

AC DC kvíz

(Scope: DC/AC coupling; DMM: ACV, DCV)

AC : Alternating Current – **váltakozó** jel (AC voltage, AC current)

DC : Direct Current – **egyen** jel (DC voltage, DC current)

Periódikus jel ($T = 1/f$):

V_p : **peak** – **csúcs** érték

$$V_{pp} = V_{max} - V_{min}$$

V_{p-p} : **V_{pp}**: **peak-to-peak** – csúcstól-csúcsig vett érték

$$V_{rms} = \sqrt{\frac{1}{T} \int_0^T V^2(t) dt} = \sqrt{AVG(v^2)}$$

V_{rms} : **RMS** (root-mean-square) – **effektív** érték (négyzet-átlag négyzetgyöke)

- RMS (ac) – **true RMS**, DC komponens **nélküli** jel effektív értéke
- RMS (dc) – **totális** (a DC komponenssel **együtt** mért) effektív érték

$$total\ rms = RMS(dc) = \sqrt{(RMS(ac))^2 + (AVG)^2}$$

Scope:

$$RMS(dc) = \sqrt{\frac{\sum_{i=1}^n x_i^2}{n}}$$

V_{avg} : **AVG** (average, mean, DC component) – **átlag** érték (közép érték, a DC komponens)

$$V_{avg} = \frac{1}{T} \int_0^T V(t) dt$$

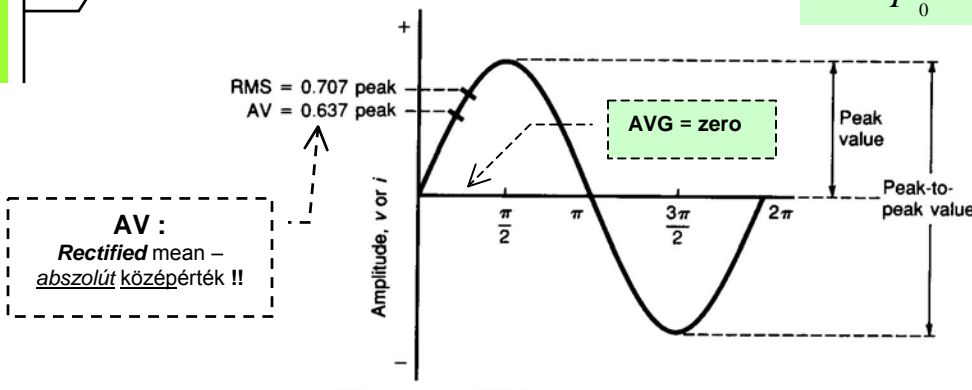
$$Average = \frac{\sum x_i}{n}$$

Scope
AC coupled

DMM
ACV
ac coupled
Max C.F. = 5

Scope
54622A/D
DC coupled

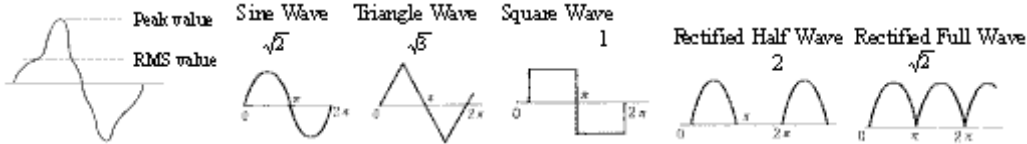
DMM
33401A
DCV



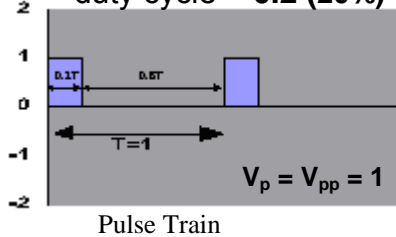
C.F. = V_p / V_{rms} : crest factor – „csúcs” tényező

$$\sqrt{2} \approx 1.41 \quad \sqrt{3} \approx 1.73$$

Crest Factor : Ratio of PEAK value respected to RMS value



duty cycle = 0.2 (20%)



$$total\ rms = RMS(dc) = \sqrt{\frac{1}{T} \int_0^{0.2T} 1^2 dt} = \sqrt{0.2} = 0.447$$

$$AVG = (0.2 \cdot T / T) \cdot 1 = 0.2$$

$$true\ rms = RMS(ac) = \sqrt{(\sqrt{0.2})^2 - (0.2)^2} = 0.4$$

$$C.F. = 1/0.4 = 2.5 \quad (? \text{ vagy } C.F. = 1/0.447 = 2.237 ?)$$

Utility / Output setup
High-Z



ARB gen
33220A

DC/AC coupling,

Quick Meas : **Average, RMS**



Scope
54622A/D

/ Note: Auto-scale → DC-coupled (!!)



DMM
33401A

Function : **ACV** (true rms), **DCV**

(Hiánypótlás után, méréssel ellenőrizzük az adatokat ...)

ARB gen f = 1 KHz	Scope AC-coupled ¹	DMM		Scope DC-coupled	
	RMS	ACV (ac coupled)	DCV	Average	RMS
Sine Vpp = 2 Offset = 1		0.707 = 1/√2	1		1.225
Sine Vpp = 2 Offset = zero					
Square Vpp = 2 Offset = 1 Duty Cycle: 0.5	1			1	
Square Vpp = 2 Offset = zero Duty Cycle: 0.5					
Square HiLevel = 1 LoLevel = zero Duty Cycle: 0.2	0.4	0.4	0.2*	0.2	0.447
Ramp Vpp = 2 Offset = zero Symmetry : 0.5	0.577 = 1/√3			0	
Ramp Vpp = 2 Offset = 1 Symmetry : 0.5					1.155
...					

¹ **Scope, AC-coupled** - **Average = zero** (!!)

*Why do I get [incorrect 34401A DCV measurements](#) on an AC signal? (The autoranging algorithm is **not perfect** when attempting to track a moving signal, so you should use fixed range under those circumstances.)