

Resistance Bridge Calibrator

RBC100M & RBC400M



The Resistance Bridge Calibrators employ a powerful combinatorial calibration method and a patented resistor network.

The network generates 35 different four-terminal resistances from various series and parallel

combinations of just four resistors.

Analysing the combination measurements, combined with knowledge of the interrelationships between them, enables a complete calibration of your resistance bridge.

Calibrate thermometry bridges quickly, simply and in-house
Calibrate AC and DC thermometry bridges

Resistance Bridge Calibrator RBC100M & RBC400M

Calibrate thermometry bridges quickly, simply and in-house

- Calibrate ac and dc thermometry bridges
- High accuracy - better than 0.1 ppm at 100 Ohms
- Patented design licensed from IRL
- Windows application for full analysis and reporting

Operating principles

The problem: Temperature measurement is one of the most demanding applications of resistance measurement. It requires the measurement of resistance ratios to accuracies of 1 part in 10^7 or better. While dc resistance standards are sometimes available at this level, ac resistance standards are generally not. So how can we show our bridges are accurate at this level, and that our resistance and temperature measurements are traceable?

The linearity check:

One simple method for checking a resistance bridge is to measure a pair of resistors separately, and then measure the two in series. Ideally the series measurement should equal the sum of the two individual measurements. If not, then the measurements give us a little bit of information about the errors in the bridge readings. Note that we do not need to know the values of the resistors to make this test work.

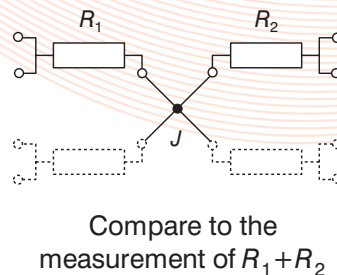
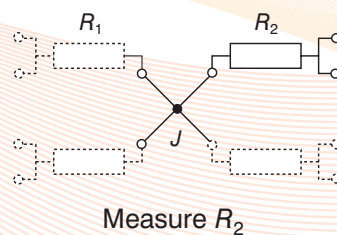
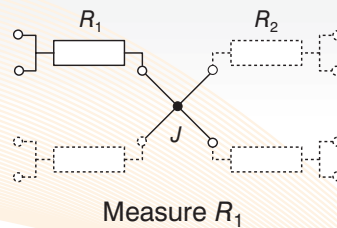
The complement check:

Another check is to measure the ratio of two resistances, say R_1/R_2 , then swap the resistors and measure the reciprocal ratio (or complement), R_2/R_1 . Ideally the product of the two measurements should equal 1.0 exactly, if not, the measurements give us more information on the bridge errors. Once again, we do not need to know the values of the resistors to make this test work.

The combinatorial method:

The RBC exploits the same principles as the linearity and complement check. It uses a network of four stable four-terminal resistors that can be connected in 35 different series and parallel combinations. By measuring each RBC combination in the two different ways (as with the complement check) up to 70 different measurements can be made. Since the RBC has just four unknown resistance values, we have up to 66 independent measurements containing information about the errors in the bridge readings.

The combinatorial calibration method is particularly powerful because it is not necessary to know the actual values of the four resistors, or their frequency dependence. This means we can calibrate any ac or dc bridge to any accuracy, so long as the various resistance combinations are accurate.



The patented RBC Calibrators are a result of research carried out by Rod White at the Measurement Standards Laboratory of New Zealand, which operates within Industrial Research Ltd (IRL). Isothermal Technology Ltd has an exclusive license from IRL to develop, sell and produce the RBC.

Using the RBC:

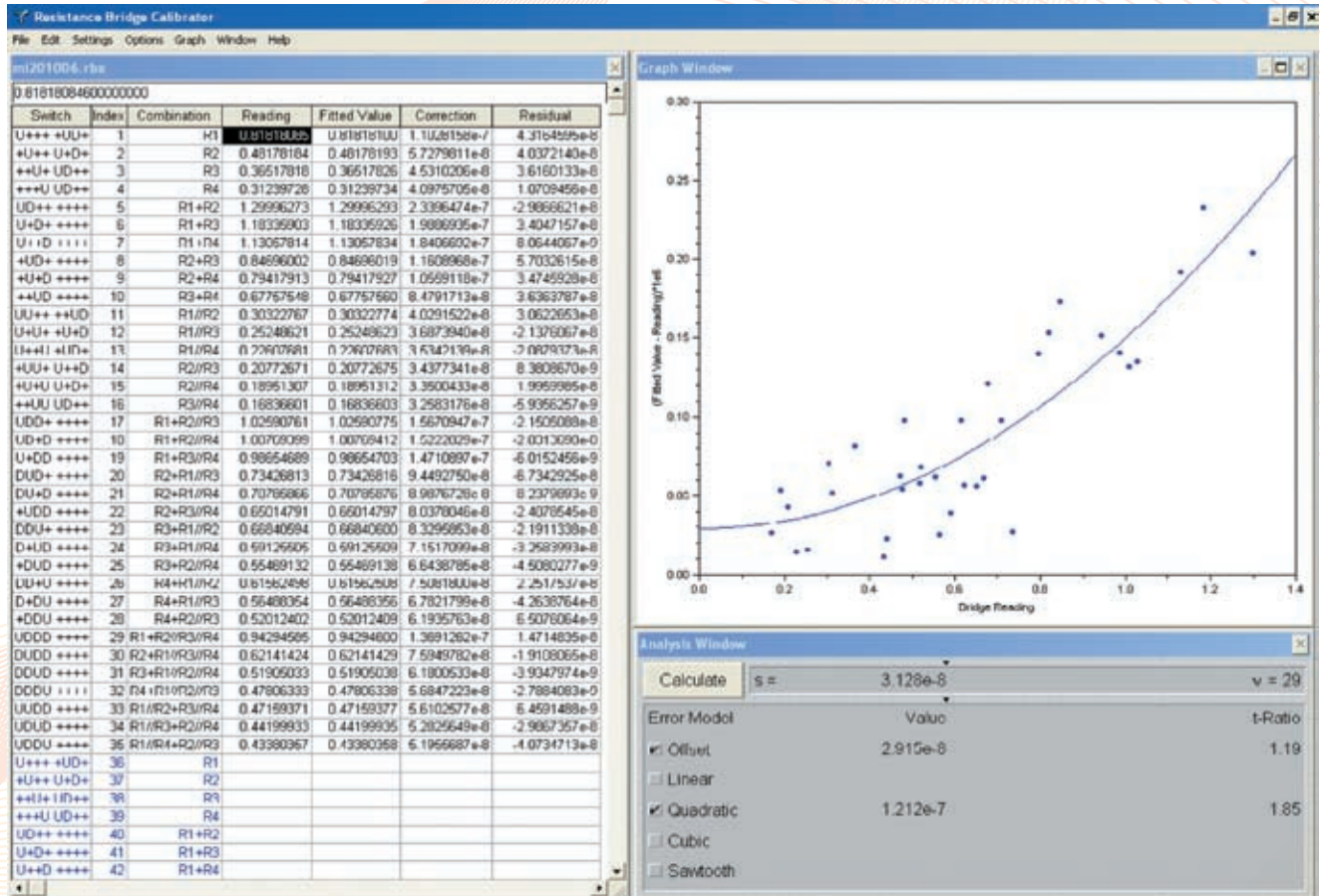
Calibrating a resistance bridge is simple. First, take as many of the 70 possible measurements of the RBC combinations as is practical. For a good quality 7-digit bridge this will take an hour or so. The data is then entered into the RBC software application for analysis. The software carries out a least-squares fit to a model of the bridge error. For most bridges a simple-low order polynomial is sufficient: but some bridges also exhibit a type of sawtooth error. In some cases the errors can be recognised as caused by minor faults in the bridge. The software calculates the appropriate corrections to be made for the bridge error, prepares a table and graph of the bridge error versus reading and the corrections and

uncertainties for bridge readings. If required, a calibration certificate can also be printed.

User Support:

The RBC is supplied with a detailed user manual giving the operating principles of the RBC, instructions for the RBC and software, and a complete uncertainty analysis explaining the limitations in the performance of the RBC and resistance thermometry bridges. We can also provide advice on validation of the software, and alternative applications of the RBC.

For further information, see our website <http://www.isotech.co.uk/>



The RBC software in use: the data is input on the left and the results of the analysis are seen in the right-hand windows.

Can you trust your bridge?

In the paper "A Method for Calibrating Resistance Thermometry Bridges" Rod White evaluated 38 Bridges, small but significant faults were found with 15% of those tested, but "like the walking wounded" they continued to provide a plausible reading.

The RBC allows easy verification and calibration of your bridge ensuring measurements are accurate and traceable, use it to Restore Bridge Confidence

Specifications

Accuracy: <math><0.1\text{ ppm}</math> at 100 Ω
(For DC and AC to 400 Hz)

Temperature Coefficient: <math>< \pm 0.3\text{ ppm}/^\circ\text{C}</math>

Maximum Sensing current: RBC100M: 10mA
RBC400M: 5mA

Resistance range: RBC100M: 16 Ω to 127 Ω
RBC400M: 43 Ω to 346 Ω

Power supply: None - the RBC is completely passive

Connections: Four-terminal coaxial using separate BNC for the current and voltage leads

Case Dimensions: Width 215mm
Height 105mm
Depth 200mm
(2U height by half rack width)

Weight: 2.5 kg

Software

Tabular and graphical representation of data
Least-squares fit to determine model of bridge error
Tabular summary of data and results
Print calibration report

Minimal hardware requirements:

486/66 PC
8 Mb RAM (16 Mb for NT)
SVGA (800 x 600) monitor
Compatible with Microsoft Windows platforms



The RBC shown with the software application and microK 100