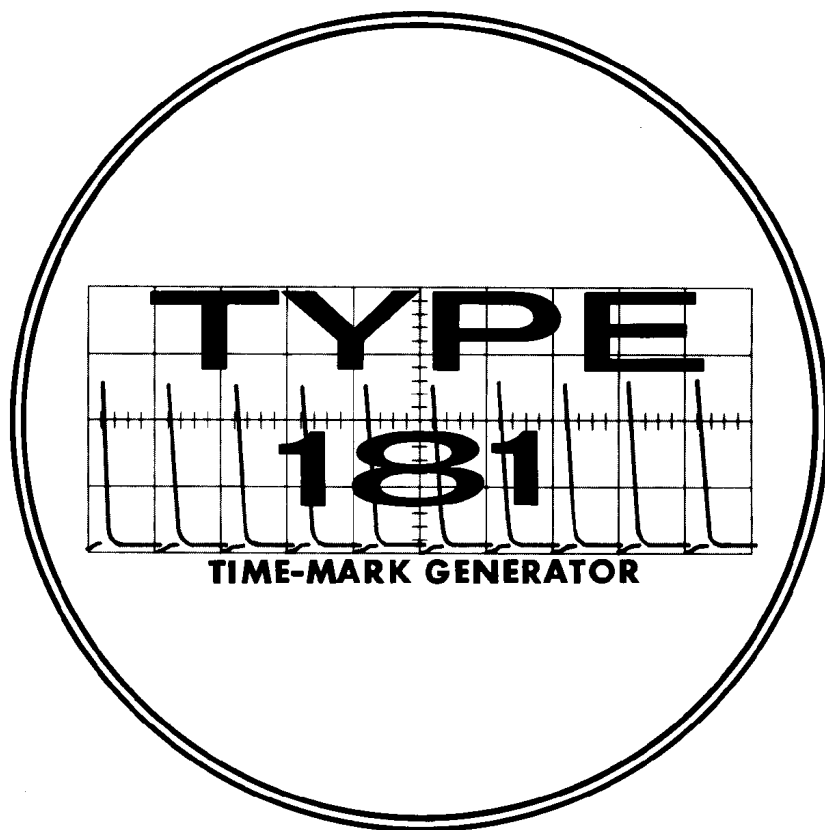


INSTRUCTION MANUAL



S. W. Millikan Way • P.O. Box 500 • Beaverton, Oregon • Phone MI 4-0161 • Cables: Tektronix
070-292



TYPE 181 TIME-MARK GENERATOR

SERIAL 00000000

OUTPUT

OUTPUT SELECTOR

MSEC 1 10 100 10 1 μSEC 0.1 1 10 100
CHECK COUNT

1 μ SEC.

10 μ SEC.

100 μ SEC.

1 MSEC.

10 MSEC.

10 μ SEC.

100 μ SEC.

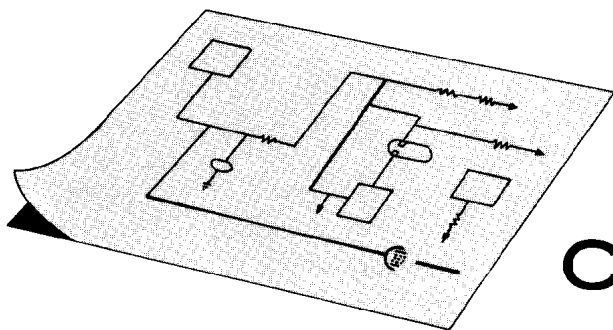
1 MSEC.

10 MSEC.

POWER
ON



TEKTRONIX, INC., PORTLAND, OREGON, U.S.A.



SECTION 1

CHARACTERISTICS

General

The Type 181 Time-Mark Generator is a compact, portable, laboratory instrument. It provides accurate time markers which can be displayed on an oscilloscope for the purpose of calibrating the sweep or for comparison time measurements.

Output Waveforms Available

Front-panel binding posts provide markers of 1, 10, 100, 1000, and 10,000 microseconds. Each of these can be selected by a selector switch which applies them to a front-panel coax connector. In addition to the markers, a ten-megacycle sine wave can be selected and applied to the coax connector.

A CHECK COUNT switch mixes the five markers so that they are all present in the output.

Nominal Voltage, Impedance,
and Risetime Values

Marker	Amplitude	Risetime	Impedance
0.1 μsec	2 v	sine wave	150 Ω
1 μsec	2 v	0.05 μsec	80 Ω
10 μsec	2 v	0.13 μsec	80 Ω
100 μsec	2 v	0.2 μsec	80 Ω
1,000 μsec	2 v	0.4 μsec	80 Ω
10,000 μsec	2 v	0.4 μsec	80 Ω

A crystal-controlled oscillator, operating at one megacycle, controls all outputs. The frequency tolerance of this oscillator is about .03 per cent with a short-time stability, after initial warm-up, of about .005 per cent per hour. For uses requiring better stability, a plug-in temperature-controlled crystal is available. This may be installed at any time without wiring changes.

You may order the crystal oven from the factory at any time. Order Tektronix part number 158-007.

Power Supply

All dc voltages are regulated to accommodate line-voltage variations between 105 and 125 volts or between 210 and 250 volts, 50 to 60 cycles, ac. Power consumption is 100 watts at 117 or 234 volts, 105 watts with crystal oven installed.

Mechanical Characteristics

Construction

Aluminum alloy chassis and cabinet. Photo-etched aluminum panel with anodized finish. Blue wrinkle finished cabinet.

Dimensions

17-1/2 inches long, 5-5/8 inches wide, 8-3/4 inches high.

Weight

17-1/2 pounds.

Front-Panel Controls and Connectors

CHECK COUNT (red knob)

Two-position switch removes or inserts a common cathode resistor in all marker-output cathode-follower cathodes to mix the markers.

(Screwdriver
Adjustment)

OUTPUT SELECTOR (black knob)

Six-position switch selects marker to be connected to OUTPUT coax connector.

POWER

On-off switch in primary lead of power transformer.

OUTPUT

UHF coax connector from the OUTPUT SELECTOR switch.

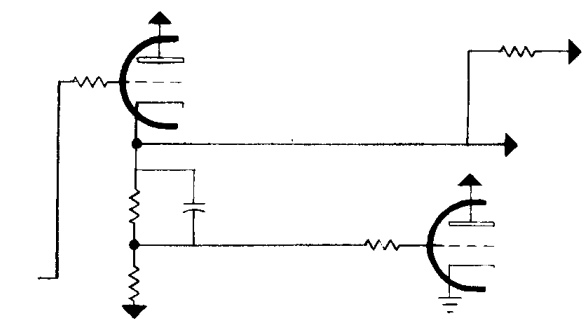
10 μSEC
100 μSEC
1,000 μSEC
10,000 μSEC

Variable resistors adjust the frequency dividers for the correct count-down ratio.

1 μSEC
10 μSEC
100 μSEC
1,000 μSEC
10,000 μSEC

Binding posts supply markers as indicated.

CIRCUIT DESCRIPTION



Block Diagram

The block diagram shows the functional parts of the time-mark generator and their interconnections. A functional drawing of the OUTPUT SELECTOR switch is incorporated.

The controlling oscillator of the instrument is a crystal-controlled, electron-coupled oscillator. One output of the oscillator goes to the amplifier-shaper which drives the ten-megacycle multiplier and provides the one-microsecond markers.

The second output of the oscillator goes through an isolation cathode follower to a series of frequency dividers. A pulse from each divider triggers the next lower-frequency divider. The markers come out at a low impedance from cathode followers. The cathode followers connect to binding posts and to the OUTPUT SELECTOR switch.

OSCILLATOR AND MULTIPLIER

Oscillator

The crystal-controlled oscillator, V103, operates at one megacycle. It is an electron-coupled oscillator with the screen operating as the anode for the purpose of maintaining oscillation. Feedback occurs in the capacitor, C103, from the screen grid to the control grid. L102 is broadly tuned by its stray capacitance to resonate at one megacycle. The signal is electron coupled to the plate, minimizing the effects of loading on the oscillator.

A trimmer capacitor, C101, allows a slight adjustment of the oscillator frequency. For maximum frequency stability, a temperature-controlled crystal is available which is easily plugged into the octal socket wired for that purpose.

One-Microsecond Amplifier-Shaper

The amplifier-shaper, V110B, is an over-driven amplifier with grid-leak bias. L112 improves the rise time of the waveform at the plate.

Ten-Megacycle Multiplier

The one-megacycle waveform at the plate of the amplifier-shaper is applied to the grid of the ten-megacycle frequency multiplier, V120B. The multiplier operates with grid-leak bias, and has as a plate load, the double-tuned transformer, L130,

tuned to ten megacycles. The ten-megacycle output is taken from a low-impedance coil, inductively coupled to this transformer.

One-Microsecond Cathode Follower

The one-megacycle waveform at the plate of the amplifier-shaper is sharpened by the differentiating network, C120 and R120 and applied to the grid of V120A. The -25 -volt bias on this grid holds the tube below cut-off so that only the positive peaks of the differentiated waveform appear at the cathode of V120A.

Isolation Cathode-Follower

A cathode-follower, V110A, transmits the one-megacycle waveform from the oscillator to the first divider stage, to prevent loading of the oscillator output by the multivibrator.

FREQUENCY DIVIDER

10-Microsecond Divider

The 10-microsecond frequency divider, V140, is a monostable, cathode-coupled multivibrator. After an initiating pulse, a recovery time of nine to ten microseconds is required for the multivibrator to return to its quiescent state.

One-megacycle input is supplied from the isolation cathode-follower, through the decoupling diode, V135A. In the quiescent state, the grid of V140B is held slightly positive by R143 and R144 and the clamp diode V135B. V140B conducts holding its cathode and that of V140A slightly positive. The -8 -volt bias on V140A holds this section cut off. R139, in this grid, is a parasitic suppressor.

The disconnect diode, V135A, couples a negative pulse to the plate of V140A and to the grid of V140B through C138. The cathode of V140B follows the grid down until the bias on V140A is overcome. At this time V140A conducts, causing its plate voltage to drop. This drives the grid of V140B below cut off.

The plate of V140B rises rapidly to 300 volts. C138 begins to discharge immediately through R143 and R144. As C138 discharges, the grid of V140B rises until this section again begins to conduct, restoring the circuit to its quiescent condition. At this time, C138 is recharged through the clamp diode, V135A, and R137 and R138.

Circuit Description — Type 181

After the initiating pulse from the disconnect diode begins the cycle, the plate of this diode is held negative with respect to the cathode. This prevents further pulses from affecting the circuit until the quiescent condition is again restored, at which time the next negative pulse will initiate another cycle of operation.

The primary time-determining elements are C138 and R143 and R144. R144 is adjustable so that the recovery time can be adjusted to be more than nine microseconds yet less than ten. When this is done, every tenth one-microsecond pulse will initiate a cycle of operation.

The negative pulse on the plate of V140A is used as the triggering waveform for the next divider.

The positive pulse on the plate of V140B is differentiated by C149 and R149, providing a sharp pulse on the grid of V149B. The bias of -25 volts applied to the grid of V149B holds the grid below cutoff so that only the positive peaks of the differentiated waveform appear at the cathode.

100-Microsecond Divider

The negative pulse from V140A is applied to the monostable multivibrator, V160, through the disconnect diode, V155B. The timing resistors, R163 and R164, and the timing capacitor, C173, fix the recovery time of this multivibrator between 90 and 100 microseconds. Thus every tenth pulse initiates a cycle of operation.

The negative pulse on the plate of V160B is used to trigger the next divider. The positive pulse on V160A is differentiated by C169 and R169 and applied to the cathode follower, V169B.

1-Millisecond Divider

The negative pulse from V160B is applied to the monostable multivibrator, V175, through the disconnect diode, V170B. The timing resistors, R178 and R179, and the timing capacitor, C173, fix the recovery time of this multivibrator between 900 and 1,000 microseconds. Thus every tenth pulse initiates a cycle of operation.

The negative pulse on the plate of V175B is used to trigger the next divider. The positive pulse on V175A is differentiated by C184 and R184 and applied to the cathode follower, V169A.

10-Millisecond Divider

The negative pulse from V175B is applied to the monostable multivibrator V190 through the disconnect diode V185B. The timing resistors, R193 and R194, and the timing capacitor, C188, fix the recovery time of this multivibrator between 9,000 and 10,000 microseconds. Thus every tenth pulse initiates a cycle of operation.

The positive pulse on the plate of V190B is differentiated and applied to the cathode follower, V149A.

Switch Detail

The cathode resistors for the marker cathode followers are mounted on the OUTPUT SELECTOR and CHECK COUNT

switches which are concentrically mounted on the front panel. One end of each resistor is grounded by the CHECK COUNT switch in parallel with R201. When the CHECK COUNT switch is open, R201 becomes common to all the marker cathode-follower cathodes, mixing the markers in the output at about one-tenth normal amplitude.

POWER SUPPLY

Transformers

The power supply operates on 105 to 125 and 210 to 250 volts, 50 to 60 cycles ac. The transformer, T400, has two primary windings that can be connected in parallel for 117-volt operation or in series for 234-volt operation. In addition, there are two high-voltage windings and three heater windings.

— 150-Volt Supply

A full-wave rectifier, V400, supplies the dc voltage for the -150 -volt supply. A voltage reference tube, V403, serves as the basic reference element of this power supply. The voltage of this tube is compared with the voltage on the voltage divider, R408 and R409, between the negative 150-volt bus and ground. The difference voltage is amplified by V404 and applied to the grid of the series-regulator tube, V405. C407 improves the ac regulation by increasing the ac gain in the regulator loop.

A portion of the ripple ahead of the regulator tube is applied to the screen of V404 through R404. The phase of this ripple is such that the ripple in the regulated supply is minimized.

C401B reduces the impedance of the supply to frequencies above the cutoff frequency of the regulator.

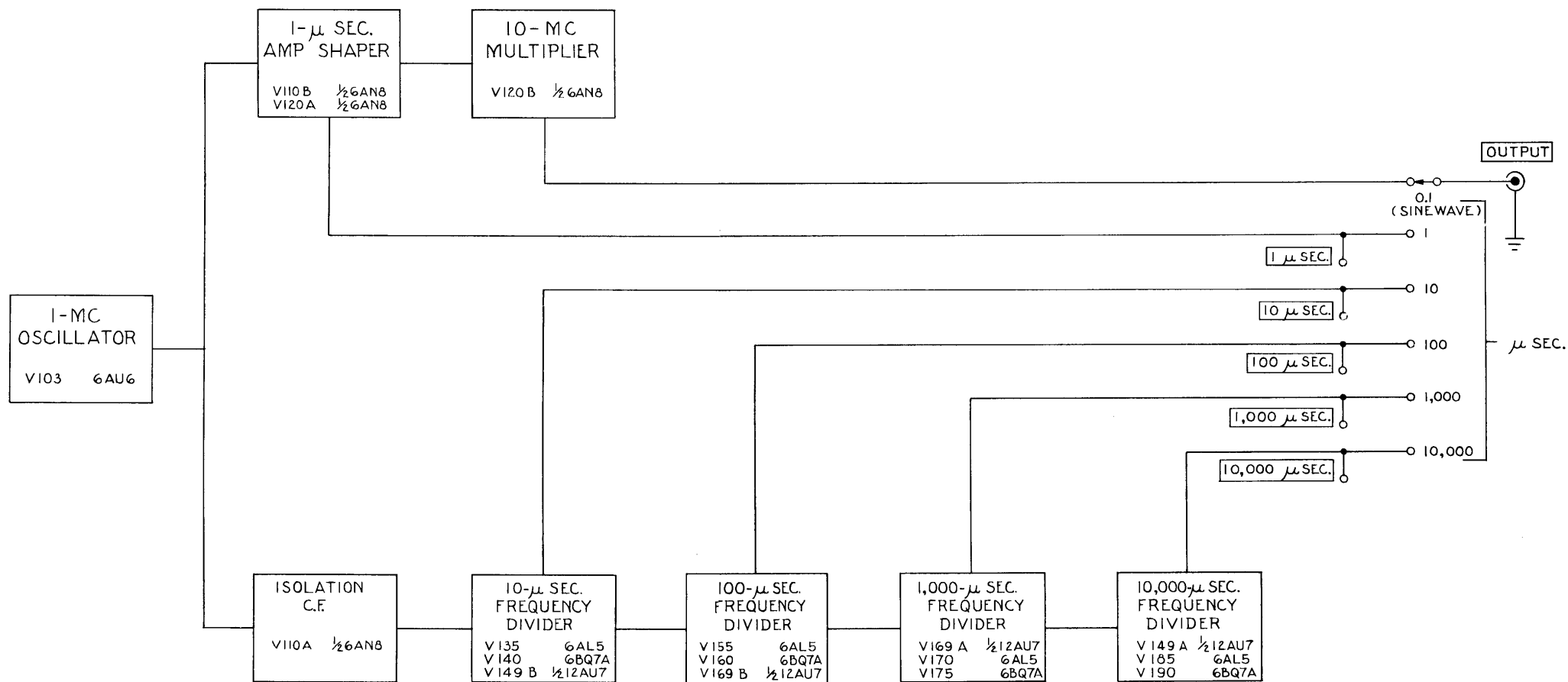
Bias Supply

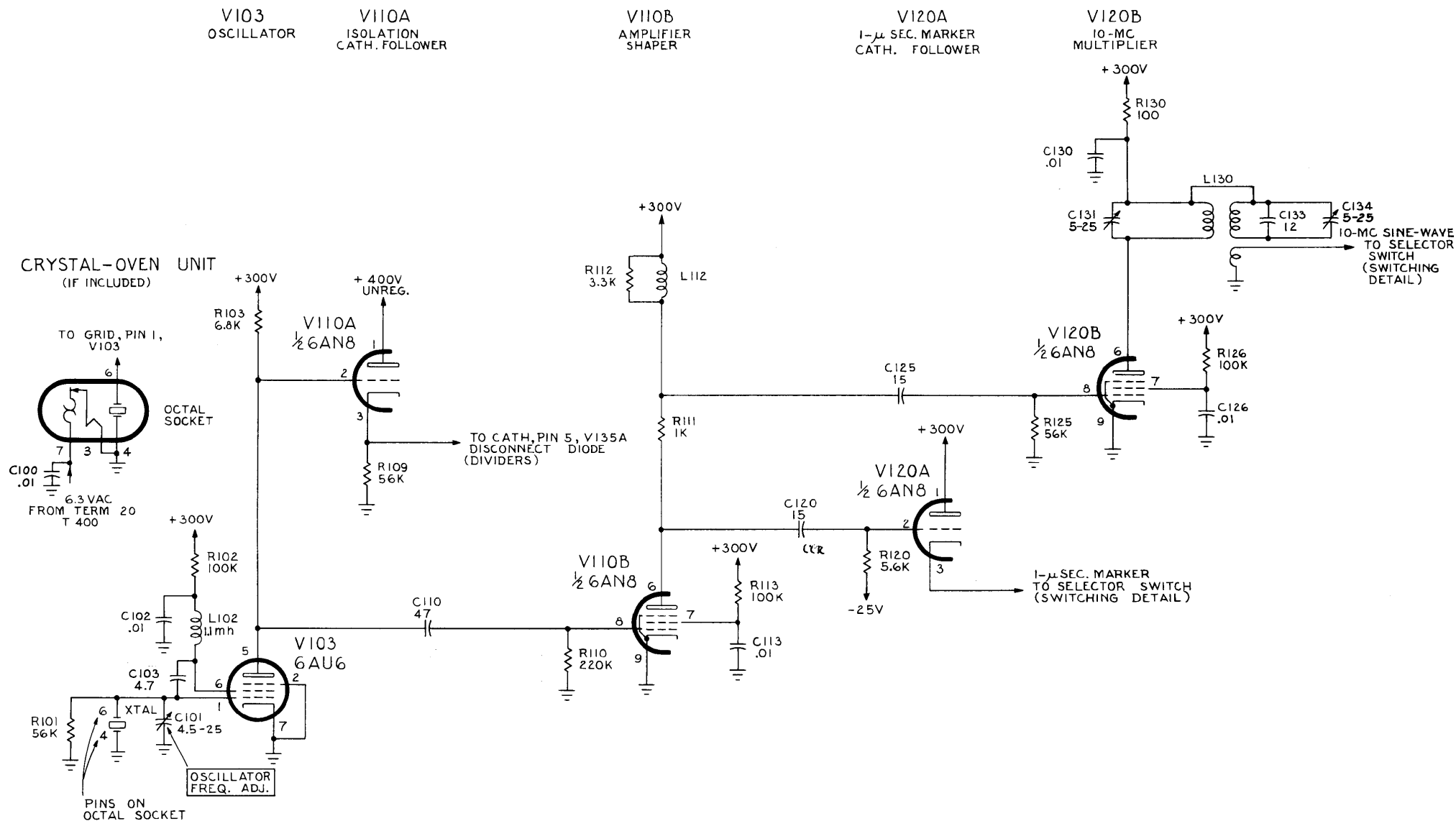
The divider, R420 and R421, provides bias voltage for the marker cathode followers. C420 reduces the impedance of the bias supply to ac signals. Similarly, divider R425 and R426 supplies the bias for the multivibrators.

+ 300-Volt Supply

A full-wave rectifier, V430, supplies the dc voltage for the $+300$ -volt supply. The comparator tube, V432, compares a point close to ground potential on the precision divider, R436 and R437, with ground potential. The amplified difference is applied to the series-regulator tube, V435.

R432 applies to the screen of V432, a portion of the ripple voltage ahead of the regulator. This minimizes the ripple in the regulated supply. C436 improves the ac regulation by increasing the ac gain in the feedback loop. C431B reduces the impedance of the regulated supply to high frequencies.



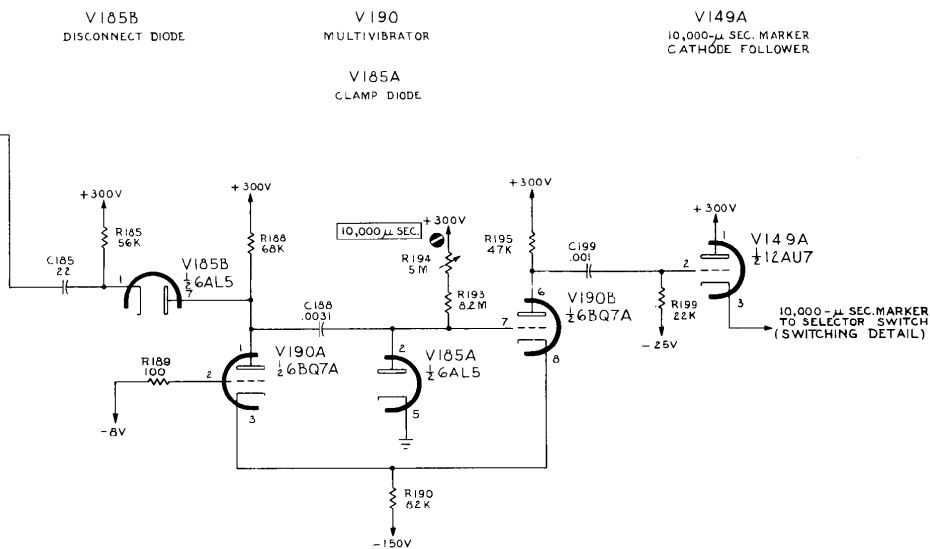
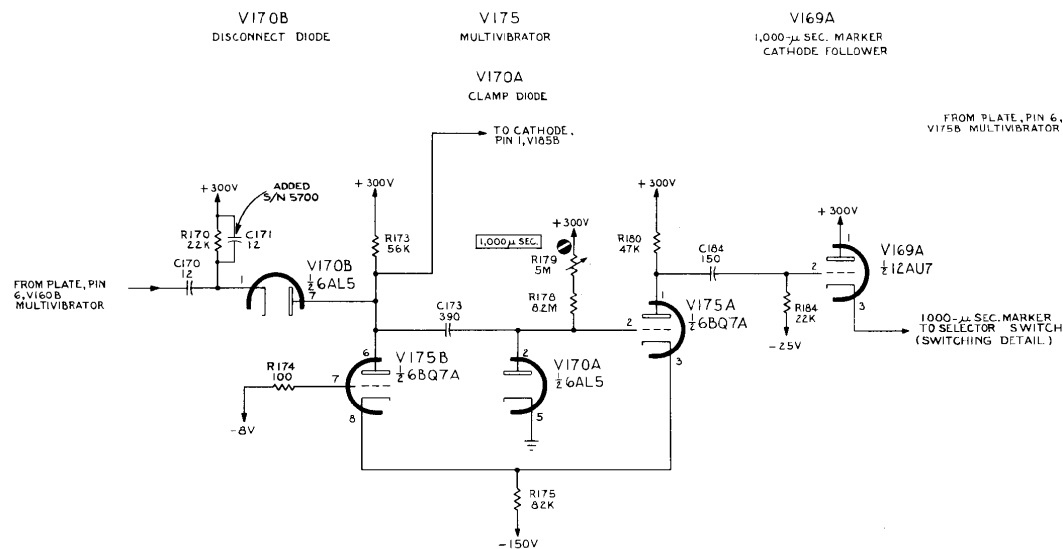
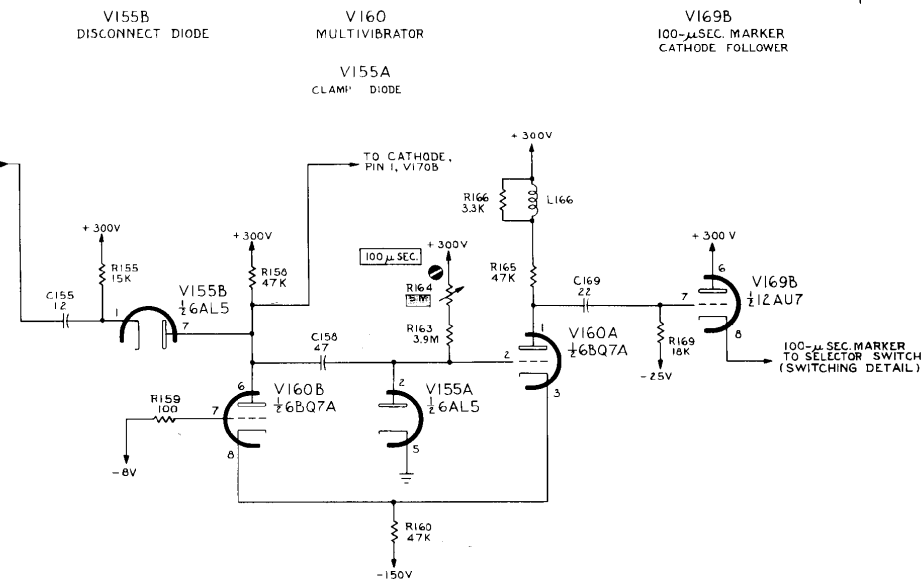
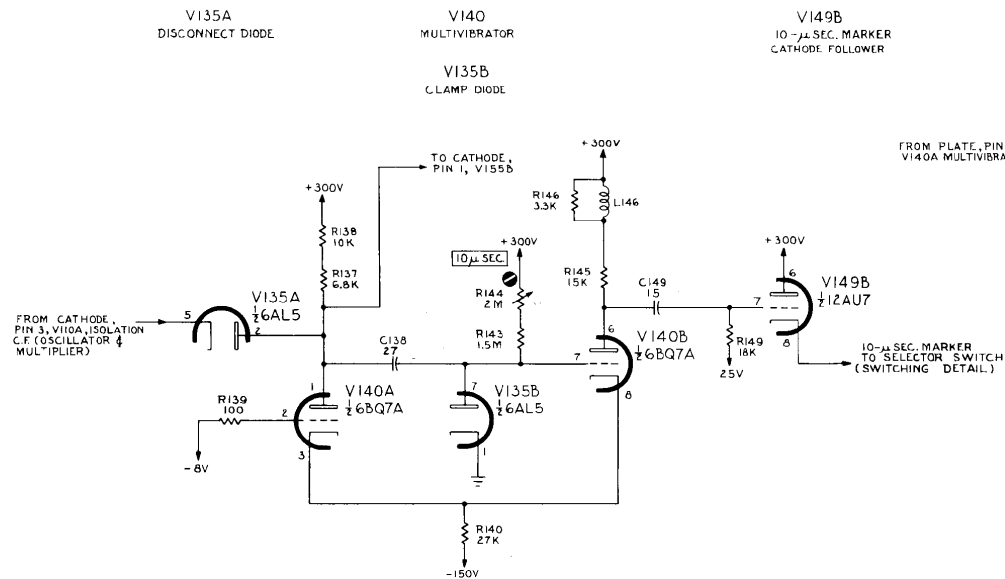


TYPE 181 TIME-MARK GENERATOR

AA

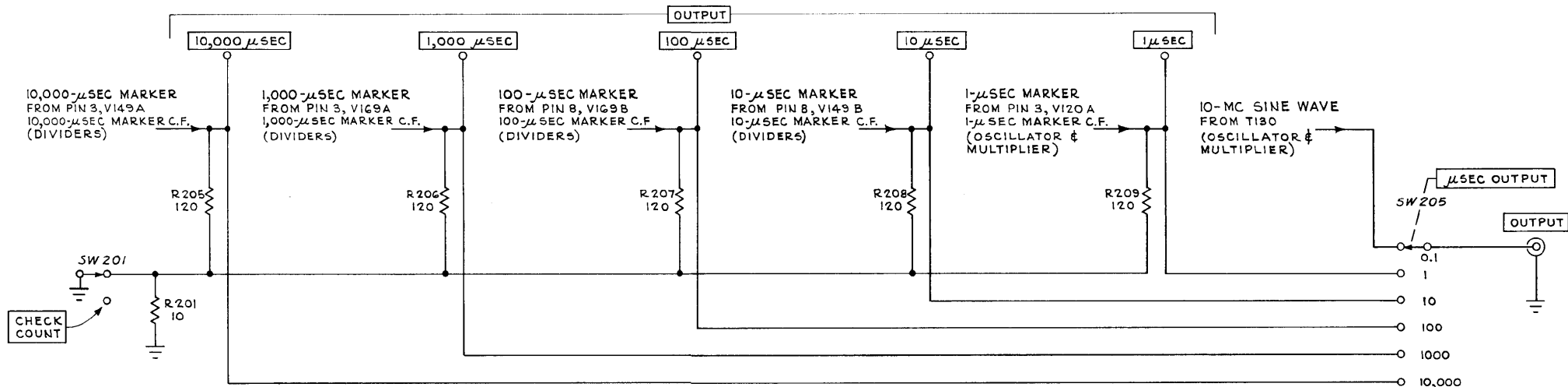
OSCILLATOR & MULTIPLIER

7-13-61



SEE PARTS LIST FOR EARLIER
VALUES AND S/N CHANGES
OF PARTS MARKED

R.O.W.
7-13-61

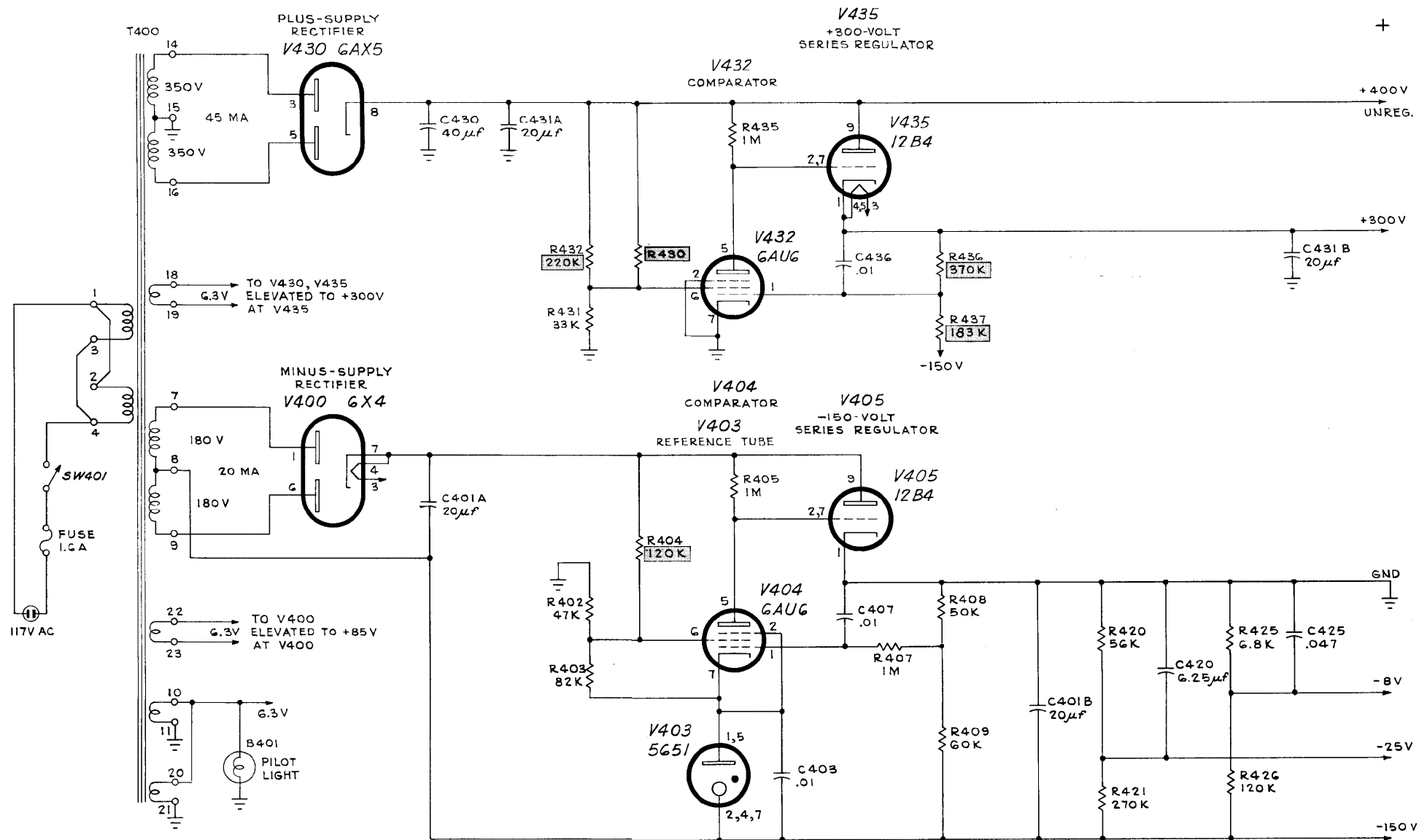


TYPE 181 TIME-MARK GENERATOR

AA

SWITCHING DETAIL

7-13-61



SEE PARTS LIST FOR EARLIER
VALUES AND S/N CHANGES
OF PARTS MARKED

RBH
7-13-61

TYPE 181 TIME-MARK GENERATOR

AA

POWER SUPPLY