Electronic Circuits Equipment

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Electronic Circuits Equipment

CONTENTS

KL-100
Linear Circuit Lab (1) - Electric Circuits Lab

The KL-100 Linear Circuit Lab (1) Electric Circuits Lab is a comprehensive and self-contained system suitable for tuition and experimentation with electric circuits.

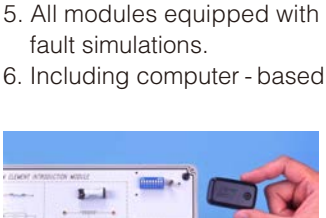
All the necessary equipment for electric circuit experiments such as power supply, function generator, analog and digital meters are installed on the main unit.

The 11 modules cover a wide variety of essential topics for electric circuit. It is indeed a time and cost saver for both students and engineers interested in training, developing and testing prototype circuits.

+ Simulation

Features

1. Ideal for electric circuit experiments and design exercises
2. Integrated trainer with complete curriculum.
3. Complete with power supplies and test systems for easy and efficient experimentation.
4. Universal breadboard (1680 tie points) for circuit design and prototyping.
5. All modules equipped with an 8-bit DIP switch for circuits fault simulations.
6. Including computer - based training



KL-29001

Storage cabinet for easily storing all modules

Specifications

Main Unit(KL-21001)

1. DC Power Supply
   (1) Fixed DC power supply
      a. Voltage range : ±5V, ±12V
      b. With output overload protection
   (2) Dual DC power supply
      a. Voltage range : ±3V~±18V, continuously adjustable
      b. With output overload protection

2. AC Power Supply
   (1) Voltage range : 9V~0~9V
   (2) With output overload protection

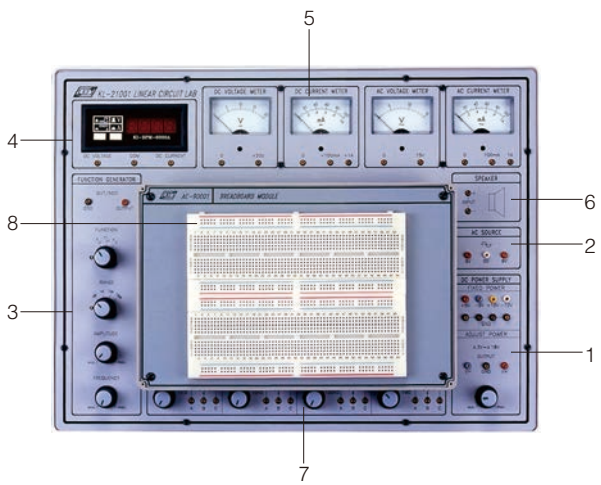
3. Function Generator
   (1) Output waveform : Sine, square and triangle
   (2) Output frequency : 10 Hz~100 KHz, 4 settings, continuously adjustable
   (3) Accuracy : ±5% of full scale value
   (4) Output impedance : 50Ω
   (5) Output voltage : ⩾18Vpp (open loop) ⩾9Vpp (with 50Ω load)

4. 3 1/2 digit Digital Voltmeter/Ammeter
   (1) DC voltage range : 2V, 200V
   (2) DC voltage accuracy : ±0.3% of reading + 1 digit
   (3) DC current range : 200μA, 2000mA
   (4) DC current accuracy : ±0.5% of reading + 1 digit

5. Analog Meters
   (1) AC current : 0 ~ 100mA ~ 1A
   (2) AC voltage : 0 ~ 15V
   (3) DC current : 0 ~ 100mA ~ 1A
   (4) DC voltage : 0 ~ 20V

6. Speaker
   one 8Ω, 0.25W speaker with driver circuit

7. Variable Resistors
   (1) 1KΩ, 0.25W variable resistor with 3 terminals (A,B,C)
   (2) 10KΩ, 0.25W variable resistor with 3 terminals (A,B,C)
   (3) 100KΩ, 0.25W variable resistor with 3 terminals (A,B,C)
   (4) 1MΩ, 0.25W variable resistor with 3 terminals (A,B,C)
8. Breadboard (AC-90001)
   1680 tie-point breadboard on top panel can be easily put into and taken off.



KL-21001

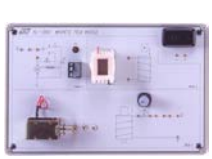
Experiment Modules

1. 11 modules, each module is equipped with an 8-bit DIP switch for circuits fault simulations. Students can practice troubleshooting by setting the DIP switch to different positions.
2. Detailed solution for fault simulation is included in the instructor's manual.
3. All sockets on the modules accept 2mm plugs.
4. Comprehensive experiment manual and instructor's manual
5. Module dimension: 255x165x30mm.

List of Modules

KL-13001
Basic Electricity Experiments Module

KL-13002
Magnetism Element Introduction Module

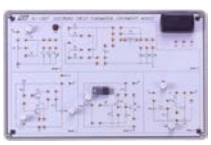


KL-13003
Magnetic Field Module

KL-13004
Ampere's Rule Module

KL-13005
Fleming's Rule Module

KL-13006
Electromagnetic Induction



KL-13007
Electronic Circuit Fundamental Experiments Module

KL-13008
Basic Electronic Circuit Experiments (1)

KL-13009
Basic Electronic Circuit Experiments (2)

KL-13010
Special Electronic Components Experiments Module

KL-13011
Oscillator Experiments and Applications Module

List of Experiments

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- 1-2 Using an ohmmeter KL-13001
- 1-3 Resistor characteristics KL-13001
- 1-4 DC current measurement KL-13001
- 1-5 Ohm's law KL-13001
- 1-6 Power in DC circuit KL-13001
- 1-7 Series-parallel network and Kirchoff's law KL-13001
- 1-8 Superposition, Thevenin's and Norton's theorems KL-13001
- 1-9 Maximum power transfer theorem KL-13001
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- 3-10 UJT characteristics KL-13007

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- 5-4 Temperature-controlled circuit KL-13010
- 5-5 Sound controlled circuit KL-13010

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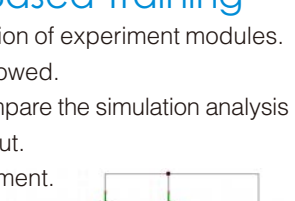
- 6-2 Electronic birdcall circuit KL-13011
- 6-3 Astable multivibrator KL-13011
- 6-4 LED flasher circuit KL-13011
- 6-5 LC resonant circuit KL-13011

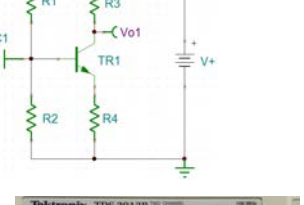
Accessories(KL-18001)

1. Experiment manual and instructor's manual
2. Connection leads and plugs : 1set
3. Inductors : 0.1H, 0.5H each 1pce
4. Magnet : 1pce
5. Key : 1pce

Computer-Based Training

1. Built-in circuit simulation of experiment modules.
2. Fault simulation is allowed.
3. Users can flexibly compare the simulation analysis result with hardware signal output.
4. Support virtual instrument.





KL-200

Linear Circuit Lab (2) - Electronic Circuits Lab

The KL-200 Linear Circuit Lab(2)-Electronic Circuits Lab is a comprehensive and self-contained system suitable for anyone engaged in electronic circuit experiments.

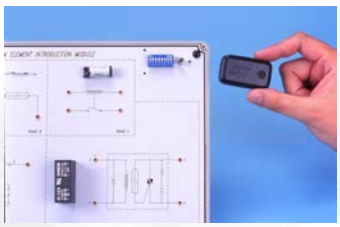
All the necessary equipment for electronic circuit experiments such as power supply, function generator, analog and digital meters are installed on the main unit.

The 17 modules cover a wide range of essential topics for electronics circuit. It is a time and cost saver for both students and engineers interested in developing and testing prototype circuits.

+ Simulation

Features

1. Ideal for electronic circuit experiments and designing exercises.
2. Integrated experimental circuit and trainer with comprehensive experiment curriculum.
3. Supply complete training device easy and effective for experiments.
4. With universal breadboard for circuit designing and prototypes.
5. All modules equipped with an 8-bit DIP switch for fault simulations.
6. Individual keeping case for all modules easy carrying and storage facilities.
7. Including computer - based training



Specifications

Main Unit (KL-21001)

1. DC Power Supply
   (1) Fixed DC power supply
      a. Voltage range : ±5V, ±12V
      b. With output overload protection
   (2) Dual DC power supply
      a. Voltage range : ±3V~±18V, continuously adjustable
      b. With output overload protection

2. AC power supply
   (1) Voltage range : 9V~0~9V
   (2) With output overload protection

3. Function Generator
   (1) Output waveform : Sine, square and triangle
   (2) Output frequency : 10Hz~100KHz, 4 settings, continuously adjustable
   (3) Accuracy : ±5% of full scale value
   (4) Output impedance : 50Ω
   (5) Output voltage : ⩾18Vpp (open loop)
      ⩾9Vpp (with 50Ω load)

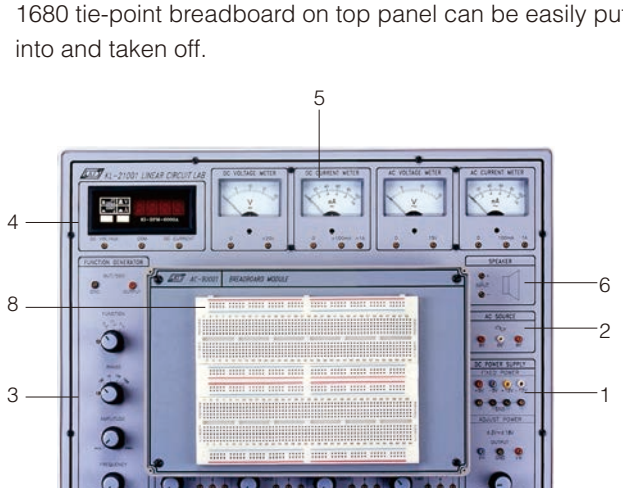
4. 3 1/2 digit Digital Voltmeter/Ammeter
   (1) DC voltage range : 2V, 200V
   (2) DC voltage accuracy : ±0.3% of reading + 1 digit
   (3) DC current range : 200μA, 2000mA
   (4) DC current accuracy : ±0.5% of reading + 1 digit

5. Analog Meters
   (1) AC current : 0 ~ 100mA ~ 1A
   (2) AC voltage : 0 ~ 15V
   (3) DC current : 0 ~ 100mA ~ 1A
   (4) DC voltage : 0 ~ 20V

6. Speaker
   one 8Ω, 0.25W speaker with driver circuit

7. Variable Resistors
   (1) 1KΩ, 0.25W variable resistor with 3 terminals (A,B,C)
   (2) 10KΩ, 0.25W variable resistor with 3 terminals (A,B,C)
   (3) 100KΩ, 0.25W variable resistor with 3 terminals (A,B,C)
   (4) 1MΩ, 0.25W variable resistor with 3 terminals (A,B,C)

8. Breadboard (AC-90001)
   1680 tie-point breadboard on top panel can be easily put into and taken off.

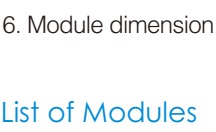


KL-21001

Experiment Modules

1. Each of 17 modules is secured in a solid-body plastic housing
2. Each module is equipped with an 8-bit DIP switch for fault simulations. Students can practice trouble shooting by setting the DIP switch to different positions
3. Detailed solutions for the fault simulation are included in the instructor's manual
4. All sockets on the modules accept 2mm plugs
5. Comprehensive experiment manual and instructor's manual
6. Module dimension : 255 x 165 x 30mm

List of Modules



KL-23001
Diode, Clipper and Clamper Module

KL-23002
Rectifier, Differential & Integrator Circuits

KL-23003
Transistor Amplification Circuits

KL-23004
Field Effect Transistor (FET) Circuits

KL-23005
Multistage Amplification Circuits

KL-23006
OTL Amplifier Circuit

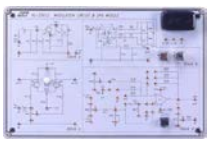
KL-23007
OCL Amplifier & Feedback Circuit

KL-23008
Oscillator Circuits (1)

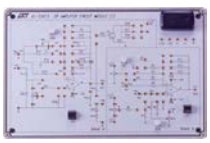
KL-23009
Oscillator Circuits (2)

KL-23010
Voltage Regulator Circuits

KL-23011
Voltage Regulator & Amplitude Modulation (AM) Circuits



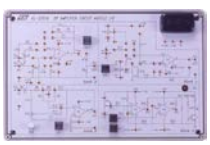
KL-23012
Frequency Modulation (FM) & OP Amplifier Circuits



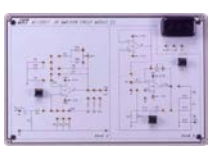
KL-23013
OP Amplifier Circuits (1)

KL-23014
OP Amplifier Circuits (2)

KL-23015
OP Amplifier Circuits (3)



KL-23016
OP Amplifier Circuits (4)



KL-23017
OP Amplifier Circuits (5)

List of Experiments

1. Characteristics of Diodes
   - 1-1 Silicon diode .....KL-23001(A)
   - 1-2 Germanium diode .....KL-23001(A)
   - 1-3 Zener diode .....KL-23001(A)
   - 1-4 Light emitting diode .....KL-23001(E)
   - 1-5 Optical diode .....KL-23001(E)

2. Clipping and Clamping Circuits with Diodes
   - 2-1 Clipping circuit (1) .....KL-23001(B)
   - 2-2 Clipping circuit (2) .....KL-23001(C)
   - 2-3 Clamping circuit (1) .....KL-23001(D)
   - 2-4 Clamping circuit (2) .....KL-23001(D)

3. Rectifier Circuits
   - 3-1 Half wave rectifier circuit .....KL-23002(C)
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   - 3-4 Dual power supply rectifier circuit .....KL-23002(C)
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   - 4-2 Differential circuit : Square wave input .....KL-23002(D)
   - 4-3 Differential circuit : Sine wave input .....KL-23002(D)
   - 4-4 Integrator circuit : Square wave input .....KL-23002(D)
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   - 4-6 RL circuit .....KL-23002(D)

5. Transistors
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   - 5-2 NPN transistor .....KL-23002(A)

6. Transistor Amplification Circuits
   - 6-1 Common emitter transistor amplification circuit .....KL-23003(A)
   - 6-2 Common base transistor amplification circuit .....KL-23003(B)
   - 6-3 Common collector transistor amplification circuit .....KL-23003(C)
   - 6-4 Switching type transistor circuit .....KL-23003(C)
   - 6-5 Darlington's circuit .....KL-23004(A)

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   - 7-2 Metal-Oxide-Semiconductor FET (MOSFET) .....KL-23004(B)

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   - 8-1 JFET common source amplification circuit : Self-bias .....KL-23004(C)
   - 8-2 JFET common source amplification circuit : Divide-bias .....KL-23004(C)
   - 8-3 JFET common drain amplification circuit : Self-bias .....KL-23004(C)
   - 8-4 JFET common drain amplification circuit : Divide-bias .....KL-23004(C)
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   - 9-1 RC coupled amplification circuit .....KL-23005(A)
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   - 9-4 Push-pull amplification circuit .....KL-23005(C)
   - 9-5 OTL amplification circuit .....KL-23006(B)
   - 9-6 OCL amplification circuit .....KL-23007(A)
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    - 10-1 Serial voltage negative feedback circuit .....KL-23007(B)
    - 10-2 Parallel voltage negative feedback circuit...KL-23007(C)
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        - b. Colpitts oscillating circuit .....KL-23009(A)
    - 11-3 Crystal oscillating circuit .....KL-23009(A)
    - 11-4 Astable oscillating circuit .....KL-23008(D)
    - 11-5 Monostable oscillating circuit .....KL-23009(B)
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    - 14-2 Characteristics of OP amplifiers
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        - b. Output impedance measurement .....KL-23012(D)
        - c. Bandwidth measurement.....KL-23012(D)
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        - e. Offset voltage measurement (1) .....KL-23012(D)
        - f. Offset voltage measurement (2) .....KL-23012(D)

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    - 16-1 Logarithm amplification circuit .....KL-23014(A)
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    - 16-4 Precision clipping circuit .....KL-23014(A)
    - 16-5 Voltage adjustment circuit .....KL-23014(B)
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    - 17-5 Tone controller circuit .....KL-23016(B)
    - 17-6 Single power supply inverse amplification circuit .....KL-23016(A)

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    - 18-5 Astable multivibrator .....KL-23017(A)
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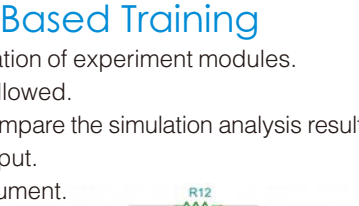
        - a. RC oscillator .....KL-23017(B)
        - b. Wien oscillator .....KL-23017(B)

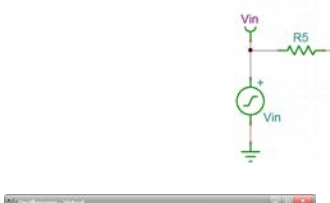
● Accessories(KL-28002)

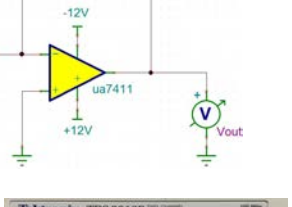
1. Experiment manual and instructor's manual
2. Connection leads and plugs : 1 set
3. Key : 1 pce

● Computer-Based Training

1. Built-in circuit simulation of experiment modules.
2. Fault simulation is allowed.
3. Users can flexibly compare the simulation analysis result with hardware signal output.
4. Support virtual instrument.







KL-210
Basic Electrical / Electronic Circuit Lab

KL-210 Basic Electrical / Electronic Circuit Lab is ideal for electrical, mechanical, automotive, science, civil & electronics engineering learning.

All the necessary equipment for electric circuit experiments such as power supply, function generator, analog and digital meters are installed on the main unit for the requirement of experiment.

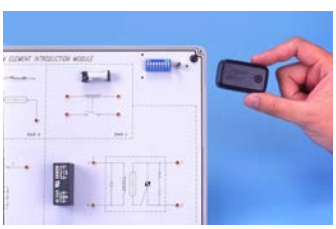
The whole essential topics of electrical circuit learning are studied by different modules.

+ Simulation

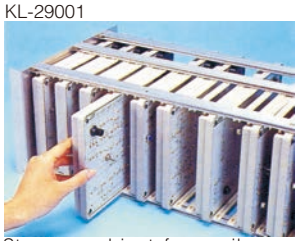
● Features

1. Ideal for students to learn the design of electrical, electronics and digital logic circuits.
2. To learn efficiently, power supply, function generator and measurement unit are all included.
3. All supply units are secured with overload protection.
4. With one main unit, user can choose the needed modules for different learning topics.
5. Including computer - based training

◎KL-210 Basic Electrical / Electronic Circuit Lab is the best choice for beginners to learn electricity circuit completely.



KL-29001

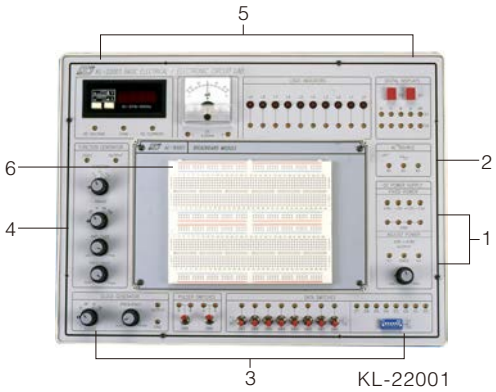


Storage cabinet for easily storing all modules

● Specifications

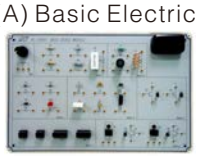
Main Unit (KL-22001)

1. DC Power Supply
   (1) Fixed DC power supply
      a. Voltage : ±5V, ±12V
      b. With output overload protection
   (2) Dual DC power supply
      a. Voltage range : ±3V~ ±18V, continuously adjustable
      b. With output overload protection
2. AC Power Supply
   (1) Voltage range : 9V~0V~9V
   (2) With output overload protection
3. Signal Generator
   (1) Pulse generator : (TTL level)
      a. Frequency range : 1Hz~10KHz/4 settings, continuously adjustable
      b. Fan out : 10 TTL load
   (2) Pulse switches
      a. 2 independent output, TTL level
      b. With Q, $\overline{Q}$ output, pulse width > 5ms
      c. Fan out : 10 TTL load
   (3) Data switches
      a. 8 sets independent control output, TTL level with Debounce circuit.
      b. Fan out : 10 TTL load
4. Function Generator
   (1) Output waveform : Sine, triangle, square
   (2) Output frequency : 10~100KHz/4 settings, continuously adjustable
   (3) Output amplitude : ⩾18Vpp (open circuit)
      ⩾ 9Vpp (50 Ω load)
5. Testing And Display
   (1) 3 1/2 digital voltmeter/ammeter
      a. DC voltage range : 2V, 200V
      b. DC voltage accuracy : ±0.3% of reading+1digit
      c. DC current range : 200μA, 2000mA
      d. DC current accuracy : ±0.5% of reading +1digit
   (2) Galvanometer
      a. Current range : ±50mA
      b. Accuracy : Class 2.5
   (3) LED indicator :
      a. 10 sets independent LED indicates high/low logic state
      b. Input impedance : ⩾100K Ω
   (4) Digital display
      a. 2 sets independent 7-segment LED
      b. With BCD-7segment decoder/driver and DP Input
      c. Input with 8-4-2-1 code
6. Breadboard (AC-90001)
   1680 tie-point breadboard on top panel can be easily put into and taken off.



List of Modules

(A) Basic Electricity Experiment Modules



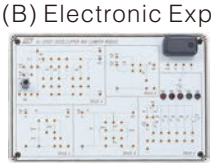
KL-24001
Basic Device Module

KL-24002
Basic Electricity Experiment Module

KL-24003
Sensor Module(1)

KL-24004
Sensor Module(2)

(B) Electronic Experiment Modules



KL-25001
Diode, Clipper and Clamper Module

KL-25002
Rectifier, Differentiator Integrator Circuit Module

KL-25003
Transistor Amplifier Circuit Module

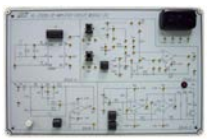
KL-25004
Multi-Stage Amplifier Circuit Module

KL-25005
FET Circuit Experiment Module

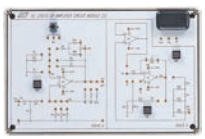
KL-25006
OP Amplifier Circuit Module (1)

KL-25007
OP Amplifier Circuit Module (2)

KL-25008
OP Amplifier Circuit Module (3)

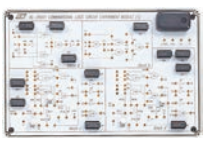


KL-25009
OP Amplifier Circuit Module (4)



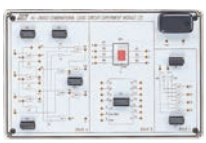
KL-25010
OP Amplifier Circuit Module (5)

(C) Digital Logic Experiment Modules

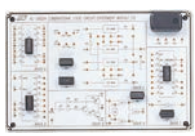


KL-26001
Combination Logic Circuit Experiment Module (1)

KL-26002
Combination Logic Circuit Experiment Module (2)



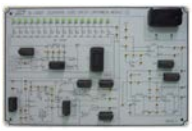
KL-26003
Combination Logic Circuit Experiment Module (3)



KL-26004
Combination Logic Circuit Experiment Module (4)

KL-26005
Combination Logic Circuit Experiment Module (5)

KL-26006
Sequential Logic Circuit Experiment Module (1)



KL-26007
Sequential Logic Circuit Experiment Module (2)

(D) Motor Experiment (Option)

KL-28001 (Option)
Low Voltage Electrical Control Module
(3Ø 220V is required)

KL-28003 (Option)
Single-phase Motor Module (1Ø AC 220V)

KL-28004 2 pcs Required (Option)
Three-phase Motor Module (3Ø 220V)

KL-28006 (Option)
Load Unit Module

KL-28010 (Option)
System Transformer(Δ→Y)

Note :
When any of above optional module is purchased, KL-28010 System Transformer is essential.

EM-3390-1A (Option)
Connecting Lead Holder

(1) Mobile type with 5-foot tubular steel base and five casters

(2) Height : 1400mm, iron plate suitable with 20 connecting leads slots

List of Experiments

(A) Basic Electricity Experiments

1. Basic Measurements
   - 1-1 Resistance measurement ..... KL-24001(A)
   - 1-2 Potentiometer characteristics ..... KL-24002(VR)
   - 1-3 DC Voltage measurement KL-22001
   - 1-4 DC Current measurement ..... KL-24002(A)
   - 1-5 Ohm's law application ..... KL-24002(A)
   - 1-6 AC voltage measurement ..... KL-24002(A)
   - 1-7 AC current measurement ..... KL-24002(C)
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   - 2-2 Wheatstone bridge ..... KL-24002(K)
   - 2-3 Superposition, thevenin's and norton's theorems ..... KL-24002(C)
   - 2-4 Power in DC circuit ..... KL-24002(A)
   - 2-5 Maximum power transfer theorem ..... KL-24002(A)
   - 2-6 DC RC circuit and transient phenomena ..... KL-24002(D)
   - 2-7 DC RL circuit and transient phenomena ..... KL-24002(F)
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   - 3-2 AC RL circuit ..... KL-24002(F)
   - 3-3 AC RLC circuit ..... KL-24002(H)
   - 3-4 Series-resonant circuit ..... KL-24002(I)
   - 3-5 Parallel-resonant circuit ..... KL-24002(J)
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   - 4-2 Metal detector ..... KL-24004(B)
   - 4-3 Light controller ..... KL-24004(A)

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   - 1-2 Zener diode characteristics ..... KL-25001(A)
   - 1-3 LED characteristics ..... KL-25001(E)
   - 1-4 Photodiode characteristics ..... KL-25001(E)
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   - 2-2 Full-wave rectifier ..... KL-25002(C)
   - 2-3 Bridge rectifier ..... KL-25002(C)
   - 2-4 Dual-power rectifier ..... KL-25002(C)
   - 2-5 Voltage doubler ..... KL-25002(B)
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   - 3-1 Clipping circuits ..... KL-25001(B.C)
   - 3-2 Clamping circuits ..... KL-25001(D)
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   - 4-1 RC circuit ..... KL-25002(D)
   - 4-2 Differentiator circuit ..... KL-25002(D)
   - 4-3 Integrator circuit ..... KL-25002(D)
   - 4-4 RL circuit ..... KL-25002(D)
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   - 5-1 Basic transistor characteristics ..... KL-25002(A)
   - 5-2 Transistor characteristic curves ..... KL-25002(A)
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   - 6-1 Common-emitter amplifier ..... KL-25003(A)
   - 6-2 Common-base amplifier ..... KL-25003(B)
   - 6-3 Common-collector amplifier ..... KL-25003(C)
   - 6-4 Switching circuit ..... KL-25003(C)
   - 6-5 Darlington amplifier ..... KL-25005(A)
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   - 7-2 Direct-coupled amplifier ..... KL-25004(A)
   - 7-3 Transformer-coupled amplifier ..... KL-25004(C)
   - 7-4 Dual-end push-pull amplifier ..... KL-25004(B)
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   - 8-1 JFET characteristics ..... KL-25005(B)
   - 8-2 MOSFET characteristics ..... KL-25005(B)
9. FET Amplifiers
   - 9-1 JFET CS amplifier ..... KL-25005(C)
   - 9-2 JFET CD amplifier ..... KL-25005(C)
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    - 10-1 Differential amplifier in OP AMP ..... KL-25006(A)
    - 10-2 OP AMP characteristic measurements ..... KL-25006(B)
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    - 11-1 Inverting amplifier ..... KL-25007(B)
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    - 11-3 Voltage follower ..... KL-25007(B)
    - 11-4 Differential amplifier ..... KL-25007(B)
    - 11-5 Adder ..... KL-25007(B)
    - 11-6 Clipping circuit ..... KL-25007(A)

11-7 Constant voltage circuit ..... KL-25007(A)
11-8 Constant current circuit ..... KL-25007(A)
11-9 Differentiator ..... KL-25007(A)
11-10 Integrator ..... KL-25007(A)
11-11 Instrumentation amplifier ..... KL-25008(A)

12. OP AMP Applications
12-1 Active high-pass filter ..... KL-25008(A)
12-2 Active low-pass filter ..... KL-25008(A)
12-3 Active band-pass filter ..... KL-25008(A)
12-4 Tone control circuit ..... KL-25009(B)

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13-2 Schmitt trigger ..... KL-25009(C)
13-3 Window comparator ..... KL-25009(D)
13-4 Monostable multivibrator ..... KL-25010(A)
13-5 Astable multivibrator ..... KL-25010(A)
13-6 Sine wave oscillator ..... KL-25010(B)
13-7 Crystal oscillator ..... KL-25009(A)

(C) Digital Logic Experiments

1. Basic Logic Gates
1-1 Logic gate circuit
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B. CMOS circuit ..... KL-26001(D)
1-2 Threshold voltage measurement
A. Measuring TTL threshold voltage ..... KL-26001(C)
B. Measuring CMOS threshold voltage ..... KL-26001(D)
1-3 Voltage/current measurement
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B. Measuring CMOS voltage and current ..... KL-26001(D)
1-4 Characteristics of basic logic gates
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B. Measuring OR gate characteristics ..... KL-26001(C)
C. Measuring NOT gate characteristics ..... KL-26001(C)
D. Measuring NAND gate characteristics ..... KL-26001(C)
E. Measuring NOR gate characteristics ..... KL-26001(C)
F. Measuring XOR gate characteristics ..... KL-26001(C)
1-5 Interface between logic
A. TTL to CMOS interface ..... KL-26001(C.D)
B. CMOS to TTL interface ..... KL-26001(C.D)

2. Combinational Logic Circuits
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2-2 NAND gate circuit ..... KL-26001(B)
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A. Constructing comparator with basic logic gates ..... KL-26001(A)
B. Constructing comparator with TTL IC ..... KL-26005(A)

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3-1 Half- and Full-Adder Circuits
A. Constructing half- and full-adders with basic logic gates ..... KL-26002(A)
B. Constructing 4-bit full-adder with IC ..... KL-26002(B)
C. Constructing BCD adder ..... KL-26002(B)
3-2 Half- and Full-Subtractor Circuits
A. Constructing half-/full-subtractors with basic logic gates ..... KL-26002(A)
B. Constructing 4-bit full-subtractor with IC ..... KL-26002(B)

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4-1 Encoder circuits
A. Constructing 4-to-2-line encoder with basic gates ..... KL-26003(A)
B. Constructing 10-to-4-line encoder with TTL IC ..... KL-26004(A)
4-2 Decoder circuits
A. Constructing 2-to-4-line decoder with basic gates ..... KL-26003(C)
B. Constructing 4-to-10-line decoder with TTL IC ..... KL-26002(C)
C. Constructing BCD-to-7-segment decoder.. KL-26003(B)

5. Multiplexers and Demultiplexers
5-1 Multiplexer circuits
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B. Using multiplexer to create function ..... KL-26004(F)
C. Constructing 8-to-1-line multiplexer with TTL IC ..... KL-26004(F)
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B. Constructing 1-to-8-line demultiplexer with CMOS IC ..... KL-26004(B)
5-3 Analog Multiplexer/demultiplexer circuits ..... KL-26004(C.D)

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6-1 Arithmatic Logic Unit (ALU) circuit ..... KL-26005(B)
6-2 Parity generator circuit
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B. Parity generator IC ..... KL-26005(C)

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7-1 Flip-flops
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B. Constructing D flip-flop with RS flip-flop .... KL-26006(C)
C. Constructing JK flip-flop with RS flip-flop.. KL-26006(C)
D. Constructing master-slave JK flip-flop with RS flip-flop ..... KL-26006(C)
E. Constructing shift register with D flip-flops ..... KL-26006(A)
F. Preset left/right shift register ..... KL-26006(B)
G. Constructing noise elimination circuit with RS flip-flops ..... KL-26006(C)
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B. Constructing synchronous counter with JK flip-flops ..... KL-26007(C)
C. Constructing divide-by-8 counter with 7490 ..... KL-26007(B)
D. Constructing BCD Counter with 7490 ..... KL-26007(B)

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8-2 Traffic light control ..... KL-26007(B)

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2. Motor forward/reverse control KL-28001, KL-28003, KL-28004
3. Motor sequence control KL-28001, KL-28004, KL-28006
4. Motor alternatively running control KL-28001, KL-28004, KL-28006
5. Wye-delta reduced voltage starting of three-phase induction motor KL-28001, KL-28004

● Accessories(KL-29004)
1. Experiment manual and instructor's manual
2. Connection leads and plugs : 1set
3. Key : 1pce

● Computer-Based Training
1. Built-in circuit simulation of experiment modules.
2. Fault simulation is allowed.
3. Users can flexibly compare the simulation analysis result with hardware signal output.
4. Support virtual instrument.

KL-300
Digital Logic Lab

The KL-300 Digital Logic Lab is a comprehensive and self-contained system suitable for anyone engaged in digital logic experiments.

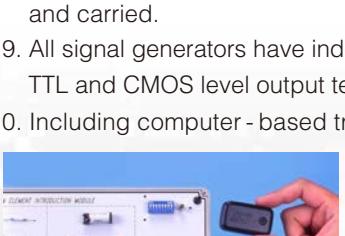
All the necessary equipment for digital logic experiments such as power supply, signal generator, switches and displays are installed on the main unit.

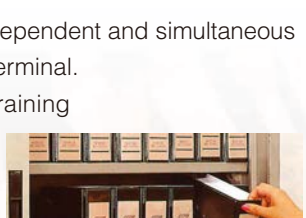
The 13 modules cover a large variety of essential topics for digital logic. It is a time and cost saver for both students and engineers interested in developing and testing circuit prototypes.

+ Simulation

● Features

1. Suitable for combination logic, sequential logic and microprocessor circuits design and experiments.
2. Ideal tool for learning the basics of digital logic circuits.
3. Comprehensive power, signal supply and testing devices for convenient experiments.
4. Experiments are expandible and flexible with universal breadboard.
5. Capable of processing TTL, CMOS, NMOS, PMOS and ECL circuits.
6. All supply units are equipped with overload protection for safety purpose.
7. All modules equipped with 8-bit DIP switch for fault simulations.
8. Individual storage cases for all modules to be easy kept and carried.
9. All signal generators have independent and simultaneous TTL and CMOS level output terminal.
10. Including computer - based training





● Specifications

Main Unit (KL-31001)

1. Dual DC Power Supply
   (1) Voltage range : +5V/1.5A, -5V/0.3A, ±12V/0.3A
   (2) With output overload protection
2. Adjustable DC Power Supply
   (1) Voltage range : +1.5V~+15V
   (2) Maximum current output : 0.5A
   (3) With output overload protection
3. Standard Frequency
   (1) Frequency : 1MHz, 60Hz, 1Hz
   (2) Accuracy : ±0.01% (1MHz)
   (3) Fan out : 10 TTL load
4. Clock Signal Generator
   (1) Frequency : 1Hz ~1MHz (6 ranges)
   a. 1Hz ~ 10Hz d. 1KHz ~ 10KHz
   b. 10Hz ~ 100Hz e. 10KHz ~ 100KHz
   c. 100Hz ~ 1KHz f. 100KHz ~ 1MHz
   (2) Fan out : 10 TTL load
5. Data Switch
   (1) 8-bit DIP switch x 2, 16-bit TTL level output
   (2) Toggle switch x 4, each with Debounce circuit
   (3) Fan out : 10 TTL load

6. Pulser Switch
   (1) 2 sets of independent control output
   (2) Each set with Q, $\overline{Q}$ output, pulse width > 5ms
   (3) Each set of switch with Debounce circuit
   (4) Fan out : 10 TTL load

7. Line Signal Generator
   (1) Frequency : 50Hz/60Hz
   (2) Output voltage : 6Vrms
   (3) With overload protection

8. Thumbwheel Switch
   2-digit, BCD code output and common point input

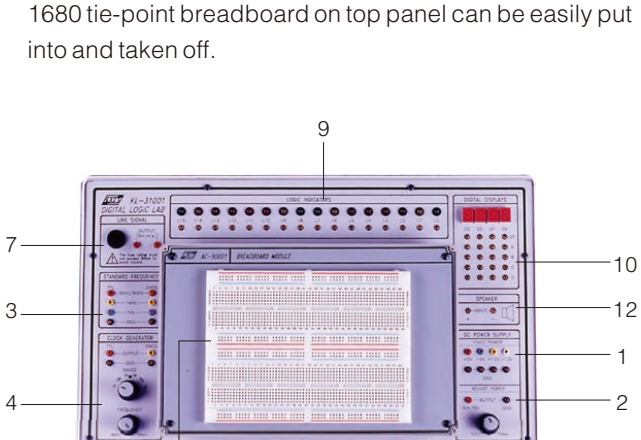
9. Logic Indicator
   (1) 16 sets of independent LED indicates high and low logic state
   (2) Input Impedance : ≥100KΩ

10. Digital Displays
   (1) 4 sets of independent 7-segment LED display
   (2) With BCD, 7-segment decoder/driver and DP input
   (3) Input with 8-4-2-1 code

11. Logic Probe
   (1) TTL and CMOS level
   (2) 5mm LED displays
   (3) "Lo" and "Hi" LED display low/high logic state respectively

12. Speaker
   One 8Ω, 0.25W speaker with driver circuit

13. Breadboard Modules (AC-90001)
   1680 tie-point breadboard on top panel can be easily put into and taken off.

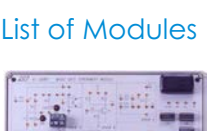


KL-31001

Experiment Modules

1. All 13 modules are equipped with an 8-bit DIP switch for fault simulation. Users learn how to solve various. problems by setting the DIP switch to different positions
2. Solutions for all fault test are listed in the experiment manual for user's reference.
3. 2mm plugs and sockets are used throughout the main unit and all modules.
4. Comprehensive experiment manual and instructor's manual
5. Module dimension : 255x165x30mm.
6. Connection plugs are used on the modules to prevent accidental damages.
7. Individual keeping case for each module.

List of Modules



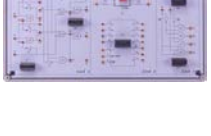
KL-33001
Basic Logic Gates Experiments

KL-33002
Combinational Logic Circuit Experiments(1)

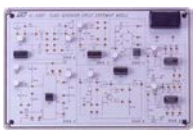
KL-33003
Combinational Logic Circuit Experiments (2)

KL-33004
Combinational Logic Circuit Experiments (3)

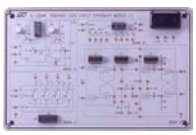
KL-33005
Combinational Logic Circuit Experiments (4)



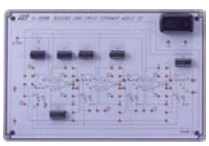
KL-33006
Combinational Logic Circuit Experiments (5)



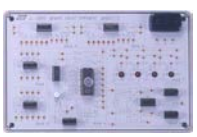
KL-33007
Clock Generator Circuit Experiments



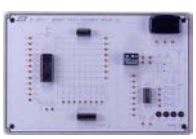
KL-33008
Sequential Logic Circuit Experiments (1)



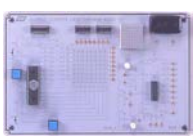
KL-33009
Sequential Logic Circuit Experiments (2)



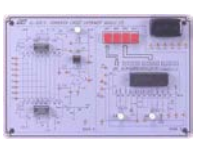
KL-33010
Memory Circuit Experiments (1)



KL-33011
Memory Circuit Experiments (2)



KL-33012
Converter Circuit Experiments (1)



KL-33013
Converter Circuit Experiments (2)

List of Experiments

1. Basic Logic Gates Experiments
   - 1-1 Introduction to logic gates and switches.....KL-33001(A)
   - 1-2 Logic gates circuits
     - a. Diode Logic (DL) circuit .....KL-33001(C)
     - b. Resistor-Transistor Logic (RTL) circuit.....KL-33001(B)
     - c. Diode-Transistor Logic (DTL) circuit .....KL-33001(B.C)
     - d. Transistor-Transistor Logic (TTL) circuit.....KL-33001(D)
     - e. CMOS logic circuit.....KL-33001(E)
   - 1-3 Threshold voltage measurement
     - a. TTL threshold voltage measurement .....KL-33001(D)
     - b. CMOS threshold voltage measurement...KL-33001(E)
   - 1-4 Voltage/current measurement
     - a. TTL I/O voltage/current measurement.....KL-33001(D)
     - b. CMOS voltage/current measurement.....KL-33001(E)
   - 1-5 Basic logic gate transmission delay measurement
     - a. TTL gate delay time measurement .....KL-33001(D)
     - b. CMOS gate delay time measurement.....KL-33001(E)
   - 1-6 Measurement of basic logic gates characteristics
     - a. AND gate characteristics measurement .....KL-33001(D)
     - b. OR gate characteristics measurement .....KL-33001(D)
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   - 2-1 NOR gate circuits .....KL-33002(A)
   - 2-2 NAND gate circuit .....KL-33002(B)
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     - a. Constructing XOR gate with NAND gate .....KL-33002(B)
     - b. Constructing XOR gate with basic gate.....KL-33002(C)
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   - 2-5 Comparator circuits
     - a. Comparator constructed with basic logic gates .....KL-33002(C)
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   - 2-6 Schmitt gate circuit .....KL-33002(A)
   - 2-7 Open-collector gate circuits
     - a. High voltage/current circuit .....KL-33002(E)
     - b. Constructing an AND gate with open-collector gate .....KL-33002(E)
   - 2-8 Tristate gate circuits
     - a. Truth table measurements.....KL-33003(C)
     - b. Constructing an AND gate with tristate gate .....KL-33003(C)
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   - 2-9 Half-adder and full-adder circuits
     - a. Constructing HA with basic logic gates.....KL-33004(A)
     - b. Full adder circuit .....KL-33004(B)
     - c. High-speed adder carry generator circuit.....KL-33003(A)
     - d. BCD code adder circuit .....KL-33004(B)
   - 2-10 Half-subtractor and full-subtractor circuit
     - a. Subtractor circuit constructed with basic logic gates .....KL-33004(A)
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     - a. Bit parity generator constructed with XOR gates .....KL-33004(A)
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b. Constructing a 10-to-4 encoder with TTL IC .....KL-33006(A)
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a. Analog switch characteristics .....KL-33006(C.D)
b. Bidirectional transmission with CMOS IC analog switches .....KL-33006(C)

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3-1 Constructing oscillator circuit with basic logic gates .....KL-33007(A)
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3-5 Monostable multivibrator circuits
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c. Constructing monostable multivibrator circuits .....KL-33007(D)
d. Constructing non-retriggerable circuit with TTL-IC .....KL-33007(F)
e. Constructing retriggerable circuit with TTL-IC .....KL-33007(G)
f. Constructing a variable duty cycle oscillator circuit with monostable multivibrator .....KL-33008(A)

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b. Constructing a D flip-flop with a R-S flip-flop .....KL-33008(D)
c. Constructing a J-K flip-flop with a D flip-flop .....KL-33008(D)
d. Constructing a J-K flip-flop with a R-S flip-flop .....KL-33008(D)
e. Constructing a shift register with a D flip-flop .....KL-33008(C)
f. Preset left/right shift register .....KL-33008(B)
g. Constructing a noise elimination circuit with R-S flip-flop .....KL-33008(D)

4-2 J-K flip-flop circuits
a. Asynchronous binary up-counter .....KL-33009(A)
b. Asynchronous decade up-counter .....KL-33010(D)
c. Asynchronous divide-by-N up-counter .....KL-33010(C)
d. Asynchronous binary down-counter .....KL-33009(A)
e. Synchronous binary up-counter .....KL-33009(A)
f. Synchronous binary up/down counter .....KL-33009(A)
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5. Memory Circuit Experiments
5-1 Constructing Read Only Memory (ROM) with diodes .....KL-33010(F)
5-2 Constructing Random Access Memory (RAM) with D flip-flop .....KL-33010(G)
5-3 64-bit RAM circuit .....KL-33011(B)
5-4 Erasable Programmable Read Only Memory (EPROM) circuit .....KL-33010(E)
5-5 Electronic EPROM (EEPROM) circuit .....KL-33011(A)
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6. Converter Circuit Experiment
6-1 Digital/Analog Converter (DAC) circuit
a. Unipolar DAC circuit .....KL-33013(A)
b. Bipolar DAC circuit .....KL-33013(A)
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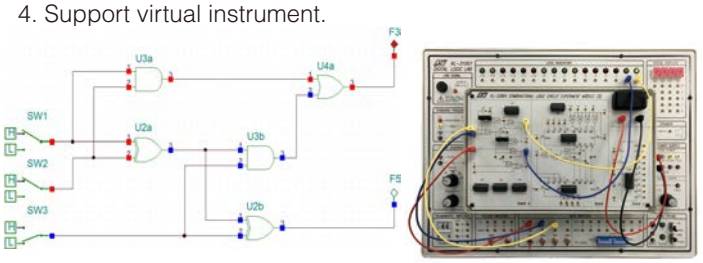
a. 8-bit converter circuit .....KL-33012(B)
b. 3 1/2-digit converter circuit .....KL-33013(B)

Accessories(KL-38002)

1. Experiment manual and instructor's manual
2. Connection leads and plugs : 1 set
3. Key : 1 pce

Computer-Based Training

1. Built-in circuit simulation of experiment modules.
2. Fault simulation is allowed.
3. Users can flexibly compare the simulation analysis result with hardware signal output.
4. Support virtual instrument.



KL-310

Advanced Digital Logic Lab

The KL-310 Advanced Digital Logic Lab is designed for students and engineers interested in developing and testing prototype circuits. The lab includes combinational logic, sequential logic, memory, ADC/DAC. experiment circuits and offers several application circuits (PWM, timer, motor control..etc.).

All the necessary equipment for digital logic experiments such as power supply, clock generator, switches, displays are built-in on the main unit. The lab has 10 experiment modules and one CPLD & breadboard experiment module.

Features

1. The whole trainer is fully designed by FPGA/CPLD logic circuit. Buffer circuits have enhanced protection for each module which is powered by main unit through power socket, avoiding wrong input power source during the experiment.
2. Cover different levels of logic circuit experiments, ranging from combinational logic, sequential logic as well as the logic circuit interfacing with microcontroller and practical application circuit for daily use.
3. Students can implement their own circuit from universal CPLD & breadboard experiment module, making it possible to prototype most analog and digital circuits in the system.
4. Include various types of ADC & DAC circuits to learn different interfacing circuits between analog and digital signal.
5. Built-in 8-channel multiplexer in main unit to measure multiple digital signals in real time.
6. Multiple operation modes from 4-digit 7-segment display (a) scanning display mode, (b) individual digit display mode, (c) frequency counter mode for measurement of internal and external clock.
7. Individual keep case for all modules for easy storing and carrying

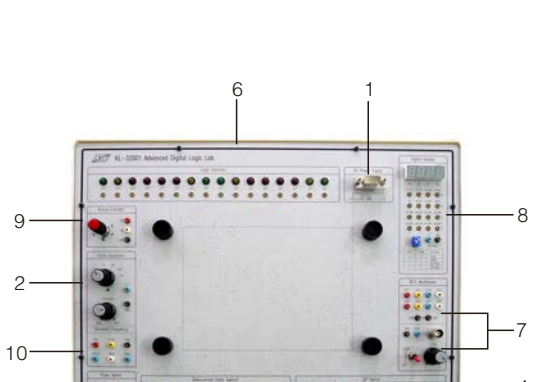
Main Unit(KL-32001)

1. The main unit is equipped with built-in power supply, clock generator, switches, logic signal indicators, multi-signal tracer, and other peripheries as handy tools to interface with experiment modules.
2. Four on-board holders located on the panel surface to firmly fix experiment modules.
3. The main unit provides a 9-pin DC power supply socket for module connection.

Specifications

1. DC Power supply
   (1) Fixed DC power supply :
   +5V/2A, -5V/0.5A, +12V/2A
   (2) With overload protection
2. Clock generator
   (1) Signal amplitude output : 3.3V
   (2) With adjustable output frequency :
   square wave, 1Hz ~ 1MHz, 6 range
   (3) Frequency display :
   4 digits 7-segment LED
3. Logic level switch
   Toggle switches x 8, 3.3V output
4. Data level switch
   8-bit DIP switch x 2, 3.3V output
5. Pulse signal generator
   (1) 2 sets of toggle switch with independent control output
   (2) Each set with Q, $\overline{Q}$ output
   (3) Pulse width >5ms, each with Debounce circuit
6. Logic level indicator
   (1) 16-bit LED with driver and protection circuit
   (2) Input Impedance : >100KΩ
7. 8 Channel logic signal tracer
   (1) 8 logic signal input :
   input impedance : ⩾100KΩ , 3.3V input
   (2) Fixed DC level shift for each channel
   (3) Input signal attenuation ratio : 1/8
   (4) Output signal : BNC or 2mm plug
   (5) Oscilloscope SYNC. select :
   ALT/CHOP and scan-frequency adjustment
   (6) The function can be used only with analog oscilloscope

8. 7-Segment LED display & frequency measurement
   2 DIP switches select the function :
   (1) 00: Scanning display mode
      a. Common anode for the control of 7-segments a~g
      b. Scanning cathode for the control of 4-digit S0~S3
   (2) 01: Independent display mode
      a. Input 4 digits of data individually and decode the data at 7-segment display separately
      b. Independent binary input and hexadecimal output
   (3) 10: Frequency counter for internal clock
      a. Display the frequency of clock generator from main unit
      b. Frequency range : 0.001KHz ~ 999.9KHz
   (4) 11: Frequency counter for external clock
      a. Display the frequency of clock signal from external unit
      b. Frequency range : 0.001KHz ~ 999.9KHz
9. Rotary encoder
   Rotary encoder output :
   PA, PB and GND signal, 3.3V output
10. Standard signal generator
    5 sets of frequency : 20MHz, 1MHz, 10KHz, 100Hz, 1Hz



KL-32001

Experiment Module

1. All built-in DC power socket module supply DC power from the main unit.
2. Each module includes a CPLD chip to implement all digital circuits shown on module panel.
3. 2mm sockets, bridge plugs, and cables are used throughout all modules so that students can easily create the circuits and compare different results in short time.
4. With comprehensive experiment manual.

List of Modules

KL-34001
Combinational Logic Circuit Experiment

KL-34002
Arithmetical Logic / Tri-state & Code Converter Experiment

KL-34003
Encoder, Decoder & Multiplexer Logic Circuit Experiment

KL-34004
Flip-flop & Sequential Logic & Counter Circuit Experiment

KL-34005
Oscillator / Pulser ; Load ; Up/Down Counter Circuit Experiment

KL-34006
Memory ; Matrix LED ; DAC/ADC & MCU Interface Circuit Experiment

KL-34007
Digital & Analog Timer ,Pulse Generator Circuit Experiment

KL-34008
Ramp-compare / SAR / Dual-slope ADC Experiment

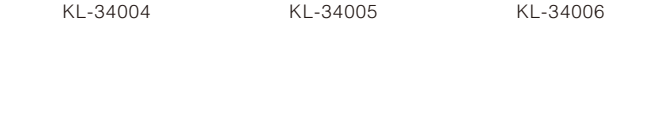
KL-34009
Keyboard & Display for Stepping Motor Position Control

KL-34010
Precise Digital Clock Timer

KL-34011
Universal CPLD & Breadboard Experiment


KL-34001 KL-34002 KL-34003


KL-34004 KL-34005 KL-34006


KL-34007 KL-34008 KL-34009


KL-34010 KL-34011

List of Experiments

1. KL-34001 Combinational Logic Circuit Experiment
   (1) NOR gate circuit
   (2) NAND gate circuit
   (3) XOR gate circuit
      a. Constructing XOR gate with NAND gate
      b. The combination with basic gates
   (4) AND-OR-INVERTER (A-O-I) gate circuit
   (5) Comparator circuit
      a. Comparator constructed with basic logic gates
      b. Comparator constructed with TTL IC
   (6) Schmitt gate circuit
   (7) Open-collector gate circuit
      a. High voltage/current circuit
      b. Constructing an AND gate with open-collector gate
   (8) Half-adder and full-adder circuit
      Construct HA with basic logic gates
   (9) Half-subtractor and full-subtractor circuit
      Subtractor circuit constructed with basic logic gates
   (10) Bit parity generator circuit
      Bit parity generator constructed with XOR gates
   (11) Constructing a 4-to-10 decoder with TTL IC
   (12) The switch characteristics of TTL level conversion circuit

2. KL-34002 Arithmetical Logic / Tri-state & Code Converter Experiment
   (1) CMOS FET tristate gate circuit
      a. Truth table measurements
      b. Constructing an AND gate with tristate gate
      c. Bidirectional transmission circuit
   (2) Half-adder and full-adder circuit
      a. Full-adder circuit with IC
      b. High-speed adder carry generator circuit
      c. BCD code adder circuit
   (3) Half-subtractor and full-subtractor circuit
      Full-adder and inverter circuit
   (4) Arithmetic Logic Unit (ALU) circuit
   (5) Bit parity generator circuit
      Bit parity generator IC
   (6) Hex to Dec/Dec to Hex digital conversion
      a. 8-digit Dec-to-Hex conversion
      b. 8-bit Hex-to-Dec conversion

3. KL-34003 Encoder, Decoder & Multiplexer Logic Circuit Experiment
   (1) Encoder circuit
      a. Constructing a 4-to-2 encoder with basic gates
      b. Constructing a 9-to-4 encoder with TTL IC
   (2) Decoder circuit
      a. Constructing a 2-to-4 decoder with basic gates
      b. BCD-to-7-segment decoder (KL-34003 block d)
   (3) Multiplexer circuit
      a. Constructing a 2-to-1 multiplexer
      b. Using multiplexers to create functions
      c . Constructing a 8-to-1 multiplexer circuit with TTL IC
   (4) Demultiplexer circuit
      Constructing a 2-output demultiplexer with basic logic gates
   (5) Digitally controlled analog multiplexer/demultiplexer circuit
   (6) The switch characteristics of CMOS level conversion circuit

4. KL-34004 Flip-flop & Sequential Logic & Counter Circuit Experiment
   (1) Flip-flop circuits
      a. Construct R-S flip-flop with basic logic gates
      b. Construct D flip-flop with R-S flip-flops
      c. Construct noise elimination circuit with R-S flip-flops
      d. Construct J-K flip-flop with D flip-flops
      e. The J-K flip-flop of delay and differential
      f. Construct master-slave J-K flip-flops with dual R-S flip-flops
      g. Construct shift register with D flip-flops
      h. Preset left/right shift register
   (2) J-K flip-flop counters
      a. Asynchronous binary up counter
      b. Asynchronous binary down counter
      c. Asynchronous decade up counter
      d. Synchronous binary counter
      e. Synchronous binary up counter
      f. Synchronous binary up/down counter
      g. Johnson counter
      h. Ring counter

5. KL-34005 Oscillator / Pulser ; Load ; Up/Down Counter Circuit Experiment
   (1) Constructing Random Access Memory (RAM) with D flip-flop
   (2) 64-bit Random Access Memory (RAM) circuit
   (3) Erasable Programmable Read Only Memory (EPROM) circuit
   (4) Asynchronous four-bit binary up counter (use of 7493 IC)
   (5) Presetable binary up/down counter
   (6) Presetable decimal up/down counter
   (7) Construct Non-retriggerable circuit with the specialized CMOS IC
   (8) Construct retriggerable circuit with CMOS IC
   (9) Construct a variable duty cycle oscillator circuit with dual monostable multivibrators

6. KL-34006 Memory, Matrix LED & DAC/ADC & MCU Interface Circuit Experiment
   (1) Electronic EPROM (EEPROM) circuit
   (2) DAC0800 unipolar conversion circuit experiments
   (3) Bipolar output conversion circuit
   (4) ADC0804 8-bit SAC analog-to-digital converter experiment
   (5) Constructing dynamic scanning counter with single chip microprocessor

7. KL-34007 Digital & Analog Timer, Pulse Generator Circuit Experiment
   (1) Constructing oscillator circuit with basic logic gates
      a. Resistor-capacitor multivibrator
      b. Resistor-capacitor crystal multivibrator
   (2) Constructing oscillator circuit with schmitt gate
      a. Resistor-capacitor oscillator
      b. Variable duty cycle resistor-capacitor oscillator
   (3) 555 IC oscillator circuit
      a. 555 oscillator circuit
      b. Voltage controlled oscillator circuit
   (4) Monostable multivibrator circuits
      a. Low-speed monostable multivibrator circuits
      b. Monostable ON/OFF delay circuit
      c. Monostable ON/OFF timer circuit
      d. Construct monostable multivibrator circuit with 555 IC
   (5) Numerically-Controlled Oscillator (NCO) signal generator
   (6) Precise-frequency function generator
   (7) Variable-duty-cycle NCO signal generator
   (8) Variable-ON/OFF delay and difference control experiments
   (9) Precise 15-bit symmetric / asymmetric PWM generator

8. KL-34008 Ramp-compare / SAR / Dual-slope ADC Experiment
   (1) Simple R-2R unipolar output D/A converter experiments
   (2) 8-bit digital-ramp A/D converter experiment
   (3) 8-bit successive-approximation A/D converter experiment
   (4) 8-bit dual-slope A/D converter experiment

9. KL-34009 Keyboard & Display for Stepping Motor Position Control
   (1) Stepper motor position/speed control experiment

10. KL-34010 Precise Digital Clock Timer
   (1) Clock experiment
   (2) Timer experiment

11. KL-34011 Universal CPLD & Breadboard Experiment
   (1) Create block diagram/schematic file in QUARTUS II
   (2) 16-bit Hex counter
   (3) 16-bit decimal counter
   (4) 16-bit presetable decimal up/down counter
   (5) 16-bit scanning controller for 7-segment display
   (6) 16-bit up/down counter and its indication by a 7-segment display
   (7) Electronic music box
   (8) The traffic light with animation and time indication

System Requirement

1. PC : 1GHz or faster 32-bit (x86) or 64-bit (x64) processor
   2GB RAM, 5GB more free disk space

2. OS : Windows XP / Vista / 7

Accessories(KL-39001)

1. Experiment manual : 1pce
2. Connection leads and plugs : 1set
3. Software : QUARTUS II Web Edition for KL-34011 use
4. USB-Blaster : for KL-34011 use

ETS-3000
Digital-Analog Training System

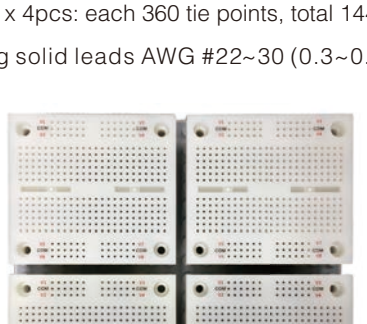
Feature

1. Suitable for basic electric circuits, linear circuits, combinational logic, sequential logic, microprocessor circuits, and FPGA.
2. User-friendly comprehensive power supply, function generator/ counter, digital meter, analog meter and testing devices.
3. Universal breadboard(1440 tie points) for circuit design, faya-Nugget breakout boards NGT-series and prototyping.
4. Tie points fitting solid leads AWG#22~30 (0.3~0.8mm).
5. USB Interface for optional fayaduino Nano board, FPGA, MCU.
6. Peripheral hardware:
   LED, JoyStick switch, Rotate switch, Potentiometer, Pulser switch, Rotary encoder, Data switches, Speaker, Power supply, Digital displays, Function generator/counter, DCV/DCA meter, Analog meter, etc,
7. Options: FPGA board (with USB Blaster), MCU board, faya-Nugget Combo Pack.

Specifications

1. Function Generator / Counter
   (1) Universal counter
      a. Frequency range :
         1Hz~99.99999MHz, 10Hz~100.00000MHz
      b. Period range TH & TL :
         0.01μs~999999.99μs, 1μs~99999999μs
      c. Input signal :
         TTL or CMOS level or any level (Vmin≧+4.2Vp±10%)
      d. Display : 8-digit 7-segment LED display
      e. Mode switch : FG/FC
   (2) Function generator
      a. Output waveform :
         sine, square, triangle, TTL (square only)
      b. Frequency range : 1mHz~2MHz
      c. Amplitude range : 100mVpp~18Vpp (open circuit)
      d. DC offset : -10V~+10V
      e. TTL mode output level : +5V±10%
2. Digital DCV/DCA Meter
   (1) DC voltage range : 2V, 40V
   (2) DC voltage accuracy : ±3% of reading + 1 digit
   (3) DC current range : 200μA, 2A
   (4) DC current accuracy : ±3% of reading + 1 digit
   (5) Project fuse : 2A
3. Analog V/A Meter
   (1) Voltmeter :
      0~30VDC full scale, class 2.5, impedance=320KΩ
   (2) Ampere meter : 0~100mA & 0~1A
4. Logic Indicators
   8 sets of independent LED indicates high/low logic state
5. JoyStick Switch
   (1) X / Y- axis potentiometer : 5KΩ
   (2) Switch type : momentary
6. Potentiometer
   (1) Variable resistor : 1KΩ(B) ,4-pin output
   (2) Variable resistor :100KΩ(B) ,4-pin output
7. Rotate Switch
   6 positions rotary switch, 2 set output
8. Pulser Switch
   (1) Independent output, TTL level
   (2) With A, $\bar{A}$ output, pulse width > 5ms
9. Rotary Encoder
   (1) PA, PB signal output
   (2) TTL level
10. Data Switches
    8 sets independently control output high/low, TTL level
11. Speaker
    8Ω/0.5W to be used for load
12. Adapter
    For point tip / BNC socket exchange adapters, 2 sets

13. Adjustable Power Supply
    (1) Positive output voltage :
        0~+15V±10%, continuously adjustable
    (2) Negative output voltage :
        0~-15V±10%, continuously adjustable
    (3) Maximum output current: 500mA
14. Fixed Power Supply
    (1) Fixed DC output : +5V±10%, 1A
    (2) Fixed DC output : +3.3V±10%, 1A
    (3) Fixed DC output : -5V±10%, 300mA
15. Digital Displays
    (1) 4 sets of independent 7-segment LED display
    (2) With BCD, 7-segment decoder/driver and DP input
    (3) Input with 8-4-2-1 code
16. Breadboards
    (1) Fitted on brick plate by brick posts
    (2) LA-60 x 4pcs: each 360 tie points, total 1440 tie points
    (3) Fitting solid leads AWG #22~30 (0.3~0.8mm)



17. USB Jack
    Type A on front panel and Type B at the rear
18. Power Switch and Fuse

Accessories

1. Power Cord
2. USB Cable (Type A to Type B)
3. User Manual

General Characteristic

1. AC Power Input : AC 110V/220V, 50Hz/60Hz, ±10%, 1A
2. Weight : 4.5Kg
3. Operating Temperature : ambient temperature

Options

1. FPGA Board (ETS-33051)

USB Blaster

(1) Chip : Altera EPM 570T100C5
(2) Operating voltage: +5V
(3) Digital input pins : 20
(4) Digital output pins : 16
(5) Clock speed : 20MHz
(6) Interface : JTAG
(7) With USB blaster
(8) User guide / sample code

2. MCU Board (ETS-33052)

USB ISP

(1) Chip : Atmel AT89S52
(2) Operating voltage : +5V
(3) Digital I/O pins : 32
(4) Clock speed : 8MHz
(5) Interface : USB ISP
(6) User guide / sample code

3. faya-Nugget Combo Pack (NGT-601)

Running Arduino experiments with fayalab Electronic Blocks

- Main Controller :
  fayaduino NANO
- Modules :
  1. Touch Slider
  2. RGB LED
  3. Color Sticker
  4. Light Sensor
  5. Humidity&Temperature Sensor
  6. IR Pulse Sensor
  7. IR Distance Sensor
  8. DC Motor
  9. Step Motor
  10. IR Receiver
  11. IR Transmitter
  12. Basic Logic Gates
- Accessories :
  1. Brick Post Pack
  2. Brick Cap Pack
  3. Mini USB Cable
  4. Power Wire Pack
  5. Signal Wire Pack
  6. Tutorial CD

ETS-8000A

General Digitized Training System

The ETS-8000A is a basic digital logic circuit training system. It includes combinational logic and sequential logic experiment circuit. The course content of experiment has hardware emulation and software simulation.

All necessary equipment for digital logic experiment such as power supply, signal generator, indicator, measurement are installed on the main unit.

Features

1. Suitable for combinational logic, sequential logic experiments and designs
2. Ideal tool for learning the basics of digital logic circuits
3. Comprehensive power, signal supply and measurement devices for making experiments easily
4. Expandable and flexible experiments with universal breadboard
5. All supply units are equipped with overload protection for safety
6. Computer interaction includes software simulation & hardware emulation

Specification

Main Unit (ETS-81001A)

1. Power Supply Units
   a. Fixed DC power supply
      - Voltage range : +5 V, -5 V
      - Maximum current output : 0.3 A
      - With overload protection

   b. Dual adjustable DC power supply
      - Voltage range : ±3 V ~ ±18 V, continuously adjustable
      - Maximum current output : 1 A
      - With overload protection

2. Signal Generator Units
   a. Function generator
      - Output waveform : sine, triangle, square, TTL level
      - Output frequency : 1~100 KHz; 5 settings, continuously adjustable
      - Output impedance : 50Ω
      - Output amplitude : ≥18Vpp (open loop); ≥9Vpp (with 50Ω load)
      - Digital display : 4 sets of 7-segment LED display With Hz, KHz, gate, OVFL LED With frequency counter
      - Minimum input voltage : 300mVpp
      - Counter range : DC ~ 100KHz

   b. Data switch
      - 8 sets of independent output
      - Output level : TTL
      - Fan out : 10 TTL load

   c. Pulse switch
      - 2 sets of independent control output
      - Each set with Q,$\overline{Q}$ output, pulse width > 5ms
      - Output Level : TTL
      - Each set of switch with Debounce circuit
      - Fan out : 10 TTL load

   d. Potentiometer
      - 1 KΩ, 0.25W, variable resistor with 3 terminals (1,2,3) with overload protection
      - 100 KΩ, 0.25W, variable resistor with 3 terminals (1,2,3) with overload protection

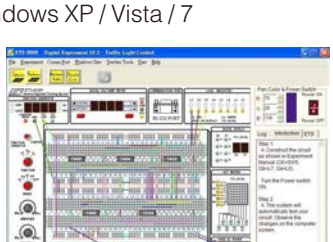
3. Measurement Units
   a. 3 1/2-digit digital volt/amp meter
      - DC voltage range : 2 V, 20V
      - DC voltage accuracy : ±0.3% of reading +1-digit
      - DC current range : 2 mA, 2 A
      - DC current accuracy : ±0.5% of reading +1-digit

4. Indicator Units
   a. Logic indicators
      - Logic level : TTL
      - Display : Red LED for logic high, green LED for logic low; open status is none
      - 8 sets of independent input terminal

   b. Digital display
      - Logic level : TTL
      - 2 sets of independent 7-segment LED display
      - With BCD, 7-segment decode/driver input terminal

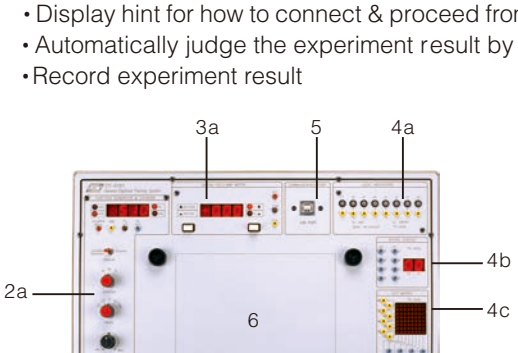
   c. 8x8 LED dot matrix
      - Logic level : TTL
      - With row input terminal : R0~R7
      - With column input terminal: C0~C7

5. USB Port
6. System requirement
   (1) PC : 1GHz or faster 32-bit (x86) or 64-bit (x64) processor
   128MB RAM, 100MB more free disk space
   (2) OS : Windows XP / Vista / 7



a. Software simulation
- Simulate all the active status of digital logic circuits on the platform of ETS-8000A
- With simulation software of breadboard
- Simulate all digital experiments of user manual
- Hint for experiment procedure
- Automatically judge the line connection is true or false by computer
- Record experiment result

b. Hardware emulation
- Receive signal status of ETS-8000A platform through USB
- Display the entity operation of ETS-8000A platform in screen
- Display hint for how to connect & proceed from screen
- Automatically judge the experiment result by software
- Record experiment result



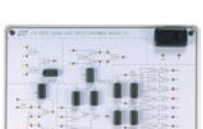
ETS-81001A

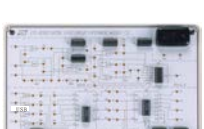
Experiment Modules

1. Each module is equipped with an 8-bit DIP switch for fault simulations. Students can practice trouble shooting by setting the DIP switch to different positions.
2. All terminals on the modules accept 2 mm plugs.
3. Comprehensive experiment manual
4. Module dimension : 255 x 165 x 30 mm
5. Individual storage case for each module

List of Modules

ETS-83001 Digital Logic Circuit Experiment Module (1)
ETS-83002 Digital Logic Circuit Experiment Module (2)
ETS-83003 Digital Logic Circuit Experiment Module (3)
ETS-83004 Digital Logic Circuit Experiment Module (4)


ETS-83001


ETS-83003


ETS-83002


ETS-83004

List of Experiments

1. Basic Logic Gates
   (1) OR gate
   (2) NOT gate
   (3) NOT-OR gate
   (4) NOR gate
   (5) 2-input NAND gate
   (6) 4-input NAND gate
   (7) AND-NOR gate
   (8) Staircase light control
2. Combinational Logic Circuits
   (1) Verifying X+0=X and X+1=1
   (2) Verifying X•0=0 and X•1=X
   (3) Verifying X+X=X and X+X'=1
   (4) Verifying X•X=X and X•X'=0
   (5) Verifying (X•Y)'=X'+Y'
   (6) Verifying (X+Y)'=X'•Y'
   (7) 2-Bit magnitude comparator
   (8) Voting machine
   (9) Displaying patterns
3. Adders and Subtractors
   (1) Half adder
   (2) Full adder
   (3) Half subtractor
   (4) Full subtractor
   (5) 4-Bit adder
   (6) 4-Bit subtractor
   (7) BCD adder
4. Decoders and Encoders
   (1) 8-to-3 Encoder
   (2) 3-to-8 Decoder
5. Multiplexers and Demultiplexers
   (1) Logic unit
   (2) Implementing logic function with multiplexer
6. Basic Flip-Flops
   (1) NAND gate RS Flip-Flop
   (2) NOR gate RS Flip-Flop
   (3) JK Flip-Flop
   (4) T Flip-Flop
   (5) D Flip-Flop
7. Flip-Flops Applications
   (1) Converting JK to D Flip-Flop
   (2) Converting JK to T Flip-Flop
   (3) Implementing Mod-8 ripple counter with JK Flip-Flops
8. Counters
   (1) Implementing Divide-by-8 counter with 7490
   (2) Implementing Divide-by-4 synchronous counter with JK Flip-Flops
9. Applications of Digital Circuits
   (1) Digital dice
   (2) Traffic light control

● Accessories

1. Experiment manual
2. Connection leads and plugs : 1 set
3. CD : Software for data acquisition
4. USB cable : 1 pce
5. Key : 1 pce

ETS-9000

Advanced Digital Training System

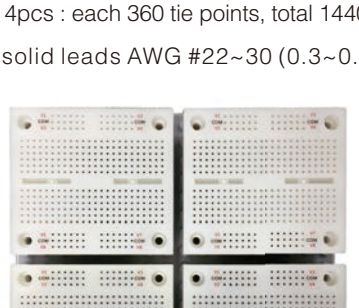
Feature

1. Suitable for combinational logic, sequential logic, microprocessor circuits, FPGA, etc.
2. User-friendly comprehensive power supply, function generator/ counter and testing devices.
3. Universal breadboard(1440 tie-points) for circuit design, faya-Nugget breakout boards NGT-series and prototyping.
4. Tie points fitting solid leads AWG#22~30 (0.3~0.8mm).
5. USB Interface for optional fayaduino Nano board, FPGA, MCU.
6. Peripheral hardware:
   LED(3 mode), Potentiometer, Pulser switch, Rotary encoder, Data switches, Speaker, Power supply, Digital displays, Universal counter, Function generator, Logic probe.
7. All signal generators have TTL and CMOS level, controlled by CMOS/ TTL switch.
8. Options: FPGA board (with USB Blaster), MCU board, faya-Nugget Combo Pack.

Specifications

1. Function Generator/Counter
   (1) Universal counter
      a. Frequency range :
         1Hz~99.99999MHz, 10Hz~100.00000MHz
      b. Period range TH & TL :
         0.01μs~999999.99μs, 1μs~99999999μs
      c. Input signal :
         TTL or CMOS level or any level (Vmin≧+4.2Vp±10%)
      d. Display : 8-digit 7-segment LED display
      e. Mode switch : FG/FC
   (2) Function generator
      a. Output waveform :
         sine, square, triangle, TTL/CMOS (square only)
      b. Frequency range : 1mHz~1MHz
      c. Amplitude range : 100mVpp~18Vpp (open circuit)
      d. DC offset : -10V~+10V
      e. TTL/CMOS output level : +5V±10% for TTL mode, 3.3V~15V for CMOS mode
2. Potentiometer
   (1) Variable resistor : 1KΩ(B) ,4-pin output
   (2) Variable resistor : 100KΩ(B) ,4-pin output
3. Pulser Switch
   (1) Independent output
   (2) With A, Ā output, Pulse width > 5ms
   (3) TTL/CMOS level
4. Rotary Encoder
   (1) PA, PB signal output
   (2) TTL/CMOS level
5. Data Switches
   (1) 10 sets independently control output high/low
   (2) TTL/CMOS level
6. Logic Probe
   (1) TTL and CMOS level
   (2) MEM and Pulse switch
   (3) 5mm LED displays
   (4) “Lo” and “Hi” LED display, low/high logic state respectively
7. Speaker
   8Ω/0.5W to be used for load
8. Adapter
   For point tip / BNC socket exchange adapters, 2 sets

9. Adjustable Power Supply
   (1) Positive output voltage : 0~+15V±10%, pull to CMOS Level :1.25V~16.25V±10%, continuously adjustable
   (2) Negative output voltage : 0~-15V±10%, continuously adjustable
   (3) Maximum output current : 500mA
10. Fixed Power Supply
   (1) Fixed DC output : +5V±10%, 1A
   (2) Fixed DC output : +3.3V±10%, 1A
   (3) Fixed DC output : -5V±10%, 300mA
11. Digital Displays
   (1) 4 sets of independent 7-segment LED display
   (2) With BCD, 7-segment decoder/driver and DP input
   (3) Input with 8-4-2-1 code
12. Breadboards
   (1) Fitted on brick plate by brick posts
   (2) LA-60 x 4pcs : each 360 tie points, total 1440 tie points
   (3) Fitting solid leads AWG #22~30 (0.3~0.8mm)



13. Logic Indicators
   12 bits LED display : TTL/CMOS mode
14. USB Jack
   Type A on front panel and Type B at the rear
15. Power Switch and Fuse

Accessories

1. Power Cord
2. USB Cable (Type A to Type B)
3. User Manual

General Characteristic

1. AC Power Input : AC 110V/220V, 50Hz/60Hz, ±10%, 1A
2. Weight : 4Kg
3. Operating Temperature : ambient temperature

Options

1. FPGA Board (ETS-33051)

USB Blaster

   (1) Chip : Altera EPM 570T100C5
   (2) Operating voltage: +5V
   (3) Digital input pins : 20
   (4) Digital output pins : 16
   (5) Clock speed : 20MHz
   (6) Interface : JTAG
   (7) With USB blaster
   (8) User guide / sample code

2. MCU Board (ETS-33052)

USB ISP

   (1) Chip : Atmel AT89S52
   (2) Operating voltage : +5V
   (3) Digital I/O pins : 32
   (4) Clock speed : 8MHz
   (5) Interface : USB ISP
   (6) User guide / sample code

3. faya-Nugget Combo Pack (NGT-601)

   Running Arduino experiments with fayalab Electronic Blocks

- Main Controller :
  fayaduino NANO
- Modules :
  1. Touch Slider
  2. RGB LED
  3. Color Sticker
  4. Light Sensor
  5. Humidity&Temperature Sensor
  6. IR Pulse Sensor
  7. IR Distance Sensor
  8. DC Motor
  9. Step Motor
  10. IR Receiver
  11. IR Transmitter
  12. Basic Logic Gates
- Accessories :
  1. Brick Post Pack
  2. Brick Cap Pack
  3. Mini USB Cable
  4. Power Wire Pack
  5. Signal Wire Pack
  6. Tutorial CD

*i*de@Lab-200

Intelligent Digitize Emulated Achievement Lab

*i*de@Lab-200 intelligent digitize emulated achievement lab is a digitized-based training system, which utilizes integrated Hardware Platform, Experimental Modules and Software Platform to help students to learn various electronic subjects. Hardware Platform is composed of multiple measuring instruments, such as digital storage oscilloscope, logic analyzer, frequency synthesizer, digital multimeters, and programmable DC power supply as well as output display unit.

Experimental Modules contain versatile electronic based topics for students to implement, including basic electricity, electronic circuits and digital logic circuits.

● Features

1. The *i*de@Lab (Intelligent Digitize Emulated Achievement Lab) is a multimedia digitized experiment/learning platform. It consists of three major parts including hardware experiment platform, experiment modules and application software platform.

2. The hardware experiment platform includes digital storage oscilloscope, logic analyzer, frequency synthesis signal generator, two digital multimeters, programmable DC power supply, internal central control and coordination interface such as output display interface, module communication interface and the interface used for command and data exchange between *i*de@Lab and personal computer.

3. The operating modes of hardware experiment platform includes a touch-panel manual control mode and a PC control mode via USB interface.

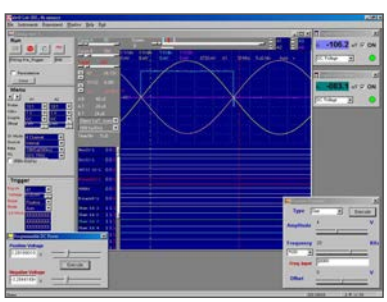
4. The *i*de@Lab system separates modules into extension unit and experiment module. The extension unit is designed to satisfy the special needs of experiment modules. The subjects of experiment modules cover basic electricity, electronic circuits, and digital logic circuits. Each subject involves several experiment modules. The application software platform contains the front-panel controls and displays of hardware experiment platform, experiment module window, procedure steps and experiment manual.

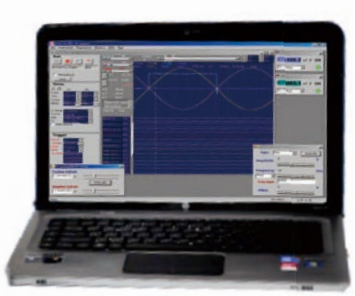
❖Software

The user interface of *i*de@Lab system contains the instruments (DMM, DSO, FG, PDC, LA) which correspond to the instruments equipped on the front panel of *I*de@Lab-21001A main unit, as well as the explanation algorithm of the programming language for human-machine communication. For easy reference, the required data and information are stored in experiment manual which represented in HTML format.

Provide experimental simulation files(*.TSC)designed by Tina Design Suite.

❖System Diagram


User Interface



● Specification

Main Unit (ide@Lab-21001A)

1. Digital Storage Oscilloscope
   (1) Channels : 4
   (2) Input coupling : DC, AC
   (3) Input impedance : 1MΩ ±2% // 17pF
   (4) Max. input voltage : ±50V
   (5) Sample rate : 1ch ~ 1GSa/s
   2ch ~ 1Sa/s ~ 500MSa/s by 1,2,5 sequence
   4ch ~ 1Sa/s ~ 250MSa/s by 1,2,5 sequence
   (6) Bandwidth : 1ch DC ~ 200MHz
   2ch DC ~ 125MHz
   4ch DC ~ 80MHz
   (7) Resolution : 8bits
   (8) Record length : 1ch~16K point
   2ch~8K point
   4ch~4K point
   (9) Repetitive mode : Sampling up to 20 GHz

2. Logic Analyzer
   (1) Channels : 12
   (2) Bandwidth : DC ~ 30MHz
   (3) Record length : 4K point
   (4) Input impedance : 50KΩ // 9pF
   (5) Max. input voltage : ±50V
   (6) Threshold voltage : -4V~ +3.98V
   (7) Trigger word : 0, 1, x (don't care) setting for all digital channels

3. DDS FG (Direct Digital Synthesis FG)
   (1) Channels : OUT, $\overline{OUT}$, TTL
   (2) Waveform type : Sine, Square, Triangle, Ramp, GND
   (3) Waveform amplitude range : 0 ~ 20Vpp
   0 ~ 10Vpp to 50Ω load
   (4) Frequency range : 1Hz ~ 2MHz
   (5) Frequency resolution : 0.03Hz
   (6) Waveform DC offset range : 0 ~ ±10V
   0 ~ ±5V to 50Ω load
   (7) Output impendence : 50Ω ±10%

4. DMM1 and DMM2 (Digital Multi-Meters)
   (1) Resistance (Ω) : 400Ω, 4KΩ, 40KΩ, 400KΩ, 4MΩ, 40MΩ auto range
   (2) DC Voltage (DCV) : 400mV, 4V, 40V auto range
   Input Impedance : ⩾10MΩ
   (3) AC Voltage (ACV) : 400mV, 4V, 40V, 400V rms auto range
   Input Impedance : ⩾10MΩ
   (4) DC Current (DCA) : 400mA(0.5A/250V fuse protected)
   (5) AC Current (ACA) : 400mA(0.5A/250V fuse protected)

5. Programmable DC Power Supply
   DC output : 2 channels
   • Positive output : 0.5 ~ 10V/0.5A
   • Negative output : -0.50 ~ -10V/0.5A

6. Fixed DC Output : +12V/0.5A, -12V/0.5A, +5V/0.5A

7. Breadboard (ide@Lab-90001) :
   1680 tie-point breadboard module

8. Communication and Display Interface
   (1) PC control and display : Communicating with PC via USB cable
   (2) Manual control and display : Touch panel (5.7" TFT-LCD with 640 x 480 resolution and 256K color.)

9. Extension Unit (ide@Lab-12001 Basic I/O Elements)
   This unit extends the functions of main unit to satisfy the needs of experiment tasks when it is added to the ide@Lab system.
   (1) Universal Counter :
   Function : Logic Probe/Frequency/Period 8-digit 7-segment LED display and function select key
   (2) LED Display : L0 ~ L7, input, TTL level
   (3) Debounce PB switch : 4 pushbuttons PSW1~PSW4 with Debounce outputs
   (4) Pulser : 2 sets, output A, $\overline{A}$, TTL level with P.P. & P.S. switch
   (5) Clock Generator : 1 set(50Hz ~ 14KHz), output, TTL level
   (6) Standard Frequency: 7 sets(0.1Hz, 1Hz, 10Hz, 1KHz, 10KHz, 100KHz, 1MHz), output, TTL level
   (7) Data Switch : DP0 ~ DP7, output, TTL level


12001

● Experiment Modules
A series of experiment modules are designed for different subjects.

List of Modules

1. ide@Lab-131xx : Basic Electricity


13101
Basic Device Module


13102
Basic Electricity Experiment Module


13103
Magnetism Element Introduction Module

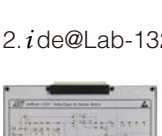

13104
Magnetic Field Module


13105
Ampere's Rule Module

13106
Fleming's Rule Module

13107
Electromagnetic Induction

2. ide@Lab-132xx : Electronic Circuits



13201
Diode, Clipper & Clamper Module

13202
Rectifier, Differential & Integral Circuit Module

13203
Transistor Amplifier Circuit Module

13204
Multi-Stage Amplifier Circuit Module

13205
FET Circuit Experiment Module

13206
OP Amplifier Circuit Module (1)

13207
OP Amplifier Circuit Module (2)

13208
OP Amplifier Circuit Module (3)

13209
OP Amplifier Circuit Module (4)

13210
OP Amplifier Circuit Module (5)

3. ide@Lab-133xx : Digital Logic Circuits

13301
Combinational Logic Circuit Experiment Module (1)

13302
Combinational Logic Circuit Experiment Module (2)

13303
Combinational Logic Circuit Experiment Module (3)

13304
Combinational Logic Circuit Experiment Module (4)

13305
Combinational Logic Circuit Experiment Module (5)

13306
Sequential Logic Circuit Experiment Module (1)

13307
Sequential Logic Circuit Experiment Module (2)

List of Experiments

ide@Lab-131xx : Basic Electricity

- 13101 Basic Device Module
  1. Potentiometer characteristics
  2. Resistor characteristics
  3. Inductor characteristics
  4. Diode characteristics
  5. Zener diode characteristics
  6. LED characteristics
  7. Capacitor characteristics
  8. FET characteristics
  9. Transistor characteristics
  10. SCR characteristics
  11. UJT characteristics

- 13102 Basic Electricity Experiment Module
  1. DC voltage measurement
  2. DC current measurement
  3. Ohm's law application
  4. AC voltage measurement
  5. Series network and kirchhoff's law
  6. Power in DC circuit
  7. Maximum power transfer theorem
  8. Power in AC circuit
  9. Parallel network and kirchhoff's law
  10. AC current measurement
  11. Superposition, thevenin's and norton's theorems
  12. DC RC circuit and transient phenomena
  13. AC RC circuit
  14. DC RL circuit and transient phenomena
  15. AC RL circuit
  16. Transformer characteristics
  17. AC RLC circuit
  18. Series-resonant circuit
  19. Parallel-resonant circuit
  20. Wheastone bridge

- 13103 Magnetism Element Introduction Module
  1. Compass characteristic
  2. Drawing magnetic curves
  3. Reed switch characteristic
  4. Reed relay characteristic
  5. Relay characteristic
  6. SSR relay characteristic

- 13104 Magnetic Field Module
  1. Magnetic field
  2. Lenz's and faraday's laws
  3. Magnetic field strength

- 13105 Ampere's Rule Module
  1. Ampere's rule 1
  2. Ampere's rule 2

- 13106 Fleming's Rule Module
  1. Fleming's rule 1
  2. Fleming's rule 2

- 13107 Electromagnetic Induction
  1. Self induction
  2. Mutual induction
  3. Magnetic flux detection

ide@Lab-132xx : Electronic Circuits

- 13201 Diode, Clipper & Clamper Module
  1. V-I curve of Si diode - DSO
  2. V-I curve of Si diode (Forward) - DMM
  3. V-I curve of Si diode (Reverse) - DMM
  4. V-I curve of Ge diode (Forward) - DMM
  5. V-I curve of Ge diode (Reverse) - DMM
  6. V-I curve of Ge diode - DSO
  7. V-I curve of Zener diode (Forward) - DMM
  8. V-I curve of Zener diode (Reverse) - DMM
  9. V-I curve of Zener diode - DSO
  10. Series diode clipping circuit
  11. Series diode clipping circuit with bias
  12. Parallel diode clipping circuit
  13. Parallel diode clipping circuit with bias
  14. Diode clamping circuit
  15. Diode clamping circuit with bias
  16. Testing for the relation between I and brightness
  17. Measuring I values of LED
  18. Photodiode characteristics

- 13202 Rectifier, Differential & Integral Circuit Module
  1. Measuring I_e, I_b and I_c of PNP transistor
  2. Measuring I_e, I_b and I_c of NPN transistor
  3. Transistor characteristic curves
  4. Voltage doubler
  5. Half-wave rectifier without filter capacitor
  6. Half-wave rectifier with filter capacitor
  7. Full-wave rectifier without filter capacitor
  8. Full-wave rectifier with filter capacitor
  9. Bridge rectifier without filter capacitor
  10. Bridge rectifier with filter capacitor
  11. Dual-power rectifier
  12. RC circuit
  13. Differentiator circuit
  14. Integrator circuit
  15. RL circuit

- 13203 Transistor Amplifier Circuit Module
  1. CE Amplifier fixed bias
  2. CE Amplifier emitter self-bias
  3. CE Amplifier bias independent of β value
  4. CE Amplifier collector-feedback bias
  5. Common-base amplifier
  6. Common-collector amplifier
  7. Measuring ON and Off current of transistor
  8. Transistor used as relay driver

- 13204 Multi-Stage Amplifier Circuit Module
  1. RC-coupled amplifier
  2. Direct-coupled amplifier
  3. Dual-end push-pull amplifier
  4. Transformer-coupled amplifier

● 13205 FET Circuit Experiment Module
1. Measuring basic characteristics of darlington Amplifier
2. Photoelectric control circuit
3. Time delay circuit
4. JFET measuring I_{DSS}
5. JFET measuring I_{GS}
6. JFET measuring V_P
7. MOSFET measuring I_{DSS}
8. MOSFET measuring V_P
9. JFET CS amplifier with self-bias
10. JFET CS amplifier with voltage-dividing bias
11. JFET CD amplifier with self-bias
12. JFET CD amplifier with voltage-dividing bias
13. MOSFET CS amplifier with self-bias
14. MOSFET CS amplifier with voltage-dividing bias

● 13206 OP Amplifier Circuit Module (1)
1. Differential amplifier in OP Amp
2. OP AMP measuring Z_i
3. OP AMP measuring Z_o
4. OP AMP measuring slew rate
5. OP AMP measuring bandwidth
6. OP AMP adjusting offset voltage of inverting amplifier
7. OP AMP adjusting offset voltage of noninverting amplifier

● 13207 OP Amplifier Circuit Module (2)
1. Clipping circuit
2. Constant voltage circuit
3. Constant current circuit
4. Differentiator
5. Integrator
6. Inverting amplifier
7. Noninverting amplifier
8. Voltage follower
9. Subtractor
10. Adder

● 13208 OP Amplifier Circuit Module (3)
1. Active high-pass filter
2. Active low-pass filter
3. Active band-pass filter
4. Instrumentation amplifier

● 13209 OP Amplifier Circuit Module (4)
1. Tone control circuit
2. Zero comparator
3. Comparator with bias
4. Schmitt trigger
5. Window comparator

● 13210 OP Amplifier Circuit Module (5)
1. Monostable multivibrator
2. Astable multivibrator square wave generator
3. Astable multivibrator pulse generator
4. Sine wave oscillator RC phase-shift
5. Sine wave oscillator wien bridge

▸▸ *i*de@Lab-133xx : Digital Logic Circuits

● 13301 Combinational Logic Circuit Experiment Module (1)
1. Constructing XOR gate with basic gates
2. AOI gate circuits
3. Constructing comparator with basic logic gates
4. NAND gate circuit
5. Constructing XOR gate with NAND gates
6. TTL circuit
7. Measuring TTL threshold voltage
8. Measuring TTL I/O voltage and current
9. Measuring AND gate characteristics
10. Measuring OR gate characteristics
11. Measuring NOT gate characteristics
12. Measuring NAND gate characteristics
13. Measuring NOR gate characteristics
14. Measuring XOR gate characteristics
15. NOR gate circuit
16. CMOS circuit
17. Measuring CMOS threshold voltage
18. Measuring CMOS voltage and current

● 13302 Combinational Logic Circuit Experiment Module (2)
1. Constructing half-and full-adders with basic logic gates
2. Constructing half-and full-subtractors with basic logic gates
3. Parity generator constructed with XOR gates
4. Constructing 4-bit full-adder with IC
5. Constructing BCD adder
6. Constructing 4-bit full-subtractor with IC
7. Constructing 4-to-10-line decoder with TTL IC

● 13303 Combinational Logic Circuit Experiment Module (3)
1. Constructing 4-to-2-line encoder with basic gates
2. Constructing BCD-to-7-segment decoder
3. Constructing 2-to-4-line decoder with basic gates

● 13304 Combinational Logic Circuit Experiment Module (4)
1. Constructing 10-to-4-line encoder with TTL IC
2. Constructing 1-to-8-line demultiplexer with CMOS IC
3. Analog multiplexer/demultiplexer circuits
4. Constructing 2-to-1-line multiplexer with basic gates
5. Constructing 1-to-2-line demultiplexer with basic gates
6. Using multiplexer to create function
7. Constructing 8-to-1-line multiplexer with TTL IC

- 13305 Combinational Logic Circuit Experiment Module (5)
  1. Constructing comparator with TTL IC
  2. Arithmetic logic unit (ALU) circuit
  3. Parity generator IC
- 13306 Sequential Logic Circuit Experiment Module (1)
  1. Constructing shift register with D flip-flops
  2. Preset left / right shift register
  3. Constructing RS flip-flop with basic logic gates
  4. Constructing D flip-flop with RS flip-flop
  5. Constructing JK flip-flop with RS flip-flop
  6. Constructing master-slave JK flip-flop with RS flip-flop
  7. Constructing noise elimination circuit with RS flip-flops
- 13307 Sequential Logic Circuit Experiment Module (2)
  1. Moving LED control
  2. Constructing divide-by-8 counter with 7490
  3. Constructing BCD counter with 7490
  4. Traffic light control
  5. Constructing divide-by-8 counter with JK flip-flops
  6. Constructing synchronous counter with JK flip-flops

System Requirement

1. PC : 1GHz or faster 32-bit (x86) or 64-bit (x64) processor, 512 MB RAM, 200 MB more free disk space
2. OS : Windows XP / Vista / 7 / 8

Accessory

*i*de@Lab-13191 / *i*de@Lab-13291 / *i*de@Lab-13391

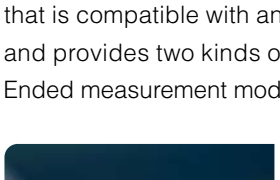
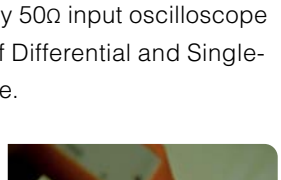
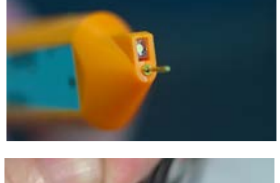
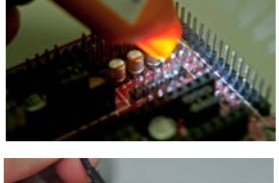
1.USB cable
2.Connection leads and plugs : 1 set
3.CD (*i*de@Lab-131xx / *i*de@Lab-132xx / *i*de@Lab-133xx)
4.User manual : 1 set
5.Storage cabinet (*i*de@Lab-13292) : 1 set
6.Oscilloscope probe kit : 4 set

Option

1. Circuit simulation software TINA design suite
2. DF-600 Differential Active Probe

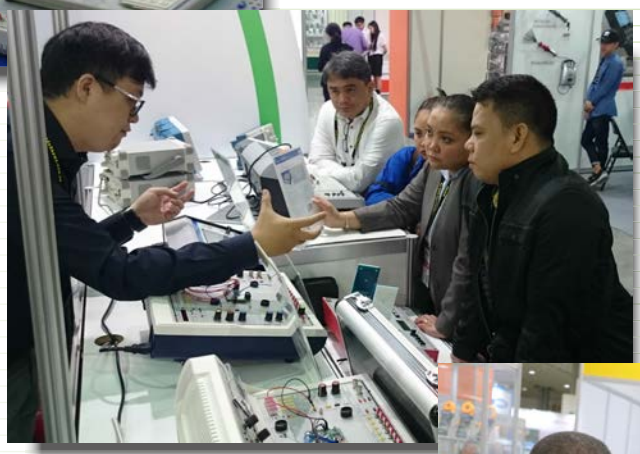
DF-600 Differential Active Probe

DF-600 Differential Active Probe is a high input impedance and low input capacitance probe that is compatible with any 50Ω input oscilloscope and provides two kinds of Differential and Single-Ended measurement mode.

Characteristics

Parameter	With 10:1 attenuator	With 200:1 attenuator	Remarks
Bandwidth	600MHz (Differential) 400MHz (Single-Ended)		50Ω input impedance oscilloscope
DC gain accuracy	1.0%		
Voltage Input Range (Differential)	≦ 30 V	≦ 620 V	(DC+AC peak to peak)
Voltage Input Range (Single-Ended)	≦ 15 V	≦ 310 V	(DC+AC peak to peak)
Rising time	≦ 300ps		
Input Impedance Resistance Capacitance	2.06 MΩ //1.5pF (Between terminals and ground) 4.12 MΩ //0.9 pF (Differential)		
Output termination impedance	50Ω		
Power Requirement	USB support 5V		
Weight	Approximately 110 Grams		
Cable Length	1.2m		



Electronic Circuits Equipment

KNOWLEDGE AND HOPE

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