

KUSAM-MECO

An ISO 9001:2008 Company

**1000A AC TRUE RMS DIGITAL CLAMPMETER WITH
VFD, EF-DETECTION, AMPTIP FUNCTION FOR LOW CURRENT
MEASUREMENT & 3 PHASE ROTATION CHECK FUNCTION &
3 PHASE SEQUENCE INDICATION****MODEL KM 086****25 Functions 32 Ranges****NEW****Preliminary Data****SPECIAL FEATURES :**

- AmpTip™ low-current range calibrated at Jaw-tip for slim-conditions for accurate readings
- MAX/MIN/AVG Recording mode (Auto ranging)
- VFD-V & Hz for fundamental V/Hz of most Variable-Frequency-Drives
- Display Hold & Non-Contact EF-Detection (NCV)
- Back-lighted easy-to-read LCD display
- Fast 80ms Peak-RMS mode to capture in-rush currents
- Auto-ranging Relative mode with DC-Zero mode & 5ms Crest (Instantaneous Peak-Hold) mode
- 3-Phase Rotation-R for MAINS supply (Probe contact)
- 3-Phase Rotation-M (Hi-sensitivity mode) for Motors (Probe-contact)

GENERAL SPECIFICATIONS :

- * Sensing : AC; True RMS
- * Jaws Opening size & conductor diameter : 51mm Max.
- * Display : 3-5/6 digits 6000 counts
- * Update Rate : 5 per second nominal
- * Polarity : Automatic
- * Operating Temperature : -10°C to 50°C
- * Relative Humidity : Non condensing ($\leq 10^\circ\text{C}$) Maximum 90%R.H. at 10-30°C decreasing linearly to 75% R.H. at 30-40°C & 45% R.H. at 40-50°C
- * Altitude : Operating below 2000m; Storage below 12000m
- * Storage Temperature : -20°C ~ 60°C, < 80% R.H. (with battery removed)
- * Temperature Coefficient : Nominal 0.10 x (specified accuracy) / °C @ (-10°C — 18°C or 28°C — 50°C), or otherwise specified
- * Power Supply : Standard 1.5V AA Battery x 2
- * Power Consumption : typical 4.3mA
- * Low Battery : Below approx. 2.85V for Capacitance & Hz
Below approx. 2.5V for other functions
- * APO timing : Idle for 32 minutes
- * APO Consumption : typical 5 μA
- * Dimension : 258(L) x 94(W) x 44(H)mm
- * Weight : approx 312 gms.

SAFETY :

- Safety : Double insulation per UL/IEC/EN61010-1 Ed. 3.0, IEC/EN61010-2-033 Ed. 1.0, CAN/CSA C22.2 No. 61010-1 Ed. 3.0, IEC/EN61010-2-032 Ed. 3.0 & IEC/EN61010-031 Ed. 1.1
- Measurement Category : CAT III 1000V AND CAT IV 600V AC & DC
- E.M.C. : Meets EN61326-1 : 2006 (EN55022, EN61000-3-2, EN61000-3-3, EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11) :
ACA, DCA and DC+ACA Functions, in an RF field of 1V/m :
Total Accuracy = Specified Accuracy + 60 digits at around 200MHz-350MHz
DC μA and Ohm Functions, in an RF field of 1V/m : Total Accuracy = Specified Accuracy + 80 digits
Other Functions, in an RF field of 3V/m : Total Accuracy = Specified Accuracy + 20 digits
- Overload Protection :
Current & Hz functions via jaws : 1000ADC/AAC rms at <400Hz
Voltage & 3-Phase Rotation functions via terminals : 1100VDC/ VAC rms
Other functions via terminals : 1000VDC/ VAC rms
- Pollution Degree : 2
- Transient Protection : 8.0kV (1.2/50 μs surge)
- Rugged Fire retarded casing.
- LVD EN61010-2-032/EN61010-2-033 to CAT III 1000V & CAT IV 600V

ACCESSORIES :

Test leads set, Users Manual, Soft carrying pouch, Bkp60 banana plug K-type thermocouple, Alligator Clip set, BKB32 banana plug to type-K socket plug adaptor (for optional purchase)

All Specifications are subject to change without prior notice

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ELECTRICAL SPECIFICATIONS : KM 086

Accuracy is \pm (% of reading digits + number of digits) or otherwise specified, at 23°C \pm 5°C
Maximum Crest Factor <2.5:1 at full scale & <5:1 at half scale or otherwise specified, and with frequency spectrum not exceeding the specified frequency bandwidth for non-sinusoidal waveforms.

AMPTIP™ CLAMP-ON AC CURRENT

Range	Resolution	Accuracy ⁽¹⁾²⁾³⁾
40Hz ~ 100Hz		
60.00 A	0.1 A	$\pm(1.5\%rdg + 5dgts)$
100Hz ~ 400Hz		
60.00 A	0.1 A	$\pm(2.0\%rdg + 5dgts)$

¹⁾ Induced error from adjacent current-carrying conductor : < 0.02A/A

²⁾ Specified with Relative Zero Δ mode applied to offset the non-zero residual readings, if any

³⁾ Add 10d to the specified accuracy @ < 4A

REGULAR CLAMP-ON AC CURRENT

Range	Resolution	Accuracy ⁽¹⁾²⁾
40Hz ~ 100Hz		
60.00 A ³⁾	0.01 A	$\pm(1.8\%rdg + 5dgts)$
600.0 A	0.1 A	
1000 A ⁴⁾	1 A	
100Hz ~ 400Hz		
60.00 A ³⁾	0.01 A	$\pm(2.2\%rdg + 5dgts)$
600.0 A	0.1 A	
1000 A ⁴⁾	1 A	

¹⁾ Induced error from adjacent current-carrying conductor : < 0.05A/A

²⁾ Specified accuracy is for measurements made at the jaw center. When the conductor is not positioned at the jaw center, add 2% to specified accuracy for position errors.

³⁾ Add 10d to the specified accuracy @ < 6A

⁴⁾ Maximum Crest Factor < 1.4 : 1 at full scale & < 2.8 : 1 at half scale

DC μ A (Via Test Leads)

Range	Resolution	Accuracy
200.0 μ A	0.1 μ A	$\pm(1.0\%rdg + 5dgts)$
2000 μ A	0.1 μ A	

Burden Voltage : 3.5mV/ μ A

HZ LINE LEVEL FREQUENCY

Function	Sensitivity ¹⁾ (Sine RMS)	Range
600 V	50 V	5.00Hz~999.9Hz
1000 V		
60 A (AmpTip™)	20 A	40.00Hz~400.0Hz
60 A	20 A	40.00Hz~400.0Hz
600 A		
1000A		

Accuracy : $\pm(1\%rdg + 5dgts)$

¹⁾ DC-bias, if any, not more than 50% of Sine RMS.

TEMPERATURE

Range	Accuracy
-40.0°C ~ 99.9°C	1.0% ~ 0.8°C
100.0°C ~ 400°C	1.0% ~ 1°C
-40.0°F ~ 211.8°F	1.0% ~ 1.5°F
212°F ~ 752°F	1.0% ~ 2°F

K-type thermocouple range & accuracy not included

DIODE TESTER

Range	Resolution	Accuracy ¹⁾
2.000 V	1 mV	$\pm(1.5\%rdg + 5dgts)$

Test Current : 0.3mA typically Open Circuit Voltage : < 3.5VDC typically

AC VOLTAGE (with Digital Low-Pass Filter)

Range	Resolution	Accuracy
50Hz ~ 60Hz		
600.0 V	0.1 V	$\pm(0.8\%rdg + 5dgts)$
1000 V	1 V	
20Hz ~ 200Hz		
600.0 V	0.1 V	$\pm(1.5\%rdg + 5dgts)$
1000 V	1 V	
200Hz ~ 400Hz		
600.0 V	0.1 V	$\pm(10\%rdg + 5dgts)$
1000 V	1 V	

Input Impedance : 10M Ω , 100pF nominal

DC VOLTAGE

Range	Resolution	Accuracy
600.0 V	0.1 V	$\pm(0.8\%rdg + 5dgts)$
1000 V	1 V	

Input Impedance : 10M Ω , 100pF nominal

RESISTANCE

Range	Resolution	Accuracy
600.0 Ω	0.1 Ω	$\pm(1.0\%rdg + 5dgts)$
6.000K Ω	1 Ω	
60.00K Ω	10 Ω	

Open Circuit Voltage : 1.0VDC typical

CAPACITANCE

Range	Resolution	Accuracy ¹⁾
200.0 μ F	0.1 μ F	$\pm(2.0\%rdg + 4dgts)$
2500 μ F	1 μ F	

¹⁾ Accuracies with film capacitor or better

NON-CONTACT EF-DETECTION

Typical Voltage	Bar-Graph Indication
20V (tolerance : 10V~36V)	-
55V (tolerance : 23V~83V)	--
110V (tolerance : 59V~165V)	---
220V (tolerance : 124V~330V)	----
440V (tolerance : 250V~1000V)	-----

Indication : Bar-graph segments & audible beep tones proportional to the field strength

Detection Frequency : 50/60Hz

Detection Antenna : Inside the top side of the stationary jaw

Probe-Contact EF-Detection : For more precise indication of live wires, such as distinguishing between live and ground connections, use one single probe to test via terminal COM for direct EF-Detection with best sensitivity.

PEAK-RMS (ACV & ACA)

Response	
	80ms to > 90%

CREST (PEAK-HOLD)

Accuracy	
	Add 250 digits to specified accuracy for changes > 5ms

AUDIBLE CONTINUITY TESTER

Audible Threshold	Between 10 Ω and 250 Ω
Response Time	32ms approx.



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USE TRUE RMS WHEN MEASURING AC WAVEFORMS

The waveforms on today's AC power lines are anything but clean. Electronic equipment such as office computers, with their switching power supplies, produce harmonics that distort power-line waveforms. These distortions make measuring AC voltage inaccurate when you use an averaging DMM.

Average voltage measurements work fine when the signal you're measuring is a pure sine wave, but errors mount as the waveform distorts. By using true RMS measurements, however, you can measure the equivalent heating effect that a voltage produces, including the heating effects of harmonics. Table 1 shows the difference between measurements taken on averaging DMMs & those taken on true RMS DMMs. In each case, the measured signal's peak-to-peak value is 2V. Therefore, the peak value is 1V.

For a 1-V peak sine wave, the average & RMS values are both 0.707V. But when the input signal is no longer a sine wave, differences between the RMS values & the average reading values occur. Those errors are most prominent when you are measuring square waves & pulse waveforms, which are rich in harmonics.

Table 1. Average versus true RMS comparison of typical waveforms.

Waveform	Actual Pk-Pk	True RMS Reading	Average Reading	Reading Error
Sine Wave	2.000	0.707	0.707	0%
Triangle Wave	2.000	0.577	0.555	-3.8%
Square Wave	2.000	1.000	1.111	+11.1%
Pulse (25% duty Cycle)	2.000	0.433	0.416	-3.8%
Pulse (12.5% duty Cycle)	2.000	0.331	0.243	-26.5%
Pulse (6.25% duty Cycle)	2.000	0.242	0.130	-46.2%

One limitation to making true RMS measurements is crest factor, and you should consider crest factor when making AC measurements. Crest factor is the ratio of a waveform's peak ("crest") voltage to its RMS voltage. Table 2 shows the crest factors for ideal waveforms.

Table 2. Crest factors of typical waveforms.

Waveform	Crest Factor
DC	1.000
Square Wave	1.000
Sine Wave	1.414
Triangle Wave	1.732
Pulse (25% duty Cycle)	1.732
Pulse (12.5% duty Cycle)	2.646
Pulse (6.25% duty Cycle)	3.873

A DMM's specifications should tell you the maximum crest factor that the meter can handle while maintaining its measurement accuracy. True RMS meters can handle higher crest factors when a waveform's RMS voltage is in the middle of the meter's range setting. Typically, a DMM may tolerate a crest factor of 3 near the top of its scale but it might handle a crest factor of 5 that's in the middle of the range. Therefore, if you're measuring waveforms with high crest factors (greater than 3), you should adjust the DMM so the measured voltage is closest to the center of the measurement range.

Another limitation of true RMS is speed. If you're measuring relatively clean sine waves, then you can save time & money by using an averaging DMM. True RMS meters cost more than averaging meters and can take longer to produce measurements, especially when measuring millivolt-level AC signals. At those low levels, true RMS meters can take several seconds to stabilize a reading. Averaging meters won't leave you waiting.