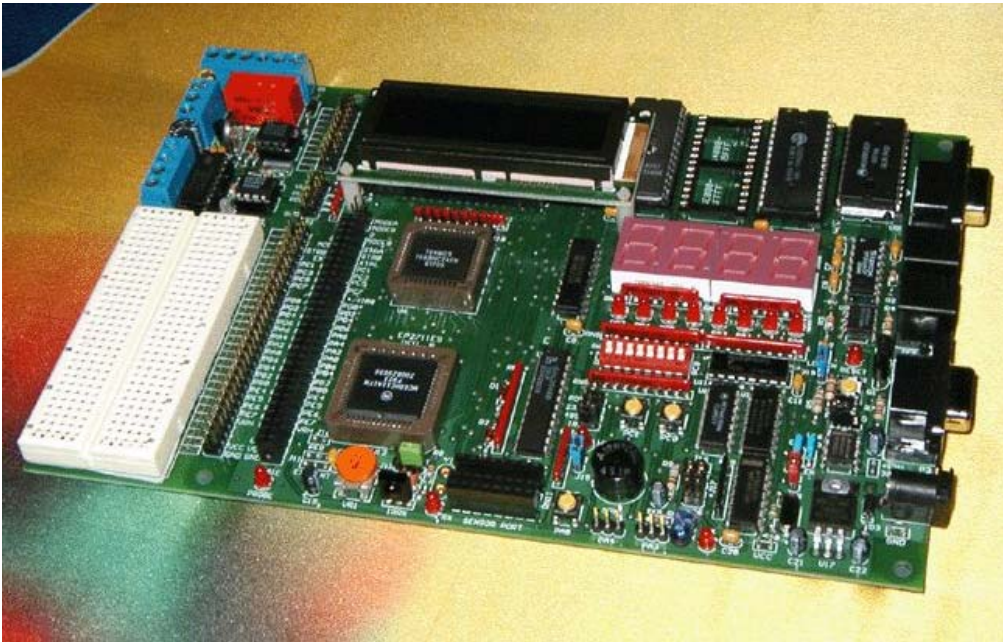


WYTEC 68HC11 : EVBplus2 Development Board



Summary

- MCU: 68HC11E1
- RAM: 30KB
- EEPROM: 8KB

Example applications:

- EVM, EVS replacement
- 68HC11 Trainer for students
- 68HC11 prototype platform for engineers
- 68HC711E9 Programmer
- Single Chip Real Time Emulation for the 68HC711E9, E20
- 68HC11 SBC, Single Board Computer

The EVBplus2 board is very similar to the original Motorola EVB board in terms of the PCB component layout, thus allowing a smooth transition for upgrading the old EVB board. All user's EVB/EVBU/EVBU2 add-on boards can also be used without any modifications. A small solderless breadboard allows quick prototyping of user's additional circuits.



All 68HC11 I/O lines (PA0-PA7, PB0-PB7, PC0-PC7, PD0-PD5, PE0-PE7) on the EVBplus2 board are available to user programs. Port B and C are emulated by 68HC24 PRU. We also added a 65C22 VIA to offer 16 more bi-direction I/O lines (port F and G) for user applications.

Because the new EVBplus2 board is the product that combines and caters to many professor's ideas and suggestions, it easily meets or exceeds the requirements of their courses and lab assignments. Not only do the many on-board features allow it to serve as an EVB replacement, but also as an EVM or EVS replacement.

EVBplus2 features:

1. Includes DB9 RS232 cable for connecting to PC serial port
2. Includes AC adapter to power the board (US and Canadian) orders)
3. On-board 16X2 LCD display module with LED backlight and it can be replaced by any size of LCD display module via a 16 pin cable assembly
4. On-board 4 digit seven segment display module
5. Dual RS232 ports, user can use 68HC11's SCI for his application program
6. Eight LEDs connected to port B
7. An 8 position DIP switch connected to port C
8. Two push button switches connected to PC0 and PC1, a third is connected to PA0
9. On-board IR transceiver with built-in crystal frequency based 38KHz digital oscillator
10. RS485 communications port with 2 RJ12 jacks for daisy chain
11. On-board 12 V programming voltage for the 68HC711E9
12. On-board speaker for music applications
13. On-board potentiometer trimmer pot for analog input
14. Capable of 68HC24 port replacement unit for port B and C in real time single chip emulation
15. Additional 16 I/O lines provided by a 65C22 VIA for port F and G besides 68HC11's ports A,B,C,D and E
16. 30K on-board RAM from \$8800 to \$FFFF for user code
17. All on-chip RAM \$00-\$1FF, and 512 bytes of EEPROM available for user program
18. All I/O pins of the 68HC11 available to user program, including PE0 and PA3
19. Installed with BUFFALO 3.4 monitor. This allows professors to avoid changing teaching material if using the board in BUFFALO monitor mode, since all programs for EVB/EVBU/EVBU2 boards can run with identical memory maps



20. Debugging features

- Code Warrior C source level debugging supported via on-board Metrowerks monitor
 - Built-in LCD driver software in firmware
 - Works as a WICE emulator without hardware breakpoint features
 - Read internal ROM code of the 68HC711E9 and disassemble it for reverse engineering
 - 38.4K baud for fast file download, 4 time faster than a BUFFALO monitor based board
 - Single –stepping
 - Eight breakpoints
 - Data watch for memory and registers
 - Re-mapping on-chip Ram and control registers via INIT register
 - User-friendly and interactive 68HC11 online assembler
 - Display 68HC11 internal registers and control bit assignment map using standard Motorola labels
 - Symbolic debugging compatibility with most assemblers and compilers, including Motorola 68HC11 assembler freeware
 - Exit a user program with <ESC> key – even if the program is hung
 - Phantom Monitor technology preserves all user interrupt vectors, including RESET – an EVBplus exclusive
21. Dual CRT screens for debugger and user program, so the user program running on the student version board can use the PC CRT as a large LCD display module
22. Accesses PC's real time clock from user's program for real time clock applications, saves user a real time clock chip
23. 4 x 4 keypad header
24. Robot servo outputs
25. Logic probe with LED indicator
26. 8-sensor port for digital switches and analog sensors for robot and home automation applications
27. Fast SPI expansion port scans 10,000 I/O devices per second
28. 40 pin Motorola EVM compatible bus signal connector for logic analyzer
29. 60 pin EVB/EVBU/EVBU2 compatible male header and female socket connector for user I/O boards and fast prototyping with the on-board solderless breadboard
30. Application Circuit Corner (ACC) provides the footprints of 4 popular 68HC11 application circuits, so students can add applications later without buying an add-on-board
31. Ability to run all sample programs in the following books:
- *“Etcheverry's Introduction to the 68HC11 Lab Manual”* by Fred Etcheverry
 - *“The 68HC11 Microcontroller”* Professor Joseph D. Greenfield
 - *“MC68HC11 An Introduction Software and Hardware Interface”* by Professor Han-Way Huang
 - *“Microcomputer Engineering”* by Professor Gene H, Miller



- *“Using the M68HC11 microcontroller: A guide to interface and programming”* by Professors John C. Skroder
- *“Microcontroller Technology: The 68HC11”* by Professor Peter Spasov

32. Package also includes useful software:

- Fully debugged 68HC11 program examples including source code
- Example program that simultaneously scans keypad, plays a song, multiplexes seven segment display, changes display brightness by adjusting trimmer pot and detects object by using IR transceiver as a proximity sensor
- Eric Engler’s Windows IDE software

33. Includes Solderless breadboard with solder pads underneath for rapid prototyping

34. Large size PC board : 8.5’’ x 5.7’’

The board comes with everything on the above picture except the components on the Application Circuit Corner above the solderless breadboard. All on-board I/O devices can be disabled if the board is used as an In-Circuit Emulator for user’s target board. The emulator cable assembly will be available soon.

Application Circuit Corner provides footprints for a DS1302 Real Time Clock with battery backup, a DS1620 Digital Thermometer and Thermostat, a 12V DPDT relay and a L293D motor driver. The components on the picture are for illustration purpose only and are not included in the price. We provide schematic diagram, but do not carry parts for the circuits. We will provide a kit for each circuit in the future.

The crystal of the 68HC11 on the picture is not shown, so you can see the pins that hold the crystal. An 8 MHz crystal is included with the board. To change the 68HC11 operating frequency is merely to replace the 8 MHz crystal with a new one. The board was fully tested at 12 MHz. We also have a 20 MHz version of board available, please email us your request for additional information if you are interested in our 20 MHz or even 24 MHz turbo version of the EVBplus2 board. The turbo version of board is only available to experienced users.

Many thanks to the authors, professors and lab managers who participated in evaluations of the EVBplus and EVBplus2 boards. Special thanks to the authors and professors who offered many instrumental ideas and suggestions. It would not have been possible to make this board what it is today without their help.

We support Motorola University Program. If you are a Professors or a Lab Manager, in the USA and Canada , is teaching a 68HC11 course, please email us a request. We will be more than happy to supply you a demo board for a 60 day free trial without any obligations.



FAQ

- **Should we change our microcontroller from the 68HC11 to a different one?**
 - No way
There are many microcontrollers available on the market today. However, none are better than the 68HC11 for the classroom atmosphere. Many OTP microcontrollers may offer a better solution in a particular application, but their computer architectures and instruction set are not suitable to a general educational purpose. To be the microcontroller in the classroom, it must be a ROMless part with external memory, not an OTP part, so all system signals can be brought out for students to observe by using a scope or a logic analyzer. Nothing can replace the real thing. Could you imagine if an EE graduate has never even seen what the memory read and memory write signals look like throughout the four years in a college classroom? Maybe it's acceptable for a student who wants to be a technician, but not an engineer. Using an OTP part to do bit banging on a data port only gets you so far, knowing computer architecture and how to interface to the real world, goes a long way to becoming an "expert".
 - The 68HC11 offers a powerful and easy-to-memorize instruction set and has been around for more than 10 years. Once you have built your solid foundation of 68HC11 microcontroller expertise, you can easily apply your 68HC11 knowledge to the HC12 family or other microcontrollers in the future. Plus, there is a lot of application software that can be downloaded from the web.

- **What can I do with EVBplus board after finishing my course?**
 - The old Motorola EVB, EVBU and EVBU2 boards are not very useful after the course after the course is finished. Students either sell the boards back to book store or store them in their closets because with the limited on-board hardware, you cannot do much with them in the real world. However, you can tackle many more complex projects with the EVBplus2 board for your senior projects in real world applications. The possible advanced applications with this board include, but are not limited to :
 - a. Robot applications
 - b. Home Automation via X10 or RS485 interface
 - c. Home Security System
 - d. Fingerprint Access Control
 - e. Electronic Voting Machine via RS485 interface



- f. Personal Alarm Clock
- g. Personal Weather Station
- h. Voice Processing Applications (Voice Recorder and Voice Recognition System)
- i. Industrial control and Instrumentation Applications
- j. Metal Detector and Ultrasonic Motion Detector Applications
- k. Eight Channel Christmas Light Chaser
- l. DC Motor Speed Control
- m. Stepper Motor Control
- n. Telephone DTMF tone Remote Control
- o. Infrared Remote Control
- p. RF wireless Remote Control System with external RF transceiver module

By the end of the semester, every student should be able to program this plus2 board into a commercial grade alarm clock, in terms of functions, or use it to decode a handheld IR transmitter. We will introduce some unique applications in the future. If any professor needs some example programs for their syllabus or teaching purposes, we will gladly write them for free.

- **Can I learn C programming with the board?**
 - Yes, you can write your code in C or Basic as long as our compilers can generate a S19 hex file that can be downloaded to the board. At this moment, we do not sell any compilers, but we will package low cost or even free Basic and C compilers with the board in future.
- **What is the WICE debugger and Phantom monitor, anyway?**
 - Take the Motorola EVB board as an example, you run PC terminal software to debug by sending commands to the BUFFALO monitor. The WICE debugger software is like the PC terminal program with many better features – data watch, symbolic debugging, and easy to use on-line assembler, just to name a few. The Phantom monitor firmware on the plus2 board is like the BUFFALO monitor on the Motorola EVB board. Normally the phantom monitor address range is \$7000-47FFF, but is \$E000-\$FFFF during the power-up. The reason it is called Phantom Monitor is that it has a ghost address range at \$E000-\$FFFF during the power up.
- **What's the purpose of the RS485?**
 - The RS485 on the EVBplus2 board is a standard communication interface port and it can communicate with any system that has a RS485 port. It could communicate a PC, a SBC or another EVBplus2 board, as long as it



has a RS485 interface port. It's mainly used in a long distance communication up to 5000 feet. If a professor uses his EVBplus2 board as the master units and daisy chain all students board as the slave units, he/she can collect some information from students in the classroom electronically in real-time.

If you have to debug a RS485 or RS232 based network product, instead of purchasing many emulators for every node, you can save a lot of money by using the EVBplus2 boards.

- **How does the board communicate with the PC?**

- Just like the Motorola EVB, the board uses the UART 68B50 to communicate with the PC Com port for debugging code, so the 68HC11's SCI can be used by a user's program. The 68HC11's can be configured to a user RS232 port or an RS485 port or an IR port. The user RS232 port is available at the lower right DB9 jack. The RS485 port is available at the two RJ12 jacks, either one can be input or output, so you can daisy chain many boards together to make a control system which has one master unit that talks to many slave units. The IR port is represented by the 38KHz IR transmitter (located near the Speaker and the bottom edge of the PC board) and the IR detector (located near the trimmer pot and at the bottom edge of PC board)

- **Which board to buy, EVBplus or EVBplus2 ?**

- The EVBplus board runs in expanded mode, without the 68HC24. the port B and C are simulated on the CRT screen in near real-time as output ports only. You can use the Port A, D and E of the 68HC11, except the PA3, PD0-PD1 and PE0. If you think it is acceptable, you can buy the EVBplus board at \$99.00. However, if you have some applications that need to emulate the port B and C in real time and IR remote control, it might be a better idea to pay extra for the plus2 board, not to mention the fact that you would get lot more hardware features. If you are student, we strongly recommend the EVBplus2 board, the extra \$30.00 is well worth it and you will gain much more 68HC11 programming knowledge and experience.
- If your need is only to work on software for a SPI based LED display, the EVBplus board is a good choice because it has 4 digit LED display module driven by the SPI port of the 68HC11. If you use the board as a particular production tester, which performs a fixed function, the EVBplus board might be a better choice due to the low cost.



- If you are a software consultant who develops many products based on the 68HC11, we strongly recommend the EVBplus2 professional version board. It has a High Level Language switch that will bypass the on-board monitor firmware and auto start your code from the U3 (an 8K EEPROM, or EPROM). The jumper HLL is used for high-level language support with a user supplied monitor. When this jumper is installed, the LED above it will be lit to indicate the HLL mode. After reset or power up, the board will enter the HLL mode. While the U3 EEPROM address range was \$4000-\$5FFFF in the normal debugging mode, it now becomes \$E000-\$FFFF in the HLL mode. While the U4 SRAM address range was \$8000-\$FFFF in the normal debugging mode, it now becomes \$8000-\$DFFF (U3), it can bypass the on-board Wytec's proprietary phantom monitor. This is an easy way for users to customize the board for running their own applications or adding a high-level language source level debugger. We may supply an EPROM for BASIC and C language debugging in the future. In normal debugging mode, this jumper must not be installed, so the LED should be off.
- If you are a software consultant who has to write software for different microcontrollers, but you are much more familiar with the HC11 controller than others, then you can use the EVBplus2 professional version board to develop demo software on the 68HC11 only. When all specifications are agreed upon, you can change the coding for the actual microcontroller.

