

INSTRUCTION MANUAL

MODIFICATION INSERT

Serial Number _____

TYPE 515A
MOD 760C

FILE COPY

This insert has been written to supplement the Instruction Manual furnished with this modified instrument. The information given in this insert will supersede that given in the manual.

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/ TYPE 515A

MOD 760C

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TYPE 515A
MOD 760C

The Oscilloscope for which this insert was prepared has been modified to provide a photographic record of line transients in the range of 25 volts to 12 kilovolts, using the 1000X Probe. The sweep may be triggered by three methods; once each hour by a built-in timer, in the normal manner when a pulse above a preset level causes a trigger, and manually by pressing the MANUAL ADVANCE button.

SPECIFICATIONS

The specifications listed below are different for this modified instrument from those listed in the manual.

Vertical Deflection System

Volts/Div---Four calibrated positions; .05, .5, 1, and 2 V/Div, plus a 4 Division Calibrated signal connected internally from the Calibrator.

Maximum Peak Input Voltage to 1000X Probe---12 kv
Input Impedance---100 meg, 2.5 pf with 1000X Probe

Horizontal Deflection System

Sweep Duration---Five calibrated sweeps; 10, 20, 100 and 500 μ sec Exponential, and 10 msec Linear.

Maximum Sweep Repetition Rate---Approximately 5 cps.
Sweep Voltage rises Exponentially at approximately:

Where: $d = k(1 - e^{-2.5t})$
d=horizontal displacement in div.
k=approximately 10.9
t=fraction of total time

Magnifier---Deleted

Trigger Requirements---2 minor divisions of deflection.

Cathode Ray Tube

Type T55P11

Accelerating Potential---Approximately 6325 volts.

Graticule

Special High-Voltage. One graticule division equals .85 cm.

Output Signals Available

Calibrator Only

OPERATION

Front panel controls and connectors not needed for the operation of this instrument have been removed. These Include: INPUT SELECTOR, INPUT 1, DC BAL(moved to internal), VARIABLE VOLTS/CM, TRIGGER INPUT, TRIGGER SELECTOR, TRIGGER LEVEL (moved to internal), HORIZONTAL DISPLAY, EXT. HORIZ. INPUT, VARIABLE TIME/CM, + GATE OUT, and SAWTOOTH OUT. The TIME/CM switch has been replaced by the SWEEP DURATION switch. The MANUAL ADVANCE button has been added.

Triggering

When connected to photograph line transients, this instrument will be triggered by signals with amplitudes producing more than 2 minor divisions of CRT display and timed pulses from the automatic timer, and may also be triggered manually. Each time the sweep is triggered, a relay completes the film advance circuit for operating a camera.

A Time Clock, which is adjustable from 5 to 60 minutes, provides automatic triggers at preset intervals. When the timer reaches the preset time, one sweep is displayed and photographed. When a signal of suitable amplitude triggers the sweep, or when the MANUAL ADVANCE button is pressed, the Time Clock resets and starts a new time cycle. The Time Clock therefore, sets the maximum time between displays.

When the Trig. Level Adj. is adjusted as described in the calibration procedure which follows, the sweep will be triggered on any signal, either positive or negative, which produces more than 2 minor divisions of vertical deflection. All signals below this level will be locked out, and will not produce a trigger pulse. The triggering level may be adjusted however, so the sweep will trigger only on signals producing more than 2 minor divisions of vertical deflection. To do this, apply a signal giving the desired minimum deflection and adjust the Trig. Level Adj. to the minimum setting at which a sweep is produced. Do not adjust this control to trigger on signals producing less than 2 minor divisions of deflection. If it is set too sensitive, random noise will trigger the sweep.

NOTE: If it becomes necessary to remove V610, first remove the four screws in the corners of the Time Clock. Move the clock out slightly and remove the tube. The wires need not be disconnected.

CALIBRATION

The following is a complete Calibration procedure which replaces the procedure in the manual.

Make the following circuit changes before proceeding with the calibration of the instrument:

- a. Disable the 6DJ8, V180 and the relay circuit by removing the tube from its socket.
- b. Connect a jumper from the 330k (R166) to the 9-1 wire (w, bn) on the front side of the second wafer on the TIME/DURATION switch.
- c. Disconnect C3 (at the input of the trigger circuit). The sweep will now always start on the rising portion of the waveform.
- d. Connect 100k in parallel with R25, 470k which is connected to the center arm of the Trigger Level Adjust pot.

Power Supply

All power supply voltages except the CRT voltages are available at the ceramic strip behind the transformer. The 10 Ω resistors are ahead of the regulators and the bare wires carry the regulated voltages.

1. -150 volt Supply Adjustment

The -150 volt supply is the one to which all other supplies are referenced.

- a. Connect an accurate voltmeter to the -150 volt bus.
- b. Adjust the -150 ADJ control, located behind the delay line, to obtain a reading of -150 volts.

2. CRT Supply Adjustment

This adjustment determines the total accelerating voltage on the CRT and thus affects the deflection sensitivity.

- a. Connect a voltmeter having a resistance of $5000\Omega/\text{volt}$ or higher, from terminals 24 or 25 of the power transformer to ground.
- b. Adjust the -1675 ADJ control located at the rear of the upper chassis, accessible from the right, to obtain a reading of 1675 volts.

3. Calibrator Adjustment

When the CALIBRATOR switch is turned off, the calibrator cathode follower, V570B remains conducting at the current required to develop 100 volts across the voltage divider. The CAL ADJ control, located just behind the CAL OUT connector, allows this voltage to be set accurately to 100 volts. Be careful to use an accurate meter as the accuracy of the calibrator can be better than 3 per cent if accurately set.

- a. Turn the CALIBRATOR control OFF.
- b. Connect the meter from ground to the pin jack labeled CAL TEST POINT, located behind the CALIBRATOR switch.
- c. Adjust the CAL ADJ control for 100 volts.

Triggering

- a. Set up triggering by grounding pin 2 of V10 with a clip lead. Then set the TRIGGER SENSITIVITY control fully counterclockwise and the TRIGGER LEVEL CENTERING control fully clockwise. Turn the PRESET STABILITY control counterclockwise until the trace disappears from the CRT screen.
- b. Change the VOLTS/DIVISION switch to 1 volt. Set the CALIBRATOR to .1 volt and jumper to vertical INPUT. Adjust TRIGGER LEVEL CENTERING to a point that a trace just appears on the screen. Then adjust TRIGGER SENSITIVITY control for a stable display. Adjust both of the controls back and forth until a stable display is obtained. The trigger should not be so sensitive that it will oscillate.
- c. Remove clip lead from pin 2 of V10, and adjust Calibrator Output for 1 volt. Set SWEEP DURATION switch to 10 msec position. Adjust TRIGGER LEVEL control for a triggered display when 1 major division of signal is displayed on the screen. There will be a finer adjustment of the control later.

Refer to the chart below for timing and specifications. The timing is done on 9th and 10th major divisions. The other major divisions will fall within ± 1 minor division.

$$\text{Exponential Sweep} \quad t = .4 \ln \frac{10.9}{10.9 - d}$$

Graticule Division d	Sweep Duration Range t μsec			
	500 μsec	100 μsec	20 μsec	10 μsec
0	0	0	0	0
1	19	3.8	.8	.4
2	40	8	1.6	.8
3	64	13	2.6	1.3
4	92	18	3.6	1.8
5	122	24	4.9	2.4
6	160	32	6.4	3.2
7	205	41	8.2	4.1
8	265	53	10.6	5.3
9	350	70	14.0	7.0
10	500	100	20.0	10.0

f. Change SWEEP DURATION switch to 500 μsec position. Apply 500, 50, and 10 μsec markers and adjust TRIGGER LEVEL control for a stable display. Adjust R180B and R160A together for the 500 μsec range. (Be sure to remove the probe).

g. Change to 100 μsec position and apply 100, 10 and 5 μsec markers and adjust TRIGGER LEVEL control for a stable display. Adjust C160D and R160C together.

h. Change to 20 μsec and apply 10, 5 and 1 μsec markers. Adjust TRIGGER LEVEL control. Adjust C160E and R160E.

i. Change to 10 μsec with same markers and adjust C160F and R160G. Note: On the fast speed, C224 may be adjusted slightly to improve linearity.

j. Change SWEEP DURATION to 100 μsec and adjust Sweep Length for exactly 100 μsec . Check 10msec, 500 μsec , and 20 μsec positions for 10 divisions of length.

k. Adjust C170 for a sweep length of 10 μsec and 10 major divisions of length in 10 μsec sweep.

b. Remove signal from Vertical and press MANUAL ADVANCE button. Only one trace should appear. Also check to see if the relay operates.

c. Apply Calibrator to Vertical. Change the Calibrator to 1 volt and the VOLTS/DIVISION to .5 volts. Change SWEEP DURATION to 500 μ sec. Connect 10X probe to pin 3 of V210 with test scope Time/Cm switch set to .1 sec. Check for approximately 5 c.p.s. repetition rate. (Approximately 200 msec between sweeps). If sweep cannot be obtained, replace V140. (Use low grid current tube.)

d. Check the duration of the relay by connecting another 10X probe to the Film Advance jack with a VOM. Put the VOM in the X100ohms range. (This is a battery source only.) Put test scope in ADDED, VOLTS/CM in .5 volts, and apply 1 sec markers to the Vertical of the scope under calibration. Connect external triggers from the 180 to the External Trigger Input of the test scope. (1 sec). Look at the time duration that the relay is closed. Should be more than 100msec. Make sure that the sweep has finished before the relay closes in all positions of the SWEEP DURATION switch.

Time Clock

a. Set the SWEEP DURATION switch to 10msec, VOLTS/DIV to 2 and CAL off. With no Vertical signal applied, press the MANUAL ADVANCE button. One sweep should occur. The relay should operate and the Timer should move to the preset time. Manually move the pointer on the timer to 3 minutes. Press MANUAL ADVANCE. One sweep should occur and the pointer should return to the preset time. Change the brake pressure if necessary. Set the pointer to 3 minutes again. Let the timer advance the pointer and observe one trace on the CRT. The timer should again return to the preset time.

PARTS LIST

The following parts have been added to this modified instrument. When ordering replacement parts, specify instrument type, serial number and MOD number. Include circuit number, part number, and description of the desired item.

CAPACITORS

C2	Change	283-0001-00	.005	500v		disc
C3	Change	283-0001-00	.005	500v		disc
C5	Add	283-0000-00	.001	500v		disc
C6	Add	283-0000-00	.001	500v		disc
C51	Add	285-0553-00	1 μ f	600v		PMC
C140	Add	285-0510-00	.01	400v		
C160A	Change	285-0664-00	.01			tek
C160B	Change	285-0665-00	.001			tek
C160C	Change	283-0544-00	150pf		10%	mica
C160D	Change	281-0012-00	7-45			var
C160E	Change	281-0012-00	7-45			var
C160F	Change	281-0010-00	4.5-25			var
C170	Add	281-0044-00	80-480			var
C182	Add	285-0501-00	.001	600v		
C184	Change	285-0515-00	.022	400v		
C185	Add	290-0145-00	10 μ f	50v		EMT
C224	Change	281-0007-00	3-12			var
C721	Change	283-0071-00	.0068	5kv		
C723	Add	283-0071-00	.0068	5kv		

DIODES

D2	Add	152-0008-00	T12G
D3	Add	152-0008-00	T12G
D180	Add	152-0061-00	6061
D185	Add	152-0061-00	6061

RELAYS

K180	Add	031-0009-00	4-pole double throw
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RESISTORS

R2	Change	302-0562-00	5.6k	1/2w	10%	comp
R3	Change	302-0562-00	5.6k	1/2w	10%	comp
R5	Change	302-0225-00	2.2m	1/2w	10%	comp
R6	Change	302-0105-00	1m	1/2w	10%	comp
R7	Add	302-0103-00	10k	1/2w	10%	comp
R8	Change	302-0392-00	3.9k	1/2w	10%	comp

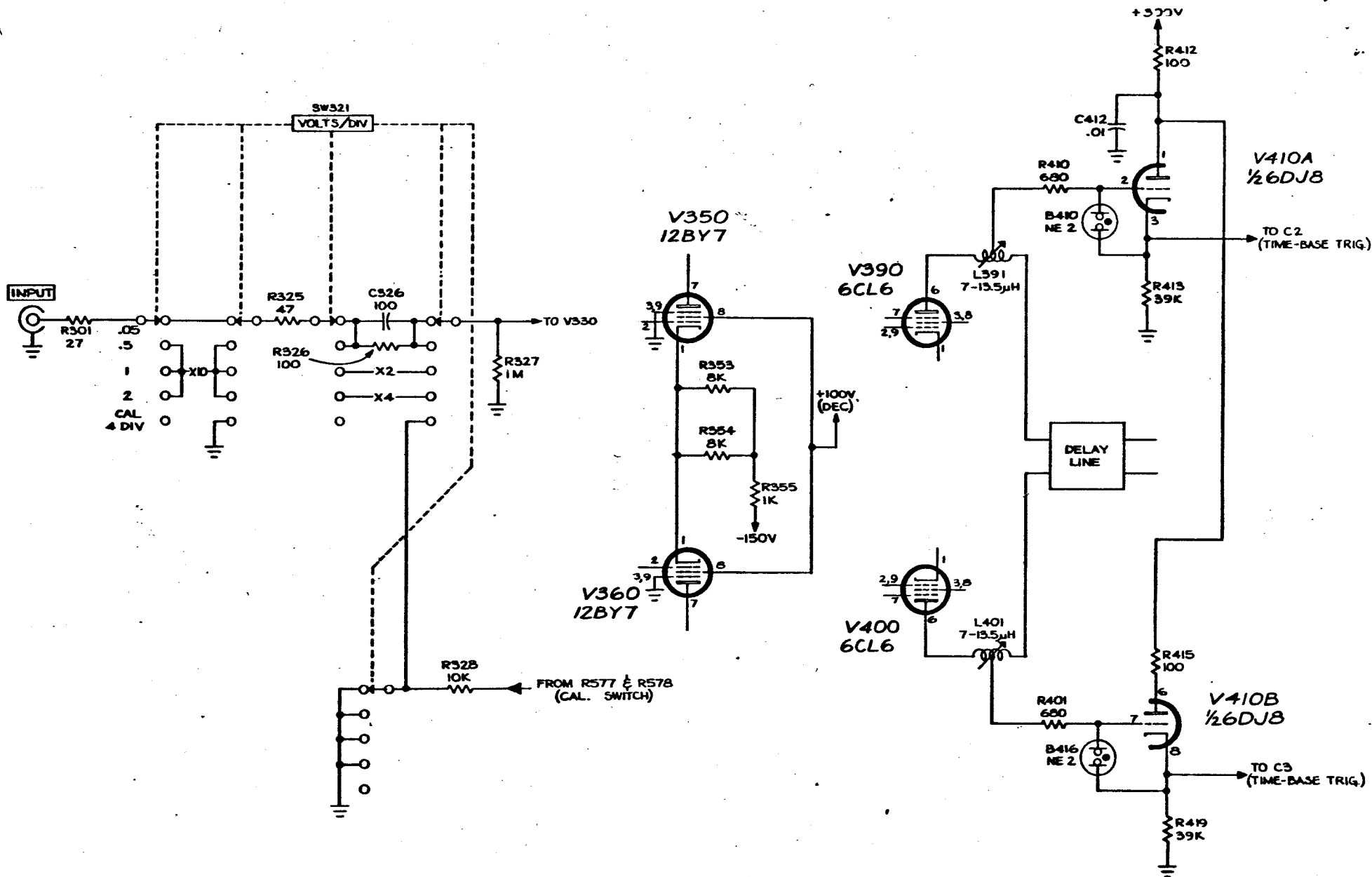
TYPE 515A, MOD 760C

MECHANICAL

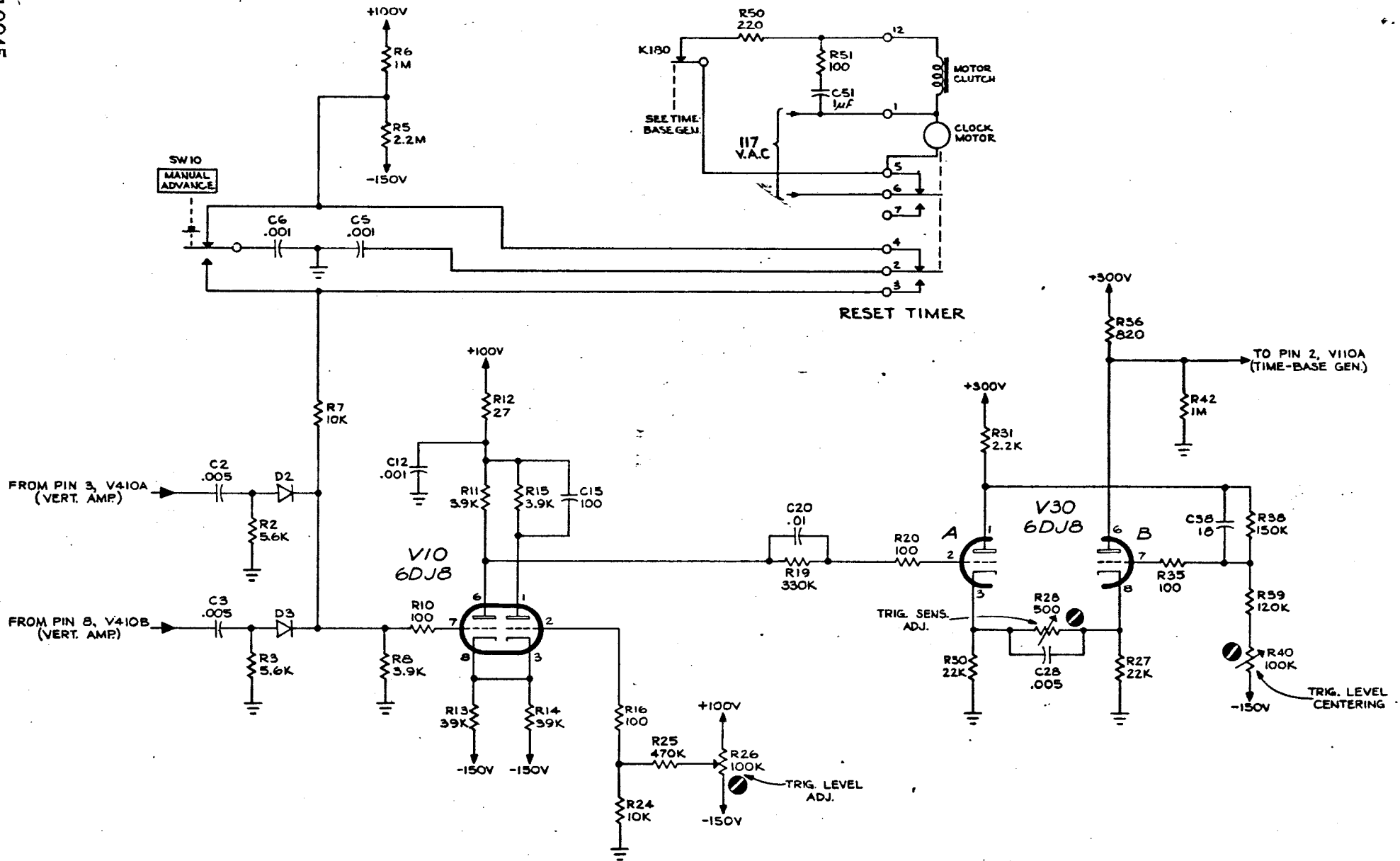
BRACKET, Brace, Cap Mtg	Add	1	406-0224-00
BRACKET, Pot, Trigger Level	Add	1	030-0453-01
BRACKET, Pot, Sweep Duration	Add	1	030-0454-01
BRACKET, Rectifier	Change	1	030-0391-02
BRACKET, Resistor	Add	1	030-0462-01
BRACKET, Timer	Add	1	030-0397-02
BRAID, Ground	Add		176-0047-00
BRAKE, Reset Timer	Add	1	030-0466-01
CHASSIS, Sweep	Change	1	030-0300-04
CLIP, Delrin	Add	6	214-0153-00
CONNECTOR, UHF, 2-hole flange	Add	2	131-0051-00
FLANGE, Socket	Add	1	030-0460-01
GRATICULE, .85 cm	Change	1	331-0051-00
GROMMET, Delrin, 1/4"	Add	1	361-0007-00
GROMMET, Rubber, 1/4"	Add	1	348-0002-00
KNOB, Large Black	Change	1	366-0042-00
METER, Jack	Add	1	131-0024-00
SHIELD	Add	1	030-0465-01
SHIELD, Brass, Volts/Cm	Add	1	337-0145-00
SHIELD, Timer	Add	1	030-0424-03
SOCKET, STM 8	Add	1	136-0013-00
SPACER, Alum., tapped 6/32" ends	Add	4	385-0160-00
SPACER, Bracket	Add	1	030-0461-01
SPACER, Ceramic Strip	Add	4	361-0009-00
SPACER, 5/16 x 1/4", .180 ID	Add	2	166-0032-00
STRIP, Ceramic, 4 x 3/4"	Add	1	124-0088-00
STRIP, Ceramic, 9 x 3/4"	Add	1	124-0090-00
TIMER, Haydon Reset Acro-Timer, series BP, Model BP1204, time range - 60 minutes.	Add	1	037-5007-00

SHIPPING KIT

PROBE, P6013	1	010-0106-00
ADAPTER, Power Cord, 3-wire to 2-wire	1	103-0013-00
POWER CORD	1	161-0010-00



PARTIAL VERTICAL AMPLIFIER

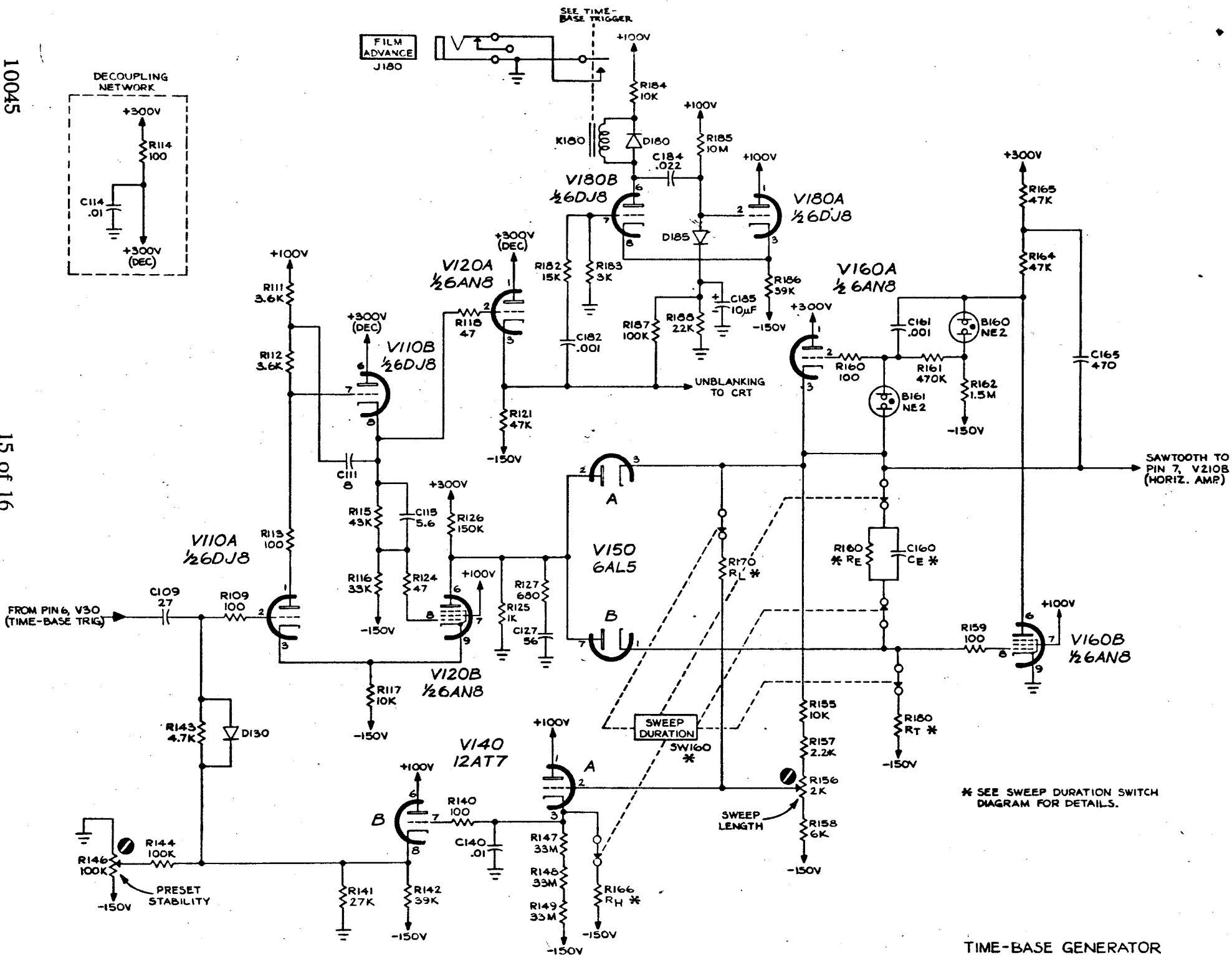


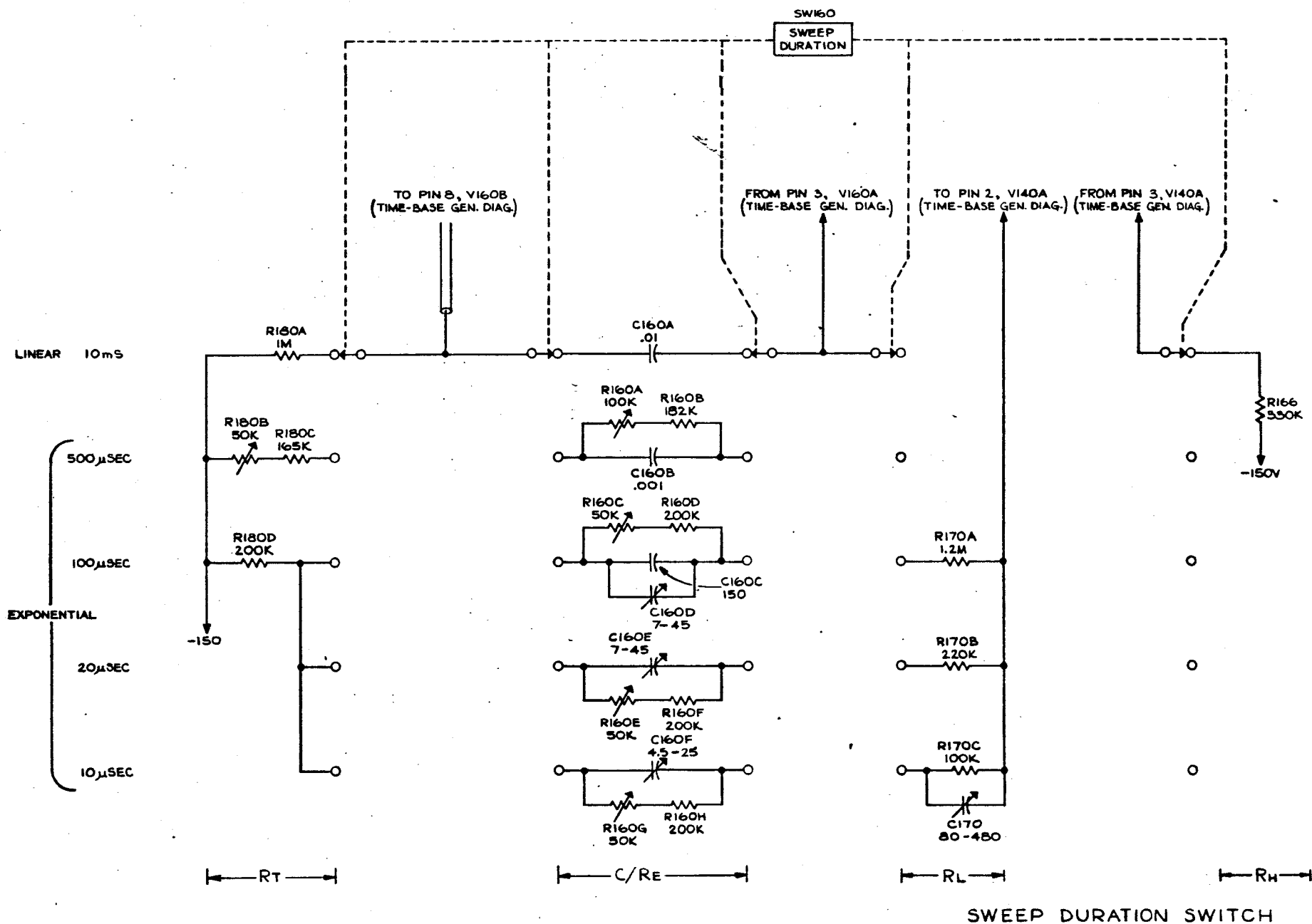
TIME-BASE TRIGGER

TIME-BASE GENERATOR

10045

15 OF 16





SWEEP DURATION SWITCH