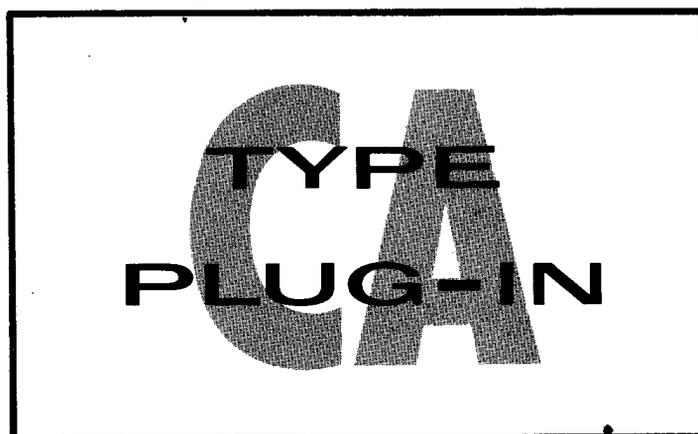


# INSTRUCTION MANUAL



**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

**070-318**



CHANNEL A

VARIABLE VOLTS/CM  
2 1 .5  
5 10 20  
0.2 .1 .05  
CALIBRATED

POLARITY  
NORMAL INVERTED  
(+) (-)

VERTICAL POSITION

1 MEG. 20  $\mu$ F

DC AC

TEKTRONIX

GAIN ADJ. DC BAL.

TYPE CA PLUG-IN UNIT

MODE  
A ONLY  
B ONLY  
ALTERNATE

ADDED ALGEBRAICALLY  
CHOPPED

DUAL-TRACE CALIBRATED PREAMP  
.05-20 V/CM DC COUPLED  
PREAMP RISETIME = .01  $\mu$ SEC

CHANNEL B

VARIABLE VOLTS/CM  
2 1 .5  
5 10 20  
0.2 .1 .05  
CALIBRATED

POLARITY  
NORMAL INVERTED  
(+) (-)

VERTICAL POSITION

1 MEG. 20  $\mu$ F

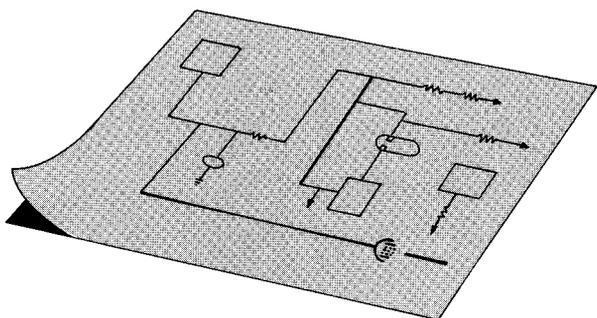
DC AC

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

GAIN ADJ. DC BAL.

SERIAL

# SECTION 1



# CHARACTERISTICS

## GENERAL

The Type CA 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 accomplished 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 nsec can be made.

Either amplifier channel can be used separately without electronic switching, making the Type

AMPLIFIER TRANSIENT RESPONSE

With Instrument Type	Risetime	Passband	
	INPUT SELECTOR switch in any position	INPUT SELECTOR switch in either DC position	INPUT SELECTOR switch in either AC position
541/541A, 545/545A, 555,581, 585	15nsec	DC to 24 Mc	2 cps to 24 Mc .2 cps to 22 Mc with P6000 or P6017 Probe
551	16 nsec	DC to 22 Mc	2 cps to 22 Mc .2 cps to 22 Mc with P6000 or P6017 Probe
531/531A, 533/533A, 535/535A	23nsec	DC to 15 Mc	2 cps to 10 Mc .2 cps to 10 Mc with P6000 or P6017 Probe.
536	35nsec	DC to 10 Mc	2 cps to 10 Mc .2 cps to 5 Mc with P6000 or P6017 Probe.
532	70nsec	DC to 5 Mc	2 cps to 10 Mc .2 cps to 5 Mc with P6000 or P6017 Probe.

CA 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.

### **Operating Modes**

Channel A only.

Channel B only.

CHOPPED (Electronic switching at 100 kc.)

ALTERNATE (Electronic switching on alternate sweeps.)

ADDED ALGEBRAICALLY (Both channels combined at output (A + or - B))

### **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.

### **Input Impedance**

Plug-in alone 1 megohm shunted by 20 pf.

10 megohms at 14 pf with P6000 or P6017 probe.

P410 probe with plug-in will be 10 megohms at 7.5 pf.

### **Physical Characteristics**

Construction--Aluminum alloy chassis.

Finish--Photo-etched anodized panel.

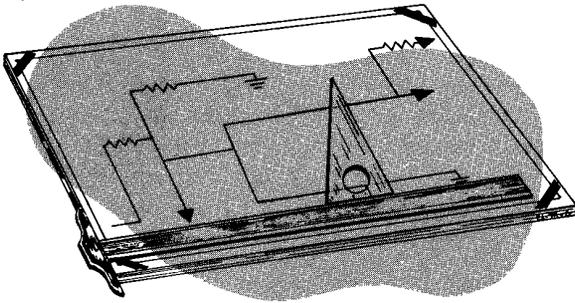
Weight--4 1/2 lbs.

### **Accessories**

2-Instruction Manuals.

## SECTION 3

# CIRCUIT DESCRIPTION



### AMPLIFIERS

The Type CA 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 V3323 (V4323) by way of the AC-DC switch and the VOLTS/CM switch. The AC-DC switch is a two-position slide switch that bypasses C3300 (C4300) in the DC position so the input is dc coupled. In the AC position of this switch the signal must pass through C3300 (C4300) 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 sensitivity of the unit is .05 volts/cm. The input voltage is reduced by the eight individually selected attenuator sections to give nine fixed calibrated ranges.

#### Input Stage

The input stage consists of the cathode follower V3323 (V4323) and the cathode-coupled phase inverters V3334 and V3354 (V4334 and V4354). The control-grid dc level of V3334 (V4334) is established by the dc connection to the cathode of V3323 (V4323). The control-grid dc level of V3354 (V4354) is adjustable by means of the DC BAL controls so that the dc level of the cathodes of V3334 and V3354 (V4334 and V4354) 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 2 1/2 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 V3364 and V3374 (V4364 and V4374) and inverts the displayed waveform. 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 V3364 and V3374 or V4364 and V4374, depending on which channel is conducting. V3364 and V4364 have a common plate load and likewise V3374 and V4374. Since one amplifier is always cut off while the other is conducting, the shunt loading effect is negligible.

V4383 is the output cathode follower that provides a low-impedance source for driving the oscilloscope's vertical amplifier. The Vert. Pos. Range control located in the grid circuit of the output cathode followers permits the trace to be centered vertically under no-signal conditions.

### SWITCHING CIRCUIT

#### A ONLY, B ONLY

V3375 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 V3375A is held positive and this half of the multivibrator conducts while the grid of V3375B is held negative and this half is cut off. When V3375A is conducting the cathode is above ground which causes V3384B to conduct and it in turn pulls the grid of V3393B toward ground lowering the plate voltage of V4334 and V4354. This reduced plate voltage cuts off the following stage (V4364 and V4374) and the B-channel amplifier is held in a non-conducting state. The converse is true of the A-channel amplifier. The grid of V3384A is near ground potential with reduced plate current, therefore, the plate of V3384A and consequently the grid of V3393A are permitted to become more positive thus providing plate voltage for V3334 and V3354. The A-channel amplifier then conducts.

### **ALTERNATE**

Turning the MODE switch to the ALTERNATE position returns both grids of the multivibrator to a negative potential. It is then a bistable multivibrator. At the end of each sweep cycle a negative-going trigger is generated and is coupled to the multivibrator through the Trigger Coupling Diode V3382. Each trigger causes the multivibrator to "flip" from one stable state to the other. This alternately switches the amplifiers on and off. The switching rate is now determined by the repetition rate of the sweep.

### **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.

### **ADDED ALGEBRAICALLY**

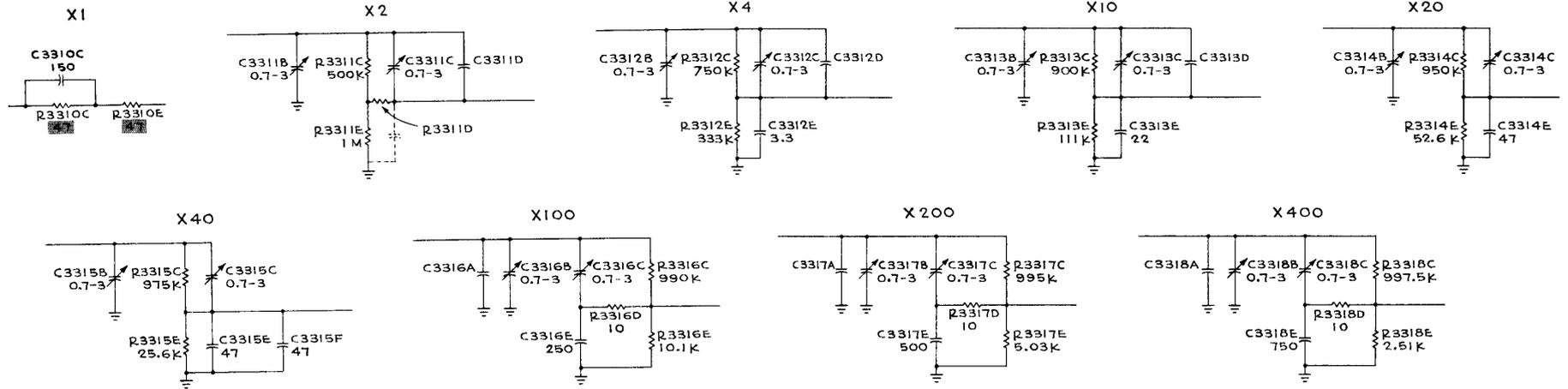
Turning the MODE switch to the ADDED ALGEBRAICALLY position returns both grids of the multivibrator to a negative voltage. Both sides of the multivibrator (V3375) are held sufficiently negative so that incoming triggers have no effect on the multivibrator grids. The cathodes of both halves of the multivibrator follow the grids down, driving V3384A and V3384B to cut off. With V3384A and V3384B cut off the plate voltage rises, carrying the grids of the following stages, V3393A and V3393B with it. The cathodes of V3393A and V3393B follow the grids up. When the cathodes are up, both amplifier channels conduct equally in the absence of any signal.

#### **Note**

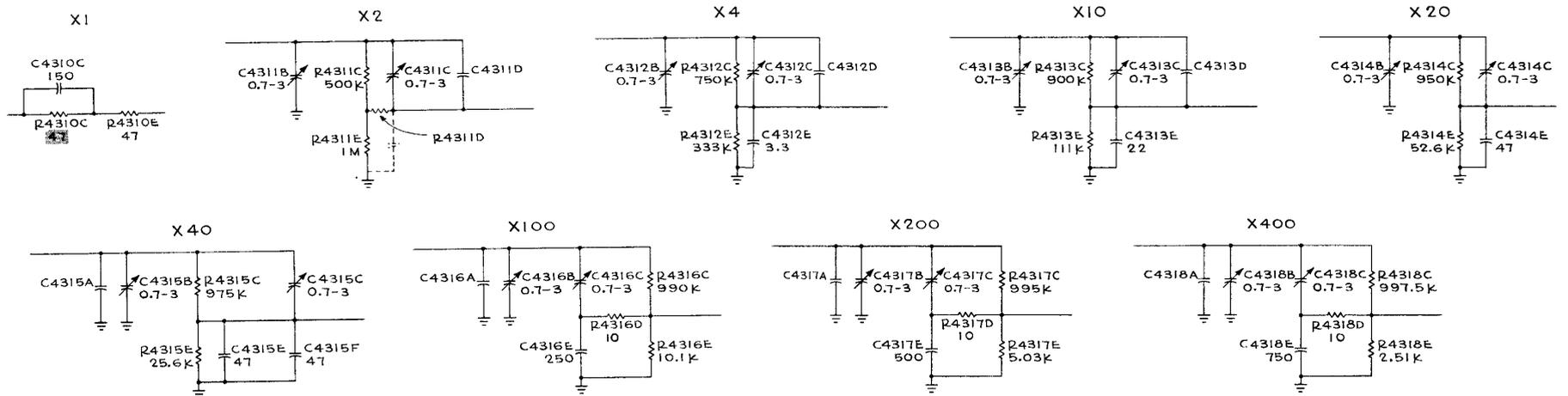
Plate voltage for the input amplifier stages of both channels is supplied by the cathodes of either V3393A or V3393B.

Under the conditions described above signals applied to both inputs will be amplified equally by either channel. Algebraic addition of the signal occurs at the grids of the output stage, V4383. In phase input signals add, out of phase input signals subtract, at the grid of each tube if the polarity switches are at the same setting.

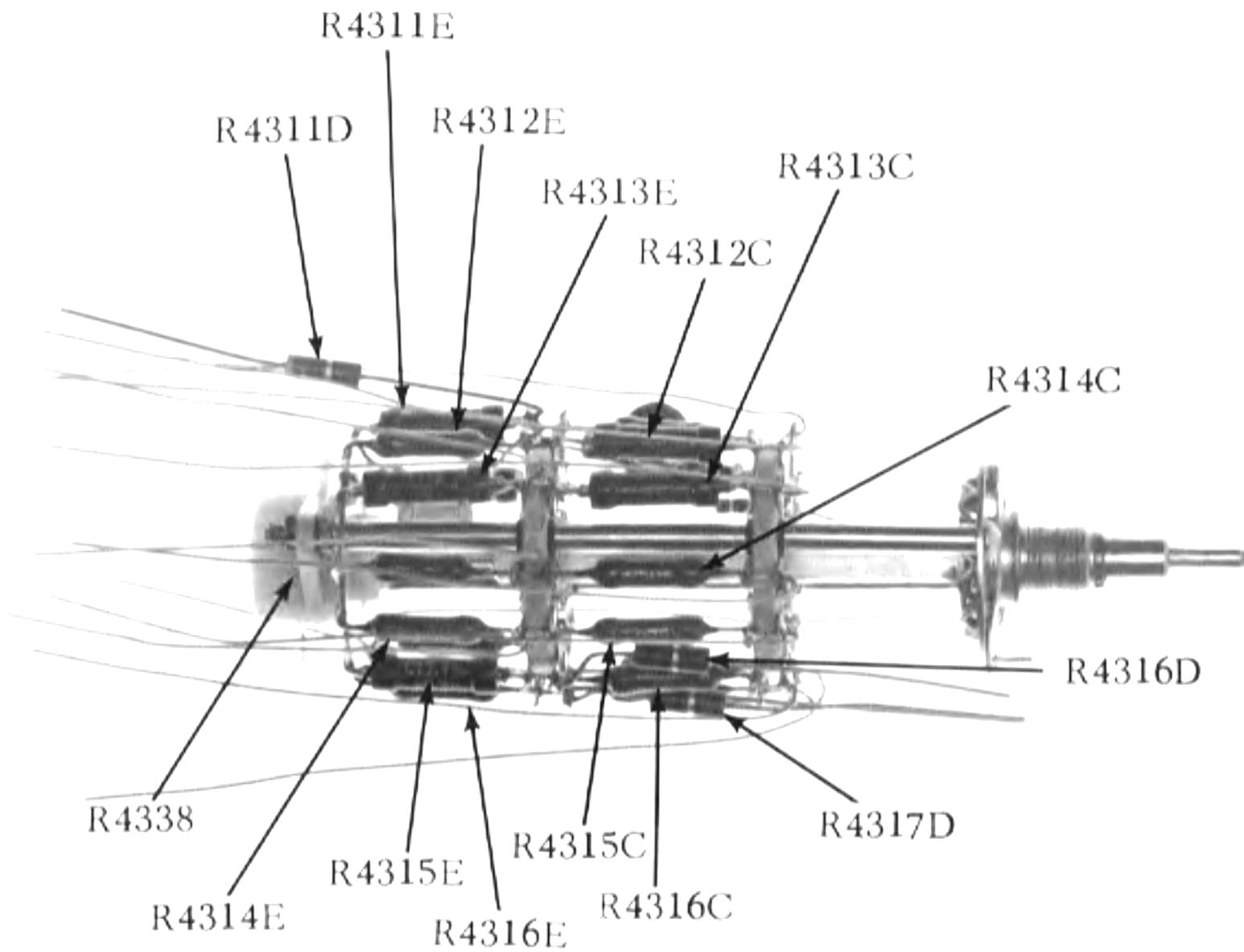
CHANNEL A



CHANNEL B



PARTS SHOWN WITHOUT VALUES ARE  
SELECTED COMPONENTS.  
SEE PARTS LIST.



TYPE CA

A

**VOLTS/CM "B" BOTTOM VIEW**

