Specifications Chapter 8

8.1 General Specifications

Measurement modes	• Measurement of battery internal resistance • Measurement of battery terminal voltage (DC voltage only) • Temperature measurement
Measurement range • Resistance • Voltage • Temperature	(After 0 adjustment) 0.000 mΩ to 3.100 Ω (Four-range structure) 0.000 V to ± 60.00 V (Two-range structure) -10.0°C to 60.0°C / 14°F to 140°F (Single range)
Measurement method • Resistance • Temperature	 AC four-terminal method Open circuit voltage: 5 Vmax. Platinum temperature sensor (voltage-output method)
Measured current	1.5 mA to 150 mA (Fixed according to resistance measurement range)
Display update rate	Once/second (resistance, voltage, and temperature measured as a set)
Detection of constant-current irregularities	"- - - -" is displayed
Disconnect detection	"- - - -" is displayed
Processing excess input	"OF" is displayed

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Input terminals	• Resistance, voltage measurement terminals Banana-plug type Maximum input voltage: DC ± 60 Vmax. (Not compatible with AC input) Input resistance: 20 kΩ or higher • Temperature-measurement input terminal Earphone-type jack (3.5 mm in diameter) • Switch input terminal Earphone-type jack (2.5 mm in diameter)

Averaging feature

Details of operation	Calculating a moving average of displayed resistance values
Initial status	OFF
Configuration method	Change number of times averaging is conducted by pressing the **AVG** key OFF (once) → 4 times → 8 times → 16 times → OFF...

Zero-adjustment

Details of operation	Measured values upon implementation (upon obtaining adjusted values) are set at zero
Initial status	OFF
Adjustment range	Up to 300 counts for each range (resistance, voltage)

Auto holding of measured values

Details of operation	Holding (ceasing updating of) displayed values
Hold method	(1) Pressing the **HOLD** key (2) Inputting signals to the EXT.HOLD/ MEMO terminal (3) Stabilizing measured values (when the auto-hold feature is on)

Comparator feature

Details of operation	Comparison of measured values with permissible values
Initial status	OFF
Setting method	Press the **COMP** key to select the comparator no. to use Configure resistance upper limit no. 1, resistance upper limit no. 2, and the voltage lower limit.
Settings saved	200

	Resistance (low)	Resistance (medium)	Resistance (high)
Voltage (high)	PASS	WARN	FAIL
Voltage (low)	WARN	WARN	FAIL

Memory Feature

Details of operation	While the measured values are being held, press the **MEMO** key to save them to the instrument's internal memory. When the auto-memory feature is on, measured values will be saved to the instrument's internal memory when held. Saved data can be deleted.
Data saved	Date and time, resistance, voltage, temperature, comparator permissible values, results of judgment
Number of data sets that can be saved	4,800
Memory structure	400 data sets per unit (12 units)
Unit names	A, b, C, d, E, F, G, H, J, L, n, P
Reading data	Conducted using the keys on the instrument or the PC application
Deleting data	Available (single data sets, single units, or all data)
Backup	Saved to internal EEPROM (nonvolatile memory)

Auto-hold Feature

Details of operation	Holds measured values automatically when stabilized
Releasing the hold	(1) Pressing the **HOLD** key (2) Inputting signals to the EXT.HOLD/MEMO terminal
Initial status	OFF

Auto-memory Feature

Details of operation	Saves measured value data automatically when held. Saved data can be cancelled by pressing the **CLEAR** key.
Initial status	OFF

Auto-power-save Feature (power on option)

Details of operation	Cuts off power to the instrument automatically when it has not been used for ten minutes or longer and detection of constant-current irregularities has continued for ten minutes or longer This feature is cancelled during data communication using the PC application

Comparator Buzzer

Details of operation	OFF ON (Sounds when result is PASS) ON (Sounds when result is FAIL / WARNING)
Initial status	ON (Sounds when result is FAIL / WARNING)

Battery Level Indicator

Details of operation	Remaining battery power shown as zero at 8.0 V (± 0.2 V) (Measurement functions stopped) Power turned off at 7.6 V (± 0.2 V)

System Reset (power on option)

Details of operation	All settings except data and time, comparator no., and saved data returned to initial configuration

Clock

Features	24-hour clock; automatically adjusts for leap year
Precision	+/- approximately 4 minutes/month
Other features	Runs on internal backup lithium battery Battery life: approximately 10 years

Data Stored (to internal EEPROM [nonvolatile memory])

Measurement range configuration, zero-adjust values, averaging settings, measurement data saved to memory, comparator permissible values, comparator nos., memory settings, memory nos., reading nos., buzzer settings, auto-hold settings, auto-memory settings, APS settings, temperature units

Operated using	Formed rubber keys (18)
Display	LCD (monochrome, 159 segments)
Guaranteed accuracy period	For one year
Operating temperature and humidity	0°C to 40°C (32°F to 104°F), 80%RH or less (non-condensating)
Storage temperature and humidity	-10°C to 50°C (14°F to 122°F), 80%RH or less (non-condensating)
Operating environment	Indoors, altitude up to 2000 m (6562-ft.)
Power supply	LR6 alkaline batteries × 8
Rated supply voltage	DC1.5 V × 8
Maximum rated power	2 VA
Continuous operating time	Approx. 10 hours When using alkaline batteries; may vary depending on conditions of use

Dimensions	Approx. 192W × 121H × 55D mm / 7.56"W × 4.76"H × 2.17"D (sans protrusions)
Mass	Approx. 790 g / 27.9 oz. (within batteries)
Dielectric strength	Between all measurement terminals and USB terminal: AC 1.5 kV; 15 seconds; cutoff current: 5 mA
Maximum input voltage	Between positive and negative measurement terminals: DC 60 V
Maximum rated voltage to earth	Between all measurement terminals and ground: DC 70 V
Applicable standards	EMC EN61326:1997+A1:1998+A2:2001+A3:2003 Safety EN61010-1:2001 Pollution degree 2 Measurement category I (anticipated transient overvoltage 500 V)
Effect of radiated radio-frequency electromagnetic field	± 3.0% f.s. when measuring both resistance and voltage (at 3 V / m)

Accessories	Model 9465-10 PIN TYPE LEAD..... 1 USB cable ..... 1 Application Software CD ..... 1 Strap ..... 1 Instruction manual ..... 1 Carrying case ..... 1 Zeroadjustment board ..... 1 LR6 alkaline batteries..... 8 Fuse (216.315, Littelfuse,INC) (F315mAH / 250 V) 1
Options	Model 9460 CLIP TYPE LEAD WITH TEMPERATURE SENSOR Model 9466 REMOTE CONTROL SWITCH Model 9467 LARGE CLIP TYPE LEAD Model 9772 PIN TYPE LEAD Model 9465-90 TIP PIN (For replacing the point of 9465-10) Model 9772-90 TIP PIN (For replacing the point of 9772)

8.2 Accuracy

Accuracy guarantee for temperature and humidity	23°C ± 5°C (73°F ± 9°F), 80%RH or less (non-condensating)
Guaranteed accuracy conditions	Warming up: not required Zero adjustment: implemented
Temperature coefficient	Calculated using temperature coefficient * (T - 23); T: temperature used (°C) 18 to 28°C: no temperature coefficient

Resistance measurement

- Temperature coefficient:
  3 mΩ range: (± 0.01 rdg. ± 0.8 dgt.)/°C
  Other range: (± 0.01 rdg. ± 0.5 dgt.)/°C
- Measurement current reliability: ± 10%
- Measurement current frequency: 1 kHz ± 30 Hz

Range	Maximum displayed value	Resolution	Accuracy	Measured current
3 mΩ	3.100 mΩ	1 μΩ	± 1.0 %rdg. ± 8 dgt.	150 mA
30 mΩ	31.00 mΩ	10 μΩ	± 0.8 %rdg. ± 6 dgt.	150 mA
300 mΩ	310.0 mΩ	100 μΩ		15 mA
3 Ω	3.100 Ω	1 mΩ		1.5 mA

DC Voltage Measurement

- Temperature coefficient; (± 0.005 %rdg. ± 0.5 dgt.) /°C

Range	Maximum displayed value	Resolution	Accuracy
6 V	± 6.000 V	1 mV	± 0.08 %rdg. ± 6 dgt.
60 V	± 60.00 V	10 mV	

Temperature Measurement

Range	Maximum displayed value	Resolution	Accuracy
-10 to 60°C (14 to 140°F)	60.0°C (140.0°F)	0.1°C (0.1°F)	± 1.0 °C (± 1.8°F)

Individual reliability under simulated input: ± 0.5°C (± 0.9°F)

8.3 Communications

USB Interface

Hardware	Uses RS-232C/USB converter
Operating method	When connecting the instrument to a personal computer via the USB cable, the instrument shifts to PC mode. Measurement ceases when in PC mode.
Details of communication	Output of various settings and saved data
Transfer method	Start-stop synchronization, Full duplex
Baud rate	38,400 bps
Data length	8 bit
Stop bit	1
Parity bit	None
Delimiter	CR+LF
Hand shake	None
XON / XOFF	Unused