



DECUS

PROGRAM LIBRARY

DECUS NO.

8-150

TITLE

PTOD8 HIGH AND PTOD8 LOW

AUTHOR

R.A. Gruenewald

COMPANY

Dr. Neher Laboratory
Netherlands Postal and Telecommunication Service
Leidschendam, The Netherlands

DATE

May 29, 1968

SOURCE LANGUAGE



PTOD8 - PTT TRACE AND OCTAL ON-LINE DEBUGGING PROGRAM

DECUS Program Library Write-up

DECUS No. 8-150

Abstract

PTOD8 (PTT Trace and Octal On-Line Debugging Program for PDP-8) is a program to debug a running program.

Communication between operator and program is via the ASR-33 Teletype.

Features

- Register examination and modification
- Multiple breakpoints (break-traps)
- Memory protection (of a chosen block)
- Word search (masked or not masked)
- Tracing a running program (gives a full print out of consequently executed instructions)
- It is interrupt proof (ION in investigated program is dealt with to make a genuine interrupt)
- Binary tape punching (automatic leader-trailer code and checksum).

Requirements

Storage

PTOD8 requires 1343 (octal) registers.
PTOD8 HIGH is stored between 6200 and 7543.
PTOD8 LOW is stored between 200 and 1543.

Equipment

Standard PDP-8

Usage

Loading

PTOD8 is loaded by means of the Binary Loader (8-2-U).

Place PTOD8 (High or Low) in proper reader (ASR-33 or 750).

Switch register to 7777 and press Load Address.

For type 750 reader set switch 0 down and press START.

For ASR-33 put switch 0 up and press START.

For PTOD8 version B press CONTINUE switch.

Load binary tape of program to be debugged.

Start up.

PTOD8 has starting address 200 (LOW) and 6200 (HIGH)

Start PTOD8 with switch register and control switches.

PTOD8 is now running and awaiting commands from ASR-33 Teletype.

Restrictions

Status Active Registers

Register 0001 and 0002 are used by PTOD8 when Program to be debugged involves ION. In case an ION is executed (by means of PTOD8) a trap is placed in locations to 0001 and 0002 as follows:

0001, JMP I 2

0002, ADDRESS OF INTERRUPT DEALING ROUTINE OF PTOD8.

As soon as genuine interrupt occurs the interrupt dealing routine restores locations 0001 and 0002 with the proper instructions of the program to be debugged.

By thus interchanging traps and proper instructions it is taken care of that program to be debugged may use registers 0001 and 0002 unaware of the fact that PTOD8 uses the same locations.

This only holds for programs with ION in them. When there is no ION, PTOD8 only uses locations 200-1543 (LOW) or 6200-7543 (HIGH).

Status Core

PTOD8 will not operate outside of the core memory module in which it resides.

Description

PTOD8 is an octal debugging program for PDP-8. Communication between operator and PTOD8 occurs on ASR-33 Teletype.

Commands

The register examination character / causes the contents of the register addressed by the preceding expression to be typed out in octal. The register is then opened for modification. (In all examples everything between double quotes (") is typed by the operator and everything underlined is typed by PTOD8.)

Carriage Return (cr)

The value of any expression that has been typed by the user immediately preceding the carriage return will replace the contents of the open register (if opened anyway) and the register is closed.

If nothing has been typed, the contents will not be changed.

Line Feed (lf)

Line feed has the same effect as carriage return, but, in addition, the next sequential register is opened and its contents typed.

Correction ←

Any typed octal number can be neglected by typing ←.

Semicolon (;)

Separation of first address and last address of a chosen block in memory.

Used for memory protection, word search and punch binary tape.

Asterisk (*)

Asterisk is not printed.

Used for checksum and trailer punch.

Trailer is automatically punched after accumulated checksum has been punched.

So, ASR-33 can be left on line.

Ampersand (&)

The octal number that has been typed by the user immediately preceding the & will set the MASK used for Word Search. Initially this MASK is set to 7777.

After each Word Search the Mask is reset to 7777.

W (Word Search Block)

The number typed by the user preceding W sets the upper limit of the block in memory used for Word Search.

Z (Search)

PTOD8 will perform a Word Search and print the address and contents of every register in the desired block of memory whose contents, when masked, are equal to the value of the number typed by the user preceding Z.

- A (Accu) Typing the letter A causes the contents of the Accumulator to be printed and opened for modification. A is the accumulator as it occurs in the running program under investigation.
- L (Link) Typing the letter L causes the contents of the LINK to be printed and opened for modification. L is the LINK as it occurs in the running program under investigation.
- B (Breakpoint) Insert a breakpoint at the address printed by the user immediately preceding command B.
- A maximum of 40 (octal) breakpoints can be inserted at one time.
- R (Remove) Remove the breakpoint that was previously inserted at the address given by the number immediately preceding R.
- E (Erase) Remove all previously inserted breakpoints.
- T (Trace) The number typed by the user immediately preceding T gives the address where PTOD8 will start to trace (print out consequently executed instructions) the program to be debugged.
- Cancelling the T-mode can be done by:
- "mT" where $m >$ the highest reachable address of the program to be debugged.
- Restart PTOD8.
- G (Go) Start the program to be debugged at address typed by the user immediately preceding G.
- C (Continue) When PTOD8 has returned command to the user (in a breakpoint or in trace mode, etc.) typing letter C means to continue executing instructions.
- S (Skip) When PTOD8 has returned command to the user (in a breakpoint or in a trace mode) typing letter S means to execute an unconditional Skip.

This can be useful when the instruction to be executed is, for example, an ISZ or when the program to be debugged has a reading sequence.

M (Memory Protection)

The number typed by the user immediately preceding M is the upper boundary of the section in memory that is protected. Whenever the running program uses any address within this section of memory PTOD8 will print a message.

P (Punch Binary Tape)

Number typed by the user preceding letter B is upper limit of a block of instruction to be punched in binary format. After command P the PTOD8 provides leader code automatically provided the previous command of the user was an Asterisk (*) for checksum and trailer code). It is thus possible to punch consequent block in binary format whereas only the first time leader code will be punched.

Illegal Character

PTOD8 punches ? and returns command.

Switch Register

When PTOD8 is dealing with an object program in Trace Mode, switch register setting means:

SR = 0 Print every executed instruction of object program without returning command to user.

SR \neq 0 Print one executed instruction of object program and return command to user.

SR(0) = 1 (PTOD8 version B only.) Print next instruction to be executed and return command to user.

This can be of use to trap a program that is running beyond control of the user in case he forgot to request Trace Mode, etc.

CHANGES TO DECUS NO. 8-150

When using DECUS No. 8-150 (PTOD8) with a PDP-8/S computer, a defect occurs which affects the 8/S. The problem is the combined micro instruction CMA RAL that occurs at location 1013 (low) and 7013 (high). This combination is illegal on the serial logic PDP-8/S. It is, however, valid on the PDP-8 machines with parallel internal logic.

Patch space is rather short in a neat program such as PTOD8, but the following patch will correct operation on PDP-8/S machines (PTOD8 low).

1013	5375		JMP PATCH 1
1175	7040	PATCH 1,	CMA
1176	7004		RAL
1177	5214		JMP 1014/RETURN

For PTOD8 (high) add 6000 to all addresses.

One other error has been found in the interpretive execution of ION and IOF instructions. At present, the pseudo-accumulator and pseudo-link are cleared erroneously by these instructions. The following patch rectifies this problem, but extends the program area to the end of the last program page.

(PTOD8 low) Add 6000 to addresses marked * for PTOD8 high.

*1402	5373		JMP PATCH 2
*1415	5373		JMP PATCH 2
*1417	5373		JMP PATCH 2
*1573	2777	PATCH 2,	ISZ PC
*1574	7000		NOP
*1575	5776		JMP TRRET
*1576	* 0602		TRRET
*1577	* 0753		PC

/PTT TRACE AND OCTAL DEBUGGING PROGRAM MODIFIED VERSION 1
 /FEATURES:REGISTER EXAMINATION AND MODIFICATION,
 /MULTIPLE BREAKPOINTS, MEMORY PROTECTION, INTERRUPT FACILITY
 /WORD SEARCH, TRACING A RUNNING PROGRAM, BINARY TAPE PUNCHING
 /PAGE 1

0200	6032	BEGIN,	6032	/INITIATE LOW SPEED READER
0201	6046		6046	/INITIATE LOW SPEED PUNCH
0202	3370		DCA TSW	/TSW:=0
0203	3365		DCA TMODS	/TMODS:=0
0204	5772		JMP I CLEAR	/CLEAR OTHER PROGRAM SWITCHES
0205	5336		JMP CLIST	/CLEAR LIST OF BREAKPOINTS
0206	4773	BEG2,	JMS I CRLF1	/PUNCH CRLF
0207	3371	BEG3,	DCA WORD	/CLEAR REGISTER WORD
0210	4774		JMS I READI	/READ NEXT CHARACTER
0211	4323		JMS SAD	/SKIP IF ACCU DIFFERS FROM NUMBER
0212	0215	CR,	215	/CARRIAGE RETURN?
0213	5250		JMP CRLF2	/YES
0214	4323		JMS SAD	
0215	0212	LF,	212	/LINE FEED?
0216	5250		JMP CRLF2	/YES
0217	4323		JMS SAD	
0220	0252		252	/ASTERISK?
0221	5775		JMP I STARI	/YES
0222	4776		JMS I PNCI	/FROM NOW ON PRINT CHAR.
0223	3354		DCA CSW	/CSW:=0
0224	6036		KRB	/READ SAME CHAR. FROM TTI BUFFER
0225	4323		JMS SAD	
0226	0257	SLSH,	257	/SLASH?
0227	5242		JMP SLASH	/YES
0230	4323		JMS SAD	
0231	0302		302	/LETTER B?
0232	5276		JMP BMOD	/YES
0233	4323		JMS SAD	
0234	0324		324	/LETTER T?
0235	5311		JMP TMOD	/YES
0236	4323		JMS SAD	
0237	0307		307	/LETTER G?
0240	5316		JMP GO	/YES
0241	5777		JMP I GOON	/NO, GO ON COMPARING
0242	1371	SLASH,	TAD WORD	/ADDRESS OF REGISTER TO BE EXAMINED
0243	3363		DCA REG	/STORE IN ORDER TO GO INDIRECT
0244	1763		TAD I REG	/CONTENT OF REQUIRED REGISTER
0245	4761		JMS I OCTP	/PUNCH IN OCTAL FORMAT
0246	3357		DCA LOCK	/LOCK:=0
0247	5207		JMP BEG3	/RETURN COMMAND TO OPERATOR
0250	1354	CRLF2,	TAD CSW	/SWITCH FOR CIPHER RECEPTION
0251	7650		SNA CLA	/FORE LAST CHAR. WAS A CIPHER?
0252	5256		JMP CLOSE	/NO
0253	1371		TAD WORD	/YES, DATA FOR REGISTER MOD.
0254	2357		ISZ LOCK	/(LOCK)=-1?
0255	3763		DCA I REG	/NO, MODIFY REGISTER
0256	7040	CLOSE,	CMA	/YES, NO MODIFICATION ALLOWED. ACCU:4
0257	3357		DCA LOCK	/(LOCK):=-1
0260	3354		DCA CSW	/CSW:=0, PREPARATION FOR NEXT NUMBER
0261	6036		KRB	/READ CHAR ONCE MORE FROM TTI BUFFER
0262	4323		JMS SAD	
0263	0215		215	/CR?
0264	5206		JMP BEG2	/YES, PUNCH CRLF , RETURN COMMAND
0265	7200		CLA	
0266	2363		ISZ REG	/NO, EXAMINE NEXT REGISTER
0267	7000		NOP	
0270	4773		JMS I CRLF1	/PUNCH CRLF
0271	1363		TAD REG	/ADDRESS NEXT REGISTER
0272	4761		JMS I OCTP	/PUNCH OCTAL

0273	1226	PSLH,	TAD SLSH	/SLASH
0274	4776		JMS I PNCI	/PUNCH SLASH
0275	5244		JMP SLASH+2	/RETURN TO EXAMINATIONROUTINE
0276	4344	BMOD,	JMS PREPR	/PREPARE POINTER AND COUNTER
0277	1762	BNXT,	TAD I PNTR	
0300	7650		SNA CLA	/EMPTY PLACE IN LIST?
0301	5306		JMP.+5	/YES, INSERT BREAKPOINT
0302	2362		ISZ PNTR	/NO, TRY AGAIN
0303	2356		ISZ LCNT	/END OF LIST?
0304	5277		JMP BNXT	/NO
0305	5206		JMP BEG2	/YES RETURN COMMAND
0306	1371		TAD WORD	/REQUIRED BREAKADDRESS
0307	3762		DCA I PNTR	/INSERT IN LIST
0310	5206		JMP BEG2	/RETURN COMMAND TO OPERATOR
0311	1371	TMOD,	TAD WORD	/ADDRESS OF FIRST INSTR. TO BE TRACE
0312	3366		DCA TMREG	/STORE
0313	3370		DCA TSW	/CLEAR TRACE SWITCH
0314	2365		ISZ TMODES	/INDICATION THAT T MODE IS REQUIRED
0315	5206		JMP BEG2	/RETURN COMMAND
0316	3353	GO,	DCA LINK	/CLEAR LINK
0317	3352		DCA ACCU	/CLEAR ACCU
0320	1371		TAD WORD	/START ADDRESS OF PROGRAM TO BE HAND
0321	3364		DCA STADR	
0322	5767		JMP I TRACER	/GO AND TRACE
0323	0000	SAD,	0	/SUBROUTINE SKIP IF ACCU DIFFERS
0324	3344		DCA PREPR	/STORE CHAR TEMPORARELY
0325	1723		TAD I SAD	/NUMBER
0326	7041		CIA	/ CONVERT INTO NEGATIVE
0327	1344		TAD PREPR	/ADD STORED NUMBER
0330	7650		SNA CLA	/EQUAL?
0331	5334		JMP.+3	/YES
0332	1344		TAD PREPR	/NO, RESTORE ACCU
0333	2323		ISZ SAD	/INCREMENT RETURN ADDRESS
0334	2323		ISZ SAD	/INCREMENT RETURN ADDRESS
0335	5723		JMP I SAD	/EXIT
0336	4344	CLIST,	JMS PREPR	
0337	3762		DCA I PNTR	/CLEAR
0340	2362		ISZ PNTR	/STEP UP POINTER
0341	2356		ISZ LCNT	/READY?
0342	5337		JMP.-3	/NO, RETURN
0343	5206		JMP BEG2	/YES
0344	0000	PREPR,	0	/SUBROUTINE TO INIT. POINTER AND LCN
0345	1360		TAD M40	/LENGTH OF LIST
0346	3356		DCA LCNT	
0347	1355		TAD LADR	/ADDRESS OF LIST
0350	3362		DCA PNTR	
0351	5744		JMP I PREPR	/EXIT

/CONSTANTS AND INDIRECT ADDRESSES PAGE 1

0352	0000	ACCU,	0
0353	0000	LINK,	0
0354	0000	CSW,	0
0355	1525	LADR,	BLST
0356	0000	LCNT,	0
0357	0000	LOCK,	0
0360	7740	M40,	-40
0361	0671	OCTP,	OCPN
0362	0000	PNTR,	0
0363	0000	REG,	0
0364	0000	STADR,	0
0365	0000	TMODES,	0
0366	0000	TMREG,	0
0367	0600	TRACER,	TRACE
0370	0000	TSW,	0
0371	0000	WORD,	0
0372	1227	CLEAR,	CLR

0373	1221	CRLF1,	PCL	
0374	0745	READI,	READ	
0375	0535	STARI,	STAR	
0376	0726	PNCI,	PUNCH	
0377	0400	GOON,	PROC	
		*BEGIN+200		
0400	4747	PROC,	JMS I SAD1	/INVESTIGATION OF COMMAND SIGNS
0401	0305		305	/LETTER E?
0402	5751		JMP I ERSE	/YES ERASE ALL BREAKPOINTS
0403	4747		JMS I SAD1	
0404	0322		322	/LETTER R?
0405	5231		JMP RMUV	/YES REMOVE 1 BREAKPOINT
0406	4747		JMS I SAD1	/NO
0407	0301		301	/LETTER A?
0410	5246		JMP ACU	/YES
0411	4747		JMS I SAD1	/NO
0412	0314		314	/LETTER L?
0413	5245		JMP LNK	/YES
0414	4747		JMS I SAD1	
0415	0303		303	/LETTER C?
0416	5750		JMP I INTP1	/GO TO INTERPRETATOR
0417	4747		JMS I SAD1	
0420	0315		315	/LETTER M?
0421	5253		JMP MPRT	/YES MEMORY PROTECTION MODE
0422	4747		JMS I SAD1	
0423	0320		320	/LETTER P?
0424	5264		JMP BINT	/YES, PUNCH TAPE IN BINARY
0425	4747		JMS I SAD1	
0426	0273		273	/;?
0427	5261		JMP FADR	/YES , FIRST ADDRESS OF BLOCK
0430	5775		JMP I GOON1	/INVESTIGATION OF COMMAND SIGNS
0431	4752	RMUV,	JMS I PREP1	/PREPARE LIST HANDLING
0432	1753		TAD I PNTR1	
0433	3346		DCA TEM3	/STORE TO GO INDIRECT
0434	1746	RNXT,	TAD I TEM3	/CONTENT OF FIRST PLACE IN LIST
0435	7041		CIA	/CONVERT TO NEGATIVE
0436	1754		TAD I WRDI	/ADD ADDRESS OF BREAKPOINT
0437	7650		SNA CLA	/EQUAL?
0440	3746		DCA I TEM3	/YES, REMOVE
0441	2346		ISZ TEM3	/NO, TRY NEXT
0442	2755		ISZ I LCNT1	/END OF LIST?
0443	5234		JMP RNXT	/NO
0444	5756		JMP I BEG2I	/YES RETURN COMMAND
0445	7201	LNK,	CLA IAC	/ACCU:=1, ADDRESS LINK=ADDRESS ACCU+
0446	1357	ACU,	TAD ACCUI	/ADDRESS OF PROGRAM ACCU
0447	3760		DCA I REG1	/FILL REG FOR REG EXAMINATION
0450	1361		TAD SP	/SPACE
0451	4763		JMS I PNCI1	/PUNCH
0452	5762		JMP I PSLH1	/PUNCH SLASH
0453	2365	MPRT,	ISZ MSW	/MEMORY PROTECT SWITCH:=1
0454	1754		TAD I WRDI	/LAST ADDRESS OF BLOCK
0455	3364		DCA EADR	/STORE
0456	1343		TAD TBADR	/TEMP. FIRST ADDRESS OF BLOCK
0457	3367		DCA BADR	/STORE IN FIRST ADDR. OF MEMPROT.
0460	5756		JMP I BEG2I	/RETURN COMMAND
0461	1754	FADR,	TAD I WRDI	/FIRST ADDRESS OF BLOCK
0462	3343		DCA TBADR	/STORE
0463	5766		JMP I BEG3I	/RETURN COMMAND WITHOUT CRLF
0464	7402	BINT,	HLT	/ROUTINE TO PUNCH BINARY TAPE
0465	4776		JMS I PTRI	/ROUTINE TRAILER-LEADER PUNCH
0466	4745		JMS I RSTI	/RESTORE PLACE 1 AND 2
0467	1754		TAD I WRDI	/LAST ADDRESS OF BLOCK TO BE PUNCHED

0470	3364		DCA FADR	/STORE
0471	1370		TAD C100	/CHARACTER
0472	3371		DCA ASRS	/IDENTIFICATION OF FIRST ADDRESS
0473	1364		TAD EADR	
0474	7040		CMA	
0475	1343		TAD TBADR	/NUMBER OF WORDS TO PUNCH
0476	3372		DCA BCNT	/STORE
0477	1343		TAD TBADR	/FIRST AND CONSEQUENT ADDRESSES
0500	4311		JMS PBIN	/PUNCH BINARY
0501	3371		DCA ASRS	/CLEAR IDENTIFICATION MARK
0502	1743		TAD I TBADR	/INSTRUCTION
0503	4311		JMS PBIN	/PUNCH BINARY
0504	2343		ISZ TBADR	/STEP UP POINTER OF BLOCK
0505	7000		NOP	/IN CASE ISZ SKIPS
0506	2372		ISZ BCNT	/END OF BLOCK?
0507	5302		JMP.-5	/NO, NEXT WORD
0510	5766		JMP I BEG3I	/RETURN COMMAND WITHOUT CRLF
0511	0000	PBIN,	0	/PUNCH ONE WORD BINARY
0512	3346		DCA TEM3	/STORE WORD
0513	1346		TAD TEM3	
0514	7012		RTR	
0515	7012		RTR	
0516	7012		RTR	/MOST SIGNIFICANT PART FIRST
0517	0373		AND M77	/MASK 6 BITS
0520	1371		TAD ASRS	/ADD IDENTIFICATION MARK
0521	4326		JMS PCHS	/PUNCH AND KEEP CHECKSUM
0522	1346		TAD TEM3	
0523	0373		AND M77	/LEAST SIGNIFICANT PART OF THE WORD
0524	4326		JMS PCHS	
0525	5711		JMP I PBIN	/EXIT
0526	0000	PCHS,	0	
0527	6046		6046	
0530	6041		6041	
0531	5330		JMP.-1	
0532	1374		TAD CHS	/CHECKSUM
0533	3374		DCA CHS	/ADD UP
0534	5726		JMP I PCHS	/EXIT
0535	3777	STAR,	DCA I LFLGI	
0536	1374		TAD CHS	/PUNCH CHECKSUM, END BINARY TAPE
0537	4311		JMS PBIN	
0540	3374		DCA CHS	/CLEAR CHECKSUM
0541	4744		JMS I PTRALI	
0542	5766		JMP I BEG3I	/RETURN COMMAND WITHOUT CRLF
/CONSTANTS AND VARIABLES TRACER PAGE 2				
0543	0000	TBADR,	0	
0544	1430	PTRALI,	PTRAIL	
0545	1420	RSTI,	RST	
0546	0000	TEM3,	0	
0547	0323	SAD1,	SAD	
0550	1000	INTP1,	INTP	
0551	0336	ERSE,	CLIST	
0552	0344	PREP1,	PREPR	
0553	0362	PNTR1,	PNTR	
0554	0371	WRDI,	WORD	
0555	0356	LCNT1,	LCNT	
0556	0206	BEG2I,	BEG2	
0557	0352	ACCU1,	ACCU	
0560	0363	REG1,	REG	
0561	0240	SP,	240	
0562	0273	PSLH1,	PSLH	
0563	0726	PNCI1,	PUNCH	
0564	0000	EADR,	0	
0565	0000	MSW,	0	
0566	0207	BEG3I,	BEG3	
0567	0000	BADR,	0	

0570	0100	C100,	100?	
0571	0000	ASRS,	0	
0572	0000	BCNT,	0	
0573	0077	M77,	77	
0574	0000	CHS,	0	
0575	1463	GOON1,	PROC2	
0576	1440	PTRI,	LEAD	
0577	1500	LFLGI,	LFLAG	
		*BEGIN+400		
0600	1752	TRACE,	TAD I STAD1	/ROUTINE TO DETERMINE WHETHER NEXT
0601	353		DCA PC	/INSTRUCTION HAS TO BE PRINTED OR NOT
0602	1354	TRRET,	TAD IONF	/PROGRAM INTERRUPT SWITCH
0603	7640		SZA CLA	/HAS THERE BEEN ION?
0604	6001		ION	/YES ENABLE INTERRUPTS
0605	1757		TAD I TMOD1	/TRACE MODE REQUESTED ?
0606	7650		SNA CLA	/NO
0607	5226		JMP SBPT	/NO, IS IT BREAKPOINT?
0610	6002		IOF	/YES , DISABLE INTERRUPTS
0611	1760		TAD I TSW1	
0612	7640		SZA CLA	/IS TRACING ACTIVE ALREADY?
0613	5243		JMP PINS	/YES, PRINT
0614	1761		TAD I TMRG1	/NO, FIRST ADDRESS TO BE TRACED
0615	7100		CLL	
0616	7041		CIA	
0617	1353		TAD PC	/PC - TRACE ADDRESS
0620	4316		JMS COMPR	/COMPARE ROUTINE
0621	7410		SKP	/EQUAL
0622	5226		JMP SBPT	/PC<TMREG, IS IT BREAKPOINT?
0623	7001		IAC	/PC>TMREG
0624	3760		DCA I TSW1	/TSW:=1
0625	5243		JMP PINS	/PRINT INSTRUCTION, ACCU ETC
0626	4755	SBPT,	JMS I PREPI	
0627	1762		TAD I PNTR2	
0630	3253		DCA PRIN	/STORE TO GO INDIRECT
0631	1653	SNXT,	TAD I PRIN	
0632	7041		CIA	
0633	1353		TAD PC	/COMPARE WORDS IN BREAKLIST WITH PC
0634	7650		SNA CLA	/EQUAL?
0635	5243		JMP PINS	/YES PRINT
0636	2253		ISZ PRIN	/STEP UP POINTER
0637	2763		ISZ I LCNT2	/END OF LIST?
0640	5231		JMP SNXT	/NO, NEXT
0641	6002		IOF	/DISABLE INTERRUPTS
0642	5764		JMP I INTP2	/EXIT
0643	6002	PINS,	IOF	/DISABLE INTERRUPTS
0644	4253		JMS PRIN	/PRINT ADDRESS, LINK, ACCU AND INSTR
0645	7604		LAS	/LOAD WITH SWITCHREG
0646	7650		SNA CLA	
0647	5764		JMP I INTP2	/CONTINUE
0650	1353	PRET,	TAD PC	
0651	3765		DCA I REG2	/LOAD REG WITH PC FOR
0652	5756		JMP I SLS1	/REGISTER EXAMINATION
0653	0000	PRIN,	0	
0654	4766		JMS I CRLF3	/CRLF
0655	1353		TAD PC	/PROGRAM COUNTER
0656	4271		JMS OCPN	/PRINT OCTAL
0657	1767		TAD I LINK1	/LINK
0660	1372		TAD C260	/CHARACTER IN ASCII
0661	4326		JMS PUNCH	
0662	1371		TAD SP1	/SPACE
0663	4326		JMS PUNCH	
0664	1770		TAD I ACCU1	/ACCU
0665	4271		JMS OCPN	

0666	1753		TAD I PC	/INSTRUCTION
0667	4271		JMS OCPN	
0670	5653		JMP I PRIN	/EXIT
0671	0000	OCPN,	0	/SUBROUTINE PRINT NUMBER OCTAL
0672	3316		DCA COMPR	
0673	1374		TAD M4	/-4
0674	3375		DCA OCNT	/INITIATE COUNTER
0675	1316		TAD COMPR	/NUMBER
0676	7004		RAL	
0677	7004		RAL	
0700	7006		RTL	/SHIFT MOST SIGNIFICANT OCTAL
0701	3316		DCA COMPR	/STORE
0702	1316		TAD COMPR	
0703	0373		AND MS7	/MASK 3 BITS
0704	1372		TAD C260	/CHARACTER IN ASCII
0705	4326		JMS PUNCH	
0706	1316		TAD COMPR	
0707	2375		ISZ OCNT	/READY?
0710	5277		JMP.-11	/NO, NEXT OCTAL
0711	7300		CLA CLL	/YES
0712	3316		DCA COMPR	
0713	1371		TAD SP1	/SPACE
0714	4326		JMS PUNCH	
0715	5671		JMP I OCPN	/EXIT
0716	0000	COMPR,	0	/SUBROUTINE TO COMPARE TWO NUMBERS
0717	7650		SNA CLA	/DIFFERENCE IN ACCU
0720	5716		JMP I COMPR	/EQUAL
0721	7430		SZL	
0722	2316		ISZ COMPR	/>
0723	2316		ISZ COMPR	/<
0724	7100		CLL	
0725	5716		JMP I COMPR	/EXIT
0726	0000	PUNCH,	0	
0727	6046		6046	
0730	6041		6041	
0731	5330		JMP.-1	
0732	7200		CLA	
0733	5726		JMP I PUNCH	
0734	7200	INTD,	CLA	
0735	3354		DCA IONF	/IONF:=0 UNTIL NEXT ION
0736	3777		DCA I IONFHI	/CLEAR IONFH
0737	1353		TAD PC	
0740	3000		DCA 0	/RETURN ADDRESS TO 0
0741	4776		JMS I RESRE	
0742	7001		IAC	/ACCU:=1
0743	3353		DCA PC	/SET PC TO 1
0744	5202		JMP TRRET	/TRACER
0745	0000	READ,	0	
0746	6031		6031	
0747	5346		JMP.-1	
0750	6036		6036	
0751	5745		JMP I READ	
			/CONSTANTS AND VARIABLES TRACER PAGE3	
0752	0364	STAD1,	STADR	
0753	0000	PC,	0	
0754	0000	IONF,	0	
0755	0344	PREPI,	PREPR	
0756	0246	SLS1,	SLASH+4	
0757	0365	TMOD1,	TMODS	
0760	0370	TSW1,	TSW	
0761	0366	TMRG1,	TMREG	
0762	0362	PNTR2,	PNTR	
0763	0356	LCNT2,	LCNT	
0764	1000	INTP2,	INTP	

0765	0363	REG2,	REG	
0766	1221	CRLF3,	PCL	
0767	0353	LINK1,	LINK	
0770	0352	ACCU1,	ACCU	
0771	0240	SP1,	240	
0772	0260	C260,	260	
0773	0007	MS7,	7	
0774	7774	M4,	-4	
0775	0000	OCNT,	0	
0776	1044	RESRE,	REST	
0777	1172	IONFHI,	IONFH	
		*BEGIN+600		
1000	1372	INTP,	TAD IONFH	
1001	3750		DCA I IONF1	
1002	1740		TAD I PCI	/INTERPRETATION ROUTINE
1003	3341		DCA PCD	/STORE TO GO INDIRECT
1004	1742		TAD I MSWI	/MEMORY PROTECT SWITCH
1005	7650		SNA CLA	/PROTECTION REQUESTED?
1006	5212		JMP.+4	/NO
1007	1341		TAD PCD	/PROGRAM COUNTER
1010	4764		JMS I INBL1	/IN PROT. BLOCK?
1011	5252		JMP PMES	/YES, PRINT MESSAGE
1012	1741		TAD I PCD	/NO
1013	7044		CMA RAL	/IF LINK=0 AND ACCU POS. THEN
1014	7730		SPA SZL CLA	/GROUP 6 OR 7
1015	5260		JMP GR5	/NO, GROUP 5
1016	1741		TAD I PCD	/NO, INSTRUCTION
1017	1343		TAD MION	/-6001
1020	7450		SNA	/IS IT ION?
1021	5771		JMP I PIONI	/YES
1022	1344		TAD M1	/,NO, ADD -1
1023	7650		SNA CLA	/IS IT IOF?
1024	5770		JMP I PIOFI	/YES
1025	1741		TAD I PCD	/INSTRUCTION
1026	3232	DO,	DCA .+4	/STORE INSTRUCTION
1027	1745		TAD I LINK2	/LINK
1030	7110		CLL RAR	/RESTORE LINK
1031	1746		TAD I ACCU2	/ACCU
1032	0000		0	
1033	7410		SKP	/NON SKIPPING INSTRUCTION
1034	2740		ISZ I PCI	/STEP UP PROGRAM COUNTER
1035	7000		NOP	
1036	2740		ISZ I PCI	/SKIPPING INSTRUCTION
1037	7000		NOP	
1040	3746		DCA I ACCU2	/SAVE ACCU
1041	7204		GLK	
1042	3745		DCA I LINK2	/SAVE LINK
1043	5747		JMP I TRAC1	/GO TO TRACING PROGRAM
1044	0000	REST,	0	/RESTORE 1 AND 2
1045	1373		TAD DUM1	
1046	3001		DCA 1	
1047	1374		TAD DUM2	
1050	3002		DCA 2	
1051	5644		JMP I REST	
1052	4751	PMES,	JMS I PINS1	/PRINT INSTRUCTION
1053	1352		TAD F	/LETTER F
1054	4754		JMS I PRNT	/PRINT
1055	1353		TAD A	/LETTER A
1056	4754		JMS I PRNT	
1057	5755		JMP I PRETI	/RETURN COMMAND
1060	1741	GR5,	TAD I PCD	/INSTRUCTION
1061	0356		AND MS177	/MASK RELATIVE ADDRESS BITS
1062	3357		DCA TEM1	/STORE TEMPORARELY
1063	1741		TAD I PCD	

1064	7006		RTL	
1065	7006		RTL	/I-BIT TO LINK, P-BIT TO SIGN
1066	7700		SMA CLA	/IS P-BIT PRESENT/
1067	5327		JMP AUTO	/NO, PAGE 0 ,LOOK FOR AUTOINDEX
1070	1341		TAD PCD	/YES
1071	0360		AND MS7600	/PAGE BITS OF ADDRESS
1072	1357		TAD TEM1	
1073	3357		DCA TEM1	/ABSOLUTE ADDRESS OF MEMORY
1074	7420	ADID,	SNL	/REFERENCE INSTRUCTION
1075	5300		JMP.+3	/NO I-BIT
1076	1757		TAD I TEM1	/I-BIT, GO INDIRECT
1077	3357		DCA TEM1	
1100	1742	MPRT1,	TAD I MSWI	/MEMORY PROTECTION ABSOLUTE ADDRESS
1101	7650		SNA CLA	/REQUESTED?
1102	5306		JMP.+4	/NO, FORGET ABOUT IT
1103	1357		TAD TEM1	/YES, ABSOLUTE ADDRESS
1104	4764		JMS I INBL1	/IN PROTECTED BLOCK?
1105	5252		JMP PMES	/YES, PRINT MESSAGE
1106	1741		TAD I PCD	/NO, INSTRUCTION
1107	0367		AND MS7000	/OP CODE
1110	1361		TAD M4000	/-4000
1111	7450		SNA	/IS IT JMS?
1112	5320		JMP PJMS	/YES
1113	1362		TAD M1000	/IS IT JMP?
1114	7450		SNA	
1115	5324		JMP PJMP	/YES
1116	1363		TAD IST	/IST=JMP I TEM1
1117	5226		JMP DO	
1120	7001	PJMS,	IAC	/RETURN ADDRESS SUBROUTINE
1121	1740		TAD I PCI	/+1
1122	3757		DCA I TEM1	/STORE IN FIRST PLACE
1123	7001		IAC	/OF SUBROUTINE
1124	1357	PJMP,	TAD TEM1	/ADDRESS NEXT INSTRUCTION
1125	3740		DCA I PCI	/TO BE EXECUTED
1126	5747		JMP I TRAC1	/GO TO TRACING PROGRAM
1127	7420	AUTO,	SNL	/I-BIT?
1130	5300		JMP MPRT1	/NO, RETURN
1131	1741		TAD I PCD	/INSTRUCTION
1132	0365		AND MS370	/MASK TO FIND AUTOINDEX
1133	1366		TAD M10	
1134	7640		SZA CLA	/AUTOINDEX?
1135	5276		JMP ADID+2	/NO
1136	2757		ISZ I TEM1	/YES, INCREMENT CONTENTS OF TEM1
1137	5276		JMP ADID+2	/RETURN
			/CONSTANTS AND VARIABLES TRACER PAGE4	
1140	0753	PCI,	PC	
1141	0000	PCD,	0	
1142	0565	MSWI,	MSW	
1143	1777	MION,	-6001	
1144	7777	M1,	-1	
1145	0353	LINK2,	LINK	
1146	0352	ACCU2,	ACCU	
1147	0602	TRAC1,	TRRET	
1150	0754	IONF1,	IONF	
1151	0653	PINS1,	PRIN	
1152	0306	F,	306	
1153	0301	A,	301	
1154	0726	PRNT,	PUNCH	
1155	0650	PRET1,	PRET	
1156	0177	MS177,	177	
1157	0000	TEM1,	0	
1160	7600	MS7600,	7600	
1161	4000	M4000,	4000	
1162	7000	M1000,	-1000	
1163	5757	IST,	JMP I TEM1	

1164	1200	INBL1,	INBLK	
1165	0370	MS370,	370	
1166	7770	M10,	-10	
1167	7000	MS7000,	7000	
1170	1416	PIOFI,	PIOF	
1171	1400	PIONI,	PION	
1172	0000	IONFH,	0	
1173	0000	DUM1,	0	
1174	0000	DUM2,	0	
		*BEGIN+1000		
1200	0000	INBLK,	0	/SUBROUTINE USED FOR MEMORY
1201	7100		CLL	
1202	3221		DCA PCL	/PROTECTION
1203	1744		TAD I BADR1	
1204	7041		CIA	
1205	1221		TAD PCL	/DIFFERENCE
1206	4745		JMS I COM1	/COMPARE ROUTINE
1207	5600		JMP I INBLK	/EQUAL, FIRST EXIT MEANS
1210	5217		JMP OUTB	/IN BLOCK, SECOND MEANS OUT BLOCK
1211	1746		TAD I EADR1	
1212	7041		CIA	
1213	1221		TAD PCL	/DIFFERENCE WITH UPPER LIMIT
1214	4745		JMS I COM1	
1215	5600		JMP I INBLK	/FIRST EXIT MEANS IN BLOCK
1216	5600		JMP I INBLK	/SECOND ALSO
1217	2200	OUTB,	ISZ INBLK	/SECOND
1220	5600		JMP I INBLK	/OUT OF BLOCK
1221	0000	PCL,	0	/SUBROUTINE TO PUNCH CRLF
1222	1370		TAD CRT	/CR
1223	4765		JMS I PNCI2	/PUNCH
1224	1371		TAD LFD	/LF
1225	4765		JMS I PNCI2	
1226	5621		JMP I PCL	/EXIT
1227	4740	CLR,	JMS I PRCL	/CLEAR MSW AND RESTORE 1,2
1230	3747		DCA I IONF2	/CLEAR IONFLAG
1231	3750		DCA I CHS2	/CLEAR CHECKSUM
1232	3751		DCA I TSW2	/CLEAR TRACE SWITCH
1233	3752		DCA I TMD2	/CLEAR TRACE MODE SWITCH
1234	3761		DCA I CSWI	/CLEAR CIPHER SWITCH
1235	3742		DCA I IONFH2	
1236	5753		JMP I CLST1	/RETURN
1237	4774	PROC1,	JMS I .SAD2	/CONTINUE COMMAND RECOGNITION
1240	0246		246	/ & FOR MASK?
1241	5277		JMP PAND	/YES
1242	4774		JMS I SAD2	
1243	0332		332	/LETTER Z?
1244	5302		JMP PSERC	/YES
1245	4774		JMS I SAD2	
1246	0323		323	/LETTER S?
1247	5336		JMP SKIP	/YES
1250	4774		JMS I SAD2	
1251	0337		337	/CORRECTION SIGN?
1252	5760		JMP I BEG3I1	/YES SKIP READ WORD
1253	3366		DCA TEM2	/STORE CHARACTER FOR CIPHER
1254	1366		TAD TEM2	/RECOGNITION
1255	0372		AND MAS370	
1256	1373		TAD M260	/ STRIP AND SUBTRACT
1257	7640		SZA CLA	/IS IT 0-7?
1260	5274		JMP QMRK	/NO, PRINT?
1261	1366		TAD TEM2	/YES
1262	0343		AND MASK7	/MASK CIPHER BITS
1263	3366		DCA TEM2	/STORE
1264	7001		IAC	
1265	3761		DCA I CSWI	/CSW:=1

1266	1762		TAD I WRD2	/WORD
1267	7106		CLL RTL	
1270	7004		RAL	/FORM OCTAL NUMBER
1271	1366		TAD TEM2	/ADD NEW CIPHER
1272	3762		DCA I WRD2	/RESTORE WORD
1273	5763		JMP I BEGN	/RETURN COMMAND
1274	1364	QMRK,	TAD C277	/QUESTIONMARK
1275	4765		JMS I PNCI2	/PUNCH
1276	5760		JMP I BEG3I1	/RETURN COMMAND
1277	1762	PAND,	TAD I WRD2	/WORD
1300	3355		DCA MASK	/STORE MASK FOR WORD SEARCH
1301	5760		JMP I BEG3I1	/RETURN COMMAND
1302	1775	PSERC,	TAD I WBADRI	
1303	3366		DCA TEM2	/STORE TO GO INDIRECT
1304	1766	SRNXT,	TAD I TEM2	/WORD ON THIS ADDRESS
1305	0355		AND MASK	
1306	7041		CIA	
1307	1762		TAD I WRD2	/COMPARE
1310	7650		SNA CLA	/EQUAL?
1311	5326		JMP FND	/YES
1312	1366	TEND,	TAD TEM2	/NO
1313	7041		CIA	
1314	1776		TAD I WEADRI	/END OF BLOCK?
1315	7640		SZA CLA	
1316	5322		JMP.+4	/NO
1317	7240		STA	/YES
1320	3355		DCA MASK	/MASK:=7777
1321	5767		JMP I BEG2I2	/RETURN COMMAND
1322	7001		IAC	/ACCU:=1
1323	1366		TAD TEM2	
1324	3366		DCA TEM2	/STEP UP BEGA
1325	5304		JMP SRNXT	/TRY NEXT
1326	4221	FND,	JMS PCL	/PRINT CRLF
1327	1366		TAD TEM2	/ADDRESS
1330	4754		JMS I OCTPR	/PRINT OCTAL
1331	1341		TAD C334	/BACKSLASH
1332	4765		JMS I PNCI2	/PUNCH
1333	1766		TAD I TEM2	/PUNCH CONTENTS
1334	4754		JMS I OCTPR	
1335	5312		JMP TEND	/FIND OTHER WORDS
1336	1356	SKIP,	TAD SKIPIN	/7410
1337	5757		JMP I DOI	/EXECUTE AN UNCONDITIONAL SKIP
			/CONSTANTS AND VARIABLES TRACER PAGE5	
1340	1454	PRCL,	CLCON	
1341	0334	C334,	334	
1342	1172	IONFH2,	IONFH	
1343	0007	MASK7,	7	
1344	0567	BADR1,	BADR	
1345	0716	COM1,	COMPR	
1346	0564	EADR1,	EADR	
1347	0754	IONF2,	IONF	
1350	0574	CHS2,	CHS	
1351	0370	TSW2,	TSW	
1352	0365	TMD2,	TMODS	
1353	0336	CLST1,	CLIST	
1354	0671	OCTPR,	OCPN	
1355	7777	MASK,	7777	
1356	7410	SKIPIN,	7410	
1357	1026	DOI,	DO	
1360	0207	BEG3I1,	BEG3	
1361	0354	CSWI,	CSW	
1362	0371	WRD2,	WORD	
1363	0210	BEGN,	BEG3+1	
1364	0277	C277,	277	
1365	0726	PNCI2,	PUNCH	

1366	0000	TEM2,	0	
1367	0206	BEG2I2,	BEG2	
1370	0215	CRT,	215	
1371	0212	LFD,	212	
1372	0370	MAS370,	370	
1373	7520	M260,	-260	
1374	0323	SAD2,	SAD	
1375	1521	WBADRI,	WBADR	
1376	1520	WEADRI,	WEADR	
		*BEGIN+1200		
1400	1701	PION,	TAD I IONFH3	
1401	7640		SZA CLA	
1402	5702		JMP I DO7I	/NOT FIRST ION MET
1403	1001		TAD 1	
1404	3703		DCA I DUM1I	/SAVE LOC. 1
1405	1002		TAD 2	
1406	3704		DCA I DUM2I	/SAVE LOC. 2
1407	1305		TAD INIS	/TRAP
1410	3001		DCA 1	
1411	1306		TAD INTDI	
1412	3002		DCA 2	
1413	7001		IAC	
1414	3701		DCA I IONFH3	/IONFH:=1
1415	5702		JMP I DO7I	
1416	4220	PIOF,	JMS RST	/RESTORE LOC 1 AND 2
1417	5702		JMP I DO7I	/RETURN
1420	1420	RST,	0	/RESTRE ROUTINE
1421	1701		TAD I IONFH3	
1422	7650		SNA CLA	/IONFH3=1?
1423	7410		SKP	/NO
1424	4710		JMS I RESTI	/RESTORE
1425	3701		DCA I IONFH3	
1426	3707		DCA I IONACT	/CLEAR ION FLAGS
1427	5620		JMP I RST	
1430	1420	PTRAIL,	0	
1431	1311		TAD M200	/ROUTINE TRAIL PUNCH
1432	3312		DCA COUNT	
1433	1313		TAD C200	
1434	4714		JMS I PNCI3	/PUNCH TRAIL
1435	2312		ISZ COUNT	/READY?
1436	5233		JMP.-3	/NO
1437	5630		JMP I PTRAIL	/YES
1440	0000	LEAD,	0	/ROUTINE LEADER PRINT?
1441	1300		TAD LFLAG	/FIRST TIME BINPUNCH?
1442	7650		SNA CLA	
1443	4230		JMS PTRAIL	/YES, PUNCH TRAIL
1444	2300		ISZ LFLAG	/LFLAG
1445	5640		JMP I LEAD	/EXIT
1446	0000	CATCH,	0	/CATCH DEPENDS ON SR
1447	7604		LAS	
1450	7710		SPA CLA	/SR NEGATIVE?
1451	5676		JMP I PRINT	/YES, PRINT INSTR.
1452	1677		TAD I TMOD2	/NO
1453	5646		JMP I CATCH	/RETURN TO TRACER
1454	0000	CLCON,	0	/RESTORE BEFORE RESTART PTOD
1455	4220		JMS RST	
1456	7240		STA	
1457	3675		DCA I MSK	/SET WORD MASK TO 7777
1460	3674		DCA I MSWI 1	/CLEAR MSW
1461	3724		DCA I LFLI	/CLEAR LEADER FLAG
1462	5654		JMP I CLCON	/CONTINUE CLEARING
1463	4715	PROC2,	JMS I SAD3	/INVESTIGATE COMMANDS
1464	0327		327	/LETTER W?
1465	5267		JMP WBLK	/YES
1466	5716		JMP I GOON2	/NO, CONTINUE

1467	1717	WBLK,	TAD I WRD3	/LAST WORD TYPED BY USER
1470	3320		DCA WEADR	/STORE
1471	1722		TAD I TBADRI	/FIRST WORD TYPED BY USER
1472	3321		DCA WBADR	/STORE
1473	5723		JMP I BEG2I1	/RETURN COMMAND WITH CRLF

*TRRET+3

0605 4757 JMS I TRACE+157

*TRACE+157
CATCH

0757 1446

/CONSTANTS AND VARIABLES PAGE6

1474	0565	MSWI1,	MSW
1475	1355	MSK,	MASK
1476	0643	PRINT,	PINS
1477	0365	TMOD2,	TMODS
1500	0000	LFLAG,	0
1501	1172	IONFH3,	IONFH
1502	1035	DO7I,	DO+7
1503	1173	DUM1I,	DUM1
1504	1174	DUM2I,	DUM2
1505	5402	INIS,	JMP I 2
1506	0734	INTDI,	INTD
1507	0754	IONACT,	IONF
1510	1044	RESTI,	REST
1511	7600	M200,	-200
1512	0000	COUNT,	0
1513	0200	C200,	200
1514	0726	PNCI3,	PUNCH
1515	0323	SAD3,	SAD
1516	1237	GOON2,	PROC1
1517	0371	WRD3,	WORD
1520	0000	WEADR,	0
1521	0000	WBADR,	0
1522	0543	TBADRI,	TBADR
1523	0206	BEG2I1,	BEG2
1524	1500	LFLI,	LFLAG
1525	0000	BLST,	0

A	1153	ERSE	0551	M10	1166	READI	0374
ACCU	0352	F	1152	M1000	1162	REG	0363
ACCUI	0557	FADR	0461	M200	1511	REG1	0560
ACCU1	0770	FND	1326	M260	1373	REG2	0765
ACCU2	1146	GO	0316	M4	0774	RESRE	0776
ACU	0446	GOON	0377	M40	0360	REST	1044
ADID	1074	GOON1	0575	M4000	1161	RESTI	1510
ASRS	0571	GOON2	1516	M77	0573	RMUV	0431
AUTO	1127	GR5	1060	OCNT	0775	RNXT	0434
BADR	0567	INBLK	1200	OCPN	0671	RST	1420
BADR1	1344	INBL1	1164	OCTP	0361	RSTI	0545
BCNT	0572	INIS	1505	OCTPR	1354	SAD	0323
BEGIN	0200	INTD	0734	OUTB	1217	SAD1	0547
BEGN	1363	INTDI	1506	PAND	1277	SAD2	1374
REG2	0206	INTP	1000	PBIN	0511	SAD3	1515
BEG2I	0556	INTP1	0550	PC	0753	SBPT	0626
BEG2I1	1523	INTP2	0764	PCD	1141	SKIP	1336
BEG2I2	1367	IONACT	1507	PCHS	0526	SKIPIN	1356
BEG3	0207	IONF	0754	PCI	1140	SLASH	0242
BEG3I	0566	IONFH	1172	PCL	1221	SLS1	0756
BEG3I1	1360	IONFHI	0777	PINS	0643	SNXT	0631
BINT	0464	IONFH2	1342	PINS1	1151	SP	0561
BLST	1525	IONFH3	1501	PIOF	1416	SP1	0771
RMOD	0276	IONF1	1150	PIOFI	1170	SRNXT	1304
BNXT	0277	IONF2	1347	PION	1400	STADR	0364
CATCH	1446	IST	1163	PIONI	1171	STAD1	0752
CHS	0574	LADR	0355	PJMP	1124	STAR	0535
CHS2	1350	LCNT	0356	PJMS	1120	STARI	0375
CLCON	1454	LCNT1	0555	PMES	1052	TBADR	0543
CLEAR	0372	LCNT2	0763	PNCI	0376	TBADRI	1522
CLIST	0336	LEAD	1440	PNCI1	0563	TEM1	1157
CLOSE	0256	LF	0215	PNCI2	1365	TEM2	1366
CLR	1227	LFD	1371	PNCI3	1514	TEM3	0546
CLST1	1353	LFLAG	1500	PNTR	0362	TEND	1312
COMPR	0716	LFLGI	0577	PNTR1	0553	TMD2	1352
COM1	1345	LFLI	1524	PNTR2	0762	TMOD	0311
COUNT	1512	LINK	0353	PRCL	1340	TMODS	0365
CR	0212	LINK1	0767	PREPI	0755	TMOD1	0757
CRLF1	0373	LINK2	1145	PREPR	0344	TMOD2	1477
CRLF2	0250	LNK	0445	PREP1	0552	TMREG	0366
CRLF3	0766	LOCK	0357	PRET	0650	TMRG1	0761
CRT	1370	MASK	1355	PRETI	1155	TRACE	0600
CSW	0354	MASK7	1343	PRIN	0653	TRACER	0367
CSWI	1361	MAS370	1372	PRINT	1476	TRAC1	1147
C100	0570	MION	1143	PRNT	1154	TRRET	0602
C200	1513	MPRT	0453	PROC	0400	TSW	0370
C260	0772	MPRT1	1100	PROC1	1237	TSW1	0760
C277	1364	MSK	1475	PROC2	1463	TSW2	1351
C334	1341	MSW	0565	PSERC	1302	WBADR	1521
DO	1026	MSWI	1142	PSLH	0273	WBADRI	1375
DOI	1357	MSWI1	1474	PSLH1	0562	WBLK	1467
DO7I	1502	MS177	1156	PTRAIL	1430	WEADR	1520
DUM1	1173	MS370	1165	PTRALI	0544	WEADRI	1376
DUM1I	1503	MS7	0773	PTRI	0576	WORD	0371
DUM2	1174	MS7000	1167	PUNCH	0726	WRDI	0554
DUM2I	1504	MS7600	1160	QMRK	1274	WRD2	1362
EADR	0564	M1	1144	READ	0745	WRD3	1517
EADR1	1346						

