Application Note: Triggering

Events

The last trigger delay mode available in the ScopeMeter is EVENTS. It actually involves two signals. The first signal will be the master trigger, while the second signal will be the event count. The master trigger switches the unit to a binary mode based on the input. We select TRIGGER and choose EXT as the trigger source and choose between two voltage levels, 0.2V or 2V. The +SLOPE or -SLOPE selects the slope for the events on channel A. Now we push TRIGGER again, select DELAY and EVENTS. We can tell the instrument to hold off displaying the waveform until a certain number of events have occurred after the main external event. We can tell the instrument what the screen would look like after changing an EXT trigger source. Once the external signal is selected, delay by EVENTS can be enabled. This is perhaps the most difficult of triggering applications, but may be the only way to acquire certain signals.

Summary

Triggering involves very simple electrical concepts applied in a very artful manner to the application under study. In its most simple form, we choose a source, a level, and a slope. This is not always the case. Many times when we have to select the proper trigger, we have to be more complex in our trigger design. In this case, we need a more advanced trigger scheme. From delay by TIME, N-CYCLE, or EVENTS, the only solution. If a waveform is asynchronous, we need some combination of advanced delay modes to be used. This is an extremely difficult waveform analysis. We need an external trigger. This can be used in many applications where a waveform is asynchronous. In this case, we need to be able to use an external event to trigger the instrument. This is perhaps the most difficult of triggering applications, but may be the only way to acquire certain signals.

The answer is both! If a general purpose oscilloscope is used, the answer is very basic. In most instances the oscilloscope is used as a camera. When we point the camera at a subject, we take a picture. However, the oscilloscope is not a camera. Instead, it is a device that can capture and display a waveform.

The key to successful triggering is practice. Oscilloscopes are general purpose tools used in a wide variety of applications. What works in one instance will most likely not work in the next. With time and experience, the most difficult of applications will become simply another trick learned.
Here we are using the shutter button to capture a single event. Since the shutter is opened, the waveform will be captured as soon as it crosses a certain level. The level is set on the instrument and can be adjusted for delay. In this case, we used the default setting of 1.0V. The waveform is captured when it crosses this level, and the display will be frozen.

Trigger Delay
Delay is an important feature that can be used to trigger on a specific part of a waveform. The delay is the amount of time that occurs before the trigger event. The delay can be set to be either pre or post trigger. Pre trigger delay is the amount of time that occurs before the trigger event, and post trigger delay is the amount of time that occurs after the trigger event.

In Figure 4 we have modified our setup. Instead of setting the pre-trigger level to zero, we set it to a higher level of 1.4V. We set the trigger level to 1.0V and take a picture. What happens? Since the waveform has three occurrences of each trigger event before the trigger event, we can see three cycles of the waveform in figure 4.

N-Cycle
Since the waveform has three occurrences of each trigger event before the trigger event, we can see three cycles of the waveform in figure 4. This is a very powerful feature that can be used to capture complex waveforms. The N-Cycle feature can be used to capture waveforms that are not completely in sequence. For example, if we were trying to capture the exact waveform and capture it at a specific time, we could use the N-Cycle feature to capture the waveform at a specific time.

By trial and error, we can increase or decrease the delay to obtain the exact waveform and capture it at a specific time. The delay can be set to be either pre or post trigger. Pre trigger delay is the amount of time that occurs before the trigger event, and post trigger delay is the amount of time that occurs after the trigger event.
Why is triggering so important? Мost electrical signals are active for a much longer period of time than we can see on the screen. If we try to look at the signal with an oscilloscope, we see a line that is a single cycle. To look at this signal, we must use a trigger in our oscilloscope. We must use a trigger to stop the display for an oscilloscope to show the waveform. The trigger is the exact moment to look at the waveform. If we use a trigger, we will see the correct waveform. If we do not use a trigger, we will see a single cycle.

The level is the exact moment to trigger. If we use no trigger, we will see a single cycle. The level is a trigger level. If we use too low or too high of a level, we will not see the waveform. If we use the correct level, we will see the waveform. We can use the trigger to stop the display. We can use the trigger to stop the wave from the scope. If we use the trigger, we will see the waveform. If we use no trigger, we will see a single cycle.

Trigger Delay
If we use a trigger delay, we can select the exact moment for the scope to start the capture. The trigger delay is the amount of time between the trigger event and the start of the capture. The trigger delay is always in cycles. The trigger delay is always in cycles. The trigger delay is always in cycles. The trigger delay is always in cycles.

Advanced Delay
When we use an advanced delay, we can use the trigger to set the delay. We can use the trigger to set the delay. We can use the trigger to set the delay. We can use the trigger to set the delay.

N-CYCLE
The scope meter has two additional solutions. First, we can use a trigger to set the delay. The second is the trigger delay. The second is the trigger delay. The second is the trigger delay. The second is the trigger delay.
The level is the exact moment to trigger. Since no digital oscilloscope has a digital level, the level is simply a memory. For the Fluke ScopeMeter, we can choose channel 1 or 2 for the source, a completely separate external event. The level can be adjusted anywhere in the display area. By using the pulse in Figure 1, let us visually describe the trigger event. First, we would tell the instrument to use channel A as a source because this is where the signal is coming from. Since the signal is zero for pulse-some time, we want to capture when it goes above zero. The signal level is LV, and decide we are interested in the rising portion only as the level. In Figure 2 and 3, we show how the signal is played. Initially, the signal went up to LV, and we notice the rising slope. For Figure 2 and 3, we aim to trigger on the negative slope. The ScopeMeter ignores the signal at LV 0, and decides we are interested in the falling portion only as the level. The level is LDF, and we select the negative slope. In Figure 2, we want the instrument to trigger just as in the earlier examples and the results come out the same. By selecting the LV 1, we get a completely different screen. The ScopeMeter is triggered on the rising slope, and the level is 1 V. For example, if we select the LV 2, the screen will be unstable. What is the solution to this problem?

**Trigger Delay**

Later it was mentioned that we would want to capture a waveform in the middle of the display. This is a very powerful capability the user will get with the digital oscilloscope versus the analog scope. Because we have a memory to store captured waveforms, the user can get a picture of the waveform at any time after the trigger event occurred. The Trigger Delay allows for a delayed time when the trigger occurs upon the waveform. If we push + DELAY the screen will appear stable, but at other times they may be unstable. At times they may not trigger very well. At times they run across waveforms that just will not trigger. A common occurrence is seen when trying to capture Digital signals. Often we have a memory to put the trigger at the end of the waveform. The ScopeMeter will not trigger upon the square wave, and the new feature will allow the user to enter a choice of delay. This waveform would be highly unstable. What is the solution to this problem?

**N-CYCLE**

The problem is the exact moment to trigger. Since no digital oscilloscope has a digital level, the level is simply a memory. For the Fluke ScopeMeter, we can choose channel 1 or 2 for the source, a completely separate external event. The level can be adjusted anywhere in the display area. By using the pulse in Figure 1, let us visually describe the trigger event. First, we would tell the instrument to use channel A as a source because this is where the signal is coming from. Since the signal is zero for pulse-some time, we want to capture when it goes above zero. The signal level is LV, and decide we are interested in the rising portion only as the level. In Figure 2 and 3, we show how the signal is played. Initially, the signal went up to LV, and we notice the rising slope. For Figure 2 and 3, we aim to trigger on the negative slope. The ScopeMeter ignores the signal at LV 0, and decides we are interested in the falling portion only as the level. The level is LDF, and we select the negative slope. In Figure 2, we want the instrument to trigger just as in the earlier examples and the results come out the same. By selecting the LV 1, we get a completely different screen. The ScopeMeter is triggered on the rising slope, and the level is 1 V. For example, if we select the LV 2, the screen will be unstable. What is the solution to this problem?

**Triggering**

The term is used to describe the moment to trigger. Since no digital oscilloscope has a digital level, the level is simply a memory. For the Fluke ScopeMeter, we can choose channel 1 or 2 for the source, a completely separate external event. The level can be adjusted anywhere in the display area. By using the pulse in Figure 1, let us visually describe the trigger event. First, we would tell the instrument to use channel A as a source because this is where the signal is coming from. Since the signal is zero for pulse-some time, we want to capture when it goes above zero. The signal level is LV, and decide we are interested in the rising portion only as the level. In Figure 2 and 3, we show how the signal is played. Initially, the signal went up to LV, and we notice the rising slope. For Figure 2 and 3, we aim to trigger on the negative slope. The ScopeMeter ignores the signal at LV 0, and decides we are interested in the falling portion only as the level. The level is LDF, and we select the negative slope. In Figure 2, we want the instrument to trigger just as in the earlier examples and the results come out the same. By selecting the LV 1, we get a completely different screen. The ScopeMeter is triggered on the rising slope, and the level is 1 V. For example, if we select the LV 2, the screen will be unstable. What is the solution to this problem?

**Triggering**

The term is used to describe the moment to trigger. Since no digital oscilloscope has a digital level, the level is simply a memory. For the Fluke ScopeMeter, we can choose channel 1 or 2 for the source, a completely separate external event. The level can be adjusted anywhere in the display area. By using the pulse in Figure 1, let us visually describe the trigger event. First, we would tell the instrument to use channel A as a source because this is where the signal is coming from. Since the signal is zero for pulse-some time, we want to capture when it goes above zero. The signal level is LV, and decide we are interested in the rising portion only as the level. In Figure 2 and 3, we show how the signal is played. Initially, the signal went up to LV, and we notice the rising slope. For Figure 2 and 3, we aim to trigger on the negative slope. The ScopeMeter ignores the signal at LV 0, and decides we are interested in the falling portion only as the level. The level is LDF, and we select the negative slope. In Figure 2, we want the instrument to trigger just as in the earlier examples and the results come out the same. By selecting the LV 1, we get a completely different screen. The ScopeMeter is triggered on the rising slope, and the level is 1 V. For example, if we select the LV 2, the screen will be unstable. What is the solution to this problem?

**Triggering**

The term is used to describe the moment to trigger. Since no digital oscilloscope has a digital level, the level is simply a memory. For the Fluke ScopeMeter, we can choose channel 1 or 2 for the source, a completely separate external event. The level can be adjusted anywhere in the display area. By using the pulse in Figure 1, let us visually describe the trigger event. First, we would tell the instrument to use channel A as a source because this is where the signal is coming from. Since the signal is zero for pulse-some time, we want to capture when it goes above zero. The signal level is LV, and decide we are interested in the rising portion only as the level. In Figure 2 and 3, we show how the signal is played. Initially, the signal went up to LV, and we notice the rising slope. For Figure 2 and 3, we aim to trigger on the negative slope. The ScopeMeter ignores the signal at LV 0, and decides we are interested in the falling portion only as the level. The level is LDF, and we select the negative slope. In Figure 2, we want the instrument to trigger just as in the earlier examples and the results come out the same. By selecting the LV 1, we get a completely different screen. The ScopeMeter is triggered on the rising slope, and the level is 1 V. For example, if we select the LV 2, the screen will be unstable. What is the solution to this problem?

**Triggering**

The term is used to describe the moment to trigger. Since no digital oscilloscope has a digital level, the level is simply a memory. For the Fluke ScopeMeter, we can choose channel 1 or 2 for the source, a completely separate external event. The level can be adjusted anywhere in the display area. By using the pulse in Figure 1, let us visually describe the trigger event. First, we would tell the instrument to use channel A as a source because this is where the signal is coming from. Since the signal is zero for pulse-some time, we want to capture when it goes above zero. The signal level is LV, and decide we are interested in the rising portion only as the level. In Figure 2 and 3, we show how the signal is played. Initially, the signal went up to LV, and we notice the rising slope. For Figure 2 and 3, we aim to trigger on the negative slope. The ScopeMeter ignores the signal at LV 0, and decides we are interested in the falling portion only as the level. The level is LDF, and we select the negative slope. In Figure 2, we want the instrument to trigger just as in the earlier examples and the results come out the same. By selecting the LV 1, we get a completely different screen. The ScopeMeter is triggered on the rising slope, and the level is 1 V. For example, if we select the LV 2, the screen will be unstable. What is the solution to this problem?
Triggering

Events

The last trigger delay mode available in the ScopeMeter is EVENTS. This actually involves two signals. The first signal will be the master trigger, while the second signal will be the event count. The master trigger can be either a single trigger or a delay trigger. For a single trigger, select TRIGGER and choose EXT as the trigger source. Then choose a voltage level, 0.2V or 2V. The +SLOPE or -SLOPE selects the slope for the master trigger.

Once the external trigger is selected, delay by EVENTS can be enabled. This is perhaps the most difficult of triggering applications, but may be the only way to acquire certain signals.

Summary

Triggering involves very simple electrical concepts applied in a very artful manner to the application under study. In its most simple form, we choose a source, a level, and a slope. There are many times when more advanced delay modes will be needed. If an extremely difficult waveform is under analysis, an external trigger may be used. In many applications where a waveform is asynchronous, such as a data line in a computer, an external synchronous trigger will be needed. In the case of a data line, a read or write enable could be used.

The key to successful triggering is practice. Oscilloscopes are general purpose tools used in a wide variety of applications. What works in one instance will most likely not work in the next. With time and experience, the most difficult of applications will become simply another trick learned.

Figure 13. Missing Pulse

Figure 14. EXT Source
Events
The last trigger delay mode avail-
able in the ScopeMeter is EVENTS. This actually involves two signals. The first signal will be the master trigger, while the second signal will be the event count. The master trigger will be selected via the binary jacks located on the rear. We want TRIGGER and choose EXT as the trigger source and choose between two voltage levels, 0.2V or 2V. The +SLOPE or -SLOPE will select the slope of the events on channel A. Now we push TRIGGER again, select DELAY and EVENTS. We can tell the instrument to hold off displaying the waveform until a certain number of events have occurred after the main external event. Now we can select what the screen would look like after choosing an EXT trigger source.

Summary
Triggering involves very simple electrical concepts applied in a very artful manner to the application under study. In its most simple form, we choose a source, a level, and a slope. This is done many times when we automatically select the proper trigger. You may run across a situation that requires a more complex trigger scheme. Here delay by TIME, N-CYCLE, or EVENTS may be the only solution. If a waveform is asynchronous, some combination of advanced delay modes will be needed. If an extremely difficult waveform is under analysis, an external trigger may be used. In many applications, when a waveform is asynchronous, an external trigger can be used. In the case of a data line, a read or write enable could be used. The key to successfully triggering in practice is practice. Oscilloscopes are general purpose tools used in a wide variety of applications. The key will be to practice and experience. The most difficult of applications will become simply another trick learned.

The answer is both! For a general purpose oscilloscope, the science is very basic. The key to successfully triggering is the art of applying the sci-
ence. To use a common analogy, the osteoporosis is very much like a camera. When we point the camera at a subject, unless our eyes, it records nothing until the shutter button is pushed. Our eyes, on the other hand, are constantly recording the subject until the shutter is closed. The event (or trigger) is simply the “shut-
ing” of the eye. The eye becomes very stable. Once the eye is removed, we can combine delay by TIME and N-CYCLE to repetition. The eye-

Figure 13. Missing Pulse

Figure 14. EXT Source