

HIOKI



All the functions you need for PCB repair

PCB repair tester handles short localization

REPAIR HI TESTER

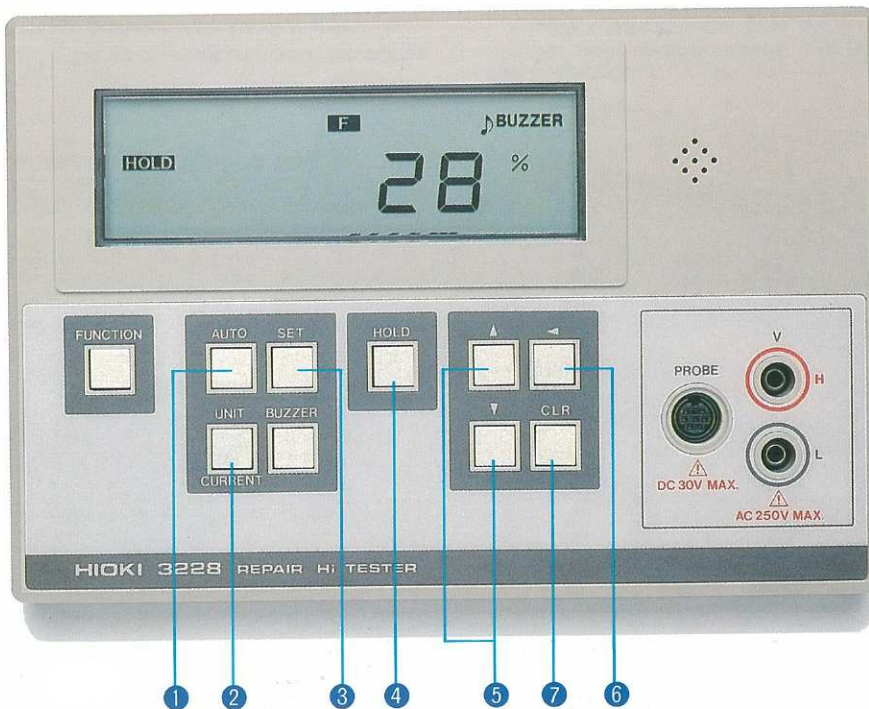
3228



PCB Repair Tester

Current measurement without cutting the pattern

Current measurement

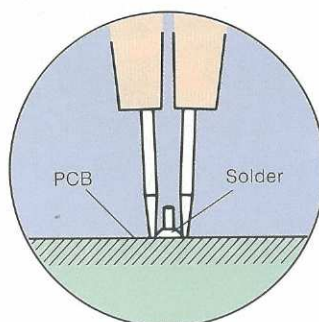


Part names and functions

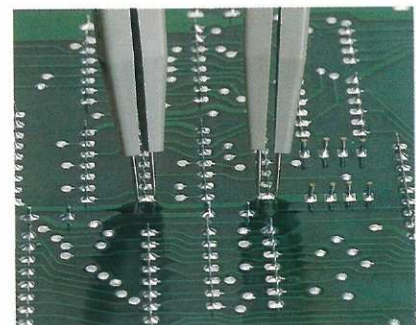
- 1 Auto/manual switch**
Allows switching to voltage or resistance measurement.
- 2 Unit/current switch**
Display unit selection (% , mm) for short localization (abbreviated F below). Displays measured current when depressed during fixed current voltage drop measurement.
- 3 Set switch**
Used to start, enter and stop numeric set for resistance comparator (RC) and F measurement.
- 4 Hold switch**
Sets and releases hold mode in measurement functions other than RC and F measurement.
- 5 Up-down switch**
Sets the measurement ranges for V, R and RC measurement. Changes the current range in IV measurement. Numeric set in RC and F measurement numeric set state.
- 6 Column shift switch**
Moves input column for input in RC and F measurement numeric set state.
- 7 Clear switch**
Returns all displayed columns to 0 in RC and F measurement numeric set state.

9169 5-terminal probe

Consists of a current source (blue) probe, a current sink (red) probe and a mini-clip, each of which is split into a voltage pin (V mark) and a current pin (I mark). When the tip of the 9169 is pressed against the mounted PCB land for measurement, clamp the solder as low as possible, as indicated.



Can measure current (autoranging) without cutting the pattern. This means that where, for example, component failure causes the PCB current consumption to rise considerably over design values, you can connect a power supply with a current limiter and localize the faulty part by probing pattern current one portion at a time, maintaining current levels at a point where they will not harm mounted components. The last data value is captured for reference by the data hold function.



Note: Situations where accurate measurement is not possible

Where the pattern branches between measurement lands, as shown between a and b in Fig. 1, and the current branches. Where I_1 , I_2 and I_3 are split and measured as in Fig. 2.

Where pattern resistance exceeds 5Ω . Current measurement is only possible for pattern resistances of from $5m\Omega$ to 5Ω .

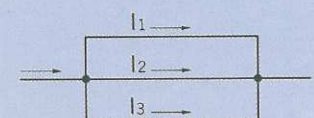
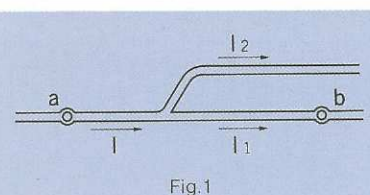


Fig. 2

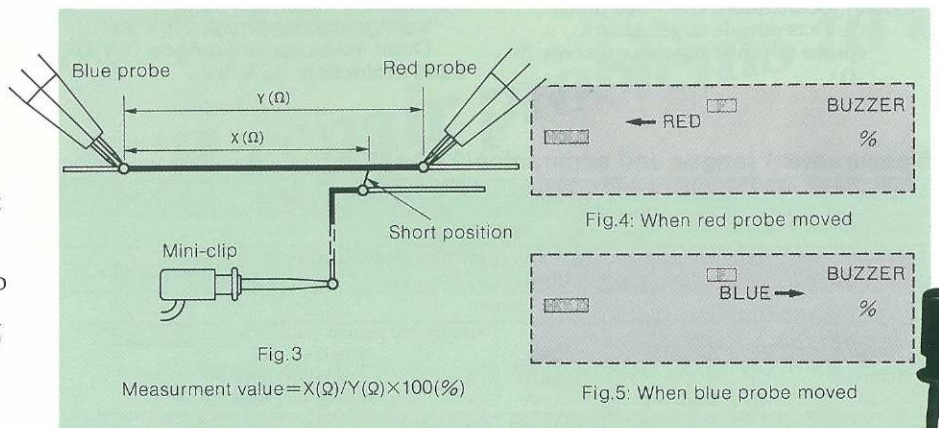


For localization of solder bridges and other faults

F Short localization

Solder bridges on the solder surface can be seen visually, but bridges on the component surface are difficult to spot, requiring skill and considerable time. The use of the 3228 localizes faults by merely pressing the probe against the pattern.

As indicated in Fig. 3, the measurement method consists of merely connecting the mini-clip to one part of the pattern, and touching the blue and red probes to the other part of the pattern. The faulty position will be displayed in units of % or mm.



Measurement in % units

The resistance ratio, the ratio of X/Y , is displayed in the range from 0 to 99%. When the blue probe is fixed and the red probe shifted, the measurement value approaches 99% as the red probe approaches the short position. When the red probe is fixed, and value approaches 0% as the blue probe approaches. When the red probe is above the short position, or between the short position and the blue probe, the display is as indicated in Fig. 4 (the result when the blue probe is shifted is indicated in Fig. 5).

Measurement in mm units

When the pattern width is fixed, the pattern resistance and the distance are roughly proportional, and therefore the distance from the blue probe to the short position can be measured in mm units. When the blue probe is moved in mm unit measurement, the displayed value will change.

Selecting the mm display mode

1. In the F function press the unit/current switch (% to no unit display).
2. Measure the pattern resistance.
3. Press the set switch to enter the numeric set state.
4. The column that may be entered will be flashing. Use the up/down switch and the column shift switch to enter the pattern length in mm between the red and blue probes. Press CLEAR to return the input value to 0.

5. After inputting the pattern length press the set switch to measure in mm units.
6. To return from mm unit measurement to % unit measurement, press the unit/current switch.

Effects of pattern branching

When the pattern branches between the measurement points, as indicated in Fig. 6, and there is a short beyond that point, the measured value will appear to exist at the branch point. In this case, the pattern resistance X (ohms) from the blue probe to the branch point will be displayed as the numerator. For patterns where the solder land travels under components, as is common in IC power supplies and

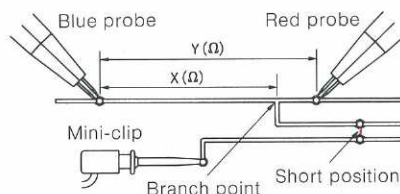


Fig.6: When pattern branches at measurement point and shorts later

grounds (see Fig. 7), and branches off the main line, the probe position may cause the apparent short to move, causing erroneous readings when the probe is actually on the short location.

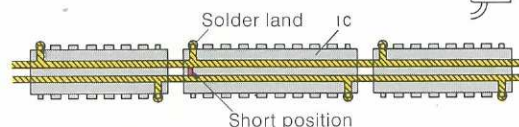


Fig.7: When solder land branches from main line

Shorts at multiple points

For two or more shorts, as shown in Fig. 8, with the resistance from the blue probe to each X_1 and X_2 (ohms), short resistance will cause measurement current to split, displaying $X_1 \leq X \leq X_2$ as the numerator.

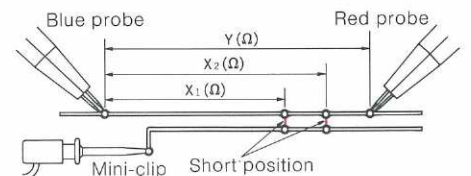
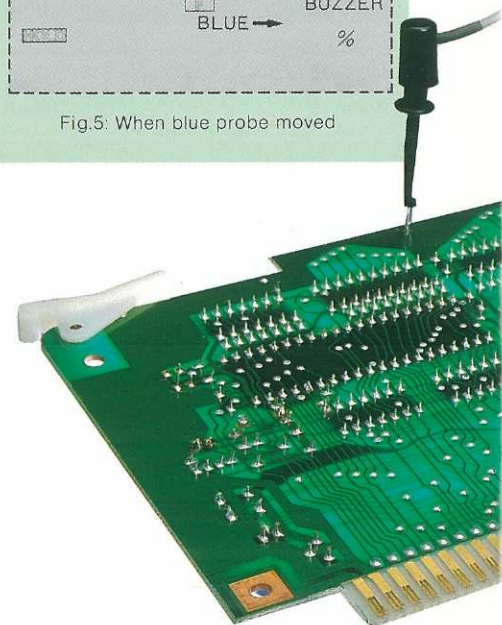
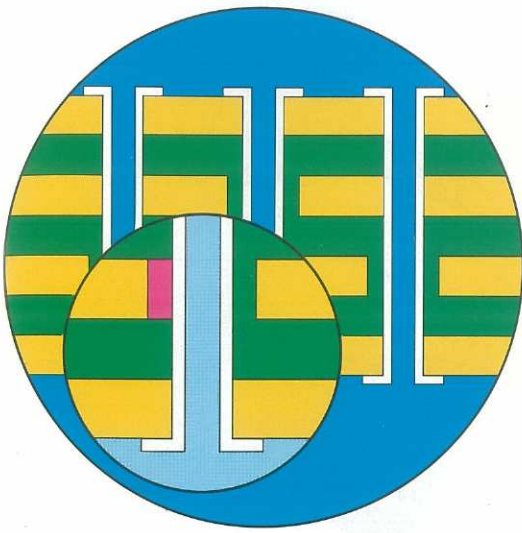


Fig.8

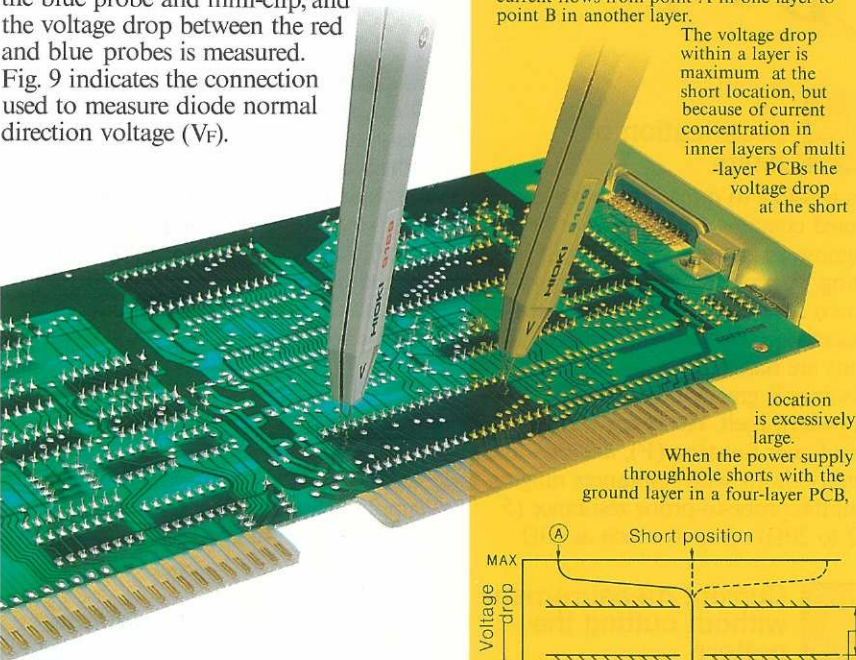




Faults localization even in inner layers of multi-layer PCBs

IV Fixed current input voltage drop measurement

Fixed current input voltage drop measurement makes it possible to localize faults in inner layers of multi-layer circuit boards, and evaluate diode characteristics. In fixed current input voltage drop measurement a fixed current flows between the blue probe and mini-clip, and the voltage drop between the red and blue probes is measured. Fig. 9 indicates the connection used to measure diode normal direction voltage (V_F).



Application examples
Localization of fault between power supply and ground in multi-layer PCB
 Inter-layer shorts in multi-layer PCBs generally can be expressed as indicated in Fig. 10, where a voltage drop exists when current flows from point A in one layer to point B in another layer.

The voltage drop within a layer is maximum at the short location, but because of current concentration in inner layers of multi-layer PCBs the voltage drop at the short location is excessively large.

When the power supply through-hole shorts with the ground layer in a four-layer PCB, location is excessively large.

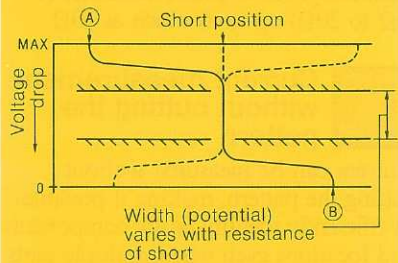


Fig.10: Short position, width (potential) varies with resistance of short

as indicated in Fig. 11, the voltage drop caused when current flows from a point in the power supply layer to a point in the ground layer is maximum at point C in the power supply layer due to current concentration.

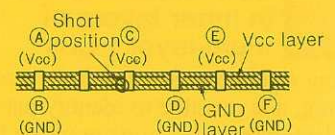


Fig.11: Short between power supply and ground layers of 4-layer PCB

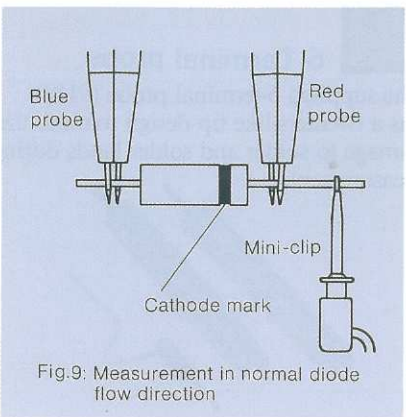


Fig.9: Measurement in normal diode flow direction

Other measurement functions

V Voltage measurement

The 9067 test lead is used for voltage measurement. Minimum resolution is 1mV, and up to DC 25V can be measured. The peak hold function is provided.

R Resistance measurement

Eight ranges from 100 mΩ to 1 MΩ (minimum resolution 10 μΩ). Can measure printed circuit board pattern resistance and contact resistance such as in switches. When the red probe is removed from contact with the PCB in the HOLD mark display state, the current value is captured and held for reference.

RC Resistance comparator

A comparator function is provided to compare and evaluate resistance values. High and low limits can be set independently, and judgment results may be set to high and low displays and buzzers.



Leave your PCB repair problems to us

The 3228 Repair Hi-Tester offers a range of DC voltage and resistance measurement functions, in addition to a fault localization function and a special current measurement function. It can detect faults due to solder bridges and other causes, identify faulty components through detection of abnormal current, and provide all the other specialized functions you need to diagnose and repair faulty PCBs.

Features

- Voltage drop measurement with fixed voltage input
- Solder bridge and other fault localization
- Voltage measurement with peak hold function
- Current measurement without cutting pattern
- Data hold function
- Measurement from pattern resistance to 1 M Ω
- Upper and low comparator function (ohmmeter)

Localization of faults

It is possible to quickly localize faults in printed circuit boards that have been diagnosed as having a short in in-circuit testing. A problem with searching for pattern shorts by checking point-to-point resistance on the pattern is that such shorts are hard to discern when the short resistance is greater than the resistance of the pattern itself. However, with the 3228's short finder function (F), it is possible to identify shorts with resistances ranging from the probe-to-probe resistance (5 m Ω to 20 Ω) up to as much as 50 Ω .

Current measurement without cutting the pattern

Current can be measured without cutting the pattern, making it possible to efficiently identify faulty components and locations even when multiple parts are mounted on the pattern. Checking pattern current in this manner makes it possible to identify defective components in environments that would defeat other types of in-circuit testing.

Can localize faults in inner layers of multi-layer PCBs

Using regulated-current voltage drop testing, it is possible to identify pattern bridges, inter-layer shorts resulting from incomplete etching, and shorts resulting from insulation failures in components such as capacitors and integrated circuits.

Contact resistance measurements

It can not only measure PCB pattern resistance and resistance for relays and other contacts, but also can measure up through 1 M Ω . The 10M Ω range uses a discharge electrode voltage maximum of 20mV to prevent damage to contact oxidation layers. A window comparator function is also provided, handy for parts checking.

2 Range voltmeter provided

Can measure common PCB voltage supplies (5V, $\pm 12V$, $\pm 15V$, 24V) and circuit operational voltages.

Two power supplies: battery and AC adapter

With compactness and light weight, portability is vastly enhanced with a dry cell power supply.

5-Terminal probe

The supplied 5-terminal probe (9169) has a tweezers-like tip design to minimize damage to solder and solder lands during measurement.



General specifications

Measurement method: 4-pin measurement for resistance and current. Current measurement displayed value converted from voltage drop and resistance measurement. Short localization and fixed current voltage drop measurement with 5-pin measurement.

Sampling rate: About 4 times/s (voltage) to 2 times/s (current)

Operating environment: 5°C~40°C, 10~80% RH (no condensation)

Temperature coefficient: 0.1%/10°C

Display

LCD: Maximum 999

Measurement function: V, A, R, RC, F, IV

Units: V, mV, mA, Ω, mΩ, kΩ, %, mm

Polarity: —

Range: AUTO or fixed point

Overrange: 9999 flashing

Measurement not possible: — — — —

Battery low warning: BATT

Other: HOLD, BUZZER, DATA, ←, →, RED, BLUE

Buzzer

Resistance comparator: ON outside set range

Short localization: ON when probe contacts outside target pattern (probe-to-probe resistance exceeds 20 Ω).

Current measurement · Short localization · Fixed current voltage drop measurement: Short beeps when measuring. Long warning beep when mini-clip removed, except in current measurement. All may be disabled.

Range select

Voltage measurement: Auto/manual range

Current measurement: Auto range

Resistance measurement: Auto/manual range

Resistance comparator: Manual range

Short localization: Auto range

Fixed current voltage drop measurement: Auto range (manual select for current set)

Data hold

Short localization: always in hold mode

Only operates in hold mode in other measurement functions.

Except in voltage measurement, captures last reading when red probe removed from contact.

Voltage measurement: Peak hold (hold mode only)

Permissible maximum input

Voltage measurement: 250V AC

Other measurement ranges: 30V DC

Input protection: 0.2A fuse

Power supply: SUM-3 (AA) × 8, or AC adapter.

BATT mark displayed: about 7.2V, auto power off at about 6.5V.

Continuous battery operation: about 20 hours (in voltage measurement range).

Applicable AC adapter specifications:

Output voltage with 200mA load: 7.5V min.

No-load output voltage: 12V max.

Plug dimensions: 5.5, 2.1 diameter, center common.

Dimensions and weight: approx. 150H × 222W × 44D mm. 600g (excluding batteries)

Accessories

9169 5-terminal probe

9067 Test lead

9141 AC adapter

0.2A fuse

Measurement ranges and accuracies (23°C ± 5°C)

Range	Accuracy	Resolution	Notes
Voltage			
DC10V	±0.3% rdg. ± 3dgt.	1mV	Input resistance fixed to 1MΩ
25V	"	10mV	
Current			
DC			Measurable pattern resistance
20mA	±1% rdg. ± 2dgt.	10μA	200mΩ ~ 5Ω
200mA	"	100μA	20mΩ ~ 200mΩ
1A	±2% rdg. ± 3dgt.	1mA	5mΩ ~ 20mΩ
Resistance · Comparator			
			Open voltage Measurement current
100mΩ	±0.5% rdg. ± 10dgt.	10μΩ	20mV 100mA
1 Ω	±0.3% rdg. ± 4dgt.	100μΩ	20mV 10mA
10 Ω	"	1mΩ	20mV 1mA
100 Ω	±0.5% rdg. ± 4dgt.	10mΩ	200mV 1mA
1 kΩ	"	100mΩ	2 V 10μA
10 kΩ	"	1 Ω	2 V 10μA
100 kΩ	"	10 Ω	2 V 10μA
1MΩ	"	100 Ω	2 V 1μA
	±1% rdg. ± 4dgt.		
Short localization			
100%	±5% rdg. ± 4dgt. ³⁾	1%	Measurement current, automatic selection between 10/100mA. Probe-to-probe resistance 5mΩ~20Ω. Measurable short resistance less than 50Ω.
1m	Not defined	1mm	Teaching from measurement of sample pattern resistance and pattern length input.
Voltage drop			
	Measurement accuracy ⁴⁾		Measurement current (3-range manual set)
10mV	±0.3% rdg. ± 4dgt.	1μV	1mA Open voltage 1V
100mV	Current accuracy	10μV	10mA 0.5V
1 V	±0.3% rdg. ± 2dgt.	100μV	100mA 0.5V

Notes: 1. Under 500 kΩ

2. 500 kΩ or more

3. Accuracy not defined for probe-to-probe resistance under 50 mΩ and short resistance 2 Ω or more.

4. However, 100mA measurement current in 10mV range has accuracy of ±0.3% ± 10dgt.

Standard packing (double carton box)

Sets	N.W.kg	G.W.kg	M ³
20	13.0	14.7	0.10

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All specifications are subject to change without notice.