Faster debugging using specialized triggers

In addition to the generic edge trigger, modern oscilloscopes offer triggers that are specialized to address specific problems.

Your task

When a circuit is bad, there is often little time to correct the problem; design and development results must be delivered quickly. Correction can be difficult with conventional edge triggers because the error state cannot be precisely selected. Solutions tailored to the specific problem are required in this situation.

T&M solution

The specialized digital triggers from Rohde & Schwarz are extremely accurate because they directly access the acquired samples and support a large selection of trigger conditions. These permit targeted debugging of recurring development tasks. This application card describes the most important trigger types. In addition to the standard settings, additional qualifiers such as >, <, = and ≠ are available to expand the scope of application. Most triggers can be used on both analog and digital channels.

Trigger types

Width and glitch

The (pulse) width trigger acts directly on the duration of a positive or negative pulse. Very short pulse widths are referred to as glitches. These triggers are used during the analysis of pulse width modulations, for example with rotary encoders. They are also important in the analysis of logic circuits where missing clock pulses can lead to very large pulse widths, or glitches can interfere with the circuit.
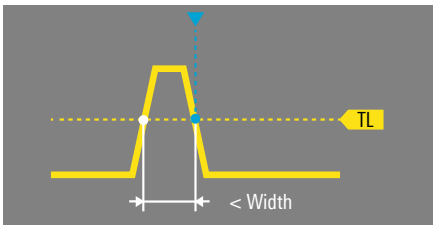
Timeout and interval

These two trigger modes expand the pulse width trigger functionality in two directions. The timeout trigger checks whether or not a pulse is followed by another pulse within a defined time window. The interval trigger checks the distance between two pulses of the same polarity. This makes it easy to find any missing clock pulses.

Pattern and state

The pattern trigger is used for measurements on parallel buses because it makes it possible to logically link pulse width triggers on multiple channels. The state trigger is different in that it references the pattern to a clock edge (see next page for screenshots). Both triggers permit targeted isolation of complex circuit states, such as those that occur on parallel buses.
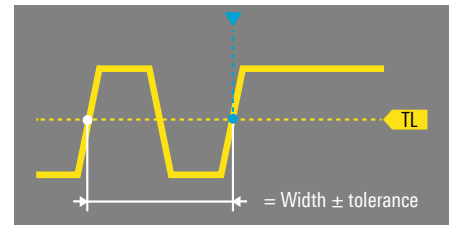
Width.

TL

< Width

Timeout.

TL

Time

Interval.

TL

= Width ± tolerance

ROHDE & SCHWARZ
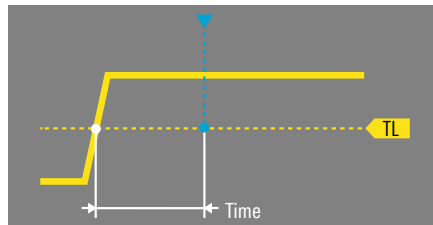
Data2Clock and setup and hold

The Data2Clock or setup-and-hold trigger checks two special timings on the data line as a function of the circuit clock pulse. A violation of these time relationships can easily perpetuate in logic circuits and must be avoided at all costs. This is critical for memory ports, for example.

Rise time

A faulty rise time for a signal can lead to timing problems during on/off switching operations of DC power supply units. These problems can easily be isolated using the rise time trigger. This trigger determines whether the level of a signal reaches a target threshold value within the defined time window.

Runt

A rise time that is too slow can lead to a runt, i.e. a pulse that is too low. The runt trigger can be used to define the lower and the upper pulse height limits as well as the pulse length limits. This makes it possible to specifically isolate metastable states in circuits.

Window

The window trigger checks whether the signal is inside or outside a defined voltage range. This check is performed with a time limit for timed segments. The window trigger is used to analyze voltage deviations in power supply units.
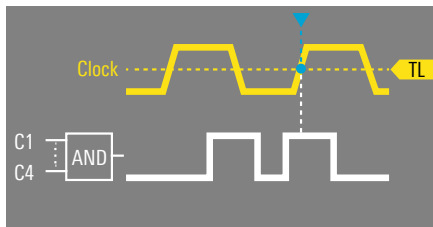
TV/video

The TV/video triggers represent a special class of triggers that resemble the protocol triggers. These triggers can be linked to specific components, such as the lines and frames of various video standards, including PAL, NTSC and HD 1080p.
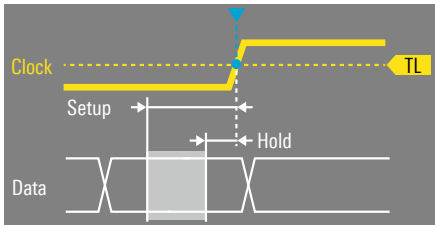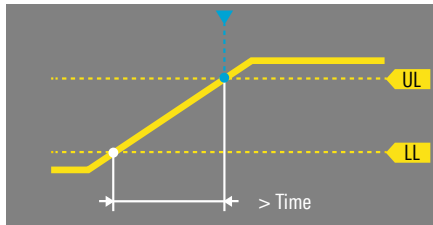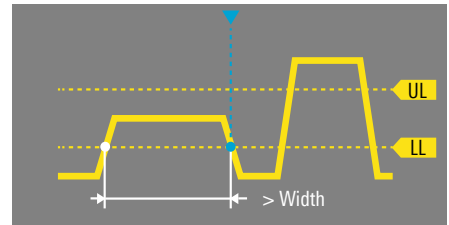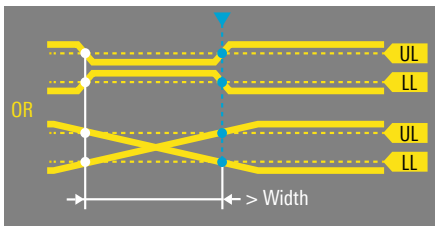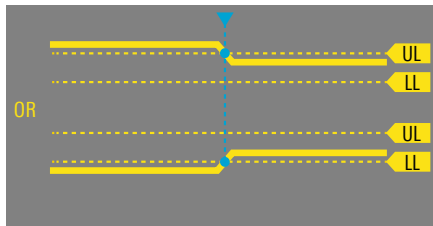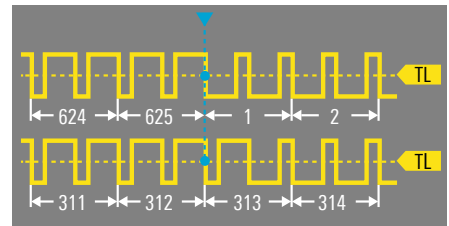
Pattern.
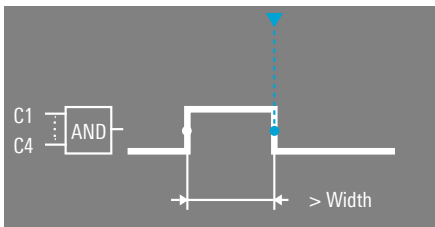
State.

Data2Clock.

Rise time.

Runt.

Window (1).

(2).

Video.