

DUAL-TRACE CALIBRATED PREAMP TYPE 53/54C

INSTRUCTION MANUAL



TEKTRONIX, INC.

MANUFACTURERS OF CATHODE-RAY AND VIDEO TEST INSTRUMENTS

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GENERAL DESCRIPTION

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The Type 53/54C Dual-Trace Unit contains two identical amplifier channels that can be electronically switched either by the oscilloscope sweep or at a free-running rate of approximately 100 kc. When amplifier switching is triggered by the oscilloscope sweep, the two signals to be compared appear on alternate sweeps. Because the sweeps are identical, and time-delay characteristics of the two amplifier channels are closely controlled, time comparisons accurate within 1 μ sec can be made.

Stationary display of two signals unrelated in frequency can be accomplished by internal triggering of the sweep alternately by the two signals. In free-running operation, switching occurs at a rate of approximately 100 kc, making it possible to view two simultaneous transients. Transients of as little as one-millisecond duration can be well delineated, with about one hundred elements in each trace. For many purposes, shorter transients can be adequately observed.

Either amplifier channel can be used separately without electronic switching, making the Type 53/54C also useful in all single-trace applications within its frequency-response and sensitivity capabilities. Maximum flexibility is obtained by providing separate positioning, sensitivity, and polarity-inverting controls for each channel.

TYPE 53/54C SPECIFICATIONS

Operating Modes

The two amplifier channels can be displayed alternately at a rate of approximately 100 kc, alternately every other sweep, or either channel can be used separately.

Amplifier Sensitivity

Basic deflection factor — .05 v/cm, ac or dc.

Nine calibrated sensitivities — .05 v/cm to 20 v/cm, accurate within 3% when set on any one step.

Amplifier Transient Response

With 541 or 545, rise time .015 μ sec.

With 531 or 535, rise time .032 μ sec.

With 532, rise time .070 μ sec.

Amplifier Frequency Response

With 541 or 545, 3 db down at approximately 24 mc.

With 531 or 535, 3 db down at approximately 11 mc.

With 532, 3 db down at approximately 5 mc.

Input Impedance

1 megohm shunted by 20 μ f; with P410 probe 10 megohms, 7.5 μ f

Physical Characteristics

Construction — Aluminum alloy chassis. Finish — Photo-etched anodized panel. Weight — 4½ lbs.

FUNCTIONS OF CONTROLS AND CONNECTORS

CHANNEL A CHANNEL B	Signal input to the A-channel or B-channel amplifier.
DC — AC	Slide switch to provide either ac or dc coupled input into the amplifiers.
VOLTS/CM	Nine-position switch used to select the calibrated vertical-deflection sensitivities.
VARIABLE	Potentiometer concentric with the VOLTS/CM switch to provide continuously variable attenuation between the calibrated sensitivities and to extend the attenuation to a sensitivity of 50 v/cm.
POLARITY	Two-position switch to provide optional in-phase or out-of-phase output.
VERTICAL POSITION	Potentiometer to provide for shifting the position of the trace vertically.
GAIN ADJ.	Screwdriver adjustable potentiometer to permit the gain of the amplifier to be accurately set.
DC BAL.	Screwdriver adjustable potentiometer to provide for setting the VARIABLE attenuator dc levels so the trace does not shift position when the attenuation is varied.
MODE	Four-position switch to allow either amplifier to be used independently, to provide for switching the two amplifiers at an arbitrary rate, or to synchronize the switching with the oscilloscope's sweep.



CIRCUIT DESCRIPTION

AMPLIFIERS

The Type 53/54C Plug-In Unit consists of two identical amplifier channels and a channel-switching multivibrator. The following description of the amplifiers applies equally well to either channel.

Input Coupling and Attenuation

The signal to be displayed is applied to the input cathode follower V3053 (V4053) by way of the **AC-DC** switch and the **VOLTS/CM** switch. The **AC-DC** switch is a two-position slide switch that shorts out C3003 (C4003) in the **DC** position so the input is dc coupled. In the **AC** position of this switch the signal must pass thru C3003 (C4003) so the dc component of the signal is blocked.

The **VOLTS/CM** switch is a 9-position rotary switch that selects the various frequency-compensated rc attenuator sections. The basic sensitivity of the unit is .05 volts/cm. This sensitivity is reduced by the eight individually selected attenuator sections to give nine fixed calibrated sensitivities.

Input Stage

The input stage consists of the cathode follower V3053 (V4053) and the cathode-coupled phase inverters V3083 and V3263 (V4083 and V4263). The control-grid dc level of V3083 (V4083) is established by the dc connection to the cathode of V3053 (V4053). The control-grid dc level of V3263 (V4263) is adjustable by means of the **DC BAL** control so that the dc level of the cathodes of V3083 and V3263 (V4083 and V4263) can be made equal. Any dc level difference between these two cathodes would act as a signal and cause the trace to shift position when the **VARIABLE** control is rotated. The **VARIABLE** gain control establishes the amount of cathode coupling and thus allows the stage gain to be varied over about a 2½ to 1 range.

The **GAIN ADJ** control permits the basic gain of the unit to be accurately set to agree with the front-panel calibration.

Polarity and Positioning

With the **POLARITY** switch in the **NORMAL** position the displayed waveform will have the same polarity as the input signal. Placing the **POLARITY** switch in the **INVERTED** position reverses the signal-grid connection of V3303 and V3343 (V4303 and V4343) and turns the displayed waveform upside down. Rotation

of the **VERTICAL POSITION** control forces one plate of the input stage toward a higher potential and the opposite plate toward a lower potential. The resulting dc level shift moves the trace vertically.

Amplifier Stage and Output CF

The signal is further amplified by V3303 and V3343 or V4303 and V4343, depending on which channel is conducting. V3303 and V4303 have a common plate load and likewise V3343 and V4343. Since one amplifier is always cut off while the other is conducting, the shunt loading effect is negligible.

V3503 is the output cathode follower that provides a low-impedance source for driving the oscilloscope's vertical amplifier. The **POSITIONING ADJ** control located in the grid circuit of the output cf permits the trace to be centered vertically under no-signal conditions.

SWITCHING CIRCUIT

A Only, B Only

V3703 is a multivibrator that is controlled by the **MODE** switch. With the **MODE** switch in the **A ONLY** or **B ONLY** position the multivibrator is held in one of its two possible states by returning one grid to a positive voltage and the other grid to a negative voltage. For example, in the **A ONLY** position the grid of V3703A is held positive and this half of the multivibrator conducts while the grid of V3703B is held negative and this half is cut off. While V3703A is conducting the cathode is above ground which causes V3903A to conduct and in turn pulls the grid of V3953B toward ground lowering the plate voltage of V4083 and V4263. This reduced plate voltage cuts off the following stage (V4303 and V4343) and the B-channel amplifier is held in a non-conducting state. The converse is true of the A-channel amplifier. The grid of V3903B is near ground potential and with reduced plate current the plate of V3903B and consequently the grid of V3953A are permitted to become more positive providing plate voltage for V3083 and V3263 and the A-channel amplifier then conducts.

Chopped

Turning the **MODE** switch to the **CHOPPED** position returns both grids of the multivibrator to a positive voltage and the multivibrator free runs at a rate determined by the time constant of the grid circuits. The two amplifiers are alternately cut off and allowed to conduct at the free-running rate of the multivibrator.



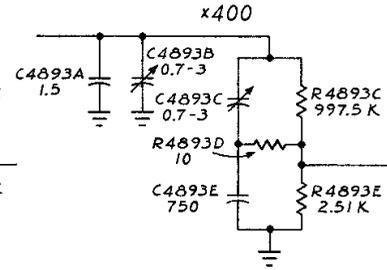
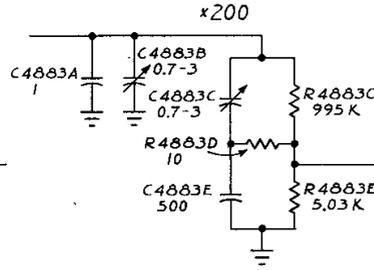
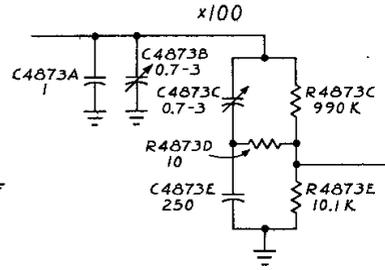
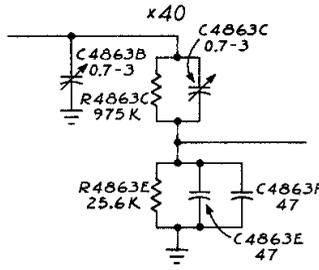
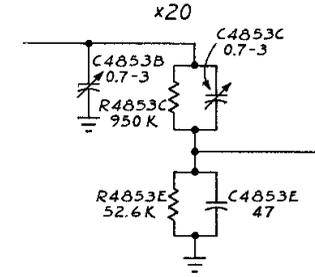
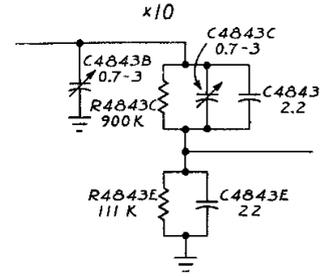
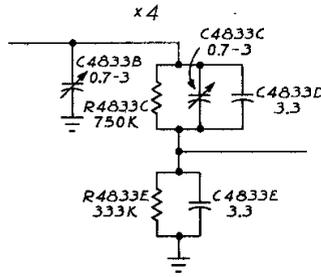
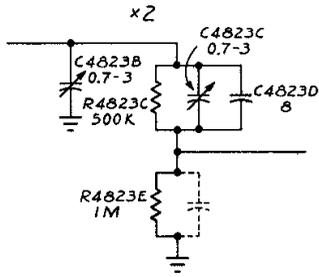
Alternate

Turning the **MODE** switch to the **ALTERNATE** position returns both grids of the multivibrator to a negative potential and it is then bistable. At the end of each sweep cycle a negative-going trigger is generated and is coupled

to the multivibrator through the Trigger Coupling Diode V3803. Each trigger causes the multivibrator to "flip" from one stable state to the other. This alternately switches the amplifiers on and off but now the switching rate is determined by the sweep repetition rate.



CHANNEL A



CHANNEL B

