DIGITAL TRAINER - Modular Experiments

DT-3000A

The DT-3000A Digital Trainer is an comprehensive and self-contained system specially design for digital logic experiments training. All necessary equipments for digital logic experiments such as power supply, signal generator, switches and displays are installed on the main unit. The system consist of **Main Module Unit** and **13 Experiment Modules** covers a wide variety of essential topics in the field of digital logic. It is a time and cost saving device for both students and researchers interested in developing and testing circuit prototypes in institution and universities.

- Suitable for combined logic, sequential logic and microprocessor circuits designing and experiments.
- Ideal tool for learning the basics of digital logic circuits.
- Comprehensive power, signal supply and testing devices for convenient experiments.
- Expandability and flexibility of experiments greatly increased with universal breadboard.
- Capable of processing TTL, CMOS, NMOS, PMOS and ELC circuits.
- All supply units are equipped with overload protection for better safety.
- All modules equipped with 8-bit DIP switch for fault simulations.
- Individual storage cases for all modules for easy storing and carrying.

LIST OF EXPERIMENTS (13 MODULES)

- **Basic Logic Gates Experiments**
- **Assembled Logic Circuits Experiments**
- **Sequential Logic Circuit Experiments**
- **Clock Generator Circuit Experiments**
- **Memory Circuit Experiments**
- **Converter Circuit Experiment**

SPECIFICATION
MAIN MODULE UNIT (AULS-3000A)

SPECIFICATIONS

1. Regulated DC Power Supplies
+5V/1.5A, -5V/0.5A,
+12V/0.5A, -12V/0.5A,
Adjustable / Variable 0 to ±20V/0.5A
(short circuit & over load protection)

2. Function Generator
All signal generators has independent and simultaneous TTL and CMOS level output terminal.
CMOS level output range from + 1.5V to + 15V and is controlled from the voltage adjustment knob of the Adjustable DC Power Supply
Sine, Square, Triangle waveform with Symmetry control and adjustable Amplitude,
Frequency Range : 0Hz to 1MHz
Standard TTL Square Waveform Output

3. Clock Signal Generator
1. Frequency : 1Hz ~ 1 MHz (6 Ranges)

a.	1 Hz ~ 10 Hz		d.	1 KHz ~ 10 KHz	
b.	10 Hz ~ 100 Hz		e.	100 KHz ~ 1000 KHz	
c.	100 Hz ~ 1 KHz		f.	1000 KHz ~ 1 MHz	

4. Removable Breadboard
2200 tie points removable breadboard on top panel

5. 3-state Logic Probe
with 7-segment display

6. 2-Single Shot Pulser Switch
2 sets of independent control output
Each set with Q, Q output, pulse width > 5mS
Each set of switch with DEBOUNCE circuit

7. 16-bit LED Logic Indicator
16 sets of independent LED indicates high and low logic state

8. Eight HI / LO Data Output Switches
±5V/0V

9. Two Level Switches Module

10. Four digits BCD & 7-Segment LED Digital Display
4 sets of independent 7-segment LED display
With BCD, 7-segment decorder/driver and Dp input terminal

11. Loud Speaker
8Ohm, 0.25W

12. Frequency Counter
Measuring Range : 1Hz To 100KHz

13. Potentiometer
With 1 K, 10K,100K and 1M Ohm Potentiometers

14. AC Power Supply
25V – 0 – 25V, 50Hz

15. Digital LCD Display Multimeter Module
DC Voltage : 200mV ~ 1000V.
DC Current : 2000uA ~ 10A
AC Voltage : 200mV ~ 750V rms
Resistance : 200 Ohm ~ 2000 Ohm
Diode Test
hFE, Logic Test
Transistor Test : NPN & PNP
Continuity Beep

16. Programmable Capacitors
Programmable from 1.0nF to 1000nF

17. Network Resistors
Discrete, Parallel & Series

EXPERIMENT MODULES

1. **DT-EM01: Basic Logic Gates Experiments**
2. **DT-EM02: Assembled Logic Circuit Experiments (1)**
3. **DT-EM03: Assembled Logic Circuit Experiments (2)**
4. **DT-EM04: Assembled Logic Circuit Experiments (3)**
5. **DT-EM05: Assembled Logic Circuit Experiments (4)**
6. **DT-EM06: Assembled Logic Circuit Experiments (5)**
7. **DT-EM07: Clock Generator Circuit Experiments (1)**
8. **DT-EM08: Sequential Logic Circuit Experiments (1)**
9. **DT-EM09: Sequential Logic Circuit Experiments (2)**
10. **DT-EM010: Memory Circuit Experiments (1)**
11. **DT-EM011: Memory Circuit Experiments (2)**
12. **DT-EM012: Converter Circuit Experiments (1)**
13. **DT-EM013: Converter Circuit Experiments (2)**

LIST OF EXPERIMENTS

1. Basic Logic Gates Experiments

1.1 Introduction to Logic and Switches
1.2 Logic Gates Circuit Experiments
  a. Diode Logic (DL) Circuit
  b. Resistor-Transistor Logic (RTL) Circuit
  c. Diode-Transistor Logic (DTL) Circuit
  d. Transistor-Transistor Logic (TTL) Circuit
  e. CMOS Logic Circuit
1.3 Threshold Voltage Measurement Experiments
  a. TTL Logic Circuit
  b. CMOS Logic Circuit
1.4 Voltage/Current Measurement Experiments
  a. TTL I/O Voltage/Current Output Measurement
  b. CMOS I/O Voltage/Current Output Measurement
1.5 Basic Logic Gate Transmission Delay Measurements
  a. TTL Logic Gate Transmission Delay Measurements
  b. Schmitt Gate Transmission Delay Measurements
  c. CMOS Transmission Delay Measurements
1.6 Measurement of Basic Logic Gates Characteristics
  a. AND Gate Characteristics Measurement
  b. OR Gate Characteristics Measurement
  c. Inverse Gate Characteristics Measurement
  d. NAND Gate Characteristics Measurement
  e. NOR Gate Characteristics Measurement
  f. XOR Gate Characteristics Measurement
1.7 Interface Between Logic Gates
  a. TTL to CMOS Interface
  b. CMOS to TTL Interface

2. Assembled Logic Circuit Experiments

2.1 NOR Gate Circuit Experiment
2.2 NAND Gate Circuit Experiment
2.3 XOR Gate Circuit Experiments
  a. With NAND Gate
  b. With Basic Equations
2.4 A-O-I Gate Circuit Experiment
2.5 Comparator Circuit Experiments
  a. With Basic Logic Gates
  b. With IC type TTL comparator
2.6 Schmitt Gate Circuit Experiment
2.7 Open Collector Gate Circuit Experiments
  a. High Voltage/Current Driver Circuit
  b. Constructing and AND Gate with Open Collector Gate
2.8 Three-State Gate Circuit Experiments
  a. True Table Measurement Experiment
  b. Constructing and AND gate with Three-State Gate
  c. Bidirectional Transmission Circuit
2.9 Half Adder and Full Adder Experiments
  a. With Basic Logic Gates
  b. Full Adder Circuit
  c. High-Speed Adder Carrier Generator
  d. BCD Code Adder Circuit
2.10 Half-Subtractor and Full Subtractor Experiments
  a. With Basic Logic Gates
  b. With Full Adder and Inverter Circuit
2.11 Arithmetic Logic Unit (ALU) Circuit Experiment
2.12 Bit Parity Generator Experiments
  a. With XOR Gate

b. With IC Bit Parity Generator

2.13 Encoder Circuit Experiments
- a. Constructing a 4 to 2-bit Encoder with Basic Logic Gates
- b. Constructing a 10 to 4-bit Encoder with TTL IC

2.14 Decoder Circuit Experiments
- a. Constructing a 4 to 2-bit Decoder with Basic Logic Gates
- b. Constructing a 10 to 4-bit Decoder with TTL IC
- c. Decoding 7-segment Display with BCD Code

2.15 Multiplexer Circuit Experiments
- a. Constructing a 2 to 1-bit Multiplexer with Basic Logic Gates
- b. Using multiplexer to Create Functions
- c. Constructing a 8 to 1-bit Multiplexer with TTL IC

2.16 Demultiplexer Circuit Experiments
- a. Constructing a 1 to 2-bit Demultiplexer with Basic Logic Gates
- b. Constructing a 1 to 8-bit Demultiplexer with CMOS IC

2.17 Digitally Controlled Analog Multiplexer / Demultiplexer Circuits
- a. Characteristics of Analog Switches
- b. Bidirectional Transmission with CMOS IC Analog Switches

3. Clock Generator Circuit Experiments

3.1 Constructing Oscillator Circuit with Basic Logic Gates
3.2 Constructing Oscillator Circuit with Schmitt Gate
3.3 Voltage Controlled Oscillator (VCO) Circuit
3.4 555 IC Oscillator Circuit Experiments
- a. 555 Oscillator Circuit
- b. Voltage Controlled Oscillator Circuit

3.5 Monostable Multivibrator Circuit Experiments
- a. Low-Speed Monostable Multivibrator Circuits
- a.1 Non-Retriggerable circuit
- a.2 Retriggerable Circuit
- b. High-Speed Monostable Multivibrator Circuits
- b.1 Non-Retriggerable circuit
- b.2 Retriggerable Circuit
- c. Constructing Monostable Multivibrator with 555 Trigger
- d. Constructing Non-Retriggerable Circuit with TTL IC
- e. Constructing Retriggerable Circuit with TTL IC
- f. Constructing a Variable Duty Cycle Oscillator Circuit with Monostable Multivibrator.

4. Sequential Logic Circuit Experiments

4.1 Constructing a R-S Flip-Flop with Basic Logic Gates
4.2 Constructing a D Flip-Flop with a R-S Flip-Flop
4.3 Constructing a T Flip-Flop with a D Flip Flop
4.4 Constructing a J-K Flip-Flop with a R-S Flip-Flop
4.5 Constructing a Shift Register with D Flip-Flop
- a. Serial-in Serial-Out Shift Register
- b. Serial-in Parallel-Out Shift Register
- c. Parallel-in Serial-Out Shift Register
- d. Parallel-in Parallel-Out Shift Register

4.6 Preset Left/Right Shift Register Circuit Experiment
4.7 Noise Elimination Circuit with R-S Flip-Flop
4.8 Constructing Counter with J-K Flip-Flop
- a. Asynchronous Binary Up-Counter Circuit
- b. Asynchronous Decimal Up-Counter Circuit
- c. Asynchronous Divide-by-N Up-Counter Circuit
- d. Asynchronous Binary Down-Counter Circuit
- e. Synchronous Binary Up-Counter Circuit
- f. Synchronous Binary Up-Down Counter Circuit
- g. Preset Synchronous Binary Up/Down Counter Circuit
- h. Preset Synchronous Decimal Up/Down Counter Circuit
- i. Ring Counter Circuit
- j. Johnson's Counter Circuit

5. Memory Circuit Experiments

5.1 Constructing READ ONLY MEMORY (ROM) with Diodes
5.2 Constructing RANDOM ACCESS MEMORY (RAM) with D Flip-Flop
5.3 64-bit RAM Circuit
5.4 ERASABLE PROGRAMMABLE READ ONLY MEMORY (EPROM) Circuit
5.5 Electronic EPROM (EEPROM) Circuit
5.6 Constructing Dynamic Scanning Counter with Single-Chip Microprocessor

6. Converter Circuit Experiments

6.1 Digital/Analog Converter Circuit Experiments
  a. Unipolar Output Converter Circuit
  b. Bipolar Output Converter Circuit
6.2 Analog/Digital Converter Circuit Experiments
  a. 8-bit Converter Circuit
  b. 3 1/2-digit Converter Circuit

7. Circuit Application Experiments

7.1 4-channel Trigger Selector
7.2 Tone-Adjustable Electronic Organ
7.3 Level Indicator
7.4 Monostable Coded Lock
7.5 Depth Monitor
7.6 Electronic Stopwatch
7.7 Flashing Light with Metronome
7.8 Entrance/Exit Counter
7.9 Multiple Switches
7.10 Electronic Clock
7.11 Frequency Counter
7.12 Telephone Ringing Generator

ACCESSORIES (DT-MA)

A. Connect Leads : 1) 2mm ~ 0.65mm, 300mmL, 6pcs
2) 2mm ~ 2mm, 450mmL, 10pcs
B. Test Probe : 2mm ~ 2mm, 600mmL, 1pc
C. Connect Plugs : Ø2mm, 10mmL
D. Experiment manual and Instructor's manual
E. User's Manual
F. Fuse
G. AC Cord
H. Anti-Dust Cover
I. Key - 1 pc

GENERAL CHARACTERISTICS

A. Main Module Unit dimension: (W x D x H) 390 x 345 x 130 mm
B. Module dimension: (W x D x H) 255x165x30mm
C. Power Source : 240V ± 10%, 50Hz
D. Operating Temperature : 0° C ~ 50° C
E. Humidity : < 90% relative humidity