DEPARTMENT OF ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

Electrical & Electronic Measurement Laboratory (EE-352) 3rd Semester EE students

Expt. No. 1.

"CALIBRATION OF SINGLE PHASE A.C. KWh/ENERGY METER"

Object : a) to measure Energy by an a.c. house service meter at different resistive load.

Procedure : Make connections as shown in figure 1 Switch on the supply and adjust voltage and current to rated values Note that the test meter runs freely in proper direction. Allow it to run for some time to warm up to operating condition.

Run-1 : Short time test on unity power factor load

With rated load current at unity power factor observe time T in seconds take for a certain number N of complete revolutions of the meter disc. The measured time interval, usually must correspond to three revolutions of the disc or not less than 100 sec. Whichever is larger period. But in any case full number of revolutions must be counted. The load must be kept constant during this period. Note the wattmeter reading 'W' in watts and the time taken for a certain number of revolutions. Calculate for error will be as follows :

Observed meter constant

$$K_0 = \frac{N}{\frac{W}{1000} \times \frac{T}{3600}} = \frac{36 \times 10^5 \times N}{W \times T} \text{rev / kwH}$$

Percent error =

$$\frac{K_0 - K}{K} \text{x}100$$

Where k in rev./kWh. Is the nominal meter constant (given on the name plate of the test meter).

Repeat the test for 50% and 10% of rated load. Record the results in **TABLE – 1**

Run-2 : Dial tests (Long duration)

Adjust at the 100% rated load at unity power factor. Take initial reading if the meter dials. With the load held constant, allow the meter to run for a relatively long time (at least 15 minutes) at the end of which note the final reading of the meter dials. Note the wattmeter reading during this test. Calculate as follows :

Observed Dial Advance (D_o) = Final reading (kWh) – initial reading (kWh)

Actual energy during test

$$D_T = \frac{W}{1000} \times \frac{T}{3600} = \frac{W \times T}{36 \times 10^5}$$

where "W" is in watts and "T" is in sec.

Percent error =

$$\frac{D_O - D_T}{D_T} \times 100$$

Run-3 : Creep test

Disconnect the load, keep the potential coil circuit of the energy meter excited at rated voltage. If the meter disc rotates continuously for more than one revolution, creep is said to be present

Report :

1. Draw the circuit diagram of the apparatus actually used
2. List of the apparatus in tabular form
3. Enter test data of the various runs in table no 1 & 2
4. Show sample calculations for runs 1 & 2
5. Justify the necessity of each run
6. Why it is necessary to test the meter at other power factors (say at 0.5 lag)
7. If the creep is present in a meter who will be looser? The consumer or the supplier?

Ref. :

1. Indian Standards Specification for a.c. electricity meters IS - ...... parts (I) & (II)
2. Electrical Measurements and Measuring Instruments – Rajendra Prasad.
3. Electrical Measurement and Measuring Instruments – Golding & Widdis.

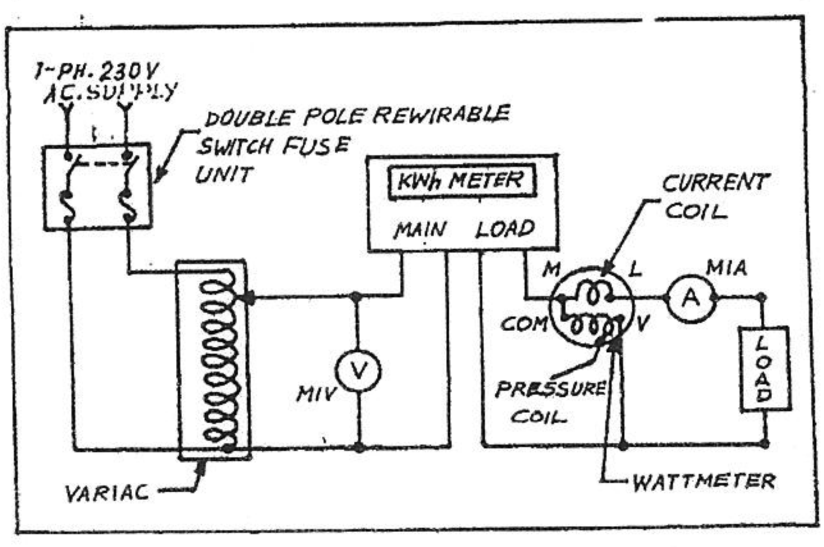


Fig 1 : Connection Diagram

DATA SHEET

"CALIBRATION OF SINGLE PHASE A.C. KWh/ENERGY METER"

Name : ______________________________ Roll No. : ___________

Date : _____________

Apparatus used :

Sl. No.	Item	Range	Maker's Name	Lab No.
1.				
2.				
3.				
4.				
5.				
6.				
7.				

TABLE – 1

Percentage Of rated Load	Wattmeter Readings In watts	No. of Revolutions 'R'	Time taken In 'R' Revolutions In 'T' Seconds	Observed Meter constant 'K_o'	Percentage error

TABLE – 2

Percentage Of rated load	Initial dial Readings In watt (kWh)	Final dial Reading (kWh)	Observed Dial reading (D_o) In kWh	Wattmeter Reading In watts	Time 'T' In sec.	Actual Energy (D_t)	Percentage Error

____

(Signature of the Teacher)

DEPARTMENT OF ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

Electrical & Electronic Measurement Laboratory (EE-352) 3rd Semester EE students

Expt. No. 2

"EXTENSION OF INSTRUMENT RANGES USING C.T. AND P.T."

OBJECT : Connect instrument transformers along with ammeter, voltmeter and wattmeter as shown in fig. 1. Ensure that the C.T. secondary is connected across the current of the wattmeter. Switch on the supply with variac in minimum voltage position. Set the voltage at 230 volts and vary the load.

Record the readings in Table No. 1.

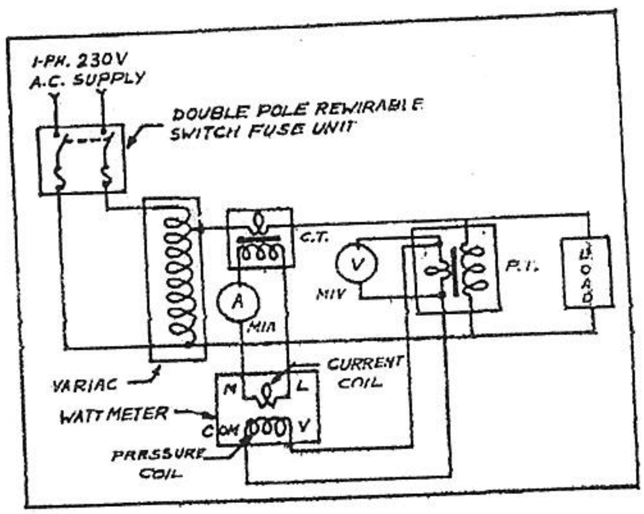


FIG. 1 : Connection Diagram

Report :

1. Apparatus used including range, maker's name. Lab.
2. Show the connections of the instrument transformers to extend wattmeters for the measurement of power in a three phase circuit.
3. Answer the following questions and submit this sheet along with your report.
4. Indicate whether the following statements are **TRUE** or **FALSE**
   a. C.T. can extend instrument range
   b. A high current (A.C.) can be measured by a low current range ammeter using C.T.
   c. Primary current of a C.T. is dependent on its secondary current

d. C.T. can electrically isolate the metering circuit from the main circuit.

e. Secondary of a measuring C.T. is practically short circuited by an ammeter.

f. A C.T. with a rating of 100/IC can be expressed as 10/1 by canceling the numerator and denominator.

g. A 100/10 C.T. and a 10/1 C.T. can carry maximum current of 1000 amps and 10 amps respectively through their primaries and the corresponding secondary currents will be 10 amps and 1 amp.

h. The primaries of a 100/10 and 10/1 C.T. are connected in sories and 10 amps is following through the primary windings. The secondary current in both the C.Ts. will be 1 amp.

i. The Secondary of a C.T. should never be open circuited.

j. 'Normal ratio' and 'actual ratio' of a C.T. are not same due to the presence of *exciting current*.

k. Shunt can extend the instrument range.

l. Shunt can electrically isolate the *metering circuit from the main circuit* like C.T.

m. P.T. is used to extend the range of a voltmeter & not ammeter.

n. A high voltage (A.C.) can be measured by a low range voltmeter using P.T.

o. P.T. can electrically isolate the measuring circuit from the main circuit.

p. Secondary of a *measuring* P.T. is practically short circuited like C.T.

q. Secondary voltage of a P.T. is dependent on primary voltage.

r. Potential divider can extend instrument range like P.T.

s. Potential divider can electrically isolate the measuring circuit from the main circuit.

t. If 100 volts a.c. is applied across the primaries of a 1000/100 and 100/10 P.T. the secondary voltage in both the cases will be 10 volts.

DATA SHEET

"EXTENSION OF INSTRUMENT RANGES USING C.T. AND P.T."

Name : ______________________________ **Roll No. :** ___________

Date : _____________

Sl. No.	Apparatus	Range	Lab Number
1.	Ammeter		
2.	Voltmeter		
3.	Wattmeter		
4.	Current Transformer (C.T.)	C.T. Ratio ___________, VA ____, Class ______	
5.	Potential Transformer (P.T.)	C.T. Ratio ___________, VA ____, Class ______	
6.	Variae		
7.			

Experiment Data :

Sl. No.	Ammeter Reading In amps	C.T. Ratio	Circuit Current In Amps	Voltmeter Reading In Volts	P.T. ratio	Circuit Voltage In Volts	Wattmeter Reading In Volts	Multiplying Factor (MF) Of wattmeter	Actual Power Consumed By the Load in Watts

____

(Signature of the Teacher)

DEPARTMENT OF ELECTRICAL ENGINEERING
INDIAN INSTITUTE OF ENGINERING SCIENCE AND TECHNOLOGY, SHIBPUR

Electrical &Electronic Measurement Laboratory(EE-352) **3rd Semester EE students**

Expt. No.**3**

Title Of Experiment : Kelvin Double Bridge

Object: To measure the unknown low value resistances using Kelvin Double Bridge.

Procedure: Procedure and connection diagrams are given in the **Instruction manual**.

SAMPLE DATA SHEET

Name :________________________________ Roll No :_____________

Date :______________

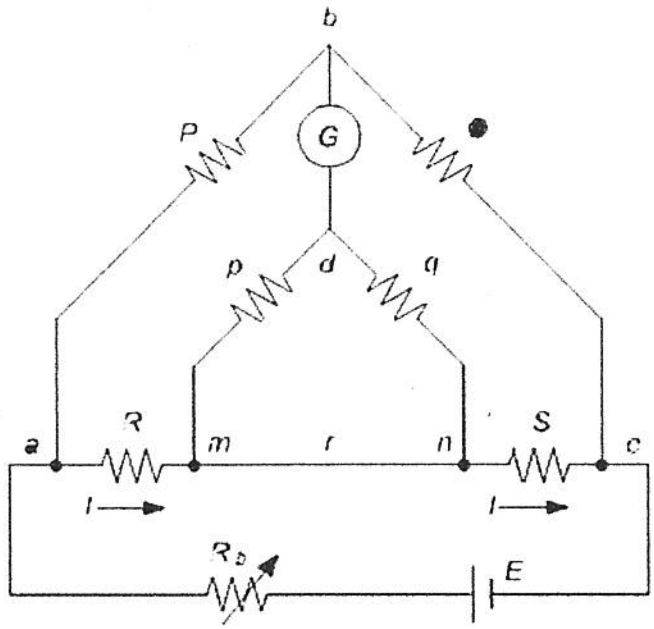
Apparatus used:

Sl. No	Item	Range	Maker's Name	Lab No

Results:

Sl. No	Sample material	Range Multiplier (m)	Value of S at balance			Value of unknown resistance ($R_X = M\times S$)	Temperature Of the sample
			At Normal current	At Reverse current	Mean		

(Signature of the teacher)



The kelvin double bridge incorporates the idea of a second set of ratio arms - hence the name double bridge- and the use of four terminal resistors for the low resistance arms. Fig.1. shows the schematic diagram of kelvin bridge. The first ratio arms is P and Q. The second set of ratio arms p and q is used to connect the galvanometer to a point d at the appropriate potential between points m and n to eliminate the effect of connecting lead resistance r between the unknown resistance R and the standard resistance S.

The ratio p/q is made equal to P/Q. Under balance conditions there is no current through the galvanometer which means that the voltage drop between a and b, E_{ab} is equal to voltage drops E_{amd} between a and c.

$$E_{ab} = \frac{P}{P+Q} E_{ac} \text{ and } E_{ac} = I\left[R + S + \frac{(p+q)r}{p+q+r}\right]$$

$$\text{and } E_{amd} = I[R + \frac{p}{p+q}\left\{\frac{(p+q)r}{p+q+r}\right\}] = I[R + \frac{pr}{p+q+r}]$$

for zero galvanometer deflection, $E_{ab}=E_{amd}$

$$\frac{PI}{P+Q}[R+S+\frac{(p+q)r}{p+q+r}] = I[R + \frac{pr}{p+q+r}]$$

$$\text{or } R = \frac{P}{Q}S + \frac{qr}{p+q+r}[\frac{P}{Q} - \frac{p}{q}] \text{ ------------ (1)}$$

now if

$$\frac{P}{Q} = \frac{p}{q} \text{ Eq (1) becomes, } R = \frac{P}{Q}S \text{ -------- (2)}$$

Eq (2) is the usual working equation for the kelvin bridge. It indicates that the resistance of connecting lead, r, has no effect on the measurement, provided that the two sets of ratio arms have equal ratios.

OPERATING MANUAL

FOR

KELVIN BRIDGE

CAT.NO. PL39.

Manufactured by:

TOSHNIWAL INDUSTRIES PVT.LTD.,
INDUSTRIAL ESTATE,
MAKHUPURA,
AJMER - 305 002.

Tel: 0145-2695171, 2695205 Fax: 0145-2695174 Email: ajmer@tipl.com

1. THEORY OF OPERATION

Compare the simple circuit (Fig.1) with the comprehensive circuit of our instrument (Fig.2). It will be seen that :

2.1 The ratio arms MQ and mq have five ratio positions for range multiplication. (XO.01, XO.1, X1, X10,X100).

2.2 The left-hand ratio arms (M & m) connections are via contact wipers to the standard resistance "S" which takes the form of ten steps of 10 milli ohms in series with a 0-10 milli ohms.

2.3 The right-hand ratio arm (Q & q) connections are to terminals P & P which serve to connect the "x" resistance under test in conjunction with terminals C & C.

2.4 Links across terminals CP & C_1 P_1 are shown in a position for one type of "x" connection. Other types of connections are described in paragraph 4.5 below.

2.5 Terminals G_1,S & G_2 are for the connection of the external galvanometer null detector to the ratio arm apex, via the two balance keys, the use of which is described in greater detail in paragraph 5.4 and 5.5. below .

2.6 The external D.C. supply is connected to the terminal marked CURRENT INPUT and is switched into circuit via the three position current switch..

3. PANEL CONTROLS

3.1 Fig. 3 shows the layout of the panel controls etc.

3.2 The five position ratio arms (x0.01, x0.1, x1, x10, x100) are selected by the RANGE MULTIPLER switch mounted in the top right hand corner.

3.3 The MILLIOHMS decade (bottom left -hand corner) and the milliohms slide wire (central knob and circular scale) and the "S" section of the bridge in conjunction with the RANGE MULTIPLIER they indicate the resistance measure.

3.4 Terminals P & P_1 (middle bottom) are for connecting the resistance under test, with the links C, P & C_1, P_1 in position.

3.5 Terminals G_1 S and G_2 situated on the right -hand side are for connection of the external galvanometer (see paragraph 5.4 below). Fig. 4 and Fig.5 show different types of connection.

3.6 INITIAL and FINAL galvanometer keys are situated together at the bottom right hand corner.

3.7 Terminals marked CURRENT INPUT (left-hand side) are for connecting to an external d.c. supply (See paragraph 5.1)

3.8 The CURRENT SWITCH (top left-hand corner), serves to connect, disconnect or reverse the d.c. supply.

4. PRINCIPLE OF OPERATION

resistance required for critical damping. The following formula is given to determine the resistor values. The circuit arrangement is shown in Fig.4.

If R_g is the galvanometer coil resistance, R_d the external resistance to critically damp the galvanometer , and X the sensitivity reduction factor, thea.

$R_2 = XR_d$
$R_1 = R_d - R_2$
and R_s =

5.6 Recommend Galvanometer ,Cat.No. PL64 for moderate accuracy.

6. OPERATION

6.1 Ensure that the CURRENT SWITCH is off

6.2 Connect the current supply to the terminals marked CURRENT INPUT, in case of variable supply, set limiter to minimum current.

6.3 Connect galvanometer to bridge as shown in Fig.4 and Fig.5 whichever is required.

6.4 Checkzero of milliohm slide wire (circular scale).

6.4.1 Set milliohm decade switch to zero.

6.4.2 Connect terminals C to C_1 and P to P_1 with small thick wires.

6.4.3 Adjust current to desired value.

6.4.4 Set Range Multiplier to any value

6.4.5 Operate desired Galvanometer key and observe galvanometer and adjust milliohm slide wire to obtain a balance. The milliohm slide wire scale should read zero.

6.5 Connect the resistance under test to the bridge terminals C. C_1 and P. P_1 according to the methods outlined in paragraphs 7, 8 and 9, ensuring that all connections make goods contact. This is most important because dirty or insecure connections will result in unstable reading and inaccuracies.

6.6 Set CURRENT SWITCH to NORMAL and in case of variable supply, adjust the current to the required value.

6.7. Set all externally operated galvanometer shunts (if in use) to a minimum sensitivity

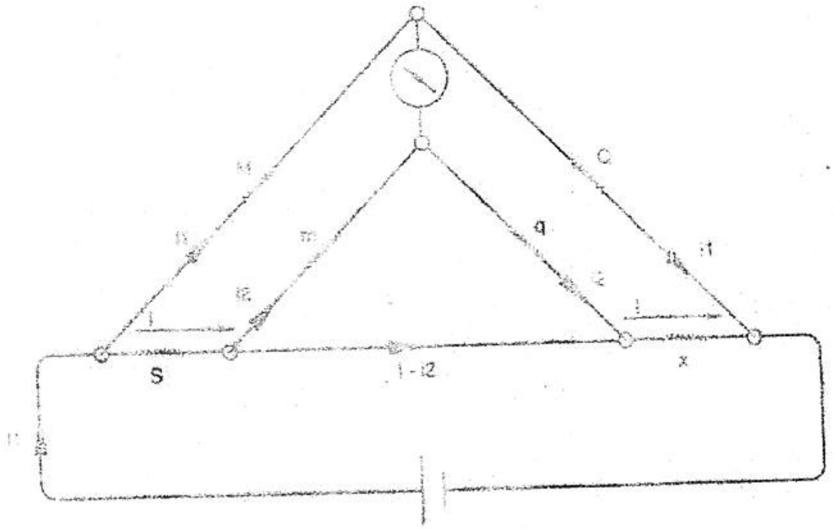
6.8. Set the RANGE MULTIPLIER to "x100".

6.9.1 Operate Galvanometer keys by depressing the INITIAL KEY intermittently (if in use), otherwise depress the FINAL KEY intermittently.

CIRCUIT DIAGRAM OF KELVIN BRIDGE

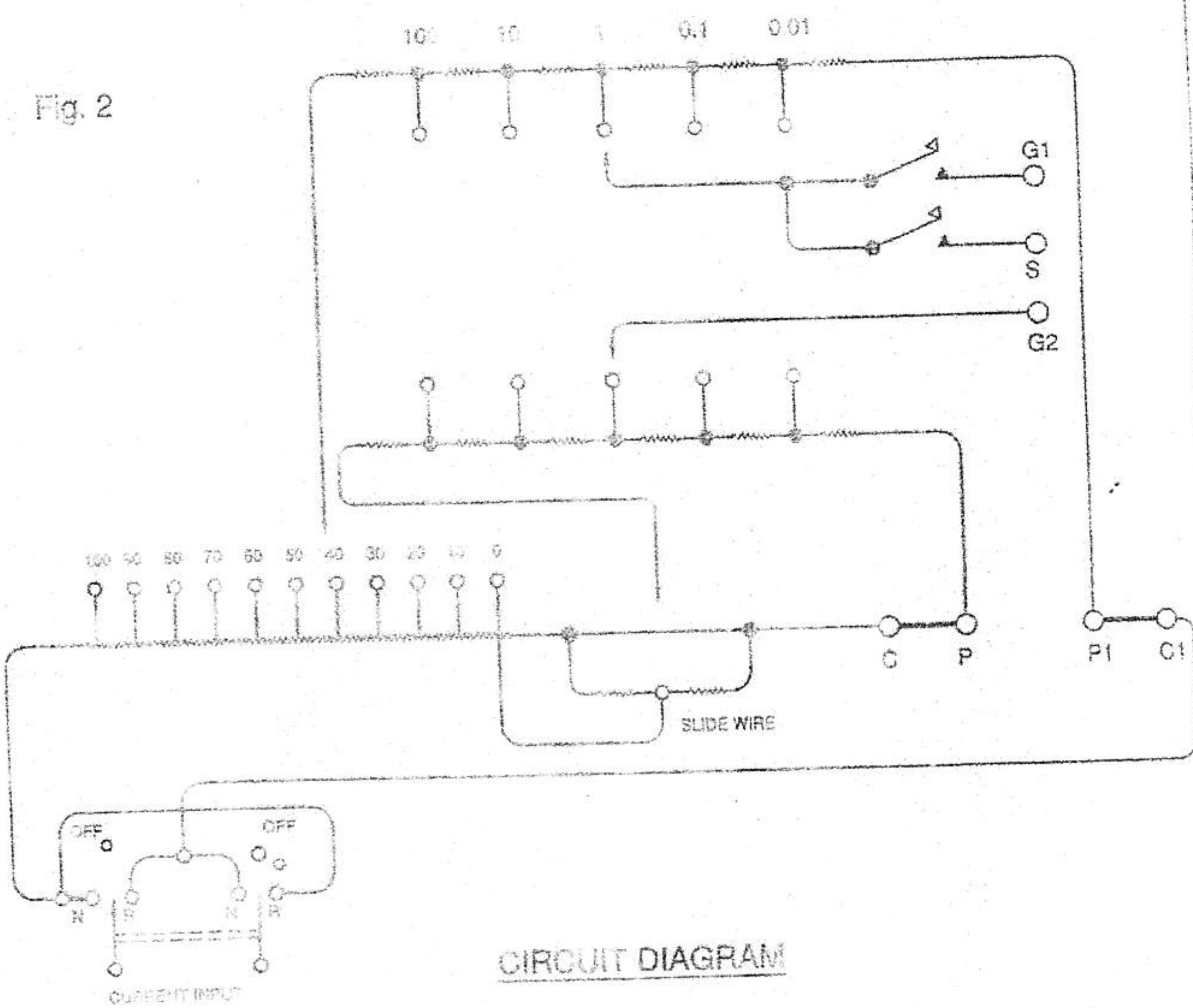
TIPL

Fig. 1



PRINCIPLE OF OPERATION

Fig. 2



CIRCUIT DIAGRAM

DRN.	CHD.	APPD.	TOSHNIWAL INDUSTRIES PVT. LTD.	DRAWING NO. K 1 (4)

LAYOUT DIAGRAM OF KELVIN BRIDGE

TIPL

Fig. 3

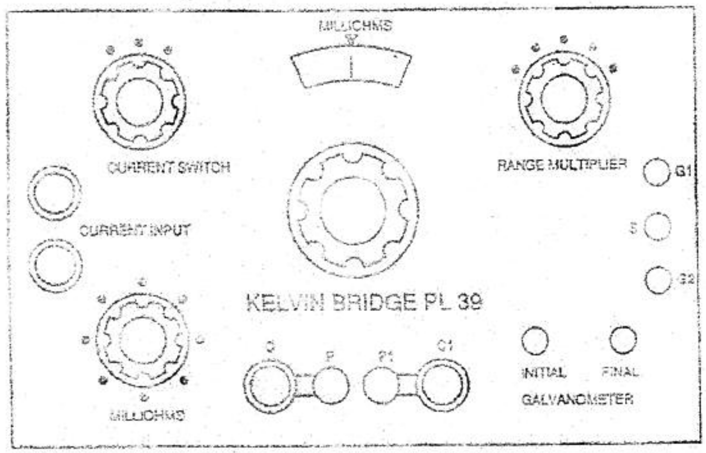


Fig. 4

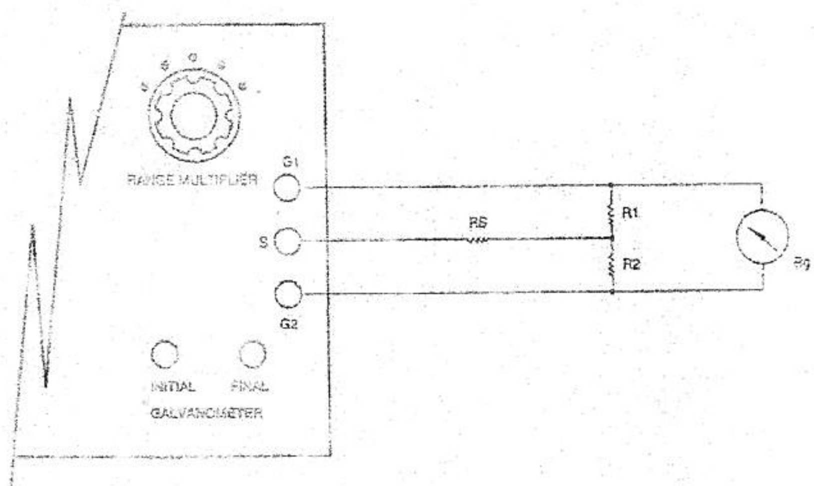
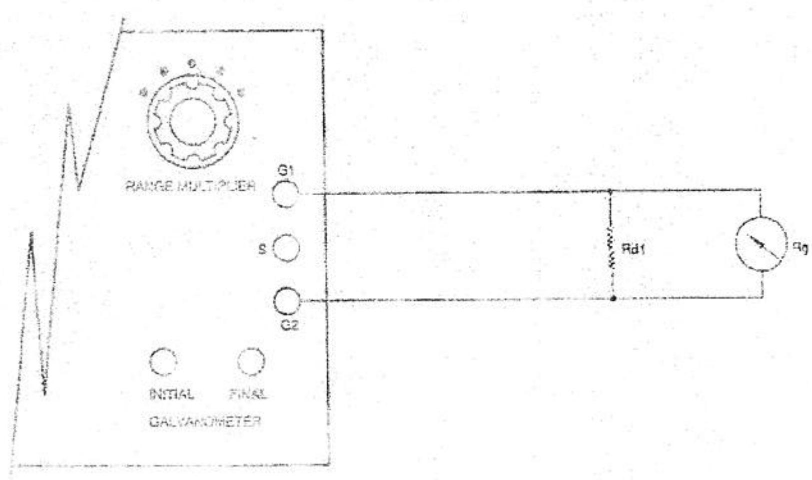


Fig. 5

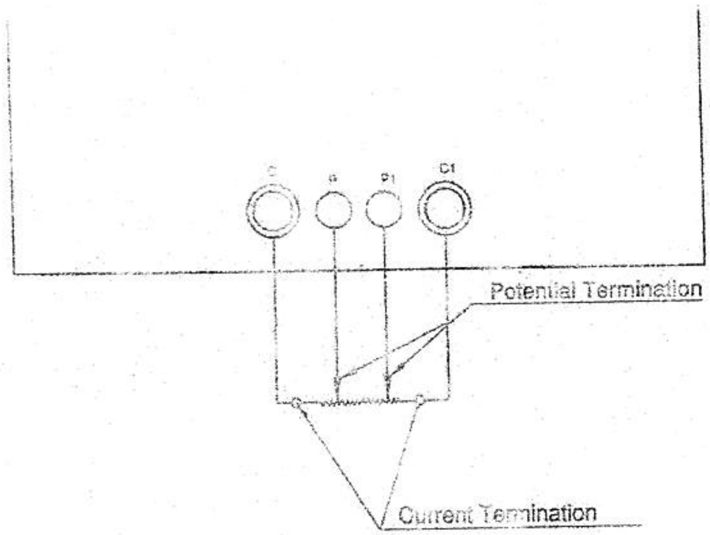


DRN. MAHESH 8/10/2003	CHD. BM GUPTA	APPD. BM GUPTA	TOSHNIWAL INDUSTRIES PVT. LTD. AJMER-305 002	DRAWING NO. K 2 (4)

CIRCUIT DIAGRAM OF KELVIN BRIDGE

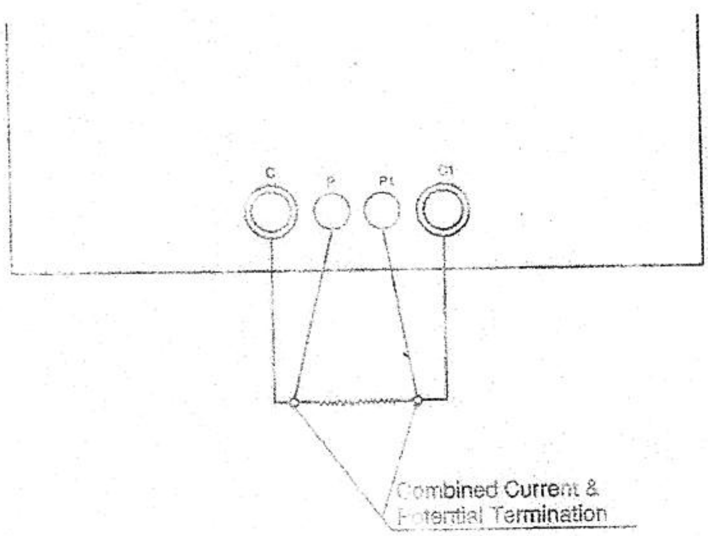
TIPL

Fig. 6



RESISTANCE MEASUREMENT OF FOUR TERMINAL RESISTANCE

Fig. 7



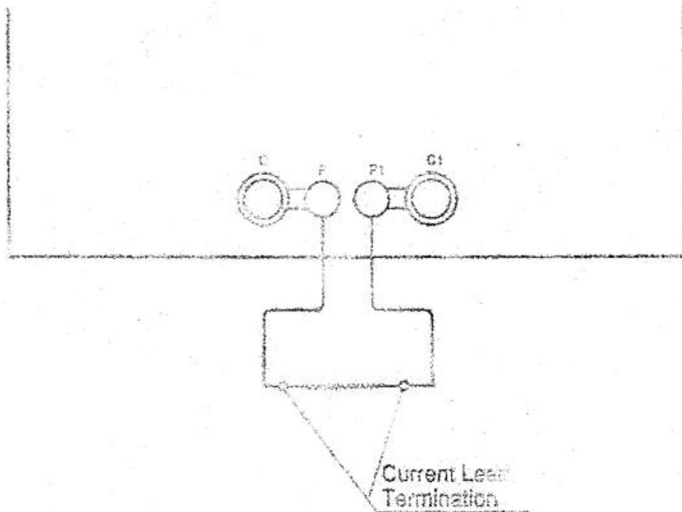
RESISTANCE MEASUREMENT OF TWO TERMINAL RESISTANCE BY FOUR TERMINAL METHOD

DRN.	CHD.	APPD	TOSHNIWAL INDUSTRIES PVT. LTD.	DRAWING NO.
MAHESH 8/10/2003	BM GUPTA	BM GUPTA	AJMER-305 002	K 3 (4)

CIRCUIT DIAGRAM OF KELVIN BRIDGE

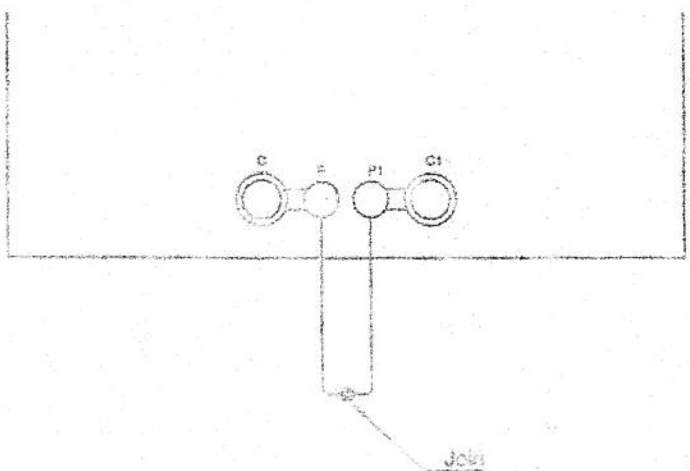
TIPL

Fig. 8



RESISTANCE MEASUREMENT BY TWO TERMINAL METHOD

Fig. 9



LEAD RESISTANCE MEASUREMENT

DRN. MAHESH 8/10/2003	CHD. BM GUPTA	APPD. BM GUPTA	TOSHNIWAL INDUSTRIES PVT. LTD. AJMER-305 002	DRAWING NO. K 4 (4)

DEPARTMENT OF ELECTRICAL ENGINEERING

INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

Electrical & Electronic Measurement Laboratory (EE-352) **3rd Semester EE students**

Expt. No. 4.

TITLE OF EXPERIMENT: **PHASE ANGLE & FREQUENCY MEASUREMENTS BY ELECTRONIC METHOD**

OBJECT: 1. To understand the principle of the phase shifting Bridge Circuit.

2. To measure Phase Angle with a CRO.
3. To calibrate a high impedance Moving Coil Voltmeter with an electronic phase sensitive detector attachment for using it as a phase angle meter.
4. To measure mains frequency comparing with that of a standard oscillator in a CRO.

APPARATUS: (Note Item, Range, Type/Model, Make, Sl./Lab. No. etc. in a table)

1. Phase-shifting bridge, 2. Oscilloscope, 3. PMMC Voltmeter/DMM
4. Resistance box, 5. Standard Capacitor 6. Function Generator

EXPERIMENTAL PROCEDURE:

(For objects 1. 2 & 3)

1. Study the principle and circuit diagram of the phase shifting bridge (Fig.1) and the vector diagram (Fig. 2).
2. Make connections to the CRO as per Figs. 2 and 3. Depending on the phase difference between V_B or V_C and V_O, which can be varied by adjusting R_V or C_p, a Liss'ajous pattern will be obtained on the screen of the CRO in the form of an ellipse or a circle or a straight line. Adjust the X and Y axes sensitivities so that the deflections along them are equal. Note down various parameters and the measured values as shown in Table-I for different values of R so that phase angle varies between 0° and 180° through 90°.
3. A Moving Coil Voltmeter connected to a phase sensitive detector (right half of Fig.1) can be calibrated in terms of the phase angle difference between V_B and V_C. Make connections as per Fig. 1. Adjust R_V of the phase shifter circuit to the value ($R_V = 1/\omega\ C_p$) so that exact 90° phase shift is obtained between voltages V_B and V_C. Connect CC'. Under this condition the voltmeter should read zero (check by adjusting *r*). Change the value of R_V in suitable steps and note down the voltmeter readings in Table II.

(For object 4)

4. Make the connection as in Fig.4 and obtain a stationary Liss'ajuous pattern by varying the oscillator frequency. Note down the number of peaks or closed loops and also note whether they are arranged horizontally or vertically (TABLE III).

REPORT:

1. (a) Comment on the working principles of the phase shifting bridge and phase Detector circuits with the help of Phasor diagram.

   (b) Discuss the effect of replacing capacitor C_p by an inductor.

2. Calculate the phase angle theoretically and using the Methods I and II and compare the results.

3. Plot a curve of calculated phase shifts vs. voltmeter readings (ordinate).

Table – I

No. of Obs.	C_p (μF)	R_V (Ω)	Method- I		Method-II		Phase Angle Φ		
			Y_1	Y_2	m	M	Theoretical	Method-I	Method-II

Method-I : $\sin\Phi = Y_1 / Y_2$

Method-II : $\tan(\Phi/2) = m/M$

Table – II

No. of Obs.	C_p (μF)	R_V (Ω)	Calculated Phase-Shift	Voltmeter Reading

Table – III

No. of Obs.	Oscillator Frequency	No. of Peak with orientation	Calculated Mains Freq.

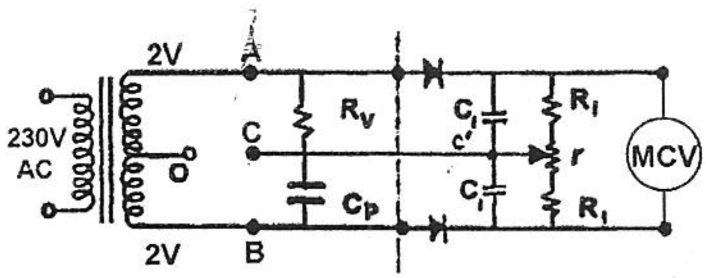


Fig. 1

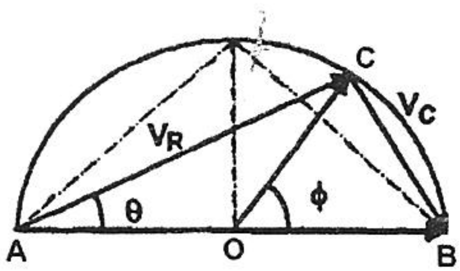


Fig. 2

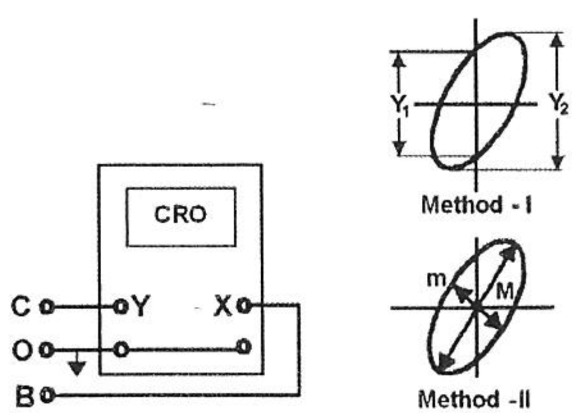


Fig. 3

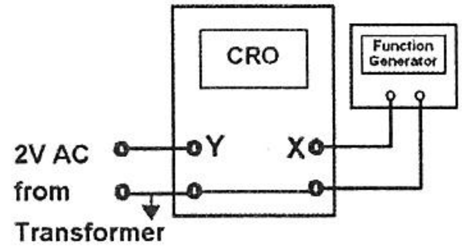


Fig.4

DEPARTMENT OF ELECTRICAL ENGINEERING
INDIAN INSTITUTE OF ENGINERING SCIENCE AND TECHNOLOGY, SHIBPUR

Electrical &Electronic Measurement Laboratory(EE-352) **3rd Semester EE students**

Expt. No.5

TITLE OF EXPERIMENTS : STUDY ON AC BRIDGES

OBJECT : a) To study the operation and use of Schering Bridge to determine the value of a capacitance, its dissipation factor and power factor.
b) To study the operation and use of Anderson Bridge to measure the value and Q factor of an inductance coil.

REFERENCE : [1] Cooper - Electrical Instrumentation & Measurement Techniques.
[2] Rajaram - Electrical Measurement and Instrumentation.
[3]R.K.Rajput - Electrical Measurements and Measuring Instruments

INTRODUCTION :

A. **Schering Bridge**: It is one of the important A.C. bridges widely used for the measurement of low loss capacitor, its dielectric loss and power factor. Fig. 1 below shows the basic circuit elements of Schering bridge. The capacitor C_2 is high quality capacitor (low loss) is used as a standard capacitor for measurement. The general balance equation from the bridge circuit of Fig. 1, unknown impedance $Z_x= Z_2 Z_3 Y_4$,

Where $Z_x=(R_x+ R_1) - j/\omega C_1$

Equating real and imaginary parts of impedances,

$R_x+ R_1= R_3 C_4/C_2$ and

$C_1= R_4 C_2/ R_3$

The dissipation factor is $D= \omega C_1 R_x$ and Power factor is also approximately the same. Thus for Schering bridge, $R3$, $R4$ and $C4$ are adjusted to obtain the bridge balance.

Anderson Bridge: It is used for precise measurement of inductance over a wide range in terms of a standard capacitor. Both high-Q and low-Q inductors can be measured. Fig. 2 below shows the basic circuit elements of Anderson bridge. The capacitor C is high quality standard capacitor. Equating real and imaginary parts of impedances in bridge balance equation;

$R_x+S_1=R_2 R_3/R_4 = QR/P$

and $L_x= CR_3/R_4 [r(R_2+R_4)+R_2R_4] = CR/P[r(Q+P)+QP]$

The Q-factor $Q=X_{Lx} / R_x =\omega L_x/R_x$

R_2 is made adjustable and $R3/R4$ ratio can be selected depending on the range of Q.

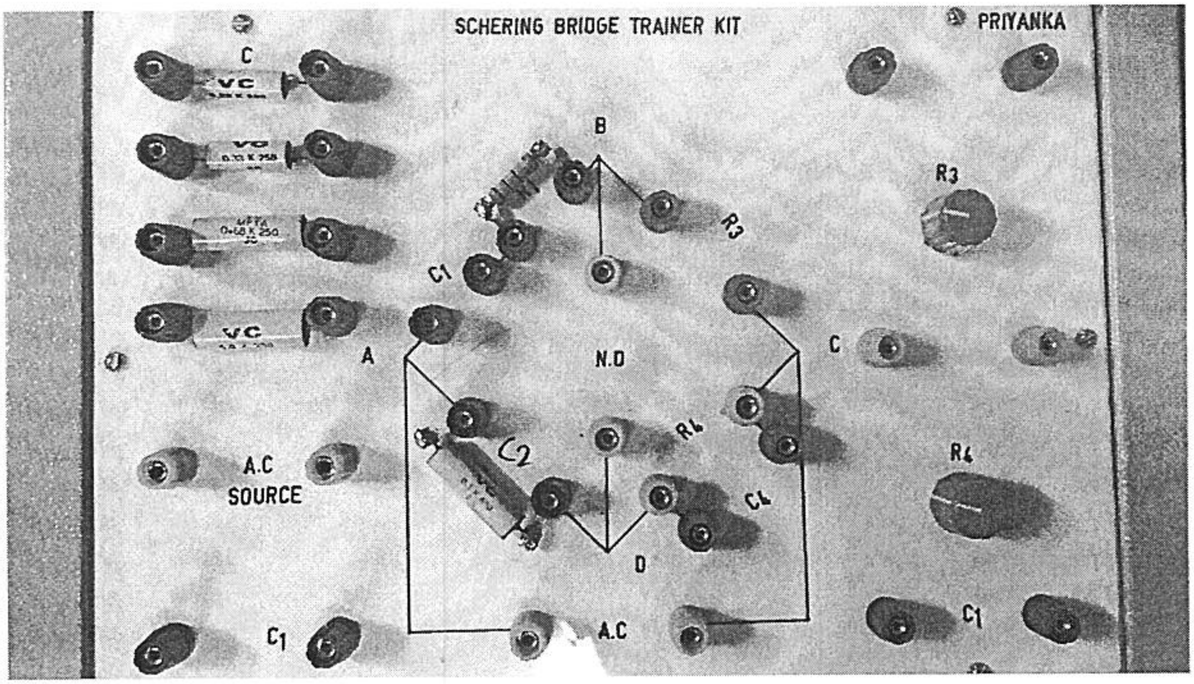


Figure 1

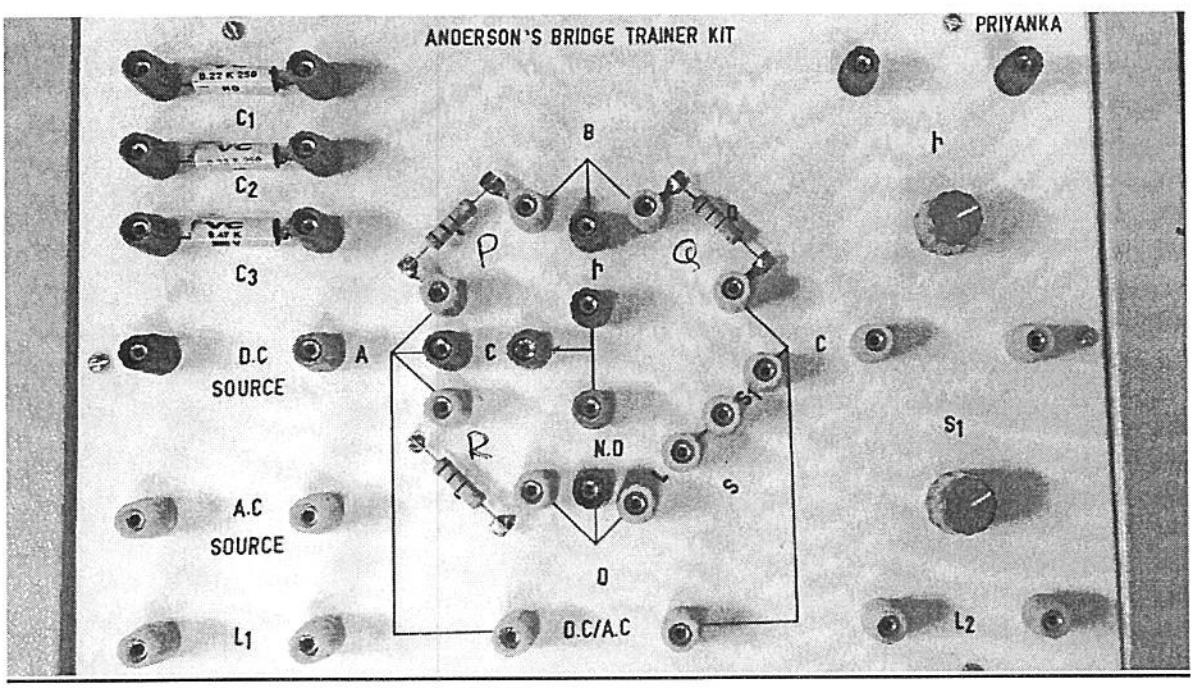


Figure 2

LIST OF APPARATUS & EQUIPMENT : (Note Item, Range, Type/Model, Make, Sl.No. in a table).

PROCEDURE & OBSERVATIONS :

A. Study on Schering bridge :
   1. Study the Schering bridge Setup.
   2. connect one unknown capacitor (C_1) in arm AB and adjust the armR_4 ,C_4 ,andR_3 to obtain the null. Read the values of adjusted resistors by Multimeter. Calculate unknown capacitance C_1,its effective series resistance R_x ,the dissipation factor and power factor .
   3. Repeat step 2 for other unknown capacitors.

B. Study on Anderson Bridge :
   1. Now take the Anderson Bridge setup.
   2. Connect one unknown inductor in arm DC.Connect the DC supply and DC null detector to the bridge. Now adjust r and S to obtain the null position. After that replace DC source and DC null detector by AC source and AC null detector respectively. Adjust C,S_1 and r to obtain the null position again. measure the values of r,S_1 and C. calculate the values of L_x, its effective series resistance and Q-factor.
   3. Repeat step 2 for other unknown inductors.

SAMPLE DATA SHEET

Table -I

Sl.No	R_3	R_4	C_2	C_4	R_1	C_X	R_X

Table-II

Sl.No	C	S_1	R_3	R_4	R_1	r	R_X	L_x

REPORT:

1. Make the respective tables of data. Find the values of the unknown parameters.
2. Draw the phasor diagram for both the bridges taking any one set of data from the table

DEPARTMENT OF ELECTRICAL ENGINEERING
INDIAN INSTITUTE OF ENGINERING SCIENCE AND TECHNOLOGY, SHIBPUR

Measurement Lab **3RD Semester [redacted] EE**

Expt. No. 3

FAMILIARIZATION WITH OSCILLOSCOPE (C.R.O.)

Objectivess :

a) To understand the working principle of an Oscilloscope

b) To Use Oscilloscone for measurement of voltage, current and frequency

c) Use of Oscilloscope for X-Y Display in x-Y mode.

Procedure : 1.0. Read Appendix carefully and study the front panel of t oscilloscope.

1.1. Switch on the mains.

1.2. Adjust the grid (intensity) control knob for a reasonable good visible light spot on the screen.

1.3. Adjust the focus (anode No. 1) control knob to obtain sharply defined spot on the screen.

1.4. Now vary the brilliancy and observe intensily of illumination of the spot.

1.5. Vary the horizontal deflecting plot Voltage (X-Shift) and vertical deflecting plane voltage (Y-shift) to deflect the spot in horizontal and vertical directions.

2. Connect the probe to the Y-input BNC socket and check the calibration of the scope by connecting the probe to the calibrated output available at the rear panel of the oscilloscope make sure that the time base is connected to the X-input in the internal mode.

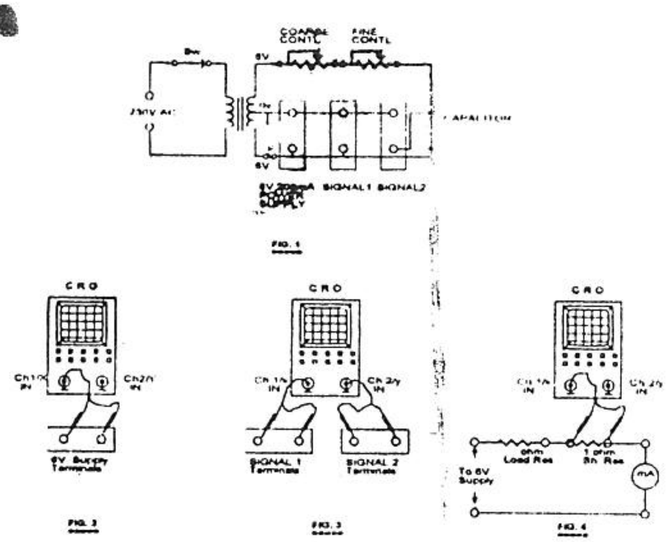
Now observe the wave form and adjust the probe for obtaining sharp square pulses. Note the magnitude of the displayed wave form and the sensitivity. Adjust the gradual control of y-direction for obtaining the proper display.

Note the period of the wave form and adjust X-deflection gain so as to obtain the proper time period corresponding to the calibrated wave. The magnitude and frequency of the calibrated will be supplied).

Now connect the unknown voltage to the Y-input and observe the wave form to be stationary only when the trigger is internal.

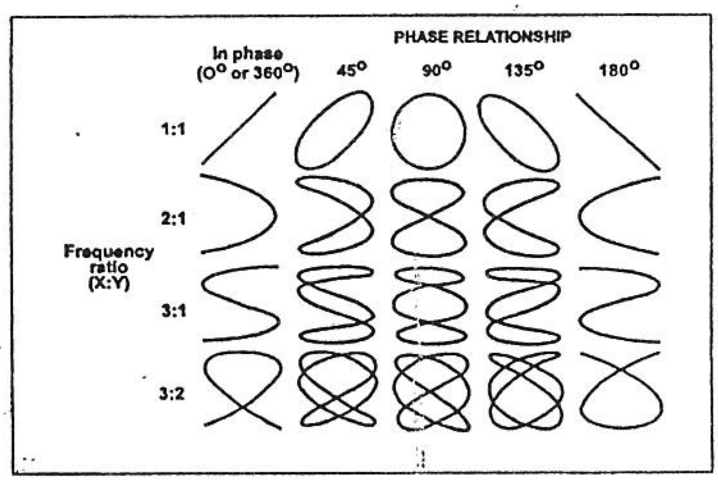
Set the deflection sensitivities so that magnitude & frequency can be measured correctly.

Plot the waveform indicating magnitude and time for both the cases on the same graph paper.



Voltage Measurement **Phase angle Measurement** **Current Measurement**

Connection Diagrams



Lissajous Patterns

REPORT :

1. Determine the frequency and magnitude of the unknown voltage.
2. With reasons suggest the suitable waveform for the time.
3. Why triggering of the time is required?
4. Which of the following alternatives are correct.

A linear time-base is achieved by the spot being moved horizontally at :

(a) Increased speed ; (b) Constant acceleration ; (c) Constant speed.

DATA SHEET

FAMILIARIZATION WITH OSCILLOSCOPE (C.R.O.)

Name : ______________________

Roll No. : __________

Date : __________

Apparatus used :

Sl. No.	Item	Range	Maker's Name	Lab No.
1.				
2.				
3.				
4.				

TABLE – I(For Voltage Measurement)

No. of Obvs.	Sensitivity V/div	No, of division	Voltage

TABLE – II (For Current Measurement)

No. of Obvs.	Sensitivity Time/div.	No. of Division	Time period (T. in sec.)	Frequency F = I/T (Hz)

TABLE – III (Frequency Measurement)

No. of Obvs.	Oscillator Frequency	No. of loops Or peak	Arrangement Of the fig. (HORZ/VERT)	Multiplying Factor	Unknown Freq.

TABLE – IV (For Current Measurement)

No. of Obvs.	Sensitivity V/div	No. of division	Voltage	Current= V/Shunt Resistance

(Signature of the Teacher)

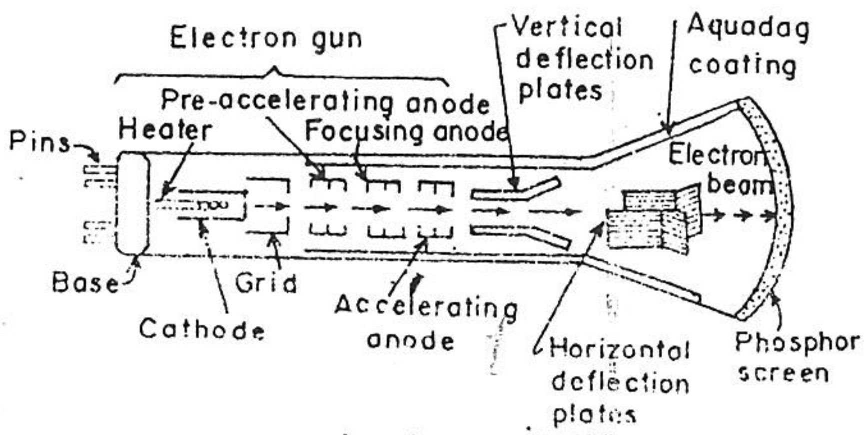
APPENDIX

CATHODE RAY OSCILLOSCOPE (C. R. O)

CRO is an universal measuring device. It is capable of showing (simultaneously) if necessary) the magnitude, form, phase and frequency of a wave and its relation to other qualities. The block diagram of a simple CRO is shown in figure.

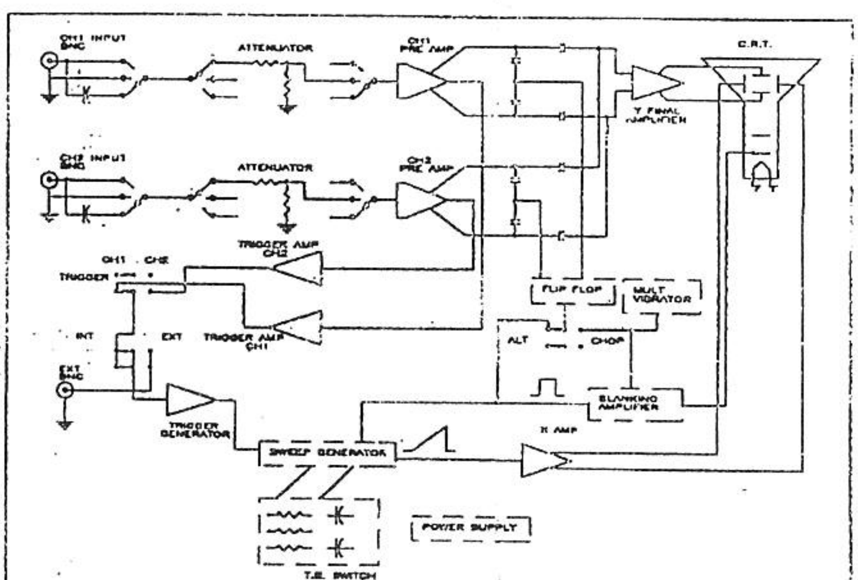
It consists of a cathode-ray tube (CRT), a vertical deflection amplifier (Y-amp), time base circuit(X –amplifier), a H.T. and a L.T. Power units. The time base circuit generates a saw-tooth wave that is applied on X-amplifier and it helps in displaying the wave shape of the voltage connected across Y plate.

CRO is basically a voltage measuring device. So electrical (except voltages) and non-electrical quantities that are going to be measured by a CRO must be converted into a proportional voltage quantity first. Readings obtained from CRO is then properly scaled to get the actual



Values.

Internal structure of a CRT.



Circuit Block Diagram