

DEC's 1974 PDP-8 Pocket Reference Card

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An [index](#) has been appended at the end of this document, along with [notes](#) on the transcription.

Editors Notes

In this reproduction, every effort has been made to preserve the typography of the original, but the results you see may vary depending on your web browser. Page breaks in the original are marked here with double horizontal rules, and the original was printed with black text and brown headings and figures on heavy white paper, using what might have been 6 point News Gothic (a small, light sans-serif font), with all titles and subtitles left justified. The original pages were 3.375" by 7" (8.7 by 18cm), stapled into book form.

The 1974 edition focused on the PDP-8/E instruction set, with figures integrated into the text and coverage of a variety of common peripherals from the early 1970's. Curiously, extended memory addressing instructions are not included in this reference card, and unfortunately, the typos in the original 1965 reference card were reintroduced in the descriptions of the SMA SZA, the SPA SZL and the SPA CLA combined operate microinstructions, along with a new typo on the SNA CLA instruction. These are corrected here.



POCKET REFERENCE CARD

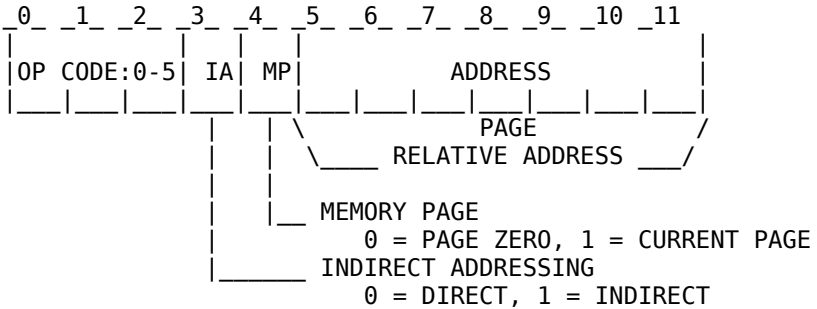
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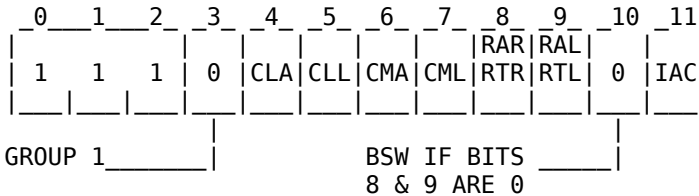
BASIC INSTRUCTIONS

| | | | |
|------------|------|----------------------------|-----|
| AND | 0000 | logical AND | 2.6 |
| TAD | 1aaa | 2's complement add | 2.6 |
| ISZ | 2aaa | increment and skip if zero | 2.6 |
| DCA | 3aaa | deposit and clear AC | 2.6 |
| JMS | 4aaa | jump to subroutine | 2.6 |
| JMP | 5aaa | jump | 1.2 |
| IOT | 6ddf | in-out transfer | --- |
| OPR | 7fff | operate | 1.2 |



Memory Reference Instruction Bit Assignments

GROUP 1 OPERATE MICROINSTRUCTIONS (1.2 usec)



Sequence

| | | | |
|---|-----|------|--------------------------|
| - | NOP | 7000 | no operation |
| 1 | CLA | 7200 | clear AC |
| 1 | CLL | 7100 | clear link |
| 2 | CMA | 7040 | complement AC |
| 2 | CML | 7020 | complement link |
| 4 | RAR | 7010 | rotate AC & link right 1 |
| 4 | RAL | 7004 | rotate AC & link left 1 |
| 4 | RTR | 7012 | rotate AC & link right 2 |
| 4 | RTL | 7006 | rotate AC & link left 2 |
| 4 | SWP | 7002 | swap bytes in AC |
| 3 | IAC | 7001 | increment AC |

GROUP 2 OPERATE MICROINSTRUCTIONS (1.2 usec)

GROUP 2

| | | | | | | | | | | | |
|---|---|---|---|-----|-----|-----|-----|---|-----|-----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | | CLA | SMA | SZA | SNL | 0 | | | |
| 1 | 1 | 1 | 1 | | SPA | SNA | SZL | 1 | OSR | HLT | 0 |
| | | | | | | | | | | | |

Sequence

1 (Bit 8 Zero) skip if SMA or SZA or SNL
 1 (Bit 8 One) skip if SPA and SNA and SZL

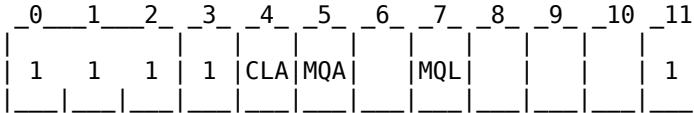
| | | | |
|---|-----|------|---------------------------------------|
| 1 | SMA | 7500 | skip on minus AC |
| 1 | SZA | 7440 | skip on zero AC |
| 1 | SPA | 7510 | skip on plus AC |
| 1 | SNA | 7450 | skip on non-zero AC |
| 1 | SNL | 7420 | skip on non-zero link |
| 1 | SZL | 7430 | skip on zero link |
| 1 | SKP | 7410 | skip unconditionally |
| 1 | CLA | 7600 | clear AC |
| 1 | OSR | 7404 | inclusive OR, switch register with AC |
| 1 | HLT | 7402 | halts the program |

COMBINED OPERATE MICROINSTRUCTIONS (1.2usec)

| | | | Sequence |
|---------|------|-------------------------------------|----------|
| CIA | 7041 | complement and increment AC | 2,3 |
| LAS | 7604 | load AC with switch register | 2,3 |
| STL | 7120 | set link (to 1) | 1,2 |
| GLK | 7204 | get link (put link in AC bit 11) | 1,4 |
| CLA CLL | 7300 | clear AC and link | 1 |
| CLL RAR | 7110 | shift positive number one right | 1,4 |
| CLL RAL | 7104 | shift positive number one left | 1,4 |
| CLL RTL | 7106 | clear link, rotate 2 left | 1,4 |
| CLL RTR | 7112 | clear link, rotate 2 right | 1,4 |
| SZA CLA | 7640 | skip if AC=0, then clear AC | 1,2 |
| SZA SNL | 7460 | skip if AC=0, or link is 1, or both | 1 |
| SNA CLA | 7650 | skip if AC/=0, then clear AC | 1,2 |
| SMA CLA | 7700 | skip if AC<0, then clear AC | 1,2 |
| SMA SZA | 7540 | skip if AC<=0 | 1 |
| SMA SNL | 7520 | skip if AC<0 or line is 1, or both | 1 |
| SPA SNA | 7550 | skip if AC>0 | 1 |
| SPA SZL | 7530 | skip if AC>=0 and if the link is 0 | 1 |
| SPA CLA | 7710 | skip of AC>=0, then clear AC | 1,2 |
| SNA SZL | 7470 | skip if AC=0 and link=0 | 1 |

MQ MICROINSTRUCTIONS (1.2usec)

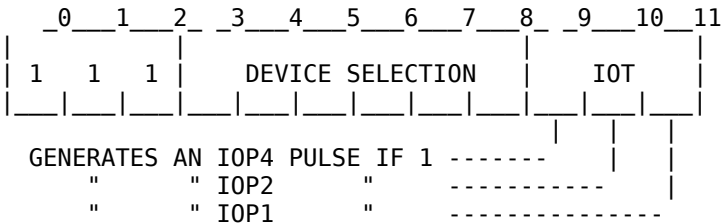
GROUP 3



Sequence

| | | | |
|---|----------|------|---------------------------------|
| | NOP | 7401 | no operation |
| 1 | CLA | 7601 | clear AC |
| 2 | MLQ | 7421 | load MQ from AC then clear AC |
| 2 | MQA | 7501 | inclusive OR the MQ with the AC |
| 3 | CAM | 7621 | clear AC and MQ |
| 3 | SWP | 7521 | swap AC and MQ |
| 3 | ACL | 7701 | load MQ into AC |
| 3 | CLA, SWP | 7721 | load AC from MQ then clear MQ |

IOT Instruction Bit Assignments



INTERNAL IOT MICROINSTRUCTIONS

PROGRAM INTERRUPT AND FLAG (1.2usec.)

| | | |
|------|------|------------------------------------|
| SKON | 6000 | skip if interrupt ON, and turn OFF |
| ION | 6001 | turn interrupt ON |
| IOf | 6002 | turn interrupt OFF |
| SRQ | 6003 | skip interrupt request |
| GTF | 6004 | get interrupt flags |
| RTF | 6005 | restore interrupt flags |
| SGT | 6006 | skip on Greater Than flag |
| CAF | 6007 | clear all flags |

EXTERNAL IOT MICROINSTRUCTIONS

TELETYPE KEYBOARD/READER--TYPE KE8

| | | | Time (usec.) |
|-----|------|--|--------------|
| KCF | 6030 | Clear Keyboard/Reader Flag, do not start Reader | 1.2 |
| KSF | 6031 | Skip if Keyboard/Reader Flag = 1 | 1.2 |
| KCC | 6032 | Clear AC and Keyboard/Reader Flag, set Reader run | 1.2 |
| KRS | 6034 | Read Keyboard/Reader Buffer Static | 1.2 |
| KIE | 6035 | AC 11 to Keyboard/Reader Interrupt Enable F.F. | 1.2 |
| KRB | 6036 | Clear AC, Read Keyboard Buffer Clear Keyboard Flags | 1.2 |

TELETYPE TELEPRINTER/PUNCH--TYPE KE8

| | | | Time (usec.) |
|-----|------|--|--------------|
| SPF | 6040 | Set Teleprinter/Punch Flag | 1.2 |
| TSF | 6041 | Skip if Teleprinter/Punch Flag = 1 | 1.2 |
| TCF | 6042 | Clear Teleprinter/Punch Flag | 1.2 |
| TPC | 6044 | Load Teleprinter/Punch Buffer Select and Print | 1.2 |
| SPI | 6045 | Skip if Teletype Interrupt | 1.2 |
| TLS | 6046 | Load Teleprinter/Punch Buffer, Select and Print and Clear Teleprinter/Punch Flag | 1.2 |

HIGH SPEED PERFORATED TAPE READER--TYPE PR8-E

| | | | Time (usec.) |
|-----|------|---|--------------|
| RPE | 6010 | Set Interrupt Enable for Reader and Punch | 1.2 |
| RSF | 6011 | Skip if Reader Flag = 1 | 1.2 |
| RRB | 6012 | Read Reader Buffer and Clear Flag | 1.2 |
| RCF | 6014 | Clear Flag and Buffer and Fetch Character | 1.2 |
| RCC | 6016 | Read Reader Buffer, Clear Flag and Buffer, and Fetch Character | |
| PCE | 6020 | Clear interrupt Enable for Reader and Punch | 1.2 |

HIGH SPEED PERFORATED TAPE PUNCH--TYPE PC03

| | | | Time (usec.) |
|-----|------|---|--------------|
| RPE | 6010 | Set Interrupt Enable for Reader and Punch | 1.2 |
| PCE | 6020 | Clear interrupt Enable for Reader and Punch | 1.2 |
| PSF | 6021 | Skip If Punch Flag = 1 | 1.2 |
| PCF | 6022 | Clear Flag and Buffer | 1.2 |
| PPC | 6024 | Load Buffer and Punch Character | 1.2 |
| PLS | 6026 | Clear Flag and Buffer, Load Buffer and Punch Character | 1.2 |

DECTAPE AND CONTROL--TYPE TU56/TC08

| | | | Time (usec.) |
|------|------|-------------------------|--------------|
| DTRA | 6761 | read status register A | 2.6 |
| DTCA | 6762 | clear status register A | 2.6 |
| DTXA | 6764 | load status register A | 2.6 |
| DTSF | 6771 | skip on flags | 2.6 |
| DTRB | 6772 | read status register B | 2.6 |
| DTLB | 6774 | load status register B | 2.6 |

RANDOM ACCESS DISC FILE--TYPE DF32D

| | | | Time (usec.) |
|------|------|---|--------------|
| DCMA | 6601 | clear disk memory address register, & disk flags | 2.6 |
| DMAR | 6603 | load disk memory address register & read | 3.6 |
| DMAW | 6605 | load disk memory address register and write | 3.6 |
| DCEA | 6611 | clear disk extended address register and address memory extension | 2.6 |
| DSAC | 6612 | skip on address confirmed flag | 2.6 |
| DEAL | 6615 | load disk extended address and memory address extension | 3.6 |
| DEAC | 6616 | read disk extended address register | 3.6 |
| DFSE | 6621 | skip on zero error flag | 2.6 |
| DFSC | 6622 | skip on data completion flag | 2.6 |
| DMAC | 6626 | read disk memory address register | 3.6 |

EXTENDED ARITHMETIC ELEMENT--KE8-E

MODE INSTRUCTIONS

| | | |
|------|------|-------------------------|
| SWAB | 7431 | switch Mode from A to B |
| SWBA | 7447 | switch Mode from B to A |

SHIFT INSTRUCTIONS

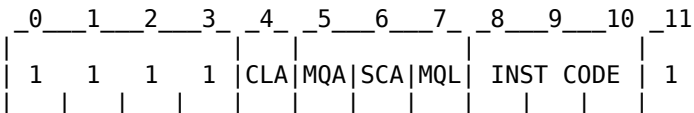
| | | |
|---------|---------------|---------------------------------|
| SCA | 7441 | logical OR step counter with AC |
| SCA CLA | 7641 | step counter to AC |
| SCL | 7403 (Mode A) | step counter load (from memory) |
| NMI | 7411 | normalize |
| SHL | 7413 | shift left |
| ASR | 7415 | arithmetic shift right |
| LSR | 7417 | logical shift right |
| ASC | 7403 (Mode B) | AC to step counter |

ARITHMETIC INSTRUCTIONS

| | | |
|-----|------|---------------------|
| MUY | 7405 | multiply |
| DVI | 7407 | divide |
| SAM | 7457 | subtract AC from MQ |

DOUBLE PRECISION INSTRUCTIONS (MODE B)

| | | |
|------|------|-------------------------------|
| DLD | 7763 | double precision load |
| DST | 7445 | double precision store |
| DAD | 7443 | double precision add |
| DPIC | 7573 | double precision increment |
| DCM | 7575 | double precision complement |
| DPSZ | 7451 | double precision skip if zero |



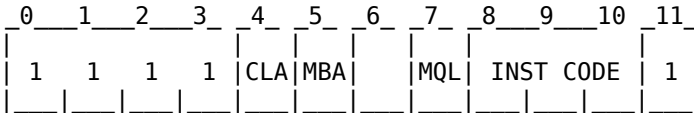
| | | | | | | |
|------------------|----|---|---|---|---|------------------|
| Logical Sequence | 1* | 2 | 2 | 2 | 3 | Instruction Code |
|------------------|----|---|---|---|---|------------------|

*Except for MQL

**Cannot be combined with other EAE operations

0=No Operation
 1=SCL
 2=MUY
 3=DVI
 4=NMI**
 5=SHL
 6=ASR
 7=LSR

EAE MODE B BIT ASSIGNMENTS



| | | |
|--|----------------|------------------|
| Logical | 1* 2 | 2 3 |
| | | Instruction Code |
| *Except for MQL | Bit 6=0 | Bit 6=1 |
| **Cannot be combined with other EAE operations | 0=No Operation | 0=SCA |
| | 1=ACS | 1=DAD |
| ***Bits 5 and 7 must be 1 | 2=MUY | 2=DST |
| | 3=DVI | 3=SWBA |
| | 4=NMI** | 4=DPSZ |
| | 5=SHL | 5=DPIC*** |
| | 6=ASR | 6=DCM*** |
| | 7=LSR | 7=SAM |

EAE INSTRUCTION DIFFERENCES

| | | |
|-------------|--------|--------|
| Instruction | Mode A | Mode B |
|-------------|--------|--------|

| | | |
|-------------------|--|--|
| MUY | The next location holds the multiplier | The next location holds the address of the multiplier |
| DVI | The next location holds the divisor | The next location holds the address of the divisor |
| SHL LSR ASR | The next location holds one less than the number of shifts. On right shifts, MQ11 is lost. | The next location holds the number of shifts. (A shift of zero places is legal.) On rights shifts, MQ11 is shifted into the GT flag. |

EAE INSTRUCTION TIMES

Mode A

| | MEM CYCLES | INSTR TIME | LONGEST CYCLE | NOTES |
|------|---------------|---------------|------------------|----------------|
| SWAB | 1 | 1.2us | 1.2us | |
| SWBA | 1 | 1.2 | 1.2 | |
| SCL | 2 | 2.6 | 1.4 | |
| MUY | 2 | 7.4 | 6.2 | |
| DVI | 2 | 7.4 | 6.2 | No overflow |
| NMI | 1 | 1.5+.3N | 8.1 | |
| SHL | 2 | 2.6+.3N | 8.9* | 25-place shift |
| ASR | 2 | 2.6+.3N | 8.9* | 25-place shift |
| LSR | 2 | 2.6+.3N | 8.9* | 25-place shift |
| SCA | 1 | 1.2 | 1.2 | |

Mode B

| | MEM CYCLES | INSTR TIME | LONGEST CYCLE | NOTES |
|------|---------------|---------------|------------------|----------------|
| SWAB | 1 | 1.2us | 1.2us | |
| SWBA | 1 | 1.2 | 1.2 | |
| ACS | 1 | 1.2 | 1.2 | |
| MUY | 3 | 8.6 | 6.2 | |
| DVI | 3 | 8.6 | 6.2 | No overflow |
| NMI | 1 | 1.5+.3N | 8.1 | |
| SHL | 2 | 2.9+.3N | 9.2** | 25-place shift |
| ASR | 2 | 2.9+.3N | 9.2** | 25-place shift |
| LSR | 2 | 2.9+.3N | 9.2** | 25-place shift |
| SCA | 1 | 1.2 | 1.2 | |
| DAD | 4 | 5.2 | 1.4 | |
| DST | 4 | 5.2 | 1.4 | |
| DPSZ | 1 | 1.2 | 1.2 | |
| DPIC | 1 | 1.6 | 1.6 | |
| DCM | 1 | 1.6 | 1.6 | |
| SAM | 1 | 1.2 | 1.2 | |

*Computed from 1.4+.3N

**Computed from 1.7+.3N

CONTROL CODES

| 8-bit ASCII CODE | Character Name | Remarks |
|------------------------|-------------------|---|
| 000 | null | Ignored in ASCII input. |
| 200 | leader/trailer | Leader/trailer code precedes and follows the data portion of binary files. |
| 203 | CTRL/C | OS/8 break character, forces return to Keyboard Monitor, echoed as ^C. |
| 207 | BELL | CTRL/G. |
| 211 | TAB | CTRL/I, horizontal tabulation. |
| 213 | VT | CTRL/K, vertical tabulation. |
| 214 | FORM | CTRL/L, form feed. |
| 215 | RETURN | Carriage return, generally echoed as carriage return followed by a line feed. |
| 217 | CTRL/O | Break Character, used conventionally to suppress Teletype output, echoed as ^O. |
| 225 | CTRL/U | Delete current input line, echoed as ^U. |
| 232 | CTRL/Z | End-of-File character for all ASCII and binary files (in relocatable binary files CTRL/Z is not a terminator if it occurs before the trailer code). |
| 233 | ESC | Escape replaces ALTMODE on some terminals. Considered equivalent to ALTMODE. |
| 375 | ALTMODE | Special break character for Teletype input. |
| 376 | PREFIX | PREFIX replaces ALTMODE on some terminals. Considered equivalent to ALTMODE. |
| 377 | RUBOUT | Key is labeled DELETE on some terminals Deletes the previous character typed. |

CHARACTER CODES

| 8-bit ASCII Code | 6-bit Code | DEC 029 Card Code | DEC 026 Card Code | Character Repre- sentation | Remarks |
|------------------------|---------------|-------------------------|-------------------------|----------------------------------|-------------------------------|
| 240 | 40 | blank | blank | | space |
| 241 | 41 | 11-8-2 | 12-8-7 | ! | exclamation point |
| 242 | 42 | 8-7 | 0-8-5 | " | quotation marks |
| 243 | 43 | 8-3 | 0-8-6 | # | number sign (10) |
| 244 | 44 | 11-8-3 | 11-8-3 | \$ | dollar sign |
| 245 | 45 | 0-8-4 | 0-8-7 | % | percent |
| 246 | 46 | 12 | 11-8-7 | & | ampersand |
| 247 | 47 | 8-5 | 8-6 | ' | apostrophe or acute accent |
| 250 | 50 | 12-8-5 | 0-8-4 | (| opening parenthesis |
| 251 | 51 | 11-8-5 | 12-8-4(1) |) | closing parenthesis |
| 252 | 52 | 11-8-4 | 11-8-4 | * | asterisk |
| 253 | 53 | 12-8-6 | 12 | + | plus |
| 254 | 54 | 0-8-3 | 0-8-3 | , | comma |
| 255 | 55 | 11 | 11 | - | minus sign or hyphen |
| 256 | 56 | 12-8-3 | 12-8-3 | . | period or decimal point |
| 257 | 57 | 0-1 | 0-1 | / | slash |
| 260 | 60 | 0 | 0 | 0 | |
| 261 | 61 | 1 | 1 | 1 | |
| 262 | 62 | 2 | 2 | 2 | |
| 263 | 63 | 3 | 3 | 3 | |
| 264 | 64 | 4 | 4 | 4 | |
| 265 | 65 | 5 | 5 | 5 | |
| 266 | 66 | 6 | 6 | 6 | |
| 267 | 67 | 7 | 7 | 7 | |
| 270 | 70 | 8 | 8 | 8 | |
| 271 | 71 | 9 | 9 | 9 | |
| 272 | 72 | 8-2 | 11-8-2 | : | colon |
| 273 | 73 | 11-8-2 | 0-8-2 | ; | semicolon |
| 274 | 74 | 12-8-4 | 12-8-6 | < | less than |
| 275 | 75 | 8-6 | 8-3 | = | equals |
| 276 | 76 | 0-8-6 | 11-8-6 | > | greater than |
| 277 | 77 | 0-8-7 | 12-8-2 | ? | question mark |

CHARACTER CODES

| 8-bit ASCII Code | 6-bit Code | DEC 029 Card Code | DEC 026 Card Code | Character Repre- sentation | Remarks |
|------------------------|---------------|-------------------------|-------------------------|----------------------------------|-----------------------------|
| 300 | 00 | 8-4 | 8-4 | @ | at sign |
| 301 | 01 | 12-1 | 12-1 | A | |
| 302 | 02 | 12-2 | 12-2 | B | |
| 303 | 03 | 12-3 | 12-3 | C | |
| 304 | 04 | 12-4 | 12-4 | D | |
| 305 | 05 | 12-5 | 12-5 | E | |
| 306 | 06 | 12-6 | 12-6 | F | |
| 307 | 07 | 12-7 | 12-7 | G | |
| 310 | 10 | 12-8 | 12-8 | H | |
| 311 | 11 | 12-9 | 12-9 | I | |
| 312 | 12 | 11-1 | 11-1 | J | |
| 313 | 13 | 11-2 | 11-2 | K | |
| 314 | 14 | 11-3 | 11-3 | L | |
| 315 | 15 | 11-4 | 11-4 | M | |
| 316 | 16 | 11-5 | 11-5 | N | |
| 317 | 17 | 11-6 | 11-6 | O | |
| 320 | 20 | 11-7 | 11-7 | P | |
| 321 | 21 | 11-8 | 11-8 | Q | |
| 322 | 22 | 11-9 | 11-9 | R | |
| 323 | 23 | 0-2 | 0-2 | S | |
| 324 | 24 | 0-3 | 0-3 | T | |
| 325 | 25 | 0-4 | 0-4 | U | |
| 326 | 26 | 0-5 | 0-5 | V | |
| 327 | 27 | 0-6 | 0-6 | W | |
| 330 | 30 | 0-7 | 0-7 | X | |
| 331 | 31 | 0-8 | 0-7 | Y | |
| 332 | 32 | 0-9 | 0-7 | Z | |
| 333 | 33 | 12-8-2(5) | 11-8-5 | [| opening bracket, SHIFT/K |
| 334 | 34 | 11-8-7(6) | 8-7 | / | backslash, SHIFT/L(8) |
| 335 | 35 | 0-8-2 | 12-8-5 |] | closing bracket, SHIFT/M |
| 336 | 36 | 12-8-7(7) | 8-5 | ^ | circumflex(2) |
| 337 | 37 | 0-8-5(3) | 8-2(3) | _ | underline(4)(9) |

Footnotes:

- (1) On some DEC 026 Keyboards, this character is graphically represented as [].
- (2) On most DEC Teletypes circumflex is replaced by up-arrow (^).
- (3) A card containing this code in column 1 with all remaining columns blank is an end-of-file card.
- (4) On most DEC teletypes underline is replaced by backarrow (<-).

- (5) On some 029 keyboards this character is graphically represented as cent sign (¢)
- (6) On some 029 keyboards this character is graphically represented as logical not (~).
- (7) On some 029 keyboards this character is graphically represented as vertical bar (|).
- (8) On some LP8 line printers, the character diamond (◇) is printed instead of backslash (\).
- (9) On some LP8 line printers, the character heart (♥) is printed instead of underline.
- (10) The number sign on some terminals is replaced by pound sign (£)

Paper Tape Rim Loader

| (Low Speed) | | (High Speed) | |
|-------------|-------------|--------------|-------------|
| 7756/ | <u>6032</u> | 7756/ | <u>6014</u> |
| 7757/ | <u>6031</u> | 7757/ | <u>6011</u> |
| 7760/ | 5357 | 7760/ | 5357 |
| 7761/ | <u>6036</u> | 7761/ | <u>6016</u> |
| 7762/ | 7106 | 7762/ | 7106 |
| 7763/ | 7006 | 7763/ | 7006 |
| 7764/ | 7510 | 7764/ | 7510 |
| 7765/ | <u>5357</u> | 7765/ | <u>5374</u> |
| 7766/ | <u>7006</u> | 7766/ | 7006 |
| 7767/ | <u>6031</u> | 7767/ | <u>6011</u> |
| 7770/ | 5367 | 7770/ | 5367 |
| 7771/ | <u>6034</u> | 7771/ | <u>6016</u> |
| 7772/ | 7420 | 7772/ | 7420 |
| 7773/ | 3776 | 7773/ | 3776 |
| 7774/ | 3376 | 7774/ | 3376 |
| 7775/ | <u>5356</u> | 7775/ | <u>5357</u> |



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