## Input Capacitance

**Schematic Information**

Measuring input capacitance may require an external input resistor for values less than 15pF. The Bode 100 has an internal source resistance of 50 ohms, but for small input capacitances a larger external resistor is attached in series with the BODE output. The bode can compensate for an external resistor up to 1kohm. Larger external resistors require the use of an external labview program.

**Instrument Information**

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| Instrument | Model | Purpose |
| Gain/Phase Analyzer | Bode 100 | Generate and Measure small-signal response |

**Test Information**

* What is Input Capacitance?

Input Capacitance is the parasitic capacitance due to the geometry of the input devices. Input Capacitance can be represented by two parameters: Common-Mode Capacitance (CCM) and Differential Mode Capacitance (CDM). CCM is measured from each input to ground and CDM is the capacitance between both inputs. Input capacitance may change with VCM on non-SOI (silicon on insulator) processes and characterization of input capacitance vs VCM may be required.

* How do we do this test?

Capacitance can be measured using a known resistance in series with the target capacitor. This is done by sweeping a sine-wave vs frequency and measuring the phase across the resistor. The impedance of the capacitor will change vs frequency and result in a phase and magnitude change across the resistor. This can also be simplified as a basic impedance divider. Calibration should be performed using the user calibration menu (Calibration >> User Calibration >> Impedance). For external resistances above 1kohm, the BODE measurement needs to be done in Gain/Phase instead of impedance and completed in Labview.

* How do we analyze the results?

The input capacitance vs frequency can be split into two regions: a lower-frequency CCM dominant region and a higher-frequency region where both CCM and CDM are summed. In the below example, the low frequency region is the CCM = 4.5 pF, and the high frequency region is CCM + CDM = 14 pF. Therefore, CDM = 9.5 pF.

**Graph Example**

