

Instruction for Using
Standard Square-Wave Calibrators (SSWC)

The following instructions give directions for installing and using a SSWC. The setup, as outlined here, provides a somewhat simplified procedure over previous methods for their calibration. Use of a #14 ground strap between bench scope and SSWC reduces hum-level adequately for most applications. For scopes with high gain verticals, two 1N3209 diodes, parallel opposed, can be inserted in the Variac ground lead to the unknown scope. This provides additional hum attenuation by raising the millivolt impedance path of ground currents.

SSWC with serial numbers above 2000 have provisions for using them as a readout for TU-4's. The attached schematic shows this modification. In SSWC's with serial numbers between 2000 and 2012, the STD/MIX switch is labeled "NORMAL".

Other modifications have also been made. The box has been enlarged to accommodate larger resistors and more components. An AC-DC switch has been added. This allows internal 1 meg loads on standard and unknown divider to be removed when being used to compare two AC voltages (e.g., 1 kc square wave).

INSTALLATION:

1. Disconnect the bench scope internal calibrator divider string and connect the calibrator cathode follower cathode directly to the CAL OUT jack.
2. Connect the SSWC chassis to the bench scope chassis with a short length of #14 A.W.G. or equivalent, and appropriate lugs. This reduced the errors due to ground currents.
3. Connect CAL OUT of the bench scope to CAL IN of the SSWC.
4. Connect line input to 117 volts AC.
5. Connect an 0.05% or better accuracy voltmeter to the Standard Calibrator OUTPUT; switch Standard Calibrator to "100 v", Standard Only", and "STD/MIX". Switch bench scope calibrator "OFF" and set "Cal Adj" for exactly 100.00 volts.

INSTALLATION (continued)

6. Run line voltage applied to the bench scope from 105 to 125 volts. See that the 100 volt output remains accurate to $\pm 0.1\%$. If this limit is exceeded and the change is in phase with the line voltage change, replace the calibrator cathode follower with the H.V. regulator tube and install a fresh tube in the H.V. regulator circuit. If a cold tube must be used, allow at least 1/2 hour stabilizing time. If the error is too great and the change is out-of-phase with line voltage change, replace the +100 v error amplifier tube with the 6AU6 from the calibrator and install a fresh one in the calibrator. Again, if a new tube must be used, allow at least 1/2 hour stabilizing time.
7. Steps 5 and 6 should be done biweekly after one hour of warmup. A permanent record of errors measured before resetting should be kept. An error of 0.1% is typical.

TO CALIBRATE A VERTICAL:

1. Connect Standard Calibrator Output to the Vertical Input.
2. Switch bench scope calibrator to .2 mv.
3. Set Standard Calibrator to required output, "STD/MIX", "Standard Only", and "AC".
4. Set gain and/or check attenuator ratio.

TO CHECK AND CALIBRATE AN AMPLITUDE CALIBRATOR:

1. Switch bench scope calibrator "OFF" and disable multivibrator of calibrator under test by doing one of the following:
 - a. Remove V875, 6AU6, in 515-16, 530-40-80, etc..
 - b. Ground pin 8 of V884 in 561-64.
 - c. Or, similarly disable multi.
2. Connect SSWC "Output" to the bench scope vertical (B, D, etc. Plug-In).

Instruction for Using Standard Square-Wave Calibrators (SSWC) (continued)

TO CHECK AND CALIBRATE AN AMPLITUDE CALIBRATOR: (continued)

3. Connect the SSWC "Unknown Input" to "Cal Out" of scope under test.
4. Switch both calibrators to 100 v and the Standard to "MIXED", "STD/MIX", and "D.C."
5. Set Cal. Adj. of scope under test for less than .1 volt difference between calibrators as observed on bench scope. Use +Line Trigger and 5 ms/cm sweep; the standard then always appears first on the CRT.
6. Switch both calibrators simultaneously through all ranges, observing difference signals with a vertical sensitivity of 1%/DIV where possible. Add the error observed at 100 mv to each of the other errors observed to determine the errors at lower voltages in scopes using a millivolt divider (530-40-80, 561-64).

An error may be introduced into this check by the hum level of the standard calibrator. The error can be measured by turning both the standard calibrator and the calibrator of the scope under test to OFF and observing the vertical displacement.

TO CALIBRATE A POWER SUPPLY (IN CONJUNCTION WITH A TU-4 OR EQUIVALENT TEST LOAD):

1. Connect the SSWC "Unknown" input to the RIPPLE AND PER CENT DC ERROR jack, and the "Output" to the 5 mv/cm vertical input, a.c. coupled.
2. Switch the SSWC to "OFF", "STD/MIX", "MIXED", and "DC".
3. Observe power supply per cent error as displayed square-wave amplitude. Use Line trigger and 5 ms/cm sweep.
4. Observe ripple with SSWC switched to "Unknown Only".

Instruction for Using Standard Square-Wave Calibrators (SSWC) (continued)

NOTE: The use of the Standard Square Wave Calibrator/Chopper in conjunction with the TU-4 or equivalent test loads has the following advantages:

1. The error introduced by the Type H plug-in input cathode follower grid current is eliminated.
2. The necessity for manual ground reference location is obviated.
3. One equipment setup is eliminated, since the same setup is used for adjusting and checking the amplitude calibrator and the power supplies.
4. Since a.c. coupling is used at the error indicating scope input, the cheaper, more generally available Type B plug-in may be used in the test scope.

This use is facilitated by the following modifications. These have been incorporated in Standard Square Wave Calibrators, serial numbers 2000 and above:

1. Install a s.p.d.t. switch to connect the Unknown input directly to the Output, at will. This permits power supply ripple measurements without changing cables.
2. Replace the 1 meg-ohm load on the Unknown input by a parallel combination of 4 meg-ohm and 1.33 meg-ohm (4 meg-ohm and 2 meg-ohm paralleled.) Connect the 4 meg-ohm portion to ground through the amplitude switch section that is open in the "OFF" position. If this change is not made, the only effect will be that the amplitude of the error readout of TU-4 will be 8.9 mv/% instead of 10 mv/%.

It has been found advantageous to replace the PUSH TO REMOVE RIPPLE switch with a positive action type (rotary in the TU-4, toggle in the 661 vertical test load.)

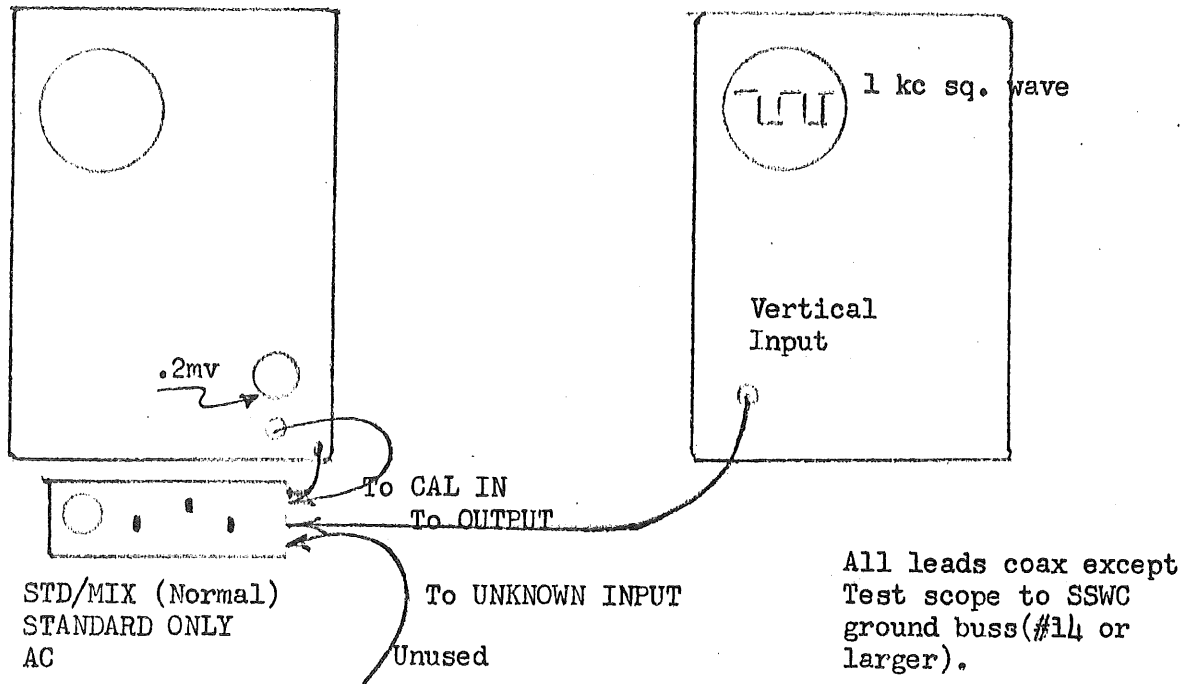


Albert Crane, Mgr.
Measurement Stds. Lab.
Mfg. Quality Assurance

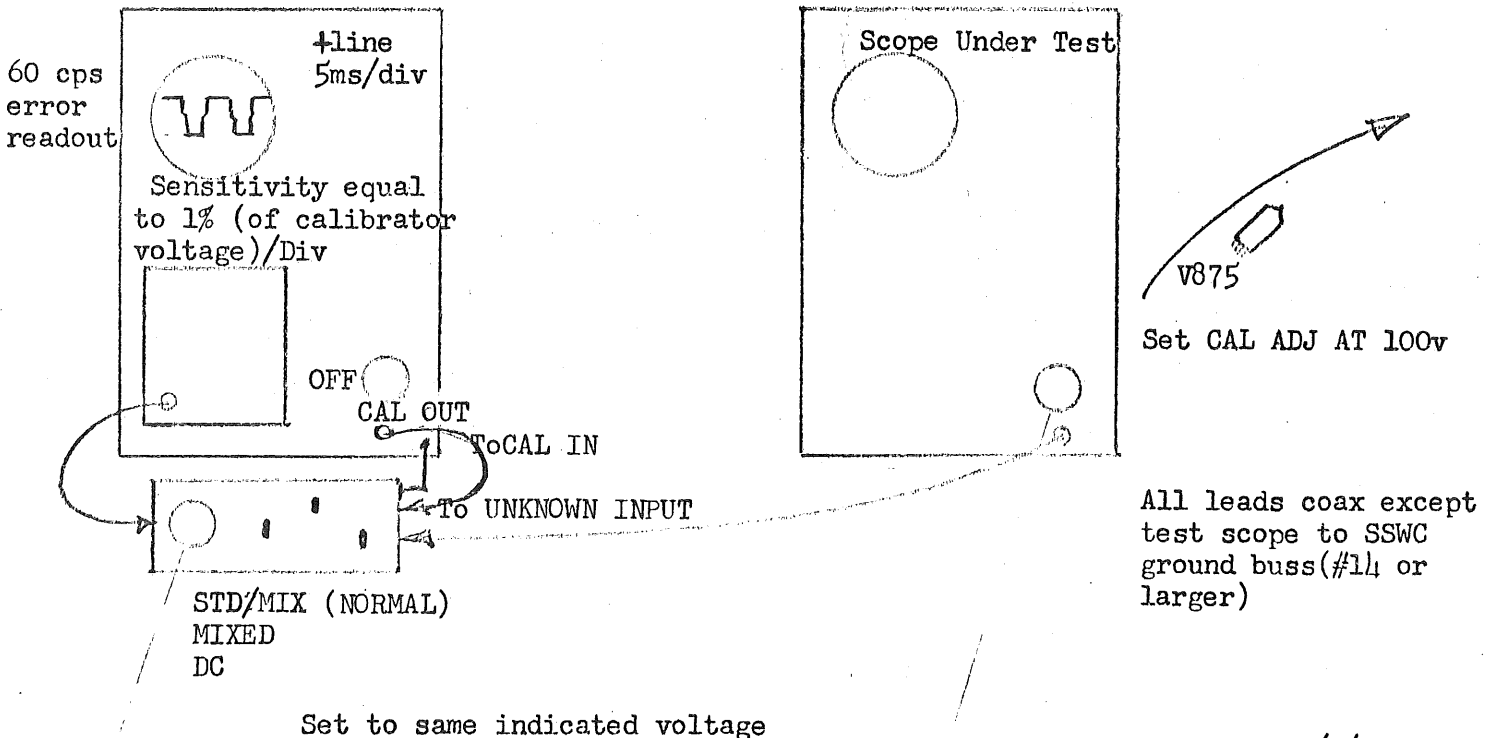
AC/mb

October 9, 1963

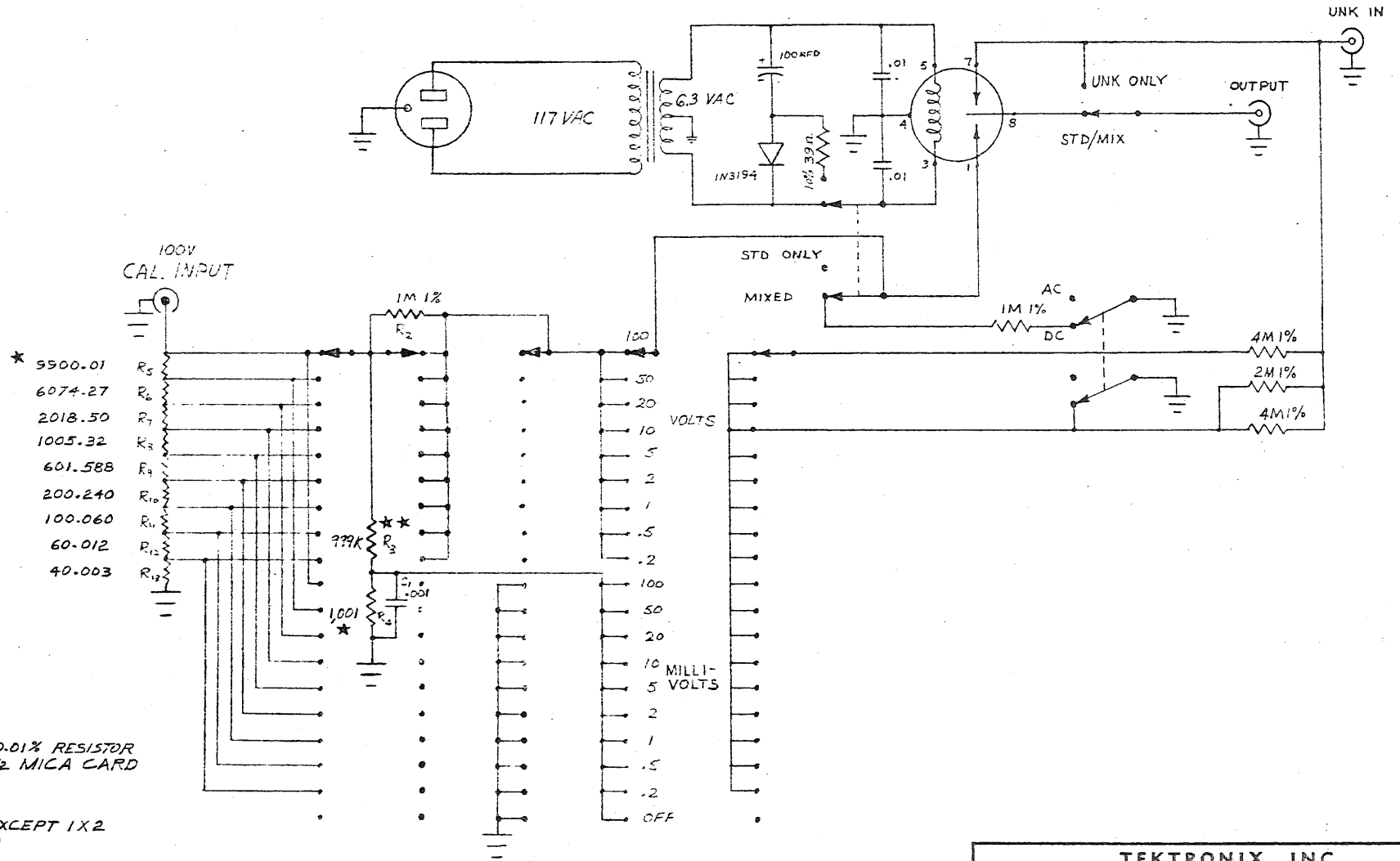
SET-UP FOR CHECKING VERTICAL GAIN AND ATTENUATORS



SET-UP FOR CHECKING AMPLITUDE CALIBRATORS



10/9/63
A. Crane



- * 5900.01
- 6074.27
- 2018.50
- 1005.32
- 601.588
- 200.240
- 100.060
- 60.012
- 40.003

* TEK W.W. ±0.01% RESISTOR ON 3/4 X 1/2 MICA CARD

** AS ABOVE EXCEPT 1X2 MICA CARD

TEKTRONIX, INC.

TITLE: STANDARD SQUARE-WAVE CALIBRATOR

REVISED 10-10-63 mgf
 REVISED 10-29-62 RR

NO. 4075 SCALE 0.5 INCH