Appendix A

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Appendix B

Error Analysis

B1. Capacitance

Based from the specifications given in the Instruction Manual Model 590 CV Analyzer (1 MHz), the Capacitance Reading Limits can be calculated from the following equation

\[ R = C + \Delta R \]  
\[ = C + \frac{1}{\mu \text{m}} \left[ \frac{(P \times C)}{100} + C_0/D \right] \]

where:
- \( R \) = Reading limits (pF or nF)
- \( C \) = Displayed capacitance (pF or nF)
- \( \Delta R \) = Allowed Capacitance Error
- \( P \) = Percent of reading value from specifications (percent)

[Given in the Instruction Manual, the accuracy is 0.29%]

\( C_0 = \) Fixed count value from specifications

\( D = \) Divisor to adjust count units: \( D = 1,000 \) (20pF); \( 100 \) (200pF); \( 10,000 \) (2nF / 20 nF)

As an example, using \( P = 0.29\% \) from specification given in the Keithley 590/1MHz Instruction Manual for an actual of 8.9nF read using the 20nF range the allowed error is

\[ \Delta R = \left[ \frac{(P \times C)}{100} + C_0/D \right] \]
\[ = \left( 0.29 \times 8.9000 \right)/100 + (5/10,000) \]
\[ = 0.0258 + 0.0005 \]
\[ = 0.0263 \]
If the lower and higher limits are $R_L$ and $R_H$, therefore

$$R_L = 8.9000 - 0.0263 = 8.8737\text{nF}$$

and,

$$R_H = 8.9000 + 0.0263 = 8.9263\text{nF}$$

Thus, the allowable reading range for rated accuracy would be between $8.8737\text{nF}$ and $8.9263\text{nF}$.

**B2. Conductance**

Conductance errors can be calculated using the same mentioned method as above (i.e using Equation 2 in Section B1) except the unit is change to $uS$ or $mS$. 

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