0503	1450	0404	0404	/55:-
0504	1451	0404	0404	
0505	1452	0001	0001	/56:.
0506	1453	0000	0000	
0507	1454	0601	0601	/57:\
0510	1455	4030	4030	
0511	1456	4536	4536	/60:0
0512	1457	3651	3651	
0513	1460	2101	2101	/61:1
0514	1461	0177	0177	
0515	1462	4523	4523	/62:2
0516	1463	2151	2151	
0517	1464	4122	4122	/63:3
0520	1465	2651	2651	
0521	1466	2414	2414	/64:4
0522	1467	0477	0477	
0523	1470	5172	5172	/65:5
0524	1471	0651	0651	
0525	1472	1506	1506	/66:6
0526	1473	4225	4225	
0527	1474	4443	4443	/67:7
0530	1475	6050	6050	
0531	1476	5126	5126	/70:8
0532	1477	2651	2651	
0533	1500	5122	5122	/71:9
0534	1501	3651	3651	
0535	1502	2200	2200	/72::
0536	1503	0000	0000	
0537	1504	4601	4601	/73:;
0540	1505	0000	0000	
0541				/CODE 74:<NOT DISPLAYED
0542	1506	0002	QAU, 2	/CONSTANT
0543	1507	0000	0	/NOT USED
0544	1510	1212	1212	/75:=
0545	1511	1212	1212	
0546				/CODE 76:> NOT DISPLAYED
0547	1512	0016	QAW, NOP	
0550	1513	3506	ADD QAU	
0551	1514	4020	4020	/77:?
0552	1515	2055	2055	
0553			/	
0554	1516	1760	QAF, DSC I	
0555	1517	6000	6000	

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0556      1520  7131      JMP QAI
0557      /
0560      /END Q+A
0561      /
0562      /
0563      /
0564      /
0565      /KEYBOARD INPUT ROUTINE
0566      /
0567      QAKRB=6036      /PDP-8 IOT KBD
0570      QATSF=6041      /TSF
0571      QATLS=6046      /TLS
0572      /
0573      1521  1000      GETKBD, LDA
0574      1522  0000      0
0575      1523  5643      STC QAEXIT+6      /SAVE RETURN
0576      1524  2001      ADD 1      /SAVE XRS 1 AND 2
0577      1525  5640      STC QAEXIT+3
0600      1526  2002      ADD 2
0601      1527  5642      STC QAEXIT+5
0602      1530  5636      STC QAEXIT+1
0603      1531  0415      KST      /WAS SOMETHING TYPED?
0604      1532  6000      JMP 0      /NO: EXIT
0605      1533  0500      IOB
0606      1534  6036      QAKRB      /GET TTY CHAR, CLEAR FLAG
0607      1535  1060      STA I      /SAVE IT
0610      1536  0000      QATY, 0
0611      1537  1120      ADA I
0612      1540  7540      -237
0613      1541  0451      APO      /BETWEEN 200 AND 237?
0614      1542  7604      JMP QACNTR      /CONTROL CHAR. CHECK FOR ■
0615      /
0616      1543  0061      SET I 1      /NO
0617      1544  1654      QACHAR-1
0620      1545  0062      SET I 2
0621      1546  7770      -7
0622      1547  1000      LDA
0623      1550  1536      QATY
0624      1551  1461      SAE I 1
0625      1552  7554      JMP .+2
0626      1553  7635      JMP QAEXIT      /ILLEGAL CHAR. DONT ECHO
0627      1554  0222      XSK I 2 /CHECKED THEM ALL?
0630      1555  7551      JMP .-4
0631      /
0632      1556  1120      ADA I
0633      1557  7440      -337
0634      1560  0451      APO      /BETWEEN 240 AND 337?
0635      1561  7575      JMP QALEGL      /YES. LEGAL CHAR
0636      /
0637      1562  1461      SAE I 1      /NO. CHECK FURTHER.
0640      1563  7572      JMP .+7
0641      1564  1020      LDA I      /RUBOUT
0642      1565  0334      334
0643      1566  7644      JMP QATPE      /ECHO BACKSLASH
0644      1567  1020      LDA I
0645      1570  0037      37
0646      1571  7637      JMP QAEXIT+2      /LEGAL EXIT
0647      /
0650      1572  1461      SAE I 1
0651      1573  7635      JMP QAEXIT      /ILLEGAL
0652      /ALT
0653      1574  7637      JMP QAEXIT+2      /EXIT, DONT ECHO
0654      /

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0655	1575	1000	0ALEGL, LDA	
0656	1576	1536	0ATY	
0657	1577	7644	JMP 0ATPE	/ECHO CHAR
0660	1600	3536	ADD 0ATY	
0661	1601	1560	BCL I	/STRIP IT TO 6-BIT
0662	1602	7700	7700	
0663	1603	7637	JMP 0AEXIT+2	
0664			/TO HERE IF CONTROL CHAR	
0665	1604	1460	0ACNTR, SAE I	
0666	1605	7755	7755	
0667	1606	7621	JMP 0ACKLF	
0670	1607	1020	LDA I	/CR
0671	1610	0043	43	
0672	1611	5636	STC 0AEXIT+1	
0673	1612	1020	LDA I	
0674	1613	0215	215	
0675	1614	7644	JMP 0ATPE	
0676	1615	1020	LDA I	
0677	1616	0212	212	
0700	1617	7644	JMP 0ATPE	
0701	1620	7635	JMP 0AEXIT	
0702			/	
0703	1621	1460	0ACKLF, SAE I	
0704	1622	7752	7752	
0705	1623	7627	JMP .+4	
0706	1624	1020	LDA I	/LF
0707	1625	0045	45	
0710	1626	7611	JMP 0ACNTR+5	
0711	1627	1460	SAE I	
0712	1630	7751	7751	
0713	1631	7635	JMP 0AEXIT	/ILLEGAL
0714	1632	1020	LDA I	
0715	1633	0047	47	
0716	1634	7637	JMP 0AEXIT+2	/EXIT, DONT ECHO
0717			/	
0720	1635	1020	0AEXIT, LDA I	/GET 6-BIT ASCII
0721	1636	0000	0	
0722	1637	0061	SET I 1	/RESTORE XRS
0723	1640	0000	0	
0724	1641	0062	SET I 2	
0725	1642	0000	0	
0726	1643	6000	JMP	/EXIR SNR GETKBD
0727			/SNR TO PRINT C(AC)	
0730	1644	0500	0ATPE, IOB	
0731	1645	6046	0ATLS	/PDF-8 IOT TLS
0732	1646	1000	LDA	
0733	1647	0000	0	
0734	1650	5654	STC .+4	/SAVE RETURN
0735	1651	0500	IOB	
0736	1652	6041	0ATSF	/WAIT FOR FLAG
0737	1653	7651	JMP .-2	
0740	1654	6000	JMP	/EXIT
0741			/	
0742	1655	0243	0ACHAR, 243	/HASH
0743	1656	0244	244	/DOLLAR SIGN
0744	1657	0245	245	/PER CENT
0745	1660	0247	247	/APOSTROPHE
0746	1661	0300	300	/AT SIGN
0747	1662	0336	336	/UP ARROW
0750	1663	0337	337	/BACK ARROW
0751	1664	0040	40	/RUBOUT
0752	1665	0036	36	/ALT
0753			/END OF SNR GETKBD	

0000 ERRORS

GETKRD 5521
QAB 5004
QACA 5015
QACHAR 5655
QACKLF 5621
QACNTR 5604
QAD 5026
QAF 5050
QAFXIT 5635
QAF 5516
QAG 5062
QAH 5114
QAI 5131
QAINIT 5000
QAJ 5136
QAK 5305
QAKRB 6036
QAL 5175
QALEGL 5575
QAM 5101
QAN 5223
QAO 5231
QAP 5242
QAO 5263
QARESH 5053
QAT 5270
QATLS 6046
QATPE 5644
QATSE 6041
QATY 5536
QAU 5506
QAV 5316
QAW 5512
QAX 5424
QAY 5412
QAZ 5301