FACTORY CALIBRATION PROCEDURE

CONTENTS:

564

This isn't a field recalibration procedure as is the procedure in your instruction manual. This is a guide in calibrating brand-new instruments, just assembled instruments that have never been turned on before. Therefore it calls out many procedures and adjustments that are rarely required for subsequent recalibration.

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Supersedes
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For 564 and RM564, all serial numbers.

Even though we wrote this procedure primarily for our own factory test department, it's valuable to others also if used with some caution:

1. **Special test equipment**, if mentioned, is not available from Tektronix unless it's listed also in our current catalog. This special equipment is used in our test department to speed calibration. Usually you can either duplicate its function with standard equipment in your facility, devise alternate approaches, or build the special test equipment yourself.

2. **Factory circuit specifications** are not guaranteed unless they also appear as catalog or instruction manual specifications. Factory circuit specs usually are tighter than advertised specs. This helps insure the instrument will meet or exceed advertised specs after shipment and during subsequent field recalibrations over several years of use. Your instrument may not meet factory circuit specs but should meet catalog or instruction manual specs.

3. **Presetting internal adjustments**, if mentioned, usually is unnecessary. This is helpful for "first-time" calibration only. If internal adjustments are preset, you'll have to perform a 100% recalibration. So don't preset them unless you're certain a "start-from-scratch" policy is the best.

In this procedure, all front panel controls for the instrument under test are in capital letters (SENSITIVITY) and internal adjustments are capitalized only (Gain Adj).

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)
emt	electrolytic, metal tubular
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

FACTORY CIRCUIT SPECIFICATIONS

SPEC QUALIFICATION

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

NOT INTENDED FOR INCOMING INSPECTION

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

1. EQUIPMENT REQUIRED

2. PRELIMINARY INSPECTION

3. 564 PRESETS

4. RESISTANCE CHECKS

5. POWER SUPPLIES

5b,c,d,

supply	tolerance	max ripple 105-125 v ac Hi Load	Lo Load
-100 v	±.5%	5 mv	
- 12 v	±.5%	3 mv	
+125 v	±.5%	10 mv	
+300 v	±.5%	80 mv full load	10 mv no load
+475 unreg	±10% @ 117 v ac		
+6.3 v ac elevated to 125 v	+6.3 v ac ±1% typically over +120 v		
+355 volts	355-365 volts		

6. HIGH VOLTAGE, FOCUS

6a. -3300: ±2%, max.
6a. Regulation: ±20 v, max.

7. ALTERNATE SWEEP, LEFT SIDE

8. DUAL-TRACE BLANKING

9. EXTERNAL CRT CATHODE INPUT

10. SCALE ILLUM, ALIGN CRT

11. GEOMETRY

11a. Horiz geometry: 1 mm, max total.
11b. Vert geometry: 1 mm, max.

12. LINE TRIGGER PHASING

13. VERT SENSITIVITY, CRT ELECTRICAL CENTER

13a. Vert sensitivity: 18.5 to 20.5 v/div
13b. Crt electrical center: ±.3 major div, max.

14. CALIBRATOR

14b. Accuracy: ±2%, max.
14b. 100 mv: ±2%, max. into 50 Ω
14c. Symmetry: ±20%, max.
14d. Risetime: 5 μsec max

15. INTENSIFIED PULSE CIRCUIT

16. VERT COMPENSATION, INT TRIGGER

17. ALTERNATE SWEEP, RIGHT SIDE

18. HORIZ SENSITIVITY, ELECTRICAL CENTER

18b. Horiz sensitivity: 17.5 to 19.25 v/div.
18c. Crt electrical center: ±.8 major div, max.

19. HORIZ COMPENSATION, INT TRIGGER

20. CRT INTENSIFIED CIRCUIT

21. FLOOD GUN ADJUST

22. COVERAGE NUMBER 2 COLLIMATION ELECTRODE

22a. +225 volts maximum

23. COVERAGE NUMBER 1 COLLIMATION ELECTRODE

24. COLLIMATION IN ERASE

25. STORAGE LEVEL

25b. Stable range, FP-RT=15 volt minimum
25b. Storage level, (225 ±75)

26. NON-STORAGE ADJUSTMENT

26a. 1/2 screen must store to within 2 mm of split, other half must not store, stored half must not fade positive when other half is erased. No background glow on non-stored half.

27. WRITING SPEED

27b.	T5640-200	25 K CM/SEC MIN
	T5640-201	100 K CM/SEC MIN

Conditions: 3 lines/cm with breaks no greater than .025" (.6 mm) in the center 6 x 8 cm.

28. WRITING RATE INCREASE

28b. Pulse width typically less than 1 msec min, greater than 6 msec max.

28c.	T5640-200	at least 10 times
	T5640-201	at least 5 times

29. LOCATE FUNCTION

29a. Dot must fall to left of first vertical graticule line.

30. INTEGRATE FUNCTION

31. CONTRAST RATIO, PHOSPHOR, LOCATE AREA, AND STORED BRIGHTNESS

31b. Locate Area:
Area to left of first graticule line must not store.

31c. Contrast Ratio:

T5640-200	2:1 minimum
T5640-201	2:1 minimum

31d. Stored Brightness:

T5640-200	6 ft L minimum
T5640-201	2 ft L minimum

32. NON-STORE AND WRITING RATE INCREASE DISCONNECT (RM564 ONLY)

32a. Target must not store when in a non-store display. Writing rate increase connected when either or both displays, upper and lower, are in store.

33. REMOTE ERASE (RM564 ONLY)

THE END

CALIBRATION

NOTES

1. EQUIPMENT REQUIRED

a. Test scope

1	530 series	Tektronix type scope
1	D	Tektronix type wide-band, high gain plug-in unit
1	10X probe	Tektronix type probe

b. Test equipment

1	2A60	Tektronix type amplifier plug-in unit
1	2B67	Tektronix type time-base plug-in unit
1	105	Tektronix type square-wave generator
1	180A	Tektronix type time-mark generator
1	3B1	Tektronix type time-base plug-in unit
2	TU-4	Tektronix type test loads

c. Test accessories

1	011-045	50Ω termination
1	011-032	50Ω 5:1 attenuator
3	012-057	50Ω 42" cables, bnc connectors

d. Miscellaneous equipment

1	630	Triplett meter, 20,000Ω/v dc
or	262	Simpson meter, 20,000Ω/v dc
1	---	Variable line voltage source with meter
1	special	Crt capacitance standardizer
1	special	Standard calibrator
1	special	Remote erase checker
1	special	Photo meter

1b. Test equipment

(1) TU-40 may be substituted for 105 and 190B.
(2) TU-50 may be substituted for 105, 180A and 190B.

NOTES

2. PRELIMINARY INSPECTION

a. Check for unsoldered joints, rosin joints, lead dress and long leads. Check for loose hardware and protruding parts. Check controls for smooth mechanical operation, proper indexing, and knob spacing from front panel.

b. RM564: Check rack securing knobs for correct direction of travel during rotation. Check that fan screen is securely mounted against back panel.

c. Fuse

Fuse-RM564

117 v operation :	159-005	3	a	mdx	slo-blo
234 v operation :	159-003	1.6	a	mdl	slo-blo
F720					
(-12 v, internal):	159-023	2	a	mdx	slo-blo

Fuse-564

117 v operation :	159-005	3	a	mdx	slo-blo
234 v operation :	159-003	1.6	a	mdl	slo-blo
F720					
(-12 v, internal):	159-023	2	a	mdx	slo-blo

d. Crt

Check wall band fingers for proper action.

Loosen crt neck clamp. Insert crt into indicator until shoulders of rubber seal are resting on front panel and two rubber feet on bottom of rubber seal are resting on subpanel.

Level the crt by adjusting support bracket. Check neck pin connection tightness.

Note crt serial number.

Check crt for mechanical defects: phosphor defects, scratches, cracks around neck pins, etc.

Install graticule cover. Check split on screen to graticule alignment.

e. HV shield(s)

Install HV shield(s).

a. External controls

FOCUS	ccw
INTENSITY	ccw
ASTIGMATISM	ccw
SCALE ILLUM (RM564 pwr off)	mid r
POWER (564 only)	off
CALIBRATOR	OFF
WRITING RATE INCREASE	push in
TRACE ALIGNMENT	mid r
DISPLAY (upper and lower)	NON-STORE

b. Internal adjustments

All other internal adjustments	mid r

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

4. RESISTANCE CHECKS

a. Check resistance to ground.

supply	approx resistance
117 v ac (power switch on)	inf
-100 v	6.2 k
+125 v	11 k
+300 v	19 k
-12 v	9.5 Ω*
+210 unreg	5 k
+6 v unreg	37 Ω*
+75 v unreg	17 k
+420 v unreg	40 k
+475 v unreg	33 k

*common lead (+) to gnd.

b. Terminal 18-19 continuity

Connect an ohmmeter between terminals 18 on both Amphenol connecting plugs and check continuity. Repeat procedure for terminals number 19. Check for inf resistance between terminals 18 and 19.

3b. Presetting internal adjustments

(1) Presetting internal adjustments is helpful for "first-time" calibration but is usually unnecessary for recalibration. If you preset, you'll have to perform a 100% recalibration. Don't preset them unless you're certain a "start-from-scratch" policy is the best.

c. Terminal 11-12 continuity

Connect ohmmeter between terminal 11 on one amphenol and 12 of other amphenol and check continuity. Check from 12 to 11 for continuity. Check for inf resistance between terminals 11 and terminals 12 on the same amphenol plug.

d. Terminal 3-4 continuity

Repeat c. except for terminals 3 and 4.

5. POWER SUPPLIES

a. Setup

Insert both TU-4's in 564-RM564 and connect a 52 Ω cable between one TU-4's ripple and dc error connector and the D unit input. Set both TU-4's to 561 indicator; -100 v, full load, dual trace.

Set test scope to 5 mv/div, A dc, 5 msec/cm, +line, auto. Connect 564-RM564 to variable line voltage, set source to 117 v and turn POWER ON. Note red indicator light on and RM564 fan operating.

b. Low voltage adjustments ±.5%, max

All regulated low voltage supplies must be adjusted within ±.5% of the rated values under full load.

Depress the push for gnd ref of TU-4 to obtain a zero error reading on the test scope. Push the push to remove ripple button to remove the supply ripple and set the -100 Volts R616 for zero error indication on test scope.

Repeat this procedure for adjustment of +125 Volts R656, +300 Volts R676, and -12.2 Volts R730. Recheck adjustments.

Note: +125 Volts R656 should be adjusted before -12.2 Volts R730 and +300 Volts R676.

c. Regulation ±1%, max

All regulated low voltage supplies must maintain regulation within ±1% of nominal values when the line voltage is varied from 105 to 125 v ac under full and no load conditions.

5a. Test-load functions

(1) Each TU-4 is capable of half loading the supplies when set to full load. To check the supplies under full load conditions, set both TU-4's to full load. Conversely, for low load conditions set both TU-4's to no load.

(2) The push to remove ripple button removes ripple so that a more accurate reading may be obtained.

(3) The push for gnd ref button will give a zero reference on test scope.

5b. Percent error

(1) Each div on the test scope (supply level compared to zero reference) represents a .5% error in supply voltage when D is at 5 mv/cm.

NOTES

d. Check ripple to following maximums

supply	full load	no load
-100 v	5 mv	5 mv
+125 v	10 mv	5 mv
+300 v	80 mv	10 mv
-12.2 v	3 mv	3 mv

Check both TU4's as above.

Remove shielded cable from TU-4 to D plug-in.

Readjust the line voltage to 117 v ac and check as follows:

supply	check at	tolerance
+475 v unreg	pin 1 V955	±10%
+6.3 v ac elevated to +125 v dc	pins 4, 5 V913-pins 7, 8 V667 (also pins 4,5 V955, V965 on RM564)	6.3 v ac ±10% over 120 v dc
+355 v	R903, B903 junction	355-365 volts

e. Line polarity neons at 117 v ac

Upper neon on and lower neon off indicates correct line polarity. If both neons are on line polarity is reversed. Check both sides of indicator.

6. HIGH VOLTAGE, FOCUS

a. HV Adj R841 -3300: ±2%, max regulation: ±20 v from -3300

Connect a meter from gnd to the crt filament end of R851 (100 k). Adjust HV Adj R841 for -3300 v.

Set INTENSITY max cw. Check hv supply for regulation by varying line voltage from 105 to 125 v ac at full load and no load. Voltage should not vary more than ±20 v.

Leave line voltage at 117 v ac.

b. FOCUS

Vary FOCUS over its range while noting meter. Voltage should not vary.

Remove meter.

6a. Phosphor burns

(1) The spot should be positioned off the screen to prevent phosphor burns.

7. ALTERNATE SWEEP, LEFT SIDE

a. Setup

Remove the right hand TU-4 and install a 2B67 time base. Set as follows:

TRIGGERING

LEVEL	FREE RUN
SLOPE	+
COUPLING	AC FAST
SOURCE	INT
MODE	NORMAL
POSITION	MR
TIME/DIV	1 MSEC

b. Check dual trace

Set TU-4 to DUAL TRACE and check for a dual trace on all settings of TIME/DIV except EXT INPUT.

8. DUAL-TRACE BLANKING

a. Setup

105--50 Ω term--50 Ω cable--signal input, TU-4 or TU-50, 105 gen--50 Ω atten*--signal input, TU-4

*When needed

b. Dual-trace blanking, left side only

Adjust 105 for 1 cm display of 100 kc signal. Adjust INTENSITY for normal trace intensity. Connect a jumper from the TU-4 signal input to the TU-4 Z axis input. Set the CRT CATHODE SELECTOR to CHOPPED BLANKING. Upper portion of the crt display must disappear and the lower portion will get brighter. Remove 105 signal and TU-4 jumper.

9. EXTERNAL CRT CATHODE INPUT

a. EXT CRT CATHODE

Remove EXT CRT CATHODE gnd strap from scope rear. Insert a 10 v calibrator signal to EXT CRT CATHODE. Set CRT CATHODE SELECTOR to EXT CRT CATHODE and check the sweep for intensity modulation. Remove the signal and replace the gnd strap.

10. SCALE ILLUM, ALIGN CRT

a. SCALE ILLUM

Rotate SCALE ILLUM through its range. Check for open spots and for brightest graticule lights when SCALE ILLUM is cw.

b. Align crt

Remove TU-4 and insert 2A60.

Set 2B67 to 1 msec/cm, free run. Adjust FOCUS and ASTIGMATISM for well defined trace. Adjust TRACE ALIGNMENT to align trace with the center horiz graticule line.

11. GEOMETRY

a. Horiz geometry 1 mm, max total

Set 2B67 to 1 msec/div, free-run. Recheck crt alignment. Position the trace from top to bottom of graticule area and check for horizontal bowing deviation from horizontal line: 1 mm, max total.

b. Vert geometry 1 mm, max

Connect 180A 1000 μsec and 100 μsec markers to 2A60 input. Adjust 2B67 triggering level for stable display and timing, if needed. Adjust 2A60 for markers reaching from bottom to top of graticule. Adjust ASTIG and FOCUS for well defined trace. Max deviation of vertical trace from vertical graticule line, top to bottom, is 1 mm. Readjust R940 as necessary and recheck horiz geometry. Remove 180A signal.

12. LINE TRIGGER PHASING

Connect a jumper to the type 2A60 input, set the type 2B67 triggering as follows: source to line; coupling to +; level to auto. Set time/div to 5 millisec. Grasp the jumper with one hand and switch slope from + to - and check for proper + and - phase.

13. VERT SENSITIVITY, CRT ELECTRICAL CENTER

a. Vert sensitivity 18.5 to 20.5 v/div

Connect a meter across vertical deflection plates. Set trace to top graticule line, note meter reading. Set trace to bottom graticule line, note meter reading. Total swing over 8 cm must be between 148 to 164 v.

b. Crt electrical center .3 major div, max

Short the vertical crt plates (use non-magnetic metal). Note distance of trace from crt graticule center: .3 major div, max.

14. CALIBRATOR

a. Setup

accurate +100 v--52 Ω cable--cal in, standard cal
test scope, vert input--52 Ω cable--output, standard cal
564 CAL OUT--52 Ω cable--unk-in, standard cal

Set standard calibrator to 100 v, mixed.

Ground V884, pin 8.

b. Accuracy ±2%, max

Check CALIBRATOR accuracy as follows:

564 CALIBRATOR VOLTS	stand cal volts	test scope sensitivity mv/cm, ac	deflection max
100	100	10	adjust to zero with Cal Adj R871
50	50	500	2 cm
20	20	200	2 cm
10	10	100	2 cm
5	5	50	2 cm
2	2	20	2 cm
1	1	10	2 cm
.5	.5	5	2 cm
.2	.2	2	2 cm
.1	.1	1	2 cm

14a. Known accurate +100 v

(1) A good source is the test scope:
(2) Connect the standard calibrator cal in connector to the test scope cal out connector.
(3) Connect the standard calibrator output to the test scope input.
(4) Remove the output section of the test scope amplitude calibrator's multivibrator and set the amplitude calibrator control to 100 volts.
(5) Connect an accurate voltmeter (John Fluke type 803 differential voltmeter) to the cal out connector and adjust the Cal Adj for exactly +100 v on the voltmeter.
(6) Remove the meter.

14b. Interpreting display

(1) The test scope display is a 60 cps square wave: one half of each cycle is the standard calibrator dc reference (accurate); the other half is the calibrator dc reference (unknown accuracy).
(2) The amplitude of the display is the voltage difference between an accurate dc reference and a dc reference of unknown accuracy (the 564 calibrator, whose accuracy we're checking).
(3) 564 cal % error = $\frac{\text{voltage difference x 100}}{\text{564 CALIBRATOR setting}}$
(4) Example:

	case 1	case 2
Standard calibrator	100 volts	20 volts
564 CALIBRATOR setting:	100 VOLTS	20 VOLTS
Test scope vert sensitivity:	5 v/cm	.1 v/cm
Test scope vert deflection:	1 cm	2 cm

Check for 100 mv signal into 50 Ω load with CALIBRATOR at .5 VOLTS.

.5	.1	1	2 cm

Remove V884, pin 8 gnd strap. Remove calibrator signal.

RM564 CALIBRATOR	stand cal	test scope sensitivity mv/cm, ac	deflection max
100 VOLTS	100 v	10	adjust to zero with Cal Adj R871
10 VOLTS	10 v	100	2 cm
1 VOLTS	1 v	10	2 cm
.1 VOLTS	.1 v	1	2 cm
10 mVOLTS	10 mv	1	.2 cm
1 mVOLTS	1 mv	1	.02 cm

(Or insert RM564 1 mv direct to D unit set to 1 mv and compare.)

Check for 100 mv signal into 50 Ω load with CALIBRATOR at 1 VOLTS.

1 VOLTS	.1	1	2 cm

Remove V884, pin 8 gnd strap. Remove calibrator signal.

c. Cal symmetry ±20%, max

Connect voltmeter between V884, pin 7 and gnd. Note voltage as CALIBRATOR is turned through all of the steps: 40 to 60 v. Remove meter.

d. Risetime 5 μsec, max

Set "D" to 10 millivolts/cm, 20 mv/cm multiplier, calibrator from 564/RM564 to A DC. Measure rise time of 5 μsec or less.

15. INTENSIFIED PULSE CIRCUIT

a. D838 - D839 junction .3 to .6 v, max

Connect meter to D838 - D839 junction. Note meter reading: +.3 to +.6 v, max. If the reading exceeds +.6 v, any sweep unit with an intensifying circuit could be damaged. Remove meter.

Case 1: % error = $\frac{5 \times 100}{100}$ = 5%

Case 2: % error = $\frac{.2 \times 100}{20}$ = 1%

(5) In the table of step 14b, we've worked out the settings so that the deflection listed is the maximum allowable to remain within test specifications.

16. VERT COMPENSATION, INT TRIGGER

a. Setup

Install a crt capacitance standardizer (special) in the left compartment, behind the 2A60 plug-in.

105--50Ω term--50Ω cable--2A60--standardizer --564
or TU-50, 105 gen--50Ω atten*--50Ω term--50Ω cable--2A60--standardizer--564

*When needed

2B67 presets: +slope, ac slow coupling, int source.

Set 2A60 to .05 v/div.

b. Crt Plate Compensation C760

Set 105 for 10 kc signal. Adjust 105 and 2A60 for 6 major div of display at normal intensity. Adjust 2B67 triggering level for a stable display. Adjust Crt Plate Compensation C760 and vertical crt plate leads for best square wave while depressing INTEGRATE button.

Check internal trigger by switching ac, dc, gnd switch on 2A60 to gnd. The trace must disappear.

Remove 105 signal. Switch 2A60 back to dc.

17. ALTERNATE SWEEP, RIGHT SIDE

Remove type 2B67 from right side, 2A60 from left side, place 2B67 in left side, and a TU-4 into right side. Remove the crt capacitance standardizer at this time. Set time base triggering level to free run and TU-4 to dual trace. Check for dual trace on all settings of 2B67.

NOTES

16a. Setup

(1) Don't use 47 pf input time-constant standardizer.

18. HORIZ SENSITIVITY, ELECTRICAL CENTER

a. Setup

Remove TU-4 and install 2A60 in right side.

b. Horiz sensitivity 17.5 to 19.25 v/div

Connect a meter across horizontal deflection plates. Set trace to left vert graticule line, note meter reading. Set trace to right line, note meter reading. Total swing over 10 cm must be between 177 to 195 v.

c. Crt electrical center ±.8 major div, max

Short the horiz crt plates (use non-magnetic metal). Note distance of the trace from crt graticule center: ±.8 major div, max.

19. HORIZ COMPENSATION, INT TRIGGER

a. Setup

Install a crt capacitance standardizer (special) in the right compartment, behind the 2A60 plug-in.

105--50Ω term--50Ω cable--2A60--standardizer --564
or TU-50, 105 gen--50Ω atten*--50Ω term--50Ω cable--2A60--standardizer--564

*When needed.

2B67 presets: +slope, ac slow coupling, int source.

Keep 2A60 to .05 v/div.

b. Crt Plate Compensation C761

Set 105 for 10 kc signal. Adjust 105 and 2A60 for 6 major div of display at normal intensity. Adjust 2B67 triggering level for a stable display. Adjust Crt Plate Compensation C761 for best square wave.

Check internal trigger lead by switching ac, dc, gnd switch on 2A60 to gnd. The sweep must disappear.

Remove 105 signal. Switch 2A60 back to dc.

NOTES

20. CRT INTENSIFIED CIRCUIT

a. Setup

Install 2A60 into left hand compartment and 3B1 into right hand compartment.

3B1 presets: normal sweep, time/div to 1 msec and delayed sweep to .1 msec, mode to norm, and normal sweep triggering coupling to auto. The sweep should appear on the crt. Set 3B1 mode to inten. and check for an intensified portion of the sweep.

21. FLOOD GUN ADJUST

a. Setup

With a 2B67 in the right compartment set as follows:

Triggering

Level	Free run
Slope	+
Coupling	AC slow
Source	Int
Time/div	.1 μsec

Turn INTENSITY full cw (max). Set DISPLAY to STORE, UPPER and LOWER, write the whole target by positioning the trace from top to bottom of the target with the position control of a type 2A60 plug-in in the left compartment. (Note: If the whole target doesn't fade positive, advance the Storage Level more cw until this procedure works.)

b. Adjust flood gun grids

Adjust R944 and R946 starting from ccw until the point of most uniform (brightest) coverage of target, including corners, is reached. Avoid over coverage.

Switch DISPLAY, UPPER and LOWER, to ERASE and release to STORE position.

22. COVERAGE NUMBER 2 (COLLIMATION ELECTRODE)

a. Adjust R398

Adjust Coverage Number 2, R398, from ccw until a definite increase in background brightness is noted, (≈150 v), on the target. Set adjustment cw to a point just below this definite increase, a point where best overall coverage is observed.

Note: It will be necessary in this and the following adjustments to erase upper and lower target after each adjustment to assure proper appearance.

23. COVERAGE NUMBER 1 (COLLIMATION ELECTRODE)

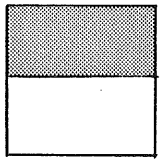
a. Adjust R930

Adjust Coverage Number 1 R930 for best appearance of target (No. 6 75 v, No. 7 50 v). sharp edges and uniform brightness. Avoid over coverage.

24. COLLIMATION IN ERASE MODE

a. Upper target

Set DISPLAY, UPPER and LOWER to STORE. Turn off (push in) WRITING RATE INCREASE. Turn off sweep (2B67 mode to single sweep). Switch DISPLAY, UPPER to ERASE and observe fade positive of upper target with proper collimation of of upper target during erase.



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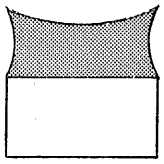


Improper Collimation

Connect a voltmeter to the high voltage and note a decrease of about 50 v dc when the integrate button is depressed.

Note: In the 564 the target will remain bright as long as DISPLAY is in STORE. In RM64 the erased target will fade positive, the brightness will disappear, then return to normal store presentation. All of this will happen even though DISPLAY is held in the ERASE position.

b. Lower target

Repeat the above procedure, only this time DISPLAY, LOWER to ERASE, and observe proper collimation of the lower target.

25. STORAGE LEVEL

a. Setup

Attach common lead of voltmeter to ground and positive lead to pin no. 8 of V913. DISPLAY, UPPER and LOWER, to STORE. Mode to single sweep, triggering to auto. INTENSITY set to a position just below the defocusing point.

b. Adjust Storage Level

Set Storage Level ccw. Alternately allow one single sweep and advance Storage Level cw until the single sweeps will store anywhere in the 7x9 cm area with no gaps. Reverse direction of rotation and observe voltage at which sweeps will start to disappear.

Record this reading as R.T. (retention threshold).

Raise Storage Level until one single sweep blends or spreads into the background causing poor resolution after a 10 second wait. Record this meter reading as F.P. (fade positive).

Adjust Storage Level for a voltage midway between F.P. and R.T. This is then the recommended Storage Level. Do not change this setting.

S.R. (stable range) = F.P.-R.T. 15 volt min, operating level, +225 ±75 v dc.

NOTE: Maximum intensity may damage the target.

26. NON-STORAGE ADJUSTMENT

a. Adjust R906

Set DISPLAY UPPER to STORE and LOWER to NON-STORE. ERASE upper display and return to STORE. Adjust non-storage level, R906 for best screen division between the stored and non-stored halves of the screen, with no background glow in the non-stored half. The upper or stored screen must store to within 2 mm of the split. Also, the upper target must not fade positive at any time while lower target is being erased.

Set the display to UPPER NON-STORE and LOWER to STORE. Check lower target stores to within 2 mm of split, upper target does not store a repetitive sweep, and lower target does not fade positive while upper target is being erased.

Note: Writing Rate Increase off for this step.

b. Erase pulse width, RM564 only, .25 sec max

Connect a test scope probe to pin 3 or 8 of V913 and check for .25 sec or less pulse width for RM564. Remove probe.

27. WRITING SPEED

a. Setup

Set DISPLAY UPPER and LOWER to STORE, 2B67 auto, single sweep. INTENSITY to a position just below the defocusing point. Start time/div at 1 msec. Alternately depress single sweep, erase UPPER and LOWER, and advance sweep speed to a point where the trace will store with breaks no greater than 0.6 mm (.025"), anywhere in 6x8 cm centered area.

Note: The variable time/div may be used to find a speed between the 1, 2, 5 sequence of the time/div.

b. Compute writing speed.

Apply 100 μsec time markers to vertical input, set DISPLAY, UPPER and LOWER, to NON-STORE, 2B67 mode to normal, and without changing time/div or variable, note distance between markers, then use following formula:

$$W.S. = \frac{D}{TM}$$

WS = writing speed
D = distance between markers in cm
TM = time markers used

I.E. D = 4 cm
TM = 100 μsec

$$WS = \frac{4\text{ cm}}{100\text{x}10\text{-}6} = .04\text{x}10^{-6}\text{ cm} = 40\text{ kcm/sec}$$

This writing speed must be 25 kcm/sec or better for a 564-200 and 564-201, 100 kcm/sec. If the minimum spec is not obtained, repeat using maximum intensity. If still not obtained, increase storage in 5 volt steps until minimum spec is met. Do not exceed a voltage 10 volts below the fade positive voltage.

Note this reading.

NOTES

28. WRITING RATE INCREASE

a. Adjust R984

Adjust Pulse Amplitude, R984, ccw. Set DISPLAY, UPPER and LOWER, to STORE. WRITING RATE INCREASE on, (pull out), and set cw. Set type 2B67 triggering to auto, time/div to .1 msec, and mode to single sweep. Alternately allow one sweep, advance Pulse Amplitude cw a few degrees, then erase upper and lower target. Repeat this procedure until the background becomes faded positive to the point that the written information is no longer readable.

b. Measure pulse amplitude

The pulse measured at the center arm of R984, will be about:

CRT type	approx pulse amplitude	approx pulse width less than	approx pulse width greater than
T5640-200	-40 v	1 msec	6 msec
T5640-201	-30 v	1 msec	6 msec

c. Measure writing rate increase

To measure the writing rate increase, repeat the procedure for finding the writing speed, but this time, have the WRITING RATE INCREASE on and full cw.

The writing rate increase must be as follows:

CRT type	Writing rate increase, typically
T5640-200	20 times
T5640-201	5 times

Note: Use 1 or 5 μsec markers for the measurement.

29. LOCATE FUNCTION

a. Check operation

Set DISPLAY, UPPER and LOWER, to NON-STORE, position the start of a free running trace to left vertical graticule line. Turn sweep off by setting 2B67 mode to single sweep. Set DISPLAY, UPPER and LOWER, to STORE. Press LOCATE switch and observe stationary dot to left of left vertical graticule line in the non-store (locate zone) area.

30. INTEGRATE FUNCTION

a. Check operation

Set DISPLAY, UPPER and LOWER, to STORE. Turn WRITING RATE INCREASE off, (push in). Set 2B67 trigger to auto, time/div to .1 μsec and set INTENSITY to a point where the target will not store with repeated single sweeps. Switch DISPLAY, UPPER and LOWER, to ERASE, then to STORE. Push in the INTEGRATE button and actuate 3 or 4 single sweeps. Release the INTEGRATE button and observe a stored trace.

564 only – check that the enhance will trigger once when writing speed increase is on, when the integrate button is released.

NOTES

31. CONTRAST RATIO, PHOSPHOR, LOCATE ZONE, AND STORED BRIGHTNESS

a. Phosphor defects

Check for phosphor defects in fade positive and non-store.

b. Locate zone

The area to the left of the first vertical line is the locate zone. It must not store. Check by setting DISPLAY, UPPER and LOWER, to STORE. Position a free running sweep, set to 1 Ms/Div with maximum intensity over the locate zone, it must not store.

c. Contrast ratio

To measure contrast ratio, turn off sweep, (mode to single sweep). Set DISPLAY, UPPER and LOWER, to ERASE twice, then wait ten seconds. With a photometer, make six point measurement; three across the top screen, and three across the bottom screen, record. This is the background light level.

d. Stored brightness

To get the stored brightness, free run sweep at maximum INTENSITY and write the whole target positive. Again, with a photometer, make the same six point measurement; record. Any reading must not be below the following minimums:

CRT type	stored brightness	minimum
T5640-200	6 ft - L	(foot Lamberts)
T5640-201	2 ft - L	

Divide background brightness into stored brightness using figures of each point. Each point must not be less than 2:1.

32. NON-STORE AND WRITING RATE INCREASE DISCONNECT (RM564 ONLY)

a. Proper operation

Switch DISPLAY, UPPER and LOWER, to NON-STORE. Switch WRITING RATE INCREASE off, (push in). Position a free running trace set to 1 msec/div at maximum intensity over the entire target area. Check that it does not store.

Repeat this procedure with the WRITING RATE INCREASE on (pull out) and set cw. Check that it does not store. (WRITING RATE INCREASE is disconnected internally when both DISPLAY, UPPER and LOWER, are in NON-STORE.)

Position trace to lower target. Switch DISPLAY, UPPER, to STORE. Note that when the WRITING RATE INCREASE is on and cw, the upper target will fade positive, and the lower target will store. Turn WRITING RATE INCREASE off, Erase DISPLAY, UPPER and LOWER, return LOWER to NON-STORE. Note that upper target does not fade positive, and the lower target does not store.

Repeat the above procedure, only this time set DISPLAY UPPER to NON-STORE and LOWER to STORE.

33. REMOTE ERASE (RM564 ONLY)

a. Check operation

Connect the RM564 Remote Erase Checker to the Remote Erase plug, J950, at the rear of the instrument. Set DISPLAY, UPPER and LOWER, to STORE. On the RM564 Remote Erase checker, Switch the upper erase from normal to upper erase. Observe only the upper target erase. Switch the lower erase from normal to lower erase. Observe only the lower target erase. Switch upper and lower erase together. Observe both halves erase.

33a. 564 Remote Erase

Mod 113Z installs a remote erase plug in the 564.

34. THE END.

SPECIAL TEST EQUIPMENT

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

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

USE OF STANDARD CALIBRATOR

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

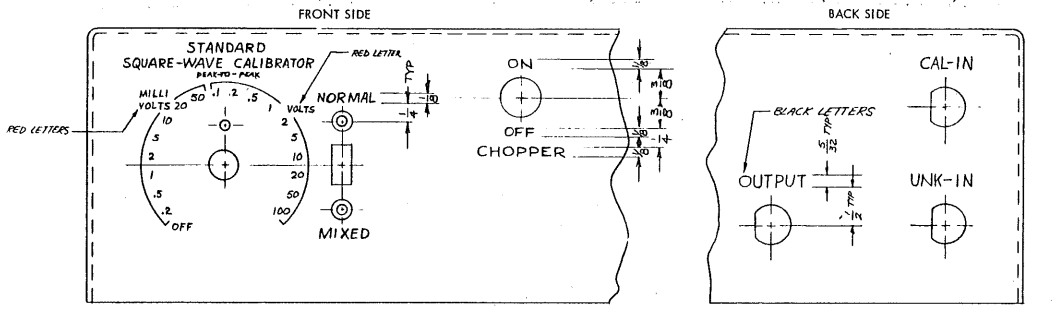
The circuit consists of a chopper and a divider network of 0.1% accurate resistors. The divider network provides a standard voltage output when loaded with 1 meg and when an accurate +100 v is applied to the input. The chopper allows the voltage output of the standard calibrator to switch between a known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

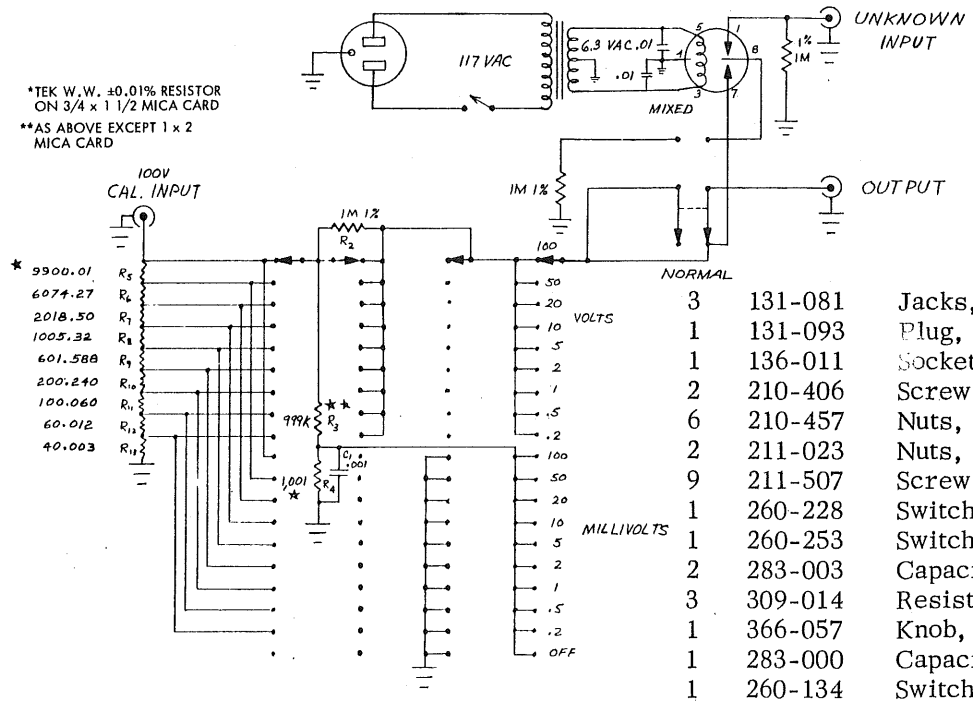
You must take the hum level of the standard calibrator into account when checking divider accuracy at low levels (.1 v and below). Measure the error introduced by hum level by turning both the standard calibrator and the calibrator of the scope under test to off. Observe the vertical displacement (hum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

Leave the standard calibrator in NORMAL when not in use.

STANDARD CALIBRATOR

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

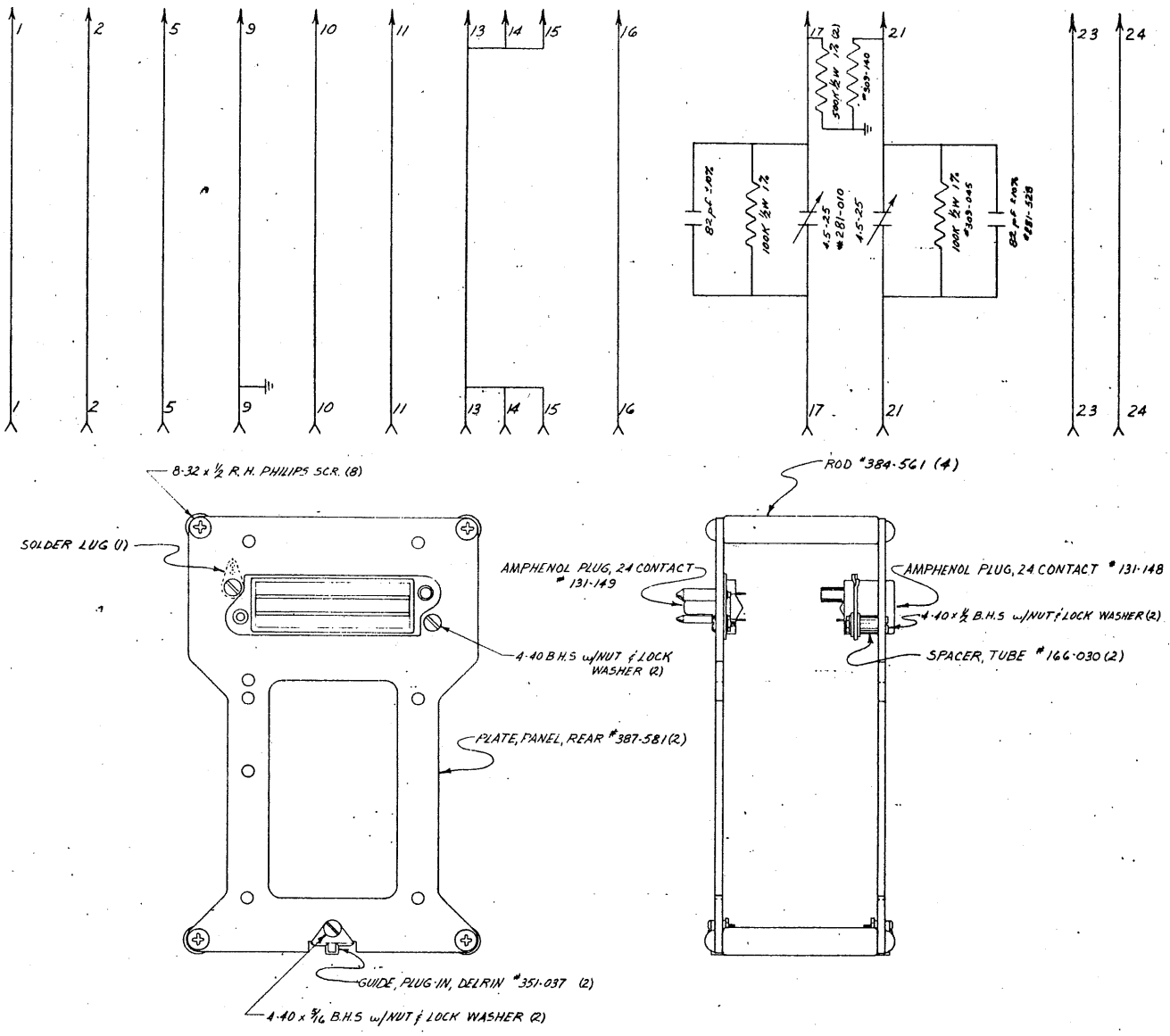




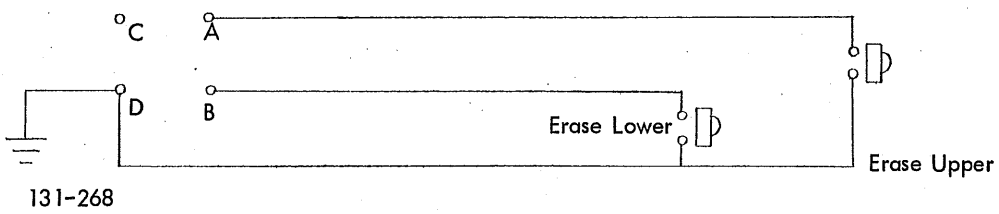
3	131-081	Jacks, Amphenol
1	131-093	Plug, receptacle
1	136-011	Socket, octal
2	210-406	Screws, 4-40 1/4"
6	210-457	Nuts, 6-32 Kep
2	211-023	Nuts, 4-40
9	211-507	Screws, 6-32
1	260-228	Switch, dpdt slide
1	260-253	Switch, 19 pos., 3 sec. rotary
2	283-003	Capacitors, .01 μf 150 v disc type
3	309-014	Resistors, 1 meg 1/2 w 1% prec
1	366-057	Knob, large black
1	283-000	Capacitor, .001 μf 500 v disc type
1	260-134	Switch, spst toggle
11	--	Resistors, special Tek-made WW, ±.01% mica plate

CRT CAPACITANCE STANDARDIZER

Dwgs: 457-B, 2-23-61 (schematic); 456-B, 2-23-61 (assembly)



REMOTE ERASE CHECKER



STORAGE TUBE NOMENCLATURE

Nomenclature	Abbrev.	Definition
Background Light Level	BL	The average brightness of the light emitted by the storage target when completely erased, with the backplate set at a given voltage.
Background Suppression		A method of altering electrode potentials to reduce background light level.
Brightness Uniformity Ratio	BR	The ratio of the brightest to the dimmest area when the target is fully stored.
Collimation Lens		An electrostatic low-voltage lens used to adjust the trajectories of the flood gun electrons.
Collimation Electrodes		Elements used in the collimation lens
Contrast Ratio	CR	The ratio of stored brightness to background light level with the backplate set at a given voltage.
Enhance		A method of momentarily altering electrode potentials to increase writing speed.
Fade Positive	FP	The backplate voltage at which an unwritten area fades up as bright as an adjacent written area anywhere within the quality area.
Flood Gun	FG	A low-energy electron gun directing a large area flow of electrons toward the entire screen.
Integrate		A method of operation that interrupts flooding of the target and permits the writing gun electrons to sum over several sweeps.
Ion Repeller	IR	An electrode that produces a potential barrier against ions.
Locate Zone		A non-storing zone on the left hand side of the graticule that permits pre-setting of the vertical position of the trace.
Operating Level or Storage Level	OL	The backplate voltage within the operating range where the tube gives optimum performance.
Operating Range	OR	The backplate voltage range within which information can be stored at writing speeds in excess of a specified value (fade positive minus writing threshold).
Quality Area		The target area over which given specifications apply.
Retention Threshold	RT	The lowest backplate voltage at which written information can be stored anywhere within the quality area.
Stable Range	SR	The backplate voltage range within which information can be stored (fade positive minus retention threshold).
Storage Target	ST	A surface having the ability to store information when bombarded by an electron beam.

Nomenclature	Abbrev.	Definition
Storage Target Backplate (Backplate)	STB	A conductive surface physically supporting, and electrically coupled to, the storage target.
Stored Brightness	SB	The average brightness of stored information, with the backplate set at a given voltage.
Stored Resolution		The ability of the tube to display discrete elements of stored information usually defined by the number of line pairs resolvable per in. on the tube face.
Writing Gun	WG	A high-energy electron gun giving a narrow focused beam. This beam can be deflected and is used to write the information to be stored.
Writing Rate	WR	The time rate, i.e. sec/cm, at which the writing beam will register stored information when scanning the storage target, under stated conditions of operation.
Writing Speed	WS	The speed, i.e. cm/sec, at which the writing beam will register stored information when scanning the storage target, under stated conditions of operation.
Writing Threshold	WT	The lowest backplate voltage at which a signal of fixed writing speed can be completely stored.