



# **SNS COLLEGE OF TECHNOLOGY**

**Coimbatore-35**  
**An Autonomous Institution**



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **OPTICAL AND MICROWAVE ENGINEERING**

III YEAR/ VI SEMESTER  
1

#### **UNIT 3 – MICROWAVE MEASUREMENTS**

**TOPIC– IMPEDANCE MEASUREMENT**

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# Impedance Measurement



Apart from Magic Tee, we have two different methods, one is using the slotted line and the other is using the reflectometer.

## Impedance Using the Slotted Line

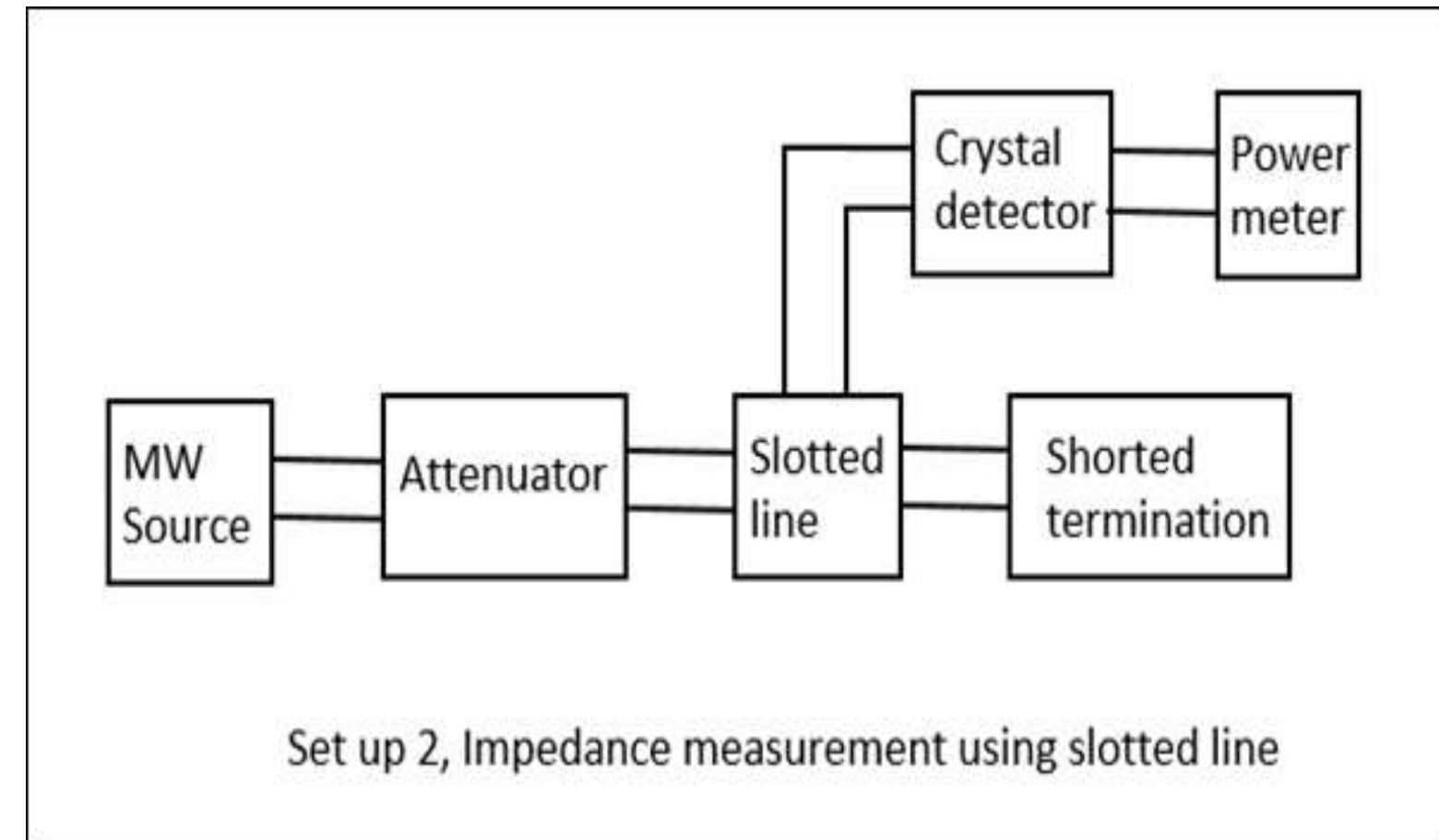
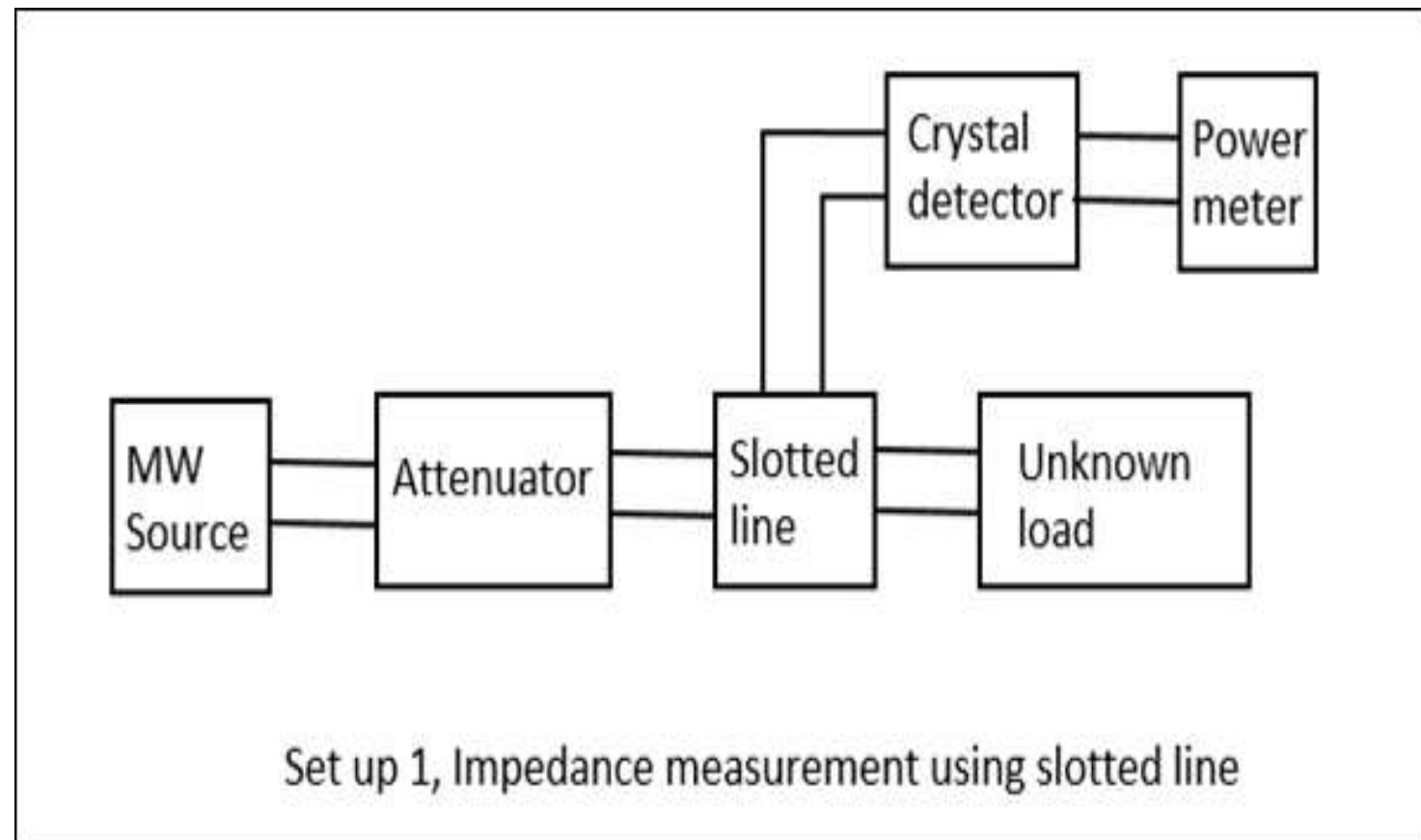
In this method, impedance is measured using slotted line and load  $Z_L$  and by using this,  $V_{max}$  and  $V_{min}$  can be determined. In this method, the measurement of impedance takes place in two steps.

**Step 1** – Determining  $V_{min}$  using load  $Z_L$

**Step 2** – Determining  $V_{min}$  by short circuiting the load.



# Impedance Measurement



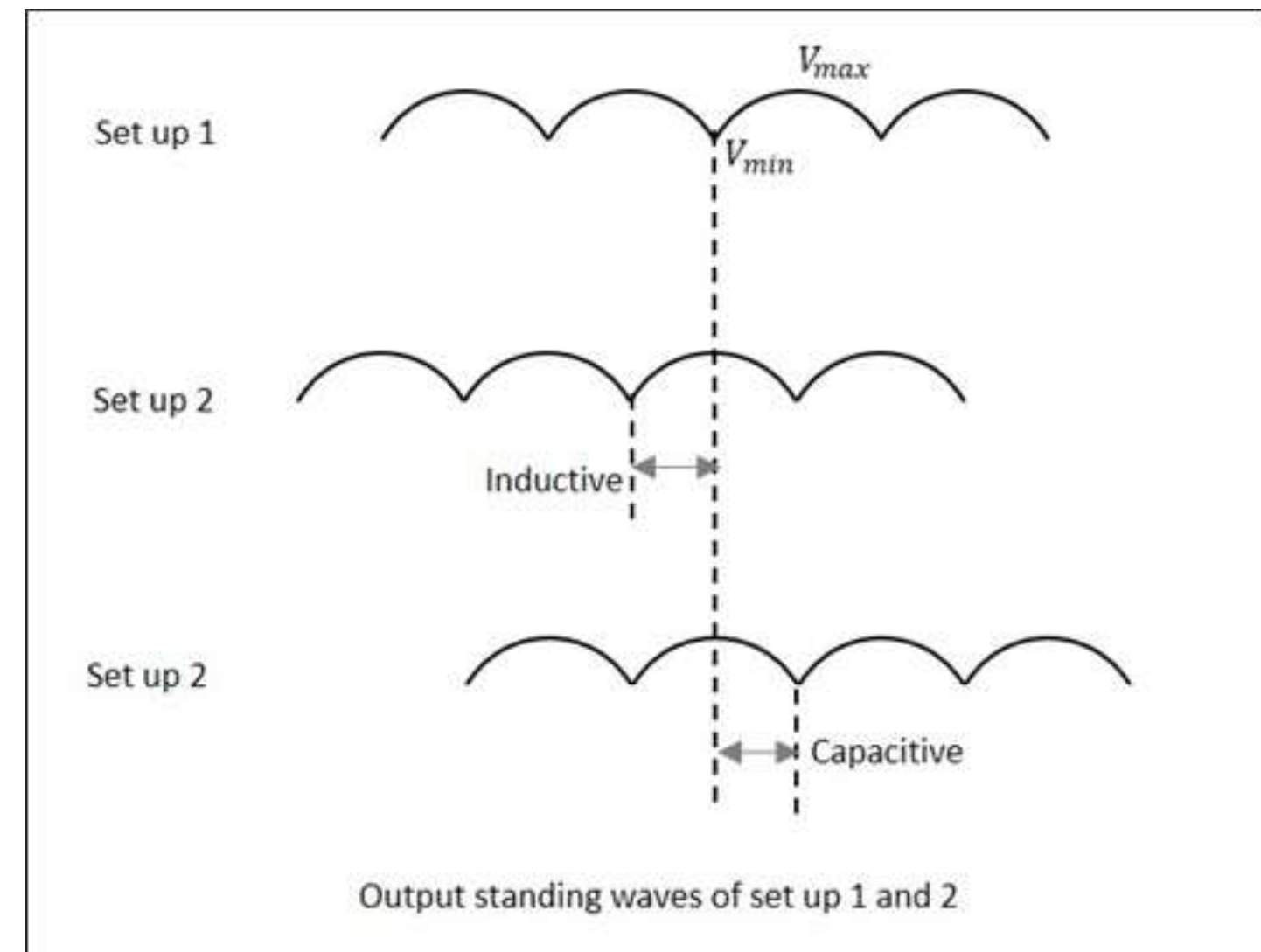


## Impedance Measurement



When we try to obtain the values of  $V_{max}$  and  $V_{min}$  using a load, we get certain values. However, if the same is done by short circuiting the load, the minimum gets shifted, either to the right or to the left. If this shift is to the left, it means that the load is inductive and if it the shift is to the right, it means that the load is capacitive in nature.

By recording the data, an unknown impedance is calculated. The impedance and reflection coefficient  $\rho$  can be obtained in both magnitude and phase.





# Impedance Measurement



## Impedance Using the Reflectometer

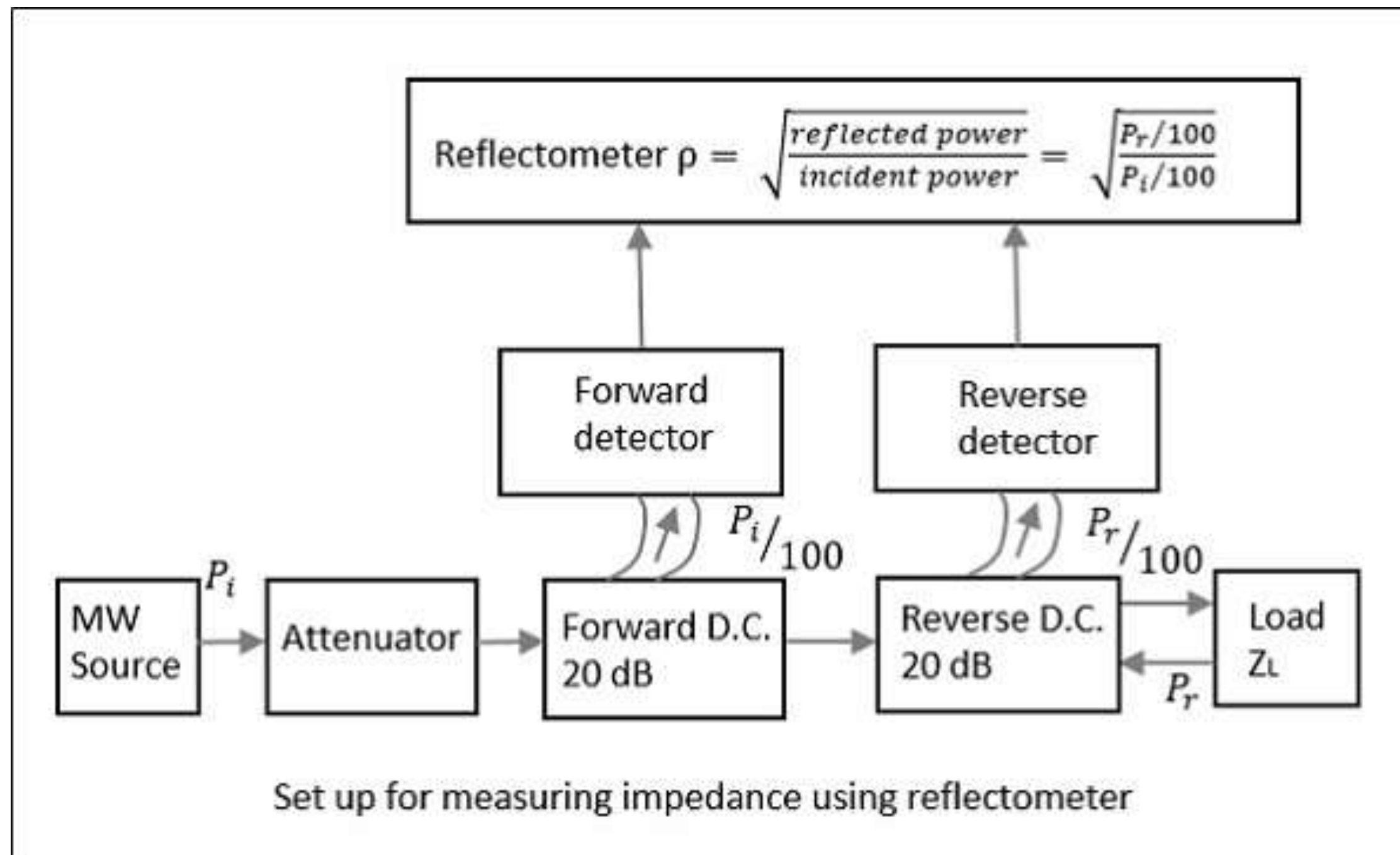
Unlike slotted line, the Reflectometer helps to find only the magnitude of impedance and not the phase angle. In this method, two directional couplers which are identical but differs in direction are taken.

These two couplers are used in sampling the incident power  $P_i$  and reflected power  $P_r$  from the load. The reflectometer is connected as shown in the following figure. It is used to obtain the magnitude of reflection coefficient  $\rho$ , from which the impedance can be obtained.





# Impedance Measurement-Reflectometer





# Impedance Measurement-Reflectometer



From the reflectometer reading, we have

$$\rho = \sqrt{\frac{P_r}{P_i}}$$

From the value of  $\rho$ , the  $VSWR$ , i.e.  $S$  and the impedance can be calculated by

$$S = \frac{1 + \rho}{1 - \rho} \quad \text{and} \quad \frac{z - z_g}{z + z_g} = \rho$$

Where,  $z_g$  is known wave impedance and  $z$  is unknown impedance.

Though the forward and reverse wave parameters are observed here, there will be no interference due to the directional property of the couplers. The attenuator helps in maintaining low input power.



**THANK YOU**