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Introduction

This engineering bulletin describes the user monitor CONFIG1 register error that is present on the M68DEMO908QT4 boards. The user monitor CONFIG1 register error can lead to the disabling of user monitor operation on the demo board. If your demo board executes the application code that you have programmed into it but will not allow in-circuit debugging or programming, your board may be experiencing this error. In this engineering bulletin the error will be explained in detail and ways to avoid and correct the error will be outlined.

This engineering bulletin is organized into these sections:

- Description of the user monitor CONFIG1 register error
- How to avoid the user monitor CONFIG1 register error
- How to correct the user monitor CONFIG1 register error

Description of the User Monitor CONFIG1 Register Error

The version of user monitor that was installed on some of the QT4 demo boards is not the latest version of the code that is contained in *AN2305/D: User Mode Monitor Access for MC68HC908QY/QT Series MCUs*. The code contained on the demo board contains the lines shown below.

```

MonStart:   lda    UConfig1    ;get user's value for CONFIG1
            tax                      ;save a copy
            and    #%00110001    ;check for LVI on, COP reset off
            cmp    #%00000001    ;LVIRSTD=LVIPWRD=0, COPD=1
            beq    skipload      ;if so value in X is OK
            ldx    #InitConfig1  ;else force default settings
            stx    CONFIG1       ;write-once register to set config
    
```

```

        bra    skipload    ;around ADC and KBD vectors
;* ADC and KBD vectors are located at $FFDE-FFE1
        org    $FFE2      ;unused block in vectors
skipload:  ldx    #8       ;loop count for 8 characters

```

As explained in AN2305/D, the user monitor code checks the user's value of CONFIG1 (UCONFIG1) to ensure that an acceptable value is used. If the value of UCONFIG1 is not acceptable (COP is not disabled and LVI is not activated), the user monitor code will place a default value of \$49 into CONFIG1. If the value of UCONFIG1 is acceptable, the user monitor code should write CONFIG1 with the value provided by UCONFIG1. In the code shown above, this write is skipped by the instructions

```

        and    %#00110001 ;check for LVI on, COP reset off
        cmp    %#00000001 ;LVIRSTD=LVIPWRD=0, COPD=1
        beq    skipload   ;if so value in X is OK

```

Once the code has reached skipload, CONFIG1 never gets written. CONFIG1 is not initialized upon reset. This leads to the disabling of the user monitor because when attempting to enter user monitor mode, the COP is not disabled. For user monitor to work properly, the COP must be disabled to prevent COP resets halting user monitor communication.

The code from AN2305/D (shown below) does not contain this error. If the UCONFIG1 value is acceptable, the code branches to skipload that does write to CONFIG1.

```

MonStart:  lda    UConfig1    ;get user's value for CONFIG1
           tax                    ;save a copy
           and    %#00110001 ;check for LVI on, COP reset off
           cmp    %#00000001 ;LVIRSTD=LVIPWRD=0, COPD=1
           beq    skipload   ;if so value in X is OK
           ldx    #InitConfig1 ;else force default settings
skipload:  stx    CONFIG1    ;write-once register to set config
           bra    toFFE2     ;around ADC and KBD vectors
;* ADC and KBD vectors are located at $FFDE-FFE1
           org    $FFE2      ;unused block in vectors
toFFE2:   ldx    #8         ;loop count for 8 characters

```

How to Avoid the User Monitor CONFIG1 Register Error

The user monitor CONFIG1 register error will only present itself if an acceptable value of UCONFIG1 is programmed into the demo board. If an unacceptable value is used, you will not see this error because the user monitor writes its own acceptable value. So the user monitor CONFIG1 register error can be avoided by not setting UCONFIG1 (location \$FDEA) to any value that contains %XX00XXX1. The user monitor software will ignore any other values of UCONFIG1. It will be easiest to just leave UCONFIG1 blank (\$FF). This will ensure that the error will not occur. The side effect of this workaround is that \$49 is the only possible setting for CONFIG1 when using the demo board. Replacing the user monitor code as shown below resolves this issue.

How to Correct the User Monitor CONFIG Error

If you have already experienced the user monitor CONFIG1 register error, or if you would like to configure your demo board so that it contains the corrected version of the user monitor code, you must erase and reprogram the entire FLASH of the MC68HC908QT4 contained on the demo board. To do this, the board must be in normal monitor mode. Any of the methods described in *AN2317/D: Low-Cost Programming and Debugging Options for M68HC08 MCUs* could be used to accomplish this. Also, the demo board contains the footprint for the 16-pin header that is used by the MON08 connector. If this is installed, a P&E Cyclone or Multilink tool could be used to reprogram the board. Another option is to modify the demo board so that 9 V (from the battery) is placed on $\overline{\text{IRQ}}$ /pin5. OSC1/pin2 must be supplied by a 9.8304-MHz external signal. If this is done, the board can enter normal monitor mode with a minimum amount of external hardware.

Once the demo board has been brought into normal monitor mode, the software that is downloadable with AN2305/D should be programmed into the MC68HC908QT4. Afterwards, user monitor mode can be entered and the user monitor CONFIG1 register error will be corrected.

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