TN-Number	Author	Phone	Filename	Date	Page
TN608-02	R.Bachmann	+41 56 486 8103	TN608-02 HOLDOFF.docx	30.01.2017	1 / 3

Concern

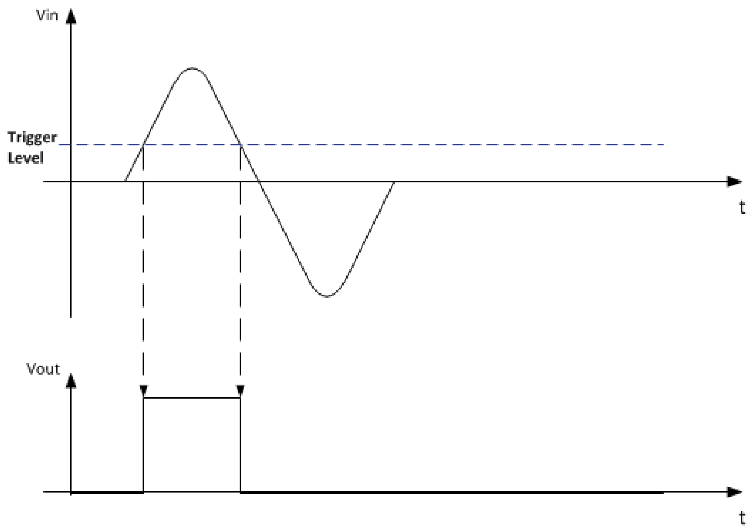
Blocking parasitic triggering with the HOLDOFF function

1. Introduction

This paper shows the advantage and the usage of the HOLDOFF function provided by PI608 Versatile Trigger Unit.

Things will be shown for illustration in a typical example. A reluctance sensor is used to monitor the speed or blade passing of a rotating machine. Unfortunately the chosen test setup tends to oscillate.

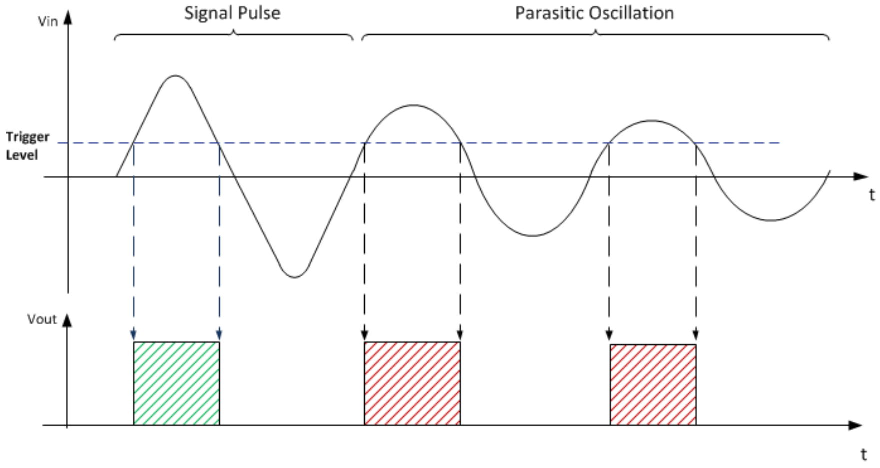
One would expect the sensor signal (V_{in}) and the according output signal (V_{out}) of Versatile Trigger Unit to look as shown in the graph below.



The sensor signal (V_{in}) is symmetrical and transformed to a proper, single trigger pulse (V_{out}).

2. The problem

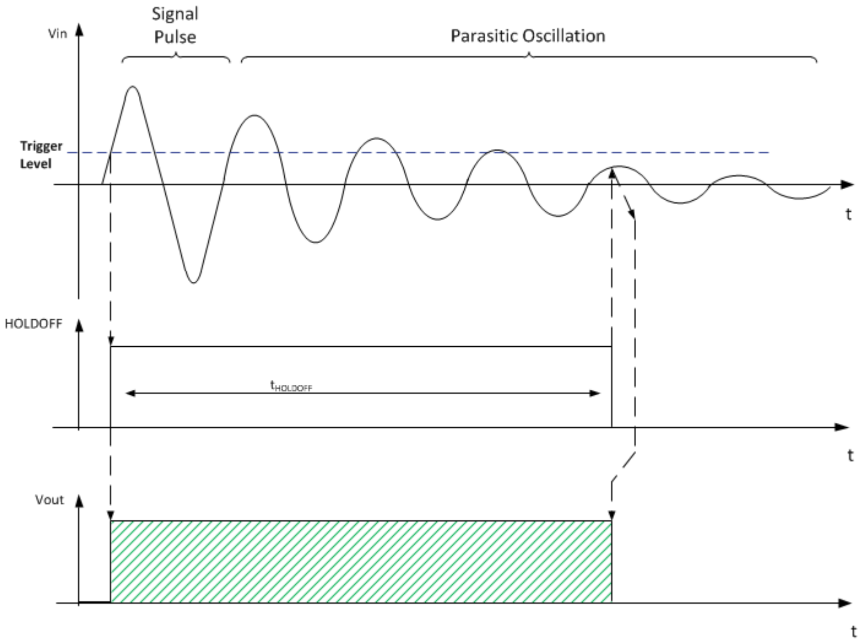
As described in the introduction, unfortunately the systems resonance frequency is very close to the fundamental frequency of the sensor signal.



The signal generated by the sensor stimulates an oscillation in the system connected to it.
As the resulting waveform (V_{in}) crosses the trigger level several times, a bunch of parasitic trigger pulses are generated (V_{out}).
The parasitic oscillation of V_{in} cannot be attenuated by a low pass filter. Filtering would reduce the signal amplitude almost in the same way as the amplitude of the oscillation.

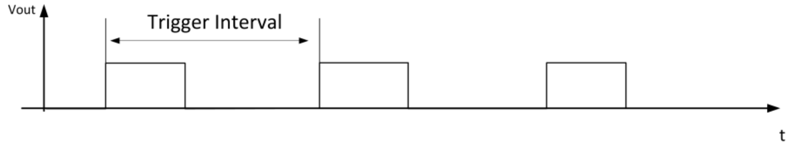
3. The Solution: Holdoff

Electrical systems are causal systems. That means that an oscillation as shown in this example is always the reaction of the system to an external action. The oscillation will always follow after the signal pulse.
When the holdoff function is activated, the trigger unit remains triggered for a specified time after a trigger event. When the holdoff time is over, the Versatile Trigger Unit is getting active again and senses the input (V_{in}). If the signal is below the trigger level in this moment, the output becomes untriggered again.



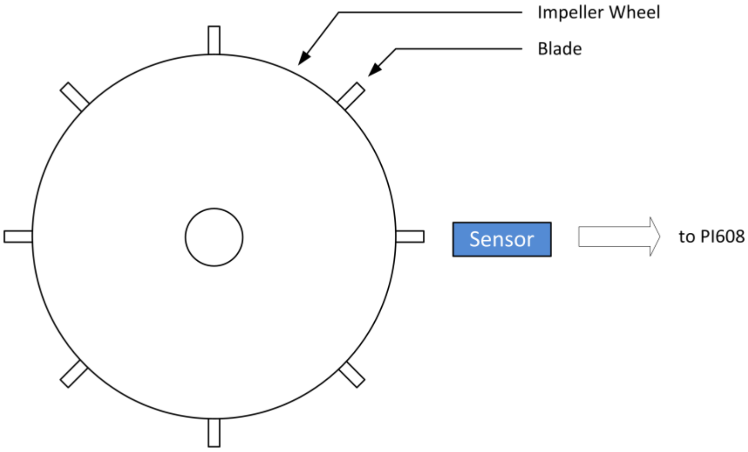
4. Calculating Holdoff Time

The main thing about a proper holdoff setup is knowing the minimum expected trigger interval or trigger rate. In other words, the minimum time between two valid trigger edges.



In the application shown, the expected minimum trigger interval can be calculated with the maximum rotating speed of the machine and the number of objects passing the sensor.

In the example below the calculation for a turbine with 8 blades and a maximum rotating speed of 60 Hz is made.



It is easy to see, that it is not necessary that the trigger system is triggerable all the time. After a blade passed the sensor, one can be sure that for a certain time no other blade will pass the sensor. The minimum trigger interval is calculated as followed:

$$t_{min} = \frac{1}{f_{max} * N_{baldes}} = \frac{1}{60\ Hz * 8} = 2.08\ ms$$

In any case the chosen holdoff time shall be shorter than the minimum expected time betwean two trigger pulses. Depending on how fast a machine can speed up and slow down is has to be more or less reduced.
Let's assume based on possible maximum acceleration and an additional safety factor, a reduction to 80% is calculated or estimated. Then the holdoff time would be set to:

$$t_{holdoff} = 0.8 * \frac{1}{f_{max} * N_{baldes}} = 0.8 * \frac{1}{60\ Hz * 8} = 1.67\ ms$$