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Cross-Trigger Two Oscilloscopes To Create A Delayed-Sweep Display

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ED Online ID #2320
[June 10, 2002](#)

Many oscilloscopes lack a delayed-sweep function. Plus, because typical users only occasionally require this simpler, more adaptable methods are worthwhile. Cross-triggering two standard oscilloscopes produces both delayed-sweep displays. This arrangement also grants designers certain advantages over purchasing a spe trace oscilloscope with delayed sweep.

For one, it comes at much lower cost, particularly if two single-trace scopes are already available—including higher bandwidth than the dual-trace unit. Additionally, this double-beam system offers both main and delay traces on every shot, an essential feature for single-shot work. In contrast, the dual-trace unit supplies only c traces, alternately.

Also, the gate output, G, may easily be used as a delayed-pulse generator to trigger or probe a DUT at vario timing and resulting outputs clearly displayed. Finally, other delayed scopes can be triggered from the ramp to monitor additional circuit details. Modern oscilloscopes don't generally feature the required outputs.

Neither oscilloscope needs the delayed-sweep function, but both should contain triggered-sweep and input c entire signal display. Furthermore, one should have a time-base ramp output, T, and a Z-input for beam-inter modulation by gate output G ([Fig. 1](#)).

Alternatively, a second channel may be used to display G and identify the delayed-sweep interval. A third me be to add the gate G to the input, V_{IN} , so that G shows as a displacement on the display, using a simple resi averaging network to form the sum.

A 10-MHz Philips PM3230 (main) and a 15-MHz Tektronix 515A (de-layed) were implemented for these test tandem delayed-sweep system, input V_{IN} is connected to both 1-M Ω oscilloscope inputs (In). However, depe source impedance, one or both may be connected via a 10 \times , low-capacitance probe, or 50- Ω terminated cat

First, the "Main" scope triggers, either by V_{IN} or some suitable external trigger, and its trace displays V_{IN} . So synchronized ramp output, T, triggers the delayed scope via its external trigger input, E. The system's trigger (LEV) determines the point on the ramp where triggering occurs.

Thus, arbitrary adjustment of this LEV knob controls the second display's start delay, which may be chosen c main-display range. Duration of each scope's display is adjusted in the usual manner, using their time/divisio shown).

The gate output, G, is simply the unblanking pulse generated within the delayed scope. This can readily be a main scope's unblanking pulse by connecting it to its Z input. If G is too strong, an ordinary 10 \times (or 5 \times) low-c probe may be used for the connection, rather than a coaxial cable. The augmented main beam will accuratel the delayed-display interval, as shown on the PM3230 display.

This basic arrangement works very well. Yet, the delayed display exhibits jitter on fast transitions from the cc the signal's own jitter, ramp T fluctuations, and trigger comparator at E. The latter two may be eliminated by i at any constant phase of the 60-Hz power frequency. This procedure always eradicates power-supply ripple

Further illustrating this point: If V_{IN} is a fast pulse triggered at a slight offset frequency, like 61 Hz, a low-jitter actually meander to-and-fro on the delayed display, at the difference frequency of 1 Hz. Precisely at 60 Hz, t freezes.

To examine a fast transition at higher repetition rates, the transition must be retriggered after the delay. Most delayed-sweep units can do that. The optional passive averaging network in [Figure 2](#) provides just such a de trigger function. If ramp T and the V_{IN} transition have equal polarity, then by tuning the LEV knob, E can relia delayed scope on that transition—excluding all others. On the other hand, when they're of opposite polarities be inverted before the adding network by an inversion transformer or amplifier.

This network was first tested using a 2-kHz squarewave for V_{IN} to determine the optimum compensation cap of 56 pF. The process is analogous to tuning a low-capacitance probe. To display the resultant E while it ext triggers the delayed oscilloscope, employ a 1-pF, 100-M Ω low-capacitance probe. If plugged into the Tek 51 any other 1-M Ω scope, this 100 \times attenuation probe will show the V_{IN} signal added to the ramp, while triggerri desired transition at E. After plugging in V_{IN} , the 515A will display any transition reliably and clearly, with no μ jitter.

READER COMMENTS:

Paco - Excellent! I was looking for a way to regenerate my laser's clock signal to produce a synchronous TTL signal. After readir got the idea of using the scope's gate output. It just might work

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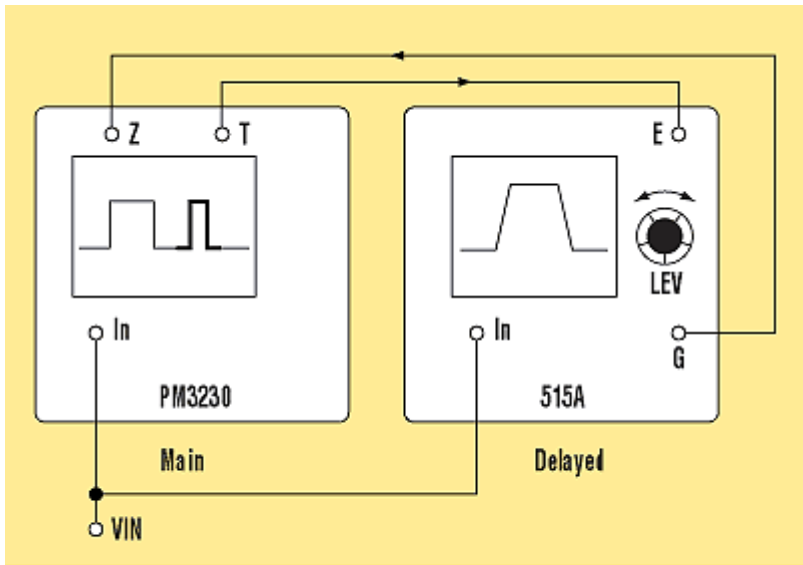
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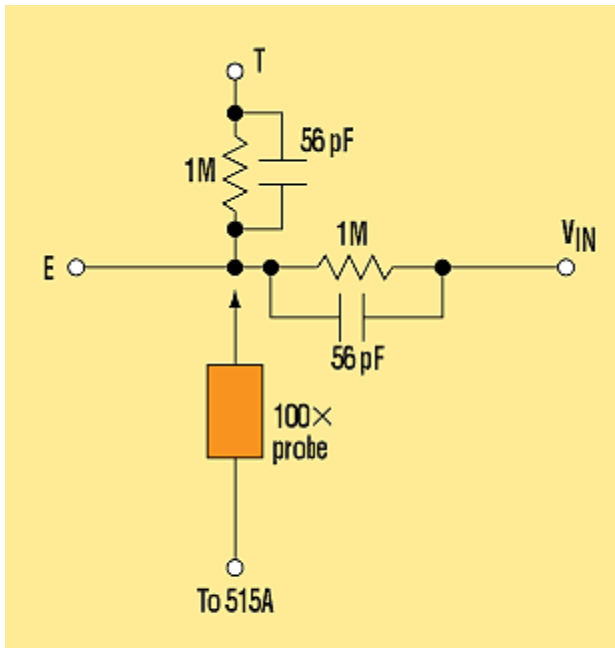
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1. Properly connected, tandem oscilloscopes create a highlighted main display and a delayed-sweep display. The trigger level (LEV) controls the delay.



2. An optional passive network adds V_{IN} to the main scope's ramp, T, producing a delay-qualified trigger at E.