



MILLIOHM METER MODEL 16502

The Chroma 16502 is a digital milliohm meter that offers high precision with a basic accuracy of 0.05%, a wide measurement range from 0.001mΩ to 1.9999MΩ, and a fast measurement speed of up to 65ms. It is ideal for use in automated production lines, incoming and outgoing quality control, and R&D applications.

To meet diverse measurement needs, the 16502 provides multiple types of test signals and a Dry Circuit mode. The pulsed test signal minimizes errors caused by thermal electromotive force when measuring very low resistances; the DC test signal supports high-speed measurements; and Dry Circuit mode is suitable for contact resistance testing where the open-circuit voltage must remain below 20mV. With its versatile functions and precision capabilities, the 16502 is ideal for measuring the low DC resistance of inductive components, cables, connectors, relay contacts, and other conductive materials.

The 16502 features a temperature compensation function that provides an estimate of the DUT's resistance at a user-specified temperature. As resistance varies with temperature, this function uses the resistance value at a known temperature together with the DUT's temperature

coefficient to convert the measured resistance to its equivalent at the desired temperature.

The 16502 includes a temperature conversion function suitable for evaluating the temperature characteristics of motors and coils. As the internal temperature of a motor or coil is typically not directly measurable when the motor is stopped, this function infers the DUT's temperature based on its measured resistance, aiding in the assessment of internal temperature characteristics.

The 16502 adopts a 4-wire measurement method to ensure high measurement accuracy and includes a zeroing function to eliminate measurement errors caused by residual lead resistance. It also offers comparison and binning functions based on absolute values or percentage differences, enhancing measurement efficiency and application flexibility.

The 16502 comes standard with an RS232 interface and offers optional GPIB and Handler interfaces. It delivers high-speed and stable measurement performance, making it suitable for a wide range of applications such as component characterization on production lines and benchtop milliohm-level resistance measurements.

MODEL 16502

Key Specifications and Features

- Basic accuracy: 0.05%
- Measurement range: 0.001mΩ to 1.9999MΩ
- Pulsed test signal
(eliminates thermoelectric effects)
- DC test signal
(enhances measurement speed)
- Dry circuit measurement mode
(prevents DUT damage)
 - Up to 20mV, 100mA output
 - Complies with IEC 60512-2-1
- Temperature compensation and conversion functions
- Compare and bin-sorting functions
- LabView driver support
- Optional A165017 4-channel scanner available
- Standard RS-232 interface
- Optional GPIB & Handler interfaces with temperature compensation support

Applications

- Various inductive components and current sensing resistors
- Wires, switching components
(e.g., connectors, relay contacts)
- Conductive materials
(precise measurement of small DC resistance values)



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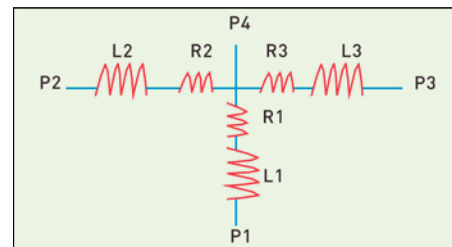
Function Overview

Dry Circuit Function

The Dry Circuit function limits the open-circuit voltage and output current to prevent damage to contact surfaces when measuring contact resistance of switches, relays, connectors, and similar DUTs. When the Dry Circuit mode is enabled on the 16502 milliohm meter, the open-circuit voltage is limited to 20mV and the output current to 100mA, complying with the IEC 60512-2-1 measurement standard.

Resistance Scanning Function

The 4-channel resistance scanning and balance check function can be applied to resistance measurements of fan motor windings (requires the optional A165017 4-channel resistance scanner). For fan motors, it is essential that the resistance values of each coil remain balanced to prevent abnormal noise during operation. Therefore, coil balance testing is a critical step in the fan motor manufacturing process. Paired with the optional A165017 scanner, the 16502 milliohm meter enables resistance scanning measurements, which can be combined with temperature compensation to further enhance measurement accuracy.



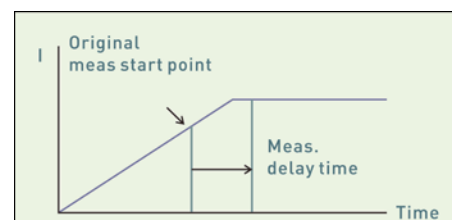
Fan Motor Equivalent Circuit

Compare and Bin-Sorting Functions

When either the compare or bin-sorting function is enabled, upper and lower limit values can be set according to test requirements. Both absolute value and percentage modes are available for judgment. Measurement results are indicated by on-screen display and audible warnings, and can be output via Handler, RS-232, and GPIB interfaces.

Measurement Delay Function

The measurement delay function defines the time interval between the output of the test signal and the sampling of the measurement value. When testing highly inductive components, it is necessary to adjust the delay time to ensure that the test current stabilizes before measurement begins, thereby improving overall measurement stability.



Measurement Delay Function

Trigger Delay Function

The trigger delay function defines the time interval between reception of the trigger signal and output of the measurement signal. This delay is typically used to accommodate the operation timing of automated equipment.

Zeroing Function

The zeroing function eliminates measurement errors caused by leakage current in external test leads and internal circuitry, ensuring more accurate reading.

Sampling Average Function

The sampling average function reduces fluctuations in the displayed reading by showing the average measurement value over a defined time window. This helps stabilize the readings and can be used together with the measurement speed setting to achieve a balance between accuracy and measurement efficiency.

Power Line Noise Filter

Measurements involving low current levels are susceptible to interference from power line noise. The 16502 employs advanced noise filtering technology to suppress noise based on the selected power line frequency, ensuring accurate measurement results.

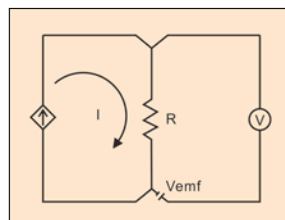
Measurement Signal Modes

DC+/DC- Measurement Signal Modes

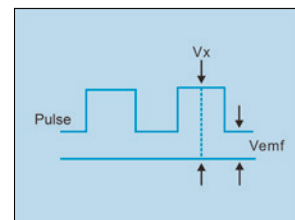
These modes provide a single-polarity DC test current output, enabling fast measurement speeds of up to 65ms. They are ideal for high-throughput testing of DUTs on automated production lines.

Pulse+/Pulse- Measurement Signal Modes

At wire junctions or contact interfaces, thermoelectric electromotive force (EMF) can be generated due to thermal coupling between dissimilar metals, resulting in small potential differences that may introduce measurement errors. By selecting the Pulsed test signal mode on the 16502 milliohm meter, the influence of EMFs can be effectively eliminated, making it well-suited for precision measurement of low resistance values.



V_{emf} = Thermoelectric EMFs



$V_x - V_{emf} = IR$
 V_{emf} = Thermoelectric EMFs

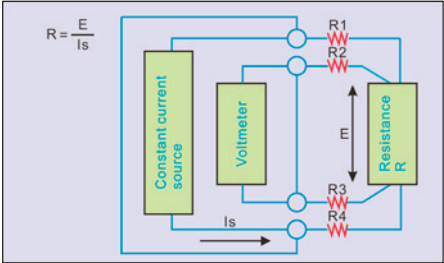
Pulse+/- Measurement Signal Modes

Cancels the influence of thermoelectric EMFs and reduces errors caused by magnetization history when measuring magnetic components; however, the testing time is correspondingly longer.

Four-Wire Resistance Measurements

Minimizes Influence of Test Lead and Contact Resistance

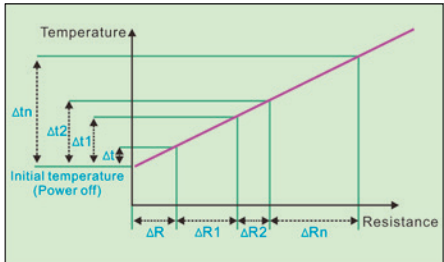
In a 2-wire measurement setup, the conductor resistance of the test leads and the contact resistance at the connection points are included in the measured resistance value, leading to measurement errors. The 4-wire method utilizes a high-impedance voltmeter, ensuring that nearly all the measurement current flows through the DUT (resistor R). By measuring only the voltage drop across R, this method effectively eliminates the influence of R1 to R4 (the combined resistance of the leads and contact points), thus ensuring high measurement accuracy.



R1 to R4 represent the combined resistance of the test leads and contact points.

Temperature Compensation Function

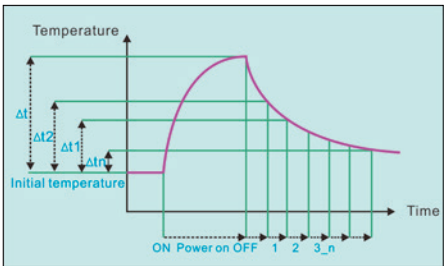
The 16502 milliohm meter features a temperature compensation function. When used with the optional A165015 temperature probe and A165013/A165014 temperature compensation cards, it can measure ambient temperature and apply corrections to the resistance value based on the material's temperature coefficient. This allows resistance values to be displayed as if measured at any specified temperature. Since the resistance of most materials varies with temperature, this function helps eliminate the need for complex manual calculations and reduces the risk of calculation errors, enabling quick and accurate resistance readings adjusted for temperature. The 16502 supports both PT100 and PT500 temperature probes. Simply connect the temperature probe to the temperature compensation card at the rear panel to perform temperature measurements. When a temperature probe is not available, users can also manually input the ambient temperature to activate the temperature compensation function.



Temperature Compensation

Temperature Conversion Function

The 16502 milliohm meter features a temperature conversion function. When used with the optional A165015 temperature probe and A165013/A165014 temperature compensation cards, it can measure the ambient temperature and calculate the DUT's temperature and temperature change (Δt) based on the measured resistance. The temperature conversion function cannot be used simultaneously with the temperature compensation function. It is especially suitable for evaluating the temperature rise of motors or coils under load conditions, providing a fast and effective way to determine the maximum temperature increase when power is applied. The 16502 supports both PT100 and PT500 temperature probes. Simply connect the temperature probe to the temperature compensation card on the rear panel to enable temperature measurement.



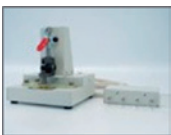
Temperature Conversion Function Diagram

Applications

- Testing contact resistance of switches, relays, connectors, wires, and other low-resistance components
- Testing various inductive components such as coils, chokes, and transformer windings
- Testing small resistors, fuses, thermal sensors, and other thermally sensitive materials
- Measuring winding resistance of motors, transformers, solenoids, and ballasts
- Conductivity evaluation in product design
- Incoming inspection and quality assurance testing
(compatible with fixtures A165016, A165018, and A165019)



A165016



A165018



A165019

Specifications

Model	16502
Range Basic Measurement Accuracy *1; Test Current	
2m Ω	$\pm$ (0.2% of reading + 0.035% of range); 1A typical
20m Ω	$\pm$ (0.1% of reading + 0.03 % of range) ; 1A typical
200m Ω	$\pm$ (0.05% of reading + 0.03 % of range) ; 100mA typical
2 Ω	$\pm$ (0.05% of reading + 0.03 % of range) ; 10mA typical
20 Ω	$\pm$ (0.05% of reading + 0.03 % of range) ; 1mA typical
200 Ω	$\pm$ (0.05% of reading + 0.02 % of range) ; 1mA typical
2k Ω	$\pm$ (0.05% of reading + 0.01 % of range) ; 1mA typical
20k Ω	$\pm$ (0.1% of reading + 0.01% of range) ; 100 μ A typical
200k Ω	$\pm$ (0.2% of reading + 0.01 % of range) ; 10 μ A typical
2M Ω	$\pm$ (0.3% of reading + 0.01 % of range) ; 1 μ A typical

Test Signal		
Drive Mode		DC+, DC-, Pulsed+, Pulsed-, Pulsed $\pm$, Stand by
Dry Circuit		Open Circuit Voltage less than 20mV; for 200m Ω , 2 Ω , 20 Ω ranges only
Measurement Time ^{*2*4}		
Fast		65ms
Medium		150ms
Slow		650ms
Temp/Masurement Accuracy ^{*3}		
Temp. Measurement Accuracy (Option)	-10.0°C to 39.9°C	$\pm$ (0.3% of reading+0.5°C) ^{*3}
	40.0°C to 99.9°C	$\pm$ (0.3% of reading+1.0°C) ^{*3}
Temp. Sensor Type (Option)		PT100/PT500
Interface & I/O		
Interface		RS-232 (Standard) , GPIB, Handler (Optional)
Output Signal		Bin-sorting & Pass/Fail judge
Comparator		Upper/Lower limits in value
Bin Sorting		8 bin limits in %, ABS
Trigger Delay		0-1000ms
Trigger		Internal, Manual, External, BUS
Display		240 x 64 dot-matrix LCD display
Correction Function		Zeroing
General		
Operation Environment		Temperature: 10.0°C to 40°C
Power Consumption		80 VA max.
Power Requirement		90–132Vac or 180–264Vac, 47–63Hz
Dimensions (H x W x D)		100 x 320 x 346 mm/3.94 x 12.6 x 13.62 inch
Weight		4.2 kg/9.25 lbs

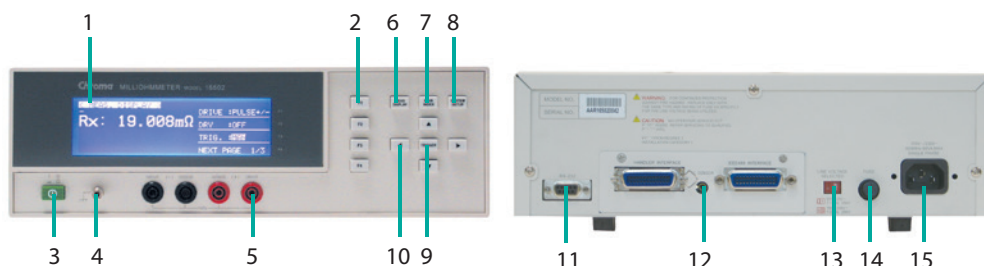
Note*1 : 23 $\pm$ 5°C after Zeroing correction. Slow measurement speed. Refer to Operation Manual for details on measurement accuracy.

Note*2 : Measurement time includes sampling, calculation, and result judgment.

Note*3 : Does not include temp. sensor accuracy

Note*4 : The measurement time for the 2m Ω range is approximately 95ms (with the power filter set to 50Hz) and 80ms (with the power filter set to 60Hz).

Panel Description



- LCD Display
- Function Keys
- Power Switch
- Ground Terminal
- Measurement Terminals
- Measurement Display Key
- Main Index Keys
- System Setup Keys
- Trigger Key
- Cursor Keys
- RS232 Interface
- GPIB & Handler Interface with Temperature Compensation Card (Optional A165013)
- Line Voltage Selector Switch
- Fuse
- AC line Input

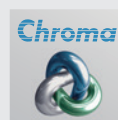
Ordering Information

- 16502: Milliohm Meter
- A110235: GPIB & Handler Interface
- A110236: 19" Rack Mounting Kit
- A113012: Vacuum Generator for A165018
- A113014: Vacuum Pump for A165018
- A165013: GPIB and Handler Interface with Temperature Compensation
- A165014: Temperature Compensation Card
- A165015: PT100 Temperature Probe
- A165016: Pin Type Leads (flat)
- A165017: 4 Channels R Scanner
- A165018: Test Fixture for SMD Power Choke
- A165019: Pin Type Leads (taper)
- A165022: Four Terminal Test Cable

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