Wave Window User's FAQ – Advanced Topics Revision 1.5

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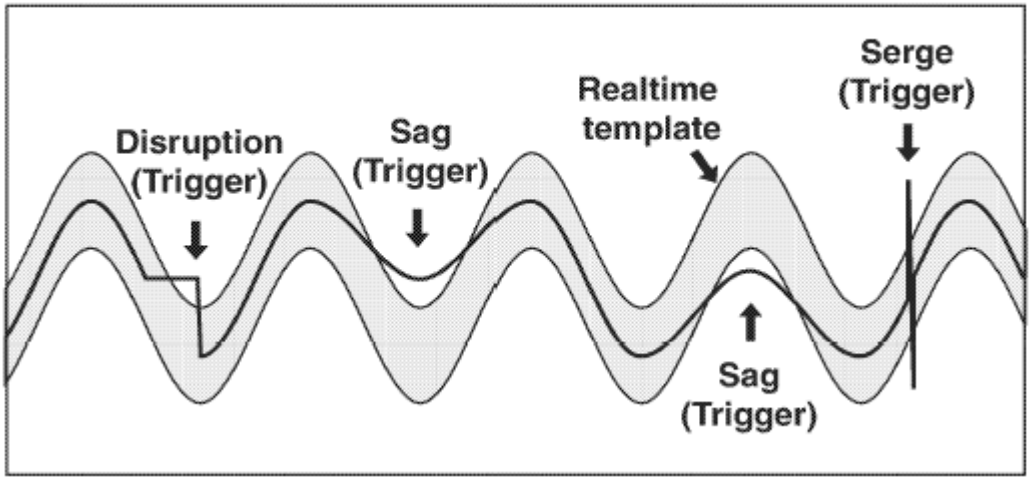
Purpose of this FAQ:
The following FAQ was assembled from questions which are frequently asked by end-users of the ScopeCorder line. In addition, it is designed to assist you in deciding how to best utilize your ScopeCorder. Advanced users will find it very useful as they do more with the Wave Window trigger feature. New ScopeCorder owners will find it useful in deciding if, when, and how to best utilize the Wave Window trigger function.

PRE-REQUISITE:
Before reading this FAQ, it is recommended that you work the exercise and example described in *'Getting Started with Wave Window Trigger on the DL850.PDF'* in order to gain a basic understanding of the behavior of the Wave Window trigger.

After performing the included basic exercise and then reading this FAQ, you will be better prepared to get the very most of out the Wave Window trigger function. It is expected, too, that you have *some* experience with the DL850 ScopeCorder.

Q1 – What is the Wave Window trigger?
A1 – A trigger method which creates a *dynamic realtime template* as the trigger criteria. If the realtime template is violated by new channel waveform data – then the ScopeCorder will trigger. It is designed for power supply waveforms between 40 and 1000 Hertz, and works best on sine waves; It is not designed for waveforms exhibiting fast rise times. The input channel is compared against the *dynamic realtime template* and the result is a trigger; A trigger occurs when a surge, sag, glitch, or other disruption occurs; i.e. the realtime template is violated by surge/sag/glitch/disruption.



Q2 – Can the Wave Window trigger be used to automatically save my acquired data?
A2 – Yes, in conjunction with the 'Action On Stop' or 'Action On Trigger' features, it can save your data to either a binary or ascii file. You can also manually save your waveform data. Please review 'Getting Started with Action-On-Stop using the DL850.PDF' which includes an exercise for you as well.

Q3 – What is the best use for Wave Window, in general?
A3 – The Wave Window trigger is best used to detect rapid changes in your waveform.

Q4 – Does that mean that slow or gradual waveform changes might go un-noticed by the Wave Window trigger?
A4 – It is possible, yes. Because the Wave Window trigger continuously creates a *dynamic realtime template* using one, two, or four *Reference Cycle(s)* of the input channel waveform data, the trigger criteria changes also along with the input channel waveform data. If this change is sufficiently gradual, then both the template and the waveform being evaluated can “follow one another” slowly enough so as to go un-detected and triggered-upon;

For example, the input waveform could taper down in amplitude and go un-detected by the Wave Window Trigger feature. In this case, it is best to select and use another trigger type for your testing. An RMS module used in conjunction with a pair of Window triggers, for example, would allow you to catch a waveform which is going either too high or too low in RMS.

Q5 – So, could I use a function generator source, or “Golden Waveform” source, as my Sync Channel?
A5 – No. Because each waveform is, in essence, compared with a previous version of it's self. The Wave Window trigger function does not compare the waveform on Ch1to the waveform on Ch2, as an example. This trigger function *only* compares a previous waveform on Ch1 to the waveform on Ch1; Ch2 gets compared to Ch2; etc.

Q6 – Could I coax this trigger to work upon a square wave, even though it is not intended for that purpose?
A6 – Please give it a trial run – you may find some success with a variety of waveforms; however, Wave Window trigger feature was designed for and intended for use with waveforms which do not have fast rise times. Please make sure that you thoroughly understand this trigger and have mastered its use on sine waves (for example) before you start pushing the limits of this trigger feature.

Q7 – Which modules can I use Wave Window trigger with?
A7 – 701250, 701251, 701255, 701260, 701270, 701271, & 701275.

Q8 – How many channels does the Wave Window trigger function support?
A8 – Up to sixteen channels can each be analyzed against simultaneously.

Q9 – I tried to use it – but I get error messages, what am I doing wrong?
A9 – Study the message carefully – the ScopeCorder will coach you into using this trigger successfully. Also, study this FAQ very carefully, and make some notes which are pertinent to your application.
For the most common errors: Be certain that the ScopeCorder is setup for: between 10 kSa/sec to 500 kSa/sec, NORMAL trigger mode (or Single, or Single(N)), your waveform is between 40 Hz and 1000 Hz, T/Div must be greater than 10 msec/div.
Your settings within the Wave Window trigger must each be adjusted as well – but these will not typically cause error messages.
One option too, is, if you continue to have error messages – consider performing a factory RESET (hold RESET button while applying power) to clear out all of the adjustments or settings which may have accumulated in your instrument; and now you may start from scratch using neutral factory settings; this will often give you a fresh-start and delete any previous or forgotten adjustments.

Q10 – What is the ‘Sync Channel’?
A10 – *Sync Channel* is the channel which is used to determine exactly at what point in time-voltage (via a voltage-threshold) each of the sixteen channels begins to collect the *realtime template*. This threshold level translates or maps into a begin-time for all of the enabled channels. At that time, a ‘Reference Cycle(s)’ is collected for each channel – that ‘Reference Cycle(s)’ is one, two, or four full-cycles in duration. This would permit a UPS designer, for example, to choose to place emphasis upon the upper-most portion of the waveform.

Q11 – What is the ‘Cycle Frequency’?
A11 – Cycle Frequency is the frequency of the waveform(s) which you are acquiring. Wave Window trigger feature is designed to work with essentially frequency-stable waveforms. If you are monitoring a 400 Hertz UPS Output Waveform – you should adjust this to 400 Hertz; you are permitted +/- 10% deviation in frequency from this set-point. As an example: if that UPS output waveform frequency should drift to 399 Hertz, you can expect Wave Window trigger feature to ignore that drift. If your waveform varies very much – you will experience a lot of trigger events. In the event that you wish to trigger upon frequency – please use the 701280 frequency module and set a window trigger or a pair of window triggers (not the same as wave window trigger).

Q12 – What is the ‘Reference Cycle’?
A12 – The ‘Reference Cycle’ is the actual waveform cycle(s) used to create the *realtime template*. There are between one and four reference cycles. These reference cycles are averaged with one another to create a one-cycle *realtime template*.

Q13 – Can I view the ‘Reference Cycle(s)’?
A13 – The ‘Reference Cycle(s)’ are on the display; this portion of your waveform is located to the left in the pre-trigger portion of your display. Look for the letter “T” at the top, and your Reference Cycle(s) are located to the left of that trigger-point indicator (T). If you are in NORMAL mode and the display is frozen with the last acquisition, then you are viewing *that* acquisition’s Reference Cycle.

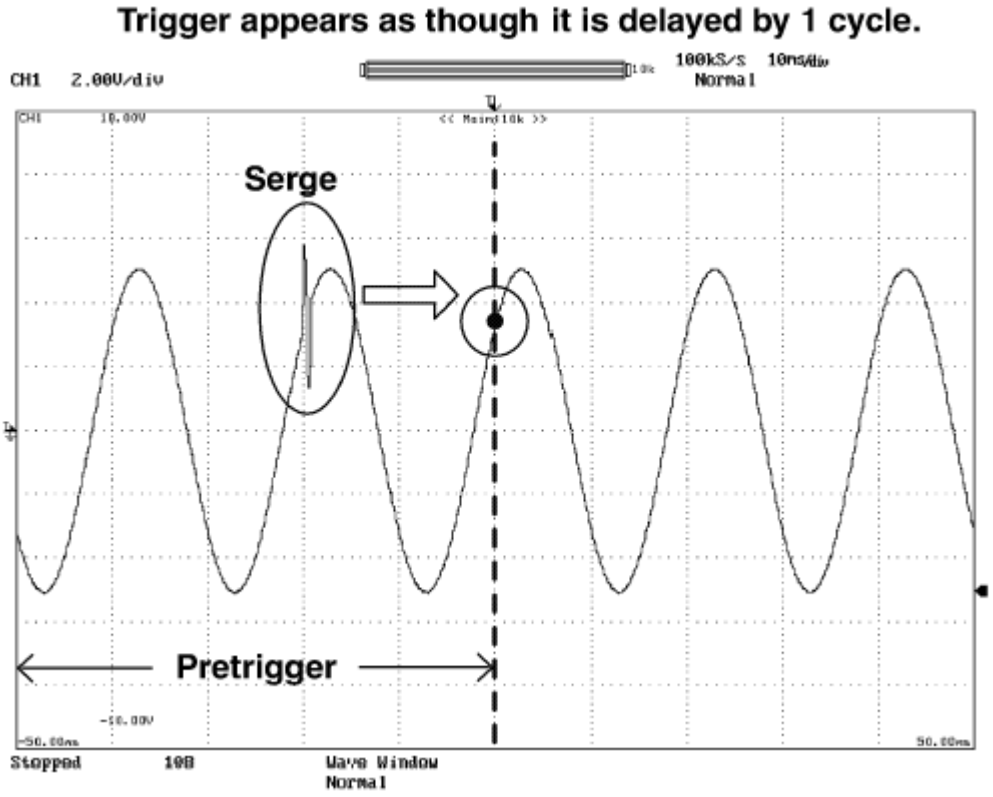
Q14 – Where does the dynamic *realtime template* come from?
A14 – The dynamic *realtime template* is produced by using waveform data - aka ‘Reference Cycle(s)’ - from each of the target channel(s). Thus, the realtime template of Channel one comes from between one and four previous waveform cycles (‘Reference Cycles’) on Channel one; Likewise, the realtime template of Channel two comes from between one and four previous waveform cycles (‘Reference Cycles’) on Channel two; and so on.

Q15 – How many ‘Reference Cycle(s)’ and how many ‘*realtime templates’* are there actually?
A15 – Each channel which has been enabled as a target channel within the Wave Window trigger menu has either 1, 2, or 4 ‘Reference Cycle(s)’; (each channel has the same number of Reference Cycles(s). Furthermore, each channel which has been enabled as a target channel within the Wave Window trigger menu has exactly one dynamic *realtime template*.

Q16 – How often does the *realtime template* change?
A16 – Very often. It is dynamic. The ScopeCorder continues to re-acquire and replenish / renew the Reference cycle waveform on an ongoing basis; this occurs whether or not there a trigger has occurred; in the case of no trigger the display of the instrument remains un-changed. In a few moments time, the *realtime template* changes thousands of times. To get an idea of how often this is occurring, set your Trigger Mode to AUTO and watch the *acquisition count* run-up – with each acquisition, you will have a new *realtime template*. This occurs (is occurring) whether or not the ScopeCorder triggers.

Q17 – Wait a minute - because of the fact that the dynamic realtime template comes from actual test data, can't it contain noise or anomalies and therefore (possibly) trigger upon a normal waveform?
A17 – Yes, the dynamic realtime template waveform can contain noise or anomalies. So, in this case, the Wave Window trigger function *can* compare a flawed waveform (the realtime template) to a nominally good waveform – and a trigger could occur. This can be averaged-out by choosing a Reference Cycle of 2 or 4. A certain number of nuisance triggers can be expected, and is normal; again, this can be minimized by increasing the Reference Cycle number. See the example screenshot below (within answer of next question).

Q18 – How can I tell if this has occurred?
A18 – See the example below:



Q19 – What is the best trigger mode to use with Wave Window?
A19– Wave Window trigger works best with Normal, Single, or Single(N).

Q20 – What is the slowest/fastest trigger rate that I can use with Wave Window?
A20 – 10 kSa/sec, and 500 kSa/sec respectively.

Q21 – What if I want to create a custom realtime template for myself?
A21 – Wave Window trigger does not support this at this time (in this case, please consider Go / No-Go mode on your ScopeCorder. Please obtain and read '*How to Demonstrate Go No-Go Using the DL850.PDF*'). It is important to understand that the Wave Window trigger *realtime template* is dynamic, meaning that it changes with each acquisition, and, in-fact, changes with each trigger event. The *dynamic realtime template* is one of the strengths of the Wave Window trigger feature – it does not simply rely upon amplitude, for example, as a trigger condition.

Q22 – What if I want to retrieve the realtime template data points?
A22 – Wave Window trigger function does not support this at this time; but, here is a suggestion for you which will work in many test applications: If you need this sort of data, you may wish to acquire a few 'Reference Cycles' and add and subtract ½ of your WIDTH adjustment to them to create a ZONE of test waveform datum – do this in post-processing software (this could even be accomplished in an Excel workbook).

Q23 – I setup Wave Window, but it does not appear to be working. What do I do?
A23 – There are several possibilities:

1. First, go back to basics: Start by using the Wave Window trigger on ONE channel only. If you are just learning – use a sine wave;
2. You probably have left trigger mode in Auto or Auto Level. While Wave Window trigger does in-fact work in those modes, you will see that the display does not freeze and hold the most recent acquisition, so you may be led to believe that it is continuously triggering; so, consider setting the trigger mode to NORMAL; from there, you may graduate to SINGLE or SINGLE(N) with this trigger feature.
3. Did you perform the exercise detailed in *'Getting Started with Wave Window Trigger on the DL850.PDF"*? This is the best way to get acquianted with this trigger feature.
4. You may have nuisance triggers due to noise – these can be difficult to see, but make certain the WIDTH adjustment is appropriate (increase WIDTH if you have nuisance triggers and want to have fewer trigger events). If you wish to see the noise – please use ZOOM function. Remember, that ½ the value of WIDTH is the amount of voltage deviation permitted for a non-trigger status on the ScopeCorder.

Q24 – I get trigger events – but I don't see any anomalies.
A24 – Use the ZOOM function and zoom the area under the trigger indicator (the letter "T" at the top of the display graticule). The anomaly is there. If you do not see it there, look in the pre-trigger area for an anomaly; please study Question numbers seventeen and eighteen.

Q25 – My trigger events are sometimes in the wrong place; the events sometimes fall in the pre-trigger area of the display (to the left of the 'T') – what happens & why?
A25 – The realtime template was recorded using the anomaly. When the realtime template (which contains an anomaly) was compared to a normal waveform, the result is a trigger output. This is normal behavior for the Wave Window trigger feature – and cannot be prevented, it is simply the nature of this dynamic trigger.

Q26 – Can't I just keep one realtime template as a static realtime template?
A26 – This is not supported at this time. I would recommend Go / No-Go testing.

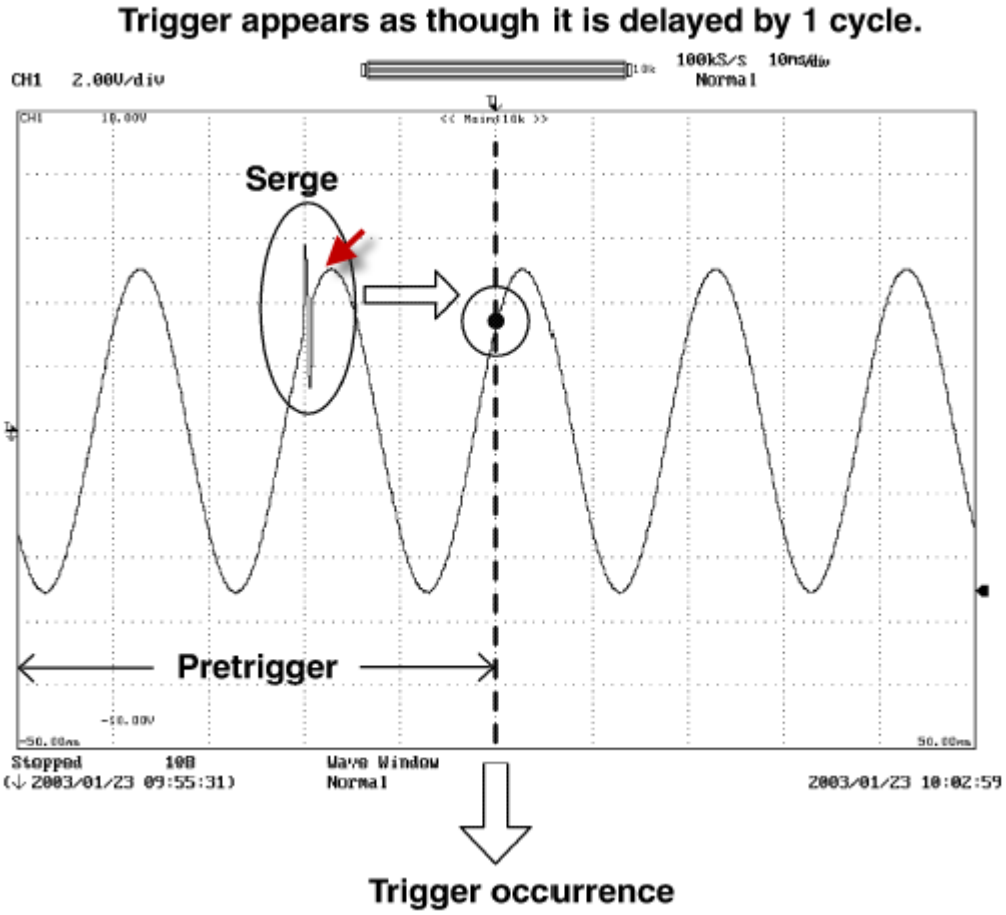
Q26 – I seem to be getting too many trigger events or 'nuisance triggers.
A26 – A number of possibilities:

1. Be sure to use trigger mode NORMAL in order to ascertain that you are experiencing actual trigger events.
2. Investigate your 'nuisance' trigger events using ZOOM window.
3. Adjust WIDTH. Remember that WIDTH is 2X an actual glitch amplitude.
4. Increase Reference Cycles which will average 1, 2, or 4 full-cycles to create one template. Nuisance triggers can occur when your Reference Cycle contains noise.
5. Increase HYSTERESIS – this will make the trigger less susceptible to noise. See 'Setting the Hysteresis' in User Manual (Section 5.5).

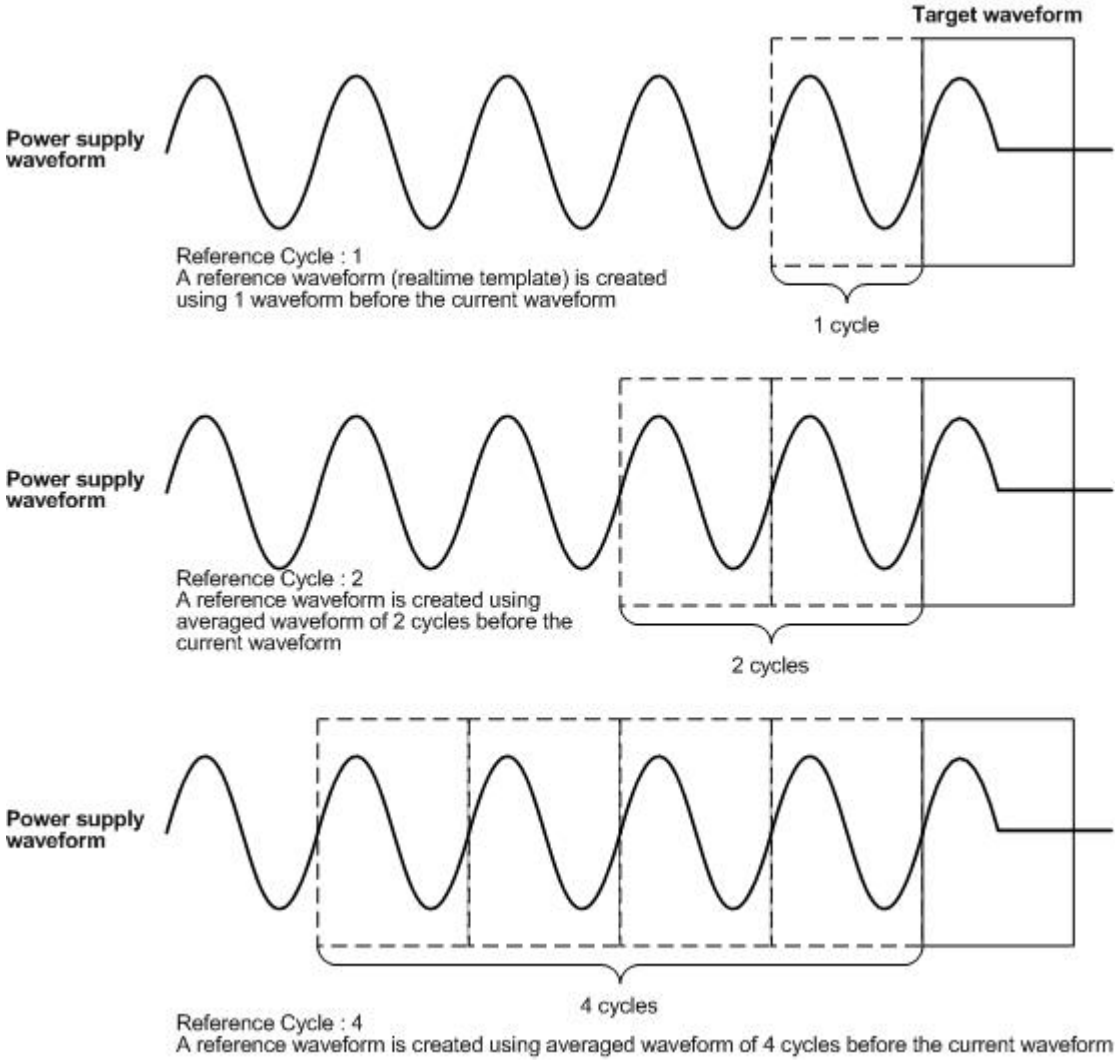
Q27 – I see no triggered events, where do I start?
A27 – To investigate this further, press MANUAL TRIG on the front panel – this will give you a snapshot of what is currently happening.

Q28 – I am certain that I am getting ‘false triggers’, what can I do?
A28 – Study your setup very carefully, you may have a mis adjustment. Create a simple trigger first, verify that they work as planned, and then add more channels or other complexity to it. To explore for trigger conditions – use a ZOOM window and carefully examine your waveform data for faults or glitches.

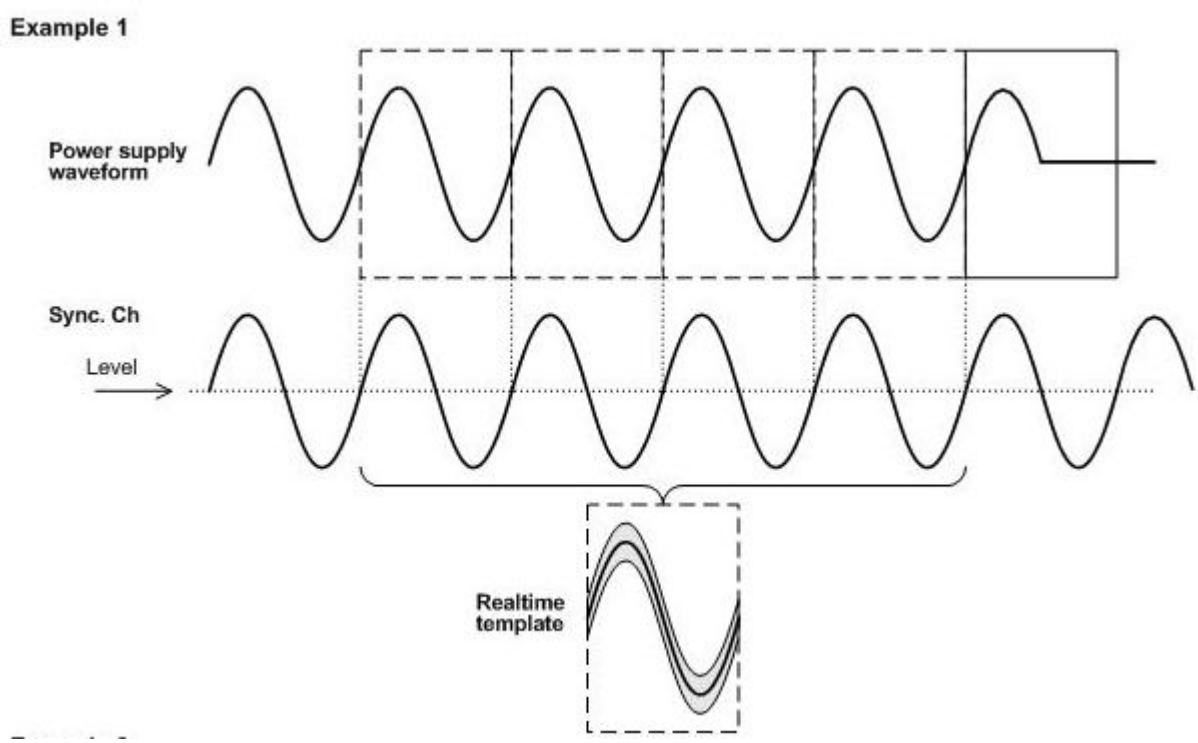
Q29 – I believe that the trigger is delayed with respect to the trigger event, why is that?
A29– The nature of the Wave Window trigger feature is that the trigger point (see letter “T” at top of the display graticule) sometimes delays the actual event by between 0 and 4 cycles. This delay is normal. Keep Reference Cycle to a minimum to decrease the likelihood of this delay. If you feel that you have false triggers – keep this in mind; also, investigate for trigger events using the ZOOM feature – if there is a trigger event, you can find it using ZOOM. See graphic below:



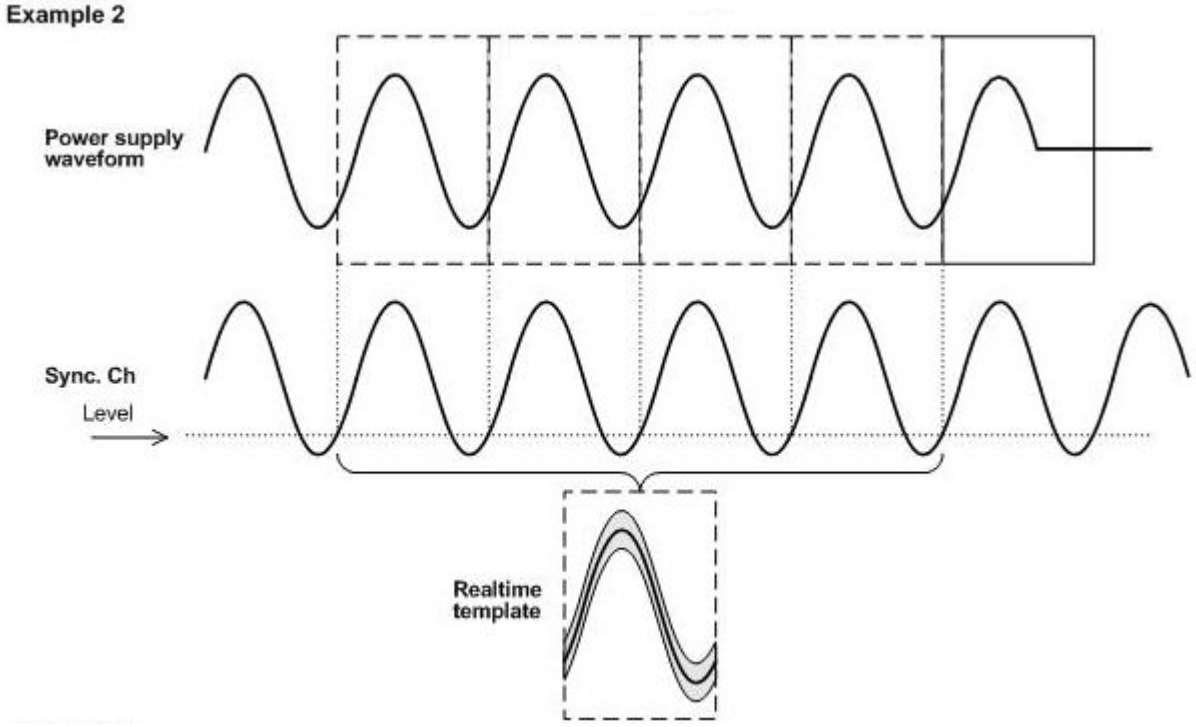
Q30 – Please explain the Reference Cycle number.
A30 – The *Reference Cycle* number is a specification of how many previous waveform cycles are *averaged-together* and then used to create a single, one-cycle *realtime template*. This can be one, two, or four full cycles, which averaged-together, to form one cycle only.
Thus, a *single-cycle realtime template* is continuously and automatically created using the averaged waveforms prior to the current waveform. Please refer to graphic figure below.



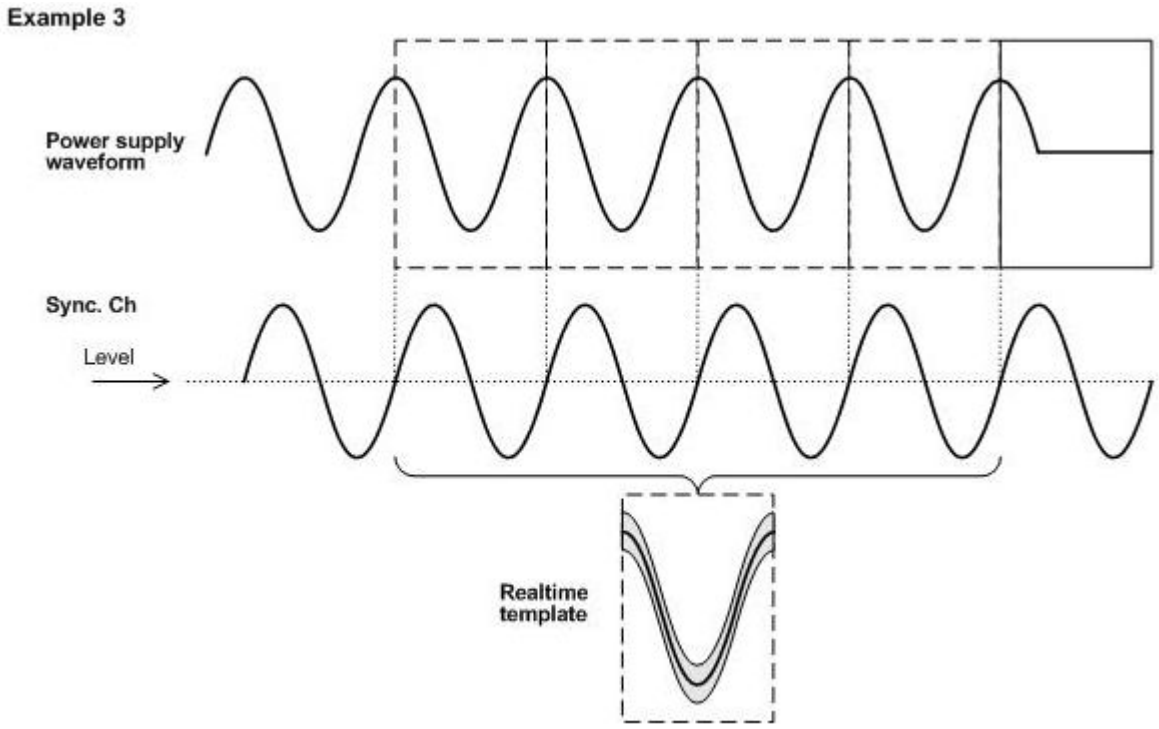
Q31 – Please give an example of Sync Channel Level:
A31 – Sync Channel Level is the absolute voltage or current value within a cycle which determines the “beginning” of either a single cycle or that of multiple cycles (up to four) – to be captured as a realtime template. In the Example 1, below, the Sync Level is ½ of the peak-to-peak value (which could be zero)The waveform determination start point will vary with the synchronization channel and level. The Sync Channel level is 1/2 the peak-to-peak value of the Sync. Channel. The reference cycle is 4 in this example. Please note that in this case, the Sync Channel and the Power Supply waveform channel are not the same. The end-result is *one realtime template.*



Q32 – Please give another example of Sync Channel Level:
A32 – See example below. The waveform determination start point will vary with the synchronization channel and level. The level is lower than the previous example. The reference cycle is 4. Please note that in this case, the Sync Channel and the Power Supply waveform channel are not the same.



Q33 – Please give one more example of Sync Channel Level:
A33 – See example below. The waveform determination start point will vary with the synchronization channel and level. In this case, the waveform on the snyc channel and the power supply waveform channel are not the same – they are out of phase with one another. The reference cycle is 4. Please note that in this case, the Sync Channel and the Power Supply waveform channel are not the same the same channel; they are not in-phase with one another. If the two waveforms happen to be "slipping" past one another due to phase differences, then the realtime template will be quite different as a function of the phase difference between the two channels.



Q34 – Please show some screenshots of the Wave Window trigger feature.
A34 – Example follows.

Q35 – Please show some screenshots of the Wave Window trigger feature.
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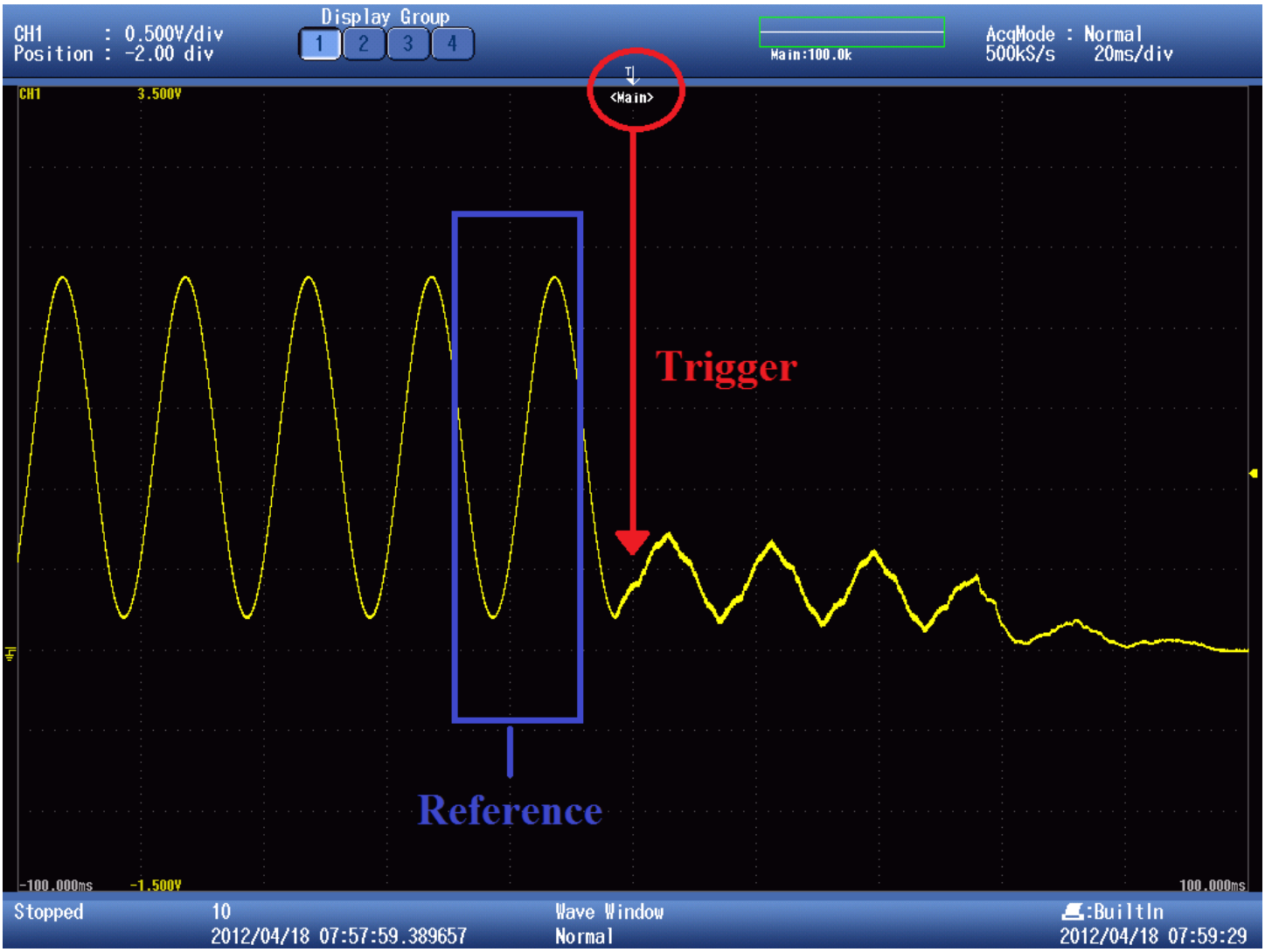

Q36 – Please show some screenshots of the Wave Window trigger feature.
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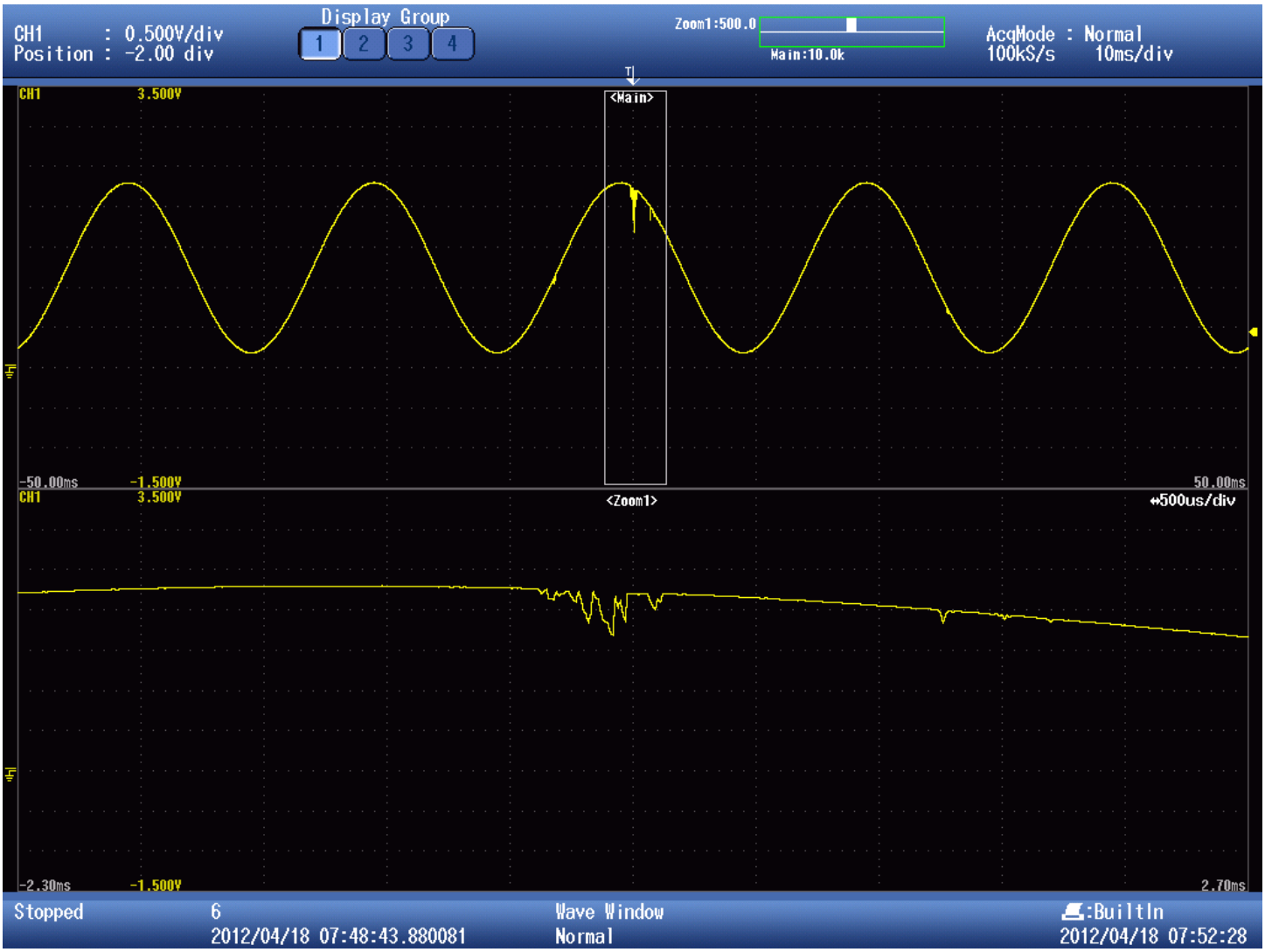

You have reached the end of the Wave Window FAQ.