

INSTRUCTION MANUAL

AUTOMATIC CORD CONTINUITY & INSULATION TESTER

MODEL CAD-3L / CAD-3H

**sanwa**

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# AUTOMATIC CORD CONTINUITY & INSULATION TESTER

## MODEL CAD-3L / CAD-3H

### §1. OUTLINE

The SANWA Automatic Cord Tester is intended for continuity and insulation testings of various electrical cords, shielded wires etc. in a simple, accurate and speedy way to afford a great deal of inspection efficiency to the production line.

### §2. FEATURES

1. The Model CAD-3L has the 3 switching and voltage impressing ranges in DC 100V/250V/500V, applicable to cords with small type plugs or jacks that have no concern to high voltage application.

By means of an electronic switch, the continuity and insulation tests are changed over automatically assuring speedy and high reliable measurements.

2. The Model CAD-3H is for high voltage application, providing the 2 switching and voltage impressing ranges of DC 1000V/2000V, applicable to cords of high withstanding voltage.

The continuity and insulation tests are effected by using a high withstanding lead relay, to enable high reliable measurements as well as the automatic switching between the measured lines. (Relay contact)

3. Fixing between measuring lines makes the instrument function as a 2-line mode tester.

4. The testing methods have 2 systems, one by the automatic measurement that judges the good-bad just by connecting the test cord to the measuring terminals. Another is the manual measuring starting the measuring work by means of a measuring switch.

For manual measurement, the external control input terminal is separately provided in order to control output signal from another device such as an automatic checking machine etc.

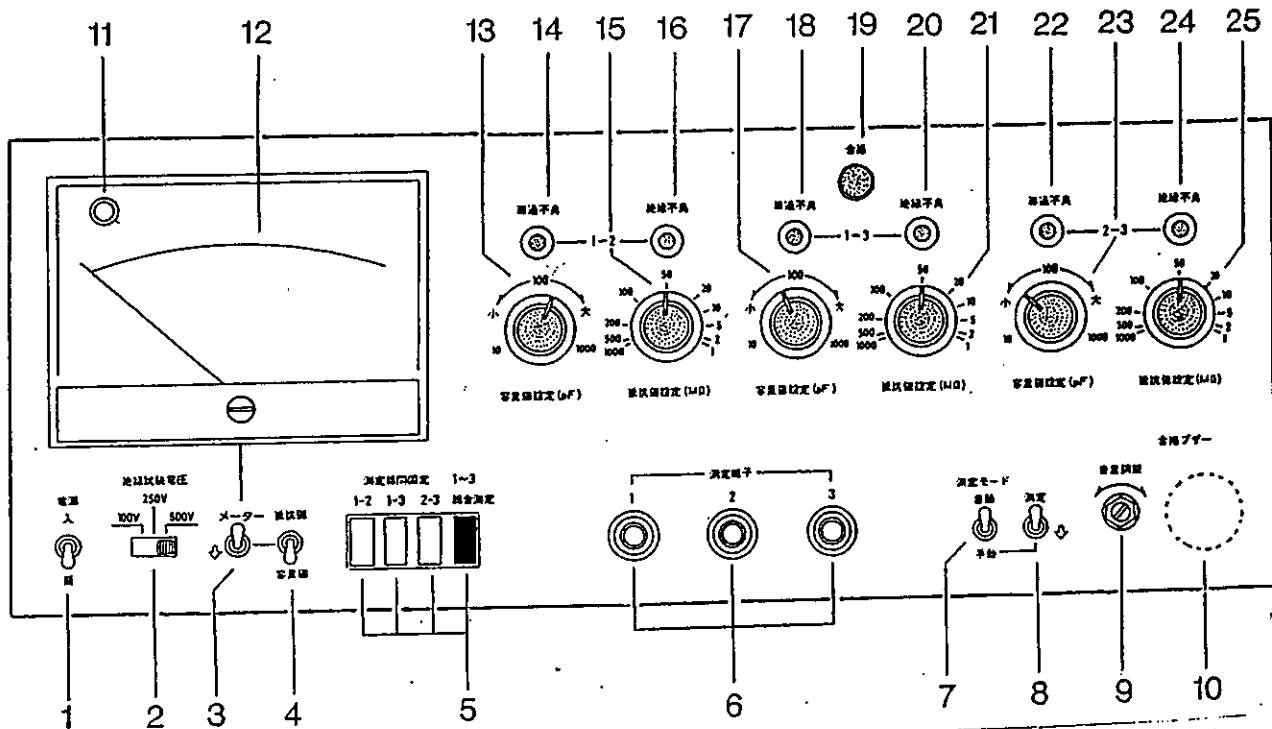
5. When the test cord is judged good, in addition to the lamp indication, an intermittent sounding buzzer works. The sound volume is optionally variable.

6. The meter usually indicates bad values only when the electrostatic value at the continuity test, and the resistance value at the insulation tests are faulty.

However, it is possible by means of the meter switch to watch always the meter indication regardless of the good-bad result of the test cord, by setting the change over switch between the measured lines fixed either at 2 lines of 1-2, 1-3 or 2-3.

Moreover, by utilizing the meter switch, a faint open circuit at a bending test of a tested cord, or a faint short circuit detection becomes possible, only when the fixed switch at the 2 lines is applied between the measured lines. (External control input terminal provided)

### § 3. FRONT PANEL ARRANGEMENT

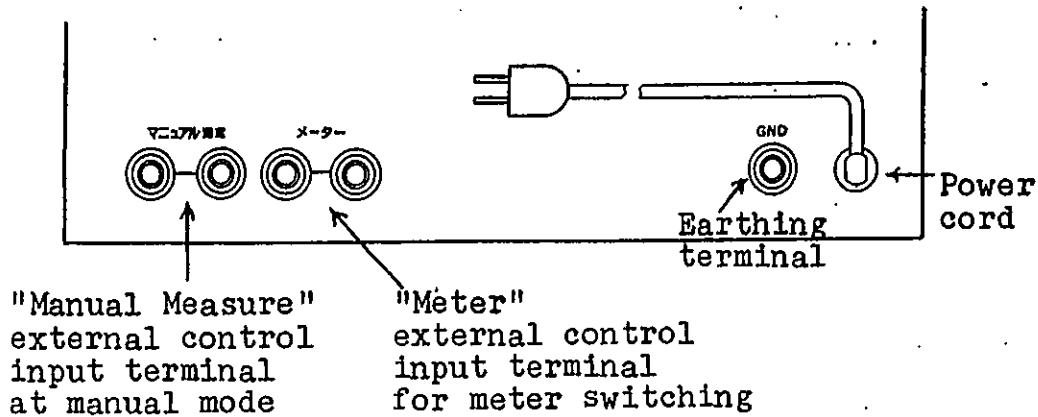


1. Power switch (ON-OFF)
2. Insulation test voltage change over switch  
(100V/250V/500V for CAD-3L and 1000V/2000V for CAD-3H)
3. Meter switch  
The change over switch of between 5 measured lines are set fixed between 1-2, 1-3 and 2-3. Push down the switch and the meter works to detect either a faint open circuit or a short circuit, regardless of the good-bad of the tested cord.
4. Resistance value/Capacitance value change over switch
5. Change over switch between measured lines  
When operated in the 2-line mode, either one of 1-2, 1-3 or 2-3 is fixed set.

Overall measurement at 1 to 3: When operated in the 3-line mode, either one of among 1-2, 1-3 or 2-3 is automatically changed over.

6. Terminals of measurement (1 in red, 2 in blue and 3 in black)
7. Measurement mode change over switch (AUTO/MANUAL)
8. Measurement switch in manual mode: To start measurement, push down the lever.
9. Semi-fixed controller of the "GOOD" buzzer sound volume
10. "GOOD" buzzer
11. Power indicator lamp (red LED)
12. Capacitance and resistance indication meter
13. Capacitance value setting knob between 1-2
14. Continuity fault indication lamp between 1-2 (red LED)
15. Resistance value setting knob between 1-2
16. Insulation fault indication lamp between 1-2 (red LED)
17. Capacitance value setting knob between 1-3
18. Continuity fault indication lamp between 1-3 (red LED)
19. "GOOD" indication lamp (green LED)
20. Insulation fault indication lamp between 1-3 (red LED)
21. Resistance value setting knob between 1-3
22. Continuity fault indication lamp between 2-3 (red LED)
23. Capacitance value setting knob between 2-3
24. Insulation fault indication lamp between 2-3 (red LED)
25. Resistance value setting knob between 2-3

#### §4. REAR PANEL ARRANGEMENT



#### §5. CAUTIONS IN OPERATION

1. Avoid to use in an environment of high temperature and high moisture. In the rainy season, the insulation test in high moisture creates leakage current to affect an accurate judgement. Test is to be carried in as much dried environment as possible.
2. Most care is wanted in operating Model CAD-3H, as its voltage is as high as DC 1000V/2000V to meet high tension cords.
3. With a good (test passed) cord, when the continuity and insulation tests are repeated, or with a faulty insulation, when the test stops, an insulation test voltage is impressed to the measuring terminal 1 (red) or 2 (blue). Avoid to touch it with hands directly, lest you should be shocked.
4. Besides the measuring terminals, direct touch to the insulation coating also affects the accurate judgement owing to the body capacitance to the earth.

In the actual operation, it is recommended to use well insulated gloves to protect you from an electric shock.

5. For testing insulation voltages, be sure to set the power switch at OFF position, at the change over of 100V/250V/500V for CAD-3L and 1000V/2000V for CAD-3H.
6. The "GND" terminal on the rear panel needs be earthed to prevent danger and erroneous operation.
7. In case a test box panel is to be handmade in order to mount test sockets etc. to it, choose materials of high wetproof and high insulation.

8. Also use testing sockets of high resistant to humidity and high insulation.
9. Wires from the test box terminals to the testing sockets need as much separated as possible and that at the shortest length.

Twisted wires or parallel cords in the continuity test may degrade the measurement accuracy owing to the by-pass signal current. Do not use such wires nor cords.

10. In case the tested cord is shielded, the twisted wires are connected to the terminal 2 (blue) and 3 (black), and the shielded wire to the terminal 1 (red).
11. When the withstanding voltage of the tested cord is lower than the rated insulation voltage, the judgement becomes unstable.

This is because at the moment shifting to the insulation test, the test voltage is 100% impressed to cause an insulation breakdown to extremely lower the resistance value and the impressed voltage causing again the condition of insulation breakdown.

When the above condition is continuously repeated, the judgement becomes unstable, since in the 2-line mode, the defective insulation lamp and the good lamp light alternately, or the indication becomes very irregular.

In the 3-line mode, a faulty insulation between any lines, change over between lines and good indication are irregularly repeated, which is judged to have caused due to insufficient withstanding voltage to the tested cord.

## §6. OPERATION

1. Firstly, receptacles of the tested cords, sockets or connectors etc. are connected to the panel.

Detach the panel from the test box by removing 4 pcs. of 3ø screws. Sockets or connectors adaptable to the tested cords are mounted to the panel to be wired. Fasten them with screws and insert into the measuring terminals.

2. In accordance with the rated voltage of the insulation test for the tested cord, the insulation test voltage change over switch is set either at 100V, 250V or 500V for CAD-3L, and at 1000V or 2000V for CAD-3H.
3. The resistance value setting knob is adjusted to the rated insulation resistance value of the tested cord. In the 3-line mode, it is set among respective 3 lines. In the 2-line mode, it is set only between the tested lines.

4. The capacitance value setting knob is turned full clockwise in advance or towards 1000pF position. In the 3-line mode, all the setting knobs among 3 lines are turned full clockwise. In the 2-line mode, the setting knob between the tested lines only is turned full clockwise.
5. Even in the 3-line mode, firstly, for decision of the judgement setting for the continuity test capacitance of a good cord, the change over switch between measured lines is set at the 2-line mode by fixing either at 1-2, 1-3 or 2-3.
6. Even in the manual mode measurement, the change over switch is set at first to the AUTO side in order to set the good-bad judgement standard for the continuity test capacitance of a good cord.
7. By manual measurement, in order to control measurement by means of another signal, the control line is connected to the external control input terminal "MANUAL MEASURE" on the rear panel.

External control input terminal "Manual":  
Open = Non-measurement. Short = Measurement

8. The power cord is connected to the AC mains of 50/60Hz and the power is on.
9. As the power switch is thrown, firstly the continuity fault indication lamp remains lit between the specified lines by the between lines switch.
10. A good cord same as the tested cord of the same length is inserted in the sockets on the test box panel to decide the judgement standard value for the continuity test.
11. The capacitance setting knob between lines specified by the measured lines change over switch, is turned slowly from right to left. The continuity fault indication lamp disappears between the lines at which point it is well adjusted.

The length of the tested cord varies more or less, and in case it is shorter than the good cord, it is judged as faulty due to insufficient capacitance even if it is not open circuited.

The setting knob is better to be set at a little leftward direction or to the less capacitance point than the continuity good-bad cross point in order to obtain an assured good-bad judgement.

In the 3-line mode, the setting is applied to all among 3 lines. In the 2-line mode, the setting is applied between the tested lines only.

12. After the setting of the good-bad judgement standard value for the continuity test is over, when using as the 3-line mode, the change over switch between the measured lines is turned to the 1-3 overall measurement.

13. The preparation is over to proceed to the measurement.

A. Automatic Measurement

1. In the 3-line mode: As the tested cord is put in the socket on the box, between each lines is automatically switched over to show a result of good-bad by lamp.

a. Faulty continuity

When the measuring terminal 1 is open, the continuity fault indication lamp lights either between 1-2 or 1-3.

When the measuring terminal 2 is open, the continuity fault indication lamp lights either between 1-2 or 2-3.

When the measuring terminal 3 is open, the continuity fault indication lamp lights either between 1-3 or 2-3.

b. Faulty insulation

Faulty insulation indication lamp lights between the faulty lines.

c. Good (test passed)

After the continuity and insulation tests have been over between 1-2, 1-3 and 2-3 lines, the indication lamp winks to indicate it is good (passed).

At the same time, it is indicated by buzzer sound of which the sound volume is adjustable by an ordinary screw driver.

2. In the 2-line mode: As the tested cord is plugged in the test box, the good-bad result between the lines is instantly indicated by lamp.

a. Faulty continuity

The faulty continuity indication lamp remains lit between the lines.

b. Faulty insulation

The faulty continuity lamp between the lines is off and the faulty insulation indication lamp is on.



c. Good (passed)

The faulty continuity lamp between the lines is off and the "GOOD" indication lamp winks. The intermittent sound buzzer can also be adjusted to the proper volume in the same way as in the 3-line mode.

3. Indication by meter:

It usually indicates only at the faulty display. The change over switch of resistance value/capacitance value is turned to the resistance value, the resistance value of the faulty cord is indicated when it is of faulty insulation. When it is turned to the capacitance value, when the continuity is faulty, the capacitance value of a faulty cord is indicated respectively on the meter.

Only when the change over switch between the measured lines is set fixed in the 2-line mode, as the meter switch lever is pushed down, regardless of the good-bad of the tested cord, the resistance or capacitance value is indicated on the meter respectively by the resistance value/capacitance value change over switch.

B. Manual Measurement

The tested cord is plugged in the test box sockets. To start the measurement, push down the measuring switch lever or the external control input terminal on the rear panel "Manual Measure" is short circuited.

The indication of result is same as in "Automatic Measurement" both in the 3-line and the 2-line modes. To stop the measurement, return the measuring switch lever, or open the external control input terminal "Manual Measure".

14. Tested cords terminated on both ends with plugs or jacks

The continuity test by this instrument is effected by measuring the capacitance value between the line capacitance of the tested cords in order to compare with the specified standard value to judge the good-bad.

If the tested cord is open circuited in the line, the capacitance value becomes lower than the specified value to show it faulty.

When the terminated place on the opposite side of the test box plugs or jacks is open circuited, the capacitance value is less different from the specified value to obtain a faulty judgement.

Accordingly, in case of the tested cords terminated on both sides with plugs or jacks, if the appearance is same, after the "GOOD" indication, plugs or jacks on the opposite side may be plugged in the sockets of the test box to repeat the tests.

However, in most cases, the appearance is not same, and after the "GOOD" indication, the plugs or the jacks on the opposite side are shorted together, and if the insulation is faulty, the tested cord is judged good at the both ends.

In the 3-line mode, the short-circuiting is effected either one of among 1-2, 1-3 or 2-3 on the opposite side terminals. If one of between the lines, indicates faulty of insulation, the tested cord is judged good.

## §7. OUTLINE OF OPERATION AND TESTING ORDER

### 1. Operation in the 3-line mode

The testing between lines is effected in the order of 1-2, 1-3 and 2-3, starting from the continuity test. After the continuity is good, it automatically proceeds to the insulation test.

First, start from the position between lines where the power is thrown (either any one of 1-2, 1-3 or 2-3). For instance, if the tested cord is connected in the state of faulty continuity between 1-3, first, the continuity test is effected between 1-3 and after it is noted good, proceed to the insulation test between 1-3.

When the insulation is also good, then proceed to 2-3, and then to 1-2 in the order of the continuity and insulation.

When between all the lines are good, "GOOD" indication is noted, and return to the first step of the continuity test between 1-3, and the change over switch is continuously repeated till the tested cord becomes faulty on the way, otherwise the tested cord is removed from the test box.

When faulty insulation exists between specified lines, the operation stops at the lines, indicating a state of faulty insulation between the specified lines.

As the tested cord is removed from the test box, the state of faulty insulation restores to the state of "GOOD", to indicate the faulty continuity of the following lines, entering in the state of stand-by automatically.

### 2. Operation in the 2-line mode

In the same way as in the 3-line mode, proceed to in the order of continuity and insulation. After "GOOD" indication, the continuity and insulation tests in the lines are continuously repeated till the tested cord becomes faulty during testing, or removed from the test box.

## §8. DETECTION OF FAINT OPEN CIRCUIT AND FAINT SHORT CIRCUIT

When the tested cord is judged good, the continuity and insulation tests are repeated. In such a case, the tested cord may become faulty at the plug due to improper pressing, moulding or soldering work to produce incomplete contact followed by instant open circuit or a faint open circuit.

Or, when a part of twisted wires may almost touch another part to create a delicate fault in insulation or a faint short circuiting. The detection of open circuit in such a continuity test is very difficult since the time needing for the continuity test is very short compared with the insulation testing time.

Moreover, detection of faulty insulation is effected at an instant during the repetitive functions. Therefore, such an instant faint open circuit and a faint short circuit are hard to be detected in the usual repetitive procedures.

However, only when this instrument is operated in the 2-line mode, pushing down the meter switch lever, or shorting the external control input terminal "Meter" on the rear panel, makes it continuity test mode or insulation test mode, enabling to detect a faint open circuit and a faint short circuit.

In other words, in the usual function as the 2-line mode, after the "GOOD" indication, the resistance value/capacitance value change over switch is set either to the capacitance value for a faint open circuit, and to the resistance value for a faint short circuit.

Push the meter change over switch lever down, or short circuit the external control input terminal "Meter" on the rear panel, to detect a faint open circuit or a faint short circuit by bending the plug section of the tested cord.

When an instant open circuit or a faint short circuit is found, either the faulty continuity or the faulty insulation lamp is instantly on, and at the same time, the meter indication deflects though instantly.

Since a faint open circuit and a faint short circuit tests are carried frequently in a factory inspection line, a foot switch is conveniently applicable to the external control panel "Meter" on the rear panel.

In the 3-line mode, after "GOOD" indication, among 3 lines changing over is always effected which makes impossible to detect a faint open circuit or a faint short circuit.

In this case, after "GOOD" indication, the switch between the measured lines is set fixed to operate by using as one of the 2-line mode for 1-2, 1-3 or 2-3.

In the 3-line mode, a faint open circuit is detected between either 2 lines of 1-2, 1-3 or 2-3 resulting in completing detection of all the lines. For a faint short circuit detection, it is necessary to check among all the 3 lines.

## §9. RATINGS

1. Number of Line to Measure: In the 3-line mode 3 lines  
In the 2-line mode 2 lines

### 2. Continuity Testing Section

- A. Testing power supply: AC 10kHz 5Vp-p approx.
- B. Capacitance value setting: 10pF - 1000pF approx.  
Continuously variable. Independent  
setting among 3 lines.
- C. Effective length of judgement

When the real capacitance of the tested cord is too much as compared with the setting capacitance value, the effective length for judgement of the good-bad becomes shorter accordingly.

For instance, in the setting capacitance of 100pF, when a good tested cord of 200pF is open circuited at a distance of 50% more apart from the test box, the capacitance is not less than 100pF, and is not be judged faulty.

However, for a faulty continuity of an ordinary cord at an open circuited part, faults almost exist near the plugs and jacks, and if the capacitance of a good cord is set at a lower value than the crossing point, an accurate judgement is available.

- D. Meter scale range: 0 - 1000pF (center 100pF approx.)

### 3. Insulation Testing Section (CAD-3L)

- A. Testing power supply: DC 100V/250V/500V in 3 ranges
- B. Resistance value setting range: 1M $\Omega$  - 1000M $\Omega$  continuously  
variable. Separate setting  
among 3 lines.

- C. Setting errors: Below 10M $\Omega$  within  $\pm 50\%$   
10M $\Omega$  - 100M $\Omega$  "  $\pm 20\%$   
100M $\Omega$  - 500M $\Omega$  "  $\pm 30\%$   
Over 500M $\Omega$  "  $\pm 50\%$

- D. Effective length of judgement: All the area of the tested cord.

- E. Meter scale range: 0 - 1000M $\Omega$  (center 50M $\Omega$  approx.)

### (3) Insulation Testing Section (CAD-3H)

- A. Testing power supply: DC 1000V/2000V in 2 ranges
- B. Resistance value setting range: 2M $\Omega$  - 2000M $\Omega$  continuously  
variable. Separate setting  
among 3 lines.

- C. Setting errors: Below 20M $\Omega$  within  $\pm 50\%$   
 20M $\Omega$  - 200M $\Omega$  "  $\pm 20\%$   
 200M $\Omega$  - 1000M $\Omega$  "  $\pm 30\%$   
 Over 1000M $\Omega$  "  $\pm 50\%$
- D. Effective length of judgement: All the area of the tested cord.
- E. Meter scale range: 0 - 2000M $\Omega$  (center 100M $\Omega$  approx.)
4. Judgement Indication Lamp: GOOD (passed) Green LED 1 pce.  
 BAD continuity Red LED 3 pcs.  
 BAD insulation Red LED 3 pcs.
5. Indication Buzzer: Intermittent sound by piezo miniature speaker.
6. Mode of Measurement: AUTO/MANUAL switching over.
7. Manual Measurement Switch: Manual measurement switch on the front Panel. External control input terminal "Manual Measure" on the rear panel.
8. Testing Time (CAD-3L): Continuity Abt. 10ms for 1 line  
 Insulation " 0.3s for 1 line  
 GOOD indication Within 1s for the 3-line  
 " 0.3s for the 2-line
- Testing Time (CAD-3H): Continuity Abt. 10ms for 1 line  
 Insulation " 0.8s for 1 line  
 GOOD indication Within 3s for the 3-line  
 " 1s for the 2-line
9. Faint Open Circuit and Faint Short Circuit Detectable Time:  
 About 10ms min.
10. Operating External Power: AC V 50/60Hz
11. Dimensions and Weight: Instrument W375 x H155 x D230mm  
 Abt. 3.4 Kgs.  
 Test Box W125 x H55 x D105mm  
 Abt. 400 gr.
12. ACCESSORIES: Test Box 1 pce. & Instruction Manual 1 copy