CMD11E1

Development Board for the Motorola / Freescale 68HC11E1

xiom
anufacturing

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GETTING STARTED

The Axiom CMD11E1 single board computer is a fully assembled, fully functional development system for the Motorola 68HC11E1 microcontroller, complete with wall plug power supply and serial cable. Support software for this development board is provided for Windows 95/98/NT operating systems. XP and later systems require a host PC with embedded COM serial port that is PC - AT class compliant.

Follow the steps in this section to get started quickly and verify everything is working correctly.

Installing the Software

1. Insert the Axiom 68HC11 support CD in your PC. If the setup program does not start, run the file called "SETUP.EXE" on the CD.

2. Follow the instructions on screen to install the AxIDE software onto your hard drive.

3. After installation completes, double-click the AxIDE icon to start the utility program.

4. Select the PC serial port you're using to connect to the board. Click [OK].

5. Select your development board "CMD11E1" from the drop-down menu bar just below the main menu.

Board Startup

Follow these steps to connect and power on the board. This assumes you're using the provided AxIDE terminal (installed in the previous section) or a similar communications terminal program on your PC, and that all jumpers are in their default (from the manufacturer) positions. If you're using a different terminal program than the one provided, set it's parameters to 9600 baud, N,8,1.

1. Connect one end of the supplied 9-pin serial cable to a free COM port on your PC. Connect the other end of the cable to the COM1 port on the CMD11E1 board.

2. Apply power to the board by plugging in the wall plug power adapter that came with the system.

3. If everything is working properly, you should see a Buffalo Monitor prompt similar to that below in the Terminal window. Press the ENTER key and you should see a prompt which is the > character.

```
BUFFALO 3.4AX – Axiom Version of the Motorola Monitor / Debugger
>_
```

4. Your board is now ready to use!

If you do not see the buffalo message prompt like that above, or if the text is garbage, see the **TROUBLESHOOTING** section at the end of this manual.

Support Software

There are many useful programs and documents on the included HC11 support CD that can make developing projects on the CMD11E1 easier. You should browse the CD and copy anything you want to your hard drive. See the README.TXT file for a description of what is included.

The main programming interface to the CMD11E1 board is the AxIDE program for 32-bit Windows. This program communicates with the board via its COM1 port and includes a Terminal window for interfacing with other programs running on the CMD11E1, such as the Buffalo Monitor or the Basic11 interpreter. It is also useful for displaying information from your own programs that send output to the serial port.

In addition to the terminal interface, this program also provide an easy to use memory programming and micro configuration interface to the board. Also on the disk is a free Assembler, example source code, and other tools to get you started.

Software Development

Software development on the CMD11E1 can be performed using the Buffalo Monitor utility programmed in U7 EEPROM to test and debug your program stored in RAM on U5. During this debug phase your program should be located just above the internal register block, for example $2000 (see the **Memory Map** section for details).

After satisfactory operation your program can be relocated to start at address $E000 then written to the EEPROM in U7 using the provided utility called AxIDE. After setting the appropriate jumpers your program will start automatically when the board is powered on.

TUTORIAL

This section was written to help you get started with the specifics of the CMD11E1 software development process. Be sure to read the rest of this manual as well as the documentation on the disk if you need further information.

The following sections take you through the complete development cycle of a simple "hello world" program, which sends the string "Hello World" to the serial port.

Creating source code

You can write source code for the CMD11E1 board using any language that compiles to Motorola 68HC11 instructions. Included on the software disk is a free Assembler and also a freeware C compiler and Basic compiler.

You should write your source code using a standard ASCII text editor. Many powerful code editors are available or you can use the free EDIT or NOTEPAD programs that come with your computer. Once your source code is written and saved to a file, you can assemble or compile it to a Motorola S-Record (hex) format. This type of output file usually has a .MOT, .HEX or .S19 file extension and is in a format that can be read by the programming utilities to be programmed into the CMD11E1 board.

It's important to understand your development board's use of Memory and Addressing when writing source code so you can locate your code at valid addresses. For example, when in "debug" mode, you should put your program CODE in External RAM. In assembly language, you do this with ORG statements in your source code. Any lines following an ORG statement will begin at that ORG location, which is the first number following the word ORG, for example: **`ORG $2000`**.

You must start your DATA (or variables) in a RAM location unused by your program, for example: ORG $1040. When finished debugging, you must change these ORG statements so that your program is moved to a valid EEPROM area - somewhere after hex E000 (or 8000 on a 32k board). Do this by putting an ORG $E000 in front of your Program CODE. Data may remain where it is or be moved down to internal RAM starting at ORG $0000. You must also program the STACK register somewhere at the top of your available RAM, for example hex 1FF. Do this with this instruction as the first instruction in your program code: LDS #$01FF.

A look at the example programs on the disk can make all of this clearer. If you're using a Compiler instead of an assembler, consult the compiler documentation for methods used to locate your code and data.

Source code created to run under the buffalo monitor environment will be slightly different than code written for stand-alone operation. The buffalo monitor contains interrupt and RESET vectors that your code must provide when it's no longer running under the monitor. See the **Programming External EEPROM** section for more information on this.

Assembling source code

An example program called “HELLO.ASM” is provided under the \EXAMPLE directory.

You can assemble your source code using command line tools under a DOS prompt by typing:

```
AS11 HELLO.ASM –l cre s >HELLO.LST
```

Most compilers and assemblers allow many command line options so using a MAKE utility or batch file is recommended if you use this method.

The AxIDE utility software provided with this board contains a simple interface to the free assembler. Use it by selecting "Build" from the menu. This will prompt you for the file to be assembled.

DO NOT use long path names (> 8 characters). The free assembler is an old DOS tool that does not recognize them.

If there are no errors in your source code, 2 output files will be created:

`HELLO.S19`	a Motorola S-Record file that can be programmed into memory

`HELLO.LST` a common listing file which shows the relationship between source and output

The listing file is especially helpful to look at when debugging your program. If your program has errors, they will be displayed and no output will be generated, otherwise the listing file will be displayed.

Running your application

After creating an S-Record file you can "upload" it to the development board for a test run. The provided example “HELLO.ASM” was created to run from RAM so you can use the Buffalo Monitor to test it without programming it into EEPROM.

If you haven’t done so already, verify that the CMD11E1 board is connected and operating properly by following the steps under “GETTING STARTED” until you see the buffalo prompt, then follow these steps to run your program:

1. Press and release the RESET button on the CMD11E1 board. You should see the Buffalo Monitor message. Hit the return key ↵ to get the monitor prompt.

2. Type **`LOAD T`** ↵
   This will prepare buffalo to receive a program.

3. Select Upload and when prompted for a file name select your assembled program file in s-record format that was created in the previous section called: **`HELLO.S19`**
   Your program will be sent to the board thru the serial port.

4. When finished loading you will see the > prompt again.
   Type **`CALL 2400`** ↵
   This tells buffalo to execute the subroutine at address $2400, which is the start of our test program.

5. If everything is working properly you should see the message “Hello World” echoed back to your terminal screen then, since we return at then end of our program, a line containing the internal register status displayed by buffalo and the buffalo prompt.

6. If you do not get this message, try going thru this tutorial once more, then if still no go, see the **TROUBLESHOOTING** section in this manual

You can modify the hello program to display other strings or do anything you want. The procedures for assembling your code, uploading it to the board and executing it remain the same. Buffalo has many powerful features such as breakpoints, assembly/disassembly, memory dump and modify and program trace. Type HELP at the buffalo prompt for a listing of commands or consult the buffalo documentation file for more information.

Programming External EEPROM

When finished with program development you can program your application into EEPROM so it executes automatically when you apply power to the board. The following procedure does this:

1. Make a backup copy of the HELLO.ASM source code.

2. Use a text editor to modify HELLO.ASM. Change the start of the program to **`$E000`** which is the beginning of the EEPROM in U7. Do this by changing the **`”ORG $2400” to ”ORG $E000”`**.

3. Remove the comment **`*`** character from before the following lines also:

```
*       LDS  #$23FF          set the stack pointer

*eloop       nop             endless loop
*       bra  eloop

*       org  $FFFE           set the reset vector
*       fdb  START
```

4. This will initialize the stack pointer which is necessary when running outside of buffalo but should not be done while running under buffalo since it must handle the stack; cause the program to NOT try to "return" at the end and lastly, program the HC11 reset vector to go to the beginning of the program (the label START) when powered on.

5. Re-Assemble HELLO.ASM as described in the "Assembling Source Code" section.

6. Select "Program” and enter your newly assembled HELLO.S19 file if not already there.

7. Make sure External EEPROM is selected in this dialog box then click OK and follow the onscreen instructions (installing the programming jumpers then power off then on or press the RESET switch).

8. When finished programming, remove the jumpers as instructed by the program.

9. Cycle power or press RESET on the board. Your new program should start automatically and the “Hello World” prompt should be displayed in the terminal window.

To return to the buffalo monitor program, repeat the above steps starting with number 6, substituting **BUF34X.S19** (in the AxIDE program directory) instead of HELLO.S19. The buffalo monitor should execute again the next time the board is powered on.

MEMORY

ADDRESS DECODING

Address decoding is accomplished using a GAL16V8 programmable logic device. Address lines A<8:15>, AS (address strobe), R/W (read/write), and E (clock) are processed to provide the memory control signals as shown below by default. Custom configurations, differing from that shown below, are also possible. Contact the factory for assistance in redefining the memory map if required.

OE Output enable to U5, U6, and U7

WR Write enable to U5 direct, and to U6 and U7 through jumpers JP6 and JP10 respectively.

M1 Chip select to U5 active from 0 to 8K (with mirrored mapping) or 0 to 32k depending on the status of JP3. See U5 JP3 selection for more information.

M2 Chip select to U6 active for the 24k between 8000 and DFFF, with the exception of B580 through B7FF inclusive. B580 to B5FF is used to generate the peripheral chip selects.

M3 Chip select to U7 active for the 8k between E000 and FFFF.

P Peripheral Access CS0 - CS7. B580 through B5FF.

All of these signals except P are active low. P is active high. Signal line M2 is also connected to the BUS_PORT expansion connector allowing M2 to work in conjunction with the CS and Address lines to implement off board, page banked memory. When M2 is used in this manner, U6 must be removed from the board.

U5 is intended to be either an 8k or a 32k RAM. U6 can accommodate RAM, EEPROM, or ROM. U7 is to be used primarily for ROM but it can also accommodate EEPROM. Jumpers JP3 through JP10 determine how U5, U6, and U7 are used. See the **Memory Selection Jumpers** section for details.

Peripheral Access 'P' is used in conjunction with A<4:6>, and AS to generate CS<0:7>. Each of these eight chip selects controls sixteen bytes in the memory map from B580 through B5FF. CS<7:0> are brought out to the BUS_PORT where they can be used to control peripherals external to the development board. See the Memory Map on the next page for further clarification.

MEMORY MAP

The following memory map is for a 68HC11E9 as shipped in this development board. Other 68HC11 devices in the A and E series may also be used with this board. These optional devices differ in the amount of internal RAM, ROM and EEPROM available and the factory default value of the CONFIG register. Consult the HC11 technical reference manual on the support CD for additional information.

FFFF **FFFE**	**RESET Vector Address**
E000	Memory Socket U7 (8K device) (Buffalo Monitor default)
DFFF **B800**	Program or Data Memory EEPROM or RAM in U6
B7FF **B600**	HC11 Internal EEPROM in U1 Program or Data

B5FF
B580
	Peripheral Area CS0 – CS7
	CS7 = **B5F2-B5FF** CS5 = **B5D0-B5DF** CS2 = **B5A0-B5AF**
	LCD = **B5F0-B5F1** CS4 = **B5C0-B5CF** CS1 = **B590-B59F**
	CS6 = **B5E0-B5EF** CS3 = **B5B0-B5BF** CS0 = **B580-B58F**

B57F **8000**	Program or Data Memory EEPROM or RAM in U6
7FFF **1040**	Data Memory RAM in U5
103F **1000**	68HC11 Internal Registers See 68HC11 Technical Data Manual
0FFF **0200**	Data Memory RAM in U5
01FF **0000**	68HC11 Internal RAM in U1 - (0-FF reserved by Buffalo Monitor)

JUMPERS

The CMD11E1 board is shipped from the manufacturer with the following default jumper settings:

JP1 = OFF	JP3 = ON	JP6 = ON	JP9 = OFF
JP2 = OFF	JP4 = ON	JP7 = ON	
JP10 = ON	JP5 = OFF	JP8 = OFF	JP13 = OFF

Memory socket U5 is shipped with a 32K byte RAM device. U7 is shipped with an 8K byte EEPROM flash memory device. U6 is shipped with a 32K byte EEPROM flash memory device.

Also, the 68HC11 chip configuration word is set as follows:

EEON On Chip EEPROM	ENABLED
ROMON On Chip ROM	DISABLED
NOCOP Watchdog System	DISABLED
NOSEC Security	DISABLED

MODE Select Jumpers – JP1 and JP2

The MODA and MODB pins of the HC11 are pulled high by two 10k resistors. This is the normal EXPANDED MODE configuration. A shunt on JP1 will take MODA to ground. A shunt on JP2 will take MODB to ground. These two jumpers allow selection of any of the following modes of operation:

JP1 – MODA	**JP2 - MODB**	**MODE OF OPERATION**
ON	ON	Special Bootstrap
OFF	ON	Special Test
ON	OFF	Normal Single Chip
OFF	OFF	Normal Expanded (default)

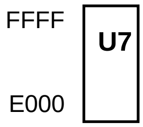
Buffalo Trace Jumper – JP13

The Buffalo Monitor Trace and Single Step functions can be enabled by installing option jumper **JP13**. This jumper will connect the PA3 Output Compare 5 pin to the XIRQ line for nonmaskable interrupt service for the Buffalo Trace functions. Use caution when installing this jumper that no other connections are made to the XIRQ or PA3 I/O pins of the 68HC11.

Memory Selection Jumpers JP3 – JP10

The factory setting for the jumpers should be correct for the memory devices that came with your board. If you add or modify the type or size of memory, you must change the following jumpers accordingly. All jumpers are two-pin jumpers and are installed vertically.

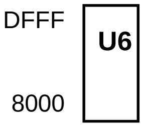
U7 - ROM or **EEPROM**



JP8	**JP9**	**JP10**	**U7 DEVICE**	
OFF	OFF	ON	8k EEPROM	**< DEFAULT >**
OFF	OFF	OFF	8k EPROM.	
OFF	ON	OFF	32k EPROM.	
ON	OFF	ON	32k EEPROM.	

JP10 write protects U7 memory device when OFF.

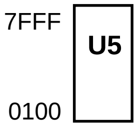
U6 - RAM or **EEPROM** or **ROM**



JP4	**JP5**	**JP7**	**JP6**	**U6 DEVICE**	
OFF	OFF	OFF	ON	8k RAM or EEPROM.	
OFF	OFF	OFF	OFF	8k EPROM.	
OFF	ON	ON	OFF	32k EPROM.	
ON	OFF	ON	ON	32k RAM or EEPROM.	**< DEFAULT >**

JP6 write protects U6 memory device when OFF.

U5 - RAM



For 32K device **JP3** = **ON** **<DEFAULT>** 32K bytes from 200 hex to 7FFF hex (minus register area, see memory map) and recommended position for Buffalo Monitor and Small C operation. No segmentation occurs.

For 8K device **JP3** = **OFF** 8K bytes from 0000 hex to 1FFF hex and mirrored at 2000 – 3FFF, 4000 – 5FFF, and 6000 - 7FFF. This position will allow CPU internal Ram and I/O ports to segment the 8K address space. Use this position to run Basic11 with an 8K device.

You can determine the size of memory devices by reading the label on top of the chip. Memory devices that contain 64 in the part number are usually 8K. Those with 256 are usually 32K.

The type of memory can also be determined by reading the chip label. If you don’t recognize the memory type you can look up the part number in a catalog or device manual. If the chip is by Atmel™ or XICOR™ it is probably an EEPROM. If it has HY or SEC it is probably RAM.

PORTS AND CONNECTORS

LCD_PORT

The LCD Display interface is connected to the data bus and memory mapped to locations **$B5F0** through **$B5F3**. Addresses **$B5F0** and **$B5F1** are the Command and Data registers respectfully. The LCD interface supports all OPTREX™ DMC series displays up to 80 characters and provides the most common pinout.

Power, ground and Vee are also available at the LCD_PORT connector. The potentiometer, R23, located to the right of the LCD connector is used to adjust the contrast of the LCD display by varying Vee from –5v to +5v.

A list of valid command codes is provided in the Tables section at the back of this manual. Example programs using this LCD device are provided on the support CD, see the files:

B5F0	Command Register
B5F1	Data Register

+5V	**2**	**1**	GND
A0	**4**	**3**	Vee
/LCDCS	**6**	**5**	/RW
D1	**8**	**7**	D0
D3	**10**	**9**	D2
D5	**12**	**11**	D4
D7	**14**	**13**	D6

KLCD-D.C
KEYLCD-D.C
KEYLCD-D.ASM
KLCD-E.C
KEYLCD-E.C
KEYLCD-E.ASM

KEYPAD

The KEYPAD Connector is an eight position connector that implements 4 bits of AUX_PORTC and 4 bits of AUX_PORTA as a simple keypad interface. This interface is implemented as a software keyscan.

1	2	3	4	5	6	7	8
□	○	○	○	○	○	○	○
C4	C5	C6	C7	A4	A5	A6	A7

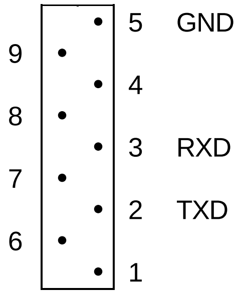
See the files called **KLCD-D.C, KEYLCD-D.C, KEYLCD-D.ASM** and **KEYPAD.BAS** on the support CD for example programs using this connector.

SERIAL PORTS

The onboard serial port COM1 is a simple three wire asynchronous serial interface with hard wired Clear to Send (CTS) and Data Terminal Ready (DTR). It is driven by the HC11 internal SCI port using I/O pins PD0 and PD1. These two logic level signals are coupled through an RS232 level shifter to the COM1 connector.

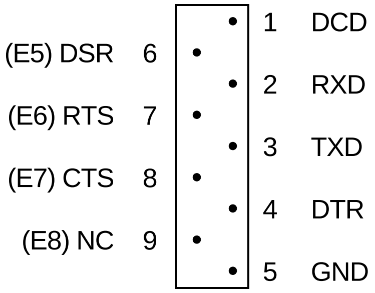
COM1 is the default serial interface for the Buffalo Monitor and programming software.

COM1 DB9 S Style Connector



- Cut-Away jumpers between following pins:
  4 → 1 and 6 (DTR/DSR/DCD)
  7 → 8 (RTS/CTS)
- COM1 is set to connect directly to a PC serial port with a straight thru type of cable (supplied).

COM2 DB9 P Style Connector



- To connect COM2 to a PC serial port you must use a NULL modem cable or NULL modem adapter.
- With U13 removed, CTS, DTR, and DCD will be idled automatically allowing the R65C51 ACIA to function normally.

To change COM2 from RS232 to RS485/422:

1. Remove U13 from its socket to isolate P_COM2.
2. Add a jumper wire or connector from E5 thru E8 to the RS422/485 output connector.

COM2 Option Jumpers

RX_SEL

1 2 3	1 - 2 = RS232
○ ○ ○	2 - 3 = RS485/422

2W / 4W

1	○	1 - 2 = RS485 / 2W
2	○	2 - 3 = RS422 / 4W
3	○	

422/485 OUT

4 ○	A(+)	4W Transmit
3 ○	B(-)	4W Transmit
2 ○	A(+)	4W Receive, 2W Transmit / Receive
1 ○	B(-)	4W Receive, 2W Transmit / Receive

SS: KEBOARD

The SS:KEYBOARD interface is available but not brought out to a connector. It can be implemented with software drivers through the SPI feature of the 68HC11. Such a configuration is used with a serially encoded keyboard. This port can also be used as a keypad by using PD<2:5> as column lines with E<1:4> as row lines. Note that E<1:4> are open termination's with pull-down resistors on the board. E<1:4> are ONLY connected to pins 7, 8, 9, and 10 of the SS:KEYBOARD connector. In order to use those pins, E<1:4> must be connected to I/O lines. AUX_PORT C is recommended because it is capable of nibble or 4 bit configuration. While such a dual parallel matrix will work, it dedicates the SPI to keypad use only. If implemented through the SPI as a SIMPLE SERIAL port, four separate, additional SPI serial devices can be supported by the SEL lines defining E<1:4> for a total of five slave serial devices. (Note: this still requires E<1:4> be connected. Each to its own I/O line, but this will support four additional peripheral devices.)

1	□	+5		
2	○	GND		
3	○	PD2/SI	SPI	
4	○	PD3/SO		
5	○	PD4/SCLK		
6	○	PD5/SEL0		
7	○	SEL1		E1
8	○	SEL2	Auxiliary select lines terminated to ground	E2
9	○	SEL3	(10kohm)	E3
10	○	SEL4		E4

See the files called **`KLCD-E.C, KEYLCD-E.C, KEYLCD-E.ASM`** on the support CD for example programs using this connector.

PARALLEL PORTS

The 68HC11 is configured for expanded/multiplexed mode. It uses Port B and Port C for address and data buss to external memory and memory mapped I/O devices. This leaves CPU Port D, Port A, and Port E to provide all other parallel I/O from the controller. CPU port lines are mixed as input only, output only, and some are input or output. All CPU port lines serve dual functions with internal CPU peripherals such as the timer subsystem and port A, the A/D converter on port E, and the SPI or SCI on port D.

To increase general purpose input/output capability an 82C55 peripheral port expander is memory mapped onto the data buss providing three auxiliary ports. The auxiliary port lines are all input or output configurable and are available on the AUX_PORT connector. All port lines are limited to sinking and sourcing approximately 1mA. maximum. Refer to Chapter 6 Memory Map and Appendix C for more information on the 82C55.

AUX_PORT

The AUX_PORT connector is a dual row 13 pin Berg-style connector (26 pins total) configured as follows:

```
25 23 21 19 17 15 13 11  9  7  5  3  1
 ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  □
 ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○
26 24 22 20 18 16 14 12 10  8  6  4  2
```

PIN	FUNCTION	PIN	FUNCTION
1	AUX PA7	2	AUX PA6
3	AUX PA5	4	AUX PA4
5	AUX PA3	6	AUX PA2
7	AUX PA1	8	AUX PA0
9	AUX PC7	10	AUX PC6
11	AUX PC5	12	AUX PC4
13	GND	14	+5
15	AUX PC0	16	AUX PC1
17	AUX PC2	18	AUX PC3
19	AUX PB0	20	AUX PB1
21	AUX PB2	22	AUX PB3
23	AUX PB4	24	AUX PB5
25	AUX PB6	26	AUX PB7

AUX_PORT ADDRESSES

- AUX PA @ $B5F4
- AUX PB @ $B5F5
- AUX PC @ $B5F6
- AUX PORT CONTROL REGISTER @ $B5F7

See also the Memory Map

MCU_PORT

The MCU_PORT connector is a dual row 17 pin Berg-style connector (34 pins total) configured as follows:

```
33 31 29 27 25 23 21 19 17 15 13 11  9  7  5  3  1
 ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  □
 ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○  ○
34 32 30 28 26 24 22 20 18 16 14 12 10  8  6  4  2
```

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
1	PA0	2	PA1	19	GND	20	+5
3	PA2	4	PA3	21	IRQ	22	XIRQ
5	PA4	6	PA5	23	VRL	24	VRL
7	PA6	8	PA7	25	VRH	26	VRH
9	+5	10	+5	27	PE7	28	PE3
11	GND	12	GND	29	PE6	30	PE2
13	PD0/RXD0	14	PD1/TXD0	31	PE5	32	PE1
15	PD2/SI	16	PD3/SO	33	PE4	34	PE0
17	PD4/SCLK	18	PD5/SEL0				

PD0 and PD1 are used by the HC11 SCI to implement COM1. PD<2:5> are used by the HC11 SPI to implement the SS:KEYBOARD port. These port D lines can also be used for parallel I/O, but then they will not be available for COM1 or SS: KEYBOARD. Use caution when assigning port D lines to other functions.

BUS_PORT

The BUS_PORT supports off-board parallel devices. Power (+5V), ground, address lines, data lines, and control lines are brought out to this 34 pin connector. Pin assignments are as follows:

	PIN	**BUS_PORT**	**PIN**	
GND	1	□ ○	2	D3
D2	3	○ ○	4	D4
D1	5	○ ○	6	D5
D0	7	○ ○	8	D6
A0	9	○ ○	10	D7
A1	11	○ ○	12	A2
A10	13	○ ○	14	A3
OE	15	○ ○	16	A4
A11	17	○ ○	18	A5
A9	19	○ ○	20	A6
A8	21	○ ○	22	A7
A12	23	○ ○	24	A13
W/R	25	○ ○	26	CS0
CS1	27	○ ○	28	CS2
CS3	29	○ ○	30	CS4
CS5	31	○ ○	32	IRQ
+5	33	○ ○	34	M2

A/D REFERENCE

The VRH and VRL lines from the HC11 are connected to +5v through R3 and to ground through R2 respectively. These two resistors are located next to the MCU_PORT header. The resistors are identified on the silk screen by their reference designators. The appropriate resistor(s) need to be removed in order to apply an external reference to the VRH and/or VRL inputs.

TROUBLESHOOTING

The CMD11E1 board is fully tested and operational before shipping. If it fails to function properly, inspect the board for obvious physical damage first. Ensure that all IC devices in sockets are properly seated. Verify the communications setup as described under GETTING STARTED and see the **Tips and Suggestions** sections following for more information.

The most common problems are improperly configured communications parameters, and attempting to use the wrong COM port.

1. Verify that your communications port is working by substituting a known good serial device or by doing a loop back diagnostic.

2. Verify the jumpers on the board are installed correctly.

3. Verify the power source. You should measure approximately 9 volts between the GND and +9V test point pads on the board.

4. If no voltage is found, verify the wall plug connections to 115VAC outlet and the power connector.

5. Disconnect all external connections to the board except for COM1 to the PC and the wall plug.

6. Make sure that the RESET line is not being held low.
   Check for this by measuring the RESET pin on P4 for +5V.

7. Verify the presence of an 8MHz sine wave on the crystal, or 2MHz E clock signal if possible.

Tips and Suggestions

Following are a number of tips, suggestions and answers to common questions that will solve most problems users have with the CMD11E1 development system. You can download the latest software from the Support section of our web page at:

www.axman.com

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- If you're program code memory, make sure jumpers 1 and 2 are set parallel to the MC68HC11 micro, not pointing away from it.
- If you're trying to start a program in external EEPROM (U7), make sure jumpers 1 and 2 are NOT installed.
- Be certain that the data cable you're using is bi-directional and is connected securely to both the PC and the board. Also, make sure you are using the correct serial port.
- Make sure the correct power is supplied to the board. You should only use a 9 volt, 200mA adapter or power supply. If you're using a power strip, make sure it is turned on.
- If the configuration file loads (the first 100 bytes or so), but you get a time-out error when the program section begins to download, make sure the HC11 is internally configured correctly by selecting Configure Processor from the main menu. During program development the EEON should be enabled. The other bits should be disabled.
- Make sure you load your code to a valid address. See the Memory Map.

Code Execution

- Make sure ALL jumpers are set correctly according to your board's configuration. Read the hardware manual section on jumpers carefully if you're not sure.
- Always remember to remove JP1 and JP2 after programming the code memory.
- If you programmed your code into external EEPROM memory and it doesn't run, check the HC11 reset vector, located at $FFFE - $FFFF. These 2 bytes contain the reset vector address where execution will begin when the unit is powered on or reset. The default vector is E000, which is the beginning of the 8k program address space.
- Verify that all peripheral devices are initialized properly in your code. Failure to initialize the serial port, for example, is a common problem. This is usually the case when the code works under buffalo but not after programming.

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- Your make or build should create a .MAP file. Some versions change this to a .MP file. At the top of this file should be a label __START. This is where you should CALL or GO to when debugging in buffalo.

TABLES

TABLE 1. LCD Command Codes

Command codes are used for LCD setup and control of character and cursor position. All command codes are written to LCD panel address $B5F0. The BUSY flag (bit 7) should be tested before any command updates to verify that any previous command is completed. A read of the command address $B5F0 will return the BUSY flag status and the current display character location address.

Command	**Code**	**Delay**
Clear Display, Cursor to Home	**$01**	1.65ms
Cursor to Home	**$02**	1.65ms
Entry Mode:		
Cursor Decrement, Shift off	**$04**	40us
Cursor Decrement, Shift on	**$05**	40us
Cursor Increment, Shift off	**$06**	40us
Cursor Increment, Shift on	**$07**	40us
Display Control:		
Display, Cursor, and Cursor Blink off	**$08**	40us
Display on, Cursor and Cursor Blink off	**$0C**	40us
Display and Cursor on, Cursor Blink off	**$0E**	40us
Display, Cursor, and Cursor Blink on	**$0F**	40us
Cursor / Display Shift: (nondestructive move)		
Cursor shift left	**$10**	40us
Cursor shift right	**$14**	40us
Display shift left	**$18**	40us
Display shift right	**$1C**	40us
Display Function (default 2x40 size)	**$3C**	40us
Character Generator Ram Address set	**$40-$7F**	40us
Display Ram Address set	**$80- $FF**	40us

TABLE 2. LCD Character Codes

$20	Space	$2D	-	$3A	:	$47	G	$54	T	$61	a	$6E	n	$7B	{
$21	!	$2E	.	$3B	;	$48	H	$55	U	$62	b	$6F	o	$7C	|
$22	“	$2F	/	$3C	{	$49	I	$56	V	$63	c	$70	p	$7D	}
$23	#	$30	0	$3D	=	$4A	J	$57	W	$64	d	$71	q	$7E	>
$24	$	$31	1	$3E	}	$4B	K	$58	X	$65	e	$72	r	$7F	<
$25	%	$32	2	$3F	?	$4C	L	$59	Y	$66	f	$73	s		
$26	&	$33	3	$40	Time	$4D	M	$5A	Z	$67	g	$74	t		
$27	‘	$34	4	$41	A	$4E	N	$5B	[	$68	h	$75	u		
$28	(	$35	5	$42	B	$4F	O	$5C	Yen	$69	i	$76	v		
$29	)	$36	6	$43	C	$50	P	$5D	]	$6A	j	$77	w		
$2A	*	$37	7	$44	D	$51	Q	$5E	^	$6B	k	$78	x		
$2B	+	$38	8	$45	E	$52	R	$5F	_	$6C	l	$79	y		
$2C	,	$39	9	$46	F	$53	S	$60	`	$6D	m	$7A	z		

TABLE 3. Buffalo Monitor Commands

ASM [<address>]	Assembler/Disassembler
BF <addr1> <addr2> <data>	Block fill memory with data
BR [-] [<address>]...	Breakpoint set
BULK	Bulk erase EEPROM
BULKALL	Bulk erase EEPROM + CONFIG register
CALL [<address>]	Execute subroutine
G [<address>]	Execute program
HELP	Display monitor commands
LOAD T	Download S-records via terminal port
MD [<addr1> [<addr2>]]	Dump memory to terminal
MM [<address>]	Memory modify
MOVE <addr1> <addr2> [,dest>]	Move memory to new location
P	Proceed/continue from breakpoint
RM[p,y,x,a,b,c,s,]	Register modify
T [<n>]	Trace $1-$FF instructions (TRACE Jumper = ON)
VERIFY T	Compare memory to download data via terminal

NOTE

- Address and data values should be given in Hex notation, for example: asm 2bf0
- See the buffalo monitor users guide (on disk) for more information.