

ANALOG - DIGITAL TRAINER (Model : XPO-ANADIGI)



SPECIFICATIONS OF MASTER UNIT

- ◆ Built in Power Supply:
DC Power Supply : 5V / 1A, $\pm 12V$, 500mA
0 - $\pm 12V$ 150mA (variable),
AC 12-0-12, 150mA AC
- ◆ Built in Function Generator:
Output Waveform: Sine, Triangle & Square / TTL
Output Frequency: 1 Hz to 200KHz in 6 ranges,
with amplitude & frequency control pots. O/P
Voltage 20V p-p max.
- ◆ Clock Generator : 10 MHz TTL clock.
- ◆ Input Data Switches and output LED status indicators for High/Low indication (15+1No.)
- ◆ Pulsar switches (2 Nos.) With four debounced outputs - 2 No.
- ◆ Fixed TTL (5V) clocks : 4 Nos. 1KHz, 100Hz, 5Hz, 1Hz
- ◆ Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status.
- ◆ 2 digit 7 segment display with BCD to 7 segment decoder.
- ◆ LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input.
- ◆ Onboard DPM is provided with mode selection. DC volt/current: 200mA/20V - 1No.
- ◆ Audio Amplifier with gain 20.
- ◆ Onboard POTS: 1K - (1No.) & 1M - (1No.)
- ◆ Onboard speaker: 8 Ω , 0.5 Watt - (1No.)
- ◆ Built in bread board panel with 1280 tie points and 400 distribution points, totalling to 1680 points along with 4mm banana sockets for tapping from the trainer +5V, +12V GND for the circuits to be assembled on bread board using single stand (#22/24)wire.
- ◆ Computer Interface Adapter:
Facilitates connecting your trainer to either IEEE 488 or RS232 com port of PC using 25 pin (male) D connector through 25 nos. of banana sockets. Optionally a 16 pin ZIF may be provided in place of 'D' connector.
- ◆ Mechanical Dimensions:
Master Unit : 400mm(W), 125mm(H), 270mm(D)
Net weight:8Kg., Gross weight:10Kg.
Panel : 215mm(W), 165mm(H), 40mm(D)
Net weight: 700 gm approx.
- ◆ Operating Voltage: 230V $\pm 10\%$, 50Hz/35A.

SALIENT FEATURES

- ◆ Aesthetically designed injection molded electronic desk.
- ◆ Master unit carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will hold various replaceable experiment panels.
- ◆ Connection through Sturdy 4mm Banana Sockets & Patch Cords.
- ◆ Hands on learning by constructing circuits using built in power bread board panel as well as optionally using Discrete component panel.
- ◆ Set of Users Guide provided with each Unit.

OPTIONAL ACCESSORIES : Can be used with both models : CT & Anadigi

Discrete Component Panel (DCP)	Panel with following discrete components : 7 Resistors, 5 diodes, 1 LDR, 1 Zener, 3 NPN transistors, 1 PNP transistors, 1 UJT, 4 Capacitors, 1 HV Capacitors, 2 SCR, 2 FET & MOSFET, 1 12V RELAY, 3 Inductors, 1 Linear pot, 1 Triac, 1 Audio transformer, 1 PUT, 1 HW Resistor, 1 DIAC, 92 Banana sockets for patch cording to construct various circuits.				
DIP / ZIF panel	Model	Digital IC Trainer (DIT I)	TTL CMOS Trainer (DIT II)	Linear IC Trainer	ZIF Panel (I & II)
(order separate DIP/ZIF panel for each of application)	IC used	7400, 04, 08, 32, 86, 76, 90, 76, 95 or 02	74280, 7407, 74HCT14, 4011, 7485, 74191, 4051, 74123	LM339, TL084, 741, 555	40 pin universal ZIF socket
	No. of sockets	142	142	142	76
	Discrete component used	10Kx1, 0.1 F x 1, 100K pot	10K x 2, 100K pot, 4K7 x 1, 220K x 1, 0.1 F x 1, 0.047 F x 1	Resi-15nos, Cap.-15nos, Transi-2Nos, Diodes-4Nos, Zener-1No., Regulator-3Nos, Pot-1No.	10Kx2
	No. of Expt.	>50/TTL characteristics Combinational logic 18 Nos. of Demorgan Theorem's Asynchr-onous sychr. counters, Flip Flop	>22/CMOS characteristics, CMOS TTL I/F, Flip Flop, parity, mux - demux, monostable, synchronous counter	>40	Various Option II 6 Nos. of 20 Pin ZIF Socket with 120 BS-5 sockets.
Overlay Learning System (OLS)	Digital			Analog	
	16 Nos. of tracings supporting 56 Experiments.			14 Nos. of tracings supporting 39 Experiments.	
Set of Components useful for Above OLS	As per your order and specification consisting of Resistor(92nos.), Capacitor (43nos.), Inductor (4nos.), Transistor (11nos.), Diode (9 nos.), LEDs (13 nos.), ICs (53 nos.) etc. Supplied with 22 or 24 SWG SS Hook up wires for BB panel 1 mtr length & 4mm yo 22 SWG SS (300mm) X 10Nos				
Bread Board Trainer (Power Project Board)	Bread board : With 1280 tie points & 400 distribution points totalling to 1680 points with built in power supply : +5V, ±12V, variable 0 to ±12V				

MODULAR EXPERIMENT PANELS : Following experiment panels normally work in conjunction with CT Master Unit. However they can be ordered as stand alone units with built in power supply.

Magnetism, Electromagnetism & Transformer Characteristics (P1)

(Provided with 38 banana tags.)
Faraday's law of magnetic induction, Left-hand rule for north pole of coils / conductors & Corkscrew rule for flux around current carrying conductor. Fleming's left-hand rule (motor law -force on a current carrying conductor in a magnetic field), Lenz's Law.

Transformer- DC / AC resistance, transformation / Voltage ratio, loading of transformer, Auto transformer, self & mutual inductance, **B-H curve tracer.**

DC/AC & Wave Shaping Circuit Experiment Panel (P2)

(Provided with 65 banana tags)
DC : Resistance, current and voltage measurements, Ohm's law, Power DC circuits, Series, parallel and mixed circuits, Kirchoff's law, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Compensation theorem, Millman's theorem, Max. Power transfer theorem, Voltage distribution of capacitors in series & parallel, total capacitance of capacitors in series and parallel, charging and discharging of capacitor through resistance & time constant, Wheatstone's Bridge, 2 Port Network Y, Z, ABCD Parameters & Star Delta Network.

AC : AC Voltage & Current Measurements - R-L series, R-C series, R-L-C series circuit (Series Resonance). R - L parallel, R-C parallel, R-L-C parallel (Parallel Resonance), Active, Reactive power & power factor (Vector Diagram), average & RMS Value measurement.

Wave Shaping: Differentiator, Integrator, Clipping, Clamping, Passive filters LC / RC, LPF / HPF

Semiconductor & Power Semiconductor Devices Experiment Panel (P3)

(Provided with 41 banana tags)
Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac, bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET, IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, **Band gap energy Calculations**, Thermistor, V-I Characteristics on CRO of SCR, Triac, Transistor as a Switch & MOSFET as a Switch.

Sensors & Transducers Experiment Panel (P4)

(Provided with 17 banana tags)
Temperature Sensors: AD 590 (IC Sensor), RTD (PT100), Thermistor, (NTC).

Light Sensor: Photo Transistor & Photo Diode, LDR, Photovoltaic Cell.

Rectifier, Filter, Zener Regulator Experiment Panel (P5)

(Provided with 67 banana tags)
Transformer & its study (Transformer DC/AC resistance, Transformation Ratio, Electromagnetic Induction, Loading of Transformer), Half wave rectifier, Full wave rectifier, Bridge rectifier, Filter, Voltage multiplier, Zener shunt regulator

Voltage Regulator Experiment Panel (P6)

(Provided with 40 banana tags)
Zener regulator with current boost transistor, Transistorised series regulator, IC voltage (variable) regulator using IC 723 (Positive/negative voltage regulator), IC current regulator using IC LM317.

Transistor h-parameters & CB/CC/CE amplifiers experiment panel (P7)

(Provided with 62 banana tags)
Thermal stability (Transistor bias stability), Determination of h-parameters, Common base, common collector, common emitter, cascode amplifier, boot-strapping & transistor switching.

Transistor Amplifier Experiment Panel (P8)

(Provided with 44 banana tags)
Differential amplifier, 2 stage R-C coupled amplifier, Transformer coupled amplifier, common source FET amplifier, common drain FET amplifier (source follower) Push pull amplifier, Complementary symmetry amplifier, Class-D amplifier.

Transistor Signal & Feedback Amplifiers Experiment panel (P9)

(Provided with 40 banana tags.)
Current & Voltage shunt feedback amplifier and Direct coupled Amplifier, Current & Voltage Series (Darlington Transistor Amplifier) feedback amplifier, RF tuned Amplifier / Oscillator with AM-FM facility, Class A amplifier, Class B amplifier, Class AB amplifier Class C amplifier, Class D or Switching amplifier, Pulse width modulator.

Transistor / Diode Applications Experiment Panel (P10)

(Provided with 61 banana tags.)
Components suitably arranged so that following 30 projects can be constructed: Electronic storage tank, One way street, "Invisible power" Radio, Transistor, Electronic trigger, Transistor and amplification, Sunrise-Sunset light, Slow -motion Sunrise-Sunset light, Secret code key, Highs

& lows of oscillations, Beacon light, Music from a pencil, Leaky facet, Bee, Electronic canary, Burglar alarm, Touching light, Rain detector, Radio station, Wireless rain detector, Metal detector, Blowing 'ON' a candle, Blinker, Two transistor oscillator, Timer, Memory, AND, OR, NAND, NOR gate.

Oscillator & Multivibrator Experiment Panel (P11)

(Provided with 22 banana tags.)
Hartley oscillator, Colpitts oscillator, Crystal oscillator, Clapp oscillator, Blocking oscillator, Astable multivibrator, Monostable multivibrator, Bistable multivibrator, Twin T Oscillator, RF tuned oscillator.

Digital Logic Gates Experiment Panel (P12)

(Provided with 28 banana tags.)
AND, OR, Inverter, NAND, NOR, EX-OR, EX-NOR, Demorgan's theorems, Input / Output characteristics, propagation delay.

Flip Flop, Counters & Shift Register Experiment panel (P13)

(Provided with 60 banana tags.)
R-S Flip-flop, 'D' flip-flop, 'T' flip-flop, 'J-K' flip-flop, Master-slave J-K flip-flop, Binary Counter, Rotary feed back application of counter, Decade counter, Shift registers: Shift left/Right/Ring counter, Parallel mode, Twisted ring counter.

Multiplexer, Decoder & Encoder Experiment panel (P14)

(Provided with 51 banana tags.)
Multiplexer, Decoder / Demultiplexer, BCD to seven segment decoder driver, Tristate logic, Encoder.

Half/Full Adder, Subtractor, ALU Experiment panel (P15)

(Provided with 56 banana tags.)
Half adder, Half subtractor, Full adder, Full subtractor, ALU, Applications of ALU: Mathematical-addition, subtraction; Logical-AND, OR, EX-OR, NOT etc; Code conversion-binary to gray, gray to binary, BCD to Excess-3, Excess-3 to BCD, 9's compliment, 10's compliment, Substitution of CAM for timing control.

Operational Amplifier Circuit Experiment panel (P16)

(Provided with 56 banana tags.)
Inverting amplifier, Non-inverting amplifier, Summing amplifier, Difference amplifier, Integrator circuit, Differentiator circuit, Precision rectifier: Half wave & full-wave, Voltage to current converter, Current to voltage p-

converter, Op-amplifier characteristics, Instrumentation amplifier, Schmitt trigger, Comparator, Sign Changer, Offset Null, Peak detector, Clipping circuit, Clamping circuits (DC restorer), Waveform Generator.

Advance Operational Amplifier Experiment Panel (P17)

(Provided with 56 banana tags.)

Lowpass filter, High pass filter, Bandpass filter, Band stop(Notch)filter, Wien Bridge oscillator, Phase Shift oscillator, Sample & hold circuit, Log amplifier, Antilog amplifier, Voltage to frequency converter, Frequency to voltage converter, Root extractor.

Timer (555) & Frequency (565) application Experiment Panel (P18)

(Provided with 41 banana tags.)

Using 555: Timer (1 shot/Monostable), Free running (Astable), Bistable. Applications of 555: Saw tooth generation, long duration timer, tachometer, missing pulse detector. Using PLL (IC565), VCO, Phase detector, Determination of Lock freq., Capture freq., & freq. Multiplier / Synthesizer, FM demodulation (Using PLL).

AM / FM Transistor Radio kit (P19)

(No. of Test points = 17)

Functional study of RF amplifier, Mixer, Local oscillator, If amplifier, Detector & Audio amplifier for both AM & FM radios. Supplied either fully assembled or CKD form. Operates from 9V built in battery. Wall transformer optional.

Power Semiconductor Application Expt. panel (P20)

(Provided with 29 banana tags.)

Triac lamp dimmer, AC fan regulator, SCR/DIAC operated light sensitive switch using LDR, SCR/DIAC operated temperature sensitive switch using thermistor, UJT relaxation oscillator, Half and full wave (Phase shift controlled) rectifier using SCR, Timer using SCR & UJT.

DC-DC, DC-AC Experiment panel (P21)

(Provided with 14 banana tags.)

DC to AC, AC to DC, DC to DC Voltage converter circuit. DC to AC Circuit (Converts 5VDC I/P to 12-0-12VAC O/P) AC to DC circuit (Converts 12-0-12VAC I/P to ±12VDC O/P)

Power Semiconductor Application Expt. Panel II (P22)

(Provided with 17 banana tags & 11 TPs)

SCR phase shift controlled converter using IC555 through opto isolator (Potentiometric), Triac AC power control using IC 555 (Potentiometric) (optoisolated), SCR AC power control using UJT/PUT (Potentiometric) Triac AC power control using UJT/PUT (Potentiometric), SCR/Triac temperature control using thermistor, SCR/Triac intensity control using LDR, Opto isolated DC switch & Photo relay & thermal relay (street light control), power control using UJT/PUT (Potentiometric) Triac AC power control using

UJT/PUT (Potentiometric), SCR/Triac temperature control using thermistor, SCR/Triac intensity control using LDR, Opto isolated DC switch & Photo relay & thermal relay (street light control).

FM Transmitter Experiment panel(P23)

(Provided with 10 banana tags.)

Single band frequency range : 88 MHz to 108 MHz.

Power O/P : 100 mW.

DC/AC Bridge circuits Expt. Panel (P24)

(Provided with 52 banana tags.)

Wheatstone's Bridge, Kelvin's Bridge, Maxwell's Bridge, Hay's Bridge, DC Sauty's Bridge, Owen's Bridge, Anderson's Bridge, Shearing Bridge, Wien bridge.

Stepper Motor Demonstrator Expt. Panel(P25)

(Provided with 11 banana tags.)

Direction, speed, auto, manual operations of Stepper Motor

Analog Multiplexer / Demultiplexer & ADC, DAC Expt. Panel (P26)

(Provided with 40 banana tags.)

8 Channel Analog Multiplexer, 1 of 8 Analog Demultiplexer, Flash A to D Converter (3 bit), D to A Converter (4 bit) weighted binary and R-2R.

Microphones Expt. Panel (P27)

(Provided with 15 banana tags.)

Frequency & directional response of Carbon Microphone, Dynamic / Moving coil Microphone, Condenser / Electret Microphone, Crystal Microphone.

Study of Logic Gates & Applications Expt. Panel (P28)

(Provided with 58 banana tags.)

Logic Gates, & input output characteristics Boolean Algebra Theorems, Demorgan's Theorems, Logical equations, Digital code lock, R-S flip-flop using NOR gates, Multivibrators - Astable, Monostable & Bistable multivibrator etc..4 bit synchronous counter, Synchronous non binary counter/Decade counter /MOD 10 counter etc.

Switch Mode Power Supply Expt. Panel (P29)

(Provided with 11 banana tags.)

SMPS (TV), To study Crow bar protection circuit.

3 Phase sequence indicator Expt. Panel (P30)

(Provided with 7 banana tags.)

Phase sequence indicator and Study Expt. Panel (P30)

(Provided with 7 banana tags.)

Study 3 phase 440V Electric utility supply -Determination of over voltage, under voltage, single phasing and reverse phasing / Displays OV,UV,SP,RP on digital display, 9V Battery / +12V supply operated.

JFET, MOSFET & IGBT Expt. Panel (P31)

(Provided with 49 banana tags)

MOSFET : Drain characteristics of MOSFET, MOSFET Amplifier, MOSFET Switch,

JFET : Characteristics of JFET, JFET amplifier, JFET crystal oscillator, Phase shift osc. Using FET,

Phase splitter using FET, FET Analog switch, **IGBT** : Characteristics of IGBT, IGBT as switch.

Passive / Active / M Derived Filter Panel (P32)

(Provided with 114 banana tags)

Passive (RC) filters- Low pass , High pass, Notch filter, **Active filters**- Low pass, High pass, Unity gain phase shifting, Butterworth, Bessel, Chebyshev filter

LC (M derived / constant K type filters)- T type high pass Active filters, High pass M derived, Band stop, Band pass, M derived Band pass, Constant K type pass band, Band Elimination, Composite Low/High pass filter can construct above filters & plot their characteristics.

ADC & DAC Circuits Experiment Panel(P33)

(Provided with 23 banana tags)

8 bit ADC, 0-5V I/P:- Dual slope ADC, Tracking ADC, SAR ADC, RAMP ADC, Bipolar ADC using level translator, Delta Sigma ADC , 8 bit DAC:- O/P Range 0.5V & +/-5V.

Memory Experiment Panel (P34)

(Provided with 55 banana tags)

Constructing ROM with Diode Matrix (4x8 bits), RAM with D flip flop, EEPROM (28C64) - 8K x 8, EPROM (2764) 8K x 8, RAM (6264) 8K x 8. Flash memory microcontroller.

Oscillator & Amplifier Experiment Panel (P35)

(Provided with 19 banana tags)

Blocking Oscillator Circuit, Schmitt Trigger/Oscillator, OTL Amplifier, OCL Amplifier, 0.5W/8 ohm Loud speaker with Audio amplifier, Mic with preamplifier, Electronic Birdcall circuit, transistorized wien bridge oscillator & phase shift oscillator. 8 bit fault switches to simulate various commonly occurring faults.

3Phase Laws Experiment Panel (P36)

(Provided with 40 banana tags)

Star, Delta relationship between V.I. Use of Low volatge isolated secondaries to prevent shocks, various rectifier circuits. Need 3 phase 4 wire supply.

Advance DC to DC Converter Panel (P37)

(Provided with 63 banana tags)

Open loop & Closed loop scheme for Step Up (Boost), Step Down (Buck), Polarity Inverter, Forward, Fly back, Push Pull, Negative Voltage Converter, Cascaded Negative Voltage Converter.

AVO Meter, Lamp, Relays, Cells Expt. Panel (P38)

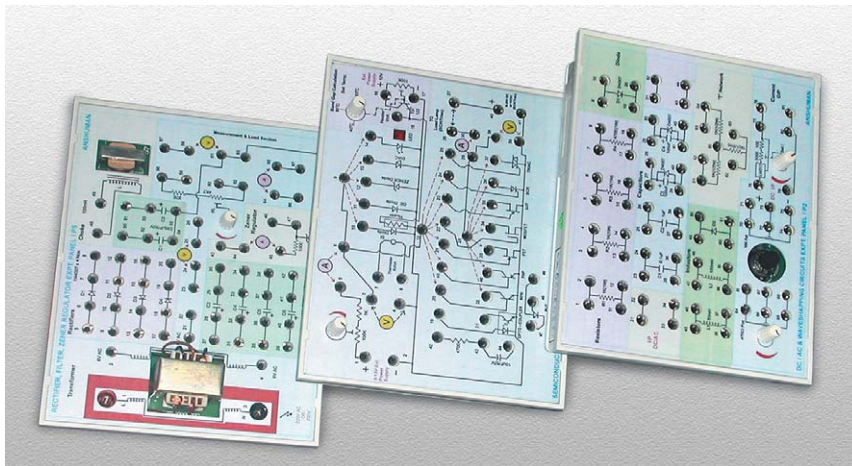
(Provided with 48 banana tags)

1.5 x 4 No. cells for series parallel expts., moving coil meter (100 uA) to construct voltmeter, ammeter AC / DC and ohmmeter, bulbs in series parallel Relay characteristics, staircase lamp logic.

OP AMP Parameter Measurement Panel (P39)

(Provided with 15 banana tags)

Experimental measurement of 9 parameters-opamp input resistance, output resistance, open loop voltage gain, bandwidth, offset voltage, CMRR, input offset current, input bias current & Slew rate.



LABWISE EXPERIMENT PANEL SELECTION CHART

Networks & Fields (3)	P1, P2, P36, P38
Discrete Electronics (13)	P3, P4, P5, P6, P7, P8, P9, P10, P11, P24, P31, P35, DCP
Digital Electronics(10)	DIT I, DIT II, P12, P13, P14, P15,P26, P28, P33, P34
Opamps / Linear Electronics(8)	LIT, P16,P17, P18, P26, P32, P33, P35
Power Electronics(7)	P20, P21, P22, P25, P29, P30, P36, P37
Communication Electronics(5)	P18, P19, P23, P27, P32

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