

4.3 Synthesis of various relays using Static comparators:

4.3.1 Static over current relays

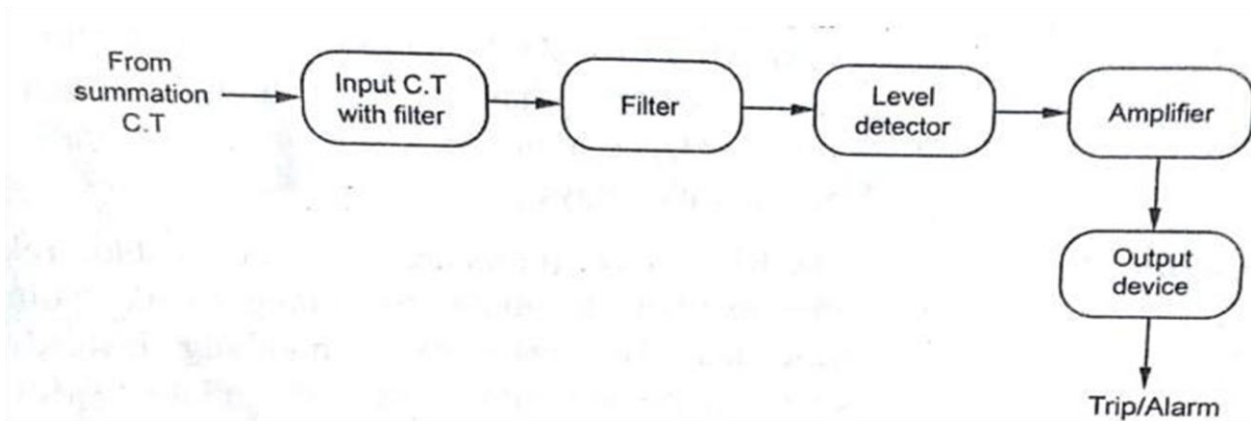


Figure 4.3.1 Block diagram of static over current relays

[Source: "Power System Protection and Switchgear" by B.Rabindranath and N.Chander, Page: 416]

- The output of this summation C.T is fed to an auxiliary C.T. whose output is rectified, smoothed and applied to the measuring unit called level detector.
- When the input current to the level detector is less than the threshold value or set value, the output of the level detector is zero.

For the over current relay,

If $I_{in} < I_{threshold}$, $I_{out} = 0$

If $I_{in} \geq I_{threshold}$, $I_{out} = \text{positive quantity}$

- The output of the level detector is output device to cause trip/alarm.

4.3.2 Directional Static over current relay

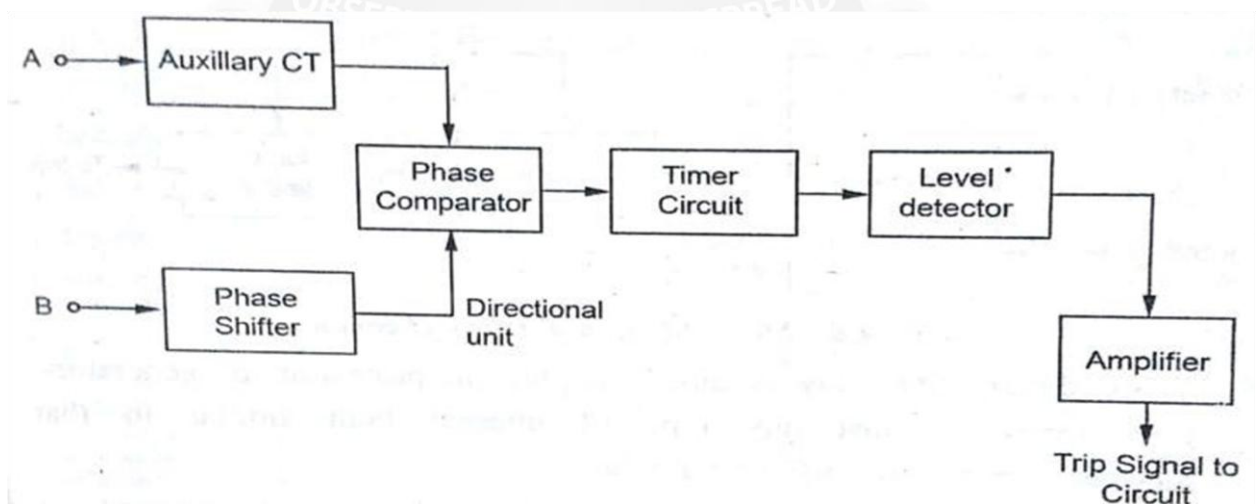


Figure 4.3.2 Block diagram of directional static over current relay

[Source: "Power System Protection and Switchgear" by B.Rabindranath and N.Chander, Page:417]

- The directional relay is nothing but a differential power relay which operates the power in the circuit flows in a particular direction. Thus it requires sensing the system voltage as well as the system current.
- The input A is proportional to the system current supplied to a directional unit through auxiliary transformer.
- The input B is proportional to the system voltage, supplied to a directional unit through phase shifter.
- The phase comparator compares the phase angle between the two points.
- The phase comparator is generally two types
 - (i) Hall effect generator which is popularly used in Russian countries.
 - (ii) Rectifier bridge type comparator used in India.

4.3.3 Static differential relay

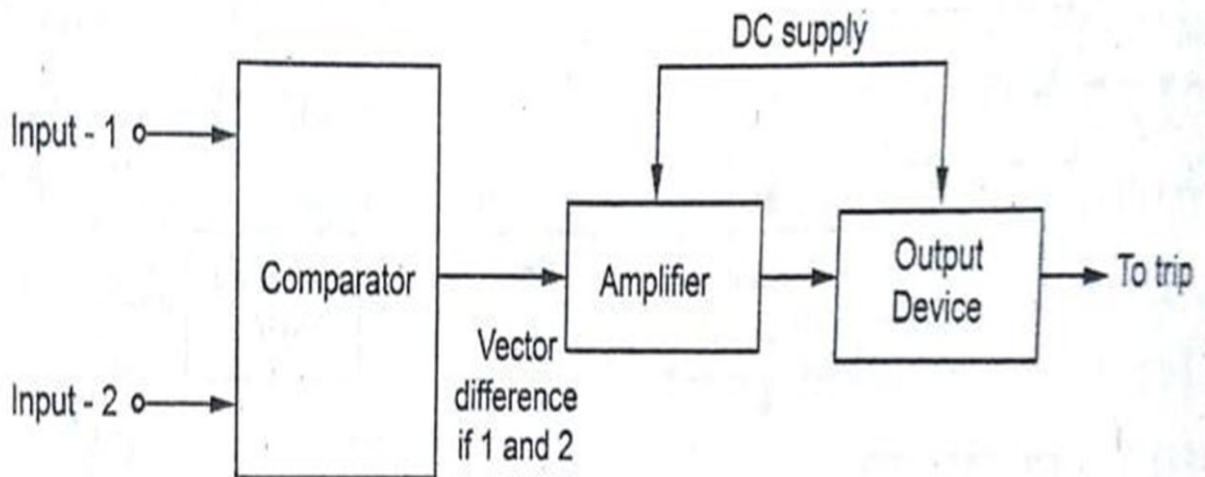


Figure 4.3.3 Block diagram of static differential relay

[Source: "Power System Protection and Switchgear" by B.Rabindranath and N.Chander, Page: 419]

- In this relay the two similar input quantities (I or V) are compared. The comparator is usually a bridge rectifier. The differential relay measures the vector difference between the two similar electrical quantities say V or I.

- Static differential relay is mostly applied in protection of generators and transformers against any type of internal fault similar to that of electromagnetic type differential relay.
- It is very compact, highly sensitive, high stability, low power Consumption lower VA burden.

4.3.4 Static distance relay

- In the distance relay, the operation is dependent on the ratio of the voltage and current, which is expressed in terms of impedance. The relay operates when the ratio of V/I i.e., impedance is less than the pre determined value.

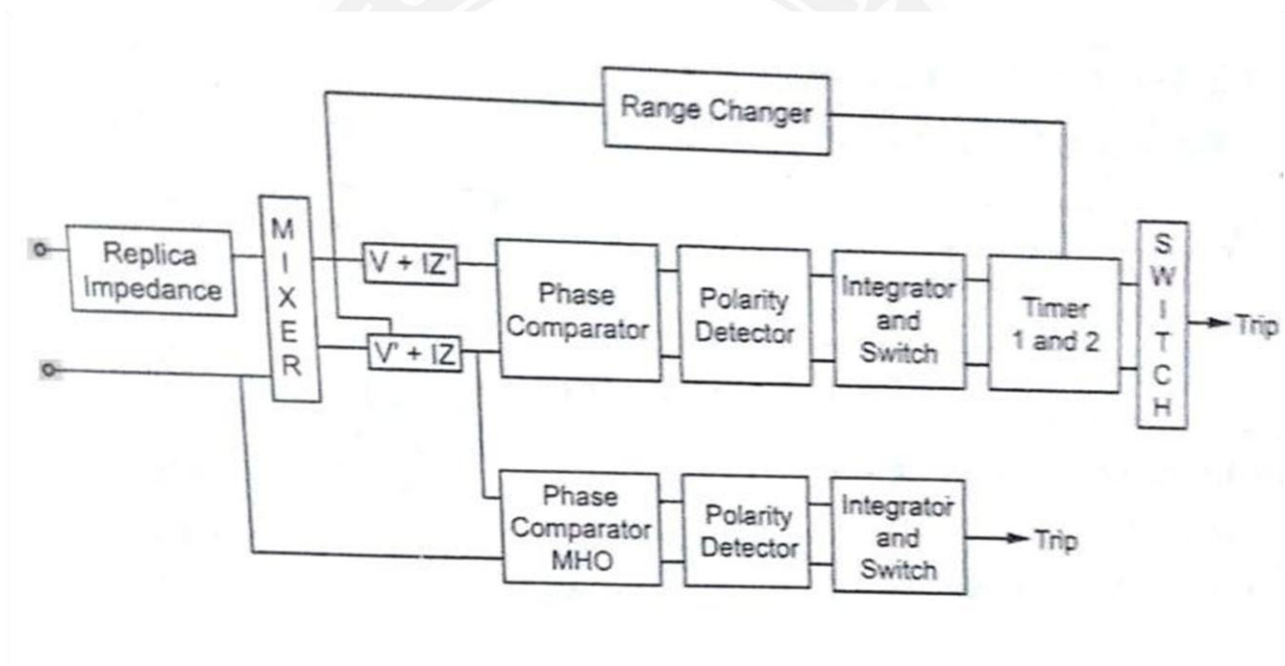


Figure 4.3.4 Block diagram of static distance relay

[Source: "Power System Protection and Switchgear" by B.Rabindranath and N.Chander, Page: 420]

- The measurement of impedance, reactance, and admittance are done by comparison of input current and voltage. In static comparators the two input quantities are either V or I .
- Current is converted to equivalent voltage by producing a voltage drop in impedance within the relay.
- This voltage drop is then compared with the other voltage.

- The output from the comparator is fed into a polarity detector where, when the input currents to the comparator are 90 apart, the output device will be turned on for +90 and turned -90 and hence the output wave will be a square wave with equal space ratios.
- Static distance relay are used extremely for protection of medium and long transmission lines, parallel feeders and unit back up protections as well as interconnected lines.

