

# USER'S MANUAL

BM110M, BM111M, BM112M Single Display

BM127M, BM128M Twin Displays

Versatile Clamp-on Multimeter Series



## 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 meets the requirements for double insulation to IEC61010-2-032, EN61010-2-032, UL61010B-2-032, IEC61010-1 2nd Ed., EN61010-1 2nd Ed., UL61010-1 2nd Ed.:

Category III 600 Volts ac and dc.

### **PER IEC61010 OVERVOLTAGE INSTALLATION CATEGORY**

#### *OVERVOLTAGE CATEGORY II*

Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation.

Note – Examples include household, office, and laboratory appliances.

#### *OVERVOLTAGE CATEGORY III*

Equipment of OVERVOLTAGE CATEGORY III is equipment in fixed installations.

Note – Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

#### *OVERVOLTAGE CATEGORY IV*

Equipment of OVERVOLTAGE CATEGORY IV is for use at the origin of the installation. Note – Examples include electricity meters and primary over-current protection equipment.

### **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.

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

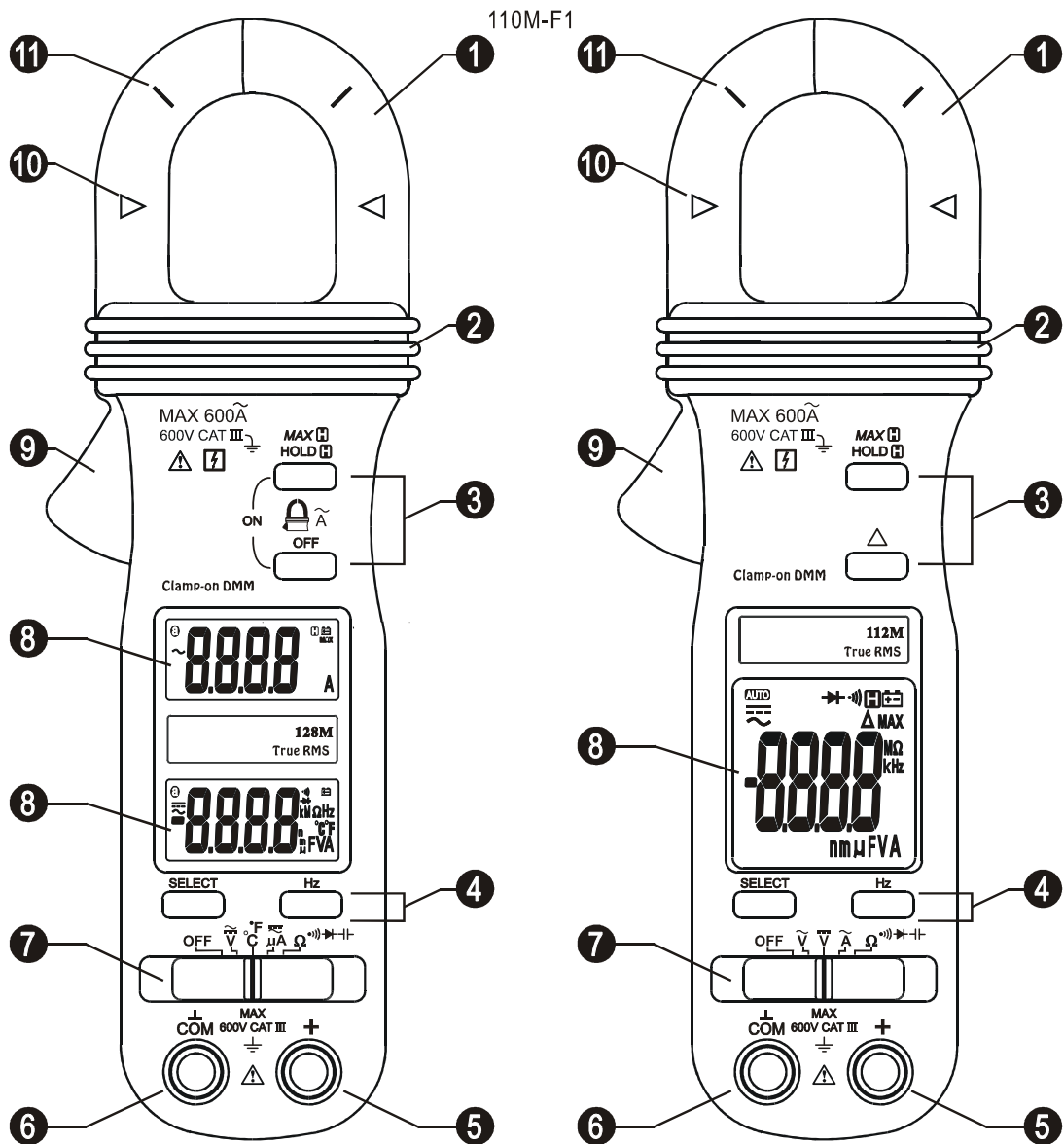
	Caution ! Refer to the explanation in this Manual
	Caution ! Risk of electric shock
	Earth (Ground)
	Double Insulation or Reinforced insulation
	Fuse
	AC--Alternating Current
	DC--Direct Current
	Application around and removal from hazardous live conductors is permitted

## 2) CENELEC Directives

The instruments conform to CENELEC Low-voltage directive 73/23/EEC and Electromagnetic compatibility directive 89/336/EEC

## 3) PRODUCT DESCRIPTION

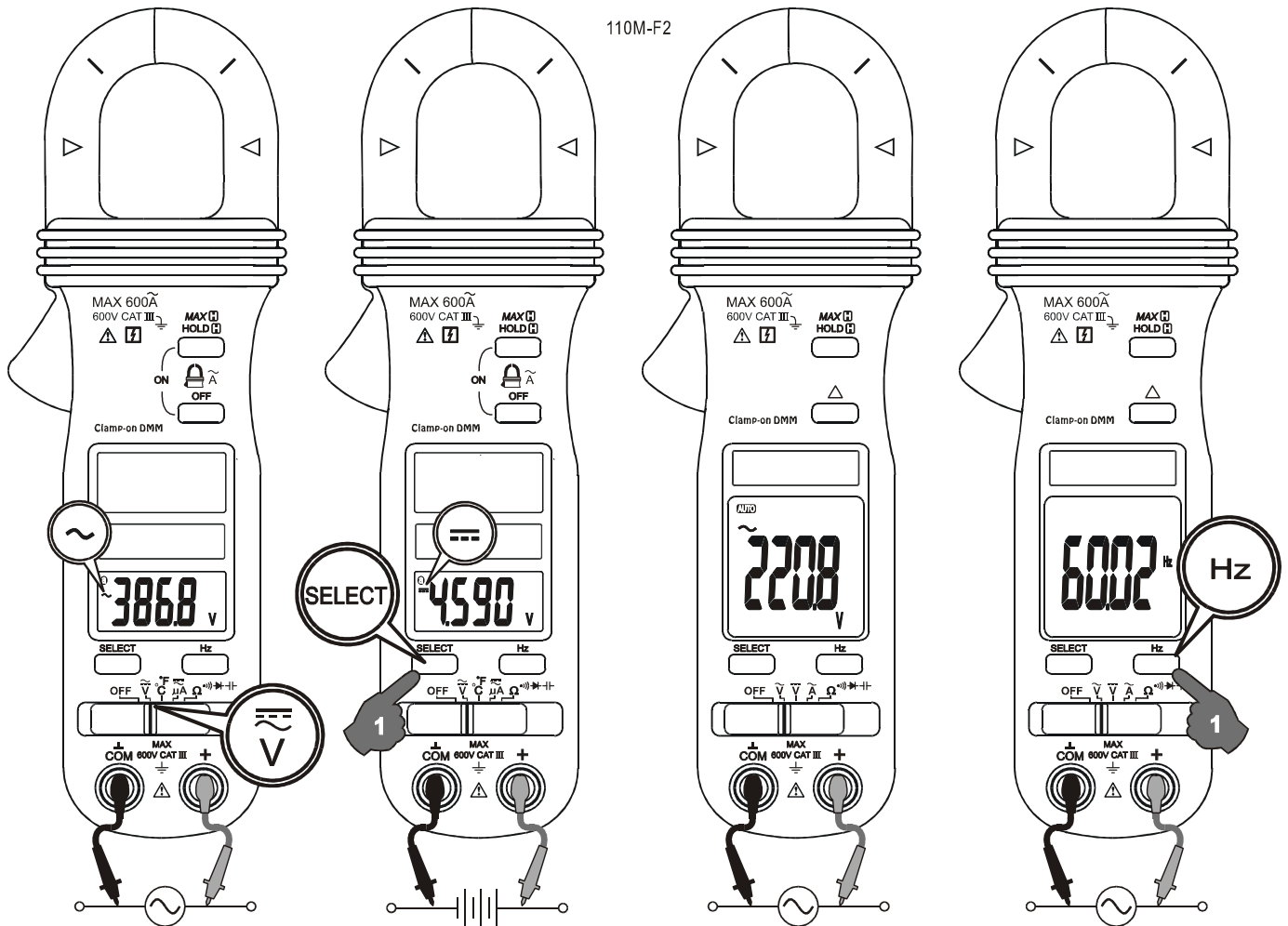
This user's manual uses only representative model(s) for illustrations. Please refer specification details for function availability to each model.



- 1) Transformer Clamp Jaw for AC current magnetic field pick up
- 2) Hand/Finger Barrier to indicate the limits of safe access of the meter during measurement
- 3) Push-buttons for special functions & features. Also as power ON/OFF buttons for ACA function in Twin Display Models
- 4) Push-buttons for special functions & features on Slide-switch Selector functions
- 5) Input Jack for all functions EXCEPT non-invasive ACA current function
- 6) Common (Ground reference) Input Jack for all functions EXCEPT non-invasive ACA current function
- 7) Slide-switch Selector to turn the power ON/OFF and Select a function
- 8) 3-3/4 digits 4000 counts LCD display(s)
- 9) Jaw trigger for opening the transformer clamp jaw
- 10) Jaw center Indicators, at where best ACA accuracy is specified
- 11) Jaw marking lines for ACA position error indication

## 4) OPERATION

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



### DC Voltage, AC Voltage, Hz Frequency functions

Set slide-switch to Voltage function position(s). Inputs are made through the test leads terminals. For Twin Display Models, slide-switch on defaults at AC voltage. Press **SELECT** button momentarily to select DC voltage.

Press the **Hz** button momentarily to activate Hz Frequency function in the following slide-switch functions:

Single Display Models: DCV & ACV via the test leads; ACA via the clamp jaw

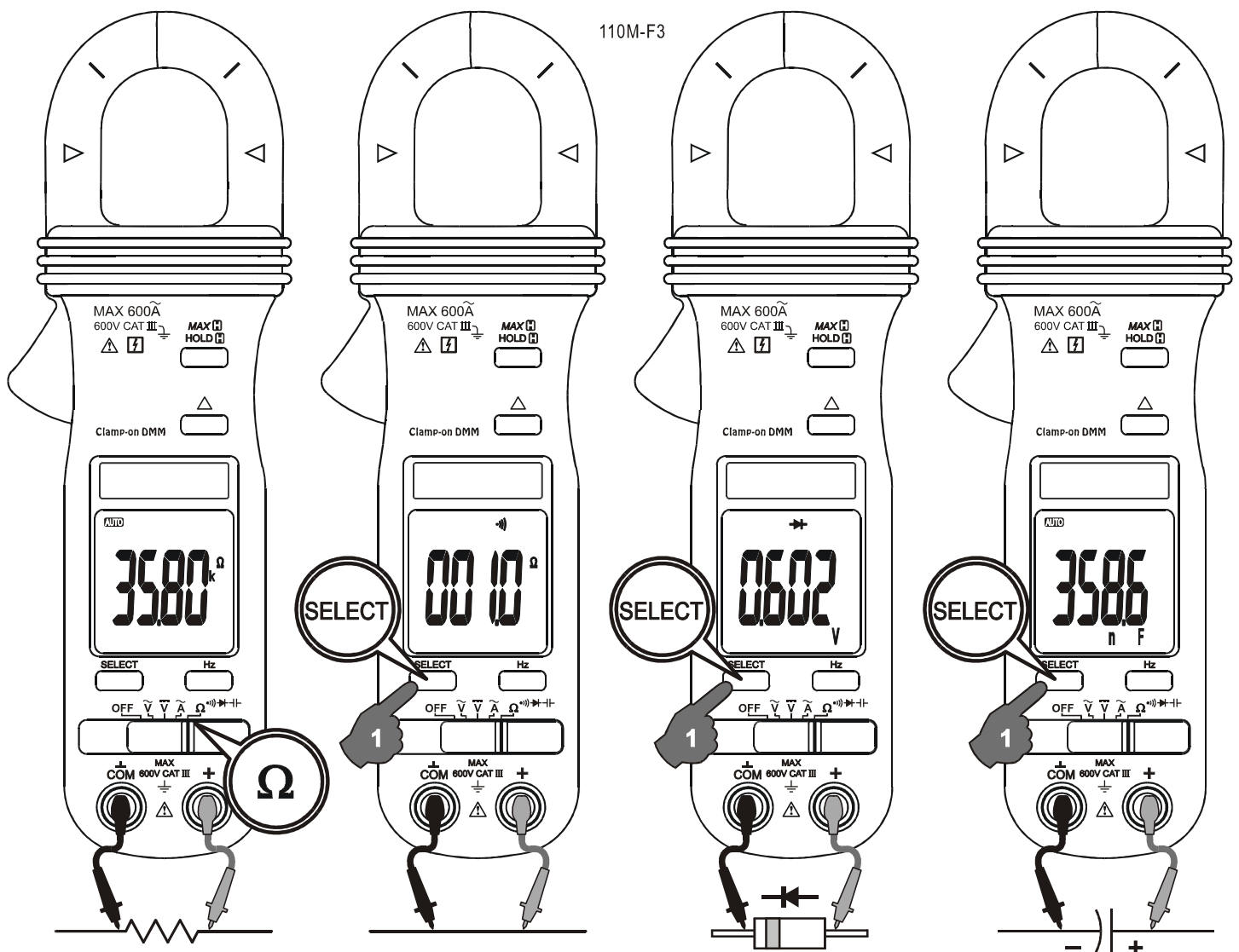
Twin Display Models: DCV, ACV, DC $\mu$ A & AC $\mu$ A via the test leads (not available to ACA)

Note: DC 400.0mV range is designed with 1000M $\Omega$  high input impedance for least current drain in measuring small signals, and can cope better with most commercially available voltage output transducers/adapters. The non-zero display reading is normal when the meter inputs are open circuit, which will not affect actual measurement accuracy. The meter will show close to zero readings when the inputs are shorted. Open input is actually a floating condition, which is not a zero-volt-input condition.

Note: The Hz trigger level is determined by the selected function-range from where the Hz function is activated. In ACV function:

Activating the Hz function during significant measurements can get the most appropriate trigger level to avoid electrical noises in most cases. Electrical noise may cause unstable Hz reading.

Activating the Hz function at AC 4.000V range (before making significant measurements) can get lower trigger level (higher sensitivity). Hz reading may show zero when the sensitivity is insufficient.



### CAUTION

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

## **$\Omega$ Resistance, and $\rightarrow$ ) Continuity functions**

Inputs are made through the test leads terminals. Slide-switch on defaults at  $\Omega$ . Press SELECT button momentarily to select  $\rightarrow$ ) Continuity function which is convenient for checking wiring connections and operation of switches. A continuous beep tone indicates a complete wire.

### **$\rightarrow$ Diode test function**

Inputs are made through the test leads terminals. Slide-switch on defaults at  $\Omega$ . Press SELECT button momentarily 2 times to select  $\rightarrow$  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).

### **$\rightarrow$ Capacitance function (not available to Model 110M)**

Inputs are made through the test leads terminals. Slide-switch on defaults at  $\Omega$ . Press SELECT button momentarily 3 times to select  $\rightarrow$  Capacitance function.

Note: (applies to Models 111M & Model 112M only)

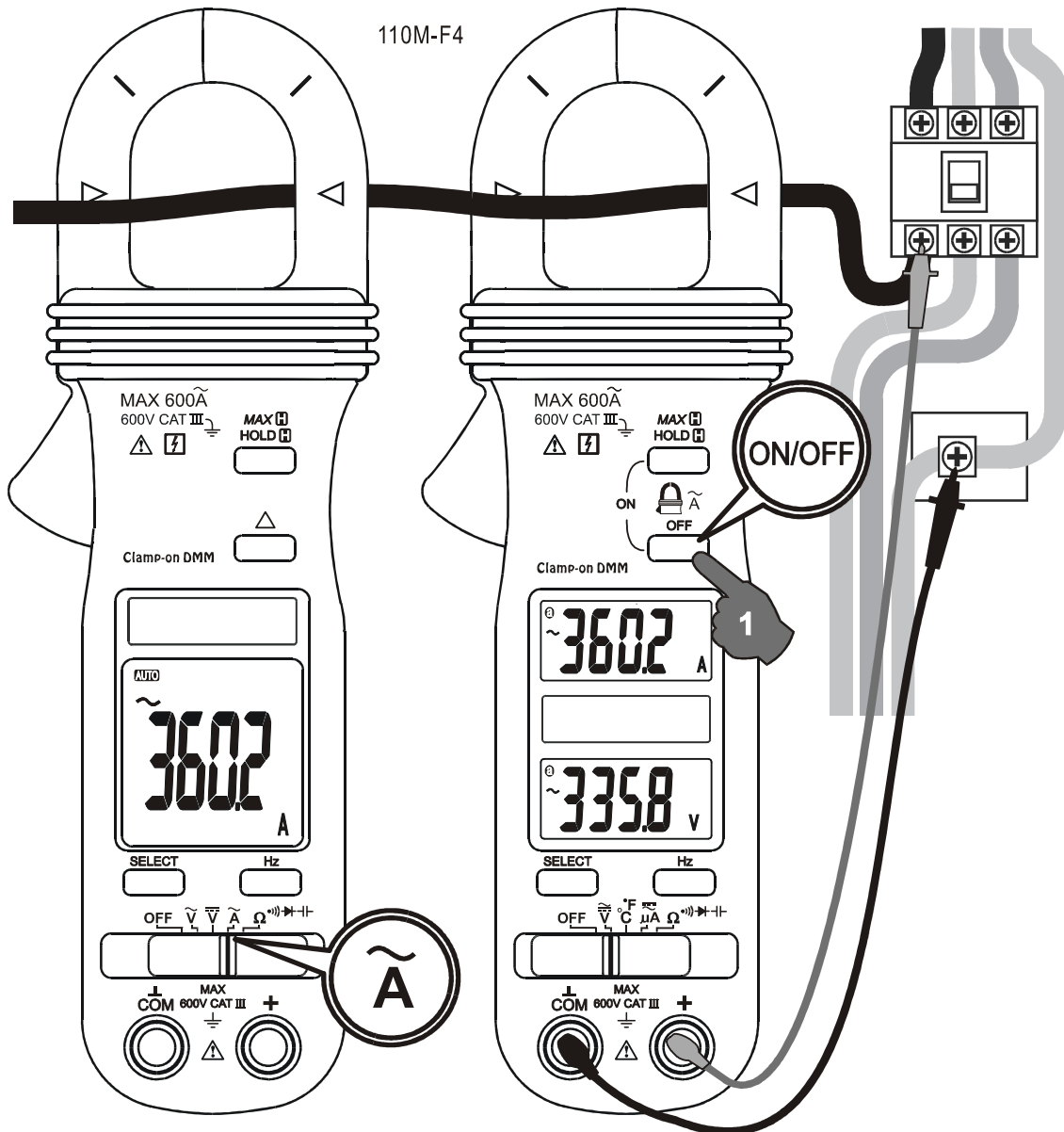
Relative zero  $\Delta$  mode can be used to zero out the parasitic capacitance of the leads and the internal protection circuitry of the meter when measuring low capacitance in the order of Pico Farad (pF).

### **CAUTION**

Discharge capacitors before making any measurements. Large value capacitors should be discharged through an appropriate resistance load

### **ACA function**

Inputs are made through the clamp jaws for non-invasive ACA current measurements. For Single Display Models, set the slide-switch to select the ACA function. For dual inputs Twin Display Models, press the **OFF** push button momentarily to power on and off the separate ACA function display. The **HOLD** push button can also be used as the ACA function power on hotkey. This twin display ACA function can be used simultaneously with the voltage or any other slide-switch functions when making measurements.



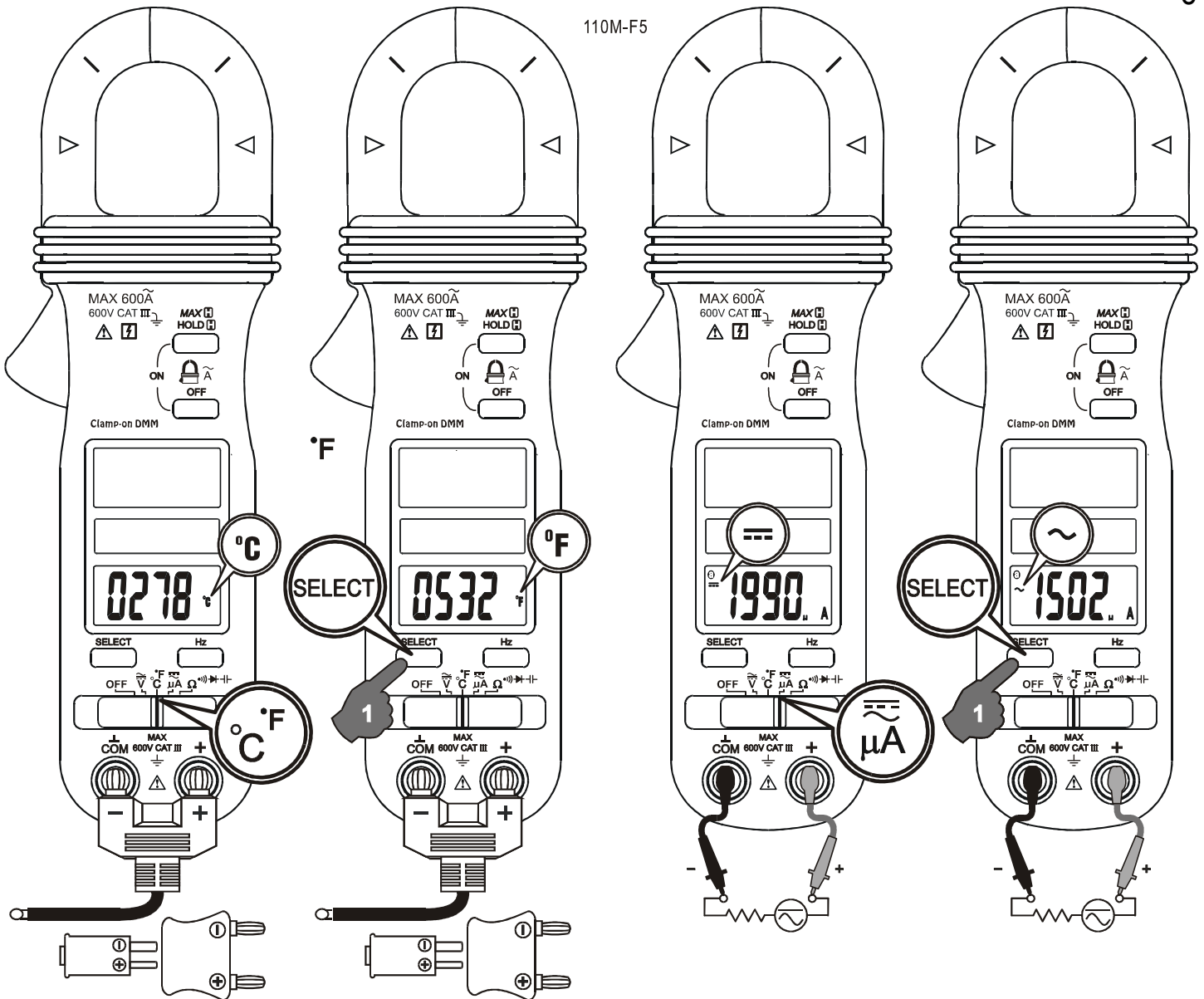
### **CAUTION (Application and removal of the Clamp-on meter)**

For non-invasive ACA current measurements, press the jaw trigger and clamp the jaws around only one single conductor of a circuit for load current measurement. Make sure the jaws are completely closed, or else it will introduce measurement errors. Enclosing more than one conductor of a circuit will result in differential current (like identifying leakage current) measurement. Locate the conductor(s) at the Jaws center 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 will affect measurement accuracy. Keep the jaws away from them as much as possible to minimize influence.



110M-F5



### Temperature function (Twin Display Models only)

Be sure to insert the banana plug type-K temperature bead probe Bkp60 with correct **+** **-** polarities. Slide-switch on defaults at degree C (Celsius). Press **SELECT** button momentarily to select degree F (Fahrenheit). 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.

### µA Current function (Twin Display Models only)

Inputs are made through the test leads terminals. Slide-switch on defaults at DC. Press **SELECT** button momentarily to select AC.

Application notes:

The DCµA function is designed especially for HVAC/R flame sensor applications. The 0.1µA 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  $2\mu\text{A}$  for a rectification type, or  $1.5\mu\text{A}$  for an ultraviolet type ( $8\mu\text{A}$  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 :

1-1) For gas or oil flames (Minipeeper):

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


1-2) For oil flames (Photocell):

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

1-3) For gas flames (Flame Rod):

- Ignition interference (A flame signal current difference with the ignition both on and off greater than  $0.5\mu\text{A}$  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.


## **HOLD**

The hold feature freezes the display for later view. Press the **HOLD**  button momentarily toggles to hold mode in the following function(s):

Single Display Models: All functions

Twin Display Models: Upper display ACA function

## **MAX**

The max feature compares and displays the measured maximum value as fast as 30ms with auto-ranging capability. Press the **MAX**  button for 1 second or more toggles to max feature in the following function(s):

Single Display Models: DCV, ACV & ACA functions

Twin Display Models: Upper display ACA function

### **Relative zero $\Delta$ mode (Single Display Models only)**

Relative zero  $\Delta$  mode allows the user to offset the meter consecutive measurements with the displaying reading as the reference value. The display will now show readings relative to the stored reference value. That is, display = reading - stored value. Press the  $\Delta$  button momentarily toggles to relative zero mode.

### **Auto-ranging**

Where there is more than one measuring range under a selected meter function, the LCD annunciator “a” turns on. The meter will automatically switch to the best resolution range when making measurements. No manual ranging selection is required.

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

When the meter is on, the Auto Power Off (APO) feature will switch the meter into a sleep mode automatically to extend battery life after approximately 30 minutes of no slide-switch nor push button operations. To wake up the meter from APO, press the buttons momentarily or set the slide-switch to the OFF position and then slide back on again. Always set the slide-switch to the OFF position manually 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) by accident or abnormal conditions of operation, the series fusible resistors will be blown off (become high impedance) like fuses to protect the user and the instrument. Most measuring functions through this terminal will then be open circuit. The series fusible resistors and the spark gaps should then be replaced by qualified technician. Refer to the LIMITED WARRANTY section for obtaining warranty or repairing service.

## Cleaning and Storage

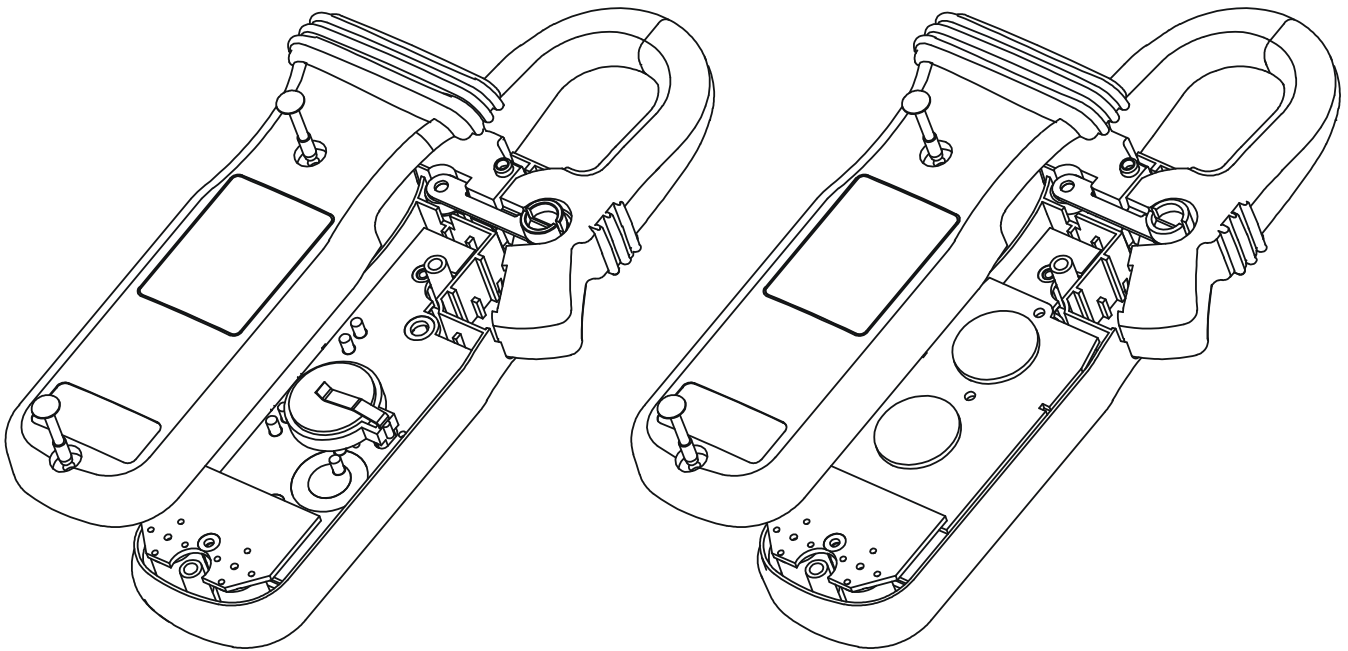
Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. If the meter is not to be used for periods of longer than 60 days, remove the batteries and store them separately.

## Battery replacement

The meters use standard 3V IEC-CR2032 coin batteries

- In Single Display Models: One battery is used.
- In Twin Display Models: Two batteries are used. One is used for slide-switch functions, and the other one is used for the twin display ACA function separately.

Loosen the two screws from the case bottom and remove the bottom case. Slide the battery out the side of the holder and replace with a new battery (observe polarity). Replace the bottom case. Re-fasten the screws.



## GENERAL SPECIFICATION

**Display** : 3-3/4 digits 4000 counts LCD display(s)

**Update Rate** : 3 per second nominal

**Polarity** : Automatic

**Low Battery** : Below approx. 2.4V

**Operating Temperature** : 0°C to 40°C

**Relative Humidity** : Maximum relative humidity 80% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C

**Altitude** : Operating below 2000m

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

**Temperature Coefficient** : nominal 0.15 x (specified accuracy)/°C @ (0°C ~ 18°C or 28°C ~ 40°C), or otherwise specified

**Sensing** : Average sensing for Models 110M, 111M & 127M; True RMS for Models 112M & 128M

**Overload Protections** :

ACA Clamp-on jaws : AC 600A rms continuous

+/ $\mu$ A & COM terminals: 600VDC/VAC rms

**Transient protection** : 6.5kV (1.2/50 $\mu$ s surge) for all models

**Safety** : Meets IEC61010-2-032, EN61010-2-032, UL61010B-2-032, IEC61010-1 2nd Ed., EN61010-1 2nd Ed., UL61010-1 2nd Ed.

Measurement Category : III 600 Volts ac & dc

**Pollution degree** : 2

**E.M.C.** : Meets EN61326 (1997, 1998/A1), EN61000-4-2 (1995, 2000/A2), and EN61000-4-3 (2002)

In an RF field of 3V/m:

Capacitance function is not specified

$\mu$ A function (Models 127M & 128M only) :

Total Accuracy = Specified Accuracy + 65 digits

Other function ranges:

Total Accuracy = Specified Accuracy + 45 digits

Performance above 3V/m is not specified

**Power Supply** : 3V coin battery IEC-CR2032

One battery for Single Display Models;

Two batteries for Twin Display Models

**Power Consumption** : 2.8mA typical except that 3.3mA typical for ACA function

**APO Timing** : Idle for 30 minutes

**APO Consumption** : 5 $\mu$ A typical on all model functions except that 40 $\mu$ A typical on voltage function of Models 127M & 128M

**Dimension** : L190mm X W63mm X H32mm

**Weight** : 139 gm approx

**Jaw opening & Conductor diameter** : 26mm max

**Accessories** : Test leads (pair), battery(ies) installed, user's manual, & soft carrying pouch; Banana plug type-K bead probe Bkp60 x 1 (Models 127M & 128M only)

**Optional Accessories** : Banana pins to type-K socket plug adapter Bkb32 (Models 127M & 128M only)

**Special Features** : 30ms Max Hold (except Model 110M); Data Hold; Relative Zero mode (Models 110M, 111M & 112M only); Simultaneous A+V, A+ $\Omega$ , A+ $^{\circ}$ C (Models 127M & 128M only); Slim jaws; Light Weight

## ELECTRICAL SPECIFICATION

Accuracy is  $\pm$ (% reading digits + number of digits) or otherwise specified, at 23 $^{\circ}$ C  $\pm$ 5 $^{\circ}$ C & less than 75% R.H.

Models 112M & 128M True RMS accuracy of ACV is specified from 5 % to 100 % of range, and ACA is specified from 10 % to 100 % of range, or otherwise specified. Maximum Crest Factor < 1.75 : 1 at full scale & < 3.5 : 1 at half scale, and with frequency spectrums, besides fundamentals, fall within the meter specified AC bandwidth for non-sinusoidal waveforms

### DC Voltage

RANGE	Accuracy
400.0 mV	0.3% + 4d
4.000V, 40.00V, 400.0V	0.5% + 3d
600V	1.0% + 4d

NMRR : >50dB @ 50/60Hz

CMRR : >120dB @ DC, 50/60Hz,  
Rs=1k $\Omega$

Input Impedance : 10M $\Omega$ , 30pF nominal  
(1000M $\Omega$  for 400.0mV range)

### AC Voltage

RANGE	Accuracy
<b>50Hz ~ 500Hz</b>	
4.000V, 40.00V, 400.0V	1.5% + 5d
600V	2.0% + 5d

CMRR : >60dB @ DC to 60Hz,  
Rs=1k $\Omega$

Input Impedance : 10M $\Omega$ , 30pF  
nominal

### ACA Current (Clamp-on)

RANGE	Accuracy <sup>1) 2) 3)</sup>
<b>50Hz / 60Hz</b>	
40.00A*	1.5% +8d
400.0A	1.5% +8d
600A	1.5% + 8d

\*Not available to Model 110M

<sup>1)</sup>Induced error from adjacent current-carrying conductor: 0.05/A

<sup>2)</sup>Specified accuracy is from 1% to 100% of range and for measurements made at the jaw center. When the conductor is not positioned at the jaw center, position errors introduced are:

Add 2% to specified accuracy for measurements made BEYOND jaw marking lines (toward jaw opening)

<sup>3)</sup>Add 8d to specified accuracy @ reading < 10% of range

### Max Hold\* (where applicable)

Specified accuracy  $\pm$  50 digits for changes > 25ms in duration

\*Not available to Model 110M

**Ohms**

RANGE	Accuracy
400.0Ω	0.8% + 8d
4.000kΩ, 40.00kΩ, 400.0kΩ	0.6% + 4d
4.000MΩ	1.0% + 4d
40.00MΩ	2.0% + 4d

Open Circuit Voltage : 0.4VDC typical

**Audible Continuity Tester**

Audible threshold : between 5Ω and 120Ω.

**Diode Tester**

Open Circuit Voltage	Test Current (Typical)
< 1.6 VDC	0.25mA

**Hz Frequency**

Function	Sensitivity (Sine RMS)	Range
400.0mV	350mV	10Hz ~ 2kHz
4.000V	1V	10Hz ~ 5kHz
4.000V, 40.00V	32V	10Hz ~ 100kHz
400.0V	100V	10Hz ~ 10kHz
600V	500V	10Hz ~ 5kHz
400.0μA <sup>1)</sup>	500μA	10Hz ~ 30kHz
2000μA <sup>1)</sup>	500μA	10Hz ~ 30kHz
400.0A <sup>2) 3)</sup>	60A	40Hz ~ 400Hz

Display counts: 5000

Best resolution: 0.001Hz

Accuracy: 0.5%+4d

<sup>1)</sup>Available to Models 127M & 128M only

<sup>2)</sup>Available to Models 111M & 112M only

<sup>3)</sup>Unspecified for Model 110M

**Capacitance\***

RANGE <sup>1)</sup>	Accuracy <sup>2) 3)</sup>
500.0nF, 5.000μF, 50.00μF, 500.0μF, 3000μF	3.5% + 6d

\*Not available to Model 110M

<sup>1)</sup>Additional 50.00nF range accuracy is not specified

<sup>2)</sup>Accuracies with film capacitor or better

<sup>3)</sup>Specified with battery voltage above

2.8V (approximately half full battery).

Accuracy decreases gradually to 12% at low battery warning voltage of approximately 2.4V

**DC μA (Models 127M & 128M only)**

RANGE	Accuracy	Burden Voltage
400.0μA	2.0% + 4d	2.8mV/μA
2000μA	1.2% + 3d	2.8mV/μA

**AC μA (Models 127M & 128M only)**

RANGE	Accuracy	Burden Voltage
<b>50Hz ~ 500Hz</b>		
400.0μA	2.0% + 5d	2.8mV/μA
2000μA	1.5% + 5d	2.8mV/μA

**Type-K Temperature (Models 127M & 128M only)**

RANGE	Accuracy
-20°C ~ 300°C	2% + 3°C
301°C ~ 537°C	3% + 3°C
-4°F ~ 572°F	2% + 6°F
573°F ~ 999°F	3% + 6°F

Type-K thermocouple range & accuracy not included

## 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, 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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