PS106

Protection Relays Training System

Overview

Protective relay training system is an educational unit which conducts many experimental operations including: power plants, substations and factory relay. The training system is based on interchangeable modules that allow circuits to be assembled by simply connecting the modules using the equipment's flexible leads. The trainer is equipped with AC and DC current and voltmeter to measure the output of any module. The system is designed for training on electrical power protection and considered a complete program that extends training in protective relaying beyond the operation and of individual relays into broader circuit applications.



Specifications

- A Protection Relays Training System is a specialized educational framework designed to teach the principles, applications, and testing of protective relays used in electrical power systems.
- The system includes a wide range of modules that constitute a complete learning transmission line protection system with all necessary loads and auxiliary systems.
- This system has been intended to allow students to connect and apply a wide range of electric and electronic protection relays to circuits of increasing complexity, as well as validate their properties.

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- Students will learn the principles of electrical protection design, relay coordination, and breaker operation. They will also get a grasp of digital protective relaying as we look at real instances of electrical protection for generators, feeders, motors, and transformers.
- The trainer frame is equipped with caster wheels for easy mobility; wheels are equipped with braking mechanism to prevent the unit from sliding.
- The Training System comprises of 24 modules that include various types of protective relays as well as CT and VT transformer.

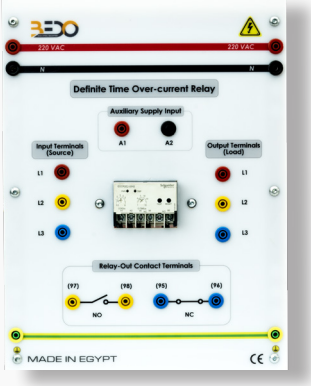
Protective relays

- » Time Over-Current Relay
- » Inverse-Time Overcurrent Relay
- » Synchro Check Relay
- » Current Relay
- » Earth Fault Relay
- » Motor Power Factor Relay
- » Phase Balance Relay
- » Phase Sequence Relay
- » Reserve Power Relay
- » Single Phase Under/Over Voltage Relay
- » Three-Phase Under/Over Voltage Relay Module &Phase Balance Relay
- » Three-Phase Over Current Relay
- » Under/Over Frequency Relay

Protective relays: **(Not Included)**

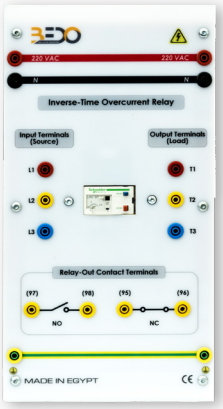
- » Distance Relay
- » Differential Relay

Definite Time Over-Current Relay Module (PS106.01)



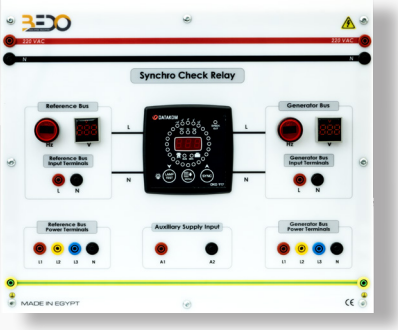
- The relay operates after a fixed and predetermined time delay once the current exceeds the set threshold.
- Technical Data:
  - » Electronic Overcurrent Relay
  - » Current Range: 0.5....6A
  - » Supply: AC/DC 24-240V, 50/60HZ

Inverse-Time Overcurrent Relay Module (PS106.02)



- The operation time is inversely proportional to the magnitude of the fault current. As the fault current increases, the time delay for the relay to trip becomes shorter. This allows for better discrimination between different fault conditions.
- Technical Data:
  - » Inverse time OC relay (thermal overload relay).
  - » Network type: DC/AC.
  - » Thermal protection adjustment range: 1.6...2.5 A.
  - » Network frequency: 0...400 Hz.
  - » Permissible current: 3 A at 120 V AC-15 for signaling circuit 0.22 A at 125 V DC-13 for signaling circuit

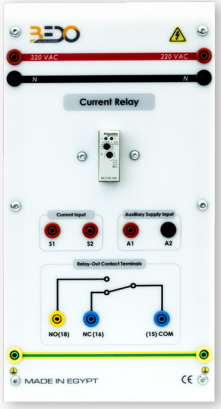
Synchro Check Relay Module (PS106.03)



- The synchro check relay monitors and compares the electrical parameters of the two systems or sources, before allowing a circuit breaker to close.
  - » The parameters checked are:
  - » Voltage Magnitude
  - » Frequency
  - » Phase Angle
- Technical Data:
  - » Generator voltage: 300 V-AC max. (Ph-N)
  - » Generator frequency: 0-100 Hz.

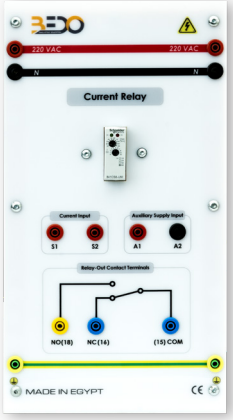
- » Busbar voltage: 300 V-AC max. (Ph-N)
- » Digital inputs: 0 30 V-DC.
- » Internally connected to battery positive via 4700- ohm resistor.
- » DC Supply Range: 9.0 to 33.0 V-DC
- » Maximum Operating Current: 150 mA-DC (Relay outputs open)
- » Check Synch Relay Output: 10 A/28V-DC

Current Relay Module (PS106.04)



- A current relay monitors the current flowing through a circuit and operates when the current exceeds a predefined threshold.
- Technical Data:
  - » Current Relay
  - » Rated Supply Voltage: 24...240 V AC 50...60 Hz
  - » Time Delay Range: 0...10 s
  - » Power Consumption in VA: 1.5 VA 24...240 V
  - » Relay Output Type: SPDT

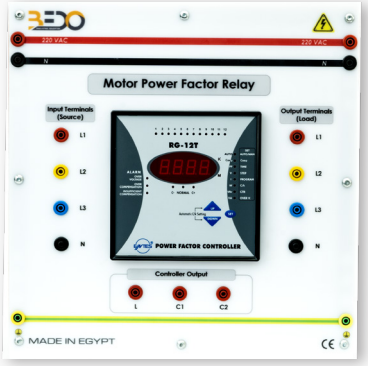
Earth Fault Relay Module (PS106.05)



- The Earth Fault Relay (EFR) detects ground fault conditions by monitoring the imbalance in current flow between the phase conductors and the neutral or ground conductor.

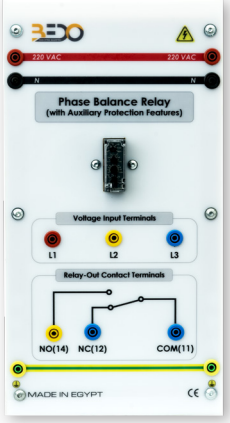
- Technical Data:
  - » Supply Voltage: 100-120/220-240/380-440 V AC ± 20%
  - » Ext. Input: 5A/1A (Selection Via. Terminals)
  - » Frequency: 50/60 Hz • Power Consumption: 3 VA max
  - » Output Relay Contact: 1CO / (2 CO)
  - » Output Contact Rating: 5A, 240 VAC (Resistive)

Motor Power Factor Relay Module (PS106.06)



- A Motor Power Factor Relay monitors an electric motors power factor, detecting low efficiency and triggering alarms or disconnecting the motor to prevent damage
- Technical Data:
  - » Motor power factor relay
  - » Operating Voltage (Un): 160V - 260V AC
  - » Operating Frequency 50 Hz.
  - » Operating Power: <10 VA
  - » Current Range: 100mA - 5,5A
  - » Display: 3x20mm display and leds
  - » Contact: 2x 5A/250V AC (Resistive Load)

Phase Balance Relay Module (PS106.07)

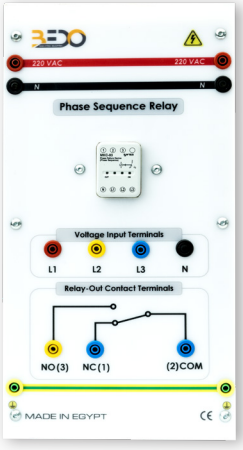


- A Phase Balance Relay monitors three-phase electrical systems, detecting phase imbalances due to uneven loads or faults,

and triggering corrective actions to prevent equipment damage, particularly motors.

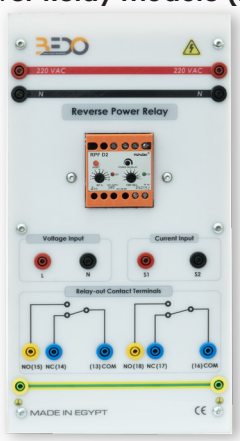
- Technical Data:
  - » Three phase balance relay
  - » Measurement range: 208...480 V voltage AC
  - » Rated Supply Voltage: 24...240 V AC 50...60 Hz
  - » Operating Voltage: 220 VAC
  - » Operating frequency: 50/60Hz
  - » Output Contact: 1CO,8A,2000 VA

Phase Sequence Relay Module (PS106.08)



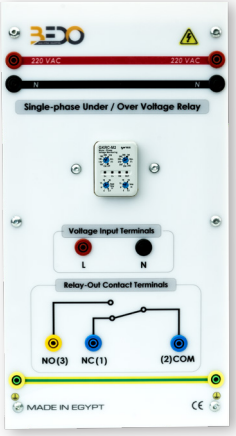
- A Phase Sequence Relay ensures correct phase sequence in a three-phase electrical system, preventing reverse motor running, potential damage, or malfunction.
- Technical Data:
  - » Phase Sequence Relay
  - » Rated Supply Voltage: 3 phase and neutral 220-230 VAC
  - » Rated Frequency: 50/60 Hz
  - » Output Contacts: 1 C/O with 8A, 250 VAC, 2000 VA, Coso=1
  - » Warning LEDs: LED Output, normally ON (OFF for any fault)

Reserve Power Relay Module (PS106.09)



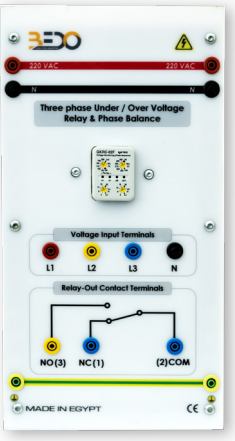
- A Reverse Power Relay detects power flow in the reverse direction. This occurs when the generator starts drawing power from the grid instead of supplying it, which can damage the generator.
- Technical Data:
  - » Reserve power relay (Monitoring Relay)
  - » Supply Voltage: 100-120/220-240/380-440 V AC ± 20%
  - » Ext. Input: 5A, CT Secondary & R,Y, B
  - » Output Contact: 2 CO
  - » Reverse Power: 2% - 20% (adjustable)
  - » Power On Delay: 1 - 10 secs. (adjustable)

Single Phase Under/Over Voltage Relay Module (PS106.10)



- A Single Phase Under/Over Voltage Relay monitors voltage levels in a single-phase electrical system, triggering alarms when voltage falls below or exceeds preset limits, preventing potential equipment damage.
- Technical Data:
  - » One-Phase Under/Over Voltage Relay
  - » Supply Voltage (Un): 220, 230V AC
  - » Supply Voltage Gap (U): 150...300V AC
  - » Supply Frequency: 48 ... 63 Hz

Three-Phase Under/Over Voltage Relay Module &Phase Balance Relay (PS106.11)

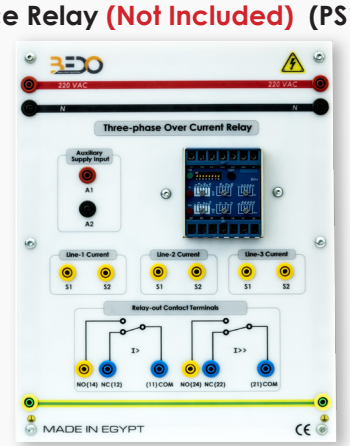


- A Three-Phase Under/Over Voltage Relay monitors voltage levels in three-phase electrical systems, triggering alarms or disconnecting circuits when voltage falls below or exceeds specified limits, preventing equipment damage.
- Technical Data:
  - » Three-phase under/over voltage relay
  - » Supply Voltage (Un): 220, 230V AC
  - » Supply Voltage Gap (U): 150...300V AC
  - » Supply Frequency: 48 ... 63 Hz

Three-Phase Over Current Relay Module (Smart Grid High Voltage Transmission Line) (PS106.12)

- Under/Over Frequency Relay Module
- Under/Over Frequency Relays protect electrical equipment from frequency deviations, ensuring reliable operation in power generation, distribution, and industrial applications by continuously monitoring and providing protective actions.
- Technical Data :
  - » Under/Over Frequency Relay
  - » Relay monitored parameters: 50 or 60 Hz
  - » Time delay Adjustable: 0.1...10 s, +/- 10 % on crossing the threshold
  - » Switching capacity in VA: 1250 VA
  - » Minimum switching current: 10 mA at 5 V DC
  - » Power consumption in VA: <= 6 VA AC
  - » Measurement range: 40...70 Hz frequency
  - » Reset time: 2000 ms for time delay
  - » Maximum switching voltage: 250 V AC/ DC
  - » Supply voltage limits: 102...308 V AC

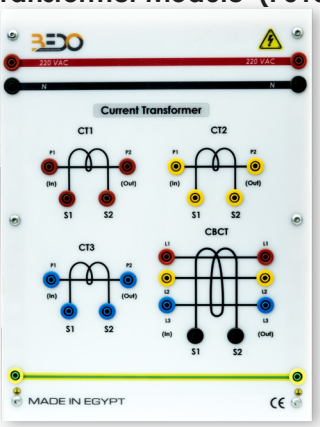
Distance Relay (Not Included) (PS106.13)



- Distance relays measure the apparent impedance seen from the relay location to the fault, which is proportional to the distance to the fault

- Differential Relay
- Differential relays are crucial in electrical systems for detecting internal faults and comparing currents, ensuring the safe and efficient operation

Current Transformer Module (PS106.14)

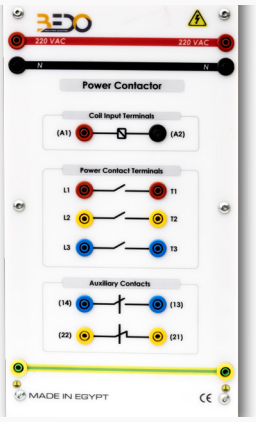


- A Current Transformer (CT) module is a device that converts primary AC to a manageable value for metering or protection purposes.
- Technical Data:
  - » Core Balance Current Transformer
  - » System Voltage: 720V max.
  - » Insulation Voltage: 3 kV for 1 minute
  - » System Frequency: 50/60 Hz
  - » Current Ratio: 5/25
  - » Current Transformer
  - » System Voltage: 720V max.
  - » Current Transformer, 2.5VA, Class 1,
  - » Current ratio: 25/5A
  - » Rated system voltage: 0.72/3kV,
  - » Ambient temperature range: -30°C to 85°C.
  - » Continuous current: 1.2 x rated current

DC Battery Module (PS106.15)

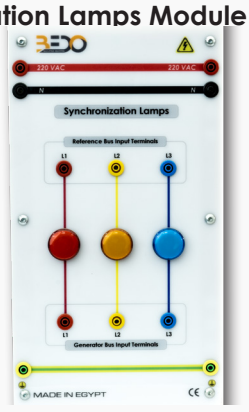
- DC Battery Modules provides reliable storage and supply of direct current electricity.

Power Contactor Module (PS106.16)



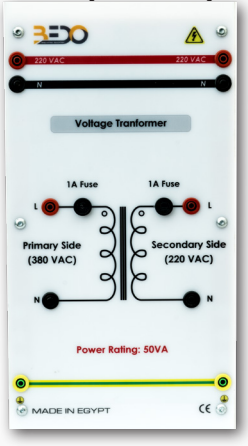
- A Power Contactor Module is an electromechanical device used to control the power supply to electrical circuits and equipment. It functions as a switch, allowing or interrupting the flow of electrical current in high-power applications

Synchronization Lamps Module (PS106.17)



- A Synchronization Lamps Module is a crucial device in electrical power systems that visually indicates the synchronization status of generators or other power sources before connecting to a common bus.

Timer with Module (PS106.18)



- A Timer with Module is a device that integrates timing functions with an engine control system.
- Technical Data:
  - » Timer with Engine
  - » Supply Voltage (Un): 220, 230V AC
  - » Time operation: POWER ON START
  - » Terminal: 8-pin plug
  - » Power supply: 100-240VAC~, 24-240VDC
  - » Setting range: 0.05 sec to 1 hour
  - » Allowable voltage range: 90 to 110% of the rated voltage

Voltage Transformer Module (PS106.19)

- A Voltage Transformer Module is a crucial device that reduces high voltage levels in electrical systems, ensuring accurate measurements and equipment protection.

Earth Leakage Circuit Breaker Module (PS106.20)

- An ELCB module safeguards electrical systems from earth faults, preventing electric shocks and fire hazards by monitoring current flow and disconnecting circuits when imbalances occur.

Source Impedance Module (PS106.21)

- A Source Impedance Module is a crucial component in electrical systems, analyzing and measuring the impedance of power sources for system stability and performance evaluation.

Fault Module (PS106.22)

- Fault Modules are essential in electrical systems for testing and diagnosing faults, ensuring protection devices› performance and reliability, and ensuring appropriate response to fault conditions.

Fault Insertion Module (PS106.23)

- Fault Insertion Modules are crucial in electrical testing and training for introducing controlled fault conditions into power systems, evaluating protective devices performance under fault conditions.

Experiments

- Adjusting a generators frequency and line voltages for synchronization with a synchro module
- Investigating the tripping time of the thermal overload relay under various load circumstances.
- Learning how to configure parameters for an electronic overload relay.
- Evaluating relay performance under various overload and short circuit conditions.
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- Understanding the concept of differential current.
- Learning how to use Earth Leakage C.B. to protect against earth faults.
- Understanding the operating principle of a current transformer (CT).
- Exploring ways to prevent over and under frequency conditions.
- Understanding how to calculate the transformation ratio for a current transformer.
- Learning how to set inverse definite time currents.
- Learning to use an earth fault relay to interrupt the system during a fault condition.
- earning how to use the phase balance relay to prevent the system from becoming imbalanced and protect the load.
- Exploring the significance of phase sequence relay.
- Setting a three-phase under-overvoltage relay to guard against under-load and over-voltage conditions.
- Setting a reverse power relay to prevent such conditions

Scope of Delivery

- Protection Relays Training System(PS106)
- Hard copy user manual

Options

- 2X Universal Measuring Unit (Machine)
- Transmission Line 150 Km Module

Required for Operation

- Machine & Drive Lab Supply Unit (ML100)

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