KUSAM-MECO®
An ISO 9001:2008 Company

4 DIGIT 1000A DC/AC TRUE RMS DIGITAL CLAMPMETER WITH INRUSH CURRENT MEASUREMENT

Model 9999

15 FUNCTIONS 9 RANGES

SPECIAL FEATURES :

- Inrush Current Measuring Function for DC & AC
- Synchronous measurement of Inrush Current (100mS) for measuring the true starting current for motors, lighting, breaker etc.
- Recessed safety designed input jacks.
- Good for PWM trouble shooting & in noisy environment measurement.

FEATURES :

- High Accuracy, Digital Reading
- ACA/DCA measurement upto 999.9A
- Indoor use
- Overload Protection on all ranges
- Diode & Continuity Test
- Auto Power Off
- Low Battery Indication
- Instant Continuity Buzzer
- Data Hold, Peak Hold & Max Hold Functions.
- Relative Zero Mode function.

GENERAL SPECIFICATIONS :

- **Sensing :** TRUE RMS
- **Jaw Opening Size :** 46.5 mm
- **Display :** 4 digits 9999 counts large LCD display
- **Display Size :** 27 mm x 55 mm
- **Crest Factor :** Less than equal to 3
- **Pollution Degree :** 2
- **Low Battery :** The "battery symbol" is displayed when the battery Voltage drops below the operating level.
- **Over range indication :** "O.L" indicated
- **Measurement Rate :** 2 times per second, nominal
- **Operating Temperature :** 0°C to 50°C,at <70% R.H.
- **Storage Temperature:** -20°C to 60°C,at <80% R.H. With battery removed from meter.
- **Accuracy stated at ambient temperature 18°C to 28°C(65°F to 82°F), <70% R.H.**
- **Temperature Coefficient :** 10% of applicable accuracy per °C(5% per °F) out side the range of 18 to 28°C (65°F to 82°F)
- **Altitude :** 2000m
- **Power Supply :** 9V battery
- **Dimension :** 250(H) X 100(W) X 46(D) mm
- **Weight :** Approx. 425 gm (battery included)

ACCESSORIES :

Test leads, Carrying Case, Battery installed, User's Manual & Banana plug K-Type Thermocouple, Thermocouple Adaptor

SAFETY :

- All input are protected to EN61010-1, CAT III 600V.
- Withstand Voltage : 6000V

ELECTRICAL SPECIFICATIONS - 9999

Accuracy is ± (% reading digits + number of digits) or otherwise specified, at 23°C ± 5°C & less than equal to 80% R.H.

AC CURRENT

Range	Resolution	Accuracy
0~999.9A	0.1 A	±(2%rdg + 5dgts) on 20~100Hz
		±(6%rdg + 5dgts) on 100~400Hz

Crest Factor : <3@ 0 to 500A; <2.5@ 500 to 600A
<1.42@ 600 to 1000A
Overload Protection : 1000A AC max. for 1 min.
*Accuracy specified for measurements taken at the centre of the clamp.

DC VOLTAGE

Range	Resolution	Accuracy
0~600.0V	0.1 V	±(1%rdg + 5dgts)

Input Impedance : 1M
Overload Protection : 600V DC/AC rms

RESISTANCE

Range	Resolution	Accuracy
0~999.9	0.1	±(1.5%rdg + 5dgts)
1000~9999	1	

Overload Protection : 600V DC/AC rms

DC CURRENT

Range	Resolution	Accuracy
0~999.9A	0.1 A	±(2%rdg + 5dgts)

Overload Protection : 1200A DC max. for 1 min.
*Accuracy specified for measurements taken at the centre of the clamp.

AC VOLTAGE

Range	Resolution	Accuracy
0~600.0V	0.1 V	±(1%rdg + 5dgts) on 20~100Hz
		±(6%rdg + 5dgts) on 100~400Hz

Input Impedance : 1M
Overload Protection : 600V DC/AC rms

CAPACITANCE

Range	Resolution	Accuracy
0~999.9 F	0.1 F	±(5%rdg + 10dgts)

Overload Protection : 600V DC/AC rms

DIODE TEST

Test Current	Test Voltage
0.2mA ± 0.1 mA	<3.0V DC

Accuracy : ±(3.0%rdg + 3dgts)
Resolution : 1mV
Overload Protection : 600V DC/AC rms

TEMPERATURE (K-Type Thermocouple)

Range	Accuracy
-40°C ~ 1200°C	±(0.5%rdg + 1°C)
-40°F ~ 2200°F	±(0.5%rdg + 2°F) (Not including Thermocouple error)

Resolution : 0.1°C on -40°C~999.9°C
0.1°C on 1000°C~1200°C
0.1°F on -40°F~999.9°F
1°F on 1000°F~2200°F
Overload Protection : 600V DC/AC rms
Supplied Thermocouple is suitable for measurement upto 250°C.

FREQUENCY

Range	Accuracy
20~400.0Hz	±(0.5%rdg + 5dgts)

Resolution : 0.1Hz
Sensitivity : 5V rms. TTL signal
≥5A @ 20~100Hz
≥10A @ 100~400Hz
Overload Protection : 600V DC / AC rms

CONTINUITY

Audible Indication	< 30

Overload Protection : 600V DC/AC rms

All Specifications are subject to change without prior notice

KUSAM-MECO®
An ISO 9001:2008 Company
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

What is Inrush Current? Why is it important?

INTRODUCTION

Due to high cost of Electricity, coupled with power shortage all over the country, especially in cities & small towns in India, it is necessary to install high efficiency motors in industry. While they consume less electricity than their older, less efficient counterparts, they are more likely to trip the circuit protector (circuit breakers) when they're started, which are caused by the initial start up current - or " inrush current ". This starting current is several times greater than their normal running current. In a three-phase motor, for example, starting current or " in-rush current " generally lasts between 75-150 milliseconds with a current spike between 500% and 1200%. Although for a very short duration, this current surge creates problems.

The consequence of inrush current is mostly called a "nuisance trip" of the circuit protector. If the protector is not designed to handle the amount of inrush current that is present, the device can trip upon energizing the circuit or during circuit operation.

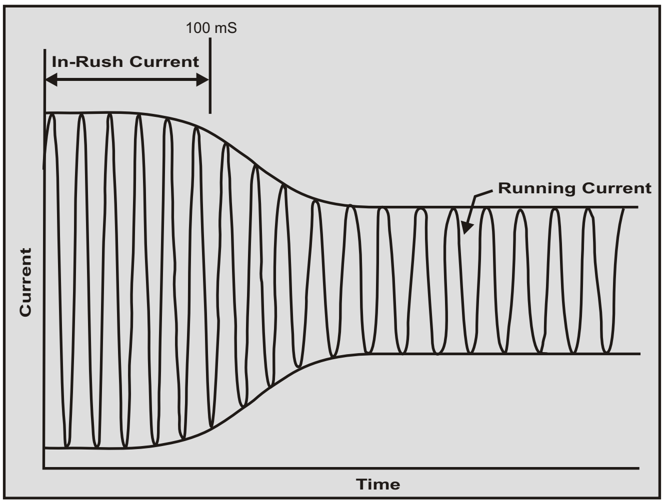
Excessive inrush current may also shorten the life of switches and circuit protectors. Switches are most likely to be damaged since the current spike occurs as the contacts are closed, causing the contacts to become pitted. In severe cases, the heat generated due to excess current can weld switches.

Because of this, precise measurement of inrush current is all the more necessary; it's a critical element of motor installation. KUSAM-MECO has a new unique Clamp meter that can accurately measure inrush current.

The KUSAM-MECO clamp meter uses a unique circuitry and high-speed digital signal processing to filter out electronic "noise" and capture the starting inrush current **as the circuit protector sees it.**

NUISANCE TRIPPING

The issue of nuisance tripping of circuit breakers or overload heating by motors was considered when deciding the specification of a new clamp meter. A useful feature would be the ability to accurately measure inrush current.



Motor starting current

For achieving this important feature in the new Clampmeter. Model-9999, KUSAM-MECO examined existing methods that have been used to perform this function, such as peak hold, max hold, and min/max hold. Measurements by these methods are inadequate, since none of them give readings that accurately depict the current the circuit protector experienced.

After studying motor starting current profiles, KUSAM-MECO introduced Clamp meter with inrush function as a highly accurate method to measure actual startup current. One of the most common problems with previous methods of measuring inrush was that **the measurements weren't necessarily synchronized with the motor start-up, so measurements were not only inaccurate but unrepeatable as well.**

In order to avoid this pitfall, the KUSAM-MECO clampmeter 9999 inrush function is triggered by rising current in the start-up phase. The technician first "arms" the inrush function of the clamp meter. The meter is then triggered by the inrush current. Once triggered, it takes a large number of samples during a 100 millisecond period and then digitally filters and processes the samples to calculate the actual starting current. **This results in a highly accurate, synchronous indication of the start current not previously available in any other clamp meter**

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.