

# Understanding and Using Offset in InfiniiMax Active Probes

Application Note 1451

This application note explains how offset is applied in the Agilent InfiniiMax Active Probes and how to use offset for various applications. The purpose of offset in active probes or oscilloscope front ends is to allow the subtraction of most or all of the dc component of the input signal so the signal can better utilize the dynamic range of the input. A simplified diagram of how offset is applied for InfiniiMax probes is shown in Figure 1.

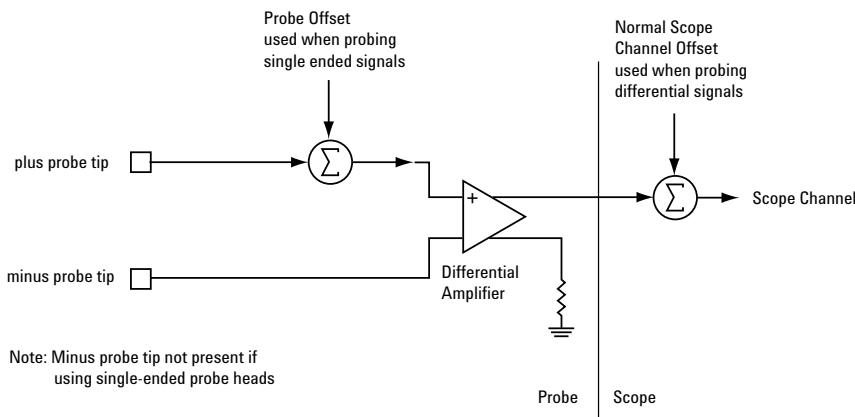
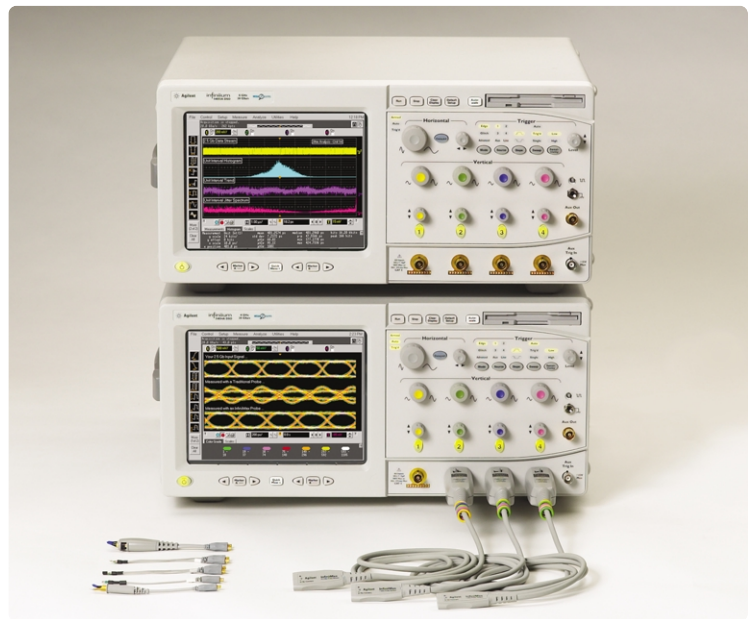


Figure 1. InfiniiMax Probe



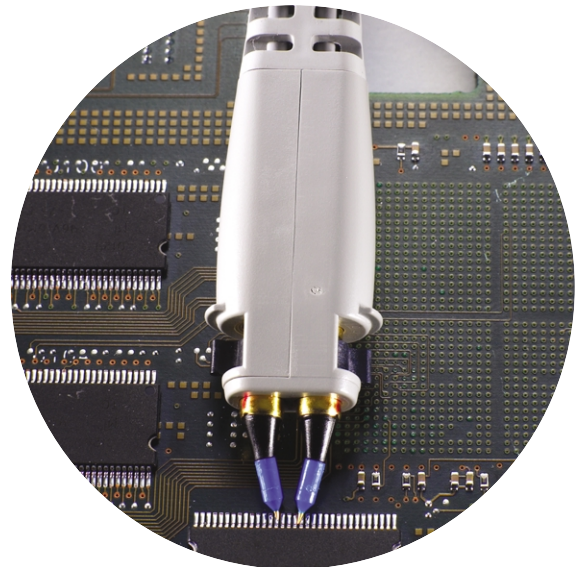
The three cases for types of signals and probe head types are:

1. A single-ended probe head probing a single-ended signal
2. A differential probe head probing a single-ended signal
3. A differential probe head probing a differential signal

When using an InfiniiMax probe with an Infiniium oscilloscope you can select the case that applies for your measurement by selecting the “Probes” button under the channel setup menu. This allows you to select which type of probe head is being used and if it is a differential probe head, allows you to select whether you are probing a single-ended or differential signal. With these inputs the oscilloscope will use the proper type of offset for your measurement case. The specifics of each case are:

**Case 1:** A single-ended probe head probing a single-ended signal. For this case the offset control on the oscilloscope controls the probe offset and the channel offset is set to zero. This allows the offset voltage to be subtracted from the input signal before the signal gets to the differential amplifier. Since this subtraction is done before any active circuits the offset range is large (+/- 12 V for the 113X amplifiers and 25 kΩ probe heads). Note that the minus probe tip is not present when using a single-ended probe head which means nothing is plugged into the “-” input of the probe amp. This is normal and causes no problems.

**Case 2:** A differential probe head probing a single-ended signal. For this case the offset control on the oscilloscope controls the probe offset and the channel offset is set to zero. This allows the offset voltage to be subtracted from the input signal before the signal gets to the differential amplifier. Since this subtraction is done before any active circuits the offset range is large (+/- 12 V for the 113X amplifiers and 25 kΩ probe heads). A differential probe can make higher bandwidth and more accurate measurements on single-ended signals than a single-ended probe (See Related Literature) and this method of applying offset to only the plus side of a differential probe means that there is no sacrificing of offset range.



**Case 3:** A differential probe head probing a differential signal. For this case the offset control on the oscilloscope controls the oscilloscope channels offset. The probe offset is not used and set to zero. Since the plus and minus sides of differential signals have the same dc component, it will be subtracted out and the output of the probe will by definition be centered around ground. The channel offset allows the waveform seen on screen to be moved as desired. The allowable dc component in the plus and minus signals is determined by the common mode range of the probe which for the 113X probe amps and 25 kΩ probe heads is +/- 6.75 V.

Understanding how to properly use offset for your application can insure that you get the maximum performance and dynamic range from your InfiniiMax Probes. Additionally, the unique method of applying probe offset in InfiniiMax differential probes allows the full benefits of differential probing for single-ended signals without sacrificing offset range.

## Related Literature

| <b>Publication Title</b>   | <b>Publication Type</b>  | <b>Publication Number</b> |
|--|--------------------------|---------------------------|
| <i>Performance Comparison of Differential and Single-Ended Active Voltage Probes</i> | Application Note 1419-03 | 5988-8006EN               |

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