



## **PROK DEVICES PRIVATE LIMITED**

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### **DIP SWITCH BASED EARTH LEAKAGE RELAY (ELR) WITH CORE BALANCE CURRENT TRANSFORMER (CBCT / ZCT) → EL SERIES**

#### **IEEE Device Code-64**

##### **Introduction:**

Earth Leakage Current give rise to generation of heat and result in progressive failure of insulation, which leads to earth faults sparking flashovers, deterioration of earthing and finally results into catastrophic fires which destroys costly equipments, gadgets and precious lives. It is therefore essential to detect earth leakage current well before they cross the threshold limits and isolate the circuit in the event of leakages. Conventional over current and short circuit protection device are not designed detect earth leakage currents.

Prok dv's make Earth Leakage Relay (ELR) with Core Balance Current Transformer ( CBCT / ZCT) are used to detect the leakage current in an Electrical Power System. Earth Leakage Relay (ELR) transmits a signal to activate the trip coil of the MCCB/ACB/OCB CONTACTOR in the event of Earth leakage, resulting in automatic isolation of the electrical power system. Earth leakage relay (ELR) and core balance current transformer (CBCT / ZCT) have been widely used and accepted because these have field adaptability and are economic.

##### **Features**

- ❖ Consistent reliability with accuracy.
- ❖ Fixed or variable current sensitivity by Dip Switch selection
- ❖ LED's for visual indication of fault.
- ❖ High Barrier connector at rear for easy termination and safety standards.
- ❖ Tamper proof polycarbonate cover in the front.
- ❖ Test & Reset Facility for testing healthiness of the relay

##### **Applications**

- ❖ Frame Leakage protection for L.T. Control Panels and switch boards.
- ❖ Earth Leakage protection for Feeders / Motors / Generators / Transformers / Mobile Operating Equipments.
- ❖ Protection for hazardous sensitive environments like Oil Refineries/ Cement Plant/Steel Plant /Chemical Platforms/Pulp industries and General Electrical Distribution.
- ❖ Protection for Mining & Control Engineering

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## Specifications

- ❖ **Input auxiliary voltage:** 110V/230V/415V/ 550V AC 50H or 60HZ  
48V/110V/220V VDC
- ❖ **Current Sensitivity range:**  
Variable:30-300mA, 50-2000mA, 300-3000mA 1-4 Amps, 1-8 Amps, 1-10 A,12A.  
Fixed: 30mA, 100mA, 300mA, 500mA, also user specified ranges(sensitivity)
- ❖ **Tripping time:** Variable: 0.15 – 3 sec  
Fixed: 100 millisec, 500 millisec, 1 sec & 3 sec
- ❖ **Core balance:** current transformer type: Tape wound or Resin cast
- ❖ **CBCT / ZCT:** Standard size I.D. Circular: 40mm, 65mm, 100mm, 150mm, 200mm  
250mm, and 300mm  
Rectangular: User specified
- ❖ **Relay contacts:** One pair of potential free NO & NC contacts or Two change over  
Potential free NO & NC Contacts
- ❖ **Contact Rating:** 8 Amps/ 250V AC/ 8 Amps, 30 V DC
- ❖ **Mounting Type:** Flush / Din
- ❖ **Dimensions (in mm):**  
Flush: 96mm x 96mmx70mm  
Panel Cutout size: 90x90+ 2 mm  
Din: 75x95x75 mm (LxHxD) (fixing on 35mm din channel)

**Note:** 30-300 mA, 50-2000mA & 30-3000 mA, ELR is available upto 150 mm I.D.  
CBCT / ZCT only

### **Principle of Operation**

Earth Leakage Relay(ELR) employs a Core Balance Current Transformer (CBCT / ZCT) to sense the leakage current. The CBCT / ZCT mounted externally and load current carrying cable is passed through the CBCT / ZCT. Ideally in a leakage free system the incoming and outgoing currents are equal and opposite in direction, which means that the vector sum of three phase currents is zero and can be expressed as:  
 $I_r + I_y + I_b = 0$  for 3 phase 3 wire system.

$I_r + I_y + I_b + I_n = 0$  for 3 phase, 4 wire system.

For the above condition the CBCT / ZCT produces zero resultant magnetic flux keeping the system healthy.

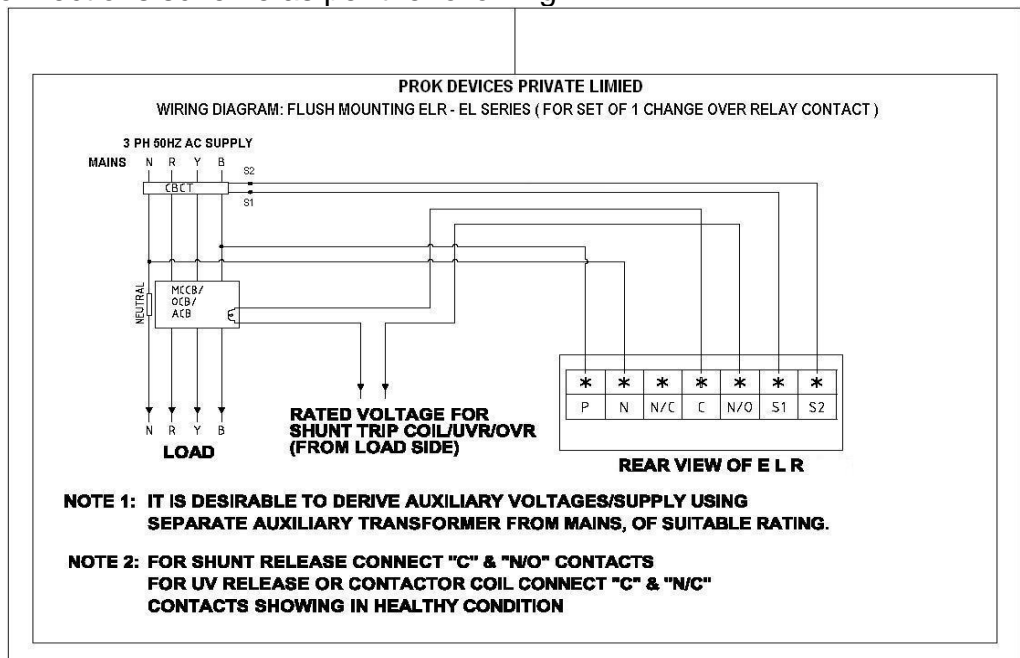
In case of the Earth Leakage due to insulation failure of direct line to ground fault, the vector sum of currents is not zero and therefore generates resultant magnetic flux in the CBCT / ZCT, and signal is fed to the electronic circuit of Earth Leakage Relay (ELR). This signal is compared with internal reference determined by the selected position of the leakage current scale in the front fascia of the relay. This energizes the output when the signal crosses the preset level. The potential free contacts of the relay is connected to the Shunt Trip/ No volt coil of the main trip device like MCCB/OCB/ACB/CONTACTOR etc., Under fault condition the output relay gets activated by cutting off or tripping against Earth Leakage /Faults. It is worthwhile to emphasize that the unequal/ unbalanced loading on the phases does not effect the

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vector sum and as such there is no difficulty in the use of Earth Leakage Relay (ELR) with Core Balance Current Transformer (CBCT / ZCT) on electrical distribution systems with unbalanced loading.

## INSTALLATION PROCEDURE FOR EARTH LEAKAGE RELAY WITH CBCT

1. Check the sensitivity of Earth Leakage Relay and also the inner diameter of core balance current transformer.
2. The Serial No. of the ELR and CBCT should match for better performance (the performance shall be guaranteed if the serial no. of the ELR and CBCT are matched).
3. Check the Auxiliary Supply of ELR and proper Voltage i.e. the rated Auxiliary Voltage.
4. The ELR have one pair of potential free change over contact for tripping purpose. Use rated current and rated voltage (refer the specification of our product). One pair of change over contact i.e., N/O Contact and N/C Contact can be used depending upon the tripping management.
5. The ELR can be flush mounting or Din mounting type and CBCT can be tape wound or resin cast type.
6. The CBCT can be mounted at the incoming or outgoing side of the breaker.
7. The ELR has low burden on CBCT.
8. The ELR is fitted in/outside the Panel depending on the type of mounting. The Auxiliary rated voltage is brought to the relay from the incoming supply source. The CBCT outputs are wired up to relay. The tripping arrangement like Shunt trip / Under Voltage Coil can be chosen and accordingly the wiring can be done using potential free contact
9. The connections scheme as per the following :



A. For ELR the Auxiliary supply should be given from incoming i.e. from mains side only. The reason being the relay should indicate that the systems is healthy or fault.

B. The CBCT can be mounted at the incoming cable entry or at the

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incoming of tripping mechanism. Alternatively the CBCT can be mounted at the outgoing side or at Bus Bar side. Care should be taken at the cable entry that the cable sheath / shielding should be terminated or Earthed before connecting the CBCT.

- C. Use C and N/O Contact for shunt trip and C and N/C Contact for under voltage coil.

After the successful completion of above mentioned scheme the Earth Leakage Relay is ready for use and installation is completed.

## **TESTING AND SIMULATION OF FAULT**

### **Method 1:**

1. The Earth Leakage Relay has two settings current setting and trip time setting. The same can be set by selecting any one dip switch in on position at a time as shown in the front fascia of the static earth leakage relay.



2. Having selected current sensitivity and trip time. The leakage current can be injected, slightly above set value at load side. ELR trips after the set time delay.

To simulate the fault connect a bulb/suitable load between a phase and ground using a switch (of suitable rating). The load/bulb should be such that the current drawn by it should be greater than leakage current set in the relay.

3. After making doubly sure of correct wiring and setting of the relay, close the switch and observe tripping of the relay.

**Note:** The Test should be conducted at the load side of the control panel and not at incoming side. And all the simulation of the leakage current should be done after the CBCT at load side and not before the CBCT.

Preferable use the Resistive load and use hand gloves when you are simulating the fault current. The proper earthing should be done before testing and make doubly sure of earthing. The Tripping arrangement should be made properly and ensure the tripping coils are in working conditions, before doing the actual test.

**ELR SHALL BE TEST ALONG WITH CBCT (Don't inject the fault current directly to the S1 & S2 terminals of ELR)**

**HV 2KV shall be applicable for all live terminals connected together & body.**

### **Method 2:**

#### **Steps:**

- Connect the suitable Aux. supply to ELR (85 – 275 V AC/DC, Line – Line 380V, 440V, 550V)
- Connect CBCT to ELR terminal S1 & S2 of the relay.

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- Set the leakage current in the relay and the corresponding time for tripping.
- Inject the current (AC) through CBCT (bar primary) by passing a wire of suitable capacity .connect a suitable calibrated ammeter in series to observe the leakage or fault current.
- Increase the current gradually above the set value, set in the ELR
- ELR picks up and operates
- The magnitude of the current at tripping instant will be displayed by the ELR and the ammeter
- After observing the operation of the ELR for the SET value of current, reset the relay, select a different value of current and repeat the steps mentioned above.

### Method 3:

By operating the TEST button in ELR

- Connect the suitable Aux. supply to ELR (85 – 275 V AC/DC, Line – Line 380V, 440V, 550V)
- Operate the test button to check the operation of the - relay trip.  
(This test is not the actual simulation, but the test ensures the correct operation of the miniature relay and the trip circuit mechanism.)

**Note:** If the system frequency is 60Hz accuracy is  $\pm 5\%$  on maximum current setting and for 50Hz accuracy is  $\pm 2\%$  on maximum current setting

### FRONT FASCIA

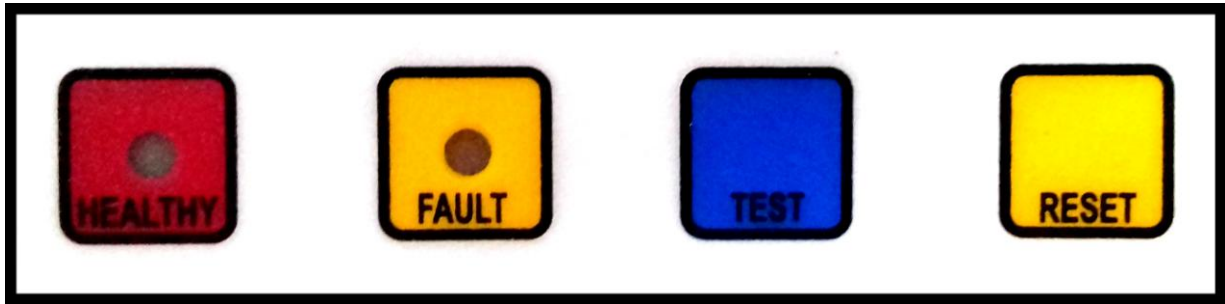


### Operation & Indication:

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- The relay has two indications: Healthy and Fault
- In order to check the connection of the relay and CBCT, the Test button has been provided.
- In case the relay trips/fault indication is on, the reset button to resets the relay

**Wiring diagrams:**

