

Power System Protection Laboratory

(Location: High Voltage building, ground floor)

1- Lab Photos



Photo 1



Photo 2

2- Lab Description

The protection lab is used to teach the practical part of the courses of power systems protection for students of the fourth level of the Electrical Power Engineering and Machines Program. It is also used in teaching the laboratory part of electrical machines courses for students of the other programs.

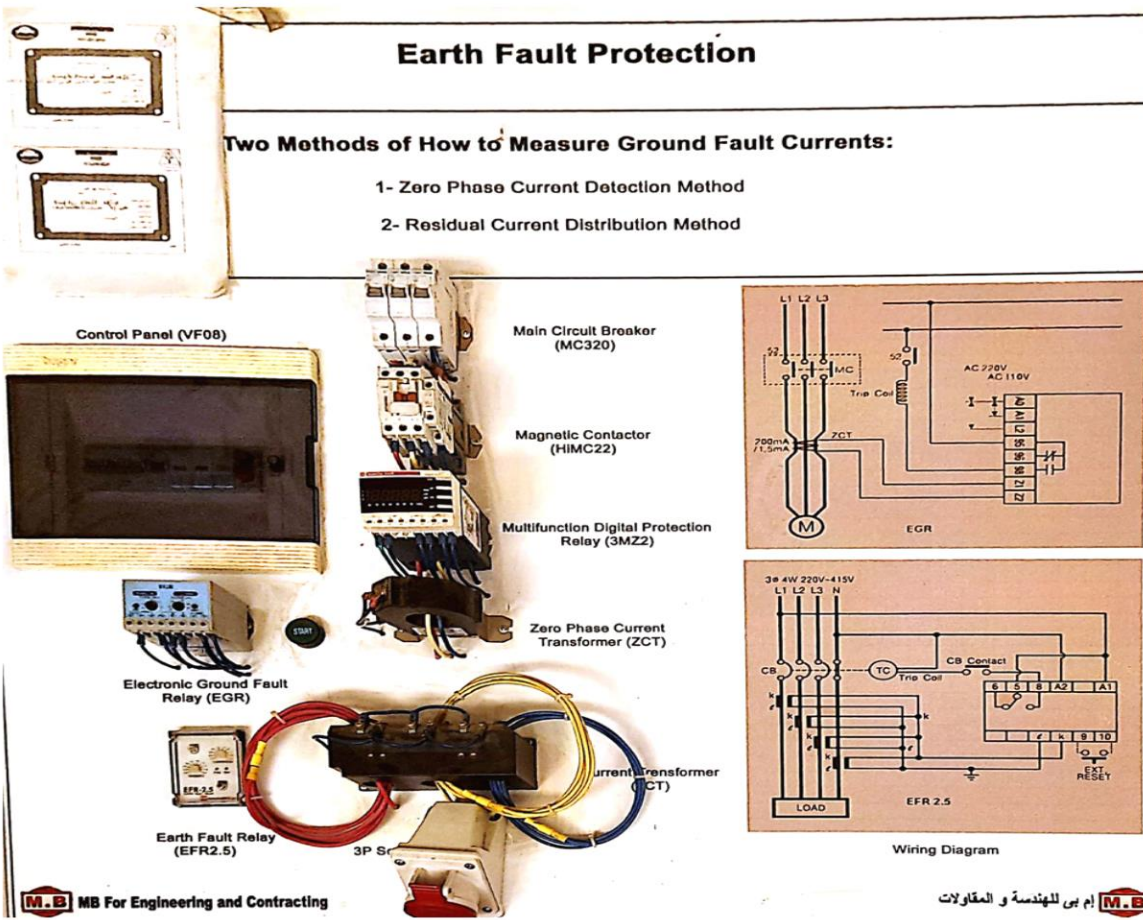
3- Lab Equipment

The following is a table of equipment and devices that are used in the experiments.

Earth Fault Protection

Two Methods of How to Measure Ground Fault Currents:

1- Zero Phase Current Detection Method
2- Residual Current Distribution Method



The photograph shows a physical lab setup for Earth Fault Protection. On the left is a Control Panel (VF08) with two digital displays. In the center is a Main Circuit Breaker (MC320) with a Magnetic Contactor (HIMC22) and a Multifunction Digital Protection Relay (3MZ2) mounted on a rack. Below these are a Zero Phase Current Transformer (ZCT), an Electronic Ground Fault Relay (EGR), and an Earth Fault Relay (EFR2.5). A 3P 5A switch is also visible. On the right, there are two wiring diagrams. The top diagram, labeled 'EGR', shows a 3-phase supply (L1, L2, L3) connected to a motor (M) through a ZCT and a Trip Coil. The bottom diagram, labeled 'EFR 2.5', shows a similar setup with a Load and a Trip Coil connected to a CB Contact and a TC. The diagrams include labels for AC 220V, AC 110V, and various relay contacts (A1, A2, B1, B2, B3, B4, B5, B6, B7, B8, B9, B10).

Control Panel (VF08)

Main Circuit Breaker (MC320)

Magnetic Contactor (HIMC22)

Multifunction Digital Protection Relay (3MZ2)

Zero Phase Current Transformer (ZCT)

Electronic Ground Fault Relay (EGR)

Earth Fault Relay (EFR2.5)

3P 5A

Wiring Diagram

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Earth Fault Protection board

Components:

Control Panel (VF08)

Circuit Breaker (MC320)

Contactor (HIMC22)

Multifunction Digital Protection Relay (3MZ2)

Electronic Ground Fault Relay (EGR)

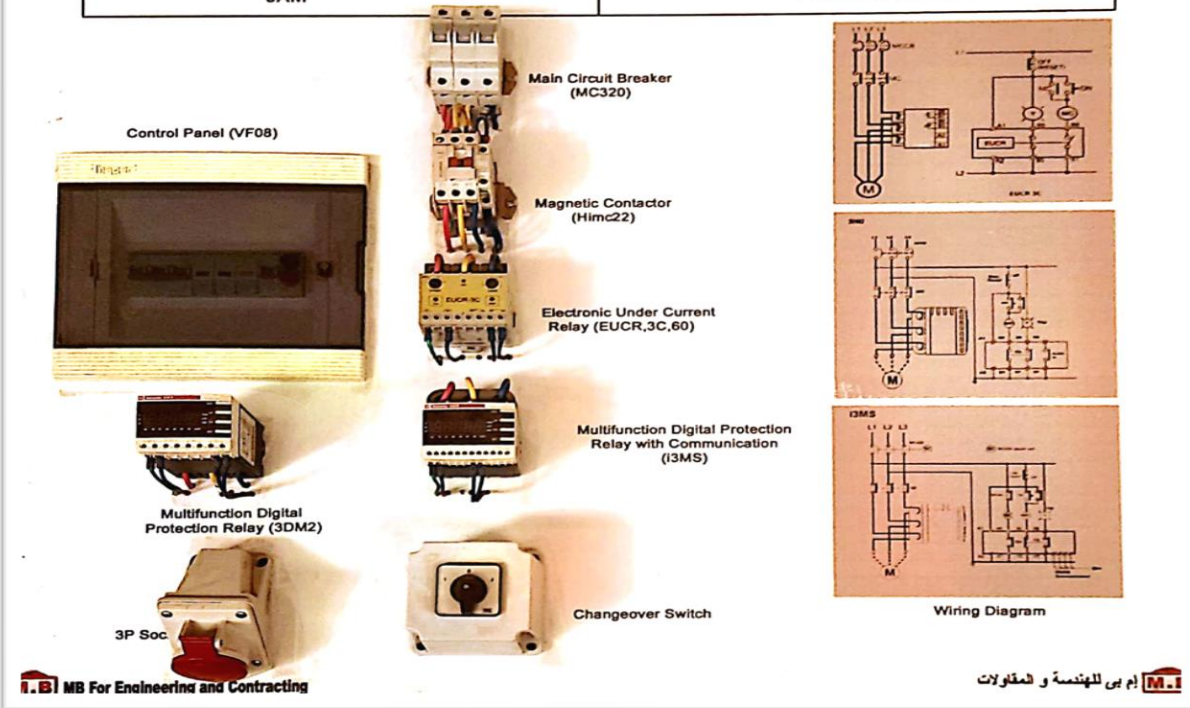
Earth Fault Relay (EFR2.5)

Zero Phase Current Transformer (ZCT)

Current Transformer

Current Protection

OVERLOAD	PHASE UNBALANCE
UNDER CURRENT	PHASE LOSS
STALL	SHORT CIRCUIT
JAM	PHASE REVERSAL



Current Protection board

Components:

Control Panel (VF08)

Circuit Breaker (MC320)

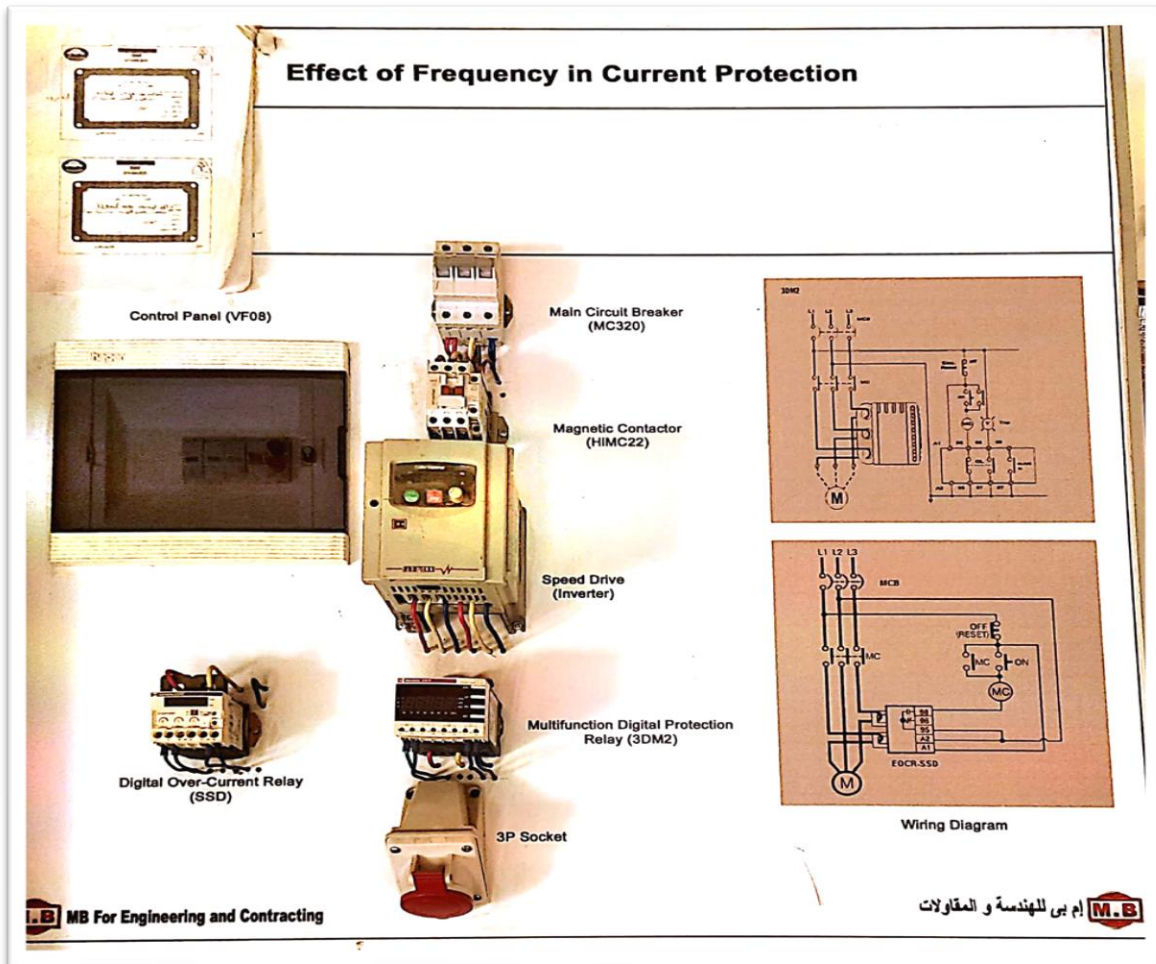
Contactor (HIMC22)

Multifunction Digital Protection Relay with Communication (i3MS)

Multifunction Digital Protection Relay (3DM2)


Electronic under Current Relay (EUCR,3C,60)

Changeover Switch




Effect Of Frequency on Current Protection board
Components:
Control Panel (VF08)
Circuit Breaker (MC320)
Contactor (HIMC22)
Speed Drive (Inverter)
Multifunction Digital Protection Relay (3DM2)
Digital Over-Current Relay (SSD)

COMMUNICATION




Multifunctional Protective Relay with Communication
Communication Protocol : Modbus
RS485


Control Panel (VF08)




Main Circuit Breaker (MC320)




Magnetic Contactor (HIMC22)



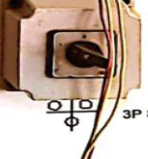
Multifunction Digital Protection Relay with Communication (i3MS)

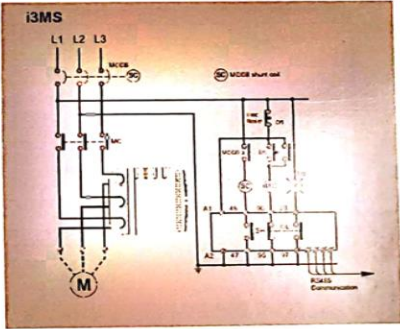


Changeover Switch





3P Socket





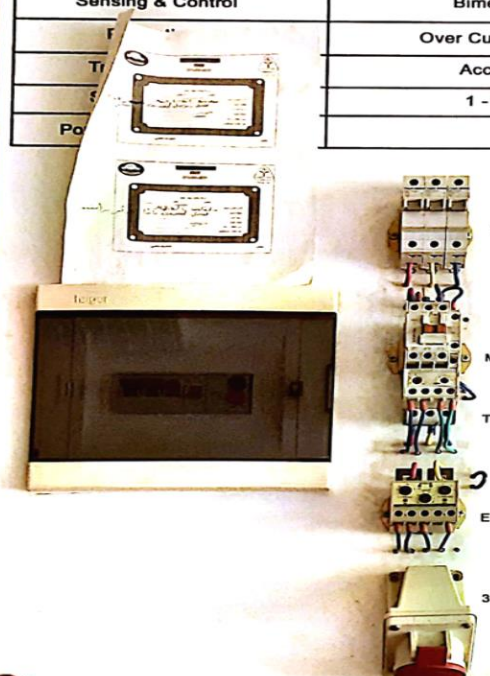
Wiring Diagram

- Communication board**
Components:
Control Panel (VF08)
Circuit Breaker (MC320)
Contactor (HIMC22)
Multifunction Digital Protection Relay with Communication (i3MS)
Changeover Switch

Thermal Overload V.S Electronic Overload

Features	Thermal Overload	Electronic Overload
Sensing & Control	Bimetal / Mechanical	2 CT / Solid State
T	Over Current, Phase Failure	Over Current, Phase Loss & Locked Rotor (by O.L.)
S	According to Curve	Adjustable by O-Time Setting
Po	1 - 1.6 A (±30%)	Wide Range 0.5-6A, 3-30A & 5-60A
	Over 6W	0.5W



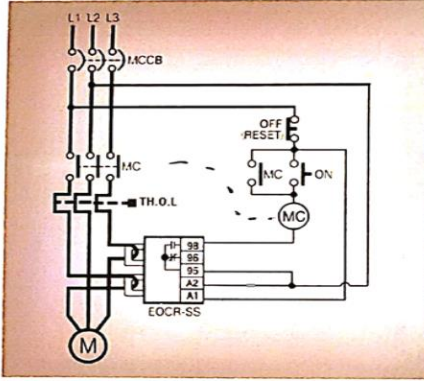
Main Circuit Breaker (MC320)

Magnetic Contactor (HIMC 22)

Thermal Overload Relay (HITH22K5)

Electronic Over Current Relay (EOCR-SS)

3P Socket



Wiring Diagram

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Thermal Overload V.S Electronic Overload board


Components:

- Control Panel (VF08)
- Circuit Breaker (MC320)
- Contactor (HIMC22)
- Thermal Overload Relay (HITH22K5)
- Electronic Over Current Relay (EOCR-SS)


Voltage Protection


PMR	EVR-PD
<ul style="list-style-type: none"> • PHASE REVERSAL • PHASE LOSS • VOLTAGE UNBALANCE 	<ul style="list-style-type: none"> • OVER VOLTAGE • UNDER VOLTAGE • PHASE LOSS • PHASE REVERSAL • VOLTAGE UNBALANCE

Control Panel (VF08)



3P Socket





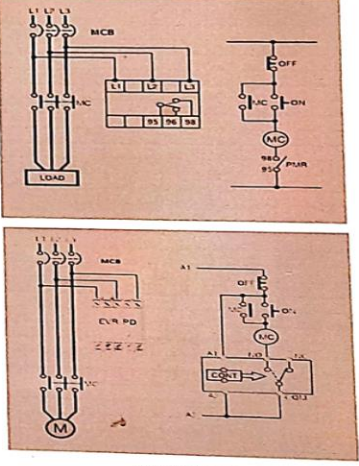
Main Circuit Breaker (MC320)

Magnetic Contactor (HIMC22)


Electronic Phase Monitor Relay (PMR)


Electronic AC Voltage Relay (EVR-PD)

Change Over Switch



Wiring Diagram




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- Voltage Protection board**
- Components:**
- Control Panel (VF08)**
 - Circuit Breaker (MC320)**
 - Contactor (HIMC22)**
 - Electronic Phase Monitor Relay (PMR)**
 - Electronic AC Voltage Relay (EVR-PD)**
 - Changeover Switch**



**Relay Testing Unit
Model SVERKER 780 Megger**



**Voltage Regulation Auto transformer
Input Voltage : 380VAC
Output Voltage : 0-450VAC**



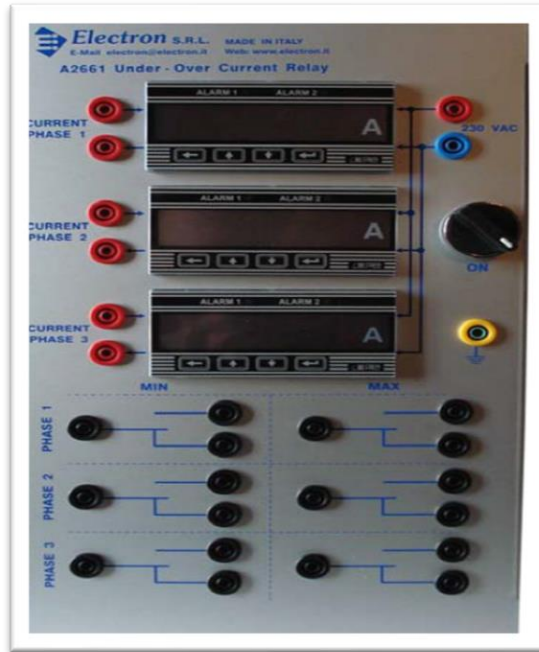
Voltage Transformer with load combinations combinations
Model TERCO MV 1934



Current Transformer with load combinations
Model TERCO MV 1933



Under – Over Voltage and Phase Failure Relay
Power supply : 230VAC, 50Hz, 5VA
Max Voltage : 600V
Contacts Rating : 10A – 250VAC
Model A2662 Electron S.R.L



Under – Over Current Relay
Power supply : 230VAC, 50Hz, 5VA
Max Current : 10A
Contacts Rating : 10A – 250VAC
Model A2661 Electron S.R.L

4- Lab Experiments

First year:

Course: None

Code: None

Second year:

Course: None

Code: None

Third year:

Course: None

Code: None

Fourth year:

Course: Power System Protection

Code: ELE422

- 1- Exp-1: Measurement of accuracy limit current ratio of a current transformer. 1- Using the equivalent circuit.
- 2- Exp-2: Measurement of accuracy limit current ratio of a current transformer. 2- Using the magnetization curve.
- 3- Exp-3: Voltage transformer error measurement.
- 4- Exp-4: Induction motor protection: Overload protection.
- 5- Exp-5: Induction motor protection: Overvoltage protection, undervoltage protection and phase loss protection.
- 6- Exp-6: Earth fault protection: Source-side down conductor fault, Downed Conductor with Feedback Condition, Downed Energized Conductor and No-loaded system.
- 7- Exp-7: Relay testing unit: 1-Testing procedure of three Phase Digital undervoltage, overvoltage and Phase Failure Protection Relay A2662. 2- Operating characteristics evaluation of overvoltage relays.

5- Lab Maintenance

The laboratory is evaluated to determine the experiments and their readiness to participate in the teaching process and to determine the required maintenance periodically, and the capabilities and problems of the laboratory are periodically reported after each experiment.