Inductors in Series and Parallel

Information found in Lesson 1420-1. Basic Schematics, Pictorials, Formulas and Wiring Diagrams on a Trainer
Things to Remember

• Inductors come in many forms. They can look similar to other components, such as a resistor, capacitor, transformer. (Inductors have two leads unless center tapped)

• Inductors do not have stated polarities.
• Placement of the inductors closely together on the breadboard is not as important as maintaining a clean easy to follow circuit.

• Make sure the inductors are connected correctly. This may mean using jumper wires to make clean, easy to follow connections and test points / posts.
Inductors currently in use
100mh Inductor, looks similar to a Capacitor
470mh Inductor, looks similar to a Resistor
470mh Inductor, looks similar to a tantalum Cap, except for the color dots
Experiment 1, Inductors connected in Series

$L_1$ 100mH $L_2$ 55mH $L_3$ 100mH
Formula to Calculate Total Series Inductance

$$L_T = L_1 + L_2 + L_3 + \ldots + L_n$$
Example using the schematic values

\[ c \]

\[ 100\text{mH} + 55\text{mH} + 100\text{mH} = 255\text{mH} \]
Fig 2 in 1420-1 to measure $X_L$

Terminal 1

30V AC Source

Terminal 3

Do not use terminal 2

$E_L$

$E_R$

$R \ 100\Omega$

Pot

1

2

3
Inductance also can be calculated with the following formula if you have the value of $X_L$.

$$L_T = 2\pi f X_{CT}$$
Wiring Diagram, Two Inductors in Series to measure $X_L$
Three Inductors in Parallel, Schematic

\[ L_1 \]
\[ 100 \text{ mh} \]

\[ L_2 \]
\[ 55 \text{ mh} \]

\[ L_3 \]
\[ 100 \text{ mh} \]

\[ L_T \]
Reciprocal Formula

\[ L_T = \frac{1}{1 + \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} \ldots + \frac{1}{L_n}} \]
Example using the schematic values

\[
\frac{1}{100\, m} + \frac{1}{100\, m} + \frac{1}{55\, m} = \frac{1}{38.18} \approx 26\, m
\]
• You can also take the common values and divide by the amount of common inductors to get the total of the common parallel inductors. You would then have two values to work with, in this circuit, to calculate the total inductance.
Example:

- \[ 100 \times 10^{-3} / 2 = 50 \times 10^{-3} \]

\[
\frac{L_1 \times L_2}{L_1 + L_2} = \frac{55 \times 50}{55 + 50} = \frac{2.75m}{105m} = 26.190mh
\]
Inductance also can be calculated with the following formula if you have the value of $X_L$.

$$L_T = 2\pi f X_{CT}$$
• In 1420-1, the author discusses mathematically how to prove $Z_T$ with $X_L$ and then $L$. Circuit in Fig 8 works to measure $X_L$ to determine $L_T$.

• He wanted to prove mathematically the circuit to measure $X_L$ to determine $L_T$ works.
• This circuit would not be used by technicians in real life. Technicians would not calculate LT using the method described in the Introduction for Experiment 2.

• The circuits are there to get you used to working with the components and to learn their characteristics.
Fig 8 in 1420-1 Two Inductors in Parallel, to measure XL and verifying $L_T$
Circuit to measure $L_T$, Fig 10 in 1420
Questions?
The End

Developed and Produced by the Instructors in the CIE Instruction Department.

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