



SALIENT FEATURES

- ◆ Each of following independent Applied PE trainer may need a few set of associated panels (4 nos. typically) which are mounted in a light weight sturdy aluminum flat demo panel system.
- ◆ Facilitates easy and safe wiring by students due to 4mm sturdy shrouded banana patch cords and shrouded socket arrangement for high voltage circuits.
- ◆ Each panel has ABS molded plastic sturdy enclosure, and colorful screwless overlays showing circuit diagram & its connection tag numbers for easy understanding and connections.
- ◆ Set of Instructor Guide & Student Workbook.

Technical Specifications : Note : All of following panels may not be used in any one single trainer.

- ◆ **Input 3 phase DOL Starter panel (EMT1)** (10 Shrouded Banana)
 - 4 pole MCB of 415 V/2A.
 - DOL 9A Contactor with 230V / 50 Hz / 11VA COIL.
 - Bimetallic thermal O/L relay with range 1.4A - 2.3A.
- ◆ **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/ needed simultaneously.
- ◆ **Lamp Load (EMT 7)**
 - 1 230V /15/40/60/100W X 3 bulbs with individual ON/OFF using 6A toggle switch.
- ◆ **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.
- ◆ **SCR Actuator (variable DC) cum sensor signal conditioning panel (EMT9)** (4 Shrouded Banana)
 - 1 Full bridge SCR based 0V-195V / 5 Amp cosine firing with linear characteristics.
 - 1 Supports signal conditioning circuit for speed, torque in kg wt to output 0-2.5Vdc (FS).
 - 1 3 Nos. of these supplies required for DC Armature, DC motor field and AC generator field.
- ◆ **LC Load (EMT 15A/15B) panel**
 - (A) Inductive load = 0.75H/3H/300mAX3Nos.
 - (B) Capacitive load = 1.25mF/2.5mF/5mF/415VX 3Nos.
- ◆ **1 phase Motor, Alternator & Sync. Motor Panel (EMT 16)** (14 Shrouded Banana)
 - 1 phase MCBs of 4A/1.6A 2nos.
 - 2no. 2P2W selector switches to run as 1 phase alternator then as synchronous motor.
 - 8A pushbutton switch to simulate as centrifugal switch.
- ◆ **Integrated AC (3 phase) measurement panel EMT20 or optionally EMT 34 Bidirectional)** (14 Shrouded Banana)
 - Consist of 96x96mm Digital meters for 3 phase Measures V, I, PF(0.2 lag unity 0.2 lead), Hz. Hence separate analog wattmeters (3 phase, 1 phase) are not needed.
 - Current specs for 3 phase meter = 1.5A (Balanced load)
- ◆ **3 phase SCR Firing/Synchronizing Panel(PE4A)**
 - Cosine firing scheme to facilitate linear control for better harmonic ripple control.
 - Cyclo converter frequency generator 25 Hz / 125 Hz
- ◆ **6 SCR/Diode Power Module(PE4B)** (36 Shrouded Banana)
 - Consist of 6 SCR [Anode to body type] with PIV rating 1000V / 25A.
 - 6 diode with PIV rating of 1000V/6Amp
 - 6 No. of Snubbers for protection of thyristors consisting of capacitor 0.1uF/1000V and 0.1E/5W ceramic resistors.
- ◆ **Single Phase Dual Converter Controller Panel (PE5A)** (12 Shrouded Banana)
 - 2 No. CTs (1A/30mA) to detect current zero condition in each converter bridge
 - Converter reference voltage generator and required output polarity signal generator.
 - Current zero sensing circuit and pulse block signals.
- ◆ **Load Distribution Panel (PE5B)** (6 Shrouded Banana)
 - 2 Nos. of Multi Tap Inductors (0-0.3-0.6-0.75-0.9-1.2-1.5 H) @1A
 - 2P 6W rotary switch to select inductor tapping.
- ◆ **3 phase Inverter Panel (PE7)**
 - Consist of full bridge inverter with 6 Nos. of IGBT/MOSFET, 1200 V/10A
 - V to F converter
 - P/PI controller
- ◆ **Input/output Module /UP1**
- ◆ **Battery/Transformer Module /UP2**
- ◆ **AVR/Charger Module /UP3**
- ◆ **Inverter Module /UP4**

Choice of Model : Select one or more trainers.

S. N.	Model Name Specifications	1. XPO-HVDC	2. XPO-SPDC	3. XPO-DMSC	4. XPO-AMSC	5. XPO-UPS	6. XPO-3 INV
1.	Trainer Name	3 Phase HV Thyristor Control Trainer	Single Phase Dual Converter Trainer	DC Motor Speed Control Trainer	AC Motor Speed Control Trainer	Uninterruptible Power Supply Trainer	3 Phase inverter trainer
2.	Rack. config. [No. of panels]	4 x 2 (7)	4 x 2 (5)	4 x 2 (5)	4 x 1 (3)	4 x 1 (4)	4 x 2 (8)
3.	Resource Panels needed.	EMT1, EMT6B, EMT7, EMT15A, EMT20 PE4A, PE4B.	EMT 8, EMT9 [2 Nos.] EMT16, PE5A, PE5B(Double length) Optionally instead of EMT9 (2 Nos.), 2 Nos. of MOSFET-IGBT Panel PE6.	EMT6B, EMT8, EMT9. For optional motor 1 more EMT9 and EMT6A is required. Optional PE6, Variable IGBT/MOSFET based PWM Controlled Power for Armature Supply.	EMT6, EMT8, EMT9,	Input Module (UP1) AVR/Charger Module (UP2) Inverter Module (UP3) Output Module (UP4)	EMT1, EMT6B, EMT7, EMT15A, EMT20 PE4A, PE4B, PE7.
4.	Sensors Used	3 Nos. of PT's arranged in Y circuit 230V : 12-0-12V @50mA	2 No CTs 1A : 30 mA to detect zero current condition in each converter.	Electronic tacho 0 - 1V /1000 rpm optionally 10V/1000 rpm electrical tacho	Electronic tacho 0 - 1V /1000 rpm	---	Electronic tacho 0 - 2.5V /1500 rpm
5.	Table Top M/C's / accessories	<ul style="list-style-type: none"> Optionally 3 phase Step Down [430/110VAC] Isolation Transformer or, 3 phase dimmer of 500VA may be ordered from safety point of view. Optional : 3 phase induction motor (F.H.P.) 	<ul style="list-style-type: none"> DC Motor 200VDC / 200W with 1500 rpm OR 60W Lamp Load on EMT16 panel Isolation Transformer 230 : 230 @ 3A, 1 ph. 	PMDC Motor 200V / 200W Chassis Mounted table top with break pulley and spring balance [5kg] Optional : 1) 160W / 180V Shunt Motor. OR 2) 300W/ 180V DC Motor with series, shunt & compound winding.	Fractional HP AC/DC Motor 230VAC, 1/12 HP. Chassis Mounted table top with break pulley and spring balance [5kg]	---	3 -phase squirrel cage I.M. 1/2HP, 4 pole, 1500RPM, 6 terminals (Delta-220VAC) star-415 VAC).
6.	List of Experiments	<ul style="list-style-type: none"> Study of 3 phase SCR cosine firing circuits 3 phase half bridge uncontrolled converter Full bridge uncontrolled converter Half bridge controlled converter Full bridge controlled converter 3 phase cyclo converter (25Hz / 12.5Hz). 3 phase AC power control for resistive lamp load 3 phase Induction motor speed control using SCR based AC voltage control. 	<ul style="list-style-type: none"> Study of Dual converter topology & control strategy. Study of Dual converter operation: Resistive load / motor load. Study of circulating & non circulating current mode operation. Study of 4 SCR full bridge O/P 0-195V / 3A, cosine firing (EMT9) Optionally using MOSFET-IGBT panel (PE6) 	<ul style="list-style-type: none"> Open loop torque speed characteristics. Closed loop speed control using Armature voltage / speed feed back using PIPI mode 	<ul style="list-style-type: none"> Open loop torque speed characteristics. Closed loop speed control using speed feed back with AC controller using PIPI mode. 	<ul style="list-style-type: none"> Study of AVR, charger Study of change over logic Study of PWM inverter Study and working of typical offline UPS. <ul style="list-style-type: none"> a) Input Range is 170 -270VAC 50HZ b) Output (input present) 195-250VAC sine c) Output (input unhealthy / absent) 230V \pm5% quasi-sine AVR d) Capacity 200W lamp load on AVR e) Battery 12V/7AH, "Panasonic" (Maintenance free lead acid) f) Backup of 5 min. on 200W lamp load or 20 min. on one PC with 14" colour monitor. g) 17 test points are provided 	<ul style="list-style-type: none"> Study of 3 phase Inverter Close loop control V/F method
7.	Mechanical dimension (mm) / Kg. Wt.	960(L) x 300(W) x 545(H) 28Kg	960(L) x 300(W) x 545(H) 35Kg	960(L) x 300(W) x 545(H) 15Kg	960(L) x 300(W) x 545(H) 15Kg	960(L) x 300(W) x 545(H) 18Kg	960(L) x 300(W) x 545(H) 25Kg