# Capacitor WIZARD®

IN-CIRCUIT ESR METER

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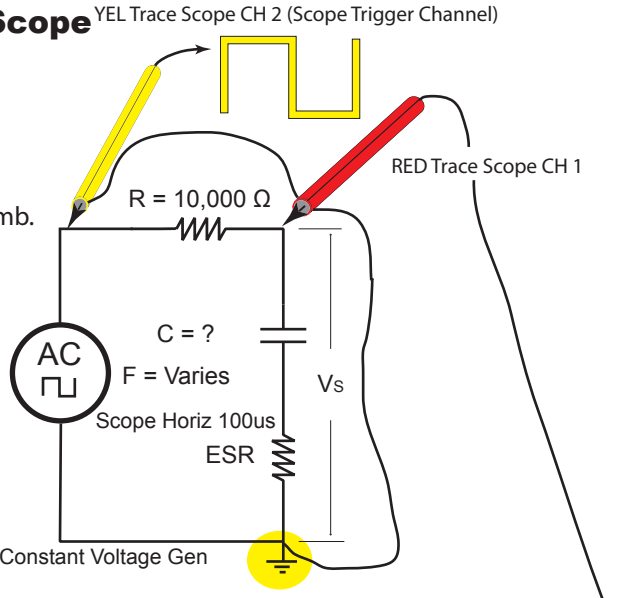
# Basic Capacitance Measurement Technique

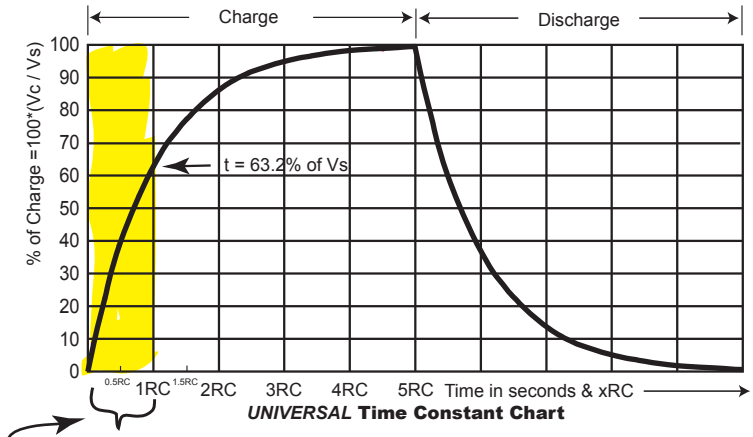
Isolate the safety grounds on the power plugs of both the oscilloscope and the waveform generator

Use the "Time Constant" formula **t = RC** to solve for capacitance
Capacitance in FARADS, time in SECONDS and resistance in OHMS

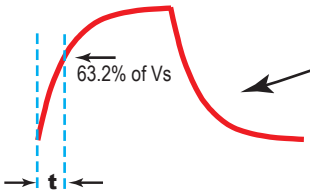
## Compute Capacitance with Sq Wave Gen and Scope

a) Demonstrate how to measure capacitance with this setup
b) Measure "time" in seconds at 63.2% of waveform height
c) Place time and resistance in formula - pop capacitance
d) Verify capacitance with Fluke 87-V
e) Note the use of low frequencies: 340 Hz, 80Hz, 0.100Hz
f) Other capacitor values you'll have to hunt for the correct Freq/Res comb.
g) For CONSTANT VOLTAGE **maintain a square wave** on CH 2
h) ESR does not upset this measurement ***unless it is a large % of R***
i) **Vs can be any voltage!** Adjust Vs or scope for 10 scope div.




**C = t / R** (for 1 time constant)
"t" is Measured from 0 to 63.2% of Vs




Time Interval to Measure (1 "time constant")

Place a 0.015uf capacitor in the test circuit.
Adjust the scope horiz and vertical & waveform gen until a "tooth" pattern is observed.
Measure the TIME in SECONDS from the beginning of the "tooth" waveform to 63.2% of Vs (1 time constant).

t = 0.000150S **C = t / R** (for 1 time constant) = 0.000150s / 10,000 Ω = 0.0000000150F = 0.0150uf

Place a 0.100uf capacitor in the test circuit. Re-adjust Frequency and vertical gain for "Tooth" pattern.

t = 0.00100S **C = t / R** (for 1 time constant) = 0.00100s / 10,000 Ω = 0.000000105F = 0.100uf

Place a 180uf capacitor in the test circuit. Reduce R to 5000 Ω. Re-adjust Frequency and vertical gain for "Tooth" pattern.

t = 0.900S **C = t / R** (for 1 time constant) = 0.900s / 5,000 Ω = 0.000180F = 180uf

## Examples Equipment Setup:

Scope Settings for: 0.015uf
Horiz: 500us 100us
CH1: DC X1 1V/div
CH2: DC X1 5V/div Trigger
R = 10,000 Ω

Waveform Gen: State 2
Output Square High Z
F = 340 Hz
VPPgen = 9.800
Acquire Mode: Average 16
Acquire Length: 1K

Scope Settings for: 0.10uf
Horiz: 2ms 500us
CH1: DC X1 1V/div
CH2: DC X1 5V/div Trigger
R = 10,000 Ω

Waveform Gen: State 3
Output Square High Z
F = 80 Hz
VPPgen = 9.800

Scope Settings for: 180uf
Horiz: 500ms
CH1: DC X1 200mv//div
CH2: DC X1 1V/div Trigger
R = 5,000 Ω

Waveform Gen: State 4
Output Square High Z
F = 0.100 Hz
VPPgen = 3.400
Acquire mode: Sample Acquire Length: 10M