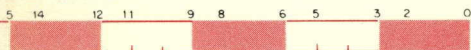


**digital****pdp11****PROGRAMMING CARD**

FOR FAMILY OF PDP-11 COMPUTERS

**WORD FORMAT:**BINARY-OCTAL  
REPRESENTATION

|      |   |
|------|---|
| MODE | R |
|------|---|

| Mode | Name               | Symbolic | Description                  |
|------|--------------------|----------|------------------------------|
| 0    | register           | R        | (R) is operand [ex. R2=%2]   |
| 1    | register deferred  | (R)      | (R) is address               |
| 2    | auto-increment     | (R)+     | (R) is adrs; (R) + (1 or 2)  |
| 3    | auto-incr deferred | @(R)+    | (R) is adrs of adrs; (R) + 2 |
| 4    | auto-decrement     | -(R)     | (R) - (1 or 2); (R) is adrs  |
| 5    | auto-decr deferred | @-(R)    | (R) - 2; (R) is adrs of adrs |
| 6    | index              | X(R)     | (R) + X is adrs              |
| 7    | index deferred     | @X(R)    | (R) + X is adrs of adrs      |

**PROGRAM COUNTER ADDRESSING:**

Reg = 7

|      |   |
|------|---|
| MODE | 7 |
|------|---|

|   |                   |     |                                    |
|---|-------------------|-----|------------------------------------|
| 2 | immediate         | #n  | operand n follows instr            |
| 3 | absolute          | @#A | address A follows instr            |
| 6 | relative          | A   | instr adrs + 4 + X is adrs         |
| 7 | relative deferred | @A  | instr adrs + 4 + X is adrs of adrs |

**LEGEND:****Op Codes**

■ = 0 for word/1 for byte  
 SS = source field (6 bits)  
 DD = destination field (6 bits)  
 R = gen register (3 bits), 0 to 7  
 XXX = offset (8 bits), +127 to -128  
 N = number (3 bits)  
 NN = number (6 bits)

**Operations**

( ) = contents of  
 s = contents of source  
 d = contents of destination  
 r = contents of register  
 ← = becomes  
 X = relative address  
 % = register definition

**Boolean**

Λ = AND  
 V = inclusive OR  
 ∨ = exclusive OR  
 ~ = NOT

**Condition Codes**

\* = conditionally set/cleared  
 - = not affected  
 0 = cleared  
 1 = set

**NOTE:**

- ▲ = Applies to the 11/35, 11/40, 11/45 & 11/70 computers
- = Applies to the 11/45 & 11/70 computers

**digital equipment corporation**

MAYNARD, MASSACHUSETTS

July 1975



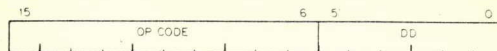
# NUMERICAL OP CODE LIST:

| OP Code   | Mnemonic     | OP Code   | Mnemonic   | OP Code  | Mnemonic         |
|-----------|--------------|-----------|------------|----------|------------------|
| 00 00 00  | HALT         | 00 60 DD  | ROR        | 10 40 00 | } EMT            |
| 00 00 01  | WAIT         | 00 61 DD  | ROL        | 10 43 77 |                  |
| 00 00 02  | RTI          | 00 62 DD  | ASR        | 10 44 00 | } TRAP           |
| 00 00 03  | BPT          | 00 63 DD  | ASL        | 10 47 77 |                  |
| 00 00 04  | IOT          | 00 64 NN  | MARK       |          |                  |
| 00 00 05  | RESET        | 00 65 SS  | MFPI       |          |                  |
| 00 00 06  | RTT          | 00 66 DD  | MTPI       |          |                  |
| 00 00 07  | { (unused)   | 00 67 DD  | SXT        |          |                  |
| 00 00 77  |              |           |            |          |                  |
| 00 01 DD  | JMP          | 00 70 00  | { (unused) | 10 50 DD | CLRB             |
| 00 02 OR  | RTS          | 00 77 77  |            | 10 51 DD | COMB             |
| 00 02 10  | { (unused)   | 01 SS DD  | MOV        | 10 52 DD | INCB             |
| 00 02 27  |              | 02 SS DD  | CMP        | 10 53 DD | DECB             |
| 00 02 3N  | SPL          | 03 SS DD  | BIT        | 10 54 DD | NEGB             |
| 00 02 40  | NOP          | 04 SS DD  | BIC        | 10 55 DD | ADCB             |
| 00 02 41  | { cond codes | 05 SS DD  | BIS        | 10 56 DD | SBCB             |
| 00 02 77  |              | 06 SS DD  | ADD        | 10 57 DD | TSTB             |
| 00 03 DD  | SWAB         | 07 OR SS  | MUL        | 10 60 DD | RORB             |
| 00 04 XXX | BR           | 07 1R SS  | DIV        | 10 61 DD | ROLB             |
| 00 10 XXX | BNE          | 07 2R SS  | ASH        | 10 62 DD | ASRB             |
| 00 14 XXX | BEQ          | 07 3R SS  | ASHC       | 10 63 DD | ASLB             |
| 00 20 XXX | BGE          | 07 4R DD  | XOR        | 10 64 00 | } (unused)       |
| 00 24 XXX | BLT          | 07 50 OR  | FADD       | 10 64 77 |                  |
| 00 30 XXX | BGT          | 07 50 1R  | FSUB       | 10 65 SS | MFPD             |
| 00 34 XXX | BLE          | 07 50 2R  | FMUL       | 10 66 DD | MTPD             |
| 00 4R DD  | JSR          | 07 50 3R  | FDIV       | 10 67 00 | } (unused)       |
| 00 50 DD  | CLR          | 07 50 40  | { (unused) | 10 77 77 |                  |
| 00 51 DD  | COM          | 07 67 77  |            |          |                  |
| 00 52 DD  | INC          | 07 7R NN  | SOB        | 11 SS DD | MOVB             |
| 00 53 DD  | DEC          | 10 00 XXX | BPL        | 12 SS DD | CMPB             |
| 00 54 DD  | NEG          | 10 04 XXX | BMI        | 13 SS DD | BITB             |
| 00 55 DD  | ADC          | 10 10 XXX | BHI        | 14 SS DD | BICB             |
| 00 56 DD  | SBC          | 10 14 XXX | BLOS       | 15 SS DD | BISB             |
| 00 57 DD  | TST          | 10 20 XXX | BVC        | 16 SS DD | SUB              |
|           |              | 10 24 XXX | BVS        | 17 00 00 | } floating point |
|           |              | 10 30 XXX | BCC, BHIS  | 17 77 77 |                  |
|           |              | 10 34 XXX | BCS, BLO   |          |                  |

# TRAP VECTORS:

|     |                          |     |                    |
|-----|--------------------------|-----|--------------------|
| 000 | (reserved)               | 114 | Memory Parity      |
| 004 | Time Out & other errors  | 240 | PIRQ, prog int req |
| 010 | illegal & reserved instr | 244 | Floating Point     |
| 014 | BPT instruction          | 250 | Memory Management  |
| 020 | IOT instruction          |     |                    |
| 024 | Power Fail               |     |                    |
| 030 | EMT instruction          |     |                    |
| 034 | TRAP instruction         |     |                    |

# SINGLE OPERAND: OPR dst



| Mnemonic | Op Code | Instruction | dst Result | N | Z | V | C |
|----------|---------|-------------|------------|---|---|---|---|
|----------|---------|-------------|------------|---|---|---|---|

# General

|        |         |                    |          |   |   |   |   |
|--------|---------|--------------------|----------|---|---|---|---|
| CLR(B) | ■ 050DD | clear              | 0        | 0 | 1 | 0 | 0 |
| COM(B) | ■ 051DD | complement (1's)   | $\sim d$ | * | * | 0 | 1 |
| INC(B) | ■ 052DD | increment          | $d + 1$  | * | * | * | * |
| DEC(B) | ■ 053DD | decrement          | $d - 1$  | * | * | * | * |
| NEG(B) | ■ 054DD | negate (2's compl) | $-d$     | * | * | * | * |
| TST(B) | ■ 057DD | test               | d        | * | * | 0 | 0 |

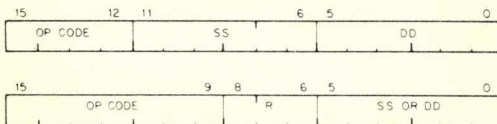
# Rotate & Shift

|        |         |                   |                    |   |   |   |   |
|--------|---------|-------------------|--------------------|---|---|---|---|
| ROR(B) | ■ 060DD | rotate right      | $\rightarrow C, d$ | * | * | * | * |
| ROL(B) | ■ 061DD | rotate left       | $C, d \leftarrow$  | * | * | * | * |
| ASR(B) | ■ 062DD | arith shift right | $d/2$              | * | * | * | * |
| ASL(B) | ■ 063DD | arith shift left  | 2d                 | * | * | * | * |
| SWAB   | 0003DD  | swap bytes        |                    | * | * | * | 0 |

# Multiple Precision

|        |         |                |         |   |   |   |   |
|--------|---------|----------------|---------|---|---|---|---|
| ADC(B) | ■ 055DD | add carry      | $d + C$ | * | * | * | * |
| SBC(B) | ■ 056DD | subtract carry | $d - C$ | * | * | * | * |
| ▲SXT   | 0067DD  | sign extend    | 0 or -1 | - | * | 0 | - |

# DOUBLE OPERAND: OPR src, dst OPR src, R or OPR R, dst



| Mnemonic | Op Code | Instruction | Operation | N | Z | V | C |
|----------|---------|-------------|-----------|---|---|---|---|
|----------|---------|-------------|-----------|---|---|---|---|

# General

|        |         |          |                      |   |   |   |   |
|--------|---------|----------|----------------------|---|---|---|---|
| MOV(B) | ■ 1SSDD | move     | $d \leftarrow s$     | * | * | 0 | - |
| CMP(B) | ■ 2SSDD | compare  | $s - d$              | * | * | * | * |
| ADD    | 06SSDD  | add      | $d \leftarrow s + d$ | * | * | * | * |
| SUB    | 16SSDD  | subtract | $d \leftarrow d - s$ | * | * | * | * |

# Logical

|        |         |                |                                  |   |   |   |   |
|--------|---------|----------------|----------------------------------|---|---|---|---|
| BIT(B) | ■ 3SSDD | bit test (AND) | $s \wedge d$                     | * | * | 0 | - |
| BIC(B) | ■ 4SSDD | bit clear      | $d \leftarrow (\sim s) \wedge d$ | * | * | 0 | - |
| BIS(B) | ■ 5SSDD | bit set (OR)   | $d \leftarrow s \vee d$          | * | * | 0 | - |

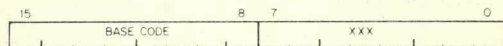
# Register

|      |        |                      |                           |   |   |   |   |
|------|--------|----------------------|---------------------------|---|---|---|---|
| MUL  | 070RSS | multiply             | $r \leftarrow r \times s$ | * | * | 0 | * |
| DIV  | 071RSS | divide               | $r \leftarrow r/s$        | * | * | * | * |
| ASH  | 072RSS | shift arithmetically |                           | * | * | * | * |
| ASHC | 073RSS | arith shift combined |                           | * | * | * | * |
| XOR  | 074RDD | exclusive OR         | $d \leftarrow r \oplus d$ | * | * | 0 | - |

B - - location

If condition is satisfied:  
Branch to location,  
New PC  $\leftarrow$  Updated PC + (2 x offset)

$\underbrace{\hspace{10em}}_{\text{adrs of br instr} + 2}$


$$\text{Op Code} = \text{Base Code} + \text{XXX}$$

| Mnemonic | Base Code | Instruction | Branch Condition |
|----------|-----------|-------------|------------------|
|----------|-----------|-------------|------------------|

### Branches

|     |        |                         |          |       |
|-----|--------|-------------------------|----------|-------|
| BR  | 000400 | branch (unconditional)  | (always) |       |
| BNE | 001000 | br if not equal (to 0)  | $\neq 0$ | Z = 0 |
| BEQ | 001400 | br if equal (to 0)      | = 0      | Z = 1 |
| BPL | 100000 | branch if plus          | +        | N = 0 |
| BMI | 100400 | branch if minus         | -        | N = 1 |
| BVC | 102000 | br if overflow is clear |          | V = 0 |
| BVS | 102400 | br if overflow is set   |          | V = 1 |
| BCC | 103000 | br if carry is clear    |          | C = 0 |
| BCS | 103400 | br if carry is set      |          | C = 1 |

### Signed Conditional Branches

|     |        |                            |          |                         |
|-----|--------|----------------------------|----------|-------------------------|
| BGE | 002000 | br if greater or eq (to 0) | $\geq 0$ | $N \neq V = 0$          |
| BLT | 002400 | br if less than (0)        | $< 0$    | $N \neq V = 1$          |
| BGT | 003000 | br if greater than (0)     | $> 0$    | $Z \vee (N \neq V) = 0$ |
| BLE | 003400 | br if less or equal (to 0) | $\leq 0$ | $Z \vee (N \neq V) = 1$ |

### Unsigned Conditional Branches

|      |        |                          |                |
|------|--------|--------------------------|----------------|
| BHI  | 101000 | branch if higher         | $C \vee Z = 0$ |
| BLOS | 101400 | branch if lower or same  | $C \vee Z = 1$ |
| BHIS | 103000 | branch if higher or same | $C = 0$        |
| BLO  | 103400 | branch if lower          | $C = 1$        |

**JUMP & SUBROUTINE:**

| Mnemonic | Op Code | Instruction              | Notes                                                         |
|----------|---------|--------------------------|---------------------------------------------------------------|
| JMP      | 0001DD  | jump                     | PC ← dst                                                      |
| JSR      | 004RDD  | jump to subroutine       | } use same R                                                  |
| RTS      | 0002OR  | return from subroutine   |                                                               |
| ▲MARK    | 0064NN  | mark                     | aid in subr return                                            |
| ▲SOB     | 077RNN  | subtract 1 & br (if ≠ 0) | (R) - 1, then if (R) ≠ 0:<br>PC ← Updated PC - 1<br>(2 x NN). |

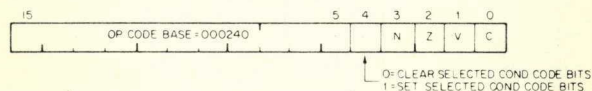
### TRAP & INTERRUPT:

| Mnemonic | Op Code             | Instruction                            | Notes              |
|----------|---------------------|----------------------------------------|--------------------|
| EMT      | 104000<br>to 104377 | emulator trap<br>(not for general use) | PC at 30, PS at 32 |
| TRAP     | 104400<br>to 104777 | trap                                   | PC at 34, PS at 36 |
| BPT      | 000003              | breakpoint trap                        | PC at 14, PS at 16 |
| IOT      | 000004              | input/output trap                      | PC at 20, PS at 22 |
| RTI      | 000002              | return from interrupt                  |                    |
| ▲RTT     | 000006              | return from interrupt                  | inhibit T bit trap |

**MISCELLANEOUS:**

| Mnemonic | Op Code | Instruction                    |
|----------|---------|--------------------------------|
| HALT     | 000000  | halt                           |
| WAIT     | 000001  | wait for interrupt             |
| RESET    | 000005  | reset external bus             |
| NOP      | 000240  | (no operation)                 |
| ● SPL    | 00023N  | set priority level (to N)      |
| ▲ MFPI   | 0065SS  | move from previous instr space |
| ▲ MTPI   | 0066DD  | move to previous instr space   |
| ● MFDP   | 1065SS  | move from previous data space  |
| ● MTPD   | 1066DD  | move to previous data space    |

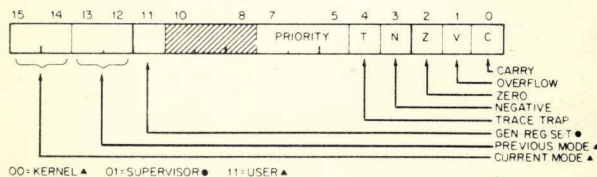
CONDITION CODE OPERATORS:



| Mnemonic | Op Code | Instruction       | N | Z | V | C |
|----------|---------|-------------------|---|---|---|---|
| CLC      | 000241  | clear C           | - | - | - | 0 |
| CLV      | 000242  | clear V           | - | - | 0 | - |
| CLZ      | 000244  | clear Z           | - | 0 | - | - |
| CLN      | 000250  | clear N           | 0 | - | - | - |
| CCC      | 000257  | clear all cc bits | 0 | 0 | 0 | 0 |
| SEC      | 000261  | set C             | - | - | - | 1 |
| SEV      | 000262  | set V             | - | - | 1 | - |
| SEZ      | 000264  | set Z             | - | 1 | - | - |
| SEN      | 000270  | set N             | 1 | - | - | - |
| SCC      | 000277  | set all cc bits   | 1 | 1 | 1 | 1 |

### PROCESSOR REGISTER ADDRESSES:

Processor Status Word  
PS - 777 776



## ▲ Stack Limit Register — 777 774

● Program Interrupt Request —777 772

|                          |              |              |
|--------------------------|--------------|--------------|
| <b>General Registers</b> | R0 — 777 700 | R4 — 777 704 |
| (console use only)       | R1 — 777 701 | R5 — 777 705 |
|                          | R2 — 777 702 | R6 — 777 706 |
| (not for 11/45)          | R3 — 777 703 | R7 — 777 707 |

**Console Switches & Display Register — 777 570**



**DEVICE REGISTER ADDRESSES:**

| Device                                   | Registers                                                                                                                                                                                                | Address                                                                                                                                                                                                              | Int<br>Vec-<br>tor | Prior-<br>ity | NPR | Device                                                                                                                                                                                                                                                                                                                    | Registers                                                                                                                                                                                                                                                                                                                                      | Address | Int<br>Vec-<br>tor | Prior-<br>ity | NPR |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------|---------------|-----|
| CD11                                     | Card Reader, high speed<br>status & control<br>column count<br>current address<br>data                                                                                                                   | (CDST) 777 160<br>(CDCC) 777 162<br>(CDBA) 777 164<br>(CDDB) 777 166                                                                                                                                                 | 230                | BR4           | X   | RJP04/ Disk<br>RWP04/ control & status #1<br>control word count<br>UNIBUS address<br>desired sector/track<br>address                                                                                                                                                                                                      | (RPCS1) 776 700<br>(RPWC) 776 702<br>(RPBA) 776 704<br>(RPDA) 776 706                                                                                                                                                                                                                                                                          | 254*    | BR5**              | X             |     |
| CR11                                     | Card Reader<br>status<br>buffer, 12-bit char<br>buffer, 8-bit char                                                                                                                                       | (CRS) 777 160<br>(CRB1) 777 162<br>(CRB2) 777 164                                                                                                                                                                    | 230                | BR6           |     | RH11 control &<br>status<br>drive status<br>error register #1<br>attention summary<br>look ahead<br>data buffer<br>maintenance register<br>drive type<br>serial number<br>offset<br>desired cylinder<br>current cylinder<br>error #2<br>error #3<br>ECC position<br>ECC pattern<br>bus address ext<br>control & status #3 | (RPCS2) 776 710<br><br>(RPDS) 776 712<br>(RPER1) 776 714<br>(RPAS) 776 716<br>(RPLA) 776 720<br>(RPDB) 776 722<br>(RPMR) 776 724<br>(RPDT) 776 726<br>(RPSN) 776 730<br>(RPOF) 776 732<br>(RPDC) 776 734<br>(RPCC) 776 736<br>(RPER2) 776 740<br>(RPER3) 776 740<br>(RPEC1) 776 744<br>(RPEC2) 776 746<br>(RPBAE) 776 750†<br>(RPCS3) 776 752† |         |                    |               |     |
| KW11-L                                   | Line Clock                                                                                                                                                                                               | (LKS) 777 546                                                                                                                                                                                                        | 100                | BR6           |     |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                |         |                    |               |     |
| KW11-P                                   | Programmable Clock<br>control & status<br>count set buffer<br>counter                                                                                                                                    | 772 540<br>772 542<br>772 544                                                                                                                                                                                        | 104                | BR6           |     |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                |         |                    |               |     |
| LA30,<br>LA36,<br>LT33,<br>VT05,<br>VT50 | Console Terminal<br>keyboard/reader status<br>keyboard/reader buffer<br>printer/punch status<br>printer/punch buffer                                                                                     | 777 560<br>777 562<br>777 564<br>777 566                                                                                                                                                                             | 60<br>64           | BR4           |     |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                |         |                    |               |     |
| LP11,<br>LS11,<br>LV11                   | Line Printer<br>printer status<br>printer data                                                                                                                                                           | 777 514<br>777 516                                                                                                                                                                                                   | 200                | BR4           |     |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                |         |                    |               |     |
| PC11                                     | Paper Tape<br>reader status<br>reader buffer<br>punch status<br>punch buffer                                                                                                                             | (PRS) 777 550<br>(PRB) 777 552<br>(PPS) 777 554<br>(PPB) 777 556                                                                                                                                                     | 70<br>74           | BR4           |     | RJS04/ Disk<br>RWS04/ control & status #1<br>word count<br>UNIBUS address<br>desired disk adrs<br>RH11 control & status<br>drive status<br>error<br>attention summary<br>look ahead<br>data buffer<br>maintenance<br>drive type<br>bus address ext<br>control & status #3                                                 | (RSCS1) 772 040<br>(RSWC) 772 042<br>(RSBA) 772 044<br>(RSDA) 772 046<br>(RSCS2) 772 050<br>(RSDS) 772 052<br>(RSER) 772 054<br>(RSAS) 772 056<br>(RSLA) 772 060<br>(RSDB) 772 062<br>(RSMR) 772 064<br>(RSDT) 772 066<br>(RSBAE) 772 070†<br>(RSCS3) 772 072†                                                                                 | 204*    | BR5**              | X             |     |
| RK11/<br>RK05                            | Disk Cartridge<br>drive status<br>error<br>control & status<br>word count<br>current bus adrs<br>disk address<br>data buffer                                                                             | (RKDS) 777 400<br>(RKER) 777 402<br>(RKCS) 777 404<br>(RKWC) 777 406<br>(RKBA) 777 410<br>(RKDA) 777 412<br>(RKDB) 777 416                                                                                           | 220                | BR5           | X   |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                |         |                    |               |     |
| RF11/<br>RS11                            | Disk<br>disk control status<br>word count<br>current mem adrs<br>disk address<br>disk adrs ext & error<br>disk data buffer<br>maintenance<br>adrs of disk segment                                        | (DCS) 777 460<br>(WC) 777 462<br>(CMA) 777 464<br>(DAR) 777 466<br>(DAE) 777 470<br>(DBR) 777 472<br>(MA) 777 474<br>(ADS) 777 476                                                                                   | 204                | BR5           | X   | TJU16/ Tape<br>TWU16/ control & status #1<br>TU16 word count<br>UNIBUS address<br>frame count<br>RH11 control & status<br>drive status<br>error<br>attention summary<br>check character<br>data buffer<br>maintenance<br>drive type<br>serial number<br>tape control<br>bus address ext<br>control & status #3            | (MTSC1) 772 440<br>(MTWC) 772 442<br>(MTBA) 772 444<br>(MTFC) 772 446<br>(MTCS2) 772 450<br>(MTDS) 772 452<br>(MTER) 772 454<br>(MTAS) 772 456<br>(MTCK) 772 460<br>(MTDB) 772 462<br>(MTMR) 772 464<br>(MTDT) 772 466<br>(MTSN) 772 470<br>(MTTC) 772 472<br>(MTBAE) 772 474†<br>(MTCS3) 772 476†                                             | 224*    | BR5**              | X             |     |
| RP11-C/Disk<br>RP03,<br>RPR11/<br>RPR02  | device status<br>error<br>control status<br>word count<br>bus address<br>cylinder address<br>disk address<br>maintenance 1<br>maintenance 2<br>maintenance 3<br>selected unit<br>cyl adrs<br>silo memory | (RPDS) 776 710<br>(RPER) 776 712<br>(RPCS) 776 714<br>(RPWC) 776 716<br>(RPBA) 776 720<br>(RPCA) 776 722<br>(RPDA) 776 724<br>(RPM1) 776 726<br>(RPM2) 776 730<br>(RPM3) 776 732<br>(SUCA) 776 734<br>(SILO) 776 736 | 254                | BR5           | X   | TMA11/ Magnetic Tape<br>TU10, status<br>TS03 command<br>byte record cntr<br>current mem adrs<br>data buffer<br>read lines                                                                                                                                                                                                 | (MTS) 772 520<br>(MTC) 772 522<br>(MTBRC) 772 524<br>(MTCMA) 772 526<br>(MTD) 772 530<br>(MTRD) 772 532                                                                                                                                                                                                                                        | 224     | BR5                | X             |     |
| RX11/<br>RX01                            | Floppy Disk<br>command & status<br>data buffer                                                                                                                                                           | (RXCS) 777 170<br>(RXDB) 777 172                                                                                                                                                                                     | 264                | BR5           |     |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                |         |                    |               |     |
|                                          |                                                                                                                                                                                                          |                                                                                                                                                                                                                      |                    |               |     | *Jumper Selectable<br>**Plug Selectable<br>† Implemented on PDP-11/70 only                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                |         |                    |               |     |

\*Jumper Selectable

\*\*Plug Selectable

† Implemented on PDP-11/70 only

| Device        | Registers                                                                   | Address                                                                                | Int<br>Vec-<br>tor | Prior-<br>ity | NPR |
|---------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------|---------------|-----|
| TA11          | Cassette<br>command & status<br>data buffer                                 | (TACS) 777 500<br>(TADB) 777 502                                                       | 260                | BR6           |     |
| TC11/<br>TU56 | DECTape<br>control & status<br>command<br>word count<br>bus address<br>data | (TCST) 777 340<br>(TCCM) 777 342<br>(TCWC) 777 344<br>(TCBA) 777 346<br>(TCDT) 777 350 | 214                | BR6           | X   |

# ABSOLUTE LOADER

Starting Address: — 500  
Memory Size: —  
4K 017  
8K 037  
12K 057  
16K 077  
20K 117  
24K 137  
28K 157  
(or larger)

# BOOTSTRAP LOADER

| Address | Contents               | Address | Contents          |
|---------|------------------------|---------|-------------------|
| — 744   | 016 701                | — 764   | 000 002           |
| — 746   | 000 026                | — 766   | — 400             |
| — 750   | 012 702                | — 770   | 005 267           |
| — 752   | 000 352                | — 772   | 177 756           |
| — 754   | 005 211                | — 774   | 000 765           |
| — 756   | 105 711                | — 776   | 177 560 (TTY)     |
| — 760   | 100 376                |         | or 177 550 (PC11) |
| — 762   | 116 162                |         |                   |
| 773 000 | Paper Tape Bootstrap   |         |                   |
| 773 100 | Disk/DECTape Bootstrap |         |                   |
| 773 200 | Card Reader Bootstrap  |         |                   |
| 773 300 | Cassette Bootstrap     |         |                   |
| 773 400 | Floppy Disk Bootstrap  |         |                   |

## BM873-YA BOOTSTRAP LOADER:

| Starting Address | Device                                              |
|------------------|-----------------------------------------------------|
| 773 000          | RF11                                                |
| 773 010          | RK11                                                |
| 773 020          | Transfer to address contained in<br>Switch Register |
| 773 030          | TC11                                                |
| 773 050          | TM11                                                |
| 773 100          | RP11                                                |
| 773 144          | RC11                                                |
| 773 210          | ASR paper tape reader                               |
| 773 230          | TA11                                                |
| 773 312          | PC11                                                |

## BM873-YB BOOTSTRAP LOADER:

| Starting<br>Address | Device                                         |
|---------------------|------------------------------------------------|
| 773 000             | RJS03/RJS04                                    |
| 773 002             | RJS03/RJS04                                    |
| 773 030             | RK11                                           |
| 773 032             | RK11                                           |
| 773 070             | TC11                                           |
| 773 110             | TM11                                           |
| 773 136             | RF11                                           |
| 773 150             | TJU16                                          |
| 773 212             | RC11                                           |
| 773 320             | RJP04                                          |
| 773 322             | RJP04                                          |
| 773 344             | Transfer to address in console switch register |
| 773 350             | RP11                                           |
| 773 352             | RP11                                           |
| 773 510             | KL11/DL11                                      |
| 773 524             | TA11                                           |
| 773 526             | TA11                                           |
| 773 620             | PC11                                           |

## PDP-11/70 BOOTSTRAP LOADER:

Starting Address 17 765 000

|              |   |      |    |         |   |
|--------------|---|------|----|---------|---|
| 21           | 8 | 7    | 3  | 2       | 0 |
| DEVICE TYPE  |   |      |    |         |   |
| UNIT #       |   |      |    |         |   |
| Device Type: | 1 | TM11 | 6  | TWU16   |   |
|              | 2 | TC11 | 7  | RWP04   |   |
|              | 3 | RK11 | 10 | RWS03/4 |   |
|              | 4 | RP11 | 11 | RX11    |   |

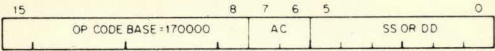
## MR11-DB BOOTSTRAP LOADER:

| Starting Address | Device |
|------------------|--------|
| 773 100          | RF11   |
| 773 110          | RK11   |
| 773 120          | TC11   |
| 773 136          | TM11   |
| 773 154          | RP11   |
| 773 220          | RC11   |

## 7-BIT ASCII CODE:

| Octal<br>Code | Char | Octal<br>Code | Char | Octal<br>Code | Char | Octal<br>Code | Char |
|---------------|------|---------------|------|---------------|------|---------------|------|
| 000           | NUL  | 040           | SP   | 100           | @    | 140           | \    |
| 001           | SOH  | 041           | !    | 101           | A    | 141           | a    |
| 002           | STX  | 042           | "    | 102           | B    | 142           | b    |
| 003           | ETX  | 043           | #    | 103           | C    | 143           | c    |
| 004           | EOT  | 044           | \$   | 104           | D    | 144           | d    |
| 005           | ENQ  | 045           | %    | 105           | E    | 145           | e    |
| 006           | ACK  | 046           | &    | 106           | F    | 146           | f    |
| 007           | BEL  | 047           | '    | 107           | G    | 147           | g    |
| 010           | BS   | 050           | (    | 110           | H    | 150           | h    |
| 011           | HT   | 051           | )    | 111           | I    | 151           | i    |
| 012           | LF   | 052           | *    | 112           | J    | 152           | j    |
| 013           | VT   | 053           | +    | 113           | K    | 153           | k    |
| 014           | FF   | 054           | ,    | 114           | L    | 154           | l    |
| 015           | CR   | 055           | -    | 115           | M    | 155           | m    |
| 016           | SO   | 056           | .    | 116           | N    | 156           | n    |
| 017           | SI   | 057           | /    | 117           | O    | 157           | o    |
| 020           | DLE  | 060           | 0    | 120           | P    | 160           | p    |
| 021           | DC1  | 061           | 1    | 121           | Q    | 161           | q    |
| 022           | DC2  | 062           | 2    | 122           | R    | 162           | r    |
| 023           | DC3  | 063           | 3    | 123           | S    | 163           | s    |
| 024           | DC4  | 064           | 4    | 124           | T    | 164           | t    |
| 025           | NAK  | 065           | 5    | 125           | U    | 165           | u    |
| 026           | SYN  | 066           | 6    | 126           | V    | 166           | v    |
| 027           | ETB  | 067           | 7    | 127           | W    | 167           | w    |
| 030           | CAN  | 070           | 8    | 130           | X    | 170           | x    |
| 031           | EM   | 071           | 9    | 131           | Y    | 171           | y    |
| 032           | SUB  | 072           | :    | 132           | Z    | 172           | z    |
| 033           | ESC  | 073           | ;    | 133           | [    | 173           | {    |
| 034           | FS   | 074           | <    | 134           | \    | 174           |      |
| 035           | GS   | 075           | =    | 135           | ]    | 175           | }    |
| 036           | RS   | 076           | >    | 136           | ^    | 176           | ~    |
| 037           | US   | 077           | ?    | 137           | _    | 177           | DEL  |

PDP-11/45, 11/70 FLOATING POINT PROCESSOR:



| Mnemonic     | Op Code           | Instruction              | Operation      |
|--------------|-------------------|--------------------------|----------------|
| CFCC         | 170000            | copy fl cond codes       |                |
| SETF         | 170001            | set floating mode        | FD ← 0         |
| SETI         | 170002            | set integer mode         | FL ← 0         |
| SETD         | 170011            | set fl dbl mode          | FD ← 1         |
| SETL         | 170012            | set long integer mode    | FL ← 1         |
| LDFPS        | 1701 src          | load FPP prog status     |                |
| STFPS        | 1702 dst          | store FPP prog status    |                |
| STST         | 1703 dst          | store (exc codes & adrs) |                |
| CLRF, CLRD   | 1704 fdst         | clear floating/double    | fdst ← 0       |
| TSTF, TSTD   | 1705 fdst         | test fl/dbl              |                |
| ABSF, ABSD   | 1706 fdst         | make absolute fl/dbl     | fdst ←  fdst   |
| NEGF, NEG D  | 1707 fdst         | negate fl/dbl            | fdst ← -fdst   |
| MULF, MUL D  | 171 (AC) fsrc     | multiply fl/dbl          | AC ← AC x fsrc |
| MODF, MOD D  | 171 (AC + 4) fsrc | multiply & integerize    |                |
| ADDF, ADD D  | 172 (AC) fsrc     | add fl/dbl               | AC ← AC + fsrc |
| LDF, LD D    | 172 (AC + 4) fsrc | load fl/dbl              | AC ← fsrc      |
| SUBF, SUB D  | 173 (AC) fsrc     | subtract fl/dbl          | AC ← AC — fsrc |
| CMPF, CMP D  | 173 (AC + 4) fsrc | compare fl/dbl (to AC)   |                |
| STF, ST D    | 174 (AC) fdst     | store fl/dbl             | fdst ← AC      |
| DIVF, DIV D  | 174 (AC + 4) fsrc | divide fl/dbl            | AC ← AC / fsrc |
| STEXP        | 175 (AC) dst      | store exponent           |                |
| STCFI, STCFL | 175 (AC + 4) dst  | store & convert fl or    | {              |
| STCDI, STCDL |                   | dbl to int or long int   |                |
| STCFD, STCDF | 176 (AC) fdst     | store & convert (dbl-fl) |                |
| LDEXP        | 176 (AC + 4) src  | load exponent            |                |
| LDCIF, LDCID | 177 (AC) src      | load & convert int or    | {              |
| LDCLF, LDCLE |                   | long int to fl or dbl    |                |
| LDCDF, LDCFD | 177 (AC + 4) fsrc | load & convert (dbl-fl)  |                |

PDP-11/35, 11/40 FLOATING POINT UNIT:

|      |        |                   | N | Z | V | C |
|------|--------|-------------------|---|---|---|---|
| FADD | 07500R | floating add      | * | * | 0 | 0 |
| FSUB | 07501R | floating subtract | * | * | 0 | 0 |
| FMUL | 07502R | floating multiply | * | * | 0 | 0 |
| FDIV | 07503R | floating divide   | * | * | 0 | 0 |

POWERS OF 2:

| n | 2 <sup>n</sup> | n  | 2 <sup>n</sup> |
|---|----------------|----|----------------|
| 0 | 1              | 10 | 1,024          |
| 1 | 2              | 11 | 2,048          |
| 2 | 4              | 12 | 4,096          |
| 3 | 8              | 13 | 8,192          |
| 4 | 16             | 14 | 16,384         |
| 5 | 32             | 15 | 32,768         |
| 6 | 64             | 16 | 65,536         |
| 7 | 128            | 17 | 131,072        |
| 8 | 256            | 18 | 262,144        |
| 9 | 512            | 19 | 524,288        |