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Programming EPROM and EEPROM on the M68HC11EVM

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Introduction

The M68HC11EVM is one of the most versatile development tools for the MC68HC11 A- and E-series microcontrollers. This engineering bulletin applies to EVM revision G boards using the EVMBug monitor version 3.0.

The EVM can be used to support development for these MC68HC11 Family members: A0, A1, A7, A8, E0, E1, E8, E9, 711E9, and 811E2.

The EVM also can be used to program the EEPROM and EPROM of these devices. The dual features of emulation and programming make the EVM a good choice for new product development.

To bring your board up to Rev. 3.0 status, access the Freeware Data System. Retrieve the hardware upgrade from the FreeFAX System. The file is titled 3hc11evmdu9,2 for M68HC11EVM design upgrade 9. This document also details the hardware and firmware changes necessary for the upgrade.

The S-records for EVMBug monitor version 3.0 are also available on the Motorola website, http://www.mcu.motsps.com, in the ftp file server. The file is titled EVM1130.S19 for version 3.0 of the EVMBug monitor and resides in the EVM directory. If your EVM is not already at revision G,

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make the revisions outlined in design upgrade 9 before attempting to program any of the MC68HC11 devices listed here.

NOTE: *Do not make these modifications if you intend to program the MC68HC811A8.*

General Information

Hardware
Preparation

The EVM is shipped with an MC68HC11A1 in the resident MCU socket, U2. You may use this chip to program any MC68HC11 A- or E-series devices. Many users will object at this point, saying, "What about jumper J20?" Jumper J20 merely determines what on-board memory resources are available in the expanded-multiplexed emulation mode.

If J20 is on pins 1 and 2, then the RAM device addressed from $C000 to $DFFF is not visible, thereby allowing proper emulation of an A-series device, which only contains an 8-K ROM addressed from $E000 to $FFFF.

If J20 is on pins 2 and 3, then the RAM chip from $C000 to $DFFF is enabled, allowing the user to emulate properly the MC68HC11E9, which contains 12 K of ROM from $D000 to $FFFF.

Jumper J20 must be on pins 2 and 3 for E-series programming and is ignored for A-series programming.

Be aware of the internal memory map of the device you are trying to program; the EVM must have some memory resource available that uses the addresses you are trying to program. Toward that end, install jumpers J10 and J11 to enable the on-board memory resources from $E000–$FFFF and $B600–$B7FF, respectively. Ensure that an 8-K RAM is installed in U15 to enable memory from $C000–$DFFF.

Some problems with programming MC68HC11 devices on the EVM are due to a noisy clock line to the programming socket. This noise is caused by the physical distance between the crystal circuit and the programming socket and can be reduced by removing capacitor C26 from the board and shorting the leads of resistor R22.

V_{PP}, the programming voltage necessary to program EPROM on the EVM, is +12 Vdc. This power must be applied to the V_{PP} power connector, J5, through a 100-W resistor for current limiting. This power is not necessary if you only intend to program EEPROM, since the MC68HC11 contains an on-chip charge pump which provides the necessary voltage for EEPROM programming.

Software Preparation

Using the Freeware cross assembler, IASM11 from P&E Microcomputer Systems, or any other assembler which generates Motorola S-records as object code, assemble your source code and generate an S-record file.

Remember that your code must specify addresses for the assembler which correspond to the addresses you wish to program in the MC68HC11. For example, use ORG $E000 to tell the assembler to generate the code that follows beginning with address $E000. ORG $B600 would tell the assembler to begin at the EEPROM addresses on all A- and E-series MC68HC11 devices except the MC68HC811E2.

Use a terminal emulator program like Procomm or IASM11 to communicate with the EVM board via your computer's serial port. Setup is 9600 baud, 8 data bits, 1 stop bit, and no parity.

Follow these steps:

- Apply power to the EVM board via connector J5.

- After applying power and attaching the serial cable to your serial port, press RETURN on the keyboard to establish communications. If boot up is successful, the EVMBug prompt will appear on your terminal, followed by a display of register contents.

- If boot up is unsuccessful, check the voltage from your power supply, your serial cable, the communications protocol (8 data, 1 stop, and no parity bits), and the computer serial port.

- Correct any errors and depress and release the master reset switch, S3, on the EVM.

- Then press RETURN on your keyboard. The EVMBug prompt and register display should now appear.

> ***NOTE:*** *If you do not intend to program EEPROM, ignore the next paragraph.*

- Enter the command MD 103F.

The factory-shipped default for this location is $0D. This location is the CONFIG register, and the $0D indicates that internal ROM or EPROM is disabled and internal EEPROM is enabled in the memory map. Attempts to download to internal EEPROM will not be successful. To download code into the internal EEPROM, you must either reprogram the CONFIG register to $0C or write a routine to program data into the internal EEPROM. Reprogramming the CONFIG register can be accomplished by following example 1 in this bulletin.

Programming Procedure

To program, follow these steps:

1. Apply power to the EVM board via connector J5.

2. Launch your terminal emulation software on the PC and install a 25-pin straight serial cable from your PC to the EVM (9600 baud, 8 data bits, 1 stop bit, and no parity).

3. Press RETURN to synchronize communications. The EVMBug prompt should appear in addition to the register display. If not, return to step 2, ensuring that power, cable, protocol, and COM port are all correct.

4. Download your previously assembled S-records to the EVM board by entering the command LOAD T. The EVM board is now waiting for your terminal emulator to send the S-record file.

   - In IASM11, use the F6 key to send a file to the EVM. IASM11 will prompt for a file name.
   - Type the file name and press RETURN. You should see the S-records on your screen as they are downloaded. The last line of all your S-records should be S9030000FC.

– Press RETURN and ignore the Illegal command error.

– Visually verify the download by entering the MD command followed by the address you wish to see. For example, type MD E000 to see the memory at $E000.

5. Move switches S4 to RESET and S5 to OFF.

6. Insert the MCU to be programmed in U32 or U56. Remember to follow the orientation and placement information shown in the *Evaluation Module User's Manual* (Rev. AD7), page 3-33, Motorola document order numbe M68HC11EVM/AD7.

7. Apply power to the MCU by moving switch S5 from OFF to PWR.

8. Depress and release the master reset switch, S3. Press RETURN on your keyboard. If the board and the PC are still communicating correctly, you will see the EVMBug prompt and the register display.

9. Move switch S4 from RESET to OUT to bring the MCU in the programming socket out of reset in bootstrap mode.

Now any of the commands BULK, CHCK, COPY, ERASE, PROG, or VERF can be entered using the syntax shown in chapter 3 of the *Evaluation Module User's Manual.*

10. Remove power to the programming socket by moving switch S4 to RESET and switch S5 to OFF.

11. Remove the programmed MCU from the programming socket.

Examples

Three programming examples are included here.

Example 1   This example shows how to reprogram the CONFIG register. This is useful for disabling the internal EEPROM and EPROM so that the user can replace the resident MC68HC11 and program EEPROM on other chips.

- Type: PROG 103F 103F 0C

  You should see:

  MC68HC11 NOT BLANK ENTER RETURN TO CONTINUE

- Press Return. Then you should see:

  103F MC68HC11 DOES NOT VERIFY

- To verify that programming did take place, move switch S4 from OUT to RESET, then back to OUT.

- Now type: COPY 103F 103F E000

- Then type: MD E000

The "Does not verify" message appears because new values in the CONFIG register do not take effect until a reset occurs. However, copying the value back to user memory and displaying it allows you to verify programming success.

Now you can exchange your programmed MCU with the MCU in the resident socket, U2, to allow downloading into the $B600–$B7FF area of memory.

Example 2   To program your code or data into the internal EEPROM of an MCU:

- Download your code from your PC into the $B600 to $B7FF area of user memory on the EVM board using the LOAD T command.

- Then enter this command: PROG B600 B7FF

  The EVM may respond with:

  MC68HC11 NOT BLANK, ENTER RETURN TO CONTINUE.

  Hitting RETURN will cause the processor to attempt to program the chip in the programming socket with the data from $B600 to $B7FF of the user map.

- If this does not verify, you must enter the BULK command to erase the EEPROM before attempting to program it. If the EEPROM was already blank, you should see VERIFY COMPLETE, which indicates the operation was successful. (These addresses can be replaced by $F800 and $FFFF for the MC68HC811E2.)

Example 3   To program the EPROM of an MC68HC711E9:

- Download your code or data from your PC into the user map of the EVM from $D000 to $FFFF using the LOAD T command.

- Then enter this command: PROG D000 FFFF.

  If the EPROM was blank and the programming operation was successful, you will see the reply VERIFY COMPLETE.

  If the EPROM was not erased beforehand, you will see the message, MC68HC11 NOT BLANK, ENTER RETURN TO CONTINUE.

- Either erase the EPROM under ultraviolet light or attempt to program the part by hitting RETURN. If you press RETURN and then get the message MC68HC11 DOES NOT VERIFY, then programming was unsuccessful and you will need to erase the part.

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