



## 1) SAFETY

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

The meter protection rating, against the users, is double insulation per UL/IEC/EN61010-1 Ed. 3.0, IEC/EN61010-2-033 Ed. 1.0, CAN/CSA C22.2 No. 61010-1 Ed. 3.0, IEC/EN61010-2-032 Ed. 3.0 & IEC/EN61010-031 Ed. 1.1:

Measurement Category III 1000V & Category IV 600V AC & DC.

### Per IEC61010-1 (2010) OVERVOLTAGE CATEGORY

**OVERVOLTAGE CATEGORY II (CAT II)** is for equipment intended to be supplied from the building wiring. It applies both to plug-connected equipment and to PERMANENTLY CONNECTED EQUIPMENT.

**OVERVOLTAGE CATEGORY III (CAT III)** is for equipment intended to form part of a building wiring installation. Such equipment includes socket outlets, fuse panels, and some MAINS installation control equipment.

**OVERVOLTAGE CATEGORY IV (CAT IV)** is for equipment installed at or near the origin of the electrical supply to a building, between the building entrance and the main distribution board. Such equipment may include electricity tariff meters and primary overcurrent protection devices.

### TERMS IN THIS MANUAL

**WARNING** identifies conditions and actions that could result in serious injury or even death to the user.

**CAUTION** identifies conditions and actions that could cause damage or malfunction in the instrument.

### WARNING

To reduce the risk of fire or electric shock, do not expose this product to rain or moisture. The meter is intended only for indoor use.

To avoid electrical shock hazard, observe the proper safety precautions when working

with voltages above 60 VDC or 30 VAC rms. These voltage levels pose a potential shock hazard to the user. Before and after hazardous voltage measurements, test the voltage function on a known source such as line voltage to determine proper meter functioning.









Keep your hands/fingers behind the hand/finger barriers (of the meter and the test leads) that indicate the limits of safe access of the hand-held part during measurement. Inspect test leads, connectors, and probes for damaged insulation or exposed metal before using the instrument. If any defects are found, replace them immediately. Only use the test lead provided with the equipment or UL Listed Probe Assembly rated CAT III 1000V or better.

This Clamp-on meter is designed to apply around or remove from uninsulated hazardous live conductors. But still, individual protective equipment must be used if hazardous live parts in the installation where measurement is to be carried out could be accessible.

### **CAUTION**

Disconnect the test leads from the test points before changing meter functions.

### **INTERNATIONAL ELECTRICAL SYMBOLS**

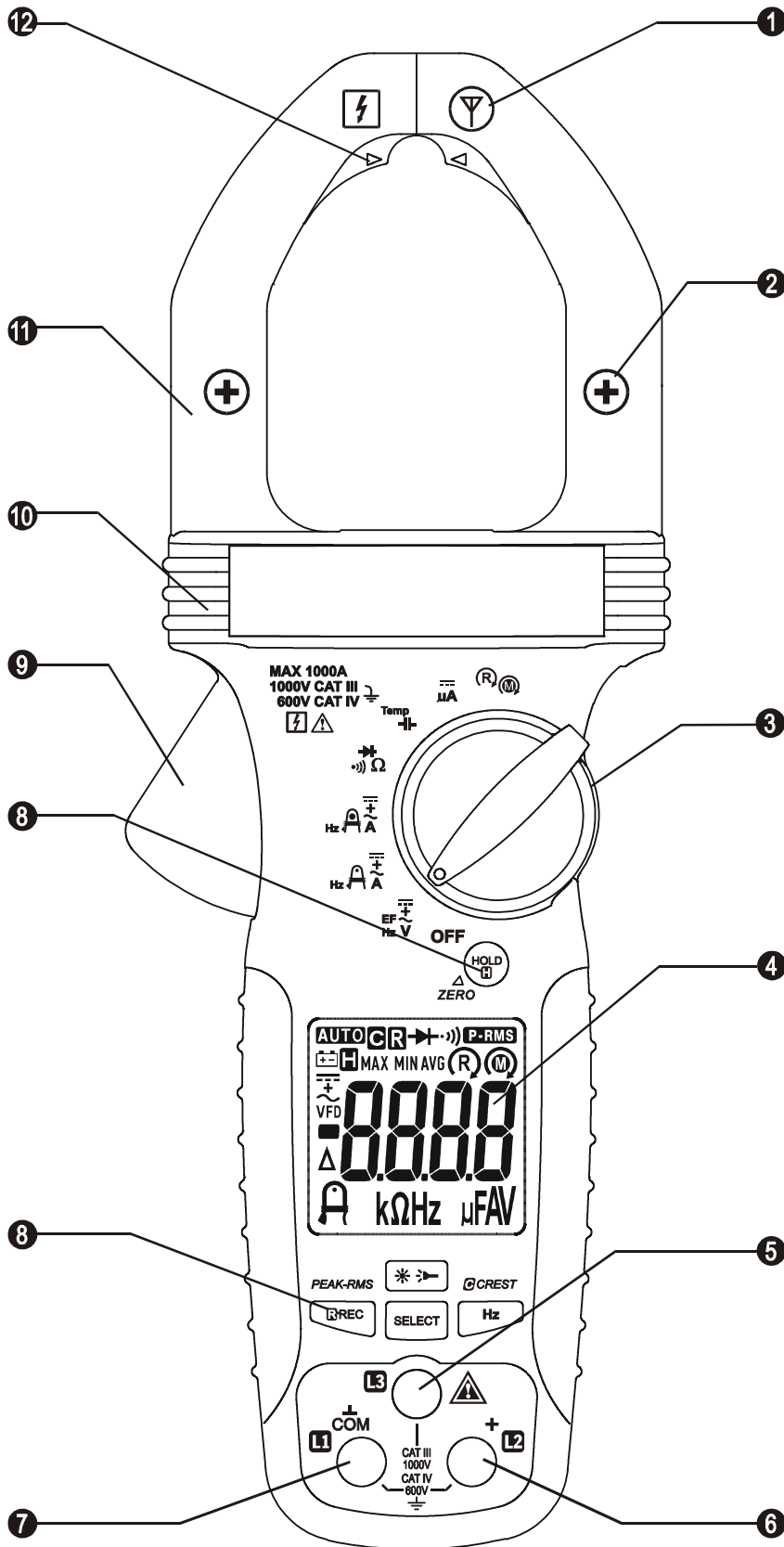
	Caution ! Refer to the explanation in this Manual
	Caution ! Risk of electric shock
	Earth (Ground)
	Double Insulation or Reinforced insulation
	Fuse
	AC--Alternating Current
	DC--Direct Current
	Application around and removal from hazardous live conductors is permitted

### **2) CENELEC Directives**

The instruments conform to CENELEC Low-voltage directive 2006/95/EC and Electromagnetic compatibility directive 2004/108/EC

### **3) PRODUCT DESCRIPTION**

This user's manual uses only representative model(s) for illustrations. Please refer specification details for function availability to each model.



1) Antenna area for Non-Contact EF-Detection

2) Jaw center indicator (with DCA polarity for Models 089 & 088), at where best current accuracy is specified

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

4) 3-5/6 digits 6000 counts numeric LCD display

5) Additional input Jack for Phase Rotation function only

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) Hand/Finger Barrier to indicate the limits of safe access of the meter

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

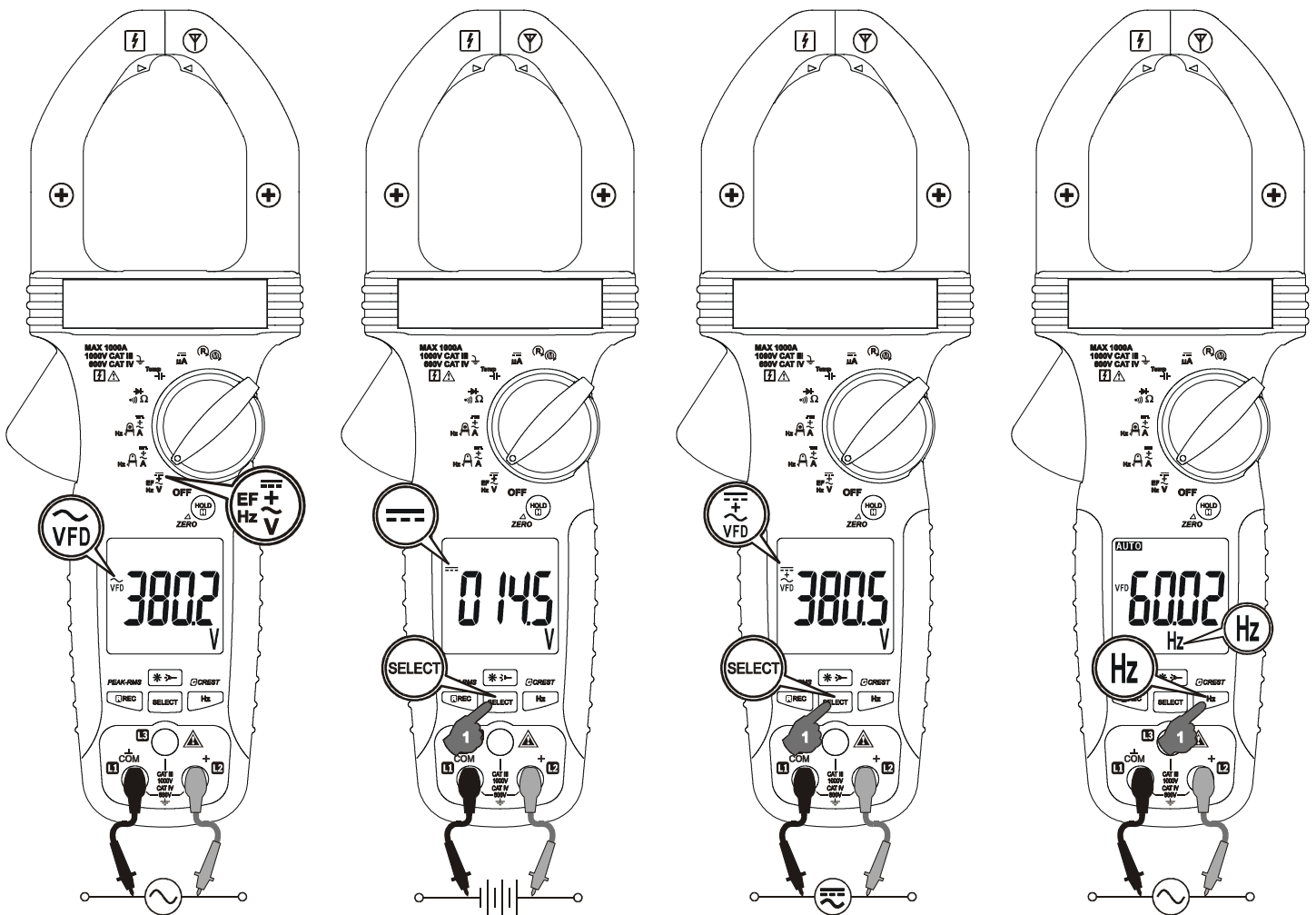
12) Additional center indicator for AmpTip™ Low-current function, at where best AmpTip™ current accuracy is specified

## 4) OPERATION

**WARNING:** Before and after hazardous voltage measurements, test the voltage function on a known source such as line voltage to determine proper meter functioning.

### ACV, DCV, DC+ACV (Models 089 & 088 only), EF (NCV), & Line-level Hz functions

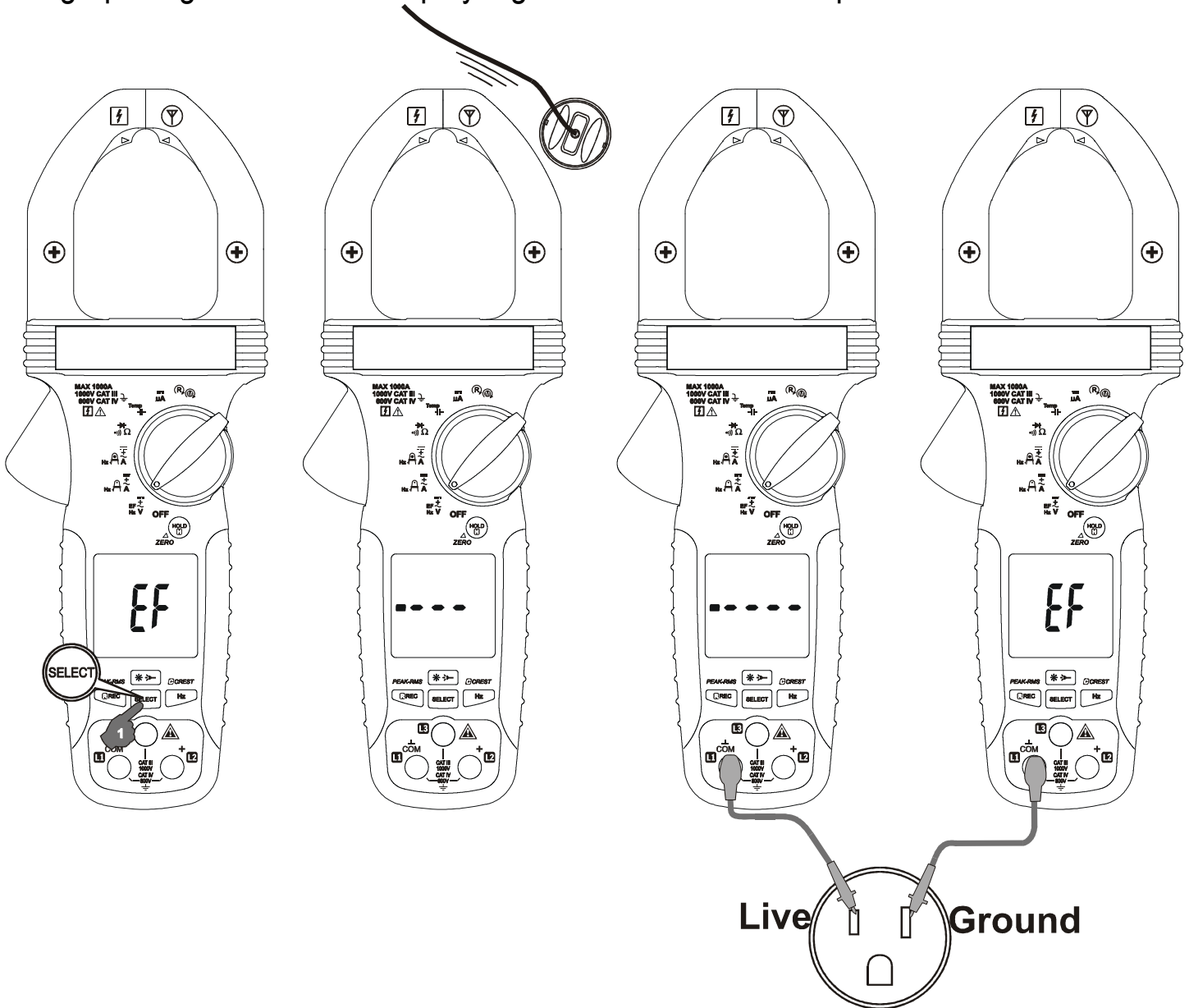
Inputs, other than that of **EF** as described below, are made through the test lead terminals **COM/+**. Press **SELECT** button momentarily to select the subject functions in sequence. Last selection will be saved as power up default for repeat measurement convenience. Press **Hz** button momentarily to toggle the **Line-level Hz** function.



Note: **ACV** (and hence **AC+DCV** & **Line-level Hz**) function is equipped with digital low-pass filter, and is capable of dealing with **VFD** (Variable Frequency Drives) signals. It also improves ACV reading stability in noisy electrical environments.

## Electric Field EF-Detection

The meter displays “EF” when it is ready. Signal strength is indicated as a series of bar-graph segments on the display together with variable beep tones.



- **Non-Contact EF-Detection:** 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 breakage and to distinguish between live or earth connections.

- **Probe-Contact EF-Detection:** For more precise indication of live wires, such as distinguishing between Live and Ground connections, use one single probe to test via terminal **COM** for direct contact EF-Detection with best sensitivity.

**CAUTION & WARNING for Non-Invasive (Clamp-on) Current Measurements:****CAUTION**

*(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.*

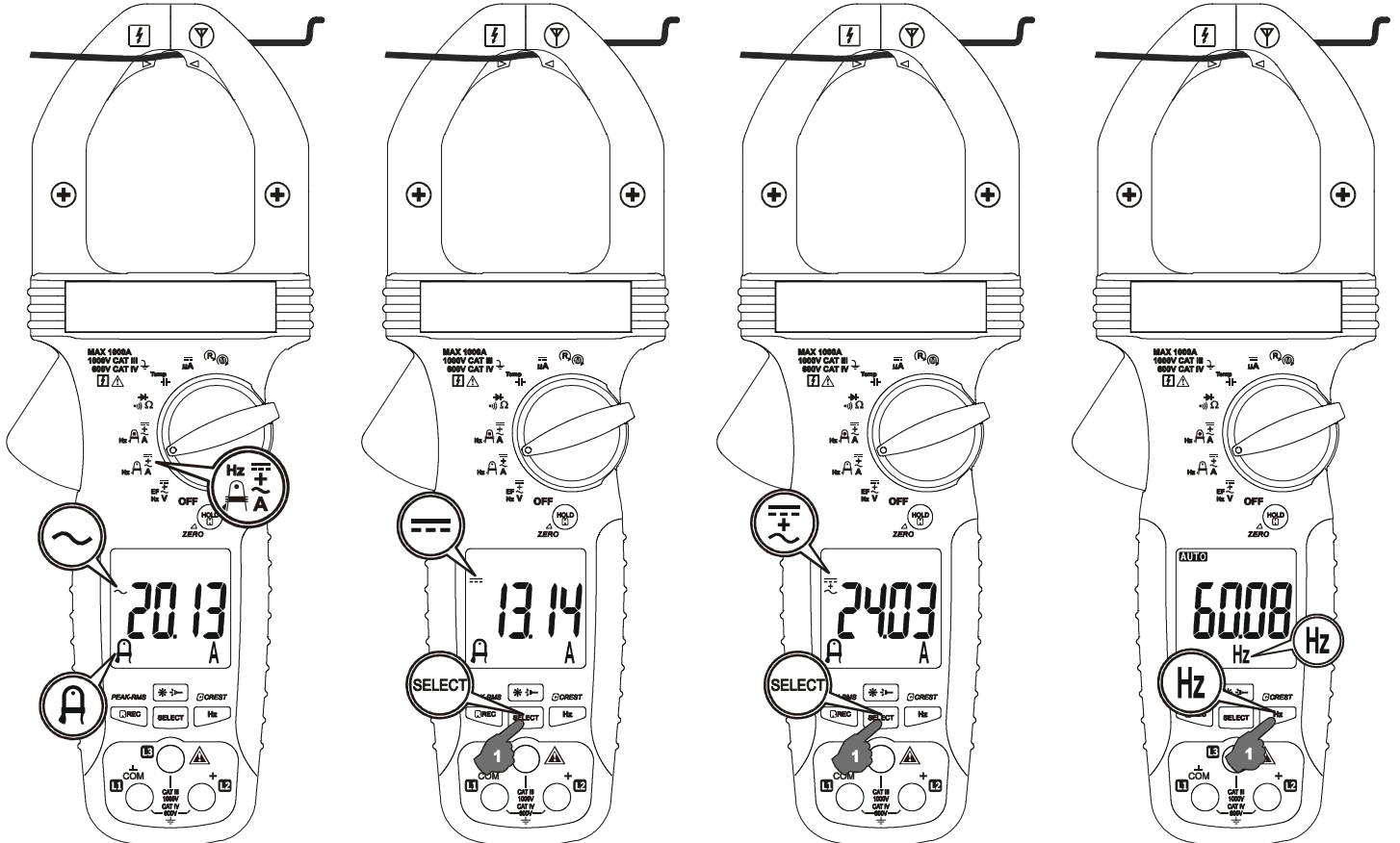
**WARNING**

*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 AmpTip™ Low-Current Functions:

ACA, DCA (Models 089 & 088 only), DC+ACA (Models 089 & 088 only), & Hz

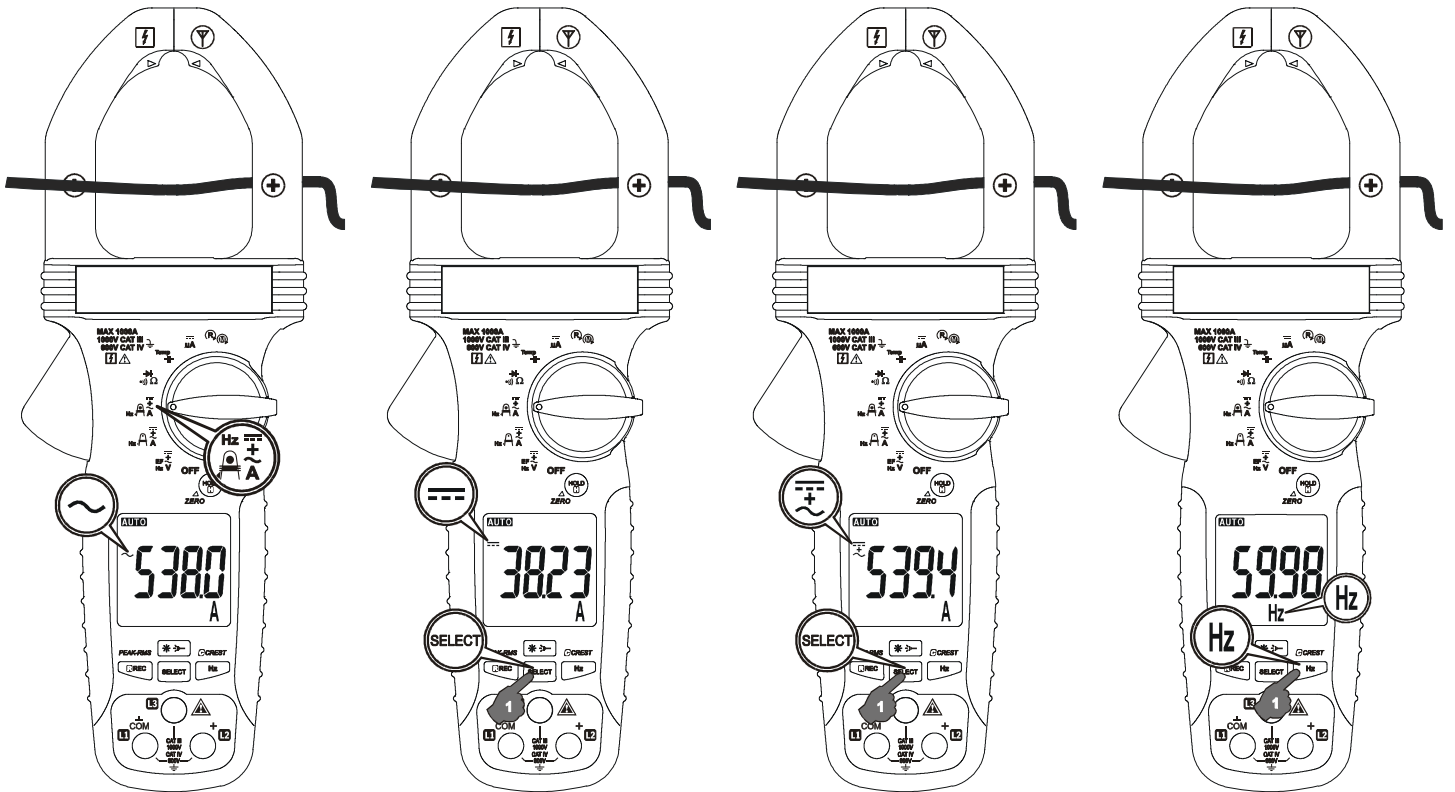
Input is made via the clamp jaws with best accuracy specified near the jaw tip area for small conductors low-current measurements. Press **SELECT** button momentarily to select the subject functions in sequence. Last selection will be saved as power up default for repeat measurement convenience. Press Hz button momentarily to toggle the Hz function.



## Non-Invasive Regular Current Functions:

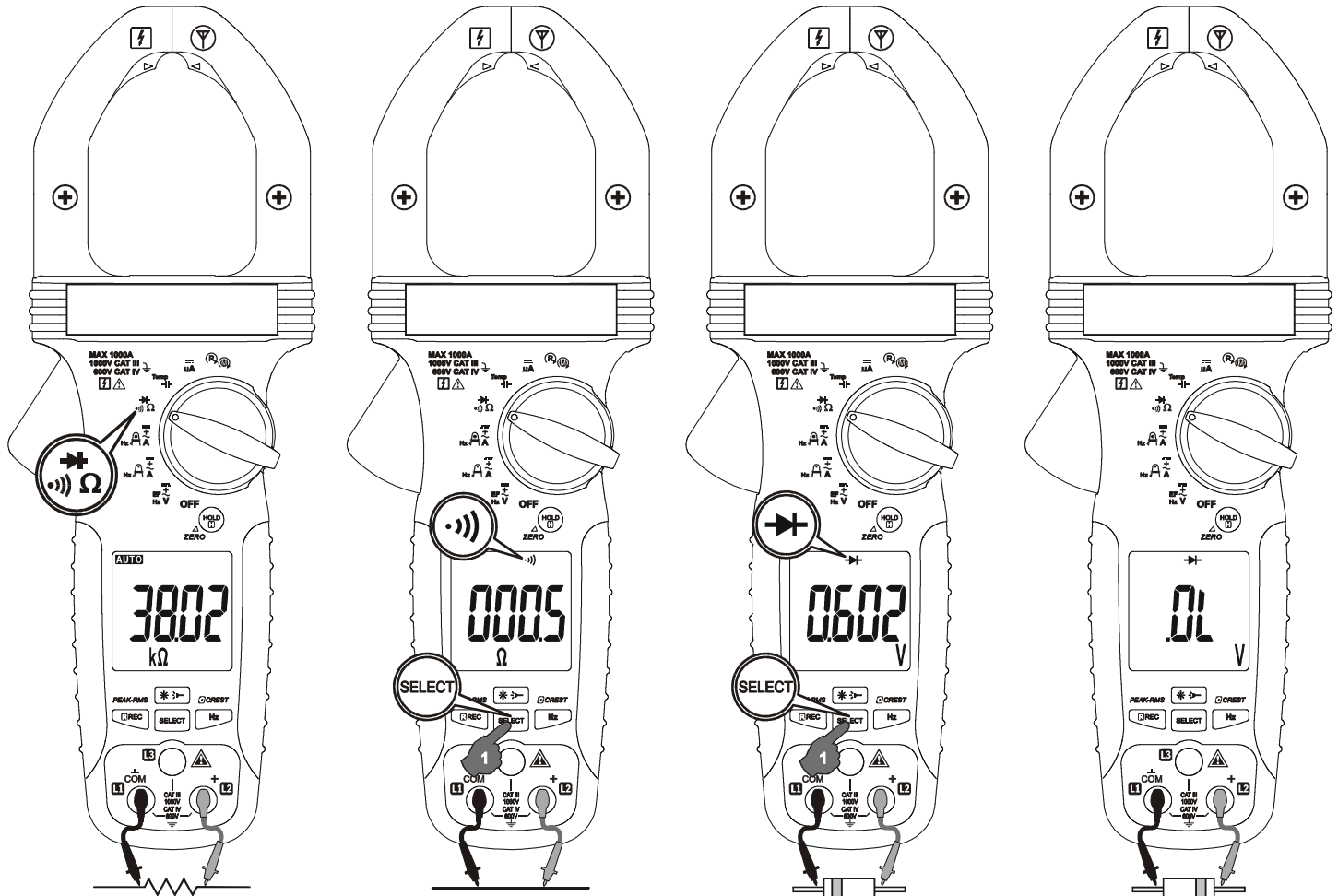
### ACA, DCA (Models 089 & 088 only), DC+ACA (Models 089 & 088 only) & Hz

Input is made via the clamp jaws with best accuracy specified at the jaw center for regular current measurements. Press **SELECT** button momentarily to select the subject functions in sequence. Last selection will be saved as power up default for repeat measurement convenience. Press Hz button momentarily to toggle the Hz function.



## $\Omega$ Resistance, $\rightarrow$ ) Continuity & $\rightarrow$ Diode functions

Inputs are made through the test lead terminals **COM/+**. Press **SELECT** button momentarily to select the subject functions in sequence. Last selection will be saved as power up default for repeat measurement convenience.



### Note

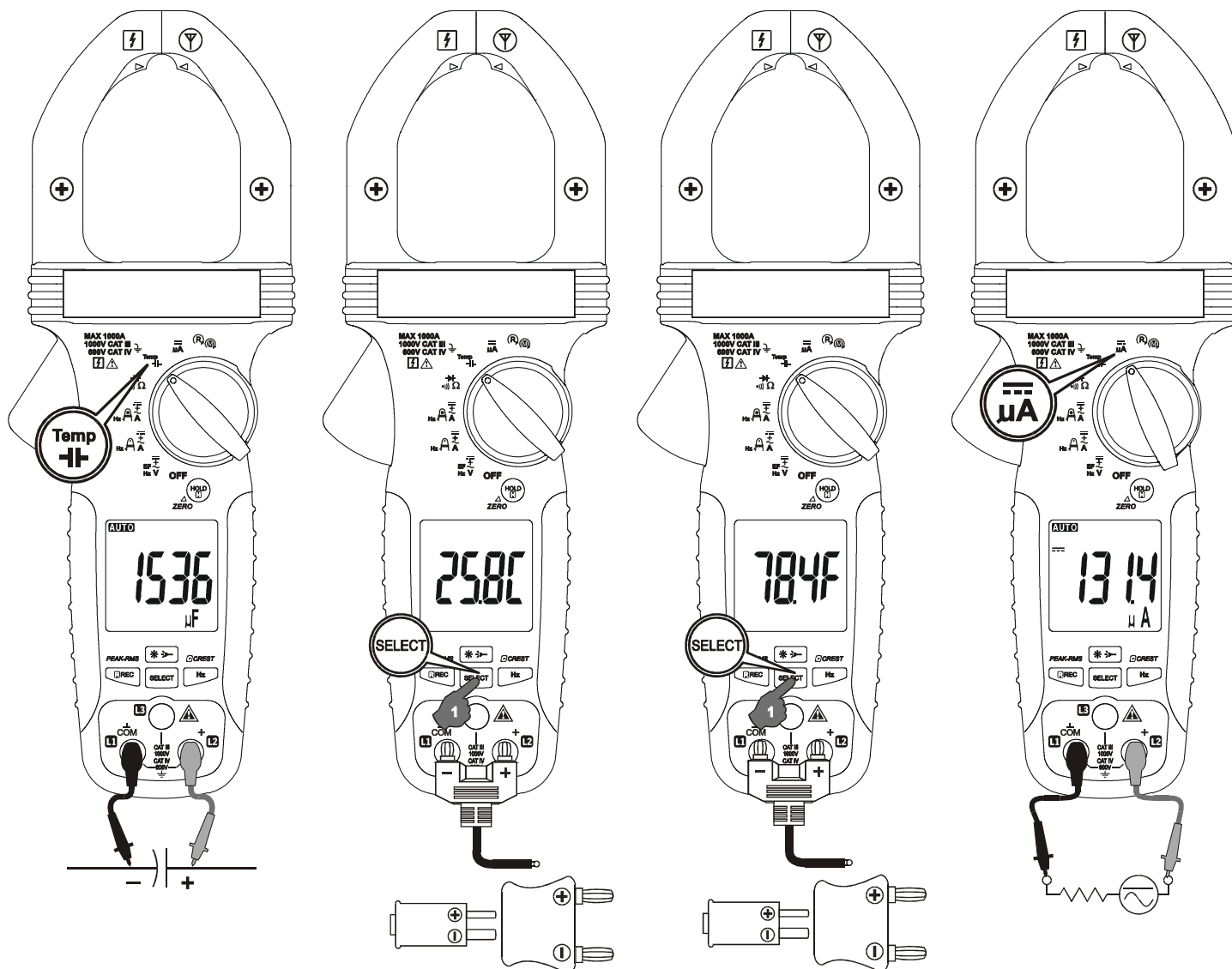
When using Diode test function, normal forward voltage drop (forward biased) for a good silicon diode is between 0.400V to 0.900V. A reading higher than that indicates a leaky diode (defective). A zero reading indicates a shorted diode (defective). An OL indicates an open diode (defective). Reverse the 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).

### CAUTION

Using Resistance, Continuity or Diode 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.

## ⚡ Capacitance, Temperature °C & °F (Models 089 & 086 only) functions

Inputs are made through the test lead terminals **COM/+**. Last selection will be saved as power up default for repeat measurement convenience. Press **SELECT** button momentarily to select the subject functions in sequence.



### Note

Be sure to insert the banana plug type-K temperature bead probe Bkp60 with correct **+** **-** polarities. You can also use a plug adapter Bkb32 (Optional purchase) with banana pins to type-K socket to adapt other type-K standard mini plug temperature probes.

### CAUTION

1. Using 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.

2. *When using Capacitance function, discharge capacitor(s) before making any measurements. Large value capacitors should be discharged through an appropriate resistance load*

### **DC $\mu$ A Current function (Models 089 & 086 only)**

Inputs are made through the test lead terminals **COM/+**.

Application notes:

The **DC $\mu$ A** function is designed especially for HVAC/R flame sensor applications. The 0.1 $\mu$ A resolution is useful for identifying the minute current changes in flame detector applications. Flame signal current check should indicate steady flame signal of at least 2 $\mu$ A for a rectification type, or 1.5 $\mu$ A for an ultraviolet type (8 $\mu$ A for self checking systems). If a flame signal current with inadequate strength or fluctuation beyond 10%, check the following to avoid the risk of unwanted flame relay dropout :

For gas or oil flames (Minipeeper):

- Low supply voltage
- Detector location
- Defective detector wiring
- Dirty viewing windows
- Faulty Minipeeper

For oil flames (Photocell):

- Detector location & wiring
- Smoky flame or poorly adjusted air shutter
- Faulty Photocell
- Temperature over 165 °F (74 °C) at photocell

For gas flames (Flame Rod):

- Ignition interference (A flame signal current difference with the ignition both on and off greater than 0.5 $\mu$ A indicates the presence of ignition interference)
- Insufficient ground (must be at least 4 times the detector area)
- Flame lifting off burner head (ground), or not continuously in contact with the flame rod
- Temperature in excess of 600 °F (316 °C) at the flame electrode insulator causing short to ground.

## Ⓜ & Ⓡ 3-Phase Rotation function (Models 089 & 086 only)

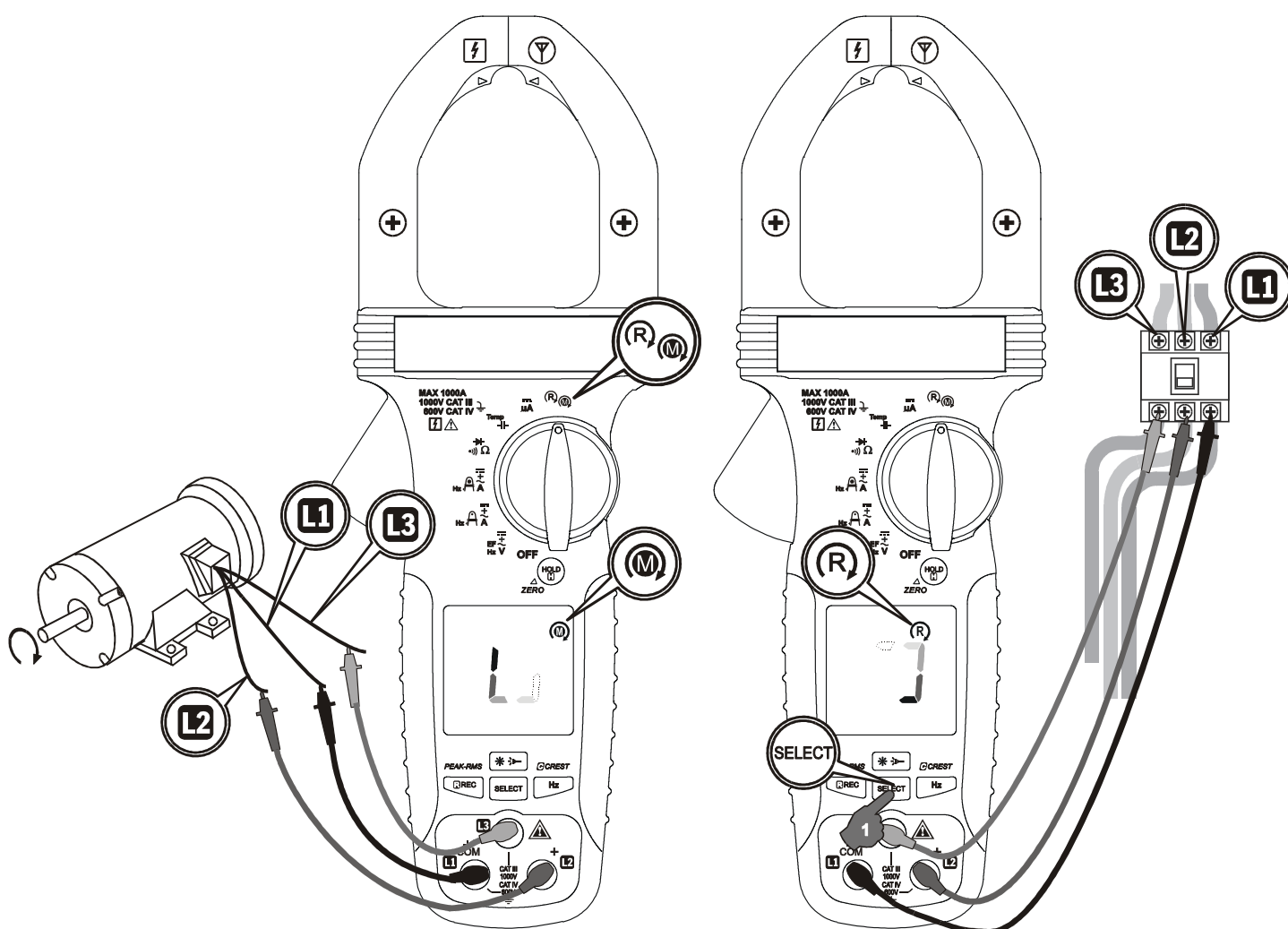
Inputs are made through the test lead terminals L1/L2/L3. Phase Rotation directions are indicated as symbolic movements by the LCD segments. Press **SELECT** button momentarily toggles between Ⓜ and Ⓡ modes. Last selection will be saved as power up default for repeat measurement convenience.

Ⓜ: Hi-sensitivity mode, which detects relatively low signal outputs generated from motor spinning, for checking phase connections of Motors.

Ⓡ: Normal-sensitivity mode for identifying phase sequence of MAINS (electricity supply).

### CAUTION

*Proper Rotation detection relies on solid signal connection to all three test lead terminals simultaneously. Any single disconnection will lead to detection failure and may produce false indication. To verify signal connection and hence proper meter indication, swap any two connects (between the meter and the test points) to check for indication of reverse movement*



### Using the Hi-sensitivity mode (M) for Motors:

Connect to the Motor as illustrated. Be sure the electricity supply is removed. From the perspective of looking down the shaft of the motor, speed-spin it clockwise to generate sufficient signal strength for proper meter detection. If the meter indicates a clockwise movement, the motor leads connected to L1, L2 and L3 of the meter are L1, L2 and L3 (also known as R, S and T), respectively. If the meter indicates a counter-clockwise movement, swap any two connects between the meter and motor. Then retest.

### Using the Normal mode (R) for MAINS (electricity supply):

Connect to the MAINS as illustrated. If the meter indicates a clockwise movement, the phases connected to L1, L2 and L3 of the meter are L1, L2 and L3 (also known as R, S and T), respectively. If the meter indicates a counter-clockwise movement, swap any two connects between the meter and phases. Then retest. Connect the above mentioned L1, L2 and L3 of a Motor and that of the MAINS respectively should get a clockwise motor movement.

### Using the Complementary Beeper feature:

The Complementary Beeper feature is selected in Power-up option. Press and hold the **REC** button while turning the meter on to enable. If the segments indicate a clockwise movement, the beeper sounds a single long beep per segment cycle. If the segments indicate a counter clockwise movement, the beeper sounds 3 short beeps per segment cycle.

### Hold

Hold feature freezes the display for later view. LCD “H” turns on. Press the **HOLD** button momentarily to toggle the hold feature.

### Record mode

Press **REC** button momentarily to activate MAX/MIN/AVG recording mode. LCD “R” & “**MAX MIN AVG**” turn on. The meter beeps when new MAX (maximum) or MIN (minimum) reading is updated. AVG (Average) reading is calculated over time. Press the button momentarily to read the MAX, MIN and AVG readings in sequence. Press the button for 1 second or more to exit this mode. Auto-Power-Off is disabled automatically in this mode.

### Relative-Zero (Δ) mode

Relative-Zero allows the user to offset the meter consecutive measurements with the main display displaying reading as the reference value. LCD “Δ” turns on. Press the

**Δ (HOLD)** button for one second or more 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 & DC+ACA** functions. Press the **Δ (HOLD)** button for one second or more to activate/ re-activate this mode. Apply this mode before making any single DCA or DC+ACA measurement for best measuring accuracy. The meter shows “**dc\_0**” shortly to confirm activation before continuing measurements. The beeper will sound 3 short beeps, however, to warn for null activation if the residual is beyond a reasonable hysteresis reading of -5 to 5 DCA.


### **80ms PEAK-RMS mode (Models 089, 088 & 086 only)**

Press **PEAK-RMS** button for one second or more to toggle **PEAK-RMS** mode to capture inrush current or voltage RMS values in duration as short as 80ms. LCD **P-RMS** turns on. Auto-Power-Off is disabled automatically in this mode.

### **5ms CREST mode (Models 089, 088 & 086 only)**

Press **CREST** button for one second or more to activate **CREST** mode (Instantaneous PEAK-HOLD) to capture current or voltage peak values in duration as short as 5ms. LCD **C** & “**MAX**” turn on. The meter beeps when new MAX (maximum) or MIN (minimum) reading is updated. Press the button momentarily to read the MAX and MIN readings in sequence. Press the button for 1 second to exit this mode. Auto-Power-Off is disabled automatically in this mode.

### **Flashlight (Models 089 & 088 only) & Backlighted LCD display**

Press the  button momentarily to toggle the LCD backlight & flashlight ON and OFF. The backlight & flashlight will also be turned off automatically after 32 seconds to extend battery life.

### **Intelligent Auto-Power-Off (APO)**

The Auto-Power-off (APO) mode turns the meter off automatically to extend battery life after approximately 32 minutes of no specified activities, where applicable:

- 1) Rotary switch or push button operations
- 2) Significant measuring readings of above 8.5% of ranges
- 3) Non-OL readings for Resistance, Continuity or Diode function
- 4) Non-zero readings for Hz function
- 5) Significant movement indication as in Phase Rotation functions

In other words, the meter will intelligently avoid entering the APO mode when it is under normal measurements. To wake up the meter from APO, press the **SELECT**

button momentarily 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

## **5) MAINTENANCE**

### **WARNING**

*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.*

### **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.

If the instrument voltage-resistance input terminal has subjected to high voltage transient (caused by lightning or switching surge to the system under test) by accident or abnormal conditions of operation, the protective impedance components in series might be blown off (become high impedance) like open fuses to protect the user and the instrument. Most measuring functions through this terminal might then be open circuit. Such components should only be replaced by qualified technician. Refer to the LIMITED WARRANTY section for obtaining warranty or repairing 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. Refer to the LIMITED WARRANTY section for obtaining calibration, repairing or warranty service.

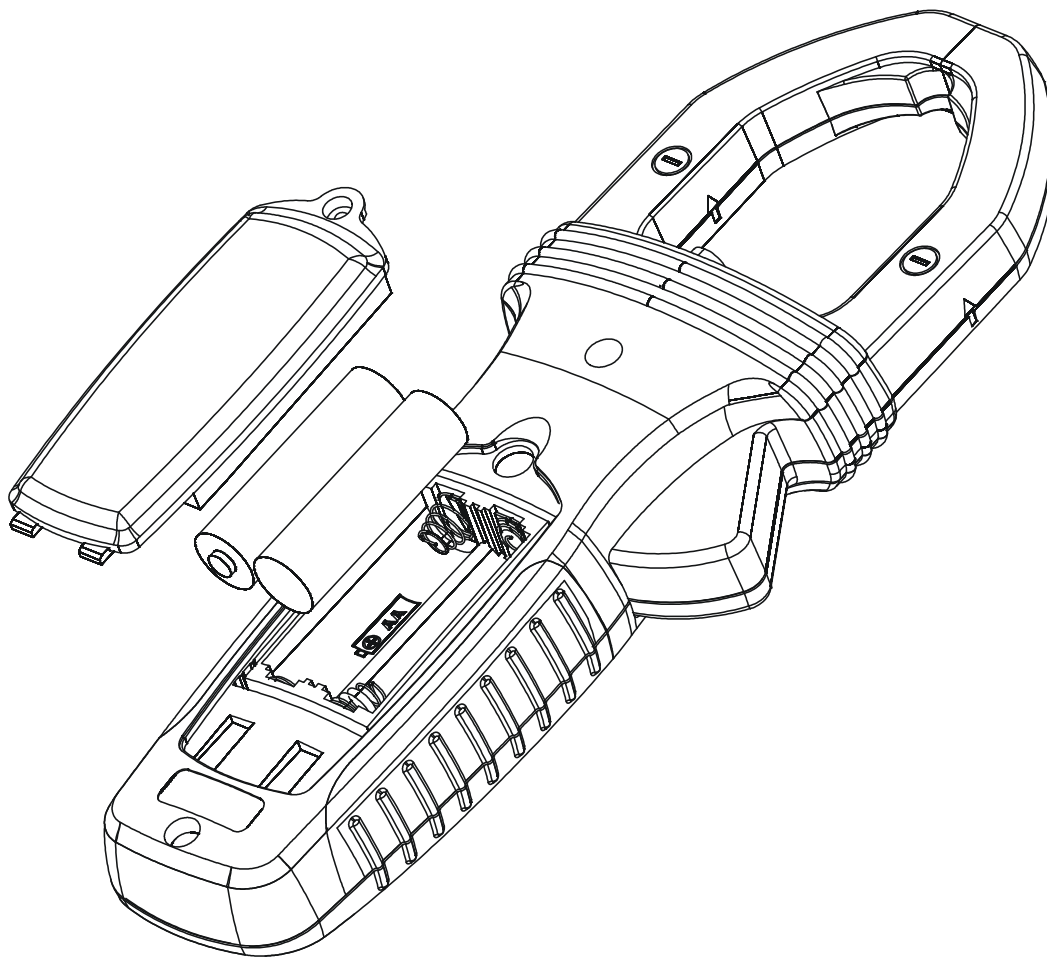
### **Cleaning and Storage**

Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. 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 R6) battery X 2

Loosen the 2 captive screws from the battery cover case. Lift the battery cover case. Replace the batteries. Replace battery cover case. Re-fasten the screws.



## GENERAL SPECIFICATIONS

**Display:** 3-5/6 digits 6000 counts.

**Polarity:** Automatic

**Update Rate:** 5 per second nominal;

**Operating Temperature:** -10°C to 50°C

**Relative Humidity:** Non condensing ( $\leq 10^\circ\text{C}$ )

$\leq 90\% \text{ RH}$  (at 10~30°C)

$\leq 75\% \text{ RH}$  (at 30~40°C)

$\leq 45\% \text{ RH}$  (at 40~50°C)

**Pollution degree:** 2

**Storage Temperature:** -20°C to 60°C, < 80% R.H. (with battery removed)

**Altitude:** Operating below 2000m; Storage below 12000m

**Temperature Coefficient:** nominal  $0.10 \times (\text{specified accuracy}) / ^\circ\text{C}$  @(-10°C -- 18°C or 28°C -- 50°C), or otherwise specified

**Sensing:** True RMS

**Safety:** Double insulation per UL/IEC/EN61010-1 Ed. 3.0, IEC/EN61010-2-033 Ed. 1.0,

CAN/CSA C22.2 No. 61010-1 Ed. 3.0, IEC/EN61010-2-032 Ed. 3.0 & IEC/EN61010-031 Ed. 1.1 to CAT III 1000V and CAT IV 600V AC & DC

**Transient Protection:** 8.0kV (1.2/50 $\mu$ s surge)

**Overload Protections:**

Current & Hz functions via jaws: 1000ADC/AAC rms at <400Hz

Voltage & 3-Phase Rotation functions via terminals: 1100VDC/VAC rms

Other functions via terminals: 1000VDC/VAC 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):

ACA, DCA, and DC+ACA Functions, in an RF field of 1V/m:

Total Accuracy = Specified Accuracy + 60 digits at around 200MHz~350MHz

Ohm and DC $\mu$ A Functions, in an RF field of 1V/m:

Total Accuracy = Specified Accuracy + 80 digits

Other Functions, in an RF field of 3V/m:

Total Accuracy = Specified Accuracy + 20 digits

**Power Supply:** 1.5V AA Size battery X 2

**Power Consumption:** Typical 13mA for Current functions of Models 089 & 088; 4.3mA for others

**Low Battery:**

Below approx. 2.85V for Capacitance & Hz

Below approx. 2.5V for other functions

**APO Timing:** Idle for 32 minutes

**APO Consumption:** 5 $\mu$ A typical

**Dimension:** L258mm X W94mm X H44mm

**Weight:** 392gm for Models 088 & 089; 312gm for Models 083 & 086

**Jaw opening & Conductor diameter:** 51mm max

**Accessories:** Test lead set, User's manual, Soft carrying pouch, Bkp60 banana plug K-type thermocouple (Models 089 & 086 only), Alligator clip set (Models 089 & 086 only)

**Optional purchase accessories:** BKB32 banana plug to type-K socket plug adaptor (Models 089 & 086 only)

**Special Features:** AmpTip™ low-current range; MAX/MIN/AVG Recording mode; Display Hold; EF-Detection (NCV); Backlighted LCD; Flashlight (Models 089 & 088 only); 80ms Peak-RMS mode for inrush current (Models 089, 088 & 086 only); 5ms Crest (Instantaneous Peak-Hold) mode (Models 089, 088 & 086 only); Relative-Zero, 3-Phase Rotation detection (Models 089 & 086 only)

## Electrical Specifications

Accuracy is  $\pm$ (% reading digits + number of digits) or otherwise specified, at  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

Maximum Crest Factor  $< 2.5 : 1$  at full scale &  $< 5 : 1$  at half scale or otherwise specified, and with frequency spectrum not exceeding the specified frequency bandwidth for non-sinusoidal waveforms.

### DC Voltage

RANGE	Accuracy
600.0V, 1000V	0.8% + 5d

Input Impedance:  $10\text{M}\Omega$ , 100 pF nominal

### AC Voltage (with Digital Low-Pass Filter)

RANGE	Accuracy
50Hz ~ 60Hz	
600.0V, 1000V	0.8% + 5d
20Hz ~ 200Hz	
600.0V, 1000V	1.5% + 5d
200Hz ~ 400Hz	
600.0V, 1000V	10% + 5d

Input Impedance:  $10\text{M}\Omega$ , 100 pF nominal

### DC+AC Voltage (with Digital Low-Pass Filter) (Models 089 & 088 Only)

RANGE	Accuracy
50Hz ~ 60Hz	
600.0V, 1000V	1.0% + 7d
DC, 40Hz ~ 200Hz	
600.0V, 1000V	1.8% + 7d
200Hz ~ 400Hz	
600.0V, 1000V	12% + 7d

Input Impedance:  $10\text{M}\Omega$ , 100 pF nominal

### PEAK-rms (ACV & ACA of Models 089, 088 & 086 only)

Response: 80ms to  $> 90\%$

### CREST (Peak-Hold)

Accuracy: Add 250 digits to specified accuracy for changes > 5ms

### **Audible Continuity Tester**

Audible Threshold: At between  $10\Omega$  and  $250\Omega$

Response time: 32ms approx.

### **Ohm**

RANGE	Accuracy
600.0 $\Omega$ , 6.000K $\Omega$ , 60.00K $\Omega$	1.0% + 5d

Open Circuit Voltage: 1.0VDC typical

### **Capacitance**

RANGE	Accuracy <sup>1)</sup>
200.0 $\mu$ F, 2500 $\mu$ F	2.0% + 4d

<sup>1)</sup>Accuracies with film capacitor or better

### **Diode Tester**

RANGE	Accuracy
2.000V	1.5% + 5d

Test Current: 0.3mA typically

Open Circuit Voltage: < 3.5VDC typically

### **DC $\mu$ A (Models 089 & 086 only)**

RANGE	Accuracy	Burden Voltage
200.0 $\mu$ A, 2000 $\mu$ A	1.0% + 5d	3.5mV/ $\mu$ A

**Temperature (Models 089 & 086 only)**

RANGE	Accuracy
-40.0 °C ~ 99.9 °C	1.0% + 0.8°C
100 °C ~ 400 °C	1.0% + 1°C
-40.0 °F ~ 211.8 °F	1.0% + 1.5°F
212 °F ~ 752 °F	1.0% + 2°F

K-type thermocouple range & accuracy not included

**AmpTip™ clamp-on DCA (Models 089 & 088 only)**

RANGE	Accuracy <sup>1) 2) 3)</sup>
60.00A	1.5% + 5d

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

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

<sup>3)</sup>Add 10d to the specified accuracy @ < 4A

**Regular Clamp-on DCA (Models 089 & 088 only)**

RANGE	Accuracy <sup>1) 2)</sup>
60.00A <sup>3)</sup> , 600.0A, 1000A	1.8% + 5d

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

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

<sup>3)</sup>Add 10d to the specified accuracy @ < 9A

**AmpTip™ clamp-on DC+ACA (Models 089 & 088 only)**

RANGE	Accuracy <sup>1) 2) 3)</sup>
DC, 40Hz ~ 100Hz	
60.00A	2.0% + 7d
100Hz ~ 400Hz	
60.00A	2.2% + 7d

<sup>1)</sup>Induced error from adjacent current-carrying conductor: <0.08A/A

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

<sup>3)</sup>Add 10d to the specified accuracy @ < 4A

**Regular Clamp-on DC+ACA (Models 089 & 088 only)**

RANGE	Accuracy <sup>1) 2)</sup>
DC, 40Hz ~ 100Hz	
60.00A <sup>3)</sup> , 600.0A, 1000A <sup>4)</sup>	2.2% + 7d
100Hz ~ 400Hz	
60.00A <sup>3)</sup> , 600.0A, 1000A <sup>4)</sup>	2.5% + 7d

<sup>1)</sup>Induced error from adjacent current-carrying conductor: < 0.08A/A

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

<sup>3)</sup>Add 10d to the specified accuracy @ < 9A

<sup>4)</sup>Maximum Crest Factor < 1.4 : 1 at full scale & < 2.8 : 1 at half scale

**AmpTip™ clamp-on ACA**

RANGE	Accuracy <sup>1) 2) 3)</sup>
40Hz ~ 100Hz	
60.00A	1.5% + 5d
100Hz ~ 400Hz	
60.00A	2.0% + 5d

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

<sup>2)</sup>Specified with Relative Zero  $\Delta$  mode applied to offset the non-zero residual readings, if any

<sup>3)</sup>-Add 10d to the specified accuracy @ < 4A

**Regular Clamp-on ACA**

RANGE	Accuracy <sup>1) 2)</sup>
40Hz ~ 100Hz	
60.00A <sup>3) 4)</sup> , 600.0A, 1000A <sup>5)</sup>	1.8% + 5d
100Hz ~ 400Hz	
60.00A <sup>3) 4)</sup> , 600.0A, 1000A <sup>5)</sup>	2.2% + 5d

<sup>1)</sup>Induced error from adjacent current-carrying conductor:

< 0.02A/A for Models 089 & 088

< 0.05A/A for Models 086 & 083

<sup>2)</sup>For Models 086 & 083, specified accuracy is for measurements made at the jaw center. When the conductor is not positioned at the jaw center, add 2% to specified accuracy for position errors

<sup>3)</sup>For Models 086 & 083, add 10d to specified accuracy @ < 6A

<sup>4</sup>)For Models 089 & 088, add 10d to the specified accuracy @ < 9A

<sup>5</sup>)Maximum Crest Factor < 1.4 : 1 at full scale & < 2.8 : 1 at half scale

### Hz Line Level Frequency

Function	Sensitivity <sup>1)</sup> (Sine RMS)	Range
600V, 1000V	50V	5.00Hz ~ 999.9Hz
60A (AmpTip™)	40A	40.00Hz ~ 400.0Hz
60A, 600A, 1000A	40A	40.00Hz ~ 400.0Hz

Accuracy: 1%+5d

<sup>1</sup>)DC-bias, if any, not more than 50% of Sine RMS

### Non-Contact EF-Detection

Typical Voltage	Bar-Graph Indication
20V (tolerance: 10V ~ 36V)	-
55V (tolerance: 23V ~ 83V)	--
110V (tolerance: 59V ~ 165V)	---
220V (tolerance: 124V ~ 330V)	----
440V (tolerance: 250V ~ 1000V)	-----

Indication: Bar-graph segments & audible beep tones proportional to the field strength

Detection Frequency: 50/60Hz

Detection Antenna: Inside the 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 one single probe to test via terminal COM for direct contact EF-Detection with best sensitivity.

## LIMITED WARRANTY

BRYMEN warrants to the original product purchaser that each product it manufactures will be free from defects in material and workmanship under normal use and service within a period of one year from the date of purchase. BRYMEN's warranty does not apply to accessories, fuses, fusible resistors, spark gaps, varistors, batteries or any product which, in BRYMEN's opinion, has been misused, altered, neglected, or damaged by accident or abnormal conditions of operation or handling.

To obtain warranty service, contact your nearest BRYMEN authorized agent or send the product, with proof of purchase and description of the difficulty, postage and insurance prepaid, to BRYMEN TECHNOLOGY CORPORATION. BRYMEN assumes no risk for damage in transit. BRYMEN will, at its option, repair or replace the defective product free of charge. However, if BRYMEN determines that the failure was caused by misused, altered, neglected, or damaged by accident or abnormal conditions of operation or handling, you will be billed for the repair.

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