

- **TWO OPERATIONAL AMPLIFIERS**
- **15 MHz OR GREATER GAIN-BANDWIDTH PRODUCT**
- **2500 OR GREATER OPEN-LOOP GAIN**
- **SELECTABLE INTERNAL Z_i AND Z_f COMPONENTS**
- **PROVISION FOR EXTERNAL Z_i AND Z_f COMPONENTS**

The Type O Operational Amplifier Unit performs integration, differentiation, function generation, linear and non-linear amplification. It contains two operational amplifiers and a display amplifier. Each operational amplifier has identical features, including front-panel selection of internal Z_i and Z_f components. External components can be used independently or in combination with the internal resistor-capacitor combinations. The output of either operational amplifier can be applied to the other operational amplifier; either output can be applied to the display amplifier. The results can be viewed on Tektronix Type 530, 540, 550, and 580* Series Oscilloscopes and/or fed to other devices.

Type 127, 132, and 133 Power Supplies are available to operate this plug-in unit outside an oscilloscope. See description of these instruments for details.

DISPLAY AMPLIFIER

TYPE O UNIT AND OSCILLOSCOPE	BANDWIDTH† (—3 dB)	RISETIME
531A, 533A, 535A	DC to 14 MHz	25 ns
536	DC to 10 MHz	35 ns
543B, 544, 545B, 546, 547, 555, 556, 581A*, 585A*	DC to 25 MHz	14 ns
549, 551	DC to 23 MHz	16 ns

*A Type 81A Adapter is required.

†Low-frequency 3-dB point, AC coupled: 2 Hz, 0.2 Hz with 10X probe.

DEFLECTION FACTOR

50 mV/cm to 20 V/cm in 9 calibrated steps (1-2-5 sequence), accurate within 3%. Uncalibrated, continuously variable between steps and to approx 50 V/cm.

INPUT

1 megohm paralleled by approx 47 pF.
600 V DC + peak AC max input voltage.

OPERATING MODES

Signal source selection from either operational amplifier or an external signal. AC or DC coupling. The display can be inverted to provide the desired deflection polarity.

OPERATIONAL AMPLIFIERS

OPEN-LOOP GAIN

2500 minimum.

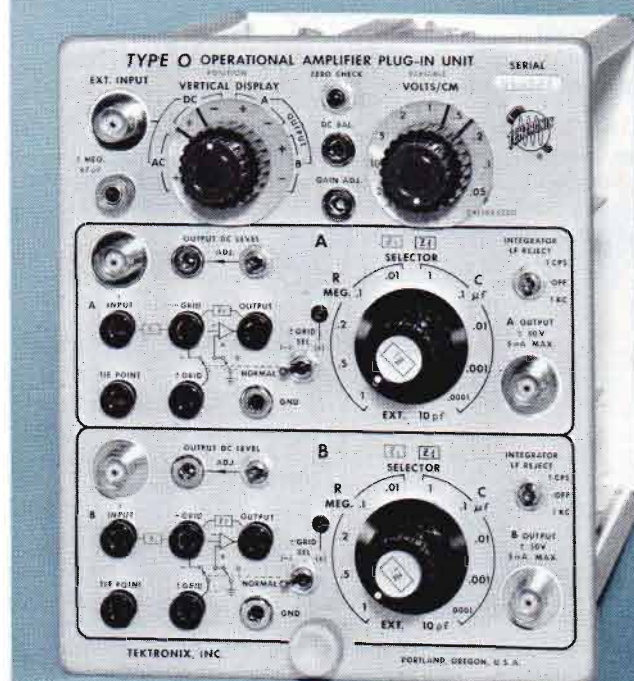
OPEN-LOOP GAIN-BANDWIDTH PRODUCT

15 MHz or greater; checked at 10 MHz for open-loop gain greater than 1.5.

CLOSED-LOOP BANDWIDTH

750 kHz or greater at unity gain with internal input and feedback resistors, up to 10 MHz with external compensation (such as provided by the optional Compensating Adapter).

OPERATIONAL AMPLIFIER UNIT



OUTPUT RANGE

± 50 V, ± 5 mA.

OUTPUT DC LEVEL

Adjustable to ground at front panel.

OUTPUT IMPEDANCE

Approx 30 Ω at 1 MHz for compensated unity-gain amplifier.

DRIFT

Typically < 10 mV/hour referred to input (after warmup).

NOISE

Typically < 0.5 mV peak-to-peak (equivalent input noise), approx 3 mV peak-to-peak additional output noise when $R_f = 1$ megohm.

GRID CURRENT

< 0.5 nA for each input grid; adjustable to < 0.3 nA for —grid and < 0.15 nA for +grid.

CROSSTALK BETWEEN AMPLIFIERS

$\geq 300:1$ with 1-kHz squarewave.

FEEDBACK

Provision for negative and/or positive feedback. Negative feedback utilizes internal and/or external impedances; positive feedback utilizes external impedances only.

SELECTABLE INPUT AND FEEDBACK COMPONENTS

Front-panel switches allow independent selection of the following resistors and capacitors in any combination as Z_i and Z_f : 10, 100, 200 and 500 k Ω , 1 M Ω ; 10 and 100 pF, 0.001, 0.01, 0.1, and 1 μ F. All values are $\pm 1\%$ except 10 and 100 pF which are adjustable.

INTEGRATION LOW-FREQUENCY REJECT

For high-frequency integration applications, reduces integration of drift and signals below approx 1 Hz or 1 kHz; can be switched out when desired.

TYPE O

TERMINAL ADAPTERS

Two shielded adapters included for construction of external circuitry for custom applications. Suggested circuits for special applications are shown in the instruction manual.

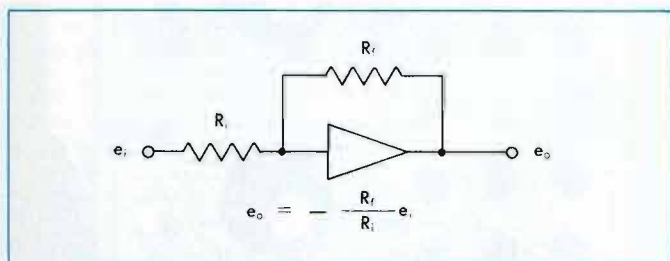
WEIGHTS

Net weight	5½ lb	2.5 kg
Domestic shipping weight	≈10 lb	≈4.5 kg
Export-packed weight	≈14 lb	≈6.4 kg

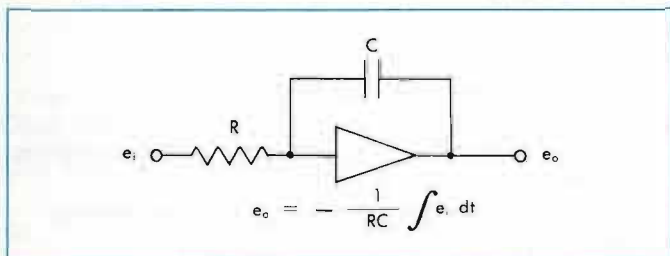
INCLUDED STANDARD ACCESSORIES

Two terminal adapters (103-0048-01); two terminal shields (013-0049-01); two BNC-to-binding post adapters (103-0033-00); two BNC-to-BNC 18-in patch cords (012-0087-00); two instruction manuals (070-0323-00).

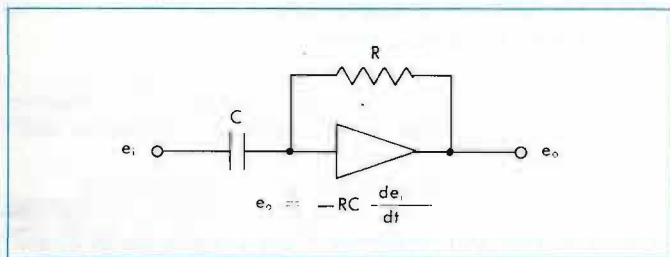
BASIC OPERATING MODES



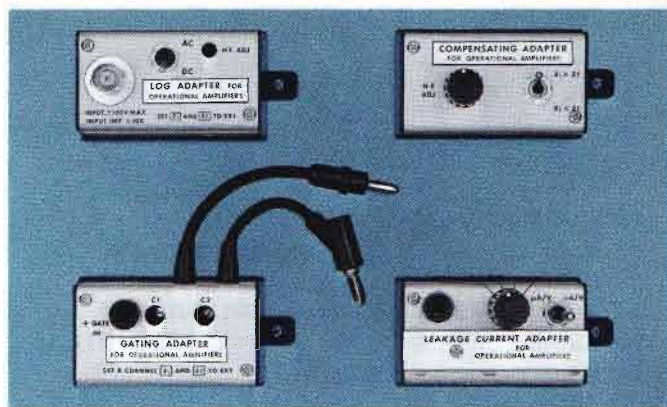
AMPLIFICATION is determined by the ratio of input to feedback resistors. This provides convenient signal step-up or step-down, with low output impedances, to over 750 kHz. Use of external compensation extends the closed-loop gain-bandwidth product to 10 MHz or more.



INTEGRATION is obtained by placing a capacitor in the feedback loop. Unlike the RC integrator, this circuitry permits loading of the output, and integration without loss of signal level. Integration at repetition rates of approximately 5 MHz is possible. Low-frequency rejection allows drift-free repetitive-waveform integration.



DIFFERENTIATION is accomplished by placing a capacitor in the input circuit. The unique characteristic of differentiation is its ability to extract higher frequency waveform components. It can advantageously detect minute information such as transients and slope changes. Differentiation of waveforms with significant components as high as 1.5 MHz is possible.



OPTIONAL ACCESSORIES

LOG ADAPTER

The Log Adapter with the Type O Plug-In Unit allows the display and measurement of high-amplitude signals mixed with low-amplitude signals. Pulses and transient waveforms differing in amplitude by up to 1000 to 1 can be displayed and measured on the same trace.

The Log Adapter is a logarithmic feedback network that converts the A or B operation amplifier in a Type O Plug-In Unit from a linear amplifier to essentially a logarithmic amplifier. The adapter can be plugged directly into the jacks on the front panel of the Type O Plug-In Unit.

Order 013-0067-00

COMPENSATING ADAPTER

The Compensating Adapter extends the high-frequency performance of either operational amplifier of the Type O Plug-In Unit when the internal Z_i and Z_f resistors are used in any combination for either gain or attenuation.

Without the Compensating Adapter, stray capacitance associated with the internal Z_i and Z_f resistors limits the operational amplifiers high-frequency performance. The adapter can be plugged into the front panel of the Type O Plug-In Unit.

Order 013-0081-00

GATING ADAPTER

The Gating Adapter allows integration and display of repetitive signals, by resetting the integrator to zero during the oscilloscope's retrace time. The adapter uses Operational Amplifier "B" of the Type O to gate Amplifier "A" on and off in response to an external gating signal, such as the +Gate from the oscilloscope. The signal applied to Amplifier "A" is then amplified, integrated, or differentiated only during the "on" time.

Order 013-0068-00

LEAKAGE CURRENT ADAPTER

Used with the Type O Plug-In Unit, the Leakage Current Adapter provides the facility for measuring leakage current of semiconductor diodes and small signal transistors.

The adapter plugs into the operational jacks located on the front panel of the Type O Unit. A positive-going sawtooth voltage is required for driving the adapter. Tektronix Oscilloscopes that accept the Type O Plug-In Unit have a Sawtooth or Sweep-Out jack conveniently located on the front panel for supplying the required sawtooth voltage.

Order 013-0086-00

Please refer to the catalog accessory pages for complete information on the above adapters.

Please refer to Terms and Shipment, General Information page.