The Inductance & Capacitance Meter Projects

I have taken these two projects from the ARRL Handbook 2002. It had been in the book for a few years now. A couple of years ago I made both of the projects, and they have been performing well since.

Since the words and schematics were so small and unclear, I had decided to re-type all the text and re-do both schematics...as to make it easier for viewing.

Also, I would like to say a few things that I have found since making both units. Digi-Key sells the 74HCT132 Integrated Circuit. Scroll down to the bottom of the page for their toll-free phone number. I have used the chip for both projects and it has performed well. Also, I had written to ARRL back when I had just completed the units and requested that they put an added comment for the Inductance Project. I let them know that R3's value needed to be altered a little for the fact that I could not achieve calibration that was described in the text. They were so gracious that they put it in the book the following year. My R3 value is 302 ohms...not 200. I used a 220 ohm and an 82 ohm in series.

Below are well-made plans for both projects...

...taken from the ARRL Handbook (2002 Edition)

Many of us have a DVM (digital volt-meter) or VOM (volt-ohm meter) in the shack, but few of us own an inductance or capacitance meter. If you have ever looked into your junk box and wanted to know the value of the unmarked parts, these simple circuits will give you the answer. They may be built in one evening and will adapt your DVM or VOM to measure inductance or capacitance. The units are calibrated against a known part. Therefore, the overal accuracy depends only on the calibration values and not on the components used to build the circuits. If it is carefully calibrated, an overall accuracy of 10% may be expected if used with a DVM and slightly less with a VOM.

Inductance Adapter for a DVM or VOM

Construction...

The circuits may be constructed on a small perf board (Radio Shack dual mini-board (#276-168), or if you prefer, on a PCB (Printed Circuit Board). Layout is non-critical - almost any construction technique will suffice. Wire-wrapping or point-to-point soldering may be used.

Description...

The schematic shown below converts an unknown inductance into a voltage that can be displayed on a DVM or VOM. Values between 3uH and 500uH are measured on the L (low) range and from 100uH to 7mH on the H (high) range. NAND gate ICA is a two frequency RC square-wave oscillator. The output frequency (pin 3) is approximately 60 KHz in the L (low) range and 6 KHz in the H (high) range. The square-wave output is buffered by ICB and applied to a differentiator formed by R3 and the unknown inductor; LX. The stream of spikes produced at pin 9 decay at a rate proportional to the time constant of R3-LX. Because R3 is a constant, the decay time is directly proportional to the value of LX. ICC squares up the positive going spikes, producing a stream of negative going pulses, at pin 8 whose width is proportional to the value of LX.

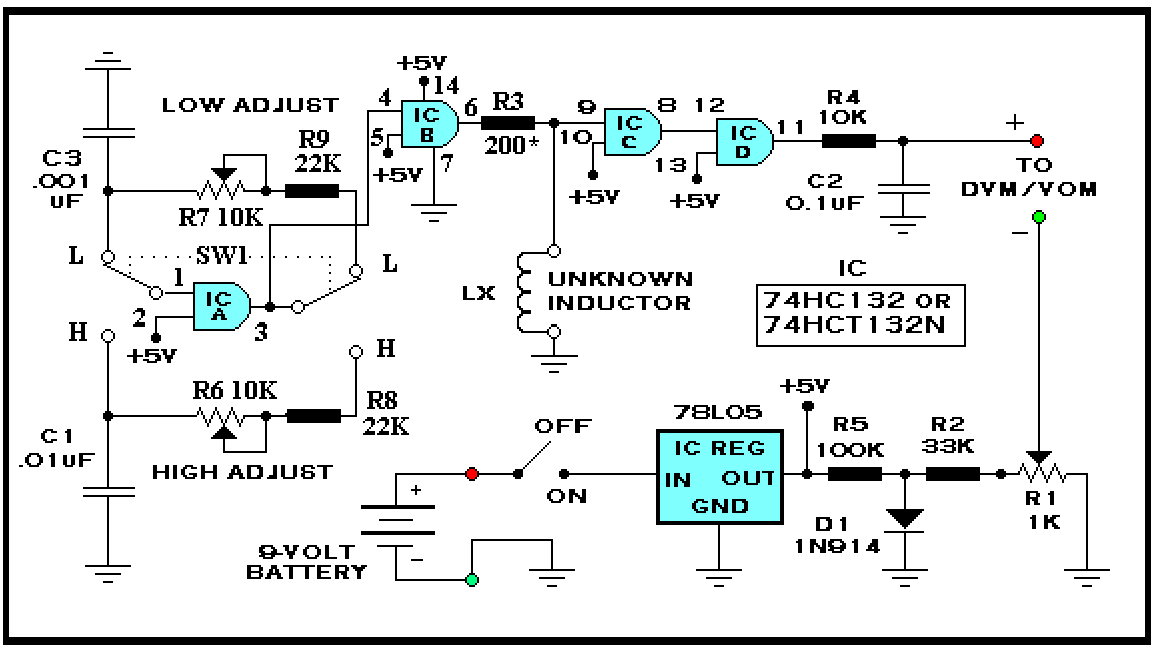
They are inverted by ICD (pin 11) and integrated by R4-C2 to produce a steady dc voltage at the + output terminal. The resulting dc voltage is proportional to LX and the repetition rate of the oscillator. R6 and R7 are used to calibrate the unit by setting a repetition rate that produces a dc voltage corresponding to the unknown inductance. D1 provides a 0.7 volt constant voltage source that is scaled by R1 to produce a small offset reference voltage for zeroing the meter on the L (low) inductance range.

When SW1 is L (low), mV corresponds to uH, and when H (high), mV corresponds to mH. A sensitive VOM may be substituted for the DVM with a sacrifice in resolution.

Test and Calibration...

Short the LX terminals with a piece of wire and connect a DVM set to the 200-mV range to the output. Adjust R1 for a zero reading. Remove the short and substitute a known inductor of approximately 400uH. Set SW1 to the L (low) position and adjust R7 for a reading equal to the unkown inductance. Switch SW1 to the H (high) position and connect a known inductor of about 5mH. Adjust R6 for the corresponding value. For instance, if the actual value of the calibration inductor is 4.76mH, adjust R7 so the DVM reads 476mV.

Inductance Meter Schematic



All components are 10% tolerance. 1N4146 or equivalent may be substituted for D1. An LM7805 may be substituted for the 78L05. All fixed resistors are 1/4 watt carbon composition. Capacitors are in uF. R3 value may need to be increased or decreased slightly if calibration cannot be achieved as described in text.

Capacitance Adapter for a DVM or VOM

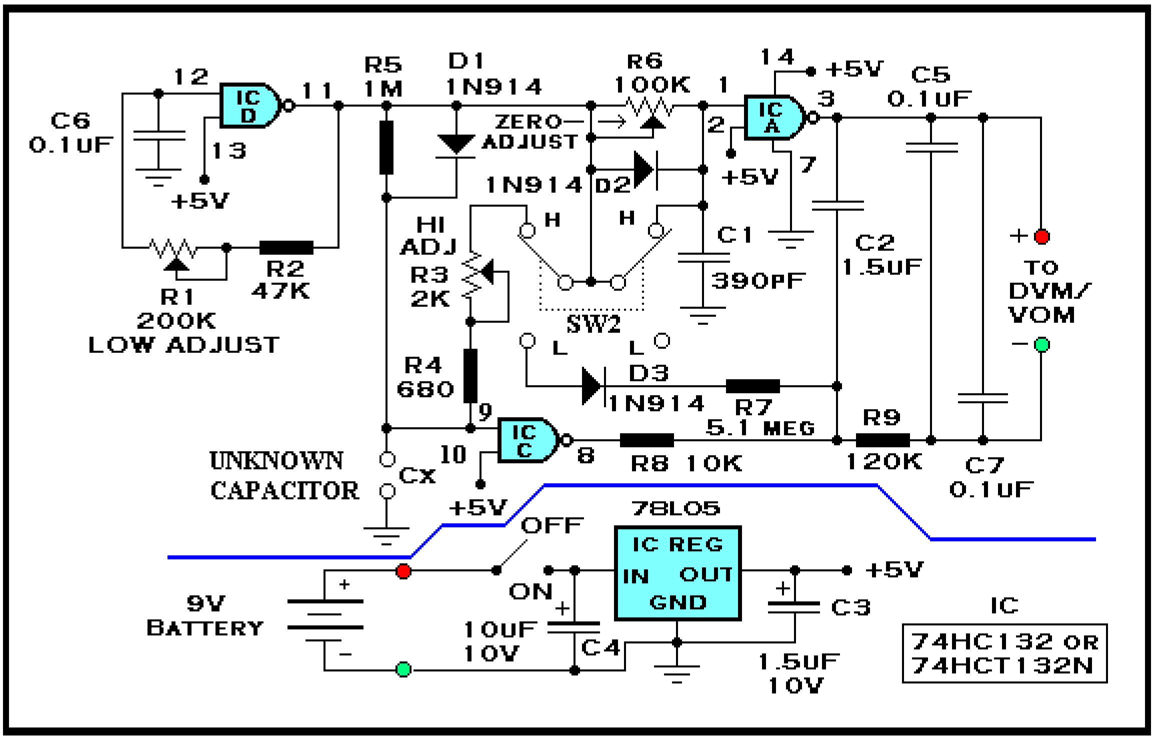
Description...

The schematic shown below measures capacitance from 2.2pF to 1000pF in the L (low) range, and from 1000pF to 2.2uF in the H (high) range. ICD of the 74HC132 (pin 11) produces a 300 Hz square-wave clock. On the rising edge CX rapidly charges through D1. On the falling edge CX slowly discharges through R5 on the L (low) range and through R3-R4 on the H (high) range. This produces an asymmetrical waveform at pin 8 of ICC with a duty cycle proportional to the unknown capacitance; CX. This signal is integrated by R8-R9-C2 producing a dc voltage at the negative meter terminal proportional to the unknown capacitance. A constant reference voltage is produced at the positive meter terminal by integrating the square-wave at ICA, pin 3. R6 alters the symmetry of this square-wave producing a small change in the reference voltage at the positive meter terminal. This feature provides a zero adjustment on the L (low) range. The DVM measures the difference between the positive and negative meter terminals. This difference is proportional to the unknown capacitance.

Test and Calibration...

Without a capacitor connected to the input terminals, set SW2 to the L (low range) and attach a DVM to the output terminals. Set the DVM to the 2-volt range and adjust R6 for a zero meter reading. Now connect a 1000pF 'calibration' capacitor to the input and adjust R1 for a reading of 1.00 volt. Next, switch SW2 to the H (high) range and connect a 1.00uF 'calibration' capacitor to the input. Adjust R3 for a meter reading of 1.00 volt. The 'calibration' capacitors do not have to be exactly 1000pF or 1.00uF, as long as you know their exact value. Fro instance, if the 'calibration' capacitor is known to be .940uF, adjust the output for a reading of 940mV.

Capacitance Meter Schematic



All components are 10% tolerance. An LM7805 may be substituted for the 78L05. All fixed resistors are 1/4 watt carbon composition. Capacitors are in uF unless otherwise indicated.

There you have it my friend! When beginning the project, do let patience be your right hand guide...and if questions pop-up along the way, I will be as close as your computer to help!

Special thanks goes to Mr. John Cook, who so graciously looked and re-looked the whole webpage over for corrections that needed to be attended to! ......thank you John

...and let the project begin!