

<p><b>LIVE INSULATION TESTER</b></p> <p><b>MLIT - 1</b></p>
<p><b>INSTRUCTION MANUAL</b></p>

Thank you very much for selecting our model MLIT-1  
Live Insulation Tester.

Before use the instrument, read this instruction  
manual completely and familiarize yourself thoroughly  
with all functions.

Keep this instruction manual carefully to take out  
whenever you need.

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## SAFETY SUMMARY

observe by all means

- To use this instrument safely, read this " SAFETY SUMMARY " carefully and apply the instrument correctly.
- The CAUTIONs and WARNINGS which appear on the following pages are stated to prevent the operator & other people from the dangers and their properties from the damages beforehand.

△ WARNING : This symbol indicates the contents " Possibilities of the death or the serious wound can be supposed " caused from mis-operations.

△ CAUTION : This symbol indicates the contents " Possibilities of the injury or only the material damage can be supposed" caused from mis-operations.

## ○ OPERATION ENVIRONMENT

### △ CAUTION

- Do not use or storage this instrument under the condition of direct rays of the sun, high temperature & humidity and or condensation, as it may cause the deformation and or the isolation defect of the instrument.
- Do not use this instrument in the environment influenced by acids, alkalis, organic solutions, corrosive gas, etc.
- Do not use or storage this instrument where the mechanical vibration can be directly transmitted, as it may cause defect of the instrument.
- Do not use this instrument nearby the appliances which generate strong magnetic field and or electrified, as it may cause mis-movement of the instrument.
- This instrument does not have the water / dust-proof structure. Do not use this instrument in the environment with a lot of dust and drops of water, as it may cause defect of the instrument.

○ OPERATION CONDITION & CONNECTION

⚠ WARNING

POSSIBLE ELECTRICAL SHOCK

- This instrument is for the use of low voltage circuit.  
Do not make measurements of power lines carrying more than AC500V.  
Before use, check and confirm the voltage of circuit to be measured.
- Apply only the coated cables and do not clamp bare cables.

POSSIBLE ELECTRICAL SHOCK OR ACCIDENT

- Do not handle the instrument in the rain, at humid place, with a drop of water and or with wet hands.
- Do not use the instrument if the CT or CT case are damaged and if something is wrong with the CT cables.
- When replacing the batteries, remove the instrument from all measuring circuits.
- Do not load the voltage exceeding AC10V to the input & output terminals of instrument body.

⚠ CAUTION

FOR SAFETY USE

- Do not drop the instrument & CTs and or do not give the strong shock .
- Do not put heavy goods on the cables of instrument, CTs & Accessories and do not modify those cables.
- If dropping CTs and or giving strong shock, the joint surface of CTs are damaged and it may cause wrong influences to the measurement.
- To avoid defect of CTs due to the break of cables, do not bend and or pull the cables at the base of CTs. Handle them very carefully.

1. GENERAL

This instrument is the world first Live Line Clamp Insulation Resistance Tester which can measure insulation resistances of motors, electric appliances and circuits by clamping CT to the live lines. Formerly, the insulation resistances of motors, etc. have been measured after disconnected the power lines but nowadays, the insulation measurements are getting more & more difficult, as there are so many places where we cannot cut down the electricity easily.

The model MLIT-1 applied the super precision split-core type ZCT and enabled the insulation resistance measurement up to 20MΩ , which has been mostly impossible by clamping CT.

2. SUGGESTIONS BEFORE USE

After opening the package, inspect the appearance of the instrument and check the accessories.

If you find any damage of appearance and or the lack of accessories, inform to the dealer you bought the instrument.

( COMPOSITION)

Instrument Body	• • • 1
Detection CT	• • • 1
Voltage Input Sensor	• • • 1
Carrying Case	• • • 1
Instruction Manual	• • • 1

### 3. SPECIFICATIONS

#### 1) INPUT PART

##### (1) VOLTAGE INPUT (PHASE VOLTAGE)

- ① Input Method : Direct Input by Test Leads
- ② Input Impedance : more than 1M $\Omega$
- ③ Input Voltage Range : AC50V $\sim$ AC500V
- ④ Input Frequency : 50Hz or 60Hz by Switch
- ⑤ Minimum Resolution : 0.1V

##### (2) CURRENT INPUT (GROUNDING LINE CURRENT)

- ① Input Method : Split-Core Type ZCT

#### 2) CURRENT DETECTION PART

- ① Inside Diameter of CT :  $\Phi$  30mm
- ② Method : Split-Core Type ZCT
- ③ Structure : Manual Slide Method
- ④ Withstanding Voltage : AC2000V, 1 Minute
- ⑤ Length of Cable : 2000mm
- ⑥ Dimension & Weight : 29.6 x 90.2 x 70.7mm, Approx. 200g

#### 3) MEASUREING PART

- ① Measuring Function : AC Voltage, Line Current, Leakage Current, Resistive Leakage Current (Ior), Insulation Resistance
- ② Measuring Method : Clamp CT Method
- ③ Measuring Range : Leakage & Line Current (Auto-range)  
0 $\sim$ 200  $\mu$  A / 2mA / 20mA / 200mA  
AC Voltage : 0 $\sim$ 500.0V (1 range)  
Insulation Resistance : Calculation by Current & Voltage
- ④ Input Frequency : 45 $\sim$ 65Hz (by Frequency Change Switch)
- ⑤ Minimum Resolution : Leakage, Line, Ior Current : 0.1  $\mu$  A  
AC Voltage : 0.1V
- ⑥ AC Detection Method : Average Sensing RMS Conversion
- ⑦ A/D Conversion : Successive Comparison Method
- ⑧ Display : Max. 1999 Count LCD with Annunciators

- ⑨ Sampling Rate : 2 times/second
- ⑩ Over Range : 「OL」 mark on LCD
- ⑪ Data Hold : 「DH」 mark on LCD and Holding Data
- ⑫  $\tan \delta$  Measurement : By 「 $\tan \delta$ 」 ON, display insulation resistance calculated with  $\tan \delta$  value
- ⑬ Low Battery : 「B」 mark on LCD
- ⑭ Auto Power Off : Automatically power off approx. 10 minutes after the final key operation
- ⑮ Memory Function : The displayed value can be stored into the internal memory and they can be taken out on the display if necessary.  
There are also “all clear mode”, etc.

#### 4) GENERAL SPECIFICATION

- ① Circuit Voltage to be applied : Less than AC500V (Insulated Conductor)
- ② Operating Temperature : 0°C~50°C, < 85%RH (Non-condensing)
- ③ Storage Temperature : -10°C~60°C, < 85%RH (Non-condensing)
- ④ Withstanding Voltage : AC2000V / 1 minute between CT part and Instrument Body
- ⑤ Power Supply : Alkaline Battery (LR6 x 4 pcs.)
- ⑥ Consumption Current : Approx. 15mA (Approx. 110 hours / continuous use)
- ⑦ Dimension & Weight : 78(W) x 155(H) x 32(D) mm, approx. 300g.

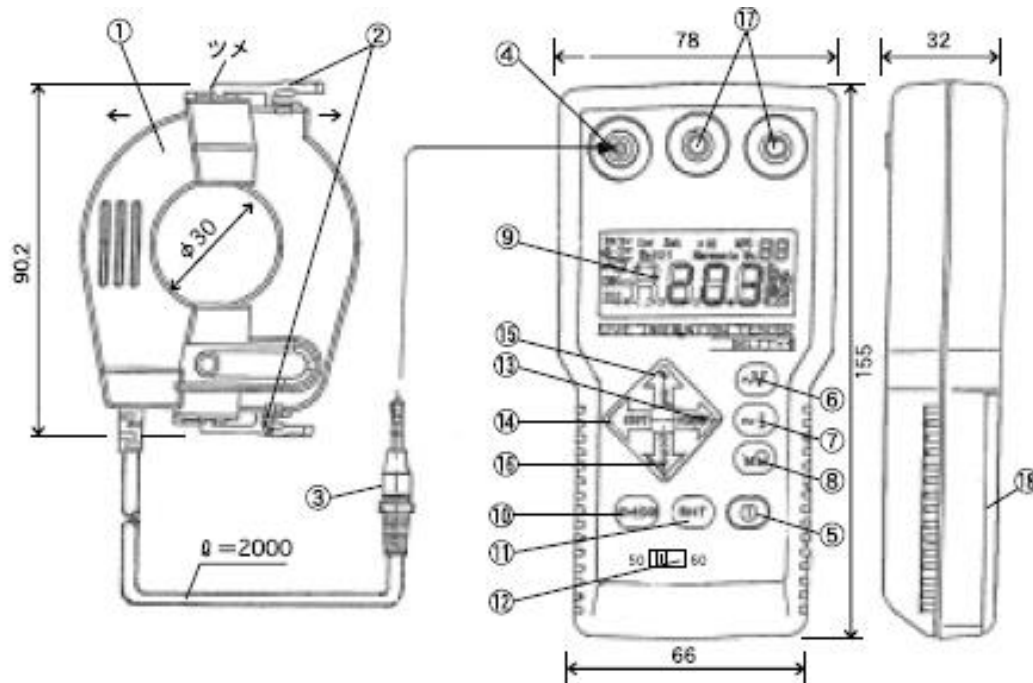
ACCURACY ( 23°C ± 5°C, Less than 85%RH )
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Leakage Current (I<sub>o</sub>), Line Current (I), Resistive Leakage Current (I<sub>or</sub>)  
 rdg : reading dgt : digit

Range		Resolution	Accuracy (50Hz / 60Hz)
Voltage (V)		0.1V	0~499.9V ±1.0%rdg ±10dgt
I, I <sub>o</sub>	200 μA	0.1 μA	0~199.9 μA ±1.0%rdg ±10dgt
	2mA	0.001mA	0.200~1.999mA ±1.0%rdg ±10dgt
	20mA	0.01mA	2.00~19.99mA ±1.0%rdg ±10dgt
	200mA	0.1mA	20.0~220.0mA ±1.0%rdg ±10dgt
I <sub>or</sub>	200 μA	0.1 μA	0~199.9 μA ±1.5%rdg ±15dgt
	2mA	0.001mA	0.200~1.999mA ±1.5%rdg ±15dgt
	20mA	0.01mA	2.00~19.99mA ±1.5%rdg ±15dgt
	200mA	0.1mA	20.0~220.0mA ±1.5%rdg ±15dgt

- ※ Accuracy with the condition that the conductor to be measured is located in the center of CT.
- ※ AC Conversion Method : Average Sensing RMS conversion
- ※ Accuracy of I<sub>or</sub> : In case of single phase (1 Φ), the phase angle of voltage & current should be 0° .  
 In case of 3 phase / 3 wires (Δ), the phase angle of voltage & current at Δ wiring should be 300° .
- ※ Use frequency select switch at the time of measurement.
- ※ The insulation resistance values are figured out by formulas between voltage & current (I<sub>or</sub>) at each wiring system.

#### 4. NAME & FUNCTION OF EACH PART



- |                                      |  |
|--------------------------------------|--|
| ① Clamp Type ZCT                     | : Current detection Sensor   |
| ② Open / Close Lever                 | : ZCT will be opened, when pushing up the both levers and pulling CT to arrow directions.  |
| ③ ZCT Output Plug                    | : to be connected with instrument body.  |
| ④ CT Input Terminal                  | : Insert ZCT plug into the terminal.   |
| ⑤ Power Switch (POWER)               | : Power on by pressing the switch and power off by pressing once more.   |
| ⑥ Voltage Select Switch ( $\sim V$ ) | : By pressing this switch, the voltage value will be displayed.  |
| ⑦ Current Range Switch ( $\sim I$ )  | : By pressing this switch, Io current value will be displayed. By pressing once more, Ior of 1 $\Phi$ and by pressing three times, $\Delta$ Ior, and by pressing once more, Y Ior value will be displayed. Select the correct range according to wiring system and or circuit to be measured. The sing of present range will be showed on the display ( in case of no sign, the displayed value in Io ). |

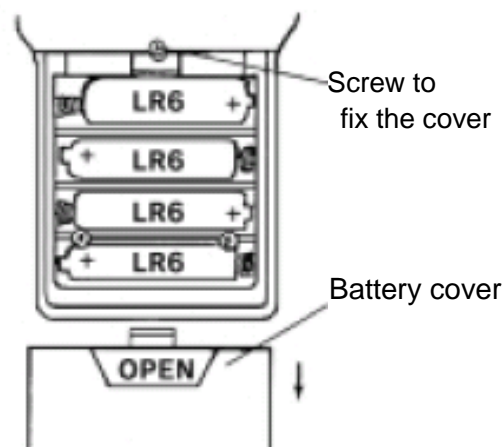


- ⑧ Insulation Resistance Switch ( $M\Omega$ ) : By pressing this switch, the insulation resistance value calculated by voltage and Ior value will be displayed. When voltage is not inputted, the display will become "OL". Fix the wiring system correctly. By once for  $1\Phi$ , twice for  $\Delta$  and three times for Y.
- ⑨ LCD Display (LCD) : Showing the measured values, measuring mode, conditions of battery, etc.
- ⑩ Data Hold Switch (D-HOLD) (MEM CLR) : By once press, 「DH」 mark will be displayed. At the same time, the empty block number will be displayed and the displayed value will be memorized in the displayed block by pressing 「ENT」 switch. By pressing 「DH」 switch again without 「ENT」 switch, Data Hold function will be released.
- ⑪ Empty Switch (ENT) : This switch is for memorization of displayed values.
- ⑫ Frequency Change Switch : Set according to power supply frequency.
- ⑬ RIGHT·tan  $\delta$  ON Switch : Press this switch to measure Ior current and  $M\Omega$  by calculating tan  $\delta$  and "tan  $\delta$  " mark will be blinking on the display. During MEMORY ON, press this switch to change the first ordinal number and it will be blinking.
- ⑭ LEFT·tan  $\delta$  OFF Switch : Press this switch to release "tan  $\delta$  " display and "tan  $\delta$  " will become non-blinking. During MEMORY ON, press this switch to change the tenth ordinal number and it will be blinking.
- ⑮ UP Switch : To memorize the display data, press this switch to set the memory number. During MEMORY ON, press this switch to select the memory number to be recalled.
- ⑯ DOWN Switch : Use this switch to set the memory number together with UP Switch.
- ⑰ Voltage Input Terminal ( $\sim V$  INPUT) : To measure Ior current, input voltage to this terminal (black one is Ior the grounding side).
- ⑱ Battery Cover (Rear Side) : Remove this cover to change the batteries.

## 5. OPERATION PROCEDURE

### 5-1) CHANGE OF BATTERIES

Confirm that the power is "OFF".  
Take out the instrument from carrying case and remove the screw of battery cover by ⊕ driver. Slide the battery cover to the arrow direction and remove the battery cover. Take out 4 batteries and replace them. Put the battery cover back to the original position and tighten the screw.



- 「B」 sign will appear on the display when batteries are exhausted and get less than operation voltage. Replace to new batteries immediately.
- Do not use the batteries mixed new one and once used and or different kind ones.

### ⚠ WARNING

#### POSSIBLE ELECTRICAL SHOCK

- When removed the battery cover, put it back to the original position certainly. Do not operate the instrument, leaving the battery cover off.
- Do not replace the batteries with clamping CT to the conductor.

### ⚠ CAUTION

#### POSSIBLE DAMAGE TO THE INSTRUMENT

- When not using the instrument for a long period, remove the batteries and keep separately. The batteries may leak and may cause damage to the instrument.

## 5-2) MEASUREMENT

To use the instrument safely, follow the contents described in WARNING and CAUTION without fail.

### WARNING

#### POSSIBLE ELECTRICAL SHOCK

- For safety, use the instrument in circuit less than 500V.  
Before operation, confirm the circuit voltage to be used.

#### POSSIBLE ELECTRICAL SHOCK OR ACCIDENT

- Do not handle the instrument in the rain, at humid place, with a drop of water and or with wet hands.
- Do not use the instrument if the CT or CT case are damaged.
- Do not use the instrument, leaving the battery cover off.

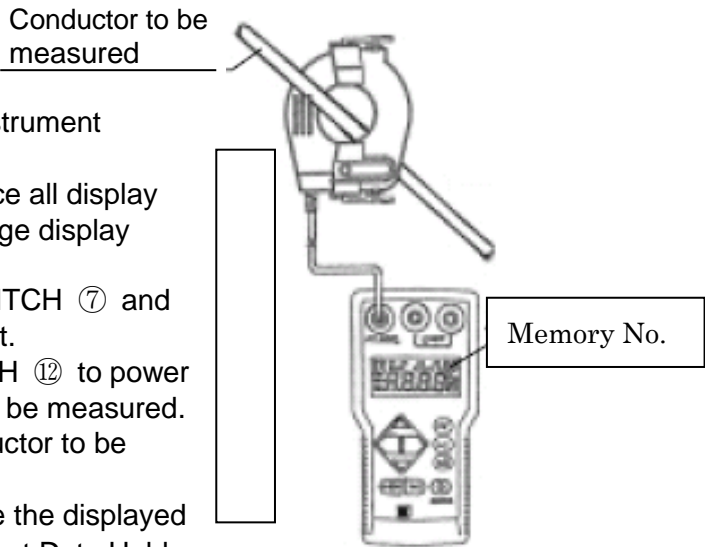
#### POSSIBLE FIRE HAZARD AND BURN ACCIDENT

- Part of ZCT will get heat when applying excessive current.  
Do not apply more than maximum capable current (10A rms) to ZCT part.
- Do not apply more than AC 500V to voltage input terminal ( $\sim$ V INPUT)

#### Note :

- In case of input "0" at Ior range, the display will not become completely "0" but it is not defect.
- Connect the grounding phase to the black voltage input terminal. Otherwise, Ior value will have error from the influence of electric fields.

### (1) Measurement of Line Current

- ① Connect ZCT to CT INPUT of the instrument like as the drawing.
- ② Press POWER SWITCH ⑤ on. Once all display will be lightened and then, the voltage display will appear.
- ③ Once press CURRENT RANGE SWITCH ⑦ and then, the display become for current.
- ④ Set FREQUENCY CHANGE SWITCH ⑫ to power supply frequency of the conductor to be measured.
- ⑤ Open ZCT and Clamp it to the conductor to be measured and then close ZCT.
- ⑥ Read the display value. To memorize the displayed value, press D·HOLD switch ⑩ to get Data Hold mode. Then, press ENT switch ⑪ and the data will be memorized. Not to make memorization, press D-HOLD Switch once again to release the data hold function. (In case of over range, 「OL」 mark will be displayed).
- 
- Conductor to be measured
- Memory No.

#### Note :

- The instrument has auto power off function and the power will get off approx. 10 minutes after the final switch operation.
- At lor measurement mode, line current cannot be measured.

### (2) Measurement of Leakage Current

#### ① Measurement of Leakage Current of Grounding Line

The operations are the same as for line current measurement.

#### ② Measurement of Leakage Current except of Grounding Line

The operations are the same but clamp CT to 2 wires at the same time in case of single phase / 2 wires and clamp 3 wires or 4 wires at 3 phase / 3 wires or 4 wires.

### (3) Measurement of Resistive Leakage Current (I<sub>or</sub>) & Insulation Resistance (MΩ)

#### CAUTION FOR MEASUREMENT

- This instrument measures insulation resistance at live line and sometimes, the measurement values may get different from ordinary insulation resistance testers.
- The voltage inputs for the measurement of circuit insulation resistance are different according to single phase / 2 wires, three phase / 3 wires and three phase / 4 wires. Refer to the wiring systems and use the instrument correctly.
- Also, be careful that the wiring system is different according to the kind of motors.
- Pay sufficient attention to the wiring in case of measurement of I<sub>or</sub> (MΩ), as the instrument regards phase factors of current & voltage. Also, the current measurement cannot be done if mistaking the frequency setting, as the phase factors are changed.

#### ⚠ WARNING

- Do not apply more than AC500V to voltage input terminal (∼V INPUT). It may cause the damage.

#### POSSIBLE ELECTRICAL SHOCK

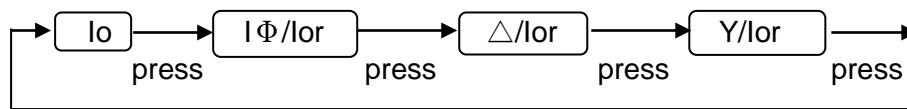
- The test leads are consumption articles. Before connecting to the instruments, confirm that there are no damage at the insulated coating of test leads. If you found any unusualness, immediately stop the operation and repair or change to new ones.

#### POSSIBLE FIRE HAZARD AND BURN ACCIDENT

- Connect the test leads firmly. The connection error may cause the spark.
- Do not apply the voltage more than 10V to CT INPUT terminal absolutely.

- ① Press POWER switch ⑤ once. All display appears and then, becomes voltage display.
- ② Connect ZCT to CT INPUT and test leads to  $\sim V$  INPUT according to each color.
- ③ According to the circuit and apparatus to be measured, input the voltage and current to the instrument. Refer to wiring method for voltage & current input.
- ④ By frequency change switch, set the power supply frequency to be measured.
- ⑤ Confirm the voltage value on display and once press current range switch. The display becomes  $I_o$  current. Confirm  $I_o$  current value and press current range switch once again. The display becomes  $1\Phi/\text{lor}$  showing  $\text{lor}$  current of single phase. Measure  $\text{lor}$  current value by pressing current range switch according to wiring system to be measured.

By pressing current range switch :

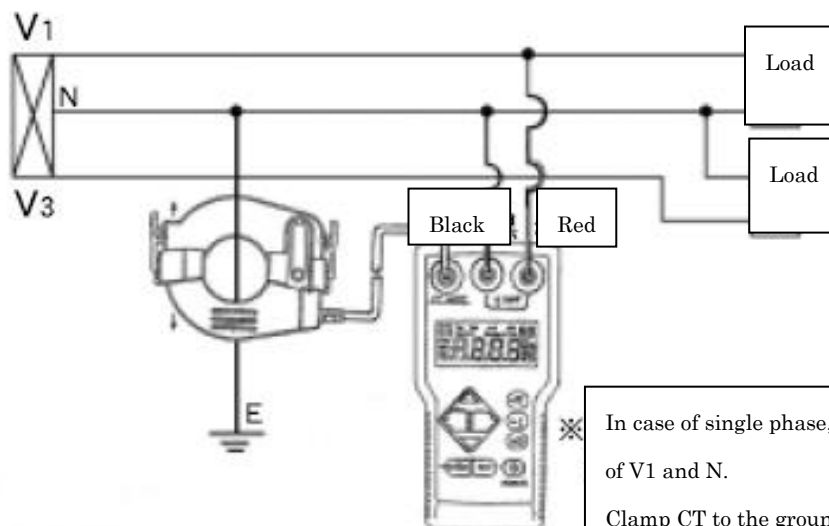


In order to consider  $\tan \delta$ , once press  $\tan \delta$  ON switch ⑬, " $\tan \delta$ " appears on the display. To get back before, press  $\tan \delta$  OFF switch ⑭ and " $\tan \delta$ " disappears.

- ⑥ To measure the insulation resistance ( $M\Omega$ ), once press insulation resistance switch. In case of no voltage input, the display becomes "OL".
- ⑦ In order to memorize  $\text{lor}$  current or  $M\Omega$  values, press D-HOLD switch ⑩ and then, press ENT switch ⑪ at each time.

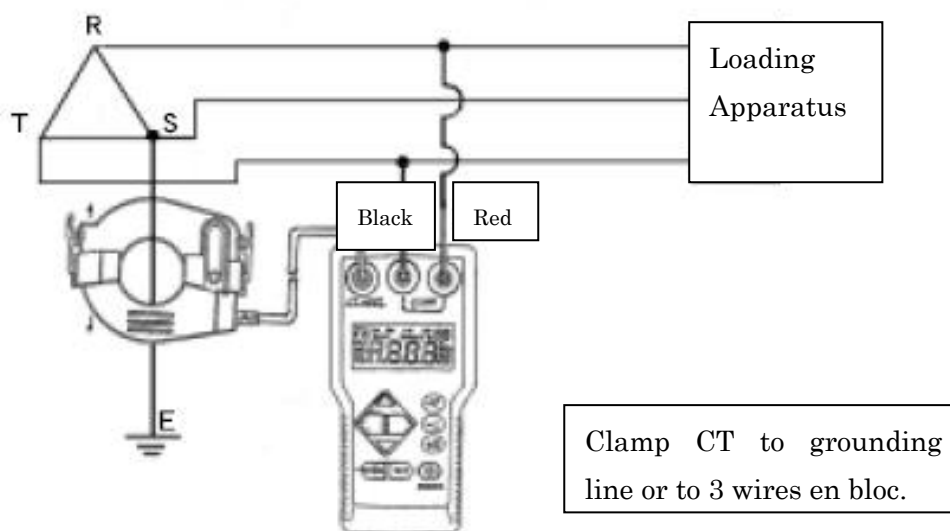
### (WIRING SYSTEM)

- ② 1P/1W, 1P/3W CIRCUIT : Wiring Mode  $1\Phi/\text{lor}$

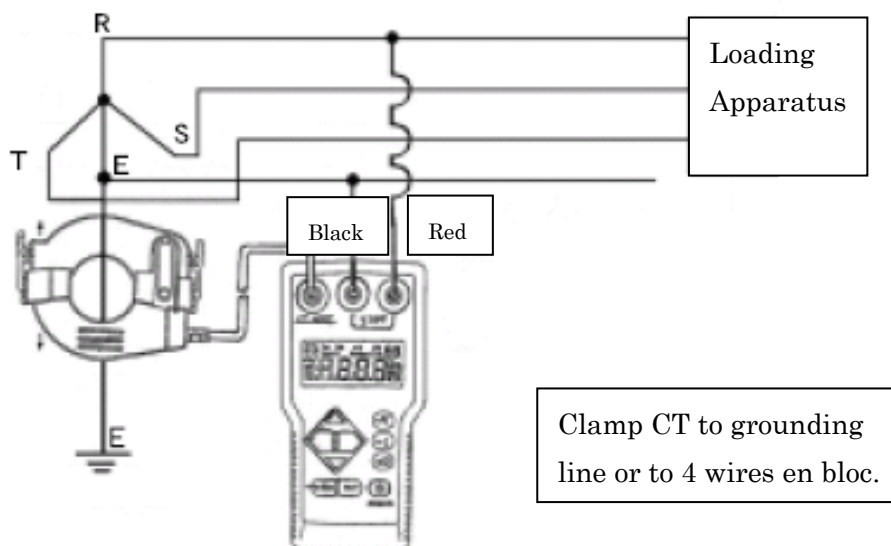


In case of single phase, wiring consists of V1 and N.  
Clamp CT to the grounding line or to 3 wires en bloc.

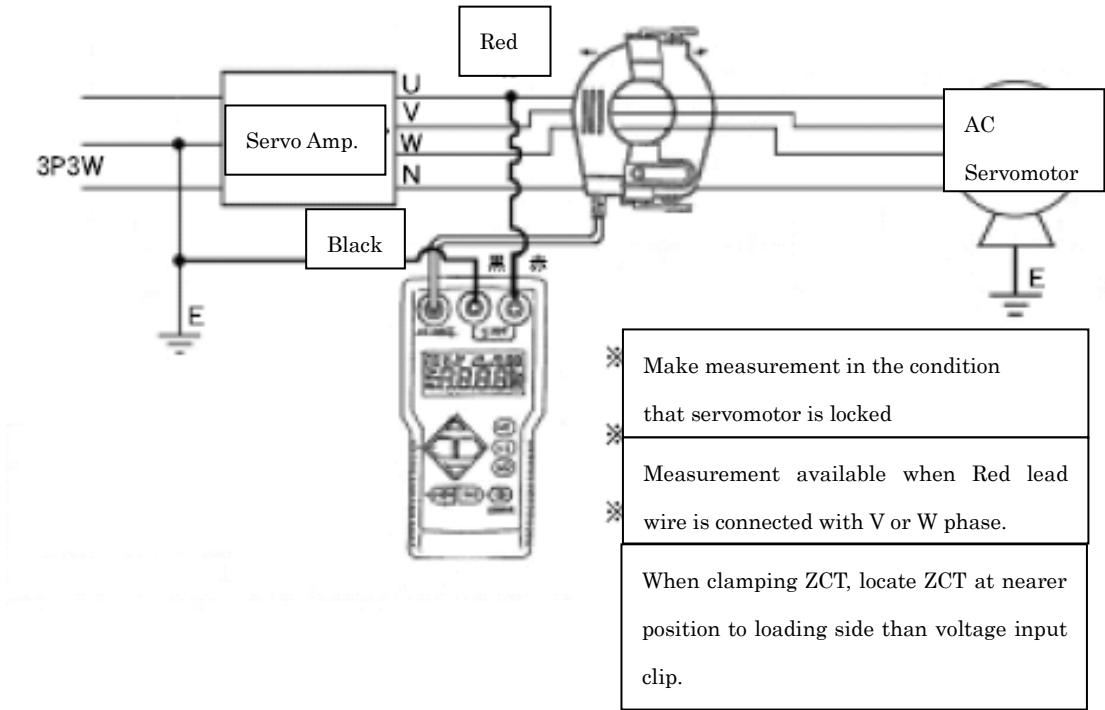
⑥ 3P/ 3W CIRCUIT : Wiring Mode  $\Delta$ /lor



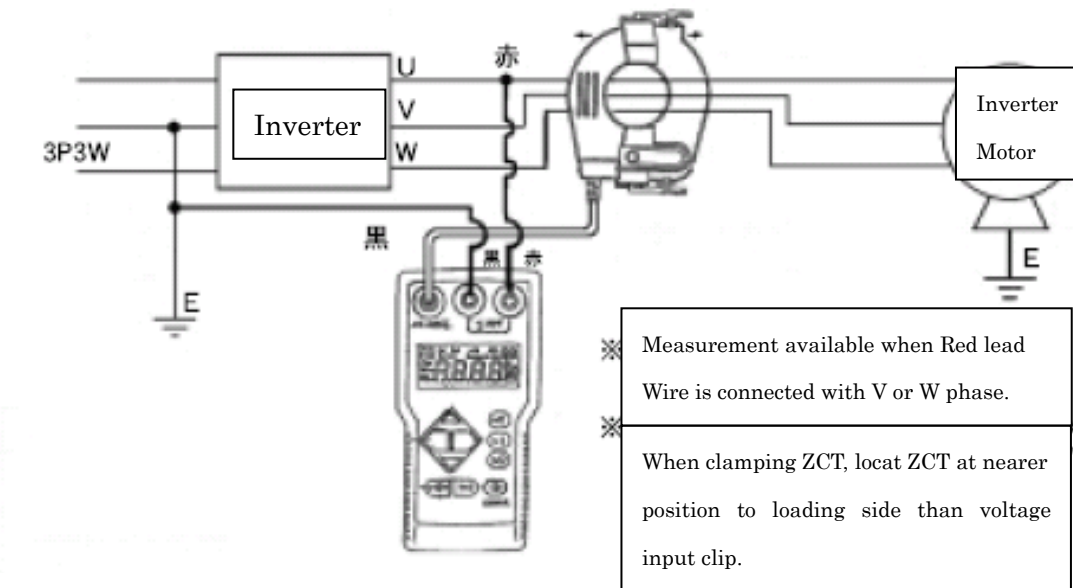
⑦ 3P / 4W CIRCUIT : Wiring Mode Y/lor



④ **AC SERVOMOTOR** : Wiring Mode 1  $\Phi$ /lor



⑤ **INVERTER MOTOR** : Wiring Mode 1  $\Phi$ /lor



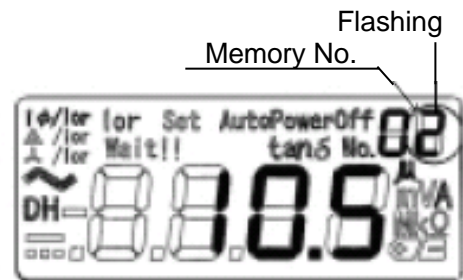


### 5-3) MEMORY FUNCTION

This instrument has memory function and can memorize the measured data and can display such memorized data in LCD.

#### (1) How to memorize

- ① During the measurement of voltage, Io current, Ior current and or MΩ, once press D-HOLD switch ⑩. 「DH」 mark appears on the display and memory number is flashing.  
By pressing ENT switch ⑪, the data will be memorized into the flashing memory number.



- ※ In case of choosing own favorable numbers, decide the number by using UP, DOWN, RIGHT, LEFT switches (⑬～⑯) and then, press ENT switch ⑪.
- ※ If you use the memory number which has data already, the old data will be deleted and the new one will be memorized.

#### (2) How to see the memorized data on the display (MEMORY ON MODE)

- ① Pressing LEFT switch ⑭ and RIGHT switch ⑮, push POWER switch ⑤.
- ② No. 1 data will be displayed. By using UP, DOWN, RIGHT, LEFT switches ⑬～⑯, set the favorable memory number and read the data.
- ③ To delete the data on the display, press MEMCLR switch. The data will be disappeared and only the memory number will remain.
- ④ To terminate MEMORY ON MODE, push POWER switch ⑤ once again.

#### (3) How to delete all memorized data (MEM ALL CLR MODE)

- ① Pressing D-HOLD switch ⑩ and ENT switch ⑪, push POWER switch ⑤.
- ② Memory number on the display, gets increment and all data will be deleted.
- ③ Push POWER switch ⑤ once again.

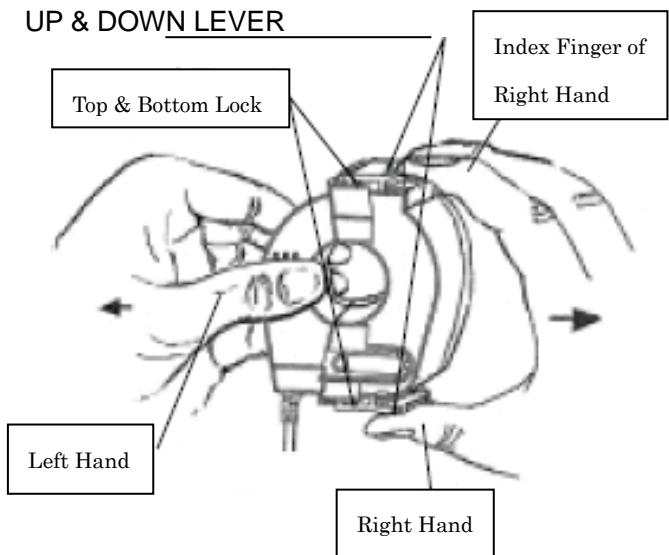
#### Note

Be careful sufficiently not to delete memorized data mistakenly.

#### 5-4) USE OF SPLIT-CORE TYPE ZCT (ZCT-30SP)

(How to open/close)

- ① Push up and down levers by fingers and pull CT to the arrow directions like as drawing.
- ② When clamping CT to the conductor to be measured, join left & right side slowly and push them up until up & down levers get clicked completely.



#### ⚠ CAUTION

1. The secondary side of the ZCT is open. When clamping CT to the conductor without inserting to the instrument, voltage will occur at the secondary side, which may cause danger. In case of clamping ZCT to the conductor to be measured, definitely insert the output plug to the instrument beforehand.
2. This ZCT is the highest precise product and treat it very carefully. Keep this ZCT closed, as it is fragile if leaving CT open.

## 6. REPAIR SERVICE

When requesting for repair service, Please bring the instrument directly to the dealer where you bought.

When mailing the instrument, always pack it in its original or equivalent packing materials to avoid any damage during the transportation and also put together with documents showing your name, address, phone number and defect point.

## 7. WARRANTY

This instrument is sent out from our factory after the sufficient internal inspections but if you find any defect due to the fault in our workmanship or the original parts, please contact the dealer where you bought the instrument.

The warranty period is 12 months from the date of purchase and the instrument shall be repaired at free of charge, provided that we judge the cause of defect is obviously resulted from our responsibility.

## GUARANTEE REGULATIONS

1. This instrument is warranted for the operation under normal use for 12 months from the date of purchase.
2. This warranty does not cover the following defects:
  - a. Defect caused from the improper use and operation.
  - b. Defect caused from the use, operation and storage beyond the original specifications, designs and conditions.
  - c. Defect caused from the renovations or repairs done by someone else than us or our representatives.
  - d. Defect not caused from our responsibilities.