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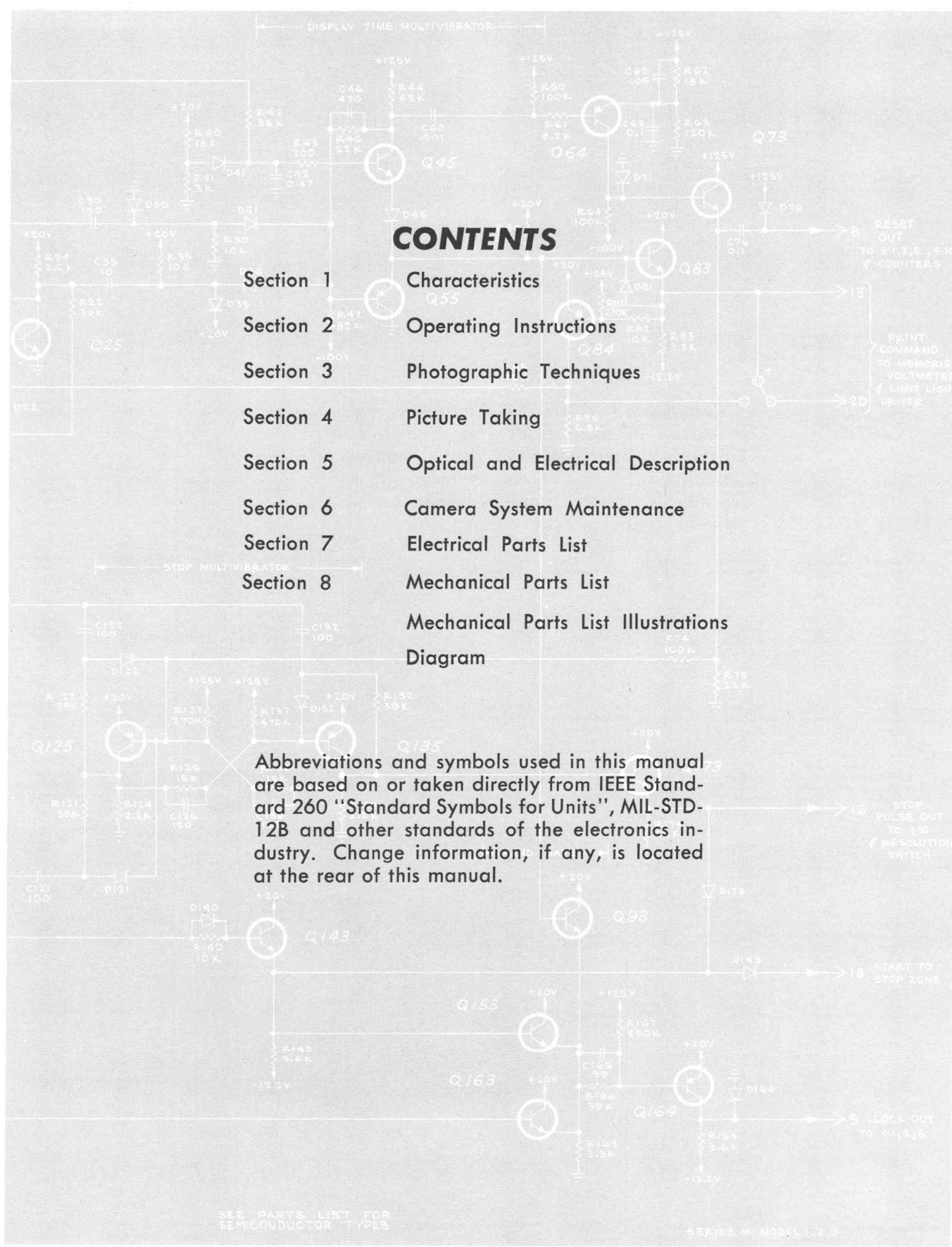
TEKTRONIX®

No. 3 *ELECTRIC SHUTTER AND SPEEDCOMPUTER*

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97077

Serial Number _____



CONTENTS

- Section 1 Characteristics
- Section 2 Operating Instructions
- Section 3 Photographic Techniques
- Section 4 Picture Taking
- Section 5 Optical and Electrical Description
- Section 6 Camera System Maintenance
- Section 7 Electrical Parts List
- Section 8 Mechanical Parts List
- Mechanical Parts List Illustrations
- Diagram

Abbreviations and symbols used in this manual are based on or taken directly from IEEE Standard 260 "Standard Symbols for Units", MIL-STD-12B and other standards of the electronics industry. Change information, if any, is located at the rear of this manual.

SECTION 1

CHARACTERISTICS

No. 3 Electric Shutter and Speedcomputer

The No. 3 Electric Shutter and Speedcomputer¹ system consists of a solenoid-operated shutter and a unit containing a power supply and timing circuitry. The system has been designed so that the Electric Shutter can replace the existing mechanical shutter in any of the lenses which can be used with the C-12, C-13, C-19, C-27 and C-40 camera systems.

The Electric Shutter/Speedcomputer system permits electrical triggering of the camera shutter. It can also be used to trip more than one camera shutter simultaneously by connecting the required number of systems to one remote switching control.

The Speedcomputer is supplied in a small box which can be easily attached to the camera back (by using the mounting bracket Tektronix Part No. 122-0713-00) or the Speedcomputer may be set on an object near the camera.

ELECTRICAL CHARACTERISTICS

NOTE

In the following description, the below listed definitions and criteria established by the United States of American Standards Institute shall apply: Items 2.1 and 4.3 of USA Standard PH3.32-1959; Item 3.1 of USA Standard PH3.18-1957.

TABLE 1-1

Electric Shutter

Characteristic	Performance Requirement
Synchronization	Internal; X-Type, as described in 3.1 of USA Standard PH3.18-1957
Action	Actuated by Speedcomputer
Actuation Voltage Initial Pulse	At least 120 VDC; at least 5 ms in duration
Holding Voltage	At least 20 VDC

TABLE 1-2

Speedcomputer

Characteristic	Performance Requirement
Output Voltage Initial Pulse	At least 120 VDC; at least 5 ms in duration
Holding Voltage	At least 20 VDC
Exposure-time Settings	Time (T), 4, 2, 1, 1/2, 1/4, 1/8, 1/15, 1/30, 1/60 second and Bulb (B)
Exposure-time Accuracy	Within 20% of exposure-time markings in a temperature range of 0° C to +40° C. (In accordance with item 4.3 of USA Standard PH3.32-1959.)

¹Registered trademark of the Ilex Optical Company.

Synchronization	Determined by Electric Shutter (see Table 1-1).
Shutter-open Indication	Indicator light turns on when shutter blades are more than 80% open.
Remote Actuation	Accomplished by connecting pins A and C of J20 together or by supplying +27 VDC to pin A of J20; using pin B of J20 as ground.
Line Voltage	115 VAC ±10%, 50-60 Hz. Can be converted for 230 VAC ±10%, 50-60 Hz operation.
Power Indication	Indicator light turns on if power is applied to instrument when ON-OFF switch SW 1 is ON.

TABLE 1-3

Physical Characteristics

Characteristic	Description
Finish: Electric Shutter	Die-cast aluminum finished with grey paint. The identification plate is anodized aluminum.
Speedcomputer	Aluminum case is finished with textured black vinyl paint. The front-panel is anodized aluminum.
Dimensions: Electric Shutter	3 5/16 inches diameter X 1 inch thick.
Speedcomputer	4 1/2 inches long X 3 1/16 inches wide X 3 1/8 inches deep.

TABLE 1-4

Environmental Characteristics

Characteristic	Performance Requirement
Temperature Operating	0° C to +50° C
Non-operating	-40° C to +65° C
Altitude Operating	To 15,000 feet
Non-operating	To 50,000 feet. Refer to temperature characteristic for lowest allowable temperature.
Vibration: Operating ²	15 minutes in each of the three planes at 0.010 inch double amplitude. Vary frequency from 5 to 55 to 5 c/s in 1-minute cycles.

²Electric Shutter and Speedcomputer mounted on a camera in a normal manner.

Characteristics—No. 3 Electric Shutter

TABLE 1-4 (cont)

Characteristic	Performance Requirement
Shock: Operating ³	15 g's, 1/2 sine, 11 ms duration, 1 shock in vertical plane only. Guillotine-type shocks.
Non-operating ³	60 g's, 1/2 sine, 11 ms duration, 1 shock in each of 6 face plates. Guillotine-type shocks.
Humidity ⁴	5 cycles (120 hours) of MIL-STD-202C, method 106B. Omit freezing and vibration. Allow 24 hour post-test drying period at 25°C, ±5°C with a relative humidity of 20% to 80%.

Supplemental Information

The following information applies to the following listed electric shutters and lens assemblies:

TABLE 1-5

Electric Shutter and Lens Assemblies

Fits Tektronix Camera	Tektronix Part No.	Description	
		Max. Aperture	Object to Image Ratio
C-12, C-13,	122-0772-00	f/1.9	1:0.7
C-19, C-27,	122-0773-00	f/1.9	1:0.5
C-40	122-0840-00	f/1.4	1:1
	122-0769-00	f/1.3	1:0.5
	122-0771-00	f/1.9	1:0.85

The electric shutter is operated by a single solenoid against the spring tension of the shutter release mechanism. Power is required to open the shutter; removal of power allows the shutter to close. The solenoid is intended for operation from DC voltage only.

³Electric Shutter and Speedcomputer separated and not mounted on a camera.

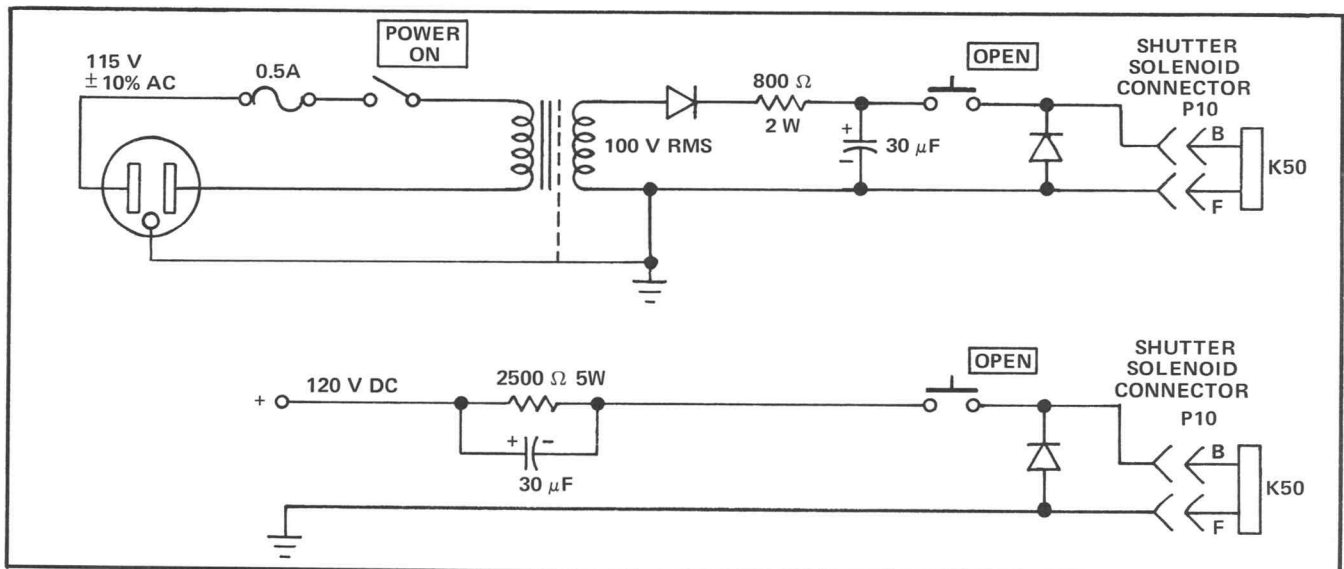
⁴Applies to Speedcomputer only.

To obtain quick shutter opening, a brief pulse of up to 120 V may be applied. As soon as the shutter is open, the applied voltage may be dropped quickly to 24 V or less, to avoid overheating of the solenoid and possible damage to the electric shutter.

The recommended operating waveform is an opening pulse of 120 V, decaying on an rc time-constant of 15 ms to a holding voltage of 20 V. A circuit for deriving such a waveform is shown below.

TABLE 1-6
Electric Shutter

Characteristic	Information	
Solenoid Resistance	500 ohms, ±10% at 25°C	
Maximum Input Voltage Peak Value	140 V DC for not more than 5 ms	
Continuous	24 V DC	
Minimum Input Voltage To Open Shutter	45 V DC for a duration of 60 ms	
To Hold Shutter Open	18 V DC	
Opening Time	Mechanical in-shutter opening time to 100% light-transmission point at maximum aperture	Delay from input voltage application to fully open
	120 V DC	5 ms
100 V DC	6 ms	14 ms
80 V DC	6 ms	17 ms
60 V DC	10 ms	22 ms
45 V DC	15 ms	50 ms
Closing Time To 0% Light-Transmission Point From Maximum Aperture	30 V DC Holding Voltage	6 ms
	18 V DC Holding Voltage	6 ms



SECTION 2

OPERATING INSTRUCTIONS

Mounting Lens Elements to Electric Shutter Assembly¹

NOTE

It is suggested that lens assemblies to be modified to include an electric shutter be sent to Tektronix, Inc. for installation of the electric shutter. The following procedures are provided for those customers who wish to do the job themselves.

Ilex Lens Elements. The adapter rings must be installed into the shutter assembly before installing the lens elements. The deep ring (I1) must be screwed into the front side (the side manufacturer's name and shutter description is on) of the shutter assembly and the shallow ring (I2) must be screwed into the back side of the shutter assembly. Failure to install the adapter rings properly may result in shutter damage.

The lens elements are now installed in the normal manner; that is, the front lens element is screwed into the front side (identification side) and the rear lens element is screwed into the back side of the shutter assembly. The elements are screwed into the shutter assembly as far as they will go and are hand tightened.

Wollensak Lens Elements. The adapter rings must be installed into the shutter assembly before installing the lens elements. The shallow ring (W1) must be screwed into the front side (side manufacturer's name and shutter description is on) of the shutter assembly and the deep ring (W2) must be screwed into the back side of the shutter assembly. Failure to install the adapter rings properly may result in shutter damage.

The lens elements are now installed in the normal manner; that is, the front lens element is screwed into the front side (identification side) and the rear lens element is screwed into the back side of the shutter assembly. The elements are screwed into the shutter assembly as far as they will go and are hand tightened.

NOTE

When installing the lens elements for a Wollensak 88mm, f1.4, 1:1 ratio lens, the lens elements must be reversed from normal; that is, the rear lens element is screwed into the front side (identification side) and front lens element is screwed into the back side of the shutter assembly. The elements are screwed into the shutter assembly as far as they will go and are hand tightened.

The adapter rings are installed in the normal manner for Wollensak lenses.

Mounting Electric Shutter Lens Assembly in the Camera

Refer to the information in section 2 in the camera instruction manual under the title Changing Lenses.

¹When ordering an Electric Shutter from Tektronix, Inc. specify maximum lens aperture, object-to-image ratio, focal length and manufacturer.

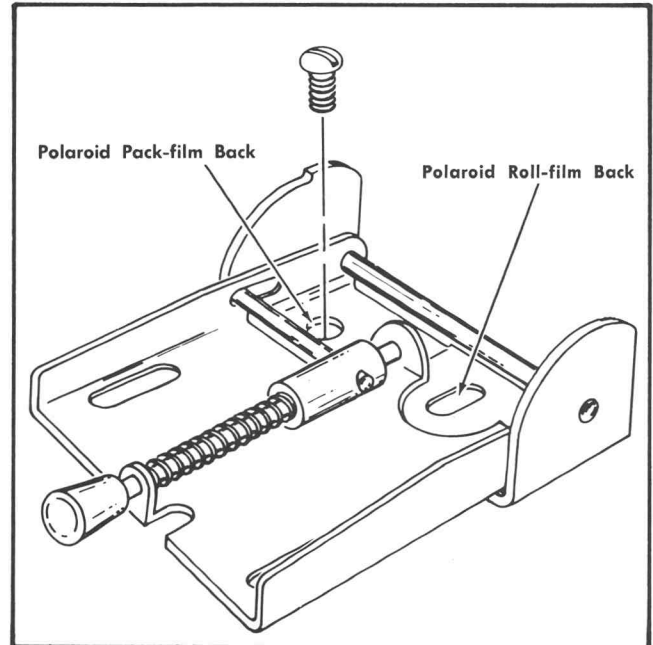


Fig. 2-1. Selecting proper mounting hole in mounting bracket for Speedcomputer (Tektronix Part No. 122-0713-00).

Grasp the Speedcomputer so that the front panel is toward you and the top of the Speedcomputer is down. With the Speedcomputer in this position, remove the two bottom screws. Lay the mounting bracket (see Fig. 2-1) on the Speedcomputer so the flat surface of the bracket is against the Speedcomputer and the plastic knob is toward you. Line up the slots in the bracket so they are over the holes in the Speedcomputer from which the two bottom screws were just removed. When the slots and screw holes are lined up, re-insert the two bottom screws through the slots into the Speedcomputer cabinet. Do not tighten the screws at this time.

The Speedcomputer is mounted on a camera back by inserting the screw supplied with the Speedcomputer mounting bracket through the proper hole in the bracket and into the tripod socket on the bottom of the camera back. The proper hole to mount the mounting bracket to the camera back is shown in Fig. 2-1.

After securing the Speedcomputer mounting bracket to the camera back, push the Speedcomputer toward the camera back until the rubber feet rest against the camera back. The two bottom screws holding the bracket to the Speedcomputer are now tightened.

When it is necessary to open the camera back, the Speedcomputer may be rotated out of the way. The Speedcomputer is unlocked from its operating position by pulling outward on the plastic knob. Keep the knob pulled out (away from the camera back) and rotate the Speedcomputer out

Operating Instructions—No. 3 Electric Shutter

and down. Release the knob and allow the Speedcomputer to rotate into its down position. After the camera back is closed again, the Speedcomputer is rotated back to normal position by pushing it up and in toward the camera. The Speedcomputer locks into position automatically.

Operating Controls and Connectors

POWER	Indicator lamp lights when line-voltage is applied to the Speedcomputer and the ON-OFF switch is in ON position.
ON-OFF	Turns the line voltage to the Speedcomputer on or off.
SHUTTER	Indicator lamp lights when the shutter blades are open. The lamp will stay lit as long as the shutter blades are open.

NOTE

If Electric Shutter fails to operate and POWER indicator lamp will not light, check fuse. The fuse is located inside the Speedcomputer case. Instructions for disassembly of the Speedcomputer will be found in Section 6.

ACTUATE (Pushbutton)	Causes the solenoid in the Electric Shutter to be energized, thereby opening the shutter blades. In any speed setting except (T) the solenoid will automatically de-energize (shutter blades close) when the indicated (speed setting) time has passed. In the (T) position the ACTUATE pushbutton must be pushed twice, once to open the shutter blades and once to close the shutter blades.
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Speed	Knob that determines the time the shutter blades will remain open. In (T) the shutter blades can remain open for an indefinite time without any damage to the Electric Shutter or Speedcomputer.
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Remote (3 pin connector on side of actuator)	The action of pressing the ACTUATE pushbutton may be done remotely by either shorting pins A and C of the connector together momentarily, or by connecting +27 VDC to pin A of the connector using pin B as ground. Accepts male connector (Tektronix Part No. 131-0423-00).
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Electric Shutter (6 pin connector on side of actuator)	Receptacle into which connector from the Electric Shutter connects to obtain power (J10, pins F and B) for the solenoid and to supply (via J10, pins D and E) shutter-blade position information open or closed) to the Speedcomputer. It also supplies the switch connections (J10, pins A and C) to the X Sync Posts from the Electric Shutter.
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Power Cord	The power cord is permanently attached.
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X Sync Posts (2 pin connector on side of actuator)	An extension of normally open switch contacts in the shutter assembly. Contacts are open (off) when shutter blades are closed and closed (on) when shutter blades are opened.
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Press Focus (Lever located on side of shutter assembly) Raise lever to open shutter blades for focusing purposes. Close shutter blades by lowering lever or actuating Electric Shutter normally.

Power Transformer Line-Voltage Conversion

The Speedcomputer as shipped from Tektronix, Inc., unless otherwise ordered, will be wired for 105-130 volt AC operation. To change the Speedcomputer so it will operate on a 210-260 volt AC line voltage, refer to Fig. 2-2B. Fig. 2-2A illustrates how to convert the Speedcomputer back to 105-130-volt AC line voltage. Whenever the line voltage is changed, the fuse must also be changed, see electrical parts list for correct value.

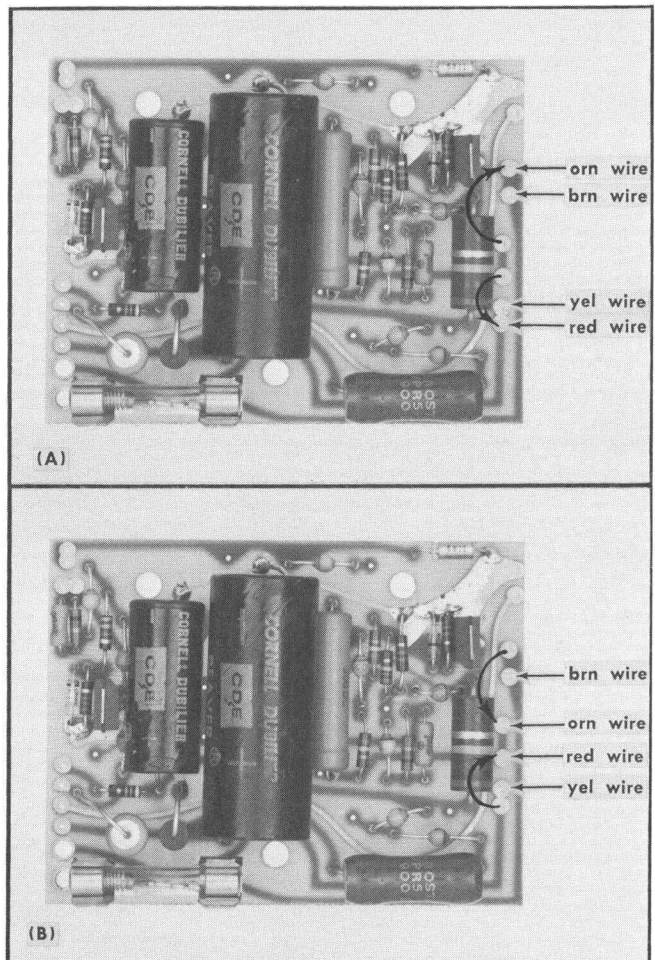


Fig. 2-2. Transformer primary connections for: (A) 105-130 VAC operation. (B) 210-260 VAC operation.

Disassembly instructions for the Speedcomputer will be found in Section 6.

Operating Electric Shutter and Speedcomputer

NOTE

To prevent a misleading display on the oscilloscope, the leads of the Electric Shutter/Speed-

computer system should not be interwound with the input leads to the oscilloscope. Maximum separation of the leads is recommended since there is a magnetic field present when the Electric Shutter solenoid is energized.

Focusing with Electric Shutter

The aperture opening is controlled and selected in a normal manner. The shutter blades may be opened for focusing by setting the Speed switch on the Speedcomputer to (T) and pressing the ACTUATE pushbutton once to open the shutter blades and pressing it again, when finished focusing, to close the shutter blades. Another method is to press the Press Focus lever on the side of the shutter assembly down to open the shutter blades and either lifting the Press Focus lever up to close the shutter blades or pressing the ACTUATE pushbutton until the SHUTTER indicator lamp goes out (once for any speed setting except (T) and twice for a (T) speed setting).

Photographing Repetitive Waveforms

Mount the Electric Shutter and Speedcomputer on the camera as described under Mounting, then mount the camera on the oscilloscope.

1. After connecting the Electric Shutter to the Speedcomputer, apply line voltage to the Speedcomputer, then set the Speed selector to any speed, for example $\bar{2}$ ($1/2$ s).
2. Open the shutter blades by lifting the Press Focus lever.
3. Focus the camera.
4. After focusing the camera, close the shutter blades by turning on the Speedcomputer and pressing the ACTUATE pushbutton.

To photograph a repetitive waveform, using any shutter setting other than (T) or (B), first obtain a stable display of the desired waveform on the CRT. Second, with the camera back ready for exposure, push the ACTUATE pushbutton and release.

To photograph a repetitive waveform using a shutter setting of (T), the ACTUATE pushbutton must be pushed twice. The first time it is pushed, the shutter will open. The second operation will close the shutter.

To photograph a repetitive waveform using a shutter setting of (B), the ACTUATE pushbutton must be held in the pushed-in position for the desired exposure time and then released.

Photographing Non-Repetitive Waveforms

Mount and focus the camera system as described previously under "Photographing Repetitive Waveforms."

When photographing a non-repetitive waveform using a Speedcomputer Speed setting of (T), set the oscilloscope for single-sweep operation so that the display, when presented, will not have jitter. Push the ACTUATE pushbutton to open the shutter blades. Wait for the waveform to occur, then push the ACTUATE pushbutton to close the shutter blades.

When using a Speedcomputer speed setting of (B) to photograph a non-repetitive waveform, set the oscilloscope for single-sweep operation. Then push the ACTUATE pushbutton in and hold it for the duration of the waveform. After the waveform has occurred, then release the pushbutton to close the shutter blades.

NOTE

In (T) the shutter blades can remain open for an indefinite time without any damage to the Electric Shutter of Speedcomputer.

SECTION 3

PHOTOGRAPHIC TECHNIQUES

Refer to section 3 of the instruction manual furnished with the camera for information.

SECTION 4

PICTURE TAKING

Refer to section 4 of the instruction manual furnished with the camera for information.

SECTION 5

OPTICAL AND ELECTRICAL DESCRIPTION

Circuit Description

Line voltage is supplied to the Speedcomputer via ON-OFF switch SW1 (see electrical diagram), fuse F1 and transformer T1. T1 secondary has two voltage outputs; the approximate 27-volt output which is rectified and filtered by D7 and C7. This supplies power to the actuate circuit. The approximate 160 volt output rectified and filtered by D2 and C2 supplies power to the timing circuit, POWER indicator and the SHUTTER indicator via pins D and E of J10. The approximate 160 volt output is also rectified and filtered by D1 and C1 to supply power to the shutter solenoid energizing.

Initially, when the Speedcomputer is turned on, a positive voltage from the +160-volt supply is applied via R14, R17, and R27 to the gate of silicon controlled rectifier (SCR) D25, turning it on. SCR D15 is receiving anode voltage via shutter solenoid K50, but it not conducting since the only way its gate can get a positive signal is through ACTUATE switch SW14 or the remote actuate circuit.

Operation of Bulb (B) Exposure-time Setting

The solenoid energizing circuitry for bulb (B) is the same as was described above for an exposure-time speed setting except, that as long as the actuating circuit is supplied with +27 volts, transistor Q29 will be conducting. Q29 conducting will hold the voltage at the junction of R13 and D30 very close to ground thereby not allowing C21 to charge up sufficiently to fire B21.

The solenoid de-energizing circuit is the same as was described for exposure-time speed settings since, once the +27 volts to the actuating circuit is removed from Q29 it will turn off and C21 will charge toward +160 volts using R13 as the timing resistor.

Operation of All Exposure-time Settings Except Time (T) and Bulb (B)

Actuating the circuit by either—(1) Pressing the ACTUATE button, (2) shorting pins A and C of Remote Actuate connector together, or (3) applying +27 VDC to pin A (use pin B for ground) of the Remote Actuate connector, causes a positive 27 volt initiating pulse to be applied to the gate of silicon controlled rectifier (SCR) D15 via R12-C12, D12 and R15, turning D15 on. At the same time D15 gate is receiving a positive pulse, a pulse is also being sent toward the gate of D25 via R22-C22, and D22. This positive pulse, however, is shorted to ground via D21 and conducting SCR D25.

When D15 turns on, its anode voltage drops to a level near ground, creating a negative voltage drop. This negative voltage step is coupled through C17 to the anode of D25 and

through D17 and R27 to the gate of D25 causing D25 to turn off. The negative voltage step is also applied to C21 via D21, giving C21 a negative charge.

With D15 conducting, a current path is completed from ground through D15, D10, shutter solenoid K50, R1, D1 and T1 back to ground. Energizing K50, causes the contacts of K50A to close and turn on the SHUTTER indicator B7.

Solenoid K50 remains energized until the charge across C21 (which can now charge toward 160 volts through R29 and the selected timing resistor) becomes large enough to fire neon lamp B21. The charge rate of C21 is controlled by timing resistors selected by SW30. Zener diode D38 limits the maximum charge across C21.

When B21 fires a positive pulse is coupled via R25 to the gate of D25, turning it on. When D25 turns on, its anode voltage drops to a level near ground, creating a negative voltage step. This negative voltage step is coupled through C17 to the anode of D15 and through D11 and R15 to the gate of D15, causing D15 to turn off.

With D15 not conducting the current path for K50 is broken and the solenoid can not remain energized. As K50 de-energizes it causes the contacts of K50A to open and the SHUTTER indicator B7 extinguishes.

Operation of Time (T) Exposure-time Setting

The solenoid energizing circuitry for time (T) is the same as was described above for an exposure-time speed setting, therefore only the solenoid de-energizing circuit will be described.

After the desired shutter open time, the actuating circuit is again triggered (C21 cannot be charged to a plus voltage because R40 returns it to ground, therefore B21 can not fire) by one of the three methods already described, causing a +27 volt initiating pulse to be applied via R22-C22, D22 and R25 to the gate of SCR D25, turning D25 on. At the same time D25 gate is receiving a positive pulse, a pulse is also being sent toward the gate of D15 via R12-C12 and D12. This positive pulse, however, is routed to ground via D11 and conducting SCR D15.

When D25 turns on, its anode voltage drops to a level near ground, creating a negative voltage step. This negative voltage step is coupled through C17 to the anode of D15 and through D11 and R15 to the gate of D15, causing D15 to turn off.

With D15 not conducting, the current path for K50 is broken and the solenoid can not remain energized. As K50 de-energizes, it causes the contacts of K50A to open and the SHUTTER indicator B7 extinguishes.

SECTION 6

CAMERA SYSTEM MAINTENANCE

Refer to section 6 of the instruction manual which was furnished with the camera for lens care information and soldering instructions.

COMPONENT REPLACEMENT

Disassembly of Speedcomputer

- a. Disconnect the power cord from its line voltage source.
- b. Remove all connections to Speedcomputer.
- c. Remove the three screws indicated in Fig. 6-1 from the rear of the Speedcomputer case.
- d. Lift the front panel and its attached (upper) circuit board and power transformer out of the case.
- e. Remove the lower circuit board by lifting it out of the case.

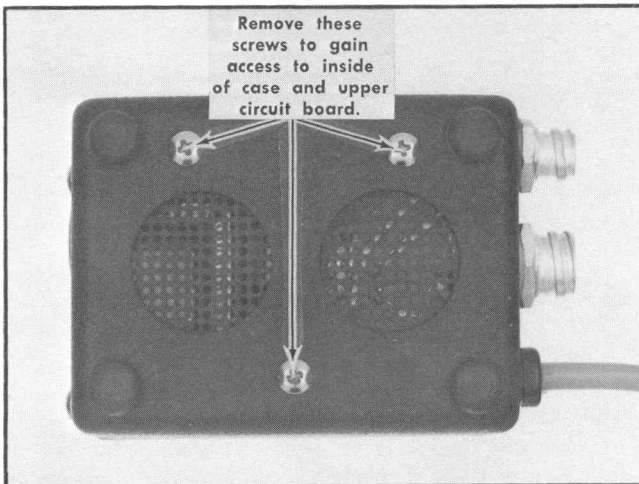


Fig. 6-1. Screw removal for Speedcomputer.

Reassembly of Speedcomputer

- a. Reinstall lower circuit board in position being careful that no wires are pinched by the circuit board.
- b. Set the front panel with its associated upper circuit board and power transformer into the Speedcomputer case, dressing the wires and positioning the ornament ring as necessary for proper clearances.
- c. Reinstall the three screws removed in part c of the disassembly instructions.
- d. Reconnect the Electric Shutter and Speedcomputer.

Disassembly of Electric Shutter

NOTE

When disassembling the shutter, lay the parts out in an orderly manner as they are removed. This will make reassembly easier.

Microswitch Repairs

- a. Remove the connecting cable to Speedcomputer.
- b. Remove the lens elements from shutter assembly.
- c. Remove two small screws from the identification plate on the shutter and remove the identification plate (see Fig. 6-2 items 1 and 2).
- d. Remove the three screws from the shutter cover and remove the shutter cover (see Fig. 6-2 items 3 and 4).
- e. Remove the cable clamp screw and microswitch clamp screws (see Fig. 6-2 items 5 and 6). Remove the piece of electrical tape.
- f. Perform necessary maintenance.

Solenoid Repairs

- a. Do parts a through e of Microswitch Repairs, then proceed with the following.
- b. Remove the Press Focus lever (see Fig. 6-2 item 7).
- c. Remove three screws from the master plate and lift the master plate out of the shutter case (see Fig. 6-2, items 8 and 9). The shutter blades (Fig. 6-2, item 10) will normally fall out of position.
- d. Remove five screws from the ring plate on the rear of the master plate and remove the ring plate (see Fig. 6-2 items 11 and 12).
- e. Remove the three screws (from the rear of the master plate) which hold the solenoid in place, see Fig. 6-2, item 13.
- f. Carefully lift the solenoid from the front of the master plate, taking care not to bend the main lever pin (see Fig. 6-2 items 14 and 15).
- g. Perform necessary maintenance.

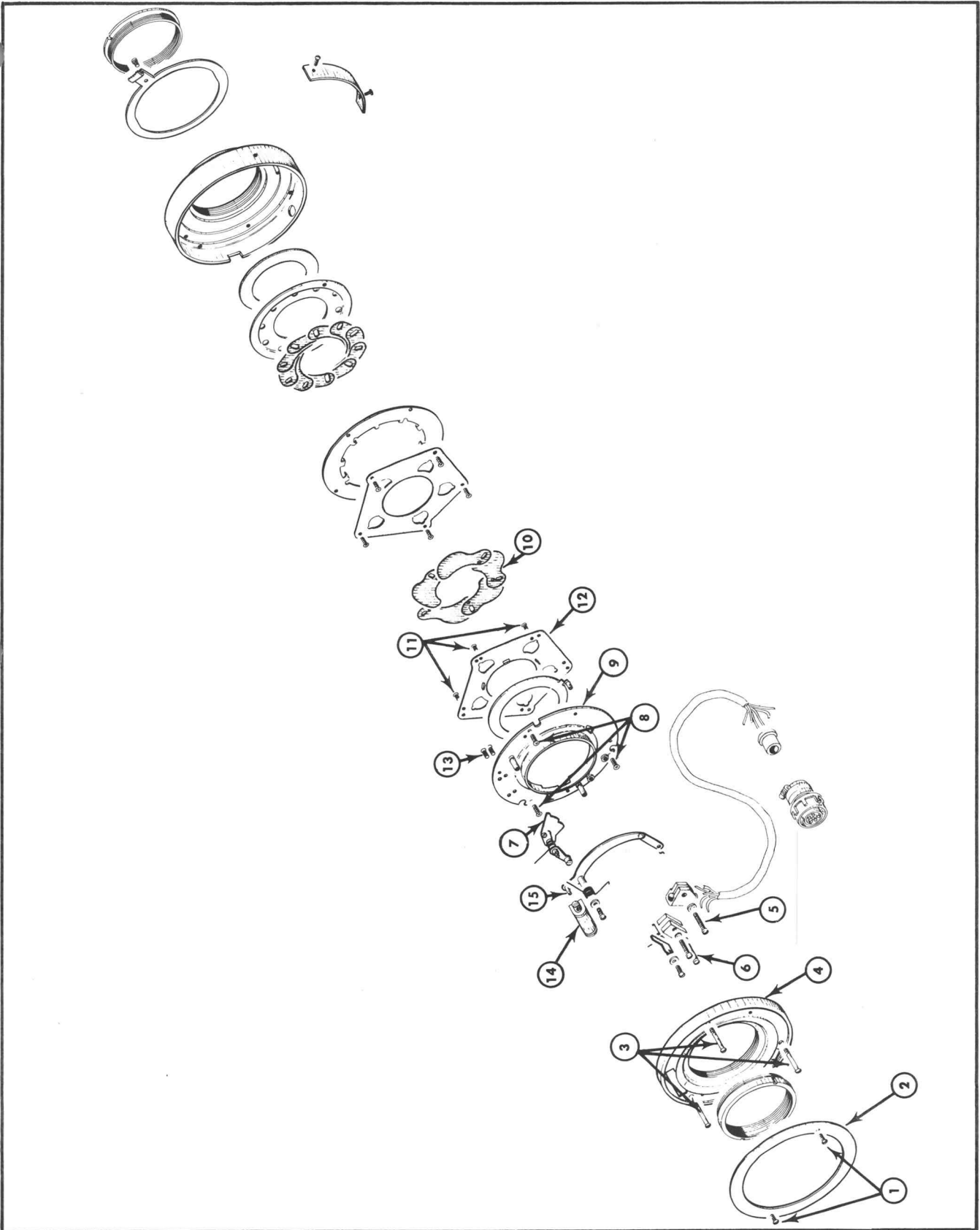


Fig. 6-2. Exploded illustration of the Electric Shutter.

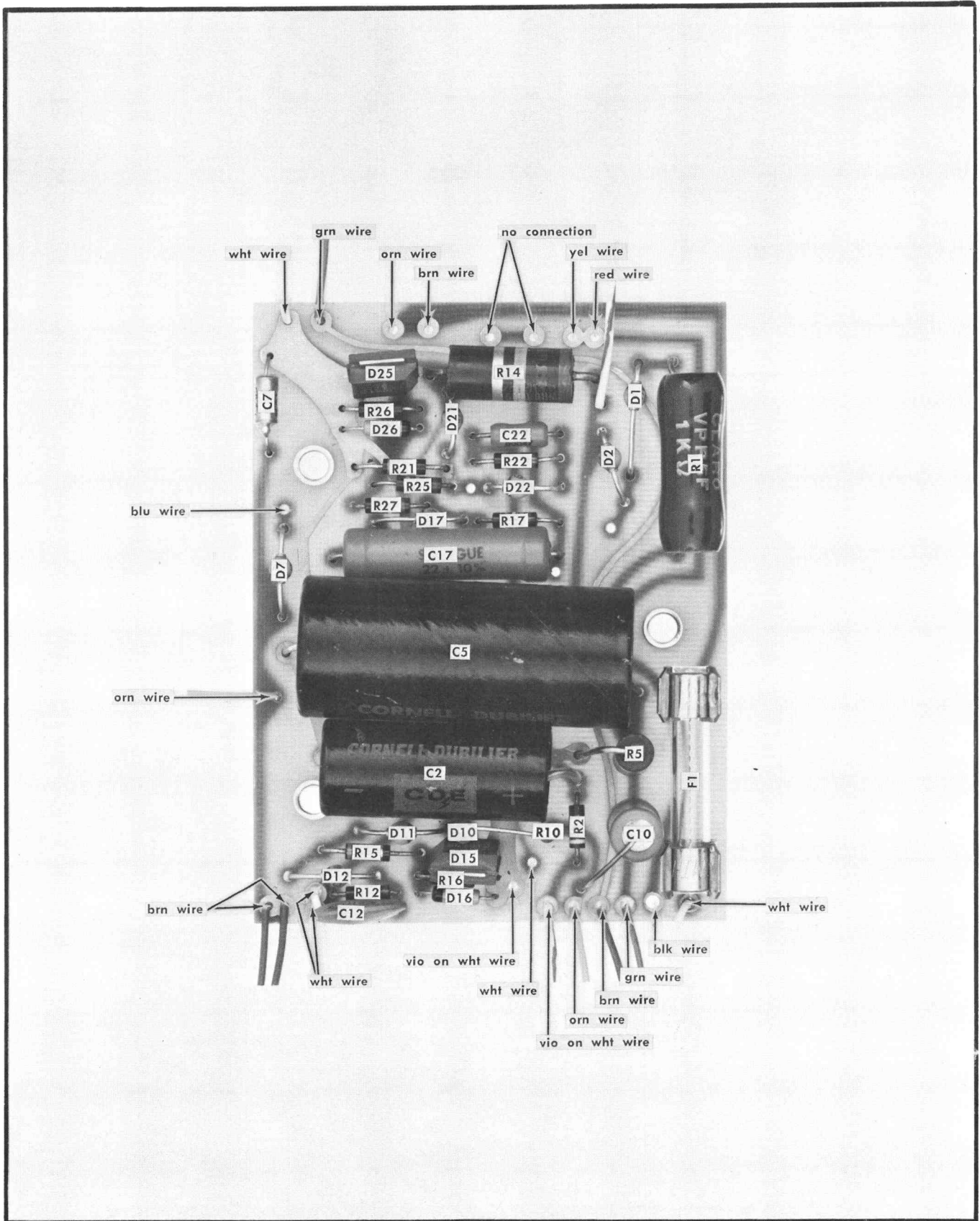


Fig. 6-3. Speedcomputer lower circuit board components and wire color codes.

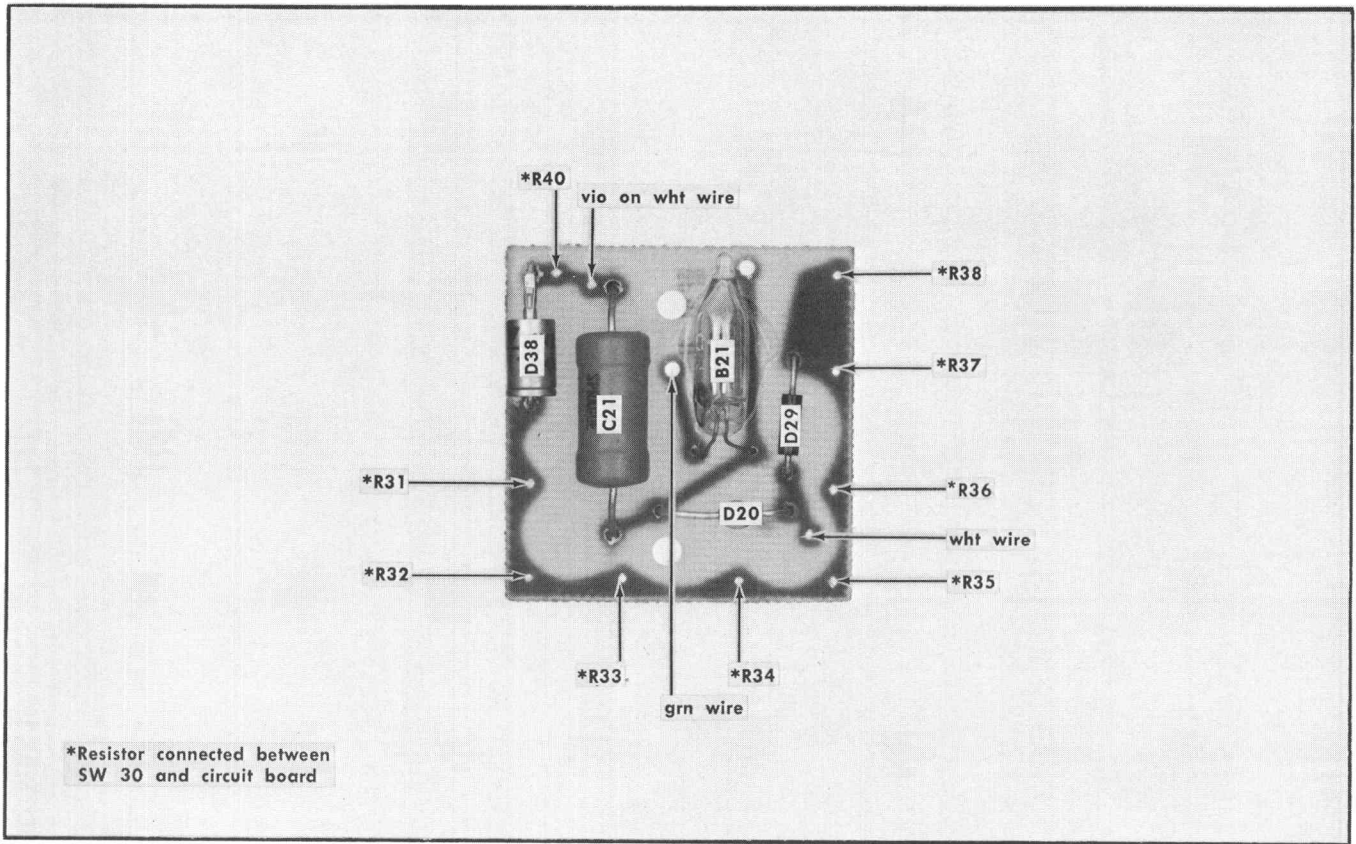


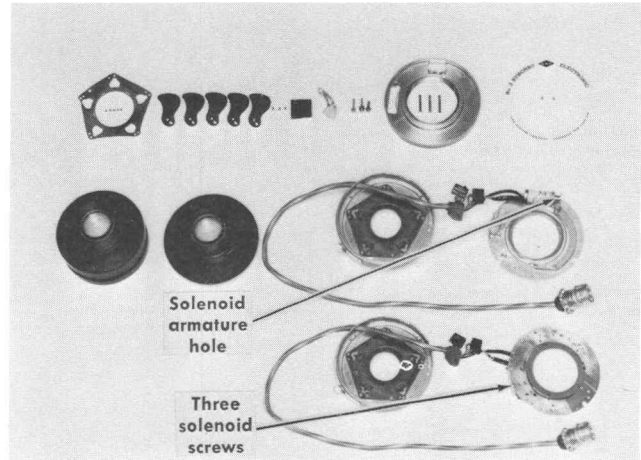
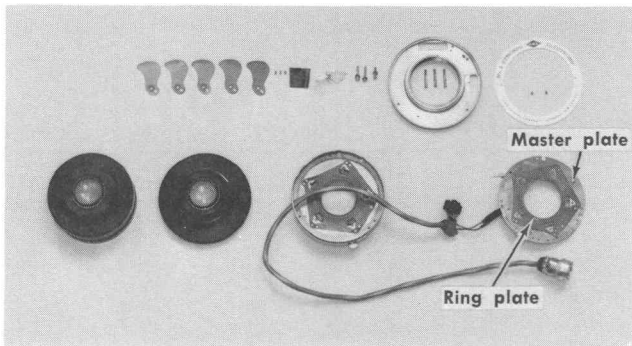
Fig. 6-4. Speedcomputer upper circuit board components and wire color codes.

Reassembly of Electric Shutter

Perform parts a through f if solenoid repairs were made; skip parts a through f and start with part g if only microswitch repairs were made.

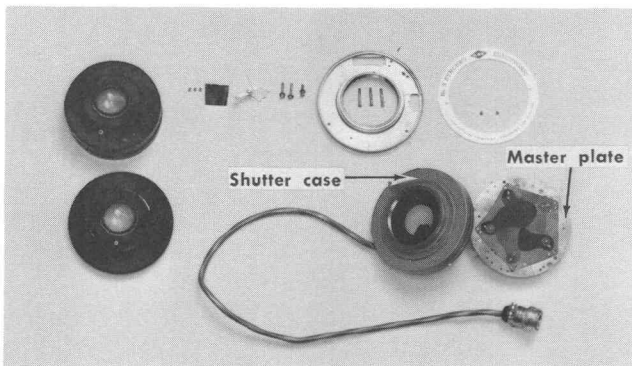
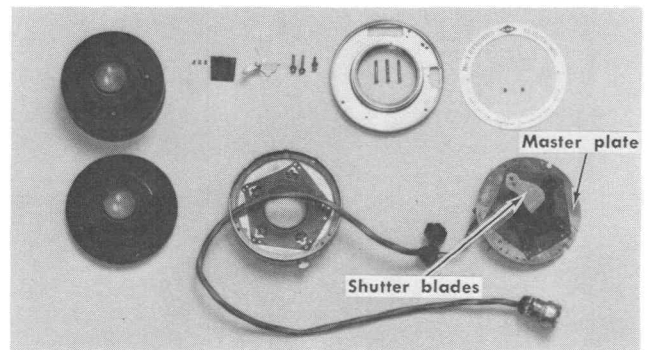
Reassembly for Solenoid Repairs

- a. Install the solenoid onto the front side of the master plate (engage main level pin in solenoid armature hole) and fasten with three screws from the rear side of the master plate. If the solenoid leads are not soldered to cable, do it now. Refer to the electrical diagram for wire color.

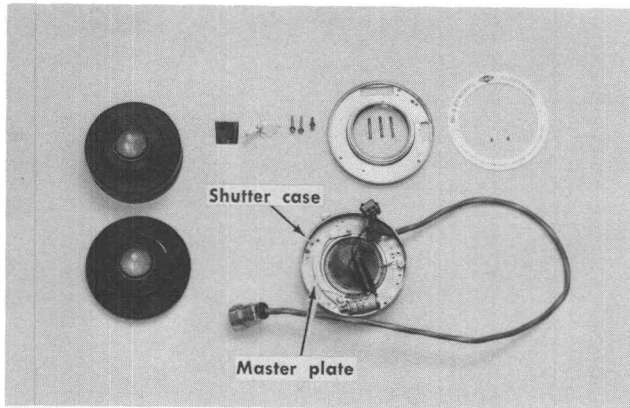


- b. Install the ring plate on the rear of the master plate with five screws. Check main lever movement for any binding.

- c. Hold the master plate with rear up and install shutter blades on pins as shown.

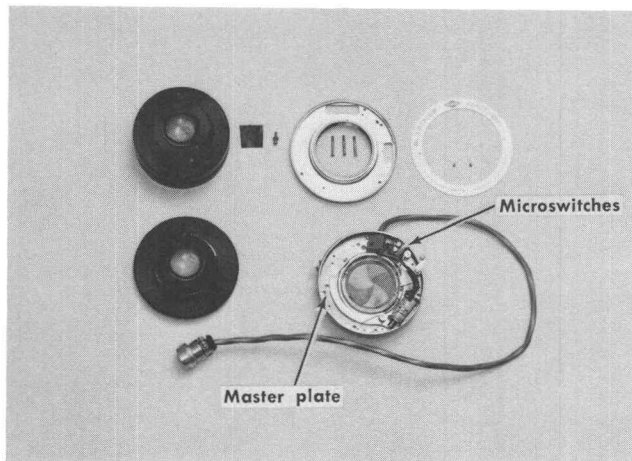
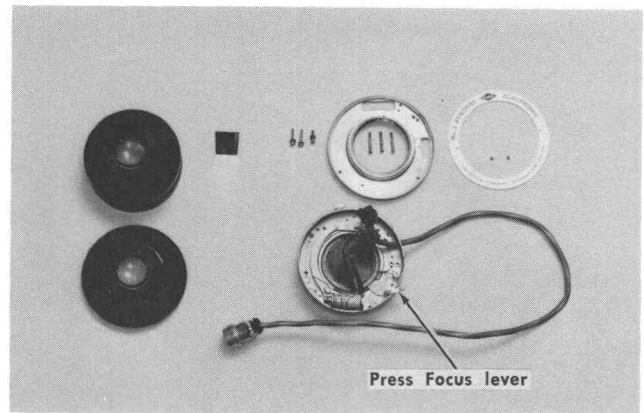


- d. Still holding the master plate with rear up, install the shutter case over master plate. When the master plate is fully installed (position as far in as possible) turn the assembly over and move springs into proper position.



e. Install the three screws to fasten the master plate to the shutter case.

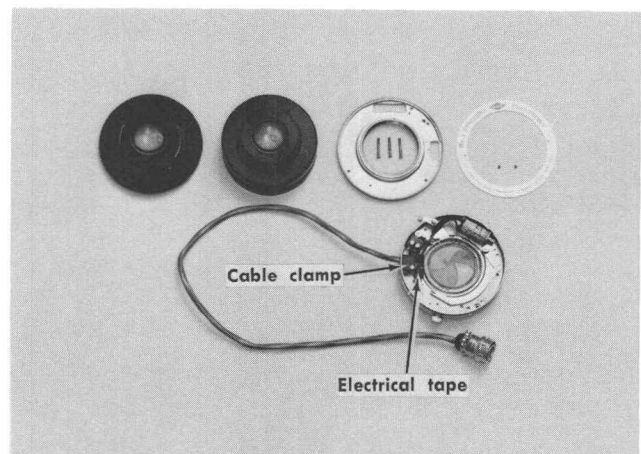
f. Install the Press Focus lever.



Reassembly for Solenoid and Microswitch Repairs

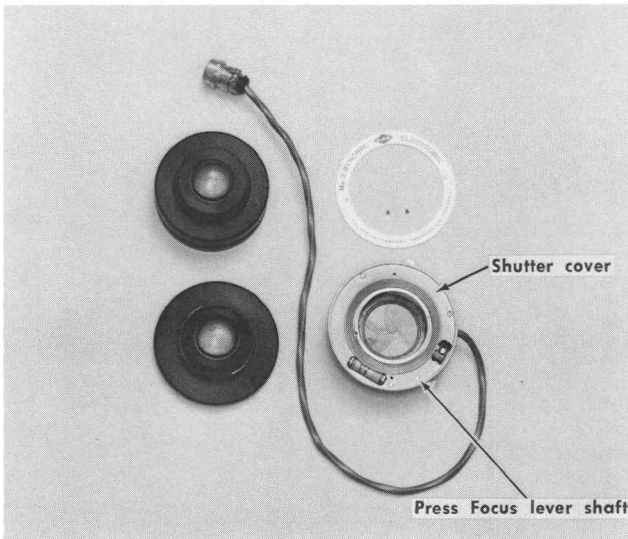
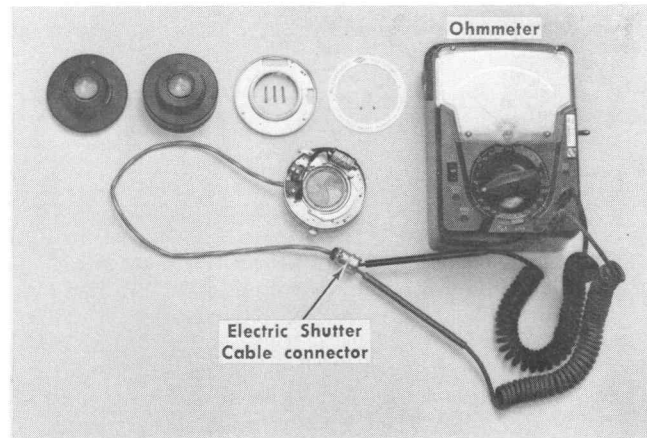
g. Install microswitches onto the master plate and fasten with two screws. If microswitches are not soldered to the cable, do it now. Refer to electric diagram for wire color.

h. Fasten cable clamp into position with one screw. Install a piece of electrical tape to protect wires.



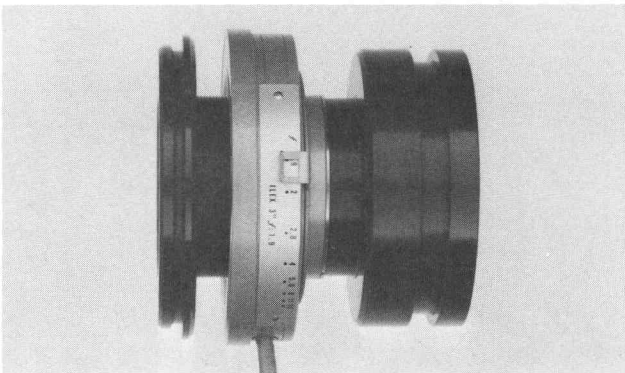
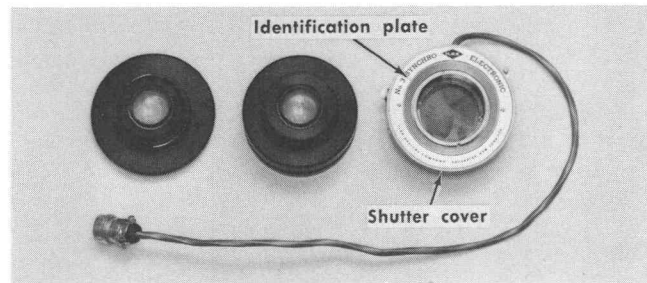
Camera System Maintenance—No. 3 Electric Shutter

- i. Connect an ohmmeter between pins A and C of P5 (Electric Shutter cable connector) and open shutter blades 80% by pushing the solenoid armature into solenoid. Check that microswitch K50B (X - Sync Posts switch) shows a short, if not, loosen screws and position microswitch. Remove ohmmeter.
- j. Connect an ohmmeter between pins D and E of P5 and again open the shutter blades 80%. Check that microswitch K50A (SHUTTER indicator lamp) shows a short, if not loosen screws and position microswitch. Remove ohmmeter.



- k. Install the shutter cover, positioning the cable wires and the Press Focus lever shaft as necessary for a proper fit.
- l. Install three screws to fasten shutter cover to the shutter case.

- m. Position the identification plate on shutter cover and fasten with two screws.



- n. Install lens elements into the shutter assembly.

- o. Connect the Electrical Shutter to Speedcomputer and check operation.

SECTION 7

ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model Eff	Disc	Description		
Bulbs						
B3	150-0040-00			Neon NE2H, assembly, translucent lens		
B7	150-0041-00			Neon NE2H, assembly, amber lens		
B21	150-0021-00			Neon NE76		
Capacitors						
Tolerance $\pm 20\%$ unless otherwise indicated.						
C2	290-0431-00		4 μF	Elect.	250 V	
C5	290-0430-00		30 μF	Elect.	250 V	
C7	290-0267-00		1 μF	Elect.	35 V	
C10	285-0572-00		0.1 μF	PTM	200 V	
C12	285-0832-00			PTM	200 V	
C17	285-0533-00		0.22 μF	MT	400 V	
C21	285-0572-00		0.1 μF	PTM	200 V	
C22	283-0597-00		470 pF	Mica	300 V	10%
Semiconductor Device, Diodes						
D1	152-0066-01		Silicon	400 V		0.75A
D2	152-0066-01		Silicon	400 V		0.75A
D7	152-0066-01		Silicon	400 V		0.75A
D10	152-0066-01		Silicon	400 V		0.75A
D11	152-0066-01		Silicon	400 V		0.75A
D12	152-0066-01		Silicon	400 V		0.75A
D15	151-0506-00		Silicon controlled rectifier, C106B			
D16	152-0025-00		Germanium	1N634		
D17	152-0066-01		Silicon	400 V		0.75A
D20	152-0066-01		Silicon	400 V		0.75A
D21	152-0066-01		Silicon	400 V		0.75A
D22	152-0066-01		Silicon	400 V		0.75A
D25	151-0506-00		Silicon controlled rectifier, C106B			
D26	152-0025-00		Germanium	1N634		
D28	152-0185-00		Silicon	Replaceable by 1N4152		
D29	152-0066-01		Silicon	400 V		0.75A
D30	152-0066-01		Silicon	400 V		0.75A
D38	152-0417-00		Zener	1N3047B, 1 W, 130 V, 5%		

Electrical Parts List—No. 3 Electric Shutter

Fuse

Ckt. No.	Tektronix Part No.	Serial/Model Eff	Disc	Description
F1	159-0028-00 159-0033-00			1/4 A 3AG Fast-Blo 115 V 1/8 A 8AG Fast-Blo 230 V

Connectors

J10	131-0425-00			Receptacle, electrical
J20	131-0424-00			Receptacle, electrical

Sync Post

P5	122-0822-00			
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Resistors

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

R1	308-0106-00	1 k Ω	5 W	WW	5%
R2	316-0473-00	47 k Ω	1/4 W		
R3	316-0473-00	47 k Ω	1/4 W		
R5	304-0473-00	47 k Ω	1 W		
R10	316-0150-00	15 Ω	1/4 W		
R11	316-0223-00	22 k Ω	1/4 W		
R12	316-0105-00	1 M Ω	1/4 W		
R13	316-0224-00	220 k Ω	1/4 W		
R14	306-0153-00	15 k Ω	2 W		
R15	316-0222-00	2.2 k Ω	1/4 W		
R16	316-0221-00	220 Ω	1/4 W		
R17	316-0274-00	270 k Ω	1/4 W		
R21	316-0562-00	5.6 k Ω	1/4 W		
R22	316-0105-00	1 M Ω	1/4 W		
R25	316-0223-00	22 k Ω	1/4 W		
R26	316-0562-00	5.6 k Ω	1/4 W		
R27	216-0274-00	270 k Ω	1/4 W		
R31		Selected			
R32		Selected			
R33		Selected			
R34		Selected			
R35		Selected			
R36		Selected			
R37		Selected			
R38		Selected			

Resistors (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
R39 R40	316-0824-00		Selected 820 k Ω	1/4 W

Transistor

Q29	151-0292-00		Silicon	
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Transformer

T1	122-0823-00			
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Switches

SW1	260-0834-00		Toggle	ON-OFF
SW14	122-0821-00		Lever	ACTUATE
SW30	122-0820-00		Rotary	EXPOSURE TIME
K50	122-0878-00			SOLENOID
K50A ¹				

K50B¹

Circuit Boards

122-0818-00	Complete Lower Circuit Board
122-0819-00	Complete Upper Circuit Board

¹See Mechanical Parts List.



SECTION 8

MECHANICAL PARTS LIST

FIG. 1 ELECTRIC SHUTTER (see page 8-5)

Fig & Index No.	Tektronix Part No.	Serial/Model No. Eff	No. Disc	Q					Description
				y	1	2	3	4	
1-	122-0768-00			1					SHUTTER, camera
	- - - - -			-					shutter includes:
-1	122-0801-00			1					PLATE, identification
	- - - - -			-					mounting hardware: (not included w/plate)
-2	122-0784-00			2					SCREW
	- - - - -								
-3	122-0799-00			1					COVER, shutter
	- - - - -			-					mounting hardware: (not included w/cover)
-4	122-0788-00			3					SCREW
	- - - - -								
-5	122-0815-00			1					ACTUATOR, switch
	- - - - -			-					mounting hardware: (not included w/actuator)
-6	122-0781-00			1					SCREW
-7	122-0795-00			1					WASHER, flat
-8	122-0813-00			1					SPRING
	- - - - -								
-9	- - - - -			2					SWITCH
	- - - - -			-					mounting hardware: (not included w/switch)
-10	122-0786-00			2					SCREW
-11	122-0812-00			2					WASHER, flat
	- - - - -								
-12	122-0811-00			1					CLAMP, cable
	- - - - -			-					mounting hardware: (not included w/clamp)
-13	122-0786-00			1					SCREW
	122-0810-00			1					WASHER, flat
	- - - - -								
-14	- - - - -			1					SOLENOID
	- - - - -			-					mounting hardware: (not included w/solenoid)
-15	122-0787-00			3					SCREW
	- - - - -								
-16	122-0806-00			1					LEVER, main
	- - - - -			-					mounting hardware: (not included w/lever)
-17	122-0781-00			1					SCREW
	122-0795-00			1					WASHER, flat
-18	122-0798-00			1					SPRING
-19	122-0809-00			1					PIN
	- - - - -								
-20	122-0816-00			1					LEVER, press focus
-21	122-0814-00			1					SPRING
-22	122-0796-00			1					KNOB
	- - - - -			-					mounting hardware: (not included w/knob)
	122-0784-00			1					SCREW

FIG. 1 ELECTRIC SHUTTER (cont)

Fig & Index No.	Tektronix Part No.	Serial/Model Eff	No. Disc	Q					Description	
				t	y	1	2	3		4
1-23	122-0807-00			1						PLATE, master
	- - - - -			-						mounting hardware: (not included w/plate)
-24	122-0783-00			3						SCREW
-25	122-0805-00			1						RING, shutter
-26	122-0794-00			1						PLATE, ring
	- - - - -			-						mounting hardware: (not included w/plate)
-27	122-0782-00			5						SCREW
-28	122-0803-00			1						CABLE, w/connector
-29	122-0793-00			5						BLADE, shutter
-30	122-0792-00			1						PLATE, diaphragm
	- - - - -			-						mounting hardware: (not included w/plate)
-31	122-0785-00			5						SCREW
-32	122-0791-00			1						PLATE, iris
-33	122-0790-00			10						LEAF, iris
-34	122-0804-00			1						RING, iris
-35	122-0789-00			1						WASHER, flat
-36	122-0800-00			1						CASE, shutter
-37	122-0797-00			1						INDICATOR, iris
	- - - - -			-						mounting hardware: (not included w/indicator)
-38	122-0783-00			1						SCREW
-39	122-0831-00			1						PLATE, scale (Ilex f 1.9)
	122-0832-00			1						PLATE, scale (Ilex f 1.3)
	122-0833-00			1						PLATE, scale (Wollensak f 1.9)
	122-0834-00			1						PLATE, scale (Wollensak f 1.4)
	- - - - -			-						mounting hardware: (not included w/plate)
40	122-0784-00			2						SCREW
41	122-0779-00			1						ADAPTER RING SET, front & rear, use w/Ilex lens
	122-0780-00			1						ADAPTER RING SET, front & rear, use w/Wollensak lens

FIG. 2 SPEEDCOMPUTER (see page 8-6)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Disc	Q t y	1 2 3 4 5					Description
				1	2	3	4	5	
2-	122-0767-02		1						SPEEDCOMPUTER, [®] w/bulb position
	- - - - -		-						speedcomputer includes:
	131-0423-00		1						CONNECTOR, plug, 3 pin
	212-0069-00		2						SCREW, 2-56 x 1/8 inch, PHS
	122-0767-00		1						SPEEDCOMPUTER, [®] w/o bulb position
	122-0767-01		1						SPEEDCOMPUTER, [®] w/bulb position
	- - - - -		-						speedcomputer includes:
-1	122-0826-00		1						KNOB
-2	122-0825-00		1						PANEL, front, w/o bulb position
	122-0825-01		1						PANEL, front, w/bulb position
-3	122-0827-00		1						SUB-PANEL, w/posts
	122-0828-00		1						SUB-PANEL, w/o posts
-4	122-0829-00		2						POST
-5	150-0040-00		1						ASSEMBLY, bulb, neon, w/mounting hardware
-6	260-0834-00		1						SWITCH, ON-OFF
	- - - - -		-						mounting hardware: (not included w/switch)
-7	210-0562-00		2						NUT, hex., 1/4-40 x 5/16 inch
-8	210-0020-00		1						LOCKWASHER, internal, #12
-9	122-0821-00		1						SWITCH—ACTUATE, w/mounting hardware
-10	122-0820-00		1						SWITCH—EXPOSURE TIME, w/mounting hardware
-11	122-0819-00		1						ASSEMBLY, circuit board, front
	- - - - -		-						mounting hardware: (not included w/assembly)
-12	211-0017-00		2						SCREW, 4-40 x 3/4 inch, RHS
-13	150-0041-00		1						ASSEMBLY, bulb, neon, amber, w/mounting hardware
-14	- - - - -		1						TRANSFORMER
	- - - - -		-						mounting hardware: (not included w/transformer)
-15	122-0824-00		1						POST, tapped both ends
-16	210-0004-00		1						LOCKWASHER, internal, #4
-17	210-0408-00		1						NUT, hex., 6-32 x 5/16 inch
-18	210-0202-00		1						LUG, solder, SE #6
-19	211-0541-00		2						SCREW, 6-32 x 1/4 inch, 100° csk, FHS
-20	354-0239-00		1						RING, ornamental
-21	122-0818-00		1						ASSEMBLY, circuit board, rear
	- - - - -		-						mounting hardware: (not included w/assembly)
-22	211-0504-00		3						SCREW, 6-32 x 1/2 inch, THS
-23	122-0830-00		1						BOX
-24	348-0013-00		4						FOOT, rubber, black
-25	212-0069-00		2						SCREW, 8-32 x 1/4 inch, THS
-26	131-0424-00		1						CONNECTOR, 3 pin, female, w/mounting hardware
-27	131-0425-00		1						CONNECTOR, 6 pin, female, w/mounting hardware
-28	122-0822-00		1						SYNC POST
	- - - - -		-						mounting hardware: (not included w/sync post)
-29	210-0405-00		2						NUT, hex., 2-56 x 3/16 inch
-30	210-0001-00		2						LOCKWASHER, internal, #2
-31	210-0259-00		2						LUG, solder, #2
-32	161-0023-00		1						CORD, power, 3 conductor

[®]Registered Trademark Ilex Optical Co.

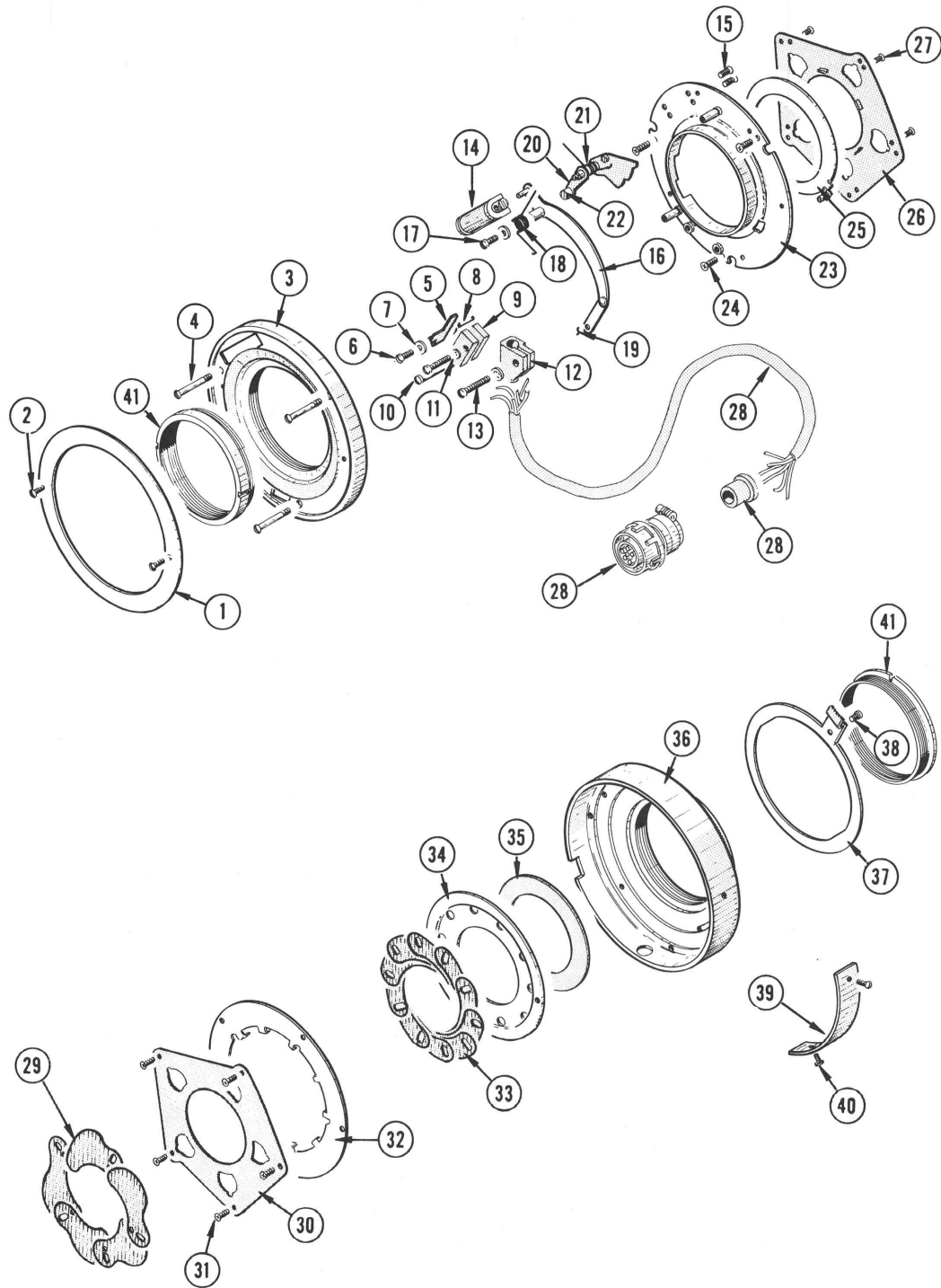


Fig. 1 No. 3 Electric Shutter

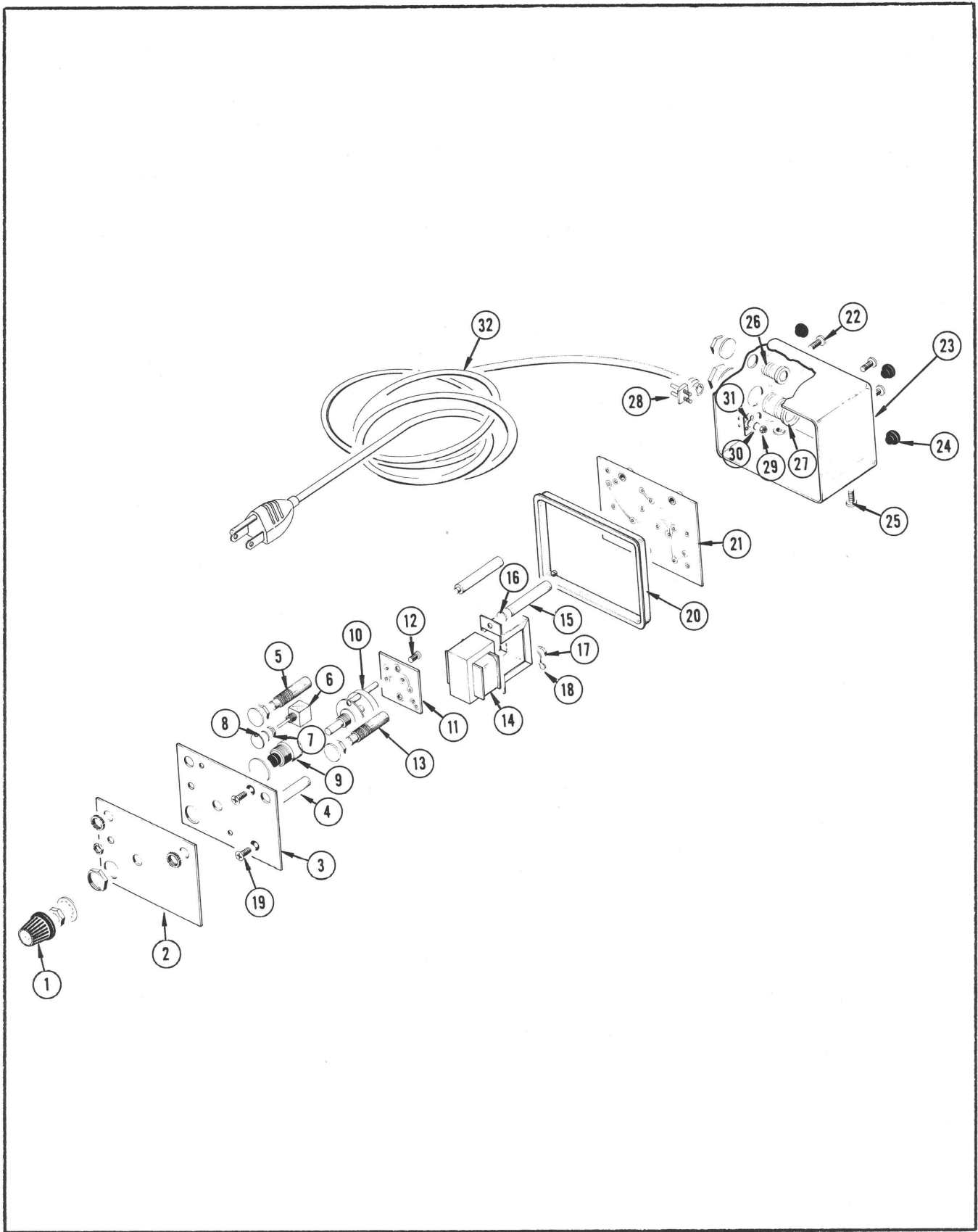
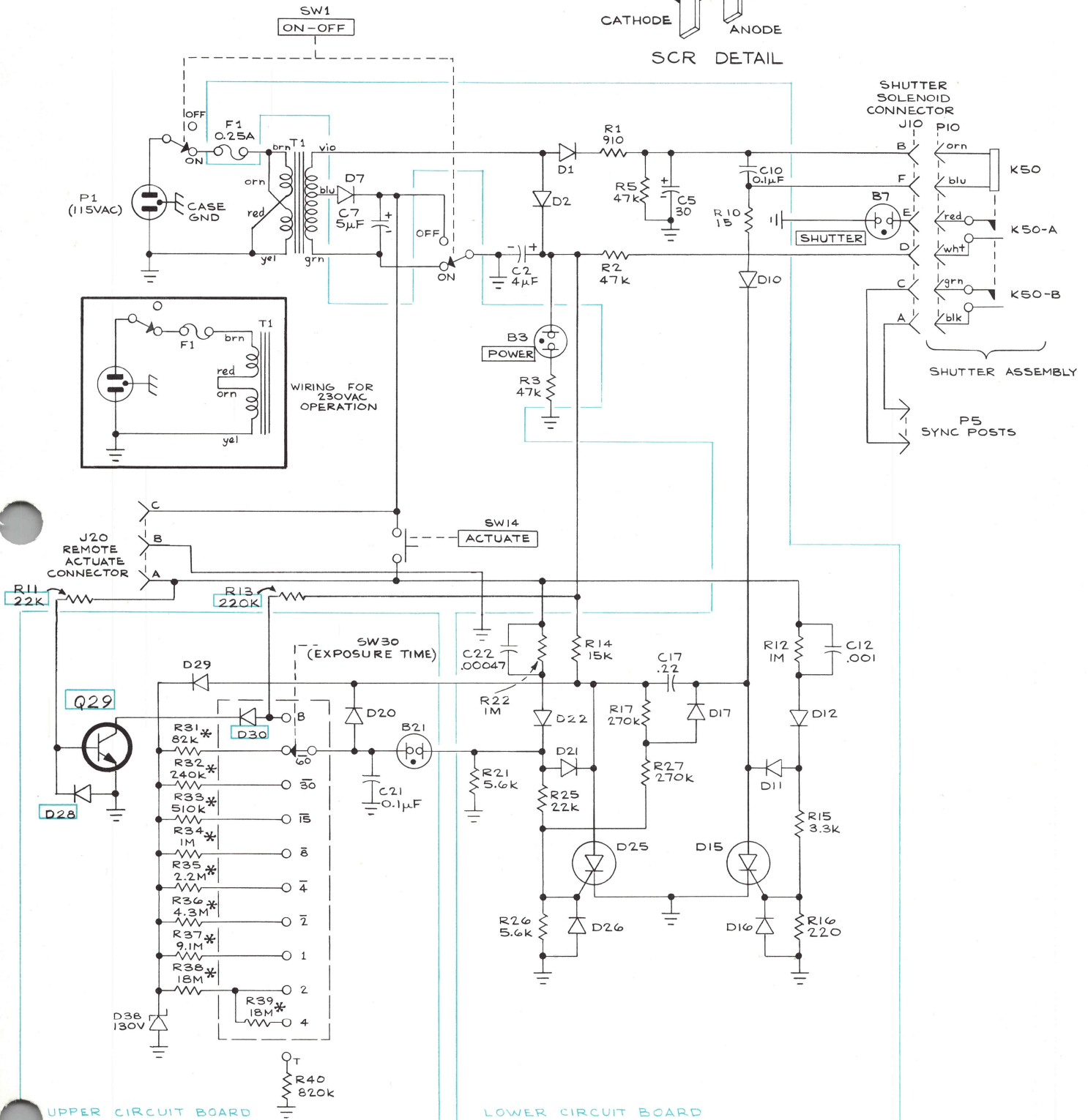
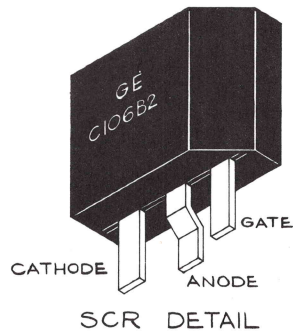


Fig. 2 Speedcomputer



* DENOTES SELECTED PART

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

0370
SPEEDCOMPUTER

