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# КОНТРОЛЛЕРЫ СИСТЕМ МОНИТОРИНГА

11050, 11050-5M, 11021, 11021-L, 11022, 11025,  
11200, 11800, 11801, 11802, 11805, 11810, 11890,  
11891, 13001, 13350, 16502, 1810, 1870D, 1871

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# MODEL 11050 SERIES

### Key Features

- Test Parameter: L/C/R/Z/Y/DCR/Q/D/  $\theta$
- Test Frequency:
  - 1kHz ~ 10MHz (11050)
  - 60Hz ~ 5MHz (11050-5M)
- Test Level: 10mV ~ 5V
- Basic Accuracy: 0.1%
- 15ms fast speed measurement
- 3 output impedance modes
- Test signal monitoring function
- Compare & bin-sorting function
- Open/short zeroing & load correction function
- Detached measurement & display unit design
- Standard Handler, RS-232C, USB storage & external bias current control interface
- Optional GPIB or LAN interface

## HF LCR METER MODEL 11050 SERIES

The 11050/11050-5M HF LCR Meter is a precision test instrument designed to accurately measure and evaluate passive components at high speeds. Its measurement capabilities cover the primary and secondary parameters required for testing the inductance, capacitance, resistance, quality factor and loss factor of passive components. The HF LCR Meter has a broad testing frequency range 1kHz~10MHz/60Hz~5MHz suitable for analyzing the components' characteristics under different frequencies. Its 0.1% basic measurement accuracy provides stable and highly reliable results. A fast 15ms measurement speed effectively increases productivity when working in an automated environment.

In addition to the excellent measurement features found in other LCR Meters, the 11050/11050-5M includes additional useful functions. It has 3 output impedance modes to satisfy demands of measuring and working with other instruments. The versatile digital display can be configured to best fit the current testing resolution; furthermore, the test signal monitoring function displays the voltage and current that is actually carried to the DUT. The timing settings of trigger delay, measure delay and average number of times allow the measurements to transfer seamlessly to an automated test environment providing accurate results within a limited testing time.

The detached design adopted by the 11050/11050-5M provides several advantages. Since test processing and the display use separate CPUs, the testing speed is increased and shorter test leads are needed when integrated into an automated test environment. Shorter test leads improve the accuracy of high frequency measurements.

Chroma's 11050/11050-5M HF LCR Meter has multiple remote interface options. Handler and RS-232C remote interfaces come standard for software or hardware control of test conditions, measurement trigger, judge test results, and collect measured data. The standard USB port saves device settings and controls the output of an external DC bias current source. Optional GPIB and Ethernet remote interfaces are available as well for software control.

Due to the design of modern portable electronic communication devices with thin form factors and low power consumption, required frequency testing of power inductors is increasing. The equivalent series resistance of components has become a critical indicator to identify if it is good or bad. The buffer capacitor plays an important role for overall circuit reliability and must function properly under various voltage transient conditions; the equivalent series resistance must remain at a very low level when operated at high frequencies. The 11050/11050-5M is focused on testing passive components at high frequencies and with enhanced key measurement capabilities during R&D so that it simulates the user's actual application as closely as possible. The increased accuracy of low impedance measurements demonstrates the usefulness of 11050/11050-5M in high frequency testing applications.

The 11050/11050-5M HF LCR Meter was designed with many enhancements and key features to make it the best choice to meet the demands of modern component characterization analysis and high speed testing for automated production line or incoming/outgoing inspection applications.



## SPECIFICATIONS

Model	11050	11050-5M
Test Parameter	L, C, R, Z, Y, DCR, Q, D, $\theta$	
<b>Test Signal</b>		
Test Frequency	1kHz ~ 10MHz $\pm$ (0.1% + 0.01Hz)	60Hz ~ 5MHz $\pm$ (0.1% + 0.01Hz)
Test Level	$\leq$ 1MHz: 10mV ~ 5V; $\pm$ [(10 + fm)% + 10mV]; >1MHz: 10mV ~ 1V; $\pm$ [(10 + fm)% + 1mV]; fm: test frequency [MHz]	
Output Impedance	100 $\Omega$ , 25 $\Omega$ , OFF	
<b>Measurement Display Range</b>		
L	0.00001uH ~ 99.999MH	
C	0.00001pF ~ 999.999F	
R, Z	0.01m $\Omega$ ~ 9999.99M $\Omega$	
DCR	0.01m $\Omega$ ~ 999.99M $\Omega$	
Q, D	0.00001 ~ 99999	
$\theta$	-90.00° ~ 90.00°	
<b>Basic Accuracy</b>		
Z	$\pm$ 0.1%	
DCR	$\pm$ 0.1%	
$\theta$	$\pm$ 0.04°	
<b>Measurement Speed</b>	Fast : 15ms ; Medium : 150ms ; Slow : 295ms (1kHz)	
<b>Communication Interface</b>	RS-232C, Handler, USB storage, External bias current control, GPIB (option), LAN (option)	
<b>Measurement Functions</b>		
Trigger Mode	Internal, Manual, External, Bus	
Range Switching Mode	Auto, Hold	
Equivalent Circuit Mode	Series, Parallel	
Judgment	Compare, Bin-sorting	
Correction	Open/Short Zeroing, Load Correction	
<b>Others</b>		
Operating Environment	Temperature : 0°C ~ 40°C ; Humidity : 10% ~ 90%	
Power Consumption	60VA max.	
Power Requirement	100 ~ 240V $\pm$ 10% , 47Hz ~ 63Hz	
Dimension (H x W x D)	230 x 428 x 290 mm / 9.06 x 16.85 x 11.42 inch	
Weight	Approx. 8 kg / 17.64 lb	

\*All specifications are subject to change without notice. Please visit our website for the most up to date specifications.

## LCR METER

### MODEL 11021/11021-L

The 11021/11021-L are the most cost-effective digital LCR Meters, provide 100Hz, 120Hz, 1kHz, and 10kHz test frequencies for the 11021 and 1kHz, 10kHz, 40kHz, 50kHz test frequencies for the 11021-L. Standard RS232 interface, optional GPIB & Handler interface, high speed and stable measurement capabilities enable the 11021/11021-L can be used for both component evaluation on the production line and fundamental impedance testing for bench-top applications.

#### Bin-sorting Function

The 11021/11021-L provides 8-bins sorting function with bin count statistics. It is very convenient for magnetic core sorting or capacitor sorting. And the bin count statistics can be used to analysis distribution of tested results or production quality.

#### HI/GO/LO Comparator

The 11021/11021-L has a comparator function to judge HI/GO/LOW of capacitance measured results, and to judge GO/NG of D factor. And an alarming beeper for total GO/NG judge.

#### Trigger Delay Time

For large capacitance measurement in automatic production, a RC (meter output resistance and unknown capacitance ) delay time for test signal transient is necessary. The 11021/11021-L provides trigger delay time for it, and is convenient for automatic equipment timing adjustment.

#### Input Protection

Un-discharged device (generally, a capacitor) under test is the most general reason causes destroy on a LCR Meter. The 11021/11021-L using an excellent input protection circuit to prevent it from this kind of damage.

#### Open/Short Zeroing

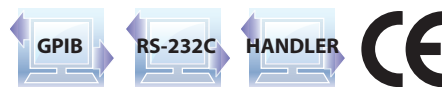
General low-end LCR meter just provides zero offset to substrate stray capacitance, residual resistance or residual inductance only for C, R, L measurement which can not accurately measure Q (quality factor) for L, R measurement and D (dissipation factor) for C measurement. The 11021/11021-L provides full open/short circuit zeroing function.

## LCR Meter

### MODEL 11021/11021-L

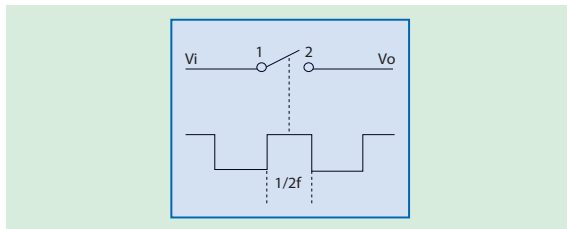
#### Key Features

- Test frequencies: 100Hz, 120Hz, 1kHz and 10kHz (9.6kHz) (11021) 1kHz, 10kHz, 40kHz, 50kHz (11021-L)
- Basic accuracy: 0.1% (11021), 0.2% (11021-L)
- 0.1m $\Omega$  ~99.99 M $\Omega$  measurement range, 4½ digits resolution
- Lower harmonic-distortion affection
- Fast measurement speed (75ms)
- Standard RS-232 interface
- Optional GPIB & Handler interface
- Programmable trigger delay time is convenient for measurement timing adjustment in automatic production
- Bin-sorting function
- Comparator and pass/fail alarming beeper function
- Text mode 40x4 matrixes LCD display
- Friendly user interface
- Open/short zeroing
- On-line firmware refreshable (via RS-232)
- Input protection (1 Joule)

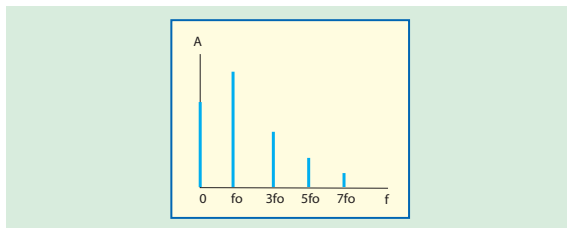


## Lower Harmonic-distortion Phase-detection Technology

The 11021/11021-L uses lower harmonic-distortion phase-detection technology to reduce affection of measurement accuracy caused by hysteresis distortion in magnetic component or high dielectric-coefficient capacitor measurement, which is not provided in general low-end LCR meters. General low-end LCR meters use half period integration method as phase detector. The 11021-L is the ideal selection for high frequency coil, core, choke, ect passive components incoming/outgoing material quality inspect and automatic production. The frequency spectrum of half period square wave is shown as figure 1 and 2, which non-ignorable 3<sup>rd</sup>, 5<sup>th</sup> order harmonics are included. For non-linear devices under testing, odd-order (3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, etc.) harmonics may occur in measured potential or current signals. Then, this phase-detection method will cause obvious accuracy error because of same low order harmonics are included in both unknown signal and phase-detect signal. The 11021/11021-L uses eight steps sine-wave multiplier as phase detector to reduce low-order harmonics affection to an ignorable level.



**Figure 1** : The frequency spectrum of half period square wave (general low-end LCR meters)



**Figure 2** : Non-ignorable 3<sup>rd</sup>, 5<sup>th</sup> order harmonics (11021 uses eight steps sin-wave multiplier)

## SPECIFICATIONS

Model	11021	11021-L
<b>Measurement Parameter</b>		
Primary Display	L, C, R,  Z	
Secondary Display	Q, D, ESR, Xs, $\theta$	
<b>Test Signals Information</b>		
Test Level	0.25V / 1V, $\pm(10\% + 3\text{ mV})$	50mV/ 1V, $\pm 10\%+3\text{mV}$
Test Frequency	100Hz, 120Hz, 1kHz, 10kHz (9.6kHz)	1kHz, 10kHz, 40kHz, 50kHz
Frequency Accuracy	$\pm 0.25\%$	$\pm 0.02\%$
Output Impedance (Typical)	Varies as range resistors 25, 100, 1k, 10k, 100k	
<b>Measurement Display Range</b>		
Primary Parameter	L: 0.01 $\mu$ H ~ 9.999kH, C: 0.01pF ~ 99.99mF, R, Z : 0.1m. ~ 99.99M $\Omega$	
Secondary Parameter	Q: 0.1 ~ 9999.9, D: 0.0001 ~ 9999.9, $\theta$ : -180.00° ~ +180.00°	
Basic Accuracy *1	$\pm 0.1\%$	$\pm 0.2\%$
<b>Measurement Time (1KHz) *2</b>		
Fast	Freq = 1k/10kHz : 75ms Freq = 100/120Hz: 85ms	Freq = 1kHz/10kHz : 75ms Freq = 40kHz : 105ms Freq = 50kHz : 90ms
Medium	145ms	*3
Slow	325ms	*4
Trigger	Internal, Manual, External, BUS	
<b>Display</b>		
L, C, R,  Z , Q, D, R, $\theta$	40 x 4 (Character Module) LCD Display	
<b>Function</b>		
Correction	Open/Short zeroing	
Equivalent Circuit Mode	Series, Parallel	
<b>Interface &amp; Input/Output</b>		
Interface	RS-232 (Standard), Handler & GPIB (Optional)	
Output Signal	Bin-sorting & HI/GO/LOW judge	
Comparator	Upper/Lower limits in value	
Bin Sorting	8 bin limits in %	
Trigger Delay	0 ~ 9999mS	
<b>General</b>		
Operation Environment	Temperature : 10°C ~ 40°C, Humidity < 90 % R.H.	
Power Consumption	50VA max.	
Power Requirement	90 ~ 132Vac or 180 ~ 264Vac, 47 ~ 63Hz	
Dimension (H x W x D)	100 x 320 x 206.4 mm / 3.94 x 12.6 x 8.13 inch	
Weight	4 kg / 8.81 lbs	

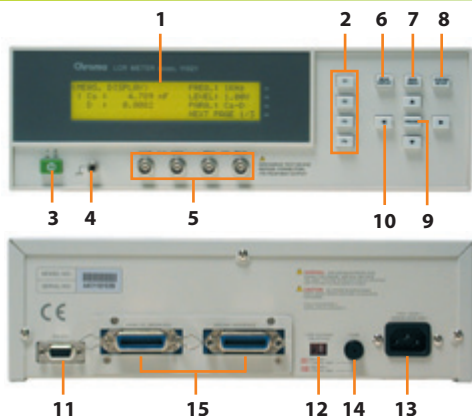
**Note\*1** : 23  $\pm$  5°C after OPEN and SHORT correction, slow measurement speed. Refer to operation manual for detail measurement accuracy descriptions.

**Note\*2** : Measurement time includes sampling, calculation and judge test parameter measurement.

**Note\*3** : Freq.=1kHz/10kHz 145ms Freq.=40kHz 185ms Freq.=50kHz 150ms

**Note\*4** : Freq.=1kHz/10kHz 325ms Freq.=40kHz 415ms Freq.=50kHz 400ms

## PANEL DESCRIPTION



1. LCD Display
2. Function Keys
3. Power Switch
4. Ground Terminal
5. Measurement Terminals
6. Measurement Display Key
7. Main Index Key
8. System Setup Key
9. Trigger Key
10. Cursor Keys
11. RS232 Interface
12. Power Voltage Selector
13. AC Line Input
14. Fuse
15. GPIB and Handler Interface

## MODEL 11022/11025

### Key Features

- 0.1% basic accuracy
- Transformer test parameters (11025), Turns Ratio, DCR, Mutual Inductance
- 50Hz, 60Hz, 100Hz, 120Hz, 1kHz, 10kHz, 20kHz, 40kHz, 50kHz, 100kHz test frequencies
- 21ms measurement time ( $\geq 100\text{Hz}$ )
- Agilent 4263B LCR Meter commands compatible
- 4 different output resistance modes selectable for non-linear inductor and capacitor measuring
- High resolution in low impedance ( $0.01\text{m}\Omega$ ) and high accuracy 0.3% till  $100\text{m}\Omega$  range
- Adjustable DC bias current up to 200mA (constant  $25\Omega$ ) (11025)
- 1320 Bias Current Source directly control capability
- $0.01\text{m}\Omega \sim 99.99\text{M}\Omega$  wide measurement range (4 1/2 digits)
- Dual frequency function for automatic production
- BIAS comparator function
- Comparator function and 8/99 bin-sorting function
- Pass/fail judge result for automatic production
- Handler interface trigger edge (rising/falling) programmable
- Test signal level monitor function
- Standard GPIB, RS-232, and handler interface
- Open/short zeroing, load correction
- LabView® Driver

## LCR METER MODEL 11022/11025

The 11022 and 11025 LCR Meters are passive component testers that give you the most cost effective alternative equivalent to other high priced meters. They are designed for the demanding applications of production test, incoming inspection, component design and evaluation. Programmable test signal level settings are from 10mV to 1V in steps of 10mV, and the VM/IM signal level monitor functions allow you to evaluate your devices at the level you specify. Ten test frequencies of 50Hz, 60Hz, 100Hz, 120Hz, 1kHz, 10kHz, 20kHz, 40kHz, 50kHz, and 100kHz, can be used to evaluate passive components and transformers/ LF coils.

Other low cost LCR meters on the market have shortcomings when used for low impedance component evaluations, such as the large capacitance of electrolytic capacitors and low inductance of coils. As the 11022/11025 are equipped with high resolution ( $0.01\text{m}\Omega$ ) in low impedance, and high accuracy (0.3%) until  $100\text{m}\Omega$  range, they can be used to evaluate low impedance components to meet measurement requirements.

The 11025 LCR Meter can also measure DC resistance, turn ratio and mutual inductance of transformers. It is suitable for pulse transformer

or LF coil evaluation. Chroma's Transformer Test Fixture used with the 11025, can measure both the primary and the secondary parameters automatically by changing the internal relays in the 11025. With this, there is no need to change the connections required for measuring transformer parameters. With an adjustable internal DC bias current source up to 200mA as a standard function, the 11025 is the right tool for inductance inspection of telecom transformers and small power chokes under DC bias current.

The 11022/11025 LCR Meters provide a powerful combination of features designed to maximize productivity in all testing environments. Measurement speed in the SHORT integration time mode is  $15\text{ms}(\geq 100\text{Hz})$ . Handler interface, Pin-out, GPIB Interface, and IEEE 488 commands are compatible with 4263B.

Finally, the 11022/11025 have a built in comparator, 8 bin sorting, trigger delay functions, and handler interface trigger functions, making system integration easy, and improving measurement throughput as well as reliability.



## SPECIFICATIONS

Model	11022	11025
Test Parameter	L, C, R,  Z , Q, D, ESR, X, $\theta$	L, C, R,  Z , Q, D, ESR, X, $\theta$ DCR4, M, Turns Ratio, L2, DCR2
<b>Test Signals</b>		
Level	10 mV~1V, step 10 mV; $\pm(10\% + 3 \text{ mV})$	
Frequency	50Hz, 60Hz, 100Hz, 120Hz, 1kHz, 10kHz, 20kHz, 40kHz, 50kHz, 100kHz; $\pm 0.01\%$	
Output Impedance (Nominal Value)	Constant 107X : 25 $\Omega$ ; Constant 320X : 100 $\Omega$ ; Constant 106X : 2 $\Omega$ , for $Z \geq 10 \Omega$ , 100mA (1V setting) for reactive load $\leq 10 \Omega$ ; Constant 102X : 25 $\Omega$ , for $Z < 1 \Omega$ , 100 $\Omega$ for else	
DC Bias Current (Freq. $\geq 1 \text{ kHz}$ )	--	50mA max. for Constant 100 $\Omega$ , 200mA max for Constant 25 $\Omega$ (AC level $\leq 100 \text{ mV}$ )
<b>Measurement Display Range</b>		
C (Capacitance)	0.001 pF ~ 1.9999F	
L, M, L2 (Inductance)	0.001 $\mu\text{H}$ ~ 99.99k	
Z (Impedance), ESR	0.01m $\Omega$ ~ 99.99M $\Omega$	
Q (Quality Factor) ; D (Dissipation Factor)	0.0001 ~ 9999	
$\theta$ (Phase Angle)	-180.00° ~ +180.00°	
Turns Ratio (Np:Ns)	--	0.9~999.99
DCR	--	0.01m $\Omega$ ~ 99.99M $\Omega$
<b>Basic Measurement Accuracy *1</b>	$\pm 0.1\%$	
<b>Measurement Time (Fast) *2</b>	21ms	
<b>Interface &amp; I/O</b>		
Interface	handler (50pin), GPIB, RS-232	
Output Signal	Bin-sorting & HI/GO/LOW judge	
Comparator	Upper/Lower limits in value	
Bin Sorting	8/99 bin limits in %, ABS	
Trigger Delay	0~9999ms	
<b>Display</b>	240 x 64 dot-matrix LCD display	
<b>Function</b>		
Correction	Open/ Short zeroing, load correction	
Averaging	1~256 programmable	
Cable Length	0m, 1m, 2m, 4m	
Test Sig. Level Monitor	Voltage, Current	
Equivalent Circuit mode	Series, Parallel	
<b>Memory (Store/ Recall)</b>	50 instrument setups	
<b>Trigger</b>	Internal, Manual, External, BUS	
<b>General</b>		
Operation Environment	Temperature : 10°C~40°C Humidity : < 90 % R.H.	
Power Consumption	65VA max	
Power Requirements	90 ~ 132Vac or 180 ~ 264Vac, 47 ~ 63Hz	
Dimension (H x W x D)	100 x 320 x 347.25 mm / 3.94 x 12.6 x 13.67 inch	
Weight	5.5 kg / 12.11 lbs	

**Note\*1** : 23  $\pm$  5°C after OPEN and SHORT correction. Slow measurement speed. Refer to Operation Manual for detailed measurement accuracy descriptions.  
**Note\*2** : Measurement time includes sampling, calculation and judgment of primary and secondary test parameter measurement.

## MODEL 13350

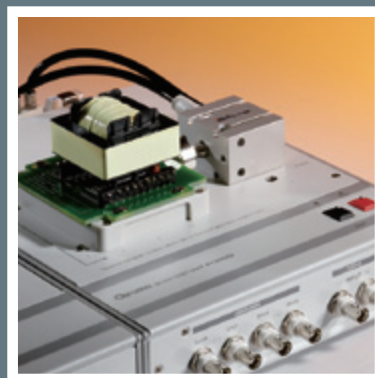
### Key Functions :

- Test frequency 20Hz ~ 200KHz
- Turn Ratio, Phase, L, Q, Lk, ACR, DCR, Cp, Pin short, Balance
- Basic accuracy : 0.1%
- Three different output impedance modes
- Scan unit/box including :
  - 20ch scan test unit
  - 80ch\* scan box
  - C.T.\* test fixture

### Key Features :

- Compensation for individual channel
- \*Combined measurement unit and scan box to reduce measurement errors
- \*USB storage interface
- \*10-100 LAN/ USB-H interface (option)
- \*Built-in programmable 100mA bias current (RJ-45)
- \*Test frequency, voltage and speed set separately
- \*Fail Lock function
- \*Auto Test function
- \*Equipped with external standard test on 20ch scan test unit
- \*Reduce the short-circuit loss in secondary side for leakage (Lk) test (A133502 20ch scan unit)
- \*Short-circuit pin selectable for every test item
- \*Multiple language: English & Simplified Chinese
- \*RS232 interface compatible SCPI commands (option)

\*New features compared to 3250 Series



## AUTOMATIC TRANSFORMER TESTER MODEL 13350

Acquired from many years of marketing experiences and cumulative results, 13350 is the newest generation of Automatic Transformer Tester that not only retains the merits of old 3250 model but also has many new functions including the combination of measurement unit and scan box to reduce measurement error caused by long wire, C.T. test fixture and 80/20 channels scan box support, USB interface for test conditions back-up, LAN communication interface, separate setting of test frequency/voltage/speed, Fail Lock function and Auto Test. It solves the performance and quality problems as well as human errors occurred on production line for the transformer industry today.

For instance: To reduce human errors on production line, the 13350 Fail Lock function is able to lock the defect DUT (Device Under Test) when the test is done to prevent it from flowing out accidentally. In order to cut down the time for placement, the 13350 Auto Test function can conduct test directly without pressing the trigger key. In addition, the 13350 adopts the design of dual CPU to increase the test speed by processing the measurement and display units simultaneously.

The compensation function of 13350 can do OPEN/SHORT for individual channel to solve the errors due to different layout on various fixtures.

13350 provides 20Hz-200kHz test frequency and scan test items to cover low voltage test parameters for various transformers including

Inductance (L), Leakage (Lk), Turn-Ratio, DC Resistance (DCR), Impedance (Z), Stray Capacity (C), Quality Factor (Q), Equivalent Series Resistance (ESR), Pin Short (PS), Winding Phase (PH) and Balance.

### Applicable Test Options for Selection

#### A133502 20 Channels Scan Box

13350 uses split screen that allows the measurement unit to integrate the 20 channels scan box without using any connecting wires to reduce measurement errors. Furthermore, the 20 channels scan box has external standard test function that can perform verification test directly without any act of disassembly.

#### A133505 80 Channels Scan Box

13350 along with 80 channels scan box can mainly offer three different applications:

- 1) RJ-45 & LAN Filter test solution that can test up to 80 pins one time.
- 2) Transformer automation solution that can place 4 transformers on one carrier for scan test simultaneously.
- 3) Island-type production line planning that provides a time division multiplexing module to increase the equipment utilization rate.

#### A133506 C.T. (Current Transformer)

##### Test Fixture

When the 13350 works with A133506 C.T. Test Fixture, it can measure the turns, inductance and DC resistance easily and rapidly by putting in the C.T. directly.





## SPECIFICATIONS

<b>Model</b>	<b>13350</b>	
<b>Main Function</b>	Transformer Scanning Test	
<b>Test Parameter</b>		
Transformer Scanning	Turn Ratio, Phase, Turn, L, Q, Leakage L, Balance, ACR, Cp, DCR, Pin Short	
<b>Test Signals Information</b>		
Test Level	Turn	10mV~10V, $\pm 10\%$ 10mV/step
	Others	10mV~2V, $\pm 10\%$ 10mV/step
Test Frequency	Turn	20Hz~200kHz, $\pm (0.1\% + 0.01\text{Hz})$ , Resolution: 0.01Hz
	Others	20Hz~200kHz, $\pm (0.1\% + 0.01\text{Hz})$ , Resolution : 0.001Hz (<1kHz)
Output Impedance	Turn	10 $\Omega$ , when level $\leq 2\text{V}$ / 50 $\Omega$ , when level > 2V
	Others	Constant = OFF : Varies as range resistors ; Constant = 320X : 100 $\Omega \pm 5\%$ ; Constant = 107X : 25 $\Omega \pm 5\%$ Constant=106X : 100mA $\pm 5\%$ (1V setting); for inductive load less than 10 $\Omega$ , 10 $\Omega \pm 10\%$ , for impedance $\geq 10 \Omega$
<b>Measurement Display Range</b>		
L, LK	0.00001 $\mu\text{H}$ ~9999.99H	
C	0.001pF~999.999mF	
Q, D	0.00001~99999	
Z, X, R	0.0001 $\Omega$ ~999.999M $\Omega$	
$\theta$	-90.00° ~ +90.00°	
DCR	0.01m $\Omega$ ~99.999M $\Omega$	
Turn,Ratio	0.01~99999.99 turns (Secondary voltage less than 100 Vrms)	
Ratio (dB)	-39.99dB~+99.99dB (secondary voltage less than 100 Vrms)	
Pin-Short	11 pairs, between pin to pin	
<b>Basic Accuracy</b>		
L, LK, C, Z, X, Y, R, DCR	$\pm 0.1\%$ (1kHz if AC parameter)	
DCR	$\pm 0.5\%$	
$\theta$	$\pm 0.04^\circ$ (1kHz)	
Turn, Ratio (dB)	$\pm 0.5\%$ (1kHz)	
<b>Measurement Speed (Fast)</b>		
L, LK, C, Z, X, Y, R, Q, D, $\theta$	50 meas./sec.	
DCR	12 meas./sec.	
Turn, Ratio (dB)	10meas./sec.	
<b>Judge</b>		
Transformer Scanning	PASS/FAIL judge of all test parameters output from Handler interface, 100 bin sorting for Lk	
<b>Trigger</b>	Internal, Manual, External	
<b>Display</b>	Color 640x480 LCD panel	
<b>Equivalent Circuit Mode</b>	Series, Parallel	
<b>Correction Function</b>	Open/Short Zeroing, Load correction	
<b>Memory</b>	15 instrument setups, expansion is possible via memory card	
<b>General</b>		
Operation Environment	Temperature:10°C~40°C, Humidity: 10%~90% RH	
Power Consumption	60 VA max.	
Power Requirement	90 ~ 132Vac or 180 ~ 264Vac, 47 ~ 63Hz (Auto Switch)	
Dimension (H x W x D)	13350M : 58 x 280 x 300 mm / 2.28 x 11.02 x 11.8 inch ; 13350D : 45 x 140 x 225 mm / 1.77 x 5.51 x 10.03 inch	
Weight	13350M : Approx. 3.5 kg / 7.71 lbs ; 13350D : Approx. 1.3 kg / 2.86 lbs	

\* All specifications are subject to change without notice. Please visit our website for the most up to date specifications.

# CAPACITOR LEAKAGE CURRENT/IR METER

## MODEL 11200

The 11200 Capacitor Leakage Current / IR Meter is Chroma's newest digital leakage current meter. It provides DC 1~650V, 0.5~500mA (150mA for V>100V) or DC1~800V, 0.5~500mA (50mA for V>100V) DC power source with voltage meter and nano-ampere meter. Mainly used for electrolytic capacitor leakage current testing, and aluminum-foil withstand voltage testing (EIAJ RC-2364A). And also can be used for active voltage checking or leakage current testing of absorber, zener diode, neon lamp, etc. Standard RS-232 interface, optional GPIB & Handler interface, high speed and stable measurement capabilities enable the 11200 can be used for both component evaluation on the production line and fundamental leakage current or IR testing for bench-top applications.

**1~650V, 150mA/500mA or 1~800V, 50mA/500mA Low Noise DC Voltage Source**  
A low noise linear power supply is designed in the 11200. The DC output voltage range is from 1.0V to 650V/800V, which covers low WV capacitor leakage current testing and aluminum-foil withstand voltage testing range. The maximum charge current is 500mA/100V, 150mA/650V or 50mA/800V, provides quick charge for large capacitor testing.

**Precision Low Constant Current Charge Capability (0.5mA ±0.05mA)**  
In general, the aluminum electrolytic capacitor's anode oxide-foil is using extremely low constant current (0.5mA, 1mA or 2mA ±10% depending on the type of the foil, defined by EIAJ RC-2364A standard) to test foil withstand voltage (Vt) and rise time (Tr).

The 11200 provides constant charge current low to 0.5mA with high stability.

**0.001μA~20.00mA Leakage Current Test Range with 4 Digits Resolution**  
A 0.001uA to 20mA test range nano-ampere meter is built in the 11200. It is proper to be used for leakage current or IR testing of electrolytic capacitor and high dielectric ceramic capacitors. And the extremely low input resistance (the lowest is 0 ohm) design enables high speed testing for high capacitance device LC or IR testing.

**Output Voltage Monitor**  
The 11200 always keeps monitoring the real output voltage no matter in the test or setup operation status for safety of the operator. In addition to display the real output voltage in TEST page, an error message shows up in case the output voltage abnormally exceeds 10 volts in other operation pages.

**65W/50W Semi-constant Power Discharge Circuit**  
A 65W/50W semi-constant power discharge circuit is built in the 11200 for high speed and complete discharge after test. It satisfies quick discharge requirement for charged large capacitors.

**Built-in RS-232 Interface and Optional GPIB & Handler Interface**  
The 11200 built-in RS-232 interface can be used in R&D or QC for remote control and tested data fetch. And, GPIB & handler interface (A110235) is optional for automation.



## MODEL 11200

### KEY FEATURES

- Capacitor leakage current test function
- Insulation resistance (IR) test function
- Basic accuracy: 0.3%
- Constant current DC power source with discharge function
- Forward voltage function for diode, LED, zener diode and varistor
- Surge voltage test function for electrolytic capacitor (JIS C5101/5102/5140/5141)
- Option contact check function to improve test reliability
- Aluminum-foil withstand voltage and rise-time test function (for EIAJ RC-2364A)
- Precision low constant current charge capability (0.5mA ±0.05mA, meet EIAJ RC-2364A requirement for withstand voltage testing of lower WV aluminum-foil)
- Large charge current (500mA) capability to fasten charge speed
- 1.0V~650V/800V DC voltage source
- 0.001uA~20.00mA leakage current test range with 4 digits resolution
- Digital timer inside
- Comparator and pass/fail alarming beeper function
- Standard RS-232 interface
- Optional GPIB & handler interface

### APPLICATIONS

- Various electrolytic capacitors, high dielectric ceramic capacitor, etc.
- Aluminum-foil withstand voltage test (for EIAJ RC-2364A)
- Semiconductor component leakage current test or insulation resistance test
- Insulation resistance test of various anti-static electric materials or non-ultra-high insulation materials (IR<100GΩ)



## SPECIFICATIONS

Model	11200 (650V)		11200 (800V)	
Main Function	Capacitor Leakage Current / IR Meter			
Test Parameter	LC, IR			
<b>Test Signals Information</b>				
Voltage	1.0 V~100 V, step 0.1 V; 101V~650 V, step 1V; $\pm(0.5\% + 0.2V)$		1.0 V~100 V, step 0.1 V; 101V~800V, step 1V; $\pm(0.5\% + 0.2V)$	
Charge Current Limit	V $\leq$ 100V: 0.5mA~500mA, 50W max. V > 100V: 0.5mA~150mA, 97.5W max. step 0.5mA; $\pm(3\% + 0.05mA)$		V $\leq$ 100V: 0.5mA~500mA, 50W max. V > 100V: 0.5mA~50mA, 40W max. step 0.5mA; $\pm(3\% + 0.05mA)$	
Measurement Display Range	LC : 0.001 $\mu$ A~20.00mA			
Basic Measurement Accuracy *1	LC Reading : $\pm(0.3\% + 0.005\mu A)$			
Measurement speed (Ext. Trigger, Hold Range, Line Frequency 60Hz)	Fast	77 ms		
	Medium	143 ms		
	Slow	420 ms		
<b>Function</b>				
Correction	Null zeroing			
Test Voltage Monitor	Vm: 0.0 V~660.0V; $\pm(0.2\%$ of reading + 0.1V)		Vm: 0.0 V~900.0V; $\pm(0.2\%$ of reading + 0.1V)	
Charge Timer	0~999 sec.			
Dwell Timer	0.2~999 sec.			
<b>Foil WV Tester</b>				
Test Parameter	Tr (Rise Time), Vt (Foil Withstand Voltage)			
Test Signals	Voltage Limit	650 V typical		800V typical
	Constant Charge Current	0.5mA~150mA, step 0.5mA; $\pm(3\%$ of reading + 0.05mA)		0.5mA~50mA, step 0.5mA; $\pm(3\%$ of reading + 0.05mA)
Test Display Range	Tr (Rise Time)	0.05~600.0 sec.		
	Charge Voltage	0.1V~660.0V		0.1V~900.0V
Test Time	30~600 sec.			
Interface	RS-232(Standard), Handler, GPIB (Optional)			
Display	240 x 64 dot-matrix LCD display			
Trigger	Internal, External, Manual, BUS			
<b>General</b>				
Operation Environment	Temperature : 10°C~40°C Humidity : < 90 % RH			
Power Consumption	400 VA max.			
Power Requirement	90 ~ 132Vac or 180 ~ 264Vac, 47 ~ 63Hz			
Dimension (H x W x D)	100 x 320 x 346.1 mm / 3.94 x 12.6 x 13.63 inch			
Weight	8 kg / 17.62 lbs			

Note\*1 : 23  $\pm$  5°C after null correction. Refer to Operation Manual for detail measurement accuracy descriptions.

\*All specifications are subject to change without notice. Please visit our website for the most up to date specifications.

# RIPPLE CURRENT TESTER

## MODEL 11800/11801/11810

The 11800/11801/11810 Ripple Current Tester is a precision tester designed for electrolytic capacitors load life testing. It provides constant ripple current output and constant peak voltage ( $V_{peak} = V_{dc} + V_{ac\_peak}$ ) output digital control function. Let load life testing for electrolytic capacitors becomes easier and more reliable. And, the 11800/11801/11810 use excellent output amplifier design technology to reduce power consumption and internal temperature rising. For long time testing requirement, it can reduce electricity cost and perform high stability. The 11800/11801/11810 is a just right test solution for electrolytic capacitors quality evaluation.

The 11800/11801/11810 Ripple Current Tester is the experience and technology accumulation for several years. According to JIS-C-5102 test method to design large LCD display and computer digital programmable precision measurement instrument, which aim at electrolytic capacitor, tantalum capacitor and solid-state capacitor manufacturers to execute life test instead of wasting time and complicated traditional operation method.

To simplify the operation setting procedure and automatic discharge function for ensuring the operational personnel safety, also connect with the computer through RS485 to monitor Ripple Current Tester include test conditions and monitored status.

The precise measurement data and humanization operation is not only to promote reliability of life test but also assure product quality. It is the best choice in measurement.

### Four Terminal Contact Test Jig Design

Four terminal contact test jig design, ensure accurate monitoring of voltage dropped on capacitors under test (Patent pending).

### Paired Cooper-foil Wiring Test Cable

The 11800/11801/11810 provides the test fixture for series and parallel, and it improves the loss effectively as high frequency testing causes by the test cable and fixture. The paired cooper-foil wiring test cable reduces voltage drop on the current driving loop and ensures accurate monitoring of ac level dropped on capacitors under test (Patent pending). Working voltage or rated voltage measurement specification too low will be result in the manufacturer's verification invalid problem.

### Large LCD Display

The 11800/11801/11810 uses large 320x240 dot-matrix display, shows more test information at the same time. Combine with guided operation design, makes the tester easier to operation. Users can operate instrument easily with great view of setting functions and test result.

## MODEL 11800/11801/11810

### Key Features

- Digital constant current output and constant peak voltage output control function
- Four terminal contact test jig design, ensure accurate monitoring of voltage dropped on capacitors under test (patent pending)
- Paired cooper-foil wiring test cable to reduce voltage drop on the current driving loop and to ensure accurate monitoring of ac level dropped on capacitors under test (patent pending)
- 0-500 V DC bias voltage source, 0.3% basic accuracy
- 0.01~30A, 100Hz/120Hz/400Hz/1kHz AC ripple current source, ( $\pm 0.5\%$  reading+0.1% of range) basic accuracy (Model 11800)
- 0.01~10A, 20kHz~100kHz AC ripple current source, 2% basic accuracy (Model 11801)
- 0.03~10A, 20kHz~1MHz AC ripple current source (Model 11810)
- Monitoring software (option) for multiple Ripple Current Testers
- Lower power consumption and lower electricity cost
- Large LCD display (320 x 240 dot-matrix)
- Alarm for indicating of normal or abnormal test termination, Tested time will be recorded if the test is terminated abnormally. An automatic discharge is always performed after test termination
- Standard RS485 interface is provided for computer monitoring
- Optional 20-fixtures Series or Parallel test jigs
- Digital timer inside
- CE marking (Model 11800/11801)



## SPECIFICATIONS

Model		11800	11801	11810
<b>Ripple Current Source</b>				
<b>Current Output Range</b>		0.01~30A	0.01~10A	0.03~10A, *3
<b>Frequency</b>		100Hz/120Hz/400Hz/ 1kHz $\pm$ 0.1%	20kHz~100kHz	20kHz~1MHz
<b>Accuracy *1</b>	0.030A~0.199A	$\pm$ (0.5% of reading + 0.1% of range)	$\pm$ (3% + 0.005 A)	0.03~0.39A, $\pm$ (3% + 0.01 A), *2
	0.20A~1.99A		$\pm$ (2.5% + 0.05 A)	
	2.0A~10A		$\pm$ (2% + 0.2 A)	0.40~10.0A, $\pm$ (2% + 0.05 A), *2
	10.0A~30A		--	
<b>Ripple Voltage Output Range</b>		90Vrms / 10Arms, 30Vrms / 30Arms	15Vrms maximum	
<b>DC Bias Voltage Source</b>				
<b>Voltage Output Range</b>		DC 0 ~ 500V, $\pm$ (0.3% + 0.05V)		
<b>Charge Current</b>		200mA, 40W Maximum		
<b>Signal Monitor Parameter Accuracy</b>				
<b>Irms (Ripple Current)</b>	0.001A~0.199A	$\pm$ (0.5% of reading + 0.1% of range)	$\pm$ (2% + 0.005 A)	0.030A~0.399A: $\pm$ (3% + 0.01A), *2, *3
	0.20A~1.99A		$\pm$ (2% + 0.05 A)	
	2.0A~10A		$\pm$ (2% + 0.2 A)	0.400A~10.00A: $\pm$ (2% + 0.05A), *2, *3
	10.0A~30A		--	
<b>Vpeak (Normally, set to capacitor rated voltage)</b>		Vpeak = Vdc + Vac_peak		
<b>Vdc (DC Bias Voltage)</b>		$\pm$ (0.3% + 0.05V)		
<b>Vrms (Ripple Voltage)</b>		0~1.99V, $\pm$ (0.3% of reading + 0.5% of range) 2.00~19.99V, $\pm$ (0.3% of reading + 0.1% of range) 20.00V~200.0V, $\pm$ (0.3% of reading + 0.1% of range)	$\pm$ (1% + 0.005V)	$\pm$ (1% + 0.01V) *2
<b>Control Function</b>				
Timer		1 min~10000 hour, 30min error per year		
Interface		RS-485 (Standard)		
Display		320 x 240 dot-matrix LCD display		
Operation		Start, Stop, Continue		
Protection		OCP, OTP, Over Load		
<b>General</b>				
Operation Environment		Temperature : 10°C~40°C, Humidity : < 90 % RH		
Power Consumption		3000 VA max.	700 VA max.	1000VA max.
Power Requirement		180 ~ 264Vac, 47 ~ 63Hz		
Dimension (H x W x D)		221.5 x 440 x 609.8 mm / 8.72 x 17.32 x 24.01 inch	353.6 x 440 x 609.8 mm / 13.92 x 17.32 x 24.01 inch	221.5 x 440 x 609.8 mm / 8.72 x 17.32 x 24.01 inch
Weight		54 kg / 118.94 lbs	60 kg / 132.16 lbs	40 kg / 88 lbs

**Note\*1** : 23  $\pm$  5°C

**Note\*3** : Frequency > 500kHz : 0.10~10.0A only

**Note\*2** : Multiple accuracy for test frequency 20~100kHz (x 1), 101~500kHz (x 2.5), 501kHz~1MHz (x 5)

**Note\*4** : Frequency > 500kHz : 0.100~10.00A only

All specifications are subject to change without notice. Please visit our website for the most up to date specifications.

# PROGRAMMABLE HF AC TESTER

## MODEL 11802 SERIES

11802 Series Programmable HF AC Tester is a digital controlled high frequency AC source platform which can be combined with various modules to provide test method with high frequency/high voltage or high frequency mass current. The 11802 series output frequency range is 20kHz~200kHz which covers application frequencies for SMPS, LCD inverter, ballast, etc. The output voltage can coordinate with transformer module to adjust to required range. It also provides programmable output waveform control to simulate the operating condition for DUT, and cycle count or timer mode digital function for load life test. Tracking DC Source is also used inside the 11802 series for output amplifier to reduce power consumption and temperature rising. It decreases electricity cost and remains stability for long time testing.

The comprehensive design is suitable for various electronic components which used

under high frequency and high voltage tests such as LCD Inverter transformer secondary coil, high voltage capacitor, SMPS main power primary coil. It is applicable to high frequency mass current tests such as ballast inductor, ballast capacitor, electrolytic capacitor or other electronic components which are operated under environment of high frequency mass current.

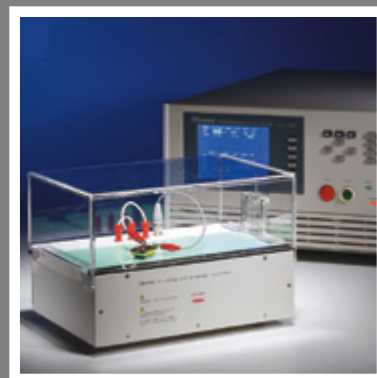
11802 Series Programmable HF AC Tester is an outcome accumulated by years of experience and technology. Control measurement and output accurately with the design of large LCD display to simplify operating procedure as well as support RS485 interface for users monitor test condition and monitoring situation of load life test via PC. The precise measured data and user-friendly operation design can enhance reliability of test. It is the best choice for high frequency test.

## MODEL 11802 SERIES

- MODEL 11802 : Full Function
- MODEL 11805 : Full Function
- MODEL 11890 : Withstand Voltage Test
- MODEL 11891 : Load Life Test

### Key Features:

- Main Frame :
  - 11802 : 167V/3A, 500VA
  - 11805 : 167V/6A, 1000VA
  - 11890 : 167V/3A, 500VA
  - 11891 : 167V/3A, 500VA
- Module Output :
  - A118017 : 8kV/60mA
  - A118013 : 5kV/100mA
  - A118031 : 5kV/100mA+shielding
  - A118014 : 2.5kV/200mA
  - A118016 : 250V/2A
  - A118015 : 33V/30A
  - A118018 : 1kV/1A
- Frequency : 20kHz ~ 200kHz
- Sine wave Output
- Output voltage/current monitoring function
- Programmable output voltage waveform control
- Cycle count or time count test mode
- Lower power consumption and lower temperature rising design
- Large LCD Display
- Built-in digital timer
- RS485 interface



## APPLICATIONS

Model	Main Function	Option	Application Description
11802	High Frequency High Voltage Test	A118013 Module 5kV/100mA max	LCD inverter (transformer, ceramic capacitor, cable, PCB) load life test/ withstanding voltage/ breakdown voltage test
		A118014 Module 2.5kV/200mA max	EEFL, backlight load life test/ lamp current test
		A118016 Module 250V/2A max	SMPS main transformer and active PFC choke load life test and electrical analysis
		A118017 Module 8kV/100kHz max	Medical equipment high frequency leakage current safety inspection
		A118031 Module 5kV/100mA max	Automobile motor corona discharge inspection
		A118022 Single Lamp Module 8kV/100kHz max	CCFL, HCFL, backlight load life/ kick-off voltage and lamp voltage test
11805	High Frequency High Voltage Test	A118018 Module 1kV/1A max + specified resonant inductor / capacitor	Ballast capacitor/ inductor ignition voltage load life test
	High Frequency High Current Test	A118015 Module 33V/30A max	Snubber capacitor load life test
11890 (F3)	High Frequency High Voltage Test	A118013 Module 5kV/100mA max	LCD inverter transformer (ceramic capacitor, cable, PCB) withstanding voltage test for production line
		A118014 Module 2.5kV/200mA max	Medical equipment high frequency leakage current safety inspection
		A118017 Module 8kV/100kHz max	Automobile motor corona discharge inspection
		A118031 Module 5kV/100mA max	
11891 (F1, F2)	HF, CV Test	HF, Voltage Step-up Module	Constant voltage load life test
	HF, CI Test	HF, Current Step-up Module	Constant current load life test

# SPECIFICATIONS

Model	11802/11890/11891		11805
<b>HF AC Source Output</b>			
Frequency	20KHz ~ 200KHz $\pm 0.02\%$ , Programmable		
Basic Maximum Output Power	500VA		1kVA
Output Current Range (rms)	0.01A ~ 3.00A, $\pm(5\%$ of setting + 10mA)		0.05A ~ 6.00A, $\pm(5\%$ of setting + 10mA)
Output Voltage Range (rms)	167V maximum		
<b>Output Parameters [Note 1]</b>			
With option A118017/ A118022 (HF HV, 8.0kV/60mA)	Output Voltage Range	0.05kV ~ 8.00kV, $\pm(5\%$ of setting + 0.02kV) [Note 2]	--
	Output Current Range	60mA maximum (100kHz maximum)	
With option A118013 / A118031 (HF HV, 5.0kV/100mA)	Output Voltage Range	0.05kV - 5.00kV, $\pm(5\%$ of setting + 0.02kV) [Note 2]	--
	Output Current Range	100mA maximum	
With option A118014 (HF HV, 2.5kV/200mA)	Output Voltage Range	0.05kV - 2.50kV, $\pm(5\%$ of setting + 0.01kV) [Note 2]	--
	Output Current Range	200mA maximum	
With option A118016 (HF HV, 250V/2A)	Output Voltage Range	5V ~ 250V, $\pm(5\%$ of setting + 1V) [Note 2]	--
	Output Current Range	2A maximum	
With option A118018 (HF HC, 1kV/1A)	Output Voltage Range	--	0.05kV ~ 1.00kV, $\pm(5\%$ of setting + 0.01kV) [Note 2]
	Output Current Range		1A maximum
With option A118015 (HF HV, 33V/30A)	Output Voltage Range	--	0.1V ~ 33V, $\pm(5\%$ of setting + 0.15V) [Note 2]
	Output Current Range		30A maximum
<b>Signal Monitor Parameter Accuracy</b>			
With option A118017/ A118022 (HF HV, 8.0kV/60mA)	Output Voltage Reading	0.05kV ~ 8.00kV, $\pm(4\%$ of reading + 0.02kV) [Note 2]	--
	Output Current Reading	0.5mA ~ 60.00mA, $\pm(3\%$ of reading + 0.3mA) [Note 2]	
With option A118013/ A118031 (HF HV, 5.0kV/100mA)	Output Voltage Reading	0.05kV ~ 5.00kV, $\pm(4\%$ of reading + 0.02kV) [Note 2]	--
	Output Current Reading	0.5mA ~ 100.00mA, $\pm(3\%$ of reading + 0.3mA) [Note 2]	
With option A118014 (HF HV, 2.5kV/200mA)	Output Voltage Reading	0.05kV ~ 2.50kV, $\pm(4\%$ of reading + 0.01kV) [Note 2]	--
	Output Current Reading	0.5mA ~ 200.00mA, $\pm(3\%$ of reading + 0.5mA) [Note 2]	
With option A118016 (HF HV, 250V/2A)	Output Voltage Reading	5.00V ~ 250.0V, $\pm(4\%$ of reading + 1V) [Note 2]	--
	Output Current Reading	0.02A ~ 2.00A, $\pm(3\%$ of reading + 0.01A) [Note 2]	
With option A118018 (HF HV, 1kV/1A)	Output Voltage Reading	--	0.05kV - 1.00kV, $\pm(4\%$ of reading + 0.01kV) [Note 2]
	Output Current Reading		0.01A - 1.00A, $\pm(3\%$ of reading + 10mA) [Note 2]
With option A118015 (HF HC, 33V/30A)	Output Voltage Reading	--	0.10V - 33.0V, $\pm(4\%$ of reading + 0.15V) [Note 2]
	Output Current Reading		0.1A - 30.00A, $\pm(3\%$ of reading + 0.1A) [Note 2]
<b>Control Function</b>			
Timer	1 min ~ 10000 hour, 30min error per year 0.1 sec ~ 999.9 sec		
Display	320 X 240 dot-matrix LCD display		
Operation	Start, Stop, Continue		
Protection	OCP, OTP, Over Load		
<b>General</b>			
Operation Environment	Temperature : 10°C~ 40°C, Humidity : < 90% RH		
Power Consumption	2700 VA max.		3000 VA max.
Power Requirement	220Vac $\pm 10\%$ ; 48 Hz ~ 62 Hz		
Weight	Approx. 32 Kg		
Dimension (W x H x D)	440 x 241.5 x 609.8 mm		

Note 1: Under rated load and voltage correction is well performed.

Note 2: For test frequency above 100kHz, multiply the accuracy error by 2 times.

All specifications are subject to change without notice.



# MILLIOHM METER

## MODEL 16502

The 16502 Milliohm Meter is Chroma's newest digital Milliohm Meter. With a basic accuracy of 0.05% the instrument offers a  $0.001\text{m}\Omega$  ~ $1.9999\text{M}\Omega$  wide measurement range. It provides measurement range with 4 1/2 digits resolution. The fast measurement time is 65 ms. It suits component evaluation on production line.

The 16502 Milliohm Meter provides three kinds of mode for the different material applications. Pulsed test current output mode is used to reduce thermal EMFs affection on milliohm measurement. DC test current output mode is used to fasten measurement speed for inductive DUT. Dry-circuit test current output mode is used to measure such contact resistances where the maximum open-circuit voltage must be limited to 20mV. DC, Pulsed, and Dry-circuit test current driving modes, enable the 16502 can be properly used in DC resistance measurement for various inductive components (coil, choke, and transformer winding etc.), cable, metallic contact (connector, relay switch etc.) and conduction materials.

The 16502 provides temperature correction function. Temperature correction (TC function) without regarding to material or temperature. Users usually get different resistance value with different ambient temperature. Conventional units have the temperature correction using a copper wire at 20 °C only, but 16502 provides the converted values regardless of material or temperature.

The 16502 offers temperature conversion function. It is helpful temperature conversion function for motor / coil evaluation. Users usually should not take the motor / coil temperature through touch the surface directly when the motor just stops. The temperature conversion function shows the temperature (t) or increase in temperature ( $\Delta t$ ) of motor / coil, deriving the values from the measured resistance of the motor / coil and the ambient temperature. It is helpful for user to do the temperature evaluation of motor / coil.

The 16502 provide the menu list on front panel of LCD Display, and the programming assure that low resistance measurements can be made quick and easy. Provides a programmable Hi/Lo comparator function in absolute value or %, as well as 8 sorting bins for categorization of components.

For measurement integrity, contacting to the test device is made via a 4-terminal Kelvin connection that incorporates an automatic zeroing function to compensate for lead errors.

Standard RS232 interface, optional GPIB & Handler interface, high speed and stable measurement capabilities enable 16502 can be used for both component evaluation on the production line and milliohm measurement for bench-top applications.



# MILLIOHM METER

## MODEL 16502

### Key Features

- Basic accuracy : 0.05%
- Pulsed test current output mode is used to reduce thermal EMFs affection on milliohm measurement
- DC test current output mode is used to fasten measurement speed for inductive DUT
- Dry-circuit test current output mode (limited Max. 20mV) is used to measure such contact resistances where the maximum open-circuit voltage must be limited to 50mV
- Temperature correction (TC function) regardless of material or temperature
- Useful temperature conversion function for motor/ coil evaluation
- 4 channels R scan with balance check function for fan motor (combined with A165017 option)
- $0.001\text{m}\Omega$  ~ $1.9999\text{M}\Omega$  wide measurement range with 4½ digits resolution
- Standard RS-232 interface
- Optional GPIB & Handler interface
- Bin-sorting function
- Comparator and pass/fail alarming beeper function
- Large LCD display (240 x 64 dot-matrix)
- Friendly user interface
- LabView® Driver



## SPECIFICATIONS

Model		16502
<b>Range Basic Measurement Accuracy *1; Test Current</b>		
20m $\Omega$		$\pm$ (0.1% of reading + 0.03 % of range) ; 1A typical
200m $\Omega$		$\pm$ (0.05% of reading + 0.03 % of range) ; 100mA typical
2 $\Omega$		$\pm$ (0.05% of reading + 0.03 % of range) ; 10mA typical
20 $\Omega$		$\pm$ (0.05% of reading + 0.03 % of range) ; 1mA typical
200 $\Omega$		$\pm$ (0.05% of reading + 0.02 % of range) ; 1mA typical
2k $\Omega$		$\pm$ (0.05% of reading + 0.01 % of range) ; 1mA typical
20k $\Omega$		$\pm$ (0.1% of reading + 0.01 % of range) ; 100 $\mu$ A typical
200k $\Omega$		$\pm$ (0.2% of reading + 0.01 % of range) ; 10 $\mu$ A typical
2M $\Omega$		$\pm$ (0.3% of reading + 0.01 % of range) ; 1 $\mu$ A typical
<b>Test Signal</b>		
Drive Mode		DC+, DC-, Pulsed+, Pulsed -, Pulsed $\pm$ , Stand by
Dry Circuit		Open Circuit Voltage less than 20mV; for 200m $\Omega$ , 2 $\Omega$ , 20 $\Omega$ ranges only
<b>Measurement Time *2</b>		
Fast		65ms
Medium		150ms
Slow		650ms
<b>Temp. Correction / Conversion Function</b>		
Temp. Measurement Accuracy (Option)	-10.0 $^{\circ}$ C ~ 39.9 $^{\circ}$ C	$\pm$ (0.3% of reading+0.5 $^{\circ}$ C) *3
	40.0 $^{\circ}$ C ~99.9 $^{\circ}$ C	$\pm$ (0.3% of reading+1.0 $^{\circ}$ C) *3
Temp. Sensor Type (Option)		PT100/ PT500
<b>Interface &amp; I/O</b>		
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		0~9999ms
<b>Trigger</b>		Internal, Manual, External, BUS
<b>Display</b>		240 x 64 dot-matrix LCD display
<b>Correction Function</b>		Zeroing
<b>General</b>		
Operation Environment		Temperature : 10 $^{\circ}$ C~40 $^{\circ}$ C, Humidity : < 90 % R.H.
Power Consumption		80 VA max.
Power Requirement		90 ~ 132Vac or 180 ~ 264Vac, 47 ~ 63Hz
Dimension (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 $^{\circ}$ C after Zeroing correction. Slow measurement speed. Refer to Operation Manual for detail measurement accuracy descriptions.

**Note\*2** : Measurement time includes sampling, calculation and judge test parameter measurement.

**Note\*3** : Not include temp. sensor accuracy

## Inductor Test and Packing Machine

### MODEL 1870D Series

#### KEY FEATURES

- Test and packing speeds from 80ppm to 1,800ppm
- Standard functions
  - Inductance/quality factor test
  - Winding resistance test
  - Polarity test
- Optional functions
  - Layer short test
  - Insulation resistance test
  - Bias current test
- Circular vibrating plate design feeds inductors steadily and rapidly
- Index disc design eliminates dropped inductors
- Four-wire measurement test socket design
- Automatic discharge mechanism when feeding errors occur
- Each test station has an independent NG (No Good) product collection box
- Test without packaging function provided, good products gathered in bulk collection box
- Exclusive data collection software designed for monitoring product quality in real time
- Reserved stations for number spraying and automatic optical inspection
- Switchable Chinese/English/Japanese operating interface
- Equipment is fast, stable and safe

## INDUCTOR TEST AND PACKING MACHINE MODEL 1870D SERIES

The 1870D Series (1870D/1870D-12) are specifically designed automated test equipment for wafer-type power inductors. It comprises various test functions that are required for verifying wafer-type power inductors. In addition, an automated tape packaging machine at the end of production line is equipped to fulfill demand for automated manufacturing.

The standard test functions of 1870D series are inductance (Ls)/quality factor (Q), winding resistance(RDC) measurements and polarity tests, along with optional layer short (IWT), insulation resistance (IR) and BIAS current tests that cover all test items for measuring wafer-type power inductor quality and standard specifications.

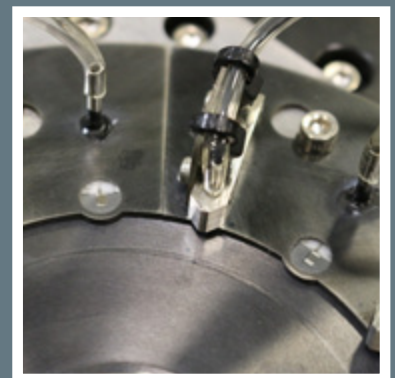
As miniature inductors are widely used in the electronic products today, mass production of power inductors is necessary. The production capacity of 1870D/1870D-12 is up to 1,800 ppm, which can satisfy the quantity demanded. Besides testing, the 1870D/1870D-12 is also equipped with an automated packaging machine to tape and pack the inductors mechanically in order to meet the desired style of SMD production lines.

The 1870D/1870D-12 uses a circular vibrating plate that carries thin products at high speed for feeding. The circular vibrating plate uses a guide rail design, fiber detection and blow hole to determine the feed direction. This is fast and space saving when compared to traditional linear reciprocating mechanical feeders.

When moving inductors for testing, the traditional reciprocating or turret-type mechanical structure uses a nozzle to attract the inductor for movement, and the product often drops due to inertial effects or inaccurate positioning making it unable to test. The 1870D/1870D-12 uses an index disc design for testing, so that the equipment is within a closed architecture that can eliminate dropped inductors during high-speed movement. It is faster and more stable when compared to the traditional mechanical structure.

ATE Inc. not only specializes in electronic testing technology but are also masters in fixture design for automated test equipment. The test socket used by the 1870D/1870D-12 test station is a four-wire measurement design that is more accurate and stable than common automatic test equipment. The chip design applied to the connection of the test socket and inductor is easier to contact and has longer product life compared to a probe in use. The chip design is also more stable and easier to maintain than a probe.

The 1870D/1870D-12 has exclusive software for monitoring test status during production in real time, and saving the collected test data for each inductor. Real-time monitoring functions can benefit the production unit by reducing the production risk during manufacturing and cut down unnecessary working hours. The data collection function is favorable to R&D and QA units for product analysis and quality control.



## SPECIFICATIONS

1870D Application Size Maximum Productivity										Unit : pcs/min
W x D (mm)	3.2 x 2.5		2.5 x 2.0		2.0 x 1.6 / 2.0 x 1.2			1.6 x 0.8		
H (mm)	1.2	1.0	1.2	1.0	1.2	1.0	0.8	1.0	0.8	0.6
Single-sided electrode	600	600	800	800	800	800	1,000	800	800	1,200
Five-sided electrodes	900	900	1,200	1,200	1,500	1,500	1,500	1,500	1,500	1,800

\* The maximum productivity listed above does not include layer short testing, insulation resistance testing, or bias current testing.

\* Production efficiency >1,200 pcs/min with paper tape used for packing. Do not use plastic tape.

\* Above is the using efficiency of single size. Additional assessment is required for different size.

1870D-12 Application Size Maximum Productivity						Unit : pcs/min				
W x D (mm)	4.0x4.0		6.0x6.0		8.0x8.0		10.0x10.0		12.0x12.0	
Single-sided electrode	250		200		150		100		80	

\* Above maximum production efficiency does not include IWT test, IR test and BIAS I test.

\* Above is the using efficiency of single size. Additional assessment is required for different size.

General Specifications	
Power requirement	Single phase 220V, frequency 50 Hz / 2.0kW
Air pressure system	CDA pressure 5~6 kg/cm <sup>2</sup> ; CDA flow: 150~200 L/min
Operating environment	8~38°C ; < 70%RH
Weight	approx. 450 kgs
Dimension (W x H x D)	1192 x 1660 x 1000 mm

# INDUCTOR LAYER SHORT ATS MODEL 1871

The 1871 is an automatic test system specifically designed for chip inductors in testing layer short for mass production applications. This system inherits all judgment functions from the 19301A impulse winding tester including Area, Laplacian, and two new test functions -  $\Delta$  Peak Ratio and  $\Delta$  Resonant Area.

As miniature inductors are widely used in the electronic products today, mass production of power inductors is necessary. The production capacity of 1871 is up to 1,500ppm, which can satisfy the quantity demanded. It uses 5 layer short test stations to conduct the testing at one time for fast production. Alternatively, it can select 2 layer short test stations for R&D or QA unit use to run in a cost-effective way.

The 1871 uses a circular vibrating plate that carries thin products at high speed for feeding. The circular vibrating plate uses a guide rail design, fiber detection and blow hole to determine the feed direction. This is fast and space saving when compared to traditional linear reciprocating mechanical feeders.

When moving inductors for testing, the traditional reciprocating or turret-type mechanical structure uses a nozzle to attract the inductor for movement, and the product often drops due to inertial effects

or inaccurate positioning making it unable to test. The 1871 uses an index disc design for testing, so that the equipment is within a closed architecture that can eliminate dropped inductors during high-speed movement. It is faster and more stable when compared to the traditional mechanical structure.

ATE Inc. not only specializes in electronic testing technology but also masters in fixture design for automated test equipment. The test socket used by the 1871 is a four-wire measurement design that is more accurate and stable than common automatic test equipment. The chip design applied to the connection of the test socket and inductor is easier to contact and has longer product life compared to a probe in use.

The 1871 has exclusive software for monitoring test status during production in real time, and saving the collected test data for each inductor. Real-time monitoring functions can benefit the production unit by reducing the production risk during manufacturing and cut down unnecessary working hours. The data collection function is favorable to R&D and QA units for product analysis and quality control. The software can perform data analysis to improve the product quality and increase profit.

## MODEL 1871

### KEY FEATURES

- Applicable size 3.2mm x 2.5mm to 1.6mm x 0.8mm
- Test and packing speeds from 600ppm to 1500ppm
- Layer short judgment functions:
  - Area
  - Laplacian
  - $\Delta$  Peak Ratio
  - $\Delta$  Resonant Area
- Equipped with contact check function to extend the fixture lifespan.
- Provides from 2 to 5 test stations for ATS selections based on testing requirements.
- Index disc design eliminates dropped inductors
- Four-wire measurement test socket design.
- Each test station has an independent NG (No Good) product collection box.
- Exclusive data collection software designed for monitoring product quality in real time
- Switchable Chinese/English/Japanese operating interface
- Equipment is fast, stable and safe



## SPECIFICATIONS

1871 Application Size Maximum Productivity										Unit : pcs/min
WxD(mm)	3.2 x 2.5		2.5 x 2.0		2.0 x 1.6 / 2.0 x 1.2			1.6 x 0.8		
H(mm)	1.2	1.0	1.2	1.0	1.2	1.0	0.8	1.0	0.8	0.6
Single-sided electrode	600	600	800	800	800	800	800	800	800	800
Five-sided electrodes	900	900	1,200	1,200	1,500	1,500	1,500	1,500	1,500	1,500

\* The maximum productivity listed above does not include layer short testing, insulation resistance testing, or bias current testing.

General Specifications	
Power requirement	Single phase 220V ; frequency 60 Hz / 2.0kW
Air pressure system	CDA Pressure 5~6 kg/cm <sup>2</sup> , CDA Flow150~200 L/min
Operating environment	8~38°C , < 70%RH
Weight	Approx. 500 kg
Dimension (W x H x D)	W 1280 x H 1495 x D 900 mm

\*All specifications are subject to change without notice.

## HIGH PERFORMANCE HARDWARE DEVICES

### LCR METER

The 11022 LCR Meters are the measurement instruments for passive components. They are applicable to the automatic manufacturers for passive components in material inspection. With the features of 21ms high-speed measurement and 0.1% accuracy, 11022 LCR Meter fulfills the requirements for fast production. Its functions of 8-level counting, pass/fail judgment, and 50 sets of internal save and recall settings totally meet the production line requirements for easy operation.

The four impedance output modes can measure the results with the LCR Meters of other brands to get a common measurement standard. The measurement results can also be compared with other brand of LCR Meters. Chroma11022 is the ideal selection for passive components quality assurance and automatic production.



Model	11022
Test Parameter	L, C, R,  Z , Q, D, ESR, X, $\theta$
<b>Test Signals</b>	
Level	10 mV~1V, step 10 mV; $\pm (10\% + 3 \text{ mV})$
Frequency	50Hz, 60Hz, 100Hz, 120Hz, 1kHz, 10kHz, 20kHz, 40kHz, 50kHz, 100kHz; $\pm 0.01\%$
<b>Measurement Display Range</b>	
C (Capacitance)	0.001 pF ~ 1.9999F
L, M, L2 (Inductance)	0.001 $\mu$ H ~ 99.99kH
Z (Impedance), ESR	0.01m $\Omega$ ~99.99M $\Omega$
Q (Quality Factor)	0.0001 ~ 9999
D (Distortion Factor)	
$\theta$ (Phase Angle)	-180.00° ~ +180.00°
<b>Basic Measurement Accuracy (Note1)</b>	$\pm 0.1\%$
<b>Measurement Time (Fast) (Note2)</b>	21ms

Note 1 :  $23 \pm 5^\circ \text{C}$  after OPEN and SHORT correction. Slow measurement speed. Refer to Operation Manual for detail measurement accuracy descriptions

Note 2 : Measurement time includes sampling, calculation and judge of primary and secondary test parameter measurement.

### CAPACITOR LEAKAGE CURRENT/ IR METER

The 11200 Capacitor Leakage Current/IR Meter is Chroma's newest digital leakage current meter. It provides DC 1~650 V, 0.5mA~500mA (150mA for V>100V) DC power source. It is mainly used for electrolytic capacitor leakage current testing, and aluminum-foil withstand voltage testing (EIAJ RC-2364A). And, it also can be used for active voltage checking or leakage current testing of absorber, Zener diode, and Neon lamp among others. Standard RS232 interface, optional GPIB & Handler interface, high speed and stable measurement capabilities enable the 11200 be used for both component evaluation on the production line and fundamental leakage current testing for bench-top applications.

Model	11200 (650V)	
Main Function	Capacitor Leakage Current / IR Meter	
Test Parameter	LC, IR	
<b>Test Signals Information</b>		
Voltage	1.0 V~100 V, step 0.1 V; 101V~650 V, step 1V; $\pm (0.5\% + 0.2\text{V})$	
Charge Current Limit	V $\leq$ 100V: 0.5mA~500mA V > 100V: 0.5mA~150mA, 65W max. step 0.5mA; $\pm (3\% + 0.05\text{mA})$	
Measurement Display Range	LC : 0.001 $\mu$ A~20.00mA	
Basic Measurement Accuracy (Note)	LC Reading : $\pm (0.3\% + 0.005 \mu\text{A})$	
Measurement speed	Fast	77 ms
(Ext. Trigger, Hold Range, Line Frequency 60Hz)	Medium	143 ms
	Slow	420 ms
<b>Function</b>		
Correction	Null zeroing	
Test Voltage Monitor	Vm: 0.0 V~660.0V; $\pm (0.2\% \text{ of reading} + 0.1\text{V})$	
Charge Timer	0~999 Sec.	
Dwell Timer	0.2~999 Sec	

**Note :**  $23 \pm 5^\circ \text{C}$  after Null correction. Refer to Operation Manual for detail measurement accuracy descriptions.



## COMPONENT TEST SCANNER

13001 component test scanner performs switch and scan tests for L, C, R and other measurements combined with LCR Meter ( 3302/3252/11022/11025) including turn ratios, if the model has it, and IR test combined with 11200 CLC / IR Meter. It also offers short function for leakage inductance measurement. One unit can accommodate plug-in modules up to 8 slots. It can be up to 320 channels for one unit if combined with 8 optional A1130007 40 channels modules. It provides master and slave designs and up to 8 slave units for a multiple scanner. Users can control the output test circuit through RS232, GPIB or USB interfaces.



<b>Model</b>	<b>13001 (MASTER &amp; SLAVE)</b>
Mode	SCAN
Interface (Master only)	RS232 , USB , GPIB
<b>General</b>	
Operation Environment	Temperature: 0°C ~ 45°C, Humidity: 15% to 80% R.H@ ≤ 40°C
Power Consumption	150VA Max. (with rated load)
Power Requirements	90 ~ 132Vac or 180 ~ 264Vac, 47 ~ 63Hz
Weight	Approx.20Kg (13001 main frame only, without module)
Size(WxHxD)	About 430mm x 311mm x 570mm



# Magnetic Component Test System

Model No.

# 1810



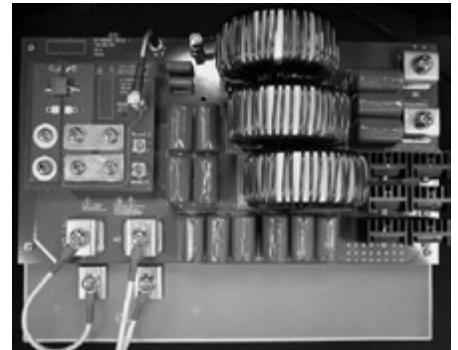
Magnetic component's heat comes from copper loss and iron loss. The copper loss caused by flowing current and wire resistance. The iron loss including Hysteresis Loss and Eddy Current Loss, mainly comes out from AC current. The inductance of magnetic component will drop unexpectedly if the temperature gets too high.

1810 is a test system for detecting the power loss of magnetic component. It provides DC current and AC voltage to the component, and it has a temperature sensor detects the temperature on component. The analysis reports will record the result in computer by using test program. These statistic analysis reports are important for researching and quality control department.

## Magnetic Component Test System Model 1810

### KEY FEATURES

- Sine Wave Voltage : 20kHz~500kHz
- High Frequency Current Step-up Module : 30A/16V max., 30A/33V/16V max.
- High Frequency Voltage Step-up Module : 250V/2A max.
- 60A max DC Bias Current
- Power Consumption Detection
- Temperature Detection
- Statistic Report with Software Control



A118026 + A118019

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