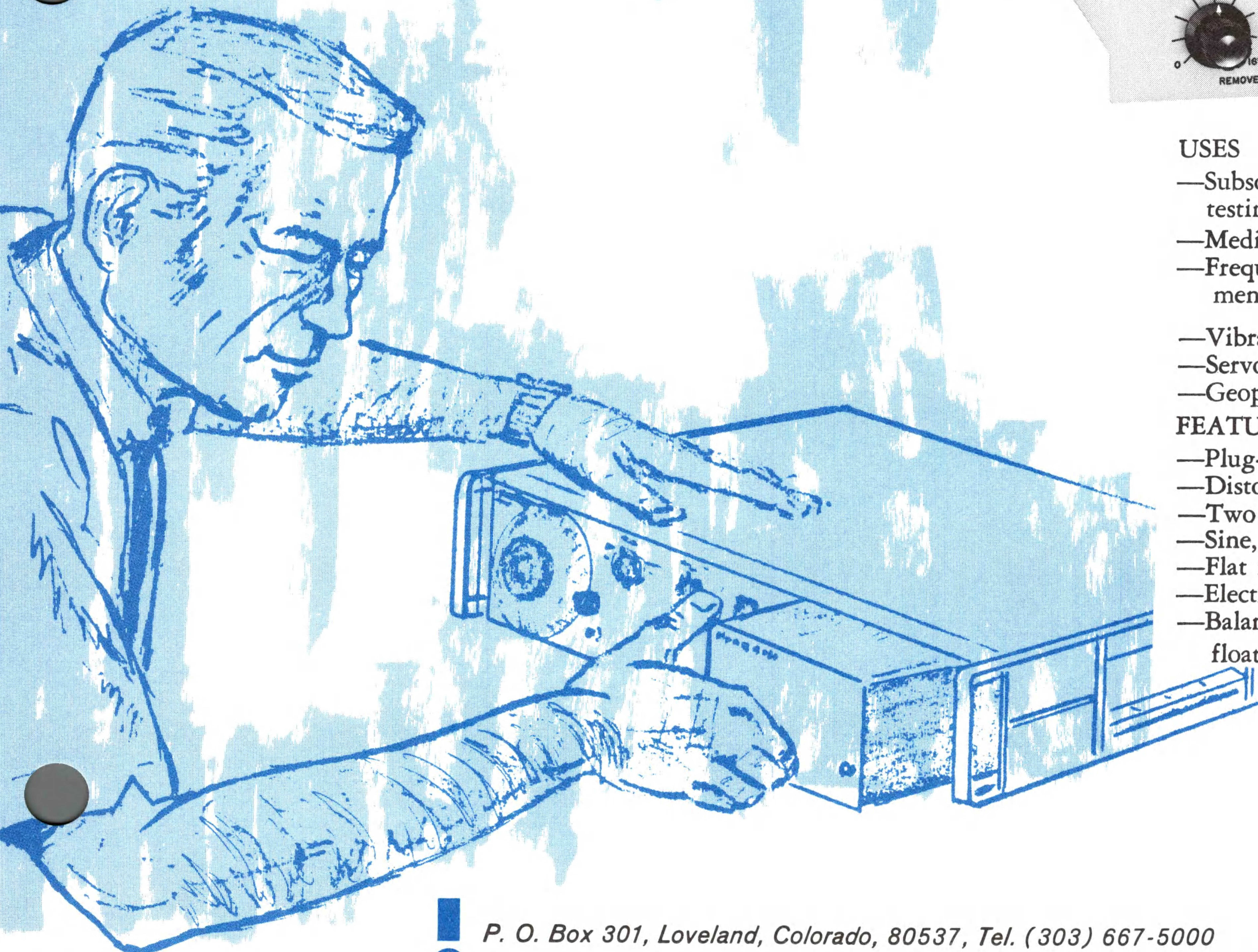
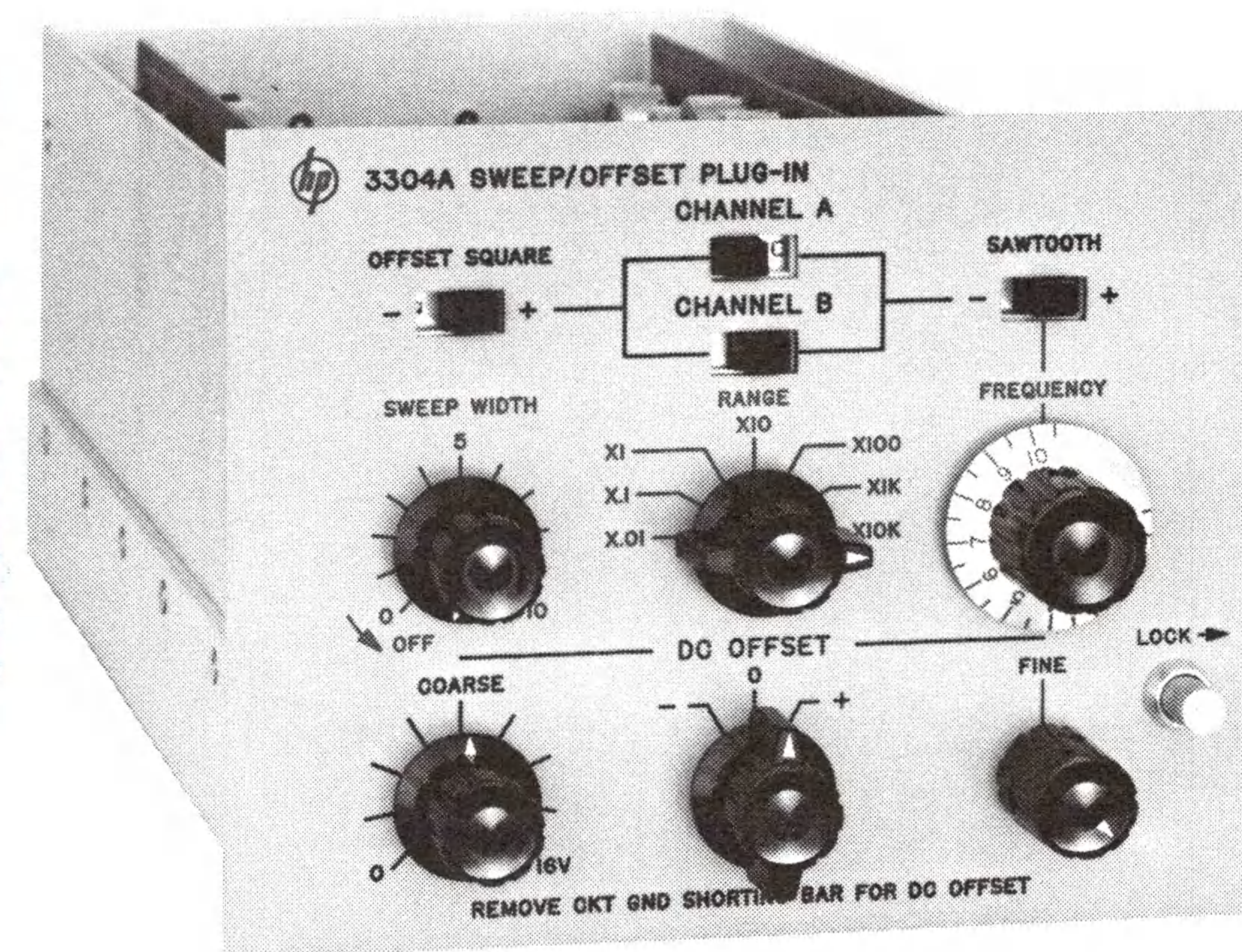
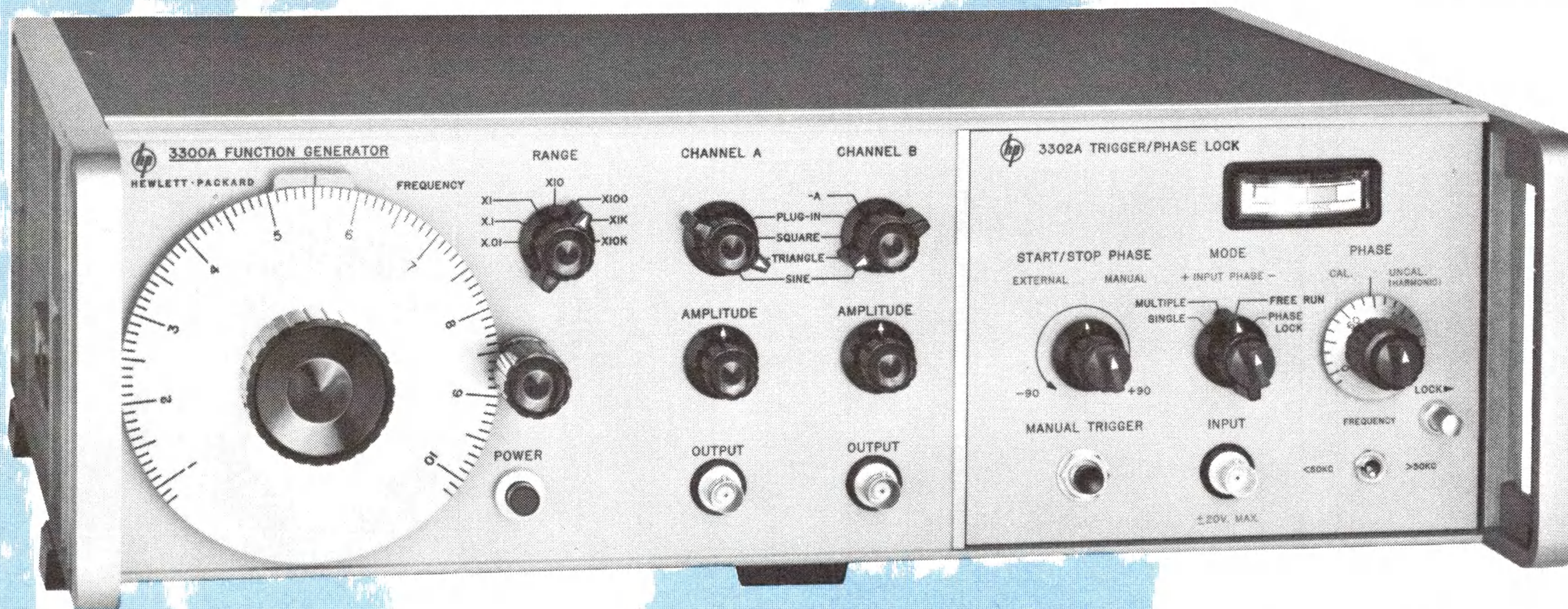


FUNCTION GENERATOR

model
3300A
 3301A
 3302A
 3304A
 Plug-In Units

TECHNICAL DATA 10 NOV 66

Revised



USES

- Subsonic, audio ultrasonic testing
- Medical research
- Frequency response measurements
- Vibration studies
- Servo applications
- Geophysical problems

FEATURES

- Plug-in capability
- Distortion less than 1%
- Two output amplifiers
- Sine, square, triangular waves
- Flat frequency response
- Electronic frequency control
- Balanced, single ended, and floating output

P. O. Box 301, Loveland, Colorado, 80537, Tel. (303) 667-5000

Europe: 54 Route Des Acacias, Geneva, Switzerland, Cable: "HEWPACKSA" Tel. (022) 42.81.50

DESCRIPTION

Maximum versatility and usefulness with plug-ins and multiple outputs set the HP 3300A Function Generator apart from other function generators. Any two of three waveforms—sine, square, or triangular—may be selected by a front-panel switch over the frequency range from 0.01 Hz to 100 kHz, continuously adjustable in seven decade ranges. This solid-state, multi-purpose source provides simultaneous signals of any two waveforms, with constant amplitude over the entire frequency range.

Plug-ins, which insert directly into the front panel include the HP 3301A Auxiliary Plug-in, the HP 3302A Trigger-Phase Lock Plug-in, and the 3304A Sweep/Offset Plug-in. The 3302A plug-in provides single and multiple-cycle operation with adjustable start-stop phase. A phase-lock loop in the 3302A permits synchronizing the 3300A with an external signal and provides adjustable phase control. The HP 3304A Sweep/Offset plug-in provides internal sweeping, dc offset, sawtooth waves and offset square waves. The HP 3300A Function Generator with plug-in versatility provides a compact, convenient, multi-purpose source of test waveforms useful for testing servo, geophysical and medical equipment, and for the electrical simulation of mechanical or medical phenomena.

ELECTRONIC FREQUENCY CONTROL

The frequency of the HP 3300A can be controlled by either the front-panel frequency dial or an external voltage applied to a rear-terminal connector. This feature is useful for sweeping filters, amplifiers and other frequency-dependent devices and for externally programming frequencies for production testing. An input voltage of +0.3 to -10 volts will linearly control the frequency over approximately a 50:1 range. Frequency can be changed remotely over a decade on any one range in approximately 1 μ sec.

OUTPUT SYSTEM

The output system of the HP 3300A is dc coupled and fully floating with respect to power-line ground. An internal shield reduces radiated interference and provides common-mode rejection with floating output. Separate connectors on the rear panel provide terminals for circuit ground, shield ground, and power-line ground. The operator may connect a dc supply to the rear terminals and obtain a dc offset voltage on the output up to ± 25 volts between circuit ground and output ground and ± 250 volts between power line ground and output ground or between shield ground and output ground.

The 3300A may be used to supply a balanced output, using both output amplifiers. Each output amplifier will deliver 35 Volts pk-pk into an open circuit.

SPECIFICATIONS

3300A FUNCTION GENERATOR

*Available Plug-In Units:

Model 3301A Auxiliary Plug-In

Model 3302A Trigger Plug-In

Model 3304A Sweep/Offset Plug-In.

*3300A requires a plug-in to operate.

Output Waveforms: Sinusoidal, square, and triangular selected by panel switch. (Any two outputs available simultaneously).

Frequency Range: 0.01 Hz to 100 kHz in seven decade ranges.

Frequency Response: $\pm 1\%$, 0.01 Hz to 10 kHz; $\pm 3\%$, 10 kHz to 100 kHz.

Dial Accuracy: $\pm 1\%$ of maximum dial setting (1 minor division) .01 Hz to 10 kHz; $\pm 2\%$ of maximum dial setting (2 minor divisions) 10 kHz to 100 kHz. T.C. 0.1%/°C.

Maximum Output Per Channel: > 35 volts peak-peak open circuit; > 15 volts peak-peak into 600 ohms; > 2 volts pk-pk into 50 ohms.

► **Output Attenuators:** (both channels) 40 dB range.

Sine Wave Distortion: $< 1\%$, 0.01 Hz to 10 kHz; $< 3\%$, 10 kHz to 100 kHz.

Square Wave Response: < 250 ns rise and fall time on all ranges; $< 1\%$ sag, $< 5\%$ overshoot at full output; $< 1\%$ symmetry error.

► **Triangle Linearity Error:** $< 1\%$ 0.01 Hz to 10 kHz; $< 2\%$, 10 kHz to 100 kHz; $< 1\%$ symmetry error.

Sync Pulse Output: > 10 Volts pk-pk, open circuit; < 5 μ sec duration. Sync pulse occurs at crest of sine and triangular wave output.

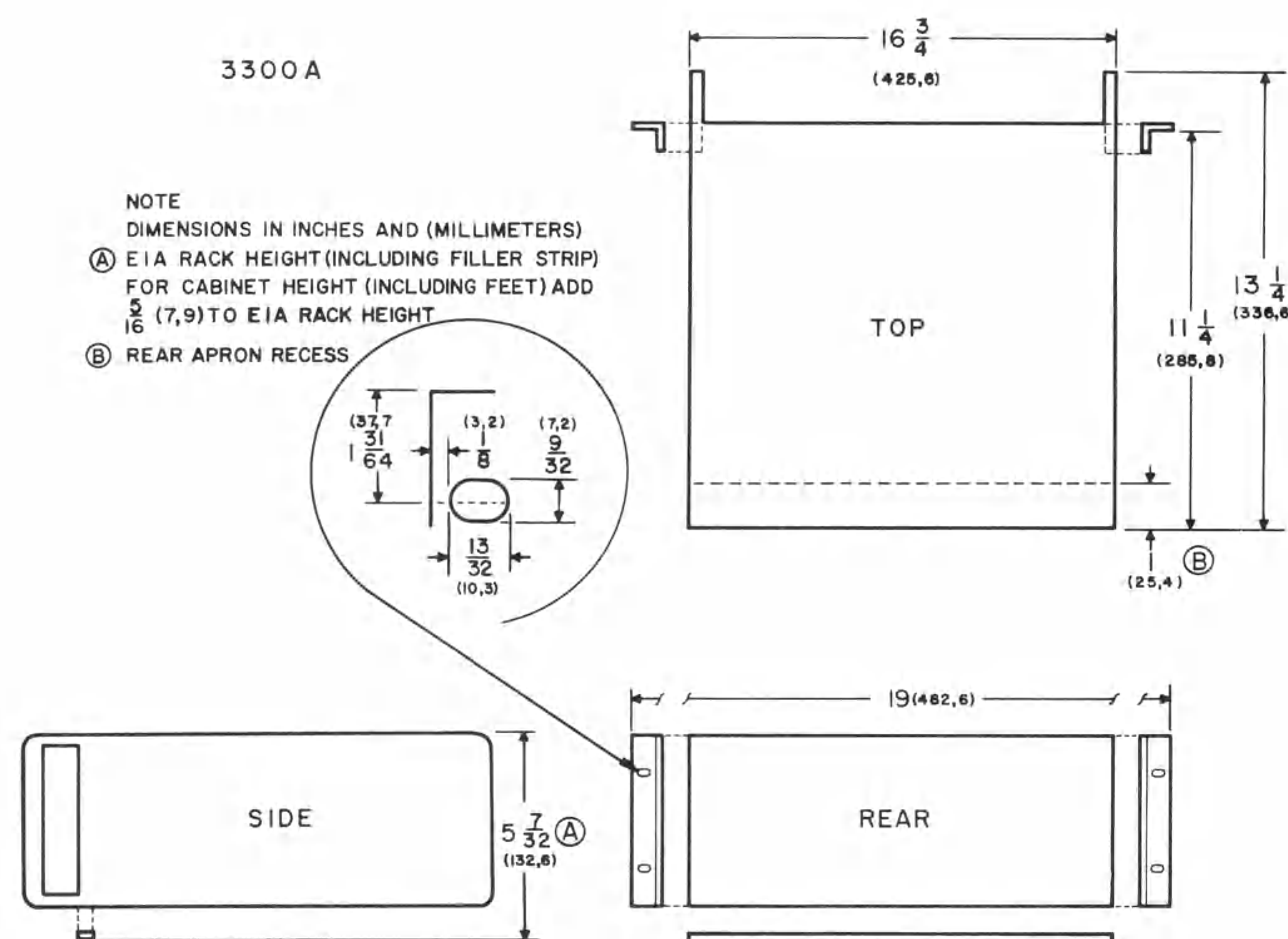
Output Impedance: (both channels) 600 ohms nominal.

DC Stability: Drift: $< \pm 0.25\%$ of peak-to-peak amplitude over a period of 24 hours. (After 30 minute warmup).

Remote Frequency Control: 0 to -10 volts will linearly change frequency > 1 decade within a single range. Frequency resetability with respect to voltage $\pm 1\%$ of maximum frequency on range selected.

Power: 115 or 230 Volts $\pm 10\%$, 50 to 1000 Hz. Approximately 50 watts.

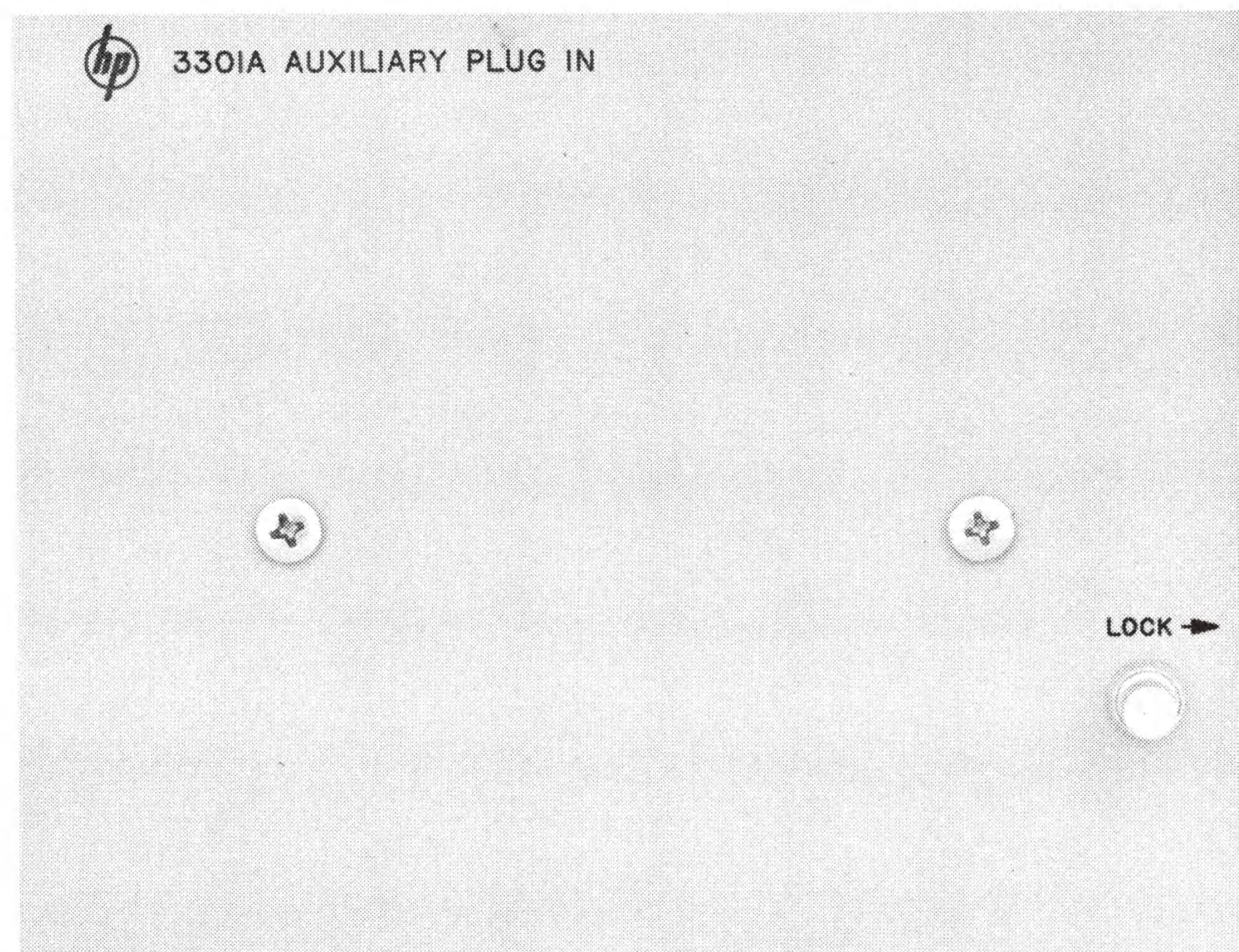
Outline Drawing: Standard HP full module; 5" high, 16" wide, 11" deep. (127 x 406 x 279 mm).



Weight: Net: 20 lbs. (9 kg); Shipping: 24 lbs. (10,8 kg).

► **Price:** HP 3300A Function Generator: \$625.00.

3301A AUXILIARY PLUG-IN



DESCRIPTION

The HP 3301A Auxiliary Plug-in provides internal connections for basic unit operation.

SPECIFICATIONS

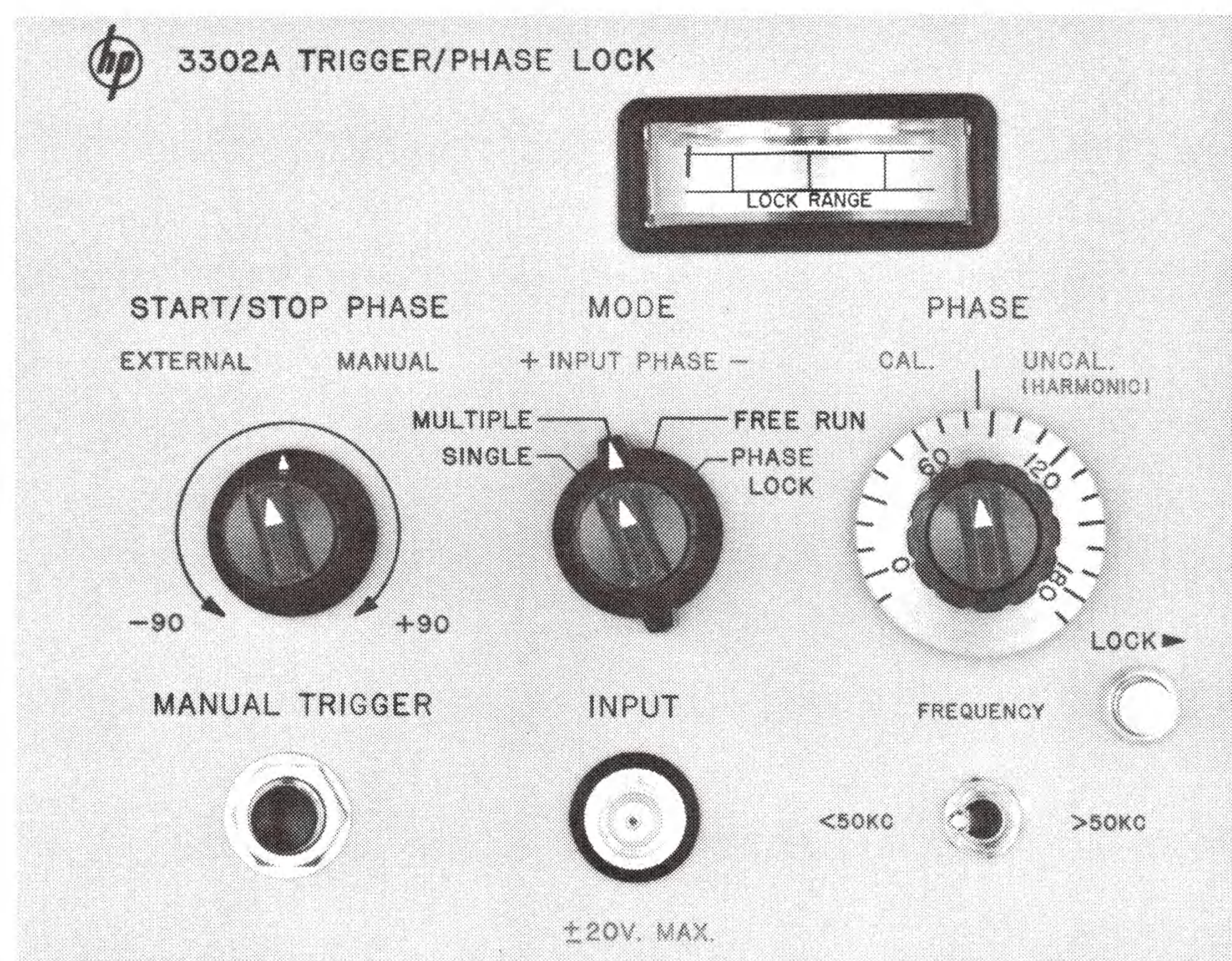
3301A

Weight: Net: 2 lbs. (.8 kg); Shipping: 4 lbs. (1,8 kg).

Dimensions: 4-3/4" high, 6-1/16" wide, 10-1/4" deep (120,7 x 153,9 x 260,4 mm).

Price: HP 3301A Auxiliary Plug-In: \$20.00.

3302A TRIGGER/PHASE LOCK PLUG-IN



DESCRIPTION

The HP 3302A Trigger/Phase Lock Plug-in is designed to provide single cycle, multiple cycle, and phase-lock operation. The instrument can be triggered over the entire frequency range, either manually or by applying an external voltage.

SINGLE CYCLE OPERATION

In single cycle operation, one cycle of any function can be obtained by pushing the manual trigger or applying a voltage to the external trigger input. The output starts and stops at the same phase, which is adjustable from -90 degrees to $+90$ degrees with the front-panel start/stop phase control. The input trigger circuit is DC coupled and can be actuated with either polarity of applied voltage determined by a front-panel switch.

In the single-cycle mode, a variable-phase output can be obtained by triggering with an external sine wave tuned to the same frequency as the 3300A, using the input-phase

switch and the start/stop phase control. This is particularly useful at frequencies below 10 Hz where a phase-lock system is not practical.

In addition, when an external trigger is applied, the instrument can be used as a low-frequency pulse generator using the square wave output. The pulse repetition rate is determined by the repetition rate of the applied trigger voltage; the pulse width is controlled by the 3300A frequency control; and the pulse delay is adjustable using the start/stop phase control. Pulses can also be obtained by using the manual trigger.

MULTIPLE CYCLE OPERATION

In the multiple-cycle mode of operation, any number of complete cycles of any function can be obtained by pushing the manual trigger to start and stop, or by applying an external gate voltage. The output signal will start and stop at the same phase which is adjustable from -90 to $+90$ degrees with the start/stop phase control and over a 360 degree range using both the start/stop phase control and $-A$ function on the channel B amplifiers. The 3302A is useful for generating waveform bursts or pulse trains for transient response and coding system measurements.

PHASE LOCK OPERATION

The 3300A may be phase-locked to any periodic signal with a frequency from 10 Hz to 100 kHz to obtain sine, triangle, and square wave outputs with frequency characteristics of the externally applied signal. A meter located on the plug-in, front panel, indicates when phase lock is achieved. The phase shift between the input signal and the 3300A can be adjusted over a 360 degree range using the phase control and the input phase switch. This feature is particularly useful for generating a variable phase output at frequencies greater than 10 Hz.

The instrument may also be phase-locked to a harmonic of an externally applied signal, making it useful for synthesis of complex waveforms.

SPECIFICATIONS

3302A Trigger/Phase Lock Plug-In

Modes of Operation:

- Single cycle
- Multiple cycle
- Phase lock
- Free run

TRIGGER REQUIREMENTS:

Single Cycle: Manual or external. DC coupled. Requires at least 0.5 Volt to trigger externally. May be triggered with positive or negative input voltage (± 20 V peak max).

Multiple Cycle: Manual or external start/stop. DC coupled. Requires at least 0.5 Volt to start, 0 Volts to stop. May be triggered with either positive or negative input voltage. (± 20 V peak max).

Phase Lock: (10 Hz to 100 kHz) DC coupled. Requires 0.5 Volt peak-to-peak to lock, 10 Volts peak-to-peak for specified accuracy with sine wave input. The HP 3302A will lock on a fundamental or harmonic of the input signal.

Phase Dial Accuracy: $\pm 10^\circ$ from 10 Hz to 10 kHz. $\pm 20^\circ$ from 10 kHz to 100 kHz. (Fundamental only).

Introduced Distortion: $< 1\%$ 10 Hz to 10 kHz
 $< 3\%$ 10 kHz to 100 kHz. (Fundamental only).

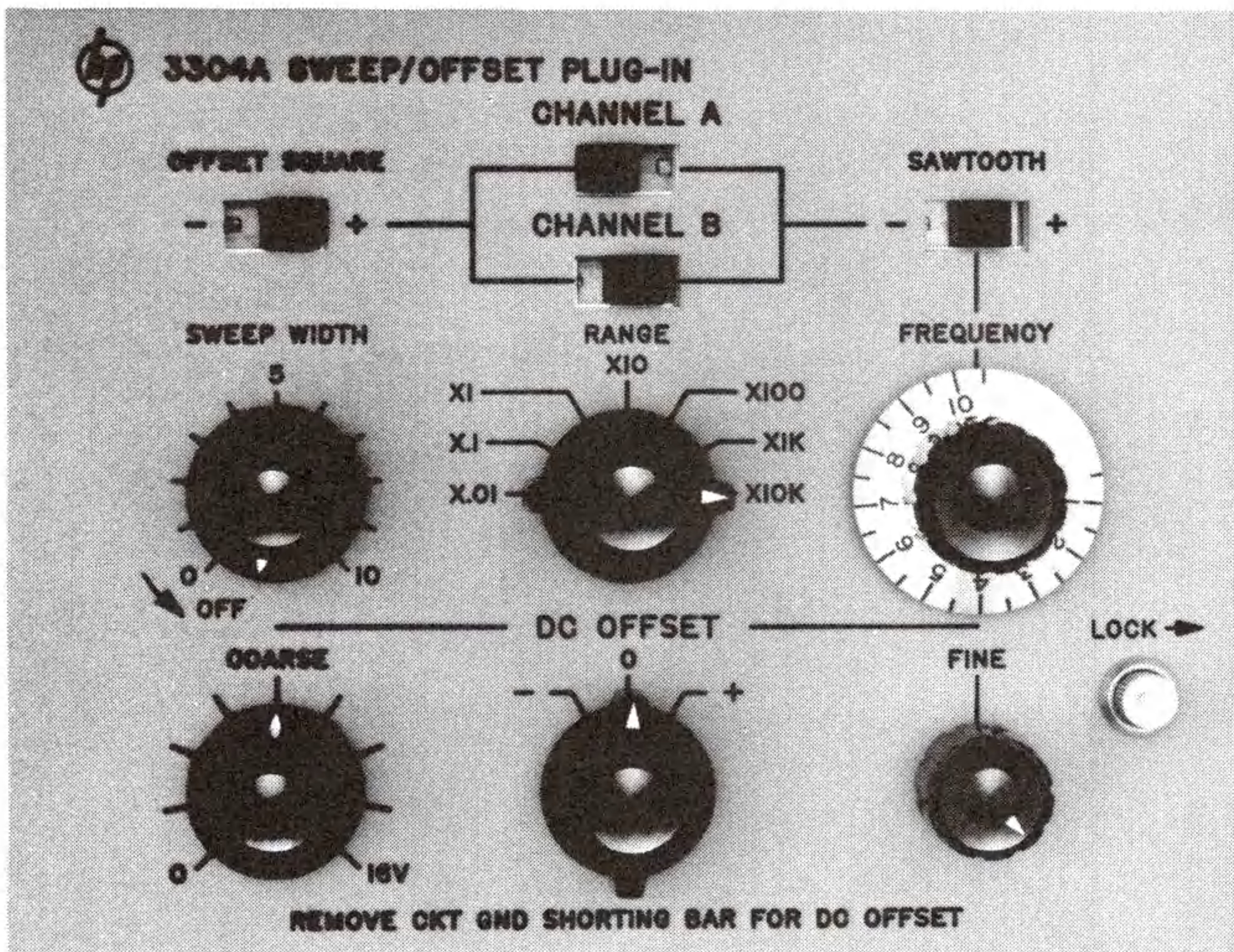
Weight: Net: 3 lbs. (1,4 kg); Shipping: 5 lbs. (2,5 kg).

Dimensions: 4-3/4" high, 6-1/16" wide, 10-1/4" deep (120,7 x 153,9 x 260,4 mm).

Price: HP 3302 Trigger/Phase Lock Plug-In: \$190.00.

3304A SWEEP / OFFSET PLUG-IN

SPECIFICATIONS



DESCRIPTION

The HP 3304A Sweep/Offset plug-in provides internal sweeping, dc offset, sawtooth waves and offset square waves. Up to ± 16 volts of dc offset is available for all signals generated in the main frame and plug-in. In addition, the independently frequency controlled sawtooth wave may be switched internally to the frequency control circuit of the HP 3300A Function Generator to permit sweeping over a decade of frequency within a single range.

APPLICATIONS

The dc Offset features of the 3304A plug-in fulfill the needed requirement for a signal baseline above or below ground potential when driving or stimulating an electro-mechanical or medical system.

The sawtooth output can be used for sweeping or driving systems where a single direction sweep is desired. In addition, it is also useful as a sweep output when internally sweeping the main frame.

The offset square wave provides added versatility by clamping either the top or the bottom of the waveform to the dc offset voltage or ground potential.

DC OFFSET

Voltage Range: Adjustable 0 to ± 16 Volts open circuit and a ± 1 Volt vernier control.

DC Stability: ± 50 mV over a 24 hour period (after 30 minute warmup).

OFFSET SQUARE WAVE

Output Polarity: Positive or negative, from dc offset voltage or ground potential.

Amplitude: Greater than 15 Volts peak-to-peak open circuit. Continuously adjustable with 3300A amplitude control.

Rise Time: < 400 ns.

Overshoot: $< 5\%$ at full output.

Sag: $< 1\%$.

SAWTOOTH WAVEFORM:

Frequency Range: 0.01 Hz to 100 kHz, continuously adjustable over seven decade ranges.

Dial Accuracy: $< \pm 10\%$ full scale, 0.01 Hz to 1 Hz.
 $< \pm 5\%$ full scale, 1 Hz to 100 kHz.

Amplitude: > 15 Volts peak-to-peak, open circuit: continuously adjustable with 3300A Amplitude Control.
Attenuator Range: 40 dB.

Frequency Response: $< 2\%$, 0.01 Hz to 10 kHz.
 $< 5\%$, 10 kHz to 100 kHz.

Output Polarity: Positive or negative, from dc offset voltage or ground potential.

Linearity: $< 1\%$, 0.01 Hz to 10 kHz, overshoot: $< 5\%$
 $< 2\%$, 10 kHz to 100 kHz, overshoot: $< 5\%$

Flyback Time: $< 5\%$ +250 ns.

INTERNAL SWEEP

Controls: Start frequency set by 3300A frequency dial; sweep range set by sweepwidth control on plug-in.

Sweep Rate: Determined by sawtooth frequency setting.

► **Sweep Width:** Adjustable from 0 to at least one decade.

GENERAL

Weight: Net: 4 lbs. (1,8 kg); Shipping: 6 lbs. (2,7 kg).

Dimensions: 4-3/4" high, 6-1/16" wide, 10-1/4" deep (120,7 x 153,9 x 260,4 mm).

Price: HP 3304A Sweep/Offset Plug-In, \$210.00.

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