Inductive Ringing and Resistive Loading

By: Agilent Technologies

Purpose:

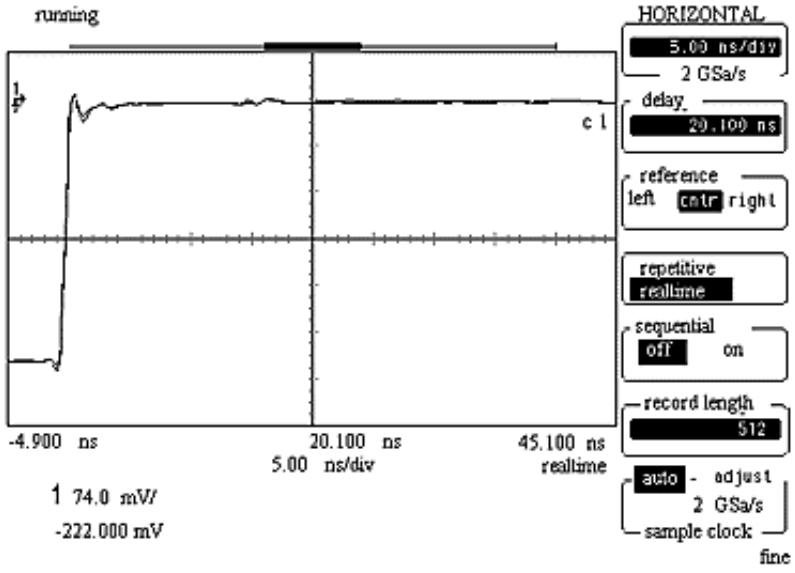
Compare probe response using different ground paths.

Part A: The four inch ground lead supplied with most probes can add significant ringing to the signal. At 25 nH per inch, a four inch ground lead can add 100 nH of inductance to your circuit. When practical, you would be better off using the ground spanner which adds much less inductance. In this part of the lab you use the rear panel cal signal as a "golden waveform", then use a 1 M ohm passive probe and a probing fixture to show the difference in ringing between the four inch ground lead and ground spanner as compared to the golden waveform.

Equipment:

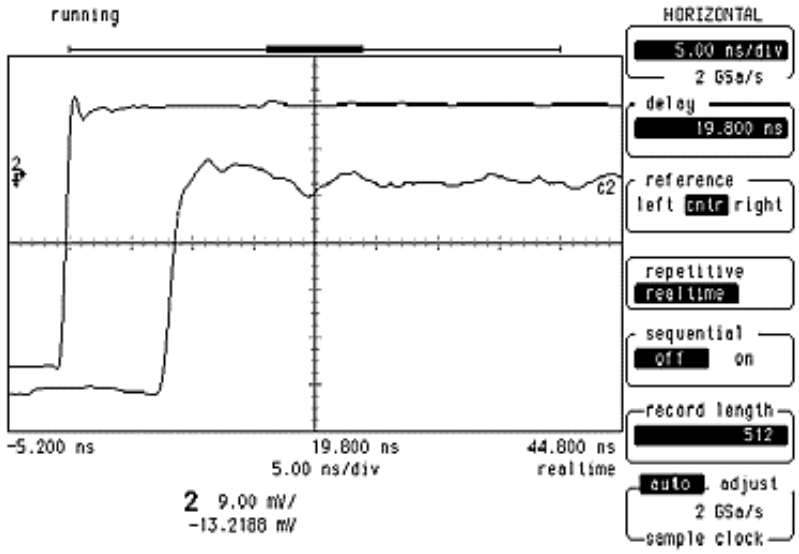
- Agilent 54520-Series Oscilloscope
- Agilent 54720-66506 Application Training board
- ground spanner

1. Connect a BNC cable from the rear panel AC cal BNC to one end of the probing fixture. Then, connect the other end of the probing fixture directly to channel 1 with the cutaway portion of the semi-rigid cable facing up. (Do not use a BNC cable to connect the probing fixture to the scope.)
   a. Press **Recall** and press **Clr**.
   b. Set channel 1 to 50 ohm.
   c. Press **Auto-scale**.
   d. Set the time base to 2 ns/div.
   e. Use the vertical **Position** and horizontal **Delay** knobs to position the top left of the pulse near the top left of the display.
   f. Press **Wform save** and select **[nonvolatile] m1, [source] 1, and [store].**

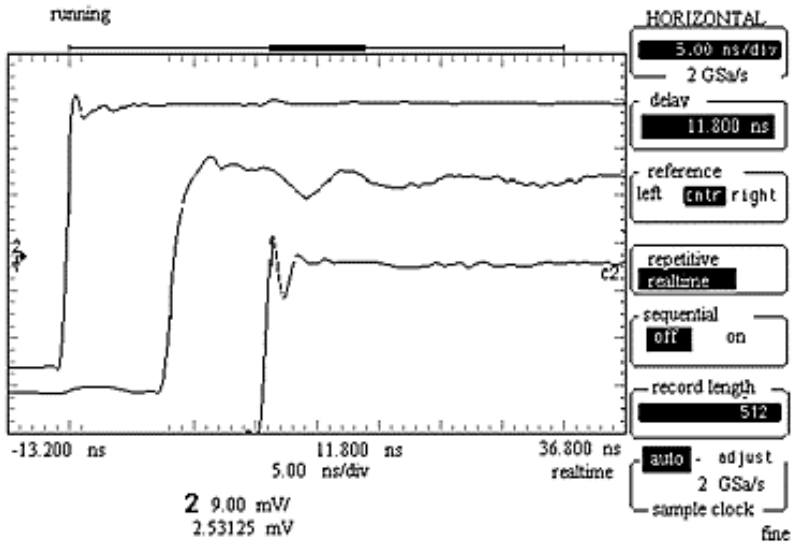


2. Connect a passive probe to channel 2. Connect the four inch ground lead of the probe to ground on the probing fixture board.
   a. Probe the center lead of the cutaway portion of the probing fixture.

b. Press **Auto-scale**.
c. Set the time base to 2 ns/div.
d. Use the vertical and horizontal position knobs to position the top left of the pulse just below and to the right of the "golden" waveform.
e. Use averaging to "smooth" the waveform.
f. Press **Wform save** and select **[nonvolatile] m2, [source] 2**, and **[store].**



3. Remove the four inch ground lead from the probe, then put on the ground spanner.
   a. Change **Display** to **[frame].**
   b. Turn on the memory 1 waveform and turn off channel 1.
   c. Turn on the memory 2 waveform.
   d. Position the live channel 2 waveform to the right and below the memory 2 waveform.



Note the reduced ringing with the ground spanner.

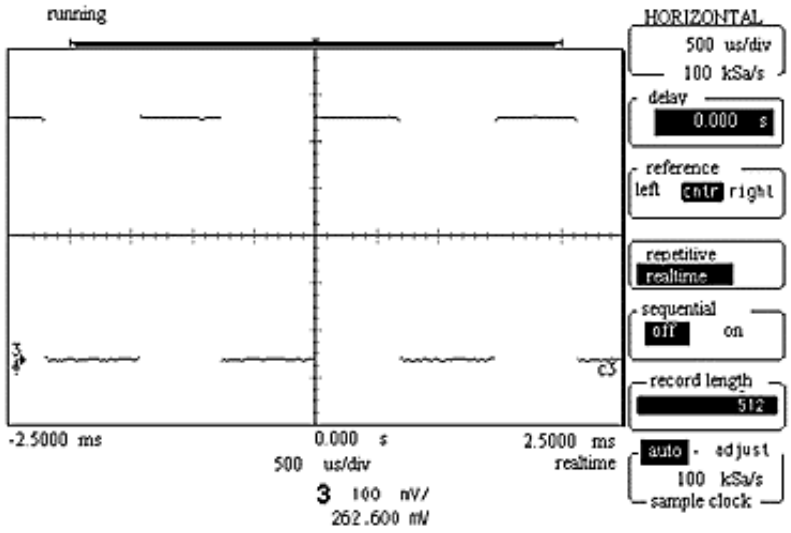
Purpose:

Compare the effects of resistive loading using different probes.

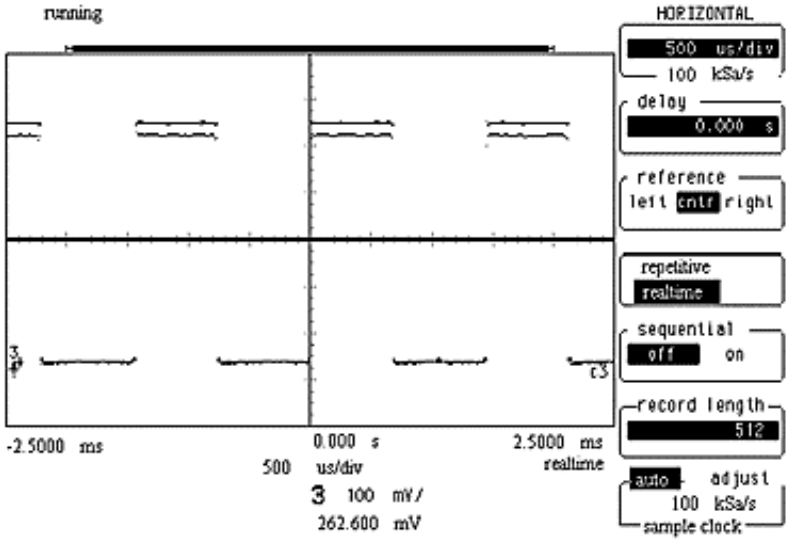
***Part B Resistive Loading**:*

Resistive probes have a low input C which minimizes the impact/slowing-down of the systems response. This makes resistive divider probes good for rise time and time delay measurements. However, resistive probes can significantly load down your system, resulting in inaccurate voltage measurements. The amount of loading depends on the value of the resistive tip used. In this part of the Lab, a 1 M ohm passive probe is connected to TP7 on the Agilent 54720-66506 Application Traning board as a golden waveform. You then "probe" the same pin with the simulated Agilent 10020A resistive divider probe (using resistors) to compare the loading effects of the 250 ohm (5:1 tip) and the 50 ohm (1:1 tip).

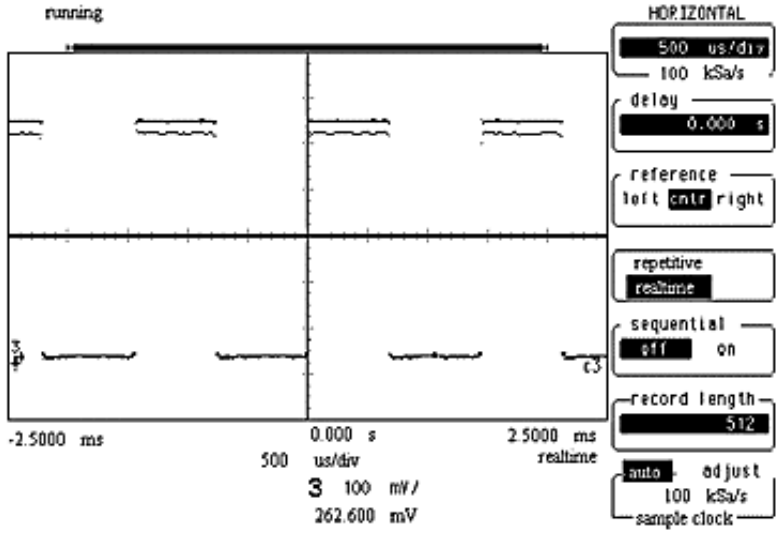
1. Connect a 1 M ohm passive probe to channel 1, and connect the other end of the probe to TP7 on the Agilent 54720-66506 Application Traning board and ground the probe at TP18.
   a. Press **Recall** and press **Clr.**
   b. Press the **Auto-scale** key. If necessary, adjust the amplitude for about 6 divisions.
   c. Press **Wform save** and select **[nonvolatile] m1** and **[source] chan 1,** and **[store]**, and **[display] on**.



2. Connect the 250 ohm resistor (simulating the 5:1 probe tip of the 10020A probe), to TP7 and to ground. Leave the passive probe connected.
   a. Press **Wform save** and select **[nonvolatile] m2** and **[source] chan 1**, and **[store]**, and **[display]on**.



3. Connect the 50 ohm resistor (simulating the 1:1 probe tip of the 10020A probe), to TP7 and to ground. Leave the passive probe connected.
   a. Note the further reduction in amplitude due to the resistive loading of the simulated Agilent 10020A.



What would be the effect on your amplitude measurements if you were probing with the resistive divider probe?