

## Instruction Set of M68HC11

MNEMO	immediate			direct			extended			indexed by X			indexed by Y			inherent			flags	Operation
	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C		
ABA																1B	1	2		(A) + (B) -> A
ABX																3A	1	3	-----	(X) + (0:B) -> X
ABY																183A	2	4	-----	(Y) + (0:B) -> Y
ADCA	89	2	2	99	2	3	B9	3	4	A9	2	4	18A9	3	5					(A) + (ea) + (C) -> A
ADCB	C9	2	2	D9	2	3	F9	3	4	E9	2	4	18E9	3	5					(B) + (ea) + (C) -> B
ADDA	8B	2	2	9B	2	3	BB	3	4	AB	2	4	18AB	3	5					(A) + (ea) -> A
ADDB	CB	2	2	DB	2	3	FB	3	4	EB	2	4	18EB	3	5					(B) + (ea) -> B
ADDD	C3	3	4	D3	2	5	F3	3	6	E3	2	6	18E3	3	7				-	(D) + (ea:ea+1) -> D
ANDA	84	2	2	94	2	3	B4	3	4	A4	2	4	18A4	3	5				-   0-	(A) ^ (ea) -> A
ANDB	C4	2	2	D4	2	3	F4	3	4	E4	2	4	18E4	3	5				-   0-	(B) ^ (ea) -> B
ASL							78	3	6	68	2	6	1868	3	7				-	C <- b7....b0 <- 0
ASLA																48	1	2	-	C <- b7....b0 <- 0
ASLB																58	1	2	-	C <- b7....b0 <- 0
ASLD																05	1	3	-	C <- b15....b0 <- 0
ASR							77	3	6	67	2	6	1867	3	7				-	b7 -> b7....b0 -> C
ASRA																47	1	2	-	b7 -> b7....b0 -> C
ASRB																57	1	2	-	b7 -> b7....b0 -> C
BCLR				15	3	6				1D	3	7	181D	4	8				-   0-	(ea) ^ /mask -> ea
BITA	85	2	2	95	2	3	B5	3	4	A5	2	4	18A5	3	5				-   0-	(A) ^ (ea) only flags
BITB	C5	2	2	D5	2	3	F5	3	4	E5	2	4	18E5	3	5				-   0-	(B) ^ (ea) only flags
BSET				14	3	6				1C	3	7	181C	4	8				-   0-	(ea) ^ mask -> ea
CBA																11	1	2	-	(A) - (B) only flags
CLC																0C	1	2	-----0	0 -> C-flag
CLI																0E	1	2	-----	0 -> I-flag
CLR							7F	3	6	6F	2	6	186F	3	7				-0100	0 -> ea
CLRA																4F	1	2	-0100	0 -> A
CLRB																5F	1	2	-0100	0 -> B
CLV																0A	1	2	---0-	0 -> V-flag
CMPA	81	2	2	91	2	3	B1	3	4	A1	2	4	18A1	3	5				-	(A) - (ea) only flags
CMPB	C1	2	2	D1	2	3	F1	3	4	E1	2	4	18E1	3	5				-	(B) - (ea) only flags
COM							73	3	6	63	2	6	1863	3	7				-   01	(ea) -> ea 1's compl.
COMA																43	1	2	-   01	(A) -> A 1's compl.
COMB																53	1	2	-   01	(B) -> B 1's compl.
CPD	1A83	4	5	1A93	3	6	1AB3	4	7	1AA3	3	7	CDA3	3	7				-	(D)-(ea:ea+1) only flags
CPX	8C	3	4	9C	2	5	BC	3	6	AC	2	6	CDAC	3	7				-	(X)-(ea:ea+1) only flags
CPY	188C	4	5	189C	3	6	18BC	4	7	1AAC	3	7	18AC	3	7				-	(Y)-(ea:ea+1) only flags
DAA																19	1	2	-	adjust sum to 8421-code
DEC							7A	3	6	6A	2	6	186A	3	7				-     -	(ea) - 1 -> ea
DECA																4A	1	2	-     -	(A) - 1 -> A
DECB																5A	1	2	-     -	(B) - 1 -> B
DES																34	1	3	-----	(S) - 1 -> S
DEX																09	1	3	-- --	(X) - 1 -> X
DEY																1809	2	4	-- --	(Y) - 1 -> Y
EORA	88	2	2	98	2	3	B8	3	4	A8	2	4	18A8	3	5				-   0-	(A) ≠ (ea) -> A
EORB	C8	2	2	D8	2	3	F8	3	4	E8	2	4	18E8	3	5				-   0-	(B) ≠ (ea) -> B
FDIV																03	1	*	--	D / X -> X; R -> D
IDIV																02	1	*	--   0	D / X -> X; R -> D
MNEMO	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	flags	Operation
	immediate			direct			extended			indexed by X			indexed by Y			inherent			flags	

MNEMO	immediate			direct			extended			indexed by X			indexed by Y			inherent			flags	Operation
	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	HNZVC	
INC							7C	3	6	6C	2	6	186C	3	7				-      -	(ea) + 1 -> ea
INCA																4C	1	2	-      -	(A) + 1 -> A
INCB																5C	1	2	-      -	(B) + 1 -> B
INS																31	1	3	-----	(S) + 1 -> S
INX																08	1	3	--    -	(X) + 1 -> X
INY																1808	2	4	--    -	(Y) + 1 -> Y
JMP							7E	3	3	6E	2	3	186E	3	4				-----	ea -> PC
JSR				9D	2	5	BD	3	6	AD	2	6	18AD	3	7				-----	PC -> (S), ea -> PC
LDA	86	2	2	96	2	3	B6	3	4	A6	2	4	18A6	3	5				-    0-	(ea) -> A
LDAB	C6	2	2	D6	2	3	F63	3	4	E6	2	4	18E6	3	5				-    0-	(ea) -> B
LDD	CC	3	3	DC	2	4	FC	3	5	EC	2	5	18EC	3	6				-    0-	(ea:ea+1) -> D
LDS	8E	3	3	9E	2	4	BE	3	5	AE	2	5	18AE	3	6				-    0-	(ea:ea+1) -> S
LDX	CE	3	3	DE	2	4	FE	3	5	EE	2	5	CDEE	3	6				-    0-	(ea:ea+1) -> X
LDY	18CE	4	4	18DE	3	5	18FE	4	6	1AEE	3	6	18EE	3	6				-    0-	(ea:ea+1) -> Y
LSL							78	3	6	68	2	6	1868	3	7				-	C <- b7....b0 <- 0
LSLA																48	1	2	-	C <- b7....b0 <- 0
LSLB																58	1	2	-	C <- b7....b0 <- 0
LSLD																05	1	3	-	C <- b15....b0 <- 0
LSR							74	3	6	64	2	6	1864	3	7				-	0 -> b7....b0 -> C
LSRA																44	1	2	-	0 -> b7....b0 -> C
LSRB																54	1	2	-	0 -> b7....b0 -> C
LSRD																04	1	3	-	0 -> b15....b0 -> C
MUL																3D	1	*	-----	(A) * (B) -> D
NEG							70	3	6	60	2	6	1860	3	7				-	0 - (ea) -> ea 2's compl.
NEGA																40	1	2	-	0 - (A) -> A 2's compl.
NEGB																50	1	2	-	0 - (B) -> B 2's compl.
NOP																01	1	2	-----	no operation
ORAA	8A	2	2	9A	2	3	BA	3	4	AA	2	4	18AA	3	5				-    0-	(A) ∨ (ea) -> A
ORAB	CA	2	2	DA	2	3	FA	3	4	EA	2	4	18EA	3	5				-    0-	(B) ∨ (ea) -> B
PSHA																36	1	3	-----	(A) -> (S), (S) - 1 -> S
PSHB																37	1	3	-----	(B) -> (S), (S) - 1 -> S
PSHX																3C	1	4	-----	(X) -> (S), (S) - 2 -> S
PSHY																183C	2	5	-----	(Y) -> (S), (S) - 2 -> S
PULA																32	1	4	-----	(S) + 1 -> S, ((S)) -> A
PULB																33	1	4	-----	(S) + 1 -> S, ((S)) -> B
PULX																38	1	5	-----	(S) + 2 -> S, ((S)) -> X
PULY																1838	2	6	-----	(S) + 2 -> S, ((S)) -> Y
ROL							79	3	6	69	2	6	1869	3	7				-	C <- b7....b0 <- C
ROLA																49	1	2	-	C <- b7....b0 <- C
ROLB																59	1	2	-	C <- b7....b0 <- C
ROR							76	3	6	66	2	6	1866	3	7				-	C -> b7....b0 -> C
RORA																46	1	2	-	C -> b7....b0 -> C
RORB																56	1	2	-	C -> b7....b0 -> C
RTI																3B	1	*		return from interrupt
RTS																39	1	5	-----	(S) + 2 -> S, ((S)) -> PC
SBA																10	1	2	-	(A) - (B) -> A
SBCA	82	2	2	92	2	3	B2	3	4	A2	2	4	18A2	3	5				-	(A) - (ea) - (C) -> A
SBCB	C2	2	2	D2	2	3	F2	3	4	E2	2	4	18E2	3	5				-	(B) - (ea) - (C) -> B
MNEMO	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	flags	Operation
	immediate			direct			extended			indexed by X			indexed by Y			inherent			flags	

MNEMO	immediate			direct			extended			indexed by X			indexed by Y			inherent			flags			Operation						
	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C		H	N	Z	V	C	
SEC																		0D	1	2	----	1				1 -> C-flag		
SEI																		0F	1	2	-----					1 -> I-flag		
SEV																		0B	1	2	---1-					1 -> V-flag		
STAA				97	2	3	B7	3	4	A7	2	4	18A7	3	5						-		0-			(A) -> ea		
STAB				D7	2	3	F7	3	4	E7	2	4	18E7	3	5						-		0-			(B) -> ea		
STD				DD	2	4	FD	3	5	ED	2	5	18ED	3	6						-		0-			(D) -> ea:ea+1		
STOP																		CF	1	2	-----					stop internal clocks		
STS				9F	2	4	BF	3	5	AF	2	5	18AF	3	6						-		0-			(S) -> ea:ea+1		
STX				DF	2	4	FF	3	5	EF	2	5	CDEF	3	6						-		0-			(X) -> ea:ea+1		
STY				18DF	3	5	18FF	4	6	1AEF	3	6	18EF	3	6						-		0-			(Y) -> ea:ea+1		
SUBA	80	2	2	90	2	3	B0	3	4	A0	2	4	18A0	3	5						-					(A) - (ea) -> A		
SUBB	C0	2	2	D0	2	3	F0	3	4	E0	2	4	18E0	3	5						-					(B) - (ea) -> B		
SUBD	83	3	4	93	2	5	B3	3	6	A3	2	6	18A3	3	7						-					(D) - (ea:ea+1) -> D		
SWI																		3F	1	*	-----					software interrupt		
TAB																		16	1	2	-		0-			(A) -> B		
TAP																		06	1	2						(A) -> CCR		
TBA																		17	1	2	-		0-			(B) -> A		
TPA																		07	1	2	-----					(CCR) -> A		
TST							7D	3	6	6D	2	6	186D	3	7						-		00			(ea) - 0      only flags		
TSTA																		4D	1	2	-		0-			(A) - 0      only flags		
TSTB																		5D	1	2	-		0-			(B) - 0      only flags		
TSX																		30	1	3	-----					(S) + 1 -> X		
TSY																		1830	2	4	-----					(S) + 1 -> Y		
TXS																		35	1	3	-----					(X) - 1 -> S		
TYS																		1835	2	4	-----					(Y) - 1 -> S		
WAI																		3E	1	*	-----					wait for interrupt		
XGDX																		8F	1	3	-----					(X) -> D, (D) -> X		
XGDY																		188F	2	4	-----					(Y) -> D, (D) -> Y		
MNEMO	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	OP	B	C	flags			Operation
	immediate			direct			extended			indexed by X			indexed by Y			inherent			flags									

- \*)
- FDIV = 41 cycles
  - IDIV = 41 cycles
  - MUL = 10 cycles
  - RTI = 12 cycles
  - SWI = 14 cycles
  - WAI = 14+ cycles

## relative branches

MNEMO	relative			direct			indexed by X			indexed by Y			flags	Operation
	OP	B	C	OP	B	C	OP	B	C	OP	B	C	HNZVC	
BCC	24	2	3										-----	if (C=0) ea -> PC simple
BCS	25	2	3										-----	if (C=1) ea -> PC simple
BEQ	27	2	3										-----	if (Z=1) ea -> PC simple
BGE	2C	2	3										-----	if ((N≠V) = 0) ea -> PC signed
BGT	2E	2	3										-----	if ((Z∨N≠V) = 0) ea -> PC signed
BHI	22	2	3										-----	if ((C∨Z) = 0) ea -> PC unsigned
BHS	24	2	3										-----	if (C=0) ea -> PC unsigned
BLE	2F	2	3										-----	if ((Z∨N≠V) = 1) ea -> PC signed
BLO	25	2	3										-----	if (C=1) ea -> PC unsigned
BLS	23	2	3										-----	if ((C∨Z) = 1) ea -> PC unsigned
BLT	2D	2	3										-----	if ((N≠V) = 1) ea -> PC signed
BMI	2B	2	3										-----	if (N=1) ea -> PC simple
BNE	26	2	3										-----	if (Z=0) ea -> PC simple
BPL	2A	2	3										-----	if (N=0) ea -> PC simple
BRA	20	2	3										-----	ea -> PC
BRCLR				13	4	6	1F	4	7	181F	5	8	-----	if ((ea) ∧ mask=0) ea -> PC
BRN	21	2	3										-----	branch never (no operation)
BRSET				12	4	6	1E	4	7	181E	5	8	-----	if ((ea) ∧ /mask=0) ea -> PC
BSR	8D	2	6										-----	(PC) > (S), ea -> PC
BVC	28	2	3										-----	if (V=0) ea -> PC simple
BVS	29	2	3										-----	if (V=1) ea -> PC simple
MNEMO	OP	B	C	OP	B	C	OP	B	C	OP	B	C	flags	Operation
	relative			direct			indexed by X			indexed by Y			flags	

## Interrupt Vector Assignment

address	name	function
\$FFD6	SCIVEC	SCI serial
\$FFD8	SPIVEC	SPI or MOD
\$FFDA	PAIVEC	Pulse Accumulator Input Edge
\$FFDC	PAOVEC	Pulse Accumulator overflow
\$FFDE	TOFVEC	Timer overflow
\$FFE0	OC5VEC	Timer OC5
\$FFE2	OC4VEC	Timer OC4
\$FFE4	OC3VEC	Timer OC3
\$FFE6	OC2VEC	Timer OC2
\$FFE8	OC1VEC	Timer OC1
\$FFEA	IC3VEC	Timer IC3
\$FFEC	IC2VEC	Timer IC2
\$FFEE	IC1VEC	Timer IC1
\$FFF0	RTIVEC	Real Time Interrupt
\$FFF2	IRQVEC	IRQ, STRA, Spurious Interrupt
\$FFF4	XRQVEC	XIRQ
\$FFF6	SWIVEC	SWI
\$FFF8	IOPVEC	Illegal Opcode
\$FFFA	COPVEC	COP Watchdog Timeout
\$FFFC	CMFVEC	Clock Monitor Fail
\$FFFE	RESVEC	RESET

## Stacking Order

