

**HIGH ACCURACY
RESISTANCE DECADE
BOXES TYPE RBB
4, 5 & 6 DECADES**

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HIGH ACCURACY RESISTANCE DECADE BOXES – RBB 4, 5 & 6 DECADES

The RBB series of resistance boxes are available in 4, 5 & 6 decades. High Accuracy and wide range 0.001 ohm to 11 Megohms are combined in a compact case. The switches have gold plated contacts to ensure a low contact resistance and negligible thermal emf. Some models are particularly suited to Pt100 simulation with resolution as low as 0.001 ohm ($\pm 0.0025^{\circ}\text{C}$).

The Switches

Cropico Type SP1
Contact Resistance $< 1\text{m}\Omega/\text{Decade}$
Insulation Resistance (all paths $> 10\text{G}\Omega$)

Resistance Coils

Temperature Co-efficient
 $\pm 5\text{ppm}$ maximum over -55°C to $+125^{\circ}\text{C}$
0.1, 0.01 and 0.001 dials $10\text{ppm}/^{\circ}\text{C}$

Full Load Stability

$\pm 35\text{ppm}/10,000$ hours
 $\pm 50\text{ppm}/26,000$ Hours

No Load Stability

$\pm 25\text{ppm}/10,000$ hours
 $\pm 35\text{ppm}/26,000$ hours over full temperature range; -55°C to 125°C

Power Rating

0.33 watt ($+85^{\circ}\text{C}$)
0.25 watt ($+110^{\circ}\text{C}$)

Maximum Continuous Working Voltage

Up to 250V DC

Noise

Essentially non-measurable

Thermal EMF

$< 0.4\mu\text{V}/^{\circ}\text{C}$ typical
 $< 1.5\mu\text{V}/^{\circ}\text{C}$ max

Encapsulation

Moulded Epoxy

Leads

22 SWG tinned copper

Windings

Exclusive 'air cushion' technique provides virtually stressless elements for improved performance. Non inductively wound. Direction of winding reversed at half turns point

7 Models to choose from

Model	Number of Decades	Total Resistance	Resolution	Residual Resistance	Size	Weight
RBB4-A	4	1,111 Ω	0.1 Ω	0.01 Ω	310x100x140	2.7 kg
RBB4-B	4	11,110 Ω	1 Ω	0.01 Ω	310x100x140	2.7 kg
RBB4-C	4	111,100 Ω	10 Ω	0.01 Ω	310x100x140	2.7 kg
RBB5-B	5	1,112.1 Ω	0.01 Ω	1 Ω	348x100x140	3.4 kg
RBB5-C	5	11,111 Ω	0.1 Ω	0.012 Ω	348x100x140	3.4 kg
RBB5-D	5	111,110 Ω	1 Ω	0.012 Ω	348x100x140	3.4 kg
RBB5-E	5	1.1111M Ω	10 Ω	0.012 Ω	348x100x140	3.4 kg
RBB5-F	5	11.111M Ω	100 Ω	0.012 Ω	348x100x140	3.4 kg
RBB6-B	6	1,112.11 Ω	0.001 Ω	1 Ω	450x100x140	3.85 kg
RBB6-C	6	11,112.1 Ω	0.01 Ω	1 Ω	450x100x140	3.85 kg
RBB6-D	6	111,111 Ω	0.1 Ω	0.013 Ω	450x100x140	3.85 kg
RBB6-E	6	1.11111M Ω	1 Ω	0.013 Ω	450x100x140	3.85 kg
RBB6-F	6	11.1111M Ω	10 Ω	0.013 Ω	450x100x140	3.85 kg

Accuracy of Decades

Decade (Ohms)	Accuracy of adjustment Incremental Steps	Power Reading	Temperature Coefficient
10 x 1 M Ω	± 0.1 %	0.5 W	10ppm/ $^{\circ}$ C
10 x 100 k Ω	± 0.1 %	0.5 W	10ppm/ $^{\circ}$ C
10 x 10 k Ω	± 0.05 %	0.33 W	3ppm/ $^{\circ}$ C
10 x 1 k Ω	± 0.05 %	0.33 W	3ppm/ $^{\circ}$ C
10 x 100 Ω	± 0.05 %	0.33 W	3ppm/ $^{\circ}$ C
10 x 10 Ω	± 0.05 %	0.33 W	3ppm/ $^{\circ}$ C
10 x 1 Ω	± 0.2 %	0.33 W	3ppm/ $^{\circ}$ C
10 x 0.1 Ω	± 0.5 %	0.75 W	10ppm/ $^{\circ}$ C
10 x 0.01 Ω	± 1 %	0.75 W	10ppm/ $^{\circ}$ C
10 x 0.001 Ω	± 2 %	0.75 W	10ppm/ $^{\circ}$ C
10 x 0.0001 Ω	± 10 %	0.75 W	10ppm/ $^{\circ}$ C

The RBB series of decade resistance boxes has been designed to be robust, reliable, and require the minimum maintenance. The switches should be serviced and cleaned annually to ensure best performance. The resistance elements are factory adjusted to be within specification and it is not possible to alter their value. In the event of a resistor becoming damaged it is necessary to replace the whole resistor.

Residual Resistance

With all the decade dials set at 0 there will be a resistance measured at the terminals, this resistance is made up from 2 components. The resistance of the wires connecting the decade

switches to the terminals; this is a constant value. The contact resistance of the decade switches, this will vary each time the switch is turned or disturbed. This residual resistance must be added to the decade values set on the decades, it is therefore important that this residual should be as low and constant as possible.

The CROPICO decade boxes have a low and stable residual resistance per decade. This value is controlled by the use of special low resistance switches.

It is not practical to manufacture decade resistance boxes where the lowest decade is less than 0.1Ω . To switch in steps of 0.01Ω and lower, special techniques need to be employed.

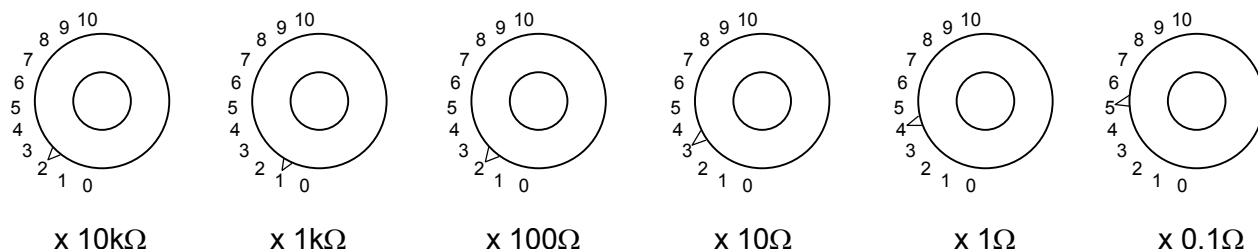
Low Value Decades

When switching decade resistance of 0.01Ω and lower the switch contact resistance variations become significant, this variation can be typically $10m\Omega$ for an 4 decade unit and $13m\Omega$ for a 6 decade unit. In addition the total residual resistance which would also include the internal wiring of the decade box could be significantly higher than the lowest decade values. CROPICO overcome this problem by using the Wagner Wolf decade, this technique enables higher resistance values to be used for the decade which are then shunted to give the correct incremental steps. The residual value of the unit is deliberately increased to 1Ω , and the 1Ω decade will start at 1 and not zero. This is not normally a problem, because the applications that require values to be selected with high resolution would have a much greater full scale resistance, typical applications include the simulation of Pt100 temperatures. The Pt100 resistance thermometers have a resistance of 100Ω at 0°C and 0.01°C is approximately equal to 0.001Ω .

Operation

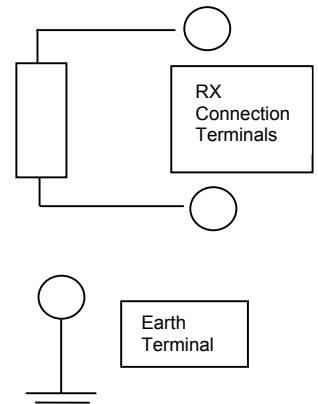
To select a resistance value turn the dial of the appropriate decade until the desired value is indicated by the switch pointers. The multiplier for each decade is shown below the dial i.e. $\times 0.1$ or $\times 10$ etc.

Example to select $21,234.5\ \Omega$



Connection

The connections to the resistance box are made via the two 4mm terminals marked with the resistance symbol either banana plugs or spade terminals may be used. The third terminal marked with an earth symbol is connected directly to the top panel.



OPERATING AND MAINTENANCE INSTRUCTIONS

These Resistance Boxes are supplied calibrated to specification and ready for use.

The specified accuracy refers to the dial setting. To maintain the calibrated accuracy, avoid subjecting the box to thermal shocks or rough handling

Prior to having the box re-certified by e.g. a UKAS Laboratory, it is good practice to return the box to us first for service of the switch contacts.

1. Before using, at all times rotate each dial twice in both directions to ensure a constant contact resistance.
2. When using in a voltage carrying circuit, to determine the correct resistance value to be used, always start by setting the dials at a high value. This avoids the possibility of overloading the resistance box and possible permanent damage to the resistance coils.
3. Remember that the box has a residual resistance which must be added to the final reading. This value is defined in the specification and is usually insignificant. The low value boxes with decades of 10×0.01 , 0.001 and 0.0001 are constructed using the WAIDNER-WOLFF system, in which case the residual resistance is clearly defined, as the 1 ohm dial starts at "1" and not "0".
4. The models with low value decades are often used for resistance thermometer simulation, in which case the following data may be useful.

Platinum resistance thermometers ballasted to give a total resistance of 100 ohms at U°C.

Fundamental interval 38.50 ohms

Degrees C	Resistance Ohms BS1904/I.E.C. 751
-100	60.25
-50	80.31
-25	90.19
0	100.00
±25	109.73
±50	119.40
±100	138.40
±150	157.31
+200	175.84
+250	194.07
+300	212.02
+350	229.67
+400	247.04
+450	264.11
+500	280.90
+550	297.39
+600	313.59

Calibration Temperature 20°C
Proofing voltage to the earth connection 2kV

Prior to despatch, each box is subjected to 100% inspection and issued with a Certificate of Conformity. Information regarding traceability to the National Standard is also supplied.

The only maintenance that these Resistance Boxes should require is the cleaning of the switch contacts. They should be inspected annually and if the contacts are dirty, or tarnished due to lack of use, proceed as follows:

a) Remove the instrument from its box by unscrewing the screws around the outer edge of the top panel. The instrument can then be removed from its case.

b) The switches can now be seen and cleaned as follows:

Clean all contacts with a lint-free cloth and lightly lubricate all contacts with "SGB Contact Treatment Grease". Do not use aerosol cleaning and degreasing agents unless absolutely necessary. If they are used, make sure that the contact grease is applied to all the stud and centre return contacts before re-assembly.

c) After greasing the switch contacts, rotate each switch rapidly backwards and forwards 10 times.

The resistors will remain within specification for many years and with normal usage should never need attention. However, accidents do happen, and should they be burnt out due to overloading, the connections to the faulty resistors can be unsoldered and the resistor replaced. Order replacement resistors are as follows:

One ohm resistor for decade box type RBB or RB

Note a dial marked 10 x 100 would have 10 x 100 ohm resistors wired in series.

Additional Products From Cropico

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