

AC mΩ Hi TESTER

# 3225

**Measurement current: 5mA (20mΩ)**

**This contact resistance meter uses the AC 4-terminal method.**

- High resolution of 10  $\mu\Omega$
- DC superposed measurements permit the measurement of the internal resistance of batteries and semiconductors
- High-speed sampling
- Comparator function included
- Analog output terminal
- Hold function
- Also available: GP-IB interface (-01 specification)
- Printer (-02 specification) BCD output (-03 specification)



# Excellent for measuring the contact resistance of switch connectors and the internal resistance of batteries!

## Outline

The 3225 contact resistance meter uses an AC 4-terminal method. The small measurement currents involved mean that the contact resistance of the various kinds of switch contacts used in electronic equipment can be measured under conditions that are close to actual operating conditions. It is also possible to measure internal resistance of batteries and semiconductors under operating (DC superposed) conditions.

Supplied as standard equipment with the 3225 are comparator and analog output functions. A GP-IB interface (-01 specification), printer (-02 specification), and a BCD output (-03 specification) are available as options. These features enable the 3225 to be used over a wide range of applications from simple tests and sorting to production line activities and other system uses.

## Excellent for Measurements of Contact and Internal Resistance

The 3225 uses the 4-terminal method for measurements, which permits measurements to be made excluding the resistance of the measurement leads and the contact resistance of the connection areas. This means good-accuracy measurements of very small resistances.

AC is used for the measurement power supply enabling a stabilized power of a mere  $0.5 \mu\text{W}$  ( $5 \text{ mA} - 20 \text{ m}\Omega$ ) to be used for measurements. This allows measurements to be made without the adverse effects of oxidizing films that destroy switch contacts as well as temperature increases. (Note that coils and capacitors require impedance measurements and so they cannot be read as resistance values.)

Since the 3225 can make measurements in the DC superposed condition, making possible measurements of the internal resistance of batteries and semiconductors under operating conditions.

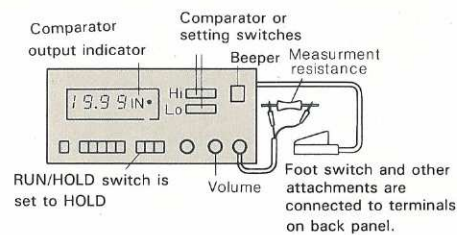
This device meets all of the following measurement conditions stipulated by IEC, the International Electrotechnical Commission:

- Frequency:  $1 \text{ kHz} \pm 200 \text{ Hz}$
- Accuracy: Within  $\pm 10\%$
- Current (effective value): Less than  $1 \text{ A}$
- Voltage (peak value): Less than  $20 \text{ mV}$

## Great for Testing and Quality Control!

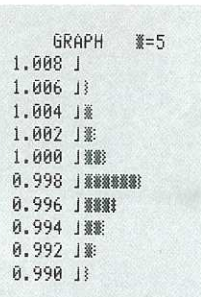
### A Comparator is Standard Equipment

The built-in comparator is very convenient for testing and sorting. Connecting a foot switch to the control terminals on the back panel and setting the RUN/HOLD switch in the HOLD position will permit measurements to be made under foot switch control, in addition to the keeping of comparative results. There are three methods by which the discrimination results are output: display, beeper, and relay.



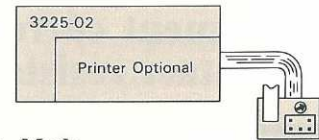
	0	Lo	Hi	OVER
Display	Lo	IN	Hi	
Beeper	Hi-Lo	ON	OFF	ON
	IN	OFF	ON	OFF
Relay	Hi	OFF		ON
	IN	OFF	ON	OFF
	Lo	ON	OFF	

### • Graph



### Printer (-02 specification)

Measurement data will be printed out at a fixed time interval or each time a manual measurement is made. The statistics function permits on-the-spot data processing and the recording of comparator results.



### No. Mode

Manual data collection and immediately preceding data cancellation functions.

Average value, Maximum and minimum data collection, Standard deviation, and Histogram printout.

```

No.
1 13.14 mΩL
2 15.13 mΩI
3 19.13 mΩH
4 17.13 mΩH
5 3.14 mΩL
5 CANCEL
5 13.14 mΩL
20 13.14 mΩL
END
N = 20
x̄ = 14.5860
MIN = 10.13
(No. 12)
MAX = 19.13
(No. 3)
σn-1 = 2.37002
    
```

### TIME Mode

Automatic data collection by self-seeking time interval. Average value, Maximum and minimum data collection, and Calculation functions.

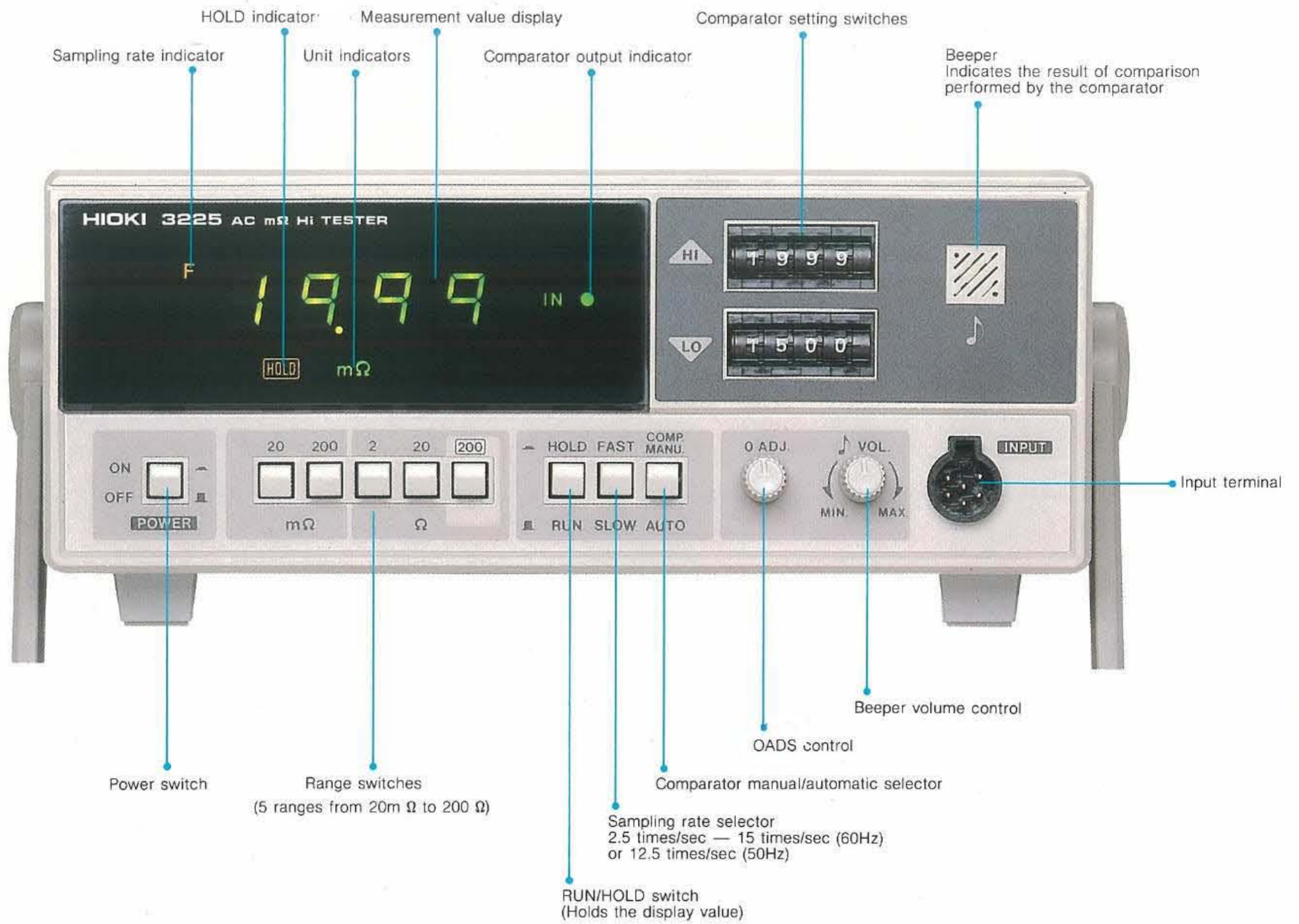
### • Data

```

00:00 13.18 mΩL
00:05 16.16 mΩH
00:10 15.16 mΩI
00:15 15.16 mΩI
00:20 19.16 mΩH
00:25 17.18 mΩH
END
N = 6
x̄ = 16.0000
MIN = 13.18
(00:00:00)
MAX = 19.16
(00:00:20)
    
```

	Contact resistance meter	Low resistance meter
Measurement principle	• AC (impedance) measurement	• DC (resistance) measurement
Advantages	• Very small current (low-power) measurements • DC superposed measurements • Internal resistance (operating resistance) measurements • No heating effects	• Permits measurement of resistance values without the effects of inductance or capacitance; therefore, the lead wire resistance of coils can be measured.
Drawbacks	• Resistance values of components including inductance and capacitance, e.g., coils cannot be measured. (These are impedance measurements.)	• Heating effects are received.
Use	• Switches used in very low current circuits, e.g., contact resistance measurements of electronic part. • Internal resistance measurements (operating resistance) of batteries and semiconductors • Conductor resistance measurements of differing types of bonded metals	• Conductor resistance measurements of coils • Contact resistance measurements of power supply switches (under conducting conditions) • Resistance measurements of leads or conductors • General resistance measurements

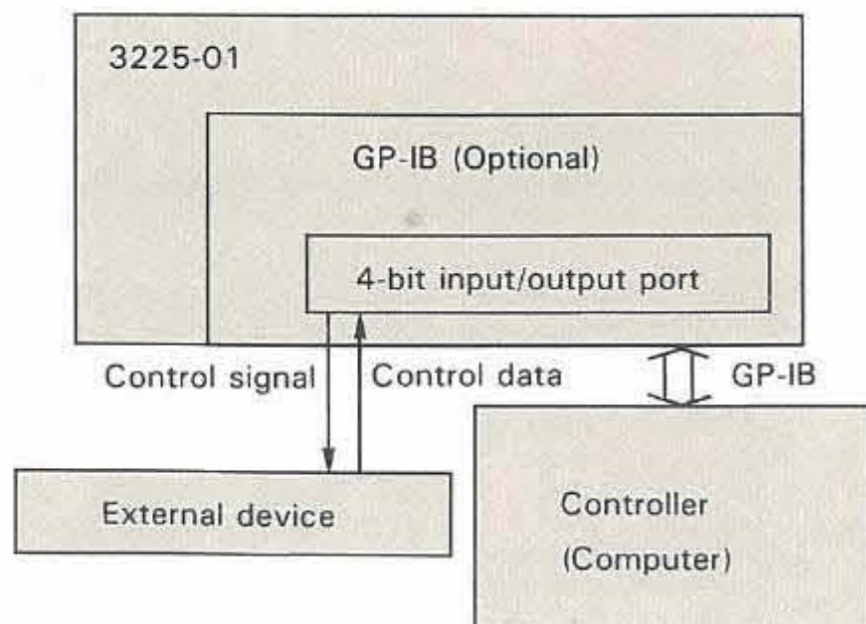
Suits a wide range of applications from the simple up to the systems level.



### Ideal for Automatic Measuring and Systems Applications

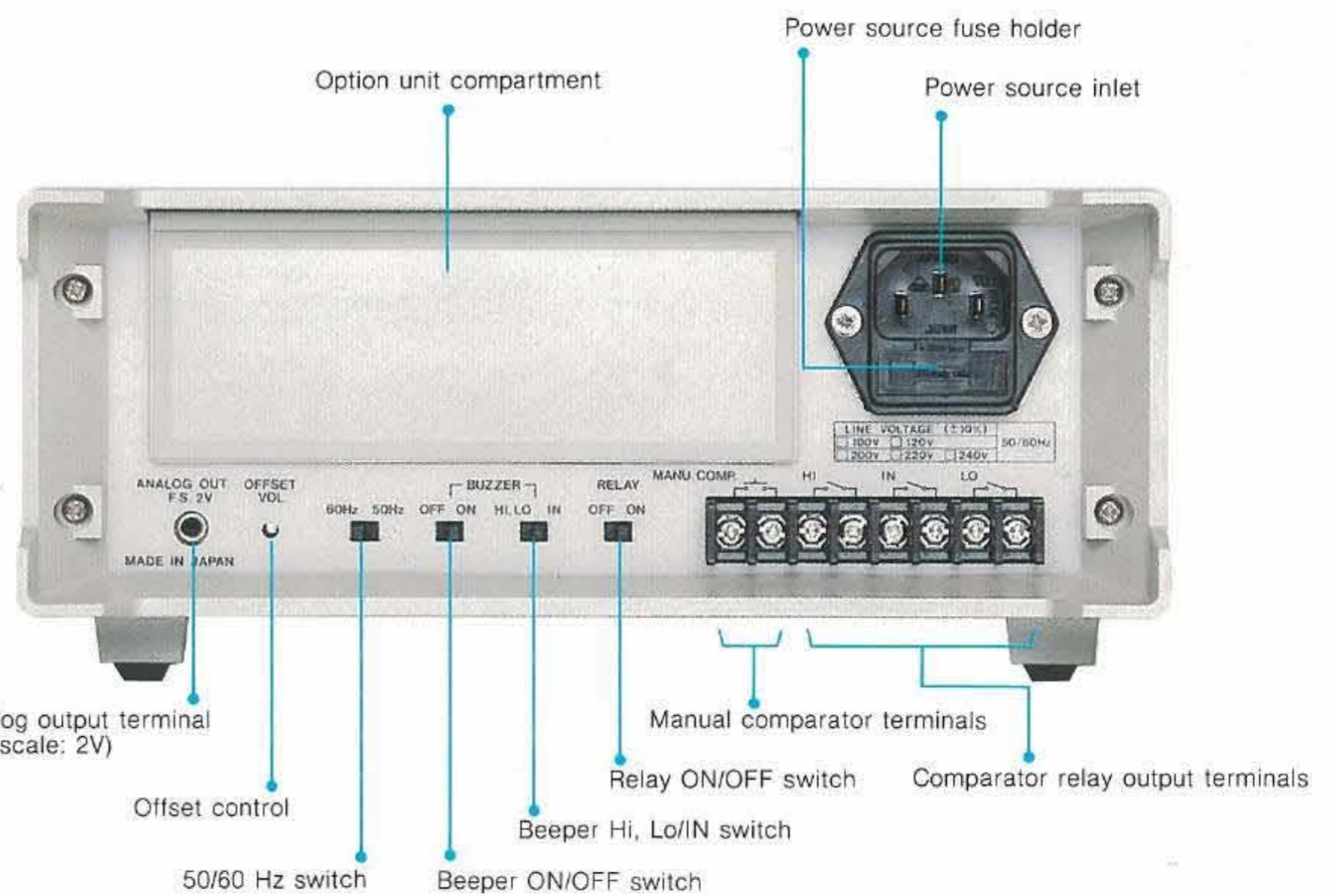
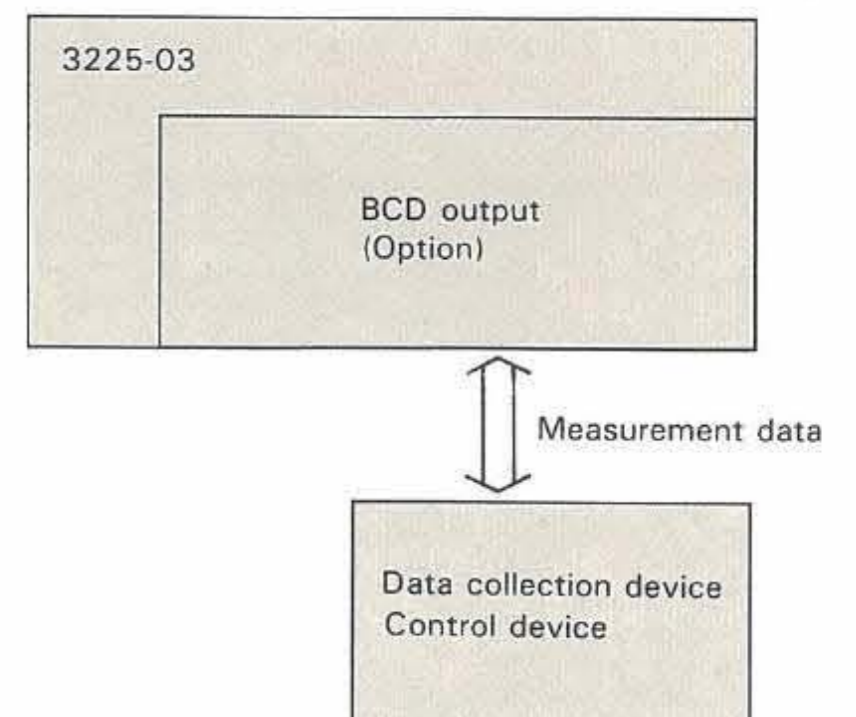
#### GP-IB interface (-01 specification)

Addition of the GP-IB interface permits the measurement data to be read by computer and enables diverse processing possibilities. The 4-bit input/output port that has been provided allows the control and surveillance of peripheral devices.



#### BCD Output (-03 specification)

The BCD output provides BCD code output of measurement data, comparator results, and range code (digit serial and bit parallel). These digital outputs can be used for direct data reading, data collection, or control applications.



## Specifications

### Conditions:

23°C ± 5°C, less than 80% RH (provided there is no condensation) Set for accuracy following zero adjustment on all ranges.

Period over which accuracy is guaranteed: 6 months

Range	20mΩ	200mΩ	2Ω	20Ω	200Ω
Resolution	10μΩ	100μΩ	1 mΩ	10mΩ	100mΩ
Measurement current	5mA	500μA	50μA	5μA	5μA
Maximum applied measurement voltage	100μV				1mV
Accuracy	±0.5%rdg. ±5dgt.		±0.5%rdg. ±3dgt.		
Open terminal voltage	Less than 20 mV peak				

### Measurement method:

AC 4-terminal method

### Measurement frequency:

1 kHz ± 100 ppm

### Display:

LED (max. 1999)

### Unit and symbol display:

mΩ, Ω, F, HOLD, Hi, IN, Lo, GP-IB (-01 specification)

### Input overload:

Flashing

### Sample rate:

Slow — 2.5 times/s Fast — 12.5 times/s (50 Hz), 15 times/s (60 Hz) Fast — "F" lights up

### Comparator:

3 levels (Hi, IN, Lo), AUTO/MANUAL switching  
LED display, beeper (ON/OFF switching, Hi - Lo/IN operation switching, volume control possible)  
Relay output (ON/OFF switching possible, Hi - IN - Lo, each make contact, contact capacity 3 A at 250 V AC and 3 A at 30 V DC, resistance load)

### Analog output:

2 V full scale, zero-adjustment possible  
Operating temperature and humidity: 0°C to 40°C, less than 80% RH (providing there is not condensation)

### Withstand voltage:

500 V (DC or peak AC) between the case and between the AC voltage line

### Power supply:

100 V AC, 120 V AC, 220 V AC, 240 V AC (±10%) Specify voltage when ordering. 50/60 Hz selectable

### Power consumption:

11W or less

### Dimensions:

Approx. 85 H x 218 W x 356 D (mm) (not including projecting parts)

### Weight:

Approximately 2.9 kg

### Accessories included:

9175 clip type test leads, power cord, spare 3 A fuse

## GP-IB Specifications (3225-01)

Confirming to IEEE 488 - 1978 standards

### Interface function

SH1, AH1, T6, L4, SR1, RLO, PPO, DC1, DT0, CO,

### Output data format

ABC + DDDDE ± D CR LF

① ② ③

- ① TC, comparator, Overload condition
- ② Measurement value
- ③ Delimiter

### Input/output port

This is a 4-bit input/output port from which data can be input or output using a controller.

## Printer Specifications (3225-02)

### Printer:

Thermal-type character printer

### Recording paper:

38 mm W x 8.5m, approx. 2,200 lines can be printed

Life: 500,000 lines

### Printing method:

TIME No. switch

### TIME mode:

Automatic printing by interval setting

### Printing interval:

1-2-5-10-15-30 [sec]  
1-2-3-5-6-10-15-30 [min]  
1 [hour]

### Modification after starting is possible

### No. mode:

Manual printing Data No. 1 ~ 1000

### Comparative results:

H. I. L. printout

### Data processing

	No.		TIME
	N ≤ 100	N > 100	
N = (Number of data)	○	○	○
$\bar{x}$ = (Average value)	○	○	○
MIN. = (Minimum value)	○	○	○
MAX. = (Maximum value)	○	○	○
$\sigma_{n-1}$ = (standard deviation)	○	○	○
$\sigma_n$ = (standard deviation)	○	○	○
GRAPH = (Graph generation)	○	○	○

### Cancellation:

Immediately preceding data can be cancelled

### Graph generation:

Automatic generation of graphs Min. - Max. is divided into about 10 equal parts and the distribution is made into a graph.

Graph generation of rank width settings

The center value and the rank width are set and made into a graph.

Center value setting:

Higher ranking 3.5 digits

Rank width setting:

0.1, 0.2, 0.5, 1, 2, 5, 10, 20% ± ranks

0.1, 0.2, 0.5, 1, 2, 5, 10% ± 10 ranks

Setting of optional units and decimal point is possible.

External control terminals are provided (Print and Stop)

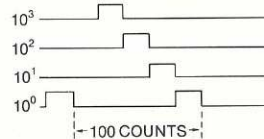
Cord to main unit: 1 m

## BCD Output Specifications (3225-03)

### BCD Output:

Digit serial and bit parallel, with output of comparator results and range code

Note: Fanout at TTL



### Standard clock

SLOW 10KHz

FAST 50KHz Power supply frequency

60KHz Power supply frequency

### Column Output

DATA	A	B	C	C
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1

### RANGE CODE

RANGE	A	B	C
20mΩ	0	0	0
200mΩ	1	0	0
2Ω	0	1	0
20Ω	1	1	0
200Ω	0	0	1

## Ordering Information

3225

3225-01 (GP-IB)

3225-02 (with printer)

3225-03 (BCD output)

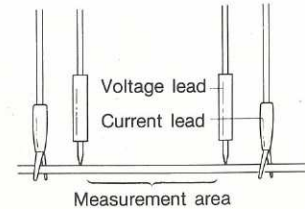
## Consumables

9222 Chart paper (for 3225-02)

9094 Output cable (for 3225)

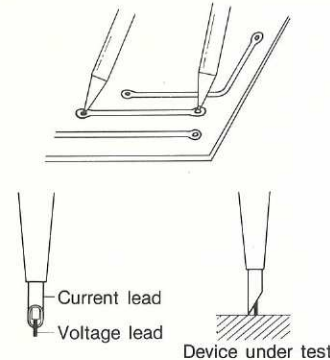
## A Wide Variety of Test Leads are Available

### 9173 4-terminal test lead set (optional)



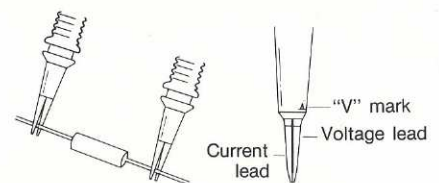
Note: Probes 9097, 9098, and 9099 (for 3220 and 3224) cannot be used with the 3225.

### 9174 Pin-type test lead set (optional)



The voltage lead is set within the current lead and both leads contact the device under test. The voltage lead can also enter the through hole of a printed circuit board to make contact.

### 9175 Clip-type test lead set (provided)



### Standard Packing (Double carton box)

Sets	N.W.(kg)	G.W.(kg)	M <sup>3</sup>
1	5	7	0.10

**HIOKI E.E. CORPORATION**

DISTRIBUTED BY

HEAD OFFICE: P.O. Box 1, Sakaki, Nagano, 389-06 Japan.  
Tlx: 3327508 HIOKI J / Cable: HEWLOV, Ueda  
Tel. (0268) 82-3030 / Fax. (0268) 82-3215

HIOKI-RCC, INC.: 198 Route 206 South Somerville, N.J. 08876 U.S.A.  
Tel. (201) 874-6484