OPERATING AND SERVICE MANUAL

MODEL 5262A

TIME INTERVAL UNIT

SERIALS PREFIXED: 516-

This manual applies directly to hp Model 5262A Time Interval Unit having serial number prefix 516. This manual with changes provided in the Appendix also applies to Models having serial prefix numbers 450, 229, and 217.

01290-4

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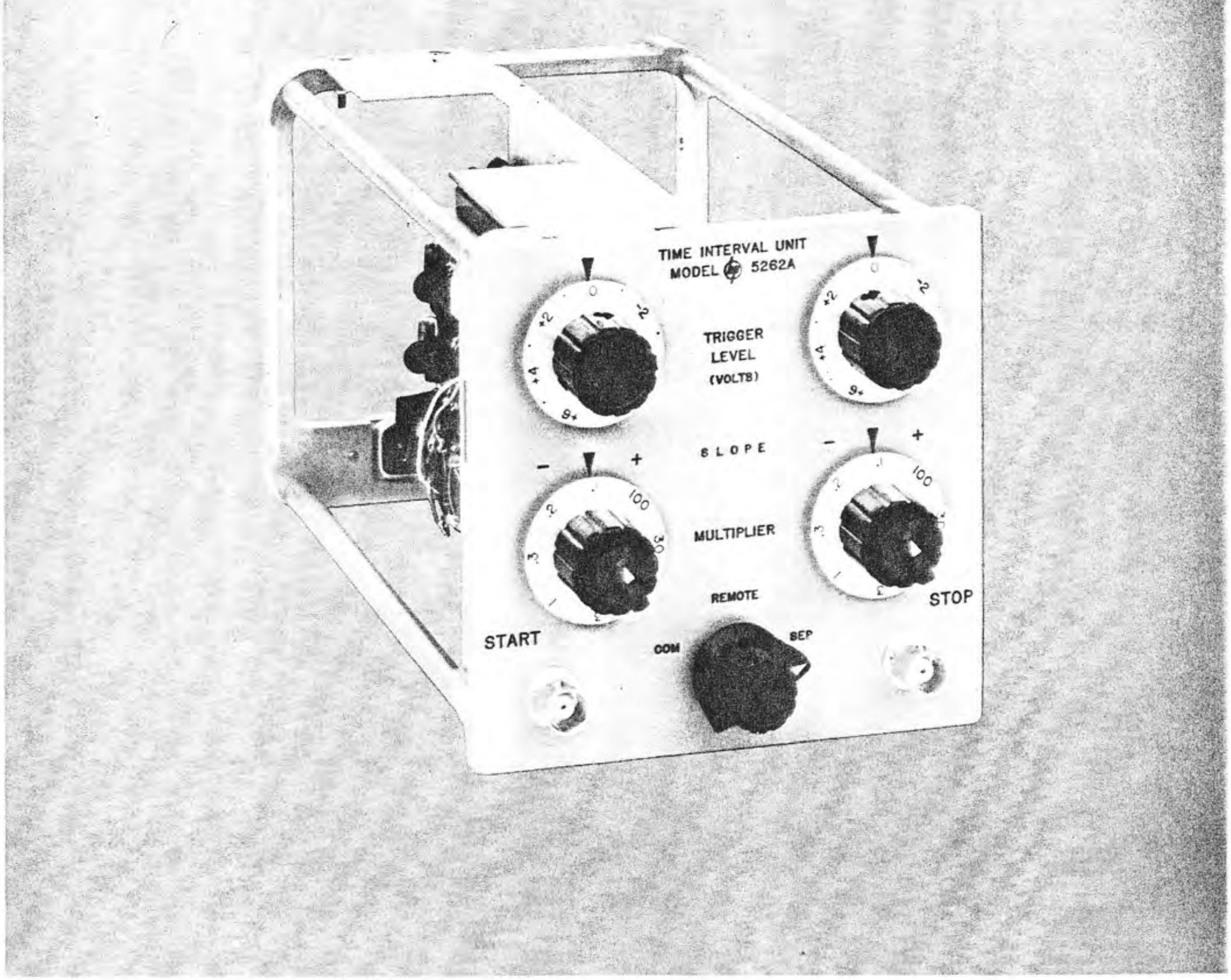
TABLE OF CONTENTS

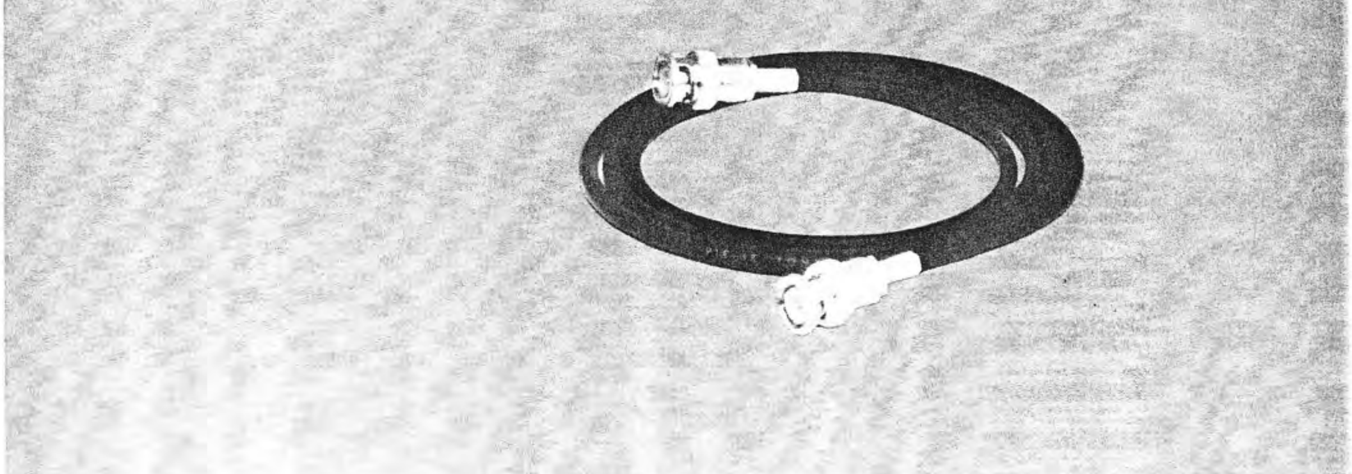
LIST OF ILLUSTRATIONS

LIST OF TABLES

model 5262A



bnc-bnc cable



SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. CONTENT. This manual provides instructions on operation and maintenance of the ⓗⓟ Model 5262A Time Interval Unit.

1-3. SERIAL PREFIX. The Model 5262A carries a five-digit serial number with a three digit prefix (000-00000). If the prefix number on the instrument agrees with the prefix number on the title page, this manual applies to the instrument directly. If the serial prefixes do not agree, change sheets with the manual describe changes which are necessary so that the manual can be used with the instrument.

1-4. DESCRIPTION.

1-5. The Model 5262A, shown in figure 1-1, provides start and stop pulses, initiated by electrical inputs, to open and close the main gate of the ⓗⓟ Model 5243L or similar electronic counter enabling it to make time interval measurements. Time intervals from 1 microsecond to 10^8 seconds are measured with a resolution of 0.1 microsecond using frequencies available in the Model 5243L or external frequencies of 20 mc or less. When the counter counts a signal derived from its crystal oscillator, counter time base accuracy is retained. Specifications are given in table 1-1. The Model 5262A has two independent channels, each with its own controls. A function switch permits selection of three modes of operation.

1-6. APPLICATIONS.

1-7. DIRECT ELECTRICAL MEASUREMENTS. Basic time interval measurements can be made between pulses on isolated cables, between leading and trailing edges of a pulse, or between consecutive pulses on a single cable (figure 1-2). Start-stop signals may be initiated by inputs of either positive or negative polarity; positive or negative slope and at a predetermined voltage.

Table 1-1. Specifications

Range: 1 μsec to 10^8 sec (Start and stop pulses must be separated by 1 μsec to give useful readings.)	**Trigger Amplitude:** Both channels continuously adjustable from - 250 volts to +250 volts
Accuracy: ±1 period of standard frequency counted ± time base accuracy	**Frequency Range of 5262A when used as an input signal discriminator:** 0 to 2 mc
Registration: On 5243L counter	
Input Voltage: 0.3 volt, peak-to-peak, minimum, direct coupled input	**Standard Frequency Counted:** 10^7 to 1 cps in decades from 5243L, or externally applied frequency
Input Impedance: 10K ohms, less than 80 pf, on X.1 and X.2 multiplier positions; constant up to ±40 volts peak times multiplier position 100K ohms times multiplier position on X.3 to X100 positions, less than 40 pf on X.3, and less than 20 pf on X1 to X100; constant up to ±40 volts times multiplier position	**Markers:** Separate output voltage steps, 0.5 volts peak-to-peak from source impedance of approximately 7K ohms, 100 pf; available at rear panel of 5243L with negative step coincident with trigger points on input waveforms for positive slope and positive step coincident for negative slope
Overload: 50 volts rms, or ±150 volts peak on X.1, .2, and .3 multiplier positions is tolerable; 150 volts rms, or ±250 volts peak, on X1 and X3; 250 volts rms, or ±250 volts peak, on X10, 30 and 100	**Reads In:** μs, ms, sec with measurement units indicated and decimal point positioned
Start Stop: Independent or common channels	**Accessories Furnished:** ⓗⓟ AC-16K Cable Assembly, male BNC to male BNC 48 inches long
Trigger Slope: Positive or negative on Start and Stop channels, independently selected	**Net Weight:** 2 lb

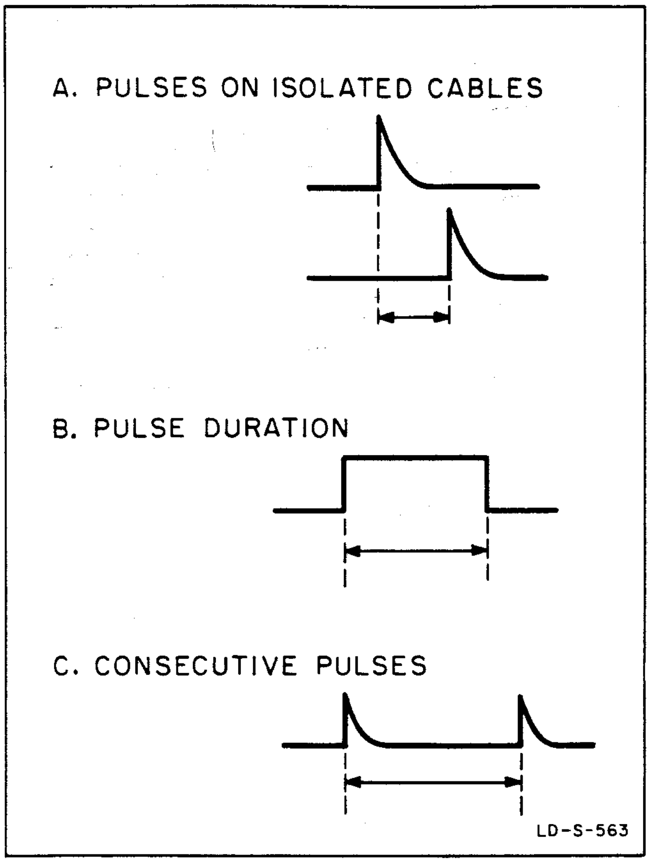


Figure 1-2. Basic Start-Stop Signals

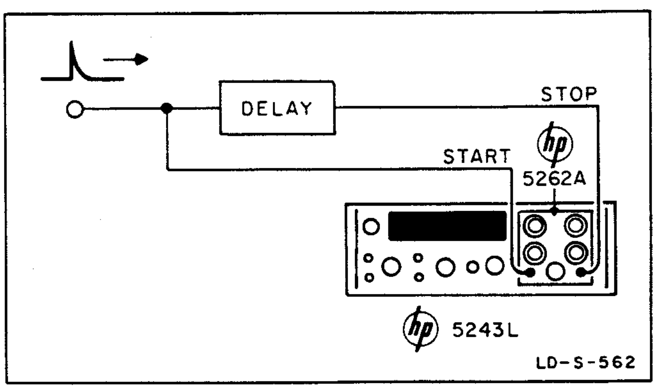


Figure 1-3. Delay Measurement

1-8. DELAY. Figure 1-3 shows a circuit arrangement of measurement of delay for a fixed delay line.

1-9. VELOCITY. Velocity of an object can be determined by measuring the time required for it to pass from one transducer to another.

1-10. ROTATIONAL SPEED. High-speed rotation can be measured using a photomultiplier pickup to scan a shaft which has been prepared with an alternately reflective and non-reflective surface. Speed determinations for slow-speed shafts can be made in a small fraction of a revolution from an optical pickup scanning a pattern of closely spaced lines.

1-11. UNPACKING AND INSPECTION.

1-12. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken knobs, etc). If the instrument is damaged or fails to meet specifications (Performance Check, Para 4-14), notify the carrier and the nearest Hewlett-Packard field office immediately (field offices are listed at the back of this manual). Retain the shipping carton and the padding material for the carrier's inspection. The field office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

1-13. STORAGE AND RESHIPMENT.

1-14. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used in original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. If original materials are unavailable, proceed as follows:

a. Cover panel with soft wrapping paper.

b. Wrap corrugated cardboard completely around instrument.

c. Pack instrument securely in strong corrugated container (350 lb/square inch bursting test).

d. Insert filler between wrapped instrument and container to insure a snug fit on all surfaces of the instrument.

1-15. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

a. Maximum altitude 20,000 feet.

b. Minimum temperature -40^{o}F (-40^{o}C).

c. Maximum temperature 167^{o}F (75^{o}C).

SECTION II
OPERATING INSTRUCTIONS

2-1. INTRODUCTION.

2-2. The Model 5262A has two independent channels which determine the beginning and the end of a time interval. Each channel has its own TRIGGER SLOPE, TRIGGER LEVEL, and MULTIPLIER controls. Figures 2-4 and 2-5 show procedures for making a time interval measurement and a phase measurement. The following paragraphs describe installation of the Model 5262A and the function of each control.

2-3. INSTALLATION.

2-4. Installing the Model 5262A is a simple matter. Just slide it all the way into the plug-in compartment of the Model 5243L and turn the knurled knobs on either side of the compartment clockwise until tight. Power is supplied to the Model 5262A from the Model 5243L.

2-5. CONTROLS.

2-6. FUNCTION SWITCH. The function switch provides the operator with three modes of operation: common, separate, and remote.

a. With the function switch in the COMMON position START and STOP input connectors are connected together internally. Thus, if start and stop signals come from the same source, set function switch to COMMON and apply the signal to either input connector. Adjust MULTIPLIER and TRIGGER LEVEL controls for each channel separately.

b. With the function switch in the REMOTE position, the time interval function becomes one of the remote programming operations of the counter.

c. With the function switch in the SEPARATE position the start signal must be applied to START input connector and stop signal must be applied to STOP input connector.

2-7. TRIGGER SLOPE. The TRIGGER SLOPE controls determine the slope a signal must have as it crosses the voltage level set by the MULTIPLIER and TRIGGER LEVEL controls to start or stop a measurement.

2-8. MULTIPLIER AND TRIGGER LEVEL. These controls work together to determine the voltage level a signal must cross to start or stop a measurement. For example with the TRIGGER LEVEL dial set at +2 and the MULTIPLIER set at .3 the Model 5262A will trigger as the input crosses the +0.6 volt level. Suppose you have a pulse as shown in figure 2-1A, there will be little difference whether measurement begins at V_a or V_b. However, to measure interval "y" of figure 2-1B, you must be more careful. Set TRIGGER LEVEL dial reading near 0 as a preliminary adjustment. Adjust the start and then the stop TRIGGER LEVEL controls. Watch for definite changes in measured time. Thus you know that start and stop voltage levels are above the step and that the indicated time interval is actually "y".

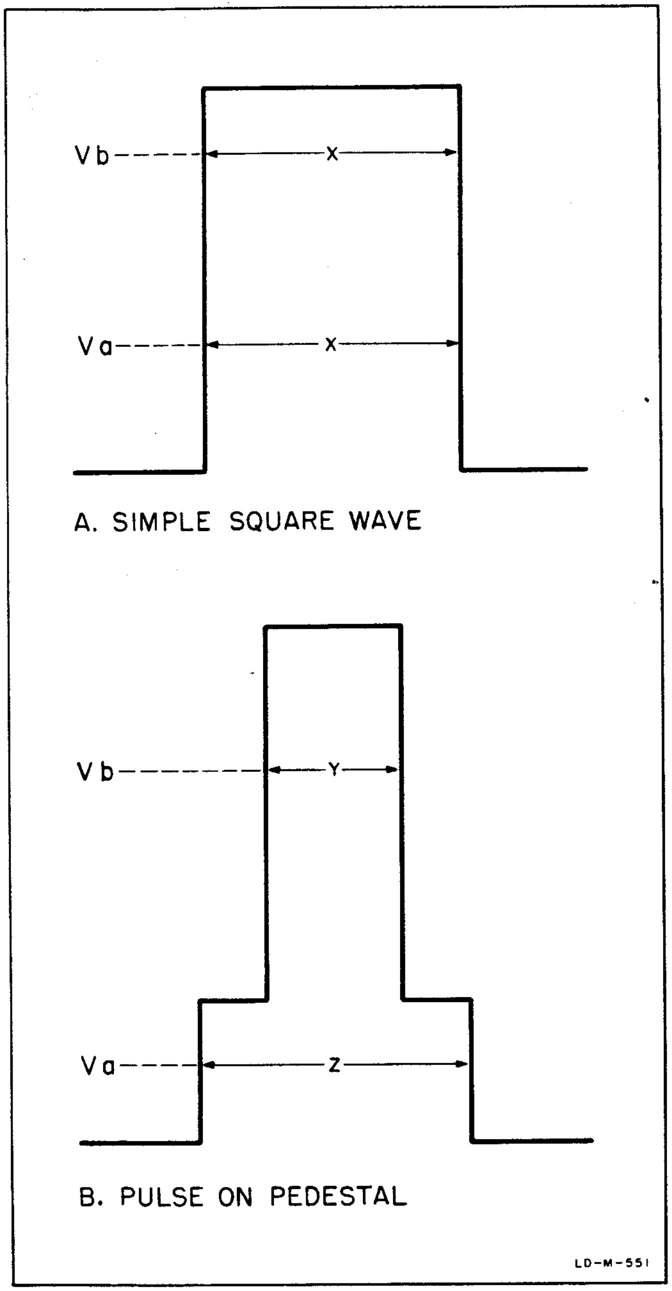


Figure 2-1. Trigger Level Settings

2-9. MULTIPLIER AND TRIGGER LEVEL USING OSCILLOSCOPE. This is an easier method because you can see where the pulses are occurring with respect to the signal. Connectors at the rear of the

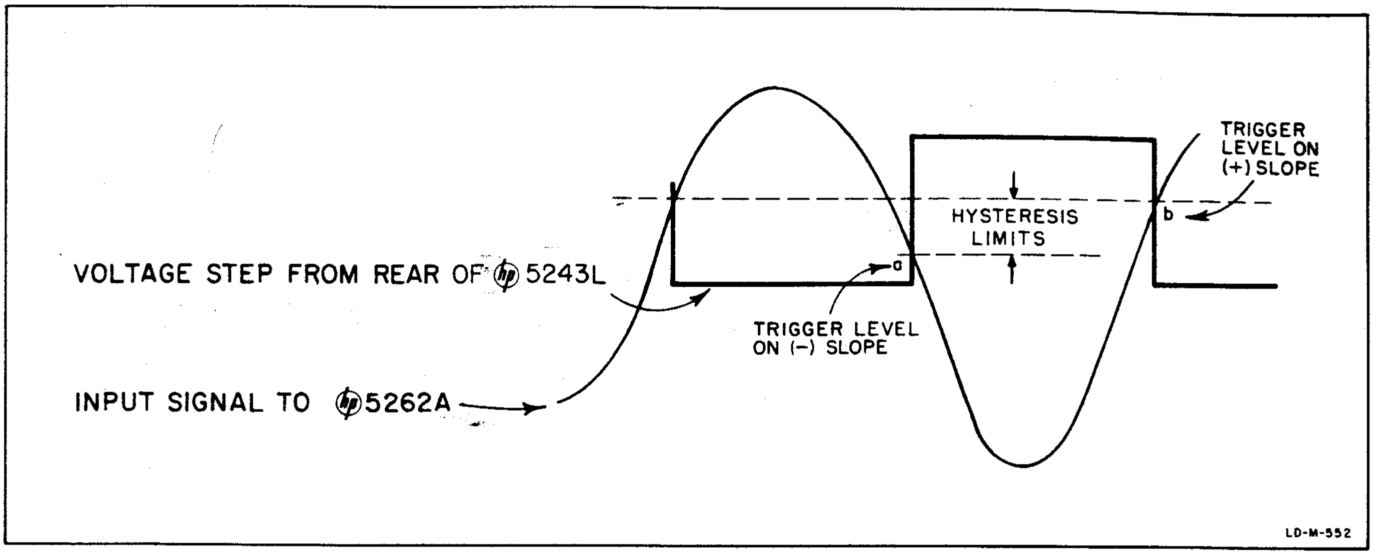


Figure 2-2. Oscilloscope Display of Trigger Levels (front panel slope control set to neg.)

Model 5243L Electronic Counter provide separate voltage steps which occur at the same time as the trigger pulses. Use the following procedure:

a. Connect BNC-to-BNC cable between START input connector on front panel of Model 5262A and EXT AC SYNC input of oscilloscope; use tee connector UG-274A/U at Model 5262A.

b. Connect the START output connector at the rear of the Model 5243L and one input channel of the oscilloscope.

c. Set Model 5262A function switch to COM.

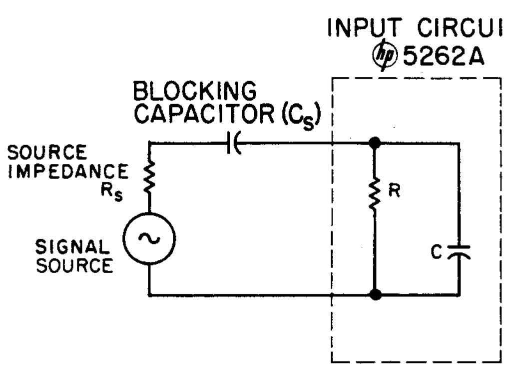
d. Connect a cable from an oscillator to the START input connector of the Model 5262A; frequency is not important if it is a sine wave and the range is between 0 and 2 mc.

e. Connect the STOP input connector of the ⓗ 5262A and the other channel of the oscilloscope.

f. Set VERTICAL SENSITIVITY controls to .2 volts/cm.

g. Set the VERTICAL PRESENTATION selector of the oscilloscope to CHOPPED or ALTERNATE.

h. Display on the oscilloscope will be similar to that shown in figure 2-2.

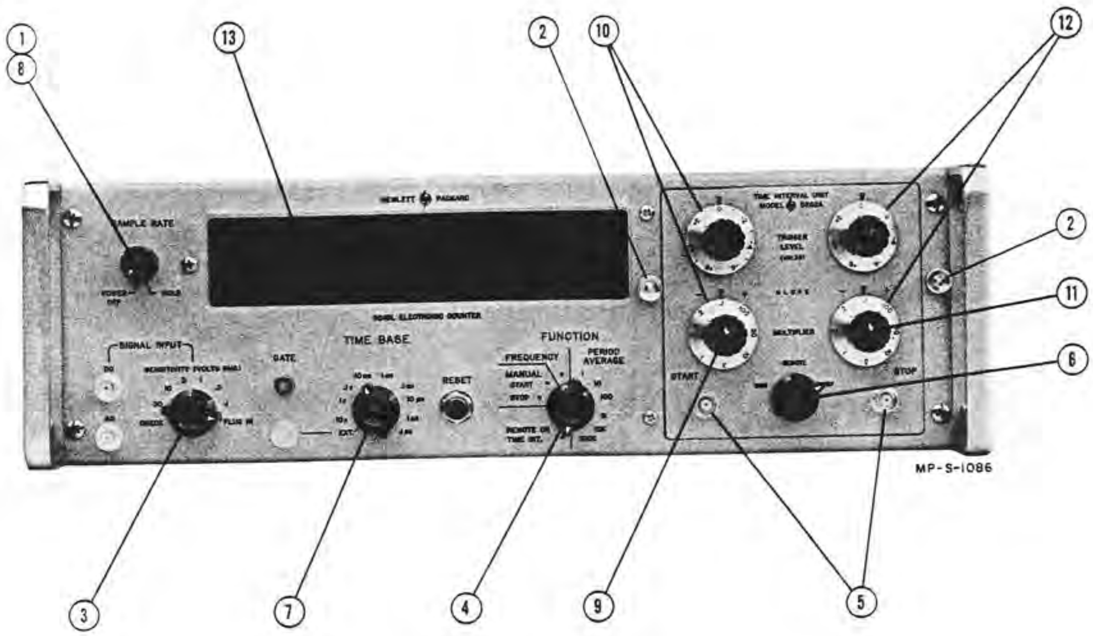


MULTIPLIER SETTING	0.1	0.2	0.3	1	3	10	30	100
K ($\times 10^{-4}$)	.237	.237	.355	.592	1.30	.039	.118	.39

$$C_s = \frac{1}{K R_s f^2} \qquad K = 4\pi^2 RC$$

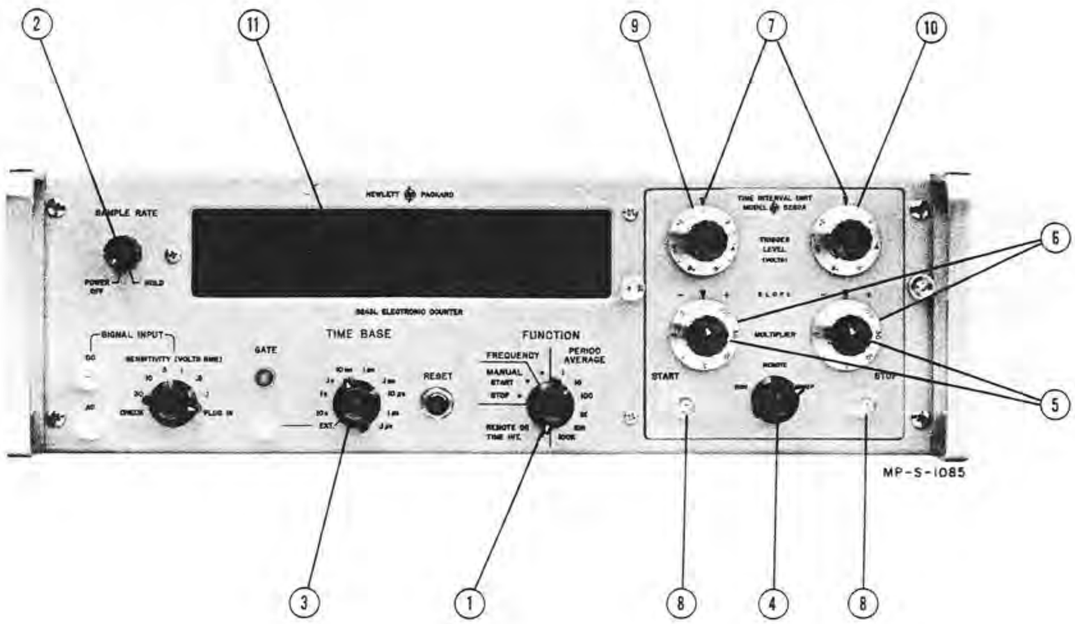
LD-M-553

Figure 2-3. Remove DC Component from Sine Wave Input



1. Turn SAMPLE RATE control to POWER OFF.
2. Plug in Model 5262A, turning knurled knobs clockwise until tight.
3. Set SENSITIVITY switch to PLUG-IN.
4. Set FUNCTION switch to REMOTE OR TIME INT.
5. Connect signal to START or STOP with selector at common, to START and STOP at other positions of selector switch.
6. Set COM-REMOTE-SEP to:
   a. COM if start and stop signals are from same source.
   b. REMOTE if the Model 5243L is being operated from a remote control box.
   c. SEP if start and stop signals are from different sources.
7. Set TIME BASE switch to obtain greatest possible count, or to EXT if an external time unit is to be used.
8. Set SAMPLE RATE control for desired operating rate.
9. Set start channel SLOPE control to "+" if you want measurement to start on positive slope. Set to "-" if you want to start count on negative slope.
10. Adjust start MULTIPLIER and TRIGGER LEVEL controls to set measurement start point at desired voltage level.
11. Set stop channel SLOPE control to "+" if you want measurement to stop on positive-going part of signal. Set to "-" if you want to stop count on negative slope.
12. Adjust stop MULTIPLIER and TRIGGER LEVEL controls to set measurement stop points at desired voltage level.
13. Read time interval units.

Figure 2-4. Operating the Model 5262A



1. Set FUNCTION to REMOTE OR TIME INT.
2. Set SAMPLE RATE to position just before POWER OFF. (MAX SAMPLE RATE)
3. Set TIME BASE switch to obtain greatest possible count, or to EXT if an External Freq is counted to give an answer in degrees.
4. Set COM-REMOTE-SEP to SEP.
5. Set start and stop TRIGGER SLOPE to same polarity.
6. Set both START and STOP MULTIPLIER concontrols to 0.1 position.
7. Set both start and stop TRIGGER LEVEL controls to 0 position.
8. Connect signals whose phase difference is to be measured to START and STOP inputs. (Note: For specified accuracy, do not exceed ± 40 volts peak times multiplier setting.)
9. Set start TRIGGER LEVEL control for no difference in counter reading as start MULTIPLIER is switched between the 0.1 and 0.2 positions. Procedure:
   a. Note counter reading with MULTIPLIER set to 0.1 position.
   b. Note counter reading with MULTIPLIER set to 0.2 position.
   c. Subtract the smaller reading from the larger reading.
   d. If reading in step b is less than reading in step a, add result of step c to reading of step a and adjust TRIGGER LEVEL for result.
   e. If reading in step b is greater than reading in step a, subtract result of step c from reading of step a and adjust TRIGGER LEVEL for result.

   Note

   The procedure may have to be repeated to obtain exact zero crossing.
10. Repeat step 9 for stop TRIGGER LEVEL control.
11. Read phase difference in units selected by TIME BASE switch.

Figure 2-5. Procedure for Phase Measurement

2-10. ELIMINATING DC COMPONENT FROM SINE WAVE INPUT.

2-11. As the input circuits of the Model 5262A are dc coupled it is sometimes easier to set the MULTIPLIER and TRIGGER LEVEL controls when any dc component from the start and/or stop sine wave input signals is eliminated with blocking capacitors. With the aid of figure 2-3 you can select the proper value of blocking capacitor for no readout error. For example, on the .1 MULTIPLIER range, at 400 cps and with a source impedance of 10,000 ohms the proper value of blocking capacitor is 25 μf.

2-12. However, if the right value of capacitor is not available, use the following approximate formula to determine what the error per channel in seconds will be (for phase shifts less than 10° and signals less than ± 40 volts peak times multiplier position):

$$\text{Error in seconds} = \frac{-1}{Cs(R_s + R)(2\pi f)^2} + \frac{R_s(RC)}{R_s + R}$$

C_s = Blocking capacitor

R_s = Signal source impedance

RC = 6×10^{-7} for 0.1 and 0.2 MULTIPLIER settings, 9×10^{-7} for 0.3, 1.5×10^{-6} for 1, 3.3×10^{-6} for 3, 1×10^{-5} for 10, 3×10^{-5} for 30, 1×10^{-4} for 100.

2-13. For example, on the .1 MULTIPLIER range, the use of a 10 μf blocking capacitor at 400 cps and with a source impedance of 600 ohms results in an error of 1.5 microseconds.

2-14. PHASE MEASUREMENT.

2-15. Phase measurement is a special application of time interval measurement. You measure the time interval between like points on two similar waveforms and relate the reading to phase angle. The measurement is made between the points where the signals cross 0 volt going in the same direction. The zero-crossing is the reference point for two reasons: first, it is the easiest point to determine accurately on the counter; and second, for sinewaves it is in the region of maximum slope, allowing maximum resolution.

2-16. Phase difference is measured in time units if one of the internal standard frequencies is counted. The following formula converts time interval (t) to phase (ϕ) in degrees:

$$\phi = \frac{360t}{\text{period of either signal}}$$

2.17. If the two signals are not equal in amplitude, use the larger for the period measurement. You can measure phase directly in degrees if you apply the appropriate external frequency (360 x frequency of signals whose phase you are measuring) to the counters in place of an internal standard frequency. However, the external frequency cannot exceed the maximum counting rate of the instrument. Procedure for phase measurement is given in figure 2-5.

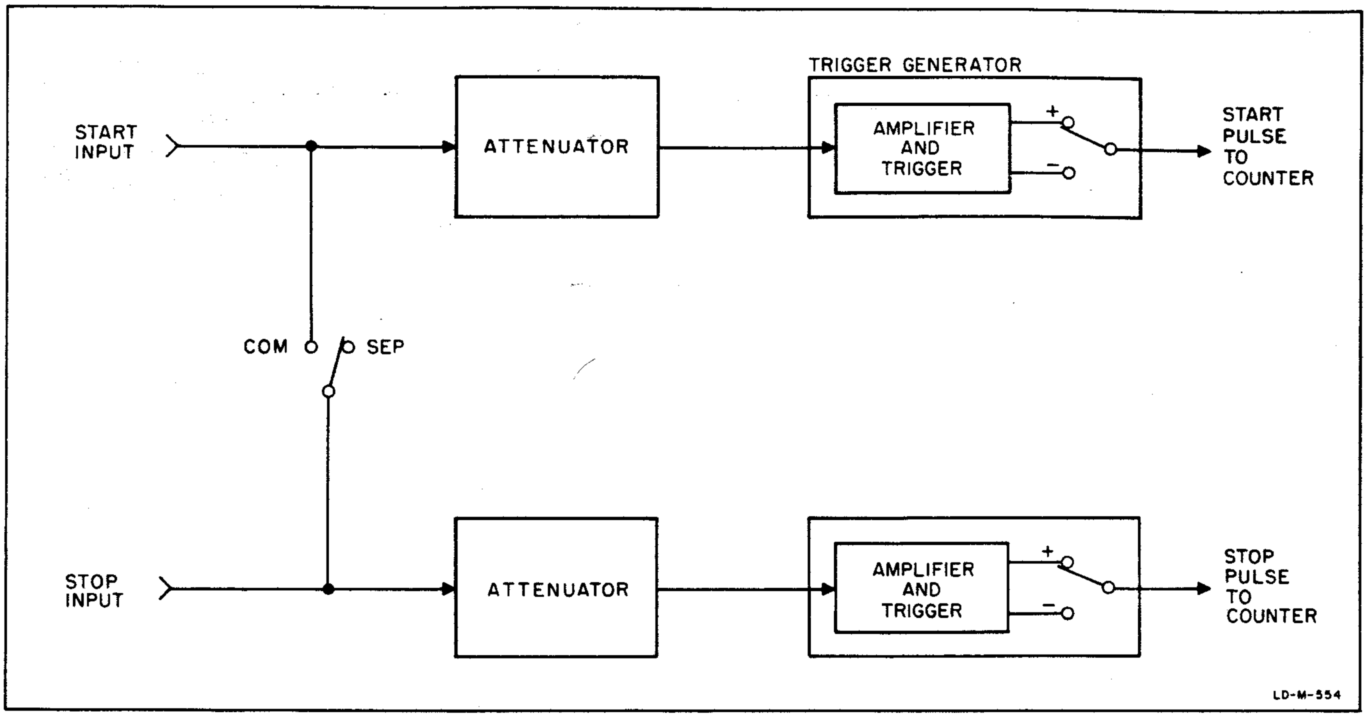


Figure 3-1. Overall Block Diagram of Model 5262A

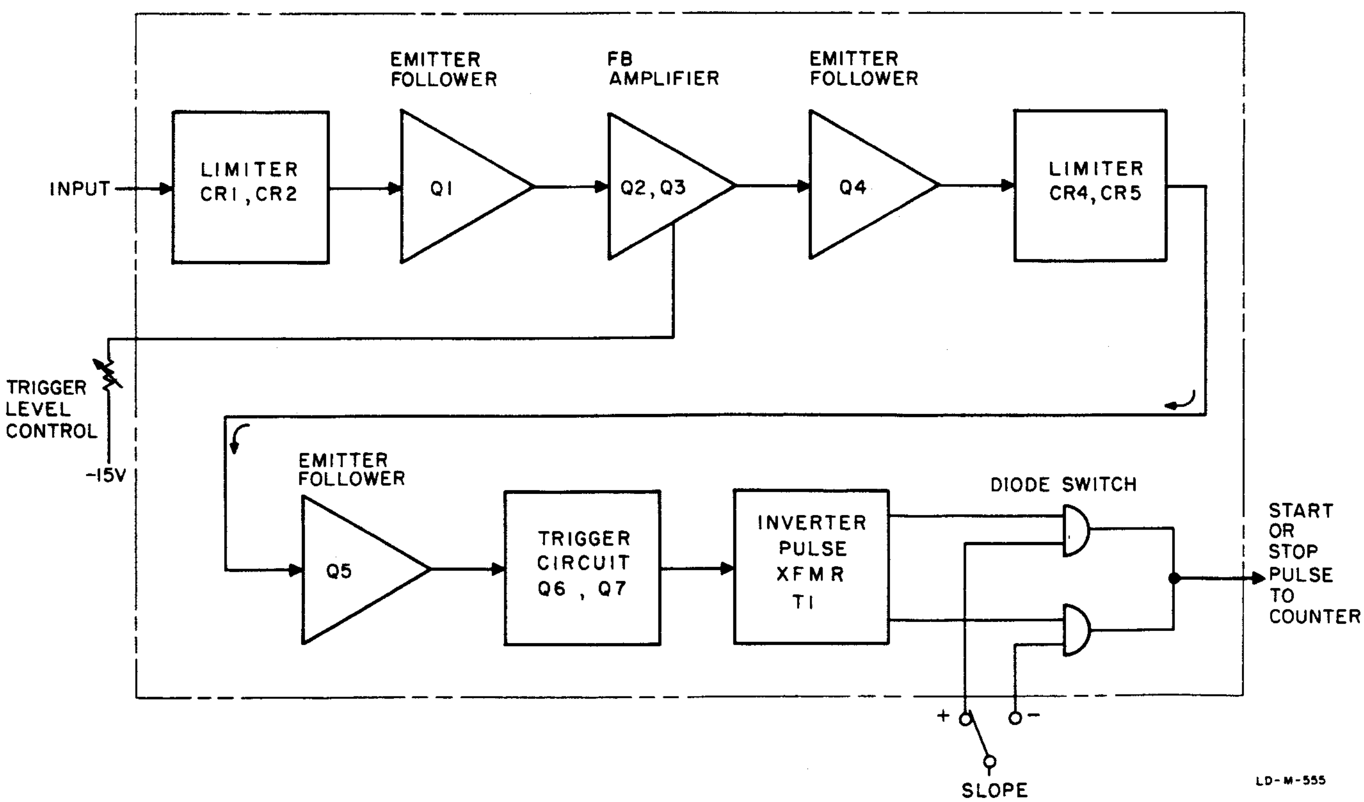


Figure 3-2. Block Diagram of ⓗⓟ 5262A-65A Trigger Generator Assembly

SECTION III
PRINCIPLES OF OPERATION

3-1. INTRODUCTION.

3-2. The Model 5262A has two independent channels, one for start pulse, the other for stop pulse. Each channel includes an attenuator circuit followed by an amplifier and Schmitt trigger. The block diagram, figure 3-1, shows the main functional sections and signal flow through the Model 5262A. For each time interval measurement, the counter receives two negative pulses; a start pulse and a stop pulse. The start pulse opens a signal gate within the counter, which then counts one of its internal frequencies or an external frequency until the stop pulse closes the signal gate.

3-3. TRIGGER GENERATOR.

3-4. GENERAL. The trigger generator forms the pulses which start or stop the time interval measurement. Signal flow initiating the output pulses can be traced on the block diagram, figure 3-2. Paragraphs 3-5 through 3-12 describe the circuits included in the trigger generator assembly in more detail.

3-5. AMPLITUDE LIMITER. Figure 3-3 shows the circuit with input and output waveforms. Under normal operation diodes CR1 and CR2 act as low resistance elements. However, positive peak overloading back-biases CR2 and negative peak overloading back-biases CR1. Thus no signal level beyond the bias limits reaches Q1.

3-6. FEEDBACK AMPLIFIER AND TRIGGER LEVEL. Figure 3-4 shows the circuit with the feedback path. Q2 and Q3 form a feedback amplifier which provides a very stable gain over a wide band of frequencies. Q2 functions as a differential amplifier amplifying the difference between the input voltage appearing at its base and the feedback voltage appearing at its emitter.

3-7. The feedback circuit also includes the TRIGGER LEVEL control (R1). Varying the dc bias of Q2 controls the trigger level. This effectively shifts the signal with respect to the hysteresis limits of the trigger circuit thereby controlling the levels at which the Model 5262A triggers.

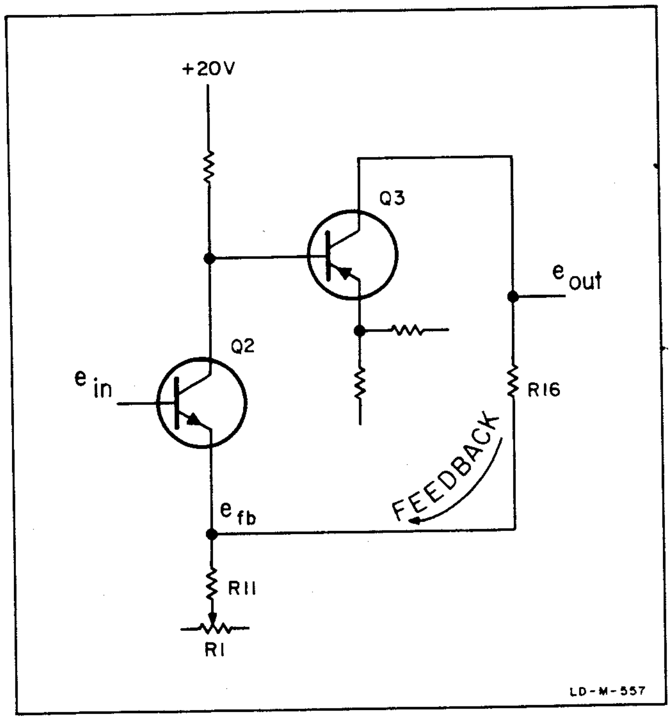


Figure 3-4. Feedback Amplifier Circuit

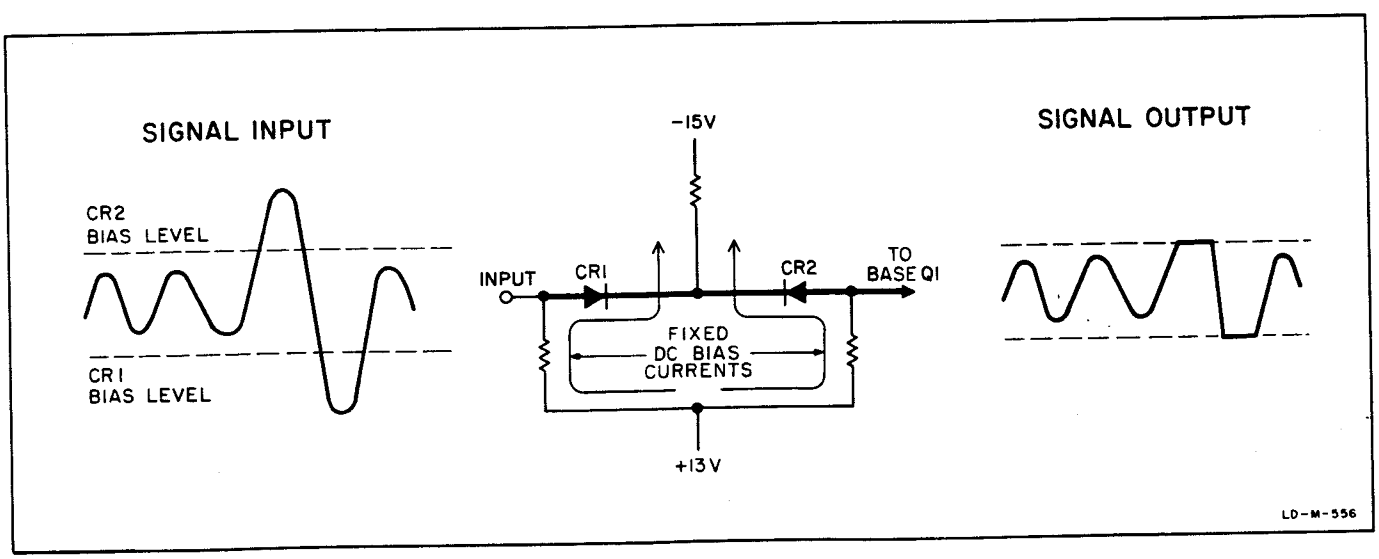


Figure 3-3. Amplitude Limiter Operation

3-8. SCHMITT TRIGGER. The trigger circuit is a special form of switching circuit (bi-stable multivibrator) which produces fast-rising signals. Figure 3-5 shows the trigger circuit with input and output waveforms. If initially the input signal becomes more positive, it will eventually reach a predetermined level, point a in figure 3-5, at which the circuit changes state; Q6 turns on and Q7 turns off. If the input signal then goes negative, the emitter potential decreases and Q7 base goes positive. When the input reaches a second predetermined level, point b in figure 3-5, Q7 turns on and the circuit switches back to its initial state. The output of the circuit is a current step, either positive or negative depending upon the slope of the input. (Transformer T1 inverts and differentiates these current steps.)

3-9. HYSTERESIS LIMITS. The trigger circuit switches at certain input signal levels. Notice that the circuit does not switch unless the input signal crosses both limits alternately. However, as shown in figure 3-5, the trailing edge of E_{out} occurs at a lower input voltage level than that which causes the leading edge. The reason for this is as follows: The alternate off and on states of Q7 yields high and low outputs, respectively. These off and on states of Q7 are caused by the on and off states of Q6. When Q6 is off, Q7 turns on and produces a low output. Current flow through R26 due to the conduction of Q7 biases the emitters of both Q6 and Q7 positively with respect to ground. This positive bias at the emitter of Q6 necessitates a positive signal of certain amplitude on the base of Q6 before Q6 will turn on and thereby turn off Q7. When Q7 turns off, the current will then flow through Q6 and R26. Since R23 is in the collector circuit of Q6, the voltage drop across R26 is less than when Q7 was on. Consequently, the positive bias on the emitters is now less than when Q6 was off.

3-10. In the meantime, the input signal has progressively (1) gone sufficiently positive to cause Q6 to turn on, (2) increased to its maximum, and then (3) decreased from maximum to the point where its voltage level is equal to that which is necessary to turn Q6 on. This would be the point where Q6 might be expected to turn off; but now its emitter is at a lower positive potential, so Q6 now requires a lower positive voltage on its base to suppress the electron flow from its emitter and effectively turn it off. Therefore, the delay in the turn-off of Q6 caused by its lower emitter bias results in a slight increase in the length of the square-wave output of Q7.

3-11. SHORT PULSES. An input signal will cause a voltage step to appear at the collector of Q7, either positive or negative depending upon the slope of the input signal. Transformer T1 forms these voltage steps into short pulses and inverts them.

3-12. TRIGGER SLOPE. The block diagram (figure 3-1) shows this control symbolically as a switch. Diode switching places the useful, NEGATIVE start or stop trigger pulse on the proper slope. Figure 3-6 shows the diode-switch circuit. Forward biasing either CR6 (for negative slope) or CR7 (for positive slope) provides trigger pulse for the desired slope. The TRIGGER SLOPE control on the front panel switches the bias from one diode to the other.

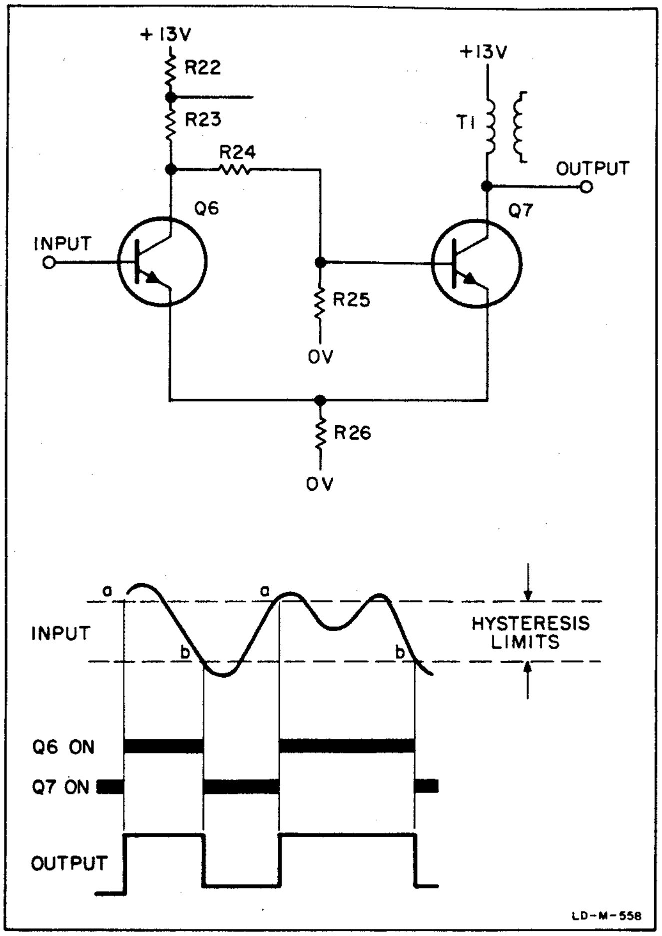


Figure 3-5. Trigger Circuit Operation

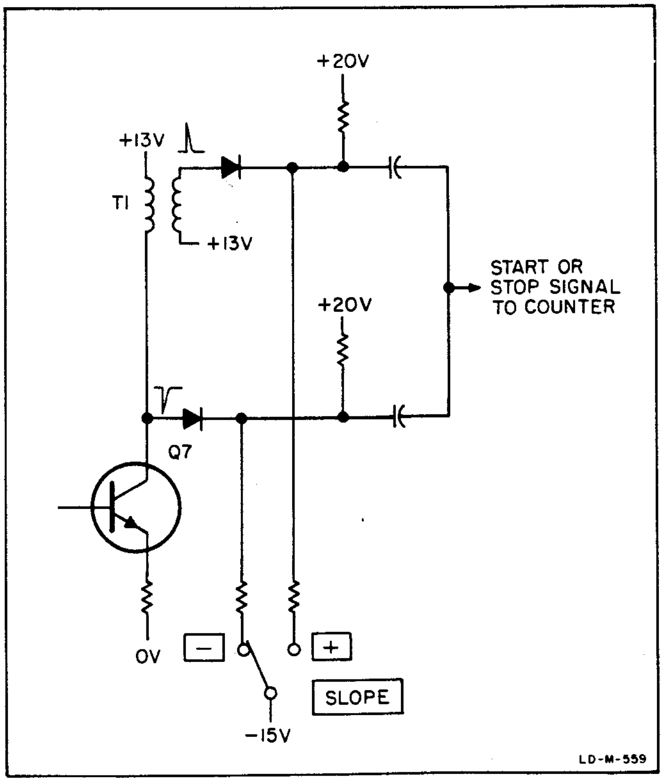


Figure 3-6. Diode Switch Circuit

SECTION IV
MAINTENANCE

4-1. INTRODUCTION.

4-2. This section contains troubleshooting information and a performance check for the Model 5262A. No preventive maintenance is required for the Model 5262A Time Interval Unit except an occasional visual inspection.

4-3. TEST EQUIPMENT.

4-4. Test equipment required for troubleshooting, for the performance check, and for adjustment of the Model 5262A is listed in table 4-1. Equipment of equivalent characteristics may be substituted for those listed.

4-5. TROUBLESHOOTING.

4-6. A possible troubleshooting procedure follows:

a. Remove the Model 5262A from the Model 5243L and reconnect it using the AC-16Y extender cable.

b. Interchange trigger generator boards to isolate trouble in a faulty channel to its board. The start and stop channels of the Model 5262A are independent, and trouble in one generally will not affect the other.

c. Refer to waveform chart, component location drawing, and schematic diagrams (figures 4-1 through 4-6) for guidance.

d. Apply a sine wave to input of Model 5262A and check points listed with waveforms in figure 4-1.

4-7. The transistor is the component most likely to be at fault. For example, a short between the collector and the emitter isolates the base from all following circuits and the applied signal would be blocked at the base. Another likely fault is either a shorted or open diode.

4-8. SERVICING PRINTED CIRCUIT BOARDS.

4-9. To prevent damage to the board when replacing components, apply heat sparingly and work carefully. The following replacement technique is recommended:

a. Remove defective component.

Table 4-1. Test Equipment

Type	Required Specifications	Application	Recommended
Electronic Counter	ⓗⓟ Model 5243L	Supply power for unit, visual indication of operation of unit	ⓗⓟ Model 5243L, Electronic Counter
AC Vacuum Tube VOLTMETER	0 to 300 vac	Voltage Measurements	ⓗⓟ Model 400D/H/L, AC Vacuum Tube Voltmeter
DC Vacuum Tube Voltmeter	0 to 300 vdc	Voltage and resistance measurements	ⓗⓟ Model 412A, DC Vacuum Tube Voltmeter
Oscilloscope	Dual Channel, 2 mc	General troubleshooting, checking out waveforms	ⓗⓟ Model 150A Oscilloscope with 152B Plug-In, or ⓗⓟ Model 160B with 162A Plug-In, or ⓗⓟ Model 170A with 162A Plug-In
Oscillator	0 to 2 mc	Signal injection, check response of circuits in unit	ⓗⓟ Model 650A, Test Oscillator
Square Wave Generator	10 cps to 100 kc	Signal injection, check response of circuits in unit	ⓗⓟ Model 211A, Square Wave Generator
Test Cable		Allows unit to be operated outside of the counter	ⓗⓟ **10506A**, (AC-16Y) Extender cable

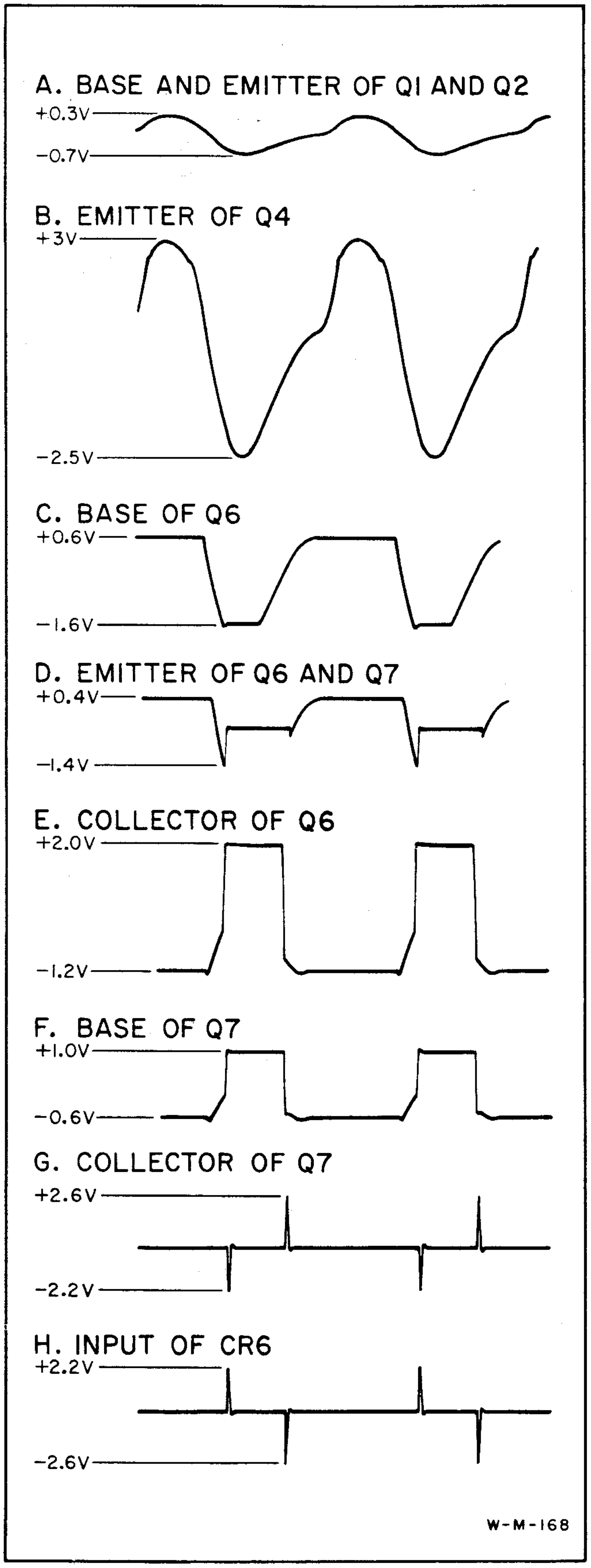


Figure 4-1. Waveforms Resulting from Input Sine Wave at 1 Volt Peak-to-peak

b. Melt solder in holes; clean holes with toothpick or wooden splinter. Do not use a metal tool which may damage board.

c. Bend component leads to correct shape and insert in holes. Solder leads in place from opposite side of board.

d. If plating breaks on inside of holes (indicated by lifting of conductor pad on opposite side of board) press pad against board and solder component lead to conductor on each side of board.

4-10. ADJUSTMENTS AFTER REPAIR.

4-11. As a general rule, unless a transistor or diode is replaced, no adjustments will be necessary. Paragraphs 4-12 and 4-13 indicate adjustments that are necessary if transistors or diodes are replaced.

4-12. ZERO-SET INPUT. If repair is made to start channel, proceed as follows:

a. With the counter turned off, connect Model 5262A by means of the cable ⓗⓟ AC-16Y.

b. Connect a cable from input of oscilloscope to START input of Model 5262A. Set oscilloscope vertical sensitivity to .05 v/cm.

c. On Model 5262A set both TRIGGER LEVEL controls to 0, both MULTIPLIER controls to 100, and the COM-REMOTE-SEP switch to SEP.

d. On the START channel circuit board (ⓗⓟ5262A-65A) adjust R6 for zero volts (plus or minus 10 millivolts) measured between center terminal of START connector and chassis ground.

e. Repeat steps a through d for STOP channel if repair is made in the STOP channel board.

4-13. ATTENUATOR (MULTIPLIER). If repair is made to START channel proceed as follows:

a. Connect square-wave generator (use 75-ohm output of Model 211A) output to START input of Model 5262A.

b. Set square wave generator for an output of 100 kc at a 300 millivolt peak level (Model 211A generates only negative pulses).

c. Set start MULTIPLIER switch to .2, and adjust C9 on input MULTIPLIER switch so that same shape square wave is seen at emitter of Q4 as when MULTIPLIER switch is in .1 position (square wave amplitude will decrease by two).

d. Repeat steps a through c for STOP channel if repair is made in the STOP channel board.

4-14. IN-CABINET PERFORMANCE CHECK.

4-15. PRELIMINARY CHECK. Steps a through p of the following procedure confirm that the feedback

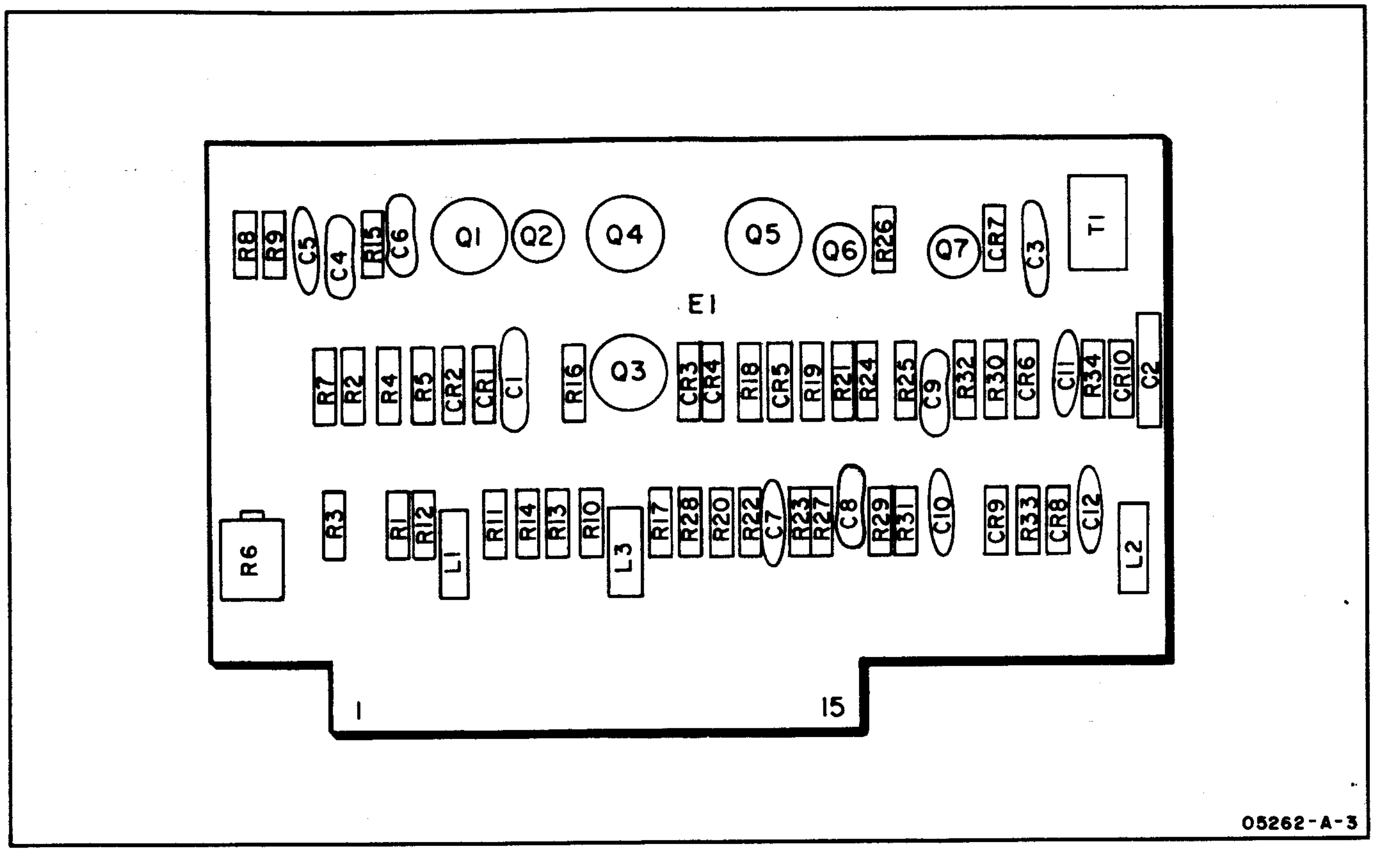


Figure 4-2. Component Location, Trigger Generator Assembly (A3, A4)

amplifier, the trigger circuit, the trigger level controls and the slope controls are working properly.

a. With the SAMPLE RATE control of the Model 5243L in the POWER OFF position plug the Model 5262A into the compartment. Now turn SAMPLE RATE control slightly clockwise turning it on.

b. Set STORAGE switch at rear of Model 5243L to off.

c. Set COM-REMOTE-SEP of Model 5262A to SEP.

d. Set MULTIPLIER to .1.

e. Set TRIGGER LEVEL to 0.

f. Set FUNCTION switch to REMOTE OR TIME INT.

g. On Model 5243L set TIME BASE switch to 1 ms.

h. Set SIGNAL INPUT switch to PLUG IN.

i. Set start and stop SLOPE controls to "-".

j. Rotate start TRIGGER LEVEL control from +6 to -6 and back to +6. The Model 5243L will start counting; the display will indicate the count and the gate light will glow.

k. Rotate stop TRIGGER LEVEL control from +6 to -6 and back to +6. The Model 5243L will stop counting indicated by gate light going off.

m. Set start and stop SLOPE controls to "+".

n. Rotate start TRIGGER LEVEL control from -6 to +6 and back to -6. The Model 5243L will start counting.

p. Rotate stop TRIGGER LEVEL control from -6 to +6 and back toward -6. The Model 5243L will stop counting.

4-16. MINIMUM TIME INTERVAL. This check shows that the gate binary of the Model 5243L will respond to pulses which are as close as one microsecond.

a. On Model 5243L set TIME BASE to .1 μs and FUNCTION to REMOTE or TIME INT.

b. On Model 5262A set start and stop TRIGGER LEVEL controls to 0.

c. On Model 5262A set MULTIPLIERS to .1, TRIGGER SLOPES to opposite polarity, and COM-REMOTE-SET to COMMON.

d. Connect 500kc sine wave at 300mv rms to START input.

e. Slowly adjusting TRIGGER LEVEL controls will produce readout on Model 5243L of 1 microsecond.

4-17. SENSITIVITY AND RESPONSE CHECK. Checks are identical for START and STOP channels.

a. With the exception of step c follow procedure of paragraph 4-15 steps a through h.

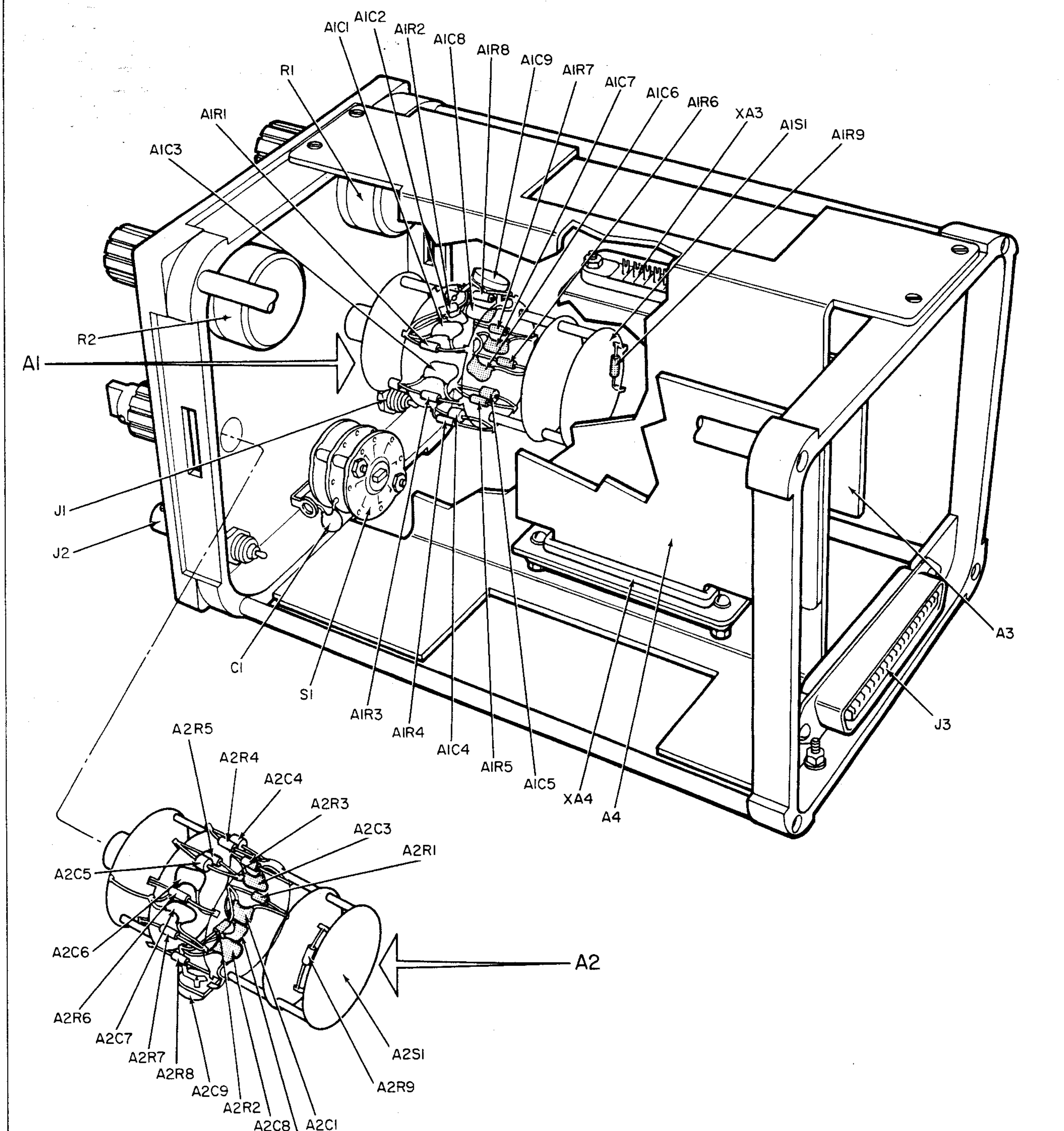


Figure 4-3. Component Location Model 5262A (overall)

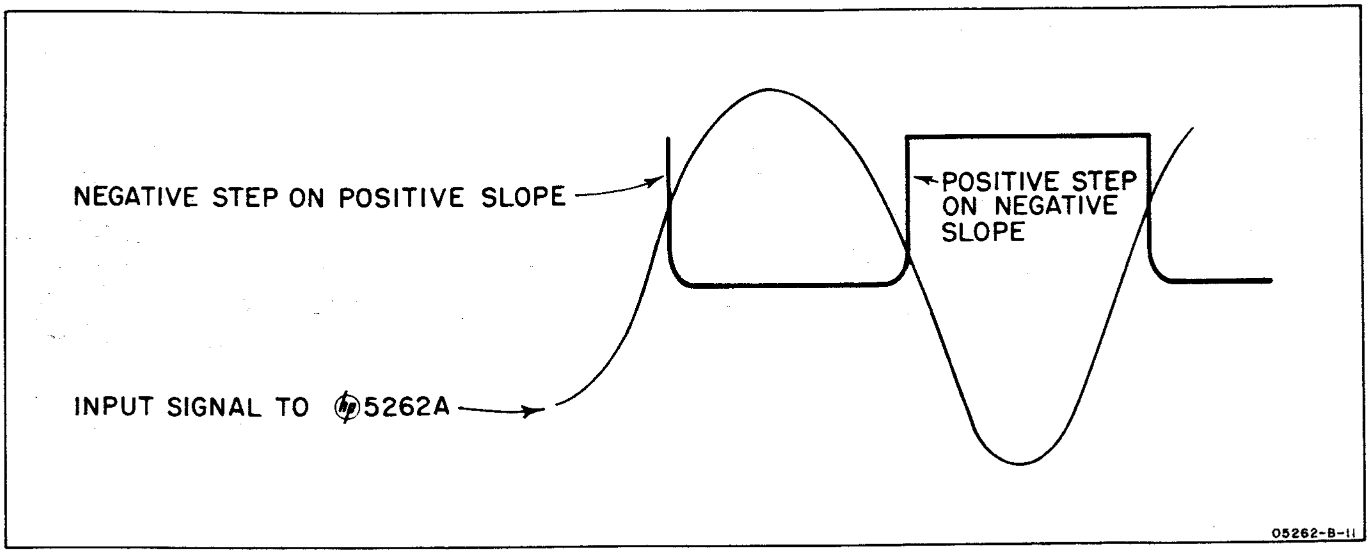


Figure 4-4. Voltage Step Coincident with Trigger Pulses

b. Connect START connector at the rear of the Model 5243L to one input channel of the oscilloscope.

c. Connect a signal from an oscillator of 300 millivolts to START connector of the Model 5262A and the other input channel of the oscilloscope.

d. Set VERTICAL PRESENTATION of the oscilloscope to **CHOPPED.**

e. Sweep the range of input frequencies from 1 kc to above 2 mc at a level of 300 millivolts.

f. Over this range, voltage steps (coincident with trigger pulses) similar to those shown in figure 4-4 will appear.

g. Repeat steps a through f for STOP channel of Model 5262A.

4-18. ATTENUATOR (MULTIPLIER) AND TRIGGER LEVEL CHECK.

a. Connect negative output square-wave generator (600 Ω output of Model 211A) to START input of the Model 5262A and to one of the channels of the oscilloscope so as to show the input signal level.

b. Set square wave generator to approximately 10 kc at about 300 millivolts peak.

c. Set start MULTIPLIER to 0.1 position.

d. Set start TRIGGER LEVEL to 0.

e. Rotate start TRIGGER LEVEL control slowly until gate light of Model 5243L goes on.

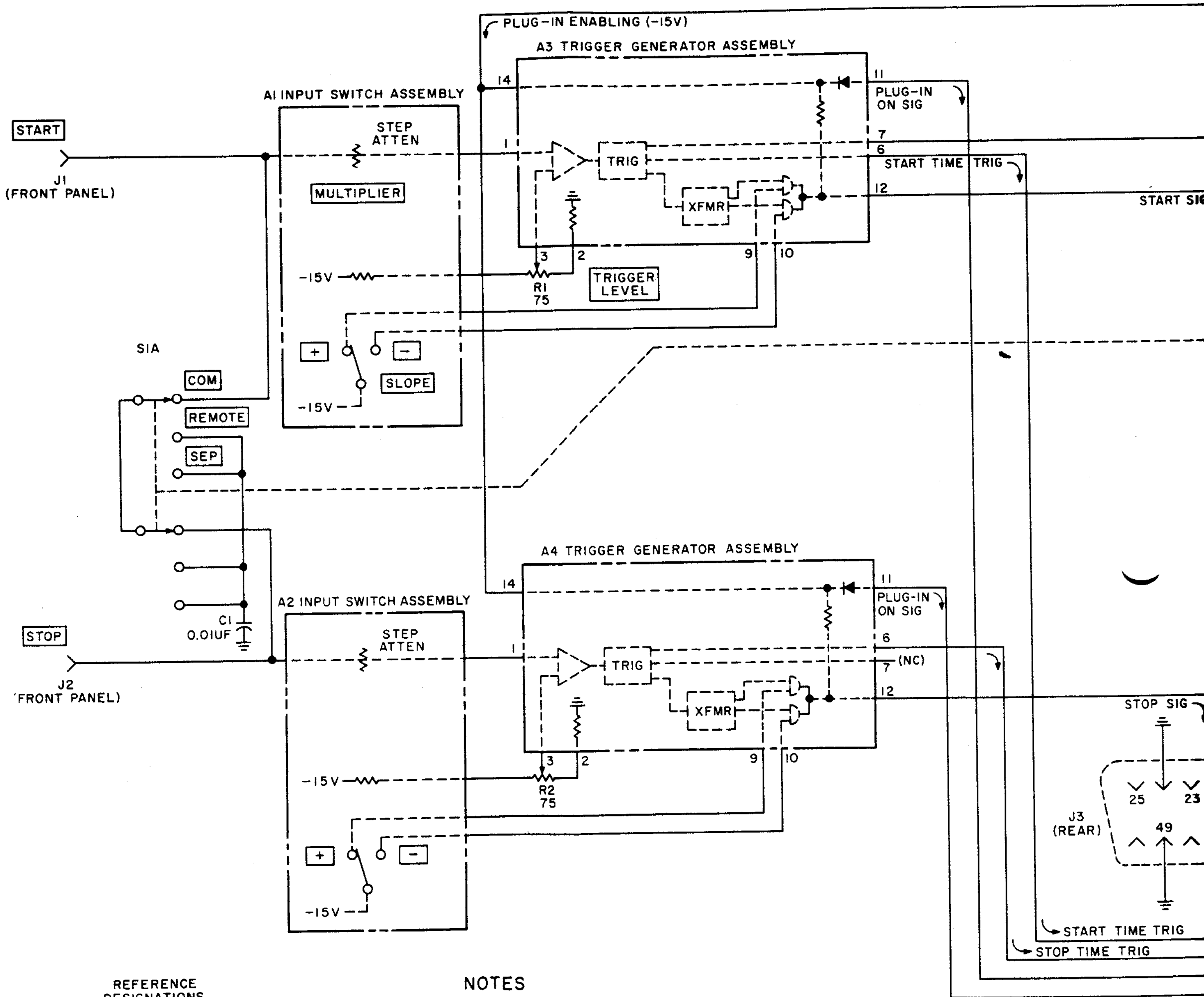
f. The TRIGGER LEVEL dial calibration should indicate −1.5 within plus or minus one division.

g. Change setting of MULTIPLIER control to .2 and repeat step e.

h. Increase signal level of square wave generator to 600 millivolts peak.

i. The TRIGGER LEVEL dial calibration should indicate −1.5 within plus or minus one division.

j. Repeat for all MULTIPLIER control settings. Increase output of square wave generator and increase MULTIPLIER steps, and note that the attenuation inserted by the MULTIPLIER switch agrees with the change in square-wave level.



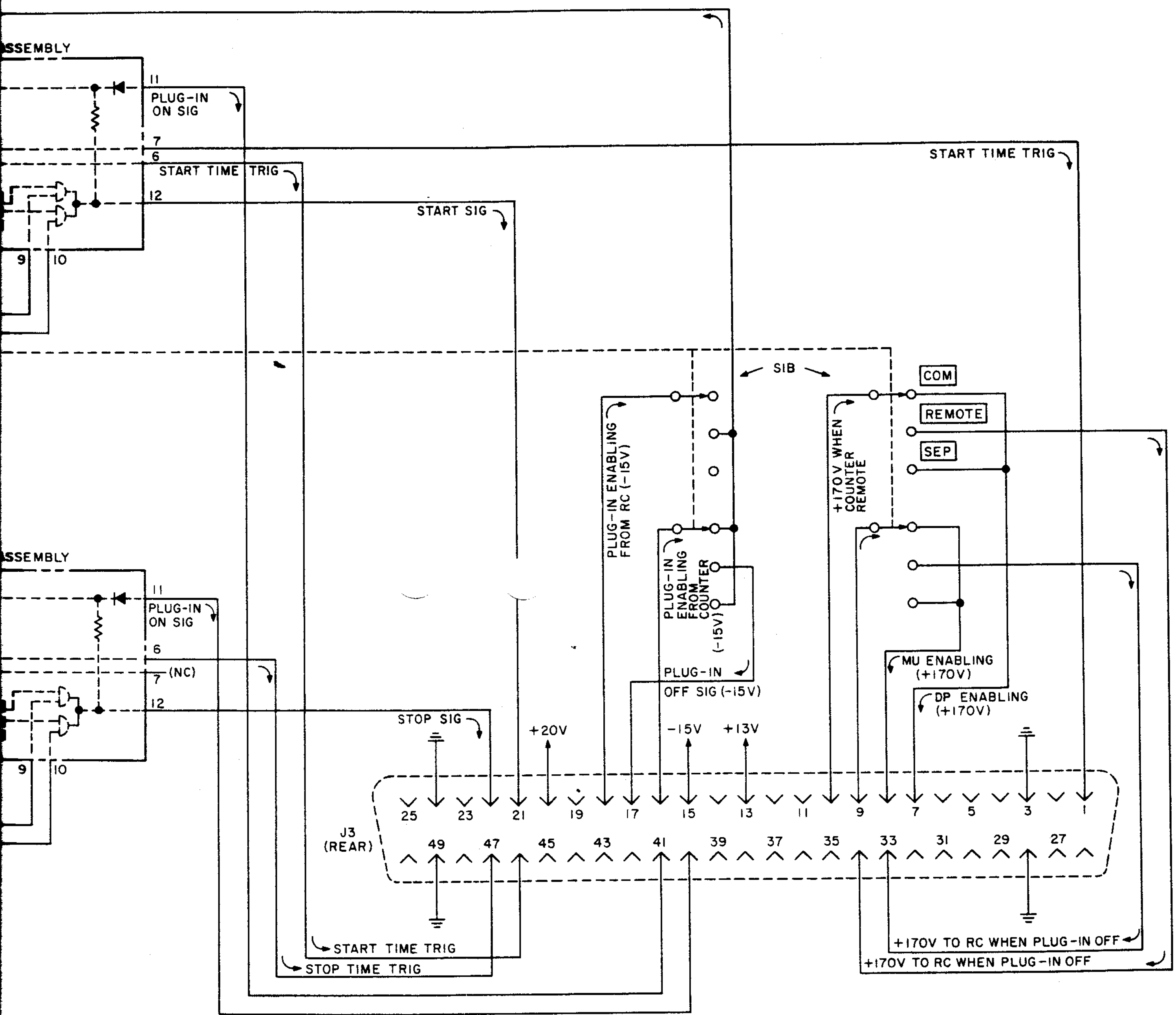
REFERENCE DESIGNATIONS

A1 - 4
C1
J1 - 3
R1 - 2
S1

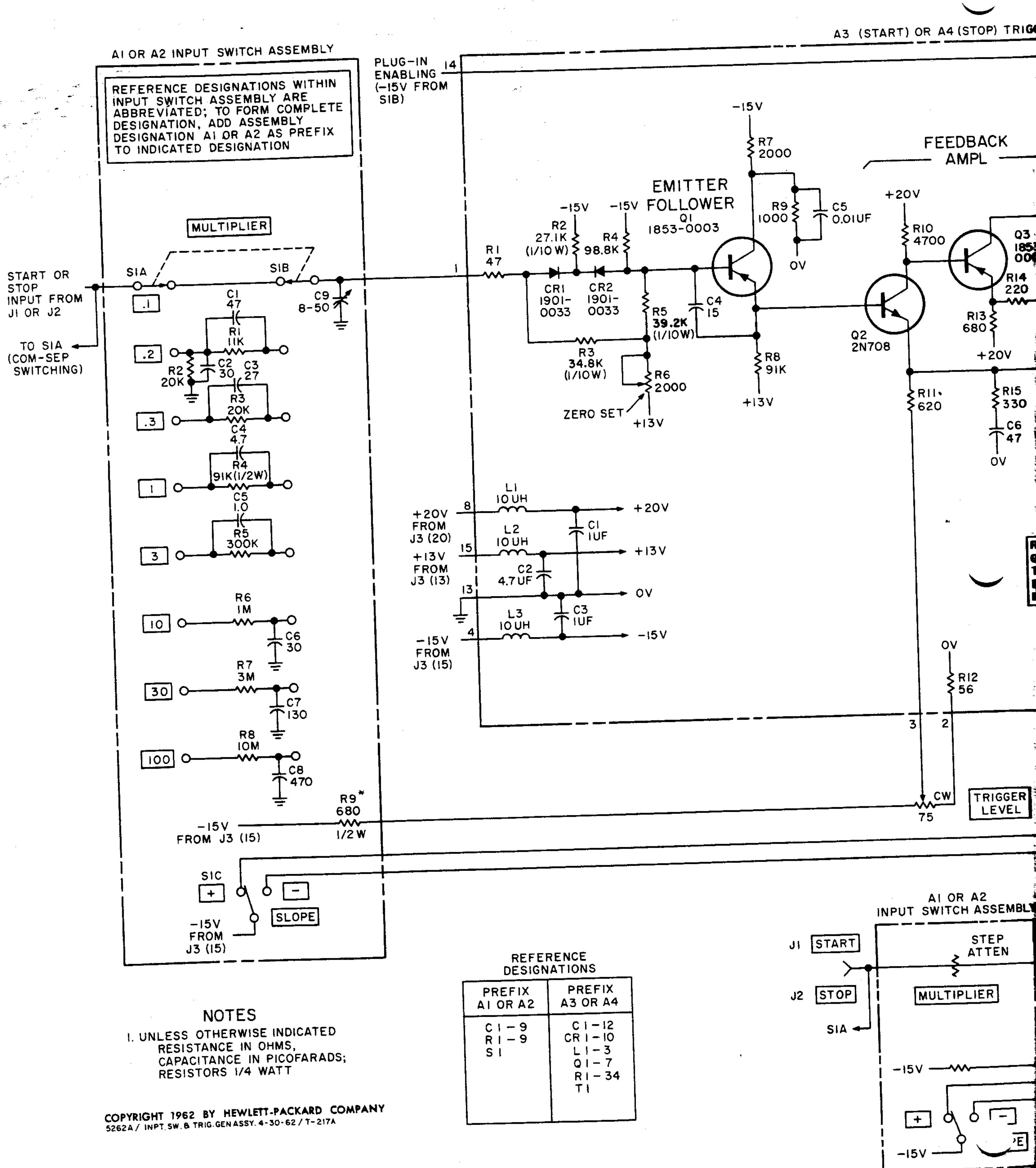
NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS
2. ABBREVIATIONS:
   DP = DECIMAL POINT
   MU = MEASUREMENT UNIT
   RC = REMOTE CONTROL

Figure 4-5. Overall Functional Diagram



SSEMBLY
11
PLUG-IN ON SIG
7
6
START TIME TRIG
12
START SIG
9
10
START TIME TRIG
SIB
COM
REMOTE
SEP
PLUG-IN ENABLING FROM RC (-15V)
PLUG-IN ENABLING FROM COUNTER (-15V)
+170V WHEN COUNTER REMOTE
SSEMBLY
11
PLUG-IN ON SIG
6
7 (NC)
12
9
10
PLUG-IN OFF SIG (-15V)
MU ENABLING (+170V)
DP ENABLING (+170V)
STOP SIG
+20V
-15V
+13V
J3 (REAR)
25 23 21 19 17 15 13 11 9 7 5 3 1
49 47 45 43 41 39 37 35 33 31 29 27
START TIME TRIG
STOP TIME TRIG
+170V TO RC WHEN PLUG-IN OFF
+170V TO RC WHEN PLUG-IN OFF



REFERENCE DESIGNATIONS

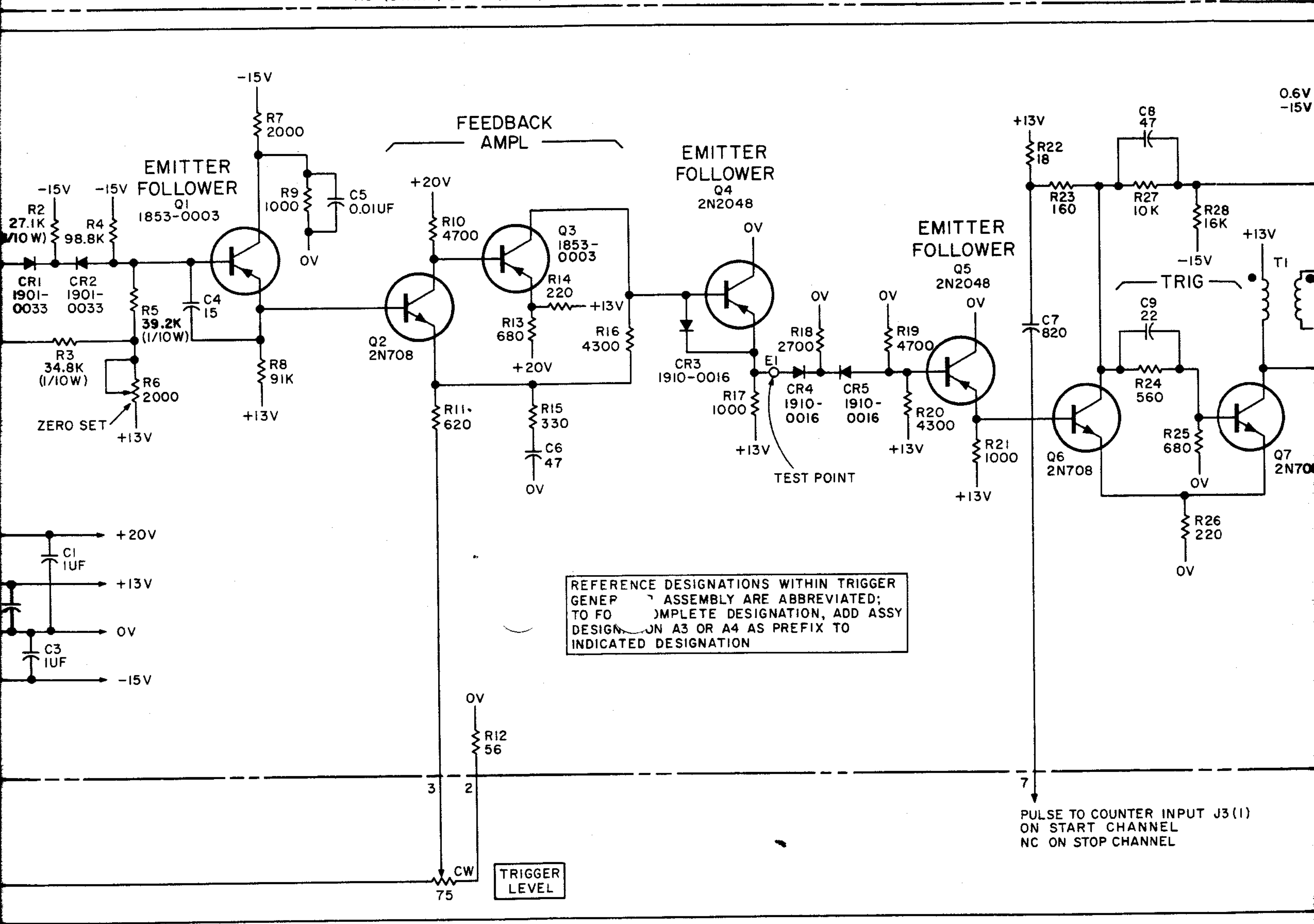
PREFIX A1 OR A2	PREFIX A3 OR A4
C 1 - 9 R 1 - 9 S 1	C 1 - 12 CR 1 - 10 L 1 - 3 Q 1 - 7 R 1 - 34 T 1

NOTES

1. UNLESS OTHERWISE INDICATED RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS; RESISTORS 1/4 WATT

5262A / INPT. SW. & TRIG. GEN ASSY. 4-30-62 / T-217A

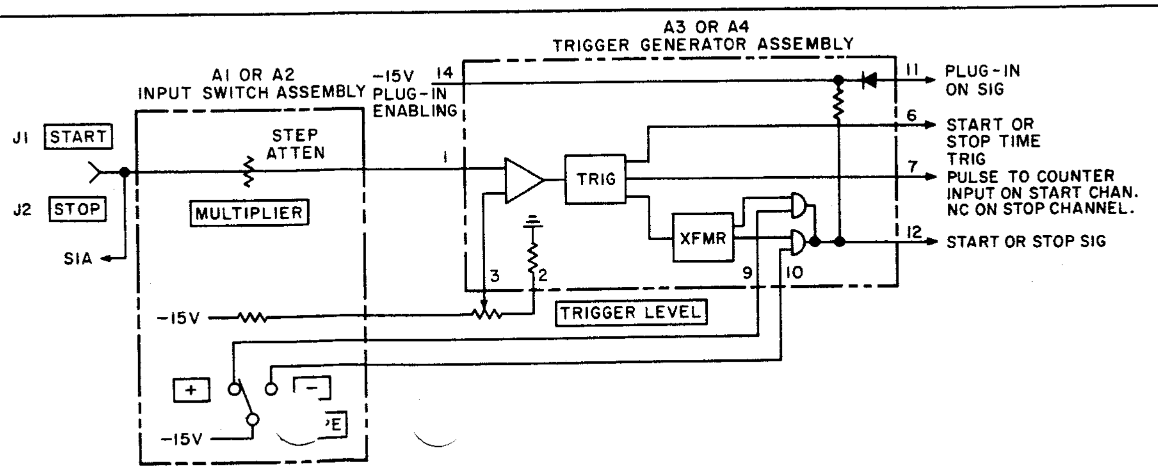
A3 (START) OR A4 (STOP) TRIGGER GENERATOR ASSEMBLY (5262A-65A)



REFERENCE DESIGNATIONS WITHIN TRIGGER GENER[illegible] ASSEMBLY ARE ABBREVIATED; TO FO[illegible]MPLETE DESIGNATION, ADD ASSY DESIGN[illegible]ON A3 OR A4 AS PREFIX TO INDICATED DESIGNATION

...RENCE
...ATIONS

PREFIX A3 OR A4
C1-12 CR1-10 L1-3 Q1-7 R1-34 T1



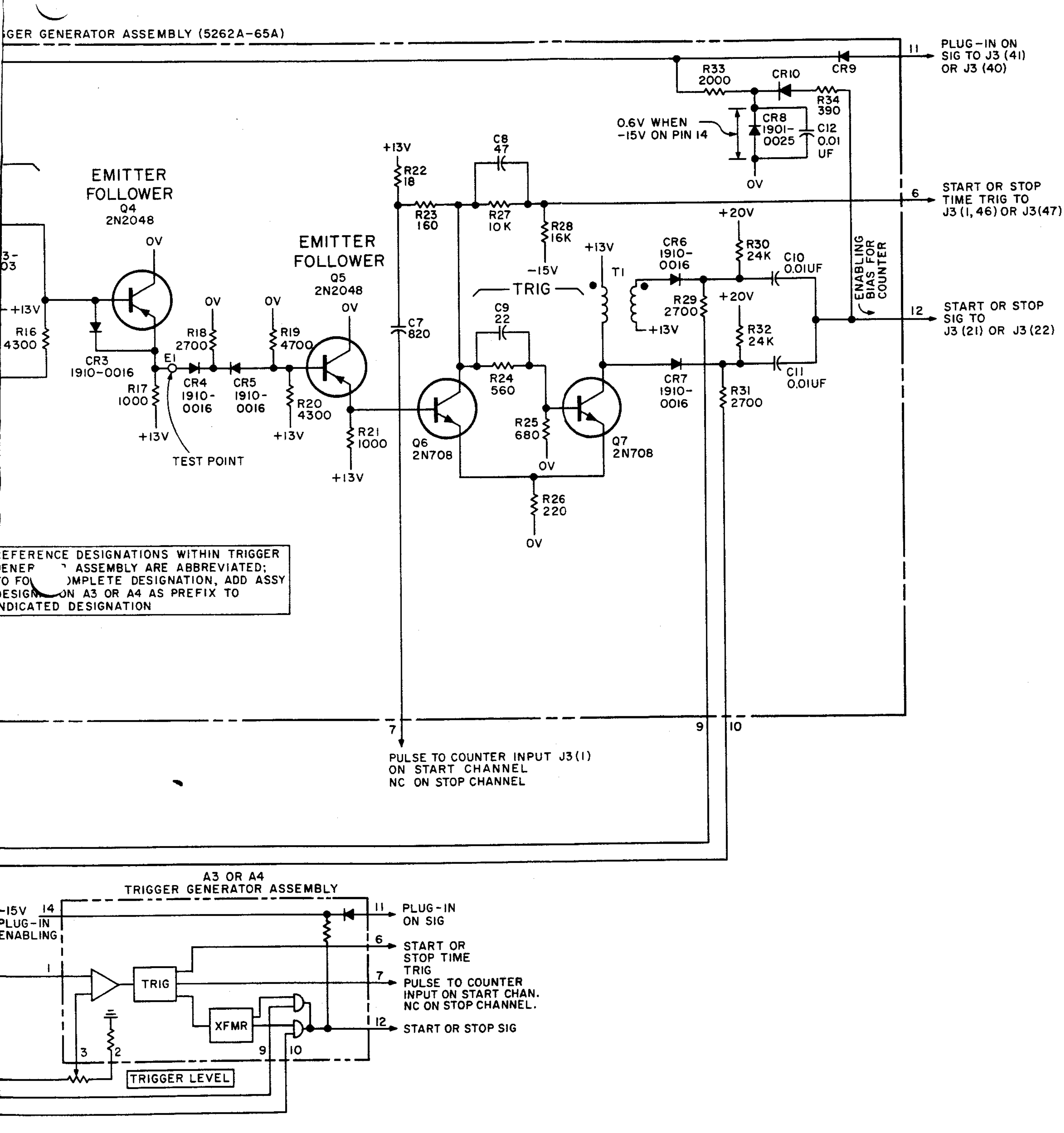


Figure 4-6. Switch and Trigger Generator

SECTION V
REPLACEABLE PARTS

5-1. INTRODUCTION.

5-2. This section contains information for ordering replacement parts. Tables 5-1 thru 5-3 list parts in alpha-numerical order of their reference designations and indicate the description and ⓗ stock number of each part, together with any applicable notes. Table 5-4 lists parts in alpha-numerical order of their ⓗ stock number and provides the following information on each part.

a. Description of the part (see list of abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 5-5.

c. Manufacturer's part number.

d. Total quantity used in the instrument (TQ column).

5-3. Miscellaneous parts are listed at the end of Table 5-1.

5-4. ORDERING INFORMATION.

5-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office (see list at rear of this manual for addresses). Identify parts by their Hewlett-Packard stock numbers.

5-6. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

REFERENCE DESIGNATORS

A = assembly
B = motor
C = capacitor
CP = coupling
CR = diode
DL = delay line
DS = device signaling (lamp)
E = misc electronic part
F = fuse
FL = filter
J = jack
K = relay
L = inductor
M = meter
MP = mechanical part
P = plug
Q = transistor
R = resistor
RT = thermistor
S = switch
T = transformer
TB = terminal board
TP = test point
V = vacuum tube, neon bulb, photocell, etc.
W = cable
X = socket
Y = crystal

ABBREVIATIONS

A = amperes
A.F.C = automatic frequency control
AMPL = amplifier

B.F.O. = beat frequency oscillator
BE CU = beryllium copper
BH = binder head
BP = bandpass
BRS = brass
BWO = backward wave oscillator

CCW = counter-clockwise
CER = ceramic
CMO = cabinet mount only
COEF = coefficient
COM = common
COMP = composition
CONN = connector
CP = cadmium plate
CRT = cathode-ray tube
CW = clockwise

DEPC = deposited carbon
DR = drive

ELECT = electrolytic
ENCAP = encapsulated
EXT = external

F = farads
FH = flat head
FIL H = fillister head
FXD = fixed

GE = germanium
GL = glass
GRD = ground(ed)

H = henries
HEX = hexagonal
HG = mercury
HR = hour(s)

IF = intermediate freq
IMPG = impregnated
INCD = incandescent
INCL = include(s)
INS = insulation(ed)
INT = internal

K = kilo = 1000

LIN = linear taper
LK WASH = lock washer
LOG = logarithmic taper
LPF = low pass filter

M = milli = 10^{-3}
MEG = meg = 10^6
METFLM = metal film
MFR = manufacturer
MINAT = miniature
MOM = momentary
MTG = mounting
MY = "mylar"

N = nano (10^{-9})

N/C = normally closed
NE = neon
NI PL = nickel plate
N/O = normally open
NPO = negative positive zero (zero temperature coefficient)
NRFR = not recommended for field replacement
NSR = not separately replaceable

OBD = order by description
OH = oval head
OX = oxide

P = peak
PC = printed circuit
PF = picofarads = 10^{-12} farads
PH BRZ = phosphor bronze
PHL = Phillips
PIV = peak inverse voltage
P/O = part of
POLY = polystyrene
PORC = porcelain
POS = position(s)
POT = potentiometer
PP = peak-to-peak
PT = point
RECT = rectifier
RF = radio frequency
RH = round head

RMO = rack mount only
RMS = root-mean-square

S-B = slow-blow
SCR = screw
SE = selenium
SECT = section(s)
SEMICON = semiconductor
SI = silicon
SIL = silver
SL = slide
SPL = special
SST = stainless steel
SR = split ring
STL = steel

TA = tantalum
TD = time delay
TGL = toggle
TI = titanium
TOL = tolerance
TRIM = trimmer
TWT = traveling wave tube

U = micro = 10^{-6}

VAR = variable
VDCW = dc working volts

W/ = with
W = watts
WW = wirewound
W/O = without

Table 5-1. Components Located on Chassis (No Prefix)

Circuit Reference	Stock No.	Description	Note
A1, A2	5262A-19A	Switch, attenuator	
A3, A4	5262A-65A	Assy, trigger generator	
C1	0150-0093	C: fxd, cer, 0.01 μf +80% -20%, 100 vdcw	
J1, J2	1250-0083	Connector: female, type UG-1094/U	
J3	1251-0099	Connector: male, 50 pin	
R1, R2	2100-0076	R: var, comp, 75 ohms ±10%	
S1	3100-0338	Switch, rot: 2 sect, 3 pos	
XA1, XA2		Not assigned	
XA3, XA4	1251-0135	Connector: 15 pin, (for pc)	
		MISCELLANEOUS	
	0370-0076	Knob: TRIGGER LEVEL	
	0370-0077	Knob: FUNCTION	
	0370-0102	Knob: TRIGGER SLOPE	
	0370-0110	Knob: MULTIPLIER	
	5262A-40A	Knob, skirt: TRIGGER LEVEL	
	5262A-40B	Knob, skirt: MULTIPLIER	
	05262-0001	Board Mounting Bracket	
	05262-2002	Panel - Front	

See introduction to this section

Table 5-2. Attenuator Switch Assy, 5262A-19A (designations prefixed A1 or A2)

Circuit Reference	ⓗ Stock No.	Description	Note
C1	0160-0182	C: fxd, mica, 47 pf ±5%, 500 vdcw	
C2	0160-0181	C: fxd, mica, 30 pf ±5%, 500 vdcw	
C3	0160-0178	C: fxd, mica, 27 pf ±5%, 300 vdcw	
C4	0150-0042	C: fxd, TiO_2, 4.7 pf ±5%, 500 vdcw	
C5	0150-0029	C: fxd, TiO_2, 1 pf ±10%, 500 vdcw	
C6	0140-0203	C: fxd, mica, 30 pf ±5%, 500 vdcw	
C7	0160-0183	C: fxd, mica, 130 pf ±5%, 300 vdcw	
C8	0140-0149	C: fxd, mica, 470 pf ±5%, 300 vdcw	
C9	0130-0008	C: var, cer, 8-50 pf	
R1	0683-1135	R: fxd, comp, 11K ohms ±5%, 1/4 W	
R2, R3	0683-2035	R: fxd, comp, 20K ohms ±5%, 1/4 W	
R4	0686-9135	R: fxd, 91K ohms ±5%, 1/2 W	
R5	0683-3045	R: fxd, comp, 300K ohms ±5%, 1/4 W	
R6	0683-1055	R: fxd, comp, 1M ±5%, 1/4 W	
R7	0683-3055	R: fxd, comp, 3M ±5%, 1/4 W	
R8	0683-1065	R: fxd, comp, 10M ±5%, 1/4 W	
R9	0686-6815	R: fxd, comp, 680 ohms ±5%, 1/2 W	a
		a. Optimum value selected at factory, average value shown.	

Table 5-3. Trigger Generator Assy, 5262A-65A (designations prefixed A3 or A4)

Circuit Reference	ⓗ Stock No.	Description	Note
C1	0160-0127	C: fxd, cer, 1 μf ±20%, 25 vdcw	
C2	0180-0100	C: fxd, tantalum elect, 4.7 μf ±10%, 35 vdcw	
C3	0160-0127	C: fxd, cer, 1 μf ±20%, 25 vdcw	
C4	0140-0202	C: fxd, mica, 15 pf ±5%, 500 vdcw	
C5	0150-0093	C: fxd, cer, 0.01 μf +80% -20%, 100 vdcw	
C6	0140-0204	C: fxd, mica, 47 pf ±5%, 500 vdcw	
C7	0140-0151	C: fxd, mica, 820 pf ±2%, 300 vdcw	
C8	0140-0204	C: fxd, mica, 47 pf ±5%, 500 vdcw	
C9	0140-0145	C: fxd, cer, 22 μf ±5%, 500 vdcw	
C10 thru C12	0150-0093	C: fxd, cer, 0.01 μf +80% -20%, 100 vdcw	

See introduction to this section

Table 5-3. Trigger Generator Assy, 5262A-65A (designations prefixed A3 or A4) (Cont'd)

Circuit Reference	ⓗⓟ Stock No.	Description	Note
R26	0683-2215	R: fxd, comp, 220 ohms ±5%, 1/4 W	
R27	0683-1035	R: fxd, comp, 10K ohms ±5%, 1/4 W	
R28	0683-1635	R: fxd, comp, 16K ohms ±5%, 1/4 W	
R29	0683-2725	R: fxd, comp, 2.7K ohms ±5%, 1/4 W	
R30	0683-2435	R: fxd, comp, 24K ohms ±5%, 1/4 W	
R31	0683-2725	R: fxd, comp, 2.7K ohms ±5%, 1/4 W	
R32	0683-2435	R: fxd, comp, 24K ohms ±5%, 1/4 W	
R33	0683-2025	R: fxd, comp, 2K ohms ±5%, 1/4 W	
R34	0683-3915	R: fxd, comp, 390 ohms ±5%, 1/4 W	
T1	9130-0018	Transformer, pulse: 10 μh	

See introduction to this section

Table 5-4. Replaceable Parts

ⓗⓟ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ			
0370-0076	Knob: TRIGGER LEVEL	28480	0370-0076	2			
0370-0077	Knob: FUNCTION	28480	0370-0077	1			
0370-0102	Knob: TRIGGER SLOPE	28480	0370-0102	2			
0370-0110	Knob: MULTIPLIER	28480	0370-0110	2			
05262-0001	Board Mounting Bracket	28480	05262-0001	2			
05262-2002	Panel, Front	28480	05262-2002	1			
5262A-19A	Switch, attenuator	28480	5262A-19A	2			
5262A-40A	Knob, skirt: TRIGGER LEVEL	28480	5262A-40A	2			
5262A-40B	Knob, skirt: MULTIPLIER	28480	5262A-40B	2			
5262A-65A	Assy, trigger generator	28480	5262A-65A	2			
0130-0008	C: var, cer, 8-50 pf	72982	557-023U2P034R	2			
0140-0145	C: fxd, mica, 22 pf ±5%, 500 vdcw	72136	DM15C220J	2			
0140-0149	C: fxd, mica, 470 pf ±5%, 300 vdcw	72136	DM15F471J	2			
0140-0151	C: fxd, mica, 820 pf ±2%, 300 vdcw	72136	DM15F821G	2			
0140-0202	C: fxd, mica, 15 pf ±5%, 500 vdcw	72136	DM15C150J500V	2			
0140-0204	C: fxd, mica, 47 pf ±5%, 500 vdcw	72136	DM15E470J	6			
0150-0029	C: fxd, TiO_2, 1 pf ±10%, 500 vdcw	82142	Type JM, obd#	2			
0150-0042	C: fxd, TiO_2, 4.7 pf ±5%, 500 vdcw	82142	Type JM, obd#	2			
0150-0093	C: fxd, cer, 0.01 μf+80%-20%, 100 vdcw	91418	TA, obd#	9			
0160-0127	C: fxd, cer, 1 μf ±20%, 25 vdcw	56289	5C13	4			
0160-0178	C: fxd, mica, 27 pf ±5%, 300 vdcw	72136	DM15E270J300V	2			
0160-0181	C: fxd, mica, 30 pf ±5%, 300 vdcw	72136	DM15E300J300V	4			
0160-0182	C: fxd, mica, 47 pf ±5%, 300 vdcw	72136	DM15E470J300V	2			
0160-0183	C: fxd, mica, 130 pf ±5%, 300 vdcw	72136	DM15E131J300V	2			
0180-0100	C: fxd, ta elect, 4.7 μf ±10%, 35 vdcw	56289	150D475X9035B2	2			
0683-1025	R: fxd, comp, 1K ohms ±5%, 1/4W	01121	CB1025	6			
0683-1035	R: fxd, comp, 10K ohms ±5%, 1/4W	01121	CB1035	2			
0683-1055	R: fxd, comp, 1M ohm ±5%, 1/4W	01121	CB1055	2			
0683-1065	R: fxd, comp, 10M ohms ±5%, 1/4W	01121	CB1065	2			
0683-1135	R: fxd, comp, 11K ohms ±5%, 1/4W	01121	CB1135	2			
0683-1615	R: fxd, comp, 160 ohms ±5%, 1/4W	01121	CB1615	2			
0683-1635	R: fxd, comp, 16K ohms ±5%, 1/4W	01121	CB1635	2			
0683-1805	R: fxd, comp, 18 ohms ±5%, 1/4W	01121	CB1805	2			
0683-2025	R: fxd, comp, 2K ohms ±5%, 1/4W	01121	CB2025	4			
0683-2035	R: fxd, comp, 20K ohms ±5%, 1/4W	01121	CB2035	4			

#See introduction to this section

Table 5-4. Replaceable Parts (Cont'd)

ⓗⓟ Stock No.	Description #	Mfr.	Mfr. Part No.	TQ			
0683-2215	R: fxd, comp, 220 ohms ±5%, 1/4 W	01121	CB2215	4			
0683-2435	R: fxd, comp, 24K ohms ±5%, 1/4 W	01121	CB2435	4			
0683-2725	R: fxd, comp, 2.7K ohms ±5%, 1/4 W	01121	CB2725	6			
0683-3045	R: fxd, comp, 300K ohms ±5%, 1/4 W	01121	CB3045	2			
0683-3055	R: fxd, comp, 3M ±5%, 1/4 W	01121	CB3055	2			
0683-3315	R: fxd, comp, 330 ohms ±5%, 1/4 W	01121	CB3315	2			
0683-3915	R: fxd, comp, 390 ohms ±5%, 1/4 W	01121	CB3915	2			
0683-4325	R: fxd, comp, 4.3K ohms ±5%, 1/4 W	01121	CB4325	4			
0683-4705	R: fxd, comp, 47 ohms ±5%, 1/4 W	01121	CB4705	2			
0683-4725	R: fxd, comp, 4.7K ohms ±5%, 1/4 W	01121	CB4725	4			
0683-5605	R: fxd, comp, 56 ohms ±5%, 1/4 W	01121	CB5605	2			
0683-5615	R: fxd, comp, 560 ohms ±5%, 1/4 W	01121	CB5615	2			
0683-6215	R: fxd, comp, 620 ohms ±5%, 1/4 W	01121	CB6215	2			
0683-6815	R: fxd, comp, 680 ohms ±5%, 1/4 W	01121	CB6815	4			
0683-9135	R: fxd, comp, 91K ohms ±5%, 1/4 W	01121	CB9135	2			
0686-6815	R: fxd, comp, 680 ohms ±5%, 1/2 W	01121	EB6815	2			
0686-9135	R: fxd, comp, 91K ohms ±5%, 1/2 W	01121	EB9135	2			
0757-0122	R: fxd, mfgl, 27.1K ohms ±1%, 1/10 W	75042	obd#	2			
0757-0123	R: fxd, mfgl, 34.8K ohms ±1%, 1/10 W	75042	obd#	2			
0757-0124	R: fxd, mfgl, 39.2K ohms ±1%, 1/10 W	75042	obd#	2			
0757-0125	R: fxd, mfgl, 98.8K ohms ±1%, 1/10 W	75042	obd#	2			
1250-0083	Connector: female, type UG-1094/U	91737	UG-1094/U	2			
1251-0099	Connector: male, 50 pin	02660	57-10500	1			
1251-0135	Connector: 15 pin, (for pc)	95354	SD-615UR, Special	2			
1850-0091	Transistor: 2N2048	87216	2N2048	4			
1853-0003	Transistor: Si, PNP	73293	HA9079	4			
1854-0005	Transistor: 2N708	07263	2N708	6			
1901-0025	Diode, Si	07933	RD1526	2			
1901-0033	Diode, Si: 1N459A	07910	19459A	4			
1910-0016	Diode, Ge	98925	CGD1003	13			
2100-0076	R: var, comp, 75 ohms ±10%	01121	JA1N056S750UA	2			
2100-0355	R: var, comp, 2K ohms ±20%	80294	Type 220, obd#	2			

#See introduction to this section

Table 5-4. Replaceable Parts (Cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ			
3100-0338	Switch, rot: 2 sect, 3 pos	71590	obd#	1			
9130-0018	Transformer, pulse: 10 μh	01961	PE4502	2			
9140-0146	Inductor: fxd, 10 μh	99800	1025-44	6			

#See introduction to this section

APPENDIX

This manual applies directly to the 5262A Time Interval Units having serial number prefix 516. This manual with the following changes also applies to 5262A Time Interval Units having serial prefix numbers 450, 229, and 217.

To adapt this manual to instruments with serial number prefixes other than 516 make the following changes:

Instrument Serial Prefix	Change No.
450	1
229, 217	1, 2

CHANGE 1: Tables 5-1, 5-4,
Change: 05262-0001 to 5262A-1A
05262-2002 to 5262A-2A

CHANGE 2: Figure 4-6, Tables 5-3, 5-4,
Delete A3CR10 ⓗⓟ Part No. 1910-0016.