

EARTH LOOP VOLTAGE DETECTOR WITH BREAKER

From day one, electric power used to assist human to do his day to day work and keep his life more enjoyable. By the invention of electric lights, fans, kitchen equipments like mixer, grinder, toaster, hot plate, blender etc. In addition to this house hold essentials like washing machine, water heaters found its way to the homes of all. However, the associated electric shock while using the appliances were also started increasing.

Early days electricity was distributed with two wire (Phase and Neutral), with a fuse to protect the installation. This arrangement was protecting the over load on load side and not the fatal electric shock that causes death to the user and also to the people coming in accidental contact with the defective home appliances.

To prevent electric shock to the user various methods of safety procedure were tried. The most and even now used by electrical utility is the Protective Multiple Earthing (PME) in our Low Voltage & Minimum Voltage Distribution system. To achieve this all the appliances manufacturers were forced to have 3 wires input to their product/appliances.

Even though the idea was good, in practice the desired results were not achieved.

As the protection to be effective, the earthing at consumer end should be perfect and the earth resistance should not be more than 5 ohms.

This is never achieved in most of the places, due to soil condition (elaborate engineering design is required to achieve the desired result). Moreover, the earth pit has to be maintained once in a year without fail. The earth connection and earth resistance are to be measured at frequent intervals, which needs qualified engineer with proper equipment and associated cost. Hence, none of the domestic users ever maintained the earth connection and hence met with fatal electric shock even after this Protective Multiple Earthing was insisted by the supplier of energy (It is not out place to mention that, even small and medium scale industries, where inspection by the Statutory Electrical Inspector is done over a specified period under Indian Electricity Supply Act, the earth pits were rarely maintained).

In addition, the earth wire that run inside the building shall also be continuous in all room and up to earth point. These two conditions are very rarely satisfied in home and the people used to get electric shock.

Thus to have protection form electric shock with PME, the house should have good earth connection and rated fuse link according to the load at the input.

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Then in 1980's the industry invented another system called Earth Leakage Circuit Breaker (ELCB) to protect the user. The principle of the ELCB, is that in the event of an earth fault, some of the current which normally flows through the live feeder and returns through the neutral, leaks to earth. Consequently, there exists an imbalance between the respective live (or phase) and neutral currents. The imbalance is detected and, if it exceeds a predetermined threshold level, a relay is energized which interrupts the electrical supply voltage fed to the live and neutral feeders.

The value of ELCBs is particularly manifest when protecting against earth leakage in an appliance having an electrically conductive housing which is connected to ground. In such case, if a fault occurs in the appliance whereby the casing becomes live, then the earth leakage current flows to ground and immediately operates the ELCB. However, if the ground connection is faulty such that there is no leakage path for current to flow in the event that the casing becomes live, then the ELCB will not become energized until somebody touches the electrically conductive housing and thereby provides a leakage path to ground. In such case, the leakage current passes through the person giving rise to the required imbalance between the live and neutral feeder currents which causes the ELCB to operate. Under these circumstances, whilst the ELCB will still operate, there is an inevitable earth leakage through the person who touches the appliance.

The ELCB must be so adjusted that the leakage current which occurs in such circumstances is not fatal. However, what constitutes a "fatal" leakage current varies from one person to another. Moreover, the leakage current which will actually flow through a person consequent to the casing of an electrical appliance becoming "live" is a function of the person's body resistance. People whose skin is apt to be moist (mothers and children, for example) have a much lower skin resistance than building site personnel, for example, whose skin tends to be dry and callose. A leakage current which might give the latter a slight shock might nevertheless prove fatal for the former. Furthermore, the magnitude of leakage current which could be fatal for a youngster is so low that to adjust the ELCB so as to be effective against such a small leakage current would, in practice, result in false alarms and unnecessary tripping of the ELCB.

There is, in fact, no perfect solution to this problem. The best that can be done is to adjust the ELCB to operate at an "average" leakage current, typically in the order of 30mA, mindful of the fact that such a current can indeed be fatal for a segment of the population. When it is further borne in mind that, if the ground connection of an appliance is absent or faulty then a leakage current will generally find a return path to ground through a person who inadvertently touches an appliance's metal casing, it is apparent that, in some cases at least, ELCBs give an apparent, but not altogether justified, impression of safety.

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All these deficiencies in protection, made the safety engineers to develop a system of protection without the need of earthing system. That means a protecting system that operates both under earthed and unearthed electrical distribution systems. This system of protection, the potential difference between the neutral feeder and the electrically conductive body / housing of appliance which is connected to the power input of the appliance by means of 3 Pin connection (earth wire).

With the advent of electronics and its development, lots of new components were developed that are used in industrial electronics to control power. These components can sense voltage at very low levels and amplify the same to operate other circuits accurately. These components are now used to protect human from electric shock by sensing the Earth Loop Voltage. The product, invented, has been named as Earth Loop Voltage Detector (ELVD) with circuit breaker without the need of earth connection.

This device does not depend on the goodness of earth connection with the appliances as in the case of three wire systems. Infact, ELVD can be used even when two wire system of power and distribution is functional. This device now manufactured and marketed as ELVD has the following unique advantage over the existing ELCB.

HOW THE ELVD IS THE SAFEST WAY TO PROTECT YOUR LIFE:

- An intelligent sensor in the ELVD senses and compares the voltage of the neutral and the earth terminals (Body) of the appliance.
- If the voltage level or fault signal exceeds 75V a positive signal is sent to the circuit breaker to cut the power only to the faulty appliance. All other lights and electrical appliances in the home continue to function normally.
- All that needs to be done to restore power to the appliance is to restart it after rectifying the fault in the appliance

Foolproof system: Until the fault has been fixed, ELVD will not allow the appliance to be powered.

SPECIAL FEATURES:

1. Even if ground neutral loop resistance is high or open and consequent voltage rise happens between the neutral and body of appliance, the ELVD disconnects the appliances from power supply, when the appliance is faulty.
2. Instantaneous operation i.e. Disconnects appliance in less than 10 milli seconds.
3. No separate d.c power source.
4. No maintenance.