LIST OF PRODUCTS

* Digital Multimeter
* AC Clamp Adaptor
* Thermo Anemometer
* Distance Meter
* Network Cable Tester
* Earth Resistance Tester
* DC Power Supplies
* Calibrators
* Frequency Counter
* Phasing Sticks
* Waterproof Pen Testers
* Digital AC & AC/DC Clampmeter
* AC/DC Current Adaptor
* Thermo Hygrometer
* Digital Lux Meter
* Power Factor Regulator
* Digital Panel Meters
* High Voltage Detector
* Gas Analysers
* Function Generator
* Battery Tester
* Solar Power Meter
* EMF Detector
* Wood, Paper & Grain Moisture Meter
* Transistorised Electronic Analog & Digital Insulation Resistance Testers(upto 10 KV)
* Digital Sound Level Meter & Sound Level Calibrator
* Digital contact & Non-contact Type Tachometer
* Digital Non-contact (infrared) Thermometer
* Maximum Demand Controller/Digital Power Meter
* Digital Hand Held Temperature Indicators

KUSAM-MECO ®

KUSAM-MECO ®

AN ISO 9001:2015 COMPANY

POWER CLAMP-ON MULTIMETER

MODEL - KM 099

OPERATION MANUAL

KUSAM-MECO

WARRANTY

Each "KUSAM-MECO" product is warranted to be free from defects in material and workmanship under normal use & service. The warranty period is one year (12 months) and begins from the date of despatch of goods. In case any defect occurs in functioning of the instrument, under proper use, within the warranty period, the same will be rectified by us free of charges, provided the to and fro freight charges are borne by you. This warranty extends only to the original buyer or end-user customer of a "KUSAM-MECO" authorized dealer.

This warranty does not apply for damaged Ic's, fuses, disposable batteries, carrying case, test leads, or to any product which in "KUSAM-MECO's" opinion, has been misused, altered, neglected, contaminated or damaged by accident or abnormal conditions of operation or handling. "KUSAM-MECO" authorized dealer shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of "KUSAM-MECO". "KUSAM-MECO's" warranty obligation is limited, at option, free of charge repair, or replacement of a defective product which is returned to a "KUSAM-MECO" authorized service center within the warranty period. THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. "KUSAM-MECO" SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE WHATSOEVER.

All transaction are subject to Mumbai Jurisdiction.

KUSAM-MECO

AC & AC+DC TRMS
Power Clamp-on Multimeter

MODEL - KM 099

KUSAM-MECO

TAKE MEASUREMENT CAREFULLY AND YOU'LL SPARE YOUR METER AND YOURSELF, SOME PAIN

Nearly every electrical engineer has a hand held digital clamp meter (Tongtester). We sometimes take them for granted, until we damage them or "burn them out". If you incorrectly connect your clamp meter to a circuit, or if you have the clamp meter on wrong setting, you damage the meter and possibly hurt yourself. You can also get into trouble if you try to measure the voltage across a charged capacitor.

Clamp meter users frequently burn their meters by trying to measure current the same way as they measure voltage. Remember, you measure voltage across a circuit, and current through a circuit. When you use the current input, your clamp meter becomes a low impedance circuit element.

Even if you correctly insert your clamp meter in to the circuit, you can still damage your meter. Don't try to measure current in excess of your meter's capacity. Check the current capacity of the Clamp meter.

If you are measuring current in industrial environment to prevent excess current from flowing through your meter, always disconnect your test leads from the circuit under test whenever you change Clamp meter functions. Set your meter to the correct function, say current, and its highest range for the setting. If the reading is small, change the range to the next lower range till the reading can be read with the best possible accuracy. When measuring voltage, connect the test leads before your apply power to your circuit. To be safe, start by setting your meter to its highest range first.

KUSAM-MECO

MUMBAI

TEST CERTIFICATE

AC & AC+DC TRMS Power Clamp-on Multimeter

This Test Certificate warranties that the product has been inspected and tested in accordance with the published specifications.

The instrument has been calibrated by using equipment which has already been calibrated to standards traceable to national standards.

MODEL NO. _____ **KM 099** _____

SERIAL NO. _____

DATE: _____

ISO 9001:2015
REGISTERED

QC
KUSAM-MECO
PASS

Trouble Shooting

If the instrument fails to operate, check batteries and test leads etc., and replace as necessary. Double check operating procedure as described in this user's manual. Refer to the LIMITED WARRANTY section for obtaining calibration, repairing or warranty service.

Accuracy and Calibration

Accuracy is specified for a period of one year after calibration. Periodic calibration at intervals of one year is recommended to maintain meter accuracy.

Cleaning and Storage

Periodically wipe the meter and the test probe assembly with a damp cloth and mild detergent. Do not use abrasives or solvents. Allow to dry completely before operating. If the meter is not to be used for periods of longer than 60 days, remove the batteries and store them separately.

Battery replacement

The meter uses standard 1.5V AA Size (IEC LR6) battery X 2 Loosen the 2 captive screws from the battery cover. Lift the battery cover. Replace the batteries. Place back the battery cover. Re-fasten the screws.
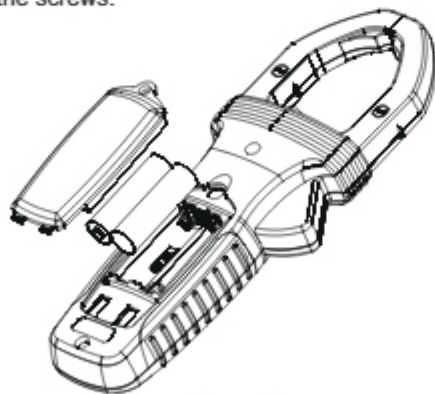
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1) SAFETY

This manual contains information and warnings that must be followed for operating the meter safely and maintaining the meter in a safe operating condition. If the meter is used in a manner not specified by the manufacturer, the protection provided by the meter may be impaired.

Observe proper safety precautions when working with voltages above 30 Vrms, 42.4 Vpeak or 60 VDC. These voltage levels pose a potential shock hazard to the user. Do not expose this product to rain or moisture. The meter is intended only for indoor use. Individual protective equipment must be used if hazardous live parts in the installation where measurement is to be carried out could be accessible.

Keep your hands/fingers behind the hand/finger barriers (of the meter and the test probe assembly, where applicable) that indicate the limits of safe access of the handheld parts during measurements. Inspect lead wires, connectors, and probes periodically for damaged insulation or exposed metal If any defects are found, replace them immediately.

Only use the test probe assembly provided with the meter or a UL Listed test probe assembly with the same rating or better. Optional offers using silicone lead wire insulation, at agent's discretion, is equipped with white inner insulation layers as wear indicators. Replace them immediately if any of the white layers has become visible.

The meter meets IEC/EN/BSEN/CSA_C22.2_No./UL standards of 61010-1 Ed. 3.1, 61010-2-032 Ed. 4.0 to Measurement Categories CAT III 1000V and CAT IV 600V ac & dc.
The accompanied test probe assembly meets IEC/EN/BSEN/CSA _C22.2_No./UL standards of 61010-031 Ed. 2.0 to the same meter ratings or better. The 61010-031requires exposed conductive test probe tips to be ≤ 4mm for CAT III & CAT IV ratings. Refer to the category markings on your probe assemblies as well as on the add-on accessories (like detachable Caps or Alligator Clips), if any, for applicable rating changes.

Power-on Options

◘ **Disabling APO**

Press-and-hold the **Harm**. button while powering on the meter can disable **APO** feature temporarily during the power-on session. The LCD will display "**dAPO**" to confirm selection before the button is released.

◘**Shortening APO idling time for inspection**

Press-and-hold the Ⓡ **REC** button while powering on the meter can shorten the **APO** idling time to approximately 8 seconds temporarily during the power-on session. The LCD will display "**FSLP**" to confirm before the button is released. This mode is designed mainly for production verification use.

◘ **Measurement Line Frequency setup**

Press-and-hold the **HOLD** button while powering on the meter can select and set measurement frequency for Power functions. The LCD will display "**SLFq**". After the button is released, the LCD will display the Frequency selected. Further short-press Ⓡ **REC** button to toggle 50Hz or 60Hz selection to match your line frequently. Then short-pres **SELECT** button to confirm the selection. Last selection will be saved for new power measurements.

Note:
It is important to select proper 50Hz or 60Hz measurement Line frequency before the **Single-Phase Power** measurement or 3-phase **Balanced-Lode Power** measurement. Otherwise, their respective VAR (reactive power) measurements may become out of specification.

5) MAINTENANCE

Note: To avoid electrical shock, disconnect the meter from any circuit, remove the test leads from the input jacks and turn OFF the meter before opening the case. Do not operate with open case.

HOLD

HOLD feature freezes the display for later viewing. LCD " 🄷 " turns on. Short-press the **HOLD** button to toggle the **HOLD** feature.

Relative-Zero (△) mode

Relative-Zero mode allows the user to offset the meter consecutive measurements with the main display displaying reading as the reference value. LCD "△ " turns on. Long-press the △ (**HOLD**) button to toggle Relative-Zero mode.

DC-Zero mode is set instead of Relative-Zero mode, however, to only offset the non-zero DCA residuals caused by magnetic hysteresis of the jaws as **in DCA, AC+DCA & AC+DC Apparent Power** functions. Long-press the △ (**HOLD**) button to activate/re-activate this mode. Apply this mode before making any single DCA, AC+DCA or AC+DC Apparent Power measurement for best measuring accuracy. The meter shows "**dc_0**" shortly to confirm activation before continuing measurements. The beeper will sound two short beeps, however, to warn for null activation if the residual is beyond a reasonable hysteresis reading of -5 to 5 DCA.

MAX/MIN Record mode

Short-press 🆁 **REC** button to activate **MAX/MIN** recording mode. LCD "🆁   MAX MIN" turn on. The meter beeps when the new **MAX** (maximum) or **MIN** (minimum) reading is updated. Short-press the button to read the **MAX**, **MIN** and **MAX/MIN** (active measurement) readings in sequence. Long-press 🆁 **REC** button to exit this mode. Auto-Power-Off is disabled automatically in this mode.

Auto-Power-Off (APO)

The Auto-Power-off (APO) mode turns the meter off automatically to extend battery life after approximately 30 minutes of no rotary switch or push button operations. To wake up the meter from APO, short-press any button or turn the rotary switch OFF and then back on. Always turn the rotary switch to the OFF position when the meter is not in use.

BRIEF INFORMATION ON MEASUREMENT CATEGORIES

Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation. Examples are measurements on devices installed before the main fuse or circuit breaker in the building installation.

Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation. Examples are measurements on distribution boards (including secondary meters), circuit-breakers, cables, bus-bars, junction boxes, switches, socket-outlets, stationary motors in the fixed installation, and equipment for industrial use.

Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation. Examples are measurements on MAINS CIRCUITS of household appliances, portable tools and similar equipment, on the consumer side only of socket-outlets in the fixed installation.

INTERNATIONAL ELECTRICAL SYMBOLS

♲	Marking of Electrical and Electronic Equipment (EEE). Do not dispose of this product as unsorted municipal waste. Contact a qualified recycler
⚠	Caution ! Refer to the explanation in this Manual
⚡	Caution ! Risk of electric shock
⏚	Earth (Ground)
▣	Double Insulation or Reinforced Insulation
⎓	Fuse
∼	AC--Alternating Current
⎓	DC--Direct Current
3∼	Three-phase Alternating Current
⚡	Application around and removal from hazardous live conductors is permitted

2) CENELEC Directives

The instruments conform to CENELEC Low-Voltage directive 2014/35/EU and Electromagnetic compatibility directive 2014/30/EU.

3) SPECIFICATIONS
General Specifications

Display: 6000 counts / 9999 counts+999 counts dual

display nominal

Update Rate: 2 per second nominal

Operating Temperature: -10°C to 50°C

Relative Humidity: Maximum relative humidity 80% for

temperature up to 31°C decreasing linearly to 50% relative

humidity at 50°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 @ (-10°C -- 18°C or 28°C -- 50°C), or otherwise specified

Sensing: AC & AC+DC True RMS

Safety: Double insulation per IEC/UL/EN/BSEN 61010-1 Ed. 3.1,

IEC/UL/EN/BSEN 61010-2-032 Ed. 4.0, IEC/UL/EN/BSEN

61010-031 Ed. 2.0 and the corresponding CAN/CSA-C22.2

regulations to Measurement Categories III 1000V AC & DC and

Category IV 600V AC & DC

Transient Protection: 8.0kV (1.2/50us surge)

■**3rd Measurement:** as reminded by the annunciators " Ⓐ **L3**", clamp the jaws around the Third line (**Line 3**).

● as reminded by the annunciators " Ⓥ ᴨ3 " on the mini-display, connect the Red test probe (**+** terminal) to the same first line (**Line 3**) and the Black test probe (**COM** terminal) to the Neutral line(**Line n**).

● When the reading is stable, Short-press " Enter " button to enter the third measuring value.

■ The meter will then display the calculate, total 3-Phase Power **W** automatically. the Annunciators "Ⓐ **L1 L2 L3**" turn on.

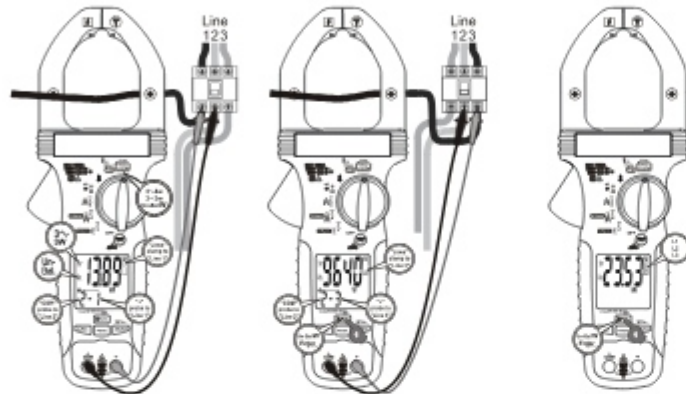■Short-press the "Enter" button again for new measurements.
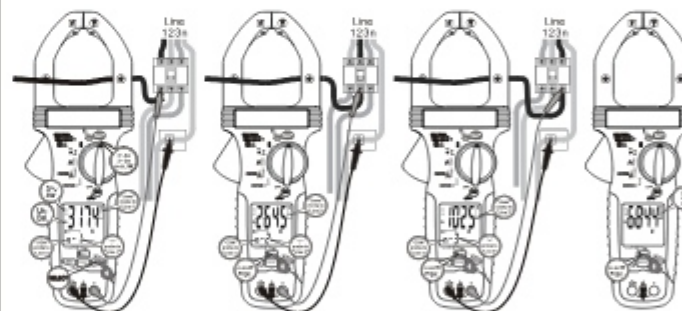
Note:
For push-button operations. The meter give one short beeps for normal activations and two short beeps to warn against null activations.

Flashlight & Backlighted LCD display
Long-Press the [✳⊱] (**SELECT**) button to toggle the LCD backlight & flashlight ON and OFF.

■In the **4-Wire** mode, the annunciators"**3~**","**4W**"&"**Un-Bal.**" turn on.

■**1ˢᵗ Measurement:** as reminded by the annunciators " Ⓐ **L1**", clamp the jaws around the first line (**Line 1**).

● As reminded by the annunciators "Ⓥ ⌐1 " on the mini–display, connect the Red test probe (**+** terminal) to the same first line (**Line 1**) and the Black test probe (**COM** terminal) to the Neutral line(**Line n**).

●When the reading is stable, Short-press "**Enter** " button to enter the first measuring value.

■**2ⁿᵈ Measurement:** as reminded by the annunciators " Ⓐ **L2**", clamp the jaws around the second line (**Line 2**).

● as reminded by the annunciators "Ⓥ ⌐2 " on the mini–display, connect the Red test probe (+ terminal) to the same second line (**Line 2**) and the Black test probe (**COM** terminal) to the Neutral line(**Line n**).

●When the reading is stable, Short-press " **Enter** " button to enter the Second measuring value.

Overload Protection:

Current via Clamp-on Jaws: 1000A rms at <400Hz

Voltage via terminals: 1100V rms

Other functions via terminals: 1000V rms

E.M.C.: Meets EN61326-1:2013

Power Supply: 1.5V AA Size (IEC LR6) battery X 2

Power Consumption: Typical 33mA for Current & Power functions, and 22mA for others

Low Battery: Below approx. 2.5V

APO Timing: Idle for 30 minutes

APO Consumption: 25uA typical

Dimension: Approx. L258mm X W94mm X H44mm

Weight: Approx.394 gm

Jaw opening & Conductor diameter: 51mm max

Accessories : Test leads set, User's Manual, Soft carrying pouch, Bkp60 banana plug K-type Thermocouple

Optional Accessories : Bkb32 banana pins to K-type socket plug adapter.

ELECTRICAL SPECIFICATIONS

Accuracy is ±(% reading digits + number of digits) or otherwise specified, at 23°C ± 5°C & less than 75% relative humidity.

Maximum Crest Factor < 1.56 : 1 at full scale & < 3.12 : 1 at half scale, and with frequency spectrum not exceeding the specified frequency bandwidth for non-sinusoidal waveforms.

DCV

Range	Accuracy
60.00V, 999.9V	0.5%+5d

Input Impedance: 2MΩ, 50pF nominal

ACV (with Low-Pass Filter)

Range	Accuracy		
60.00V [1]), 999.9V	@ 50Hz / 60Hz	@ 10Hz / 200Hz	@ 200Hz / 400Hz
	0.5% + 5d	4.0% + 5d	14% + 5d [2])

Input Impedance: 2MΩ, 50pF nominal
1)Specified accuracy adds 40d @ <20Vac
2)Accuracy linearly decreases from 4%+5d @ 200Hz to 14%+5d @ 400Hz

AC+DCV

Range	Accuracy		
999.9V	@DC, 50Hz / 60Hz	@ 45Hz ~ 400Hz	@ 500Hz / 3kHz
	0.5% + 5d	2.5% + 5d	3.5% + 5d

Input Impedance: 2MΩ, 50pF nominal

3-Phase Unbalanced-Load Power Functions
●Default at **3-Wire** mode (**3-Phase 3-Wire Unbalanced-Load**). Short-press the **"SELECT"** button toggles to the **4-Wire** mode (**3-Phase 4-Wire Unbalanced-Load**).
▣In the **3-Wire** mode, the annunciators"**3~**","**3W**"&"**Un-Bal.**" turn on.
■**1ˢᵗ Measurement:** as reminded by the annunciators " Ⓐ **L1**", clamp the jaws around the first line (**Line 1**).
● as reminded by the annunciators " Ⓥ ʔ-ł " on mini-display, connect the Red test probe (+ terminal) to the same first line (**Line 1**) and the Black test probe (**COM** terminal) to the Second line(**Line 2**).
●When the reading is stable, Short-press " Enter " button to enter the first measuring value.

■**2ⁿᵈ Measurement:** as reminded by the annunciators " Ⓐ **L3**", clamp the jaws around the remaining third line (**Line 3**).
● as reminded by the annunciators " Ⓥ ʔ-ɜ " on mini-display, connect the Red test probe (+ terminal) to the same third line (**Line 3**) and the Black test probe (**COM** terminal) to the Second line(**Line 2**).

●When the reading is stable, Short-press " Enter " button to enter the Second measuring value.

■The meter will then display the calculate, total 3-Phase Power **W** automatically. the Annunciators " Ⓐ **L1 L2 L3**" turn on.

■Short-press the "Enter" button again for new measurements.

●When encountering largely distorted waveforms with the influence of harmonics, It is recommended to tackle (e.g. filter out) harmonics problems in the first place before dealing with phase-shift problems.

AC+DC Apparent Power

The DC Current component (A_{DC}) is displayed automatically on the mini-display. long press the **Zero** Δ button to apply **DC-Zero** before each measurement session for best-measuring accuracies. Refer to **DC-Zero mode** operations for more details.
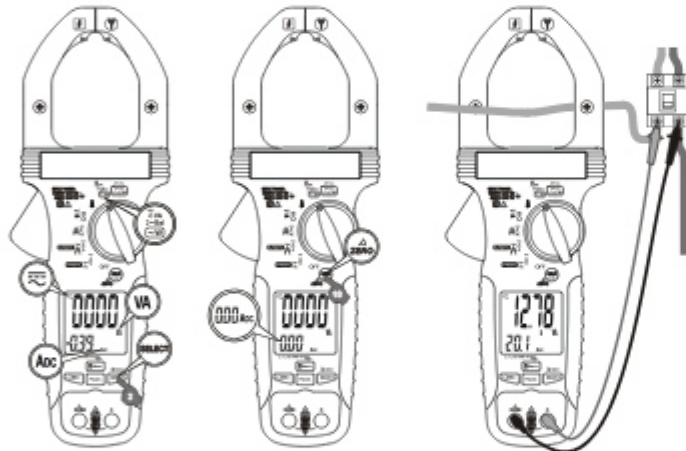
Total Harmonic Distortion-THD% of ACV [5]) or AC+DCV

Total Harmonic Distortion	Range	Accuracy	
ACV, AC+DCV	60.00V [1],999.9V	@ 50Hz ~ 60Hz	0.5% + 5d
		@ 45Hz ~ 500Hz	2.5% + 5d
		@ 500Hz ~ 3kHz	3.5% + 5d
THD% [2][3][4]	2.0% ~ 600.0%	1.0% + 5d	

Input Impedance: 2MΩ, 50pF nominal
1)Range available to ACV only. specified accuracy adds 40d @ <20Vac
2)Total Harmonic Distortion-THD% is defined as:
(Total Harmonic RMS / Fundamental RMS) x 100%
3)Fundamental frequency range: 45Hz ~ 70Hz
4)Accuracy specified @ Total RMS ≥ 70V
5)When the Harmonic-related feature is activated, the Low Pass Filter of ACV turns off automatically for maximum measuring bandwidth.

Total Distortion Factor-DF% of ACV [5]) or AC+DCV

Total Distortion Factor	Range	Accuracy	
ACV, AC+DCV	60.00V [1],999.9V	@ 50Hz / 60Hz	0.5% + 5d
		@ 45Hz ~ 500Hz	2.5% + 5d
		@ 500Hz ~ 3kHz	3.5% + 5d
DF% [2][3][4]	2.0% ~ 100.0%	1.0% + 5d	

Input Impedance: 2MΩ, 50pF nominal
1)Range available to ACV only. specified accuracy adds 40d @ <20Vac
2)Total Distortion Factor-DF% is defined as: (Total Harmonic RMS / Total RMS) x 100%

3)Fundamental frequency range: 45Hz ~ 70Hz

4)Accuracy specified @ Total RMS ≥ 70V

5)When the Harmonic-related feature is activated,

the Low Pass Filter of ACV turns off automatically for maximum measuring bandwidth.

Individual Harmonic orders of ACV [7] or AC+DCV

Parameter	Range	Accuracy [1] [2] [3]
Individual Harmonic order: Hdc, H01 ~ H10		
Vrms	999.9V	2.0% + 5d[4]
THD%[5]	**0.0% ~ 600.0%**	**15d**
DF%[6]	0.0% ~ 100.0%	15d
Individual Harmonic order: H11~ H25		
Vrms	999.9V	3.0% + 5d[4]
THD%[5]	**0.0% ~ 600.0%**	20d
DF%[6]	0.0% ~ 100.0%	20d

1)Fundamental frequency range: 45Hz ~ 70Hz

2)Accuracy specified @ Total RMS ≥ 70V

3)Unspecified @ Harmonic Order Voltage < 2V

4)Specified accuracy adds 3% @ DF% < 10%

5)Individual Harmonic-THD% is defined as:

(Harmonic order RMS / Fundamental RMS)x 100%

6) Individual Distortion Factor-DF% is defined as:

(Harmonic order RMS / Total RMS) x 100%

7) When the Harmonic-related feature is activated, the Low Pass Filter of ACV turns off automatically for maximum measuring bandwidth.
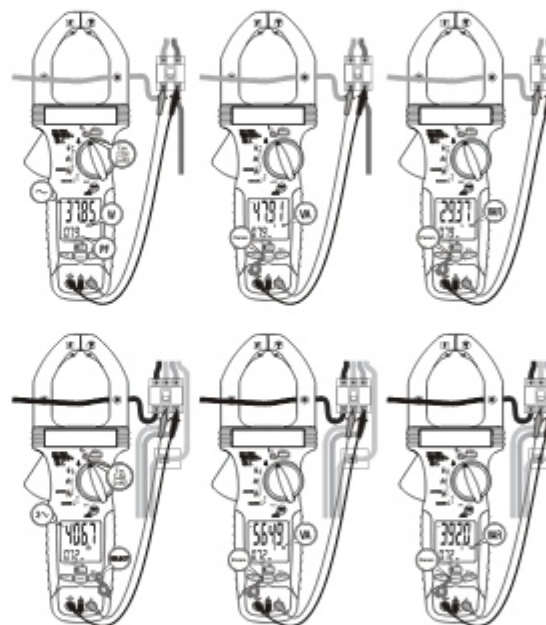

Single-Phase Power & 3-Phase Balanced-Load Power

Press "**Param.**" button momentarily selects between **W** (real power), **VA** (apparent power), and **VAR** (reactive power) displays. **PF** (Total Power Factor) is displayed automatically in the secondary mini display.


Note:

●Under proper measurement setups for load circuits, the **W** (real power) readings are always positive. Negative **W** readings indicate reversed clamp-on jaws direction or test leads polarities, or even incorrect voltage lines are being measured as in 3-phase measurement setups.

To improve overall system power factor, nowadays power-system engineer needs to address both phase-shift and harmonics problems. Practically, harmonics should be dealt with (e.g. filtering out) before phase-shift to be corrected (e.g. installing capacitors in parallel with inductive loads).

Note:

It is important to Select and set proper 50Hz or 60Hz Measurement Frequency before **Single-Phase Power** measurement or **3-Phase Balanced-Load Power** measurement. Otherwise, their respective VAR (reactive power measurements may become out of specification. Refer to the **Measurement Line Frequency setup** in **Power-on Options**.

Single-Phase Power, 3-Phase Balanced-Load Power, & AC+DC Apparent Power Default at **Single-Phase Power** function. Short- Press the **"SELECT"** button to select the subject functions in sequence.
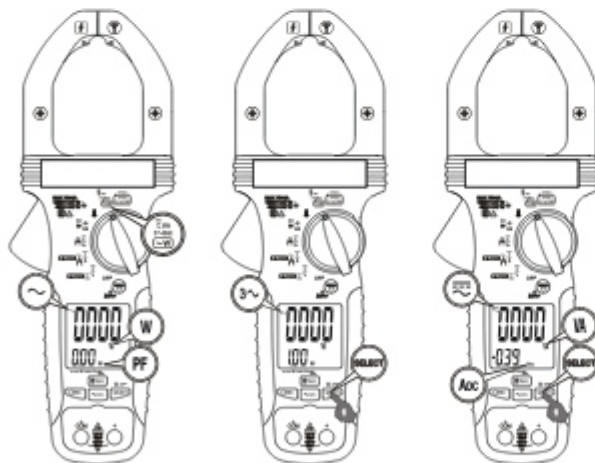
AmpTip® Clamp-on DCA

Range	Accuracy [1] [2] [3]
40.00A	2.0%+5d

1) Induced error from adjacent current-carrying conductor: <0.02A/A
2) Specified with DC-Zero mode applied to offset the non-zero residual readings, if any
3) Add 15d to the specified accuracy @ <10A

AmpTip® Clamp-on ACA

Range	Accuracy [1] [2]
50Hz / 60Hz	
40.00A	1.5%+5d
45Hz / 400Hz	
40.00A	2.0%+5d

1) Induced error from adjacent current-carrying conductor: <0.02A/A
2) Add 30d to the specified accuracy @ <10A

AmpTip® Clamp-on AC+DCA

Range	Accuracy [1] [2] [3]
DC	
40.00A	2.0%+5d
50Hz / 60Hz	
40.00A	1.5%+5d
45Hz / 400Hz	
40.00A	2.0%+5d

1) Induced error from adjacent current-carrying conductor: <0.02A/A
2) Specified with DC-Zero mode applied to offset the non-zero residual readings, if any
3) Add 30d to the specified accuracy @ <10A

Regular Clamp-on DCA

Range	Accuracy [1) 2)]
999.9A	2.0%+5d

1) Induced error from adjacent current-carrying conductor: <0.02A/A
2) Specified with DC-Zero mode applied to offset the non-zero residual readings, if any

Regular Clamp-on AC+DCA

Range	Accuracy [1) 2)]
DC	
999.9A	2.0%+5d
50Hz / 60Hz	
999.9A	2.0%+5d
45Hz ~ 400Hz	
999.9A	2.5%+5d

1) Induced error from adjacent current-carrying conductor: <0.02A/A
2) Specified with DC-Zero mode applied to offset the non-zero residual readings, if any

Regular Clamp-on ACA

Range	Accuracy [1)]
50Hz / 60Hz	
999.9A	2.0%+5d
45Hz ~ 400Hz	
999.9A	2.5%+5d

1) Induced error from adjacent current-carrying conductor: <0.02A/A

Note: Displacement Power Factor & Total Power Factor

●**Introduction**: Power is the rate of change of energy with respect to time (in terms of voltage V and current A). Instantaneous (real) power $w = vi$ where v is the instantaneous voltage and i the instantaneous current. The average (real) power is the mean of vi and is given by:

$W = \omega/2\pi \int vi \, dt$, over the interval from 0 to $2\pi/\omega$

●**Displacement Power Factor (more traditional)**: Assuming V and A are pure sinusoidal waveforms without harmonics (as in most traditional cases), that is, $v = V \sin\omega t$ and $i = I \sin(\omega t - \theta)$, the expression can be simplified to:

$W = 1/2 \times V \times I \times \cos\theta$ where V and I are the peak values, θ is the displacement power factor angle, and $\cos\theta$ is the displacement power factor. Using RMS values, it is written as:

$W = V_{rms} \times A_{rms} \times \cos\theta$

Practically, in such cases without harmonics, θ is also called the phase-shift angle of the current A to the voltage V. An inductive circuit is said to have a lagging power factor since current A lags voltage V (phase-shift angle θ and thus $\sin\theta$ are both "+"), and a capacitive circuit is said to have a leading power factor since current A leads voltage V (phase-shift angle θ and thus $\sin\theta$ are both "-").

●**Total Power Factor (encountering harmonics)**: When encountering distorted waveforms with the presence of harmonics, however, the simplified power expression should not be used since substituting the above mentioned pure sinusoidal V and A functions cannot fulfill the actual conditions. Cosine of phase-shift angle ($\cos\theta$), or the displacement power factor, is no longer the only component constituting the overall power factor. Harmonics do increase apparent power and thus decrease the overall power factor. That is, the Total Power Factor is actually affected by both phase-shift angle and harmonics, and is given by the expression: Total Power Factor (PF) = Real Power (W) / Apparent Power (VA)

Type-K Temperature

Inputs are made via the input terminals **V-COM**. Default at **°C** (Celsius). Press **SELECT** button to toggle between °C (Celsius) and °F (Fahrenheit) readings.
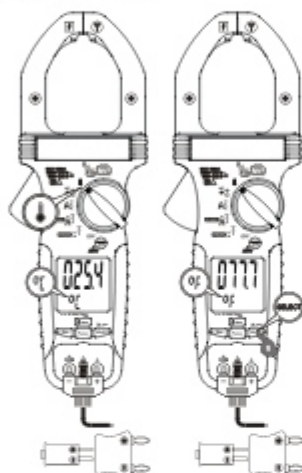
Note

- Be sure to insert the banana-plug when type-K temperature bead-probe with correct +-polarities. Banana-pins to type-K socket adapter Bkb32 (Optional purchase) can be used to adapt other type-K probes with standard miniature plugs.

- Temperature accuracies assume the meter interior has the same temperature (isothermal stage) as the ambient, particularly at the plug of the probe being used, for a correct junction voltage compensation. Allow the meter's interior temperature to catch up with that of the plug after any significant changes in the measuring environment and hence the ambient temperature. This can take up to an hour for changes > 5°C, within a low-ventilated sturdy meter housing. The uncompensated temperature differences, if any, will be reflected as offsets on the meter readings.

Total Harmonic Distortion-THD% 1) of Regular Clamp-on ACA or AC+DCA

Range	Accuracy [2) 3)]
2.0%~600.0%	1.0%+5d

1) Total Harmonic Distortion-THD% is defined as: (Total Harmonic RMS / Fundamental RMS) x 100%
2) Fundamental frequency range: 45Hz ~ 70Hz
3) Accuracy specified @ Total RMS ≥ 10A

Total Distortion Factor-DF% 1) of Regular Clamp-on ACA or AC+DCA

Range	Accuracy [2) 3)]
2.0%~100.0%	1.0%+5d

1) Total Distortion Factor-DF% is defined as: (Total Harmonic RMS / Total RMS) x 100%
2) Fundamental frequency range: 45Hz ~ 70Hz
3) Accuracy specified @ Total RMS ≥ 10A

Individual Harmonic orders of Regular Clamp-on ACA or AC+DCA

Parameter	Range	Accuracy [1) 2) 3)4) 5)]
Individual Harmonic order: Hdc, H01 ~ H10		
Current RMS	999.9A	2.0% + 5d [6)]
THD% [7)]	**0.0% ~ 600.0%**	+/-15d
DF% [8)]	0.0% ~ 100.0%	+/-15d
Individual Harmonic order: H11 ~ H25		
Current RMS	999.9A	5.0% + 5d [6)]
THD% [7)]	**0.0% ~ 600.0%**	+/-20d
DF% [8)]	0.0% ~ 100.0%	+/-20d

1)Induced error from adjacent current-carrying conductor: <0.02A/A

2)Specified with DC-Zero mode applied to offset the non-zero residual readings, if any

3)Fundamental frequency range: 45Hz ~ 70Hz

4)Accuracy specified @ Total RMS ≥ 10A

5)Unspecified @ Harmonic Order Current < 2A

6)Specified accuracy adds 3% @ DF% < 10%

7)Individual Harmonic-THD% is defined as: (Harmonic order RMS / Fundamental RMS) x 100%

8)Individual Distortion Factor-DF% is defined as: (Harmonic order RMS / Total RMS) x 100%

OHM

Range	Accuracy
600.0Ω~6.000kΩ	1.0%+5d

Open Circuit Voltage: 1.2VDC typical

Audible Continuity Tester

Audible Threshold: Between 10Ω and 300Ω

Response time: 32ms approx.

Capacitance

Range	Accuracy[1]
10.0µF~999.9µF	3.0%+6d

1)Accuracies with film capacitor or better

Diode

Range	Accuracy
1.000V	1.0%+3d

Test Current: 0.3mA typically

Open Circuit Voltage: < 1.2VDC typically

Temperature

Range	Accuracy [1] [2]
-40.0°C~400.0°C	1.0%+2°C
-40.0°F~752.0°F	1.0%+3°F
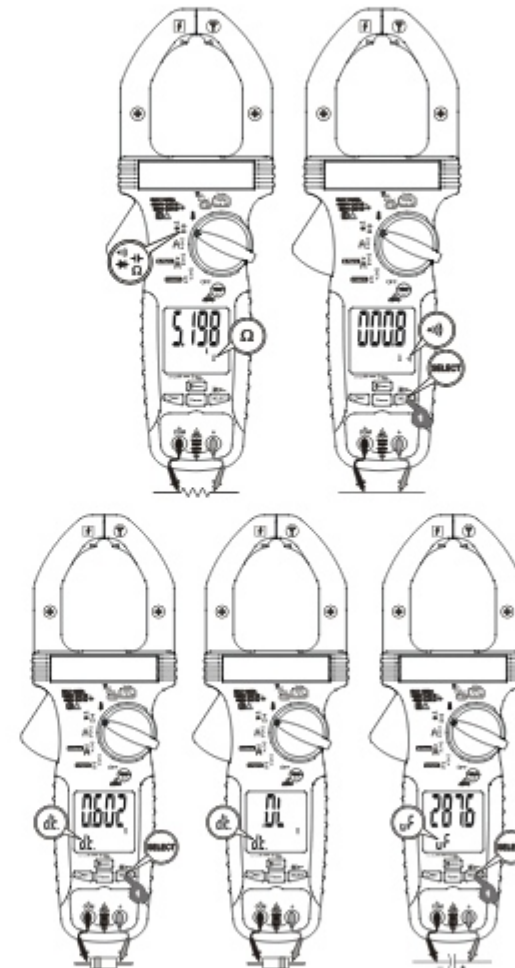
BeepLit™ Continuity

This function is having improved convenience for checking wiring connections and operation of switches. Resistance threshold is being used. A continuous beep sound together with the display backlight flashing indicates a complete wire. Such audible and visible indications improve continuity readabilities in noisy working environments.

Note

● Using Resistance, Continuity, Diode, or Capacitance function in a live circuit will produce false results and may damage the meter. In many cases the suspected component(s) must be disconnected from the circuit to obtain an accurate measurement reading.

● When using Diode test function, normal forward voltage drop (forward biased) for a good silicon diode is between 0.400V to 0.900V. A reading higher than that indicates a leaky diode (defective). A zero reading indicates a shorted diode (defective). An OL indicates an open diode (defective). Reverse the test leads connections (reverse biased) across the diode. The digital display shows OL if the diode is good. Any other readings indicate the diode is resistive or shorted (defective).

● Discharge capacitor(s) before making capacitance measurements. Large-value capacitors should be discharged through an appropriate resistance load.

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1)Accuracies assume meter interior has the same temperature (isothermal stage) of the ambient for a correct junction voltage compensation. Allow the meter and the type-K probe set to reach isothermal stage for a significant change of ambient temperature. It can take up to an hour for changes > 5°C.
2)Type-K thermocouple range & accuracy not included

Single-Phase & 3-Phase Balanced-Load Power

Active Power (w)

Range		Accuracy[4]		
0010 W~9999 W	@ PF	≥0.5;≤1.0	>0.31;<0.5	≥0.2;<0.31
10.00 kW~99.99 kW	@ ACA ≥20A	2%+2d	5%+5d	8%+5d
	@ ACA<20A;≥3A	4%+5d		
100.0 kW~999.9 kW	@ ACA<3A;≥1A	20%+8d		

Apparent Power (VA)

Range		Accuracy[4]
0010 VA~9999 VA	@ ACA ≥20A	2%+2d
10.00 kVA~99.99 kVA	@ ACA<20A;≥3A	4%+5d
100.0 kVA~999.9 kVA	@ ACA<3A;≥1A	20%+8d

Reactive Power (Var)

Range		Accuracy[4]		
	@ PF	≤0.8;≥0.0	≤0.9;>0.8	≤0.98;>0.9
0010 Var~9999 Var	@ ACA ≥10A	2%+2d	3%+5d	8%+5d
10.00 kVar~99.99 kVar	@ ACA<10A;≥6A			
100.0 kVar~999.9 kVar	@ ACA<6A;≥3A	7%+5d	7%+5d	10%+5d[2]
	@ ACA<3A;≥1A	20%+8d	N/A	N/A

Power Factor (PF)

Range	Accuracy[3]
0.51~1.00	-3%+4d
0.21~0.50	5%+4d
0.00~0.20	10%+4d

1)Accuracy specified from fundamental ACA ≥ 1A
   fundamental ACV ≥ 66V fundamental frequency @ 50/60Hz
3)Specified from @ PF ≤ 0.95; >0.9 @ACA<6A;≥3A
4)Accuracy specified from fundamental ACA ≥3A and fundamental
   ACV≥66V; fundamental @ 50/60Hz.

KUSAM-MECO

AC+DC Power (VA)

Range	Accuracy[a) b) c)]
0010~9999 VA	2.0%+2d [1-9)]
10.00~99.99 kVA	
100.0~999.9 kVA	

DC Current

Range	Accuracy
9.99 A	2.0%+40d
99.9 A	2.0%+5d
999 A	2.0%+5d

a) AC Accuracy specified from fundamental_ACA ≥ 3A and fundamental_ACV ≥3V for AC signals with no DC component; fundamental@50/60Hz.

1) Best 2%+2nd@ACA≥20A and ACV≥15V

2) 6%+4d instead @either 12A ≤ ACA ≤ 20A or 9V ≤ ACV < 15V

3) 12%+5d instead @ either 5A ≤ ACA < 12A or 5V ≤ ACV < 9V

4) 20%+5d instead @ either 3A ≤ ACA < 5A or 3V ≤ACV < 5V

b) DC Accuracy specified from DCA ≥ 1A and DCV ≥3V for DC signals with no AC component:

5) Best 2%+2d@DCA≥6A and DCV≥20V

6) 6%+4d instead @ either 3A ≤ DCA < 6A or 5V ≤ DCV < 20V

7) 10%+5d instead @ either 1A ≤ DCA < 3A or 3V ≤DCV < 5V

c) AC+DC Accuracy specified from fundamental @ AC+DCA ≥12A and fundamental_AC+DCV≥9V for AC+DC composite signals; fundamental @50/60Hz:

8) Best 2%+8d@ACA≥12A & DCA ≥20A and ACV≥9V & DCV ≥15V

9) 6%+8d instead @ either ACA≥12A & 1A≤DCA ≤20A or ACV≥9V & 3V ≤ DCV < 15V

KUSAM-MECO

Non-Invasive AmpTip® Low-Current ACA, AC+DCA, DCA, & Hz
Input are made via the clamp jaws with the best accuracy specified near the jaw tip area for low-current measurements on small conductors. Default at **AmpTip® Low-Current ACA**. Short-Press the **SELECT** button to select the subject functions in sequence.
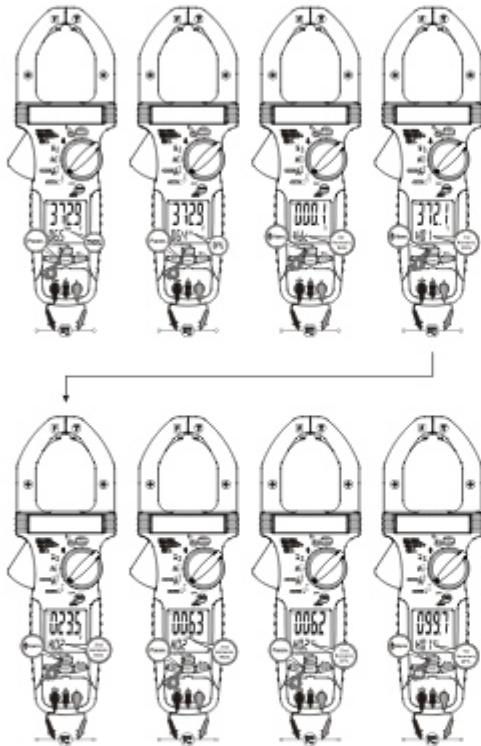
NOTE
Before making any **AmpTip® DCA** or **AmpTip® AC+DCA** measurement, long press the **Zero △** button to apply **DC-Zero** with which the best measuring accuracy is specified. Refer to **DC-Zero mode** for more operation details.
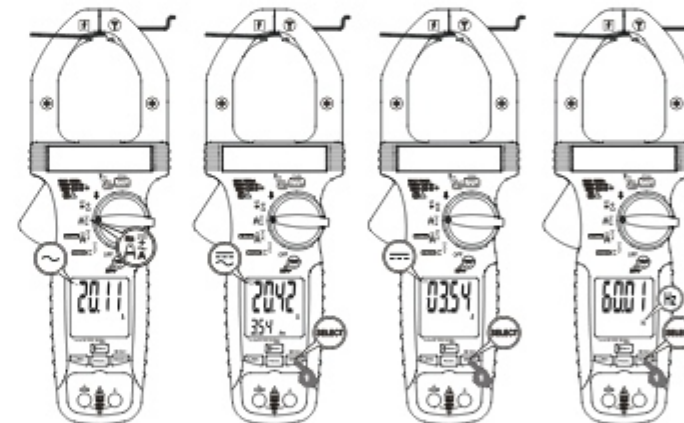
Ω Resistance; •))) BeepLit™ Continuity; Diode; Capacitance
Inputs are made via the test lead terminals **V-COM**. Default to **Ω Resistance**. Short-Press the **SELECT** button to select the subject functions in sequence.

Refer to **DC-Zero mode** for more operation details.

NOTE:
- Total Harmonic Distortion % or **Total-THD%**
  = (Total Harmonic RMS / Fundamental RMS) x 100%
- Individual Harmonic Distortion % or **Individual -THD%**
  = (Individual Harmonic RMS / Fundamental RMS) x 100%
- Total Distortion Factor % or **Total-DF%**
  = (Total Harmonic RMS / Total RMS) x 100%
- Individual Distortion Factor % or **Individual -DF%**
= (Individual Harmonic RMS / Total RMS) x 100%

Hz Line Level Frequency

Function	Sensitivity (Sine RMS)	Range
999.9V	20V	40.00Hz ~ 70.00Hz
999.9A	2A	40.00Hz ~ 70.00Hz

Accuracy: 0.5%+5d

Non-Contact EF-Detection

Typical Voltage (Tolerance)	Bar-Graph Indication
70V (10V ~ 150V)	–
140V (50V ~ 250V)	– –
200V (100V ~ 350V)	– – –
250V (150V ~ 450V)	– – – –
350V (200V ~ 1000V)	– – – – –

Indication: Bar-graph segments & audible beep tones proportional to the field strength Detection Frequency: 50/60Hz
Detection Antenna: Top side of the stationary jaw
Probe-Contact EF-Detection: For more precise indication of live wires, such as distinguishing between live and ground connections, use direct contact testing with one single test probe via the input terminal(Black) has the best sensitivity.

3) PRODUCT DESCRIPTION

1) Antenna area for Non-Contact EF-Detection

2) Jaw center indicator with DCA polarity, at where best current accuracy is specified

3) Hand/Finger Barrier to indicate the limits of safe access of the meter during a non-invasive current measurement

4) Rotary Selector to turn the power ON/OFF and Select a function

5) Numeric LCD display

6) Input Jack for all functions EXCEPT non-invasive DCA, DC+ACA, or ACA current functions

7) Common (Ground reference) Input Jack for all functions EXCEPT non-invasive DCA, DC+ACA, or ACA current functions

8) Push-buttons for special functions & features.

9) Jaw trigger for opening the clamp jaw

10) Clamp Jaw for DC or AC current magnetic field pick up

11) Additional center indicator for AmpTip® Low-current function, at where best AmpTip® current accuracy is specified

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■ When a Harmonic order is selected, short-press the **Param.** button can cycle the main display readings to show the **Individual- Volt/Amp**, **Individual-THD%** or **Individual-DF%** of The designated Harmonic order.

▶ Short-press the **SELECT** button to exit out Harmonic measurements.

Note :

● **H01, H02,**....denote harmonics of the First order (Fundamental), the Second order, and so forth respectively.

● **Hdc** denotes the DC component and is only included in the Harmonics readings of DC- related functions AC+DCV and AC+DCA. It is not included in that of the traditional AC-coupled functions ACV and ACA.

●**ALL** denotes the summation of **H02** to **H25**, together with **Hdc** in AC+DC mode, in ALL-THD% and ALL-DF% harmonics readings. However, it is the **Total-RMS** including **H01**, together with **Hdc** in AC+DC mode, in ALL-voltage readings (ALL - ampere readings alike).

That is:

✓ When the ALL-THD% and ALL-DF% harmonics reading is being displayed, **ALL** harmonics denotes the summation of merely the harmonics from **H02** to **H25**, plus **Hdc** in AC+DC mode, NOT including the Fundamental **H01**.

✓ When the ALL-voltage reading is selected, however, **ALL** voltage denotes the Total-RMS voltage including the Fundamental **H01**, plus **Hdc** in AC+DC mode, instead. ALL-ampere readings alike.

● Before making any harmonics Measurements on the **AC+DCA** function, long-press the **Zero△** button to apply **DC-Zero** with which the best measuring accuracy is specified.
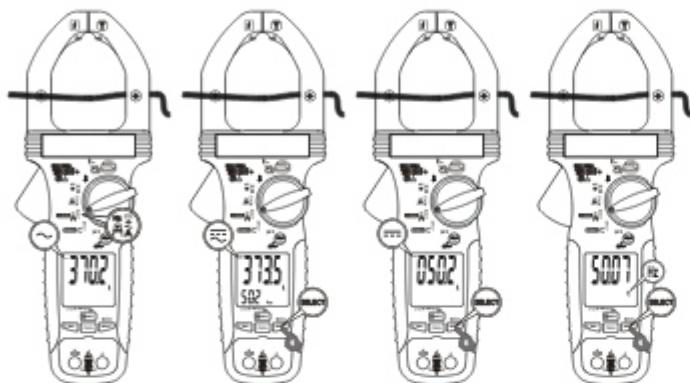
Harmonics measurement:

V/A, Harmonics Distortion % (THD%), and Distortion Factor% (DF%) Readings

The Harmonics Measurment feature is available on the 4 main V/A functions. They are the ACV, AC+DCV, Regular ACA & Regular AC+DCA. Operations of the feature are alike in all these functions. The LPF on ACV will be turned off automatically when the feature is activated to maximize the measurning bandwidth.

►Under the function default display, short-press the **Param**. button to show its auxiliary **Total-THD%** readings on the mini-display. Short-press again the **Param**. button can toggle to the **Total-DF%** readings.

►Short-press the **Harm**. button can select a designated individual Harmonic order in Ascending(**up**) cycling sequence. The corresponding indication of **Hdc, H01**,...., or **ALL** (cycling) will be shown on the mini-display where available.

■ However, long-press the **Harm**. button can select a designated individual Harmonic order in Descending (**dn**, down) cycling sequence instead. The corresponding indication **ALL,....,H01,** or **Hdc** (cycling) will be shown on the mini-display where available.

4) OPERATION

Note: Before and after hazardous voltage measurements, test the voltage function on a known source such as line voltage to determine proper meter functioning.
● Long-press (a button): press for one second or more
● Short-press (a button): press momentarily

ACV (with Low Pass Filter); AC+DCV; DCV; ~Hz; EF-Detection
Default at **ACV** function. Press the **SELECT** button to select the subject functions in sequence. inputs are made via the test lead terminals **V-COM** except for the **EF-DETECTION** functions as specified later.

Note: The low pas filter (LPF) feature turns on by default on the ACV function and turns off on the other functions.
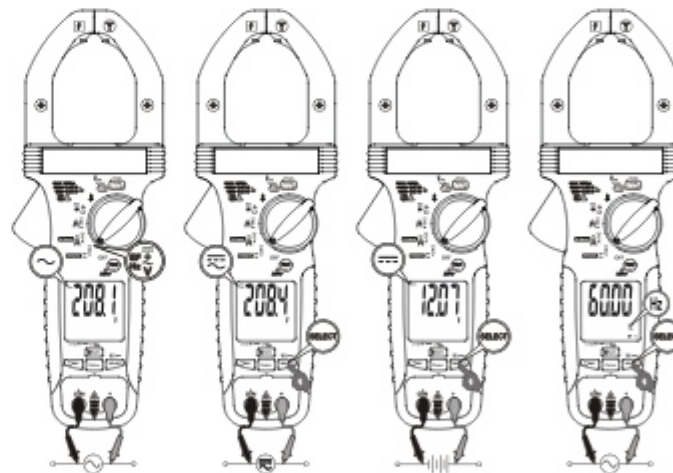

EF-Detection Functions:

Press the **SELECT** button to select. The meter displays **"EF"** when it is ready. The detected Electric Field strength is indicated as a series of bar-graph segments on the display plus variable beep tones.

●Non-Contact EF-Detection (NCV):

An antenna is located along the top-right end of the stationary clamp jaw, which detects electric field surrounds energized conductors. It is ideal for tracing live wiring connections, locating wiring breakages and to distinguish between live and earth connections.

●Probe-Contact EF-Detection (Single-pole):

For more precise indication of live wires, such as distinguishing between Live and Ground connections, use one single test-probe to test via terminal **COM** by direct metal contact probing to achieve the most distinctive indications.

Live | Ground
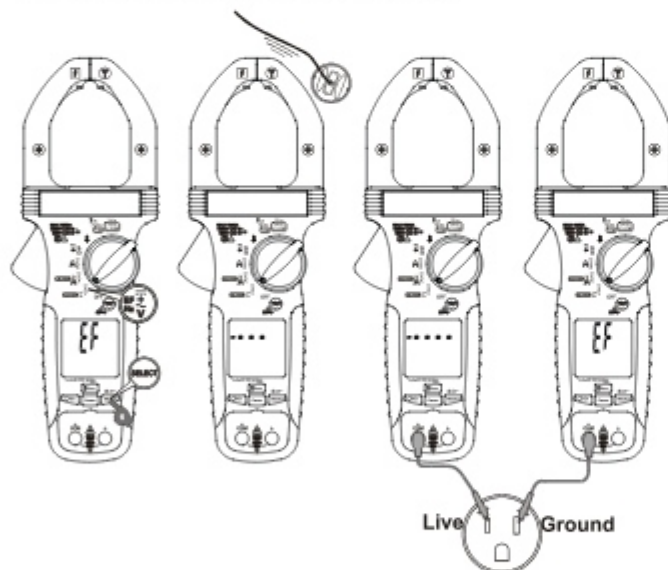
NOTES for Non-Invasive (Clamp-on) Current Measurements:

●(Application and Removal of the Clamp-on Jaws) For non-invasive current measurements, press the jaw trigger and clamp the jaws around conductor(s) of only

one single pole of a circuit for load current measurement. Make sure the jaws are completely closed, or else it will introduce measurement errors. Enclosing conductor(s) of more than one pole of a circuit may result in differential current (like identifying leakage current) measurement. Align the conductor(s) to the Jaws center indicators (Regular or AmpTip™ indicators where applicable) as much as possible to get the best measuring accuracy. For removal, press the jaw trigger and remove the jaws from the conductor(s).

●Adjacent current-carrying devices such as transformers, motors and conductor wires may affect measurement accuracy. Keep the jaws away from them as much as possible to minimize influence.

●Do not use the meter to measure currents above the rated frequency (400Hz). Circulating currents may cause the magnetic circuits of the Jaws reach a hazardous temperature.

Non-Invasive Regular Current Functions: ACA, AC+DCA, DCA & Hz

Input is made via the clamp jaws with the best accuracy specified at the jaw center for regular current measurements. Default at **ACA**. Press **SELECT** button to select the subject functions in sequence.

NOTE

Before making any **single DCA or AC+DCA** measurement long-press the **Zero Δ** button to apply **DC-Zero** with which the best measuring accuracy is specified. Refer to **DC-Zero mode** operations for more details.