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TEKSCOPE

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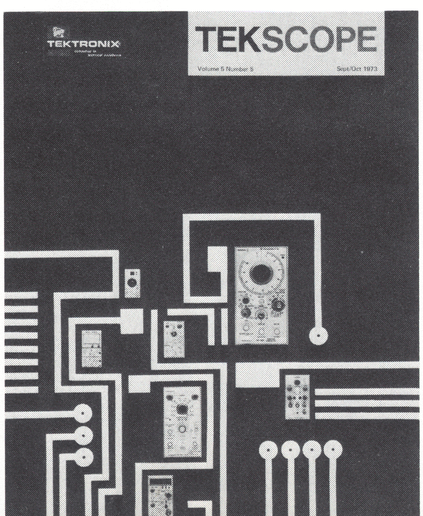
Cover: Some of the newest members of the TM 500 family are pictured on the front cover. It's a distinguished family that includes counters, multimeters, power supplies, signal sources, signal processors, and CRT monitors, with more on the way.



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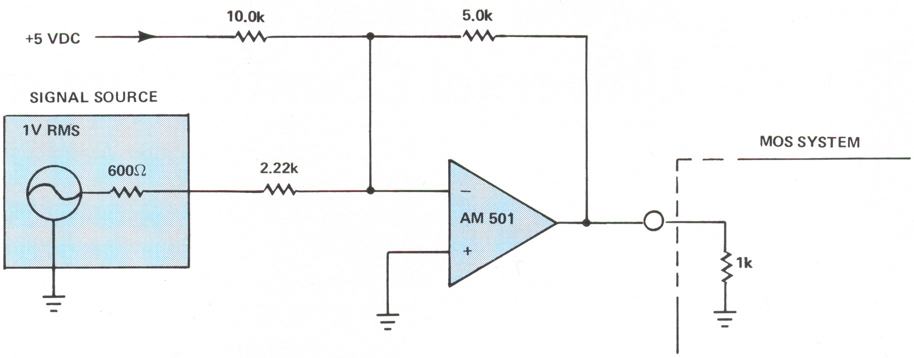
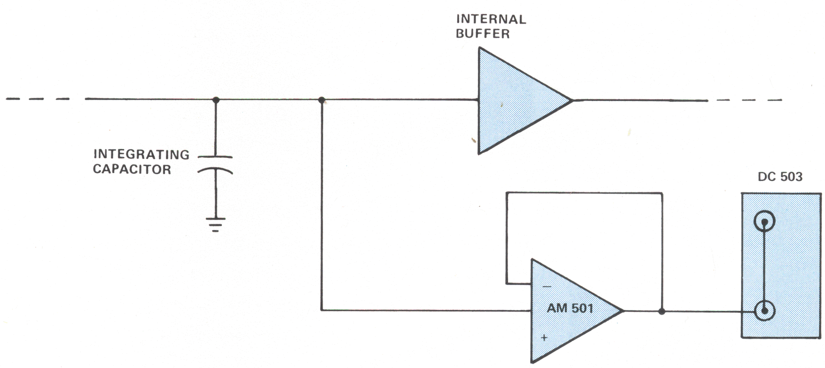
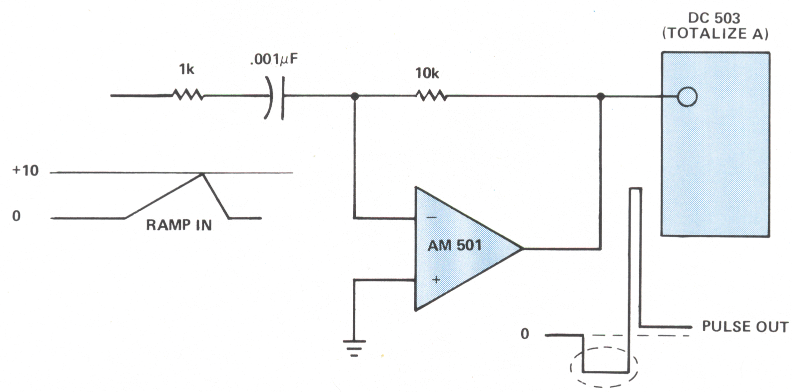


Problem 1.—A sinewave source needs to be clocked into an MOS system. The amplitude is insufficient (one volt RMS behind 600 Ω) and the DC level is wrong (centered at ground). The signal has to swing between zero and at least five volts minus.
Solution—Interface the signal with an AM 501 connected as a summing amplifier. Introduce the necessary offset by summing the signal with a DC voltage from a power supply.



Problem 2. You want to connect the signal on an integrating capacitor to a time-interval meter (TIM). The signal amplitude is several volts, and only a few nanoamps of load current can be tolerated; the one megohm input impedance of the TIM is too low. The circuit under test has an internal buffer, but it shifts the DC level to an unsuitable value. Capacitive coupling will introduce signal aberration or excessive load current.
Solution—Interface the signal with an AM 501 connected as a follower. Input current is less than one nanoamp at room temperature; output signal is nearly identical to input signal.



Problem 3. A system generates ramps at random intervals. The ramps are of uniform amplitude, but are of two different durations. You want to count the number of fast ramps only, which occur in one hour. Both ramps have a 10 V amplitude; the slow ramp has a duration of 50 μsec and the fast ramp lasts 10 μsec.
Solution—Using the AM 501, differentiate the ramps so that only the fast ramp generates an output voltage adequate to trigger the counter.

To properly contrast the improvements available, let's first consider typical calibration practices now in use. In many facilities, procedures for calibration of test instruments involve physically collecting the instruments from their usage points and transporting them to the metrology lab. This collection and transportation involves the risk of physical damage in handling and the loss of use of the instrument for at least a few days. The instruments are, of course, turned off during transportation and while awaiting calibration. They thus are cooled down and then warmed up again in the calibration facility. If the time allowed for thermal stabilization in the cal lab is inadequate, if the lab ambient temperature is different than that at the usage point, or if the room ambient is the same but the immediate thermal environment is different (as when a normally rackmounted instrument is removed from a factory test station and calibrated on an open bench), a less than ideal situation prevails. While the instrument is normally specified for operation over a reasonably wide temperature range, best accuracy is achieved if the thermal environments are identical for calibration and actual use.

Following the stabilization period, the instrument performance is usually verified before calibration takes place. This practice is particularly useful in determining whether calibration intervals should be lengthened or shortened. With conventional calibration equipment, verification requires both visual interpolation and calculation. The calibration technician sets his time mark generator or standard amplitude calibrator to the appropriate range and reads the deviation of the resultant display from the scope graticule divisions. Interpolation is generally necessary, so both subjective judgment and possible parallax errors can become significant factors. The technician then calculates, by longhand, slide rule or other means, the percentage deviation of the instrument from exact accuracy.

Even if the deviation is within specifications, verification is typically followed by full recalibration. In this procedure, the technician feeds the standard calibrating signal (time marks or amplitude) to the oscilloscope and "tweaks" the appropriate controls until the display is exactly aligned with the proper graticule divisions.

Finally, appropriate record keeping is done, and a new calibration sticker is affixed to the instrument.

Now let's consider a new approach using the TM 500 oscilloscope "Cal Package". The package typically consists of the TG 501 Time Mark Generator, the PG 506 Calibration Generator, and either an SG 503 or SG 504 Leveled Sinewave Generator, all contained in a TM 503 Power Module.

With this highly portable calibration system, verification moves from the cal lab to the user's work site. The calibration technician carries the TM 503 with instruments (approximate weight, 18 pounds) to the oscilloscope and powers up the Cal Package. The oscilloscope is neither turned off nor moved.

If the time base is to be checked first, a cable connection from the oscilloscope input is made to the TG 501, and the scope time base and TG 501 are set to corresponding ranges. With the time-variable knob on the TG 501 set to its outer position, the technician turns the knob until the time marks exactly align with the graticule and then reads the scope timing error in percent fast or slow, from the two-digit readout on the TG 501 front panel. Other ranges can be verified just as rapidly, with the deviation percentages recorded by the technician if that is part of the established procedures. No interpolation is required, no computations are necessary, and the entire operation takes place with the oscilloscope in its normal environment.

Vertical sensitivity verification is done in a virtually identical fashion using the PG 506 Calibration Generator. The two-digit readout on the PG 506 panel indicates percentage deviation of the generator output, high or low, from the switch-indicated (standard range) value. High generator output, when adjusted for squarewave alignment with the graticule, corresponds to low oscilloscope sensitivity and vice-versa. This contrasts to the Time Mark Generator case, where a fast generator and fast time base correspond.

The key parameters of vertical and horizontal accuracy have thus been verified "on location" in a matter of minutes. The bandwidth can be quickly checked with the SG 503 or SG 504, as appropriate for the instrument bandwidth. If all parameters have been verified as falling within acceptable deviations from perfect accuracy, the technician can re-sticker the oscilloscope, unplug his TM 503, and move on to the next location. No unnecessary recalibration needs to take place, and the instrument is ready for use in less time than a typical coffee break, rather than being shut down for hours. If a parameter was outside spec but within "tweak-in" range, both the TG 501 and PG 506 can function as normal fixed calibration sources simply by pushing the variable knob in. The digital readout is then disabled and the generator output is set only by the indicator-range switch.

With verification and minor calibration performed at the user's site, the metrology lab, as far as oscilloscopes are concerned, now becomes only a place for troubleshooting and repairing instruments which have actually failed.