FACTORY CALIBRATION PROCEDURE

CONTENTS:

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

This procedure is company confidential

1S2

Aug 1968
For serial numbers 1990 and up.

Equipment Required

Factory Test Limits - 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.

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

Main Procedure - 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).

CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 39-307. (RS)

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Test Equipment

*2	TYPE 544, 546, 547 SERIES OSCILLOSCOPE
*1	TYPE W PLUG-IN UNIT
1	TYPE P6006 10X PROBE
1	TYPE P6028 1X PROBE
*1	TYPE 184 TIME MARK GENERATOR
*1	TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR
1	TYPE 111 PULSE GENERATOR (067-0517-00) mod kit
1	TYPE 76 TU LINE VOLTAGE CONTROL UNIT
1	TYPE 113 DELAY CABLE

b. Test Fixtures and Accessories

1	GR 874 WN Short-Circuit Termination (017-0087-00)
1	GR 874-L20
2	50Ω 5nsec connecting cables (017-0502-00)
3	50Ω 10nsec connecting cables (017-0501-00)
1	50Ω 2nsec connecting cable (017-0505-00)
1	Flexible plug-in extension (012-0038-00) (pin 16, should be coaxial connected)
*1	50Ω Amplitude Calibrator (modified) (067-0508-00)
1	Tunnel Diode Pulse Generator (067-0513-00)
1	111 Variable Attenuator (067-0511-00)
*1	Standard Amplitude Calibrator (SAC) (067-0502-00)
1	GR to BNC male adapter (017-0064-00)
1	50Ω 2:1 Attenuator (017-0046-00)
1	50Ω 5:1 Attenuator (017-0045-00)
4	50Ω 10:1 Attenuators (017-0044-00)
2	50Ω GR elbows (017-0070-00)
1	50Ω Termination (017-0081-00)
1	50Ω power divider (017-0082-00)
*1	DC Voltage Bridge (DCVB) (067-0543-99)
*1	50Ω ±.2% wire wound Terminator (067-0120-00)

b. 50Ω AMPLITUDE CALIBRATOR must be modified to increase output frequency. C25, change to .0033μFd. C60, change to 68pF.

EQUIPMENT REQUIRED: (continued)

c. Other Equipment

1 20,000 /VDC meter (VOM)
1 Polarad 1107 Signal Generator (or equivalent)
1 Thermal Air Bath Gun Model TAB-600 (or equivalent)[1]

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

[1] A hairdryer may be used as a substitute, if it is capable of alternate hot and cool air operation

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.

QUALIFICATION

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 (set-ups, 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. POWER SUPPLIES

a. Power Supply voltages: ±3%
b. Power Supply ripple and regulation between 103 and 127VAC:

Supply	Ripple
-19	5mV
+19	10mV
-136	5mV

c. 3.6 VAC supply: 3.3 to 3.9 VAC

9. SWEEP START AND LENGTH

a. Sweep start: -1V ±5%
b. Sweep length: 10.4 ±.1V

12. MEMORY GATE WIDTH

Memory gate width: 310 to 370nsec

16. BRIDGE VOLTS

+ and - bridge voltage: ≥2 Volts

17. GAIN AND UNITS/DIV ACCURACY

b. VERT GAIN range: ±10%
*c. VERTICAL UNITS/DIV accuracy: ±2%

18. VARIABLE UNITS/DIV RANGE

VARIABLE range: 0.5:1 to 2.5:1

19. OFFSET RANGE AND ACCURACY

*a. OFFSET OUTPUT accuracy: ±1%
b. OFFSET OUTPUT range: + and -2V min

20. OUTPUT DC LEVEL

Output DC level 67.5V ±2.5V

22. TIMING

*a. Sampler Ramp Timing: ±2%
*b. C585B: ±2%
*c. 1μs RANGE: ±2%
*d. MAGNIFIER accuracy: ±2%
e. MAGNIFIER VARIABLE range: 2.7-1

23. POSITION

*b. Incremental accuracy: ±1% of full scale

*24. DIELECTRIC

a. POLYETHYLENE dielectric: ±3%
b. TFE dielectric: ±3%
c. AIR dielectric: ±3%
d. PRESET range: ccw, 8.6 to 9.2cm
cw, 7.8 to 8.4cm

25. 1V PULSER

c. Pulser risetime: 1.1ns
d. Pulser amplitude: .9 to 1 volt
e. ρCal amplitude: 5 volts at VERT OUTPUT ±1%
f. Jitter: 20ps max
g. Blowby, common aberrations: ±2.5%

26. .25V PULSER

c. Pulser amplitude: 230mV to 260mV
d. ρ Cal: 5 volts at VERT OUTPUT ±1%
e. Jitter: 2ps, max

28. TRANSIENT RESPONSE AND RISETIME

a. Transient response and aberrations: +7%, -7%, total of 14% or less P-P within first 0.5ns; +3%, -3%, total of 3% or less P-P after 0.5ns
b. TDR risetime: 140pS
c. 1V pulser aberration: + and - 2.5% max first 10ns after leading edge; + and - 1% max after first 10ns
d. Sampler risetime: 95ps

29. INTERNAL REFLECTIONS

Internal reflections: 10% max

30. PULSE TRIGGERING

Pulse triggering jitter: 100ps max

32. TANGENTIAL NOISE

Tangential noise: 2mV max

34. UHF SYNC

UHF SYNC jitter: 20ps max

35. EXT TRIG

EXT TRIG jitter: 100ns max
@350kHz: 100ps max @ 100MHz

36. OFFSET RANGE

OFFSET RANGE: + and - 2V min

37. EXT HORIZONTAL

$\leq$2V/div to $\geq$15V/div

THE END

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

SHORT FORM PROCEDURE

Factory TEST LIMITS are limits an instrument must meet 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, it is necessary to set up some circuits so their performance is better than required by Factory Test Limits. Therefore, the instructions given in the Factory Calibration Procedure may call for checks or adjustments which result in less error than that allowed by the Factory Test Limits.

1. POSITION DIAL ALIGN

2. PRESET CONTROLS

a. Preset plug-in scope controls
b. Preset TYPE 1S2 controls
c. Preset internal adjustments

3. RESISTANCE

a. Check amphenol resistance
b. Check power supply resistance

4. HORIZONTAL SENSITIVITY

a. Setup
b. Adjust horizontal sensitivity

5. POWER SUPPLIES

a. Adjust power supply voltages: ±3%
b. Check power supply ripple and regulation
c. Check 3.6VAC supply

6. CONTROL TD BIAS

Adjust Control TD Bias, R544

7. INT TRIG LEVEL

Adjust Int Trig Level, R523

8. COMPARATOR FIRING LEVEL

Adjust Comparator Firing Level, R677

9. SWEEP START AND LENGTH

a. Check sweep start: -1V ±5%
b. Adjust sweep length: 10.4V ±.1V

10. SWEEP TIME, MANUAL SCAN AND SINGLE SWEEP

Check sweep time, MANUAL SCAN and SINGLE SWEEP operation.

11. INVERT ZERO

Adjust Invert Zero

12. MEMORY GATE WIDTH

Check memory gate width: 310 to 370 ns

13. AVALANCE AND STROBE PULSES

a. Adjust Avalance Pulse amplitude
b. Preset Snap-Off current

14. MEMORY AND BRIDGE BALANCE

a. Set X1 OFFSET OUTPUT to OV
b. Adjust Memory Gate Bal
c. Adjust Bridge Bal

15. VARIABLE BALANCE AND OFFSET RANGE

a. Adjust Variable Bal R388
b. Adjust Offset Range R396

16. BRIDGE VOLTS

Check + and - bridge voltage: $\geq$2 Volts

17. GAIN AND UNITS/DIV ACCURACY

a. Set Volts Cal
b. Check VERT GAIN range + and - 10% and adjust gain
c. Check VERTICAL UNITS/DIV accuracy: ±2%

18. VARIABLE UNITS/DIV RANGE

Check VARIABLE range: 0.5:1 to 2.5:1

19. OFFSET RANGE AND ACCURACY

a. Check OFFSET OUTPUT accuracy: ±1%
b. Check OFFSET OUTPUT range: + and - 2V min

20. OUTPUT DC LEVEL

Check output DC level 67.5 ±2.5V

21. UHF SYNC

Adjust UHF Sync Sens R481 for smooth decrease in number of spikes

22. TIMING

a. Adjust Sampler Ramp Timing, R588: ±2%
b. Adjust C585B: ±2%
c. Check 1μS Range: ±2%
d. Check MAGNIFIER: ±2%
e. Check MAGNIFIER VARIABLE range: 3:1 min

23. POSITION

a. Adjust Position Cal
b. Check incremental accuracy: ±1% of full scale

24. DIELECTRIC

a. Check POLYETHYLENE dielectric: ±3%
b. Check TFE dielectric: ±3%
c. Check AIR dielectric: ±3%
d. Check PRESET range: 7.8 to 8.4cm

25. 1V PULSER

a. Adjust STABILITY
b. Adjust pulse level, R443
c. Check pulser risetime
d. Check pulser amplitude
e. Adjust ρ Cal, R351: 5 volts at VERT OUTPUT ±1%
f. Check Jitter: 20 ps max
g. Adjust blowby, common aberrations: ±2.5% max

26. .25V PULSER

a. Adjust STABILITY
b. Adjust pulse level
c. Check pulser amplitude
d. Adjust .25V ρ Cal: 5 volts at VERT OUTPUT ±1%
e. Check jitter: 20ps max
f. Adjust Temp Compensation, R428

27. LOOP GAIN

Adjust loop gain

28. TRANSIENT RESPONSE AND RISETIME

a. Set transient response and aberrations +7%, -7%, total of 14% or less P-P within first 0.5ns; +3%, -3%, total of 3% or less P-P after 0.5ns
b. Check TDR risetime: 140ps
c. Check 1V pulser aberrations: + and - 2.5% max first 10ns after leading edge; + and - 1% max after first 10ns
d. Check Sampler Risetime: 95ps, max

29. INTERNAL REFLECTIONS 10% max

Check reflected aberration

31. MEMORY AND BRIDGE REBALANCE

a. Set X1 OFFSET OUTPUT to OV
b. Adjust Memory Gate Bal (R247)
c. Adjust Bridge Bal

32. TANGENTIAL NOISE

Check for tangential noise: 2mV, max

33. PULSE POSITION

a. Set 10μs Pulse Position
b. Set 1μs Pulse Position
c. Set .1μs Pulse Position

34. UHF SYNC

Check UHF SYNC, and readjust R481 for min jitter: 20ps max

35. EXT TRIG

Check EXT TRIG: jitter: 100ns max @350kHz 100ps max @100MHz

36. OFFSET RANGE

Check OFFSET range: + and - 2V min

37. EXT HORIZONTAL

Check EXT HORIZ ATTEN range: $\leq$2V/div to $\geq$15V/div

38. READOUT

Check readout operation

THE END

1. POSITION DIAL ALIGN

Loosen set screw on shaft of POSITION control and align so dial reads 9.95 at the full cw position.

2. PRESET CONTROLS

a. Preset plug-in scope controls

HORIZONTAL DISPLAY	EXT X10
A & B TRIGGERING MODE	TRIG
A & B TRIGGERING LEVEL	full cw
SW 673	pulled out

b. Preset TYPE 1S2 controls

OFFSET	midr
FINE	midr
VERTICAL UNITS/DIV	.5
VARIABLE	CAL
DISPLAY MODE	MAN
MODE	EXT TRIG
MAGNIFIER	X1, CAL
RANGE	1km 10μS
POSITION	0.00
HORIZONTAL UNITS/DIV	TIME
ρ VOLTS	VOLTS
MANUAL SCAN	full ccw
UHF SYNC OR TRIGGER SENS	full cw
DIELECTRIC	POLYETHYLENE
RESOLUTION	NORMAL

c. Preset Internal adjustments

Set R131 and R544 full ccw. All other adjustments midr.

3. RESISTANCE

a. Check Amphenol resistance

Connect the common lead of the VOM to the TYPE 1S2 chassis ground and measure the DC resistance of the Amphenol connector.

3a. (cont'd)

Pin	Approximate Resistance
1	44k
2	0
3	19.5k
4	inf
5	inf
6	inf
7	inf
8	2.2k
9	15k
10	14k
11	24k
12	200k
13	inf
14	inf
15	800Ω
16	250k

Resistances were taken using a Triplett in X1k scale

b. Check power supply resistance

Measure resistance of the power supplies to ground:

Supply	Approx Resistance
-19V	250Ω
+19V	250Ω
+136V	5kΩ

4. HORIZONTAL SENSITIVITY

a. Setup

Connect the TYPE 1S2 to the plug-in test scope using the flexible extension. Connect plug-in scope to the TYPE 76TU and turn power on. Set TYPE 76TU for 115VAC as read on meter.

b. Set horizontal sensitivity

Connect a 5 volt signal from the SAC to plug-in scope HORIZ INPUT. Set HORIZ INPUT VAR 10-1 for exactly 5cm horizontal deflection. Remove SAC signal and connect patch cord from 1S2 HORIZ OUTPUT to plug-in scope HORIZ INPUT. Set UHF SYNC or TRIGGER SENS to midr.

4b. Use OFFSET and Offset Range, R396 to position display vertically.

SAC must be grounded to the plug-in test scope while making setting.

5. POWER SUPPLIES

a. Set supply voltages: ±3%

Connect DCVB to TP869. Adjust R867 for -19V ±3%. Connect DCVB to TP889 and adjust R887 for -136 Volts ±3%. Connect DCVB to TP829 and check for +19V, ±3%.

b. Check power supply ripple and regulation

Connect X1 probe from TYPE W UNIT to supply indicated and measure ripple, while varying line voltage from 103 to 127VAC. Return line voltage to 115VAC.

Supply	Ripple
-19	5mV
+19	10mV
-136	5mV

c. Check 3.6VAC supply:

Connect VOM between ground and pin 10, T810 and check for 3.3 to 3.9VAC.

6. CONTROL TD BIAS

Set UHF SYNC or TRIGGER SENS ccw. Connect a X1 probe from TYPE W to TP545 and adjust R544 cw for a free running waveform. Note mechanical position of pot. Set UHF SYNC or TRIGGER SENS to midr. Adjust R544 cw for free running waveform. Set R544 halfway between the two settings.

7. INT TRIG LEVEL

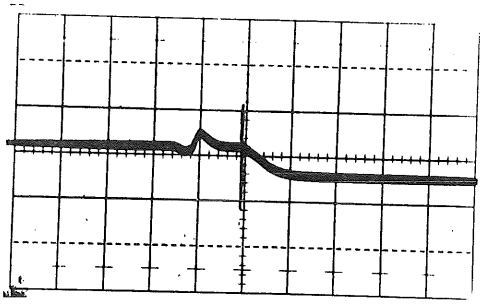
Set UHF SYNC or TRIGGER SENS full cw and connect a X10 probe from the test scope to TP525. Adjust R523 to obtain display of pulses that do not change in number between full cw and ccw positions of the UHF SYNC or TRIGGER SENS.

6&7 Steps 6 and 7 interact so it may be necessary to go through each step more than once.

7 There should be approximately 10 sawteeth after adjustments are complete.

8. COMPARATOR FIRING LEVEL

Set POSITION to 4:00 and the MANUAL SCAN control full ccw. Connect a X1 probe to TP673. Adjust R677 cw until a spike appears. Continue cw until spike jumps to the left. Set R677 so the spike is positioned just prior to the jump.



9. SWEEP START AND LENGTH

a. Check Sweep Start: -1V ±5%

Switch DISPLAY MODE to normal and connect X1 probe to the coax leading to the VARIABLE MAGNIFIER, R641. Set the TYPE W to measure -1 volt using the comparison voltage. Measure the DC level of the baseline of the ramp.

b. Set Sweep length: 10.4 ±.1V

Set TYPE W to measure +9.4 volts and adjust R787 to set P-P waveform ampltiude at 10.4 volts.

10. SWEEP TIME, MANUAL SCAN AND SINGLE SWEEP

Note the duration of the waveform on the test scope. It should be approximately 12ms. Switch RESOLUTION to HIGH and note duration of the ramp to be approximately 0.8sec. Switch DISPLAY MODE to SINGLE SWEEP and push START button. Observe a single sawtooth on the test scope. Switch DISPLAY MODE to MANUAL and rotate MANUAL SCAN. Observe a change in DC level over the range of the ramp amplitude. Return DISPLAY MODE and RESOLUTION to NORMAL.

11. INVERTER ZERO

Set RANGE to 10μS, connect X1 probe to TP674. Adjust R681 so that the center of sawtooth baseline is at 0 VDC.

12. MEMORY GATE WIDTH

Connect the X1 probe to TP235 and check for pulse width between 310 and 370nsec.

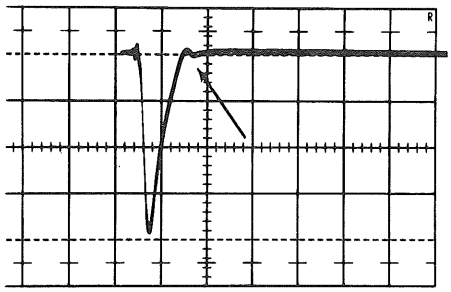
13. AVALANCHE AND STROBE PULSES

a. Set Avalanche Pulse amplitude

Connect X1 probe to the forward end of R143. Set TYPE W for 5 volts/div. Adjust R131 for maximum pulse amplitude as seen on test scope (not free running).

b. Preset Snap-Off current

Adjust R140 for best corner as indicated in illustration:

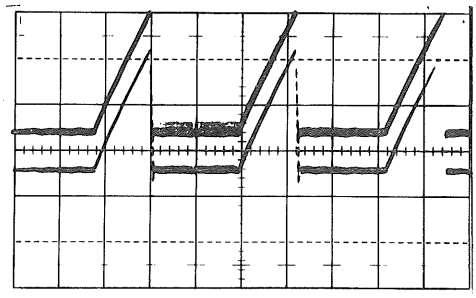


14. MEMORY AND BRIDGE BALANCE

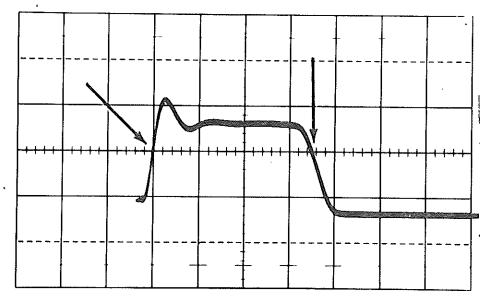
a. Set X1 OFFSET OUTPUT to 0V

Connect X1 probe to X1 OFFSET OUTPUT and set OFFSET and FINE for 0 VDC.

11.



12.



0.1μs/cm

13. TYPE W will display approx 20 volts of amplitude due to its low bandwidth.

14. (cont'd)

b. Adjust Memory Gate Bal

Connect the X1 probe to the TYPE 1S2 VERT OUT and adjust R247 for zero volts DC level.

c. Adjust Bridge Bal

Set R396 to bring the trace to center screen. Adjust R360 for no trace shift while switching VERTICAL UNITS/DIV through its range.

14c. It may be necessary to reset R396 to keep the trace in the display area.

d. Readjust Memory Gate Bal

Switch UNITS/DIV to .5 and readjust Memory Gate Bal as in step b.

15. VARIABLE BALANCE AND OFFSET RANGE

a. Adjust Variable Bal R388

While monitoring the Vert Output voltage to be sure it remains at zero volts, adjust R388 for no trace shift while rotating VARIABLE UNITS/DIV.

b. Adjust Offset Range R396

Adjust R396 to set trace at the center of graticule.

16. BRIDGE VOLTS

Connect the X1 probe to the + bridge volts lead and check for ≥2 volts DC level. Connect the X1 probe to - bridge voltage and check for ≥2 volts DC level.

16. Bridge volts can be measured at the shielded cable going to the sampler board. The red lead is negative and the black is positive.

17. GAIN AND UNITS/DIV ACCURACY

a. Set Volts Cal

Terminate THRU SIGNAL CHANNEL 50Ω in 50Ω ±.1% and set VERTICAL UNITS/DIV to .2. Connect the X1 probe

17a. (cont'd)

from VERT OUTPUT to TYPE W and apply 1.2 volts signal to THRU SIGNAL CHANNEL 50Ω from the 50Ω AMPLITUDE CALIBRATOR. Externally trigger the TYPE 1S2 from the 50Ω AMPLITUDE CALIBRATOR TRIGGER OUTPUT and measure the pulse amplitude with the TYPE W using the slide back technique. Adjust Volts Cal R356 for 6 volts pulse amplitude as read on the test scope.

b. Set VERT GAIN and check range: + & - 10%

Rotate the VERT GAIN through its entire range and check for a gain range of + & - 10%. Adjust VERT GAIN for 6cm deflection.

c. Check VERTICAL UNITS/DIV accuracy: ±2%

Check VERTICAL UNITS/DIV accuracy referring to the table below:

AMPLITUDE CALIBRATOR	VERTICAL UNITS/DIV	deflection
2V	.5	4cm
1.2	.2	6cm
.6	.1	6cm
.3	.05	6cm
.12	.02	6cm
.06	.01	6cm
.03	.005	6cm

18. VARIABLE UNITS/DIV RANGE 0.5:1 to 2.5:1

Set 50Ω AMPLITUDE CALIBRATOR to 1.2 VOLTS and VERTICAL UNITS/DIV to .5. Rotate VARIABLE full ccw and note deflection: 1.2cm max. Rotate VARIABLE full cw and note deflection: 6.0cm min. Return VARIABLE to CAL.

19. OFFSET OUTPUT RANGE AND ACCURACY

a. Check OFFSET OUTPUT accuracy: ±1%

Preset the TYPE W as follows:

COMPARISON VOLTAGE	0.00
V_C RANGE	-11
DISPLAY	A-V_C
INPUT ATTEN	R=∞
MILLIVOLTS/CM	20

Connect the X1 probe to A input and set the AC-DC-GND switch to GND. Position the test scope trace to the center graticule line and switch the A INPUT to DC. Connect the X1 probe to the TYPE 1S2 X1 OFFSET OUTPUT and set FINE OFFSET for zero volts.

Set 50Ω AMPLITUDE CALIBRATOR VOLTS to 2. Use OFFSET to bring bottom of waveform to center of the graticule and use TYPE W COMPARISON VOLTAGE to measure DC level of X1 OFFSET OUTPUT: 2 volts ±1% (1%/cm).

b. Check OFFSET OUTPUT range: + & - 2V min

Turn OFFSET through its range and monitor the X1 OFFSET OUTPUT with test scope. Check for +2V minimum at the cw extreme and -2V minimum at the ccw extreme.

Remove 50Ω AMPLITUDE CALIBRATOR connections.

20. OUTPUT DC LEVEL 67.5V ±2.5V

Connect the meter from pins 1 and 2 of the TYPE 1S2 Amphenol connector to ground and measure the DC level during sweep time of the TYPE 1S2. (Set RESOLUTION to HIGH for this check). Check for 67.5V ±2.5V.

21. UHF SYNC

Switch MODE to UHF SYNC or TRIGGER SENS. Connect X10 probe from the test scope to TP525. Adjust R481 for the maximum amount of effect while rotating UHF SYNC or TRIGGER SENS through its range.

22. TIMING

a. Adjust Sampler Ramp Timing Accuracy: ±2%

Set RANGE to 10μs, set MODE to EXT TRIG and from TYPE 184 apply 1μS markers to THRU SIGNAL CHANNEL 50Ω. Connect the GR elbows to EXT TRIG INPUT from THRU SIGNAL CHANNEL 50Ω and adjust Sampler Ramp Timing R588 for 1 marker/cm.

22a. It may be necessary to reset horizontal sensitivity (step 4b) before doing step 22.

b. Adjust C585B Accuracy ±2%

Switch RANGE to .1μs and TYPE 184 to 10nS. Adjust C585B for 1 marker/cm.

c. Check 1μs Range Accuracy ±2%

Set RANGE to 1μs and from the TYPE 184 apply .1μs markers. Check for 1 marker/cm.

d. Check MAGNIFIER Accuracy ±2%

Referring to the table, check MAGNIFIER accuracy to be within specified limits.

22d. (cont'd)

TYPE 184	RANGE	MAGNIFIER	Cycles/cm
1μS	10μs	X1	1
.5μS	10μs	X2	1
.1μS	10μs	X5	2
.1μS	10μs	X10	1
50nS	10μs	X20	1
20nS	10μs	X50	1
10nS	10μs	X100	1

e. Check MAGNIFIER VARIABLE range: 2.7:1 min

Set the TYPE 184 for 1μS markers, TYPE 1S2 RANGE to 10μs and MAGNIFIER to X1. Set MAGNIFIER VARIABLE full cw and check for at least 2.7 cm between markers. Return VARIABLE to CAL and MAGNIFIER to X100.

23. POSITION

a. Set Position Cal

Set TYPE 184 for 5μS markers and turn the POSITION dial ccw from the full cw position until the first marker lines up with the 1cm graticule line. Note dial reading. Turn the dial five major divisions ccw and adjust R661 to place leading edge of mark behind the 1cm graitulce line. Repeat adjustment as necessary to compensate for interaction.

b. Check incremental accuracy: ±1% of full scale

Set TYPE 184 for 1μS markers and set POSITION full cw. Turn POSITION ccw until marker is observed. Place marker behind the 1cm graticule line and note dial reading. Continue turning dial ccw and note dial reading when next marker crosses the 1cm graticule line. Must be 1 major dial division ±10 minor div. Check complete range of dial in a like manner.

23. Set MAGNIFIER to X1 for rough adjustment. Increase magnification as adjustment is refined.

24. DIELECTRIC

a. Check POLYETHYLENE dielectric, Accuracy: ±3%

Set RANGE to 1μs and MAGNIFIER to X2. From the TYPE 184 apply 50nS marker to TYPE 1S2. Set HORIZONTAL UNITS to DISTANCE and measure distance between 1st and 9th marker: 7.86cm ±3mm.

b. Check TFE dielectric, accuracy: ±3%

Switch DIELECTRIC to TFE and measure distance between 1st and 9th marker: 8.27cm ±3.4mm.

c. Check AIR dielectric, accuracy: ±3%

Switch DIELECTRIC to AIR and measure distance between the 1st and 7th markers: 8.9cm ±3mm.

d. Check PRESET range: ccw, 8.6 to 9.2cm
cw, 7.8 to 8.4cm

Switch DIELECTRIC to PRESET and turn PRESET full ccw, measure distance between 1st and 7th marker: 8.9cm ±3mm. Turn PRESET full cw. Measure distance between 1st and 9th marker: 7.8 to 8.4cm. Remove TYPE 184 connections.

25. 1V PULSER

a. Set STABILITY

Switch HORIZONTAL UNITS/DIV to TIME. Set POSITION to 0.00 and ρ-VOLTS to ρ. Set MODE to INT PULSE (1.0V, 1ns), VERTICAL UNITS/DIV to .2 and from the 1.0V 1ns PULSE SOURCE connect the 2 GR elbows to THRU SIGNAL CHANNEL 50Ω. Terminate THRU SIGNAL CHANNEL 50Ω in 50Ω (017-0081-00). Adjust 100mA TD Bias, R411 for a positive step.

25. (cont'd)

b. Set pulse level

Remove 50Ω Term and insert 20CM air line. Insert (874WN) short Circuit Termination in end of 20CM air line. Position trace to center graticule line with OFFSET. Remove 874WN and adjust R443 to place foot of pulse at graticule center. Replace 20cm air line with 50 Term.

c. Check pulser risetime: 1.1ns max

Set RANGE to .1μs and MAGNIFIER to X20. Check pulse risetime, 1.1ns max.

d. Check pulser amplitude: .9-1V

Switch ρ-VOLTS to VOLTS and check pulser amplitude. Must be between .9 and 1 volt. Return ρ-VOLTS to ρ.

e. Adjust ρ Cal amplitude: 5 volts at VERT OUTPUT ±1%

Set MAGNIFIER to X1. Connect the X1 probe from the TYPE W to the TYPE 1S2 VERT OUTPUT. Use OFFSET to place pulse baseline at the zero volt level on test scope. Use TYPE W V_C to measure pulse amplitude and adjust 1 (one) volt ρ Cal R351 for 5 volts amplitude.

f. Check jitter: 20ps max

Set VERTICAL UNITS/DIV to .005, RANGE to .1μs and MAGNIFIER to X100. Measure pulse jitter to be less than 20ps.

g. Adjust blowby, common aberrations: ±2.5% max

Set VERTICAL UNITS/DIV to .01, MAGNIFIER to X1, RANGE to 1μs and adjust C128 and R129 for optimum flat top. Set RANGE to 10μs, RESOLUTION to HIGH and check for optimum flat top. Return RESOLUTION to NORMAL.

26. .25V PULSER

a. Setup

Switch MAGNIFIER to X1, RANGE to .1μs, VERTICAL UNIT/DIV to .2 and MODE to INT PULSE .25V. Remove the GR elbows from the 1V pulser and attach to the .25V 50ps pulser and THRU SIGNAL CHANNEL 50Ω. Terminate THRU SIGNAL CHANNEL 50Ω with 50Ω (017-0081-00). Adjust .25V STABILITY R433 for a positive step.

b. Adjust pulse level

Remove 50Ω Termination and insert 20cm air line. Insert (874WN) Short Circuit Termination in end of 20CM Airline. Position trace to center graticule line with OFFSET. Remove 874WN and adjust R439 to place foot of pulse at graticule center. Replace 50Ω Termination.

c. Check Pulser amplitude: 230mV to 260mV

Switch VERTICAL UNIT/DIV to .05 and ρ-VOLTS to VOLTS. Check pulser amplitude for 230mV to 260mV. Return VERTICAL UNIT/DIV to .2 and ρ-VOLTS to ρ.

e. Adjust .25V ρCal amplitude: 5 volts at VERT OUTPUT ±1%

Set RANGE to 10μS. Connect the X10 probe from the TYPE W to TYPE 1S2 VERT OUTPUT. Use OFFSET to place pulse baseline at the zero volt level on test scope. Use TYPE W V_C to measure pulse amplitude and adjust .25 volt ρ Cal, R353 for 5 volts amplitude.

26. (cont'd)

f. Adjust Temp Comp R428

Set RANGE to .1μs. Set MAGNIFIER to X100. Set POSITION to place display to center graticule. Place a piece of 1 inch wide tape along the outside edge of pulser board and shields to dispurse hot air (100°C) flow. Direct hot air flow from TAB-600 to heat pulser board and shields for approx 30 seconds. Adjust R428 to bring pulse back to center graticule. Repeat and adjust R428 for minimum effect of temperature change.

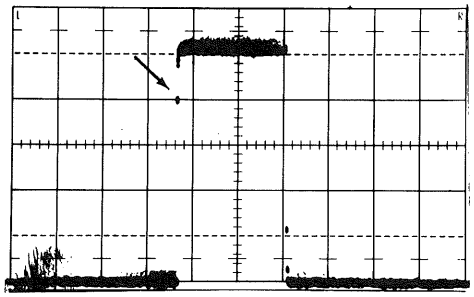
g. Check jitter: 20ps max

Set VERTICAL UNITS/DIV to .005. Measure pulse jitter to be less than 20ps.

27. LOOP GAIN

Connect X1 probe to VERT OUTPUT. Set ρ - VOLTS to VOLTS. VERTICAL UNITS/DIV to .2. RESOLUTION to NORMAL, RANGE, to 10μs, MAGNIFIER to X1. Set TYPE W VARIABLE MILLIVOLTS/CM for a 5cm display. Adjust R168 for approximately 80% gain.

27.



Dot indicated by arrow is 80% gain point

28. TRANSIENT RESPONSE AND RISETIME

a. Set transient response and aberrations: +7%, -7% total of 14% or less P-P within first 0.5ns; +3%, -3% total of 3% or less P-P after .5ns

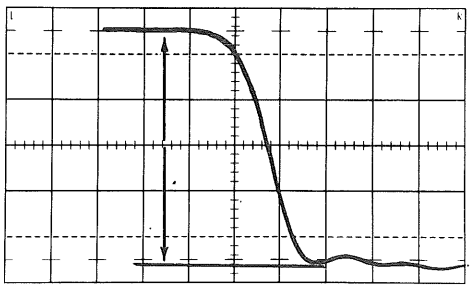
Set ρ-VOLTS to ρ. Adjust R140 and R131 for optimum risetime and aberrations.

28. (cont'd)

b. Check TDR Risetime: 140ps, max

Connect a 20cm airline to the upper THRU SIGNAL CHANNEL 50Ω connector. Connect a GR short to the other end of the airline. Set POSITION to 0.0, RANGE to .1μSEC, HORIZONTAL UNITS/DIV to TIME, MAGNIFIER to X100, and MODE to INT PULSE. Adjust POSITION to display the falling portion of the reflected waveform and measure risetime to be equal to or less than 140ps.

28b.



TDR risetime reference amplitude.

d. Check Sampler Risetime: 95ps max

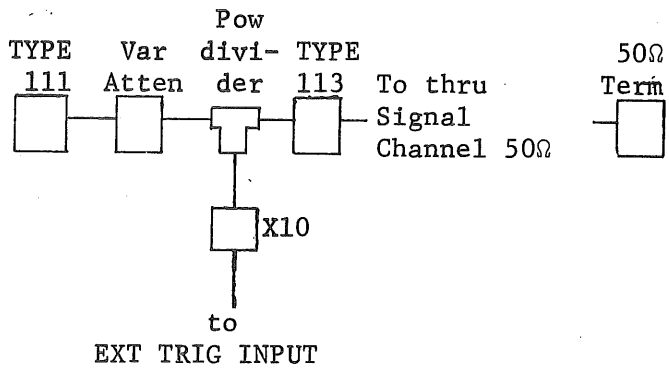
Remove GR elbows and connect the 30ps TUNNEL DIODE PULSE GENERATOR through a 20cm airline to the upper THRU SIGNAL CHANNEL 50Ω. Connect a 5nS GR cable from the TUNNEL DIODE PULSE GENERATOR PRE-TRIGGER to TYPE 1S2 EXT TRIG INPUT. Switch MODE to EXT TRIG. Trigger the display and position on screen. Check for equal to or less than 95ps risetime.

29. INTERNAL REFLECTIONS 10% max

Connect GR elbows to the .25V pulser and THRU SIGNAL CHANNEL 50Ω. Set RANGE to .1μs and MAGNIFIER to X10. Switch MODE to .25V PULSE. Connect the 20cm airline to the upper THRU SIGNAL CHANNEL 50 and use POSITION to observe and measure the aberration 3ns after the reflected pulse leading edge. Check the aberration to be equal to or less than 10% of the reflected pulse amplitude. Remove the GR elbows and airline.

30. PULSE TRIGGERING Jitter: 100ps max

Set MAGNIFIER to X100 and RANGE to .1μs. Set TYPE 1S2 MODE to EXT TRIG and make setup as follows.



Set the VAR ATTEN for a 500mV signal. Set VERTICAL UNITS/DIV to .005, observe pulse leading edge and check for equal to or less than 100ps jitter. Remove cables from TYPE 1S2.

31. MEMORY AND BRIDGE REBALANCE

a. Adjust X1 OFFSET OUTPUT to OV

Install a 50Ω termination in one of the THRU SIGNAL CHANNEL 50Ω connectors. Connect X1 probe to X1 OFFSET OUTPUT and set OFFSET and FINE for 0 VDC.

b. Adjust Bridge Bal

Set R396 to bring the trace to center screen. Adjust R360 for no trace shift while switching VERTICAL UNITS/DIV through its range.

c. Adjust Memory Gate Bal

Switch MODE to .25V pulser. Adjust R247 for no trace shift when switching ρ-VOLTS between ρ and VOLTS.

32. TANGENTIAL NOISE 2mV, max

Connect the 50Ω AMPLITUDE CALIBRATOR--50Ω 10ns cable--10X attenuator--111 VARIABLE ATTENUATOR--TYPE 1S2 THRU SIGNAL CHANNEL 50Ω. Terminate the THRU SIGNAL CHANNEL 50Ω with 50Ω. Set the 50Ω AMPLITUDE CALIBRATOR to .12 VOLTS and trigger the TYPE 1S2 externally from the AMPLITUDE CALIBRATOR.

Using the 111 VARIABLE ATTENUATOR, set display for a 1:1 signal to noise ratio. Switch AMPLITUDE CALIBRATOR to 1.2 and divide displayed signal amplitude by 10. Must be 2mV max.

33. PULSE POSITION

a. Adjust 10μs Pulse Position

Set MAGNIFIER to X100. Connect the GR elbows to the .25V Pulser Output and to THRU SIGNAL CHANNEL 50Ω terminated in 50Ω. Adjust R621 for pulse to start at the 1cm graticule line.

b. Adjust 1μs Pulse Position

Set RANGE to 1μs and adjust C615F to place start of pulse at the 1cm line.

c. Adjust .1μs Pulse Position

Set RANGE to .1μs and adjust C615H to place pulse at the 1cm line.

33. It may be necessary to readjust R677, as in step 8, in order to place pulse at the 1cm graticule line.

Recheck POSITION to assure it is set at 0.00.

C615F is located on the inboard side and C615H on the outboard side of the RANGE switch.

34. UHF SYNC Jitter: 20ps max

Apply a 5gHz signal from the Polarad 1107 to the lower THRU SIGNAL CHANNEL 50Ω and connect the 2:1 GR attenuator and 2ns cable from EXT TRIG INPUT to

34. It may be necessary to readjust R481 for minimum jitter.

34. (cont'd)

THRU SIGNAL CHANNEL 50Ω. Set VERTICAL UNITS/DIV to .2, MODE to UHF SYNC and set UHF SYNC OR TRIGGER SENS for stable display. Set the 5 gHz oscillator amplitude for 3cm of displayed signal. Check for 20ps or less jitter. Remove 5 gHz signal.

35. EXT TRIG Jitter: 100ns max @ 350kHz
100ps max @ 100MHz

Connect a 500mV 350kHz signal from the TYPE 191 to THRU SIGNAL CHANNEL 50Ω and connect the 2ns cable directly from THRU SIGNAL CHANNEL 50Ω to EXT TRIG INPUT. Set UHF SYNC OR TRIGGER SENS for stable display and check for less than 100ns jitter. Set TYPE 191 to supply 500mV of 100 MHz signal and check for less than 100ps jitter.

36. VERTICAL POSITION RANGE + and - 2V min

Switch VERTICAL UNITS/DIV to .5. Increase AMPLITUDE of TYPE 191 for 3 div of signal. Set OFFSET ccw, top of display must be at least 1div below graticule center. Set OFFSET cw, bottom of display must be at least 1 div above graticule center.

37. EXT HORIZONTAL ≤2V/div to ≥15V/div

Set DISPLAY MODE to EXT HORIZ and apply 2 volts from the SAC to EXT HORIZ INPUT. Set the EXT HORIZ ATTEN fully cw. Check for 1cm deflection or more. Set EXT HORIZ ATTEN full ccw and set SAC for 100V. Check for 6.66cm or less horizontal deflection.

38. READOUT

Referring to the table below for control settings, check front panel readout:

HORIZONTAL UNITS/DIV	RANGE	MAGNIFIER	READOUT
TIME	10μS	X1	1000nS
"	"	X2	500nS
"	"	X5	200nS
"	"	X10	100nS
"	"	X20	50nS
"	"	X50	20nS
"	"	X100	10nS
"	1μS	X100	1nS
"	"	X50	2nS
"	"	X20	5nS
"	"	X10	10nS
"	"	X5	20nS
"	"	X2	50nS
"	"	X1	100nS
"	.1μS	X1	10nS
"	"	X2	5
"	"	X5	2
"	"	X10	1
"	"	X20	500ps
"	"	X50	200ps
"	"	X100	100ps
DISTANCE	.1μS	X100	1cm
"	1μS	X100	10cm
"	10μS	X100	1m

THE END