



# DECUS

## PROGRAM LIBRARY

DECUS NO.	8/8S-83 A & B
TITLE	OCTAL DEBUGGING PROGRAM (With and without Floating Point)
AUTHOR	James Rothman
COMPANY	Digital Equipment Corporation
DATE	June, 1967
FORMAT	

Paper Tapes - contents

1. Basic Package : 1) ASCII source  
(8/85-83a) 2) Binary (2 tapes for high & low)
  
2. 8/85-83b 4 word Fl. Pt. debug
  - a) ASCII source
  - b) Binary
  - c) Additions (Source + Binary)  
↑  
There are 2 binary tapes, but they seem to be different
  
3. 3 word fl. pt. debug
  - 1) ASCII source
  - 2) Binary
  - 3) Additions (source)

## OCTAL DEBUGGING PROGRAM WITHOUT FLOATING POINT

Program Library Write-up

DECUS No. 8/8S-83 A

### ABSTRACT

This program is an on-line debugger which will communicate with the operator through the ASR-33 Teletype. It allows register examination and modification, octal dumping, binary punching, multiple simultaneous breakpoints, starting a program, and running at a particular location with preset AC and link. ODP is completely relocatable at the beginning of all pages except page zero, and is compatible with the PDP-5, the PDP-8, and the PDP-8/S.

### REQUIREMENTS

#### 1. Storage

The high version of ODP requires from location 7000 to 7577. The low version requires from 0200 to 0777. All versions will require three pages. Also, location 0002 is used for a breakpoint pointer to ODP.

#### 2. Equipment

The standard PDP-8 package with ASR-33 Teletype are required. In addition, a high-speed punch is optional.

### LOADING

1. Be sure the binary loader is properly in core. If not, examine the RIM loader, and read in the binary loader.
2. Load in program that needs attention via this loader.
3. Load ODP via binary loader.

### USAGE

1. Set SR toggles to the value of starting address (7000 in high version, 0200 in low). Press load address. Then push start.
2. ODP will execute a CR/LF and is prepared to execute user commands.

### RESTRICTIONS

#### 1. Breakpointer register

On page zero register 0002 is used as a pointer to ODP. It should be avoided.

## 2. Overlap

The user must not use any of the three pages of core in use by ODP.

## 3. Status core

ODP will operate only within the memory field in which it resides.

## OPERATION

### 1. Description

ODP is essentially a unified collection of short routines for handling various user commands. The user types a letter representing a particular command, and an octal number if that is appropriate. For example, to insert a breakpoint (an effective JMS ODP which will trap an instruction at a desired location) one need only type B, followed by the octal absolute value of the address where the trapped instruction lies. A special feature of ODP is that many breakpoints (up to 7) may be simultaneously in core with the trapped instruction preserved. For instructions that require an octal number to be typed, ODP will type a space immediately after it identifies the command. After most instructions, a CR/LF combination will be executed to signal completion of that command. All octal numbers are automatically terminated after four digits, but may be terminated earlier by ALTMODE. ODP ignores all irrelevant characters.

### 2. Summary of commands

- O XXXX Open register XXXX. ODP types out contents.
- I XXXX Insert in most recently opened register the number XXXX.
- N Type out the location followed by the contents of the next register. May be followed by I command.
- B XXXX Put a breakpoint at location XXXX.
- A Examine AC register. May be modified by I instruction.
- L Examine link register. May be modified by I instruction. A 0001 is a set link; a 0000 is an off link.
- D XXXX XXXX Dump in octal the contents of XXXX to XXXX inclusive. Four words are placed per TTY line.

- S XXXX Start (or go) at XXXX with AC and link equal to zero.
- R XXXX Go from XXXX, the same as S, but with AC equal to the value of A register, and link equal to the value of L register.
- C Continue from most recently encountered breakpoint. Trapped instruction is replaced and C program is continued from the location of the trapped instruction. The initial contents of the link and AC are that of the L and A registers respectively.
- J This must be carefully watched! It causes program control to jump to location 6000 where single-stepper, written by the author for an interpretive language, usually resides.
- P Binary punch requested. Computer halts. Further information is via the SR.

### 3. Notes on various commands

#### 1. Open (O)

After the register is examined it is automatically closed. Hence the user cannot accidentally modify the contents, as with DDT, by typing a new command string while the register is still open.

#### 2. Insert (I)

Sequential insertion is possible with ODP. That is, after one I instruction, say at location XXXX, typing another I will cause insertion at location XXXX+1, and so on.

#### 3. Breakpoints (B)

Up to seven breakpoints may be placed in core at once. If the user attempts to place more than seven in core, then the computer will halt. The same result will occur if, upon encountering a breakpoint, ODP cannot find it listed in its internal table. When the trapped instruction is re-installed (by the C instruction) that breakpoint is eliminated from the table. Upon encountering a breakpoint, the contents of the AC link are preserved in the A and L registers for user examination, and ODP will execute a CR/LF combination to signal return to its control.

4. Go instructions (S, C, and R)

After recognizing an S, C, or R command, the computer will set the AC and link appropriately, then halt. This is in case the user should want to place the computer in the single-step mode after one of these instructions. If this should not be the case, merely depress the continue switch.

5. Binary Punch (P)

After the user typed a P, the computer will halt. There are several functions that the user must now handle through the SR.

- a. Put up bit 11 for high-speed punch, leave off for ASR-33 punch. Push continue to indicate the output mode.
- b. Set the SR to the octal value of the number of individual blocks that are to be punched with a single checksum. Push continue. Leader is punched.
- c. Set the SR to the initial address of the first block. Push continue. Set the SR to the final address in the first block. Push continue. That block, with an origin setting, is punched out in binary loader format. Punch is inclusive from initial to final location.
- d. For the next block, go through the same steps as outlined in (c) except with the new initial and final addresses, and continue in this way. When the last block has been punched, the checksum and trailer will be punched. A CR/LF will be executed and ODP will await further instructions.
- e. RIM format

To punch in RIM format, put the number of blocks equal to (octal), and use the address of one register as both the initial and final addresses for each block. When done punching, set SR to 7264, load address, and push continue. (Make sure the AC is clear). Trailer will be punched. For the low version, set SR to 0464 and proceed as above.

LISTING ATTACHED

## COMBINED DEBUGGING PACKAGE with FLOATING POINT

DECUS No. 8/8S-83 B

### ABSTRACT

The Combined Debugging Package (CDP) consists of the Octal Debugging Program (ODP) by this author plus certain additions which will enable the user to debug in floating point interpretive mode. Additional instructions provided include the insertion of interpretive breakpoints and single-stepping. At present the package is located directly below the floating point package to leave the lower portion of the memory to the user. It may easily be relocated to any desired position. Two versions are available: one for the three word package and a second for the four word package.

### REQUIREMENTS

The standard version of CDP requires cells 3600-4614, and is compatible with floating point packages A, B, C. It must be relocated to 3400 to accommodate package D, due to the presence of the output controller. The four word version occupies memory locations 4200-5221, and is compatible with two additional versions of the four word package: that with output controller and that with extended functions, both written by this author. All versions of CDP require in addition, cell 2 for breakpoints, and cells 5, 6, 7 as pointers to the input, output, and arithmetic packages respectively.

### OPERATION

CDP is an on-line debugger with two modes: floating and machine. Transfer to floating mode is accomplished by typing F. Machine mode is entered by the instruction M. When CDP is initially started, it is in machine mode. While in M mode it behaves exactly as ODP, with the minor exception that the J instruction has been liquidated in favor of the F command.

When transfer to F mode has been accomplished, a new set of instructions are enabled. The command B YYYY will insert an interpretive breakpoint (code 0017) at location YYYY. The original instruction is preserved and can be replaced with the C or S command. There may be up to seven interpretive breakpoints in core. Interpretive breakpoints and machine breakpoints are stored on separate tables. Hence there will be no interference between them, and seven of each type may be in core simultaneously. Upon encountering a breakpoint, the contents of the floating accumulator (FAC) will be typed out in decimal, floating point format, and control is returned to CDP.

The user then has several alternatives. He may choose to single-step, interpretively. To do this he merely types S, and the trapped instruction is replaced and executed. After its completion of that one interpretive command the FAC is typed out. Another S will cause another step to be executed after which the FAC is typed out. This process may continue indefinitely, until the user attempts to single-step over a FEXT. In this case CDP will type an up-arrow " " and transfer automatically to M mode. Because the single-stepping process is accomplished by continually moving the breakpoint one ahead, after the last S instruction one breakpoint will remain. To eliminate that breakpoint and restore the lost instruction, one must use the C command as described below. If one single-steps over a FEXT, the instruction past the FEXT is lost, replaced by an 0017. That is the penalty for carelessness. Also, there must be at least two locations on the breakpoint table free (or no more than five breakpoints in core at one time) for the S instruction to operate properly.

Another alternative after encountering a breakpoint is to continue full speed. This is accomplished by the C instruction. The breakpoint is replaced with the original instruction and processing continues from that point. If the user placed a breakpoint on a FEXT, and then wants to C, an up-arrow will be typed and automatic transfer to M mode will take place. Unlike the S instruction, however, there is no residue breakpoint in this case.

A third alternative might be to transfer back to M mode. This is done by typing M. If for some reason the user is not sure of what mode he is currently in, he may type the letter of the mode he thinks he is in. If there is no CR/LF response by CDP, it means that he typed a character that was not recognized, and hence is in the mode typed. If a CR/LF occurs, it means the user guessed wrong, but a transfer has occurred placing him in the mode he thought he was in before. Automatic transfer takes place upon encountering a breakpoint. If CDP is in M mode, and a floating breakpoint is encountered, automatic transfer to F mode is effected, and vice-versa.

The following instructions are also available in F mode and retain the same meaning as in M mode: O, I, N, A, L, D, R, and P.



ADDITIONS TO COMBINED DEBUGGING PACKAGES  
for  
FLOATING EXAMINATION and MODIFICATION

An addition has been written for CDP which will enable the user to examine and modify floating point numbers in core. Versions are available for both three and four word packages.

Old commands that were deleted from F mode include O, N, and I. The O was changed to E, for examination. The meanings of the commands N and I have been changed, although the mnemonics remain the same. Below is a summary of new commands.

- E XXXX      Output in decimal the contents of the floating point number whose exponent is held in XXXX and whose mantissa follows in sequential registers.
- I XXXX      Insert a floating point number exponent of which will be placed at XXXX and whose mantissa will follow in sequential registers. The user types the decimal number following the command. Also, note that sequential insertion is possible.
- N            Examine the next sequential floating point number. If working with the four word package, this would be the location of the last exponent plus four.

For all the above commands, the FAC is saved and replaced after execution. To examine the FAC, the user need only type E 44 followed by an ALT-MODE to terminate the number before four digits.

The additions require 50 (octal) locations and are located directly under CDP. Thus, new core requirements are the following:

3 WORD VERSION: 3530-4614  
4 WORD VERSION: 4130-5221

Starting addresses remain unchanged. Also, the program assumes that location 5 contains 7400. Check on this before using the additional instructions. Listings follow.

-----  
/OCTAL DEBUGGING PROGRAM -JAMES ROTHMAN 6/15/67

```

x7000
7000 6046      TLS
7001 4752  END,  JMS I CHLF
7002 4753      JMS I READ      /READ A NUMBER
7003 4754      JMS I TYPE
7004 1355      TAD N14 /RESET CONSTANTS
7005 3357      DCA CNT
7006 1360      TAD RTABA
7007 3361      DCA TABA
7010 1362      TAD RTABB
7011 3363      DCA TABB
7012 1763  LOOP1, TAD I TABB
7013 3337      DCA CHECK
7014 6034      KRS
7015 1761      TAD I TABA      /IDENTIFY REQUEST
7016 7650      SNA CLA
7017 5737      JMP I CHECK      /ENTER REQUESTED ROUTINE
7020 2361      IS7 TABA
7021 2363      IS7 TABB
7022 2357      IS7 CNT
7023 5212      JMP LOOP1
7024 5202      JMP END+1      /CAN'T IDENTIFY=READ AGAIN
7025 4764  O,   JMS I OCTRD      /OPEN INSTRUCTION
7026 3365      DCA CURLOC
7027 1765      TAD I CURLOC
7030 4304      JMS OCTPNT      /TYPE CONTENTS
7031 5201      JMP END
7032 4764  II,  JMS I OCTRD      /INSERT INSTRUCTION
7033 3765      DCA I CURLOC
7034 2365      IS7 CURLOC
7035 5201      JMP END
7036 2365  N,   IS7 CURLOC      /NEXT REGISTER REQUESTED
7037 1365      TAD CURLOC
7040 4304      JMS OCTPNT
7041 5227      JMP II-3

7042 4764  D,   JMS I OCTRD      /OCTAL DUMP REQUESTED
7043 3361      DCA INIT      /RECORD FIRST AND LAST
7044 4764      JMS I OCTRD      /OF REQUESTED REGISTERS
7045 7041      CIA
7046 3363      DCA FIN
7047 4752  LOOP2, JMS I CHLF
7050 1361      TAD INIT
7051 4304      JMS OCTPNT
7052 1366      TAD HYPH
7053 4754      JMS I TYPE
7054 1367      TAD N4
7055 3357      DCA CNT
7056 1761  LOOP3, TAD I INIT      /OUTPUT 4 SEQUENTIAL REGISTER
7057 4304      JMS OCTPNT
7060 1361      TAD INIT      /FINISHED?
7061 1363      TAD FIN
7062 7650      SNA CLA
7063 5201      JMP END
7064 2361      IS7 INIT
7065 2357      IS7 CNT

```

7066	5256		JMP LOOP3	
7067	5247		JMP LOOP2	
7070	4764	S,	JMR I OCTRD	/START REQUESTED
7071	3361		DCA LOCJMP	
7072	4752		JMS I CRLF	
7073	7402	GO,	HLT	
7074	5761		JMP I LOCJMP	
7075	4764	R,	JMR I OCTRD	/RUN WITH PRESET AC
7076	3361		DCA LOCJMP	/AND LINK REQUESTED
7077	4752		JMR I CRLF	
7100	1370		TAN LINK	
7101	7110		CLL RAR	
7102	1371		TAN AC	
7103	5273		JMP GO	
7104	0000	OCTPNT,	0	/OCTAL PRINT SUB-ROUTINE
7105	3373		DCA TEMP4	
7106	1374		TAN R240	
7107	4754		JMR I TYPE	
7110	1367		TAN N4	
7111	3372		DCA TEMP3	
7112	1373	LOOP6,	TAN TEMP4	
7113	7104		CLL RAL	
7114	7006		RTL	
7115	3373		DCA TEMP4	
7116	1373		TAN TEMP4	
7117	7004		RAL	
7120	0356		AND M7	
7121	1375		TAN R260	
7122	4754		JMR I TYPE	
7123	2372		IS7 TEMP3	
7124	5312		JMP LOOP6	
7125	5704		JMP I OCTPNT	
7126	5776	J,	JMP I M0000	/JUMP TO SINGLE-STEPPER
7127	1371	A,	TAN AC	/AC REFERENCED
7130	4337		JMR CHECK	
7131	3371		DCA AC	/RE-INSERT AC
7132	5201		JMP END	
7133	1370	L,	TAN LINK	/LINK REFERENCED
7134	4337		JMR CHECK	
7135	3370		DCA LINK	/RE-INSERT LINK
7136	5201		JMP END	
7137	0000	CHECK,	0	/CHECK FOR INSERT REQUEST
7140	4304		JMS OCTPNT	
7141	4752		JMR I CRLF	
7142	4753		JMR I READ	
7143	4754		JMR I TYPE	
7144	6034		KRq	
7145	1377		TAN N311	
7146	7640		SZA CLA	
7147	5204		JMP END+3	/CONTINUE AS USUAL
7150	4764		JMR I OCTRD	
7151	5737		JMP I CHECK	
7152	7466	CRLF,	LF	/CONSTANTS AND VARIABLES
7153	7474	READ,	RD	
7154	7501	TYPE,	TY0	
7155	7764	N14,	-14	
7156	0007	M7,	7	
7157	0000	CNT,	0	
7160	7177	RTABA,	LETTER	

7161	7177	TABA,	LETTER
7162	7551	RTABB,	LOCS
7163	7551	TABB,	LOCS
7164	7313	UCTKD,	RDNCT
7165	0000	CURLOC,	0
7166	0255	HYPH,	255
7167	7774	N4,	-4
7170	0000	LINK,	0
7171	0000	AC,	0
7172	0000	TEMP3,	0
7173	0000	TEMP4,	0
7174	0240	R240,	240
7175	0260	R260,	260
7176	6000	M6000,	6000
7177	7467		
7200	7461		
7201	7462		
7202	7476		
7203	7477		
7204	7464		
7205	7474	LETTER,	-311,-317,-316,-302,-301,-314,-304
7206	7455		
7207	7456		
7210	7475		
7211	7466		
7212	7460		-323,-322,-303,-312,-320
7213	3350	P,	DCA CHK /MEMORY PUNCH REQUESTED
7214	7402		HLT
7215	7604		LAS
7216	0375		AND M1
7217	7640		SZA CLA
7220	1360		TAN HTYPE
7221	1365		TAN TYPE2
7222	3373		DCA LOCPNT
7223	1373		TAN LOCPNT
7224	3774		DCA I LURCAL
7225	7402		HLT
7226	7604		LAS
7227	7041		CIA
7230	3351		DCA CNT2
7231	4752		JMS I LEADER
7232	7402	LOOP4,	HLT /RECORD FIRST AND LAST REGISTERS
7233	7604		LAS
7234	3353		DCA INIT2
7235	7402		HLT
7236	7604		LAS
7237	3354		DCA FIN2
7240	1355		TAN M177
7241	3356		DCA M77
7242	7120		STL
7243	1353		TAN INIT2
7244	4266		JMS PRINT
7245	1357		TAN R77
7246	3356		DCA M77
7247	1753	LOOP5,	TAN I INIT2
7250	4266		JMS PRINT
7251	1353		TAN INIT2
7252	7041		CIA

7253	1354		TAN FIN2
7254	7650		SNA CLA
7255	5260		JMP DONE
7256	2353		IS7 INIT2
7257	5247		JMP LOOP5
7260	2351	DONE,	IS7 CNT2
7261	5232		JMP LOOP4
7262	1350		TAN CHK
7263	4266		JMS PRINT
7264	4752		JMS I LEADER
7265	5761		JMP I ENDIT
7266	0000	PRINT,	0 /BINARY FORMAT PRINT
7267	3362		DCA TEMP1
7270	1362		TAN TEMP1
7271	7012		
7272	7012		
7273	7012		RTR,RTR,RTR
7274	0356		AND M77
7275	4304		JMS SUM
7276	4773		JMS I LOCPNT
7277	1362		TAN TEMP1
7300	0357		AND R77
7301	4304		JMS SUM
7302	4773		JMS I LOCPNT
7303	5666		JMP I PRINT
7304	0000	SUM,	0
7305	3363		DCA TEMP2
7306	1363		TAN TEMP2
7307	1350		TAN CHK
7310	3350		DCA CHK
7311	1363		TAN TEMP2
7312	5704		JMP I SUM
7313	0000	RDOCT,	0 /OCTAL READ SUB-ROUTINE
7314	1364		TAN M240
7315	4765		JMS I TYPE2
7316	3363		DCA TEMP2
7317	1366		TAN MN4
7320	3362		DCA TEMP1
7321	4767	BACK,	JMS I READ2
7322	4765		JMS I TYPE2
7323	6034		KRS
7324	1370		TAN N375
7325	7650		SNA CLA
7326	5346		JMP TERM
7327	6034		KRS
7330	0371		AND M270
7331	1372		TAN N260
7332	7640		SZA CLA
7333	5321		JMP BACK
7334	1363		TAN TEMP2
7335	7104		CLL RAL
7336	7006		RTL
7337	3363		DCA TEMP2
7340	6034		KRS
7341	1372		TAN N260
7342	1363		TAN TEMP2
7343	3363		DCA TEMP2
7344	2362		IS7 TEMP1
7345	5321		JMP BACK

7346	1363	TERM,	TAN TEMP2
7347	5713		JMP I RDOCT
7350	0000	CHK,	0
7351	0000	CNT2,	0
7352	7515	LEADER,	LDR
7353	0000	INIT2,	0
7354	0000	FIN2,	0
7355	0177	M177,	177
7356	0077	M77,	77
7357	0077	R77,	77
7360	0006	HTYPE,	HITYPE-TYP
7361	7001	ENDIT,	END
7362	0000	TEMP1,	0
7363	0000	TEMP2,	0
7364	0240	M240,	240
7365	7501	TYPE2,	TY0
7366	7774	MN4,	-4
7367	7474	READ2,	RD
7370	7403	N375,	-375
7371	0270	M270,	270
7372	7520	N260,	-260
7373	0000	LOCNT,	0
7374	7546	LDRCAL,	JMSLOC
7375	0001	M1,	1
7376	0000		
7377	0000		
7400	0000		
7401	0000		
7402	0000		
7403	0000		
7404	0000	ADDR,	0,0,0,0,0,0,0
7405	4243	B,	JMS RESET
7406	1350		TAD BRPNTR
7407	3002		DCA 2
7410	4253		JMS FIND
7411	4731		JMS I RDOCT2
7412	3726		DCA I TABC
7413	1726		TAN I TABC
7414	3333		DCA TEMP5
7415	1733		TAN I TEMP5
7416	3730		DCA I TABD
7417	1334		TAN BRINST
7420	3733		DCA I TEMP5
7421	5735		JMP I END2
7422	0000	PNTHIT,	0 /FOUND BREAK-POINT
7423	3736		DCA I ACC
7424	7004		RAI
7425	3737		DCA I LINK2
7426	7240		STA
7427	1222		TAN PNTHIT
7432	3222		DCA PNTHIT
7431	5735		JMP I END2
7432	4243	C,	JMS RESET
7433	1222		TAN PNTHIT
7434	7041		CIA
7435	4253		JMS FIND
7436	1730		TAN I TABD
7437	3622		DCA I PNTHIT
7440	3726		DCA I TABC

7441	1222		TAN PNTHIT
7442	5740		JMP I RPLUS1
7443	0000	RESET,	0
7444	1325		TAN RTABC
7445	3326		DCA TARC
7446	1327		TAN RTABD
7447	3330		DCA TABD
7450	1341		TAN RN4
7451	3332		DCA CNT4
7452	5643		JMP I RESET
7453	0000	FIND,	0
7454	3243		DCA RESET
7455	1243		TAN RESET
7456	1726		TAN I TABC
7457	7650		SNA CLA
7460	5653		JMP I FIND
7461	2326		IS7 TARC
7462	2330		IS7 TABD
7463	2332		IS7 CNT4
7464	5255		JMP .-7
7465	7402		HLT
7466	0000	LF,	0
7467	1342		TAN M215
7470	4301		JMS TYP
7471	1343		TAN M212
7472	4301		JMS TYP
7473	5666		JMP I LF
7474	0000	RD,	0
7475	6031		KSF
7476	5275		JMP .-1
7477	6036		KRR
7500	5674		JMP I RD
7501	0000	TYP,	0
7502	6041		TSP
7503	5302		JMP .-1
7504	6046		TLR
7505	7300		CLA CLL
7506	5701		JMP I TYP
7507	0000	HITYPE,	0
7510	6021		PSP
7511	5310		JMP .-1
7512	6026		PLR
7513	7300		CLA CLL
7514	5707		JMP I HITYPE
7515	0000	LDR,	0
7516	1344		TAN N75
7517	3347		DCA LEADCT
7520	1345		TAN M200
7521	4746		JMS I JMSLOC
7522	2347		IS7 LEADCT
7523	5320		JMP .-3
7524	5715		JMP I LDR
7525	7376	RTABC,	ADDR
7526	7376	TABC,	ADDR
7527	7565	RTABD,	INST
7530	7565	TABD,	INST
7531	7313	RDOCT2,	RDOCT
7532	0000	CNT4,	0
7533	0000	TEMP5,	0

```

7534 4402 BRINST, JMS I 2
7535 7001 EN02, EN0
7536 7171 ACC, AC
7537 7170 LINK2, LINK
7540 7076 RPLUS1, R+i
7541 7771 RN4, -7
7542 0215 M215, 215
7543 0212 M212, 212
7544 7634 N75, -144
7545 0200 M200, 200
7546 0000 JMSLOC, 0
7547 0000 LEADCT, 0
7550 7422 BRPNTR, PNTHIT
7551 7032
7552 7025
7553 7036
7554 7405
7555 7127
7556 7133
7557 7042
7560 7070
7561 7075
7562 7432
7563 7126
7564 7213 LOGS, II,0,N,0,A,K,0,D,S,R,C,J,P
7565 0000
7566 0000
7567 0000
7570 0000
7571 0000
7572 0000
7573 0000 INST, 0,0,0,0,0,0,0
      FIN=TABB
      INIT=TABA
      LOCJMP=TABA
      N311=LETTE

```

```

-----
A      7127
AC     7171
ACC    7536
ADDR   7376
R      7405
RACK   7321
BRINST 7534
BRPNTR 7550
C      7432
CHECK  7137
CHK    7350
CNT    7157
CNT2   7351
CNT4   7532
CRLF   7152
CURLOC 7165
D      7042
DONE   7260
END    7001
ENDIT  7361
END2   7535
FIN    7163

```



FIND	7453
FIN2	7354
GO	7073
HITYPE	7507
HTYPE	7340
HYPH	7166
II	7032
INIT	7161
INIT2	7353
INST	7565
J	7126
JMSLOC	7546
L	7133
LDR	7512
LDRCAL	7374
LEADCT	7547
LEADER	7352
LETTER	7177
LF	7466
LINK	7170
LINK2	7537
LOCJMP	7151
LOCPNT	7373
LOCS	7551
LOOP1	7012
LOOP2	7047
LOOP3	7056
LOOP4	7232
LOOP5	7247
LOOP6	7112
MN4	7366
M1	7375
M177	7355
M200	7545
M212	7543
M215	7542
M240	7364
M270	7371
M6000	7176
M7	7156
M77	7356
N	7036
N14	7155
N260	7372
N311	7177
N375	7370
N4	7167
N75	7544
O	7025
OCTPNT	7124
OCTRD	7164
P	7213
PNTHT	7422
PRINT	7266
R	7075
RD	7474
RDOCT	7313
RDOCT2	7531
READ	7153
READ2	7367

RESET	7443
RN4	7541
RPLUS1	7540
RTABA	7160
RTABB	7162
RTABC	7525
RTABD	7527
R240	7174
S260	7175
R77	7357
S	7070
SUM	7304
TABA	7161
TABB	7163
TARC	7526
TARD	7530
TEMP1	7362
TEMP2	7363
TEMP3	7172
TEMP4	7173
TEMP5	7533
TERM	7346
TYP	7501
TYPE	7154
TYPE2	7365
D	

13 WORD PARAGRAPH  
 /JAMES ROJANE ... JULY 6, 1967

/ADDITIONS TO ODP TO HANDLE FLOATING  
 /POINT DEBUGGING. THIS PORTION IS  
 /PLACED BEFORE THE FLOATING POINT  
 /PACKAGE. A FLOATING BREAKPOINT IS  
 /INTERPRETIVE #017. COMMANDS IN THIS  
 /MODE ARE: B-XXXX -BREAKPOINT, C -  
 /CONTINUE AFTER BREAKPOINT, REINSTATING  
 /TRAPPED INSTRUCTION, S-SINGLE STEP (OR  
 /EFFECTIVELY MOVE BREAKPOINT ONE AHEAD)  
 /AND M - JUMP BACK TO MACHINE MODE.  
 /ENTRY INTO FLOATING MODE IS EFFECTED BY  
 /THE COMMAND F IN NORMAL, MACHINE LANGUAGE  
 /DEBUGGING MODE. THE F COMMAND REPLACES THE  
 /FORMER J COMMAND IN ODP. IN F MODE, THE  
 /COMMANDS T, D, A, L, D, R, AND P HAVE THE SAME  
 /EFFECT AS IN M MODE.  
 /NOTE: TO BE COMPATIBLE WITH PACKAGE D,  
 /THIS PROGRAM MUST BE RELOCATED TO 4200.  
 X4400

4400	7300	BERZ,	CLA OLI	
4401	1303		TAB REVA	/RESET POINTERS TO OPERATIONS T BL S
4402	3707		DCAL LUCA	/IN ODP TO POINT TO FLOATING DE UG ER
4403	1304		TAB REVB	
4404	3710		DCAL LUOB	
4405	1305		TAB REVC	
4406	3711		DCAL LUCC	/RESET POINTERS IN ODP FOR A FL AT NG
4407	1306		TAB REVD	/BREAKPOINT TABLE
4408	3712		DCAL LUOD	
4409	1315		TAB REJMP	
4412	3716		DCAL RESR2	/MODIFICATION IN C INSTRUCTION N DP
4413	1313		TAB REBIN	/CHANGE BREAKPOINT INSTRUCTION G 01
4414	3714		DCAL LUOBIN	
4415	5725		JMP TO ODP	
			/M INSTRUCTION - SWITCH TO MACHINE MODE.	
			/THEREFORE ALL OLD POINTERS AND TABLES MUST	
			/BE REPLACED.	
4416	1317	M,	TAB RLDA	
4417	3707		DCAL LUCA	
4420	1320		TAB RLDB	
4421	3710		DCAL LUOB	
4422	1321		TAB RLDC	
4423	3711		DCAL LUCC	
4424	1322		TAB RLDD	
4425	3712		DCAL LUOD	
4426	1323		TAB RLBIN	
4427	3714		DCAL LUOBIN	
4430	1324		TAB RLJMP	
4431	3716		DCAL RESR2	
4432	5725		JMP TO ODP	
4433	0000	BRKPT,		/LOCATION OF RETURN FROM AN
4434	1727		TAB RPNT	/INTERPRETIVE BREAK POINT
4435	3326		DCAL STRE	
4436	1044		TAB RA	
4437	3332		DCAL EVD	
4440	1045		TAB RB	

4441	3333	DCB	40RD	
4442	1046	TAB	46	
4443	3334	DCB	40RD	
4444	4735	JMS	I ORLF2	
4445	4406	JMS	I 6	
4446	1332	TAB	EXP	
4447	3044	DCB	44	
4450	1333	TAB	40RD	
4451	3045	DCB	45	
4452	1334	TAB	40RD	
4453	3046	DCB	46	
4454	7242	SET		
4455	1326	TAB	STORE	
4456	3731	DCB	I 602	
4457	1731	TAB	I 602	
4460	3730	DCB	I PNTHT	
4461	5200	JMP	REG4	
4462	1742	HERE,	TAB I CIAHD	/RETURN FROM C ROUTINE IN ODP
4463	3334		DCB 40RD	
4464	1734		TAB I 40RD	
4465	7642	SZA	40A /FETCH INSTRUCTION, WAS IT FEXT?	
4466	5633	JMP	I BRKPN1	/NO-RE-ENTER INTERPRETER
4467	1336	TAB	OPAR	/YES-ENTER M MODES, TYPE UP ARR0
4470	4737	JMS	I TYPIT	
4471	5216	JMP	B /ENTER M MODE	
4472	4741	SS,	JMS I RSET	/SINGLE STEP ROUTINE, RESET POINT FR
4473	4742		JMS I FINDI1	/FIND INSTRUCTION FROM GIVEN ADDR S
4474	1343		TAB -R1LOC	/CHANGE POINTER IN BREAKPOINT R UT NE
4475	3744		DCB I LEND2	
4476	1326		TAB STORE	/INSERT BREAKPOINT AT NEXT REG? TE
4477	5745		JMP I RPLUS5	/ENTER B ROUTINE
4500	1325	RETPNT,	TAB JMP /RETURN FROM B, RESET POINTER TO END	
4501	3744		DCB I LEND2	
4502	5746		JMP I 01	/ENTER CONTINUE ROUTINE
		/CONSTANTS AND POINTERS		
4503	4547	NEWA,	LETH0	
4504	4563	NEWB,	L0N50	
4505	4577	NEWC,	ADDR2	
4506	4606	NEWD,	IN012	
4507	1707	L0NA,	RT000	
4510	3762	L0NB,	RT005	
4511	4325	L0NC,	RT001	
4512	4327	L0ND,	RT001	
4513	0017	NEWBIN,	17	
4514	4334	LOCBIN,	BRKST	
4515	5774	NEWJMP,	5774	
4516	4241	RECM2,	RESET-2	
4517	3777	OLNA,	LETTER	
4520	4351	OLNB,	L0N5	
4521	4176	OLNC,	ADDR	
4522	4365	OLND,	IN01	
4523	4402	OLNDIN,	JMS I 0	
4524	1222	OLNDAD,	1222	
4525	3602	ODP,	END	
4526	4200	STORE,		
4527	5600	FPNT,	5600	
4530	4222	PNTHT,	PNTHT	
4531	5605	GO2,	5605	
4532	5200	EXP,		

4533	4200	HURU,	A
4534	4202	LURU,	
4535	4205	CRIF2,	LF
4536	4336	UPAR,	33A
4537	4341	TYBIT,	TYE
4540	4337	UTABU,	TABU
4541	4243	RSFI,	RECFY
4542	4253	FIMDII,	FIDC
4543	4500	RETLOC,	RETRM
4544	4335	LEAD2,	ENF2
4545	4212	BPIUS2,	R+R
4546	4232	CI,	C
4547	7467		
4550	7461		
4551	7462		
4552	7476		
4553	7477		
4554	7464		
4555	7474		
4556	7455	LETR2,	-301,-317,-316,-302,+301,-314,-304,-323
4557	7456		
4558	7475		
4561	7463		
4562	7462		
			-322,-303,-315,-320,
4563	3633		
4564	3626		
4565	3637		
4566	4205		
4567	3727		
4570	3733		
4571	3643		
4572	4472		
4573	3676		
4574	4252		
4575	4416		
4576	4013	LOUS2,	II,III,IV,V,VI,VII,VIII,SS,R,C,M,P
4577	0000		
4580	0000		
4581	0000		
4582	0000		
4583	0000		
4584	0000		
4585	0000	ADNR2,	0,0,0,0,0,0,0,0
4586	0000		
4587	0000		
4590	0000		
4591	0000		
4592	0000		
4593	0000		
4594	0000	INST2,	0,0,0,0,0,0,0,0
		x6	
6566	7242		7242 / POINTER TO OUTPUT PACKAGE
		x6563	
6563	4433		4433 / INTERPRETATION TABLE OF PACKAGE

CONTROL DEBUGGING PROGRAM - JAMES RUTHMAN 6/15/67

```

x3600
3600 6046 TLo
3601 6046 RLS
3602 4752 ENDP JMS I ORLF
3603 4723 JMS I READ /READ A NUMBER
3604 4724 JMS I TYPE
3605 1355 TAB #14 /RESET CONSTANTS
3606 3357 DCA CNT
3607 1361 TAB #1434
3608 3361 DCA TARA
3609 1362 TAB #1438
3610 3363 DCA TABB
3611 1763 LOOP1, TAB I TABB
3612 3357 DCA CHECK
3613 6054 KRF
3614 1761 TAB I TABA /IDENTIFY REQUEST
3615 7652 SNA #LA
3616 5737 JMS I CHECK /ENTER REQUESTED ROUTINE
3617 2361 ISZ TARA
3618 2363 ISZ TABB
3619 2357 ISZ CNT
3620 5213 JMP LOOP1
3621 5203 JMP END*1 /CAN'T IDENTIFY*READ AGAIN
3622 4705 D, JMS I DCTRD /OPEN INSTRUCTION
3623 3366 DCA CURLOC
3624 1766 TAB I CURLOC
3625 4305 JMS DCTPNT /TYPE CONTENTS
3626 5202 JMP END
3627 4765 II, JMS I DCTRD /INSERT INSTRUCTION
3628 3766 DCA I CURLOC
3629 2366 ISZ CURLOC
3630 5202 JMP END
3631 2366 N, ISZ CURLOC /NEXT REGISTER REQUESTED
3632 1366 TAB CURLOC
3633 4305 JMS DCTPNT
3634 5232 JMP II-3
3635 4765 D, JMS I DCTRD /OCTAL DUMP REQUESTED
3636 3361 DCA I#1 /RECORD FIRST AND LAST
3637 4765 JMS I DCTRD /OF REQUESTED REGISTERS
3638 7041 CIL
3639 3363 DCA #14
3640 4752 LOOP2, JMS I ORLF
3641 1361 TAB INIT
3642 4305 JMS DCTPNT
3643 1367 TAB #14
3644 4754 JMS I TYPE
3645 1370 TAB #4
3646 3357 DCA CNT
3647 1761 LOOP3, TAB I INIT /OUTPUT 4 SEQUENTIAL REGISTER
3648 4305 JMS DCTPNT
3649 1361 TAB I#1 /FINISHED?
3650 1363 TAB #14
3651 7652 SNA #LA
3652 5202 JMP END
3653 2361 ISZ I#1
3654 2327 ISZ CNT

```

3667	5257		JMP L00P3	
3672	5252		JMP L00P2	
3671	4765	S,	JMS L00TRD	/START REQUESTED
3672	3361		DOZ L00JMP	
3673	4752		JMS L00KLF	
3674	7402	GO,	PLT	
3675	5761		JMP L00JMP	
3676	4765	R,	JMS L00TRD	/RUN WITH PRESET AC
3677	3361		DOZ L00JMP	/AND LINK REQUESTED
3700	4752		JMS L00KLF	
3701	1371		TAB LINK	
3702	7110		OLI BAR	
3703	1372		TAB AC	
3704	5274		JMP RD	
3705	2000	OCTPNT,	X	/SOCIAL PRINT SUB-ROUTINE
3706	3374		DOZ TEMP4	
3707	1375		TAB BAR	
3710	4754		JMS L00TYPE	
3711	1370		TAB BA	
3712	3373		DOZ TEMP3	
3713	1374	L00P6,	TAB TEMP4	
3714	7104		OLI BAL	
3715	7006		RTD	
3716	3374		DOZ TEMP4	
3717	1374		TAB TEMP4	
3720	7004		RAB	
3721	6356		AND 7	
3722	1376		TAB BAR	
3723	4754		JMS L00TYPE	
3724	2373		ISZ TEMP3	
3725	5313		JMP L00P6	
3726	5705		JMP L00OCTPNT	
3727	1372	A,	TAB AC	/AC REFERENCED
3730	4337		JMS CHECK	
3731	3372		DOZ AC	/RE-INSERT AC
3732	5202		JMP END	
3733	1371	L,	TAB LINK	/LINK REFERENCED
3734	4337		JMS CHECK	
3735	3371		DOZ LINK	/RE-INSERT LINK
3736	5202		JMP END	
3737	2000	CHEK,	X	/CHECK FOR INSERT REQUEST
3740	4305		JMS OCTPNT	
3741	4752		JMS L00KLF	
3742	4753		JMS L00READ	
3743	4754		JMS L00TYPE	
3744	6034		KRS	
3745	1364		TAB BAR	
3746	7642		SZ BAR	
3747	5205		JMP L00P3	/CONTINUE AS USUAL
3750	4765		JMS L00TRD	
3751	5737		JMS L00CHECK	
3752	4256	CHRT,	LF	/CONSTANTS AND VARIABLES
3753	4274	READ,	RD	
3754	4301	TYPE,	TYE	
3755	7764	N14,	N14	
3756	2007	N7,	7	
3757	2000	CNT,	C	
3760	3777	HTAB,	LETTER	
3761	3777	TABA,	LETTER	

3762	4351	RTAB, LOTS
3763	4351	TAB, LOTS
3764	7457	311, -311
3765	4113	UCTR, -311
3766	5202	DUPL, -311
3767	5225	MY, -311
3770	7774	34, -34
3771	5202	L1, -311
3772	5202	40, -311
3773	5202	TEMP, -311
3774	5202	TEMP, -311
3775	5242	240, -311
3776	5252	240, -311
3777	7457	
4000	7461	
4001	7462	
4002	7476	
4003	7477	
4004	7464	
4005	7474	LETTER, -311, -312, -316, -322, +331, -314, -304
4006	7455	
4007	7425	
4010	7475	
4011	7472	
4012	7400	-303, -322, -323, -326, -324
4013	3357	NO MEMORY PUNCH REQUESTED
4014	7472	LT
4015	7604	LAF
4016	5375	APP
4017	7547	S40
4020	1300	TAB TYPE
4021	1365	TAB TYPE2
4022	3373	DUPLICATE
4023	1373	TAB COMPAT
4024	3774	DUPLICATE
4025	7402	HLT
4026	7604	LAF
4027	7041	01A
4030	3351	NO UNIT
4031	4752	UNIT LEADER
4032	7402	LUNF4, HLT /RECORD FIRST AND LAST REGISTERS
4033	7604	LAF
4034	3353	NO UNIT
4035	7402	HLT
4036	7604	LAF
4037	3354	NO UNIT
4040	1355	TAB 177
4041	3356	DUPLICATE
4042	7120	ST
4043	1353	TAB 177
4044	4266	UNIT PRINT
4045	1357	TAB 177
4046	3356	DUPLICATE
4047	1753	LUNF5, TAB 177
4050	4266	UNIT PRINT
4051	1353	TAB 177
4052	7041	01A
4053	1354	TAB 177



4054	7600		SWA 0LA
4055	5200		JMP 000E
4056	2303		ISZ 0012
4057	5247		JMP 0010
4060	2301	DUPE,	ISZ 0012
4061	5232		JMP 0004
4062	1350		TAR 005
4063	4206		JMP 0010
4064	4752		JMP 0010
4065	5701		JMP 0010
4066	2200	PRINT,	0010 BINARY FORMAT PRINT
4067	3362		0010
4070	1302		TAR 001
4071	7012		
4072	7012		
4073	7012		RTN 0010
4074	2306		AND 077
4075	4304		JMP 000
4076	4773		JMP 0010
4077	1302		TAR 001
4100	2307		AND 077
4101	4304		JMP 000
4102	4773		JMP 0010
4103	5606		JMP 0010
4104	2200	SUM,	0010
4105	3363		0010
4106	1303		TAR 002
4107	1300		TAR 001
4110	3350		0010
4111	1303		TAR 002
4112	5704		JMP 000
4113	2007	RDOUT,	0010 TOTAL READ SUR-ROUTINE
4114	1304		TAR 000
4115	4705		JMP 0010
4116	3363		0010
4117	1306		TAR 000
4120	3302		0010
4121	4707	BACK,	JMP 0010
4122	4705		JMP 0010
4123	6034		0010
4124	1370		TAR 000
4125	7600		SWA 000
4126	5346		JMP 0010
4127	6034		0010
4130	2371		AND 070
4131	1372		TAR 000
4132	7600		SWA 000
4133	5321		JMP 0010
4134	1303		TAR 002
4135	7104		0010
4136	7006		0010
4137	3303		0010
4140	6034		0010
4141	1372		TAR 000
4142	1303		TAR 002
4143	3303		0010
4144	2302		ISZ 0010
4145	5321		JMP 0010
4146	1303	TERM,	TAR 002

```

4147 5713          /PRODUCT
4150 2000  CHM,          /CONSTANTS AND VARIABLES
4151 2000  CNT2,
4152 4315  LEADER, LDR
4153 2000  INT12,
4154 2000  FINE2,
4155 1177  M177, 177
4155 2277  M77, 77
4157 2277  T77, 77
4160 1016  HTYPE,  CITY PL-TYP
4161 3600  ENH11,  EP
4162 2000  TEMP1,
4163 2000  TEMP2,
4164 2247  M240, 24
4165 4301  TYPE2,  TY
4165 7774  PNA, 74
4167 4274  PADD, 70
4170 7403  M370, 2370
4171 1270  M270, 270
4172 7520  M240, 240
4173 1000  LUPH1,
4174 4346  LOGICAL,  AMBL
4175 2001  M1, 1
4176 2002
4177 2000
4200 2000
4201 2000
4202 2000
4203 2000
4204 2000  ADJND,  @@@@@@@@@@
4205 4243  B,  JMS RESET
4206 1350  TAB 0:PTR
4207 3600  DC 0
4208 4253  JMS 0:END
4211 4731  JMS 1:PRODUCT2
4212 3726  DC 1:TAB0
4213 1726  TAB 1:TAB0
4214 3333  DC 1:TEMP5
4215 1733  TAB 1:TEMP5
4216 3730  DC 1:TAB0
4217 1334  TAB 0:INST
4220 3733  DC 1:TEMP5
4221 3735  JMS 1:END2
4222 2000  PNTI1,          /FOUND BREAK-POINT
4223 3736  DC 1:ACC
4224 7004  BAL
4225 3737  DC 1:LINK2
4226 7240  STA
4227 1222  TAB 0:INIT
4228 3222  DC 0:INIT
4231 5775  JMS 1:LOCK
4232 4243  C,  JMS RESET
4233 1222  TAB 0:INIT
4234 7041  CIE
4235 4253  JMS 0:END
4236 1730  TAB 1:TAB0
4237 3622  DC 1:PNTI1
4240 3726  DC 1:TAB0
4241 1222  TAB 0:INIT

```

4242	5742		JMP I PLUS1
4243	0000	RESET,	?
4244	1325		TAB TAB0
4245	3326		EQ TAB0
4246	1327		TAB TAB0
4247	3332		CL TAB0
4250	1341		TAB TAB
4251	3302		EQ TAB4
4252	5643		JMP I RESET
4253	0000	FIND,	?
4254	3243		DOA RESET
4255	1243		TAB RESET
4256	1725		TAB TAB0
4257	7652		SWA SWA
4260	5653		JMP I FIND
4261	2326		IS7 TAB0
4262	2330		IS7 TAB0
4263	2332		IS7 TAB4
4264	5225		JMP .-7
4265	7402		HLT
4266	0000	LF,	?
4267	1342		TAB TAB0
4270	4301		JMP TYP
4271	1343		TAB TAB0
4272	4301		JMP TYP
4273	5666		JMP I LF
4274	0000	RD,	?
4275	6031		4SR
4276	5275		JMP .-1
4277	6236		KRP
4302	5674		JMP I RD
4301	0000	TYP,	?
4302	6241		1SR
4303	5302		JMP .-1
4304	6246		1LS
4305	7300		CLL CLL
4306	5701		JMP I TYP
4307	0000	HITYPE,	?
4310	6021		2SR
4311	5312		JMP .-1
4312	6246		PLC
4313	7307		CLL CLL
4314	5707		JMP I HITYPE
4315	0000	LDP,	?
4316	1344		TAB TAB
4317	3347		JCA PRODUCT
4320	1345		TAB TAB
4321	4746		JMP I UNSLOC
4322	2347		IS7 PRODUCT
4323	5348		JMP .-1
4324	5715		JMP I LDR
4325	4176	RTAB0,	ADPR
4326	4176	TAB0,	LDPR
4327	4365	RTAB0,	[var]
4330	4365	TAB0,	[var]
4331	4113	RDOUT2,	RUNOFF
4332	0000	CNT4,	?
4333	0000	TEMP5,	?
4334	4402	BRINST,	JMP I ?



CIABD	4540
CURLOC	3760
CI	4540
F	3643
DORE	4140
END	3622
ENDIT	4161
END2	4330
EXP	4532
F	4376
F10	3760
FIND	4250
FINDIT	4542
FIND2	4154
FPNT	4527
FRAMS	4377
GO	3674
GO2	4531
HERE	4462
HITYPE	4327
HORD	4530
HTYPE	4160
HYPH	3767
II	3630
INIT	3761
INIT2	4150
INST	4360
INST2	4620
JMSLOC	4340
L	3730
LDR	4310
LDRCAL	4174
LEADOT	4347
LEADER	4152
LEAD2	4544
LETR2	4547
LETTER	3777
LF	4260
LINK	3771
LINK2	4337
LOCA	4527
LOCB	4510
LOCBIN	4514
LOCC	4511
LOCD	4512
LOCJMP	3761
LOCM	4370
LOCPNT	4170
LOCS	4351
LOCS2	4560
LOOP1	3610
LOOP2	3650
LOOP3	3657
LOOP4	4232
LOOP5	4247
LOOP6	3710
LORD	4534
M	4410
MM4	4160
MI	4170

177	4155
226	4345
212	4345
215	4342
224	4164
276	4171
7	3756
77	4156
	3637
81A	4523
81B	4534
81C	4513
81D	4525
81E	4526
81F	4512
81G	4374
81H	3755
826	4172
831	3764
835	4170
84	3770
8/5	4344
C	3620
COCPAT	3725
COCTRD	3765
COUP	4525
OLNA	4517
OLNB	4526
OLNBIN	4523
OLNC	4521
OLND	4522
OLNTAD	4524
P	4213
PNTHT	4222
PNTHT	4530
PNTHT	4266
R	3676
RD	4274
RUNCT	4113
RUNCT2	4331
READ	3753
READ2	4167
RESET	4243
RES42	4516
RETLOC	4543
RETPT	4520
SN4	4341
TRPLUS1	4340
RSET	4541
SIABA	3760
SIABP	3762
SIABC	4325
SIABD	4327
224	3775
226	3776
77	4157
S	3671
SS	4472
SIABF	4526

SUM	4124
TARA	3761
TARB	3763
TARC	4326
TARD	4330
TEMP1	4162
TEMP2	4163
TEMP3	3773
TEMP4	3774
TEMP5	4333
TEMP	4146
TYR	4321
TYPE	3754
TYPE2	4165
TYRIT	4537
IPAR	4536

HEG2=5000  
 /JAMES ROITMAN ... JULY 6, 1967

/4 WORD PACKAGE  
 /ADDITIONS TO ODP TO HANDLE FLOATING  
 /POINT DEBUGGING. THIS PORTION IS  
 /PLACED BELOW THE FLOATING POINT  
 /PACKAGE. A FLOATING BREAKPOINT IS  
 /INTERPRETIVE 0017. COMMANDS IN THIS  
 /MODE ARE: B XXXX -BREAKPOINT, C -  
 /CONTINUE AFTER BREAKPOINT, REINSTATING  
 /TRAPPED INSTRUCTION, S-SINGLE STEP (OR  
 /EFFECTIVELY MOVE BREAKPOINT ONE AHEAD)  
 /AND M - JUMP BACK TO MACHINE MODE.  
 /ENTRY INTO FLOATING MODE IS EFFECTED BY  
 /THE COMMAND F IN NORMAL, MACHINE LANGUAGE  
 /DEBUGGING MODE. THE F COMMAND REPLACES THE  
 /FORMER J COMMAND IN ODP. IN F MODE, THE  
 /COMMANDS T, D, N, A, L, D, R, AND P HAVE THE SAME  
 /EFFECT AS IN M MODE.  
 XBFG2

5000	7300	CLL CLL	
5001	1307	TAR NEWA	/RESET POINTERS TO OPERATIONS TABLES
5002	3713	DCA I LUCA	/IN ODP TO POINT TO FLOATING DEBUGGER
5003	1310	TAR NEWB	
5004	3714	DCA I LUOB	
5005	1311	TAR NEWC	
5006	3715	DCA I LUCC	/RESET POINTERS IN ODP FOR A FLOATING
5007	1312	TAR NEWD	/BREAKPOINT TABLE
5010	3716	DCA I LUOD	
5011	1321	TAR NEWJMP	
5012	3722	DCA I RESM2	/MODIFICATION IN C INSTRUCTION IN ODP
5013	1317	TAR NEWBIN	/CHANGE BREAKPOINT INSTRUCTION TO 017
5014	3720	DCA I LUOBIN	
5015	5731	JMP I ODP	
		/M INSTRUCTION - SWITCH TO MACHINE MODE.	
		/THEREFORE ALL OLD POINTERS AND TABLES MUST	
		/BE REPLACED.	
5016	1323	M, TAR OLDA	
5017	3713	DCA I LUCA	
5020	1324	TAR OLDB	
5021	3714	DCA I LUOB	
5022	1325	TAR OLDC	
5023	3715	DCA I LUCC	
5024	1326	TAR OLDD	
5025	3716	DCA I LUOD	
5026	1327	TAR OLDBIN	
5027	3720	DCA I LUOBIN	
5030	1330	TAR OLDIAD	
5031	3722	DCA I RESM2	
5032	5731	JMP I ODP	
5033	0000	BRKPT, 0	/LOCATION OF RETURN FROM AN
5034	1732	TAR I FPNT	/INTERPRETIVE BREAK POINT
5035	3347	DCA STORE	
5036	1044	TAR 44	
5037	3335	DCA EXP	
5040	1045	TAR 45	

5041	3336	DCA	HORD	
5042	1046	TAN	46	
5043	3340	DCA	MIDDL	
5044	1047	TAN	47	
5045	3337	DCA	LORD	
5046	4741	JMS	I ORLF2	
5047	4406	JMS	I 6	
5050	1335	TAN	EXP	
5051	3044	DCA	44	
5052	1336	TAN	HORD	
5053	3045	DCA	45	
5054	1340	TAN	MIDDL	
5055	3046	DCA	46	
5056	1337	TAN	LORD	
5057	3047	DCA	47	
5060	7242	STA		
5061	1347	TAN	STORE	
5062	3734	DCA	I GU2	
5063	1734	TAN	I GU2	
5064	3733	DCA	I PNTHT	
5065	5200	JMP	REG2	
5066	1744	HERE,	TAN I CIABD	/RETURN FROM C ROUTINE IN ODP
5067	3337	DCA	LORD	
5070	1737	TAN	I LURD	
5071	7642	SZA	CLA /FETCH	INSTRUCTION.WAS IT FEXT?
5072	5633	JMP	I HRKPN1	/NO-RE-ENTER INTERPRETER
5073	1342	TAN	UPAK	/YES-ENTER M MODES.TYPE UP ARR0
5074	4743	JMS	I TYPIT	
5075	5216	JMP	M	/ENTER M MODE
5076	4745	SS,	JMS I RSET	/SINGLE STEP ROUTINE.RESET POINTER
5077	4746	JMS	I FINDIT	/FIND INSTRUCTION FROM GIVEN ADDRESS
5100	1350	TAN	RELOC	/CHANGE POINTER IN BREAKPOINT ROUTINE
5101	3751	DCA	I LEND2	
5102	1347	TAN	STORE	/INSERT BREAKPOINT AT NEXT REGISTER
5103	5752	JMP	I PPLUSB	/ENTER B ROUTINE
5104	1331	RETPNT,	TAN ODP	/RETURN FROM B, RESET POINTER TO END
5105	3751	DCA	I LEND2	
5106	5753	JMP	I CI	/ENTER CONTINUE ROUTINE
				/CONSTANTS AND POINTERS
5107	5154	NEWA,	LETR2	
5110	5170	NEWB,	LOCS2	
5111	5204	NEWC,	ADDR2	
5112	5213	NEWD,	INST2	
5113	4360	LOCA,	RTABA	
5114	4362	LOCB,	RTABB	
5115	4725	LOCC,	RTABC	
5116	4727	LOCD,	RTABD	
5117	0017	NEGBIN,	17	
5120	4734	LOCBIN,	BRINST	
5121	5774	NEWJMP,	5774	
5122	4641	RESM2,	RESET-2	
5123	4377	OLDA,	LETTER	
5124	4751	OLDB,	LOCS	
5125	4576	OLDC,	ADDR	
5126	4765	OLDP,	INST	
5127	4402	ULnBIN,	JMS I 2	
5130	1222	OLDTAB,	1222	
5131	4202	ODP,	END	
5132	5600	FPNT,	5600	
5133	4622	PNTHT,	PNTHT	



5134	5661	GO2,	56A1
5135	0200	EXP,	0
5136	0200	HOPD,	0
5137	0200	LOAD,	0
5140	0000	MINDL,	0
5141	4606	CRIF2,	LF
5142	0336	UPAR,	33A
5143	4701	TYBIT,	TYB
5144	4730	CTABD,	TABD
5145	4643	RSET,	RESET
5146	4653	FINUIT,	FINU
5147	0000	STORE,	0
5150	5104	RETLOC,	RETRAT
5151	4735	LEAD2,	END2
5152	4612	BPLUS,	B+5
5153	4632	CI,	C
5154	7467		
5155	7461		
5156	7462		
5157	7476		
5160	7477		
5161	7464		
5162	7474		
5163	7455	LETR2,	-311,-317,-316,-302,+301,-310,-304,-323
5164	7456		
5165	7475		
5166	7463		
5167	7462		
			-302,-303,-315,-320,
5170	4233		
5171	4226		
5172	4237		
5173	4605		
5174	4327		
5175	4333		
5176	4243		
5177	5076		
5200	4276		
5201	4632		
5202	5016		
5203	4413	LOAS2,	II,0,0,0,0,A,0,0,SS,R,C,M,P
5204	0000		
5205	0000		
5206	0000		
5207	0000		
5210	0000		
5211	0000		
5212	0000	ADnH2,	0,0,0,0,0,0,0,0
5213	0000		
5214	0000		
5215	0000		
5216	0000		
5217	0000		
5220	0000		
5221	0000	INS12,	0,0,0,0,0,0,0,0
		x6	
0006	7200		7200 / POINTER TO OUTPUT PACKAGE
0007	5600		5600
		x5707	
5/67	5033	BR4P01	/ INTERPRETATION TABLE OF PACKAGE

ASSEMBLY DEBUGGING PROGRAM - JAMES RUTHMAN 6/15/67

```

x4200
4200 6046      TLS
4201 6026      PLS
4202 4752     ENH,  JMS I ORLF
4203 4753      JMS I READ      /READ A NUMBER
4204 4754      JMS I TYPE
4205 1355     TAP R14 /RESET CONSTANTS
4206 3357     DCA CNT
4207 1360     TAP R1ABA
4208 3361     DCA TABA
4209 1362     TAP R1ABB
4210 3363     DCA TARB
4211 1763     LOOP1, TAP I TABB
4212 3337     DCA CHECK
4213 6034     KRS
4214 1761     TAP I TABA      /IDENTIFY REQUEST
4215 7650     SNA CLA
4216 5737     JMP I CHECK      /ENTER REQUESTED ROUTINE
4217 2361     IS7 TARA
4218 2363     IS7 TARB
4219 2357     IS7 CNT
4220 5213     JMP LOOP1
4221 5203     JMP END+1      /CAN'T IDENTIFY-READ AGAIN
4222 4765     U,      JMS I OUTRD      /OPEN INSTRUCTION
4223 3366     DCA CURLOC
4224 1766     TAP I CURLOC
4225 4305     JMS OCTPNT      /TYPE CONTENTS
4226 5202     JMP END
4227 4765     II,     JMS I OUTRD      /INSERT INSTRUCTION
4228 3766     DCA I CURLOC
4229 2366     IS7 CURLOC
4230 5202     JMP END
4231 2366     M,      IS7 CURLOC      /NEXT REGISTER REQUESTED
4232 1366     TAP CURLOC
4233 4305     JMS OCTPNT
4234 5230     JMP II-3
4235 4765     D,      JMS I OUTRD      /OCTAL DUMP REQUESTED
4236 3361     DCA INIT      /RECORD FIRST AND LAST
4237 4765     JMS I OUTRD      /OF REQUESTED REGISTERS
4238 7041     DIA FIN
4239 3363     DCA FIN
4240 4752     LOOP2, JMS I ORLF
4241 1361     TAP INIT
4242 4305     JMS OCTPNT
4243 1367     TAP HYPH
4244 4754     JMS I TYPE
4245 1370     TAP R4
4246 3357     DCA CNT
4247 1761     LOOP3, TAP I INIT      /OUTPUT 4 SEQUENTIAL REGISTER
4248 4305     JMS OCTPNT
4249 1361     TAP I-11      /FINISHED?
4250 1363     TAP FIN
4251 7650     SNA CLA
4252 5202     JMP END
4253 2361     IS7 INIT
4254 2357     IS7 CNT

```

4267	5257		JMP LOOP3	
4270	5250		JMP LOOP2	
4271	4765	S,	JMS I OUTRD	/START REQUESTED
4272	3361		DCA LUCJMP	
4273	4752		JMS I CRLF	
4274	7402	GO,	HLT	
4275	5761		JMP I LUCJMP	
4276	4765	R,	JMS I OUTRD	/RUN WITH PRESET AC
4277	3361		DCA LUCJMP	/AND LINK REQUESTED
4300	4752		JMS I CRLF	
4301	1371		TAB LINK	
4302	7110		CLI PAR	
4303	1372		TAB AC	
4304	5274		JMP GO	
4305	0000	UCTPNT,	0	/OCTAL PRINT SUB-ROUTINE
4306	3374		DCA TEMP4	
4307	1375		TAB R240	
4310	4754		JMS I TYPE	
4311	1370		TAB R4	
4312	3373		DCA TEMP3	
4313	1374	LOOP6,	TAB TEMP4	
4314	7104		CLI HAL	
4315	7006		RTL	
4316	3374		DCA TEMP4	
4317	1374		TAB TEMP4	
4320	7004		RAI	
4321	0356		AND R7	
4322	1376		TAB R260	
4323	4754		JMS I TYPE	
4324	2373		IS7 TEMP3	
4325	5313		JMP LOOP6	
4326	5705		JMP I OUTPNT	
4327	1372	A,	TAB AC	/AC REFERENCED
4330	4337		JMS CHECK	
4331	3372		DCA AC	/RE-INSERT AC
4332	5202		JMP END	
4333	1371	L,	TAB LINK	/LINK REFERENCED
4334	4337		JMS CHECK	
4335	3371		DCA LINK	/RE-INSERT LINK
4336	5202		JMP END	
4337	0000	CHECK,	0	/CHECK FOR INSERT REQUEST
4340	4305		JMS UCTPNT	
4341	4752		JMS I CRLF	
4342	4753		JMS I READ	
4343	4754		JMS I TYPE	
4344	6034		KRC	
4345	1364		TAB R311	
4346	7640		SZA CLA	
4347	5205		JMP END+3	/CONTINUE AS USUAL
4350	4765		JMS I OUTRD	
4351	5737		JMP I CHECK	
4352	4666	CHRF,	LF	/CONSTANTS AND VARIABLES
4353	4674	READ,	RD	
4354	4701	TYPE,	TYO	
4355	7764	N14,	-14	
4356	0007	M7,	7	
4357	0000	CNT,	0	
4360	4377	RTABA,	LETTER	
4361	4377	TARA,	LETTER	

4362	4751	RTABR,	LOPS
4363	4751	TARB,	LOPS
4364	7467	N311,	-311
4365	4513	DOYRD,	HDCST
4366	0000	CUALOC,	0
4367	0255	HYBM,	255
4370	7774	N4,	-4
4371	0000	LINK,	0
4372	0000	AC,	0
4373	0000	TEMP3,	0
4374	0000	TEMP4,	0
4375	0240	R240,	240
4376	0260	R260,	260
4377	7467		
4400	7461		
4401	7462		
4402	7476		
4403	7477		
4404	7464		
4405	7474	LETTER,	-311,-317,-316,-302,-301,-314,-304
4406	7455		
4407	7456		
4410	7475		
4411	7472		
4412	7460		-303,-322,-303,-306,-320
4413	3350	P,	DOA CHK /MEMORY PUNCH REQUESTED
4414	7402		HLT
4415	7604		LAS
4416	0375		AND R1
4417	7640		SZA LLA
4420	1360		TAN HTYPE
4421	1365		TAN TYPE2
4422	3373		DOA LDCPNT
4423	1373		TAN LDCPNT
4424	3774		DOA LDRCAL
4425	7402		HLT
4426	7604		LAS
4427	7041		CIA
4430	3351		DOA CNT2
4431	4752		JMS I LEADER
4432	7402	LOOP4,	HLT /RECORD FIRST AND LAST REGISTERS
4433	7604		LAS
4434	3353		DOA INIT2
4435	7402		HLT
4436	7604		LAS
4437	3354		DOA FIN 2
4440	1355		TAN R177
4441	3356		DOA R77
4442	7120		STI
4443	1353		TAN INIT2
4444	4206		JMS PRINT
4445	1357		TAN R77
4446	3356		DOA R77
4447	1753	LOOP5,	TAN I INIT2
4450	4206		JMS PRINT
4451	1353		TAN INIT2
4452	7041		CIA
4453	1354		TAN FIN 2

4454	7650		SWA CLA
4455	5260		JMP DONE
4456	2323		ISZ INIT2
4457	5247		JMP LOOP5
4460	2351	DONE,	ISZ INIT2
4461	5232		JMP LOOP4
4462	1350		TAB CHK
4463	4266		JMC PRINT
4464	4752		JMC T LEADER
4465	5761		JMP T ENDIT
4466	0000	PRINT,	0 /BINARY FORMAT PRINT
4467	3362		DCA TEMP1
4470	1362		TAB TEMP1
4471	7012		
4472	7012		
4473	7012		RTR,RTN,RTR
4474	0356		AND R77
4475	4304		JMS SUM
4476	4773		JMS I LUCPNT
4477	1362		TAB TEMP1
4500	0357		AND R77
4501	4304		JMS SUM
4502	4773		JMS I LUCPNT
4503	5666		JMP I PRINT
4504	0000	SUM,	0
4505	3363		DCA TEMP2
4506	1363		TAB TEMP2
4507	1350		TAB CHK
4510	3350		DCA CHK
4511	1363		TAB TEMP2
4512	5704		JMP I SUM
4513	0000	RDCNT,	0 /OCTAL READ SUB-ROUTINE
4514	1364		TAB 0000
4515	4705		JMS I TYPE2
4516	3363		DCA TEMP2
4517	1366		TAB 0000
4520	3362		DCA TEMP1
4521	4767	BACK,	JMS I READ2
4522	4765		JMS I TYPE2
4523	6034		KRS
4524	1370		TAB 0370
4525	7650		SWA CLA
4526	5346		JMP TERM
4527	6034		KRS
4530	0371		AND R270
4531	1372		TAB 0260
4532	7640		SZA CLA
4535	5321		JMP BACK
4534	1363		TAB TEMP2
4535	7104		CLI HAL
4536	7006		RTI
4537	3363		DCA TEMP2
4540	6034		KRS
4541	1372		TAB 0260
4542	1363		TAB TEMP2
4543	3363		DCA TEMP2
4544	2302		ISZ TEMP1
4545	5321		JMP BACK
4546	1363	TERM,	TAB TEMP2

4547	5713		JMP I RDOCT
4550	0000	CHK,	0 /CONSTANTS AND VARIABLES
4551	0000	CNT2,	0
4552	4715	LEADER,	LDR
4553	0000	INIT2,	0
4554	0000	FIN2,	0
4555	0177	M177,	177
4556	0077	M77,	77
4557	0077	R77,	77
4560	0006	HTYPE,	HTYPE-IYP
4561	4202	ENRIT,	ENR
4562	0000	TEMP1,	0
4563	0000	TEMP2,	0
4564	0240	M240,	240
4565	4701	TYPE2,	TYP
4566	7774	MN4,	-4
4567	4674	HEAD2,	RD
4570	7403	M375,	-375
4571	0270	M270,	270
4572	7520	M2A0,	-2A0
4573	0000	LUCHT,	0
4574	4746	LURCAL,	JMELUC
4575	0001	M1,	1
4576	0000		
4577	0000		
4600	0000		
4601	0000		
4602	0000		
4603	0000		
4604	0000	ADR,	0,0,0,0,0,0,0,0
4605	4243	D,	JMS RESET
4606	1350		TAR RHPNTR
4607	3002		DCR 0
4610	4253		JMS RHPD
4611	4751		JMS I RDOCT2
4612	3726		DCR I TABC
4613	1726		TAR I TABC
4614	3333		DCR TEMP5
4615	1703		TAR I TEMP5
4616	3730		DCR I TAHD
4617	1334		TAR --INST
4620	3733		DCR I TEMP5
4621	5735		JMP I END2
4622	0000	RNTHIT,	0 /FOUND BREAK-POINT
4623	3736		DCR I RUC
4624	7204		RAL
4625	3737		DCR I LINK2
4626	7240		STR
4627	1222		TAR RNTHIT
4630	3222		DCR RNTHIT
4631	5715		JMP I LUJM
4632	4243	D,	JMS RESET
4633	1222		TAR RNTHIT
4634	7441		DL
4635	4253		JMS RHPD
4636	1700		TAR I TAHD
4637	3622		DCR I RNTHIT
4640	3726		DCR I TABC
4641	1222		TAR RNTHIT

4642	5740		JMP I RPLUS1
4643	0000	RESET,	W
4644	1325		TAR RTAB0
4645	3326		DCA TAB0
4646	1327		TAR RTAB0
4647	3330		DCA TAB0
4650	1341		TAR CNT4
4651	3332		DCA CNT4
4652	5643		JMP I RESET
4653	0000	FIND,	W
4654	3243		DCA RESET
4655	1243		TAR RESET
4656	1726		TAR I TAB0
4657	7650		SNA CLA
4660	5653		JMP I FIND
4661	2326		IS7 TAB0
4662	2330		IS7 TAB0
4663	2332		IS7 CNT4
4664	5255		JMP .-7
4665	7402		HLT
4666	0000	LF,	W
4667	1342		TAR R212
4670	4301		JMS TYP
4671	1343		TAR R212
4672	4301		JMS TYP
4673	5666		JMP I LF
4674	0000	RD,	W
4675	6031		KSE
4676	5275		JMP .-1
4677	6036		KRE
4700	5674		JMP I RD
4701	0000	TYP,	W
4702	6041		TSE
4703	5302		JMP .-1
4704	6046		TLE
4705	7300		CLA CLL
4706	5701		JMP I TYP
4707	0000	HITYPE,	W
4710	6021		PSE
4711	5310		JMP .-1
4712	6026		PLR
4713	7300		CLA CLL
4714	5707		JMP I HITYPE
4715	0000	LDR,	W
4716	1344		TAR R75
4717	3347		DCA LEAUCT
4720	1345		TAR R000
4721	4746		JMS I JMSLOC
4722	2347		IS7 LEAUCT
4723	5320		JMP .-3
4724	5715		JMP I LDR
4725	4576	RTAB0,	ADDR
4726	4576	RTAB0,	ADDR
4727	4765	RTAB0,	INST
4730	4765	TAB0,	INST
4731	4513	RDOCT2,	RDOCT
4732	0000	CNT4,	W
4733	0000	TEMP5,	W
4734	4402	BRINST,	JMS I 2

4735	4202	END2,	END
4736	4372	ACC,	AC
4737	4371	LINK2,	LINK
4740	4277	RPIUS1,	P+1
4741	7771	RN4,	-7
4742	2215	M215,	215
4743	2212	M212,	212
4744	7634	N75,	-144
4745	2200	M200,	200
4746	0000	JMSLOC,	%
4747	0000	LEAUCT,	A
4750	4622	BRONTR,	PNTHT1
4751	4233		
4752	4226		
4753	4237		
4754	4605		
4755	4327		
4756	4333		
4757	4243		
4760	4271		
4761	4276		
4762	4632		
4763	4776		
4764	4413	LONS,	II,0,0,0,0,0,0,0,S,R,C,F,P
4765	0000		
4766	0000		
4767	0000		
4772	0000		
4771	0000		
4772	0000		
4773	0000	INSI,	0,0,0,0,0,0,0,0
4774	5066	HEW,	HEBE /POINTER TO CI ROUTINE
4775	5216	LUM,	M
4776	5777	F,	JMP FTRANS
4777	5000	FTRANS,	RE
		FIN=TAB	
		INTI=TAB	
		LUCJMP=TAB	

-----

A	4327
AC	4372
ACC	4736
ADDR	4576
ADDR2	5204
B	4605
BACK	4521
HEC2	5000
RPIUS5	5152
RPIINST	4734
RPIPNT	5233
RPIPTR	4750
C	4632
CHECK	4337
CHK	4550
CNT	4357
CNT2	4551
CNT4	4732
CRIF	4352
CRIF2	5141



CTABD	5144
CURLOC	4366
CI	5156
D	4243
DONE	4840
END	4212
ENDIT	4561
END2	4735
EXP	5135
F	4776
FIN	4363
FIND	4653
FINDIT	5146
FIN2	4554
FPNT	5132
FTRANS	4777
GO	4274
GO2	5134
HERE	2866
HITYPE	4767
HORG	5130
HIYPE	4560
HYPH	4367
II	4235
INIT	4361
INIT2	4553
INST	4765
INST2	5215
JMSLOC	4746
L	4335
LDR	4715
LDRCAL	4574
LEADCT	4747
LEADER	4552
LEND2	5151
LETR2	5154
LETTER	4377
LF	4646
LINK	4371
LINK2	4737
LOCA	5115
LOCB	5114
LOCBIN	5120
LOCC	5115
LOCD	5116
LOCJMP	4361
LOCM	4775
LOCPNT	4576
LOCS	4751
LOCS2	5176
LOCP1	4215
LOCP2	4250
LOCP3	4257
LOCP4	4432
LOCP5	4447
LOCP6	4315
LORD	5137
M	5416
MIDDL	2140
MN4	4566

MI	4575
M177	4595
M200	4745
M212	4745
M215	4742
M242	4564
M272	4571
M7	4356
M77	4556
M	4237
MEWA	5117
MEWB	5110
MEWBIN	5117
MEMC	5111
MEMD	5112
MEMUMP	5121
MEMR	4774
M14	4355
M266	4572
M311	4364
M375	4570
M4	4370
M75	4744
M	4226
MOCTPNT	4305
MOCTRD	4365
MOCP	5131
OLPA	5123
OLPB	5124
OLPBIN	5127
OLPC	5125
OLPD	5126
OLPTAD	5130
P	4413
PNTHT	4622
PNTHT	5135
PRIVT	4460
P	4270
PU	4674
RUOCT	4513
RUCCT2	4731
READ	4353
READ2	4567
REGET	4643
RES42	5122
RETLOG	5150
RETPNT	5104
RN4	4741
RPLUS1	4740
RSET	5145
RTABA	4340
RTABR	4362
RTABO	4725
RTABD	4727
R242	4375
R266	4376
R77	4557
S	4271
SS	5276

STORE	5147
SUM	4574
TARA	4361
TARB	4363
TARC	4726
TARD	4730
TEMP1	4562
TEMP2	4563
TEMP3	4373
TEMP4	4374
TEMP5	4733
TERM	4546
TYP	4771
TYPE	4354
TYPE2	4563
TYBIT	5143
UPAR	5142
D	

/ADDITIONS TO CDP FOR FLOATING EXAMINATION AND  
 /MODIFICATION. 3 WORD PACKAGE.  
 /JAMES ROTHMAN JULY 27, 1967

```

*3530          OUTPUT=11          /ADDITIONS TO ODP FOR EXAMINING AND
                INPUT=12          /MODIFYING FLOATING POINT NUMBERS
3530  4774  EX,   JMS I OCTRD      /EXAMINE INSTRUCTION
3531  3370          DCA TEMP
3532  4407          JMS I 7
3533  6371          FPUT TEMP2     /SAVE FAC
3534  5770          FGET I TEMP
3535  0011          OUTPUT
3536  5371          FGET TEMP2
3537  0000          FEXT
3540  5776          JMP I BEG
3541  4407  IN,   JMS I 7 /INSERT INSTRUCTION
3542  6371          FPUT TEMP2
3543  0012          INPUT
3544  6770          FPUT I TEMP
3545  5371          FGET TEMP2
3546  0000          FEXT
3547  1367          TAD P4
3550  1370          TAD TEMP        /NEXT FLOATING NUMBER
3551  3370          DCA TEMP
3552  5776          JMP I BEG
3553  1367  NEXT, TAD P4 /EXAMINE NEXT
3554  1370          TAD TEMP
3555  3370          DCA TEMP
3556  1370          TAD TEMP
3557  4775          JMS I OCTPNT    /PRINT ADDRESS
3560  5332          JMP EX+2
3561  0000  IPUT, 0 /CHECK AND CALL INPUT
3562  4405          JMS I 5
3563  1060          TAD 60         /VALID INPUT?
3564  7650          SNA CLA
3565  5362          JMP .-3 /NO. TRY AGAIN.
3566  5761          JMP I IPUT     /YES. EXIT.

```

/CONSTANTS AND POINTERS FOR ADDITIONS.

3567	0003	P4,	3	
3570	0000	TEMP,	0	
3571	0000			
3572	0000			
3573	0000	TEMP2,	0:0:0	/TEMP. FAC STORAGE
3574	4113	OCTRD,	4113	
3575	3705	OCTPNT,	3705	
3576	3602	BEG,	3602	
		*4563		/MODIFICATIONS TO ADDRESS TABLE IN ODP
4563	3541		IN	
4564	3530		EX	
4565	3553		NEXT	
		*4550		/COMMAND TABLE IN ODP
4550	7473		-305	/CHANGE 0 TO E
		*6555		/INTERPRETATION TABLE IN PACKAGE
6555	7200		7200	/FLOATING OUTPUT
6556	3561		IPUT	/FLOATING INPUT

BEG	3576
EX	3530
IN	3541
INPUT	0012
IPUT	3561
NEXT	3553
OCTPNT	3575
OCTRD	3574
OUTPUT	0011
P4	3567
TEMP	3570
TEMP2	3571

/ADDITIONS TO CDP FOR FLOATING EXAMINATION AND  
/MODIFICATION. 4 WORD PACKAGE.

/JAMES ROTHMAN JULY 27, 1967

```
*4130 /ADDITIONS TO ODP FOR EXAMINING AND
      OUTPUT=11 /MODIFYING FLOATING POINT NUMBERS
      INPUT=12

4130 4775 EX,   JMS I OCTRD /EXAMINE INSTRUCTION
4131 3370      DCA TEMP
4132 4407      JMS I 7
4133 6371      FPUT TEMP2 /SAVE FAC
4134 5770      FGET I TEMP
4135 0011      OUTPUT
4136 5371      FGET TEMP2
4137 0000      FEXT
4140 5777      JMP I BEG
4141 4407 IN,   JMS I 7 /INSERT INSTRUCTION
4142 6371      FPUT TEMP2
4143 0012      INPUT
4144 6770      FPUT I TEMP
4145 5371      FGET TEMP2
4146 0000      FEXT
4147 1367      TAD P4
4150 1370      TAD TEMP /NEXT FLOATING NUMBER
4151 3370      DCA TEMP
4152 5777      JMP I BEG
4153 1367 NEXT, TAD P4 /EXAMINE NEXT
4154 1370      TAD TEMP
4155 3370      DCA TEMP
4156 1370      TAD TEMP
4157 4776      JMS I OCTPNT /PRINT ADDRESS
4160 5332      JMP EX+2
4161 0000 IPUT, 0 /CHECK AND CALL INPUT
4162 4405      JMS I 5
4163 1061      TAD 61 /VALID INPUT?
4164 7650      SNA CLA
4165 5362      JMP .-3 /NO. TRY AGAIN.
4166 5761      JMP I IPUT /YES. EXIT.
      /CONSTANTS AND POINTERS FOR ADDITIONS.
4167 0004 P4, 4
```

4170	0000	TEMP,	0	
4171	0000			
4172	0000			
4173	0000			
4174	0000	TEMP2,	0;0;0;0	/TEMP. FAC STORAGE
4175	4513	OCTRD,	4513	
4176	4305	OCTPNT,	4305	
4177	4202	BEG,	4202	
		*5170		/MODIFICATIONS TO ADDRESS TABLE IN ODP
5170	4141			IN
5171	4130			EX
5172	4153			NEXT
		*5155		/COMMAND TABLE IN ODP
5155	7473		-305	/CHANGE O TO E
		*5761		/INTERPRETATION TABLE IN PACKAGE
5761	7200		7200	/FLOATING OUTPUT
5762	4161		IPUT	/FLOATING INPUT

BEG	4177
EX	4130
IN	4141
INPUT	0012
IPUT	4161
NEXT	4153
OCTPNT	4176
OCTRD	4175
OUTPUT	0011
P4	4167
TEMP	4170
TEMP2	4171