Oven Controlled Crystal Oscillators

Oven controlled crystal oscillators are used when extreme frequency stability is required, typically between a part per billion and a part per million. Stability is obtained by keeping the temperature of the crystal constant in a proportionally controlled oven at a temperature where the frequency vs temperature slope is zero. Several tradeoffs are made in order to achieve this stability.

- The addition of an oven has a major impact on increased size and current drain.
- The oscillators also require several minutes to an hour to reach thermal equilibrium and as a result are normally left on continuously.

Two crystal cuts are commonly used in oven controlled oscillators, AT and SC. The AT is the more common and less expensive crystal and is a singly rotated cut. When higher performance is required, the doubly rotated SC (stress compensated) is used. It offers improved frequency–temperature performance, improved temperature transient response, improved aging and improved noise, but is more expensive to manufacture and requires a more complex oscillator circuit.

Many oven controlled oscillators, particularly the most stable, utilize extremely high Q crystals which provide much improved close-in phase noise by reducing the frequency at which the noise floor begins. This performance is impossible in TCXOs as only moderate Q crystals give the TCXOs their necessary frequency adjustability.

APPLICATION NOTES

Aging

Oven controlled crystal oscillators provide the best stability when left undisturbed. Whenever possible, leave the oscillators constantly powered as there is a period of time ranging from hours to days after power is restored during which the frequency is aging at a higher rate than it was before power was interrupted. Aging tends to be logarithmic; that is, the bulk of the aging occurs early in its life: please keep this in mind when specifying aging.

Aging Adjust and Modulation

High levels of frequency stability and extreme frequency adjustment, be it for aging or signal modulation, are not compatible. Do not over-specify frequency adjust requirements.

Standard Frequencies

Oven controlled oscillators require a good deal of unique design when a new frequency is required. Using an existing frequency is the best way to obtain proven performance and lowest price. When unique frequencies are absolutely required, keep in mind that lower frequency crystals tend to be more stable. Please consult us as early as possible when requiring a special frequency to ensure that the best compromises are made.

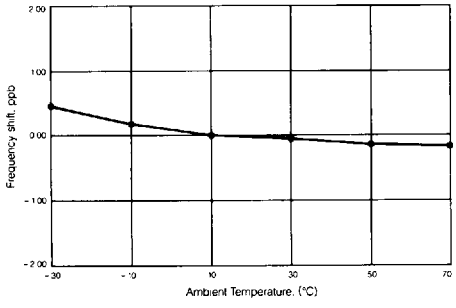
Power Supplies

The power supply should be noise free if possible so as not to degrade noise performance. Care must be taken when using switching power supplies so as not to modulate the oscillator.

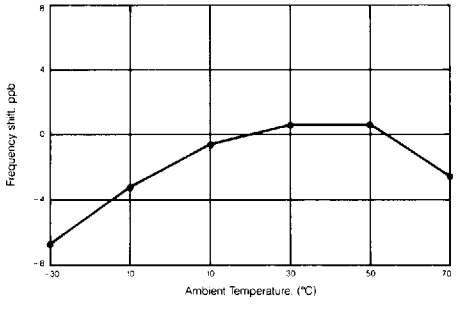
Current Drain

Current drain is specified at room temperature in still air. Placing the oscillator in a moving airstream will increase the power requirement as the surface temperature is lowered.

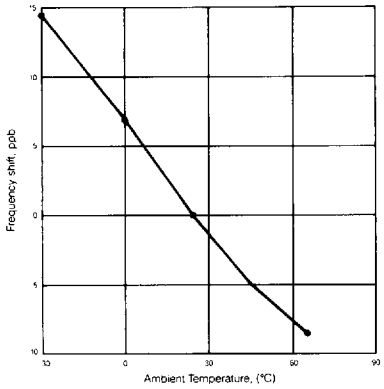
Ultra High Stability KXN1130AA



Very High Stability KXN1159AA



High Stability KXN1176AA



Oven Controlled Crystal Oscillators

NEL

ULTRA HIGH STABILITY: KXN1130AA

Oscillator Frequency
5.000 MHz

Frequency Stability
vs temperature: ±2.0 ppb (parts per billion)
aging: ±0.5 ppb/day ±30ppb/year

Operating Temperature Range
-30°C to +65°C

Output Power
0.5Vrms into 50 Ohms

Output Waveform
Sinewave
Harmonics -25 dBc below fundamental

Input Voltage
11.50 VDC

Input Current
1.2 Amp maximum at turn-on
0.525 Amps stabilized at 25°C

Phase Noise (dBc/Hz)
100 Hz: -135
1.0kHz: -145
50kHZ: -150

Tuning Range
Mechanical: ± 1.0 ppm minimum
Electrical: 0.1 ppm minimum from 0 to 6 volts applied

Package Dimensions (inches, L x W x H)
5.42 x 3.13 x 3.13 (see next page for drawing)

Connectors
BNC RF-out
8 pin solder header

VERY HIGH STABILITY: KXN1159AA

Oscillator Frequency
16.384 MHz

Frequency Stability
vs temperature: ±10 ppb (parts per billion)
aging: ±0.5 ppb/day ±50 ppb/year

Operating Temperature Range
-30°C to +70°C

Output Power
7.0 dBm minimum

Output Waveform
Sinewave
Harmonics -30dBc below fundamental
Spurious -80 dBc below fundamental

Input Voltage
12.00 VDC

Input Current
670 mA maximum at turn-on
250 mA stabilized at 25°C

Short-term Stability
less than ±0.01 ppb/second

Tuning Range
Electrical: V set=1v to 7v, positive transfer
±0.1 ppm to ±0.5 ppm

Package Dimensions (inches, L x W x H)
3.02 x 2.02 x 1.25 (see next page for drawing)

Connectors
Input/output: 0.040 inches PC pins (for SMA)

HIGH STABILITY: KXN1176AA

Oscillator Frequency
5.000 MHz

Frequency Stability
vs temperature: ±25 ppb (parts per billion)
aging: ±3 ppb/day ±0.3 ppb/year

Operating Temperature Range
-30°C to +65°C

Output Power
0.5 Vrms into 50 Ohms

Output Waveform
Sinewave
Harmonics -25 dBc below fundamental

Input Voltage
12.0 VDC

Input Current
1.125 Amp maximum at turn-on
0.333 Amps stabilized at 25°C

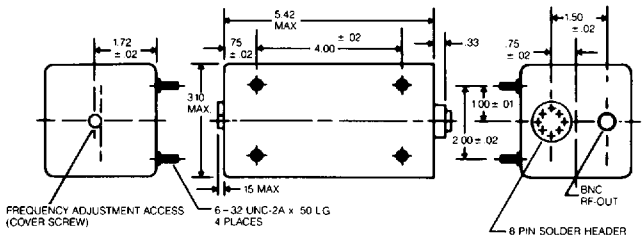
Phase Noise (dBc/Hz)
100 Hz: -135
1.0 kHz: -145
50 kHZ: -150

Tuning Range
Mechanical: ± 8.0 ppm minimum
Electrical: 0.9 ppm minimum, 0.6 ppm nominal,
0.3 ppm maximum (0 to 5.1 V applied)

Package Dimensions (inches, L x W x H)
4.039 x 2.020 x 2.020 (see next page for drawing)

Connectors
BNC RF-out
8 pin solder header

ULTRA HIGH STABILITY: KXN1130AA PACKAGE (DIMENSIONS IN INCHES)



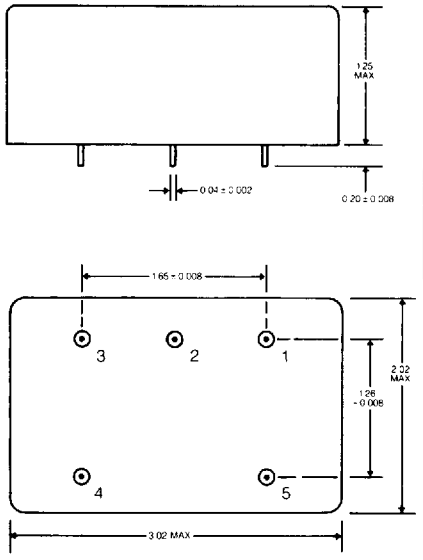
TO AVOID SERIOUS DAMAGE TO THIS UNIT IT IS SUGGESTED THAT THE FOLLOWING WARNING APPEAR ON THE SCREENING: "CAUTION: AVOID EXCESSIVE TORQUE" MAX 7 IN OZ

ELECTRICAL TUNING

PIN
7 5.6V D.C. REFERENCE
8 VARACTOR D.C. FREQ. ADJ.

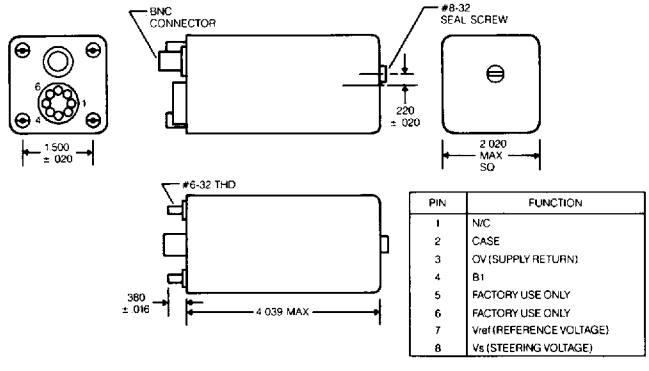
PIN	FUNCTION
1	N/C
2	CASE
3	0V (SUPPLY RETURN)
4	B+
5	FACTORY USE ONLY
6	FACTORY USE ONLY
7	FACTORY USE ONLY
8	FACOTRY USE ONLY

VERY HIGH STABILITY: KXN1159AA PACKAGE (DIMENSIONS IN INCHES)



PIN	FUNCTION
1	GROUND
2	FREQUENCY CONTROL
3	+ 8V REFERENCE OUT
4	+ 12V SUPPLY
5	OUTPUT FREQUENCY

HIGH STABILITY: KXN1176AA PACKAGE (DIMENSIONS IN INCHES)



PIN	FUNCTION
1	N/C
2	CASE
3	0V (SUPPLY RETURN)
4	B1
5	FACTORY USE ONLY
6	FACTORY USE ONLY
7	Vref (REFERENCE VOLTAGE)
8	Vs (STEERING VOLTAGE)

This information is believed to be reliable at the time of printing; no responsibility is assumed for inaccuracies. NEL Frequency Controls reserves the right to make changes at any time.

NEL FREQUENCY CONTROLS, INC. 357 Beloit Street, Burlington WI U.S.A. 53105 Phone 414/763-3591 FAX 414/763-2881