Keysight Technologies
Pulse Parameter Definitions

Application Note

KEYSIGHT TECHNOLOGIES

Introduction

Electrical pulses are used to synchronize, trigger or control multiple electrical devices in a test system. Pulses are also used for clock generation or radar testing. In order to describe a pulse and make its creation repeatable, a set of parameters has been defined. This document describes and illustrates all main pulse parameter definitions. It is a collection of terms used in the test and measurement environment. The information will help the reader to understand the nature of a pulse, and will make instrument specifications comparable amongst each other.

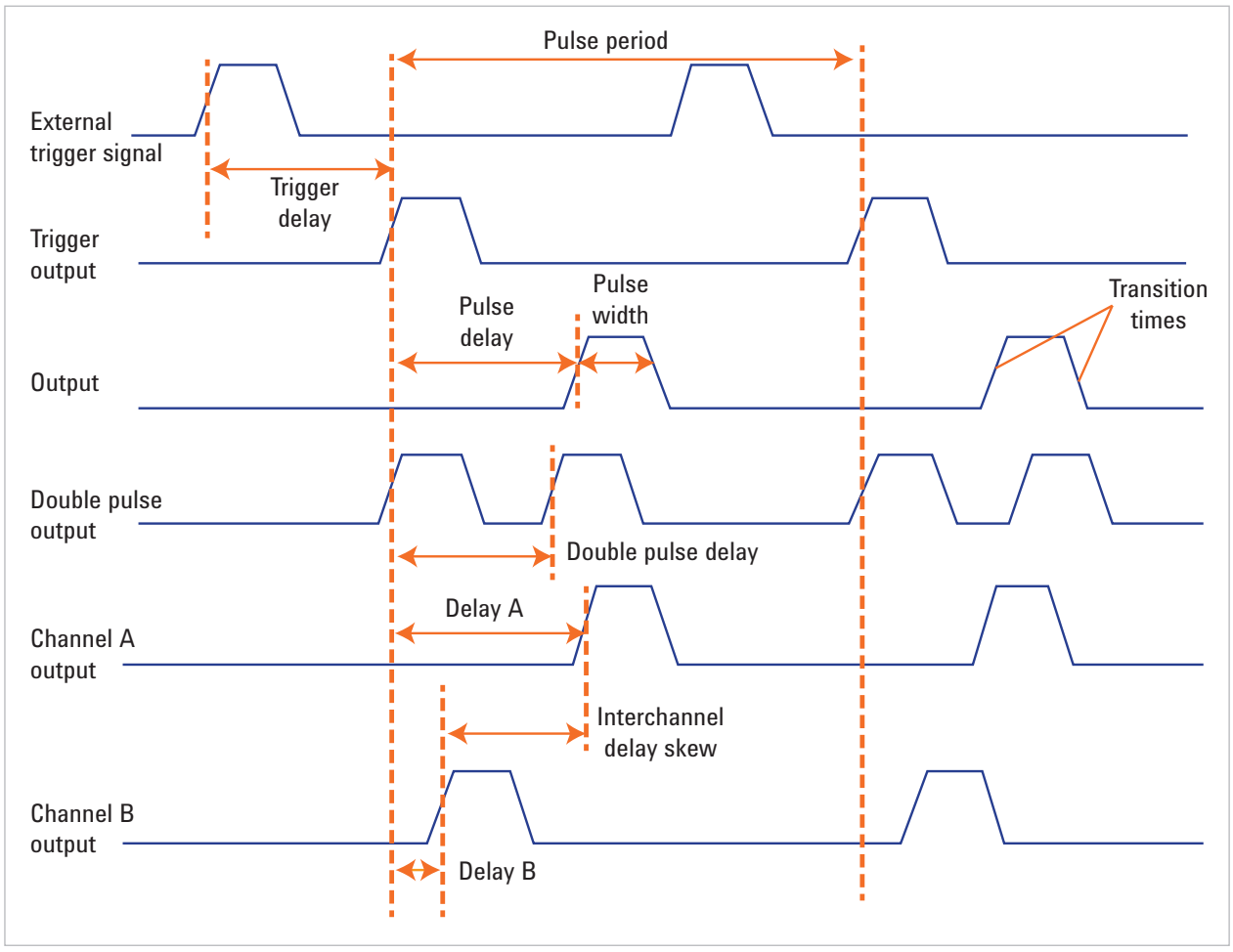

Figure 1. Overview of the pulse parameters

Time Reference Point

The time reference point is at the median of the amplitude (50% amplitude point on pulse edge).

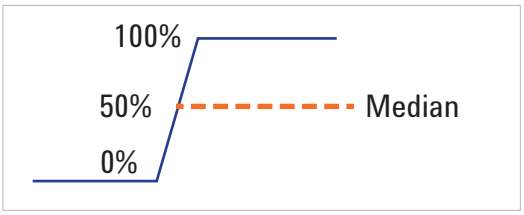

Figure 2. Time reference at median amplitude

Pulse Period

The time interval between the leading edge medians of consecutive output pulses.

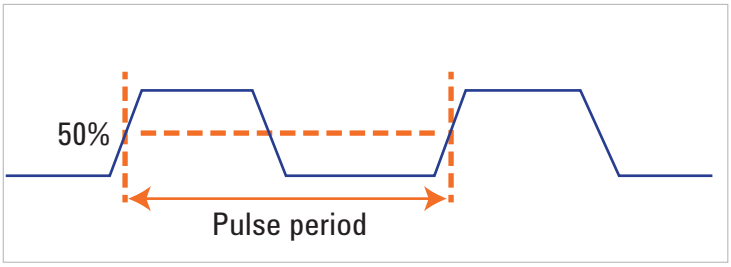

Figure 3. Pulse period

Trigger Delay

Interval between trigger point of the external trigger input signal and the trigger output pulse's leading-edge median.

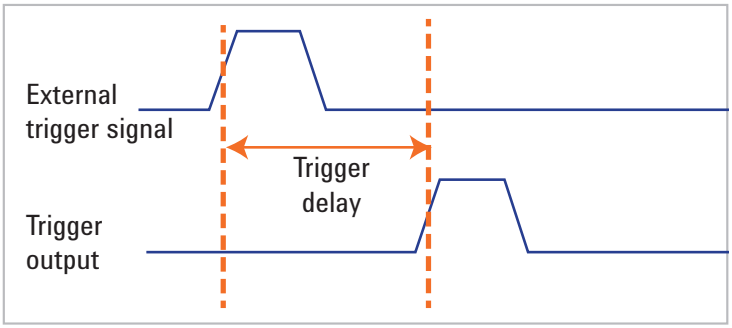

Figure 4. Trigger delay

Pulse Width

Interval between leading- and trailing-edge medians. The specified and displayed value is that obtained with fastest edges, essentially equal to the interval from the start of the leading edge to the start of the trailing edge. By designing so that the pulse edges turn about their start points, the interval from leading-edge start stays unchanged (in practice, start points may shift with changes in transition time) when transition times are varied. This is more convenient for programming and the width display is easy to interpret.

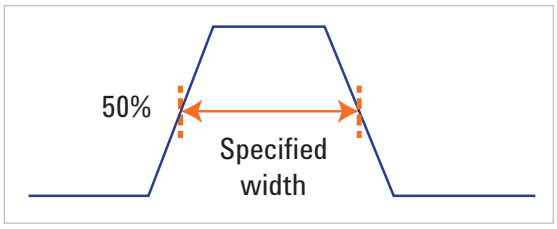

Figure 5. Pulse width

Pulse Levels

Pulse output is specified as pulse top and pulse base (usually referred to as high level and low level), or as peak to peak amplitude and median offset. A "window" specification shows the limits within which the pulse can be positioned.

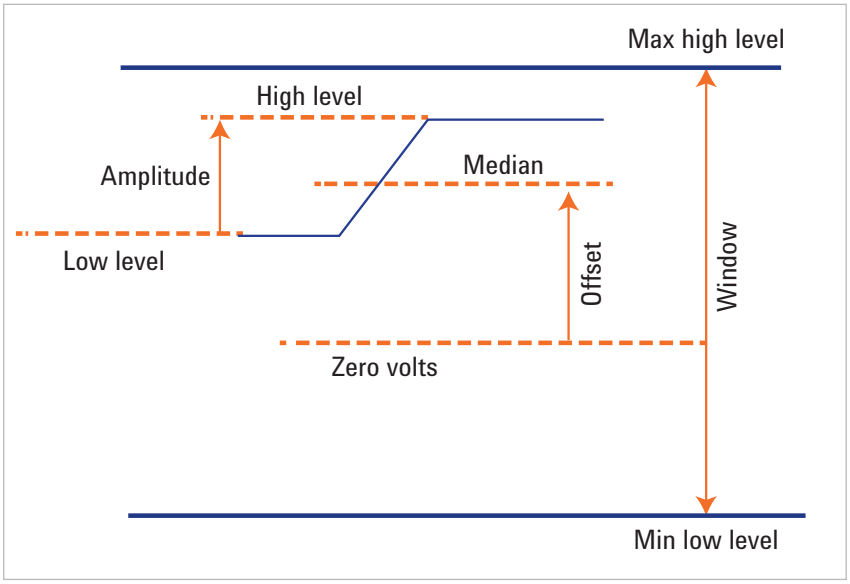

Figure 6. Pulse levels

Pulse Delay

Interval between leading edge medians of trigger output pulse and output pulse. The specified and displayed value is that obtained with the fastest leading edge. Pulse delay has two components, a fixed delay from trigger output to output signal and a variable delay with respect to the trigger output.

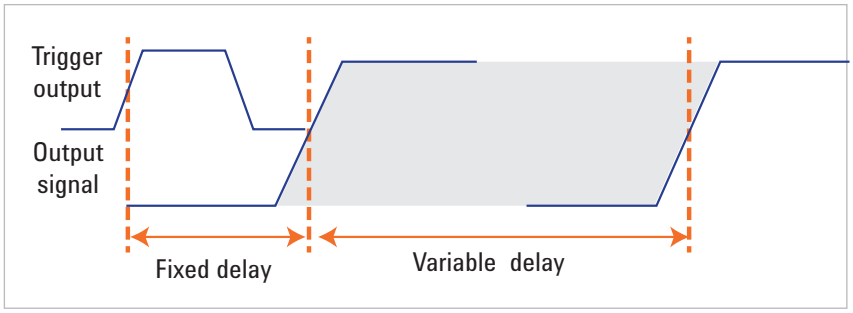

Figure 7. Pulse delay

Double Pulse Delay

Interval between leading edge medians of the double pulses.

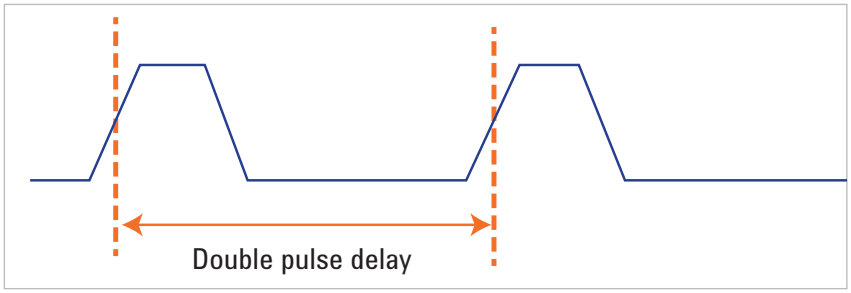

Figure 8. Double pulse delay

Interchannel Delay (Skew)

Interval between corresponding leading-edge medians of the output signals.

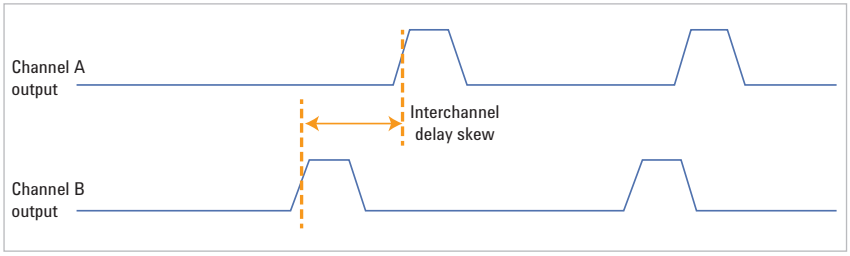

Figure 9. Interchannel delay

Transition Time

Interval between the 10%- and 90%- amplitude points on the leading/trailing edge.

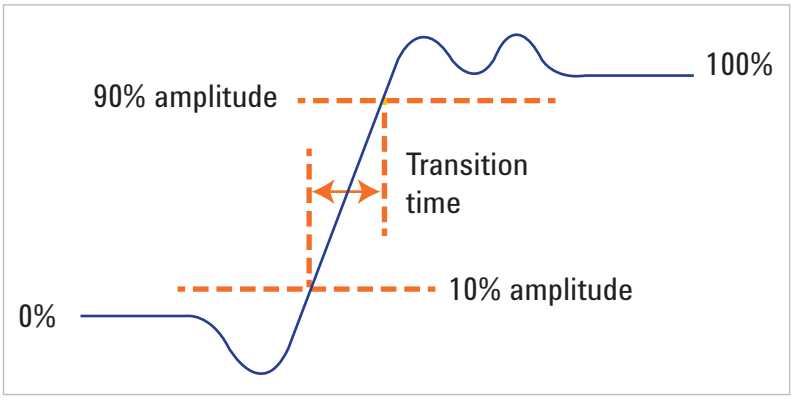

Figure 10. Transition time

Linearity

Peak deviation of an edge from a straight line through the 10%- and 90%-amplitude points, expressed as percentage of pulse amplitude.

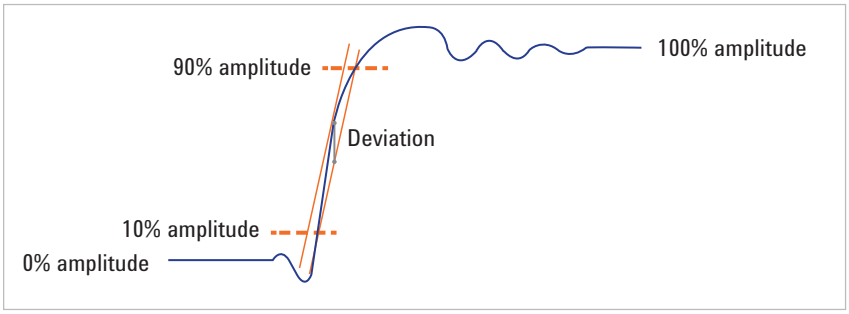

Figure 11. Linearity

Jitter

Short-term instability of one edge relative to a reference edge. Usually specified as rms value, which is one standard deviation or "sigma". If distribution is assumed Gaussian, six sigma represents 99.74% of the peak-peak jitter.

The reference edge for period jitter is the previous leading edge. That for delay jitter is the leading edge of the trigger output. Width jitter is the stability of the trailing edge with regard to the leading edge.

Stability

Long-term average instability over a specific time, for example, hour, year. Jitter is excluded.

Preshoot, Overshoot, Ringing

Preshoot and overshoot are peak distortions preceding/following an edge. Ringing is the positive-peak and negative-peak distortion, excluding overshoot, on pulse top or base. A combined preshoot, overshoot, and ringing specification of e.g. 5% implies:

– Overshoot/undershoot < 5%

– Largest pulse-top oscillation

– < +5%, of pulse amplitude

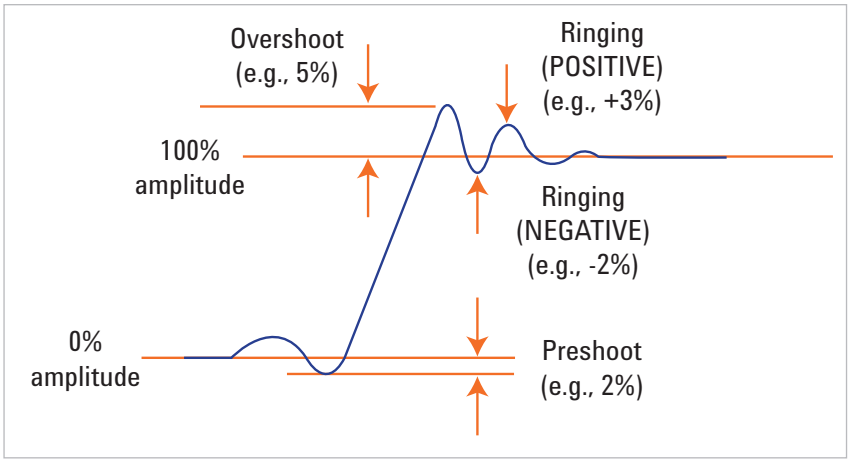

Figure 12. Preshoot, overshoot, ringing

Settling Time

Time taken for pulse levels to settle within level specifications, measured from 90% point on leading edge.

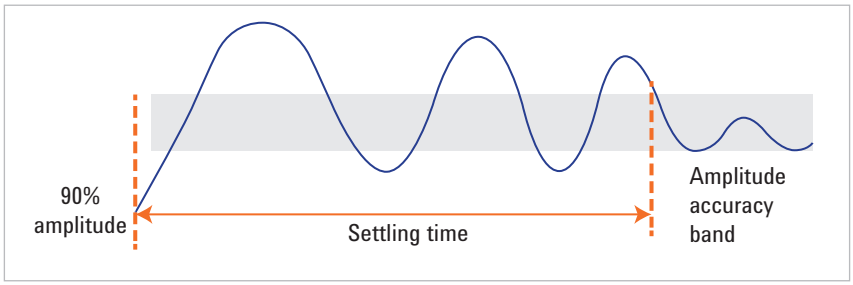

Figure 13. Setting time

Repeatability

When an instrument operates under the same environmental conditions and with the same settings, the value of a parameter will lie within a band inside the accuracy window. Repeatability defines the width of this band.

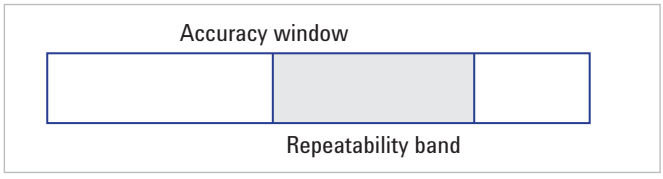

Figure 14. Repeatability

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Published in USA, August 3, 2014
5991-1943EN
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