FACTORY CALIBRATION PROCEDURE

CONTENTS:

INTRODUCTION:

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.).

1A4

Tek form number:
0-360
January 1967

For all serial numbers.

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. (DH)

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Instruments

*	1	TYPE 547 OSCILLOSCOPE (plug-in scope)
	1	TYPE 544, 546, or 547 OSCILLOSCOPE with
	1	TYPE 1A1 PLUG-IN UNIT (test scope)
*	1	TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR
	1	TYPE 106 SQUARE WAVE GENERATOR
	1	TYPE 76TU LINE VOLTAGE CONTROL UNIT
	1	TYPE P6006 X10 PASSIVE PROBE (010-0127-00)
	1	TYPE P6028 X1 PASSIVE PROBE (010-0074-00)

b. Test Fixtures and Accessories

*	1	LF Sine Wave Generator (067-0542-99)
*	1	DC Voltage Bridge (067-0543-99)
*	1	Standard Amplitude Calibrator (SAC) (067-0502-00)
*	1	% Deviation From 67.5% Bridge
	1	20pF Capacitance Normalizer
	1	Dual Input Connector (067-0525-00)
	1	GR to BNC Female Adapter (017-0063-00)
	2	50Ω BNC cables (012-0057-00)
	1	50Ω Termination (011-0049-00)
	1	Flexible Extension (012-0038-00)
	1	600V Variable DC Supply (See PMPE Dwg #1421-A)

c. Other Equipment

1	20,000Ω/Volt Multimeter

* This equipment must be traceable to NBS for instrument certification.

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.

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

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 checkout methods and test equipment differ substantially from those in this procedure.

1. PRELIMINARY INSPECTION

2. PRESET CONTROLS

3. RESISTANCE

4. POWER SUPPLIES, SWITCHING, VAR BALANCE AND OUTPUT DC LEVEL

b. Adjust -15V Supply: ±0.1%
c. Check +12.1V Supply: ±2%
d. Adjust VAR BAL: ±2mm max
h. Set Output DC Level: 67.5% of plug-in scope +100V supply (not decoupled) ±2%
i. Check regulation and ripple

Test Point	Supply	Regulation	Ripple
Logic Board	-15	±0.3V (±2%)	2mV
Logic Board	+12.1	±.24V (±2%)	2mV

5. POSITION RANGE ≥+ & -9cm

6. MAXIMUM INPUT VOLTAGE +&- 600V

7. GAIN

* a. Check CHANNEL 1 Preamp Range and Adjust Gain: Range + & -5%
Gain Accuracy ±1%

7. (cont'd)

b. Check GAIN Range: + & -6%
* c. Set CHANNEL 2, 3 & 4 Preamp Gain with respect to CHANNEL 1: ±0.5%
* d. Check Added Accuracy: ±1%

8. MICROPHONICS AND GATE CURRENT

a. Check Microphonics: 2mm, max
b. Check Gate Current: 1nA, max

9. V/CM, VARIABLE AND AC

a. Check VARIABLE V/CM Range: 2.5:1 min
* c. Check V/CM accuracy: ±2%

10. TRIGGER SELECTOR BALANCE ±2mm, max

11. NORM INVERT BALANCE ±1cm, max

12. IDENTIFY +2mm to 5mm shift

13. HF COMPENSATIONS

a. Adjust HF Compensations: Aberrations 2% PTP
b. Check VARIABLE aberrations: 5% PTP max
c. Check CAHNNEL 2, 3 & 4 aberrations:
Variable: 5% PTP max
In CAL: 2% PTP max
d. Check Added Aberrations: 5% PTP max

14. FREQUENCY RESPONSE ≥50 MHz at -3dB

15. INPUT AND V/CM COMPENSATIONS

a. Adjust CHANNEL 1 Input Compensation: Aberrations 1% PTP max
b. Adjust CHANNEL 1 Attenuator Compensations: aberrations 1% PTP max

* 16. COMMON MODE REJECTION 20:1 min @ 10 MHz

17. INTER-CHANNEL ISOLATION

a. Check Amplifier Isolation: ≥50:1 @ 20 MHz
b. Check Attenuator Isolation: ≥5000:1 @ 20 MHz

18. CHOPPED MODE

a. Check Chop Frequency: 400 kHz ±20%
b. Check Blanking Pulse Width: 0.5μs ±40% @50% pts.
c. Check Distortion: 1mm, max

19. SIGNAL AND TRIGGER SOURCE

* a. Check SIGNAL OUTPUT Gain: 0.5V/CM, min
b. Adjust SIGNAL OUTPUT Transient Response: Aberrations 15% PTP max
* c. Check SIGNAL OUTPUT Bandwidth: 20 Hz to 10 MHz; In Chopped: 500 kHz ±20%
d. Check Plug-In Triggering: 2cm at 10 MHz
e. Check SIGNAL OUTPUT Hum and Noise: AC Hum: 10mV PTP; Total Noise: 30mV PTP
f. Check SIGNAL OUTPUT Chopped Transients: 85mV PTP max
g. Check Power Supply Chopped Transients: 100mV PTP max -15V 50mv PTP max
+12.1V 100mv PTP max

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

1. PRELIMINARY INSPECTION

Check the component assembly of the instrument; unsoldered joints, rosin joints, lead dress and unclipped wire ends. Check for loose hardware and protruding parts. Check controls for smooth mechanical operation, proper indexing and spacing. Correct all defects found.

2. PRESET CONTROLS

a. TYPE 1A4

All Channels

V/CM	.01
VARIABLE	CAL
INPUT	GND
POSITION	Midr
INVERT PULL	Pushed in
MODE 1 & 2	ALT
MODE 3 & 4	ALT
DISPLAY	ALT
GAIN	Midr
SIGNAL & TRIGGER SOURCE	1
547 TRACE SLAVING (rear of chassis	LOCK
Int Adjs	R395, R396 & R397 at max resistance C395, C396 & C397 at min capacitance All others, midr (skip atten comp)

b. TYPE 547 (Plug-in scope)

HORIZONTAL DISPLAY	A
TIME BASE A & B	
TRIGGERING LEVEL	cw, pulled out
TRIGGERING MODE	AUTO
TRIGGERING SLOPE	+
TRIGGERING COUPLING	AC
TRIGGERING SOURCE	NORM INT
TIME/CM	.1mSEC

3. RESISTANCE

Check interconnecting Plug Resistance to chassis ground as follows:

Pin	Approximate Resistance	Use
1	6.5k	Output
2	0	Ground
3	6.5k	Output
4	0	Trig Out Ground
5	1.7k	Trig Out

3. (cont'd)

Pin	Approximate Resistance	Use
6	inf	unused
7	15k	Trace Slaving Pulse
8	3.0k	Sync Pulse
9	6.5k	-150V
10	5.7k	+100V
11	15.5k	+225V
12	inf	unused
13	inf	V364 fil
14	inf	V364 fil
15	700Ω	+75V
16	50k	Chopped Blanking

Check resistance from INPUT switch side of R2 to chassis ground, should be 0Ω. Repeat for all channels.

4. POWER SUPPLIES, SWITCHING, VAR BALANCE AND OUTPUT DC LEVEL

a. Setup

Connect the TYPE 1A4 to the plug-in scope using the Flexible extension. Connect the scope to the TYPE 76TU set for 115 VAC and turn POWER ON.

b. Adjust -15V Supply: ±0.1%

Connect DC Voltage Bridge between ground and the -15V test point located on the plug-in logic board. Adjust R610 for -15V.

c. Check +12.1V supply: ±2%

Connect the DC Voltage Bridge between ground and the +12.1V test point located on the logic board. Voltage must be +12.1V ±.24V.

d. Adjust VAR BAL: ±2mm max

With the CHANNEL 1 POSITION control, position the CHANNEL 1 trace to the graticule center. Rotate the CHANNEL 1 VARIABLE V/CM through its range while adjusting the VAR BAL for minimum trace shift. Repeat for all channels.

4. (cont'd)

e. Check Alternate Mode

Position the 4 traces 1cm apart, set A TIME/CM to .5 SEC and check sequence of alternation (1, 2, 3, 4). Check alternation at 50mSEC, .5mSEC, 50µSEC, 5µSEC and .5µSEC. Set A TIME/CM to 50mSEC and B TIME/CM to .5mSEC. Set HORIZONTAL DISPLAY to A-ALT-B and check that CHANNEL's 1 and 2 sweep at 50mSEC and CHANNEL's 3 and 4 sweep at .5mSEC. Set A and B TIME/CM controls to .1mSEC.

Set the 547 TRACE SLAVING switch to UNLOCK and check for 8 traces on the display. Return the HORIZONTAL DISPLAY to A and set the 547 TRACE SLAVING switch to LOCK.

f. Check Chopped Mode

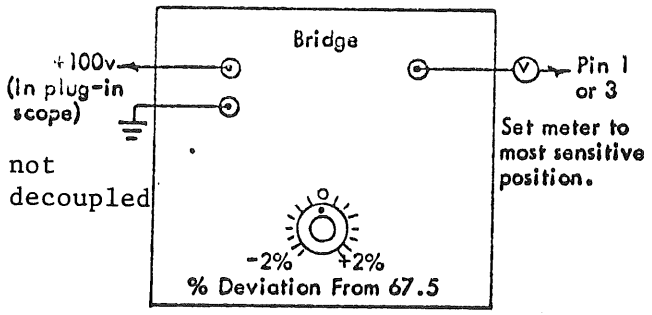
Set DISPLAY and both MODE switches to CHOP. Set the A TIME/CM control to 2µSEC and the A TRIGGERING LEVEL control for a stable display. Check for a chopped display. Return the A TIME/CM control to .1mSEC.

g. Check Added Mode

Set the DISPLAY and both MODE switches to ADD. Push each channel IDENTIFY switch and note that each channel will cause the trace to shift. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2.

h. Set Output DC Level: 67.5% of plug-in scope +100V supply (not decoupled) ±2%

Momentarily short pins 1 and 3 of the interconnecting plug and note the plug-in scope electrical center. Using the CHANNEL 1 POSITION control, position the trace to the electrical center and make setup as illustrated.



4h. (cont'd)

Set % Deviation from 67.5 to 0 and adjust the Output DC Level, R360 for zero volts as read on meter. Set MODE (1 & 2) to CHANNEL 2, position the trace to the electrical center and check % deviation from 67.5 by rotating % deviation dial. Set DISPLAY control to 3 & 4 and repeat check for channels 3 and 4. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2.

i. Check Regulation and Ripple

Using the DC Voltage Bridge and test scope at appropriate settings, check regulation and ripple of supplies as indicated below while varying the TYPE 76TU from 103.5 VAC to 126.5 VAC.

Test Point	Supply	Regulation	Ripple
Logic Board	-15	±0.3V (±2%)	2mV
Logic Board	+12.1	±.24V (±2%)	2mV

Remove the flexible extension and insert the TYPE 1A4 into the plug-in scope.

5. POSITION RANGE + & -9cm min

Set CHANNEL 1 INPUT to AC and V/CM to .05. Set the SAC AMPLITUDE control to .2 VOLTS and connect the SAC OUTPUT to INPUT 1. With the CHANNEL 1 VARIABLE V/CM control, adjust the display amplitude for 3.6cm. Set the CHANNEL 1 V/CM to .01. Using the POSITION control it must be possible to position the top and bottom of the display to the graticule center. Repeat for all channels. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2.

6. MAXIMUM INPUT VOLTAGE + & -600V

Set all inputs to AC and V/CM switches to .01. Position the CHANNEL 1 trace to the graticule center and connect a 50Ω cable from the 600V Variable DC Supply to INPUT 1. Set the 600V Variable DC Supply to FAST RISE, the POLARITY switch to + and push the TEST button. Check that trace returns to graticule center ±2cm after initial shift. Release the TEST button, set the POLARITY switch to - and again push the TEST button. Check that trace returns to graticule center ±2cm after shift. Repeat for all channels. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2. Return all inputs to DC.

7. GAIN

a. Check CHANNEL 1 Preamp Range and Adjust Gain: Range + & -5%
Gain Accuracy ±1%

Set the SAC AMPLITUDE control to 50mVOLTS and connect the SAC OUTPUT to INPUT 1. Rotate CHANNEL 1 Preamp Gain, R77 full cw and check for a minimum display amplitude of 5.25cm. Rotate R77 full ccw and check for a 4.75cm maximum deflection. Adjust R77 for a 5cm display amplitude. Check range of channels 2, 3 and 4 and return the SAC OUTPUT to CHANNEL 1.

b. Check GAIN Range: + & -6%

Rotate the GAIN control full cw and check for a minimum display amplitude of 5.3cm. Rotate the GAIN control full ccw and check for a 4.7cm maximum deflection. Set GAIN for a 5cm display.

c. Set CHANNEL 2, 3 & 4 Preamp Gain with respect to CHANNEL 1: ±0.5%

Connect a dual input connector to INPUTS 1 and 2. Set the SAC AMPLITUDE to .1 VOLTS and connect the SAC OUTPUT to the dual input connector. Set MODE (1 & 2) to ADD and pull CHANNEL 1 INVERT PULL. Set CHANNEL 2 Preamp Gain, R97, for a null indication ±.5mm.

Set MODE (1 & 2) to CHANNEL 1, MODE (3 & 4) to 3 and DISPLAY to ADD, connect Dual Input Connector to INPUTS 1 and 3 and set Channel 3 Preamp Gain, R97, for null ±.5mm.

Set MODE (3 & 4) to 4 and connect Dual Input Connector to INPUTS 1 and 4. Set Channel 4 Preamp Gain, R97, for null ±.5mm.

7. (cont'd)

d. Check Added Accuracy: ±1%

Set MODE (+&-) to CHANNEL 2. Pull CHANNEL 4 INVERT. Connect dual input to INPUTS 2 & 4. Check for null indication of ±1mm max. Set DISPLAY to (3 & 4), MODE (3 & 4) to ADD and connect dual input to INPUTS 3 & 4. Check for null indication of ±1mm max. Set MODE 3 & 4 to 3 & DISPLAY to ADD. Connect dual input to INPUTS 2 & 3 and pull CHANNEL 3 INVERT. Check for null indication of ±1mm max. Set MODE (192) to CHANNEL 1, DISPLAY to (192).

Repeat step 4d (VAR BAL). Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2.

8. MICROPHONICS AND GATE CURRENT

a. Check Microphonics: 2mm, max

Set INPUT 1 to GND and rap lightly on the left side of the plug-in scope. Check microphonics: 2mm or less.

b. Check Gate Current 1nA, max

Switch INPUT 1 to DC. Check for trace shift: 1mm or less. Repeat steps a and b for all channels. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2.

9. V/CM, VARIABLE AND AC

a. Check VARIABLE V/CM Range: 2.5:1 min

Connect a 50mVOLT SAC signal to INPUT 1 and note 5cm display. Rotate VARIABLE full ccw but not in CAL and check for 2cm or less display amplitude. Set VARIABLE to CAL.

b. Check INPUT AC

Set SAC AMPLITUDE to 20mVOLTS and position bottom of waveform to center graticule line. Switch INPUT 1 to AC and note that trace shifts downward and center graticule line is approximately through the center of the display. Switch INPUT 1 to DC.

9. (cont'd)

c. Check V/CM accuracy: ±2%

Referring to table below for control settings check accuracy of each V/CM setting.

V/CM	SAC AMPLITUDE	Deflection, ±2%
.01	50mVOLTS	5cm
.02	.1 VOLTS	5cm
.05	.2 VOLTS	4cm
.1	.5	5cm
.2	1	5cm
.5	2	4cm
1	5	5cm
2	10	5cm
5	20	4cm
10	50	5cm
20	100	5cm

Repeat steps 12a, 12b and 12c for each channel.

10. TRIGGER SELECTOR BALANCE ±2mm max

Set DISPLAY and both MODE switches to ALT. Switch the SIGNAL AND TRIGGER SOURCE control to 2. Note position of CHANNEL 1 trace. Return control to 1 and adjust R-55 until trace is at previous location. Repeat until there is no trace shift. Repeat from 1 to 2 observing CHANNEL 2 trace and adjusting R-56. Repeat from 2 to 3 observing CHANNEL 2 and adjusting R-57. Repeat from 3 to 4 observing CHANNEL 4 trace and adjust R-58. Return the control to 1.

11. NORM INVERT BALANCE ±1cm max

Position the CHANNEL 1 trace to the graticule center and pull CHANNEL 1 INVERT PULL out. Note shift to be 1cm or less. Push INVERT PULL in. Repeat check for all channels.

If shift is greater than 1cm, readjust VAR BAL for minimum trace shift and repeat.

12. IDENTIFY +2mm to 5mm shift

Push CHANNEL 1 IDENTIFY switch. Check trace shift for a minimum of 2mm and a maximum of 5mm. Repeat for all channels. Set MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2.

13. HF COMPENSATIONS

a. Adjust HF Compensations:
Aberration 2% PTP

Connect a 50Ω cable from the TYPE 106 FAST RISE + OUTPUT with a 50Ω termination to INPUT 1. Adjust the TYPE 106 for 100 kHz and a display amplitude of 4cm. Set plug-in scope A TIME/CM to .1μSEC and position the front corner of the waveform to the graticule center. Adjust R395, R396, R397, C395, C396 and C397 for optimum response. Set TIME/CM to 10μSEC and check waveform. Readjust C397 and R397 if necessary for optimum flat top.

b. Check VARIABLE aberrations: 5% PTP, max

Set CHANNEL 1 VARIABLE full ccw, not in detent, and adjust the TYPE 106 for a 4cm display. Check aberrations to be equal to or less than 2mm. Return VARIABLE to CAL.

c. Check CHANNEL 2, 3 & 4 aberrations:
Variable: 5% PTP max
In CAL 2% PTP max

Check HF response on CHANNEL 2, 3 & 4 with VARIABLE full ccw and with VARIABLE in detent.

d. Check Added Aberrations: 5% PTP max

Set MODE (1 & 2) to ADD and DISPLAY to 1 & 2. Connect a dual input connector to INPUT 1 and 2 and connect the 50Ω cable with 50Ω termination from the TYPE 106. Adjust the TYPE 106 for a 4cm display and check for 2mm maximum aberrations. Set MODE (1 & 2) to 2, DISPLAY to ADD and MODE (3 & 4) to 3. Connect the dual input connector to INPUT 2 and 3 and again check for 2mm maximum aberrations. Set DISPLAY to 3 & 4 and MODE (3 & 4) to ADD. Connect the dual input connector to INPUT 3 and 4 and check for 2mm maximum aberrations. Remove the dual input connector.

14. FREQUENCY RESPONSE ≥50 MHz at -3dB

Set MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2. Connect a 50Ω cable with 50Ω termination from the TYPE 191 to INPUT 1. Set the TYPE 191 to 50 kHz and adjust AMPLITUDE controls for a 4cm display. Increase the TYPE 191 frequency until the display amplitude decreases to 2.8cm. Check frequency: 50 MHz, min. Repeat for all channels. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2.

15. INPUT AND V/CM COMPENSATIONS

a. Adjust CHANNEL 1 Input Compensation: aberrations 1% PTP max

Apply 4cm of a 1 kHz square wave from the TYPE 106 HI AMPLITUDE OUTPUT through a GR to BNC male adapter, 10X Attenuator, 50Ω cable, 50Ω Termination, 20pF capacitance Normalizer to INPUT 1. Set the plug-in scope A TIME/CM to .5mSEC. Adjust CHANNEL 1 input capacitor, C26 for optimum flat top.

b. Adjust CHANNEL 1 Attenuator Compensations: aberrations 1% PTP max

Compensate each V/CM setting for optimum front corner and flat top. Maintain a 4cm display if possible for each step (remove X10 and 50Ω termination when necessary).

	Adjust	
V/CM	Front Corner	Flat Top
.02	C32	C31
.05	C39	C38
.1	C6A	C5
.2	check*	check*
.5	check*	check*
1	C12A	C11
2	check*	check*
5	check*	check*
10	C19A	C18
20	check*	check*

* If necessary, make compromise adjustments to positions involved (within limits) to bring the stacked positions within limits.

Repeat steps a and b for all channels. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2. Set all V/CM to .01.

16. HF COMMON MODE REJECTION 20:1 min @ 10 MHz

Connect a 50Ω cable with 50Ω termination from the TYPE 191 set at 10 MHz to a dual input connector. Set CHANNEL 1 and 2 V/CM controls to .02 and connect the dual input connector. Set MODE (1 & 2) to ALT and obtain a 6cm display for each channel. Do not adjust VARIABLE V/CM. Set MODE (1 & 2) to ADD and pull the CHANNEL 1 INVERT PULL switch. Set the CHANNEL 1 and 2 V/CM controls to .01 and check the display amplitude to be 6mm or less. Repeat for CHANNEL 2 & 3 and 3 & 4. Remove the dual input connector.

17. INTER-CHANNEL ISOLATION

a. Check Amplifier Isolation:
≥50:1 @ 20 MHz

Set MODE (1 & 2) to CHANNEL 1, DISPLAY to 1 & 2 and MODE (3 & 4) to 3. Connect the 50Ω cable with the 50Ω termination from the TYPE 191 to INPUT 1. Set the CHANNEL 1 V/CM to .02. Set the TYPE 191 to 20 MHz and adjust the AMPLITUDE controls for a 6cm display. Set MODE (1 & 2) to CHANNEL 2 and the CHANNEL 1 V/CM to .01. The displayed amplitude must not exceed 2.4mm. Repeat for CHANNEL 2 to 3 and 3 to 4.

b. Check Attenuator Isolation:
≥5000:1 @ 20 MHz

Set MODE (1 & 2) to CHANNEL 1, DISPLAY to 1 & 2 and MODE (3 & 4) to 4. Connect the TYPE 191 OUTPUT to INPUT 1 and set CHANNEL 1 V/CM to 2. Adjust the TYPE 191 for a 5cm display. Set MODE (1 & 2) to CHANNEL 2 and with the CHANNEL 2 V/CM set at .01 check that the displayed amplitude does not exceed 2mm. Repeat for CHANNEL 2 to 3 and 3 to 4.

18. CHOPPED MODE

a. Check Chop Frequency: 400 kHz ±20%

Set DISPLAY to 1 & 2 and MODE (1 & 2) to CHOP. Set the A TIME/CM control to 50mSEC and connect a X10 probe from the test scope to pin 16 of the TYPE 1A4. Set test scope TIME/CM control to 1μSEC and adjust appropriate controls to obtain a 4cm display.

If the chopping rate of MODE 1 & 2 and MODE 3 & 4 are within 5% of each other, switch the BO transistors Q420 and Q460. The chopping rates must be different and MODE 1 & 2 must be faster than MODE 3 & 4.

18a. (cont'd)

Check pulse period at the 50% points to be 2 to 3μs.

b. Check Blanking Pulse Width: 0.5μs ±40% @ 50% pts

Set test scope TIME/CM to .5μSEC and check blanking pulse width (negative portion of the display) at the 50% points, to be 0.5μs ±0.2μs. Repeat steps a and b with MODE (1 & 2) in ADD, DISPLAY in 3 & 4 and MODE (3 & 4) in CHOP. Repeat steps a and b with DISPLAY in CHOP and both MODE switches in ADD.

Set both MODE switches to CHOP and set the plug-in scope A TIME/CM to 1mSEC. Check the trace width of all traces to be 1mm, max.

19. SIGNAL AND TRIGGER SOURCE

a. Check SIGNAL OUTPUT Gain: 0.5V/CM min

Set DISPLAY to 1 & 2 and MODE (1 & 2) to CHANNEL 1. Connect the 50Ω cable with 50Ω termination from the TYPE 106 FAST RISE + OUTPUT to INPUT 1. Adjust the TYPE 106 + TRANSITION AMPLITUDE control for a 4cm display. Set CHANNEL 2 V/CM to .5, connect the TYPE 1A4 SIGNAL OUT to INPUT 2 and set MODE (1 & 2) to ALT. Check CHANNEL 2 display amplitude to be equal to or more than CHANNEL 1. Remove the cable from the SIGNAL OUTPUT connector and set CHANNEL 2 V/CM to .01.

b. Adjust SIGNAL OUTPUT Transient Response aberrations 15% PTP, max

Connect an X10 probe from the test scope to the TYPE 1A4 SIGNAL OUTPUT connector. Set the test scope VOLTS/CM to .05 and adjust the TYPE 106 + TRANSITION AMPLITUDE control for a 4cm display. Adjust C117, C137 and C147 for optimum response. Check aberrations to be equal to or less than 15% (6mm PTP). Remove the TYPE 106 signal from INPUT 1.

19. (cont'd)

c. Check SIGNAL OUTPUT Bandwidth
<20 Hz to >10 MHz
In Chopped: 500 kHz ±20%

Connect a 50Ω cable with 50Ω termination from the TYPE 191 OUTPUT to INPUT 1. Set the TYPE 191 to 50 kHz and set AMPLITUDE controls for a 4cm display on test scope. Increase TYPE 191 Frequency until display drops to 2.8cm. Note frequency to be 10 MHz minimum. Return TYPE 106 to 50 kHz.

Set MODE (1 & 2) to CHOP. Adjust amplitude for 4cm at 50 kHz on test scope. Increase the TYPE 191 frequency until the test scope display drops to 2.8. Check frequency to be between 400 kHz and 600 kHz. Set MODE (1 & 2) to CHANNEL 1. Set DISPLAY to CHOP and repeat check. Return DISPLAY to 1 & 2, set MODE (3 & 4) to CHOP and repeat check. Return MODE (3 & 4) to CHANNEL 3.

Remove the lead from Pin M on the logic board and connect it to Pin N. The frequency at which the test scope display drops to 2.8 must be 400 kHz to 600 kHz regardless of the settings of the DISPLAY or MODE switches. Remove the lead from Pin N and connect it to Pin L. The frequency at which the test scope display drops to 2.8 must be 10 MHz minimum regardless of the settings of the DISPLAY or MODE switches. Remove the lead from Pin L and return to Pin M.

Set MODE (1 & 2) to CHANNEL 1, DISPLAY to 1 & 2 and MODE (3 & 4) to CHANNEL 2. Remove the TYPE 191 signal from INPUT 1. Connect a 50Ω cable from the OUTPUT of the LF Sine Wave Generator to INPUT 1. Set the LF Sine Wave Generator to 1 kHz and adjust the AMPLITUDE for a 4cm display on the test scope. Decrease the frequency until the display drops to 2.8cm. Check for a frequency of 20 Hz or less. Remove the X10 probe and the Sine Wave Generator signal.

19. (cont'd)

d. Check Plug-In Triggering 2cm at 10 MHz

Connect a 50Ω cable with 50Ω termination from the TYPE 191 OUTPUT to INPUT 1. Set the TYPE 191 for 10 MHz and adjust the AMPLITUDE controls for a 2cm display. Set the plug-in scope TRIGGERING SOURCE to PLUG-IN and check for stable triggering.

Set MODE (1 & 2) to CHANNEL 2, connect TYPE 191 signal to INPUT 2, set SIGNAL AND TRIGGER SOURCE to 2 and check for stable triggering.

Set DISPLAY to 3 & 4, MODE (3 & 4) to CHANNEL 3, SIGNAL AND TRIGGER SOURCE to 3 and apply TYPE 191 signal to INPUT 3. Check for stable triggering.

Set MODE (3 & 4) to 4, SIGNAL AND TRIGGER SOURCE to 4, connect TYPE 191 signal to INPUT 4 and check for stable triggering. Return MODE (1 & 2) to 1, MODE (3 & 4) to 3 and DISPLAY to 1 & 2. Set the plug-in scope TRIGGER SOURCE to NORM.

e. Check SIGNAL OUTPUT Hum and Noise
AC Hum: 10mV PTP
Random Noise: 30mV PTP

Connect a X1 probe from the test scope to the TYPE 1A4 SIGNAL OUTPUT connector. Set MODE 3 & 4 to CHOP. Set test scope VOLTS/CM to .01 AC coupled and TIME/CM to 5mSEC. Check AC hum to be 1cm or less. Set MODE 3 & 4 to CHANNEL 3 and test scope TIME/CM to 0.1ms/cm. Check random noise to be 3cm or less.

f. Check SIGNAL OUTPUT Chopped Transients:
85mV PTP max

Set MODE (1 & 2), MODE (3 & 4) and DISPLAY to CHOP. Set test scope VOLTS/CM to .02 V/CM. Check test scope display for 50mV PTP, or less, of the chopped transients. Repeat check with SIGNAL and TRIGGER SOURCE switch in 2, 3 and 4.

g. Check Power Supply Chopped Transients:
-15V 50mV PTP max
+12.1V 100mV PTP max

Connect the test scope X1 probe to -15V test point and check chopped transients; 50mV PTP, max. Connect the probe to the +12.1V test point, and check chopped transients to be 100mV PTP or less. Return MODE (1 & 2) to CHANNEL 1 and DISPLAY to 1 & 2.