

68HC11 Training Lab Instructor Manual

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Introduction

The objective of the 68HC11 Training Kit is to give the students hands-on experience with micro-controllers by developing practical applications using 68HC11 Assembly language. The 68HC11 Training Kit consists of several labs that vary from simple to complicated. It is recommended that the lab accompany a micro-controller course during the semester.

Depending on the duration of each lab during the week, each Lab in the student manual can be covered during one or two lab weeks. Based on the remaining time during the semester, the instructor is advised to have the students to work on one or more advanced projects. Some project ideas are listed in Advanced Projects section of this manual.

Preparation

The 68HC11 Training Kit consists of the following components:

- Motorola M68HC11 EVBU Micro-controller Board (Training Board)
- Motorola M68HC11 Assembler (as11)
- Micro-IDE Integrated Development Environment
- Terminal Board
- Terminal Expansion Cable
- Serial cable
- 1K Resistors (6 pieces)
- 5K Variable Resistor
- Red LED
- Yellow LED
- Green LED
- Numeric Keypad

The following external items are required for each Training Kit station:

- IBM Compatible Personal Computer (PC) running Windows 95/98 or NT 4.0.
(M68HC11 Training Kit will not work with DOS, Windows 3.1 or lower).
Minimum 16MB memory and 10 MB of available hard disk space.
One available RS232 Serial Port.
- 5 Volts regulated power supply.
- Digital Voltmeter

Prepare each Training Kit station as follows:

Installing the hardware

1. Connect the Terminal Board to the Training Board using the Terminal Board Extension Cable (60-wire colored ribbon cable) as shown in Figure 1. Make sure that the cable is connected properly by checking the color coding of the cable.
2. Place the Training Board and Terminal Board on a clean benchtop (if possible on an anti-static mat) close to the PC.
3. While the 5-Volt Power Supply is off, connect the power supply outputs to the Training Board Power Supply Connector (P1) as shown in Figure 1.

Positive supply is connected to the RED terminal block (labeled VDD) on the M68HC11EVBU board.

Negative supply (ground) is connected to BLACK terminal block (labeled GND) on the M68HC11EVBU board.

CAUTION: Connecting the supply leads incorrectly will permanently DAMAGE the board !

4. Turn on the 5-Volt Power Supply.
5. Turn off the PC.
6. Connect the M68HC11EVBU board to the PC's serial port using the supplied serial cable as shown in Figure 1.
7. Turn on the PC and start Windows.

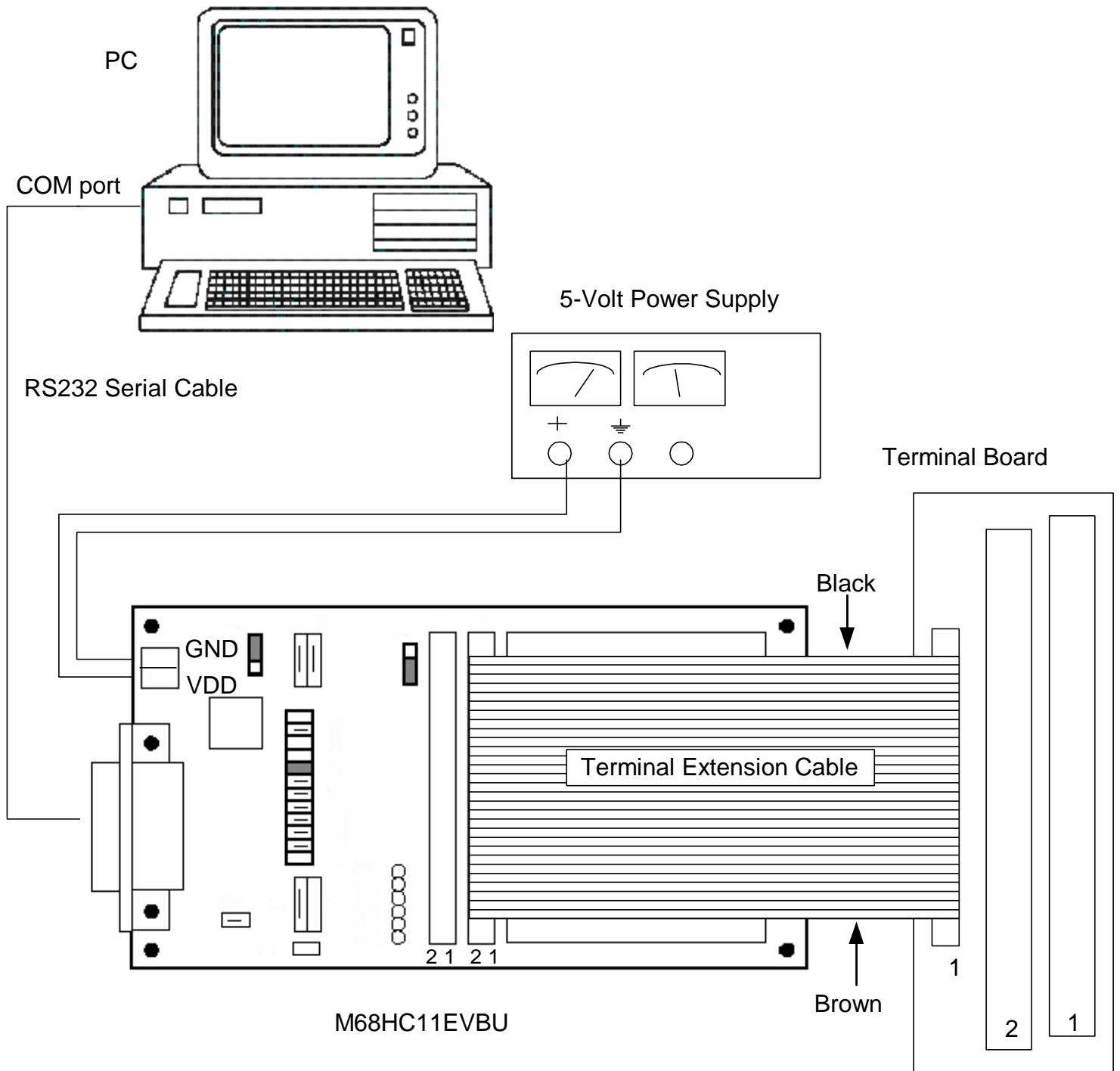


Figure 1

Installing the Software

1. Install the Motorola 68HC11 assembler from the M68HC11EVBU Program Disk:

- Create a folder on your hard disk:

C:\motorola

- Copy all the files from the M68HC11EVBU Program Disk to c:\motorola

The following files are included:

AS11.EXE: Motorola Assembler for 68HC11

ASSEMBLER.DOC: Manual for AS11.EXE

README: Description of the contents of the disk

BUF32.ASM: Source code (in Assembly language) for BUFFALO Monitor

RTCSUBS.ASM: Source code (in Assembly language) for real-time clock (RTC)

2. Install the Micro-IDE software on the PC following the instructions on the Micro-IDE User's Guide that came with the package. You will be prompted for the Serial number for Micro-IDE during installation; this number is printed on the Micro-IDE User's Guide for each Training Kit.
3. After installation, start Micro-IDE by selecting Start, Programs and Micro-IDE. Select the Micro-IDE option under Micro-IDE folder. This will start Micro-IDE.

Configuring communications

1. Select the correct COM port and communications parameters. From the Micro-IDE menu, select Tools and Options.
2. Under Build tab, check mark Build With box. Select Motorola 68HC11 Cross Assembler as the toolkit. Select Motorola M68HC11-EVBU Serial Loader as the loader (next to Download with checkbox).
3. Under Terminal tab, make sure Com Port is selected as the port that you connected to the Training Board. For example, if the board is connected to COM1, select COM1 under Terminal tab. Make sure that the Terminal options are set as follows:

Baud Rate: 9600
Data Bits: 8
Stop Bits: 8
Parity: None
Echo: Off

4. Under Loader tab, make sure Com Port is selected as the port that you connected M68HC11EVBU board. For example, if M68HC11EVBU is connected to COM1, select COM1 under Loader tab. Make sure that the Loader options are set as follows:

Baud Rate: 9600
Data Bits: 8
Stop Bits: 8
Parity: None
Echo: Off

5. Check communications to the M68HC11EVBU board. Start the Terminal program by selecting Terminal under View menu. A blank terminal screen will appear on the right side of the Micro-IDE window. (You can resize the terminal screen by selecting the left edge of the terminal window with the left mouse button and dragging to the right.)
6. Select Tools, Terminal and Connect. This will establish communications to the M68HC11EVBU.

7. Press the RESET button on the Training Board. The following message should appear on the terminal screen.

BUFFALO 3.4 (ext) – Bit User Fast Friendly Aid to Logical Operation

8. Click the left mouse button once in the Terminal window to set the input focus to that window. Press <ENTER> once. The '>' prompt will be displayed. This means you have established communications with the board and ready to enter commands.

Downloading programs

Check if you can assemble and download programs to the board by following the steps below:

1. Make sure the board is waiting at the '>' prompt. Open the real-time clock sample program (RTCSUBS.ASM) that came with the board. From the Micro-IDE menu, select File, Open and open the file RTCSUBS.ASM under c:\motorola. This will display the file in edit window. Note that the M68HC11 instructions, comments and assembler directives are highlighted in various colors.
2. Select Build and then Build (or click the Build All button). This will assemble the RTCSUBS.ASM file and generate the RTCSUBS.S19 file (which is a hex file in Motorola S Format). Download the file to the board by selecting Download under Build menu.
3. You should see a progress indicator during download. When the download is finished, you should see the message

>done

on the Terminal screen. This means that the board has received the program successfully.

Advanced Projects

- Connecting a printer to the 68HC11
- Using the 68HC11 as a frequency counter
- Using the 68HC11 as a temperature controller
- Connecting the 68HC11 to a Liquid Crystal Display (LCD)
- Expanding the memory of the 68HC11 by adding external RAM and EPROM.
- Using the 68HC11 EEPROM and the Analog-To-Digital Converter as a multi-channel data logger.

Corrections

The M68HC11EVBU Universal Evaluation Board User's Manual contains a printing error regarding the pseudo-interrupt vectors to be used when running the BUFFALO monitor. These vectors are located in \$0XXX space, not \$EXXX space as the manual states. Go to Table 3-2 (titled 'Interrupt Vector Jump Table') in the manual and change \$E's with \$0's with a pen. The rest of the information is correct.