

BOOKLET E600 (7th Edn.)

Instructions for use of

**“UNIVERSAL INDICATOR”  
MOVING-COIL INSTRUMENTS**

INCLUDING

**“THE ALLTEST”**

D.C. VOLTAGE

D.C. CURRENT

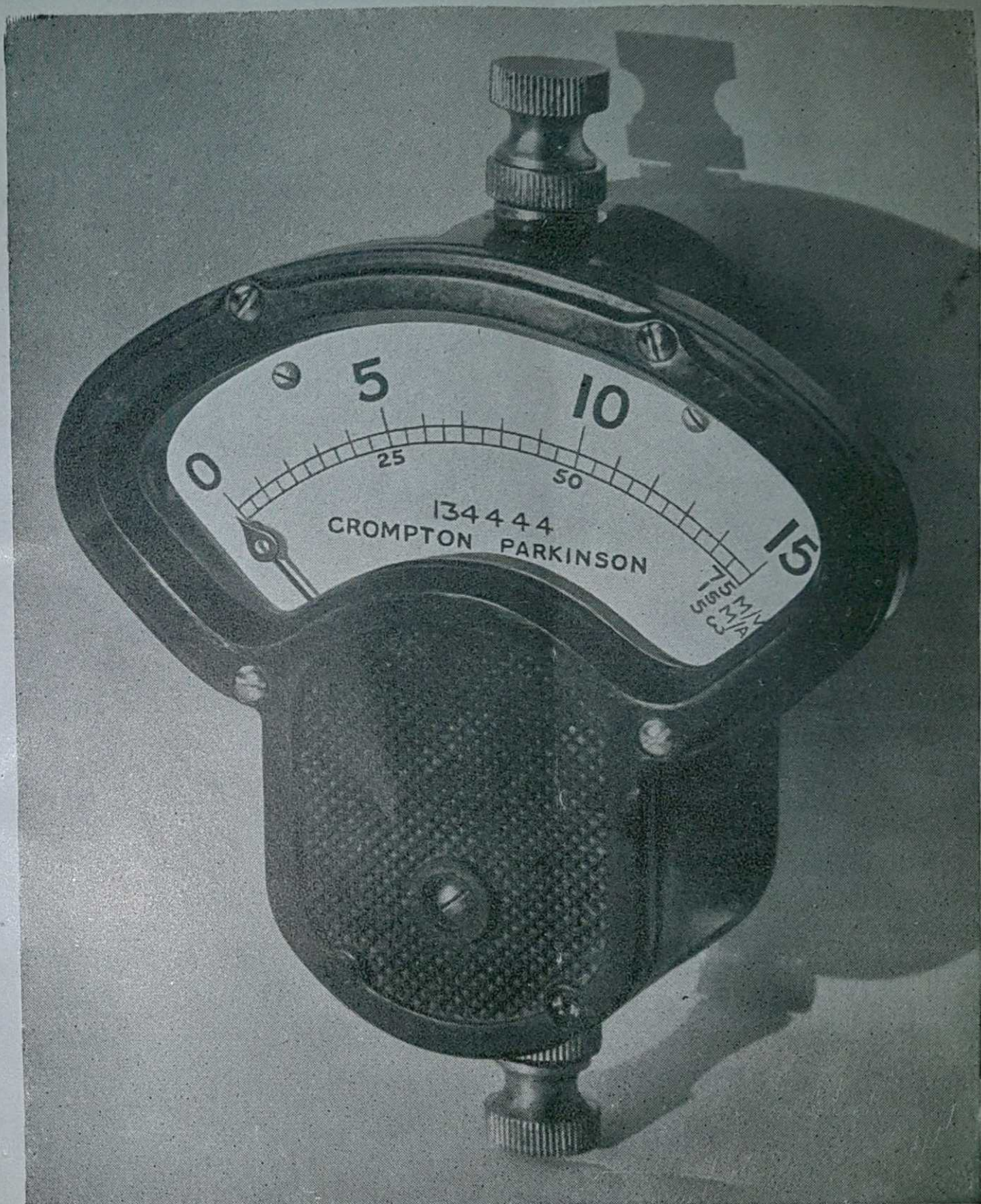
A.C. VOLTAGE

**Crompton**  **Parkinson**  
LIMITED

---

CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2





The "ALLTEST," approximate full size



## CONTENTS

	<i>see page</i>
DESCRIPTION OF THE "ALLTEST" AND 3" DIAL "UNIVERSAL INDICATOR" ... ..	3
USE AS A MILLI-AMPERE METER ... ..	4
USE AS A MILLI-VOLTMETER ... ..	5
USE AS A DIRECT-CURRENT AMPERE METER ...	7
USE AS A DIRECT-CURRENT VOLTMETER... ..	9
USE AS AN ALTERNATING CURRENT VOLT- METER ... ..	11
USE AS A RESISTANCE MEASURER ... ..	12
3" DIAL UNIVERSAL INDICATORS ... ..	14
UNIVERSAL INDICATORS OF LARGER SIZES ...	16
TECHNICAL PARTICULARS ... ..	17

## INTRODUCTION

The term "Universal Indicator" is applied to a moving-coil instrument having a resistance of 5 ohms and calibrated for ranges of 0-15 milli-amperes and 0-75 milli-volts. Such an instrument can be used with any ammeter shunt having a volt drop of 75 milli-volts at rated current or can be used as a voltmeter with resistance bobbins.

The "Alltest," which was the first of this type of instrument, was introduced over 25 years ago as a pocket portable direct-current testing instrument having a scale  $2\frac{5}{8}$ " long. It is not shielded magnetically and should not be used in a strong magnetic field. (See Specification A600.)

For school and laboratory use the 3" dial instruments with ranges and scale lengths similar to those of the "Alltest" are now generally preferred as they are magnetically self-shielding and the movement is in view through a transparent cover. (See Specification A622.)

The same shunt and resistance bobbin multipliers are used with each of the foregoing types of "Universal Indicator." The shunts are fitted to the 3" instrument by means of a shunt carrier or adaptor the use of which ensures correct sequence of connecting up and disconnecting.

The instruments are robust both mechanically and electrically and will withstand overloads up to 10 times the value represented by the top scale mark.

The accuracy is within the requirements of the current B.S.89 for first grade electrical indicating instruments.

## AS A MILLI-AMPERE METER

0/15, 0/30, 0/60, 0/90, 0/150, 0/300, 0/600 and 0/1500  
Milli-amperes

The "Universal Indicators" including the "Alltest" have a self-contained range of 0/15 milli-amperes.

As there are 30 scale divisions each represents half a milli-ampere, i.e., a half of a thousandth of an ampere, and as the width of each division is nearly  $\frac{3}{32}$ " it is easy to estimate indications to within 1/150th of the maximum scale value, i.e., one ten-thousandth of an ampere on the 0/15 mA. range.

With external shunts the range of milli-amperes can be extended as required, the standard shunts for this purpose giving ranges of 0/30, 0/60, 0/90, 0/150, 0/300, 0/600 and 0/1500 milli-amperes.

As the effective scale of these instruments extends from the maximum scale value down to 1/10th of the maximum scale value it will be seen that a "Universal Indicator" or "Alltest" with an 0/150 and 0/1500 milli-ampere shunt will enable any value of milli-amperes from 1.5 to 1500 to be measured.

To obtain the highest sensitivity the lowest range of shunt which covers the current to be measured should be used.

When using a shunt care must be taken that it is securely clamped to the instrument or shunt carrier under the inner "milled" nut as shown on page 6.

## AS A MILLI-VOLTMETER

0/75, 0/150, 0/750 and 0/1500 Milli-volts

The "Universal Indicators" including the "Alltest" have a self-contained range of 0/75 milli-volts.

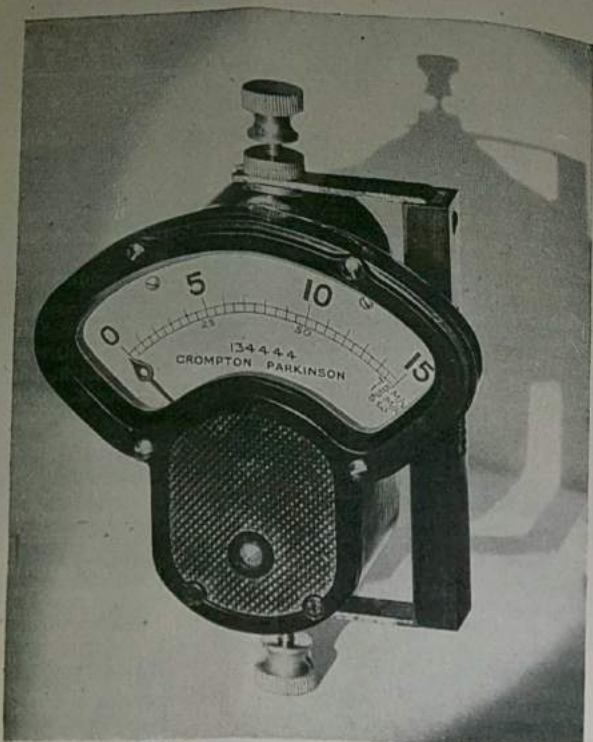
With the 30 scale divisions provided each division represents two-and-a-half-thousandths of a volt and as each division measures nearly  $\frac{3}{32}$ " it is easy to estimate the indication within 1/150th of the maximum scale value, i.e., to half-a-thousandth of a volt.

For ranges greater than 0/75 milli-volts it is necessary to add externally-attached resistance in the form of bobbins as shown on page 8.

The milli-volt ranges provided by standard resistance bobbins are 0/150, 0/750 and 0/1500.

The sensitivity of the instrument with these resistance bobbins is 5 mV., 25 mV. and 50 mV. per scale division respectively and it will be seen; therefore, that the lower the range it is possible to use for any purpose the higher is the sensitivity.





The "ALLTEST" as an ammeter with shunt attachment

## AS AN AMPERE METER OF ANY RANGE

The majority of shunts built to comply with B.S.89 for use with moving-coil indicating instruments are adjusted to have a voltage drop of  $.075$  v. (75 milli-volts) at rated current. As the "Universal Indicators" including the "Alltest" are adjusted to give full-scale deflection at  $.075$  v. (75 milli-volts) it is, therefore, only necessary to connect the terminals of the instrument to the potential terminals of a shunt of suitable rating to obtain the required range of amperes.

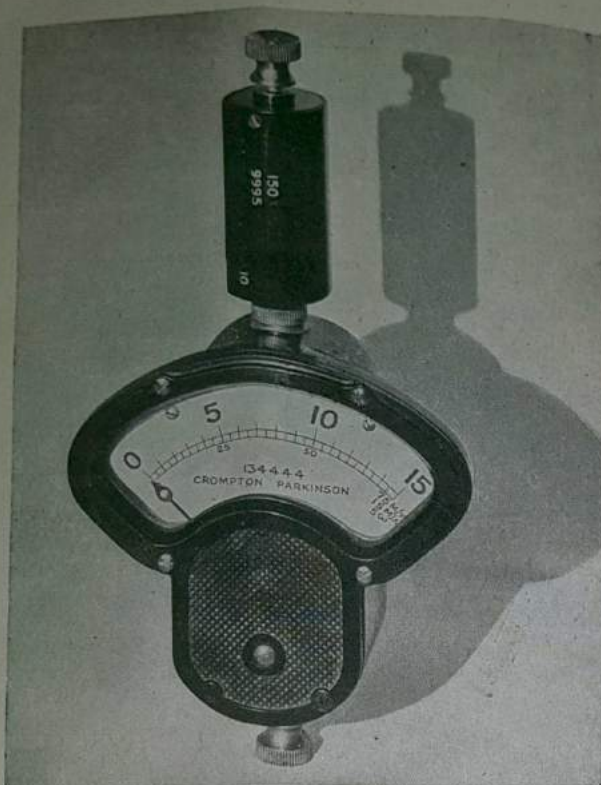
For the convenience of users special shunts have been designed for direct attachment to "Alltests" and to the 3" "Universal Indicators" by means of a shunt carrier. These shunts are available for various standard ratings up to 30 amperes as scheduled on page 17 and are each marked with their rated current, resistance and scale multiplying factor.

Care must be taken to clamp the shunt down securely as shown on page 6.

For current ratings above 30 amps separate shunts connected to the instrument by shunt leads of suitable resistance must be used.

The normal resistance of shunt leads is  $0.025$  ohm and these are supplied in red and black flexible cable with a length of 4' 6".

The use of shunts with leads having a resistance of  $.025$  ohm introduces an error of  $0.5\%$ , the instrument indicating low by that amount and the indication should be multiplied by  $1.005$  if the highest accuracy of reading is required.



The "ALLTEST" as a voltmeter with bobbin attachment

## AS A VOLTMETER OF ANY RANGE.

"Universal Indicators" including the "Alltest" are calibrated for a range of 0/15 mA. and have a resistance of 5 ohms.

To provide a voltmeter having a sensitivity of 66.6 ohms per volt it is only necessary to add in series with the indicator a resistance to the value required for the desired range of volts, i.e., to produce a voltmeter with a range of 0/150 volts a resistance to the value of 9995 ohms must be added to the 5 ohms of the indicator.

This resistance is conveniently housed in a bobbin resistance element for direct attachment to one terminal of the instrument as shown on page 8.

These bobbins are available for various voltage ratings up to a maximum of 150 volts as scheduled on page 17.

Each bobbin is marked with its rating, resistance and scale multiplying factor.

For voltage ranges greater than 0/150 additional bobbins are added in series with the instrument, i.e., if a range of 0/300 volts is required, two 150-volt bobbins would be connected in series with the instrument.

---

### AS A VOLTMETER OF ANY RANGE (cont.)

---

When more than one bobbin is connected in series with the instrument the scale multiplying factor is the sum of the multiplying factors marked on the individual bobbins used.

As the bobbins are arranged with screw and screw socket terminals any reasonable number may be connected in series to give the desired voltage range.

As each individual bobbin is adjusted to have a resistance of  $\left(\frac{V}{.015} - 5\right)$  ohms it will be seen that when two bobbins are used in series with the instrument the total resistance will be 5 ohms less than the correct resistance for the voltage range so obtained, i.e., for a range of 0/300 the correct total resistance is 20,000 ohms and the actual resistance is  $5 + 9995 + 9995 = 19995$  ohms.

Such error may be neglected for practical purposes.

When the "Alltest" is required for cell or battery testing a bobbin resistance of suitable range should be attached to the instrument with a spike terminal screwed to the bobbin terminal and an insulated lead with spike screwed to the other instrument terminal.

---

### AS AN A.C. VOLTMETER

---

An Alternating Current Volt Unit is available which permits any D.C. moving-coil "Universal Indicator" or an "Alltest" to be used as an A.C. Voltmeter.

It consists of a Westinghouse full-wave metal rectifier and resistances mounted conveniently for direct attachment to the "Alltest" instrument or to the shunt carrier of the 3" dial "Universal Indicator" in the same manner as the shunts.

The device has compensation to permit the instrument to be read directly in A.C. volts without a correction factor. When supplied with a new instrument or when used with an existing instrument, assuming it to be undamaged and in its original condition, the combination will give indications within the requirements of B.S.89 for first grade accuracy.

The ranges standardised are 0/30, 0/150 and 0/300 volts, i.e., one volt per division on the lowest range with the "Alltest" or 3" dial instruments. The resistance per volt is 50 ohms and the current for full-scale deflection 20 mA., 16.6 mA. by the instrument and 3.4 mA. by the protective circuit in the unit.

The Volt Unit with the associated "Universal Indicator" will withstand without damage a momentary overload of up to three times the rated voltage. A protective circuit is incorporated to prevent damage to the rectifier if the Unit is detached from the instrument without first disconnecting it from the A.C. supply.

Although the Unit cannot be connected directly to the terminals of the larger "Universal Indicators" it can be mounted on the small shunt carrier and connected in parallel with the instrument when A.C. voltage readings are required.



## AS A RESISTANCE MEASURER

As previously explained on pages 4 and 5, the standard adjustment of the "Universal Indicator" and the "Alltest" instrument is 0/15 milli-amperes and 0/75 milli-volts.

Apart from these being the most useful ranges for use in connection with standard resistance units, to enable the instrument to be used as a voltmeter, and with standard shunts, so that ampere readings may be obtained, it will be obvious to an electrician that a winding having these characteristics must have a resistance of 5 ohms.

$$\left\{ \frac{75 \text{ milli-volts}}{15 \text{ milli-amps}} = 5 \text{ ohms} \right\}$$

When bobbin resistances are supplied for voltage measurements, an allowance is made in the resistance winding for the 5-ohm "Alltest" movement resistance. Thus the 150-volt bobbin has an actual resistance of 9,995 ohms.

See page 17 for table of resistance values of the bobbin attachments.

If an unknown resistance is to be measured, the following is the method of procedure:—

Volts must first be ascertained, using the "Universal Indicator" or "Alltest" as a voltmeter with the necessary number of suitable bobbins (see pages 9 and 10). Next, the resistance to be measured must be placed in series with the instrument. The milli-ampere reading which is then obtained

## AS A RESISTANCE MEASURER (cont.)

must be divided into the volts. Subtract the value of the resistance of the Instrument (5 ohms) and the resistance of each bobbin, and the answer is the value of the hitherto unknown resistance.

### EXAMPLE 1 (HIGH RESISTANCES)

100-volt supply (measured with one 150-volt bobbin).  
Unknown resistance placed in series.

Reading on Instrument in milli-amperes is, say, 7.5.  
Divide 7.5 milli-amps. (0.0075 amps.) into 100 volts =  
13,333 ohms.

Subtract value of the instrument's self-contained resistance, i.e., 5 ohms and 9,995 ohms, the resistance of bobbin = 10,000 ohms, and it is found that the value of the unknown resistance is 3,333 ohms.

### EXAMPLE 2 (LOW RESISTANCES)

A 2-volt cell available, measured with a 3-volt bobbin.  
With the unknown resistance in series the reading on the  
Instrument is say, 5 mA. = .005 amps.  
Divide 2 volts by .005 amps. = 400 ohms.

The Instrument and bobbin have a combined resistance of 200 ohms; subtracting this, 200 ohms is obtained as the value of the unknown resistance.



### 3" MOVING-COIL "UNIVERSAL INDICATOR"

#### Its Use for Voltage Measurements

The illustration on right shows a "Universal Indicator" with the same ranges as the "Alltest" instrument, with a standard bobbin resistance attached to one terminal, adapting it for voltage measurements. A further bobbin resistance is in the foreground.

The pointer of the "Universal Indicator" can deflect  $\frac{3}{16}$ " behind the zero mark, thus permitting the use of the instrument as a Galvanometer for null work, a bobbin resistance being screwed to its terminals to give it suitable resistance, generally 200 ohms.



### 3" MOVING-COIL "UNIVERSAL INDICATOR"

#### Its Use for Current Measurements

The "Universal Indicator" fitted to inclined india-rubber base on left is arranged for current measurements, a standard shunt carrier being attached to the terminals, with a shunt and main current leads connected. This instrument without the shunt and shunt carrier can be used in parallel with any standard 75 mV. drop shunt for any current rating. The connecting leads from the shunt to the instrument should be of negligible resistance or the necessary correction made as described on page 7.



## UNIVERSAL INDICATORS

### Larger Sizes

To meet the requirements of research and other work requiring closer reading and smaller scale subdivisions than can be given on an instrument with a scale length of  $2\frac{3}{8}$ " instruments with self-contained ranges of 0/15 mA. and 0/75 mV. have been produced in portable cases (Specification A601) with 8" scales also in moulded plastic cases (Specification A627) with 6" scales and cast-iron cases (Specification A611) for portable batten or switchboard mounting with scales 6" or 8" long. The 6" and 8" scales have 75 and 150 scale divisions respectively. With the 8" scale each division represents 100 micro-amps and 500 microvolts. The movements are in view for demonstration purposes. All the tests described in this booklet can be made with these larger instruments.

For "Universal Indicators" required for class lectures the 8" scale instrument described in Specification A611 generally meets requirements but for lecture theatres large sector-shaped instruments having scales 15" or 18" long should be selected. These are described in Specification A618 and in the Publication No. E690 "Electrical Instruments of particular interest to Educational Institutions" which will be posted on request.

## TECHNICAL PARTICULARS

### POLARITY

The top terminal of the "Alltest" is the positive and the bottom terminal the negative connection. This is indicated by the red washer which appears under the top terminal. The left-hand terminal of the "Universal Indicator" is positive and is marked +.

### ADJUSTMENT OF INDICATOR

Milli-amperes	...	15
Milli-volts	...	75

Accuracy is within plus or minus 1 per cent of the maximum reading at any part of the scale and the instrument is adjusted to read within these limits at 20°C. Its temperature co-efficient as a milli-voltmeter is 1 per cent increase for every 7°C. rise.

Resistance 5 ohms at 20°C.

### RESISTANCE OF SHUNT ATTACHMENTS AT 20°C.

30 amps.	...	0.002502 ohm	600 mA.	...	0.1282 ohm
15 "	...	0.005005 "	300 "	...	0.263 "
6 "	...	0.01253 "	150 "	...	0.5556 "
3 "	...	0.0251 "	90 "	...	1.0 "
1.5 "	...	0.05051 "	60 "	...	1.666 "
			30 "	...	5.0 "

Accuracy is within plus or minus 1 per cent and the temperature co-efficient is negligible.

### RESISTANCE OF BOBBIN ATTACHMENTS AT 20°C.

150 volts	...	9,995 ohms	3 volts	...	195 ohms
75 "	...	4,995 "	1.5 "	...	95 "
15 "	...	995 "	750 mV.	...	45 "
6 "	...	395 "	150 "	...	5 "

Accuracy is within plus or minus 0.25 per cent, and the temperature co-efficient is negligible. When, however, the 150 milli-volt bobbin is used the temperature co-efficient of the combination is 1 per cent for 14°C.

It is useful to note that the shunts and bobbins may be used separately from the instrument as standard resistances, and by combining the 150 milli-volt bobbin with any one other bobbin, even values of resistance, such as 100, 1,000, 10,000 ohms, etc., are obtained.



# **Crompton** **Parkinson** LIMITED

HEAD OFFICE:  
**GUISELEY, YORKS**

INSTRUMENT WORKS:  
**CHELMSFORD**

HOME BRANCHES:

**LONDON**  
CROMPTON HOUSE  
ALDWYCH, W.C.2  
Telephone: Chancery 3333

**BELFAST**  
17 COLLEGE STREET  
Telephone: Belfast 27164

**BIRMINGHAM**  
CROMPTON HOUSE  
SEVERN STREET, 1  
Telephone: Birmingham Midland 6351

**BRISTOL**  
CROMPTON HOUSE  
TEMPLE GATE, 1  
Telephone: Bristol 25363

**CARDIFF**  
17 CHARLES STREET  
Telephone: Cardiff 8185

**DUBLIN**  
212 ST. STEPHEN'S GREEN  
WEST, C.2  
Telephone: Dublin 51061/2

**GLASGOW**  
164 BOTHWELL STREET, C.2  
Telephone: Glasgow Central 0756/9

**HOME COUNTIES**  
WRITTLE ROAD  
CHELMSFORD  
Telephone: Chelmsford 3161

**LEEDS**  
4-6 NEW YORK ROAD, 2  
Telephone: Leeds 30511

**MANCHESTER**  
3 CATEATON STREET  
Telephone: Deansgate 5771/9

**NEWCASTLE**  
25/27 PEARL ASSURANCE  
BUILDINGS  
NORTHUMBERLAND STREET, 1  
Telephone: Newcastle 21645

**NOTTINGHAM**  
CROMPTON HOUSE  
BROADWAY  
Telephone: Nottingham 45678