

**LINEAR CIRCUIT LAB (2) -ELECTRONIC CIRCUIT LAB** **KL-200**



**T**HE KL-200 LINEAR CIRCUIT LAB (2) — *ELECTRONIC CIRCUIT LAB* is a comprehensive and self-contained system suitable for anyone engaged in electronic circuit experiments. All necessary equipments for electronic circuit experiments such as power supply, function generator, analog and digital meters are installed on the main unit. The 17 modules covers a wide variety of essential topics in the field of electronics circuit. It is a time and cost saving device for both students and researchers interested in developing and testing circuit prototypes.

- Ideal for electronic circuit experiments and designing exercises.
- Integrated experimental circuit and trainer, with complete electronic circuit experiment curriculum
- Complete supply and testing units for easy and efficient experiments.
- With universal breadboard for circuit designing and prototypes.
- All modules equipped with an 8-bit DIP switch for fault simulations.



- Individual storage case for all modules for easy carrying and storing.



**SPECIFICATIONS**

**MAIN UNIT(KL-21001)**

**① DC POWER SUPPLY**

**A. Fixed DC Power Supply**

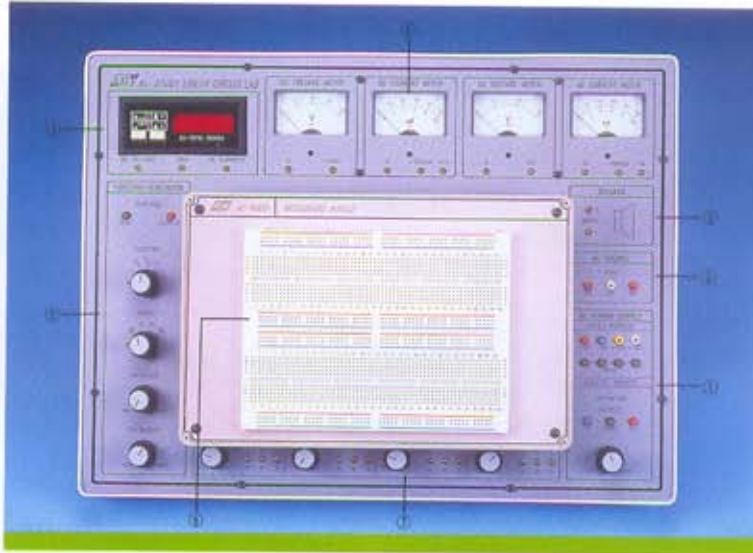
- (1). Voltage Range :  $\pm 5V, \pm 12V$
- (2). Maximum Current Output : 0.3A
- (3). With output overload protection.

**B. Dual DC Power Supply**

- (1). Voltage Range :  $\pm 3V - \pm 18V$ , continuously adjustable
- (2). Maximum Current Output : 1A
- (3). With output overload protection.



**KL-200 LINEAR CIRCUIT LAB (2) -ELECTRONIC CIRCUIT LAB**



② AC POWER SUPPLY

- (1). Voltage Range : 9V – 0V – 9V
- (2). Maximum Current Output : 500mA
- (3). With output overload protection.

③ SIGNAL GENERATOR

A. Function Generator

- (1). Output Waveform : Sine, Square and Triangle.
- (2). Output Frequency : 10 Hz – 100 KHz, 4 settings, continuously adjustable.
- (3). Accuracy :  $\pm 5\%$  of full scale value.
- (4). Output Impedance : 50 $\Omega$
- (5). Output Voltage :  $\geq 18V_{p-p}$  (open loop);  $\geq 9V_{p-p}$  (with 500 load).

④ 3 1/2-DIGIT DIGITAL VOLTMETER/AMPMETER

- A. DC Voltage Range : 2V, 200V
- B. DC Voltage Accuracy :  $\pm 0.3\%$  of reading + 1 digit
- C. DC Current Range : 200 $\mu$ A, 2000mA
- D. DC Current Accuracy :  $\pm 0.5\%$  of reading + 1 digit

⑤ ANALOG METERS

- A. AC Current : 0 – 100mA – 1A
- B. AC Voltage : 0 – 15A
- C. DC Current : 0 – 100mA – 1A
- D. DC Voltage : 0 – 20V

⑥ SPEAKER

one 8 $\Omega$ , 0.25W speaker with driver circuit.

⑦ VARIABLE RESISTORS

- A. 1K $\Omega$ , 0.25W variable resistor with 3 terminals (A,B,C).
- B. 10K $\Omega$ , 0.25W variable resistor with 3 terminals (A,B,C).
- C. 100K $\Omega$ , 0.25W variable resistor with 3 terminals (A,B,C).
- D. 1M $\Omega$ , 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.

⑨ ACCESSORIES

- A. Connect Lead: 2mm-0.65mm, 300mmL 6pcs.
- B. User's Manual
- C. Fuse
- D. AC Cord
- E. Anti-Dust Cover

EXPERIMENT MODULES

1. 17 modules each secured on to 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 solution for the simulated faults are included in the instructor's manual.
4. All terminals on the modules accept 2mm plugs.
5. Comprehensive experiment and instructor's manual.
6. Module dimension: 255 x 165 x 30mm.

MODULES AND THE EXPERIMENTS THEY PERFORM



KL-23001 : Clipping & Clamping Circuits



KL-23002 : Rectifier, Differential & Integrator Circuits



KL-23003 : Transistor Amplification Circuits



KL-23004 : Field Effect Transistor (FET) Circuits



**LINEAR CIRCUIT LAB (2) -ELECTRONIC CIRCUIT LAB** **KL-200**



KL-23005 : Multi-Stage Amplification Circuits



KL-23006 : OTL Amplifier Circuit



KL-23007 : OCL Amplifier 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)
3-2 Full Wave Rectifier Circuit.....	KL-23002(C)
3-3 Bridge Rectifier Circuit.....	KL-23002(C)
3-4 Dual Power Supply Rectifier Circuit.....	KL-23002(C)
3-5 Voltage Magnifying Rectifier Circuit.....	KL-23002(B)

**4. Differential and Integration Circuits**

4-1 RC Direct Current Charge/Discharge Circuit.....	KL-23002(D)
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)
4-5 Integrator Circuit : Sine Wave Input.....	KL-23002(D)
4-6 RL Circuit.....	KL-23002(D)

**5. Transistors**

5-1 PNP Transistor.....	KL-23002(A)
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)

**7. Field Effect Transistors (FET)**

7-1 Junction Type FET (JFET).....	KL-23004(B)
7-2 Metal-Oxide-Semiconductor FET (MOSFET).....	KL-23004(B)

**8. FET Amplification Circuits**

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)
8-5 MOSFET Amplification Circuit : Biased (1).....	KL-23004(D)
8-6 MOSFET Amplification Circuit : Biased (2).....	KL-23004(D)

**9. Multi - Stage Amplification Circuits**

9-1 RC Coupled Amplification Circuit.....	KL-23005(A)
9-2 Direct Coupled Amplification Circuit.....	KL-23005(A)



KL-200

**LINEAR CIRCUIT LAB (2) -ELECTRONIC CIRCUIT LAB**

9-3 Transformer Coupled Amplification Circuit	KL-23005(B)
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)
9-7 IC Amplification Circuit	KL-23006(A)

**10. Transistor Negative Feedback Circuits**

10-1 Serial Voltage Negative Feedback Circuit	KL-23007(B)
10-2 Parallel Voltage Negative Feedback Circuit	KL-23007(C)
10-3 Serial Current Negative Feedback Circuit	KL-23007(B)
10-4 Parallel Current Negative Feedback Circuit	KL-23007(C)

**11. Transistor Positive Feedback Circuits**

11-1 Low-Frequency Sine Wave Oscillating Circuit	
a. RC Phase-Shifting Oscillating Circuit	KL-23008(A)
b. Wine's Bridge Oscillating Circuit	KL-23008(B)
11-2 High-Frequency Sine Wave Oscillating Circuit	
a. Hartley's Oscillating Circuit	KL-23008(C)
b. Copy's 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)
11-6 Bistable Oscillating Circuit	KL-23009(C)
11-7 Intermittent Oscillating Circuit	KL-23009(D)
11-8 Schmitt's Oscillating Circuit	KL-23010(A)
11-9 Sawtooth Oscillating Circuit	KL-23010(B)

**12. Regulated Voltage/Constant Current Circuits**

12-1 Regulated Voltage Circuit with Zener Diode	KL-23010(C)
12-2 Regulated Voltage Circuit with Zener Diode/Transistor	KL-23010(D)
12-3 Regulated Adjustable Voltage Circuit	KL-23010(E)
12-4 Current-Limiting Regulated Voltage Circuit	KL-23011(A)
12-5 Regulated Voltage Circuit with IC	KL-23011(B)
12-6 Constant Current Circuit	KL-23011(C)

**13. Modulation and Demodulation**

13-1 Amplitude Modulation Circuit (AM)	KL-23011(D)
13-2 Frequency Modulation Circuit (FM)	KL-23012(A)
13-3 Amplitude Modulation Detection Circuit	KL-23011(E)
13-4 Amplitude Demodulation Circuit	KL-23012(B)

**14. OP Amplifiers**

14-1 Transistor Differential Amplification Circuit	KL-23012(C)
14-2 Characteristics of OP Amplifiers	
a. Input Impedance Measurement	KL-23012(D)
b. Output Impedance Measurement	KL-23012(D)
c. Bandwidth Measurement	KL-23012(D)
d. Slew Rate Measurement	KL-23012(D)
e. Offset Voltage Measurement (1)	KL-23012(D)
f. Offset Voltage Measurement (2)	KL-23012(D)

**15. Basic Characteristics of OP Amplifier**

15-1 Inverse Amplification	KL-23013(B)
15-2 Non-Inverse Amplification	KL-23013(B)
15-3 Voltage-Follower Circuit	KL-23013(B)
15-4 Difference Amplification	KL-23013(B)
15-5 Sum Amplification (Adder)	KL-23013(B)
15-6 Clipping Circuit	KL-23013(A)
15-7 Constant Voltage Circuit	KL-23013(A)

15-8 Constant Current Circuit	KL-23013(A)
15-9 Differentiator Circuit	KL-23013(A)
15-10 Integrator Circuit	KL-23013(A)

**16. Basic Characteristics of OP Amplifier (1) - Negative Feedback**

16-1 Logarithm Amplification Circuit	KL-23014(A)
16-2 Exponential Amplification Circuit	KL-23014(A)
16-3 Peak Value Detection Circuit	KL-23014(A)
16-4 Precision Clipping Circuit	KL-23014(A)
16-5 Voltage Adjustment Circuit	KL-23014(B)
16-6 Sampling/Hold Circuit	KL-23014(C)
16-7 Instrument Amplification Circuit	KL-23015(B)

**17. Basic Characteristics of OP Amplifier (2) - Negative Feedback**

17-1 High Pass Amplification Circuit	KL-23015(A)
17-2 Low Pass Amplification Circuit	KL-23015(A)
17-3 Band Pass Amplification Circuit	KL-23015(A)
17-4 RIAA Amplification Circuit	KL-23016(A)
17-5 Tone Controller Circuit	KL-23016(A)
17-6 Single Power Supply Inverse Amplification Circuit	KL-23016(B)

**18. Basic Characteristics of OP Amplifier - Positive Feedback**

18-1 Comparator	KL-23016(C)
18-2 Schmitt Trigger	KL-23016(C)
18-3 Window-type Comparator	KL-23016(D)
18-4 Monostable Multivibrator	KL-23017(A)
18-5 Astable Multivibrator	KL-23017(A)
18-6 Sine Wave Oscillation Circuit	
a. RC Oscillator	KL-23017(B)
b. Wine's Oscillator	KL-23017(B)

**ACCESSORIES (KL-28002)**

- A. Connect Leads: 2mm-2mm, 300mmL, 25pcs
- B. Connect Plugs:  $\phi$ 2mm, 10mmL, 10pcs
- C. Experiment manual and Instructor's manual.
- D. Key: 1pc

**GENERAL CHARACTERISTICS**

- A. Individual storage case for each module (205 × 295 × 65mm).
- B. Power Source : 110V/220V $\pm$ 10%, 50/60Hz
- C. Operating Temperature: 0 $^{\circ}$ C-50 $^{\circ}$ C
- D. Humidity : <90% relative humidity
- E. Dimension : 400 × 300 × 130mm
- F. Weight : Approx. 5.8 Kg