

INSTRUCTION MANUAL

Serial Number _____

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TV SYNC SEPARATOR

Tektronix, Inc.

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070-0542-00

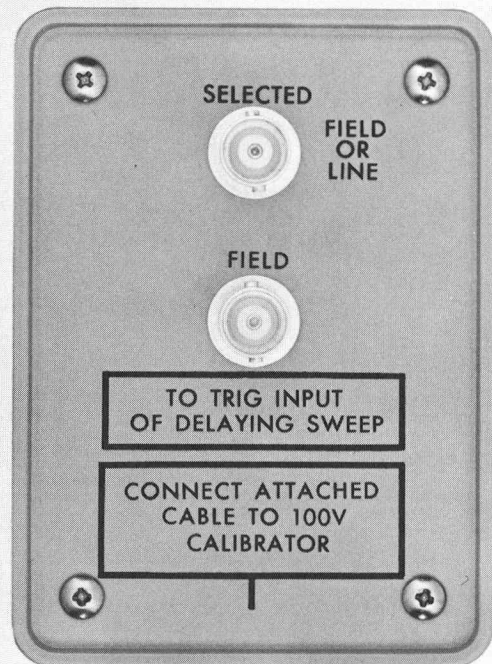
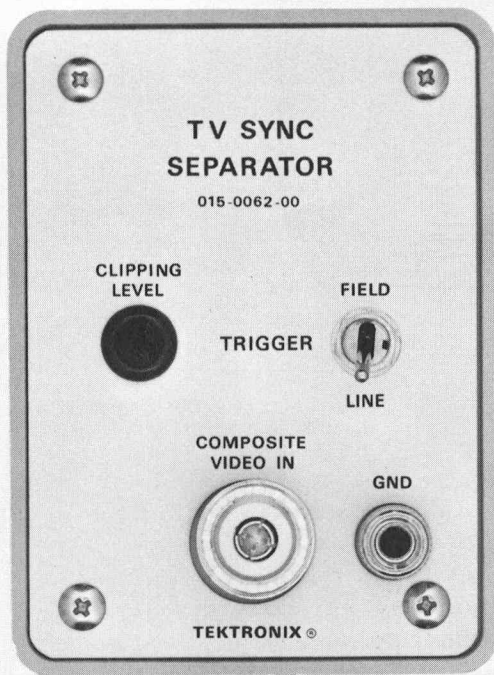


Fig. 1-1. TV Sync Separator.

SECTION 1

CHARACTERISTICS

General Information

The TV Sync Separator has been designed to permit Tektronix real time oscilloscopes to display composite video

TABLE 1-1

Connector	Output or Input Signal
100 V CAL IN	Needs +100 V DC or 100 volt square-wave Amplitude Calibrator signal.
COMPOSITE VIDEO IN	Needs 0.5 to 8.5 ¹ volt peak-to-peak sync negative composite video signal.
FIELD RATE	A group of one to six pulses, whose minimum amplitude is 6 volts negative, shall reoccur at a field rate. The width of each individual group of pulses shall not exceed 3H.
SELECTED RATE FIELD OR LINE	The field pulses available at this connector will be the same as described for the FIELD RATE connector. The line trigger pulses available at this connector shall have a clean leading edge and a minimum amplitude of 4.5 volts negative.

¹The 8.5 volts of peak-to-peak sync negative composite video signal is arrived at by considering the maximum signal amplitude which is available at the vertical signal output of the Tektronix oscilloscope having the largest volts/division of deflection output and the largest graticule area, see Table 1-2.

signals. The TV Sync Separator clips video information from the incoming video signal, then it amplifies and separates the field or vertical trigger pulses from the line or horizontal trigger pulses and makes them available separately at the rear panel. One rear panel connector provides either line rate or field rate trigger pulses depending on the position of a front panel switch, while a second connector on the rear panel provides only field rate trigger pulses.

Compatibility

The TV Sync Separator can be used with any real time Tektronix Oscilloscope.

Standard Accessories

Standard accessories supplied with this instrument will be found in the Mechanical Parts List section of this manual. For optional accessories, see the Tektronix, Inc. catalog.

TABLE 1-2

Oscilloscope Type	Approximate Volts/Division of Deflection	Maximum Vertical Graticule Area
531A, 535A	1.5	6 cm
541A, 545A	1.5	4 cm
543B, 545B	1.2	6 cm
544, 546, 547	0.4	6 cm

TV SYNC SEPARATOR

TEXT CORRECTION

Page 1-1, Table 1-1:

100 V CAL IN ... Output or Input Signal should read:

Needs +100 V DC or 100 volt square-wave Amplitude Calibrator signal with the frequency near 1 kHz.

C1/666

SECTION 2

OPERATING INSTRUCTIONS

Introduction

This section describes connecting the TV Sync Separator, adjusting the CLIPPING LEVEL control R26 and obtaining a display.

Connecting the TV Sync Separator

Connect the coaxial cable (100 V CAL IN connector) to the Amplitude Calibrator Cal Out connector on the oscilloscope being used. Set the Amplitude Calibrator control to either 100 volts or 100 VDC.

Oscilloscope with Horizontal Magnifier & Vert Sig Out Connector (e.g., Type 543B or 544)

a. Connect a coaxial cable from the SELECTED RATE FIELD OR LINE connector to the oscilloscope Trigger Input connector.

b. Connect another coaxial cable from the oscilloscope vertical signal input connector to a composite video signal source of such amplitude as to produce at least 2 major divisions of vertical deflection.

c. Connect a patch cord from the COMPOSITE VIDEO IN connector to the oscilloscope Vert Sig Out connector.

d. Set the oscilloscope Triggering Source switch to Ext and the Triggering Slope switch to —.

e. Refer to the information under Obtaining A Display in this section, to obtain a display.

Oscilloscope with Horizontal Magnifier but no Vert Sig Out

a. Connect a coaxial cable from the SELECTED RATE FIELD OR LINE connector to the oscilloscope Trigger Input connector.

b. Connect a T connector to the COMPOSITE VIDEO IN connector.

c. Connect a coaxial cable from the oscilloscope vertical signal input connector to one end of the T connector.

d. Connect another coaxial cable from the remaining end of the T connector to a 0.5 to 8.5 peak to peak composite video signal source.

e. Set the oscilloscope Triggering Source switch to Ext and the Triggering Slope switch to —.

f. Refer to the information under Obtaining A Display in this section, to obtain a display.

Oscilloscope with Delaying Sweep & Vert Sig Out (e.g., Type 545B or 547)

a. Connect a coaxial cable from the FIELD RATE connector to the oscilloscope Main Time Base B Trigger Input connector.

b. Connect another coaxial cable from the SELECTED RATE FIELD OR LINE connector to the oscilloscope Time Base A Trigger Input connector and set the TV Sync Separator TRIGGER switch to FIELD.

c. Connect another coaxial cable from the oscilloscope vertical signal input connector to a composite video signal source of such amplitude as to produce at least 2 major divisions of vertical deflection.

d. Connect a patch cord from the COMPOSITE VIDEO IN connector to the oscilloscope Vert Sig Out connector.

e. Set the oscilloscope Triggering Source switches to Ext and the Triggering Slope switches (both time bases to —).

f. Refer to the information under Obtaining A Display in this section, to obtain a display.

Oscilloscope with Delaying Sweep but no Vert Sig Out

a. Connect a coaxial cable from the FIELD RATE connector to the oscilloscope Main Time Base B Trigger Input connector.

b. Connect another coaxial cable from the SELECTED RATE FIELD OR LINE connector to the oscilloscope Time Base A Trigger Input connector and set the TV Sync Separator TRIGGER switch to FIELD.

c. Connect a T connector to the COMPOSITE VIDEO IN connector.

d. Connect a coaxial cable from the oscilloscope vertical signal input connector to one end of the T connector.

e. Connect another coaxial cable from the remaining end of the T connector to a 0.5 to 8.5 peak to peak composite video signal source.

f. Set the oscilloscope Triggering Source switches (both time bases) to Ext and the Triggering Slope switches (both time bases) to —.

g. Refer to the information under Obtaining A Display in this section, to obtain a display.

Adjusting the CLIPPING LEVEL Control (R26)

NOTE

If the input amplitude level of the composite video changes, it may be necessary to readjust the CLIPPING LEVEL control (R26).

a. Connect the TV Sync Separator as described under the heading Connecting the TV Sync Separator.

b. Turn the CLIPPING LEVEL control (R26) fully clockwise.

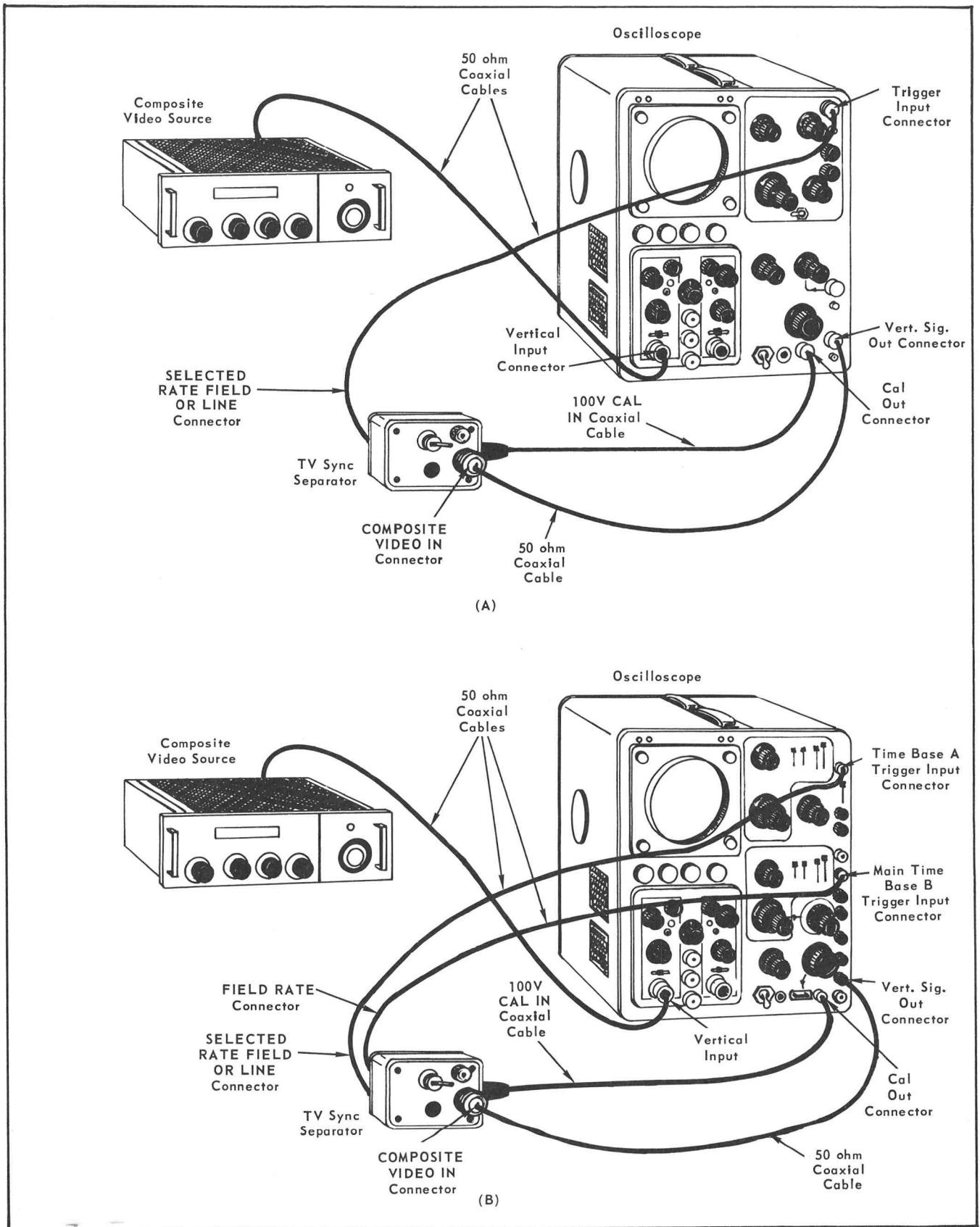


Fig. 2-1. TV Sync Separator connections for use with: (A) A Type 543B or 544 Oscilloscope, (B) A Type 545A or 547 Oscilloscope. Note that both oscilloscopes shown have Vert Sig Out connectors.

Operating Instructions—TV Sync Separator

c. Set the oscilloscope controls to obtain the desired video display.

d. Slowly rotate the CLIPPING LEVEL control (R26) counter-clockwise until a point is found where the most stable video display results.

Obtaining A Display

Connect the TV Sync Separator to the oscilloscope as described under Connecting the TV Sync Separator and shown in Fig. 2-1. Part (a) of the following procedure uses an oscilloscope having a magnifier, such as a Tektronix Type 543B or 544. Part (b) of the procedure uses an oscilloscope having delayed sweep, such as a Tektronix Type 545B or 547.

Part (a) Set the oscilloscope controls as follows:

Vertical Position	Centered
Variable Volts/Cm	Calibrated
Volts/Cm	.5
Input Selector	AC
Horizontal Display	Normal ($\times 1$)
Single Sweep Switch	Normal
Triggering Level	Fully clockwise and pushed in
Triggering Source	Ext
Triggering Coupling	AC
Triggering Slope	—
Triggering Mode	TRIG
Time/Cm	2 ms^{-1}
Variable (Time/Cm)	Calibrated
Horizontal Position	Trace positioned to the far left graticule line
Amplitude Calibrator	100 volts

If it is desired to view the vertical sync pulses, equalizing pulses or vertical interval test signals, set the TRIGGER switch to FIELD. To view the horizontal sync pulses set the TRIGGER switch to LINE.

Adjust the oscilloscope triggering controls to obtain a stable display, then set the Horizontal Display switch to desired magnification. Use the horizontal position controls to position the desired part of the display onto the viewing area.

If the field being viewed is not the desired one, interrupt the trigger momentarily and see if the correct field is displayed; if not, continue to interrupt the trigger momentarily until the correct field is displayed.

¹Must be set so more than one field and not more than two fields are displayed, if discrimination between fields is needed.

Part (b) Set the oscilloscope controls as follows:

Vertical Position	Centered
Variable Volts/Cm	Calibrated
Volts/Cm	.5
Input Selector	AC
Horizontal Display	B
Sweep Magnifier	$\times 1$ off
Triggering Level (Both Time Bases)	Fully clockwise and pushed in
Triggering Source (Both Time Bases)	Ext
Triggering Coupling (Both Time Bases)	AC
Triggering Slope (Both Time Bases)	—
Triggering Mode (Time Base B)	TRIG
Triggering Mode (Time Base A)	²
Time/Cm or Delay Time (Time Base B)	2 ms^{-1}
Time/Cm (Time Base A)	$20 \mu\text{s}$
Variable Time/Cm (Time Base A)	Calibrated
Horizontal Position	Trace positioned to the far left graticule line
Amplitude Calibrator	100 volts

Adjust the oscilloscope Main Time Base B triggering controls to obtain a stable display, then set the Horizontal Display switch to B Intens By A and position the brightened portion of the display with the Delay-Time Multiplier 1-10 control to the area to be magnified.

Set the Horizontal Display switch to A Dly'd and observe the $100\times$ magnified display. By resetting the Time Base A Time/Cm switch, different magnifications of the display can be obtained. Horizontal positioning of the display can be accomplished either with the Delay-Time Multiplier 1-10 control or the Horizontal Position controls.

If the field being viewed is not the desired one, interrupt the trigger momentarily and see if the correct field is displayed; if not, continue to interrupt the trigger momentarily until the correct field is displayed.

²For a nontriggered delaying sweep, set the Time Base A Triggering Mode switch to Trig. Make sure the Time Base A Triggering Level control is rotated fully clockwise. For a triggered delaying sweep, set the Time Base A Triggering Mode switch to Trig and adjust the Time Base A Triggering Level control to obtain a triggered condition.

SECTION 3

CIRCUIT DESCRIPTION

A +100 V DC or 100 volt square-wave Amplitude Calibrator signal is supplied to P1 (100 V CAL IN) connector. From P1 the amplitude calibrator signal passes through rectifier diode D5 and filter network C6, C8 and R5. The resulting DC voltage is used to supply all the operating power for the TV Sync Separator.

A composite video signal from 0.5 volts peak to peak to 8.5 volts peak to peak must be supplied to J10 (COMPOSITE VIDEO IN) connector to get the required triggers from this instrument. From J10, the composite video signal passes through a clipping circuit composed of emitter follower Q13, clipping amplifier Q24 and associated circuitry. The clipping circuit whose clipping level is set by R26 (CLIPPING LEVEL), clips only the video from the composite video signal.

From the clipping circuit the remaining pulses of the composite video signal are amplified by Q34. The negative (line or horizontal sync) pulses present at the collector of Q34 pass through D34 and C66 to SW67. When SW67 (TRIGGER) switch is set to LINE the negative (line or horizontal sync) pulses are available at J69 (SELECTED RATE FIELD OR LINE) connector.

The positive (field or vertical sync) pulses present at the collector of Q34 cannot pass through D34; however they and the negative (line or horizontal sync) pulses will pass through D31 to the base of Q54. The negative (line or

horizontal sync) pulses will pass through D31, since during the greater percentage of their duty cycle the line or horizontal sync pulses are positive and will appear to D31 as positive pulses.

The line or horizontal sync pulses are kept from getting through Q54 by the RC network of C56-R56. During the line or horizontal sync pulse time, Q54 is kept cut off by the bias provided by C56. The charge across C56 is kept high by the high repetition rate of the line or horizontal sync pulses.

During the field or vertical sync pulse time C56 biases Q54 to cutoff only part of the time, due to the relatively low repetition rate of the field or vertical sync pulses. The time that Q54 is allowed to conduct is such that every other field or vertical sync pulse will be amplified by Q54. The negative field or vertical trigger pulses present at the collector of Q54 are supplied through emitter follower Q64 and C65 to J68 (FIELD RATE) connector and to SW67. The field or vertical trigger pulse group are available constantly at J68 (FIELD RATE) connector, but are available at J69 (SELECTED RATE FIELD OR LINE) connector only when SW67 (TRIGGER switch) is set to FIELD.

C60, located in the collector circuit of Q54 and the base circuit of Q63, serves to filter out any line or horizontal sync pulses which may still be present. D65 sets the bias on Q63.

SECTION 4

MAINTENANCE

Visual Inspection

If trouble occurs in the TV Sync Separator, make sure the associated equipment is operating and the controls are properly set. If it is determined that the trouble is definitely in the TV Sync Separator, 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 the 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.

Circuit Board

Removal and Reassembly

- Remove the four screws holding the front casting to the remainder of the instrument.
- Gently separate the front casting from the remainder of the instrument just far enough to permit the wires connecting the front casting to the circuit board to be removed from the square plug-on pins.
- Disconnect all wires from the circuit board.
- Completely remove the front casting from the remainder of the instrument.
- Remove the wrap-around cover from the back casting and circuit board.
- Remove the four screws holding the back casting to the circuit board.
- To reassemble the TV Sync Separator, reverse the above procedure. Fig. 4-1 shows the wire connections to the circuit board.

Parts Removal and Replacement

Most parts in the TV Sync Separator 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.)

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 available, a defective transistor can be found by measuring the transistor forward-to-back resistance using proper ohmmeter resistances, or by using the substitution method. A component location guide is given in 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 source voltage may permanently damage the transistor.

NOTE

As a general rule, use the $R \times 1k$ range where the current is usually limited to less than 2 mA and internal voltage is usually $1\frac{1}{2}$ 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, 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 $R \times 1k$ Range
Emitter-Collector	High reading 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).

¹Test 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.

Soldering Precautions and Procedures. Premium workmanship and materials are used in the construction of the circuit board. Each component hole is "through-plated" to the opposite side of the board, giving it strength and resoldering durability. With care, components can be

removed and replaced on the circuit board numerous times without lifting the circuit from the glass laminate.

Use solder containing 3% silver (Tektronix Part No. 251-0514-00) and 35- to 40-watt soldering iron with a small wedge-shaped tip for soldering and unsoldering components. Let the iron reach operating temperature. Use needle nose pliers to grip the component lead next to its body before applying heat. Apply heat and lift the lead out of its mounting hole.

When installing a new component, bend the leads to match the length and position of the leads of the removed part. Heat the solder in the mounting hole to a liquid state and shake out the excess. Tin the prepared leads of the new part, then install the leads in the mounting holes. When soldering, do not apply excessive heat nor leave the soldering iron on the circuit board an undue length of time. Use sufficient heat, however, along with a small amount of new solder, to establish a full flow, clean joint.

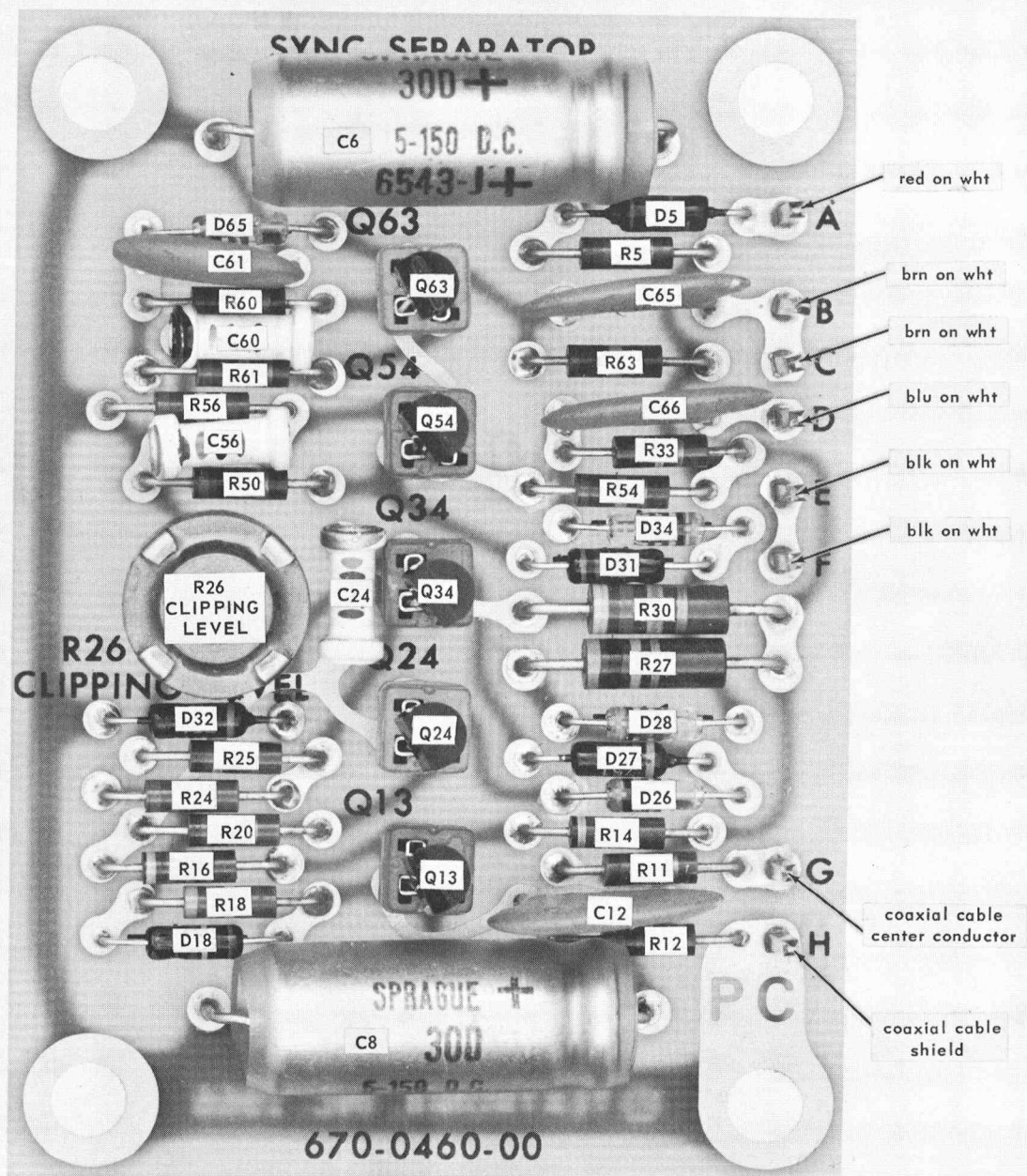


Fig. 4-1. Component locations on circuit board.

SECTION 5

PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Description	S/N Range
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Capacitors

Tolerance $\pm 20\%$ unless otherwise indicated.

C6	290-0149-00	5 μ F	EMT	150 V	
C8	290-0149-00	5 μ F	EMT	150 V	
C12	283-0092-00	0.03 μ F	Cer	200 V	+80%—20%
C24	281-0550-00	120 pF	Cer	500 V	10%
C54	281-0615-00	3.9 pF	Cer	200 V	
C56	281-0605-00	200 pF	Cer	500 V	
C60	281-0511-00	22 pF	Cer	500 V	10%
C61	283-0010-00	0.05 μ F	Cer	50 V	
C65	283-0092-00	0.03 μ F	Cer	200 V	+80%—20%
C66	283-0092-00	0.03 μ F	Cer	200 V	+80%—20%

Diodes

D5	*152-0107-00	Silicon	Replaceable by 1N647
D18	*152-0185-00	Silicon	Replaceable by 1N3605
D26	*152-0075-00	Germanium	Tek Spec
D27	152-0195-00	Zener	1N751A 0.4 W, 5.1 V, 5%
D28	*152-0075-00	Germanium	Tek Spec
D31	*152-0185-00	Silicon	Replaceable by 1N3605
D32	152-0195-00	Zener	1N751A 0.4 W, 5.1 V, 5%
D34	*152-0075-00	Germanium	Tek Spec
D65	*152-0075-00	Germanium	Tek Spec

Connectors

J10	131-0302-00	Coaxial, chassis mt., UHF
J68	131-0106-00	Coaxial, 1 contact, BNC
J69	131-0106-00	Coaxial, 1 contact, BNC

Transistors

Q13	151-0188-00	Silicon	2N3906
Q24	151-0188-00	Silicon	2N3906
Q34	*151-0192-00	Silicon	Replaceable by MPS-6521
Q54	*151-0192-00	Silicon	Replaceable by MPS-6521
Q63	*151-0188-01	Silicon	Replaceable by 2N3251

Parts List—TV Sync Separator

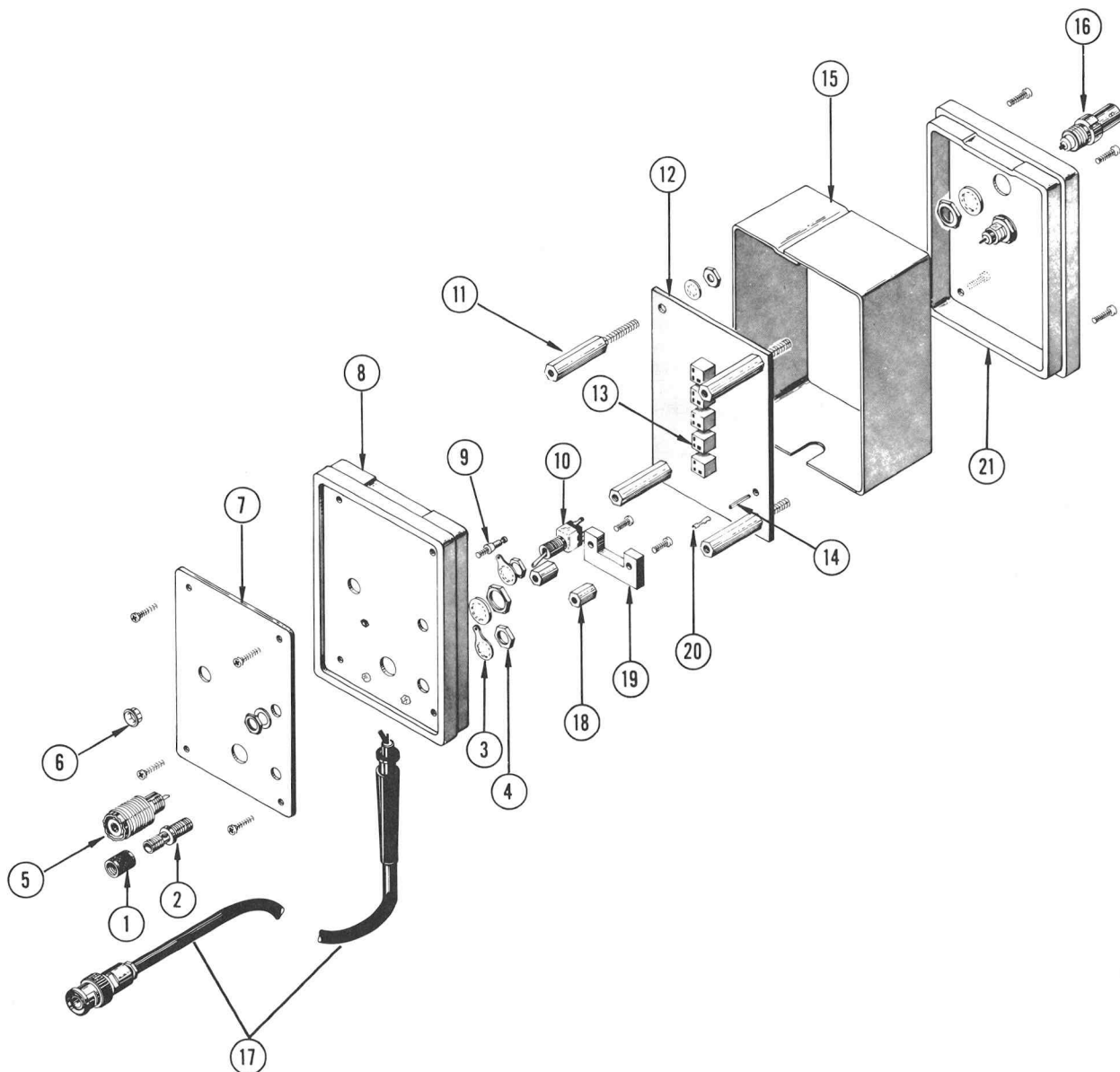
Resistors

Ckt. No.	Tektronix Part No.	Description		S/N Range
Resistors are fixed, composition, $\pm 10\%$ unless otherwise indicated.				
R5	315-0271-00	270 Ω	$\frac{1}{4}$ W	5%
R11	315-0221-00	220 Ω	$\frac{1}{4}$ W	5%
R12	315-0105-00	1 M Ω	$\frac{1}{4}$ W	5%
R14	315-0474-00	470 k Ω	$\frac{1}{4}$ W	5%
R16	315-0471-00	470 Ω	$\frac{1}{4}$ W	5%
R18	315-0334-00	330 k Ω	$\frac{1}{4}$ W	5%
R20	315-0203-00	20 k Ω	$\frac{1}{4}$ W	5%
R24	315-0182-00	1.8 k Ω	$\frac{1}{4}$ W	5%
R25	315-0242-00	2.4 k Ω	$\frac{1}{4}$ W	5%
R26	311-0496-00	2.5 k Ω	Var	
R27	301-0303-00	30 k Ω	$\frac{1}{2}$ W	5%
R30	301-0473-00	47 k Ω	$\frac{1}{2}$ W	5%
R33	315-0224-00	220 k Ω	$\frac{1}{4}$ W	5%
R50	315-0105-00	1 M Ω	$\frac{1}{4}$ W	5%
R54	315-0753-00	75 k Ω	$\frac{1}{4}$ W	5%
R56	315-0154-00	150 k Ω	$\frac{1}{4}$ W	5%
R60	315-0822-00	8.2 k Ω	$\frac{1}{4}$ W	5%
R61	315-0123-00	12 k Ω	$\frac{1}{4}$ W	5%
R63	315-0104-00	100 k Ω	$\frac{1}{4}$ W	5%

Switch

	Unwired	Wired		
SW67	260-0643-00		Toggle	TRIGGER

REPLACEABLE PARTS



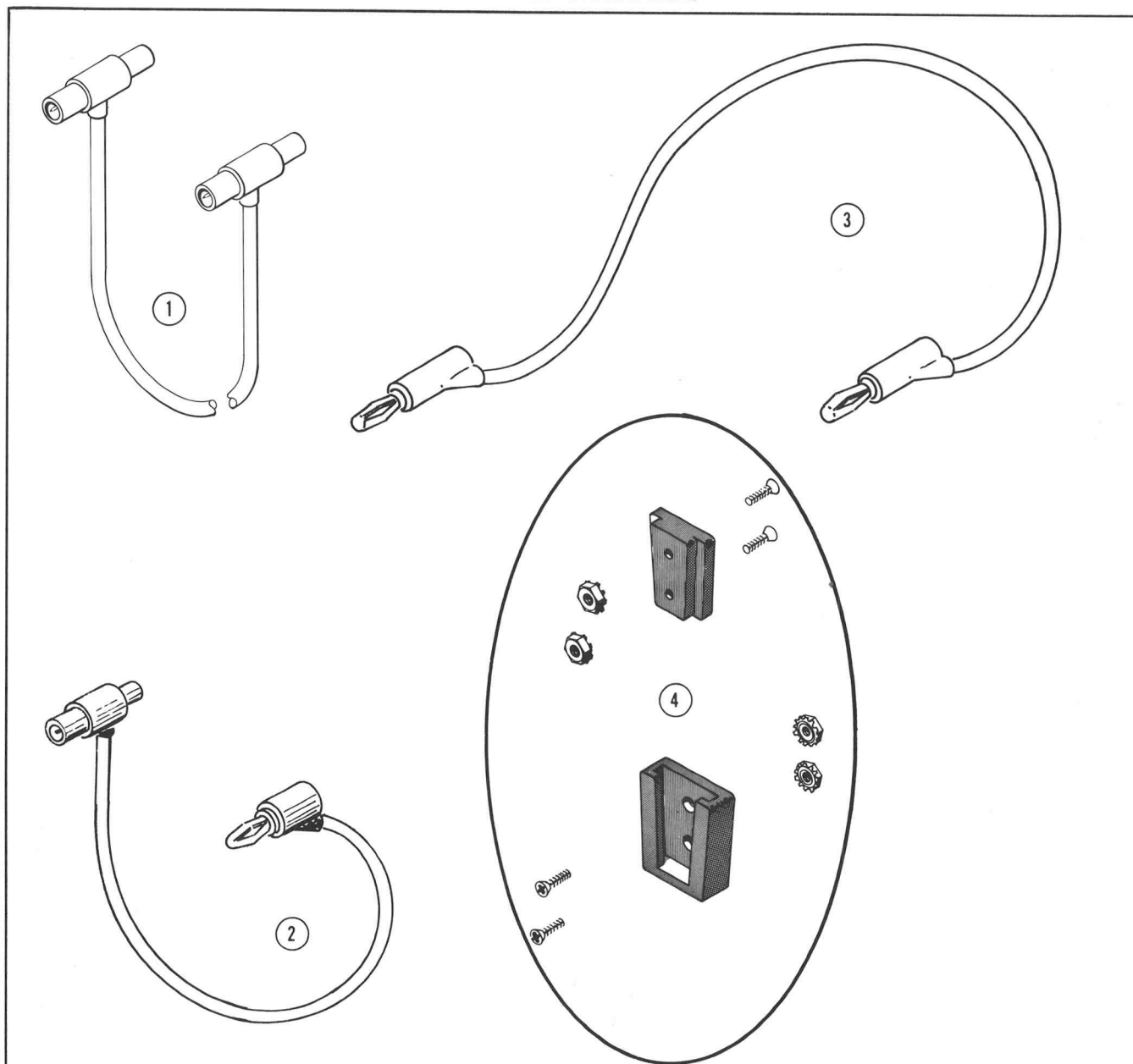
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REF. NO.	PART NO.	SERIAL/MODEL NO.		QTY.	DESCRIPTION
		EFF.	DISC.		
	129-0053-00			1	ASSEMBLY, binding post
	- - - - -			-	assembly includes:
1	200-0103-00			1	CAP, binding post
2	355-0507-00			1	STEM, binding post adapter
	- - - - -			-	mounting hardware: (not included w/stem)
3	210-0223-00			1	LUG, solder, 1/4 ID x 7/16 inch OD, SE
4	210-0455-00			1	NUT, hex., 1/4-28 x 3/8 inch
	- - - - -			-	
5	131-0302-00			1	CONNECTOR, coaxial, UHF
	- - - - -			-	connector includes:
	- - - - -			-	NUT
	- - - - -			-	LOCKWASHER
6	358-0178-00			1	BUSHING, front panel, charcoal

REPLACEABLE PARTS (Cont)

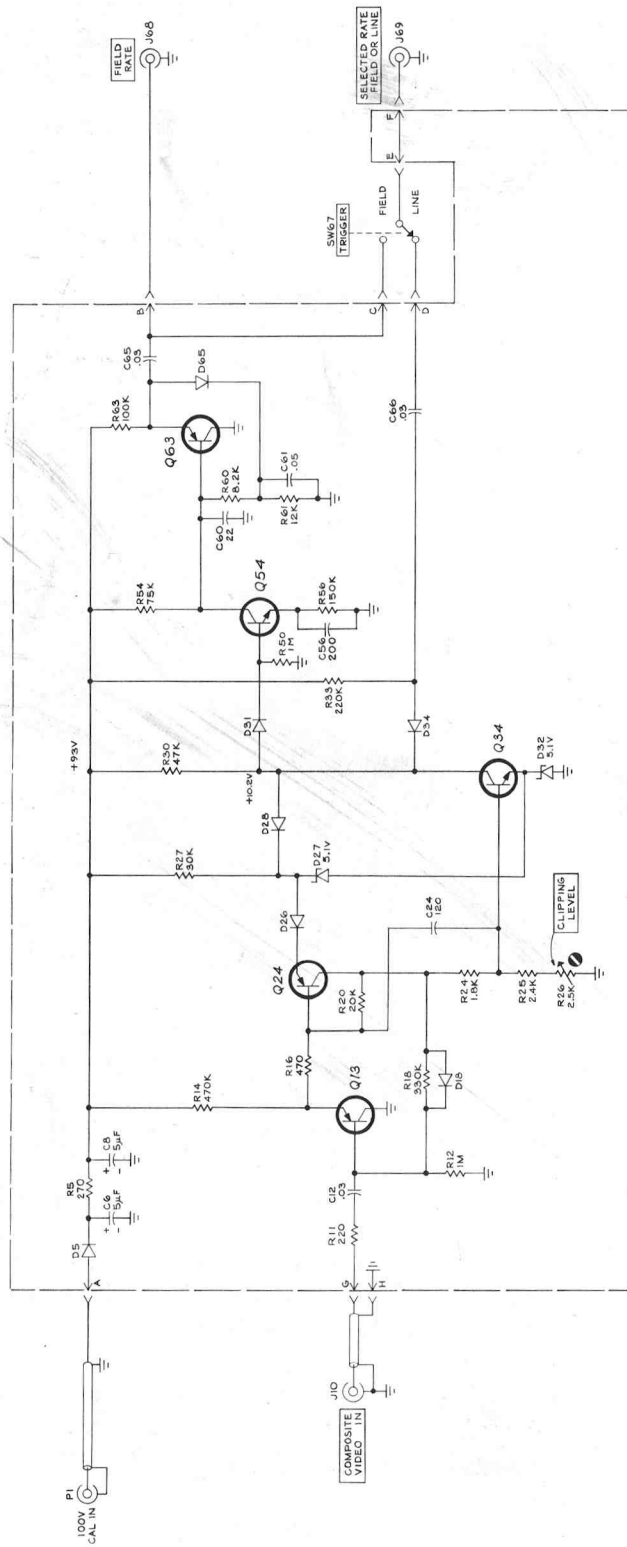
REF. NO.	PART NO.	SERIAL/MODEL NO.		Q T Y.	DESCRIPTION
		EFF.	DISC.		
7	333-0941-00			1	PANEL, front
	- - - - -			-	mounting hardware: (not included w/panel)
	211-0071-00			4	SCREW, 4-40 x $\frac{3}{8}$ inch, PHS
8	200-0276-04			1	COVER, front
9	129-0070-00			1	POST, terminal, insulated tie, w/2-56 stud
10	260-0643-00			1	SWITCH, toggle, SPDT
	- - - - -			-	mounting hardware: (not included w/switch)
	210-0583-00			1	NUT, hex., $\frac{1}{4}$ -32 x $\frac{5}{16}$ inch
	210-0940-00			1	WASHER, flat, $\frac{1}{4}$ ID x $\frac{3}{8}$ inch OD
	210-0223-00			1	LUG, solder, $\frac{1}{4}$ ID x $\frac{7}{16}$ inch OD, SE
	210-0562-00			1	NUT, hex., $\frac{1}{4}$ -40 x $\frac{5}{16}$ inch
11	129-0096-00			4	POST, electrical mechanical equipment
	- - - - -			-	mounting hardware for each: (not included w/post)
	210-0410-00			1	NUT, hex., 10-32 x $\frac{5}{16}$ inch
	210-0010-00			1	LOCKWASHER, internal, #10
12	670-0460-00			1	ASSEMBLY, circuit board
	- - - - -			-	assembly includes:
	388-0736-00			1	BOARD, circuit
13	136-0220-00			5	SOCKET, 3 pin transistor
14	214-0506-00			8	PIN, connector, straight
15	380-0104-00			1	HOUSING, wrap around
16	131-0106-00			2	CONNECTOR, coaxial, 1 contact, female
	- - - - -			-	each connector includes:
	- - - - -			1	NUT
	- - - - -			1	LOCKWASHER
17	175-0377-00			1	CABLE ASSEMBLY
18	384-0617-00			2	ROD, spacer
19	343-0094-00			1	CLAMP, cable, alum
	- - - - -			-	mounting hardware: (not included w/clamp)
	211-0008-00			2	SCREW, 4-40 x $\frac{1}{4}$ inch, PHS
20	131-0371-00			8	CONNECTOR, single contact
21	200-0276-00			1	COVER, rear
	- - - - -			-	mounting hardware: (not included w/cover)
	211-0071-00			4	SCREW, 4-40 x $\frac{3}{8}$ inch, PHS

STANDARD ACCESSORIES



A

REF. NO.	PART NO.	SERIAL/MODEL NO.		QTY.	DESCRIPTION
		EFF.	DISC.		
1	012-0087-00			2	CORD, patch, BNC to BNC, red
2	012-0031-00			1	CORD, patch, banana plug both ends
3	012-0091-00			2	CORD, patch, BNC to banana plug, red
4	014-0029-00			1	HANGER, ASSEMBLY
5	070-0542-00			1	MANUAL, instruction (not shown)



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A