

## TYPE 111 PULSE AND PRE-TRIGGER GENERATOR

### FACTORY CALIBRATION PROCEDURE

#### EQUIPMENT NEEDED:

- 1 Type 541 or equivalent (Test Scope)
- 1 Type 531 or equivalent (Use with N unit)
- 1 Type L Plug-In or equivalent with X10 probe
- 1 Type N Plug-In
- 1 Multimeter (Triplet 630 or equivalent)
- 1 Unblanking cable for N Plug-In
- 1 Horizontal cable for N Plug-In
- 2 5 nsec cables (GR Connectors) RG-8
- 2 10 nsec cables (GR Connectors) RG-58
- 1 Cable (Amphenol connectors) 2 feet or longer
- 4 Attenuators (with GR connectors) X2, X5, X10, X10

A selection of 1/2 watt, 5% carbon resistors from 39 ohms to 130 ohms.

#### PRELIMINARY INSPECTION:

Check for unsoldered joints, rosin joint, lead dress, correct components, polarity at diodes, panel scratches, fuse value, condition of printed board, and mechanical assembly especially connectors on rear panel.

Check resistance to ground of transformer, and that line filter feed through capacitor nearest center of instrument connects to fuse.

Do not install transistors, remove them if installed. Pre-center minimum and maximum delay pots.

#### 1. CHECK VOLTAGES:

From 105 to 125 volts AC: RANGE switch to EXT. TRIG.

<u>VOLTS</u>	<u>TOLERANCE</u>	<u>RIPPLE</u>
+135	±3%	10 mv
+6	±5%	10 mv
-15	±5%	10 mv

#### 2. CHECK MULTIVIBRATOR OUTPUT:

RANGE switch at 1 KC.

AC couple test scope. Observe waveform at output plate of V15 (pin 6). Check amplitude (approximately 100 volts peak to peak) and symmetry (no worse than 2 to 1).

Check that front panel controls adjust frequency of output over a range of 10 cps to 100 kc, ±5%. Note that VARIABLE control overlaps from range to range of MULTIPLIER.

#### 3. TRIGGER SENSITIVITY:

Connect 10 nsec cable from PRE-TRIGGER OUT on rear panel to REGEN. TRIG. INPUT of "N" Unit. Set PULSE GEN. frequency controls to about 50 KC. Preset TRIG. SENS. full CCW. Insert SMO4 (Q40) and monitor pre-trigger output at FIXED INCREMENT switch with test scope. Advance TRIGGER SENS. until trigger B.O. is triggered.

Pulse on test scope should be about +10 volts, 260 to 350 nanosecs wide.

Switch PULSE GEN. frequency controls to EXT. TRIG. Connect test scope calibrator output (set at 2 volts) to EXT. TRIG. INPUT on rear panel. Check that 2 volts is sufficient to trigger Type 111 externally. Adjust TRIGGER SENS. as needed. Return frequency controls to about 50 KC.

4. CHECK FAST RAMP:

Externally trigger test scope with pre-trigger pulse obtained at FIXED INCREMENT switch.

At emitter of Q60 observe fast ramp starting from 1.4 volts and rising to 4.4 volts approximately. Ramp duration should be equal to pulse width noted in step 3.

5. ADJUST MAXIMUM AND MINIMUM DELAY:

Insert SMO4 (Q60), observe same waveform as in step 4 still using external triggering on test scope. Adjust MIN. DELAY and MAX. DELAY pots so that comparator "fires" about 15 Nsecs after start of fast ramp with VARIABLE DELAY full CCW, and at least 250 Nsecs after start of fast ramp with VARIABLE DELAY full CW. These adjustments are interacting, so repeat if necessary.

Remove test scope probes from Type 111.

6. AVALANCHE ADJUST:

Preset AVALANCHE ADJUST full CCW, install selected 2N636 (Q84). Connect 5 nanosec cable (RG-8) to Signal Input of N unit. Connect 5 nanosec cable (RG-8) to Pulse Output of "111". Insert attenuators between these two cables (X5, X5, X10). Connect 10 nanosec cable (RG-58) to charge line on rear of "111", leave other end open. Turn N unit scope on. Set N unit controls as follows:

Samples/Display	200
Vertical Position	Set Trace on bottom graticule line
Nanosec/cm	10
Trigger Sens.	CCW
Delay	CW
Vernier	CW

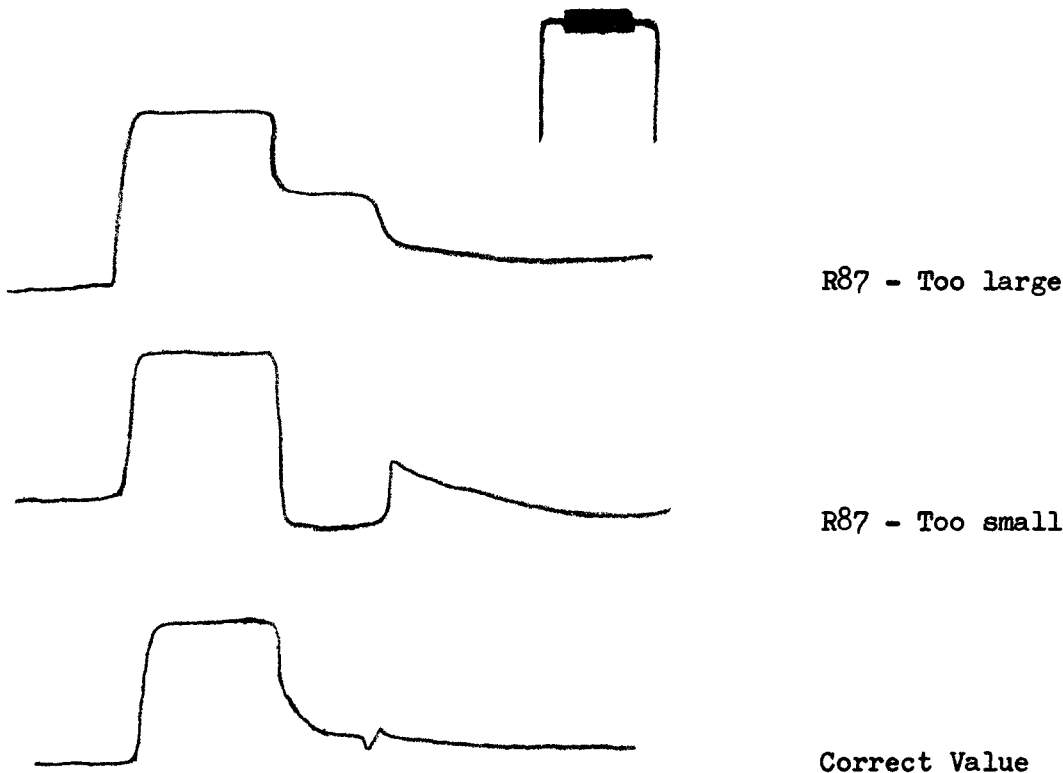
Set "111" controls as follows:

Variable	Full CCW
Fixed Increment	0
Output Polarity	+
Range	10 KC
Rep. Rate	Centered

Advance AVALANCHE ADJ. until Q84 free runs (shown by random dots on N unit scope). Back off just CCW of this point, until pulse appears. Find point at which pulse is stable while varying repetition rate from 100 KC to 10 KC. Leading edge of pulse must be less than thirty Nanosecs from start of trace. If slightly later than 30 Nanosec (say 35 Nanosec) re-adjust MIN. DELAY so that leading edge is delayed less than 30 Nanosec for all rep. rates.

7. SELECTION OF R87:

Select R87 for a smooth "back porch" following pulse. Use picture guide as an aid to selection. Bend resistor as shown. Do not cut leads.



8. ADJUSTMENT OF C77 and R87:

Switch N unit sweep speed to 2 Nsec/cm. Set Delay controls to position leading edge of pulse on screen. Adjust C77 and lead length of R87 for best front corner and fastest rise on leading edge. "Tack" R87 in this position with a small amount of solder. Do not cut leads, this will be done by Q.C.

9. CHECK FIXED INCREMENT SWITCH:

Set N unit Sweep Speed at 1 Nsec/cm. While observing pulse, check to see that FIXED INCREMENT switch delays pulse 1 Nsec (1 cm).

10. FINAL ADJUSTMENTS:

Re-adjust AVALANCHE ADJUST and TRIG. SENS. ADJUST for least amount of time jitter. This is when trace forming leading edge of pulse is narrowest on N unit scope.

11. ACCEPTANCE CHECKS:

Calibration of Type 111 will be complete if following specifications can be met with output pulse on both + and - polarity.

11. (continued)

- A. Pulse Amplitude 6 Volts or more.
- B. Max. Risetime .5 Nsec (.8 Nsec as measured on N) 10% to 90%.
- C. Time Jitter Not over 100 pico seconds (subtract time jitter of N unit from total observed).
- \*D. Aberrations Not over  $\pm 5\%$  of pulse amplitude.
- E. Slope in Volts (top of pulse) Not over  $\pm 10\%$  of pulse amplitude.
- F. Min. Pulse Width 2 Nsec or less (measured at 50% points with Ext. charge line removed.)

\* Aberrations can be read in % of pulse amplitude by noting pulse height in cm, then removing a X10 attenuator in signal path. 10% at pulse amplitude will now equal in cm the original pulse height.

\* For lowest noise from the avalanche, the positive trigger spike at the collector of Q60 should be at least 3V with the Delay set at minimum.