KUSAM-MECO®

An ISO 9001:2008 Company

AC; AC+DC TRUE RMS MULTI PARAMETER MOBILE-LOGGER DIGITAL MULTIMETER WITH PC INTERFACE

17 FUNCTIONS 69 RANGES

Model KM 525 / KM 521

CAT IV 1 KV

KM 521 Stand-alone logging capability 5400 / 10800 points for dual / single display. KM 525 Stand-alone logging capability 43500 / 87000 points for dual / single display with selectable logged interval 0.05s, 0.1s, 0.5s, 1s, 2s, 3s, 4s, 5s, 10s, 15s, 30s, 60s, 120s, 180s, 300s, 600s.

SPECIAL FEATURES :

- **Stand alone Multi Parameter logging.**
- **Record Max/Min/MAX-MIN readings, Auto Ranging**
- **Audible & Visible Input Warning;**
- **Auto-Ranging Relative Zero Mode**
- **AutoCheck V & Auto-Ranging 50ms Record;**
- **T1-T2 differential temperature readings**
- **NCV & Probe-Contact EF-Detection**
- **nS conductance**
- **Lo-Z volts to drain Ghost Voltages (AutoCheck Feature)**
- **Logic & Line Level Frequency**
- **Logic Level Duty Cycle Readings**

FEATURES :

- DC Voltage basic Accuracy 0.08%
- 4 digit 10,000 counts Backlight Dual Digital LCD Display
- Low Battery Indication
- AC, AC+DC True RMS Conversion; Frequency Bandwidth 20kHz (V) & 1kHz (A)
- Fast Measurements, 5/sec
- Auto Power Off

ACCESSORIES :

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

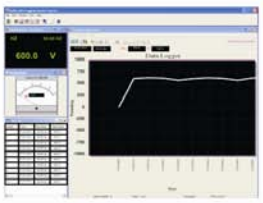
OPTIONAL ACCESSORIES :

PC 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.

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 :** Maximum 80% R.H. For Temperature up to 31°C decreasing linearly to 50% R.H. at 45°C
- ✳ **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
- ✳ **Dimension :** 208(L) x 103(W) x 64.5(H) mm
- ✳ **Weight :** Approx. 635gm with holster

Software CD


Software


Fuse


Software Cable


Thermocouple

Magnetic Hanger

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)
- **Pollution degree :** 2
- **Terminals (to COM) Measurement Category :** V/A/mAµA: Category IV 1000V AC & V DC
- **Overload Protection :**
  µA & mA : 0.44A/1000V AC & V DC,IR 10kA or better, F Fuse
  A : 11A/1000V AC & V DC, IR 20kA or better, F Fuse
  V, mV, Ω & Others : 1050Vrms, 1450Vpeak
- 1000V High Breaking Capacity fuses protected on Current inputs
- **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 Accuracy+ 100digits
  Performance above 3V/m is not specified.
- Rugged fire retarded casing with battery access door.
- Replaceable protective holster with probe-holders & Tilt-stand
- 1000V (Ohm,Capacitance & all other Functions) Input protection
- LVD meets EN61010-1 CAT IV 1kV

All Specifications are subject to change without prior notice

ELECTRICAL SPECIFICATIONS : KM 525/521

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

Function	Range	Accuracy
50Hz ~ 60Hz		
mV	60.00 mV, 600.0 mV	±(0.5%rdg + 3dgts)
V	9.999 V, 99.99 V, 999.9 V	
40Hz ~ 500Hz		
mV	60.00 mV, 600.0 mV	±(0.8%rdg + 4dgts)
V	9.999 V, 99.99 V	±(1.0%rdg + 4dgts)
	999.9 V	±(2.0%rdg + 4dgts)
500Hz ~ 1kHz		
mV	60.00 mV, 600.0 mV	±(2.0%rdg + 3dgts)
V	9.999 V, 99.99 V	±(1.0%rdg + 4dgts)
	999.9 V	±(2.0%rdg + 4dgts)
1kHz ~ 3kHz		
mV	60.00 mV, 600.0 mV	±(2%rdg + 3dgts)
V	9.999 V, 99.99 V, 999.9 V	±(3.0%rdg + 4dgts)
3kHz ~ 20kHz		
mV	60.00 mV [1], 600.0 mV [1]	±(2%rdg + 3dgts)
V	9.999 V, 99.99 V	3dB
	999.9 V	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

Function	Range	Accuracy
mV	60.00 mV	±(0.12%rdg + 2dgts)
	600.0 mV	±(0.06%rdg + 2dgts)
V	9.999 V, 99.99 V, 999.9 V	±(0.08%rdg + 2dgts)

NMRR : > 60dB @ 50/60Hz

CMRR : > 110dB @ DC 50/60Hz, Rs=1KΩ

Input Impedance :

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

CAPACITANCE

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

[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.**

CREST MODE (INSTANTANEOUS PEAK HOLD)

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

AC & AC+ DC CURRENT

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

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

DC CURRENT

Range	Accuracy	Burden Voltage
600.0 µA, 6000 µA	±(0.2%rdg + 4dgts)	0.08mV / µA
60.00 mA		2.1mV / mA
600.0 mA		
6.000 A, 10.00 A		0.02V / A

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

RESISTANCE

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

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

CONDUCTANCE

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

TEMPERATURE (K-TYPE THERMOCOUPLE)

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

Type-K thermocouple range & accuracy not included.

Supplied thermocouple suitable for measurement upto 250°C.

RECORD MODE

Accuracy : Specified accuracy adds 10 digits for changes > 100 ms in duration

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ELECTRICAL SPECIFICATIONS : KM 525/521

AUTOCHECK (DCV)

Range	Accuracy
999.9mV, 9.999V, 99.99V, 999.9V	±(0.5%rdg + 3dgts)

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]	Accuracy
50Hz ~ 60Hz	
999.9mV, 9.999V, 99.99V, 999.9V	±(1.0%rdg + 4dgts)

Lo-Z ACV Threshold : >2VAC (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
500kΩ @ 1000V

AUTOCHECK (OHMS)

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

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

LINE LEVEL FREQUENCY (Hz)

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

Accuracy : 0.04% + 4d

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

AUDIBLE CONTINUITY TESTER

Audible threshold : between 20Ω and 300Ω;
Response time : < 100µs

DIODE TESTER

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

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

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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.

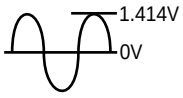
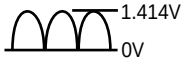
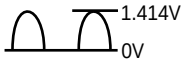
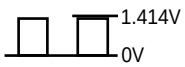
INPUT WAVEFORM	DC + AC TRMS	AC RMS	AVERAGE RESPONSE
Sine 	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0% CF=1.414	1.000V ERROR= 0%
Full wave rectified Sine 	1.000V ERROR= 0% CF=1.414	0.436V ERROR= 56.4% CF=3.247	0.421V ERROR= 57.9%
Half wave rectified Sine 	0.707V ERROR= 0% CF=2.000	0.546V ERROR= 22.7% CF=2.591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