GFL 1000 Training

What is a Ground fault?

Ground faults are defined as an inadvertent contact between an energized conductor and ground. They can exist on all electrical systems both AC and DC. This paper specifically refers to ground faults and the way they impact a battery backed standby system in which neither pole of the battery is referenced to ground.

They can occur anywhere from:

Why is finding a ground fault important?

Ground Faults Can Cause;

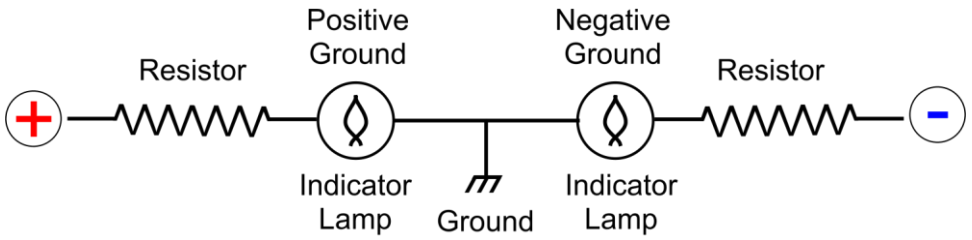
Equipment Failure

Fire

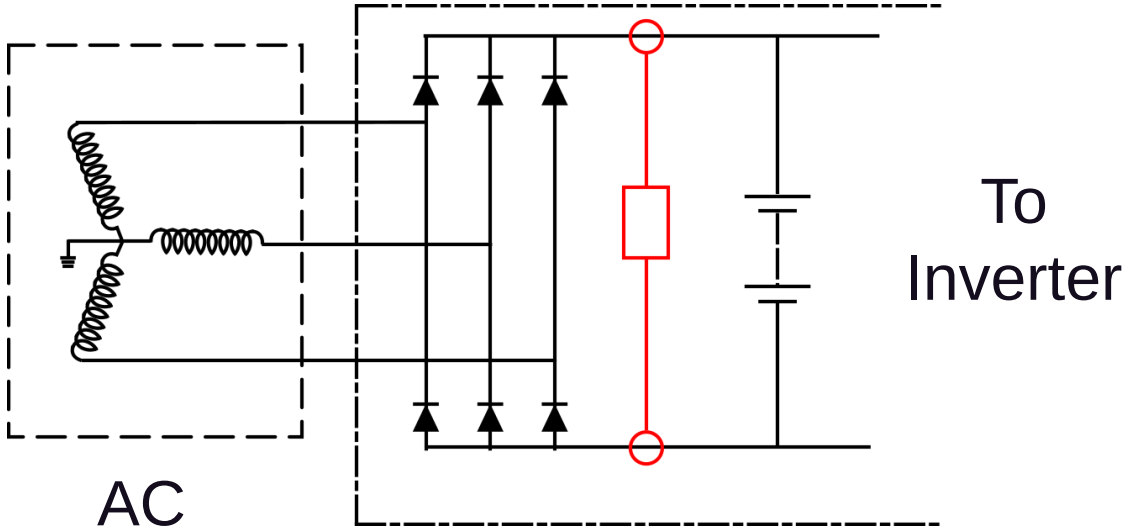
Death

How do you identify a ground fault?

There are a number of products and methods by which you can identify a ground fault condition.



Creating a high resistance balanced ground reference

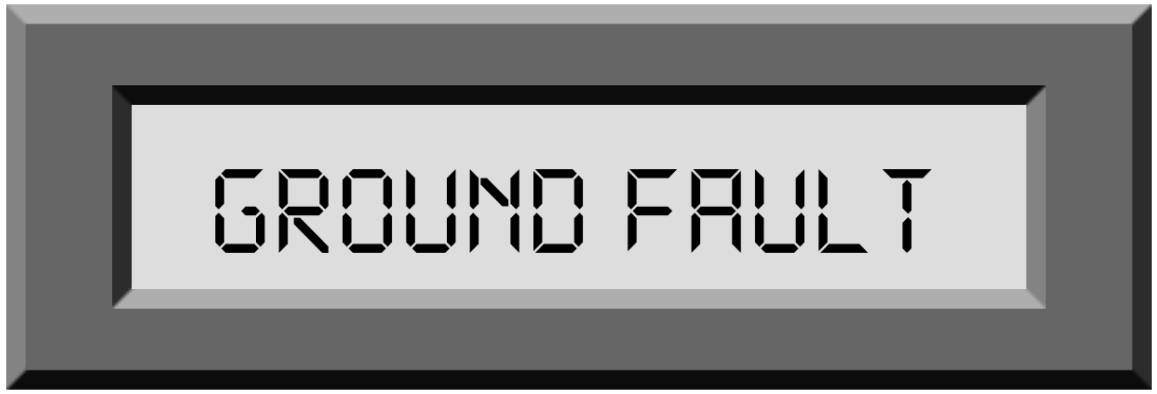


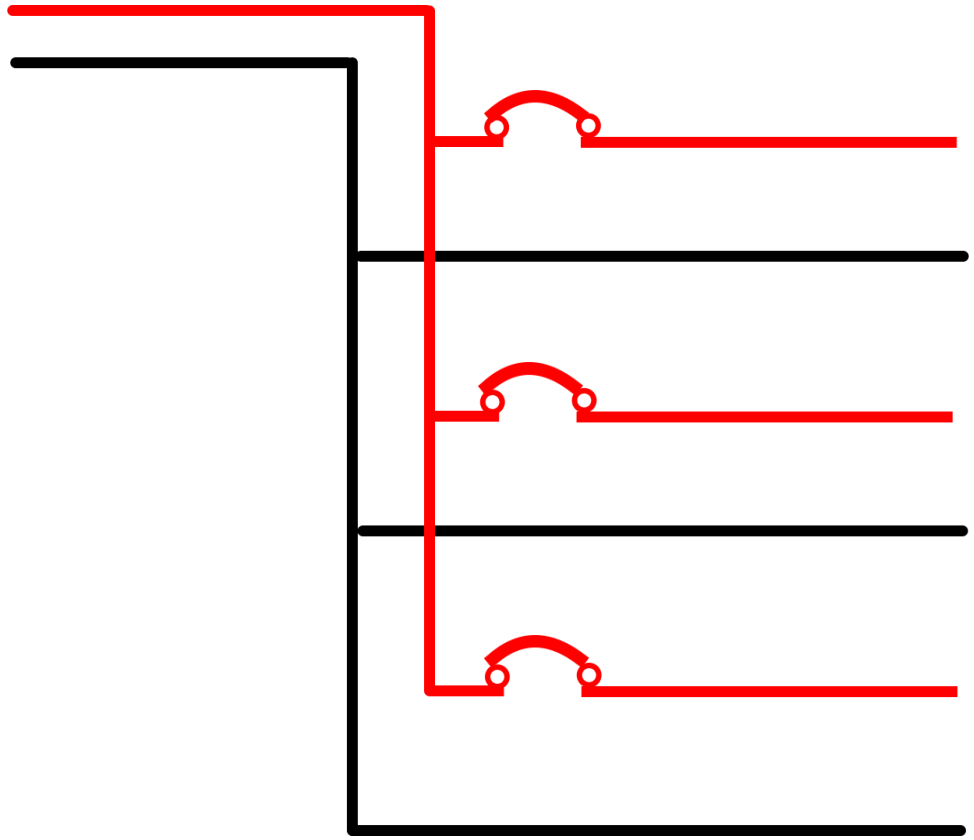
So what can cause a ground fault

Ground Faults can be caused by:

- Damaged cables
- Dirty or Leaking Batteries

Locating the ground fault





One possible way is to switch of each load circuit in turn until the fault disappears

There has to be a better way

The GFL – 1000 is designed to locate ground faults in DC bus systems used in a wide variety of applications.

The detector works by injecting an AC signal into the bus system with respect to ground using the signal generator.

The signal path is then traced using current clamps connected to the signal receiver. The direction of current flow is indicated on the receiver display, enabling the clamps to be moved to another branch or section of wiring.

Before we Start

Make sure you have access to the drawings showing the DC Power Distribution that can be critical in tracing the fault.

If a ground fault detection is part of the DC Power System and is a balanced resistor type it will have to be disconnected from the bus.

This can require;

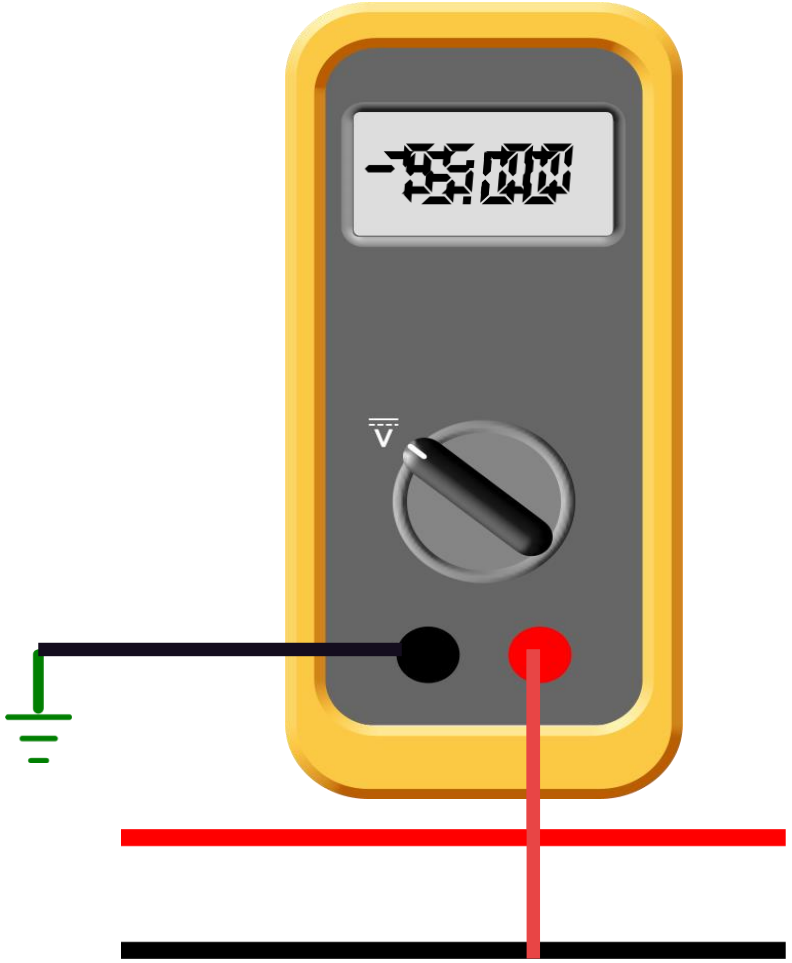
- Isolating the sensor board within the charger.
- Disconnecting the charger from the bus

If that is necessary, then check that the battery will sustain the load while the fault is traced

Which polarity of the battery is grounded?

In order to trace the ground fault we have to identify which polarity is grounded.

- Using a multimeter;
- Connect the negative test probe to ground
- Connect the positive probe to the positive bus
- Note the reading
- Connect the positive probe to the negative bus
- The lower voltage is the polarity with the ground fault



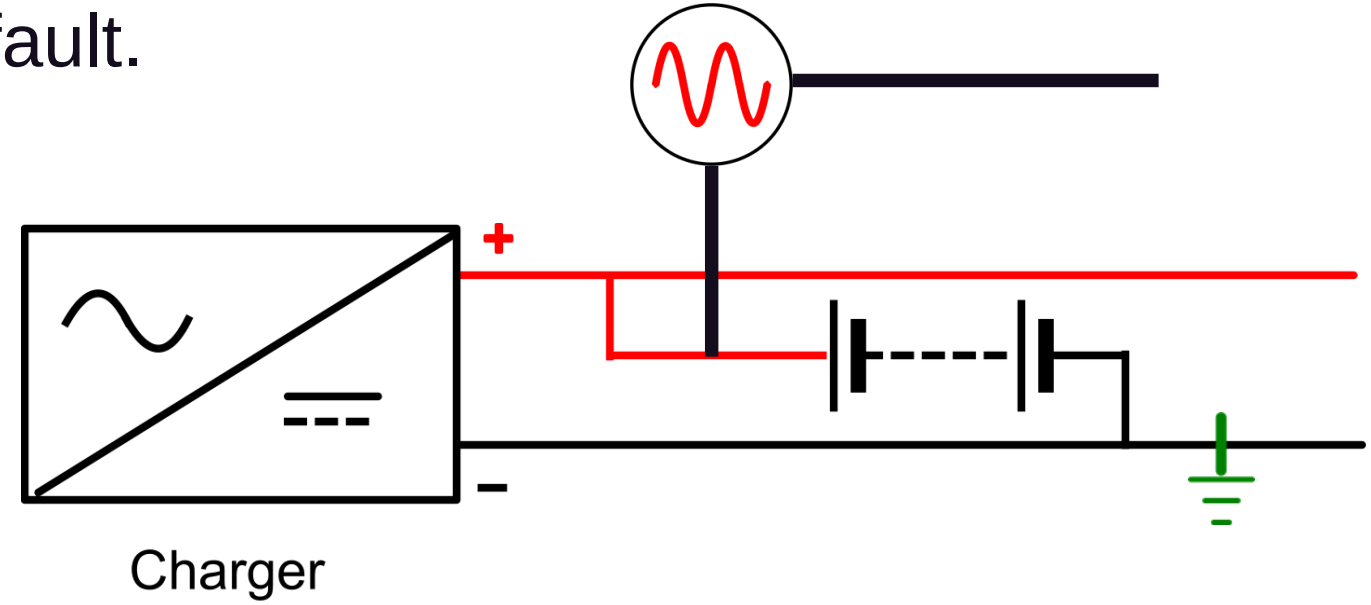
Installing the Signal Generator Test Leads

Plug in the test leads to the sockets on the front of the Signal Generator. Connect the red lead to the red socket marked (+) and the black lead to the black socket marked (-).

Ensure these are correctly connected Fit the alligator clips to the end of the leads. Note that one of the clips includes an insulation piecing point.

Getting started tone injection

Connect the transmitter between ground and the polarity with the ground fault.



If the positive bus appears faulty, connect the positive (red lead and connector) to that bus, and the negative (black lead and connector) to ground.

If the negative bus is faulty, connect the negative lead to it, and connect the positive lead to ground.

Signal Generator Start up Menu

Switch on the unit.

On the main screen, select GND-Fault using the arrow keys until it is highlighted; then press ENT.

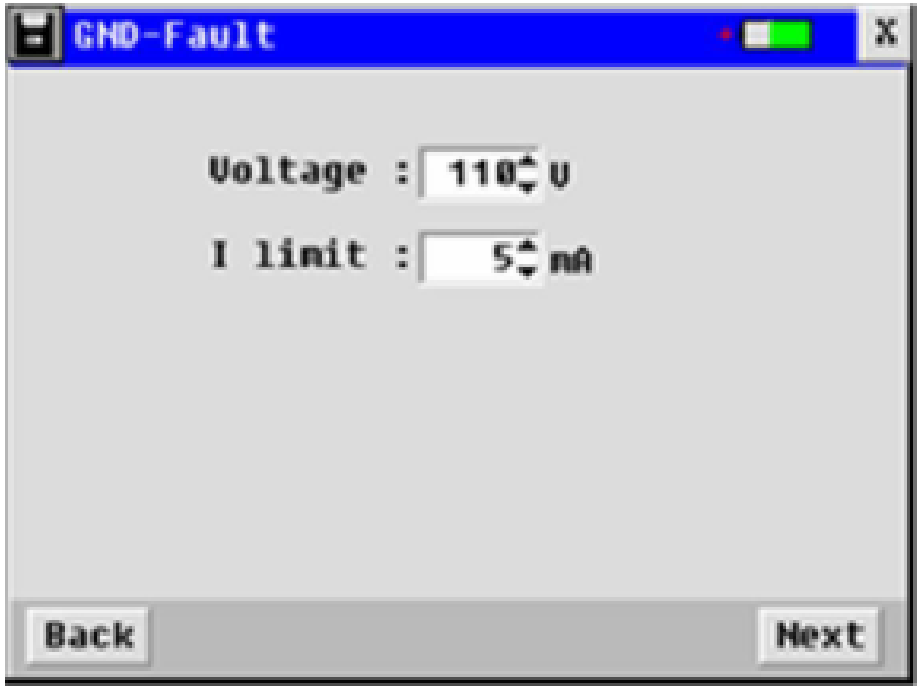
The next screen will allow the output signal to be adjusted

Voltage and Current Limit Settings

Set the output voltage and current limit by highlighting the appropriate value using the left and right arrow keys, adjusting the value using the up down arrow keys, pressing ENT again to save to value.

Use the arrow keys to move to the next value, or to the Back or Next buttons as required

Select the output voltage to best suit the voltage of the system under test. For example, if the system operates at 100V DC, choose an output voltage of 110V.



Settings of 24V, 48V, 110V, 220V, 500V, and 1000V are available.

Current Limit

The current limit should be used only where high levels of current may cause alarms or protection systems to be triggered.

For example, railway signaling systems may indicate an alarm if leakage current – or injected current from the signal generator exceeds 5mA.

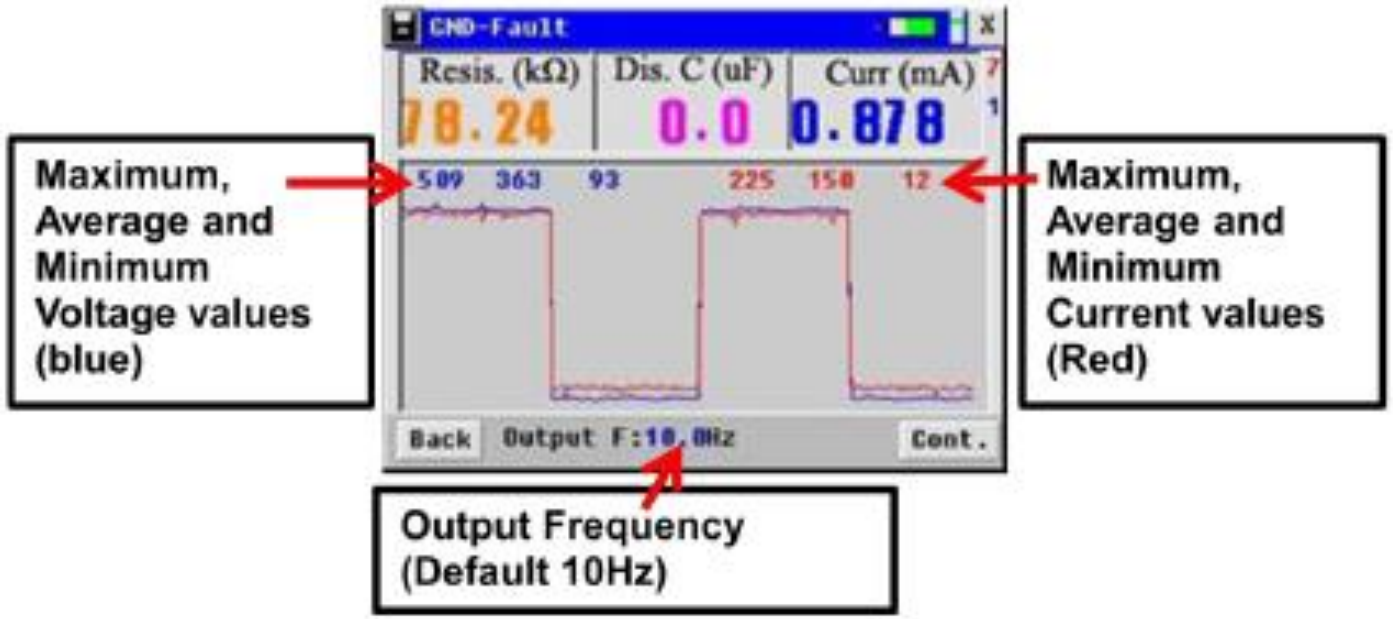
In this case the current limit should be set to 5mA.

If no signal sensitive systems are present, set the current limit to UL, which will in any case limit the output power to about 5W or 40mA, whichever is less.

Initial Set Up Screen

Select Next to continue. The signal generator will operate and a screen similar to this will appear. The generator will briefly produce an output in order to measure the system impedance

The display shows the signal generator voltage and current waveforms, together with calculated values of fault current, resistance and leakage capacitance.

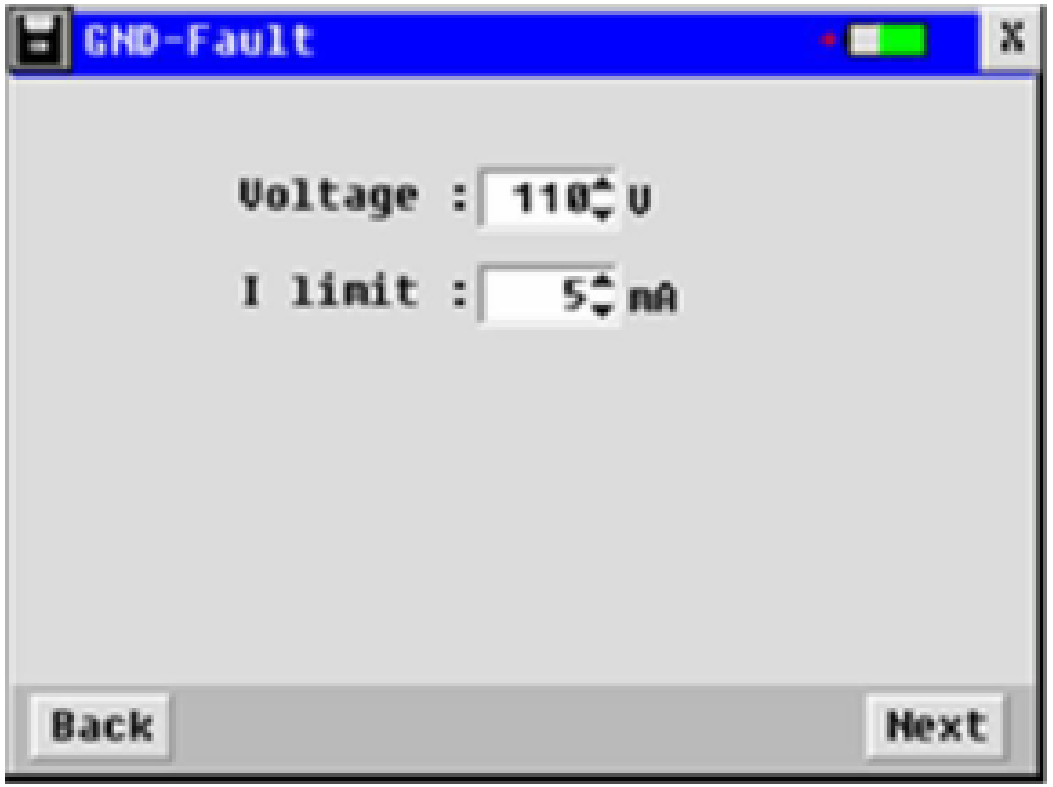


Adjusted Settings

Press Cont. The initial stings screen will be shown again.

The output voltage may have been reduced automatically to limit the output current.

If the output current is too low, the output voltage may have been increased.



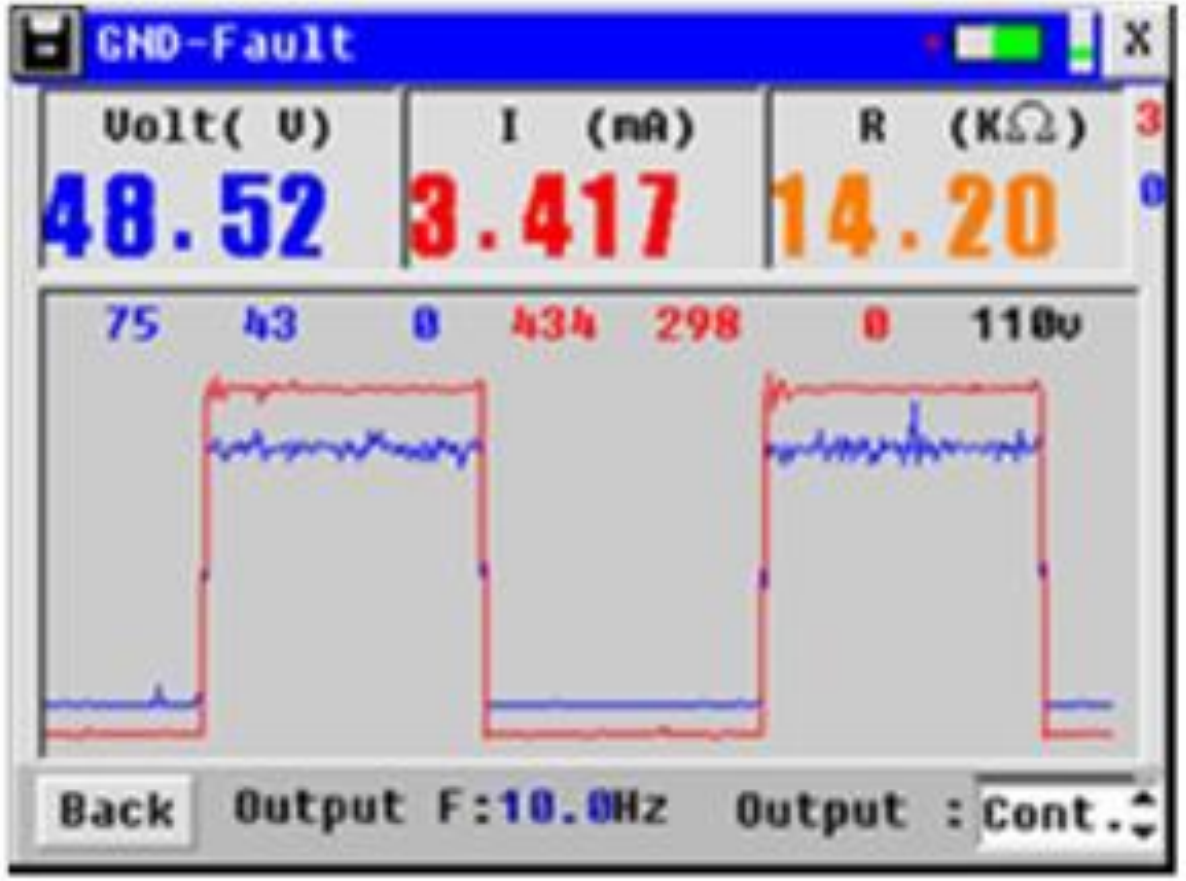
Signal Generator Output

Press Next and the generator will produce an output and this screen will be shown

The signal generator is now producing a continuous output voltage and current which is displayed on the screen.

A discontinuous (pulsed) output may be selected if desired by changing the setting Cont. in the bottom right hand corner of the screen.

If a discontinuous (Disc.) output is selected, the output will be pulsed on and off at roughly half second intervals.



Signal Receiver

There are several ways to navigate through the menus. In all cases Ent or Enter will carry out the action, while Esc will go to the previous screen.

On the Signal Receiver, the screen is touch sensitive and selections may be made using fingers or (more easily) the stylus provided at the top back of the unit. The keypad may also be used, and the buttons at the side duplicate the up, down, enter and escape functions.

Signal Receiver Starting Screen

Switch on the unit and select GND-Fault from the initial signal receiver screen

The green light above the screen should flash every second or so. This indicates normal operation.

Setting the Frequency and Audio Indicator.

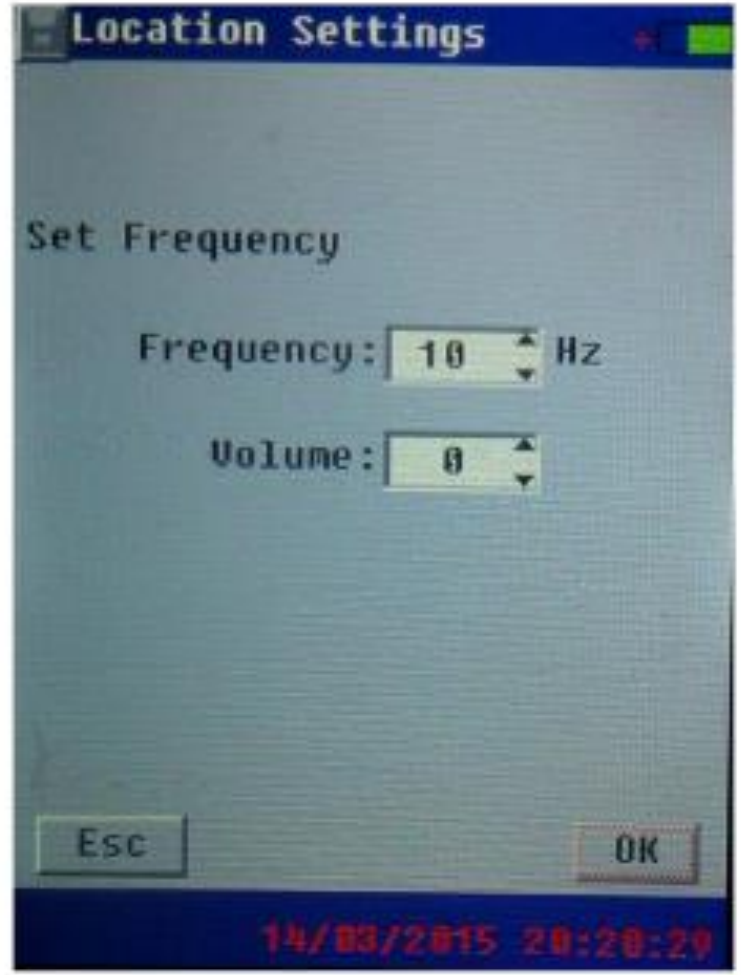
This screen is shown in when GND-Fault is selected in the previous screen. The receiver frequency is fixed at 10Hz, so this cannot be changed

An audio indicator can be set to assist fault tracing. The level at which the audio sounds a ‘beep’ is set here,

If, for example, the Audio indicator is set to 4, the ‘beep’ will sound if a value above 40% of the reference value is detected. This can be useful during fault tracing.

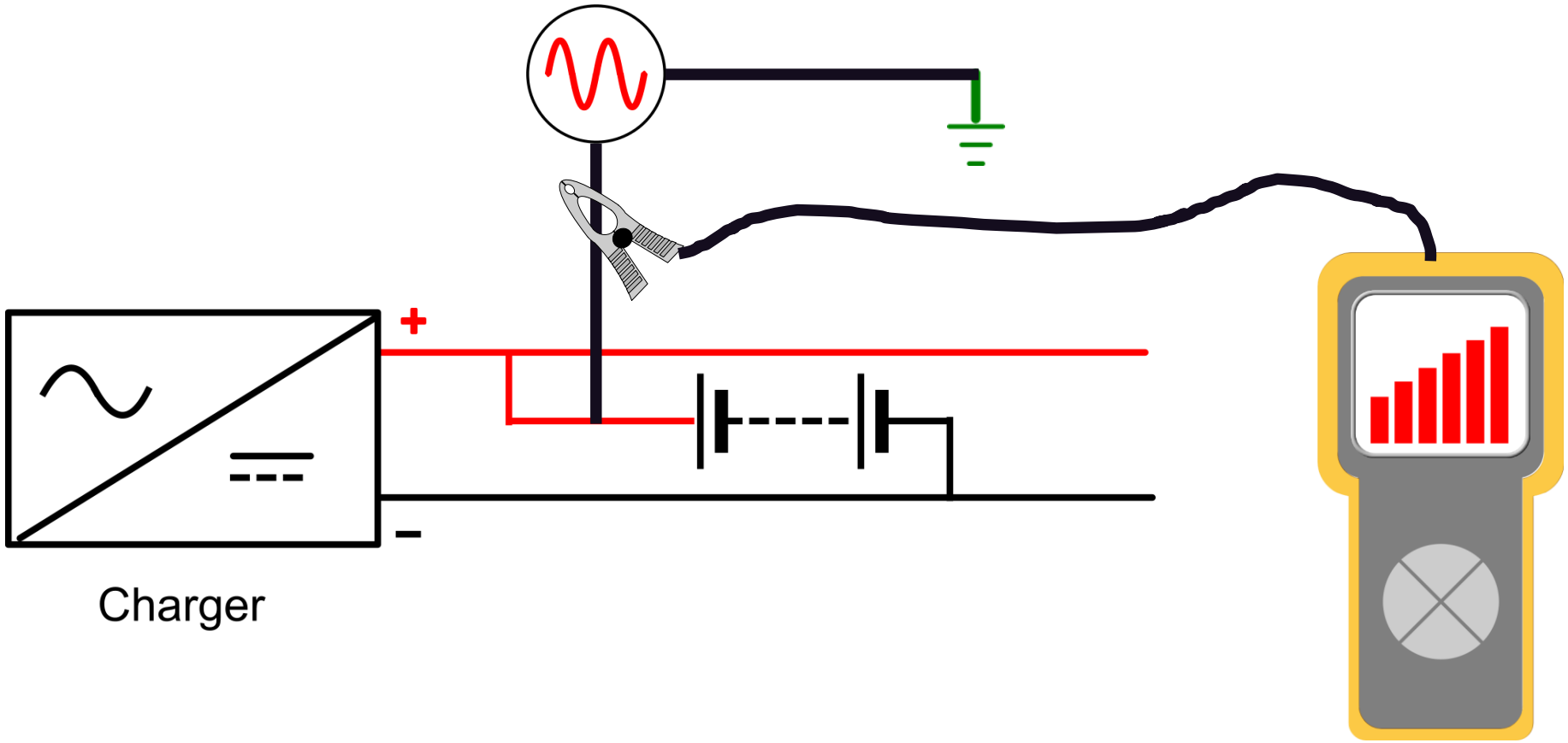
Set the audio values based on experience with the circuit under test, or begin with a value such as 4.

Once the Audio value has been set, select OK



Getting Started Tone Receiver

Check and calibrate the receiver



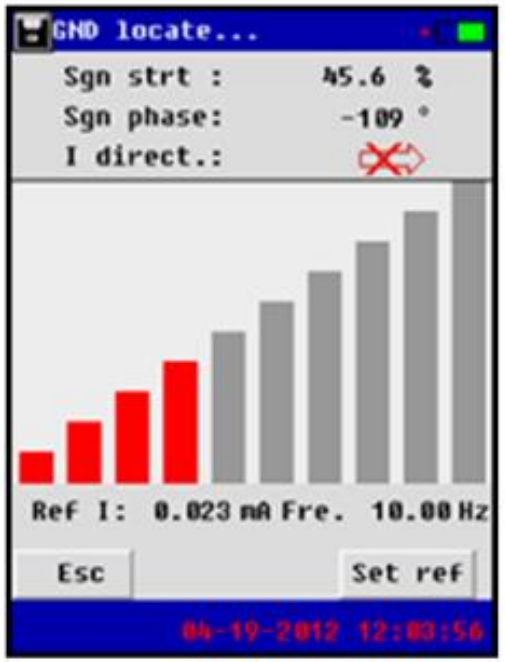
Reference Calibration

Ensure the output of the Signal Generator has been set to continuous (Cont). Check that there is current flowing from the signal generator by noting the reading on the screen.

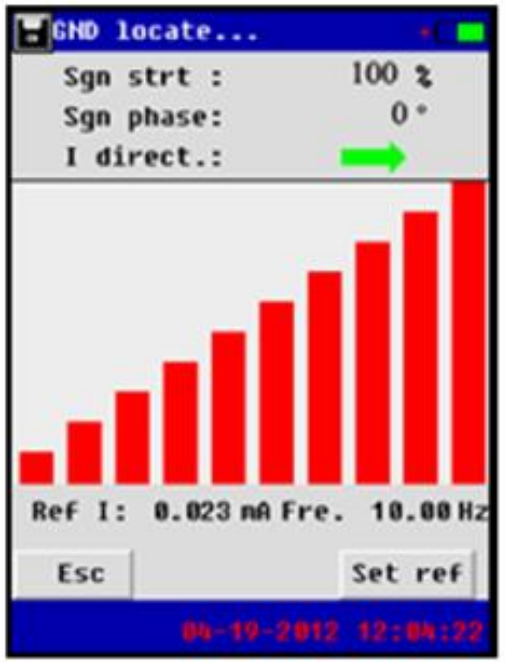
Clip one of the current clamps around the positive voltage lead from the signal generator with the arrow pointing in the direction of current flow; i.e. away from positive as shown.

Allow the measurement to stabilize for five seconds, then select Set ref on the signal receiver screen. The display will state Setting Ref… and after a few seconds will indicate Setting Done!

Setting the Reference



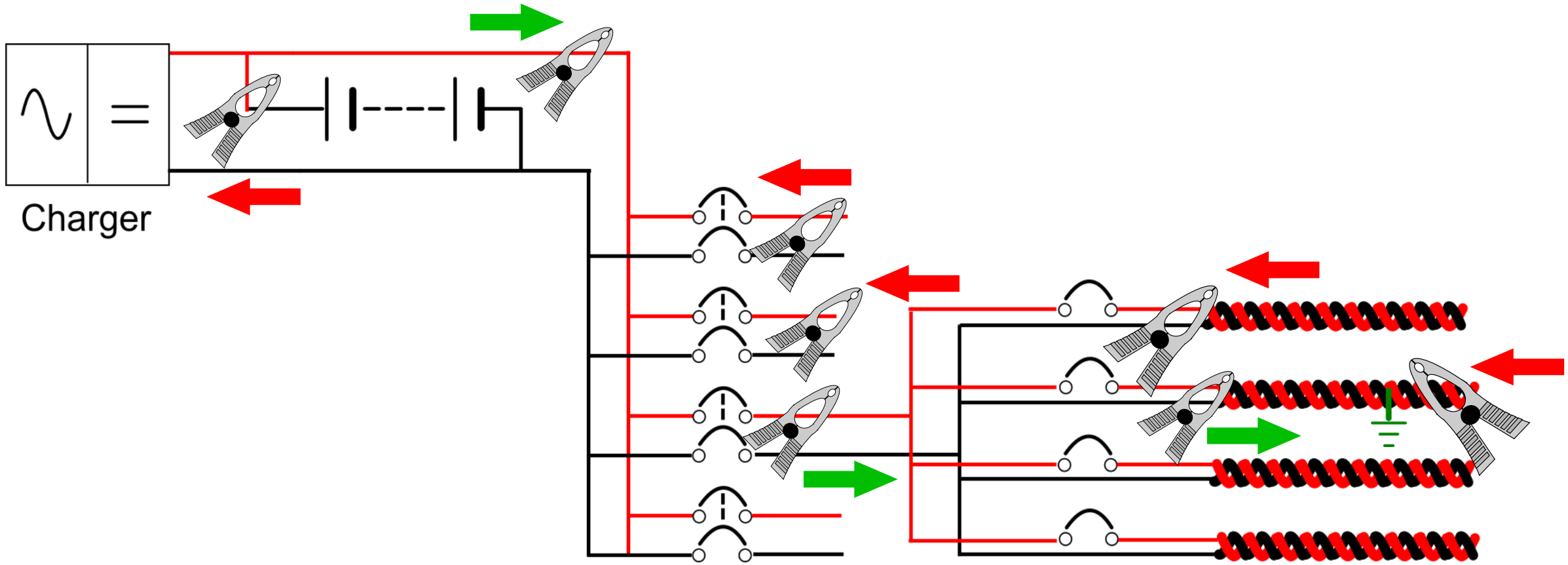
Typical reading before Setting



Typical reading after Setting

This is how a typical reading in the signal receiver display before and after the Reference is set. The more red bars, the greater the signal strength. The reference may be reset at any time

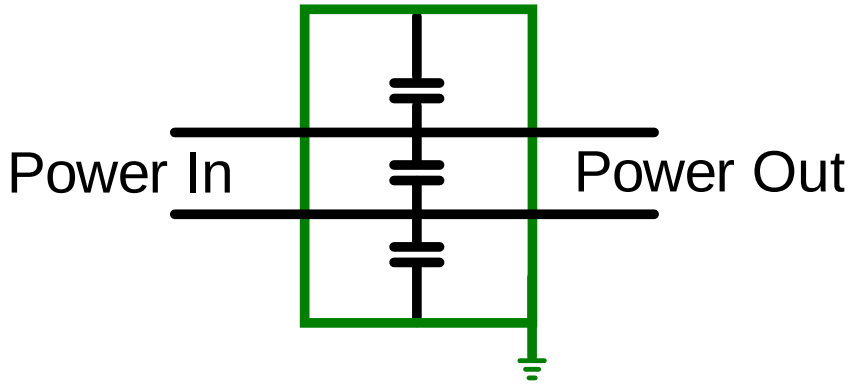
Tracing the ground fault



It might not be that simple

With electronics replacing relay based systems they have added a few challenges

Electronic have capacitor based filters



This can give phantom ground indications

Using the station battery for other things

Due to space restrictions there may be a need for the communication equipment to be powered from the station battery.

This can be a problem if the conversion from a floating 120V battery to a positively grounded 48V power system is not done correctly

Look out for Murphy

During a training demonstration of a ground fault locator on a real ground fault all the procedure outlined in this presentation were followed.

As a result a damaged cable was identified

Once the cable was isolated, we checked that the voltage on each leg with the multimeter to see if it was now balanced.

The meter was giving random readings, so we assumed that we had another ground fault

How to humbled

After a fruitless attempt to find another ground fault common sense took over.

We put everything back together and checked again and now we had balanced reading.

Why was this?

When we reconnected the ground fault detector in the charger, we reestablished the reference ground.

Lesson 1 if you don’t have a ground fault or a reference ground you can't check with a single meter

ANY QUESTIONS?