

**EAS FINGER BOARD II**  
**68HC11**  
**Single Board Computer**  
Ver. 11/24/03

**Embedded Acquisition Systems**

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EAS FINGER BOARD was created as a small compact general purpose embedded controller to be used for robotics, data logging, smart instruments, and custom control applications. It can run "Interactive C" and emulates many of the hardware functions of "Handy Board" by MIT. Motor functions as well as push buttons were left out of the design to keep it small, simple and versatile. All functions of the "Handy Board" can be added via expansion board, circuits of older "Rug warrior" designs as well. The Finger Board uses very common easily found parts and a low parts count to keep costs down. All mating contacts are spaced .1" apart to allow the Finger Board to plug on top of standard prototyping boards. The Finger Board comes as two separate circuit boards, the CPU board and the Communications board. It can be ordered as one board if size is not an issue.

## FINGER BOARD II ASSEMBLY

### Construction notes

This kit requires good soldering techniques due to its small size.

Tools necessary: A fine tip soldering gun and a good wire cutter.

Recommended tools: Mechanical clamp-known as a third hand, fine solder wick to remove excess solder. A good source of information for beginners is found on the "Handy Board" web site.

An online construction manual with images is available on our web site to help in the construction of the Finger Board. A copy of the Finger Board schematic, silkscreen and parts placement guide can also be downloaded from our web site and printed out.

**Caution:** Integrated circuits are static and heat sensitive. Do not apply too much heat with your soldering iron when installing these parts. Please take precautions while handling IC's. To protect against static electricity, ground your body before handling parts.

We will start with the CPU board first.

### CPU Board

#### Step 1

Start by installing the IC's. Observe proper orientation for pin 1. You may install an IC socket for U7 and U6 but do not socket U5. The installation of a socket for U5 will interfere with U3, the 256kbit ram, which will require the need for a socket. We normally do not install sockets for these IC's.

U5 - 74HC573

U6 - 74HC00

U7 - 74HC138

#### Step 2

Install capacitor C6 and the 28 pin IC socket for U3. You may need to snip off the center plastic section of the IC socket so it will fit over U5.

C6 - .1uf monolithic capacitor. The printed value on the capacitor will normally be 104, denoting a .1uf value.

U3 - 28pin IC socket

**Step 3**

Install the 52pin PGA IC socket for U4. Observe proper orientation for pin 1 before soldering.

**Step 4**

Install the resistors R2, R3, R5, R6 and R8. Bend the resistor so that it may stand end up on the PCB.

R2, R5, R6, R8 - 10K ohm

R3 - 1 Meg ohm

**Step 5**

Install resistor R4. This is a 47K inline sip resistor. Observe proper orientation for pin 1 before soldering. Pin 1 is usually marked with a dot.

R4 - 47K ohm inline sip resistor. Part#10-1-473

**Step 6**

Install capacitor C3 and C4.

C3, C4 - 22pf capacitor (20pf may be substituted)

**Step 7**

Install capacitor C1, C2, C3, C5 and C7. Observe the polarity for C1. Place positive side closest to the silkscreened "+" symbol.

C1 - 1uf tantalum, 25 volts or greater

C2, C5, C7 - .1uf monolithic. The printed value on the capacitor will normally be 104, denoting a .1uf value.

**Note:** R1 and C13 are no longer needed

**Step 8**

Install diodes D2 and D3. Observe proper orientation. Place the cathode side of the diodes to line up with the silkscreened bar on the PCB.

D2 - 1N4007 or 1N5817

D3 - 1N4148

Note:

1N5817 has a lower voltage drop while the 1N4007 can handle more current, your choice

You can omit diode D2 and use solder pad J4 to bridge the connection. We recommend installing D2. This will protect the Finger Board from reverse input supply voltage connections. J4 is located on the bottom side of the board, near JP1.

**Step 9**

The following headers are normally installed on the topside of the Finger Board. Depending on user applications all or none of the headers may be soldered in.

Headers are usually purchased in longer lengths and cut down to the size needed. Use headers with a contact lead length of .230"(shorter style).

JP1 - 2 terminal block connector

JP2 - Header 7x2

JP6 - Header 2x2  
JP10, JP12, JP13 - installed as one Header 3x2  
JP14 - Header 3x2  
JP18 - Header 2x1  
JP19 - Header 2x1

**Note:**

If you have the one piece Finger Board with attached Communications board, you do not have to install JP14. There are already pcb traces connecting JP14 to JP15.

You can omit JP6 and use the solder pads J1 and J2. By bridging solder pad J1, A/D ref input VRH will be connected to VCC. Bridging solder pad J2 will connect A/D ref input VRL to ground. These two pads are located on the bottom side of the board, near JP6.

**Step 10**

The following headers are normally installed on the bottom side of the Finger Board so that prototyping boards can be used. Depending on your actual application, these headers can be placed on top. Trim any excess lead lengths at this time before installing the headers.

JP4 - Header 4x2  
JP7 - Header 8x2  
JP9 - Header 10x2  
JP11, JP8, JP17, JP16 - installed as one Header 12x2

**Step 11**

Install reset IC U1 and 5 volt regulator U2. Observe the silkscreened symbols on the PCB for proper placement.

U1 - Dallas Semiconductor DS1233m (Note: DS1233 can be used, but its pins are different from the DS1233m and will need to be oriented correctly)

We are currently replacing mc34064 with Dallas DS1233 from JDR Microdevices. We are still looking for a source for the DS1233m, this is an equivalent part but has the same pin configuration as the mc34064. The DS1233 is a far superior reset chip, we are very happy with the results and highly recommend it over the mc34064. It will also reduce your parts count. If you are using the DS1233, you will need to put the part in backwards and move the center pin to pin 1-square pad on the board. You should also put a sleeve to prevent the wires from touching. (ie. pin1 now goes to pin 3 on the pcb board, 2=>1, 3=>2). If you have the DS1233m, no changes are needed since it is a replacement for the mc34064. We have provided a picture of this on our web page, under What's New.

U2 - LM7805

**Note:**

A low drop-out (LDO) voltage regulator can be substituted for the standard LM7805 regulator. Applications that require low current use such as a solar cell powered Finger Board or running off 4 cell batteries may need a LDO regulator. If you install a LDO regulator, omit diode D2 and bridge solder pad J4. The diode voltage drop will interfere with the LDO lowest voltage regulation. J4 is located on the bottom side of the board, near JP1.

**Step 12**

Install crystal Y1. Cut a small piece of Mylar or thin cardboard insulation to prevent a short on the pc board. Punch two small holes for the crystal leads so the insulator can fit against the bottom.

Y1 - 8Mhz crystal

### **Step 13**

Bridge solder Pad J5 using a small blob of solder. This will connect the SRAM supply to VCC. J5 is located on the bottom side of the board, near JP4.

Note:

If you plan to use a standard 256kbit SRAM memory chip and not a Dallas battery backed memory module, do not bridge solder pad J5. See step 22 for optional external SRAM battery backup.

### **Step 14**

You should wash and clean the completed board before installing U3 and U4. We use water soluble flux solder here at EAS. This permits easy board cleaning. Radio Shack sells flux removing solvent made for pc board cleaning. Take a close look at all solder joints and touch-up any joints that look bad. A 2x or 3x magnifying glass helps to find any solder bridges.

When installing the 68HC11 processor, observe pin one polarity. Some PLCC sockets may require firm pressure when pushing in the processor. Also observe proper pin placement when install the memory module.

U4 - MC68HC11A1FN CPU

U3 - DS1230AB/Y Dallas 256kbit (32Kbyte) battery backed static ram. Substitute a DS1244Y if a real time clock is needed. You can also use a Dallas DS1216D 28pin lithium battery socket but will need separate 256kbit 62256-100LP static memory chip.

Note:

If you are using a header for JP6, place a couple of jumper shunts on JP6. This is the A/D reference input voltage. Install a shunt across pins 1 and 2 to tie VRH to VCC. Install a shunt across pins 3 and 4 to tie VRL to ground.

A small hole is provided underneath the 68HC11 to be used to remove the processor. Use a small diameter screwdriver to push the processor out of the IC socket.

## **Communications Board Assembly**

### **Step 15**

Install U8 on the Communications printed circuit board. Observe proper orientation for pin 1. If you want, you can install an IC socket for U8.

U8 - MAX232CPE (Maxim)

Note: We have noticed when using 3<sup>rd</sup> party manufactured equivalent Maxim MAX232CPE chips, downloading S19 files from DOS isn't as reliable. Please purchase exact Maxim part for the Communications Board.

### **Step 16**

Install capacitors C8, C9, C10, C11, C12. Observe the polarity of the capacitors before soldering.

C8, C9, C10, C11, C12 - 1uf tantalum 16 volt or greater.

### **Step 17**

Install resistor R7 and LED D1. The shorter lead on LED D1 is the cathode. If D1 is installed

backwards, the communications board will not operate. Place the cathode side of the LED to line up with the silkscreened bar on the PCB.

R7 - 1K ohm  
D1 - HLMP1790 LED

**Note:**

The LED is rated for 2ma. If a higher current model is substituted, the Communications board will not work. You can decide not to install the LED, since it just indicates download mode. The download mode will also be indicated on your computer screen while Interactive C is sending out the pcode.

Tech America (1-800-877-0072) sells a 3ma LED (model#90-1555) that can be substituted for the HLMP-1790. The resistor R7 value must be increased to 2.2K, or else the current drain from the LED will prevent communications

**Step 18**

Install switch S1 and S2.

S1, S2 - momentary normally open push button switch.

Use the middle two sets of holes on the PCB when installing the switches.

**Step 19**

Install connector P1 and header JP15.

P1 - Female DB9 pin connector  
JP15 - Header 3x2

**Note:**

If you have the one piece Finger Board with attached Communications board, you do not have to install JP15. There are already pcb traces connecting JP14 to JP15.

**Step 20**

To connect the main CPU board to the Communications board, you will need a short length of ribbon cable and two female IDC connectors (3x2). When making the cable, make sure pin 1 line up together on both connectors. The ribbon cable length should be no more than 1 foot between the CPU board and Communications board. Serial communication errors may occur if cable is too long due to noise. If you need a longer length from your computer to the Finger Board, then increase the length of cable going from the Communications board to the PC serial port, since this length can be as long as 25ft.

**Step 21**

When using Interactive C, the Finger Board supports a 16x2 line LCD module connected to header JP2. To connect the LCD module, you will need a short length of ribbon cable and two female IDC connectors (7x2). When making the cable, make sure pin 1 line up together on both connectors. The ribbon cable length should be no more than 1 foot.

**Note:**

If you cannot locate a LCD module, you can purchase one directly from EAS. The cable is included in the price.

The Finger Board II was designed to allow our LCD module to mount directly on top using a header and socket with the communications board attached.

## **Optional parts installation**

### **Step 22 SRAM Battery Backup**

If you plan to use a standard 256kbit SRAM memory chip and not the Dallas battery backed memory module, install diodes D4 and D5. Place the cathode side of the diodes to line up with the silkscreened bar on the PCB.

Do not bridge solder pad J5.

D4, D5 – IN5817

Note:

Placing a 3 to 5 volt battery on header JP19 will retain the SRAM memory when the main supply voltage is disconnected. We do recommend using the Dallas battery backed memory chip, as it is very reliable. However if you do use standard SRAM memory, use a good quality on/off switch for the power. Power cycle switch bounce can corrupt the data in memory.

### **Step 23 Remote Serial Reset**

To use the remote serial port reset feature, install mosfet Q1 and bridge solder pad J3.

Q1 - BS170 or MOSFET N

Note:

If you plan to use Interactive C, do not implement this feature

## PARTS LIST FOR FINGER BOARD II

Bill Of Materials, all parts can be found from Radio Shack, Digikey, JDR and Jameco. All resistors ½ Watt or less. All similar parts found on "Handy Board" can also be used on Finger Board.

Item #	Quantity	Part Reference #	Description
1	1	C1	1uf tantalum capacitor, 25 volts or greater
2	4	C2,C5,C6,C7	.1uf monolithic capacitor
3	2	C3,C4	22pf capacitor (20pf can be substituted)
4	5	C8,C9,C10,C11,C12	1uf tantalum capacitor, 16 volts or greater
5		C13	Note: C13 is no longer needed
6	1	D1	HLMP-1790 LED (2ma rating)
7	1	D2	1N4007 or 1N5817
8	1	D3	1N4148
9		D4,D5	1N5817 (optional, only for external SRAM battery backup)
10	1	JP1	OST 2 terminal block connector 3.5mm lead spacing. Digikey Part#ED1514-ND
11	7	JP10,JP12,JP13, JP16 JP17,JP18,JP19	Header 2x1 (all headers are .1" straight male double row Jameco Part#103405 - snap apart to correct length)
12	1	JP2	Header 7x2
13	1	JP4	Header 4x2
14	2	JP6,JP11	Header 2x2
15	2	JP7,JP8	Header 8x2
16	1	JP9	Header 10x2
17	2	JP14,JP15	Header 3x2
18		J1,J2,J3,J4,J5	Solder Pads (on PCB, not a part)
19	1	P1	Female DB9 pin connector short profile
20		Q1	BS170 or MOSFET N (optional, for remote serial reset)
21	4	R2,R5,R6,R8	10K ohm resistor
22	1	R3	1Meg ohm resistor
23	1	R4	47Kohm 10 pin inline resistor pack. (Part# 10-1-473)
24	1	R7	2.2K ohm resistor model#90-1555 LED (3ma) or 1K ohm resistor HLMP-1790 LED (2ma rating)
25	2	S1,S2	Momentary normally open push button switch Digikey Part# SW263CT-ND
26	1	U1	DS1233m (Note: DS1233 can be used, but its pins are positioned differently from the DS1233m)
27	1	U2	LM7805 or LM340T (+5 volt regulator)
28	1	U3	DS1230AB/Y Dallas 256kbit (32Kbyte) battery backed static ram. Substitute a DS1244Y if a real time clock is needed. You can also use a Dallas DS1216D 28 pin lithium battery socket but will need separate 256kbit 62256-100LP static memory chip
29	1	U4	MC68HC11A1FN CPU (Motorola)
30	1	U5	74HC573
31	1	U6	74HC00
32	1	U7	74HC138
33	1	U8	MAX232CPE (Maxim)
34	1	Y1	8Mhz Crystal - Series
35	1	IC socket	28 pin socket
36	1	IC socket	52 pin PLCC socket
37	2		3x2 Female IDC connectors
38	1		Ribbon cable - 6" length , 6 conductor
39		Optional	16x2 character LCD module
40		Optional	Beeper 5Volt TTL or speaker
41		BT1	3 Volt Battery (optional external battery for SRAM backup)
42	1	PCB	Finger Board II printed circuit board

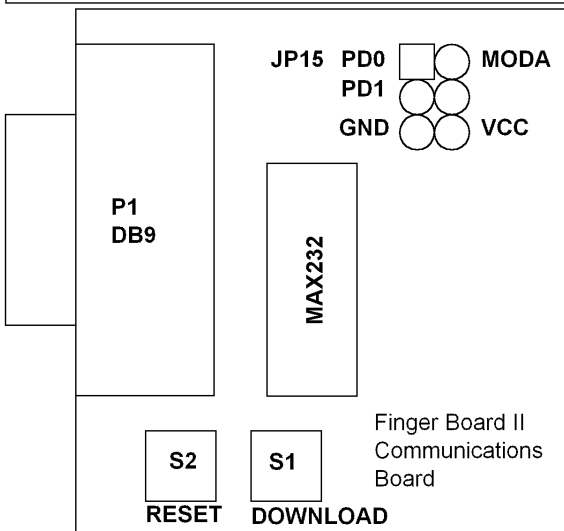
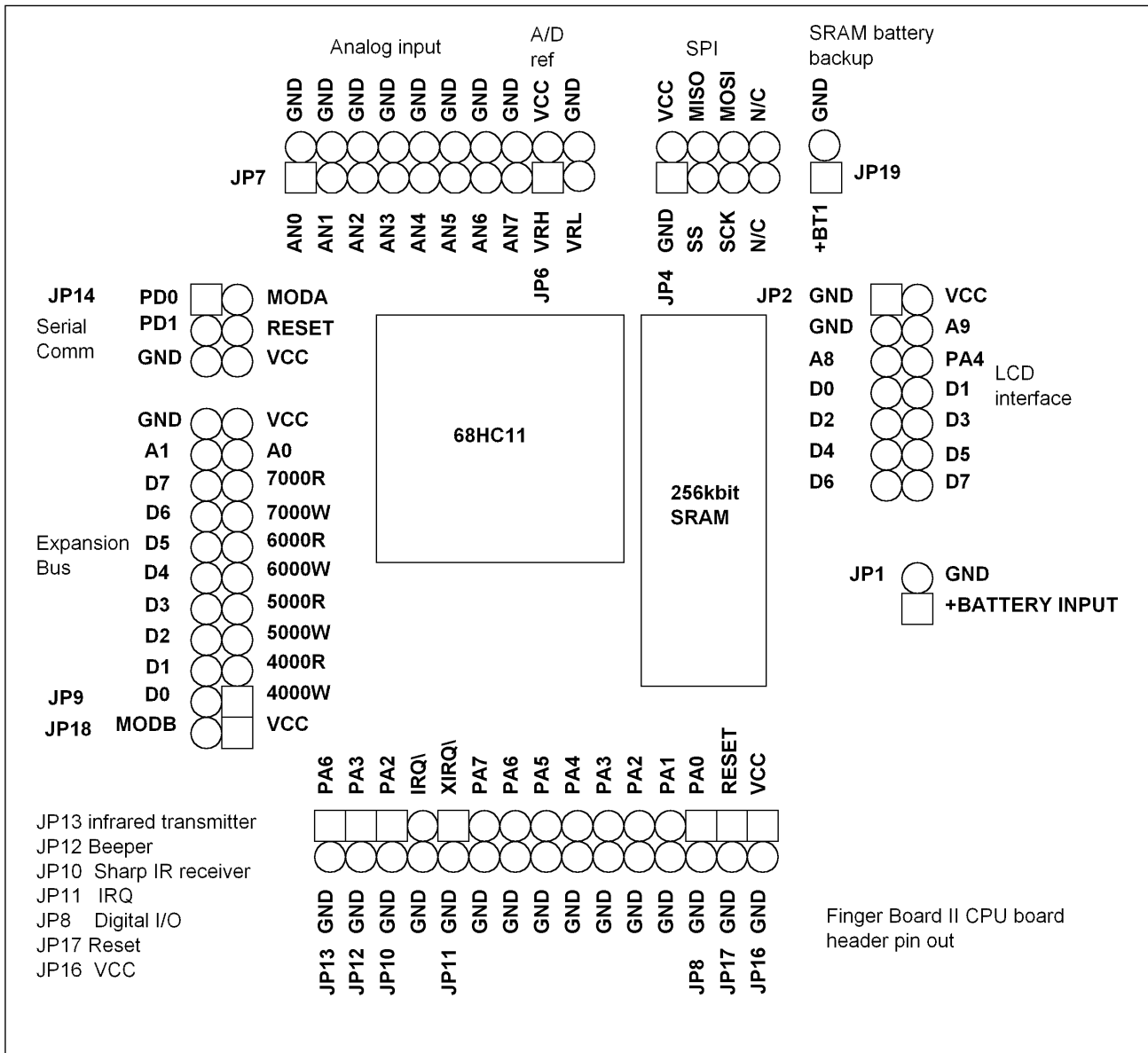
### Optional items not included:

½" 4-40 plastic standoffs for mounting, 2 jumper shunts for JP6

Use headers with a contact lead length of .230"(shorter style) for expansion boards.

Prototype expansion board with .1" spacing, can be found at your local Radio Shack.

## CONNECTING TO THE FINGER BOARD



Headers are counted in the same pattern as drawn on the schematic diagram. When possible we have placed the label closest to pin 1 on the printed circuit board. Pin 1 is marked with a square pad. See silkscreen top view drawing.

**JP1** is the DC input connector used to power the Finger Board. You can use any voltage from 7 to 18 volts.

<u>Pin</u>	<u>Function</u>
1	+Battery input
2	ground

**JP2** is an Interactive C compatible LCD interface. If you have the 14 x 1 type connector on your LCD, you should be able to rewire with the pattern shown.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	ground	2	VCC
3	ground	4	A9
5	A8	6	PA4
7	D0	8	D1
9	D2	10	D3
11	D4	12	D5
13	D6	14	D7

**JP4** is an SPI high-speed serial peripheral interface. There are lots of industry SPI compatible devices that can be attached to this port.

For those who wish to connect two Finger Boards together using the SPI port, you must not connect pin 2 (VCC) together between the Finger Boards. Doing so will short out the voltage regulators. You can use a straight through IDC ribbon cable but cut out pin 2 from one or both of the JP4 headers.

For other SPI devices, pin 2 can be used to supply +5 volt power. The 5 volt source is taken from the onboard 7805 voltage regulator.

Pins 7 and 8 on the header are not connected. They can be wired up to user determined chip selects.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>	
1	ground	2	VCC	n/c not connected
3	SS	4	MISO	
5	SCK	6	MOSI	
7	n/c	8	n/c	

**JP6** analog A/D reference input voltage. For normal use, pins 1 and 2 are shorted and pins 3 and 4 are shorted together using jumper shunts. See "M68HC11 Reference Manual" for further info.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	VRH	2	VCC
3	VRL	4	ground

**JP7** is the 68HC11 8-bit A/D analog input port. Input voltages between 0 and 5volts can be applied to the A/D. Grounds are provided for each analog input.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	AN0	2	ground
3	AN1	3	ground
4	AN2	5	ground
6	AN3	6	ground
7	AN4	8	ground
9	AN5	10	ground
11	AN6	12	ground
13	AN7	14	ground

**JP8** is PORT A on the 68HC11. This is an 8-bit digital input/output port. Reading the "M68HC11 Reference Manual", by Motorola will give information on how to utilize this port. In Interactive C, some of these pins are pre-assigned. By editing the library routines, you can change the pre-assigned functions.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	PA0	2	ground
3	PA1	4	ground
5	PA2	6	ground
7	PA3	8	ground
9	PA4	10	ground
11	PA5	12	ground
13	PA6	14	ground
15	PA7	16	ground

**JP9** is the expansion bus. It is setup so you can easily enhance the Finger Board with additional circuits. You can have up to 32 memory mapped digital inputs and 32 digital outputs. Circuit diagrams are available at our Web page on how to utilize this header. Data lines are brought out as well as power and ground pins. Hexadecimal address map is shown. W is for write; R is for read.

CPU address lines A0 and A1 are available for memory mapped LCD's or other peripheral devices.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	4000W2	D0	
3	4000R	4	D1
5	5000W6	D2	
7	5000R	8	D3
9	6000W10	D4	
11	6000R	12	D5
13	7000W14	D6	
15	7000R	16	D7
17	A0	18	A1
19	VCC	20	ground

**JP10** is a dedicated header for a Sharp IR receiver when running Interactive C.

<u>Pin</u>	<u>Function</u>
1	Sharp IR receiver (68HC11 output pin PA2)
2	Ground

**JP11** is useful for external interrupt requests.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	XIRQ\	2	ground
3	IRQ\	4	ground

**JP12** is a dedicated header for a Piezo beeper or speaker when running Interactive C.

<u>Pin</u>	<u>Function</u>
1	+ Piezo beeper or speaker (68HC11 output pin PA3)
2	ground

**JP13** is a dedicated header for an Infrared transmitter when running Interactive C.

<u>Pin</u>	<u>Function</u>
1	Infrared transmitter (68HC11 output pin PA6)
2	ground

**JP14** is the serial communications header on the CPU board that is used to connect to the Communications Board.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	PD0	2	MODA
3	PD1	4	reset
5	ground	6	VCC

**JP15** is the serial communications header on the Communications board that is used to connect to the main CPU board.

<u>Pin</u>	<u>Function</u>	<u>Pin</u>	<u>Function</u>
1	PD0	2	MODA
3	PD1	4	reset
5	ground	6	VCC

**JP16** is an available 5volt source (VCC) taken from the onboard 7805 voltage regulator.

<u>Pin</u>	<u>Function</u>
1	VCC
2	Ground

**JP17** is used to connect an external reset switch.

<u>Pin</u>	<u>Function</u>
1	reset
2	ground

**JP18** is the MODB select. By placing a jumper on JP18, this will enable you to change the reset vector from 0xBFFE, 0xBFFF to 0xFFFE,0xFFFF. It is used in conjunction with the Download switch (S1) on the Communications board. Pressing the Download switch pulls the MODA line low (open).

<u>Pin</u>	<u>Function</u>
1	MODB
2	VCC

CPU Hardware Mode select summary

JP18 Download Switch S1 (default is closed, pressing S1 opens)

<u>MODB</u>	<u>MODA</u>	
closed	closed	Normal Expanded (reset at 0xFFFE,0xFFFF)
open	open	Special Bootstrap (for downloading programs into memory)
open	closed	Special Test (Default mode for Interactive C, reset at 0xBFFE, 0xBFFF)

**JP19** is used to connect an external battery for SRAM battery backup. Use a 3-5 volt battery. This is not needed if you use a Dallas battery backup memory module.

<u>Pin</u>	<u>Function</u>
1	+BT1 3-5Volt battery
2	ground

**P1** is the Communications board DB9 RS232 connector. It is a simple three wire asynchronous serial interface. When using Interactive C, set your PC serial port to 9600 baud, 1 start, 1 stop, 8 data, no parity. Use a standard serial cable to connect the PC serial port to the Finger Board. If your PC has a 25 pin serial port, use a 9 to 25 pin adapter.

<u>Pin</u>	<u>Function</u>	
1	n/c	n/c not connected
2	TxD	
3	RxD	
4	n/c	
5	ground	
6	n/c	
7	RTS	
8	CTS	

## RUNNING INTERACTIVE C

Interactive C (IC) is a simple to use C compiler for the 68HC11. The freeware version of IC can be downloaded from MIT's FTP site at

<ftp://cherupakha.media.mit.edu/pub/projects/6270/interactive-c> along with a manual that can be printed out for reference. There is also more information on the "Handy Board" web page on how to use IC.

To use the Finger Board you need to connect the serial port of your PC to the serial connector P1 of the Finger Board Communications board. You should be able to run version 2.86 or the newest commercial version of IC from Newton Labs, but you must load the "Rug Warrior" version of the pcode.

The MODB setting (JP18) should be un-jumpered. This sets the 68HC11 CPU in "Special Test Mode" with a reset vector address location of \$BFFE:BFFF. Interactive C will not run if JP18 is jumpered.

When using version 2.86. Make sure ic.exe is set. Example setup by executing "ic -config" is shown:

```
C:\IC>ic -config
Interactive C for 6811. Version 2.860 BETA (Nov 29 1994)
```

IC written by Randy Sargent and Anne Wright. Copyright 1994.  
(uses board pcode by R. Sargent, F. Martin, and A. Wright)

This program is freeware and unsupported. It is provided as a service to hobbyists and educators. Type 'about' for information about support and obtaining newer versions of IC.

```
Backing up C:\IC\IC.EXE to C:\IC\IC.bak
Done
Default editor: edit
Directory where libraries reside: /ic/libs/
Default library file (blank for none): /ic/libs/lib_rw11.lis
Default serial device name (in the form /dev/*): com1
Finished configuring
```

Note: lib\_rw11.lis should be edited if you need to add additional library routines. The nicest thing about 2.860 is all source code is made public and can be recompiled.

To put Finger Board in download mode. You need to hit the reset switch or just re-power Finger Board while pressing the download push button S1 on the Communications board. Once you release the download push button S1, the LED D1 will turn off, indicating that the board is in download mode. This LED works the same as on the "Handy Board". Note: If you are using a reset switch you must release the reset switch first then release the download push button S1. Initially, the LED may not be on, once initial communications is established it will function normally.

## USING OTHER COMPILERS AND PROGRAMS

The Finger Board was designed to take advantage of the many public domain software available on the web as well as any commercial compilers. There are links on our web site to freeware and shareware compilers and programs that can be downloaded and used to write programs for the Finger Board II. Check out our related sites page for links to commercial compilers

To use certain compilers, you must be aware of the reset vector location. The reset vector address can be changed by jumping JP18. The default mode of operation for Interactive C is "Special Test Mode" and the reset vector is located at address \$BFFE:BFFF. By jumping JP18, the reset vector location can be set to address \$FFFE:FFFF. Read the "M68HC11 Reference Manual" by Motorola for a better description.

You can use DL.EXE (found in Interactive C) to download compiled S19 records to the Finger Board. There are other C compilers for the 68HC11 that can be used, Small C, ICC11, and GCC. For BASIC programs, use SBasic by Karl Lunt. Karl also has written a version of FORTH for the HC11 called tiny4th. Two very good interactive debuggers are NoICE by John Hartman and PCbug (Pcbug342.exe) by Motorola. A good bootloader is Hcload by Sylvain Bissonnette. The one we have found to be very reliable is DL68hc11 by Wilfried Markenstein. Motorola also has a freeware assembler, as11.

## FREQUENTLY ASKED QUESTIONS (FAQ)

Please check our web site for the latest version of the Finger Board FAQ.

### TROUBLE SHOOTING

If you have purchased the assembled Finger Board, it is fully tested and operational before shipping. If it fails to function properly, inspect the board for obvious physical damage. If there is damage, please contact us for replacement.

The most common problems are improperly configured communications parameters or attempting to use the wrong COM port on the PC. Verify that your communications port is working by substituting a known good serial device or by doing a loopback diagnostic. Also check your power source. The input voltage should not fall below 7 volts DC.

For kits,

Check for +5VCC voltage on header JP16.

Check and make sure all components are installed and properly orientated.

Check all resistor and capacitor values.

Check LED polarity.

Check IC positions.

Check Tantalum capacitor polarities.

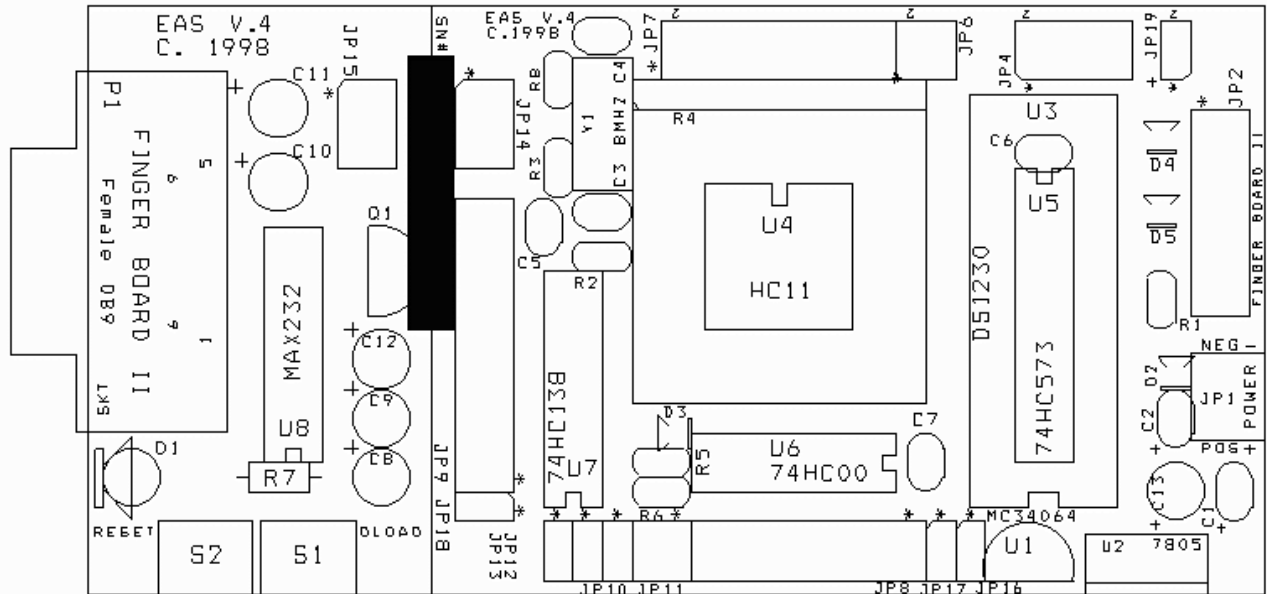
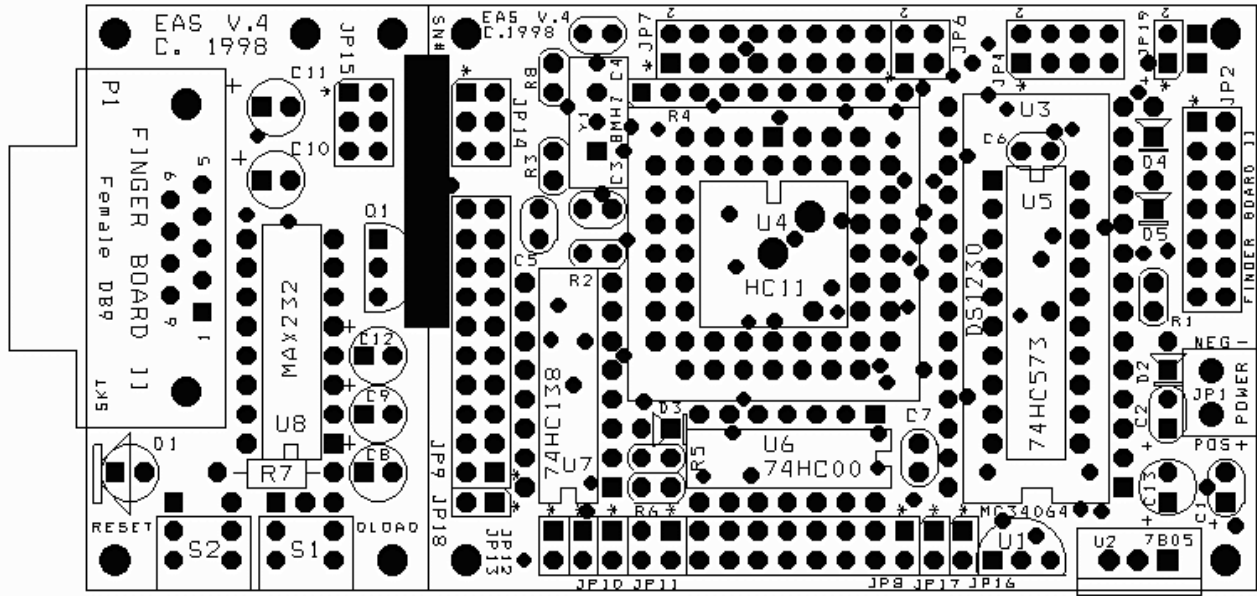
Check for shorts.

Check for cold solder joints.

Problems communicating, remove LED D1, it's probably in backwards.

If not using the optional SRAM battery backed feature, make sure solder pad J5 is bridged.

Silkscreen Top View. Pin 1 on all headers are indicated by the square pad.



Parts placement

## **SPECIFICATIONS:**

Motorola 68HC11 CPU A0, A1, A8, E2, or E9 versions can be used.

256kbit (32Kbyte) Dallas 10 year battery-backed memory module, no need to use EPROMs or slower EEPROMs.

Compact size 2" X 2.85".

Interactive C compatible LCD interface.

Network capable, Serial Peripheral Interface (SPI).

Jumper selectable reset address. Reset vector can be located at 0xFFFFE,0xFFFF or 0xBFFE,0xBFFF improved over the Handy Board.

No expensive hardware programmer needed, programs can be downloaded using a standard serial port.

Easily expandable, using standard headers. List of Headers:

Port A of 68HC11, 8 multi function I/O pins (JP8)

Port E of 68HC11, 8 analog channels (JP7)

Memory mapped I/O, Finger Board can be easily expanded to have 32 digital inputs and 32 digital output lines (JP9)

IRQ and XIRQ lines brought out for external interrupts (JP11)

Standard 9pin serial port (P1).

SPI high speed serial interface (JP4)

LCD display interface (JP2)

Sharp IR receiver input (JP10)

Speaker output (JP12)

Infrared transmitter output (JP13)

MODB select (JP18)

External A/D reference input (JP6)

Optional external battery backup capable (JP19)

Optional Low Dropout voltage regulator

Optional remote reset through serial port

Optional real time clock

### **Power requirements:**

7 to 18volts DC. Can easily run from a 9volts DC battery.

Current consumption: 24 ma DC without communications board < 10ma in WAIT mode, or STOP mode. 30ma with communications board

For remote data logging - using an Alkaline 9volt battery to supply power, we were able to get 19 hours using the Finger Board without the communications board, but with an attached LCD for display. The total current draw was ~25 ma. The LCD display typically draws about ~1ma.

For low battery situations and Solar Cell applications. Special modifications can be made to the Finger Board. With a few easy component changes, we were able to bring the current draw down to 22ma. By changing the voltage regulator to a low dropout version, the Finger Board was able to run from 26volts down to 4.8volts. These application specific modifications are posted on our web site.

### **Dimensions:**

CPU board only: 2.85" long, 2.0" wide

Communications board: 1.15" long, 2.0" wide

CPU board with attached Communications board: 4" long, 2.0" wide

## **STANDARD LEGAL STUFF**

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## PARTS LIST FOR FINGER BOARD II

Bill Of Materials, all parts can be found from Radio Shack, Digikey, JDR and Jameco.  
All resistors ½ Watt or less. All similar parts found on "Handy Board" can also be used on Finger Board.

Item #	Quantity	Part Reference #	Description
1	1	C1	1uf tantalum capacitor, 25 volts or greater
2	4	C2,C5,C6,C7	.1uf monolithic capacitor
3	2	C3,C4	22pf capacitor (20pf can be substituted)
4	5	C8,C9,C10,C11,C12	1uf tantalum capacitor, 16 volts or greater
5		C13	Note: C13 is no longer needed
6	1	D1	HLMP-1790 LED (2ma rating)
7	1	D2	1N4007 or 1N5817
8	1	D3	1N4148
9		D4,D5	1N5817 (optional, only for external SRAM battery backup)
10	1	JP1	OST 2 terminal block connector 3.5mm lead spacing. Digikey Part#ED1514-ND
11	7	JP10,JP12,JP13, JP16 JP17,JP18,JP19	Header 2x1 (all headers are .1" straight male double row Jameco Part#103405 - snap apart to correct length)
12	1	JP2	Header 7x2
13	1	JP4	Header 4x2
14	2	JP6,JP11	Header 2x2
15	2	JP7,JP8	Header 8x2
16	1	JP9	Header 10x2
17	2	JP14,JP15	Header 3x2
18		J1,J2,J3,J4,J5	Solder Pads (on PCB, not a part)
19	1	P1	Female DB9 pin connector short profile
20		Q1	BS170 or MOSFET N (optional, for remote serial reset)
21	4	R2,R5,R6,R8	10K ohm resistor
22	1	R3	1Meg ohm resistor
23	1	R4	47Kohm 10 pin inline resistor pack. (Part# 10-1-473)
24	1	R7	2.2K ohm resistor model#90-1555 LED (3ma) or 1K ohm resistor HLMP-1790 LED (2ma rating)
25	2	S1,S2	Momentary normally open push button switch Digikey Part# SW263CT-ND
26	1	U1	DS1233m (Note: DS1233 can be used, but its pins are positioned differently from the DS1233m)
27	1	U2	LM7805 or LM340T (+5 volt regulator)
28	1	U3	DS1230AB/Y Dallas 256kbit (32Kbyte) battery backed static ram. Substitute a DS1244Y if a real time clock is needed. You can also use a Dallas DS1216D 28 pin lithium battery socket but will need separate 256kbit 62256-100LP static memory chip
29	1	U4	MC68HC11A1FN CPU (Motorola)
30	1	U5	74HC573
31	1	U6	74HC00
32	1	U7	74HC138
33	1	U8	MAX232CPE (Maxim)
34	1	Y1	8Mhz Crystal - Series
35	1	IC socket	28 pin socket
36	1	IC socket	52 pin PLCC socket
37	2		3x2 Female IDC connectors
38	1		Ribbon cable - 6" length , 6 conductor
39		Optional	16x2 character LCD module
40		Optional	Beeper 5Volt TTL or speaker
41		BT1	3 Volt Battery (optional external battery for SRAM backup)
42	1	PCB	Finger Board II printed circuit board