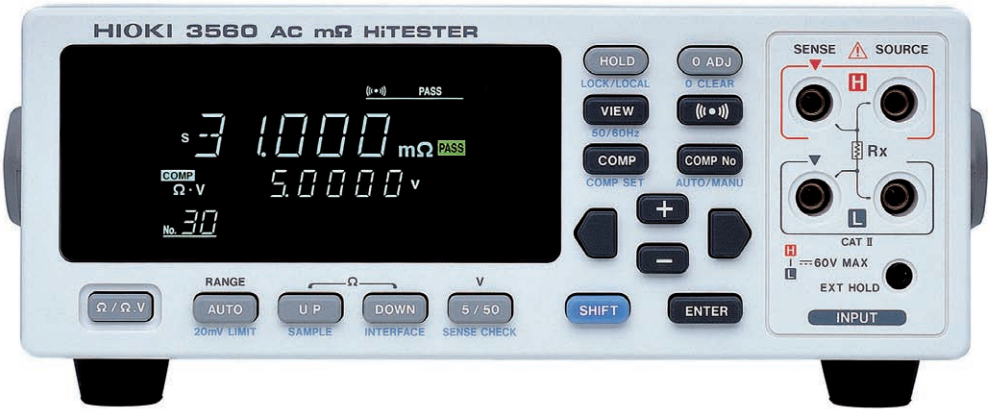
HIOKI

AC mΩ HiTESTER 3560

Components measuring instruments



CE

Contact resistance meter with high-speed response

Meeting measurement requirements from contact resistance to internal resistance and voltage of batteries.

This contact resistance meter complete with comparator function and external interface utilizes the principles of the AC 4-terminal method that gives priority to line use and allows measurement offering high speed, high accuracy and high resolution.
External output terminal, external control terminal and RS-232C interface are standard features. GP-IB interface and printer interface are optionally available. The instrument also features an Ω and V mode that offers simultaneous measurement and comparison of battery internal resistance and open-circuit voltage, making it highly suitable for battery inspection lines as one unit can act as both a low-resistance meter and DMM.

ISO 9001 JMI-0216
ISO14001 JQA-E-90091

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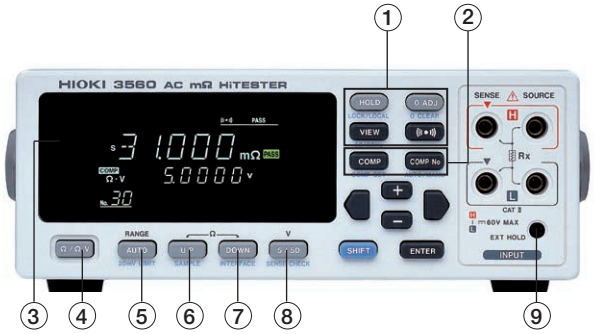
Rapid response time - approximately 84 ms (60 Hz)

■ Intuitive Operation Interface



1. HOLD button (press to hold the measurement value on the display, as well as to control measurement using the trigger)
   VIEW button (press to check comparator conditions using a one-touch operation, as well as to set the power supply frequency)
   Executes zero adjustment and switches the buzzer ON/OFF
2. COMP button (press to switch the comparator ON/OFF, as well as to enter condition setting mode)
   COMP No. button (press to select the comparator table and result output trigger)
3. Clearly visible display employing fluorescence display tube
4. Switches between the resistance and resistance/voltage measurement modes
5. Switches the auto range or the open terminal voltage limiter ON/OFF
6. Raises the range and switches the sampling rate
7. Lowers the range and switches between the RS-232C and the GP-IB interface mode
8. Switches the voltage range, and the sense check function ON/OFF
9. External hold terminal

Features

● Fast measurement and fast quality determination

In the FAST mode, the instrument performs lightning fast measurements at 60 times/sec with a response time of about 84 ms (at 60 Hz) to reduce the line tact time. This helps increase mass-production efficiency. The comparator has memory for 30 configuration tables which enables one unit to perform quality determination of many measurement objects all having different characteristics.

● Low-power resistance measurement

Conduct low power resistance measurements according to the IEC 512-2 standard. Accurately measure contact resistance without destroying the oxide film on contact surfaces of components such as relays and connectors.

● Battery measurement

Since DC voltage measuring can be performed simultaneously, the **3560** can also be applied to measure open-circuit voltage of batteries. One unit can measure both internal resistance and open-circuit voltage for complex quality evaluation. Furthermore, using the voltage limiter OFF function enables even more stable measurement of battery internal resistance.

● High-resolution measuring

High-resolution measurement of 1 $\mu\Omega$ in the 30 mΩ range.

● Sense check function for prevention of erroneous measurements

Earlier instruments only perform sense check on the source side, but the **3560** unit also conducts a check on the sense side to guarantee against erroneous measuring and wrong evaluation.

● PC interfaces

RS-232C interface and external control terminal are standard features. Printer interface and GB-IP interface are available as options.

● Comfortable operation

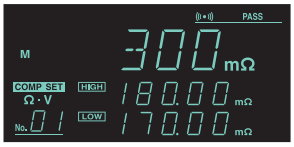
The number of switch operations has been reduced to achieve simple and intuitive operation.

● Versatile array of leads

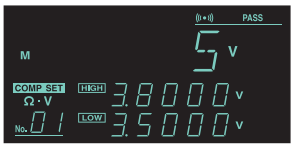
A wide selection of test leads, such as clip leads, pin leads and 4-terminal leads, are available, allowing you to select the most suitable type for the component to be measured.

■ Comparator Function

Two settings are available in the resistance measurement mode: the upper limit and lower limit value settings. In the low-resistance and voltage measurement mode, the upper limit and lower limit value settings can be made separately for the two measurement items. When both are determined as IN, PASS is indicated, in other cases FAIL is indicated. In addition to the Hi/IN/Lo and PASS/FAIL indications, the results can also be signaled by a buzzer and output via an open-collector output.
Up to 30 comparator configuration tables can be memorized, each storing settings for a measurement mode, measurement range, upper and lower limit values and a buzzer mode.



Resistance comparator value setting



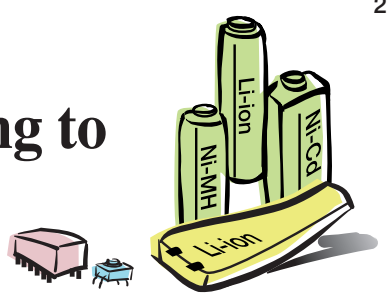
Voltage comparator value setting

Buzzer mode setting

■ Comparator setting example

Resistance range 300 mΩ (upper limit value 180.00 mΩ/lower limit value 170.00 mΩ), voltage range 5 V (upper limit value 3.8000 V/lower limit value 3.5000 V), Table No.1, buzzer set to sound for PASS.

High-Speed Measurement Contributing to Super Efficient Production Lines

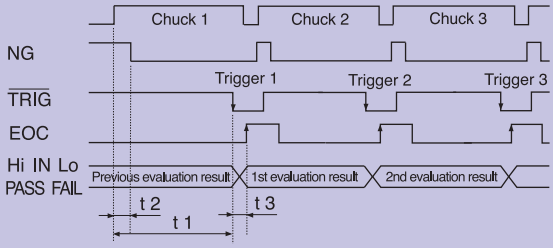


■ Designed for System Use

Utilize the built-in external control terminal to select the comparator table, as trigger and for requesting printout, etc. The external output can be used for output of comparator results, measurement completion (EOC) and NG output. These external input and output capabilities have been designed with systems integration in mind.

Timing Chart Example

The following shows a timing example for reading out the comparator results using the HOLD function and external input and output features.



t1: Approx. 80 ms (FAST 60 Hz), approx. 660 ms (MEDIUM 60 Hz), approx. 1.6s (SLOW 60 Hz)
Approx. 95 ms (FAST 50 Hz), approx. 795 ms (MEDIUM 50 Hz), approx. 1.92s (SLOW 50 Hz)
t2: Approx. 5 ms
t3: Approx. 1 ms

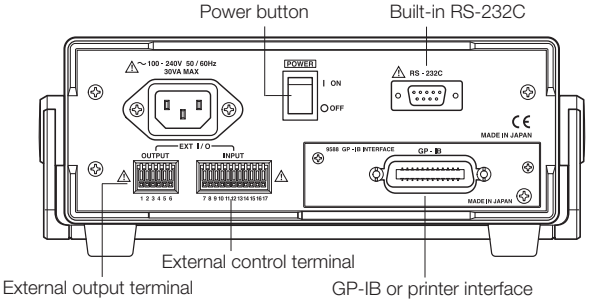
In the HOLD mode, the sequence is simple as EOC is retained until the next trigger is input. Furthermore, the display and output are retained until the next EOC is entered.

t1: [Stabilizing time] Following chuck, the trigger is input after the measuring current has stabilized.

t2: [Detection time] Time from when chuck is detected until the NG signal becomes Lo.

* t1 and t2 differ with the measured object. The figures are reference values in case of pure resistance.

t3: [Evaluation time] The time from when the measurement value is judged at the point when the trigger is input and until the EOC signal is output. The comparison result is decided on the rising edge of EOC. At this point, the evaluation result is obtained.



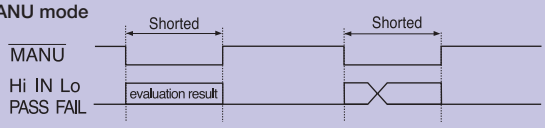
Nature of external control and outputs (negative logic)

● Control
(CMOS/5 V max.)
- Measurement trigger (TRIG)
- Comparator output request (MANU)
- Zero adjustment request (0 ADJ)
- Print request (PRINT)
- Comparator table selection (COMP)
- EXT.DCV (DC5V - 24V)
- GND

● Output
(Open-collector output/35V - 50mA max.)
- Comparator result signals (Hi, IN, Lo/PASS, FAIL)
- Measurement termination signal (EOC)
- Measurement irregularity detection signal (NG)

Switch between automatic and manual output of comparator results
(set using panel buttons)
In the AUTO mode, the comparator results are continuously output. In the MANU mode, the results are only output when the external MANU and GND terminals are shortened.

● MANU mode



RS-232C Interface Specifications

Transmission method: Start-stop synchronization, full duplex. Transmission speed: 9600 bps. Data length: 8 bits. Parity: None. Stop bit: 1 bit. Handshake: Hardware. Delimiter: CR+LF. Connecting cable: D-Sub 9-pin female/female connector. Reverse connection.

■ External Interfaces (Options)

Install the optional GP-IB Interface 9588 to gain full remote control of the instrument from a PC. Add the Printer Interface 9589 to enhance the device with printing capabilities via the Digital Printer 9203 or your own Centronics-based printer. (Note: Centronics printer is limited to the type of printer which can print ASCII text directly.) Connecting the 9203 provides multi-function printing, such as interval printing, statistical processing of maxima, minima, average, standard deviation, histogram and graph printing.

GP-IB Interface 9588 Specifications

Conforming standard: IEEE-488.1 1987/Reference standard: IEEE-488.2 1987

Digital Printer 9203 Specifications

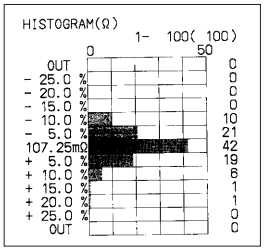
- Printer type: Thermal Line Printer
- Statistical processing: Up to 99,999 data points
- Histogram and graphics: Up to 5,000 data points
- Dimensions and mass: Approx. 215 (W)×160 (H)×54 (D)mm ,1kg / [8.5" (W) × 6.3" (H) × 2.1" (D) , 35.3 oz.]

*Note: For further details, please refer to the product catalog for the 3550 series HIOKI Battery HiTESTER, or click onto our website at http://www.hioki.com.

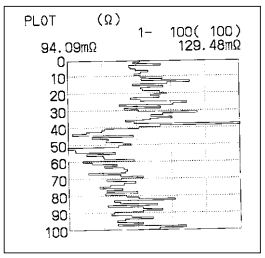
Print example

```
START     '98- 9- 7 13:41:52
    1 13:41:52  109.09mΩ Pass
                  1.6093 V
    2 13:42:00  107.63mΩ Pass
                  1.6089 V
    3 13:42:06  113.33mΩ Pass
                  1.6091 V
    4 13:42:11  106.75mΩ Pass
                  1.6093 V



   97 13:55:28  104.06mΩ Pass
                  1.6071 V
   98 13:55:36  118.10mΩ Fail
                  1.6100 V
   99 13:55:44  112.70mΩ Pass
                  1.6082 V
  100 13:55:51  110.48mΩ Pass
                  1.6103 V
END       '98- 9- 7 13:56:11

STATISTICS
 N    =      100    (*  100)
 AVE  =  107.247mΩ
 MIN  =   94.09mΩ   (   52)
 MAX  =  129.48mΩ   (   38)
 σn   =    5.972mΩ
 σn-1 =    6.002mΩ
 Cp   =   140.91
 CpK  =    3.16

STATISTICS
 N    =      100    (*  100)
 AVE  =    1.610 V
 MIN  =   1.6066 V  (   16)
 MAX  =   1.6132 V  (   31)
 σn   =    0.001 V
 σn-1 =    0.001 V
```

Statistical processing



Resistance value histogram



Resistance value graph printout

Specifications

Measurement method: Resistance AC (1kHz ± 0.2Hz) 4-terminal method

A/D method: ∑-Δ method with sample hold function

Display: Fluorescent character display tube.
Resistance [31000], voltage [50000] counter

Auto-ranging: Provided (disabled when comparator is ON)

Input overrange: " OF " display

Measurement irregularity: " ---- " display (NG: External output of measurement irregularity signal)

Sampling rate:

	50 Hz	60 Hz
[FAST]	50 times/s	60 times/s
[MEDIUM]	6.25 times/s	7.52 times/s
[SLOW]	1.56 times/s	1.88 times/s

Response time:

	50 Hz	60 Hz
[FAST]	100 ms	84 ms
[MEDIUM]	800 ms	667 ms
[SLOW]	1.92 s	1.60 s

(When non-conductive resistance is measured. The response time differs depending on the measured object.)

Comparator: Comparator output (Resistance/voltage measurement mode)

Voltage \ Resistance	Hi	IN	Lo
Hi	FAIL (red)	FAIL (red)	FAIL (red)
IN	FAIL (red)	PASS (green)	(FAIL) (red)
Lo	FAIL (red)	FAIL (red)	FAIL (red)

* Restricted to Hi, IN, Lo in the resistance measurement mode.

- **Mode switch:** Switchable between AUTO and MANU.
- **Comparator points:** Up to 30 comparator condition settings can be memorized.

- **Buzzer output:** (ON/OFF setting possible) [Resistance measurement mode]: Switchable between Hi, Lo and IN. [Resistance/voltage measurement mode]: Switchable between PASS and FAIL.

Maximum input voltage: DC 60 V max. (AC input is not possible)

Withstand voltage: Between power supply line and protective ground terminal / AC 2.3 kV rms for 1 minute

External output terminals: [Open-collector output] (DC 35V-50mA max.) comparator results, measurement termination, measurement irregularity signal

External control terminal: [CMOS input] Measurement trigger, comparator trigger, printer, zero-adjustment, comparator number selection, external power supply possible (DC 5 V to 24 V)

Interfaces: RS-232C (standard), GP-IB or printer interface [Centronics] (option)

Environment conditions: Operating temperature and humidity range: 0 to 40°C (32°F to 104°F) , 80% RH or less.
(no condensation) Storage temperature and humidity range: -10 to 50°C (14°F to 122°F) , 80% RH or less.
Operating conditions: Indoors, below an altitude of 2000 m.

Power supply: AC 100V to 240V (±10%), automatic voltage selection, 50/60Hz

Maximum rated power: 30 VA

Dimensions and mass: 215(W) × 80(H) × 320(D)mm, 2.1kg / [8.5"(W) × 3.1"(H) × 12.6"(D), 74.1 oz.] (not including options)

Included accessory: CLIP TYPE LEADS 9287-10 × 1

Conforming standards: EMC EN61326
EN61000-3-2
EN61000-3-3
Safety EN61010
Pollution degree: level 2

Measurement Ranges

Conditions for guaranteed accuracy: at 23°C±5°C[73.4°F ±9°F], 80% RH (no condensation), following 30 min. warming-up, and after zero adjustment

[Resistance measurement] (Sampling speed : SLOW)

Range	30mΩ	300mΩ	3Ω	30Ω	300Ω	3kΩ
Maximum display value	31.000mΩ	310.00mΩ	3.1000Ω	31.000Ω	310.00Ω	3.1000kΩ
Resolution	1μΩ	10μΩ	100μΩ	1mΩ	10mΩ	100mΩ
Measurement current	7.4mA	1mA	100μA	10μA	5μA	1.5μA
Accuracy (6 months, [1 year])	±0.5%rdg.±8dgt. / [±0.7%rdg.±8dgt.]					
	* In the case of MEDIUM: Add 3 dgt. to the above dgt. error FAST: ±0.5% rdg. ±8 dgt. (30 mΩ)/±0.5% rdg. ±6 dgt. (other ranges) / [±0.7% rdg. ±8 dgt. (30 mΩ)/±0.7% rdg. ±6 dgt. (other ranges)] However, in the case of FAST, the display counter decreases 4 digits in all ranges.					
Temperature modules	(±0.05% rdg. ±0.8 dgt.)/°C (1.8°F) *FAST: 300m to 3kΩ range (±0.05% rdg. ± 0.6 dgt.)/°C (1.8°F)					
Open-terminal voltage	20 mV peak max. (when limiter is ON)					

[Voltage measurement] (Sampling speed : SLOW)

Range	DC 5V	DC 50V
Maximum display	±5.0000V	±50.000V
Resolution	100μV	1mV
Accuracy (6 months, [1 year])	±0.05%rdg. ±5dgt. / [±0.07%rdg. ±5dgt.]	
Temperature modules	(±0.005% rdg. ±0.5 dgt.)/°C (1.8°F)	

* MEDIUM: Add 3 dgt. to the accuracy dgt. error
FAST: Add 5 dgt. to the accuracy dgt. error

* During charging, the measurement value may be unsteady due to ripple voltage.
* Resistance with inductance elements may not always be measurable.

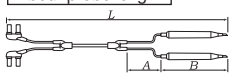
AC mΩ HiTESTER 3560

Options

CLIP TYPE LEADS 9452
FOUR TERMINAL LEADS 9453
ZERO ADJUSTMENT BOARD 9454 (for 9461,9465)
PIN TYPE LEADS 9455 (for high-precision use)
PIN TYPE LEADS 9461
PIN TYPE LEADS 9465
REMOTE CONTROL SWITCH 9466
LARGE CLIP TYPE LEADS 9467
PIN TYPE LEADS 9770
PIN TYPE LEADS 9771
* GP-IB INTERFACE 9588
GP-IB CONNECTION CABLE 9151-02 (2 meters)
PRINTER INTERFACE 9589
DIGITAL PRINTER 9203
CONNECTION CORD 9425 (20-pin half-pitch—36pin/D-sub)
[for connecting the 3560 to the 9203/2meters]
RECORDING PAPER 9233 (for the 9203/10meters,10rolls)

* Not CE marked.

About probe length



A : between junction and probe
B : probe length
L : between connector and probe tip

9287-10 (supplied)

A:130 mm, B:83 mm, L:1100 mm

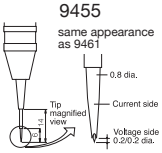
9452

A:220 mm, B:197 mm, L:1360 mm

9453

A:280 mm, B:118 mm, L:1360 mm

9455



A:260 mm, B:136 mm, L:890 mm

9461

A:240 mm, B:132 mm, L:804 mm

9465 & 9466

A:100 (red), 210 (black, max 500) mm, B:130 mm, L:1912 mm

9467

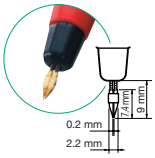
A:300 mm, B:116 mm, L:1360 mm

9770/9771

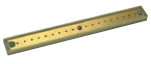
A:260 mm, B:140(9770), 138(9771) mm, L:850 mm

9770 -- in detail

9771 -- in detail



9454



For zero-adjustment when 9461 or 9465 is used.

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