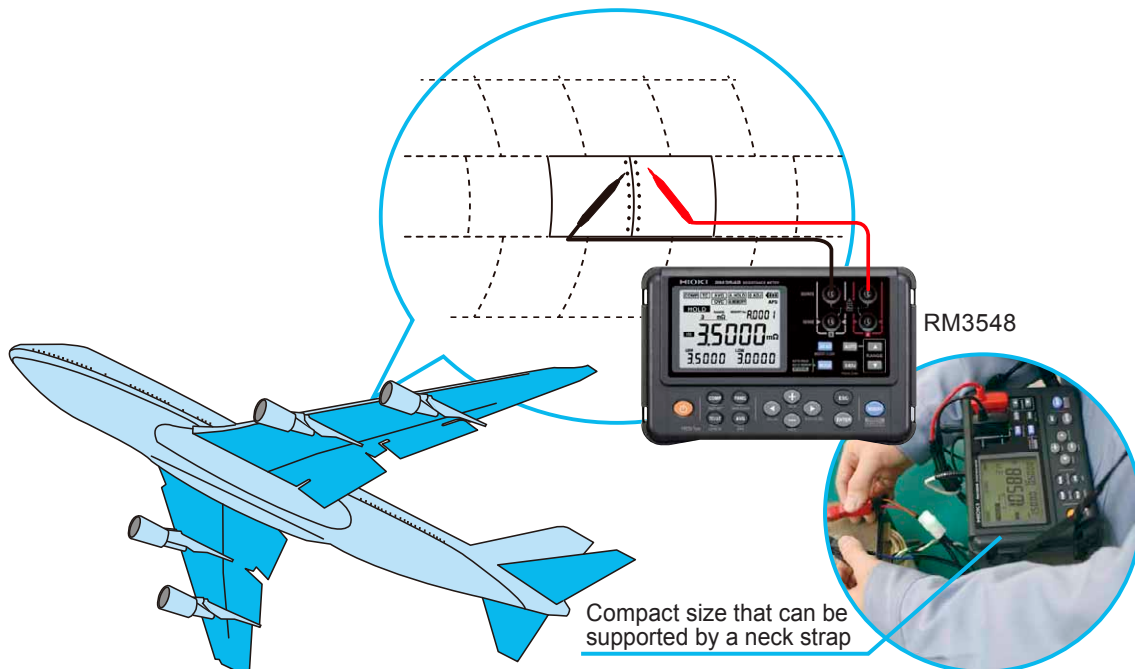


Testing the Electrical and Mechanical Condition of Aircraft Frames

The contact state of bolt-fastened panels and the state of welds is tested using minuscule resistance values with the Resistance Meter RM3548.

- Aircraft components including the main frame, body, and internal metallic parts are required to be connected to the ground plane in order to minimize the effects of static electricity and lightning strikes. To verify proper connectivity, the status of connections throughout the fuselage is tested using resistance values.
The Resistance Meter RM3548's neck strap makes the instrument conveniently portable, and its 0.1 $\mu\Omega$ resolution allows it to measure minuscule resistance values at a high level of precision.
- Functionality for automatically determining when the measured value has stabilized and then holding and recording it (auto-hold and auto-memory functions) increase work efficiency.



- The Resistance Meter RM3548 provides functionality that is convenient for measurement in the field.
- An extensive selection of probes designed for use with different measurement targets ensures that probes can be selected based on the painted surface or shape with which they will be used.
- An LED Comparator Attachment lets you check judgments without the need to look at the instrument's display.
- Data saved in the instrument's memory can easily be transferred to a computer.

Products used

RESISTANCE METER RM3548

PIN TYPE LEAD 9465-10

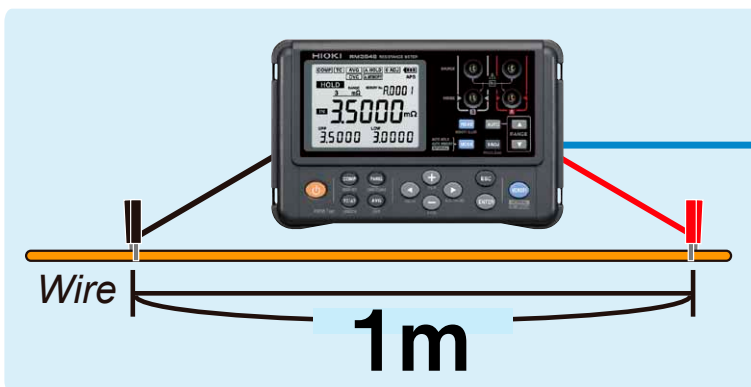
PIN TYPE LEAD 9772

LED COMPARATOR ATTACHMENT L2105

Estimating the Length of Copper Wire

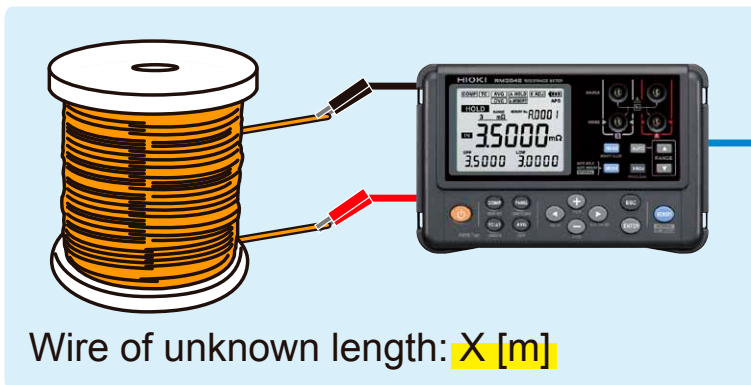
The length of copper wire can be estimated by measuring its resistance.

- Verify the length of copper wire available by using the RM3544/RM3545/RM3548 Resistance Meter.
 1. Using the RM3544/RM3545/RM3548 Resistance Meter, measure the resistance of a 1 m length of the wire whose overall length you wish to estimate.
 2. Next, measure the resistance of the entire wire whose length you wish to calculate.
 3. By dividing the resistance value for the entire wire by the resistance value for the 1 m length, you can estimate the overall length of the wire (in meters).



You can also use the RM3544/RM3545 to perform this measurement.

Measure the resistance of a 1 m length of the wire whose overall length you wish to estimate.
The resistance of a 1 m length of the wire : **A [Ω/m]**



You can also use the RM3544/RM3545 to perform this measurement.

Measure the resistance of the wire of unknown length.
Resistance value of wire X [m]: **B [Ω]**

$$\text{Wire of unknown length } X \text{ [m]} = B \text{ [}\Omega\text{]} / A \text{ [}\Omega\text{/m]}$$

To ensure accurate measurement

Since copper wire has a comparatively large temperature coefficient, an error will be introduced if the temperature of the wire when the resistance per meter is measured differs from the temperature of the wire when the overall resistance is measured.

The resistance meter's temperature correction function can be used to correct temperature variations in the wire's resistance.

Products used

RESISTANCE METER RM3544

RESISTANCE METER RM3545

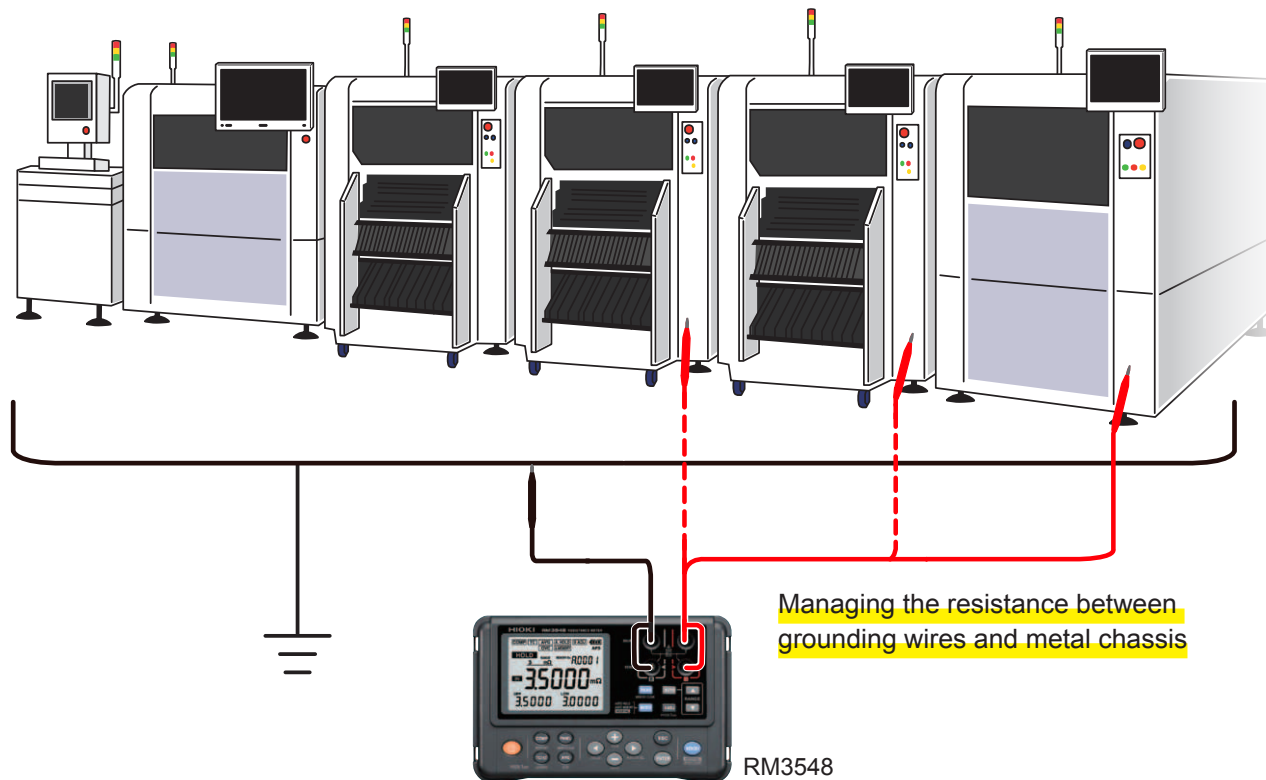
RESISTANCE METER RM3548

TEMPERATURE SENSOR Z2001

Verify that Large Equipment Have the Same Electrical Potential

Increase the safety of equipment and systems by reducing the electrical resistance between ground connections (grounds and grounding wires) and metal equipment chassis.

When the ground potential of equipment increases, that equipment becomes more likely to malfunction or introduce measurement errors. By keeping the electrical resistance between the metal chassis, which serves as the reference potential, and the equipment's grounding wire, customers can minimize the equipment's ground potential.



In large equipment, a large current may flow to the metal chassis, which serves as the reference potential. If there is a resistance distribution in the metal chassis when this occurs, the current may cause a potential difference, which may in turn cause the equipment to malfunction or introduce measurement errors. Metal chassis are usually grounded, so by minimizing the connection resistance between the metal chassis and the ground, technicians can prevent large potential differences even when such current flows. In this way, a stable ground potential translates into stable operation of the equipment or system.

To measure the resistance between the metal chassis and ground, use a precise and portable resistance meter. Since the RM3548 uses the 4-terminal measurement method, it can measure minuscule resistance values with a high degree of precision without being affected by the measurement leads' resistance or contact resistance. Larger equipment means longer measurement leads and greater susceptibility to the effects of external noise, so exercise appropriate caution. The RM3548's portability also helps to minimize the distance from the equipment to the measuring instrument.

*Longer leads are more susceptible to the effects of external noise, which can be minimized by increasing measurement times and using the RM3548's averaging function.

Products used

RESISTANCE METER RM3548

Automotive, Transportation / R&D, Testing

Testing for Protection Against Electrocutation in Electric and Hybrid Vehicles

Comply with Safety Standards Requirements of a Minimum 0.2A Testing Current and 0.1Ω Resistance Reading

Vehicle Safety During Operation and After a Collision

National and global vehicle safety standards such as those issued by the U.S. National Highway Traffic Safety Administration (NHTSA) determine vehicle performance requirements that protect driver and passenger safety after a crash and during everyday, normal operation of an electric, hybrid electric or other alternative energy vehicle. The United Nations World Forum for Harmonization of Vehicle Regulations (WP.29¹) has also established a working group to address safety issues associated with electric vehicles.

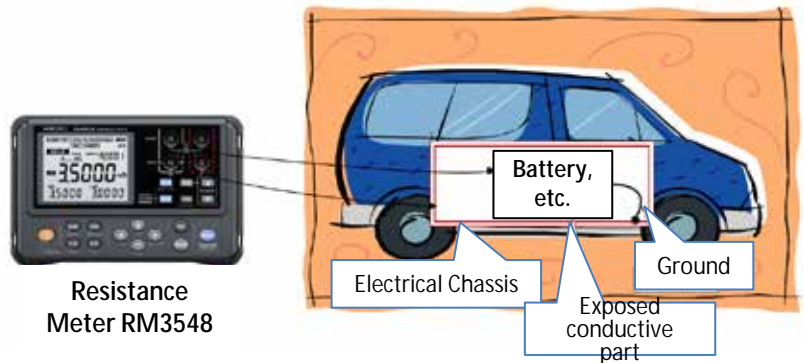
Included in many standards are electrical safety requirements to protect against direct and indirect contact of high voltage sources, or loss in electrical isolation, involving use of physical barriers in order to prevent contact by vehicle occupants. They limit the spilling of electrolyte and retention of electric energy storage/conversion devices during and after a crash in order to protect passengers and emergency rescue personnel from harmful electric shock.

In NHTSA's Federal Motor Vehicle Safety Standard (FMVSS) No. 3052, for example, the following two safety characteristics are required of vehicles when tested according to prescribed procedures using a resistance meter in order to verify protection against indirect contact from high voltage sources:

- The resistance between all exposed conductive parts of electrical protection barriers and the electrical chassis shall be **less than 0.1 Ω**; and
- The resistance between any two simultaneously reachable exposed conductive parts of the electrical protection barriers that are less than 2.5 meters from each other shall be **less than 0.2 Ω**

Test Methods and Equipment

Safety authorities do not specify a particular model or brand of instrument to verify resistance values but do stipulate test methods to be carried out by either a resistance meter or combination of DC power supply, voltmeter and ammeter. When using a resistance meter, one that can measure current levels of at **least 0.2 Amperes** with a resolution of 0.01 Ω or less is required for the above tests.



A Convenient Solution in the Hioki RM3548 Resistance Meter

The Hioki RM3548 Resistance Meter offers both the advanced specifications and portability to carry out these tests quickly and accurately thanks to its **0.0 μΩ to 3.5 MΩ measurement range, 0.1 μΩ resolution and 1A maximum testing current**, more than sufficient to meet the low resistance characteristics demands, very fine resolution and testing current levels.

How to Test

1. Use the Hioki DT4221 Digital Meter at its voltage function to test that voltage is not present between exposed conductors and electrical chassis
2. Set the test current of the 300mΩ range on the RM3548 to 300mA (0.3A)
3. Touch one of the test leads of the RM3548 to the exposed conductive part, and the other to the electrical chassis
4. Set the RM3548 to the 30mΩ or 300mΩ range and maintain the testing current of at least 300mA
5. Verify that the resistance reading is not more than 0.1Ω (100mΩ) as per the requirements

¹UNECE: http://www.unece.org/trans/main/wp29/presentation_wp29.html. Accessed 2019/12/6.

²Federal Motor Vehicle Safety Standards; Electric-Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection, A Rule by the National Highway Traffic Safety Administration on 09/27/2017

Products used

- Resistance Meter RM3548
- Digital Multimeter DT4221

Information valid as of December 2019

Specifications are subject to change and revision without notice.