

Thank you for purchasing the YOKOGAWA 2404 Insulation Tester.
To optimize all the functions of the instrument, please read this manual thoroughly before operating it.

Model: 240413, 240414, 240415, 240416

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YOKOGAWA ◆
Yokogawa Meters & Instruments Corporation

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Safety Precautions

■ For safe use, the following symbols are used on the instrument or in this manual:

⚠ Danger! Handle with Care.

This symbol indicates that the operator must refer to an explanation in the user's manual in order to avoid risk of injury or death of personnel or damage to the tester.

~ AC Voltage

This symbol indicates the presence of an AC voltage.

⚠ **WARNING**

Indicates a hazard that may result in the loss of life or serious injury of the user unless the described instruction is abided by.

⚠ **CAUTION**

Indicates a hazard that may result in an injury to the user and/or physical damage to the product or other equipment unless the described instruction is abided by.

⚠ High-voltage Terminal

This symbol indicates a dangerous voltage level (terminals with voltages exceeding 1000 volts must be so marked). Never touch the terminals.

⚠ **WARNING**

■ To avoid injury, death of personnel, carefully observe and follow the warnings listed below:

1. During the measurement of insulation resistance

- A high voltage is generated in the probe during the measurement of insulation resistance. Do not touch the measured object, the EARTH or LINE terminals or the GUARD terminal.

2. During the measurement of AC voltage

- There is AC voltage at the GUARD terminal during the measurement of AC voltage. Do not touch the GUARD terminal.

3. Immediately after the measurement of insulation resistance

- The probes or measured object may remain highly charged. Do not touch them immediately after measurement.

4. Probe

- Use the probe supplied by Yokogawa Corporation for the instrument concerned.
- Do not use a deteriorated or damaged probe.
- Do not attach/detach the probe to/from the instrument prior to releasing it from the measured object.

5. Protection

- If there are any cracks or other damage in the case because of being dropped or struck, the instrument may not be safely insulated. Do not use the instrument before any remedial measures are taken.

6. Object to be measured

- When insulation resistance or resistance is measured, turn off the power to the measured object.
- When the instrument is used in a location where an electric current is flowing, never touch the power line. Use rubber gloves as a safety precaution.

7. Fuse

- To prevent a fire, use the rated fuse to meet the voltage, current and type (Spare Fuse).
- Prior to detaching the cover for replacing the fuse, release the probe from the measured object and turn off the switch.
- Do not touch the measurement switch during replacement. Otherwise, a high voltage may be produced.

8. Operating Environment

- Do not operate the instrument in a flammable or explosive gas atmosphere.
- Do not operate the instrument, if there is condensation on it.

9. Disassembly

- Do not attempt to disassemble the instrument.

⚠ **CAUTION**

■ To avoid injury of personnel or damage to the instrument, carefully observe and follow the cautions listed below.

1. Measurement of AC voltage

- Do not apply a voltage over the allowable limits between the terminals.

2. GUARD terminal

- The GUARD terminal is an auxiliary measurement terminal to eliminate a leakage current. Do not apply a voltage to the terminal.

3. Power supply to the measured object

- Metals and wiring connected to the electric equipment may have a voltage being applied. Confirm that no voltage is being applied prior to connecting the measurement terminal. The same precaution applies to the grounding system.

4. Function select switch (except for 240415, 240416)

- Do not change the function select switch setting during measurement.

(Before changing the switch, wait 2 or 3 seconds after a measurement. Immediately after the measurement, the electric shock charged by probes or measured objects may damage the tester or the measured objects. This tester has the discharge feature.)

- Do not apply a voltage to the measurement terminals during the measurement of insulation resistance or continuity test.

1. GENERAL

1.1 Description

Periodically testing of the insulation resistance of electrical machines, power distribution lines, communication cables and other electric devices, helps to locate faults before they become serious.

The 2404 Insulation Tester is a hand-driven type insulation resistance tester incorporating a built-in generator and a constant DC voltage circuit to provide a stable output and give a direct resistance reading. The insulation resistance is indicated on a moving coil type indicator with a logarithmic scale. Not only insulation resistance testing and AC voltage measurement, but also general continuity testing and low resistance measurement are possible using the 500Ω full scale low resistance measuring range of the instrument (not on Models 240415, 240416).

The black indicator scale is easy-to-read. This insulation tester is ruggedly built and uses a shock-and heat-resistant polycarbonate resin case.

1.2 Specifications

Item	Specifications		
	Insulation Resistance Rated Voltage/Rated Resistance	Ac Voltage Measuring Range	Low Resistance Measuring Range (continuity test range)
Model			
240413	500 V/ 100 MΩ	0 to 300 V	0 to 500 Ω (central scale mark 50Ω)
240414	500 V/ 1000 MΩ	0 to 300 V	0 to 500 Ω (central scale mark 50Ω)
240415	1000 V/ 2000 MΩ	0 to 300 V	—(See Note 1)
240416	2000 V/ 5000 MΩ	0 to 300 V	—
Accuracy	±5% of indicated value in Effective Measuring Range 1 (See Note 2), ±10% of indicated value in Effective Measuring Range 2 (See Note 2) Less than 0.7% of scale length at zero and infinity scale marks. AC Voltage Measurement: ±10% of full scale.		
Measuring Terminal Voltage	Accuracy: ±10 % of rated voltage at infinity scale mark, or more than 90 % of rated voltage at center scale mark.		
Rotational Speed of Crank	More than 120 rpm.		
Case Material	Polycarbonate resin.		
Dimensions	Approx. 184 × 112 × 105 mm (7-1/4 × 4-3/8 × 4-1/8")		
Weight	Approx. 1.3 kg(2.9 lbs)		
Accessories Supplied at No Extra Cost	User's Manual Spare Fuse (2 pcs installed), Carrying Case		

- Optional Accessories Available,
Measuring leadwires B9634FA
- Spare Part
Fuse (0.1 A)

Note 1 : The center scale mark is the scale position of 1, 2, 5 or multiples of 10 there of and corresponds to a value of approximately one-fiftieth the rated resistance.

Note 2: Effective Measuring Range 1 extends from 1/1000 of the rated resistance to the center scale mark at 1, 2, 5 or multiples of 10 there of which most nearly correspond to 1/2 of the rated resistance.

Effective measuring range 2 extends from the upper limit of effective measuring range 1 to the rated resistance value.

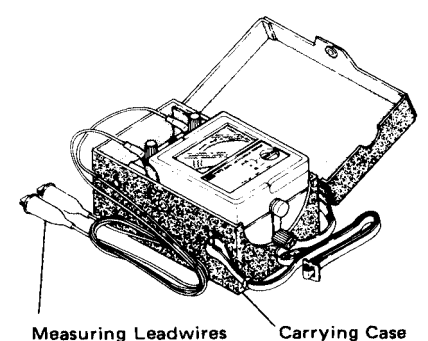


Figure 1-1

2. NAMES AND FUNCTIONS OF COMPONENTS

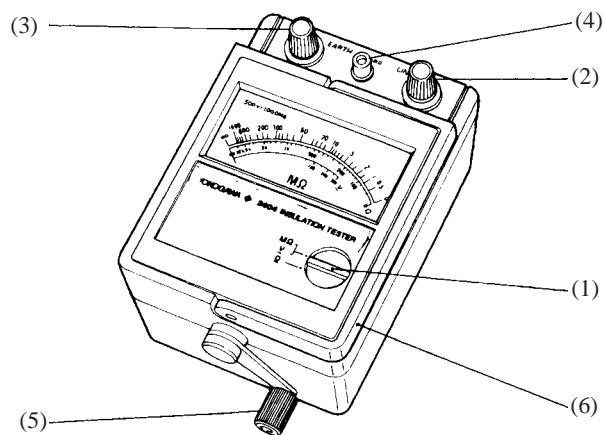


Figure 2-1

(1) Function Select Switch :

Insulation and AC voltage measurements ($M\Omega$ and V) and resistance Test (Ω) can be selected with this switch. (except Models 240415, 240416)

(2) LINE Terminal:

To measure Insulation resistance, AC voltage and resistance use this LINE terminal and the EARTH terminal (3) below.

(3) EARTH (ground) Terminal

(4) GUARD Terminal

(5) Crank

(6) Carrying Handle

3. OPERATION

3.1. AC Voltage Measurement

- (1) Power line AC voltages can be measured using this tester. Always prior to an insulation resistance measurement, use the tester to check whether the object to be measured is live or not.
- (2) Connect measuring lead wires to the LINE and EARTH terminals. Use optional accessory B9634FA measuring leadwires or equivalent high insulation resistance leadwires.
- (3) Place the instrument on a fairly level surface with the crank facing you. Turn the carrying handle down.
- (4) Set the function select switch to V. Prior to connecting an object for an AC voltage measurement, short-circuit the tester LINE and EARTH lead wires. Turn the crank to check to see that the indicator shows zero ohms. This confirms that the tester is operating normally.
- (5) To make a voltage measurement touch the LINE and EARTH lead wires to the line to be measured and read the indication on the "AC V" scale as you would read in ordinary voltmeter. During voltage measurement, do not turn the crank.

3.2 Insulation Resistance Measurement

- (1) Read the NOTE below, then connect the object to be measured between the LINE and EARTH terminals. Set the function select switch to $M\Omega$.
- (2) Turn the crank at a speed of more than 120 rpm to obtain a constant voltage output. The pointer will indicate the measured insulation resistance value.
*Crank rotation may be either clockwise or counterclockwise.
- (3) While turning the crank, read the pointer indication.

CAUTION

- When one side of the measured circuit is grounded, connect the earth side to the EARTH terminal (positive side) of the tester. Normally, this connection gives smaller (conservative) values of insulation resistance, to be on the safe side. In this case, the lead-wires connected to the LINE terminal (negative side) should be kept always from earth and other objects.
- When the measured circuit is not grounded, it may be connected to either LINE or EARTH terminal.
- The GUARD terminal is used only when volume resistance is to be measured without being influenced by surface leakage resistance. For example, when the insulation test is conducted on a cable such as shown in Figure 3-1, wind a bare wire around the insulating material and connect this wire to the GUARD terminal. In this arrangement, the leakage current flowing on the surface of the insulating material will not pass through the indicator. Thus, only the volume resistance is measured.

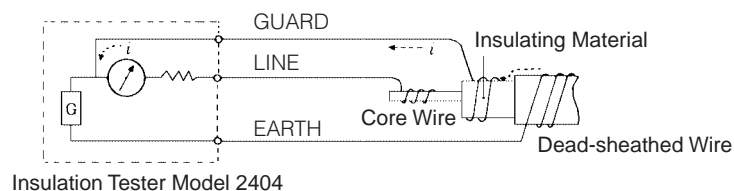


Figure 3-1 Connections

3.3 Low Resistance Measurement

Set the function select switch to Ω . Connect the object at be measured between the LINE and EARTH leadwires. Turn the Crank at a speed of more than 120 rpm and read the indication on the " Ω " scale. Low resistance measurement cannot be made using the Models 240415 (1000 V/2000 $M\Omega$) and 240416 (2000 V/5000 $M\Omega$) insulation testers.

CAUTION

- Be sure not to apply a voltage between the terminals during low resistance measurement.
- If power line AC voltage is applied to the instrument in error while on the low resistance range, the instrument is protected by an internal fuse. If the fuse is blown, replace it according of the procedure as described in paragraph 4.2. Insulation resistance and AC voltage can be measured normally even when the fuse is blown.
- If the fuse is blown, the pointer points to the "*" mark during low resistance measurement. (See Figure 3-2)
- The 1k mark on the Ω scale is not accurate and may be considered as being "off scale". Note that there is no resistance scale mark for $R_x = \infty$ (when test probes are not connected to anything).

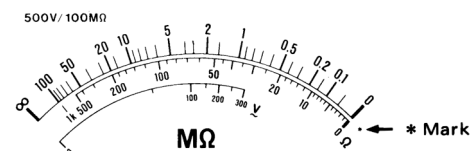


Figure. 3-2

4. MAINTENANCE

4.1 Storage

When storing the Insulation Tester, avoid area which is:

- Very humid.
- Subject to direct sunlight.
- Near high temperature heat sources.
- Subject to strong vibration.
- Very dusty, or contains corrosive gases.

4.2 Fuse Replacement

If the fuse is blown during the low resistance measurement, replace the fuse as follows. Remove two case fixing screws on the bottom of the instrument. Then the instrument can be disassembled into two parts as shown in Figure 4-1. Replace the fuse on the printed circuit board with a spare fuse (0.1 A). Two spare fuses are installed inside the instrument case.

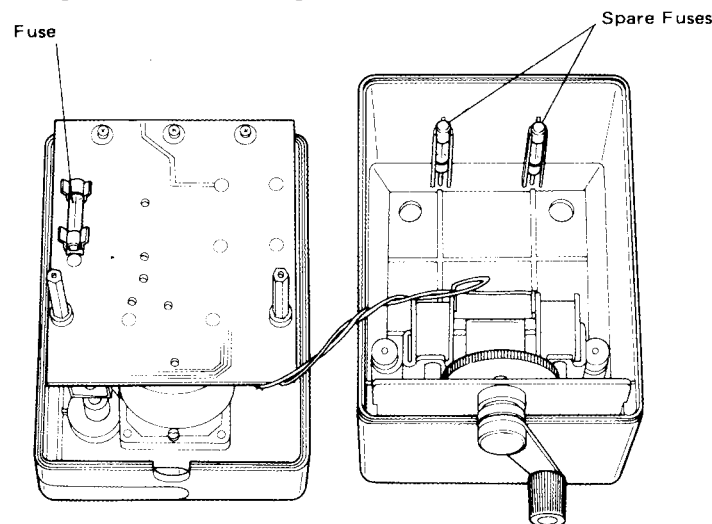


Figure 4-1 Fuse Replacement

Notice Regarding This Manual

1. The contents of this manual are subject to change without prior notice.
2. If any questions arise or errors are found, or if any information is missing from this manual, please inform Yokogawa.
3. Yokogawa is by no means liable for damage resulting from the misuse of this product by the user.
4. This manual is intended to explain the functions of this product Yokogawa does not warrant that the functions will suit a particular purpose of the user.

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