Loop Tester Operation Overview

Loop testers measure the resistance/impedance of the mains. They do this by switching a load on and off and measuring the voltage drop when the load is applied.

From ohms law the resistance can be calculated from the voltage drop / Current Load

The load current is usually about 25 Amps, and is switched on only for short period of time.
The load current produces a great deal of heat inside the tester

25A x 240V = 6,000 Watts

The tester will need time to cool down after making several measurements.

The normal test is to measure the Line/earth resistance; therefore the test current I flows from live to earth. This will normally trip an RCD. To enable testers to measure loop impedance/resistance on a protected supply there is usually a no – trip mode. Different manufacturers have different solutions to this, with the load current being reduced to much less; this results in a smaller voltage drop, giving a noisy, less repeatable reading. Most loop testers take several readings internally and display the average to improve the repeatability. However if the supply is noisy, with the mains voltage changing quickly as other loads in the circuit switch on/off then the loop resistance reading will be poor. Some testers will not give a reading in this situation, others will indicate that the reading may be unreliable, by displaying a sine wave symbol with a spike on it.

Note: The measurement that the loop tester makes is a **2 wire ohms measurement**, which means everything, including the resistance of the loop testers lead itself & its connector will be included in the measurement. All loop testers come with a lead, which it was originally calibrated with - the resistance of this lead has been taken into account when the tester was calibrated. **Using a different lead, with a different resistance, even a different fuse value, e.g. 13A instead of 5A, will give an error in the reading.**

It is important to also understand that Loop testers often read resistance with resolution of 10mOhm (0.01 Ohm). This is a very small resistance - a dirty plug; loose socket etc can cause variations up to a 100mOhm. For loop testers, which use flying Probes and clips, the contact resistance can be several hundred mOhms

2100/3200 Loop Calibration Overview

The 2100/3200-loop calibration function simply adds resistance into the earth return connection. There are 10 available resistance values plus a short circuit residual, (these are numbered ranges 0 to 11),which can be switched in. The resistors are high wattage, high power resistors designed to withstand the 25Amp load current passed by the tester, but not continuous power. The resistors are mounted on a heat sink to help dissipate the heat and are thermally protected.

Displayed Value of Loop resistance by the 2100/3200

The 2100/3200 displays the actual value of loop resistance at the 2100/3200 test socket - this value is made up of two parts which are added together :

1: The calibrated value of the internal resistors

2: The intrinsic value of the loop resistance

The value of the internal resistors are measured and stored in the 3200/2100 memory.

The intrinsic loop value can be either measured (with a calibrated loop tester) at the 2100/3200-test socket and then entered manually into the 3200/2100, or alternatively if the **Auto loop option** is fitted to the 2100/3200, the intrinsic loop value can be measured automatically.

> **Note : For manually entered loop the values loop value is measured at the 3200/2100-test socket, not the supply socket into which the 2100/3200 is plugged into.**

The intrinsic loop value is then stored in non-volatile memory in the 2100/3200.

Note: As supply loop resistance changes only slowly it is only necessary to update the intrinsic loop value for example, weekly, or when the 2100/3200 is plugged into a different socket.

> **Note: The auto-loop function should only be run once, and should not be run again for at least 3 minutes. A thermal cut out will operate giving unreliable loop impedance readings.**

Once the intrinsic loop value has been stored the displayed value of loop on the 2100/3200 will show the value at the test socket (the intrinsic loop resistance plus the calibrated value of the resistor selected). This value can be used directly by the user **without any other additions or subtraction for local loop, or the internal resistance of the2100/3200**.

Using 2100/3200 with ProCal

ProCal will read back from the calibrator at the time of running a test the displayed loop resistance. In this way ProCal will always get the latest value for loop resistance even if a new value of intrinsic loop has been entered, or auto loop run. A ProCal procedure only selects the nominal Range, not the absolute value which will be selected by the calibrator.

Common Problems.

Problem Encountered	Solution
Loop tester out of specifications	➤ **Must be calibrated with the mains lead supplied with tester.** ➤ **Intrinsic loop value not entered or auto-loop not run.** **Note : Repeated use of auto loop on 2100/3200 will cause thermal cut out to operate.**
Loop Tester has overheated by performing too many tests	**Leave for 5 minutes to cool down**
2100/3200 displays `Fault – Test Aborted`	**Loop tester faulty, the 2100/3200 ramps down load to tester at start of a test and aborts test if excessive current flowing in earth conductor.**
No power to Loop test socket	**Check 2100/3200 fuses on rear panel**
RCD trips when running Loop test	**Use 2100/3200 on un-protected supply**