



Digital LC Meter Version 2

Updated software - March 2020. The revised software checks for the presence (or absence) of a 1K resistor from pin 11 of the PIC to ground. This determines how the LCD is addressed.

An "improved" inductance / capacitance meter by Phil Rice VK3BHR

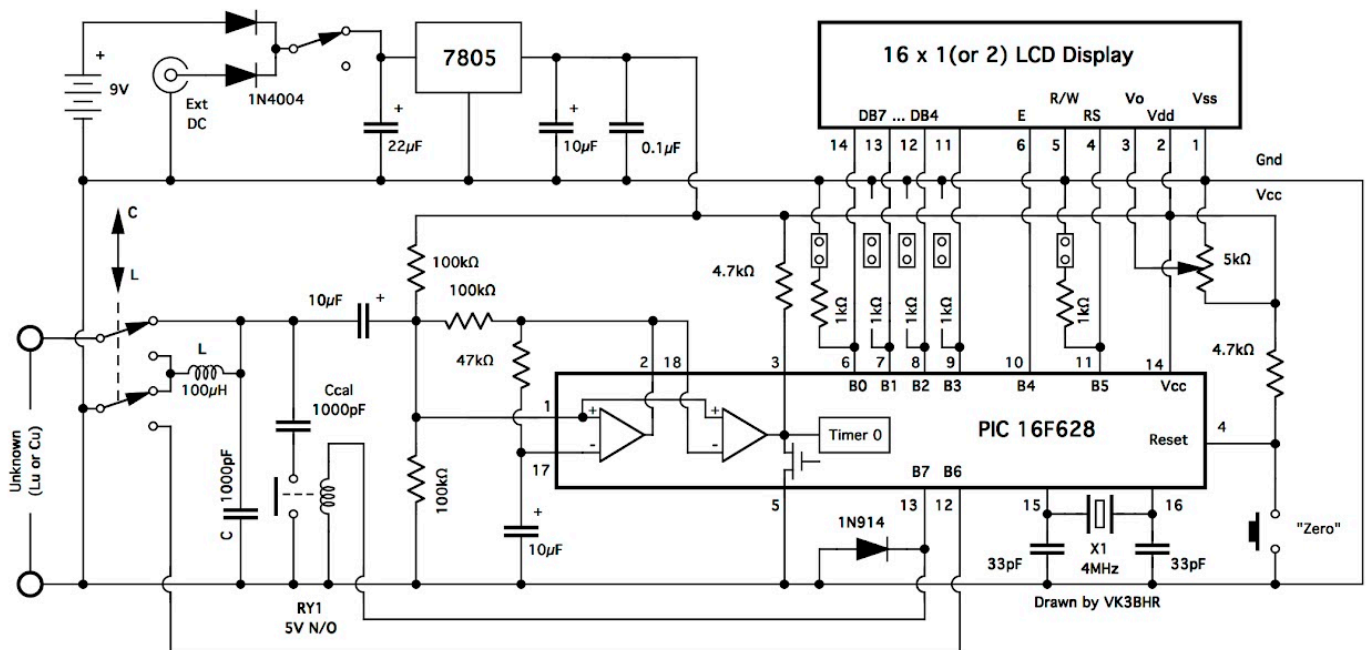
Actually, it works much the same as the original.

This version was a club project of the Midland Amateur Radio Club - <http://www.marc.org.au>

It differs from the original in that:

- A 16F628 PIC is used. This has internal comparator, which means the LM311 is no longer needed.
- Software calibration is used. The finished meter can be calibrated against "any" accurate capacitor within the range 100pF to about 10000pF.
- A PC Board layout is available, but not quite the most recent. I have misplaced that one. The version here, does not include the resistor & link connected to pin 11 of the PIC. Sorry about that.

The Circuit



Special Components.



- No particularly accurate components are required, except for one (or more) accurately known "external" capacitors used to calibrate the meter.
- The two 1000pF capacitors ("C" and "Ccal") should be fairly good quality (stability is important, accuracy is not ;-). Polystyrene are preferred. MKT are fine, as are Mica. Greencaps tend to drift in value too much. Avoid ceramic capacitors. Some of these can have high losses (and it is hard to tell).
- The two 10uF capacitors in the oscillator should be **NEW** tantalum ones (for low series resistance/inductance). Alternatively, "low ESR" aluminium capacitors can be used. You could add a 0.01uF ceramic capacitor in parallel with each, "just to be safe".
- The 4MHz crystal should be a genuine 4.000MHz one, not something approximate to 4MHz. Every 1% error in crystal frequency adds 2% error to the indicated inductance value.
- The 100uH inductor should have a low "DC" resistance. Ideally less than an Ohm or two.
- The relay should be a low current one. The PIC can only provide about 30mA of drive current. The relay should be able to "pull in" with 4.5 volt applied to the coil. (Most 5volt reed relays will be OK).
- Don't forget the "catch" diode across the relay coil!

PC Board

Note that this version is missing the resistor & link from pin 11 of the PIC to ground.

Board artwork, "ready for ironing on" (missing resistor on PIC pin 11)


Board component layout & and better copy of Circuit diagram (missing resistor on PIC pin 11)

The Code

Source code, excluding floating point +/-*

Assembled Hex code (complete, ready to work!)

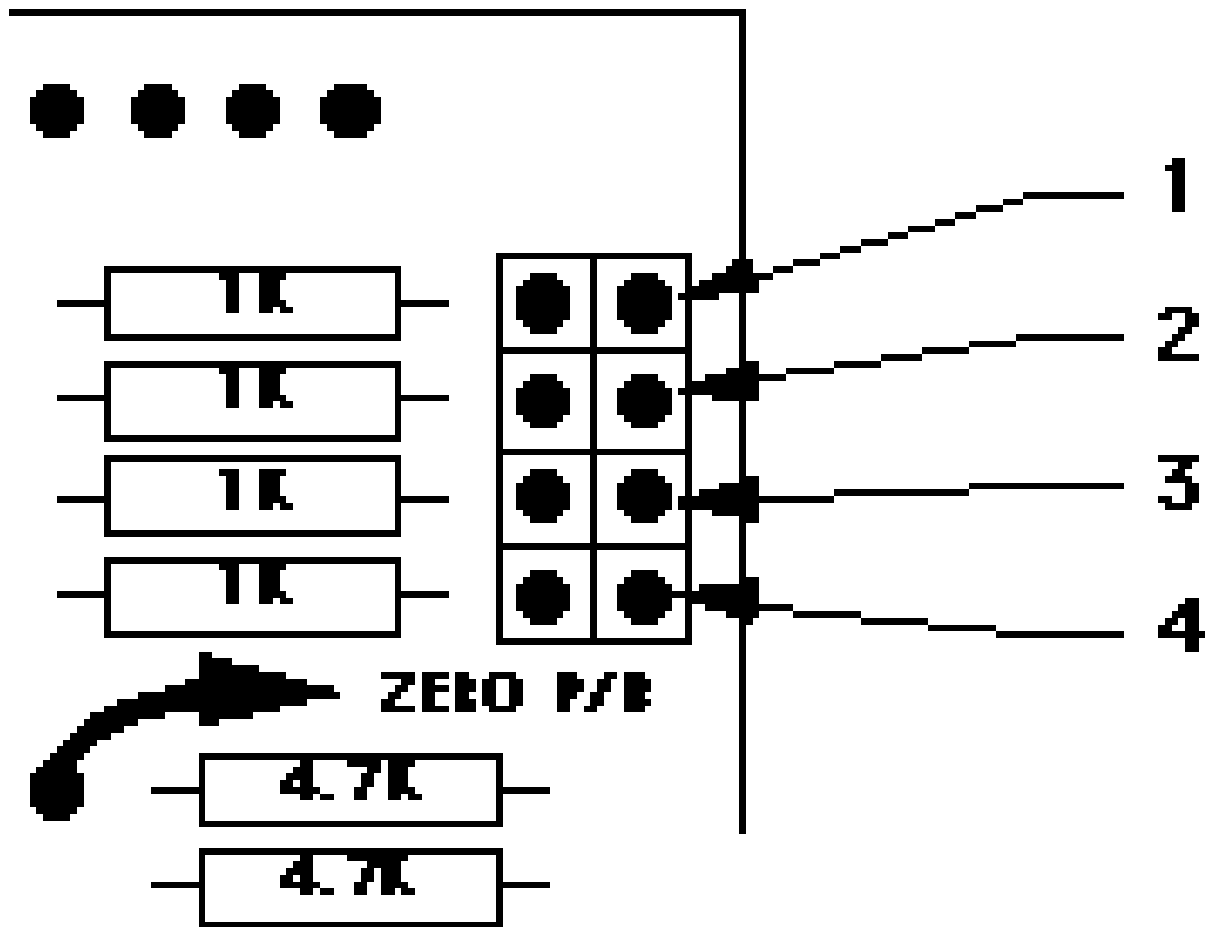
Calibration Instructions.

1. Check that you have put all the components in the right places.
2. Check that you have soldered every lead.
3. Double check the PIC orientation, the diode and the 7805.
4. Don't forget - the PIC (as purchased) isn't programmed. You gotta load the LC Meter code into it before it will work.
5. Apply power carefully. If possible, use a variable regulated supply for the first try. Measure the supply current while gradually increasing the  page. The current should be below 20mA. The prototype drew just 8mA. If you see nothing on the display and everything else checks out OK, try adjusting the Contrast

trimpot. If it is set too far off, you will see nothing. The display should briefly show the word Calibrating, then $C=0.0\text{pF}$ (or some other capacitance up to $\pm 10\text{pF}$).



6. Allow several minutes "warm-up", then press the "zero" button to force a re-calibration. The display should now show $C=0.0\text{pF}$.
7. Connect your "standard" capacitor. The LC meter should read somewhere near its value (with up to $\pm 10\%$ error).
8. To raise the indicated capacitance, join the links marked "4" on the diagram below. To lower the indicated capacitance, join the links marked "3" on the diagram below. When the indicated value is "close enough" to the standard, remove the link. The PIC will remember the calibration. You can repeat this as many times as you like (up to 10,000,000 times I think before you wear out the PIC).
9. If the meter misbehaves, you can use the links "1" & "2" to check the oscillator frequency. Apply link "2" to check the free running frequency "F1" of the oscillator. This should be shown as 00050000 $\pm 10\%$. If the reading is too low (say below 00040000), you will lose some accuracy. Apply link "1" to check the "calibration" frequency "F2". This should be near 71% $\pm 5\%$ of the "F1" reading that you get by applying link "2". If the two frequencies are less than 2% different, then the relay may be "faulty". [See the FAQ](#)
10. Experts may like to adjust the inductor value to raise F1 to near 00060000 to obtain maximum resolution from the meter. An "L" value of 82uH is preferred instead of the specified 100uH (but you can't buy 82uH inductors in Bendigo).
11. If the meter shows near 00000000 for F1 and or F2, then recheck the wiring around the L/C switch, 'cos it sounds like your oscillator has stopped.
12. The Inductance measuring function is automatically calibrated when you calibrate the capacitance function. All the testing required is to check that the meter can be "zeroed" with the terminals shorted together.



1. Check F2
2. Check F1
3. Lower C
4. Raise C

HELP! It doesn't work.

There is now a "faq". [Click this link.](#)

I will add answers as problems arise (as they are bound to do ;-).