

TYPE 585 OSCILLOSCOPE

FACTORY CALIBRATION PROCEDURE

Quick check for long ends, unsoldered joints, wire dress, etc. Preset all pots and trimmers to mid-range. Check to see that the CRT pin connections are tight. Tighten setscrew in TRIGGER LEVEL knobs just snug enough that the knob can be turned on the shaft. Turn the INTENSITY and SCALE ILLUM. controls full left. (CCW)

1. CHECK POWER SUPPLY RESISTANCE TO GROUND.

With the TYPE 80 POWER TEST UNIT in place and switched to the HIGH LOAD position, the 100 and -150 v supplies will measure approximately 1 k Ω to ground, the 225 v 2.5 k Ω , the 350 v 10 k Ω , and the 500 v 20 k Ω . The 12 v supply will measure from 5 to 10 Ω to ground with no load and approximately 3.5 Ω with the test unit in place. Check transformer primaries for infinite resistance to ground.

2. CHECK TIME DELAY RELAY

Turn the scope on and check time delay relay delay. (15 to 45 seconds)

3. CHECK VOLTAGES, REGULATION AND MEASURE RIPPLE.

Adjust the -150 v supply with -150 ADJ. Check 100 v, 225 v, 350 v, and 500 v supplies. (Voltage $\pm 2\%$) Check elevated heater supplies at transformer terminals. (350 v at 9 and 16, 225 v at 27 and 28, 50 v at 22 and 23, and - hv at 24 and 25.) Check power supplies for proper regulation (measured with test scope.) With line at 103 v, TEST LOAD UNIT switched to HI LOAD and also with line at 125 v, TEST LOAD UNIT switched to LO LOAD. The ripple on each supply in regulation will be approximately: -150 5 mv, 100 v 5 mv, 225 v 5 mv, 350 v 10 mv, and 500 v 12 mv. The 12 v supply will be 3 to 15 mv ripple and may run over 13 volts at high line and low load.

4. SET CAL ADJ.

With the SQUARE WAVE CALIBRATOR OFF, adjust CAL. ADJ. for 100 v at CAL TEST PT. Turn CALIBRATOR ON. Voltage at CAL TEST PT. must read between 45 and 55 volts.

5. SET HV ADJ.

Turn scope to an upright position and adjust HV ADJ. control for -1350 v. Read at front of the 27K resistor at the forward ceramic strip located above the crt shield. This adjustment can be made conveniently on the 1200 v scale on the meter by measuring with respect to -150 instead of ground. Turn off the scope and install shield over high voltage supply.

6. CHECK SCALE ILLUM. AND POSITIONING CONTROLS

Check the SCALE ILLUM. control. Check position controls against the position indicating neon lights. With the STABILITY Control at the cw position, advance the INTENSITY control to obtain a trace. Align trace with horizontal graticule lines, push CRT forward against graticule and tighten CRT clamp. Check hv regulation by varying line from 103 to 125 with signal or trace defocused and high intensity. There should be no trace blooming.

7. SET SHIELD VOLTAGE ADJ.

Connect a voltmeter from the center of the SHIELD VOLTAGE ADJ. pot to ground. Set the shield voltage for approximately 300. This may have to be varied later to bring the geometry or compression of the CRT into specs.

8. SET CRT GEOM. ADJ.

Insert from the AMPLITUDE CALIBRATOR enough signal so that only the rising and falling portions of the signal are visible within the graticule. Adjust STABILITY and TRIGGERING LEVEL controls for a stable display. (The trigger circuit has not been adjusted so if it is not possible to obtain a stable display, adjust the TRIG. SENS. and/or TRIGGERING LEVEL CENTERING pot.) Adjust GEOM ADJ. to obtain minimum curvature of the vertical traces. (HORIZONTAL DISPLAY in A position.)

9. CHECK BIAS ON DISTRIBUTED AMPLIFIER

Set the GAIN control at maximum. The bias on the first distributed amplifier, measured from grid to cathode, must be at least 0.35 v on each tube. The bias on the second distributed amplifier will be approximately 0.75 v at maximum gain.

10. SET VERTICAL GAIN

Switch the TEST LOAD UNIT to X100 and apply 100 v from the AMPLITUDE CALIBRATOR. Set the vertical GAIN for 2.2 cm of vertical deflection. Vary the line voltage from 103 to 125 v. The vertical gain should not change more than 8%. (The TEST LOAD UNIT gain must be properly set.)

11. CHECK VERTICAL AMPLIFIER BALANCE

Short pin 1 to pin 3 of V1284. The trace should not shift more than 0.5 cm. Short pin 2 to pin 7 of V1214. The trace should not shift more than 0.5 cm. Short pin 2 to pin 7 of V1014. The trace should not shift more than 0.5 CM. (The shorting push button on the TEST LOAD UNIT will connect pins 2 and 7 of V1014.)

12. CHECK D.C. SHIFT.

Position the trace just off the screen either direction. Push the input shorting button on the TEST LOAD UNIT. After the trace stops in the center of the graticule, it should not drift over 1 mm.

13. CHECK VERTICAL DRIFT.

The trace must not drift more than 2 mm when the line voltage is varied from 103 to 125 volts.

14. CHECK VERTICAL COMPRESSION OR EXPANSION.

Display 1 cm of CALIBRATOR signal. The signal must not be compressed or expanded more than 1 mm at either the top or the bottom of the graticule. The total of expansion and/or compression must not exceed 1.5 mm.

15. CHECK ALTERNATE SWEEP OPERATION

Switch the TEST LOAD to X1 and Alternate Sweep. The scope should dual trace on either A or B trace.

16. CHECK SQUARE WAVE CALIBRATOR

Check accuracy of SQUARE WAVE CALIBRATOR with the V/CM switch of the test scope. ($\pm 2\%$)

17. SET TIME BASE "A" TRIGGERING LEVEL CONTROL

Set the trigger controls to +INT and TIME/CM to 100 μ sec, STABILITY full left (ccw), but not to PRESET. Set the test scope VERTICAL INPUT to .02 VOLTS/CM, DC, set the trigger on LINE, AUTOMATIC and set the sweep TIME/CM switch to 2 MILLISEC. Use a 10X probe properly adjusted. Center the trace on the test scope for a zero reference. Connect the probe to the ungrounded end of R14 on scope under calibration and set pot to zero volts. Physically center knob and tighten set screw. Leave TRIGGERING LEVEL control at zero volts during following adjustments. Connect a jumper to ground from the ungrounded end of R14 to maintain the ground reference exactly.

18. ADJUST TIME BASE "A" TRIGGER LEVEL CENTERING AND TRIGGER SENS.

Using a 10X probe on the test scope, set the test scope at: AUTO, +INT, sweep rate 2 MILLISEC/CM, and vertical sensitivity .05 V/CM. With the ungrounded end of R14 grounded, connect the 10X probe to R41/C45 junction. Feed 10 mv into the TEST LOAD UNIT. (The lowest level it is desired to trigger on.) Adjust the TRIGGER LEVEL CENTERING for multivibrator operation. Back off the TRIGGER SENS. till the oscillations on the multi waveform cease and the multi is stable on + and - triggering SLOPE.

19. ADJUST TIME BASE "A" PRESET STABILITY.

Turn the TRIGGERING SOURCE switch to LINE and the slope switch to \pm . Connect a meter to the center arm of PRESET STABILITY pot. (R111, screw driver adj on front panel.) Turn the STABILITY control to the PRESET position. Turn the PRESET STABILITY control clockwise until the sweep triggers. The meter should now read approx 65 volts. Now continue turning PRESET STABILITY until the sweep free runs. (The trace will

brighten.) This is easier to see with a sweep speed of 100 μ sec/CM. The meter should now read 15 volts or more higher. Turn the control back until the meter reads half way between the two readings obtained. The scope should now trigger + and - on INT with 10 mv into the vertical input. Remove the ground from R14.

20. CHECK TRIGGER CIRCUIT FOR PROPER OPERATION.

The scope should trigger on 200 mv on EXTERNAL AC or DC. Check the SLOPE switch for proper operation.

21. CHECK LINE TRIGGER FOR PROPER PHASE

Connect a 2X or a 10X probe to the input of the TEST LOAD UNIT. Connect the probe to the line at the fuse holder. Check that the trigger SLOPE switch triggers on the proper phase with the TRIGGER SOURCE switch to LINE. If it does not and the SLOPE switch is wired properly, switch leads to terminals 12 and 13 on the power transformer.

22. SET TIME BASE "B" TRIGGERING LEVEL CONTROL

Set the trigger controls to +INT, TIME/CM to 100 μ sec, STABILITY full left (ccw) but not to PRESET. Set the test scope VERTICAL INPUT to .05 VOLTS/CM, DC, set the trigger on LINE, AUTOMATIC and set the sweep TIME/CM to 2 MILLISEC. Use a 10X probe properly adjusted. Center the trace on the test scope for a zero reference. Connect the probe to the 270K resistor coming from the arm of TRIGGERING LEVEL pot on scope under calibration. (Connect to the rear end of the resistor, the end away from the pot arm.) Set pot to zero volts. Physically center knob and tighten set screw. Leave TRIGGERING LEVEL control at zero volts during succeeding adjustments.

23. ADJUST TIME BASE "B" TRIGGER LEVEL CENTERING

Set TRIGGERING SOURCE switch to INT. and TRIGGER SLOPE to +. Switch test scope VOLTS/CM switch to 0.2 VOLTS/CM, AC. Connect probe to pin 6 of V95, on scope under calibration, and adjust TRIGGERING LEVEL CENTERING for stable multi operation (with 50 mv of CALIBRATOR signal applied to the input of the TEST LOAD UNIT.) on + and - TRIGGER SLOPE.

24. ADJUST TIME BASE "B" PRESET ADJ.

Turn TRIGGERING SOURCE to + LINE. Turn STABILITY to PRESET. Turn PRESET ADJUST control clockwise until the sweep triggers. The center arm of the control should read about -80 v on a meter. Now continue turning PRESET ADJUST until the sweep free-runs. (Trace will brighten) The center arm on the control should be between -15 and -25 v higher. Turn the control back until the meter reads half way between the two readings.

25. CHECK TIME BASE "B" TRIGGER OPERATION

The scope should trigger on 0.5 v on EXTERNAL AC or DC. Check the SLOPE switch for proper operation.

26. ADJUST MAG GAIN

Turn HORIZONTAL DISPLAY to TIME BASE "B".

Turn the TIME BASE "B" TIME/CM switch to 1 MILLISEC and insert 1 millisecond and 100 μ sec markers from the time-mark generator.

Turn MAGNIFIER ON and adjust MAG GAIN for 5X magnification.

(1 large mark every 5 cm and 2 small marks every cm.) Check magnifier linearity over the entire sweep length. Check MAG indicating neon.

27. ADJUST SWEEP CAL.

After adjusting MAG GAIN, switch MAG OFF. Adjust SWEEP CAL. for one large time mark per centimeter. When any timing adjustments are made, always make them from the 1 cm line to the 9 cm line on the graticule.

28. ADJUST TIME BASE "A" TO TIME BASE "B" TIMING

Switch HORIZONTAL DISPLAY to TIME BASE "A", TIME BASE "A" TIME/CM at 1 MILLISEC and adjust R 160Z for the same timing, $\pm 0.5\%$ as TIME BASE "B". (R 160 Z is on the TIME BASE A TIME/CM bracket.)

29. ADJUST TIME BASE "A" SWEEP LENGTH

Adjust TIME BASE "A" SWP LENGTH control for approximately 10.5 cm of horizontal sweep.

30. ADJUST SWP/MAG REGIS

With MAGNIFIER ON, position the trace so that the first time mark (1 millisecond) falls on the center line of the graticule. Turn MAGNIFIER OFF and adjust SWP MAG REGIS. so that the first time mark again falls on the center line of the graticule. Check to see that the MAG ON and MAG OFF positions register properly in the middle and at the end of the sweep.

31. CHECK TIME BASE "A" SWEEP RATES

Switch HORIZONTAL DISPLAY to "A" and check all timing rates from 100 μ sec/CM through 2 sec/CM. Timing must be $\pm 2\%$. Check VARIABLE TIME/CM for smooth operation and coverage between ranges. Check UNCALIBRATED neon. Neon must light whenever control is not at the CALIBRATED position. ($\pm 2\%$ on the 3 slowest ranges.)

32. ADJUST HF TIMING

<u>TIME MARK GENERATOR</u>	<u>TIME/CM</u>	<u>ADJUST</u>	<u>FOR TIMING</u>
10 μ sec	10 μ sec	C160E	1 & 9 cm
1 μ sec	1 μ sec	C160C	1 & 9 cm
1 μ sec	0.5 μ sec	C160B	*1 & 9 cm
10 mc	0.1 μ sec	C348	1 & 9 cm
10 mc	0.05	C160A	*1 & 9 cm
100 mc	0.05 x 5 Mag	C364	1 & 9 cm
		C384	
100 mc	0.05 x 5 Mag	C372	Note below

When adjusting C372, first position the start of the sweep on the left edge of graticule. Adjust for exact timing between graticule marks 4 and 5. Neglect the linearity of first 4 cm.

50 mc 0.1 μ sec x 5 Mag Check timing

(NOTE C160B affects the 0.1 μ sec x 5 Mag range. You may need to compromise between 0.5 μ sec and 50 mc range.)

* One cycle every second cm.

33. SET TIME BASE B SWEEP LENGTH

Switch HORIZONTAL DISPLAY to TIME BASE B, TIME/CM to 0.5 MILLISEC and install the sweep LENGTH control limiting resistors. R277 (usually 12K to 18K) shunts the LENGTH control. R278 (usually 47 to 150K) shunts the 12K resistor between the LENGTH control pot and -150.

34. SET DELAY START ADJ AND DELAY STOP ADJ

Switch HORIZONTAL DISPLAY to "B" INTENSIFIED BY "A". From the Time mark generator feed 500 μ sec markers to the INPUT. Adjust STABILITY and TRIGGERING LEVEL for a stable display. Turn TIME BASE "A" STABILITY full right (cw) to free-run sweep. Check DELAY-TIME MULTIPLIER dial for mechanical zero. By turning the DELAY-TIME MULTIPLIER, a brightened portion of the sweep can be moved along the trace. The size of this bright portion depends on the TIME BASE "A" sweep speed. Turn the DELAY TIME MULTIPLIER to 1.00. Adjust DELAY START ADJ. till the bright portion just reaches the first time mark. (Always use the left hand edge of the brightened portion for calibration or measurement.) Turn the DELAY TIME MULTIPLIER to 9.00 and adjust DELAY STOP ADJ. so that the bright spot reaches the ninth time mark. There will be interaction between these adjustments so it will be necessary to go back and forth several times. Switch HORIZONTAL DISPLAY to "A" DELAYED BY "B" and make final adjustments. Check linearity of the DELAY TIME MULTIPLIER at all major divisions.

35. CHECK TIME BASE "B" SWEEP RATES 1SEC/CM THRU 0.2 MILLISECONDS.

When timing or checking any other than 500 μ sec ranges of the TIME BASE "B" sweep, first turn the DELAY TIME MULTIPLIER to 1.00 and notice the error in delay start, this is due to the trigger circuit. Now turn the DELAY TIME MULTIPLIER back to 9.00 plus the error noted at 1.00. (Error due to the trigger circuit may be as much as 15 minor divisions on the higher sweep speeds.) The reading obtained at 1.00 must not be more than + or - 5 minor divisions different than that obtained at 9.00. The 3 slowest speeds may be off \pm 8 minor divisions.

36. ADJUST TIME BASE "B" SWEEP RATES 0.1 MILLISEC THRU 2 μ sec

RANGE	ADJUST	TIME MARKERS	HORIZONTAL DISPLAY	MAIN SWP
50 μ sec	C260C	50 μ sec	Delaying sweep*	1 μ sec
5 μ sec	C260A	5 μ sec	Delaying sweep*	.1 μ sec

Check 50 and 5 μ sec ranges for linearity. \pm 2 minor divisions.
Check timing of all delaying sweep rates 0.1 millisecc thru 2 μ sec.

*Make final adjustments in "A" DELAYED BY "B".

37. CHECK "A" DELAYED BY "B" JITTER

Set the TIME BASE B TIME/CM switch to 1 MILLISEC, and TIME BASE A TIME/CM switch to 1 μ sec. Display 1 millisecc markers with the HORIZONTAL DISPLAY switch to "B" INTENSIFIED BY "A". Set the DELAY TIME MULTIPLIER so that the brightened portion of the sweep coincides with the marker at the 1 cm graticule line. Switch the HORIZONTAL DISPLAY to "A" DELAYED BY "B". The horizontal jitter should not exceed 2 mm. Repeat the process at the 9 cm graticule line, jitter at this position should not exceed 4 mm.

38. CHECK HOLD-OFF

Connect a probe from a test scope, set for DC input, to the right-hand end of C330. Set TIME BASE A STABILITY full right (cw). Check all ranges of TIME/CM switch for sufficient hold-off. Now switch HORIZONTAL DISPLAY to TIME BASE B and repeat the last step in B TIME BASE.

39. SET LOCKOUT LEVEL ADJUST (R 125)

Set HORIZONTAL DISPLAY to "B" INTENSIFIED BY "A" with TIME BASE B STABILITY full right (cw), set TIME BASE A TIME/CM switch to 100 μ sec. Turn the TIME BASE A STABILITY control until a trace first appears. Connect a test scope through a 10X probe to pin 3 of V 133 and observe a composite sawtooth and gate waveform. Adjust R 125 to the point where the sawtooth portion of the waveform is about two-thirds of the amplitude of the gate portion. The gate portion of the waveform must be at least 9 v in amplitude. Each time the setting of R 125 is changed, readjust the TIME BASE A STABILITY as above or an adjustment of R 125 will result.

40. ADJUST EXTERNAL SWEEP AMPLIFIER

Ground the Horizontal input. Reduce the INTENSITY to the minimum usable. Switch the HORIZONTAL DISPLAY to X1 EXT. Check the VARIABLE 10:1 pot for smooth operation while observing the spots travel across the screen. Connect SAWTOOTH OUT to input (x100) of TEST LOAD UNIT. Adjust EXT. HORIZ AMP DC BAL ADJ (R317) for no horizontal shift while turning ATTENUATOR pot. Apply 0.2 v from the CALIBRATOR to the HORIZONTAL INPUT X1 with the ATTENUATOR cw. There should be 1 cm or more of deflection. Apply 1 volt from the CALIBRATOR to the HORIZONTAL INPUT, and note the resulting deflection. Turn the ATTENUATOR knob to the ccw end and apply 10 volts from the CALIBRATOR. The resulting deflection should be the same or less than that noted previously. Reduce the CAL voltage to 1 volt again and set the ATTENUATOR for 5 centimeters of deflection. Switch to 10 volts from the CAL and to 10X on the HORIZ DEFLECTION switch. There should be 5 cm of deflection $\pm 2\%$. Sync the scope externally and apply 10 v of square wave to the EXTERNAL INPUT in the X10 position. Adjust C301C for approximately the same waveform as obtained in the X1 position.

41. CHECK CRT CATHODE INPUT

Remove CRT CATHODE GROUND. Strap from the rear of scope and insert signal from CALIBRATOR and check sweep for intensity modulation. With normal intensity, 20 v of signal will modulate the trace.

42. CHECK FRONT PANEL WAVEFORMS

With a test scope set for DC input, using a 1X (straight through) probe check +GATE A and +GATE B for gate waveforms of about 20 v amplitude with base on the zero-reference line. SAWTOOTH A should be about 150 v in amplitude with its base line on a zero reference, except on the fastest speeds where its base line will raise about 20 v. DEL'D TRIG. from TIME BASE A of TIME BASE B sweep should be a spike of at least 5 v on all sweep rates.

43. SET HF RESPONSE

Install a TYPE 80 plug-in in scope. Connect probe to CAL and apply 0.2 v. This should give 2 cm of deflection. Connect the probe to the output of a 105. Check for interface. Adjust probe compensation for flat top at 10 kc. Apply 1 mc to the probe from a 107. Adjust the trimmers in 2nd distributed amplifier for minimum wrinkles and best level. It may be necessary to touch up the adjustments in the TYPE 80 and probe. There should be at least 40 millimicroseconds of delay from the beginning of the trace to the rising portion of the square wave.

44. CHECK RISETIME

With the 107 connected to the TYPE 80 probe, the risetime observed must not exceed 4 millimicroseconds from the 10% to the 90% portion of the waveform.

45. RECORD CRT TYPE AND SERIAL NUMBER ON RECORD.

46. CHECK FOR CATHODE INTERFACE

Display about 3 cm of 400 kc square wave. Cathode interface will appear to be a spiking of the front corner of the square wave. Interface can be most readily identified by varying the line voltage. It will be worst at low line voltage and best at high line voltages.

