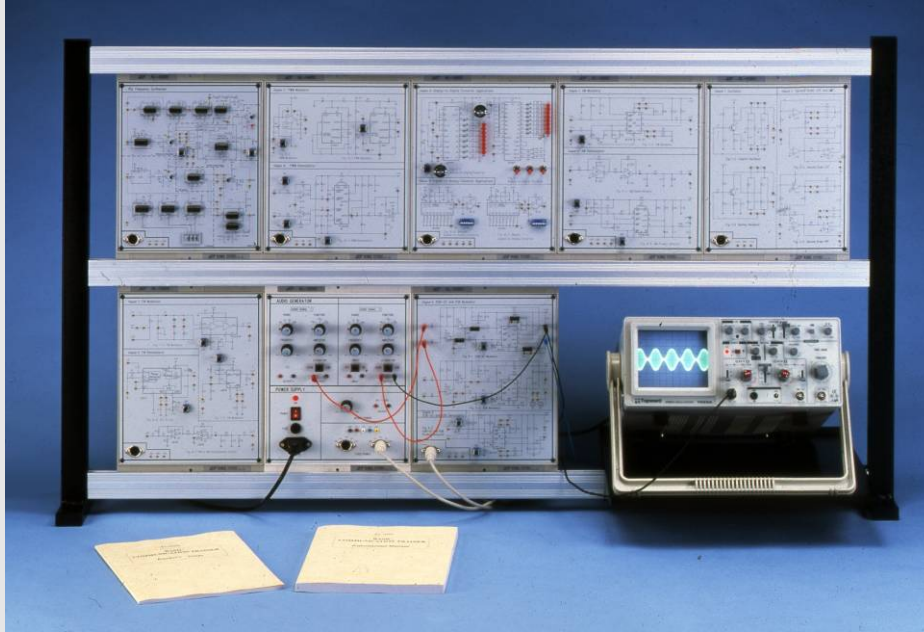


KL-900A

BASIC COMMUNICATION TRAINER



The KL-900A offers experiment for fundamental-level topics of a telecommunication course. It enables the student to acquire a clear experimental view of the basic concepts and, further, they will be familiar with the operative aspects of the work in the telecommunication laboratory.

- The trainer combines the basic modules with experimental circuits. It offers the beginner complete courses of basic Communication.
- KL-900A is equipped with power supply and signal unit. Students only have to adopt the oscilloscope or Spectrum Analyzer together for completing various experiments independently.
- With a open-modularized design, it enables range of experiment extended

Experiment Modules



1. 2mm connection leads are used throughout the system.
2. The building blocks and components symbols of the circuits are printed on the surface of each module.
3. All modules are secured in plastic housings (297 x 226 x 60mm).
4. Cabinet for all modules easy storage facilities
5. Completed experimental manual and teacher's guide

List Of Modules

1. Analog Communication Modules (KL-900A1)

- (1) KL-93001 Oscillator/Second Order LPF & HPF
- (2) KL-93002 AM Modulator/Demodulator
- (3) KL-93003 DSB-SC & SSB Modulator/Demodulator
- (4) KL-93004 FM Modulator/Demodulator
- (5) KL-93005 PLL Frequency Synthesizer
- (6) KL-93006 TDM. Multiplexer & Demultiplexer
- (7) KL-93007 FDM. Multiplexer & Demultiplexer
- (8) KL-93008 Signal Converter & Regeneration Module

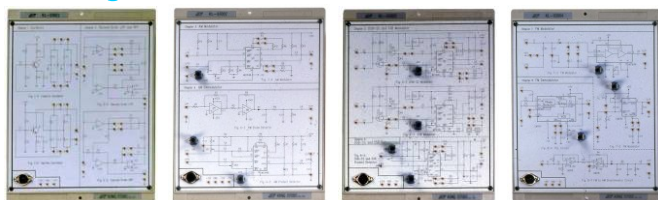
2. Digital Communication Modules (KL-900A2)

- (9) KL-94001 A/D, D/A Converter Applications
- (10) KL-94002 PWM Modulator/Demodulator
- (11) KL-94003 FSK Modulator/Demodulator
- (12) KL-94004 CVSD Modulator/Demodulator, Manchester Code Encode/Decode
- (13) KL-94005 ASK Modulator/Demodulator
- (14) KL-94006 PSK/QPSK Modulator
- (15) KL-94007 PSK/QPSK Demodulator

3. Power Supply & Audio Generator Modules (KL-92001)

- (16) KL-92001

Analog Communcional Modules



KL-93001

KL-93002

KL-93003

KL-93004



KL-93005

KL-93006

KL-93007

KL-93008

1. KL-93001

- (1) RF Oscillator
 - a. Oscillator Frequency : 500KHz , 10MHz
 - b. Power Supply : +12V
- (2) Second Order LPF and HPF
 - a. Low Pass -3db Frequency : 1KHz , 10KHz
 - b. High Pass -3db Frequency : 800Hz , 8KHz
 - c. Power Supply : +12V , -12V

2. KL-93002

- (1) AM Modulator
 - a. Carrier Signal : 100KHz ~ 2MHz
 - b. Audio Signal : 1KHz ~ 3KHz
 - c. Power Supply : +12V, -5V
- (2) AM Demodulator
 - a. Carrier Signal : 100KHz ~ 2MHz
 - b. Audio Signal : 1KHz ~ 3KHz
 - c. Power Supply : +12V, -12V

3. KL-93003

- (1) DSB-SC and SSB Modulator
 - ◆ DSB-SC Modulator
 - a. Carrier Signal : 500KHz ~ 1MHz
 - b. Audio Signal : 1KHz ~ 2KHz
 - c. Power Supply : +12V, -5V
 - ◆ SSB Modulator
 - a. Carrier Signal : 453KHz
 - b. Audio Signal : 1KHz ~ 2KHz
 - c. Power Supply : +12V, -5V
- (2) DSB-SC and SSB Demodulator
 - ◆ DSB-SC Demodulator
 - a. Carrier Signal : 500KHz
 - b. Audio Signal : 1KHz ~ 3KHz
 - c. Power Supply : +12V
 - ◆ SSB Demodulator
 - a. Carrier Signal : 453KHz
 - b. Audio Signal : 2KHz
 - c. Power Supply : +12V

4. KL-93004

- (1) Frequency Modulator
 - ◆ MC 1648 Modulator
 - a. Carrier Signal : 2MHz ~ 3MHz
 - b. Audio Signal : 3KHz ~ 8KHz
 - c. Power Supply : +5V

◆ Lm566 Modulator

- a. Carrier Signal : 2KHz ~ 20KHz
- b. Audio Signal : 1KHz ~ 5KHz
- c. Power Supply : +5V, -5V

(2) DSB-SC and SSB Demodulator

◆ LM565 Demodulator

- a. Carrier Signal : 2KHz ~ 20KHz
- b. Audio Signal : 1KHz ~ 5KHz
- c. Power Supply : +5V, -5V

◆ FM-to-AM Demodulator

- a. Carrier Signal : 500KHz ~ 2MHz
- b. Audio Signal : 1KHz ~ 5KHz
- c. Power Supply : +5V, -5V

5. KL-93005 PLL Frequency Synthesizer

- (1) Frequency Selection Range : 1KHz ~ 1.5MHz
- (2) Reference Frequency : Crystal osc.
1KHz or 10KHz
- (3) Phase Detector & VCO : IC 4046
- (4) Adjustable Capture Range
- (5) Adjustable Lock-in Range

6. KL-93006 TDM. Multiplexer & Demultiplexer

1. TDM Multiplexer
 - (1) Audio Signal Generator
 - a. Triangle Generator : 1kHz~10kHz, +/- 5Vpp
 - b. Square Generator : 1kHz~10kHz, +/- 5Vpp
 - c. Sine Generator : 20kHz~ 50kHz, 5Vpp
 - (2) Analog Switch Multiplexer
 - a. TDM. Channel : Channel A, B, C 3 Port
 - b. Switch SYN. Voltage Level +/- 7Vpp
 - c. TDM. Switch Frequency : M1, M0 Selector
00:100kHz 01:10kHz 10:5kHz 11:1kHz
 - d. TDM. Frame Generator :
 - I . FSYNO : TDM. Frame Start Pulse : TTL Level
 - II . FCLKX : TDM. Data Synchronal Clock : TTL Level
 - III . SYNCO : TDM. Channel Frame Synchronal Clock : TTL Level
 - e. TDM. Frame Auto Start Level For Synchronization : TTL Level
2. TDM Demultiplexer
 - (1) Analog Switch Demultiplexer
 - a. TDM. Mix Signal Level +/- 7Vpp
 - b. Switch Voltage Level +/- 7Vpp
 - c. TDM. Switch Frequency : M1, M0 Selector
00:100kHz 01:10kHz 10:5kHz 11:1kHz
 - d. FSYNI: TDM. Start Frame Input : TTL Level
 - e. Auto Start Frame Detector : TTL Level
 - (2) TDM Demultiplexer Output : Channel A, B, C 3 Port
 - (3) TDM. Frame Receiver Counter : Fcnt0~Fcnt7
: 8 Bit : TTL Level

7. KL-93007 FDM. Multiplexer & Demultiplexer

1. FDM Multiplexer
 - (1) FDM. Multiplexer Channel : Channel A,B,C 3 Port
 - (2) Wien Bridge Audio Signal Generator
 - a. Variable Sine Generator : 1kHz ~ 10kHz, 0~ 12Vpp
 - b. Fixed Sine Generator : 3kHz, +/- 20%, 0~ 3Vpp
 - c. Fixed Sine Generator : 1kHz, +/- 20%, 0~ 3Vpp

- (3) HARTLEY Carrier Signal Generator
 - a. Trimming Carrier Generator : 500kHz, +/- 5%, 0 ~ 12Vpp
 - b. Trimming Carrier Generator : 300kHz, +/- 5%, 0 ~ 12Vpp
 - c. Fixed Carrier Generator : 100kHz, +/- 5%, 0 ~ 12Vpp
 - (4) AM Modulator
 - a. Carrier Signal : 100kHz ~ 500kHz
 - b. Audio Signal : 1kHz ~ 20kHz
 - c. Modulation Rate & Level : 10% ~ 100%
 - d. FDM. High Bandwidth SUM : 1Hz ~ 1MHz
2. FDM Demultiplexer
- (1) FDM. Demultiplexer Channel : Channel A,B,C 3 Port
 - (2) AM Band Tune
 - a. Carrier Bandpass Filter BPF : 3 Channel Input : 2Vpp
 - ChannelA : 500kHz Adj. +/- 20%, BW: 100kHz, +/- 10%
 - ChannelB : 300kHz Adj. +/- 20%, BW: 100kHz, +/- 10%
 - ChannelC : 100kHz Adj. +/- 20%, BW: 100kHz, +/- 10%
 - (3) AM Demodulator
 - a. AM. Rectifier:
 - b. LPF. Audio Band : 1Hz ~ 10kHz
 - c. Audio Signal Amplifier : 1kHz ~ 20kHz, 0 ~ 10Vpp
 - d. FDM. Demultiplexer Audio Signal Output :
 - Channel A : Sine : 1kHz ~ 10kHz, 10Vpp
 - Channel B : Sine : 3kHz, +/- 20%, 10Vpp
 - Channel C : Sine : 1kHz, +/- 20%, 10Vpp

8. KL-93008 Signal Converter & Regeneration Module

- 1. Up and Down Frequency Converter
 - (1) AD633 Multiplier
 - a. Frequency A Input : 10kHz ~ 1MHz
 - b. Frequency B Input : 10kHz ~ 1MHz
 - (2) Second order LPF. Down Converter : 1kHz ~ 100kHz
 - (3) Second order HPF. Up Converter : 500kHz ~ 1MHz
 - (4) External LPF. & HPF for others Up/Down Converter
- 2. Carrier Signal Recovery
 - (1) Uses Up Converter for Double Carrier Input 0.5VPP
 - (2) Signal Amplifier : Gain 1 ~ 20
 - (3) PLL & F/2
 - (4) Second Order LPF : Remove Harmonic for Carrier Sine Signal Recovery
- 3. Synchronal Clock Recovery
 - (1) Manchester Encoder Enclose Synchronal Signal : TTL Level
 - (2) Clock and Clock Delay XOR. for Double Clock : TTL Level
 - (3) PLL for Synchronal Clock Recovery Output : TTL Level

9. KL-94001

- (1) Analog to Digital Converter
 - a. Resolution : 8 bits or 256 steps
 - b. Clock Frequency : 100KHz~800KHz
 - c. Input Voltage Range : 0~5V
 - d. Power Supply : +5V
- (2) Digital to Analog Converter
 - a. Digital Input : 8 bits
 - b. Output Voltage Type : Single or Bipolar
 - c. Power Supply : +12V, -12V

10. KL-94002

- (1) PWM Modulator
 - ◆ Use LM741 PWM
 - a. Carrier Signal : 1.5KHz~2KHz
 - b. Audio Signal : 500Hz
 - c. Power Supply : +12V, -12V Use
 - ◆ Lm555 PWM
 - a. Carrier Signal : 5KHz~10KHz
 - b. Audio Signal : 1KHz
 - c. Power Supply : +12V
- (2) PWM Demodulator
 - a. Audio Signal : 500Hz~700Hz
 - b. Modulation Signal : 5KHz~6KHz
 - c. Demodulation Signal : 500Hz~700Hz
 - D. Power Supply : +12V

11. KL-94003

- (1) FSK Modulator
 - a. Space Signal : 1270Hz
 - b. Mark Signal : 1070Hz
 - c. Output Voltage : 0~5V
 - d. Power Supply : +12V, -12V
- (2) FSK Demodulator
 - a. Space Signal : 1270Hz
 - b. Mark Signal : 1070Hz
 - c. Output Voltage : 0~5V
 - d. Power Supply : +5V, -5V

12. KL-94004

- (1) CVSD Modulators & Demodulators
- (2) Manchester Code Encode & Decode
 - a. Encode of Manchester Code
 - B. Decode of Manchester Code

13. KL-94005

- (1) ASK Modulator
 - a. Carrier Signal : 20KHz~200KHz
 - b. Modulated Signal : 1KHz~10KHz
- (2) ASK Demodulator
 - ◆ Asynchronous Envelope Detector of ASK Demodulator
 - a. Carrier Signal : 20KHz~200KHz
 - b. Modulated Signal : 1KHz~10KHz
 - ◆ Synchronous Product Detector of ASK Demodulator
 - a. Carrier Signal : 20KHz~200KHz
 - b. Modulated Signal : 1KHz~10KHz

14. KL-94006

- (1) PSK/QPSK MODULATOR
 - ◆ Production & Measurement of Data Stream of QPSK
 - a. Data Speed : 400bps ~ 1000bps
 - ◆ QPSK Modulator
 - a. Carrier Signal : 7KHz
 - b. Data Speed : 400bps

Digital Communication Modules



KL-94001



KL-94002



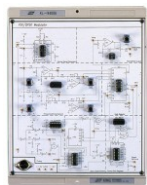
KL-94003



KL-94004



KL-94005



KL-94006



KL-94007

Educational & Training Equipment

15.KL-94007

- (1) PSK/QPSK DEMODULATOR
 - a. Carrier Signal : 7KHz

Power Supply and Audio Generator Module



KL-92001

16.KL-92001

- (1) Fixed DC Power Supply
 - a. Output Voltage : +5V, -5V, +12V, -12V
 - b. Output Current : +5V/0.3A, -5V/0.3A, +12V/0.3A, -12V/0.3A
 - c. Output Connector : 2 x 5PIN DIN Connector
 - d. Output Overload Protection
- (2) Variable DC Power Supply
 - a. Output Voltage : 0V~15V
 - b. Output Current : 0.5A
 - c. Output Overload Protection
- (3) Generator
 - ◆ Audio Generator (1)
 - a. Frequency : 10Hz~200KHz
 - b. Output Waveforms : Sine, Triangle, Square
 - c. Output Impedance : 50 Ω
 - d. Output Attenuation : 0, -20dB
 - e. Output Amplitude : 10Vp-p (at open)
 - f. TTL Output
 - ◆ Audio Generator (2)
 - a. Frequency : 10Hz~200KHz
 - b. Output Waveforms : Sine, Triangle, Square
 - c. Output Impedance : 50 Ω
 - d. Output Attenuation : 0, -20dB
 - e. Output Amplitude : 10Vp-p (at open)
 - f. With VCF Input

List Of Experiments

ANALOG COMMUNICATION

1. RF Oscillator Experiment
2. Second Order LPF & HPF Experiment
3. AM Modulator Experiment
4. AM Demodulator Experiment
5. DSB-SC and SSB Modulator Experiment
6. DSB-SC and SSB Demodulator Experiment
7. FM Modulator Experiment
8. FM Demodulator Experiment
9. PLL Frequency Synthesizer
10. TDM Multiplexer Experiments
11. TDM Demultiplexer Experiments
12. FDM Multiplexer Experiments
13. FDM Demultiplexer Experiments
14. Multiplier Frequency Up/Down Converter Experiment
15. Carrier Frequency Recovery Experiment
16. Synchronal Clock Recovery Experiment

DIGITAL COMMUNICATION

1. Analog to Digital Experiment
2. Digital to Analog Experiment
3. PWM Modulator Experiment
4. PWM Demodulator Experiment
5. FSK Modulator Experiment
6. FSK Demodulator Experiment
7. CVSD Modulators & Demodulators/Manchester Code Encode/Decode
8. ASK Modulator/Demodulator
9. PSK/QPSK Modulator/Demodulator

Accessories (KL-98001)

STANDARD ACCESSORIES

1. Connector leads 1 set
2. Experiment manual 1pce and teacher guide 1 pce
3. AC cord 1 pce
4. Storage cabinet 2 sets (KL-99001)
5. DC Connection plug 2 pcs

OPTIONAL ACCESSORIES

1. Rack frame (KL-97001)
2. RF generator (KI-2220)
3. Digital storage oscilloscope with FFT



Storage Cabinet (KL-99001)



Option : Rack Frame. (KL-97001)



Option : KI-2220 150MHz RF Generator