## Instruction

## Instruction Format

| ABCD | Add decimal with extend                 | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       1     1     0     0     Rx     1     0     0     0     0     R/M     Ry  |
|------|---|--|
|      | ABCD Dy, Dx<br>ABCD -(Ay), -(Ax)        | R/M = 0 data register to data register R/M = 1 memory to memory  |
| ADD  | Add binary                              | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       1     1     0     1     Dn     Opmode     Effective Address       Mode     Register  |
|      | ADD <ea>, Dn<br/>ADD Dn, <ea></ea></ea> | Opmode byte word long<br>000 001 010<br>100 101 110  |
|      | Source effective address:               | Mode         Register         Mode         Register           Dn         000         #         d(An,Rn)         110         #           An         001         #         (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+         011         #         d(PC)         111         010           -(An)         100         #         d(PC,Rn)         111         011           d(An)         101         #         * <data>         111         100</data>                     |
|      | Destination effective address:          | Mode         Register         Mode         Register           Dn           d(An,Rn)         110         #           An           (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+         011         #         d(PC)             -(An)         100         #         d(PC,Rn)             d(An)         101         #         # <data> </data>  |
| ADDA | Add address<br>ADDA <ea>, An</ea>       | 15         14         13         12         11         10         9         8         7         6         5         4         3         2         1         0           1         1         0         1         An         Opmode         Effective Address           Mode         Register  |
|      |   | Opmode word long 011 111   |
|      | Source effective address:               | Mode         Register         Mode         Register           Dn         000         #         d(An,Rn)         110         #           An         001         #         (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+         011         #         d(PC)         111         010           -(An)         100         #         d(PC,Rn)         111         011           d(An)         101         #         * <ahref="data">data         111         100</ahref="data"> |

| ADDI | Add immediate                   | 15       | 14       | 13    | 12       | 11    | 10                | 9      | 8      | 7   | 6          | 5     | 4     | 3 2         | 1      | 0 |
|------|---------------------------------|----------|----------|-------|----------|-------|-------------------|--------|--------|---|------------|-------|-------|-------------|--------|---|
|      | ADDI # <data>, <ea></ea></data> | 0        | 0        | 0     | 0        | 0     | 1                 | 1      | 0      | Si  | ze         |       |       | ective Add  |        |   |
|      |                                 |          |          |       | <u> </u> | L.,   |                   |        |        |   |            |       | Mode  |             | egiste | r |
|      |                                 |          |          | Word  |          |       | bits)             |        |        |   |            |       |       | ta (8 bits) |        |   |
|      |                                 |          |          |       | Lor      | ng Da | ata (3            | 32 bit | s, ind | cludir  | ng pr      | eviou | JS W  | ord)        |        |   |
|      |                                 |          |          |       |          |       |                   |        |        |   |            |       |       |             |        |   |
|      |                                 | S        | ze       |       |          | /te   |                   |        | ord    |   |            | ng    |       |             |        |   |
|      |                                 |          |          |       | 0        | 0     |                   | 0      | 1      |   | 1          | 0     |       |             |        |   |
|      |                                 |          |          |       |          |       |                   |        |        |   |            |       |       |             |        |   |
|      | Destination effective address:  |          |          |       | ode      | Reg   |                   |        |        |   |            |       | de    | Register    |        |   |
|      |                                 |          | )n       | 00    |          | 7     | #                 |        |        | An,R  |            | 11    |       | #           |        |   |
|      |                                 |          | n        |       | -        |       | -                 |        |        | xx).۱   |            | 11    |       | 000         |        |   |
|      |                                 | •        | ın)      |       | 10       |       | #                 |        |        | xxx).   |            | 11    | 11    | 001         |        |   |
|      |                                 | ,        | n)+      |       | 11       |       | #                 |        |        | d(PC  |            | -     | -     |             |        |   |
|      |                                 | ,        | ۹n)      | 10    | 00       |       | #                 |        | •      | PC,R  | ,          | -     | -     |             |        |   |
|      |                                 | d(       | ٩n)      | 10    | 01       | 7     | #                 |        | #-     | <data< th=""><th><b>1</b>&gt;</th><th>-</th><th>-</th><th></th><th></th><th></th></data<> | <b>1</b> > | -     | -     |             |        |   |
|      |                                 |          |          |       |          |       |                   |        |        |   |            |       |       |             |        |   |
|      |                                 |          |          |       |          |       |                   |        |        |   |            |       |       |             |        |   |
|      |                                 |          |          |       |          |       |                   |        |        |   |            |       |       |             | , ,    |   |
| ADDQ | Add quick                       | 15       | 14       | 13    | 12       | 11    | 10                | 9      | 8      | 7   | 6          | 5     | 4     | 3 2         | 1      | 0 |
|      | ADDQ # <data>, <ea></ea></data> | 0        | 1        | 0     | 1        |       | Data              |        | 0      | Si  | ze         |       |       | ective Add  |        |   |
|      |                                 | Ľ        | ·        | Ů     | •        |       | Data              | '      | Ů      | Ü.,   |            | ľ     | Mode  | e R         | egiste | r |
|      |                                 | _        |          |       |          |       |                   |        |        |   |            |       |       |             |        |   |
|      |                                 | D        | ata      | - 3 b | oits, {  | 1-7,  | 0}, w             | hich   | repre  | esent   | the        | range | e {1- | -7, 8}      |        |   |
|      |                                 | c        | ze       |       | h        | /te   |                   | 14/6   | ord    |   | lo         | ng    |       |             |        |   |
|      |                                 | 3        | ZE       |       |          | 0     |                   |        | )1u    |   |            | 0     |       |             |        |   |
|      |                                 |          |          |       | U        | U     |                   | U      | 1      |   | '          | U     |       |             |        |   |
|      | Destination effective address:  |          |          | Mc    | de       | Rea   | ister             |        |        |   |            | Мо    | de    | Register    |        |   |
|      | Destination enective address.   | г        | )n       | 00    |          |       | #                 |        | 4(     | An,R  | n)         | 11    |       | #           |        |   |
|      |                                 |          | 'n       |       | 01       |       | <i>,</i><br>#     |        |        | (xx).\  |            | 11    |       | 000         |        |   |
|      |                                 |          | n)       |       | 10       |       | <del>,</del><br># |        |        | XXX).   |            | 11    |       | 001         |        |   |
|      |                                 | ,        | n)+      |       | 11       |       | <i>,</i><br>#     |        |        | d(PC  |            | -     |       |             |        |   |
|      |                                 | `        | An)      |       | 00       |       | <i>,</i><br>#     |        |        | PC,R  |            | _     |       |             |        |   |
|      |                                 |          | 4n)      |       | 01       |       | <i>,</i><br>#     |        |        | <data< th=""><th></th><th>_</th><th></th><th></th><th></th><th></th></data<>              |            | _     |       |             |        |   |
|      |                                 | ۵(,      | ,        | .,    |          |       | •                 |        |        | ·uutt   | •          |       |       |             |        |   |
|      |                                 |          |          |       |          |       |                   |        |        |   |            |       |       |             |        |   |
|      |                                 |          |          |       |          |       |                   |        |        |   |            |       |       |             |        |   |
| ADDX | Add extended                    | 15       | 14       | 13    | 12       | 11    | 10                | 9      | 8      | 7   | 6          | 5     | 4     | 3 2         | 1      | 0 |
| ADDA | , ida exteriaca                 | 1        | 1        | 0     | 1        |       | Rx                | Ū      | 1      | Si  |            | 0     |       | R/M         | Ry     |   |
|      |                                 | <u> </u> | <u> </u> | Ū     |          |       | 1 (//             |        |        | J .   |            |       |       | 1. 2.141    | 1 \ y  |   |
|      |                                 | S        | ze       |       | b١       | /te   |                   | w      | ord    |   | loi        | ng    |       |             |        |   |
|      |                                 | 0        |          |       |          | 0     |                   |        | 1      |   |            | 0     |       |             |        |   |
|      |                                 |          |          |       |          | -     |                   |        | •      |   |            | -     |       |             |        |   |
|      | ADDX Dy, Dx                     | R/M      | = 0      |       | data     | reai  | ster t            | o da   | ta re  | aiste   | r          |       |       |             |        |   |
|      | ADDX -(Ay), -(Ax)               | R/M      |          |       |          | _     | to me             |        |        | J. 2.20   |            |       |       |             |        |   |
|      | ( ) / ( ) /                     |          | •        |       |          | ,     |                   |        | ,      |   |            |       |       |             |        |   |

| AND    | AND logical   | 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  |
|--------|---|--|
| 7.1.12 |   | Effective Address  |
|        |   | 1 1 0 0 Dn Opmode Mode Register  |
|        | AND <ea>, Dn<br/>AND Dn, <ea><br/>Source effective address:</ea></ea> | Opmode         byte 000 001 010 100 100 100 100 100 100 10   |
| ANDI   | AND immediate   | (An) 010 # (xxx).L 111 001<br>(An)+ 011 # d(PC)<br>-(An) 100 # d(PC,Rn)<br>d(An) 101 # # <data></data>   |
|        | ANDI # <data>, <ea></ea></data>                                       | 0         0         0         0         0         1         0         Size         Effective Address Mode Register           Word Data (16 bits)         Byte Data (8 bits)           Long Data (32 bits, including previous word)           Size         byte word long 00           00         01         10 |
|        | Destination effective address:  | Mode Register       Mode Register         Dn 000 # d(An,Rn) 110 #         An (xxx).W 111 000         (An) 010 # (xxx).L 111 001         (An)+ 011 # d(PC) d(An) 100 # d(PC,Rn)   |
| ANDI   | AND immediate to CCR<br>ANDI # <data>, CCR</data>                     | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     0     0     0     0     1     0     0     0     1     1     1     1     1     0     0       0     0     0     0     0     0     0     0     0     Byte Data (8 bits)                             |
| ANDI   | AND immediate to SR<br>ANDI # <data>, SR</data>                       | 15   |

ASL, ASR

Arithmetic shift
ASd Dx, Dy
ASd #<data>, Dy

| 15 | 14 | 13 | 12 | 11 | 10    | 9  | 8  | 7  | 6  | 5   | 4 | 3 | 2 | 1  | 0 |
|----|----|----|----|----|-------|----|----|----|----|-----|---|---|---|----|---|
| 1  | 1  | 1  | 0  | C  | ount/ | Dx | dr | Si | ze | i/r | 0 | 0 |   | Dy |   |

dr = 0 shift left dr = 1 shift right

i/r = 0 immediate shift count i/r = 1 register shift count

Count If immediate, 3 bits, {1-7, 0}, which represent the range {1-7, 8} Dx If register, shift count in register Dx

| Size | byte | word | long |
|------|------|------|------|
|      | 00   | 01   | 10   |

ASd <ea>

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8  | 7 | 6 | 5                 | 4 | 3 | 2 | 1 | 0  |
|----|----|----|----|----|----|---|----|---|---|-------------------|---|---|---|---|----|
| ٦  | 1  | 1  | >  | 0  | 0  | 0 | ٦r | 1 | 1 | Effective Address |   |   |   |   |    |
| '  | '  | '  | U  | U  | U  | U | dr | ' | ' | Mode Register     |   |   |   |   | er |

dr = 0 shift left dr = 1 shift right

Destination effective address:

|       | Mode | Register |                 | Mode | Register |
|-------|------|----------|-----------------|------|----------|
| Dn    |      |          | d(An,Rn)        | 110  | #        |
| An    |      |          | (xxx).W         | 111  | 000      |
| (An)  | 010  | #        | (xxx).L         | 111  | 001      |
| (An)+ | 011  | #        | d(PC)           |      |          |
| -(An) | 100  | #        | d(PC,Rn)        |      |          |
| d(An) | 101  | #        | # <data></data> |      |          |

Bcc

Branch conditionally Bcc <label>

| 15  | 14 | 13 | 12 | 11        | 10 | 9 | 8 | 7 | 6 | 5     | 4    | 3    | 2    | 1 | 0 |
|---|----|----|----|-----------|----|---|---|---|---|-------|------|------|------|---|---|
| 0   | 1  | 1  | 0  | Condition |    |   |   |   |   | 8-bit | disp | lace | ment |   |   |
| 16-bit displacement if 8-bit displacement = 0 |    |    |    |           |    |   |   |   |   |       |      |      |      |   |   |

<label> = PC + displacement where displacement is 2's complement

Condition:

| CC | 0100 | MI | 1011 |
|----|------|----|------|
| CS | 0101 | GE | 1100 |
| NE | 0110 | LT | 1101 |
| EQ | 0111 | GT | 1110 |
| VC | 1000 | LE | 1111 |
| VS | 1001 | HI | 0010 |
| PL | 1010 | LS | 0011 |
|    |      |    |      |

|      | T ( 1% )                                    |   |                           |                    |        |                 |      | 1                    |  |                    |                       |                          |
|------|---|---|---------------------------|--------------------|--------|-----------------|------|----------------------|--|--------------------|-----------------------|--------------------------|
| BCHG | Test a bit and change<br>BCHG Dn, <ea></ea> | 15 14   | 13                        | 12                 | 11     | 10              | 9    | 8                    | 7  | 6                  |                       | 3 2 1 0 tive Address     |
|      | Borio Bii, (ear                             | 0 0   | 0                         | 0                  |        | Dn              |      | 1                    | 0  | 1                  | Mode                  | Register                 |
|      |   |   |                           |                    | l      |                 |      | l                    |  |                    |                       | 1 23 222                 |
|      | B0110 # 1 #                                 | 15 14   | 13                        | 12                 | 11     | 10              | 9    | 8                    | 7  | 6                  | 5 4                   | 3 2 1 0                  |
|      | BCHG # <data>, <ea></ea></data>             | 0 0   | 0                         | 0                  | 1      | 0               | 0    | 0                    | 0  | 1                  | Effec<br>Mode         | tive Address<br>Register |
|      |   | 0 0   | 0                         | 0                  | 0      | 0               | 0    | 0                    |  |                    | bit nur               |                          |
|      |   |   |                           |                    | ı      |                 |      | ı                    |  |                    |                       |                          |
|      | Destination effective address:              | D   |                           | de                 |        | jister          |      | -1/                  | ۸ ۵  | \                  |                       | Register                 |
|      |   | Dn<br>An  | 00                        | JU<br>-            |        | #<br>           |      | ,                    | An,R<br>(xx).\   | ,                  | 110<br>111            | #<br>000                 |
|      |   | (An)  |                           | 10                 |        | #               |      |                      | xxx).  |                    | 111                   | 001                      |
|      |   | (An)+   | 01                        |                    |        | #               |      | (                    | d(PC   | )                  |                       |                          |
|      |   | -(An)   |                           | 00                 |        | #<br>           |      |                      | PC,F   |                    |                       |                          |
|      |   | d(An)   | 10                        | 01                 | 7      | #               |      | #                    | <data< th=""><th>3&gt;</th><th></th><th></th></data<>        | 3>                 |                       |                          |
|      |   |   |                           |                    |        |                 |      |                      |  |                    |                       |                          |
| BCLR | Test a bit and clear                        | 15 14   | 13                        | 12                 | 11     | 10              | 9    | 8                    | 7  | 6                  | 5 4                   | 3 2 1 0                  |
|      | BCLR Dn, <ea></ea>                          | 0 0   | 0                         | 0                  |        | Dn              |      | 1                    | 1  | 0                  |                       | tive Address             |
|      |   |   | U                         | U                  |        | ווט             |      | '                    | '  | U                  | Mode                  | Register                 |
|      |   | 15 14   | 13                        | 12                 | 11     | 10              | 9    | 8                    | 7  | 6                  | 5 4                   | 3 2 1 0                  |
|      | BCLR # <data>, <ea></ea></data>             | 0 0   | 0                         | 0                  | 1      | 0               | 0    | 0                    | 1  | 0                  |                       | tive Address             |
|      |   |   |                           |                    |        |                 |      |                      |  | U                  | Mode                  | Register                 |
|      |   | 0 0   | 0                         | 0                  | 0      | 0               | 0    | 0                    |  |                    | bit nur               | nber                     |
|      | Destination effective address:              |   | Мо                        | ode                | Reg    | jister          |      |                      |  |                    | Mode F                | Register                 |
|      |   | Dn  | 00                        | 00                 |        | #               |      |                      | An,R   |                    | 110                   | #                        |
|      |   | An<br>(An)  |                           | -                  |        | <br>4           |      |                      | (xx).\   |                    | 111                   | 000                      |
|      |   | (An)<br>(An)+   | 01                        | 10<br>11           |        | #<br>#          |      |                      | xxx).<br>d(PC  |                    | 111<br>               | 001<br>                  |
|      |   | -(An)   |                           | 00                 |        | #               |      |                      | PC,F   |                    |                       |                          |
|      |   | d(An)   | 10                        | 01                 | 7      | #               |      | #-                   | <data< td=""><td><b>1</b>&gt;</td><td></td><td></td></data<> | <b>1</b> >         |                       |                          |
|      |   |   |                           |                    |        |                 |      |                      |  |                    |                       |                          |
|      | D 1 1                                       | T T   |                           |                    |        |                 |      |                      |  |                    |                       |                          |
| BRA  | Branch always<br>BRA <label></label>        | 15 14<br>0 1  | 13<br>1                   | 12                 | 11     | 10              | 9    | 8                    | 7  | 6                  | 5 4<br>8-bit displa   | 3 2 1 0                  |
|      | Bi o C stabels                              | <u> </u>  |                           |                    | -      | _               | _    |                      | 8-bit  |                    | lacement =            |                          |
|      |   |   |                           |                    |        |                 |      |                      |  |                    |                       |                          |
|      |   | <label< th=""><th>&gt; = F</th><th>PC +</th><th>disp</th><th>lacer</th><th>nent</th><th>whe</th><th>re dis</th><th>splac</th><th>ement is 2</th><th>'s complement</th></label<> | > = F                     | PC +               | disp   | lacer           | nent | whe                  | re dis   | splac              | ement is 2            | 's complement            |
|      |   |   |                           |                    |        |                 |      |                      |  |                    |                       |                          |
| DOET | Test a bit and set                          | 45 44   | 40                        | 40                 | 44     | 40              |      |                      | 7  |                    |                       | 3 2 1 0                  |
| BSET | BSET Dn, <ea></ea>                          | 15 14   | 13                        | 12                 | 11     | 10              | 9    | 8                    | 7  | 6                  | 5 4 Effec             | 3 2 1 0 tive Address     |
|      |   | 0 0   | 0                         | 0                  |        | Dn              |      | 1                    | 1  | 1                  | Mode                  | Register                 |
|      |   |   |                           |                    |        |                 |      |                      |  |                    |                       |                          |
|      | BSET # <data>, <ea></ea></data>             | 15 14   | 13                        | 12                 | 11     | 10              | 9    | 8                    | 7  | 6                  |                       | 3 2 1 0 tive Address     |
|      | BOET " data", "ca"                          | 0 0   | 0                         | 0                  | 1      | 0               | 0    | 0                    | 1  | 1                  | Mode                  | Register                 |
|      |   | 0 0   | 0                         | 0                  | 0      | 0               | 0    | 0                    |  |                    | bit nur               |                          |
|      |   |   |                           |                    |        |                 |      |                      |  |                    |                       |                          |
|      | Doctination offentive address:              | '   | 1.40                      | nda                | Do-    | ietor           |      |                      |  |                    | Mode <sup>r</sup>     | Pegister                 |
|      | Destination effective address:              | Dn  |                           | ode<br>00          | _      | jister<br>#     |      | d۱                   | An.R   | n)                 |                       | Register<br>#            |
|      | Destination effective address:              | Dn<br>An  | 00                        |                    | 7      | jister<br>#<br> |      |                      | An,R<br>(xx).\   |                    | Mode F<br>110<br>111  | Register<br>#<br>000     |
|      | Destination effective address:              | An<br>(An)  | 00<br>-<br>01             | 00<br><br>10       | ;<br>- | #<br><br>#      |      | ()                   | (xx).\<br>xxx).  | N<br>L             | 110<br>111<br>111     | #<br>000<br>001          |
|      | Destination effective address:              | An<br>(An)<br>(An)+   | 00<br>-<br>01<br>01       | 00<br><br>10<br>11 | ;<br>; | #<br><br>#<br># |      | ()                   | (XX).\<br>XXX).<br>d(PC                                      | N<br>L<br>)        | 110<br>111<br>111<br> | #<br>000<br>001<br>      |
|      | Destination effective address:              | An<br>(An)  | 00<br>-<br>01<br>01<br>10 | 00<br><br>10       | ;<br>; | #<br><br>#      |      | ()<br>()<br>()<br>() | (xx).\<br>xxx).  | N<br>L<br>)<br>ln) | 110<br>111<br>111     | #<br>000<br>001          |

Branch to subroutine BSR <label>

| 15  | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7                  | 6 | 5 | 4 | 3 | 2 | 1 | 0 |  |  |
|---|----|----|----|----|----|---|---|--------------------|---|---|---|---|---|---|---|--|--|
| 0   | 1  | 1  | 0  | 0  | 0  | 0 | 1 | 8-bit displacement |   |   |   |   |   |   |   |  |  |
| 16-bit displacement if 8-bit displacement = 0 |    |    |    |    |    |   |   |                    |   |   |   |   |   |   |   |  |  |

<label> = PC + displacement where displacement is 2's complement

Test a bit BTST Dn, <ea>

| 15 | 14 | 13 | 12 | 11 | 10  | 9 | 8 | 7 | 6 | 5 | 4    | 3     | 2   | 1      | 0  |
|----|----|----|----|----|-----|---|---|---|---|---|------|-------|-----|--------|----|
| )  | 0  | )  | 0  |    | Dn  |   | 1 | 0 | 0 |   | Effe | ctive | Add | ress   |    |
| U  | U  | U  | U  |    | ווט |   | ' | U | U | ı | Mode | ιν    | R   | egiste | er |

Destination effective address:

|       | Mode | Register |                 | Mode | Register |
|-------|------|----------|-----------------|------|----------|
| Dn    | 000  | #        | d(An,Rn)        | 110  | #        |
| An    |      |          | (xxx).W         | 111  | 000      |
| (An)  | 010  | #        | (xxx).L         | 111  | 001      |
| (An)+ | 011  | #        | d(PC)           | 111  | 010      |
| -(An) | 100  | #        | d(PC,Rn)        | 111  | 011      |
| d(An) | 101  | #        | # <data></data> | 111  | 100      |

BTST #<data>, <ea>

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4      | 3     | 2   | 1     | 0  |
|----|----|----|----|----|----|---|---|---|---|---|--------|-------|-----|-------|----|
| 0  | 0  | 0  | 0  | 1  | 0  | 0 | 0 | 0 | 0 |   | Effe   | ctive | Add | ress  |    |
| U  | U  | U  | U  | 1  | U  | U | U | U | U | - | Mode   | ;     | R   | egist | er |
| 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 |   |   |   | oit nu | ımbe  | r   |       |    |

Destination effective address:

|       | Mode | Register |                 | Mode | Register |
|-------|------|----------|-----------------|------|----------|
| Dn    | 000  | #        | d(An,Rn)        | 110  | #        |
| An    |      |          | (xxx).W         | 111  | 000      |
| (An)  | 010  | #        | (xxx).L         | 111  | 001      |
| (An)+ | 011  | #        | d(PC)           | 111  | 010      |
| -(An) | 100  | #        | d(PC,Rn)        | 111  | 011      |
| d(An) | 101  | #        | # <data></data> |      |          |

## CHK

Check register against bounds CHK <ea>, Dn

| Ī | 15 | 14 | 13 | 12 | 11 | 10                   | 9 | 8 | 7 | 6 | 5 | 4    | 3    | 2 | 1     | 0  |
|---|----|----|----|----|----|----------------------|---|---|---|---|---|------|------|---|-------|----|
| ſ | )  | 1  | 0  | 0  |    | Do 1 1 0 Effective A |   |   |   |   |   | Add  | ress |   |       |    |
|   | U  | '  | U  | U  |    | ווט                  |   | 1 | ' | U |   | Mode | 9    | R | egist | er |

Source effective address:

|       | Mode | Register |                 | Mode | Register |
|-------|------|----------|-----------------|------|----------|
| Dn    | 000  | #        | d(An,Rn)        | 110  | #        |
| An    |      |          | (xxx).W         | 111  | 000      |
| (An)  | 010  | #        | (xxx).L         | 111  | 001      |
| (An)+ | 011  | #        | d(PC)           | 111  | 010      |
| -(An) | 100  | #        | d(PC,Rn)        | 111  | 011      |
| d(An) | 101  | #        | # <data></data> | 111  | 100      |

| CLR  | Clear an operand               | 15  | 14                  | 13 | 12       | 11       | 10                           | 9  | 8        | 7  | 6  | 5 4         | 3        | 2 1 0               |
|------|--------------------------------|-----|---------------------|----|----------|----------|------------------------------|----|----------|--|----|-------------|----------|---------------------|
|      | CLR <ea></ea>                  | 0   | 1                   | 0  | 0        | 0        | 0                            | 1  | 0        | Si   | ze | Mod         |          | Address<br>Register |
|      |                                |     | l .                 |    |          |          |                              |    |          | l  |    | •           |          | i togiotoi          |
|      |                                | Si  | ze                  |    |          | ⁄te<br>0 |                              |    | ord<br>1 |  |    | ng<br>0     |          |                     |
|      |                                |     |                     |    | U        | U        |                              | U  |          |  | '  | U           |          |                     |
|      | Destination effective address: | -   |                     |    | de       | _        |                              |    | 17       |  |    | Mode        |          | ister<br>"          |
|      |                                |     | n<br>.n             |    | 00       |          | <b>#</b><br>-                |    |          | An,R<br>(xx).\   |    | 110<br>111  |          | #<br>00             |
|      |                                | (A  | n)                  | 0  | 10       | #        | <b>#</b>                     |    | (        | xxx).  | L  | 111         |          | 01                  |
|      |                                |     | n)+<br>An)          |    | 11<br>00 |          | ‡<br>‡                       |    |          | d(PC   | ,  |             |          | -                   |
|      |                                |     | ٦١ <i>١)</i><br>٩n) |    | )1       |          | <del>/</del><br>#            |    |          | PC,F<br><data< th=""><th></th><th></th><th></th><th><br/></th></data<>                 |    |             |          | <br>                |
|      |                                | `   | ,                   |    |          |          |                              |    |          |  |    |             |          |                     |
|      |                                |     |                     |    |          |          |                              |    |          |  |    |             |          |                     |
| CMP  | Compare                        | 15  | 14                  | 13 | 12       | 11       | 10                           | 9  | 8        | 7  | 6  | 5 4         | 3        | 2 1 0               |
|      | CMP <ea>, Dn</ea>              | 1   | 0                   | 1  | 1        |          | Dn                           |    | 0        | pmo  | de | Effe<br>Mod |          | Address<br>Register |
|      |                                |     |                     |    |          |          |                              |    |          |  |    | IVIOU       | <u> </u> | Negistei            |
|      |                                | Opn | node                |    | •        | /te      |                              |    | ord      |  |    | ng          |          |                     |
|      |                                |     |                     |    | 00       | 00       |                              | 00 | 01       |  | 0  | 10          |          |                     |
|      | Source effective address:      |     |                     |    | de       | Reg      |                              |    |          |  |    | Mode        |          | ister               |
|      |                                |     | n<br>.n             | 00 | 00       |          | <del>#</del><br>#            |    | ,        | An,F<br>(xx).\   | ,  | 110<br>111  |          | #<br>00             |
|      |                                |     | ın)                 |    | 10       |          | <del>/</del><br><del>/</del> |    |          | XXX).<br>XXX).   |    | 111         |          | 01                  |
|      |                                |     | n) <sup>′</sup> +   |    | 11       |          | <b>#</b>                     |    | (        | d(PC   | )  | 111         |          | 10                  |
|      |                                | •   | An)<br>An)          |    | 00<br>01 |          | <del>#</del><br>#            |    | •        | PC,F<br><data< th=""><th>,</th><th>111<br/>111</th><th></th><th>11<br/>00</th></data<> | ,  | 111<br>111  |          | 11<br>00            |
|      |                                | u(, | ,                   |    |          | ,        | ,                            |    | "        | ·uut   | 4- |             |          | 50                  |
|      |                                |     |                     |    |          |          |                              |    |          |  |    |             |          |                     |
| CMPA | Compare address                | 15  | 14                  | 13 | 12       | 11       | 10                           | 9  | 8        | 7  | 6  | 5 4         | 3        | 2 1 0               |
|      | CMP <ea>, An</ea>              | 1   | 0                   | 1  | 1        |          | An                           |    | 0        | pmo  | de |             |          | Address             |
|      |                                |     |                     |    |          |          |                              |    |          |  |    | Mod         | e        | Register            |
|      |                                | Opn | node                |    |          |          |                              |    | ord      |  |    | ng          |          |                     |
|      |                                |     |                     |    |          |          |                              | 01 | 11       |  | 1  | 11          |          |                     |
|      | Source effective address:      |     |                     | Мс | de       | Reg      | ister                        |    |          |  |    | Mode        | Reg      | ister               |
|      |                                |     | )n                  |    | 00       |          | <b>#</b>                     |    | ,        | An,R   | ,  | 110         |          | #                   |
|      |                                |     | n<br>n)             | 00 | )1<br>10 |          | ‡<br>‡                       |    |          | (XX).\<br>XXX).  |    | 111<br>111  |          | 00<br>01            |
|      |                                | •   | n)+                 | 0. |          |          | <i>;</i><br>‡                |    | ,        | d(PC   |    | 111         |          | 10                  |
|      |                                |     | An)                 |    | 00       |          | <b>#</b>                     |    | d(       | PC,F   | n) | 111         |          | 11                  |
|      |                                | d(A | ۹n)                 | 1( | 01       | #        | <b>#</b>                     |    | #*       | <data< th=""><th>3&gt;</th><th>111</th><th>10</th><th>00</th></data<>                  | 3> | 111         | 10       | 00                  |
|      |                                |     |                     |    |          |          |                              |    |          |  |    |             |          |                     |
|      |                                |     |                     |    |          |          |                              |    |          |  |    |             |          |                     |

**CMPI** 

Compare immediate CMPI #<data>, <ea>

| 15 | 14 | 13   | 12  | 11    | 10  | 9      | 8      | 7                      | 6     | 5     | 4    | 3    | 2 | 1     | 0  |
|----|----|------|-----|-------|---|--------|--------|------------------------|-------|-------|------|------|---|-------|----|
| 0  | 0  | 0    | 0   | 1     | 1   | 0      | 0      | Size Effective Address |       |       |      |      |   |       |    |
| U  | U  | U    | U   | 1     |   | U      | U      | 31.                    | 26    | -     | Mode | Э    | R | egist | er |
|    | '  | Word | Dat | a (16 | 1         1         0         0         Size         Mode         Register           (16 bits)         Byte Data (8 bits)           Data (32 bits, including previous word) |        |        |                        |       |       |      |      |   |       |    |
|    |    |      | Lor | ng Da | ata (3  | 32 bit | s, ind | cludir                 | ng pr | eviou | JS W | ord) |   |       |    |

| Size | byte | word | long |
|------|------|------|------|
|      | 00   | 01   | 10   |

Destination effective address:

|       | Mode | Register |                 | Mode | Register |
|-------|------|----------|-----------------|------|----------|
| Dn    | 000  | #        | d(An,Rn)        | 110  | #        |
| An    |      |          | (xxx).W         | 111  | 000      |
| (An)  | 010  | #        | (xxx).L         | 111  | 001      |
| (An)+ | 011  | #        | d(PC)           |      |          |
| -(An) | 100  | #        | d(PC,Rn)        |      |          |
| d(An) | 101  | #        | # <data></data> |      |          |

CMPM Compare memory

CMPM (Ay)+, (Ax)+

| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7  | 6  | 5 | 4 | 3 | 2 | 1  | 0 |
|----|----|----|----|----|----|---|---|----|----|---|---|---|---|----|---|
| 1  | 0  | 1  | 1  |    | Ax |   | 1 | Si | ze | 0 | 0 | 1 |   | Αv |   |

Size byte word long 00 01 10

**DBcc** Test condition, decrement, branch

DBcc Dn, <label>

| 15           | 14 | 13 | 12 | 11 | 10   | 9      | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1  | 0 |
|--------------|----|----|----|----|------|--------|---|---|---|---|---|---|---|----|---|
| 0            | 1  | 0  | 1  |    | Cond | dition |   | 1 | 1 | 0 | 0 | 1 |   | Dn |   |
| displacement |    |    |    |    |      |        |   |   |   |   |   |   |   |    |   |

<label> = PC + displacement where displacement is 2's complement

Condition:

| CC | 0100 | MI | 1011 |
|----|------|----|------|
| CS | 0101 | GE | 1100 |
| NE | 0110 | LT | 1101 |
| EQ | 0111 | GT | 1110 |
| VC | 1000 | LE | 1111 |
| VS | 1001 | HI | 0010 |
| PL | 1010 | LS | 0011 |
| F  | 0001 | T  | 0000 |

DIVS Signed divide

DIVS <ea>, Dn

| 15 | 14 | 13 | 12 | 11 | 10  | 9 | 8 | 7 | 6 | 5 | 4    | 3     | 2   | 1     | 0  |
|----|----|----|----|----|-----|---|---|---|---|---|------|-------|-----|-------|----|
| 1  | 0  | 0  | 0  |    | Dn  |   | 1 | 1 | 1 |   | Effe | ctive | Add | ress  |    |
| '  | U  | U  | U  |    | ווט |   | ! |   |   | ı | Mode | 9     | R   | egist | er |

Source effective address:

|               | Mode | Register |                 | Mode | Register |
|---------------|------|----------|-----------------|------|----------|
| Dn            | 000  | #        | d(An,Rn)        | 110  | #        |
| An            |      |          | (xxx).W         | 111  | 000      |
| (An)          | 010  | #        | (xxx).L         | 111  | 001      |
| (An)+         | 011  | #        | d(PC)           | 111  | 010      |
| -(An)         | 100  | #        | d(PC,Rn)        | 111  | 011      |
| $d(\Delta n)$ | 101  | #        | # <data></data> | 111  | 100      |

|         |  |                                       |            |              | -           |                          | <del> </del>            |                        | _ |
|---------|--|---------------------------------------|------------|--------------|-------------|--------------------------|-------------------------|------------------------|---|
| DIVU    | Unsigned divide DIVU <ea>, Dn</ea>     | 15 14                                 | 13 12      | 11 10        | 9 8         | 7 6                      | 5 4                     | 3 2 1 0 ective Address | + |
|         | DIVO (car, Dil                         | 1 0                                   | 0 0        | Dn           | 0           | 1 1                      | Mode                    |                        | 1 |
|         | Source effective address:              |                                       | Mode       | Register     |             |                          | Mode                    | Register               |   |
|         | Source effective address.              | Dn                                    | 000        | #            | d           | (An,Rn)                  | 110                     | #                      |   |
|         |  | An                                    |            |              |             | xxx).W                   | 111                     | 000                    |   |
|         |  | (An)                                  | 010        | #            |             | (xxx).L                  | 111                     | 001                    |   |
|         |  | (An)+<br>−(An)                        | 011<br>100 | #<br>#       |             | d(PC)<br>(PC,Rn)         | 111<br>111              | 010<br>011             |   |
|         |  | d(An)                                 | 101        | #            |             | <data></data>            | 111                     | 100                    |   |
|         |  |                                       |            | , ,          |             | T T                      |                         |                        | _ |
| EOR     | Exclusive OR logical EOR Dn, <ea></ea> | 15 14                                 | 13 12      | 11 10        | 9 8         | 7 6                      | 5 4                     | 3 2 1 0 ective Address | + |
|         | LOTT DII, Jour                         | 1 0                                   | 1 1        | Dn           | С           | pmode                    | Mode                    |                        | 1 |
|         |  | Opmode                                |            | yte<br>00    | word<br>101 |                          | ong<br>110              |                        | - |
|         | Destination effective address:         | _                                     | Mode       | Register     |             |                          | Mode                    | Register               |   |
|         |  | Dn<br>An                              | 000        | #            |             | (An,Rn)<br>xxx).W        | 110<br>111              | #<br>000               |   |
|         |  | (An)                                  | 010        | #            |             | (xxx).L                  | 111                     | 000                    |   |
|         |  | (Àn)+                                 | 011        | #            |             | d(PC)                    |                         |                        |   |
|         |  | -(An)                                 | 100        | #            |             | (PC,Rn)<br><data></data> |                         |                        |   |
|         |  | d(An)                                 | 101        | #            | #           | <uala></uala>            |                         |                        |   |
| EORI    | Exclusive OR immediate                 | 15 14                                 | 13 12      | 11 10        | 9 8         | 7 6                      | 5 4                     | 3 2 1 0                | 7 |
| LOIG    | EORI # <data>, <ea></ea></data>        | 0 0                                   | 0 0        | 1 0          | 1 0         | Size                     |                         | ctive Address          | 1 |
|         |  |                                       |            |              | 1 0         | Size                     | Mode                    |                        | ] |
|         |  | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ |            | ta (16 bits) | 2 hite in   | cluding r                | Byte Dat<br>previous wo |                        | + |
|         |  |                                       | LO         | ng Data (o   | Z DI(3, III | cluding p                | orcvious we             | ora)                   |   |
|         |  | Size                                  |            | yte<br>00    | word<br>01  |                          | ong<br>10               |                        |   |
|         | Destination effective address:         |                                       | Mode       | Register     | 01          |                          | Mode                    | Register               |   |
|         | Destination encetive address.          | Dn                                    | 000        | #            | d           | (An,Rn)                  | 110                     | #                      |   |
|         |  | An                                    |            |              |             | xxx).W                   | 111                     | 000                    |   |
|         |  | (An)<br>(An)+                         | 010<br>011 | #<br>#       |             | (xxx).L<br>d(PC)         | 111                     | 001                    |   |
|         |  | -(An)                                 | 100        | #            |             | (PC,Rn)                  |                         |                        |   |
|         |  | d(An)                                 | 101        | #            |             | <data></data>            |                         |                        |   |
|         |  |                                       |            |              |             |                          |                         |                        |   |
| EORI    | Exclusive OR immediate to CCR          | 15 14                                 | 13 12      | 11 10        | 9 8         | 7 6                      | 5 4                     | 3 2 1 0                | ] |
|         | EORI # <data>, CCR</data>              | 0 0                                   | 0 0        | 1 0          | 1 0         | 0 0                      |                         | 1 1 0 0                | 4 |
|         |  | 0 0                                   | 0 0        | 0 0          | 0 0         |                          | Byte Dat                | ta (8 bits)            | ⅃ |
|         |  |                                       |            |              |             |                          |                         |                        |   |
| EORI    | Exclusive OR immediate to SR           | 15 14                                 | 13 12      | 11 10        | 9 8         | 7 6                      | 5 4                     | 3 2 1 0                | 7 |
| <b></b> | EORI # <data>, SR</data>               | 0 0                                   | 0 0        | 1 0          | 1 0         | 0 1                      | 1 1                     | 1 1 0 0                | 1 |
|         |  |                                       |            |              | Vord Da     | ta (16 bit               | s)                      |                        | 1 |
|         |  |                                       |            |              |             |                          |                         |                        |   |
|         |  |                                       |            |              |             |                          |                         |                        |   |

| EVO     | Evoluncia vanistava                         |   |
|---------|---|---|
| EXG     | Exchange registers EXG Rx, Ry               | 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0<br>1 1 0 0 Rx 1 Opmode Ry   |
|         |   | Opmode - specifies whether exchanging Opmode Dn An Dn/An* 01000 01001 10001   |
|         |   | * if exchange is between Dn and An, then Rx=Dn and Ry=An  |
| EXT     | Sign extend<br>EXT Dn                       | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     0     0     Opmode     0     0     0     Dn   |
|         |   | Opmode B -> W W -> L<br>010 011   |
| ILLEGAL | Illegal instruction<br>ILLEGAL              | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     0     1     0     1     1     1     1     1     1     0     0   |
| JMP     | Jump<br>JMP <ea></ea>                       | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     1     0     1     1     1     Effective Address       Mode     Register   |
|         | Source effective address:                   | Mode Register  Dn d(An,Rn) 110 #  An (xxx).W 111 000  (An) 010 # (xxx).L 111 001  (An)+ d(PC) 111 010  -(An) d(PC,Rn) 111 011  d(An) 101 # # <data></data>  |
| JSR     | Jump to subroutine<br>JSR <ea></ea>         | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     1     0     1     0     Effective Address       Mode     Register   |
|         | Source effective address:                   | Mode         Register         Mode         Register           Dn           d(An,Rn)         110         #           An           (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+           d(PC)         111         010           -(An)           d(PC,Rn)         111         011           d(An)         101         #         # <data> </data> |
| LEA     | Load effective address<br>LEA <ea>, An</ea> | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     An     1     1     1     1     Effective Address       Mode     Register  |
|         | Source effective address:                   | Mode Register  Dn d(An,Rn) 110 #  An (xxx).W 111 000  (An) 010 # (xxx).L 111 001  (An)+ d(PC) 111 010  -(An) d(PC,Rn) 111 011  d(An) 101 # # <data></data>  |

LINK

Link and allocate

LINK An, #<displacement>

| 15                            | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1  | 0 |
|-------------------------------|----|----|----|----|----|---|---|---|---|---|---|---|---|----|---|
| 0                             | 1  | 0  | 0  | 1  | 1  | 1 | 0 | 0 | 1 | 0 | 1 | 0 |   | An |   |
| displacement (2's complement) |    |    |    |    |    |   |   |   |   |   |   |   |   |    |   |

LSL, LSR

Logical shift LSd Dx, Dy LSd #<data>, Dy

| 15 | 14 | 13 | 12 | 11 | 10    | 9  | 8  | 7  | 6  | 5   | 4 | 3 | 2 | 1  | 0 |
|----|----|----|----|----|-------|----|----|----|----|-----|---|---|---|----|---|
| 1  | 1  | 1  | 0  | Co | ount/ | Dx | dr | Si | ze | i/r | 0 | 1 |   | Dy |   |

dr = 0 shift left dr = 1 shift right

i/r = 0 immediate shift count i/r = 1 register shift count

Count If immediate, 3 bits, {1-7, 0}, which represent the range {1-7, 8} Dx If register, shift count in register Dx

DX II register, shift count in register DX

Size byte word long 00 01 10

| 15 | 14  | 13 | 12 | 11 | 10 | 9 | 8  | 7 | 6 | 5 | 4    | 3     | 2   | 1     | 0  |
|----|-----|----|----|----|----|---|----|---|---|---|------|-------|-----|-------|----|
| 1  | 1   | 1  | 0  | 0  | 0  | 1 | dr | 1 | 1 |   | Effe | ctive | Add | ress  |    |
| '  | l ' | '  | 0  | U  | ٠  | ' | ui | ' | ' |   | Mode | 9     | R   | egist | er |

dr = 0 shift left dr = 1 shift right

Destination effective address:

LSd <ea>

|       | Mode | Register |                 | Mode | Register |
|-------|------|----------|-----------------|------|----------|
| Dn    |      |          | d(An,Rn)        | 110  | #        |
| An    |      |          | (xxx).W         | 111  | 000      |
| (An)  | 010  | #        | (xxx).L         | 111  | 001      |
| (An)+ | 011  | #        | d(PC)           |      |          |
| -(An) | 100  | #        | d(PC,Rn)        |      |          |
| d(An) | 101  | #        | # <data></data> |      |          |

MOVE

Move data MOVE <ea>, <ea>

| 15 | 14 | 13       | 12 | 11 | 10       | 9 | 8     | 7    | 6 | 5 | 4    | 3   | 2    | 1     | 0  |
|----|----|----------|----|----|----------|---|-------|------|---|---|------|-----|------|-------|----|
| 0  | 0  | Size Des |    |    |          |   | natio | n    |   |   |      | Soi | ırce |       |    |
| U  | U  | 31       | 26 | R  | Register |   |       | Mode | ; | - | Mode | 9   | R    | egist | er |

d(PC) d(PC,Rn)

#<data>

|                                | Size  |      | yte<br>01 | word<br>11      | long<br>10 |          |
|--------------------------------|-------|------|-----------|-----------------|------------|----------|
| Source effective address:      |       | Mode | Register  |                 | Mode       | Register |
|                                | Dn    | 000  | #         | d(An,Rn)        | 110        | #        |
|                                | An    | 001  | #         | (xxx).W         | 111        | 000      |
|                                | (An)  | 010  | #         | (xxx).L         | 111        | 001      |
|                                | (An)+ | 011  | #         | d(PC)           | 111        | 010      |
|                                | -(An) | 100  | #         | d(PC,Rn)        | 111        | 011      |
|                                | d(An) | 101  | #         | # <data></data> | 111        | 100      |
| Destination effective address: |       | Mode | Register  |                 | Mode       | Register |
|                                | Dn    | 000  | #         | d(An,Rn)        | 110        | #        |
|                                | An    |      |           | (xxx).W         | 111        | 000      |
|                                | (An)  | 010  | #         | (xxx).L         | 111        | 001      |

011

100

101

#

#

#

(An)+

-(An)

d(An)

| MOVE | Move to CCR                    | 15          | 14          | 13 | 12      | 11            | 10                | 9 | 8   | 7   | 6  | 5        | 4    | 3 2           |       |
|------|--------------------------------|-------------|-------------|----|---------|---------------|-------------------|---|-----|---|----|----------|------|---------------|-------|
|      | MOVE <ea>, CCR</ea>            | 0           | 1           | 0  | 0       | 0             | 1                 | 0 | 0   | 1   | 1  |          |      | ctive Addres  |       |
|      |                                | Ů           |             | Ů  | Ū       | Ŭ             | •                 | Ů | Ů   |   |    | 1        | Mode | e Regi        | ister |
|      |                                |             |             |    |         | _             |                   |   |     |   |    |          |      | Б             |       |
|      | Source effective address:      | _           |             |    | de      | Register<br># |                   |   | /ام | ۸ ٦   | \  | Mo       |      | Register<br># |       |
|      |                                |             | n<br>.n     | 00 | JU<br>- |               |                   |   | ,   | An,R<br>(xx).\  | ,  | 11<br>11 |      | #<br>000      |       |
|      |                                |             | n)          | 0. |         |               | -<br>#            |   |     | xxx).\<br>xxx).   |    | 11       |      | 000           |       |
|      |                                | (Aı         | ,           | 0. |         |               | <del>7</del><br># |   |     | лл).<br>d(PC  |    | 11       |      | 010           |       |
|      |                                |             | ۱).<br>An)  |    | 00      |               | <del>,</del><br># |   |     | PC,F  |    | 11       |      | 011           |       |
|      |                                |             | ۱۱۱)<br>An) |    | 01      |               | ,<br><del> </del> |   |     | <data< th=""><th></th><th>11</th><th></th><th>100</th><th></th></data<> |    | 11       |      | 100           |       |
|      |                                | ٠,٠         | ,           |    |         |               | •                 |   |     |   | •  | •        |      | 100           |       |
|      |                                |             |             |    |         |               |                   |   |     |   |    |          |      |               |       |
|      |                                |             |             |    |         |               |                   |   |     |   |    |          |      |               |       |
| MOVE | Move to SR                     | 15          | 14          | 13 | 12      | 11            | 10                | 9 | 8   | 7   | 6  | 5        | 4    |               | 1 0   |
|      | MOVE <ea>, SR</ea>             | 0           | 1           | 0  | 0       | 0             | 1                 | 1 | 0   | 1   | 1  |          |      | ctive Addres  | SS    |
|      |                                | Ŭ           |             | Ü  | Ü       | Ů             | '                 |   | Ŭ   |   |    | 1        | Mode | e Regi        | ister |
|      |                                |             |             |    |         | _             |                   |   |     |   |    |          |      |               |       |
|      | Source effective address:      | -           |             |    | de      |               | ister             |   |     |   |    |          |      | Register      |       |
|      |                                |             | n           | 00 | JU<br>- |               | <del>‡</del>      |   |     | An,R  |    | 11       |      | #             |       |
|      |                                |             | n<br>.n)    | 0  |         |               | -<br>#            |   |     | (xx).\  |    | 11<br>11 |      | 000           |       |
|      |                                |             | า)+         | 0. |         |               | <del>†</del><br>‡ |   |     | xxx).<br>d(PC   |    | 11       |      | 001<br>010    |       |
|      |                                |             | ۱).<br>An)  |    | 00      |               | <del>7</del><br># |   |     | PC,F  |    | 11       |      | 010           |       |
|      |                                |             | ۱۱)<br>۹n)  | 10 |         |               | <del>,</del><br># |   |     | data  |    | 11       |      | 100           |       |
|      |                                | α( <i>i</i> | ,           |    | '       | ,             | •                 |   | "   | ·uuit   | 4- | •        |      | 100           |       |
|      |                                |             |             |    |         |               |                   |   |     |   |    |          |      |               |       |
|      |                                |             |             |    |         |               |                   |   |     |   |    |          |      |               |       |
| MOVE | Move from SR                   | 15          | 14          | 13 | 12      | 11            | 10                | 9 | 8   | 7   | 6  | 5        | 4    |               | 1 0   |
|      | MOVE SR, <ea></ea>             | 0           | 1           | 0  | 0       | 0             | 0                 | 0 | 0   | 1   | 1  |          | Effe | ctive Addres  | SS    |
|      |                                | U           | '           | U  | U       | U             | U                 | U | U   |   |    | 1        | Mode | e Regi        | ister |
|      |                                |             |             |    |         | _             |                   |   |     |   |    |          |      |               |       |
|      | Destination effective address: | _           |             | Mo |         |               | ister             |   | -1/ | ۸ ۵   | \  | Mo       |      | Register      |       |
|      |                                |             | n<br>.n     | 00 | JU<br>- |               | <b>#</b>          |   |     | An,R  |    | 11<br>11 |      | #<br>000      |       |
|      |                                |             | n)          | 0. |         |               | -<br>#            |   |     | (xx).\<br>xxx).   |    | 11       |      | 000           |       |
|      |                                | (Aı         |             | 0. |         |               | <del>7</del><br># |   |     | ^^^).<br>d(PC   |    |          |      |               |       |
|      |                                |             | 4n)         |    | 00      |               | <b>;</b>          |   |     | PC,F  |    | _        |      |               |       |
|      |                                |             | ۱۱.,<br>۹n) | 10 |         |               | #                 |   | •   | <data< td=""><td>,</td><td>_</td><td></td><td></td><td></td></data<>    | ,  | _        |      |               |       |
|      |                                | ~(,         | ,           |    |         |               |                   |   | ••  |   |    |          |      |               |       |
|      |                                |             |             |    |         |               |                   |   |     |   |    |          |      |               |       |
|      |                                |             |             |    |         |               |                   |   |     |   |    |          |      |               |       |
| MOVE | MOVE USP                       | 15          | 14          | 13 | 12      | 11            | 10                | 9 | 8   | 7   | 6  | 5        | 4    | 3 2           |       |
|      | MOVE USP, An                   | 0           | 1           | 0  | 0       | 1             | 1                 | 1 | 0   | 0   | 1  | 1        | 0    | dr A          | n     |
|      | MOVE An, USP                   |             |             |    |         |               |                   |   |     |   |    |          |      |               |       |

dr = 0 transfer address register to USP dr = 1 tramsfer USP to address register

| MOVEA | Move address   | 15                                      | 14           | 13 12  | 11               | 10                                  | 9                      | 8                          | 7   | 6                               | 5                          | 4                    | 3                   | 2                                  | 1       | 0       |
|-------|--|---|--------------|--|------------------|-------------------------------------|------------------------|----------------------------|---|---------------------------------|----------------------------|----------------------|---------------------|------------------------------------|---------|---------|
| MOVEA | MOVEA <ea>, An</ea>  |   |              |  |                  | stina                               |                        |                            |   |                                 |                            |                      |                     | ırce                               |         | Ů       |
|       | ,  | 0                                       | 0            | Size   |                  | egist                               |                        | 0                          | 0   | 1                               | 1                          | Mode                 | )                   | Re                                 | egist   | er      |
|       |  | Siz                                     | е            |  |                  |                                     | wo<br>1                |                            |   | loı<br>1                        | -                          |                      |                     |                                    |         |         |
|       | Source effective address:                                    | Dn<br>An<br>(An<br>(An)<br>–(Ar<br>d(Ar | )<br>+<br>า) | Mode<br>000<br>001<br>010<br>011<br>100<br>101 | #<br>#<br>#<br># | ister<br>#<br>#<br>#<br>#<br>#<br># |                        | (x<br>()<br>()<br>()<br>() | An,R<br>xx).\<br>xxx).<br>l(PC<br>PC,R<br><data< th=""><th>N<sup>°</sup><br/>L<br/>)<br/>Rn)</th><th>Mo<br/>11<br/>11<br/>11<br/>11</th><th>10<br/>11<br/>11<br/>11</th><th>0:<br/>0:<br/>0:</th><th>ister<br/>#<br/>00<br/>01<br/>10<br/>11</th><th></th><th></th></data<>       | N <sup>°</sup><br>L<br>)<br>Rn) | Mo<br>11<br>11<br>11<br>11 | 10<br>11<br>11<br>11 | 0:<br>0:<br>0:      | ister<br>#<br>00<br>01<br>10<br>11 |         |         |
| MOVEM | Move multiple registers MOVEM <reg list="">, <ea></ea></reg> | 15                                      | 14           | 13 12<br>0 0                                   | 11               | 10<br>dr                            | 9                      | 8                          | 7   | 6<br>Sz                         | 5                          |                      |                     | 2<br>Addr                          |         | 0       |
|       | MOVEM <ea>, <reg list=""></reg></ea>                         | <u> </u>                                | •            | ŭ ŭ  | •                |                                     | Regi                   |                            |   |                                 |                            | Mode                 | <del>)</del>        | Re                                 | egist   | er      |
|       |  |   |              | men  | nory<br>d trar   | to re                               | mory<br>gister<br>sfer |                            |   |                                 |                            |                      |                     |                                    |         |         |
|       | Source effective address:                                    | Dn<br>An<br>(An<br>(An)<br>–(Ar<br>d(Ar | )<br>+<br>า) | Mode<br><br><br>010<br>011<br><br>101          | -<br>-<br>#<br># | -                                   |                        | (x<br>()<br>()<br>()<br>() | An,R<br>xx).\<br>xxx).<br>I(PC<br>PC,R<br><data< th=""><th>N<sup>′</sup><br/>L<br/>)<br/>Rn)</th><th>Mo<br/>11<br/>11<br/>11<br/>11</th><th>10<br/>11<br/>11<br/>11</th><th>9<br/>00<br/>00<br/>01</th><th>ister<br/>#<br/>00<br/>01<br/>10<br/>11</th><th></th><th></th></data<> | N <sup>′</sup><br>L<br>)<br>Rn) | Mo<br>11<br>11<br>11<br>11 | 10<br>11<br>11<br>11 | 9<br>00<br>00<br>01 | ister<br>#<br>00<br>01<br>10<br>11 |         |         |
|       | Destination effective address:                               | Dn<br>An<br>(An<br>(An)<br>–(Ar<br>d(Ar | )<br>+<br>า) | Mode<br><br><br>010<br><br>100<br>101          | -<br>#           | -                                   |                        | (x<br>()<br>()<br>()<br>() | An,R<br>xx).\<br>xxx).<br>(PC<br>PC,R<br><data< th=""><th>N<sup>′</sup><br/>L<br/>)<br/>Rn)</th><th>Mo<br/>11<br/>11<br/>11<br/>-</th><th>10<br/>11<br/>11<br/>-</th><th>9<br/>00<br/>00<br/>-</th><th>ister<br/>#<br/>00<br/>01<br/><br/></th><th></th><th></th></data<>         | N <sup>′</sup><br>L<br>)<br>Rn) | Mo<br>11<br>11<br>11<br>-  | 10<br>11<br>11<br>-  | 9<br>00<br>00<br>-  | ister<br>#<br>00<br>01<br><br>     |         |         |
|       | Register List Mask<br>Addressing mode -(An):                 |   | 14<br>D1     | 13 12<br>D2 D3                                 | 11<br>D4         | 10<br>D5                            | 9<br>D6                | 8<br>D7                    | 7<br>A0   | 6<br>A1                         | 5<br>A2                    | 4<br>A3              | 3<br>A4             | 2<br>A5                            | 1<br>A6 | 0<br>A7 |
|       | All other addressing modes:                                  |   | 14<br>46     | 13 12<br>A5 A4                                 | 11<br>A3         | 10<br>A2                            | 9<br><b>A1</b>         | 8<br><b>A</b> 0            | 7<br>D7   | 6<br>D6                         | 5<br>D5                    | 4<br>D4              | 3<br>D3             | 2<br>D2                            | 1<br>D1 | 0<br>D0 |

<sup>=&</sup>gt; low order bit is the first register to be transferred

| MOVEP | Move peripheral data                         | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     0     0     0     Dx     Opmode     0     0     1     Ay   displacement   |
|-------|--|---|
|       | MOVEP d(Ay), Dx<br>MOVEP Dx, d(Ay)           | Opmode - specifies direction and size of operation Opmode word long 100 101 110 111   |
| MOVEQ | Move quick<br>MOVEQ # <data>, Dn</data>      | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     1     1     1     0 <t< th=""></t<> |
| MULS  | Signed multiply<br>MULS <ea>, Dn</ea>        | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       1     1     0     0     Dn     1     1     1     1     Effective Address       Mode     Register  |
|       | Source effective address:                    | Mode         Register         Mode         Register           Dn         000         #         d(An,Rn)         110         #           An           (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+         011         #         d(PC)         111         010           -(An)         100         #         d(PC,Rn)         111         011           d(An)         101         #         * <data>         111         100</data>  |
| MULU  | Unsigned multiply<br>MULU <ea>, Dn</ea>      | 15       14       13       12       11       10       9       8       7       6       5       4       3       2       1       0         1       1       0       0       Dn       0       1       1       Effective Address         Mode       Register  |
|       | Source effective address:                    | Mode Register  Dn 000 # d(An,Rn) 110 #  An (xxx).W 111 000  (An) 010 # (xxx).L 111 001  (An)+ 011 # d(PC) 111 010  -(An) 100 # d(PC,Rn) 111 011  d(An) 101 # # <data> 111 100</data>  |
| NBCD  | Negate decimal with extend<br>NBCD <ea></ea> | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     0     0     0     0     0     0     0     Effective Address       Mode     Register   |
|       | Destination effective address:               | Mode         Register         Mode         Register           Dn         000         #         d(An,Rn)         110         #           An           (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+         011         #         d(PC)             -(An)         100         #         d(PC,Rn)             d(An)         101         #         # <data> </data>   |

| NEG  | Negate                              | 15         | 14         | 13  | 12                     | 11  | 10                | 9     | 8                  | 7  | 6          | 5        | 4         | 3 2              | 1          | 0  |
|------|-------------------------------------|------------|------------|-----|------------------------|-----|-------------------|-------|--------------------|--|------------|----------|-----------|------------------|------------|----|
| 0    | NEG <ea></ea>                       | 0          | 1          | 0   | 0                      | 0   | 1                 | 0     | 0                  | Siz  |            |          |           | ctive Add        |            | Ů  |
|      |                                     | U          | ļ '        | U   | U                      | U   | ı                 | -     | U                  | SI.  | <u> </u>   | N        | Лode      | F                | Regist     | er |
|      |                                     | S          | ize        |     | by                     | /te |                   | wo    | ord                | lo   |            | ng       |           |                  |            |    |
|      |                                     |            |            |     | C                      | 00  |                   | 0     | 1                  |  |            | 0        |           |                  |            |    |
|      | Destination effective address:      | ſ          | On         |     | Mode Register<br>000 # |     | d(An,Rn)          |       |                    | n)   | Mo:        |          | Register  | -                |            |    |
|      |                                     |            | Αn         | -   |                        |     |                   |       | (xxx).W            |  |            | 11       |           | 000              |            |    |
|      |                                     | ,          | An)<br>տ)+ |     | 10<br>11               |     | #<br>#            |       |                    | xxx).l<br>d(PC   |            | 11       |           | 001<br>          |            |    |
|      |                                     |            | An)        |     | 00                     |     | <del>,</del><br># |       |                    | PC,R   |            |          |           |                  |            |    |
|      |                                     | d(         | An)        | 10  | 01                     | 7   | <b>#</b>          |       | #                  | <data< th=""><th><b> </b>&gt;</th><th></th><th>-</th><th></th><th></th><th></th></data<> | <b> </b> > |          | -         |                  |            |    |
|      |                                     |            |            |     |                        |     |                   |       |                    |  |            |          |           |                  |            |    |
| NEGX | Negate with extend                  | 15         | 14         | 13  | 12                     | 11  | 10                | 9     | 8                  | 7  | 6          | 5        | 4         | 3 2              | 1          | 0  |
|      | NEGX <ea></ea>                      | 0          | 1          | 0   | 0                      | 0   | 0                 | 0     | 0                  | Siz  | ze         | _        |           | ctive Add        |            |    |
|      |                                     |            |            |     |                        |     |                   |       |                    |  |            | IN.      | Node      | )   F            | Regist     | er |
|      |                                     | S          | ize        |     |                        | /te |                   |       | ord                |  |            | ong      |           |                  |            |    |
|      |                                     |            |            |     | C                      | 00  |                   | 0     | 1                  |  | 1          | 0        |           |                  |            |    |
|      | Destination effective address:      |            |            | Мс  | ode                    | Reg | ister             |       |                    |  |            | Мо       | de        | Register         | -          |    |
|      |                                     |            | On<br>^    | 000 |                        | #   |                   |       | d(An,Rn)           |  |            | 11       |           | #                |            |    |
|      |                                     | An<br>(An) |            |     | 10                     |     | -<br><b>#</b>     |       | (xxx).W<br>(xxx).L |  |            | 11<br>11 |           | 000<br>001       |            |    |
|      |                                     | (An)+      |            | 0.  | 11                     | 7   | #                 | d(PC) |                    |  | )          |          |           |                  |            |    |
|      |                                     |            | An)        |     | 00<br>01               |     | #<br>#            |       |                    | PC,R<br><data< th=""><th></th><th></th><th></th><th></th><th></th><th></th></data<>      |            |          |           |                  |            |    |
|      |                                     | u(         | An)        | 10  | J 1                    | 1   | +                 |       | #                  | ~uala  | -          |          | -         |                  |            |    |
|      |                                     |            | 1          | 1   | 1                      | ı   |                   |       |                    | 1  |            | 1        |           |                  |            |    |
| NOP  | No operation<br>NOP                 | 15         | 14         | 13  | 12                     | 11  | 10<br>1           | 9     | 8                  | 7  | 6<br>1     | 5<br>1   | 4         | 3 2<br>0 0       | 0          | 0  |
|      | NOF                                 |            | '          | U   | U                      |     |                   |       | U                  | U  |            | ! !      | '         | 0   0            | 1 0        |    |
|      |                                     |            |            |     |                        |     | 1                 |       |                    |  |            |          |           |                  | _          |    |
| NOT  | Logical complement<br>NOT <ea></ea> | 15         | 14         | 13  | 12                     | 11  | 10                | 9     | 8                  | 7  | 6          | 5        | 4<br>Effe | 3 2<br>ctive Add | 1<br>dress | 0  |
|      | NOT SOUP                            | 0          | 1          | 0   | 0                      | 0   | 1                 | 1     | 0                  | Si   | ze         |          | Node      |                  | Regist     | er |
|      |                                     | S          | ize        |     | by                     | yte |                   |       | ord                |  |            | ng       |           |                  |            |    |
|      |                                     |            |            |     | C                      | 00  |                   | U     | 1                  |  | 1          | 0        |           |                  |            |    |
|      | Destination effective address:      |            |            |     | ode                    |     |                   |       |                    |  |            | Мо       |           | Register         | -          |    |
|      |                                     |            | On<br>An   |     | 00<br>                 |     | #                 |       |                    | An,R<br>xxx).\   |            | 11<br>11 |           | #                |            |    |
|      |                                     |            | ٦п<br>An)  |     | 10                     |     | -<br><b>#</b>     |       |                    | xxx).v<br>xxx).l   |            | 11       |           | 000<br>001       |            |    |
|      |                                     | (A         | n)+        | 0.  | 11                     | 7   | #                 |       |                    | d(PC   | )          |          |           |                  |            |    |
|      |                                     |            | An)<br>An) |     | 00<br>01               |     | #<br>#            |       |                    | PC,R<br><data< td=""><td></td><td></td><td></td><td></td><td></td><td></td></data<>      |            |          |           |                  |            |    |
|      |                                     | u(         | AII)       | 10  | <i>J</i> I             | ,   | <del>T</del>      |       | #                  | -uala  | -          |          | -         |                  |            |    |
|      |                                     |            |            |     |                        |     |                   |       |                    |  |            |          |           |                  |            |    |
|      |                                     |            |            |     |                        |     |                   |       |                    |  |            |          |           |                  |            |    |

| OR  | Inclusive OR logical                                     | 15 14 13 12 11 10 9 8 7 6 5 4  | 3 2 1 0                             |
|-----|--|--|-------------------------------------|
| OK  | melasive of clogical                                     | Effe   | ctive Address                       |
|     |  | 1 0 0 0 Dn Opmode Mode   |                                     |
|     | OR <ea>, Dn<br/>OR Dn, <ea></ea></ea>                    | Opmode byte word long<br>000 001 010<br>100 101 110  |                                     |
|     | Source effective address:                                | Mode Dn         Register         Mode d(An,Rn)         110           An           (xxx).W         111           (An)         010         #         (xxx).L         111           (An)+         011         #         d(PC)         111           -(An)         100         #         d(PC,Rn)         111           d(An)         101         #         *         *    | Register # 000 001 010 011 100      |
|     | Destination effective address:                           | Mode         Register         Mode           Dn           d(An,Rn)         110           An           (xxx).W         111           (An)         010         #         (xxx).L         111           (An)+         011         #         d(PC)            -(An)         100         #         d(PC,Rn)            d(An)         101         #         # <data> </data> | Register<br>#<br>000<br>001<br><br> |
| ORI | Inclusive OR immediate<br>ORI # <data>, <ea></ea></data> | Word Data (16 bits)  Long Data (32 bits, including previous wo   | a (8 bits)                          |
|     | Destination effective address:                           | Mode       Register       Mode         Dn       000       #       d(An,Rn)       110         An         (xxx).W       111         (An)       010       #       (xxx).L       111         (An)+       011       #       d(PC)          -(An)       100       #       d(PC,Rn)          d(An)       101       #       *       *  | Register<br>#<br>000<br>001<br><br> |
| ORI | OR immediate to CCR<br>ORI # <data>, CCR</data>          | 15 14 13 12 11 10 9 8 7 6 5 4 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0  | 3 2 1 0<br>1 1 0 0<br>a (8 bits)    |
| ORI | OR immediate to SR<br>ORI # <data>, SR</data>            | 15 14 13 12 11 10 9 8 7 6 5 4 0 0 0 0 0 0 0 0 1 1 1 Word Data (16 bits)  | 3 2 1 0 1 1 1 0 0                   |

| DEA                     | Duah offactive address               | 45 44              | 40 40                | 144                  | 40     | 0 0        | 1 -   |     |            | 1 . 1     | 0 1 4         |        |
|-------------------------|--------------------------------------|--------------------|----------------------|----------------------|--------|------------|---|-----|------------|-----------|---------------|--------|
| PEA                     | Push effective address PEA <ea></ea> | 15 14              | 13 12                |                      |        | 9 8        | 7   | 6   | 5 4        |           | 2 1<br>Addres | 0      |
|                         | TEXT TOUR                            | 0 1                | 0 0                  | 1                    | 0      | 0 0        | 0   | 1   | Mo         |           | Regis         |        |
|                         | Source effective address:            |                    | Mode                 | Regis                | etor   |            |   |     | Mode       | Regi      |               |        |
|                         | Source effective address.            | Dn                 |                      |                      | olei - | c          | l(An,F  | Rn) | 110        | #         |               |        |
|                         |                                      | An                 |                      |                      |        |            | (xxx).  | W   | 111        | 00        |               |        |
|                         |                                      | (An)<br>(An)+      | 010<br>              | #                    |        |            | (xxx).<br>d(PC  |     | 111<br>111 | 00<br>01  |               |        |
|                         |                                      | -(An)              |                      |                      |        | d          | (PC,F   |     | 111        | 01        |               |        |
|                         |                                      | d(An)              | 101                  | #                    |        |            | ∔ <data< th=""><th></th><th></th><th></th><th>-</th><th></th></data<>       |     |            |           | -             |        |
|                         |                                      |                    |                      |                      |        |            |   |     |            |           |               |        |
| RESET                   | Reset external devices               | 15 14              | 13 12                | 11                   | 10     | 9 8        | 7   | 6   | 5 4        | 3         | 2 1           | 0      |
|                         | RESET                                | 0 1                | 0 0                  |                      |        | 1 0        | 0   | 1   | 1 1        | 0         | 0 0           | 0      |
|                         |                                      |                    |                      |                      |        |            |   |     |            |           |               |        |
| ROR, ROL                | Rotate                               | 15 14              | 13 12                | 11                   | 10     | 9 8        | 7   | 6   | 5 4        | 3         | 2 1           | 0      |
| ,                       | ROd Dx, Dy                           | 1 1                | 1 0                  |                      | unt/Dx |            |   | ze  | i/r 1      |           | Dy            |        |
| ROd # <data>, Dy</data> |                                      |                    |                      |                      |        |            |   |     |            |           |               |        |
|                         |                                      | dr = 0             |                      | ate left             |        |            |   |     |            |           |               |        |
|                         |                                      | dr = 1             | rot                  | ate righ             | t      |            |   |     |            |           |               |        |
|                         |                                      | i/r = 0<br>i/r = 1 |                      | nediate<br>ister ro  |        |            | nt  |     |            |           |               |        |
|                         |                                      | Count<br>Dx        | If imme<br>If regist |                      |        |            |   |     | present    | t the rai | nge {1-7      | ', 8}  |
|                         |                                      | Size               |                      | yte<br>00            |        | word<br>01 |   | lo: | ng<br>0    |           |               |        |
|                         |                                      |                    |                      | 1 1                  |        |            |   |     | I - I -    | 1 - 1     |               |        |
|                         | ROd <ea></ea>                        | 15 14              | 13 12                |                      |        | 9 8        | 7   | 6   | 5 4<br>E1  |           | 2 1<br>Addres | 0<br>S |
|                         |                                      | 1   1              | 1 0                  | 0                    | 1      | 1 dr       | 1   | 1   | Мо         |           | Regis         |        |
|                         |                                      | dr = 0<br>dr = 1   |                      | ate left<br>ate righ | t      |            |   |     |            |           |               |        |
|                         | Destination effective address:       |                    | Mode                 | Regis                | ster   |            |   |     | Mode       | Regi      | ster          |        |
|                         |                                      | Dn                 |                      |                      |        | C          | l(An,F  | Rn) | 110        |           |               |        |
|                         |                                      | An<br>(An)         | <br>010              | #                    |        |            | (xxx).\<br>(xxx).   |     | 111<br>111 | 00        |               |        |
|                         |                                      | (An)+              | 011                  | #                    |        |            | d(PC  |     |            | -         |               |        |
|                         |                                      | -(An)              | 100                  | #                    |        |            | (PC,F   |     |            | -         |               |        |
|                         |                                      | d(An)              | 101                  | #                    |        | 7          | # <data< th=""><th>3&gt;</th><th></th><th>-</th><th>-</th><th></th></data<> | 3>  |            | -         | -             |        |
|                         |                                      |                    |                      |                      |        |            |   |     |            |           |               |        |
|                         |                                      |                    |                      |                      |        |            |   |     |            |           |               |        |
|                         |                                      |                    |                      |                      |        |            |   |     |            |           |               |        |

| RORX, ROLX | Rotate with extend<br>ROXd Dx, Dy<br>ROXd # <data>, Dy</data> | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       1     1     1     0     Count/Dx     dr     Size     i/r     1     0     Dy   |
|------------|---|---|
|            |   | dr = 0 rotate left<br>dr = 1 rotate right   |
|            |   | i/r = 0 immediate rotate count<br>i/r = 1 register rotate count   |
|            |   | Count If immediate, 3 bits, {1-7, 0}, which represent the range {1-7, 8} Dx If register,rotate count in register Dx   |
|            |   | Size byte word long<br>00 01 10   |
|            | ROXd <ea></ea>  | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       1     1     1     0     0     1     0     dr     1     1     Effective Address       Mode     Register  |
|            |   | dr = 0 rotate left<br>dr = 1 rotate right   |
|            | Destination effective address:                                | Mode         Register         Mode         Register           Dn           d(An,Rn)         110         #           An           (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+         011         #         d(PC)   |
|            |   | -(An) 100 # d(PC,Rn)<br>d(An) 101 # # <data></data>   |
| RTE        | Return from exception<br>RTE                                  | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     1     0     0     1     1     1     0     0     1     1     1     0     0     1     1   |
| RTR        | Return and restore CCR<br>RTR                                 | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     1     0     0     1     1     1     0     1     1     1     0     1 <t< th=""></t<> |
| RTS        | Return from subroutine<br>RTS                                 | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     1     0     0     1     1     1     0     1     0     1   |
| SBCD       | Subtract decimal with extend                                  | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       1     0     0     0     0     0     0     0     R/M     Ry  |
|            | SBCD Dy, Dx<br>SBCD -(Ay), -(Ax)                              | R/M = 0 data register to data register<br>R/M = 1 memory to memory  |

| Scc  | Set according to condition Scc <ea>&gt;</ea>          | 15 14                                       | 13 12  | 11 10                                       | 9 8 7 6  | 5 4                                     | 3 2 1 0 ective Address              |
|------|---|---|--|---|--|---|-------------------------------------|
|      |   | 0 1   | 0 1  | Condi                                       | ition 1 1  | Mod                                     |                                     |
|      | Condition:  | CC<br>CS<br>NE<br>EQ<br>VC<br>VS<br>PL<br>F | 0100<br>0101<br>0110<br>0111<br>1000<br>1001<br>1010<br>0001 | MI<br>GE<br>LT<br>GT<br>LE<br>HI<br>LS<br>T | 1011<br>1100<br>1101<br>1110<br>1111<br>0010<br>0011<br>0000           |   |                                     |
|      | Destination effective address:                        | Dn<br>An<br>(An)<br>(An)+<br>-(An)<br>d(An) | Mode<br>000<br><br>010<br>011<br>100<br>101                  | Register # # # # #                          | d(An,Rn)<br>(xxx).W<br>(xxx).L<br>d(PC)<br>d(PC,Rn)<br># <data></data> | Mode<br>110<br>111<br>111<br><br>       | Register<br>#<br>000<br>001<br><br> |
| STOP | Load status register and stop<br>STOP # <data></data> | 15 14<br>0 1                                | 13 12<br>0 0   | 11 10 1 1 1                                 | 9 8 7 6<br>1 0 0 1<br>Immediate data                                   | 5 4 1 1                                 | 3 2 1 0<br>0 0 1 0                  |
| SUB  | Subtract binary                                       | 15 14                                       | 13 12  | 11 10 Dn                                    | 9 8 7 6<br>Opmode  | 5 4<br>Effe<br>Mod                      | 3 2 1 0 ective Address e Register   |
|      | SUB <ea>, Dn<br/>SUB Dn, <ea></ea></ea>               | Opmode                                      | C  | yte<br>000<br>00                            | 001  | ong<br>010<br>110                       |                                     |
|      | Source effective address:                             | Dn<br>An<br>(An)<br>(An)+<br>–(An)<br>d(An) | Mode<br>000<br>001<br>010<br>011<br>100<br>101               | Register # # # # # #                        | d(An,Rn)<br>(xxx).W<br>(xxx).L<br>d(PC)<br>d(PC,Rn)<br># <data></data> | Mode<br>110<br>111<br>111<br>111<br>111 | Register # 000 001 010 011 100      |
|      | Destination effective address:                        | Dn<br>An<br>(An)<br>(An)+<br>–(An)<br>d(An) | Mode<br><br><br>010<br>011<br>100<br>101                     | Register # # # #                            | d(An,Rn)<br>(xxx).W<br>(xxx).L<br>d(PC)<br>d(PC,Rn)<br># <data></data> | Mode<br>110<br>111<br>111<br><br>       | Register # 000 001                  |

| SUBA | Subtract address                | 15 14          | 13 12       | 11 10         | 9 8 7 6                     | 5 4 3 2 1 0                      |
|------|---------------------------------|----------------|-------------|---------------|-----------------------------|----------------------------------|
|      | SUBA <ea>, An</ea>              | 1 0            | 0 1         | An            | Opmode                      | Effective Address                |
|      |                                 |                |             |               | 95                          | Mode Register                    |
|      |                                 | Opmode         |             |               | word lor                    | na                               |
|      |                                 | Opinioue       |             |               | 011 11                      |                                  |
|      |                                 |                |             |               |                             | •                                |
|      | Source effective address:       |                | Mode        | Register      |                             | Mode Register                    |
|      |                                 | Dn             | 000         | #             | d(An,Rn)                    | 110 #                            |
|      |                                 | An             | 001         | #             | (xxx).W                     | 111 000                          |
|      |                                 | (An)           | 010         | #             | (xxx).L                     | 111 001                          |
|      |                                 | (An)+          | 011         | #             | d(PC)                       | 111 010                          |
|      |                                 | −(An)<br>d(An) | 100<br>101  | #<br>#        | d(PC,Rn)<br># <data></data> | 111 011<br>111 100               |
|      |                                 | u(AII)         | 101         | π             | # \uala>                    | 111 100                          |
|      |                                 |                |             |               |                             |                                  |
|      |                                 |                |             |               |                             |                                  |
| SUBI | Subtract immediate              | 15 14          | 13 12       | 11 10         | 9 8 7 6                     | 5 4 3 2 1 0                      |
|      | SUBI # <data>, <ea></ea></data> | 0 0            | 0 0         | 0 1           | 0 0 Size                    | Effective Address                |
|      |                                 |                | Word Dat    | a (16 bits)   |                             | Mode Register Byte Data (8 bits) |
|      |                                 |                |             |               | L bits, including pre       |                                  |
|      |                                 |                |             | 9 2 414 (0.   | - 2.to,o.a ag p. t          |                                  |
|      |                                 | Size           |             | yte           | word lor                    |                                  |
|      |                                 |                | (           | 00            | 01 10                       | )                                |
|      | Destination effective address:  |                | Mode        | Register      |                             | Mode Register                    |
|      | Destination enective address.   | Dn             | 000         | #             | d(An,Rn)                    | 110 #                            |
|      |                                 | An             |             |               | (xxx).W                     | 111 000                          |
|      |                                 | (An)           | 010         | #             | (xxx).L                     | 111 001                          |
|      |                                 | (An)+          | 011         | #             | d(PC)                       |                                  |
|      |                                 | -(An)          | 100         | #             | d(PC,Rn)                    |                                  |
|      |                                 | d(An)          | 101         | #             | # <data></data>             |                                  |
|      |                                 |                |             |               |                             |                                  |
|      |                                 |                |             |               |                             |                                  |
| SUBQ | Subtract quick                  | 15 14          | 13 12       | 11 10         | 9 8 7 6                     | 5 4 3 2 1 0                      |
|      | SUBQ # <data>, <ea></ea></data> | 0 1            | 0 1         | Data          | 1 Size                      | Effective Address                |
|      |                                 |                |             |               |                             | Mode Register                    |
|      |                                 | Data           | _ 3 hite    | 11_7 Al wh    | ich represent the r         | ange /1_7 8\                     |
|      |                                 | Data           | - 5 bits, 1 | [1-7, O], WII | ich represent the r         | ange (1-7, of                    |
|      |                                 | Size           | b           | yte           | word lor                    | ng                               |
|      |                                 |                | (           | 00            | 01 10                       |                                  |
|      | Destination offertive address   |                | Meda        | Dogistas      |                             | Mada Dagistar                    |
|      | Destination effective address:  | Dn             | Mode<br>000 | Register<br># | d(An,Rn)                    | Mode Register<br>110 #           |
|      |                                 | An             | 000         | #             | (xxx).W                     | 111 000                          |
|      |                                 | (An)           | 010         | #             | (xxx).VV                    | 111 001                          |
|      |                                 | (An)+          | 011         | #             | d(PC)                       |                                  |
|      |                                 | -(An)          | 100         | #             | d(PC,Rn)                    |                                  |
|      |                                 | d(An)          | 101         | #             | # <data></data>             |                                  |
|      |                                 |                |             |               |                             |                                  |
|      |                                 |                |             |               |                             |                                  |

| SUBX  | Subtract with extend                  | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       1     0     0     1     Rx     1     Size     0     0     R/M     Ry  |
|-------|---------------------------------------|---|
|       |                                       | Size byte word long 00 01 10  |
|       | SUBX Dy, Dx<br>SUBX -(Ay), -(Ax)      | R/M = 0 data register to data register<br>R/M = 1 memory to memory  |
| SWAP  | Swap register halves<br>SWAP Dn       | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     0     0     0     1     0     0     0     Dn  |
| TAS   | Test and set an operand TAS <ea></ea> | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     0     1     0     1     1     1     Effective Address       Mode     Register   |
|       | Destination effective address:        | Mode         Register         Mode         Register           Dn         000         #         d(An,Rn)         110         #           An           (xxx).W         111         000           (An)         010         #         (xxx).L         111         001           (An)+         011         #         d(PC)             -(An)         100         #         d(PC,Rn)             d(An)         101         #         # <data> </data> |
| TRAP  | Trap<br>TRAP # <vector #=""></vector> | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     0     0     1     0     0     Vector #  |
| TRAPV | Trap on overflow<br>TRAPV             | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     1     0     0     1     1     1     0     1     1     0   |
| TST   | Test an operand<br>TST <ea></ea>      | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     0     1     0     Size     Effective Address<br>Mode     Register   Size byte 00 01 10  |
|       | Destination effective address:        | Mode Register  Dn 000 # d(An,Rn) 110 #  An (xxx).W 111 000  (An) 010 # (xxx).L 111 001  (An)+ 011 # d(PC)  -(An) 100 # d(PC,Rn)  d(An) 101 # # <data></data>  |
| UNLK  | Unlink and deallocate<br>UNLK An      | 15     14     13     12     11     10     9     8     7     6     5     4     3     2     1     0       0     1     0     0     1     1     0     0     1     0     1     1     An  |