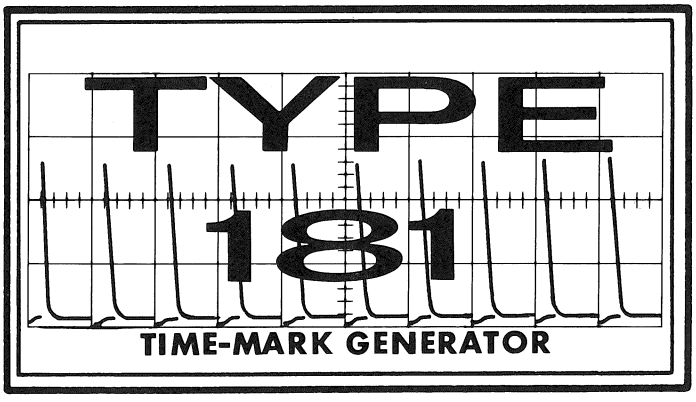
INSTRUCTION MANUAL



S/N 6917

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

Tektronix International A.G.
Terrassenweg 1A ● Zug, Switzerland ● PH. 042-49192 ● Cable: Tekintag, Zug Switzerland ● Telex 53.574

070-292

WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

Any questions with respect to the warranty mentioned above should be taken up with your Tektronix Field Engineer.

Tektronix repair and replacement-part service is geared directly to the field, therefore all requests for repairs and replacement parts should be directed to the Tektronix Field Office or Representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type and Serial number with all requests for parts or service.

Specifications and price change privileges reserved.

TYPE 181

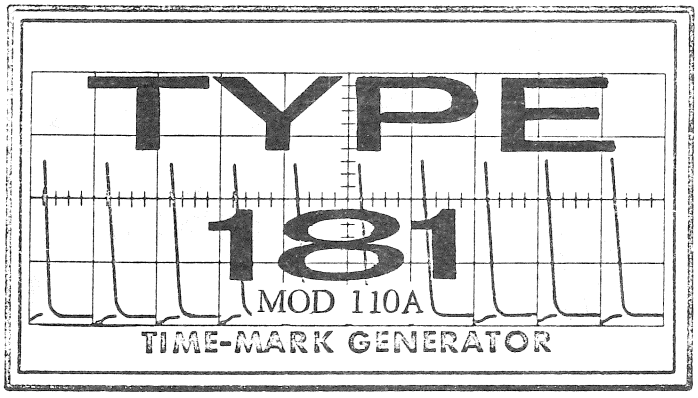
MOD 110 A

The instrument for which this manual was prepared has been modified to include a crystal oven for frequency stability. The modification is shown schematically on the Oscillator and Multiplier diagram of this manual. Accuracy of the crystal-oven combination is 0.001% and frequency stability is 2 parts per million over a 24-hour period. Additional calibration information for this modification is given in the Calibration Procedure section of this manual.

PARTS LIST

The following part changes have been made in this modified instrument. When ordering replacement parts, give a description of the part and specify instrument type, serial number and mod number.

CRYSTAL, Oven Assembly	Change to	158-007
PANEL, Front	Change to	333-439B



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TYPE 181 TIME-MARK GENERATOR
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OUTPUT SELECTOR
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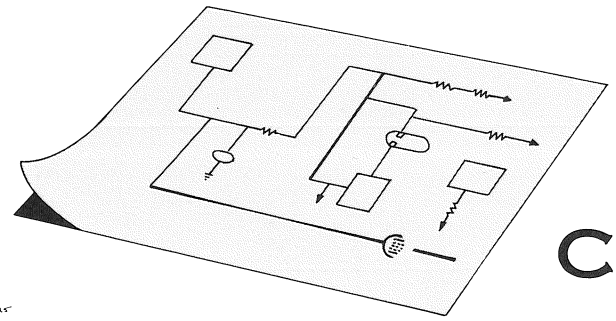
1
μSEC
MSEC
1
10
0.1
SINE WAVE
1 μ SEC.
10 μ SEC.
100 μ SEC.
1 MSEC.
10 MSEC.
10 μ SEC.
100 μ SEC.
1 MSEC.
10 MSEC.
POWER ON
TEKTRONIX, INC., PORTLAND, OREGON, U.S.A.



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	1 v Min	sine wave	150 Ω
1 μsec	1 v Min	0.1 μsec	80 Ω
10 μsec	1 v Min	0.2 μsec	80 Ω
100 μsec	1 v Min	0.3 μsec	80 Ω
1,000 μsec	1 v Min	0.5 μsec	80 Ω
10,000 μsec	1 v Min	0.8 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 800 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
18 inches long, 6⅞ inches wide, 10½ inches high.

Weight
17-1/2 pounds.

Accessories

1—93 Ω output cable, BNC, 012-075
1—Black output lead, 012-014.
1—Red output lead, 012-015.
1—3 to 2-wire adapter, 103-013.
1—3-conductor power cord.
2—Instruction manuals.
1—Adapter, BNC-to-binding post, 103-033

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.

OUTPUT SELECTOR (black knob) — Six-position switch selects marker to be connected to OUTPUT coax connector.

10 μSEC
100 μSEC
1,000 μSEC
10,000 μSEC
(Screwdriver Adjustment) — Variable resistors adjust the frequency dividers for the correct count-down ratio.

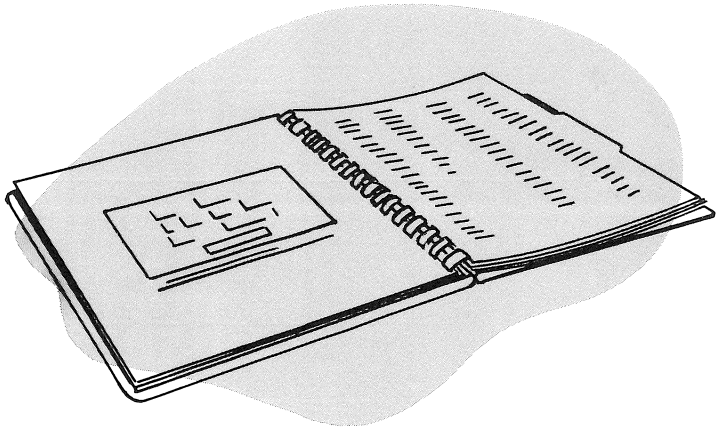
POWER — On-off switch in primary lead of power transformer.

OUTPUT — UHF coax connector from the OUTPUT SELECTOR switch.

1 μSEC
10 μSEC
100 μSEC
1,000 μSEC
10,000 μSEC — Binding posts supply markers as indicated.

SECTION 2

OPERATING INSTRUCTIONS



Handling

The Type 181 Time-Mark Generator depends on free circulation of air for cooling. Be sure to leave adequate clearance at the sides of the instrument to prevent overheating. Although the instrument is rigidly constructed for portable operation, it should not be subjected to excess vibration or rough handling.

Markers

To obtain markers, connect to the desired binding post and to ground. Or if you prefer, connect to the OUTPUT coax connector and select a marker with the OUTPUT SELECTOR switch. The ten-megacycle sine wave is available at the OUTPUT coax connector only.

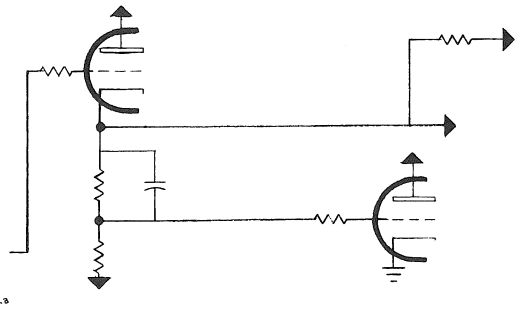
Triggering

To provide stable triggering on the ten-megacycle sine wave, you can connect the external trigger input of an oscilloscope to one of the binding posts. In this way, you can select lower sweep repetition rates.

Check Count

To superimpose the other markers on the marker you are using, turn the CHECK COUNT switch (red knob) to the right. This provides a way to check the counting ratio and can help you interpolate between markers.

Tube aging may occasionally cause the dividers to count incorrectly. You can correct for this if it occurs by readjusting the front-panel screwdriver controls. (See Maintenance Section).



SECTION 3

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.

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 reguator 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.

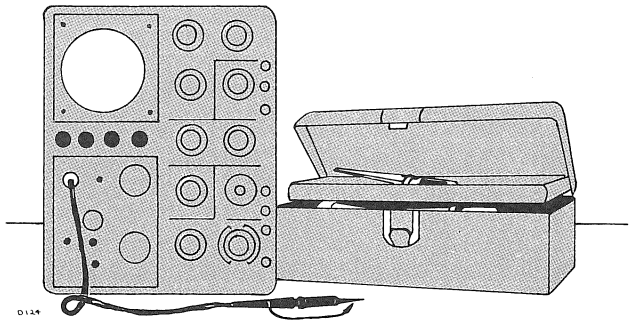
Bias Supply

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 mutivibrators.

+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.



SECTION 4

MAINTENANCE

Soldering and Ceramic Strips

Many of the components in your Tektronix instrument are mounted on ceramic terminal strips. The notches in these strips are lined with a silver alloy. Repeated use of excessive heat, or use of ordinary tin-lead solder will break down the silver-to-ceramic bond. Occasional use of tin-lead solder will not break the bond is excessive heat is not applied.

If you are responsible for the maintenance of a large number of Tektronix instruments, or if you contemplate frequent parts changes, we recommend that you keep on hand a stock of solder containing about 3% silver. This type of solder is used frequently in printed circuitry and should be readily available from radio-supply houses. If you prefer, you can order the solder directly from Tektronix in one-pound rolls. Order by Tektronix part number 251-514.

Because of the shape of the terminals on the ceramic strips it is advisable to use a wedge-shaped tip on your soldering iron when you are installing or removing parts from the strips. Fig. 4-1 will show you the correct shape for the tip of the soldering iron. Be sure and file smooth all surfaces of the iron which will be tinned. This prevents solder from building up on rough spots where it will quickly oxidize.

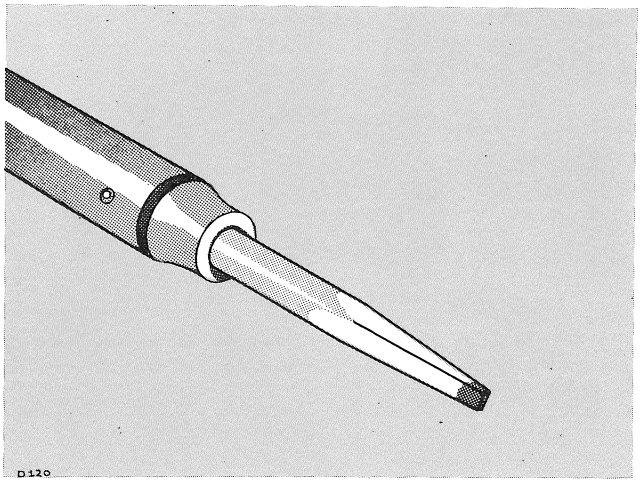


Fig. 4-1. Soldering iron tip properly shaped and tinned.

When removing or replacing components mounted on the ceramic strips you will find that satisfactory results are obtained if you proceed in the manner outlined below.

1. Use a soldering iron of about 75-watt rating.
2. Prepare the tip of the iron as shown in Fig. 4-1.
3. Tin only the first 1/16 to 1/8 inch of the tip. For soldering to ceramic terminal strips tin the iron with solder containing about 3% silver.
4. Apply one corner of the tip to the notch where you wish to solder (see Fig 4-2).

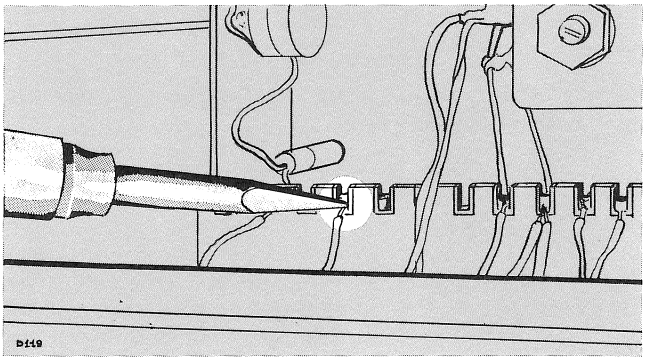


Fig. 4-2. Correct method of applying heat in soldering to a ceramic strip.

5. Apply only enough heat to make the solder flow freely.
6. Do not attempt to fill the notch on the strip with solder; instead, apply only enough solder to cover the wires adequately and to form a slight fillet on the wire as shown in Fig. 4-3.

In soldering to metal terminals (for example, pins on a tube socket) a slightly different technique should be employed. Prepare the iron as outlined above, but tin with ordinary tin-lead solder. Apply the iron to the part to be soldered as shown in Fig. 4-4. Use only enough heat to allow the solder to flow freely along the wire so that a slight fillet will be formed as shown in Fig. 4-3.

General Soldering Considerations

When replacing wires in terminal slots clip the ends neatly as close to the solder joint as possible. In clipping the ends of wire take care the end removed does not fly across the room as it is clipped.

Occasionally you will wish to hold a bare wire in place as it is being soldered. A handy device for this purpose is a short length of wooden dowel, with one end shaped as shown in Fig. 4-5. In soldering to terminal pins mounted in plastic rods it is necessary to use some form of "heat sink" to avoid melting the plastic. A pair of long-nosed pliers (see Fig. 4-6) makes a convenient tool for this purpose.

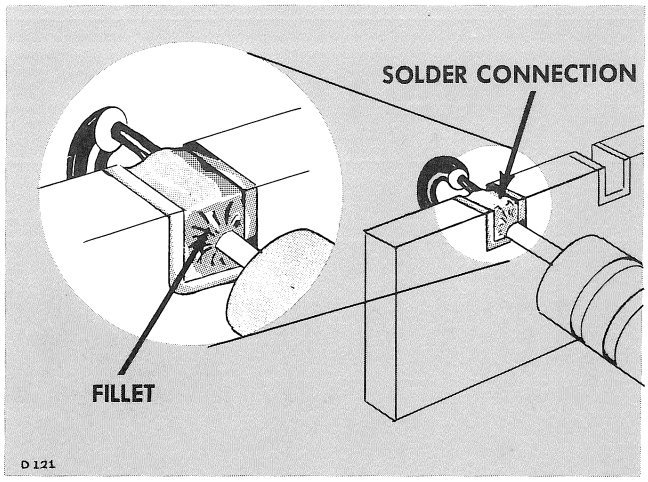


Fig. 4-3. A slight fillet of solder is formed around the wire when heat is applied correctly.

Ceramic Strips

Two distinct types of ceramic strips have been used in Tektronix instruments. The earlier type mounted on the chassis by means of #2-56 bolts and nuts. The later is mounted with snap-in, plastic fittings. Both styles are shown in Fig. 4-7.

To replace ceramic strips which bolt to the chassis, screw a #2-56 nut onto each mounting bolt, positioning the bolt so that the distance between the bottom of the bolt and the bottom of the ceramic strip equals the height at which you wish to mount the strip above the chassis. Secure the nuts to the bolts with a drop of red glyptal. Insert the bolts through the holes in the chassis where the original strip was mounted, placing a #2 starwasher between each nut and the chassis. Place a second set of #2 flatwashers on the protruding ends of the bolts, and fasten them firmly with another set of #2-56 nuts. Place a drop of red glyptal over each of the second set of nuts after fastening.

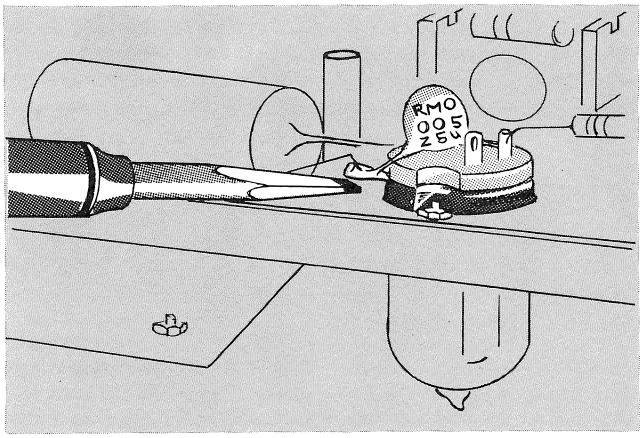


Fig. 4-4. Soldering to a terminal. Note the slight fillet of solder—exaggerated for clarity—formed around the wire.

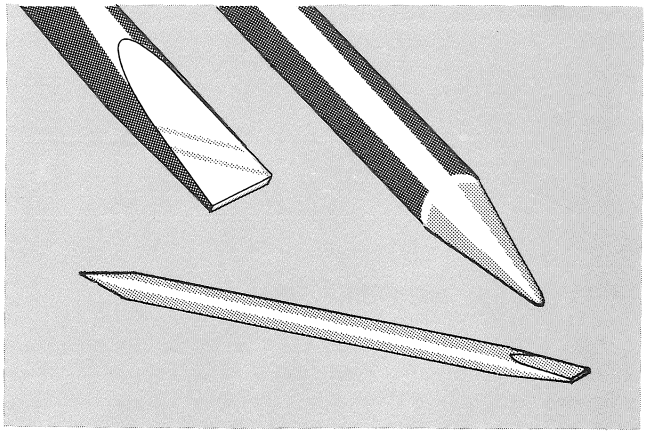


Fig. 4-5. A soldering aid constructed from a 1/4 inch wooden dowel.

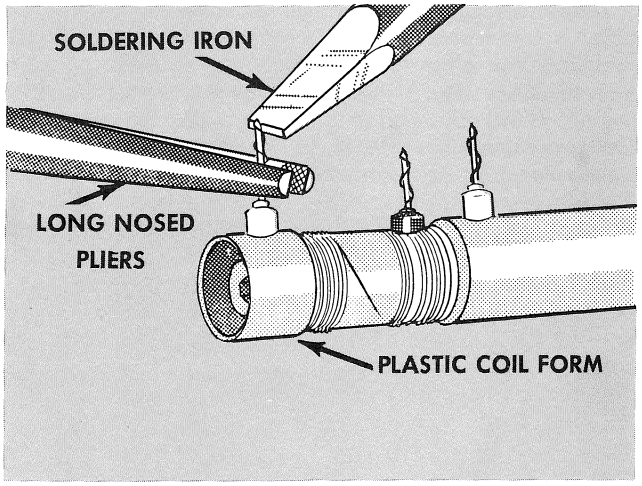


Fig. 4-6. Soldering to a terminal mounted in plastic. Note the use of the long-nosed pliers between the iron and the coil form to absorb the heat.

Mounting Later Ceramic Strips

To replace strips which mount with snap-in plastic fittings, first remove the original fitting from the chassis. Assemble the mounting post on the ceramic strip. Insert the nylon collar into the mounting hole in the chassis. Carefully force the mounting post into the nylon collar. Snip off the portion of the mounting post which protrudes below the nylon collar on the reverse side of the chassis.

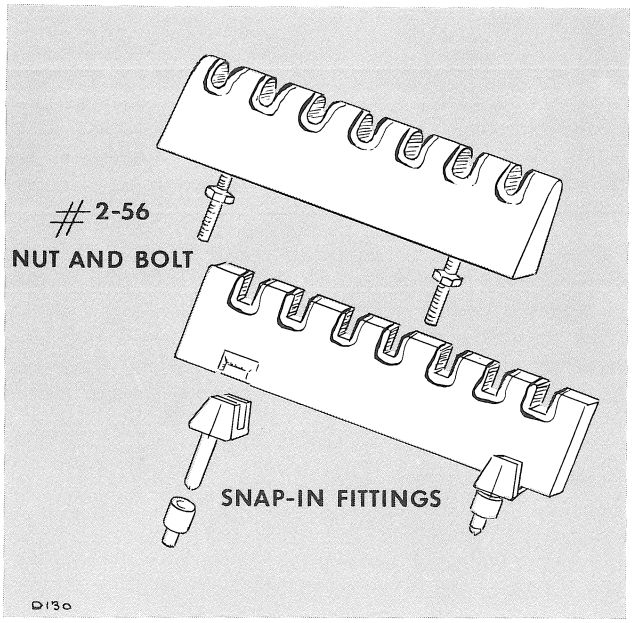


Fig. 4-7. Two types of ceramic strip mountings.

NOTE

Considerable force may be necessary to push the mounting rods into the nylon collars. Be sure that you apply this force to that area of the ceramic strip directly above the mounting rods.

Color Coding

Wires used in this instrument are color coded to help you identify the various circuits. Thus the ac power leads are yellow and coded 1-1-1 (brown-brown-brown) following the RETMA resistor color code. The +300-volt bus is white and coded 3-0-0 (orange-black-brown beginning with the widest stripe). The —150-volt bus is black and coded 1-5-0. The heater leads are coded 6-1, 6-2 and 6-5, not to indicate that the voltages are different, but to identify different windings. All signal leads have a single stripe.

Troubleshooting

If the instrument fails to operate at all and the pilot light does not light, check the source of ac power and see that the power-cord plug is firmly in place. Then check the 1.6-amp fuse at the back of the instrument. A quick way to check the fuse is to replace it with a new one.

If the instrument is operating but the dividers are counting wrong, check the adjustment of the front-panel screwdriver controls. Start with the 10-microsecond divider and then adjust each lower-frequency divider in order of frequency. (See adjustment section.) It is necessary to start with the highest frequency divider first because each divider depends on the next higher frequency divider for its signal. If the higher-frequency divider is counting incorrectly, all lower-frequency dividers may be thrown off.

If a divider cannot be adjusted, or if one of the outputs is missing, you will need to remove the cabinet. In Type 181 instruments, S/N's 101 through 888, the cabinet can be removed by unfastening the single fastener at the back of the instrument and slipping the cabinet off. In S/N's 889 and up, side and bottom panels can be removed by loosening the holding screws and removing the panels individually.

WARNING

When you have the cabinet off, be careful of high voltages. The unregulated 400-volt supply and the 300-volt supply are the most dangerous because they have rather large filter capacitors across them. The terminals on these capacitors are exposed and should be avoided when picking the instrument up or turning it over. Do not hold the frame of the instrument with one hand when you are using the other to take measurements.

Troubles are usually caused by tube failures, and you can frequently correct them by finding the bad tube and replacing it. Sometimes a tube burns a resistor or breaks down an electrolytic capacitor when it fails. Often you can find these parts by visual inspection.

The power supply, if not working properly, can cause other more obvious troubles. It can also indicate extremes in load caused by trouble in other circuits. It is a good place, therefore, to begin troubleshooting.

Power Supply

The —150-volt supply should be between 140 and 160 volts. The normal ripple on this supply is less than 50 millivolts. A convenient place to measure this supply is the negative (can) terminal of the electrolytic capacitor nearest the transformer.

If the voltage or ripple exceeds these limits, try checking the tubes in this supply, V400, V403, V404 and V405. A good way to do this is to change all four tubes, and, if this corrects the trouble, replace them one at a time until the trouble recurs. If it does not correct the trouble, check the voltage divider, R408 and R409.

The —8-volt and —25-volt bias supplies should be within about 10% of their rated values. You can measure the —25-volt supply at the front end of the electrolytic capacitor at the top of the rear row of ceramic strips. The —8-volt supply is at the front end of the .047-μf capacitor at the top of the next row of ceramic strips.

The 300-volt supply should be between 285 and 315 volts, depending on the negative supply voltage. (If the —150-volt supply is high, the 300-volt supply will be high). The normal 120-cycle ripple on this supply is less than 50 millivolts. A convenient place to measure the +300 v supply is on the third electrolytic capacitor from the transformer. If the voltage or ripple exceeds these limits, check the 400-volt unregulated supply. You can measure this on the second electrolytic from the transformer. It will vary between 360 and 440 volts, depending on line voltage, but should be about 405 volts at 117 volts ac line voltage. If it is low, change the rectifier, V430. If the 400-volt supply is normal, check V432 and V435 and the voltage divider, R436 and R437.

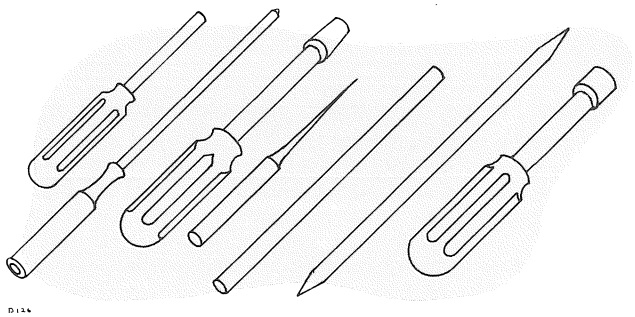
If the supplies regulate normally at normal or high line voltage, but drop out of regulation at low line voltage, the rectifiers or series regulator tubes are most likely at fault.

Oscillator and Dividers

If the power supply is working but there are no signal outputs, the most likely trouble is the controlling oscillator or the amplifier-shaper and cathode follower. Suspect first the tubes, V103 and V110, and then the crystal and other circuit components. If markers are present but the 10-megacycle sine wave is missing, try V120. If the 10-megacycle output is present but the 10-microsecond markers are missing, suspect V140, V149 or V135; for the 100 microsecond markers, V140, V149, or V135; for the 1-millisecond markers, V160, V169, or V155; for the 10 millisecond markers V190, V149, or V185.

Normally, if the trouble in any marker stage is caused by the multivibrator tube or the clamp and disconnect diodes, all lower-frequency markers will be missing or will be affected, depending on the nature of the trouble. A bad cathode follower, V149 or V169, will affect only the two markers to which it is connected.

If any marker stage cannot be made to count down correctly, suspect first the multivibrator tube and clamp diode. Be sure the power supply and bias voltages are correct. If the frequency division is still incorrect, check the timing capacitor and resistors (see circuit description), then check the multivibrator plate load resistors and cathode resistor.



SECTION 5

CALIBRATION PROCEDURE

Normally it will not be necessary to make all the adjustments in this procedure at any one time. However, any adjustments which you do make should be made in the indicated sequence.

Equipment

The following equipment or its equivalent is recommended for a full recalibration of the Type 181.

1. Tektronix Type 541A Oscilloscope and Tektronix Type B Plug-In Preamplifier.

If a Type 541A is not available an oscilloscope having the following characteristics may be substituted: Calibrated vertical-deflection factors from .005 volts per centimeter to .2 volts per centimeter. The .005 volts per centimeter range is only used in Step 2 of the Operational Checks (measurement of ripple amplitude). The remainder of the procedure requires only the .2 volts per centimeter range.

Calibrated sweep rates from .1 microsecond per centimeter to 10 milliseconds per centimeter. The .1 microsecond range is only required for accurate measurement of the 10-megacycle output from the Type 181. The remainder of the procedure may be carried out on an oscilloscope which does not have the .1 microsecond range. In either case, the timing of the sweep rates must be accurate to within plus-or-minus 3% on all ranges.

Bandpass of 20 megacycles. This is necessary only for accurate measurement of the amplitude of the 10 megacycle sine wave. For the remainder of the procedure, an oscilloscope with a bandpass of 4 megacycles is adequate.

2. Tektronix Type P6017 Probe.

The Type P6017 has an attenuation ratio of 10:1, an input resistance of 10 megohms, and an input capacitance of approximately 14 picofarads when connected to a Type B Plug-In Unit.

3. Accurate rms-reading ac voltmeter, 0-150 volts, calibrated for an accuracy of ±1% at 117 volts.

4. DC voltmeter of at least 5000 ohms per volt, calibrated for an accuracy of ±1% at 150 volts and 300 volts.

5. An autotransformer (Powerstat, Variac, etc.) capable of varying the input voltage to the instrument being calibrated from 105 to 125 volts.

6. A single test lead 18 inches long terminated at each end with a banana plug.

PROCEDURE

Frequency Divider Adjustments

The frequency dividers used in the Type 181 are monostable, cathode-coupled multivibrators. The dividing rate of each multivibrator is determined by a screwdriver adjustment on the front panel. It is not necessary to remove the instrument from its cabinet to adjust the dividing rate circuits.

During the adjustment procedure it is necessary to observe the Type 181 output on the test oscilloscope.

Use the following front-panel control settings for the Type 541A and the Type B:

Type 541A

STABILITY	full right (clockwise)
TRIGGERING LEVEL	full right
TRIGGERING MODE	AC
TRIGGER SLOPE	+INT
TIME/CM	1 MICROSEC
5X MAGNIFIER	OFF
HORIZONTAL DISPLAY	NORM
HORIZONTAL POSITION	centered
POWER	ON
SQUARE-WAVE CALIBRATOR	OFF

Type B:

INPUT SELECTOR	INPUT A, AC
VOLTS/CM	1
VARIABLE	CALIBRATED
VERTICAL POSITION	centered

TABLE I

Frequency Divider Adjustments

Test Oscilloscope		Type 181
TIME/CM	OUTPUT SELECTOR	Adjustment
1 microsec	1 microsec	check
10 microsec	10 microsec	10 μSEC
100 microsec	100 microsec	100 μSEC
1 millisec	1 millisec	1 mSEC
10 millisec	10 millisec	10 mSEC

Connect the Type P6017 probe to INPUT A of the Type B.

Turn the OUTPUT SELECTOR control of the Type 181 to 1 μsec.

Turn the STABILITY control of the test oscilloscope slowly to the left until the display just disappears. Turn the TRIGGERING LEVEL control slowly to the left until the display reappears. This should result in a stable display. Slight readjustment of the controls may be necessary from time to time, particularly after shifting to a display of different amplitude.

Table 1 indicates the necessary front-panel control settings for the test oscilloscope and the Type 181. It also indicates the appropriate screwdriver adjustment for each setting of the OUTPUT SELECTOR switch. To adjust the Type 181 divider circuits, set the front-panel controls as indicated in the table. Then, adjust the corresponding screwdriver adjustment for a display of one marker per centimeter.

Output amplitude on all ranges should be 2 volts or more. The trigger pulses are supplied from the row of connectors at the right-hand side of the front panel, and may be checked at the same time the output amplitude is checked. Each trigger pulse should have an amplitude of 2 volts or more.

10-megacycle output

The 10-megacycle sine-wave output available at the OUTPUT connector (OUTPUT SELECTOR switch at 0.1), should have an amplitude of at least 2 volts, peak-to-peak. Misadjustment of the internal variable capacitors, C131 and C134 is indicated if the amplitude is less than 2 volts or if the waveform is amplitude modulated.

To adjust C131 and C134, slide the instrument out of the cabinet about four inches. C131 and C134 are mounted on the double-tuned transformer located directly behind the top of the front panel.

Set the front-panel controls of the test oscilloscope and plug-in as described in the Frequency Divider Adjustments section of this Recalibration Procedure with the following exception: set the TIME/CM control on the test oscilloscope to .1. Switch the OUTPUT SELECTOR control of the Type 181 to 0.1 position and adjust the STABILITY and TRIGGERING LEVEL controls of the test oscilloscope for a stable display.

Adjust C131 and C134 for maximum amplitude. Probably, when C131 and C134 have been adjusted for maximum amplitude a slight amount of amplitude modulation will be present on the sine-wave. This can easily be checked by switching the TIME/CM control on the test oscilloscope to some slower sweep rate—10 MICROSEC being satisfactory in most cases. If amplitude modulation is present, readjust C131 and C134 until it is removed. Switch the TIME/CM control on the test oscilloscope back to the 0.1 range and check the peak-to-peak amplitude as well as the frequency (1 cycle per centimeter). It may be necessary to repeat this process several times to achieve suitable amplitude with a minimum of amplitude modulation.

Crystal Oscillator Frequency

The oscillator frequency of the Type 181 MOD110 may be adjusted with the variable capacitor C101 to exactly 1 megacycle. To set the oscillator frequency, the test oscilloscope may be triggered from the Type 181, and a signal of known frequency stability viewed on the crt. The apparent drift of the signal observed on the crt can be brought to zero by means of C101.

All broadcast stations operate on frequencies which are multiples of 10 kc, and are required to maintain a frequency tolerance of ±20 c.p.s. The procedure which follows describes a method of using a standard broadcast station carrier frequency as a standard frequency for calibrating the Type 181 crystal oscillator.

Construct a tuned circuit which will tune to the frequency of the strongest broadcast station near your location. The output of this tuned circuit should be connected to the INPUT A connector of the Type B Plug-In. With a single lead terminated in banana plugs, connect the 100 μSEC. trigger connector on the Type 181 front panel to the EXTERNAL TRIGGER connector of the test oscilloscope. Set the front-panel conrol of the test oscilloscope and plug-in as described in the Frequency Divider Adjustments section of this Procedure, with the following exceptions: set the TIME/CM control on the oscilloscope to 10 MICROSEC. and the TRIGGER MODE switch to +EXT.

Adjust the STABILITY and TRIGGERING LEVEI controls on the test oscilloscope until the modulation envelope of the broadcast station is observed to drift slowly across the graticule. Adjust C101 until the drift is about the same in each direction from the center of the graticule as the crystal heats up and cools down.

There are several methods of adjusting the frequency of the crystal oscillator if an oscilloscope is not readily obtainable. The first of these requires a radio receiver capable of tuning to the transmissions of the Bureau of Standards radio transmitters, WWV located near Washington, D.C., or WWVH in Honolulu. These stations transmit on frequencies of 5, 10 and 20 megacycles, any one of which may be used. Tune the receiver to receive one of these transmissions. Place a wire lead, connected to the OUTPUT connector of the Type 181, near the antenna connector of the receiver. Turn the OUTPUT SELECTOR switch of the Type 181 to 1 or 0.1. A beat will be heard between the generator output and the standard-frequency signal when the right amount of coupling into the receiver is made. Adjust C101 for a zero beat.

A similar though less accurate comparison against a standard AM broadcast station may be made. Connect a wire lead to the 100-μSEC. output binding post. Tune the receiver to a broadcast-station signal, preferably not too strong, and adjust the coupling until a beat is heard. Adjust C101 for a zero beat.

OPERATIONAL CHECKS

Power Supply Voltage

There are no adjustments in the Type 181 power supply. However, it is desirable to measure the output voltages from time to time as a check for possible component or tube failure. To perform this operational check, remove the instrument from the cabinet, connect it to the output of the autotransformer, and adjust the input voltage to the instrument to 117 volts.

To measure the output voltage of the —150-volt supply connect a voltmeter between pin 8 of the power transformer and ground. The voltage at this point should be within ±2% of —150 volts.

To check the positive supplies connect the voltmeter ground lead to the ground strap of the power transformer. The +300-volt supply may be measured at pin 1 of V435, and should be within ±5% of +300 volts. The +400-volt supply can be measured at pin 9 of V435, and must be within ±5% of +400 volts.

The —25-volt bias supply ±2.5 v can be measured between ground and the junction of R420 and R421. The —8-volt bias supply can be checked at pin 7 of V175 and should be within 1 volt of its rated output voltage.

Power Supply Ripple

The power supply regulating circuits of the Type 181 are capable of holding the ripple present on the output voltages at a very low level. Measurement of the ripple provides a convenient check upon the operation of the regulating circuits.

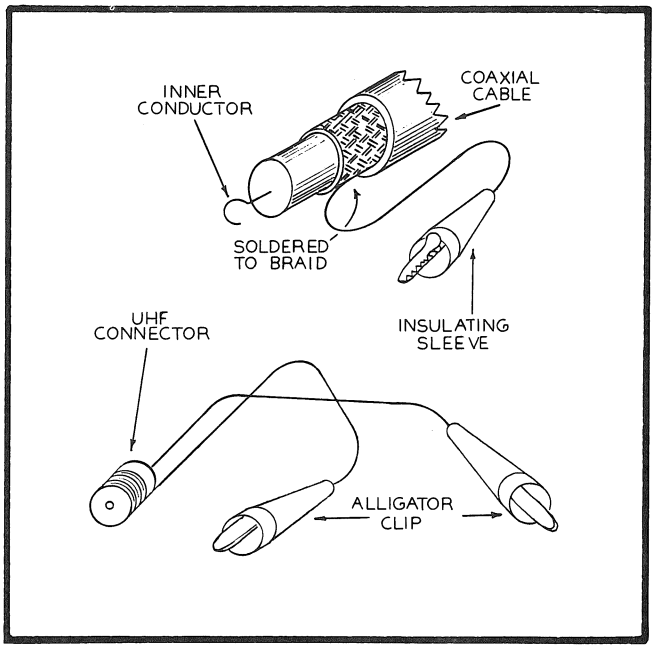


Fig. 5-1. Construction details for test lead used in checking the operation of the Type 181 circuits.

To accurately measure the ripple on the supplies, it will be necessary to construct a test lead which will not attenuate the signal. Fig. 5-1 shows the construction of such a lead.

Set the front-panel controls of the test oscilloscope and plug-in as shown below:

Type 541A:

STABILITY	*PRESET
TRIGGERING LEVEL	not used in AUTOMATIC mode
TRIGGERING MODE	*AUTOMATIC
TRIGGER SLOPE	+LINE
TIME/CM	10 MILLISEC
5X MAGNIFIER	OFF
HORIZONTAL DISPLAY	NORM
HORIZONTAL POSITION	centered
POWER	ON
SQUARE-WAVE CALIBRATOR	OFF

Type B:

INPUT SELECTOR	INPUT A,AC
VOLTS/CM	.005
VARIABLE	CALIBRATED
VERTICAL POSITION	centered

The front-panel controls of the Type 181 may be left in any position. Remove the instrument from its cabinet, connect it to the output of the autotransformer, and adjust the input voltage to 117 volts and turn on the Type 181.

To measure the ripple on the —150-volt supply, connect the test lead between ground and pin 2 of V403. Ripple on the —150-volt supply should not exceed 10 millivolts for line voltages in the 105- to 125-volt range. The ripple frequency should be approximately 120 cps—indicated by a display of about 6 cycles on the graticule.

To check the ripple on the +300-volt supply, connect the test lead between pin 1 of V435 and ground. Ripple on this supply should not exceed 25 millivolts as the line voltage is varied from 105 to 125 volts. The ripple frequency should be approximately 120 cps.

When observing the ripple it will be necessary to take into account any output signal radiating from the oscillator of the Type 181.

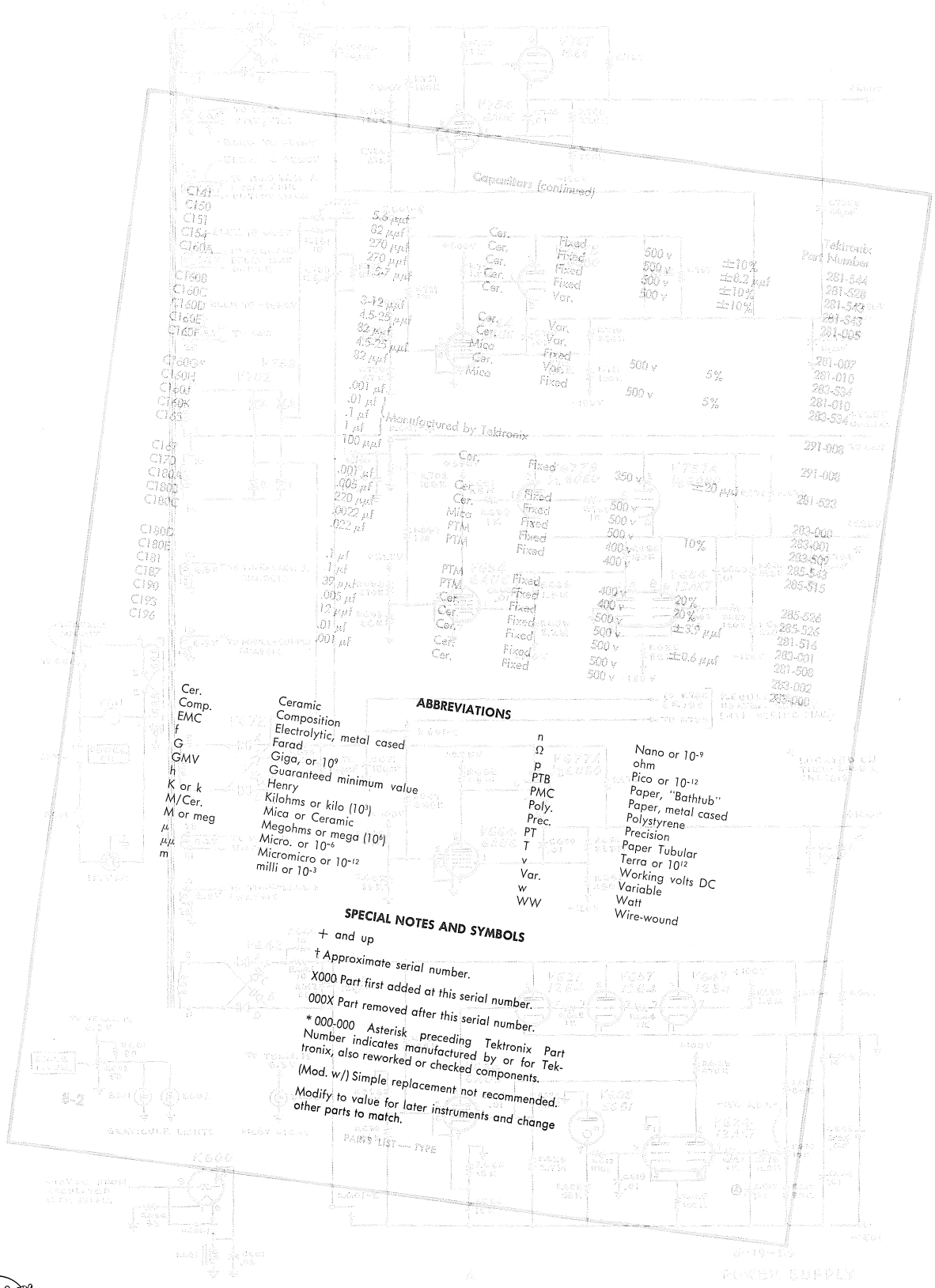
NOMINAL VOLTAGE READINGS

Tube No.	Pin No.	Voltage Reading	Tube No.	Pin No.	Voltage Reading
V103 6AU6	1 5 6	—18 270 135	V190 6BQ7A	1 2 3 & 8 6 7	170 —7.6 —3.7 287 —53
V110 6AN8	1 2 3 6 7 8	410 270 278 290 118 —18	V403 5651	1 & 5 2, 4 & 7	—64 —150
V120 6AN8	1 2 3 6 7 8	300 —26 .7 295 113 —12	V404 6AU6	1 2 & 7 5 6	—57 —64 —10 +3
V140 6BQ7A	1 2 3 & 8 6 7	210 —7.6 —2.2 282 —19	V405 12B4	2 & 7 9	—10 85
V160 6BQ7A	1 2 3 & 8 6 7	270 —39 —3.2 170 —7.6	V432 6AU6	1 5 6	—5 286 150
V175 6BQ7A	1 2 3 & 8 6 7	285 —38 —2.4 208 —7.6	V435 12B4	1 2 & 7 9	300 286 410

Nominal current at rectifier cathodes.

Positive supply (pin 8, V430)	58 ma
Negative supply (pin 7, V400)	17 ma

PARTS LIST *and* DIAGRAMS



Cer.	Ceramic
Comp.	Composition
EMC	Electrolytic, metal cased
f	Farad
G	Giga, or 10^9
GMV	Guaranteed minimum value
h	Henry
K or k	Kilohms or kilo (10^3)
M/Cer.	Mica or Ceramic
M or meg	Megohms or mega (10^6)
μ	Micro. or 10^{-6}
μμ	Micromicro or 10^{-12}
m	milli or 10^{-3}

ABBREVIATIONS

n	Nano or 10^{-9}
Ω	ohm
p	Pico or 10^{-12}
PTB	Paper, "Bathtub"
PMC	Paper, metal cased
Poly.	Polystyrene
Prec.	Precision
PT	Paper Tubular
T	Terra or 10^{12}
v	Working volts DC
Var.	Variable
w	Watt
WW	Wire-wound

SPECIAL NOTES AND SYMBOLS

+ and up

† Approximate serial number.

X000 Part first added at this serial number.

000X Part removed after this serial number.

* 000-000 Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, also reworked or checked components.

(Mod. w/) Simple replacement not recommended. Modify to value for later instruments and change other parts to match.

MANUFACTURERS OF CATHODE-RAY OSCILLOSCOPES

HOW TO ORDER PARTS

Replacement parts are available through your local Tektronix Field Office.

Improvements in Tektronix instruments are incorporated as soon as available. Therefore, when ordering a replacement part it is important to supply the part number including any suffix, instrument type, serial number, plus a modification number where applicable.

If the part you have ordered has been improved or replaced, your local Field Office will contact you if there is a change in part number.

PARTS LIST

Values fixed unless marked Variable.

Bulbs

			Tektronix Part Number
B401	101-5000	Incandescent #47	150-001
B401	5001-up	Incandescent #12	150-018

Capacitors

Tolerance ±20% unless otherwise indicated.

C100	X5254-up	.01 μf	Cer.		500 v	GMV	283-002
C101	101-412	1.5-7 μμf	Cer.	Var.	500 v		281-005
	413-up	4.5-25 μμf	Cer.	Var.	500 v		281-010
C102		.01 μf	PT		400 v		285-510
C103		4.7 μμf	Cer.		500 v	±1 μμf	281-501
C110		47 μμf	Cer.		500 v		281-518
C113		.01 μf	PT		400 v		285-510
C120		15 μμf	Cer.		500 v	10%	281-509
C125	101-504	8 μμf	Cer.		500 v		Use 281-509
	505-up	15 μμf	Cer.		500 v	10%	281-509
C126		.01 μf	PT		400 v		285-510
C130		.01 μf	Cer.		500 v	GMV	283-002
C131		5-25 μμf	Cer.	Var.	500 v		281-011
C133		12 μμf	Cer.		500 v	10%	281-505
C134	101-746	3-12 μμf	Cer.	Var.	500 v		Use 281-011
	747-up	5-25 μμf	Cer.	Var.	500 v		281-011
C138	101-785	22 μμf	Cer.		500 v		Use 281-515
	786-up	27 μμf	Cer.		500 v	5%	281-515
C149		15 μμf	Cer.		500 v	10%	281-509
C155		12 μμf	Cer.		500 v	10%	281-506
C158		47 μμf	Mica		500 v	10%	283-502
C169		22 μμf	Cer.		500 v		281-510
C170		12 μμf	Cer.		500 v	10%	281-506
C171	X5700-up	12 μμf	Cer.		500 v	10%	281-506
C173		390 μμf	Mica		500 v	10%	283-520
C184		150 μμf	Mica		500 v	10%	283-508
C185	101-6669	22 μμf	Cer.		500 v		281-510
C185	6670-up	10 μμf	Cer.		500 v	10%	281-504
C186	X6670-up	51 μμf	Cer.		500 v	5%	281-540
C188		.003 μf	Mica		500 v	10%	283-538
C199	101-6669	.001 μf	PT		600 v		285-501
C199	6670-up	.001 μf	Cer.		500 v		283-000
C401A,B		2 x 20 μf	EMC		450 v	−10+50%	290-036
C403		.01 μf	PT		400 v		285-510
C407		.01 μf	PT		400 v		285-510
C420		6.25 μf	EMC		300 v	−10%+100%	290-000
C425		.047 μf	PT		400 v		285-519
C430		40 (2 x 20) μf	EMC		450 v	−10%+50%	290-037
C431A,B		2 x 20 μf	EMC		450 v	−10%+50%	290-037
C436		.01 μf	PT		400 v		285-510

Crystal

			Tektronix Part Number
Crystal	Type Z-1	1000 KC ±.005%	158-002
Crystal Oven	181-S1 only		158-007

Fuses

					Tektronix Part Number
Fuse	1.6 Amp	3 AG	Slo-Blo	117 V operation	159-003
	0.8 Amp	3 AG	Slo-Blo	234 V operation	159-018

Inductors

		Tektronix Part Number
L102	1.1 mh	*108-065
LR112	600 μh on 3.3 k, 1 watt resistor	*108-068
L130	9.5 μh; 12.4 μh	*108-110
LR146	1 mh on 3.3 k, 1 watt resistor	*108-058
LR166	1 mh on 3.3 k, 1 watt resistor	*108-058

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

							Tektronix Part Number
R101	56 k	½ w					302-563
R102	100 k	1 w					304-104
R103	6.8 k	1 w					304-682
R109	56 k	2 w					306-563
R110	220 k	½ w					302-224
R111	1 k	½ w					302-102
R112	3.3 k	1 w					with L112
R113	100 k	1 w					304-104
R120	5.6 k	½ w					302-562
R125	56 k	½ w					302-563
R126	100 k	1 w					304-104
R130	100 Ω	½ w					302-101
R137	6.8 k	2 w					306-682
R138	10 k	2 w					306-103
R139	100 Ω	½ w					302-101
R140	27 k	2 w				5%	305-273
R143	1.5 meg	1 w					304-155
R144	2 meg	2 w	Var.	Comp.	10 μ	SEC.	311-042
R145	15 k	1 w					304-153
R146	3.3 k	1 w					with L146
R149	18 k	½ w					302-183
R155	15 k	½ w					302-153
R158	47 k	2 w					306-473
R159	100 Ω	½ w					302-101
R160	47 k	2 w				5%	305-473

Resistors *(continued)*

							Tektronix Part Number
R163		3.9 meg	1 w				304-395
R164	101-255	2 meg	2 w	Var.	Comp.	100 μ SEC.	Use 311-044
	256-up	5 meg	2 w	Var.	Comp.	100 μ SEC.	311-044
R165		47 k	1 w				304-473
R166		3.3 k	1 w				with L166
R169		18 k	½ w				302-183
R170		22 k	½ w				302-223
R173	101-6669	56 k	1 w				304-563
R173	6670-up	68 k	1 w				304-683
R174		100 Ω	½ w				302-101
R175		82 k	2 w			5%	305-823
R178	101-6669	8.2 meg	1 w				304-825
R178	6670-up	5.6 meg	1 w				304-565
R179		5 meg	2 w	Var.	Comp.	1000 μ SEC.	311-044
R180		47 k	½ w				302-473
R184		22 k	½ w				302-223
R185	101-6669	56 k	½ w				302-563
R185	6670-up	47 k	½ w				302-473
R188	101-6669	68 k	1 w				304-683
R188	6670-up	56 k	1 w				304-563
R189		100 Ω	½ w				302-101
R190		82 k	2 w			5%	305-823
R193	101-6669	8.2 meg	1 w				304-825
R193	6670-up	10 meg	1 w				304-106
R194		5 meg	2 w	Var.	Comp.	10,000 μ SEC.	311-044
R195		47 k	½ w				302-473
R199		22 k	½ w				302-223
R201		10 Ω	½ w				302-100
R205		120 Ω	½ w				302-121
R206		120 Ω	½ w				302-121
R207		120 Ω	½ w				302-121
R208		120 Ω	½ w				302-121
R209		120 Ω	½ w				302-121
R402		47 k	1 w				304-473
R403		82 k	½ w				302-823
R404	101-195	100 k	1 w				304-104
	196-up	120 k	1 w				304-124
R405		1 meg	½ w				302-105
R407		1 meg	½ w				302-105
R408		50 k	½ w		Prec.	1%	309-090
R409		60 k	½ w		Prec.	1%	309-041
R420		56 k	½ w			5%	Use 301-563
R421		270 k	½ w			5%	Use 301-274
R425		6.8 k	½ w			5%	Use 301-682
R426		120 k	½ w			5%	Use 301-124
R430	101-322X	47 k	1 w				304-473
R431		33 k	1 w				304-333
R432	101-195	150 k	1 w				304-154
	196-318	82 k	1 w				304-823
	319-up	220 k	1 w				304-224
R435		1 meg	½ w				302-105
R436	101-5251	300 k	½ w		Prec.	1%	309-125
	5252-up	370 k	½ w		Prec.	1%	309-055
R437	101-322	143 k	½ w		Prec.	1%	Use 309-049
	323-5251	150 k	½ w		Prec.	1%	309-049
	5252-up	183 k	½ w		Prec.	1%	309-050

Switches

			Tektronix Part Number	
			Wired	Unwired
SW201, SW205	Rotary	OUTPUT SELECTOR	*262-097	*260-086
SW401	Toggle	POWER ON		260-134

Transformers

T400	Plate & Heater Supply Type 181PA	*120-050

Electron Tubes

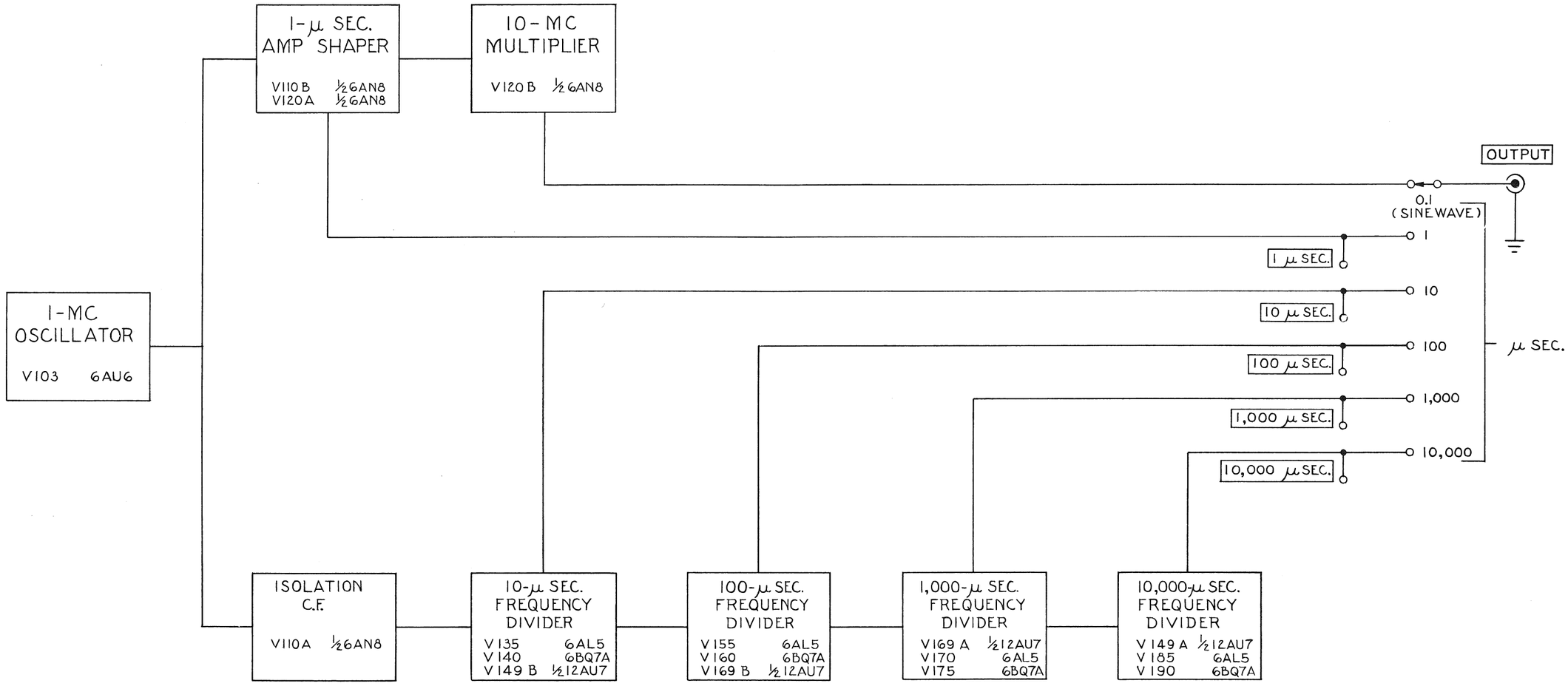
V103	6AU6	154-022
V110	6AN8	154-078
V120	6AN8	154-078
V135	6AL5	154-016
V140	6BQ7A	154-028
V149	12AU7	154-041
V155	6AL5	154-016
V160	6BQ7A	154-028
V169	12AU7	154-041
V170	6AL5	154-016
V175	6BQ7A	154-028
V185	6AL5	154-016
V190	6BQ7A	154-028
V400	6X4	154-035
V403	5651	154-052
V404	6AU6	154-022
V405	12B4	154-044
V430	6AX5	154-023
V432	6AU6	154-022
V435	12B4	154-044

Type 181
Mechanical Parts List

	Tektronix Part Number
ADAPTER, POWER CORD, 3 WIRE TO 2 WIRE	103-013
ADAPTER, BNC TO BINDING POST S/N 6670-up	103-033
ANGLE, FRAME, BOTTOM (BLUE WRINKLE) SN 5001-5649	122-052
ANGLE, FRAME, BOTTOM (BLUE VINYL) SN 5650-up	122-074
BAR, TOP SUPPORT W/PAKAWA HANDLES & BLUE VINYL SN 5001-up	Use 381-128
BRACKET, TRANSFORMER SUPPORT SN 6050-up	Use 406-778
BUSHING, $\frac{3}{8}$-32 x $\frac{9}{16}$ x .412	358-010
BUSHING, NYLON, FOR 5-WAY BINDING POST	358-036
CABINET SN 101-1000	437-022
CABLE, HARNESS SN 101-6669	179-074
CABLE, HARNESS S/N 6670-up	179-816
CAP, FUSE	Use 200-582
CHASSIS	441-059
CLAMP, FOR PAKAWA HANDLES SN 5720-up	343-052
CONNECTOR,CHASSIS MOUNTED, 2 CONTACT, G.E. MOTOR BASE SN 101-1000	131-010
CONNECTOR, CHASSIS MOUNTING, 1 CONTACT, FEMALE SN 101-6669	131-012
CONNECTOR, CHASSIS MOUNTED, BNC S/N 6670-up	131-277
CONNECTOR, CHASSIS MOUNTED, 3 WIRE, TEK MOTOR BASE	131-102
CORD, POWER	161-010
GROMMET, RUBBER $\frac{1}{4}$	348-002
GROMMET, RUBBER $\frac{3}{8}$	348-004
GROMMET, RUBBER $\frac{1}{2}$	348-005
HANDLE, PAKAWA LEATHER	367-001
HANDLE, BLACK LEATHER	367-009
HOLDER, FUSE	352-010
JEWEL, PILOT LIGHT, RED SN 101-1000	378-518
KNOB, SMALL RED, $\frac{1}{8}$ HOLE PART WAY	366-038
KNOB, LARGE BLACK, $\frac{17}{64}$ HOLE THRU	366-040
LOCKWASHER, INT. #4	210-004
LOCKWASHER, INT. #6	210-006
LOCKWASHER, INT. #8	210-008
LOCKWASHER, INT. #10	210-010
LOCKWASHER, POT, $\frac{3}{8}$ x $\frac{1}{2}$	210-012
LOCKWASHER, INT., $\frac{3}{8}$ x $\frac{11}{16}$	210-013

	Tektronix Part Number
LUG, SOLDER, SE4	210-201
LUG, SOLDER, SE6 W/2 WIRE HOLES	210-202
LUG, SOLDER, SE10, LONG	210-206
NUT, HEX, 4-40 x 3/16	210-406
NUT, HEX, 6-32 x 1/4	210-407
NUT, HEX, 8-32 x 5/16	210-409
NUT, HEX, 10-32 x 5/16	210-410
NUT, HEX, 3/8-32 x 1/2	210-413
NUT, HEX, 15/32-32 x 9/16	210-414
NUT, HEX, 10-32 x 3/8 x 1/8	210-445
NUT, KEPS 6-32 x 5/16	210-457
NUT, 12 SIDED, 15/32-32 x 5/64	210-473
NUT, HEX, 10-32 x 3/8 x 1/8	210-564
NUT, HEX, 3/8-32 x 1/2 x 11/16	210-494
NUT, KEPS STEEL 10-32 x 3/8	220-410
PANEL, FRONT SN 101-5000	333-121
PANEL, FRONT SN 5001-up	333-439
PLATE, SUB-PANEL, FRONT SN 101-5000	386-347
PLATE, SUB-PANEL, FRONT SN 5001-up	386-778
PLATE, BOTTOM .063 x 8 3/16 x 9 15/16 SN 101-5000	387-537
PLATE, SUB-PANEL, REAR SN 101-5000	387-535
PLATE, SUB-PANEL, REAR SN 5001-up	386-779
PLATE, CABINET BOTTOM, BLUE WRINKLE SN 5001-5649	386-760
PLATE, CABINET BOTTOM, BLUE VINYL SN 5650-up	387-040
PLATE, CABINET SIDE, BLUE WRINKLE SN 5001-5649	386-762
PLATE, CABINET SIDE, BLUE VINYL SN 5650-up	387-039
PLATE, OVERLAY REAR, BLUE WRINKLE SN 5001-5649	386-780
PLATE, OVERLAY REAR, BLUE VINYL SN 5650-up	387-041
POST, BINDING, METAL	129-020
POST, BINDING, BLACK NYLON	129-036
RING, LOCKING SWITCH	354-055
ROD, FRAME SN 101-1000	384-511
SCREW, 4-40 x 5/16 FHS, PHILLIPS	211-038
SCREW, 6-32 x 5/16 BHS	211-507
SCREW, 6-32 x 3/8 BHS	211-510
SCREW, 6-32 x 5/16 PAN HS, W/LOCKWASHER	211-534
SCREW, 6-32 x 3/8 TRUSS HS, PHILLIPS	211-537
SCREW, 6-32 x 5/16 FHS, 100°, CSK, PHILLIPS	211-538
SCREW, 8-32 x 3/8 FHS, 100°, PHILLIPS	212-040

	Tektronix Part Number
SCREW, 10-32 x 2¼ HHS	212-511
SCREW, 5-32 x 3/16, PAN HS, PHILLIPS, THREAD CUTTING	213-044
SCREW, #4 x ¼ PHS, PHILLIPS, THREAD FORMING	213-088
SOCKET, STM7G	136-008
SOCKET, STM8, GROUND	136-011
SOCKET, STM9G	136-015
SOCKET, LIGHT, JEWEL ASS'Y SN 101-1000	136-025
SOCKET, LIGHT, JEWEL ASS'Y SN 5001-up	136-047
SPACER, NYLON, 5/16, FOR CERAMIC STRIP	361-009
STRIP, CERAMIC, ¾ x 7 NOTCHES, CLIP MOUNTED	124-089
STRIP, CERAMIC, ¾ x 11 NOTCHES, CLIP MOUNTED	124-091
TAG, VOLTAGE RATING 117 V, 50-800 CYCLES	Use 334-650
WASHER, STEEL, .390 x 9/16 x .020	210-840
WASHER, RUBBER, FOR FUSE HOLDER	210-873
WASHER, STEEL, .470 x 21/32 x .030	210-902
WASHER, HANDLE MOUNTING	210-903

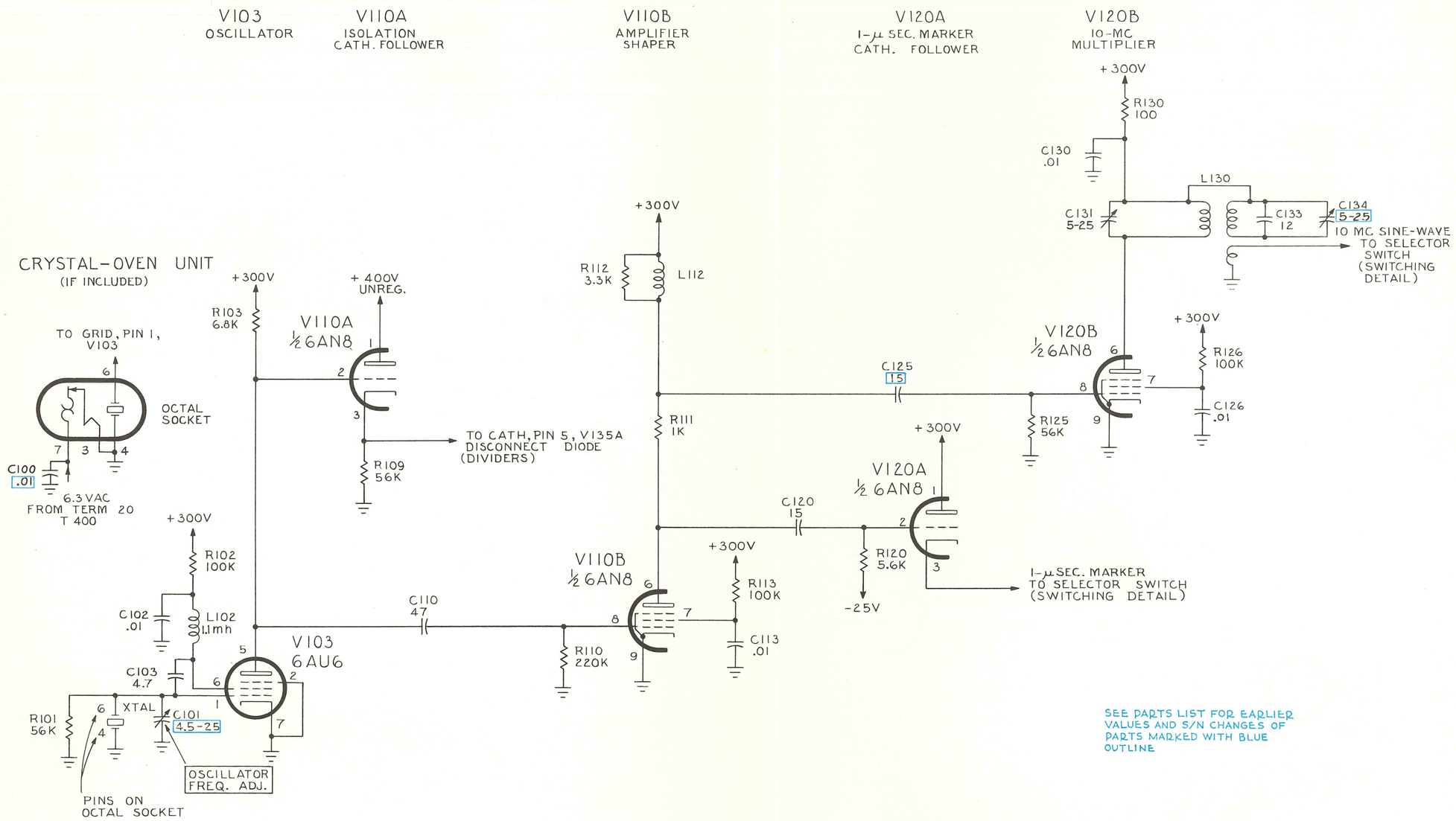


181 TIME-MARK GENERATOR

AA

BLOCK DIAGRAM

7-13-61



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

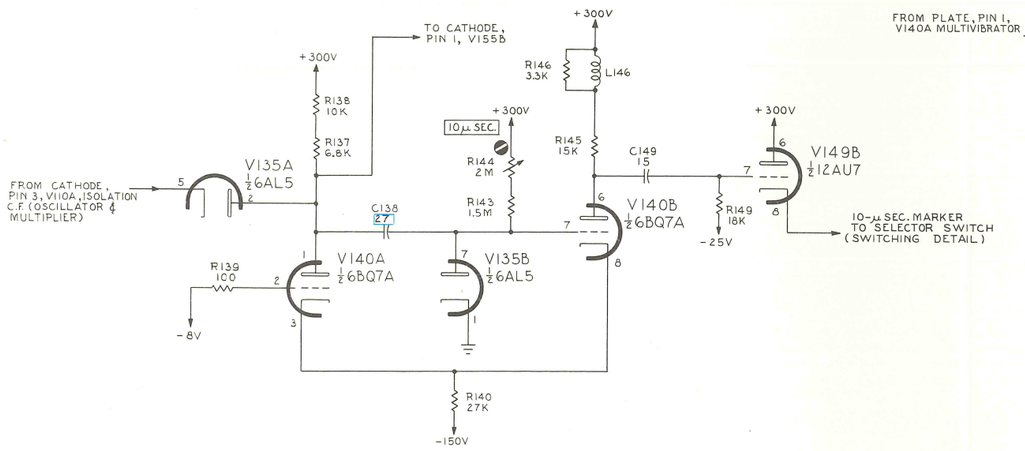
R.O.W.
9-17-59

V135A
DISCONNECT DIODE

V140
MULTIVIBRATOR

V149B
10-μSEC. MARKER
CATHODE FOLLOWER

V135B
CLAMP DIODE

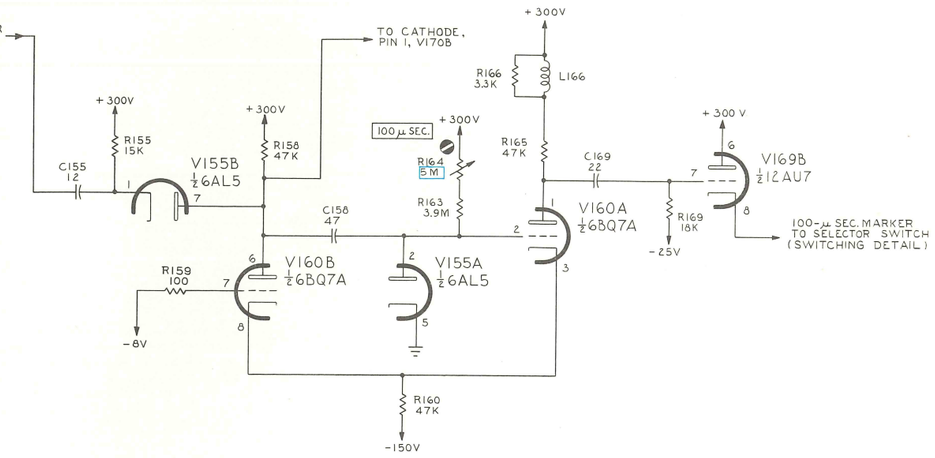


V155B
DISCONNECT DIODE

V160
MULTIVIBRATOR

V169B
100-μSEC. MARKER
CATHODE FOLLOWER

V155A
CLAMP DIODE

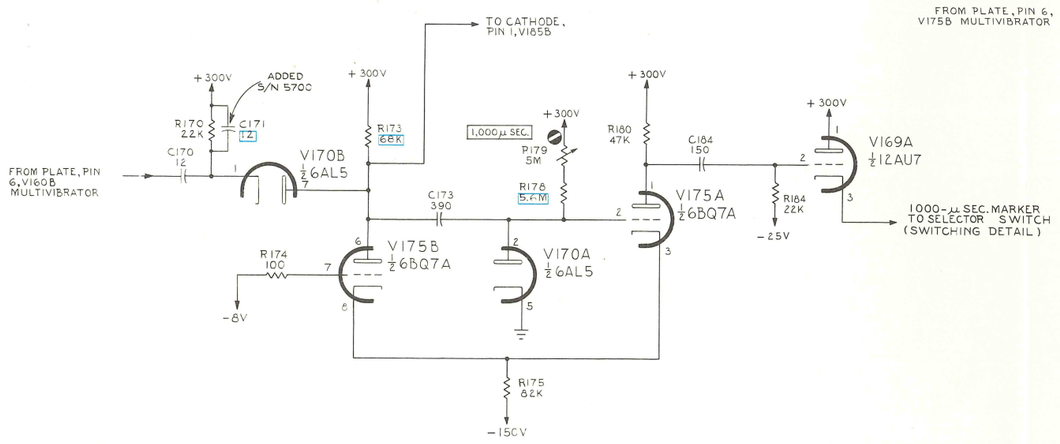


V170B
DISCONNECT DIODE

V175
MULTIVIBRATOR

V169A
1,000-μ SEC. MARKER
CATHODE FOLLOWER

V170A
CLAMP DIODE

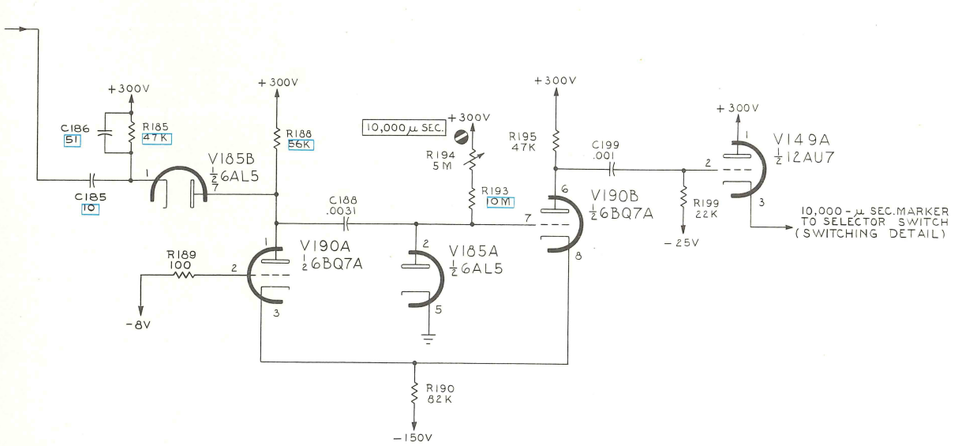


V185B
DISCONNECT DIODE

V190
MULTIVIBRATOR

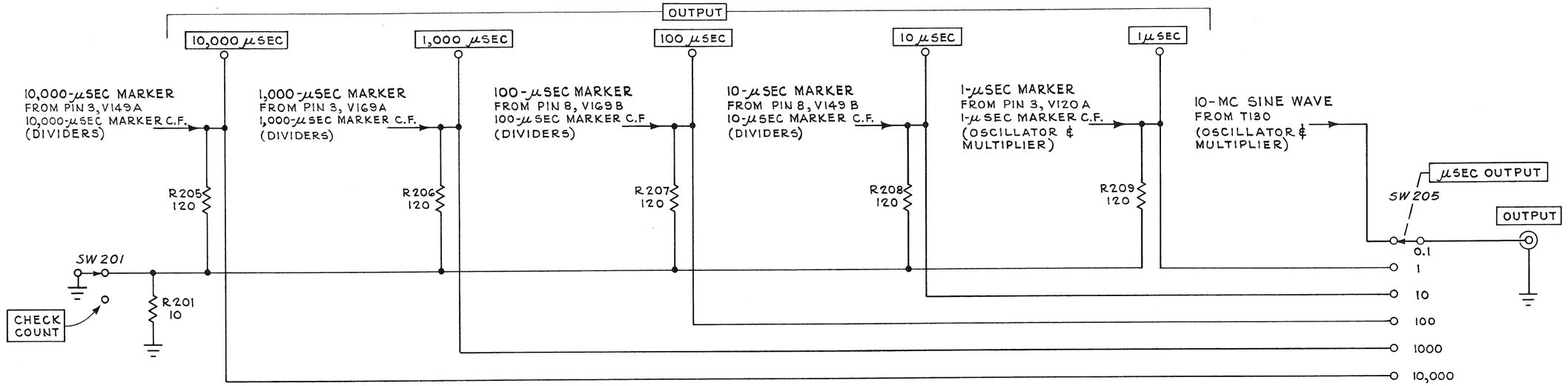
V149A
10,000-μ SEC. MARKER
CATHODE FOLLOWER

V185A
CLAMP DIODE



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

R.O.W. 863



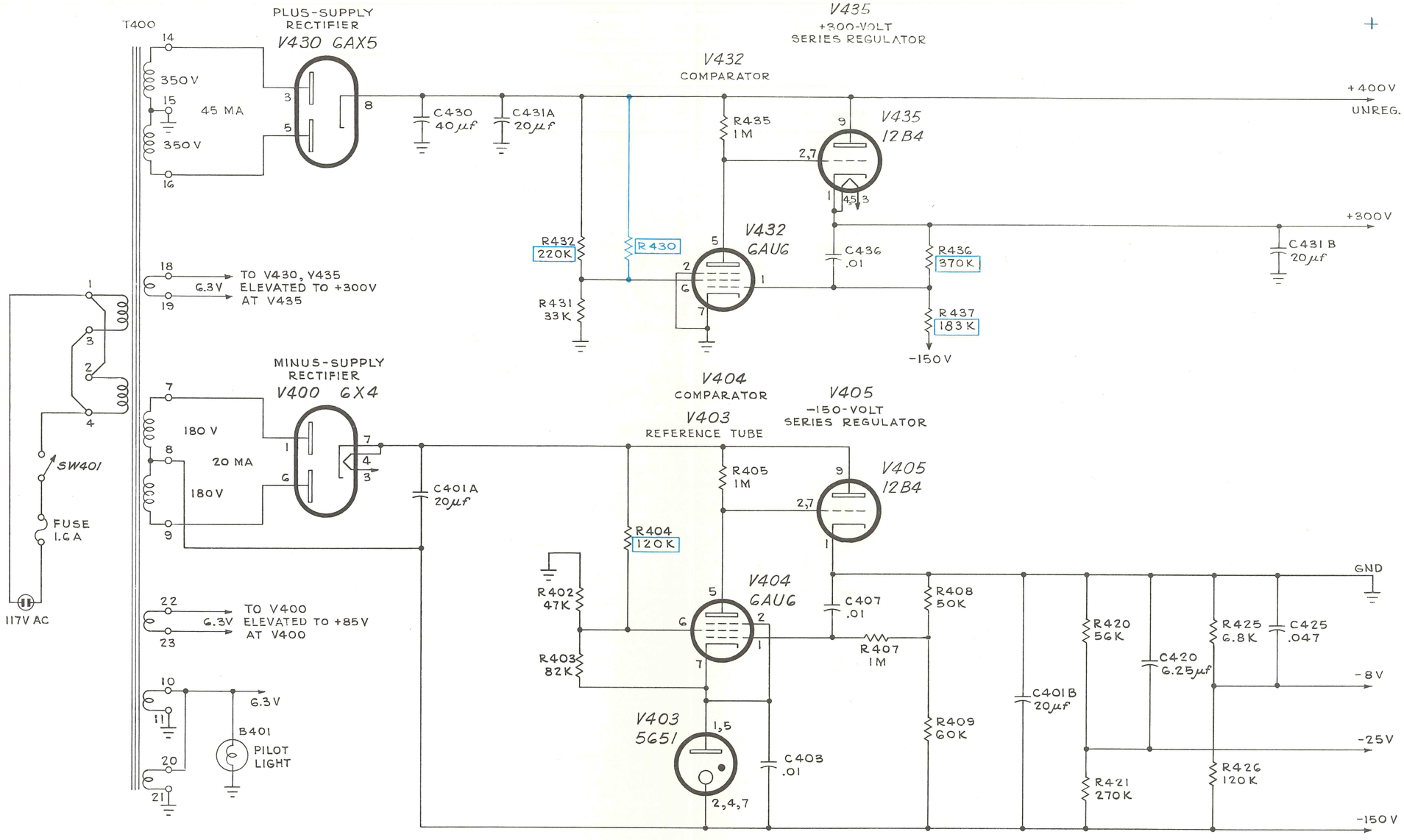
TYPE 181 TIME-MARK GENERATOR

AA

SWITCHING DETAIL

7-13-61

SWITCHING DETAIL



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

RBH
7-13-61

TYPE 181 TIME-MARK GENERATOR

AA1

POWER SUPPLY

POWER SUPPLY

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages. If it does not, your manual is correct as printed.

TYPE 181 -- TENT. S/N 6850

TYPE RM181 -- TENT. S/N 1582

PARTS LIST CORRECTION

CHANGE TO:

C188	.0033 µf	Cer.	500 v	5%	283-041

M8370/764