## 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.

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## SPECIAL NOTE

At serial number 707 the plug-in type changed to permit use in 540 series as well as 530 series instruments. Type 53D becomes Type 53/54D. At serial number 7245 the front panel designation changed from Type 53/54D to Type D. For purposes of reference in this manual, the instrument will be described as Type $D$ in all cases.

## General

The Type D adapts Type 530- and 540-Series Oscilloscopes (530-Series Oscilloscopes S/N 101-706) for work requiring dc coupling at sensitivities as high as $1 \mathrm{mv} / \mathrm{cm}$, and for differential input with high rejection ratio for in-phase signals. The differential-input connection permits cancellation of unwanted or interfering signals.

## Characteristics

## Sensitivity

Calibrated, $1 \mathrm{mv} / \mathrm{cm}$, continuously variable, $1 \mathrm{mv} / \mathrm{cm}$ to $125 \mathrm{v} / \mathrm{cm}$.

## Frequency Response

DC to 300 kc at $1-\mathrm{mv} / \mathrm{cm}$ sensitivity, increasing to dc to 2 mc at $50-\mathrm{mv} / \mathrm{cm}$ and lower sensitivity.

## Differential Input

The rejection ratio for in-phase signals is greater than 10,000 to $1, D C$ coupled. At low frequencies, in the AC coupled position, the rejection ratio decreases with frequency. The rejection ratio at 60 cps is about 600 to $1, \mathrm{AC}$ coupled.

## Physical Characteristics

Construction, aluminum alloy chassis; Finish, photo-etched, anodized panel; weight, 4 lbs .

## Functions of Controls and Connectors

INPUT A
INPUT B
Separate signal inputs to the preamplifier by way of the input selector switch.

INPUT
SELECTOR SWITCH

MILLIVOLTS/CM ATTENUATORS

Six-position switch, providing choice of either input separately, or the two inputs differentially, with either ac or dc coupling.

Four-position switch to insert attenuators between the signal inputs and the amplifier.

MV/CM MULTIPLIER DEFLECTION SENSITIVITY

VARIABLE

VERTICAL
POSITION
DIFF. $\quad$ Screwdriver-adjust potentiometer sets dc BAL.

PREAMP
BALANCE

FINE
(S/N 707-up)
Six-position switch to change gain of amplifier and provide 24 calibrated sensitivities in conjunction with the MILLIVOLTS /CM switch.

Potentiometer, concentric with the deflec-tion-sensitivity switch, to provide continuously variable attenuation between the calibrated sensitivities and to decrease the sensitivity to $125 \mathrm{v} / \mathrm{cm}$.

Potentiometer to move the trace vertically. differential bias on input tubes to provide a fine differential adjustment of the inputstage gain, so maximum rejection will be obtained with differential input.

Seven-position switch to balance the dc voltage on the plates of the input cascode amplifiers.

Potentiometer to provide a fine adjustment of the dc balance on the input-am- plifier plates.

## Accessories

2-Instruction Manuals

## OPERATING INSTRUCTIONS



## General

The Type D High-Gain Differential Calibrated DC preamp is designed to operate as the preamplifier for a Tektronix 530-540- or 550 -series Oscilloscope [S/N 101 to 706 in 530 series oscilloscopes). We assume that it will be operated in this manner in the following instructions.

Be sure to let the preamp warm up for a few minutes after you first apply power to it so it can stablize. Normally, it will be quite stable after about five minutes.

## Signal Inputs

Either of the two signal inputs can be used independently by turning the input-selector switch to one of the two inputs and connecting the signal to the corresponding input connector.
The $D C$ and $A C$ positions of this switch differ only in that, in the AC positions, a capacitor is inserted in series with the input to remove the dc component of the signal. In the two positions of the switch marked A-B, both inputs are connected to the amplifier, and the signal presented to the main amplifier in the oscilloscope is the difference between the two signals connected to INPUT A and INPUT B.

## Deflection Sensitivity S/N 101-706

The DEFLECTION SENSITIVITY control is a step control which inserts various frequency-compensated attenuators between the input connectors and the amplifier. The DEFLECTION SENSITIVITY MULTIPLIER further decreases the gain by factors of $1,10,100$, or 1,000 and in conjunction with the DEFLECTION SENSITIVITY switch will give 24 fixed calibrated sensitivities. The variable attenuator control, which is concentric with the DEFLECTION SENSITIVITY control, has a range of about $21 / 2$ to 1 , to fill in between the fixed steps, thus making the attenuation continuously variable from $1 \mathrm{mv} / \mathrm{cm}$ to $125 \mathrm{v} / \mathrm{cm}$.

## Deflection Sensitivity S/N 707-up

The MILLIVOLTS/CM control is a step control which inserts frequency-compensated attenuators between the input connectors and the amplifier. The MV/CM MULTIPLIER further decreases the gain of the amplifier by factors of 1, 2, $5,10,20$, and 50 . This allows the ranges of the MILLIVOLTS /CM switch to overlap so you can keep the MULTIPLIER
switch in the maximum-band-width positions except when maximum sensitivity is desired. The approximate band width in megacycles is marked along the bottom of the MULTIPLIER switch. The variable attenuator controls which is concentric with the MULTIPLIER switch fills in between the fixed steps of this switch making the attenuation continuously variable from $1 \mathrm{mv} / \mathrm{cm}$ to $125 \mathrm{v} / \mathrm{cm}$.

Except when you require sensitivity in excess of 10 millivolts per centimeter, keep the MV/CM MULTIPLIER control in the 10,20 , and 50 positions. In these positions the reduced amplifier gain provides improved stability and increased frequency response. This is especially helpful in reducing the warm-up drift.

NOTE:
The VARIABLE attenuator must be turned full right to the CALIBRATED position for the indicator deflection sensitivity to agree with the ruled lines on the graticule.

The ten-times-attenuation probe furnished with the oscilloscope will extend the attenuation to a maximum of 1250 $\mathrm{v} / \mathrm{cm}$ and reduce the loading on the circuit under test to 10 megohms shunted by about $12 \mu \mu \mathrm{f}$. The peak voltage to ground applied to the probe should not exceed 600 volts. Larger signals must be externally attenuated. Occasionally, when you are measuring small ac signals in the presence of large de voltages, you may have to adjust the VERTICAL POSITION control to return the trace to the screen.

## Preamp Balance S/N 707-up

The input cascode amplifier can be balanced by means of the concentric, front-panel PREAMP BALANCE controls. If these controls are properly set, the trace will not shift vertically when the MULTIPLIER switch is rotated.

To make this adjustment set the MILLIVOLTS/CM switch to 100 and the MULTIPLIER switch to 50. Position the trace near center and turn the MULTIPLIER switch to 20. Return the trace to center with the FINE control and, if necessary, with the PREAMP BALANCE switch. Continue turning the MULTIPLIER to the 10 and 5 positions, adjusting the PREAMP BALANCE controls as necessary until there is no trace shift as the MULTIPLIER control is switched between the 5 and 10 positions.

Any shift remaining as the MULTIPLIER control is switched to 1 may be partially compensated for by a slight readjustment of the FINE control until the 2ND STAGE PLATE BAL. control can be adjusted as described in the Maintenance section of this manual.

Sometimes when it appears that PREAMP BALANCE should be readjusted, it is actually the DIFFERENTIAL BALANCE control that needs adjusting. See below.

## Differential Balance S/N 1393-up

The differential input makes possible the application of balanced inputs to the preamp. The best rejection ratio for common-mode signals occurs when the MILLIVOLTS/CM switch is at 1 . If the attenuator trimmers and balance re-
sistors are carefully adjusted, the rejection ratio will remain about 10,000 to 1 in the 10,100 and 1000 positions of the MILLIVOLTS/CM switch. To avoid distortion of the signal, the common-mode signal should not exceed 5 volts, peak-to-peak, at the grid of the first stage. Thus, in the 10 and 100 positions of the MILLIVOLTS/CM switch, the input signal amplitude should not exceed 50 volts and 500 volts respectively.

Use of the probes ahead of the preamp reduces the rejection ratio to about 50 to 1 because of the 1 per cent tolerance of the probe resistors.

## CIRCUIT DESCRIPTION

## General

The Type D Plug-in unit has a minimum passband DC to 300 kc and a maximum passband DC to 2 mc , depending upon sensitivity. It has four calibrated sensitivity steps and six multiplier positions for each step. The variable attenuator control fills in between these steps making the attenuation continuously variable.

The VERTICAL POSITIONING control is located in the plug-in unit. This is possible because the remainder of the vertical amplifier system is dc coupled so that a de change at this level becomes a dc change at the crt deflection plates.

## Input Connectors

Either of two input connectors can be switched into the input circuits by means of SW3004. Each of the signal grids of the push-pull input stage is brought out to the front panel by way of the input-selector switch.
In either the $A$ or the $B$ positions of the switch, one of the grids is grounded and the other one is left free for the signal input. In the A-B position of the switch, both grids are left free for signal inputs. In the DC positions of the switch, the blocking capacitors C3004 and C3204 are shorted out.

## Attenuators

The MILLIVOLTS/CM control (DEFLECTION SENSITIVITY MULTIPLIER control S/N 101-706) inserts various frequencycompensated attenuators between the input connectors and the signal grids of the input stage. The four attenuation ratios are $1,10,100$, and 1,000 .

V3404 and V3454 comprise a cascode push-pull amplifier stage. V3504B is a voltage-setting cathode follower. R3574, the DIFF. BAL. control, adjusts the relative do levels of the two grounded grids of the cascode amplifier stage. This control is used to equalize the gain of the two halves of the stage for maximum rejection of common-mode signals with differential input.

In serial numbers 101-706 R3553, marked AMPLIFIER BALANCE, adjusts the dc level of the plate of V3404B so that the de input to the next stage is balanced.

In serial numbers 707 -up the PREAMP BALANCE switch, SW 3484, provides a coarse adjustment of the dc level on
the plate of V 3454 B and the concentric FINE adjustment varies the de level of V3404B so the input to the next stage can be balanced.

## Output Stage

V3604 and V3704 comprise a push-pull gain stage. V3504A is a voltage-setting cathode follower which supplies the screen voltage for this stage. The MULTIPLIER switch, SW3604, (DEFLECTION SENSITIVITY switch, SW3014 S/N 101-706) selects fixed resistors for the plate loads of the cascode and output amplifiers to adjust the gain in fixed steps. R3664, GAIN ADJ., and R3724, VARIABLE, also adjust the gain of this stage by varying the cathode coupling between the two tubes.

## Output-Stage Controls

The relative screen potentials of the two tubes are adjusted by R3704, marked VAR. ATTEN. BAL. This adjustment is necessary to set the two cathodes at the same potential so that a vertical shift of the trace will not occur when either the GAIN ADJ. or the VARIABLE controls are varied.

R3814, marked 2ND STAGE PLATE BAL, balances the output of this stage so the input to the cathode follower stage will be balanced. V3904 is a cathode-follower stage to drive the main amplifier, R3914, marked VERTICAL PO. SITION, adjusts the relative de potentials of the two cathodes which positions the trace vertically. R3964, marked VERT. POS RANGE. adjusts the relative bias on the grids of V3094 to make it possible to center the trace vertically with the VERTICAL POSITION control set at mid-range.

## Heaters

The heaters of all tubes in this unit are supplied with dc from the main unit. Terminal 15 of the connecting plug furnishes current to operate the heater string.

The Type D was modified at serial number 3461 to accept 12AU7's for V3404 and V3454. R4014 which was in the earlier plug-ins to furnish additional heater current for V3404 and V3454 has been removed. The additional current for the earlier models was taken from the +100 volts bus.


## Replacement of Components

Tektronix will supply replacement components at current net prices. However, since most of the components are standard electronic and radio parts we suggest you get them from your local dealer if you can. Be sure to consult your instruction manual first to see what tolerances are required.

We specially select some of the components, whose valves must fall within prescribed limits, by sorting through our regular stocks. The components so selected will have standard RETMA color-code marks showing the values and tolerances of the stock they were selected from, but they will not in general be replaceable from dealer stocks.

Such selected parts, as well as the parts we manufacture at Tektronix, are indentified in the parts list either by notes or by our own stock numbers. Order these parts from the Tektronix factory in Portland, Oregon.

## Tube Replacement Notice

In serial numbers 3462 and up the 12AU7 tubes used as V3404 and V3454 in this plug-in unit are of Telefunken manufacture, and are especially selected and aged at the factory. Tests indicate that these tubes give the best overall performance with regard to drift and microphonics in this particular application.

## Parts-Ordering Information

You will find a serial number on the frontispiece of this manual. This is the serial number on the instrument the manval was prepared for. Be sure the manual number matches the number of the instrument when you order parts.

A Tektronix instruction manual usually contains handmade changes to diagrams and parts list, and sometimes text. These changes are in general only appropriate to the instrument the manual was prepared for, the instrument whose serial number appears on the manual frontispiece. The hand-made changes show changes to the instrument that have been made after printing of the manual.

We make some of the instrument changes during the factory test procedure. Our technicians hand-tailor the circuits, if it seems appropriate, to provide the widest possible latitude of operation. Other changes are made to include the latest circuit improvements as they are developed in our engineering department, or when improved components become available. In any event, the changes are to your benefit. We have tried to give you the best instrument we can.

## MAINTENANCE



Fig. 4-1 Preparation of soldering iron tip

## 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 if 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 onepound 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.

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.


Fig. 4-2 Applying soldering iron tip to ceramic strip
2. Prepare the tip of the iron as shown in Fig. 4-1.
3. Tin only the first $1 / 16$ to $1 / 8$ 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).
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.

## General Soldering Considerations

When replacing wires in terminal slots clip the ends neatly as close to the solder point as possible. In clipping


Fig. 4-3. Fillet on wire


Fig. 4-4. Soldering to metal terminals
the ends of wires 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.

## 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 type 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


Fig. 4-5. Wooden dowel used as soldering aid.


Fig. 4-6. Long-nosed pliers used as a heat sink.
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.

## Mounting Later Ceramic Strips

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

## Equipment needed for calibration of Type D

1. Type 530-540-Series Oscilloscope
2. Tektronix Type 105 Square-Wave Generator or equivalent, providing square-waves at 1 kc and 100 kc with a frequency accuracy of $\pm 3 \%$ and rise time of at least $.02 \mu \mathrm{sec}$.
3. Input Capacitance Standardizer (CS47)
4. $52 \Omega$ termination resistor (B52R)
5. $52 \Omega$ cable
6. Plug-In Extension (EP53).


Fig. 4-7. Ceramic strips and fittings.

## Step 1. Oscilloscope Controls

The test oscilloscope should have control settings as follows, unless otherwise stated:

HORIZONTAL DISPLAY
INTERNAL SWEEP or TIME BASE A

TRIGGERING MODE
AUTOMATIC

| TRIGGER SLOPE | -INT |
| :--- | ---: |
| STABILITY | PRESET |
| TIME/CM | 1 MSEC |

## Step 2. Determine Vertical System Electrical Center

Determine the "Vertical-System Electrical Center" of the oscilloscope by placing a jumper between pins 1 and 3 of the interconnecting socket and observing the vertical level of the crt trace. This level will be referred to later in the calibration procedure.

## Step 3. Adjust Vertical Position Range

Connect a jumper across R3854 17.3 k resistor on the DEFLECTION SENSITIVITY or MV/CM MULTIPLIER switch) and adjust the VERT. POS. RANGE control to center the trace on the graticule "Vertical System Electrical Center." The MV/CM multiplier switch should be in the SMV position for this adjustment.

## Step 4. Adjust 2nd Stage Plate Balance and Variable Attenuator Balance

Connect a jumper between the grids, pins 1, of V3604 and V3704. Adjust the VAR. ATTEN BAL. control (labeled C.F. ADJ. S/N 101-650), so that the trace remains stationary on the screen as the VARIABLE control is varied throughout its range. Now adjust the 2ND STAGE PLATE BAL. so that the trace remains stationary as the MV/CM MULTIPLIER or DEFLECTION SENSITIVITY switch is varied between 1 and 2. These controls may interact slightly, so that one or two readjustments are necessary.

Step 5. Adjust Preamp Balance and Diff. Bal.
Set Type D controls as follows:

$$
\begin{aligned}
& \text { MV/CM MULTIPLIER } \\
& \text { (DEFLECTION SENSITIVITY) } \\
& \text { INPUT SELECTOR SWITCH }
\end{aligned}
$$

From the Square-Wave Calibrator apply 10 volts to both INPUT A and INPUT B. Adjust the DIFF. BAL. control for minimum deflection while keeping, the trace centered with the PREAMP BALANCE or AMPLIFIER BALANCE controls. If these controls are far out of adjustment, it may be helpful to start with the MV/CM MULTIPLIER at 10 or 20.

## Step 6. Set Millivolts/CM Switch Adjustments (S/N 1393 and up only)

Leave Type D controls set as in the previous step. From the SQUARE WAVE CALIBRATOR on the oscilloscope, apply signal in both INPUT A and INPUT B.

Adjust balance controls for minimum deflection:

|  |  | ADJUST FOR |
| :---: | :---: | :---: |
| MILLIVOLTS/CM SWITCH | CALIBRATOR | FLAT TOP |
| 10 | 20 volts | R3044 |
| 100 | 50 volts | R3074 |
| 1000 | 100 volts | R3154 |

## Step 7. Adjust Gain

Set up Type D controls as follows:

| MILLIVOLTS/CM | 1 |
| :--- | ---: |
| MV/CM MULTIPLIER | 50 |
| INPUT SELECTOR SWITCH | A DC |

From the SQUARE WAVE CALIBRATOR, apply .2 volts to INPUT A and adiust R3664 for 4 centimeters of deflection.

## Step 8. Adjust Output Compensations

Leaving Type D controls as in the previous step, reset the oscilloscope TIME/CM control to $10 \mu \mathrm{sec}$. From the Type 105, apply a 100 kc signal to INPUT A and set the 105 OUTPUT AMPLITUDE control for 3.5 cm of deflection. Adjust C3824 and C3874 for optimum flat top and square corner on the display.

## Step 9. Adjust Input Capacitors (Shunt and Neutralization)

Leaving Type D controls as previously, reset the oscilloscope TIME/CM control to 1 MILLISEC. Terminate the Type 105 cable with an Input Capacitance Standardizer (CS 47). From the Type 105, apply a 1 kc signal to INPUT A and set the Type 105 OUTPUT AMPLITUDE control for 3.5 cm of deflection. Adjust C3424 for flat top. Set the Type D INPUT SELECTOR switch to A-B DC and adjust C3444 for flat top (neutralization). Repeat the same procedure on Type D $\mathbb{N}$ PUT B, using C3434 for input capacitor adjustment and C3414 for neutralization adjustment.

Since the above adjustments will be effected by step 10 , step 9 should be rechecked after step 10 has been completed.

## Step 10. Adjust MILLIVOLTS/CM Switch Compensations

Leaving Type D controls and scope controls as in the previous step, apply a 1 kc signal to INPUT B from the Type 105. Adjust 105 OUTPUT AMPLITUDE for 3.5 cm of deflection.

| MILLIVOLTS/CM | ADJUST FOR | ADJUST FOR |
| :---: | :---: | :---: |
| SWITCH | FLAT TOP | MIN. OVERSHOOT |
| 10 | C3214 | C3224 |
| 100 | C3244 | C3254 |
| 1000 | C3274 | C3284 |

Switch 1 kc signal to INPUT A and adjust as follows:

| MILLIVOLTS/CM | ADJUST FOR | ADJUST FOR |
| :---: | :---: | :---: |
| SWITCH | FLAT TOP | MIN. OVERSHOOT |
| 10 | C3014 | C3024 |
| 100 | C3044 | C3054 |
| 1000 | C 3074 | C 3084 |

## Step 11. Adjust HF Differential Balance Capacifor (S/N 1393 and up only)

Set Type D controls as follows:

```
MILLIVOLTS/CM 1
MV/CM MULTIPLIER 1 INPUT SELECTOR SWITCH A-B DC
```

From the SQUARE WAVE CALIBRATOR on the oscilloscope, apply 10 volts of signal to both INPUT A and INPUT B. Adjust C3394 for minimum spike on waveform.


Fig. 4-8. Type D Unit, Top View.


Fig. 4-9. Type D Unit, Left Side View.

## Maintenance - Type D



Fig. 4-10. Type D Unit, Bottom View.


## 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

## *000-000 Asterisk preceding Tektronix Part Number indiates manufatured

 by or for Tektronix, also reworked or checked components.Values fixed unless marked Variable.
Tolerance $\pm 20 \%$ unless otherwise indicated.

## Capacitors

|  |  |  |  |  |  |  | Tektronix Part Number |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| C3004 |  | . $1 \mu \mathrm{f}$ | PTM |  | 600 v |  | Use *295-066 |
|  | C3004 and C3204 matched within $\pm 1 \%$ of each other, furnished as a unit. |  |  |  |  |  |  |
| C3014 | $\begin{array}{r} 101-1392 \\ 1393-u p \end{array}$ | $\begin{aligned} & 8-50 \mu \mu f \\ & 7-45 \mu \mu f \end{aligned}$ | Cer. Cer. | Var. Var. | $\begin{aligned} & 500 \mathrm{v} \\ & 500 \mathrm{v} \end{aligned}$ |  | $\begin{aligned} & 281-022 \\ & 281-012 \end{aligned}$ |
| $\begin{aligned} & \text { C3024 } \\ & \text { C3034 } \\ & \text { C3044 } \end{aligned}$ |  | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-005 |
|  | 101-6594X | $27 \mu \mu \mathrm{f}$ | Cer. |  | 500 v | 10\% | 281-512 |
|  | 101-1392 | $8-50 \mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-022 |
|  | 1393-up | 7-45 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-012 |
| C3054 |  | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-005 |
| $\begin{aligned} & \mathrm{C} 3064 \\ & \mathrm{C} 3074 \end{aligned}$ |  | $330 \mu \mu \mathrm{f}$ | Mica |  | 500 v | 10\% | 283-518 |
|  | 101-1392 | 8-50 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-022 |
|  | 1393-up | 7-45 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-012 |
| C3084 |  | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281.005 |
| C3094 | 101-1392 | . $0068 \mu \mathrm{f}$ | Mica |  | 500 v | 10\% | 283-532 |
|  | 1393-up | . $002 \mu \mathrm{f}$ | Mica |  | 500 v | 5\% | 283-529 |
| C3204 |  | . $1 \mu \mathrm{f}$ | PTM |  | 600 v |  | Use *295-066 |
|  | C3204 and C3004 matched within $\pm 1 \%$ of each other, furnished as a unit. |  |  |  |  |  |  |
| C3214 | 101-1392 | 8-50 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-022 |
|  | 1393-up | 7-45 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-012 |
| C3224 |  | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-005 |
| C3234 | 101-6594X | $27 \mu \mu \mathrm{f}$ | Cer. |  | 500 v | 10\% | 281-512 |
| C3244 | 101-1392 | 8-50 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-022 |
|  | 1393-up | 7-45 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-012 |
| C3254 |  | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-005 |
| C3264 |  | $330 \mu \mu \mathrm{f}$ | Mica |  | 500 v | 10\% | 283-518 |
| C3274 | 101-1392 | 8-50 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-022 |
|  | 1393-up | $7.45 \mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-012 |
| C3284 |  | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-005 |
| C3294 | 101-1392 | . $0068 \mu \mathrm{f}$ | Mica |  | 500 v | 10\% | 283-532 |
|  | 1393-up | . $002 \mu \mathrm{f}$ | Mica |  | 500 v | 5\% | 283-529 |
| C3384 | X1846-up | $2.2 \mu \mu \mathrm{f}$ | Cer. |  | 500 v | $\pm 1 / 2 \mu \mu \mathrm{f}$ | 281-500 |
| C3404 | X1846-up | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-005 |
|  |  | . $001 \mu \mathrm{f}$ | Cer. |  | 500 v | GMV | 283-000 |
| $\begin{aligned} & \text { C3414 } \\ & \text { C3424 } \end{aligned}$ |  | 1.5-7 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-005 |
|  | 101-3461 |  | Cer. | Var. | 500 v | Use | 281-010 |
|  | 3462-up | 4.5-25 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-010 |
| C3434 | 101-3461 | 5-20 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v | Use | 281-010 |
|  | 3462-up | 4.5-25 $\mu \mu \mathrm{f}$ | Cer. | Var. | 500 v |  | 281-010 |

Tektronix Part Number

| Cer. | Var. | 500 v |  | $281-005$ |
| :--- | :--- | :--- | :--- | :--- |
| Cer. |  | 500 v | GMV | $283-000$ |
| Cer. |  | 500 v | GMV | $283-002$ |
| Cer. |  | 500 v | GMV | $283-002$ |
| Cer. | Var. | 500 v |  | $281-022$ |
|  |  |  |  |  |
| Cer. | Var. | 500 v |  | $281-022$ |
| Cer. |  | 500 v | GMV | $283-002$ |

## Inductors

13014
L3214

| X1393-up | $1.8 \mu h$ |
| :--- | :--- |
| X1393-up | $1.8 \mu h$ |

$1.5-7 \mu \mu f$
$.001 \mu f$
$.01 \mu f$
$.01 \mu f$
$8-50 \mu \mu f$

$8-50 \mu \mu f$
$.01 \mu f$

500 v
283-002
C3444
C3454
C3514
C3614
C3824

C3874
C4004

1. $8 \mu \mathrm{~h}$

## Resistors

| 1/2w |  | Comp. | 5\% | 301-221 |
| :---: | :---: | :---: | :---: | :---: |
| $1 / 2 w$ |  | Prec. | 1\% | Use 309-394 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-046 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-161 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-395 |
| 1/10w | Var. | Comp. | 20\% | 311-017 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-013 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-034 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-160 |
| 1/10w | Var. | Comp. | 20\% | 311-056 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-014 |
| 1/2w |  | Prec. | 1\% | 309-115 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-158 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-159 |
| 1/10w | Var. | Comp. | 20\% | 311-010 |
| $1 / 2 \mathrm{w}$ |  | Comp. | 5\% | 301-221 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | Use 309-394 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-046 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-161 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-395 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-013 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-034 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-160 |
| $1 / 2 w$ |  | Prec. | 1\% | 309-159 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-014 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-115 |
| 1/2w |  | Prec. | 1\% | 309-158 |
| 8 w |  | WW | Use | *310-514 |
| 4 w | Mica Plate |  | Use | *310-514 |
| 4 w | Mica Plate |  | 1\% | *310-514 |
| 1/2w |  | Comp. | 10\% | 302-470 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-014 |
| $1 / 2 \mathrm{w}$ |  | Prec. | 1\% | 309-014 |
| $1 / 2 \mathrm{w}$ |  | Comp. | 10\% | 302-470 |

Tektronix Part Number
*310-514
*310-514
*310-514
309-091
304-564
301-682

302-822
303-183
308-008
308-008
304-125
311-034

308-008
311-006
308-008
309-037
309-050
309-036
309-124
309-122
309-118
311-010
*312-582
*312-582

309-043
302-682

311-011
309-043
311-011
*312-582
*312-582

309-036

304-824
311-039

310-086
310-086
310-088
310-088
309-123

309-120
310-088
310-088
310-086 310-086

304-103
304-822
311-016
311-011
304-822

Tektronix Part Number

## Switches

|  |  |  |  | Unwired Wired |
| :---: | :---: | :---: | :---: | :---: |
| SW3004 | 101-212 | 2 wafer, 6 pos., rotary | INPUT SEL. | *260-074 |
| (SW1) | 213-up | 2 wafer, 6 pos., rotary | INPUT SEL. | *260-088 |
| SW3014 | 101-706 | 4 wafer, 4 pos., rotary | DEFL. SENS. MULT. | *260-075 *262-071 |
| (SW2) | 707-1392 | 4 wafer, 4 pos., rotary | MV/CM | *260-075 *262-071 |
|  | 1393-16439 | 4 wafer, 4 pos., rotary | MV/CM | *260-142 *262-108 |
|  | 16440-up | 4 wafer, 4 pos., rotary | MV/CM | Use 262-474 |
| SW3604 | 101-706 | 4 wafer, 6 pos., rotary | DEFL. SENS. | *260-077 *262-072 |
| (SW3) | 707-up | 4 wafer, 6 pos., rotary | MV/CM MULTIPLIER | *260-077 * 262 -072 |
| SW3484 | X651-16439 | 1 wafer, 7 pos., rotary | PREAMP BALANCE | *260-090 *262-081 |
|  | 16440-up | 1 wafer, 7 pos., rotary | PREAMP BALANCE | *260-090 *262-473 |

## Vacuum Tubes

| V3404 $\dagger$ | $101-1826$ | 5814 |
| :--- | ---: | :--- |
|  | $1827-3460$ | 5814 |
|  | $3461-\mathrm{up}$ | $12 \mathrm{AU7}$ |
| V3454 $\dagger$ | $101-1826$ | 5814 |
|  | $1827-3460$ | 5814 |
|  | $3461-\mathrm{up}$ | $12 \mathrm{AU7}$ |


| Use | $* 157-049$ |
| :--- | :--- |
| Use | $* 157-049$ |
|  | $* 157-049$ |
| Use | $* 157-049$ |
| Use | $* 157-049$ |
|  | $* 157-049$ |

$\dagger$ V3404 and V3454 are a matched pair.

| V3504 |  | 12 AU7 |
| :--- | ---: | :--- |
| V3604 $\dagger$ | $101-3392$ | 5879 |
|  | $3393-$-up | 5879 |
| V3704 $\dagger$ | $101-3392$ | 5879 |
|  | 3393 -up | 5879 |


|  | $154-041$ <br> Selected <br>  <br> Selected$\quad$$* 157-018$  <br>  $* 157-051$ <br>  $* 157-018$ <br>  $* 157-051$,$~$ |
| :--- | ---: |

$\dagger$ V3604 and V3704 are a matched pair.
V3904
12AU7
154-041

## Type D <br> Mechanical Parts List

Tektronix Part Number
BINDING POST CAP 200-103
BINDING POST ADAPTOR STEM 355-507
BLOCK, PLASTIC ..... 391-051
BRACKET, SWEEP CHASSIS ..... 406-125
BRACKET, VERT. POS. POT MOUNTING ..... 406-127
BRACKET, ATTEN. MTG. SN 393-up ..... 406-185
BRACKET, SWITCH SUPPORT SN 4564-up ..... 406-214
BUSHING, $3 / 8-32 \times 9 / 16 \times .412$ ..... 358-010
CABLE HARNESS ..... 179-059
CERAMIC POST $1 / 2^{\prime \prime}$ SN 101-8609 ..... 129-009
CERAMIC POST 1" SN 101-8609 ..... 129-017
CERAMIC STRIP $3 / 4 \times 2$ notches, clip mounted ..... 124-086
CERAMIC STRIP $3 / 4 \times 4$ notches, clip mounted ..... 124-088
CERAMIC STRIP $3 / 4 \times 7$ notches, clip mounted ..... 124-089
CERAMIC STRIP $3 / 4 \times 1$ notches, clip mounted SN 8610-up ..... 124-100
CLAMP, CABLE $1 / 2^{\prime \prime}$ SN 10,790 -up ..... 343-006
CLAMP, CABLE $5 / \mathbf{8}^{\prime \prime}$ ..... 343-007
CHASSIS ..... 441-072
CONNECTOR, CHASSIS MT. 1-contact, female ..... 131.012
CONNECTOR, 16-contact, male ..... 131-017
COUPLING, POT ..... 376-014
EYELET, BRASS ..... 210-601
FASTENER, SNAP, Double pronged Delrin ..... 214-153
FRAME PLATE $5^{11 / 32} \times 6^{11 / 32}$ ..... 387-532
GROMMET, RUBBER $1 / 4^{\prime \prime}$ ..... 348-002
GROMMET, RUBBER 5/16" ..... 348-003
KNOB, SMALL RED ..... 366-038
KNOB, LARGE BLACK $1 / 4^{\prime \prime}$ hole thru ..... 366-040
KNOB, LARGE BLACK w/2 dots $180^{\circ}$ apart ..... 366-041
KNOB, LARGE BLACK $1 / 4$ " hole part way ..... 366-042
KNOB, SMALL BLACK ..... 366-044
KNOB, PLUG-IN SECURING ..... 366-125
LOCKWASHER \#2 EXT ..... 210-002
LOCKWASHER \#4 INT ..... 210-004
LOCKWASHER \#6 INT ..... 210-006
LOCKWASHER \#8 INT ..... 210-008
LOCKWASHER $1 / 4$ INT ..... 210-011
LOCKWASHER Pot INT ..... 210-012
LOCKWASHER $3 / 8 \times 11 / 16$ INT ..... 210-013
LUG, SOLDER SE4 ..... 210-201

Tektronix

|  | Part Number |
| :---: | :---: |
| LUG, SOLDER Pot | 210-207 |
| NUT, HEX 2-56x $3 / 16$ | 210-405 |
| NUT, HEX $4-40 \times 3 / 16$ | 210-406 |
| NUT, HEX $6-32 \times 1 / 4$ | 210-407 |
| NUT, HEX $8-32 \times 5 / 16$ | 210-409 |
| NUT, HEX 3/8-32 $\times 1 / 2$ | 210-413 |
| NUT, HEX $1.72 \times 5 / 32$ | 210-438 |
| NUT, HEX $1 / 4-28 \times 3 / 8 \times 3 / 32$ | 210-455 |
| NUT, KEP $6.32 \times 5 / 16$ | 210-457 |
| NUT, HEX $6-32 \times 5 / 16$ | 210-478 |
| NUT, HEX $3 / 8-32 \times 1 / 2 \times 11 / 16$ | 210-494 |
| PANEL, FRONT SN 101-212 | 333-110 |
| PANEL, FRONT SN 213-651 | 333-127 |
| PANEL, FRONT SN 652-3498 | 333-148 |
| PANEL, FRONT SN 3499-7244 | 333-285 |
| PANEL, FRONT SN $7245-u p$ | 333-512 |
| RING, RETAINING | 354-025 |
| ROD, EXTENSION $1 / 8 \times 73 / 16$ | 384-075 |
| ROD, EXTENSION $1 / 8 \times 13 / 16$ | 384-082 |
| ROD, FRAME $3 / 8 \times 87 / 8$ tapped $8-32$ | 384-508 |
| ROD, SECURING $3 / 16 \times 101 / 2,10-24$ thread one end | 384-510 |
| ROD, ALUM. $3 / 8 \times 23 / 32$, tapped $6-32 \mathrm{SN} 4564-\mathrm{up}$ | 385-093 |
| SCREW, $4-40 \times 1 / 4$ BHS | 211-008 |
| SCREW, 4-40 5 516 BHS | 211-011 |
| SCREW, $4-40 \times 3 / 8$ BHS | 211-012 |
| SCREW, $4-40 \times 1 / 2$ RHS | 211-015 |
| SCREW, $4-40 \times 7 / 8$ RHS | 211-018 |
| SCREW, $4-40 \times 5 / 16$ Pan HS w/lockwasher | 211-033 |
| SCREW, $4-40 \times 5 / 16$ FHS Phillips slot | 211-038 |
| SCREW, $6.32 \times 5 / 16$ BHS | 211-507 |
| SCREW, $6-32 \times 3 / 8$ FHS | 211-509 |
| SCREW, $6-32 \times 1 / 2$ BHS | 211.511 |
| SCREW, $6-32 \times 3 / 8$ BHS | 211-510 |
| SCREW, $6.32 \times 3 / 4$ THS | $211-544$ |
| SCREW, 8 - $32 \times 21 / 2$ RHS | 212-015 |
| SCREW, $8-32 \times 21 / 2$ RHS | 212-022 |
| SCREW, $8-32 \times 1 / 2$ FHS Phillips slot | 212-043 |
| SCREW, $8-32 \times 1 / 2$ RHS Phillips slot | 212-044 |
| SCREW, $4-40 \times 5 / 16$ RHS Thread cutting, Phillips slot | 213-034 |
| SCREW, $4.40 \times 1 / 4$ PHS Thread cutting, Phillips slot | 213.035 |
| SHIELD, SOCKET $29 / 32$ ID | 337-005 |

## Mechanical Parts List (continued)

Tektronix
Part Number
SHIELD, TUBE $11 / 32$ ID $w /$ spring ..... 337-008
SHIELD, INPUT, S-SHAPE ..... 337-072
SHIELD, INPUT ..... 337-131
SHOCKMOUNT, RUBBER ..... 348-007
SOCKET, STM9G ..... 136-015
SPACER, ALUM. . 118 ID $\times 5 / 32$ OD $\times 11 / 16$ ..... 166-106
SPACER, NYLON $5 / 32^{\prime \prime}$ for Ceramic strip ..... 361-007
SPACER, NYLON $3 / 8$ " for Ceramic strip ..... 361-009
SUBPANEL ..... 386-352
TUBING \#20 BLACK PLASTIC ..... 162-504
WASHER, $5 S \times 9 / 32 \times .025$ ..... 210-801
WASHER, $6 S \times 5 / 16 \times .028$ ..... 210-802
WASHER, $6 L \times 3 / 8 \times .032$ ..... 210-803
WASHER, $85 \times 3 / 8 \times .32$ ..... 210-804
WASHER, FIBER \# 10 SHOULDERED ..... 210-812
WASHER, STEEL .390 ID $\times 9 / 16$ OD $\times .020$ ..... 210-840
WASHER, STEEL \#2 . 093 ID $\times 9 / 32$ OD $\times .020$ ..... 210-850
WASHER, STEEL \#4L . 119 ID $\times 3 / 8$ OD $\times .025$ ..... 210-851
WASHER, FIBER, RED ..... 210-906
WIRE \#22 SOLID, WHITE ..... 175-522
WIRE \#26 STRANDED, WHITE ..... 175-529


TYPE D DIFFERENTIAL HIGH-GAIN PREAMP $\begin{gathered}\text { RBH } \\ 4-19-6\end{gathered}$



L $\qquad$
$\times 10$


INPUT-B
ATTENUATORS
$\times 100$
$\times 1000$
SEE PARTS LIST FOR EARLIER
VALUES AND S/N CHANGES OF
PARTS MARKED WITH RED
TINT BLOCKS
RBH
4-19-61

TYPE D HIGH-GAIN DIFFERENTIAL PREAMP $S / N 1393$ \& UP

## 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 D, E, H, 122, 1121 and 519
IMPORTANT
Before operating this instrument, be sure to remove the plastic shipping clamps from the shock mounts of the amplifier chassis. These clamps should be saved and reinstalled as shown in the sketch if the instrument is to be shipped. Be sure the tongue is inserted next to the chassis to prevent damage to the shock mount.

The clamp should be on the same side of the shock mount as the nut.


