

GFL 1000 Tech Note

Using the GFL 1000 to Trace an Unresolved Ground Fault

Detailed set up instructions for the signal generator and the receiver are contained in the instruction manual. This Tech Note is intended to provide guidance on the actual testing, including where and how to locate the current clamps when tracing a ground fault.

The first step is to identify whether the ground fault is on the positive or negative bus. This is done by measuring the voltage from each bus to ground. On a system with no ground faults the voltage on each bus should be half the system voltage, i.e. on a 120 volt system the voltages should be 60 volts to ground from each bus. If the voltages are not balanced the bus with the lower voltage is the one on which the ground fault is located.

If the fault is on the positive bus, then the red lead of signal generator should be hooked to the positive bus and the black lead to ground. If the fault is on the negative bus, then the black lead is connected to the negative bus and the red lead to ground.

Before starting to trace a ground fault it is important to isolate any ground fault detection circuits either stand alone or built into the charger. The reason for this is, the most common form of ground fault detection used today is a balanced bridge network which is referenced to ground at the center point. As we saw with our basic multimeter test above, any ground fault will unbalance the bridge and generate an alarm. The problem is when we inject the AC test signal from the GFL 1000 it will go to ground via the ground fault detector and give a false indication.

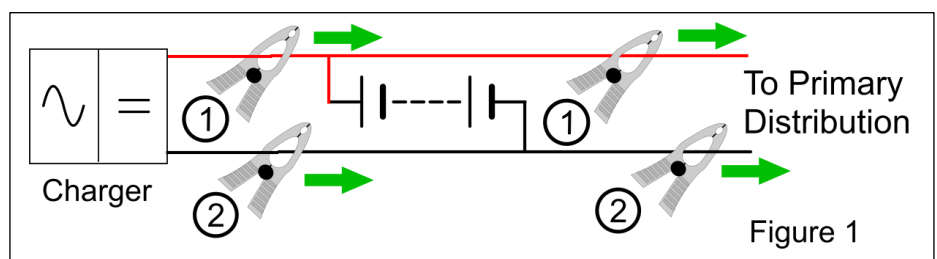
The GFL 1000 is supplied with two current clamps which are used to follow the path of the test signal from the point at which it is injected to the ground fault. Only one of the two clamps is used to set the reference level at the start of the test. That clamp should then be used as the primary clamp for the rest of the fault finding. Where possible, the clamp should be placed around both the positive and negative cables of the circuit being investigated for the best results. If that is not possible, due to the layout of the cables, it may be necessary to have the second clamp placed around the other cable in the circuit pair to improve sensitivity and help minimize the impact of the interference that is present at some level in all electrical circuits.

It is important before starting the investigation that the layout of the power plant and the distribution is fully understood. This will ensure that the branches and sub branches of the distribution can be identified and isolated, this will minimize the number false starts.

The following is an example of the steps that should be followed on a very basic power system configuration.

The first location at which the signal should be injected is at the point where the battery and charger first meet. This can be a serial connection such as that shown in Figure 1 where the charger feeds the battery and the feed to the primary distribution comes off the battery terminal plates.

Depending on the size of the cables from the charger it may be possible to go around both cables as they exit the charger with Clamp 1 which was used in setting the reference. If that is not possible, Clamp 1 should be placed on either the positive or



negative cable depending on which was identified as being the source of the ground fault. If the reference level is not stable, then it will be necessary to use the second current clamp which should be placed on the opposite polarity cable. The green arrow on the cable clamps should be pointing towards the battery and primary distribution, away from the charger.

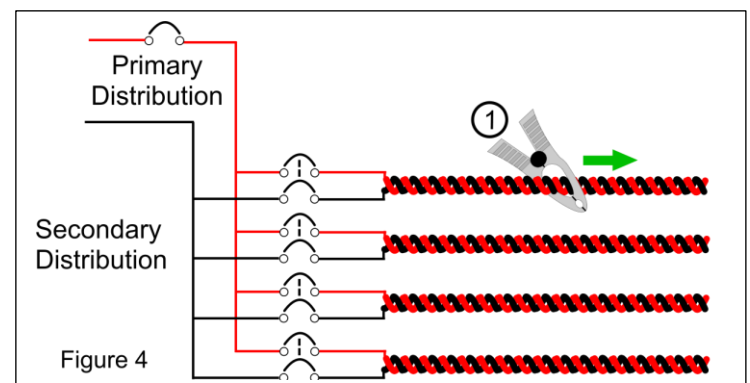
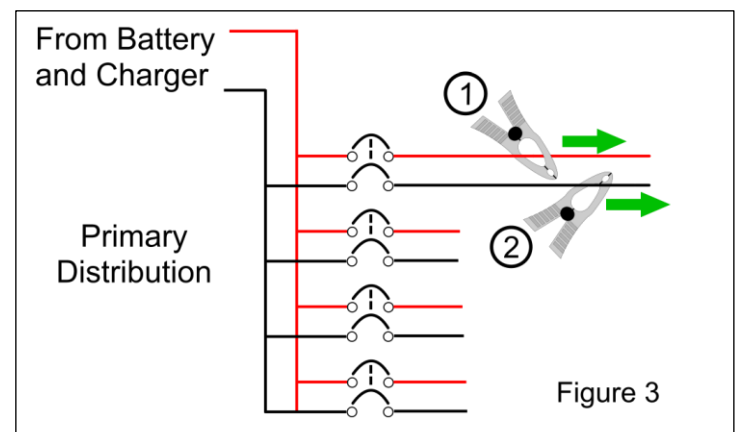
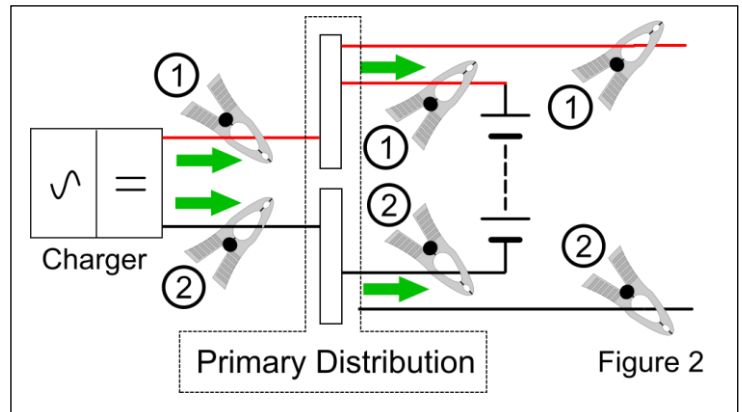
The battery is the next point to be checked, if both clamps were required initially, they should be moved to a point beyond the battery on the cables going to the primary distribution. If the signal continues to indicate that the fault is beyond that point this, will indicate that the battery is not the source of the ground fault.

If the charger and battery are independently terminated at the primary distribution point as shown in Figure 2, then the clamps should be moved to the battery cables to verify that the ground fault is not at the battery. The green arrows on the diagrams show the direction in which the arrows on the clamps should be pointing.

The primary distribution is the point at which the power is distributed to the individual cabinets or racks. If possible, Clamp 1 should in turn be placed around both conductors of each circuit being fed from the primary distribution and checked to identify which of them indicates a path to ground. If it is not possible to put the clamp around both cables it may be necessary to use both clamps. A lot depends on the resistance of the actual ground fault. The lower the resistance the clearer the indication will be, even with only one clamp being used. It may also be possible that more than one ground fault is present so you may get multiple indications.

In locations where a lot of control electronics are installed the power supplies in these units will have capacitors to ground as part of the filter circuits and these can give a false positive indication. To help identify these, the signal receiver also provides an indication of the phase angle of the signal being followed. If the phase angle is quite high there is a possibility that it is a pseudo ground, a true resistive ground will have close to a zero phase angle so they should be followed first to minimize wasted effort.

Once the indications of a ground fault are traced to a specific secondary distribution then the individual circuits at that distribution point can be checked. Here it should be possible to place the clamp on each pair of cables as shown in Figure 4



If the distance from the signal generator to potential ground fault is so far that the signal strength is falling off, it is possible to move the signal generator further in to the distribution system and reset the reference using Clamp 1, which should be the clamp that was used to set the initial reference.