KUSAM-MECO®

An ISO 9001:2008 Company

AC; AC+ DC TRUE RMS DIGITAL MULTIMETER WITH PC INTERFACE

26 FUNCTIONS ; 64 RANGES

Model KM 829

SPECIAL FEATURES :

- Beep-Jack Audible & Visible Input Warning
- Auto-Ranging
- Relative Zero Mode
- PC Interface Capability
- AutoCheck V-Ω; Auto-Ranging
- Crest (Instantaneous Peak Hold)
- T1-T2 differential Temperature readings.
- Data Hold

FEATURES :

- DC Voltage Basic Accuracy 0.08%
- AC; AC+DC True RMS Conversion Frequency Bandwidth upto 20kHz (V) & 1kHz (A)
- 4 Digit 10,000 counts large easy to read Backlight LCD display
- Fast Measurements, 5/sec; Fully Auto-Ranging
- Record Max/Min readings, Auto Ranging
- NCV & Probe-Contact EF-Detection
- dBm function with 20 selectable values
- Lo-Z volts to drain Ghost Voltages (AutoCheck Feature)
- Logic & Line Level Frequency
- Logic Level Duty Cycle Readings & Diode Tester
- Fast Audible Continuity
- Auto Power Off

ACCESSORIES :

Test lead pair, Battery installed, User Manual,
One BKP60 banana plug type-K Thermocouple.

OPTIONAL ACCESSORIES :

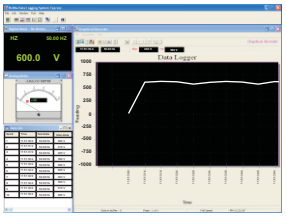
USB interface kit BU-82X; BMH-01 Magnetic Hanger; BKB32 banana plug to type-K socket plug adaptor. Current Clamp CA300, Current Clamp Adaptor CA500, CA1000, CA2000, High Voltage Probe PD-28.

Software CD

Fuse

Thermocouple

Magnetic Hanger



Software

Software Cable

GENERAL SPECIFICATIONS

- ✶ **Sensing :** AC, AC+DC True RMS
- ✶ **Display :**
  9999 Counts : ACV, DCV, Hz & nS
  6000 Counts : mV, µA, mA, A, Ohm & Capacitance
- ✶ **Update Rate :**
  Digital Display : 5 per second nominal;
  41 Segments Bar-graph : 60 per second max
- ✶ **Low Battery :** Below approx 7V
- ✶ **Operating Temperature :** 0°C to 45°C
- ✶ **Relative Humidity :** Max. 80% R.H. for Temperature up to 31°C decreasing linearly to 50% R.H. at 45°C
- ✶ **Pollution degree :** 2
- ✶ **Storage Temperature :** -20°C to 60°C, <80% R.H. (with battery removed)
- ✶ **Altitude :** Operating below 2000m
- ✶ **Temperature Coefficient :** nominal 0.15 x (specified accuracy)/°C @ (0°C ~ 18°C or 28°C ~ 45°C), or otherwise specified
- ✶ **Power Consumption :** 5mA typical
- ✶ **APO Timing :** Idle for 30 minutes
- ✶ **APO Consumption :** 50µA typical
- ✶ **Power Supply :** Single 9V battery
- ✶ **Weight :** Approx. 635gm with holster
- ✶ **Dimension :** 208(L) x 103(W) x 64.5(H) mm

SAFETY :

- Double insulation per IEC61010-1 2nd Ed., En61010-1 2nd Ed., UL61010-1 2nd Ed., & CAN/CSA C22.2 No. 61010.1-0.92 to Category IV 1000V AC & V DC.
- **Transient Protection :** 12 kV (1.2/50µs surge)
- **Terminals (to COM) Measurement Category :**
  V : Category IV 1000VAC & DC
  mAµA : Category IV 600VAC & 300VDC
  A : Category IV 600VAC & 500VDC
- **Overload Protection :**
  µA & mA : 1A/600VAC, IR 100kA, F Fuse
  A : 10A/600VAC , IR 100kA, F Fuse
  V : 1050Vrms, 1450Vpeak
  mV,Ω & Others : 600VDC & VAC rms
- **EMC :** 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)
  In an RF field of 3V/m :
  Capacitance function is not specified
  Other function ranges :
  Total Accuracy = Specified Accu. + 100 dgts
  Performance above 3V/m is not specified.
- Rugged fire retarded casing with battery access door
- Replaceable protective holster with probe-holders & Tilt-stand.
- 600V (Ohm, Capacitance & all other Functions) Input protection.
- 600V High Breaking Capacity fuses protection on Current inputs.
- LVD meets EN61010-1 CAT IV 1kV.

All Specifications are subject to change without prior notice

Marketed By: **MICRODYNE SYSTEMS** **Website: www.microdynesystems.in**

No 81, 1st Floor, 33rd Cross, Next to IDBI Bank, Juganahalli, Dr. Rajkumar Road, Rajajinagar 2nd Block, Bangalore-560010.
Ph: 91-80-23324539/ 23329219, 09341227857, Email:microdynesystems@gmail.com; microdyne@vsnl.net

ELECTRICAL SPECIFICATIONS : KM 829

Accuracy is (% readings digits + number of digits) or otherwise specified, at 23°C ± 5°C & less than 75% relative humidity.True RMS Voltage & Current accuracies are specified from 10% to 100% of range or otherwise specified. Maximum Crest Factor < 3:1 at full scale & <6:1 at half scale, and with frequency components within the specified frequency bandwidth for non-sinusoidal waveforms.

AC & AC+ DC VOLTAGE

Range	Resolution	Accuracy
50Hz ~ 60Hz		
60.00 mV	0.01 mV	±(0.5% rdg + 3 dgts)
600.0 mV	0.1 mV	
9.999 V	1 mV	
99.99 V	10 mV	
999.9 V	100 mV	
40Hz ~ 500Hz		
60.00 mV	0.01 mV	±(0.8% rdg + 4 dgts)
600.0 mV	0.1 mV	
9.999 V	1 mV	±(1.0% rdg + 4 dgts)
99.99 V	10 mV	
999.9 V	100 mV	±(2.0% rdg + 4 dgts)
500Hz ~ 1kHz		
60.00 mV	0.01 mV	±(2.0% rdg + 3 dgts)
600.0 mV	0.1 mV	
9.999 V	1 mV	±(1.0% rdg + 4 dgts)
99.99 V	10 mV	
999.9 V	100 mV	±(2.0% rdg + 4 dgts)
1kHz ~ 3kHz		
60.00 mV	0.01 mV	±(2% rdg + 3 dgts)
600.0 mV	0.1 mV	
9.999 V	1 mV	±(3.0% rdg + 4 dgts)
99.99 V	10 mV	
999.9 V	100 mV	
3kHz ~ 20kHz		
60.00 mV[1)]	0.01 mV	±(2% rdg + 3 dgts)
600.0 mV[1)]	0.1 mV	
9.999 V	1 mV	3dB
99.99 V	10 mV	3dB
999.9 V	100 mV	Unspec'd

[1)] Specified from 30% to 100% of range.

CMRR : > 60dB @ DC to 60Hz, Rs=1KΩ

Input Impedance : 10MΩ, 50pF nominal (80pF nominal for 600mV range)

Residual reading less than 5 digits with test leads shorted.

DC VOLTAGE

Range	Resolution	Accuracy
60.00 mV	0.01 mV	±(0.12%rdg + 2dgts)
600.0 mV	0.1 mV	±(0.06%rdg + 2dgts)
9.999 V	1 mV	±(0.08%rdg + 2dgts)
99.99 V	10 mV	
999.9 V	100 mV	

NMRR : >60dB @ 50/60Hz

CMRR : >110dB @ DC 50/60Hz, Rs=1KΩ

Input Impedance : 10MΩ, 50pF nominal (80pF nominal for 600mV range)

AC & AC+ DC CURRENT

Range	Resolution	Accuracy	Burden Voltage
50Hz ~ 60Hz			
600.0 μA	0.1 μA	±(0.6%rdg + 3dgts)	0.08mV / μA
6000 μA	1 μA		
60.00 mA	0.01 mA		2.1mV / mA
600.0 mA	0.1 mA	±(1.0%rdg + 3dgts)	
6.000 A	0.001 A	±(0.8%rdg + 6dgts)	0.02V / A
10.00 A	0.01 A		
40Hz ~ 1kHz			
600.0 μA	0.1 μA	±(0.8%rdg + 4dgts)	0.08mV / μA
6000 μA	1 μA		
60.00 mA	0.01 mA		2.1mV / mA
600.0 mA	0.1 mA	±(1.0%rdg + 4dgts)	
6.000 A	0.001 A	±(0.8%rdg + 6dgts)	0.02V / A
10.00 A	0.01 A		

10A continuous, > 10A to 20A for 30 second max with 5 minutes cool down interval

DC CURRENT

Range	Resolution	Accuracy	Burden Voltage
600.0 μA	0.1 μA	±(0.2% rdg + 4 dgts)	0.08mV / μA
6000 μA	1 μA		
60.00 mA	0.01 mA		1.5mV / mA
600.0 mA	0.1 mA		
6.000 A	0.001 A		0.04V / A
10.00 A	0.01 A		

10A continuous, > 10A to 20A for 30 second max with 5 minutes cool down interval

CAPACITANCE

Range	Accuracy [1)]
60.00nF, 600.0nF	0.8% + 3d
6.000μF	1.0% + 3d
60.00μF	2.0% + 3d
600.0μF [2)]	3.5% + 5d
6.000mF [2)]	5.0% + 5d
25.00mF [2)]	6.5% + 5d

[1)] Accuracies with film capacitor or better

[2)] In manual-ranging mode, measurements not specified below 50.0μF, 0.54mF and 5.4mF for 600.0μF, 6.000mF and 25.00mF ranges respectively.

RESISTANCE (OHMS)

Range	Resolution	Accuracy
600.0 Ω	0.1 Ω	±(0.1%rdg + 3dgts)
6.000 kΩ	0.001 kΩ	
60.00 kΩ	0.01 kΩ	
600.0 kΩ	0.1 kΩ	
6.000 MΩ	0.001 MΩ	±(0.4%rdg + 3dgts)
60.00 MΩ	0.01 MΩ	±(1.5%rdg + 5dgts)

Open Circuit Voltage : < 1.2VDC (<1.0VDC for 60MΩ range)

ELECTRICAL SPECIFICATIONS : KM 829

AUTOCHECK (DCV)

Range	Resolution	Accuracy
50Hz ~ 60Hz		
9.999 V	0.001 V	±(0.5%rdg + 3dgts)
99.99 V	0.01 V	
999.9 V	1 V	

Lo-Z DCV Threshold : >+1.5 VDC or < -1.0VDC nominal
Lo-Z DCV Input Impedance : Intially approx. 3.0kΩ,
165pF nominal; Impedance increases abruptly within a fraction of a second as display voltage is above 50V (typical).
Ended up impedances vs display voltages typically are:
18kΩ @ 100V 125kΩ @ 300V
320kΩ @ 600V 500kΩ @ 1000V

AUTOCHECK (ACV)

Range [1]	Resolution	Accuracy
50Hz ~ 60Hz		
9.999 V	0.001 V	±(1.0%rdg + 4dgts)
99.99 V	0.01 V	
999.9 V	1 V	

Lo-Z ACV Threshold : >3VAC (50/60Hz)nominal
Lo-Z ACV Input Impedance : Intially approx. 3.0kΩ,
150pF nominal Impedance increases abruptly within a fraction of a second as display voltage is above 50V (typical). Ended up impedances vs display voltages typically are:
18kΩ @100V 125kΩ @300V
320kΩ @600V 460kΩ @1000V

AUTOCHECK (RESISTANCE)

Range	Resolution	Accuracy
600.0 Ω	0.1 Ω	±(0.5%rdg + 4dgts)
6.000 kΩ	0.001 kΩ	
60.00 kΩ	0.01 kΩ	
600.0 kΩ	0.1 kΩ	
6.000 MΩ	0.001 MΩ	±(0.8%rdg + 3dgts)
60.00 MΩ	0.01 MΩ	±(2.0%rdg + 5dgts)

Open Circuit Voltage : < 1.2VDC (<1.0VDC for 60MΩ range)

CONDUCTANCE

Range	Resolution	Accuracy
99.99nS	0.01 nS	±(0.8%rdg + 10dgts)

Open Circuit Voltage : < 1.2VDC (<1.0VDC for 60MΩ range)

AUDIBLE CONTINUITY TESTER

Audible threshold	Between 20Ω and 300Ω
Response time	< 100μs

dBm

At 600Ω, -11.76 dBm to 54.25 dBm,
Accuracy : ± 0.25dB + 2d (@40Hz -- 20kHz)
Input Impedance : 10MΩ, 50pF nominal
Selectable reference impedance of 4, 8, 16, 32, 50, 75, 93, 110, 125, 135, 150, 200, 250, 300, 500, 600, 800, 900, 1000, 1200Ω.

LINE LEVEL FREQUENCY (Hz)

Function Range	Frequency	Sensitivity (sine Rms)
AC 60.00mV	15.00 ~ 50.00kHz	40mV
AC 600.0mV		60mV
AC 9.999V	15.00 ~ 10.00kHz	2.5V
AC 99.99V		25V
AC 999.9V		100V
AC 600.0μA	15.00 ~ 3.000kHz	45μA
AC 6000μA		600μA
AC 60.00mA		40mA
AC 600.0mA		60mA
AC 6.000A		4A
AC 10.00A		6A

Accuracy : 0.04% + 4d

NON-CONTACT EF-DETECTION

Typical Voltage	Bar Graph Indication
20V (tolerance : 10V ~ 36V)	—
55V (tolerance : 23V ~ 83V)	— —
100V (tolerance : 59V ~ 165V)	— — —
220V (tolerance : 124V ~ 330V)	— — — —
440V (tolerance : > 250V)	— — — — —

Indication : Bar graph segments & audible beep tones proportional to the field strength.
Detection Frequency : 50/60 Hz
Detection Antenna : Top end of the meter
Probe-Contact EF-Detection : For more precise indication of live wires, such as distinguishing between live and groundconnections, use the Red(+) test measurements.

LOGIC LEVEL FREQUENCY (Hz) & DUTY CYCLE (D%)

@DCmV Function	Range	Accuracy [1]
Frequency	5.00Hz ~ 1.000MHz	±(0.004%rdg + 4dgts)
Duty Cycle	0.00% ~ 100.0%	±(3d/kHz + 2d [2])

[1] **Sensitivity :** 2.5Vp (Square wave) for 3V & 5V Logic Family
[2] **Specified Frequency :** 5Hz ~ 10kHz

TEMPERATURE (K-Type Thermocouple)

Range	Accuracy
-50°C to 1000°C	±(0.3% + 2°C)
-58°F to 1832°F	±(0.3% + 5°F)

Type-K thermocouple range & accuracy not included.
Supplied thermocouple suitable for measurement upto 250°C.

DIODE TESTER

Range	Accuracy
2.000V	±(1.0%rdg + 1dgts)

Test Current (Typically) : 0.4mA
Open Circuit Voltage : < 3.5V DC

CREST MODE (INSTANTANEOUS PEAK HOLD)

Accuracy :
Specified accuracy adds 250 digits for changes > 1.0ms in duration

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WHAT IS DC + AC TRUE RMS

DC AC TRUE RMS

DC AC True RMS is a term which identifies a DMM that responds accurately to the total effective RMS value regardless of the waveform, and is given by the expression :

$$\sqrt{DC^2 + (AC\ rms)^2}$$

DC + AC True RMS voltage is the total effective voltage having the same heating value corresponding a DC voltage. With DC + AC True RMS voltage measurement, you can accurately measure the voltage values regardless of the waveforms such as: square, sawtooth, triangle, pulse trains, spikes, as well as distorted waveforms with the presence of harmonics and DC components / Harmonics and DC components may cause:

1) Overheated transformers, generators and motors to burn out faster than their rated life
2) Circuit breakers to trip prematurely
3) Fuses to blow
4) Neutrals to overheat due to triplen harmonics present on the neutral (180Hz)
5) Bus bars and electrical panels to vibrate

Only AC or True RMS and Average responding meters can introduce significant errors in many applications.

See TABLE 2 for typical example.

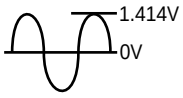
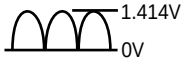
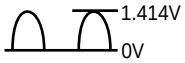
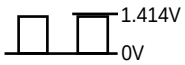
INPUT WAVEFORM	DC + AC TRMS	AC RMS	AVERAGE RESPONSE
Sine 	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0%
Full wave rectified Sine 	1.000V ERROR= 0% CF=1.414	0.436V ERROR= 56.4% CF=3.247	0.421V ERROR= 57.9%
Half wave rectified Sine 	0.707V ERROR= 0% CF=2.000	0.546V ERROR= 22.7% CF=2.591	0.550V ERROR= 22.2%
50% duty pulse train 	1.000V ERROR= 0% CF=1.414	0.707V ERROR= 29.3% CF=2.000	0.785V ERROR= 21.5%

TABLE 2. WAVEFORMS AND CREST FACTORS

KUSAM-MECO®

An ISO 9001:2008 Company

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 readig 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 as 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.