

Application Note

Performing Substation Ground Grid Test Using GGT500

Beneath every substation there is a ground grid which provides proper grounding of all apparatuses in substations. The purpose of this grid is to improve the safety of both personnel and apparatuses in the substation.

Over time, this grid can deteriorate due to corrosion, ground movements, grid fatigue, high energy conductance (lightning) and construction damage. All this can cause various safety problems.

There are various test procedures to inspect the state of grounding systems. The most relevant standard is IEEE 81 which refers to practical test methods and techniques for measuring the electrical characteristics of grounding systems. The test method explained in this application note has been developed based on practical testing experience collected from end users in the field.

The ground grid testing method described here can be performed quickly and easily in order to obtain information about the condition of the grounding system. This test method is completely different comparing to the “ground resistance measurement test” which requires the use of an AC source.

When performing a test with GGT500, a single pair of current cables should be used. One cable (black) is connected to the reference grounding point in the substation. Ideal reference grounding point is usually near the center of the substation, next to major apparatus like transformer or circuit breaker that usually have multiple ground connections. The second current cable (red) is connected to the ground point of the substation under test. See Figure 1.

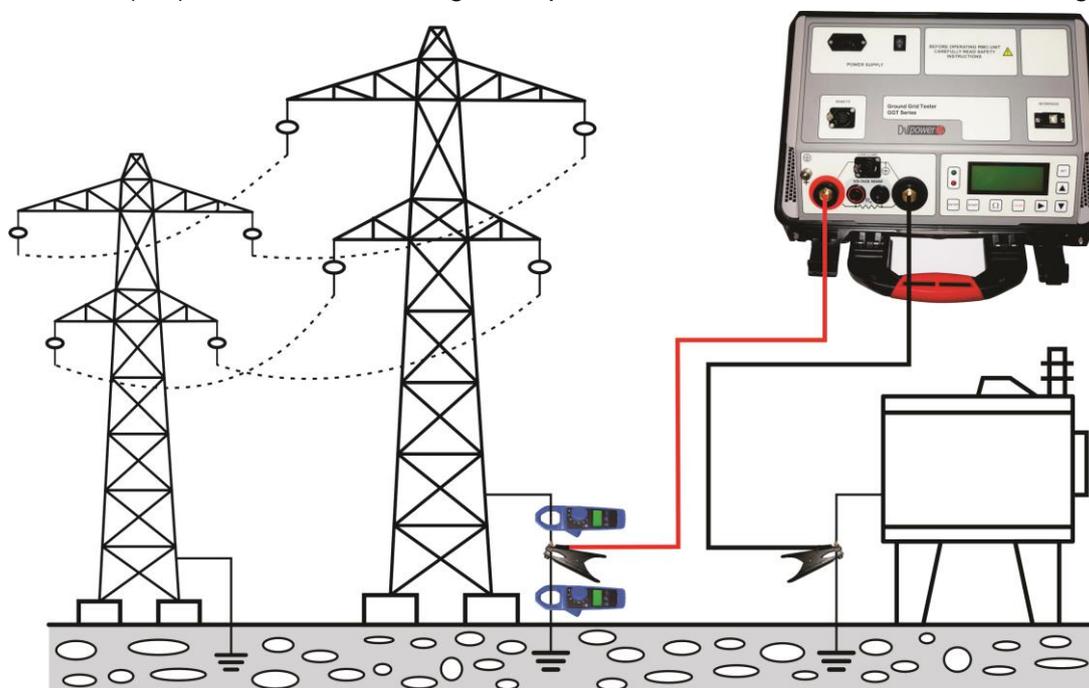


Figure 1: GGT500 cable connection for ground grid test

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The test is performed by injecting continuous DC current between the desired measurement point and reference point. In the **Ground Grid** menu of the GGT500 instrument, test parameters can be predefined. Test current is by default set to 300 A with duration of 60 s. If necessary, all test parameters could be manually changed.

During the test, two current values should be measured by external current clamp meter(s) – current through the grounding cable above (“up” current) and current below (“down” current) the point where the red cable/clamp is connected. Test duration depends on how much time the user needs to measure these two currents. If the measurements are completed before the selected test time expires, the test can be stopped. Based on the measured current values a conclusion about the condition of the grounding grid can be made.

If the “up” current is low (up to 3% of selected test current), and down current is high (97% of the test current or higher), it is concluded that grounding is in good condition and it is a good “ground path”. If the “up” current is higher, that grounding point should be inspected in order to check if there is any deterioration or damage that has to be repaired. All grounding points in the substation should be tested that way.

During testing, the instrument will inject DC current to the ground grid and measure the voltage drop. If total resistance value (combined resistance of cables and ground grid) is known, expected voltage drop can be calculated. If this voltage drop (that is shown on the device's display) is higher than expected for several measurements or if the unit cannot generate 300A that means that there is a problem with grid or a bad reference point has been chosen. For example, if total resistance of the system is 23mΩ (combined resistance of cables and ground grid) and we perform the test with current of 300A, expected voltage drop will be 6,9 V.

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