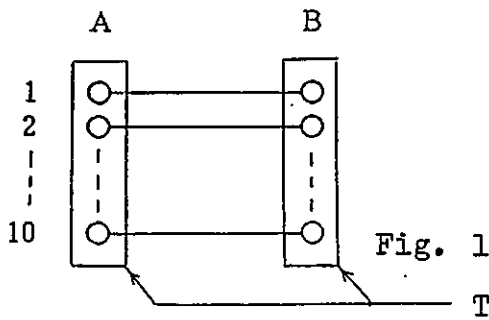


AUTOMATIC MULTIPLE CORD TESTER

MODEL CS-10VB

§ 1 OUTLINE

1. This multiple cord tester is applicable to testing continuity, faulty contact (faint open circuit) and insulation between lines of such a multiple cord with both ends treated (harnessed) or unified in one, as those provided with connectors or plugs, in a very simple and speedy way.
2. The applicable cord is exclusively the one as shown in Fig. 1 where both ends are named A and B, and between A and B are connected to each other at the same numbers, without branched off.



Continuity, faulty contact (faint open circuit) between A - B terminals, and insulation between each line of 1 - 10 is tested as per the left figure.

§ 2 FEATURES

1. Measurement is conducted at one action.

Just by connecting a tested cord to the measurement terminal, "GOOD-BAD" is indicated by lamp in a short time.

2. Setting of measured lines.

If the number of lines of a tested cord is less than 10, the setting is available between 2 - 10.

3. Faint open circuit detector function increases the value added in an inspection work.

Faulty contact caused by loose soldering or incomplete press work, which is normally difficult to be found, can assuredly be detected in a short time.

4. Setting of insulation testing time.

Regardless of the difference of electrostatic capacitance between lines caused by the variety of cord and length, an assured insulation test is conducted by switching over the insulation testing time.

5. Insulation testing voltage transferrable.

By means of a changeover switch, setting is available either at DC 250V or 500V.

6. Holding up of faulty state of insulation.

At an instance of faulty insulation detected, the faulty state can be held up to enable an accurate insulation test.

7. Testing insulation by group-combination system sharp cuts the testing time.

Dividing respective line in 2 groups, by changing the combination to be tested, the insulation testing time can be sharply cut for a cord with multiple lines, to improve the working efficiency.

8. By providing an insulation meter (a megohm meter), an insulation resistance value is indicated on it, in case faulty insulation is detected.

§ 3 FRONT PANEL ARRANGEMENT

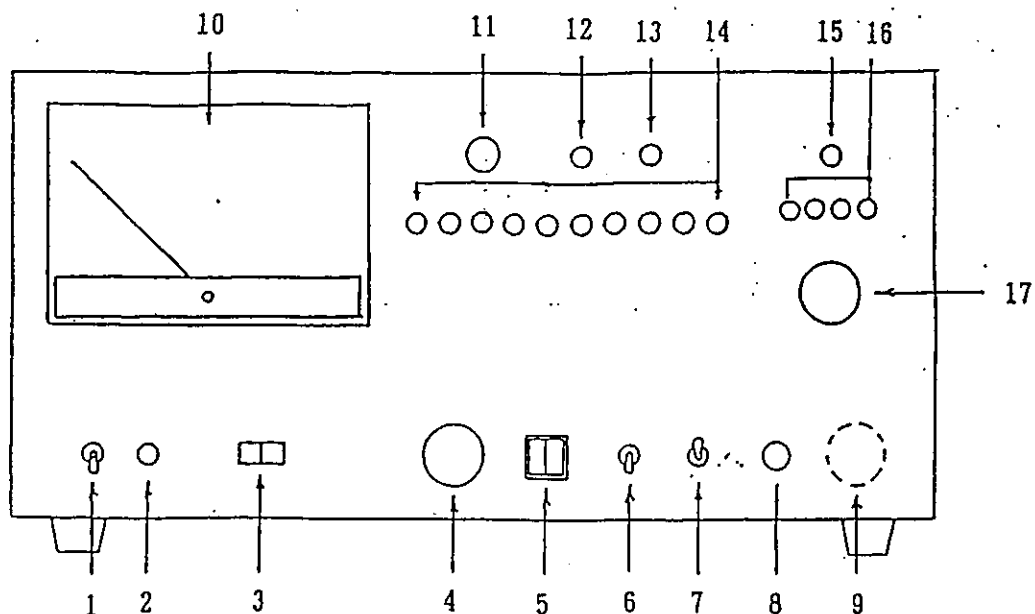


Fig. 2

1. Power switch
2. Power indicator lamp (red LED)
3. Insulation testing voltage changeover switch (250V/500V)
4. Insulation testing time changeover switch (0.2s, 0.4s, 0.6s, 0.8s, 1s in 5-step)
5. Digital switch to set the number of measured line (in the range of 02 - 10)
6. Changeover switch (Detection of faint open circuit/ Repetitive measurement)
7. Resetting switch at faulty insulation
8. Semi-fixed controller of "GOOD" buzzer volume
9. "GOOD" buzzer (miniature piezo speaker)
10. Insulation resistance indicator
11. "GOOD" indicator lamp (green LED)
12. Insulation fault indicator lamp (red LED)
13. Faint open circuit indicator lamp (red LED)
14. Faulty number of line indicator lamp (red LED 10 pcs.)
15. Insulation fault indicator lamp (red LED)
16. Insulation testing step indicator lamp (red LED 4 pcs.)
17. Insulation testing resistance setting variable resistor knob

§ 4 REAR PANEL ARRANGEMENT

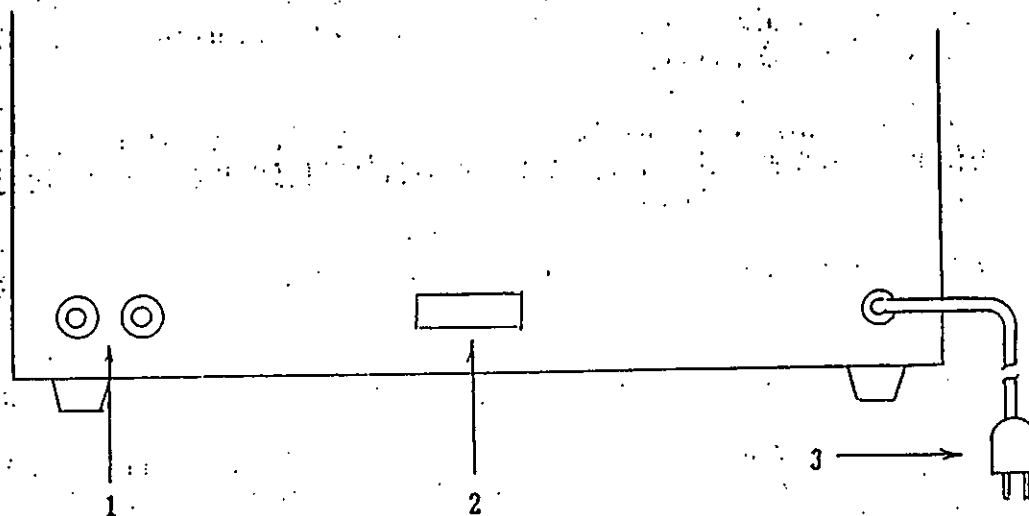


Fig. 3

1. External terminal for faint open circuit detection (for connection of a foot switch, etc.)
2. Measurement terminal (for connection of a tested cord)
3. Power cord

§ 5 IN ADVANCE TO OPERATION

1. Before operation, detach the panel from the accessoried adaptor box by removing 4 pcs. of 3Ø screws. Connectors, plugs, etc. adaptable to a tested cord are mounted to the panel to be wired in accordance with the pin numbers.
2. Connectors on the rear panel and accessoried adaptor box are numbered line 1 - 10 from left to right. Wiring to the receptacles to which a tested cord is connected must be so lined that the connectors on the rear panel and each terminal of the tested cord are lined in the same row. (Either terminal may be set as A or B.)

It should be so wired that the numbers correctly correspond to 1 - 10.

When the tested cord is less than 9 lines, say for instance 5 lines, lines 1 - 5 only are wired with the rest lines unwired.

As to the unwired pins, by setting at 5 the changeover switch of the measured line, those after pin 6 are to work same as in a wired condition to make the measurement invalid after pin 6.

3. After the mounting of connectors, plugs, etc. and wiring work is over, the panel is screwed again to the adaptor box. The connector on the rear panel and the adaptor box is connected.
4. In case a foot switch is connected to the external terminal to detect a faint open circuit, it is connected to the terminal on the rear panel.

§ 6 CAUTIONS IN OPERATION

In operating this instrument, pay caution to the following points.

1. It is requested to use in high temperature and high humidity. Especially in high humidity, parts concerned to measurement terminal, will be lowered of insulation to disturb accurate judgement in the insulation test. Pay much caution to the environmental temperature and humidity.
2. Plugs, jacks, etc. adaptable to a tested cord are connected to an adaptor box. Panels of the adaptor box are made of rigid vinyl chloride board. If you are to make it yourself, using a different material, select one of good damp proofing and insulation.
3. Including use of the attached adaptor box, wiring to plugs and jacks must be shortest possible to be least affected by external inductance.
4. A branched connector cannot be tested directly by this instrument. In testing it in a different circuit by switching or relaying, it is at times made difficult to give a normal GOOD-BAD judgement, owing to electro-magnetic inductance in the relay circuit or to external inductance caused by long wiring.

A device is added to the insulation test detecting outlet of the instrument so that an external inductance may be removed.

In case an influence by other wiring effect is more than the terminal parts at the tested cord, a normal GOOD-BAD judgement is unavailable.

In testing a branched connector in this method, avoid to use a relay that may cause electro-magnetic inductance and try to make wiring shortest in the terminal parts to be least affected by external inductance.

5. Be sure to set the power switch at "OFF" when the insulation testing voltage is changed over between 250V and 500V.

6. At the insulation test, including the operation stop with faulty insulation indicated, either 250V or 500V is impressed to the measurement terminal. Pay caution not to touch it with a naked hand lest you should be shocked.

However, a high resistance is connected in the power circuit output with very little current capacity to cause least danger.

7. Be sure to conduct changeover of the digital switch to set the number of measured line, with the tested cord disconnected or in non-testing state.
8. At the faint open circuit detection mode, in detecting a state of near open circuit, due to faulty soldering to the tested cord, faulty press or mould work, an incomplete contact at such a point other than the tested cord as the terminal connecting part, may be misjudged as faint open circuit. Pay caution to the wiring work to the measurement terminal.

§ 7 OPERATION

1. The insulation testing voltage changeover switch is set either at 250V or 500V according to the specified insulation testing voltage of the tested cord.
2. The power cord is connected to the AC mains of 50/60Hz and the power is thrown.
3. According to the number of line of the tested cord, the digital switch of the number of line to be measured is set within the effective testing range.

In case the setting switch is set at 00, 01 or 11 - 99, both "GOOD" and "BAD" indicator lamps do not light, and the function does not work even with the tested cord connected to it.

4. The insulation resistance setting knob is adjusted to the standard passed resistance value of the tested cord.
5. The insulation testing time changeover switch is set at a proper time according to the electrostatic capacitance value between lines of the tested cord.

The electrostatic capacitance value between lines differs according to the length, material, number of lines of the tested cord, and presence of shielded wires.

The testing time is set at 0.2s range when the maximum value of the capacitance between lines is less than 2000pF, and at the ratio of 0.1s per 1000pF when it is more than 2000pF.

However, in case shielded wires are contained to produce a big difference of capacitance value between lines, it is required to be set by making the maximum value between lines the standard.

Whereas, if the time setting is improper, especially when the testing time is short against a capacitance value of the tested cord, the indication becomes faulty even if the tested cord is passed of the insulation test.

As per Fig. 4, if the insulation testing time is set T_s , when the time T_s is over with a tested cord C (small), the detection voltage (e) is within the range of GOOD, and BAD is not indicated.

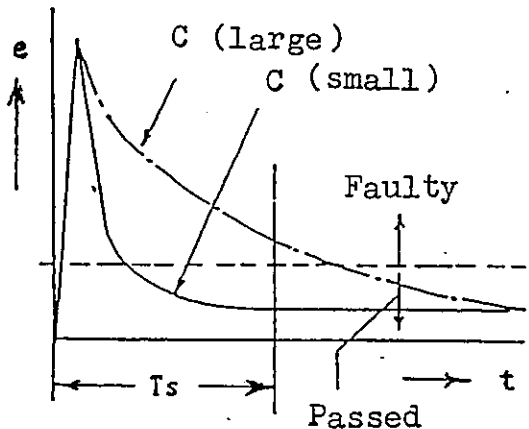


Fig. 4

e: Insulation test detection voltage

T_s : Insulation testing time

C (large), C (small): Capacitance between lines of a tested cord

When the time T_s is over with a tested cord C (large), the detection voltage (e) is still in the range of BAD, and BAD is indicated as the time T_s is over.

Even if the detection voltage drops down to the GOOD level afterwards, a faulty insulation is held by the instrument, and the indication is retained as faulty insulation.

However, when the faulty insulation is indicated, a resistance then is indicated on the meter, and it is possible to judge whether or not a proper insulation time is selected.

6. The changeover switch of "faint open circuit detection/repetitive measurement" is set to the side of "repetitive measurement" which is used for normal continuity and insulation tests.

* In case of detection by bending test of faulty contact owing to faulty mould and soldering work at the terminal of a tested cord, after "GOOD" indication at the normal continuity and insulation testing mode "repetitive measurement", the changeover switch is shifted to "faint open circuit detection", or in case a foot switch is used for the external terminal of the faint open circuit detection, the foot switch is pushed (external terminals being shorted) to detect a state of faint open circuit.

7. When a tested cord is not connected, the "GOOD-BAD" indicator lamp at first is in a state of faulty continuity and the faulty line number "1" remains lit respectively.
8. A tested cord is connected to the terminal on the panel of the adaptor box, and its "GOOD-BAD" is automatically indicated by lamp.
9. In case of faulty continuity

A. Open circuit

Two indicator lamps light at "faulty continuity" and "faulty line No.". When more than 2 lines are open circuited, one faulty number is indicated always for the smaller number only.

B. Erroneous wiring

Three indicator lamps in total light at "faulty continuity" and "faulty line numbers" erroneously wired to each other.

If one of the erroneously wired should contact further to another number of line, all such lamps light at "faulty line numbers".

Indication at "faulty continuity" and more than two "faulty line numbers" mean faulty continuity by erroneous wiring.

* A state of short circuit cannot be detected by continuity test, but be detected by insulation test as "faulty insulation".

10. In case of faulty insulation

The operation stops simultaneous with the detection of faulty insulation, the indicator lamp "faulty insulation" lights, and the insulation testing step indicator lamp also stops at the faulty point.

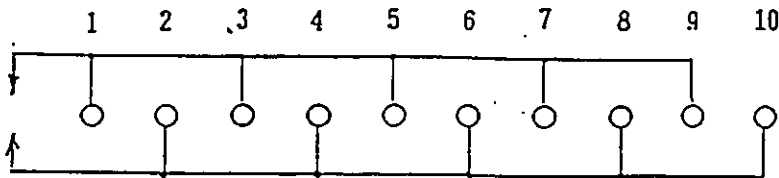
The insulation resistance meter indicates the resistance value then. The indication of "faulty insulation" can be held up with this instrument, and even the tested cord is detached from the terminal, the fault indication lamp remains light, whereas the meter indication returns to the ∞ position. Proceed to the next test after the indication is reset by means of "faulty insulation rest" switch.

- * In case of insulation test, the number of between lines of a tested cord is set as N, resulting in the number of between lines of the tested cord in order to test all the between lines as $N(N - 1)/2$.

Therefore, for a tested cord with 10 lines, the number between lines is calculated 45. If the test is carried from 1-2, 1-3, 9-10, 45 times of test are repeated needing a very long time. Thanks to the group measurement method by this instrument, only 4 times of test can complete all the number between lines of a tested cord with 10 lines.

However, by the group measurement method, indication between faulty lines is unavailable. Couplings at each step and between lines are as mentioned below:

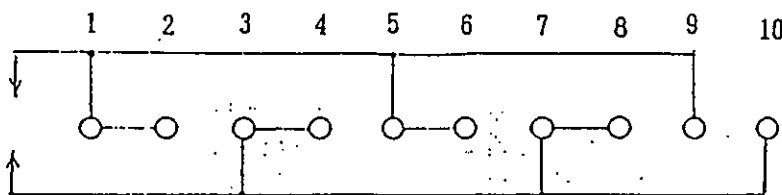
o Step 1



- 1-2 2-3 3-4 4-5 5-6 6-7 7-8 8-9 9-10
- 1-4 2-5 3-6 4-7 5-8 6-9 7-10
- 1-6 2-7 3-8 4-9 5-10
- 1-8 2-9 3-10
- 1-10

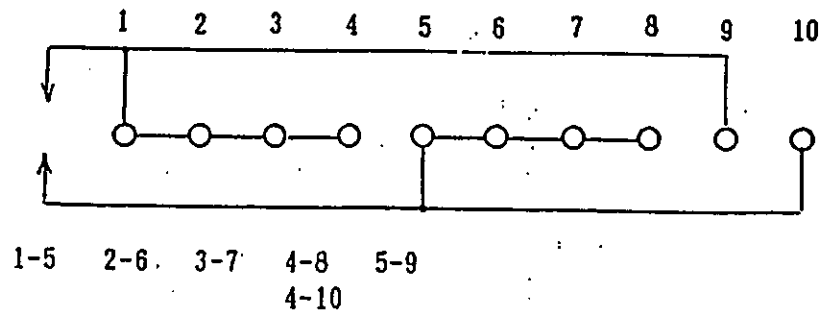
All even and uneven numbers are coupled.

o Step 2

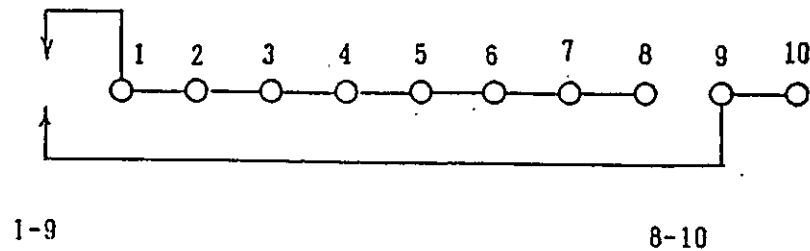


- 1-3 2-4 3-5 4-6 5-7 6-8 7-9
- 1-7 2-8 3-9 6-10
- 2-10

o Step 3



o Step 4



After a couple between some lines has been tested, if tested again on the next step, the indication on the next step is omitted if it was measured on the initial step.

Also, according to the values stipulated by the changeover switch of the number of measured lines, the number of step of the insulation test differ as follows:

<u>Number of measured line</u>	<u>Number of step</u>
2	1
3, 4	2
5 - 8	3
9, 10	4

11. In case of "GOOD"

Simultaneous with flickering of the "GOOD" lamp, the "GOOD" buzzer intermittently sounds. The sound is adjusted to a proper volume by adjusting the semi-fixed variable resistor.

12. Detection of faint open circuit

The changeover switch "faint open circuit/repetitive measurement" is shifted to the side of "faint open circuit".

Now, after the "GOOD" indication, without repeating ordinary continuity and insulation tests, measurement can be proceeded to faint open circuit detection mode on all the lines of the tested cord.

When the faint open circuit detection (bending test) is frequently repeated, the optional foot switch can be conveniently connected to the terminal for faint open circuit detection on the rear panel.

In this case, the changeover switch of the "faint open circuit detection/repetitive measurement" needs to be set to the latter side.

After the "GOOD" indication, when the above changeover switch is set to the side of "faint open circuit detection" or the foot switch connected to the external terminal being pushed (between the terminals being shorted), it is shifted to the faint open circuit mode.

The terminal of the tested cord is mechanically deflected by bending, vibration device of external vibration, an instant detection is possible for loose contact by faulty soldering and incomplete press work that occurred in a very short time.

When faint open circuit is detected, the "faint open circuit" and the "faulty line No." lamps light. The indication is retained till the tested cord is disconnected from the measurement terminal.

- * The indication of faint open circuit can be reset by disconnecting the tested cord from the measurement terminal. (Detection of all the lines are in the state of open circuit simultaneously and continuously).

As faint open circuit is detected on all the lines at a time, several numbers of faulty line may be indicated.

§ 8 TESTING ORDER & OUTLINE OF FUNCTION

1. Use on the side of repetitive measurement.

With a tested cord connected to the measurement terminal, continuity test is conducted between A and B terminals, in the order of line 1 - (number of line of the tested cord).

When the cord is passed of continuity, proceed to the Step 1 insulation test. When it is passed of the Step 1 insulation, return to the initial continuity test. (Return once to the continuity test between the insulation test and each step). When it is passed of continuity test, proceed to the Step 2 insulation test.

After conducted the insulation tests (for the number of steps) according to the number of lines of the tested cord, when the tested cord is passed, after "GOOD" is indicated the test is over.

Afterwards, the testing operation is continuously repeated until a fault is detected on the way, or the test cord is disconnected from the measurement terminal.

2. Use on the side of faint open circuit.

At first, same function is conducted as on the repetitive measurement. After "GOOD" is indicated, it is proceeded to the state of continuity test for faint open circuit on all the line 1 - (number of line of the tested cord).

If a terminal between A and B of some line is in a state of open circuit even instantly, the open circuit is detected and help up to indicate faint open circuit.

- * Even when the changeover switch is, from the beginning, set to the side of "faint open circuit", after completing ordinary continuity and insulation tests, only when the tested cord is passed, it is automatically shifted to the mode of faint open circuit detection.

For assured measurement, first set to the side of "repetitive measurement", and after "GOOD" is indicated, changeover to the side of "faint open circuit", as it operates ordinary continuity and insulation tests repeated several times.

9 RATINGS

1. Number of line of the tested cord:
Max. 10 (setting available between 2 - 10)
2. Testing power supply:
Continuity test and Faint open circuit detection-
DC 12V abt. 1mA at normal continuity

Insulation test- DC 250V/500V in 2 ranges

At measurement terminals short circuited-
Abt. 100 μ A/500V range
Abt. 50 μ A/250V range

3. Resistance value setting range for GOOD-BAD judgement in the insulation test:
 - 1M Ω - 500M Ω Continuously variable
4. Setting error for the above:
 - Below 10M Ω within $\pm 50\%$
 - 10M Ω - 100M Ω " $\pm 20\%$
 - Over 100M Ω " $\pm 50\%$
5. Indicator lamp:
 - GOOD (passed) Green LED 1 pce. flicker
 - BAD (faulty) continuity Red LED 1 pce.
 - Faint open circuit Red LED 1 "
 - Number of faulty line Red LED 10 pcs.
 - Faulty insulation Red LED 1 pce.
 - Step of insulation test Red LED 4 pcs.
6. Indication buzzer: Intermittent sound by miniature piezo speaker
7. Testing time:
 - Continuity test Below 10ms
 - Insulation test 0.2s, 0.4s, 0.6s, 0.8s, 1s at each step (5-step)
 - GOOD indication Varies according to setting of insulation testing time and number of line of a tested cord (numbers of step of insulation test)
8. Detectable time of faint open circuit: Abt 1ms over
9. Insulation resistance meter: 0 - 1000M Ω (abt 50M Ω at center)
Indication at a faulty time only
10. Measurement terminal: FC type connector 20P
Rear panel 1 set
11. Faint open circuit detector external terminal;
Rear panel 1 set
12. Accessories:
 - Adaptor box to mount the measurement terminal that accepts a tested cord 1 pce.
 - Cable with connector Abt 50cm long/pce.
 - Instruction manual 1 copy
13. Power supply: AC mains ($\pm 10\%$), 50/60Hz
14. Dimensions & weight:
 - Instrument W345 x H175 x D220mm, abt 5kg
 - Adaptor box W125 x H55 x D105, abt 400gr.

