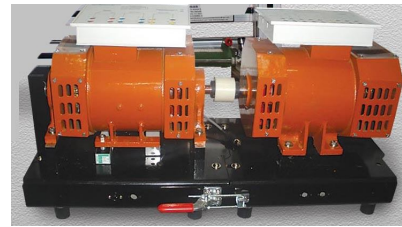
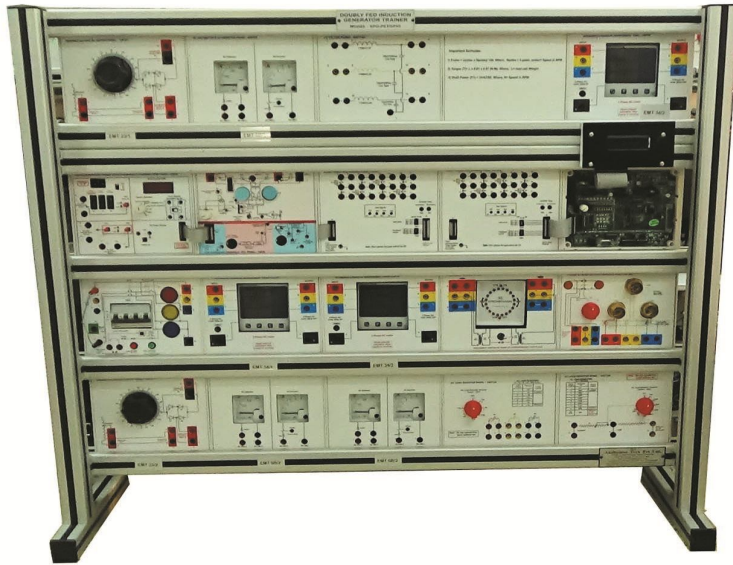


Doubly Fed Induction Generation Trainer (Model: XPO-PET/DFIG)



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 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 415V/4A.
- DOL 16A Contactor with 24DCV / 11VA COIL
- Settable thermal O/L relay with range 1.4A (2.4A)
- RYB inputs indicators.
- Manual start / stop with local trip contact
- Power ON LED indicator

■ Instrumentation power supply cum multichannel DPM panel (EMT 8) X 1 No.

- Power supply +12V, -12V, 500 mA, +5V/300mA
- Unregulated 17VDC /750 mA
- line synchronizing signal.
- Multi channel DPM for digital display of torque & speed.

■ Variable AC and DC supply panel (EMT 23) X 3 Nos.

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

■ 3 Phase Bidirectional Power cum Energy meter panel (EMT 34) 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
- Optionally modbus RTU RS 485 for RTU/SCADA interface.

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

- Consisting of synchronization digital meter (Synchroscope)
- Manual Synchronization switch.
- 15W lamps X 6 nos.
- 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 ckt & sensing panel (PE7A-L/R) 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
- 1000µf/250V electrolytic capacitor paralleled with 2.2µf/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 (100µf/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) (0.5HP) X 1 No.**

- AC Resistors = 10K/5K/3.5K/2.5K/2K/1.5K/200WX3 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) (3HP) 1 No.**

- 3 nos of 600W resistors with switch selectable 6 nos of taps at 100, 112, 150, 175, 200, 225Ω & 265Ω fix

■ **List of experiments:**

- To verify $F1 \pm F2$ algebraic addition of delta connected stator of DFIG.
- To verify $F1 \pm F2$ algebraic addition of star connected stator of DFIG.
- To calculate the efficiency of DFIG (delta stator) setup when connected ON grid by manual Synchronization of DFIG with grid supply.
- To calculate the efficiency of DFIG (star stator) setup when connected ON grid by manual Synchronization of DFIG with grid supply.
- To study DFIG (delta stator) power sharing between grid & load when grid tied.
- To study DFIG (star stator) power sharing between grid & load 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 Φ 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	Rack: 1170(L) x 300(W) x 990(H) Net Wt.: 65, Gross Wt.:73. Coupled machine: 760(L) x 300(W) x 400(H) Net Wt.: 80	Rack: 1170(L) x 300(W) x 990(H) Net Wt.: 65, Gross Wt.:73. Coupled machine:1228(L) x 300(W) x 500(H) Net Wt.: 100 EMT42A & EMT74 panel: 600(L)x275(W)x500(H) Net Wt.: 60