

Doubly Fed Induction Generation Trainer (Model: TMS-PET/DFIG)



SALIENT FEATURES

- 2 models: 0.5HP /3HP power ratings
- The 3 phase slip ring alternator acts as DFIG coupled to trunnion mounted DC shunt motor simulating variable speed wind power (F1) with electronic torque & speed sensors mounted to determine wind power input accurately.
- Manual synchronization with grid provided using 3 lamp method & synchroscope.
- Variable frequency & variable amplitude VFD provided using FPGA controller to supply rotor winding of DFIG (F2).
- 16X2 LCD is provided to observe VFD frequency
- Multifunction Measurement AC analysers (MMM) read the rotor input voltage /power and stator voltage /power & frequency.
- Experiments with ON grid & OFF grid measurements to verify $F1 \pm F2$ algebraic addition of shaft frequency & VFD frequency to match supply grid frequency.
- Facilitates easy and safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords and shrouded socket arrangements for high voltage circuits
- Each panel has ABS molded plastic sturdy enclosure, and colorful screw less overlays showing circuits diagrams & its connection tag numbers for easy understanding and connection
- Set of Instructor Guide & Student Workbook..

Technical Specifications

◆ Input 3 phase DOL Starter panel (EMT1) X 1 No.

- 4 pole MCB of 415 V/20A.
- DOL 16A Contactor with 230V/50Hz / 11VACOIL
- Bimetallic thermal O/L relay with range 9A- 15A
- RYB inputs indicators.
- Manual start / stop with local trip contact
- Power ON LED indicator
- Green SBS5 socket is provided for extend earth

◆ Instrumentation power supply cum multichannel DPM panel (EMT8) X 1 No.

- DC Multi Output power supply.
- Supplies DC power to neighboring signal conditioning circuit panels like EMT9, CIP1, CIP2, MIT12, CE7 etc. through 20 pin FRC cable.
- Provides 1 Ph. AC supply through 3 MCB's, 4A each to power up other panels in the rack.
- Optionally Multichannel 4 position DPM for Speed, Torque etc.
- Green SBS5 socket is provided for extend earth

◆ Variable AC and DC supply panel (EMT23) X 2 Nos

- Input 0-230VAC, 50Hz
- Variable O/PAC: 0-270V/3A(6A).
- Variable O/P DC: 0-250V/3A(6A)

◆ 3 Phase Bidirectional Power cum Energy Meter Panel (EMT34A) X 3 Nos.

- Bidirectional Multifunction
- 3 Phase 3/4 wire, 415VAC, CT Input 5A
- LCD/LED display, Aux. Supply 230V, 45-65Hz, 5W.
- Measure V.I, Hz, Pf, KVA, KW, KWH.
- Modbus RTU RS 485 for RTU/SCADA interface.
- Green SBS5 socket is provided for extend earth

◆ Synchronization Panel (EMT26A/B) X 1 No.

- Consisting of Synchronization digital meter (Synchroscope)
- Manual Synchronization switch
- Manual start / stop with local trip contact

◆ DC Voltmeter & DC Ammeter Panel (EMT6B) X 3 Nos.

- DC voltmeter: 0-300VDC

- DC ammeter: 5A(20A)
- 4A(12A) circuit breaker.
- ◆ **8 Nos. of IGBT Power Circuit and sensing panel (PE7A-L/R) X 1 No**
- 1200V/40A IGBT with opto isolated (LV) TTL compatible driver circuit & individual heat sink with built in isolated DC power supply for gate drive - 8 nos.
- 2 nos of push buttons to increment/decrement frequency
- Forced air cooling fans 2 nos
- 1000 μ f/250V electrolytic capacitor paralleled with 2.2 μ f/400V film capacitor for DC smoothening & to dampen surge
- Test points are provided to observe gate signals
- ◆ **FPGA based controller panel (XPO-EST) FPGA-II (XC3S400) X 1 No.**
- 16MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, T/C etc.
- 6 LVTTTL gate drive outputs to and 6 status feedback inputs from 6 nos IGBT power modules through 26 pin FRC cable.
- 16X2 LCD display to observe VFD frequency
- 8 nos of LEDs to indicate IGBT faults
- ◆ **SCR Actuator (variable DC) cum sensor signal conditioning panel (EMT 9) X 1 No.**
- Thyristor rating: 10A(25A)
- Full bridge SCR based 0V-220V / 3A (10A) cosine firing with linear characteristics.
- Supports signal conditioning circuit for speed, torque in kg to give output 0-2.5Vdc (FS).
- External control signal (0 - 2.5VDC) to set O/P volt (0-100VDC) to control inverter input voltage.
- ◆ **LC filter panel (EMT74A/B) X 1 No.**
- Inductors (0.15H-2.5/5A) X 3 nos.
- Capacitors (100 μ f/440Vac) X 3 nos.
- ◆ **Single phase supply panel (EMT16A) (3HP) X 1 No.**
- Single phase MCBs of 4A/20A 1each

- Lamp load
- **Resistor Load panel (EMT14A/B) for (0.5HP) X 1 No.**
- **AC Resistors** = 10K / 5K / 3.5K / 2.5K / 2K / 1.5K / 200W X 3 phases / 6 taps
- **DC Resistors** = 750E / 600E / 300E / 212E / 162E / 125E / 112E / 100E / 400W / 6 taps+OFF+ separate 60E tap for DC series Gen.

OR

- ◆ **Resistor Load panel (EMT42A) for (3HP) 1 No.**
- 3 nos of 600W resistors with switch selectable 6 nos of taps at 100, 112, 150, 175, 200, 225? & 265? fix
- ◆ **Diode Bridge & LC Filter Panel (PE8A)**
- Diode bridge : 1000V/35A
- Electrolytic capacitor : 1000 μ F/250V--- 2 Nos.
- Film capacitor : 2.2 μ F/400V--- 2 Nos.

Table Top Panel :

- ◆ **Variable AC and DC supply panel (EMT 23) X 1 Nos.**
- Input 0-230VAC, 50Hz
- Variable O/PAC: 0-270V/3A(6A)
- Variable O/P DC: 0-250V/3A(6A)

List of experiments:

- 1) To verify $F1 \pm F2$ algebraic addition of delta connected stator of DFIG.
- 2) To verify $F1 \pm F2$ algebraic addition of star connected stator of DFIG.
- 3) To calculate the efficiency of DFIG (delta stator) setup when connected ON grid by manual Synchronization of DFIG with grid supply.
- 4) To calculate the efficiency of DFIG (star stator) setup when connected ON grid by manual Synchronization of DFIG with grid supply.
- 5) To study DFIG (delta stator) power sharing between grid & load when grid tied.
- 6) To study DFIG (star stator) power sharing between grid & load when grid tied.
- 7) To study active and reactive power control of DFIG (Delta stator) when grid tied.

Setup parameters :

S.N.	Parameters	XPO-PET/DFIG (0.5HP Setup)	XPO-PET/DFIG (3HP Setup)
1.	Prime Mover	0.5HP DC integrated machine Armature: 180V, 2A Field: 180V, 0.45A 1500 RPM	3HP DC separated excited shunt machine Armature: 220V, 12A Field: 220V, 0.6A 1500 RPM
2.	3 Ph. Alternator/Generator	0.5HP 3 phase AC integrated machine Stator: 415V/0.42A 6 terminals of 3 windings brought out to make star delta Rotor: 70Vdc/2.6A Y connected 3 winding brought out from slip ring	3HP 3 phase AC integrated machine Stator: 415V/4.7A Y connected 3 winding brought out from stator Rotor: 180V/7.5A Y connected 3 winding brought out from slip ring
3.	Mechanical/Weight (in kg)	Rack: 1165(L) x 300(W) x 990(H) Net Wt.: 65, Gross Wt.:73 Kg Coupled machine: 760(L) x 300(W) x 400(H) Net Wt.: 80 Kg	Rack: 1165(L) x 300(W) x 990(H) Net Wt.: 65, Gross Wt.:73 Kg Coupled machine:1228(L) x 300(W) x 500(H), Net Wt.: 100 Kg EMT42A & EMT74 panel: 600(L)x275(W)x500(H), Net Wt.: 60 Kg