FREQUENCY DEVICES™

450 SERIES: SINGLE PHASE, FIXED FREQUENCY SINEWAVE OSCILLATORS

FREQUENCY DEVICES INC

T-50-05

FEATURES

- High Purity Sinewave Output
- User-Specified Operating Frequency
  Any Frequency from 100Hz to 10kHz
- Stable Performance
  Frequency Stability: 0.02%/°C
  Amplitude Stability: 0.002dB/°C
- User-Adjustable Output Amplitude
  Adjustable Range: 1 to 20Vp-p
- Low Profile (0.4" high) Package

DESCRIPTION

Frequency Devices' 450 Series are economy price, fixed frequency sinewave oscillators that deliver a single phase, high purity sinusoidal output. These fully finished devices can be user-specified to operate to any frequency between 100Hz and 10kHz (see ORDERING INFORMATION).

APPLICATIONS

- Reference Oscillator
- Airborne Equipment
- Mobile Equipment
- Test Apparatus
- Telemetry Systems
- Distortion Testing

For versatility, each 450 Series model includes provisions for the user to adjust the output amplitude over a 1 to 20Vp-p range by external resistive or voltage programming. Over the full output range, total harmonic distortion is a low 0.1%, while the peak-to-peak amplitude stability of any fixed level selected is 0.002dB/°C.

The 450 Series utilizes a low profile, 0.4 inch-high case style which contains a versatile, read-to-use oscillator that can be user-adjusted to serve in a variety of applications.

TABLE OF CONTENTS

Frequency Devices Incorporated | 25 Locust Street | Haverhill, Massachusetts 01832 | (508) 374-0761 FAX (508) 521-1839

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Typical at 25°C and $\pm V_S$ = ±15Vdc unless otherwise noted.

OSCILLATION FREQUENCY (f_o)	
Range[1]	100Hz to 10kHz
Tolerance[2]	±1%
External Adjustment Range	±5%
Frequency Stability with Temperature	0.02% / °C
Frequency Stability with Supply and Output Amplitude Variation	0.01% / %
OUTPUT CHARACTERISTICS	
AMPLITUDE	
Preset	20V p-p ±1%
Adjustment Range[3]	1 to 20V p-p
Stability vs. Temperature[4]	0.002dB / °C
Stability vs. Supply Voltage[5]	0.1dB / %
DRIVE CAPABILITY	
Output Current @ 20V p-p[6]	±5mA peak
Output Resistance @ 20V p-p	< 10Ω
DISTORTION	
Harmonic	0.1%
Noise[7]	50 μV RMS
DC POWER SUPPLY ($\pm V_S$)	
Nominal Operating Voltage	±15V
Quiescent Current	±8mA
Operating Voltage Range	±12V to ±18V
TEMPERATURE	
Operating	0°C to +70°C
Storage	−25°C to +85°C

NOTES:

1) Specify desired fixed frequency by a 3 digit number at time of order.
2) Externally adjustable to zero.
3) All models can deliver 6V p-p to a 600Ω external load.
4) The amplitude stability of a resistively programmed unit is directly proportional to the external programming resistor tempco.
5) The amplitude stability of a voltage programmed unit having the programming dc voltage applied to Pin T3 is 0.1dB / % V_{T3}.
6) The output is short circuit protected.
7) Distortion is primarily third harmonic. Specification is for resistive loading.

Specifications are subject to change without notice.

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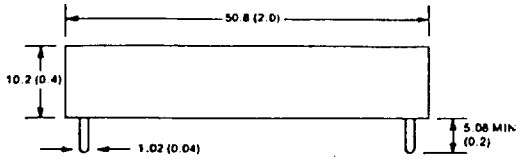
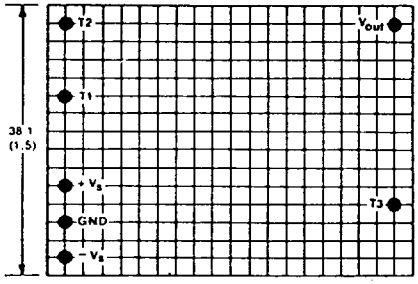
DIMENSIONS IN MM(INCHES)





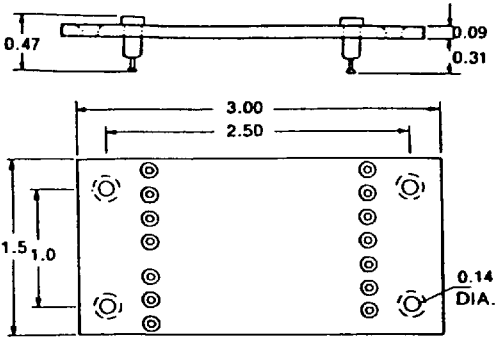
BOTTOM VIEW 0.1 INCH GRID

TERMINAL KEY	
V_{OUT}	Signal Output
T1	Fine Frequency Adjust
T2	Frequency Adjust Enable*
T3	Output Amplitude Adjust
$+V_s$	Power Supply Voltage, Positive
GND	Ground
$-V_s$	Power Supply Voltage, Negative

*Must be connected to ground when fine frequency adjustment is not required.

SOCKET S1006

DIMENSIONS IN INCHES



BOTTOM VIEW

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FIXED FREQUENCY OPERATION

The output signal frequency of each 450 Series Sinewave Oscillator is factory calibrated to within ±1% of the user specified value. Independent of frequency setting, the output amplitude is preset to 20V p-p.

To put the oscillator into operation, simply connect the power supply common, voltages ($\pm V_s$), and GROUND PIN T2. PIN T2 MUST BE CONNECTED TO GROUND IN THIS MODE OF OPERATION.

FINE FREQUENCY ADJUSTMENT (±5%)

For applications requiring a more accurate frequency setting, disconnect Pin T2 from ground. Connect a Cermet potentiometer as shown in Figure 1 for a ± 5% frequency adjustment range.

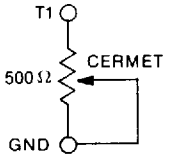

Figure 1

AMPLITUDE ADJUSTMENT (1 to 20V p-p)

For applications requiring either variable or lower level output signals, a single resistor or a dc control voltage can externally program the 450 Series output amplitude to any value between 1 and 20V p-p. WARNING: ADJUSTING FOR OUTPUTS BELOW 1V p-p WILL CAUSE LOSS OF THE OUTPUT SIGNAL.

DISCRETE RESISTIVE PROGRAMMING: The method of Figure 2A provides discrete-level output control, while that of Figure 2B provides continuous control of the output amplitude. For both methods, Equation 1 defines the value of R1 for the specific set of conditions.

$$R1\ (K\Omega) = \frac{450V_o}{4V_s - 3V_o}\ \text{Eq(1)}$$

V_o = Output Voltage in Volts Peak-to-Peak

V_s = B + Supply Voltage

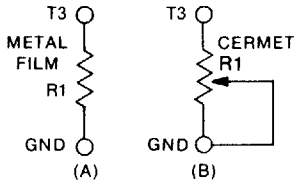

Figure 2

CONTINUOUS RESISTIVE PROGRAMMING: To determine the value of potentiometer R1 in Figure 2B, simply insert the appropriate values into Eq 1. Suppose, for example, the required output amplitude range is 1 to 10Vp-p and the positive power supply is $+V_S$ = 15Vdc. Equation 1 becomes $R1(k\Omega) = \frac{450(10)}{4(15)-3(10)}$, or potentiometer R1 = 150kΩ.

VOLTAGE PROGRAMMABLE AMPLITUDE: The output amplitude of the 450 Series Oscillators can be voltage controlled by applying dc programming voltage V_{T3} to Pin T3. The output response is found from Eq 2, below:

$V_{T3} = \frac{V_o}{2}$ . . . Eq (2); where V_o is the output voltage expressed in volts peak-to-peak, and V_{T3} is the dc control voltage applied to Pin T3.

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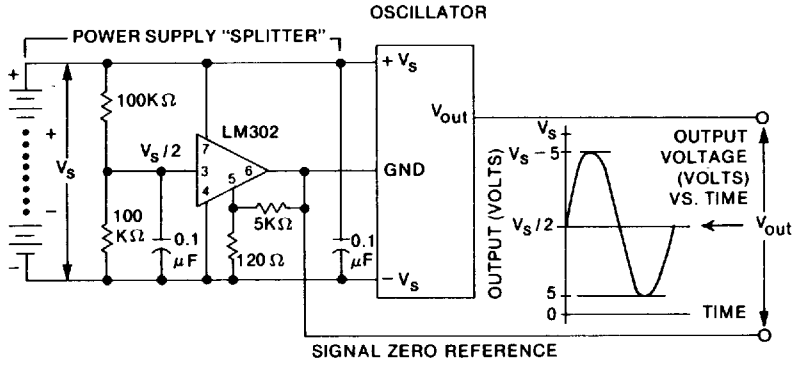
OPERATING OSCILLATORS FROM SINGLE-ENDED POWER SUPPLIES

The 450 Series Oscillators require dual polarity power supplies, nominally ± 15Vdc, but can be externally adapted to operate from a single polarity power source. This capability is particularly useful for portable and mobile applications deriving power from a single-ended battery or motor generator.

The circuit in Figure 3 simulates a dual power supply. The op amp output creates a low impedance power and signal return for the oscillator and serves as the polarity zero reference. But the "zero" level is actually one-half the external power supply voltage, or V_S /2: a power or signal voltage is positive if it exceeds V_S /2 and negative if less than V_S /2. In this way the oscillator "sees" dual polarity supply voltages and delivers a bipolar output signal to an EXTERNAL LOAD THAT RETURNS TO V_S /2 - NOT GROUND.

For illustration, let the external power source V_S = +30Vdc. The 450 Series Sinewave Oscillator with no amplitude adjustment will deliver a 20V p-p output REFERENCED TO V_S /2 = +15Vdc. With respect to ground, the positive peak will be +25V and the negative peak will be +5V. The 5 volt margin between the peak-to-peak output levels and the "positive" and "negative" supply voltages assures linear operation. AGAIN, THE EXTERNAL LOAD MUST RETURN TO V_S /2 - NOT GROUND.



Power supply "splitter" adapts the oscillator for operation from single-ended power source.

Figure 3

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GATING THE 450 SERIES OSCILLATORS

SQUELCH MODE: The output signal of the 450 Series Oscillator can be gated on and off by several methods. The most straight forward approach is to ground module Pin T3 for any desired period. Grounding Pin T3 reduces the oscillator loop gain to less than unity, causing oscillation to cease. However, turn-off is not instantaneous, rather, it is determined by the natural time constant of the circuit. See Figure 4.

If a turn-off command (ground Pin T3) occurs at t_1, oscillation will not fully end until t_3 seconds later. Conversely for a turn-on command (remove T3 ground) occuring at t_2, the oscillator will require t_4 seconds to attain full-rated output amplitude.

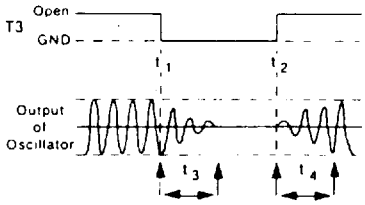

Figure 4

Pin T3 is a high impedance point, in the order of 0.5 megohm. Excessive lead lengths or stray capacitance connected to this pin will increase t_3 and t_4, thereby reducing the maximum achievable squelch rate.

GATING THE OUTPUT: For applications requiring higher gating rates, a series FET switch/op amp combination serves best. The FET, which can be a p- or n-channel device, must withstand the full signal swing. This approach buffers, or isolates the oscillator stage from external load efforts.

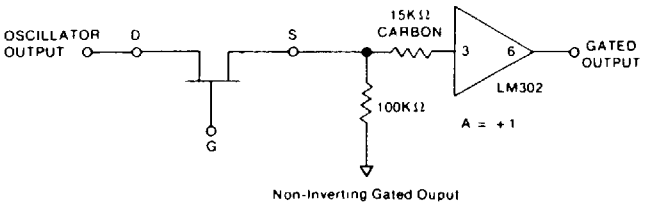

Figure 5

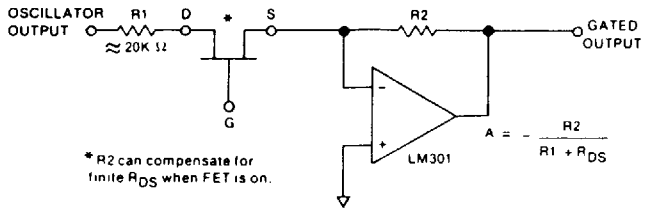

Figure 6

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450 SERIES
ORDERING INFORMATION

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HOW TO ORDER

When ordering a 450 Series Oscillator, it is necessary to specifiy the desired oscillation frequency (f_o). This is done by adding a 3-digit suffix in which the letter "K" represents the "thousands" comma.

Examples:	450-0K1	100Hz
	450-3K55	3.55kHz
	450-10K0	10kHz

Please note that no more than three digits are valid due to the ±1% tolerance specified for the oscillation frequency f_o.

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