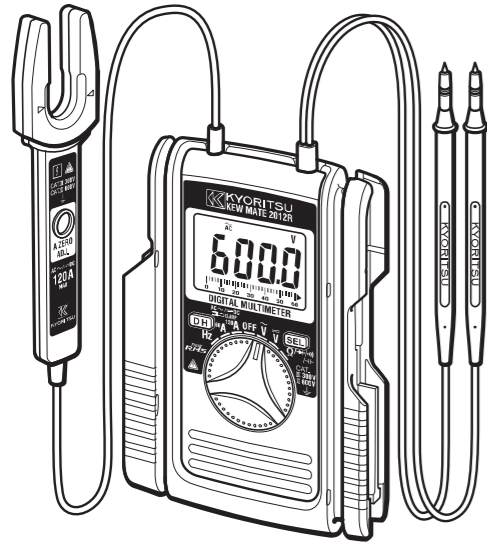


INSTRUCTION MANUAL



DIGITAL MULTIMETER WITH AC/DC CLAMP SENSOR KEW MATE 2012R

KYORITSU ELECTRICAL INSTRUMENTS WORKS, LTD.

1. SAFETY WARNINGS

This instrument has been designed and tested according to IEC Publication 61010: Safety Requirements for Electronic Measuring Apparatus. This instruction manual contains warnings and safety rules which must be observed by the user to ensure safe operation of the instrument and to retain it in safe condition. Therefore, read through these operating instructions before starting using the instrument.

- WARNING**
- Read through and understand instructions contained in this manual before starting using the instrument.
 - Save and keep the manual handy to enable quick reference whenever necessary.
 - Be sure to use the instrument only in its intended applications and to follow measurement procedures described in the manual.
 - Be sure to understand and follow all safety instructions contained in the manual.

Failure to follow the above instructions may cause injury, damage to the instrument and/or damage to equipment under test.

The symbol Δ indicated on the instrument means that the user must refer to related parts of the manual for safe operation of the instrument. Be sure to carefully read the instructions following each Δ symbol in this manual.

- Δ **DANGER** : is reserved for conditions and actions that are likely to cause serious or fatal injury.
- Δ **WARNING** : is reserved for conditions and actions that can cause serious or fatal injury.
- Δ **CAUTION** : is reserved for conditions and actions that can cause minor injury or instrument damage.

Following symbols are used on the instrument and in the instruction manual. Attention should be paid to each symbol to ensure your safety.

- Δ Refer to the instructions in the manual. This symbol is marked where the user must refer to the instruction manual so as not to cause personal injury or instrument damage.
- \square Indicates an instrument with double or reinforced insulation.
- ⚡ Indicates that this instrument can clamp on bare conductors when measuring a voltage corresponding to the applicable Measurement category, which is marked next to this symbol.
- \sim Indicates AC (Alternating Current).
- — Indicates DC (Direct Current).

3. SPECIFICATIONS

- Measuring Ranges and Accuracy (at 23 °C ±5 °C , relative humidity 75% or less)

AC Current \sim A (RMS value detection) Maximum Input Current : 120A

Range	Display range	Allowable input	Accuracy
60A	0.00~60.39A	0.00~60.00Arms (85Apeak or less)	±2.0%rdg±5dgt (45~65Hz)
120A	0.0~603.9A	0.0~120.0Arms (170Apeak or less)	(sine wave)

※For non-sinusoidal waveforms, add ±(2% of reading + 2% of full scale), for Crest factor<2.5.

DC Current — A Maximum Input Current : 120A

Range	Display range	Allowable input	Accuracy
60A	±0.00~60.39A	±0.00~60.00A	±2.0%rdg±8dgt
120A	±0.0~603.9A	±0.0~120.0A	±2.0%rdg±5dgt

AC Voltage \sim V (RMS value detection, Auto-range) Maximum Input Voltage : 600V

Range	Display range	Allowable input	Accuracy
6V	0.000~6.039V	0.300~600.0Vrms (850Vpeak or less)	±1.5%rdg±5dgt (45~400Hz) (sine wave)
60V	5.60~60.39V		
600V	56.0~603.9V		

※Input Impedance : approx. 10M Ω <200pF
 ※For non-sinusoidal waveforms, add ±(2% of reading + 2% of full scale), for Crest factor<2.5.

DC Voltage — V (Auto-range) Maximum Input Voltage : 600V

Range	Display range	Allowable input	Accuracy
600mV	±0.0~603.9mV	±0.0m~600.0V	±1.0%rdg±3dgt
6V	±0.560~6.039V		
60V	±5.60~60.39V		
600V	±56.0~603.9V		

※Input Impedance : approx. 10M Ω

⚡ This instrument satisfies the marking requirement defined in the WEEE Directive. This symbol indicates separate collection for electrical and electronic equipment.

DANGER

- Never make measurement on circuits with a maximum voltage difference of 600V or greater between conductors (300V or greater between a conductor and ground).
- Do not attempt to make measurement in the presence of flammable gasses. Otherwise, the use of the instrument may cause sparking, which leads to an explosion.
- Never attempt to use the instrument if its surface or your hand is wet.
- Do not exceed the maximum allowable input of measuring ranges.
- Never open the battery compartment cover while making measurement.
- Never try to make measurement if any abnormal conditions, such as broken Clamp Sensor or case is noted.
- The instrument is to be used only in its intended applications or conditions. Otherwise, safety functions equipped with the instrument doesn't work, and instrument damage or serious personal injury may be caused.

WARNING

- Never attempt to make any measurement, if any abnormal conditions are noted, such as broken case, cracked test leads or Clamp Sensor Cable and exposed metal parts or internal wiring.
- Do not turn the Function Selector Switch while the test leads are connected to the circuit under test.
- Do not install substitute parts or make any modification to the instrument. Return the instrument to Kyoritsu or your distributor for repair or re-calibration.
- Do not try to replace the batteries if the surface of the instrument is wet.
- Always disconnect the clamp sensor and the test leads from the circuit under test and switch off the instrument before opening the battery compartment cover for battery replacement.
- A cap is provided on the tip of a test lead. Use a test lead with the cap on for safety.

CAUTION

- Make sure that the Function Selector Switch is set to an appropriate position before making measurement.
- Always make sure to place the test leads in the holster before making current measurement.
- Do not expose the instrument to the direct sun, extreme temperatures or dew fall.
- This instrument isn't dust & water proofed. Keep away from dust and water.
- Be sure to set the Function Selector Switch to the "OFF" position after use. When the instrument will not be used for a long period of time, place it in storage after removing the batteries.
- Use a damp cloth and detergent for cleaning the instrument. Do not use abrasives or solvents.

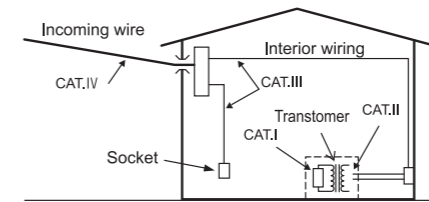
○ Measurement categories (Over-voltage categories)
 To ensure safe operation of measuring instruments, IEC61010 establishes safety standards for various electrical environments, categorized as CAT I to CATIV, and called measurement categories. Higher-numbered categories correspond to electrical environments with greater momentary energy, so a measuring instrument designed for CAT III environments can endure greater momentary energy than one designed for CAT II.

CAT. I : Secondary electrical circuits connected to an AC electrical outlet through a transformer or similar device.

CAT. II : Primary electrical circuits of equipment connected to an AC electrical outlet by a power cord.

CAT. III : Primary electrical circuits of the equipment connected directly to the distribution panel, and feeders from the distribution panel to outlets.

CAT. IV : The circuit from the service drop to the service entrance, and to the power meter and primary over-current protection device (distribution panel).



2. FEATURES

- Permits AC/DC current measurement up to 120A using a clamp sensor that comes standard with the instrument
- Clamp sensor for ease of use in crowded cable areas and other tight places
- Permits current measurement with an open current-clamp sensor that does not require opening and closing operations by the user
- True-RMS measurements ACV and ACA.
- Auto-power-save function
- Buzzer for easy continuity checking
- Data hold function to freeze the readings
- LCD with a bar graph
- Shock absorbing holster for ease of storage
- Designed to international safety standard IEC61010-1: over-voltage category CAT. III 300V, CAT. II 600V and pollution degree 2.

[Effective Value (RMS)]

Most alternating currents and voltages are expressed in effective values, which are also referred to as RMS (Root-Mean-Square) values.

The effective value is the square root of the average of square of alternating current or voltage values. Many clamp meters using a conventional rectifying circuit have "RMS" scales for AC measurement. The scales are, however, actually calibrated in terms of the effective value of a sine wave though the clamp meter is responding to the average value. The calibration is done with a conversion factor of 1.111 for sine wave, which is found by dividing the effective value by the average value. These instruments are therefore in error if the input voltage or current has some other shape than sine wave.

[CF (Crest Factor)]

CF (Crest Factor) is found by dividing the peak value by the effective value.

Examples: Sine wave: CF=1.414
 Square wave with a 1: 9 duty ratio: CF=3

Waveform	Effective value Vrms	Average value Vavg	Conversion factor Vrms/ Vavg	Reading errors for average sensing instrument	Crest factor CF
	$\frac{1}{\sqrt{2}}A$ ≈0.707	$\frac{2}{\pi}A$ ≈0.637	$\frac{\pi}{2\sqrt{2}}$ ≈1.111	0%	$\sqrt{2}$ ≈1.414
	A	A	1	$\frac{AX1.111-A}{A} \times 100$ = 11.1%	1
	$\frac{1}{\sqrt{3}}A$	0.5A	$\frac{2}{\sqrt{3}}$ ≈1.155	$\frac{0.5AX1.111-\frac{1}{\sqrt{3}}A}{\frac{1}{\sqrt{3}}A} \times 100$ = -3.8%	$\sqrt{3}$ ≈1.732
	$A\sqrt{D}$	$\frac{A}{T} = A \cdot D$	$\frac{A\sqrt{D}}{AD} = \frac{1}{\sqrt{D}}$	$(\frac{1.111\sqrt{D}-1}{\sqrt{D}}) \times 100\%$	$\frac{A}{A\sqrt{D}} = \frac{1}{\sqrt{D}}$

- Safety Standard IEC 61010-1
 CAT.III 300V, pollution degree 2
 CAT.II 600V, pollution degree 2
 IEC 61010-031
 IEC 61010-2-032
 IEC 61326(EMC)
- Operating System Δ Σ modulation
- Display Liquid crystal display
 Maximum Reading:6039
 Except Hz : 9999, CAP : 4039,
 Diode : 1999
 Bar graph with maximum points of 30.
 approx. 3 times per second
- Display Indication renewal
- Location for use Indoor use, 2000m max, above sealevel
- Operating Temperature and Humidity Range 0 ~ +40°C , relative humidity 85% or less (without condensation)
- Storage Temperature and Humidity Range -20 ~ +60°C , relative humidity 85% or less (without condensation)
- Source Two 1.5VDC R03 (UM-4) batteries
- Current Consumption approx. 3mA (DCV), approx. 13mA (ACA)
- Power-save Function Shifts to the power-save state about 15 minutes after the last switch operation.
- Low battery warning "BAT" Appears when the batteries become low (2.4±0.15V or less)
- Overload Protection AC voltage / DC voltage / Frequency ranges :
 DC / ACrms 720V for 10 seconds
 AC current / DC current ranges :
 DC / ACrms 150A for 10 seconds
 Resistance / Continuity / Diode / Capacitor ranges :
 DC / ACrms 600V for 10 seconds
 AC3540Vrms for 5 seconds between electrical circuit and housing case
- Withstand Voltage 100M Ω or greater at 1000V between electrical circuit and housing case
- Insulation Resistance
- Conductor Size Approx. ϕ 12mm diameter max
- Dimensions 128(L)×92(W)×27(D)mm
- Weight Approx. 220g
- Accessories Two R03 (UM-4) batteries
 Instruction Manual

DISTRIBUTOR

Kyoritsu reserves the rights to change specifications or designs described in this manual without notice and without obligations.

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Resistance Ω (Auto-range)

Range	Display range	Allowable input	Accuracy
600 Ω	0.0~603.9 Ω	0.0 Ω ~60.00M Ω	±1.0%rdg±5dgt
6k Ω	0.560~6.039k Ω		
60k Ω	5.60~60.39k Ω		
600k Ω	56.0~603.9k Ω		±2.0%rdg±5dgt
6M Ω	0.560~6.039M Ω		
60M Ω	5.60~60.39M Ω		

※Open-loop Voltage : approx.0.6V, Measuring Current : 0.3mA or less

Continuity •

Range	Display range	Allowable input	Accuracy
600 Ω	0.0~603.9 Ω	0.0~600.0 Ω	±1.0%rdg±5dgt

※The buzzer turns on for resistances lower than 35±25 Ω .
 ※Open-loop Voltage : approx.0.6V, Measuring Current : 0.3mA or less

Diode ▶

Range	Display range	Allowable input	Accuracy
2V	0.000~1.999V	0.000~1.999V	±3.0%rdg±5dgt

※Open-loop Voltage : approx.2.7V

Capacitor — (Auto-range)

Range	Display range	Allowable input	Accuracy
40nF	0.00~40.39nF	40.0n~40.00 μ F	±2.5%rdg±10dgt
400nF	36.0~403.9nF		
4 μ F	0.360~4.039 μ F		
40 μ F	3.60~40.39 μ F		
400 μ F	36.0~403.9 μ F	—	—
4000 μ F	360~4039 μ F		

Frequency Hz (AC Current) (Auto-range)

Range	Display range	Allowable input	Accuracy
10Hz	0.000~9.999Hz	—	—
100Hz	9.00~99.99Hz	9.00Hz~9.999kHz	±0.2%rdg±2dgt
1000Hz	90.0~999.9Hz		±0.1%rdg±1dgt
10kHz	0.900~9.999kHz	—	—
100kHz	9.00~99.99kHz		
1000kHz	90.0~999.9kHz		
10MHz	0.900~9.999MHz		

※Input Current : more than 2A

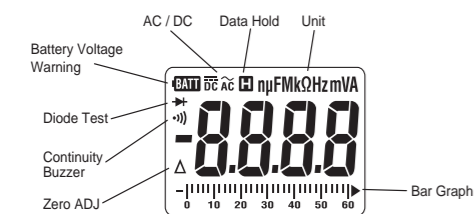
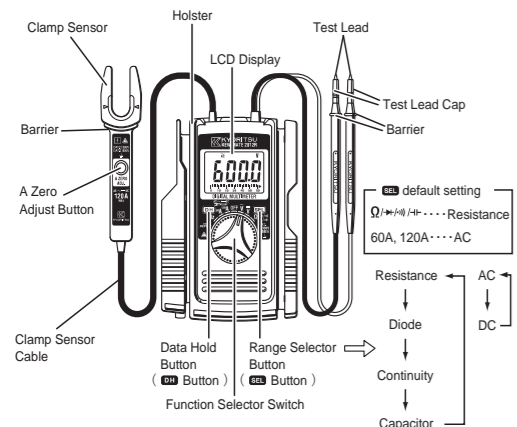
Frequency Hz (AC Voltage) (Auto-range)

Range	Display range	Allowable input	Accuracy
10Hz	0.000~9.999Hz	—	—
100Hz	9.00~99.99Hz	9.00Hz~300.0kHz	±0.2%rdg±2dgt
1000Hz	90.0~999.9Hz		±0.1%rdg±1dgt
10kHz	0.900~9.999kHz	—	—
100kHz	9.00~99.99kHz		
300kHz	90.0~300.0kHz		
1000kHz	300.1~999.9kHz		
10MHz	0.900~9.999MHz	—	—

※Input Voltage : more than 2V (~10kHz) , more than 20V (10k~300kHz)
 ※Input Impedance : approx. 900k Ω

Note:◁The symbol of "—" in the above table means that the instrument only displays the value, but the accuracy, the proper operation and the safety are not guaranteed.

4. INSTRUMENT LAYOUT



5. PREPARATIONS FOR MEASUREMENT

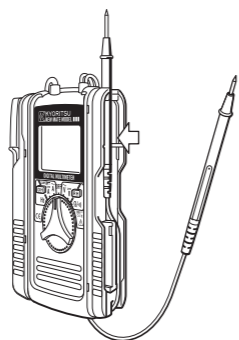
- Checking battery voltage
Set the Function Selector Switch to any position other than the OFF position. If the marks on the display are clearly legible without symbol "BAT" showing, battery voltage is OK. If the display blanks or "BAT" is indicated, replace the batteries according to section 8: Battery Replacement.

NOTE

- When the instrument is left powered on, the auto-power-save function automatically shut the power off; The display blanks even if the Function Selector Switch is set to a position other than the OFF position in this state. To power on the instrument, turn the Function Selector Switch or press any Button. If the display still blanks, the batteries are exhausted. Replace the batteries.

- Make sure that the Function Selector Switch is set to the appropriate range. Also make sure that data hold function is not enabled. If inappropriate range is selected, desired measurement cannot be made.

- Permits the measurement by placing the one test lead in the holster while confirming the measurement value.



WARNING

- Verify proper operation on a known source before use or taking action as a result of the indication of the instrument.

6-4 Diode Measurement

- Set the Function Selector Switch to "Ω/→/←/→/←".
- Press the **SEL** Button. "→" mark is shown on the display.
- Connect the test leads to the circuit under test. The measured value appears on the display.

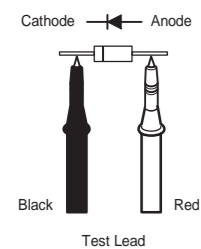
[Forward-bias Diode Test]

Connect the red test lead to the anode and the black test lead to the cathode.

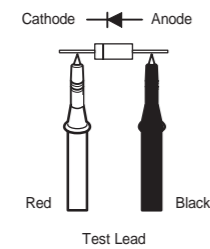
[Reverse-bias Diode Test]

Connect the red test lead to the cathode and the black test lead to the anode.

Forward-bias Diode Test



Reverse-bias Diode Test



Note:◇Hold the clamp sensor in the holster, while making the diode measurement

6-5 Continuity Measurement

- Set the Function Selector Switch to "Ω/→/←/→/←".
- Press the **SEL** Button. "→" mark is shown on the display.
- Connect the test leads to the circuit under test. The measured value appears on the display. When the measurement value is lower than 35±25Ω, the instrument beeps.

Note:◇Hold the clamp sensor in the holster, while making the continuity measurement

6-6 Capacitor Measurement

- Set the Function Selector Switch to "Ω/→/←/→/←".
 - Press the **SEL** Button. "F" mark is shown on the display.
 - Connect the test leads to the circuit under test. The measured value appears on the display.
- Note:◇Hold the clamp sensor in the holster, while making the capacitor measurement.

6-7 Frequency Measurement

DANGER

- In order to avoid possible shock hazard, never make measurement on circuits with a maximum voltage difference of 600V or greater between conductors (300V or greater between a conductor and ground).
- Do not make measurement with the test leads connected to the circuit under test. Never make measurement with the battery compartment cover removed.
- Do not make current measurement with the test leads connected to the circuit under test.
- Keep your fingers and hands behind the barrier during measurement.

- Set the Function Selector Switch to "Hz."
- Measuring frequency of current:
Adjust one of the conductors to the center of the clamp sensor's arrow. Measured value is shown on the display.

Measuring frequency of voltage:
Connect the test leads to the circuit under test. Measured frequency is shown on the display.

Note:◇Do not use both the clamp sensor and the test leads at the same time, while making the frequency measurement.



- Hold the test leads in the holster, while making the frequency measurement by using the clamp sensor.
- Hold the clamp sensor in the holster, while making the frequency measurement by using the test leads.

6. HOW TO MAKE MEASUREMENT

6-1 Current Measurement

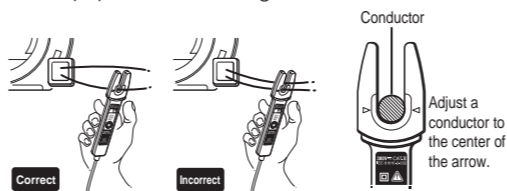
DANGER

- In order to avoid possible shock hazard, never make measurement on circuits with a maximum voltage difference of 600V or greater between conductors (300V or greater between a conductor and ground).
- Do not make measurement with the test leads connected to the circuit under test.
- Never make measurement with the battery compartment cover removed.
- Keep your fingers and hands behind the barrier during measurement.
- To avoid electrical shock by touching the equipment under test or its surroundings, be sure to wear insulated protective gear.

CAUTION

- When handling the clamp sensor, exercise caution not to apply excessive shocks or vibration to the sensor.
- Maximum measurable conductor size is 12mm in diameter.

Note: ◇Make sure that the test leads are in the holster while making current measurement.
◇Instrument can show the value over 120A, but the safe and proper measurement range is limited lower than 120A.



6-1-1 DC Current Measurement

- The Function Selector Switch to the "60A" or "120A" position. ("AC" marks are shown on the top of the display.)
- Press the **SEL** Button. "DC" mark is shown on the display.
- Press the A ZERO ADJ Button to set the reading of the instrument to zero. (Incorrect zero adjustment makes measurement errors.)
- Adjust one of the conductors to the center of the clamp sensor's arrow. (When the position of the conductor is not at the center of the arrow, the error occurs.) Measured value is shown on the display.

7. OTHER FUNCTIONS

7-1 Auto-Power-Save Function

NOTE

- A small amount of current is consumed even in the power-save state. Make sure to set the Function Selector Switch to the OFF position when the instrument is not used.

This function helps to avoid unwanted exhaustion of the batteries because of leaving the instrument powered on and extend battery life.

The instrument automatically shifts to the power-save state about 15 minutes after the last Function Selector Switch or other switch operation. A minute before power-save mode the instrument beeps 5 times, finally beeps longer and then shifts to the power-save mode.

To return to the normal state:
Press the **DH** Button or the **SEL** Button to return from the power-save mode state to the normal state.

Note:◇Pressing the **DH** Button or the **SEL** Button over 2 sec to return from the power-save mode state, the function of each button is also enabled.

(ex.) When the function is 60A and in the power-save mode, pressing **SEL** Button over 2sec releases the power-save mode and changes from initial "AC" mode to "DC" mode.

To cancel the Auto-Power-Save Function
To cancel the Auto-Power-Save Function, turn the function switch from OFF position to any other position with pressing **SEL** Button.

Note:◇When the function switch is 60A or 120A, pressing A ZERO ADJ Button over 2 sec enables to cancel the Auto-Power-Save Function. In this case, pressing A ZERO ADJ Button over 2 sec once again enables the Auto-Power-Save Function.

To enable the Auto-Power-Save Function once again
Turn the function switch to the OFF, and then to any position.

Note:◇The direction of current is plus(+) when the current flows from the upside (A ZERO ADJ. Button side) to the underside. The direction is minus(-) when the current flows from the underside to the upside.

- Minus "-" mark is shown at the left side of the value and the bar graph while making minus current measurement.
- By changing the function switch 60A or 120A to the other position, the AC/DC mode is reset to the default (AC mode). To set the DC mode, press the **SEL** Button again.
- The zero adjustment is effective only for the current measurement.
- After the zero adjustment the instrument operates as follows.
 - The bar graph disappears.
 - The maximum counts is changed according to the adjusted value. (ex.) The maximum count is 6039-100=5939, when adjusted +100 counts to zero.
 - "Δ" mark is shown on the display.
 - Pressing A ZERO ADJ. Button again or **SEL** Button, or changing the function switch releases zero adjustment function when the zero adjustment is effective.
- Pressing the A ZERO ADJ button over 2 sec releases the zero adjustment function.

6-1-2 AC Current Measurement

- Set the Function Selector Switch to "60A." or "120A". ("AC" mark is shown on the top of the LCD.)
- Adjust one of the conductors to the center of the clamp sensor's arrow. (When the position of the conductor is not at the center of the arrow, the error occurs.) Measured value is shown on the display.

Note:◇Unlike DC current measurement, zero adjustment is not necessary. There is not polarity indication either.

6-2 Voltage Measurement

DANGER

- In order to avoid possible shock hazard, never make measurement on circuits with a maximum voltage difference of 600V or greater between conductors (300V or greater between a conductor and ground).
- Do not make measurement with the battery compartment cover removed.
- Keep your fingers and hands behind the barrier during measurement.

7-2 Data Hold Function

This is a function to freeze a measured value on the display. Press the **DH** Button once to hold the current reading. In this data hold state, the reading is held even if input varies. "H" mark is shown on the LCD. To exit the data hold state, press the **DH** Button again.

Note:◇Data Hold Function is not effective while making Continuity or Diode measurement.
◇When the function is on the position where **SEL** Button or A ZERO ADJ Button is effective, pressing **SEL** Button or A ZERO ADJ Button cancels the held indication.

8. BATTERY REPLACEMENT

WARNING

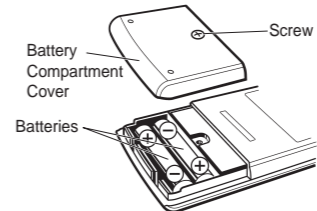
- In order to avoid possible shock hazard, always disconnect the test leads from the circuit under test and set the Function Selector Switch to the OFF position before trying to replace the batteries.

CAUTION

- Do not mix new and old batteries.
- Install batteries in the orientation as shown inside the battery compartment, observing correct polarity.

When the battery voltage warning mark "BAT" is shown on the top left corner of the LCD, replace the batteries. Note that the display blanks and "BAT" mark is not shown if the batteries are completely exhausted.

- Set the Function Selector Switch to "OFF."
- Remove the instrument from the holster.
- Loosen the battery-compartment-cover-fixing screw on the lower back of the instrument.
- Replace the batteries with two new R03 (UM-4) 1.5V batteries.
- Put the battery compartment cover back in place and tighten the screw.



Note:◇Make sure that the clamp sensor is in the holster while making voltage measurement.
◇Instrument may show the value over 600V, but the safe and proper measurement range is limited lower than 600V.

6-2-1 DC Voltage Measurement

- Set the Function Selector Switch to "V". ("DC" mark is shown on the LCD.)
- Short-circuit the tips of test leads to make the indication zero.
- Connect the red test lead to the positive (+) side of the circuit under test and the black test lead to the negative (-) side. Measured voltage value is shown on the display. When the connection is reversed, "-" is shown on the display.

6-2-2 AC Voltage Measurement

- Set the Function Selector Switch to "V". ("AC" mark is shown on the LCD.)
- Connect the test leads to the circuit under test. Measured voltage value is shown on the display.

Note:◇The displayed value might be few digits instead of zero even if shorting the test leads.

6-3 Resistance Measurement

DANGER

- Never make measurement on circuits that are live.
- Never make measurement with the battery compartment cover removed.
- Keep your fingers and hands behind the barrier during measurement.

- Set the Function Selector Switch to "Ω/→/←/→/←".
- Press the **SEL** Button and "Ω" mark is shown and "→" mark is not shown on the display (Resistance Measurement). Immediately after setting the Function Selector Switch to "Ω/→/←/→/←", is not necessary to operate the **SEL** Button.
- Check that the display shows "OL". Short the test leads and check that the display reads about zero.
- Connect the test leads to the circuit under test. Measured resistance value is shown on the display.

Note:◇When the test leads are shorted, the display may read a small resistance value. This is the resistance of the test leads.
◇If there is an open in either of the test leads, "OL" is shown on the display.
◇The capacitive factor of the tested circuit may cause the fluctuation of the measurement value, while making the resistance measurement of high value.
◇Make sure that the clamp sensor is in the holster while making resistance measurement.

[How to storage the clamp sensor and the test leads]

