

Background:

Neutral resistance failure relay became necessary with the advent of restricted neutral earth system. In this system neutral is grounded through a resistance to restrict the ground fault current to 750 mA. At present this is the standard and may change in future. This new system is being adopted because it is inherently safer than grounded neutral system for both human being and machines. Though the necessity was felt some time back the then prevalent electromechanical system did not have the required level of sensitivity to operate at lower leakage currents. Leakage current trip level of 80mA and less are common in this system for effective protection.

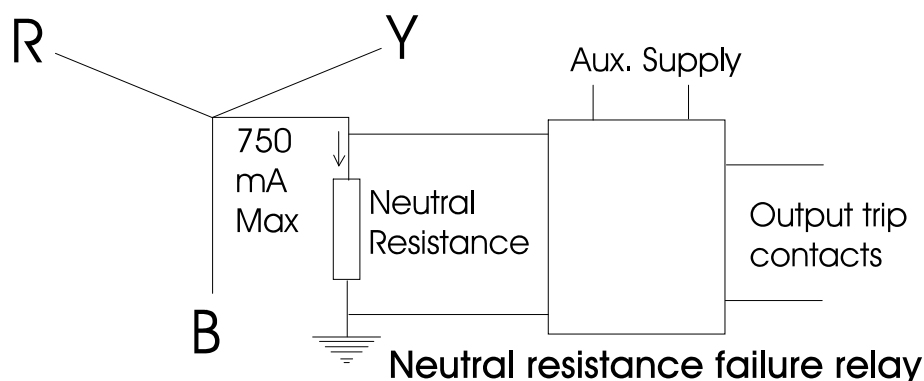
Today's electronic earth leakage relays do not have this limitation. Design and material of Core Balance Current Transformers (CBCT) have undergone vast change for reliable sensing of mA level earth leakage current.

Necessity:

As the heart of this system lies in the grounding element between neutral and earth, protection of that element is vitally necessary for running of the system. As inductors which will restrict the ground current to 750 mA is both bulky and costly. Resistors are used as substitute with very little sacrifice of quality. At the same time necessity of protecting the resistor arise as they much more prone to failure than inductors. Hence arises the necessity of "Neutral Resistance Protection Relay".

Operating Principle:

A fluctuating amount of current always flows through the neutral resistance if the line is active. A current of different nature which is clearly distinguishable from 50 Hz. A.C. is sent through the neutral resistance and value of the resistance measured. This signal may be pulse width modulated, pulse position modulated pulse code modulated. DC current of high frequency AC signal magnitude of this signal is very low and put to the system a power which is much below the intrinsic safe level of the system. The signal thus obtained is processed and sent through amplifier comparator and time delay stages before actuating a relay which handles the tripping device of the respective switchgear. Shown below is the basic skeleton of the system.

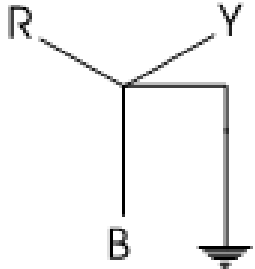
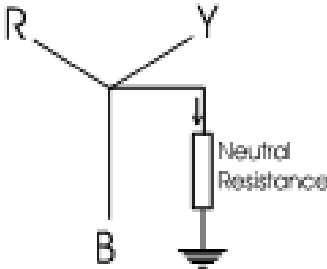
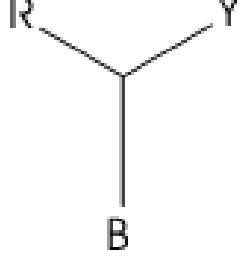


INTRODUCTION:

Earth leakage relay is one of the most fundamental protective devices in switchgears. It is required for safety of both man and machines. As safety factor is basically dependent on grounding of the distribution system the same thing become hazardous when line develops a fault or leakage to ground. Primarily grounding of the star connected secondary is done at the substation or output of trans-switches of UTS. Hence whenever a leakage is developed from line to earth either the leaking cable or devices are in danger of catching fire the leaking current passing through ground-neutral path. Sensing of this current through a suitable means becomes the cornerstone of design of earth leakage of earth fault relay to interrupt the line for protection.

SYSTEMS:

There are three different system relating the power line to earth.

 <p style="text-align: center;">Grounded Neutral</p> <p>In this system neutral of the distribution line is solidly grounded. In case of an earth fault current may rise to a very high value limited only by the impedance of the system.</p>	 <p style="text-align: center;">Restricted Neutral</p> <p>In this system neutral is grounded through a reactor or resistor to restrict the ground current to 750 mA.</p>	 <p style="text-align: center;">Isolated Neutral</p> <p>In this system neutral is isolated from ground. No current is flow when one phase is earthed.</p>
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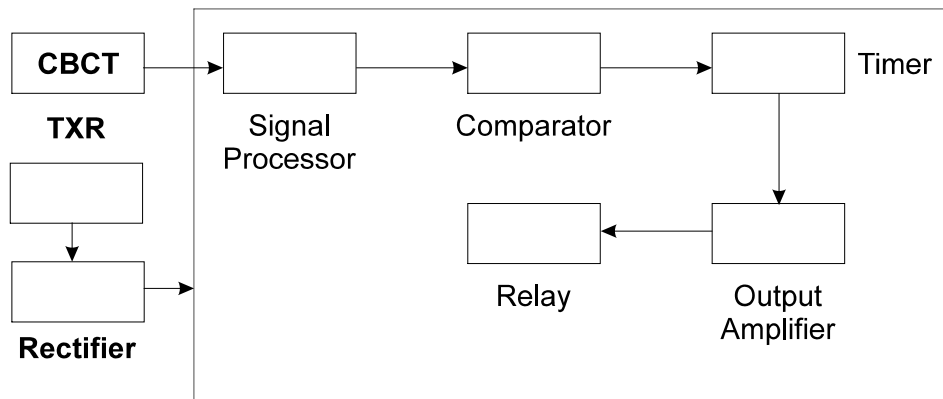
It is obvious that less the system is grounded safe it becomes. Previously electromagnetic systems were in use in earth leakage relays. These relays had limited sensitivity and only higher earth leakage current could be sensed. The system was accordingly grounded neutral one. As electronic circuit were gradually incorporated sensitivity increased greatly. It becomes possible to incorporate restricted neutral system. Isolated neutral system is not in common use up till now. But it has been used in limited scale in industry and also in Long wall mines.



OPERATING PRINCIPLE:

Leakage or fault current is sensed normally by Core Balance Current Transformer (CBCT), or by measuring neutral voltage if neutral resistance terminals are available. This zero-sequence current is then processed and compared with a reference voltage. The comparator output is send through a time delay circuit to prevent nonsense operation. The output of the time circuit operates a relay whose contacts are used to actuate a trip device to interrupt the line. Visual or audio-visual indication is provided as necessary.

For grounded neutral system sensing of earth leakage/ fault current through CBCT is almost universal.



Schematic diagram of Earth Leakage Relay

OTHER FEATURES:

TEST AND RESET FACILITY: This facility is provided to enable the user to check the condition of the relay. A test winding is providing on the CBCT through which a current signal is injected. This simulates the total condition of the relay and the relay operates.

OUTPUT LATCH: This facility when provided maintains the output state of the relay irrespective of power supply and is not automatically reset in case of absence of power.

AUDIO VISULA ALARM: This facility alerts the user in case of leakage/ fault even if attention is not paid.

