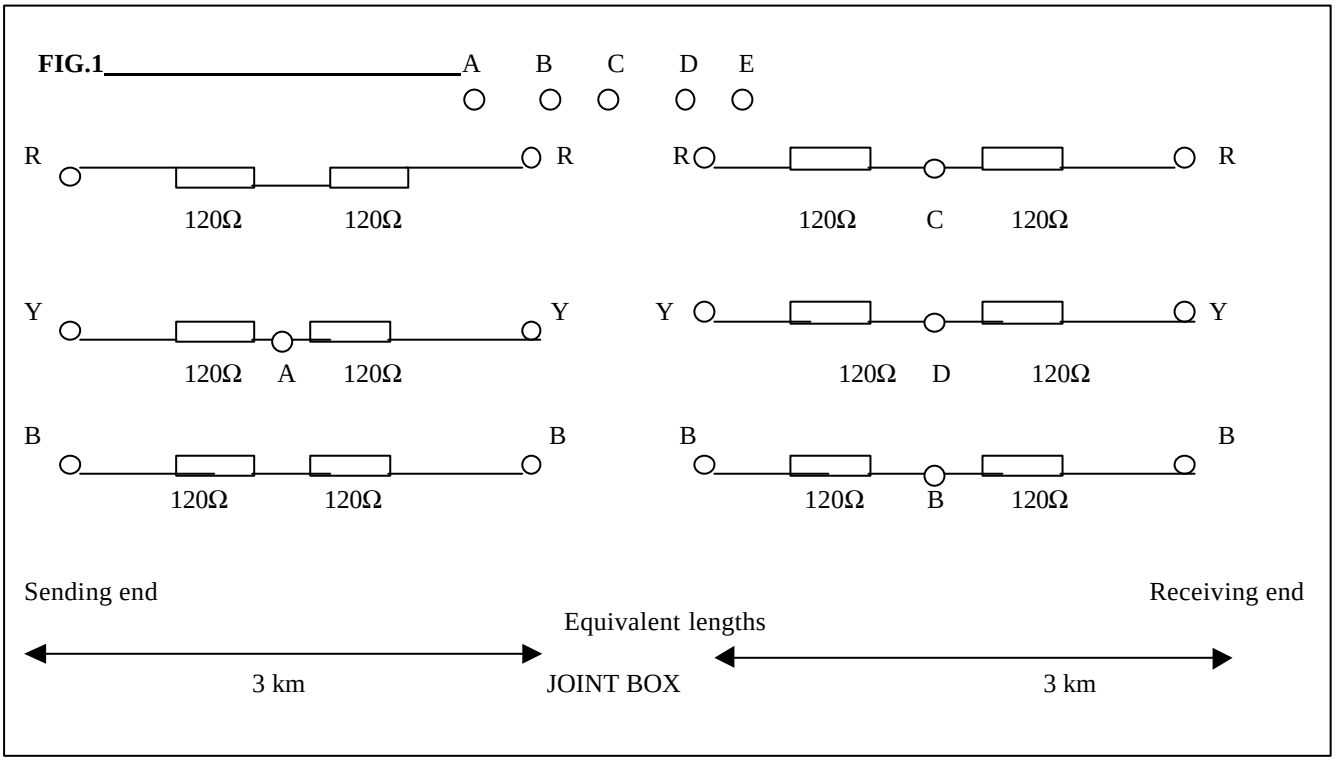
CABLE TESTING-Fault location

OBJECT:

To determine the type & position of various faults on a model 3-core distribution cable

APPARATUS:

A Wheatstone bridge
An Ohmmeter
10.8 Ohm rheostat
6-km cable located in laboratory bench
(The circuit for this is shown in Fig. 1.It contains four 120-ohm resistors for each phase as shown in the Figure. Each 120-ohm resistor represents 1.5 km of the cable length)
20 V DC Power Supply



THEORY:

When fault finding, an engineer would have access to the terminals at the sending and receiving ends of a cable. He may also have access to a joint box where two sections of each phase could be separated. A measuring bridge could therefore be connected at any set of 3 phase terminals but could not be connected at intermediate points between the terminal sites and the joint box.

Wheatstone Bridge

The bridge comprises three pairs of accurately adjusted non-inductive ratio arms and a four-decade variable resistance for balancing purposes.
A sensitive galvanometer is incorporated which is protected by diodes against accidental overloads and a variable sensitivity switch in series with the galvanometer is also fitted.

Range of measurement: 0 to 1.111 Megs

It can be shown that the bridge equation is

R1/R2 = Rx/R3

Where R1 and R2 are the "ratio arms"
R3 is the 4-dial variable resistance
Rx is the unknown resistance.

A DC supply of 2 Volts in series with a protective resistor of 10.8 ohms is required for the bridge.

A null balance is obtained by adjustment of the four-decade variable R3 and observing the movement of the detector.

The detector only works when the press switch is depressed, and turning the sensitivity control clockwise may increase the sensitivity of the galvanometer.

Table of setting for various ranges of Rx

Rx ohms	R1 ohm	R2 ohm
100 K to 1 Meg	1000	10
10K to 100K	1000	100
1K to 10 K	1000	1000
100 to 1K	100	1000
10 to 100	10	1000
1 to 10	10	1000
0.1 to 1	10	1000

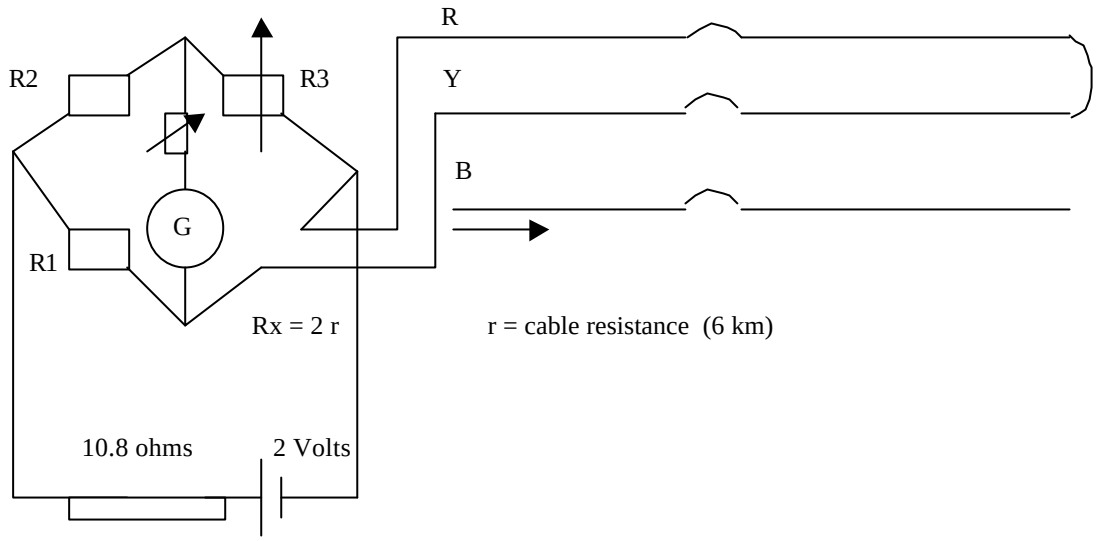
If necessary, the bridge may be supplied from an Ac source and used with an oscilloscope as a detector.

Procedure:

Use the ohmmeter to check the continuity and phase connections. Prepare a table to receive your results and your comments on the type of fault for each test.

Test 1
Use the Wheatstone bridge to find the resistance of each conductor and thus the resistance per meter run of he cable. FIG.2

FIG.2



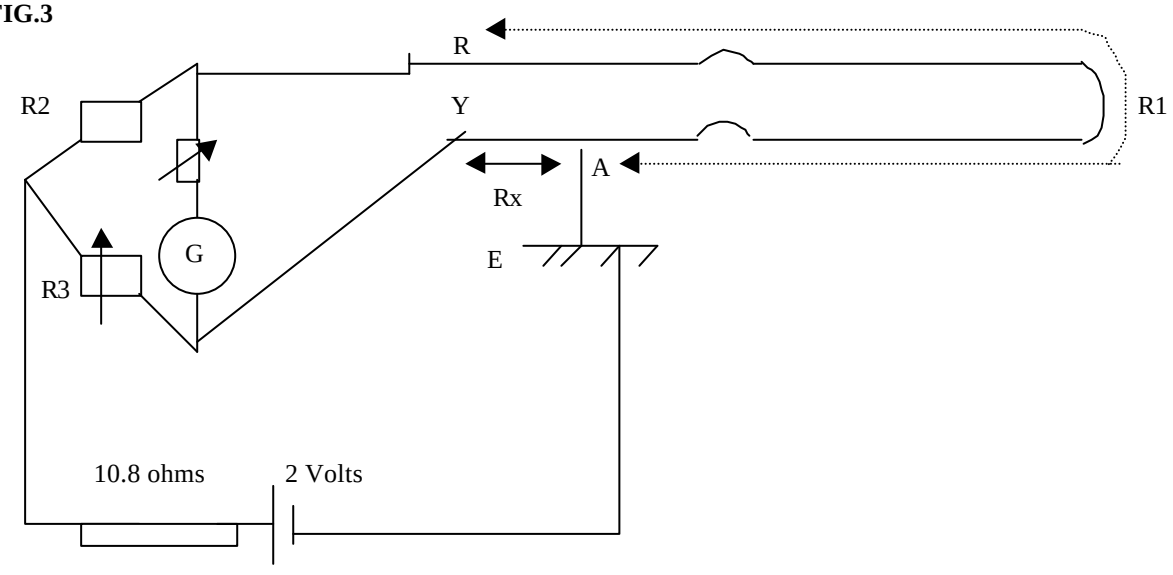
The galvanometer resistance should be anti-clockwise at the beginning of each test Why? Set the supply voltage to 2 V. What is the purpose of the 10.8-ohm rheostat?

Test 2 Single-line to ground fault

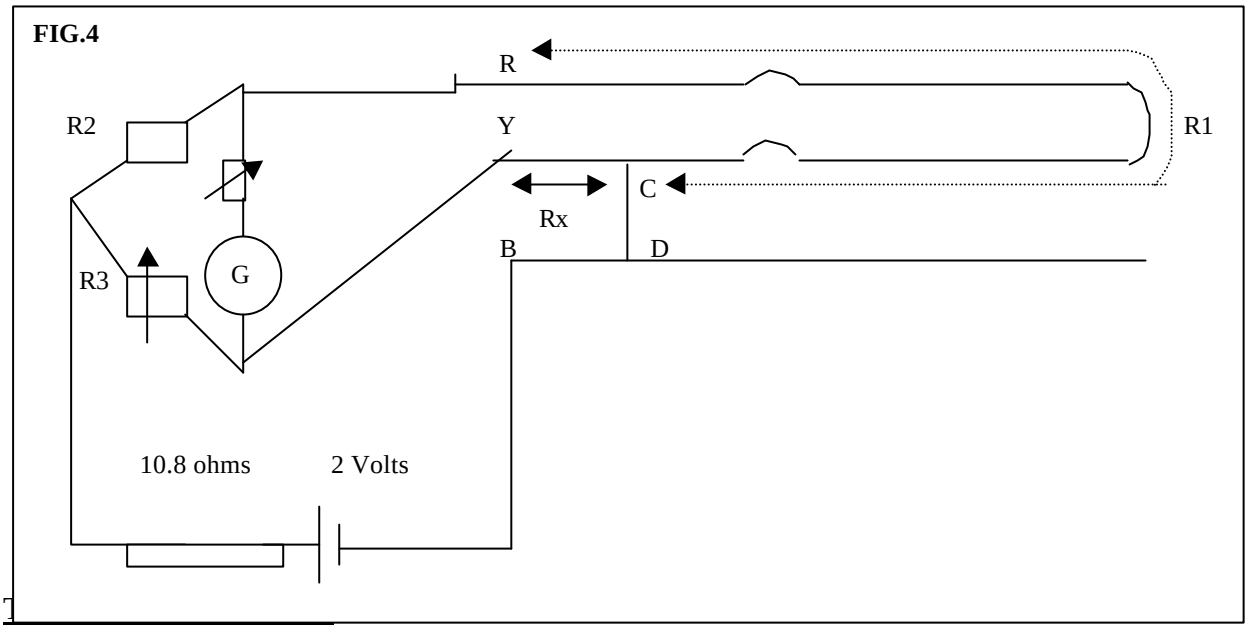
1. Join terminal A to E. Check each phase for ground and between ohase for a short. Which phase has a fault? What is the type of fault?
2. Find the resistance from the sending end to the fault. FIG.3. Use the resistance per meter, r to find the distance to the fault.
3. Connect B to E with the fault resistance and check the type of fault.

R2/R3 = R1/Rx
(R2+R3)/R3 = (R1+Rx)/Rx = 2r/Rx
Therefore, Rx = 2r R3/(R2+R3)

FIG.3



Join C to D with the fault resistor. Identify the faulty phases and establish the type of fault. Find the distance to the fault. FIG.4



For a line to line fault in phases Y & B,

Rx = 2r.R3/(R2+R3).

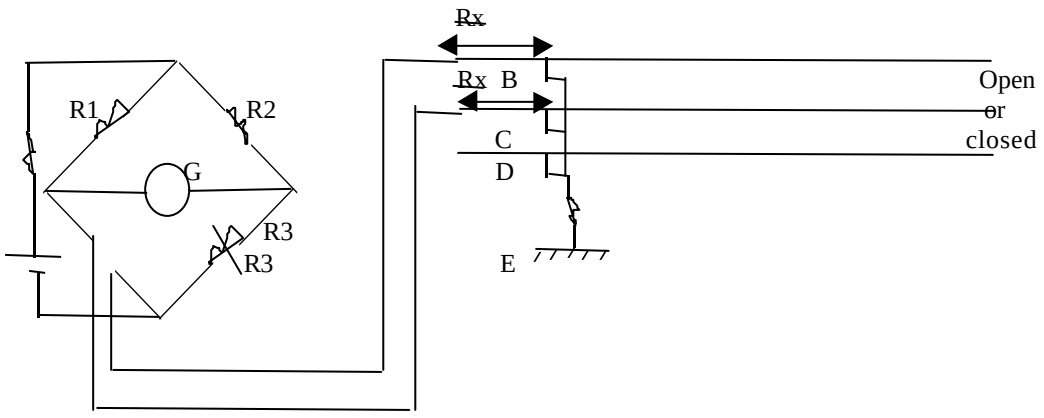
For a line to line fault in phases R & Y, the circuit of FIG.4 should be appropriately changed, and then

Rx = 2.r. R2/(R2+R3)

Test 4 Three-phase fault

Link C, D and B. Identify the faulty phases and establish the type of fault. Find the location of the fault. FIG.5. $\frac{2Rx}{R3} = \frac{R1}{R2}$

FIG.5



Show details of the calculation for each test and atable of results. Show the position of all the faults A,B,C and D on Fig.1