KUSAM-MECO®

An ISO 9001:2008 Company

5-4/5 DIGITS 50000/500,000 COUNTS HAND HELD TRMS DIGITAL MULTIMETER with PC INTERFACE

13 FUNCTIONS 42 RANGES

Model KM 857

CAT III 1KV CAT IV 600V UL Approved

SPECIAL FEATURES

- 500,000 counts high resolution stable reading mode.
- 20kHz Bandwidth voltage function
- Record MAX, MIN, MAX-MIN readings.
- Crest (Instantaneous Peak Hold) MAX, MIN, MAX- MIN readings.
- Relative zero mode.
- dBm readings.
- % 4 -20mA loop current readings.
- High noise rejection filtered Line Level Frequency mode.
- Line Level Frequency with 4 Trigger Levels.
- HBC Fuse Protection

FEATURES :

- DC Voltage Basic Accuracy 0.03%
- Fully Autoranging
- Backlighted display.
- Fast Data Measurement 5/sec
- Data Hold function
- Diode Test & Duty Cycle
- Audible & Visible input warning.
- Auto Power Off

GENERAL SPECIFICATIONS :

- **Sensing :** AC, AC + DC True RMS; Frequency Bandwidth 20kHz (V) & 1kHz (A)
- **Display :** 4-4/5 digits 50,000 counts. Selectable stable mode 5-4/5 digits 500,000 counts for DC Voltage & 6 digits 999,999 counts for Hz
- **Update Rate :** 4-4/5 digits fast mode : 5 per second nominal; 5-4/5 digits stable mode : 1.25 per second nominal; 42 Segments Analog Bar graph :60 per second max.
- **Polarity :** Automatic
- **Low Battery :** Below approx. 7V
- **Operating Temperature :** 0°C to 45°C
- **Relative Humidity :** Maximum 80% R.H. For Temperature upto 31°C decreasing linearly to 50% R.H. at 45°C
- **Pollution Degree :** 2
- **Storage Temperature :** -20°C~60°C, < 80% R.H. (With battery removed)
- **Altitude :** Operating below 2000m
- **Temperature Coefficient :** nominal 0.1 x (specified accuracy) / °C @ (0°C -- 18°C or 28°C -- 40°C), or otherwise specified
- **Power Consumption :** 6mA typical
- **APO Timing :** Idle for 17 minutes
- **APO Consumption :** 55µA typical
- **Power Supply :** Single Alkaline 9V battery.
- **Dimension :** 186(L) mm x 87(W) mm x 35.5(H) mm; 198(L) mm x 97(W) mm x 55(H) mm with Holster
- **Weight :** Approx. 390 gm, Approx. 500 gm with Holster

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 CAT III 1000V AC & DC and CAT IV 600V AC & DC.
- **Transient Protection :** 8KV (1.2/50µS surge)
- **Terminals (to Com) Measurement Category:**
  V : CAT III 1000V AC & V DC & CAT IV 600V AC & V DC.
  A/mAµA : CAT III & CAT IV 600V AC & V DC.
- **Overload Protections :**
  µA & mA : 1A/600V, IR 10kA, or better, F fuse
  A : 10A/600V, IR 100kA or better, F fuse
  V : 1050Vrms, 1450Vpeak
  mV, & Others : 600V DC & V AC rms
- **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)
  In an RF field of 3V/m:
  Capacitance function is not specified
  Other function ranges:
  Total Accuracy = Specified Accuracy +100 digits
  Performance above 3V/m is not specified

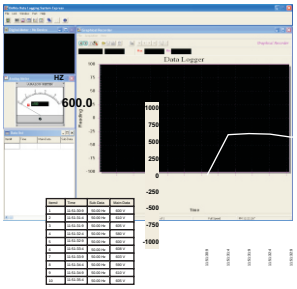
ACCESSORIES :

Test Leads pair, Holster, Battery installed, User Manual

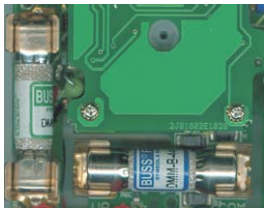
OPTIONAL ACCESSORIES :

PC interface kit, RS232 optical adapter cable + Software CD + BUA-2303 USB-to-Serial adaptor.
Current Clamp CA300,
Current Clamp Adaptor CA500, CA1000, CA2000,
High Voltage Probe PD-28.

Software CD



Software



Fuse

Software Cable

All Specifications are subject to change without prior notice

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ELECTRICAL SPECIFICATIONS : KM-857

Accuracy is ± (%Reading 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 5% to 100% of range or otherwise specified. Maximum Crest Factor < 5:1 at full scale & <10:1 at half scale, and with frequency components within the specified frequency bandwidth for non-sinusoidal waveforms.

DC VOLTAGE

Range	Resolution	Accuracy
500.000 mV	1 V	±(0.03%rdg + 2dgts)
5.00000 V	10 V	
50.0000 V	100 V	
500.000 V	1 mV	±(0.05%rdg + 2dgts)
1000.00 V	10 mV	±(0.01%rdg + 2dgts)

NMRR : > 60dB @ 50/60Hz
CMRR : > 120dB @ DC, 50/60Hz, Rs = 1k
Input Impedance : 10M , 30pF nominal
(80pF nominal for 500mV ranges)

DC CURRENT

Range	Resolution	Accuracy	Burden Voltage
500.00 A	10 nA	±(0.15%rdg + 20dgts)	0.15 mV/ A
5000.0 A	0.1 A	±(0.1%rdg + 20dgts)	0.15 mV/ A
50.000 mA	1 A	±(0.15%rdg + 20dgts)	3.3 mV/mA
500.00 mA	10 A	±(0.1%rdg + 30dgts)	3.3 mV/mA
5.0000 A	100 A	±(0.5%rdg + 20dgts)	45 mV/A
10.000 A*	1 mA	±(0.5%rdg + 20dgts)	45 mV/A

* 10A continuous, >10A to 15A for 30 second max with 5 minutes cool down interval.

AC & AC+DC CURRENT

Range	Resolution	Accuracy	Burden Voltage
50Hz -- 60Hz			
500.00 A	10 nA	±(1.0%rdg + 40dgts)	0.15mV/ A
5000.0 A	0.1 A		0.15mV/ A
50.000 mA	1 A		3.3 mV/mA
500.00 mA	10 A		3.3 mV/mA
5.0000 A	100 A		45 mV/A
10.000 A*	1 mA		45 mV/A
40Hz -- 1kHz			
500.00 A	10 nA	±(1.0%rdg + 40dgts)	0.15mV/ A
5000.0 A	0.1 A		0.15mV/ A
50.000 mA	1 A		3.3 mV/mA
500.00 mA	10 A		3.3 mV/mA
5.0000 A	100 A		45 mV/A
10.000 A*	1 mA		45 mV/A

***10A continuous, >10A to 15A for 30 second max with 5 minutes cool down interval.**

DC LOOP CURRENT %4--20mA

4mA = 0% (zero); 20mA = 100% (span)
Resolution : 0.01%
Accuracy : ± 25d

AC & AC+DC VOLTAGE

Range	Resolution	Accuracy*
20Hz -- 45Hz		
500.00 mV	10 V	Unspec'd
5.0000 V	100 V	
50.000 V	1 mV	
500.00 V	10 mV	
1000.0 V	100 mV	
45Hz -- 300Hz		
500.00 mV	10 V	±(0.8%rdg + 60dgts)
5.0000 V	100 V	
50.000 V	1 mV	
500.00 V	10 mV	
1000.0 V	100 mV	
300Hz -- 1kHz		
500.00 mV	10 V	±(0.8%rdg + 40dgts)
5.0000 V	100 V	±(2.0%rdg + 60dgts)
50.000 V	1 mV	
500.00 V	10 mV	
1000.0 V	100 mV	±(1.0%rdg + 40dgts)
1kHz -- 20kHz		
500.00 mV	10 V	1 dB**
5.0000 V	100 V	2 dB**
50.000 V	1 mV	
500.00 V	10 mV	3 dB**
1000.0 V	100 mV	Unspec'd

*From 5% to10% of range : Accuracy % of reading(or in dB) + 80d
**From 5% to10% of range : Accuracy % of reading(or in dB) + 180d
** From 10% to 15% of range : Accuracy % of reading(or in dB) + 100d
CMRR : > 80dB @ DC to 60Hz, Rs = 1k
Input Impedance : 10M , 30pF nominal (80pF nominal for 500mV range) Residual reading less than 50 digits with test leads shorted.

RESISTANCE

Range	Resolution	Accuracy
500.00	10 m	±(0.1%rdg + 6dgts)
5.0000 k	100 m	±(0.1%rdg + 6dgts)
50.000 k	1	±(0.1%rdg + 6dgts)
500.00 k	10	±(0.1%rdg + 2dgts)
5.0000 M	100	±(0.4%rdg + 6dgts)
50.000 M	1 k	±(2.0%rdg + 6dgts)

Open Circuit Voltage : <1.3VDC (<3VDC for 500 range)

CAPACITANCE

Range	Resolution	Accuracy*
50.00 nF	10 pF	±(0.8%rdg+3dgts)
500.0 nF	100 pF	±(0.8%rdg+3dgts)
5.000 F	1 nF	±(1.5%rdg+3dgts)
50.00 F	10 nF	±(2.5%rdg+3dgts)
500.0 F**	100 nF	±(3.5%rdg+5dgts)
9999 F**	1 F	±(5.0%rdg+5dgts)

***Accuracies with film capacitor or better**
****In manual-ranging mode, measurement not specified below 45.0 F & 450 F for 500.0 F & 9999 F ranges respectively.**

~HZ LINE LEVEL FREQUENCY

Function Range	Sensitivity (sine Rms)	Range
500 mV	100 mV	10Hz ~ 200kHz
5 V	1 V	10Hz ~ 200kHz
50 V	10 V	10Hz ~ 100kHz
500 V	100 V	10Hz ~ 100kHz
1000 V	900 V	10Hz ~ 10kHz

Accuracy : 0.02%+4d

dBm :

At 600 , -11.76 dBm to 54.25 dBm,
Accuracy :
± 0.25dB + 2d (@40Hz -- 20kHz)
Input Impedance:10M , 30pF nominal
Selectable reference impedance values of 4, 8, 16, 32, 50, 75, 93, 110, 125, 135, 150, 200, 250, 300, 500, 600, 800, 900, 1000, 1200

% DIODE TESTER

Range	Resolution	Accuracy
5.0000V	100 V	±(1%rdg + 1dgt)

Test Current(typical) : 0.4mA
Open Circuit Voltage : < 3.5VDC

AUDIBLE CONTINUITY TESTER

Audible threshold	between 20 & 200 .
Response Time	<100 s

CREST MODE (Instantaneous Peak Hold) :

Accuracy : Specified accuracy ± 100 digits for changes > 0.8ms in duration

% DUTY CYCLE

Range	Accuracy
0.1%--99.99%	3d/kHz+2d

Input Frequency : 5Hz -- 500 kHz, 5V Logic Family

HZ LOGIC LEVEL FREQUENCY

Range	Accuracy
5.0000Hz -- 2.00000MHz	±(0.002%rdg + 4dgts)

Sensitivities : 2.5Vp square wave

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G-17, Bharat Industrial Estate, T. J. Road, Sewree (W), Mumbai - 400 015. INDIA.
Sales Direct.: 022 -2 4156638, **Tel. :** 022-241224540, 24181649, **Fax :** 022 - 24149659
Email : kusam_meco@vsnl.net, **Website :** www.kusamelectrical.com,

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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.

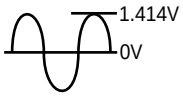
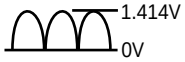
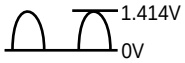
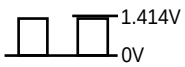
INPUT WAVEFORM	DC + AC TRMS	AC RMS	AVERAGE RESPONSE
Sine 	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0%
Full wave rectified Sine 	1.000V ERROR= 0% CF=1.414	0.436V ERROR= 56.4% CF=3.247	0.421V ERROR= 57.9%
Half wave rectified Sine 	0.707V ERROR= 0% CF=2.000	0.546V ERROR= 22.7% CF=2.591	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

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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 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.