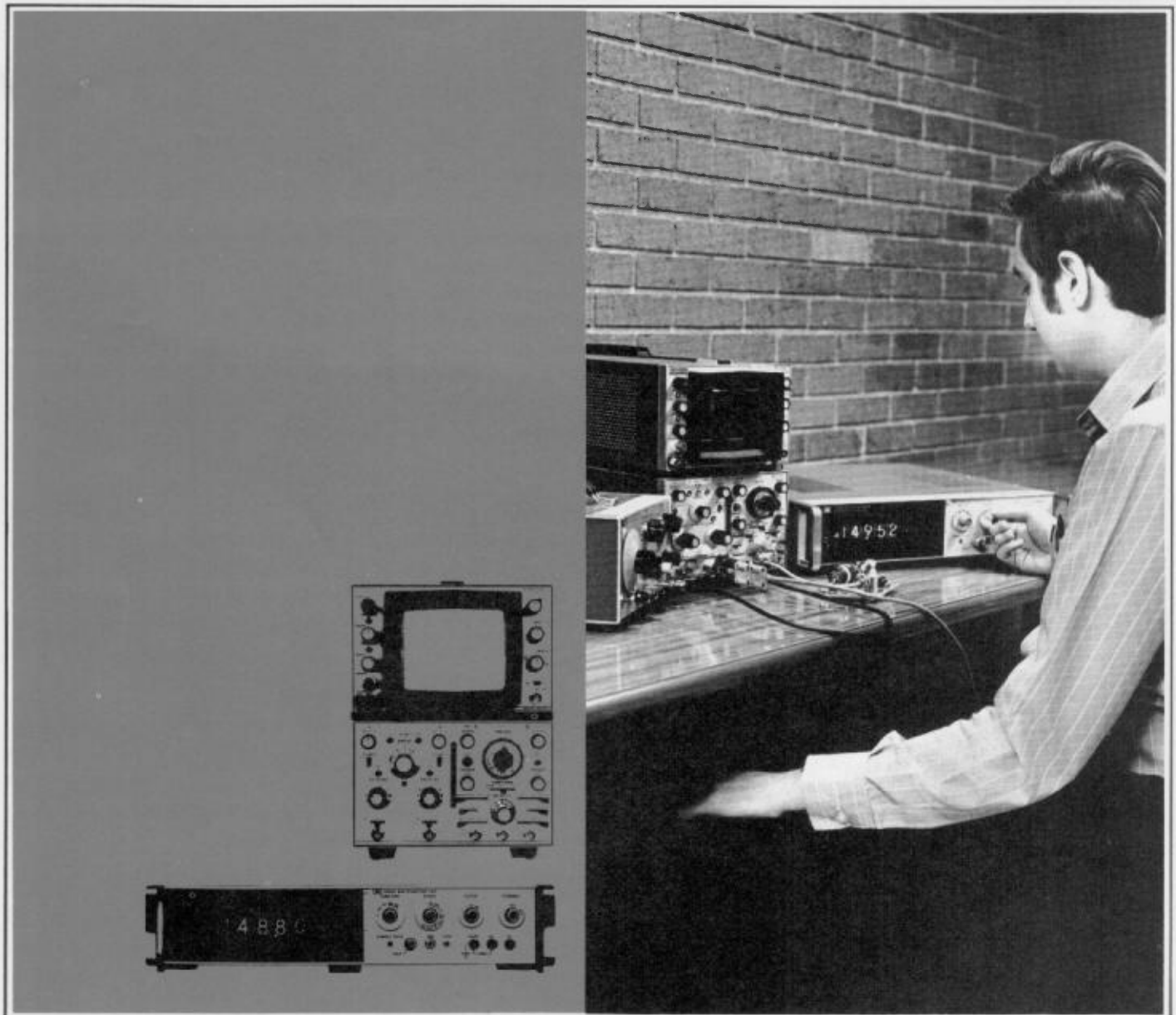


LOW FREQUENCY PULSE AMPLITUDE MEASUREMENTS

using the 3480 DVM and the 180A Oscilloscope



LOW FREQUENCY PULSE AMPLITUDE MEASUREMENTS



Low frequency square wave amplitude measurements being made using the 3480A Multifunction Digital Voltmeter and the 180A Oscilloscope.

The amplitude and flatness of low frequency pulses and square waves may be measured with 4 digit resolution and $\pm 0.02\%$ accuracy using the combination of the HP 3480A/B Multifunction Digital Voltmeter and the 180A Oscilloscope. The amplitude of square waves up to 500 Hz may be measured with this equipment. The flatness of a square wave or pulse may be checked by using the delayed trigger from the 180A Oscilloscope to sample the waveform at any given point.

The reading period of the 3480 DVM is slightly less than 1 ms (including response time to a full scale input). The 3480 DVM has five dc voltage ranges (100 mV to 1000 V full scale) with a basic accuracy of $\pm 0.02\%$ at full scale for 90 days, $25^\circ\text{C} \pm 5^\circ\text{C}$. The 3480 DVM has 4 full digits with a 5th digit for 50% overranging.

The 180A Oscilloscope with an 1821A Time Base and Delay Generator plug-in acts to supply a delayed trigger to the 3480 DVM and as a display. The delayed trigger occurs at the beginning of the delayed sweep which appears on the oscilloscope screen as an intensity modulated segment (See Figure 1).

By using the DELAY control, the DVM's reading period may be moved along the wave shape as indicated by the delayed segment. The length of the intensity modulated segment may be adjusted to 1 ms using the TIME/DIV control thus giving an exact indication where on the wave shape the DVM is beginning and ending its reading period. A block diagram of this setup is shown in Figure 2. The trigger supplied by the 180A Oscilloscope requires an inverting circuit to be compatible with the input levels of the 3480 DVM (see Figure 3). If a more exact representation of the reading period is required, the print command from the 3480 (pin 48 on the BCD connector) may be simultaneously displayed on the oscilloscope (using a dual channel plug-in).

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APPLICATION CONDITIONS

- 950 μ s reading period including response to a full scale change.
- Up to 1000 readings/second (≥ 1 ms between triggers).
- 5 dc ranges; 100 mV to 1000 V full scale; 10 μ V sensitivity in the last digit on the 100mV range.
- $\pm 0.02\%$ basic accuracy, 90 days, 25°C $\pm 5^\circ$ C ($\pm 0.03\%$ on the 100mV range).
- 4-digit resolution with 50% overranging.
- Input: floating and guarded.
- Filter: 3 position (used with filter out for this application).
- Optional functions: true rms ac and ohms (not required for this application).

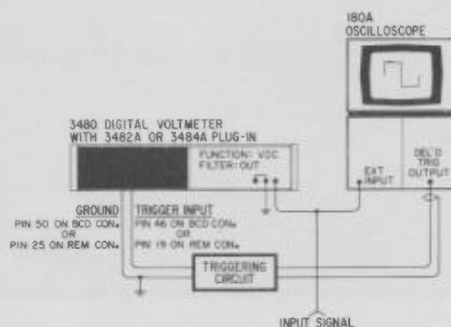
- The duration of the pulse or square wave must be 950 μ s or greater to be included within the 3480's reading period.
- Trigger pulses to the 3480 must have at least 1 ms separation.
- To maintain rated accuracy, the input voltage to the 3480 during its reading period may not change more than 10% of the voltage range/second. For example on the 100mV range, the maximum rate of change is 10 mV/second.*

*The use of an external sample-and-hold circuit can partially overcome this limitation.

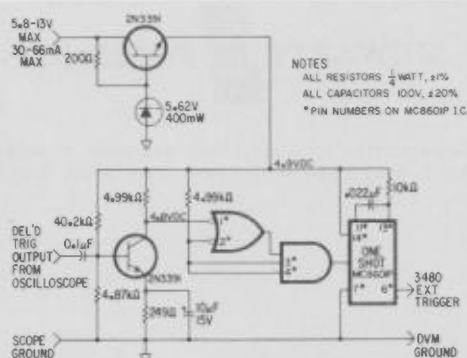
Oscilloscope display of the delayed sweep. The intensity modulated delayed sweep may be calibrated using the TIME/DIV control on the 180A Oscilloscope (or 140A Oscilloscope) to equal 1 ms, the encoding time of the 3480 DVM. The delayed sweep may be moved along the wave shape using the DELAY control on the 180A. This allows the user to check the flatness of a pulse or square wave with 4-digit resolution and $\pm 0.02\%$ accuracy.



Block diagram of low frequency pulse or square wave measuring system. Trigger signals may be supplied to the 3480 via the BCD connector or the remote connector. See Figure 3 for triggering circuit.



Triggering circuit for 3480 DVM using the DEL'D Trigger Output from the 180A Oscilloscope (or 140A Oscilloscope).

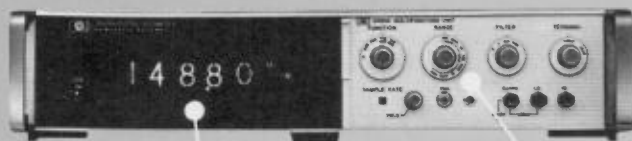


The triggering circuit consists of a one transistor pulse amplifier followed by a one-shot. A transistor regulator is included to stabilize operation from either batteries or an unregulated power supply.

Peak amplitude of the delay trigger pulse from the 180A Oscilloscope or 140A Oscilloscope is approximately 1.5 V. When this pulse is not present, the amplifier is biased to present a constant 4.8V level to the input of the one-shot. A delay trigger pulse saturates the transistor causing the one-shot to trigger on the collector voltage's negative going slope. At this time, the one shot's output falls from 5V to ground for 75 μ s, due to the external RC timing network. The 3480 is triggered by this pulse.

INSTRUMENTATION

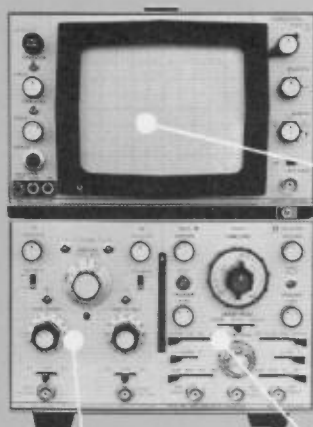
Digital Voltmeter:



3480B (full rack width)
or 3480A (1/2 module)

3484A Multifunction Unit
(3482A DC Range Unit may also be used)

Oscilloscope:



Note: a 140A Oscilloscope with a 1421A
Time Base and Delay Generator may
also be used for this application.

180A (modular cabinet)
or 180AR (full rack width)

1821A Time Base and Delay Generator

1801A Dual Channel Vertical Amplifier



For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181
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