PROVISIONAL DATA

Resistance Bridge Calibrators

RBC100A/M & RBC400A/M

Calibrate thermometry bridges quickly, simply and in-house

- Calibrate ac and dc thermometry bridges
- High accuracy - better than 0.01 ppm at 100 Ohms (RBC100A)
- 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:

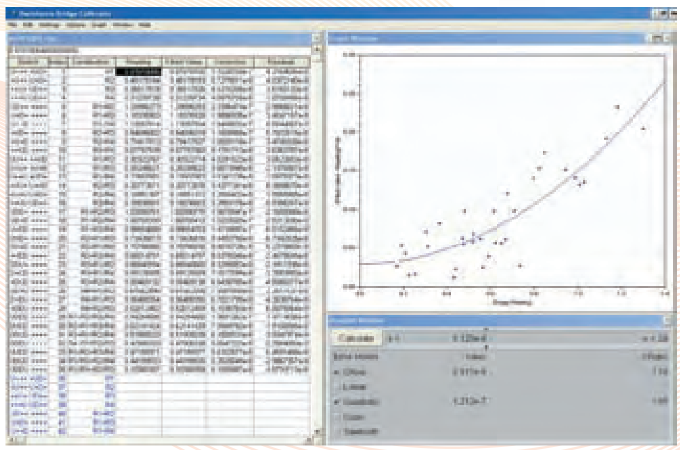
One simple method for checking a resistance bridge is to measure a pair of resistors separately, and then measure the two in series. Ideally the series measurement should equal the sum of the two individual measurements. If not, then the measurements give us a little bit of information about the errors 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.

Automatic vs Manual

The manual model is operated from switches, and the data manually entered into the software for analysis and reporting.

The new automatic model is operated from a PC via a USB connection. There are drivers for the Isotech milliK and AC and DC bridges from other manufactures that allow for fully automatic and unattended calibration of commonly used thermometry bridges. The software design allows for new drivers to be created as DLLs and we expect to support a growing number of bridges, check the website for full details.

The RBC 100A / 400A benefits not only from automatic operation but with changes to the internal circuitry to increase the accuracy and they can be immersed in oil to allow for temperature control.

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

Manual Specifications

Accuracy:	<0.1ppm at 100Ω (For DC and AC to 400 Hz)	
Temperature Coefficient:	< ±0.3 ppm/ °C.	
Maximum Sensing current:	RBC100M: RBC400M:	10mA 5mA
Resistance range:	RBC100M: RBC400M:	16Ω to 127Ω 43Ω to 346Ω
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	

Automatic Specifications

Accuracy:	<0.01ppm at 100Ω (For DC and AC to 400 Hz. When RBC is temperature controlled)	
Temperature Coefficient:	< ±0.3 ppm/ °C	
Maximum Sensing current:	RBC100A: RBC400A:	5mA 3mA
Resistance range:	RBC100A: RBC400A:	16Ω to 127Ω 43Ω to 346Ω
Power supply:	5V, via the USB cable. Idle current typically less than 5mA, switching currents less than 200mA.	
Connections:	Signal: Five-terminal guarded dc spade lugs.	
Digital control:	USB.	
Case Dimensions:	Diameter 88mm Height 140mm Identical to Tinsley type standard resistors.	
Weight:	1.25 kg	

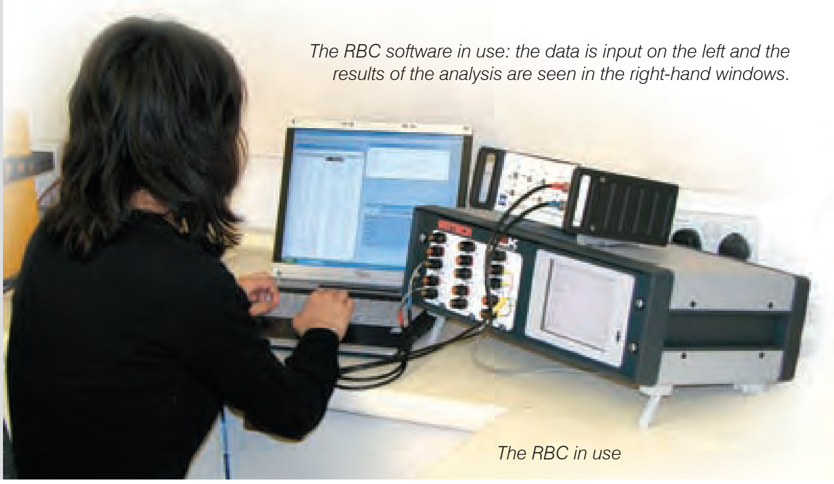
Software

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



The RBC in use

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