Aging
The slow change of a frequency with time, if all other influences are held constant. The primary causes are mass transfer and stress relaxation mechanisms in the crystal unit. These can be reduced by maximizing the ratio of quartz resonator mass to contamination mass by increasing the number of the overtone, and by careful design and processing of the resonator. In a good oscillator the aging rate will tend to decrease with time. Aging rates in OCXO's below 0.5 PPB per day can be achieved after initial aging of 30 to 60 days. Aging shifts will occur whether the unit is powered up and may be significant if the units are left in stock for extended periods before installation in target systems.

Current Consumption
Current consumption is the total amount of current drawn by the oscillator in its operating condition. Different output types require different input current.

Duty Cycle
The duty cycle is a measure of the uniformity of the output waveform. It is defined as the ratio of the time periods of the logic 1 level to the logic 0 level measured at 1.4V for TTL output and 50% of the peak to peak voltage for CMOS and PECL logic.

Harmonics
For sine wave outputs is the measure of the next highest-level frequency component which is an integer multiple of the output frequency, relative to the output frequency level. Measured in dBc, or dB relative to the carrier.

Frequency Accuracy
The difference between the oscillator frequency and the nominal frequency.

Frequency Stability
The change in frequency due to all external influences, over time. This is a combination of environmental and electrical changes external to the oscillator. Although the stability of a crystal oscillator is largely due to the stability of the crystal, the oscillator is also influenced by the oscillator circuitry. Both sections need to be optimized for best performance.

Linearity
Linearity can be expressed in several ways. In the method of MIL-0-55310 a best-fit straight line is drawn and the ratio of the deviation of the worst point on that line to the maximum deviation is used as the specification. This is normally specified as a percentage, with ±10% being the most common. Other measures are based on the resulting modulation distortion or the slope variation.

Nominal Frequency
Nominal frequency is the desired frequency of the oscillator. For any given crystal cut, lower frequency crystals exhibit superior stability. For a given frequency, the highest possible overtone will provide the best stability. Here the rule is, "the greater the mass of quartz, the greater the stability". The only constraint here is crystal package, and ultimately oscillator package. Frequency ranges down to 10 MHz. Below this frequency dividers and CMOS outputs work best. Above 100 MHz phase-locked loops and frequency multipliers are used to take advantage of the stability of low frequency crystals.

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Operating Temperature Range
The range of temperature over which the oscillator will meet the specified frequency stability. Outside of this range, the frequency will change rapidly, as the oscillator may not be able to deal with the extremes. No functional damage will result as long as this is within the storage temperature range. For temperatures much higher than the maximum, increased aging rates will occur, and internal component damage may occur.

Operating Voltage
The voltage necessary to operate an oscillator.

Output Load
For sine wave this is limited to +0dBm into a 50 Ohm load, and other parameters include harmonic and spur levels. For CMOS, the load is limited to 50pF, and the number of gates, duty cycle, and rise and fall times are specified. TTL levels are specified as a subset of CMOS levels, as the latter is able to drive the former.

Output Type
Outputs can be specified as either sine wave or logic (TTL, CMOS, ECL, etc.). In the case of OCXO's these are limited to low level sine wave, and CMOS, capable of driving TTL loads, or low current loads. Load sensitivity will depend on the output type.

Phase Noise
The measure of short-term frequency fluctuations of the oscillator. It is usually specified as the single side band (SSB) power density in a 1Hz bandwidth at a specified offset frequency from the carrier. It is measured in dBc/Hz.

Pullability
The total range of frequency adjustment available. For TCXO's this can be of the order of ±20 ppm. For OCXO's this is normally of the order of ±5ppm to ±15ppm. This is intended to compensate for long-term drift.

Reference Frequency
The frequency used to calculate the maximum deviation. This can be the nominal frequency, or a frequency measured at a given temperature, usually 25°C.

Room Temperature Offset
Allows optimum peak to peak temperature deviation. The oscillator frequency is often deliberately offset at room temperature to minimize the largest deviation from nominal frequency over the whole temperature range. This results in the maximum positive and negative frequency deviations being equally spaced about the nominal frequency.

Short Term Frequency Stability
The measure of oscillator stability in the time-domain. Also, commonly referred to as the Allan variance, it measures the RMS change in successive frequency measurements for short gate times (milliseconds to seconds) and is important in timing applications. It typically improves as the gate time increases until it becomes a measure of the medium to long term drift of the oscillator. This drift is either the result of the temperature coefficient of the oscillator, and/or the aging.

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Start-up Time
The start-up time is defined as the time an oscillator takes to reach its specified RF output amplitude. The start-up time is determined by the closed loop time constant and the loading conditions of the circuit.

Storage Temperature Range
Range of temperature over which the oscillator may be stored. Exceeding these temperatures can result in increased aging rates, and internal component damage may occur.

Thermal Hysteresis
The ability of a TCXO to repeat the frequency versus temperature data over multiple temperature cycles. Here the frequency of a TCXO is measured at one temperature. The temperature is changed and then returned to the original temperature and the frequency is measured again. The two frequencies are not the same. The difference between the two frequencies is called "thermally induced hysteresis". This is present even if the unit is allowed to stabilize at the same temperature for a long time. This phenomenon is at best unpredictable but may display a pattern weakly dependent on the directions and rates of temperature change. This is normally of the order of ±0.1 ppm for a good TCXO.

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