

INSTRUCTION MANUAL

Serial Number _____

TYPE 3S76
SAMPLING
DUAL-TRACE UNIT

Tektronix, Inc.

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070-332



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Any questions with respect to the warranty mentioned above should be taken up with your Tektronix Field Engineer.

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A list of abbreviations and symbols used in this manual will be found on page 7-1.



The Type 3576 Dual-Trace Sampling plug-in unit.

SECTION 1

CHARACTERISTICS

General Information

The Type 3S76 Dual-Trace Sampling Plug-In Unit is designed for vertical deflection of Tektronix Types 561A and RM561A Oscilloscopes and the Type 567 Readout Oscilloscope. Also, it is equipped to drive the readout circuitry of the Type 6R1 Digital Unit. A sampling sweep plug-in unit (such as the Tektronix Type 3T77) must be used with the Type 3S76.

The Type 3S76 permits observation of low-level signals of fractional nanosecond duration or risetime. These observations can be made at frequencies up to 875 megacycles*. The dual-trace feature of the Type 3S76 permits simultaneous displays of two signals.

The Type 3S76 takes a small sample of successive input signals. Each sample is completed in a fraction of a nanosecond. Each sample is initiated by the sweep plug-in unit, slightly later in time with respect to the last sampled pulse. The samples are reconstructed on a relatively slow time base provided by the sampling sweep plug-in unit.

The sampling process is unaffected by the characteristics of the device under test or by changes in sensitivity settings. Low noise and absence of jitter provide a high-resolution display comparable to conventional oscilloscopes.

Risetime

0.4 nsec (corresponding to an upper 3-db frequency of about 875 mc), each channel.

Input Impedance

50 ohms, $\pm 1\%$, each channel.

Deflection Factor

Variable in seven steps of 2, 5, 10, 20, 50, 100, and 200 mv/div, each channel. For 10 to 200 mv/div, accuracy is $\pm 3\%$ when the 2-200 VAR. control is set to CALIB. For 2 and 5 mv/div, accuracy is $\pm 5\%$. The 2-200 VAR. controls provide a continuously variable deflection factor (uncalibrated) from 2 to 200 mv/div.

Maximum Allowable Signal Input

± 2 volts, combined dc and peak ac, with respect to ground.

Noise (Referred to Input)

1 mv, peak-to-peak, with SMOOTH-NORMAL switch at SMOOTH.

2 mv, peak-to-peak, with SMOOTH-NORMAL switch at NORMAL.

*The Type 3T77 Time Base will trigger to 500 mc. For signals above this limit, a trigger-countdown circuit may be employed to furnish trigger signals for the Type 3T77.

Operating Modes

Single-Channel Operation: Channel A display or channel B display only.

Dual-Trace Operation: Both channels display signals simultaneously.

A + B: Display of the algebraic sum or difference ($\pm A \pm B$) of two signals.

A Vertical — B Horizontal: Both channels operate. Channel A provides vertical deflection, channel B provides horizontal deflection. Permits X-Y operation at 0.4-nsec risetime.

Vertical Signal Output

Dc-coupled signal output from either channel. Output of A OUT or B OUT jacks is 1 volt for each division of vertical deflection, with a source impedance of 10 kilohms. Open-circuit output voltage swing is about +2 to +18 volts.

Dynamic Range

± 8 major graticule divisions.

Dc Offset

± 1 volt, referred to input, available in each channel. Monitor voltage is ± 100 volts through 100 kilohms.

Signal Delay

55 nsec in both channels. For example, when used with the Type 3T77 Sampling Sweep Plug-In Unit with minimum delay, the sweep function reaches the crt deflection plates about 12 nanoseconds ahead of the signal.

Mechanical

Construction: Aluminum-alloy front panel and chassis.

Finish: Photo-etched, anodized front panel.

Weight: 7 lbs.

Accessories Supplied With the Type 3S76

| | Tektronix Part Number |
|--|--------------------------|
| 2 10XT attenuators, 50-ohm GR connectors | (017-044) |
| 2 5-nanosecond, 50-ohm cables, RG/58 with 50-ohm GR connectors | (017-502) |
| 2 Instruction manuals | (070-332) |

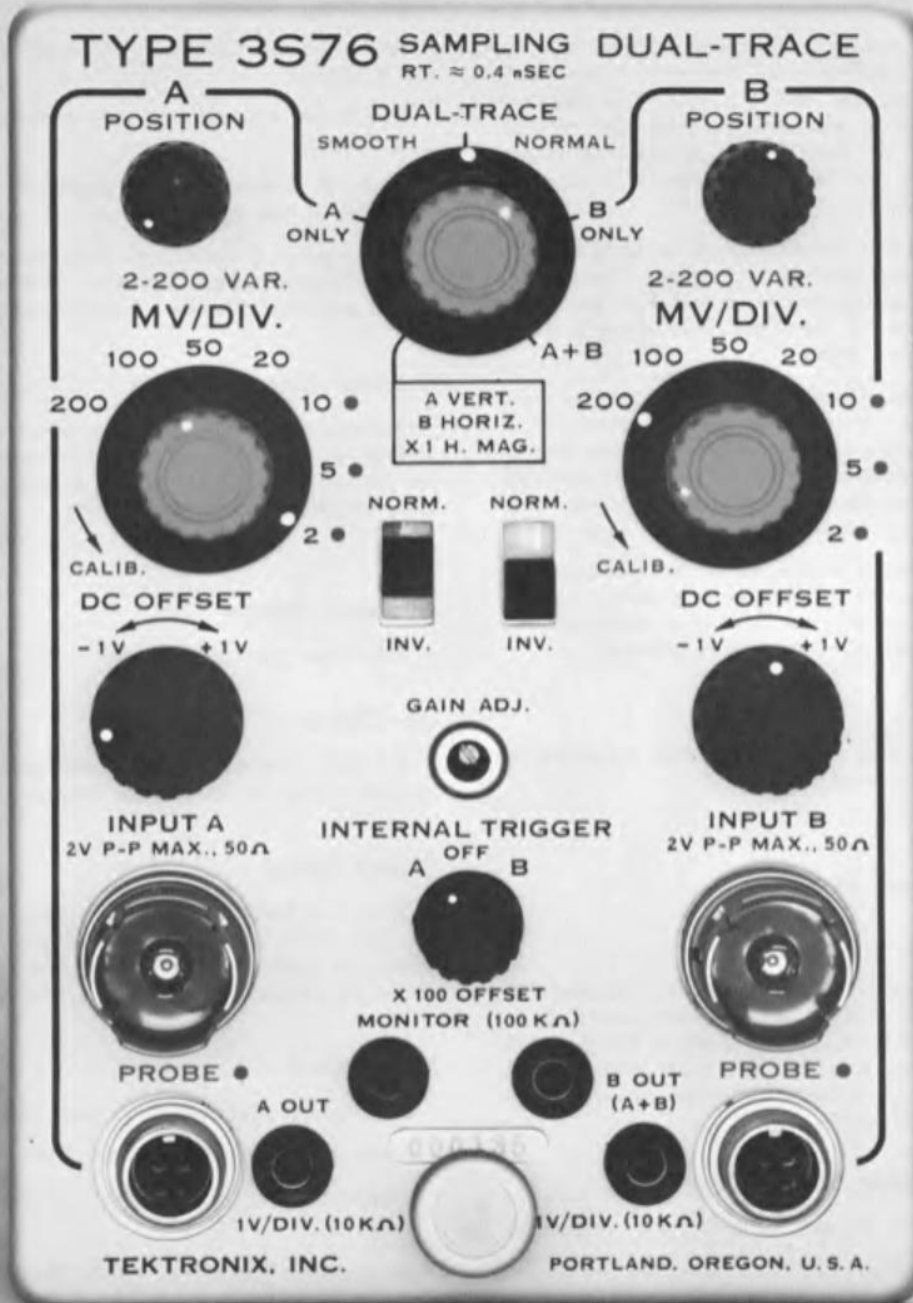


Fig. 2-1. Front panel of the Type 3576.

SECTION 2

OPERATING INSTRUCTIONS

Introduction

This section covers the operation of the front-panel controls and connectors of the Type 3S76. Certain general items are included to help the operator obtain the best results from the system (see Fig. 2-1).

The Type 3S76 (with a sampling sweep plug-in unit) converts any Type 561A, RM561A, 567, or RM567 Oscilloscope into a dual-trace sampling system. The system is completely self contained, has internal trigger and signal delay, and normally does not require an external trigger.

The basic front-panel deflection factors of 2 to 200 millivolts, coupled with plug-on external attenuators, adapt to a wide range of input signal levels.

Functions of Front-Panel Controls and Connectors

Vertical Mode Switch

Selects one of five operational modes:

A ONLY: The channel A signal is displayed.

B ONLY: The channel B signal is displayed.

DUAL-TRACE: Both channels display signals simultaneously.

A+B: The algebraic sum ($\pm A \pm B$) of the two channels is displayed as a single trace.

A VERT. B HORIZ.: Channel A signal controls vertical deflection and channel B signal controls horizontal deflection for X-Y operation.

SMOOTH-NORMAL Switch (Red knob concentric with Vertical Mode switch)

In the **SMOOTH** position, display noise is not more than 1 millivolt, peak-to-peak. In the **NORMAL** position display noise is not more than 2 millivolts, peak-to-peak.

POSITION Controls

Adjust vertical position of the display.

MV/DIV. Switches

Select desired deflection factor for either channel. For example, with the channel A MV/DIV. switch set at 100, each major division of channel A vertical deflection corresponds to 100 millivolts of applied signal when the 2-200 VAR. control is in the **CALIB.** position.

2-200 VAR. Controls (Red knobs concentric with MV/DIV. switches)

Provide an uncalibrated, variable adjustment of deflection factor between steps of the MV/DIV. switches. For all settings of the MV/DIV. switches except 2, deflection factor can be decreased (increased sensitivity) by approxi-

mately 2.5. The 2-200 VAR. control has no effect when the MV/DIV. switch is set to 2.

DC OFFSET Controls

Vary the offset voltage between +1 volt and -1 volt. These controls may be used to offset the effects of a dc input level, or to display any portion of a high amplitude signal. By monitoring the voltage at the appropriate X100 OFFSET MONITOR jack, highly accurate ($\pm 2\%$) voltage difference measurements can be taken.

X100 OFFSET MONITOR (100 K Ω) Jacks

The output voltage at these jacks is always 100 times the internal offset voltage which is variable with the DC OFFSET controls.

INPUT A and INPUT B Connectors

Connectors for applying the input signal. Connectors are GR type with a 50-ohm input impedance.

A OUT 1V/DIV. (10 K Ω) Jack

The channel A output signal is available at this connector. Output amplitude is 1 volt for each division of vertical deflection on the crt. Source impedance is 10 kilohms. Voltage swing is about +2 to +18 volts, open circuit. The average dc level of this output signal varies with the setting of the 2-200 VAR., NORM.-INV., MV/DIV., DC OFFSET, and POSITION controls.

B OUT 1V/DIV. (10 K Ω) Jack

Same as A OUT except applies to channel B operation. (A+B signal available when Vertical Mode switch is set to A+B.)

NORM.-INV. Switches

In the **NORM.** position, the displayed signal has the same polarity as the applied signal (positive up, negative down). In the **INV.** position, the display is inverted. When the Vertical Mode switch is set to A+B, algebraic addition is obtained with both NORM.-INV. switches set in the same position. Algebraic subtraction is obtained with the NORM.-INV. switches set in opposite positions.

INTERNAL TRIGGER Switch

Selects the source of the internal triggering signal (from either channel A or B). The switch should be set to **OFF**, if the sweep plug-in unit is externally triggered, to reduce coupling between units.

PROBE Connectors

Provides power for active probes. Designed for use with the Tektronix P6032 cathode follower probe (Tektronix part number 010-098).

GAIN ADJ.

Matches the amplifier gain to the oscilloscope crt deflection factor.

Operating Instructions—Type 3S76

Installing the Type 3S76 Into the Oscilloscope

CAUTION

Turn the oscilloscope off when inserting or removing plug-in units. Otherwise, power supplies in the oscilloscope may fail to regulate momentarily as the plug-in units are removed or replaced.

The Type 3S76 is designed to drive the vertical deflection plates of the oscilloscope crt and therefore must be used in the left-hand compartment of the oscilloscope.

To insert the Type 3S76 into the compartment, place the latch at the bottom of the front panel in a horizontal position. Then slide the Type 3S76 completely into the compartment. Once the plug-in unit is seated, turn the aluminum knob a few turns clockwise until it is hand-tight.

Cable Considerations

If transmission lines or terminations are improper, reflections, standing waves, or undue loading on the device under test may cause signal distortion. If it is necessary to use other than the 50-ohm cables supplied, use suitable matching devices to couple between cables or inputs. Be sure to use only low-loss transmission lines and keep all connections as short as practical to minimize cable losses.

Time delay of cables varies with length and construction. Time delay is especially important when making time-difference measurements between two signals, as in dual-trace or X-Y operation. In this case, each signal should travel through cables that produce equal delay to preserve the true time relationship.

Connect the signal to be displayed to either the INPUT A or INPUT B connector on the front panel of the Type 3S76. Both connectors are General Radio 50-ohm connectors and will mate with either end of the 50-ohm cables supplied.

Coupling a Signal into the 50-Ohm Input

To observe the output signal of an instrument having a 50-ohm output impedance, connect a 50-ohm coaxial cable directly between the output of the instrument and either the INPUT A or INPUT B connector. GR Type 874 adapters are available that will mate with most common connectors. If the output of the instrument is other than 50 ohms, use a suitable matching device.

To observe a signal at some point within a given circuit, other factors must be considered. First, to avoid distortion, the circuit must not be heavily loaded by the coupling method. Second, the coupling method should be equally responsive to all frequencies within the limits of the Type 3S76. In constructing coupling networks, it is common practice to use $\frac{1}{4}$ - or $\frac{1}{8}$ -watt resistors for their small size. In general, resistors tend to be inductive below 50 ohms, and capacitive above 500 ohms. Good shielding, short, solid grounds, and short leads are essential.

Figs. 2-2 and 2-3 show two coupling methods. In the parallel method (Fig. 2-2), a resistor R_s is connected in series with the 50-ohm input of the Type 3S76. $R_s + 50$ ohms is then placed across the impedance of the circuit under test. A reasonable maximum circuit loading might

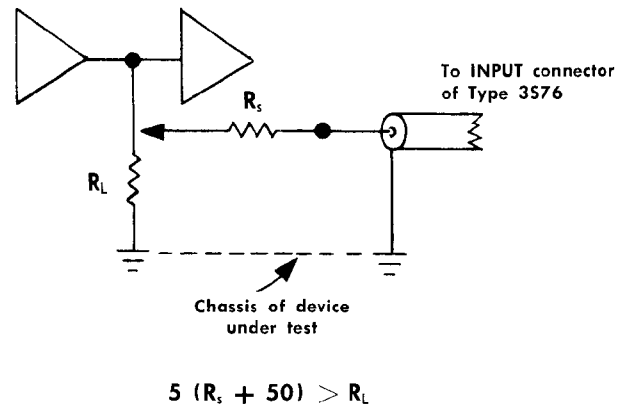


Fig. 2-2. Parallel method for coupling a signal from a circuit under test.

be when the resistance of R_s plus the 50-ohm input of the Type 3S76 is at least 5 times greater than the impedance of the circuit under test R_L , thus requiring only 20% correction.

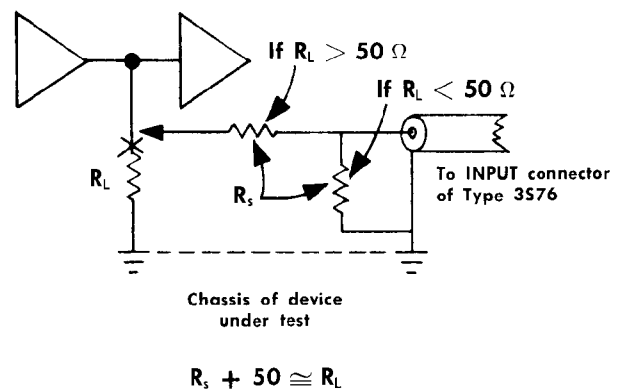


Fig. 2-3. Series method for coupling a signal from a circuit under test.

In the series coupling method (Fig. 2-3), the 50-ohm input resistance of the Type 3S76 becomes part of the impedance of the circuit under test. If the impedance of the circuit under test equals 50 ohms, simply connect directly to the Type 3S76 input. However, if the impedance of the circuit under test (shown as R_L in Fig. 2-3) exceeds 50 ohms, place a resistance in series with the Type 3S76 input. The size of this resistance, plus 50 ohms, should equal the original impedance of the circuit under test. If R_L is less than 50 ohms, R_s must be placed in parallel with the input of the Type 3S76. The equivalent parallel resistance of R_s and the 50-ohm input resistance of the Type 3S76 should equal the impedance of the circuit under test.

The probe network shown in Fig. 2-4 is an example of the parallel method in Fig. 2-2. The probe network is

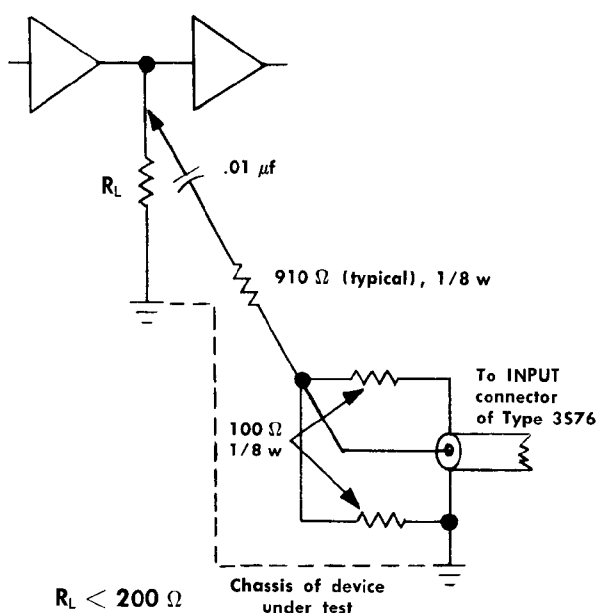


Fig. 2-4. Probe method for coupling a signal from a circuit under test.

highly versatile and will require less than 20% correction when used across impedances below 200 ohms. The 0.01- μ f capacitor in the probe network will block any dc component and protect the 910-ohm resistor. Use of the capacitor is optional. The two 100-ohm resistors placed directly across the cable input serve to back-terminate any small reflections from the output circuit due to imperfect coupling. When observing signals of short duration, the reflections may occur off the crt or, if reflections of a few percent are unimportant, the two resistors can be deleted with about a two times increase in signal amplitude at the Type 3S76 input. Attenuation of the probe network shown in Fig. 2-4 with the two 100-ohm resistors is about 40; without the resistors, it is about 20.

More versatile passive probes are available from Tektronix, such as the P6026, P6034, and P6035 Probes. Probes are also available with less loading effect, such as the Tektronix P6032 Cathode Follower Probe.

First-Time Operation

To display a signal, set the Type 3S76 front-panel controls as follows:

| | |
|----------------------|-----------------------------|
| Vertical Mode Switch | A ONLY |
| A and B POSITION | Midrange |
| A and B MV/DIV. | 200 |
| A and B 2-200 VAR. | CALIB. |
| A and B DC OFFSET | 2 1/2 turns from either end |
| A and B NORM.-INV. | NORM. |
| INTERNAL TRIGGER | A |

Apply the signal you wish to observe to the Type 3S76 INPUT A connector. Be sure the applied signal meets the triggering requirements of the sweep plug-in unit, is less than ± 1 volt dc, and does not exceed 2 volts peak-to-peak. Free run the triggering circuit of the sweep plug-in unit.

Center the trace on the graticule with the A POSITION control (and the DC OFFSET control, if necessary). Adjust the triggering controls of the sweep plug-in unit for a stable display and set the channel A MV/DIV. switch for the desired amount of vertical deflection.

Now check channel B by applying the input signal to the INPUT B connector, and setting the INTERNAL TRIGGER switch to B and the Vertical Mode switch to B ONLY.

Experiment with the various front-panel controls and notice the effect of each. For example, notice that the DC OFFSET control changes the vertical position of the trace, as does the POSITION control. Also, the DC OFFSET control varies the voltage at the X100 OFFSET MONITOR jacks. The display may be inverted by placing the NORM.-INV. switch to INV.

Positioning the Display

When making accurate time or amplitude measurements, it is usually advantageous to align the display with the graticule markings. Vertical positioning of the display can be controlled with the appropriate POSITION or DC OFFSET control.

The effect of the DC OFFSET control is most significant at low deflection factors. As the MV/DIV. switch is set to a lower number, the display may be deflected entirely off the crt. In this case, use the DC OFFSET control to return the display to the crt. The POSITION control may be used for more precise positioning.

Precise pulse-height measurements can be made by measuring the voltage change at the X100 OFFSET MONITOR jacks as the setting of the DC OFFSET control is changed from one point on the pulse (such as the baseline) to another (such as peak height).

Smooth-Normal Switch

Display noise can be reduced from 2 millivolts to 1 millivolt by setting the SMOOTH-NORMAL switch to SMOOTH. This reduces the gain of the sample amplifier by 4. However, when observing the rising or falling edge of a waveform, it is desirable to use at least 100 dots. Otherwise, the dispersion of dots cannot faithfully follow the input signal. Therefore, if there are fewer than 100 dots in a rising or falling portion of the display, use the NORMAL position of the SMOOTH-NORMAL switch.

Dual-Trace Operation

The dual-trace feature of the Type 3S76 effectively permits observing signals from both channels simultaneously. This is useful for comparing amplitude, risetime, waveshape, and time delay of two signals. However, to obtain a stable display of both signals, the signals must be related in frequency or repetition rate. When the dual-trace feature is used, be sure to trigger from the channel with the earliest signal event. Use equal length input cables to preserve the time relationships.

To set the controls of the Type 3S76 for dual-trace operation, proceed as follows:

Operating Instructions—Type 3S76

1. Set the Vertical Mode switch to DUAL-TRACE.
2. Set the MV/DIV. switches to the positions that will provide about two or three divisions of display for each channel.
3. Set the INTERNAL TRIGGER switch to either A or B. (For time-delay or time-difference measurements, choose the channel that has the earliest signal applied to it.)
4. For external triggering, set the INTERNAL TRIGGER switch to OFF. Be sure the external signal is early enough to start the sweep.

Gain Adjustment

The GAIN ADJ. control (a front-panel screwdriver adjustment) matches the gain of the Type 3S76 to the oscilloscope crt deflection factor. The gain must be checked and adjusted (if necessary) each time the Type 3S76 is used with a different oscilloscope. The setting of the GAIN ADJ. control should also be checked occasionally during regular use of the instrument.

To check and/or adjust the Type 3S76 GAIN ADJ. control, proceed as follows:

1. Make sure the equipment has warmed up for at least five minutes.
2. From the Calibrator of the Type 561A, RM561A, 567, or RM567, apply the 0.1-volt signal (that is intended to work into 50 ohms; see the following note) to the INPUT A connector.

NOTE

Early models of the Type 560-Series Oscilloscopes may not provide the signal accuracy required for this step without a slight modification.

For a Type 561 or 561A Oscilloscope, R898 in the Calibrator circuit must be a 100-ohm, $\frac{1}{2}$ -watt, 1% resistor. If it is not, replace it with one having these specifications. The 0.5-volt Calibrator position will then supply 0.1 volt into 50 ohms.

For a Type RM561 or RM561A Oscilloscope, R898 in the Calibrator circuit must be a 250-ohm, $\frac{1}{2}$ -watt, 1% resistor. If it is not, replace it with one having these specifications. The 1-volt Calibrator position will then supply 0.1 volt into 50 ohms.

For a Type 567 or RM567 Oscilloscope, a resistor R890 should be located between the 0.5-volt Calibrator jack and the junction of R887 and R888. The resistor has a value of 100 ohms, $\frac{1}{2}$ -watt, 1%. If your oscilloscope does not have this resistor, install one at the point indicated (in series with the 0.5-volt Calibrator jack). This jack will then provide 0.1 volt into 50 ohms.

3. Free run the triggering circuit of the sweep plug-in unit (i.e., set the TRIGGER SENSITIVITY control fully clockwise).

4. On the Type 3S76, set the Vertical Mode switch to A ONLY, the channel B 2-200 VAR. to CALIB., and the A MV/DIV. to 20; other controls may be set to any position.

5. With the channel A POSITION and DC OFFSET controls, align the display with the appropriate graticule lines and check for exactly five major graticule divisions of vertical deflection on the crt. If the amount of vertical deflection is not exactly five major divisions, adjust the GAIN ADJ. control.

6. Connect the Calibrator signal to the INPUT B connector, set the Vertical Mode switch to B ONLY, the channel B 2-200 VAR. to CALIB., and MV/DIV. to 20; other controls may be set to any position.

7. With the channel B POSITION and DC OFFSET controls, align the display with the appropriate graticule lines and check for exactly five major graticule divisions of deflection on the crt. If the vertical deflection is not exactly five major divisions, the Type 3S76 needs calibration; refer to the Calibration section of this manual.

A OUT and B OUT Jacks

The portion of the input signal displayed on the crt appears at the appropriate A OUT or B OUT jack. Since the signal at the A OUT or B OUT jack is produced after the sampling process, it is much slower than the original input signal. Consequently, the triggering and sweep rate controls of the sampling sweep plug-in unit determine the shape of the waveform at the A OUT and B OUT jacks.

The signal at the A OUT or B OUT jack is proportional to the displayed signal. The amplitude of the signal at the appropriate jack is 1 volt for each division of deflection on the crt, through a source impedance of 10 kilohms.

The average dc level at the A OUT or B OUT jack depends on the setting of the appropriate POSITION control. The POSITION control varies the open-circuit dc level from about +2 to +18 volts.

With the Vertical Mode switch set at A+B, the combined channel A and B signals appear at the B OUT jack.

Since the actual frequency of the signal at the appropriate A OUT or B OUT jack is much lower than the applied signal, the A OUT or B OUT signals are useful for pen recorder applications.

SECTION 3

APPLICATIONS

Voltage Measurements

Vertical displacement of the trace on the crt is directly proportional to the voltage at an INPUT connector. The amount of displacement for a given voltage can be selected with the MV/DIV. switch. To provide sufficient deflection for best resolution, set the MV/DIV. switch so the display spans a large portion of the graticule. Also, when measuring between points on a display, be sure to measure consistently from either the bottom, middle, or top of the trace. This prevents the width of the trace from affecting your measurements.

To make a voltage-difference measurement between two points on a display, proceed as follows:

1. Note the vertical deflection, in major graticule divisions, between the two points on the display. Make sure the 2-200 VAR. control is in the CALIB. position.
2. Multiply the major divisions of vertical deflection by the setting of the MV/DIV. switch and the attenuation factor (if any) of external attenuators or probe. The product is the voltage difference between the two points measured.

For example, suppose you measure 4.4 divisions of deflection between two points on the display and the MV/DIV. switch is set at 20. Multiplying 20 millivolts/division by 4.4 divisions, the product is 88 millivolts. This is the voltage at the INPUT connector. Now, assume there is a 10X external attenuator between the INPUT connector and the signal source. To determine the actual signal voltage at the source, multiply 10 (the attenuation factor) by 88 millivolts; this product (880 millivolts or 0.88 volt) is the actual voltage at the signal source.

If desired, you can measure the instantaneous (or dc) voltage to ground from the display. This measurement is accomplished in the same manner except that, with no signal applied, you must first establish a ground-reference point on the crt. To do this, allow the sweep plug-in unit to free run and present a trace. Then, position the trace so it is exactly aligned with one of the horizontal graticule lines. The actual graticule line you select will be largely determined by the polarity and amplitude of the applied signal. After establishing the ground reference, make no further adjustments with the POSITION controls.

Apply the signal and measure the voltage the same as previously described. Make all measurements from the established ground-reference point.

If the applied signal has a relatively high dc level, the ground-reference point and the actual signal may be so far apart that neither will appear on the crt. In this case, refer to the following discussion on "Dc Offset Voltage Measurements."

Dc Offset Voltage Measurements

The dc offset voltage cancels the effects of an applied dc level (up to ± 1 volt) on the display. Also, accurate amplitude measurements of the applied signal can be ob-

tained by positioning the display to various points and measuring the amount of voltage change at the appropriate X100 OFFSET MONITOR (left-hand jack monitors channel A; right-hand jack monitors channel B).

Output impedance of the X100 OFFSET MONITOR jacks is 100 kilohms, therefore, meter loading may be appreciable. The accuracy of the dc offset voltage measurements depends on the accuracy and the loading effect of the measuring device. The following measuring devices are recommended in the order of preference, for measuring the voltage at the X100 OFFSET MONITOR jacks.

- (1) Differential, non-loading dc voltmeter with an accuracy of 0.2% or better. This type of device provides 2% accuracy to offset voltage measurements.
- (2) Vacuum-tube voltmeter with an input impedance of at least 10 megohms. Accuracy of the vtvm should be as high as practical.
- (3) Zero-center ± 1 -ma milliammeter with as high an accuracy as practical. The milliammeter should be connected directly between the appropriate X100 OFFSET MONITOR jack and ground. When using a milliammeter, 10 microamperes is equivalent to 1 volt at the X100 OFFSET MONITOR jack.

To measure the voltage difference between two points on a waveform (such as peak or peak-to-peak volts), proceed as follows:

1. Set the appropriate DC OFFSET control to about mid-range.
2. Apply the signal to be measured to the appropriate INPUT connector. Adjust for a stable display with about 7 divisions of vertical deflection between the two points of the signal to be measured. Make sure the 2-200 VAR. control is set to CALIB.
3. With the POSITION and DC OFFSET controls, move one of the points to be measured to the centerline of the graticule and measure the voltage at the appropriate X100 OFFSET MONITOR jack. Use one of the measuring devices mentioned previously. Do not move the POSITION control after this step.
4. With the DC OFFSET control, move the display so the other point to be measured is aligned with the centerline of the graticule and again measure the voltage at the appropriate X100 OFFSET MONITOR jack.
5. Find the difference between the voltage measured in step 3 and the voltage measured in step 4, and divide by 100. The result is the voltage difference, in volts, between the two points measured on the waveform.

X-Y Phase Measurements

X-Y operation is obtained by placing the Vertical Mode switch in the A VERT. B HORIZ. XI H. MAG. position. This allows channel A to control vertical deflection and channel B to control horizontal deflection.

Applications—Type 3576

To produce a lissajous display of two signals of the same frequency, proceed as follows:

1. Set the Type 3576 front-panel controls as follows:

| | |
|----------------------|--------------------|
| Vertical Mode Switch | A ONLY |
| NORM.-INV. Switches | NORM. |
| DC OFFSET Controls | Midrange |
| INTERNAL TRIGGER | A or B, as desired |

2. Apply one signal to the INPUT A connector and the other signal to the INPUT B connector through equal lengths of coaxial cable.

3. Set the triggering controls of the sampling sweep plug-in unit for a stable display of at least one complete event.

4. Adjust the following channel A controls, as required, to obtain a centered, 6-division display: MV/DIV., 2-200 VAR., DC OFFSET, and POSITION.

5. Set the Vertical Mode switch to B ONLY and repeat steps 3 and 4 using the channel B controls.

6. Set the Vertical Mode Switch to A VERT. B HORIZ.

7. Using both Type 3576 POSITION controls, position the display on the graticule (both vertically and horizontally) for the type of X-Y display desired.

8. If the input signals are sine waves, the display will probably be an ellipse. Fig. 3-1 shows a method for calculating the phase difference between the two signals. (If the display appears as a diagonal straight line, the two sine waves are either in phase or 180° out of phase; if the display is a circle, the two sine waves are 90° out of phase.)

Impedance Measurement by Reflection

Pulse reflections are produced by a mismatch in transmission-line systems. The Type 3576 is useful for observing and evaluating the impedance producing these reflections.

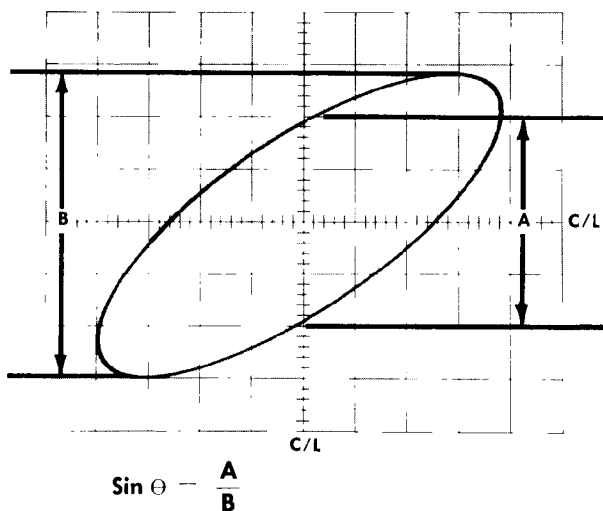


Fig. 3-1. X-Y method of calculating phase difference (θ) between two sine waves.

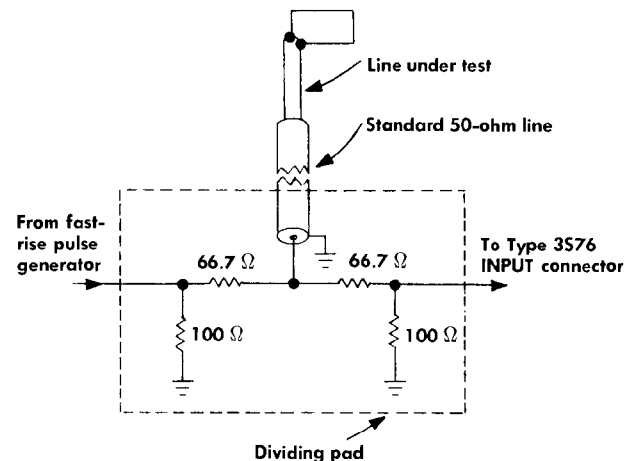


Fig. 3-2. Three-way dividing pad for observation and evaluation of reflections.

The dividing pad shown in Fig. 3-2 supplies a three-way termination for connecting the 50-ohm input of the Type 3576 to a transmission system consisting of a pulse generator and a transmission line under test.

The amplitude of a reflected wave increases with the degree of mismatch. In the two extremes of mismatch (i.e., zero and infinite impedance), the reflection equals the amplitude of the applied pulse. The result, in this case, is that the reflection either cancels or doubles the applied signal at the instant it returns to the dividing pad. The relationship between the amplitude of the reflection and the unknown impedance at the end of a 50-ohm standard-impedance line is

$$Z = \frac{50}{2 \frac{V_o}{V_x} - 1}$$

where: Z = the unknown impedance.

V_o = the peak amplitude produced by the 50-ohm standard impedance.

V_x = the peak amplitude at the time of the reflection.

Fig. 3-3 shows the result of a 90-ohm shorted transmission line connected on the end of a 50-ohm standard transmission line and the dividing pad of Fig. 3-2. The first upward voltage step on top of the pulse originates from the pulse entering the 90-ohm line. The downward step is produced by the shorted end of the 90-ohm line. The time between the two voltage steps equals twice the delay time of the 90-ohm line.

This method is not limited to transmission line tests. Any impedance can be connected to the 50-ohm standard-impedance line and measured as it changes in time.

Algebraic Addition or Subtraction of Signals

The algebraic sum or difference of two signals is displayed on the crt when the Vertical Mode switch is in the

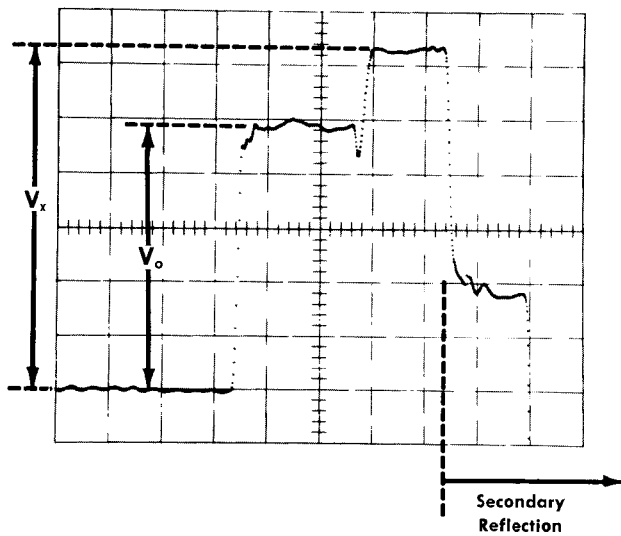


Fig. 3-3. Display from the dividing pad of Fig. 3-2 with a 50-ohm standard line and a shorted 90-ohm line.

A+B position. The sum of the signals is obtained with both NORM.-INV. switches set in the same position. The signal difference is obtained with the NORM.-INV. switches set in opposite positions.

This mode of operation is particularly useful for cancelling the effects of an undesired common-mode signal. For example, suppose the signal you wish to observe contains an undesired 60-cycle hum component. In normal operation, this could cause an unstable display. However, in the A+B mode, you can cancel the effect of the hum by applying the signal plus hum to one channel and the hum only to the opposite channel. Then, by experimenting with the hum-only channel MV/DIV., 2-200 VAR., and NORM.-INV. controls you can set the instrument for best hum rejection. However, be sure the hum component you apply to the opposite channel is as free as possible from the signal you wish to observe.

Dual-Trace Applications

The dual-trace mode of operation allows you to view two separate events simultaneously. This is useful if you wish to compare two signals in amplitude or time. To obtain a suitable display of two signals, the signals must bear a fixed time relationship to each other in a period that does not exceed the maximum sweep duration. Set the INTERNAL TRIGGER switch to A or B (whichever signal arrives earliest).

The differences in delay time between two coaxial cables, for example, can easily be displayed in dual-trace operation by applying a common signal through two lengths of coaxial cable to both INPUT connectors. By knowing the delay through one of the cables and comparing the time difference between the displayed signals, you can determine the delay through the unknown cable. For example, suppose your known cable had a delay of 10 nanoseconds. Triggering on the known cable channel, a pulse 5 nanoseconds later on the unknown cable channel would indicate a 15-nanosecond cable.

Pen Recorder Operation

The signals available at the A OUT and B OUT jacks provide a convenient source for driving the Y axis of a recorder. It is common practice to manually scan the crt (with the sampling sweep plug-in controls) while driving the time axis of the recorder with the sweep-output voltage. Another method for pen recording is to couple the scanning voltage of the recorder to the external sweep input connector of the sweep unit. (To use the recorder voltage, it must vary between 0 and at least +50 volts.)

The source impedance of the A OUT and B OUT jacks is 10 kilohms. This impedance may have to be considered in the calibration of some types of pen recorder amplifiers.

With the Vertical Mode switch set at A+B, the algebraic sum or difference of the two channels appears at the B OUT jack. This enables you to obtain algebraic addition, subtraction, or common-mode signal rejection while using a recorder. See the previous discussion in this section under "Algebraic Addition or Subtraction of Signals".

SECTION 4

CIRCUIT DESCRIPTION

General Operation

Operation of a sampling system is somewhat different from that of conventional oscilloscope circuitry. In a conventional oscilloscope system, the crt beam is continuously deflected vertically by the signal applied to the input; thus, the selected portion of the signal is displayed completely each time the electron beam makes a sweep. This is not the case in a sampling system. Instead, only a very small segment or sample of the input signal is displayed each time the sampling system is triggered. The Type 3S76 takes very short samples of the input signal amplitude. Each sample is obtained progressively later in time on successive (but not necessarily consecutive) pulses. The precise time at which the samples are taken is controlled by the sampling sweep plug-in unit. A thorough discussion of the timing technique is contained in the sweep unit instruction manual.

The samples are reconstructed on a slow sweep and appear as dots on the crt. The slow sweep is actually a series of horizontal steps; one for each sample. The rate of the slow sweep depends on how many dots are contained in the total display and the repetition rate of the input signal. Since each sample represents the instantaneous amplitude at the time the sample was taken, the position of the dots on the crt corresponds to sampled points along the input signal.

SNAP-OFF & MEMORY CIRCUITS

Input Circuitry

From the front-panel 50 Ω INPUT A or INPUT B connector, the incoming signal passes through the primary winding of the Trigger Takeoff Transformer T1030 or T2030, depending on which channel is used. At this point, about one-fifth of the input signal voltage is coupled to the transformer secondary and sent to the sampling sweep plug-in unit for triggering. The INTERNAL TRIGGER switch selects either channel A or B as an internal trigger source. The INTERNAL TRIGGER switch should be turned OFF when external triggering is used to minimize undesired signal coupling between plug-in units.

From T1030 or T2030, the input signal goes through a 55-nanosecond delay line. This 55-nanosecond delay follows the sweep unit time to operate before the signal is applied to the vertical system.

The matching network at the output of the delay line serves three functions: (1) It properly terminates the line, thus preventing reflections; (2) It compensates for the inherent losses of the delay line; (3) It corrects for the trigger signal removed by the Trigger Takeoff transformer.

The diodes in the four-diode Sampling Gates are special gallium arsenide diodes with very fast switching characteristics. The diodes are quiescently back biased to prevent the incoming signal from reaching the grid of Nuvistors V1073 or V2073. The exact amount of quiescent back-bias

voltage is set by the A or B BRIDGE VOLTS adjustment. When properly calibrated, the bridge voltage is normally 1.6 to 2.0 volts with respect to ground. When a sample is taken, the diodes are forward biased for a fraction of a nanosecond by a sharp pulse from the Driver Blocking Oscillator (Q2010) and Snap-Off circuit (D2002). The Driver Blocking Oscillator is, in turn, triggered by a signal from the sweep plug-in unit.

Driver Blocking Oscillator and Snap-Off Circuit

The Driver Blocking Oscillator Q2010 is a triggered (monostable) oscillator which receives a trigger pulse from the sweep unit through pin 18 of the interconnecting plug. The output pulse of the Driver Blocking Oscillator goes to the Snap-Off circuit, the Memory Gate Driver Q2024, and the Dual-Trace Blocking Oscillator Q2230.

The Snap-Off circuit operates from the Driver Blocking Oscillator pulse to produce sharp spikes for application to the Sampling Gate. Snap-Off diode D2002 operates quiescently with a forward current of about 60 milliamps. A positive-going pulse from T2010 tries to reverse this current abruptly. Storage effects in diode D2002 prevent blocking-oscillator current from passing into the bridge-driving circuit during storage time of D2002. Suddenly, storage current through D2002 ends, and no further current flows to ground. This sudden diversion of current through D2002 to the output circuit produces the sharp sampling spike waveshape. T2001 converts the spike to push-pull. The clipping line sets the length of the spike or pulse.

Preamp and Memory Circuit

Operation of the Preamp and Memory circuits is identical for both channel A and B. The following discussion will therefore describe only the operation of channel A.

The Preamp circuits consist of V1073, Q1074, Q1084, and Q1094. The Preamp circuits are permitted at least 10 microseconds to amplify the samples of the input signal, couple the new sample to the Memory circuit, and come to rest again before the next sample.

The Memory circuit consists of V1133A, Q1134, and Q1141 and is a form of gated operational amplifier which remembers the previous sample levels. The signal amplified by the Preamp circuit is proportional to the change in signal voltage between the last sample (remembered by the Memory circuit) and the new sample of signal voltage. Thus, only the error signal, or difference signal, produces an input through the four-diode Sampling Gate to the grid of V1073. The information that passes through the Preamp circuits from the last sample is properly attenuated by the MV/DIV. switch.

To further describe the operation of the individual circuits of the Preamp and Memory, the following discussion traces the path of the sample through each circuit.

Circuit Description—Type 3S76

During the short time the Sampling Gate is open, the signal voltage is coupled to the grid circuit of cathode-follower V1073. The grid of V1073 is permitted to charge to about 25% of the instantaneous signal voltage.

V1073 has a capacitive input which remembers the signal amplitude for a time after the Sampling Gate is closed. The grid of V1073 receives two signals; the sample information admitted by the Sampling Gate and, shortly afterward, the "feedback" voltage from the Memory circuit developed on C1049. Whenever the feedback voltage equals the instantaneous voltage of the new sample, no error signal passes the Preamp circuit.

The output signal of the cathode follower is coupled directly to the base of transistor Q1074. Ac gain of Q1074 is about 6 when the SMOOTH-NORMAL switch is at NORMAL, and about 1.5 at SMOOTH. With the ac gain of the stage decreased in the SMOOTH position, the error voltage coupled to the Memory circuit is decreased. Consequently, it takes slightly longer for the Memory circuit to respond to changing peak voltages of the incoming samples. Thus, with the SMOOTH-NORMAL switch at SMOOTH, the output of the Memory circuit is only 25% of each sample. Thus, the response to random noise is reduced. This change in gain causes a lag in following the input signal changes which can only be overcome by selecting at least 100 dots during transition time of the input signal. However, the calibrated deflection factor of the Type 3S76 is not affected.

The output from Q1074 is coupled through the MV/DIV. switch to the base of Q1084. Precision divider R1081, together with R1147 (both part of the MV/DIV. switch) select the desired deflection factor.

Q1084 and Q1094 normally amplify the error signal about 100 times. Feedback resistor R1090 and the A PRE-AMP SENS. adjustment R1088 set the gain of the circuit. Thus, R1088 adjusts for proper error signal gain of the amplifier.

The output of Q1084/Q1094 amplifier is coupled through C1124 to the Memory Gate circuit. Just after each sample is passed into the Memory circuit, C1124 discharges and is again ready to accept the next error signal. The Memory Gate is a form of diode bridge. Zener diode D1124 clamps the voltage across the bridge at 6 volts. R1126 and R1127 provide the proper bridge balance so the voltage on the ends of the bridge is +3 and -3 volts with respect to ground. After the sample is taken and before the error signal passes through the delay of the Preamp circuits, the Memory Gate is opened by a pulse from Memory Gate Driver Q2024. The gating pulse from Q2024 is coupled to the center winding of T1130. This 12-volt drive pulse momentarily turns on D1130 and D1132. This allows the error signal (if any) to pass on to the grid of V1133A. When the output pulse of the Preamp circuits reaches C1124, the charge is transferred from C1124 through the Memory Gate to C1132 of the Memory circuit, according to $Q = CE$. After the error voltage reaches its peak at C1124, the gate closes from the removal of the Memory Gate Driver pulse and no further charge can be transferred to the Memory circuit until the next Memory Gate Driver pulse.

The Memory circuit, consisting of V1133A, Q1134, and Q1141, is a wide-band operational amplifier with feedback

through C1132. With the Memory Gate diodes back biased, its output voltage must equal the sum of the dc voltage at the grid of V1133A and the stored voltage in C1132. The output of the Memory circuit is from the collector of Q1141 which is capable of supplying ± 5 milliamps into the following stage.

When a charge (or error signal) is introduced to the grid of V1133A through the Memory Gate, the charge passes through C1132 changing its output voltage according to $E = Q/C$. However, the input voltage to V1133A remains essentially constant due to the high amplifier gain and degenerative feedback through C1132 to the grid of V1133A.

Dc Offset Circuit

The Dc Offset circuit, consisting of V2133A, is a controllable voltage source. Voltage from this circuit is fed back to three points on the four-diode Sampling Gate. In addition, voltage from this circuit appears at the X100 OFFSET MONITOR jack. This voltage is $100/0.772^*$ times the equivalent voltage that is fed back to the Sampling Gate. The voltage division occurs through R1158, R1148 and R1149, and related shunt resistors.

CHANNEL A & B AMPLIFIERS

Vertical Amplifier

The channel A Amplifier consists of Q1173, Q1184, and Q1183. In addition, the Inversion Stage (Q1163/Q1164) is in the circuit when the NORM.-INV. switch is in the NORM. position. When the NORM.-INV. switch is at NORM., the polarity of the displayed signal is the same as the applied signal. Gain of the Inversion Stage is set to exactly 1 with the A INV. GAIN control R1161. The A NORM. GAIN control R1172 is adjusted to set the signal amplitude at the base of Q1173. R1172 is adjusted with the NORM.-INV. switch at INV. so the Inversion Stage has no effect. When the MV/DIV. switch is set at 2, the 2-200 VAR. control (adjustable portion of R1171) is bypassed and the full resistance of R1171 appears in the circuit for maximum input signal.

The output of emitter follower Q1173 is developed across R1173. Gain of this stage is essentially unity. The signal is then coupled through the Vertical Mode switch SW2190 (in all positions except A+B) to the remaining stages of the Vertical Amplifier. In the A+B position, the signal is coupled through R2177 and combined with the signal in channel B. Channel B then produces the algebraic sum of the two signals.

From SW2190, the channel A signal passes through R1175 to the base of Q1184. Q1184 and Q1183 form a feedback amplifier which inverts and amplifies the signal. The A POSITION control R1180 provides a variable dc current through R1181 for positioning the trace on the crt. Emitter

*0.772 is the gain factor that the input signal encounters through equalization at the end of the delay line in the input circuit.

follower Q1183 provides an extremely low output impedance to drive the A OUT jack, the signal pickoff for the digital unit, and the Common Output Amplifier.

DUAL-TRACE SWITCHING & COMMON OUTPUT AMPLIFIER

Dual-Trace Multivibrator

The Dual-Trace Switching Multivibrator has three states, selected by the Vertical Mode switch SW2190. The state of the Multivibrator determines whether the output of channel A or B is applied to the Common Output Amplifier. The Dual-Trace Switching Multivibrator operates so the outputs of both channels are never applied to the Common Output Amplifier simultaneously. In dual-trace operation, the outputs of channel A and B are applied alternately to the Common Output Amplifier, with switching occurring after each sample.

When the Vertical Mode switch is set to A ONLY, a negative voltage is applied to the base of Q2255 and a positive voltage to the base of Q2245. In this mode, Q2255 is cut off and Q2245 is conducting. The collector voltage of Q2255 is at its most positive point, and the collector voltage of Q2245 is at its most negative point. The voltage difference between the two collectors is connected directly across the channel A and B diode gates. Current through R1196 and R1197 forward biases the channel A gate, and the channel A signal is passed to the Common Output Amplifier. The diodes in the channel B gate are reverse biased and cannot pass the channel B signal.

If the Vertical Mode switch is set to B ONLY, the polarity of the voltage difference between the collectors of Q2245 and Q2255 is reversed. This forward biases the channel B gate diodes and reverse biases the channel A gate diodes. This, in turn, allows only the channel B signal to pass to the Common Output Amplifier.

If the Vertical Mode switch is set to DUAL-TRACE, R2245 and R2255 are both connected to -12.2 volts. This converts the Multivibrator to a bistable configuration. In dual-trace operation, the Dual-Trace Blocking Oscillator Q2230 is monostable and is triggered by the pulses from the Memory Gate Driver. The output triggering signal of the

Dual-Trace Blocking Oscillator passes through diodes D2238 and D2239 to trigger the Switching Multivibrator.

The Dual-Trace Blocking Oscillator is in operation only when the Vertical Mode switch is in the DUAL-TRACE position. At all other times, collector voltage is removed from Q2230 and the circuit is inoperative.

Common Output Amplifier

The Output Amplifier V1224 (A and B), Q1204, and Q1214, is a cathode-emitter-coupled paraphase amplifier. It converts the signal at the base of Q1204 to a push-pull signal between the plates of V1224. The output from the amplifier drives the vertical deflection plates of the crt via pins 17 and 21 of the interconnecting plug. The GAIN ADJ. control R1209 varies the coupling between the emitters of Q1204 and Q1214 and is used to set the gain of the stage. The gain is greatest when R1209 is set for minimum resistance.

+100-Volt Power Source

The +100-Volt Power Source furnishes power to the Bridge Gates (emitter of Q2287) and the PROBE power connectors (emitter of Q2297). The source voltage is held constant by voltage regulator V2289. V2289 maintains a constant voltage drop of about 82 volts over a relatively wide current range. The 20-volt source elevates the total voltage output to about +100 volts with respect to ground.

+20- and +70-Volt Power Source

The +70 volts is obtained with a voltage divider from the +125-volt supply of the oscilloscope. Transistors Q2274 and Q2277 provide a stable +20-volt supply. Q2277 is a shunt regulator driven by Q2274. The base of Q2274 is at -0.3 volt when the emitter of Q2277 is at +20 volts. If the emitter voltage of Q2277 attempts to change from +20 volts, the base of Q2274 will move in the same direction. The change in voltage at the base of Q2274 forces the collector voltage of Q2274 and the base voltage of Q2277 to move in the opposite direction. This change appears at the emitter of Q2277 and cancels the original attempt of the +20-volt supply to change.

SECTION 5

MAINTENANCE

PREVENTIVE MAINTENANCE

Visual Inspection

The Type 3S76 Plug-In Unit should occasionally be inspected for such visual defects as poor connections, broken or damaged ceramic strips, improperly seated tubes or transistors, and heat-damaged parts. The remedy for most visual defects is obvious; however, particular care must be taken if heat-damaged parts are detected. Overheating can be caused by other, less apparent troubles in the circuit. For this reason, it is essential to determine the actual cause of overheating before the parts are replaced; otherwise, the damage may be repeated.

Recalibration

The Type 3S76 is a stable instrument that will provide many hours of dependable operation. To maintain the measurement accuracy, however, we suggest a check of the calibration after each 500 hours of operation (or every six months if used intermittently). A complete step-by-step calibration procedure is provided in Section 6 of this manual.

PARTS REMOVAL AND REPLACEMENT

General Information

Removal and replacement procedures for most of the parts in the Type 3S76 are obvious. However, some parts require special procedures. Removal and replacement instructions for these parts are contained in the following paragraphs.

Many components in the Type 3S76 are mounted in a particular way to reduce stray inductance and capacitance. Therefore, carefully install replacement components to duplicate lead length, lead dress, and location of the original component. After replacing parts, check the calibration of the instrument.

Switches

Individual wafers are normally not replaced in the switch assemblies used in the Type 3S76. If a wafer is defective, the entire switch assembly should be replaced. Switch assemblies can be ordered from Tektronix, either wired or unwired.

The wafer switches shown on the schematics are coded to indicate the position of the wafer on the switch. The wafers are numbered from front to rear (i.e., the number 1 wafer is always closest to the front panel). The letters "F" and "R" indicate the front or rear of the wafer. For example, a code designation of "3R" would mean rear side of the third wafer from the front panel.

Tubes and Transistors

The tubes and transistors in the Type 3S76 should not be changed unless they are actually defective. If tubes or transistors are removed and found to be acceptable, be sure to return them to their original sockets.

Do not use a tube- or transistor-tester as the only means for determining if a tube or transistor is defective. Testers may indicate that a tube or transistor is defective when it operates satisfactorily in a circuit, or may fail to indicate defects that affect the performance of the circuit. If a tube or transistor operates properly in the circuit, it is usable; if not, it should be replaced. Unnecessary tube or transistor replacement may require that the instrument be recalibrated.

The transistors located under the delay line can be removed and replaced more easily with a pair of tweezers or long-nose pliers. Tubes or transistors are more accessible with the plug-in unit removed from the oscilloscope.

Soldering Precautions

In the production of Tektronix instruments, a silver-bearing solder is used to establish a bond to the ceramic terminal strips. This bond may be broken by repeated use of ordinary tin-lead solder, and by excessive heating of the terminal strip with a soldering iron. Occasional use of ordinary solder is permissible if applied with moderate heat. For general repair work, however, solder used for the ceramic strips should contain about 3% silver. If this type of solder is not available locally, it may be purchased directly from Tektronix in one-pound rolls (part number 251-514).

A wedge-shaped tip on the soldering iron is best for soldering or unsoldering parts on a ceramic strip. This type of tip allows you to apply heat directly to the solder-slot in the strip, reducing the overall heating effect. Use as little heat as possible to establish a good solder bond.

To properly solder and unsolder the short-lead components, the following procedure is recommended. (1) Use long-nose pliers for a heat sink. Attach the pliers between the component and the point where the heat is applied. (2) Use a hot soldering iron for a short time. (3) Carefully manipulate the leads to prevent lead or insulation damage. (4) Use only a small amount of solder; just enough to make a good bond.

Ceramic Terminal Strips

To remove a ceramic terminal strip, first unsolder all leads and components connected to it. Then pry the strip, with yokes attached, out of the chassis. The spacers may come out with the yokes. If not, the spacers can be pulled out separately. However, if they are not damaged, they may be used with the new strip assembly.

Maintenance—Type 3S76

Another way to remove a strip from the chassis is to use diagonal cutters to cut off one side of each yoke holding the strip. This frees the strip and the remainder of the yokes can then be pulled free of the chassis with a pair of pliers. New ceramic strips are supplied with yokes attached so it is not necessary to salvage the old yokes.

After removing the damaged strip and yoke assembly, place the spacers into the holes in the chassis and insert the yokes into the spacers. Be sure the yokes are completely seated in the spacers. If necessary, use a soft-faced mallet to tap the yokes into the spacers. Fig. 5-1 shows the assembled ceramic strip.

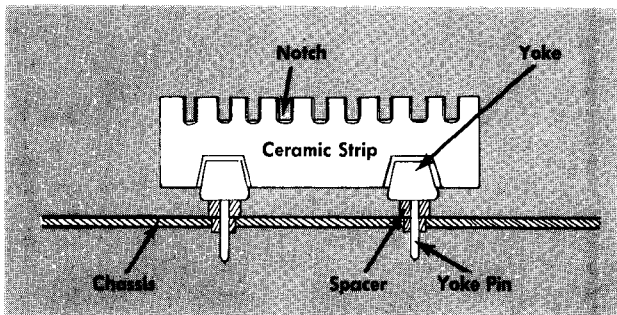


Fig. 5-1. Ceramic strip assembly.

Gallium Arsenide Diodes

The diodes in the Sampling Gates and Memory Gates are special gallium arsenide diodes manufactured by Tektronix. Each diode has a colored dot on the cathode end. The color of the dot identifies the diode as indicated in the following table.

| Dot Color | Circuit Number | Tektronix Part Number |
|-----------|--------------------------------|-----------------------|
| Red | D1132, D1130, D2132, and D2130 | 152-083 |
| Orange | D1046, D1047, D2046, and D2047 | 152-084* |
| Yellow | D1044, D1045, D2044, and D2045 | 152-085* |

*Supplied in matched pairs.

The circuit number and polarity of each diode is shown on the schematic and is also printed on the etched-circuit board next to the diode clips.

If it is necessary to remove or replace any of the gallium arsenide diodes, use a pair of tweezers or similar tool. Do not solder the diodes into the clips. Heat from the soldering iron could damage a diode.

TROUBLESHOOTING

General Information

If trouble develops, first check all controls for proper settings. For example, an improper setting of the DC OFF-SET control can cause the display to be positioned off the crt. Operate the front-panel controls and note their effect. A trouble that occurs only at certain control settings can be immediately attributed to a specific circuit.

After the trouble symptoms are clearly established, look for obvious causes. Check that line power is applied, the tube heaters are lit, etc. Next, check the power supply voltages in the oscilloscope and plug-in units (+20-, +100-, and +70-volt supplies in the Type 3S76).

If you suspect that a tube or transistor is bad, check it by substitution. That is, replace it with a good tube or transistor of the same type. If you find that the suspected tube or transistor is not bad, be sure to return it to the original socket. This will help eliminate unnecessary recalibration because of differences in tube or transistor characteristics.

Troubleshooting Procedure

If trouble occurs in the sampling system, it is usually difficult to determine whether the fault is in the Type 3S76 or in the sampling sweep plug-in unit. A trouble in either plug-in unit can cause a complete loss of the display.

To determine which plug-in unit is faulty, refer to the troubleshooting information in the sampling sweep plug-in unit instruction manual. After isolating the trouble to one of the plug-in units, refer to the troubleshooting chart in the appropriate plug-in unit instruction manual.

The troubleshooting chart in this manual provides a step-by-step check of the entire plug-in unit. The chart covers most of the troubles that could occur in the Type 3S76.

The test points shown on the schematics aid in troubleshooting and calibrating the Type 3S76. They simplify reference to particular locations in the circuitry. Each test point is indicated by a bracketed number at its location in the circuit. Physical location of the test points on the chassis of the Type 3S76 is shown in Figs. 6-1 and 6-2.

The schematic on which each test point will be found is as follows:

- [1] through [10]: Snap-Off and Memory.
- [11], [13], [14], [16], and [17]: Dual-Trace Switching and Output Amplifiers.
- [12] and [15]: Channel A and B Amplifiers.

The following equipment is recommended for troubleshooting the Type 3S76.

1. Dc volt-ohmmeter with a sensitivity of 20,000 ohms/volt.
2. Test oscilloscope with the following minimum specifications:
 - Input resistance: 10 megohms.
 - Deflection factor: 0.5 volt/division.
 - Bandpass: dc to 10 megacycles.
 (Tektronix Type 531A, 533A, 535A, 541A, 543A, 545A, 551, or 555 Oscilloscope recommended with a Type K or L Plug-In Unit and a 10X attenuator probe.)
3. Tektronix Plug-In Extension 561, Tektronix part number 012-066.
4. Sampling Sweep Plug-In Unit and Type 567 or Type 561A Oscilloscope.

5. A 1/2-watt, 10-megohm resistor.
6. An insulated shorting strap with alligator clips. Lead length should be about 4 inches.
7. Tektronix Type 109 or 110 Pulse Generator with a 20-nanosecond charge line.

Preliminary Setup

Remove the Type 3S76 from the indicator unit. Set the front-panel controls as follows:

| | |
|-------------------------------------|------------|
| Channel A and B POSITION Controls | Midrange |
| Channel A and B MV/DIV. Switches | 200 |
| Channel A and B DC OFFSET Controls | Midrange |
| Channel A and B NORM.-INV. Switches | NORM. |
| SMOOTH-NORMAL Switch | NORMAL |
| Vertical Mode Switch | DUAL-TRACE |
| INTERNAL TRIGGER | A |

Leave the controls at these settings (unless otherwise noted) throughout the troubleshooting procedure.

Resistance Check of Interconnecting Plugs

Check the resistance-to-ground of each pin on the interconnecting plugs. Tables 5-1 and 5-2 show typical resistances-to-ground of P12 and P11. The horizontal interconnecting plug on the rear of the Type 3S76 is designated P11. The vertically-mounted interconnecting plug is designated P12.

Before using the troubleshooting chart (Table 5-4), it is best to isolate the trouble to a general circuit or group of circuits. If the trouble symptom is the loss of the display in either or both channels, the general location of the trouble can be isolated by using the following procedure:

1. Install both plug-in units into the oscilloscope, turn on the power and free-run the sampling sweep plug-in unit.
2. Set both Type 3S76 NORM.-INV. switches midway between positions.
3. With the POSITION controls, try to position both traces onto the crt.
4. Use Table 5-3 to determine the general location of the trouble.

TABLE 5-1
Typical Resistance-To-Ground, P12

| Pin Number | Resistance | Pin Number | Resistance | Pin Number | Resistance |
|------------|-------------------|------------|------------|------------|------------|
| 1 | *900 and 180 ohms | 9 | infinite | 17 | infinite |
| 2 | infinite | 10 | infinite | 18 | infinite |
| 3 | *500 and 180 ohms | 11 | 2 k | 19 | infinite |
| 4 | infinite | 12 | infinite | 20 | infinite |
| 5 | infinite | 13 | infinite | 21 | infinite |
| 6 | infinite | 14 | infinite | 22 | infinite |
| 7 | infinite | 15 | infinite | 23 | infinite |
| 8 | infinite | 16 | infinite | 24 | infinite |

*Reverse ohmmeter leads to get both values of resistance.

TABLE 5-2
Typical Resistance-To-Ground, P11

| Pin Number | Resistance | Pin Number | Resistance | Pin Number | Resistance |
|------------|------------|------------|------------|------------|------------|
| 1 | infinite | 9 | zero | 17 | 100 k |
| 2 | infinite | 10 | 100 k | 18 | infinite |
| 3 | zero | 11 | zero | 19 | zero |
| 4 | zero | 12 | 50 k | 20 | 2 k |
| 5 | infinite | 13 | infinite | 21 | 100 k |
| 6 | 100 k | 14 | infinite | 22 | zero |
| 7 | infinite | 15 | 2 k | 23 | 4 k |
| 8 | infinite | 16 | 5 ohms | 24 | 12 k |

TABLE 5-3

| Symptom | Indication Obtained in Step 3 | Circuit at Fault |
|-------------------------------|---|---|
| No display either channel. | Both traces can be positioned onto the crt. | Snap-Off Blocking Oscillator or Memory Gate Driver circuit. |
| | Neither trace can be positioned onto the crt. | Common Output Amplifier. |
| No display, one channel only. | Both traces can be positioned onto the crt. | Input circuit, Preamp circuit, Memory Gate or Memory circuit of the channel that will not produce a trace. |
| | Indication the same as the original trouble. | Vertical Amplifier Driver stages of the channel that will not produce a trace, or the Dual-Trace Switching Multivibrator circuit. |

Troubleshooting Chart

In Table 5-4, start with step 1 in the "Checks to Make" column. Each step in this column describes a check to make and the normal result. Follow each check in numerical order until there is an abnormal indication. At this point, refer to the "If Abnormal" column.

The "If Abnormal" column tells which components may be faulty or, in some cases, refers to an additional check.

At several points in Table 5-4, you will be instructed to check certain diodes or transistors. This can generally be done by substituting these diodes or transistors with ones of the same type in another part of the circuit.

Before using Table 5-4, disconnect the Type 3S76 from the oscilloscope and place it on the test bench. Set all front-panel controls as described previously under "Preliminary Setup".

TABLE 5-4

TROUBLESHOOTING CHART

| Checks To Make | If Abnormal |
|---|--|
| Trigger Takeoff Circuit | |
| 1. Apply a 20-nsec, 5-volt pulse from the pulse generator to the Type 3S76 INPUT A connector. With the test oscilloscope, check for a 1-volt, peak, pulse at pin 4 of P11. (P11 is the top interconnecting plug). | Trouble is in the channel A Trigger Takeoff Transformer or the INTERNAL TRIGGER switch circuitry. |
| 2. Set the INTERNAL TRIGGER switch to B and apply the pulse generator output to the INPUT B connector. With the test oscilloscope, check for a 5-volt, peak, pulse at pin 4 of P11. | Trouble is in channel B Trigger Takeoff Transformer or the INTERNAL TRIGGER switch circuitry. |
| After completing steps 1 and 2, insert the Type 3S76 and the sampling sweep plug-in unit into the oscilloscope, turn on the power and allow a few minutes for warmup. | |
| +20-Volt Power Supply | |
| 3. Check the voltage at test point [17]; it should be +20 volts \pm 1%. | Trouble is excessive loading on the supply or a faulty regulator circuit (Q2274 or Q2277). Make sure the +125-volt supply is regulating. |
| | A low reading at test point [17] indicates an overload. A high reading indicates faulty regulation. |
| Snap-Off and Driver Blocking Oscillator Circuits | |
| 4. Set the sweep plug-in unit for free-running operation and, with the test oscilloscope, check the signal at test point [4]; it should resemble the waveform shown on the schematic. Pulse should disappear as the sampling sweep plug in unit trigger sensitivity is decreased. | Trouble is in Q2010 circuitry, or the Type 3S76 is not receiving a signal from the sampling sweep plug-in unit via pin 18 of P11. Check components and voltages in Q2010 circuit. Then check Q2010, D2018, and D2002. Q2010 is selected for a BV_{CBO} of -21 volts. |

TABLE 5-4 (Cont'd)

| Checks To Make | If Abnormal |
|---|---|
| Memory Gate Driver Circuit | |
| 5. Set the sampling sweep plug-in unit for maximum trigger sensitivity. With the test oscilloscope, check the signal at test point [6]; it should resemble the waveform shown on the schematic. | Trouble is in Q2024 circuitry, or MEMORY GATE LENGTH control R2023 is misadjusted. First, try adjusting R2023 as described in the Calibration section of this manual under "Memory Gate Length Adjustment". If trouble is not corrected, check Q2024 and D2024. |
| Channel A Gate, Preamp, and Memory Circuits | |
| 6. With a shorting strap, connect between the upper end of R1148 and ground (see Fig. 6-4). With the test oscilloscope, measure the dc voltage-to-ground at both ends of R1057 (A BRIDGE VOLTS); it should measure ± 1.6 to ± 2.2 volts. The two voltages should be within 0.2 volt of each other (disregarding polarity). | Trouble is in Sampling Gate diodes or gate voltage circuit. First, check for +100 and -100 volts at the ends of R1060 and R1065. Check the forward to back resistance of each diode in the Sampling Gate (D1044, D1045, D1046, and D1047). If none of these checks reveals the cause of trouble, try adjusting R1057 (A BRIDGE VOLTS) and R1063 (A BRIDGE BAL.) as described in the Calibration section of this manual. |
| 7. Remove diodes D1130 and D1132 from the Memory Gate and shunt across C1132 with a 10-megohm resistor (see Fig. 6-4). Measure the voltage at test point [10A]; it should be 0 ± 0.3 volt. Remove the shunt resistor from C1132. | First, adjust the A MILLER LEVEL control, R1136, and try to bring the voltage on the collector of Q1141 within the specified voltage range. If this is not effective, check the power supply voltages in the Memory circuit (especially the +70 volts on the plate of V1133A). If this does not reveal the trouble, V1133, Q1134, or Q1141 is probably defective. |
| 8. Remove the shorting strap from the upper end of R1148 and ground. Remove Q1141 from its socket. Place the shorting strap between test point [10A] and ground. With the test oscilloscope, check the signal at test point [7A]; it should vary in amplitude and polarity as the channel A DC OFFSET control is turned throughout its range. Remove the shorting strap from test point [10A]. Replace Q1141. | First, measure voltage at upper end of R1148 and vary the channel A DC OFFSET control throughout its range. The voltage should vary between about +1 volt and -1 volt. If not, the trouble is in the V2133A circuitry. If the voltage on R1148 varies as described, the trouble is in the V1073, Q1074, Q1084, or Q1094 circuitry. Check the dc voltages shown on the schematic throughout the Preamp stages. |
| 9. Replace diodes D1130 and D1132 in the Memory Gate. Place the shorting strap between the upper end of R1148 and ground. Measure the voltage at test point [10A]; it should be 0 ± 0.3 volt. | Trouble is in Memory Gate circuit. Measure voltages at test points [8A] and [9A]. Voltage at [8A] should be about -3 volts; voltage at [9A] should be about +3 volts. Check diodes D1124, D1122, D1129, D1130 and D1132. |
| 10. Remove the shorting strap from R1148 and measure the voltage at test point [10A]. With the channel A DC OFFSET control, adjust for zero volts at test point [10A]. | Trouble is in Dc Offset circuitry. Check V2133A and associated components. |
| Check channel B Gate, Preamp, and Memory circuits by repeating steps 6 through 10. All references to channel A components apply to the corresponding components in channel B. | |
| Channel A Vertical Amplifier | |
| 11. Measure voltage at A OUT jack. Set channel A POSITION control to midrange and adjust channel A DC OFFSET control for +10 volts at A OUT jack. Vary channel A POSITION control throughout its range. Voltage should vary from about +1.5 volts to about +18 volts. If normal, go to step 13. | Set channel A NORM.-INV. switch to INV. and repeat step 11. If the voltage is now proper, the trouble is in the Inversion Stage (Q1163 and Q1164). If the voltage is still not proper, go to step 12. |
| 12. Measure voltage at the emitter of Q1173 (test point [12A]). Adjust DC OFFSET control for zero volts. Leave the DC OFFSET control at this setting. If the voltage can be adjusted to zero with the DC OFFSET control, the trouble is in the Q1183 and Q1184 circuits. First, check transistors Q1183 and Q1184. | Q1173 circuit is faulty. |

TABLE 5-4 (Cont'd)

| Checks To Make | If Abnormal |
|---|--|
| Check channel B Vertical Amplifier by repeating steps 11 and 12. All references to channel A components apply to the corresponding components in channel B. | |
| Dual-Trace Switching Circuit | |
| 13. With test oscilloscope, check for trigger spikes at test point [13]. | Dual-Trace Blocking Oscillator is not functioning; check Q2230. |
| 14. With the test oscilloscope, check for the signal shown on the schematic at test point [16]. | Trouble is in the Dual-Trace Switching Multivibrator (Q2255-Q2245). Check the voltages in the multivibrator circuit against those shown on the schematic. When checking the voltages, set the Vertical Mode switch to the positions indicated on the schematic. If the voltages are not proper, diode D2244, D2254, D2238 or D2239 may be defective. |
| Blanking Amplifier | |
| 15. Set Vertical Mode switch to A ONLY. Check the signal at test point [14] with the test oscilloscope. | Blanking Amplifier circuit is faulty. First, check D2203. If this is not the trouble, check V2214. |
| Common Output Amplifier | |
| 16. Short between pins 3 and 8 of V1224. Trace should appear or remain on the crt. Remove the short. | V1224 is faulty or there is an improper voltage at one of its elements. |
| 17. Short between the bases of Q1204 and Q1214. Trace should appear or remain on the crt. If trace cannot be positioned onto the crt after the short is removed, the Q1223 circuit is faulty. | Q1204 or Q1214 is faulty. Check voltages shown on schematic. |

SECTION 6

CALIBRATION

Introduction

This section of the manual describes the calibration procedure for the Type 3S76. The instrument should be calibrated after each 500 hours of use or every six months, whichever comes first.

This procedure can be used in conjunction with the troubleshooting procedure if trouble occurs in the instrument. In many cases, calibration will either isolate or eliminate the trouble.

The steps in this procedure are in the proper sequence for a complete check and calibration of the Type 3S76. Since some adjustments interact, the steps should be performed in the order given. Do not attempt to make an individual adjustment without going through a complete calibration.

Internal adjustments and test points are shown in Figs. 6-1 and 6-2.

Equipment Required

The following equipment is required to calibrate the Type 3S76.

- Test oscilloscope with the following characteristics:

| | |
|----------------------|--------------------------------------|
| Bandpass | dc to 30 mc |
| Sweep Rate (fastest) | 0.1 μ sec/cm |
| Deflection Factor | 5 mv/cm |
| Input Resistance | 1 megohm (10 megohms with 10X probe) |

(Tektronix Type 540-Series or 550-Series Oscilloscope, and a Type L Plug-In Unit with a 10X and 1X probe, recommended.)

- Tektronix Type 561A, RM561A, 567, or RM567 Oscilloscope (in which to operate the Type 3S76).
- Tektronix Type 3T77 Sampling Sweep Plug-In Unit.
- Tektronix Type 109 or 110 Pulse Generator.
- Tektronix Type 105 Square-Wave Generator.
- A precision, non-loading type of voltmeter (such as the John Fluke Model 801B or 825A).
- Dc voltmeter with a sensitivity of at least 20,000 ohms/volt, accuracy at least 1%.
- General Radio "T" connector (General Radio part number GR874-T).
- Tektronix 24-pin flexible plug-in extension for the sampling system (Tektronix part number 012-066).
- An insulated shorting lead about 4 inches long with alligator clips.
- Small screwdriver with an insulated shank.

- Assortment of RG-8A/U coaxial cables with GR connectors.
- UHF-to-GR adapter for mating to the Type 105 Generator (Tektronix part number 017-023).
- 50-ohm, 10XT attenuator with GR connectors (Tektronix part number 017-044).
- A $\frac{1}{2}$ -watt, 10-megohm resistor.
- A 500-ohm, $\frac{1}{4}$ -watt potentiometer.
- A 680-ohm, $\frac{1}{2}$ -watt resistor.

Preliminary Procedure

Insert the Type 3T77 Sampling Sweep Plug-in Unit into the sweep compartment of a Type 561A, RM561A, 567, or RM567 Oscilloscope, and place the Type 3S76 (with flexible plug-in extension connected between the horizontal interconnecting plugs) in the left-hand compartment.

If you suspect that the Type 3S76 is extremely misadjusted, turn the A PREAMP SENS. and B PREAMP SENS. adjustments fully counterclockwise, and all other internal controls to midrange. For routine calibration of the Type 3S76, the internal controls are probably near their proper positions and should not require preadjustment.

Set the Type 3S76 front-panel controls as follows:

| | |
|----------------------|------------|
| A and B POSITION | Midrange |
| A and B MV/DIV. | 200 |
| A and B DC OFFSET | Midrange |
| A and B NORM.-INV. | INV. |
| Vertical Mode Switch | DUAL-TRACE |
| A and B 2-200 VAR. | CALIB. |
| SMOOTH-NORMAL | NORMAL |
| GAIN ADJ. | Midrange |
| INTERNAL TRIGGER | A |

Set the Type 3T77 front-panel controls as follows:

| | |
|---------------------|------------------------|
| POSITION | Midrange |
| TIME/DIV. | .2 nSEC. |
| HORIZ. MAG. | X1 |
| DOTS PER DIV. | 100 |
| DELAY | Fully counterclockwise |
| TRIGGER SENSITIVITY | Fully clockwise |
| SWEEP MODE | NORMAL |
| INT.-EXT. | +INT. |
| MANUAL SCAN | Any position |
| RECOVERY TIME | Any position |

Leave all controls in the stated positions until otherwise instructed.

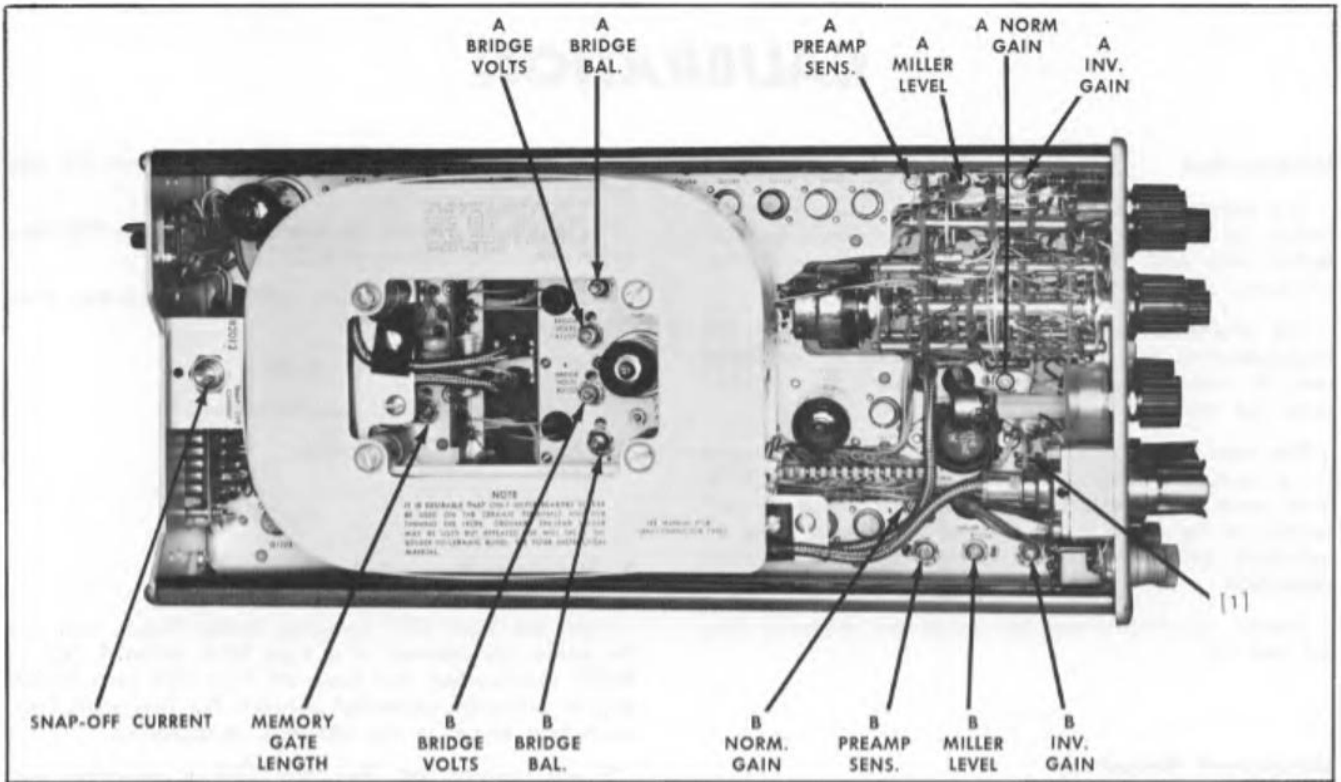


Fig. 6-1. Left-side view showing test point and internal adjustment.

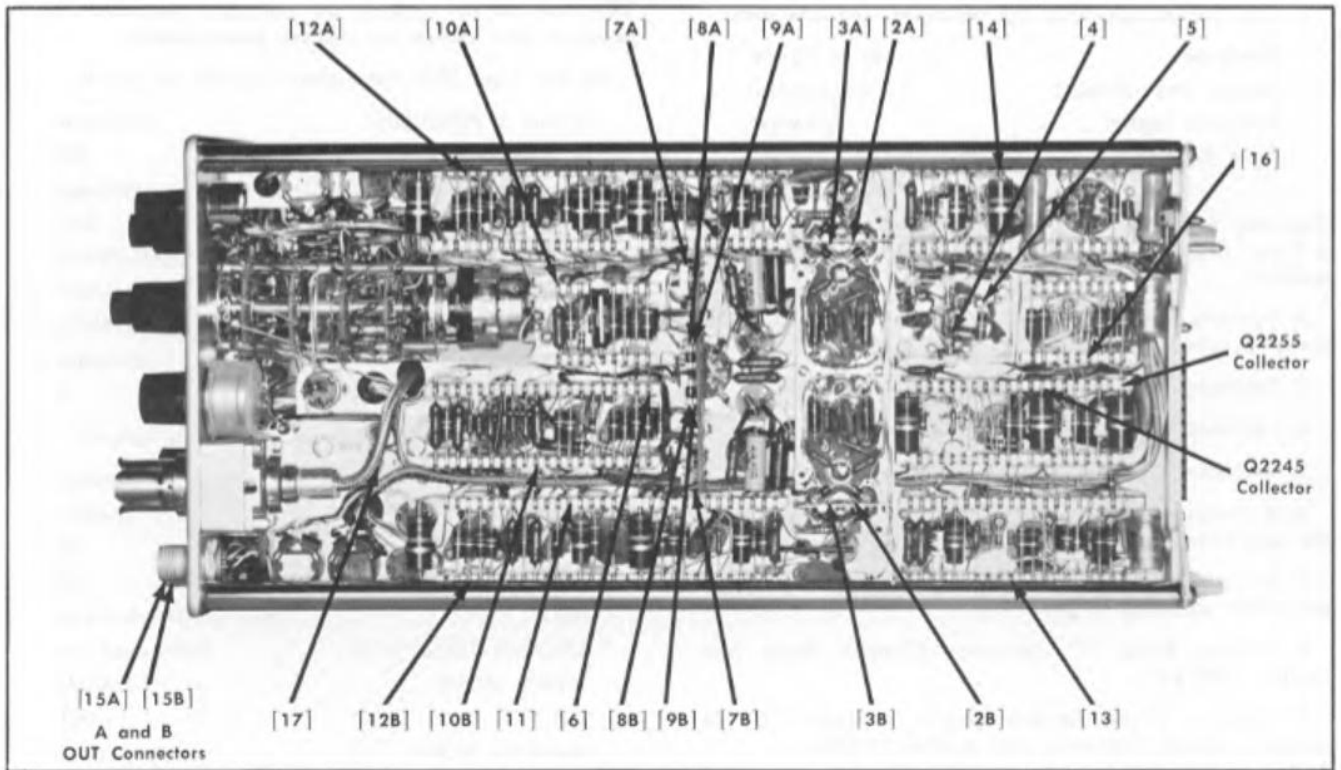


Fig. 6-2. Right-side view showing test points.

Turn on the oscilloscope power and allow the system to warmup for at least two minutes before proceeding.

Check and Adjustment Procedure

The location of each adjustment is shown in Fig. 6-1; the location of the test points is shown in Fig. 6-2.

+20-Volt Power Supply Check

1. Connect the dc voltmeter between test point [17] and ground. The voltage should be +20 volts, $\pm 2\%$.

2. With the test oscilloscope, measure the ripple voltage at test point [17]. (Note: Ac couple test oscilloscope, set for 5 mv/cm sensitivity, and use 1X probe.) Ripple voltage should not exceed 3 mv, peak-to-peak.

Snap-Off Blocking Oscillator Check

1. Connect the 10X probe from the test oscilloscope to test point [4].

2. Set the sweep rate of the test oscilloscope to 0.1 $\mu\text{sec}/\text{cm}$ and the deflection factor to 10 volts/cm (including probe).

3. Adjust the test oscilloscope triggering controls for a stable display, triggered on the positive slope of the signal. Waveform on test oscilloscope should resemble that shown on the schematic at test point [4].

Dual Trace and Output Stages Check

1. Set the channel A and B NORM.-INV. switches midway between positions. To check that the switches are between positions, vary both DC OFFSET controls; they should not affect the dc voltage at the A OUT or B OUT jacks.

2. Measure the dc voltage swing at the A OUT jack as the channel A POSITION control is turned from one extreme to the other. The voltage should swing between about +5 volts and +15 volts. Repeat this procedure at the B OUT jack with the channel B POSITION control.

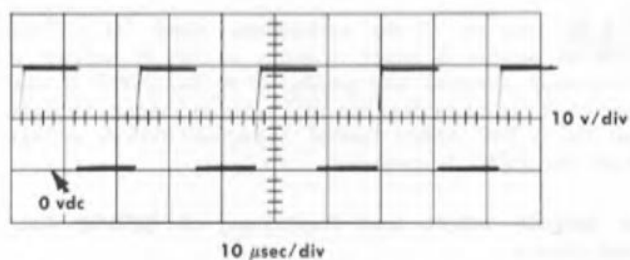


Fig. 6-3. Signal at collector of Q2245 or Q2255.

3. With the test oscilloscope, display the signals at the collectors of Q2245 and Q2255 (Fig. 6-2). The signals should resemble the waveform shown in Fig. 6-3. Vary the RECOVERY TIME control of the Type 3T77; repetition rate of the displayed waveforms should vary. Return both NORM.-INV. switches of the Type 3S76 to INV.

MEMORY GATE LENGTH Preliminary Adjustment

1. Connect the 10X probe of the test oscilloscope to test point [6].

2. Set the test oscilloscope for a sweep rate of 0.1 $\mu\text{sec}/\text{cm}$ and a deflection factor (including probe) of 10 volts/cm.

3. Set the test oscilloscope triggering controls for a stable display, triggered on the negative slope of the waveform.

4. Adjust the MEMORY GATE LENGTH control so that the most negative (flat) portion of the display is 0.3 μsec (3 cm) long. (If the serial number of your Type 3S76 is 799 or below, adjust for a length of 0.25 μsec . For these instruments, this is the final adjustment of the MEMORY GATE LENGTH.) The waveform observed at this point is shown on the schematic.

Blanking Amplifier Check

1. Connect the 10X probe of the test oscilloscope to test point [14].

2. Set the sweep rate of the test oscilloscope to 5 $\mu\text{sec}/\text{cm}$ and the deflection factor at 20 volts/cm (including probe).

3. Set the test oscilloscope triggering controls for a stable display, triggered on the positive slope of the waveform. The test oscilloscope display should resemble the waveform shown at test point [14] on the schematic.

4. Set the Vertical Mode switch of the Type 3S76 to A ONLY and to B ONLY while observing the display on the test oscilloscope. The waveform should not change. Return the Vertical Mode switch to DUAL-TRACE.

5. Turn the Type 3T77 TRIGGER SENSITIVITY control fully counterclockwise. The test oscilloscope display should disappear. Return the TRIGGER SENSITIVITY control fully clockwise and the display should reappear.

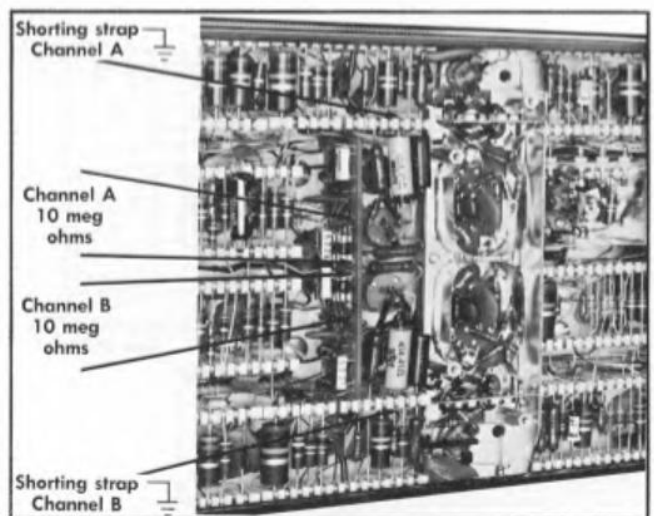


Fig. 6-4. A 10-megohm resistor connected across C1132 and R1148 shorted to ground (description on following page).

Calibration—Type 3S76

Miller and Error Amplifier Check

1. With the A and B POSITION controls, move both traces onto the graticule.

2. Rotate the A and B DC OFFSET controls to insure that both traces move vertically. Return both DC OFFSET controls to midrange.

NOTE

In some cases, it may be impossible to obtain a trace on one or both channels because one or both MILLER LEVEL adjustments are not set closely enough to their calibrated setting. In such a case, perform the following procedure and then repeat the Miller and Error Amplifier Check:

1. Place a shorting lead between the upper end of R1148 and ground (see Fig. 6-4).

2. Place the 10-megohm resistor (item 15 in Equipment Required) across C1132.

3. Connect the dc voltmeter to test point [10A] and adjust the A MILLER LEVEL for zero volts.

4. For channel B, the shorting lead goes between the upper end of R2148 and ground, the 10-megohm resistor goes across C2132, and the voltage is measured at test point [10B] as the B MILLER LEVEL is set.

A and B MILLER LEVEL Adjustment

1. Alternately switch the Type 3S76 SMOOTH-NORMAL switch from one position to the other and adjust the A MILLER LEVEL for no vertical shift of the channel A trace.

2. Repeat step 1, except this time adjust the B MILLER LEVEL for no vertical shift of the channel B trace. Return the SMOOTH-NORMAL switch to NORMAL.

A NORM. GAIN Adjustment

1. Assemble the system shown in Fig. 6-5. Adjust the 500-ohm variable resistor so exactly 1 volt appears at the Type 3S76 channel A INPUT connector.

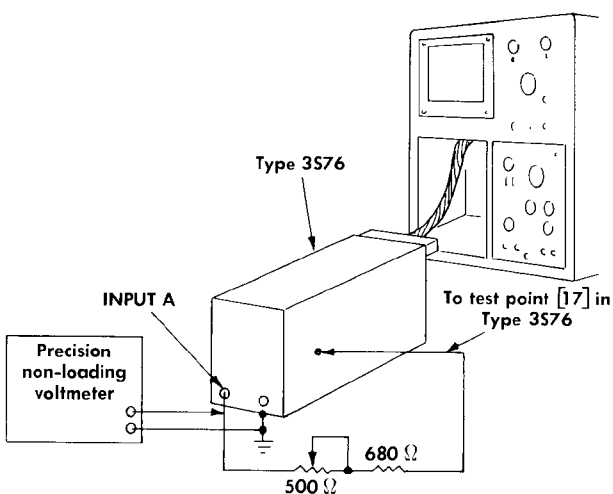


Fig. 6 5. Circuit used to set Type 3S76 gain.

2. Make sure the channel A MV/DIV. switch is set to 200, the 2-200 VAR. control is set to CALIB., and the NORM.-INV. switches are set to INV.

3. Connect the precision, non-loading voltmeter to the A OUT connector, and alternately remove and connect the dc voltage at the channel A INPUT connector. Adjust the A NORM. GAIN for an exact 5-volt change as the voltage is removed and then connected.

Leave the system of Fig. 6-5 connected to the Type 3S76.

Front-Panel GAIN ADJ.

Set the front-panel GAIN ADJ. of the Type 3S76 for a change of exactly 5 divisions of the channel A trace on the crt of the oscilloscope (to which the Type 3S76 is connected) as the dc voltage at the INPUT A connector is alternately removed and connected. Maintain all conditions for the next adjustment.

A INV. GAIN Adjustment

Set the channel A NORM.-INV. switch to NORM. Recheck the amount of vertical deflection on the oscilloscope; it should change exactly 5 major graticule divisions as described in the previous gain adjustments. If not, set the A INV. GAIN adjustment. Remove the voltage from the INPUT A connector of the Type 3S76.

B NORM. GAIN Adjustment

1. Apply the 1-volt dc voltage to the INPUT B connector of the Type 3S76. Make sure the channel B NORM.-INV. switch is set to INV., the B MV/DIV. switch is set to 200, and the 2-200 VAR. control is set to CALIB.

2. With the precision voltmeter, measure the voltage change at the B OUT jack as the dc voltage is alternately removed and connected. Voltage change should be exactly 5 volts. If not, set the B NORM GAIN control. Maintain all conditions for the next adjustment.

B INV. GAIN

1. Set the channel B NORM.-INV. switch to NORM.

2. On the crt of the oscilloscope, check for a trace shift of exactly 5 major divisions as the dc voltage is alternately removed and connected at the INPUT B connector. If the trace does not shift exactly 5 major divisions, set the B INV. GAIN control. Disconnect the dc voltage from the INPUT B connector.

A BRIDGE VOLTS and Preliminary A BRIDGE BAL. Adjustment

1. Connect the 10X probe of the test oscilloscope (dc-coupled) to test point [3A] and adjust the A BRIDGE VOLTS control for a dc voltage on the test oscilloscope of +2.5 volts.

2. Connect the 10X probe of the test oscilloscope to test point [2A] and adjust the A BRIDGE BAL. control for a dc voltage of -2.5 volts.

3. Due to interaction between the two adjustments, steps 1 and 2 will have to be repeated several times.

Preliminary B BRIDGE VOLTS and B BRIDGE BAL. Adjustment

1. Connect the 10X probe of the test oscilloscope (dc-coupled) to test point [3B] and adjust the B BRIDGE VOLTS control for a dc voltage on the test oscilloscope of +2.5 volts.
2. Connect the 10X probe of the test oscilloscope to test point [2B] and adjust the B BRIDGE BAL. for a dc voltage of -2.5 volts.
3. Due to interaction between the two adjustments, steps 1 and 2 will have to be repeated several times.

SNAP-OFF CURRENT* (Channel A Risetime Adjustment)

1. Connect a 65-nanosecond charge line between the Charge-Line connectors on the Type 109 or 110 Pulse Generator.
2. Connect the output of the pulse generator to the Type 3S76 INPUT A connector.

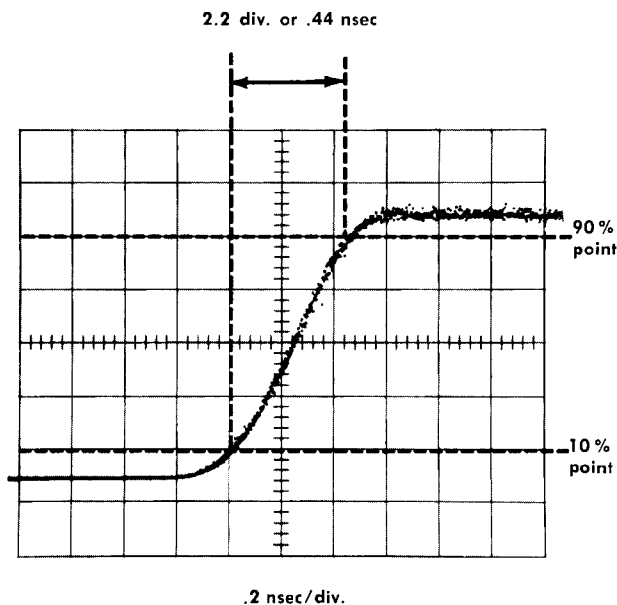


Fig. 6-6. Rising portion of a pulse with the risetime set for 0.44 nanosecond between 10% and 90% amplitude points.

3. Set the Amplitude control of the Type 109 or 110 Pulse Generator for a display of exactly 5 major divisions (1 volt, peak-to-peak). It may be necessary to readjust the Type 3T77 TRIGGER SENSITIVITY control for a stable display.
4. Set the TIME/DIV. switch of the Type 3T77 to .2 nSEC.
5. Set the Type 3T77 DELAY control to display the rising portion of the pulse-generator signal.
6. Adjust the SNAP-OFF CURRENT* adjustment for a risetime of 0.41 to 0.44 nsec, measured between the 10% and 90% amplitude points of the signal (see Fig. 6-6).

*If the serial number of your Type 3S76 is 799 or below, substitute A BRIDGE VOLTS adjustment for SNAP-OFF CURRENT adjustment.

7. On the Type 3S76, remove the signal from INPUT A and connect it to the INPUT B, and set the INTERNAL TRIGGER switch to B for the next adjustment.

B BRIDGE VOLTS (Channel B Risetime) Adjustment

1. Set the Type 3T77 TRIGGER SENSITIVITY and DELAY controls for the same display as in the previous adjustment.
2. Adjust the B BRIDGE VOLTS for a risetime of 0.41 to 0.44 nsec between the 10% and 90% amplitude points of the signal (see Fig. 6-6).
3. Remove the signal from INPUT B and return the INTERNAL TRIGGER switch to A for the next adjustment.

A BRIDGE BAL. Adjustment

1. Set the Type 3T77 TRIGGER SENSITIVITY control fully clockwise.
2. Turn the Type 3S76 channel A MV/DIV. switch back and forth between 200 and 10 while adjusting the A DC OFFSET control for no vertical trace shift.
3. With the A POSITION control, move the trace to the exact center of the graticule.
4. Connect the 10X probe of the test oscilloscope to the channel A X100 OFFSET MONITOR jack. Dc couple the test oscilloscope and readjust the A DC OFFSET control for exactly zero volts on the test oscilloscope.
5. Set the A BRIDGE BAL. control to return the trace to the exact center of the graticule on the sampling oscilloscope.
6. Return the channel A MV/DIV. switch to 200.

B BRIDGE BAL. Adjustment

1. Turn the Type 3S76 channel B MV/DIV. switch back and forth between 200 and 10 while adjusting the B DC OFFSET control for no vertical trace shift.
2. With the B POSITION control, move the trace to the exact center of the graticule.
3. Connect the 10X probe of the test oscilloscope to the channel B X100 OFFSET MONITOR jack. Dc couple the test oscilloscope and readjust the B DC OFFSET control for exactly zero volts on the test oscilloscope.
4. Set the B BRIDGE BAL. to return the trace to the exact center of the graticule on the sampling oscilloscope.
5. Return the channel B MV/DIV. switch to 200.

A and B Bridge Voltage Check

1. Dc couple the test oscilloscope and, with the 10X probe, measure the dc voltage at test points [2A] and [3A]. The voltage should be negative at test point [2A] and positive at test point [3A]. Minimum voltage at either test point is 1.6 volts; the maximum difference (neglecting polarity) between the two voltages is 0.2 volt.
2. Repeat step 1 at test points [2B] and [3B].

Calibration—Type 3S76

A PREAMP SENS. and MEMORY GATE LENGTH* Adjustment

1. Setup the Type 109 or 110 Pulse Generator as follows:

| | |
|-----------------------------|---|
| CHG. LINE 1 connector | No connection. |
| CHG. LINE 2 connector | Connect about 65-nsec charge line. |
| 50 Ω OUTPUT connector | Connect to the INPUT A of the Type 3S76 with a length of RG-8A/U coaxial cable. |
| AMPLITUDE and VOLTAGE RANGE | Set for 1.5 volts. |
| PULSE POLARITY | + |

2. Set the Vertical Mode switch of the Type 3S76 to A ONLY.

3. Set the Type 3T77 DOTS PER DIV. switch to 10 and the TIME/DIV. to 20 nSEC. Set the TRIGGER SENSITIVITY control for stable triggering on both the short and long pulse of the Type 109 or 110 (this will be evidenced by the presence of a baseline under the pulse; see Fig. 6-7).

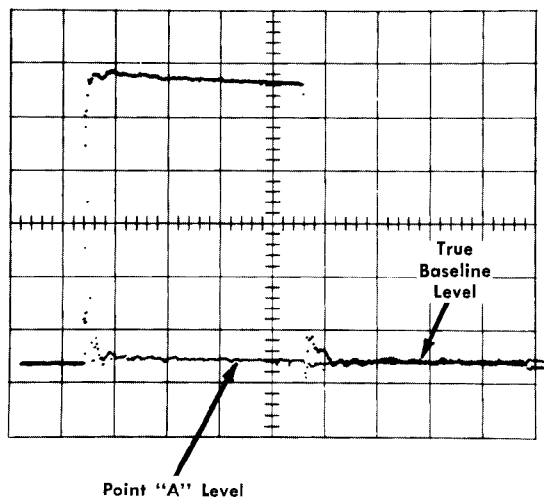


Fig. 6-7. Displayed pulse of Type 109 or 110 Pulse Generator with one charge line connected and the PREAMP SENS. control properly adjusted.

4.* Adjust the MEMORY GATE LENGTH for the maximum distance between the baseline and the top of the pulse.

5. Adjust the A PREAMP SENS. to align the baseline (point "A" level in Fig. 6-7) under the pulse with the true baseline that precedes and follows the pulse.

6. Set the Type 109 or 110 Pulse Generator for a negative pulse output of the same amplitude.

7. Set the Type 3T77 INT.-EXT. switch to —INT., and the TRIGGER SENSITIVITY for a stable display triggering on

*If the serial number of your Type 3S76 is 799 or below, delete MEMORY GATE LENGTH and step 4 from this adjustment.

both the long and short output pulse of the Type 109 or 110 Pulse Generator.

8. Check the level of the baseline under the pulse. This level should not deviate from the true baseline by more than 10% of the pulse amplitude. If the deviation is more than 10%, readjust the A PREAMP SENS. for the best compromise between steps 5 and 8.

B PREAMP SENS. Adjustment

1. Set the Vertical Mode switch of the Type 3S76 to B ONLY and the INTERNAL TRIGGER switch to B.

2. Use the same setup of the Type 109 or 110 Pulse Generator as in step 1 of the previous adjustment except apply the pulse out to the INPUT B connector of the Type 3S76.

3. Set the Type 3T77 TRIGGER SENSITIVITY and INT.-EXT. controls for stable triggering on a positive pulse. Be sure to trigger on both the long and short output pulse of the Type 109 or 110 Pulse Generator as described in the previous adjustment.

4. Adjust the B PREAMP SENS. to align the baseline under the pulse with the true baseline (Fig. 6-7).

5. Reverse the polarity of the output pulse from the Type 109 or 110 and set the INT.-EXT. switch of the Type 3T77 to —INT. Readjust the Type 3T77 TRIGGER SENSITIVITY to trigger on both the long and short pulses.

6. Check the level of the baseline under the pulse. This level should not deviate from the true baseline by more than 10% of the pulse amplitude. If the deviation is more than 10%, readjust the B PREAMP SENS. for the best compromise between steps 4 and 6. Return the Vertical Mode switch to A ONLY.

Pulse Aberration Check

1. Set up the Type 109 or 110 Pulse Generator as follows:

| | |
|-----------------------------|---|
| CHG. LINE 1 connector | Short center conductor to outer conductor with a single alligator clip. |
| CHG. LINE 2 connector | Connect about 65-nsec charge line. |
| OUTPUT connector | Connect to INPUT A of the Type 3S76 with length of RG-8A/U coaxial cable. |
| AMPLITUDE and VOLTAGE RANGE | Set for approximately 1.6 volts. |
| PULSE POLARITY | + |

2. Display the output pulse of the Type 109 or 110 at a sweep rate of 5 nsec/div.

3. Adjust the output amplitude of the pulse generator for exactly 8 divisions, as measured after the first 20 nsec of the displayed pulse (with the Type 3S76 A MV/DIV. switch at 200). Observe the first 10 nsec at the top, leading corner of the displayed pulse. Maximum aberration is

$\pm 3\%$ * (± 0.24 division with 8 divisions of deflection) of the pulse amplitude.

4. Repeat steps 1 through 3 for channel B. Maximum aberrations for channel B are the same.

5. Remove all signal connections. Return the Vertical Mode switch to A ONLY.

DC OFFSET Range Check

1. Turn the Type 3T77 TRIGGER SENSITIVITY control fully clockwise.

2. Set both Type 3S76 NORM.-INV. switches to INV.

3. With the channel A POSITION control, move the trace to the centerline of the graticule.

4. Set the channel A MV/DIV. switch to 10 and use the channel A DC OFFSET control to return the trace to the centerline of the graticule.

5. Set the channel A MV/DIV. switch to 200 and repeat steps 3, 4, and 5 until no further adjustment is required. When completed, set the channel A MV/DIV. switch to 200.

6. With the 10X probe of the test oscilloscope (dc coupled) measure the dc voltage at the channel A X100 OFFSET MONITOR. Voltage must be zero, ± 5 volts. Remove 10X probe from the channel A X100 OFFSET MONITOR.

7. With the Type 3S76 channel A POSITION control, move the trace to the bottom line of the graticule.

8. Turn the channel A DC OFFSET control fully clockwise. Trace must move up at least 4.75 divisions. With the channel A DC OFFSET control, return the trace to the bottom graticule line.

9. With the channel A POSITION control, position the trace to the top line of the graticule.

10. Turn the channel A DC OFFSET control fully counterclockwise. Trace must move down at least 4.75 divisions. With the channel A DC OFFSET control, return the trace to the top graticule line. With the channel A POSITION control return the trace to the centerline of the graticule.

11. To check the channel B DC OFFSET, set the Vertical Mode switch to B ONLY and apply steps 3 through 10 to channel B controls.

Memory Drift Check

1. Connect the output of the Type 105 Square-Wave Generator to the INPUT A connector through a 10X attenuator (item 14 of "Equipment Required").

2. Set the Type 3S76 Vertical Mode switch to A ONLY and the INTERNAL TRIGGER switch to A.

3. Set the Type 3T77 TIME/DIV. switch to 10 μ SEC and the DOTS PER DIV. switch to 10.

4. Set the output frequency of the Type 105 Square-Wave Generator to 30 cycles and adjust the output amplitude for about 6 divisions of deflection.

*For Type 3S76 instruments with serial numbers 700 and above. Maximum aberration for instruments below serial number 700 is 5%, peak-to-peak.

5. Set the triggering controls of the Type 3T77 for a stable display.

6. Check the display for the amount of vertical elongation of the dots (memory drift). Maximum elongation at 30 cycles is 1 minor division (2 millimeters) on the graticule.

7. Repeat the steps for channel B.

Lissajous Check

1. Set the Type 3S76 Vertical Mode switch to A VERT. B HORIZ.

2. Set the output frequency of the Type 105 Square-Wave Generator to about 1 mc and the output amplitude to minimum (fully counterclockwise).

3. Apply the output of the Type 105 through the GR "T" connector (item 8 of "Equipment Required") to the INPUT A and INPUT B connectors of the Type 3S76. The cables connected between the INPUT connectors and the "T" connector should be about the same length.

4. Set the Type 3T77 TIME/DIV. switch to 50 nSEC and adjust the TRIGGER SENSITIVITY control clockwise just to the point where a display appears.

5. Use both Type 3S76 POSITION controls to position the display. The display at this point should be a diagonal line at an angle of about 45°. Check that the A POSITION control moves the display vertically and the B POSITION control moves the display horizontally.

6. Adjust the output amplitude of the Type 105 for exactly 4 divisions of vertical deflection.

7. Check the amount of horizontal deflection; it must be 4 divisions $\pm 3\%$.

Signal Rejection Ratio Check

1. Set the Type 3S76 Vertical Mode switch to DUAL-TRACE, and the NORM.-INV. switches to opposite positions (one to NORM., one to INV.).

2. Set the sampling sweep plug-in unit for 10 dots/div and a sweep rate of 5 nsec/div.

3. Apply a signal from the Type 105 Square-Wave Generator to the Type 3S76 INPUT A and INPUT B through a 10X attenuator and a GR "T" connector.

4. Set the output amplitude of the Type 105 for 8 divisions of deflection in both channels with the MV/DIV. switches set at 100.

5. Set the Vertical Mode switch to A+B and position the trace onto the crt.

6. Check the amount of vertical deflection. Maximum deflection is 0.16 division (neglecting spikes) for a minimum rejection ratio of 50:1.

7. Set the Vertical Mode switch to DUAL-TRACE and decrease the amount of deflection to 4 divisions by decreasing the output amplitude of the Type 105 Square-Wave Generator.

8. Set the Vertical Mode switch to A+B and set both NORM.-INV. switches in the same position.

9. Check the amount of vertical deflection; it must be 8 divisions, ± 0.16 division.

SECTION 7

PARTS LIST AND SCHEMATICS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix Field Office.


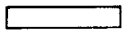
Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number including any suffix, instrument type, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix Field Office will contact you concerning any change in part number.

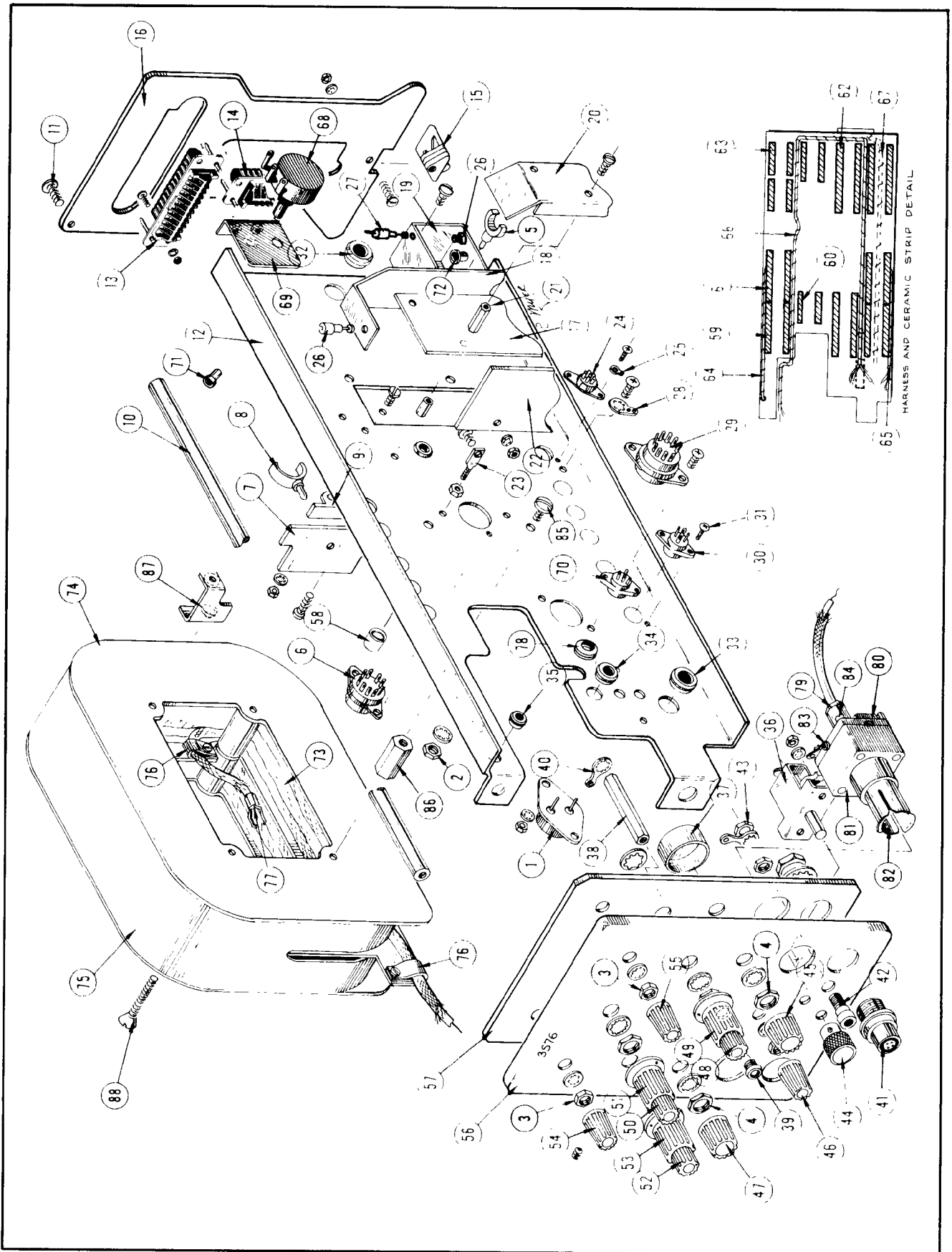
ABBREVIATIONS AND SYMBOLS

| | | | |
|----------|-----------------------------|----------|-----------------------------------|
| a or amp | amperes | mm | millimeter |
| BHS | binding head steel | meg or M | megohms or mega (10^6) |
| C | carbon | met. | metal |
| cer | ceramic | μ | micro, or 10^6 |
| cm | centimeter | n | nano, or 10^9 |
| comp | composition | Ω | ohm |
| cps | cycles per second | OD | outside diameter |
| crt | cathode-ray tube | OHS | oval head steel |
| CSK | counter sunk | p | pico, or 10^{12} |
| dia | diameter | PHS | pan head steel |
| div | division | piv | peak inverse voltage |
| EMC | electrolytic, metal cased | plstc | plastic |
| EMT | electrolytic, metal tubular | PMC | paper, metal cased |
| ext | external | poly | polystyrene |
| f | farad | Prec | precision |
| F & I | focus and intensity | PT | paper tubular |
| FHS | flat head steel | PTM | paper or plastic, tubular, molded |
| Fil HS | fillister head steel | RHS | round head steel |
| g or G | giga, or 10^9 | rms | root mean square |
| Ge | germanium | sec | second |
| GMV | guaranteed minimum value | Si | silicon |
| h | henry | S/N | serial number |
| hex | hexagonal | t or T | tera, or 10^{12} |
| HHS | hex head steel | TD | toroid |
| HSS | hex socket steel | THS | truss head steel |
| HV | high voltage | tub. | tubular |
| ID | inside diameter | v or V | volt |
| incd | incandescent | Var | variable |
| int | internal | w | watt |
| k or K | kilohms or kilo (10^3) | w/ | with |
| kc | kilocycle | w/o | without |
| m | milli, or 10^3 | WW | wire-wound |
| mc | megacycle | | |

SPECIAL NOTES AND SYMBOLS

| | |
|---|---|
| X000 | Part first added at this serial number. |
| 000X | Part removed after this serial number. |
| *000-000 | Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, or reworked or checked components. |
| Use 000-000 | Part number indicated is direct replacement. |
|  | Internal screwdriver adjustment. |
|  | Front-panel adjustment or connector. |

EXPLODED VIEW



EXPLODED VIEW

| REF. NO. | PART NO. | SERIAL/ MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|-------------------|-------|------|---|
| | | EFF. | DISC. | | |
| 1 | - - - - - | | | 1 | TRANSISTOR |
| | - - - - - | | | - | mounting hardware: (not included w/transistor) |
| | 211-0507-00 | | | 2 | SCREW, 6-32 x $\frac{3}{16}$ inch BHS |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x $\frac{1}{4}$ inch |
| 2 | - - - - - | | | - | mounting hardware for each pot (not included) |
| | 210-0046-00 | | | 1 | LOCKWASHER, internal, .400 OD x .261 ID |
| | 210-0583-00 | | | 1 | NUT, hex, $\frac{1}{4}$ -32 x $\frac{5}{16}$ inch |
| 3 | - - - - - | | | 2 | POT |
| | - - - - - | | | - | mounting hardware for each: (not included w/pot) |
| | 210-0940-00 | | | 1 | WASHER, $\frac{1}{4}$ ID x $\frac{3}{8}$ inch OD |
| | 210-0583-00 | | | 1 | NUT, hex, $\frac{1}{4}$ -32 x $\frac{5}{16}$ inch |
| 4 | - - - - - | | | 2 | POT |
| | - - - - - | | | - | mounting hardware for each: (not included w/pot) |
| | 210-0840-00 | | | 1 | WASHER, .390 ID x $\frac{9}{16}$ inch OD |
| | 210-0413-00 | | | 1 | NUT, hex, $\frac{3}{8}$ -32 x $\frac{1}{2}$ inch |
| 5 | 426-0121-00 | | | 1 | MOUNT, toroid |
| | - - - - - | | | - | mounting hardware: (not included w/mount) |
| | 361-0007-00 | | | 1 | SPACER, nylon, $\frac{1}{16}$ inch |
| 6 | 136-0014-00 | | | 2 | SOCKET, STM9 |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| | 213-0044-00 | | | 2 | SCREW, thread forming, 5-32 x $\frac{3}{16}$ inch PHS |
| 7 | 670-0015-00 | | | 1 | BOARD, Snap-off (wired) |
| | - - - - - | | | - | Includes: |
| | 361-0007-00 | | | 3 | SPACER, nylon molded |
| 8 | 426-0121-00 | | | 3 | MOUNT, toroid, nylon, $\frac{15}{32}$ x $\frac{1}{8}$ x $\frac{9}{64}$ inch |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 210-0001-00 | | | 3 | LOCKWASHER, internal #2 |
| | 210-0004-00 | | | 3 | LOCKWASHER, internal #4 |
| | 210-0405-00 | | | 3 | NUT, hex, 2-56 x $\frac{3}{16}$ inch |
| | 210-0406-00 | | | 3 | NUT, hex, 4-40 x $\frac{3}{16}$ inch |
| | 211-0001-00 | | | 3 | SCREW, 2-56 x $\frac{1}{4}$ inch RHS |
| | 211-0008-00 | | | 1 | SCREW, 4-40 $\frac{1}{4}$ inch BHS |
| | 211-0011-00 | | | 2 | SCREW, 4-40 x $\frac{5}{16}$ inch BHS |
| 9 | 406-0772-00 | | | 1 | BRACKET, etched circuit board |
| 10 | 384-0566-00 | 101 | 1459 | 4 | ROD, frame, spacing |
| | 384-0615-00 | 1460 | | 4 | ROD, frame, spacing |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| 11 | 212-0044-00 | | | 1 | SCREW, 8-32 x $\frac{1}{2}$ inch RHS |
| 12 | 441-0415-00 | | | 1 | CHASSIS, alum. $5\frac{5}{16}$ x $12\frac{1}{4}$ x $\frac{3}{4}$ inch |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 211-0504-00 | | | 3 | SCREW, 6-32 x $\frac{1}{4}$ inch BHS |
| | 211-0538-00 | | | 2 | SCREW, 6-32 x $\frac{5}{16}$ inch FHS 100° CSK |
| 13 | 131-0149-00 | | | 1 | CONNECTOR, chassis mount, 24 contact |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 210-0004-00 | | | 4 | LOCKWASHER, internal #4 |
| | 210-0201-00 | | | 1 | LUG, solder SE 4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x $\frac{3}{16}$ inch |
| | 211-0008-00 | 101 | 2909 | 2 | SCREW, 4-40 x $\frac{1}{4}$ inch BHS |
| | 211-0097-00 | 2910 | | 2 | SCREW, 4-40 x $\frac{5}{16}$ inch PHS, phillips |

Parts List — Type 3576

EXPLODED VIEW (Cont'd)

| REF. NO. | PART NO. | SERIAL/MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|------------------|-------|------|--|
| | | EFF. | DISC. | | |
| 14 | 131-0149-00 | | | 1 | CONNECTOR, chassis mount, 24 contact (not shown) |
| | ----- | | | - | Mounting Hardware: (not included) |
| | 166-0032-00 | | | 2 | TUBE, spacer, alum 1/4 OD x 5/16 inch long |
| | 210-0004-00 | | | 2 | LOCKWASHER, internal #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x 3/16 inch |
| | 211-0016-00 | | | 2 | SCREW, 4-40 x 5/8 inch RHS |
| 15 | 351-0037-00 | | | 1 | GUIDE, plug-in, delrin, 5/8 x 1 3/16 x 3/16 inch track |
| | ----- | | | - | Mounting Hardware: (not included) |
| | 210-0004-00 | | | 1 | LOCKWASHER, internal #4 |
| | 210-0406-00 | | | 1 | NUT, hex, 4-40 x 3/16 inch |
| | 211-0013-00 | | | 1 | SCREW, 4-40 x 3/8 inch RHS |
| 16 | 387-0595-00 | | | 1 | PLATE, panel, rear, alum. 5 3/32 x 3 31/32 inch |
| 17 | 670-0014-00 | | | 1 | BOARD, Signal (wired) |
| | ----- | | | - | Includes: |
| | 605-0032-00 | | | 1 | BOARD, signal (without diodes) |
| | ----- | | | - | Includes |
| | 337-0527-00 | | | 2 | SHIELD, etched circuit board |
| | 344-0108-00 | | | 16 | CLIP, ground, plain |
| | 346-0025-00 | | | 2 | STRAP, ground plain |
| | ----- | | | - | Mounting Hardware: (not included) |
| | 210-0001-00 | | | 12 | LOCKWASHER, internal #2 |
| | 211-0001-00 | | | 2 | SCREW, 2-56 x 1/4 inch RHS |
| | 211-0022-00 | | | 5 | SCREW, 2-56 x 3/16 inch RHS |
| | 211-0030-00 | | | 1 | SCREW, 2-56 x 1/4 inch FHS |
| | 361-0032-00 | | | 6 | SPACER, nut, 5/32 inch alum. rod 5/16 inch long |
| 18 | 337-0538-00 | X1960 | | 1 | SHIELD, Electrostatic |
| | 252-0562-00 | | | ft. | CHANNEL, plastic (2 pieces, .146 ft. each) |
| 19 | 337-0480-00 | | | 1 | SHIELD, Blocking Oscillator |
| | ----- | | | - | Mounting Hardware: (not included) |
| | 210-0004-00 | | | 2 | LOCKWASHER, internal #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x 3/16 inch |
| | 211-0008-00 | | | 2 | SCREW, 4-40 x 1/4 inch BHS |
| 20 | 200-0413-00 | | | 1 | COVER, shield, brass 1 5/16 x 5 3/16 inch |
| | ----- | | | - | Mounting Hardware: (not included) |
| | 210-0938-00 | | | 4 | WASHER, #2 flat |
| | 211-0079-00 | | | 4 | SCREW, 2-56 x 3/16 inch PHS |
| 21 | 214-0277-00 | | | 4 | STUD, spacer, 3/16 hex x 7/8 inch long |
| 22 | 670-0013-00 | | | 1 | BOARD, Memory (wired) |
| | ----- | | | - | Includes: |
| | 210-0001-00 | | | 2 | LOCKWASHER, internal #2 |
| | 210-0405-00 | | | 2 | NUT, hex, 2-56 x 3/16 inch |
| | 210-0406-00 | | | 4 | NUT, 4-40 x 3/16 inch |
| | 210-0001-00 | | | 2 | SCREW, 2-56 x 1/4 inch RHS |
| 23 | 214-0034-00 | | | 2 | BOLT, spade 4-40 x 5/16 inch |
| | 344-0108-00 | | | 8 | CLIP, diode, 3/16 x 5/64 inch |
| | ----- | | | - | Mounting Hardware: (not included) |
| | 210-0004-00 | | | 2 | LOCKWASHER, internal #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x 3/16 inch |

EXPLODED VIEW (Cont'd)

| REF. NO. | PART NO. | SERIAL/MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|------------------|-------|------|---|
| | | EFF. | DISC. | | |
| 24 | 136-0101-00 | | | 3 | SOCKET, 5 pin, with mounting holes |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| 25 | 210-0215-00 | | | 1 | LUG, solder, peewee |
| | 213-0055-00 | | | 2 | SCREW, thread forming, 2-56 x 3/16 inch PHS |
| 26 | 131-0180-00 | | | 7 | CONNECTOR, terminal stand-off |
| | 358-0135-00 | | | 7 | BUSHING, teflon |
| 27 | 131-0182-00 | | | 5 | CONNECTOR, terminal feed-thru |
| | 358-0135-00 | | | 5 | BUSHING, teflon |
| 28 | 210-0201-00 | | | 4 | LUG, solder, SE4 with 2 wire holes |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| | 213-0044-00 | | | 2 | SCREW, thread forming, 5-32 x 3/16 inch PHS |
| 29 | 136-0015-00 | | | 1 | SOCKET, STM9G |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 213-0044-00 | | | 2 | SCREW, thread forming, 5-32 x 3/16 inch PHS |
| 30 | 136-0095-00 | 101 | 1689 | 20 | SOCKET, 4 pin transistor |
| | 136-0181-00 | 1690 | | 20 | SOCKET, 3 pin transistor |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| 31 | 213-0113-00 | 101 | 1689 | 2 | SCREW, 2-32 x 5/16 inch RHS phillips |
| | 354-0234-00 | 1690 | | 1 | RING, locking, transistor socket |
| 32 | 348-0005-00 | | | 1 | GROMMET, rubber, 1/2 inch |
| 33 | 348-0004-00 | | | 1 | GROMMET, rubber, 3/8 inch |
| 34 | 348-0003-00 | | | 3 | GROMMET, rubber, 5/16 inch |
| 35 | 348-0002-00 | | | 1 | GROMMET, rubber, 1/4 inch |
| 36 | 214-0052-00 | | | 1 | FASTENER, pawl right, with stop |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 210-0004-00 | | | 2 | LOCKWASHER, internal #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x 3/16 inch |
| 37 | 200-0263-00 | | | 2 | COVER, dust, pot, polyethylene, 17/32 x 1 inch |
| 38 | 384-0595-00 | | | 1 | ROD, spacer, alum. hex 5/16 x 1 1/2 inch long |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| 39 | 358-0054-00 | | | 1 | BUSHING, banana jack, 1/4-32 x 13/32 inch |
| 40 | 210-0223-00 | | | 4 | LUG, solder, 1/4 inch hole lock round perimeter |
| 41 | 131-0206-00 | | | 2 | CONNECTOR, probe, power |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| | 210-0559-00 | | | 1 | NUT, hex, 7/16 inch |
| | 210-0941-00 | | | 1 | WASHER, steel, 1 1/16 OD |
| 42 | 136-0129-00 | | | 4 | SOCKET, banana jack assembly |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| | 210-0223-00 | | | 1 | LUG, solder, 1/4 inch hole lock round perimeter |
| 43 | 210-0583-00 | | | 2 | NUT, hex, 1/4-32 x 5/16 inch double chamfered |
| 44 | 366-0109-00 | | | 1 | KNOB, plug-in securing, alum. |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 45 | 366-0148-00 | | | 1 | KNOB, DC OFFSET, charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 46 | 366-0153-00 | | | 1 | KNOB, INTERNAL TRIGGER, charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |

Parts List — Type 3576

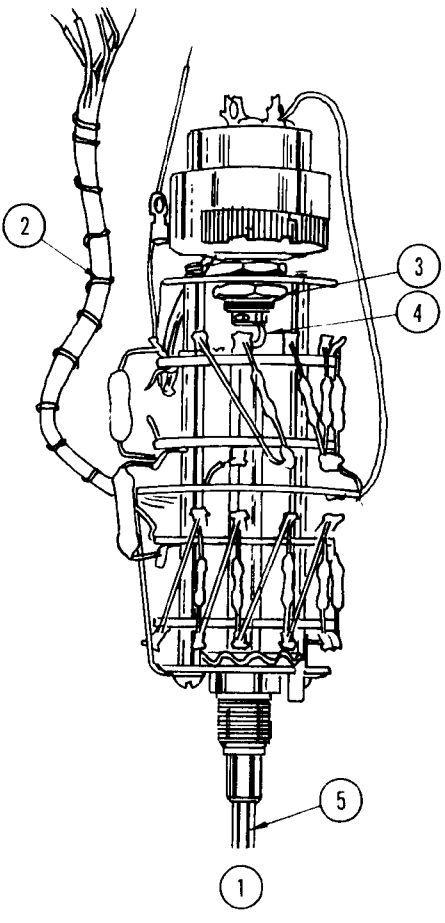
EXPLODED VIEW (Cont'd)

| REF. NO. | PART NO. | SERIAL/MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|------------------|-------|------|---|
| | | EFF. | DISC. | | |
| 47 | 366-0148-00 | | | 1 | KNOB, DC OFFSET, charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 48 | 366-0140-00 | | | 1 | KNOB, 2-200 VAR., red |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 49 | 366-0175-00 | 101 | 1509 | 1 | KNOB, MV/DIV., charcoal |
| | 366-0250-00 | 1510 | | 1 | KNOB, MV/DIV., charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 50 | 366-0140-00 | | | 1 | KNOB, SMOOTH-NORMAL, red |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 51 | 366-0175-00 | 101 | 1509 | 1 | KNOB, DUAL-TRACE, charcoal |
| | 366-0250-00 | 1510 | | 1 | KNOB, DUAL-TRACE, charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 52 | 366-0140-00 | | | 1 | KNOB, 2-200 VAR., red |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 53 | 366-0175-00 | 101 | 1509 | 1 | KNOB, MV/DIV., charcoal |
| | 366-0250-00 | 1510 | | 1 | KNOB, MV/DIV., charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 54 | 366-0153-00 | | | 1 | KNOB, A POSITION, charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 55 | 366-0153-00 | | | 1 | KNOB, B POSITION, charcoal |
| | - - - - - | | | - | Includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS allen head |
| 56 | 333-0676-00 | | | 1 | PANEL, front |
| 57 | 387-0606-00 | | | 1 | PLATE, subpanel front, alum. 6 3/32 x 4 3/32 inch |
| 58 | 200-0385-00 | | | 1 | COVER, transistor, polyethylene |
| 59 | 124-0126-00 | | | 4 | STRIP, ceramic, 16 notches, 2 7/16 x 7/16 inch |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| | 361-0009-00 | | | 2 | SPACER, nylon |
| 60 | 124-0128-00 | | | 6 | STRIP, ceramic, 9 notches, 1 7/16 x 7/16 inch |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| | 361-0009-00 | | | 2 | SPACER, nylon |
| 61 | 124-0147-00 | | | 5 | STRIP, 13 notches, 2 x 7/16 inch |
| | - - - - - | | | - | Mounting Hardware For Each (not included) |
| | 361-0009-00 | | | 2 | SPACER, nylon |
| 62 | 124-0145-00 | | | 6 | STRIP, ceramic, 20 notches, 3 x 7/16 inch |
| | - - - - - | | | - | Mounting Hardware For Each (not included) |
| | 361-0009-00 | | | 2 | SPACER, nylon |
| 63 | 124-0149-00 | | | 2 | STRIP, 7 notches, 1 5/32 x 7/16 inch |
| | - - - - - | | | - | Mounting Hardware For Each (not included) |
| | 361-0009-00 | | | 2 | SPACER, nylon |

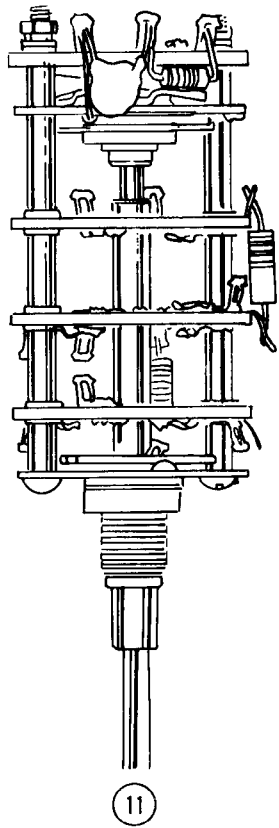
EXPLODED VIEW (Cont'd)

| REF. NO. | PART NO. | SERIAL/MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|------------------|-------|------|--|
| | | EFF. | DISC. | | |
| 64 | 179-0615-00 | | | 1 | CABLE harness, right |
| 65 | 179-0616-00 | | | 1 | CABLE harness, left |
| 66 | 179-0614-00 | | | 1 | CABLE harness, main |
| 67 | 179-0619-00 | | | 1 | CABLE harness |
| 68 | - - - - - | X800 | | 1 | POT |
| | - - - - - | | | - | mounting hardware: (not included w/pot) |
| | 210-0012-00 | | | 1 | LOCKWASHER, internal, $\frac{3}{8}$ x $\frac{1}{2}$ inch |
| | 210-0413-00 | | | 1 | NUT, hex, $\frac{3}{8}$ -32 x $\frac{1}{2}$ inch |
| 69 | 406-0946-00 | X800 | | 1 | BRACKET, pot |
| | - - - - - | | | - | mounting hardware: (not included w/bracket) |
| | 211-0504-00 | | | 2 | SCREW, 6-32 x $\frac{1}{4}$ inch BHS |
| 70 | 136-0095-00 | 101 | 1689 | 10 | SOCKET, 4 pin transistor |
| | 136-0182-00 | 1690 | | 10 | SOCKET, 4 pin transistor |
| | - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 213-0113-00 | 101 | 1689 | 2 | SCREW, thread forming, 2-32 x $\frac{5}{16}$ inch RHS phillips |
| | 354-0234-00 | 1690 | | 1 | RING, locking, transistor socket |
| 71 | 348-0031-00 | | | 2 | GROMMET, snap-in, $\frac{5}{32}$ inch |
| 72 | 348-0031-00 | 101 | 2429 | 3 | GROMMET, snap-in, $\frac{5}{32}$ inch |
| | 348-0083-00 | 2430 | | 3 | GROMMET, snap-in, $\frac{5}{32}$ inch |
| 73 | 636-0001-00 | | | 1 | ASSEMBLY, delay line (see ref #84-88) |
| | - - - - - | | | - | assembly includes: |
| 74 | 276-0066-00 | | | 1 | FORM, delay line |
| 75 | 200-0377-00 | | | 1 | COVER, delay line |
| | - - - - - | | | - | mounting hardware: (not included w/cover) |
| | 211-0514-00 | | | 2 | SCREW, 6-32 x $\frac{3}{4}$ inch BHS |
| | 210-0945-00 | | | 2 | WASHER, delay line cover |
| | 210-0560-00 | | | 2 | NUT, delay line cover |
| 76 | 343-0081-00 | | | 4 | CLAMP, coaxial cable |
| | 211-0507-00 | | | 4 | SCREW, 6-32 x $\frac{5}{16}$ inch BHS |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x $\frac{1}{4}$ inch |
| 77 | 132-0120-00 | | | 2 | FERRULE |
| | 166-0247-00 | | | 2 | TUBE, coaxial adapter |
| 78 | 348-0003-00 | | | 1 | GROMMET, rubber, $\frac{5}{16}$ inch |
| 79 | 131-0007-00 | | | 2 | CONNECTOR, cable end |
| 80 | 200-0365-00 | | | 2 | COVER, trigger take-off |
| | - - - - - | | | - | mounting hardware for each: (not included w/cover) |
| | 211-0531-00 | | | 2 | SCREW, 6-32 x $\frac{3}{8}$ inch FHS |
| | 210-0202-00 | | | 1 | LUG, solder, SE6 |
| 81 | 380-0035-00 | | | 2 | HOUSING, trigger take-off |
| 82 | 132-0001-00 | | | 2 | NUT, coupling |
| | 132-0002-00 | | | 2 | SLEEVE, conductor, outer |
| | 132-0007-00 | | | 2 | RING, snap |
| | 132-0028-00 | | | 2 | INSULATOR |
| | 132-0029-00 | | | 2 | CONDUCTOR, inner |
| | 131-0209-00 | | | 2 | CONNECTOR, inner conductor |
| | 358-0088-00 | | | 2 | BUSHING, resistor holding |
| 83 | 348-0031-00 | | | 2 | GROMMET, snap-in, $\frac{5}{32}$ inch |
| | - - - - - | | | - | mounting hardware: (not included w/assembly) |
| 84 | 210-0561-00 | | | 4 | NUT, hex, 6-32 x $\frac{3}{16}$ x $\frac{3}{16}$ inch |
| 85 | 212-0004-00 | | | 4 | SCREW, 8-32 x $\frac{5}{16}$ inch BHS |
| 86 | 361-0033-00 | | | 3 | SPACER, hex |
| 87 | 406-0773-00 | | | 1 | BRACKET, delay line mounting |
| 88 | 212-0073-00 | | | 3 | SCREW, 8-32 x $2\frac{1}{4}$ inches FHS |
| | 212-0074-00 | | | 1 | SCREW, 8-32 x 2 inches FHS |

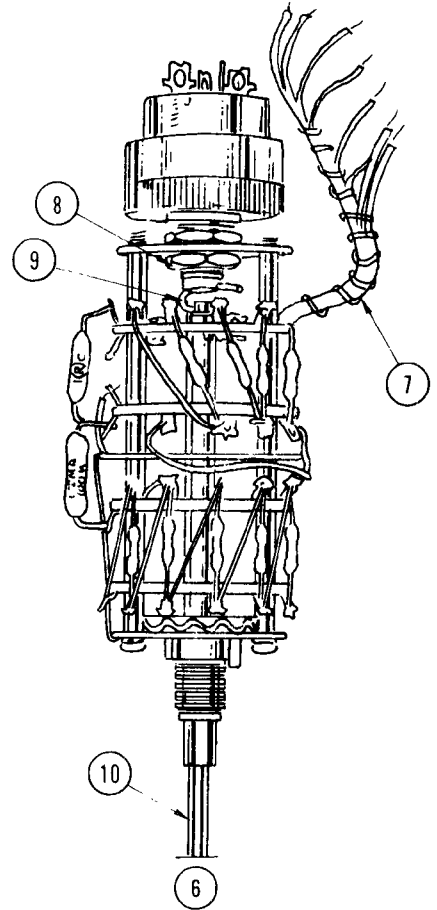
SWITCHES



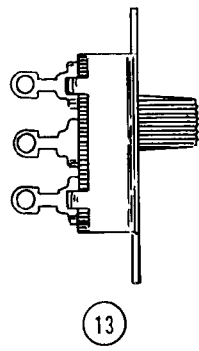
MV/DIV A



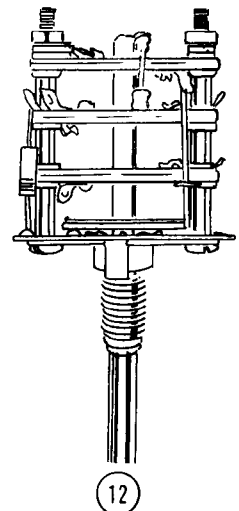
Mod.



MV DIV B



NORM
INV.

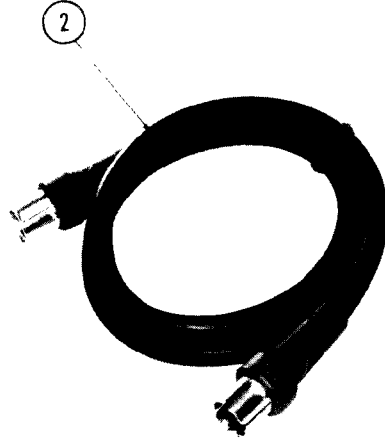
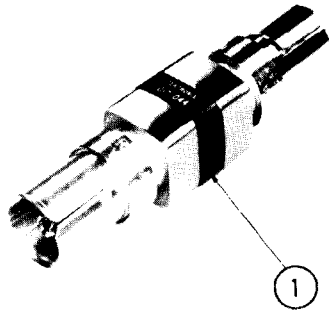


INTERNAL TRIGGER

SWITCHES

| REF. NO. | PART NO. | SERIAL/MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|------------------|-------|------|--|
| | | EFF. | DISC. | | |
| 1 | 262-0465-00 | | | 1 | SWITCH, MV/DIV., Channel A, wired |
| | - - - - - | | | - | Includes: |
| 2 | 179-0617-00 | | | 1 | CABLE harness |
| | 210-0012-00 | | | 1 | LOCKWASHER, pot, internal $\frac{3}{8} \times \frac{1}{2}$ inch |
| 3 | 210-0413-00 | | | 2 | NUT, hex, $\frac{3}{8}$ -32 x $\frac{1}{2}$ inch |
| 4 | 376-0014-00 | | | 1 | COUPLING, pot, wire steel |
| 5 | 384-0254-00 | | | 1 | ROD, extension, $\frac{1}{8}$ dia. x $3\frac{5}{8}$ inch long |
| | 260-0422-00 | | | - | SWITCH, MV/DIV., Channel A, unwired |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 210-0012-00 | | | 1 | LOCKWASHER, pot, internal $\frac{3}{8} \times \frac{1}{2}$ inch |
| | 210-0413-00 | | | 1 | NUT, hex, $\frac{3}{8}$ -32 x $\frac{1}{2}$ inch |
| | 210-0840-00 | | | 1 | WASHER, pot, flat |
| 6 | 262-0471-00 | | | 1 | SWITCH, MV/DIV., Channel B, wired |
| | - - - - - | | | - | Includes: |
| 7 | 179-0618-00 | | | 1 | CABLE harness |
| | 210-0012-00 | | | 1 | LOCKWASHER, pot, internal $\frac{3}{8} \times \frac{1}{2}$ inch |
| 8 | 210-0413-00 | | | 2 | NUT, hex, $\frac{3}{8}$ -32 x $\frac{1}{2}$ inch |
| 9 | 376-0014-00 | | | 1 | COUPLING, pot, wire steel |
| 10 | 384-0254-00 | | | 1 | ROD, extension, $\frac{1}{8}$ dia. x $3\frac{5}{8}$ inch long |
| | 260-0422-00 | | | 1 | SWITCH, MV/DIV., Channel B, unwired |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 210-0012-00 | | | 1 | LOCKWASHER, pot, internal $\frac{3}{8} \times \frac{1}{2}$ inch |
| | 210-0413-00 | | | 1 | NUT, hex, $\frac{3}{8}$ -32 x $\frac{1}{2}$ inch |
| | 210-0840-00 | | | 1 | WASHER, pot, flat |
| 11 | 262-0467-00 | | | 1 | SWITCH, Mode, wired |
| | - - - - - | | | - | Includes: |
| | 260-0423-00 | | | 1 | SWITCH, Mode, unwired |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 210-0012-00 | | | 1 | LOCKWASHER, pot, internal $\frac{3}{8} \times \frac{1}{2}$ inch |
| | 210-0413-00 | | | 1 | NUT, hex, $\frac{3}{8}$ -32 x $\frac{1}{2}$ inch |
| 12 | 262-0466-00 | | | 1 | SWITCH, INTERNAL TRIGGER, wired |
| | - - - - - | | | - | Includes: |
| | 260-0424-00 | | | 1 | SWITCH, INTERNAL TRIGGER, unwired |
| | - - - - - | | | - | Mounting Hardware: (not included) |
| | 210-0010-00 | | | 1 | LOCKWASHER, internal #10 |
| | 210-0465-00 | | | 1 | NUT, hex, $\frac{1}{4}$ -32 x $\frac{3}{8} \times \frac{3}{32}$ inch |
| 13 | 260-0145-00 | | | 2 | SWITCH, NORM.-INV. |
| | - - - - - | | | - | Mounting Hardware For Each: (not included) |
| | 210-0004-00 | | | 2 | LOCKWASHER, internal #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x $\frac{3}{16}$ inch |

STANDARD ACCESSORIES



| REF. NO. | PART NO. | SERIAL/MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|------------------|-------|------|---------------------------------|
| | | EFF. | DISC. | | |
| 1 | 017-0044-00 | 101 | 2699 | 2 | ATTENUATOR, 50 Ω, 10X |
| | 017-0078-00 | 2700 | | 2 | ATTENUATOR, 50 Ω, 10X |
| 2 | 017-0502-00 | | | 2 | CABLE, 50 Ω 5 Nsec |
| | 070-0332-00 | | | 2 | MANUAL, instruction (not shown) |

ELECTRICAL PARTS

Values are fixed unless marked Variable.

| Ckt. No. | Tektronix Part No. | | Description | | | S/N Range |
|--|--------------------|---------------|-------------|--------|--------------|-----------|
| Capacitors | | | | | | |
| Tolerance $\pm 20\%$ unless otherwise indicated. | | | | | | |
| Tolerance of all electrolytic capacitors are as follows (with exceptions): | | | | | | |
| 3 V — 50 V = -10% , $+250\%$ | | | | | | |
| 51 V — 350 V = -10% , $+100\%$ | | | | | | |
| 351 V — 450 V = -10% , $+50\%$ | | | | | | |
| C1031 | 281-589 | 167 pf | Cer. | 500 v | 5% | |
| C1032 | 283-063 | 490 pf | Disc Type | 200 v | 5% | 101-699 |
| | 283-087 | 300 pf | Disc Type | 1000 v | 10% | 700-up |
| C1033 | 283-060 | 100 pf | Disc Type | 200 v | 5% | |
| C1041 | 283-073 | .0022 μf | Disc Type | 200 v | 5% | |
| C1046 | 283-572 | 50 pf | Mica | 500 v | 5% | |
| C1047 | 283-572 | 50 pf | Mica | 500 v | 5% | |
| C1049 | 281-519 | 47 pf | Cer. | 500 v | 10% | |
| C1055 | 281-516 | 39 pf | Cer. | 500 v | 10% | |
| C1056 | 281-516 | 39 pf | Cer. | 500 v | 10% | |
| C1073 | use 283-006 | .02 μf | Disc Type | 500 v | | |
| C1077 | 283-051 | .0033 μf | Disc Type | 100 v | 5% | |
| C1080 | 283-000 | .001 μf | Disc Type | 500 v | | |
| C1088 | 283-026 | .2 μf | Disc Type | 25 v | | |
| C1121 | 283-023 | .1 μf | Disc Type | 10 v | | |
| C1124 | 281-594 | 150 pf | Cer. | 100 v | 5% | |
| C1128 | 283-023 | 1 μf | Disc Type | 10 v | | |
| C1132 | 281-594 | 150 pf | Cer. | 100 v | 5% | |
| C1134 | 283-028 | .0022 μf | Disc Type | 50 v | | |
| C1139 | 283-000 | .001 μf | Disc Type | 500 v | | |
| C1140 | 283-026 | .2 μf | Disc Type | 25 v | | |
| C1182 | 281-500 | 2.2 pf | Cer. | 500 v | ± 0.5 pf | |
| C1219 | 283-003 | .01 μf | Disc Type | 150 v | | |
| C2001 | 281-517 | 39 pf | Cer. | 500 v | 10% | |
| C2002 | 281-541 | 6.8 pf | Cer. | 500 v | 10% | |
| C2010 | 283-000 | .001 μf | Disc Type | 500 v | | |
| C2012 | 283-026 | .2 μf | Disc Type | 25 v | | |
| C2013 | 283-026 | .2 μf | Disc Type | 25 v | | 101-799 |
| | 283-001 | .005 μf | Disc Type | 500 v | | 800-up |
| C2015 | 283-026 | .2 μf | Disc Type | 25 v | | |
| C2016 | 283-000 | .001 μf | Disc Type | 500 v | | |
| C2018 | 283-032 | 470 pf | Disc Type | 500 v | 5% | |
| C2019 | 283-032 | 470 pf | Disc Type | 500 v | 5% | |
| C2026 | 283-026 | .2 μf | Disc Type | 25 v | | |
| C2031 | 281-589 | 167 pf | Cer. | 500 v | 5% | |

Parts List — Type 3S76

Capacitors (Cont'o,

| Ckt. No. | Tektronix Part No. | | Description | | | S/N Range |
|----------|--------------------|---------------|-------------|--------|--------------|-----------|
| C2032 | 283-063 | 490 pf | Disc Type | 200 v | 5% | 101-699 |
| | 283-087 | 300 pf | Disc Type | 1000 v | 10% | 700-up |
| C2033 | 283-060 | 100 pf | Disc Type | 200 v | 5% | |
| C2041 | 283-073 | .0022 μ f | Disc Type | 200 v | 5% | |
| C2046 | 283-572 | 50 pf | Cer. | 500 v | 5% | |
| C2047 | 283-572 | 50 pf | Cer. | 500 v | 5% | |
| C2049 | 281-519 | 47 pf | Cer. | 500 v | 10% | |
| C2055 | 281-516 | 39 pf | Cer. | 500 v | 10% | |
| C2056 | 281-516 | 39 pf | Cer. | 500 v | 10% | |
| C2073 | use 283-006 | .02 μ f | Disc Type | 500 v | | |
| C2077 | 283-051 | .0033 μ f | Disc Type | 100 v | 5% | |
| C2080 | 283-000 | .001 μ f | Disc Type | 500 v | | |
| C2088 | 283-026 | .2 μ | Disc Type | 25 v | | |
| C2121 | 283-023 | .1 μ f | Disc Type | 10 v | | |
| C2124 | 281-594 | 150 pf | Cer. | 100 v | 5% | |
| C2128 | 283-023 | .1 μ f | Disc Type | 10 v | | |
| C2132 | 281-594 | 150 pf | Cer. | 100 v | 5% | |
| C2134 | 283-028 | .0022 μ f | Disc Type | 50 v | | |
| C2139 | 283-000 | .001 μ f | Disc Type | 500 v | | |
| C2140 | 283-026 | .2 μ f | Disc Type | 25 v | | |
| C2182 | 281-500 | 2.2 pf | Cer. | 500 v | ± 0.5 pf | |
| C2226 | 281-580 | 470 pf | Cer. | 500 v | 10% | |
| C2229 | 283-026 | .2 μ f | Disc Type | 25 v | | |
| C2230 | 283-000 | .001 μ f | Disc Type | 500 v | | |
| C2231 | 283-026 | .2 μ f | Disc Type | 25 v | | |
| C2243 | 281-543 | 270 μ f | Cer. | 500 v | 10% | |
| C2246 | 281-528 | 82 pf | Cer. | 500 v | 10% | |
| C2247 | 283-026 | .2 μ f | Disc Type | 25 v | | |
| C2253 | 281-543 | 270 pf | Cer. | 500 v | 10% | |
| C2263 | 283-026 | .2 μ f | Disc Type | 25 v | | |
| C2264 | 290-107 | 25 μ f | EMT | 25 v | | |
| C2271 | 290-107 | 25 μ f | EMT | 25 v | | |
| C2275 | 283-006 | .02 μ f | Disc Type | 500 v | | |
| C2277 | use 283-067 | .001 μ f | Disc Type | 200 v | 10% | |
| C2279 | use 283-067 | .001 μ f | Disc Type | 200 v | 10% | |
| C2283 | 283-057 | .1 μ f | Disc Type | 200 v | | |

Diodes

| | | |
|-------|----------------|-------------------------------|
| D1044 | } use *153-014 | Checked, GaAs 2 matched pairs |
| D1045 | | |
| D1046 | | |
| D1047 | | |
| D1122 | | |

Diodes (Cont'd)

| Ckt. No. | Tektronix Part No. | Description | S/N Range |
|--|--------------------|--------------------------------|-----------|
| D1124 | 152-034 | Zener 1N753 6.2 v, 0.4 w, 10% | |
| D1129 | *152-075 | Germanium Tek Spec | |
| D1130 } D1132 } D1186 } | *152-083 | (1 pair) Capacitance 0.6 pf-up | |
| | *152-075 | Germanium Tek Spec | |
| D1191 | *152-075 | Germanium Tek Spec | |
| D1192 | *152-075 | Germanium Tek Spec | |
| D1193 | *152-075 | Germanium Tek Spec | |
| D1194 | *152-075 | Germanium Tek Spec | |
| D1292 | 152-066 | Silicon 1N3194 | |
| D1293 | 152-066 | Silicon 1N3194 | |
| D1294 | 152-066 | Silicon 1N3194 | |
| D2002 | use *153-015 | Snap-off, checked | 101-799 |
| | *152-115 | Snap-off, pre-tested | 800-up |
| D2018 | 152-071 | Germanium ED2007 | |
| D2021 | *152-075 | Germanium Tek Spec | |
| D2023 | 152-034 | Zener 1N753 6.2 v, 0.4 w, 10% | X800-up |
| D2024 | *152-075 | Germanium Tek Spec | |
| D2044 } D2045 } D2046 } D2047 } | use *153-014 | Checked, 2 matched pairs | |
| D2122 | *152-075 | Germanium Tek Spec | |
| D2124 | 152-034 | Zener 1N753 6.2 v, 4 w, 10% | |
| D2129 | *152-075 | Germanium Tek Spec | |
| D2130 } D2132 } | *152-083 | (1 pair) Capacitance 0.6 pf-up | |
| D2186 | *152-075 | Germanium Tek Spec | |
| D2191 | *152-075 | Germanium Tek Spec | |
| D2192 | *152-075 | Germanium Tek Spec | |
| D2193 | *152-075 | Germanium Tek Spec | |
| D2194 | *152-075 | Germanium Tek Spec | |
| D2202 | *152-075 | Germanium Tek Spec | |
| D2203 | *152-075 | Germanium Tek Spec | |
| D2230 | *152-075 | Germanium Tek Spec | X265-up |
| D2238 | *152-075 | Germanium Tek Spec | |
| D2239 | *152-075 | Germanium Tek Spec | |
| D2244 | *152-075 | Germanium Tek Spec | |
| D2254 | *152-075 | Germanium Tek Spec | |
| D2287 | *152-075 | Germanium Tek Spec | |
| D2292 | 152-066 | Silicon 1N3194 | |
| D2293 | 152-066 | Silicon 1N3194 | |
| D2294 | 152-066 | Silicon 1N3194 | |

Parts List — Type 3576

Inductors

| Ckt. No. | Tektronix Part No. | Description | S/N Range | | |
|----------|--------------------|---------------------------|--------------|----|------------|
| L1001 | 108-249 | 12 μ h | | | |
| L1006 | 108-249 | 12 μ h | | | |
| L1030† | *636-0001-00 | Delay Line Assy. | | | |
| L1035 | *308-220 | 400 Ω | .2 μ h | WW | 5% 101-699 |
| | *308-278 | 330 Ω | .32 μ h | WW | 5% 700-up |
| L1038 | *308-221 | 400 Ω | 4 μ h | WW | 5% 101-699 |
| | *308-277 | 500 Ω | 4.33 μ h | WW | 5% 700-up |
| L1070 | 276-507 | Toroid 4T | TD78 | | |
| L1073 | *120-285 | Core, Ferramic Suppressor | | | |
| L1225 | 108-240 | 820 μ h | | | |
| L1227 | 108-240 | 820 μ h | | | |
| L2023 | *108-215 | 1.1 μ h | | | |
| L2030† | *636-0001-00 | Delay Line Assy. | | | |
| L2035 | *308-220 | 400 Ω | .2 μ h | WW | 5% 101-699 |
| | *308-278 | 330 Ω | .32 μ h | WW | 5% 700-up |
| L2038 | *308-221 | 400 Ω | 4 μ h | WW | 5% 101-699 |
| | *308-277 | 500 Ω | 4.33 μ h | WW | 5% 700-up |
| L2070 | 276-507 | Core, Ferramic Suppressor | | | |
| L2073 | *120-285 | Toroid 4T | TD78 | | |

Resistors

Resistors are fixed, compositions, $\pm 10\%$ unless otherwise indicated.

| | | | | | | |
|-------|-------------|---------------|-----------------|-----------------|-----------------|------------------------|
| R1001 | 315-510 | 51 Ω | $\frac{1}{4}$ w | | 5% | |
| R1004 | 315-510 | 51 Ω | $\frac{1}{4}$ w | | 5% | |
| R1006 | 315-510 | 51 Ω | $\frac{1}{4}$ w | | 5% | |
| R1031 | 315-152 | 1.5 k | $\frac{1}{4}$ w | | 5% | |
| R1032 | 315-100 | 10 Ω | $\frac{1}{4}$ w | | 5% | 101-699 |
| | 315-200 | 20 Ω | $\frac{1}{4}$ w | | 5% | 700-up |
| R1033 | 318-052 | 10 Ω | $\frac{1}{8}$ w | Prec. | 1% | 101-1099 |
| R1033 | 321-003 | 10.5 Ω | $\frac{1}{8}$ w | $\frac{1}{8}$ w | 1% | 1100-up |
| R1035 | 318-040 | 100 Ω | $\frac{1}{8}$ w | Prec. | 1% | 101-1099 |
| R1035 | 321-636 | 100 Ω | $\frac{1}{8}$ w | Prec. | $\frac{1}{2}$ % | 1100-up |
| R1038 | 318-040 | 100 Ω | $\frac{1}{8}$ w | Prec. | 1% | 101-1099 |
| R1038 | 321-636 | 100 Ω | $\frac{1}{8}$ w | Prec. | $\frac{1}{2}$ % | 1100-up |
| R1041 | 315-111 | 110 Ω | $\frac{1}{4}$ w | | 5% | |
| R1044 | 315-362 | 3.6 k | $\frac{1}{4}$ w | | 5% | |
| R1046 | use 315-101 | 100 Ω | $\frac{1}{4}$ w | | 5% | |
| R1047 | use 315-101 | 100 Ω | $\frac{1}{4}$ w | | 5% | |
| R1049 | 316-274 | 270 k | $\frac{1}{4}$ w | | | |
| R1050 | 309-279 | 180 k | $\frac{1}{2}$ w | Prec. | 1% | |
| R1051 | 318-086 | 53 k | $\frac{1}{8}$ w | Prec. | 1% | |
| R1053 | 316-103 | 10 k | $\frac{1}{4}$ w | | | |
| R1054 | 316-103 | 10 k | $\frac{1}{4}$ w | | | |
| R1056 | 316-183 | 18 k | $\frac{1}{4}$ w | | | X409-up |
| R1057 | 311-154 | 50 k | | Var. | | A BRIDGE VOLTS 101-408 |
| | 311-110 | 100 k | | Var. | | 409-up |
| R1060 | 309-330 | 319 k | $\frac{1}{2}$ w | Prec. | 1% | |
| R1062 | 315-752 | 7.5 k | $\frac{1}{4}$ w | | 5% | X409-up |
| R1063 | 311-159 | 20 k | | Var. | | A BRIDGE BAL. 101-408 |
| | 311-310 | 5 k | | Var. | | 409-up |
| R1064 | 315-752 | 7.5 k | $\frac{1}{4}$ w | | 5% | X409-up |

† L1030 and L2030 furnished as a unit.

Resistors (Cont'd)

| Ckt. No. | Tektronix Part No. | | Description | | S/N Range |
|----------|--------------------|----------|-------------|-------|------------------------|
| R1065 | 309-330 | 319 k | 1/2 w | Prec. | 1% |
| R1073 | 302-102 | 1 k | 1/2 w | | |
| R1074 | 302-393 | 39 k | 1/2 w | | |
| R1077 | 304-154 | 150 k | 1 w | | |
| R1078 | 318-064 | 250 Ω | 1/8 w | Prec. | 1% |
| R1079 | 301-303 | 30 k | 1/2 w | | 5% |
| R1080 | 315-751 | 750 Ω | 1/4 w | | 5% |
| R1081A | 318-049 | 1 k | 1/8 w | Prec. | 1% |
| R1081B | 318-037 | 500 Ω | 1/8 w | Prec. | 1% |
| R1081C | 318-098 | 300 Ω | 1/8 w | Prec. | 1% |
| R1081D | 318-040 | 100 Ω | 1/8 w | Prec. | 1% |
| R1081E | 318-066 | 50 Ω | 1/8 w | Prec. | 1% |
| R1081F | 318-066 | 50 Ω | 1/8 w | Prec. | 1% |
| R1086 | 302-104 | 100 k | 1/2 w | | |
| R1087 | 302-823 | 82 k | 1/2 w | | |
| R1088 | 311-258 | 100 Ω | | Var. | A PREAMP SENS. |
| R1090 | 301-392 | 3.9 k | 1/2 w | | 5% |
| R1091 | 306-153 | 15 k | 2 w | | |
| R1093 | 315-131 | 130 Ω | 1/4 w | | 5% |
| R1120 | 301-124 | 120 k | 1/2 w | | 5% |
| R1121 | 301-102 | 1 k | 1/2 w | | 5% |
| R1124 | use 309-356 | 103 k | 1/2 w | Prec. | 1% |
| R1125 | use 309-445 | 82 k | 1/2 w | Prec. | 1% |
| R1126 | 315-153 | 15 k | 1/4 w | | 5% |
| R1127 | 315-153 | 15 k | 1/4 w | | 5% |
| R1133 | 302-682 | 6.8 k | 1/2 w | | |
| R1135 | use 301-184 | 180 k | 1/2 w | | 5% |
| R1136 | 311-171 | 5 k | | Var. | A MILLER LEVEL 101-408 |
| | 311-172 | 2.5 k | | Var. | 409-up |
| R1137 | 315-241 | 240 Ω | 1/4 w | | 5% |
| | 315-561 | 560 Ω | 1/4 w | | 5% |
| R1138 | 302-104 | 100 k | 1/2 w | | |
| R1139 | 316-390 | 39 Ω | 1/4 w | | |
| R1141 | 316-470 | 47 Ω | 1/4 w | | |
| R1142 | 301-224 | 220 k | 1/2 w | | 5% |
| | 301-564 | 560 k | 1/2 w | | 5% |
| R1144 | 306-153 | 15 k | 2 w | | |
| R1146 | 309-371 | 3.965 k | 1/2 w | Prec. | 1% |
| R1147A | 318-088 | 229.7 k | 1/8 w | Prec. | 1% |
| R1147B | 318-087 | 112 k | 1/8 w | Prec. | 1% |
| R1147C | 318-086 | 53 k | 1/8 w | Prec. | 1% |
| R1147D | 318-085 | 17.67 k | 1/8 w | Prec. | 1% |
| R1147E | 318-073 | 5.88 k | 1/8 w | Prec. | 1% |
| R1148 | 309-398 | 414.41 Ω | 1/2 w | Prec. | 1/4% |
| R1149 | 309-397 | 1.6402 k | 1/2 w | Prec. | 1/4% |
| R1150 | 318-094 | 193 k | 1/8 w | Prec. | 1% |

Parts List — Type 3S76

Resistors (Cont'd)

| Ckt. No. | Tektronix Part No. | | Description | | S/N Range |
|----------|--------------------|---------|-------------|-------|-------------|
| R1151 | 318-001 | 100 k | 1/8 w | Prec. | 1% |
| R1153 | 309-377 | 3 meg | 1/2 w | Prec. | 1% |
| R1154 | 318-096 | 1.5 meg | 1/8 w | Prec. | 1% |
| R1156 | 318-095 | 950 k | 1/8 w | Prec. | 1% |
| R1157 | 311-271 | 200 k | | Var. | DC OFFSET |
| R1158 | 309-369 | 200 k | 1/2 w | Prec. | 1/4% |
| R1159 | 309-260 | 100 k | 1/2 w | Prec. | 1% |
| R1161 | 311-171 | 5 k | | Var. | A INV. GAIN |
| R1162 | use 301-183 | 18 k | 1/2 w | | 5% |
| R1164 | 309-323 | 75 k | 1/2 w | Prec. | 1% |
| R1165 | 302-104 | 100 k | 1/2 w | | |
| R1167 | 309-392 | 20 k | 1/2 w | Prec. | 1% |
| R1168 | 302-563 | 56 k | 1/2 w | | |
| R1170 | 316-472 | 4.7 k | 1/4 w | | |
| R1171† | 311-273 | 10 k | | Var. | 2-200 VAR. |
| R1172 | use 311-326 | 10 k | | Var. | A NORM GAIN |
| R1173 | 302-823 | 82 k | 1/2 w | | |
| R1174 | 316-331 | 330 Ω | 1/4 w | | |
| R1175 | 309-388 | 6 k | 1/2 w | Prec. | 1% |
| R1176 | 316-105 | 1 meg | 1/4 w | | |
| R1177 | 315-622 | 6.2 k | 1/4 w | | 5% |
| R1178 | 316-271 | 270 Ω | 1/4 w | | |
| R1179 | 316-154 | 150 k | 1/4 w | | |
| R1180 | use 311-0173-00 | 100 k | | Var. | A POSITION |
| R1181 | 316-154 | 150 k | 1/4 w | | |
| R1182 | 318-008 | 25.6 k | 1/8 w | Prec. | 1% |
| R1183 | 304-273 | 27 k | 1 w | | |
| R1184 | 316-104 | 100 k | 1/4 w | | |
| R1186 | 318-084 | 10 k | 1/8 w | Prec. | 1% |
| R1196 | 302-183 | 18 k | 1/2 w | | |
| R1197 | 302-183 | 18 k | 1/2 w | | |
| R1206 | 301-242 | 2.4 k | 1/2 w | | 5% |
| R1208 | 316-681 | 680 Ω | 1/4 w | | |
| R1209 | use 311-091 | 1 k | 1/2 w | Var. | GAIN ADJ. |
| R1211 | 301-242 | 2.4 k | 1/2 w | | 5% |
| R1214 | 302-681 | 680 Ω | 1/2 w | | |
| R1217 | 318-033 | 20.4 k | 1/8 w | Prec. | 1% |
| R1219 | 318-033 | 20.4 k | 1/8 w | Prec. | 1% |
| R1222 | 302-223 | 22 k | 1/2 w | | |
| R1224 | 316-470 | 47 Ω | 1/4 w | | |
| R1225 | 308-054 | 10 k | 5 w | WW | 5% |
| R1226 | 316-470 | 47 Ω | 1/4 w | | |
| R1227 | 308-054 | 10 k | 5 w | WW | 5% |
| R1229 | 302-152 | 1.5 k | 1/2 w | | |
| R2001 | 316-820 | 82 Ω | 1/4 w | | |

†Ganged with SW1292. Furnished as a unit.

Resistors (Cont'd)

| Ckt. No. | Tektronix Part No. | | Description | | | S/N Range |
|----------|--------------------|---------------|-----------------|------|-------|----------------------------|
| R2011 | 301-361 | 360 Ω | $\frac{1}{2}$ w | | | 5% |
| R2012 | 316-100 | 10 Ω | $\frac{1}{4}$ w | | | 101-799 |
| | 311-413 | 1 k | 5 w | Var. | WW | SNAP-OFF CURRENT 800-up |
| R2013 | 301-361 | 360 Ω | $\frac{1}{2}$ w | | | 5% |
| R2015 | 302-102 | 1 k | $\frac{1}{2}$ w | | | |
| R2016 | 316-102 | 1 k | $\frac{1}{4}$ w | | | |
| R2017 | 302-824 | 820 k | $\frac{1}{2}$ w | | | |
| R2018 | 316-222 | 2.2 k | $\frac{1}{4}$ w | | | |
| R2019 | 315-510 | 51 Ω | $\frac{1}{4}$ w | | | 5% |
| R2020 | 315-621 | 620 Ω | $\frac{1}{4}$ w | | | 5% |
| R2021 | 316-152 | 1.5 k | $\frac{1}{4}$ w | | | X800-up |
| | 316-471 | 470 Ω | $\frac{1}{4}$ w | | | 101-264 |
| | | | | | | 265-up |
| R2022 | 316-270 | 27 Ω | $\frac{1}{4}$ w | | | |
| R2023 | 311-159 | 20 k | | Var. | | MEMORY GATE LENGTH 101-799 |
| | 311-392 | 10 k | 2 w | Var. | WW | 800-up |
| R2024 | 302-103 | 10 k | $\frac{1}{2}$ w | | | 101-799 |
| | 306-103 | 10 k | 2 w | | | 800-up |
| R2025 | 302-102 | 1 k | $\frac{1}{2}$ w | | | |
| R2026 | 316-100 | 10 Ω | $\frac{1}{4}$ w | | | |
| R2027 | 302-471 | 470 Ω | $\frac{1}{2}$ w | | | |
| R2028 | 302-471 | 470 Ω | $\frac{1}{2}$ w | | | |
| R2031 | 315-152 | 1.5 k | $\frac{1}{4}$ w | | | 5% |
| R2032 | 315-100 | 10 Ω | $\frac{1}{4}$ w | | | 5% |
| | 315-200 | 20 Ω | $\frac{1}{4}$ w | | | 5% |
| R2033 | 318-052 | 10 Ω | $\frac{1}{8}$ w | | Prec. | 1% |
| R2033 | 321-003 | 10.5 Ω | $\frac{1}{8}$ w | | Prec. | 1% |
| R2035 | 318-040 | 100 Ω | $\frac{1}{8}$ w | | Prec. | 1% |
| R2035 | 321-636 | 100 Ω | $\frac{1}{8}$ w | | Prec. | $\frac{1}{2}$ % |
| R2038 | 318-040 | 100 Ω | $\frac{1}{8}$ w | | Prec. | 1% |
| R2038 | 321-636 | 100 Ω | $\frac{1}{8}$ w | | Prec. | $\frac{1}{2}$ % |
| R2041 | 315-111 | 110 Ω | $\frac{1}{4}$ w | | | 5% |
| R2044 | 315-362 | 3.6k | $\frac{1}{4}$ w | | | 5% |
| R2046 | use 315-101 | 100 Ω | $\frac{1}{4}$ w | | | 5% |
| R2047 | use 315-101 | 100 Ω | $\frac{1}{4}$ w | | | 5% |
| R2049 | 316-274 | 270 k | $\frac{1}{4}$ w | | | |
| R2050 | 309-279 | 180 k | $\frac{1}{2}$ w | | Prec. | 1% |
| R2051 | 318-086 | 53 k | $\frac{1}{8}$ w | | Prec. | 1% |
| R2053 | 316-103 | 10 k | $\frac{1}{4}$ w | | | |
| R2054 | 316-103 | 10 k | $\frac{1}{4}$ w | | | |
| R2056 | 316-183 | 18 k | $\frac{1}{4}$ w | | | X409-up |
| R2057 | 311-154 | 50 k | | Var. | | B BRIDGE VOLTS 101-408 |
| | 311-110 | 100 k | | Var. | | 409-up |
| R2060 | 309-330 | 319 k | $\frac{1}{2}$ w | | Prec. | 1% |
| R2062 | 315-752 | 7.5 k | $\frac{1}{4}$ w | | | 5% |
| R2063 | 311-159 | 20 k | | Var. | | B BRIDGE BAL. 101-408 |
| | 311-310 | 5 k | | Var. | | 409-up |

Parts List — Type 3S76

Resistors (Cont'd)

| Ckt. No. | Tektronix Part No. | | Description | | | S/N Range |
|----------|--------------------|----------|-------------|------|-------|-------------------|
| R2064 | 315-752 | 7.5 k | 1/4 w | | | 5% |
| R2065 | 309-330 | 319 k | 1/2 w | | Prec. | 1% |
| R2073 | 302-102 | 1 k | 1/2 w | | | |
| R2074 | 302-393 | 39 k | 1/2 w | | | |
| R2077 | 304-154 | 150 k | 1 w | | | |
| R2078 | 318-064 | 250 Ω | 1/8 w | | Prec. | 1% |
| R2079 | 301-303 | 30k | 1/2 w | | | 5% |
| R2080 | 315-751 | 750 Ω | 1/4 w | | | 5% |
| R2081A | 318-049 | 1 k | 1/8 w | | Prec. | 1% |
| R2081B | 318-037 | 500 Ω | 1/8 w | | Prec. | 1% |
| R2081C | 318-098 | 300 Ω | 1/8 w | | Prec. | 1% |
| R2081D | 318-040 | 100 Ω | 1/8 w | | Prec. | 1% |
| R2081E | 318-066 | 50 Ω | 1/8 w | | Prec. | 1% |
| R2081F | 318-066 | 50 Ω | 1/8 w | | Prec. | 1% |
| R2086 | 302-104 | 100 k | 1/2 w | | | |
| R2087 | 302-823 | 82 k | 1/2 w | | | |
| R2088 | 311-258 | 100 Ω | | Var. | | B PREAMP SENS |
| R2090 | 301-392 | 3.9 k | 1/2 w | | | 5% |
| R2091 | 306-153 | 15 k | 2 w | | | |
| R2093 | 315-131 | 130 Ω | 1/4 w | | | 5% |
| R2120 | 301-113 | 11 k | 1/2 w | | | 5% |
| R2121 | 301-102 | 1 k | 1/2 w | | | 5% |
| R2124 | use 309-356 | 103 k | 1/2 w | | Prec. | 1% |
| R2125 | use 309-445 | 82 k | 1/2 w | | Prec. | 1% |
| R2126 | 315-153 | 15 k | 1/4 w | | | 5% |
| R2127 | 315-153 | 15 k | 1/4 w | | | 5% |
| R2133 | 302-682 | 6.8 k | 1/2 w | | | |
| R2135 | use 301-184 | 180 k | 1/2 w | | | 5% |
| R2136 | 311-171 | 5 k | | Var. | | B MILLER LEVEL |
| | 311-172 | 2.5 k | | Var. | | 101-408 409-up |
| R2137 | 315-241 | 240 Ω | 1/4 w | | | 5% |
| | 315-561 | 560 Ω | 1/4 w | | | 5% |
| R2138 | 302-104 | 100 k | 1/2 w | | | |
| R2139 | 316-390 | 39 Ω | 1/4 w | | | |
| R2141 | 316-470 | 47 Ω | 1/4 w | | | |
| R2142 | 301-224 | 220 k | 1/2 w | | | 5% |
| | 301-564 | 560 k | 1/2 w | | | 5% |
| R2144 | 306-153 | 15 k | 2 w | | | |
| R2146 | 309-371 | 3.965 k | 1/2 w | | Prec. | 1% |
| R2147A | 318-088 | 229.7 k | 1/8 w | | Prec. | 1% |
| R2147B | 318-087 | 112 k | 1/8 w | | Prec. | 1% |
| R2147C | 318-086 | 53 k | 1/8 w | | Prec. | 1% |
| R2147D | 318-085 | 17.67 k | 1/8 w | | Prec. | 1% |
| R2147E | 318-073 | 5.88 k | 1/8 w | | Prec. | 1% |
| R2148 | 309-398 | 414.14 Ω | 1/2 w | | Prec. | 1/4 % |

Resistors (Cont'd)

| Ckt. No. | Tektronix Part No. | | Description | | S/N Range |
|----------|--------------------|----------|-------------|-------|-------------|
| R2149 | 309-397 | 1.6402 k | 1/2 w | Prec. | 1/4 % |
| R2150 | 318-094 | 193 k | 1/8 w | Prec. | 1 % |
| R2151 | 318-001 | 100 k | 1/8 w | Prec. | 1 % |
| R2153 | 309-377 | 3 meg | 1/2 w | Prec. | 1 % |
| R2154 | 318-096 | 1.5 meg | 1/8 w | Prec. | 1 % |
| R2156 | 318-095 | 950 k | 1/8 w | | 1 % |
| R2157 | 311-271 | 200 k | | Var. | DC OFFSET |
| R2158 | 309-369 | 200 k | 1/2 w | Prec. | 1/4 % |
| R2159 | 309-260 | 100 k | 1/2 w | Prec. | 1 % |
| R2161 | 311-171 | 5 k | | Var. | B INV. GAIN |
| R2162 | use 301-183 | 18 k | 1/2 w | | 5 % |
| R2164 | 309-323 | 75 k | 1/2 w | Prec. | 1 % |
| R2165 | 302-104 | 100 k | 1/2 w | | |
| R2167 | 309-392 | 20 k | 1/2 w | Prec. | 1 % |
| R2168 | 302-563 | 56 k | 1/2 w | | |
| R2170 | 316-472 | 4.7 k | 1/4 w | | |
| R2171† | 311-273 | 10 k | | Var. | 2-200 VAR. |
| R2172 | use 311-326 | 10 k | | Var. | B NORM GAIN |
| R2173 | 302-823 | 82 k | 1/2 w | | |
| R2174 | 316-331 | 330 Ω | 1/4 w | | |
| R2175 | 309-388 | 6 k | 1/2 w | Prec. | 1 % |
| R2176 | 316-105 | 1 meg | 1/4 w | | |
| R2177 | 309-388 | 6 k | 1/2 w | Prec. | 1 % |
| R2178 | 316-271 | 270 Ω | 1/4 w | | |
| R2179 | 316-154 | 150 k | 1/4 w | | |
| R2180 | use 311-0173-00 | 100 k | .2 w | Var. | B POSITION |
| R2181 | 316-154 | 150 k | 1/4 w | | |
| R2182 | 318-008 | 25.6 k | 1/8 w | Prec. | 1 % |
| R2183 | 304-273 | 27 k | 1 w | | |
| R2184 | 316-104 | 100 k | 1/4 w | | |
| R2186 | 318-084 | 10 k | 1/8 w | Prec. | 1 % |
| R2187 | 318-009 | 10.1 k | 1/8 w | Prec. | 1 % |
| R2188 | 302-473 | 47 k | 1/2 w | | |
| R2189 | 302-473 | 47 k | 1/2 w | | |
| R2196 | 302-183 | 18 k | 1/2 w | | |
| R2197 | 302-183 | 18 k | 1/2 w | | |
| R2212 | 302-225 | 2.2 meg | 1/2 w | | |
| R2213 | 316-101 | 100 Ω | 1/4 w | | |
| R2214 | 306-103 | 10 k | 2 w | | |
| R2226 | 302-102 | 1 k | 1/2 w | | |
| R2227 | 301-124 | 120 k | 1/2 w | | 5 % |
| R2229 | 302-331 | 330 Ω | 1/2 w | | |
| R2230 | 302-182 | 1.8 k | 1/2 w | | |
| R2231 | 302-101 | 100 Ω | 1/2 w | | |
| R2235 | 302-183 | 18 k | 1/2 w | | |

†Ganged with SW2292. Furnished as a unit.

Parts List — Type 3576

Resistors (Cont'd)

| Ckt. No. | Tektronix Part No. | | Description | | S/N Range |
|----------|--------------------|-------|-------------|-------|-----------|
| R2236 | 302-273 | 27 k | 1/2 w | | |
| R2237 | 302-222 | 2.2 k | 1/2 w | | |
| R2243 | 302-473 | 47 k | 1/2 w | | |
| R2244 | 306-223 | 22 k | 2 w | | |
| R2245 | 316-123 | 12 k | 1/4 w | | |
| R2246 | Use 301-0681-00 | 680 Ω | 1/2 w | | 5% |
| R2247 | 316-470 | 47 Ω | 1/4 w | | |
| R2253 | 302-473 | 47 k | 1/2 w | | |
| R2254 | 306-223 | 22 k | 2 w | | |
| R2255 | 316-123 | 12 k | 1/4 w | | |
| R2272 | 309-100 | 10 k | 1/2 w | Prec. | 1% |
| R2273 | 309-389 | 50 k | 1/2 w | Prec. | 1% |
| R2274 | 302-124 | 120 k | 1/2 w | | |
| R2276 | 304-682 | 6.8 k | 1 w | | |
| R2277 | 302-822 | 8.2 k | 1/2 w | | |
| R2278 | 304-682 | 6.8 k | 1 w | | |
| R2279 | 302-822 | 8.2 k | 1/2 w | | |
| R2283 | 302-222 | 2.2 k | 1/2 w | | |
| R2287 | 316-105 | 1 meg | 1/4 w | | |
| R2289 | Use 304-563 | 56 k | 1 w | | |
| R2293 | 302-471 | 470 Ω | 1/2 w | | |

Switches

| | Unwired | Wired | |
|-----------|---------|----------|-------------------------|
| SW1004 | 260-424 | *262-466 | Rotary INTERNAL TRIGGER |
| SW1080† | 260-423 | *262-467 | Rotary SMOOTH-NORMAL |
| SW1101 | 260-422 | *262-465 | Rotary A MV/DIV. |
| SW1171 | 260-145 | | Slide A Signal Polarity |
| SW1292†† | 311-273 | | |
| SW2101 | 260-422 | *262-471 | Rotary B MV/DIV. |
| SW2171 | 260-145 | | Slide B Signal Polarity |
| SW2190† | 260-423 | *262-467 | Rotary VERTICAL MODE |
| SW2292††† | 311-273 | | |

Transformers

| | | | |
|-------|----------|-----------|------|
| T1030 | *120-246 | Toroid 5T | TD42 |
| T1052 | *120-243 | Toroid 8T | TD39 |
| T1130 | *120-245 | Toroid 3T | TD41 |
| T2001 | *120-242 | Toroid 4T | TD38 |
| T2010 | *120-241 | Toroid 3T | TD37 |
| T2030 | *120-246 | Toroid 5T | TD42 |
| T2052 | *120-243 | Toroid 8T | TD39 |
| T2130 | *120-245 | Toroid 3T | TD41 |
| T2230 | *120-244 | Toroid 4T | TD40 |
| T2261 | *120-286 | Toroid 2T | TD79 |
| T2262 | *120-286 | Toroid 2T | TD79 |

†SW2190 and SW1080 are concentric. Furnished as a unit.

††Ganged with R1171. Furnished as a unit.

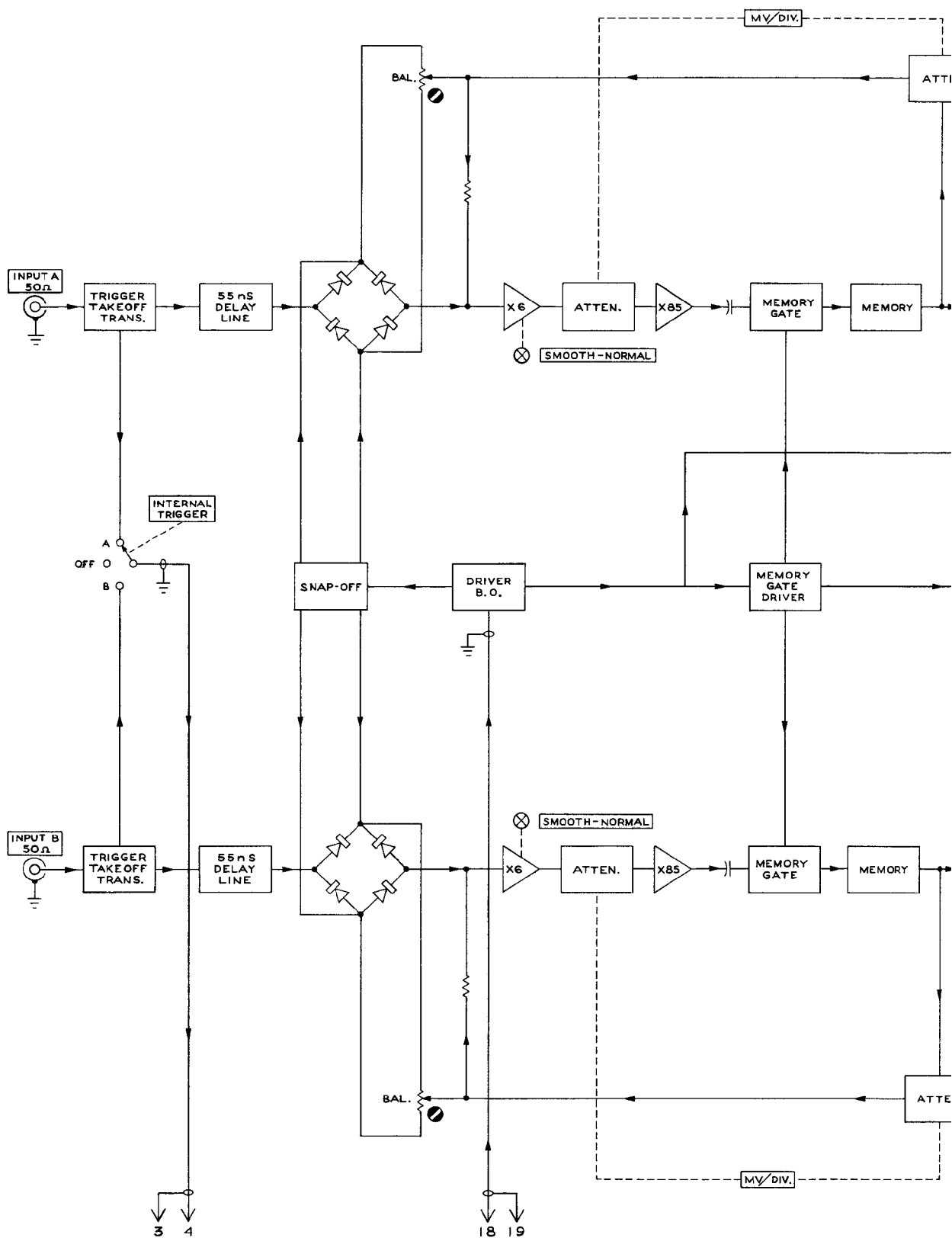
†††Ganged with R2171. Furnished as a unit.

Transistors

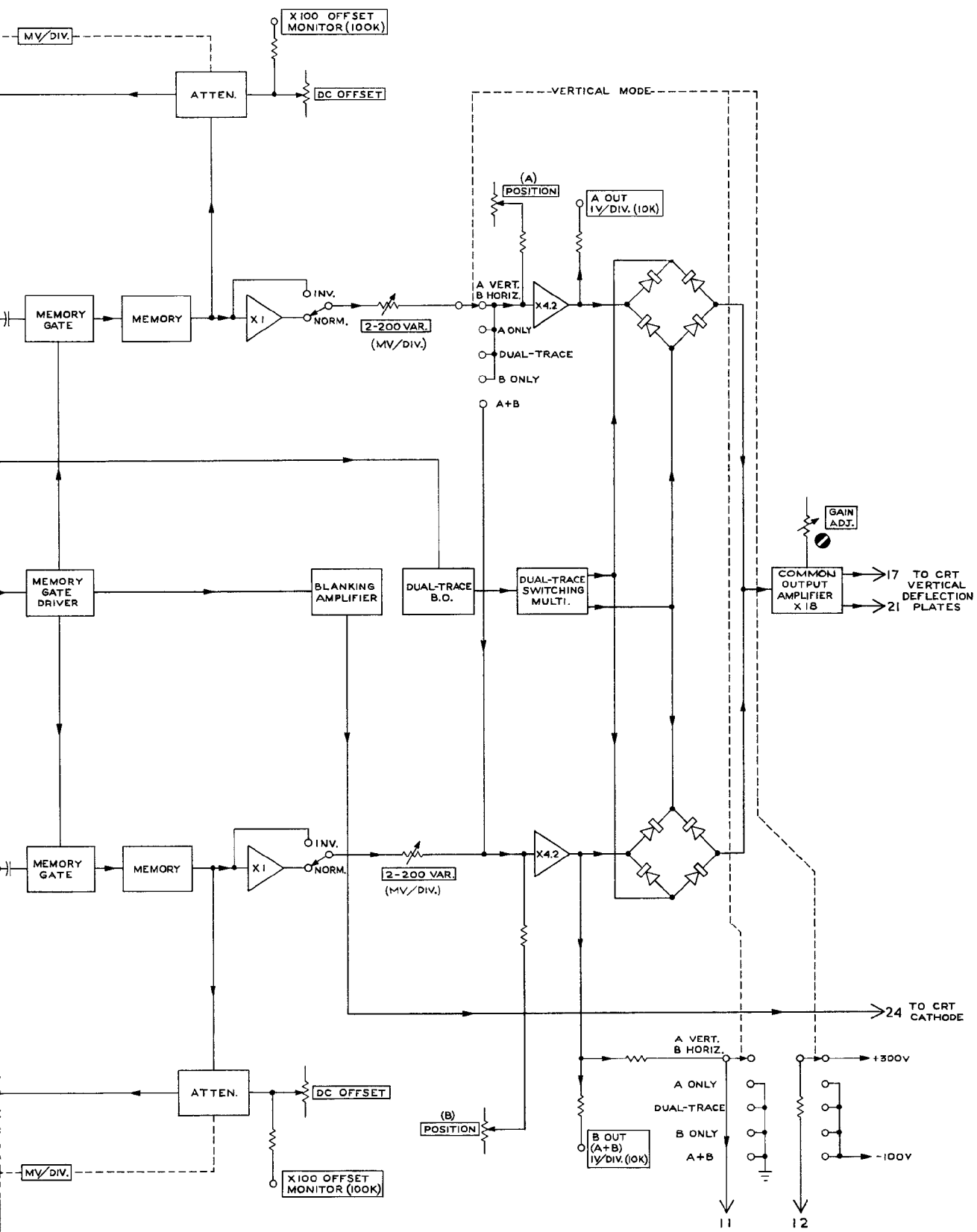
| Ckt. No. | Tektronix Part No. | Description | S/N Range |
|----------|--------------------|-----------------------|-----------|
| Q1074 | 151-015 | 2N1516 | |
| Q1084 | 151-015 | 2N1516 | |
| Q1094 | 151-058 | RT5204 | |
| Q1134 | 151-015 | 2N1516 | |
| Q1141 | 151-058 | RT5204 | |
| Q1163 | 151-015 | 2N1516 | |
| Q1164 | 151-058 | RT5204 | |
| Q1173 | 151-071 | 2N1305 | |
| Q1183 | 151-063 | 2N2207 | |
| Q1184 | 151-058 | RT5204 | |
| Q1204 | 151-040 | 2N1302 | |
| Q1214 | 151-040 | 2N1302 | |
| Q1223 | 151-042 | 2N1378 | |
| Q2010 | *151-083 | Selected from 2N964 | |
| Q2024 | 151-058 | RT5204 | 101-799 |
| | *151-103 | Replaceable by 2N2219 | 800-up |
| Q2074 | 151-015 | 2N1516 | |
| Q2084 | 151-015 | 2N1516 | |
| Q2094 | 151-058 | RT5204 | |
| Q2134 | 151-015 | 2N1516 | |
| Q2141 | 151-058 | RT5204 | |
| Q2163 | 151-015 | 2N1516 | |
| Q2164 | 151-058 | RT5204 | |
| Q2173 | 151-071 | 2N1305 | |
| Q2183 | 151-063 | 2N2207 | |
| Q2184 | 151-058 | RT5204 | |
| Q2230 | 151-076 | 2N2048 | |
| Q2245 | 151-072 | 2N1308 | 101-2969 |
| Q2245 | *151-0103-00 | Replaceable by 2N2219 | 2970-up |
| Q2255 | 151-072 | 2N1308 | 101-2969 |
| Q2255 | *151-0103-00 | Replaceable by 2N2219 | 2970-up |
| Q2274 | 151-069 | 2N1304 | |
| Q2277 | 151-060 | 2N1545 | |
| Q2287 | 151-058 | RT5204 | |
| Q2297 | 151-058 | RT5204 | |

Electron Tubes

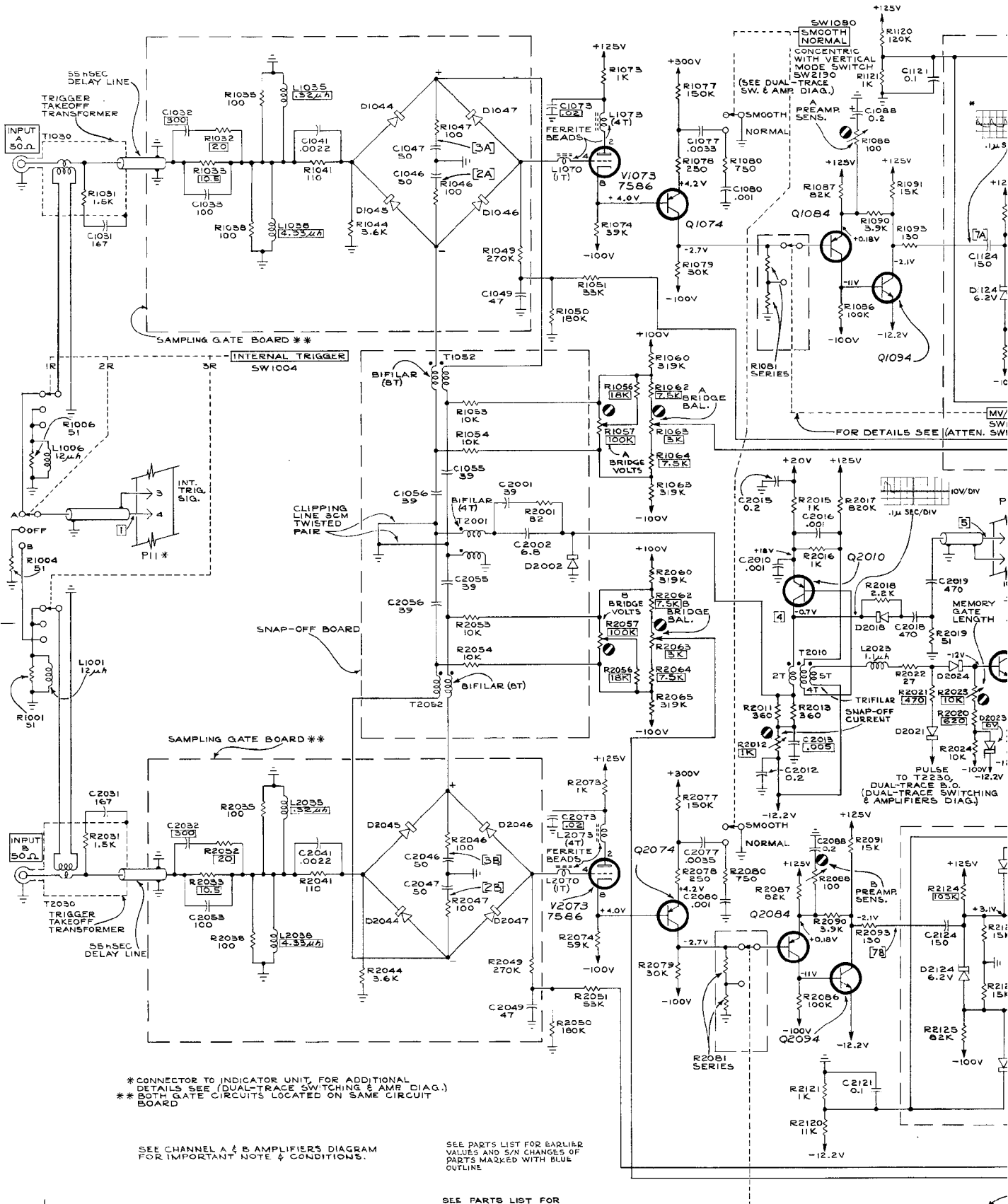
| | | |
|-------|------------------|----------------|
| V1073 | Use *154-0306-02 | 7586 (aged) |
| V1133 | Use *157-102 | 7308 (Checked) |
| V1224 | 154-187 | 6DJ8 |
| V2073 | Use *154-0306-02 | 7586 (aged) |
| V2133 | Use 154-0371-00 | 7308 |
| V2214 | 154-323 | 6CW4 |
| V2289 | 154-370 | ZZ1000 |



TYPE 3S76 SAMPLING DUAL-TRACE



CMP 563
BLOCK DIAGRAM



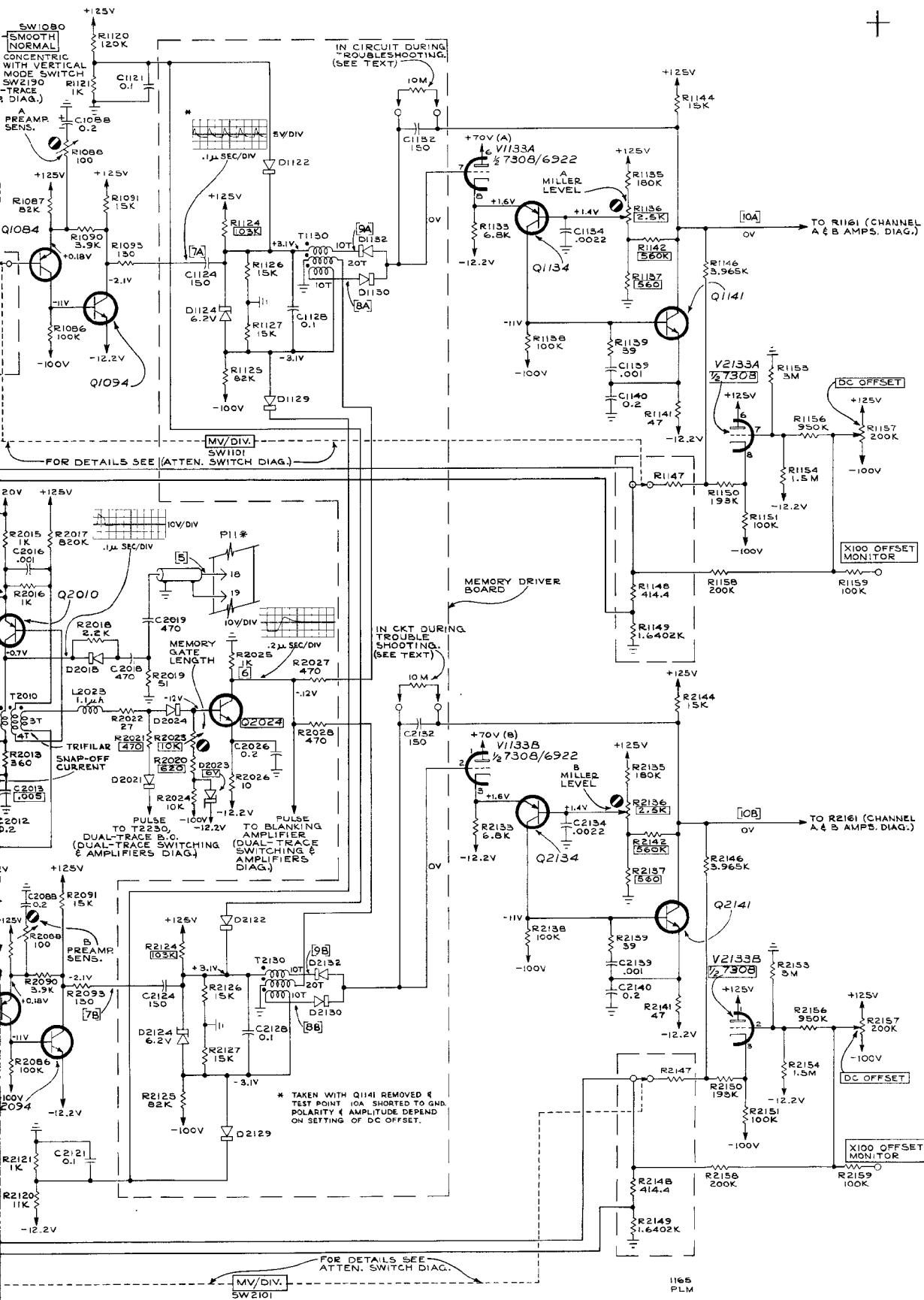
* CONNECTOR TO INDICATOR UNIT, FOR ADDITIONAL DETAILS SEE (DUAL-TRACE SWITCHING & AMP. DIAG.)
 ** BOTH GATE CIRCUITS LOCATED ON SAME CIRCUIT BOARD

SEE CHANNEL A & B AMPLIFIERS DIAGRAM FOR IMPORTANT NOTE & CONDITIONS.

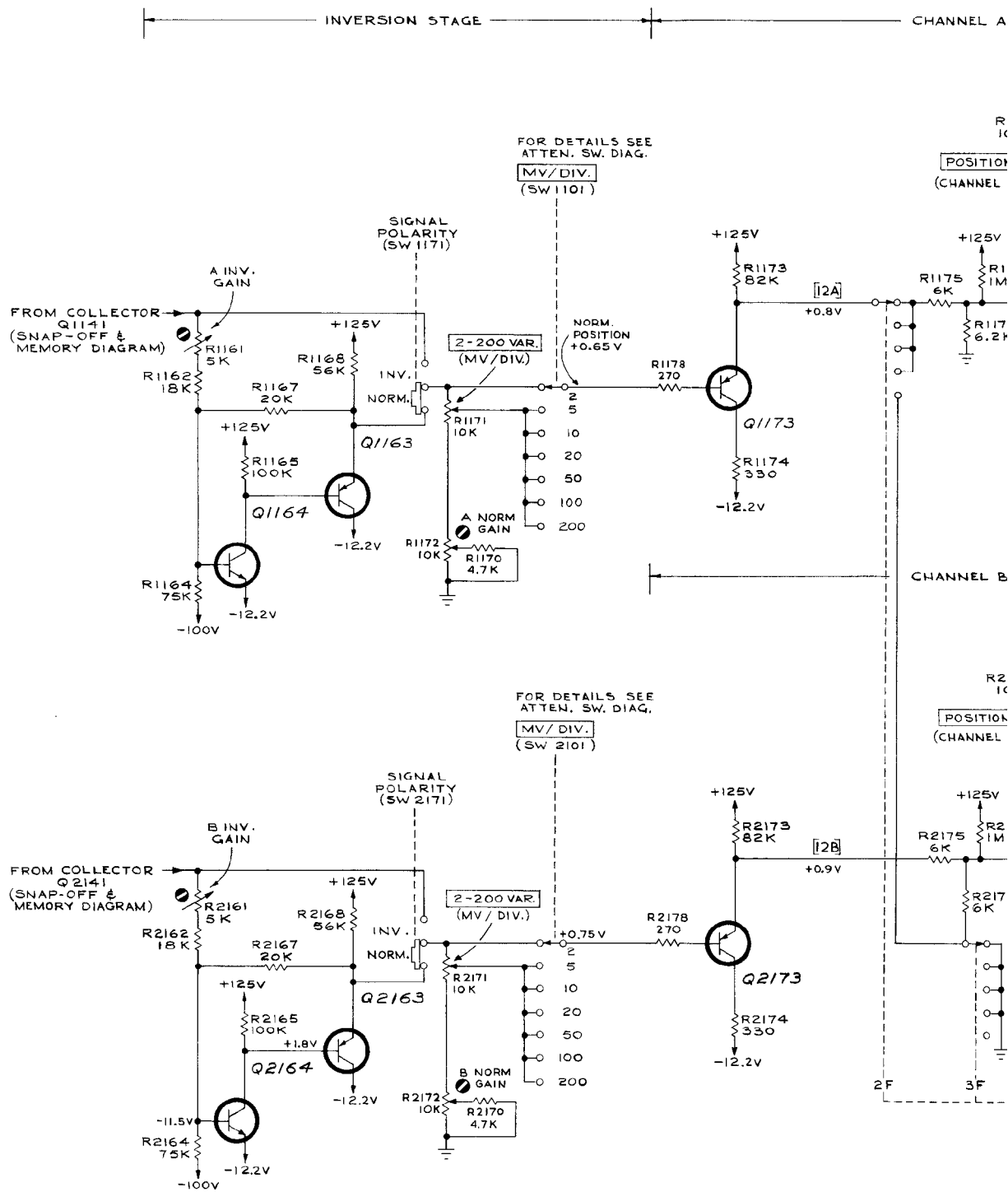
SEE PARTS LIST FOR EARLIER VALUES AND S/N CHANGES OF PARTS MARKED WITH BLUE OUTLINE.

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

TYPE 3S76 PLUG-IN UNIT

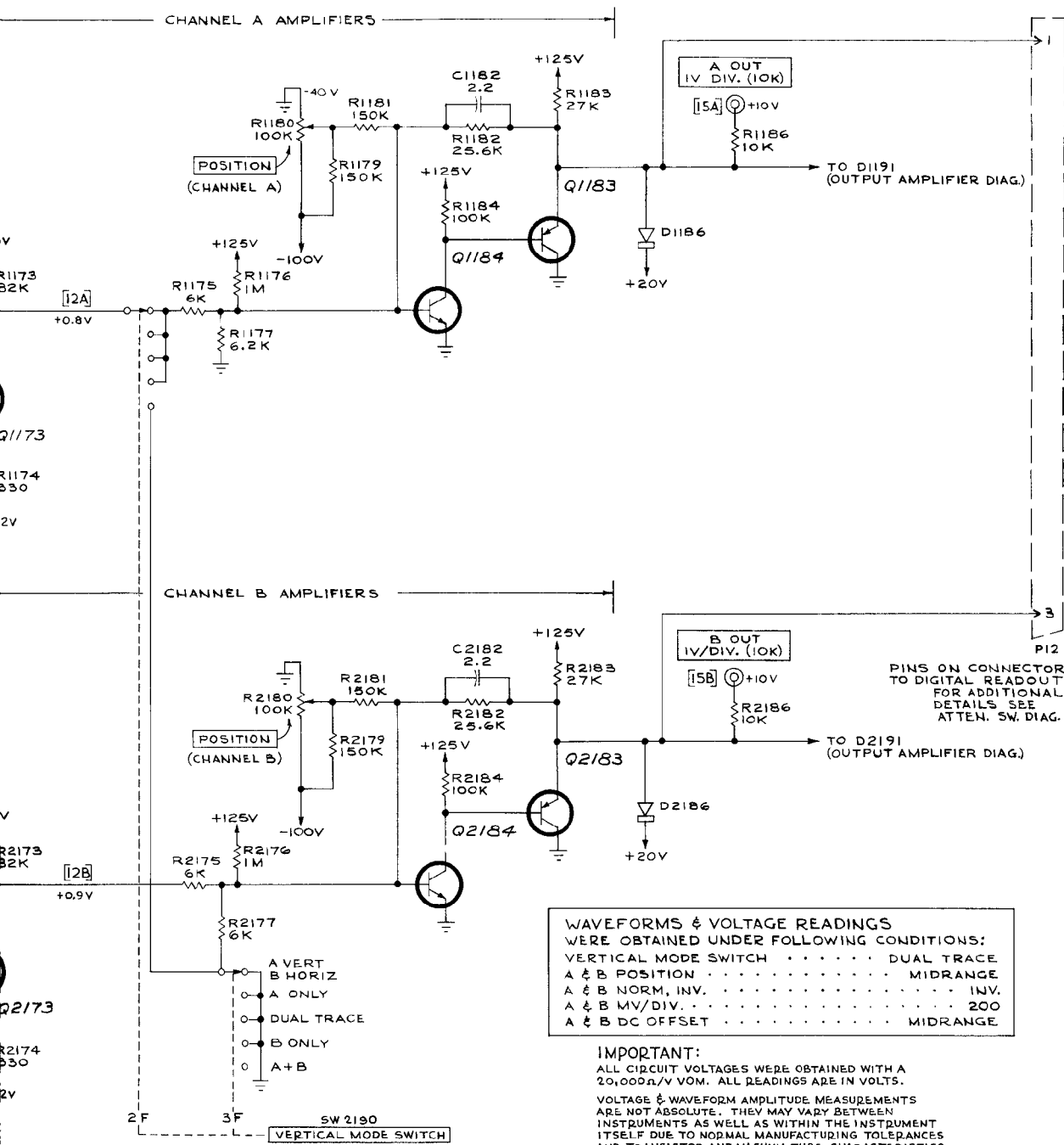


SNAP-OFF & MEMORY



TYPE 3576 PLUG-IN UNIT

+



WAVEFORMS & VOLTAGE READINGS
 WERE OBTAINED UNDER FOLLOWING CONDITIONS:
 VERTICAL MODE SWITCH DUAL TRACE
 A & B POSITION MIDRANGE
 A & B NORM, INV. INV.
 A & B MV/DIV. 200
 A & B DC OFFSET MIDRANGE

IMPORTANT:
 ALL CIRCUIT VOLTAGES WERE OBTAINED WITH A
 20,000Ω/V VOM. ALL READINGS ARE IN VOLTS.
 VOLTAGE & WAVEFORM AMPLITUDE MEASUREMENTS
 ARE NOT ABSOLUTE. THEY MAY VARY BETWEEN
 INSTRUMENTS AS WELL AS WITHIN THE INSTRUMENT
 ITSELF DUE TO NORMAL MANUFACTURING TOLERANCES
 AND TRANSISTOR AND VACUUM TUBE CHARACTERISTICS.
 ACTUAL PHOTOGRAPHS OF WAVEFORMS ARE SHOWN.
 SAMPLING SWEEP PLUG-IN IS IN NORMAL
 SWEEP MODE, FREE RUNNING CONDITION.

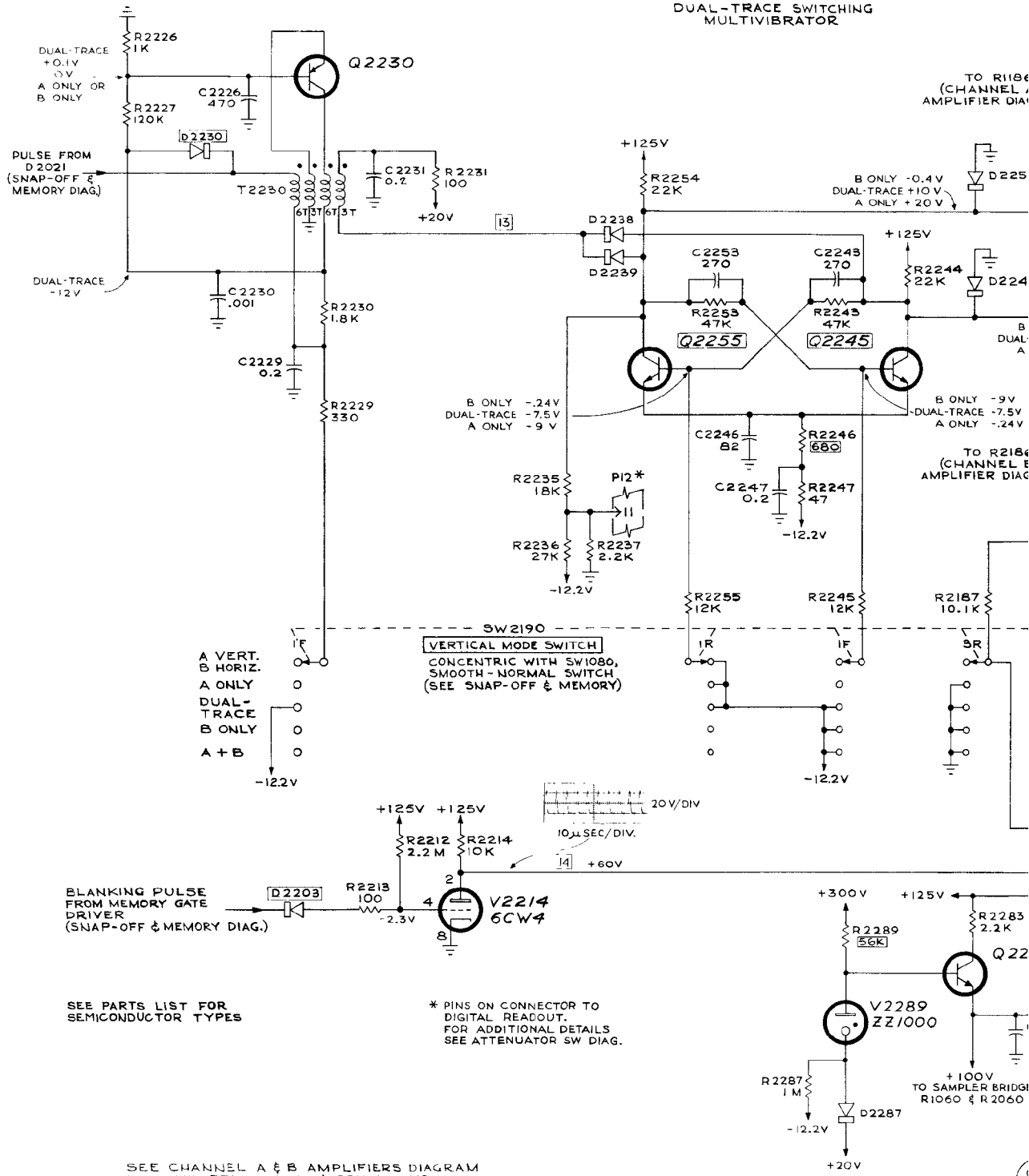
SEE PARTS LIST FOR EARLIER
 VALUES AND SERIAL NUMBER
 RANGES OF PARTS MARKED
 WITH BLUE OUTLINE.

MRH
 563

CHANNEL A & B AMPLIFIERS

A₁

DUAL-TRACE SWITCHING MULTIVIBRATOR



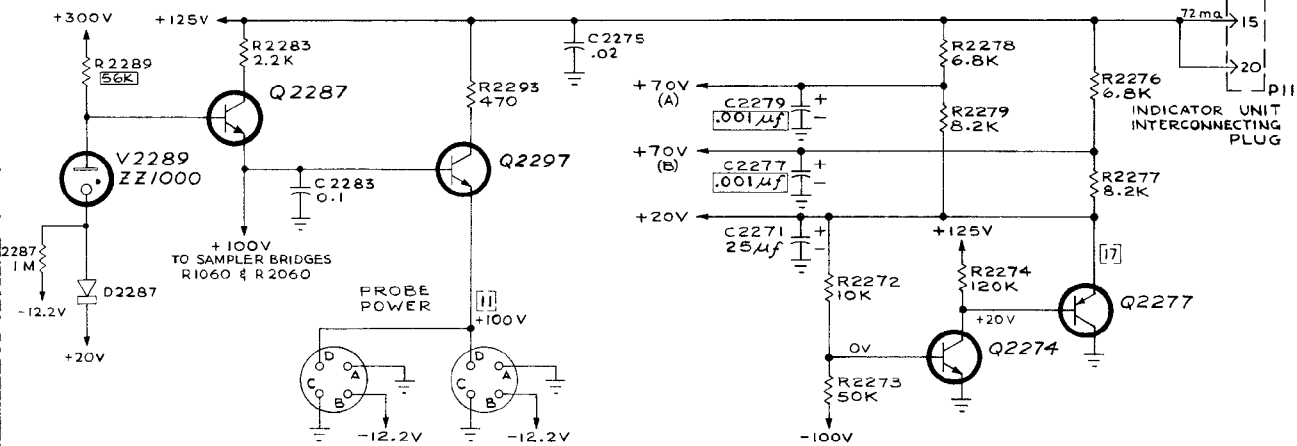
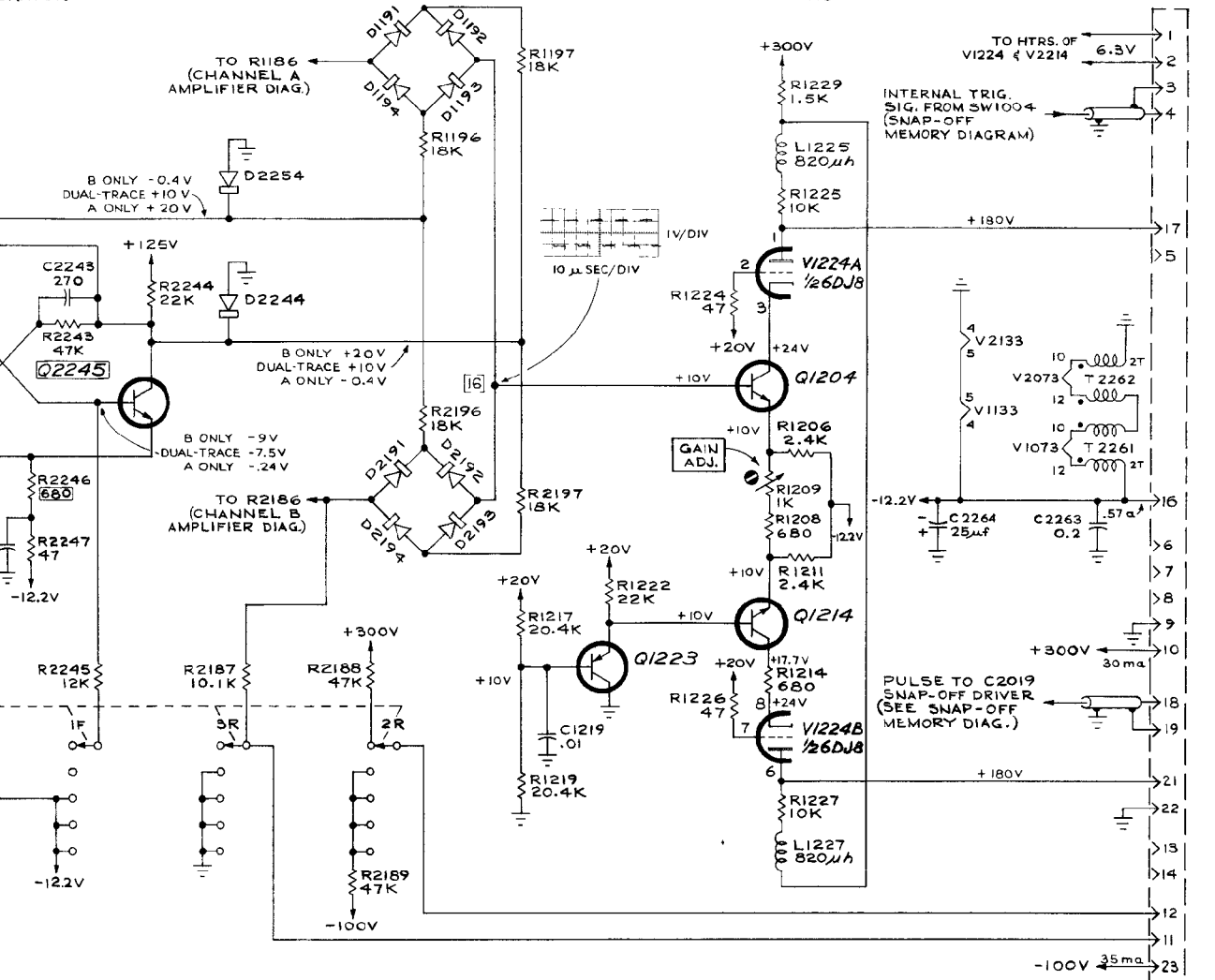
TYPE 3S76 PLUG-IN UNIT

C

+

SWITCHING
BRATOR

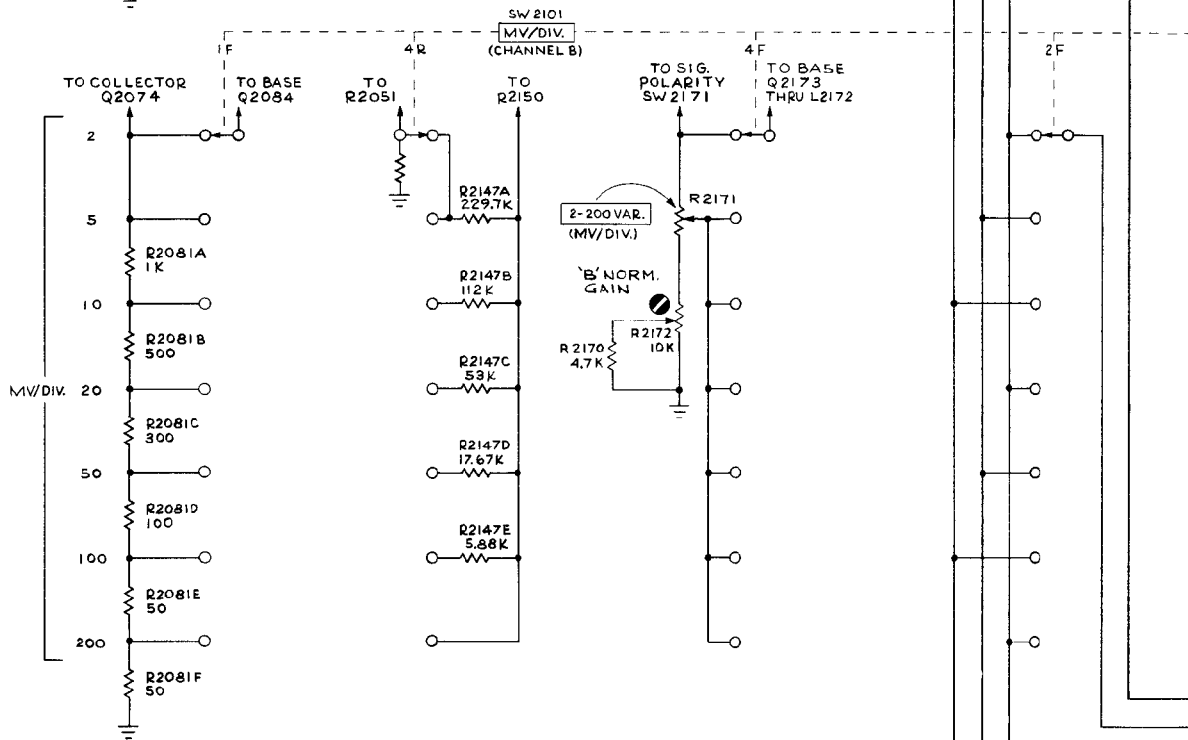
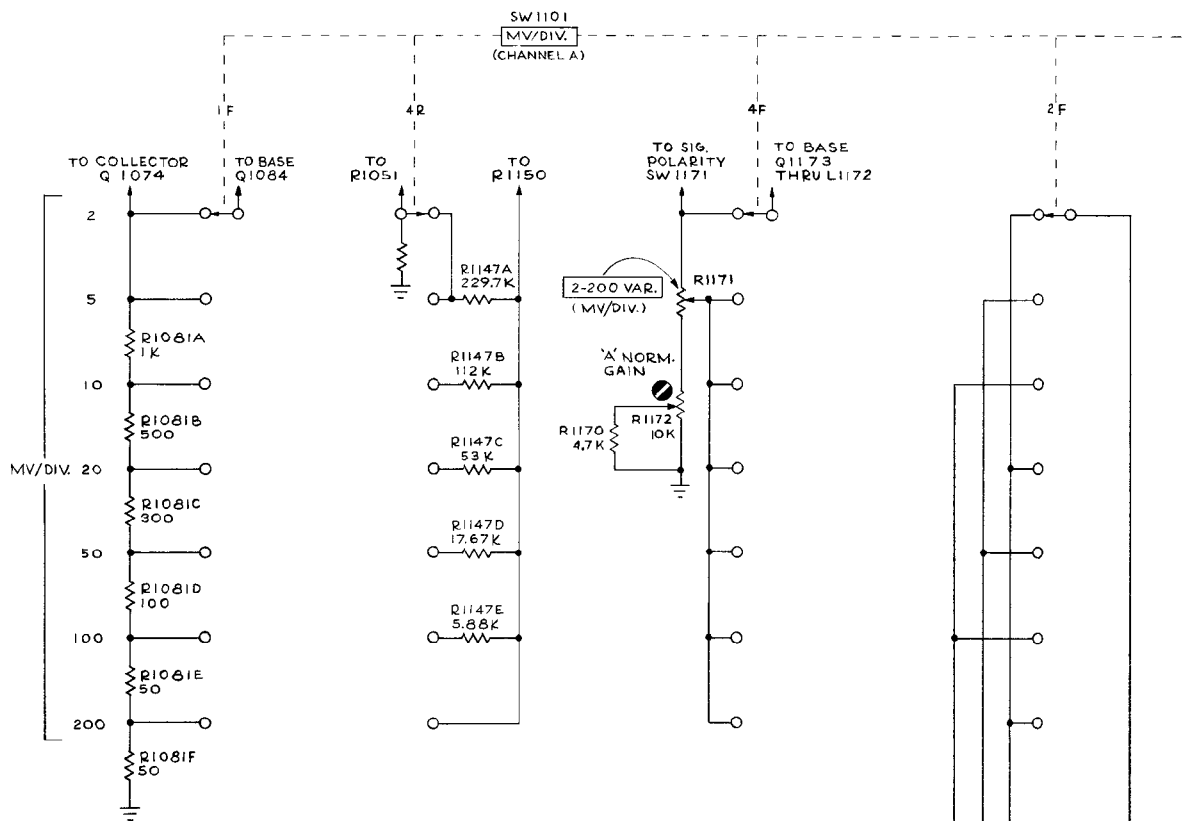
COMMON
OUTPUT
AMPLIFIER



SEE PARTS LIST FOR EARLIER
VALUES AND S/N CHANGES OF
PARTS MARKED WITH BLUE
OUTLINE

MRH
1265

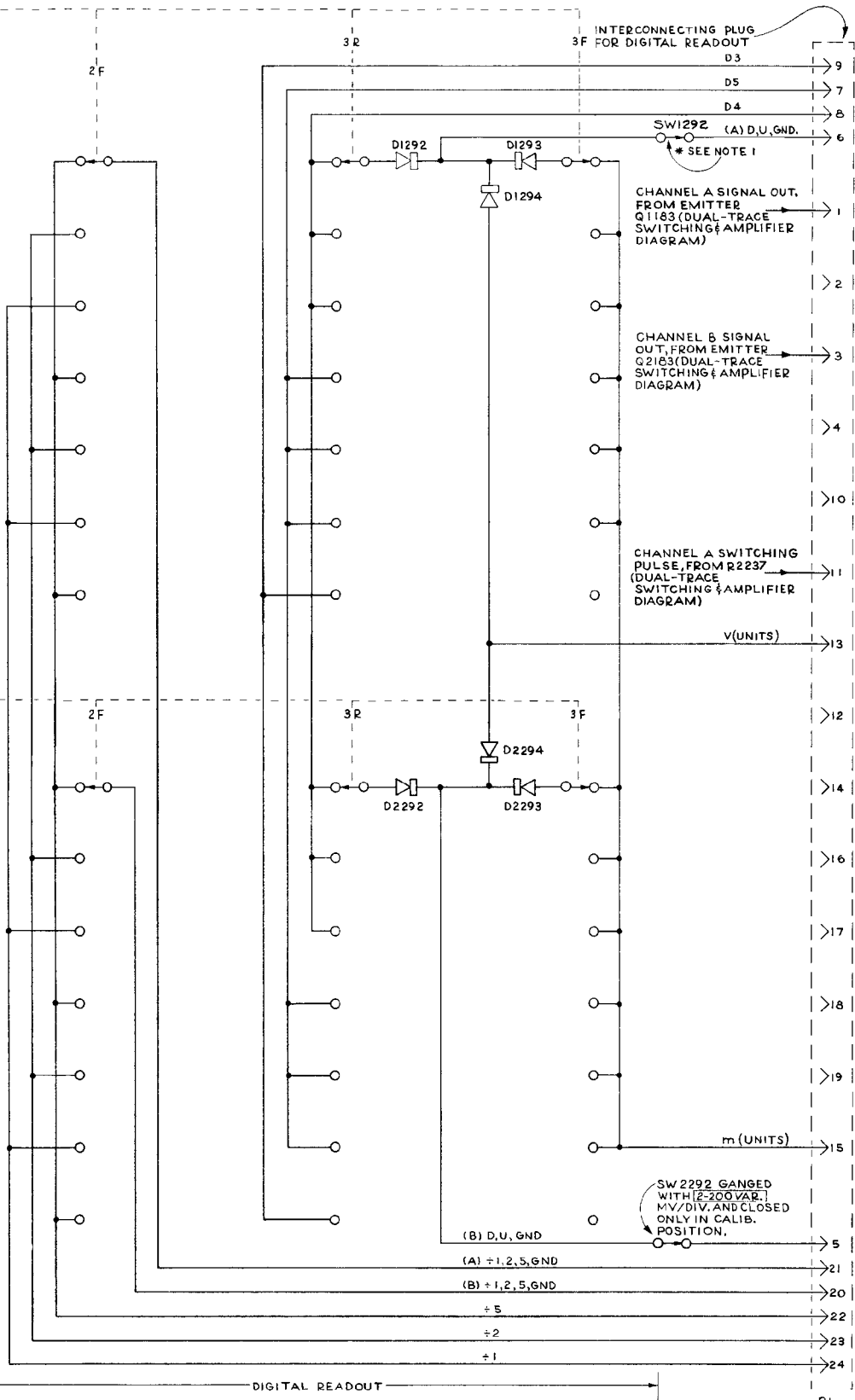
DUAL-TRACE SWITCHING & OUTPUT AMPLIFIERS



SNAP-OFF & MEMORY

TYPE 3S76 PLUG-IN UNIT

A₁



*NOTE 1
 SW1292 GANGED WITH
 2-200 VAR. MV/DIV. AND
 CLOSED ONLY IN CALIB.
 POSITION

SW 2292 GANGED
 WITH 2-200 VAR. MV/DIV. AND CLOSED
 ONLY IN CALIB.
 POSITION.

JN 563
 ATTENUATOR SWITCHES

A₁

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 3S76

TEXT CORRECTION

The following should replace paragraph (1) and (2) under 'Checks to Make' of the Troubleshooting Chart on page 5-4.

1. Apply a 20-nsec, 1-volt pulse from the pulse generator to the Type 3S76 INPUT A connector. With the test oscilloscope, check for a 1-volt, peak, pulse at pin 4 of P11. (P11 is the top interconnecting plug).
2. Set the INTERNAL TRIGGER switch to B and apply the pulse generator output to the INPUT B connector. With the test oscilloscope, check for a 1-volt, peak, pulse at pin 4 of P11.

Page 1-1, Column 2:

Under "Vertical Signal Output," the last sentence should read, "Open-circuit output voltage swing is about +5 to +15 volts."

Page 6-1, Column 2:

Item 17 of the Equipment Required list should be a 330-ohm 1/2-watt resistor (10% or 20% tolerance). Tektronix Part Number 302-0331-00.

Under "Preliminary Procedure," the Type 3T77 front-panel TRIGGER SENSITIVITY control should be set fully counterclockwise instead of fully clockwise.

Page 6-2, Column 1:

Under "Snap-Off Blocking Oscillator Check," turn the Type 3T77 TRIGGER SENSITIVITY control fully clockwise before step 1. In step 1, add "Test point (4) is the collector of Q2010."

Under "Blanking Amplifier Check," in step 2 set the test oscilloscope sweep rate to 10 μ sec/cm.

Page 6-4, Column 1:

Under "A NORM GAIN Adjustment," replace Fig. 6-5 with the following.

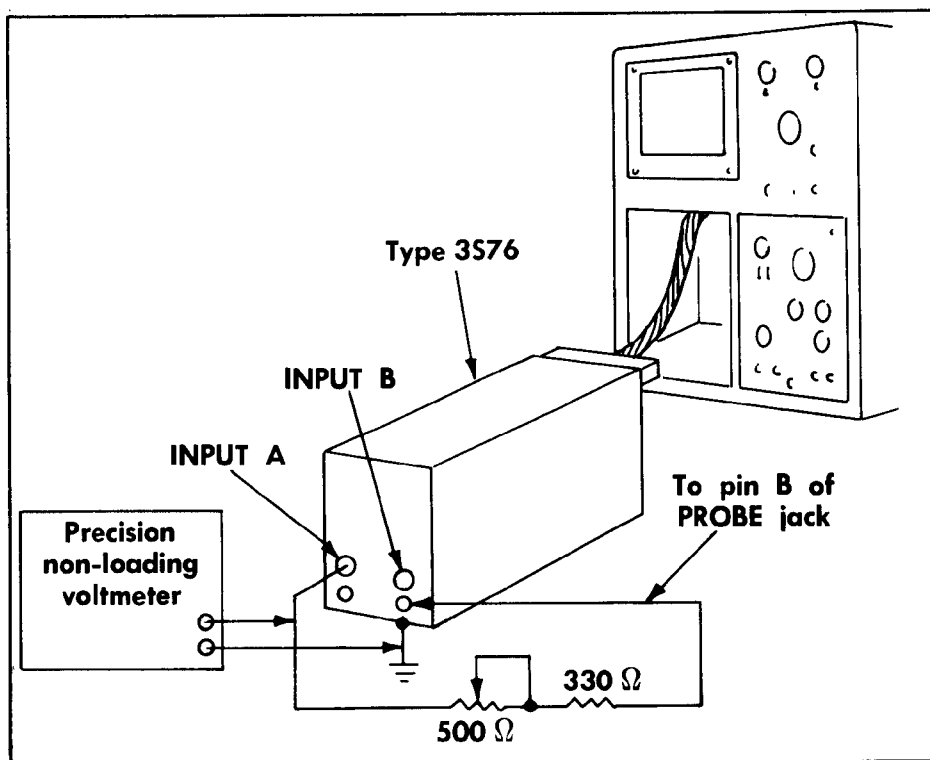


Fig. 6-5. Circuit used to set Type 3S76 gain.

Page 6-5, Column 2:

Under "A BRIDGE BAL Adjustment," add the following at the end of step 2:
"Leave the channel A MV/DIV switch set to the 10 position."

Under "B BRIDGE BAL Adjustment," add the following at the end of step 1:
"Leave the channel B MV/DIV switch set to the 10 position."

Page 6-7, Column 1:

Under "Memory Drift Check," change step 4 to read:

4. Set the output frequency of the Type 105 Square-Wave Generator to 10 kc and adjust the output amplitude for about 5 divisions of deflection.

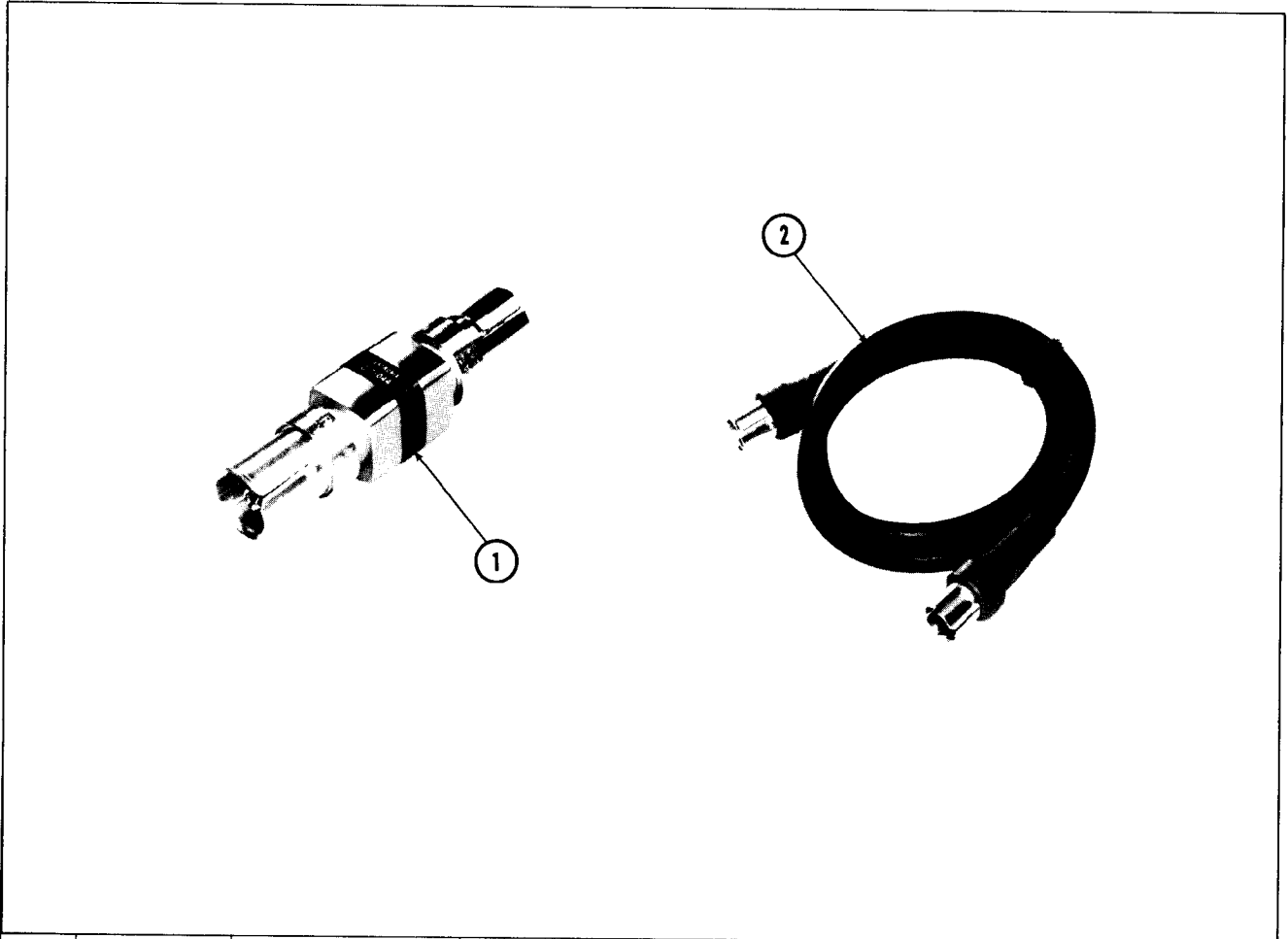
Also under "Memory Drift Check," change the first sentence of step 6 to read:

6. Set the Type 105 output frequency to 30 cycles then check the display for the amount of vertical elongation of the dots (memory drift).

Page 6-7, Column 2:

Under "Lissajous Check," step 4, set the TIME/DIV switch to 5 nSEC instead of 50 nSEC.

STANDARD ACCESSORIES



| REF. NO. | PART NO. | SERIAL/MODEL NO. | | QTY. | DESCRIPTION |
|----------|-------------|------------------|-------|------|---------------------------------|
| | | EFF. | DISC. | | |
| 1 | 017-0044-00 | 101 | 2699 | 2 | ATTENUATOR, 50 Ω, 10X |
| | 017-0078-00 | 2700 | | 2 | ATTENUATOR, 50 Ω, 10X |
| 2 | 017-0502-00 | | | 2 | CABLE, 50 Ω, 5 Nsec |
| - - | 070-0332-00 | | | 2 | MANUAL, instruction (not shown) |

TYPE 3S76 TENT SN 3500

PARTS LIST CORRECTION

CHANGE TO:

| | | | | | |
|-------|-------------|----------------|--------|----|--|
| Q2230 | 151-0188-00 | Silicon | 2N3906 | | |
| R2226 | 301-0222-00 | 2.2 k Ω | 1/2 W | 5% | |
| R2227 | 301-0563-00 | 56 k Ω | 1/2 W | 5% | |

TYPE 3S76 TENT SN 3390

PARTS LIST CORRECTION

CHANGE TO:

| | | | | |
|--------|-------------|----------------|-------|----|
| R1147B | 318-0006-00 | 111 k Ω | 1/8 W | 1% |
| R2147B | 318-0006-00 | 111 k Ω | 1/8 W | 1% |