



LCR Meter

HIOKI

1993



Measures small inductances down to 0.01 μ H precision

Dedicated inductance measurement in 70 ms

3510

L HITESTER



The test fixture is sold separately.

Great improvements in produc

There is always a demand for faster production line testing, and faster test equipment is the sine qua non of reduced test times. The 3510 provides inductance measurement in 70 ms, greatly improving on existing test times for inductance measurement.

The 3510 measures inductance values down to $0.01 \mu\text{H}$. It also measures the dissipation (loss factor) to four places of decimals and also provides a corresponding Q indication (1/D). As a

dedicated inductance tester, the notebook-sized unit has a reduced number of switches, and extremely simple operation. It includes a comparator function and a

monitoring function for applied voltage and measurement current. This production line effectiveness combines with high accuracy for a first grade tester.

HIOKI 3510 L HITESTER

L 18.19 μH D 0.1234

AV EXT COMP
OPEN SHORT RMT TLK
HI Ln

UNKNOW $\pm 40\text{V DC MAX}$

CUR L POT HPOT H CUR

COMP SET ON-OFF SAVE

RANGE
SER/PAR
INT/EXT
DISP
OPEN
D/Q

TRIG
AUTO
MANU
MONI
OSC
ADJ
SHORT
LIMIT
SAVE

- Dedicated inductance tester, with dissipation (loss factor) measurement
- Measurement time 70 ms
- Built-in comparator
- Dissipation indication accurate to four places of decimals
- Monitoring function (applied voltage and measurement current)
- Lightweight, notebook-size unit
- Simple operation
- Key lock function
- GP-IB interface (option)

Values measured

Inductance (L): The measurement frequency is fixed at 1 kHz. The lowest range provides $0.01 \mu\text{H}$ precision, allowing accurate measurement of very small inductances.

Dissipation (D): An accurate read-out, providing four places of decimals when the averaging function is being used. The Q display value ranges from 0.5 to 999.9.

Fast measurement for production line efficiency

Measurement time is 70 ms. Faster measurement means higher production line speed, and greater overall testing efficiency.

Simple operation and small lightweight unit

As a dedicated inductance tester, the notebook-sized unit has a reduced number of switches, and even simpler operation.

tion line testing throughput

Comparator function for measuring deviations

Comparator results are shown as "Hi", "In" or "Lo" and are also echoed as result signals from the EXT I/O connector on the rear panel. The comparator function can also be used to measure the numerical value of the deviation from a reference value.

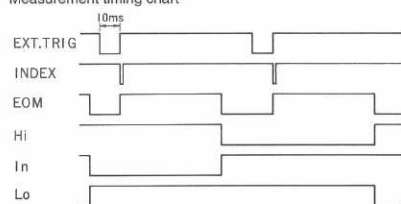
The comparator function can be used in the following combinations:

- Comparison of L value only
- Comparison of D value only
- Comparison of Q value only
- Comparisons of L and D values
- Comparisons of L and Q values (Selecting one of D or Q automatically deselects the other.)

External trigger

An external trigger signal can be used to start measurement, for automated testing, and easy integration with other test equipment.

Measurement timing chart



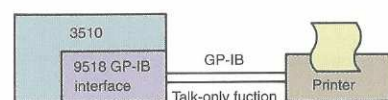
* 57 series 24-pin connector

Key lock function

This disables all the front panel keys (excluding the MANU key under external trigger operation), preventing inadvertent misoperation.

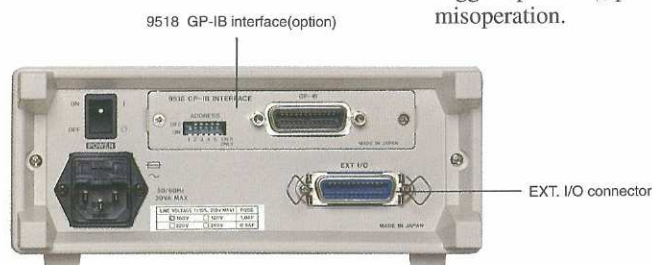
GP-IB interface (option)

This complies with IEEE 488.1-1987 and is designed with reference to IEEE 488.2-1987. Using the talk-only function, this unit can be connected directly to a printer with a listen only function, without requiring a separate controller.



Pringing example of talk-only function used

```
L + 21.24 E -03 ; D + 0.0012 E + 00
L + 21.24 E -03 ; D + 0.0012 E + 00
L + 21.24 E -03 ; D + 0.0012 E + 00
L + 21.24 E -03 ; D + 0.0013 E + 00
L + 21.24 E -03 ; D + 0.0013 E + 00
L + 21.24 E -03 ; D + 0.0012 E + 00
L + 21.24 E -03 ; D + 0.0011 E + 00
```



External on/off control of comparator function

The comparator function can be switched on and off remotely through a rear panel connection.

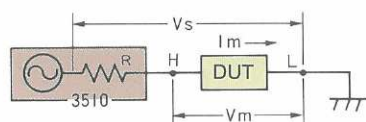
EXT I/O connector pin assignments

Pin no.	Pin no.
External DC power supply +Vin 13	1 External DC power supply +Vin
L-In 14	2 L-HI
D/Q - Hi 15	3 L - Lo
D/Q - Lo 16	4 D/Q - in
17	5(L - D/Q) - AND
Measurement ended (EOM) 18	6 Measurement error (ER)
19	7 Analog measurement ended (INDEX)
20	8
21	9
External trigger in * 22	10 Comparator on **
External supply GND in 23	11 External supply GND in
Internal DC supply COMout 24	12 Internal DC supply +Vout

* EXT. TRIG.
** COMP ON

Monitoring function

It is possible to monitor the applied voltage and measurement current.



Vs: Measurement signal level
Vm: Monitor voltage, 1m: Monitor current
R: Output impedance (depends on the measurement range - 10 to 100kΩ)
DUT: Device under test

Backup of settings

When the unit is powered off, the current settings of measurement conditions are held in memory, and reinstated when the unit is next powered on.

Range of probes and test fixtures for different applications

9261 test fixture
General-purpose four-lead fixture. The 1-meter cable length gives excellent operability.



9140 four-terminal probe
A four-lead probe with a 1-meter cable.



9143 pincher probe
For testing chips and other board-mounted components.



Note: Measurement range are restricted.

Specifications

Items measured: inductance (L), dissipation (D) and Q(1/D)
 Measurement circuit: series equivalent circuit or parallel equivalent circuit, manual or automatic (linked to range)
 Measurement frequency: 1 kHz (accuracy $\pm 0.01\%$)
 Measurement signal level: $10\ \mu$, $100\ \mu$, 1m, 10 m or 50 mA, depending on range. 1 V when open circuit.
 Output impedance: 100 k, 10 k, 1 k, 100 or 10 Ω , depending on range.
 Range switching: automatic or manual
 Display:
 LED display
 L- 3 1/2 digit, D- 4 1/2 digit (high-speed 3 1/2 digit), Q- 4 digit, frequency and monitor- 2 digit or 3 digit
 Measurement terminal: 5 terminals (Hc, Hp, Lp, Lc, GUARD), BNC terminal
 Monitor function: Voltage between terminals, accuracy $\pm 3\%$ rdg. ± 0.02 V
 Measurement current, accuracy $\pm 3\%$ rdg. ± 5 dgt.
 Trigger functions: internal (high-speed, averaging), external or manual (high-speed, averaging)

Zero adjustment function: short-circuit compensation and open-circuit compensation
 Comparator: "Hi", "In" and "Lo" indications for each of capacitance and dissipation results
 Control interface (57 series 24-pin connector, all pins isolated)
 Outputs: L Hi, L In, L Lo, D/Q Hi, D/Q In, D/Q Lo, AND of L-D/Q, INDEX (analog measurement completed), EOM (measurement completed)
 Inputs: trigger, comparator on/off
 Power supply output: internal 5 V and GND
 Power supply input: external Vcc and external GND
 Key lock function: fixes settings of all operating switches
 Measurement times: 70 ms approx. (high-speed: from external trigger input to EOM output, excluding circuit settling time); for averaging processing 450 ms.
 Interfaces:
 GP-IB interface (option)
 Complies with IEEE 488.1-1987
 Designed with reference to IEEE 488.2-1987
 EXT I/O for comparator
 Insulation resistance and withstand voltage: at least 100 M Ω at 500 V DC (frame to power

supply); 1.5 kV AC for 1 minute
 Operating temperature range: 0 $^{\circ}$ C to 40 $^{\circ}$ C, maximum relative humidity 80% (no condensation)
 Power supply: 100/120/220/240 V AC $\pm 10\%$, 50/60 Hz (specified on order)
 Power consumption: 20 VA max. (with GP-IB in use)
 Dimensions and weight: 88 mm H \times 218 mm W \times 298 mm D; 2.8 kg approx. (including GP-IB)
 Accessories: power cord, 3-pin/2-pin power adaptor, spare 1 A fuse for power supply

Note

The 3510 is not provided with a test fixture. Please purchase an optional test fixture

Optional accessories

9261 test fixture
 9140 four-terminal probe
 9143 pincher probe
 9518 GP-IB interface*
 9151-02 GP-IB connector cable (2 m)
 9151-04 GP-IB connector cable (4 m)

* Please note that the 9518 is designed for (easy) user fitting. Even when ordered together with the 3510, it will be shipped in a separate carton.

Measurement ranges and accuracy

Standard measurement conditions: 23 $^{\circ}$ C ± 5 $^{\circ}$ C, maximum 80% R.H. (no condensation). Wait 30 minutes after powering on, then carry out zero adjustment (outside 0 $^{\circ}$ C to 40 $^{\circ}$ C the tolerances are doubled); figures are for dissipation D ≤ 0.1 , using a 9261 test fixture.
 When D ≥ 0.1 , the accuracy tolerance for inductance is multiplied by $\sqrt{1+Dx^2}$, and the tolerance for D is multiplied by $\sqrt{1+Dx}$, where Dx is the displayed value for D.

Range	20.00 μ H	200.0 μ H	2.000 mH	20.00 mH	200.0 mH	2.000 H
Equivalent circuit						
Output impedance	10 Ω	100 Ω	1 k Ω	10 k Ω	100 k Ω	100 k Ω
Measurement signal	50 mA	10 mA	1 mA	100 μ A	10 μ A	10 μ A
Display range for inductance (auto)	0 ~ 1819	162 ~ 1819 dgt.				
Display range for dissipation (auto)	Averaging processing 0.0001 to 1.9999 (high-speed measurement 0.001 to 1.999/999.9 to 0.5)					
Inductance accuracy *2	$\pm (1 + 16/Lm) \%$ rdg. ± 20 dgt.	$\pm 0.3\%$ rdg. ± 4 dgt.				$\pm 0.8\%$ rdg. ± 5 dgt.
Dissipation accuracy *3 (Q=1/D)	* 1	$\pm 0.3\%$ rdg. $\pm (4 + 800/Lx)$ dgt.				$\pm 0.8\%$ rdg. $\pm (4 + 800/Lx)$ dgt.
Equivalent circuit (auto)						

*1 {(The value of % accuracy of L $\times 10$) + 20} dgt.

*2 Table shows inductance accuracy when using averaging. For high-speed measurement, multiply margin by 3.

Lm indicates inductance (μ H)

*3 Dissipation accuracy:

When using averaging, multiply reading by 10 (resolution 0.0001).

For high-speed measurement, multiply reading by 4 (resolution 0.001).

Lx indicates measured value of L.

200.0 mH	2.000 H	20.00 H	200.0 H	Equivalent circuit (auto)
Range				
Equivalent circuit				
10 Ω	100 Ω	1 k Ω	10 k Ω	Output impedance
1 V				Measurement signal
162 ~ 1819 dgt.				Display range for inductance (auto)
Averaging processing 0.0001 to 1.9999 (high-speed measurement 0.001 to 1.999/999.9-0.5)				Display range for dissipation (auto)
$\pm 0.4\%$ rdg. ± 4 dgt.		$\pm 1.5\%$ rdg. ± 4 dgt.		Inductance accuracy *2
$\pm 0.5\%$ rdg. $\pm (4 + Lx/200)$ dgt.		$\pm 1.5\%$ rdg. $\pm (4 + Lx/200)$ dgt.		Dissipation accuracy *3 (Q=1/D)

Note: The output impedance of the unit switches with the range, from 10 Ω to 100 k Ω (see table of ranges). Therefore, because of current dependency at the fixed measurement signal level of 1 V, depending on the range, this unit may provide different readings from a 100 Ω fixed impedance unit (Hioki 3530 or 3521) or 20 Ω fixed impedance unit (Hioki 3520 or 3521).

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