Low-level modulator sweeps generator over narrow range

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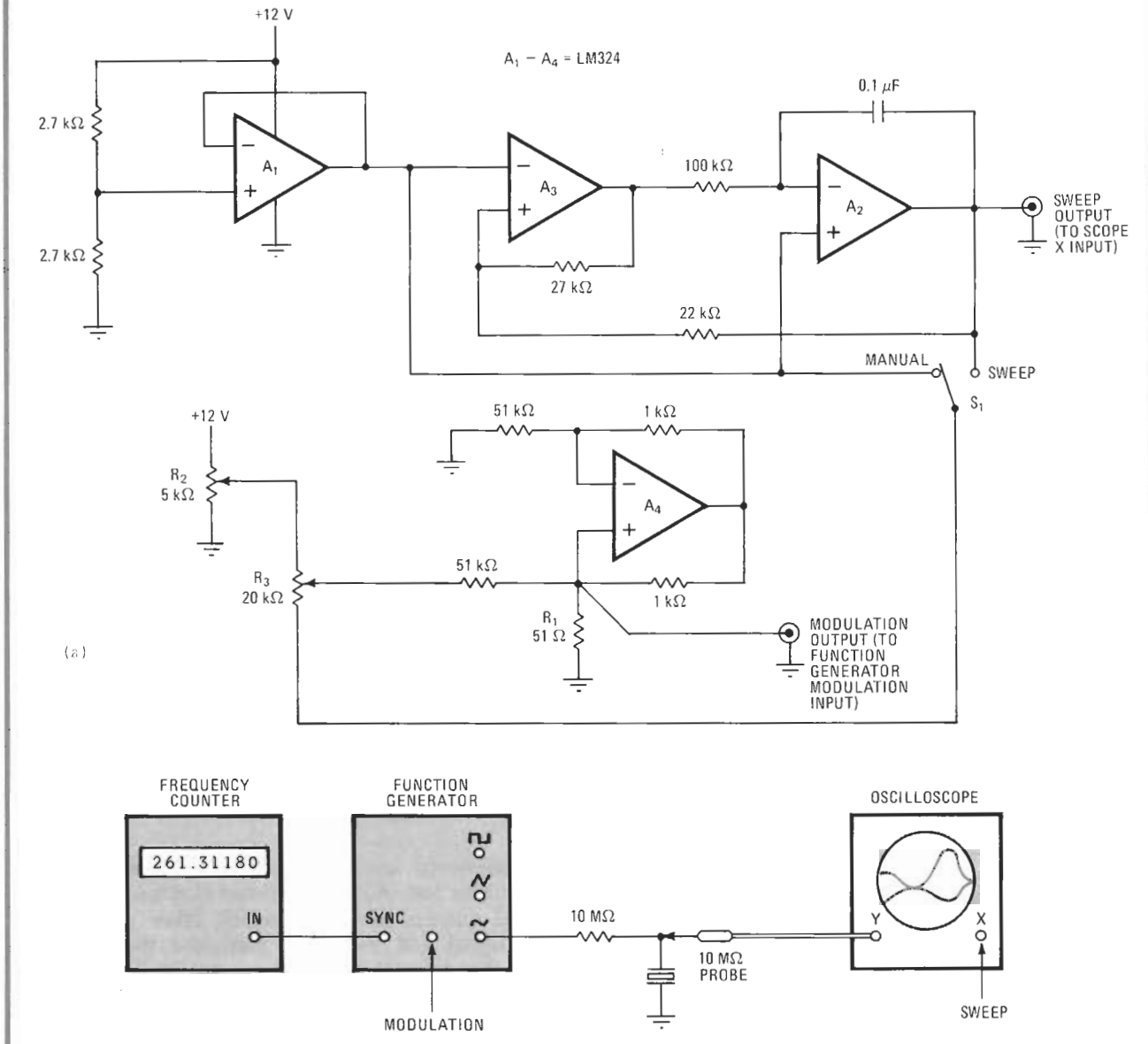
A typical function generator's ability to sweep over a 1000:1 range of frequencies by means of an externally applied 0-to-10-volt modulating signal certainly enhances its usefulness. But sometimes narrow-range sweeps on the order of kilohertz are also needed, to check the response of a precision resonant circuit, for example. The problem is that, in most cases, the unit's front-panel controls cannot provide the required resolution. The one-chip circuit shown here, however, enables the setting of any dc voltage and provides for sweeping the control signal over a minimum of $\pm 0.1\%$ of its value so that modulation of the preset center frequency will yield a proportionally small frequency variation.

Operational amplifier A_1 serves as a 6-V source for biasing the inputs of A_2–A_4 at half the supply voltage, enabling the circuit to operate from a single supply (a). A_2, an integrator, and A_3, a voltage comparator operating with heavy feedback, generate the 100-hertz triangle wave needed to sweep the generator and the x input of the oscilloscope used to display the response of the circuit under test. A_4 is a simplified Howland Pump[1], or bilateral current generator, which takes part of the sweep signal and uses it to modulate the preset dc voltage that drives the function generator.

When switch S_1 is placed in the manual position and R_3's arm is positioned at its extreme end (toward R_2), the signal at the modulation output is dc, its amplitude determined by the setting of potentiometer R_2. R_2 is thus used to set the center frequency of the function generator.

The dc value is modulated by placing S_1 in the sweep position and adjusting R_3 for the desired frequency sweep. Note that R_3 approximates a summing junction for the preset dc level and a fraction of the sweep voltage in this application.

The setup in (b) illustrates a typical application for the circuit, whereupon it is necessary to characterize the response of a quartz crystal that has resonant and antiresonant frequencies less than 3 kHz apart. The frequency counter should be driven by the trigger output of the function generator to avoid interference with the crystal drive. The function generator's output is isolated from the crystal by a large resistor. A low-capacity oscilloscope probe should be used, and the effect of the probe's capacity on the measured crystal frequency taken into consideration. A manual control switch allows the operator to measure the resonant and antiresonant frequencies



Small scan. Low-level modulator (a) superimposes small fraction of 10-V triangle wave on preset dc voltage so that externally driven function generator can be swept over very narrow ranges not normally within the resolving power of unit's front panel controls. In typical application (b), response of crystal and isolation of its resonant and antiresonant frequencies are displayed and recorded.

by adjusting the generator output with the preset dc control. □

References

1. Applications Manual for Computing Amplifiers, III.6, p. 66, George A. Philbrick Researches Inc., 1966.

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