Resistive leakage current(Ior) current clamp leaker MCL-500IRKX

Ver.5.00

Instruction manual

Thank you very much for selecting our IRV clamp leaker model MCL-500IRKX.

This model is complex instrument and employs a very reliable mechanical/electronic design.

Before you use your new instrument, read this instruction manual completely and familiarize yourself thoroughly with all functions.
Keep this instruction manual carefully so that you can refer to it whenever necessary.

MULTI
Let's Create New Concepts of Instruments

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SAFETY PRECAUTIONS

• Read these Safety Precautions carefully to use the instrument properly.
• The following warnings and precaution are intended to prevent danger and damage to the user and those around the user.

⚠ WARNING: identifies that incorrect handling may cause danger to the life and body of the user.
⚠ CAUTION: identifies that incorrect handling may cause damage to the instrument or insufficient performance.
• For safe use, the following symbol is indicated on the instrument and in the instruction manual.

⚠ This symbol indicates that you must handle with care. When it appears, it means that you must refer to the safety measures in the instruction manual on protecting the human body and the instrument.

• The following symbol indicates the standard applied

The symbol indicates that the Bluetooth wireless technologies are employed.

Trademarks (TM, (R) mark, etc. are not specified in this manual).
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⚠WARNING

To prevent electric shock
• For safety reasons, never the instrument on a circuit with a voltage greater than AC500V. Check the circuit voltage before measurement.
• Do not clamp any bare wire.
• Do not measure when the CT or the body is damaged or when the battery cover is removed.
• Do not operate with wet hands, including when you are replacing the battery. Also do not use the instrument in extremely humid places or when the instrument body is wet.
• Do not disassemble or modify the instrument.

⚠CAUTION

•Wipe the instrument gently with a soft cloth moistened with a small amount of water or neutral detergent, when it gets dirty. Do not use any abrasives or organic solvents.
• Do not use or leave the instrument in an area with excessive humidity, vapor, excessive dust, fine powder, gas containing salt / sulfur / ammonia, explosive gas, harmful smoke, or strong ultraviolet rays.
• Do not apply any input current exceeding the measuring range of the instrument.

1.OVERVIEW

This instrument is a high-accuracy clamp-type leakage current meter that has greatly improved convenience of use with the latest current transformer.

Features

- Because this instrument receives minimal influence from external magnetic field, minute current can be measured accurately even when it is near a motor or other wiring.
- The iron core is made of a special alloy that does not rust even after long-term use, so it has little time-induced degradation and can maintain stable accuracy.
- It can measure the resistive portion of the leakage current (Ior).
- The filter function allows you to investigate the extent of harmonic components of leakage current.
- It has Peak Hold function.
- It has Bluetooth communication function. It can be connected to a smartphone / tablet by Bluetooth via the application "Multi-Tracer" developed by us.

The measured values can be displayed on a smartphone and stored on a server. It can measure harmonic current, harmonic voltage, power, etc. and it can then send voltage data and current waveforms to a smartphone by using Bluetooth communication.

2.SPECIFICATION

(1) Current detection of ZCT

Inside diameter	:Φ40mm
Method	:Split core type ZCT
Withstanding voltage	:AC 2200V/1 minute

(2) Measuring part

Measuring function	:Leakage current (Io), Line current (I),Resistive leakage current (Ior), AC Voltage (V), Peak Hold(Max current), Insulation resistance(MΩ)
Measuring method	:Current: Clamp CT(when measuring Ior, based on voltage phase input by the voltage probes). Voltage: Voltage probes.
Measuring range	:Line current (I), Leakage current (Io) , Resistive leakage current (Ior) 50mA/500mA/5A Load current(I):50A/500A V(AC): 500V Insulation resistance(MΩ) is calculated by the calculation
Input frequency range	:50Hz or 60Hz(Only commercial frequencies in the exporting country may be used)
AC current detection	:I,Io,V: True RMS Ior: RMS by synchronous dual integration mode
AD conversion	:Integral type
Display change	:Via rotary switch
Display	:LCD, max.9999 reading with unit mark
Sampling rate	:2 times/sec.
Overrange indication	:“OL” mark on LCD

Low battery indication	:  mark on LCD
Auto power off	:Approximately 10 minutes after power on(This function is disabled when Bluetooth communication is being used)
Data hold	:Press data hold switch , “DH” will appear on the display. Press data hold switch again to cancel this function.
Peak hold	:When the peak hold switch is pressed, "MAX" appears on the display and the display resolution automatically be reduced by one digit, which is different from normal measurement. The instrument enters peak hold mode. It will display peak current.
Filter	Press Filter/V input switch once during I and Io current measurement, "FL" is displayed on the LCD and high frequencies are cut off. Press it again to cancel this function. The filter function is disabled during Ior measurement.
I, Ior, MΩ Switch	:When measuring Ior current, press Ior switch once to enter Ior measurement mode. Use Ior Type switch (circuit setting switch) to match with the circuit to be measured.
Bluetooth	:Bluetooth 4.2 Class2 Bluetooth wireless technology enables you to send measurement data to the application "Multi-Tracer".

(3)Accuracy conditions at 23℃±5℃, less than 85%RH

Range		Resolution	Accuracy	
I, Io	50 mA	0.01 mA	0.50 mA~50.00 mA	±0.5% rdg ±5 dgt
	500 mA	0.1 mA	5.0mA~500.0 mA	±0.5% rdg±5 dgt
	5 A	0.001 A	0.050 A~5.000 A	±0.5% rdg±5 dgt
	50 A	0.01 A	0.50 A~50.00 A	±0.5% rdg±5 dgt
	500 A	0.1 A	5.0 A~500.0 A	±1.0 % rdg±1.0%FS
Ior (Ld) Direct	50 mA	0.01 mA	0.50 mA~50.00 mA	±1.0 % rdg±15 dgt
	500 mA	0.1 mA	5.0mA~500.0 mA	±1.0 % rdg±15 dgt
	5 A	0.001 A	0.050 A~5.000 A	±1.0 % rdg±15 dgt
V	500 V	0.1 V	10.0V~500.0 V	±0.5% rdg±5 dgt
MΩ	10 MΩ	0.001 kΩ	Calculated from measurement value of voltage and Ior current	

※The wire to be measured must be located at the center of CT.

※When doing Ior measurement, please input voltage first.

※The accuracy of Ior measurement (single phase) is assumed to be achieved under the condition that phase angle between voltage and current is 0°; reference voltage:AC220V. The accuracy of Ior measurement (3 phase/4 wires) is assumed to be achieved under the condition that connection mode is Y wiring; reference voltage:AC219V(Line voltage:AC380V); phase angle between voltage and current is 0°.

※For each range, values below 9 counts are forcibly displayed as 0 (zero suppression). However, this is not applicable to insulation resistance measurement.

※Dimensions and specifications subject to change without notice due to product improvements or other reasons.

(4) Peak Hold Accuracy conditions at 23℃±5℃, less than 85%RH

Range		Resolution	Accuracy	
I、Io	50 mA	0.1 mA	1.0 mA ~50.0 mA	±1.0 % rdg±10 dgt
	500 mA	1 mA	10 mA~500 mA	±1.0 % rdg±10 dgt
	5 A	0.01 A	0.10 A~5.00 A	±1.0 % rdg±10 dgt
	50 A	0.1 A	1.0 A~50.0 A	±1.0 % rdg±10 dgt
	500 A	1 A	10 A~500A	±1.0 % rdg±1.0%FS
V	500 V	1 V	10 V~500V	±1.0 % rdg±8dgt

※The conductor must be located at the center of CT.

※Frequency must be set to the same frequency as the circuit to be measured.

※For each range, values below 9 counts are forcibly displayed as 0 (zero suppression).

※Rise time of response (0→90%) is less than 50ms.

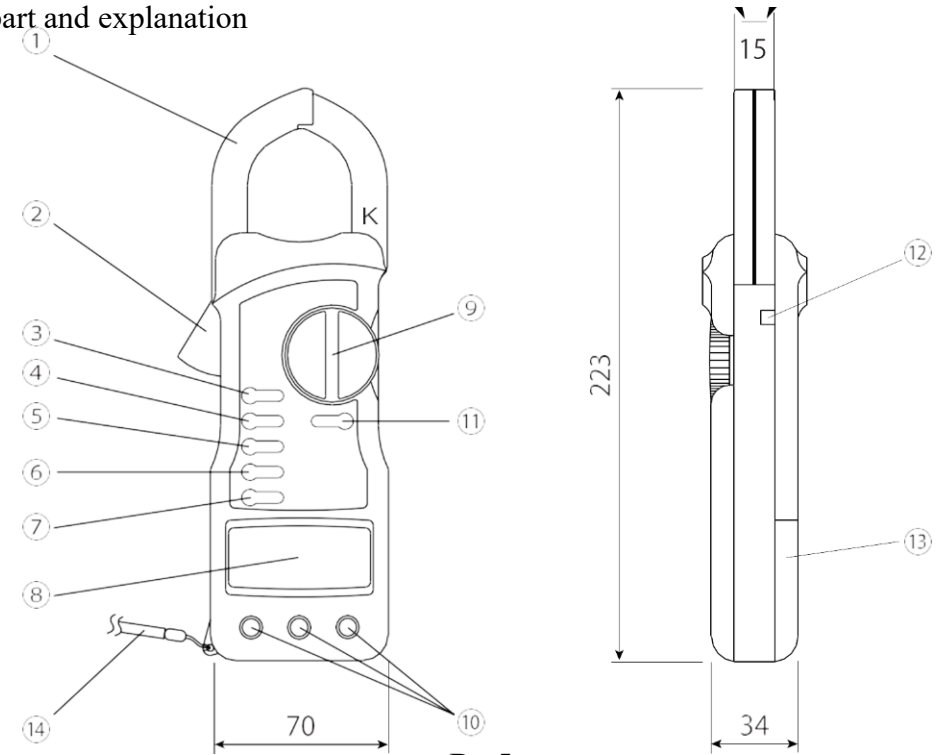
※Dimensions and specifications may change without notice due to product improvements or other reasons.

(5)General Specifications

Circuit voltage	:less than 500V (isolated wire)
Operating temperature	:0~50ºC, < 85%RH (without condensation)
Storage temperature	:－10～60 ºC, < 80%RH (without condensation)
Withstand voltage	:AC 2000V, 1 minute (between outer case and core of CT) , under the condition of no abnormalities
Consumption current	:23mA (approx. 35h for continuous use)
Power supply	:AAA alkaline battery LR03×3
Dimension/Weight	:70(W)×223(H)×34(D)mm/ Approx. 440g
Accessories	:Battery LR-03 (installed in the instrument)/3pcs.
	Carrying Case/1pc, Instruction manual/1pc.
	Pin probe & Alligator clip test lead set/1set

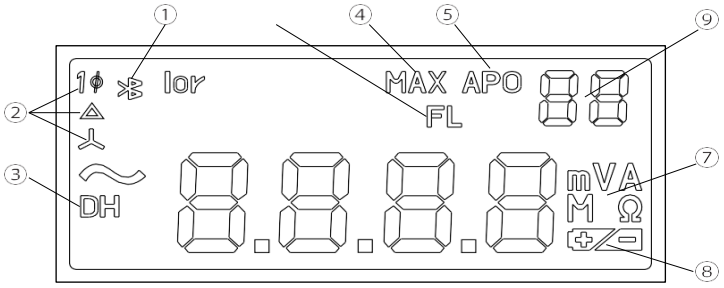
3.STRUCTURE

Name of each part and explanation



①Clamp Type ZCT	:Sensor for detecting current (clamp type).
②Open/Close Lever	:The CT will open when you push this lever inward.
③Power Switch (POWER)	:When you press this switch, the power will turn on ; press it again to turn the power off.
④Ior Type Switch	:This is the switch for circuit setting during Ior measurement. Each time you press this circuit setting switch, the circuit setting changes, and a mark is displayed in the upper left corner of the LCD. [1φ] lights up when single-phase has been selected; [Δ] lights up when 3 phase/3 wires has been selected; and [Y] lights up when 3 phase/4 wires has been selected.
⑤FILTER Switch	:Press Filter/V input switch once during I and Io current measurement, "FL" lights up in the upper left corner of the LCD and high frequencies are cut off. Press it again to cancel this function. The filter function is disabled during Ior measurement.
⑥Ior, MΩ Switch	:Pressing this switch once will switch to Ior current measurement and will display the circuit to be measured and voltage input method. You can select the circuit setting by pressing [Ior Type switch ④] Pressing this Ior, MΩ switch twice will switch to insulation resistance measurement. If voltage input method is set to "direct voltage input" (Ld), the insulation resistance value will be calculated and displayed.
⑦Bluetooth switch	:This switch is used to pair the instrument with the application "Multi Tracer".
⑧LCD Display	:Displays measured values, measurement status, battery status, etc.
⑨Range Switch	:A rotary switch for changing current (I, Io) and voltage (V) ranges.(50 mA, 500 mA, 5 A,50 A, 500 A, 500 V).
⑩Voltage Input Terminal(Red, Black) Note: The green terminal is not used, so it is covered by the rubber cap..	:Voltage input terminals for line voltage measurement(V) and resistive leakage current measurement(Ior). For line voltage measurement, set the range switch to 500V and also use voltage probes. For details of connecting method for Ior leakage current measurement, please refer to [Connecting Method].
⑪Peak hold switch	:Press it once, and “MAX” will be displayed at the top of the display, indicating that peak hold measurement is in effect. Press again to cancel this function.
⑫Data Hold (D・HOLD)	:Press it once, and “DH” will be displayed on the left of the LCD, freezing the reading on the display. Press again to cancel. When using Bluetooth communication, pressing this switch will upload the data to the server.
⑬Battery Cover	:Remove this cover to replace the batteries.
⑭Hand Strap	:During measurement, you can prevent the instrument from falling by using this strap around your wrist.

Description of the display



①Bluetooth Comm-unication Indicator	:Blinks while waiting for pairing with the application "Multi-Tracer". It lights up when the instrument has been paired with "Multi- Tracer"
②Wiring setting mark	:The mark for circuit lights up during Ior measurement. Single phase: 1φ, three-phase 3-wire: △, three-phase 4-wire: Y
③Data hold mark	:Lights up when the measured value is being frozen during data hold period
④Peak hold mark	:Lights up when Peak hold function is enabled.
⑤Auto power off mark	:Lights up when auto power off function is enabled
⑥Filter function mark	:Lights up when filter function is enabled
⑦Unit indicator	:Indicates the unit of measured value.
⑧Low battery mark	:Lights up when the battery voltage drops to a certain level. ※When it lights up, replace the batteries as soon as possible. Use under "Low Battery" condition may cause malfunctions.:During measurement, you can prevent the instrument from falling by wrapping it around your wrist.
⑨Voltage input status	When measuring Ior leakage current, "Ld" will be displayed.
Frequency Display in Peak hold mode	:50Hz or 60Hz(Cannot be used in countries with different commercial frequency bands)

Battery Replacement

⚠WARNING

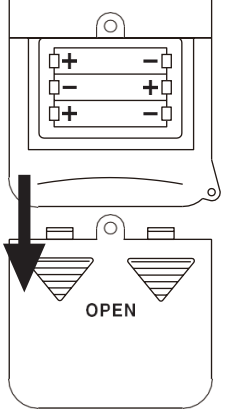
To prevent electric shock or accident
• Do not replace the battery while clamping the wires or while voltage is being inputted to the voltage input terminal.
• Do not use the instrument without the battery cover.

⚠ CAUTION

If will not use the instrument for a long period, remove the batteries from it. The batteries may leak and may cause damage to the instrument.

When batteries are depleted and the voltage drops below the operating voltage, the mark will light up on the display. Replace the battery immediately with a new one.

- Do not mix new batteries with used batteries or with different types of batteries.



〔How to replace the batteries〕

- Make sure the power is turned off. Then remove the battery cover screw on the back using a Phillips screwdriver and take off the battery cover.
- Take out all the three exhausted batteries.
- Check the battery polarity markings and insert new batteries.

• Attach the battery cover and tighten the screw with a screwdriver.

4. MEASUREMENT

To operate this instrument safely, pay attention to the cautions and warnings stated in this manual.

⚠WARNING

To prevent electric shock

There may be a risk of electric shock

- Do not make measurements on a circuit exceeding AC 500V.
- Before use, check and confirm the voltage of the circuit to be measured.

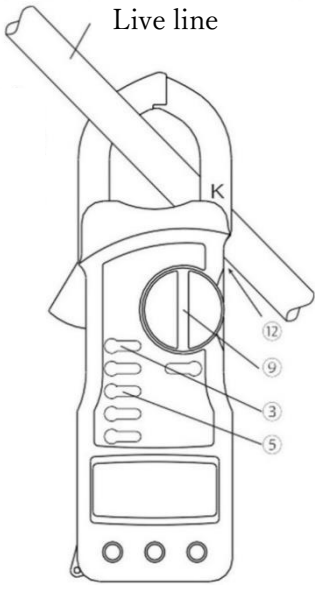
To prevent electric shock or accident

- Do not use this instrument when it is exposed to rain or moisture or when there are water droplets on it.
- Do not use this instrument with wet hands.
- Do not use this instrument if the main body case or clamp CT is damaged.
- Do not use this instrument with the battery cover removed.

There may be a risk of electric shock, burns, or fire.

- The CT part will heat up if excessive current is applied.
- Do not apply a voltage exceeding 500 V to the voltage input terminal. This may cause a malfunction.
- Do not apply impact to the tip of the clamp CT.

(1)Line Current Measurement



1) Press the POWER switch ③ once to turn the power ON.

2) Select the measurement range with the range switch ⑨.

(Set the range larger than the estimated measurement value.)

3) Open the clamp jaw and clamp the wire to be measured.

4) Read the displayed value.

(If over-range, 「OL」 will be displayed.)

Use Data Hold ⑫ in places where it is difficult to read.

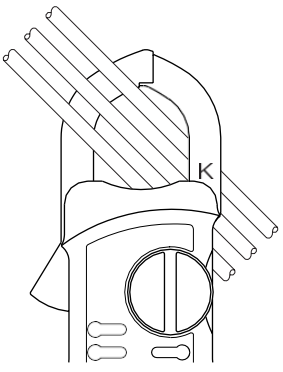
Use Filter/ V input ⑤ to cut high frequencies.

NOTE:

*Be sure to clamp only one wire. If cabtyre cables, parallel lines, etc (more than one wire) are clamped, the load current (line current) cannot be measured.

*Load current cannot be measured in Ior measurement mode.

*This device has auto power off function. The power will automatically turn off approximately 10 minutes after the last operation. (Disabled during Bluetooth communication).



(2)Leakage Current Measurement

<1> Measuring Leakage Current in Ground Wire

The steps are the same as those for [Measuring Load current (Line Current)].

<2> Measuring Leakage Current Other Than Leakage Current in Ground Wire

The steps are the same as those for [Measuring load current (line current)], but for single-phase leakage current, clamp two wires together, for three-phase leakage current, clamp three wires together.

(3)Voltage Measurement (500V Range)

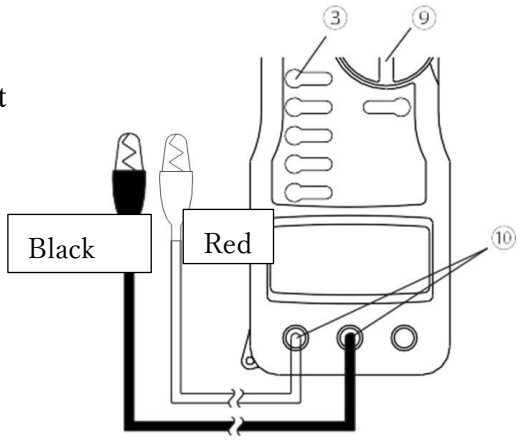
<1> Press the POWER switch ③ once to turn on the power

<2> Select the measurement range by using range switch⑨ (Set it to 500V)

<3> Insert the test leads for voltage input into the voltage input terminals⑩ (Red and Black).

<4> Measure the voltage.

<5> Read the displayed value.



⚠WARNING

• Do not apply voltage exceeding 500V AC to the voltage input terminals. Doing so may damage the instrument.

To prevent electric shock

• The voltage probes are consumables. Before connecting, check to confirm that there is no damage to the insulation coating of the cable. If any abnormalities are found, stop using it and repair it or replace it with a new one.

To prevent possible burns or fire

• Be sure to connect the voltage input cable securely. Incorrect connection may result in sparks.

(4)Resistive Leakage Current (Ior) Measurement

NOTICE

* The Ior measurement range depends on mA and A range.
First, measure Io current in mA and A range. If the Io value falls within the 50mA range, measure Ior current in the 50mA range. If the Io value falls within the 500mA range, measure Ior in the 500mA range. The maximum effective Io value for Ior measurement is 5A. If the Io value exceeds 5A, the Ior value is not reliable, even if it is displayed.

* When inputting voltage for a three-phase 4-wires (Y connection), connect R phase with red probe and connect the grounding wire with black probe (Circuit setting is set to Y).
For single-phase 3-wires, connect V1 to red probe and N to black probe. Input voltage AC220V.
For three-phase 3-wires (△ connection), connect R phase to red probe and T phase to black probe (Circuit setting is set to △).

* When performing Ior measurements, the phase angle of the voltage and current are also tested. Therefore, clamp in the correct direction to ensure accurate measurements. If no voltage is being inputted, the Ior reading value will be displayed as 「- - - -」.

* This instrument performs insulation resistance measurement on live lines, and the measured value may differ from those measured by ordinary insulation resistance testers.

⚠WARNING

• Do not apply voltage exceeding 500V AC to the voltage input terminals. Doing so may damage the instrument.

To prevent electric shock

• The voltage probes are consumables.

• Before connecting, check to confirm that there is no damage to the insulation coating of the cable. If any abnormalities are found, stop using it and repair it or replace it with a new one.

To prevent possible burns or fire

- Be sure to connect the voltage input cable securely. Incorrect connection may result in sparks.

<1> Press POWER switch ③ once.

<2> Insert the test leads of voltage probes into the voltage input terminals ⑩ (Red and Black) according to the color of each lead.

<3> Input the voltage and current according to the conditions of the circuit or the object to be measured. Please refer to the connecting method for voltage input in the following page.

<4> Select the optimal current range by using the Range switch and press the Ior, MΩ switch ⑥ once. (If Io value falls within the 50mA range, measure Ior in the 50mA range; if Io value falls within the 500mA range, measure Ior in the 500mA range. The maximum measurable Io value for Ior measurement is 5A.)

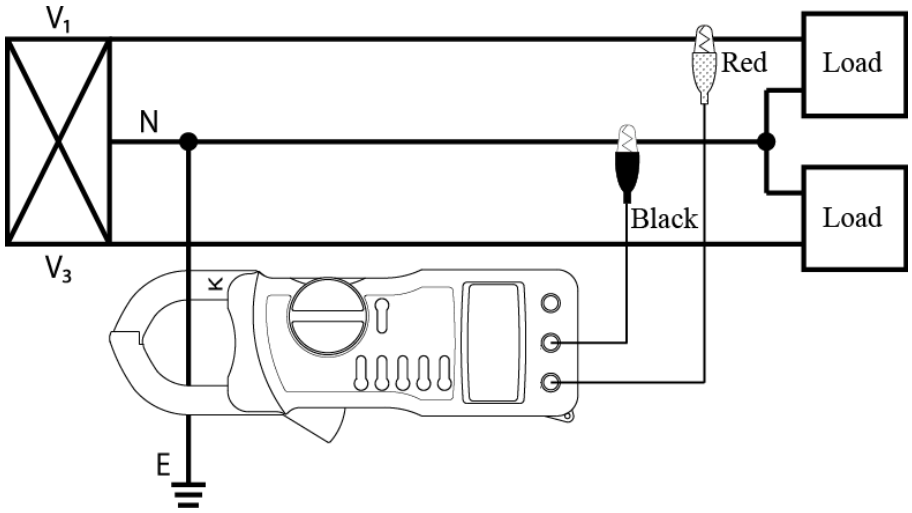
<5> Use the Ior Type (Circuit Setting switch) switch ④ to select the circuit. [1φ] lights up when single-phase is selected; [Δ] lights up when three-phase/3-wires is selected; [Y] lights up when three-phase/4-wires is selected.

<6> Read the displayed value.

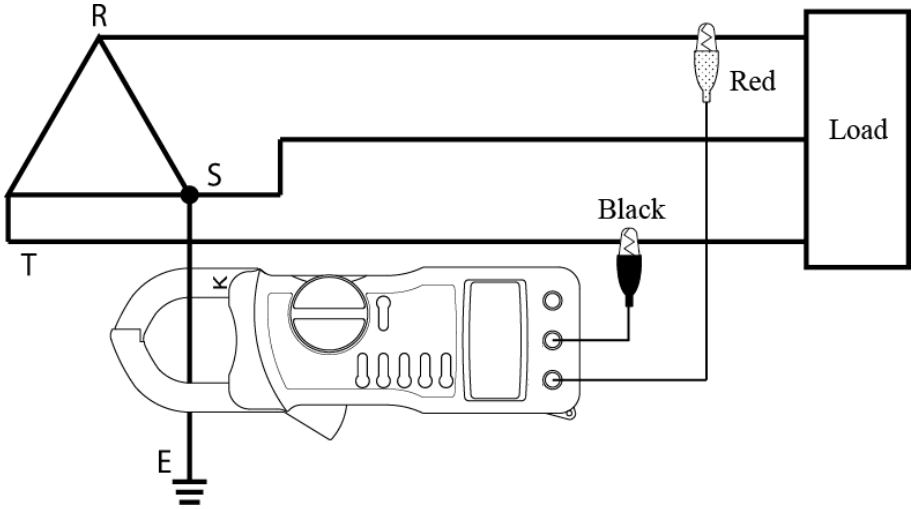
<7> If you need to check MΩ value, press the Ior, MΩ switch ⑥ once to set it to MΩ and read the measured value.

*Use Data Hold function ⑫ when you are in a difficult-to-read situation.

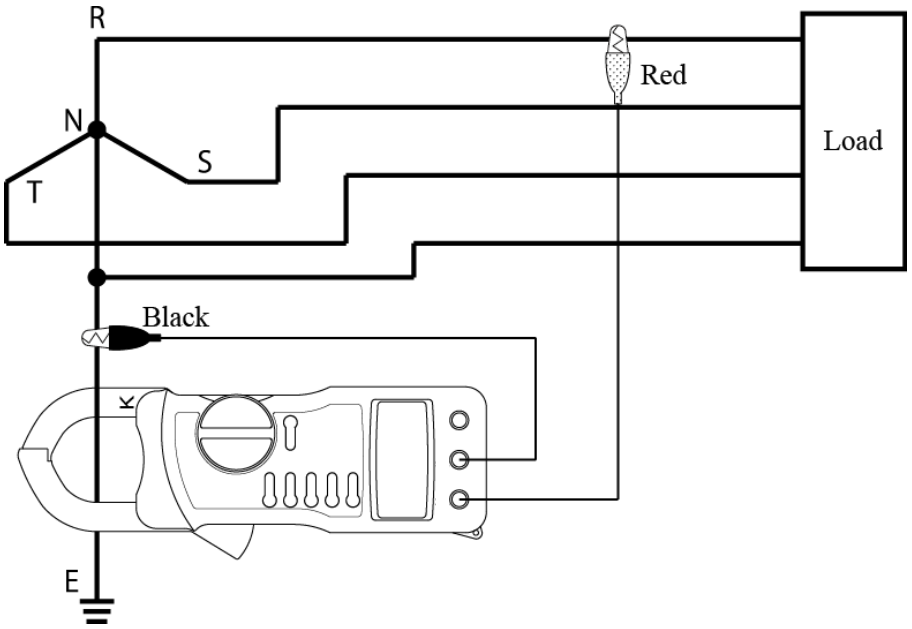
Connecting Method for Single phase/3 wires(Measuring Mode :1φ) [Ld] is displayed on LCD



Connecting Method for 3 phase/3 wires(Measuring Mode:Δ) [Ld] is displayed on LCD



Connecting Method for 3 phase/4 wires Neutral point grounding(Measuring Mode:Y) [Ld] is displayed on LCD



Peak Hold Measurement

(1) The measuring method for Peak Hold Measurement is the same as that for [Measuring Load Current (Line Current)] or [Measuring Voltage].

(2) Press the Peak Hold switch ⑪ once. “MAX” will be displayed at the top of the display, and the instrument will enter "peak hold measurement mode".

(3) Read the displayed value.* To cancel the "peak hold measurement mode", simply change the measurement range or press Peak Hold switch ⑪ once again.

NOTICE

* If you would like to perform peak current measurement, clamp the wire to be measured and then turn Peak Hold switch ON. Because the ZCT is highly sensitive, opening and closing the ZCT generates an electromotive force in the coil, and a numerical value will be displayed.
* To perform Peak Hold measurements accurately, be sure to set the frequency.
* During Peak Hold measurement, resolution will be reduced by one digit to eliminate fluctuations of the measured value.

5. BLUETOOTH COMMUNICATION

MCL-500IRKX supports Bluetooth communication.

By communicating with the "Multi-Tracer" application on smartphones and tablets, you can check and save measurement data.

* While waiting to pair with the "Multi-Tracer" application, the auto power-off function is disabled.

Download and install the "Multi-Tracer" application from the App Store if your mobile device is an iPhone or iPad, or from the Google Play if your device is an Android device.

* You have to have an Apple ID to download from the App Store.
* You need a Google account to download from the Google Play.
* For information on how to obtain an Apple ID or a Google account, please contact your mobile device supplier.

⚠ CAUTION

- This product employs radio equipment that has obtained construction design certification as a low-power data communication systems under the Radio Law.

EYSHCN:001-A10745

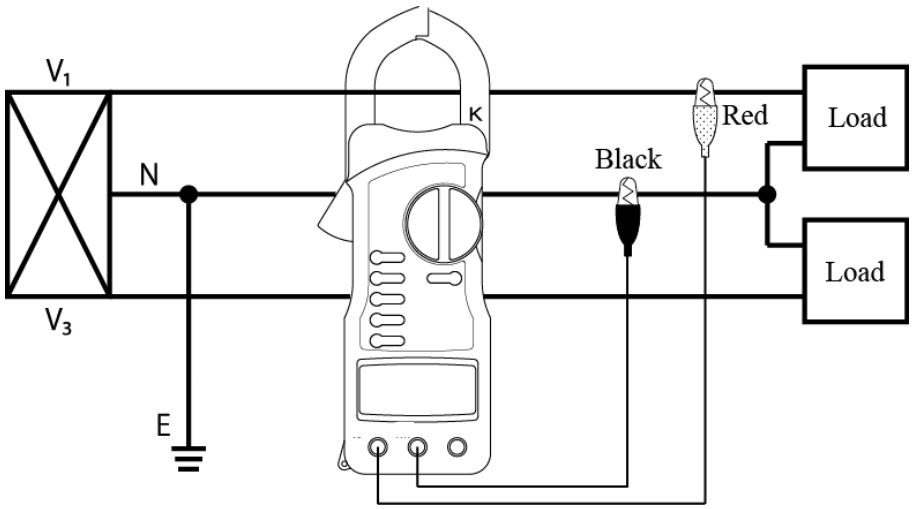
- The communicable distance greatly depends on the surrounding radio wave conditions and physical conditions (such as obstacles).
- This instrument uses the 2.4 GHz band. When this instrument is used near other wireless devices using the same frequency as this instrument, radio wave interference may occur between this instrument and the other wireless devices. When radio wave interference occurs, stop the other wireless devices or change the location where you use the instrument to avoid radio wave interference.
- The Bluetooth communication is not guaranteed to work on all mobile devices.
- The application "Multi-Tracer" can be used free of charge. However, the user is responsible for the Internet connection costs for downloading and using the application.
- The application "Multi-Tracer" is not guaranteed to work on all mobile devices.

6. ADDITIONAL MEASUREMENT BY "Multi-Tracer"

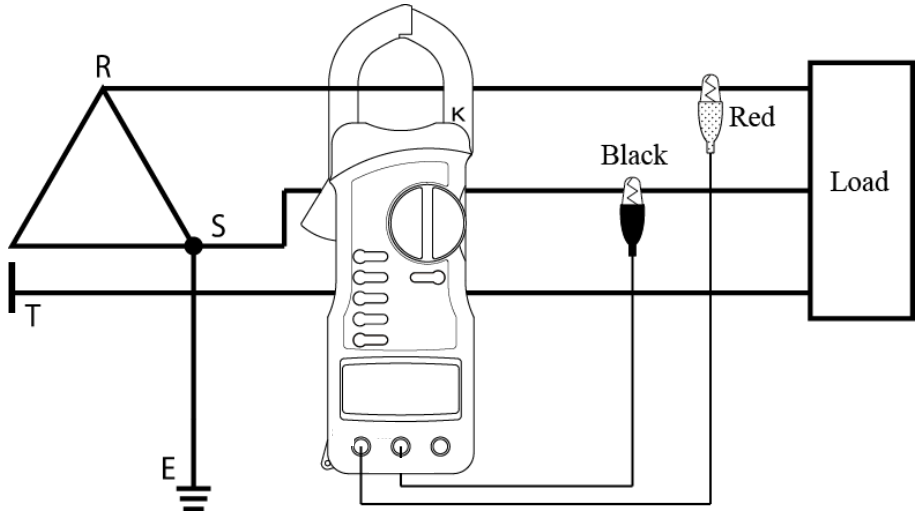
MCL-500IRKX enables simple power measurement when Bluetooth communication is activated.

How to clamp

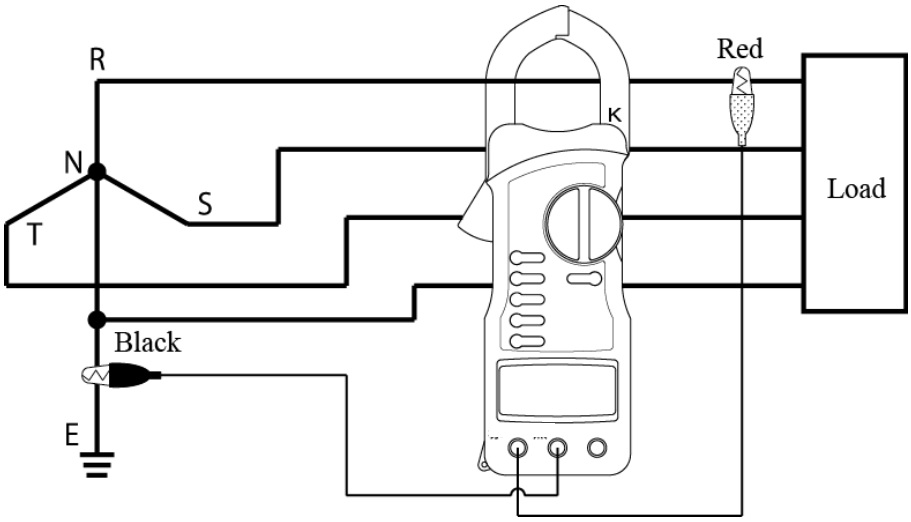
Connecting Method for Single phase/3 wires(Measuring Mode :1φ) [Ld] is displayed on "Multi-Tracer"



Connecting Method for 3 phase/3 wires(Measuring Mode:Δ) [Ld] is displayed on "Multi-Tracer"



Connecting Method for 3 phase/4 wires Neutral point grounding(Measuring Mode:Y) [Ld] is displayed on "Multi-Tracer"



7.AFTER-SALE SERVICE

If the instrument fails, contact the dealer or distributor from whom you purchased the instrument.
When sending the instrument for repair, wrap the instrument in cushioning material, store it in a sturdy box, and send it to us with the following information.

1. Customer's name, address, and telephone number
2. Description of the failure
3. Model number
4. Product serial number (if available)
5. Date of purchase
6. Where you purchased the product

8.WARRANTY

This instrument is shipped after rigorous in-house inspection, but we will repair it free of charge if the cause of the failure is determined to be our responsibility, such as a manufacturing defect. In such cases, you may contact either the dealer or us. The warranty period for this product is 12 months from the date of purchase.