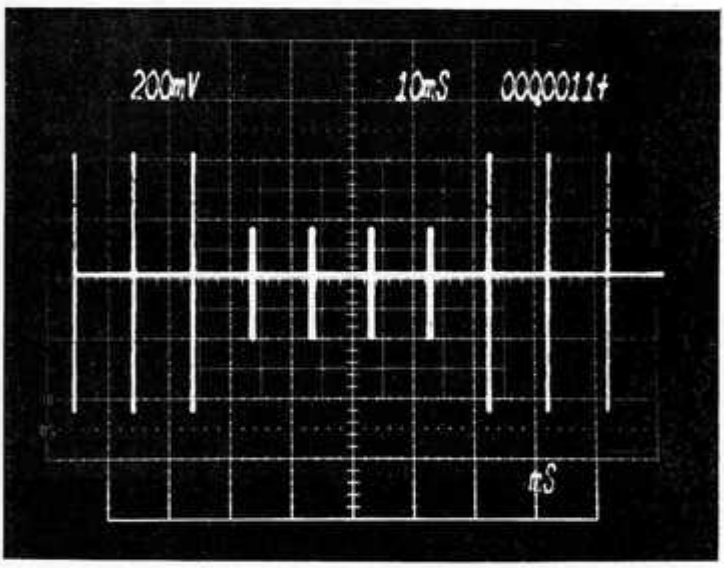
Viewing Fast Transitions at Slow Sweep Speeds



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Viewing Fast Transitions at Slow Sweep Speeds

Application:

In mechanical systems, often there are signals which have fast transitions, narrow pulse widths and occur at low rep-rates. Such signals are difficult to view in their entirety. Consider the ignition system for an 8-cylinder automobile engine. To examine the firing potential for each of eight spark plugs over a complete cycle, a relatively slow sweep rate must be used. A storage scope is often used to eliminate flicker and enhance the display.

Measurement Problem:

At slow sweep rates, in order to capture the fast spikes, a high level of beam intensity is necessary. This high intensity will often cause blooming at the baseline. In many cases, this will sacrifice valuable information as well as display quality.

The System:

But now, with the combined flexibility of a plug-in scope and the 7834's high writing speed, a solution is available. The writing speed alone provides considerable improvement over most storage scopes, but the plug-in capability makes the 7834 system far superior to others. The 7000-Series Plug-in Line avails the user to create a system tailor-made to suit his specific needs.

The system shown in the figure will capture fast transitions at slow sweep rates without troublesome and annoying blooming. Here the user may control the display intensity of the spike independent of the baseline's display intensity. The heart of the system is the 7D11 Digital Delay Unit. The 7D11 triggers on the transitions and generates a pulse, DELAY INTERVAL OUT, of selectable width which is used to drive the EXTERNAL Z-AXIS of 7834. This produces an increase in beam intensity for the length of this pulse.

The duration of the intensified zone is selected by the DELAY TIME knob of the 7D11. The CRT readout indicates this time in milliseconds. Because of propagation delays and response of various components of the system, the generated intensity zone begins approximately 45 nanoseconds after the 7D11 is triggered. In many cases this presents no difficulty. However, an external delay line may be constructed and added to delay the display by 45 nanoseconds more than the trigger signal.

The 7D11 may be triggered internally or externally as often as every 600 nanoseconds. Therefore, if the spikes occur more than 600 nanoseconds apart, all of them can be intensified.

For the systems shown, here are some important performance specifications.

System Performance Specifications

(as shown in the figure)

Z-AXIS PROPAGATION
The intensified zone begins approximately 45 nanoseconds after the 7D11 triggers.

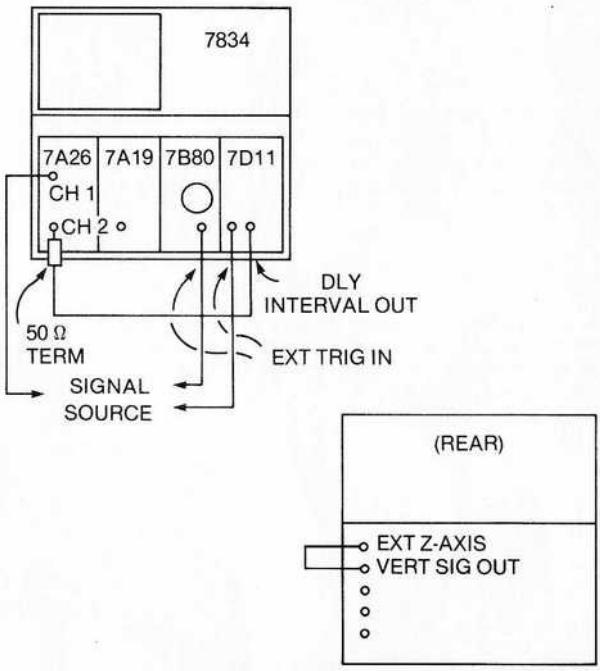
*CYCLE TIME (time between intensified zones)
t_c = 500 nanoseconds minimum

*INTENSITY ZONE DURATION
$t_d \approx$ 100 nanoseconds to 1 second

EXTERNAL TRIGGER SENSITIVITY

7D11 (DC couple)	150 mV (min), DC to 10 MHz
	500 mV (min) to 50 MHz
7B80 (DC coupled)	50 mV (min), DC to 50 MHz
	250 mV (min) to 400 MHz

*Note: Specification is directly limited by the 7D11.



CONTROL SETTINGS

7834
- Vert Mode ..... LEFT
- Horiz Mode ..... A
- Trigger Source,
  - A ..... LEFT VERT
  - B ..... Not Applicable
- Intensity
  - A ..... As Desired
- Storage Mode ..... VP FAST

7A26
- Display Mode ..... CH 1
- Trigger Mode ..... CH 2
- CH 2 Polarity ..... INVERT
- BW ..... FULL
- Sensitivity,
  - CH 1 ..... As Desired
  - CH 2 ..... Approx. 0.5V/div (or as desired)
- Coupling, CH 1 and CH 2 ..... DC

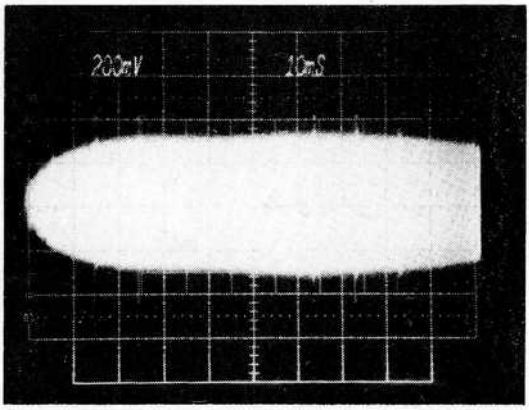
7D11
- B Sweep Mode ..... INDEPENDENT
- Count Mode ..... TIME INT CLOCK
- Fine Delay ..... Zero
- Trigger,
  - Source ..... EXT
  - Coupling ..... DC
- Delay Time ..... As Desired

7B80
- Trigger,
  - Source ..... EXT
  - Coupling ..... DC
  - Mode ..... NORM
- Time/Div ..... As Desired

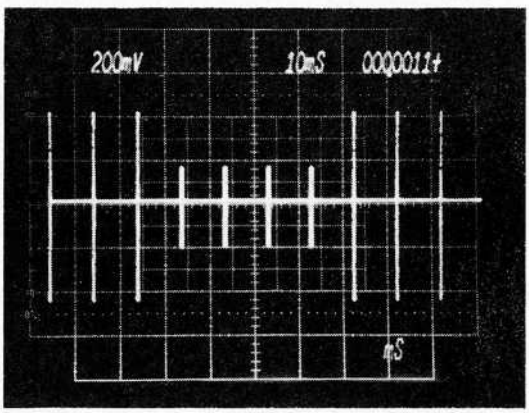
Set Up Description

The diagram of the setup shows that the 7D11 and 7B80 are triggered externally. The DELAY INTERVAL OUT is routed and inverted by CH 2 of the 7A26 through the 7834's SIG OUT (A trigger source) to the EXT Z-AXIS drive. The amplitude of the inverted 7D11's pulse varies the amount of beam intensity. Therefore, the desired contrast ratio is selected by the sensitivity and position settings of CH 2 on the 7A26. Here, the position control functions the same as the A intensity. CH 1 of the 7A26 provides the signal display.

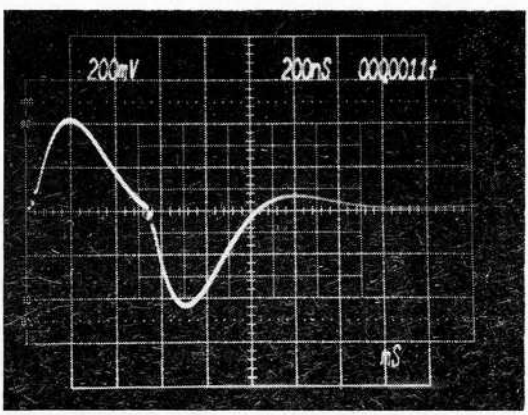
For the best results, FAST Variable Persistence has been used in the photos. Note the dramatic improvement when the 7D11 is controlling the Z-AXIS.



Crt Display without 7D11 control.



Comparison of same signal improved by 7D11 control.



An expanded sweep showing one of the spikes.

Conclusion:

The flexibility and performance of the 7000-Series Plug-in Oscilloscope allows the user to solve difficult measurement problems and permits future expansion as measurement needs arise.

General Performance:

7834

The 7834 Storage Oscilloscope has a stored writing speed of 2500 cm/μs, which enables you to capture single-shot rise times to 1.4 ns, 3.5 cm high, at full reduced scan amplitude. The 7834's mainframe bandwidth is 400 MHz (nonstore). The system bandwidth may vary from 160 MHz to 400 MHz depending on the plug-in selected. This instrument has four storage modes — bistable and variable persistence, FAST bistable and FAST variable persistence.

With the 7A19 Vertical Amplifier, a system bandwidth of 400 MHz (325 MHz @ 10 mV/div) is obtained. The 7B80 will provide up to 1 ns/div sweep rate.

7D11

The 7D11 Digital Delay Plug-in gives stable delayed trigger for measurements requiring low jitter. The 7D11 offers a delay by time or events; a digital delay readout to 7½ digits; a 100 ns to 1 s delay time; 1 ns resolution; less than 2.2 ns jitter and 0.5 ppm (± 2 ns accuracy).

This application, "Viewing Fast Transitions at Slow Sweep Speeds", is yet another illustration of how the 7000-Series Plug-In Oscilloscope enables the user to solve difficult measurement problems.