FIELD RECALIBRATION PROCEDURE

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561A

INTRODUCTION:

This recalibration procedure is intended for Tektronix Field Repair Center use.

The specifications listed are factory specs and not guaranteed unless they also appear as catalog or instruction manual specs.

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Special equipment has been kept to a minimum, depending on availability and recal time saved vs production, distribution cost and complexity.

For all serial numbers.

The recalibration steps were designed to make the procedure as simple and as fast as possible, and yet complete enough for a first-time recalibration. To accomplish this, each step was arranged in two parts -- Setup and Adjustment; detailed setup procedures were replaced in many cases with general statements. Block diagrams or circuit diagrams were included in certain steps to help locate the adjustment and show what the adjustment does to produce the desired results to aid in troubleshooting. A simplified adjustment procedure was called out next to each adjustment on the block diagram or circuit diagram to help speed up the recal once a person becomes familiar with the instrument, and waveforms were shown where needed.

The blank column on the right of the page is for notes on troubleshooting hints and general information concerning the recal. It will be filled in as we receive feedback from the Field or further information from the factory.

The "Certification Procedure" shows what part of the instrument may be certified and what is required to perform the certification. Forms may be obtained from Customer Service.

A Recal check sheet has been included for those persons who have become familiar enough with the recal procedure to use it.

Since this procedure is for the Field, we hope all Field personnel will help us improve it. Address your communications to Field Technical Support. No suggestions will go unnoticed.

ABBREVIATIONS:

a	amp
ac	alternating current
approx	approximately
b	base
bulb	light, lamp, etc.
c	collector
ccw	counterclockwise or full counterclockwise
cer	ceramic
cm	centimeter
comp	composition (resistor)
cps	cycles per second
crt	cathode ray tube
cw	clockwise or full clockwise
db	decibel
dc	direct current
div	division
e	emitter
emc	electrolytic, metal cased (capacitor)
fil	filament
freq	frequency
gmv	guaranteed minimum value (capacitor)
gnd	chassis ground
h	henry
hv	high voltage
inf	infinity
int	internal
k	kilo (10^3)
k	kilohm
m	milli (10^{-3})
ma	milliamp
max	maximum
mc	megacycle
meg	megohm
mh	millihenry
midr	midrange or centered
min	minimum
mm	millimeter
mpt	metalized, paper tubular (capacitor)
msec	millisecond
mt	mylar, tubular (capacitor)
mv	millivolt
μ	micro (10^{-6})
μf	microfarad
μh	microhenry
μsec	microsecond
n	nano (10^{-9})
nsec	nanosecond
Ω	ohm
p	pico (10^{-12})
pbt	paper, "bathtub" (capacitor)
pcc	paper covered can (capacitor)
pf	picofarad ($\mu\mu$f)
piv	peak inverse voltage
pmc	paper, metal cased (capacitor)
poly	polystyrene
pot	potentiometer
prec	precision (resistor)
pt	paper, tubular (capacitor)
ptm	paper, tubular molded (capacitor)
ptp	peak-to-peak
sec	second
sn	serial number
term	terminal
tub	tubular (capacitor)
unreg	unregulated
v	volt
var	variable
w	watt
WW	wire wound
x-former	transformer

CIRCUIT SPECIFICATIONS

Factory circuit specs are not guaranteed unless they also appear as catalog or instruction manual specs. Factory specs are usually tighter than advertised specs. This helps insure the instrument will meet or exceed advertised specifications over several years of use.

The numbers listed beside the specifications are the calibration procedure steps where the check or adjustment is made.

POWER SUPPLIES:

1.

SUPPLY	VALUE	RIPPLE (MAX)
+300.0 V	±2.5%	5 mv (no load) 80 mv (full load)
+125.0 V	±2.0%	5 mv (no load) 10 mv (full load)
- 12.2 V	±2.5%	5 mv
-100.0 V	±0.5% (adj)	

All supplies must regulate between 105 and 125 V AC line.

CALIBRATOR:

2b. Calibrator symmetry must be within ±20% at line voltages from 105 to 125 V AC.

3c. Accuracy must be within ±2% at all calibrator positions.

4. Electrical center: ±0.3 cm of vertical graticule center. ±0.6 cm of horizontal graticule center.

CATHODE RAY TUBE:

8a. Geometry: Vertical line may have ±1% (1.3 mm) max tilt in 8 cm of vertical deflection. Vertical bowing of the horizontal trace must not exceed 1.0 mm.

8b. Focus: Vertical lines 1 mm apart and focused in the center must not overlap anywhere within the middle 8.8 horizontal cm of graticule.

9d. Vertical sensitivity: 18.5 Volts/Div to 20.5 Volts/Div.

10b. Horizontal sensitivity: 17.5 Volts/Div to 19.3 Volts/Div.

11b,c. Bandwidth: At least 1 mc with Type 60 Plug-in.

RECALIBRATION PROCEDURE

NOTES

EQUIPMENT REQUIRED:

1 Type 531 Tektronix oscilloscope with Type H Plug-in or equivalent
1 Type 180A Time Mark Generator
1 Type 190 Constant Amplitude Signal Generator
1 Type 105 Square Wave Generator
1 Type 60 Plug-in
1 Type 67 Plug-in
1 Type 3B1 Plug-in (not essential)
1 Type TU-75 or TU-76 Line Voltage Control (Special, FMS)
2 Type TU-4 Test Load Units (Special, FMS)
1 561 CRT Capacitance Standardizer (Special, FMS)
1 50Ω 10XT Attenuator (TEK 011-031)
1 50Ω Terminator (TEK 011-045)
1 50Ω Coaxial Cable (TEK 012-001)
1 Voltmeter, 20,000 ohms/volt, 3% accuracy

BASIC FRONT PANEL CONTROLS

HORIZ and VERT POSITION -- Mid-range
CALIBRATOR -- Off
INTENSITY -- CCW

RECALIBRATION

1. LOW VOLTAGE POWER SUPPLIES

A. Set-up

a) Insert a TU-4 Test Load into each plug-in compartment.
b) Set test loads as follows:
1. SUPPLY -100
2. POSITION mid-range
3. LOAD no load
4. INDICATOR 561
c) Connect shielded cable from RIPPLE and PER CENT DC ERROR connector of either test load to H Unit input (.01 V/CM, DC).
d) Find zero reference on test scope by pushing PUSH FOR GND REF on test load.

B. Measurements

When checking tolerance of voltage, push the PUSH TO REMOVE RIPPLE button on the test load.

SUPPLY SELECTOR	TOLERANCE	RIPPLE (MAX)	ADJ
-100.0 V	±0.5%, ±0.5 cm	5 mv max	-100 V (R616)
+300.0 V	±2.5%, ±2.5 cm	5 mv (no load) 80 mv (full load)	
+125.0 V	±2.0%, ±2.0 cm	5 mv (no load) 10 mv (full load)	
-12.0 V	±2.5%, ±2.5 cm	5 mv max	

Check each supply for regulation and ripple as line voltage is varied from 105 to 125 V AC under no load and full load conditions.

Check line indicating neons on Test Load front panels. With upper neons only on, line polarity is correct. If both upper and lower neons are lit, line polarity is reversed.

2. HIGH VOLTAGE ADJ:

   A. Set-up
      a) Connect DC Voltmeter to CRT cathode.

   B. Adjustment
      a) Set High Voltage Adj (R841) for a reading of -300 V on the meter.

3. SET CALIBRATOR AMPLITUDE AND CAL ATTENUATORS:

   A. Set-up
      a) With CALIBRATOR turned off, connect voltmeter to pin 7, V884.

   B. Adjustment
      a) Adjust Cal Amp (R871) for +100 V on the voltmeter.
      b) Turn CALIBRATOR on. The voltmeter must now read between 40 and 60 volts.
      c) Connect the CAL OUT to the test scope input and check all positions of the CAL switch for correct voltage out.

The strap between the lower ceramic strip and Cal switch is the same as pin 7, V884.

4. CRT ELECTRICAL CENTER

   A. Set-up
      a) Turn the INTENSITY control CW until a dot appears on the CRT.
      b) Short the Vertical deflection plates together and the Horizontal deflection plates together.

   B. Check
      a) The spot should be centered ±0.3 cm vertically and ±0.6 cm horizontally.

5. CRT ALIGNMENT

A. Set-up
   a) Remove the right hand TEST LOAD and install a Type 67.
   b) Obtain a trace on the CRT.

B. Adjustment
   a) Set ALIGNMENT control so trace is parallel to center horizontal graticule line.

6. ALTERNATE SWEEP

A. Set-up
   a) Set vertical Test Load to DUAL TRACE.
   b) Obtain a trace on CRT.

B. Check
   a) Check for alternate sweep operation.

7. DUAL TRACE BLANKING

A. Set-up
   a) On the vertical Test Load, connect a jumper from the SIGNAL INPUT jack to the Z AXIS INPUT.
   b) Switch TU-4 from DUAL TRACE to NORMAL.
   c) Apply 1 cm of 100 KC square wave from the 105, unterminated, to the SIGNAL INPUT.
   d) Set CRT CATHODE SELECTOR switch to DUAL TRACE CHOPPED BLANKING.

B. Adjustment
   a) Check the CRT display. The upper portion of the square wave should disappear while the lower part gets brighter.

8. GEOMETRY AND CRT CHECK

A. Set-up
   a) Remove the Test Load from the left plug-in compartment.
   b) Install a CRT Capacitance Standardizer and Type 60 plug-in.
   c) Apply 1 msec and 100 μs time markers from the 180 and obtain a stable display of 6 cm amplitude.
   e) Adjust FOCUS and ASTIGMATISM controls for the sharpest display.

8. B. Adjustment
   a) Adjust Geometry (R865) for minimum bowing of vertical and horizontal traces.
   b) Check focus for no overlapping of time markers within the middle 8.8 horizontal cm of the graticule.

1.3 mm max tilt or bowing of vertical trace. 1 mm max bowing of horizontal trace.

9. CRT VERTICAL COMPENSATION AND SENSITIVITY

   A. Set-up
      a) Apply 6 cm of 10 KC square wave from the 105. The 105 should be terminated in a 50Ω 10XT, 50Ω cable and 50Ω Terminator, in that order.
      b) Set the Type 67 for a stable display.

   B. Adjustment
      a) Adjust C760 for best square wave display on the CRT.
      b) Remove the input signal and connect a voltmeter across the vertical deflection plates.
      c) Note the change in meter reading while moving the trace 6 cm.
      d) Divide the change in meter reading by six to find the vertical sensitivity. It must be between 18.5 V/Div and 20.5 V/Div.

10. CRT HORIZONTAL COMPENSATION AND SENSITIVITY

   A. Set-up
      a) Interchange plug-ins. The Type 67 will be in the left side and the Type 60 with Capacitance Standard will be in the right side.
      b) Connect the voltmeter across the horizontal deflection plates.

   B. Adjustment
      a) Note the change in meter reading as the trace is moved 10 cm.
      b) Divide the change in meter reading by 10 to find the horizontal sensitivity. It must be between 17.5 V/cm and 19.3 V/cm.
      c) Remove the voltmeter from the horizontal plates and apply 8 cm of 10 KC square wave to the Type 60 Input.
      d) Set the Type 67 for a stable display.
      e) Adjust C761 for best square wave.

11. FREQUENCY RESPONSE

A. Set-up
   a) Remove the CRT Capacitance Standardizer and re-insert the Type 60 in the right hand plug-in box.
   b) From a 190 terminated in 50Ω apply 200 mv (4 cm) of 50 KC signal to the Type 60 Input.

B. Adjustment
   a) Change the 190 to 1.0 mc. Don't change the 190 amplitude.
   b) There must be at least 2.8 cm of deflection on the CRT.
   c) Reverse plug-ins and check response of other axis using the same procedure.

12. LINE TRIGGER PHASING

A. Set-up
   a) Connect an X10 Probe to the Type 60 Input.
   b) Touch the other end of the probe to the AC line at the fuse holder.
   c) Set the Type 67 TRIGGER on + Line.
   d) Adjust TRIGGER LEVEL for a stable display.

B. Adjustment
   a) Switch TRIGGER SLOPE from + to - and check display for triggering on proper slope.
   b) Reverse plug-ins and repeat above operation.
   c) Put Type 60 back in left compartment and Type 67 in right compartment.

With the sweep plug-in in the left compartment, the trace moves from bottom to top of the screen and + slope of waveform is to the right.

13. EXT CRT CATHODE

A. Set-up
   a) Remove ground strap from EXT CRT CATHODE Input on scope rear.
   b) From the test scope apply 10 V of CAL signal to EXT CRT CATHODE.
   c) Set CRT SELECTOR switch to EXT CRT CATHODE.
   d) Set Type 67 TIME/CM to 1 ms.

B. Check
   a) Check sweep for intensity modulation.

14. CRT INTENSIFIED CIRCUIT

A. Set-up
   a) Remove Type 67 and replace with a 3B1.
   b) Set the 3B1 TIME/DIV and DELAY TIME RANGE to 1 msec.
   c) Set 3B1 MODE switch to NORM and NORMAL SWEEP TRIGGERING to AUTO. There should be a sweep on the CRT.

B. Adjustment
   a) Set 3B1 MODE switch to INTEN.
   b) Check for an intensified portion of the sweep display.

15. ALTERNATE METHOD

If a 3B1 is not available, the INTENSIFIED CIRCUIT can be checked by the following method.

   a) Turn the 561A power off.
   b) Measure the forward resistance from pin 14, right hand interconnecting socket to junction of D838, D839. Should be about 45 Ω.
   c) Check reverse resistance for open circuit.
   d) Measure forward resistance from GND to junction of D838, D839. Should be about 20 Ω.
   e) Check reverse resistance from D838, D839 junction to GND. Should be 2.4 K.

CERTIFICATION PROCEDURE

The following portion of the 561A may be certified:

FUNCTION	CALIBRATION STEP NO.	STANDARD TEST EQUIP.
Square Wave Calibrator 100 Volts to .1 Volt	3	Standard Calibrator from (FMS)

In order for the certification to be valid, the following conditions will have to exist:

1) The STANDARD CALIBRATOR used will have to be traceable to NBS and have a certificate on file verifying its certification.

2) Record of customer's instrument certification must be recorded and placed on file. The record should include the bench number or description and s/n of the standard test equipment used to certify the 561A.

3) A certificate (TEK) should be filled out and returned to the customer with the instrument. The instrument as whole is considered certified.

CALIBRATION CHECK SHEET

1. Check Power Supplies:

	Tolerance	Ripple	Adjust
+300.0 V	____	____	____
+125.0 V	____	____	____
- 12.5 V	____	____	____
-100.0 V	____	____	____

2. High Voltage Adj ____ R841
3. Calibrator ____
4. CRT Elect. Center ____
5. CRT Alignment ____
6. Alternate Sweep ____
7. Dual Trace Blanking ____
8. CRT Check:
   a) Geometry, 1.3 mm tilt in 8 cm ____
      1mm max bowing in 8 x 10 cm area ____
   b) Focus, Middle 8.8 cm ____
9. CRT Vertical Compensation ____
   CRT Vertical Sensitivity
   18.5 to 20.5 V/cm ____
10. CRT Horizontal Compensation ____
    CRT Horizontal Sensitivity
    17.6 to 19.3 V/cm ____
11. Frequency Response, 1 mc both sides ____
12. Line Trigger Phasing, right side ____
    left side ____
13. Ext CRT Circuit ____
14. CRT Intensified Circuit ____