

# Using the 5320A transfer ground bond resistance function

For calibrating ground bond resistance meters, portable appliance testers and similar instruments, the Fluke Calibration 5320A Multifunction Electronic Tester Calibrator is equipped with high-power rated resistors at 16 fixed points ranging from 25 mΩ to 1.8 kΩ. The best accuracy for these resistors ranges from  $\pm 5$  mΩ to  $\pm 8$  mΩ, and applies for the resistances below 500 mΩ.

When calibrating instruments that measure such small resistances at these accuracies, it is important to have reliable test conditions. Even minor variations in lead connection resistance will cause inferior calibration results. So to properly calibrate ground bond resistance meters that require such accuracy, a “transfer ground bond resistance” (or transfer GBR) function has been implemented into the 5320A calibrator. This capability dynamically evaluates and displays the effective resistance value being measured by the ground bond resistance meter during the calibration test. This function improves the  $Z_{\text{GND}}$  calibration and permits high accuracy testing for resistances below 500 mΩ.

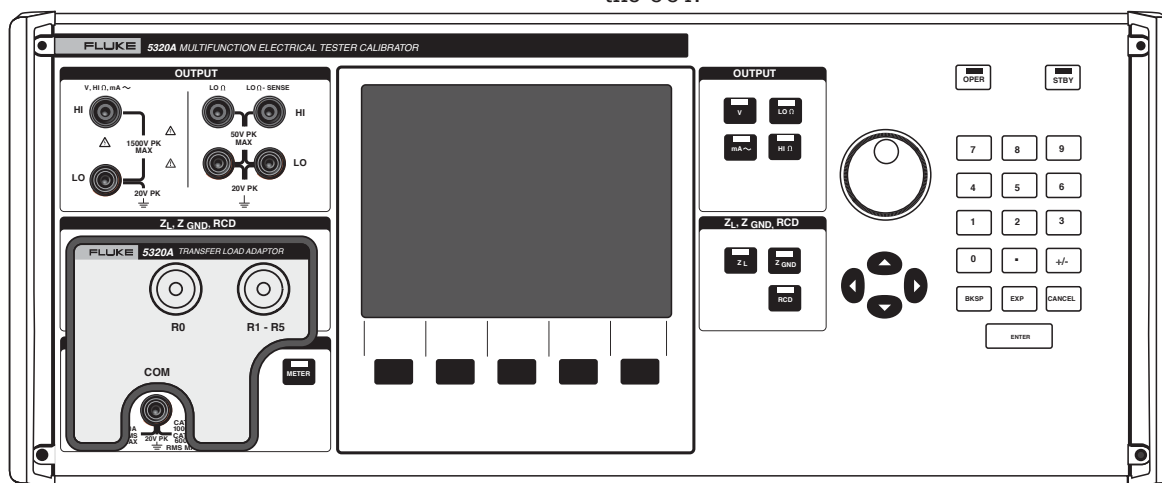
The transfer GBR function requires simultaneous connections to both the  $Z_{\text{GND}}$  and METER terminals of the 5320A. Because of this, it is important to realize that any variations in lead connection

resistance caused by either complex or inadequate test connections will also cause inferior and inconsistent calibration results. To minimize lead connection problems, a “5320A Transfer Load Adapter” has been included with the 5320A calibrator. The adapter simplifies connections to the 5320A and maintains high accuracy testing using low resistances.

**Note:** This function was not available on early 5320A models. Instruments with firmware release 3.12 or earlier. The transfer GBR capability can be installed in the earlier 5320A models by installing the latest firmware release. Contact Fluke Calibration for detailed information on upgrading to the latest firmware release and purchasing the Transfer Load Adapter accessory.

## Principle of operation

The transfer GBR function is based on an active method of measuring the real time test parameters during the calibration of the ground bond resistance tester and displaying the calibrated resistance value appropriately. Using the transfer load adapter, the 5320A connects the unit under test (UUT) to both the  $Z_{\text{GND}}$  output terminals and the calibrator’s voltage and current meter terminals. The 5320A then repeatedly measures both the test current and voltage at the point of connection to the 5320A  $Z_{\text{GND}}$  terminals. Measurement is selectable for either ac or dc test signals to fit what is generated by the UUT. From these measured values, the calibrator calculates real resistance value at the 5320A terminals. This real resistance value is used for calibrating the UUT.



## Installation

The adaptor can be installed simply by attaching the adaptor onto the 5320A front panel terminals as shown in Figure 1.

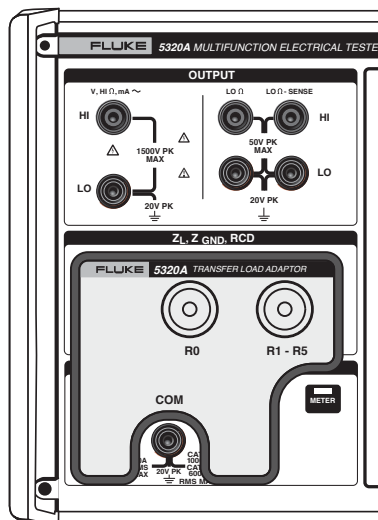


Figure 1.

## Control

The transfer GBR function is accessible via the ground bond resistance key  $Z_{GND}$ . When the ground bond resistance function is selected, push the MODE soft key and select "TRANSFER." A display similar to the display in Figure 2 appears.

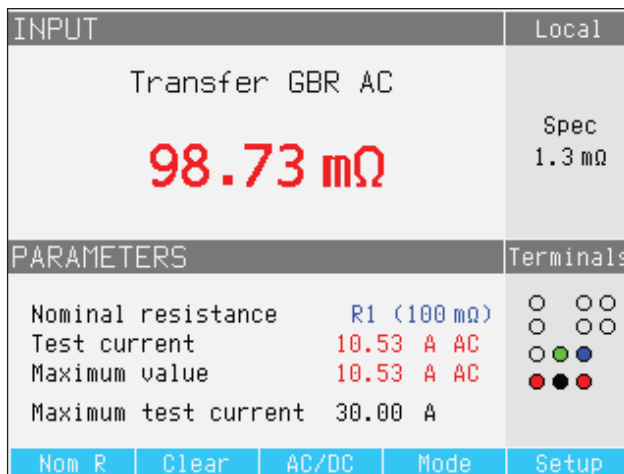


Figure 2.

### These values are shown on the screen:

Main value	Shows the effective transfer ground bond resistance as measured across the terminals. The reading is not displayed until minimal test current is detected. Then a continually updating reading is displayed in red. When the UUT test current is stopped (at the end of the test, or if the test is interrupted), the 5320A keeps the last reading on the display and the color of the reading changes to black. To reset the reading, push the CLEAR soft key.
Nominal resistance	Fixed nominal values at approximately 50, 80, 120, 170, 420, or 550 mΩ can be selected. The display shows the selected ground bond ratio resistance noted as 0, R1, R2, R3, R4, R5, followed, in parentheses, by the calibrated value of the selected transfer load resistance. This value serves as an indication of the nominal resistance.
Test current	Test current flowing from the UUT through the 5320A in dc A or ac A.
Maximum current	Maximum captured test current after switching the 5320A terminals ON.
Maximum test current	Information about limit of maximum test current for selected resistance. The captured maximum value can be reset by pushing the CLEAR soft key.
Spec	Accuracy of transfer ground bond resistance calculated by the 5320A calibrator.

### Soft keys beneath the 5320A display have following meanings:

Nom R	By pushing the key, Nominal resistance value can be changed. Push the softkey multiple times to cycle through the fixed values.
Clear	Clear maximum value field.
AC/DC	Switch between mode ac and dc test current modes. AC or dc mode has to be selected correctly to match the UUT's source current; otherwise, the wrong reading can be displayed. AC sinusoidal test signal is assumed in ac mode.

## Connecting a UUT to the 5320A calibrator

Mount the 5320A Transfer Load Adapter to the  $Z_{\text{GND}}$  and METER terminals of the 5320A. For range 80 m $\Omega$  to 550 m $\Omega$ , connect the UUT and blue terminal of the Load Adapter as shown in Figure 3.

For single value of 50 m $\Omega$ , connect the instruments to the green terminal of the Load Adapter as shown in Figure 4.

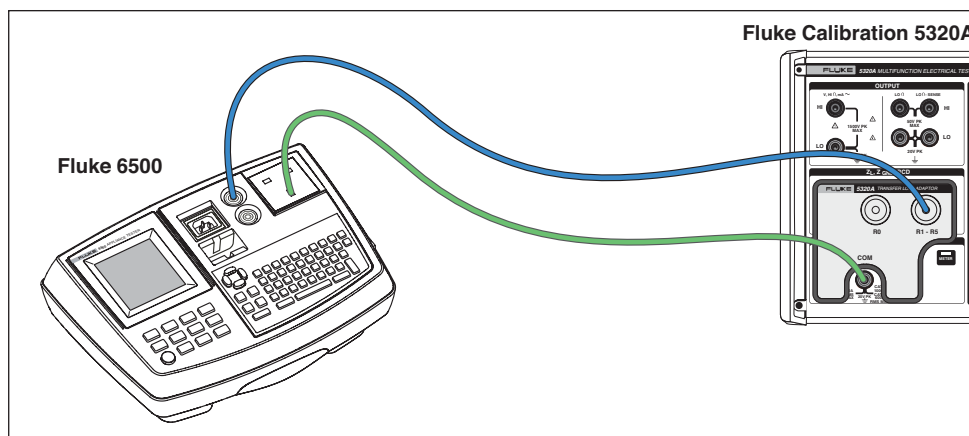


Figure 3.

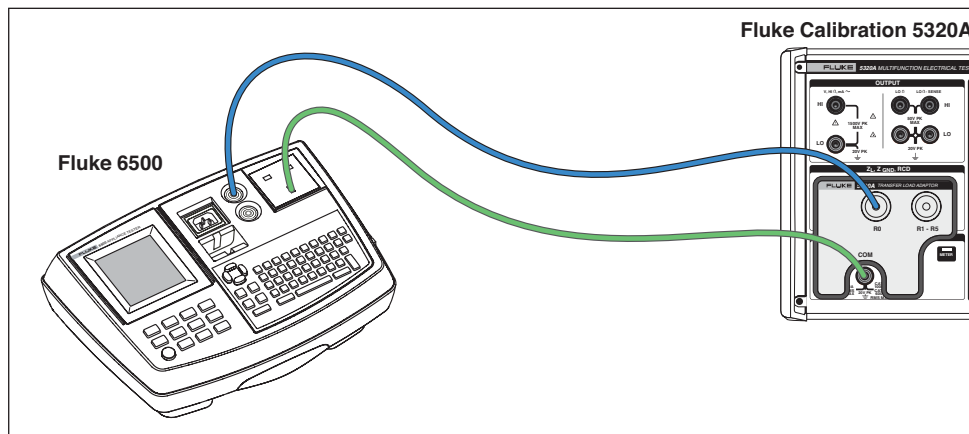


Figure 4.

**Note:** Depending on resistance of test leads nominal Transfer GBR resistance can change. If not using the original test leads then the leads should be kept as short as possible and capable of currents up to 30 A.

**Note:** Resistance of the test leads between the UUT and the 5320A directly influence the precision of calibration. Their resistance is not included in calibrator-specified transfer ground bond resistance. Manual correction of their resistance has to be performed or a ZERO function in the UUT should be applied to eliminate their influence.

**Note:** Contact resistance influences the accuracy of calibration. All test lead contacts have to be kept clean and pliable.

**Note:** All accessible terminals in transfer ground bond resistance mode are floating. This configuration is suitable for those UUTs which have one test terminal connected to PE in power supply socket. The UUTs which have floating test terminal may require the test setup to ground the circuit at one point to obtain reliable and stable readings. In this case connect the COM terminal on 5320A front panel to the ground binding post on the 5320A rear panel by a separate external lead.

## Test current range and resistance specification

The transfer GBR function is useful for those applications where calibration of low ground bond resistance is measured by a UUT with a test current between 3 A and 30 A. Calibrator resistance accuracy depends on the values of the measured test current and the measured test voltage. The lower the test current, the worse the achievable accuracy. Additionally, the maximum allowed test current is limited by the setup resistance. The table below gives a summary of application test current range and expected accuracies.

For the complete details on this calibration function, please refer to the operation manual for the Fluke Calibration 5320A Multifunction Tester Calibrator.

## Ground bond resistance accuracy in mΩ

Transfer GBR (mΩ)	Marking on display	Test Current (A)							
		30	28	25	20	14	10	8	3
50	0	0.8	0.8	0.8	0.9	1.0	1.2	1.3	2.6
80	R1	0.9	1.0	1.0	1.0	1.2	1.4	1.5	2.9
120	R2	—	1.1	1.1	1.2	1.3	1.5	1.7	3.1
170	R3	—	—	1.4	1.4	1.6	1.8	2.0	3.6
420	R4	—	—	—	—	3.0	3.3	3.6	6.0
550	R5	—	—	—	—	—	4.1	4.4	7.2

## Maximum and minimum applicable test currents from the ground bond resistance meter

5320A Transfer GBR (mΩ)	UUT minimum test current AC/DC (A)	UUT maximum test current AC/DC (A)
50	3	30
80	3	30
120	3	28
170	3	25
420	3	14
550	3	10

## Additional considerations:

1. The minimum value of the indicated test current: 0.05 A
2. The transfer GBR indication as the main value on the display is shown when the test current is 3 A or greater.

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