# ITF-202

Operational Amplifier Training Kit

This kit demonstrates how an operational amplifier works, how its specifications can be evaluated, as well as the applications it can be used for. Eventually, this kit makes it possible learn how to design an analog circuit using an operational amplifier.

External resistors and capacitors can be added to increase the design flexibility.

The training kit consists of the following six sections:
1. *Power supply section*
2. *Amplifier section*
3. *Active filter section*
4. *Wien bridge oscillator section*
5. *Differentiator/Integrator section*
6. *Test power source section*
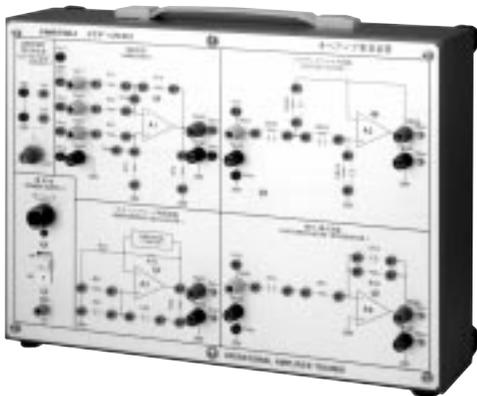
Specifications

Amplifier section
Oscillator section	
Oscillation	Wien bridge oscillator
Frequency	1 kHz to 50 kHz
Amplitude	±6 Vp-p
Limiter	Diode limiter
Active filter section	
Circuit	Voltage source type
Attenuation	2nd order (-12 dB/Oct)
Frequency range	1 kHz to 10 kHz
Integrator section	
Frequency	16 Hz or more
Differentiator section	
Frequency	16 kHz or less

Test power source section
Output voltage	1.0 V (0.990 V to 1.010 V)
	–3 V to 3 V (3.030 V to 2.970 V)
Output current	2 mA max.
Power supply	AC 100/117/200/217/234 V, 50/60 Hz, approx. 3 W
Size and weight	350 (W) X 250 (L) X 83 (D) mm,4.2kg
Operating temperature	0° to 40°C, 85% RH

ITF-203

AD/DA Converter Training Kit

The ITF-203 shows how one of today's most important circuit techniques — analog to digital conversion and digital to analog conversion — works.

Learning items:
1. *Successive-approximation A/D conversion*
2. *D/A conversion*
3. *What vertical resolution is and how it works*
4. *What a sampling clock is and how it works*
5. *Data communication via a GPIB or RS-232C interface using a personal computer*

A built-in microphone and speaker offer a simple audio digitizer circuit. Featuring test points at each circuit block allows students to easily check how each one works.

Specifications

AD input	±5.12 V, 0 to 10.24 V, or audio source	**DA output**	–5.12 V to +5.08 V or audio output
Input frequency	DC to 20 kHz or more	**Memory length**	20 kwords
AD resolution	8 bits or 4 bits	**Power supply**	AC 100/117/200/217/234 V, 50/60 Hz, approx. 13 W
Sampling rate	INT: 5 µs to 0.5 s (1-2-5 steps)		
	EXT: External clock up to 5 µs	**Size and weight**	350 (W) X 83 (H) X 250 (L) mm, 4.5 kg
DA resolution	8 bits	**Operating temperature**	0° to 40°C, 85% RH