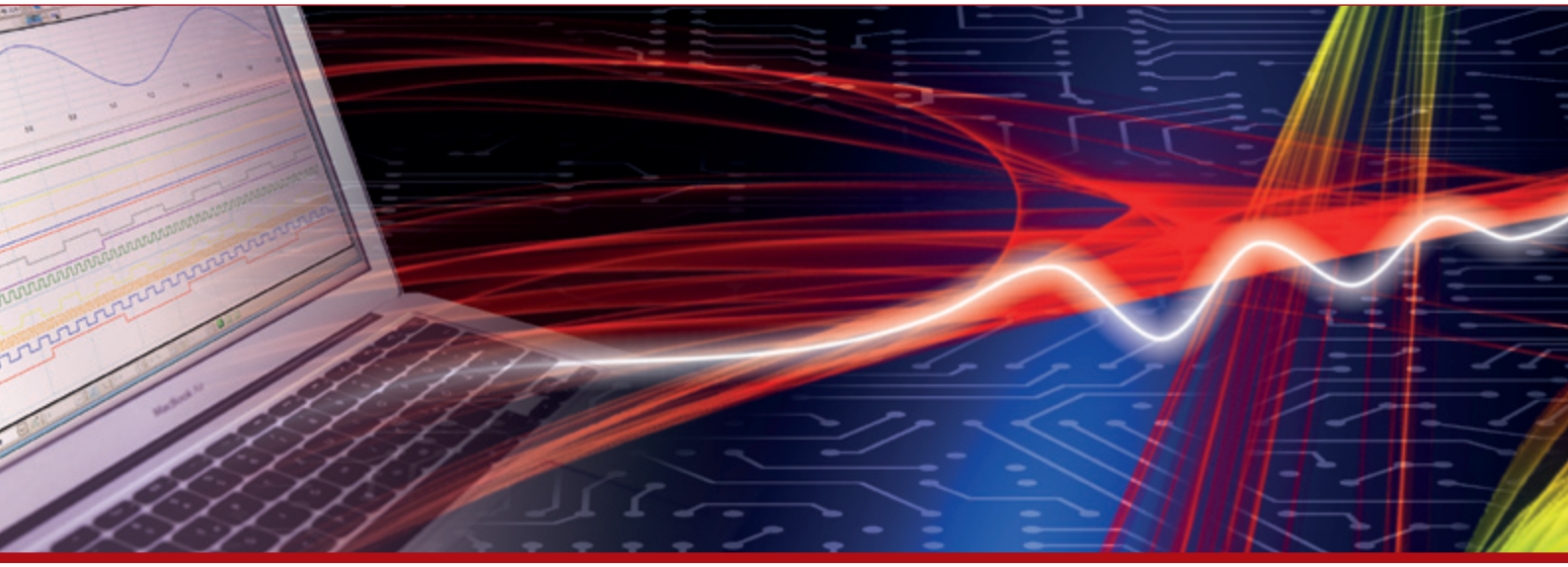
Product Datasheet - Technical Specifications



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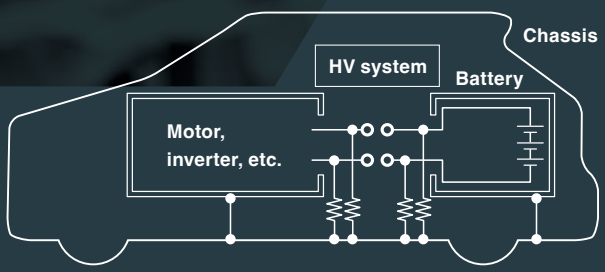
HIOKI

A Guide on Electrical Safety for EV Maintenance and Service

Stay safe during EV maintenance



High voltages make safety for EV maintenance essential. This guide outlines correct procedures and reliable electrical tests to ensure safe operations.

Zero-voltage

Temperature

Equipotential bonding

Insulation resistance

CE

3 year Warranty

Bluetooth®
When Z3210 is installed

Wireless Adapter Compatible
DT4261, RM3548-50 and IR4059

Shutting down the HV system of the vehicle

Visual inspection

For safety, be sure to carry out a visual inspection and look out for motor faults by performing a DTC (Digital Trouble Codes) scan.

DTC scan

Disconnect the HV bus

Before proceeding to electrical testing and measurement, make sure to shut down[*1] the vehicle's HV (High-voltage) system by disconnecting the service plug or using the switch.

*1 The removal of high-voltage components is hazardous work. Ensure that the work is performed by qualified personnel with professional training, following applicable laws and regulations. For details, please follow the operation manual of each vehicle manufacturer.

Temperature measurement of the HV batteries

Measure the surface temperature of the HV battery with a non-contact thermometer. In this inspection, check for variations in temperature as well as areas of high temperature. These may indicate issues that need further investigation.

INFRARED THERMOMETER FT3701

The FT3701 is an infrared thermometer with a two-point laser marker that measures the average surface temperature inside a circle formed by the two points.

Zero-voltage measurement

This measurement is conducted to prevent electric shock and to make sure that the vehicle is shut down. Safety from electrocution is ensured by measuring the voltage on surfaces that are likely to be touched when unplugging the HV connector.
In this test, voltage should be measured between specific points and the chassis ground of the vehicle. It should show up as zero volts (0 V).

DIGITAL MULTIMETER DT4261

- The DT4261's terminal shutters make it physically impossible to insert the wrong test lead. They prevent overvoltage and electrical shock accidents.
- The LoZ (low input impedance) mode gets rid of the effects of ghost voltages caused by the measurement target's stray capacitance and the multimeter's high input impedance. This lets you get accurate readings.

Disconnect the HV battery cable

After performing a zero-voltage measurement (see below), disconnect the high-voltage (HV) cable and wait at least 10 minutes for the HV system to discharge. To avoid a serious accident, it is necessary to wait for a certain period of time.
Take note that the discharge time may vary, so make sure to check with the vehicle manufacturer.

Discharge

Zero-voltage measurement

After unplugging the HV battery's connector, make sure that the HV system is shut down.

Complete shutting down the HV system

Flow after repair and inspection

Repair and inspection of vehicle

Equipotential bonding test

This test is conducted after high-voltage (HV) components have been installed or replaced. By checking the ability for electricity to flow (conductance/resistance) between all parts and the chassis, this test ensures that the chassis properly functions as a ground to capture stray voltages during and between operation. For this, the resistance is measured at the points where the chassis of the vehicle and the HV components are connected. If the resistance value is high or differs significantly from the value measured before the service work was performed, the connection of the HV component may have been installed incorrectly.

RESISTANCE METER RM3548-50

- RM3548-50 is a four-terminal (four-wire Kelvin) DC milliohm meter
- The current applied during testing (500 nA to 1 A) enables accurate measurement of tens of μΩ. This meets the ECE-R100*2 standard's requirement

*2 Safety standard for electric powertrains of road vehicles including rechargeable battery systems.

Insulation resistance test

In this test, we verify that there are no flaws in the insulation between the HV system and the ground to prevent electrocution. The insulation test is performed on both the connector of the HV battery (battery side) and the connector of the inverter (inverter side). The insulation resistance is measured between each of the sides (battery and inverter) and the chassis ground of the vehicle. The voltage applied during measurement (test voltage) must be greater than the vehicle's battery voltage. Please keep in mind that the test voltage may vary based on the vehicle model.

INSULATION TESTER IR4059

- For the HV range (500 V or 1000 V), the IR4059 has a safety feature that requires the technician to unlock in addition to choosing the voltage to prevent unintentional HV accidents
- Stable measurement under capacitive loads
- The test lead with remote switch is equipped with an LED
- The green/red light makes pass/fail judgments instantaneous and easy

Zero-voltage measurement

When the repair or inspection is finished, take a zero-voltage measurement on the inverter side and the battery side before safely reconnecting the HV system. After zero-voltage testing, install the high-voltage cable, service plug (a.k.a. switch), and return the vehicle's HV system to energized status.

Restoring the high voltage

RESISTANCE METER RM3548-50

Resistance range	3 mΩ (0.1 μΩ resolution) to 3 MΩ range (100 Ω resolution)
Testing current	500 nA DC to 1 A DC
Open-terminal voltage	5.5 V DC max.
Temperature measurement	-10.0°C to 99.9°C

TEST LEADS L2140

PIN TYPE LEAD 9465-11

WIRELESS ADAPTER Z3210

Transfers measurement data to a mobile device

MAGNETIC STRAP Z5020

Fixed to the chassis with magnets

* 2 pieces required

INSULATION TESTER IR4059

Rated output voltage	50 V DC, 125 V DC, 250 V DC, 500 V DC, 1000 V DC
Overload protection	600 V AC (10 s)
Response time	Approx. 0.3 second for PASS/FAIL judgement (based on in-house testing)

WIRELESS ADAPTER Z3210

Transfers measurement data to a mobile device

MAGNETIC STRAP Z5020

Fixed to the chassis with magnets

* 2 pieces required

DIGITAL MULTIMETER DT4261

DC voltage range	600.0 mV to 1000 V
AC voltage range	6.000 V to 1000 V (true RMS, crest factor 3 or less)
LoZ V	600.0 V (true RMS, crest factor 3 or less)
Other measurement functions	DC + AC voltage, DC current, AC current, AC current with clamp-on probe, frequency, resistance, continuity, capacitance, diode test

WIRELESS ADAPTER Z3210

Transfers measurement data to a mobile device

MAGNETIC STRAP Z5020

Fixed to the chassis with magnets

INFRARED THERMOMETER FT3701

Measurement temperature range	-60.0°C to 760.0°C (-76˚F to 1400˚F)
Measurement wavelength	8 to 14 μm
Thermal emissivity compensation (ε)	0.10 to 1.00
Measurement field diameter	ϕ 100 mm at 3000 mm (3.94 in. at 9.84 ft.) (distance : spot = 30 : 1)

CARRYING CASE C0213

It can accommodate all measuring instruments.
EV maintenance manual included.

HIOKI E.E. CORPORATION