



DECUS

PROGRAM LIBRARY

DECUS NO.	8/85-83 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 XXX 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

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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

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7066	5256		JMP LOOP3	
7067	5247		JMP LOOP2	
7070	4764	S,	JM# I OCTRD	/START REQUESTED
7071	3361		DCA LOCJMP	
7072	4752		JM# I CRLF	
7073	7402	GO,	HLT	
7074	5761		JMP I LOCJMP	
7075	4764	R,	JM# I OCTRD	/RUN WITH PRESET AC
7076	3361		DCA LOCJMP	/AND LINK REQUESTED
7077	4752		JM# 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		JM# 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		ANN M7	
7121	1375		TAN R260	
7122	4754		JM# 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		JM# CHECK	
7131	3371		DCA AC	/RE-INSERT AC
7132	5201		JMP END	
7133	1370	L,	TAN LINK	/LINK REFERENCED
7134	4337		JM# CHECK	
7135	3370		DCA LINK	/RE-INSERT LINK
7136	5201		JMP END	
7137	0000	CHECK, 0		/CHECK FOR INSERT REQUEST
7140	4304		JM# OCTPNT	
7141	4752		JM# I CRLF	
7142	4753		JM# I READ	
7143	4754		JM# I TYPE	
7144	6034		KR#	
7145	1377		TAN N311	
7146	7640		SZA CLA	
7147	5204		JMP END+3	/CONTINUE AS USUAL
7150	4764		JM# I OCTRD	
7151	5737		JM# I CHECK	
7152	7466	CRLF,	LF	/CONSTANTS AND VARIABLES
7153	7474	READ,	RD	
7154	7501	TYPE,	TY#	
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	UCTRD,	RDOCT
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	5262		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 /CONSTANTS AND VARIABLES
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,	TYB
7366	7774	MN4,	-4
7367	7474	READ2,	RD
7370	7403	N375,	-375
7371	0270	M270,	270
7372	7520	N260,	-260
7373	0000	LOCPNT,	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 Y 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		RA1
7425	3737		DCA I LINK2
7426	7240		STA
7427	1222		TAN PNTHIT
7430	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		TL9
7505	7300		CLA CLL
7506	5701		JMP I TYP
7507	0000	HITYPE,	0
7510	6021		PSF
7511	5310		JMP .-1
7512	6026		PL9
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

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7534 4402 BRINST, JMS I 2
7535 7001 END2, ENP
7536 7171 ACC, AC
7537 7170 LINK2, LINK
7540 7076 RPLUS1, R+1
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 LOC5, 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    7530
ADDR   7370
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    7165

```


FIND	7453
FIN2	7354
GO	7073
HITYPE	7507
HTYPE	7360
HYPH	7160
II	7032
INIT	7161
INIT2	7353
INST	7562
J	7126
JMSLOC	7546
L	7133
LDR	7512
LDRCAL	7374
LEADCT	7547
LEADER	7352
LETTER	7177
LF	7460
LINK	7170
LINK2	7537
LOCJMP	7161
LOCPNT	7373
LOCS	7551
LOOP1	7012
LOOP2	7047
LOOP3	7050
LOOP4	7232
LOOP5	7247
LOOP6	7112
MN4	7366
M1	7375
M177	7352
M200	7542
M212	7543
M215	7542
M240	7364
M270	7371
M6000	7170
M7	7150
M77	7356
N	7036
N14	7152
N260	7372
N311	7177
N375	7370
N4	7167
N75	7544
O	7022
OCTPNT	7104
OCTRD	7164
P	7213
PNTHT	7422
PRINT	7260
R	7072
RD	7474
RDOCT	7313
RDOCT2	7531
READ	7153
READ2	7367

RESET	7445
RN4	7541
RPLUS1	7540
RTABA	7160
RTABB	7162
RTABC	7525
RTABD	7527
R240	7174
R260	7175
R77	7357
S	7070
SUM	7304
TABA	7161
TABB	7163
TABC	7526
TABD	7530
TEMP1	7362
TEMP2	7365
TEMP3	7172
TEMP4	7173
TEMP5	7533
TERM	7346
TYP	7501
TYPE	7154
TYPE2	7365

D

/3 WORD PARAGRAPH
 /JAMES ROJAN ... 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 OLL	
4401	1303		TAR FENA	/RESET POINTERS TO OPERATIONS TABLES
4402	3707		DCM T LUCA	/IN ODP TO POINT TO FLOATING DEBUGGER
4403	1304		TAR FENB	
4404	3710		DCM I LUOB	
4405	1305		TAR FENC	
4406	3711		DCM I LUCC	/RESET POINTERS IN ODP FOR A FLOATING
4407	1306		TAR FEND	/BREAKPOINT TABLE
4408	3712		DCM I LUOD	
4409	1315		TAR FENJMP	
4410	3716		DCM I RESR2	/MODIFICATION IN C INSTRUCTION IN ODP
4411	1313		TAR FENBIN	/CHANGE BREAKPOINT INSTRUCTION TO #01
4412	3714		DCM I LUOBIN	
4413	5725		JMP I ODP	
			/M INSTRUCTION - SWITCH TO MACHINE MODE.	
			/THEREFORE ALL OLD POINTERS AND TABLES MUST	
			/BE REPLACED.	
4416	1317	M,	TAR FLDA	
4417	3707		DCM I LUCA	
4420	1320		TAR FLDB	
4421	3710		DCM I LUOB	
4422	1321		TAR FLDC	
4423	3711		DCM I LUCC	
4424	1322		TAR FLDD	
4425	3712		DCM I LUOD	
4426	1323		TAR FLDBIN	
4427	3714		DCM I LUOBIN	
4430	1324		TAR FLDBAL	
4431	3716		DCM I RESR2	
4432	5725		JMP I ODP	
4433	0000	BRKPT,		/LOCATION OF RETURN FROM AN
4434	1727		TAR I FPNT	/INTERPRETIVE BREAK POINT
4435	3326		DCM STORE	
4436	1044		TAR 44	
4437	3332		DCM 640	
4440	1045		TAR 45	

4441	3333	DOF LORU	
4442	1046	TAF 46	
4443	3334	DOF LORU	
4444	4735	JMS I ORLF2	
4445	4406	JMS I 6	
4446	1332	TAF EXP	
4447	3044	DOF 44	
4450	1333	TAF LORU	
4451	3045	DOF 45	
4452	1334	TAF LORU	
4453	3046	DOF 46	
4454	7242	STP	
4455	1326	TAF STONE	
4456	3731	DOF I GUP	
4457	1731	TAF I GUP	
4460	3732	DOF I PNTHT	
4461	5240	JMP REG4	
4462	1742	REJ2, TAF I CIAHD	/RETURN FROM C ROUTINE IN ODP
4463	3334	DOF LORU	
4464	1734	TAF I LORU	
4465	7642	SZA MIA	/FETCH INSTRUCTION, WAS IT FEXT?
4466	5633	JMP I BRKPN1	/NO-RE-ENTER INTERPRETER
4467	1336	TAF UPAR	/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 POINTER
4473	4742	JMS I FINDI1	/FIND INSTRUCTION FROM GIVEN ADDRESS
4474	1343	TAF SETLOC	/CHANGE POINTER IN BREAKPOINT ROUTINE
4475	3744	DOF I LEND2	
4476	1326	TAF STONE	/INSERT BREAKPOINT AT NEXT REGISTER
4477	5745	JMP I RPLUS5	/ENTER B ROUTINE
4500	1325	RETPNT, TAF JMR	/RETURN FROM B, RESET POINTER TO END
4501	3744	DOF I LEND2	
4502	5746	JMP I C1	/ENTER CONTINUE ROUTINE
/CONSTANTS AND POINTERS			
4503	4547	NEWA, LETR0	
4504	4563	NEWB, L0-S0	
4505	4577	NEWC, ADDR0	
4506	4606	NEWD, IN012	
4507	3707	L0A, RT00	
4508	3762	L0B, RT05	
4509	4325	L0C, RT01	
4510	4327	L0D, RT01	
4511	4017	NEWBIN, 17	
4514	4334	LOCBIN, BRKST	
4515	5774	NEWJMP, 5774	
4516	4241	REEM2, RESET-2	
4517	3777	OLNA, LET10R	
4520	4351	OLNB, L0A6	
4521	4176	OLNC, ADDR4	
4522	4365	OLND, IN01	
4523	4402	OLNDIN, JMS I 2	
4524	1222	OLNIA0, 1222	
4525	3642	ODP, END	
4526	4000	STONE, 7	
4527	5600	FPNT, 5600	
4530	4222	PNTHT, PNTHT	
4531	5605	GPC, 5600	
4532	4200	EXP, 7	

4533	4600	HURU,	A
4534	4602	LURU,	A
4535	4206	ORIF2,	LF
4536	4336	UPAN,	336
4537	4341	TYBIT,	TYE
4540	4338	UTABU,	TABU
4541	4243	RSEI,	RESEI
4542	4253	FINDII,	FIND
4543	4500	RETL00,	RETR01
4544	4335	LEAD2,	ENTR
4545	4212	BPIUSB,	R+E
4546	4232	CI,	C
4547	7467		
4550	7461		
4551	7462		
4552	7476		
4553	7477		
4554	7464		
4555	7474		
4556	7455	LETR2,	-311,-312,-316,-302,+301,-314,-304,-323
4557	7456		
4558	7475		
4561	7463		
4562	7468		
			-322,-303,-315,-320,
4563	3633		
4564	3626		
4565	3637		
4566	4205		
4567	3727		
4570	3733		
4571	3643		
4572	4472		
4573	3676		
4574	4232		
4575	4416		
4576	4013	LONS2,	II.....A..Lg,SS,R,C,M,P
4577	0000		
4600	0000		
4601	0000		
4602	0000		
4603	0000		
4604	0000		
4605	0000	ADnk2,	0,0,0,0,0,0,0,0
4606	0000		
4607	0000		
4610	0000		
4611	0000		
4612	0000		
4613	0000		
4614	0000	INST2,	0,0,0,0,0,0,0,0
		x6	
7206	7207		7200 POINTER TO OUTPUT PACKAGE
		x6563	
6563	4433		PRINT INTERPRETATION TABLE OF PACKAGE

CONTROL DEBUGGING PROGRAM - JAMES RUTHMAN 6/15/67

```

X3A00
3640 6046 TLo
3641 6046 RLS
3642 4752 ENO, JMS I CHLF
3643 4723 JMS I READ /READ A NUMBER
3644 4724 JMS I TYPE
3645 1355 TAB #14 /RESET CONSTANTS
3646 3357 DCA CNT
3647 1361 TAB #T434
3648 3361 DCA TARA
3649 1362 TAB #T43B
3650 3363 DCA TABB
3651 1763 LOOP1, TAB # TABB
3652 3357 DCA CHECK
3653 6044 KRF
3654 1761 TAB # TABA /IDENTIFY REQUEST
3655 7652 SNA #LA
3656 5737 JMS I CHECK /ENTER REQUESTED ROUTINE
3657 2361 ISZ TARA
3658 2363 ISZ TABB
3659 2357 ISZ CNT
3660 5213 JMP LOOP1
3661 5203 JMP END*1 /CAN'T IDENTIFY*READ AGAIN
3662 4705 O, JMS I DCTRD /OPEN INSTRUCTION
3663 3366 DCA CURLOC
3664 1766 TAB # CURLOC
3665 4305 JMS DCTPNT /TYPE CONTENTS
3666 5202 JMP END
3667 4765 II, JMS I DCTRD /INSERT INSTRUCTION
3668 3766 DCA # CURLOC
3669 2366 ISZ CURLOC
3670 5202 JMP END
3671 2366 N, ISZ CURLOC /NEXT REGISTER REQUESTED
3672 1366 TAB CURLOC
3673 4305 JMS DCTPNT
3674 5232 JMP II-3

3675 4765 O, JMS I DCTRD /OCTAL DUMP REQUESTED
3676 3361 DCA # I1 /RECORD FIRST AND LAST
3677 4765 JMS I DCTRD /OF REQUESTED REGISTERS
3678 7041 CIL
3679 3363 DCA # I1
3680 4752 LOOP2, JMS I CHLF
3681 1361 TAB # I1
3682 4305 JMS DCTPNT
3683 1367 TAB # I1
3684 4754 JMS I TYPE
3685 1370 TAB #4
3686 3357 DCA CNT
3687 1761 LOOP3, TAB # INIT /OUTPUT 4 SEQUENTIAL REGISTER
3688 4305 JMS DCTPNT
3689 1361 TAB # I1 /FINISHED?
3690 1363 TAB # I1
3691 7652 SNA #LA
3692 5202 JMP END
3693 2361 ISZ I1
3694 2327 ISZ CNT

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3667	5257		JMP L00P5	
3670	5250		JMP L00P2	
3671	4765	S,	JMP L00TRD	/START REQUESTED
3672	3361		DOZ L00JMP	
3673	4752		JMS L00LF	
3674	7402	GO,	PLT	
3675	5761		JMP L00JMP	
3676	4765	R,	JMP L00TRD	/RUN WITH PRESET AC
3677	3361		DOZ L00JMP	/AND LINK REQUESTED
3700	4752		JMS L00LF	
3701	1371		TAB LINK	
3702	7110		OLI 54R	
3703	1372		TAB AC	
3704	5274		JMP 00	
3705	2000	00TPNT,	00TPNT,	/SOCIAL PRINT SUB-ROUTINE
3706	3374		DOZ TEMP4	
3707	1375		TAB 0040	
3710	4754		JMS L00TYPE	
3711	1370		TAB 0A	
3712	3373		DOZ TEMP3	
3713	1374	L00P6,	TAB TEMP4	
3714	7104		OLI 0AL	
3715	7006		RTI	
3716	3374		DOZ TEMP4	
3717	1374		TAB TEMP4	
3720	7004		RAI	
3721	6356		AND 07	
3722	1376		TAB 0260	
3723	4754		JMS L00TYPE	
3724	2373		157 TEMP3	
3725	5313		JMP L00P6	
3726	5705		JMP L00TPNT	
3727	1372	A,	TAB 00	/AC REFERENCED
3730	4337		JMS 0000K	
3731	3372		DOZ 00	/RE-INSERT AC
3732	5202		JMP 00P	
3733	1371	L,	TAB LINK	/LINK REFERENCED
3734	4337		JMS 0000K	
3735	3371		DOZ LINK	/RE-INSERT LINK
3736	5202		JMP 00P	
3737	0000	CHECK,	CHECK,	/CHECK FOR INSERT REQUEST
3740	4305		JMS 00TPNT	
3741	4752		JMS L00LF	
3742	4753		JMS L00READ	
3743	4754		JMS L00TYPE	
3744	6034		KHS	
3745	1364		TAB 0311	
3746	7640		SZ 00L	
3747	5205		JMP 00P+3	/CONTINUE AS USUAL
3750	4765		JMP L00TRD	
3751	5737		JMS L00CHECK	
3752	4256	00P6,	LF	/CONSTANTS AND VARIABLES
3753	4274	READ,	RD	
3754	4301	TYPE,	TYE	
3755	7764	014,	014	
3756	2007	07,	07	
3757	0000	00P6,	00P6	
3760	3777	RTAB,	LETTER	
3761	3777	TAB,	LETTER	

3762	4321	RTAB,	LUNB
3763	4321	TAB,	LUNB
3764	7467	IS11,	-311
3765	4113	OUTR,	REPT
3766	2222	QUPLAG,	
3767	2225	HYPO,	258
3770	7774	14,	-4
3771	2222	L1PA,	
3772	2222	40,	
3773	2222	TEMP3,	
3774	2222	TEMP4,	
3775	2242	X242,	241
3776	2252	X240,	26
3777	7467		
4002	7461		
4001	7462		
4002	7476		
4003	7477		
4004	7464		
4005	7474	LETTER,	-301,-312,-316,-322,+331,-314,-304
4006	7455		
4007	7425		
4010	7475		
4011	7472		
4012	7401		-323,-322,-323,-326,-324
4013	3327	P,	NO OF MEMORY PUNCH REQUESTED
4014	7472		HLT
4015	7604		LAF
4016	2375		4001
4017	7547		S4001A
4020	1302		TAB TYPE
4021	1305		TAB TYPE2
4022	3373		DOE COMMENT
4023	1373		TAB FORMAT
4024	3774		NOE INITIAL
4025	7402		HLT
4026	7604		LAF
4027	7041		01A
4030	3321		NOE INIT
4031	4722		NOE LEADER
4032	7402	LUNF4,	HLT /RECORD FIRST AND LAST REGISTERS
4033	7604		LAF
4034	3323		NOE INIT
4035	7402		HLT
4036	7604		LAF
4037	3324		NOE INIT
4040	1325		TAB TYPE
4041	3326		DOE INIT
4042	7122		ST
4043	1323		TAB INIT
4044	4266		NOE PRINT
4045	1327		TAB INIT
4046	3326		DOE INIT
4047	1723	LUNF5,	TAB INIT
4050	4266		NOE PRINT
4051	1323		TAB INIT
4052	7041		01A
4053	1324		TAB INIT

4054	7653		SNL	DLA
4055	5202		UMP	TYPE
4056	2323		ISZ	DLT12
4057	5247		UMP	DLT12
4060	2321	NAME,	ISZ	DLT12
4061	5232		UMP	DLT14
4062	1352		TAR	DLK
4063	4266		UMP	DLT12
4064	4752		UMP	DLT12
4065	5701		UMP	DLT12
4066	2322	PRINT,	ISZ	DLT12
4067	3362		UMP	DLT12
4070	1302		TAR	DLT12
4071	7012			
4072	7012			
4073	7012		RTN	DLT12
4074	2326		ALG	DLT12
4075	4324		UMP	DLT12
4076	4773		UMP	DLT12
4077	1362		TAR	DLT12
4100	2327		ALG	DLT12
4101	4324		UMP	DLT12
4102	4773		UMP	DLT12
4103	5666		UMP	DLT12
4104	2322	SUM,	ISZ	DLT12
4105	3363		UMP	DLT12
4106	1363		TAR	DLT12
4107	1352		TAR	DLT12
4110	3353		UMP	DLT12
4111	1363		TAR	DLT12
4112	5744		UMP	DLT12
4113	2327	RDOUT,	ISZ	DLT12
4114	1364		TAR	DLT12
4115	4765		UMP	DLT12
4116	3363		UMP	DLT12
4117	1366		TAR	DLT12
4120	3362		UMP	DLT12
4121	4767	BADR,	UMP	DLT12
4122	4765		UMP	DLT12
4123	6034		UMP	DLT12
4124	1372		TAR	DLT12
4125	7653		SNL	DLA
4126	5346		UMP	DLT12
4127	6034		UMP	DLT12
4130	2371		ALG	DLT12
4131	1372		TAR	DLT12
4132	7642		SNL	DLA
4133	5321		UMP	DLT12
4134	1363		TAR	DLT12
4135	7144		UMP	DLT12
4136	7006		UMP	DLT12
4137	3363		UMP	DLT12
4140	6034		UMP	DLT12
4141	1372		TAR	DLT12
4142	1363		TAR	DLT12
4143	3363		UMP	DLT12
4144	2362		ISZ	DLT12
4145	5321		UMP	DLT12
4146	1363	TERM,	TAR	DLT12

Address	Hex	Label	Symbol
4147	5713		END PRODUCT
4150	2000	CHK,	/CONSTANTS AND VARIABLES
4151	2000	CNT2,	
4152	4315	LEADER,	LD
4153	2000	INIT2,	Y
4154	2000	FIN2,	Y
4155	1177	M177,	177
4155	2277	M277,	77
4157	2277	M77,	77
4160	1606	HTYPE,	HTYPE-LYP
4161	3602	ENR1,	EN
4162	2000	TEMP1,	
4163	2000	TEMP2,	
4164	2247	M240,	24
4165	4301	TYPE2,	LY
4165	7774	ENV,	74
4167	4274	REND2,	70
4170	7403	M370,	370
4171	2270	M270,	270
4172	7520	M260,	260
4173	1000	LUNP1,	
4174	4346	UBOVAL,	UMBL
4175	2001	M1,	1
4176	2002		
4177	2000		
4200	2000		
4201	2000		
4202	2000		
4203	2000		
4204	2000	ADDD,	ADDD
4205	4243	JMS	RESET
4206	1350	TAR	TAR
4207	3702	DC	DC
4208	4253	JMS	FIN2
4211	4731	JMS	PRODUCT2
4212	3726	DC	TAR0
4213	1726	DC	TAR0
4214	3333	DC	TEMP5
4215	1733	DC	TEMP5
4216	3733	DC	TAR0
4217	1334	DC	TEMP5
4220	3733	DC	TEMP5
4221	3735	JMS	FIN2
4222	2000	PNTHIT,	/FOUND BREAK-POINT
4223	3736	DC	TAR0
4224	7004	RAI	
4225	3737	DC	LINK2
4226	7240	STA	
4227	1222	TAR	PNTHIT
4230	3222	DC	PNTHIT
4231	5775	JMS	LOCN
4232	4243	JMS	RESET
4233	1222	TAR	PNTHIT
4234	7041	DI	
4235	4253	JMS	FIN2
4236	1730	DC	TAR0
4237	3622	DC	PNTHIT
4240	3726	DC	TAR0
4241	1222	TAR	PNTHIT

4242	5742		JMP L PLUS1
4243	0202	RESET,	?
4244	1325		TAB TABC
4245	7326		FC F1A0
4246	1327		TAB TABD
4247	3332		DC CNT4
4250	1341		TAB TAB
4251	7332		DC CNT4
4252	5643		JMP L RESET
4253	0202	FIXD,	?
4254	7243		DC RESET
4255	1243		TAB RESET
4256	1726		TAB TABC
4257	7652		SWB SWA
4260	5623		IMP L F1ND
4261	2326		IS7 TABD
4262	2332		IS7 TABD
4263	2332		IS7 CNT4
4264	5225		JMP L-7
4265	7422		HLT
4266	0202	LF,	?
4267	1342		TAB TABD
4270	4301		JMP LYP
4271	1343		TAB TABE
4272	4301		JMP LYP
4273	5666		JMP L LF
4274	0202	RD,	?
4275	6231		ASB
4276	5275		JMP L-1
4277	6236		ASB
4300	5674		JMP L LF
4301	2242	TYP,	?
4302	6241		TSB
4303	5302		JMP L-1
4304	6246		TSB
4305	7300		CLF VLL
4306	5701		JMP L TYP
4307	0202	HITYPE,	?
4310	6221		ASB
4311	5312		JMP L-1
4312	6226		PLC
4313	7307		CLF VLL
4314	5707		JMP L HITYPE
4315	0202	LDO,	?
4316	1344		TAB TAB
4317	3347		DC TABDUCT
4320	1345		TAB TAB
4321	4746		JMP L UNSLOD
4322	2347		IS7 TABDUCT
4323	5322		JMP L-1
4324	5715		JMP L LDR
4325	4176	RTABD,	ASB
4326	4176	TABD,	LDN
4327	4365	RTABD,	LDN
4330	4365	TABD,	LDN
4331	4113	RDUCT2.	RDUCT
4332	0202	CNT4,	?
4333	0202	TEMP5,	?
4334	4402	BRINST.	JMP L-2

4335	3662	END 2,	END
4336	3772	ADD,	ADD
4337	3771	LINK2,	LINK
4340	3677	RPLUS1,	RPL
4341	7771	RMA,	R
4342	0215	M215,	215
4343	0212	M212,	212
4344	7634	M76,	76
4345	0200	M200,	200
4346	0204	JMRLD,	JMRLD
4347	0000	LEAD01,	LEAD01
4350	4222	BRINTA,	BRINTA
4351	3633		
4352	3626		
4353	3637		
4354	4205		
4355	3727		
4358	3733		
4357	3643		
4360	3671		
4361	3676		
4362	4232		
4363	4376		
4364	4010	LU'S,	LU'S
4365	0000		
4366	0000		
4367	0000		
4370	0000		
4371	0000		
4372	0000		
4373	0000	INCL,	INCL
4374	4460	HEB,	HEB
4375	4416	LUOM,	LUOM
4376	5777	FR,	FR
4377	4402	FTABS,	FTABS
		FIX=TAB	
		INTI=TAB	
		LUNUMP=TAB	

.....

A	3727
AC	3772
ACC	4336
ADDR	4170
ADDR2	4577
B	4205
BACK	4121
BEQ2	4400
RPLUS5	4540
BRINST	4334
BRXPNY	4430
BRPNTR	4350
C	4232
CHECK	3737
CHK	4150
CNT	3757
CNT2	4151
CNT4	4332
DRIF	3752
DRIF2	4530

CIABD	4540
CURLOC	3760
CI	4540
CI	3643
DORE	4740
END	3672
ENDIT	4161
END2	4330
EXP	4532
F	4370
FIN	3763
FIND	4253
FINDIT	4542
FIN2	4154
FPNT	4527
FRAMS	4377
GO	3674
GU2	4531
HERE	4462
HITYPE	4377
HORD	4530
HITYPE	4160
HYPH	3767
II	3633
INIT	3761
INIT2	4153
INST	4360
INST2	4626
JMSLOC	4340
L	3733
LDR	4310
LDRCAL	4174
LEADDT	4347
LEADER	4152
LEAD2	4544
LETR2	4547
LETTER	3777
LF	4260
LINK	3771
LINK2	4337
LONA	4577
LOCB	4510
LOCBIN	4514
LOCC	4511
LOCD	4512
LOCJMP	3761
LOCM	4370
LOCPNT	4173
LOCS	4351
LOCS2	4563
LOOP1	3613
LOOP2	3650
LOOP3	3657
LOOP4	4232
LOOP5	4247
LOOP6	3713
LORD	4534
M	4410
MN4	4166
M1	4170

177	4155
200	4345
212	4345
215	4342
244	4164
270	4171
7	3756
77	4156
	3637
EA	4523
EB	4524
EBIN	4513
EBNC	4525
EBND	4526
EWJMP	4515
EWNR	4374
X14	3755
260	4172
311	3764
375	4170
4	3770
5	4344
C	3620
UCTPAT	3725
UCTRD	3765
OLP	4525
OLNA	4517
OLNB	4526
OLNBIN	4523
OLNC	4521
OLND	4522
OLNTAD	4524
P	4213
PNTHT	4222
PVHT	4530
PVINT	4266
R	3670
RD	4274
RUNCT	4113
RUNCT2	4331
READ	3753
READ2	4167
RESET	4243
RESM2	4510
RETLOC	4543
RETPNT	4520
RN4	4341
RPLUS1	4340
RSET	4541
RIABA	3760
RIABR	3762
RIABC	4325
RIABD	4357
240	3775
247	3770
77	4157
S	3671
SS	4472
SIRF	4526

SUA	4124
TARA	3761
TARB	3763
TARC	4326
TARD	4330
TEMP1	4162
TEMP2	4163
TEMP3	3773
TEMP4	3774
TEMP5	4333
TERM	4146
TYR	4321
TYPE	3754
TYPE2	4165
TYPT	4537
UPAR	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, O, N, A, L, D, R, AND P HAVE THE SAME
 /EFFECT AS IN M MODE.
 *BRG2

5000	7300	CLL OLL	
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 LUOC	/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 OLUB	
5021	3714		DCA I LUOB	
5022	1325		TAR OLDLC	
5023	3715		DCA I LUCC	
5024	1326		TAR OLDU	
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 LORU	
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	1342		TAN MIDDL	
5055	3046		DCA 46	
5056	1337		TAN LORU	
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 LORU	
5070	1737		TAN I LURD	
5071	7642		SZA CLA	/FETCH INSTRUCTION.WAS IT FEXT?
5072	5633		JMS I BRKPN1	/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 RELLOC	/CHANGE POINTER IN BREAKPOINT ROUTINE
5101	3751		DCA I LEND2	
5102	1347		TAN STORE	/INSERT BREAKPOINT AT NEXT REGISTER
5103	5752		JMP I RPLUS5	/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,	RTAB2	
5114	4362	LOCB,	RTAB3	
5115	4725	LOC,	RTAB0	
5116	4727	LOC,	RTAB1	
5117	4017	NEWBIN,	17	
5120	4734	LOCBIN,	BRINST	
5121	5774	NEWJUMP,	5774	
5122	4641	RESM2,	RESET-2	
5123	4377	OLDA,	LETTER	
5124	4751	OLDB,	LOCS	
5125	4576	OLDC,	ADDR	
5126	4765	OLD,	INST	
5127	4402	ULnBIN,	JMS I 2	
5130	1222	OLDTAD,	1222	
5131	4202	ODP,	END	
5132	5600	FPNT,	5600	
5133	4622	PNTHT,	PNTHT	

5134	5601	GO2,	5601
5135	0000	EXP,	0
5136	0000	HOPU,	0
5137	0000	LOAD,	0
5140	0000	MINDL,	0
5141	4606	ORIF2,	LF
5142	0336	UPAR,	33A
5143	4701	TYPIT,	TYP
5144	4730	CTABD,	TABD
5145	4643	RSET,	RESET
5146	4653	FINUIT,	FINU
5147	0000	STORE,	0
5150	5104	RETLOC,	RETRAT
5151	4735	LEADR2,	END2
5152	4612	BPLUS5,	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,-314,-304,-323
5164	7456		
5165	7475		
5166	7463		
5167	7462		
			-322,-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	LOrS2,	II,0,0,0,0,0,0,0,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	INST2,	0,0,0,0,0,0,0,0
		x6	
0006	7200		727K /POINTER TO OUTPUT PACKAGE
0007	5600		567K
		x5707	
5/67	5033	BRKPHI	/INTERPRETATION TABLE OF PACKAGE

MODEL DEBUGGING PROGRAM - JAMES RUTMAN 6/15/67

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x4200
4200 6046      TLR
4201 6026      PLS
4202 4752     END,   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      KRR
4214 1761      TAP I TABA      /IDENTIFY REQUEST
4215 7650      SNA CLA
4216 5737     JMS 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 INII      /RECORD FIRST AND LAST
4237 4765     JMS I OUTRD      /OF REQUESTED REGISTERS
4238 7041     DIA
4239 3363     DCA FIN
4240 4752     LOOP2, JMS I ORLF
4241 1361     TAP INII
4242 4305     JMS OCTPNT
4243 1367     TAP RYRH
4244 4754     JMS I TYPE
4245 1370     TAP R4
4246 3357     DCA CNT
4247 1761     LOOP3, TAP I INII      /OUTPUT 4 SEQUENTIAL REGISTER
4248 4305     JMS OCTPNT
4249 1361     TAP INII      /FINISHED?
4250 1363     TAP FIN
4251 7650     SNA CLA
4252 5202     JMP END
4253 2361     IS7 INII
4254 2357     IS7 CNT

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4267	5257		JMP LOOP3	
4270	5250		JMP LOOP2	
4271	4765	S,	JMS I OUTRD	/START REQUESTED
4272	3361		DCA LUCJMP	
4273	4752		JMS I CKLF	
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 CKLF	
4301	1371		TAB LINK	
4302	7110		CLI PAR	
4303	1372		TAB AC	
4304	5274		JMP GO	
4305	0000	OUTPNT,	Y	/OCTAL PRINT SUB-ROUTINE
4306	3374		DCA TEMP4	
4307	1375		TAB #240	
4310	4754		JMS I TYPE	
4311	1370		TAB #4	
4312	3373		DCA TEMPS	
4313	1374	LOOP6,	TAB TEMP4	
4314	7104		CLI HAL	
4315	7006		RTI	
4316	3374		DCA TEMP4	
4317	1374		TAB TEMP4	
4320	7004		RAI	
4321	0356		AND #7	
4322	1376		TAB #260	
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,	Y	/CHECK FOR INSERT REQUEST
4340	4305		JMS OUTPNT	
4341	4752		JMS I CKLF	
4342	4753		JMS I READ	
4343	4754		JMS I TYPE	
4344	6034		KKC	
4345	1364		TAB #311	
4346	7640		SZA CLA	
4347	5205		JMP #00+3	/CONTINUE AS USUAL
4350	4765		JMS I OUTRD	
4351	5767		JMP I CHECK	
4352	4666	CKLF,	LF	/CONSTANTS AND VARIABLES
4353	4674	READ,	RD	
4354	4701	TYPE,	TYG	
4355	7764	N14,	T14	
4356	0007	#7,	7	
4357	0000	CNT,	Y	
4360	4377	RTABA,	LETTER	
4361	4377	TARA,	LETTER	

4362	4751	RTABR,	LOPS
4363	4751	TABR,	LOPS
4364	7467	N311,	-311
4365	4513	DOCTR,	BUDGET
4366	0000	CURLOC,	0
4367	0255	HYBR,	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		LAR
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		LAR
4427	7041		CIA
4430	3351		DOA CNT2
4431	4752		JMC I LEADER
4432	7402	LOOP4,	HLT /RECORD FIRST AND LAST REGISTERS
4433	7604		LAR
4434	3353		DOA INIT2
4435	7402		HLT
4436	7604		LAR
4437	3354		DOA FIN 2
4440	1355		TAN M177
4441	3356		DOA M77
4442	7120		STI
4443	1353		TAN INIT2
4444	4206		JMC PRINT
4445	1357		TAN M77
4446	3356		DOA M77
4447	1753	LOOP5,	TAN I INIT2
4450	4206		JMC PRINT
4451	1353		TAN INIT2
4452	7041		CIA
4453	1354		TAN FIN 2

4454	7650		SNA CLA
4455	5260		JMP DONE
4456	2353		ISZ INIT2
4457	5247		JMP LOOP5
4460	2351	DONE,	ISZ DAT2
4461	5232		JMP LOOP4
4462	1350		TAN CHK
4463	4266		JMS PRINT
4464	4752		JMS I LEADER
4465	5761		JMP I ENDIT
4466	0000	PRINT,	M /BINARY FORMAT PRINT
4467	3362		DCA TEMP1
4470	1362		TAN 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		TAN TEMP1
4500	0357		AND R77
4501	4304		JMS SUM
4502	4773		JMS I LUCPNT
4503	5666		JMP I PRINT
4504	0000	SUM,	Z
4505	3363		DCA TEMP2
4506	1363		TAN TEMP2
4507	1350		TAN CHK
4510	3350		DCA CHK
4511	1363		TAN TEMP2
4512	5704		JMP I SUM
4513	0000	RDCUT,	Z /OCTAL READ SUB-ROUTINE
4514	1364		TAN 0000
4515	4705		JMS I TYPE2
4516	3363		DCA TEMP2
4517	1366		TAN 0000
4520	3362		DCA TEMP1
4521	4767	BACK,	JMS I READ2
4522	4765		JMS I TYPE2
4523	6034		KRS
4524	1370		TAN 0370
4525	7650		SNA CLA
4526	5346		JMP TERM
4527	6034		KRS
4530	0371		AND R270
4531	1372		TAN 0260
4532	7640		SZA CLA
4533	5321		JMP BACK
4534	1363		TAN TEMP2
4535	7104		CLI BAL
4536	7006		RTI
4537	3363		DCA TEMP2
4540	6034		KRS
4541	1372		TAN 0260
4542	1363		TAN TEMP2
4543	3363		DCA TEMP2
4544	2362		ISZ TEMP1
4545	5321		JMP BACK
4546	1363	TERM,	TAN TEMP2

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4547 5713      JMP I RDOCT
4550 0000  CHK,      /CONSTANTS AND VARIABLES
4551 0000  CNT2,      A
4552 4715  LEADER,    LDR
4553 0000  INIT2,      A
4554 0000  FIN2,      B
4555 0177  M177,      177
4556 0077  M77,       77
4557 0077  R77,       77
4560 0006  HTYPE,     HITYPE-ITYP
4561 4202  ENHIT,     ENH
4562 0000  TEMP1,     B
4563 0000  TEMP2,     B
4564 0240  M240,      240
4565 4701  TYPE2,     TYP
4566 7774  MN4,       -4
4567 4674  READ2,     RD
4570 7403  M375,      -375
4571 0270  M270,      270
4572 7520  M2A0,      -240
4573 0000  LUCHN1,    A
4574 4746  LURCAL,    JMCALC
4575 0001  M1,        1
4576 0000
4577 0000
4600 0000
4601 0000
4602 0000
4603 0000
4604 0000  ADDR,      0,0,0,0,0,0,0,0
4605 4243  B,          JMS RESET
4606 1350  TAP RHPNTR
4607 3002  DCA B
4610 4253  JMS RHPD
4611 4751  JMS I RDOCT2
4612 3726  DCA I TABC
4613 1726  TAP I TABC
4614 3353  DCA TEMP5
4615 1703  TAP I TEMP5
4616 3750  DCA I TAHD
4617 1354  TAP I-INST
4620 3753  DCA I TEMP5
4621 5735  JMP I END2
4622 0000  PNTHIT,    /FOUND BREAK-POINT
4623 3736  DCA I PUC
4624 7004  RAL
4625 3737  DCA I LINK2
4626 7240  STC
4627 1222  TAP PNTHIT
4630 3222  DCA PNTHIT
4631 5775  JMP I IJCM
4632 4243  C,          JMS RESET
4633 1222  TAP PNTHIT
4634 7041  CIA
4635 4253  JMS RHPD
4636 1700  TAP I TABD
4637 3622  DCA I PNTHIT
4640 3726  DCA I TABC
4641 1222  TAP PNTHIT

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4642	5740		JMP I RPLUS1
4643	0000	RESET,	0
4644	1325		TAB RTAB0
4645	3326		DCA TAB0
4646	1327		TAB RTAB0
4647	3330		DCA TAB0
4650	1341		TAB RNT4
4651	3332		DCA CNT4
4652	5643		JMP I RESET
4653	0000	FIND,	0
4654	3243		DCA RESET
4655	1243		TAB RESET
4656	1726		TAB 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,	0
4667	1342		TAB R212
4670	4301		JMS TYP
4671	1343		TAB R212
4672	4301		JMS TYP
4673	5666		JMP I LF
4674	0000	RD,	0
4675	6031		KSF
4676	5275		JMP .-1
4677	6036		KRS
4700	5674		JMP I RD
4701	0000	TYP,	0
4702	6041		TSE
4703	5302		JMP .-1
4704	6046		TLR
4705	7300		CLA CLI
4706	5701		JMP I TYP
4707	0000	HITYPE,	0
4710	6021		PSE
4711	5310		JMP .-1
4712	6026		PLR
4713	7300		CLA CLI
4714	5707		JMP I HITYPE
4715	0000	LDR,	0
4716	1344		TAB R75
4717	3347		DCA LEADCT
4720	1345		TAB R7500
4721	4746		JMS I RIMSLOC
4722	2347		IS7 LEADCT
4723	5322		JMP .-3
4724	5715		JMP I LDR
4725	4576	RTAB0,	ADDR
4726	4576	TAB0,	ADDR
4727	4765	RTAB0,	INST
4730	4765	TAB0,	INST
4731	4513	RDOUT2,	RDOUT
4732	0000	CNT4,	0
4733	0000	TEMP5,	0
4734	4402	BRINST,	JMS I 2

4/35	4202	ENH2,	END
4/36	4372	ACR,	AC
4/37	4371	LINK2,	LINK
4/40	4277	RPIUS1,	RPI
4/41	7771	RN4,	-7
4/42	2215	M215,	215
4/43	2212	M212,	212
4/44	7634	N75,	-144
4/45	2200	M200,	200
4/46	0000	JMLOC,	%
4/47	0000	LEAUCT,	%
4/50	4622	BRPNTR,	PNTR1
4/51	4233		
4/52	4226		
4/53	4237		
4/54	4605		
4/55	4327		
4/56	4333		
4/57	4243		
4/60	4271		
4/61	4276		
4/62	4632		
4/63	4776		
4/64	4413	LOCS,	II,0,0,0,0,0,0,0,S,R,C,F,P
4/65	0000		
4/66	0000		
4/67	0000		
4/70	0000		
4/71	0000		
4/72	0000		
4/73	0000	INSI,	0,0,0,0,0,0,0,0
4/74	5066	NEWR,	NEDE /POINTER TO CI ROUTINE
4/75	5216	LUM,	M
4/76	5777	F,	JMP FTRANS
4/77	5000	FTRANS,	REAR
		FIN=TABB	
		INIT=TABA	
		LUCMP=TABB	

.....

A	4327
AC	4372
ACC	4736
ADDR	4576
ADDR2	5204
R	4605
BACK	4521
HEG2	5000
RPIUS5	5152
RPNST	4734
BRPNTR	5233
BRPNTR	4750
C	4632
CHCK	4337
CHK	4550
CNT	4357
CNT2	4551
CNT4	4732
CRIF	4352
CRIF2	5141

CTABD	5144
CURLOC	4366
CI	5156
D	4243
DONE	4440
END	4242
ENDIT	4561
END2	4735
EXP	5135
F	4776
FIN	4363
FIND	4656
FINDIT	5146
FIN2	4554
FPNT	5132
FTRANS	4777
GO	4274
GO2	5134
HEGE	2266
HITYPE	4747
HORD	5136
HITYPE	4560
HYPH	4367
II	4236
INIT	4361
INIT2	4553
INST	4765
INST2	5216
JMSLOC	4746
L	4336
LDR	4715
LDRCAL	4574
LEADCT	4747
LEADER	4552
LEND2	5151
LETR2	5154
LETTER	4377
LF	4646
LINK	4371
LINK2	4737
LOCA	5116
LOCB	5114
LOCBIN	5120
LOCC	5115
LOC0	5116
LOCJMP	4361
LOCM	4775
LOCPNT	4576
LOGS	4751
LOGS2	5176
LOOP1	4216
LOOP2	4256
LOOP3	4257
LOOP4	4432
LOOP5	4447
LOOP6	4316
LORD	5137
M	5416
MIDDL	2146
MN4	4566

M1	4575
M177	4555
M200	4745
M212	4745
M215	4742
M242	4564
M272	4571
M7	4356
M77	4556
M	4237
MEMA	5111/
MEMB	5111/
MEMBIN	5111/
MEMC	5111
MEMD	5112
MEMJMP	5121
MEMR	4774
M14	4355
M260	4572
M311	4364
M375	4570
M4	4370
M75	4744
M	4226
UCTPNT	4305
UCTRD	4365
UDP	5131
OLPA	5123
OLPB	5124
OLPBIN	5127
OLPC	5125
OLPD	5126
OLPTAD	5130
P	4413
PNTHT	4622
PNTHT	5133
PRINT	4460
P	4270
PU	4674
QUOCT	4513
QUOCT2	4731
READ	4353
READ2	4567
RESET	4643
RESM2	5122
RETLOC	5150
RETPT	5124
RN4	4741
RPLUS1	4740
RSET	5145
RTABA	4340
RTABB	4362
RTABC	4725
RTABD	4727
R242	4375
R262	4376
R77	4557
S	4271
SS	5276

STORE	5141
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