

Interfacing the X24C44/45 NOVRAMs to the Motorola 68HC11 Microcontroller

by Applications Staff, July 1992

The following code demonstrates how the Xicor X24C44/45 serial NOVRAMs can be interfaced to the Motorola 68HC11 microcontroller family when connected as shown in Figure 1. The code uses three pins from port D to implement the interface. Additional

code can be found on the Xicor web site at <http://www.xicor.com> that will implement interfaces between several other Motorola microcontroller families and most Xicor serial devices.

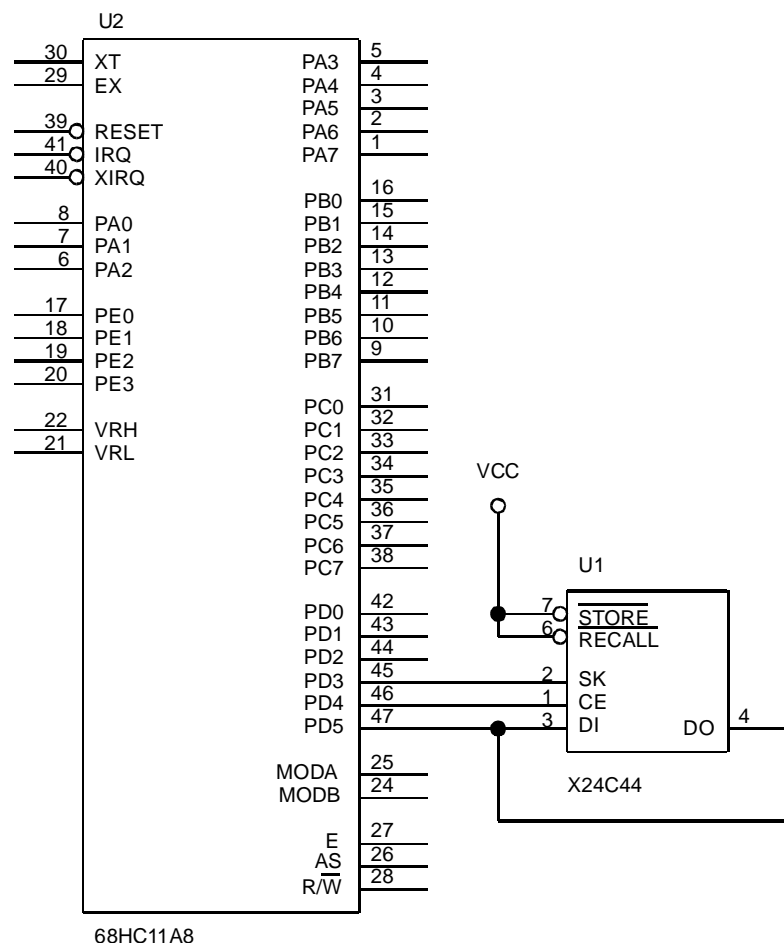


Figure 1. Interfacing an X24C44 to a 68HC11 microcontroller using Port D

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*****
* THIS CODE WAS DESIGNED TO DEMONSTRATE HOW THE X24C44 COULD BE INTERFACED TO *
* THE 68HC11 MICROCONTROLLER. THE INTERFACE USES 3 LINES FROM PORT 1 (PD3, *
* PD4, AND PD5) TO COMMUNICATE. THE DI AND DO PINS ON THE X24C44 ARE TIED *
* TOGETHER WHICH ALLOWS 1 LESS PORT LINE TO BE USED. *
* *
* THE CODE SHOWN DEMONSTRATES RCL, WREN, READ, WRITE, AND STORE *
* INSTRUCTIONS. THE REMAINING INSTRUCTIONS (WRDS AND ENAS) CAN BE ISSUED *
* USING THE SAME ROUTINE AS OTHER NON-DATA INSTRUCTIONS. *
* *
* THE PROGRAM ISSUES A SEQUENCE OF INSTRUCTIONS TO READ THE CONTENTS OF *
* ADDRESS 5 AND STORES THE SAME VALUE IN ADDRESS 9. THE SEQUENCE OF *
* INSTRUCTIONS IS AS FOLLOWS : *
* 1. RCL          SETS THE PREVIOUS RECALL LATCH *
* 2. WREN         SETS THE WRITE ENABLE LATCH *
* 3. READ         DATA FROM ADDRESS 5 IS READ *
* 4. WRITE        THE DATA READ DURING STEP 3 IS WRITTEN TO ADDRESS 9 *
* 5. STO          THE RAM'S CONTENTS IS TRANSFERED TO THE EEPROM *
* *
* DATA TRANSFER IS PERFORMED WITH THE MOST SIGNIFICANT BIT FIRST. DURING *
* THE READ AND WRITE INSTRUCTIONS THE DATA SEQUENCE IS INVERTED FROM THAT *
* SHOWN IN THE DATA BOOK (D15 IS SHIFTED FIRST). *
*****

```

SKBIT	EQU	\$08	MASK INDICATING PORTD SK POSITION
CEBIT	EQU	\$10	MASK INDICATING PORTD CE POSITION
DI0BIT	EQU	\$20	MASK INDICATING PORTD DATA POSITION
DOUT	EQU	\$38	MASK TO MAKE DI/O AN OUTPUT
DIN	EQU	\$18	MASK TO MAKE DI/O AN INPUT
WRDS	EQU	\$80	RESET WRITE ENABLE LATCH
STO	EQU	\$81	TRANSFERS FROM RAM TO EEPROM
ENAS	EQU	\$82	PLACES PART INTO POWER DOWN MODE
WRITE	EQU	\$83	RAM WRITE
WREN	EQU	\$84	SET WRITE ENABLE LATCH
RCL	EQU	\$85	TRANSFERS FROM EEPROM TO RAM, RESETS
*			WRITE ENABLE LATCH
READ	EQU	\$86	RAM READ
DDRD	EQU	\$09	DATA DIRECTION REGISTER FOR PORT D
PORTD	EQU	\$08	ADDRESS FOR PORT D
ADDR	EQU	\$80	LOCATION FOR X24C44 ADDRESS TO ACCESS
INST	EQU	\$81	INSTRUCTION FOR PART
RWDAT	EQU	\$82	LOCATION FOR X24C44 DATA TRANSFERED
COUNT	EQU	\$84	COUNTER VARIABLE

```

*****
* RESET VECTOR TO BEGINNING OF PROGRAM CODE *
*****

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```

ORG      $FFFE          RESET VECTOR TO PROGRAM ENTRY POINT
FDB      $E000

```

```
*****
* START OF PROGRAM EXECUTION *
*****
```

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                ORG          $E000          BEGINNING OF EXECUTABLE CODE

BEGIN:          LDS          #$00FF          INITIALIZE STACK POINTER
                LDX          #$1000          INITIALIZE PAGE OFFSET LOCATION
                LDAA          #DOUT
                STAA          DDRD,X          MAKE CE, SK, DI/O OUTPUTS
                LDAA          #$00
                STAA          PORTD,X          INITIALIZE CE, SK, DI/O TO ZEROS
                LDAA          #RCL           PERFORM A RECALL TO SET
                STAA          INST           THE RECALL LATCH
                JSR           CEHIGH
                JSR           OUTBYT
                JSR           CELOW
                LDAA          #WREN          PERFORM A WRITE ENABLE TO SET
                STAA          INST           THE WRITE ENABLE LATCH
                JSR           CEHIGH
                JSR           OUTBYT
                JSR           CELOW
                LDAA          #$05          READ THE CONTENTS OF ADDRESS 5
                STAA          ADDR          THE VALUE READ WILL BE IN STORED
                JSR           RDWRD          IN RWDATA
                LDAA          #$09          WRITE THE DATA JUST READ INTO
                STAA          ADDR          ADDRESS 9
                JSR           WRWRD
                LDAA          #STO          PERFORM A STORE OPERATION
                STAA          INST
                JSR           CEHIGH
                JSR           OUTBYT
                JSR           CELOW
                BRA          *              LOOP UNTIL RESET

```

```
*****
* WRITE THE WORD SPECIFIED IN RWDAT. THE ADDRESS TO *
* BE WRITTEN IS SPECIFIED IN ADDR.                  *
*****
```

```

WRWRD:          JSR          CEHIGH          WRITE VALUE IN RWDATA INTO LOCATION
                LDAA          ADDR          SPECIFIED IN ADDR
                LSLA          JUSTIFY ADDRESS IN INSTRUCTION
                LSLA
                LSLA
                ORAA          #WRITE          MASK IN WRITE INSTRUCTION
                STAA          INST
                JSR          OUTBYT          SEND WRITE INSTRUCTION TO DUT
                LDAA          RWDAT
                STAA          INST
                JSR          OUTBYT          SEND IN UPPER BYTE OF DATA
                LDAA          RWDAT+1
                STAA          INST

```

```

JSR    OUTBYT          SEND IN LOWER BYTE OF DATA
JSR    CELOW
RTS

```

```

*****
* READ THE WORD AT THE LOCATION SPECIFIED IN ADDR. THE *
* DATA READ WILL BE PLACED IN RWDAT.                  *
*****

```

```

RDWRD:    JSR    CEHIGH      READ THE ADDRESS SPECIFIED IN ADDR
          LDAA   ADDR
          LSLA
          LSLA      JUSTIFY ADDRESS TO READ
          LSLA
          ORAA   #READ      MASK IN READ INSTRUCTION
          STAA   INST
          JSR    SEND7      SEND IN 7 BITS OF READ INSTRUCTION
          LDAA   #DIN      MAKE DATA LINE AN INPUT
          STAA   DDRD,X
          JSR    CLOCK      SEND EIGHTH CLOCK PULSE FOR READ INSTRUCTION
          LDAA   #$10      PREPARE TO SHIFT IN 16 BITS
          STAA   COUNT

BITX:     CLC              ASSUME BIT IS GOING TO BE A ZERO (CLEAR CARRY)
          LDAA   PORTD,X    READ BIT VALUE
          BEQ    NO1        LEAVE CARRY FLAG ALONE IF BIT IS A 0
          SEC              SET CARRY IF BIT IS A 1
NO1:      ROL    RWDAT+1    ROLL CARRY FLAG INTO DATA WORD
          ROL    RWDAT
          JSR    CLOCK      SEND A CLOCK PULSE
          DEC    COUNT      LOOP UNTIL
          BNE    BITX       16 BITS ARE READ
          LDAA   #DOUT      MAKE DATA LINE AN OUTPUT
          STAA   DDRD,X
          JSR    CELOW      BRING CE LOW

RTS

```

```

*****
* SEND DATA OUT TO THE PART. THE DATA TO BE SENT IS *
* LOCATED IN INST.                                     *
*****

```

```

SEND7:    LDAA   #$07      SHIFT OUT 7 BITS FOR READ INSTRUCTION
          STAA   COUNT
          BRA    LOPO

OUTBYT:   LDAA   #$08      PREPARE TO SHIFT OUT 8 BITS
          STAA   COUNT

LOPO:     ROL    INST
          BCC    IS0        JUMP IF DATA SHOULD BE 0
          BSET   PORTD,X DI0BIT SEND 1 TO DI/O
          BRA    IS1

IS0:      BCLR   PORTD,X DI0BIT SEND 0 TO DI/O
IS1:      JSR    CLOCK      SEND CLOCK SIGNAL

```

```
        DEC     COUNT
        BNE     LOOPO          LOOP UNTIL ALL 8 BITS HAVE BEEN SENT
        RTS

*****
* BRING CE HIGH *
*****

CEHIGH:    BSET     PORTD,X #CEBIT    BRING CE HIGH
          RTS

*****
* BRING CE LOW *
*****

CELOW:     BCLR     PORTD,X DIOBIT    BRING DATA LINE LOW
          BCLR     PORTD,X #CEBIT    BRING CE LOW
          RTS

*****
* ISSUE A CLOCK PULSE *
*****

CLOCK:     BSET     PORTD,X SKBIT     BRING SK HIGH
          BCLR     PORTD,X SKBIT     BRING SK LOW
          RTS
```