

IDENTIFICATION

PRODUCT CODE: DEC-14-MWZ -D
PRODUCT NAME: RUN-14
DATE CREATED: JUNE 18, 1970
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: EDWARD P. STEINBERGER



1. ABSTRACT

RUN-14 is a program, written in PDP-8 language, which allows a PDP-8-type computer connected to a PDP-14 to act as the memory of the PDP-14 and allow the PDP-14 to execute the PDP-14 program contained in the PDP-8 memory.

2. LOADING PROCEDURE

RUN-14 is loaded into PDP-8 memory using the "standard" binary loader technique.

3. USING THE PROGRAM

- 3.1 Load RUN-14 into 8 memory using the Binary Loader program (Note: Load into memory bank 1 if a 4K PDP-14 program is to be run, otherwise, load into memory bank 0).
- 3.2 Load LOAD-14 into 8 memory using the Binary Loader program (See Note in 3.1)
- 3.3 Use LOAD-14 to read into 8 memory the binary image(s) of the PDP-14 program to be run, into memory bank 0.
- 3.4 Power down the PDP-8 I/L, connect the PDP-14 to the PDP-8 I/L using the appropriate cables and revision of the M745 interface module. Install INPUT and OUTPUT Register modules (M746's). Power up the PDP-8 I/L. (Ignore this paragraph if PDP-14 is already connected to the 8 and the modules plugged in).
- 3.5 Power up the PDP-14 computer while depressing PDP-14 "STOP"
- 3.6.1 If a 4K PDP-14 program is to be executed, set IF switches to 1, DF switches to 0, Switch Register (SR) to 6000, depress "LOAD ADDRESS".
- 3.6.2 If a 1K PDP-14 program is to be executed, set IF switches to 0, DF switches to 0, SR to 6001, depress "LOAD ADDRESS".
- 3.7 Set SR to starting address (4K) of PDP-14 program (usually 0000), depress PDP-8 I/L "START".
- 3.8 Depress PDP-14 "START".

3.9 PDP-14 program will be executed by the PDP-14 using PDP-8 I/L memory for instructions and memory source data.

3.10 If the PDP-14 loaded its OUTPUT Register because of an instruction in the PDP-14 program, the number in the OUTPUT Register will be typed out on the teleprinter in the form:

OUTPUT = XXXX

3.11 If the PDP-14 stops, RUN-14 will type out a message in the form:

PDP-14 STOPPED AT XXXX

RUN-14 will then wait for the operator to depress PDP-14 "CONTINUE".

3.14 If for some unknown reason the PDP-14 hangs (does not complete an instruction), RUN-14 will type out:

PDP-14 HUNG

4. DETAILS OF OPERATION

4.1 Upon starting, the program decides whether a 1K or 4K program is to be executed and sets up an address mask accordingly (The decision is made by the address at which the program is started).

4.2 The program then obtains the starting address of the PDP-14 program from the SR and saves it.

4.3 Upon detection of the PDP-14 running, the 14 is interrupted and placed in the external mode. PC1 is then loaded using a 0104 IOT to load and execute a PDP-14 JMP NNNN instruction.

4.4. The PDP-14 is checked to see if it is still running. If so, the contents of PC1 is read into the 8 AC to determine the location of the next instruction to be executed by the 14. If the 14 is not running, RUN-14 waits for 14 "CONTINUE" to be depressed, and "PDP-14 STOPPED AT c(PC1)" is displayed.

4.5 The next 14 instruction is then obtained from memory and sent to the 14 for execution.

4.6 The instruction obtained by 4.5 (above) is checked to see if it is a 2-word instruction. If it is, the program goes to 4.7. If it is not, the program goes to 4.8.

4.7 The second word of the 2-word instruction is obtained from 8 memory and sent to the 14.

- 4.8 If the OUTPUT Register flag is set, the contents of the OUTPUT Register is typed out on the teleprinter. In any case, the program then goes back to 4.4.

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/RUN 14
/COPYRIGHT 1978, DIGITAL EQUIPMENT CORP, MAYNARD, MASS,
/PROGRAM TO EXECUTE A PROGRAM IN THE MEMORY OF A PDP-8
/ON A PDP-14, THE PDP-14 IS RUN IN EXTERNAL MODE,
/THE PDP-14 PC1 REGISTER IS ACCESSED AFTER EACH
/INSTRUCTION TRANSFER OF THE PDP-8 TO SEE FROM
/WHERE THE NEXT MEMORY REFERENCE SHOULD BE OBTAINED
/THE PDP-14 PROGRAM OCCUPIES PDP-8 MEMORY FROM LOCATION 00000
/THIS PROGRAM SHOULD BE LOADED INTO MEMORY BANK 1 IF
/A 4K PDP-14 PROGRAM HAS BEEN LOADED INTO MEMORY BANK 0
/START RUN14 AT LOCATION 6000 IF A 4K PDP-14
/PROGRAM IS BEING RUN
/START RUN14 AT 6001 IF A 1K PDP-14 PROGRAM
/STARTING ADDRESS OF PDP-14 PROGRAM IS IN SWITCH REGISTER
/IF THE PDP-14 STOPS, THIS PROGRAM WILL LOOP AT LOCATION "LOOP"
/UNTIL PDP-14 "CONTINUE" IS DEPRESSED,
/IF A LOAD OUTPUT REGISTER INSTRUCTION IS GIVEN, THE
/PROGRAM WILL TYPE OUT THE
/CONTENTS OF THE OUTPUT REGISTER
/ ON THE PDP-8 TELETYPE AND CONTINUE THE PROGRAM

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6000 *6000

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6000 1315 RUN14, TAD K6000
6001 1313 TAD K1777
6002 3316 OCA MASK /SET UP PC1 MASK FOR 1K OR 4K
6003 7604 LAS
6004 3307 DCA PC1 /SET PC1 TO STARTING ADDRESS
6005 6175 SCRFB /WAIT FOR SOME ONE TO DEPRESS PDP-14 START
6006 5205 JMP ,-1
6007 1312 TAD K0600
6010 4777 JMS INTER /INTERRUPT PDP-14 TO EXECUTE AN EEM
6011 1307 TAD PC1
6012 4776 JMS SETPC1 /SET PC1 TO STARTING ADDRESS OF PDP-14 PROGRAM;
6013 6175 LOOP, SCRFB /IS THE PDP-14 STILL RUNNING
6014 5213 JMP ,-1 /NO
6015 7200 CLA /YES
6016 1310 TAD K0246
6017 6165 ILEX /INTERRUPT PDP-14
6020 4221 JMS ,*1 /TO EXECUTE
6021 0000 0 /TRR P1, OT
6022 6175 SCRFB
6023 5317 JMP NORUN
6024 6161 SIDF
6025 7410 SKP
6026 5232 JMP ,*4
6027 2221 ISZ ,-6
6030 5222 JMP ,-6
6031 4327 JMS TYMOUT
6032 6171 SOTF /OUTPUT FLAG SET?

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56	6033	7402	HLT	/NO
57	6034	6176	ROTR	/YES, READ BACK NEW PC1
58	6035	0316	AND MASK	
59	6036	3307	DCA PC1	
60	6037	1707	TAD I PC1	/GET NEXT INSTRUCTION
61	6040	6164	LDEX	/EXECUTE IT
62	6041	4242	JMS ,+1	
63	6042	0000	0	
64	6043	6175	SCRF	
65	6044	5317	JMP NORUN	
66	6045	6161	SIDF	
67	6046	7410	SKP	
68	6047	5253	JMP ,+4	
69	6050	2242	ISZ ,=6	
70	6051	5243	JMP ,=6	
71	6052	4327	JMS TYHOUT	
72	6053	0260	AND K7000	
73	6054	1314	TAD K4000	
74	6055	7640	SEA CLA /TWO WORD?	
75	6056	5275	JMP PROCED	/NO
76	6057	2307	ISZ PC1	/YES,BUMP PC1

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77
78 6060 7000 K7000, NOP
79 6061 1707 TAD I PC1 /GET SECOND WORD
80 6062 6164 LDEX /TRANSFER IT TO PDP-14
81 6063 4264 JMS ,+1
82 6064 0000 0
83 6065 6175 SCRF
84 6066 5317 JMP NORUN
85 6067 6161 SIDF
86 6070 7410 SKP
87 6071 5275 JMP ,+4
88 6072 2264 ISZ ,=6
89 6073 5265 JMP ,=6
90 6074 4327 JMS TYMOUT
91 6075 6171 PROCED, SOTF /OUTPUT REGISTER LOADED?
92 6076 5213 JMP LOOP /NO
93 6077 7200 CLA
94 6100 4775 JMS CRLF
95 6101 1774 TAD OUTPUT
96 6102 4773 JMS MESAG
97 6103 6176 ROTR /READ OUTPUT REGISTER
98 6104 4772 JMS PRINT
99 6105 4775 JMS CRLF
100 6106 5213 JMP LOOP
101 6107 0000 PC1, 0
102 6110 0246 K0246, 246
103 6111 0264 K0264, 264
104 6112 0600 K0600, 600
105 6113 1777 K1777, 1777
106 6114 4000 K4000, 4000
107 6115 6000 K6000, 6000
108 6116 0000 MASK, 0
109 6117 7200 NORUN, CLA
110 6120 4775 JMS CRLF
111 6121 1771 TAD PNORUN
112 6122 4773 JMS MESAG
113 6123 1307 TAD PC1
114 6124 4772 JMS PRINT
115 6125 4775 JMS CRLF
116 6126 5213 JMP LOOP
117 6127 0000 TYMOUT, 0
118 6130 7200 CLA
119 6131 4775 JMS CRLF
120 6132 1770 TAD PHUNG
121 6133 4773 JMS MESAG
122 6134 4775 JMS CRLF
123 6135 7402 HLT
124 6136 5727 JMP I TYMOUT

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126	6170	6336	
127	6171	6312	
128	6172	6254	
129	6173	6353	
130	6174	6301	
131	6175	6242	
132	6176	6221	
133	6177	6215	
		6200	*6200
134			
135			
136			/CHECK PDP-14 RUNNING AND WAIT ONLY SO LONG FOR DONE FLAG.
137			/
138	6200	0000	WAIT, 0
139	6201	4202	JMS ,*4
140	6202	0000	0
141	6203	6175	SCRF
142	6204	5777	JMP NORUN
143	6205	6161	SIDF
144	6206	7410	SKP
145	6207	5213	JMP ,*6
146	6210	2202	ISE ,=6
147	6211	5203	JMP ,=6
148	6212	4776	JMS TYHOUT
149	6213	7200	CLA
150	6214	5600	JMP I WAIT
151			
152			/
153			/INTERRUPT THE PDP-14 AND EXECUTE 1 INSTRUCTION (IN AC).
154			/
155	6215	0000	INTER, 0
156	6216	6165	ILEX
157	6217	4200	JMS WAIT
158	6220	5615	JMP I INTER
159			/
160			/SET PC1 TO NNNN USING JMP NNNN, ENTERED WITH NNNN IN AC.
161			/
162	6221	0000	SETPC1, 0
163	6222	3232	DCA SETTEM /SAVE NNNN,
164	6223	1233	TAD K4224 /EXECUTE PDP-14 JMP.
165	6224	6164	LDEX
166	6225	4200	JMS WAIT /WAIT FOR DONE FLAG.
167	6226	1232	TAD SETTEM /SET PC1 TO NNNN,
168	6227	6164	LDEX
169	6230	4200	JMS WAIT /WAIT FOR DONE FLAG.
170	6231	5621	JMP I SETPC1 /EXIT.
171	6232	0000	SETTEM, 0
172	6233	4224	K4224, 4224 /CODE FOR PSP-14 JMP INST.
173			/
174			/
175			/TYPE SUBROUTINE
176			/
177	6234	0000	TYPE, 0
178	6235	6046	TL5

179	6236	6041	TSF
180	6237	5236	JMP I-1
181	6240	7200	CLA
182	6241	5634	JMP I TYPE
183			
184			/CR=LF SUBROUTINE
185			
186	6242	0000	CRLF, 0
187	6243	1250	TAD K0215
188	6244	4234	JMS TYPE
189	6245	1251	TAD K0212
190	6246	4234	JMS TYPE
191	6247	5642	JMP I CRLF
192	6250	0215	K0215, 215
193	6251	0212	K0212, 212
194	6252	0007	K0007, 7
195	6253	0260	K0260, 260

/TYPE OUT THE CONTENTS OF THE AC IN OCTAL

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6254 0000
6255 3276
6256 1300
6257 3277
6260 1276
6261 7104
6262 7004
6263 7006
6264 3276
6265 1276
6266 0252
6267 1293
6270 4234
6271 1276
6272 2277
6273 5262
6274 7200
6275 5654
6276 0000
6277 0000
6300 7774

6301 6302
6302 0317
6303 0325
6304 0324
6305 0320
6306 0325
6307 0324
6310 0275
6311 0000

6312 6313
6313 0320
6314 0304
6315 0320
6316 0255
6317 0261
6320 0264
6321 0240
6322 0323
6323 0324
6324 0317
6325 0320
6326 0320
6327 0305
6330 0304
6331 0240
6332 0301

PRINT, 0
DCA NUMBER
TAD M0004
DCA PCNTR
TAD NUMBER
RAL CLL
RAL
RTL
DCA NUMBER
TAD NUMBER
AND K0007
TAD K0260
JMS TYPE
TAD NUMBER
ISZ PCNTR
JMP ,+1
CLA
JMP I PRINT

NUMBER, 0
PCNTR, 0
M0004, -4

/OUTPUT REGISTER MESSAGE

OUTPUT, OUTPUT+1
317 /O
325 /U
324 /T
320 /P
325 /U
324 /T
275 /#
0 /END

/PDP-14 STOPPED AT

PNORUN, ,+1
320
304
320
255
261
264
240
323
324
317
320
320
305
304
240
301

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251	6333	0324	324
252	6334	0240	240
253	6335	0000	0

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254
255
256
257      6336  6337
258      6337  0320
259      6340  0304
260      6341  0320
261      6342  0255
262      6343  0261
263      6344  0264
264      6345  0240
265      6346  0310
266      6347  0325
267      6350  0316
268      6351  0307
269      6352  0000
270
271
272
273
274      6353  0000
275      6354  3277
276      6355  1677
277      6356  7450
278      6357  5753
279      6360  4234
280      6361  2277
281      6362  5355
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297      6376  6127
298      6377  6117

/PDP-14 HUNG
PHUNG:  ,*1
        320
        304
        320
        255
        261
        264
        240
        310
        325
        316
        307
        0

/MESSAGE PRINT SUBROUTINE
/ENTER WITH MESSAGE ADDRESS IN AC
MESAG:  0
        DCA PCNTR
        TAD I PCNTR
        SNA
        JMP I MESAG
        JMS TYPE
        ISZ PCNTR
        JMP ,-5

/INSTRUCTION DEFINITIONS
SIDF=6161      /SKIP IF INSTRUCTION DONE
LDIN=6162     /LOAD PDP-14 INPUT REGISTER
LDEX=6164     /LOAD AND EXECUTE PDP-14 INSTRUCTION
ILEX=6165     /INTERRUPT, LOAD AND EXECUTE PDP-14 INSTRUCTION
CIDF=6167     /CLEAR INSTRUCTION DONE FLAG
SOTF=6171     /SKIP IF PDP-14 OUTPUT REGISTER LOADED
COTF=6172     /CLEAR OUTPUT FLAG
STFF=6173     /SKIP IF PDP-14 TEST FLOP SET
CTFF=6174     /CLEAR TEST FLOP
SCRF=6175     /SKIP IF PDP-14 RUNNING
ROTR=6176     /CLEAR AC, READ OUTPUT REGISTER INTO PDP-8 AC

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0000
0100

0200
0300

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1100

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1300

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3100

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4200
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5000
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5700

6000	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
6100	11111111	11111111	11111111	11111110	00000000	00000000	00000000	11111111	11111111
6200	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
6300	11111111	11111111	11111111	11111111	11111111	11111111	11100000	00000011	11111111

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7700

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CIOF 6167
COTF 6172
CRLF 6242
CTFF 6174
ILEX 6165
INTER 6215
K0007 6252
K0212 6251
K0215 6250
K0246 6110
K0260 6253
K0264 6111
K0600 6112
K1777 6113
K4000 6114
K4224 6233
K6000 6115
K7000 6060
LDEX 6164
LDIN 6162
LOOP 6013
M0004 6300
MASK 6116
MESAG 6353
NORUN 6117
NUMBER 6276
OUTPUT 6301
PC1 6107
PCNTR 6277
PHUNG 6336
PNORUN 6312
PRINT 6254
PROCED 6075
ROTR 6176
RUN14 6000
SCRF 6175
SETPC1 6221
SETTEM 6232
SIOF 6161
SOTF 6171
STFF 6173
TYMOUT 6127
TYPE 6234
WAIT 6200

ERRORS DETECTED: 0

LINKS GENERATED: 18

RUN-TIME: 3 SECONDS

2K CORE USED

CIDF	288#								
COTF	290#								
CRLF	94	99	110	119	119	122	186#	191	
CTFF	292#								
ILEX	44	156	287#						
INTER	37	159#	150						
K0007	194#	208							
K0212	189	193#							
K0215	187	192#							
K0246	43	182#							
K0260	195#	209							
K0264	103#								
K0600	36	104#							
K1777	30	105#							
K4000	73	106#							
K4224	164	172#							
K6000	29	107#							
K7000	72	78#							
LDEX	61	80	165	168	286#				
LDIN	285#								
LOOP	40#	92	100	116					
M0004	200	210#							
MASK	31	58	108#						
MESAG	96	112	121	274#	278				
NORUN	48	65	84	109#	142				
NUMBER	199	202	206	207	211	216#			
OUTPUT	95	222#	222						
PC1	33	38	59	60	76	79	101#	113	
PCNTR	201	212	217#	275	276	280			
PHUNG	120	257#							
PNORUN	111	234#							
PRINT	98	114	198#	215					
PROCD	75	91#							
ROTR	57	97	294#						
RUN14	29#								
SCRIF	34	40	47	64	83	141	293#		
SETPC1	39	162#	170						
SETTEM	163	167	171#						
SIDF	49	66	85	143	284#				
SOTF	55	91	289#						
STFF	291#								
TYMOUT	54	71	90	117#	124	148			
TYPE	177#	182	188	190	210	279			
WAIT	138#	150	157	166	169				
.L6170	120	126#							
.L6171	111	127#							
.L6172	98	114	128#						
.L6173	96	110	121	129#					
.L6174	95	130#							
.L6175	94	99	110	115	119	122	131#		
.L6176	39	132#							
.L6177	37	133#							
.L6376	148	297#							

LS377

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298#