

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.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55

```

/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

```

6000 *6000

```

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?

```

PAL10 V141

18-JUN-70

21108

PAGE 1=1

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

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	PROCD,	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

125
 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

134
 135
 136
 137
 138 6200 0000
 139 6201 4202
 140 6202 0000
 141 6203 6175
 142 6204 5777
 143 6205 6161
 144 6206 7410
 145 6207 5213
 146 6210 2202
 147 6211 5203
 148 6212 4776
 149 6213 7200
 150 6214 5600

151
 152
 153
 154
 155 6215 0000
 156 6216 6165
 157 6217 4200
 158 6220 5615
 159
 160
 161
 162 6221 0000
 163 6222 3232
 164 6223 1233
 165 6224 6164
 166 6225 4200
 167 6226 1232
 168 6227 6164
 169 6230 4200
 170 6231 5621
 171 6232 0000
 172 6233 4224
 173
 174
 175
 176
 177 6234 0000
 178 6235 6046

*6200

/CHECK PDP-14 RUNNING AND WAIT ONLY SO LONG FOR DONE FLAG.

/
 WAIT, 0
 JMS ,*4
 0
 SCRF
 JMP NORUN
 SIOF
 SKP
 JMP ,*6
 ISE ,=0
 JMP ,=6
 JMS TYHOUT
 CLA
 JMP I WAIT

/INTERRUPT THE PDP-14 AND EXECUTE 1 INSTRUCTION (IN AC).

/
 INTER, 0
 ILEX
 JMS WAIT
 JMP I INTER

/SET PC1 TO NNNN USING JMP NNNN, ENTERED WITH NNNN IN AC.

/
 SETPC1, 0
 DCA SETTEM /SAVE NNNN,
 TAD K4224 /EXECUTE PDP-14 JMP.
 LDEX
 JMS WAIT /WAIT FOR DONE FLAG.
 TAD SETTEM /SET PC1 TO NNNN.
 LDEX
 JMS WAIT /WAIT FOR DONE FLAG.
 JMP I SETPC1 /EXIT.
 SETTEM, 0
 K4224, 4224 /CODE FOR PSP-14 JMP INST.

/TYPE SUBROUTINE

TYPE, 0
 TLS

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

196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250

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

PAL10

V141

18-JUN-70

21108

PAGE 4-1

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

```

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
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
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

S

```

/

PAL10

V141

18-JUN-70

21108

PAGE 5-1

0000
0100

0200
0300

0400
0500

0600
0700

1000
1100

1200
1300

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700

4000
4100
4200
4300
4400
4500
4600
4700

5000
5100
5200
5300
5400
5500
5600
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

6400
6500
6600
6700

7000
7100
7200
7300
7400
7500
7600
7700

PAL10 V141

18-JUN-70

24188 PAGE 5-3

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				
PROCED	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

142

298#