

INSTRUCTION MANUAL NO. 724330  
FOR  
CAT. NO. 724330 SERIES  
RESISTANCE DECADE BOXES

8/86

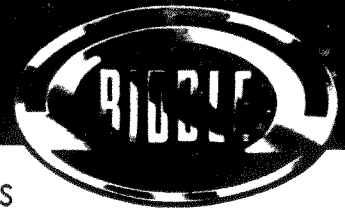
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The James G. Biddle Co.  
Blue Bell, PA 19422

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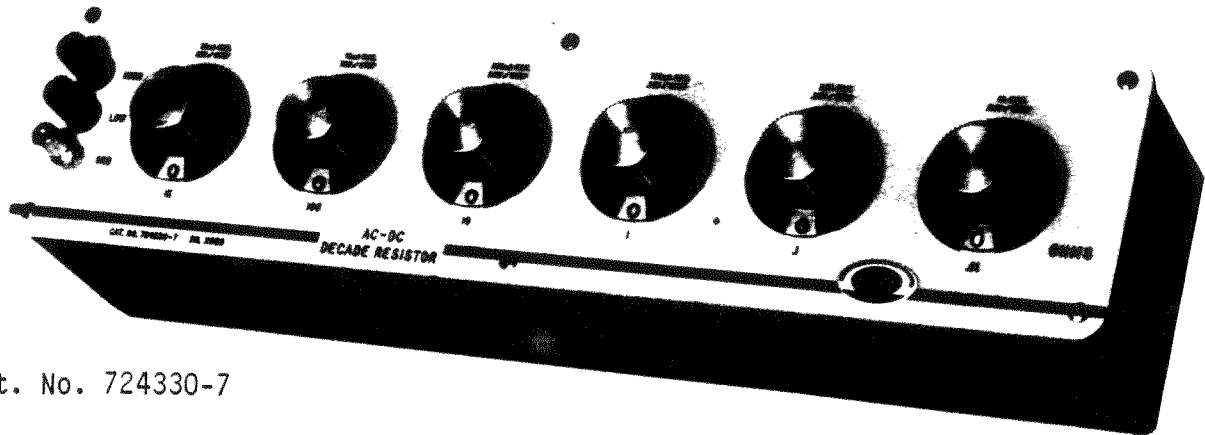
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## new product information



### HIGH RESOLUTION LOW RESISTANCE DECADE BOXES

Ideal for Simulating Resistance Thermometers



Cat. No. 724330-7

#### FEATURES

- . 0.001 Ohm steps.
- . Very low self-inductance and capacitance.
- . Maximum voltage and current for each decade marked on panel.
- . Easy-to-read decade dials rotate full 360°
- . For use in ac or dc applications. Will operate up to approximately 100 kHz.
- . DC accuracy  $\pm 0.02\%$  over most of range.
- . Low contact resistance on decade switches.
- . Very low temperature and power coefficients.

#### APPLICATIONS

These decade resistor boxes can be used to provide Wheatstone bridge or similar workshop and laboratory circuits where a high accuracy resistor is required. The boxes are suitable as a reference resistor to judge other resistors for accuracy of value, etc. Their high  $0.001\Omega$  resolution is ideal for calibrating resistance thermometer detectors.

#### DESCRIPTION

This series is composed of three different decade resistor boxes, each containing six switched decade resistors. The series provides a variety of resistance ranges and a variety of resistance steps. Each decade box is built into a strongly-made, fully screened metal case with a ground terminal for grounding if required. To reduce errors the resistors are made from very high stability alloys having a minimal thermal electromotive force with respect to copper. In addition, these alloys have a very low temperature coefficient so as to reduce, as far as possible, changes of resistance with temperature. The resistors are arranged to reduce self-inductance and capacitance to a very low figure and thus improve operation at the higher frequencies. Switches have multiple contacts made of solid silver alloy to provide a very low and stable contact resistance.

**BIDDLE INSTRUMENTS**

Blue Bell, Pennsylvania 19422 • Telephone 215-646-9200

A THORN EMI company



## SPECIFICATIONS

### Ranges

Cat. No.	No. of Decades	Resistance steps on each decade, ohms						Total Box Resistance, ohms
		1	2	3	4	5	6	
724330-6	6	10,000	1,000	100	10	1	.1	111,111
724330-7	6	1,000	100	10	1	.1	.01	11,111.1
724330-8	6	100	10	1	0.1	.01	.001	1,111.11

### RATINGS PER STEP FOR EACH DECADE

Decade Resistance Steps ( $\Omega$ )	1 year Incremental Accuracy % *	Maximum Current (A)	Maximum Power Per Step (W)	Maximum RMS Voltage (V/Step)	Temperature Coefficient PPM/ $^{\circ}$ C	Power Coefficient PPM/mW/Step
10k	0.02	0.0075	0.6	75	5	0.10
1k	0.02	0.025	0.6	25	5	0.10
100	0.02	0.075	0.6	7.5	15	0.20
10	0.02	0.25	0.6	2.5	15	0.25
1	0.05	0.75	0.6	0.75	15	0.5
0.1	0.5	2.5	0.6	0.25	**	-
0.01	5	4.0	0.16	0.04	**	-
0.001	15	4.0	0.016	0.004	**	-

\* Accuracy of the change in resistance between any two settings on the same dial.

\*\* Temperature coefficient of resistance element is  $\pm 20$ ppm per  $^{\circ}$ C but box wiring will increase the overall temperature coefficient of these decades.

**Overall Accuracy - of resistance change from zero setting (1 year):**  
 $\pm (0.02\% + 0.006 \text{ ohm})$

**Operating Frequency:** Suitable for use up to about 100 kHz.

**Resistance at Zero Setting:** Approximately 15 Milliohms.

**Short-Term Switching Repeatability (entire decade box):**  
 $\pm 0.3$  Milliohms typical

**Breakdown Voltage:** 1500 V peak to case.

**Terminals:** Three terminals of the jack-top, binding post type with standard 3/4 inch spacing. One terminal is ground.

**Dimensions:** 17 7/8" x 4 1/4" x 5" high (45.4 cm x 10.8 cm x 12.7 cm)

**Weight:** 7.2 lbs. (3.3 kg)

## SECTION A

### INTRODUCTION

The Catalog No. 724330 Series Decade Resistance Boxes are six dial decade resistance standards of high accuracy. They are useful as a calibration standard in many precision laboratory applications where a variety of exact resistance values of high resolution and stability are needed. They are ideal for calibrating resistance thermometer detectors. They are also useful as a variable ratio arm or rheostat arm for direct or alternating current bridge networks.

## SECTION B

### SAFETY PRECAUTIONS

This instrument contains no internal power supply and does not require power of any kind for operation. It does not present a shock hazard in itself, but as with all electrical equipment, safety rules must be observed. Particular care should be taken that wires carrying high voltages or power are not inadvertently connected to the instrument binding posts without sufficient resistance dial setting.

When using the instrument with high voltage applied to the binding posts observe the following safety rules:

- . Connect the instrument ground terminal to a good low resistance ground.
- . Do not come in contact with the live exposed metal parts of the binding posts and associated circuits.
- . Do not exceed the rated input voltage off ground which is 1000 volts rms.

SECTION C

RECEIVING INSTRUCTIONS

Your Catalog 724330- Decade Resistance Box has been thoroughly tested and inspected to rigid inspection specifications before being shipped and is ready for use. Check the equipment received against the packing list. Notify James G. Biddle Co., Blue Bell, PA, of any shortage of materials. The Catalog 724330- should be examined for damage received in transit. If any damage is found, file a claim with the carrier at once and notify the James G. Biddle Co. or its nearest representative giving a detailed description of the damages observed.

SECTION D  
SPECIFICATIONS

Specifications are as shown on Bulletin 724330 (front page).



SECTION E  
CONTROLS & TERMINALS

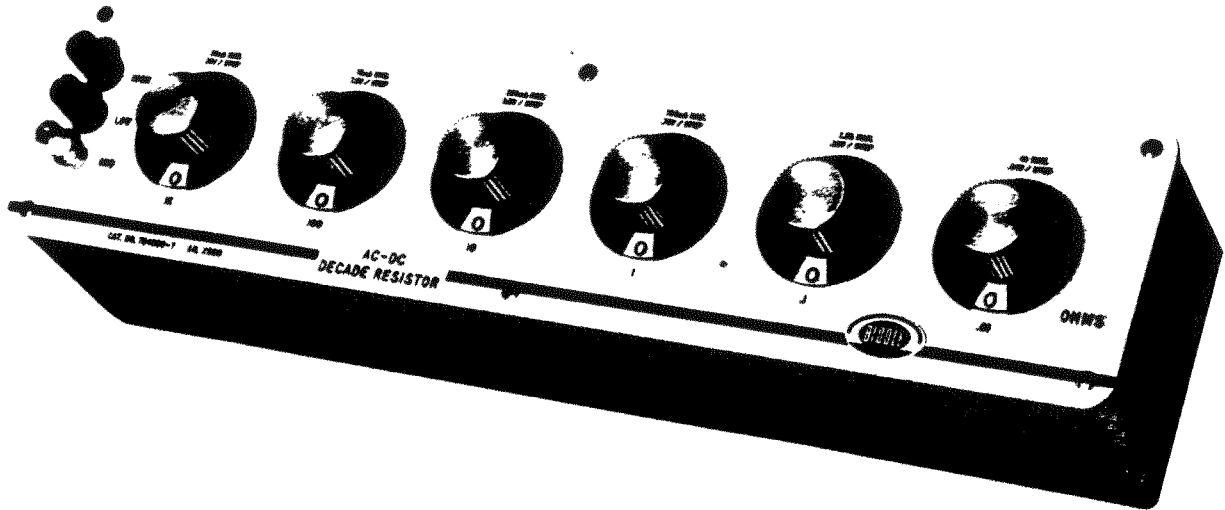


Figure 1: Controls & Terminals

Six decade dials, with indicator windows, are used to select and display the resistance value in ohms. The resistance value is indicated as an in-line digital number, with decimal point.

The current and voltage ratings per step for each decade are indicated directly above each decade dial.

The terminals are five-way Binding Posts marked HIGH, LOW & GND (GROUND).

## SECTION F

### PRINCIPLE OF OPERATION

The six decades are connected in a series circuit which is terminated at the HIGH and LOW black binding posts (Figure 2). The total resistance at any one time is the sum of all the individual decades. Each decade consists of 10 resistors of one denomination, also connected in series. The 11-position switch in each decade can switch into the circuit from 0 to 10 resistors. The value of the resistance steps for each decade is indicated directly below each decade dial, and the number of resistors in the circuit is indicated by the setting of the individual decade dial. The dials are ten-step dials to conveniently allow comparison of the total resistance of any decade with the resistance of one step of the next higher decade.

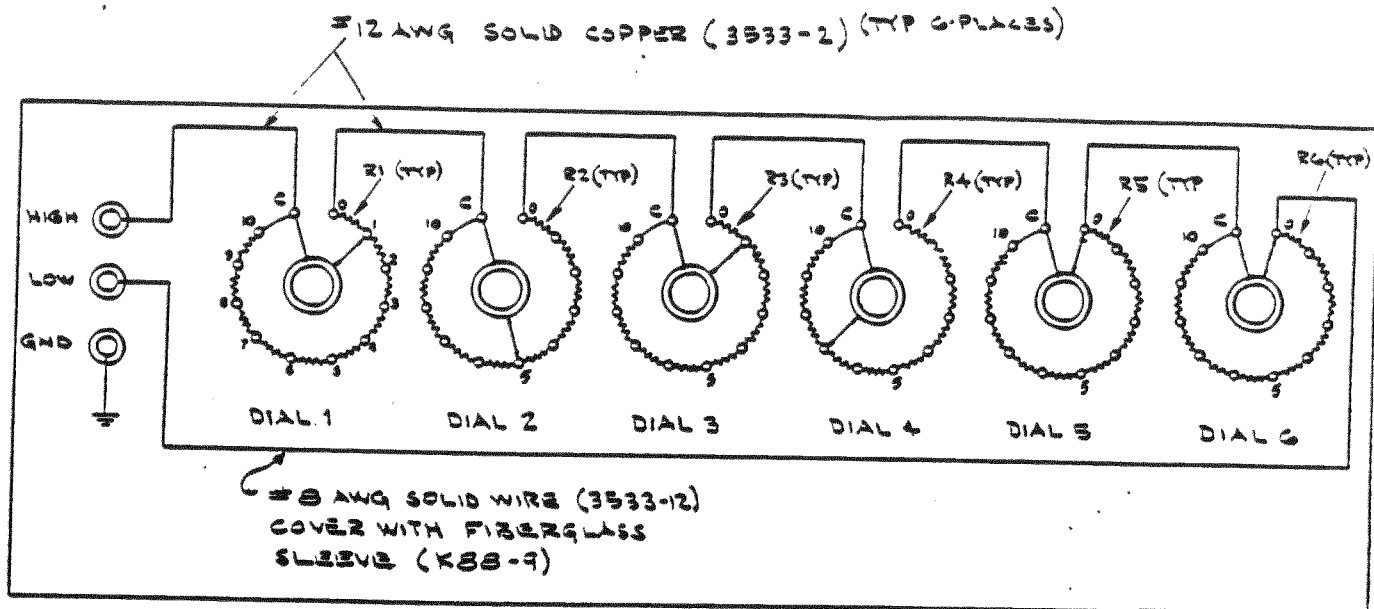


FIGURE 2 SCHEMATIC DIAGRAM  
CAT. NO. 724330  
AC/DC RESISTANCE DECADE BOX

SECTION G

CALIBRATION CHECK

It is recommended that a calibration check be made normally once a year to insure maximum accuracy and reliability. The calibration should be performed in a laboratory free from drafts and where temperature is stable and maintained at  $23 \pm 2^{\circ}\text{C}$ .

Calibration requires a precision Resistance Measuring Bridge with an accuracy of  $\pm(0.005\%$  of reading + 100 microhms).

## SECTION H

### ROUTINE MAINTENANCE

With normal use the 724330 Resistance Decade Boxes needs little or no maintenance.

The insulators on the five-way binding posts should be cleaned occasionally to avoid the shunting effect of accumulated dirt. Wiping with an alcohol moistened cloth is sufficient. Also visually check the outside of the decade box for proper dial orientation, and the inside for broken lead connections and damaged or dirty switch contacts.

When the instrument is removed from its case care should be taken to prevent damage to the resistors. Visually inspect the resistors to insure they are not touching each other or the grounded switch frame. Also inspect the resistors for evidence of damage caused by overheating.

Access to the interior is gained by removing the six panel screws.

The schematic diagram for the Resistance Decade Box is shown in Figure 2.

SECTION J

PARTS LIST

<u>BIDDLE PART NO.</u>	<u>DESCRIPTION</u>	<u>NO. REQ'D</u>
Ass'y 26769-2	10 k $\Omega$ Decade (Cat. No. 724330-6)	1
10008-2	Resistor 10 k $\Omega$	10
11090-2	Switch	1
Ass'y 26769-1	1 k $\Omega$ Decade (Cat. No. 724330-6,-7)	1
10008-1	Resistor 1 k $\Omega$	10
11090-2	Switch	1
Ass'y 26770-3	100 $\Omega$ Decade (All Cat. No.'s)	1
10000-9	Resistor 100 $\Omega$	10
11090-2	Switch	1
Ass'y 26770-2	10 $\Omega$ Decade (All Cat. No's)	1
10000-6	Resistor 10 $\Omega$	10
11090-2	Switch	1
Ass'y 26770-1	1 $\Omega$ Decade (All Cat. No's)	1
10000-2	Resistor 1 $\Omega$	10
11090-2	Switch	1
Ass'y 26771-1	0.1 $\Omega$ Decade (All Cat. No's)	1
10010-13	Resistor 0.1 $\Omega$	10
11090-1	Switch	1
Ass'y 26771-2	0.01 $\Omega$ Decade (Cat. No. 724330-7,-8)	1
10010-12	Resistor 0.01 $\Omega$	10
11090-1	Switch	1
Ass'y 26771-3	0.001 $\Omega$ Decade (Cat. No. 724330-8)	1
10010-26	Resistor 0.001 $\Omega$	10
11090-1	Switch	1
26766-6	Panel (Cat. No. 724330-6)	1
26766-7	Panel (Cat. No. 724330-7)	1
26766-8	Panel (Cat. No. 724330-8)	1
11170-6	Case	1
11166-2	Binding Post, Insulated	2
11166-4	Binding Post, Ground	1
26767	Knob and Dial Assembly	6
5599	Feet, case (3M P/N SJ-5003)	4
26768	Caution Label	1

## SECTION K

### WARRANTY

All products supplied by the James G. Biddle Co are warranted against all defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing at our option, defective equipment. Equipment returned to the factory for repair will be shipped Prepaid and Insured. The warranty does not include batteries, lamps or tubes, where the original manufacturer's warranty shall apply. **WE MAKE NO OTHER WARRANTY.**

The warranty is void in the event of abuse or failure by the customer to perform specified maintenance as indicated in the manual.

### REPAIRS

The James G. Biddle Co. maintains a complete instrument repair service. Should this instrument ever require repairs, we recommend it be returned to the factory for repair by our instrument specialists. When returning instruments for repairs, either in or out of warranty, they should be shipped Prepaid and Insured and marked for the attention of the Instrument Service Manager.