

ELECTRICAL MACHINE TRAINER (MODEL XPO-EMT)



FEATURES

- Facilitates easy and safe wiring by students due to use of 4mm sturdy **Shrouded** banana patch cords and shrouded socket arrangements.
- All machines are mounted on finely painted sturdy base frame with easy machine **interchangeability**. Use of gear coupling facilitates **screwless coupling**.
- With due emphasis on student safety machines operate upto 300W power levels and upto 1500 RPM, without compromising on didactic use. Able to draw all graphs.
- Trunnion mounted DC integrated machine is used as **Dynamometer** for loading other machines with facility to measure shaft power using electronic torque / speed measurement
- Order one Dynamometer type DC m/c per aluminum Rack with 17 (14+3) panels each (such 6sets) & one each of other m/c to complete the 6 sets.



Technical Specifications

A] Powder coated sturdy Aluminum flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility.

- § **Input 3 phase DOL Starter panel (EMT1)** [10 Shrouded Banana]
 - α 4 pole MCB of 415 V/1A .
 - α DOL 9A Contactor with 230V / 50 Hz / 11VA COIL .
 - α Bimetallic thermal O/L relay with range 1.4A - 2.3A .
- § **Integrated AC (3/1 phase) measurement panel (EMT20 & EMT20F)** [14 Shrouded Banana]
 - α Consist of 2 nos of (48X96mm) Digital meters one each for 3 ϕ & 1 ϕ . Measures V, I, PF(0.2 lag – unity – 0.2 lead), Hz. Hence separate analog wattmeters (3 ϕ , 1 ϕ) are not needed.
 - α Current specs for 3 ϕ meter = 1.5A (Balanced load) and 1A/5A for 1 ϕ meter (170-250V).
- § **FWD/REV ,Star-Delta starter panel (EMT 4)** [12 Shrouded Banana]
 - α FWD/REV, 3 pole 3 way switch with centre OFF,6A/440V.
 - α Star/Delta switch 3 pole ,3 way with centre OFF,6A/440V.
- § **3 Phase wound Rotor & Sync. Motor panel (EMT 5A/5B)** [8 Shrouded Banana]
 - α Rotor resistors of 30E/5A with 3 taps of 0E, 15E, 21E, 30E each -----3 nos
 - α Rotor resistor selector switch ,3 pole.6 Way .6A/440 V.
 - α DC Rotor excitation over current relay (3Amp)
- § **1 ϕ Motor, Alternator & Sync. Motor Panel (EMT 16)** [14 Shrouded Banana]
 - α 1 ϕ MCBs of 4A/1.6A – 2nos.
 - α 2no 2P2W selector switches to run as 1 ϕ alternator then as synchronous motor.
 - α 8A pushbutton switch to simulate as centrifugal switch.
- § **DC voltmeter and DC ammeter panel (EMT 6A/6B)** [14 Shrouded Banana]
 - a) DC voltmeter(0-300V) b) DC Ammeter (0-5A) with polarity protection diode
 - c) Field failure relay to control Armature supply. Both 6A/6B needed simultaneously.
- § **SCR Actuator (variable DC) cum sensor signal conditioning panel (EMT9)** [4 Shrouded Banana]
 - α Half bridge SCR based 0V-195V / 5 Amp cosine firing with linear characteristics.
 - α Supports signal conditioning circuit for speed, torque in kg wt to output 0-2.5Vdc (FS).
 - α 3 Nos. of these supplies required for DC Armature, DC motor field and AC generator field.
- § **Instrumentation Power supply cum Multichannel DPM panel (EMT 8)** [10 Shrouded Banana]
 - (a) +/-12 V ,500 mA (b) +5V ,300mA (c) Unregulated 17V dc/750 mA (d) line synchronizing signal.
 - (e) 13V / 3 Amp. (f) Multi channel DPM for digital display of torque, speed etc
- § **Lamp Load (EMT 7) OR Resistor Load (EMT14A/14B)**
 - α 230V /15/40/60/100W X 3 bulbs with individual ON/OFF using 6A toggle switch ----4 nos.panels.
- OR** α (1)**AC Resistors** = 10K/200WX3 phases/ 6 taps (2) **DC Resistors** = 750E/400W / 6 taps
- § **LC Load (EMT 15A/15B) panel**
 - (A) **Inductive load** = 0.75H/3H/300mAX3Nos. (B) **Capacitive load** = 1.25 μ /2.5 μ /5 μ /415VX 3Nos.
- § **Mechanical** : Nt wt = kg, Dimension(mm) = 940(W) x 1176(H) x 305(D)

Optional Accessories :

- (1) Hand held Digital tachometer
- (2) Analog AC voltmeter (EMT2) and dual range Ammeter (EMT3)
- (3) Analog watt meter (3 ϕ , 1 ϕ) (EMT10,12)
- (4) Analog Powerfactor meter (3 ϕ , 1 ϕ) (EMT 13,11)
- (5) power analyser with RS232C
- (6) 3 phase sequence indicator cum protection panel (P30)

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Specifications subject to change without notice.

P.T.O.

Electrical Machine Units offered :

M/C type	DC Integrated m/c	3 ϕ AC Integrated m/c	1 ϕ Synchronous m/c	1 ϕ AC Integrated m/c	Universal Motor	Repulsion Motor (Optional)	3 ϕ Squirrel Cage motor
Voltage	Varm = 180V Vfield = 180V	415VAC, 50Hz	230VAC, 50Hz	230VAC, 50Hz	230VAC, 50Hz / 150Vdc	230VAC, 50Hz	415VAC, 50Hz
Capacity/RP M/Terminals	300W / 2 Pole m/c / 1500RPM 6 terminals	300W / 4 Pole m/c / 1500RPM 10 terminals	300W / 4 pole m/c / 1500RPM 4 terminals	300W / 4 Pole m/c / 1500RPM 10 terminals	300W / 4 Pole m/c / 1600 / 1500RPM 4 terminals	300W / 4 Pole m/c / 1500RPM 2 terminals	300W / 4 Pole m/c / 1500RPM 12 terminals
Rotor construction	Standard commutator / brush arrangement with laminated stack, brought out on 2 terminals	Star connected, four terminals including star point brought out on 4 slip rings mounted on shaft.	Single phase wound rotor with terminals brought out on two slip rings mounted on shaft.	Diecast Rotor	Standard commutator brush arrangement brought out on 2 terminals	Standard commutator brush but short circuited.	Diecast Rotor
Stator construction	Separately excited field winding with laminated pole solid yoke and series winding brought out on 4 terminals.	Six terminals to be brought out to start the machine using STAR - DELTA starter.	One winding will be used to configure synchronous motor and Alternator output when used as single phase generator.	Two windings brought out on 4 terminals for main and auxiliary. These will be used to configure different motors Split phase , CSCR, CSIR.	Stator brought out on 2 terminals to facilitate AC/ DC operation & direction change. Built in compensating winding to minimize AR & sparking.	Stator brought out on 2 terminals. Settable handle to rotate brush position w.r.t. neutral axis.	6x2 terminals brought out to run machine at two speeds using pole changing method
Winding Temp.	A embedded Thermistor brought out on 2 eyelets mounted on terminal box for monitoring winding temperature.						
Frame / Mounting Shaft dia.	90 Frame , Chasis mounted 19mm dia. Trunnion mounted m/c for use as Dynamometer with torque & speed sensors.	90 Frame, Chasis mounted 19mm dia. with easily swappable gear coupling	90 Frame, Chasis mounted 19mm dia. with easily swappable gear coupling	90 Frame, Chasis mounted 19mm dia. with easily swappable gear coupling	90 Frame, Chasis mounted 19mm dia. with easily swappable gear coupling	90 Frame, Chasis mounted 19mm dia. with gear coupling	90 Frame, Chasis mounted 19mm dia. with easily swappable gear coupling
Net weight Gross weight	42.500kg 53.500kg	37.500kg 47kg	37.500kg 47kg	37.500kg 47kg	37.500kg 47kg	37.500kg 47kg	37.500kg 47kg
Experiments Covered	I] Motors 1) Speed torque curves of a) Shunt motor b) DC series motor c) Separately excited DC motor d) DC compound motor (Cumulative & Differential) II] Generator (Needs to be driven) 1) V-I, Efficiency curves for a) DC shunt generator b) DC series generator c) DC separately excited generator d) DC compound generator e) OCC of shunt generator III] Armature resistance starter and SCR based soft start mechanism. IV] Efficiency of all above DC machines.	I] Motors a) Speed torque curves of wound rotor induction motor with rotor shorted & with different rotor resistors. b) DOL/Star-Delta starters, rotor resistance starter. c) Application of sync. motor as power factor improvement device / V curve. II] Generator(Needs to be driven) a) Synchronous generators V-I curve of synchronous generator. III] Efficiency of all above 3phase AC machines. IV] Paralleling / synchronising of two 3ϕ Alternators (Optional) . Needs – 2 sets of XPO-EMT & double length (EMT-26) panel with 3x2 lamps, sync switch, synchroscope.	I] Motors a) Speed torque curves of Sync. motor b) V curve II] Generator (Needs to be driven) a) V-I curves of sync. single phase generator with excitation at rotor slip rings. III] Efficiency of all above single phase AC Gen & Sync. Motor IV] Parallel operation of 1ϕ Alternator with busbar (optional).	I] Motors a) Speed torque curves of split phase indn. motor b) Speed torque curves of CSIR c) Speed torque curves of CSCR	I] Motor Speed torque curves of universal motor when operated with a) 220/240V AC b) 180C DC	I] Motor a) Speed torque curves . b) Speed control & reversal with brush setting using handle to rotate brush position w.r.t neutral axis	I] Motors a) Speed torque curves of squirrel cage rotor induction motor at two speeds. b) DOL/Star - Delta / Pole change starters. II] Efficiency of 3 phase AC Squirrel cage motor.
Optional Machines : <ul style="list-style-type: none"> • Other Dynamometer options: (a) 500W DC separately excited m/c with shafts at both ends trunnion mounted with torque & speed sensor mounted. In this case order foot mounted DC integrated 300W m/c without trunnion & NDE shaft. (b) Eddy current Brake : 45Vdc/3A 400W. • Shaded pole 230V ac 50Hz, 50W 1400 RPM, foot mounted motor with spring balance pully arrangement for loading. • Swinburn's test : Measurement of NO load losses to determine efficiency of DC shunt motor. • Hopkin's test : Back to back test on two identical DC shunt m/cs. Needs 2 nos of DC m/c to be coupled to each other +2nos of EMT6 with DC Ammeters. (Use option (a) above for Dynamometer). 							

