INSTRUCTION MANUAL

MODIFICATION INSERT

Serial Number _____

TYPE RM544
MOD 720A

This insert is provided as a supplement to the Instruction Manual furnished with this modified instrument. The information given in this insert supersedes that given in the manual.

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TYPE RM544

MOD 720A

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CAUTION

DO NOT switch high voltage from 12kV to 24kV with power on.

When changing from amplifier operation to direct access plug-in operation, ALWAYS disconnect the vertical deflection plate leads before swinging the vertical amplifier chassis out of the way.

Always be sure INTENSITY is turned down before power is turned on.

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TYPE RM544
MOD 720A

INTRODUCTION

This manual insert describes the changes which have been made to a standard Tektronix Type RM544 Oscilloscope to convert it into a Type RM544, Mod 720A. This insert will also describe the special direct access plug-in furnished as part of the Mod 720A.

Mod 720A converts the standard Type RM544 to a high intensity, fast writing rate instrument for photographically recording fast rising, high amplitude non-repetitive events. When used with the Direct Access Plug-in Unit, the system has a risetime capability on the order of 1 ns.

The fastest horizontal sweep rate is 10 ns/div. In order to resolve a 1 ns risetime with a 10 ns/div sweep rate, a dot Rossi circuit is added. The dot Rossi system is used to modulate the horizontal amplifier output from an external sine wave signal. The Rossi system extends ristetime resolution into the 1 or 2 ns region. It also effectively acts as a sweep magnifier.

For maximum flexibility, the instrument is provided with a switchable 12 kV or 24 kV CRT high voltage supply and the CRT has two vertical deflection factors.

At 12 kV operation, most of the standard operational features of the Type RM544 are retained and the instrument will be operated in the standard vertical amplifier mode.

At 24 kV operation the instrument may be operated in the standard vertical amplifier mode or in the direct access mode, bypassing the standard vertical amplifier. In the direct access mode, basic deflection factors of 12.5 V/div and 38 V/div are available. At 24 kV there is no display at sweep rates slower than 20 μSEC/DIV.

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INSTRUMENT CHANGES

The electrical changes made are described briefly below and in detail in the remainder of this insert.

1. High voltage changed to permit selection of either 12 kV or 24 kV for high voltage.

2. Additional unblanking amplifier added for 24 kV operation.

3. 10X TRIGGERING LEVEL range increase changed from TRIGGERING LEVEL conntrol to a three position lever switch. A PRESET position has also been added to the three-position switch so that a fixed, predetermined trigger threshold may be selected.

4. The single sweep circuit has been modified to provide three modes of operation:

NORMAL

AUTO RESET - Sweep resets automatically approximately 350 msec after end of sweep.

NORM RESET - Sweep is reset by front panel push button or by relay from 115V line voltage source.

5. A second triggering circuit has been added to the Time Base sweep generator. The new circuit allows checking the vertical position of the oscilloscope baseline without disturbing the normal triggering controls which have already been set up to trigger on a non-repetitive waveform.

6. A frequency-compensated transformer coupling circuit has been added between the horizontal amplifier and the CRT plates to allow the sawtooth sweep voltage to be modulated (dot Rossi).

7. The split CRT plates of the normal Type RM544 Oscilloscope have had the leads brought out of the CRT for each plate to allow changing the vertical deflection factor of the CRT.

8. A special plug-in has been furnished to provide direct access to the vertical CRT deflection plates. This plug-in also provides input to the Rossi system.

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The following mechanical changes have been made:

1. Indicator lights have been added to:

    a. Indicate what high voltage is being used.
    b. Indicate if the fuse blows.
    c. Indicate if the thermal cutout opens from excessive temperature.

2. The trigger connectors, the CRT Cathode Input connectors, and the Rossi connectors are all GR type.

3. The SWEEP OUT and GATE OUT connectors are BNC type.

4. The power fuse has been moved to the front panel.

5. The HORIZONTAL POSITION, INTENSITY, GEOMETRY, ASTIGMATISM, and FOCUS control knobs have been replaced by locking dial knobs.

6. The GEOMETRY control has been moved to the front panel and the TRACE ROTATION control is now concentric with the GEOMETRY control.

7. The ROSSI AMPLITUDE and ROSSI FREQUENCY controls have been added to the front panel.

8. The ARM and CAMERA connectors are cannon type.

9. The Single Sweep switch name has been changed to NORM/SINGLE SWEEP and a push-button for Normal reset has been added.

10. Each TRIGGERING LEVEL control has been divided into two separate controls, with the 10X range increase now being in a separate three-position switch.

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SECTION 1
CHARACTERISTICS

After the paragraph titled Vertical Deflection System, add the following:

Direct Access Plug-in Vertical Response

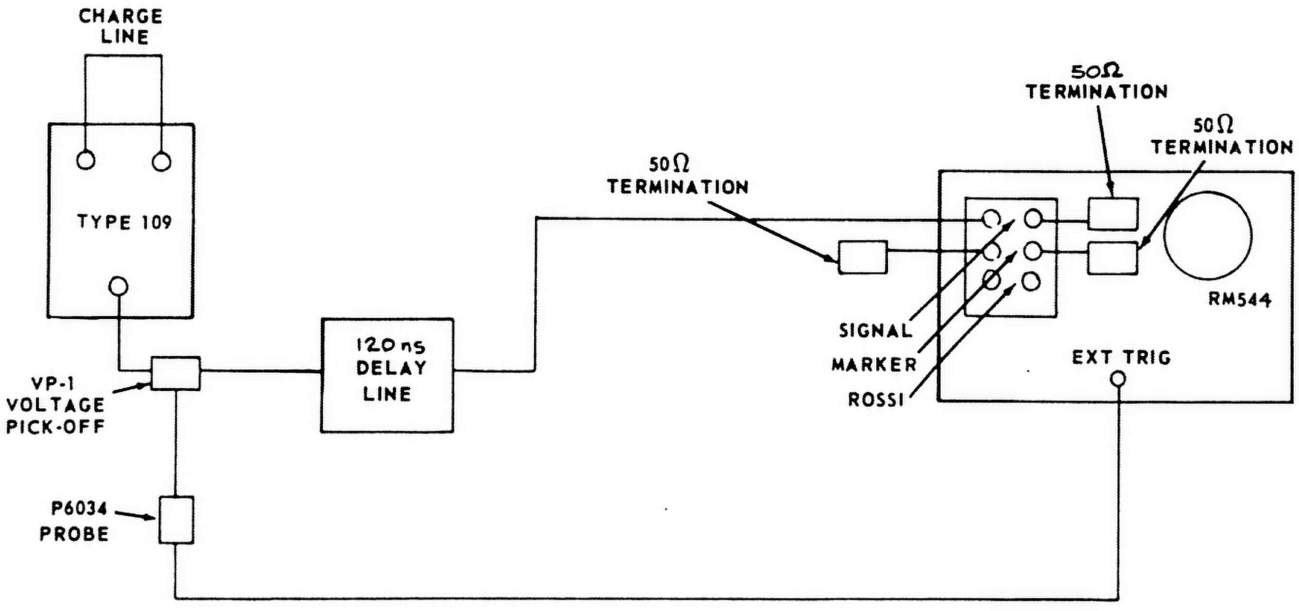
The risetime of the Direct Access Plug-In/Type RM544 is 1 nsec or less for a vertical deflection factor of either 12.5 volts/division or 38 volts/division. The amount of waveform aberration obtained when using this system will be less than 5% for a vertical deflection factor of 12.5 volts/division and less than 10% for a vertical deflection factor of 38 volts/division, with 1 ns risetime pulse applied.

Sweep Generation

Change the title Trigger Signal Requirements to read Trigger Signal Requirements at a High Voltage of 12 kV.

NOTE

1 millimeter is approximately equal to 1/10 of a major division.



METHOD USED TO MEASURE DIRECT ACCESS PLUG-IN VERTICAL RESPONSE

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Change the Trigger Signal Requirements at a High Voltage of 12 kV as follows:

> Maximum trigger level range is greater than ±5 volts with the TRIGGERING LEVEL switch at NORM and ±50 volts with the TRIGGERING LEVEL switch at 10X NORM.

Following the paragraph just changed, add the following paragraph:

> CAL TRIG: Minimum amplitude is +20 volts.

Front-Panel Output Signals

Change the information contained under the title Vert Sig Out as follows:

> Vertical Signal Output connector - Output amplitude is approximately 0.3 volts per division of deflection on the CRT. Risetime is 20 nsec or faster. Output is AC coupled.

Cathode Ray Tube

Replace the information contained under the title Accelerating Potential with the following:

> Selection of eith 12 kV or 24 kV.

Chnange the title Focus and the information under it to the following:

Focus at 12 kV High Voltage - Vertical: 2 horizontal lines/mm distinguishable over the graticule area. Horizontal: 1 time marker/mm distinguishable over the graticule area.

Delete the title Graticule and the information under it.

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SECTION 2
OPERATING INSTRUCTIONS

FUNCTIONS OF EXTERNAL CONTROLS AND CONNECTORS

Replace the indicated descriptions with the following:

TRIGGERING LEVEL	Control (potentiometer) - Selects the amplitude point on the triggering signal where sweep triggering occurs. Switch - When set to 10X NORM, greater triggering range is offered by the TRIGGERING LEVEL control for triggering on high amplitude trigger signals. With the switch set to NORM, the TRIGGERING LEVEL control will permit sweep triggering on signal amplitudes normally encountered. When the switch is set to PRESET, the front panel TRIGGERING LEVEL control is disconnected and a previously-adjusted potentiometer is substituted for it.

Substitute the following for the SINGLE-SWEEP switch and its description:

NORM-SINGLE SWEEP	Permits single sweep operation in all modes of the HORIZONTAL DISPLAY switch except EXT. In the NORM RESET position of the switch, the single sweep circuitry is reset by either the front panel push button labeled NORM RESET or by a 115V AC arming signal applied between pins A and D of the ARM connector. In the AUTO RESET position, the single sweep circuitry will reset the sweep circuits approximately 300 msec after the sweep has ended. In the NORM position the sweep circuits run normally.

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Following the description of TRIGGER INPUT (labeled TRIG IN on this instrument), add the following:

CAL TRIG	Connector for applying an external trigger signal to the Time Base Cal Trigger circuit. Front panel trigger controls do not affect the CAL TRIGGER operation.

To the list of external controls and connectors, add the following:

CAMERA	Connector supplies power from the ARM connector for the camera shutter.
ARM	Connector for applying line voltage power to the camera connector and to the arming relay, K1255, in the sweep lockout circuit (switch set to NORM RESET).
FUSE OUT	Indicator lamp which lights when AC-line fuse has blown.
OVER TEMP	Indicator lamp which lights when the thermal cutout disconnects power to the instrument because of excessive interior temperature. If the instrument is connected for 108, 115, or 122 volt operation, the fan will continue to run after the thermal cutout disconnects power the the rest of the instrument, thereby helping to reduce the interior temperature. A check that the OVER TEMP light is not burned out is provided by the light being lit when the AC-line power is applied to the instrument and before the POWER switch is turned on.
GEOMETRY	Control which adjusts the CRT display for minimum distortion.
ROSSI AMPLITUDE	Adjusts the amplitude of the modulating signal applied to the horizontal amplifier output sawtooth voltage.
ROSSI FREQUENCY	Selects a tuned circuit in the Rossi Box which corresponds to the Rossi input signal frequency, so maximum signal amplitude will be available for modulation purposes.

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ROSSI IN and ROSSI OUT	50-ohm loop-through connectors. The Rossi signal is applied to the ROSSI IN connector. The ROSSI OUT connector is used to couple the Rossi signal to another oscilloscope or for termination of the Rossi system.
MODE 12 kV - 24 kV	Indicator lamps, one of which lights to indicate the CRT acceleration potential being used. Switch for changing acceleration potential is located inside instrument.

DIRECT ACCESS PLUG-IN CONNECTORS AND CONTROLS

SIGNAL INPUT and OUTPU T	50-ohm loop-through connectors. The signal applied to the INPUT connector drives directly one or both upper deflection plates, and the OUTPUT connector. The signal from the OUTPUT connector then supplies the next oscilloscope with its signal, or the OUTPUT connector may be terminated in 50-ohms.
MARKER INPUT and OUTPUT	50-ohm loop-through connectors. The marker signal applied to the INPUT connector drives directly one or both lower deflection plates, and the OUTPUT connector. The marker signal from the OUTPUT connector then supplies the next oscilloscope with its marker signal.
AVG DP POTENTIAL	A test point and adjustment for setting average vertical deflection plate potential at +150 VDC.
EXT CALIBRATE	Connector through which a known amplitude signal can be fed to the vertical deflection plates (MODE switch set to EXT CALIBRATE) to determine vertical calibration. Signal source must be balanced around +150 volts.
MODE	Two-position switch either connects the EXT CALIBRATE connector to the vertical deflection plates for vertical calibration, or connects the VERT POSITION control to the vertical deflection plates so that the signal may be positioned.
VERT POSITION	Control to position the vertical signal. MODE switch must be set to VERT POSITION to use this control.

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Replace the paragraphs titled "Setting Triggering Level" with the following:

The TRIGGERING LEVEL control determines the amplitude point on the signal where triggering occurs.

The trigger circuit is most sensitive to AC triggering signals with the TRIGGER LEVEL control set near zero and the TRIGGERING LEVEL switch set to NORM. Moving the TRIGGERING LEVEL control in the + direction caused the trigger circuit to respond at some more positive amplitude on the triggering signal. Moving the TRIGGERING LEVEL control in the - direction causes the trigger circuit to respond at some more negative amplitude on the triggering signal. Fig.2-2 (in the manual) illustrates the effect of the TRIGGERING LEVEL control and the SLOPE switch.

The range of the TRIGGERING LEVEL control is extended 10 times when the TRIGGERING LEVEL swtich is set to 10X NORM. This permits more satisfactory triggering on larger amplitude trigger signals.

In the PRESET position, the trigger circuit threshold is set at a predetermined level (+20V) and the trigger circuit will not respond to signals of lower amplitude.

Replace the paragraphs titled "Single Sweep Operation" with the following:

In applications where the displayed signal is not repetitive or varies in amplitude, shape, or time, a conventional repetitive sweep may produce a jumbled display. To avoid this, use the single sweep feature of the Type RM544 oscilloscope.

To use single sweep, first make sure the trigger circuit will trigger on the event you will wish to display. Do this in the conventional manner with the NORM-SINGLE SWEEP switch set at either AUTO RESET or NORM.

Set the NORM-SINGLE SWEEP switch to NORM RESET (AUTO RESET could be used if it were known definitely that the triggering signal was not repetitive and that noise would not trigger the sweep) and either depress the NORM RESET button momentarily or apply a 115V, 50-60 Hz signal between pins A and D of the ARM connector.

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When this is completed, the next trigger pulse will actuate the sweep and the instrument will display the event on a single trace. The READY lamp, near the HORIZONTAL DISPLAY switch, lights when the sweep is ready to accept a trigger and goes out after triggering has taken place. To ready the circuit for another single display, depress the NORM RESET button again momentarily or if the circuit is being armed by connecting 115V, 50-60 Hz between pins A and D of the ARM connector, disconnect this voltage from the ARM connector momentarily. In single sweep operation, make sure that the MODE switch is set to TRIG.

Add the following paragraph:

CALIBRATE TRIGGER

The calibrated trigger circuitry is provided so that if the triggering controls have already been adjusted to trigger on an expected signal, the sweep may be triggered and a test set-up checked out without disturbing the triggering controls.

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SECTION 3
CIRCUIT DESCRIPTION

Replace the paragraphs titled CRT Circuit with the following:

CRT Circuit

The CRT circuit (see CRT insert schematic) includes the CRT, the high-voltage power supply, the high-voltage slow-up circuit and the controls necessary to focus and orient the display. The CRT is an aluminized, 5-inch, flat faced, glass CRT with a helical post-accelerator and electrostatic focus and deflection. The CRT circuit provides connections for externally modulating the CRT cathode. The high-voltage power supply is composed of a DC-to-50 kHz power converter, a voltage-regulator circuit, and three high-voltage outputs. Front-panel controls in the CRT circuit adjust the trace rotation (screwdriver adjustment), intensity, focus, astigmatism and geometry. Internal controls adjust the high-voltage output levels.

High-Voltage Delay Circuit

The H. V. delay circuit, a Miller circuit consisting of Q801, Q802 and C804, is added to prevent CRT burns due to sudden H. V. turn-on. The high voltage builds up gradually, taking about 35 seconds to reach 12kV and 70 to 90 seconds to reach 24kV.

When the low voltage power supplies come on, SW808 opens. Q801 Gate rises to about +2.0 volts, setting Q801 source to +2.4V and turning Q802 on. Q802 collector is at +10 volts, holding V800 screen grid down resulting in low oscillator output.

As Q801 gate attempts to go negative, Q802 collector moves positive. This positive-going signal is coupled through C804 to Q801 gate, holding Q801 gate constant. The Miller action continues until Q802 collector reaches the supply voltage (+130 volts). At that point there is no longer feedback to Q801 gate and Q801 gate drops from +2 volts to about +1.2 volts. Q802 is reverse biased.

Q801, Q802 Delay circuit controls the H. V. oscillator output until Q802 collector voltage exceeds the normal operating voltage of V800 screen grid. At that point D806 becomes reverse biased and the delay circuit has no further effect on the H. V. output. Normal operating voltage for V800 screen grid is approximately +55V in 12kV mode and +110V in 24kV mode. SW808, L812 and associated circuitry protect the CRT phosphor against burns due to short power interruptions of 10mS-200mS. With any power interruption of 10mS or longer, the H. V. output drops to a low level and then builds up again slowly.

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SW808, a normally closed reed switch, is driven by L812 which operates between the regulated and non-regulated sides of the -150V supply. With power on, L812 is actuated and SW808 is open.

D643 is added in the -150V supply to disconnect D642A and D642C from C642A when line voltage is interrupted. L812 is connected through R812 to the junction of D642, D643. Any power interruption lasting 10mS or longer drops the voltage at D642, D643 junction below the voltage at the top of C642A. D643 becomes reversed biased, effectively opening the current path for L812, R812.

With the current through L812 dropping below the holding level, SW808 closes discharging C804. At the end of the power interruption, SW808 opens and Q801 gate rises to +2 volts. Q802 is turned on, its collector and V800 screen grid dropping to about 25 volts or less. The CRT cathode voltage drops to -800V or less and the CRT anode voltage drops to +4kV or less.

The high voltage builds up slowly again through the action of Q801, Q802 delay circuit.

NOTE

> The circuit just described offers protection to the CRT from burns resulting from power turn on and from power line interruptions. It offers absolutely no protection when switching from 12kV to 24kV operation with the instrument on. It is therefore necessary to always turn the instrument off before switching the high-voltage circuit from 12kV operation to 24kV operation.

High-Voltage Power Supply

The high-voltage power supply is a DC-to-AC converter operating at approximately 50 kHz with the transformer providing three high-voltage outputs. The use of a 50kHz input to the high-voltage transformer permits the size of the transformer and filter components to be kept small. A modified Hartley oscillator converts DC from the +325-volt unregulated supply to the 50-kHz input required by high-voltage transformer T801. C808 and the primary of T801 form the oscillator tank since the exact frequency of oscillation is not important.

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Voltage Regulation

Voltage regulation of the high-voltage outputs is accomplished by regulating the amplitude of oscillations in the Hartley oscillator. The -1850 or -3850 volt output is referenced to the +350 volt regulated supply through a voltage divider composed of R841, R842, R843, R844, R845, R846, R847, R853 and variable resistors R840 and R846 or R839, R841, R842, R843, R844, R845, R846, R847, R853 and variable resistors R838, R840 and R846. Through a tap on the voltage divider, the regulator circuit samples the -1850 or -3850 volt output of the supply, amplifies any errors and uses the amplified error voltage to adjust the screen voltage of Hartley oscillator V800. If the -1850 or -3850 volt output changes, the change is detected at the grid of V814B. The detected error is amplified by V814A and V814B. The error signal at the plate of V814A is direct coupled to the screen of V800 by making the plate-load resistor of V814A serve as the screen-dropping resistor for V800. Any change in the -1850 or -3850 volt output thus changes the screen voltage of V800 and the amplitude of the 50-kHz oscillations. R840 provides a means of controlling the 12 kV high-voltage output through controlling oscillation amplitude, while R838 provides a means of controlling the 24kV high-voltage output through controlling oscillation amplitude.

CRT Grid Supply

The approximately -2035 or -4175 volt output of the high-voltage power supply is the rectified output of one of the two high-voltage secondaries on T801. To provide DC-coupled unblanking signals to the CRT grid, the CRT grid supply is floating (the DC voltage levels on the components shift in accordance with the unblanking signals). The positive side of the CRT grid supply is returned to the -150 volt supply through the unblanking cathode-follower load resistor of the selected sweep generator or the load resistor of the 24kV unblanking amplifier if 12kV/24kV switch is set to 24kV and through R831 and R832. The negative side of the CRT grid supply is applied through the INTENSITY control to the CRT grid.

At the fastest sweep rates, the stray capacitance of the floating CRT grid circuit makes it difficult for the CRT grid to rise fast enough to unblank the CRT in the required time. An isolation network consisting of R827, R828, C828, C829, C830, and C831 isolates the capacitive loading. By this arrangement, the fast leading edge of the unblanking pulse is coupled through C828, C829, C830, and C831 to the grid of the CRT. For short duration unblanking pulses, such as

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those that occur at the fastest sweep rates, the DC levels on the rectifier and secondary winding are not appreciably affected. Longer unblanking pulses, such as those that occur at the slower sweep rates, charge the stray capacitance in the -2035 or -4175 volt output through R827. This pulls up the floating CRT grid circuit and holds the CRT grid at the unblanked potential for the duration of the unblanking pulse.

+10150 or +20150 and -1850 or -3850 Volt Outputs

Both the +10150 or +20150 and the -1850 or -3850 volt outputs are derived from the same secondary winding on T801. The full secondary voltage of approximately 3480 or 6960 volts is applied to a voltage tripler consisting of rectifiers D832, D842, and D852 and associated capacitors. A tap on the secondary provides the input for half-wave rectifier V862 in the -1850 or -3850 volt output. Both the +10150 or +20150 volt and -1850 or -3850 volt outputs are referenced to the regulated +350 volt supply through a voltage divider network. The 10150 or 20150 output is connected to the CRT post-deflection-accelerator anode and the -1850 or -3850 volt output is connected to the CRT cathode, providing a total accelerating voltage of 12000 or 24000 volts.

CRT Circuit Controls and Connectors.

Optimum size and shape of the flourescent spot on the CRT is obtained by adjusting the front panel FOCUS and ASTIGMATISM controls. FOCUS control R846 provides the correct voltage for the second anode (focus ring) in the CRT. Proper voltage for the third anode is obtained by adjusting ASTIGMATISM control R864. In order to obtain optimum spot size and shape, both the FOCUS and ASTIGMATISM controls are adjusted to provide the proper electronic lens configuration in the region of the second and third anodes of the CRT. Spot intensity is adjusted by means of front-panel INTENSITY control R826. Varying the INTENSITY control changes the voltage on the CRT grid, which in turn varies the density of the electron stream. The GEOMETRY control R861 adjust the isolation shield voltage in the CRT, and is adjusted to minimize "bowing" or "tilting" of the display. Front-panel TRACE ROTATION control R778 permits minor adjustments in trace orientation. By adjusting the TRACE ROTATION control, the trace can be made parallel with the horizontal lines on the graticule, eliminating the need to physically turn the CRT to correct for minor deviations of the trace from the horizontal.

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Input binding posts on the rear panel of the Type RM544 provide an input for externally modulating the CRT cathode. One input binding post is normally grounded by a GR connector shorting cap. If it is desired to intensity modulate the display from an external source, the shorting cap is removed, and the modulating signal is coupled to the CRT cathode through C858.

When the Type RM544 is used with a multi-channel vertical plug-in preamplifier that provides dual-trace chopped blanking pulses, the blanking pulses are applied to rear-panel CRT CATHODE SELECTOR switch SW858. With the vertical plug-in preamplifier operating in the chopped mode and SW858 set to the CHOPPED BLANKING position, a positive pulse of approximately 20-volts amplitude is applied through C858 to the cathode of the CRT. At normal intensity levels, this pulse is sufficient to cut off the CRT during the time the amplifier channels in the vertical plug-in preamplifiers are being switched.

Replace the following described information under the title Time Base Generator.

Add the following information after the paragraphs titled Trigger Generator.

Sweep Calibrate Trigger

The Sweep Calibrate Trigger circuit has been adjusted to produce an output trigger when the input voltage at the CAL TRIG connector reaches +20V . When the input signal reaches +20V tunnel diode D1205 switches from its low state to its high state. When D1205 switches to its high state it produces a positive pulse which is coupled into the base of transistor Q1208, turning Q1208 on. When Q1208 turns on, current begins to flow in its collector circuit through the winding of T1208, that is, in the collector circuit. This produces a magnetic field in T1208 which couples a positive-going pulse to the base of Q1208 turning it on harder, and driving it into saturation. As the transistor reaches saturation there is no longer a changing current in the collector circuit therefore the magnetic field in the transformer winding in Q1208 collector circuit begins to collapse. This collapsing magnetic field couples a negative pulse into the base of Q1208 turning Q1208 off. The collapsing field in the collector winding also generates a positive pulse in the output winding of T1208. This positive pulse is coupled through R1209 and D1209 to the Time Base sweep gating tunnel diode D59, switching D59 to its high state and causing the Time Base sweep to run. D1201 is in the circuit to

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limit the effective amplitude of the trigger signal which can reach the triggering circuit itself. As the input signal reaches approximately 28V, D1201 is turned on. D1201 turning on couples the trigger signal into the low impedance circuit of D1202, thus limiting the signal at the anode of D1201 to approximately 6.7V. This in turn limits the maximum current available to tunnel diode D1205 to approximately 6.7ma.

24kV Unblanking Amplifier

The 24kV unblanking amplifier, Q865 and V871, operates in parallel with the 12kV unblanking amplifier, Q3734 and V393B. The 12kV/24kV switch, SW865, selects the appropriate signal for CRT unblanking.

Q865 is operated as a switch. When the sweep is off, sweep gating TD D285 is in its low state and Q284 is off. Q284 collector is at +5 volts and Q865 base is at +1.2 volts biasing Q865 off. Q865 collector is clamped at about -107V through D876, D869 and R869. D866, D868, R868 set V871 grid at -60 volts and V871 cathode at -52 volts.

Triggering the sweep , switches D285 to its high state, turning Q284 on and biasing Q865 on. Q865 collector rises to near 0V, carrying V871 cathode to +55 volts.

At sweep speeds of 50μSEC/DIV and slower, V871 grid is clamped to -107 volts through D870, thus preventing CRT unblanking at sweep speeds slower than 20μSEC/DIV. D866 becomes reverse biased and allows Q865 collector to rise during sweep time, preventing Q865 destruction at 50μSEC and slower.

Rossi

The Rossi system has been added to the Type RM544 to increase the risetime readout resolution in the 1 to 2 ns region.

In the dot Rossi system the horizontal amplifier output sawtooth waveform is modulated by a high frequency sine wave. The modulating high frequency sine wave is carried across the CRT by the horizontal amplifier output sawtooth waveform. The algebraic addition of the sine wave and sawtooth signals results in a sweep which is accelerated during the positive half-cycle of the modulating sine wave signal and reversed during the negative half-cycle of the modulating sine wave signal. When the modulating sine wave signal slope is equal and opposite to the sawtooth slope, the sweep momentarily stands still. Everytime the sweep stops and reverses, a bright dot appears on the displayed sweep, thus the name dot Rossi.

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When viewing a pulse or fast rise transient, using the Rossi system, the pulse appears to wiggle up the CRT at the modulating sine wave signal rate. The pulse risetime is determined from the modulating sine wave signal period and/or fraction of the period it takes the pulse to rise from 10% to 90% of its amplitude.

The Rossi (modulating sine wave) signal is applied to one of the Rossi input connectors on the Type RM544 front panel. The other Rossi connector is used to couple the modulating sine wave signal to another oscilloscope, or to terminate the system in 50 ohms.

The single-ended modulating sine wave signal input is coupled through C1350 to either transformer T1350 or T1351, depending on the setting of the ROSSI FREQUENCY switch, which is always set to correspond to the Rossi input signal frequency. The transformer secondary circuits are tuned by the ROSSI FREQUENCY switch to one of eight different frequencies by switching in the appropriate amount of capacitance. The output of the tuned transformer secondary is a push-pull signal which is coupled through C1368 and C1369 to the CRT horizontal deflection plates.

R1350, R1351, L1351, and R1352, R1353, L1352 isolate the transformer secondary output from the low output impedance of the horizontal amplifier cathode follower. At the higher frequency (40MHz - 200MHz) positions of the ROSSI FREQUENCY switch, resistors R1351 and R1353 are switched out of the circuit. This reduces the likelihood of sweep attenuation at the faster sweep rates. L1351 and L1352 provide the necessary isolation between the Rossi output and horizontal output cathode followers for all the Rossi frequencies.

Camera Control and Sweep Lockout Circuit

The camera control and sweep lockout circuit replaces the standard sweep lockout circuit.

The new circuit has three (3) modes of operation:

1. NORM. Normal triggered operation (at 12kV only).
2. SINGLE SWEEP - AUTO RESET. In this mode, the circuit automatically resets the sweep circuit approximately 300mSeconds after the end of the sweep.
3. SINGLE SWEEP - NORM RESET. In this mode, single sweep reset is achieved by one of three methods:

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(a) Remote reset from external pulse applied to rear panel jack J637.

(b) Remote reset from line voltage signal applied to pins A and D of front panel ARM connector.

(c) Front panel reset from the NORM RESET pushbutton.

With SW1261 in NORM position the sweep lockout circuit is disconnected and the sweep circuit operates normally.

SINGLE SWEEP - AUTO RESET: When SW1261 is placed in the AUTO RESET position, C1266 and C1267 begin to charge toward +225V through R1266. When C1266, C1267 voltage reaches approximately +75 volts, neon B1267 ignites, developing a +20 volt signal across R1268. This +20 volt signal is coupled through D1268, C365 and D363 to the cathode of V345A - turning V345A off and resetting the sweep.

With V345A turning off V345B turns on, its cathode going from -17 volts to +2 volts. This positive going signal on V345B cathode turns D1265 on, providing base current for Q1261 and turning it on. Q1261 collector goes to near 0 volts. The junction of R1262, R1263 falls to about +55V , dropping the voltage on C1266, C1267 to +55V and turning neon B1267 off. The circuit remains in this state until the Time Base Generator has swept once.

The sweep ends as V345A turns on and V345B turns off. V345B cathode drops to -17 volts, turning D1265 off, and stopping Q1261 base current, shutting Q1261 off. Q1261 collector goes to +225V. C1266 and C1267 begin charging toward +225V again. When their voltage reaches +75 volts B1267 ignites resetting the sweep about 300mSeconds after the previous sweep ended.

SINGLE SWEEP - NORM RESET: Using Line Voltage to Reset.

With switch 1261 in NORM RESET position, Q1260 is on, energizing relay K1280 and opening its contacts 5 and 6. Q1261 is off.

Applying line voltage to ARM connector contacts A and D energizes relay K1255, closing K1255 contacts 4 and 6. The voltage at R1257, R1258 drops from +68 V to about + 17V. The negative going signal is coupled through C1260 to the base of Q1260, turning 1260 off. Q1260

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turning off de-energizes K1280, closes relay contacts 5 and 6 and applies line voltage power to CAMERA connector pins A and D.

With Q1260 off, C1266 and C1267 begin charging toward +225Volts through R1267, R1281 and K1280. When C1266, C1267 voltage reaches +75 volts, B1267 ignites - resetting the sweep.

V345B in the sweep generator turns on, its cathode going from -17 volts to +2 volts. This positive signal is coupled into the sweep lockout circuit via D1265, turning Q1261 on. Q1261 collector drops to near 0V and holds Q1260 off. The circuit remains in this state until the Time Base generator has swept once.

At the end of the sweep V345B cathode drops to -17V, switching D1265 and Q1261 off. Q1261 collector rises, turning D1262 off and allowing Q1260 to draw base current. Q1260 turning on energizes relay K1280 and opens relay contacts 5 and 6, removing line voltage from CAMERA connector pins A and D. The circuit remains in this state until line voltage to the ARM connector is removed and then re-applied.

Normal resetting is also accomplished by use of pushbutton switch 1256 instead of applying line voltage to the ARM connector. Circuit operation is the same as described using line voltage reset.

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SECTION 5
CALIBRATION

To the Equipment Required list add the following:

Square-wave generator. Frequency of 1 kHz, output amplitude of at least 20 volts. Tektronix Type 106 recommended.

Pulse Inverter. Must invert the 1 kHz, 20 volt negative-going square-wave from the square-wave generator. Tektronix TU5/105 Adapter, Tektronix Part No. 013-0075-00 or equivalent.

Adapter. Connectors BNC female to BNC female. Tektronix Part No. 103-0028-00.

Adapter. Connectors BNC male to BNC male. Tektronix Part No. 103-0029-00.

Adapter. Connectors GR to BNC female. Tektronix Part No. 017-0063-00.

Adapter. Connectors GR to BNC male. Tektronix Part No. 017-0064-00.

Termination (2). Impedance, 50-ohms; accuracy, 3%; connector, GR; style, end-line.

Termination. Impedance, 50-ohms; accuracy, 3%; connector, GR; style, end-line; power rating, 15 watts.

Power Oscillator. Frequency capability of 200 MHz, 100 MHz, 80 MHz, 50 MHz, 40 MHz, 20 MHz, 10 MHz, and 5 MHz.

Sampling system. Bandwidth equivalent to DC to 1 GHz; minimum deflection factor, 2 mV/div; input impedance, 50-ohms. Tektronix Type 1S1 Sampling Unit and a Type RM546 Oscilloscope recommended.

Add the following to Table 5-2:

GEOMETRY	as is
12 kV/24 kV switch	12 kV
TRIGGERING LEVEL	NORM

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Complete the Calibration as directed in the manual with the following exceptions and additions:

Change step 3 to read: Adjust 12 kV HIGH VOLTAGE R840 - CRT circuit.

In step 8, delete the reference to the location of the GEOMETRY control, R861, as it is now on the front panel.

In step 12A, set the AMPLITUDE CALIBRATOR to 200 mV.

Add the following steps after step 15 (Check TRIGGERING LEVEL Control Zero Set - Sweep Trigger):

15A. Adjust PRESET TRIGGER R212

a. Reset the following controls:

TRIGGERING LEVEL	Preset
COUPLING	DC
SOURCE	EXT
CALIBRATOR	20 volts

b. Adjust PRESET TRIGGER (front panel) so a stable waveform is displayed on the CRT.

c. Reset the TRIGGERING LEVEL to NORM.

15B. Check Single Sweep

a. Connect a coax cable from the CALIBRATOR to the TU-7 EXT INPUT connector.

b. Set AMPLITUDE CALIBRATOR to 0.5 volts.

c. Adjust triggering for a stable display.

d. Set NORM/SINGLE SWEEP switch to AUTO RESET. Sweep must run at approximately a 3 Hz rate.

e. Remove signal. READY light must light.

f. Set NORM/SINGLE SWEEP switch to NORM RESET. Press NORM RESET push button. READY light must light.

g. Re-apply the signal. Time-Base Generator must run once and the READY light go out. Return the NORM/SINGLE SWEEP to NORM.

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15C. Adjust CAL TRIG R1204

a. Set the TRIGGERING LEVEL switch to PRESET, the SOURCE switch to IN NORM and the HORIZONTAL DISPLAY switch to B.

b. Connect the Type 106 High Amplitude Output to the CAL TRIG Input connector via a 50Ω GR to BNC male adapter, female to female adapter, a TU5/105 adapter, 42 inch 50Ω cable with BNC connectors, and BNC female to GR adapter.

c. Set the Type 106 controls as follows:

Power	On
Repetition Rate Range	1 kHz
Multiplier	Fully ccw
Symmetry	Midrange
Amplitude	Adjusted for 20 volts
Mode	High Amplitude

d. With the test oscilloscope, monitor the signal at the input end of R1201.

e. Adjust the Type 106 output for +20 volts signal amplitude on the test oscilloscope.

f. Adjust R1204 so Time-Base sweep will be just triggered by the 20 volt signal.

Complete the remainder of the calibration procedure as directed in the manual. After completing the manual procedure, procede as follows:

44. Adjust 24 kV High Voltage R838 - CRT Circuit

a. Set the Time Base controls as follows:

TRIGGERING LEVEL	About 25° cw from 0
TRIGGERING LEVEL	NORM
MODE	TRIG
SLOPE	+
COUPLING	AC
SOURCE	NORM INT
TIME/DIV	10μSEC

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The settings of the remaining front-panel controls are listed below:

INTENSITY	Full ccw
GEOMETRY	As is
FOCUS	As is
ASTIGMATISM	As is
SCALE ILLUM	As is
HORIZONTAL POSIT	Approximately centered
CALIBRATOR	OFF

Type TU-7 control settings:

Vertical Position	Centered
Variable	approx. 3
Test Function	Low Load

b. Turn the POWER off, then set the 12 kV/24 kV switch to 24 kV, and the 24 kV INTENS LIMIT, R834, fully counterclockwise.

c. Set the scale of the VOM to measure -3850 and connect the VOM between the high-voltage test point (see Fig. 5-3) and ground.

d. Adjust the 24 kV control, R838, for a -3850 V meter indication.

CAUTION

The CRT is easily burned at 24 kV operation. A bright, undeflected spot must be avoided.

e. Rotate the INTENSITY control fully clockwise, then rotate the 24 kV INTENS LIMIT control clockwise until a visible, but not excessively bright spot is displayed.

f. Connect a coaxial cable from the Marker Output connector of a Type 184 to the 067-0521-00 EXT Input Connector.

g. Set the Type 184 so only 10 μs time markers are displayed on the oscilloscope.

h. Readjust the 24 kV control, R838, for exactly 1 marker/24 kV div. (24 kV graticule is smaller one in center of CRT.)

j. Disconnect the VOM and the Type 184.

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45. Adjust Rossi Compensation

a. Turn the oscilloscope power off, then install the Direct Access Plug-In and set the 12 kV/24 kV switch to 12 kV and the NORM-SINGLE SWEEP switch to NORM.

b. Turn the oscilloscope power on and allow about five minutes of warm-up time.

c. Connect a 50Ω end-line termination to each Direct Access Plug-In MARKER connector.

d. Connect a 50Ω end-line termination to the Direct Access Plug-In SIGNAL INPUT connector. See layout at the end of this procedure.

e. Connect both a 200 MHz and a 100 MHz Rossi oscillator to the Rossi power supply and allow a few minutes for warm-up.

f. Connect the signal from the 200 MHz Rossi oscillator to the Direct Access Plug-In ROSSI INPUT connector.

g. Connect a 50Ω end-line 15 watt termination to the Direct Access Plug-In ROSSI OUTPUT connector.

h. To the Direct Access Plug-In SIGNAL OUTPUT connector, connect a 50Ω sampling system.

i. Set the Type RM544 ROSSI FREQUENCY switch to 200.

j. Set sampling system vertical sensitivity to 10 mV per division.

k. Remove the top cover of the DOT ROSSI COMPENSATION box. The top cover will have some affect upon the adjustments, particularly on the higher ranges. After making each adjustment, lay the cover back in place to check crosstalk.

l. Turn the INTENSITY control clockwise until a spot or horizontal line appears on the CRT.

m. Adjust the front panel ROSSI AMPLITUDE control for maximum horizontal deflection display on the CRT. The display may possess some vertical deflection which will be corrected later in this step.

n. Adjust the 200 MHz adjustments C1366 and C1367 for maximum horizontal amplitude. Readjust the ROSSI AMPLITUDE control (on the front panel) for maximum amplitude. If the display shows any vertical deflection, adjust one capacitor slightly and then readjust the other

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capacitor for maximum horizontal amplitude again. If the vertical deflection becomes larger, the first capacitor was turned the wrong direction. Continue adjusting the capacitors in the direction that the vertical deflection becomes smaller until both maximum horizontal amplitude and minimum vertical deflection are obtained. Keep the horizontal deflection on the Type RM544 small by adjusting the output amplitude of the Rossi generator.

o. Check the amount of signal in the vertical deflection system with the sampling system. There should not be more than 30 millivolts peak-to-peak vertical signal for a 2 div horizontal display on the Type RM544 CRT. Readjust the capacitors, if necessary, for minimum vertical deflection as seen on the sampling system and maximum horizontal deflection as seen on the RM544.

p. Lay the cover over the box and again check to see if the signal cross-coupling is within specifications.

q. Turn the ROSSI AMPLITUDE control to minimum.

r. Check for a decrease in vertical signal on the sampling oscilloscope as the control is turned towards minimum. If the vertical signal increases, it may be necessary to compromise the dot Rossi compensation adjustments between maximum amplitude and minimum signal transfer to the vertical.

s. In the following parts, apply a signal from the Rossi generator to correspond to the range being calibrated. Readjust the ROSSI AMPLITUDE control for a maximum horizontal display with each signal. However, do not readjust any adjustments in a range already calibrated.

t. Adjust the 100MHz adjustments C1364 and C1365, and the 80MHz adjustments C1361 and C1362, using the procedure given in parts l through r of this step.

u. Adjust the 50MHz adjustments C1359, and the 40MHz adjustments C1357, for maximum horizontal amplitude, using the procedure given in parts l through r of this step.

v. Adjust the 20MHz adjustment C1351, the 10MHz adjustment C1355, and the 5MHz adjustment C1353, in that order for maximum horizontal amplitude, using the procedure given in parts l through r of this step.

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w. Replace dot Rossi Compensation box cover, and swing vertical amplifier chassis into place; tighten down. Recheck all of the ranges to see that signal cross-coupling into the vertical system is within tolerance.

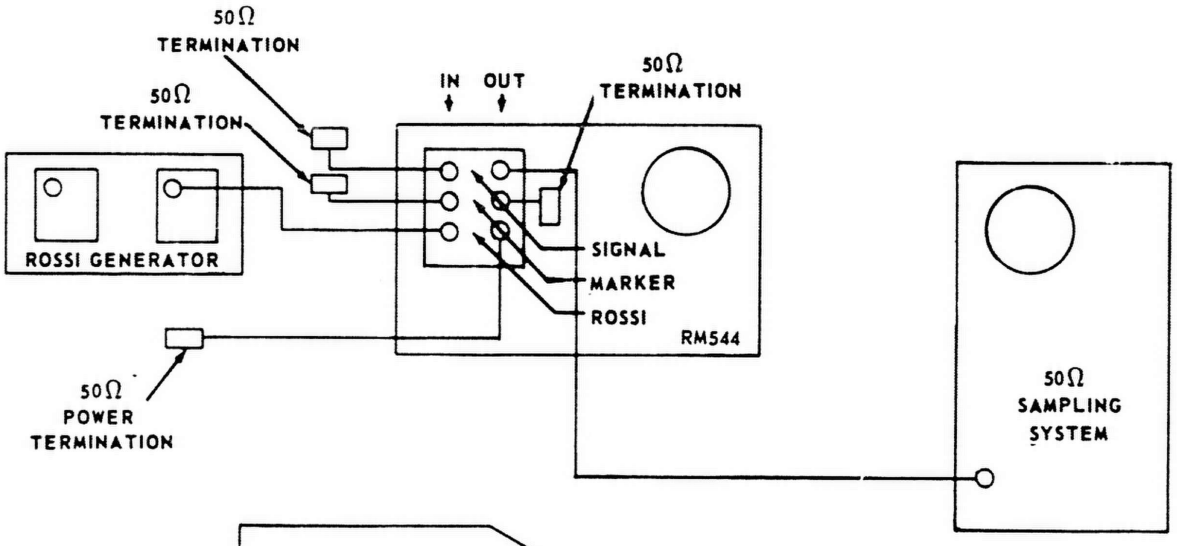
x. Disconnect the sampling system from the Direct Access Plug-In SIGNAL OUTPUT connector.

y. Connect a 50 ohm end-line termination to the Direct Access Plug-In SIGNAL OUTPUT connector.

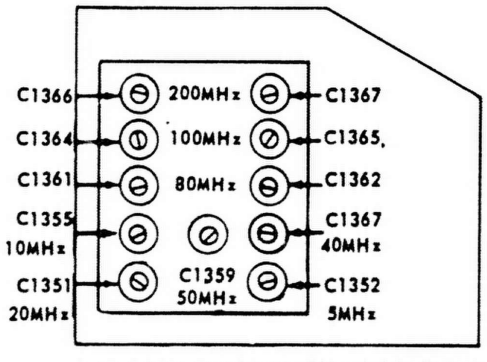
z. Remove the 50 ohm end-line termination from the Direct Access Plug-In MARKER OUTPUT connector and connect the 50 ohm sampling system to the connector.

aa. Recheck all ranges of the ROSSI FREQUENCY switch to check the amount of signal in the marker system with the sampling system. There should not be more than 50 millivolts peak-to-peak of vertical signal for a 2 div horizontal display on the Type RM544 CRT.

ab. If there is more than 50 millivolts of signal cross coupling on any range, repeat the adjustments for that range as described above.



DOT ROSSI EQUIPMENT SET-UP



DOT ROSSI COMPENSATION LOCATIONS

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DIRECT ACCESS PLUG-IN CALIBRATION

The following procedure should be used to calibrate the Direct Access Plug-In unit. For calibration, connect the deflection plate circuit for 12.5 V/div as shown in the schematic and install the plug-in unit in a Type RM544/MOD 720A(B) or Type RM546/MOD 6NP oscilloscope.

Equipment Required

1. Laboratory Oscilloscope - Tektronix Type RM544/MOD 720A(B) or Type RM546/MOD 6NP.

2. High-Impedance Voltmeter - Fluke Model 825A or equivalent.

3. Pulse Generator - Tektronix Type 109.

4. (2) Delay Cables - Tektronix Type 113.

5. 1 ns Risetime Integrator - EH Model 971-1 or equivalent.

6. 100X Voltage Probe - Tektronix P6035.

7. Voltage Pickoff - Tektronix VP-1 (017-0073-00).

8. Delay Line Compensator - Tektronix special accessory (035-2006-00).

9. (3) 50-ohm GR Terminations - (017-0081-00).

10. 20 ns length of RG213/U - (017-0504-00).

11. 10 ns length of RG58C/U - (017-0501-00).

12. (3) 5 ns lengths of RG213/U - (017-0502-00).

Procedure

1. With the power off, set the oscilloscope 12kV/24kV switch to 24kV.

2. Connect the high-impedance voltmeter from the front-panel test point (TP) to ground.

3. Switch MODE to VERT POSITION and set VERT POSITION to midrange.

4. Set NORM/AUTO RESET/NORM RESET switch to NORM RESET.

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5. Connect a cable from the CAL OUT connector to the rear-panel SINGLE SWEEP connector. Set the CALIBRATOR to 10 volts.

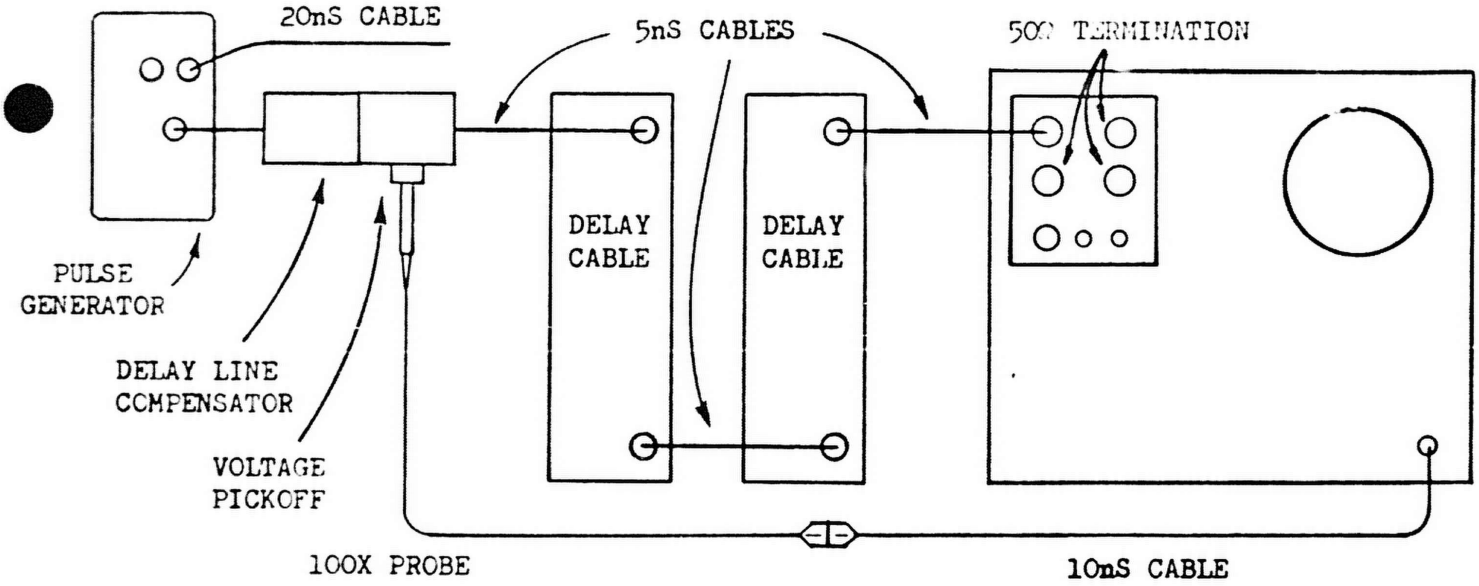
6. Turn the power on and allow approximately 90 seconds for the high voltage to stabalize.

7. Trigger the sweep on LINE. The trace should be near the center of the screen.

8. Press and hold the AVG DP POTENTIAL PUSH button while setting the ADJUST for +150 V ±0.25 V at the test point (TP).

9. Remove the high-impedance voltmeter and set oscilloscope Time-Base Triggering SOURCE to EXT.

10. Set the pulse generator Amplitude to 50 and Voltage Range to 50. Connect the 20 ns cable to one of the charge line connectors. Connect the output, through the delay line compensator, voltage pickoff, and delay cables, to the SIGNAL IN connector, Terminate the SIGNAL OUT, MARKER IN, and MARKER OUT connectors in 50 ohms. Connect a 100X probe from the voltage pickoff to the TRIG IN connector, using a 10 ns cable.



11. Turn the pulse generator on and adjust sweep triggering for a stable display.

12. Adjust C1204 and C1206 (located at the CRT pickoff) for best looking waveform. Aberrations should be 10% or less, peak to peak.

13. Disconnect the cable from the SIGNAL IN connector and connect the Risetime Integrator between the cable and the connector.

14. Check for aberrations of 5% or less on the waveform.

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SECTION 6
PARTS LIST CHANGES

The following changes should be ade to the appropriate parts list for this modified instrument. When ordering replacement parts, specify instrument type, MOD number, and serial number. Include the circuit number, part number, and description of the desired item.

Values are fixed unless marked Variable.

BULBS

B601	Add	150-0040-00	NE-2H	FUSE OUT
B605	Add	150-0040-00	NE-2H	OVER TEMP
B837	Add	150-0030-00	NE-2V	12 kV MODE
B839	Add	150-0030-00	NE-2V	24 kV MODE
B1267	Add	150-0028-00	RT 2-32-1A	

CAPACITORS

C203	Add	281-0503-00	8pF	500V	cer
C205	Delete				
C221	Add	283-0000-00	.001μF	500V	disc
C223	Add	283-0000-00	.001μF	500V	disc
C256	Change	281-0620-00	21pF	500V	cer
C257	Change	281-0620-00	21pF	500V	cer
C369	Delete				
C804	Add	285-0537-00	0.5μF	400V	PTM
C805	Add	283-0059-00	1μF	25V	cer
C807	Add	283-0000-00	.001μF	500V	cer
C809	Add	290-0106-00	10μF	15V	EMT
C811	Add	290-0244-00	0.47μF	25V	tant
C812	Add	290-0136-00	2.2μF	20V	tant
C819	Add	283-0101-01	.0047μF	6kV	cer
C820	Change	283-0101-01	.0047μF	6kV	cer
C821	Change	283-0071-00	.0068μF	5kV	cer
C823	Change	281-0556-00	500pF	10kV	cer
C829	Change	283-0071-00	.0068μF	5kV	cer
C830	Change	283-0071-00	.0068μF	5kV	cer
C831	Add	283-0071-00	.0068μF	5kV	cer
C833	Change	283-0152-00	360pF	20kV	cer
C834	Change	283-0152-00	360pF	20kV	cer
C836	Change	283-0153-00	240pF	30kV	cer
C842	Change	283-0101-01	.0047μF	6kV	cer
C843	Change	283-0101-01	.0047μF	6kV	cer
C852	Change	283-0101-01	.0047μF	6kV	cer
C853	Add	283-0101-01	.0047μF	6kV	cer

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C854	Change	283-0071-00	.0068μF	5kV	cer
C858	Change	283-0071-00	.0068μF	5kV	cer
C861	Add	283-0008-00	0.1μF	500V	cer
C865	Add	281-0630-00	390pF	500V	cer
C868	Add	283-0000-00	.001μF	500V	cer
C871	Add	283-0002-00	.01μF	500V	cer
C874	Add	283-0000-00	.001μF	500V	cer
C1103	Change	281-0600-00	35pF	500V	cer
C1202	Add	283-0026-00	0.2μF	25V	cer
C1205	Add	281-0518-00	47pF	500V	cer
C1252	Add	290-0285-00	4μF	200V	EMT
C1253	Add	290-0184-00	4μF	150V	EMT
C1260	Add	290-0305-00	3μF	150V	EMT
C1266	Add	283-0008-00	0.1μF	500V	disc
C1267	Add	283-0008-00	0.1μF	500V	disc
C1280	Add	283-0002-00	.01μF	500V	disc
C1282	Add	283-0002-00	.01μF	500V	disc
C1301	Add	283-0000-00	.001μF	500V	disc
C1302	Add	281-0529-00	1.5pF	500V	cer
C1303	Add	283-0000-00	.001μF	500V	disc
C1304	Add	281-0099-00	1.3-5.4pF		var, air
C1305	Add	281-0099-00	1.3-5.4pF		var, air
C1306	Add	281-0604-00	2.2pF	500V	cer
C1311	Add	283-0000-00	.001μF	500V	disc
C1313	Add	283-0000-00	.001μF	500V	disc
C1322	Add	281-0529-00	1.5pF	500V	cer
C1349	Add	281-0629-00	33pF	500V	cer
C1350	Add	281-0018-00	2.3-14.2pF		var, air
C1351	Add	281-0093-00	5.5-18pF		var
C1352	Add	281-0543-00	270pF	500V	cer
C1353	Add	281-0092-00	9-35pF		var
C1354	Add	281-0519-00	47pF	500V	cer
C1355	Add	281-0092-00	9-35pF		var
C1356	Add	281-0574-00	82pF	500V	cer
C1357	Add	281-0092-00	9-35pF		var
C1358	Add	281-0519-00	47pF	500V	cer
C1359	Add	281-0092-00	9-35pF		var
C1360	Add	281-0620-00	21pF	500V	cer
C1361	Add	281-0100-00	1.4-7.3pF		var
C1362	Add	281-0100-00	1.4-7.3pF		var
C1363	Add	281-0621-00	12pF	500V	cer
C1364	Add	281-0100-00	1.4-7.3pF		var
C1365	Add	281-0100-00	1.4-7.3pF		var
C1366	Add	281-0098-00	1.2-3.5pF		var
C1367	Add	281-0098-00	1.2-3.5pF		var
C1368	Add	281-0504-00	10pF	500V	cer
C1369	Add	281-0504-00	10pF	500V	cer
C1370	Add	281-0626-00	3.3pF	500V	cer

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DIODES

D203	Add	152-0061-01	Sil, Tek Spec
D204	Add	152-0022-01	Zener, 25V
D205	Add	152-0066-01	1N3194
D206	Add	152-0066-01	1N3194
D643	Add	152-0066-00	Silicon, 1N3194
D801	Add	152-0107-00	Silicon
D802	Add	152-0107-00	Silicon
D804	Change	152-0282-00	Zener, 1N972B, 30V
D805	Add	152-0107-00	Silicon
D812	Add	152-0234-00	Zener, 1N965B, 15V
D822	Add	152-0218-00	Silicon, 10kV
D832	Add	152-0336-00	Silicon, 15kV
D842	Add	152-0336-00	Silicon, 15kV
D852	Add	152-0336-00	Silicon, 15kV
D862	Add	152-0218-00	Silicon, 10kV
D865	Add	152-0107-00	Silicon, 1N647
D866	Add	152-0107-00	Silicon, 1N647
D867	Add	152-0107-00	Silicon, 1N647
D868	Add	152-0190-00	Zener, 47V
D869	Add	152-0283-00	Zener, 43V
D870	Add	152-0107-00	Silicon, 1N647
D1201	Add	152-0141-00	Silicon, 1N3605
D1202	Add	152-0104-00	Zener, 1N3016A, 6.8V
D1205	Add	152-0125-00	Tunnel, TD3A (Sel), 4.7mA
D1209	Add	152-0075-00	Germanium, Tek Spec
D1252	Add	152-0066-00	Silicon, 1N3194
D1260	Add	152-0061-00	Silicon, Tek Spec
D1261	Add	152-0061-00	Silicon, Tek Spec
D1262	Add	152-0107-00	Silicon, Tek Spec
D1265	Add	152-0061-00	Silicon, Tek Spec
D1266	Add	152-0107-00	Silicon, Tek Spec
D1267	Add	152-0107-00	Silicon, Tek Spec
D1268	Add	152-0061-00	Silicon, Tek Spec
✱ D1280	Add	152-0066-01	1N3194

INDUCTORS

FL1300	Add	119-0090-00	Filter, 230V AC
L812	Add	108-0358-00	Coil, Reed Drive
L1300	Add	037-2040-00	.01μH
L1301	Add	037-2040-00	.01μH
L1302	Add	037-2040-00	.01μH
L1303	Add	037-2040-00	.01μH
L1304	Add	037-2040-00	.01μH
LR1304	Add	037-2041-00	0.5μH wound on 130Ω
L1350	Add	108-0471-00	15.5μH and 45μH
L1351	Add	108-0231-00	4.5μH
L1352	Add	108-0231-00	4.5μH

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RELAYS

K1255	Add	148-0038-00	Arming
K1280	Add	148-0038-00	Camera

RESISTORS

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

R202	Add	316-0104-00	100k	1/4w	10%	
R203	Add	321-0452-00	499k	1/8w	1%	prec
R205	Change	315-0684-00	680k	1/4w	5%	
R208	Add	316-0473-00	47k	1/4W		
R212	Add	311-0697-00	1M	var	Preset Trigger	
R215	Change		250k	var	Triggering Level	
R216	Change	316-0333-00	33k	1/4W		
R217	Change	315-0155-00	1.5M	1/4W	5%	
R220	Change	316-0102-00	1k	1/4W		
R222	Change	316-0102-00	1k	1/4W		
R246	Change	308-0301-00	10k	3W	1%	WW
R284	Change	304-0133-00	13k	2W	5%	
R366	Change	316-0223-00	22k	1/4W		
R367	Delete					
R368	Delete					
R369	Delete					
R530A	Change	311-0342-00	50k	var, 10-turn		
R530B	Delete					
R531	Change	323-0364-00	60.4k	1/2W	1%	prec
R533	Delete					
R545	Change	323-0276-00	7.32k	1/2W	1%	prec
R600	Add	302-0823-00	82k	1/2W		
R602	Add	302-0823-00	82k	1/2W		
R737	Change	308-0033-00	4.5k	20W	5%	WW
R778*	Change	037-0022-00	2 x 50	var	Trace Rotation	
R779	Add	302-0470-00	47Ω	1/2W		
R801	Add	302-0106-00	10M	1/2W		
R803	Change	306-0683-00	68k	2W	5%	
R805	Add	302-0104-00	100k	1/2W		
R808	Add	302-0102-00	1k	1/2W		
R809	Add	302-0123-00	12k	1/2W		
R810	Add	304-0274-00	270k	1W		
R811	Add	302-0272-00	2.7k	1/2W		
R812	Add	308-0211-00	12k	5W		
R813	Add	302-0123-00	12k	1/2W		
R822	Delete					
# R807	Change	301-0272-00	2.7k	1/2w	5%	

*R778 furnished as a unit with R861.

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RESISTORS (Cont.)

R823	Add	316-0222-00	2.2k	1/4W
R824	Change	306-0106-00	10M	2W
R825	Change	306-0106-00	10M	2W
R826	Change	311-0583-00	2M	var Intensity
R829	Add	302-0106-00	10M (sel for max Intensity range)	1/2W
R830	Change	301-0334-00	330k	1/2W 5%
R833	Add	304-0825-00	8.2M	1W
R834	Add	311-0075-00	5M	var 24kV Intensity Limit
R835	Add	306-0825-00	8.2M	2W 5%
R836	Change	302-0105-00	1M	1/2W
R837	Add	316-0224-00	220k	1/4W
R838	Add	311-0044-00	5M	var 24kV Adjust
R839	Add	301-0395-00	3.9M	1/2W 5%
R840	Change	311-0042-00	2M	var 12kV Adjust
R841	Change	302-0475-00	4.7M	1/2W
R843	Change	303-0395-00	3.9M	1W 5%
R844	Add	303-0335-00	3.3M	1W 5%
R845	Change	302-0186-00	18M	1/2W
R846	Change	311-0837-00	5M	var Focus
R847	Change	302-0105-00	1M	1/2W
R848	Add	303-0395-00	3.9M	1W 5%
R849	Add	316-0222-00	2.2k	1/4W
R850	Add	316-0222-00	2.2k	1/4W
R851	Add	316-0222-00	2.2k	1/4W
R852	Add	316-0222-00	2.2k	1/4W
R853	Change	316-0103-00	10k	1/4W
R854	Add	302-0153-00	15k	1/2W
R855	Add	302-0153-00	15k	1/2W
R861*	Change	037-0022-00	100k	var Geometry
R864	Change	311-0026-00	100k	var Astigmatism
R865	Add	301-0332-00	3.3k	1/2W 5%
R866	Add	302-0224-00	220k	1/2W
R867	Add	306-0393-00	39k	2W
R868	Add	302-0154-00	150k	1/2W
R869	Add	302-0104-00	100k	1/2W
R870	Add	316-0101-00	100Ω	1/4W
R871	Add	316-0331-00	330Ω	1/4W
R872	Add	302-0104-00	100k	1/2W
R873	Add	316-0101-00	100Ω	1/4W
R874	Add	302-0474-00	470k	1/2W

*R861 furnished as a unit with R778.

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RESISTORS (Cont.)

R1201	Add	302-0182-00	1.8k	1/2W		
R1202	Add	306-0822-00	8.2k	2W		
R1203	Add	302-0561-00	560Ω	1/2W		
R1204	Add	311-0086-00	2.5k	var	Trigger Cal	
R1205	Add	323-0193-00	1k	1/2W	1%	prec
R1206	Add	316-0123-00	12 k	1/4W		
R1207	Add	316-0224-00	220k	1/4W		
R1208	Add	316-0271-00	270k	1/4W		
R1209	Add	302-0102-00	1k	1/2W		
R1252	Add	316-0102-00	1k	1/4W		
R1253	Add	303-0563-00	56k	1W	5%	
R1254	Add	302-0101-00	100Ω	1/2W		
R1255	Add	302-0101-00	100Ω	1/2W		
R1256	Add	316-0272-00	2.7k	1/4W		
R1257	Add	316-0822-00	8.2k	1/4W		
R1258	Add	301-0473-00	47k	1/2W	5%	
R1259	Add	316-0472-00	4.7k	1/4W		
R1260	Add	316-0472-00	4.7k	1/4W		
R1261	Add	302-0224-00	220k	1/2W		
R1262	Add	316-0104-00	100k	1/4W		
R1263	Add	316-0333-00	33k	1/4W		
R1264	Add	316-0563-00	56k	1/4W		
R1265	Add	316-0102-00	1k	1/4W		
R1266	Add	316-0126-00	12M	1/4W		
R1267	Add	315-0394-00	390k	1/4W	5%	
R1268	Add	316-0104-00	100k	1/4W		
R1280	Add	308-0441-00	3Ω	3W	5%	WW
R1281	Add	308-0313-00	20k	3W	1%	WW
R1282	Add	308-0441-00	3Ω	3W	5%	WW
R1303	Add	321-0097-00	100Ω	1/8W	1%	prec
R1304	Add	316-0274-00	270k	1/4W		
R1305	Add	321-0289-00	10k	1/8W	1%	prec
R1306	Add	311-0028-00	2 x 100k	var	Vert Position	
R1307	Add	311-0110-00	100k	var		
R1309	Add	301-0823-00	82k	1/2W	5%	
R1311	Add	321-0051-00	33.2Ω	1/8W	1%	prec
R1313	Add	321-0051-00	33.2Ω	1/8W	1%	prec
R1314	Add	316-0274-00	270k	1/4W		
R1315	Add	321-0289-00	10k	1/8W	1%	prec
R1317	Add	301-0104-00	100k	1/2W	5%	

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RESISTORS (Cont.)

R1318	Add	321-0105-00	121Ω	1/8W	1%	prec
R1319	Add	321-0068-00	49.9Ω	1/8W	1%	prec
R1320	Add	315-0200-00	20Ω	1/4W	5%	
R1321	Add	315-0200-00	20Ω	1/4W	5%	
R1322	Add	321-0097-00	100Ω	1/8W	1%	prec
R1331	Add	316-0102-00	1k	1/4W		
R1332	Add	316-0102-00	1k	1/4W		
R1333	Add	315-0333-00	33k	1/4W	5%	
R1334	Add	315-0683-00	68k	1/4W	5%	
R1341	Add	308-0096-00	500Ω	20W	5%	WW
R1350	Add	302-0471-00	470Ω	1/2W		
R1351	Add	302-0152-00	1.5k	1/2W		
R1352	Add	302-0471-00	470Ω	1/2W		
R1353	Add	302-0152-00	1.5k	1/2W		

SWITCHES

SW135	Delete			
SW215	Change	260-0475-00	lever	Preset/Norm/10X Norm
SW290	Change	260-0909-00	rotary	Time/Div
SW369	Delete			
SW530	Change	260-0911-00	rotary	Horizontal Display
SW808	Add	260-0721-00	reed	
SW865	Add	260-0910-00	rotary	12kV/24kV Mode
SW1256	Add	260-0247-00	push	Norm Reset
SW1261	Add	260-0798-00	lever	Norm/Auto Reset/Norm Reset
SW1300	Add	030-0132-00	rotary	Mode (Vertical)
SW1350	Add	260-0912-00	rotary	Rossi Frequency

TRANSFORMERS

T801	Change	120-0519-00	H.V. Power
T859	Add	120-0518-00	Filament Isolation
T1208	Add	120-0278-00	
T1350	Add	120-0516-00	Rossi Coupling, Lower Frequency
T1351	Add	120-0517-00	Rossi Coupling, Higher Frequency

TRANSISTORS

Q801	Add	151-1004-00	Field Effect, Tek Spec
Q802	Add	151-0150-00	2N3440
Q865	Add	151-0214-00	2N3495
Q1208	Add	151-0108-00	2N2501
Q1260	Add	151-0150-00	2N3440
Q1261	Add	151-0150-00	2N3440

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TUBES

V822	Delete		
V832	Delete		
V842	Delete		
V852	Delete		
V859	Change	037-0045-00	CRT
V862	Delete		
V871	Add	154-0187-00	6DJ8

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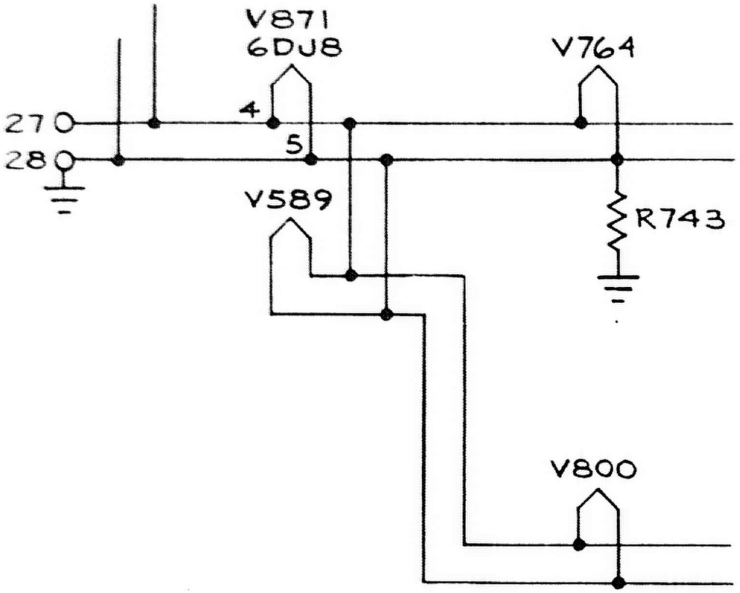
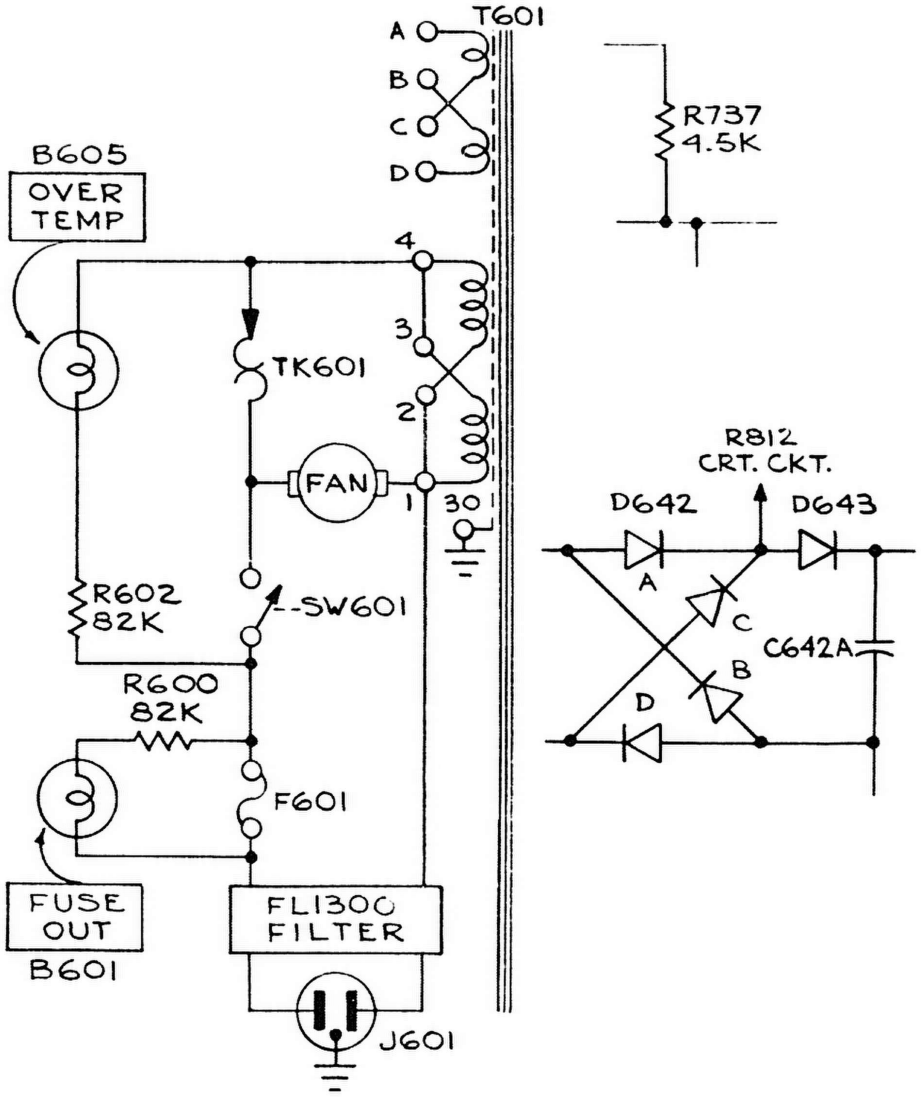


PART. HEATER WIRING

RM544-MOD 720A



PART. POWER SUPPLY

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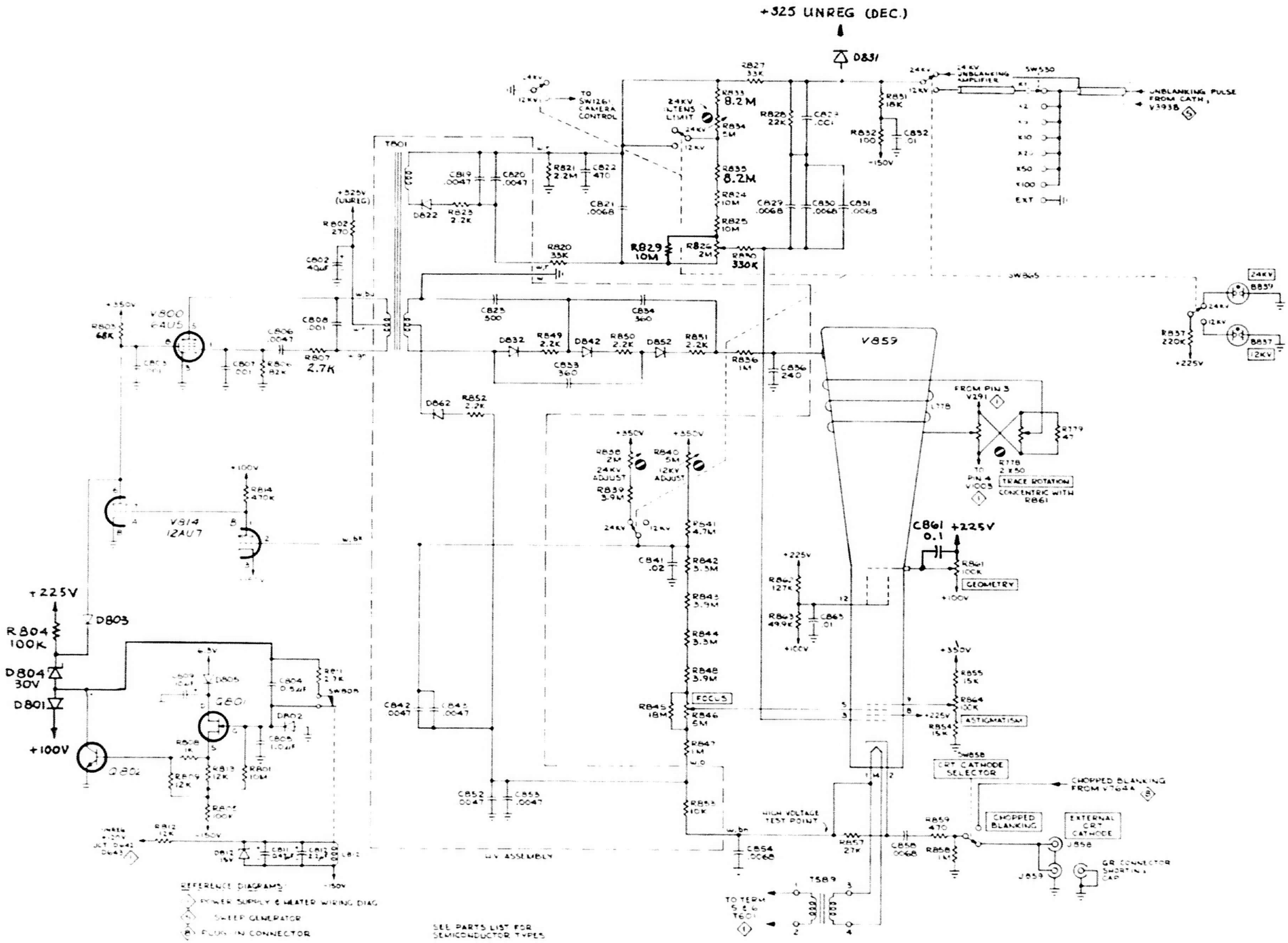

TYPE RM544 OSCILLOSCOPE
MOD 720A

CRT CIRCUIT

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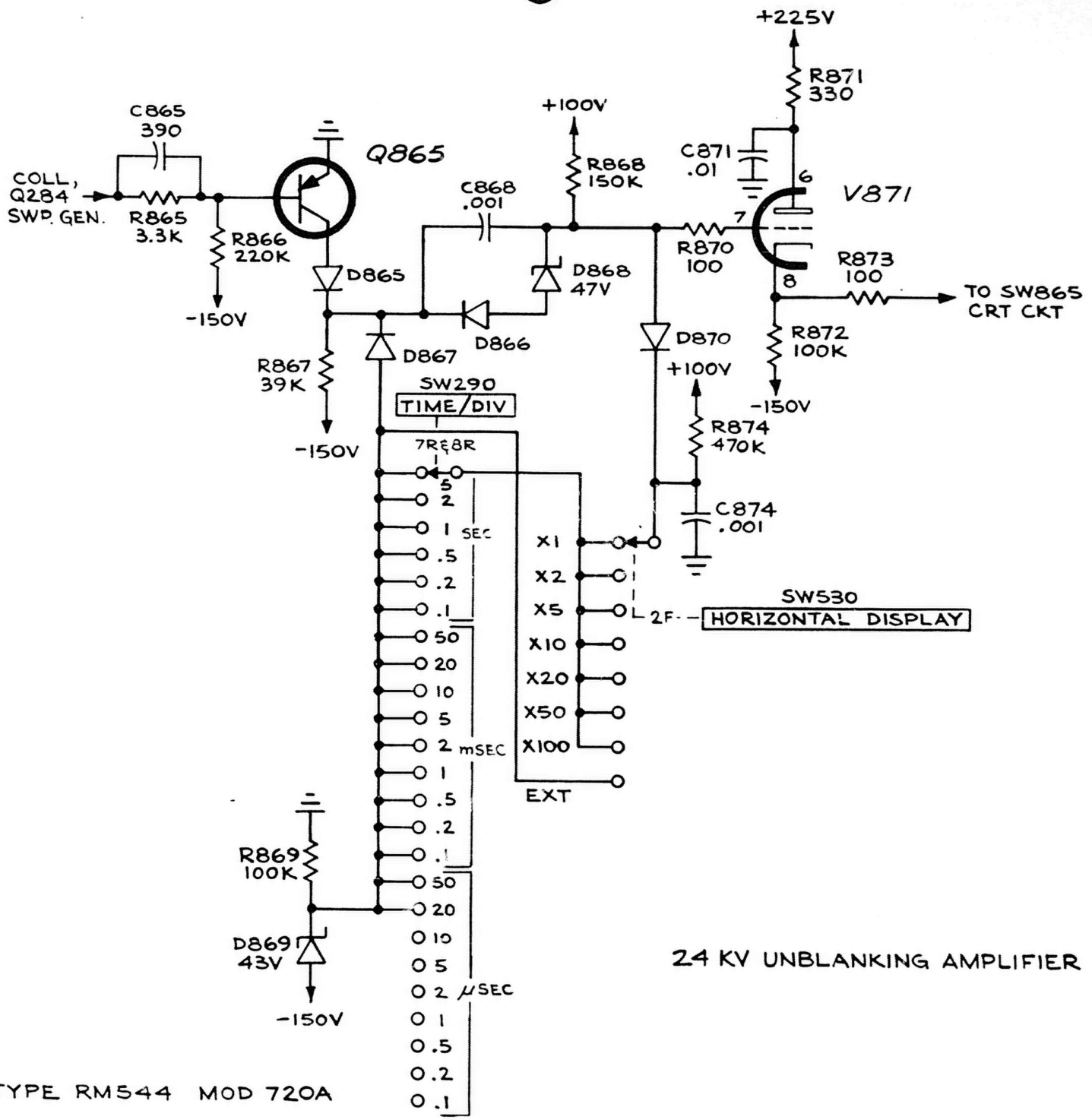

24 KV UNBLANKING AMPLIFIER

TYPE RM544 MOD 720A

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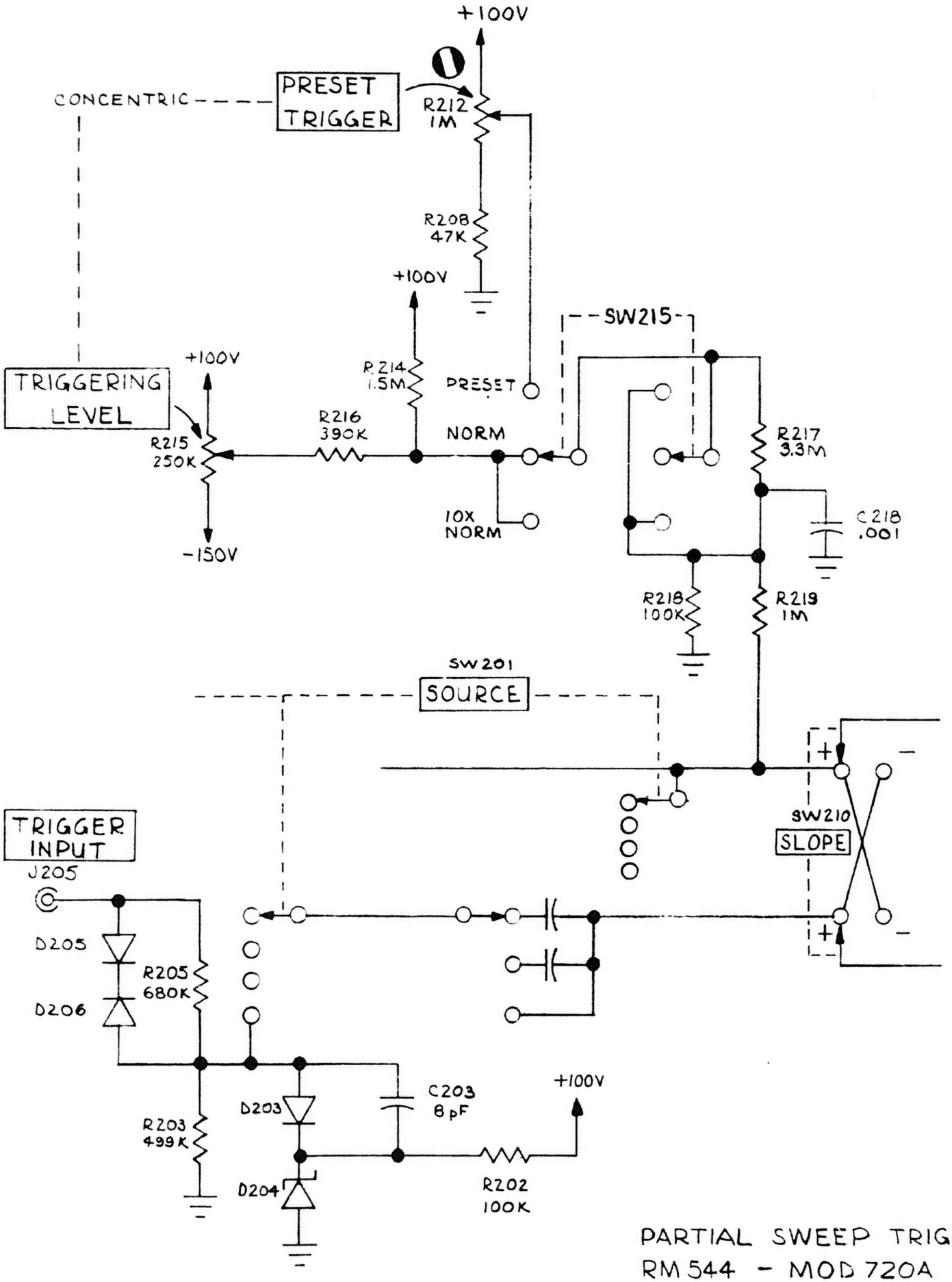

PARTIAL SWEEP TRIGGER
RM 544 - MOD 720A

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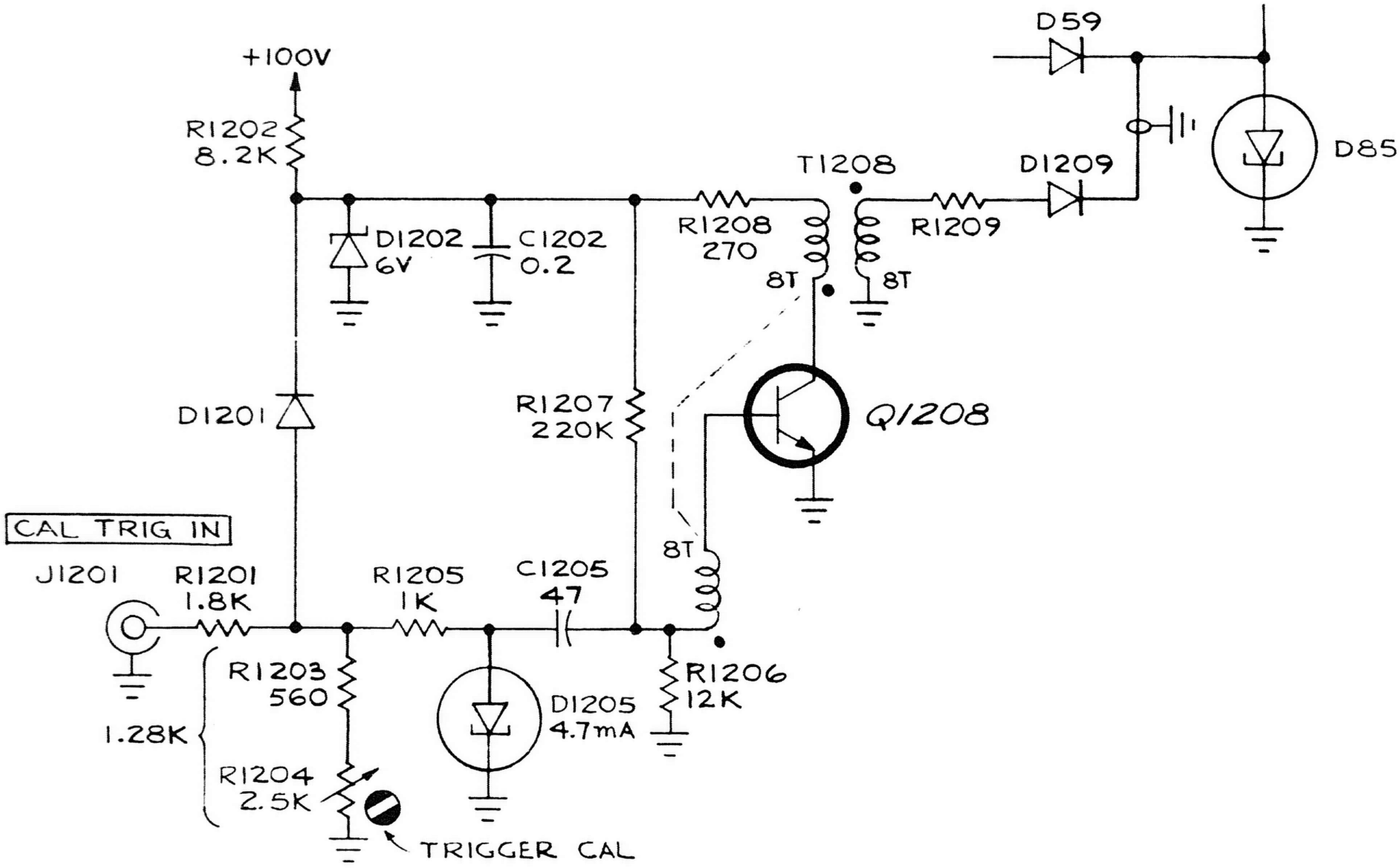

RM544 MOD 720A CAL TRIGGER

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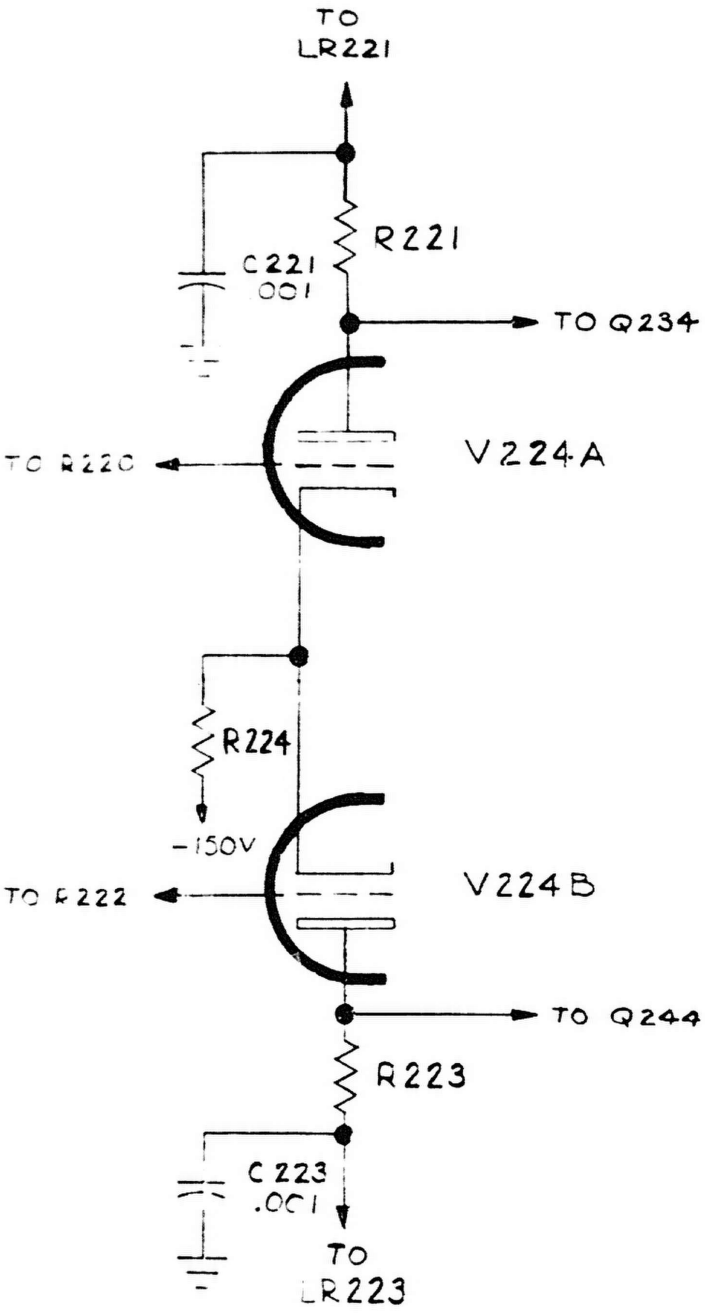
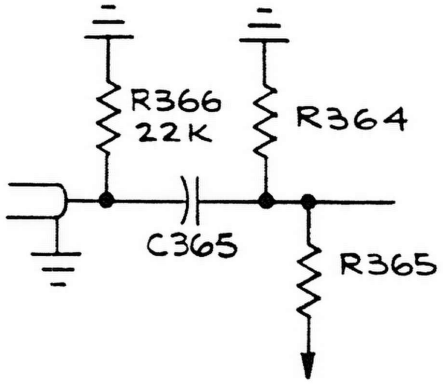


PARTIAL SWEEP TRIGGER



PARTIAL SWEEP GENERATOR

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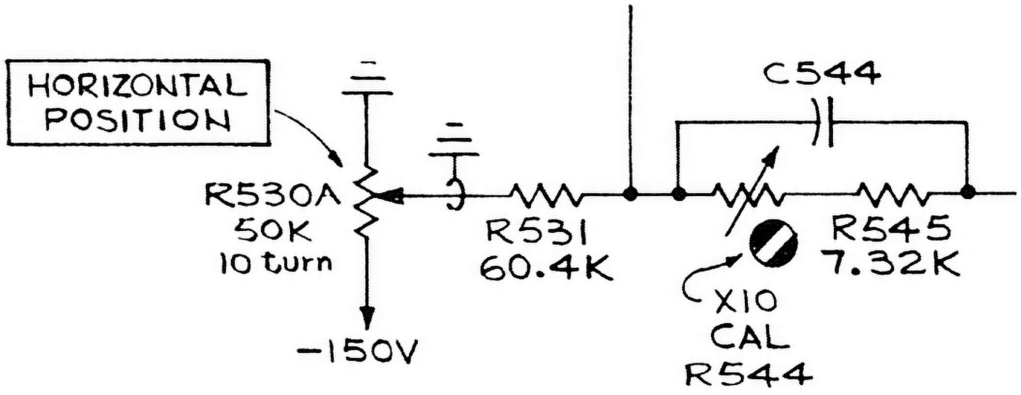
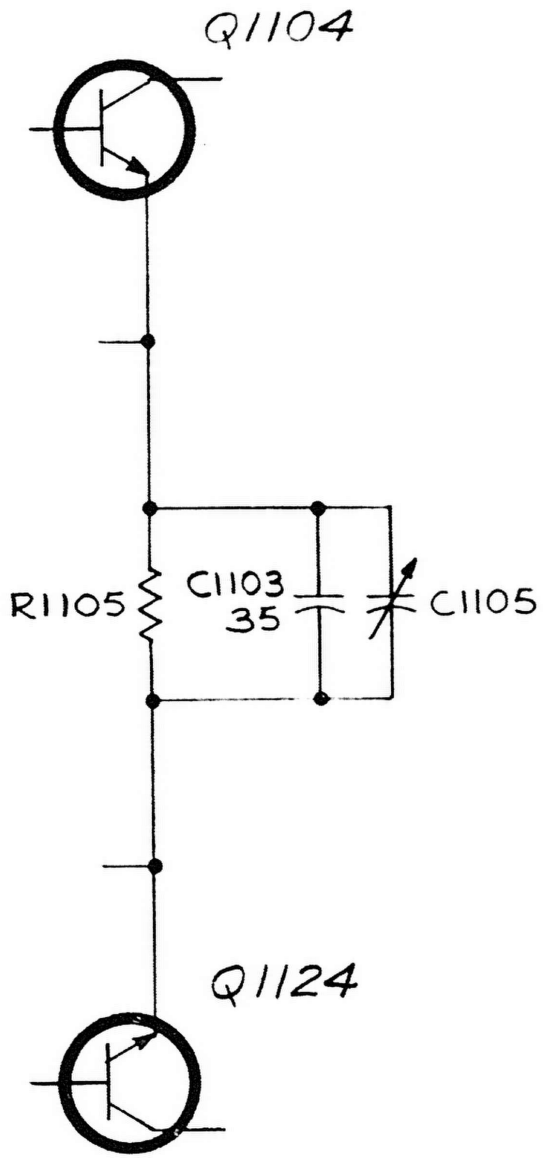


PART. HORIZ. AMP.



PART. VERT. AMP.

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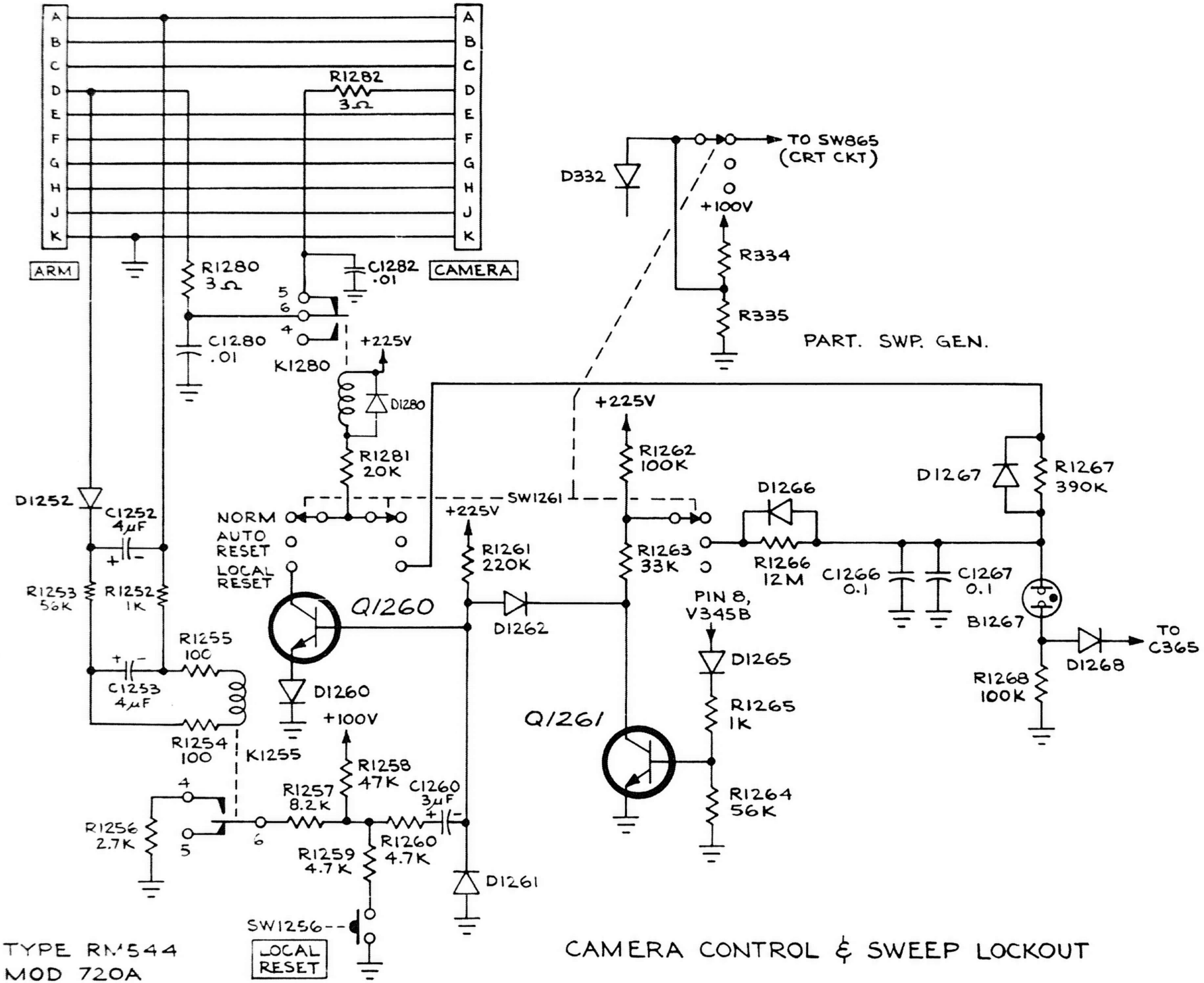

TYPE RM544
MOD 720A

CAMERA CONTROL & SWEEP LOCKOUT

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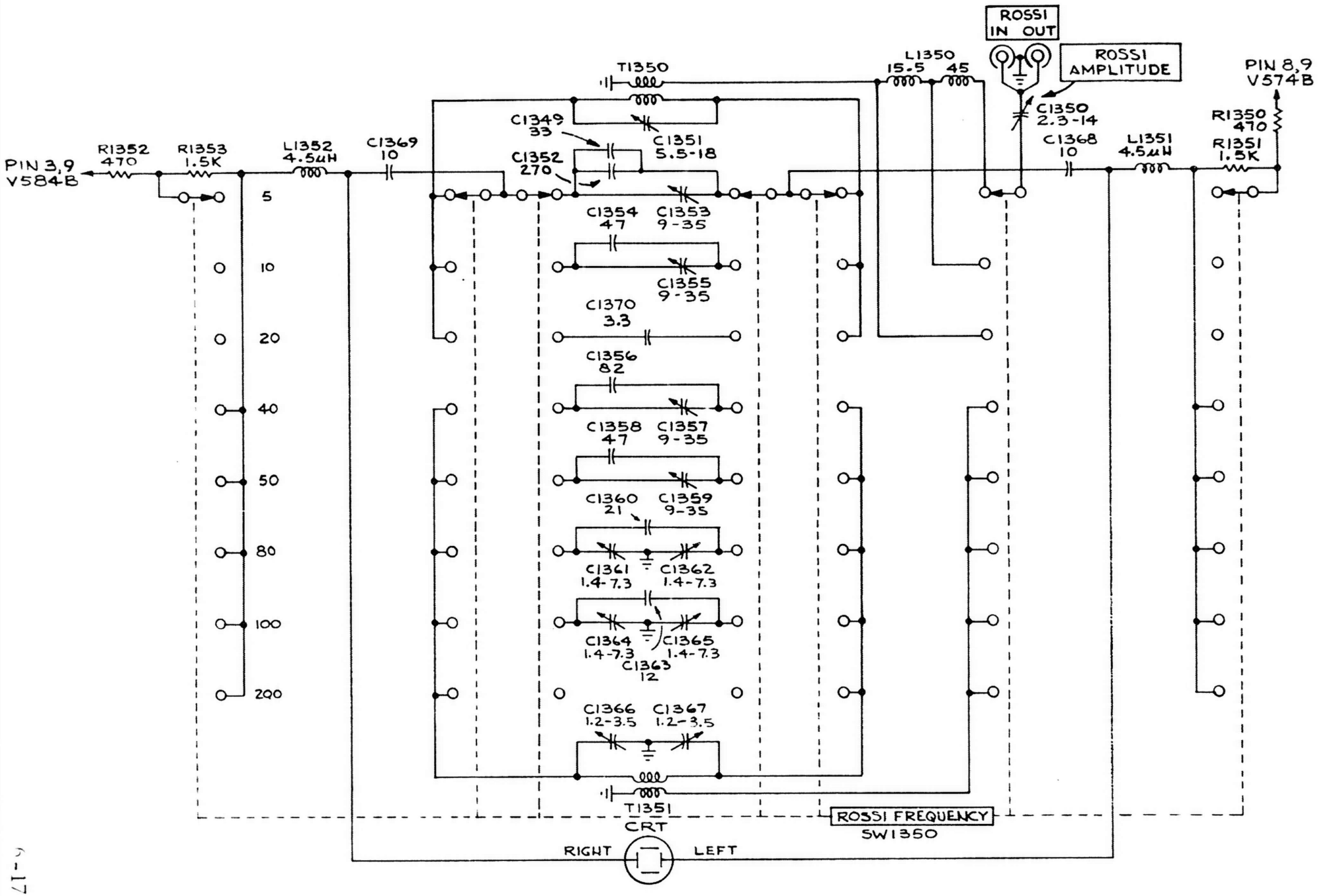

RM544 - MOD 720A

DOT ROSSI COMPENSATION

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MODIFIED PRODUCTS

Product	Mod	Description
544	101N	50-800 Hz power line.
544	172Z	Provides external grat & blank face CRT.
544	211N	12/24 k GR connectors, direct, etc.
544	811S	2 BNC changed to UHF.
RM544	720A	High intensity, fast writing rate.

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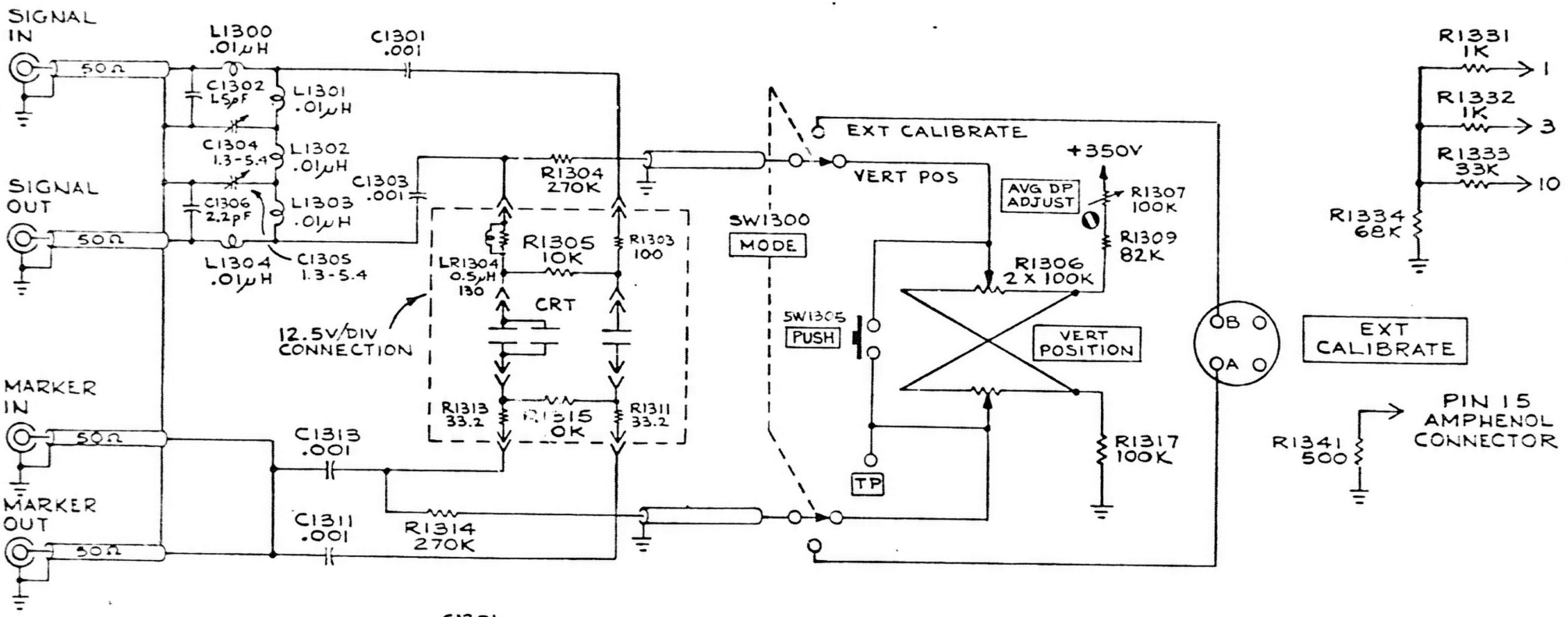

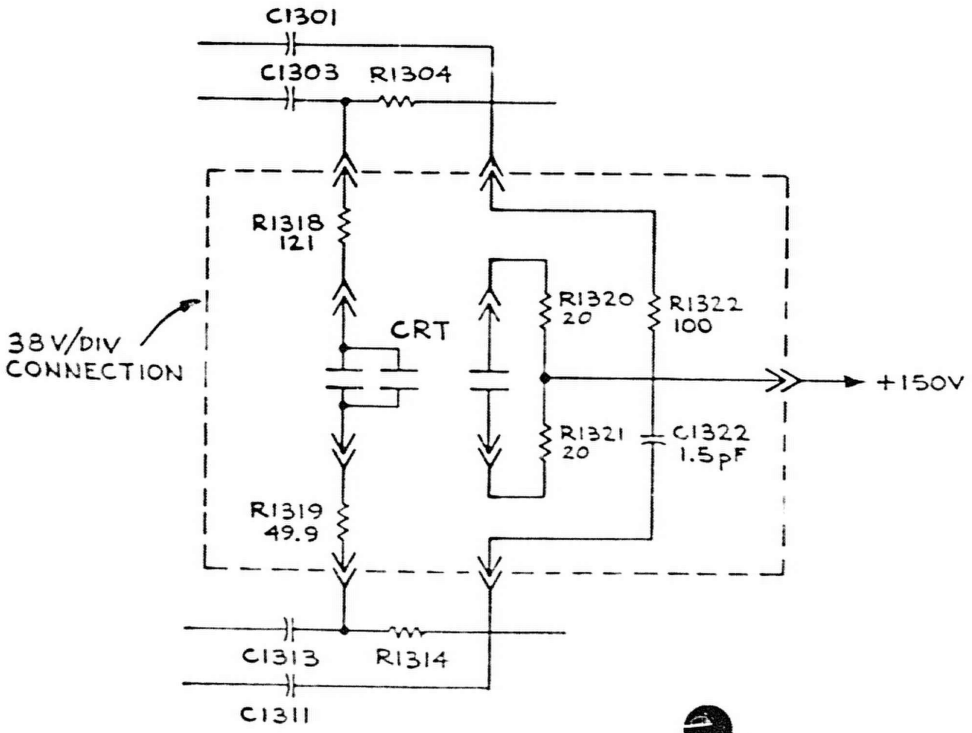

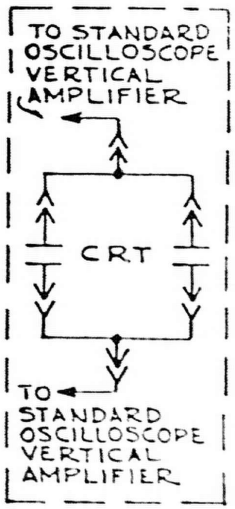

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