Lecture Notes from 4/9/99 (probes.pdf)

Scope Voltage Probes

With a 1x probe:

Model of coax cable input port

These parasitics can result in a significant loading, causing your waveforms to be distorted

With a 10x probe:

This gives a 1/10 voltage divider.
IOX VOLTAGE PROBE MODEL

\[ \frac{V_0}{V_i} = \frac{Z_2}{Z_1 + Z_2} \quad \text{(we want} \quad \frac{V_0}{V_i} = \frac{1}{10} \text{ for all frequencies)} \]

\[ Z_1 = R_1 || \frac{1}{sC_1} \]

\[ Z_2 = R_2 || \frac{1}{sC_2} \]

\text{pick} \quad C_1 = \frac{1}{9} C_2 \quad \left( C_1 \approx 8 + 0.12 \text{ pF} \right)

WHAT IS THE EQUIVALENT LOADING?

\[ \frac{1}{C_1} + \frac{1}{C_2} \]

\[ \Rightarrow \text{the loading is} \quad 10 \text{ times less than} \quad \text{a regular} \quad 1 \times \text{probe!} \]

\[ \approx 10 \text{ M} \Omega \]

\[ \approx 10 \text{ pF} \]

THE ONLY DEFICIENCY OF IOX PROBES IS THE ABILITY TO SENSE SMALL-AMPLITUDE SIGNALS (SINCE THERE IS \( \frac{1}{10} \) ATTENUATION!)