**Measuring ACV**

- 707.106 mVAC
- "Terminals" switch in "FRONT"
- Note measurement indicates only the ac portion of signal

**Measuring DCV**

- 1.000000 kΩ
- "Terminals" switch in "FRONT"
- Note measurement indicates only the dc portion of signal

**Measuring CURRENT**

- 1.000000 ADC
- "Terminals" switch in "FRONT"
- Note measurement indicates only the ac portion of signal

**Measuring Resistance**

- Two-Wire Technique

  - Turn off "Null"
  - "Terminals" switch in "FRONT"
  - Note measurement indicates only the ac portion of signal

- Four-Wire Technique

  - Turn off "Null"
  - "Terminals" switch in "FRONT"
  - Note measurement indicates only the dc portion of signal

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**RMS: Root-Mean-Square**

- RMS is a measure of a signal’s average power. Instantaneous power delivered to a resistor is: \( P = \frac{|v(t)|^2}{R} \). To get average power, integrate and divide by the period:

\[
P_{avg} = \frac{1}{T} \int_{t_0}^{t_0+T} \frac{|v(t)|^2}{R} \, dt = \frac{V_{rms}^2}{R}
\]

- Solving for \( V_{rms} \):

\[
V_{rms} = \sqrt{\frac{P_{avg} R}{T}} = \sqrt{\frac{1}{T} \int_{t_0}^{t_0+T} \frac{|v(t)|^2}{R} \, dt}
\]

- An AC voltage with a given RMS value has the same heating (power) effect as a DC voltage with that same value.

- All the following voltage waveforms have the same RMS value, and should indicate 1.000 VAC on an rms meter: Sine, Triangle, Square, DC
Integrating A/D

1) Converts voltage to time to digits
2) Integrator is a line-frequency filter
3) Integrator is a low-pass filter

Comparator

CPU

Vx(t)

Integrator

C

T

0

R1

R2

C

T

0

-1

R1

Vx(t)dt

C

T

0

-1

i(t)dt

Vout=

T

0

T+To

Vx

= 1 volt

Vx

= 2 volts

Integrator:

T is fixed at one cycle of 50 Hz or 60 Hz to eliminate line noise; Vref is fixed; R, C and Time are all ratioed, so accuracy is excellent.

The DIGITAL MULTIMETER

Hints for Accurate Measurements:

- Measure as near full scale as possible
- Measure a RATIO rather than an absolute value