FACTORY CALIBRATION PROCEDURE

CONTENTS:

INTRODUCTION:

CA

This is the guide for calibrating brand-new instruments, it therefore, calls out many procedures and adjustments that are rarely required for subsequent recalibration. *This procedure is company confidential.* In this procedure, all front panel control labels or Tektronix equipment names are in capital letters (VOLTS/DIV, etc.) internal adjustment labels are capitalized only (Gain Adj, etc.).

Tek form number:
0-178
April 1967

Supersedes
June 1965

For CA, all serial numbers; not for 53C or 53/54C.

FACTORY TEST LIMITS:

We initially calibrate the instrument to Factory Test Limits. These limits are often more stringent than advertised performance requirements. This helps insure that the instrument will meet advertised requirements after shipment, allows for inaccuracies of test equipment used, and may allow for changes in environmental conditions.

QUALIFICATION:

Factory test limits are qualified by the conditions specified in the main body of the calibration procedure. The numbers and letters to the left of the limits correspond to the factory calibration procedure steps where the check or adjustment is made. Instruments may not meet factory test limits if calibration or check-out methods and test equipment differ substantially from those in this procedure.

ABBREVIATIONS:

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100.

CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes that have been made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 47-261.

ABBREVIATIONS:

a or amp	ampere
ac	alternating current
approx	approximately
b	base
c	collector
ccw	counterclockwise
cm	centimeter
coax	coaxial
cps	cycles per second
crt	cathode ray tube
cs	ceramic strip
cw	clockwise
db	decibel
dbm	db referred to 1 mw
dc	direct current
dec	decoupled
div	division
e	emitter
fil	filament
freq	frequency
gc	gigacycles per second
gnd	chassis ground
h	henry
hf	high frequency
hv	high voltage
∞ or inf	infinity
int	intercal
k	kilo (10^3)
kΩ or k	kilohm
kc	kilocycles per second
lf	low frequency
M	mega (10^6)
m	milli (10^{-3})
ma	millampere
max	maximum
mc	megacycles per second
megΩ or meg	megohm
mh	millihenry
midr	midrange or centered
min	minimum
mm	millimeter
msec	millisecond
mv	millivolt
μ	micro (10^{-6})
μf	microfarad
μh	microhenry
μsec	microsecond
μv	microvolt
NBS	National Bureau of Standards
n	nano (10^{-9})
nsec	nanosecond
Ω	ohm
p	pico (10^{-12})
pf	picofarad (μμf)
piv	peak inverse voltage
pot	potentiometer
ptp	peak-to-peak
reg	regulated
RM	rackmount
SAC	Standard Amplitude Calibrator
sec	second
sn	serial number
SSWC	Standard Square-Wave Calibrator
term	terminal
tc	teracycles per second
unreg	unregulated
v	volt
vac	volts, ac
vdc	volts, dc
var	variable
w	watt
xfmr	transformer
Z	impedance
#	number
+	plus
-	minus
±	plus or minus
+ and -	plus and minus
Bxxx	bulb (number xxx)
Cxxx	capacitor (number xxx)
Dxxx	diode (number xxx)
Fxxx	fuse (number xxx)
Jxxx	jack (number xxx)
Kxxx	relay (number xxx)
Lxxx	inductor or coil (number xxx)
Qxxx	transistor (number xxx)
Rxxx	resistor (number xxx)
SWxxx	switch (number xxx)
Txxx	transformer (number xxx)
Vxxx	vacuum tube (number xxx)

QUALIFICATIONS

Factory test limits are qualified by the conditions specified in the main body of the calibration procedure. The numbers listed beside the limits correspond to the factory calibration procedure steps where the check or adjustment is made. Instruments may not meet factory test limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

NOT INTENDED FOR INCOMING INSPECTION

We initially calibrate the instrument to factory test limits. These limits usually are tighter than advertised performance requirements, thus helping to insure the instrument will meet or be within advertised performance requirements after shipment and during subsequent recalibrations. Instruments that have left our factory may not meet factory test limits but should meet catalog or instruction manual performance requirements.

1. EQUIPMENT REQUIRED

2. PRELIMINARY INSPECTION

3. TYPE CA PRESETS

4. RESISTANCE CHECKS

5. SETUP

6. OUTPUT DC LEVEL

6a. 67.5 v, ±2.5 v.

7. PRELIMINARY DC BALANCE

7b. DC BAL: final adj within ±90° of mid r.

8. GAS AND MICROPHONICS

8a. Gas: 2 mm, max.
8b. Microphonics: 2mm, max; no ringing type

9. VERTICAL POSITION RANGE

9a. Traces within 3 cm of each other with both VERTICAL POSITION at mid r.

9b. Vert Pos Range R4376: final adj within ±90° of mid r.

10. POLARITY

10a. Trace shift between NORMAL and INVERTED ±1 cm, max.
10b. Slow drift after initial shift (gas): ±2 mm, max.
10d. Trace shift between A or BONLY and ADDED ALGEBRAICALLY: ±2 cm, max of electrical center.

11. ALTERNATE MODE

11a. Must alternate on all sweep rates between 5 sec and .1 μsec/cm.

12. CHOPPED MODE

12a. Frequency: 100 kc ±20%.
12a. Symmetry: ratio 3 to 2, max.
12a. Flat top: distortion .5 mm, max.

13. GAIN

13b. Range, +10%, -5%.

14. AC-DC

15. ADDED ALGEBRAICALLY

15a. ADDED error: ±2%.
15b. Common mode rejection: 20 to 1.

16. VOLTS/CM

16a. VOLTS/CM error: ±2%.
16b. VARIABLE range: 2.5 to 1, min.

17. A INPUT CAPACITY

18. A VOLTS/CM COMPENSATION

19. B INPUT CAPACITY

20. B VOLTS/CM COMPENSATION

21. HIGH FREQUENCY

b. Adjust Transient response in A
   2% pp max aberration
c. Adjust transient response in B
   2% pp max aberration

22. FREQUENCY RESPONSE

b. AC: 2cps or less at 30% down to 28mc
   or more at 30% down
   DC to 24.5 mc at 30% down

23. FINDAL DC BALANCE

24. HF COMMON MODE REJECTION

24b.,c.
   dc to 28 mc.

25. A ALT B SLAVE PULSE

26. LF RESPONSE

b. Check lf response $\leq$ 3dB down at 2 Hz

THE END

CALIBRATION

1. EQUIPMENT REQUIRED

a. Plug-in scope

*1	TEKTRONIX TYPE 540B series OSCILLOSCOPE	
1	TEKTRONIX TYPE 547 OSCILLOSCOPE	

b. Test equipment

1	TEKTRONIX TYPE 105 SQUARE-WAVE GENERATOR	
1	TEKTRONIX SINE-WAVE GENERATOR	
1	TEKTRONIX TYPE 190B CONSTANT AMPLITUDE SINE-WAVE GENERATOR	

c. Test accessories

1	20 pf input time-constant standardizer, bnc connectors	011-0066-00
1	50 Ω termination, bnc connectors	011-0049-00
1	50 Ω 42" cable, bnc connectors	012-0057-00
1	Plug-in extension	013-0055-00
1	Type CA dual input connector	003-0035-00
2	Uhf female to bnc male adapters	103-0032-00
1	TU PULSER	015-0038-00
1	TU5/105 ADAPTER	015-0075-00

d. Miscellaneous equipment

1	630 Triplett meter; 20,000Ω/v dc
or	262 Simpson meter; 20,000Ω/v dc
1	Special STANDARD SQUARE-WAVE CALIBRATOR (SSWC)

2. PRELIMINARY INSPECTION

a. General

Check for unsoldered joints, rosin joints, lead dress and long leads. Check for loose hardware and protruding parts. Check controls for smooth mechanical operation and proper indexing. Correct all defects found.

NOTES

1. SUBSTITUTE EQUIPMENT

Substitute equipment may be used; however, the user must determine that the substitute equipment is equivalent and must determine proper control settings, etc. It is assumed that all equipment listed is within its manufacturer's specifications. If there is any doubt, the test equipment should be calibrated before it is used. All substitutions at the factory must be approved by the plant staff engineer.

It is assumed that all equipment is provided with BNC connectors. If equipment has other than BNC connectors, adapters, not listed, may be needed.

* This risetime of the TYPE 540B series OSCILLOSCOPE must be; 10nsec, +0%, -2.5%.

3. TYPE CA PRESETS

a. External controls

Channels A and B

input switch	DC
VOLTS/CM	.05
VARIABLE VOLTS/CM	CALIBRATED
POLARITY	NORMAL
VERTICAL POSITION	mid r
MODE	ALTERNATE
GAIN ADJ	mid r
DC BAL	mid r

b. Internal adjustments

Vert Pos Range R4376	mid r
C3322 and C4322	mid r
All coil slugs	just below bottom of windings

c. Leave controls and adjustments, for any step, as they were in the step preceding unless noted otherwise.

4. RESISTANCE CHECKS

a. Check resistances to ground

Amphenol connector pin	approx resistance	use
1	8.5 k	output
2	0	gnd
3	8.5 k	output
4 to 7	inf	not used
8	0	alt trig
9	12 k	-150 v
10	2 k	+100 v
11	6.3 k	+225 v
12	inf	+350 v
13	inf	6.3 vac
14	inf	6.3 vac
15	65 Ω	+75 v fil
16	*320 k	alt trig

*inf below sn 34790

NOTES

3b. Presetting internal adjustments:

Do not preset internal adjustments for RECALIBRATION unless you're certain a "start from scratch" policy is indicated.

4a. Resistance checks:

Readings taken with front panel controls in PRESET positions.

4a. Improper resistances:

(1) pin 12: If not inf, check V4383 for shorted filaments.
(2) pin 13, 14: If not inf, check V3375, V3382, V3384, V3393, V3364, V3374, V4364, V4374 for shorted filaments.
(3) pin 15: If inf, check for open filaments in V3323, V3334, V3354, V4323, V4334, and V4354.
(4) If pin 15 or any filament supply shows a short look for shorted tubes and disc type capacitors.

5. SETUP

a. Plug-in scope presets

MAIN TIME BASE (B)

TIME/CM	1 mSEC
STABILITY	cw
TRIGGERING LEVEL	0
TRIGGERING MODE	AC
TRIGGER SLOPE	-INT

b. Connect Type CA

Use a plug-in extension (013-0055-00) and plug Type CA into Type 540B series scope. Turn power on.

6. OUTPUT DC LEVEL

a. Output dc level
pin 1 and 3 to gnd: 65 to 70 v

Connect meter between Amphenol connector pin 1 and ground. Read 65 to 70 v. Connect meter between pin 3 and ground. Read 65 to 70 v. Disconnect meter.

7. PRELIMINARY DC BALANCE

a. Crt electrical center

Momentarily short Amphenol connector pins 1 and 3 together and note trace vertical position (electrical center of scope).

b. DC BAL ±90°

Move A trace to plug-in scope's electrical center with A VERTICAL POSITION. Rotate A VARIABLE VOLTS/CM back and forth while adjusting A DC BAL for no trace shift.

Repeat for channel B.

Both A and B DC BAL adjustments must be within ±90° of mid r after adjustment. Return VARIABLES to detent position.

7b. Extreme unbalance:

(1) Bad input cf (V3323, V4323).

7b. Not within ±90°:

(1) If DC BAL adjustments are not within ±90° of mid r, try selecting input cf or input amplifiers.

CALIBRATION	NOTES
8. GRID CURRENT AND MICROPHONICS	
a. Grid current — 2 mm, max	8a. Excessive trace shift
Ground A and B input (VOLTS/CM still at .05).	(1) Select input tubes.
Switch A input switch back and forth between AC and DC. Note trace shift (grid current): 2 mm, max.	
Return to DC. Repeat for channel B.	
b. Microphonics — 2mm, max: no ringing type	8b. Microphonics
Rotate A VOLTS/CM thru its range and note microphonics: no ringing type.	(1) Tubes; (2) Input capacitors (C3300 or C4300) improperly dressed.
Repeat for CHANNEL B. Leave inputs grounded. (If microphonics is found and cured repeat DC BAL adjustment.)	
9. VERTICAL POSITION RANGE	
a. Trace separation — 3 cm, max	9a. More than 3 cm separation
Set A and B VERTICAL POSITION to mid r.	(1) Recheck DC BAL adjustments; (2) Place VERT POS RANGE pot at mid r and select output amp tubes in the channel which has a trace most distant from the graticule center. (3) Swap output amp tubes.
Recheck DC BAL adjustment in both channels.	
Note trace separation: 3 cm, max.	
b. Vert Pos Range R4376 — ±90°	9b. If R4376 not within ±90°:
Set A and B POLARITY to NORMAL.	(1) Select output cf.
Adjust Vert Pos Range R4376 so both traces are equidistant above and below plug-in scope's electrical center.	
R4376 must be within ±90° of mid r after adjustment.	

10. **POLARITY**

a. Norm - inv trace shift ±1 cm

Move A trace to plug-in scope's electrical center with A VERTICAL POSITION. Switch POLARITY back and forth between NORMAL and INVERTED. Note trace shift: ±1 cm, max.

10a. Trace shift greater than ±1 cm:

(1) Recheck DC BAL adjustments;
(2) Swap or select input amplifiers.

b. Slow drift ±2 mm

Switch POLARITY back and forth between NORMAL and INVERTED. Note slow drift after initial shift: ±2 mm, max.

10b. Drift greater than ±2 mm:

(1) Change output amplifiers.

c. Repeat for B channel

d. ADDED ALGEBRAICALLY trace shift ±2 cm

Return A and B POLARITY to NORMAL. Move both traces to scope's electrical center with VERTICAL POSITION controls.

Change MODE to ADDED ALGEBRAICALLY and note trace shift: ±2 cm, max.

Return MODE to ALTERNATE.

10d. Trace shift greater than ±2 cm.

(1) Replace one or both 12AT7's in multi circuit (V3384 and V3393);
(2) Swap or change output amp tubes in the ailing channel;
(3) Check value of R3396.

11. **ALTERNATE MODE**

a. Alternates from 5 sec to .1 μsec/cm

Adjust VERTICAL POSITION controls so traces are 2 cm apart.

Check that display alternates between A and B traces with TIME/CM at all positions from 1 sec to .1 μsec.

11a. If ALTERNATE MODE does not work:

(1) And CHOPPED does, change V3382;
(2) Check all other tubes in multi section;
(3) Check for defective C3378, C3388, C3375, C3385;
(4) Check for defective R3376, R3386, R3396, R3394;
(5) Check for proper grounding of grid resistors at mode switch;
(6) If multi is running and one channel is cut off check for an open coil in Type CA unit.

12. CHOPPED MODE

a. Waveform specifications

Keep traces about 2cm apart. Change MODE to CHOPPED. Change plug-in scope TIME/CM to 2μSEC. Adjust STABILITY and TRIGGERING LEVEL for a stable display. Check one cycle of chopped waveform for:

(1) 4.25 to 6.25 cm duration;
(2) waveform top duration to waveform bottom duration ratio (or vice versa) 3 to 2 max;
(3) .5 mm max flat-top distortion.

12a. No chopping:

(1) Open R3383.

12a. Waveform duration out of specs:

(1) Check V3382, V3375, R3380, R3379, R3389, R3390.

b. Blanking

Set plug in scope CRT CATHODE SELECTOR (scope rear) to DUAL TRACE CHOPPED BLANKING. Rise and fall portions of chopped waveform should be blanked. Change CRT CATHODE SELECTOR back to normal. Rise and fall portions should be unblanked.

12b. No blanking

(1) Check C3385 and C3375.

13. GAIN

a. Setup

Change plug in scope TIME/CM to 1 mSEC and triggering to AUTO. Change MODE to A. ONLY. Keep VOLTS/CM at .05 and VARIABLE VOLTS/CM cw. Apply .1 v from SSWC to A input.

b. GAIN ADJ range: +10%, -5%

Set GAIN ADJ cw: note 2.2 cm deflection, min. Change GAIN ADJ ccw; note 1.9 cm deflection, max. Adjust GAIN ADJ for exactly 2 cm deflection.

Repeat for B channel

14. AC-DC

a. Waveform shift

14a. No shift

(1) Shorted input cap (C3300, C4300);
(2) Defective input cf.

Move bottom of calibrator waveform to center graticule line. Change B input to AC. Waveform must shift so it's approx centered about graticule line. Change SSWC signal to A input and repeat step 14 for CHANNEL A. Remove signal and set both input switches to DC.

15. ADDED ALGEBRAICALLY

a. ADDED accuracy error: ±2%, max

Apply .1 v SSWC signal to both A and B inputs. Change MODE to ADDED ALGEBRAICALLY. Keep both POLARITY controls at NORMAL. Observe 4 cm deflection; ±.8 mm, max.

15a. ADDED error greater than ±2%

(1) Check R3396.

b. Common mode rejection 20 to 1

Change A (or B) POLARITY to INVERTED. Change SSWC to 1 v. Note 1 cm deflection, max. If over 1 cm, vary VERTICAL POSITION controls. If still over 1 cm, reverse POLARITY controls and again vary VERTICAL POSITION controls, if necessary. One method must result in 1 cm or less deflection.

16. VOLTS/CM

a. VOLTS/CM accuracy error: ±2%, max

Change MODE to A ONLY and POLARITY control to NORMAL. Apply SSWC signal to CHANNEL A input. Check as follows:

VOLTS/CM	SSWC VOLTS	deflection ±2%, max
.05	.1	*2 cm, ±.4 mm
.1	.2	2 cm, ±.4 mm
.2	.5	2.5 cm, ±.5 mm
.5	1	2 cm, ±.4 mm
1	2	2 cm, ±.4 mm
2	5	2.5 cm, ±.5 mm
5	10	2 cm, ±.4 mm
10	20	2 cm, ±.4 mm
20	50	2.5 cm, ±.5 mm

*Adjusted previously.

b. VARIABLE VOLTS/CM range 2.5:1, min

Set VARIABLE VOLTS/CM to max atten. Note deflection: 1 cm, max. Note any noise or open spots during full rotation of VARIABLE. Return to CALIBRATED.

c. B channel

Repeat VOLTS/CM accuracy and VARIABLE VOLTS/CM check for B channel. Remove SSWC signal.

17. A INPUT CAPACITY

a. Setup

Remove plug-in extension and insert TYPE CA unit, less extension, into scope. Change MODE to A ONLY and A VOLTS/CM to .05.

Connect TYPE 105 signal as follows:

TYPE 105--50Ω cable--50Ω Termination--20pf input time constant standardizer--TYPE CA, A input.

b. C3322

Set TYPE 105 for 3.5cm of 1kc. Adjust C3322, input capacitor, for best square wave.

17b. Poor square wave:

(1) Check "dog ears" of C3322 for proper contact with slug;
(2) Redress C3300 and C3321.

18. A VOLTS/CM COMPENSATION

a. Compensation

Keep 3.5cm 1kc TYPE 105 deflection and adjust for best square wave as follows:

		adjust
VOLTS/CM	front corner	flat top
.05		C3322*
.1	C3311C	C3311B
.2	C3312C	C3312B
.5	C3313C	C3313B
1	C3314C	C3314B
2	C3315C	C3315B
5	C3316C	C3316B
10	C3317C	C3317B
20	C3318C	C3318B

*Adjusted previously

18a. VOLTS/CM compensation difficulties:

(1) Slug of C3311C down too far (approx 3 turns should be left on slug);
(2) Dress of leads and components (for instance C3300) between input connector and grid of V3323 will have an affect on adjustments in steps 18 and 19;
(3) Reselect C3311D.

19. B INPUT CAPACITY

a. Setup

Change MODE to B ONLY and B VOLTS/CM to .05. Change TYPE 105 (via 20pf input time constant standardizer) to B input, keep 3.5cm of 1kc.

b. C4322

Adjust C4322, input capacitor, for best square wave.

19b. Poor square wave:

(1) Check "dog ears" of C4322 for proper contact with slug;
(2) Redress C4300 and C4321.

20. B VOLTS/CM COMPENSATION

a. Compensation

Keep 3.5cm 1kc TYPE 105 deflection and adjust for best square wave as follows:

VOLTS/CM	adjust front corner	flat top
.05		C4322*
.1	C4311C	C4311B
.2	C4312C	C4312B
.5	C4313C	C4313B
1	C4314C	C4314B
2	C4315C	C4315B
5	C4316C	C4316B
10	C4317C	C4317B
20	C4318C	C4318B

*Adjusted previously.

Remove TYPE 105 signal.

21. HIGH FREQUENCY

a. Connect TU5 Pulser

TYPE 107 -- TU5/105 Adapter -- 50Ω cable -- 50Ω termination -- TYPE CA, A input.

b. Adjust transient response in A
2% pp max aberration

Change MODE to A ONLY and A VOLTS/CM to .05. Set the TYPE 105 to approx 100kc and near maximum amplitude. Adjust TU5 Pulser to point where fast rise waveform first appears.

Set plug-in scope TIME/CM to 1μSEC and adjust TRIGGERING LEVEL for stable display.

Adjust L3364, L4374, L3362, L3372, L3334 and L3354 for best square-wave.

c. Adjust transient response in B
2% pp max aberration

Change MODE to B ONLY and B VOLTS/CM to .05. Move signal to B INPUT.

Adjust L4362, L4372, L4334 and L4354 for best square-wave.

Remove signal from B INPUT.

d. Adjust inductors in B

Change MODE to B ONLY and B VOLTS/CM to .1. Change TYPE 107 to B input. Adjust L4362, L4372, L4334 and L4354 for best square-wave.

e. Overshoot or rolloff ±1mm

Change B VOLTS/CM to .05 and check square-wave overshoot or rolloff: ±1mm, max.

Remove TYPE 107 signal.

20a. VOLTS/CM compensation difficulties:

(1) Slug of C4311C down too far (approx 3 turns should be left on slug);
(2) Dress of leads and components (for instance C4300) between input connector and grid of V4323 will have an affect on adjustments in steps 20 and 21;
(3) Reselect C4311D.

21c., e.
Excessive spike or rolloff:

(1) Check for excessively high 47Ω resistors in X1 atten network.
(2) Long roll-up: check C4384 and C4385.

CALIBRATION	NOTES
22. FREQUENCY RESPONSE	
a. Setup	22a. TYPE 190B-50Ω termination
Change plug-in scope TIME/CM to .1mSEC. Change TYPE CA MODE to A ONLY. Attach a 50Ω termination* to 190B output and apply exactly 4cm of 50kc to A input.	(1) Do not use a 50Ω termination with TYPE 190B sn 8140 up. With the newer head of this TYPE 190B, external termination is not necessary.
* not used with TYPE 190B SN8140 and up.	
b. Response dc to 24.5mc at 30% down	22b. Less than 2.1 cm deflection:
Increase TYPE 190B frequency to 24.5 mc. Note deflection: 2.8cm, min. Repeat check for B channel. Remove TYPE 190B. Remove TYPE CA from plug-in scope.	(1) Check that both channels peak similarly or not rolled off in .05 VOLTS/CM position; (2) Select input cf.
23. FINAL DC BALANCE	
a. A and DC BAL	
Move B trace to scope's electrical center with B VERTICAL POSITION. Rotate B VARIABLE VOLTS/CM back and forth while adjusting B DC BAL for no trace shift. Change MODE to A only.	
Repeat DC BAL adjustment for A channel.	
24. HF COMMON MODE REJECTION	
a. Connect TYPE 190B	24a. 190B-50Ω termination
TYPE 190B--50Ω termination--CA dual input connector--TYPE CA inputs	(1) 190B sn 8140 up (mod 6317) does not require a 50Ω termination.
Set both VOLTS/CM to .5. Adjust TYPE 190B for 2 cm of 50 kc.	
b. Common mode rejection, dc	24b. More than 1 cm deflection:
Change both VOLTS/CM to .05, MODE to ADDED ALGEBRAICALLY and A POLARITY to INVERTED.	(1) Repeat step 23; (2) High frequency waveforms should not be peaked excessively (step 21); (3) Swap or select input cf's (repeat steps 21, 22, 23 and 24).
Check for 1 cm max deflection from 50 kc to 28 mc. If over 1 cm, change A POLARITY to NORMAL and B POLARITY to INVERTED. One method must result in 1 cm or less deflection.	
c. Common mode rejection, ac	
Change both input selectors to AC. Note deflection: 1 cm, max.	

25. A ALT B SLAVE PULSE

a. Setup

Insert TYPE CA in TYPE 547 and switch POWER ON.

Set TYPE 547 as follows: HORIZONTAL DISPLAY, A ALT B; TIME BASE A TIME/CM, .5mSEC; MAIN TIME BASE TIME/CM, 50mSEC; both TIME BASE TRIGGERING MODES, AUTO. Set TYPE CA MODE to ALTERNATE.

b. Check A ALT B Slave Pulse

Rotate the TRACE SEPARATION and note that there are only two traces.

25b. More than two traces. Check for slave pulse.

c. Rotate the TYPE CA CH A POSITION and note that CH A trace is slaved to TIME BASE A (sweeps at TIME BASE A sweep rate). Note that CH B trace is slaved to MAIN TIME BASE.

25c. CH A or B does not sweep at proper rate. Check TYPE CA slave circuit.

26. LF RESPONSE

a. Setup

SINE-WAVE GENERATOR -- 50Ω cable -- TYPE CA A input.

b. Check lf response $\leq$3dB down at 2 Hz

Set MODE to A ONLY, VOLTS/CM to .05, POLARITY to NORMAL. Apply 3cm of 2 Hz sinewave with A input at DC. Change A input to AC and check deflection: 2.1cm, min.

Repeat for B input with MODE in B ONLY.

SPECIAL TEST EQUIPMENT

Special test equipment, if mentioned, is not available from Tektronix unless it's listed also in our current catalog. This special equipment is used in our test department to speed calibration.

Usually you can either duplicate its function with standard equipment in your facility, devise alternate approaches, or build the special test equipment yourself.

USE OF STANDARD CALIBRATOR

The standard calibrator, when calibrated, is traceable to NBS and is used to guarantee tolerances of vertical amplifiers and calibrators of Tektronix oscilloscopes.

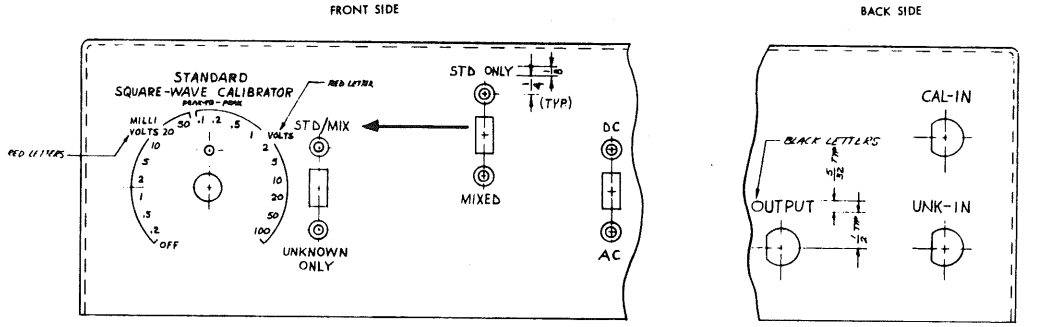
The circuit consists of a chopper and a divider network of 0.1% accurate resistors. The divider network provides a standard voltage output when loaded with 1 meg and when an accurate +100 v is applied to the input. The chopper allows the voltage output of the standard calibrator to switch between a known voltage and an unknown voltage. The difference between these voltages may then be determined by monitoring the output with an ac coupled scope.

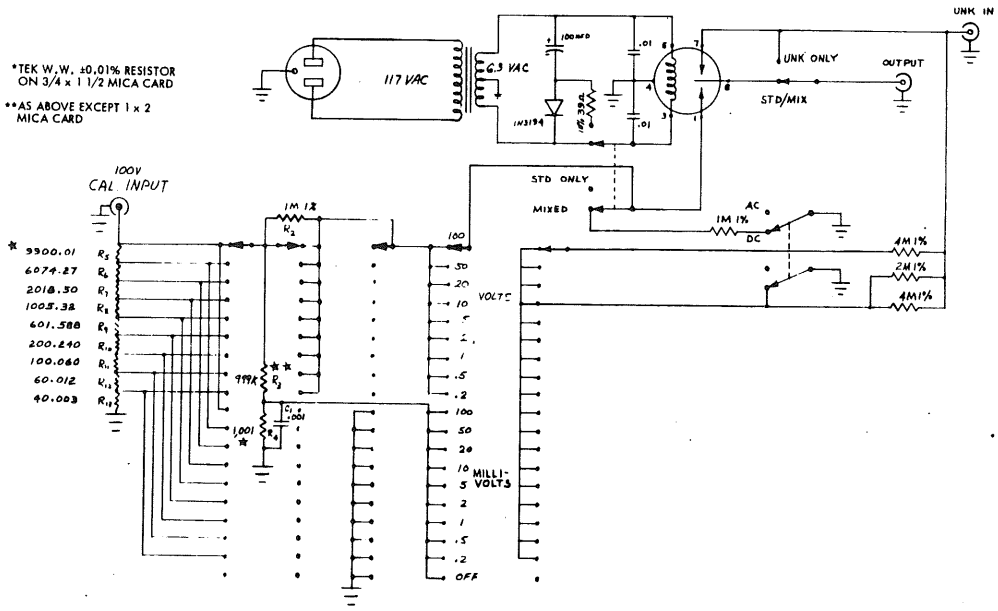
You must take the hum level of the standard calibrator into account when checking divider accuracy at low levels (.1 v and below). Measure the error introduced by hum level by turning both the standard calibrator and the calibrator of the scope under test to off. Observe the vertical displacement (hum level) and subtract this, when appreciable, from other readings.

Leave the standard calibrator in NORMAL when not in use.

STANDARD CALIBRATOR:

Dwgs 600-B, 7-10-61 (front and rear panels); 601-B, 7-10-61 (schematic); 918-A, (parts).





STANDARD SQUARE-WAVE CALIBRATOR

PARTS LIST:

Amount	Description	Part No.
3	Amphenol jacks	131-0081-00
1	Motor base plug	131-0102-00
1	Octal socket	136-0011-00
6	6-32 kep nuts	210-0457-00
9	6-32 BHHS	211-0507-00
2	mdpdt slide switch	260-0447-00
1	SPDT " "	260-0449-00
1	19 pos. 3 sec. rotary switch	260-0253-00
2	.01 μfd 150 V discap	283-0003-00
2	1 meg 1/2 watt 1% resistor	309-0014-00
1	2 " " " " "	309-0023-00
2	4 " " " " "	309-0093-00
1	100 μfd 15 V capacitor	290-0099-00
1	IN3194 diode	152-0066-00
1	39 Ω 1/2 watt 10% resistor	302-0390-00
1	.001 μfd discap 500 V	283-0000-00
11	Special Tek w.w.	See Dwg. 601-B
1	Large black knob	366-0060-00
1	Grommet	348-0002-00
1	"	348-0003-00
4	Rubber foot	348-0013-00
1	7-Notch ceramic strip	124-0089-00
2	Nylon spacer	361-0008-00
6	6-32 x 1/4 FHS (Phillips)	211-0541-00
6	#6 Lockwasher (Int.)	210-0006-00
6	6-32 hex nut	210-0401-00
1	James model C-1800 chopper	---
1	Stancor P-6134 transformer	---

HOOK UP OF STANDARD SQUARE-WAVE CALIBRATOR (SSWC)

Turn the TYPE 545B on its left side and remove bottom and right side panels. Disconnect both white, with yellow stripe, wires from R885 (9.5 kΩ) on the AMPLITUDE CALIBRATOR switch. Disconnect the switch end of R898 (100 Ω) and connect the wires previously removed from the switch to the free end of R898.

Replace the oscilloscope bottom panel and insert the plug-in to be used. Set AMPLITUDE CALIBRATOR to OFF and connect a cable from the CAL OUT connector to the CAL IN connector of the SSWC.

Turn the oscilloscope power on and allow a 10 minute warm up. Set SSWC to 100 v and attach a 1 mΩ resistor across the OUTPUT connector. Set the oscilloscope Cal Adj control for exactly 100 v across the 1 mΩ resistor. Remove the resistor. If the oscilloscope plug-in is changed, the above 100 v adjustment must be repeated.

Replace the side panel and set oscilloscope upright on the bench.

The SSWC switch will now control the voltage at its OUTPUT connector and the TYPE 545B AMPLITUDE CALIBRATOR switch will cause the SSWC output voltage to be dc (OFF) or a square-wave (some position other than OFF).