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# DESIGN OF CRITICAL DAMPING NETWORKS FOR RELAY COILS

Robert C. Acker and Warren C. Struven

April 4, 1955

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# DESIGN OF CRITICAL DAMPING NETWORKS FOR RELAY COILS

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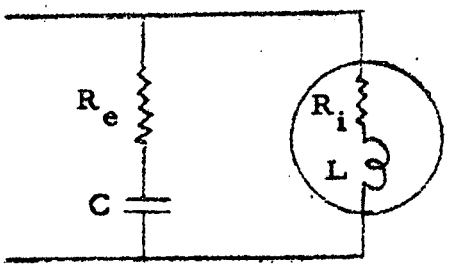
Frequently in electronic equipment it is necessary to eliminate a voltage transient produced upon interrupting the current in a relay coil or solenoid. The procedure outlined below will, in the ideal case, critically damp the offending coil, making it appear to be a constant resistance at all frequencies. In the practical case it can be expected to give results correct to ten or twenty percent, which is adequate to reduce the voltage surge to a few percent of the normal operating value; errors are due mainly to the change in resistance and inductance of the coil with change in frequency and armature position.

Measure R and L or coil (preferably on 1-kc bridge).




Let $\omega_o L = R$;

$\omega_o = R/L$;

let $1/\omega_o C = R$;

then $C = 1/\omega_o R = L/R^2$. (1)

$R_{external} = R_{internal} = R$.

Equation (1) has been plotted as a nomograph which may be solved with a straightedge.

## Illustrative Examples

| | |
|---|---|
| W. E. 275C Mercury Relay | R = 4000 ohms |
| Both Coils in Series | L = 6.4 henrys |
| | $\omega_o$ = 625 rad/sec |
| | C ≈ 0.4 μf |
| Allied B06 D42 | R = 5000Ω |
| 112 V dc Relay | L = 9.3 to 9.5 henrys |
| | $\omega_o$ ≈ 585 rad/sec |
| | C ≈ 0.38 μf |

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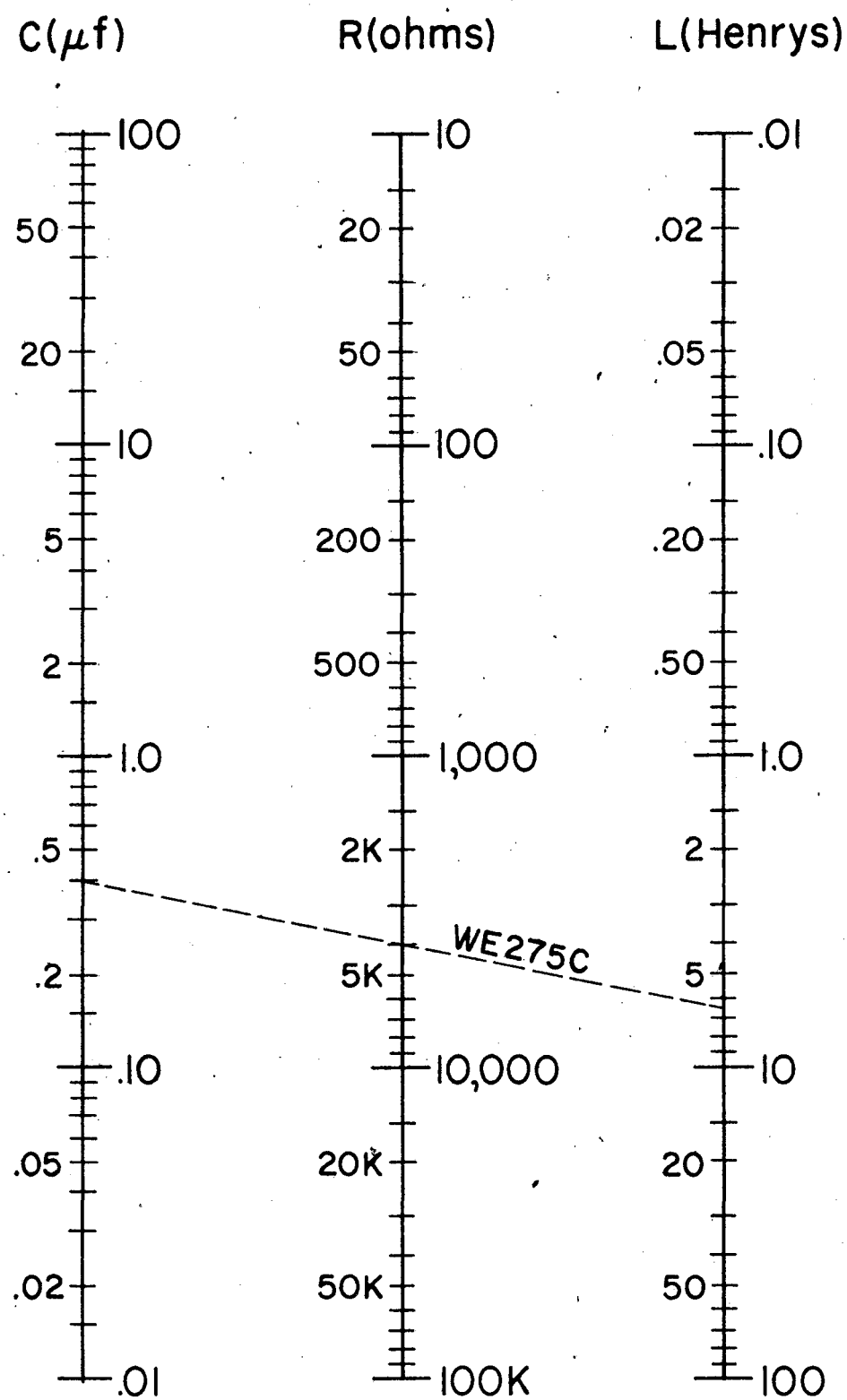


Fig. 1. Nomograph for relation between capacity, resistance, and inductance.

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