

MOTOR CONTROL DEMONSTRATION PANEL

EM-69329Q

EDU-LABS



1.0 GENERAL SPECIFICATION

1.1 This equipment are designed as instructional unit to demonstrate the construction and operation of various types of starters in different panels:

- 1.1.1 Direct On Line (D.O.L) Starter
- 1.1.2 Forward Reverse D.O.L Starter
- 1.1.3 Star Delta Starter
- 1.1.4 Forward Reserve Star Delta Starter
- 1.1.5 Auto Transformer Starter
- 1.1.6 Auto Transformer Forward Reverse Starter
- 1.1.7 Rotor Resistance Starter
- 1.1.8 Soft Start Starter
- 1.1.9 Variable Speed Drive

1.2 All of the standard controls, protections and instruments are contain IEC and approve from Suruhanjaya Tenaga or SIRIM

1.3 All equipment/components must be mounted on panel box and fully wired

1.4 All cables are neatly and systematically arranged and bunched

1.5 All front panel compartments/parts are clearly labeled marked to ensure easy reference and better understanding of the internal circuitry and/or components functions

1.6 All terminal connections and terminations are clearly numbered, marked and labeled

1.7 Marking: Engraved legends

- 1.8 Mounting: unit is mobile with heavy duty locking swivel castor
- 1.9 Panel Box: Heavy sheet steel metal console finished by baked epoxy powder coating
- 1.10 Provision for external connection via safety type terminal socket on terminal box

Suruhanjaya Tenaga Syllabus Chargeman Category A0

Module: Motor and its starter

- a) Types of motor, usage, difference and movement
- b) Maintenance, damage detection and repair
- c) Starter including characteristics of protection

2.0 TECHNICAL SPECIFICATION

2.1 Input:

- 2.1.1 400 Vac, 100 A, 3 Phase, 50 Hz
- 2.1.2 Supply and install not less than 63 A rating complete with male and female industrial combination Switched Socket Outlet and Plug come with wiring works tapping from nearest LV sub switchboard complete with protection device interconnected to the demonstration panel

2.2 Main Panel: Controls, Protections and Instruments

- 2.2.1 Incomer: 400/230 V, 50 Hz
- 2.2.2 1 unit Molded Case Circuit Breaker 63 A TPN, 36 KA c/w Shunt Trip Coil
- 2.2.3 1 unit Ammeter, range 0-30 A c/w Selector Switch
- 2.2.4 1 unit Voltmeter, range 0-500 V c/w Selector Switch
- 2.2.5 3 units 22 mm LED Pilot Lamp (Red, Yellow, Blue) – Main Phase Lamp
- 2.2.6 1 unit Frequency Meter
- 2.2.7 1 unit Power Factor Meter
- 2.2.8 1 unit Digital Three Phase Power Quality Meter complete with SCADA/RTU (Ethernet TCP/IP network port MODBUS RTU communication protocol) (Upgraded Features)
- 2.2.9 1 unit of Power Management Software (SCADA/RTU) (Upgraded Features)
- 2.2.10 3 units Current Transformer Coil 30/5 A Class 3, 5VA c/w bracket

2.3 Motor Starters & Variable Speed Drive

2.3.1 Direct On Line (D.O.L) Starter:

- 2.3.1.1 3 units LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.1.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.1.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.1.4 LED Indicator: 230 Vac, 22 mm (Red, Green)
- 2.3.1.5 Terminal Block: 600 V max, 10 A
- 2.3.1.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.1.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA
- 2.3.1.8 Thermal Overload Relay: 8 - 20 A
- 2.3.1.9 Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP

2.3.2 Forward Reverse D.O.L Starter:

- 2.3.2.1 3 units LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.2.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.2.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.2.4 LED Indicator: 230 Vac, 22 mm (Red, Green)
- 2.3.2.5 Terminal Block: 600 V max, 10 A
- 2.3.2.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.2.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA

- 2.3.2.8 Thermal Overload Relay: 8 - 20 A
- 2.3.2.9 2 unit Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP

2.3.3 Star Delta Starter:

- 2.3.3.1 3 units LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.3.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.3.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.3.4 LED Indicator: 230 Vac, 22 mm (Red, Green, Blue)
- 2.3.3.5 Terminal Block: 600 V max, 10 A
- 2.3.3.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.3.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA
- 2.3.3.8 Thermal Overload Relay: 8 - 20 A
- 2.3.3.9 3 unit Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP
- 2.3.3.10 Auxiliary Contact Block: Front Mount 2 Pole Block
- 2.3.3.11 Single Range Analogue Timer: 230 Vac, 50 Hz, 0 – 30 s adjustable

2.3.4 Forward Reverse Star Delta Starter:

- 2.3.4.1 3 unit LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.4.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.4.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.4.4 8 unit LED Indicator: 230 Vac, 22 mm (Red, Blue, Yellow)
- 2.3.4.5 Terminal Block: 600 V max, 10 A
- 2.3.4.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.4.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA
- 2.3.4.8 Thermal Overload Relay: 8 - 20 A
- 2.3.4.9 5 unit Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP
- 2.3.4.10 4 units Auxiliary Contact Block: Front Mount 2 Pole Block
- 2.3.4.11 Single Range Analogue Timer: 230 Vac, 50 Hz, 0 – 30 s adjustable

2.3.5 Auto Transformer Starter:

- 2.3.5.1 3 unit LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.5.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 220 Vac
- 2.3.5.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.5.4 LED Indicator: 230 Vac, 22 mm (Red, Green, Blue, Yellow)
- 2.3.5.5 Terminal Block: 600 V max, 10 A
- 2.3.5.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.5.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA
- 2.3.5.8 Thermal Overload Relay: 8 - 20 A
- 2.3.5.9 3 unit Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP
- 2.3.5.10 Auxiliary Contact Block: Front Mount 2 Pole Block
- 2.3.5.11 Single Range Analogue Timer: 230 Vac, 50 Hz, 0 – 30 s adjustable
- 2.3.5.12 Three Phase Auto Transformer: 3.75 kW, 415/290 Vac with 70% tapping

2.3.6 Auto Transformer Forward Reverse Starter:

- 2.3.6.1 3 unit LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.6.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.6.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.6.4 8 unit LED Indicator: 230 Vac, 22 mm (Red, Blue, Yellow)
- 2.3.6.5 Terminal Block: 600 V max, 10 A
- 2.3.6.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.6.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA

- 2.3.6.8 Thermal Overload Relay: 8 - 20 A
- 2.3.6.9 5 unit Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP
- 2.3.6.10 4 unit Auxiliary Contact Block: Front Mount 2 Pole Block
- 2.3.6.11 Single Range Analogue Timer: 230 Vac, 50 Hz, 0 – 30 s adjustable
- 2.3.6.12 Three Phase Auto Transformer: 3.75 kW, 415/290 Vac with 70% tapping

2.3.7 Rotor Resistance Starter:

- 2.3.7.1 3 unit LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.7.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.7.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.7.4 LED Indicator: 230 Vac, 22 mm (Red, Green)
- 2.3.7.5 Terminal Block: 600 V max, 10 A
- 2.3.7.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.7.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA
- 2.3.7.8 Thermal Overload Relay: 8 - 20 A
- 2.3.7.9 3 unit Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP
- 2.3.7.10 Auxiliary Contact Block: Front Mount 2 Pole Block
- 2.3.7.11 Single Range Analogue Timer: 230 Vac, 50 Hz, 0 – 30 s adjustable
- 2.3.7.12 Rotor Resistor Module

2.3.8 Soft Start Starter:

- 2.3.8.1 3 unit LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.8.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.8.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.8.4 LED Indicator: 230 Vac, 22 mm (Red, Green, Yellow)
- 2.3.8.5 Terminal Block: 600 V max, 10 A
- 2.3.8.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.8.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA
- 2.3.8.8 Thermal Overload Relay: 8 - 20 A
- 2.3.8.9 Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP
- 2.3.8.10 Soft Starter: 2 Phase - Controlled 3 \emptyset , 460 V, 10 kW, 4.8 A, U_c=110 - 230 V AC/DC

2.3.9 Variable Speed Drive:

- 2.3.9.1 3 unit LED Pilot Lamp 22 mm (Red, Yellow, Blue) – Main Phase Lamp
- 2.3.9.2 Mushroom Head Emergency Stop Button: 300 Vac, 3A, 22 mm, LED 230 Vac
- 2.3.9.3 Flat Head Push Button Switch: 300 Vac, 3 A, 22 mm (Red, Green)
- 2.3.9.4 LED Indicator: 230 Vac, 22 mm (Red, Green)
- 2.3.9.5 Terminal Block: 600 V max, 10 A
- 2.3.9.6 Miniature Circuit Breaker: 3 Pole, 230/400 V, 10 A, 50/60Hz
- 2.3.9.7 Residual Current Device: 4 Pole, 400 V, In = 40 A, I Δ n = 100 mA
- 2.3.9.8 Thermal Overload Relay: 8 - 20 A
- 2.3.9.9 Magnetic Contactor: 3 Pole, 220 V - 13A, 440 V – 9 A, 7.5 HP
- 2.3.9.10 Variable Speed Drive:
 - 2.3.9.10.1 Rated Voltage: 400 Vac 3 \emptyset
 - 2.3.9.10.2 Power Rating: 1.5 kW
 - 2.3.9.10.3 Control Method: V/F Close Loop
 - 2.3.9.10.4 Output Frequency Range: 0 – 500 Hz
 - 2.3.9.10.5 Output Voltage Adjustable Method: PWM Control
 - 2.3.9.10.6 Rated Current: 8A
 - 2.3.9.10.7 Maximum Output Frequency Range: 0 – 400 Hz

2.4 Motors

2.4.1 Three Phase AC Motor – Squirrel Cage Induction 3 HP Motor:

- 2.4.1.1 Rated Power: 2.2 kW (3 HP)
- 2.4.1.2 Rated Voltage: 230 / 450 Vac (Delta/Star)
- 2.4.1.3 Rated Current: 10.5 A (Delta/Star)
- 2.4.1.4 Rated Speed: 1500 rpm
- 2.4.1.5 Frequency: 50 Hz
- 2.4.1.6 Pole: 4
- 2.4.1.7 Cooling Method: TEFC
- 2.4.1.8 Insulation: Class F
- 2.4.1.9 Mounting: Floor Mounted B3
- 2.4.1.10 Base: Attachable To Break Load Unit Generator Unit

2.4.2 Three Phase AC Motor – Star Delta Induction 10 HP Motor:

- 2.4.2.1 Rated Power : 7.5 kW (10 HP)
- 2.4.2.2 Rated Voltage: 230 / 690 Vac (Delta/Star)
- 2.4.2.3 Rated Current: 15.3 A (Delta/Star)
- 2.4.2.4 Rated Speed: 1500 rpm
- 2.4.2.5 Frequency: 50 Hz
- 2.4.2.6 Pole: 4
- 2.4.2.7 Cooling Method: TEFC
- 2.4.2.8 Insulation: Class F
- 2.4.2.9 Mounting: Floor Mounted B3
- 2.4.2.10 Base: Attachable To Break Load Unit Generator Unit

2.4.3 Three Phase AC Motor – Slip Ring Induction 10 HP Motor:

- 2.4.3.1 Rated Power : 7.5 kW (10 HP)
- 2.4.3.2 Rated Voltage: 400 Vac 50/60 Hz, 3 Phase
- 2.4.3.3 Rated Current: 22 A / FLC
- 2.4.3.4 Rated Speed: 1400 – 1480 rpm
- 2.4.3.5 Frequency: 50/60 Hz
- 2.4.3.6 Pole: 4
- 2.4.3.7 Cooling Method: TEFC
- 2.4.3.8 Insulation: Class F
- 2.4.3.9 Mounting: Floor Mounted B3
- 2.4.3.10 Base: Attachable To Break Load Unit Generator Unit

2.5 Three Phase Motor & Generator Brake Set

2.5.1 Three Phase AC Motor – Squirrel Cage Induction 1 HP Motor:

- 2.5.1.1 Rated Power : 0.75 kW (1HP)
- 2.5.1.2 Rated Voltage: 230 / 450 Vac (Delta/Star)
- 2.5.1.3 Rated Current: 3.5 A (Delta/Star)
- 2.5.1.4 Rated Speed: 3000 rpm
- 2.5.1.5 Frequency: 50 Hz
- 2.5.1.6 Pole: 2
- 2.5.1.7 Cooling Method: TEFL
- 2.5.1.8 Insulation: Class F
- 2.5.1.9 Mounting: Floor Mounted B3
- 2.5.1.10 Base: Attachable To Break Load Unit Generator Unit

2.5.2 Three Phase AC Generator Brake:

- 2.5.2.1 Nominal Power: 750 W (1 HP)
- 2.5.2.2 Nominal Voltage: 230 / 400 Vac
- 2.5.2.3 Nominal Current: 3.5 A
- 2.5.2.4 Nominal Speed: 3000 rpm
- 2.5.2.5 Frequency: 50 Hz
- 2.5.2.6 Excitation Permanent Magnet
- 2.5.2.7 Cooling Method: Self Cooling
- 2.5.2.8 Terminal: 4 mm Safety Socket
- 2.5.2.9 Base Unit: Attachable To Motor Unit as Prime Mover
- 2.5.2.10 Manual: Instructional & Experimental

2.5.3 Three Phase AC/DC Generator Brake Controller:

- 2.5.3.1 Modular design
- 2.5.3.2 Current: 3.5 A
- 2.5.3.3 Rated Power: 750 W
- 2.5.3.4 Setting: Continuous Adjustable
- 2.5.3.5 Protection: Fuse
- 2.5.3.6 Terminal: 4 mm Safety Socket

3.0 ACCESSORIES

- 3.1 Laptop (15.6", Intel Core i7-7500U up to 3.50GHz, 16GB DDR4, 256 GB M.2 SSD) for Power Management Software
- 3.2 6 drawer Steel Wheeled Cabinet 975 (H) x 710 (W) x 450 (D) mm
- 3.3 4 mm Stackable Safety Test Lead Sets
- 3.4 Rubber Mat (size are suitable with the equipment) to put in front and back of the panel
- 3.5 2 unit Danger Signs
- 3.6 2 unit First Aid Chart c/w clear acrylic frame

Note: Due to products continuous development process, layout and specification may change without prior notices.