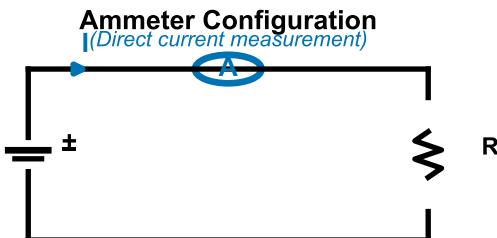


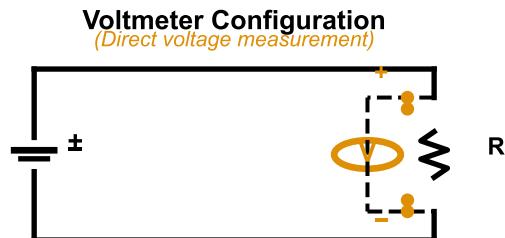
Circuit Complementarity: The Ammeter/Voltmeter Constraint

A



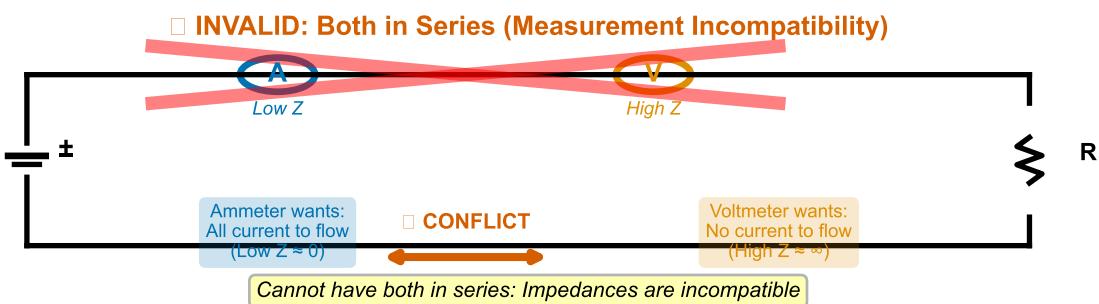
- Directly Measured: I (current)
- Calculated: $V = I \times R$ (voltage)
- Ammeter: Low Impedance ($\approx 0 \Omega$)

B



- Directly Measured: V (voltage)
- Calculated: $I = V / R$ (current)
- Voltmeter: High Impedance ($\approx \infty \Omega$)

C



D

Mapping: Circuit \leftrightarrow Dual-Membrane

Electrical Circuit		Dual-Membrane
Ammeter (measures I)		Front face (observable)
Voltmeter (measures V)		Back face (hidden)
Ohm's law: $V = IR$		Conjugate: Back = T(Front)
Switch ammeter \rightarrow voltmeter		Switch observable face
Cannot measure both		Complementarity
Low Z vs High Z		Categorical orthogonality
Same fundamental constraint: Measurement apparatus determines observable		

E

Dual-Membrane as Electrical Circuit

