# INSTRUCTION MANUAL

Serial Number ____________

# TYPE 567 READOUT OSCILLOSCOPE

*Tektronix, Inc.*
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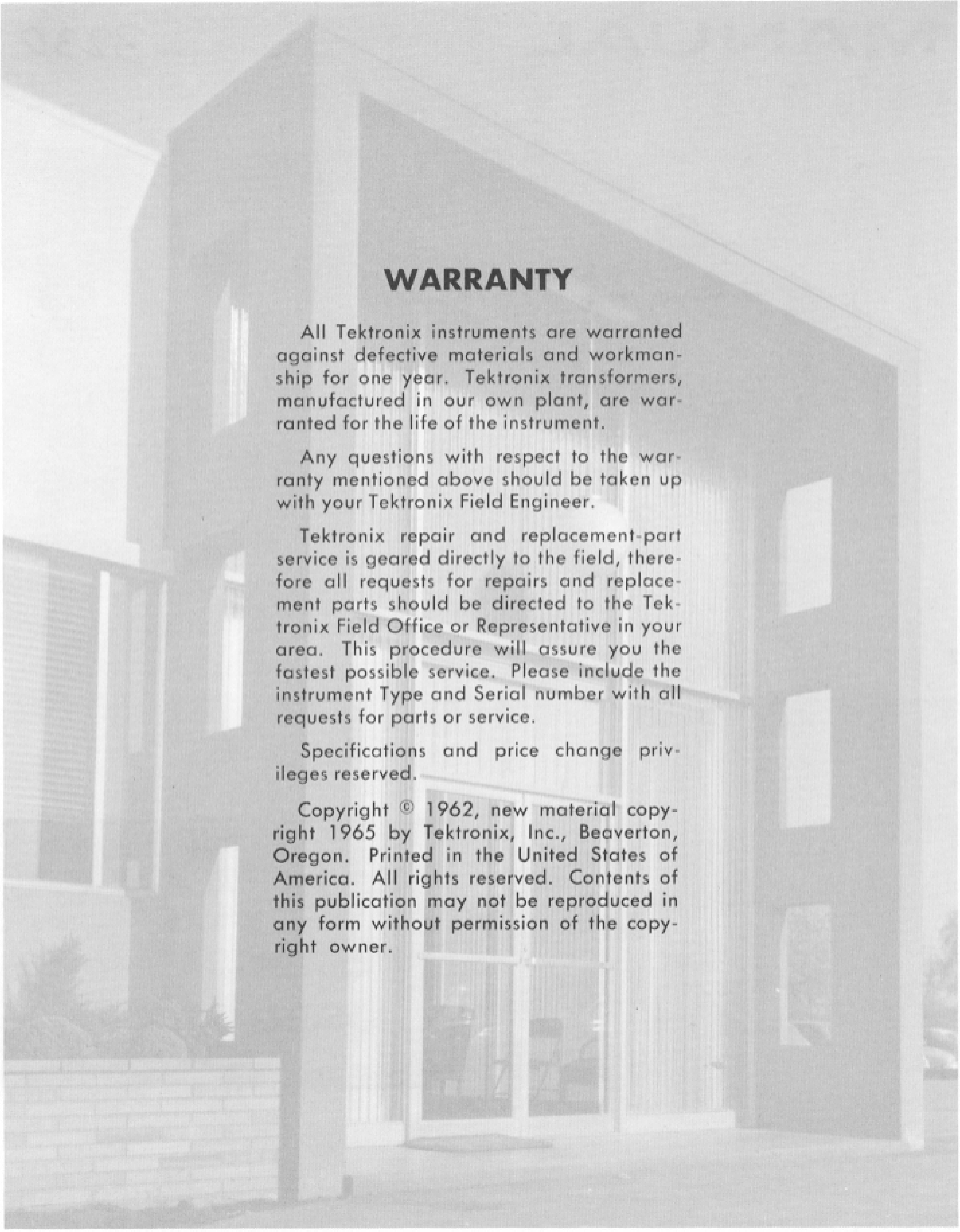


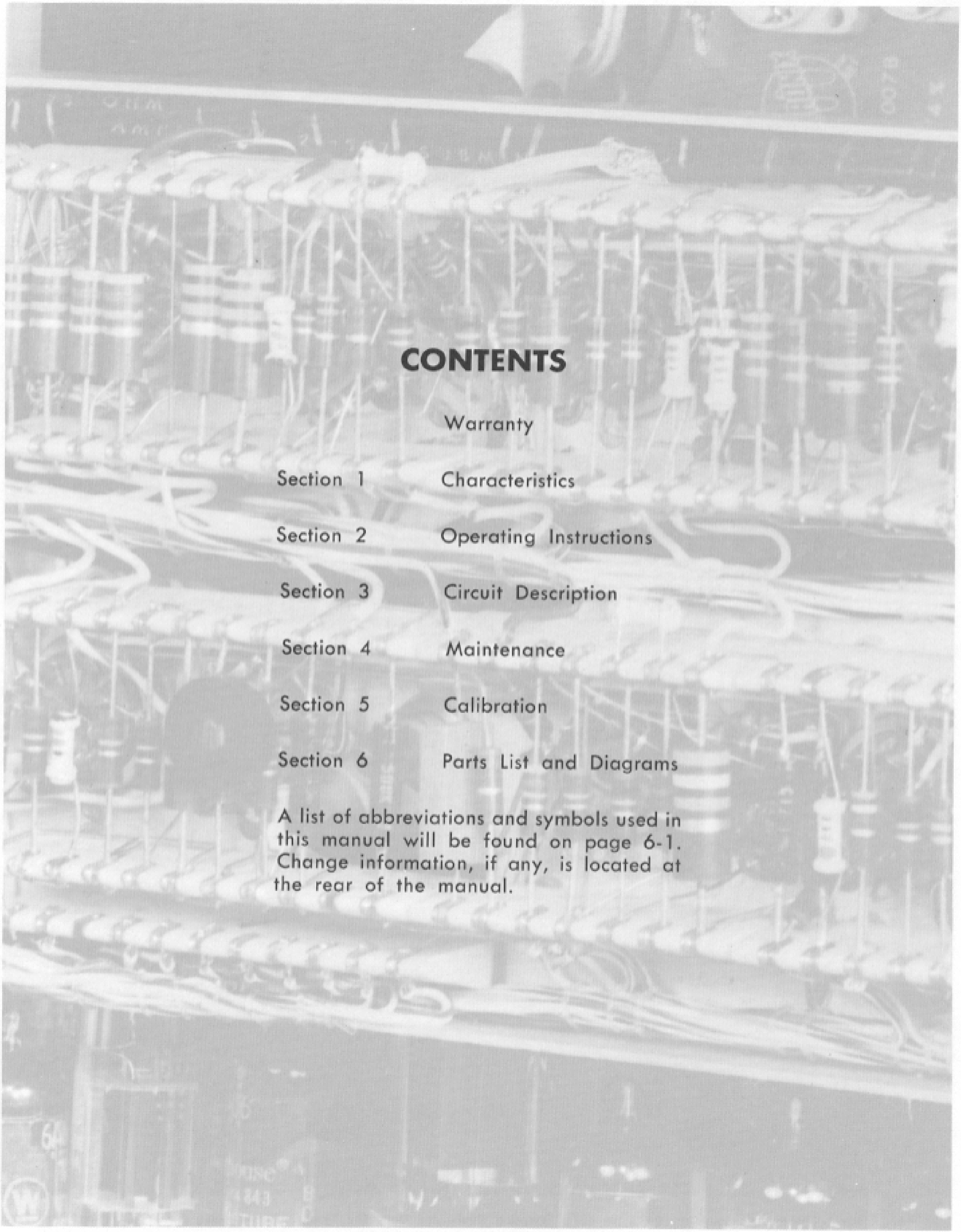
# WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our own plant, are warranted for the life of the instrument.

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

Tektronix repair and replacement-part service is geared directly to the field, therefore all requests for repairs and replacement parts should be directed to the Tektronix Field Office or Representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type and Serial number with all requests for parts or service.

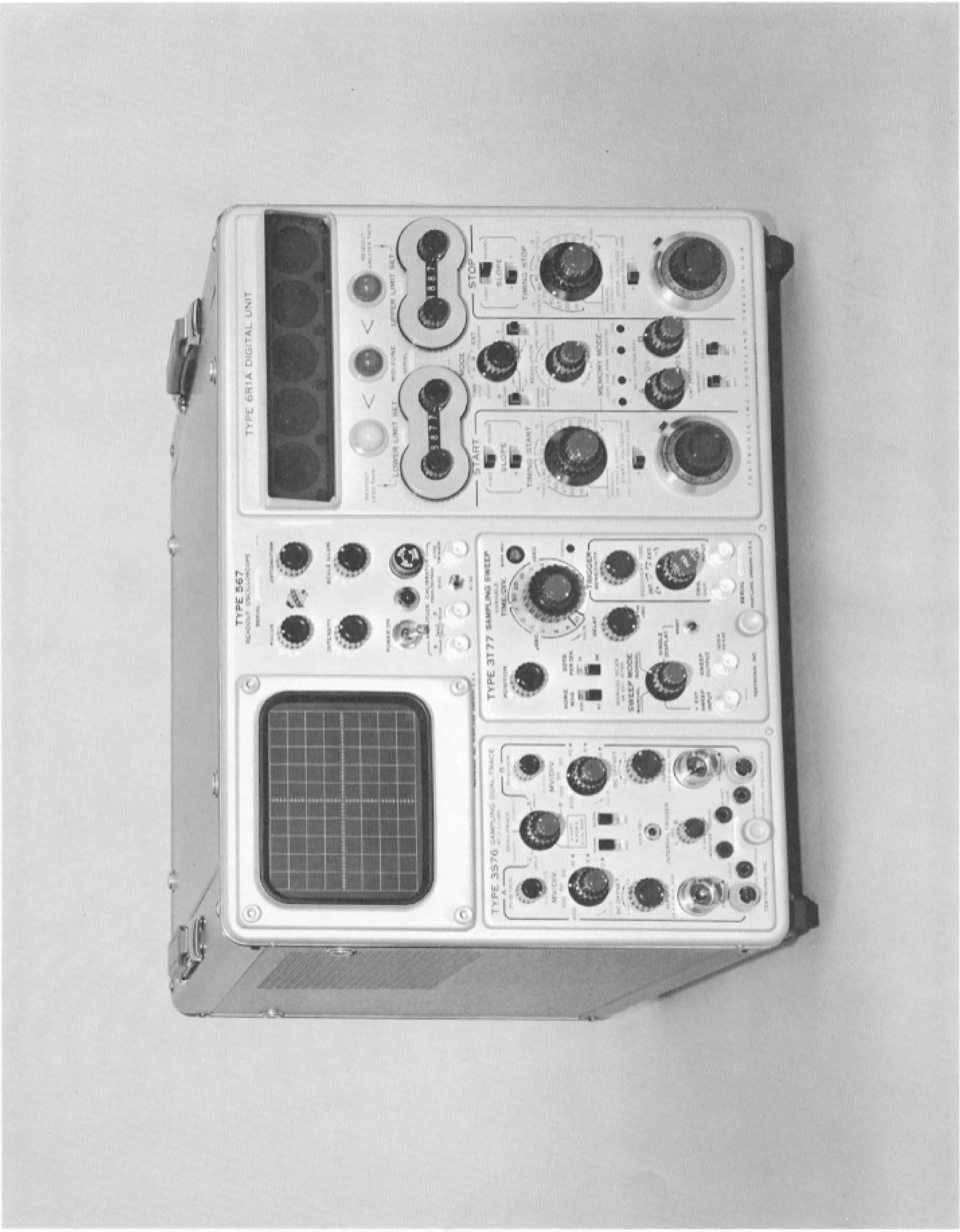
Specifications and price change privileges reserved.



# CONTENTS



A list of abbreviations and symbols used in this manual will be found on page 6-1. Change information, if any, is located at the rear of the manual.



Type 567 Readout Oscilloscope including the Type 3S76 Sampling Dual-Trace Unit, the Type 3T77 Sampling Sweep Unit, and the Type 6R1A Digital Unit.

# SECTION 1
# CHARACTERISTICS

## General Information

The Tektronix Type 567 Readout Oscilloscope is the power supply and indicator unit for a complete system that provides digital readout of signal information. The two smaller plug-in cells accept any of the Tektronix 2 or 3 Series plug-in units. The large plug-in cell accepts the Tektronix 6 Series digital units. The digital units are compatible with some (but not all) of the 2 or 3 Series units. See your Tektronix Field Engineer for details. Without the digital unit, the Type 567 will operate in the normal oscilloscope manner. With the digital unit, the system can readout its own display of risetime, amplitude or time difference for either conventional voltage-time displays or sampling equivalent-time displays. The system provides "go, no-go" signals, and can be programmed automatically using up to three Tektronix Type 262 Programmers.

### ELECTRICAL CHARACTERISTICS

## Power Supplies

Electronically regulated for stable operation with widely varying line voltages and loads.

Line voltage requirements—105 to 125 volts, or 210 to 250 volts, rms, 50 to 60 cps, single-phase ac.

Power—Approximately 400 watts when using the Type 3S76, 3T77 and 6R1A Plug-In Units.

Fuse—4 Amp Fast-Blow for 117 volts, 2 Amp Fast-Blow for 234 volts.

## Cathode-Ray Tube

Type—T5032-2-1 (S/N 1999-up)
T5610-31 (S/N 750-1998)
T5031-2 (S/N 101-749)

Phosphors—Standard phosphors as listed above, others available as listed with accessories at end of this section.

Unblanking—Deflection type, dc coupled.

Accelerating potential—Approximately 3.5 kv.

Usable viewing area—8 divisions vertical by 10 divisions horizontal.

Deflection plate deflection factors (nominal at 3.5 kv)

| | (S/N 1999-up | (S/N 101-1998) |
|---|---|---|
| Vertical— | 19.5 volts/div | 22.8 volts/div |
| Horizontal— | 18.4 volts/div | 18.4 volts/div |

## Graticule

Internal within crt (S/N 1999-up)

External plastic (S/N 101-1998)

Illumination—Variable edge lighting.

Markings—Marked in 8 vertical and 10 horizontal 1-centimeter divisions with 2-millimeter markings on the centerlines.

## Amplitude Calibrator

**(S/N 2060-up).** A square wave with accurate time duration and amplitude; intended for use when setting the vertical and horizontal plug-in units front-panel calibrate controls. Two output frequencies, an accurate 20 kc and an approximate 1 kc. The 1-kc square wave is valuable when adjusting low-frequency attenuator probes.

Output Voltage—Separate BNC connectors produce ground-referenced 0.5 and 5 volts peak to peak when loaded (one or both at the same time) by 100 k or greater. Same connectors provide 50 and 500 mv peak to peak when loaded (one at a time) by 50 ohms.

Accuracy—Voltage accurate to $\pm 2\%$ peak to peak into 100 k or greater loads. Voltage accuracy into 50 Ω depends on load resistor: $\pm 2\%$ peak to peak when 50 Ω is within 1% at one output connector at a time.

Frequency of 20-kc square wave is within 0.1% when the 1-kc square wave is within +80% and —40%; symmetry not specified for either frequency.

+Pre Trigger—A short-duration, ground-referenced, positive pulse at least 600 mv peak to peak into 100 k or greater, that occurs approximately ¼ cycle ahead of each plus rise of square-wave signal. Amplitude is reduced by 50 Ω load, but +Pre Trigger signal is intended for externally triggering the time-base units of sampling systems not employing an internal trigger pickoff.

All three output connectors of the Amplitude Calibrator are short-circuit proof. External short circuits will not damage the calibrator circuits.

**(S/N 101-299).** Waveform—Square waves at line frequency.

Output Voltage—0.05, 0.5, 5 and 50 volts, peak to peak into 1 meg or greater load, one at a time.

Accuracy—Peak-to-peak amplitude of square waves within 3% of indicated voltage.

**(S/N 300-2059).** Above characteristics plus 100-mv peak-to-peak square wave available from 0.5 jack when loaded with $\pm 1\%$ 50 Ω.

## Ventilation

Forced, filtered air. A thermal relay interrupts instrument power in the event of overheating. Fan remains on if thermal relay opens during 117-volt operation. Fan turns off if thermal relay opens during 234-volt operation. Temperature of the thermal relay must drop about 15° F before power will be restored.

## MECHANICAL CHARACTERISTICS

The Type 567 is constructed with aluminum-alloy chassis and cabinet. Cabinet is finished with a durable blue vinyl plastic. The unit sits on short anti-slide neoprene feet.

Cabinet dimensions—Height 13⅝", width 17", depth 23".

### Accessories

Information on accessories for use with this instrument is included at the rear of the mechanical parts list.

# SECTION 2
# OPERATING INSTRUCTIONS

## General Information

The Type 567 is a specially designed oscilloscope for producing digital display of information which can be obtained only from the crt on an ordinary oscilloscope. The digital readout system can be made to display either voltage or time, and may be used for such applications as measuring the peak-to-peak amplitude of a waveform, or its risetime. If dual-trace plug-in units are used with the Type 567, the digital readout system can be used to obtain both voltage and time measurements on either trace. In addition, the digital readout system will make time measurements between signals displayed on one trace and signals displayed on the other.

The Type 567 and associated units are relatively easy to operate once the basic operating procedures are understood. It is the purpose of this section and similar sections in the plug-in unit manuals to establish the proper operating techniques. This manual covers instructions for the Type 567 only. For operating instructions for the plug-in units, refer to the applicable instruction manuals.

## Preliminary Instructions

Before operating the Type 567, a suitable location for the instrument must be chosen. The location should provide a stable support for the instrument. Care should be taken that adequate air circulation is permitted through the instrument by keeping it away from walls, or from other equipment which might block the air intake through the filter or the exhaust passages in the cabinet. If the flow of air over the components in the unit is interrupted, overheating of the instrument may cause a thermal relay in the instrument to open, shutting down the instrument.

The Type 567 Oscilloscope can be operated from 110, 117, or 124 volts, or 220, 234, or 248 volts. The only changes necessary to convert from one operating voltage to another are in the wiring of the power transformer primary and the fan motor. The power transformer used in the Type 567 uses two separate primary windings plus two 6% boost-buck windings. The primary windings are connected in parallel for 117-volt operation and in series for 234-volt operation. Proper connections for each line voltage are shown on the side of the power transformer and on the Power Supply schematic.

A small metal tag near the power receptable at the rear of the instrument indicates the line voltage for which the instrument was wired at the factory. If wired for 117 volts, the instrument will operate properly with line voltages between approximately 105 and 125 volts. If wired for 234 volts, the instrument will operate properly from approximately 210 to 250 volts.

To change the power transformer connections for operation on another line voltage, change the location of the bare wire straps at the primary terminals. It is not necessary to move any of the plastic insulated wires. Place the new straps in accordance with the markings on the tag located on the power transformer side.

When a suitable location has been chosen, set the POWER ON switch to the off position and connect the instrument to an appropriate source of power. Place the desired vertical plug-in unit (for example, the Type 3A2 or 3S76) in the left plug-in compartment of the oscilloscope (see Fig. 2-1). Place the horizontal plug-in unit (for example, the Type 3B2 or 3T77) in the center compartment. Finally, place the desired digital unit (for example, the Type 6R1 or 6R1A) in the right compartment of the oscilloscope. Make certain all units are properly inserted and locked in place before turning on the oscilloscope power. The horizontal and vertical plug-in units are locked in place by turning the front-panel knurled aluminum locking knobs clockwise. The digital unit is locked in place by removing the right side panel and tightening the two fasteners at the rear of the compartment.

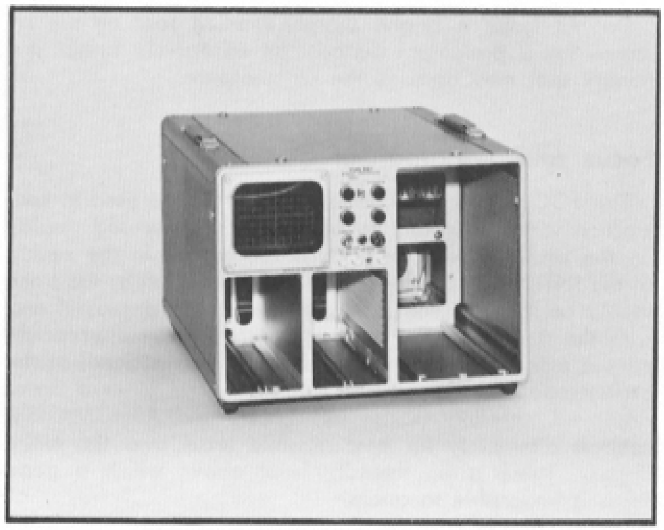


**Fig. 2-1. Type 567 plug-in compartments.**

## Checking Plug-In Unit Accuracy

Each vertical, horizontal and digital plug-in unit must be calibrated within the particular oscilloscope in which it is to be operated. Units purchased as a system (oscilloscope and three plug-ins) are calibrated together as a system at the factory. Units purchased separately, or calibrated separately, must have their basic gain adjustments made when they are installed.

Individual oscilloscope crt deflection factors differ within normal limits. The vertical and horizontal units have front-panel Calib controls so the particular amplifier gain can be set to that needed by the crt. Some sampling plug-in units have internal digital gain controls that must be correctly adjusted. See the individual plug-in unit instruction manual calibration procedure for details.

The digital unit is sensitive to the oscilloscope power-supply voltages. Digital readout accuracy is closely related to power-supply voltage accuracy. Since it is impossible to make all Type 567 Oscilloscope power supplies to have exactly the same voltage accuracy, the digital unit must be calibrated in the oscilloscope in which it is used. If a calibrated digital unit (either Type 6R1 or 6R1A) is placed into another Type 567 Oscilloscope, check the accuracy of the start and stop voltages and the rate of rise of the voltmeter ramp before relying on either time or voltage readout. See the digital unit instruction manual calibration procedure (Type 6R1A steps 5 and 6; Type 6R1 steps 15 and 17) for details.

## Intensity Control

The INTENSITY control is used to adjust the brightness of the oscilloscope display. Begin with INTENSITY control counterclockwise, because some plug-ins permit a bright spot during warm up. After turning on the instrument and waiting a few minutes for warm up, free run the oscilloscope sweep by setting the TRIGGER SENSITIVITY or LEVEL control fully clockwise. Adjust the INTENSITY control for a suitable trace intensity.

Do not leave a bright, sharply focused spot on the crt screen for a prolonged period. An excessively bright stationary spot may damage the crt phosphor.

## Focus and Astigmatism Controls

The FOCUS and ASTIGMATISM controls are used in conjunction with each other to produce a well-focused display on the oscilloscope screen. Because changes in the setting of the INTENSITY control may affect focus slightly, the trace should be focused with the actual waveform displayed and with the desired intensity setting. Refer to the appropriate plug-in manuals for instructions for applying a signal to the oscilloscope and obtaining a stable display. With a signal displayed, carefully adjust the FOCUS and ASTIGMATISM controls alternately for best possible focus over the entire display. There is an intensity level above which a good focus is impossible to attain.

## Scale Illumination Control

The crt graticule is edge-lighted by two small lamps at the bottom. The lighting can be adjusted to suit the ambient light conditions by means of the SCALE ILLUM control. Rotating the control clockwise increases the brightness of the graticule scale markings. The graticule is marked with eight 1-centimeter divisions vertically and ten 1-centimeter divisions horizontally, with 2-millimeter markings on the centerlines.

## Changing Plug-In Units

Horizontal and vertical plug-in units used in the Type 567 may be changed at any time. However, it is recommended that the instrument be turned off while a change is made. This affords maximum protection to the oscilloscope and other plug-in units against sudden transients and load changes.

Whenever a horizontal or vertical plug-in unit is changed, it is important that you check both the gain and timing of the oscilloscope. This will ensure accurate measurements.

## Amplitude Calibrator (SN 2060-up)

The Amplitude Calibrator provides a choice of four square-wave voltages with amplitude tolerance of $\pm 2\%$. 0.5 and 5 volts peak to peak when loaded (one or both at the same time) by 100 k or greater, and 50 and 500 mv when loaded (one at a time) by $50\,\Omega$ $\pm 1\%$. Two frequencies are available: crystal-controlled 20-kc ($\pm 0.1\%$) square waves, and 1-kc ($\pm 20\%$) square waves. The two frequencies are selectable by a front-panel 20 KC-$\approx$1 KC toggle switch. The voltage accuracy of any one of the four output voltages may be adjusted to within $\pm \frac{1}{2}\%$ by special calibration.

The Amplitude Calibrator is valuable for adjusting the front-panel Calib controls of both vertical and horizontal real-time or sampling plug-in units. The 20-kc frequency (and the ability to make one of the output voltages very accurate) permits checking the system operation including digital unit time and voltage readout. The 1-kc frequency is valuable for compensating low-frequency attenuator probes.

Front-panel BNC connectors permit convenient $50\,\Omega$ cable connection of calibrator signals to the plug-in unit input terminals, or to external equipment. If the vertical plug-in unit has a high-impedance input, the two higher square-wave voltages will apply. Addition of an external $50\,\Omega$ termination (Tektronix Part No. 011-0049-00) at the plug-in input connector will provide the two lower voltages. If the plug-in unit has an internal $50\,\Omega$ termination, do not add the external termination when accurate voltages are desired. (Actually, the Amplitude Calibrator is short-circuit proof, so any load is permissible, but accurate voltages are obtainable only as above.)

The +Pre Trigger connector delivers a positive pulse approximately $\frac{1}{4}$ cycle before each positive step of both the 20-kc and 1-kc square-wave signals. Sampling plug-in time-base units can effectively use the +Pre Trigger signal (at 20 kc) for external triggering. A positive step will then appear near the beginning of the display, produced without external delay cable in the pretrigger signal path.

## (S/N 300-2059)

The Amplitude Calibrator provides a choice of four square-wave signals with peak-to-peak voltages of 0.05, 0.5, 5 and 50 volts $\pm 3\%$ when loaded by 1 megohm or greater. In addition, a signal of 100 mv peak to peak $\pm 3\%$ into a $50\,\Omega$ ($\pm 1\%$) resistance is provided from the 0.5 jack. This voltage is valuable for checking the vertical calibration of sampling plug-in units. Frequency of the square wave is that of the power line.

## (S/N 101-299)

The Amplitude Calibrator provides a choice of four square-wave signals with peak-to-peak voltages of 0.05, 0.5 5 and 50 volts $\pm 3\%$ when loaded by 1 megohm or greater. Frequency of the square wave is that of the power line. The Amplitude Calibrator is valuable for checking real-time plug-in unit calibration and the compensation of attenuator probes. It is also valuable as a time reference for adjusting the horizontal unit calibration; three complete cycles at 60 cps line frequency occur in 50 milliseconds (2 cycles at 50 cps line frequency occur in 40 milliseconds).

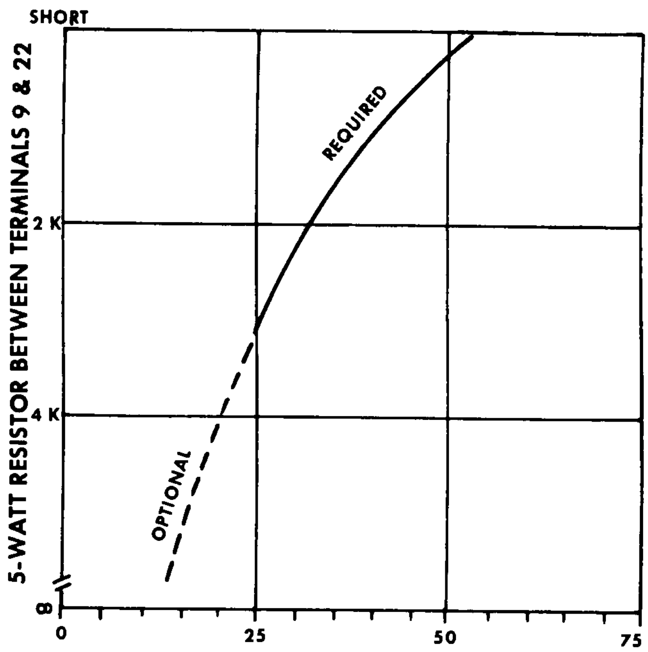



Fig. 2-2. —100-volt supply shunt.

## Skeleton Plug-In Units

Skeleton plug-in units for the vertical and horizontal sections are available for all of the Tektronix Type 560 Series oscilloscopes, including the Type 567. None are available for the large plug-in area used for digital readout. These skeleton units permit you to build your own plug-in circuitry for use in the Type 567. If you use your own circuitry, provision may be made for operating the digital readout circuits, although this is not necessary. Order the skeleton chassis as Modification Kit number 040-0245-00 from your local Tektronix Field Office.

A dummy cover is available for the digital cell. Order by Tektronix Part No. 016-0051-00.

## Power Supply Capabilities

The total dc power available for vertical and horizontal plug-in use is 85 watts divided between four regulated supplies. The remaining power available must be reserved for the digital units. Use of current from any of the unregulated dc supply leads is not recommended.

The four regulated dc supplies listed in Table 2-1 are employed by the X and Y axis amplifiers.

Since the Type 567 indicator unit employs two plug-in units to operate the X and Y axes of the crt, currents listed in Table 2-1 are normally divided between them. However, a single plug-in alone can be used, such as a vertical amplifier, with moving-film recording used instead of a horizontal sweep. In such a case, it will be necessary to elevate the crt horizontal deflection plates to approximately +180 to +210 volts dc to permit proper focus and astigmatism control.

**TABLE 2-1**

Type 567 Power Supply Current Capabilities For X and Y Plug-In Units

| Supply | Max. Total Current | Connector Terminals |
|---|---|---|
| Reg. —100 vdc | 130 ma | 23— to 9 ground |
| Reg. —12.2 vdc | 1.5 amps | 16— to 5 ground |
| Reg. +125 vdc | 150 ma | 15+ to 9 ground |
| Reg +300 vdc | 150 ma | 10+ to 9 ground |
| Unreg. 6.3 vac | 5 amps per plug-in | 1 - 2 |

The limit of the amount of power which can be dissipated in one plug-in unit is based primarily upon the ambient temperature and amount of ventilation supplied. Vacuum tubes should not be operated with envelope temperatures above 150° C when the ambient temperature is at 25° C, or above 175° C when the ambient temperature is at 50° C. The Type 567 indicator unit can be operated in ambient temperatures up to 45° C.

Separate terminals are provided for the ground return of the —12.2-volt regulated heater supply. When using this supply in your own plug-in design, it is best to run two leads to the heater terminals so that the ground lead can be connected directly to terminal 5, thus eliminating ground currents.

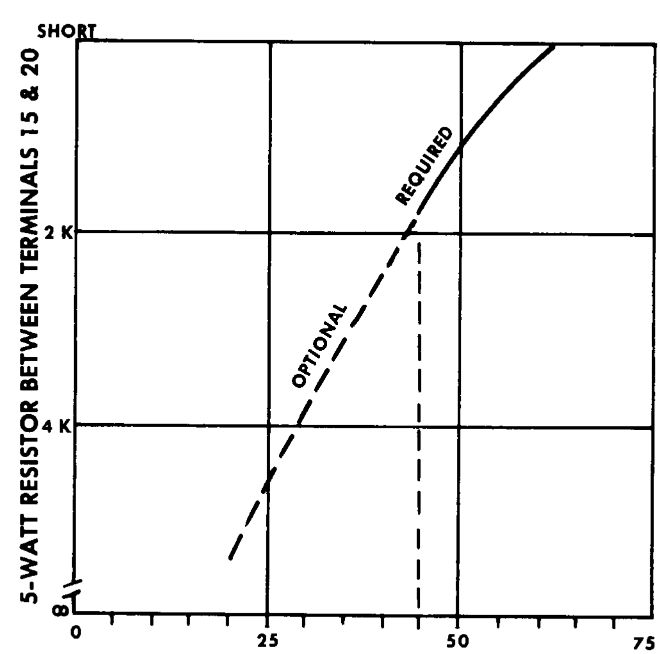



Fig. 2-3. +125-volt supply shunt.

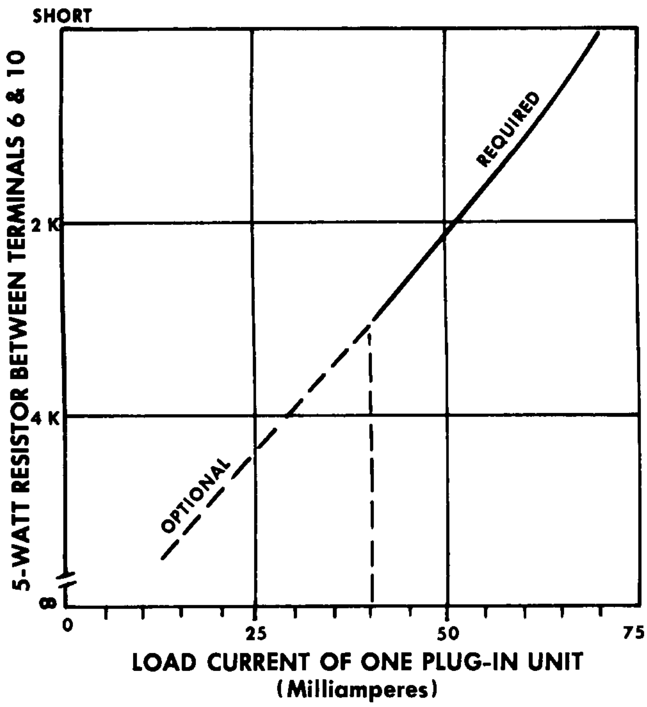



**Fig. 2-4. +300-volt supply shunt.**

above 150° C when the ambient temperature is at 25° C, or above 175° C when the ambient temperature is at 50° C. The Type 567 indicator unit can be operated in ambient temperatures up to 45° C.

Separate terminals are provided for the ground return of the —12.2-volt regulated heater supply. When using this supply in your own plug-in design, it is best to run two leads to the heater terminals so that the ground lead can be connected directly to terminal 5, thus eliminating ground currents.

**TABLE 2-2**

Recommended Type 567 Regulated Power-Supply Shunt Resistors[1]

| Shunt Resistor Values | —100 v | +125 v | +300 v |
|---|---|---|---|
| No Shunt | 0 to 25 ma | 0 to 45 ma | 0 to 40 ma |
| 2000 Ω, 5 w between proper terminals of power connector. | 20 to 45 ma | 25 to 60 ma | 35 to 67 ma |
| SHORT, between proper terminals of power connector. | 40 to 65 ma | 50 to 75 ma | 65 to 75 ma |

[1]**Currents listed are one-half total available, based on two plug-in units being used.**

## Suggested Power-Supply Shunt Resistor Values

To make efficient special use of the Type 567 indicator unit power supply, the load currents and maximum or minimum load values must be known.

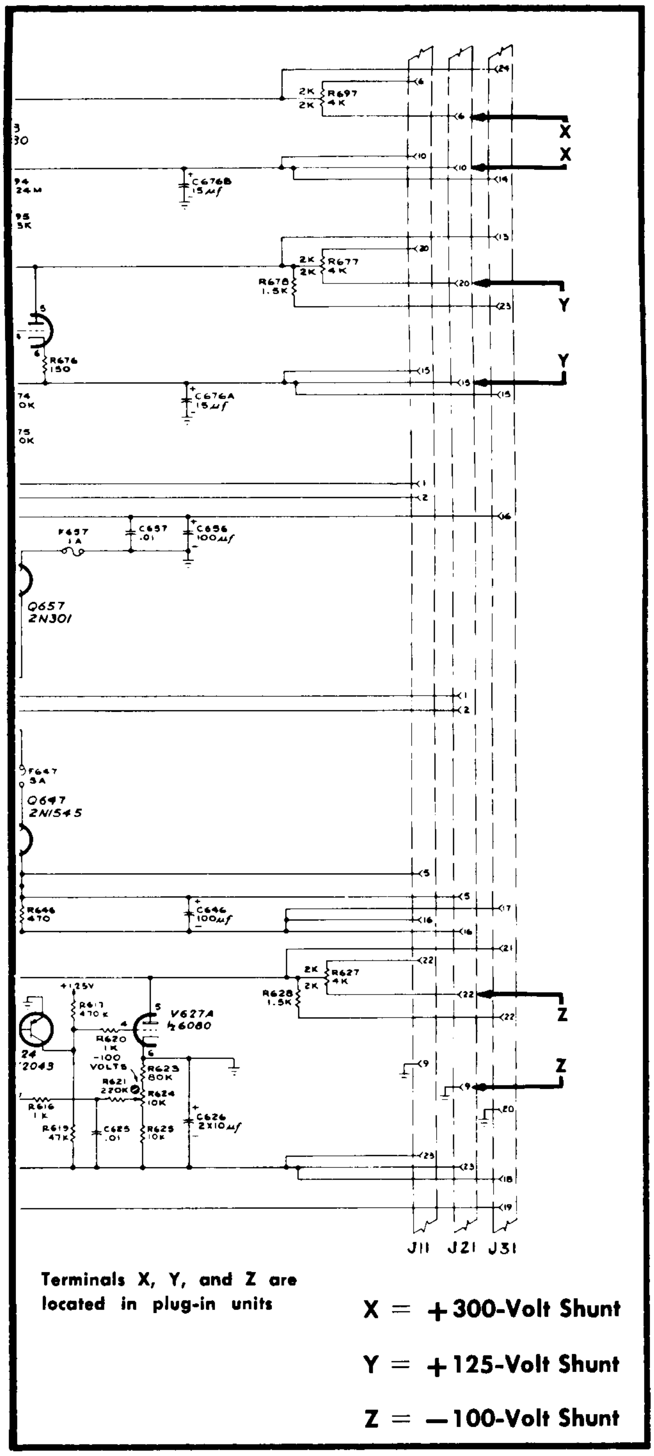



**Fig. 2-5. Power-supply shunt resistor connections.**

The nature of series-regulated power supplies permits obtaining more current from them than can normally be handled by the series tube alone (providing the power transformer and rectifiers can supply more current). By placing a shunt resistor of appropriate value across the series regulator tube, additional current can be made available for the load. The correct value shunt resistor must be chosen to permit the regulator system to deliver current with low ripple, and the

Use of shunt-resistor values suggested in Table 2-2 will lead to a minimum of total power required, and give lowest plug-in temperature. It is the simplest method that will not overtax supplies, either for regulation or temperature. However, if Table 2-2 does not meet your design needs, refer to the curves of Figs. 2-2, 2-3, or 2-4 to aid your choice of individual power-supply shunt resistors. Always plan the shunt to permit lowest plate dissipation in the series regulator tube consistent with proper regulation and ripple values.

A portion of the power-supply schematic has been reproduced in Fig. 2-5, identifying interconnecting plug terminals specified in Table 2-3. J11 and J21 are the horizontally-mounted interconnecting plugs at the rear of the vertical and horizontal plug-in cells, respectively. Do not use shunt resistors in the digital cell at J31.

**TABLE 2-3**

**Plug-In Interconnecting Plug Terminals For Regulated Supply Shunt Resistors In X and Y Amplifiers**

| Supply | Terminals |
|---|---|
| —100 | 22—9 return |
| +125 | 20—15 return |
| +300 | 6—10 return |

# NOTES

# SECTION 3

# CIRCUIT DESCRIPTION

## General Information

The Type 567 Oscilloscope consists of three major parts: the low-voltage power supplies, the crt circuits, and the Amplitude Calibrator. The oscilloscope is essentially an indicator and power supply for the plug-in units used with the instrument. Vertical and horizontal plug-in units drive the deflection plates of the crt directly, and also drive the digital unit.

The low-voltage power supplies provide outputs of —100, —12.2, +20, +125, and +300 volts.

The crt circuits contain the high-voltage power supply and crt. The high-voltage supply provides regulated 3.3-kv potential to the crt cathode.

The Amplitude Calibrator generates square waves with calibrated amplitudes at either 20 kc or 1 kc. The calibrator square waves are used as a convenient signal source to verify the calibration of the vertical, horizontal, and digital plug-in units.

## Low-Voltage Power Supplies

Low-voltage power supplies of the Type 567 supply all the power to the high-voltage power supply, the Amplitude Calibrator, and the three plug-in units. Each regulated output voltage is stable over the line voltage range of 105 to 125 volts rms, or 210 to 250 volts rms, centered at either 117 or 234 volts 50 to 60 cps. The supplies will remain within regulation for line-voltage distortion up to about 5%.

All regulated power supplies are referenced to V609 of the —100-volt supply; the output voltage of the —100-volt supply is the reference voltage for all other regulated supplies.

Vertical and horizontal plug-in units use power from all but the +20-volt supply. The +20-volt supply is used by the digital unit and can be used externally through the digital unit (Type 6R1 or 6R1A J34-G) at currents up to 500 ma.

Three of the power supplies include shunt resistors that allow more current to be drawn than can be handled by the series regulators alone. A discussion of power-supply loads and shunts is included in the section on Operating Instructions.

## —100-Volt Power Supply

Line voltage is applied through fuse F601 and the thermal cutout relay TK601 to the primary windings of T601. This energizes the secondary windings of T601. Terminals 19 and 20 of T601 apply power to a full-wave bridge rectifier consisting of D602A, B, C, and D. The unregulated output of the rectifier circuit is applied to the —100-volt regulator circuit and through the interconnecting plugs to the plug-in units.

Voltage regulator tube V609 maintains the grid of V616B at approximately —85 volts. The voltage at the grid of V616A is obtained from a divider between ground and the —100-volt output of the regulator. V616 is a cathode-coupled difference amplifier which compares the voltage at the grid of V616A against the fixed —85 volts at the grid of V616B. Potentiometer R624 sets the output of the power supply at —100 volts.

If the output voltage tends to change from —100 volts, a sample of the change is applied through the divider to the grid of V616A. This error signal is amplified and inverted by V616A and applied to the base of Q624. Q624 amplifies and inverts the error signal and applies it to the grid of series regulator V627A. The change in grid voltage of V627A changes the voltage drop across the tube and causes the output voltage to return to normal.

Capacitor C625 increases the ac loop gain of the regulator circuit. Its function is to quickly compensate for rapid changes in the output voltage. The higher ac loop gain provided by C625 also reduces ripple at the output of the regulator. C626 aids in reducing the ac output impedance of the —100-volt supply.

## +125-Volt Power Supply

A full-wave bridge rectifier circuit from terminals 33 and 34 of T601 supplies power to the +125-volt regulator circuit and to the plug-in units through the interconnecting plugs. The +125-volt supply compares its own output voltage with the —100-volt supply through the resistive voltage divider R674-R675. The divider supplies a voltage near ground to the grid of V664. If the output voltage from the regulator changes, a portion of this change is applied through the divider to the grid of error amplifier V664. The error signal is amplified by V664 and applied to the grids of series regulator V677. The change in voltage at the grids of V677 changes the voltage drop across V677 and compensates for the change in output voltage.

The screen supply for V664 is obtained primarily from the output of the regulator circuit. R665 applies ripple from the unregulated bus to the screen as a signal voltage. The ripple is amplified and helps to reduce ripple appearing on the output.

Capacitor C674 is used to increase the ac loop gain of the regulator circuit. This allows the circuit to recover rapidly from sudden changes in output voltage. The increased ac loop gain also helps to reduce the ripple at the output of the regulator. C676A reduces the ac impedance of the +125-volt supply. Resistors R671 and R676 in the cathodes of the series regulator V677 tend to balance the current through the two sections of the tube.

On all Type 567s S/N 300-up, the +125-volt supply is adjustable by R667 and R668. The —100-volt supply must be adjusted to the correct voltage before adjusting R668 to set the +125-volt supply to the correct value.

## +300-Volt Power Supply

A full-wave bridge rectifier circuit from terminals 31 and 32 of T601 supplies +165 unregulated dc volts that are added to the unregulated +235 volts (of the +125-volt regulated supply) to provide a total of +400 volts to the +300-volt regulator and to the crt circuit. A voltage divider between the regulator output and —100 volts, supplies a voltage near ground to the grid of V684. If the output voltage from the regulator changes, a portion of this change is applied through the divider and C694 to the grid of error amplifier V684. The error signal is amplified and inverted and applied to the grid of series regulator V627B. The change in voltage at V627B grid changes V627B conduction and compensates for the change in output voltage.

The screen supply for V684 is obtained from both the +400-volt unregulated lead and from the regulated +300 volts. R685 applies ripple voltage from the unregulated lead as a signal to V684 screen to help reduce ripple voltage appearing in the regulated output.

Capacitor C694 supplies fast changes in output voltage to the grid of error amplifier V684, reducing the ac output impedance of the regulator circuit. C676B also aids to reduce the ac impedance of the +300-volt supply.

On all Type 567s S/N 300-up, the +300-volt power supply is adjustable by R696 and R698. Both the —100- and +125-volt power supplies must be adjusted before calibrating R698.

## —12.2-Volt Power Supply

The —12.2-volt regulator is similar to the —100-volt regulator except that it uses transistors instead of tubes. A full-wave rectifier consisting of D632A and B provides unregulated dc voltage to the regulator. A divider between —100 volts and ground is used to provide a constant —12 volts for the base of Q634. The output voltage of the regulator, appearing at the emitter of Q634, is compared to the voltage at the base. Because of this circuit arrangement, the voltage at the base of Q634 sets the output voltage of the supply.

Normally, the voltage at the emitter and base of Q634 will be nearly the same. If the voltage at the emitter changes because of a change in the supply output voltage, this changes the current through the transistor. This in turn produces a change in the collector voltage of Q634 and in the base voltage of Q644. The change at the base of Q644 is amplified at the collector and applied to the base of the series regulator transistor Q647. The change in base voltage of Q647 changes the voltage drop across Q647 in such a direction as to compensate for the change in output voltage, and the output then returns to normal.

As an example, if the output of the supply starts to go more negative, this causes Q634 to conduct more heavily. This produces a drop in the voltage at the collector of Q634 and at the base of Q644. The drop in voltage at the base of Q644 also causes this transistor to conduct more heavily, causing its collector voltage to change in the positive direction. The more positive voltage at the base of Q647 increases the voltage drop across Q647, thereby decreasing the output voltage of the supply to normal.

Fuse F647 is used to protect Q647 in the event the output is accidentally overloaded. Capacitor C646 reduces ripple voltage at the output of the regulator circuit.

On all Type 567s S/N 300-up, the —12.2-volt supply is adjustable by R630, R631, and R632. Both the —100- and +125-volt power supplies must be adjusted before calibrating R631.

## +20-Volt Power Supply

Full-wave bridge rectifier D652A, B, C, and D rectifies voltage from terminals 11 and 12 of T601 and supplies power to the +20-volt regulator circuit. A voltage divider between +125 volts and ground sets the base of Q654 near +20 volts. The output voltage of the supply, appearing at the emitter of Q654, is compared to the voltage at the base.

If the supply voltage changes, the bias and conduction of Q654 is changed. Supply voltage changes are then amplified and inverted and applied to the base of emitter-follower Q653. Q653 provides current gain to the correcting signal and drives the base of Q657 to change its conduction and bring the output voltage back to normal. C654 provides a low ac impedance to Q654 base, reducing the supply ac output impedance. C656 and C657 also aid to reduce the supply ac output impedance.

Fuse F657 protects Q657 in the event the output is accidentally overloaded.

On all Type 567s S/N 300-up, the +20-volt supply is adjustable by R650 and R651. R650 is connected between the —12.2- and the output of the +20-volt supply. Thus, the —12.2- and +125-volt power supplies must both be adjusted to the correct voltage before adjusting R650 to set the +20-volt supply to the correct value.

## High-Voltage Power Supply

Unregulated +400 volts from the +300-volt power supply is applied to the high-voltage oscillator, V800. V800 and its associated circuitry is a modified Hartley oscillator. C802 and the primary winding of T801 form the tuned circuit in the plate of V800. The oscillator operates at approximately 35 kc. High-voltage transformer T801 provides the high voltages and heater voltages for the rectifiers.

One secondary winding of T801 and rectifier V822 form a half-wave rectifier circuit which supplies approximately —3.3 kv to the cathode of the crt. A separate secondary winding of T801 and V832 supply a floating negative voltage for the control grid of the crt.

A voltage divider between the —3.3-kv output of V822 and +300 volts supplies voltage to the focusing grid of the crt and also applies a sample of the power-supply output to the high-voltage regulator circuit. Potentiometer R841 sets the high voltage. If the output voltage changes from this set value, a portion of the change appears at the grid of V814B as an error signal. The error signal is amplified by V814B and V814A and applied to the screen grid of the High Voltage Oscillator V800. The change in screen voltage on the oscillator causes either an increase or a decrease in the amplitude of the oscillations. The change in amplitude of the oscillations is always in a direction to compensate for the error in the output voltage.

The output voltage from V832 is not regulated directly, but is regulated indirectly by the operation of the V800 screen grid regulator loop.

Capacitor C842 greatly increases the ac loop gain of the high-voltage regulator circuit. This permits the regulator to quickly compensate for rapid changes in the output voltage.

## Crt Circuits

Voltage for the control grid of the crt is obtained from R834 and R833 at the output of the control grid power supply. By varying the setting of the INTENSITY control R834, the voltage at the control grid relative to the cathode can be changed to provide the desired display brightness. Beginning with S/N 249, neon glow tubes B852-B853 were added. The bulbs ignite only when the INTENSITY control is fully counterclockwise. Thus, both the grid and cathode of the crt are protected from arcing.

Voltage for the focus grid of the crt is obtained from potentiometer R845. The Astigmatism element receives its voltage from potentiometer R864. Varying both R845 and R864 affects the crt spot size.

The presence and intensity of the crt beam is controlled by signals from each of the three plug-in units used with the Type 567. The oscilloscope uses deflection unblanking during the sweep interval. In this method an additional pair of deflection plates in the crt electron gun deflects the beam off the screen except during the sweep. When the horizontal sweep is triggered, the unblanking signal is applied from the time-base unit through terminal 13 of J21 to one of the unblanking deflection plates. The unblanking signal then moves the electron beam rapidly on screen for the duration of the sweep. The beam is then deflected off screen again until time for the next sweep.

Chopped mode blanking signals from a multi-trace vertical plug-in unit are applied through terminal 24 of J11 to the cathode of the crt. These blanking signals are used to blank switching transients which result when the plug-in unit is operated in the chopped mode. Chopped blanking prevents the chopping transients from being displayed on the crt at normal intensity.

Intensity brightening of the crt trace by either the digital unit or a two-sweep time-base unit is accomplished by coupling brightening signals to the reference voltage for the crt grid-voltage supply. The brightening signal from the digital unit changes the overall grid supply voltage through terminal 15 of J32. The brightening signal from the two-sweep timing unit changes the overall grid supply voltage through terminal 14 of J21. Two diodes, D836 and D837, provide a low-impedance return for the crt grid circuit, reducing intensity modulation caused by any normal power-supply ripple. Diode D835 disconnects +125 volts applied to terminal 14 of J21 by some plug-in units.

Sharply differentiated blanking pulses from the vertical sampling unit are applied to the crt cathode through terminal 24 of J11 to turn off the crt beam between sampling dots. Thus, the crt beam is blanked between dots, avoiding possible display confusion.

A beam rotator coil around the crt is used to align the oscilloscope trace with the horizontal graticule markings. The magnetic field set up by the coil deflects the electron beam up on one side of the crt and down on the other. By varying the strength and direction of the field with the CRT BEAM ROTATOR control, the trace can be aligned with the graticule markings.

## Amplitude Calibrator (S/N 2060-up)

The Amplitude Calibrator is a two-frequency signal source that is crystal controlled at 20 kc and rc time-constant controlled at approximately 1 kc. An astable multivibrator drives both a divide-by-two bistable multivibrator and a positive slope differentiator circuit. Square waves of known amplitude at the front-panel connectors come from the ÷2 circuit, and positive pretrigger pulses come from the differentiator circuit. The ÷2 circuit clamps off the differentiator every other astable cycle. Thus, the positive pretrigger pulse is generated approximately $1/4$ cycle before each positive portion of the output square wave.

Selection of output frequency is by a front-panel 20 KC-≈1 KC toggle switch. The switch is open for 20-kc operation, but is closed for 1-kc operation. 20-kc operation places a series-mode 40-kc crystal in the feedback path. 1-kc operation places a 0.0033 $\mu$f capacitor across the crystal, making feedback capacitive and the frequency rc controlled.

**Astable Oscillator.** Q900 and Q914 form a common-emitter astable multivibrator. The regenerative feedback circuit consists of the common connection of the two transistor emitters, and the crystal (Y905) from Q900 collector to Q914 base for 20-kc operation, or C904-D904 in parallel with the crystal for 1-kc operation. D904 is reverse biased (for 20-kc operation) by the voltage divider R912-R914; thus C904 is effectively switched out of the circuit. D904 is forward biased when SW915 connects R915 in parallel with R912, connecting C904 in parallel with Y905. Both circuit conditions are shown in simplified form in Fig. 3-1.

Fig. 3-1a shows the active circuit elements for 20-kc operation. Note the parallel resistance value with equivalent voltage source for R908 and R909. The +21 volts is the value of divider voltage when no current is drawn through either R905 or R906. If either base draws current through its 20-k resistor, the +21 volts acts as if it has a 16.6-k source resistance. Fig. 3-1b shows the active circuit elements for 1-kc operation. D904 is a low resistance when it is forward biased placing C904 in parallel with Y905.

Fig. 3-2 shows four astable circuit waveforms during 1-kc operation. D904 and C904 are drawn between waveforms for study purposes. Note that D904 is forward biased when Q900 collector is positive, but reverse biased when Q900 collector is near ground; C904 receives a charge while Q900 collector is positive, but loses its charge when Q900 collector is near ground.

A 2-kc operation cycle is as follows: Assume Q900 collector has just gone positive. D904 connects C904 from Q900 collector to Q914 base. Q914 base is taken about 12.6 volts more positive (due to previous C904 18-volt charge) cutting Q914 off. Q900 collector low resistance connects C904 between +15 volts and +32.6 volts at the junction of Q914 base and R905. Q914 base draws no current, so C904 begins to discharge through R905 and Q900 collector. Point #1 of Fig. 3-2 has just been reached. As Q914 base wave-

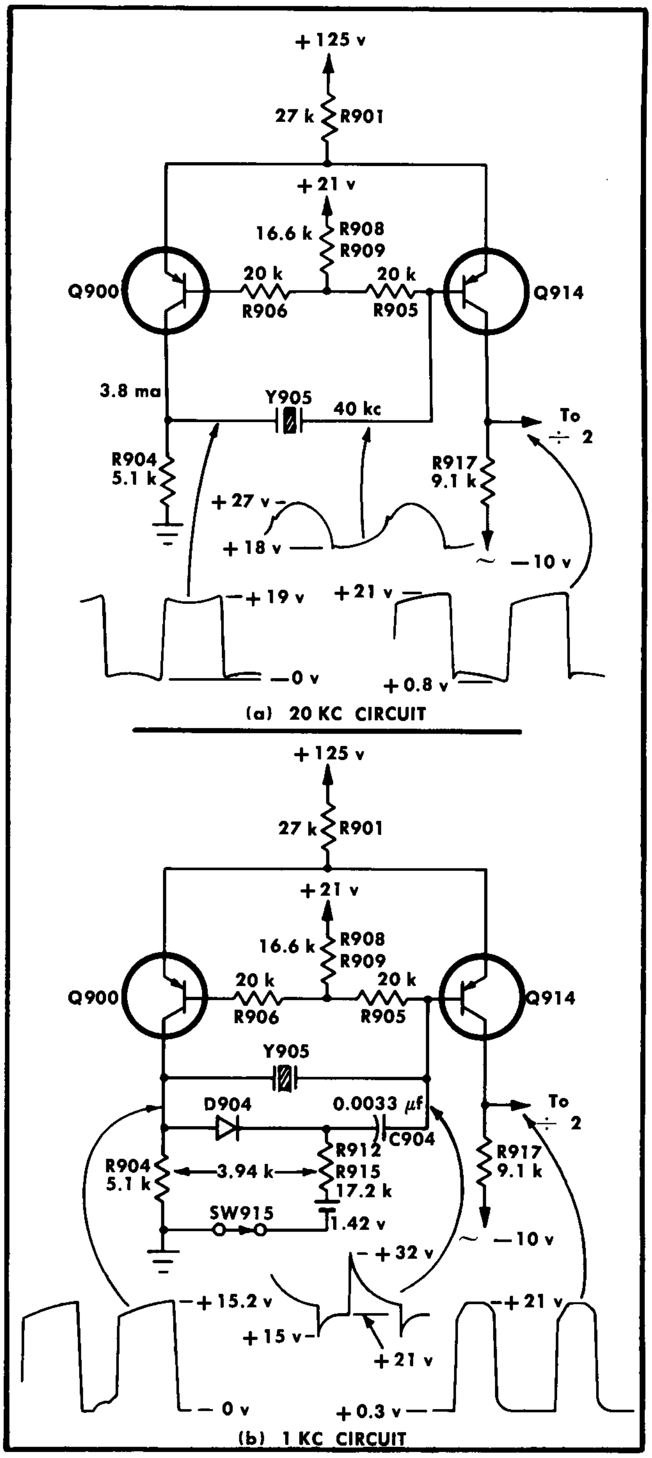



Fig. 3-1. Simplified Amplitude Calibrator astable circuits.

form drops toward +21 volts, Q900 collector voltage is prevented from quite reaching +15.2 volts. The fast drop of Q914 base waveform and slow rise of Q900 collector waveform are due to C904 discharge. As the base of Q914 reaches +22.5 volts (point #2 of Fig. 3-2) Q914 begins to conduct, adding to the current of common emitter resistor R901. Regenerative action follows immediately as Q914 emitter carries Q900 emitter toward reverse bias. Q900 collector falls as its emitter is taken negative, disconnecting D904 from C904. C904 is now connected at one end to about +1.42 volts through the equivalent resistance of 17.2 k (parallel resistance value of R912 and R915), and to the base of Q914 at the other end. The charge on C904 limits its fall at D904 cathode to about +8 volts because Q914 base begins to draw current when the base reaches +15 volts. The parallel resistance of R912-R915 and the base current of Q914 recharge C904. As the current through R912-R915 decreases (nearing point #3 of Fig. 3-2) the current through Q914 decreases letting the common emitter voltage go positive, causing Q900 to again conduct. Q900 conduction begins and its collector rises about 2.5 volts before D904 again connects the regenerative feedback circuit so the astable will flip. As D904 conducts, fast regenerative action turns Q914 off and Q900 on. The cycle is complete and C904 begins to discharge to repeat the process.

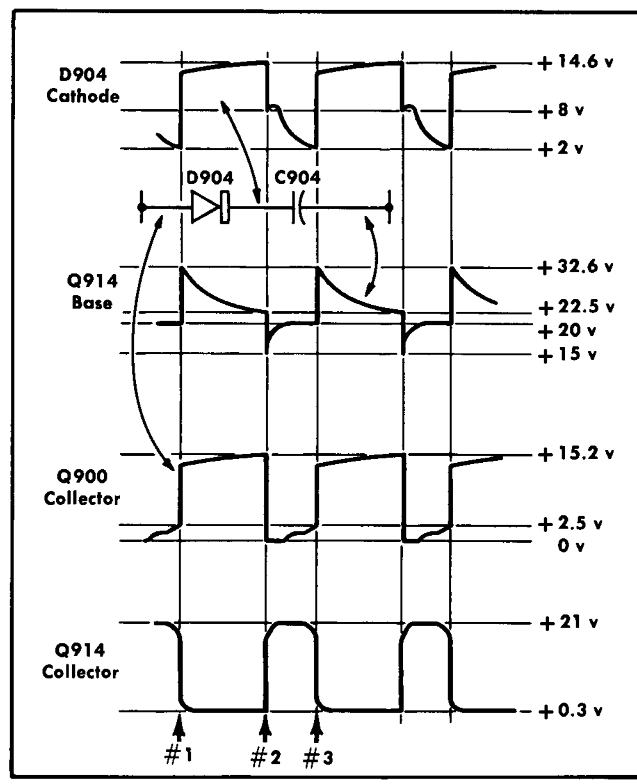



Fig. 3-2. Astable multivibrator waveforms during 1-kc operation.

A 40-kc operation cycle follows the same sequence of events, except that Y905 is the feedback element between Q900 collector and Q914 base and D904 is reverse biased all the time. Y905 is an open circuit at all frequencies other than its series resonant frequency of 40 kc. The waveform at the base of Q914 in Fig. 3-1a shows the crystal sine wave nature when Q914 is cut off. Base current of Q914 flattens off the waveform bottom as Y905 provides turn-on base current during the time Q914 conducts.

Once 40-kc oscillation is established, the crystal assumes a mechanical vibration at the rate of oscillation. At the time the operator switches from 20-kc to 1-kc operation the crystal mechanical vibration is seen to die out during the first few

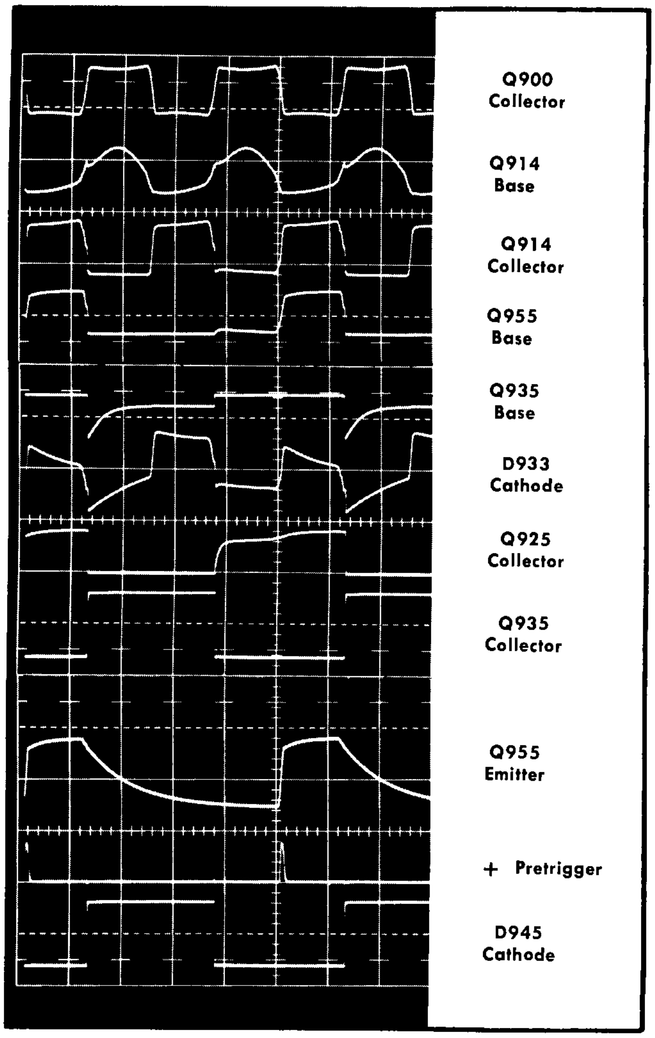



**Fig. 3-3. Amplitude Calibrator time diagram. Operation at 20 kc (partial graticule shown).**

moments of 1-kc operation. Actually, the crystal aids in coupling energy when the astable is operating at 2 kc because the rapid voltage changes at each switching time contain high frequencies. The crystal then "locks in" the 2-kc oscillations causing the 1-kc output signal to be very stable. The actual frequency of 1-kc output cannot be specified tightly because the crystal's ability to lock-in 2-kc oscillations is dependent upon transistor beta and other variables.

**÷2 Multivibrator.** Q925 and Q935 form a triggerable bistable multivibrator that divides the astable output frequency by two. It drives the output voltage divider and controls the +Pre Trigger emitter-follower Q955. The time relationships of several points throughout the whole Amplitude Calibrator are shown in Figs. 3-3 and 3-4. Each figure is made up of three multiple-exposure photographs made by externally triggering the test oscilloscope to guarantee time coincidence of each waveform; voltage amplitudes are uncalibrated.

Assume Q925 is conducting and is saturated so its collector voltage is less than a volt positive. Voltage divider R925-R937 from Q925 collector to Q935 base sets Q935 base at about −1.5 volts, assuring that Q935 is completely cut off. D935 in Q935 collector circuit permits the output voltage divider to disconnect from R934-R935. D935 anode voltage is about +5.5 volts and its cathode and Q935 collector are at about +20.2 volts. Q935 collector voltage is set by the output voltage divider. Thus, D935 assures that the output voltage divider will not be loaded by the ÷2 circuit during the positive portion of the output signal. The output voltage is adjusted by R943, and is completely independent of the ÷2 circuit.

Q925 conduction draws current through both its normal collector load R924, and through R952-D953-D954-R954 to bias D951 and Q955 to cutoff. When D951 is cut off, Q955 cannot receive positive pulses from the astable circuit.

The ÷2 multivibrator switches states whenever the astable output goes negative. R922 holds D923 cathode slightly negative in respect to its anode, but not conducting. As the astable output goes negative, C923 couples a turn-off pulse through D923 to the base of Q925. (D933 was held about 7 volts reverse biased with Q935 cut off.) As Q925 starts

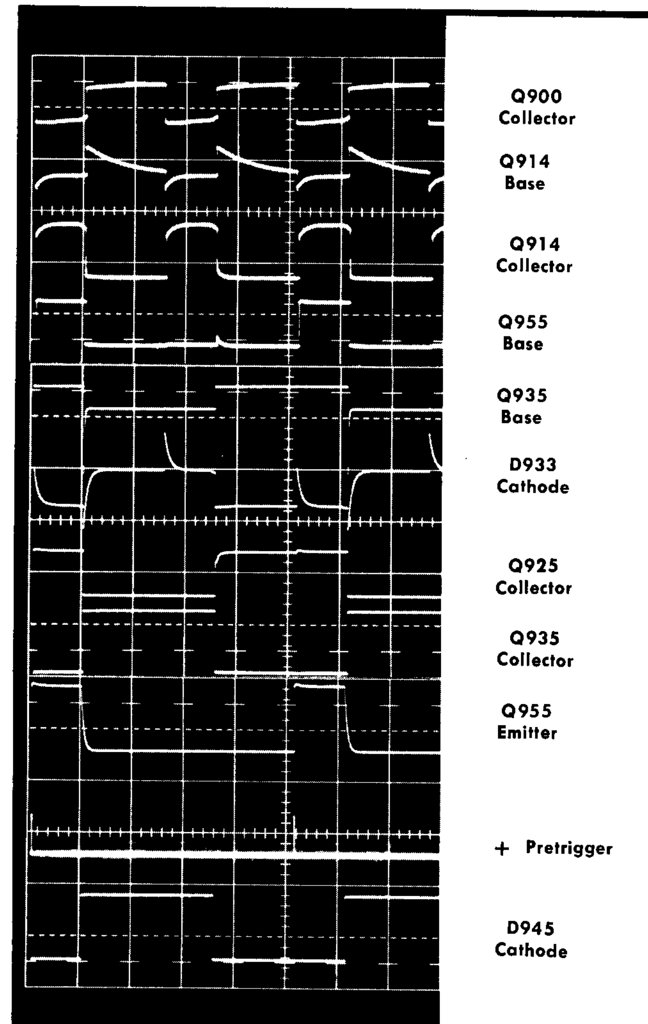



**Fig. 3-4. Amplitude Calibrator time diagram. Operation at 1 kc (partial graticule shown).**

to turn off, its collector voltage rises positive, C925 applies turn-on bias to Q935 base and the ÷2 circuit switches. Regenerative feedback is applied to Q925 base by Q935 collector and C935.

Q935 collector now rests at less than +0.2 volt, close enough to ground that D945 of the output divider carries no current. Q935 collector current passes through both its normal collector load R934 and the series resistance of R940-R941-R943.

Q925 is cut off and its collector rests at +5 volts. The ÷2 circuit will change states the next time the astable output goes negative and the cycle will repeat.

**+Pre Trigger circuit.** The +Pre Trigger circuit is an emitter-follower and differentiator circuit that responses to positive signals from the astable circuit if Q925 is cut off. When Q925 is conducting, D951 anode is held at about +1.5 volts preventing any positive signal from being applied to the base of Q955. Thus it is that a +Pre Trigger pulse is formed only when the output signal is at ground and Q925 is cut off. D954 allows Q925 collector to rise for rapid switching of the ÷2 circuit. C954 serves as a low impedance so any stored charge in D954 will not be applied to Q955 base. C954 also releases Q955 base slowly as R954 charges C954 so Q925 positive change does not reach Q955 base as a signal. D953 disconnects C954 from Q955 base so signals can couple through D951 and turn on the emitter-follower. Q955 emitter faithfully follows every other positive astable output pulse. C957 differentiates Q955 emitter signal and D959 couples only the positive pulse to the output. Any negative change at Q955 emitter, from either the astable signal drop or from Q925 collector pulling down, is stopped from reaching the output by D959.

## Amplitude Calibrator (S/N 101-299)

The calibrator consists of a bistable multivibrator, V884A and V884B, which is triggered at the line frequency by a 6.3-volt ac signal applied to the cathode of V884A. The signal at the cathode of V884A switches the multivibrator between its two states. When V884A is conducting, the low voltage at its plate cuts off V884B. Or, when V884B is conducting, its low plate voltage lowers the grid voltage of V884A sufficiently to cut V884A off. Thus, both tubes do not conduct at the same time.

When V884A is cut off, the voltage at the control grid and cathode of V884B is determined by the setting of the CAL AMPL control, R871. This determines the maximum voltage level reached by the square-wave output. The square waves start at ground at the time V884B is cut off and reach the maximum amplitude established by R871 when V884A is cut off. The CAL AMPL control is adjusted to give the appropriate output square-wave amplitudes via the output divider R885 through R889.

## Amplitude Calibrator (S/N 300-2049)

R890 was added at S/N 300 so the 0.5 output jack will provide a 100-mv peak-to-peak signal into 50 ohms. No other alterations were made and the circuit description is the same as above.

# SECTION 4
# MAINTENANCE

## Visual Inspection

If trouble occurs in the Type 567, make sure the associated equipment is operating and the controls are properly set. If it is determined that the trouble is definitely in the Type 567, a visual check may reveal the cause. Defects such as loose or broken connections, frayed or broken cables, damaged connectors, and burned components can generally be detected by a visual inspection. Except for heat-damaged components the remedy for such defects is obvious. Overheating of components is usually a symptom of other, less apparent troubles in the circuit. For this reason, it is essential to determine the actual cause of overheating before the damaged parts are replaced; otherwise, the damage may be repeated.

## Parts Removal and Replacement

Whenever a part is replaced, check and adjust the instrument calibration as necessary. Most parts in the Type 567 can be replaced without detailed instructions. Some, however, are best removed and replaced by using definite procedures contained in the following paragraphs. (Parts ordering information is included in the Parts List section of this manual.)

CAUTION

**Turn ac power off before removing tubes or transistors from their sockets.**

**Transistor Replacement.** Transistors should not be replaced unless they are actually defective. Transistor defects usually take the form of the transistor opening, shorting, or developing excessive leakage. To check a transistor for these and other defects, use a transistor curve display instrument such as a Tektronix Type 575. However, if a good transistor checker is not readily available, a defective transistor can be found by signal-tracing, by making in-circuit voltage checks, by measuring the transistor forward-to-back resistance using proper ohmmeter resistances, or by using the substitution method. The location of all transistors is silk-screened on the chassis next to each socket.

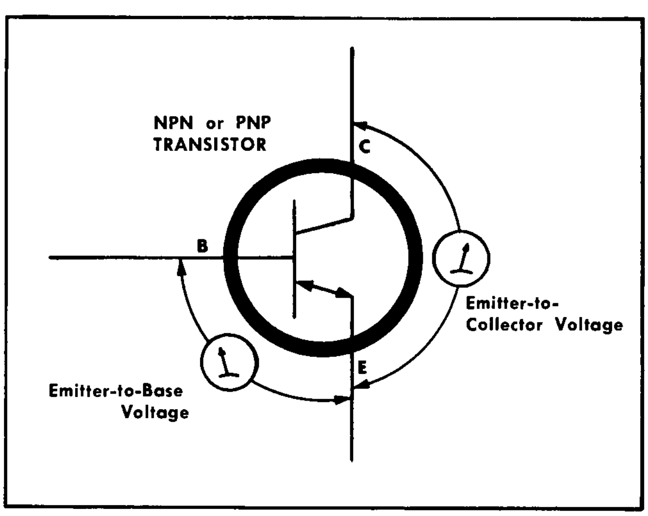



**Fig. 4-1. In-circuit voltage checks NPN or PNP transistors.**

To check transistors using a voltmeter, measure the emitter-to-base and emitter-to-collector voltages and determine if the voltages are consistent with the normal resistances and currents in the circuit (see Fig. 4-1).

To check a transistor using an ohmmeter, know your ohmmeter ranges, the currents they deliver, and the internal battery voltage(s). If your ohmmeter does not have sufficient resistance in series with its internal voltage source, excessive current will flow through the transistor under test. Excessive current and/or high internal ohmmeter source voltage may permanently damage the transistor.

NOTE

**As a general rule, use the R×1 k range where the current is usually limited to less than 2 ma and the internal voltage is usually 1½ volts. You can quickly check the current and voltage by inserting a multimeter between the ohmmeter leads and measuring the current and voltage for the range you intend to use.**

When you know which ohmmeter ranges will not harm the transistor, then use those ranges to measure the resistance with the ohmmeter connected both ways as given in Table 4-1.

**TABLE 4-1**

Transistor Resistance Checks

| Ohmmeter Connections[1] | Resistance Readings That Can Be Expected Using the R × 1 k Range |
|---|---|
| Emitter-Collector | High readings both ways (about 60 k to around 500 k). |
| Emitter-Base | High reading one way (about 200 k or more). Low reading the other way (about 400 Ω to 2.5 k). |
| Base-Collector | High reading one way (about 500 k or more). Low reading the other way (about 400 Ω to 2.5 k). |

**[1]Test prods from the ohmmeter are first connected one way to the transistor leads and then the test prods are reversed (connected the other way). Thus, the effects of the polarity reversal of the voltage applied from the ohmmeter to the transistor can be observed.**

If there is doubt about whether the transistor is good or not, substitute a new transistor, but first be certain the circuit voltages applied to the transistor are correct before making the substitution.

When checking transistors by substitution, be sure that the voltages and loads on the transistor are normal before making the substitution. If a transistor is substituted without first checking out the circuit, the new transistor may immediately be damaged by some defect in the circuit.

**Tube Replacement.** Tester checks on tubes used in the Type 567 are not recommended. Tube testers sometimes indicate a tube to be defective when that tube is operating satisfactorily in a circuit, or they may fail to indicate tube defects which affect the performance of the circuits. The criterion for the usability of a tube is whether or not it works properly in the circuit. If it does not, it should be replaced. Unnecessary replacement is not only expensive but may also require needless recalibration of the instrument.

**Lamp Replacement.** The graticule illumination lamps are bayonet Type 44, 6-8 volt bulbs. Remove the four bezel nuts, lift away the bezel and graticule eyebrow, and replace the lamps in the normal manner.

## Air Filter

The Type 567 Oscilloscope is cooled by air drawn through a plastic disposable filter located at the rear of the instrument. If the filter becomes excessively dirty, it will restrict the flow of air and may cause overheating. High internal temperatures will not only reduce the lifetime of the instrument components, but may also cause the thermal cutout to open at inconvenient times. If the oscilloscope is wired for 117 volts, the fan motor continues to run when the thermal cutout opens but all other power in the instrument is disconnected. If the instrument is wired for 234 volts, all power in the instrument including the fan is disconnected when the cutout opens. Any time that the thermal cutout opens, the filter should be checked immediately. When the interior temperature of the instrument has returned to the safe level, the thermal cutout will close to reapply power to the instrument.

The filter should be visually checked every few weeks. It should be replaced at least every three or four months, and more often if required.

## Fan Motor

Fan motor bearings have been lubricated at the factory and should not require further lubrication more often than about every six months. One or two drops of light machine oil on the bearings is adequate.

## Removal of Panels

The side, top, and bottom panels of the Type 567 can be removed separately for maintenance work. All panels are held in place by small coin-slot fasteners. To remove the panels, use a screwdriver or coin to rotate the fastener approximately two turns counterclockwise. Pull the upper portion of the side panels outward from the top. After first releasing the fasteners, the top and bottom panels can be lifted off. Panels can be replaced by reversing the order of their removal.

## Cleaning

The Type 567 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It also provides a possible electrical conduction path.

Loose dust accumulated on the outside of the Type 567 can be removed with a cloth or small paint brush. The paint brush is particularly useful for dislodging dust on and around the front-panel controls. Dirt which remains can be removed with a soft cloth dampened in a mild solution of water and detergent. Abrasive cleaners should not be used.

The high-voltage circuits, including parts located under the high-voltage shield, should receive special attention. Excessive dust and dirt in these areas may cause high-voltage arcing and result in improper instrument operation.

CAUTION

**Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Some chemicals to avoid are benzene, toluene, zylene, acetone, or similar solvents.**

To clean the crt protector plate and the face of the crt, first remove the four bezel mounting nuts. Then, remove the bezel and the protector plate. Clean all surfaces with a soft, lint-free cloth dampened with mild detergent and water. Repeat with a cloth dampened with water only.

## Recalibration

To assure accurate measurements check the calibration of this instrument after each 500 hours of operation or every six months if used intermittently. Complete calibration instructions are given in Section 5.

The calibration procedure can also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles, not apparent during normal use, may be revealed and/or corrected by recalibration.

## Resistor Coding

The Type 567 uses a number of very stable metal film resistors identified by their gray background color and color coding.

If the resistor has three significant figures with a multiplier, the resistor will be EIA color coded. If it has four significant figures with a multiplier, the value will be printed on the resistor. For example, a 333-k resistor will be color coded, but a 333.5-k resistor will have its value printed on the resistor body.

The color-coding sequence is shown in Fig. 4-2, and Table 4-2.

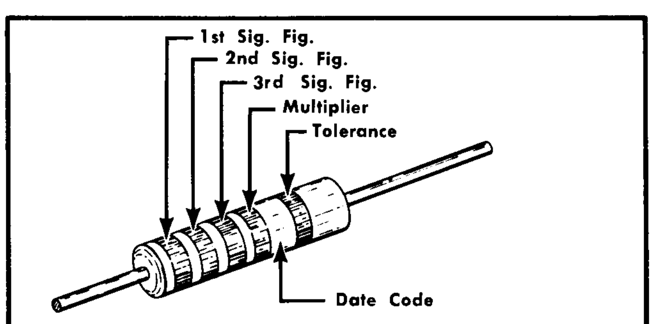



**Fig. 4-2. Standard EIA color code for metal film resistors.**

**TABLE 4-2**

Color Code Sequence

| Color | 1st Sig. Fig. | 2nd Sig. Fig. | 3rd Sig. Fig. | Multiplier | (±) % Toler-ance |
|---|---|---|---|---|---|
| Black | 0 | 0 | 0 | 1 | - |
| Brown | 1 | 1 | 1 | 10 | 1 |
| Red | 2 | 2 | 2 | 100 | 2 |
| Orange | 3 | 3 | 3 | 1,000 | - |
| Yellow | 4 | 4 | 4 | 10,000 | - |
| Green | 5 | 5 | 5 | 100,000 | 0.50 |
| Blue | 6 | 6 | 6 | 1,000,000 | 0.25 |
| Violet | 7 | 7 | 7 | 10,000,000 | 0.10 |
| Gray | 8 | 8 | 8 | 100,000,000 | 0.05 |
| White | 9 | 9 | 9 | 1,000,000,000 | - |
| Gold | - | - | - | 0.1 | 5 |
| Silver | - | - | - | 0.01 | - |
| No Color | - | - | - | - | 10 |

## Ceramic Terminal Strip Replacement

A complete ceramic terminal strip assembly is shown in Fig. 4-3. Replacement strips (including studs) and spacers are supplied under separate part numbers. The old spacers may be reused unless they are damaged.

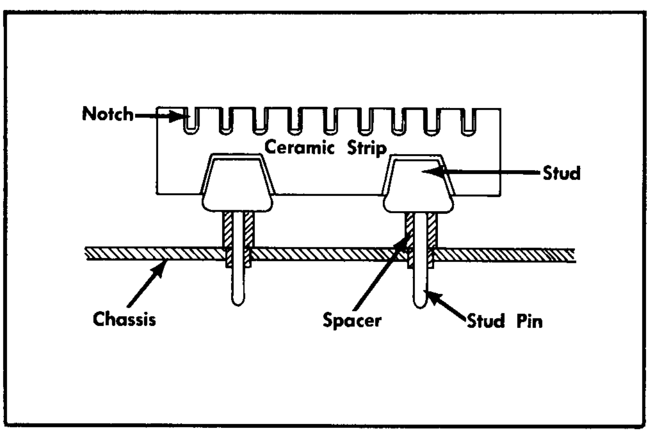



**Fig. 4-3. Ceramic terminal strip assembly.**

After the damaged strip has been removed, place the undamaged spacers in the chassis holes. Then, carefully press the studs into the spacers until they are completely seated. If necessary, use a soft mallet and tap lightly directly over the stud area of the strip.

## Soldering

**Ceramic Terminal Strips.** Solder used on the ceramic terminal strips should contain about 3% silver. Ordinary 60/40 solder can be used occasionally without damage to the ceramic terminal strips. Use a 40- to 75-watt soldering iron with a 1/8" wide chisel-shaped tip. If ordinary solder is used repeatedly or if excesive heat is applied, the solder-to-ceramic bond can be broken.

A small supply of solder containing about 3% silver is included on a spool mounted inside the instrument near top center, just behind the Amplitude Calibrator. Additional solder should be available locally, or it can be purchased from Tektronix in one-pound rolls; order by Tektronix Part No. 251-0514-00.

Observe the following precautions when soldering ceramic terminal strips:

1. Use a hot iron for a short time. Apply only enough heat to make the solder flow freely.

2. Maintain a clean, properly tinned tip.

3. Avoid putting pressure on the ceramic terminal strip.

4. Do not attempt to fill the terminal-strip notch with solder; use only enough solder to cover the wires adequately.

**Metal Terminals.** When soldering metal terminals (e.g., switch terminals, potentiometers, etc.), ordinary 60/40 solder can be used. The soldering iron should have a 40- to 75-watt rating with a 1/8" wide chisel-shaped tip.

Observe the following precautions when soldering metal terminals.

1. Apply only enough heat to make the solder flow freely.

2. If a wire extends beyond the solder joint, clip the excess close to the joint.

3. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.

## Cathode-Ray Tube

Use the following procedure for removal and replacement of the crt:

WARNING

**Use care when handling a crt. Avoid striking it on any object that might cause it to crack and implode. Flying glass from an imploding crt can cause serious injury. Wear safety glasses or a plastic face mask.**

1. Disconnect the instrument power.

2. Place the instrument on a level workbench.

3. Remove the crt bezel. Note the faceplate position.

4. Carefully remove the four neck-leads. Use long-nose pliers and slowly pull each clip off its neck pin.

5. Loosen the 10-32 bolt in the white plastic crt rear neck clamp.

6. Place one hand over the crt face. With the other hand push gently on the crt socket until the tube moves slightly forward. Remove the socket and push on the center of the crt base. Carefully guide the tube out the front, so as not to touch the magnetic shield with the neck pins.

To install a new crt:

1. Position the tube with two neck pins at both the left side and top.

2. Carefully insert the tube into the magnetic shield, being careful not to touch the shield with the neck pins.

3. Extend the finger of one hand into the rear end of the shield to help guide the base into place. Push the crt into place so the front of the tube is correctly positioned as noted above.

4. Tighten the 10-32 bolt in the plastic clamp until the crt neck is held firmly. DO NOT OVERTIGHTEN.

5. Use long-nose pliers and carefully install the neck clips to the neck pins; observe the color code as marked on the shield near each opening.

6. If the crt face is not parallel with the front panel, use a 7/64" allen wrench to loosen the two blued bolts at the mounting clamp. Raise, lower, or otherwise position the crt socket so the face is correctly positioned. Tighten the blued bolts and check that the neck pins are not grounded.

7. Reinstall the bezel and recalibrate the instrument per the Calibration Procedure.

## Troubleshooting

In the event of trouble, help with the particular problem may be obtained by reading the circuit description. Voltage checks and normal troubleshooting procedures will lead to the trouble and its correction.

When a trouble occurs in the instrument, an attempt should be made to isolate the trouble by quick operational and visual checks. You should first recheck the settings of all controls on the oscilloscope and plug-in units. Then, operate the front-panel controls to see what effect, if any, they have on the trouble. The normal or abnormal operation of the various controls will allow you to firmly establish the trouble symptoms.

Many troubles occurring will likely be located in one of the three plug-in units used with the Type 567. The first step required in troubleshooting the system is to determine if the trouble is in the Type 567 or in one of the plug-in units. The fastest and best way to determine this is by substituting other plug-in units in the oscilloscope. If other plug-in units are not available, a quick check can be made by measuring the output and ripple voltages of each regulated power supply and by checking the operation of the crt circuit. If the regulated power supplies and the crt circuit appear to be working properly, the trouble is probably located in one of the plug-in units. In this case, refer to the appropriate plug-in unit instruction manual for troubleshooting information. If the regulated power supplies or the crt circuit are not operating correctly, the trouble is probably in the Type 567.

Most troubles occurring in Tektronix instruments result from the failure of vacuum tubes or transistors. Therefore, if trouble occurs, tubes and transistors should be checked as one of the first steps. It is preferable to check them by substitution rather than with a tester since testers frequently fail to indicate certain troubles which can affect oscilloscope performance. When a tube develops shorted elements, associated components can be damaged. Look for burned resistors, etc., when replacing defective tubes.

To aid in troubleshooting the Type 567, typical circuit voltages are indicated on the circuit diagrams. These voltages may vary slightly from instrument to instrument, but should be quite close to the indicated values.

All wiring used in the Type 567 is color coded to facilitiate circuit tracing. In addition, all regulated power-supply leads are coded with specific color combinations for easy identification. In general, three stripes are placed on the wires of the regulated supplies. The first color (widest stripe) indicates the first number in the voltage on that lead, using the standard EIA number-color equivalencies. The second color indicates the second number in the lead voltage and the third color is a multiplier. The method is similar to the color coding of resistors. Thus, the —100-volt leads are coded brown, black, brown. The voltage is positive if the main color of the wire is white and negative if the main color of the wire is black. Four colors would be required to give all the digits plus a multiplier for the +125-volt leads. To avoid this, the +125 leads are coded as +120; brown, red, brown on a white base.

Reference voltages for most of the low-voltage power supplies are obtained from the —100-volt supply. Therefore, if the —100-volt supply is not operating properly, operation of the other low-voltage supplies will be affected. For this reason, it is important, when trouble is detected in the low-voltage power supply, that the —100-volt supply be checked first. If the output of the —100-volt supply is normal, then troubleshoot the power supply where the trouble was first evident.

If the instrument is not operating, check the obvious things first. Check that the instrument is plugged in and that there is power at the socket. Check that the pilot lamp and tube heaters are lit. If necessary check the line fuse. When the obvious indications and troubles have been checked, proceed to a more detailed analysis of the trouble.

Once it has been determined that the Type 567 contains the trouble, turn off the power and remove all three plug-in

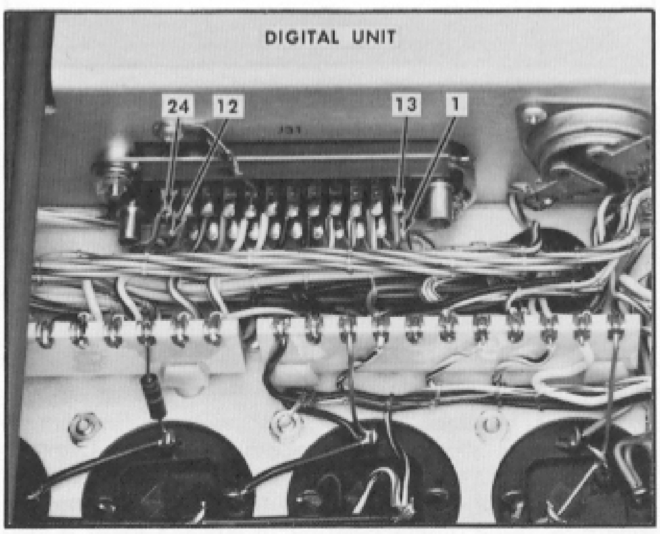



Fig. 4-4. Rear view of J31.

units. Measure power-supply resistances given in Table 4-3. Resistance is measured from the chassis to the low-voltage power-supply test points on J31 shown in Fig. 4-4. (J31 is the top connector right behind the digital unit plug-in cell. The pins numbered in Fig. 4-4 are the top row of pins, most easily reached with the leads of an ohmmeter.) If any resistance values are significantly lower than stated in Table 4-3, complete your circuit tracing using the diagrams at the back of this manual.

In the event of problems in the Amplitude Calibrator, detailed voltages and waveforms appear on the schematic diagram at the back of this manual. A voltmeter and/or a test oscilloscope, with attention to the information on the diagram and in the circuit description, should prove adequate for troubleshooting in the calibrator circuit. The location of all Amplitude Calibrator components is shown in Fig. 4-5.

**TABLE 4-3**

Power-Supply Resistances to Ground

| General | Pin | Circuit | Approx. Res. |
|---|---|---|---|
| J31 | 18 | —100-V regulated | 9 k |
| J31 | 17 | —12.2-V regulated | 110 Ω |
| J31 | 16 | +20-V regulated | 900 Ω |
| J31 | 15 | +125-V regulated | 10 k |
| J31 | 14 | +300-V regulated | 55 k |
| J31 | 22 | +75-V unregulated | 20 k |
| J31 | 23 | +22-V unregulated | 4 k |
| J31 | 24 | +380-V unregulated | 30 k |
| C632 | +pin | +4-V unregulated | 55 Ω |
| C562 | shell | —5-V unregulated | 120 Ω |

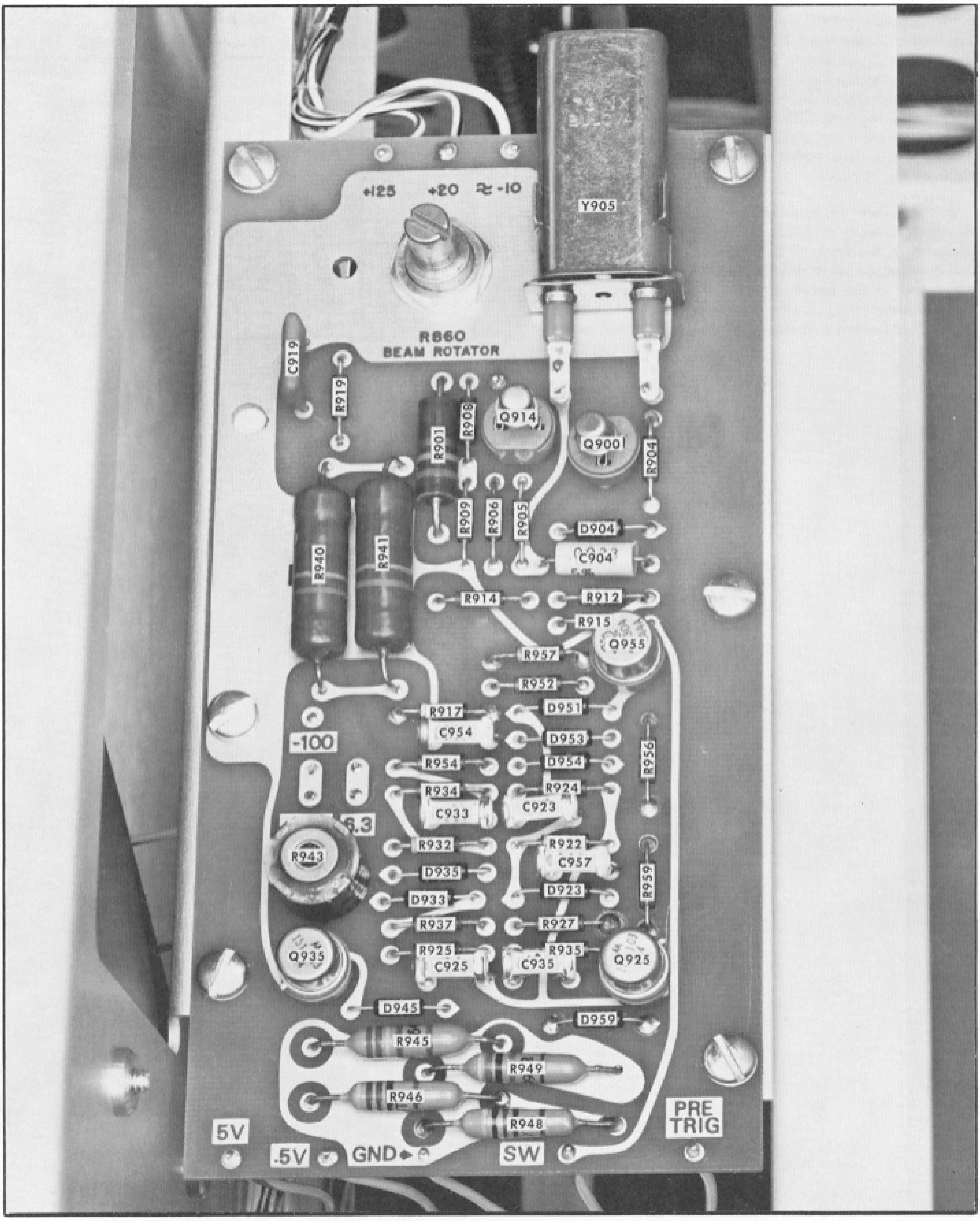



Fig. 4-5. Location of electrical components in Amplitude Calibrator.

# SECTION 5
# CALIBRATION

## Introduction

The information in this section of the manual will enable you to calibrate and check the operation of the Type 567 Oscilloscope. This section may also be used as an aid in isolating troubles occurring within the unit.

Since the number of adjustment controls in the Type 567 is small, only a short time is required to calibrate the instrument.

Care should be taken in adjusting all power-supply voltages. The output of the —100-volt supply affects the output of the other supplies. Changes in power-supply voltages may require additional adjustments in the Type 567 and associated plug-in units to bring the system into proper calibration. Do not adjust the —100 VOLTS control unless the supply output is other than —100 volts.

Changes in high voltage will cause a change in the deflection factors of the crt. This will in turn affect display gain and timing adjustments. Therefore, unless the high voltage is more than 4% from its nominal level, no adjustment of the HIGH VOLTAGE control should be made. An exception is when a complete calibration of the Type 567 and plug-in units is to be made.

This procedure is correct for the Type 567 S/N 2060-up. Notes regarding calibration for earlier instruments follow the main procedure.

## TEST EQUIPMENT REQUIRED

The following equipment, or its equivalent, is required to calibrate and check the operation of the Type 567.

(1) Test oscilloscope with a minimum deflection factor of 5 mv/div, such as the Tektronix Type 545B with Type H Plug-In Unit.

(2) 1× passive probe, such as Tektronix P6028, 3.5 foot with BNC connector. Tektronix Part No. 010-0120-00.

(3) Vertical plug-in unit, such as the Type 3A1 or Type 3S76. Use a plug-in that is normally used in the Type 567.

(4) Horizontal plug-in unit, such as the Type 2B67 or Type 3T77. Use a plug-in that is normally used in the Type 567.

(5) Digital unit, such as the Type 6R1A.

(6) Variable autotransformer. Should vary the line voltage from 105 to 125 volts ac (or 210 to 234 volts ac), minimum of 500-watt rating.

(7) Precision dc voltmeter capable of measuring 50 millivolts to 300 volts. Meter accuracy: ±0.2% or better. Minimum meter resistance of 20,000 Ω/v. Example: Fluke Type 801 Differential Voltmeter.

(8) Dc voltmeter capable of measuring —3.3 kv, ±4%. Minimum meter resistance of 20,000 Ω/v.

(9) Optional square-wave generator capable of delivering 100-kc positive-going square-wave signal between 50 and 100 volts peak to peak. Example: Tektronix Type 105 Square Wave Generator. Must use output inverter Tektronix Type TU-5/105 Adapter, Tektronix Part No. 013-0075-00.[1]

(10) Optional special Tektronix 067-0500-00 Crt Deflection Capacitance Normalizer for 560 Series Oscilloscopes. Tektronix Part No. 067-0500-00.[1]

(11) Two optional BNC 10× attenuators, Tektronix Part No. 011-0059-00.[1]

(12) Optional 1% BNC 50 Ω termination, Tektronix Part No. 011-0049-00.[1]

(13) Accurate time-mark generator capable of producing 100 μsec, 1 msec and 1 sec markers about 3 volts peak to peak, ±0.001% time accuracy. Example: Tektronix Type 180A Time-Mark Generator.

(14) Two 50 Ω coax cables with BNC connectors, 42-inch cable, such as Tektronix Part No. 012-0057-00. (A third cable will be needed in step 12e if sampling plug-in units are used.)

(15) A small screwdriver with insulated handle.

(16) Special low-capacitance tool, for adjusting crt deflection-plate capacitance.

| | Tektronix Part No. |
|---|---|
| Handle, Nylon | 003-0305-00 |
| Adjusting Insert, Nylon | 003-0304-00 |

## PRELIMINARY PROCEDURE S/N 2060-UP

Install the type of plug-in units most used in the Type 567. If sampling units are sometimes used, install them; install the Type 6R1A Digital Unit. Connect the Type 567 power cord to the variable autotransformer and set the output voltage to 117 (234) volts. Switch on the Type 567 power and turn the INTENSITY control fully counterclockwise. Let the instrument warm up for 10 to 15 minutes and then remove the side and top panels.

## SHORT FORM PROCEDURE

☐ 1. (Pg. 5-4) Check/Adjust —100-Volt Supply Voltage.
Real-time Plug-In Units: —99 to —101 volts.
Sampling Plug-In Units: —99.5 to —100.5 volts.
Final Value: ________ Volts.

☐ 2. (Pg. 5-4) Check/Adjust +125-Volt Supply Voltage.
Real-time Plug-In Units: +123.75 to +126.25 volts.
Sampling Plug-In Units: +124.37 to +125.63 volts.
Final Value: ________ Volts.

☐ 3. (Pg. 5-5) Check/Adjust +300-Volt Supply Voltage.
Real-time Plug-In Units: +297 to +303 volts.
Sampling Plug-In Units: +298.5 to +301.5 volts.
Final Value: ________ Volts.

[1]**Optional items required only if step 9 is performed. See note, page 5-12.**

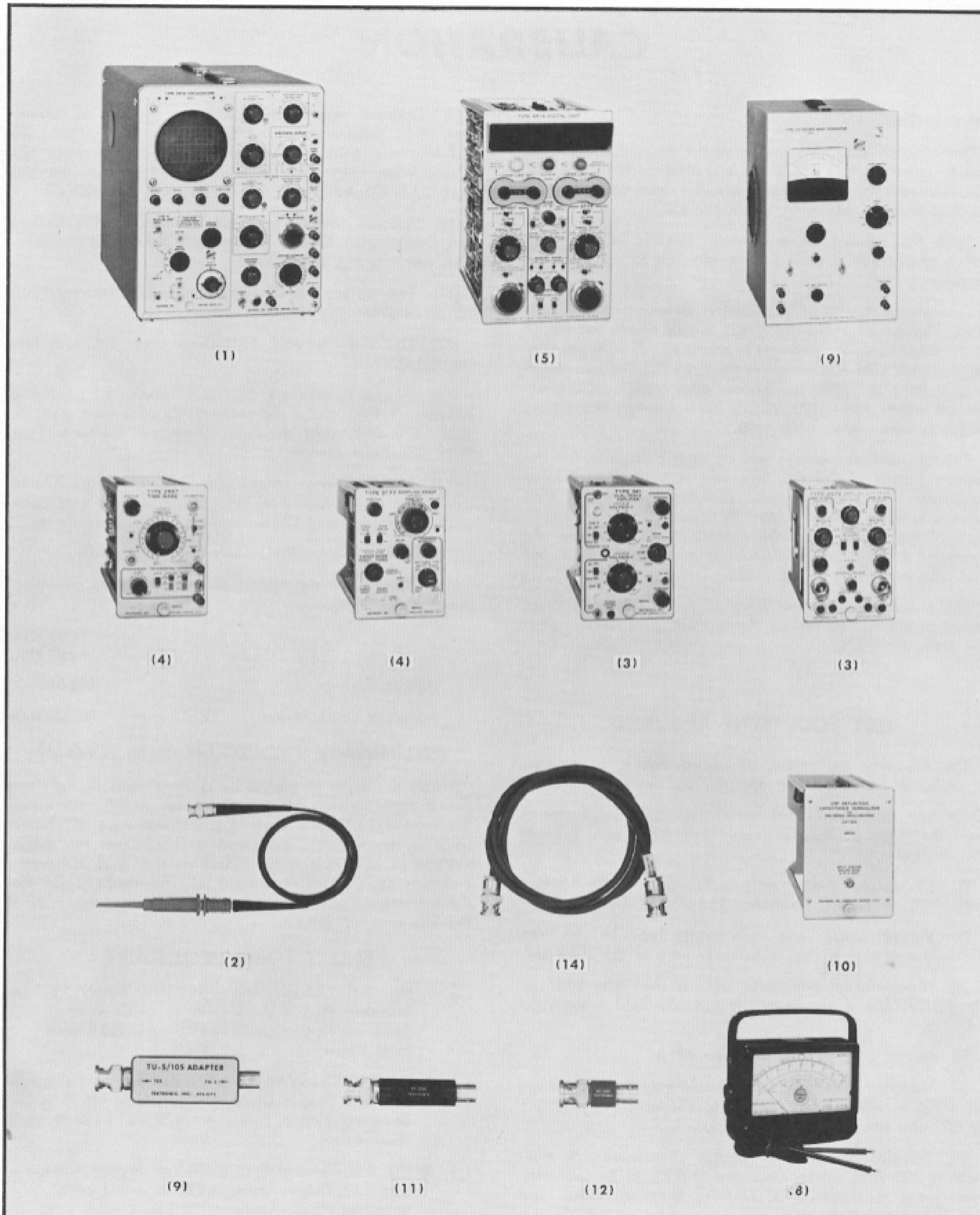



Fig. 5-1A. Recommended test equipment for calibrating the Type 567.

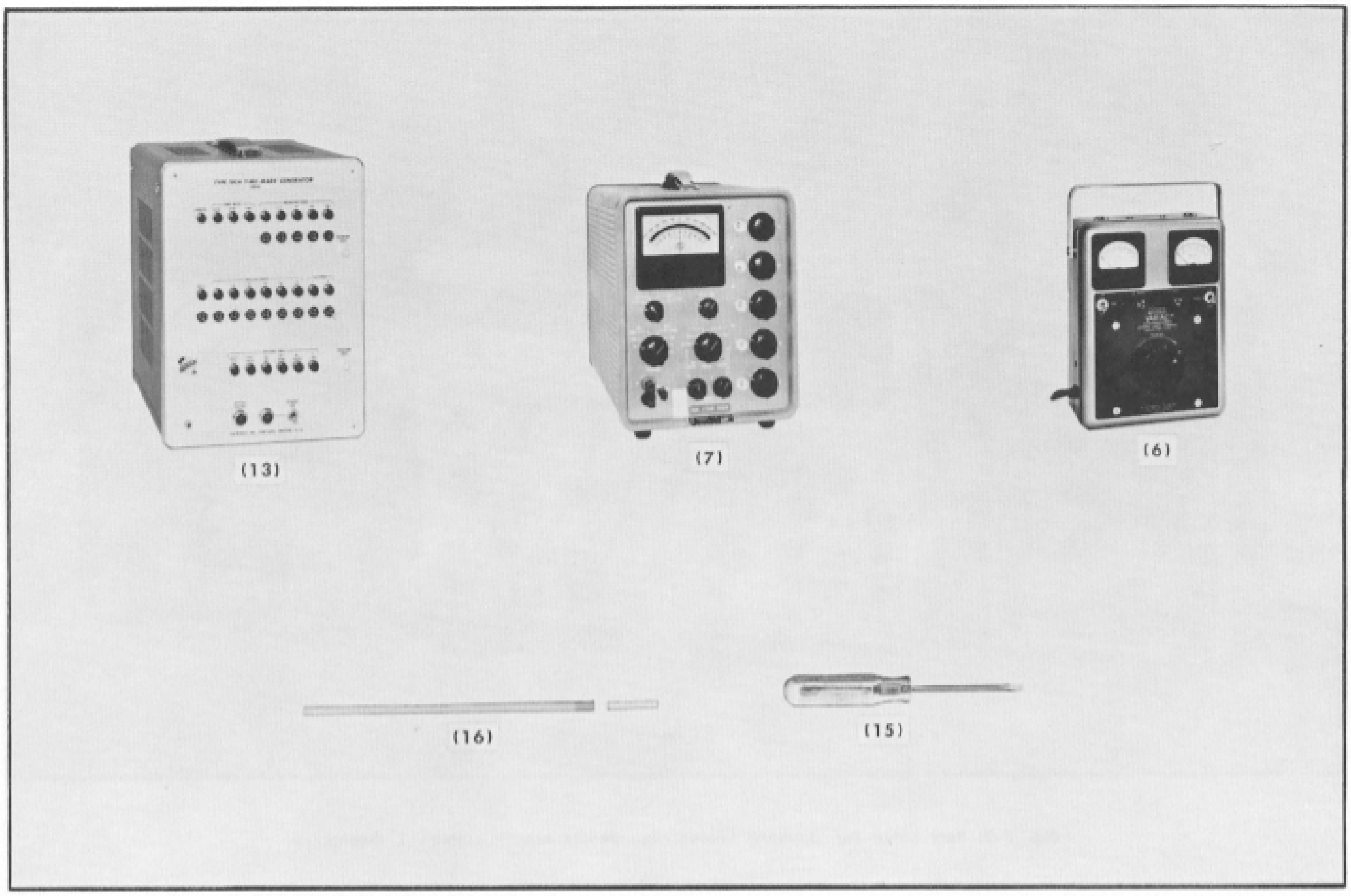



Fig. 5-1B. Recommended test equipment for calibrating the Type 567.

☐ 4. (Pg. 5-5) Check/Adjust —12.2-Volt Supply Voltage.
Limits: —12.078 to —12.322 volts.
Final Value: ________ Volts.

☐ 5. (Pg. 5-5) Check/Adjust +20-Volt Supply Voltage.
Limits: +19.8 to +20.2 volts.
Final Value: ________ Volts.

☐ 6. (Pg. 5-6) Check Low-Voltage Power Supply Ripple. See Table 5-1.
—100: ______ mv. —12.2: ______ mv.
+125: ______ mv. +20: ______ mv.
+300: ______ mv.

☐ 7. (Pg. 5-8) Check/Adjust —3300-Volt Supply Voltage.
Limits: —3268 to —3432 volts.
Final Value: ________ Volts.

☐ 8. (Pg. 5-10) Check Crt Deflection Factors.
Limits: Vertical 148.4 to 162.4 volts/8 div.
Horizontal 175 to 193 volts/10 div.
Final Value: Vert.: ______, Horiz.: ______.

☐ 9. (Pg. 5-12)
Or
☐ 10. (Pg. 5-16) Check/Adjust Crt Deflection-Plate capacitance.
☐ Vertical ☐ Horizontal

☐ 11. (Pg. 5-20) Adjust Crt Beam Rotator, R860.

☐ 12. (Pg. 5-22) Check/Adjust Amplitude Calibrator.
☐ Frequency, ±0.1%.
☐ CAL AMPL Control, R943.
☐ Terminated output.
☐ +PRE TRIGGER Amplitude.

## ADJUSTMENT PROCEDURE

The following steps are given in the sequence required for proper calibration of the Type 567. Adjust only those controls that are out of tolerance. The digital system accuracy is dependent upon power-supply voltage accuracy. Adjustments of the —100-volt supply will usually require adjustment of the remaining low-voltage power supplies. All low-voltage supplies have a ±1% voltage tolerance, but all of them are capable of closer adjustment providing the test voltmeter is sufficiently accurate. Adjustment of any supply in the Type 567 will require some recalibration of the plug-in unit system. When using sampling plug-in units, it is desirable to adjust the —100-, +125- and +300-volt low-voltage supplies to within 0.5%.

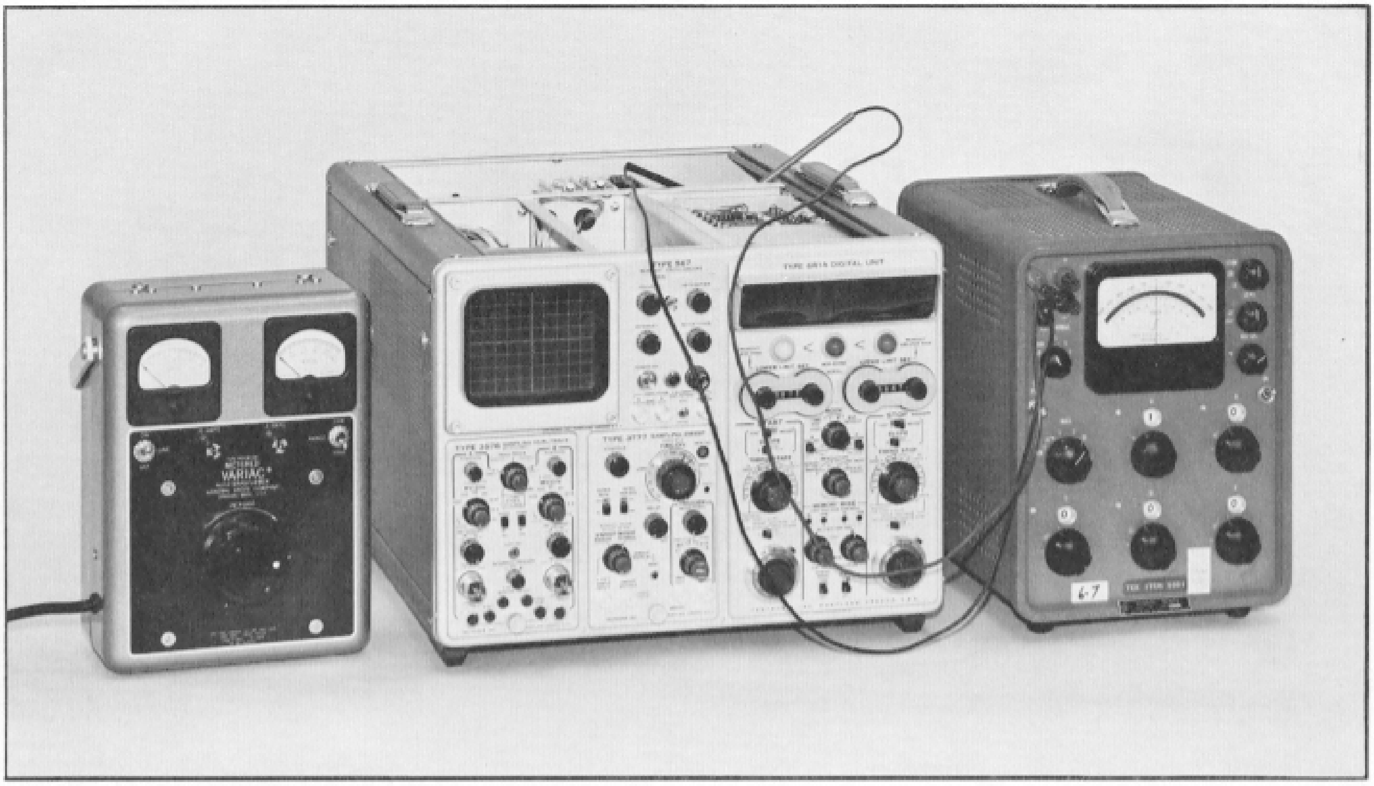


Fig. 5-2. Test setup for checking low-voltage power supplies, steps 1 through 5.

## CONTROL SETTINGS

| | |
|---|---|
| Type 567 | |
| INTENSITY | Fully counterclockwise |
| Vertical Unit | |
| Position control(s) | Midrange |
| Mode | Channel A |
| Other controls | Optional |
| Horizontal Unit | |
| Position control | Midrange |
| No sweep | |
| Digital Unit | |
| All controls | Optional |

## 1. Check/Adjust —100-Volt Supply Voltage

a. Set the autotransformer output to 117 volts (234 volts). Connect the precision voltmeter between the —100-volt test point and ground (see Fig. 5-3). If the voltage is outside the limits of —99 to —101 volts, adjust the —100 VOLTS control, R621 (see Fig. 5-4).

b. Slowly change the output of the variable autotransformer through the range of 105 to 125 volts (210 to 250 volts) and watch the precision voltmeter. The —100 volts should not change more than ±1% of the value read in the preceding paragraph when the autotransformer output was 117 volts (234 volts). As an example, if the 117-volt line value of the —100-volt supply was —99 volts, the voltage must not change outside the limits of —98.01 to —99.99 volts as the line voltage is varied from 105 to 125 volts.

If the supply changes more than ±1% as the line voltage is varied from 105 to 125 volts, the most probable cause is a defective regulator tube. Turn off the instrument and change V627. Repeat steps 1a and 1b.

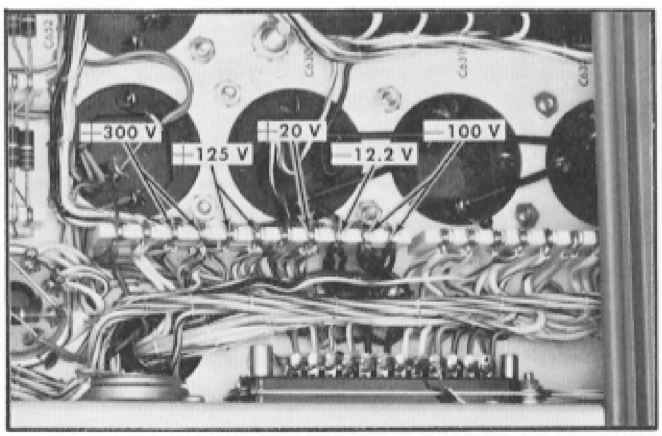



Fig. 5-3. Low-voltage power supply test points, steps 1 through 5.

## 2. Check/Adjust +125-Volt Supply Voltage

a. Set the autotransformer output to 117 volts (234 volts). Connect the precision voltmeter between the +125-volt test point and ground (see Fig. 5-3). If the voltage is outside the limits of +123.75 to +126.25 volts, adjust the +125 VOLTS control, R668 (see Fig. 5-4).

b. Slowly change the output of the variable autotransformer through the range of 105 to 125 volts (210 to 250 volts) and watch the precision voltmeter. The +125 volts should not change more than ±1% of the value read in the preceding paragraph when the autotransformer output was 117 volts (234 volts). As an example, if the 117-volt line value of the +125-volt supply was +125.5 volts, the voltage must not change outside the limits of +124.245 to +126.755 as the line voltage is varied from 105 to 125 volts.

If the supply changes more than ±1% as the line voltage is varied from 105 to 125 volts, the most likely cause is a defective regulator tube. Turn off the instrument and change V677. Repeat steps 2a and 2b. (The +125-volt supply can be caused to vary more than ±1% if the —100-volt supply varies more than ±1%.)

## 3. Check/Adjust +300-Volt Supply Voltage

a. Set the autotransformer output to 117 volts (234 volts). Connect the precision voltmeter between the +300-volt test point and ground (see Fig. 5-3). If the voltage is outside the

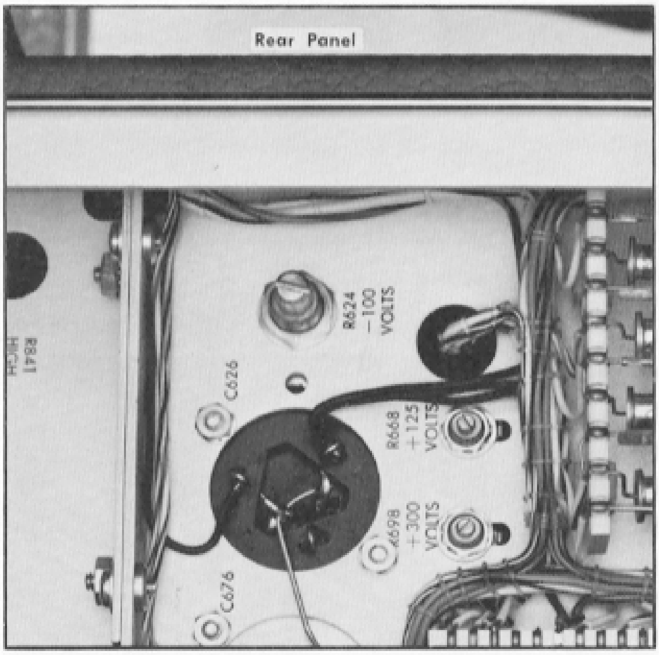



**Fig. 5-4. Upper chassis low-voltage power supply adjustment locations.**

limits of +297 to +303 volts, adjust the +300 VOLTS control, R698 (see Fig. 5-4).

b. Slowly change the output of the variable autotransformer through the range of 105 to 125 volts (210 to 250 volts) and watch the precision voltmeter. The +300 volts should not change more than ±1% of the value read in the preceding paragraph when the autotransformer output was 117 volts (234 volts). As an example, if the 117-volt line value of the +300-volt supply was +301.6 volts, the voltage must not change outside the limits of +297.584 to +304.616 volts as the line voltage is varied from 105 to 125 volts.

If the supply changes more than ±1% as the line voltage is varied from 105 to 125 volts, the most likely cause is a defective regulator tube. Turn off the instrument and change V677. Repeat steps 3a and 3b. (The +300-volt supply can be caused to vary more than ±1% if the —100-volt supply varies more than ±1%.)

## 4. Check/Adjust —12.2-Volt Supply Voltage

a. Connect the precision voltmeter between the —12.2-volt test point and ground (see Fig. 5-3). If the voltage is outside the limits of —12.078 to —12.322 volts, adjust the —12.2 VOLTS control R631 (see Fig. 5-5).

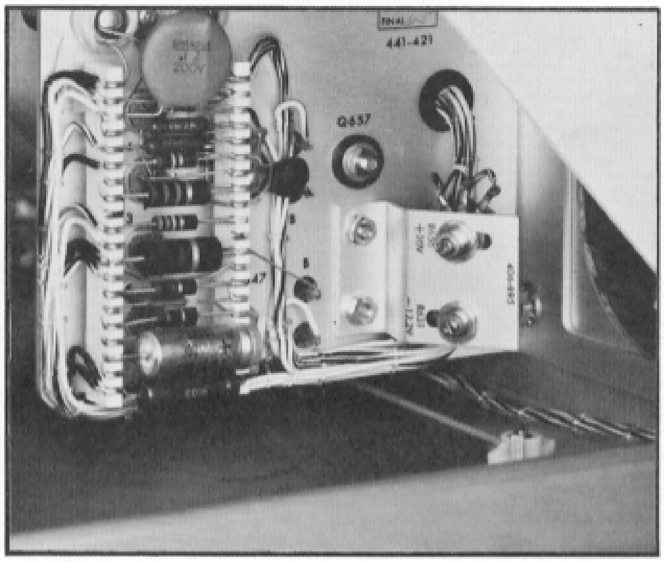



**Fig. 5-5. Right side low-voltage power supply adjustment locations.**

b. Slowly change the output of the variable autotransformer through the range of 105 to 125 volts (210 to 250 volts) and watch the precision voltmeter. The —12.2 volts should not change more than ±1% of the value read in the preceding paragraph when the autotransformer output was 117 volts (234 volts).

If the supply changes more than ±1% as the line voltage is varied from 105 to 125 volts, a possible cause is reduced capacitance of C630, C631 or C632.

## 5. Check/Adjust +20-Volt Supply Voltage

a. Set the autotransformer output to 117 volts (234 volts). Connect the precision voltmeter between the —20-volt test point and ground (see Fig. 5-3). If the voltage is outside the limits of +19.80 and +20.20 volts, adjust the +20 VOLTS control, R650 (see Fig. 5-5).

b. Slowly change the output of the variable autotransformer through the range of 105 to 125 volts (210 to 250 volts) and watch the precision voltmeter. The +20 volts should not change more than ±1% of the value read in the preceding paragraph when the autotransformer output was 117 volts (234 volts).

If the supply changes more than ±1% as the line voltage is varied from 105 to 125 volts, check to see if either the —100- or +125-volt supplies are also changing more than ±1%.

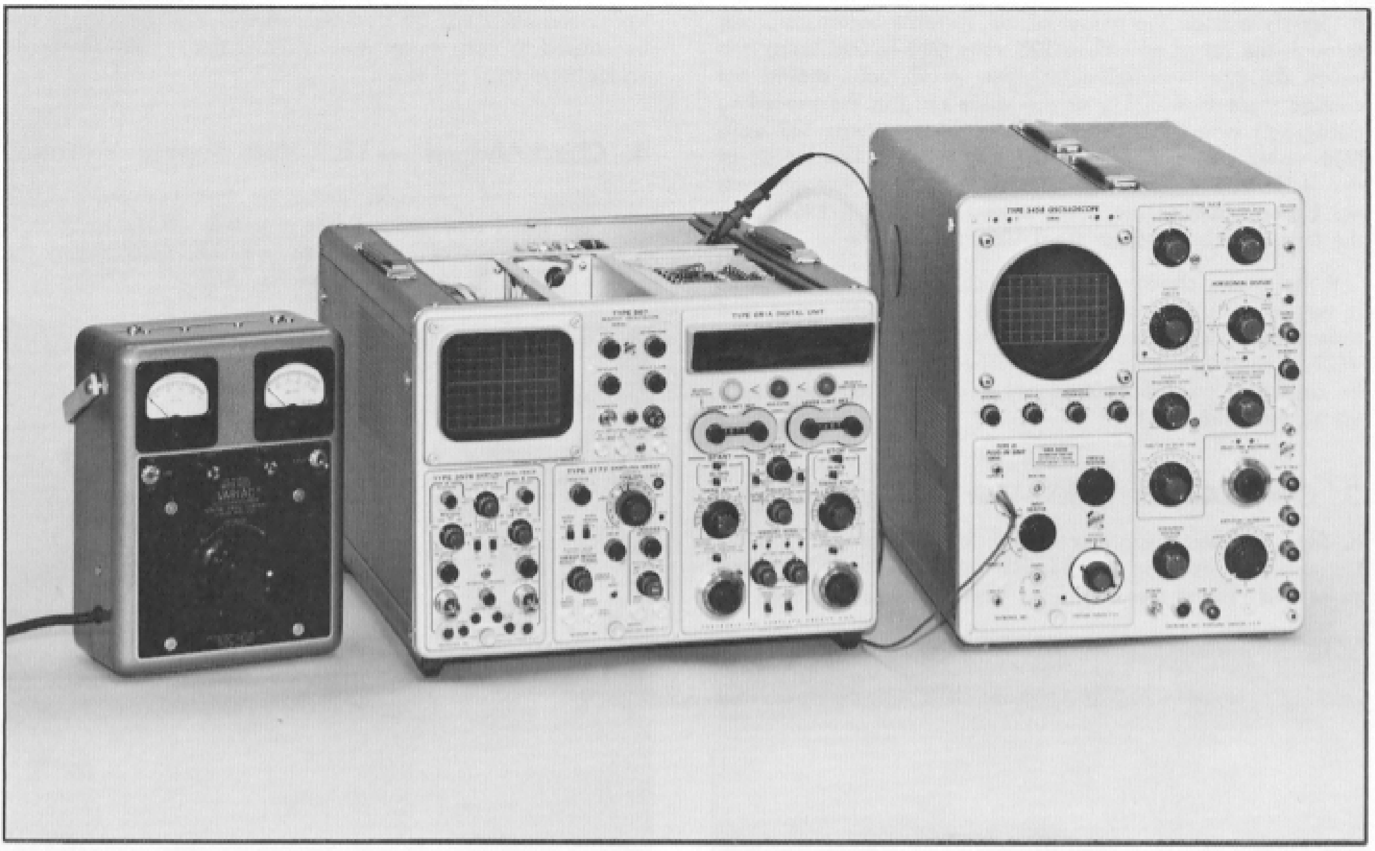


Fig. 5-6. Low-voltage power supply ripple test setup, step 6.

## CONTROL SETTINGS

Type 567 controls: Set as for voltage measurements. No sweep.

Test Oscilloscope controls:

Vertical Unit

| | |
|---|---|
| Volts/Cm | .005 |
| Input Selector | AC |

Horizontal

| | |
|---|---|
| Horizontal Display | A |
| Triggering Mode | AC |
| Triggering Slope | +LINE |
| Stability | PRESET |
| Time/Cm | 5 mSEC |
| Intensity | Normal trace brightness |
| Other controls | Optional |

The above is for a Type 545B/Type H system. For other test oscilloscopes, set the controls to obtain the same operation.

## 6. Check Low-Voltage Power-Supply Ripple

a. Connect the test oscilloscope 1× probe tip to the —100-volt test point, and the ground clip to ground as in Figs.

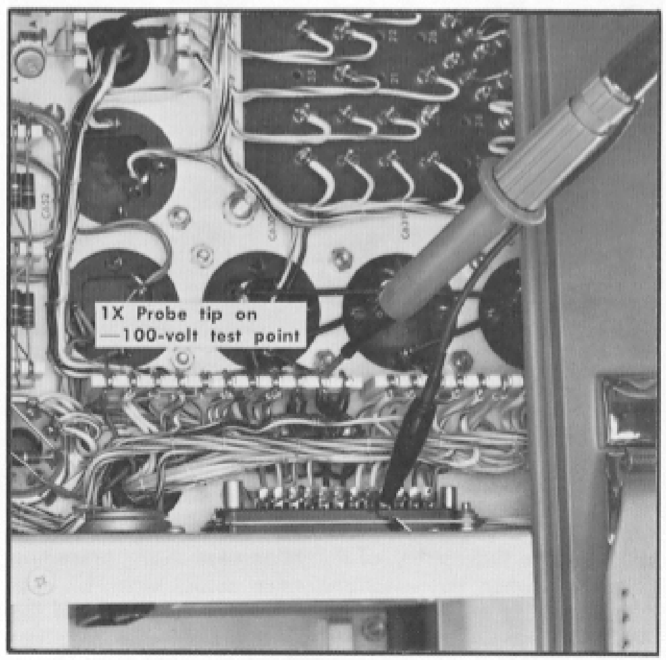



Fig. 5-7. Low-voltage power supply test points, step 6.

5-6 and 5-7. The test oscilloscope display should show no more than 4 mv peak to peak (4 minor divisions of the graticule) of 120 cps ripple. The 4-mv maximum ripple applies through the line-voltage range of 105 to 125 volts, when the Type 567 horizontal plug-in is not generating a sweep.

b. The ripple on the remaining low-voltage power supplies is measured in the same manner, connecting the probe tip to each regulated supply voltage test point in turn. Observe the limits of each in Table 5-1.

**TABLE 5-1**

Low-Voltage Power Supply Ripple

| Supply | Ripple mv max |
|---|---|
| −100 | 4 |
| +125 | 20 |
| +300 | 70 |
| −12.2 | 5 |
| +20 | 4 |

## NOTES

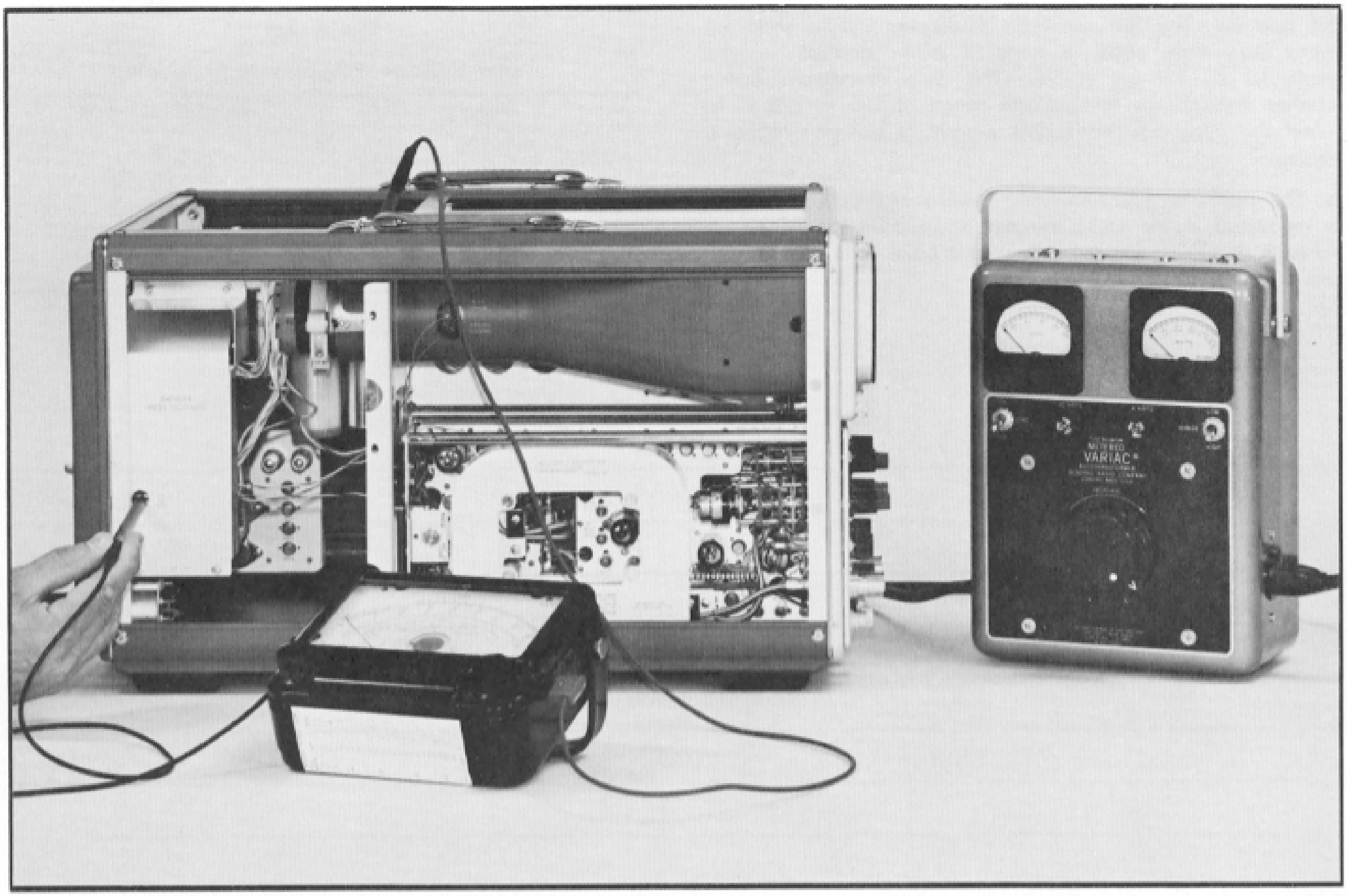


Fig. 5-8. High-voltage power supply test setup, step 7.

## CONTROL SETTINGS

| | |
|---|---|
| Real-Time Vertical Unit | |
| Position control(s) | Fully clockwise |
| Mode | Channel A |
| Other controls | Optional |
| Real-Time Horizontal Unit | |
| Position control | Fully counterclockwise |
| No sweep | |
| Type 567 | |
| INTENSITY | Fully counterclockwise |
| Sampling Vertical Unit | |
| Position control(s) | Midrange |
| Mode | Channel A |
| Other controls | Optional |
| Sampling Horizontal Unit | |
| Position control | Midrange |
| No sweep | |

## 7. Check/Adjust —3300-Volt Supply Voltage

a. Set the autotransformer output to 117 volts (234 volts). Connect the high-voltage 20,000 Ω/v meter between the —3300-volt HV TEST POINT (see Fig. 5-9) and ground. If the voltage is outside the ±4% limits of —3268 to —3432 volts, adjust HIGH VOLTAGE control, R841 (see Fig. 5-10).

b. Turn the Type 567 INTENSITY control fully clockwise. (There will be no spot if controls are set as called out for Fig 5-8.) Watch the voltmeter while slowly changing the variable autotransformer through the range of 105 to 125 volts (210 to 250 volts). The high voltage should not change more than 4% from the value noted in the preceding paragraph.

c. Turn the Type 567 INTENSITY control fully counterclockwise while looking into the HV TEST POINT opening. As the control nears its counterclockwise end of rotation, a neon glow should be noted inside the high-voltage protection cover. If, after close inspection, no glow can be seen, turn off the Type 567 power and remove the high-voltage cover. Repeat the test; B852 and B853 should both ignite when the INTENSITY control is fully counterclockwise. If they do not, change both bulbs. Replace the high-voltage cover and repeat steps 7a and 7b.

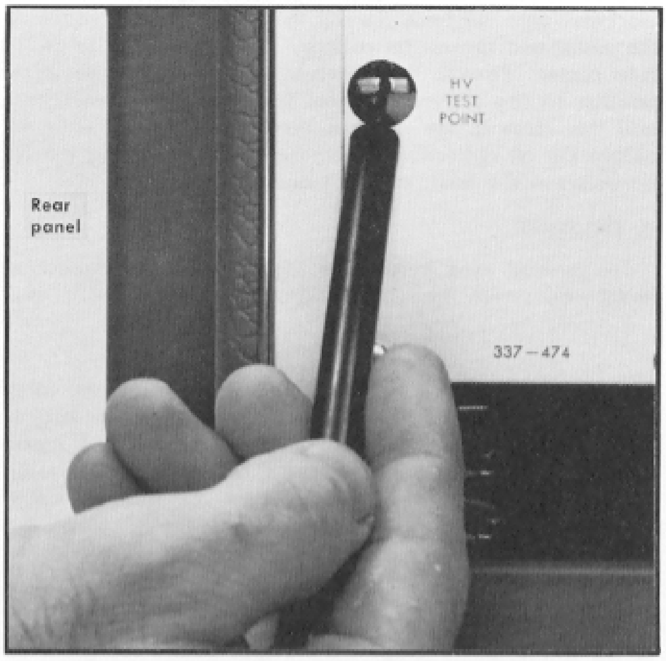



Fig. 5-9. High-voltage power supply test point, step 7.

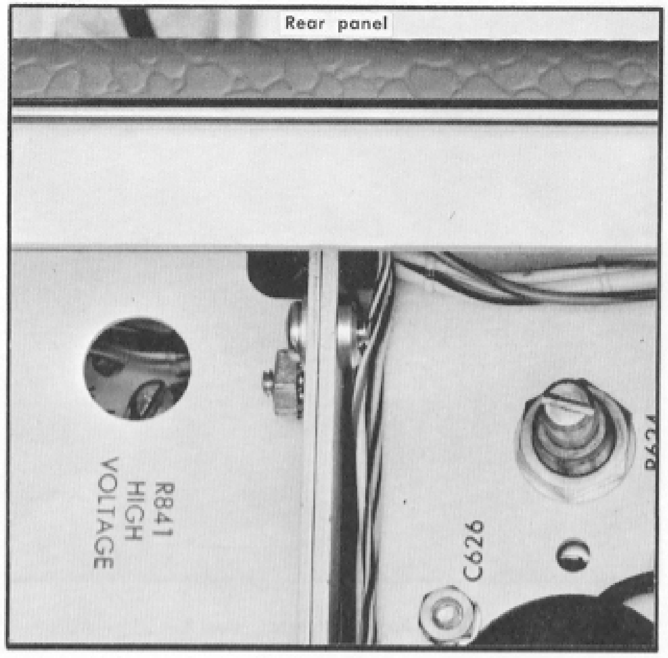



Fig. 5-10. High-voltage power supply adjustment location, step 7.

## NOTES

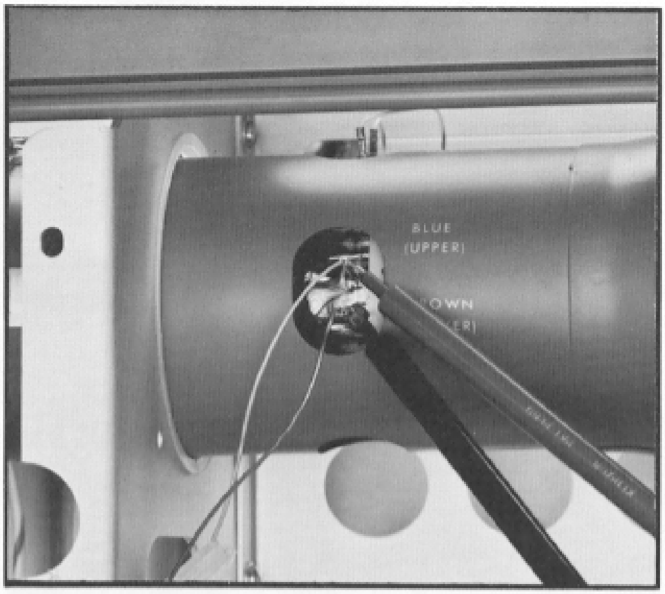



Fig. 5-11. Crt deflection factor test setup, step 8.

NOTE

Step 8 should be performed only when new crt is installed.

## CONTROL SETTINGS

Vertical Unit
- Position control(s) — Midrange (trace centered)
- Mode — Channel A

Horizontal Unit
- Free run to present a steady trace.

Type 567
INTENSITY and FOCUS controls set for normal intensity trace.

## 8. Check Crt Deflection Factors

a. Vertical.

Set the 20,000 Ω/v meter to a dc scale with a full scale value of 100 to 200 volts. Place the meter leads carefully on the crt vertical deflection plate pins, minus lead on upper plate (see Fig. 5-11). Turn the vertical unit Position control clockwise until the trace rests at the top graticule line. Read the meter and record the voltage. Return the trace to graticule center. Reverse the meter leads and adjust the trace position to the graticule bottom line. Read the meter and add this value to the previous reading. Divide by eight to obtain the crt deflection factor. Total voltage swing should be between the limits of 148.4 and 162.4 volts.

b. Horizontal.

The method used to measure the crt horizontal deflection factor varies with the type of horizontal plug-in unit in use.

### Real Time

Operate the sweep at any convenient free-run rate. Adjust the horizontal Position control so the trace begins at the far left graticule line. Stop the sweep and place the voltmeter leads on the horizontal deflection-plate pins at the top side of the crt neck; connect the positive meter lead to the red lead. Record the voltage.

Set the Time/Div control at 1 SEC and the Variable control fully counterclockwise. Start a sweep by turning the triggering Level control through its range. The voltmeter indication will begin to drop. As the spot passes the graticule center, reverse the meter polarity and record the voltage at the time the spot reaches the far right graticule line. (Since the spot is moving slowly, it may be necessary to do this two or three times, in order to get a reading within ±2 volts of the actual voltage.) Record the reading.

Add the two readings. Total voltage swing should be between the limits of 175 and 193 volts.

### Sampling

Free run the sampling time-base unit at any sweep rate, and set the horizontal Position control so the trace begins just to the left of the far left graticule line. Switch operation to Manual, reducing the crt intensity if necessary, and position the spot with the Manual Scan control to the far left graticule line. Place the voltmeter leads on the horizontal deflection-plate pins at the top side of the crt neck; connect the positive meter lead to the red lead. Record the voltage.

Remove the meter leads and position the spot with the Manual Scan control to the far right graticule line. Reverse the meter leads and record the voltage.

Add the two readings. Total voltage swing should be between the limits of 175 and 193 volts.

## NOTES

## NOTES

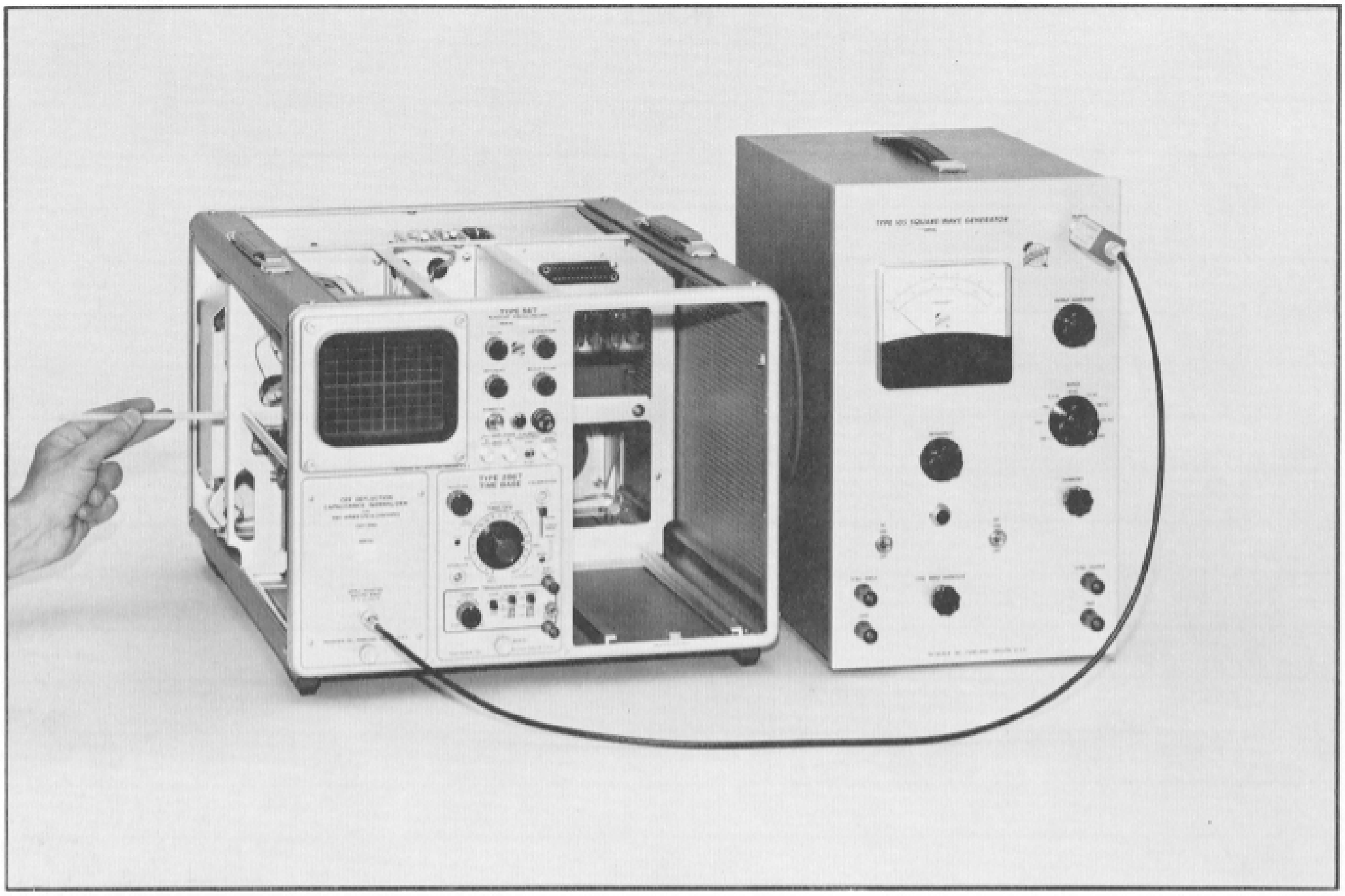


Fig. 5-12. Step 9a test setup.

## CONTROL SETTINGS

Crt Deflection Capacitance Normalizer
No controls

Horizontal Unit (such as Type 2B67)

| | |
|---|---|
| Time/Div | 20 $\mu$SEC |
| Triggering | Internal AC |

Type 105

| | |
|---|---|
| Range | 100 KC |
| Frequency | Set for full scale meter reading |
| Output Amplitude | About 1 or 2 o'clock |

## CONNECTIONS

Install Type TU-5/105 Adapter to Type 105 Output connector while the Type 105 DC power is Off. (If Type 105 has UHF connector, use UHF to BNC adapter.) Connect a 50-ohm coax cable between the Type TU-5/105 Adapter and the Capacitance Normalizer input. (Type TU-5/105 Adapter is required to invert the Type 105 negative output. The adapter contains two diodes and an electrolytic capacitor in a clamped inverter circuit.)

## 9. Check/Adjust Crt Deflection-Plate Capacitance (Using Capacitance Normalizer)

NOTE

The following crt deflection-plate capacitance compensation (steps 9 and 10) can be ignored if the Type 567 is used for sampling only, or real-time displays under 3 or 4 megacycles only. The capacitance adjustments are to be made only after changing the crt if real-time displays up to 10 megacycles are required. Step 9 uses the special Tektronix 067-0500-00 Crt Capacitance Normalizer as a calibration aid. Step 10 uses a 10-mc bandwidth plug-in unit. Adjustment accuracy and resolution are best when using the Capacitance Normalizer.

a. Vertical Deflection Plates, C760

Set up the equipment and display as shown in Fig. 5-12.

Use the low-capacitance tool (item 16) to adjust C760 for best flat-topped square-wave display. C760 is shown in Figs. 5-13 and 5-14. Proper compensation is shown in Fig. 5-15. It may be necessary to position the leads to the deflection plates to aid in obtaining a good square-wave display. C760 is to be located as in Fig. 5-13 unless correct compensation is impossible; then move it to the position between terminal 21 and chassis as shown in Fig. 5-14.

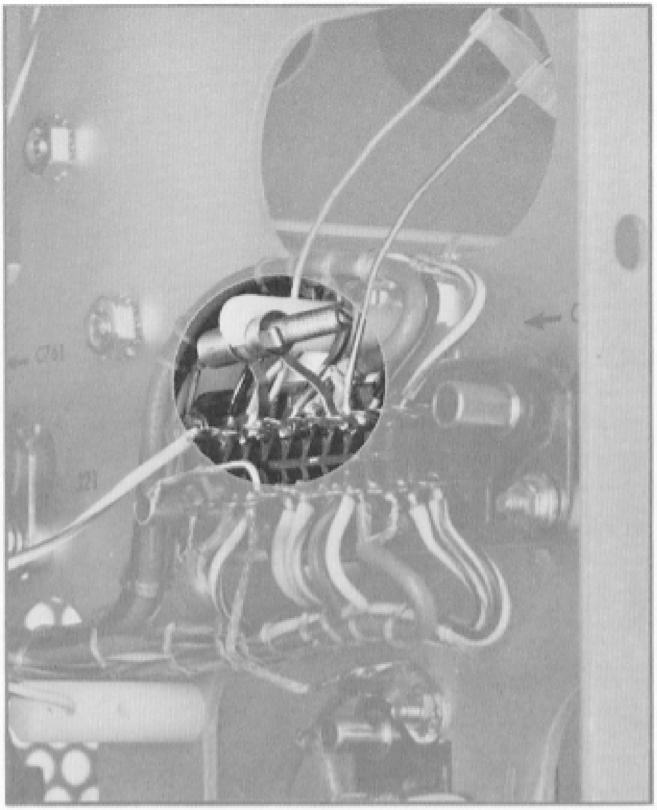


Fig. 5-13. Normal location of C760, step 9a.

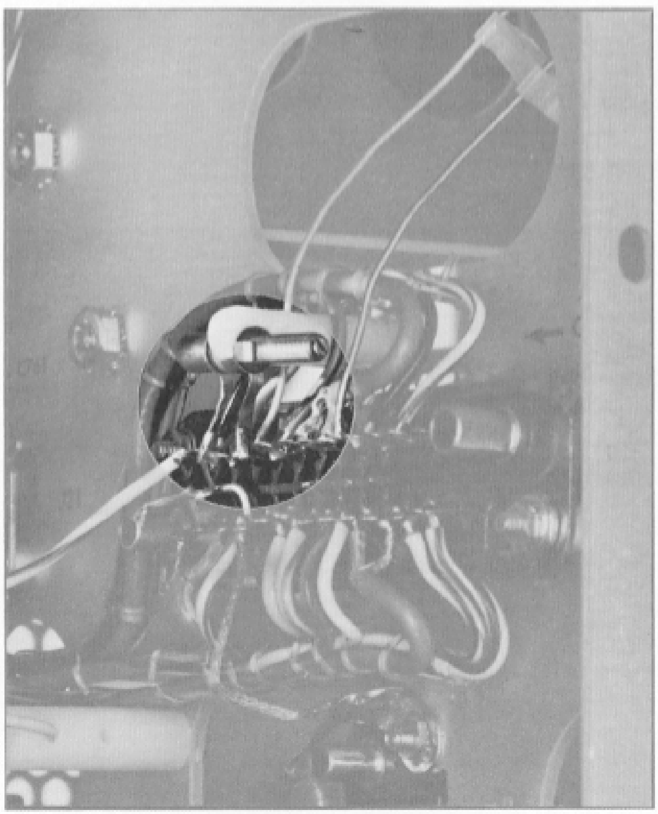


Fig. 5-14. Alternate location of C760, step 9a.

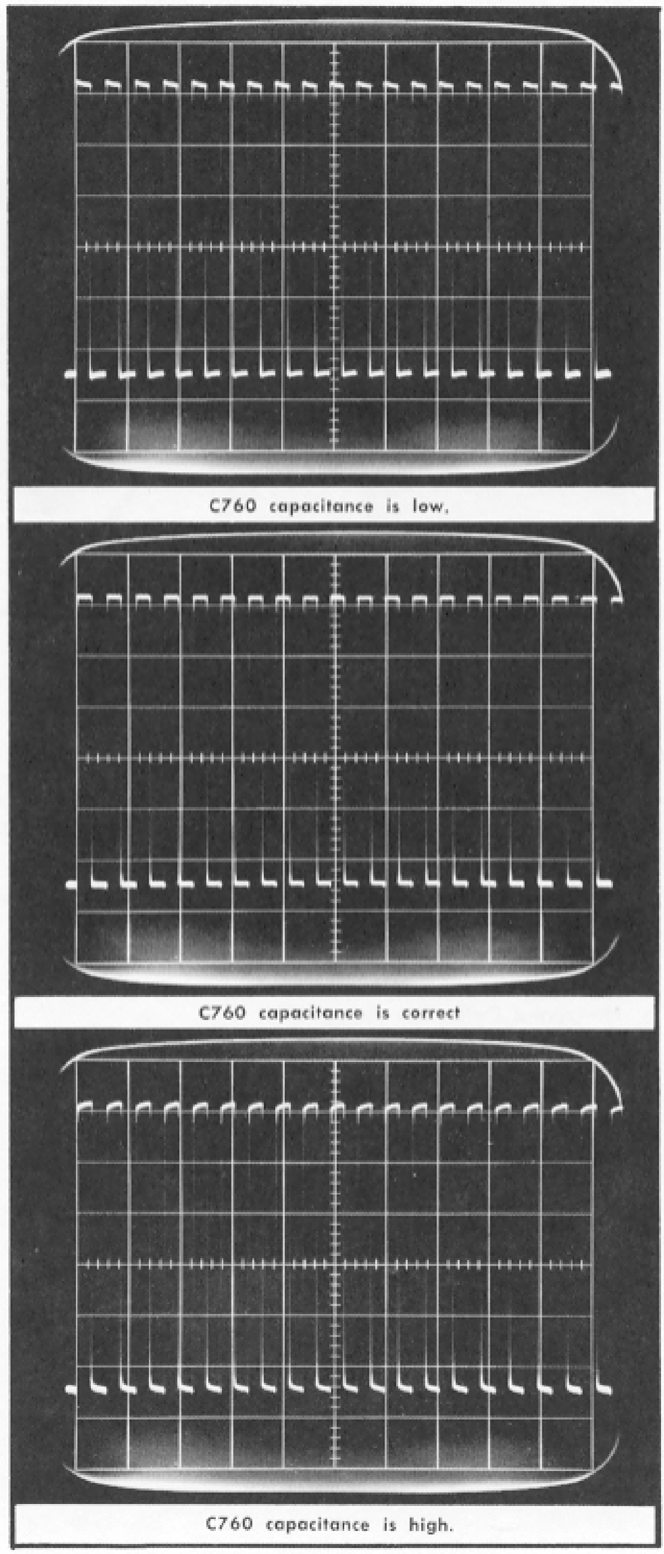



Fig. 5-15. Waveforms for step 9a.

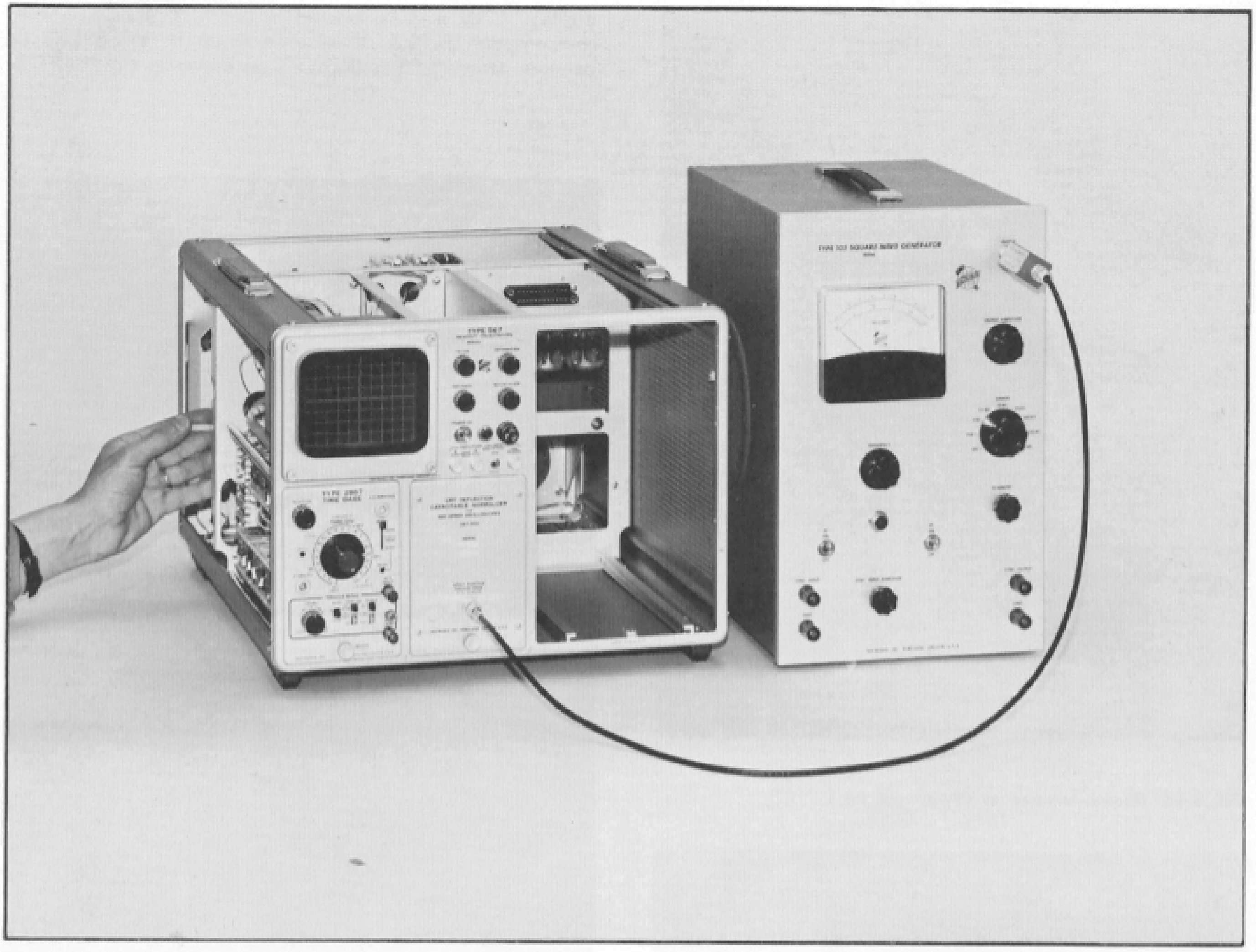


Fig. 5-16. Step 9b test setup.

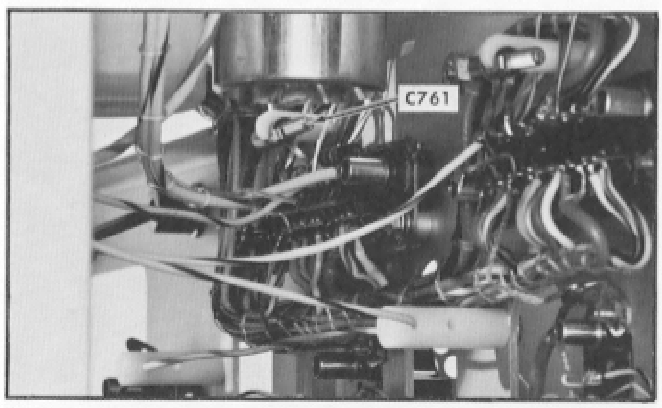



Fig. 5-17. Location of C761, step 9b.

b. Horizontal Deflection Plates, C761

Control settings and connections are the same as for step 9a, except that the Capacitance Normalizer and timing unit positions are exchanged.

Set up the equipment and display as shown in Fig. 5-16.

Use the low-capacitance tool (item 16) to adjust C761 for best flat-topped square-wave display. (C761 is shown in Fig. 5-17.) Proper compensation is shown in Fig. 5-18. It may be necessary to position the leads to the deflection plates to aid in obtaining a good square-wave display.

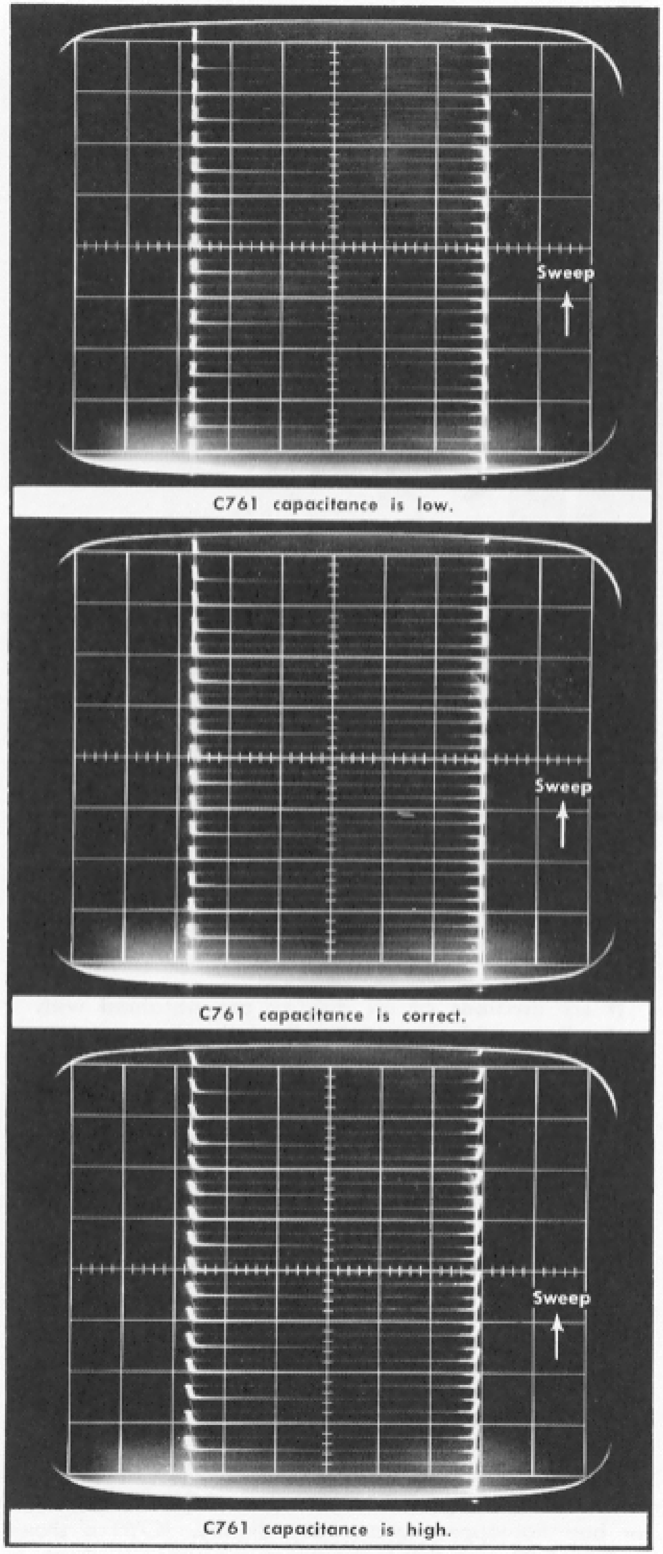



Fig. 5-18. Waveforms for step 9b.

## NOTES

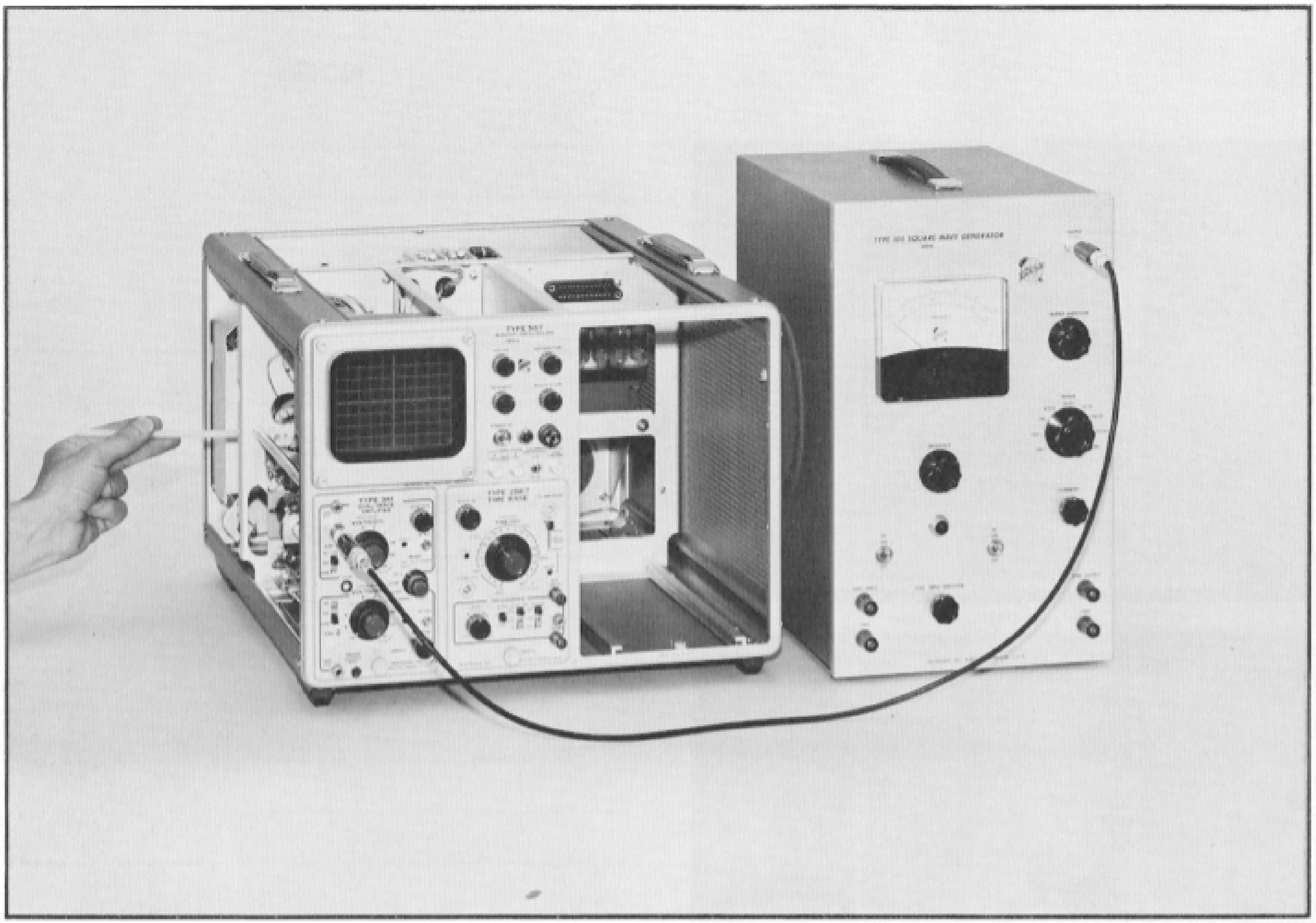


Fig. 5-19. Step 10a test setup.

## CONTROL SETTINGS

| | |
|---|---|
| Vertical Unit (such as Type 3A1) | |
| Volts/Div | .01 (max. sensitivity) |
| Mode | Channel 1 |
| Input | DC Coupled |
| Horizontal Unit (such as Type 2B67) | |
| Time/Div | 1 $\mu$SEC |
| Triggering | Internal AC |
| Type 105 | |
| Range | 100 KC |
| Frequency | Set for full scale meter reading |
| Output Amplitude | Clockwise past 10 o'clock for over 5 div display |

## CONNECTIONS

10× attenuator at Type 105 Output connector. 50 Ω coax cable to a second 10× attenuator. 50 Ω termination between second 10× attenuator and vertical unit channel 1 input connector.

NOTE

If six divisions of crt display are obtained with the Type 105 Output Amplitude control counterclockwise from 10 o'clock, add more attenuation in the line to the vertical unit. The Type 105 risetime is degraded when the Output Amplitude control is counterclockwise from about a 10 o'clock position.

### 10. Check/Adjust Crt Deflection-Plate Capacitance (Using Type 3A1 or other 10-mc vertical unit)

(Do only after installing new crt.)

a. Vertical Deflection Plates, C760

Set up the equipment and display as shown in Fig. 5-19.

Use the low-capacitance tool (item 16) to adjust C760 for best flat-topped square-wave display. (C760 is shown in Figs. 5-20 and 5-21.) Proper compensation is shown in Fig. 5-22. It may be necessary to position the leads to the deflection plates to aid in obtaining a good square-wave

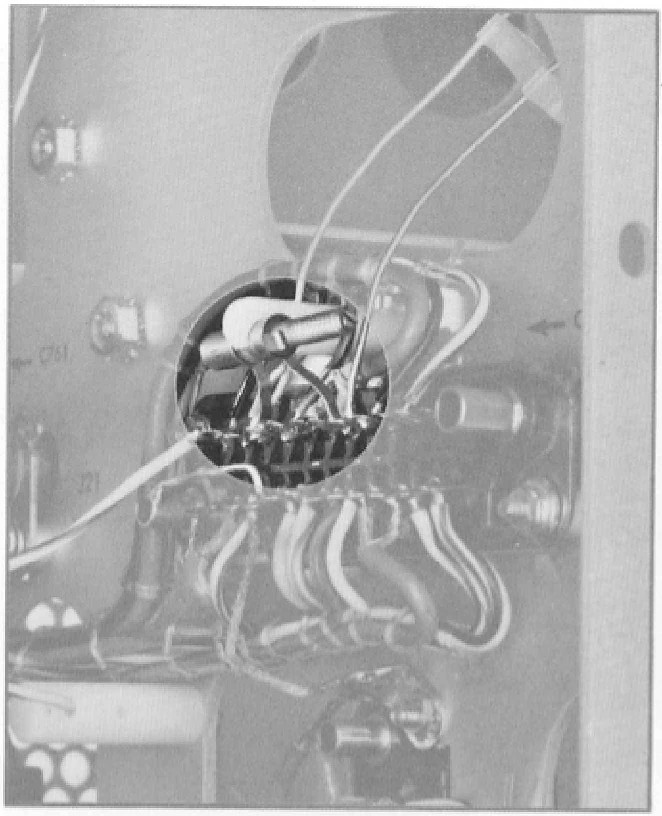


Fig. 5-20. Normal location of C760, step 10a.

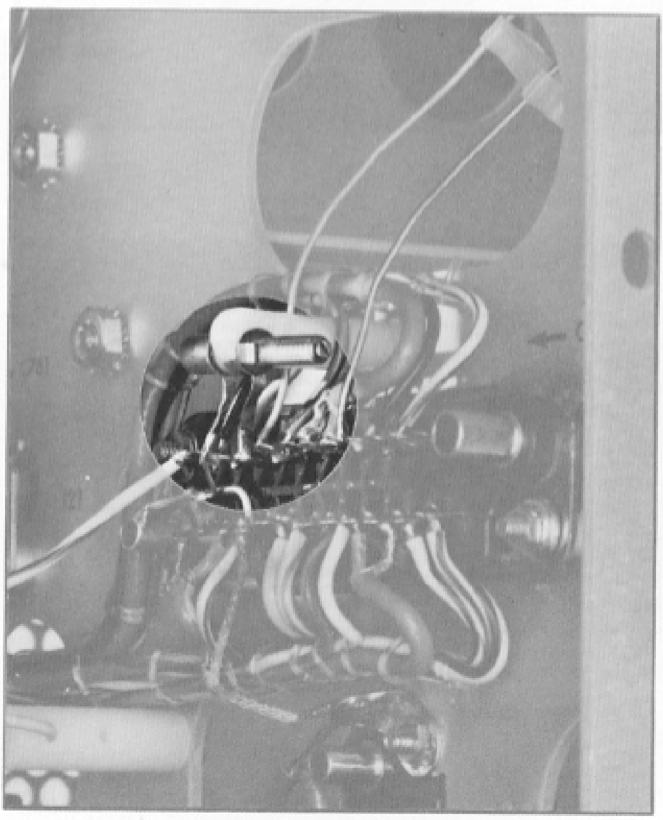
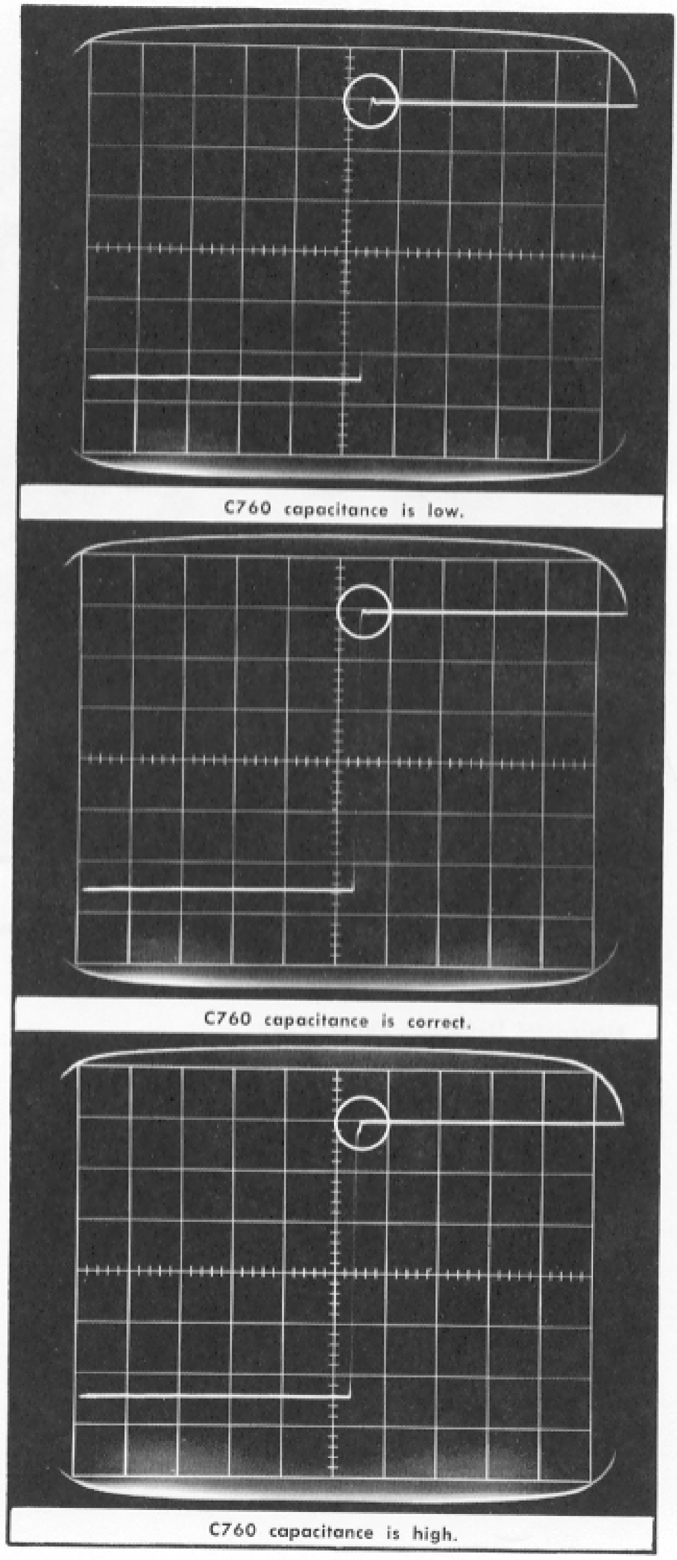


Fig. 5-21. Alternate location of C760, step 10a.

display. C760 is to be located as in Fig. 5-20 unless correct compensation is impossible; then move it to the position between terminal 21 and chassis as shown in Fig. 5-21.



C760 capacitance is low.

C760 capacitance is correct.

C760 capacitance is high.

Fig. 5-22. Waveforms for step 10a.

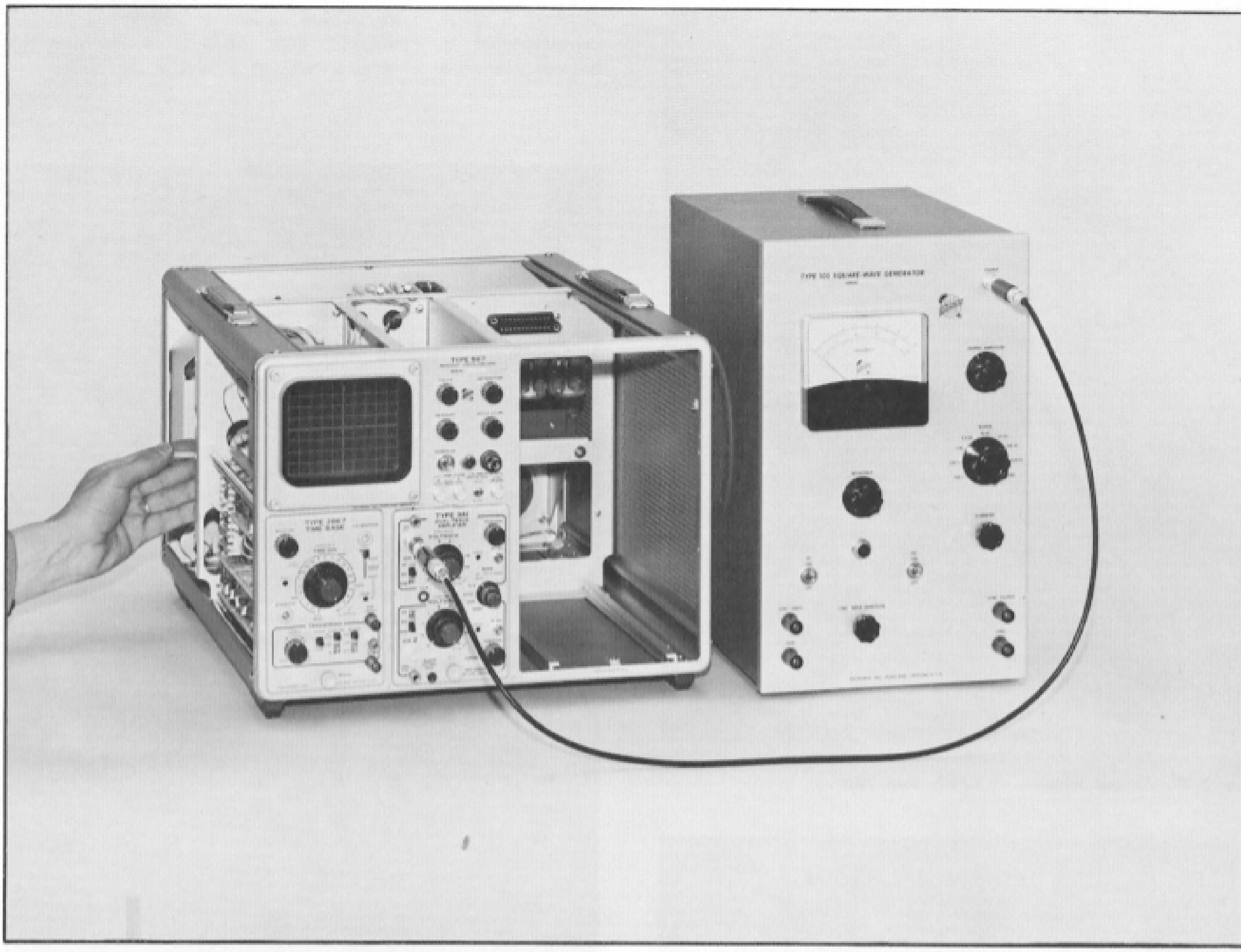


Fig. 5-23. Step 10b test setup.

b. Horizontal Deflection Plates, C761

Control settings and connections are the same as for step 10a, but with the Type 3A1 and Type 2B67 positions exchanged.

Set up the equipment and display as shown in Fig. 5-23.

Use the low-capacitance tool (item 16) to adjust C761 for best flat-topped square-wave display. (C761 location is shown in Fig. 5-24.) Proper compensation is shown in Fig. 5-25. It may be necessary to position the leads to the deflection plates to aid in obtaining a good square-wave display. (C761 does not have an alternate location as does C760.)

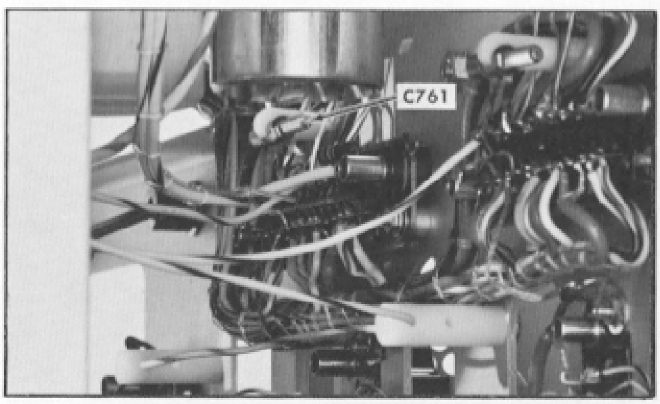
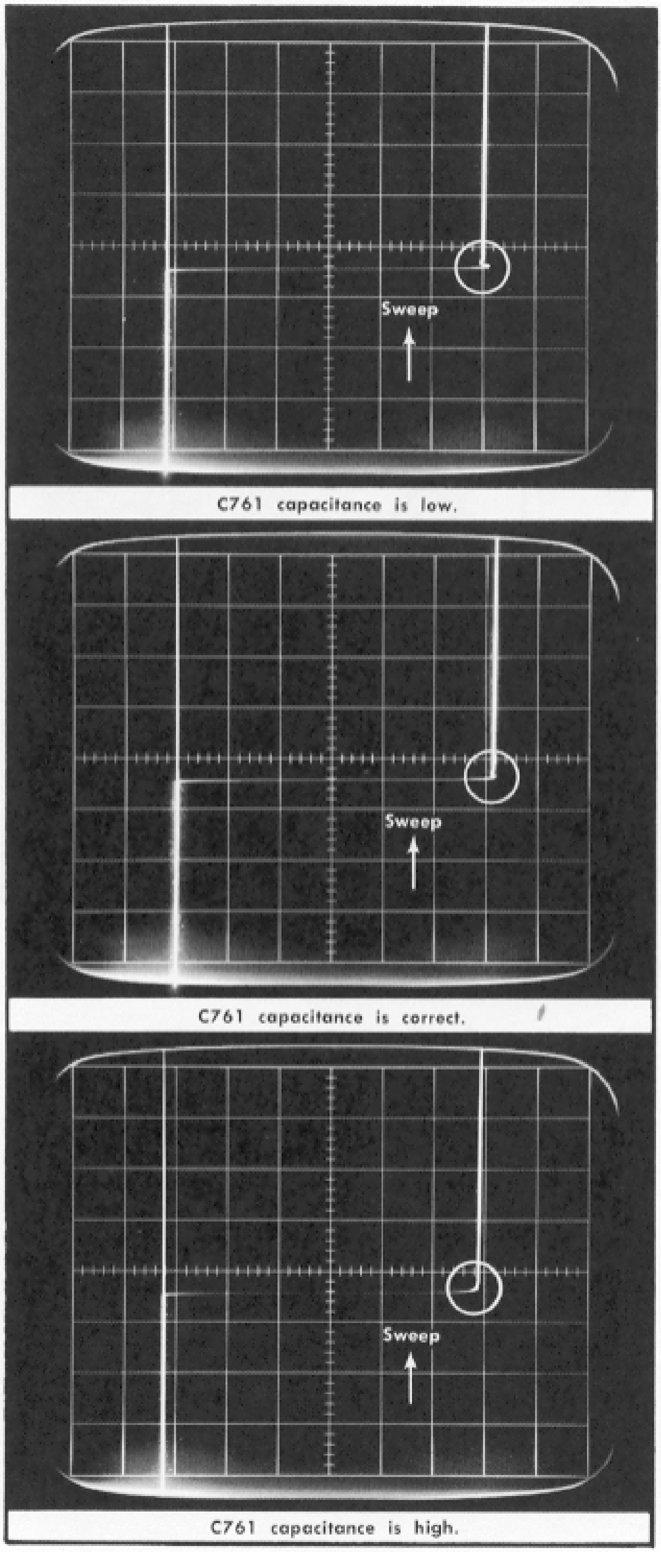



Fig. 5-24. Location of C761, step 10b.



Ⓑ




C761 capacitance is low.

C761 capacitance is correct.

C761 capacitance is high.

Fig. 5-25. Waveforms for step 10b.

## NOTES

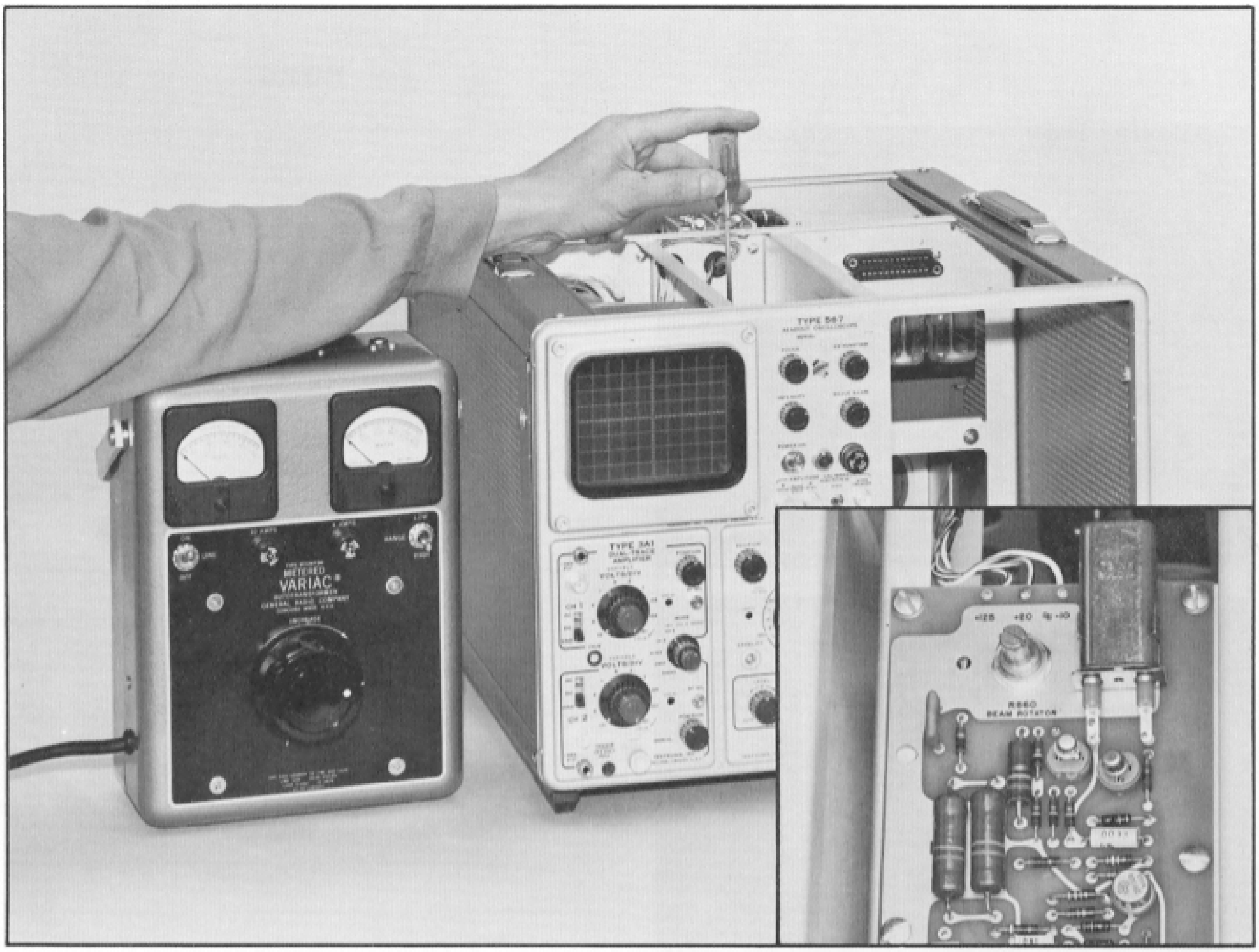


Fig. 5-26. Crt beam rotator adjustment setup for step 11.

## CONTROL SETTINGS

Vertical Unit

| | |
|---|---|
| Input | Grounded |
| Volts/Div | Insensitive |
| Position | Trace centered |

Horizontal Unit

| | |
|---|---|
| Time/Div (real time) | 1 mSEC or higher |
| Time/Div (sampling) | Optional |
| Triggering | Free-running trace |

## 11. Adjust Crt Beam Rotator, R860

NOTE

The crt beam trace level is affected by small magnetic fields. The trace level changes with change of operating position of the Type 567. Align the crt beam rotator with the instrument in the exact position of operation.

Obtain a free-running trace as shown in Fig. 5-26. Set the vertical unit Position control so the trace intersects the horizontal graticule centerline.

Adjust R860, the CRT BEAM ROTATOR control, until the trace lines up with the graticule line. (R860 is shown as an insert in Fig. 5-26.)

# NOTES

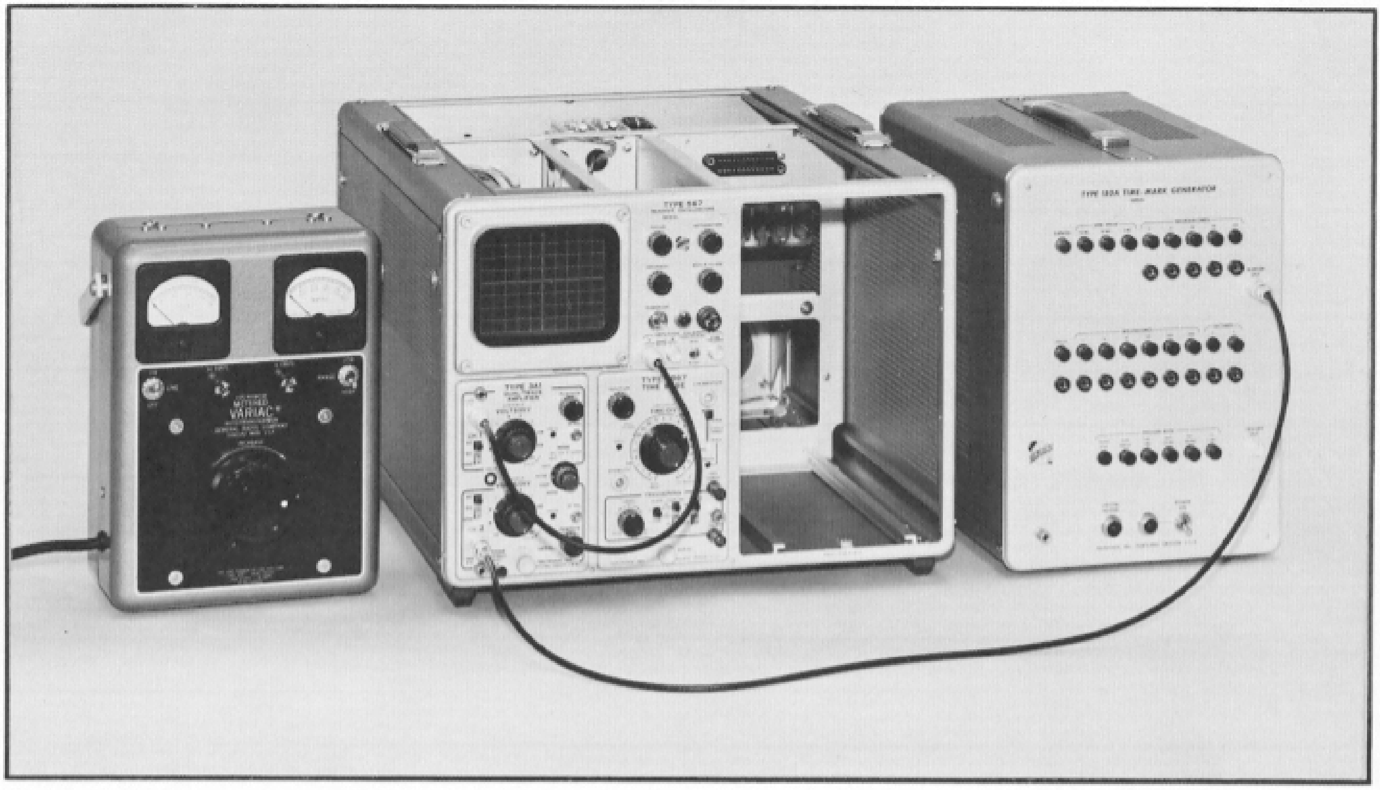


Fig. 5-27. Step 12a test setup.

## CONTROL SETTINGS

| | |
|---|---|
| Type 3A1 Vertical Unit | |
| Mode | ALTER |
| Volts/Div (both channels) | 2 |
| Trigger | CH 1 ONLY PULL |
| or | |
| Type 3A2 Vertical Unit | |
| Mode | ALTER |
| Volts/Div (both channels) | 2 |
| Trig Source | CH 1 |
| Polarity (both channels) | NORM |
| Time-Base Horizontal Unit | |
| Time/Div | .1 mSEC |
| Triggering | Internal +AC |
| Type 180A Time-Mark Generator | |
| Buttons pushed | 100 MICROSECONDS and 1 SECOND |
| Type 567 | |
| Amplitude Calibrator | 20 KC |

## CONNECTIONS

A 50 Ω coax cable from the Type 180A Marker Out connector to the vertical unit channel 2 input connector.

A 50 Ω coax cable from the Type 567 Amplitude Calibrator 5-volt connector to the vertical unit channel 1 input.

NOTE

**If you have only sampling plug-in units for the Type 567 the test oscilloscope may be used for the display required, providing a dual-channel plug-in unit is used. Use step 12b instead of 12a.**

## 12. Check/Adjust Amplitude Calibrator

a. 20-kc Frequency Check (using real-time plug-in units in Type 567).

Set up the equipment as shown in Fig. 5-27 and obtain a display that is triggered from the channel 1 calibrator signal. Note that the Amplitude Calibrator signal remains as a fixed display, but the time marks drift to the right or to the left.

The drift is an indication of frequency difference between the Amplitude Calibrator crystal and the reference oscillator of the Time-Mark Generator. If the time marks drift to the left, the Amplitude Calibrator frequency is higher than the Time-Mark Generator frequency. If the time marks drift to the right, the Amplitude Calibrator frequency is lower than the Time-Mark Generator frequency (see Fig. 5-28). Make the measurement in the following manner.

1. Watch the time-mark display. Note the regular occurrence of the 1-second marker flashing through the 100-μsecond markers.

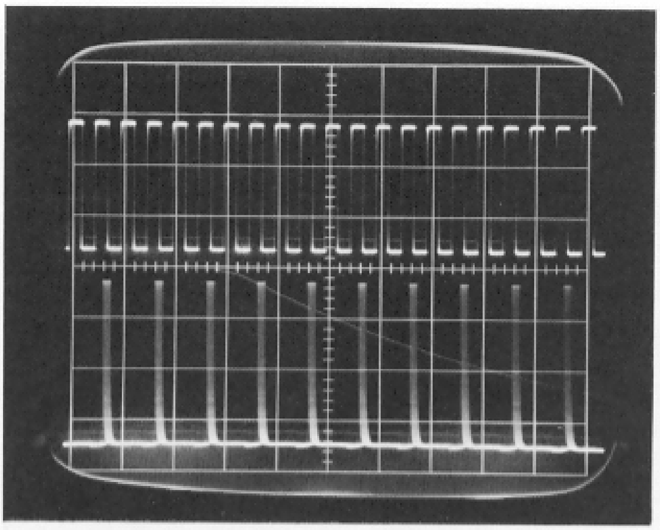


Fig. 5-28. Step 12a waveforms. 1 second time exposure. Note 1 second marker at slant through 100 msec markers.

2. Choose any one 100-μsecond marker and follow it across the crt for a count of ten seconds. Start the mark count as the chosen marker coincides with a vertical graticule line, and note the position of the same marker at the end of the tenth second. The number of divisions traveled in 10 seconds, and the time per division permits a direct measure of the frequency difference of the two oscillators.

3. With the horizontal unit Time/Div control set to .1 mSEC, if the chosen marker travels 8 divisions in 10 seconds, the time displacement is 0.08 msec each second, or 80 μsec each second. Each cycle of the Amplitude Calibrator takes 50 μsec; after 20,000 cycles the example error is 80 μsec or 1.6 cycles error out of 20,000 cycles per second. Thus, the percentage error is:

$$1.6/20{,}000 \times 100 = 0.008\%.$$

Therefore, at 0.1 msec/div, 10 divisions travel in 10 seconds indicates 0.01% error.

4. If the chosen marker travels off screen in less than 10 seconds, change the horizontal unit Time/Div control to 1 mSEC and the Time-Mark Generator push buttons to 1 MILLISECONDS and 1 SECONDS. Using the principle described in 3, each division of travel per second of the chosen marker is 0.01% error, and 10 divisions travel in 10 seconds is 0.1% error. Maximum error, ±0.1%.

## NOTES

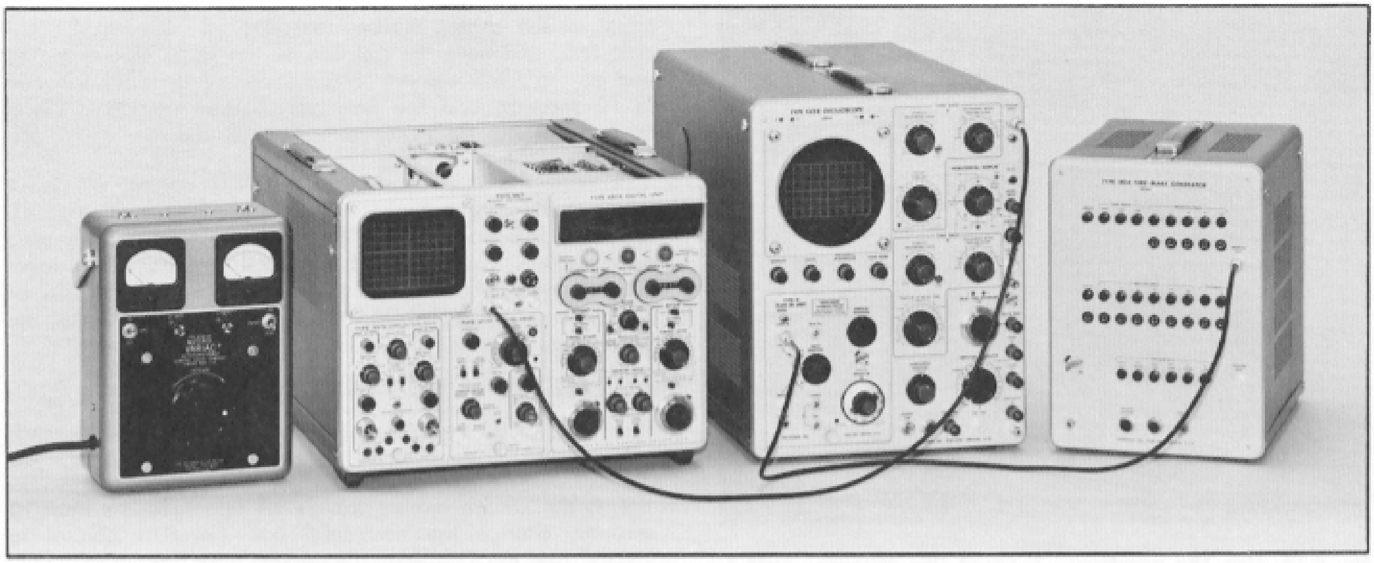


Fig. 5-29. Step 12b test setup. (6R1A not required to be installed.)

## CONTROL SETTINGS

| | |
|---|---|
| Test Oscilloscope | |
| Triggering | EXT AC AUTO |
| Time/Div | .1 mSEC |
| Vertical Unit | |
| Volts/Div | 2 |
| Type 180A Time-Mark Generator | |
| Buttons pushed | 100 MICROSECONDS and 1 SECONDS |

## CONNECTIONS

50 Ω coax cable from Type 180A Marker Out connector to test oscilloscope vertical unit input. 50 Ω coax cable from Type 567 Amplitude Calibrator 5-volt connector to the test oscilloscope Trigger Input connector.

b. 20-kc Frequency Check (when only sampling plug-in units are in Type 567).

Set up the equipment as shown in Fig. 5-29 and obtain a display that is externally triggered by the Type 567 Amplitude Calibrator signal. The display is that of the time marks that drift to the right or to the left. The drift is an indication of frequency difference between the Amplitude Calibrator crystal and the reference oscillator of the Time-Mark Generator. If the time marks drift to the left, the Amplitude Calibrator frequency is higher than the Time-Mark Generator frequency. If the time marks drift to the right, the Amplitude Calibrator frequency is lower than the Time-Mark Generator frequency (see Fig. 5-30).

Make the measurement in the following manner:

1. Watch the time-mark display. Note the regular occurrence of the 1-second marker flashing through the 100-μsecond markers.

2. Choose any one 100-μsecond marker and follow it across the crt for a count of ten seconds. Start the mark count as the chosen marker coincides with a vertical graticule line, and note the position of the same marker at the end of the tenth second. The number of divisions traveled in 10 seconds, and the time per division permits a direct measure of the frequency difference of the two oscillators.

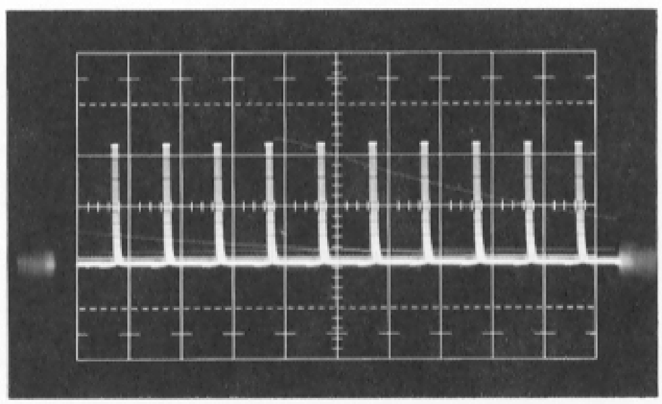


Fig. 5-30. Step 12b waveform. 1 second time exposure. Note 1 second marker at slant through 100 μsec markers.

3. With the horizontal Time/Div control set to 1 mSEC, if the chosen marker travels 8 divisions in 10 seconds, the time displacement is 0.08 msec each second, or 80 μsec each second. Each cycle of the Amplitude Calibrator takes 50 μsec; so after 20,000 cycles the example error is 80 μsec or 1.6 cycles error out of 20,000 cycles per second. Thus, the percentage error is:

$$1.6/20{,}000 \times 100 = 0.008\%.$$

Therefore, at 0.1 msec/div, 10 divisions of travel in 10 seconds indicates 0.01% error.

4. If the chosen marker travels off screen in less than 10 seconds, change the test oscilloscope Time/Div control to 1mSEC and the Time-Mark Generator push buttons to 1 MILLISECONDS and 1 SECOND. Using the principle described in 3, each division of travel per second of the chosen marker is 0.01% error, and 10 divisions travel in 10 seconds is 0.1% error.

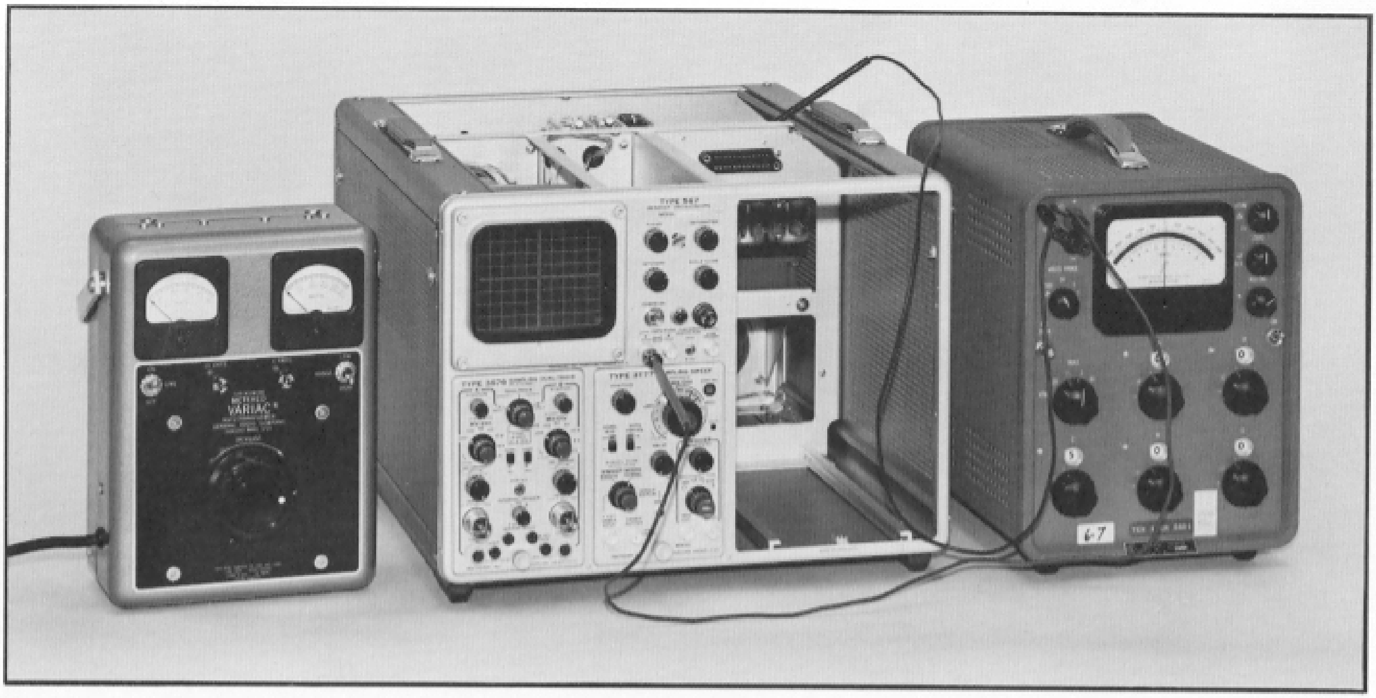


Fig. 5-31. Dc voltmeter test setup for step 12c.

## CONTROL SETTINGS

Vertical Unit
Any position

Horizontal Unit
Any position

Dc Voltmeter
Set to read 5.00 volts

Type 567
Pull Q935 out of its socket (located on Amplitude Calibrator board and shown in Fig. 5-32). This places a steady dc voltage at the two calibrator output terminals equal to the +peak of the square-wave signal.

## CONNECTIONS

Connect the minus lead of the voltmeter to the Type 567 chassis, and the plus lead to the Amplitude Calibrator 5-volt connector.

c. Set CAL AMPL control, R943.

Set up the equipment as shown in Fig. 5-31 and measure the dc voltage at the 5 V/500 mV connector of the Amplitude Calibrator. Adjust R943 (Fig. 5-32) so the voltage is as close to 5 volts as possible.

Move the voltmeter plus lead to the .5 V/50 mV connector of the Amplitude Calibrator and measure the voltage. The voltage must be within the limits of +0.49 to +0.51 volts. If the voltage is out of tolerance, readjust R943 to just bring the voltage within tolerance. Recheck the 5-volt value which must be within the limits of +4.90 to +5.10 volts. If both voltages are at the borderline of tolerance; one above normal value, and the other below normal value; it may be good preventive maintenance to check and change one or more divider resistors R945, R946, and R949.

Install a 50 Ω resistor of known ±1% accuracy (such as the 50 Ω termination, item 12 of equipment required) on the Amplitude Calibrator 5 V/500 mV connector. Set the voltmeter to read 500 millivolts. The voltage must be within the limits of +0.49 to +0.51 volts.

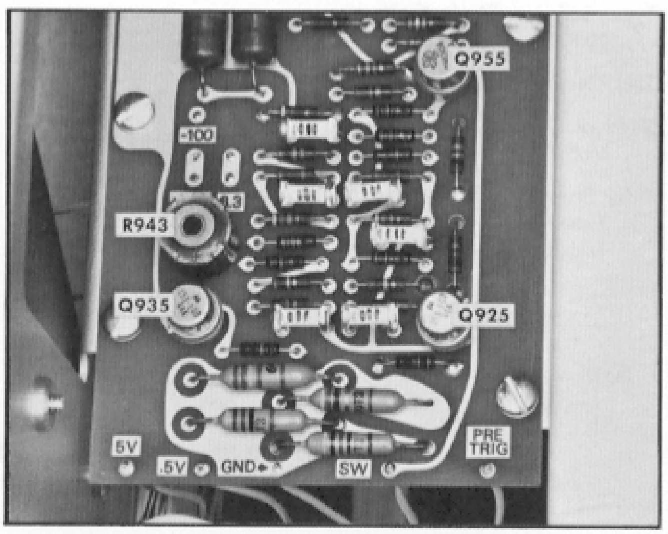



Fig. 5-32. Top view Amplitude Calibrator circuit board.

Move the 50 Ω termination and voltmeter lead to the .5 V/50 mV connector and check for an output voltage between the limits of 49 to 51 millivolts. If the voltage is out of tolerance, check and if necessary change, R948.

Replace Q935 in its socket and check for proper square waves out of the Amplitude Calibrator, at 20 KC and at about 1 KC.

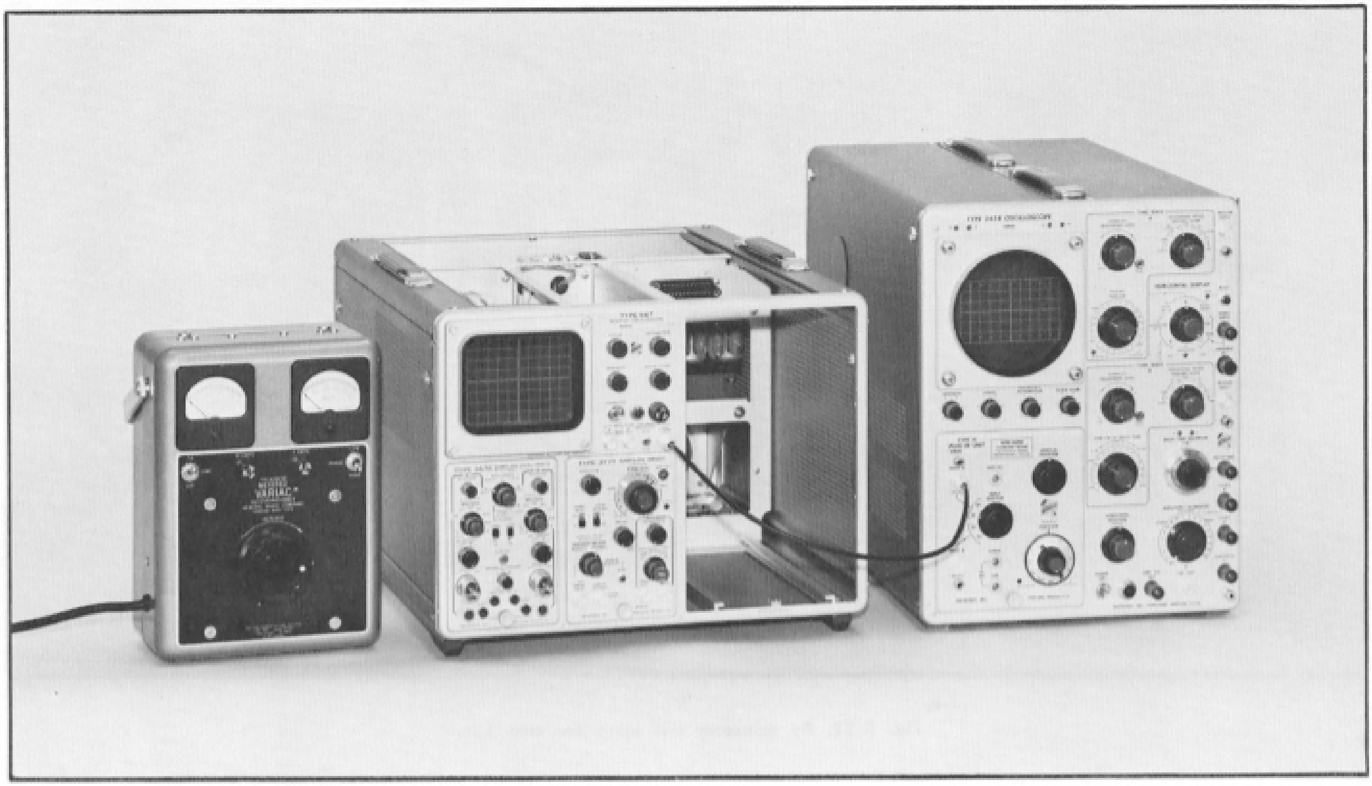


Fig. 5-33. Step 12d test setup.

## CONTROL SETTINGS

Type 567 Amplitude Calibrator
    20 KC-≈ 1 KC switch    20 KC

Test Oscilloscope

Vertical Unit
    Volts/Div    .2

Time Base
    Time/Div    5 μSEC
    Triggering    +Internal AC

## CONNECTIONS

50 Ω coax cable from Type 567 Amplitude Calibrator +PRE TRIGGER connector to the test oscilloscope vertical unit input connector.

d. +PRE TRIGGER Amplitude into 100 k or greater.

Set up the equipment as in Fig. 5-33. The peak-to-peak amplitude of the +PRE TRIGGER signal must be greater than 3 major divisions on the test oscilloscope graticule.

NOTE

The +PRE TRIGGER voltage rating into 100 k or greater includes the Type 3S3 and its Type P6038 Probes. The same test (as above) can be made using a Type 3S3 and a Type P6038 Probe placed directly into the +PRE TRIGGER connector.

## NOTES

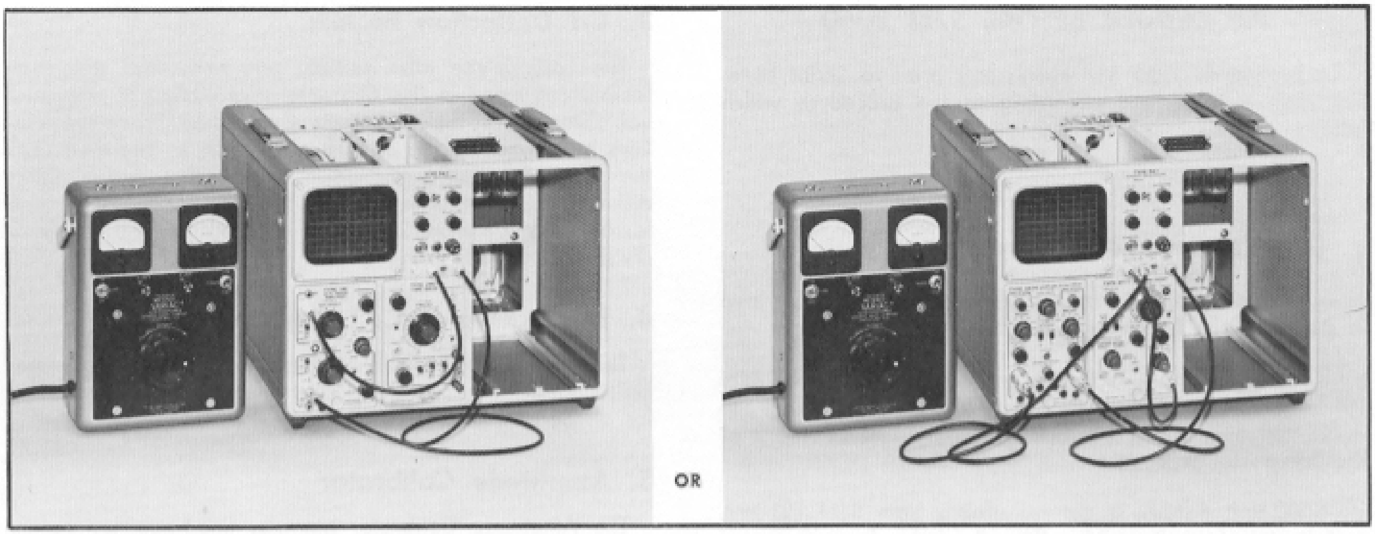




Fig. 5-34. Test setup for step 12e.

## CONTROL SETTINGS

Real Time (high impedance)

Vertical Unit
- Volts/Div (both channels) .2
- Mode ADDED
- Trigger CH 1 ONLY

Horizontal Unit
- Time/Div 10 $\mu$SEC
- Triggering +Internal AC

(If vertical unit cannot provide CH 1 ONLY triggering, externally trigger horizontal unit from 5 V connector of Amplitude Calibrator.)

## CONNECTIONS

**Real Time.** 50 Ω coax cable or BNC to BNC patch cord from Amplitude Calibrator .5 V connector to vertical unit channel A input connector. 50 Ω coax cable or BNC to BNC patch cord from Amplitude Calibrator +PRE TRIGGER connector to vertical unit channel B input connector.

## CONTROL SETTINGS

Sampling (50 Ω impedance)

Vertical Unit
- Mv/Div 50
- Mode A + B
- Internal Trigger A

Horizontal Unit
- Time/Div 10 $\mu$SEC
- Triggering +Internal

Type 567
- 20 KC-≈ 1 KC switch 20 KC
- Intensity For normal display brilliance

## CONNECTIONS

**Sampling.** 50 Ω coax cable from Amplitude Calibrator .5 V/50 mV connector to vertical unit channel A input connector through a BNC to GR adapter. 50 Ω coax cable from Amplitude Calibrator +PRE TRIGGER connector to vertical unit channel B input connector through a BNC to GR adapter. 50 Ω coax cable from Amplitude Calibrator 5 V/500 mV connector to horizontal unit external trigger input connector.

e. +PRE TRIGGER Time Check.

Set up the equipment as shown in Fig. 5-34 and obtain the display shown in Fig. 5-35. The time between the rise of the +pre trigger waveform and the following rise of the square wave must be 12.5 $\mu$sec ±5 $\mu$sec.

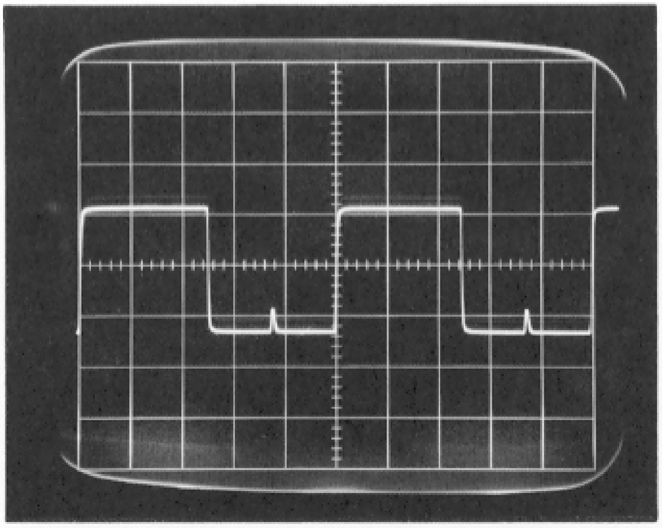


Fig. 5-35. Step 12e waveform.

## PROCEDURE BEFORE S/N 2060

Calibration of Type 567 instruments prior to Serial Number 2060 is performed according to the procedure which follows:

### 1. Low-Voltage Power Supplies

a. —100-Volt Supply is calibrated in the manner described in step 1 of the foregoing procedure.

b. +125-Volt Supply is not adjustable in instruments S/N 101-299, and its tolerance is ±3%. Adjustment of the +125-Volt Supply for S/N 300-up is described in step 2 of the foregoing procedure.

c. +300-Volt Supply is not adjustable from S/N 101-299, and its tolerance is ±3%. Step 3 of the foregoing procedure describes checking and adjustment of the +300-Volt Supply in Type 567 S/N 300-up.

d. —12.2-Volt Supply is not adjustable from S/N 101-299, and its tolerance is ±3%. Checking and adjustment of the —12.2-Volt Supply in Type 567 S/N 300-up is described in step 4 of the foregoing procedure.

e. +20-Volt Supply is not adjustable for S/N 101-2004. Its tolerance for this serial range is ±3%. For S/N 2005-up the +20-Volt Supply is adjustable, with procedure and limits as in step 5 of the preceding procedure.

### 2. High-Voltage Power Supply

The high-voltage power supply limits and adjustment have remained the same from S/N 101-up.

### 3. Crt Deflection Factors

The cathode-ray tube vertical and horizontal deflection factors are listed in the Characteristics section of this manual. Step 8 of the preceding Calibration Procedure outlines how to check the crt deflection factors. The method is the same for earlier instruments, only the vertical limits differ. In instruments below S/N 1999, the vertical deflection factor limits are from 21.7 to 24.1 volts per major graticule division, or a total swing of from 173.6 to 192.8 volts.

### 4. Beam Rotator Coil Adjustment

There is no change in the adjustment of the beam rotator coil, and the procedure included in this manual will apply for all Serial Number instruments.

### 5. Amplitude Calibrator

The Amplitude Calibrator provides line-frequency square waves with ±3% voltage accuracy into 1 megohm or greater for S/N 101-299. The output voltages are 0.05, 0.5, 5 and 50 volts. At S/N 300, R890 was added so the 0.5-volt output jack would provide 50 mv ±3% into 50 ohms.

The CAL AMPL control R871 can be properly adjusted using the following procedure:

Use a jumper lead and ground pin 8 (cathode) of V884A. The multivibrator is now held in a steady state so all the output jacks present a dc voltage rather than a square-wave voltage.

Connect a 1%, 20,000 Ω/v voltmeter between pin 7 (cathode) of V884B and ground. Adjust the CAL AMPL control R871 for a reading of 100 volts. Check the voltage at each front-panel jack to be within 3%.

**S/N 300-up.** Connect a 50 Ω (1%) resistor from the 0.5-volt jack to ground. You should measure 100 mv, ±3%. Remove the jumper lead and the voltmeter.

# SECTION 6
# PARTS LIST AND DIAGRAMS

## 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.

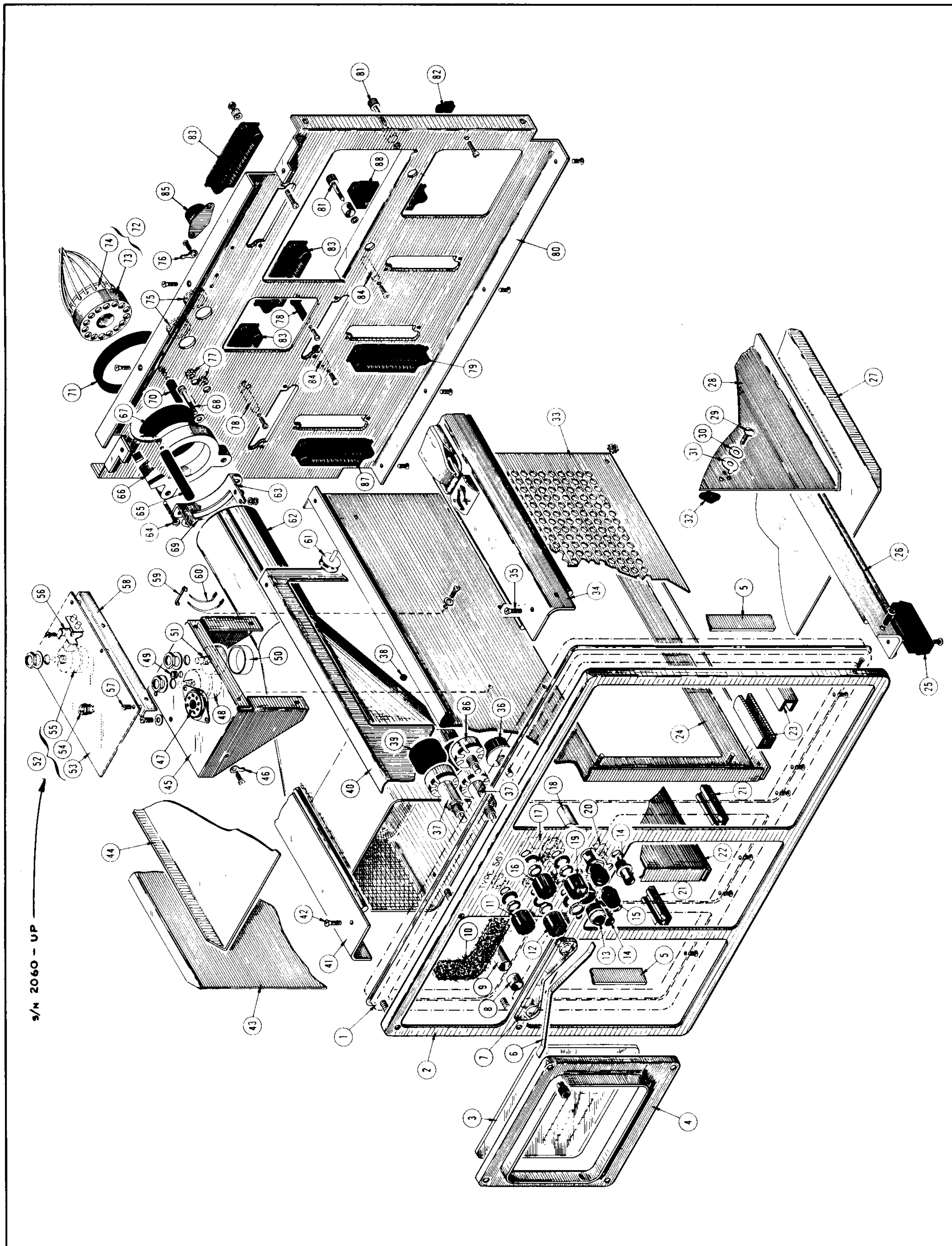
## ABBREVIATIONS AND SYMBOLS

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

### 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. |

FRONT



## FRONT

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 387-0493-00 | 101 | 2059 | 1 | PLATE, front sub-panel |
| | 387-0991-00 | 2060 | | 1 | PLATE, front sub-panel |
| | - - - - - - | | | - | plate includes: |
| | 354-0156-00 | | | 1 | RING, ornamental |
| 2 | 333-0682-00 | 101 | 2059 | 1 | PANEL, front |
| | 333-0868-00 | 2060 | | 1 | PANEL, front |
| | - - - - - - | | | - | mounting hardware: (not included w/panel) |
| | 213-0055-00 | | | 6 | SCREW, thread forming, 2-32 xx $^{3}/_{16}$ inch PHS |
| 3 | 331-0076-00 | 101 | 1998X | 1 | GRATICULE |
| 4 | 200-0272-00 | 101 | 352 | 1 | COVER, graticule |
| | 200-0409-00 | 353 | 1998 | 1 | COVER, trim & graticule assembly |
| | 200-0426-00 | 1999 | | 1 | COVER, trim & graticule assembly |
| | - - - - - - | | | - | cover includes: |
| | 101-0005-00 | X353 | 1998 | 1 | TRIM, graticule cover |
| | 101-0006-00 | 1999 | | 1 | TRIM, graticule cover |
| | - - - - - - | | | - | mounting hardware: (not included w/cover) |
| | 210-0434-00 | 101 | 352 | 4 | NUT, graticule |
| | 210-0571-00 | 353 | | 4 | NUT, graticule |
| | 210-0864-00 | | | 4 | WASHER, $^{3}/_{16}$ ID x $^{3}/_{8}$ inch OD |
| | 210-0844-00 | | | 8 | WASHER, neoprene, $^{7}/_{32}$ ID x $^{3}/_{8}$ inch OD |
| 5 | 381-0196-00 | | | 2 | BAR, stiffener |
| | - - - - - - | | | - | mounting hardware for each: (not included w/bar) |
| | 212-0002-00 | | | 2 | SCREW, 8-32 x $^{1}/_{4}$ inch FHS |
| 6 | 214-0442-00 | X1999 | | 1 | SPRING, light reflector |
| 7 | 387-0934-00 | X1999 | | 1 | PLATE, light reflector |
| 8 | 377-0064-00 | 101 | 1998X | 2 | INSERT, graticule light |
| 9 | 136-0035-00 | | | 2 | SOCKET, graticule light |
| | - - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 211-0534-00 | | | 1 | SCREW, 6-32 x $^{5}/_{16}$ inch PHS w/lockwasher |
| | 210-0803-00 | | | 1 | WASHER, 6L x $^{3}/_{8}$ inch |
| | 210-0457-00 | | | 1 | NUT, keps, 6-32 x $^{5}/_{16}$ inch |
| 10 | 124-0142-00 | 101 | 1998 | 1 | STRIP, felt |
| | 124-0167-00 | 1999 | 2599 | 1 | STRIP, felt |
| | 348-0090-00 | 2600 | | 4 | CUSHION, sponge, CRT |
| 11 | 366-0148-00 | | | 1 | KNOB, small charcoal—FOCUS |
| | - - - - - - | | | - | knob includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x $^{3}/_{16}$ inch HSS |
| 12 | 366-0148-00 | | | 1 | KNOB, small charcoal—INTENSITY |
| | - - - - - - | | | - | knob includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x $^{3}/_{16}$ inch HSS |
| 13 | 136-0031-00 | 101 | 3089 | 1 | SOCKET, light, red |
| | 136-0031-01 | 3090 | | 1 | SOCKET, light, green |

**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 14 | 136-0140-00 | 101 | 2059 | 3 | SOCKET, banana jack |
| | - - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 210-0895-00 | | | 1 | WASHER, insulating |
| | 210-0465-00 | | | 2 | NUT, hex, 1/4-32 x 3/8 inch |
| | 210-0223-00 | | | 1 | LUG, solder, 1/4 inch |
| | 131-0352-00 | 2060 | | 3 | CONNECTOR, female, BNC |
| 15 | 352-0002-00 | | | 1 | ASSEMBLY, fuse holder |
| | - - - - - - | | | - | assembly includes: |
| | 352-0010-00 | | | 1 | HOLDER, fuse |
| | 200-0582-00 | | | 1 | CAP, fuse |
| | 210-0873-00 | | | 1 | WASHER, rubber, 1/2 ID x 11/16 inch OD |
| | - - - - - - | | | 1 | NUT, hex, fuse holder |
| 16 | 366-0148-00 | | | 1 | KNOB, small charcoal—ASTIGMATISM |
| | - - - - - - | | | - | knob includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS |
| 17 | 260-0014-00 | | | 1 | SWITCH, toggle—POWER ON |
| | - - - - - - | | | - | mounting hardware: (not included w/switch) |
| | 210-0414-00 | | | 1 | NUT, hex, 15/32-32 x 9/16 inch |
| | 354-0055-00 | | | 1 | RING, locking, switch |
| | 210-0902-00 | | | 1 | WASHER, .470 ID x 21/32 inch OD |
| | 210-0473-00 | | | 1 | NUT, switch, 15/32-32 x 5/64 inch, 12 sided |
| 18 | 200-0237-00 | 101 | 669X | 1 | COVER, inslulation, fuse holder |
| 19 | 366-0148-00 | | | 1 | KNOB, small charcoal—SCALE ILLUM. |
| | - - - - - - | | | - | knob includes: |
| | 213-0004-00 | | | 1 | SCREW, set, 6-32 x 3/16 inch HSS |
| 20 | 136-0140-00 | 101 | 2059 | 1 | SOCKET, banana jack |
| | - - - - - - | | | - | mounting hardware: (not included w/socket) |
| | 210-0895-00 | | | 1 | WASHER, insulating |
| | 210-0465-00 | | | 1 | NUT, hex, 1/4-32 x 3/8 inch |
| | 210-0223-00 | | | 1 | LUG, solder, 1/4 inch |
| | 260-0613-00 | 2060 | | 1 | SWITCH, toggle—20 KC-1 KC |
| | - - - - - - | | | - | mounting hardware: (not included w/switch) |
| | 210-0940-00 | | | 1 | WASHER, 1/4 ID x 3/8 inch OD |
| | 210-0562-00 | | | 2 | NUT, hex, 1/4-40 x 5/16 inch |
| | 210-0223-00 | 2060 | 2159 | 1 | LUG, solder, 1/4 inch |
| | 210-0255-00 | 2160 | | 1 | LUG, solder, 3/8 inch |
| 21 | 351-0038-00 | | | 2 | GUIDE, rail track, plug-in |
| | - - - - - - | | | - | mounting hardware for each: (not included w/guide) |
| | 211-0541-00 | | | 2 | SCREW, 6-32 x 1/4 inch FHS phillips |
| 22 | 387-0489-00 | | | 1 | PLATE, frame, plug-in housing |
| | - - - - - - | | | - | mounting hardware: (not included w/plate) |
| | 211-0507-00 | | | 2 | SCREW, 6-32 x 5/16 inch BHS |
| | 211-0538-00 | | | 5 | SCREW, 6-32 x 5/16 inch FHS phillips |
| | 210-0457-00 | | | 7 | NUT, keps, 6-32 x 5/16 inch |

**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 23 | 351-0048-00 | | | 2 | GUIDE, rail track, large plug-in |
| | - - - - - - | | | - | mounting hardware for each: (not included w/guide) |
| | 211-0541-00 | | | 2 | SCREW, 6-32 x 1/4 inch FHS phillips |
| 24 | 387-0494-00 | 101 | 339 | 1 | PLATE, frame, plug-in housing |
| | 387-0704-00 | 340 | 2059 | 1 | PLATE, frame, plug-in housing |
| | 387-0987-00 | 2060 | | 1 | PLATE, frame, plug-in housing |
| | - - - - - - | | | - | mounting hardware: (not included w/plate) |
| | 211-0538-00 | | | 8 | SCREW, 6-32 x 5/16 inch FHS phillips |
| | 211-0507-00 | | | 4 | SCREW, 6-32 x 5/16 inch BHS |
| | 210-0803-00 | | | 4 | WASHER, 6L x 3/8 inch |
| | 210-0457-00 | | | 12 | NUT, keps, 6-32 x 5/16 inch |
| 25 | 348-0042-00 | 101 | 2019 | 4 | FOOT, gray |
| | 348-0052-00 | 2020 | | 4 | FOOT, anti-slide |
| | - - - - - - | | | - | mounting hardware for each: (not included w/foot) |
| | 212-0071-00 | | | 2 | SCREW, 8-32 x 1 inch FHS |
| | 210-0458-00 | | | 2 | NUT, keps, 8-32 x 11/32 inch |
| 26 | 122-0101-00 | | | 2 | ANGLE, rail, bottom |
| | - - - - - - | | | - | mounting hardware for each: (not included w/angle) |
| | 212-0039-00 | | | 5 | SCREW, 8-32 x 3/8 inch THS phillips |
| | 210-0458-00 | | | 4 | NUT, keps, 8-32 x 11/32 inch |
| | 210-0804-00 | | | 1 | WASHER, 8S x 3/8 inch |
| 27 | 387-0490-00 | | | 1 | PLATE, cabinet bottom |
| | - - - - - - | | | - | plate includes: |
| | 105-0007-00 | | | 4 | STOP, steel |
| | 210-0480-00 | | | 4 | NUT, latch, nylon, cabinet fastener |
| | 210-0847-00 | | | 4 | WASHER, nylon, .164 ID x .500 inch OD |
| | 213-0114-00 | | | 4 | SCREW, cabinet latch, 8-32 x .437 inch |
| 28 | 387-0485-00 | | | 1 | PLATE, cabinet side, right |
| | - - - - - - | | | - | plate includes: |
| 29 | 213-0114-00 | | | 2 | SCREW, cabinet latch, 8-32 x .437 inch |
| 30 | 210-0847-00 | | | 2 | WASHER, nylon, .164 ID x .500 inch OD |
| 31 | 105-0007-00 | | | 2 | STOP, steel |
| 32 | 210-0480-00 | | | 2 | NUT, latch, nylon, cabinet fastener |
| 33 | 387-0705-00 | X340 | 2059 | 1 | PLATE, access, plug-in |
| | 387-0993-00 | 2060 | | 1 | PLATE, access, plug-in |
| | - - - - - - | | | - | mounting hardware: (not included w/plate) |
| | 210-0457-00 | X340 | 2059 | 6 | NUT, keps, 6-32 x 5/16 inch |
| | 211-0538-00 | 2060 | | 3 | SCREW, 6-32 x 5/16 inch FHS phillips |

**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 34 | 381-0194-00 | | | 1 | BAR, rail, top right |
| | - - - - - - | | | - | bar includes: |
| | 367-0040-00 | | | 1 | ASSEMBLY, handle |
| | - - - - - - | | | - | assembly includes: |
| | 367-0011-00 | | | 1 | HANDLE |
| | 343-0073-00 | | | 2 | CLAMP, handle |
| | 211-0507-00 | | | 6 | SCREW, 6-32 x 5/16 inch BHS |
| | 210-0457-00 | | | 6 | NUT, keps, 6-32 x 5/16 inch |
| 35 | - - - - - - | | | | mounting hardware: (not included w/bar) |
| | 212-0039-00 | | | 4 | SCREW, 8-32 x 3/8 inch THS |
| | 210-0458-00 | | | 4 | NUT, keps, 8-32 x 11/32 inch |
| | 210-0804-00 | | | 1 | WASHER, 8S x 3/8 inch |
| 36 | - - - - - - | | | 1 | POT |
| | - - - - - - | | | - | mounting hardware: (not included w/pot) |
| | 210-0590-00 | | | 1 | NUT, hex., 3/8-32 x 7/16 inch |
| | 210-0012-00 | | | 1 | LOCKWASHER, internal, 3/8 x 1/2 inch |
| | 210-0840-00 | | | 1 | WASHER, .390 ID x 9/16 inch OD |
| | 210-0413-00 | | | 1 | NUT, hex, 3/8-32 x 1/2 inch |
| 37 | - - - - - - | | | 2 | POT |
| | - - - - - - | | | - | mounting hardware for each: (not included w/pot) |
| | 210-0013-00 | | | 1 | LOCKWASHER, internal, 3/8 x 11/16 inch |
| | 210-0840-00 | | | 1 | WASHER, .390 ID x 9/16 inch OD |
| | 210-0413-00 | | | 1 | NUT, hex, 3/8-32 x 1/2 inch |
| 38 | 348-0031-00 | | | 4 | GROMMET, plastic, 3/32 inch |
| 39 | 200-0269-00 | 101 | 3139 | 2 | COVER, pot |
| | 200-0745-00 | 3140 | | 2 | COVER, pot |
| 40 | 406-0737-00 | 101 | 2059 | 1 | BRACKET, crt shield |
| | 407-0071-00 | 2060 | | 1 | BRACKET, crt shield |
| | - - - - - - | | | - | mounting hardware: (not included w/bracket) |
| | 211-0507-00 | | | 2 | SCREW, 6-32 x 5/16 inch BHS |
| | 211-0538-00 | | | 4 | SCREW, 6-32 x 5/16 inch FHS |
| | 210-0803-00 | | | 6 | WASHER, 6L x 3/8 inch |
| | 210-0457-00 | | | 6 | NUT, keps, 6-32 x 5/16 inch |
| 41 | 381-0195-00 | | | 1 | BAR, rail, top left |
| | - - - - - - | | | - | bar includes: |
| | 367-0040-00 | | | 1 | ASSEMBLY, handle |
| | - - - - - - | | | - | assembly includes: |
| | 367-0011-00 | | | 1 | HANDLE |
| | 343-0073-00 | | | 2 | CLAMP, handle |
| | 211-0507-00 | | | 6 | SCREW, 6-32 x 5/16 inch BHS |
| | 210-0457-00 | | | 6 | NUT, keps, 6-32 x 5/16 inch |
| 42 | - - - - - - | | | - | mounting hardware: (not included w/bar) |
| | 212-0039-00 | | | 4 | SCREW, 8-32 x 3/8 inch THS |
| | 210-0458-00 | | | 4 | NUT, keps, 8-32 x 11/32 inch |
| | 210-0804-00 | | | 1 | WASHER, 8S x 3/8 inch |

**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 43 | 387-0486-00 | | | 1 | PLATE, cabinet side, left |
| | - - - - - - | | | - | plate includes: |
| | 105-0007-00 | | | 2 | STOP, steel |
| | 210-0480-00 | | | 2 | NUT, latch, nylon, cabinet fastener |
| | 210-0847-00 | | | 2 | WASHER, nylon, .164 ID x .500 inch OD |
| | 213-0114-00 | | | 2 | SCREW, cabinet latch, 8-32 x .437 inch |
| 44 | 387-0491-00 | | | 1 | PLATE, cabinet top |
| | - - - - - - | | | - | plate includes: |
| | 105-0007-00 | | | 4 | STOP, steel |
| | 210-0480-00 | | | 4 | NUT, latch, nylon, cabinet fastener |
| | 210-0847-00 | | | 4 | WASHER, nylon, .164 ID x .500 inch OD |
| | 213-0114-00 | | | 4 | SCREW, cabinet latch, 8-32 x .437 inch |
| 45 | 441-0405-00 | 101 | 2059X | 1 | CHASSIS, calibrator |
| | - - - - - - | | | - | mounting hardware: (not included w/chassis) |
| | 211-0507-00 | | | 6 | SCREW, 6-32 x $^5/_{16}$ inch BHS |
| | 210-0803-00 | | | 6 | WASHER, 6L x $^3/_8$ inch |
| 46 | 210-0201-00 | 101 | 2059X | 1 | LUG, solder, SE #4 |
| | - - - - - - | | | - | mounting hardware: (not included w/lug) |
| | 213-0044-00 | | | 1 | SCREW, thread cutting, 5-32 x $^3/_{16}$ inch PHS phillips |
| 47 | 136-0015-00 | 101 | 2059X | 1 | SOCKET, STM9G |
| | - - - - - - | | | - | mounting hardware: (not included w/socket) |
| | 213-0044-00 | | | 2 | SCREW, thread cutting, 5-32 x $^3/_{16}$ inch PHS phillips |
| 48 | - - - - - - | 101 | 2059X | 1 | POT |
| | - - - - - - | | | - | mounting hardware: (not included w/pot) |
| | 210-0207-00 | | | 1 | LUG, solder, $^3/_8$ inch |
| | 210-0012-00 | | | 1 | LOCKWASHER, internal, $^3/_8$ x $^1/_2$ inch |
| | 210-0840-00 | | | 1 | WASHER, .390 ID x $^9/_{16}$ inch OD |
| | 210-0413-00 | | | 1 | NUT, hex, $^3/_8$-32 x $^1/_2$ inch |
| 49 | 348-0004-00 | 101 | 2059X | 1 | GROMMET, $^3/_8$ inch |
| 50 | 200-0247-00 | 101 | 489X | 1 | CAP, pot |
| 51 | - - - - - - | 101 | 2059X | 1 | POT |
| | - - - - - - | | | - | mounting hardware: (not included w/pot) |
| | 210-0840-00 | X490 | 2059X | 1 | WASHER, .390 ID x $^9/_{16}$ inch OD |
| | 210-0413-00 | X490 | 2059X | 1 | NUT, hex, $^3/_8$-32 x $^1/_2$ inch |

**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 52 | 670-0403-00 | X2060 | | 1 | ASSEMBLY, CIRCUIT BOARD, CALIBRATOR (See Ref #57) |
| | - - - - - - | | | - | assembly includes: |
| 53 | 388-0622-00 | X2060 | | 1 | BOARD, etched circuit, calibrator |
| 54 | 136-0150-00 | X2060 | | 5 | SOCKET, 3-pin transistor |
| 55 | - - - - - - | X2060 | | 1 | POT |
| | - - - - - - | | | - | mounting hardware: (not included w/pot alone) |
| | 210-0207-00 | | | 1 | LUG, solder, 3/8 inch |
| | 210-0012-00 | | | 1 | LOCKWASHER, internal, 3/8 x 1/2 inch |
| | 210-0840-00 | | | 1 | WASHER, .390 ID x 9/16 inch OD |
| | 210-0413-00 | | | 1 | NUT, hex, 3/8-32 x 1/2 inch |
| 56 | 136-0153-00 | X2060 | | 1 | SOCKET, crystal |
| | - - - - - - | | | - | mounting hardware: (not included w/socket alone) |
| | 211-0022-00 | | | 2 | SCREW, 2-56 x 3/16 inch RHS |
| | 210-0001-00 | | | 2 | LOCKWASHER, internal, #2 |
| | 210-0405-00 | | | 2 | NUT, hex, 2-56 x 3/16 inch |
| 57 | - - - - - - | | | - | mounting hardware: (not included w/assembly) |
| | 211-0507-00 | 2060 | 2289 | 6 | SCREW, 6-32 x 5/16 inch BHS |
| | 211-0601-00 | 2290 | | 6 | SCREW, sems, 6-32 x 5/16 inch PHB, phillips |
| 58 | 407-0070-00 | X2060 | | 1 | BRACKET, calibrator |
| | - - - - - - | | | - | mounting hardware: (not included w/bracket) |
| | 211-0507-00 | | | 2 | SCREW, 6-32 x 5/16 inch BHS |
| | 210-0803-00 | | | 2 | WASHER, 6L x 3/8 inch |
| 59 | 344-0111-00 | X2020 | | 1 | CLIP, deflection lead |
| 60 | 175-0582-00 | 101 | 409 | 1 | WIRE, crt lead, .458 foot, striped brown, w/connector |
| | 175-0641-00 | 410 | | 1 | WIRE, crt lead, .833 foot, brown, w/connector |
| | 175-0583-00 | | | 1 | WIRE, crt lead, 11 1/2 inches, striped red, w/connector |
| | 175-0584-00 | | | 1 | WIRE, crt lead, 11 1/2 inches, striped green, w/connector |
| | 175-0596-00 | 101 | 409 | 1 | WIRE, crt lead, .417 foot, striped blue, w/connector |
| | 175-0642-00 | 410 | | 1 | WIRE, crt lead, .833 foot, blue, w/connector |
| 61 | 214-0210-00 | | | 1 | ASSEMBLY, solder |
| | - - - - - - | | | - | assembly includes: |
| | 214-0209-00 | | | 1 | SPOOL, solder |
| | - - - - - - | | | - | mounting hardware: (not included w/spool) |
| | 361-0007-00 | | | 1 | SPACER, nylon, .063 inch |
| 62 | 337-0495-00 | | | 1 | SHIELD, crt |
| | - - - - - - | | | - | mounting hardware: (not included w/shield) |
| | 211-0504-00 | | | 4 | SCREW, 6-32 x 1/4 inch BHS |
| | 211-0503-00 | | | 2 | SCREW, 6-32 x 3/16 inch BHS |
| 63 | 406-0730-00 | | | 1 | BRACKET, adjustment |
| | - - - - - - | | | - | mounting hardware: (not included w/bracket) |
| | 211-0534-00 | | | 4 | SCREW, 6-32 x 5/16 inch PHS w/lockwasher |
| | 210-0803-00 | | | 4 | WASHER, 6L x 3/8 inch |
| | 210-0457-00 | | | 4 | NUT, keps, 6-32 x 5/16 inch |

**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 64 | 211-0560-00 | | | 1 | SCREW, 6-32 x 1 inch RHS |
| | 210-0407-00 | 101 | 718 | 1 | NUT, hex., 6-32 x 1/4 inch |
| | 220-0419-00 | 719 | | 1 | NUT, square, 6-32 x 5/16 inch |
| 65 | 385-0137-00 | 101 | 409X | 1 | ROD, delrin, 2 1/4 inches |
| | - - - - - - | | | - | mounting hardware: (not included w/rod) |
| | 213-0041-00 | | | 1 | SCREW, thread cutting, 6-32 x 3/8 inch THS phillips |
| 66 | 354-0147-00 | 101 | 609 | 1 | RING, clamping (See Ref #68 & 69) |
| | 354-0212-00 | 610 | | 1 | RING, clamping (See Ref #68 & 69) |
| | - - - - - - | | | - | ring includes: |
| 67 | 124-0160-00 | X610 | | 1 | STRIP, liner, crt clamp |
| | - - - - - - | | | - | mounting hardware: (not included w/ring) |
| 68 | 211-0576-00 | | | 2 | SCREW, 6-32 x 7/8 inch socket head cap |
| | 210-0858-00 | | | 2 | WASHER, 5/32 ID x 1/2 inch OD |
| 69 | 214-0207-00 | | | 1 | NUT, adjustment, securing |
| 70 | 385-0137-00 | | | 1 | ROD, delrin, 2 1/4 inches |
| | - - - - - - | | | - | mounting hardware: (not included w/rod) |
| | 213-0041-00 | | | 1 | SCREW, thread cutting, 6-32 x 3/8 inch THS phillips |
| 71 | 348-0041-00 | | | 1 | CUSHION, rubber |
| 72 | 179-0596-00 | | | 1 | CABLE HARNESS, crt socket |
| | - - - - - - | | | - | cable harness includes: |
| | 136-0124-00 | 101 | 649 | 1 | SOCKET, crt, wired |
| | 136-0175-00 | 650 | | 1 | SOCKET, crt, wired |
| | - - - - - - | | | - | socket includes: |
| 73 | 136-0117-00 | | | 1 | SOCKET, crt w/o leads |
| | 131-0178-00 | | | 9 | CONNECTOR, cable end, crt |
| 74 | 387-0393-00 | | | 1 | PLATE, back, crt socket |
| | - - - - - - | | | - | mounting hardware: (not included w/plate alone) |
| | 213-0086-00 | | | 2 | SCREW, thread cutting, 2-32 x 7/16 inch PHS |
| 75 | 348-0012-00 | | | 2 | GROMMET, 5/8 inch |
| 76 | 210-0201-00 | | | 2 | LUG, solder, SE #4 |
| | - - - - - - | | | - | mounting hardware for each: (not included w/lug) |
| | 213-0044-00 | | | 1 | SCREW, thread cutting, 5-32 x 3/16 inch PHS phillips |
| 77 | 348-0002-00 | | | 2 | GROMMET, 1/4 inch |
| 78 | 352-0015-00 | 101 | 2229X | 2 | HOLDER, nylon, coil form |
| | - - - - - - | | | - | mounting hardware for each: (not included w/holder) |
| | 213-0045-00 | | | 1 | SCREW, self-tapping, 4-40 x 5/16 inch PHS phillips |
| 79 | 131-0148-00 | | | 1 | CONNECTOR, 24-contact, female |
| | - - - - - - | | | - | mounting hardware: (not included w/connector) |
| | 211-0012-00 | | | 2 | SCREW, 4-40 x 3/8 inch BHS |
| | 210-0004-00 | | | 1 | LOCKWASHER, internal, #4 |
| | 210-0201-00 | | | 1 | LUG, solder, SE #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x 3/16 inch |

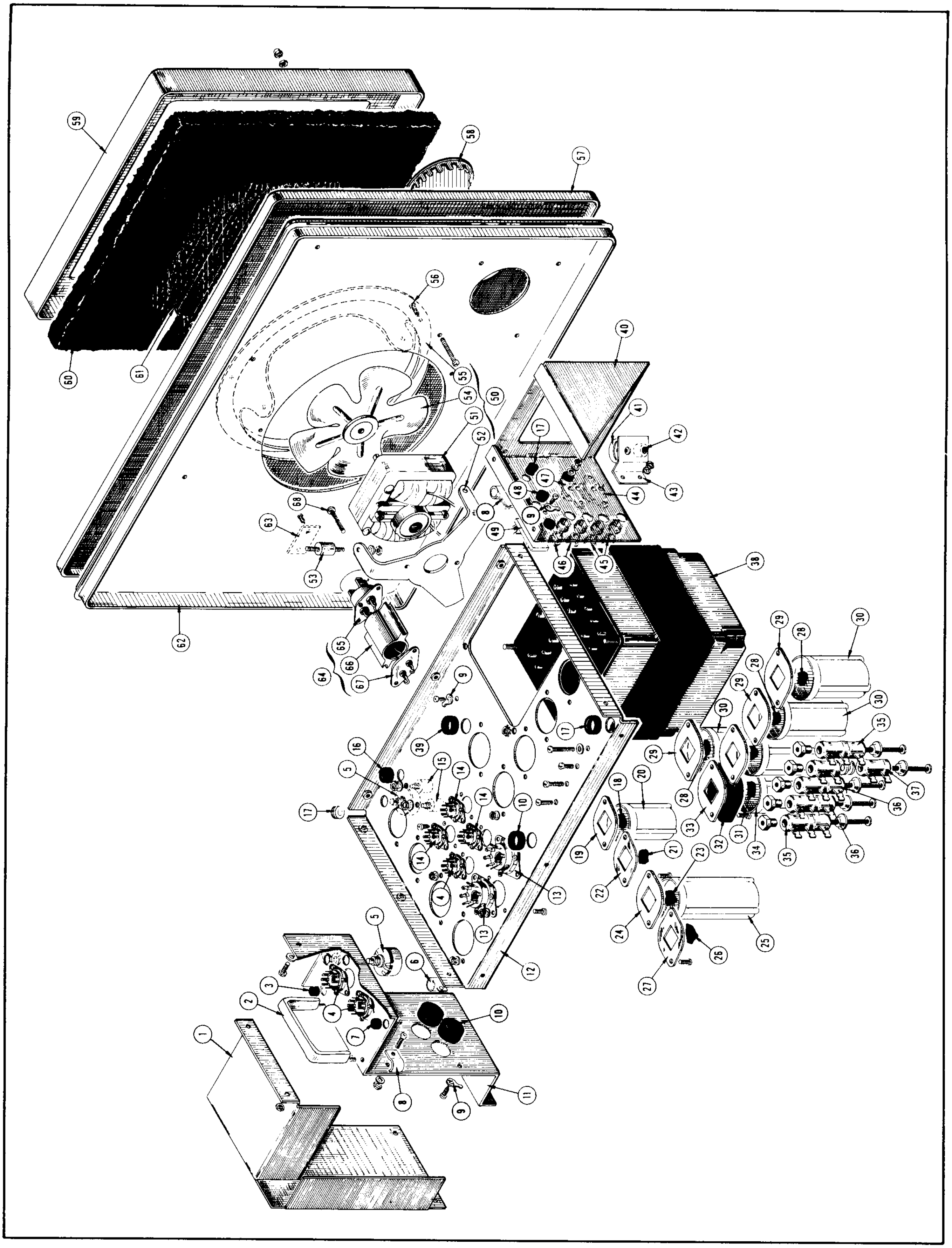
**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 80 | 387-0492-00 | 101 | 2059 | 1 | PLATE, bulkhead |
| | 387-0990-00 | 2060 | | 1 | PLATE, bulkhead |
| | - - - - - - | | | - | plate includes: |
| 81 | 214-0226-00 | | | 2 | FASTENER, screw, 10-24 x $1\frac{3}{8}$ inches |
| | 358-0182-00 | | | 2 | BUSHING, stand-off |
| | 354-0171-00 | | | 2 | RING, retaining |
| 82 | 343-0003-00 | | | 1 | CLAMP, cable, $\frac{1}{4}$ inch |
| | - - - - - - | | | - | mounting hardware: (not included w/clamp) |
| | 211-0510-00 | | | 1 | SCREW, 6-32 x $\frac{3}{8}$ inch BHS |
| | 210-0803-00 | | | 1 | WASHER, 6L x $\frac{3}{8}$ inch |
| | 210-0457-00 | | | 1 | NUT, keps, 6-32 x $\frac{5}{16}$ inch |
| 83 | 131-0148-00 | | | 3 | CONNECTOR, 24-contact, female |
| | - - - - - - | | | - | mounting hardware for each: (not included w/connector) |
| | 211-0014-00 | | | 2 | SCREW, 4-40 x $\frac{1}{2}$ inch BHS |
| | 166-0029-00 | | | 2 | TUBE, spacer |
| | 210-0004-00 | | | 2 | LOCKWASHER, internal, #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x $\frac{3}{16}$ inch |
| 84 | 385-0135-00 | | | 2 | ROD, delrin, $\frac{15}{16}$ inch |
| | - - - - - - | | | - | mounting hardware for each: (not included w/rod) |
| | 213-0041-00 | | | 1 | SCREW, thread cutting, 6-32 x $\frac{3}{8}$ inch THS phillips |
| 85 | 260-0246-00 | | | 1 | SWITCH, thermal cutout |
| | - - - - - - | | | - | mounting hardware: (not included w/switch) |
| | 211-0507-00 | | | 2 | SCREW, 6-32 x $\frac{5}{16}$ inch BHS |
| | 210-0803-00 | | | 2 | WASHER, 6L x $\frac{3}{8}$ inch |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x $\frac{1}{4}$ inch |
| 86 | - - - - - - | | | 1 | POT |
| | - - - - - - | | | - | mounting hardware: (not included w/pot) |
| | 210-0012-00 | | | 1 | LOCKWASHER, internal, $\frac{3}{8}$ x $\frac{1}{2}$ inch |
| | 210-0207-00 | | | 1 | LUG, solder, $\frac{3}{8}$ inch |
| | 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 |
| 87 | 131-0148-00 | | | 1 | CONNECTOR, 24-contact, female |
| | - - - - - - | | | - | mounting hardware: (not included w/connector) |
| | 211-0012-00 | | | 2 | SCREW, 4-40 x $\frac{3}{8}$ inch BHS |
| | 210-0201-00 | | | 2 | LUG, solder, SE #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x $\frac{3}{16}$ inch |

**FRONT** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 88 | 131-0148-00 | | | 1 | CONNECTOR, 24-contact, female |
| | - - - - - - | | | - | mounting hardware: (not included w/connector) |
| | 211-0014-00 | | | 2 | SCREW, 4-40 x $1/2$ inch BHS |
| | 166-0029-00 | | | 2 | TUBE, spacer |
| | 210-0004-00 | | | 1 | LOCKWASHER, internal, #4 |
| | 210-0201-00 | | | 1 | LUG, solder, SE #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x $3/16$ inch |

REAR





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## REAR

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | Q T Y. | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 337-0474-00 | | | 1 | SHIELD, high-voltage |
| | - - - - - - | | | - | mounting hardware: (not included w/shield) |
| | 211-0504-00 | | | 2 | SCREW, 6-32 x 1/4 inch BHS |
| | 210-0457-00 | | | 2 | NUT, keps, 6-32 x 5/16 inch |
| 2 | 346-0001-00 | | | 1 | STRAP, mounting, high-voltage transformer |
| | - - - - - - | | | - | mounting hardware: (not included w/strap) |
| | 210-0004-00 | | | 2 | LOCKWASHER, internal, #4 |
| | 210-0406-00 | | | 2 | NUT, hex, 4-40 x 3/16 inch |
| 3 | 348-0003-00 | | | 1 | GROMMET, 5/16 inch |
| 4 | 136-0015-00 | | | 3 | SOCKET, STM9G |
| | - - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 213-0044-00 | | | 2 | SCREW, thread cutting, 5-32 x 3/16 inch PHS phillips |
| 5 | - - - - - - | | | 2 | POT |
| | - - - - - - | | | - | mounting hardware for each: (not included w/pot) |
| | 210-0840-00 | | | 1 | WASHER, .390 ID x 9/16 inch OD |
| | 210-0413-00 | | | 1 | NUT, hex, 3/8-32 x 1/2 inch |
| 6 | 343-0004-00 | | | 1 | CLAMP, cable, 5/16 inch |
| | - - - - - - | | | - | mounting hardware: (not included w/clamp) |
| | 211-0510-00 | | | 1 | SCREW, 6-32 x 3/8 inch BHS |
| | 210-0803-00 | | | 1 | WASHER, 6L x 3/8 inch |
| | 210-0457-00 | | | 1 | NUT, keps, 6-32 x 5/16 inch |
| 7 | 348-0002-00 | | | 1 | GROMMET, 1/4 inch |
| 8 | 343-0042-00 | | | 2 | CLAMP, cable, 5/16 inch (half) |
| | - - - - - - | | | - | mounting hardware for each: (not included w/clamp) |
| | 211-0507-00 | | | 1 | SCREW, 6-32 x 5/16 inch BHS |
| | 210-0803-00 | | | 1 | WASHER, 6L x 3/8 inch |
| | 210-0006-00 | | | 1 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 1 | NUT, hex, 6-32 x 1/4 inch |
| 9 | 210-0201-00 | | | 4 | LUG, solder, SE #4 |
| | - - - - - - | | | - | mounting hardware for each: (not included w/lug) |
| | 213-0044-00 | | | 1 | SCREW, thread cutting, 5-32 x 3/16 inch PHS phillips |
| 10 | 348-0006-00 | | | 3 | GROMMET, 3/4 inch |
| 11 | 441-0406-00 | | | 1 | CHASSIS, high-voltage/focus & intensity |
| | - - - - - - | | | - | mounting hardware: (not included w/chassis) |
| | 211-0507-00 | | | 2 | SCREW, 6-32 x 5/16 inch BHS |
| | 210-0803-00 | | | 2 | WASHER, 6L x 3/8 inch |
| | 211-0538-00 | | | 5 | SCREW, 6-32 x 5/16 inch FHS phillips |
| 12 | 441-0407-00 | | | 1 | CHASSIS, power |
| | - - - - - - | | | - | mounting hardware: (not included w/chassis) |
| | 212-0004-00 | | | 3 | SCREW, 8-32 x 5/16 inch BHS |
| | 210-0804-00 | | | 4 | WASHER, 8S x 3/8 inch |
| | 210-0458-00 | | | 1 | NUT, keps, 8-32 x 11/32 inch |
| | 212-0040-00 | | | 5 | SCREW, 8-32 x 3/8 inch FHS phillips |

**REAR** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 13 | 136-0011-00 | | | 2 | SOCKET, STM8G |
| | - - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 211-0538-00 | | | 2 | SCREW, 6-32 x 5/16 inch FHS phillips |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x 1/4 inch |
| 14 | 136-0008-00 | | | 3 | SOCKET, STM7G |
| | - - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 213-0044-00 | | | 2 | SCREW, thread cutting, 5-32 x 3/16 inch PHS phillips |
| 15 | - - - - - - | | | 2 | POT |
| | - - - - - - | | | - | mounting hardware for each: (not included w/pot) |
| | 210-0046-00 | | | 1 | LOCKWASHER, internal, .400 OD x .261 inch ID |
| | 210-0583-00 | | | 1 | NUT, hex, 1/4-32 x 5/16 inch |
| 16 | 348-0004-00 | | | 1 | GROMMET, 3/8 inch |
| 17 | 348-0005-00 | | | 3 | GROMMET, 1/2 inch |
| 18 | - - - - - - | | | 1 | CAPACITOR |
| | - - - - - - | | | - | capacitor includes: |
| 19 | 386-0252-00 | | | 1 | PLATE, fiber, small capacitor |
| 20 | 200-0256-00 | | | 1 | COVER, capacitor |
| | - - - - - - | | | - | mounting hardware: (not included w/capacitor) |
| | 211-0534-00 | | | 2 | SCREW, 6-32 x 5/16 inch PHS w/lockwasher |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x 1/4 inch |
| 21 | - - - - - - | | | 1 | CAPACITOR |
| | - - - - - - | | | - | capacitor includes: |
| 22 | 386-0253-00 | | | 1 | PLATE, metal, small capacitor |
| | - - - - - - | | | - | mounting hardware: (not included w/capacitor) |
| | 211-0534-00 | | | 2 | SCREW, 6-32 x 5/16 inch PHS w/lockwasher |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x 1/4 inch |
| 23 | - - - - - - | | | 1 | CAPACITOR |
| | - - - - - - | | | - | capacitor includes: |
| 24 | 386-0254-00 | | | 1 | PLATE, fiber, large capacitor |
| 25 | 200-0261-00 | | | 1 | COVER, capacitor |
| | - - - - - - | | | - | mounting hardware: (not included w/capacitor) |
| | 211-0543-00 | | | 2 | SCREW, 6-32 x 5/16 inch RHS |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x 1/4 inch |
| 26 | - - - - - - | | | 1 | CAPACITOR |
| | - - - - - - | | | - | capacitor includes: |
| 27 | 386-0255-00 | | | 1 | PLATE, metal, large capacitor |
| | - - - - - - | | | - | mounting hardware: (not included w/capacitor) |
| | 211-0534-00 | | | 2 | SCREW, 6-32 x 5/16 inch PHS w/lockwasher |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x 1/4 inch |

**REAR** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | Q T Y. | DESCRIPTION |
|---|---|---|---|---|---|
| 28 | - - - - - - | | | 4 | CAPACITOR |
| | - - - - - - | | | - | each capacitor includes: |
| 29 | 386-0254-00 | | | 1 | PLATE, fiber, large capacitor |
| 30 | 200-0293-00 | | | 1 | COVER, capacitor |
| | - - - - - - | | | - | mounting hardware for each: (not included w/capacitor) |
| | 211-0543-00 | | | 2 | SCREW, 6-32 x $^5/_{16}$ inch RHS |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x $^1/_4$ inch |
| 31 | - - - - - - | | | 1 | CAPACITOR |
| | - - - - - - | | | - | mounting hardware: (not included w/capacitor) |
| 32 | 432-0044-00 | X360 | 2279X | 1 | BASE, capacitor mounting |
| 33 | 386-0254-00 | | | 1 | PLATE, fiber, large capacitor |
| | 211-0543-00 | 101 | 359 | 2 | SCREW, 6-32 x $^5/_{16}$ inch RHS |
| | 211-0514-00 | 360 | 2279 | 2 | SCREW, 6-32 x $^3/_4$ inch BHS |
| | 211-0543-00 | 2280 | | 2 | SCREW, 6-32 x $^5/_{16}$ inch RHS |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x $^1/_4$ inch |
| 34 | 200-0261-00 | 101 | 359 | 1 | COVER, capacitor, $4^1/_{16}$ inches |
| | 200-0259-00 | 360 | 2109 | 1 | COVER, capacitor, $3^9/_{16}$ inches |
| | 200-0293-00 | 2110 | 2279 | 1 | COVER, capacitor, $2^9/_{16}$ inches |
| | 200-0258-00 | 2280 | | 1 | COVER, capacitor, $3^1/_{32}$ inches |
| 35 | - - - - - - | | | 2 | RESISTOR |
| | - - - - - - | | | - | mounting hardware for each: (not included w/resistor) |
| | 212-0037-00 | | | 1 | SCREW, 8-32 x $1^3/_4$ inches Fil HS |
| | 210-0008-00 | | | 1 | LOCKWASHER, internal, #8 |
| | 210-0809-00 | 101 | 3189 | 1 | WASHER, resistor centering |
| | 210-0808-00 | 3190 | | 1 | WASHER, resistor centering |
| | 210-0462-00 | | | 1 | NUT, hex, resistor mounting |
| | 212-0004-00 | | | 1 | SCREW, 8-32 x $^5/_{16}$ inch BHS |
| 36 | - - - - - - | | | 2 | RESISTOR |
| | - - - - - - | | | - | mounting hardware for each: (not included w/resistor) |
| | 212-0037-00 | | | 1 | SCREW, 8-32 x $1^3/_4$ inches Fil HS |
| | 210-0808-00 | | | 1 | WASHER, resistor centering |
| | 210-0462-00 | | | 1 | NUT, hex, resistor mounting |
| | 212-0004-00 | | | 1 | SCREW, 8-32 x $^5/_{16}$ inch BHS |
| 37 | - - - - - - | 101 | 2004 | 1 | RESISTOR |
| | - - - - - - | 2005 | | 2 | RESISTOR (stacked on top of each other) |
| | - - - - - - | | | - | mounting hardware: (not included w/resistor) |
| | 212-0037-00 | 101 | 2004 | 1 | SCREW, 8-32 x $1^3/_4$ inches Fil HS |
| | 211-0552-00 | 2005 | | 1 | SCREW, 6-32 x 2 inches BHS |
| | 210-0808-00 | 101 | 2004 | 1 | WASHER, resistor centering |
| | 210-0886-00 | 2005 | | 3 | WASHER, centering |
| | 210-0803-00 | X2005 | | 1 | WASHER, 6L x $^3/_8$ inch |
| | 210-0805-00 | X2005 | | 1 | WASHER, 10S x $^7/_{16}$ inch |
| | 210-0462-00 | 101 | 2004 | 1 | NUT, hex, resistor mounting |
| | 210-0478-00 | 2005 | | 1 | NUT, hex, resistor mounting |
| | 212-0004-00 | 101 | 2004 | 1 | SCREW, 8-32 x $^5/_{16}$ inch BHS |
| | 211-0510-00 | 2005 | | 1 | SCREW, 6-32 x $^3/_8$ inch BHS |

**REAR** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 38 | - - - - - - | | | 1 | TRANSFORMER |
| | - - - - - - | | | - | transformer includes: (mounting hardware) |
| | 212-0546-00 | | | 4 | SCREW, 10-32 x $4\frac{1}{2}$ inches HHS |
| | 210-0812-00 | | | 4 | WASHER, fiber, #10 |
| | 220-0410-00 | | | 4 | NUT, keps, 10-32 x $\frac{3}{8}$ inch |
| 39 | 348-0012-00 | | | 1 | GROMMET, $\frac{5}{8}$ inch |
| 40 | 441-0421-00 | | | 1 | CHASSIS, regulator & transformer support |
| | - - - - - - | | | - | mounting hardware: (not included w/chassis) |
| | 212-0040-00 | | | 4 | SCREW, 8-32 x $\frac{3}{8}$ inch FHS phillips |
| | 210-0804-00 | | | 8 | WASHER, 8S x $\frac{3}{8}$ inch |
| | 210-0458-00 | | | 8 | NUT, keps, 8-32 x $\frac{11}{32}$ inch |
| 41 | - - - - - - | X2005 | | 1 | POT |
| | - - - - - - | | | - | mounting hardware: (not included w/pot) |
| | 210-0046-00 | | | 1 | LOCKWASHER, internal, .400 OD x .261 inch ID |
| | 210-0583-00 | | | 1 | NUT, hex, $\frac{1}{4}$-32 x $\frac{5}{16}$ inch |
| 42 | - - - - - - | X408 | | 1 | POT |
| | - - - - - - | | | - | mounting hardware: (not included w/pot) |
| | 210-0046-00 | | | 1 | LOCKWASHER, internal, .400 OD x .261 inch ID |
| | 210-0583-00 | | | 1 | NUT, hex, $\frac{1}{4}$-32 x $\frac{5}{16}$ inch |
| 43 | 406-0895-00 | X408 | | 1 | BRACKET, pot |
| | - - - - - - | | | - | mounting hardware: (not included w/bracket) |
| | 211-0507-00 | | | 2 | 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 |
| 44 | - - - - - - | | | 1 | TRANSISTOR |
| | - - - - - - | | | - | mounting hardware: (not included w/transistor) |
| | 211-0510-00 | | | 2 | SCREW, 6-32 x $\frac{3}{8}$ inch BHS |
| | 210-0006-00 | | | 1 | LOCKWASHER, internal, #6 |
| | 210-0202-00 | | | 1 | LUG, solder, SE #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x $\frac{1}{4}$ inch |
| 45 | 136-0095-00 | 101 | 2019 | 2 | SOCKET, 4-pin transistor |
| | 136-0181-00 | 2020 | | 2 | SOCKET, 3-pin transistor |
| | - - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 213-0113-00 | 101 | 2019 | 2 | SCREW, thread forming, 2-32 x $\frac{5}{16}$ inch RHS phillips |
| | 354-0234-00 | 2020 | | 1 | RING, transistor socket |
| 46 | 136-0095-00 | 101 | 2019 | 2 | SOCKET, 4-pin transistor |
| | 136-0182-00 | 2020 | | 2 | SOCKET, 4-pin transistor |
| | - - - - - - | | | - | mounting hardware for each: (not included w/socket) |
| | 213-0113-00 | 101 | 2019 | 2 | SCREW, thread forming, 2-32 x $\frac{5}{16}$ inch RHS phillips |
| | 354-0234-00 | 2020 | | 1 | RING, transistor socket |

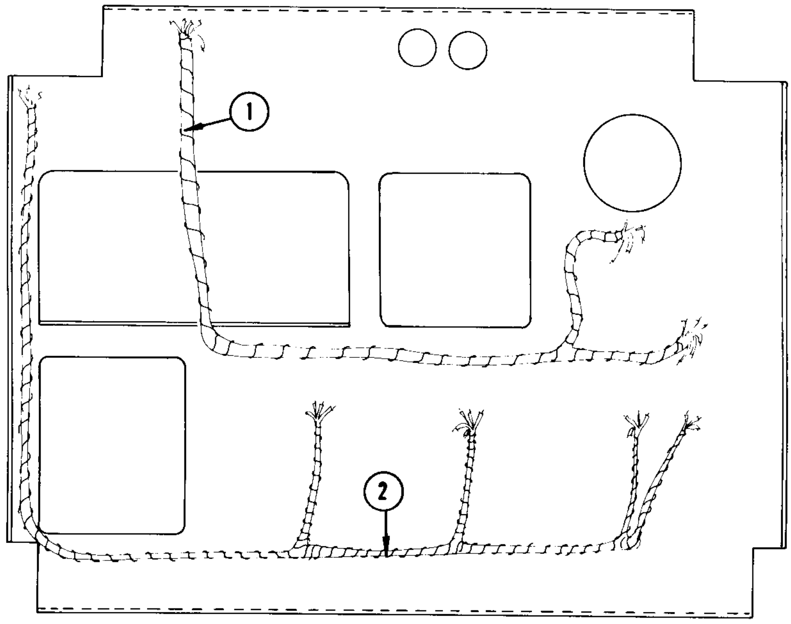
**REAR** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 47 | - - - - - - | | | 1 | TRANSISTOR |
| | - - - - - - | | | - | mounting hardware: (not included w/transistor) |
| | 129-0049-00 | 101 | 649 | 2 | POST, terminal |
| | 211-0511-00 | 650 | | 2 | SCREW, 6-32 x 1/2 inch BHS |
| | 210-0409-00 | 101 | 649 | 2 | NUT, hex, 8-32 x 5/16 inch |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x 1/4 inch |
| | 210-0008-00 | 101 | 649 | 2 | LOCKWASHER, internal, #8 |
| | 210-0006-00 | 101 | 649 | 2 | LOCKWASHER, internal, #6 |
| | 210-0006-00 | 650 | | 1 | LOCKWASHER, internal, #6 |
| | 210-0202-00 | 650 | | 1 | LUG, solder, SE #6 |
| | 210-0804-00 | 101 | 649 | 2 | WASHER, 8S x 3/8 inch |
| | 210-0803-00 | 650 | | 2 | WASHER, 6L x 3/8 inch |
| | 210-0900-00 | | | 2 | WASHER, bakelite |
| | 387-0345-00 | | | 1 | PLATE, insulator |
| 48 | 354-0068-00 | 101 | 2168 | 2 | RING, securing |
| | 354-0068-00 | 2169 | | 1 | RING, securing |
| 49 | 352-0025-00 | | | 1 | HOLDER, fuse, dual |
| | - - - - - - | | | - | mounting hardware: (not included w/holder) |
| | 211-0511-00 | | | 2 | SCREW, 6-32 x 1/2 inch BHS |
| | 210-0006-00 | | | 2 | LOCKWASHER, internal, #6 |
| | 210-0407-00 | | | 2 | NUT, hex, 6-32 x 1/4 inch |
| 50 | 635-0409-00 | | | 1 | ASSEMBLY, FAN MOTOR (See Ref #56) |
| | - - - - - - | | | - | assembly includes: |
| 51 | 147-0001-00 | | | 1 | MOTOR |
| | - - - - - - | | | - | mounting hardware: (not included w/motor alone) |
| | 355-0044-00 | | | 2 | STUD, 10-32 x 2 7/16 inches |
| | 210-0010-00 | | | 6 | LOCKWASHER, internal, #10 |
| | 210-0410-00 | | | 4 | NUT, hex, 10-32 x 5/16 inch |
| 52 | 426-0047-00 | | | 1 | MOUNT, fan motor |
| | - - - - - - | | | - | mounting hardware: (not included w/mount alone) |
| 53 | 348-0008-00 | | | 3 | SHOCKMOUNT, rubber |
| | 210-0008-00 | | | 6 | LOCKWASHER, internal, #8 |
| | 210-0409-00 | | | 6 | NUT, hex, 8-32 x 5/16 inch |
| 54 | 369-0007-00 | | | 1 | BLADE, fan, 7 inches |
| 55 | 354-0053-00 | | | 1 | RING, fan |
| 56 | - - - - - - | | | - | mounting hardware: (not included w/assembly) |
| | 213-0104-00 | | | 6 | SCREW, thread forming, 6-32 x 3/8 inch THS phillips |
| 57 | 387-0488-00 | | | 1 | PLATE, rear overlay |
| | - - - - - - | | | - | plate includes: |
| 58 | 134-0028-00 | | | 1 | PLUG, steel |
| | - - - - - - | | | - | mounting hardware: (not included w/plate) |
| | 213-0104-00 | | | 3 | SCREW, thread forming, 6-32 x 3/8 inch THS phillips |

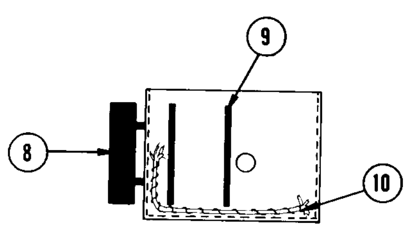
**REAR** *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 59 | 380-0018-00 | | | 1 | HOUSING, air filter |
| | - - - - - - | | | - | mounting hardware: (not included w/housing) |
| | 212-0031-00 | | | 2 | SCREW, 8-32 x 1 1/4 inches RHS |
| | 210-0458-00 | | | 2 | NUT, keps, 8-32 x 11/32 inch |
| | 210-0402-00 | | | 2 | NUT, cap, hex, 8-32 x 5/16 inch |
| 60 | 378-0011-00 | 101 | 749 | 1 | FILTER, air |
| | 378-0023-00 | 750 | | 1 | FILTER, air |
| 61 | 378-0762-00 | X750 | | 1 | SCREEN, air filter |
| 62 | 387-0487-00 | | | 1 | PLATE, rear sub-panel |
| | - - - - - - | | | - | plate includes: |
| | 354-0156-00 | | | 1 | RING, ornamental |
| 63 | 334-0649-00 | | | 1 | TAG, voltage rating |
| | - - - - - - | | | - | mounting hardware: (not included w/tag) |
| | 213-0088-00 | | | 2 | SCREW, thread forming, 4-40 x 1/4 inch PHS phillips |
| 64 | 650-0204-00 | | | 1 | ASSEMBLY, A.C. LINE FILTER (See Ref #68) |
| | - - - - - - | | | - | assembly includes: |
| 65 | 131-0102-00 | 101 | 2739 | 1 | CONNECTOR, 3-wire, motor base |
| | 131-0102-01 | 2740 | | 1 | CONNECTOR, 3-wire, motor base |
| | - - - - - - | | | - | connector includes: |
| | 129-0041-00 | 101 | 2739 | 1 | POST, ground |
| | 129-0041-01 | 2740 | | 1 | POST, ground |
| | 200-0185-00 | 101 | 2739 | 1 | COVER, motor base |
| | 200-0185-01 | 2740 | | 1 | COVER, motor base |
| | 210-0003-00 | 101 | 2739X | 2 | LOCKWASHER, external, #4 |
| | 210-0551-00 | 101 | 2739X | 2 | NUT, hex, 4-40 x 1/4 inch |
| | 211-0132-00 | X2740 | | 1 | SCREW, sems, 4-40 x 1/2 inch, PHS |
| | 211-0015-00 | 101 | 2739 | 1 | SCREW, 4-40 x 1/2 inch RHS |
| | 213-0088-00 | 2740 | | 1 | SCREW, thread forming, 4-40 x 1/4 inch, PHS |
| | 214-0078-00 | | | 2 | PIN, connecting |
| | 377-0041-00 | 101 | 2739 | 1 | INSERT, black urea |
| | 377-0051-00 | 2740 | | 1 | INSERT, black urea |
| | 386-0933-00 | | | 1 | PLATE, motor base |
| 66 | 361-0015-00 | | | 1 | SPACER, line filter |
| 67 | 387-0025-00 | | | 1 | PLATE, line filter cap |
| 68 | - - - - - - | | | - | mounting hardware: (not included w/assembly) |
| | 211-0552-00 | | | 2 | SCREW, 6-32 x 2 inches BHS |
| | 210-0457-00 | | | 2 | NUT, keps, 6-32 x 5/16 inch |

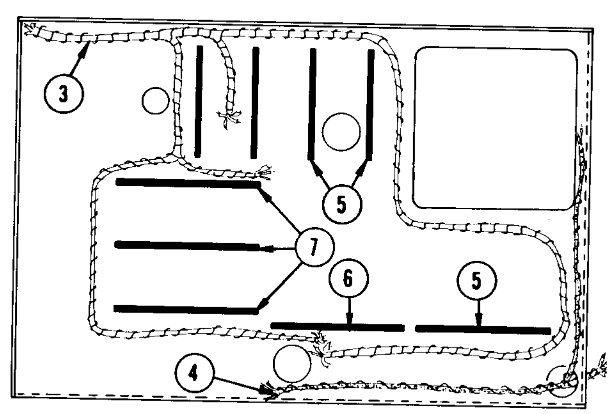
## CABLE HARNESS & CERAMIC STRIP DETAIL



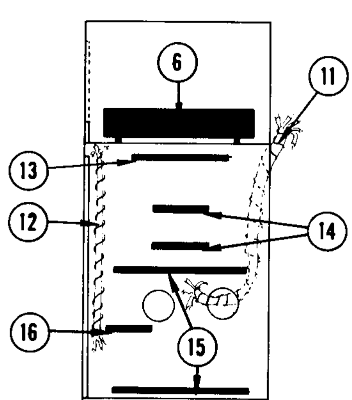

BULKHEAD



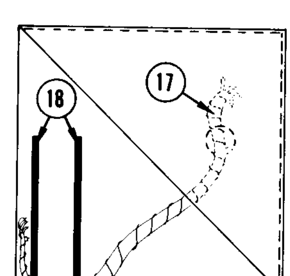

CALIBRATOR CHASSIS




POWER CHASSIS




HIGH VOLTAGE/FOCUS AND INTENSITY CHASSIS




REGULATOR & TRANSFORMER SUPPORT CHASSIS

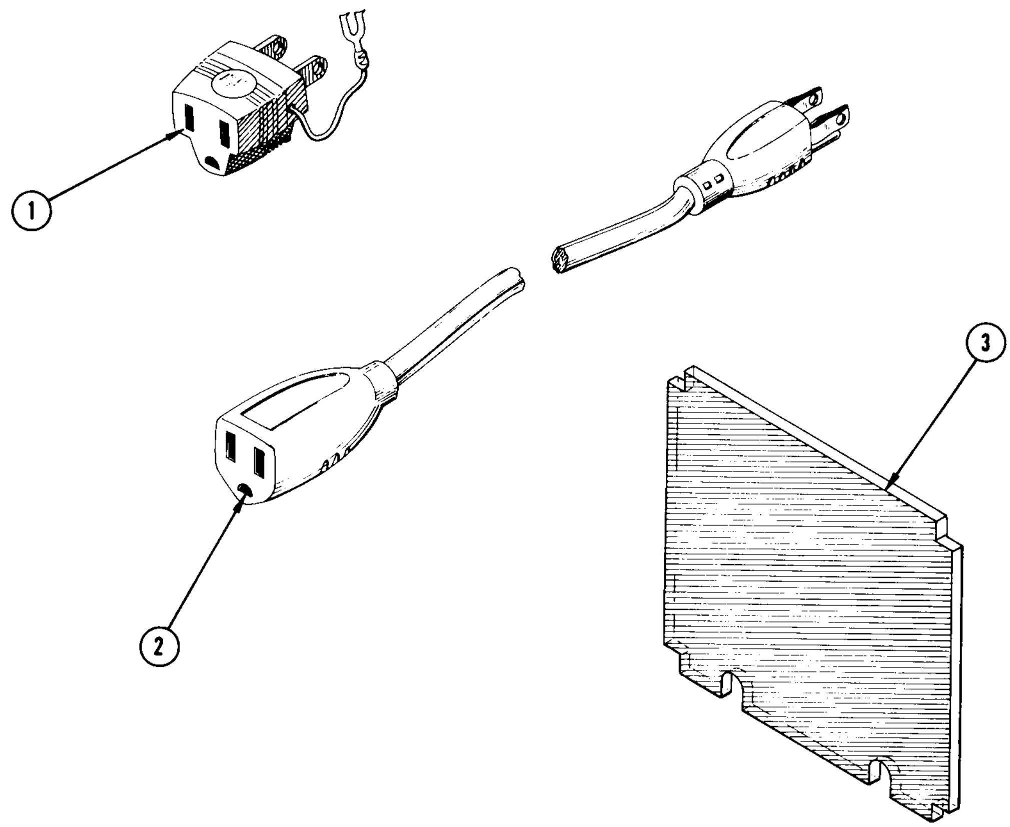
## CABLE HARNESS AND CERAMIC STRIP DETAIL

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 179-0574-00 | 101 | 649 | 1 | CABLE HARNESS, bulkhead #1 |
| | 179-0858-00 | 650 | | 1 | CABLE HARNESS, bulkhead #1 |
| 2 | 179-0575-00 | | | 1 | CABLE HARNESS, bulkhead #2 |
| 3 | 179-0573-00 | 101 | 407 | 1 | CABLE HARNESS, power |
| | 179-0721-00 | 408 | | 1 | CABLE HARNESS, power |
| 4 | 179-0578-00 | | | 1 | CABLE HARNESS, 110-volt |
| 5 | 124-0090-00 | | | 5 | STRIP, ceramic, $^3/_4$ inch x 9 notches |
| | - - - - - - | | | - | each strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware for each: (not included w/strip) |
| | 361-0009-00 | | | 2 | SPACER, nylon, .313 inch |
| 6 | 124-0091-00 | | | 3 | STRIP, ceramic, $^3/_4$ inch x 11 notches |
| | - - - - - - | | | - | each strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware for each: (not included w/strip) |
| | 361-0009-00 | | | 2 | SPACER, nylon, .313 inch |
| 7 | 124-0145-00 | | | 3 | STRIP, ceramic, $^7/_{16}$ inch x 20 notches |
| | - - - - - - | | | - | each strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware for each: (not included w/strip) |
| | 361-0009-00 | | | 2 | SPACER, nylon, .313 inch |
| 8 | 124-0094-00 | 101 | 2059X | 1 | STRIP, ceramic, $^7/_{16}$ inch x 7 notches |
| | - - - - - - | | | - | strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware: (not included w/strip) |
| | 361-0008-00 | | | 2 | SPACER, nylon, .188 inch |
| 9 | 124-0090-00 | 101 | 2059X | 2 | STRIP, ceramic, $^3/_4$ inch x 9 notches |
| | - - - - - - | | | - | each strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware for each: (not included w/strip) |
| | 361-0009-00 | | | 2 | SPACER, nylon, .313 inch |
| 10 | 179-0579-00 | 101 | 2059 | 1 | CABLE HARNESS, calibrator chassis |
| | 179-0966-00 | 2060 | | 1 | CABLE HARNESS, calibrator chassis |
| 11 | 179-0576-00 | 101 | 2059 | 1 | CABLE HARNESS, focus & intensity |
| | 179-0965-00 | 2060 | | 1 | CABLE HARNESS, focus & intensity |
| 12 | 179-0577-00 | | | 1 | CABLE HARNESS, high-voltage |
| 13 | 124-0094-00 | | | 1 | STRIP, ceramic, $^7/_{16}$ inch x 7 notches |
| | - - - - - - | | | - | strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware: (not included w/strip) |
| | 361-0009-00 | | | 2 | SPACER, nylon, .313 inch |

## CABLE HARNESS AND CERAMIC STRIP DETAIL *(Cont'd)*

| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 14 | 124-0092-00 | 101 | 101 | 1 | STRIP, ceramic, $^7/_{16}$ inch x 3 notches |
| | - - - - - - | | | - | strip includes: |
| | 355-0046-00 | | | 1 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware: (not included w/strip) |
| | 361-0009-00 | | | 1 | SPACER, nylon, .313 inch |
| | 124-0120-00 | 102 | | 2 | STRIP, ceramic, $^7/_{16}$ inch x 4 notches |
| | - - - - - - | | | - | each strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware for each: (not included w/strip) |
| | 361-0009-00 | | | 2 | SPACER, nylon, .313 inch |
| 15 | 124-0106-00 | | | 2 | STRIP, ceramic, $^7/_{16}$ inch x 11 notches |
| | - - - - - - | | | - | each strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware for each: (not included w/strip) |
| | 361-0009-00 | | | 2 | SPACER, nylon, .313 inch |
| 16 | 124-0092-00 | | | 1 | STRIP, ceramic, $^7/_{16}$ inch x 3 notches |
| | - - - - - - | | | - | strip includes: |
| | 355-0046-00 | | | 1 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware: (not included w/strip) |
| | 361-0009-00 | | | 1 | SPACER, nylon, .313 inch |
| 17 | 179-0604-00 | 101 | 407 | 1 | CABLE HARNESS, regulator |
| | 179-0722-00 | 408 | | 1 | CABLE HARNESS, regulator |
| 18 | 124-0145-00 | | | 2 | STRIP, ceramic, $^7/_{16}$ inch x 20 notches |
| | - - - - - - | | | - | each strip includes: |
| | 355-0046-00 | | | 2 | STUD, nylon |
| | - - - - - - | | | - | mounting hardware for each: (not included w/strip) |
| | 361-0008-00 | | | 2 | SPACER, nylon, .188 inch |

## STANDARD ACCESSORIES




| REF. NO. | PART NO. | SERIAL/MODEL NO. EFF. | SERIAL/MODEL NO. DISC. | QTY. | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 103-0013-00 | | | 1 | ADAPTER, power cord |
| 2 | 161-0010-00 | 101 | 2849 | 1 | CORD, power |
| | 161-0010-03 | 2850 | | 1 | CORD, power |
| 3 | 378-0525-00 | X400 | 1998 | 1 | FILTER, light |
| | 378-0544-00 | 1999 | 2168 | 1 | FILTER, light, smoke gray (installed) |
| | 378-0560-00 | 2169 | | 1 | FILTER, light, smoke gray (installed) |
| | 387-0935-00 | X1999 | | 1 | PLATE, protector |
| -- | 070-0322-01 | | | 2 | MANUAL, instruction (not shown) |

# ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

## Bulbs

| Ckt. No. | Tektronix Part No. | Description | S/N Range |
|---|---|---|---|
| B603 | 150-004 | Incandescent, G.E. #328 | |
| B604 | 150-001 | Incandescent, G.E. #47, Graticule Light | 101-1998 |
| B604 | 150-031 | Incandescent #44 Graticule Light | 1999-up |
| B605 | 150-001 | Incandescent, G.E. #47, Graticule Light | 101-1998 |
| B605 | 150-031 | Incandescent #44 Graticule Light | 1999-up |
| B852, B853 | 150-009 | Bulb, Neon NE-2 —55 v | X249-up |

## Capacitors

Tolerance ±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%

| Ckt. No. | Tektronix Part No. | Value | Type | | Voltage | Tolerance | S/N Range |
|---|---|---|---|---|---|---|---|
| C600A | 281-559 | .0015 μf | Cer. | | 500 v | | |
| C600B | 281-559 | .0015 μf | Cer. | | 500 v | | |
| C602 | Use 290-078 | 2 x 200 μf | EMC | | 250 v | | |
| C608 | 285-569 | .01 μf | PTM | | 200 v | | |
| C625 | 285-569 | .01 μf | PTM | | 200 v | | |
| C626 | Use 290-075 | 2 x 10 μf | EMC | | 250 v | | |
| C630 | Use 290-086 | 2000 μf | EMC | | 30 v | | |
| C631 | Use 290-086 | 2000 μf | EMC | | 30 v | | |
| C632 | Use 290-086 | 2000 μf | EMC | | 30 v | | |
| C633 | Use 290-201 | 100 μf | EMT | | 15 v | | X410-up |
| C638 | 283-0000-00 | .001 μf | Disc. Type | | 500 v | | X3100-up |
| C640 | 283-026 | .2 μf | Disc Type | | 25 v | | 101-2119 |
| C640 | 283-0079-00 | .01 μf | Cer. | | 250 v | | 2120-up |
| C646 | Use 290-0137-00 | 100 μf | EMT | | 30 v | +75%—15% | 101-3099 |
| C646 | 290-0248-01 | 150 μf | EMT | | 15 v | | 3100-up |
| C652 | Use 290-086 | 2000 μf | EMC | | 30 v | | |
| C653 | 283-004 | .02 μf | Disc Type | | 150 v | | X506-up |
| C654 | Use 283-057 | .1 μf | Disc Type | | 200 v | | |
| C656 | 290-015 | 100 μf | EMT | | 25 v | | |
| C657 | 283-003 | .01 μf | Disc Type | | 150 v | | |
| C662 | Use 290-130 | 2 x 125 μf | EMC | | 350 v | | |
| C674 | 285-604 | .01 μf | PTM | | 400 v | | |
| C676A,B | Use 290-007 | 2 x 15 μf | EMC | | 450 v | | |
| C682 | Use 290-130 | 2 x 125 μf | EMC | | 350 v | | |
| C694 | 285-604 | .01 μf | PTM | | 400 v | | |
| C760 | 281-027 | .7-3 pf | Tub. | Var. | | | |
| C761 | 281-027 | .7-3 pf | Tub. | Var. | | | |
| C801 | 283-006 | .02 μf | Disc Type | | 600 v | | |
| C802 | 283-538 | .003 μf | Mica | | 500 v | 10% | |
| C803 | 283-000 | .001 μf | Disc Type | | 500 v | | |
| C807 | 285-501 | .001 μf | PTM | | 600 v | | |
| C816 | 290-149 | 5 μf | EMT | | 150 v | | |
| C822 | 283-036 | .0025 μf | Disc Type | | 6000 v | | |
| C824 | 283-036 | .0025 μf | Disc Type | | 6000 v | | |
| C825 | 283-036 | .0025 μf | Disc Type | | 6000 v | | |
| C837 | 283-036 | .0025 μf | Disc Type | | 6000 v | | |
| C841 | 283-006 | .02 μf | Disc Type | | 600 v | | |
| C842 | 283-034 | .005 μf | Disc Type | | 4000 v | | |
| C854 | 283-036 | .0025 μf | Disc Type | | 6000 v | | |
| C876 | 290-025 | 6.25 μf | EMT | | 300 v | | 101-2059X |

## Capacitors *(continued)*

| Ckt. No. | Tektronix Part No. | Description | | | | S/N Range |
|---|---|---|---|---|---|---|
| C878 | 281-523 | 100 pf | Cer. | 350 v | | 101-2059X |
| C884 | 281-524 | 150 pf | Cer. | 500 v | | 101-2059X |
| C904 | 285-0627-00 | .0033 μf | PTM | 100 v | | X2060-up |
| C919 | 283-0059-00 | 1 μf | Cer. | 25 v | | X2060-up |
| C923 | 281-0543-00 | 270 pf | Cer. | 500 v | 10% | X2060-up |
| C925 | 281-0550-00 | 120 pf | Cer. | 500 v | 10% | X2060-up |
| C933 | 281-0543-00 | 270 pf | Cer. | 500 v | 10% | X2060-up |
| C935 | 281-0550-00 | 120 pf | Cer. | 500 v | 10% | X2060-up |
| C954 | 281-0536-00 | 1000 pf | Cer. | 500 v | 10% | X2060-up |
| C957 | 281-0536-00 | 1000 pf | Cer. | 500 v | 10% | X2060-up |

## Diodes

| | | | | |
|---|---|---|---|---|
| D602A,B,C,D | *152-047 | Silicon | Replaceable by 1N2862 | 101-2629 |
| D602A,B,C,D | 152-0066-00 | Silicon | 1N3194 | 2630-up |
| D632 A,B | 152-035 | Silicon | 1N1563A | |
| D652A,B,C,D | *152-047 | Silicon | Replaceable by 1N2862 | 101-2629 |
| D652A,B,C,D | 152-0066-00 | Silicon | 1N3194 | 2630-up |
| D662A,B,C,D | *152-047 | Silicon | Replaceable by 1N2862 | 101-2629 |
| D662A,B,C,D | 152-0066-00 | Silicon | 1N3194 | 2630-up |
| D682 A,B,C,D | *152-047 | Silicon | Replaceable by 1N2862 | 101-2629 |
| D682A,B,C,D | 152-0066-00 | Silicon | 1N3194 | 2630-up |
| D835 | Use *152-047 | Silicon | Replaceable by 1N2862 | 101-2629 |
| D835 | 152-0066-00 | Silicon | 1N3194 | 2630-up |
| D836 | Use *152-047 | Silicon | Replaceable by 1N2862 | 101-2629 |
| D836 | 152-0066-00 | Silicon | 1N3194 | 2630-up |
| D837 | Use *152-047 | Silicon | Replaceable by 1N2862 | 101-2629 |
| D837 | 152-0066-00 | Silicon | 1N3194 | 2630-up |
| D852 | *152-061 | Silicon | Tek Spec | 101-316X |
| D904 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D923 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D933 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D935 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D945 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D951 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D953 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D954 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |
| D959 | *152-0185-00 | Silicon | Replaceable by 1N1452 | X2060-up |

## Fuses

| | | | | | | |
|---|---|---|---|---|---|---|
| F601 | 159-017 | 4 Amp. | 3 AG | Fast Blo | 117 v oper | |
| | 159-021 | 2 Amp. | 3 AG | Fast Blo | 234 v oper | |
| F647 | 159-014 | 5 Amp. | 3 AG | Fast Blo | | 101-2819 |
| F647 | 159-0015-00 | 3 Amp. | 3 AG | Fast Blo | | 2820-up |
| F657 | 159-022 | 1 Amp. | 3 AG | Fast Blo | | |

## Inductors

| | | |
|---|---|---|
| L860 | *108-228 | Beam Rotator on 276-063 |

## Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R600 | 304-100 | 10 Ω | 1 w | | | | 101-407 |
| R600 | 306-100 | 10 Ω | 2 w | | | | 408-up |
| R603 | 304-330 | 33 Ω | 1 w | | | | |
| R604 | 311-055 | 50 Ω | | Var. | WW | SCALE ILLUM. | 101-1998 |
| R604 | 311-377 | 25 Ω | | Var. | WW | SCALE ILLUM. | 1999-up |
| R605 | 308-142 | 30 Ω | 3 w | | WW | 5% | 101-1998X |

**Resistors** *(continued)*

| Ckt. No. | Tektronix Part No. | Description | | | | | S/N Range |
|---|---|---|---|---|---|---|---|
| R608 | 302-104 | 100 k | ½ w | | | | |
| R609 | 302-222 | 2.2 k | ½ w | | | | |
| R610 | 302-106 | 10 meg | ½ w | | | | |
| R611 | 302-102 | 1 k | ½ w | | | | |
| R614 | 302-473 | 47 k | ½ w | | | | |
| R616 | 302-102 | 1 k | ½ w | | | | |
| R617 | 302-474 | 470 k | ½ w | | | | |
| R619 | 302-473 | 47 k | ½ w | | | | |
| R620 | 302-102 | 1 k | ½ w | | | | |
| R621 | 302-224 | 220 k | ½ w | | | | |
| R623 | 308-186 | 80 k | ½ w | | WW | 1% | 101-2539 |
| R623 | 308-0186-01 | 80 k | 1 w | | WW | 1% | 2540-up |
| R624 | 311-015 | 10 k | | Var. | WW | —100 VOLTS | |
| R625 | 308-226 | 10 k | ½ w | | WW | 1% | |
| R627 | 308-176 | 4 k | 20 w | | WW | 5% | |
| R628 | 308-040 | 1.5 k | 25 w | | WW | 5% | |
| R630 | 302-823 | 82 k | ½ w | | | | X408-up |
| R631 | 311-361 | 500 k | ½ w | Var. | | —12.2 V ADJ. | X408-up |
| R632 | 301-394 | 390 k | ½ w | | | 5% | X408-up |
| R633 | 309-104 | 2.05 k | ½ w | | Prec. | 1% | |
| R634 | 310-115 | 15 k | 1 w | | Prec. | 1% | |
| R637 | 302-334 | 330 k | ½ w | | | | |
| R638 | 302-272 | 2.7 k | ½ w | | | | |
| R640 | 302-151 | 150 Ω | ½ w | | | | 101-2119 |
| R640 | 301-0122-00 | 1.2 k | ½ w | | | 5% | 2120-up |
| R644 | 306-221 | 220 Ω | 2 w | | | | |
| R646 | 302-471 | 470 Ω | ½ w | | | | |
| R650 | 311-125 | 50 k | 2 w | Var. | | +20 v ADJ. | X2005-up |
| R651 | 301-434 | 430 k | ½ w | | | 5% | X2005-up |
| R652 | 302-151 | 150 Ω | ½ w | | | | X506-up |
| R653 | 309-161 | 106 k | ½ w | | Prec. | 1% | |
| R654 | 309-331 | 20.2 k | ½ w | | Prec. | 1% | |
| R655 | 302-154 | 150 k | ½ w | | | | |
| R656 | 304-183 | 18 k | 1 w | | | | |
| R657 | 302-222 | 2.2 k | ½ w | | | | X310-up |
| R660 | 304-100 | 10 Ω | 1 w | | | | 101-407 |
| R660 | 306-100 | 10 Ω | 2 w | | | | 408-up |
| R661 | 304-100 | 10 Ω | 1 w | | | | 101-407 |
| R661 | 306-100 | 10 Ω | 2 w | | | | 408-up |
| R663 | 302-273 | 27 k | ½ w | | | | |
| R664 | 302-333 | 33 k | ½ w | | | | |
| R665 | 302-684 | 680 k | ½ w | | | | 101-407 |
| | 301-124 | 120 k | ½ w | | | 5% | 408-up |
| R666 | 302-474 | 470 k | ½ w | | | | |
| R667 | 302-565 | 5.6 meg | ½ w | | | | X408-up |
| R668 | 311-361 | 500 k | ½ w | Var. | | +125 V ADJ. | X408-up |
| R669 | 302-102 | 1 k | ½ w | | | | |
| R671 | 308-218 | 150 Ω | 3 w | | | | |
| R672 | 302-102 | 1 k | ½ w | | | | |
| R673 | 302-474 | 470 k | ½ w | | | | |
| R674 | 309-101 | 330 k | ½ w | | Prec. | 1% | |
| R675 | 309-109 | 250 k | ½ w | | Prec. | 1% | |
| R676 | 308-218 | 150 Ω | 3 w | | WW | 5% | |
| R677 | 308-176 | 4 k | 20 w | | WW | 5% | 101-2004 |
| R677 | 308-113 | 3 k | 8 w | | WW | 5% | 2005-up |
| R678 | 308-040 | 1.5 k | 25 w | | WW | 5% | 101-2004 |
| R678 | 308-037 | 1 k | 25 w | | WW | 5% | 2005-up |

**Resistors** *(continued)*

| Ckt. No. | Tektronix Part No. | Description | | | | | S/N Range |
|---|---|---|---|---|---|---|---|
| R679 | 308-113 | 3 k | 8 w | | WW | 5% | 2005-up |
| R680 | 304-100 | 10 Ω | 1 w | | | | |
| R681 | 304-100 | 10 Ω | 1 w | | | | X408-up |
| R682 | 301-473 | 47 k | ½ w | | | 5% | X506-up |
| R683 | 302-394 | 390 k | ½ w | | | | |
| R684 | 302-333 | 33 k | ½ w | | | | |
| R685 | 302-224 | 220 k | ½ w | | | | 101-407 |
| R685 | 301-134 | 130 k | ½ w | | | 5% | 408-505 |
| R685 | 303-823 | 82 k | 1 w | | | 5% | 506-up |
| R686 | 302-105 | 1 meg | ½ w | | | | 101-407 |
| R686 | 301-185 | 1.8 meg | ½ w | | | 5% | 408-up |
| R689 | 302-102 | 1 k | ½ w | | | | |
| R690 | 302-102 | 1 k | ½ w | | | | |
| R692 | 302-474 | 470 k | ½ w | | | | X408-up |
| R694 | 309-156 | 1.024 meg | ½ w | | Prec. | 1% | |
| R695 | 309-139 | 333 k | ½ w | | Prec. | 1% | |
| R696 | 302-825 | 8.2 meg | ½ w | | | | X408-up |
| R697 | 308-176 | 4 k | 20 w | | WW | 5% | |
| R698 | 311-361 | 500 k | ½ w | Var. | | +300 V ADJ. | X408-up |
| R699 | 302-104 | 100 k | ½ w | | | | |
| R770 | 302-564 | 560 k | ½ w | | | | |
| R801 | 304-331 | 330 Ω | 1 w | | | | |
| R802 | 302-562 | 5.6 k | ½ w | | | | X330-up |
| R803 | 306-333 | 33 k | 2 w | | | | 101-329 |
| R803 | 306-273 | 27 k | 2 w | | | | 330-up |
| R804 | 302-101 | 100 Ω | ½ w | | | | |
| R806 | 302-563 | 56 k | ½ w | | | | |
| R807 | 302-392 | 3.9 k | ½ w | | | | |
| R815 | 302-474 | 470 k | ½ w | | | | |
| R816 | 302-222 | 2.2 k | ½ w | | | | |
| R825 | 302-104 | 100 k | ½ w | | | | |
| R828 | 302-563 | 56 k | ½ w | | | | |
| R829 | 302-471 | 470 Ω | ½ w | | | | X379-up |
| R831 | Use *050-143 | Replacement Kit | | | | | 101-649 |
| R831† | (3) 305-565 | 5.6 meg | 2 w | | | 5% | 650-up |
| | (2) 305-685 | 6.8 meg | 2 w | | | 5% | 650-up |
| R833 | 302-105 | 1 meg | ½ w | | | | |
| R834 | 311-043 | 2 meg | | Var. | | INTENSITY | 101-3139 |
| R834 | 311-0043-02 | 2 meg | | Var. | | INTENSITY | 3140-up |
| R835 | 301-683 | 68 k | ½ w | | | 5% | |
| R836 | 301-242 | 2.4 k | ½ w | | | 5% | |
| R837 | 301-242 | 2.4 k | ½ w | | | 5% | |
| R838 | 301-104 | 100 k | ½ w | | | 5% | |
| R839 | 301-122 | 1.2 k | ½ w | | | 5% | |
| R840 | 309-025 | 2.5 meg | ½ w | | Prec. | 1% | |
| R841 | 311-042 | 2 meg | | Var. | | HIGH VOLTAGE | |
| R843 | Use *050-145 | Replacement Kit | | | | | 101-649 |
| R843†† | (3) 305-565 | 5.6 meg | 2 w | | | 5% | 650-up |
| R845 | 311-121 | 5 meg | | Var. | | FOCUS | 101-3139 |
| R845 | 311-0121-01 | 5 meg | | Var. | | FOCUS | 3140-up |
| R847 | 310-103 | 4 meg | 1 w | | Prec. | 1% | |
| R849 | 302-223 | 22 k | ½ w | | | | |

† S/N 650-up. *050-143 may be used.

†† S/N 650-up. *050-145 may be used.



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**Resistors** *(Cont'd)*

| Ckt. No. | Tektronix Part No. | Description | | | | | S/N Range |
|---|---|---|---|---|---|---|---|
| R852 | Use 302-273 | 27 k | ½ w | | | | |
| R853 | 302-104 | 100 k | ½ w | | | | |
| R854 | 302-225 | 2.2 meg | ½ w | | | | |
| R855 | 302-471 | 470 Ω | ½ w | | | | X379-up |
| R860 | 311-007 | 2 x 1 k | | Var. | | CRT BEAM ROTATOR | |
| R861 | 302-680 | 68 Ω | ½ w | | | | |
| R862 | 302-224 | 220 k | ½ w | | | | |
| R863 | 302-104 | 100 k | ½ w | | | | |
| R864 | 311-032 | 250 k | 2 w | Var. | | ASTIGMATISM | |
| R870 | 301-393 | 39 k | ½ w | | | 5% | 101-2059X |
| R871 | Use 311-364 | 20 k | | Var. | | CAL. AMPL. | 101-2059X |
| R872 | 301-154 | 150 k | ½ w | | | 5% | 101-2059X |
| R873 | 301-103 | 10 k | ½ w | | | 5% | 101-2059X |
| R876 | 301-153 | 15 k | ½ w | | | 5% | 101-2059X |
| R877 | 301-183 | 18 k | ½ w | | | 5% | 101-2059X |
| R878 | 301-564 | 560 k | ½ w | | | 5% | 101-2059X |
| R879 | Use 301-114 | 110 k | ½ w | | | 5% | 101-2059X |
| R880 | 316-101 | 100 Ω | ¼ w | | | | 101-2059X |
| R883 | 305-223 | 22 k | 2 w | | | 5% | 101-2059X |
| R885 | 309-100 | 10 k | ½ w | | Prec. | 1% | 101-2059X |
| R886 | 309-235 | 9 k | ½ w | | Prec. | 1% | 101-2059X |
| R887 | 309-236 | 900 Ω | ½ w | | Prec. | 1% | 101-2059X |
| R888 | 309-238 | 90 Ω | ½ w | | Prec. | 1% | 101-2059X |
| R889 | 318-052 | 10 Ω | ⅛ w | | Prec. | 1% | 101-2059X |
| R890 | 309-112 | 100 Ω | ½ w | | Prec. | 1% | X300-2059X |
| R901 | 303-0273-00 | 27 k | 1 w | | | 5% | X2060-up |
| R904 | 315-0512-00 | 5.1 k | ¼ w | | | 5% | X2060-up |
| R905 | 315-0203-00 | 20 k | ¼ w | | | 5% | X2060-up |
| R906 | 315-0203-00 | 20 k | ¼ w | | | 5% | X2060-up |
| R908 | 315-0104-00 | 100 k | ¼ w | | | 5% | X2060-up |
| R909 | 315-0203-00 | 20 k | ¼ w | | | 5% | X2060-up |
| R912 | 315-0394-00 | 390 k | ¼ w | | | 5% | X2060-up |
| R914 | 315-0155-00 | 1.5 meg | ¼ w | | | 5% | X2060-up |
| R915 | 315-0183-00 | 18 k | ¼ w | | | 5% | X2060-up |
| R917 | 315-0912-00 | 9.1 k | ¼ w | | | 5% | X2060-up |
| R919 | 315-0100-00 | 10 Ω | ¼ w | | | 5% | X2060-up |
| R922 | 315-0473-00 | 47 k | ¼ w | | | 5% | X2060-up |
| R924 | 315-0752-00 | 7.5 k | ¼ w | | | 5% | X2060-up |
| R925 | 315-0203-00 | 20 k | ¼ w | | | 5% | X2060-up |
| R927 | 315-0124-00 | 120 k | ¼ w | | | 5% | X2060-up |
| R932 | 315-0473-00 | 47 k | ¼ w | | | 5% | X2060-up |
| R934 | 315-0752-00 | 7.5 k | ¼ w | | | 5% | X2060-up |
| R935 | 315-0203-00 | 20 k | ¼ w | | | 5% | X2060-up |
| R937 | 315-0124-00 | 120 k | ¼ w | | | 5% | X2060-up |
| R940 | 324-0313-00 | 17.8 k | 1 w | | Prec | 1% | X2060-up |
| R941 | 324-0313-00 | 17.8 k | 1 w | | Prec | 1% | X2060-up |
| R943 | 311-0462-00 | 1 k | | Var. | | CAL AMPL | X2060-up |
| R945 | 323-0216-00 | 1.74 k | ½ w | | Prec | 1% | X2060-up |
| R946 | 323-0690-00 | 422 Ω | ½ w | | Prec | ½% | X2060-up |
| R948 | 323-0689-00 | 402 Ω | ½ w | | Prec | ½% | X2060-up |
| R949 | 323-0688-00 | 47 Ω | ½ w | | Prec | ½% | X2060-up |
| R952 | 315-0153-00 | 15 k | ¼ w | | | 5% | X2060-up |
| R954 | 315-0103-00 | 10 k | ¼ w | | | 5% | X2060-up |
| R956 | 315-0103-00 | 10 k | ¼ w | | | 5% | X2060-up |
| R957 | 315-0333-00 | 33 k | ¼ w | | | 5% | X2060-up |

**Resistors** *(Cont'd)*

| Ckt. No. | Tektronix Part No. | Description | | | S/N Range |
|---|---|---|---|---|---|
| R959 | 315-0101-00 | 100 Ω | ¼ w | 5% | X2060-2819 |
| R959 | 315-0391-00 | 390 Ω | ¼ w | 5% | 2820-up |
| R960 | 302-0102-00 | 1 k | ½ w | | X2060-up |

## Switches

| | Unwired Wired | | |
|---|---|---|---|
| SW601 | 260-014 | Toggle POWER ON | |
| TK601 | 260-246 | Thermal Cutout 123° | |
| SW915 | 260-0613-00 | Toggle | X2060-up |

## Transformers

| | | |
|---|---|---|
| T600 | *120-164 | Toroid 3T TD #12 |
| T601 | *120-232 | Low Voltage |
| T801 | Use *120-292 | High Voltage |

## Transistors

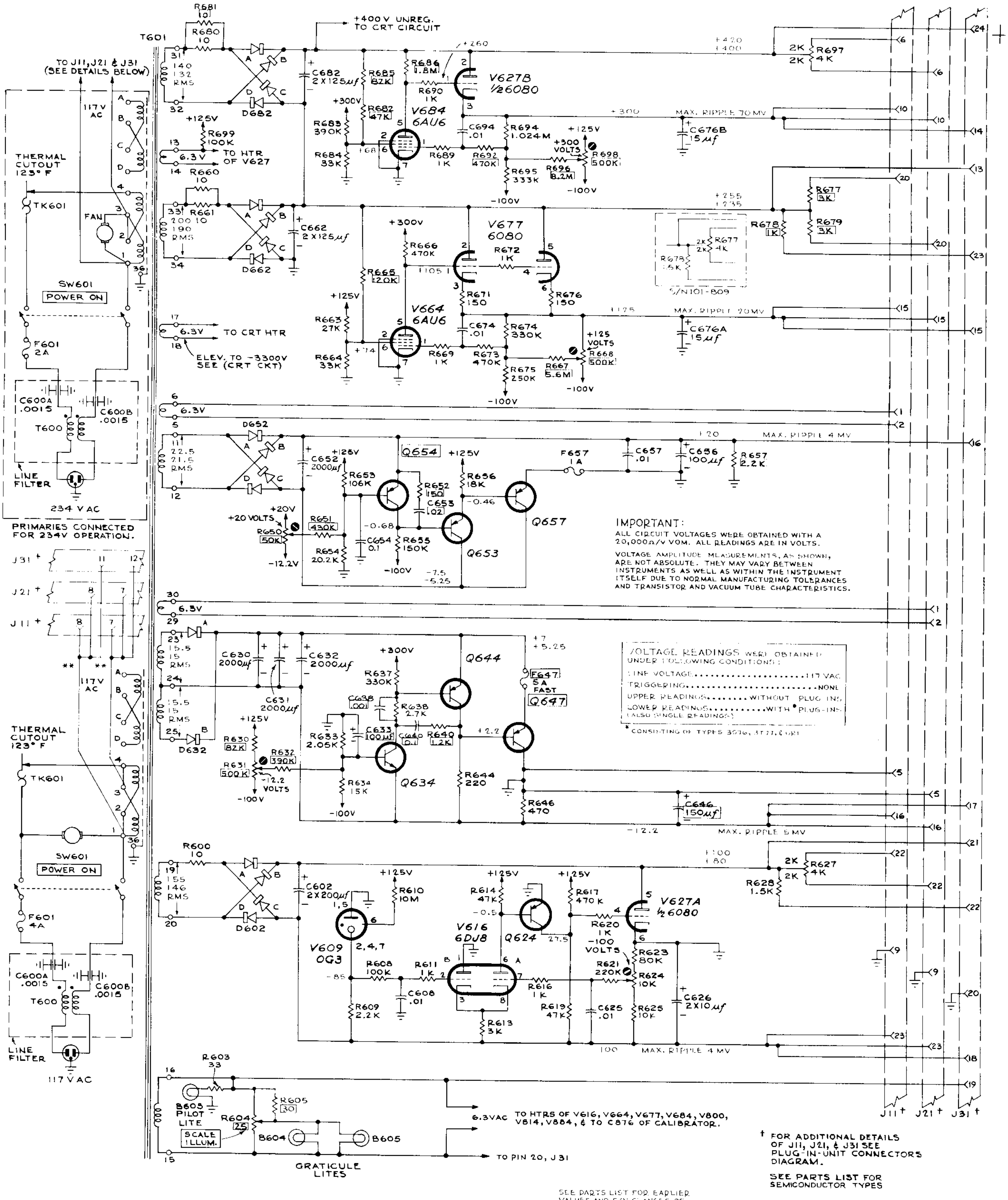
| | | | |
|---|---|---|---|
| Q624 | 151-093 | 2N2043 | |
| Q634 | 151-040 | 2N1302 | |
| Q644 | 151-042 | 2N1378 | |
| Q647 | 151-060 | 2N1545 | 101-2119 |
| Q647 | 151-0165-00 | 2N3614 | 2120-up |
| Q653 | 151-007 | 2N270 | |
| Q654 | 151-007 | 2N270 | 101-2004 |
| Q654 | *151-133 | Selected from 2N3251 | 2005-up |
| Q657 | Use 151-137 | 2N2148 | |
| Q900 | *151-0133-00 | Selected from 2N3251 | X2060-up |
| Q914 | *151-0133-00 | Selected from 2N3251 | X2060-up |
| Q925 | *151-0103-00 | Replaceable by 2N2219 | X2060-up |
| Q935 | *151-0103-00 | Replaceable by 2N2219 | X2060-up |
| Q955 | 151-0069-00 | 2N1304 | X2060-up |

## Electron Tubes

| | | | |
|---|---|---|---|
| V609 | 154-291 | OG3 | |
| V616 | 154-187 | 6DJ8 | |
| V627 | 154-056 | 6080 | |
| V664 | 154-022 | 6AU6 | |
| V677 | 154-056 | 6080 | |
| V684 | 154-022 | 6AU6 | |
| V800 | 154-167 | 6CZ5 | |
| V814 | 154-046 | 12BH7 | |
| V822 | 154-051 | 5642 | |
| V832 | 154-051 | 5642 | |
| V859 | Use *154-376 | T5032-31 CRT Standard Phosphor | 101-1998 |
| V859 | *154-454 | T5032-2-1 CRT Standard Phosphor | 1999-3195 |
| V859 | *154-0613-01 | T5611-2-1 CRT Standard Phosphor | 3196-up |
| V884 | 154-278 | 6BL8 | 101-2059X |

## Crystal

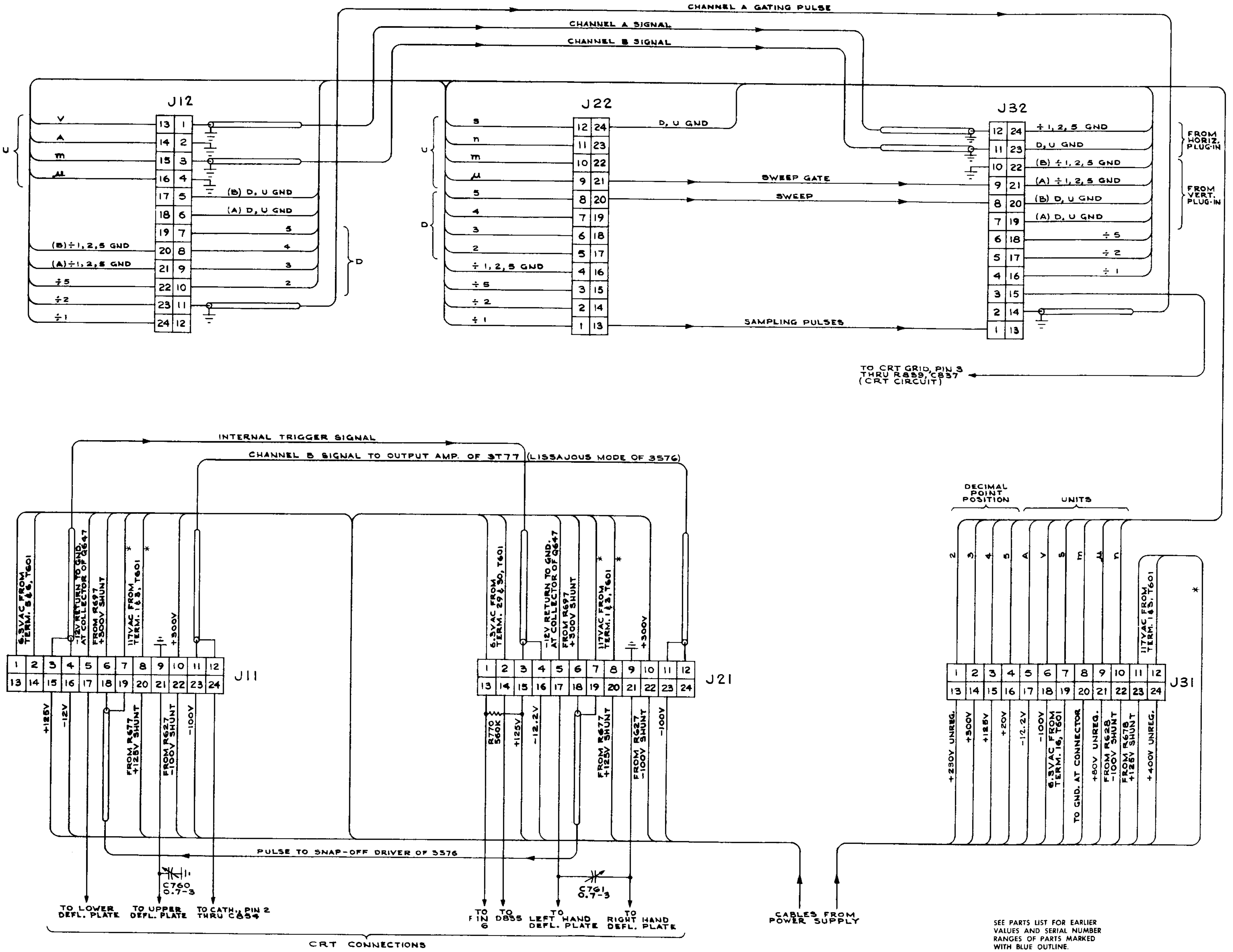
| | | | |
|---|---|---|---|
| Y905 | 158-0016-00 | 40 KC | X2060-up |




TYPE 567 READOUT OSCILLOSCOPE

POWER SUPPLY

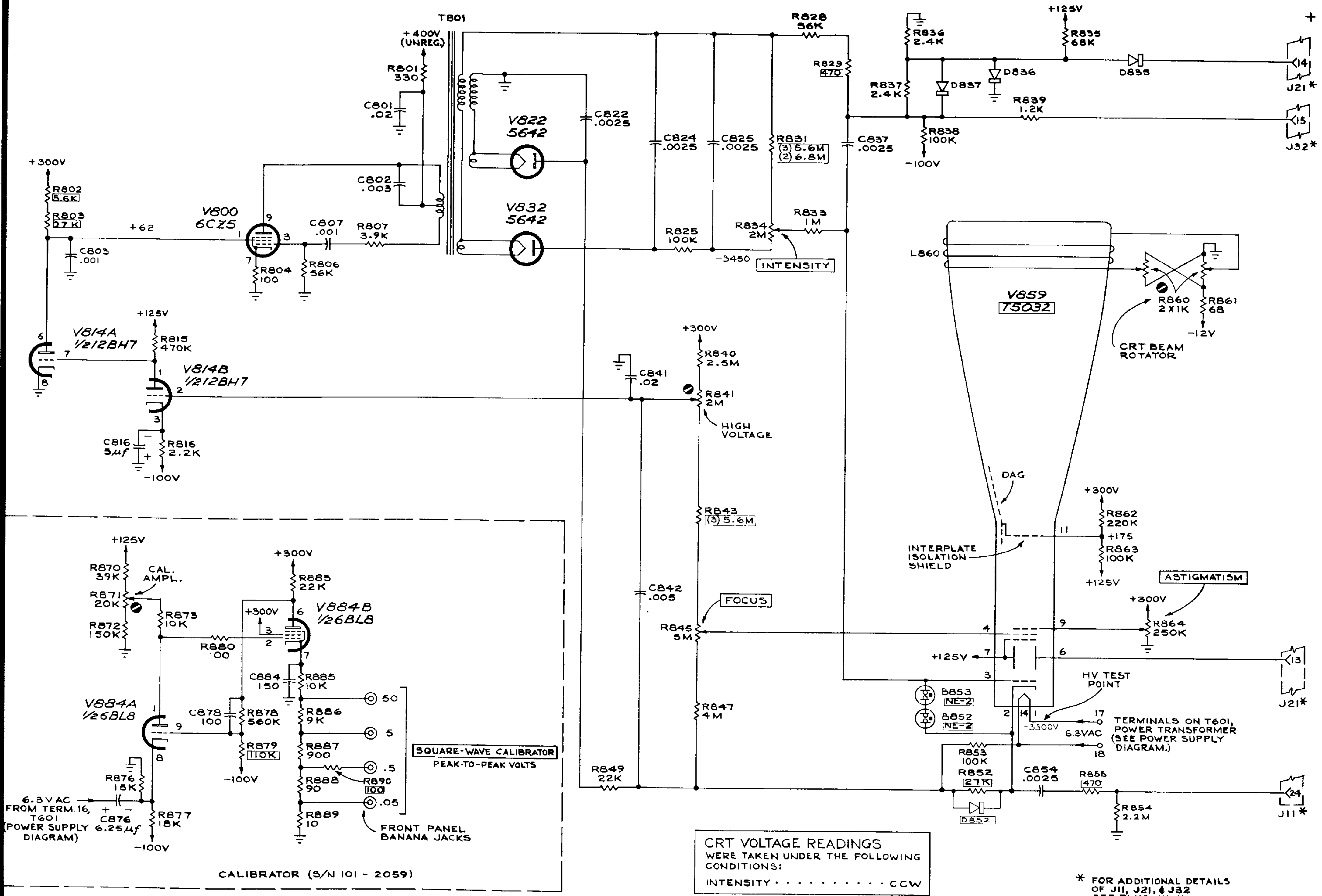
968




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

* DENOTES CONNECTIONS REMOVED AT S/N3060 & UP

MRH
168

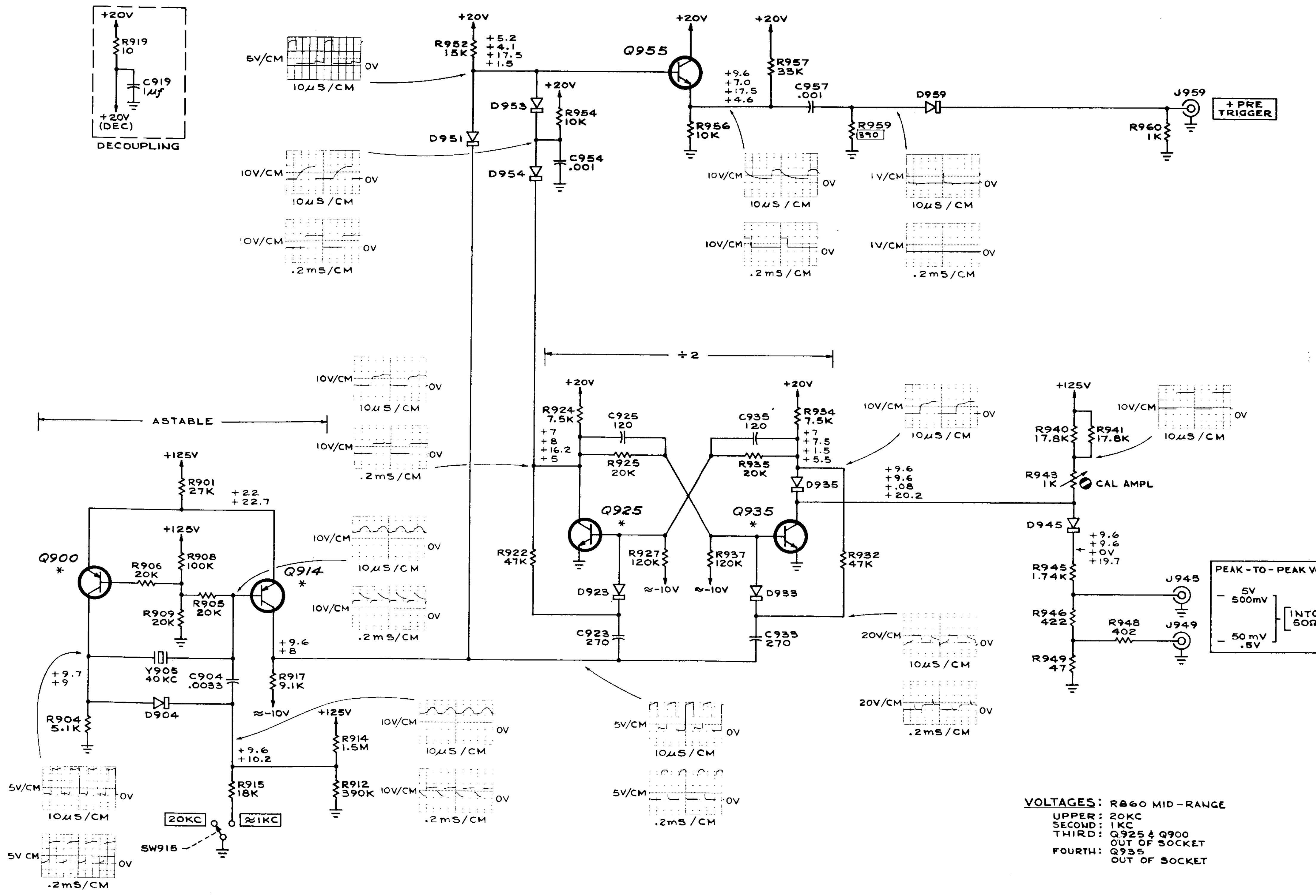



CRT VOLTAGE READINGS
WERE TAKEN UNDER THE FOLLOWING CONDITIONS:
INTENSITY · · · · · · · · · · CCW

ALSO SEE IMPORTANT NOTE ON PWR. SPLY. DIAG.

* FOR ADDITIONAL DETAILS OF J11, J21, & J32 SEE PLUG-IN-UNIT CONNECTORS DIAGRAM.

SEE PARTS LIST FOR EARLIER VALUES AND S/N CHANGES OF



DECOUPLING
+20V
R919 10
C919 1μf
+20V (DEC)
Q955
R952 15K
D951
D953
D954
R954 10K
C954 .001
R956 10K
R957 33K
C957 .001
R959 390
D959
R960 1K
J959
+PRE TRIGGER
÷2
ASTABLE
Q900
Q914
R901 27K
R906 20K
R908 100K
R909 20K
R905 20K
Y905 40KC
C904 .0033
D904
R904 5.1K
R917 9.1K
R914 1.5M
R915 18K
R912 390K
20KC
≈1KC
SW915
Q925
Q935
R924 7.5K
C925 120
R925 20K
C935 120
R934 7.5K
R935 20K
D935
R922 47K
R927 120K
R937 120K
R932 47K
D923
D933
C923 270
C933 270
≈-10V
+125V
R940 17.8K
R941 17.8K
R943 1K
CAL AMPL
D945
R945 1.74K
R946 422
R948 402
R949 47
J945
J949
PEAK-TO-PEAK V
5V 500mV
50 mV .5V
INTO 50Ω
10V/CM
5V/CM
1V/CM
20V/CM
10μS/CM
.2mS/CM
0V
VOLTAGES: R860 MID-RANGE
UPPER: 20KC
SECOND: 1KC
THIRD: Q925 & Q900 OUT OF SOCKET
FOURTH: Q935 OUT OF SOCKET

TYPE 567

## ELECTRICAL PARTS LIST CORRECTION

CHANGE:

| | | | |
|---|---|---|---|
| V859 | 154-0613-01 | T5611-2-1 | CRT Standard Phosphor |

M14,439/169

**Tektronix®**
COMMITTED TO EXCELLENCE

**data sheet**

CSG PUBLICATIONS/RESEARCH

# INSTRUCTIONS FOR REPLACING GLASS CRT's WITH ONE OF THE FOLLOWING CERAMIC CRT's:

## Part No. 154-0613-00/02/03, 154-0614-00/02/03

TYPE T5032 CRT REPLACEMENT

For the following Tektronix Oscilloscopes:

| Type | Serial Number |
|---|---|
| 561A | 5001-12399* |
| 561A | 12400-up |
| RM561A | 101-105: 5001-6885* |
| RM561A | 6886-up |
| 567 | 101-749 |
| 567 | 1999-3195 |
| RM567 | 101-228 |
| RM567 | 1999-up |
| 568/R568 | B010100-B130589 |

*This is applicable in the above indicated SN range of instruments if 050-0214-00, 050-0214-01, 050-0214-02 or 050-0214-03 has been installed.

This provides instructions for replacing the old style T5032 glass CRT (either internal or external graticule) with the style T5611 ceramic CRT. See the list below for the proper replacement CRT part number:

| Type T5032 Glass CRT | New Type T5611 Ceramic CRT |
|---|---|
| 154-0454-00 | 154-0613-00 |
| 154-0455-00 | 154-0613-02 |
| 154-0456-00 | 154-0613-03 |
| 154-0449-00 | 154-0613-00 |
| 154-0373-00 | 154-0614-00 |
| 154-0374-00 | 154-0614-02 |
| 154-0375-00 | 154-0614-03 |
| 154-0376-00 | 154-0614-00 |

NOTE 1: If the serial number of the instrument is above those listed, or if this has been installed, disregard the instructions as the T5611 CRT is a direct replacement.

INSTALLATION INSTRUCTIONS.

( ) 1. Remove the four graticule nuts, graticule cover (or Bezel if present) light filter (if used) light guide and retainer spring (if present).

( ) 2. Disconnect the deflection plate connectors from the neck pins on the CRT.

( ) 3. Remove the CRT socket connector and loosen the clamp at the base of the CRT.

( ) 4. Remove the CRT.

( ) 5. Remove the CRT cushions, 4 (for Type 561A, RM561A, 567, RM567) or 6 (Type 568, R568) from the inside of the CRT shield.

( ) 6. Install the new CRT. Complete the installation by performing steps 1, 2 and 3 in reverse order.

THIS COMPLETES THE INSTALLATION.

( ) Recalibrate your instrument according to the Calibration Section of your Instruction Manual.

( ) Please put this information in your Instruction Manual for future reference.