FACTORY CALIBRATION PROCEDURE

CONTENTS:

This is the guide for calibrating new instruments in Product Manufacturing. The procedure consists of 4 sections:

<u>Equipment Required</u>

<u>Factory Test Limits</u> - Factory Test Limits are limits an instrument must meet before leaving Manufacturing. These limits are often more stringent than advertised performance requirements. This is to insure that the instrument will meet advertised requirements after shipment, allows for individual differences in test equipment used, and (or) allows for changes in environmental conditions.

<u>Short Form Procedure</u> - The Short Form Procedure has the same sequence of steps and the same limits on checks or adjustments as the Main Procedure.

<u>Main Procedure</u> - The Main Procedure gives more detailed instructions for the calibration of the instrument. This procedure may require that some checks and adjustments be made so that performance is better than that required by the Factory Test Limits. This insures the Factory Test Limits will be met when side panels are added, permits some normal variation in test equipment and plug-in scopes, etc.

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100. Definitions of terms used in this procedure may be found in TEKTRONIX STANDARD A-101.

In this procedure, all front panel control labels and Tektronix instrument names are in capital letters (VOLT/DIV, etc). Internal adjustment labels are capitalized only (Gain Adj, etc).

This procedure is company confidential

TYPE W

January 1969

For all serial numbers.

CHANGE INFORMATION:

This procedure has been prepared by Test-Final Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact T-FSE, 39-307.

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. *TEKTRONIX Instruments*

*1 TYPE 547 OSCILLOSCOPE (plug-in scope)
1 TYPE 547 OSCILLOSCOPE (test scope)
1 TYPE W PLUG-IN UNIT
1 TYPE 106 SQUARE-WAVE GENERATOR
*1 TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR
1 TYPE TU76 LINE VOLTAGE CONTROL UNIT

b. *Test Fixtures and Accessories*

*1 Standard Amplitude Calibrator (SAC) (067-0502-00)
*1 Low Frequency Sine Wave Generator (LFSWG) (067-0542-99)
*1 Precision DC Divider with 1MΩ load resistor (067-0503-00)
1 20pF Input RC Normalizer (011-0066-00)
1 50Ω Termination (011-0049-00)
1 50Ω 10:1 Attenuator (011-0059-00)
2 GR to BNC female adapters (017-0063-00)
3 50Ω BNC cables 42" (012-0057-01)
1 Dual Input Coupler (067-0525-00)
1 36" patch cord (alligator clip to banana plug) (012-0014-00)
1 6" shorting strap with alligator clips (003-0507-00)
1 P6006 X10 Passive Probe (010-0127-00)
1 P6028 X1 Passive Probe (010-0074-00)
1 Micro-Shock Hammer (PMIE Dwg #1283-B)

c. *Other equipment*

1 20,000Ω/VDC Multimeter
*1 Differential Voltmeter ±0.5% or better accuracy

*Equipment must be traceable to NBS for certification of measurement characteristics.

Substitute test equipment may be used. The Plant Staff Engineer must approve any substitutions. All equipment listed must perform within its manufacturer's specifications, unless otherwise stated.

Factory Test Limits are qualified by the conditions specified in the main body of the Factory Calibration Procedure. The numbers and letters to the left of the limits correspond to the procedure steps where the check or adjustment is made. Steps without Factory Test Limits (setups, presets, etc.) are not listed. Instruments may not meet Factory Test Limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

5. AMPLIFIER BALANCE

b. DC BAL range: ≥80mV
c. Output transistor operation level: 6V ±0.5V
d. POSITION range: + & - 0.35V min
e. Output DC level: 67.5V ±3.3V

6. GAIN

a. GAIN range: + & -5% min
*b. MILLIVOLTS/CM accuracy: ±2%
c. VARIABLE MILLIVOLTS/CM ratio: ≥2.5:1
*d. X1000 attenuator accuracy: ±2%

7. GRID CURRENT AND MICROPHONICS

a. Grid current: ≤1nA
b. Microphonics: ≤1mV
c. Trace drift: ≤0.5cm
d. Noise: ≤3mm with ≤1mm jitter

8. AMPLIFIER TRANSIENT RESPONSE

b. HF compensations: Aberration ≤2.5% P-P
c. Positioning effect: ≤1.5%
d. Transient response: Aberration ≤2.5% P-P
e. INPUT crosstalk: ≤2.5%

9. BANDWIDTH

*b. Amplifier bandwidth: ≥26MHz @-3dB
*c. MILLIVOLTS/CM bandwidth:

MILLIVOLTS/CM	Bandwidth
20	24MHz
10	21MHz
5	18MHz
2	14MHz
1	8MHz

*d. AC LF bandwidth: ≤2Hz @-3dB

10. PEAK OVERDRIVE RECOVERY

a. AC peak overdrive recovery: ≤0.3μs to return within 10mV
b. DC overdrive recovery: ≤0.5mV shift after 1 second

11. AMPLIFIER CMRR

a. DIFF BAL CMRR: ≥20,000:1 @20Hz
*b. 20kHz CMRR: ≥20,000:1
*c. AC coupled CMRR: ≥1,000:1 @60Hz
*d. HF CMRR: ≥500:1 @500kHz
*e. DC coupled CMRR: ≥20,000:1

12. INPUT ATTENUATOR RESISTANCE

*a. X10 input attenuator, R106E & R206E: ±0.04%
*b. X100 input attenuator, R108G & R208G: ±0.14%
*c. X1 attenuator, R105B & R205B: X1 = X10 ±0.07%

14. INPUT COMPENSATION

a. A INPUT: $\leq$1% aberration P-P
b. B INPUT: $\leq$1% aberration P-P

16. $R \simeq \infty$

$\geq$10GΩ

THE END

*Indicates measurement characteristic; test equipment must be traceable to NBS for instrument certification.

SHORT FORM PROCEDURE

This instrument must meet Factory Test Limits before it leaves Manufacturing; therefore, it must be possible to inspect to these limits. Because of normal variations in test equipment and plug-in scopes, addition of side panels, etc, this procedure may require that some checks and adjustments be made so that performance is better than that required by Factory Test Limits.

1. PRELIMINARY INSPECTION

a. Install current modifications
b. Install transistor cover

2. PRESET CONTROLS

a. Preset plug-in scope
b. Preset TYPE W external controls
c. Preset TYPE W internal adjustments

3. RESISTANCE CHECKS

a. Check plug-in connector to gnd resistances
b. Check resistance to gnd of front panel connectors

4. COMPARISON VOLTAGE SERIES RESISTANCE

Install TYPE W into scope compartment, measure COMPARISON VOLTAGE and select value for R308

5. AMPLIFIER BALANCE

a. Adjust Position Range R176 for a centered trace
b. Check DC BAL range: $\geq$80mV
c. Adjust output transistor operation level: 6V ±0.5V
d. Check POSITION range: + & - 0.35V min
e. Check output DC level: 67.5V, ±3.3V
f. Adjust Heater Bal R293, for minimum shift
h. Adjust DC BAL for no shift
Repeat steps f, g & h to reduce unbalance

6. GAIN

a. Check GAIN range: + & - 5% min
b. Check MILLIVOLTS/CM accuracy: ±2%
c. Check VARIABLE MILLIVOLTS ratio: $\geq$2.5:1
d. Check X1000 attenuator accuracy: ±2%

7. GRID CURRENT AND MICROPHONICS

a. Check grid current: $\leq$1nA
b. Check microphonics: $\leq$1mV
c. Check trace drift: $\leq$0.5cm
d. Check noise: $\leq$3mm with $\leq$1mm jitter

8. AMPLIFIER TRANSIENT RESPONSE

b. Adjust HF compensations: Aberration $\leq$2.5% P-P
c. Check positioning effect: $\leq$1.5%
d. Check transient response: Aberration $\leq$2.5% P-P
e. Check INPUT crosstalk: $\leq$2.5%

9. BANDWIDTH

b. Check amplifier bandwidth: $\geq$26MHz @-3dB
c. Check MILLIVOLTS/CM bandwidth:

MILLIVOLTS/CM	Bandwidth
20	24MHz
10	21MHz
5	18MHz
2	14MHz
1	8MHz

d. Check AC LF bandwidth: $\leq$2Hz @-3dB

10. PEAK OVERDRIVE RECOVERY

a. Adjust AC peak overdrive recovery: $\leq$0.3μs to return within 10mV
b. Check DC overdrive recovery: $\leq$0.5mV shift after 1 second

11. AMPLIFIER CMRR

a. Adjust DIFF BAL for max CMRR: $\geq$20,000:1 @20Hz
b. Adjust 20kHz CMRR: $\geq$20,000:1
c. Check AC coupled CMRR: $\geq$1,000:1 @60Hz
d. Check HF CMRR: $\geq$500:1 @500kHz
e. Check DC coupled CMRR: $\geq$20,000:1

12. INPUT ATTENUATOR RESISTANCE

a. Adjust X10 input attenuator, R106E & R206E for min shift
b. Adjust X100 input attenuator, R108G & R208G for min shift
c. Adjust X1 attenuator, R105B & R205B for null on voltmeter

13. COMPARISON VOLTAGE

a. Adjust Vc Cal, R310: +11V ±0.05%
b. Adjust tracking, R323: +1 volt ±0.05%
c. Check accuracy: ±0.1% +(0.05% of Vc RANGE)
d. Check divider: 10:1 ±0.1%
e. Check minus Vc: -11 volts ±0.1%
-1.1 volt ±0.1%
f. Check 0 Vc RANGE for 0 volts

14. INPUT COMPENSATION

a. Adjust A INPUT: $\leq$1% aberration P-P
b. Adjust B INPUT: $\leq$1% aberration P-P

15. X10 ATTENUATOR COMMON MODE REJECTION

Adjust C206C for minimum amplitude

16. $R \simeq \infty$

Check A & B INPUT for $\geq$10GΩ

THE END

1. PRELIMINARY INSPECTION

a. Install current modifications

b. Install transistor cover

2. PRESET CONTROLS

a. TYPE 547

HORIZONTAL DISPLAY	B
SINGLE SWEEP	NORMAL
TRIGGERING	
MODE	AUTO STABILITY
SLOPE	+
COUPLING	AC
SOURCE	NORM INT
TRIGGER LEVEL	cw
A and B TIME/CM	.5mSEC
A and B VARIABLE TIME/CM	CALIBRATED
CRT CATHODE SELECTOR	CRT CATHODE

b. TYPE W external controls

Vc RANGE	+11V
COMPARISON VOLTAGE (Vc)	10
COMPARISON VOLTAGE dial	10.0
AC-DC-GND (both)	GND
INPUT ATTEN	1
DISPLAY	A-Vc
MILLIVOLTS/CM	50
VARIABLE	CALIB
DIFF BAL	midr
GAIN	midr
VAR BAL	midr
DC BAL	up
POSITION	midr

c. TYPE W internal adjustments

Variable resistors	midr
Variable capacitors	half meshed

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

3. RESISTANCE CHECKS

a. Check plug-in connector to gnd resistance

pin #	Approx Resistance	Use
1	6k	signal out
2	0Ω	ground
3	6k	signal out
4	inf	not used
5	inf	not used
6	inf	not used
7	inf	not used
8	inf	not used
9	10k	-150 volts
10	750Ω	+100 volts
11	11k	+225 volts
12	inf	not used
13	inf	not used
14	inf	not used
15	200Ω	+75V fil
16	inf	not used

b. Check resistance to gnd of front panel connectors

A and B INPUT connectors approx 1MΩ with INPUT ATTEN in 1, 10 100 or 1000 position. Inf, with the INPUT ATTEN switch in R≈∞.

VC OUTPUT connector approx 10kΩ.

4. COMPARISON VOLTAGE SERIES RESISTANCE

Plug the TYPE W into the TYPE 547 and turn the POWER ON. Set the TYPE 76TU to 115V as read on its meter. Allow 20 minutes of warm-up prior to performing step #6. Turn on Differential Voltmeter. Connect the X1 probe from the test scope TYPE W to the junction of R301 and D301. Set the test scope TYPE W INPUT ATTEN to 10, VC RANGE to -11. Use the COMPARISON VOLTAGE to determine the voltage at R301-D301 junction. Use the following table to select the value of R308.

4. (CONT)

Voltage	Resistor Value	Part Number
11.150 to 11.400	bare strap wire	
11.401 to 11.700	300Ω ±1%	308-0330-00
11.701 to 12.000	600Ω ±1%	308-0331-00
12.001 to 12.285	900Ω ±1%	308-0332-00

Return both VC RANGE switches to 0.

5. AMPLIFIER BALANCE

a. Adjust Position Range, R176: trace centered

Place a shorting strap across the output leads of the MILLIVOLTS/CM switch and adjust R176 for centered trace on the graticule. Remove the shorting strap.

b. Check DC BAL range: ≥80mV

The INPUT ATTEN should be at the 1 position and the MILLIVOLTS/CM set at 50. Change the A INPUT to DC and apply 0.2 VOLTS of SAC signal. Adjust the GAIN for 4cm of display and remove SAC signal. Return the A INPUT to GND and position the trace to graticule center. Rotate the DC BAL through its range and check for ≥1.6cm of trace shift. Set the DC BAL to the center of this range and set the POSITION control to midrange.

c. Adjust output transistor operation level: 6V ±0.5V

Connect the Multimeter leads to TP291 and TP296 located on the output amplifier board. Adjust the DC Level (R280) for 6V ±0.5V.

5. (CONT)

d. Check POSITION range: + & - 0.35V min

Move Multimeter leads to the wire straps that connect the output amplifier board to pins 1 and 3 of interconnecting plug. Turn the POSITION control cw and ccw and check for $\geq$0.35V at each setting. Set the POSITION control for no deflection on Multimeter.

e. Check output DC level: 67.5V, ±3.3V

Set the Multimeter for a higher range and move one meter lead from an output terminal to ground. Check for an indication of $\geq$64.2V to $\leq$70.8V on the meter, then remove the Multimeter leads.

f. Adjust Heater Bal

Change the MILLIVOLTS/CM to 10 and rotate the VARIABLE cw and ccw while adjusting Heater Bal (R293) for minimum trace shift.

f. Adjust Heater Bal in very small increments and allow enough time for the trace to stabilize before adjusting again.

g. Adjust VAR BAL: no trace shift

Rotate the MILLIVOLTS/CM between 50 and 1 positions, and adjust the VAR BAL for no trace shift.

h. Adjust DC BAL: no trace shift

Set the MILLIVOLTS/CM to 1 and adjust the DC BAL for no trace shift while turning the VARIABLE through its range.

Rotate the MILLIVOLTS/CM between 50 and 1 and check for no trace shift. Repeat steps 5f, 5g and 5h to reduce unbalance if necessary.

6. GAIN

a. Check GAIN range: + & - 5% min

Set the MILLIVOLTS/CM to 50. Connect .2 VOLTS from the SAC to the A INPUT. Set the A AC-DC-GND switch to DC. Rotate the GAIN cw, check for ≥4.2cm, and ccw, check for ≤3.8cm. Set the GAIN for 4cm.

b. Check MILLIVOLTS/CM accuracy: ±2%

Check the MILLIVOLTS/CM positions using the following table:

MILLIVOLTS/CM	SAC	amplitude	max error
50	.2 VOLTS	4cm	.8mm
20	.1 VOLTS	5cm	1mm
10	50mVOLTS	5cm	1mm
5	20mVOLTS	4cm	.8mm
2	10mVOLTS	5cm	1mm
1	5mVOLTS	5cm	1mm

Change the W MILLIVOLTS/CM switch to 20. Set the SAC to .1 VOLTS.

c. Check VARIABLE MILLIVOLTS/CM ratio: ≥2.5:1

Rotate the VARIABLE MILLIVOLTS/CM ccw. Check for 2cm or less. Return VARIABLE to CALIB.

d. Check X1000 attenuator accuracy: ±2%

Adjust the VARIABLE MILLIVOLTS/CM for exactly 5cm of display. Change the INPUT ATTEN to 1000 and the SAC to 100 VOLTS, check for 5cm of display, ±1mm.

Change the DISPLAY to Vc-B, set B INPUT to DC and connect SAC signal to B INPUT. Check for an attenuation of 1000 in the same manner. Return the VARIABLE MILLIVOLTS/CM to CALIB.

7. GRID CURRENT AND MICROPHONICS

a. Check grid current: $\leq$1nA

Remove SAC output cable from the B INPUT. Change the DISPLAY switch to A-Vc and the MILLIVOLTS/CM to 1. Change both AC-DC-GND switches to GND and the INPUT ATTEN to 1. Center the trace with the POSITION control. Change the A AC-DC-GND switch to DC. Check for $\leq$1nA (1cm) trace shift. Return A AC-DC-GND switch to GND. Repeat for B INPUT.

b. Check microphonics: $\leq$1mV

Change the plug-in scope TIME/CM switch to 1mSEC. Use the micro-shock hammer on the top, front, center of the plug-in scope. Check for $\leq$1cm of microphonics, with no ringing.

c. Check trace drift: $\leq$0.5cm

Set the TYPE W DISPLAY to A-Vc. Change the TYPE 76TU to 103.5V, wait 1 minute. Position the trace to graticule center. Change the TYPE 76TU to 126.5V, wait 1 minute. Check for $\leq$0.5cm trace shift from graticule center. Change the DISPLAY switch to Bc-B and repeat for B INPUT. Return TYPE 76TU to 115V.

d. Check noise: $\leq$3mm with $\leq$1mm jitter

Check for trace width of 3mm or less with 1mm or less of trace jitter. Change the DISPLAY switch to A-Vc. Check for trace width of 3mm or less with 1mm or less trace jitter.

8. AMPLIFIER TRANSIENT RESPONSE

a. Setup

Connect TYPE 106 +OUTPUT--GR to BNC Adapter--50Ω cable--50Ω Terminator--Dual Input Coupler--A&B INPUT.

8a. (CONT)

Connect a 50Ω Cable from TYPE 106 TRIGGER OUTPUT to B TRIGGER INPUT on plug-in scope and set TRIGGER SOURCE switch to EXT. Change both AC-DC-GND switches to AC, MILLIVOLTS/CM to 50 and the DISPLAY to A-Vc. Adjust TYPE 106 for 100kHz and 4cm of fast rise display. Set the plug-in scope TIME/CM to .1μSEC, TRIGGERING LEVEL for a stable display and center the waveform on the graticule.

b. Adjust HF compensations: Aberration ≤2.5% P-P

Preset C174 and C274 rotors so that the slots are parallel and the silvered areas have maximum separation. Adjust C184, C294 and C295 for flattest top and fastest risetime, without ringing. Switch the DISPLAY between A-Vc and Vc-B and adjust for best compromise waveform with ≤1mm aberration. If necessary, adjust C174 and C274 by turning them equal and opposite in rotation in very small increments. Readjust C184, C294 and C295 for optimum waveform compromise between A-Vc and Vc-B.

c. Check positioning effect: ≤1.5%

In the A-Vc position of DISPLAY, move the front corner of the square wave to the top graticule line and note the front corner aberration. Position the front corner to the bottom graticule line and check the aberration for ≤0.6mm of change from the aberration noted at top.

d. Check transient response: Aberration ≤2.5% P-P

Check the 20, 10, 5, 2 and 1 positions of the MILLIVOLTS/CM for 1mm aberration. In each position, check both A-Vc and Vc-B positions of DISPLAY. Add a 10:1 Attenuator as necessary, between the 50Ω Terminator and the 50Ω Cable, to maintain 4cm of deflection. Remove TRIGGER INPUT Cable and return SOURCE switch to INT.

8. (CONT)

e. Check INPUT crosstalk: ≤2.5%

Set the plug-in scope TRIGGERING LEVEL cw and adjust TYPE 106 for 4cm of amplitude with INPUT ATTEN and MILLIVOLTS/CM each set to 1. With DISPLAY in A-Vc, change A INPUT to GND and check for a display of ≤1mm as display is positioned over the graticule. Change DISPLAY to Vc-B, reverse settings of A and B INPUT switches and repeat the check for ≤1mm of display. Remove the TYPE 106 signal setup.

9. BANDWIDTH

a. Setup

Connect TYPE 191 OUTPUT--GR to BNC Adapter--50Ω cable--10:1 attenuator--50Ω termination--A INPUT.

Set the TYPE W controls as follows:

DISPLAY	A-Vc
INPUT ATTEN	1
MILLIVOLTS/CM	50
A INPUT	DC
B INPUT	GND

b. Check amplifier bandwidth: ≥26MHz @-3dB

Adjust TYPE 191 for a 4cm display of 50kHz centered on the graticule. Increase the frequency of TYPE 191 until the display is reduced to 2.8cm and check frequency of TYPE 191 for ≥26MHz.

Change the DISPLAY to Vc-B, move signal setup to INPUT B and repeat the step.

c. Check MILLIVOLTS/CM bandwidth

Check the remaining positions of the MILLIVOLTS/CM switch in both A and B INPUT as in the table below:

MILLIVOLTS/CM	Bandwidth
20	24MHz
10	21MHz
5	18MHz
2	14MHz
1	8MHz

Remove the TYPE 191 signal setup.

9. (CONT)

d. Check AC LF bandwidth: ≤2Hz @-3dB

Change MILLIVOLTS/CM to 50 and both INPUT's to AC. Set the DISPLAY to A-Vc and connect the OUTPUT of LFSWG to A INPUT. Adjust the LFSWG for a 4cm display of 50kHz. Check the AC low frequency bandwidth by reducing the frequency of the LFSWG to 2Hz without changing AMPLITUDE controls. Check that ≥2.8cm of display remains.

Change the LFSWG signal setup to the B INPUT, set DISPLAY to Vc-B and repeat the step.

10. PEAK OVERDRIVE RECOVERY

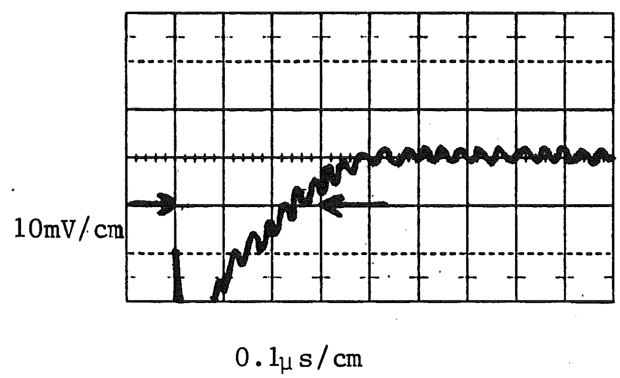
a. Adjust AC peak overdrive recovery: ≤0.3μs to return within 10mV

Connect the HI-AMPLITUDE OUTPUT of TYPE 106 through a coax cable and 50Ω Terminator to A INPUT. Set A INPUT to DC, B INPUT to GND, DISPLAY to A-Vc. MILLIVOLTS/CM to 50 and INPUT ATTEN to 100.

Adjust TYPE 106 for a 2cm display of 10kHz and trigger the waveform at .1μ SEC/CM. Change the INPUT ATTEN to 1 and the MILLIVOLTS/CM to 10. Position the start of the waveform 1cm in from the left edge of the graticule and position the flat portion of waveform top to graticule center as pictured in Fig. 10a. Adjust C116 for the best recovery by observing that waveform recovers to within 1cm of graticule center at a point ≤3cm from waveform leading edge.

Change the TYPE 106 signal setup to B INPUT, DISPLAY to Vc-B, B INPUT to DC, A INPUT to GND and TRIGGER SLOPE switch to −. Position the bottom of display to graticule center and adjust C216 for best recovery of the inverted waveform.

10a. Overdrive recovery



10. (CONT)

b. Check DC overdrive recovery: ≤0.5mV shift after 1 second

Change the B INPUT switch to GND, position the trace to graticule center and change TIME/CM to 50µSEC. Return the B INPUT switch to DC, wait 10 seconds and check for 0.5cm of shift between flat portion of pulses and graticule center. Repeat the step in INPUT A by moving the TYPE 106 signal setup to A INPUT, DISPLAY to A-Vc, B INPUT to GND and TRIGGER SLOPE back to +. Change A INPUT switch to DC and again note ≤0.5cm shift in 10 seconds time. Remove TYPE 106 signal setup.

11. AMPLIFIER CMRR

a. Adjust DIFF BAL CMRR: ≥20,000:1 @20Hz

Connect the OUTPUT of the LFSWG to A and B INPUT with the Dual Input Coupler. Set the INPUT ATTEN to 1000, MILLIVOLTS/CM to 10, DISPLAY to A-B and adjust the LFSWG for 3cm of 20Hz. Change the B INPUT switch to DC, INPUT ATTEN to 1 and MILLIVOLTS/CM to 1. Adjust the DIFF BAL for minimum amplitude, ≤1.5cm.

b. Adjust 20kHz CMRR: ≥20,000:1

Change the INPUT ATTEN to 1000, MILLIVOLTS/CM to 10 and DISPLAY to A-Vc. Set the LFSWG for 3cm of 20kHz. Return the DISPLAY to A-B, INPUT ATTEN to 1, MILLIVOLTS/CM to 1 and position the display at graticule center. Adjust C113 anc C216 for minimum amplitude, ≤1.5cm.

c. Check AC coupled CMRR: ≥1,000:1 @60Hz

Change the A and B INPUT switches to AC, INPUT ATTEN to 1000, MILLIVOLTS/CM to 10 and DISPLAY to A-Vc. Set the LFSWG for a 3cm display of 60Hz. Return the DISPLAY control to A-B and INPUT ATTEN to 1. Check for ≤3cm of amplitude.

11. (CONT)

d. Check HF CMRR: ≥500:1 @500kHz

Change the INPUT ATTEN to 1000, the MILLIVOLTS/CM to 1 and the DISPLAY to A-Vc. Set the LFSWG for 3cm of 500kHz. Change the DISPLAY control to A-B, INPUT ATTEN to 1 and the MILLIVOLTS/CM to 2. Check the display for ≤3cm of amplitude.

e. Check DC coupled CMRR: ≥20,000:1

Disconnect the LFSWG signal from the Dual Input Coupler. Change both INPUT switches to DC, MILLIVOLTS/CM to 1 and position the trace to graticule center. Set the SAC AMPLITUDE control to 10 VOLTS and SAC MODE to +DC. Connect the SAC OUTPUT cable to the Dual Input Coupler and check for ≤0.5cm of trace shift. Remove the SAC OUTPUT cable and Dual Input Coupler.

12. INPUT ATTENUATOR RESISTANCE

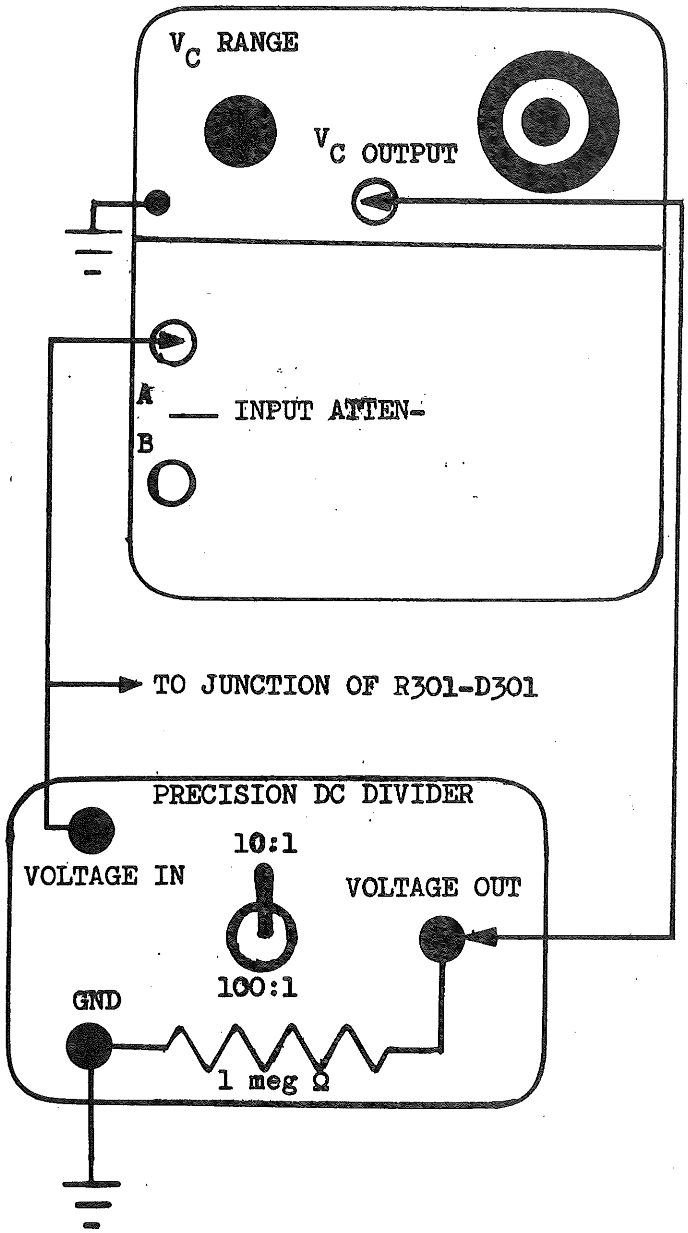
a. Adjust X10 input attenuator, R106E & R206E: ±0.04%

Connect the PRECISION DC DIVIDER as shown. Set the INPUT ATTEN switch to 10. Set the INPUT ATTEN switch to 10. Set the DISPLAY switch to A-Vc. Set the MILLIVOLTS/CM switch to 1. Set the COMPARISON VOLTAGE knob to a position between detents.

Position the trace to the graticule center line.

Change the Vc RANGE switch to +11 and adjust R106E to return the trace to graticule center. Rotate the Vc RANGE switch several times from +11 to 0 and adjust R106E for minimum trace shift, ≤4mm.

PRECISION DC DIVIDER



12a. (CONT)

Change the lead to the B INPUT. Set the Vc RANGE switch to 0 and the DISPLAY switch to Vc-B. Position the display to the graticule center line.

Rotate the Vc RANGE switch several times from 0 to +11, and adjust R206E for minimum trace shift, $\leq$4mm. Return the Vc RANGE to 0.

b. Adjust X100 input attenuator, R208G & R108G: ±0.14%

Change the PRECISION DC DIVIDER 10:1 100:1 switch to 100:1 position. Set the INPUT ATTEN switch to 100 and adjust the POSITION control to return the trace to graticule center. Rotate the Vc RANGE switch several times, from 0 to +11, and adjust R208G for minimum trace shift, $\leq$1.4mm. Set the Vc RANGE switch to 0.

Change the lead to the A INPUT. Set the DISPLAY switch to A-Vc. Reposition the display to the graticule center line.

Rotate the Vc RANGE switch several times, from 0 to +11, and adjust R108G for minimum trace shift, $\leq$1.4mm.

Remove the leads from INPUT A.

c. Adjust X1 attenuator, R105B & R205B: X1 = X10 ±0.07%

Remove the patch cord from the junction of R301-D301. Connect the 1MΩ resistor used on the PRECISION DC DIVIDER from the A INPUT to the Vc OUTPUT. Set the COMPARISON VOLTAGE knob to 10, the dial ccw to 0.00 and the Vc RANGE to +11. Change the INPUT ATTEN to 10. Connect the differential voltmeter between ground and the A INPUT and adjust it for a null reading.

Change the INPUT ATTEN to 1 and adjust R105B for a null reading of the differential voltmeter, $\leq$3mV.

Repeat for the Vc-B input. Remove the 1MΩ resistor from the Vc OUTPUT and B INPUT. Set the Vc RANGE to 0.

13. COMPARISON VOLTAGE

a. Adjust Vc Cal, R310: +11V, ±0.05%

Set the differential voltmeter to read 11 volts. Connect the plug (+) lead to the VC OUTPUT and the common lead to the gnd post. Adjust R310 Vc Cal for 11 volts.

b. Adjust tracking, R323: +1 volt, ±0.05%

Remove the differential voltmeter plus (+) lead from the Vc OUTPUT. Set the differential voltmeter for a 1 volt reading. Set the COMPARISON VOLTAGE (Vc) knob to 0. Leave the dial at 10.0. Reconnect the differential voltmeter plus (+) lead to the Vc OUTPUT and adjust R323 for 1 volt.

c. Check accuracy: ±0.1% + (0.05% of Vc RANGE)

Set the COMPARISON VOLTAGE (VC) knob to 0, and the dial to 0.00. Set the differential voltmeter to read 0 volt. Using the table below, check the accuracy of the COMPARISON VOLTAGE.

Vc knob	Vc dial	voltmeter reading	maximum deviation
0	0.00	0.0V	.005V
1	0.00	1.0V	.006V
2	0.00	2.0V	.007V
3	0.00	3.0V	.008V
4	0.00	4.0V	.009V
5	0.00	5.0V	.010V
6	0.00	6.0V	.011V
7	0.00	7.0V	.012V
8	0.00	8.0V	.013V
9	0.00	9.0V	.014V
10	0.00	10.0V	.015V
10	1.00	10.1V	.0151V
10	2.00	10.2V	.0152V
10	3.00	10.3V	.0153V
10	4.00	10.4V	.0154V
10	5.00	10.5V	.0155V
10	6.00	10.6V	.0156V
10	7.00	10.7V	.0157V
10	8.00	10.8V	.0158V
10	9.00	10.9V	.0159V
10	10.00	11.0V	.016 V

13. (CONT)

d. Check divider: 10:1 ±0.1%

Set the Vc RANGE to +1.1 and the differential voltmeter to read 1.1 volt.

Check for 1.1 volts ±.0011V.

e. Check minus Vc: -11 volts ±0.1%
-1.1 volt ±0.1%

Change the Vc RANGE to -1.1 and check for -1.1 volt ±.0011V.

Change the Vc RANGE to -11. Set the differential voltmeter to read 11 volts and check for -11 volts ±.011V.

f. Check 0 Vc RANGE: 0 volts

Change the Vc RANGE to 0 and check for 0V. Remove differential voltmeter.

14. INPUT COMPENSATION

a. Adjust A INPUT: ≤1% aberration P-P

Connect TYPE 106 OUTPUT--GR to BNC Adapter--50Ω cable--10:1 attenuator--50Ω Terminator--20pF Input RC Normalizer--A INPUT.

Set MILLIVOLTS/CM to 50, INPUT ATTEN to 1, DISPLAY to A-Vc and both INPUT switches to DC. Adjust the TYPE 106 for 4cm of 1kHz and adjust the input compensation for flat top and square corner, ±0.4mm, as in the following table. Adjust TYPE 106 AMPLITUDE and remove attenuation as required to maintain 4cm of display.

INPUT ATTEN	Adjust for Optimum Corner	Adjust for Optimum Level
1		C110
10	C106E, C106C	C106B
100	C108C	C108B
1000	C109C	C109B

14. (CONT)

b. *Adjust B INPUT: ≤1% aberration P-P*

Change back to original signal setup and apply to B INPUT. Change the DISPLAY control to Vc-B and adjust the input compensation using the following table.

INPUT ATTEN	Adjust for Optimum Corner	Adjust for Optimum Level
1		C210
10	C206E, C206C	C206B
100	C208C	C208B
1000	C209C	C209B

Remove the TYPE 106 signal setup.

15. X10 ATTENUATOR COMMON MODE REJECTION

Minimum amplitude

Connect the OUTPUT of the LFSWG to A and B INPUT with the Dual Input Coupler. Set the INPUT ATTEN to 100, MILLIVOLTS/CM to 50, DISPLAY to A-Vc and adjust LFSWG for 4cm of 20kHz. Change DISPLAY to A-B, INPUT ATTEN to 10, MILLIVOLTS/CM to 1 and adjust C206C for minimum amplitude. Remove the Dual Input Coupler and cable from TYPE W.

16. R≃∞

≥10GΩ

Connect the X10 probe to the TYPE W A INPUT. Connect the 1MΩ resistor from the probe tip to the Vc OUTPUT. Set the COMPARISON VOLTAGE knob to 10 and dial to 00. Set the Vc RANGE to 0. Change the MILLIVOLTS/CM to 10. Change the DISPLAY switch to A-Vc. Set the INPUT ATTEN to R≃∞. Position the trace to the graticule center line. Change the Vc RANGE switch to +11. Check for ≤1cm of trace shift. Return Vc RANGE to 0 and check position of the trace. Change Vc RANGE switch to -11 and check for ≤1cm of trace shift.

Change X10 probe to B INPUT, VC RANGE to 0 and DISPLAY switch to Vc-B. Repeat test for B INPUT.

THE END