

3100

Electrical Test Equipment Calibrator

Operation Manual



IMPORTANT NOTICE

**THIS CALIBRATOR
WILL
REQUIRE AN
UNLOCK CODE
AFTER THE EVALUATION
PERIOD HAS EXPIRED.**

(60 Days after invoice date)

**AFTER THE EVALUATION PERIOD HAS EXPIRED THE
OPERATION OF THE CALIBRATOR IS LOCKED AND THE
DISPLAY SHOWS A NUMBER WHICH MUST BE QUOTED TO
TRANSMILLE TO RECEIVE THE UNLOCK CODE**

**THE UNLOCK CODE IS
AVAILABLE
FROM TRANSMILLE
ONLY AFTER PAYMENT
HAS BEEN RECEIVED.**

(This code is only entered once in the life of the instrument.)

**Please contact Transmille or use the form in the back
of the manual to obtain the code.**

**Transmille Ltd.
Staplehurst , Kent.
Tel: 44 (0)1580 890700 : Fax 44(0)1580 890711
email:- sales@transmille.com**

DECLARATION OF CONFORMITY **CE**

Manufacturer's Name: Transmille Ltd.
Manufacturer's Address: Unit 4, Select Business Centre
 Lodge Road
 Staplehurst
 TN12 0QW

Declares, that the product

Product Name: Electrical Test Calibrator
Model Number: 3100
Product Options: This declaration covers all options of the above product(s)

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/73EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly

Conforms with the following product standards:

EMC**Standard****Limit**

IEC616326-1:1997+A1:1998 / EN 61326-1 EN55011:1991	:1997+A1:1998
IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995	Group 1 Class A
IEC 61000-4-3:1995 / EN 61000-4-3:1995	4kV CD, 8kV AD
IEC 61000-4-4:1995 / EN 61000-4-4:1995	3 V/m, 80-1000 MHz
IEC 61000-4-5:1995 / EN 61000-4-5:1995	0.5kV signal lines, 1kV power lines
IEC 61000-4-6:1996 / EN 61000-4-6:1996	0.5kV line-line, 1kV line-ground
IEC 61000-4-11:1994 / EN 61000-4-11:1994	3V, 0.15-80 MHz 1 cycle, 100% Dips: 30% 10ms; 60% 100ms Interrupt > 95% @ 5000ms

SAFETY

IEC 61010-1:1990+A1:1992+A2:1995 / EN 61010-1:1993+A2:1995

25/01/2004



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Managing Director

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3100 Electrical Test Equipment Calibrator Introduction

The 3100 Electrical Test Equipment Calibrator is a breakthrough in electrical test equipment calibration providing a complete solution for testing :

- Insulation Testers
- Installation Testers
- RCD Testers
- LOOP Testers

A complete electrical test equipment calibration solution from one instrument.



⚠ IMPORTANT OPERATIONAL NOTE 1

DUE TO THE OPERATIONAL CHARACTERISTICS OF THE 3100 ELECTRICAL TEST EQUIPMENT CALIBRATOR, AN UNPROTECTED SUPPLY (WITHOUT RCD TRIP) MUST BE USED *.

* Use of an isolation transformer can be employed in conjunction with a protected supply (with RCD Trip), however this will degrade performance of the calibrator. Please contact Transmille for further details.

⚠ IMPORTANT OPERATIONAL NOTE 2

It is also necessary that for correct operation the Phase (Live) and Phase (Neutral) MUST be connected round the correct way (some plugs used in non-UK countries can be connected either way round, therefore this check is necessary). There should only be a small voltage between Phase (Neutral) and Phase (Earth).

Installation & Power Requirements for the 3100

For correct operation of the 3100 it must be powered from an unprotected (ie. no RCD trip) supply. This is because the 3100 will pass current down the Earth conductor when performing tests and therefore trip any protection device present - FOR THIS REASON IT IS ESSENTIAL THAT THE 3100 IS PROPERLY EARTHED.

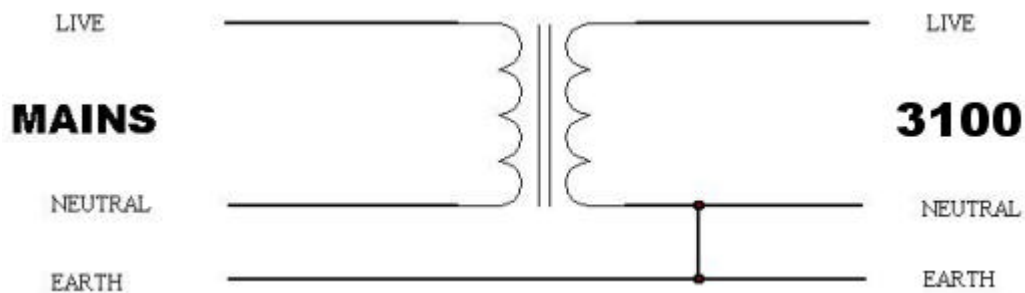
It is also necessary that for correct operation the Phase (Live) and Phase (Neutral) MUST be connected round the correct way (some plugs used in non-UK countries can be connected either way round, therefore this check is necessary). There should only be a small voltage between Phase (Neutral) and Phase (Earth).

To keep the LOOP impedance value to a minimum, the mains input to the 3100 is of a direct cable type. This avoids any introduction of unnecessary impedance.

It is desirable that the 3100 is connected to a supply point with low LOOP impedance as this will limit the lowest value available LOOP impedance from the 3100 using as good a quality outlet (contact wise) as possible.

If an unprotected supply is not available, use of an **Isolation Transformer** can be employed, however this will increase the lowest LOOP impedance available.

Connection of the isolation transformer should be as detailed below :



Designed for on use in the laboratory or portable on site calibration.

The 3100 calibrator is equally suitable for use in the standards laboratory or for on site calibration work. The Small footprint and low weight makes the 3100 calibrator ideal for on site calibration.

Input / Output Connection

The input and output terminal configuration is designed to enable simple connection to a full range of instrumentation using the supplied adapter lead. Use of a dedicated input adapter lead allows resistance measurement functions such as LOOP testing to be calibrated to include residual values right up to the socket into which test equipment is plugged.

All outputs are isolated when not in use, with an LED indicator showing the active input / output terminal(s).

Preparing the calibrator for use.

Initial Inspection.

After shipment the calibrator should be inspected for any signs of external damage. Should external damage be found contact the carrier immediately. Do not connect a damaged instrument to the line power as this may result in internal damage. Please keep the original box which can be used when returning the calibrator for service and re-calibration.



Warning

DO NOT DROP THE CALIBRATOR as this may cause internal damage.

Powering up the calibrator

After connecting line power the calibrator can be switched on with the line power switch above the mains inlet socket on the rear panel.

The front panel display will illuminate indicating power. The display will show program version number and after a short delay, during which time the processor performs a self test of the instrument, the display will show the default start-up display :

```
3100 CALIBRATOR Ver x.x
TRANSMILLE LTD.
```

The calibrator has been designed to be powered up continuously, automatically switching the display to power save mode after a pre-set period of time from the last command. In power save mode the display back light will turn off.

Input / Output Connection Types



Warning - Risk of shock.

High voltages may be present on the output sockets.

Output sockets comprise of the following types :



Mains Socket

For use directly with the lead of a LOOP or RCD tester




4mm Safety Sockets

For connection to Insulation Testers

Operation

SAFETY WARNINGS

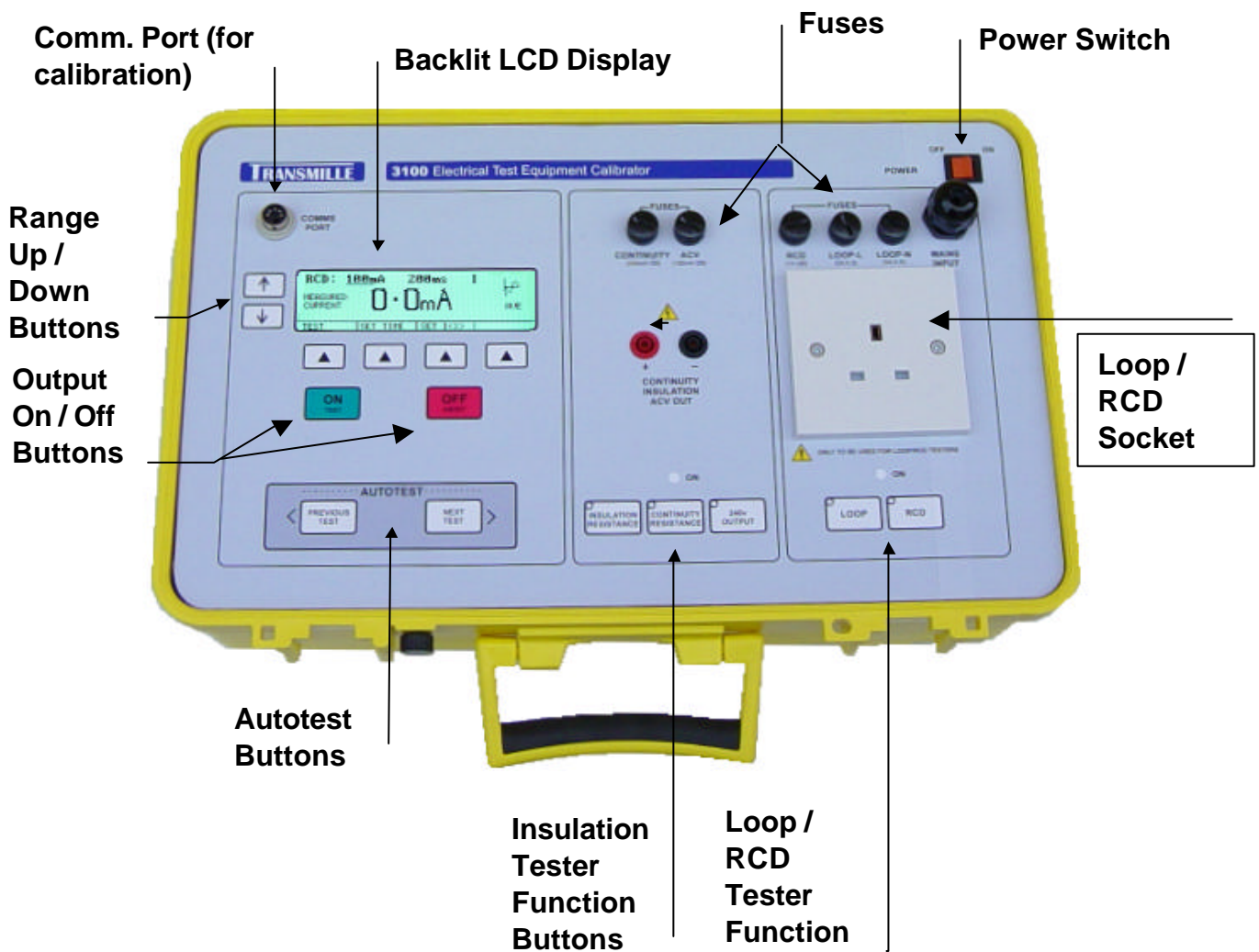
 This instrument is capable of generating high voltages.

 **WARNING :** *The information in this section is intended only for qualified personnel. The user must at all times be adequately protected from electric shock. Qualified personnel must ensure that operators of the equipment are adequately insulated from connection points.*

Introduction to Operation

All functions of the 3100 Calibrator can be controlled from the front panel.

Front Panel Controls and Indicators



Front Panel Keyboard

The front panel of the 3100 Calibrator utilises a high quality membrane switch panel with tactile feel buttons and integral display window. The front panel is therefore sealed against the ingress of moisture and dirt enabling the calibrator to be used in working environments without risk of dirt causing early failure of the operating buttons. The front panel can easily be wiped clean with a soft cloth. Care should be taken not scratch the display window. All graphics are 'under printed' so that they will not wear off with use.

IMPORTANT NOTE

The front panel key buttons are for use with fingers only - do not press the key with hard or sharp objects e.g. Ball-point pens, pencils, screwdrivers etc. Repeated actions like this will almost certainly cause the keyboard to fail. (This will not be covered under warranty). Care should also be taken when transporting the instrument - do not leave test leads plugged in which may get squashed into the display area or keys which can also cause damage.

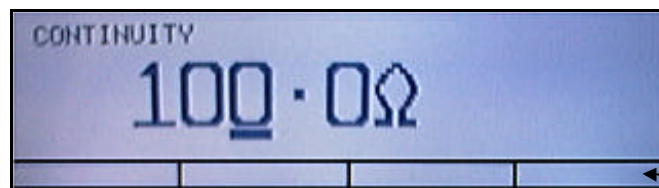
The Keyboard is divided into sections to allow rapid operation.

Functions keys for RCD, LOOP, Insulation Resistance, Continuity Resistance and ACV Output

Range up and range down keys allows range changing for the currently selected function

Output On / Off keys allow the calibrator output to be disconnected from the terminals. Led indicators are incorporated in these switches to clearly show the output status.

Graphic LCD Display



← SoftKey Menu items

A back lit graphic LCD display shows the present setting and instrument status. The bottom line of the display is used to assign the function of the four 'soft (menu) keys' immediately under the display. The display utilises a back light which automatically turns off if no activity takes place. The back light turns on as soon as a key is pressed or a command is received.

Calibrating Instruments Using the 3100

Calibrating Insulation Testers

The 3100 has five functions for calibrating insulation testers :

1. High value resistance output for insulation testing
(50k Ω • 100k Ω • 250k Ω • 500k Ω • 1M Ω • 10M Ω • 100M Ω • 1G Ω)
2. Measurement of the insulation test voltage
3. Low value resistance for continuity testing
(1 Ω • 2 Ω • 5 Ω • 10 Ω • 50 Ω • 100 Ω • 1k Ω • 10k Ω)
4. Insulation test current measurement (on 1 Ω range)
5. 240V A.C. voltage output

1. High Value Resistance for Insulation Testing

Step 1

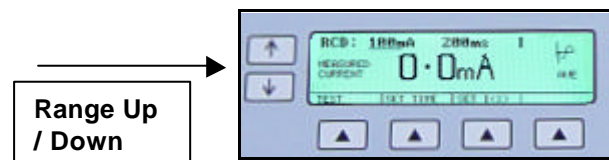
Select 'Insulation Resistance' function key on the 3100 front panel

Step 2

Connect the insulation tester to the Black & Red 4mm terminals.

Step 3

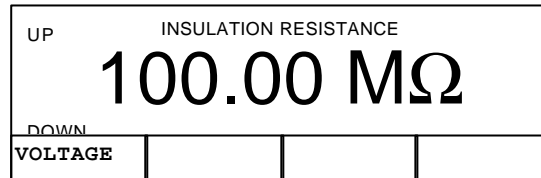
Select the required resistance value by using the up / down range buttons



2. Measuring Insulation Test Voltages & Current

Step 1

From the Insulation Resistance menu displayed on the 3100, select the **voltage** function using the 'SoftKey'.

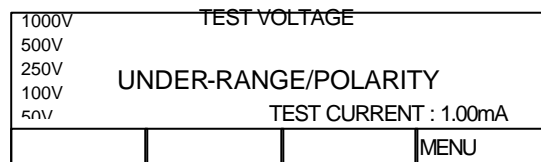


Step 2

Select the required voltage range using the up / down range buttons. The impedance of each range is automatically set to give the correct load at 1mA (see test current below) at the applied nominal voltage range.

RANGE	INPUT IMPEDANCE
50V	50kOhm
100V	100kOhm
250V	250kOhm
500V	500kOhm
1000V	1Mohm

The current load is 1mA nominal which is the correct load/test current for 16th Edition equipment - e.g. must be able to supply 1mA at the test voltage.



Step 3

Press the test button on the insulation tester to apply the insulation test voltage and read the voltage and current on the 3100 display.

To return from the Voltage measurement screen to the insulation resistance select the **Back** menu item using the Softkey.

If the voltage applied by the tester is less than 30% of the range or the polarity is incorrect, the display will show

UNDER-RANGE / POLARITY (note some tester's 'positive' red terminals are supplying negative voltage and need to have test leads reversed).

NOTE:- NEGATIVE INPUT OF 3100 (BLACK) IS CONNECTED TO SUPPLY EARTH.



Warning : The maximum input voltage is 1100 volts



The correct polarity must be applied to obtain a reading

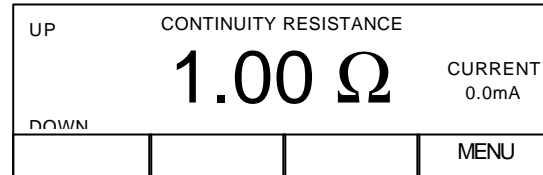
3. Low Value Resistance for Continuity Testing

Step 1

Connect the insulation tester to the Black & Red 4mm sockets.

Step 2

Select 'Continuity Resistance' on the 3100 front panel



Step 3

Select the required resistance using the up / down range buttons



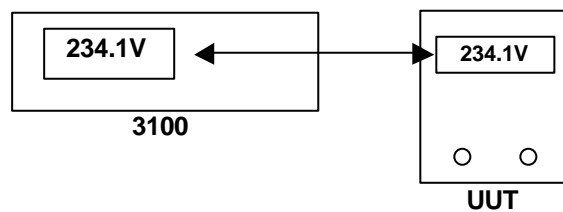
The measured current is also displayed when a resistance of 1Ω is set..

4. A.C. Voltage Output



Notes on ACV Output

To provide the power necessary for some insulation testers, the AC output from the 3100 is derived from a transformer tapping. The output is *unregulated* and will vary with line voltage and loading. The actual output voltage at any time is measured and displayed by the 3100 which can be compared to the displayed value on the UUT.



Example

3100 set to 230V range, measures mains and displays a measured value of 234.1V. The UUT is compared to check its accuracy at this value.

Step 1

Connect the insulation tester to the Black & Red 4mm sockets.

Step 2

Select '240V Output' on the 3100 front panel

Step 3

Read the voltage displayed on the insulation tester meter.
and compare it with the value displayed on the 3100



Introduction to RCD Testers

Increasingly in modern installations, earth leakage circuit breakers are used to provide protection in addition to conventional fuses and circuit breakers. These devices are referred to by a variety of names including RCD (Residual Current Devices), RCCB (Residual Current Circuit Breaker), ELCB (Earth Leakage Circuit Breaker) and GFI (Ground Fault Interrupt).

The devices operate by sensing when the current in the phase and neutral conductors within an installation are not equal and opposite. Any imbalance would imply that an additional path existed for the current to flow, invariably through the earth due to excessive leakage and/or fault situation.

RCD testers are designed to simulate a range of fault currents, with restrictions on the duration of the fault current, and to time the operation of the device. This will indicate the ability of the RCD to interrupt a particular fault current within certain time limits to ensure protection against fire, damage and electrocution.

It is important to understand that an RCD tester does not generate the current, but acts as a resistor allowing current to flow from the live to earth, simulating a fault. The 3100 measures the current flowing back to earth.

Calibrating RCD Testers using the 3100

The 3100 has three functions which can be used for complete testing of an RCD tester:

1. RCD Current measurement
2. RCD Trip Time measurement

1. RCD Current Measurements



Warning : Mains output is present during RCD testing



TEST button depressed for the duration of the test



The current measured by the 3100 is the true current drawn by the RCD tester with no allowance for the mains voltage at the time of test. Most RCD testers current specifications apply at a specific mains voltage and their current will be dependant upon mains voltage.

In this case a linear correction can be made to obtain the current at a specific mains voltage or the 3100 may be run from a variac (variable voltage transformer).

In practice, most manufacturers now specify the current at 230V. If these RCD testers are then tested at 240V they may well be out of specification.

Step 1

Connect the RCD tester to the LOOP & RCD TESTER socket using the input adapter lead supplied.

Step 2

Select 'RCD' on the 3100 front panel

Step 3

Using the 'SoftKey' beneath the **SET I (X)** menu item, select the required current mode (e.g. 1/2I, I, 2I, 5I).

UP	SET RCD CURRENT		
CURRENT	AND TRIP TIME		
DOWN	100mA	200ms	I
MENU		SET TIME	SET I(X)

Step 4

Use the 'SoftKey' beneath the **SET TIME** menu item to select the time setting menu.

UP	SET RCD CURRENT AND TRIP TIME		
CURRENT	100mA	200ms	I
DOWN			
MENU		SET TIME	SET I (X)

Step 5

Press the ON button to begin the test.

UP	SET RCD CURRENT AND TRIP TIME		
CURRENT	100mA	200ms	I
DOWN			
MENU		SET TIME	SET I (X)

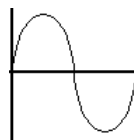
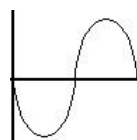
Step 6

Press the test button on the RCD tester to allow the 3100 to measure the current.

Step 7

Read the measured current from the display of the 3100.

The polarity and measurement technique will also be indicated on the 3100 screen.



PEAK

RMS

Polarity

Measurement Technique

2. RCD Trip Time Measurements



Some RCD testers may require a settling delay between the application of mains from the 3100 calibrator and pressing of the TEST button on the RCD tester. This may be indicated by a symbol on the display of the RCD tester.

Certain manufacturers RCD testers may also require the user to **keep the TEST button depressed** for the duration of the test

Step 1

Connect the RCD tester to the LOOP & RCD TESTER socket using the input adapter lead supplied.

Step 2

Select 'RCD' on the 3100 front panel

Step 3

Using the 'SoftKey' beneath the **SET I (X)** menu item, select the required current mode (e.g. $\frac{1}{A}$, I, 2I, 5I).

UP	SET RCD CURRENT AND TRIP TIME		
CURRENT			
DOWN	100mA	200ms	I
MENU		SET TIME	SET I (X)

Step 4

Use the 'SoftKey' beneath the **SET TIME** menu item to select the time setting menu.

UP	SET RCD CURRENT AND TRIP TIME		
CURRENT			
DOWN	100mA	200ms	I
MENU		SET TIME	SET I (X)

Step 5

Press the 'SoftKey' beneath the test menu item to begin the test.

UP	SET RCD CURRENT AND TRIP TIME		
CURRENT			
DOWN	100mA	200ms	I
MENU		SET TIME	SET I (X)

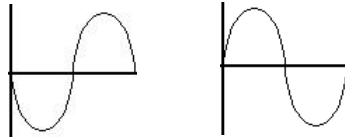
Step 6

Press the 'TEST' button on the RCD tester to allow the 3100 to output the current.

Step 7

Read the measured time from the display of the RCD tester.

The polarity and measurement technique will also be indicated on the 3100 screen.



Polarity

PEAK

RMS

*Measurement
Technique*

Introduction to LOOP Testers

What is the loop ?

When an appliance is connected to the mains supply a circuit is made. It completes the loop current flow round the circuit loop from the power station in the live wire through the appliance and then back to the power station in the neutral wire. Voltage is dropped around the loop due to the resistance of the cables etc. in which the current is flowing.

What is the loop resistance ?

The resistance of the cables etc. connecting your appliance to the power station.

There are two loop's connecting to the power station

1: The Phase-live to Phase-neutral loop.

2: The Phase-live to earth loop

Normally current will flow round the live to neutral loop but in a fault condition current from the live could return to the power station through the EARTH conductor,

What is PSCC and why is loop resistance important?

Using ohms law the loop resistance will determine the maximum current that can possibly flow round a circuit, as an example if the loop resistance is 1 ohm and the supply voltage 230 Volts using ohms law where

$$\text{VOLTAGE} / \text{RESISTANCE} = \text{CURRENT}$$

$$(230 \text{ V} / 1\text{Ohm}) = 230 \text{ Amps}$$

It can be seen that the maximum current that could flow would be 230 Amps even if the appliance was a dead short circuit. It can be clearly seen that a fuse or protection device lower than 230 amps would be needed to protect this circuit. It should be noted that some testers take the lowest loop, either live/neutral or live/phase to calculate the PSCC while other will use only the live/earth loop resistance.

Why is it normal to get large variations in PSCC measurements ?

PSCC is calculated by dividing the mains voltage by loop by the loop resistance. Loop resistance's are often very low, 0.1 to 0.4 ohms and the accuracy, resolution & repeatability possible when measuring loop resistance will give rise to large variation in PSCC as the supply voltage is being divided by a number approaching zero.

Example

A 230 volt supply with loop resistance of **0.2ohms**

$$(230\text{V} / 0.2\text{ohm}) = \text{gives a PSCC of } \mathbf{1150\text{Amps}}$$

where if the loop resistance was only 0.05Ohms less at **0.15 ohms**

$$(230\text{V} / 0.15\text{ohms}) = \text{gives a PSCC of } \mathbf{1533 \text{ Amps}}$$

What is a Loop tester measuring ?

Loop testers measure the resistance in ohms of the mains supply at a power socket, most loop testers only measure the resistance of the live(Phase) to earth resistance, some testers can measure also the resistance of the live to neutral circuit. Some loop testers can also display the PSCC (Prospective Short circuit current) or sometimes called the PFC (Prospective fault current)

How do they work ?

Loop testers work by applying a heavy load, usually 23 amps for a short duration and measuring the drop in voltage when the load is applied, then using ohms law display the loop resistance.

What happens on an RCD protected circuit when using a loop tester ?

As the test current (23Amps) flows down the earth conductor any current RCD (Residual current breaker) in the circuit will trip out. To test loop impedance on protected circuits the breaker must either be temporarily wired out or a loop tester with a **no trip** range must be used. On the 'No Trip' range the testers load current is much lower & only loads the supply for a very short periods of time so to prevent the RCD from operating. In this mode the tester will internally repeat the measurement several times and take an average. As a result the measurement takes longer and the measurement less accurate, especially if the supply is noisy. As any PSCC calculation is a reciprocal of the loop resistance (Volts/Resistance) error in the reading of resistance can make big differences in the PSCC value.

How do I Calibrate a Loop Testers

To calibrate a Loop tester first the loop impedance of the supply must be known, then several known values of resistance must be inserted in the loop to increase the loop resistance so the tester can be calibrated at several points. The resistance can either be in the live or earth return. (it is common practice to place the resistors in the earth return for safety reasons). The value displayed on the tester can then be compared to that of the known value of the resistor. plus the loop resistance of the supply.

The 3100 has 8 calibrated resistance values which are non inductive and are able to withstand the 23 Amps needed.

How can I accurately measure the loop impedance of my Test Socket ?

Firstly it is important to define what is the test socket. This is the socket into which the **Instrument being calibrated will be directly plugged into**. This is not the same as the socket on the wall which then has an extension lead to run it down to the test bench first, remember every bit of cable, plug, fuse etc is adding resistance.

 **IMPORTANT SAFETY WARNING** 

**THE FOLLOWING PROCEDURE MAKES CONNECTION DIRECTLY TO
MAINS LINE VOLTAGES WHICH ARE UNPROTECTED BY AN RCD
BREAKER - THERE IS EXTREME RISK OF ELECTRIC SHOCK UNLESS
PROPER SAFETY PRECAUTIONS ARE TAKEN.**

***THIS PROCEDURE MUST ONLY BE PERFORMED BY
QUALIFIED ENGINEERS.***

Equipment Required.

Loop resistance can be measured using a DMM calibrated on AC volts, a DMM calibrated on AC amps and a load resistor, which can easily be switched on/off, capable of taking around 10amps for a minute without a large change in value, an electric kettle can be used if nothing else is available which will take the power.

Connections

First connect the amp meter in series with the load to enable measurement of the current taken by the load. Then connect both the switched load in series with the amp meter & the AC volts measuring DMM between the **live and earth** pins in a mains plug. (**NOTE Do not connect the load at the DMM terminals otherwise the resistance of the test leads will also be measured, both leads must go to the plug.**)

Measurement Method.

Insure all connections are insulated and the load is off.

Connect the measurement Plug in to the test socket.

- 1: Record the off load voltage measured by the DMM.
- 2: Switch on the load and record
- 3: The current taken by the load
- 4: The AC volts under load.

Repeat several times and calculate the average. Use the formula below to calculate loop resistance:-

$$\text{Loop resistance} = (\text{Off load Voltage} - \text{On load voltage}) / \text{Load Current in Amps}$$

When using the 3100 it is important to remember the test socket is the socket at the end of the adapter cable, **NOT THE RESISTANCE OF THE SOCKET INTO WHICH THE 3100 IS PLUGGED**). The loop value measured at this test socket can then be manually entered into the 3100 which will add this value to the calibrated values.

The AUTOLOOP option measures the loop resistance of the supply internally by performing automatically the procedure above, the internal load of the 3100 is approx 4 Amps and the on/off load voltage measurements are taken 32 times, with noisy readings caused by mains spikes etc being discarded. The 3100 then adds the supply loop value it has measured plus a small correction for the resistance of the test adaptor. (Note this is not the value of the socket the 3100 is plugged in to but the value at the test socket, which is always greater due to the resistance added by the 3100 wiring.)

How can I calibrate a Loop Tester at Zero

It is desirable when calibrating loop testers to calibrate at as near zero as possible. However practical limitations govern how low a value can be achieved.

NOTE It is not possible to get a calibration point lower than the resistance of the supply test socket itself. Typically the 3100 will add 0.15Ohms to the resistance of the socket which the 3100 is plugged into.

The lowest value will be obtained near where the supply enters the building. Remember every switch, fuse socket, even the 3100 will add resistance. If it is required to calibrate at values below that available from of the 3100 then a short length of extension cable of which the resistance of the live + earth conductors have been measured by a 4 wire DMM can be used.

Generally however it is not necessary to calibrate at values below a normal supply. If 3 points spread across the instruments range can be achieved and the linearity can be verified it can be assumed that the zero will be correct. (The manufactures would after all have verified that the design is linear on the lowest part of the scale.)

Other Problems with calibrating Loop testers.

Loop tester measure resistance down to milli ohm levels using two wire connection, it is well understood that connection/lead resistance etc at this level make a significant difference's. The instrument specifications assume all nice new clean contacts in to tightly fitting sockets, and we all know plugs, sockets etc get dirty and worn. This obviously increases the resistance which can easily put the instrument out of spec.

It is very difficult to achieve reliable 2 wire connection when measuring milli ohms, simply plugging in and out can change a connection resistance by 100milli ohms so this is the first place to look. Also check the lead is the same as the lead supplied with the instrument, even the fuse will make a difference.

The 3100 is supplied with good quality sockets to help maintain a low contact resistance, also the mains lead is directly connected to avoid another possible problem. It is however to be expected that variation in the order of ten's of milli ohms will be present in two wire systems.

The other main problem with loop tester's is they often fail short circuit resulting in a big bang when plugged in. The 3100 first checks the tester for this by checking the current flowing with 1kohm in the earth line before a full power test. If the 3100 detects a faulty instrument the test is automatically aborted.

Calibrating LOOP Testers using the 3100

Loop testing using the 3100 is performed using a fixed set of resistance ranges, with auto loop measurement.

■ Auto Loop Measurement

The auto loop measurement allows the 3100 to automatically measure the loop resistance of the mains supply to the 3100. **THE RESISTANCE MEASURED IS NOT THE RESISTANCE AT THE SOCKET INTO WHICH THE 3100 IS PLUGGED, BUT THE RESISTANCE AT THE TEST ADAPTER SOCKET INTO WHICH THE LOOP TESTER BEING CALIBRATED IS PLUGGED.** This measurement incorporates the resistance of the supplied adapter lead and the mains circuit to provide the value at the test socket.

The adapter lead is typically 23mOhms ± 3mOhms

The 3100 will then incorporate this value into its displayed loop resistance values.

i *When the TEST softkey is pressed on the 3100 front panel, the 3100 **pre-tests** the LOOP tester to detect faulty devices. Should a faulty device be detected the output will be automatically switched off and a fault message will be displayed on the 3100 display.*

Step 1

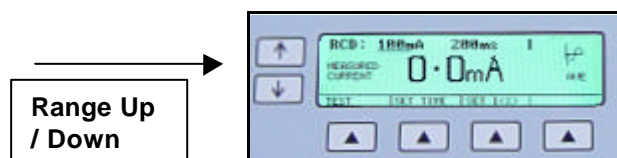
Connect the LOOP tester to the LOOP & RCD TESTER socket using the input adapter lead supplied.

Step 2

Select 'LOOP' on the 3100 front panel

Step 3

Select the required resistance value using either the range up / range down buttons



Step 4

Press the ON button on the 3100 to apply mains to the LOOP tester

Step 5

Press the 'TEST' button on the LOOP tester to begin testing.

Step 6

Read the loop resistance from the display of the LOOP tester.



Notes on the LOOP Function

By incorporating the supply loop impedance into the displayed value, this allows direct comparison to the value displayed on the loop tester being calibrated. The resistance value displayed by the 3100 is comprised of the following :

1. The **measured value of the resistor** (as measured during 3100 calibration)
2. The **supply loop impedance**
(as measured and stored by the 3100 via auto loop function)

The loop impedance of a supply will change over time, therefore it is important that the loop impedance value is checked regularly by running the auto loop function.

If the 3100 is moved to another location or plugged into a different socket, this will have an impact on the loop impedance – the auto loop function will need to be run.

PSC (Prospective Short Circuit) Testing

Some LOOP / Installation testers have the capability to measure PSCC (Prospective Short Circuit Current) which is the largest Prospective Fault Current (PFC) which could flow.

This current is limited by the LOOP resistance of the circuit and can be calculated for either :

- Phase (Live) to Earth
- Phase (Live) to Phase (Neutral)

The more usual is Phase (Live) to Phase (Neutral)

The LOOP / Installation testers calculate this measurement from the measured LOOP resistance using the sum :

$$\text{PSCC} = \frac{\text{Nominal supply voltage}}{\text{LOOP Resistance}}$$

This function can be calibrated with the 3100 by using the LOOP function

The standard lead supplied with the 3100 will enable you to simulate Phase (Live) to Earth PSCC. If Phase (Live) to Phase (Neutral) PSCC testing is required, the lead detailed below will need to be made :



To calibrate, compare the reading obtained on the Installation tester with the value calculated from the formula above using the LOOP impedance displayed on the 3100.

AutoTest Function

The 3100 calibrator incorporates an 'AutoTest' function which allows preset tests to be run for a specific type of tester.



To use this function, select a function :

- Continuity Resistance
- Insulation Resistance
- 240V Output
- Loop
- RCD

Then press the '**NEXT TEST**' button to begin

The 3100 will display 'CONNECT TESTER' – Simply press next test to step to each preset test. When the end of the test sequence is reached the 3100 will display 'END OF TESTS'.

To step to a previous test at any point during the sequence use the '**PREVIOUS TEST**' button

These preset tests for each kind of tester are detailed below :

Continuity Tester Sequence	
Insulation Resistance	1Ohm Range
	2 Ohm Range
	5 Ohm Range
	10 Ohm Range
	50 Ohm Range
	100 Ohm Range
	1000 Ohm Range
	10000 Ohm Range
Continuity Current	300mA Range

Insulation Tester Sequence

Insulation Resistance	50k Ohm Range
	100k Ohm Range
	250k Ohm Range
	500k Ohm Range
	1M Ohm Range
	10M Ohm Range
	100M Ohm Range
	1G Ohm Range
Insulation Test Voltage	50V Range
	100V Range
	250V Range
	500V Range
	1000V Range

240V Sequence

ACV Output	240V Range
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Loop Tester Sequence

AUTO LOOP MEASUREMENT	
Loop Resistance	0 Ohm Range
	100mOhm Range
	500mOhm Range
	1 Ohm Range
	5 Ohm Range
	10 Ohm Range
	100 Ohm Range
	1kOhm Range

RCD Tester Sequence

Test Type	Test Time
RCD Time @ 200mA	30ms Range
	50ms Range
	100ms Range
	300ms Range
RCD Current @ 40mA	150ms Range
RCD Current @ 50mA	100ms Range
RCD Current @ 100mA	100ms Range
RCD Current @ 200mA	200ms Range
RCD Current @ 500mA	200ms Range

Technical Description

General

The 3100 calibrator uses the latest in reference, resistor and processor technology designed to minimise cost and size yet maximise performance. The micro processor controls and monitors all functions of the calibrator. Calibration constants are held in non volatile memory allowing the calibration to be performed without removing the covers. There are no internal adjustments required in normal service.

 **Warning risk of shock.**

The line power cord must be disconnected before opening the instrument

The circuitry comprises of three printed circuit boards :

- Main PCB.
- Processor board
- Front Panel Display and keyboard control

Construction

The calibrator is constructed in a rugged transportable plastic enclosure, with integrated carry handle. The calibrator is a modular construction to allow ease of servicing.



Internal Fuses.

In normal operation these fuses should never need to be replaced. Only under fault conditions will they require changing.

NOTE : To access these fuses it is necessary to dismantle the case which should only be carried out by an engineer. See removing top cover.



Warning risk of shock.

The line power cord must be disconnected before opening the instrument.

Internal fuses include :

± 12V Supply A/S 2Amp 20mm

Opening The Case



Warning risk of shock.

The line power cord must be disconnected before opening the instrument.

To gain access to the inside first remove the main panel by removing the 10 screws located around the edge of the front panel. Then carefully pull the panel out of the enclosure.

Access to Internal Fuses

After removing the assembly the fuses will then be clearly visible on the back of the assembly.

Processor Board

Plugs into the main PCB and controls all functions within the calibrator. The processor board is a complete working board containing RAM, PROM, Clock, Cal Ram, I/O and RS232. The processor also applies all calibration factors held in RAM. Cal Factors are stored twice to prevent errors. The processor runs a self test to detect malfunction and overloads.



Warning

Removal of the processor board may corrupt the calibration factors.

Calibration and Maintenance

**WARNING**

The information in this section is intended only for qualified personnel. The user must at all times be adequately protected from electric shock.

General

The 3100 calibrator maintenance requirements are listed below. Please note that the calibrator **does not** require any regular internal servicing or adjustment.

- 1: Electrical Safety Checks on Line power lead and case
- 2: Cleaning the external case
- 3: Calibration and operation verifications

Electrical Safety Tests

These can be carried out as frequently as required. Earth bond and insulation can be tested as a class 1 standard. Flash testing is not recommended due to the possibility of damage to internal components. .

Cleaning the external case

Use a damp cloth with a mild water based cleaner for the outside case and front panel. Do not use alcohol based cleaners or solvents and do not spill or allow liquid to enter the case.

Calibration Overview

The calibration of the 3100 calibrator can be performed covers on. Calibration factors for positive, negative and zero are store in non volatile memory for each range. Values for resistance will only need adjusting after repair.

Calibration can be carried out automatically via the comm. interface if required. Adjustments to the calibration can only be made using the interface.

The recalibration of 3100 calibrator should be performed annually in a standards laboratory with the correct equipment. Adjustment should not be attempted without the required standards.

Before calibration it is important to have meet the conditions listed below

- 1: The correct environmental condition .
- 2: The calibrator must have fully warmed up and been allowed to stabilise for the correct period of time.
- 3: Operated from the correct line voltage.
- 4: To use the correct calibration equipment.
- 5: To have available the Correct Test leads required
- 6: To understand the required test specifications.
- 7: To operate the calibrator at all times within its load and voltage capabilities

Guarantee and service

Transmille Ltd. guarantees this instrument to be free from defects under normal use and service for a period of 1 year from purchase. This guarantee applies only to the original purchaser and does not cover fuses, or any instrument which, in Transmille's opinion, has been modified, misused or subjected to abnormal handling or operating conditions.

Transmille's obligation under this guarantee is limited to replacement or repair of an instrument which is returned to Transmille within the warranty period. If Transmille determines that the fault has been caused by the purchaser, Transmille will contact the purchaser before proceeding with any repair.

To obtain repair under this guarantee the purchaser must send the instrument (carriage prepaid) and a description of the fault to Transmille at the address shown below. The instrument will be repaired at the factory and returned to the purchaser, carriage prepaid.

Note :

TRANSMILLE ASSUMES NO RESPONSIBILITY FOR DAMAGE IN TRANSIT

THIS GUARANTEE IS THE PURCHASER'S SOLE AND EXCLUSIVE GUARANTEE AND IS IN LEIU OF ANY OTHER GUARANTEE, EXPRESS OR IMPLIED. TRANSMILLE SHALL NOT BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR LOSS.



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3100 Fax Back Form

Your 3100 Electrical Test Equipment Calibrator is fitted with a *security system* which requires a *security code* to be entered to allow continued operation of the unit beyond the 65 Day evaluation period.

Please complete the following details :

Company Name : _____

Contact Name : _____

Address : _____

Country : _____

Tel. : _____

Fax : _____

Instrument Model: 3100 Electrical Test Equipment Calibrator

Serial Number: _____

Please Fax This Form To : +44 (0) 1580 890711.

On receipt of this fax Transmille will, on receipt of payment for the calibrator, send details of the security code with details on how to enter this code.