*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.

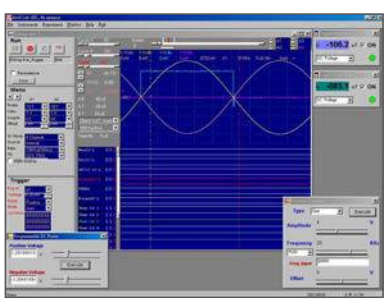
4. The *i*de@Lab system separates modules into extension unit and experiment module. The extension unit is designed to satisfy the special needs of experiment modules. The subjects of experiment modules cover basic electricity, electronic circuits, and digital logic circuits. Each subject involves several 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

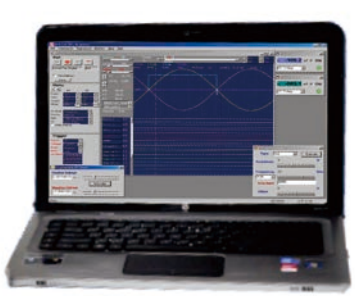
The user interface of *i*de@Lab system contains the instruments (DMM, DSO, FG, PDC, LA) which correspond to the instruments equipped on the front panel of *i*de@Lab-21001A main unit, as well as the explanation algorithm of the programming language for human-machine communication. For easy reference, 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, $\overline{\text{OUT}}$, 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, $\overline{\text{A}}$, 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 is designed for different subjects.

List of Modules

1. ide@Lab-131xx : Basic Electricity


13101
Basic Device Module


13102
Basic Electricity Experiments 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 Experiments 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

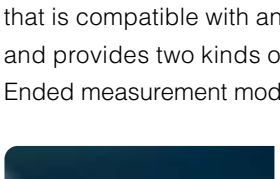
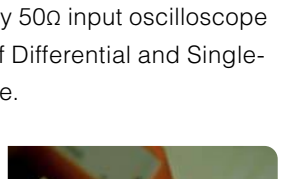
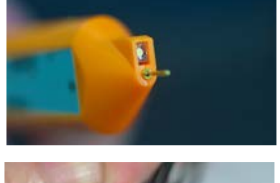
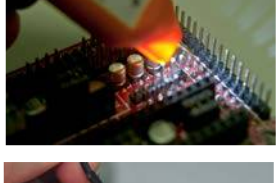
1.USB cable
2.Connection leads and plugs : 1 set
3.CD (*i*de@Lab-131xx / *i*de@Lab-132xx / *i*de@Lab-133xx)
4.User manual : 1 set
5.Storage cabinet (*i*de@Lab-13292) : 1 set
6.Oscilloscope probe kit : 4 set

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		