KUSAM-MECO®

An ISO 9001:2008 Company

3-5/6 DIGIT 6000 COUNTS DIGITAL MULTIMETER WITH VFD, EF-DETECTION

Model KM 233

SPECIAL FEATURES :

- VFD V & Hz Function
- EF-Detection (NCV)
- Paper White Backlight Display
- Auto Power Off
- Auto-ranging MAX/MIN/AVG record
- Diode & Continuity Test
- BeepLit Continuity, Features Audible Beep & Visible Backlight Effects
- Beep-Jack Input warning on μAmA/A terminals plug in
- Auto-ranging Relative Zero Mode
- Low Battery Indication
- Display Hold
- Rugged Fire retarded casing.

NEW

CAT II 1000V
CAT III 600V
CAT IV 300V
UL
APPROVED

GENERAL SPECIFICATIONS :

- ✶ **Sensing :** TRUE RMS sensing
- ✶ **Display :** 3-5/6 digits 6000 counts LCD display
- ✶ **Update Rate :** 5 per second nominal
- ✶ **Operating Temperature :** -10°C to 45°C
- ✶ **Relative Humidity :** Maximum relative humidity 80% for temperature upto 31°C decreasing linearly to 50% relative humidity at 45°C
- ✶ **Altitude :** Operating Below 2000m.
- ✶ **Storage Temperature:** -20°C to 60°C, <80% R.H. With battery removed from meter.
- ✶ **Pollution Degree :** 2
- ✶ **Temperature Coefficient :** nominal 0.15 x (specified accuracy) /°C @ (0°C~18°C or 28°C~45°C), or otherwise specified.
- ✶ **Low battery :** Below approx. 2.5V
- ✶ **Power Consumption :** Typical 3.2mA
- ✶ **APO Consumption :** Typical 10μA
- ✶ **APO Timing :** Idle for 30 minutes
- ✶ **Power Supply :** 1.5V AAA battery x 2
- ✶ **Dimension :** 161(L) X 80(W) X 50(H) mm (with Holster
- ✶ **Weight :** Approx. 334 gm (with Holster)

SAFETY :

- **Safety :** Double insulation per IEC/UL/EN61010-1 Ed. 3.0, IEC/UL/EN61010-2-030 Ed. 1.0, IEC/UL/EN61010-2-033 Ed. 1.0, IEC/UL/EN61010-031 Ed. 1.1 & the corresponding CAN/CSA-C22.2 regulations to measurement CAT II 1000V, CAT III 600V and CAT IV 300V AC & DC.
- **E. M. C. :** Meets EN61326-1:2006
  In an RF field of 3V/m :
  Ohm function :
  Total Accuracy = Specified Accuracy + 15 digits
  Other function ranges :
  Total Accuracy = Specified Accuracy
  Performance above 3V/m is not specified.
- **Transient Protection :** 6.0kV lightning surge (1.2/50μs)
- **Terminals (to COM) Measurement Category :**
  V/ mAμA / A : CAT II 1000 Volts and CAT III 600V and CAT IV 300 Volts AC & DC.
- **Overload Protections :**
  μA & mA : 0.4A / 1000V DC/AC rms, IR 30kA, F fuse
  A : 11A / 1000V DC/AC rms, IR 20kA, F fuse
  V & Auto V: 1100V DC/ACrms
  mV, Ω & Others : 1000V DC/AC rms

Magnetic Hanger

ACCESSORIES :

Test leads pair, Carrying Case, Batteries installed, User's Manual.

OPTIONAL ACCESSORIES :

Magnetic Hanger
Current Clamp CA300, Current Clamp Adaptor CA500, CA1000, CA2000, High Voltage Probe PD-28.

All Specifications are subject to change without prior notice.

ELECTRICAL SPECIFICATIONS - KM 233

Accuracy is ± (% reading digits + number of digits) or otherwise specified, at 23°C ± 5°C
ACV & ACA accuracies are specified from 1% to 100% of range or otherwise specified. Maximum Crest Factor <2:1
at full scale & <4:1 half scale, and with frequency components fall within the meter specified frequency bandwidth for non-sinusoidal waveforms.

DC VOLTAGE

Range	Resolution	Accuracy
60.00 mV	10 µV	±(0.3%rdg + 2dgts)
600.0 mV	100 µV	
6.000 V	1 mV	
60.00 V	10 mV	
600.0 V	100 mV	
1000 V	1 V	

Input Impedance : 10MΩ, 54pF nominal

AC VOLTAGE

Range	Resolution	Accuracy
50Hz -- 60Hz		
6.000 V	1 mV	±(0.7%rdg + 3dgts)
60.00 V	10 mV	
600.0 V	100 mV	
1000 V	1 V	
45Hz -- 440Hz		
6.000 V	1 mV	±(2.0%rdg + 3dgts)
60.00 V	10 mV	
600.0 V	100 mV	
1000 V	1 V	
10Hz -- 500Hz		
60.00 mV	10 µV	±(1.0%rdg + 3dgts)
600.0 mV	100 µV	
500Hz -- 800Hz		
60.00 mV	10 µV	±(2.0%rdg + 3dgts)
600.0 mV	100 µV	

Input Impedance : 10MΩ, 54pF nominal

LINE FREQUENCY

Function	Sensitivity (Sine RMS)	Range
60 mV	50 mV	10Hz - 50kHz
600 mV	50 mV	10Hz - 50kHz
6 V	3 V	10Hz - 50kHz
60 V	5 V	10Hz - 50kHz
600 V	50 V	10Hz - 1kHz
1000 V	500 V	10Hz - 1kHz
VFD 600 V	50 V	10Hz - 1kHz
VFD 1000V	500 V	10Hz - 1kHz
600 µA	500 µA	10Hz - 5kHz
6000 µA	500 µA	10Hz - 5kHz
60 mA	50 mA	10Hz - 5kHz
600 mA	50 mA	10Hz - 5kHz
6 A	8 A	50Hz - 1kHz
10 A	8 A	50Hz - 1kHz

Accuracy : 0.03%+2d

BEEPLIT CONTINUITY TESTER

Continuity Threshold :	Between 30Ω and 480Ω
Response time :	64ms
Latch time :	128ms
Audible Response :	Beep sound
Visible Response :	LCD Backlight

DC CURRENT

Range	Resolution	Accuracy	Burden Voltage
600.0 µA	100 nA	±(1.0%rdg + 3dgts)	0.1 mV / µA
6000 µA	1 µA		0.1 mV / µA
60.00 mA	10 µA	±(0.7%rdg + 3dgts)	1.9 mV / mA
600.0 mA	100 µA		1.9 mV / mA
6.000 A	1 mA		0.04 V / A
10.00 A[1]	10 mA		0.04 V / A

[1] 10A continuous, >10A to 20A for 30 Sec. Max with 5 minutes cool down interval

AC CURRENT

Range	Resolution	Accuracy	Burden Voltage
50Hz -- 400Hz			
600.0 µA	100 nA	±(1.5%rdg + 3dgts)	0.1 mV / µA
6000 µA	1 µA		0.1 mV / µA
60.00 mA	10 µA	±(1.0%rdg + 3dgts)	1.9 mV / mA
600.0 mA	100 µA		1.9 mV / mA
6.000 A	1 mA		0.04 V / A
10.00 A[1]	10 mA		0.04 V / A

[1] 10A continuous, >10A to 20A for 30 Sec. Max with 5 minutes cool down interval

VFD AC VOLTAGE (with Low Pass Filter)

Range	Resolution	Accuracy[1]
10Hz -- 440Hz (fundamental)		
600.0 V	100 mV	±(2.0%rdg + 3dgts)
1000 V	1 V	

[1] Not specified for fundamental frequency >440Hz

CAPACITANCE

Range	Resolution	Accuracy
20.00 nF	10 pF	±(1.5%rdg + 8dgts)
200.0 nF	100 pF	
2000 nF	1 nF	±(1.5%rdg + 2dgts)
20.00 µF	10 nF	
200.0 µF	100 nF	
2000 µF	1 µF	
10.00 mF	10 µF	±(4.5%rdg + 10dgts)

Accuracies with film apacitor or better

OHMS

Range[1]	Resolution	Accuracy
600.0 Ω	100 mΩ	±(0.3%rdg + 3dgts)
6.000 kΩ	1 Ω	
60.00 kΩ	10 Ω	±(0.5%rdg + 3dgts)
600.0 kΩ	100 Ω	
6.000 MΩ[2]	1 kΩ	±(0.9%rdg + 2dgts)[4]
60.00 MΩ[3]	10 kΩ	

[1] Open Circuit Voltage : 1.6VDC typical.
[2] Constant Test Current : 0.2µA Typical
[3] Constant Test Current : 0.02µA Typical
[4] 5% + 20d @ > 30MΩ.

DIODE TESTER

Range	Resolution	Accuracy
3.000 V	100mV	±(0.9%rdg + 2dgts)

Test Current : 0.3mA typical.
Open Circuit Voltage : <3.2VDC typical.

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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.