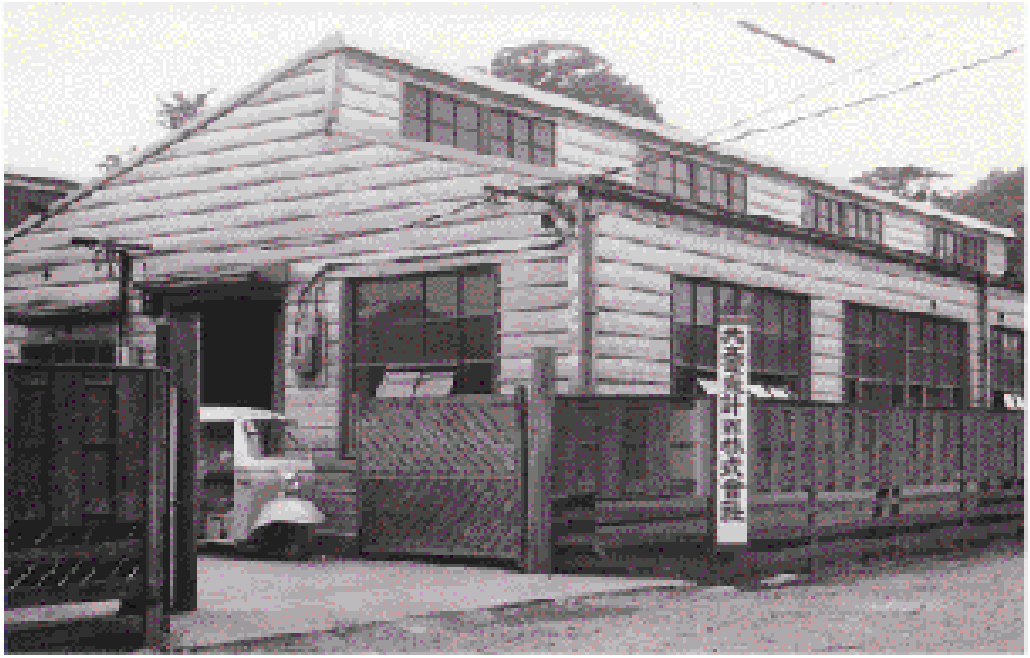
KYORITSU

IZMIR CONGRESS October 2019

THE CLASSICAL AND MODERN WAYS TO MEASURE THE EARTH RESISTANCE

1940-2019: 79 YEARS OF HISTORY



Our Factory in 1940

Our Office at present

79 YEARS OF HISTORY

Gyoda Factory

Uwajima Factory

R&D

HQ

Ehime Factory

THAI Factory

HQ

New THAI Factory

1950 1960 1970 1980 1990 2000 2010 2013 2015 2017 2019

JAPAN

TURKEY

Quality and reliability is our tradition

KYORITSU

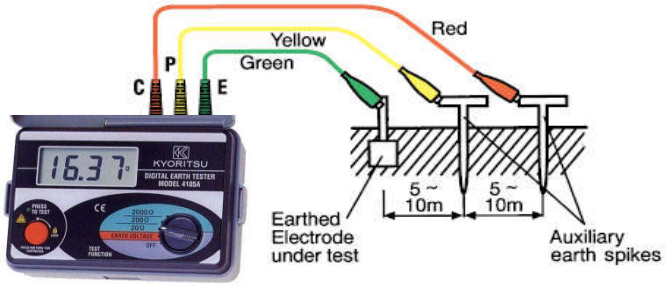
SAYMPA

27 YEARS OF GOOD BUSINESS RELATIONSHIP

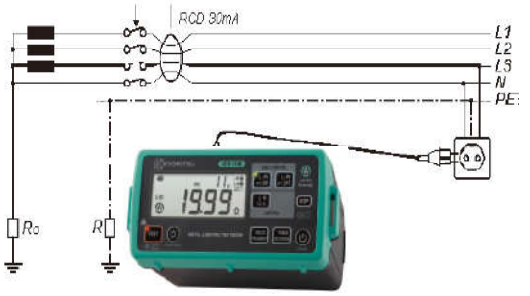
THE CLASSICAL AND MODERN WAYS TO MEASURE THE EARTH RESISTANCE

There are at least 3 possible methods for Earth measurement:

1) **Volt-Amperometric method** using classical earth resistance testers by sticking the two auxiliary earth spikes into the ground.



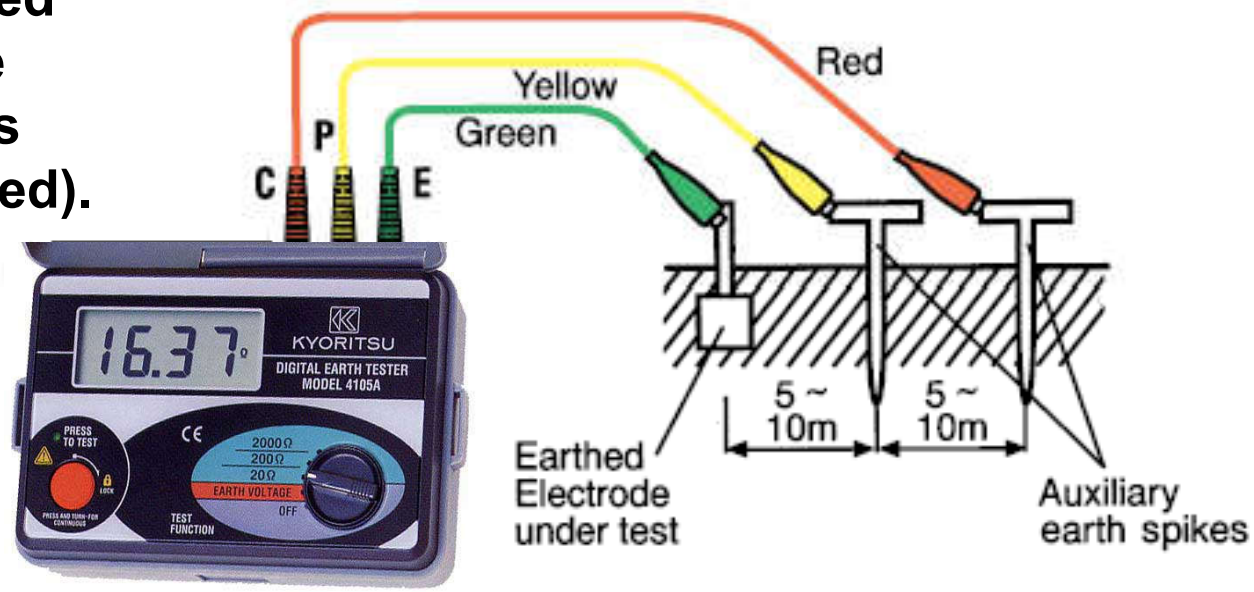
2) **Loop tester method.** This is an easy method of testing the earth resistance in a TT system, without sticking the two auxiliary earth spikes into the ground.



3) **Earth Clamp tester method.** This is simplified method for measuring the Earth Resistance in multi-Earthing systems. It does not need auxiliary earth spikes and the disconnection of the earth electrode under test.

1) Example of measurement of earth resistance by Earth Tester (Volt-Amperometric method).

-It does not need AC line for the measurements (battery powered).



-It requires auxiliary earth bars driven into the ground.
-It needs to extend the cords of the auxiliary earth bars in presence of large Earthing installations.

1) VOLT-AMPEROMETRIC METHOD

New Earth Resistance Tester Extremely robust, for outside use under all weather conditions for IP 67

KEW 4105DL

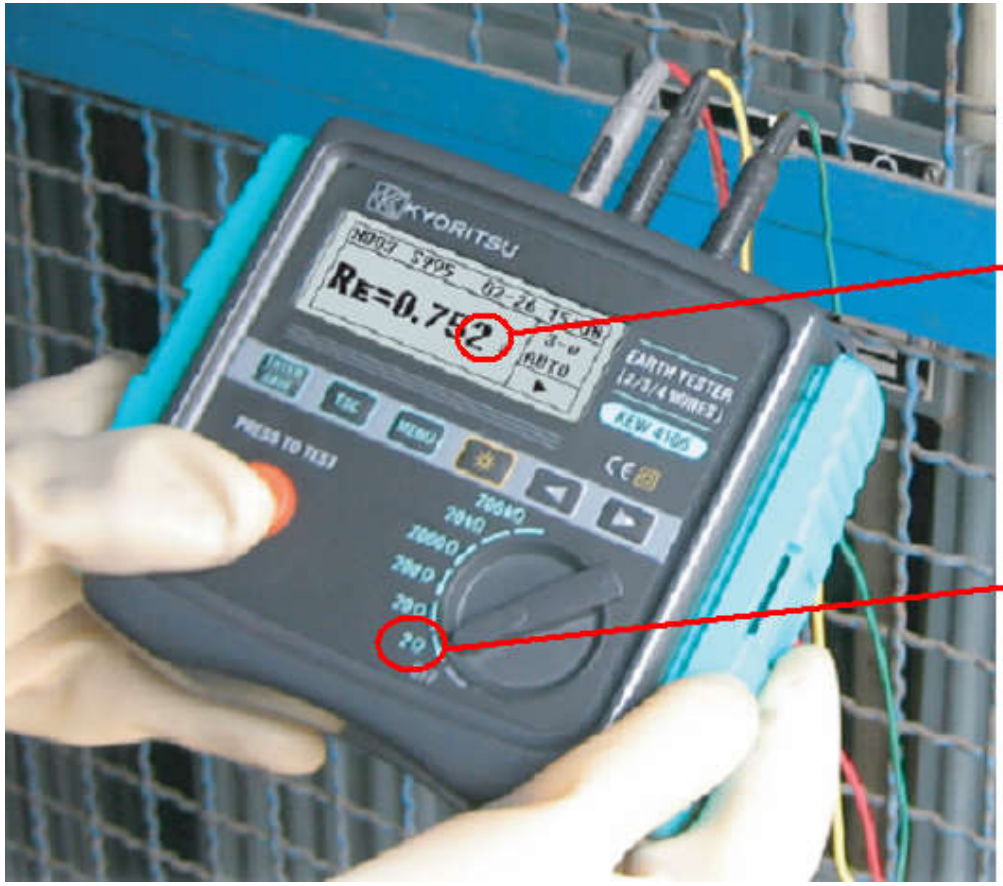
New Earth Resistance Tester Extremely robust, for outside use under all weather conditions for IP 67

KEW 4105DL

It is so well protected that you can even wash it under the running water to remove dust and mud.

IMPORTANT FEATURES:

- High test current up to 80 mA yielding resolution of 0.001Ω on 2Ω Range!



Resolution
0.001 ohm!

2 ohm Range!

KEW 4106

IMPORTANT FEATURES:

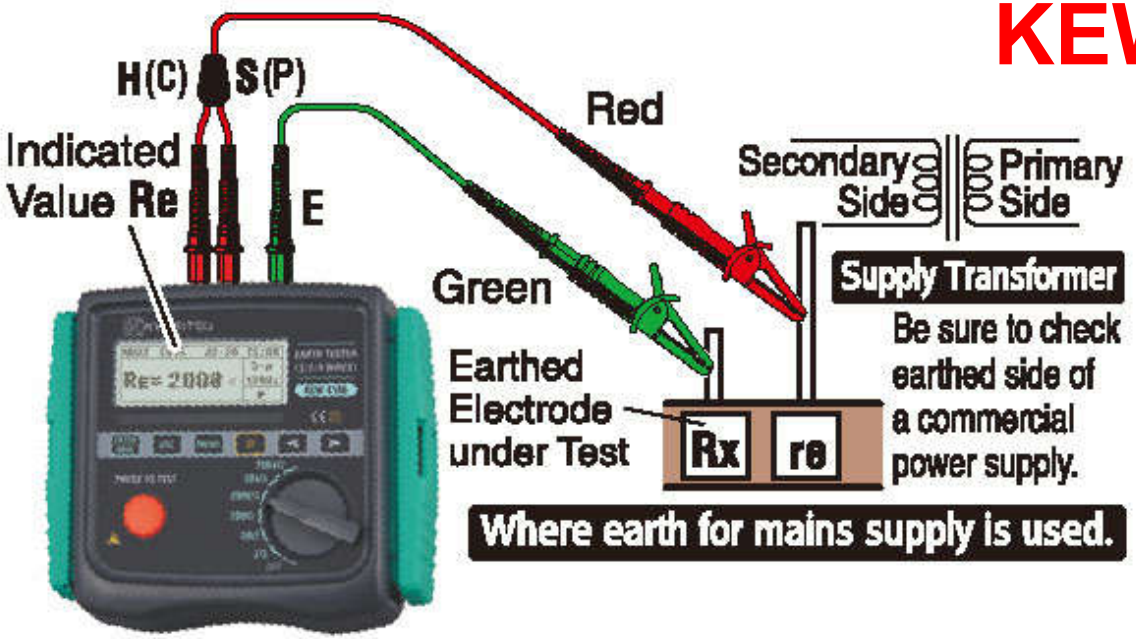
- Four test current frequencies (94/105/111/128Hz) with Automatic and Manual selection of them in order to minimize the noise influence of earth voltages during the earth resistance tests

The frequency of test current is manually selectable among 94,105,111,128 Hz.
In Automatic mode, the 4106 will select the most suitable frequency

KEW 4106

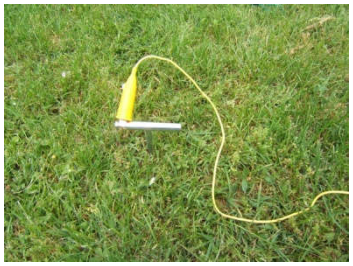
Earth Resistance Measurement with 2 wires

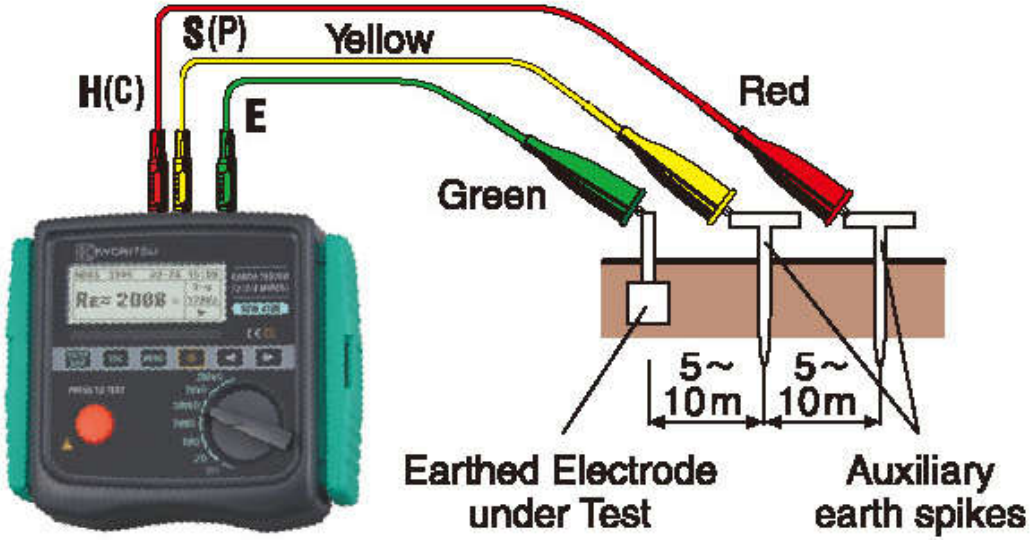
KEW 4106



2-wires (or simplified) Measurement is an alternative method that can be used in case there is not free ground to stick the auxiliary earth spikes.
4106 will indicate the Re as the sum of the earth electrode under test (Rx) and the earth of commercial power supply (re).
If the re is known beforehand, the Rx can be calculated by: Rx = Re – re.
Normally re has a negligible value, if so, the Re indicated by 4106 is equal to Rx.

Earth Resistance Measurement with 3 wires



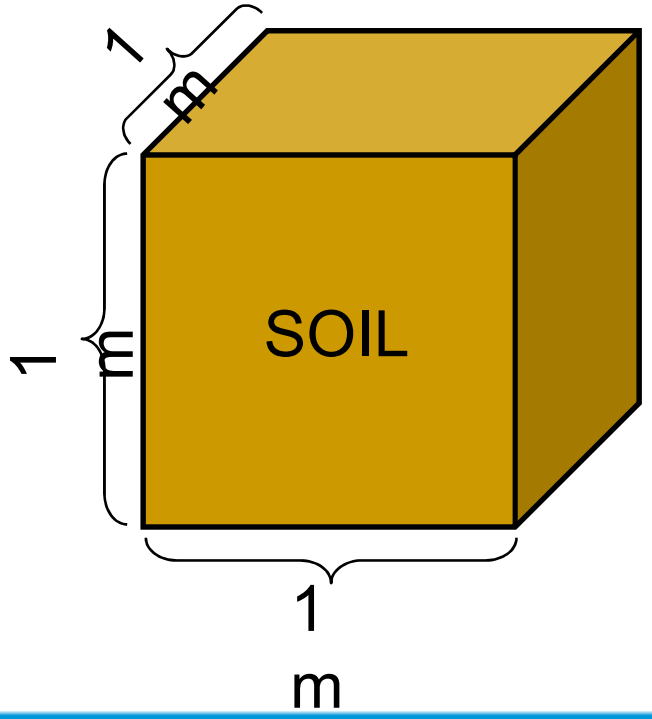


This is the classical volt-amper method that uses 3 wires with 2 auxiliary earth spikes stuck in the ground

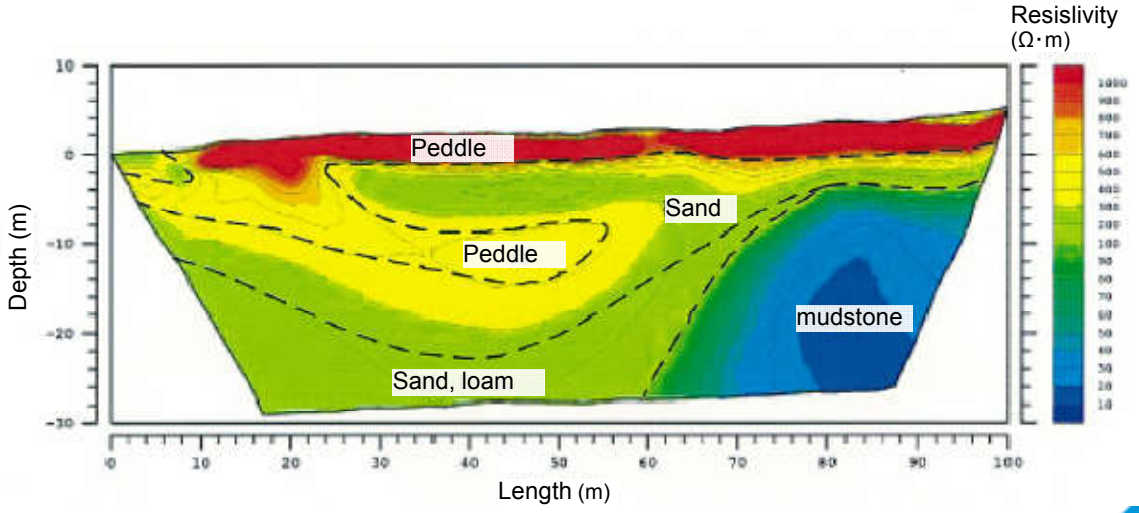
KEW 4106

What is the Earth Resistivity (ρ)?

Is the resistance of the soil / ground shaped as a cube of 1 x 1 x 1 meter (1m3)



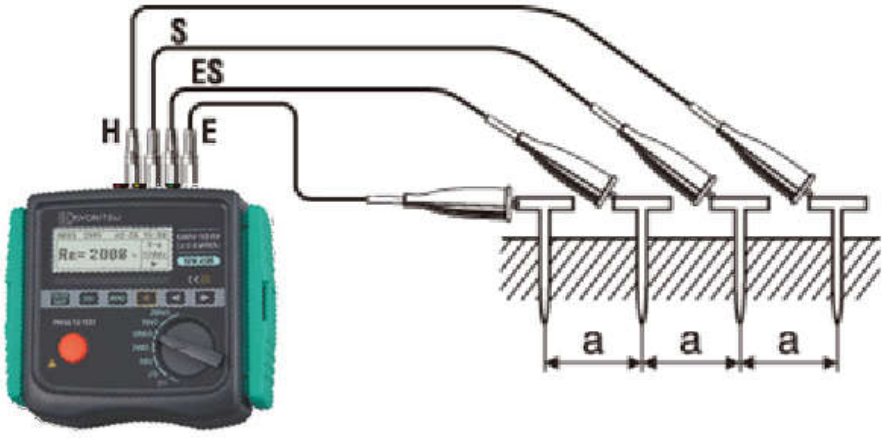
Soil resistance value depends on the nature of the soil and the percentage of water contained.



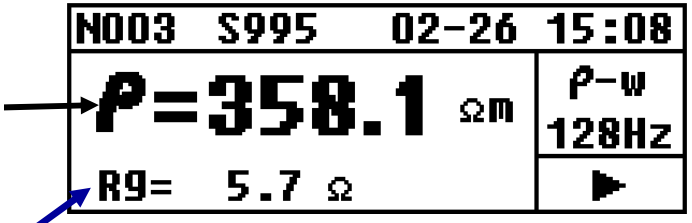
How to measure Earth Resistivity ?

Stick 4 auxiliary Earth Spikes into the ground at the same distance apart, a [m].

Note: The depth should be 5% or less of a.



Measurement result so obtained is Earth Resistivity ρ of the soil at the depth a in the point with the ▼mark.



KEW 4106

Rg= Earth resistance obtained during earth resistivity measurements

Field Measurements:

Earth resistivity measurement at building site by Earth tester 4106

KEW 4106

Field Measurements:

Earth resistance measurement at power centre (transformer cabin) by Earth tester 4106

KEW 4106

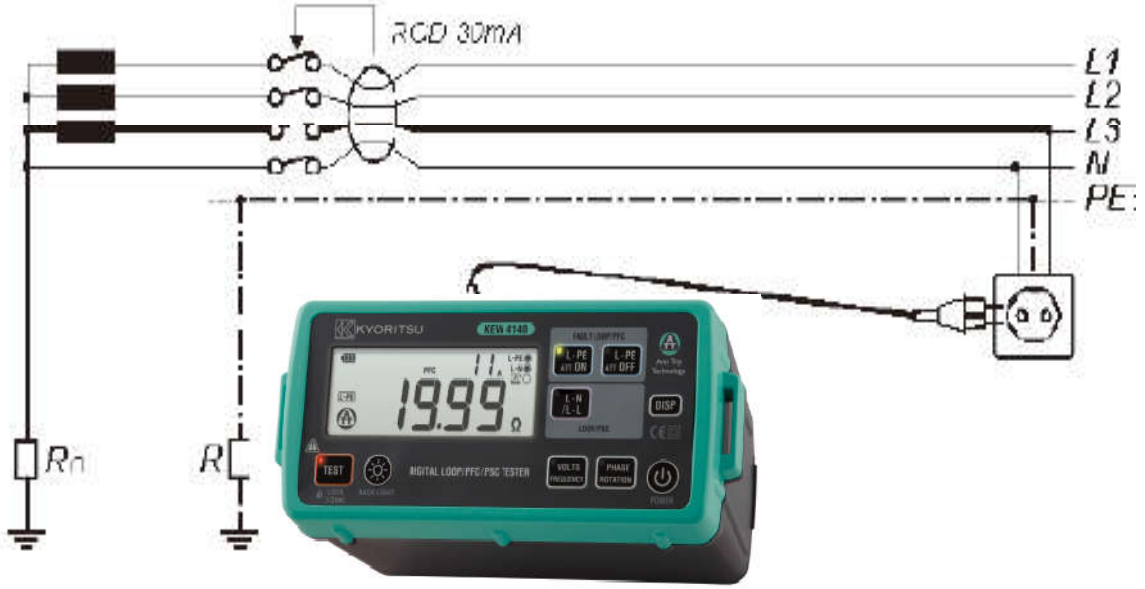
Earth Resistance Testers

Kew 4105A

Kew 4105DL

Kew 4106

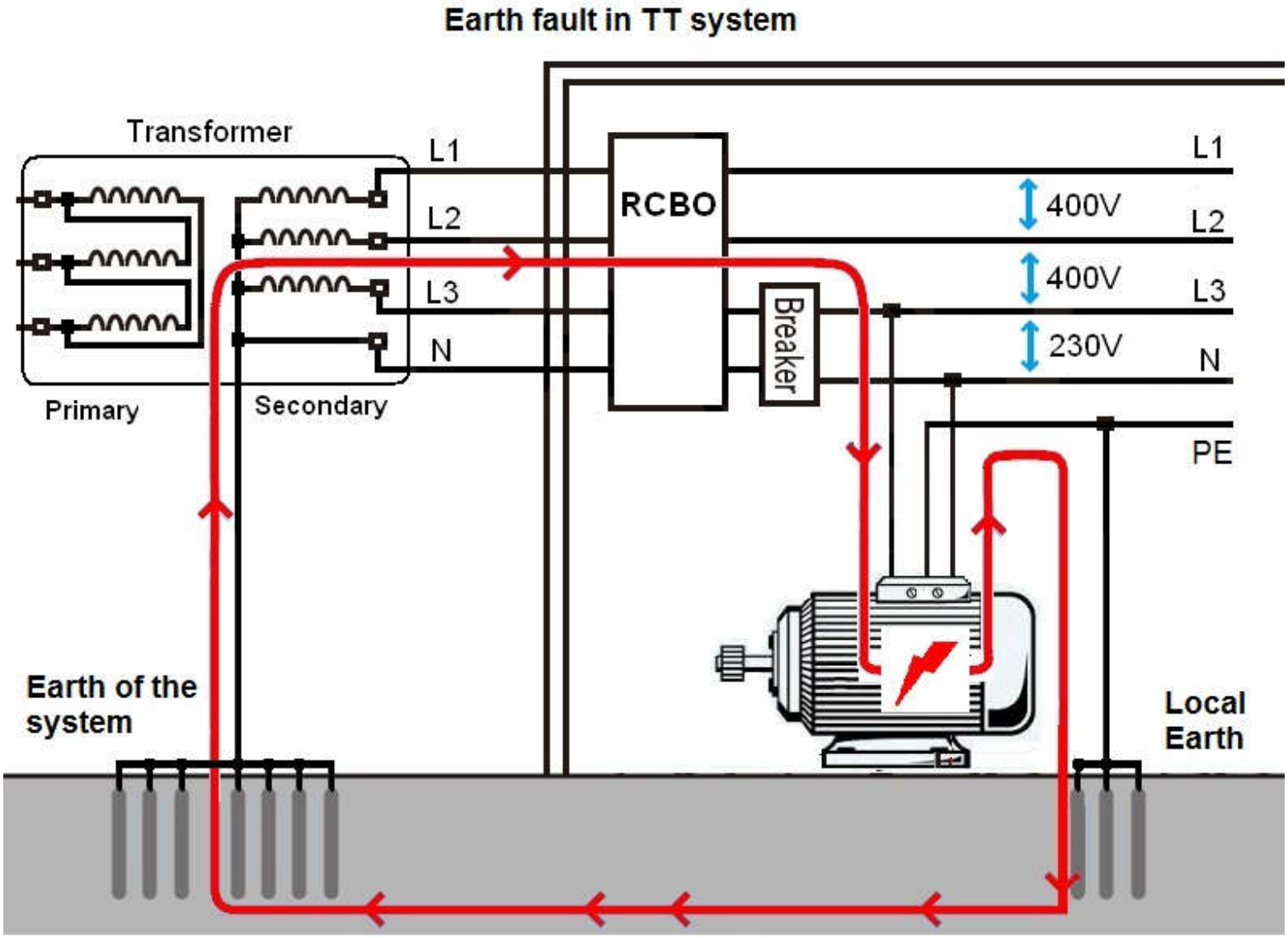
2) Example of measurement of earth resistance on TT system by Loop Tester.



-It does not need the auxiliary earth spikes.
-The earth measurements are possible also by socket.

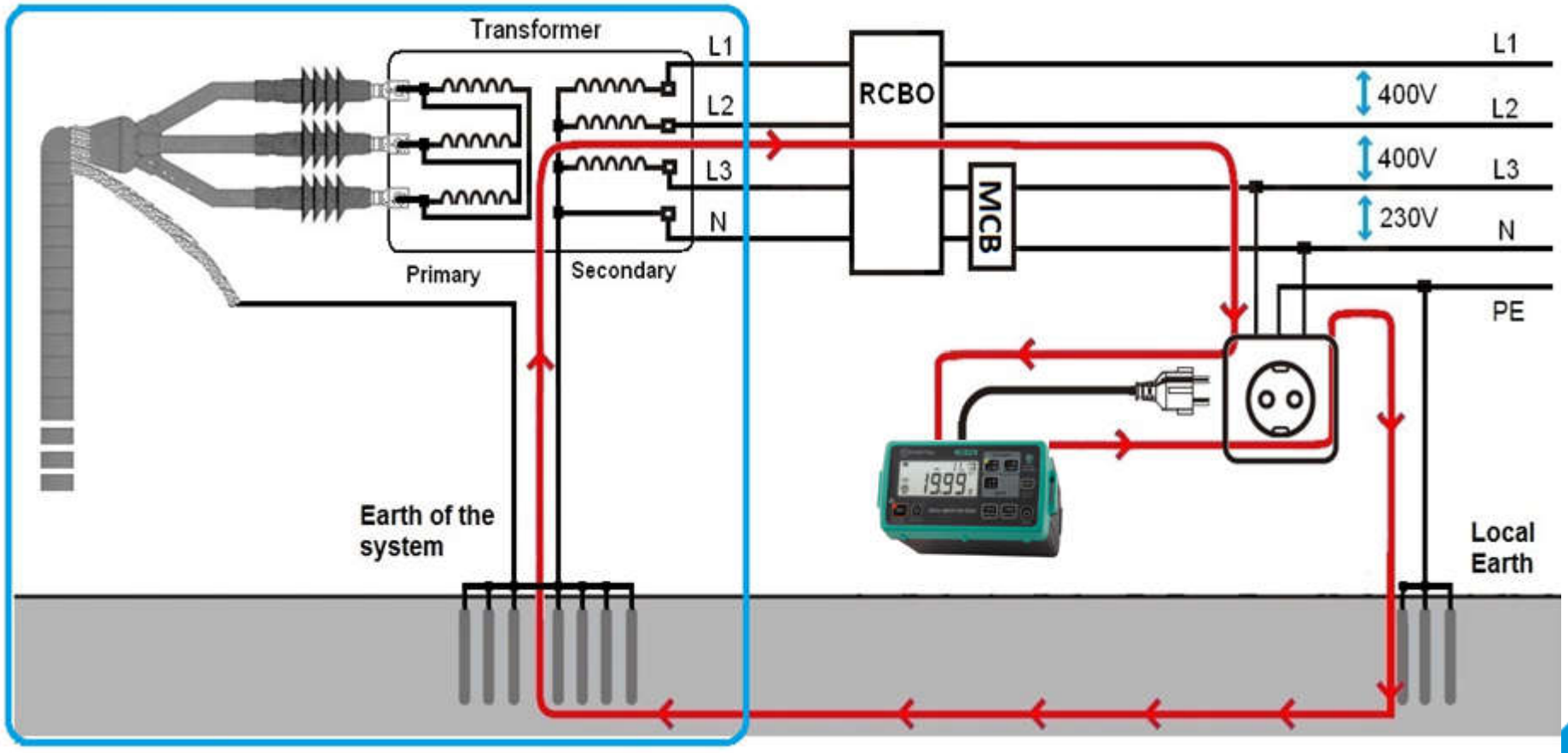
-It works on energized installations with TT system only .
-In presence of RCDs, if the Loop tester does not have an Anti-Trip Technology, the RCDs could trip before having the result.

2) LOOP TESTER METHOD



2) LOOP TESTER METHOD

Loop tester measures the Earth resistance in a TT System.



KEW 4140

2) LOOP TESTER METHOD

Examples of measurement of earth resistance on TT system by Loop Tester

KEW 4140

2) LOOP TESTER METHOD

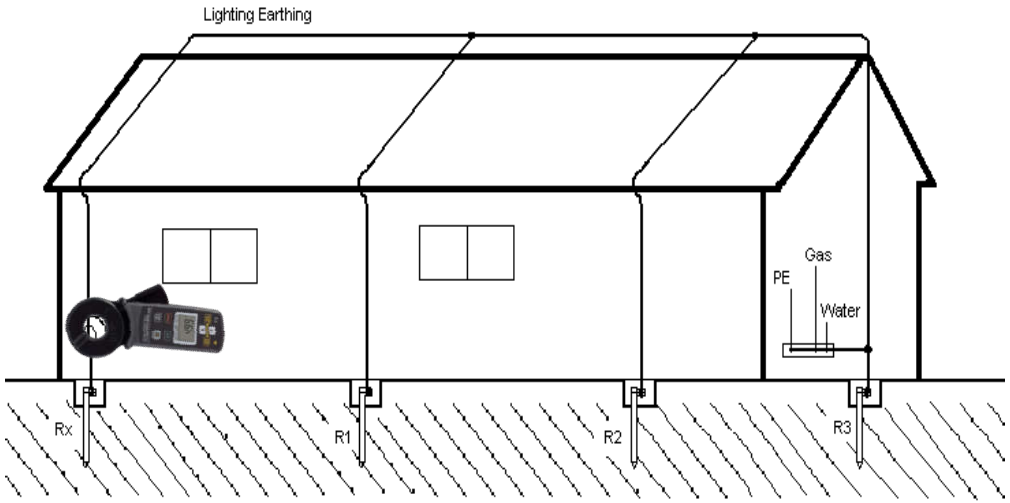
Loop Testers

Kew 4140

Kew 6016

3) EARTH CLAMP METHOD

Example of measurement of earth resistance of one Earthing Electrode by Earth Clamp Tester.



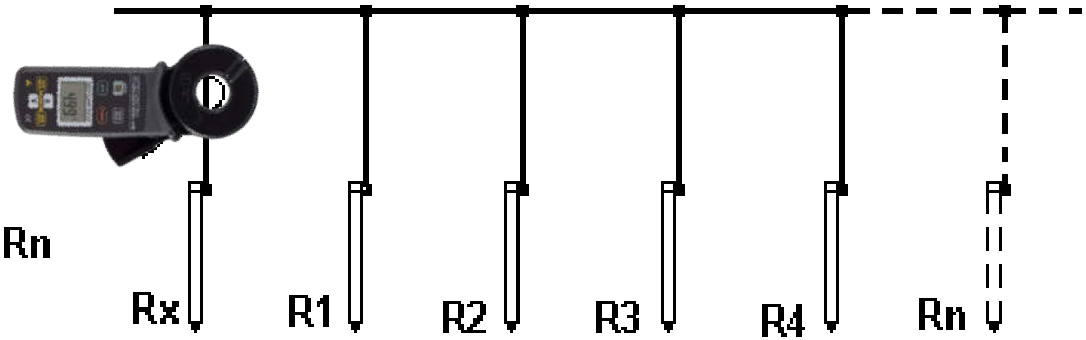
-It does not need the auxiliary earth spikes.
-It does not need to disconnect the earth electrode under test.

-It measures the earth resistance of the single earth electrode under test only if it is connected to large earth installation.

3) EARTH CLAMP METHOD

PRINCIPLE OF OPERATION

Kew 4200/4202 can measure the Earth Resistance in multi-earthing systems.



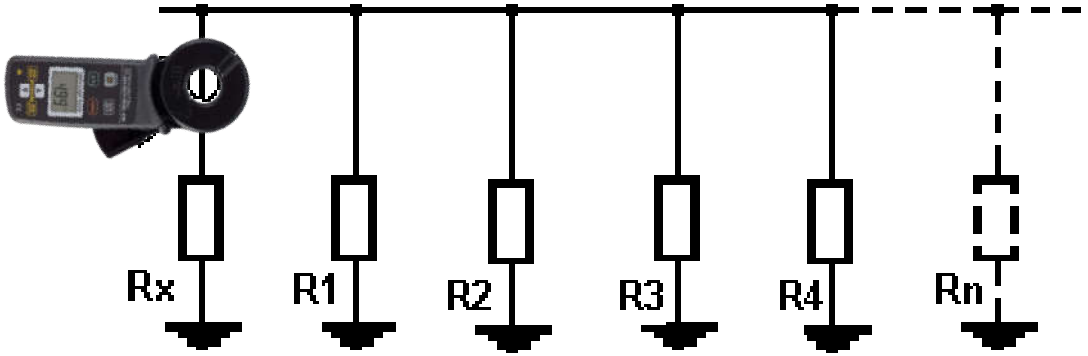
R clamp = Rx + R1//R2//R3//R4//Rn

Where, usually

Rx >> R1//R2//R3//R4//Rn

and then:

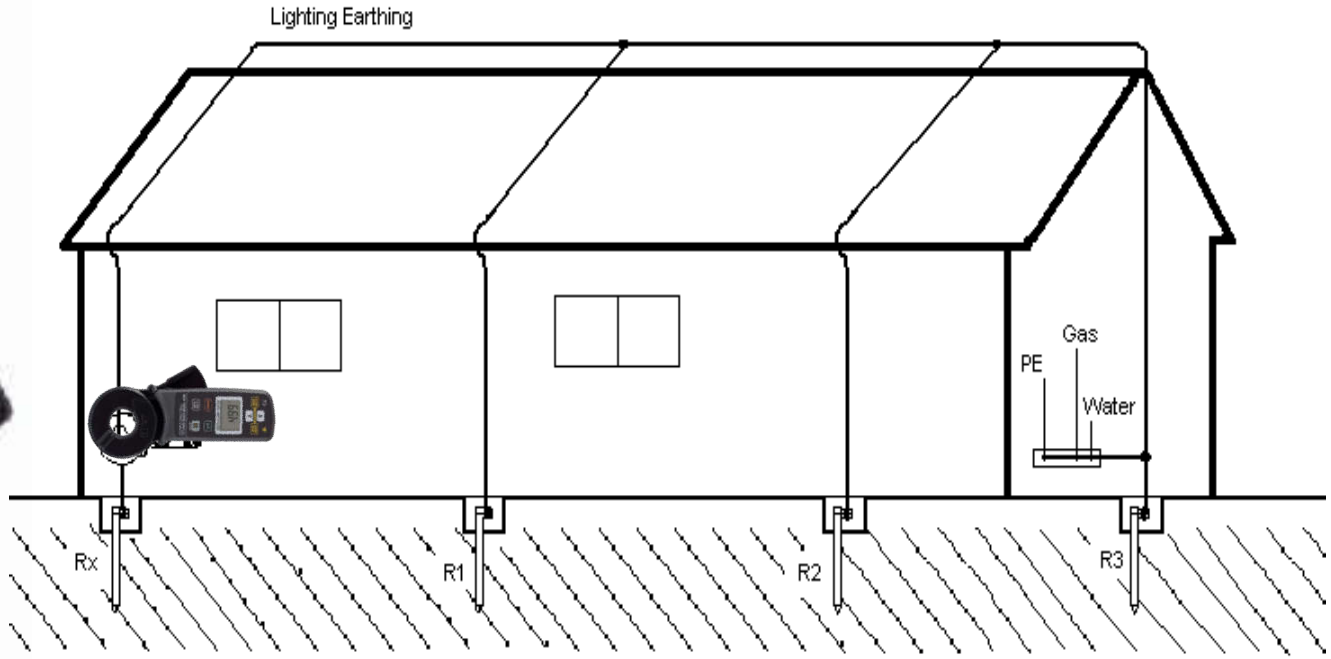
R Clamp = Rx



KEW 4200

3) EARTH CLAMP METHOD

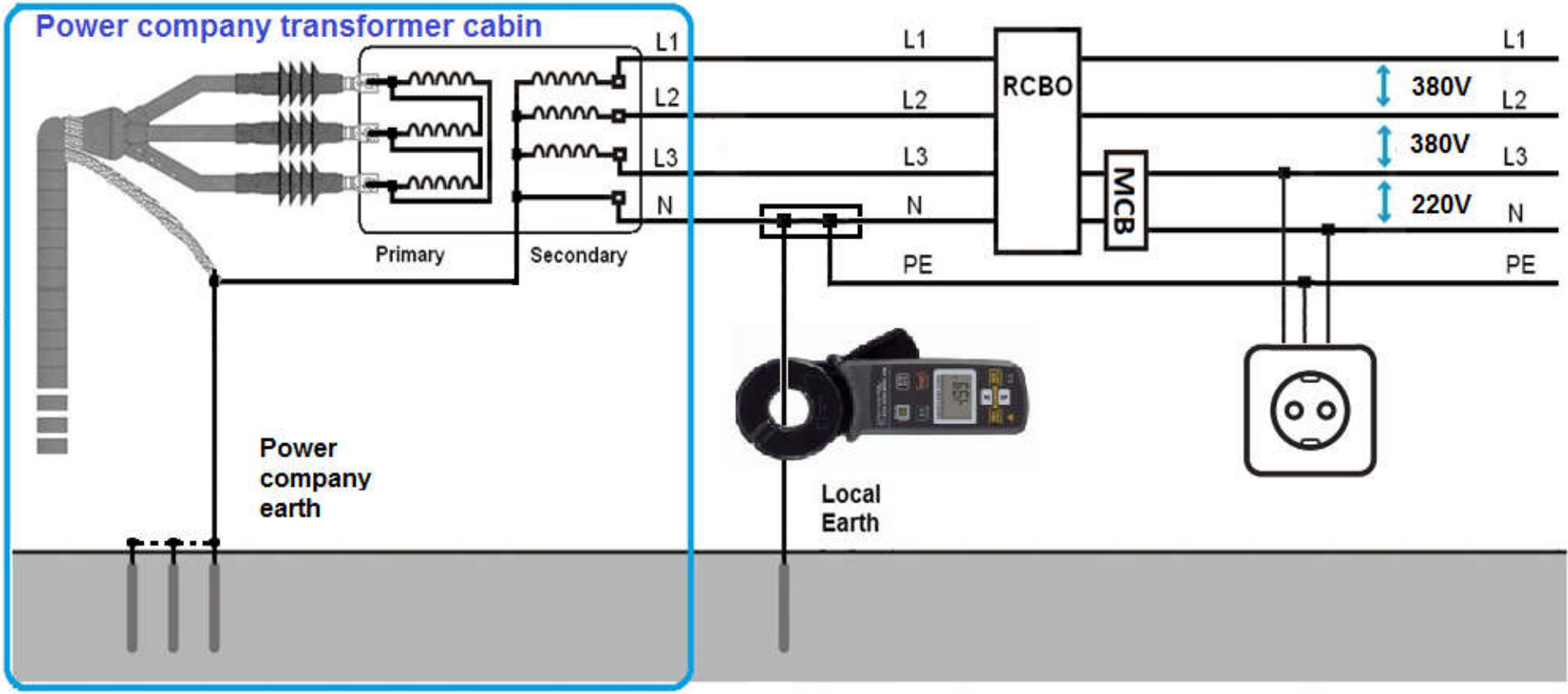
SOME EXAMPLES OF EARTH RESISTANCE TEST BY KYORITSU EARTH CLAMP KEW 4200/4202



KEW 4200

3) EARTH CLAMP METHOD

SOME EXAMPLES OF LOCAL EARTH RESISTANCE IN A TN SYSTEM
KYORITSU EARTH CLAMP KEW 4200/4202

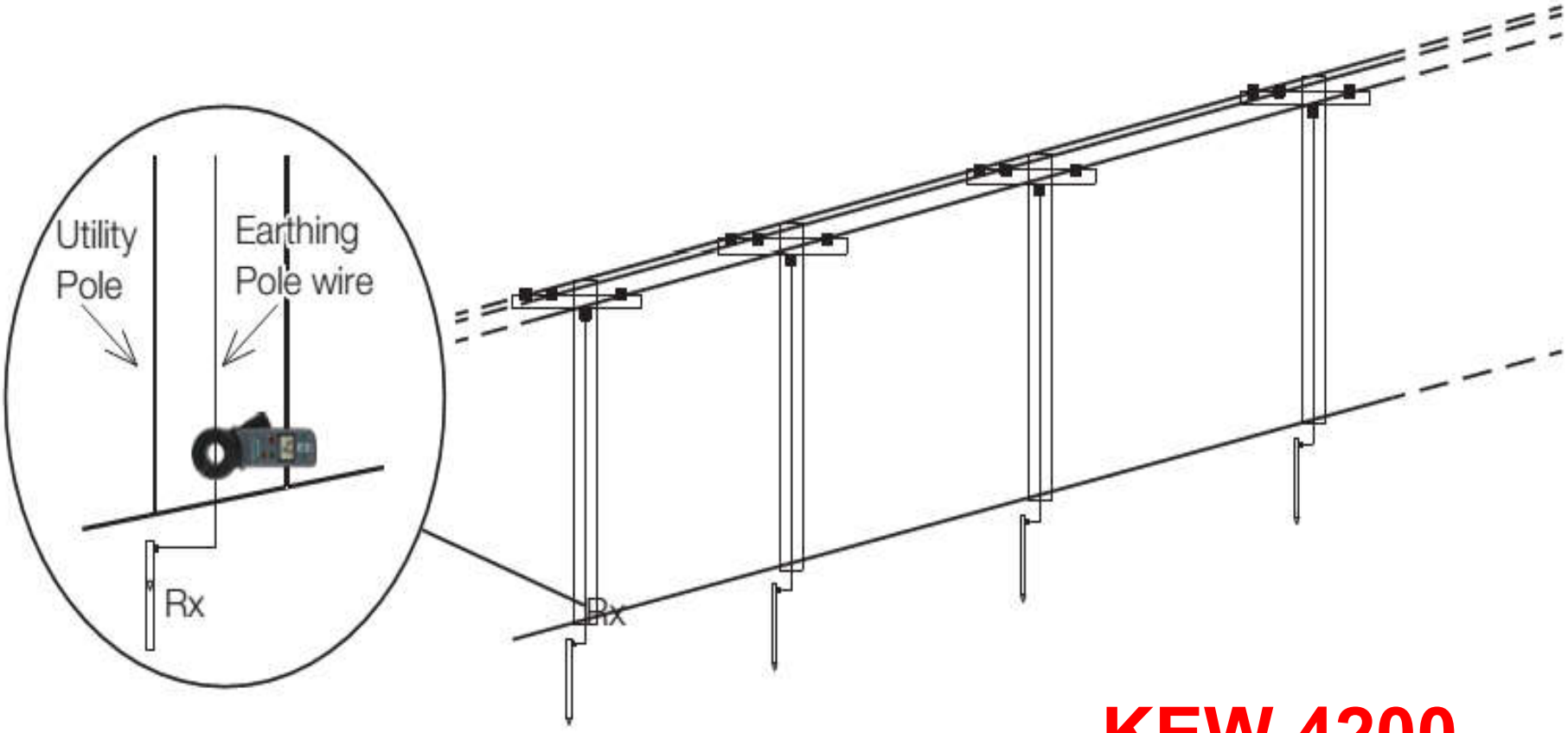


KEW 4200

3) EARTH CLAMP METHOD

SOME EXAMPLES OF EARTH RESISTANCE TEST BY KYORITSU EARTH CLAMP KEW 4200/4202

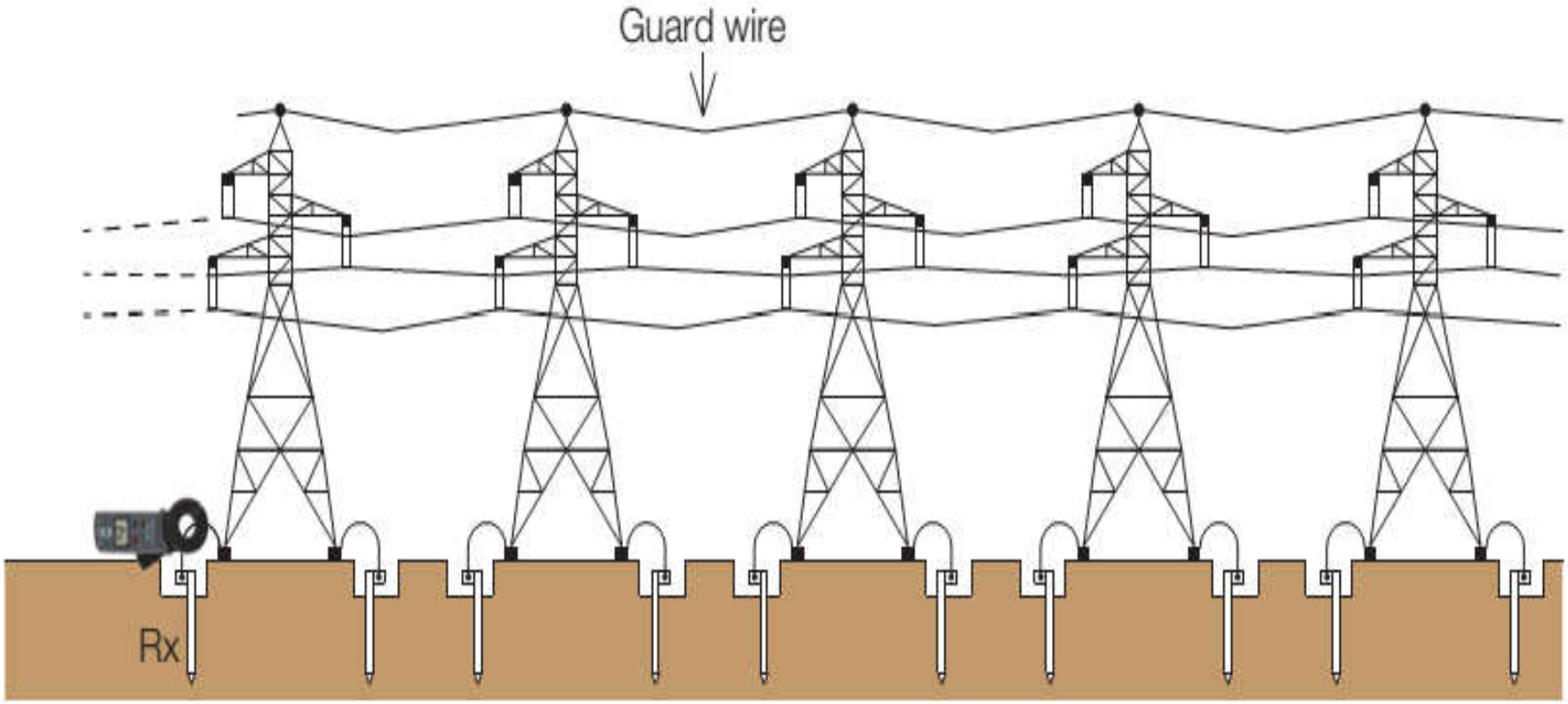
Earth resistance measurement of a pole earthing electrode:



KEW 4200

3) EARTH CLAMP METHOD

SOME EXAMPLES OF EARTH RESISTANCE TEST BY KYORITSU EARTH CLAMP KEW 4200 / 4202

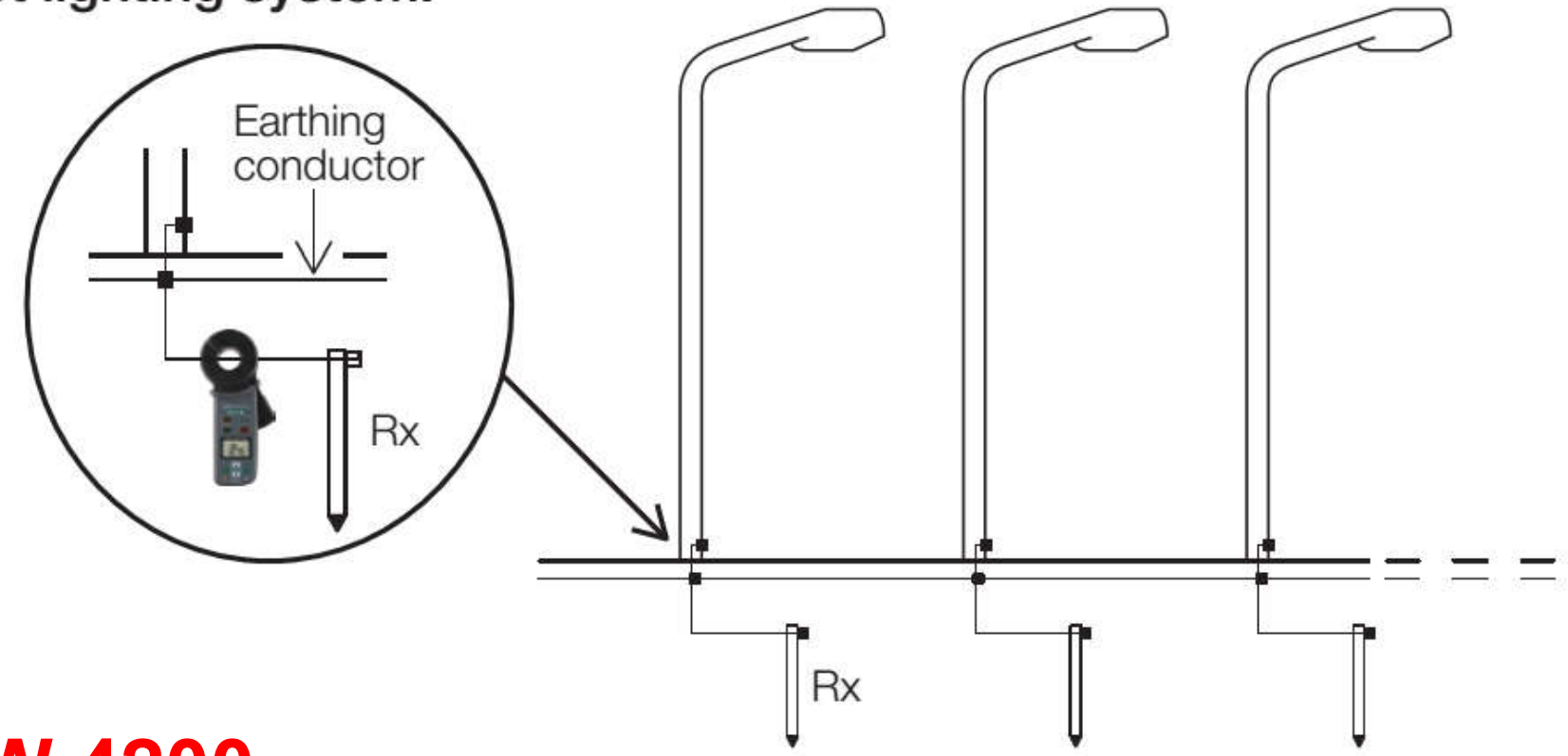


KEW 4200

3) EARTH CLAMP METHOD

SOME EXAMPLES OF EARTH RESISTANCE TEST BY KYORITSU EARTH CLAMP KEW 4200/4202

Earth resistance measurement of an earthing electrode in a street lighting system:

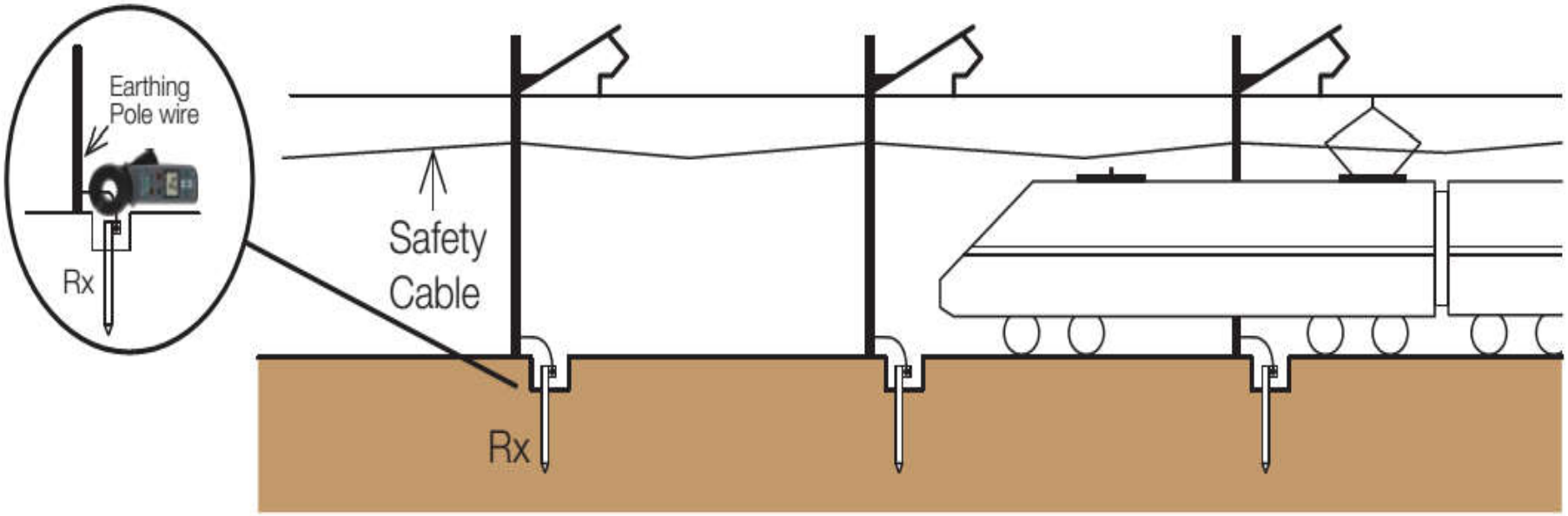


KEW 4200

3) EARTH CLAMP METHOD

SOME EXAMPLES OF EARTH RESISTANCE TEST BY KYORITSU EARTH CLAMP KEW 4200/4202

Earth resistance measurement of a pole earthing electrode in Railway:

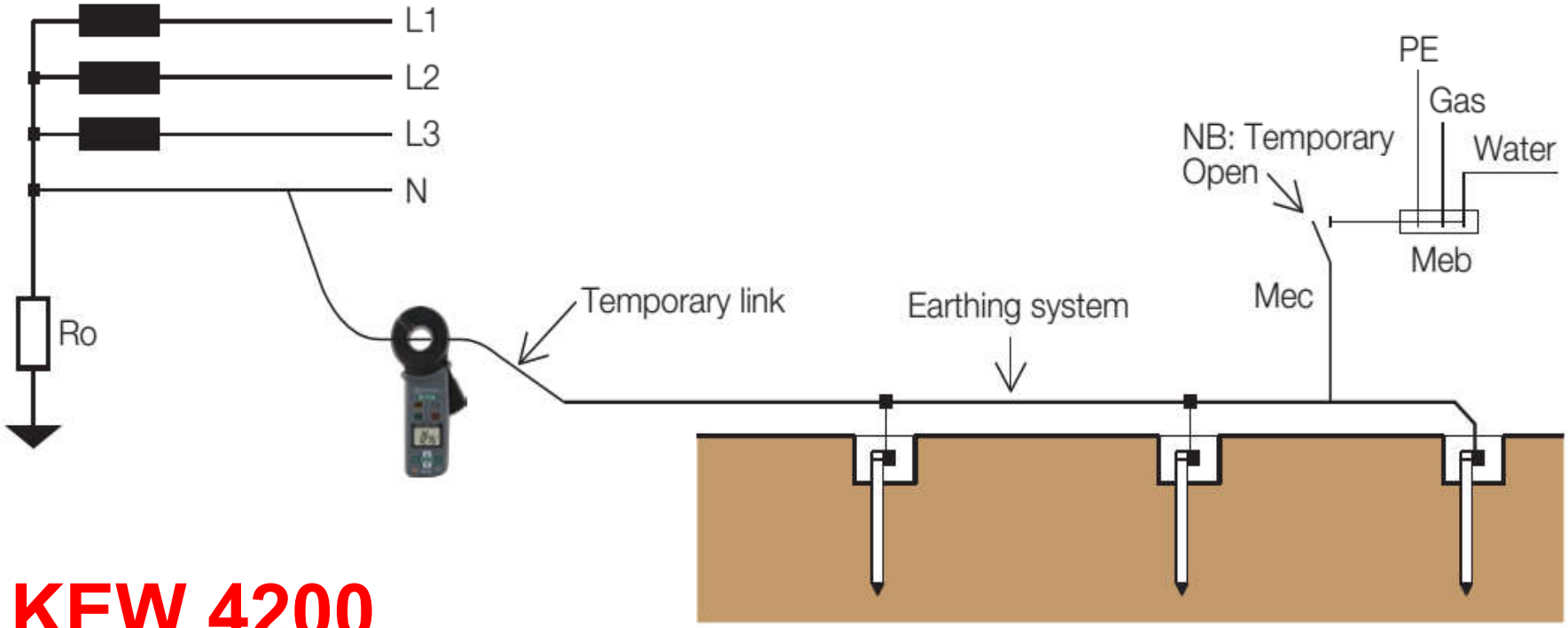


KEW 4200

3) EARTH CLAMP METHOD

SOME EXAMPLES OF EARTH RESISTANCE TEST BY KYORITSU EARTH CLAMP KEW 4200/4202

Earth resistance measurement of a simple earthing system using the Neutral conductor:

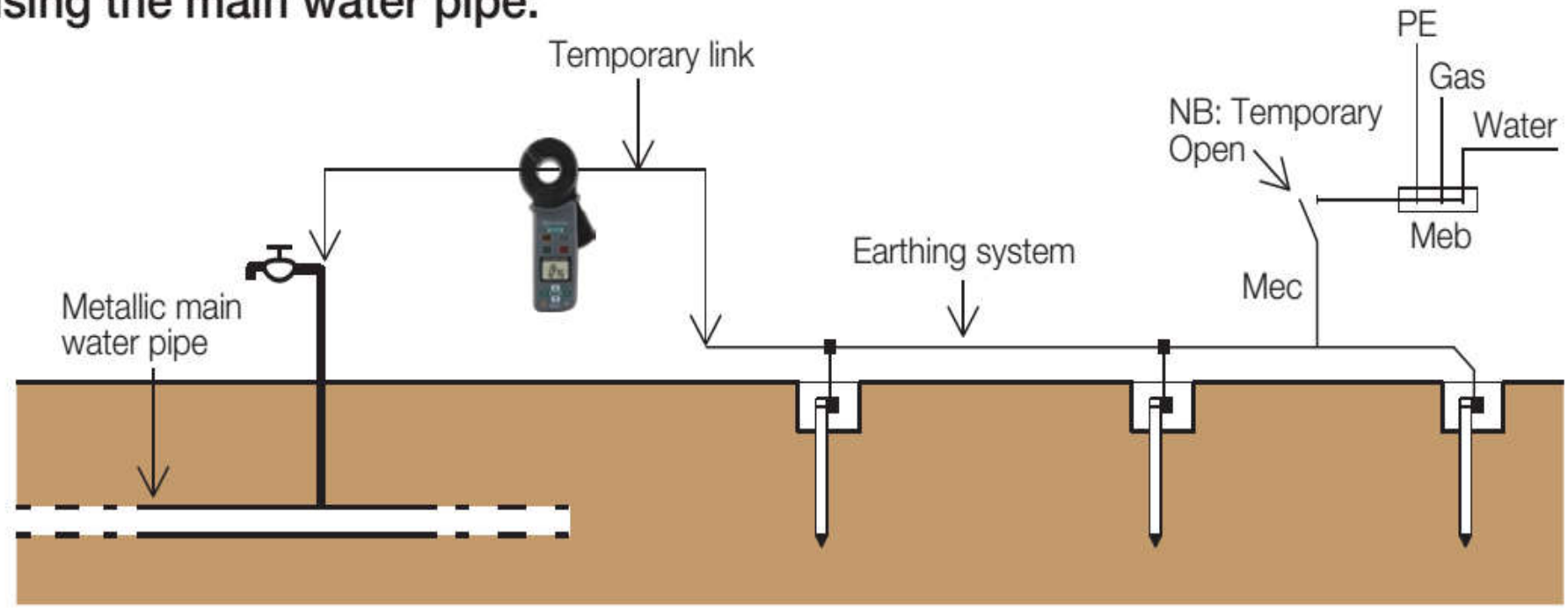


KEW 4200

3) EARTH CLAMP METHOD

SOME EXAMPLES OF EARTH RESISTANCE TEST BY KYORITSU EARTH CLAMP KEW 4200/4202

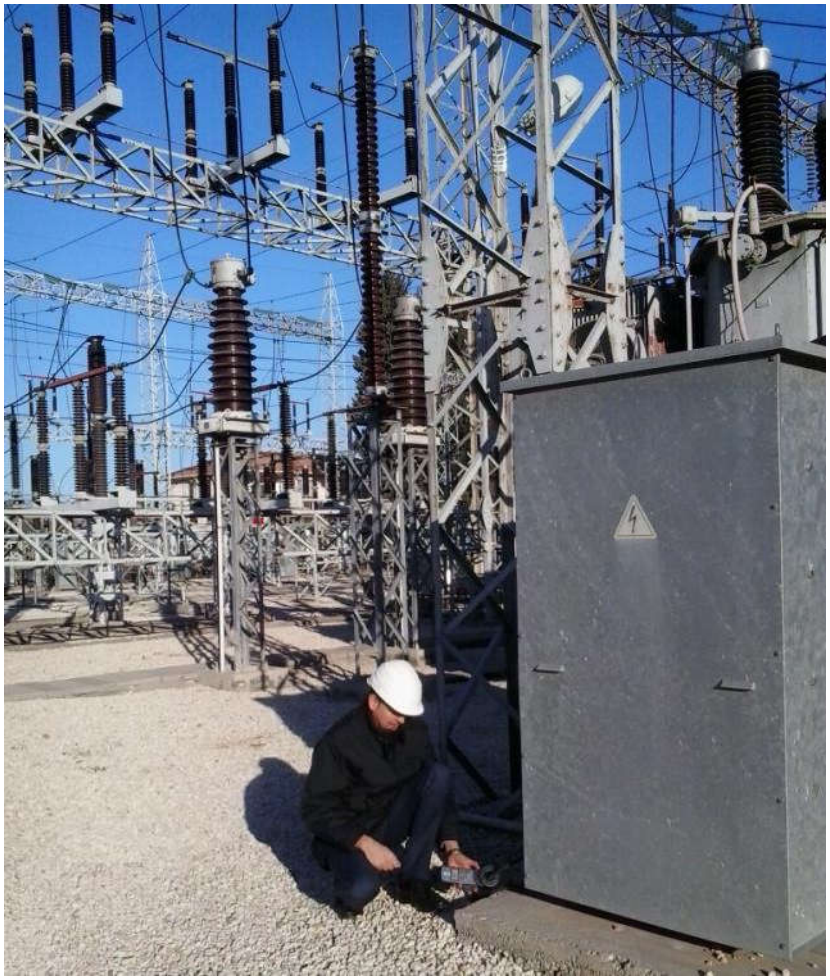
Earth resistance measurement of a simple earthing system using the main water pipe:

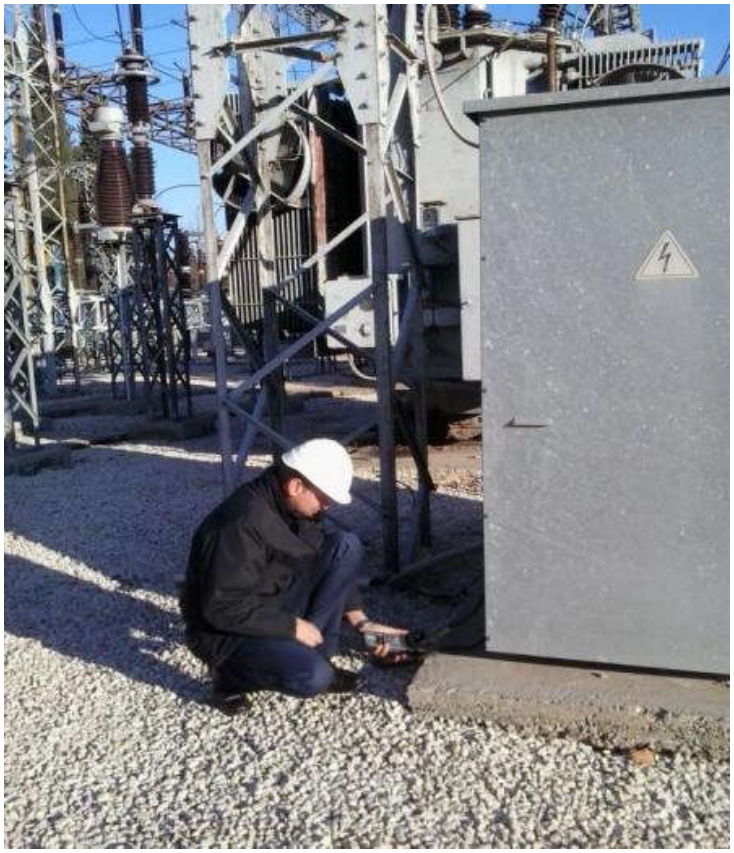


KEW 4200

3) EARTH CLAMP METHOD

Field Measurements:





A continuity check of equipotential conductors and earthing conductors at a substation by Earth clamp 4200.

KEW 4200

3) EARTH CLAMP METHOD

Field Measurements:

A continuity check of equipotential conductors of oil tanks by Earth clamp 4200.

KEW 4200

3) EARTH CLAMP METHOD

Field Measurements:

Earth resistance measurement of a telecom pole (where the earthing of the pole was connected to the earth of local grid.)

KEW 4200

3) EARTH CLAMP METHOD

Earth Clamp Testers

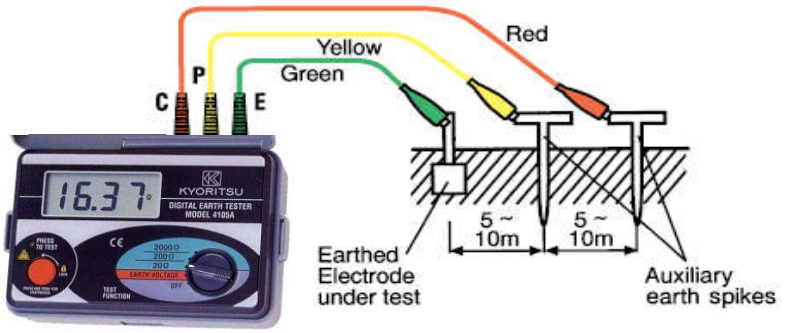
Kew 4200

Kew 4202

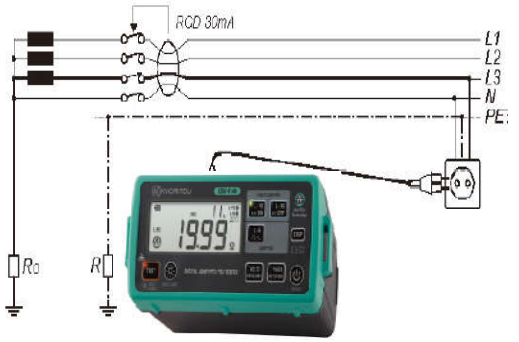
CONCLUSION

There are at least 3 possible methods for Earth measurement:

1)Volt-Amperometric method



2) Loop tester method



3) Earth Clamp tester method

CONCLUSION

We have prepared a small book that shows the earth measurement methods and it is available for free at Sanpa booth in the Izmir pavilion ground floor.

Thank You

Teşekkür