

Equipotential Line Demonstrator

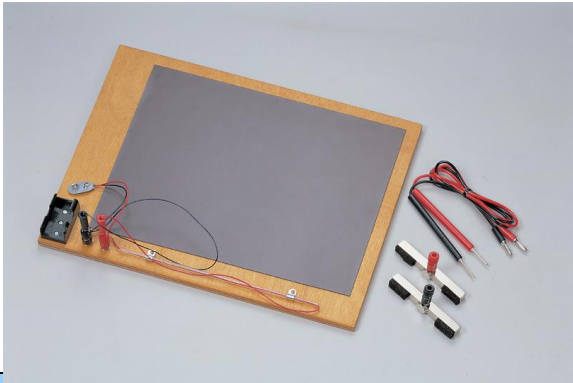
Cat. No. B10-1471-W0

Instruction Manual

Thank you very much for purchasing Cat. No. B10-1471-W0, "Equipotential Line Demonstrator". To ensure correct and safe usage, read this manual carefully first.

Contents

- 1. Measuring Board : 1pc
 - 2. Electrode : 2pcs
(Point electrode and Line electrode)
 - 3. Test leads : 2pcs
 - 4. Conducting paper (A4) : 10pcs
 - 5. Battery (9V) : 1pc
- Additional necessary equipment (not included):
Galvanometer, Digital tester,



Introduction

Purpose of this product:
To draw equipotential lines with help of conductive paper and investigate electric field.

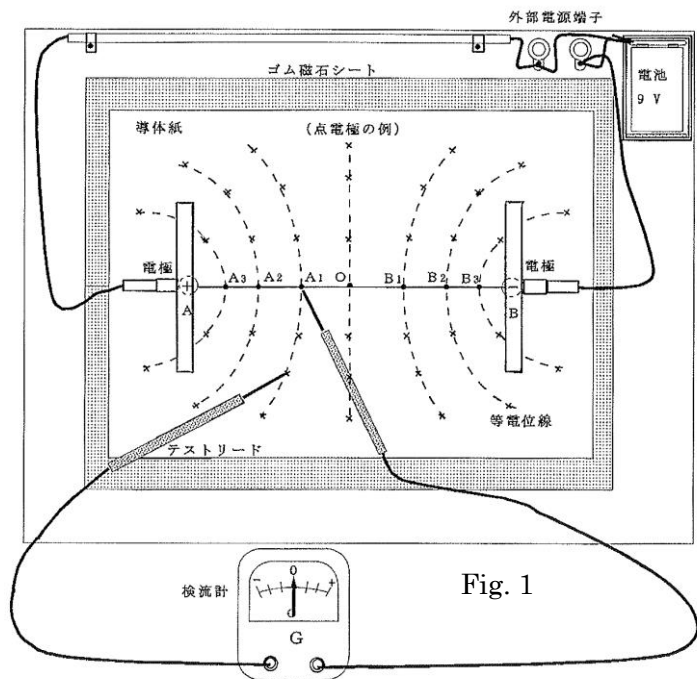
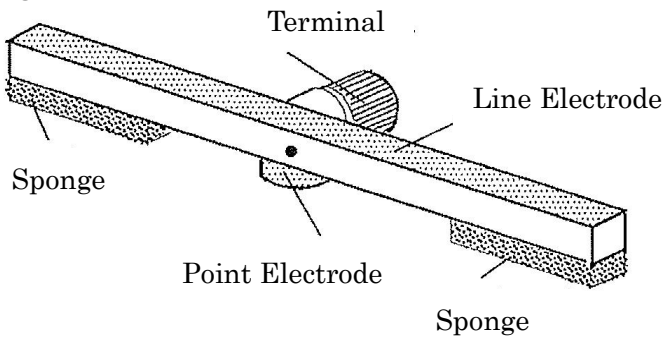


Fig. 1

The enclosed electrodes can be used as shown in the figure 2, if we use the surface with the sponges and small disk made of iron, then the electrode becomes a point electrode. If the electrode is turned the other way and all the surface is used it becomes line electrode. We can draw equipotential lines of both cases. As well we can use point electrode on one side and line electrode on the other side and conduct the experiment.

Fig. 2



Experiment Procedure

To investigate electric field between the electrodes we will draw equipotential lines with both types of electrodes (point electrode and line electrode). To ensure that the electrodes and conductive paper are close to each other rubber magnet sheet and iron electrodes are used. We will use 9V battery, but terminals to use external power supply (9-12V) are included as well. Please note that if you will use an external power supply do not forget to remove the battery from the box.

[1] Equipotential lines by Point electrodes (Fig. 1)

- ① Draw a horizontal line in the center of the conductive paper with pencil, in the middle of the line mark 0 and then place the conductive paper on the rubber magnet sheet.
- ② 2. Place the positive (red) and negative (black) terminals 16cm away from the horizontal line, then position the terminals so that 0 is in the middle between them and make the electrodes to be touching the conductive paper. Draw an outline of the electrodes with the pencil on the conductive paper so that the position of the electrodes is known during the experiment. To avoid risk of moving the electrode during measurement you can stop it from moving by sticking it to the conductive paper with cellophane tape.
- ③ Connect test leads to digital tester. Set the measurement unit to DC voltage. Fix the tip of the negative test lead to middle point 0 and slide the tip of the positive test lead from the middle point 0 following the horizontal line to the side where positive terminal (A) is located. Mark each 1V of electric potential difference with small A1, A2 ... Furthermore, switch positive test lead for negative test lead and slide the tip of the negative test lead from the middle point 0 following the horizontal line to the side where negative terminal (B) is located. Mark each 1V of electric potential difference with small B1, B2, ...
- ④ As shown in figure 1, replace the digital tester with galvanometer, fix the tip of one test lead to the middle point 0, slide the other test lead vertically through the middle point 0 and where the needle of galvanometer will become 0 (equipotential line) mark x with pencil about 6 times in appropriate intervals.
- ⑤ Next fix the tip of one of the test leads to A1, then slide the other test lead through the A1 and mark x with pencil points where equipotential lines are in appropriate intervals as shown in figure 1. Similarly search for other equipotential points of A2, A3 ... B1, B2 ... and mark them with x.

When using a digital tester instead of a galvanometer, set the measurement unit to DC voltage. Fix the tip of the negative test lead to middle point 0, slide the other test lead through A1 first and mark each 1V of electric potential difference with x and same as before. Next we search for points where the potential difference from the middle point 0 to A2 (2V) is same and mark them with x as before, similarly search for other equipotential points of each A3, A4 ... B1, B2 ..., and mark them with x. (As the number of digits of the readings get larger, the last numerical value changes and it gets difficult to measure, therefore we recommend to set the measurement value to maximum 2-3 digits.

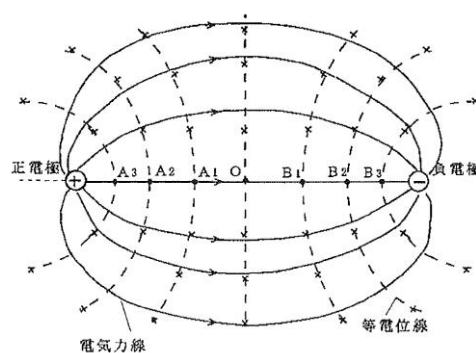


Fig. 3

- ⑥ After drawing the equipotential points, switch of the power supply or remove the battery from the box and remove the conductive paper from the measuring board. As shown in figure 3, connect with black pencil the equipotential dots in a shape of smooth curve and if you with red pencil draw lines of electric force orthogonal to the equipotential lines you can clearly see the shape of the electric field.

Caution:

1. Be careful not to move any of the electrodes during the experiment. If one of the electrodes moves, return it back to the original position drawn with a pencil and continue the experiment.
2. If you will draw equipotential lines with conducting paper still on the measurement board, the rubber magnet sheet will be damaged and marks from the pencil will remain. Therefore, before drawing the lines please remove the conductive paper from the measurement board.

[2] Equipotential lines by Line electrodes (Fig. 4)

- ① Same as when we used Point electrodes earlier, draw a horizontal line in the center of the conductive paper with pencil, in the middle of the line mark 0 and then place the conductive paper on the rubber magnet sheet. Place the positive (red) and negative (black) terminals 16cm away from the horizontal line, then position the terminals so that 0 is in the middle between them and make the electrodes to be touching the conductive paper. Draw an outline of the electrodes with the pencil on the conductive paper
- ② Same as when we used Point electrodes earlier, connect test leads to digital tester. Set the measurement unit to DC voltage. Fix the tip of the negative test lead to middle point 0 and slide the tip of the positive test lead from the middle point 0 following the horizontal line to the side where positive terminal (A) is located. Mark each 1V of electric potential difference with small A1, A2 ... Furthermore, switch positive test lead for negative test lead and slide the tip of the negative test lead from the middle point 0 following the horizontal line to the side where negative terminal (B) is located. Mark each 1V of electric potential difference with small B1, B2, ...
- ③ Replace the digital tester with galvanometer, fix the tip of one test lead to the middle point 0, slide the other test lead vertically through the middle point 0 and where the needle of galvanometer will become 0 (equipotential line) mark x with pencil about 6 times in appropriate intervals.
- ④ Switch of the power supply or remove the battery from the box and remove the conductive paper from the measuring board. As shown in figure 3, connect with black pencil the equipotential dots in a shape of smooth curve and if you with red pencil draw lines of electric force orthogonal to the equipotential lines you can clearly see the shape of the electric field.

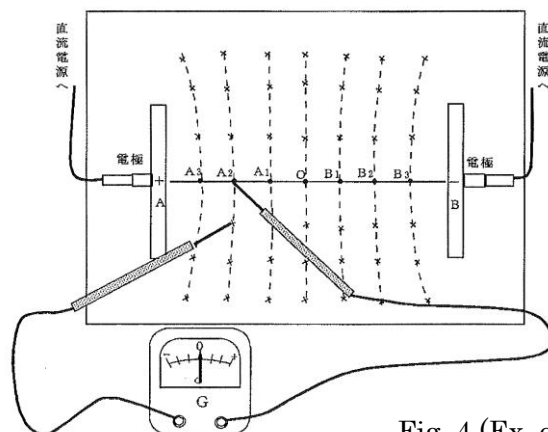


Fig. 4 (Ex. of Line Electrodes)

Caution:

- (1) After finishing the experiment, make sure to turn off the power source (battery or power supply), so that the electrodes or test leads will not touch each other and short circuit will not happen.
- (2) When using external power supply, make sure that battery (9V) is not in the battery box.
- (3) Conducting paper has high electric resistance, therefore analog voltmeter with low internal resistance is not suitable for measurement of equipotential lines. When you want to draw equipotential lines, please use digital tester, galvanometer, or DC Voltmeter "Crabee" CT-V (A05-7065-W0).

Technical Specification

Measurement board: battery box, rubber magnet attached, size: 365 x 280 x 9 mm

Electrode: point electrode and line electrode, one black and one red terminal

Note:

If you run out of the enclosed Conductive papers, you can buy them separately as follows P70-2591-W0 Conductive papers (100pcs), please inquire your local distributor.

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