

# CONFIG Register Programming for EEPROM-based M68HC11 Microcontrollers

## Introduction

To guarantee proper operation of EEPROM-based M68HC11 devices, the CONFIG register must be correctly programmed. A CONFIG register verification and reprogramming routine should be included at the beginning of critical M68HC11 programs.

## Code Listing

The following example code shows how to verify and reprogram the EEPROM CONFIG register to ensure proper operation. The same results can be accomplished with less generic, user-specified code. **Table 1** shows M68HC11 devices with EEPROM-based CONFIG registers. Use **Table 1** when customizing the source code. Refer to the appropriate M68HC11 Technical Data Book or Technical Summary for CONFIG register control bit definitions

The code will execute properly in single-chip or expanded operating modes on all EEPROM-based M68HC11 microcontrollers except for devices in the A Series. The CONFIG register in A Series devices can only be programmed in special test or bootstrap operating modes. Users devices in the A Series may choose to provide hardware support for special test or bootstrap mode operation. The code can be used as written in these modes if a proper starting address is selected. See **SECTION 3 CONFIGURATION AND MODES OF OPERATION** of the *M68HC11 Reference Manual* (M68HC11RM/AD) for more information.

```
* FILENAME: config.asm
*
* DESCRIPTION: This code checks the CONFIG register on an EEPROM-based
* HC11 device and reprograms it with the proper value if necessary.
*
```

**Refer to Table 1. Fill in the blank that follows with the register base address for the device being used.**

```
REGBASE    equ    $____    ;beginning of HC11 registers
* Offsets from the beginning of the register block.
TCNT       equ    $0E
TOC4       equ    $1C
TFLG1      equ    $23
BPROT      equ    $35
OPTION     equ    $39
PPROG      equ    $3B
CONFIG     equ    $3F
CSCSTR     equ    $5A
* The following register bit constants are needed.
OC4F       equ    $10
PTCON      equ    $10
CME        equ    $08
BYTE       equ    $10
ERASE      equ    $04
EELAT      equ    $02
EEPGM      equ    $01
```



**Fill in the blank that follows with the desired CONFIG register value.**

\* Other user constants should follow, including:

MY\_CONFIG equ \$\_\_

**Fill in the program starting address in the following blank.**

START org \$\_\_\_\_ ;program starts here

**The next line is only needed for derivatives in the K Series that are running in expanded mode.**

```

        clr    CSCSTR          ;disable clock stretching on K-series
        lds    #$00FF          ;set a valid stack pointer
        ldx    #REGBASE        ;set beginning of register block
        ldaa   CONFIG,X        ;read CONFIG
        cmpa   #MY_CONFIG      ;check for valid CONFIG
        beq    NORMAL          ;if CONFIG is OK, go on as usual
    
```

**At this point, 49 cycles remain for modifications to be made to the time protected registers on all HC11 devices except for devices in the K Series that are running in expanded mode. On these devices, 37 cycles remain because program chip-select clock stretching is enabled in expanded mode, effectively doubling the execution time of all instructions until stretching is disabled.**

```

        bclr   BPROT,X,PTCON    ;clear CONFIG protect bit
    
```

\* CONFIG erase sequence.

```

        ldaa   #{BYTE + ERASE + EELAT}
        staa   PPROG,X
    
```

**The EEPROM erase sequence requires that some data be stored to the byte being erased. The actual data stored and instructions used are irrelevant; it is only necessary to complete a memory write cycle to the location in question.**

```

        staa   CONFIG,X          ;store something to CONFIG
        ldaa   #{BYTE + ERASE + EELAT + EEPGM}
        staa   PPROG,X
        jsr    EEDELAY           ;wait 10 ms
        clr    PPROG,X          ;finish erase sequence
    
```

\* CONFIG program sequence.

```

        ldaa   #EELAT
        staa   PPROG,X
        ldaa   #MY_CONFIG        ;desired CONFIG value
        staa   CONFIG,X
        ldaa   #{EELAT + EEPGM}
        staa   PPROG,X
        jsr    EEDELAY           ;wait 10 ms
        clr    PPROG,X          ;finish program sequence
    
```

\* Now allow clock monitor to reset the HC11 and latch the new CONFIG register value.

```

        bset   OPTION,X,CME      ;enable clock monitor reset
        tpa    ;get condition code register
        anda   #$7F              ;enable STOP mode
        tap
        nop
        stop                      ;enter STOP mode and allow reset
    
```

\* User program resumes here if CONFIG does not need to be reprogrammed.

NORMAL etc.

\* This delay subroutine may be used for any EEPROM programming/erase operation.

```

EEDELAY ldd    TCNT,X            ;get current time
    
```

**Fill in the following blank with the delay term used for program and erase operations. DELAY = ECLK/100, and typical values are 40000 at 4 MHz, 20000 at 2 MHz, and 10000 at 1 MHz.**

```

        addd   #____            ;add delay
        std    TOC4,X          ;allow match at end of delay
        ldaa   #OC4F           ;clear last output compare match
        staa   TFLG1,X
    
```

\* Wait for OC4 match (end of 10 ms delay) to occur.

```


DELAYLOOP brclr TFLG1,X,OC4F,DELAYLOOP
        rts                      ;end of delay loop
    
```

**Table 1 M68HC11 Devices with EEPROM-Based CONFIG Registers**

Device	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register Base
MC68HC11A0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11A1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11A7	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11A8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A7	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11A8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E8	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68S711E9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11E20	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711E20	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC811E2	EE3	EE2	EE1	EE0	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11EA9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711EA9	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11F1	EE3	EE2	EE1	EE0	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11F1	EE3	EE2	EE1	EE0	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11K0	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11K1	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11K3	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11K4	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K0	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K1	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K3	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68L11K4	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711K4	ROMAD	—	CLK4X	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA0	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA1	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA3	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA4	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711KA4	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11KA2	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711KA2	ROMAD	—	CLKX	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC11L0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11L1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11L5	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000

**Table 1 M68HC11 Devices with EEPROM-Based CONFIG Registers (Continued)**

Device	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Register Base
MC68HC11L6	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L0	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L1	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L5	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68L11L6	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC711L6	—	—	—	—	NOSEC	NOCOP	ROMON	EEON	\$1000
MC68HC11P2	ROMAD	—	—	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000
MC68HC711P2	ROMAD	—	—	PAREN	NOSEC	NOCOP	ROMON	EEON	\$0000

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