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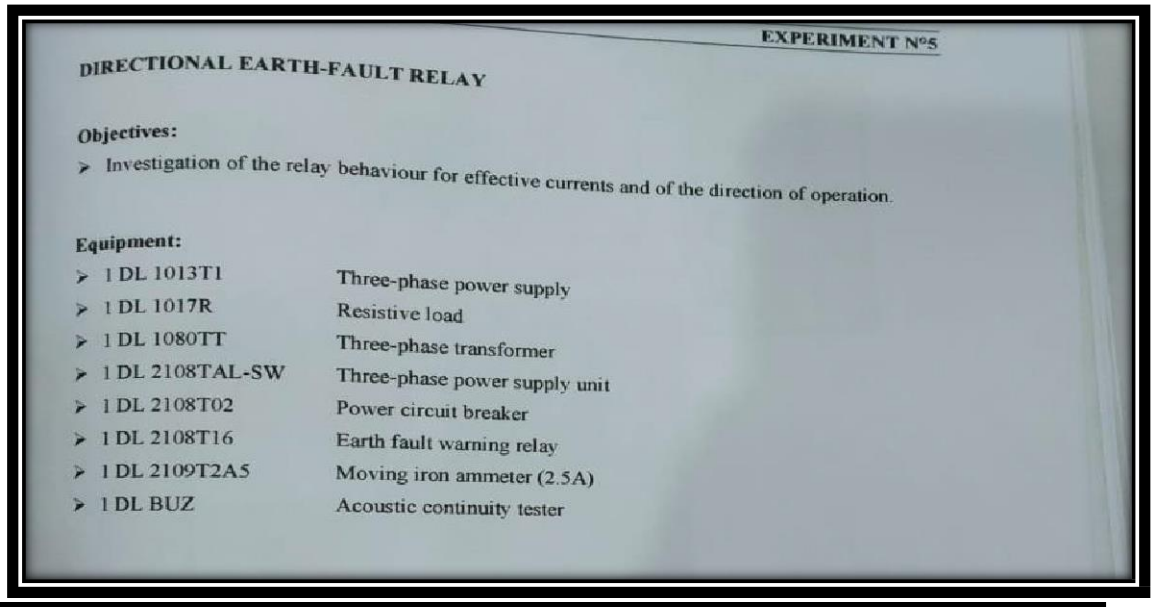
Roll No	2019-EE-381, 2019-EE-383, 2019-EE-389

Lab no 8

Directional Earth Fault

Relay



EXPERIMENT N°5

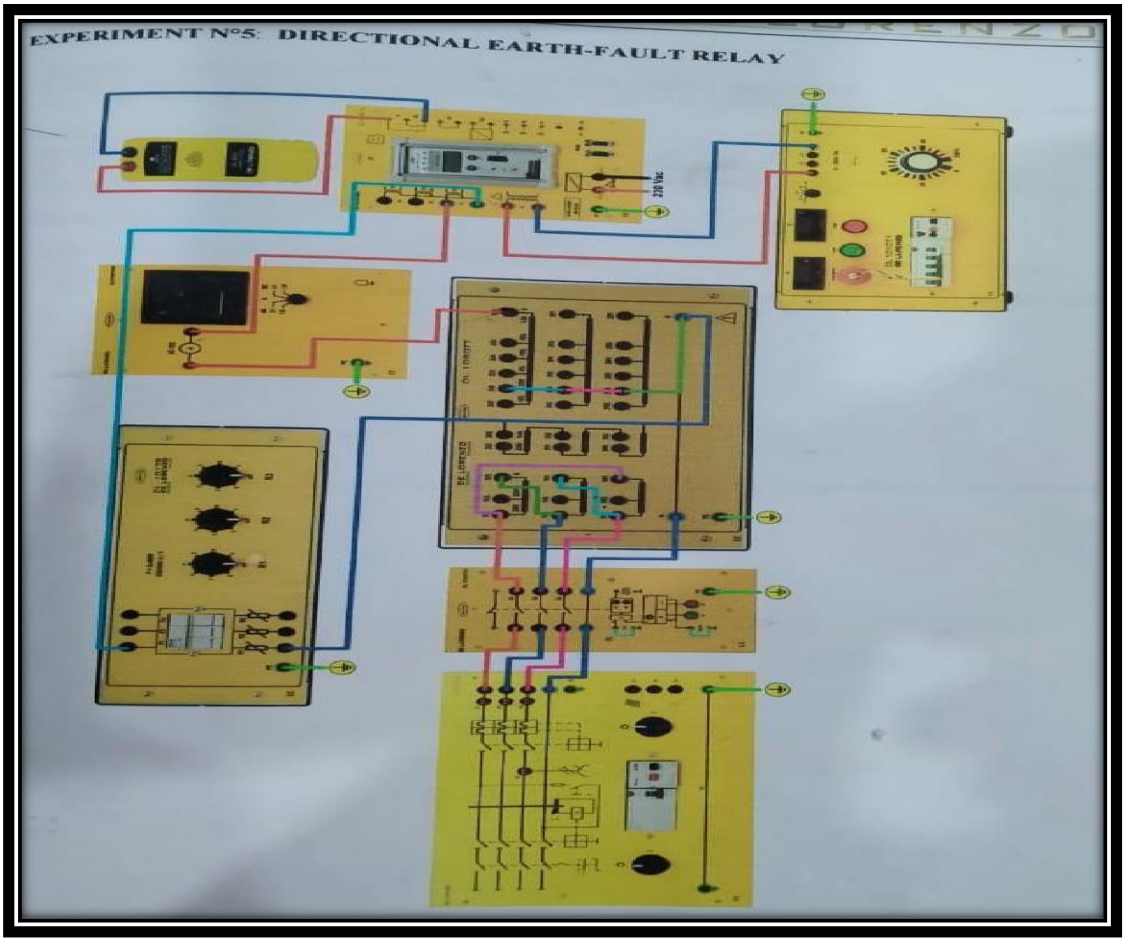
DIRECTIONAL EARTH-FAULT RELAY

Objectives:

- Investigation of the relay behaviour for effective currents and of the direction of operation.

Equipment:

1 DL 1013T1	Three-phase power supply
1 DL 1017R	Resistive load
1 DL 1080TT	Three-phase transformer
1 DL 2108TAL-SW	Three-phase power supply unit
1 DL 2108T02	Power circuit breaker
1 DL 2108T16	Earth fault warning relay
1 DL 2109T2A5	Moving iron ammeter (2.5A)
1 DL BUZ	Acoustic continuity tester



Experiment procedure

Assemble the circuit in accordance with the foregoing topographic diagram.
Set the primary-side of the three-phase transformer in delta connection 380 V and the secondary-side to star $U_N = 220V$.

Set the resistive load R_1 switching in off position.
The relay and the power circuit breaker require an auxiliary voltage.
The following initial settings are to be made at the single-phase directional relay (see relevant Manual DL 2108T16).

Setting device

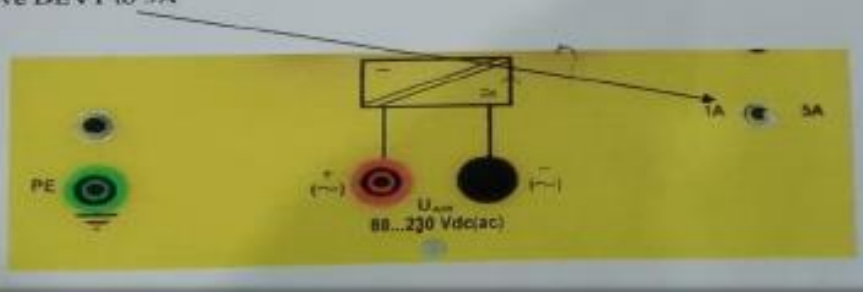
Supply the auxiliary voltage of the relay and set the following values using DL2108T16 guide:

- **To configure the equipment DL 2108T16 please refer to Appendix 2 of this document >RATED VALUE<**

- I1 = disabile
- I2 = disabile
- In = 5000
- I01 = 1000
- I02 = 1
- V01 = 50.00 KV
- V02 = 50V

- **To configure the equipment DL 2108T16 please refer to Appendix 2 of this document >FUNCTION<**

- I_0> 0.40 Ion tI_0>6s
- 67S1 > aA 1 = 260 aB 1= 350
- Move DEV1 to 5A



Experience 1

1. Positioning the load R1 to 1 on the equipment DL 1017R.
2. Switch on the power interrupt DL 2108T02
3. Observe the increment of the current I_0. The increment of current identifies a typical leakage event to earth in one device separated from ground.
4. Change the resistance value R from 1 to 2 position and observe a new increment of the current, after the trip LED (Fig.1) begins to flash and after 6 seconds the same LED stay on. In the same moment the relay R1 trip.

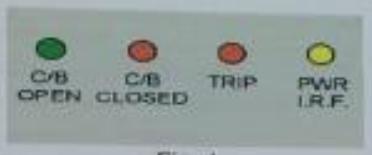


Fig. 1

Experience 2

Apply a different of voltage on the input U_0 using the equipment DL 1013T1 and observe on the display of the equipment DL 2108T16 a little drift of phase in terms of angle.
If the angle measured stay in the range set (**parameter 67S1**) the system works in the range.

Apply the same different of voltage on the input U_0 inverting the input connection look fig 2. In this situation the angle phase will be modify of 180° and you can observe the relay R1 trip. In this case the angle phase went out of the range set.

Directional Relay:

The over-current protection can be given directional feature by adding directional element in the protection system. Directional over-current protection responds to over-currents for a particular direction flow. If power flow is in the opposite direction, the directional overcurrent protection remains un-operative. Directional overcurrent relays respond to excessive current flow in a particular direction in the power system. The relay typically consists of two elements. One is a directional element, which determines the direction of current flow with respect to a voltage reference. When this current flow is in the predetermined trip direction, this directional element enables ("turns on") the other element, which is a standard overcurrent relay, complete with taps and time dial, as found on a normal non-directional overcurrent relay. Because these relays are designed to operate on fault currents, the directional unit is made so that it operates best on a highly lagging current, which is typical of faults in power systems.

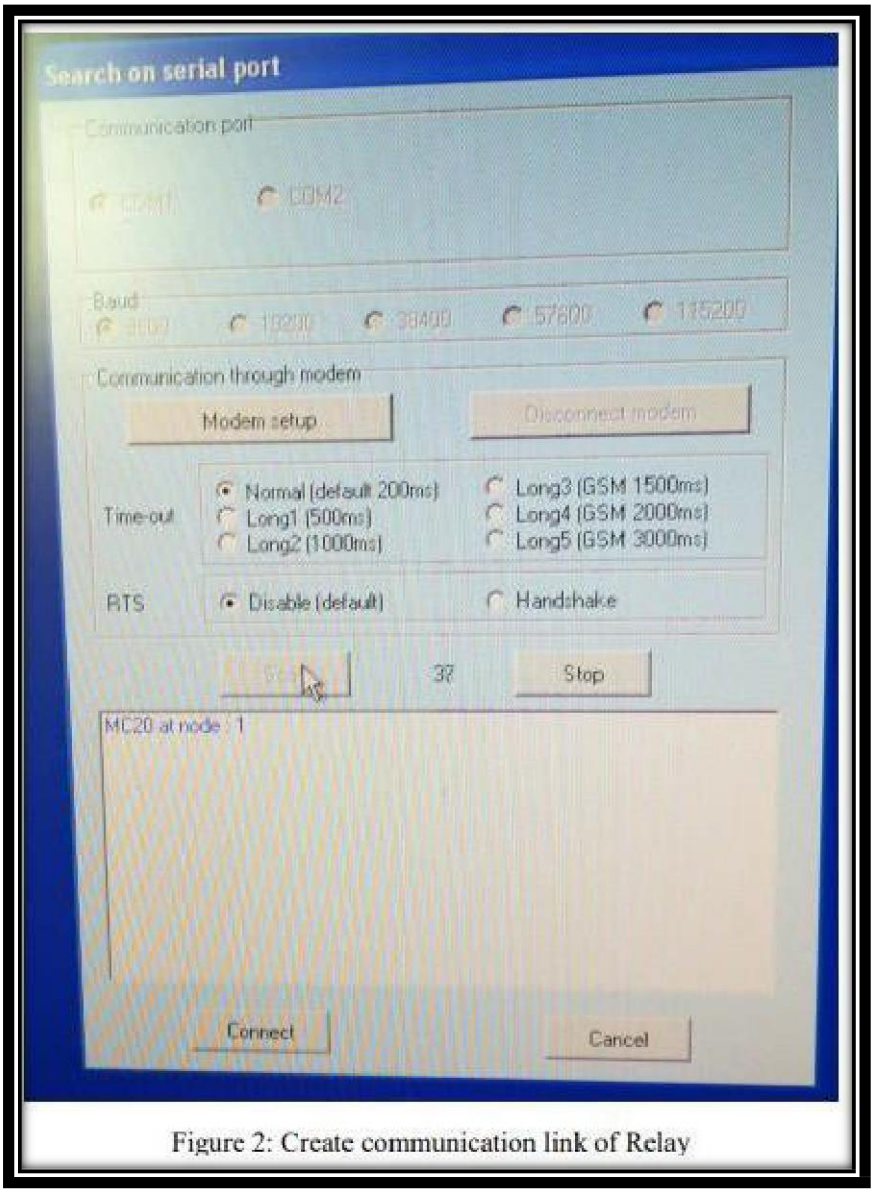


Figure 2: Create communication link of Relay

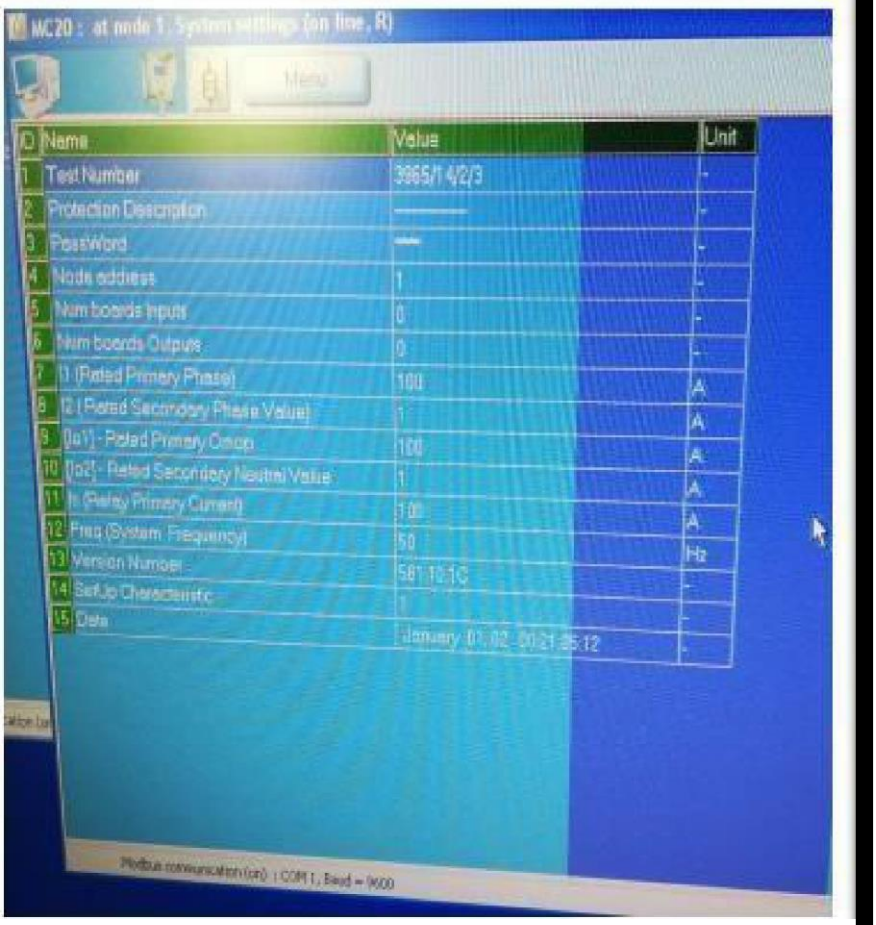
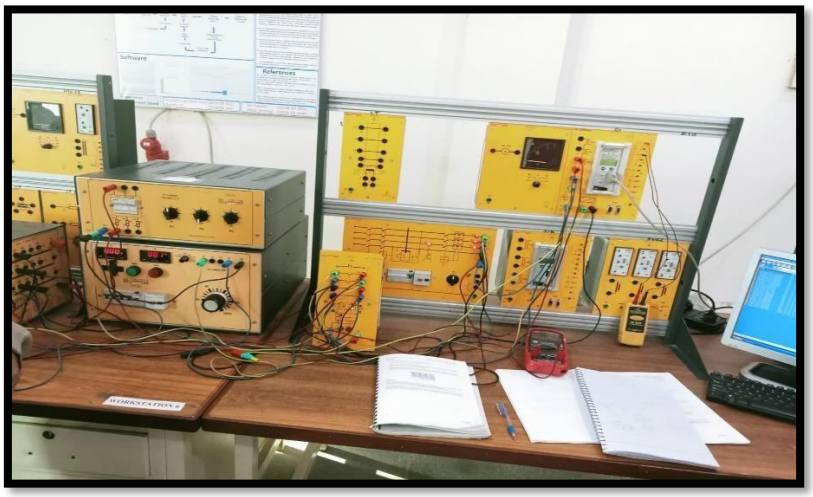


Figure 3: Setting of Fault cur.rent Vah11.e under fault condition

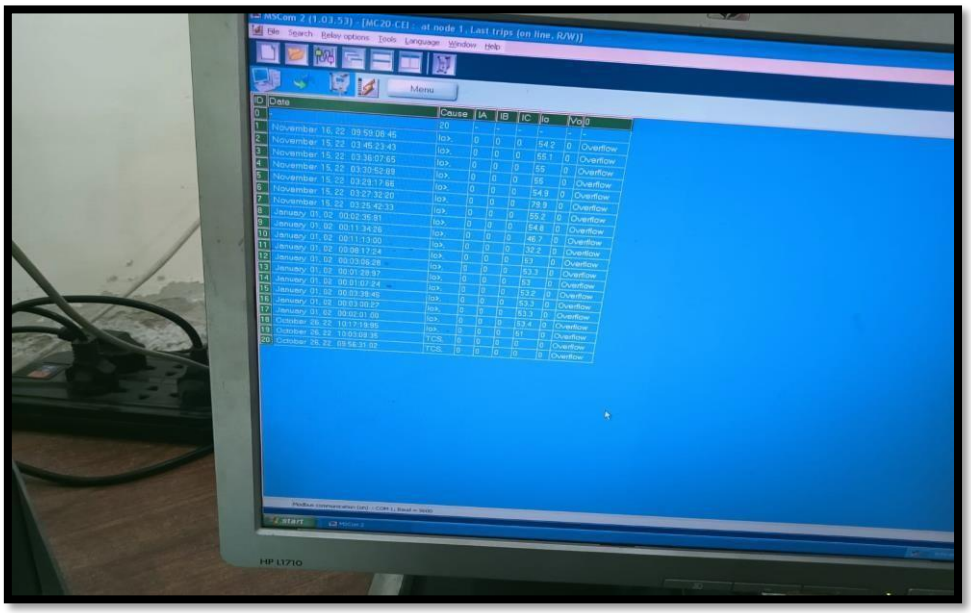
Procedure:

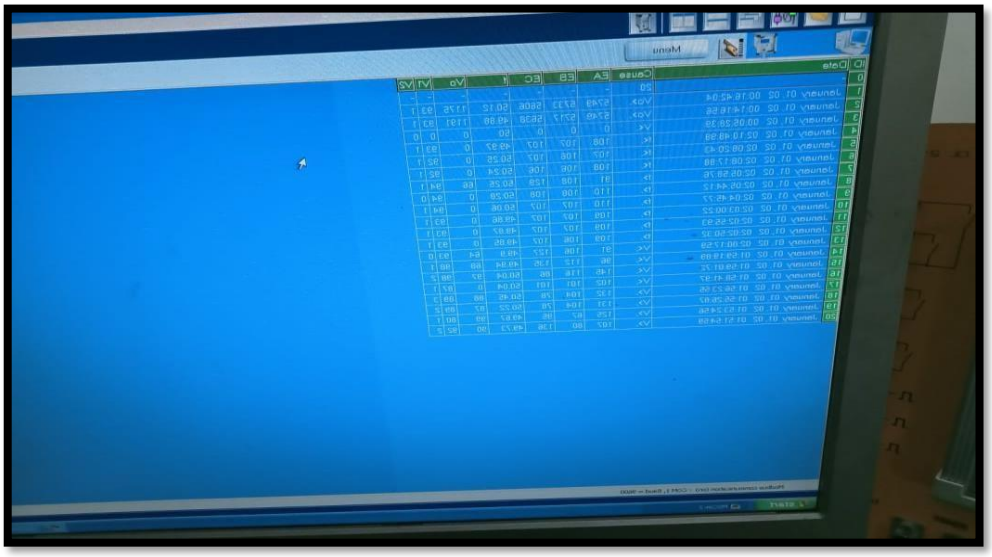
- Connect circuit as shown in Fig I
- Crea!te c-0mmunicatiow link ofRe]ay
- Set he fimJt current va]ue.
- Set tihlie,e phase power supp y voltage 380v and relay js not in operahon.
- Positioning the load RI to] on the equipment DL 1017R.
- Switch on the powe:; interrnpt DL 2108T02.
- Observe, the increment of current lo. The increme'l1!t of curt"ent ide'l1lrifies a typical]eakage event to eat1h in one device s.eparated from ground.
  Change tihe resistance from .R2 to *R3* position and observe a new increment of crnrernt after the trip LED.

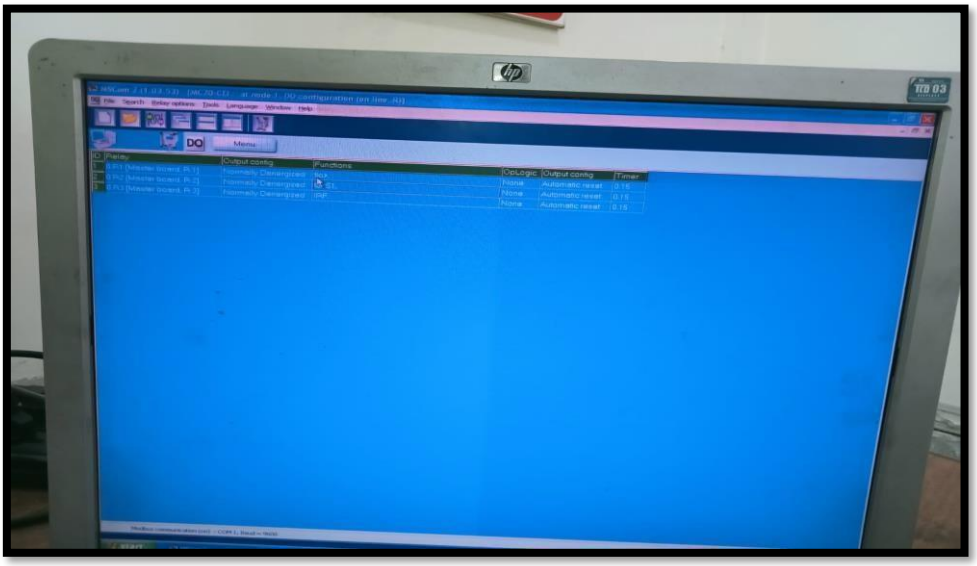
Load Setting:

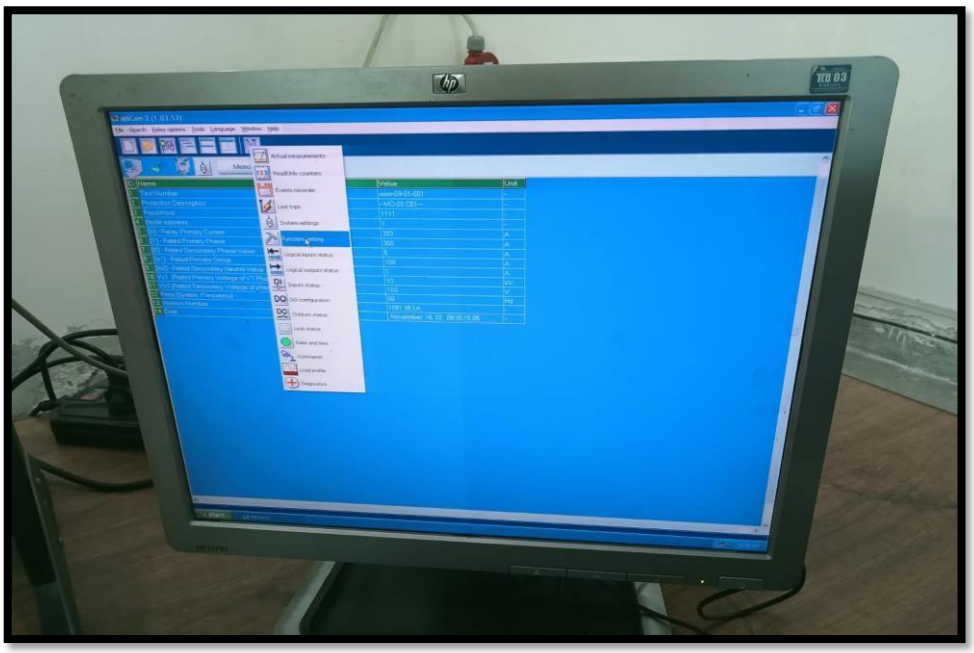


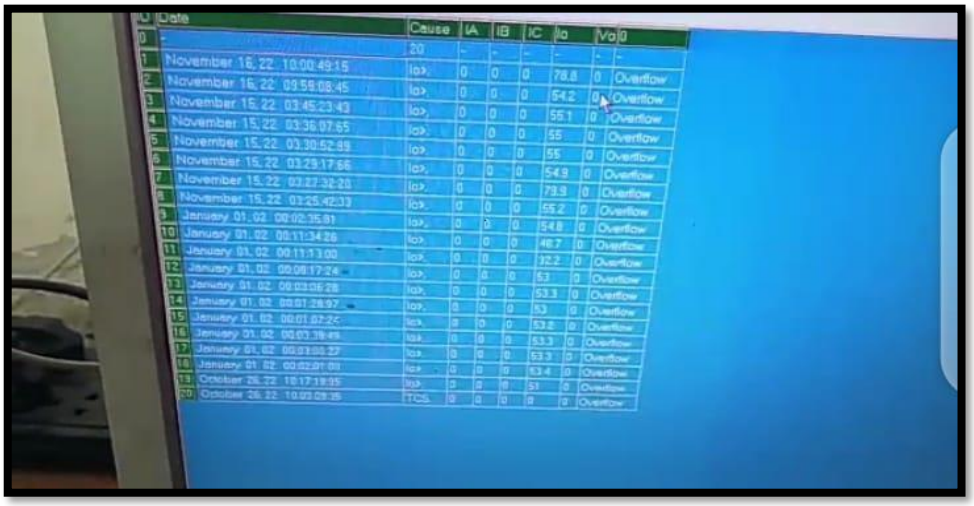
Last Tripping:











Trip Setting:


DE LORENZO
DL 2108T16
1/5A
1/5A
1/5A
MC20-CEI
LastTrip
Io>
R1
R2
R3
TCS
D1
D2
AC
A
DC
2.5
2.5


1/5A
1/5A
MC20-CEI
Meas.Io
32.8 A
R2
R3
TCS
D1
D2
D3
DC
2.5
1.25


1/5A
1/5A
MC20-CEI
Meas.Io
22.6 A
R1
R2
R3
TCS
D1
D2
D3
DC
2.5
1.25

Conclusion:

In this lab, we learn about the Implementation of Directional Earth Fault Relay by using De Lorenzo power system Protection kits. This is a basic protection relay. This relay works on principle of relationship of residual current and residual voltage which is independent of the faulted phase and is governed only by the R/X ratio of the fault path. By using this relay, we perform an experiment in lab. We set 220V as a reference voltage and measured value of current by changing load.e.g. From table: We take set value of current 500A. Secondary side current value is 1/5th of primary side value, which is equal to 100A. Trip value is obtained by dividing secondary current value by 1.818 which is equal to 55. Measured value is 54.3A. On that value of current, Directional Earth fault relay detects fault and sends tripping signal to breaker. For our experiment, we use single line to ground connection along with fixed voltage supply.

We conclude that:

- Directional Earth fault relay is computerized. So, chances of error is very small.
- This relay is very useful for all network components where direction of flow of power is likely to change.