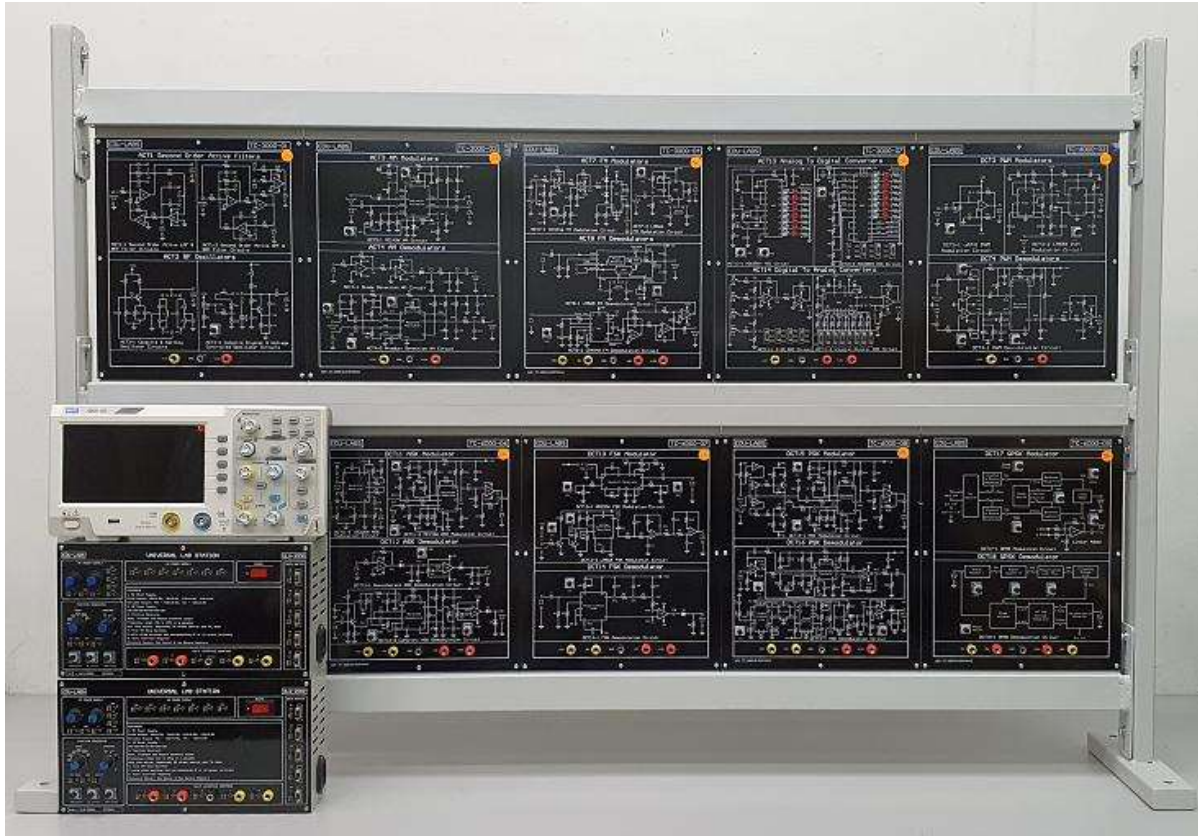


# Advanced Digital & Analog Communication Trainers



**SCIENSCOPE**  
**EDU-LABS**

## TC-8000



The TC-8000 trainer includes the basic & advanced modules to experiment on fundamental & higher level of analog & digital topics of a telecommunication course. The purpose of the modules is to enable the student to acquire a clear experimental view of the basic & advanced concepts and familiarization with the operative aspects of the work in the telecommunication laboratory. This trainer combined the modules with experimental circuits. It can offer the beginner complete courses of basic & advanced communication in 18 experiments modules: 8 Digital & 10 Analog Experiments Modules with the optional power supply and signal unit, oscilloscope or Spectrum Analyzer, then they can complete various experiments independently.

### **ANALOG COMMUNICATION MODULES**

#### **LIST OF EXPERIMENTS**

- a. RF Oscillator Experiment
- b. Second Order LPF & HPF Experiment
- c. AM Modulator Experiment
- d. AM Demodulator Experiment
- e. DSB-SC and SSB Modulator Experiment
- f. DSB-SC and SSB Demodulator Experiment
- g. FM Modulator Experiment
- h. FM Demodulator Experiment
- i. TDM Multiplexer Experiment

- j. TDM Demultiplexer Experiment
- k. FDM Multiplexer Experiment
- l. FDM Demultiplexer Experiment
- m. Analog to Digital Converter Experiment
- n. Digital to Analog Converter Experiment
- o. Frequency Converter
- p. Signal Recovery

## DIGITAL COMMUNICATION MODULES

### LIST OF EXPERIMENTS

- a. Line Code Encoder Experiment
- b. Line Code Decoder Experiment
- c. PWM Modulator Experiment
- d. PWM Demodulator Experiment
- e. PCM Modulator Experiment
- f. PCM Demodulator Experiment
- g. Delta Modulator Experiment
- h. Delta Demodulator Experiment
- i. Adaptive Delta Modulator Experiment
- j. Adaptive Delta Demodulator Experiment
- k. FSK Modulator Experiment
- l. FSK Demodulator Experiment
- m. ASK Modulator Experiment
- n. ASK Demodulator Experiment
- o. PSK Modulator Experiment
- p. PSK Demodulator Experiment
- q. QPSK Modulator Experiment
- r. QPSK Demodulator Experiment
- s. CVSD Modulation and Demodulation
- t. Manchester Encoder and Decoder

### Analog Communication Experiments Modules

<b>TC-3000-01</b>	<b>Second Order Active Filters &amp; RF Oscillators Experiments Module</b>
<b>Lab 1</b>	<b>Second Order Active Filters</b>
Experiment 1	Second Order Active Low-pass Filter (Low-pass -3dB Frequency: 1 kHz ~ 3 kHz)
Experiment 2	Second Order Active High-pass Filter (High-pass -3 dB Frequency: 5 kHz ~ 10 kHz)
Experiment 3	Second Order Active Band-pass Filter (Center Frequency: 10 kHz ~ 100 kHz, Bandwidth: (6 kHz ~ 60 kHz)
Experiment 4	Second Order Active Band-stop Filter (Cutoff Frequency: 10 kHz ~ 100 kHz, Bandwidth: 6 kHz ~ 60 kHz)
<b>Lab 2</b>	<b>RF Oscillators</b>
Experiment 1	Colpitts Oscillator (Oscillation Frequency: 1 MHz ~ 9 MHz)
Experiment 2	Hartley Oscillator (Oscillation Frequency: 500 kHz ~ 1.8 MHz)
Experiment 3	Crystal Oscillator (Oscillation Frequency: 500 kHz ~ 1.8 MHz)
Experiment 4	Voltage Controlled Oscillator (Oscillation Frequency: 3.5 MHz ~ 4 MHz)
<b>TC-3000-02</b>	<b>AM Modulator &amp; Demodulator Experiments Module</b>
<b>Lab 3</b>	<b>AM Modulator</b>
Experiment 1	Transistor AM Modulator (Carrier Signal: 1.5 kHz ~ 2 kHz, Audio Signal: 500 Hz ~ 1 kHz)

Experiment 2	MC1496 AM Modulator (Carrier Signal: 500 kHz ~ 1 MHz, Audio Signal: 500 Hz ~ 1 kHz)
<b>Lab 4</b>	<b>AM Demodulator</b>
Experiment 1	AM Diode Detector (Carrier Signal: 300 kHz, Audio Signal: 500 Hz ~ 2 kHz)
Experiment 2	AM Product Detector (Carrier Signal: 500 kHz ~ 1 MHz, Audio Signal: 500 Hz ~ 1 kHz)

<b>TC-3000-03</b>	<b>DSB-SC and SSB Modulator &amp; Demodulator Experiments Module</b>
<b>Lab 5</b>	<b>DSB-SC and SSB Modulator</b>
Experiment 1	DSB-SC Modulator (Carrier Signal: 100 kHz ~ 500 kHz, Audio Signal: 500 Hz ~ 1 kHz)
Experiment 2	SSB Modulator (Carrier Signal: 200 kHz, Audio Signal: 500 Hz ~ 1 kHz)
<b>Lab 6</b>	<b>DSB-SC and SSB Demodulator</b>
Experiment 1	DSB-SC Product Detector (Carrier Signal: 100 kHz ~ 500 kHz, Audio Signal: 500 Hz ~ 1 kHz)
Experiment 2	SSB Product Detector (Carrier Signal: 200 kHz, Audio Signal: 500 Hz ~ 1 kHz)

<b>TC-3000-04</b>	<b>FM Modulator &amp; Demodulator Experiments Module</b>
<b>Lab 7</b>	<b>FM Modulator</b>
Experiment 1	MC4046 FM Modulator (Carrier Signal: 20 kHz, Audio Signal: 1 kHz)
Experiment 2	LM566 FM Modulator (Carrier Signal: 20 kHz, Audio Signal: 500 Hz ~ 700 Hz)
<b>Lab 8</b>	<b>FM Demodulator</b>
Experiment 1	MC4046 FM Demodulator (Carrier Signal: 20 kHz, Audio Signal: 1 kHz)
Experiment 2	LM565 FM Demodulator (Carrier Signal: 20 kHz, Audio Signal: 500 Hz ~ 700 Hz)

<b>TC-3000-05</b>	<b>TDM Multiplexer &amp; Demultiplexer Experiments Module</b>
<b>Lab 9</b>	<b>TDM Multiplexer</b>
Experiment 1	Waveform Generator (Sine Wave Signal Generator: 13 kHz, Triangle Wave Signal Generator: 2.3 kHz, Square Wave Signal Generator: 2.3 kHz)
Experiment 2	TDM Multiplexer (Transmission Channels: 3 Channels, Switching Time: 500 ms ~ 50 ms)
<b>Lab 10</b>	<b>TDM Demultiplexer</b>
Experiment 1	TDM Demultiplexer (Transmission Channels: 3 Channels, Switching Time: 500 ms ~ 50 ms)

<b>TC-3000-06</b>	<b>FDM Multiplexer &amp; Demultiplexer Experiments Module</b>
<b>Lab 11</b>	<b>FDM Multiplexer</b>
Experiment 1	FDM Signal Generator (Carrier Signal: 500 kHz ~ 1.5 MHz, Audio Signal: 500 Hz ~ 1.5 kHz)
Experiment 2	DSB-SC Modulated Signal Generator (Carrier Signal: 500 kHz ~ 1.5 MHz, Audio Signal: 500 Hz ~ 1.5 kHz)
Experiment 3	FDM Multiplexer (Modulation Type: DSB-SC Signal, Transmission Bandwidth: 2 MHz)
<b>Lab 12</b>	<b>FDM Demultiplexer</b>
Experiment 1	FDM Demultiplexer (Modulation Type: DSB-SC Signal, Demultiplexing Type: Product Demultiplexer)

<b>TC-3000-07</b>	<b>A/D &amp; D/A Converter Experiments Module</b>
<b>Lab 13</b>	<b>Analog-to-Digital Converter</b>
Experiment 1	ADC0804 Analog-to-digital Converter (Resolution: 8 bits, Analog Input Voltage: 0 V ~ 5 V)
Experiment 2	ADC0809 Analog-to-digital Converter (Resolution: 8 bits, Analog Input Voltage: 0 V ~ 5 V)
<b>Lab 14</b>	<b>Digital-to-Analog Converter</b>
Experiment 1	R-2R Digital-to-analog Converter (Digital Input: 4 bits, Analog Output: 0 V ~ 5 V)

<b>TC-3000-08</b>	<b>Frequency Converter &amp; Signal Recovery Experiments Module</b>
<b>Lab 15</b>	<b>Frequency Converter</b>
Experiment 1	Frequency Multiplier (Carrier Signal: 10 kHz)
Experiment 2	Up/Down Frequency Converter (Carrier Signal @ LO port: 100 kHz; Carrier Signal @ RF port: 120 kHz)
<b>Lab 16</b>	<b>Signal Recovery</b>
Experiment 1	Carrier Signal Recovery Circuit (Carrier Signal: 10 kHz)
Experiment 2	Clock Recovery Circuit (Clock Signal: TTL, Encoded Signal: Manchester, Clock Frequency: 5 kHz ~ 10 kHz)

### Digital Communication Experiments Modules :

<b>TC-6000-01</b>	<b>Line Code Encoder and Decoder Experiments Module</b>
<b>Lab 1</b>	<b>Line Code Encoder</b>
Experiment 1	Unipolar and Bipolar NRZ Signal Encoder (Signal: TTL, Data Rate: 1 kbps ~ 4 kbps)
Experiment 2	Unipolar and Bipolar RZ Signal Encoder (Signal: TTL, Data Rate: 1 kbps ~ 2.5 kbps, CLK: 2 kHz ~ 5 kHz)
Experiment 3	AMI Signal Encoder (Signal: TTL, Data Rate: 50 bps ~ 250 bps, CLK: 100 Hz ~ 500 Hz)
Experiment 4	Manchester Signal Encoder (Signal: TTL, Data Rate: 100bps ~ 400bps, CLK: 200Hz ~ 800Hz)
<b>Lab 2</b>	<b>Line Code Decoder</b>
Experiment 1	Unipolar and Bipolar NRZ Signal Decoder (Signal: TTL, Data Rate: 1 kbps ~ 4 kbps)
Experiment 2	Unipolar and Bipolar RZ Signal Decoder (Signal: TTL, Data Rate: 1 kbps ~ 2.5 kbps, CLK: 2 kHz ~ 5 kHz)
Experiment 3	AMI Signal Decoder (Signal: TTL, Data Rate: 50 bps ~ 250 bps, CLK: 100 Hz ~ 500 Hz)
Experiment 4	Manchester Signal Decoder (Signal: TTL, Data Rate: 100bps ~ 400bps, CLK: 200Hz ~ 800Hz)

<b>TC-6000-02</b>	<b>PWM (Pulse Width) Modulation and Demodulation Experiments Module</b>
<b>Lab 3</b>	<b>Pulse Width Modulator</b>
Experiment 1	UA741 PWM Circuit (Carrier Signal: 1.5 kHz ~ 2 kHz; Audio Signal Frequency: 500Hz)
Experiment 2	LM566 PWM Circuit (Carrier Signal: 5 kHz ~ 10 kHz; Audio Signal Frequency: 1 kHz)
<b>Lab 4</b>	<b>Pulse Width Demodulator</b>
Experiment 1	PWM Demodulation Circuit (Carrier Signal: 5kHz ~ 6kHz; Audio Signal Frequency: 500Hz ~ 700Hz)

<b>TC-6000-03</b>	<b>PCM (Pulse Code) Modulation and Demodulation Experiments Module</b>
<b>Lab 5</b>	<b>PCM Modulator</b>
Experiment 1	PCM Modulator (Built-in Sample Frequency: 8 kHz, Built-in Operation Frequency: 2048 kHz, Audio Signal: 100 Hz ~ 2 kHz)
<b>Lab 6</b>	<b>PCM Demodulator</b>
Experiment 1	PCM Demodulator (Built-in Sample Frequency: 8 kHz, Built-in Operation Frequency: 2048 kHz, Audio Signal: 100 Hz ~ 2 kHz)

<b>TC-6000-04</b>	<b>Delta Modulation and Demodulation Experiments Module</b>
<b>Lab 7</b>	<b>Delta Modulator</b>
Experiment 1	Delta Modulator (Type of Sample Signal: TTL CLK, Sample Frequency: 32 kHz ~ 256 kHz, Audio Signal: 1 kHz ~ 3 kHz)
<b>Lab 8</b>	<b>Delta Demodulator</b>
Experiment 1	Delta Demodulator (Type of Sample Signal: TTL CLK, Sample Frequency: 32 kHz ~ 256 kHz, Audio Signal: 1 kHz ~ 3 kHz)

<b>TC-6000-05</b>	<b>Adaptive Delta Modulation and Demodulation Experiments Module</b>
<b>Lab 9</b>	<b>Adaptive Delta Modulator</b>
Experiment 1	Adaptive Delta Modulator (Type of Sample Signal: TTL CLK, Sample Frequency: 32 kHz ~ 128 kHz, Audio Signal: 500 Hz ~ 1 kHz)
<b>Lab 10</b>	<b>Adaptive Delta Demodulator</b>
Experiment 1	Adaptive Delta Demodulator (Type of Sample Signal: TTL CLK, Sample Frequency: 64 kHz ~ 256 kHz, Audio Signal: 500 Hz ~ 1 kHz)

<b>TC-6000-06</b>	<b>ASK (Amplitude-Shift Keying) Modulation and Demodulation Experiments Module</b>
<b>Lab 11</b>	<b>Amplitude-Shift Keying Modulator</b>
Experiment 1	XR2206 ASK Modulator (Carrier Signal: 20 kHz, Data Rate: 1 kbps)
Experiment 2	MC1496 ASK Modulator (Carrier Signal: 20 kHz ~ 100 kHz, Data Rate: 2 kbps)
<b>Lab 12</b>	<b>Amplitude-Shift Keying Demodulator</b>
Experiment 1	Asynchronous ASK Demodulator (I) (Use XR2206 as the modulated ASK signal) (Carrier Signal: 20 kHz, Data Rate: 200bps)
Experiment 2	Asynchronous ASK Demodulator (II) (Use MC1496 as the modulated ASK signal) (Carrier Signal: 20 kHz ~ 100 kHz, Data Rate: 200 bps)
Experiment 3	Synchronous ASK Demodulator (Carrier Signal: 100 kHz ~ 100 kHz, Data Rate: 200 bps)

<b>TC-6000-07</b>	<b>FSK (Frequency-Shift Keying) Modulation and Demodulation Experiments Module</b>
<b>Lab 13</b>	<b>Frequency-Shift Keying Modulator</b>
Experiment 1	FSK Modulator (Space Signal: 1370 Hz; Mark Signal: 870 Hz; Data Signal: 200Hz ~ 5 kHz)
<b>Lab 14</b>	<b>Frequency-Shift Keying Demodulator</b>
Experiment 1	FSK Demodulator (Space Signal: 1370Hz; Mark Signal: 870Hz; Data Signal: 200Hz ~ 5 kHz)

<b>TC-6000-08</b>	<b>PSK (Phase-Shift Keying) Modulation and Demodulation Experiments Module</b>
<b>Lab 15</b>	<b>Phase-Shift Keying Modulator</b>
Experiment 1	PSK Modulator (Carrier Signal: 100 kHz; Data Rate: 200 bps; Data Signal: 100 Hz ~ 1kHz)
<b>Lab 16</b>	<b>Phase-Shift Keying Demodulator</b>
Experiment 1	PSK Demodulator (Carrier Signal: 100 kHz; Data Rate: 400 bps ~ 1000 bps; Data Signal: 100 Hz ~ 1kHz)

<b>TC-6000-09</b>	<b>QPSK (Quadrature Phase-Shift Keying) Modulation and Demodulation Experiments Module</b>
<b>Lab 17</b>	<b>QPSK Modulator</b>
Experiment 1	Bit-splitter Circuit (Data Rate: 100 bps ~ 1000 bps)
Experiment 2	QPSK Modulation Circuit (Carrier Signal: 20 kHz; Data Rate: 1000bps)
<b>Lab 18</b>	<b>QPSK Demodulator</b>
Experiment 1	Signal-square and PLL Circuit (Carrier Signal: 20 kHz; Data Rate: 1000 bps)
Experiment 2	QPSK Demodulation Circuit (Carrier Signal: 20 kHz; Data Rate: 1000 bps)

<b>TC-6000-10</b>	<b>Digital Signal Processing Module</b>
<b>Lab 19</b>	<b>CVSD Modulation and Demodulation</b>
Experiment 1	a. Sampling Frequency: 16 kHz ~ 50 kHz. b. Audio Frequency Signal: 100 Hz ~ 2 kHz. c. TTL input and output level signals.
<b>Lab 20</b>	<b>Manchester Encoder and Decoder</b>
Experiment 1	a. Input TTL level signal. b. CLK: 500 Hz ~ 1 kHz. c. Data Rate: 250bps ~ 500 bps.

### Accessory Sets

<b>TC-8000-TS2</b>	<b>2mm Stackable Test Lead Set (350mm Length)</b>
	Assorting in 5 different colors 30 units : Red x 6, Yellow x 6, Blue x 6, Black x 6, Green x 6
<b>TC-8000-TS4</b>	<b>4mm Stackable Test Lead Set (350mm Length)</b>
	Assorting in 5 different colors 10 units : Red x 2, Yellow x 2, Blue x 2, Black x 2, Green x 2
<b>TC-8000-EF</b>	<b>Experiments Frame (1450mm Length)</b>
	a. Epoxy Coated Steel Bended T Slot Frame b. Din Standard A4 With Two Shelves c. Side Frame: T Shape d. Dimension: <ul style="list-style-type: none"> <li>• Length : 1450mm</li> <li>• Width : 20mm</li> <li>• Height : 300mm</li> </ul>

### Universal Lab Station ULS-2000

<b>DC Power Supply</b>	
Fixed Output:	+5V/0.5A, -5V/0.5A, +12V/0.5A, -12V/0.5A
Variable Output:	+0V ~ +23V/1A, -0V ~ -23V/1A
<b>AC Power Supply</b>	
Fixed Output:	19V-15V-9V-0V-9V-15V-19V
<b>Function Generator</b>	
Sine, Triangle and Square waveform output	

Frequency range: 1Hz to 1MHz in 6 decades	
With fine adjust, Amplitude and DC offset control	
TTL Mode Output Range: 1Hz to 1MHz in 6 decades	
Six frequency ranges:	1Hz to 10Hz
	10Hz to 100Hz
	100Hz to 1KHz
	1KHz to 10KHz
	10KHz to 100KHz
	100KHz to 1MHz
Sine wave output: 0 to 12V peak to peak variable	
Triangle wave output: 0 to 8V peak to peak variable	
Square wave output: 0 to 16V peak to peak variable	
<b>Five (5) Data Switches Module</b>	
5 units slide switches and corresponding output terminals. When switch is set at "down" position, the output is LO level; contrarily, it is to be HI level when setting at "up" position.	
<b>Multi Interface Adaptor Module</b>	
Miniature Socket, 2mm Socket & 4mm Banana Adaptors	

**Optional Equipment Need To Complete The Experiments Testing**

<b>1.0</b>	<b>3 ½ Digits Digital Multimeter</b>
<b>2.0</b>	<b>60MHz Digital Storage Oscilloscope</b>

**Note: Specification, Layout, Design etc. May Change Without Prior Notice For Products Continuous Development Process.**