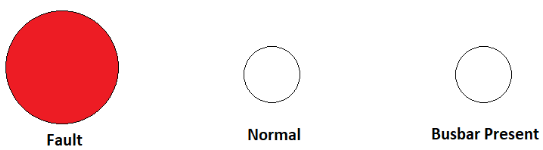
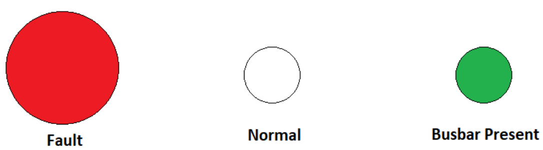
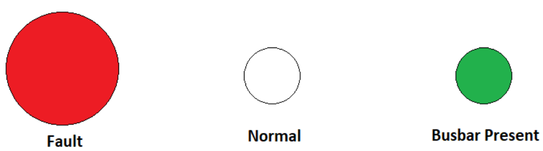
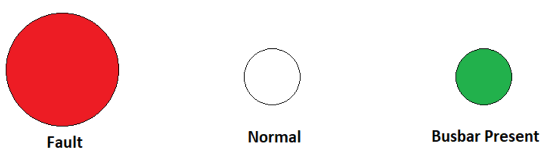
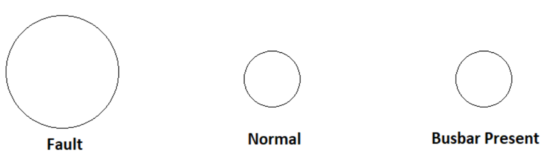
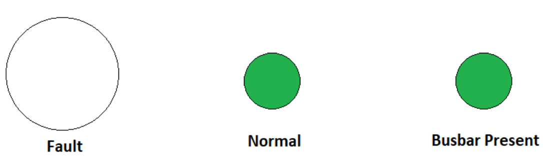
Reliance Electricals

RDSO/SPN/256/2002 Earth Leakage Detector: Fault Finding with Indication On Channel Cards

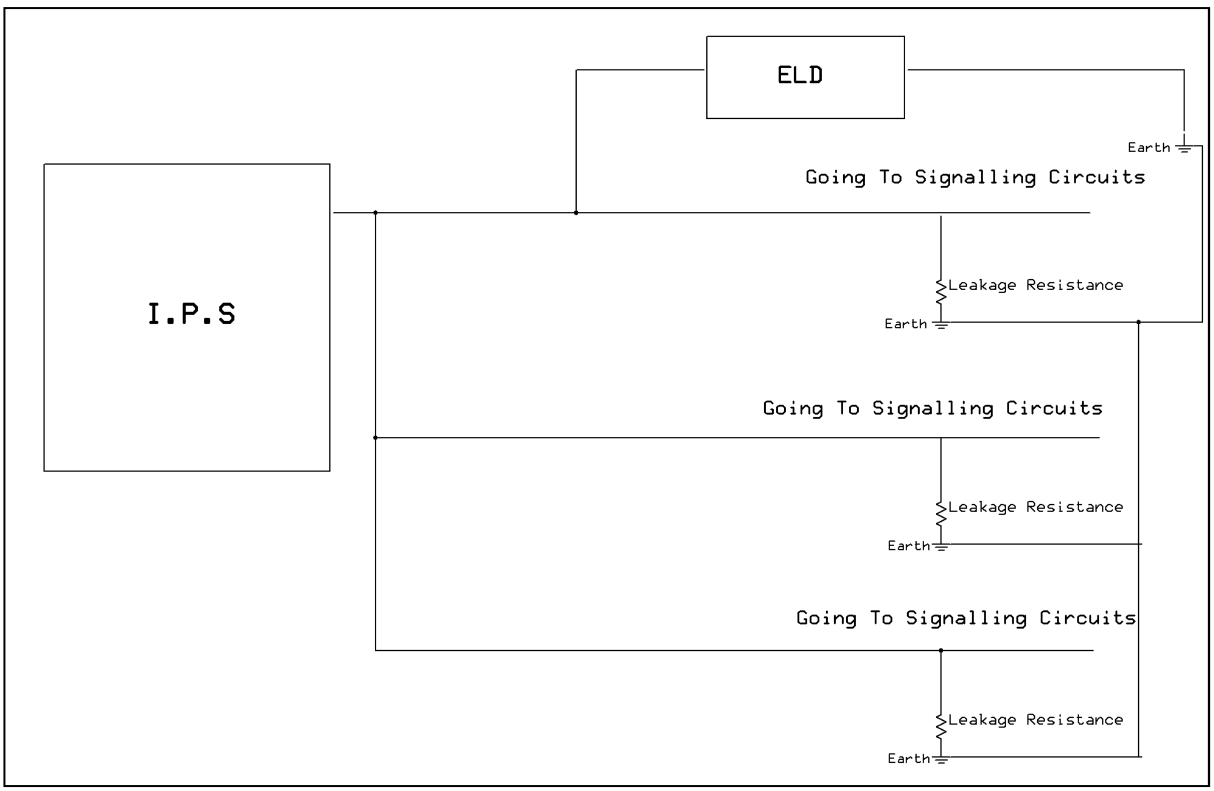
Visual Representation of Channel CARD LED indications	Status of LED indications & Display Readings	Probable cause of the fault	How to find/solve the problem
	Fault LED – ON Normal LED – OFF Busbar LED – OFF	Busbar is not connected properly	Check if the Busbar is connected properly to the unit & is getting proper voltage. For DC ELD, also check the polarity of the Busbar.
	Fault LED – ON Normal LED – OFF Busbar LED – ON LCD Display Reading – Normal, more than 2K Ohms	Earth Open Fault	Loop E1 (Earth1) & E2 (Earth2) terminals on the channel card. If the fault disappears on Reset, then it is confirmed as Earth Fault. Check the wiring of E1 & E2.
	Fault LED – ON Normal LED – OFF Busbar LED – ON LCD Display Reading – Normal; More than 2K Ohms	Alarm Setting too high	If the Alarm setting is less than the Leakage resistance, the unit will be in fault condition. Reduce the alarm setting to a value lesser than the display reading to solve the problem.
	Fault LED – ON Normal LED – OFF Busbar LED – ON LCD Display Reading – Fluctuating	Mixing in Supply	Check the supplies attached to the channel cards via a TEST LAMP. If there mixing in supplies, unit will not work. Attach only ONE of the mixed supplies & remove the rest.
	Fault LED – OFF Normal LED – OFF Busbar LED – OFF LCD Display Reading – OFF	No Supply / Channel Card Switched OFF	Check the Power Supply to the unit & the channel cards. If all is correct, check if the Channel ON/OFF switch behind each of the channels is in ON position.
	Fault LED – OFF Normal LED – ON Busbar LED – ON LCD Display Reading – Backlight ON but no Readings	Wiring problem of Power Supply	Check if the connections of Power supply of the units are correctly made. If 110V supply is used, it has to be connected in 110V terminal ONLY. Check the same if 230V supply is used. Also, try to RESET the unit when required.

Isolating Earth Faults with ELD

Earth Leakage Detector measures the insulation resistance of a non-earthed AC & DC **networks in online condition**.

The insulation of a signaling system withrespect to Earth	=	Insulation of Power Supply	+	Insulation of Control circuits	+	Insulation of Cables	+	Insulation of loads (allin parallel).

Therefore, it is crucial to note that Earth Leakage Detector does not only measure the leakageof the cables, but of **the entire network**.



All conductors of the same supply are in parallel with each other from the point of view of ELD formeasuring Leakage Resistance

Example 1 -

Suppose, Network A has only 2 cable pairs with Insulation Resistance R1 & R2 respectively.
Then the total Leakage Resistance displayed on the ELD will be –
1/R = 1/R1 + 1/R2 (Because all cables are in parallel with each other)
Let us suppose that the conductors are in good condition. In such cases, their insulationresistance will around 8MΩ.
Therefore, the Leakage Resistance displayed on the ELD will be –
1/R=1/8M + 1/8M
R = 4MΩ

Example 2 -

Suppose, Network B has 20 cable pairs with Insulation Resistance R1, R2..R10 respectively.
Then the total Leakage Resistance displayed on the ELD will be –
1/R = 1/R1 + 1/R2 + 1/R3+ 1/R4 + ….. + 1/R20 (Because all cables are in parallel with each other).
Let us suppose that the conductors are in ideal condition without any damage. In such cases,their insulation resistance will around 10MΩ.
Therefore, the Leakage Resistance displayed on the ELD will be –
1/R=1/10M + 1/10M + ….. + 1/10M
R = 500KΩ

Note that in both the above cases, the conductors in Network B are in perfect condition, yet the Leakage Resistance is drastically less simply because of the additional number of conductors in Network B.

Just by looking at the readings, it can be mistakenly interpreted that health of Network A is better than Network B. However, it is clear that is not the case.

Example 3 –

Suppose, Network C has 5 cable pairs with Insulation Resistance R1, R2..R5 respectively.
Then the total Leakage Resistance displayed on the ELD will be –
1/R = 1/R1 + 1/R2 + 1/R3+ 1/R4 + 1/R5 (Because all cables are in parallel with each other) Let us suppose that all but one conductors are in ideal condition without any damage. In suchcases, their insulation resistance will around 10MΩ. However, one conductor (R3) hassuffered damage and it's insulation resistance is only 1KΩ
Therefore, the Leakage Resistance displayed on the ELD will be –
1/R=1/10M + 1/10M + 1/1K + 1/10M + 1/10M
R = 999.60Ω

Therefore, it is clear that if the insulation of even 1 cable pair is low, it will reduce the effective leakage resistance of the entire network.

To add to this, remember ELD measures the Leakage Resistance of the entire network. This includes the power supply & the loads (in parallel).

Example 4 –

Suppose, Network D has 3 cable pairs with Insulation Resistance R1, R2..R5 respectively.
The Insulation resistance of Power supply Rp. It is connected to a load with Insulationresistance RL.
Then the total Leakage Resistance displayed on the ELD will be –
1/R = 1/Rp + 1/R1 + 1/R2 + 1/R3+ 1/RL (Because all cables are in parallel with each other) Let us suppose that all but one conductor is in ideal condition without any damage. In suchcases, their insulation resistance will around 10MΩ. Let us suppose the power supply hasproper earthing and also has Insulation Resistance of 10MΩ, However, there is a problem atthe Load (RP) and it's insulation resistance is only 1KΩ
Therefore, the Leakage Resistance displayed on the ELD will be –
1/R=1/10M + 1/10M + 1/10M + 1/10M + 1/10M + 1/1K
R = 999.60Ω

With the above examples, it is clear that even of the health of all the cables are perfectly fine, if there is problem in the load, then effective resistance of the entire network comes down. Hence, while finding faults, it is essential to check the entire network & not just cables.

What further complicated matters is that not all conductors are in the circuit at the same time.

Example 5 (Intermittent faults) –

Suppose Network E has 5 cable pairs number 1,2,3,4 & 5 with Insulation Resistance R1, R2, R3, R4 & R5 respectively.
Cable Pairs 1-4 are in good health (their IR = 10MΩ). Conductor 5 has some damage it's IR is 1KΩ.
Assume that when the aspect is Green, Cable Pairs 1,2,3 & 4 are present in the circuit. In this case, Leakage Resistance displayed on the ELD will be –
1/R=1/10M + 1/10M + 1/10M + 1/10M
R = 4M Ω

Now, assume that the aspect changes to yellow, and in this case, Conductor No.5 is alsointroduced in the circuit for just few seconds.
Therefore, the Leakage Resistance displayed on the ELD will be –
1/R=1/10M + 1/10M + 1/10M + 1/10M + 1/10M + 1/1K
R = 999.60Ω

In the above case, the ELD will give an Alarm whenever conductor no.5 enters the circuit. If an engineer checks the ELD when the Aspect is Green, network works properly. However, as soon conductor no.5 enters the circuit, the readings will change and ELD will enter fault condition because of low Leakage Resistance.

Moreover, after few seconds when the conductor is removed from the circuit after the aspect is changed, the ELD can also be reset because at the moment, there is no fault in the circuit. These conditions sometimes give the impression that ELD is faulty and showing unnecessary alarms. However, as the above clearly shows, there is a faulty conductor and ELD can only detect the same when it enters the circuit.