Specifying a Rectangular Wave Form

1. Levels

"0" Level: The average voltage of the low part of the waveform.
This voltage level is measured with respect to ground (0 VDC).

"1" Level: The average voltage of the high part of the waveform.
This voltage level is measured with respect to ground.
Note: This voltage level is sometimes referenced to the input voltage (Vcc).

Example:
"1" level > Vcc – 0.6 VDC

If the input voltage to the unit is +5.1 VDC (Vcc = + 5.1 VDC)
The 1" level must be > +4.5 VDC (+5.1 VDC – 0.6 VDC)

If the input voltage to the unit is +4.8 VDC (Vcc = + 4.8 VDC)
The 1" level must be > +4.2 VDC (+4.8 VDC – 0.6 VDC)

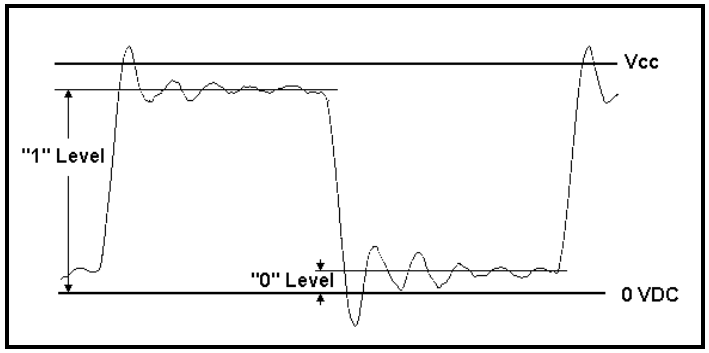

Figure 1

2. Duty Cycle

The Duty Cycle is the percentage (%) of period (T) that is above a specified voltage level.

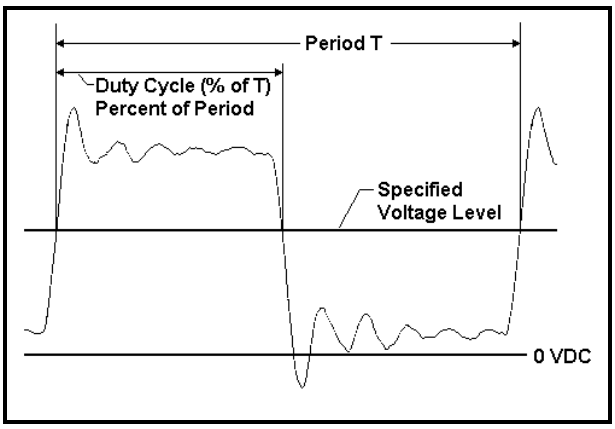

Figure 2

3. Rise/Fall Time

Rise Time: The time it takes the voltage to go from a specified low voltage to a specified high voltage.

Fall Time: The time it takes the voltage to go from a specified high voltage to a specified low voltage.

The Rise/Fall time is usually specified one of two different ways:

1. The time it takes the voltage to transit between two different fixed DC voltage levels.
   Example:
   Rise/Fall Time < 10 ns between +0.8 VDC and +2.4 VDC

2. The time it takes the voltage to transit between 10% and 90% of the voltage between the measured "0" Level and the measured "1" Level.

   Definitions:
   Lower transition Level: The "0" Level plus 10% of ("1" Level minus the "0" Level.)
   Upper transition Level: The "1" Level minus 10% of ("1" Level minus the "0" Level.)

   Example:
   Rise/Fall Time < 10 ns, 10% to 90%

   The measured "0" level = +0.2 VDC
   The measured "1" level = +4.8 VDC
   Change in level = 4.6 VDC (+4.8 VDC - +0.2 VDC)
   10% of 4.6 VDC = 0.46 VDC
   Lower Transition Level = +0.66 VDC (+0.2 VDC + 0.46 VDC)
   Upper Transition Level = +4.34 VDC (+4.8 VDC - 0.46 VDC)

   The Rise Time is the time it takes the voltage to go from +0.66 VDC to +4.34 VDC.
   The Fall Time is the time it takes the voltage to go from +4.34 VDC to +0.66 VDC.

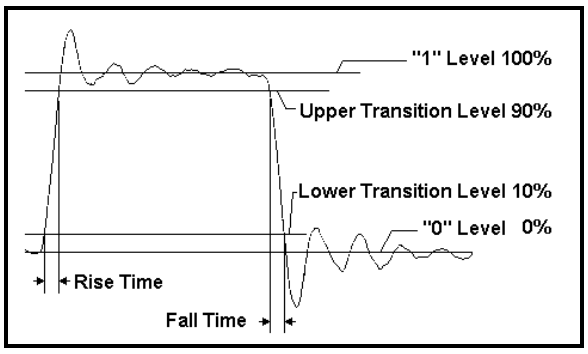

Figure 3

4. Additional Notes:

If the Rise/Fall time is very small the slew rate of the measuring device may affect the measurement.

When measuring the duty cycle a variance in the specified voltage level will affect the measurement.

The load on the device will affect all measurements.

REFERENCES: MIL-O-55310B Military specification for crystal oscillators. U.S. government.

For further information on the specification and application of Ovenized Crystal Oscillators, please contact the sales or engineering staff at Isotemp Research, Inc. For reprints of this article, ask for document number 146-012.

ISOTEMP RESEARCH, INC.
P.O. Box 3389
Charlottesville, VA 22903 USA
Voice: (804) 295-3101
FAX: (804) 977-1849
www.isotemp.com

Written by Todd S. Tignor, BSEE, V.P. of Engineering ISOTEMP RESEARCH INC.

Isotemp Research Inc. is an American company building performance ovens and oscillators since 1968