

The timing capacitor, C99, which is connected between these two points, therefore has only about 1.7 volts of charge.

The grid of cathode-follower V85 is connected to the plate of Miller tube V90 through neon glow tube B95. The grid of V90 therefore follows the plate changes of V90 but remains 55 volts below the plate. C95, R95 is a network around B95 to improve the risetime.

The -3.3-volt bias on the grid of V90 places the tube in the class-A region of its operating characteristic, where the plate-to-cathode voltage is inversely proportional to the grid-to-cathode voltage. The negative step from multivibrator to the plates of diodes V80A and V80B lowers the plates below their cathodes, and they no longer conduct. The Miller-tube grid, and plate-coupling cathode follower, are thus released to seek their own voltage levels. The grid of Miller tube V90, which is returned to -150 volts through R99, starts negative. When the grid starts negative the plate starts positive carrying cathode-follower V85 grid and cathode positive. This raises the top end of charging capacitor C99 positive which thus tends to prevent the Miller tube grid from going negative.

The gain of the Miller tube as a class-A amplifier is so high that the plate signal coupled back through charging capacitor C99 keeps the grid voltage constant within a fraction of a volt. Meanwhile, C99 is charging with current flowing through R99 from the -150-volt bus. Since the grid of V90 remains constant within a fraction of a volt, the current through R99 remains constant, and C99 thus charges at a constant rate. As C99 charges, the voltage of the upper end therefore rises linearly. Any departure from a linear rise of the cathode of cathode-follower coupler V85 will result in a change in grid voltage in the direction that will produce a change in plate voltage the right amount to correct the departure.

The linear rise of the cathode of V85 is used as the sweep sawtooth. Charging capacitor C99 is selected by means of a step switch, SW55, labeled TIME/CM on the front panel. Charging resistor R99 is also selected by a step switch so that both the size of the capacitor being charged and the current charging the capacitor can be selected to cover a wide range of sawtooth slopes.

The cathode of V85 continues to rise linearly until a positive step from multivibrator V70 returns the disconnect-diode plates back to their quiescent state, which raises the Miller tube grid. When the Miller tube grid rises, its plate drops carrying cathode-follower V85 with it until its cathode clamps again through V80B at the quiescent level of -5 volts.

Sweep Length

The positive step from multivibrator V70 occurs when a positive step is delivered to the grid of multivibrator V58A. The sawtooth to the multivibrator is delivered through cathode followers V54A and V54B from a tap on the cathode-load resistor of coupling cathode follower V85. This tap is adjustable by means of potentiometer R88, labeled SWEEP LENGTH on the chassis, a screwdriver adjustment. When the voltage of this tap is properly set the sawtooth will terminate when the spot has passed the right-hand limit of the cathode-ray screen. C54 and C56 on the grid of V54A retard the return of V58A grid to the quiescent level after the passage of the positive pulse. This holds off any trigger signals from retriggering the multivibrator until all other capacitances in the circuit have had time to reach their quiescent voltage levels. Proper sizes of capacitor C54 are switched with the TIME/CM switch so that more recovery time is permitted for the slower sweeps and the least necessary recovery time is allowed for the faster sweeps.

Sync Amplifier

Synchronizing pulses for plug-in units are supplied by V78. When the negative multivibrator, V70, generates its positive plate step, it also generates a sharp differentiated positive trigger voltage at its screen, because of L72 and damping resistor R72 which connect the screen to +100 volts. The positive screen trigger pulse is coupled to the grid of V78 through C78. Grid bias of about -7 volts is set by divider R78, R79, between ground and -150 volts. Plate voltage and cathode return circuits are completed in the plug-in unit. The negative plate pulse is used for synchronizing the dual-trace unit.

Horizontal-Display Switch

The HORIZONTAL DISPLAY switch has seven sections that select the source of signal to the

