

# Building the Super-VMW CPU Meter

<http://www.deater.net/weave/vmwprod/meter/super.html>

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## 1 Parts List

Part No	Description	Quantity	Source
	LED Board	1	SVMW-Meter-LED-Board
LTP 3786E	14-Seg 2x Alphanum Com Anode	3	DigiKey 160-1011-ND
LTA 1000G	10-segment bargraph	2	Jameco 697469
	Mini Red LED (3mm)	12	Jameco 333851
	1200mcd R,O,Y,G,B,P LEDs	6	Super Bright LED
	20-pin .3 wide DIP socket	4	Jameco 38608
	30-pin SIP header	5	All-Electronics SIP-30
	Logic Board	1	SVMW-Meter-Logic-Board
	DC Male 2.1mm Solder Jack	1	Jameco 101178
	25-pin right-angle DSUB male	1	Jameco 15150
	24-pin .6 wide DIP socket	4	Jameco 112264
	20-pin .3 wide DIP socket	4	Jameco 38608
	16-pin DIP socket	1	Jameco 112222
	4.7K Resistor	7	Jameco 691024
	27K Resistor	1	Jameco 691201
	16K Resistor	1	Jameco 691155
	3.3K Resistor	1	Jameco 690988
	2.2nF Capacitor	4	Jameco 1947327
	0.1 $\mu$ F Capacitor	4	Jameco 151116
PN2222	NPN Transistor	8	Jameco 28628
SAA1064	LED Driver w I <sup>2</sup> C	4	DigiKey 568-1107-5-ND
74HC05	Inverter w/ Open Drain	1	DigiKey 296-1568-5-ND
	SERPAC A-31 Case	1	Digikey SRA31G-ND
	20-conductor Flat 28AWG wire	16in	Jameco 643874
	IDC 20-pin DIP cable mount	8	Jameco 104097
	5V 1A power adapter	1	Jameco 252720
	Parallel Cable	1	
HT-214D	IDC DIP Crimping Tool	1	Newark 69C1030

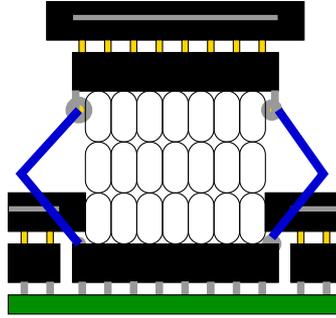


Figure 1: Lofting the cable connector (workaround).

## 2 Building the LED Board

1. Take two 30-pin headers. Cut off 4 10-pin lengths for the LED bargraph sockets. (These need to be made out of the headers, so that it is possible to solder the sockets from the other side). Solder these to the board. Place a 20-pin socket temporarily into the headers to keep them vertical while soldering.
2. Solder the 4 20-pin sockets on the back of the board. The one that comes up between the bargraph sockets is a bit tricky.
3. Take a 30-pin header and snip pins 10 and 20 off, plus trim off the 30th pin completely. Repeat. Solder into place as alphanumeric sockets. Place a wide 24-pin socket across while soldering to keep vertical.
4. Cut 22 2-pin lengths of the 30-pin headers for LED sockets. Solder them in place; scotch tape can temporarily hold them.
5. Place all of the LED displays into their sockets. **WORKAROUND** If you are using the Mark2 board the 12 red LEDs are indicated backwards, you'll have to install them opposite the way indicated on the PCB.
6. **WORKAROUND** If you have the Mark2 board then the cable connectors are too close together to fit in the socket. As a workaround build a stack of cut up 30-pin headers 8 wide and place on the middle connector. Stack 3 high. Then solder wires from the PCB up to the far right and left pins of a 10-wide socket on top. This will allow the side connectors to fit, as well as the middle one to be lofted. See Figure 1.

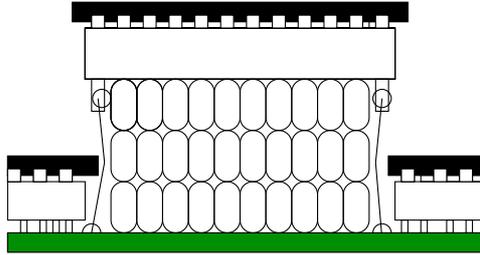


Figure 2: Lofting the chip socket (workaround).

### 3 Building the Logic Board

1. Solder the sockets in place: first the 4 24-pin wide ones, then the 4 20-pin sockets, finally the 1 16-pin socket.
2. You can optionally use parts of 30-pin header to make i2c and voltage interface sockets.
3. Bend the transistors down at a right angle (so they lie flush) so that the cable headers can fit overtop. Solder in place.
4. Solder the resistors in place. **WORKAROUND** The 27K resistor is mislabeled 21K on the board. 3.3K = Orange Orange Red. 4.7K = Yellow Violet Red. 16K = Brown Blue Orange. 27K = Red Violet Orange.
5. Solder the capacitors in place.
6. Solder the power socket.
7. Solder on the parallel connector.
8. **WORKAROUND** Loft the middle SAA1064 chip socket. Use two 10-wide headers to loft it. Then solder wires to the holes on either end and loft. You might insert heat-shrink tubing around wires to keep shorts from happening. See Figure 2.
9. Insert the 74HC05 chip and the four SAA1064 chips.

## 4 Assembling the Whole Thing

1. **WORKAROUND** If the left side of the board won't fit in the case due to the case screw channel, you'll need to file a semi-circular hole so that the board will fit.
2. Screw the logic board to base using two of the screws that came with the case.
3. Crimp the 4 cables with 20-pin connectors on either end. A crimper really helps here, and you really need one that has a DIP crimping substrate (hard to find). From the front, the left cable is 5in, next 2.5in (longer if you don't need the workaround), 3in, then 5.5in.
4. Connect cables. **WORKAROUND** If using mark1 logic board, need to trim the side off of the right-side connector so it can fit and not conflict with bottom right connector.
5. Plug in 5V adapter and parallel port. Test using one of the sample programs.

## 5 Testing

1. Before inserting ICs, apply 5V power and check that power is at proper pins.
2. Try inserting SAA1064s one at a time and then running sample programs to make sure each works/no problems before inserting all.

## 6 Optional USB Board

### 6.1 USB Parts List

Part No	Description	Quantity	Source
	USBtiny AVR Programmer	1	adafruit
	Proto Board	1	????
	Male 6-pin header	1	Jameco 115035
	8-pin machine socket	1	All Electronics HRICS-8
1N717A	22pF capacitor	2	Jameco 15404
	12MHz crystal	1	DigiKey X993-ND
	ATTiny45	1	DigiKey ATTINY45-20PU-ND
	68 $\Omega$ Resistor	2	
	2.2K Resistor	1	
	3.6V Zener Diode	2	Jameco 1579771
	10 $\mu$ F electrolytic cap	1	
	100nF (.1 $\mu$ F) cap	1	Jameco 15116
	10K Resistor	2	
	USB B connector	1	Jameco 230958
	6-foot USB cable	1	
	8-pin machine socket	1	
	Perf Board	1	Radio Shack 276-159B

### 6.2 USB AVR Programming Board

1. First we need to flash the ATTINY45. Get an AVR programmer I used the USBtinyISP, from <http://www.ladyada.net/make/usbtinyisp/>
2. You'll need to set wire up an adapter so the pins from the programmer go to the right pins of the ATTINY45. The one I made used some existing perf board I had, and can be seen in Figure 3

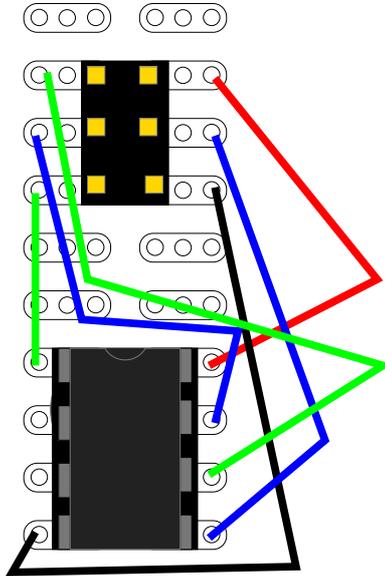


Figure 3: Setup for flashing ATTINY45 with USB-tiny-ISP

### 6.3 Flashing the ATTINY45

This assumes you are using USBtinyISP.

1. Jumper the USBtinyISP to provide USB power.
2. Insert ATTINY45 into the board, attach 6-pin jumper from USBtinyISP.
3. Plug the USBtinyISP into a USB port. The green light should come on.
4. Use `avrdude` to do the programming. On Debian Linux you can do an `apt-get install avrdude` to install.
5. Obtain the USB firmware. Get this from the i2c tiny USB page [http://www.harbaum.org/till/i2c\\_tiny\\_usb/](http://www.harbaum.org/till/i2c_tiny_usb/) or eventually I will include it here.
6. Program as so:
 

```
avrdude -Pattiny45 -c usbtiny -U lfuse:w:0xdf:m -U hfuse:w:0x5f:m
-U flash:w:firmware.hex
```

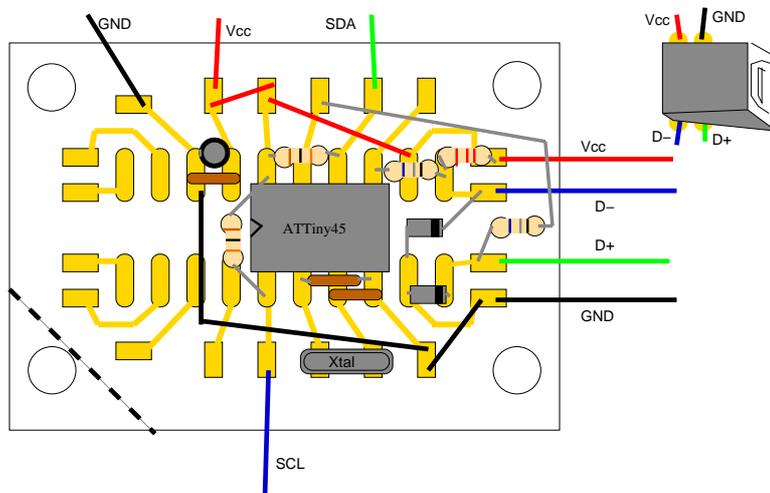


Figure 4: Layout of USB to i2c board.

#### 6.4 USB to I2C Converter Board

1. Build the USB/i2c board as described in Figure 4.
2. Trim the board corner so it won't interfere with the lofted chips on the parallel port board.
3. Connect the GND, SDA, and SCL wires to the headers on the parallel port board. **DO NOT** connect VCC. Experimentation is still underway on having a USB-bus powered board.