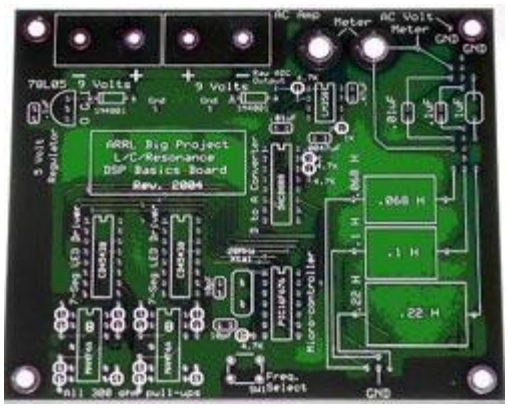
# New ETP Activity Board a Treasure Trove of Teaching Possibilities

The "L/C/R" activity board, created by former ARRL Education & Technology Coordinator Mark Spencer, WA8SME, will allow students to explore many facets of alternating current and RF theory. The board will help students to unravel the mysteries of capacitive and inductive reactance, verify reactance formulas using actual data taken from the activity board, measure the resonant frequency of either series or parallel L/C circuits and then put it all together to explore the relationship between capacitive and inductive reactance and resonance.

The L/C/R activity board connected to an OptaScope[1] digital oscilloscope and a meter.



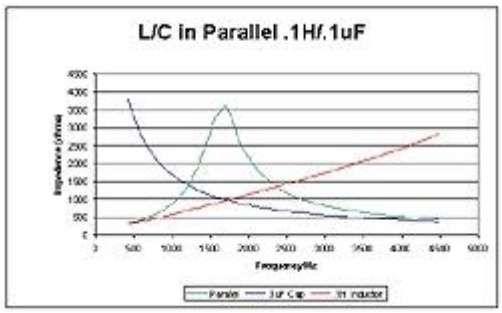

The "unpopulated" L/C/R activity board.

Because the board uses a microcontroller and a digital-to-analog converter (DAC) to generate the ac waveform used to explore L/C circuits, there is an additional learning opportunity: digital signal processing (DSP) fundamentals. This facet of the board leads to exploration of root mean square (RMS) voltage and current and the mathematical derivation of RMS.

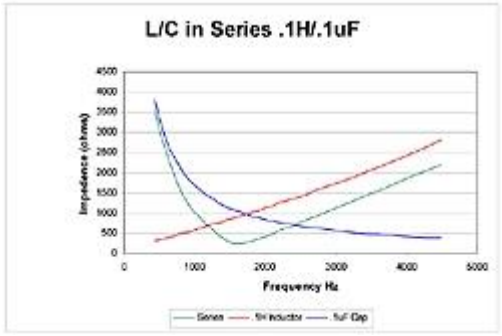
Given the level of mathematics involved, the activity board is intended primarily for high school physics or second-year algebra students. However, anyone studying for the General or Amateur Extra Class license examinations could benefit from the learning opportunities the L/C/R activity board affords.

Students use mathematical, graphing, graphing calculator, spreadsheet and critical-thinking skills to make sense of the data collected during the various board activities. Students can use graphing calculator curve-fitting techniques to verify the reactance formulas. Also, spreadsheet software helps students visualize the raw voltage and current data measurements.

During the DSP activities, students use the OptaScope digital oscilloscope to see the stair-step waveform generated by the computer and the DAC on one channel, and the smoothed waveform exiting a simple filter on the other.




Spreadsheet-generated graphs demonstrating parallel . . .




and series resonance curves.

Visualizing a waveform in discrete slices helps students understand what happens during DSP. The can students explore the mathematical concepts that are the foundation of root mean square by using the amplitude of each slice to computer-average and RMS voltages.

The L/C/R activity board kit includes the circuit board, the parts to populate it, plus documentation to support the board's construction and use. As with previous activity boards, this one is designed to be constructed by students under adult supervision.

Activity board kits are available to interested and qualified schools through generous donations to the Education & Technology Program Fund. To qualify for one of these kits, interested schools need to write the ARRL Education Services Department on school letterhead and verify that:

(1) the lead teacher has reviewed Unit 9 in the Education & Technology Program Curriculum Guide, (www.arrl.org/curriculum-guide) that supports the L/C/R activity board,
(2) the curriculum and the board fit into the school's curriculum and the school intends to use the board as an instructional activity, and
(3) the school has the capability to build the activity board (preferably, students will do the actual construction).

Send requests to ARRL Education Services Department, 225 Main St, Newington, CT 06111.

For schools wishing to construct their own L/C/R activity boards; all documentation, diagrams, a parts list, and software in hard copy are available. For more information about the ARRL Education and Technology Program, contact the ARRL Education Services Department, etp@arrl.org.

To learn more about how to support the ARRL Education and Technology Program, contact ARRL Chief Development Officer Mary Hobart, K1MMH, 860-594-0397; mhobart@arrl.org

Notes:

1. Optascope can be found at the parallax website; www.parallax.com/tabid/768/txtSearch/oscilloscope/List/0/SortField/4/Default.aspx