

SENSOR TRAINER (XPO-MIT)

DATA ACQUISITION TRAINER (XPO-DAC) (Labview based)



Table Top Flow Setup



Table Top Level Setup

MASTER UNIT

- **Built in power supply :**
DC supply +/- 12V, 500mA, Variable 7V to 14V @ 3Amp.
- **Built in function generator**
O/P waveform- sine, triangular & square, TTL O/P freq. 1Hz to 200KHz in ranges with amplitude & freq. control pots, o/p voltage 10Vpp.
- **On board measurement**
DC voltmeter 2V/20V (1 No) & LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input.
- **Computer interface (Optional)**
Interfaces through 25 pin parallel port [LPT port] optoisolated adaptor to prevent damage to PC parallel port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. P4/XP not in scope of supply. Lab View based (optionally) executable to support virtual instrumentation with drivers supplied.
4 ADC channels : 0 to 2.5V full scale
1 DAC channel : o/p 2.5 V full scale
V to I Function block : Input: 0-2.5Vdc, Output: 0
20 or 4-20mA, upto max. 2Vdc Gnd compliance
- USB converter to interface 25 pin D connector on CIA panel to USB using PIC18F microcontroller 28 Pin SOIC enclosed in 25 Pin D shell using Type A to mini B cable.
- **Mechanical Dimensions:**
a) **Master Unit** : 460mm(W), 160mm (H), 350mm(D)
Net weight : 6Kg, Gross weight : 8Kg.
b) **Panel** : 215mm(W), 165mm(H), 40mm(D),
Net weight : 700 gm approx.
- **Operating voltage** : 220V / 230V ±10%, 50Hz, 75VA

Modular experiment panels

Optionally can be ordered as stand alone units (except MIT 10 panel) with built in power supply.

1) Strain gauge Transducers (MIT1)

- Piezo resistive transducer for strain measurement.
- Micrometer 0-20mm (Accuracy 0.01mm) for strain generation.
- Strain gauges mounted on cantilever in half & full Wheatstone bridge and **instrumentation amplifier** with Zero & span adjustment for calibration.
- Experiments on Gauge factor determination, Strain indicator, Displacement measurement using Strain gauges.
- **Optional ADDONS**
a) Piezo resistive transducer for pressure measurement (0-15psi) (cannot share with Level setup) Pressure sensor 0-15 psi (30psi max.), gage type, Pressure generating handpump connected using T connector to the sensor and Bourden pressure gauge for measurement & calibration. Cannot share MIT-1 with any other option add-on.

- b) Piezo electric transducer for impact measurement with **attenuator & peak detector**.
- c) Force / Weight measurement using piezo transducer (0-20 kg weighing scale sensor).
- d) Level measurement by measuring water column height using pressure sensor by **Air bubbler** method in 250mm calibrated acrylic water tank, water pump, vibratory air pressure pump, manual bypass valve mounted on a compact (530 mm x 555 mm) panel. Cannot share MIT1 with a, f options simultaneously. (Size : 530 x 300 / x 910 mm)
- e) Torque measurement setup consisting of trunnion mounted 1/4 HP single phase 230Vac induction motor, piezo resistive force / torque sensor, loading pulley with 5kg spring balance (2 Nos.).
- f) Flow measurement using Venturi OR Orifice. Compact, lightweight setup of size (190X700) consisting of venturi OR orifice plate sensor (200LPH), ball valve to isolate, uses DPT sensor mounted in MIT1, water pump, rotameter (750 for Venturi and 200 for Orifice), U tube mercury manometer (70-0-70 mm of hg), 6 QRC's to measure differential pressure, flow measurement tank (5 litre), submersible water pump, Sump water tank (15 litre). [Cannot share MIT1 with option a,d simultaneously. Order venturi or Orifice separately].

2) Displacement Sensing Transducers (MIT2)

- **Micrometer** 0-20mm (Accuracy 0.01mm)
- **Precision phase sensitive rectifier**
- Measurement frequency of 1KHz sine.
- Zero & span adjustment for calibration of following transducers
 - i) Resistive linear transducer : 0-20mm
 - ii) Capacitive linear transducer : 0-20mm
 - iii) Capacitive angular transducer : 0-90 degree
 - iv) Inductive linear transducer : 0-20mm
 - v) LVDT transducer : 0-20mm or (-10 to +10mm)
- **Optional ADDONS**
a) Level measurement by **capacitance** transducer using 250 mm calibrated acrylic water tank, water pump, manual flow valve mounted on compact light weight (530 x 555 mm) panel.
b) Level measurement by **float type** rotary pot transducer using 250 mm calibrated acrylic water tank, water pump, manual flow valve mounted on compact light weight (530 x 555 mm) panel.
c) Angular measurement using rotary pot 0-180° Span.
d) **Humidity** measurement demonstrator using polymer hybrid sensor.

3) Speed Sensing Transducers (MIT3)

- 12V **DC motor** with speed varying from 0-4000rpm & rotating slotted wheel having 8 slots,
- Individual signal conditioning circuit with **programmable threshold comparator**.
- **F to V Converter** with **span & zero amplifier**.
- Speed transducers :-
 - i) Magnetic pickup
 - ii) Photo reflective
 - iii) Photo interruptive
 - iv) Inductive pickup with **envelop detector**.
 - v) Stroboscope
 - vi) Hall sensor

• Optional ADDON

Flow measurement - Compact, lightweight set up of size (190mm X 700mm) with small water pump, **Vane type** flow sensor (200LPH) & rotameter (200LPH), 15 lit. plastic water tank. (Size : 460 x 430 x 570 mm)

4) Sound Sensing Transducers (MIT4)

- 40KHz gated oscillator to generate **Ultrasonic** sound waves.
- **V to I function** block to convert voltage O/P into 4 to 20mA current loop.
- Sound Sensors :
 - i) Ultrasonic **Distance** Measurement.
 - ii) Dynamic microphone as Sound / Audio sensor.

5) Light Sensing Transducers (MIT5)

Incandescent lamp with variable intensity

Light sensors :

- i) Photodiode with **I to V converter**
 - ii) Phototransistor with **I to V converter**
 - iii) Photo resistor/LDR with R to V converter using constant current source.
 - iv) Photovoltaic cell / Solar cell
 - v) Opto coupler, Laser diode, Infrared LED, Red LED
- **Optional ADDON**
 - a) **Elementary Fiber Optics** : 3 nos of transmitter diodes (RED (660nm) / BLUE / IR (950nm), 1 no detector (photo transistor), 1m PMMA Cable, I/Ps - TTL & AC Coupled (0-4V), O/P's- AC, DC Coupled & TTL O/P, **Experiments performed** : Setting up ANALOG LINK (10KHz BW) (Study DC Characteristics & frequency response of different transmitter diodes), Setting up DIGITAL LINK (50KHz BW) (observe effect of varying square wave frequency on receiver output). Needs external FG.
 - b) Optical filters for Red, Green, Blue & Yellow colour to determine sensitivity transducers for colours.

6) Temperature Sensing Transducers (MIT6)

- **Instrumentation Amplifier** to amplify thermocouple signals
- Built in heat bar / mini oven driven by **Power Amplifier** of sufficient wattage
- Temp. selection upto 95 degree C in 5 ranges with ON / OFF closed loop control.
Temp. sensors:- i) Thermocouple J with room temp. calibration pot. ii) Thermocouple K with room temp. calibration pot. iii) Thermister (100K), iv) PT100, v) IC sensor (AD 590) vi) Bimetallic switch

7) Vibration sensor and Air flow sensor Experiment Panel - MIT7

Vibration sensor i) Operation Range : Audio frequency (2KHz - 8KHz), ii) **Power amplifier** : 1W capacity as a vibration generator, iii) Piezo electric sensor iv) Determination of acceleration (accelerometer), velocity, displacement components.

Air flow sensor : i) Preheated thermister = 100 ohm, ii) DC fan (12V, 1 1/2") to generate variable airflow in a mini wind tunnel with manual outlet control, iii) Bridge amplifier to O/P 0 = 2V at various temperatures (Fan speed).

8) Electrical parameters measurement sensor panel: (MIT8)

Panel Facilitates measurements of AC voltage, current (peak, average, RMS), power-S (apparent), P (active), Q (reactive), cos (PF 0.5 lag to 0.5 lead), CT (5/1 Amp) as a current transducer and PT (230V/ 12V) as a voltage transducer mounted on the panel itself.

Loading Setup provided with 100 W lamp bulb (**Process I modified**), multi tap Reactive (inductor, capacitor) load, 4 relays to automate PC based measurement. PC interface supported by master unit (Optional).

9) Encoder (absolute/incremental) experiments panel (MIT9)

Panel consists of 4 bit up/down counter with parallel loading to latch absolute encoder O/P (4 bit), comparator to stop turn table at set position, incremental encoder circuit with direction detect and incremental position clock. Position displayed on 5 Leds to indicate direction and position of turn table (1 of 16).

Encoder Set up : RTU base unit with turn table motor as prime mover with 5 track pattern stuck from below photo reflective emitter detector LED (5 pairs) signal conditioning PCB mounted from below & 15 pin D connector cable attached to MIT9 panel.

10) Temperature sensor calibration panel (MIT10)

Compact light weight setup (size: 190X700) consisting of process vessel (SS 304) with 750W heater, thermometer, provision to mount either one RTD/NTC (thermistor) & one K type TC or 2 TCs (standard & under calibration), EMT9 panel acts as heater controller consisting of signal conditioning circuit for RTD or NTC & TC. Needs MU for computer interface.

11) Electromagnetic & Magnetic sensor/actuator experiment panel/P1 (Modified)

Digital & Analog Hall flux density sensor, Magnetic Reed switch, Electromagnetic relay, magnetic compass, X'mer as transducer.

SALIENT FEATURES

- ◆ Aesthetically designed injection moulded electronic desk. Master unit carrying useful experiment resources like Power supplies, DPMS, Computer Interface, Bar graph LED indicator Function Generator etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure. Order MUs x 7 Nos. + 7 panels + addons as required.
- ◆ Has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity.
- ◆ Hands on learning by plotting sensors characteristics. 1 to 6 are basic sensors, 7 to 10 are applied sensor panels. Set of Users Guide provided with each Unit
- ◆ **Data acquisition control trainer** (Lab view based EXE program using MIT3/MIT6/Stepper motor P25 panel). Labview not in scope of supply. Labview is trademark of NI.

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