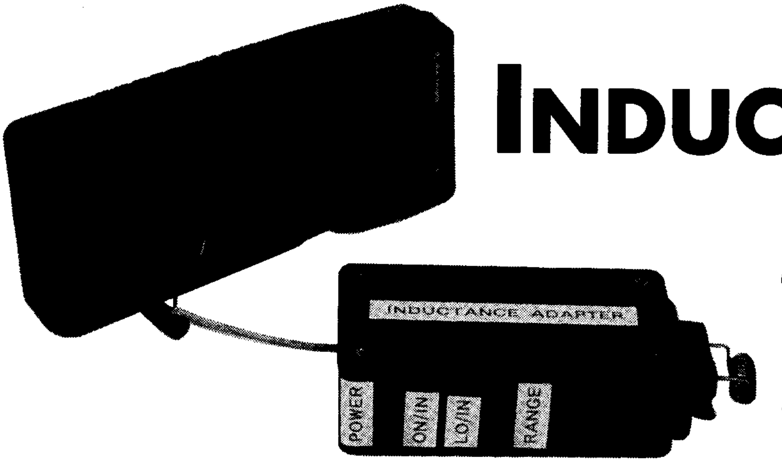

Inductance Meter Adapter

Measure inductance with this add-on circuit and an ordinary DMM.

BY MARC SPIWAK

An inductance meter could be a valuable test instrument for a hobbyist to own. However, few people own them because of the high price tags found on such instruments. That's about to change.

The *Inductance Meter Adapter* described in this article is a circuit that, when connected to digital multimeter (DMM), lets you measure low-value inductances. The project can be built for a couple of dollars, or less, depending on what parts are in your junk box. Or you can buy a kit of parts including a PC board from the source mentioned in the Parts List.

The range of the Adapter is actually quite impressive. It allows your DMM to measure inductance from 3 microhenries to 7 millihenries in two ranges. Basically, when the Adapter has an inductance connected at its input terminals, it develops a DC voltage at its output terminals that your DMM can measure and display as a calibrated inductance measurement. An analog multimeter cannot do the job because its input resistance is below the minimum 1-megohm required for the Adapter's proper operation.

The Adapter certainly can't replace a fine piece of test gear, but it's a handy little instrument for sorting unlabeled parts, screening out bad or out-of-spec parts, and matching inductors to one another. Another great feature of the Adapter is that you can have it working in less than an hour, with or without the kit.

Circuit Description. The schematic diagram for the Adapter is shown in Fig. 1. The circuit is powered from a 9-volt battery, B1, and a LM7805 regulator, IC2, provides a regulated 5-volt source for the rest of the circuit. Switch S2 turns power on and off.

The heart of the circuit is a single 74HC132 quad Schmitt NAND-gate IC1. The first gate in the package, IC1-a, is configured as an oscillator whose frequency is determined by the RC components (including trimmers R6 and R7) in its feedback loop; IC1-b is a buffer/inverter. One input of both IC1-c and IC1-d is tied to +5 volts, with both sections configured as inverters. The square-wave output from IC1-b is fed to the pin-9 input of IC1-c, and pin 9 also connects to J1, one of the test-inductor input terminals.

When an inductor is connected across J1 and J2, the voltage input to IC1, pin 9 stays higher for a longer period, depending on the value of the inductor. With the output of IC1-c feeding IC1-d, the resulting average DC voltage across the output terminals (J3 and J4) is directly proportional to the unknown inductance. Potentiometers R6 and R7 calibrate the circuit for the high and low ranges, respectively, and potentiometer R1 sets the zero point on the DMM. When the circuit is calibrated with a known

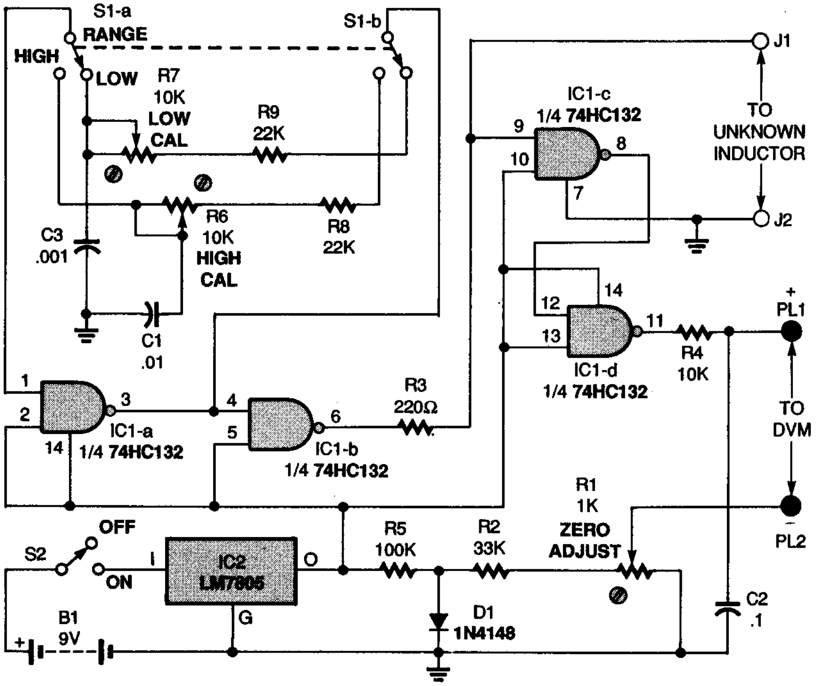

Fig. 1. With this simple Adapter circuit and an ordinary DMM you can measure inductances from 3 μH to 5 mH.

inductance and properly zeroed out, the output voltage can represent inductance. Switch S1 selects the Adapter's range; the circuit will measure from 3 μH to 500 μH in the LOW range and from 100 μH to 5 mH in the HIGH range.

Construction. The Adapter circuit is simple enough to build using point-to-point wiring. However, if you prefer to use a PC board, you can etch your own from the foil pattern shown in Fig. 2, or order the kit from the source mentioned in the Parts List.

If you're using a PC board, refer to the parts-placement diagram shown in Fig. 3 when building the circuit. Begin by mounting a socket for IC1; be sure to match the orientation shown. Install the resistors and capacitors.

Solder the switches to the board. Then go on to mount the diode and potentiometers, making sure they are oriented properly. Install wire-jumper JU1 and a battery-snap connector for B1. Then solder insulated wire leads for the connections to J1, J2, PL1, and PL2. Keep the leads to J1 and J2 as short as possible, as they could affect the readings given by the unit. The leads for PL1 and PL2, on the other hand, should be somewhat long; that will make it easier to connect the Adapter to a DMM. Solder banana-plugs PL1 and PL2 to the leads. To complete on-board assembly, mount IC2 and insert IC1 into its socket, being sure to check the polarity of both.

The next step is to prepare the en-

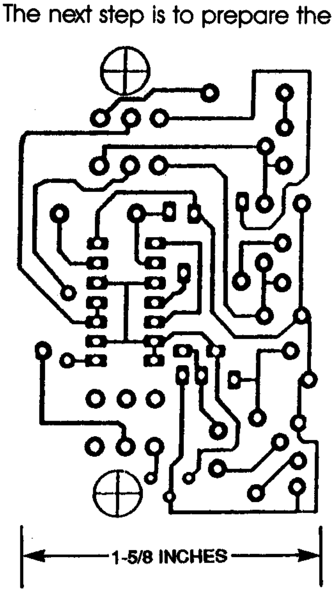

Fig 2. If you'd like to etch your own PC board for the Adapter, use this foil pattern.

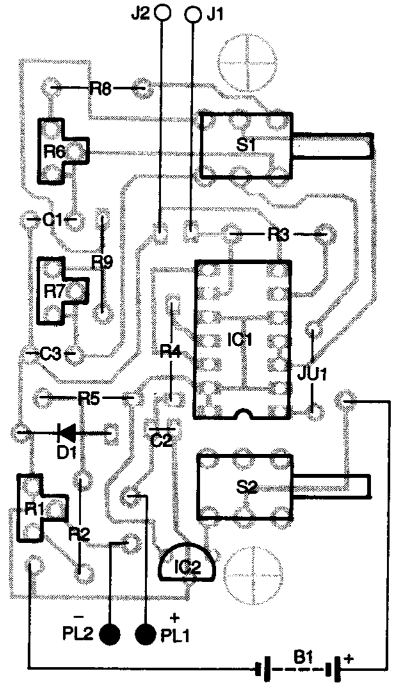

Fig 3. Use this parts-placement diagram as a guide when assembling the Inductance Meter Adapter.

closure for the Adapter. Any enclosure of a suitable size can be used. Mount jacks for J1 and J2 to the case first. To make it easier to temporarily connect unknown inductors to the circuit, use spring-loaded terminals for J1 and J2 (they come with the kit). Drill holes in the case to accommodate the switches and the PL1 and PL2 wires. Mount the PC board.

Calibration and Use. After checking your work, connect a 9-volt battery to the battery clip and set S2 to ON. To calibrate the circuit, you'll need a couple of inductors with known values, preferably values equal to or near 400 μH and 5 mH. If possible, measure the value of the inductors you use with an accurate meter to determine their exact values. Connect output leads PL1 and PL2 to a voltmeter set to the 200-millivolt scale and place a short piece of wire directly across terminals J1 and J2. Set range switch S1 to LOW and adjust R1 for a reading of zero on the meter.

Now set the DMM to the 2-volt range. Remove the wire from J1 and J2 and connect the 400-μH inductor (or whatever value you have that's closest). Adjust R7 so that the voltage displayed on the DMM is the absolute value of the inductance. For example, a 400-μH inductor will give a reading of 0.400 volt. Now connect the 5-mH inductor and set the range switch to high. Adjust R6 so that the voltage displayed on the meter is the same as the inductance value. A 5-mH inductor should read 0.500 volt on the DMM.

To use the Adapter, connect it to your DMM and set it to the 2-volt range. In the low range you can measure from 3 to 500 μH, and the display will read between 0.003 and 0.500. Remember to disregard the decimal point. In the high range, measure from 100 μH to 5 mH and the display will read from 0.001 to 0.500. ■

PARTS LIST FOR THE INDUCTANCE METER ADAPTER

SEMICONDUCTORS

IC1—74HC132 quad Schmitt trigger NAND gate, integrated circuit
IC2—LM7805 positive 5-volt regulator, integrated circuit
D1—1N4148 diode

RESISTORS

(All fixed resistors are ¼-watt, 5%.)
R1—1000-ohm trimmer potentiometer
R2—33,000-ohm
R3—220-ohm
R4—10,000-ohm
R5—100,000-ohm
R6, R7—10,000-ohm trimmer potentiometer
R8, R9—22,000-ohm

CAPACITORS

C1—0.01-μF, monolithic
C2—0.1-μF, monolithic
C3—0.001-μF, monolithic

ADDITIONAL PARTS AND MATERIALS

S1—DPDT switch, PC-mount
S2—SPDT switch, PC-mount
J1, J2—Spring-loaded terminal
PL1, PL2—Banana plug
B1—9-volt alkaline battery
Printed-circuit materials, project enclosure, battery connector, 400-μH and 5-mH (or similar-value) calibration inductors, wire, solder, hardware, etc.

Note: The following is available from Marlin P. Jones & Associates, Inc. (P.O. Box 12685, Lake Park, FL 33403-0685; Tel. 800-432-9937): Inductance Meter Adapter kit (including everything except a battery, case, and banana plugs)—$14.95 plus $4.50 shipping and handling. Florida residents please add appropriate sales tax.