INSTRUCTION MANUAL

Serial Number 6458

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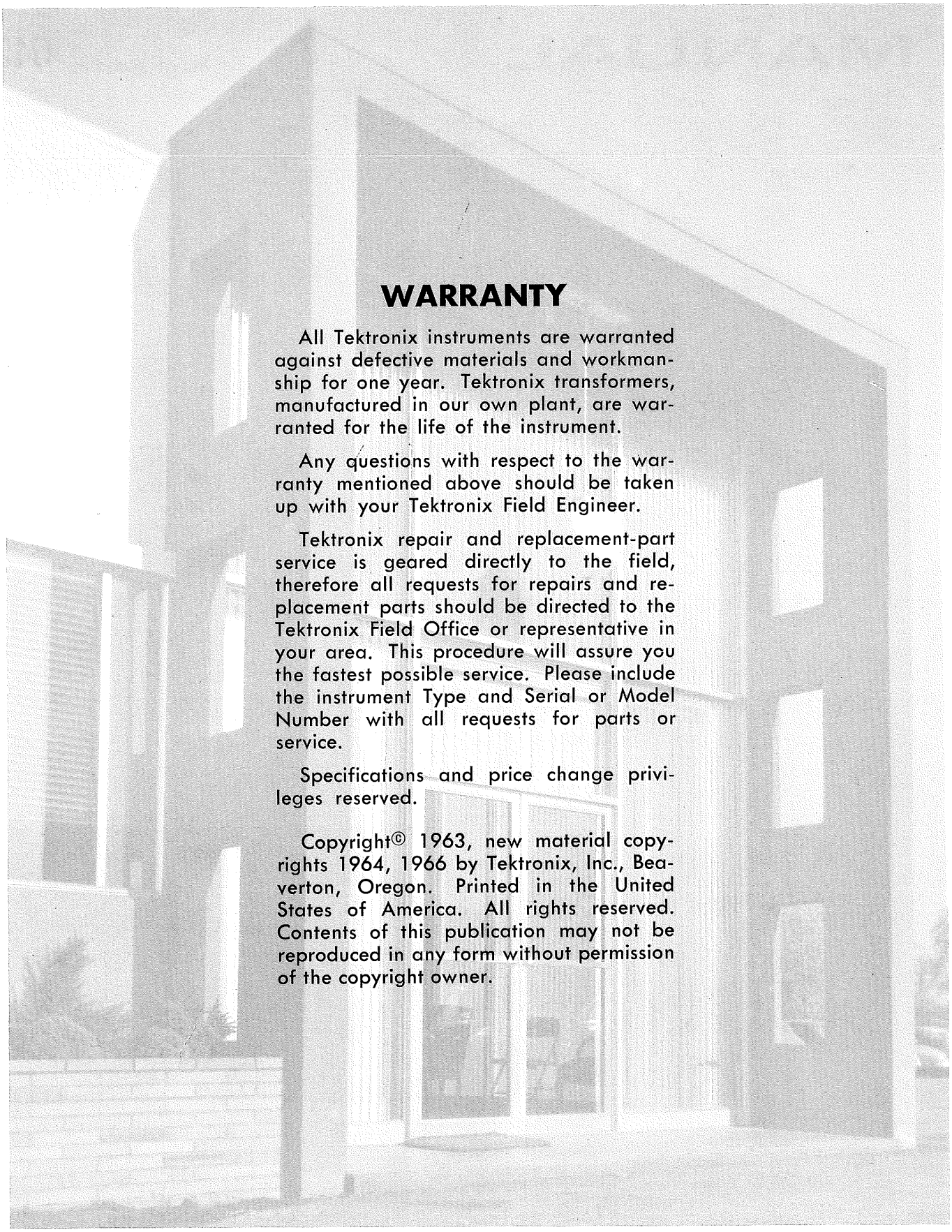


WARRANTY

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

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

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

Specifications and price change privileges reserved.

CONTENTS

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.

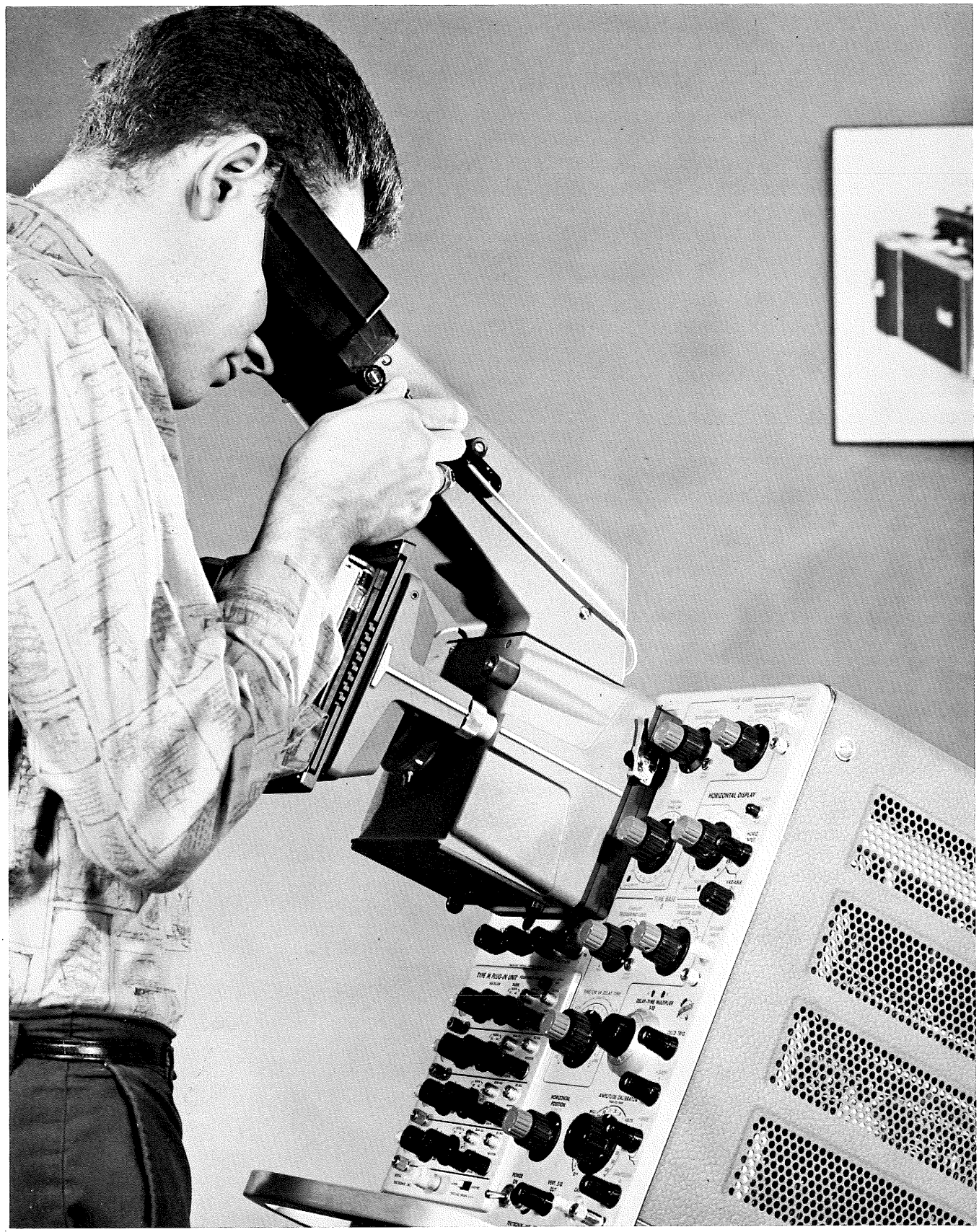


Fig. 1-1. Using a Tektronix Camera System with a Tektronix Oscilloscope.

SECTION 1
CHARACTERISTICS

General Description

Tektronix cameras have been specifically designed for photographing oscilloscope displays. The optical system of the camera permits displays to be simultaneously viewed and photographed. Photographs are made directly from the oscilloscope screen so the image is not reversed. The viewed image is undistorted and is also not reversed.

The cameras provide many new convenience features. Lift-on mounting is used so that the camera can easily be mounted or removed. Swing-away hinges allow the camera to be swung out of the way when not in use. The viewing hood on the C-12, C-19 and C-27 provides comfortable viewing with or without glasses. The rotating slide adapter allows any of the parfocal film-holding backs used with it to be locked in any of nine detented positions. All camera backs can also be rotated in 90-degree increments so that the long axis of the film will be parallel or perpendicular to the trace, as desired.

Several interchangeable lenses can be used with the camera when a rear casting is used. The wide range of object-to-image ratios and maximum apertures permit you to select the lens which is just right for your application.

Parfocal backs which can be used with the camera allow you to make photographs on Polaroid[1] Land or conventional film, in either sheet or roll film forms.

MAIN FRAMES

Information applicable to all Main Frames

Focusing

Focusing to compensate for slight differences between oscilloscopes is accomplished by means of a Focus knob on the main camera frame. Once the Focus knob has been set it may be locked in position with the Focus knob lock. This will prevent accidentally changing the focus of the camera.

Mounting (C-12, C-13 and C-19)

Graticule covers are available for mounting the camera on Tektronix 5-inch oscilloscopes. The special graticule covers have a hinged fitting to support the camera. The hinged fitting allows the camera to be easily swung in or out of the operating position.

Mounting (C-27)

Graticule covers are available for mounting the camera on all Tektronix oscilloscopes except those with three-inch CRTs. Graticule covers are also available to fit the camera to most Hewlett-Packard and DuMont oscilloscopes. All the graticule covers have hinged fittings to allow the camera to be easily swung in or out of the operating position. The camera may also be lifted completely off the graticule cover when desired.

[1]Registered trademark of the Polaroid Corporation.

C-12 (122-0635-00)

Optical System

Photographs are taken directly from the oscilloscope screen through a beam-splitting mirror. There is a two-mirror system for observation of the oscilloscope display with minimum parallax between viewed and photographed displays. Maximum CRT area which can be viewed and photographed: 8 cm vertical; 10 cm horizontal.

Transmission Characteristics of Beam-Splitting Mirror: Transmission of light through beam-splitting mirror to camera lens is nearly constant at approximately 65% for all visible light frequencies.

Viewing Hood

The viewing hood can be used by persons with or without glasses.

Size

Approximately 12 inches high, 14 inches deep, and 7 inches wide. (Measurements taken without viewing hood or bezel.)

C-13 (122-0609-00)

Optional System

Photographs taken directly from oscilloscope screen with no reversal. Maximum CRT area which can be photographed: 8 cm vertical; 10 cm horizontal.

Viewing

The viewing door may be opened for direct viewing of the waveform.

Size

Approximately 7 inches high, 8 inches deep, and 7 inches wide. (Measurements taken without bezel.)

C-19 (122-0636-00)

Optical System

Photographs taken directly from oscilloscope screen (no beam-splitting mirror is used). Two-mirror system is used for observation of the oscilloscope display. Maximum CRT area which can be photographed: 8 cm vertical; 10 cm horizontal. Maximum CRT area which can be seen through viewing hood: 5 cm vertical; 10 cm horizontal.

Viewing Hood

The viewing hood can be used by persons with or without glasses.

Size

Approximately 12 inches high, 14 inches deep, and 7 inches wide. (Measurements taken without viewing hood or bezel.)

C-27 (122-0676-00)

Optical System

Photographs taken directly from oscilloscope screen (no beam-splitting mirror is used). Parallax type viewing is used for observation. Maximum CRT area which can be photographed: 10 cm vertical; 10 cm horizontal. Maximum area which can be seen through viewing hood: 7 cm vertical; 10 cm horizontal. The Main Frame can be attached to the oscilloscope in any of four directions: viewing hood on top (0°), bottom (180°), left (270°) and right side (90°).

Viewing Hood

The viewing hood can be used by persons with or without glasses.

The viewing hood and tunnel section may be slipped off the Main Frame if desired. The viewing door in the Main Frame keeps the camera light-tight.

TABLE 1-1

Lens Stock No.	Type	Max. Aperture	Object-to-Image Ratio	Shutter
122-0547-00	Oscillo-Raptar	f/1.9	1:0.7	Alphax No.3, Pi Alphax No. 3 or Ilex (Elgeet) No. 3× Universal
[2]122-0550-00	Oscillo-Amaton	f/4.5	1:0.7	Alphax No. 1
122-0549-00	Oscillo-Raptar	f/1.9	1:0.5	Alphax No.3, Pi Alphax No. 3 or Ilex (Elgeet) No. 3× Universal
122-0608-00	Oscillo-Raptar	f/1.4	1:1	Alphax No. 3
122-0548-00	Oscillo-Navitar	f/1.9	1:0.9	Alphax No.3, Pi Alphax No. 3 or Ilex (Elgeet) No. 3× Universal
122-0662-00	Oscillo-Navitar	f/1.3	1:0.5	Ilex No. 3×
122-0692-00	Oscillo-Navitar	f/1.9	1:0.85	Alphax No.3, Pi Alphax No. 3 or Ilex (Elgeet) No. 3× Universal

[2]**Shutter Actuator Model 1 cannot be adapted to Alphax No. 1 shutter.**

Size

Approximately 7⅞ inches high, 7¼ inches deep, and 7¼ inches wide. (Measurements taken without viewing hood and tunnel or bezel.)

LENSES (see Table 1-1)

Lens and Shutter Settings

Both lens and shutter settings can be made from the side of the camera without removing or unlatching the camera from the oscilloscope.

Shutter Speeds

Alphax No. 1 Shutter—(T), (B), 1/10, 1/25, 1/50, 1/100, and 1/200. × Synchronization.

Alphax No. 3 Shutter—(T), (B), 1, 1/2, 1/5, 1/10, 1/25, 1/50 and 1/100. × Synchronization.

Pi Alphax No. 3 Shutter—(T), (B), 1, 1/2, 1/5, 1/10, 1/25 and 1/50 × Synchronization.

Ilex (Elgeet) No. 3× Universal Shutter—(T), (B), 1, 1/2, 1/5, 1/10, 1/25, 1/50 and 1/100. × Synchronization.

REAR FRAMES and ROTATING SLIDE ADAPTER

Standard (122-0591-00)

The Rear Frame is used with the rotating slide adapter (122-0739-00 or 122-0602-00) to allow the camera backs to be mounted. This combination allows any of the standard camera backs, except the Type 350, to be rotated in 90-degree steps. The long axis of the film can be either parallel or perpendicular to the trace.

The nine indentations of the standard camera backs permit the camera back to slide to any of nine positions. The position of the camera back is indicated by the number on the rotating slide adapter.

The Rear Frame and rotating slide adapter are not needed if a Type 350 Camera Attachment is to be used.

Power Supply Frame (016-0231-00)

The Power Supply Frame is used with the rotating slide adapter (122-0739-00 or 122-0602-00) to allow the camera backs to be mounted. This combination allows any of the standard camera backs, except the Type 350, to be rotated in 90-degree steps. The long axis of the film can be either parallel or perpendicular to the trace.

The nine indentations on the standard camera backs permit the camera back to slide to any of nine positions. The position of the camera back is indicated by the number on the rotating slide adapter.

The Power Supply Frame and rotating slide adapter are not needed if a Type 350 Camera Attachment is to be used.

CAMERA BACKS

Polaroid Land Roll Film Camera Back (122-0603-00)

Prints or transparencies in black and white or color may be obtained from a roll of film. Picture size in most cases is 3¼ × 4¼. Only Polaroid Land roll film can be used with this back.

Polaroid Land Pack Film Camera Back (122-0671-00)

Black-and-white or color film is available for the pack film back. Picture size is 3¼ × 4¼. 100-Series Polaroid Land film packs should be used with this camera back.

Graflok (122-0604-00)

Any type of film holder which will attach to the Graflok back can be used. The various attachments available will allow sheet or roll film of conventional or Polariod Land types to be used. Maximum image size available is 4 × 5 inches.

Graflok (016-0233-00)

Any type of film holder which will attach to the Graflok back can be used. The various attachments available will allow sheet or roll film of conventional or Polariod Land types to be used. Maximum image size available is 2¼ × 3¼ inches.

350 Camera Attachment (122-0630-00)

The Type 350 Camera Attachment (35-mm camera assembly) will mount on any of the Main Frame Assemblies (viewing assemblies). Standard 35-mm film cassettes will fit the film-supply holder. In normal operation film is taken up on an open spool, and, after exposure, is rewound into the orginal cassette before removal. However, film can be taken up in a closed NR type cassette for removal without rewinding.

The Type 350 will accept either standard 20 or 36 exposure films, or cassettes may be bulk loaded.

The Type 350 produces a 20 × 20 mm image for each exposure; therefore, it is possible to obtain approximately 30 exposures on a 20 exposure roll and approximately 55 exposures on a 36 exposure roll. Do not attempt more than 34 exposures on a 20 exposure roll nor more than 58 exposures on a 36 exposure roll.

The automatic advance feature of the Type 350 Camera Attachment will allow a sequence of pictures to be taken with no break needed to advance the film to each new frame. The spring motor automatically advances the film one frame each time the SHUTTER RELEASE lever is depressed. A full winding of the spring motor will transport approximately twenty to thirty-five frame advances. The exact number of frames transported by the fully wound motor varies because of differences in cassette design among film manufacturers.

ACCESSORIES

Projected Graticule (016-0204-00)

The Projected Graticule can be used only with the C-12 or C-13 Main Frames. The Projected Graticule eliminates the parallax problems which exist between the trace and the external graticule. If the Projected Graticule is used with the C-13, a beam-splitting mirror must be added to the Main Frame. Your local Tektronix Field Engineer can assist you in obtaining this modification.

BEZELS

Main Frame	Stock Number	Oscilloscope Style
C-12 C-13 C-19	016-0226-00	For oscilloscopes having 5-inch round CRT's.
C-12 C-13 C-19	016-0217-00	For oscilloscopes having 5-inch rectangular CRT's (560-Series).[3]
C-12 C-13 C-19	016-0229-00	For some models of Hewlett-Packard oscilloscopes. See your local Tektronix Field Engineer or representative.
C-12 C-13 C-19	016-0239-00	For Tektronix, Inc. Type 519 Oscilloscopes.[3]
C-27	016-0225-00	For oscilloscopes having 5-inch round CRT's.
C-27	016-0224-00	For oscilloscopes with 5-inch rectangular CRT's with 8 × 10 cm graticules. Will also fit some TV oscilloscopes.[3]
C-27	016-0223-00	For oscilloscopes with 5-inch rectangular CRT's with 6 × 10 cm graticules.
C-27	016-0227-00	For some models of DuMont oscilloscopes. See your local Tektronix Field Engineer or representative.
C-27	016-0240-00	For Tektronix, Inc. Type 519 Oscilloscopes.[4]
C-27	016-0249-00	For Tektronix Type 601, 602 Display Units and Type 528 Waveform Monitor.

[3]Will not fit the Type 565 and RM565 oscilloscopes. For these oscilloscopes use: C-12, C-13, C-19,—Tektronix Part No. 016-0226-00; C-27—Tektronix Part No. 016-0225-00.

[4]The Type 519 comes equipped with this bezel.

The Projected Graticule is designed so the graticule film may be changed quickly. The graticule film used may be one purchased from Tektronix or one made by you. See the Optional Accessories list for additional types of graticule films.

Some of the graticule films available for the projected graticule have clear strips above and below the graticule image. These clear strips permit you to write data about the waveform on a strip of translucent paper and insert it along with the graticule film into the graticule slide. Clamps in the graticule slide will hold the strip of translucent paper in place over the clear spaces. The exposures made will show both the waveform and the data which has been written on the translucent strip of paper.

External Voltage Output

An maximum output of 6 VAC at 0.08 A is available from the phone jack on the right side of the unit. The actual voltage available at the phone jack depends on the setting of the GRATICULE BRIGHTNESS control.

Power Requirements

Line Voltage—Normally 117 volts, 50-60 hertz. Can be obtained for 234-volt, 50-60 hertz operation.

Power—Nominally 5 watts at 117 volts, 60 hertz line.

Fuse—1/10 A slow-blowing type for 117 volts. 1/16 A slow-blowing type for 234 volts.

Mechanical Characteristics

Finish—Anodized front panel. The die cast power-supply box is finished in blue vinyl with black trim.

Dimensions—See Fig. 1-2.

Weight—4¼ pounds.

Shutter Actuator Model 1 (Non-holding Type 016-0205-00)

The Shutter Actuator Model 1 is a solenoid-operated shutter release for use with the camera system. The solenoid actuates the camera shutter approximately 15 to 20 milliseconds after a manually impressed pulse is initiated from the Shutter Actuator Power Supply.

The Shutter Actuator unit permits remote shutter release of one oscilloscope camera, or simultaneous shutter release of several oscilloscope cameras, by paralleling the complete Shutter Actuator units or by paralleling solenoids so they operate off a single power supply. It may also be used with time-delay or time-lapse equipment for photographing time-related phenomena.

The operation of the Shutter Actuator unit compares to a standard shutter release cable press and release action. A single depression of the MANUAL TRIGGER switch, on the power supply, opens or closes the shutter on the (T) setting; and momentarily trips the shutter in all other speed settings.

Shutters

Will operate with Alphax No. 3, Ilex (Elgeet) No. 3× Universal, or Alphax No. 4 shutters only.

Time Lapse

Approximately 15-20 milliseconds between pulse initiation and shutter release.

Recovery Time

Approximately two seconds between pulses.

Power Requirements

Operates on either 117 V or 234 V, 50- or 60-hertz line voltage. Depending upon the line voltage and the shutter to be operated, one power supply can operate several solenoids (refer to Table 1-2 below).

TABLE 1-2

Shutter Type	Line Voltage			
	130 260	120 240	110 220	100 200
Alphax 3	7	6	5	4
Ilex (Elgeet) No. 3× Universal	5	4	3	2
Alphax 4	5	4	3	2

Shutter Actuator Model 2 or 3 (Holding Type)

The Shutter Actuator System Model 2 or 3 is a rotary solenoid-operated shutter release control. The Shutter Actuator has been designed to be used with the Tektronix Camera Systems.

The Shutter Actuator System permits electrical triggering of the camera shutter. It can also be used to trip more than one camera shutter simultaneously, through the use of more than one Shutter Actuator System tied to the same remote switching control.

The power supply is available in two different types of housing, a Rear Frame housing and a separate small box style. The Rear Frame housing is intended to mount in place of the normal Rear Frame of the Tektronix Camera System. Since the Rear Frame type power supply is not easily moved from one camera to another, a box style power supply is available which can be easily attached to the camera back, by using the power-supply mounting bracket (Tektronix Part No. 122-0713-00), or the power supply may be set on an object near the camera.

The same Shutter Actuator solenoid is used with either style power supply.

Power Requirements

Power supply

Line Voltage—115 (230) volts, 50 to 400 hertz, or 115 (230) VDC.

Fuse—½A (0.3 A) slow-blowing type.

Shutter Actuator

Input Voltage—115 (230) VDC

Peak Current—1 (½) A

Holding Current—0.13 (0.067) A

System Delay

The length of time for the shutter to become fully open after the MOMENTARY-OFF-MAINTAIN switch has been operated is approximately 20 to 25 milliseconds, depending upon the type of shutter used.

Mechanical Characteristics

Power Supply

Power Supply Frame

Finish—Die-cast Rear Frame is finished in textured blue vinyl paint. The two control panels are anodized aluminum.

Dimensions—6⅜ inches long × 8½ inches wide × 3⅝ inches deep.

Power Supply Model 2 or 3

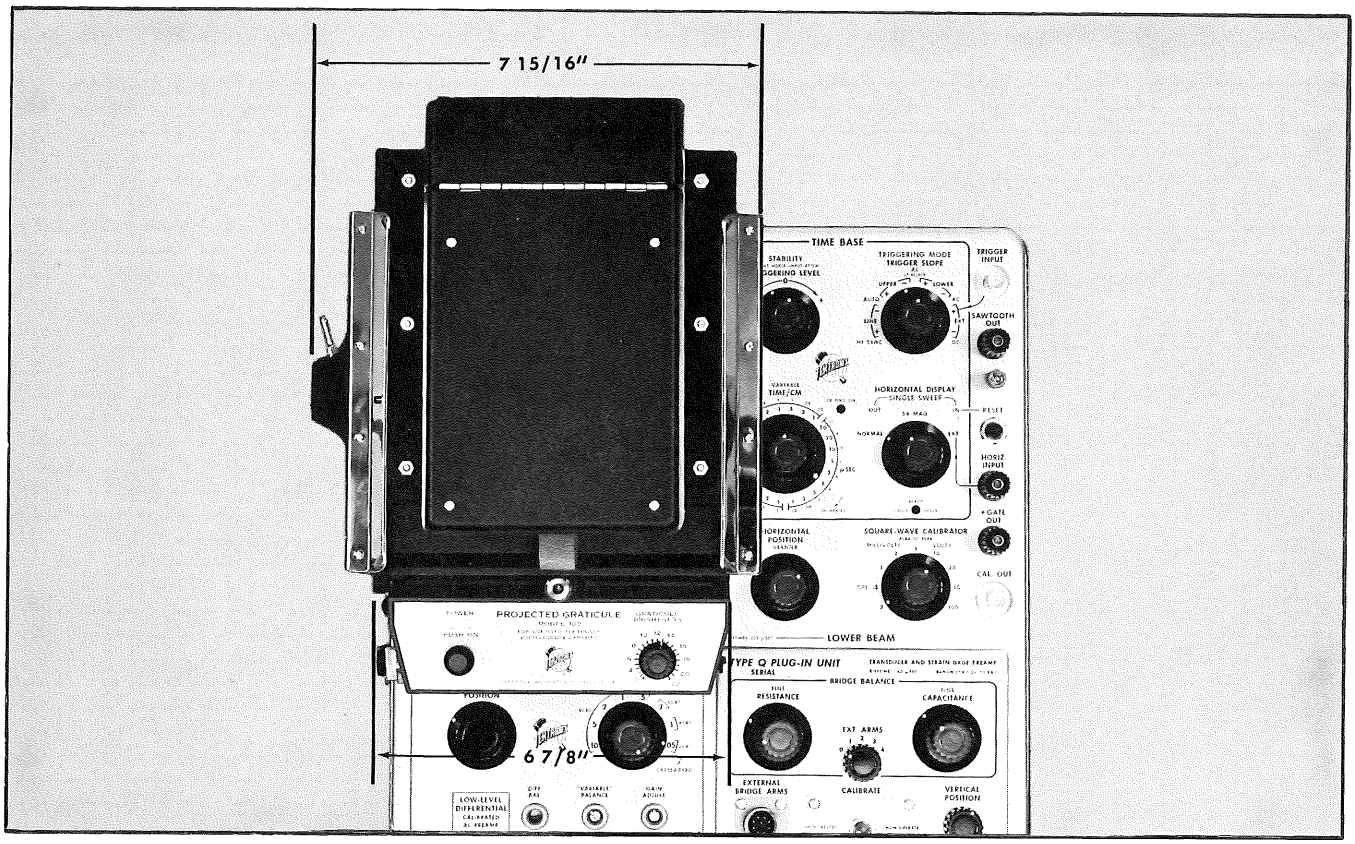
Finish—Aluminum box is finished in textured black vinyl paint. The front panel is anodized aluminum.

Dimensions—4 1/16 inches long × 3 1/16 inches wide × 3⅛ inches deep.

Shutter Actuator Solenoid

Finish—Die-cast case is finished in black. The name plate is anodized aluminum.

Dimensions—2½ inches long × 2 1/16 inches wide × 1¾ inches deep.



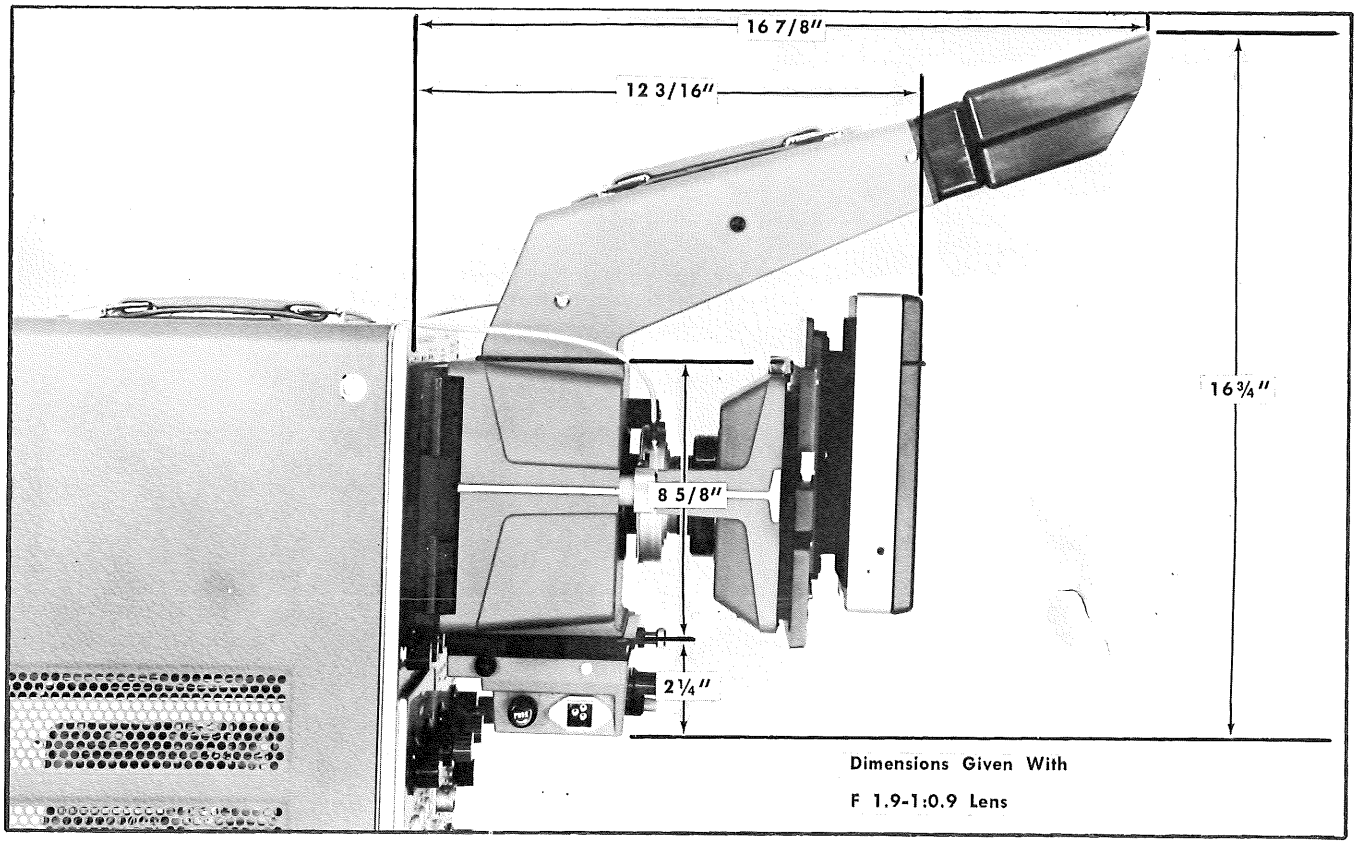


Fig. 1-2. Dimensions of a typical camera system.

NOTES

SECTION 2

OPERATING INSTRUCTIONS

MAIN FRAME

Mounting the Camera (refer below and to Bezel information later in this section for special cases)

A special mount (bezel) is used to attach the camera to the oscilloscope. The bezel takes the place of the normal graticule cover on the oscilloscope.

To mount the camera, first remove the graticule cover from the oscilloscope by unscrewing the four knurled nuts. For most photographic work it is recommended that any light filters also be removed.

Check the oscilloscope external graticule or CRT protector plate for scratches and be sure that it is clean. Place the external graticule on the graticule studs so that the scribed size is toward the CRT and the clear illumination slots are up.

Remove the bezel from its package and place it on the graticule studs. Use the four graticule nuts supplied to attach the bezel to the oscilloscope. The new graticule nuts are slotted so that a screwdriver or coin can be used to tighten them. Make certain that the hinge fittings of the bezel for the C-12, C-13 and C-19 are to the left. The camera can now be put in place by engaging the hinge pins on the camera frame with the hinge fitting on the bezel. The camera can be removed at any time by simply lifting it off the bezel. The hinge system permits the camera to be moved against the oscilloscope screen or swung away.

The Mounting Latch on the camera frame is used to lock the camera to the bezel. Before rastening the Mounting Latch, be sure to remove the plastic dust cover from the opening at the front of the camera body. Then swing the camera against the bezel and lock it by raising the Mounting Latch until snug.

Special Mounting Information

C-12, C-13 and C-19

The Type 519 Oscilloscope comes equipped with a C-12, C-13, C-19 type camera mount which will accept the hinge pins on the Main Frame. The graticule assembly of the Type 519 cannot be properly fitted into any normal bezel for the cameras.

C-27

To stack the C-27 Main Frame on stacked rackmount oscilloscopes, with 7 inch high front panels, it is necessary to face the viewing hood to the right. If the rackmount oscilloscopes are not mounted closely together, the mounting position of the C-27 Main Frame is not critical.

To change the mounting position of the C-27 it is necessary to reposition the frame support bracket. To do this, remove the four button-head screws from the outer corners of the Main Frame. Grasp the hinge pins and Mounting Latch and carefully work the frame support bracket loose from the remainder of the Main Frame Rotate the frame support bracket to its new position and gently push it into the Main Frame of the C-27. Push it into the Main Frame until the frame support bracket is firmly against the remainer of the Main Frame. If the frame support bracket will not go completely into the Main Frame, check to see that the Mounting Latch assembly and hinge pins are lined up with the proper cutouts in the Main Frame casting. If the Mounting Latch assembly and hinge pins do not line up with the cutouts, it is likely that the frame support bracket has been turned over.

After installing the frame support bracket into the Main Frame, reinstall the four button-head screws into the holes near the outer corners of the frame support bracket and tighten securely. Before mounting the C-27 Main Frame onto the bezel, check to see that the three D-shaped (light seals) pieces of foam plastic in the Main Frame have not been moved out of position. If they have been disturbed they can be stuck back into position with a small amount of rubber cement.

Mounting C-27 016-0249-00 Bezel

Slide the camera bezel down over the instrument bezel until the rib on the upper inner part of the camera bezel engages the groove on the top of the instrument bezel. When the camera bezel and the instrument bezel are engaged push the bottom of the camera bezel in toward the instrument until the clock is heard, indicating that the bottom latch of the camera bezel has engaged the instrument bezel. Check that the camera is firmly attached by pulling on it gently after it is mounted.

To remove the 016-0249-00 bezel, lift out on the plastic latch lever at the bottom of the camera bezel while pulling out slightly on the bottom of the bezel. Slide the camera bezel up until it is free of the oscilloscope.

The camera can now be put in place by engaging the hinge pins on the camera frame with the hinge fitting on the camera bezel. The camera can be removed at any time by simple lifting it off the camera bezel. The hinge system permits the camera to be moved against the oscilloscope screen or swung away.

Using the Viewing Hood of the C-12 and C-19

The viewing system uses a two-mirror system which allows you to view the oscilloscope display at a right angle to the display. This is the same view the camera Lens sees, so there is a minimum of parallax between the observed and photographed display.

The viewing hood allows persons either with or without glasses to observe the display. When the viewing tunnel is not being used, the viewing door should be closed to prevent light from entering. If the door is left open, a reflection of the open door may appear on the photograph. When you are observing the trace, light will be sealed out if your face is pressed against the rubber of the shield.

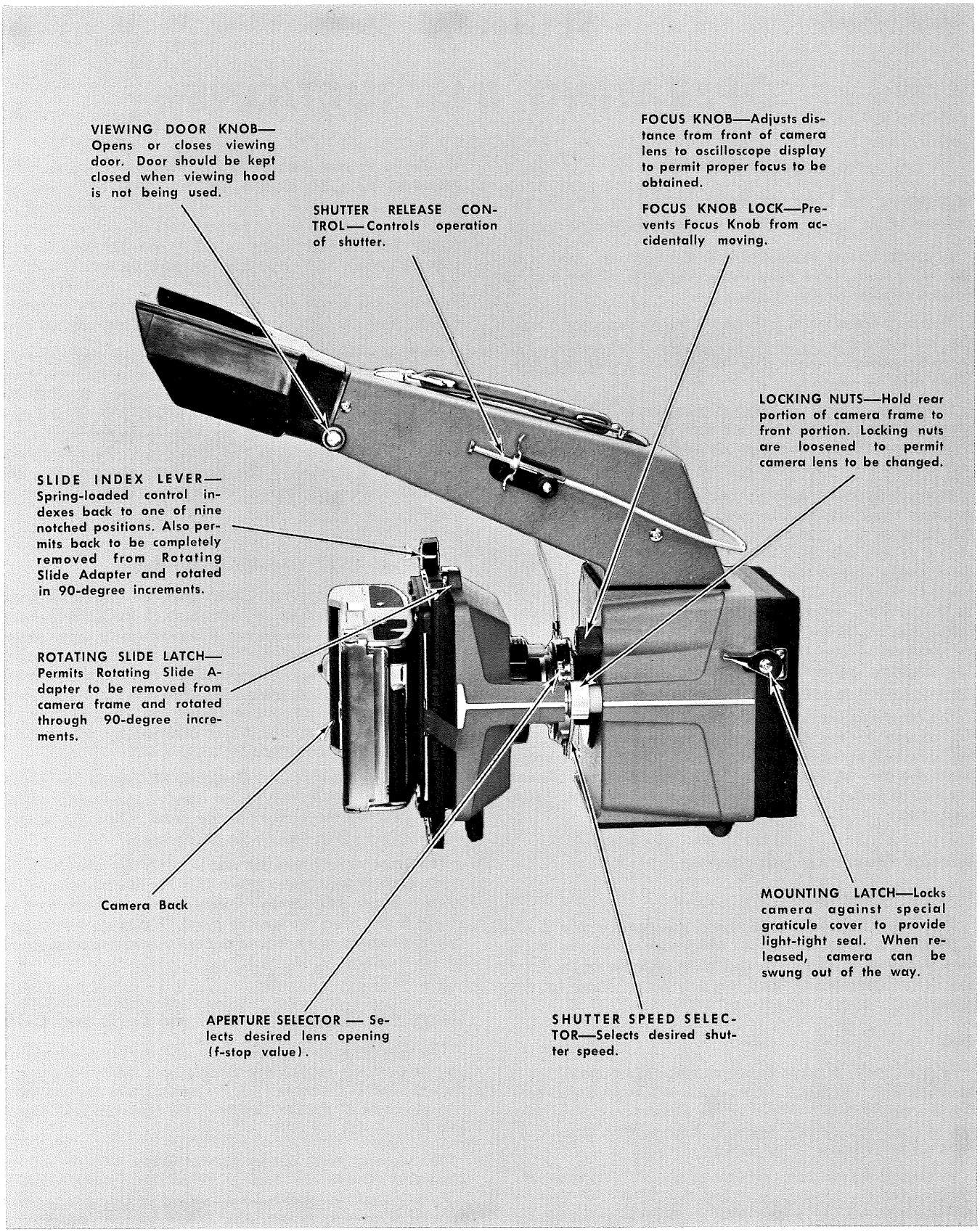


Fig. 2-1. Camera System operating controls and their functions.

Using the Viewing Hood of the C-13

The C-13 has a door on the top of the Main Frame which allows a 6 × 10 cm area of the CRT to be viewed. When the viewing door is not being used it should be closed to prevent light from entering.

Using the Viewing Hood of the C-27

The C-27 uses a parallax type viewing system which allows a 7 × 10 cm area of the CRT to be viewed. The viewing tunnel and hood may be removed from the Main Frame and the knurled nut on the handle assembly loosened to allow the handle to be folded down to provide a smaller camera.

The viewing hood can be used by persons with or without glasses. The viewing door should be closed when not viewing a display. If the door is left open or not adequately covered, a reflection of the open door may appear on the photograph.

LENSES

Adjusting the Lens Aperture

The APERTURE selector (see Fig. 2-1) is used to select the Lens opening. The dial is calibrated in f-stop numbers with a small pointer to indicate the settings.

The Lens setting to be used for a particular picture depends on several factors. Whenever possible, use of f-stop numbers lower than f/4 should be avoided. As in all cameras, the best depth of field is obtained at the smallest openings (largest f-stop numbers). This is important in all oscilloscope cameras because the trace and graticule cannot simultaneously be brought into focus when the f-stop number is lower than f/4. In applications where it is necessary to use the Lens wide open, special techniques can be used to obtain a satisfactory picture with both the trace and graticule in focus. These techniques are described in Section 4 of this manual. A Projected Graticule attachment is available which will produce a virtual image of the graticule in the same plane as the trace. This makes it possible to obtain proper focus of both the trace and the graticule at the widest Lens openings.

Additional information on selecting Lens openings for particular applications is given in the Photographic Techniques section of this manual.

Selecting the Shutter Speed

The camera shutter speed is selected by means of the SHUTTER SPEED selector (see Fig. 2-1). Numbers shown on the SHUTTER SPEED selector are actually the reciprocals of the shutter speeds. For example, when the SHUTTER SPEED selector is set at 25, the shutter is open 1/25 second. As with the aperture setting, many factors determine the shutter speed used for a particular picture. Care must be taken that the right combination of Lens opening and shutter speed is choosen so that the desired results may be obtained. More information on selecting the shutter speed is contained in the Photographic Techniques section of this manual.

Releasing the Shutter

The SHUTTER RELEASE control is located on the right side of the camera in a special holder. When the SHUTTER RELEASE control is pressed, the shutter mechanism is actuated.

In all positions of the SHUTTER SPEED selector except (T) and (B), the shutter mechanism operates independently of the time that the SHUTTER RELEASE control is held in. In the (B) position of the SHUTTER SPEED selector, the shutter remains open as long as the SHUTTER RELEASE control is held down. When the control is released, the shutter closes. In the (T) position of the SHUTTER SPEED selector, the shutter is opened the first time the control is pressed. It is then necessary to press the SHUTTER RELEASE control a second time in order to close the shutter.

The shutter can also be operated without using the cable release by using the lever at the left side of the Lens assembly. The lever is raised to actuate the shutter mechanism.

CAUTION

Do not attempt to force the SHUTTER RELEASE lever. When the SHUTTER SPEED selector is set at (T), the release lever will not return to the closed position the first time the lever is actuated. Attempting to force the lever to the closed position will damage the shutter mechanism. Raise the lever a second time to close the shutter.

Changing Lenses

Several Lenses can be used with the camera All except the Elgeet type can be changed by following the procedure outlined below: (See Fig. 2-2.)

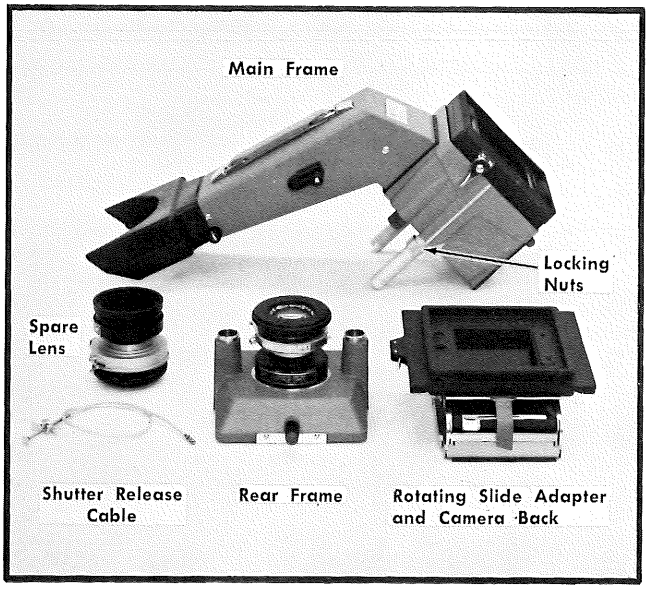


Fig. 2-2. Components described in changing the screw-in style of lens.

1. Install the dark slide in the camera back.
2. Disconnect the cable release from the Lens assembly.
3. Simultaneously, unscrew the locking nuts holding the rear and front portions of the camera frame together
4. Remove the rear portion of the camera frame and unscrew the Lens assembly.
5. After checking the new Lens for cleanliness, screw it into place on the frame and reverse the above procedure to complete re-assembly.

6. Adjust the locking nuts so the front of the Lens seats against the rear of the camera frame. Do not excessively tighten the locking nuts, as it may impair shutter operation. After changing Lenses, minor re-focusing of the camera may be necessary.

Special Information for Elgeet Lenses

Fig. 2-3 shows details of installation of an Elgeet Lens.

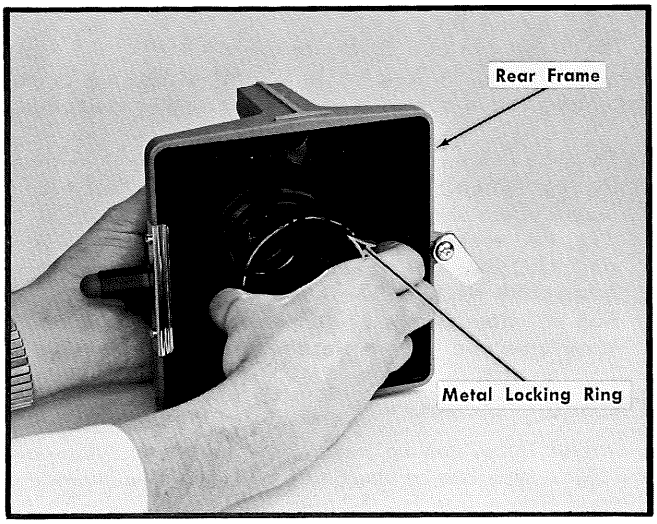


Fig. 2-3. Removing the metal locking ring from an Elgeet Lens.

In changing Elgeet Lenses, after installing the dark slide in the camera back, the rotating slide adapter must be removed. This is done by lifting the rotating slide lever and lifting out the slide adapter assembly.

After removing the rear of the camera frame as previously explained, reach in through the back of the Rear Frame and unscrew the metal locking ring which holds the Elgeet Lens in place. Once the locking ring has been removed, the Lens assembly can be lifted out from the back.

To install the new Lens assembly, the above procedure should be reversed. The metal locking ring should be screwed hand tight after the Lens assembly is seated in place.

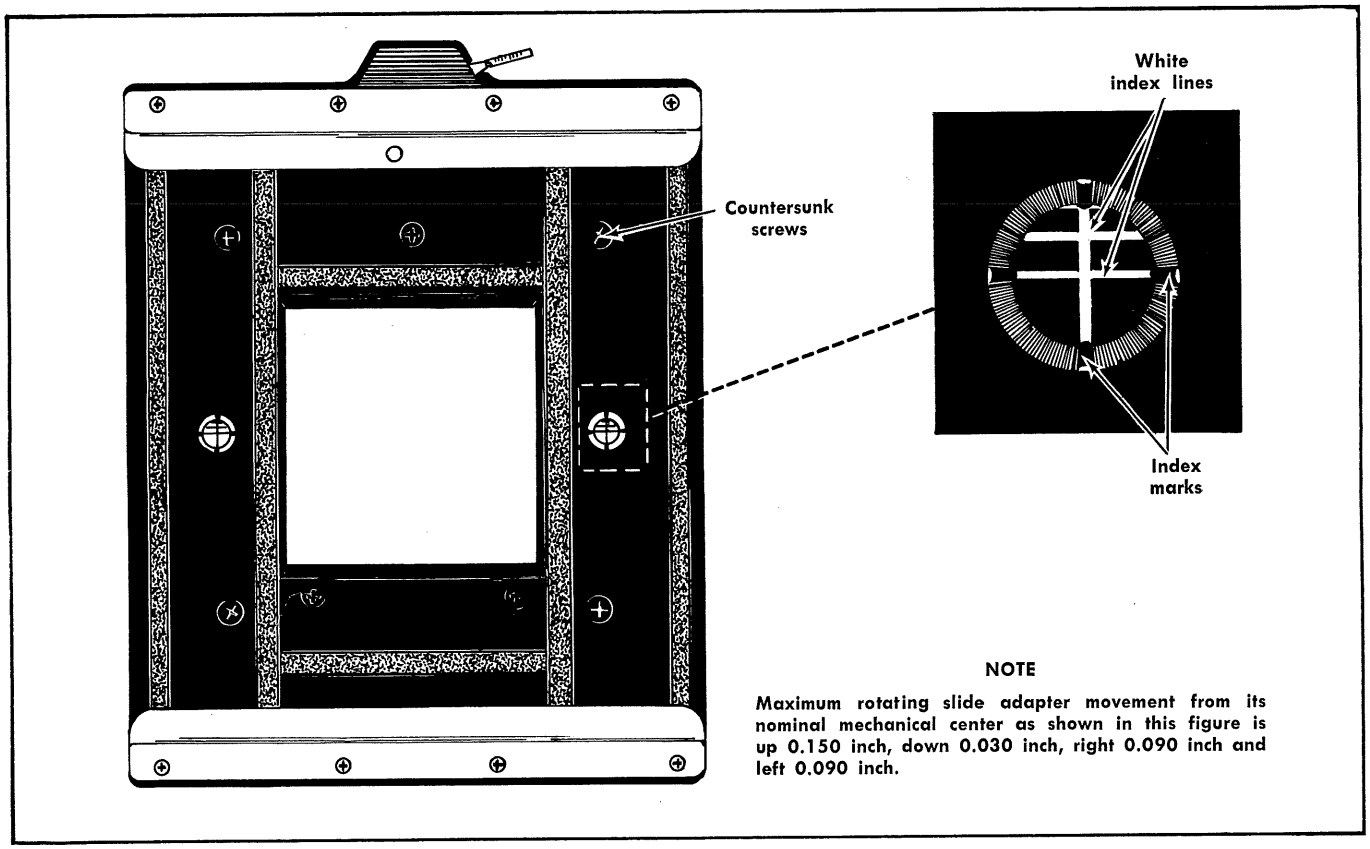
Again, minor re-focusing may be necessary after installation of the Elgeet Lens.

REAR FRAME

Standard and Power Supply Frame

Mounting

Install the desired Lens into the Rear Frame. Screw the locking nuts toward the Main Frame until the Rear Frame will slide onto the supports far enough for the Lens to be snug against the Main Frame. Tighten the two locking nuts onto the Rear Frame simultaneously until they are finger tight. If the locking nuts are tightened excessivly, pressure on the shutter assembly may make the shutter inoperative. The camera should now be focused



NOTE

Maximum rotating slide adapter movement from its nominal mechanical center as shown in this figure is up 0.150 inch, down 0.030 inch, right 0.090 inch and left 0.090 inch.

Fig. 2-4. Adjustable Style Rotating Slide Adapter.

ROTATING SLIDE ADAPTER

Mounting the Camera Backs

Lift up the rotating slide latch and slide the ledge on the bottom of the rotating slide adapter into the slot on the Rear Frame. Press the top of the rotating slide adapter up against the Rear Frame and press down on the rotating slide latch to lock the rotating slide adapter into place The rotating slide adapter can be placed on the Rear Frame to permit either vertical or horizontal sliding of the camera backs.

Early Type Rotating Slide Adapter

When the rotating slide adapter is in place, pull out the slide indexer and give it a half turn. This holds the indexer out and permits the desired camera back to be slid onto the camera back until you have given the slide indexer another half turn and permitted it to drop into place. The slide indexer prevents the camera back from coming completely out of the rotating slide adapter, but does permit the backs to be indexed to the desired position by means of the nine notches in the back.

The dark slide should be left in the film back until the back has been placed in the proper position and a check made that the shutter is closed. The dark slide should be put into place before removing either the Lens or the camera back since failure to use the dark slide will result in the fogging of one or more film frames.

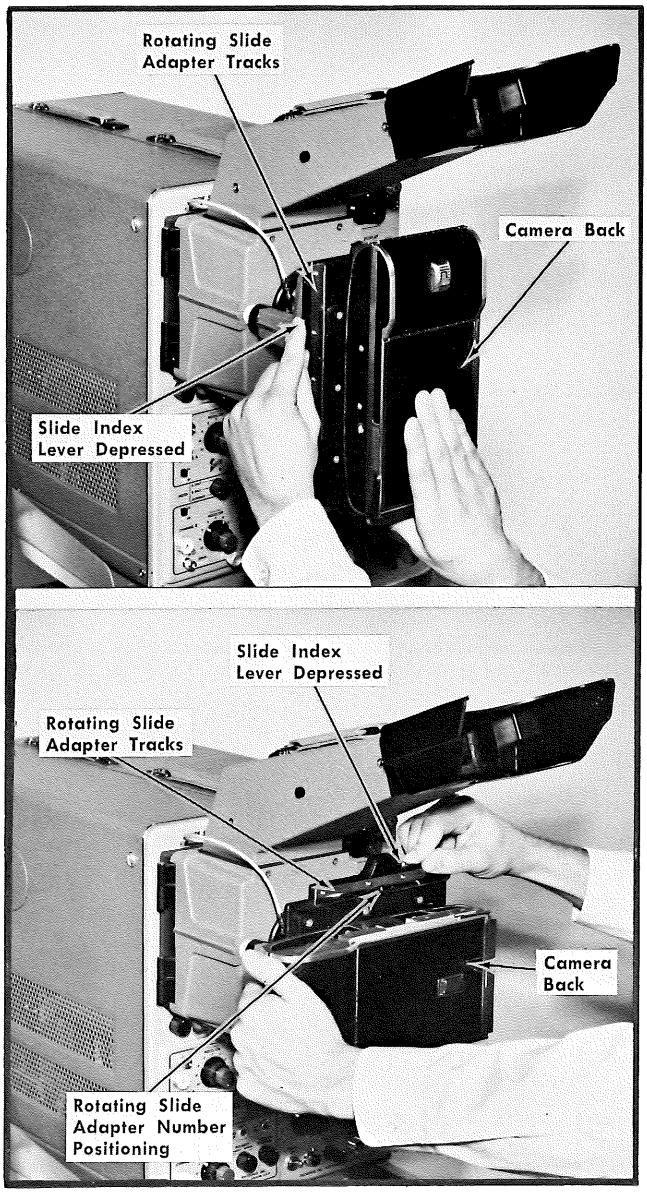


Fig. 2-5. (A) Shows the rotating slide adapter installed to permit vertical sliding of the camera back. (B) Shows the rotating slide adapter positioned for horizontal sliding.

Non-Adjusting Rotating Slide Adapter

When the rotating slide adapter is in place, press down on the slide index lever. While holding down the slide index lever, insert the desired camera back onto the tracks of the rotating slide adapter. Be sure to hold onto the camera back until the slide index lever has been released and the camera back has been firmly locked in place.

The camera back may be positioned in any one of nine positions by pressing the slide index lever and moving the camera back to the desired position. The various stops of the camera back have been numbered—this number will appear in a small hole of the slide adapter assembly.

It is a good idea to leave the dark slide in the camera back until the back has been properly seated on the camera. The dark slide should also be used whenever the camera back is changed if either back contains film.

Adjustable Style Rotating Slide Adapter

When the rotating slide adapter is in place, press down on the slide index lever. While holding down the slide index lever, insert the desired camera back onto the tracks of the rotating slide adapter. Be sure to hold onto the camera back until the slide index lever has been released and the camera back has been firmly locked in place.

The camera back may be positioned in any one of nine positions by pressing the slide index lever and moving the camera back to the desired positions. The various stops of the camera back have been numbered—this number will appear in a small hole of the slide adapter assembly.

It is a good idea to leave the dark slide in the camera back until the back has been properly seated on the camera. The dark slide should also be used whenever the camera back is changed if either back contains film.

The adjustable rotating slide adapter has been constructed so that it can correct for discrepancies in vertical and horizontal film tracking in the camera back, and/or slight camera system misalignment. If the image is always off center on the film frame in the same direction, one, or both of the above difficulties is probably the cause.

The following procedure should be used as a guide when making film framing corrections with the rotating slide adapter.

a. Note the amount and direction of image movement which will be required to center the image on the film frame.

NOTE

The amount of correction required to center the image on the film frame is one-half the distance from the present image position to the new image position.
The direction the rotating slide adapter must be moved with respect to the rear frame to enter the image is the same direction the image must be moved on the print, as normally viewed, to become centered.

b. Remove the camera back from the rotating slide adapter. It is not necessary to remove the rotating slide adapter from the remainder of the camera system.

c. Note the relationship of both the vertical and horizontal white index lines to the index marks of the rotating slide adapter; see Fig. 2-4.

d. Loosen, but do not remove the four countersunk screws, see Fig. 2-4. Move the back portion of the rotating slide adapter to the desired marks of the rotating slide adapter as alignment guides.

e. When the rotating slide adapter has been correctly positioned, re-tighten the four countersunk screws, see Fig. 2-4.

NOTE

Seldom will the adjustment of the rotating slide adapter remain ideal when the camera is switched from oscilloscope to oscilloscope or after various camera components are interchanged.

CAMERA BACK

Selecting the Camera Back

The choice of a camera back will depend primarily on the intended use for the photograph, how quickly you want the finished photograph, how large an area you wish to photograph, the magnification factor of the particular Lens used, and the size of the negative desired. If you want to obtain a negative from which a number of prints can be made, either Types 55 P/N film (which comes in Polaroid Land 4 × 5, only) or conventional film is quite satisfactory. Both the Polaroid Land 4 × 5 film holder and the holders for conventional cut and roll film are used with the Graflok back in place.

With either Polaroid Land or conventional films, the size of the flim used by the selected back must be at least as large as the image from the Lens. This will depend on the object-to-image ratio of the camera Lens and on the size of the oscilloscope display. For example, the roll film back for 120 or 620 film would probably not be used with a 1:0.9 Lens and a 10-cm wide oscilloscope display. This is because the image of the display is 9 centimeters wide and the long dimension of the film is only about 8.25 centimeters. Thus, at least 7.5 mm would be cut off of the photograph.

In actual practice, the film size should be at least 5 mm larger than the size of the image to allow for normal tolerances in the construction of the camera backs and for the position of the film in the back.

Selecting the Position of the Camera Back When Using Rotating Slide Adapter

The camera back can be rotated in 90-degree increments in either of two ways. First, the rotating slide adapter can be rotated by lifting the rotating slide latch. This permits the tracks on the rotating slide adapter to run either vertically or horizontally. This in turn allows the camera back to slide either way. The camera back itself can also be rotated by sliding it off the rotating slide adapter, rotating it, and sliding it on the rotating slide adapter in the new position. If either of these methods is used, you must place the dark slide into the camera back before rotating the camera back in order to prevent exposing the film.

For most applications involving only a single exposure per frame, it will normally be most convenient to install the rotating slide adapter so that the tracks run horizontally. The slide index lever can be either on top or bottom, as desired. Either the long or the short axis of the film can be made to run parallel with the trace by rotating the camera back itself.

When more than one exposure per frame is required, you will probably want to install the rotating slide adapter so that its tracks run vertically. This will permit the film back to move vertically and allow more than one trace to be photographed on a film frame. Again the camera back can be installed with the long axis of the film either parallel or perpendicular to the trace.

GRAFLOK BACK

Focusing With a Graflok Back

Install the Graflok back and press the release button on the back (see Fig. 2-6). Set the Lens for maximum aperture (f/1.4, f/1.9, etc., depending on the Lens) and set the SHUTTER SPEED selector on Time (T). Obtain a sharply focused trace on the CRT using the oscilloscope Focus and Astigmatism controls. Secure the camera in place on the oscilloscope. Open the camera shutter and observe the image on the ground glass screen of the Graflok back.

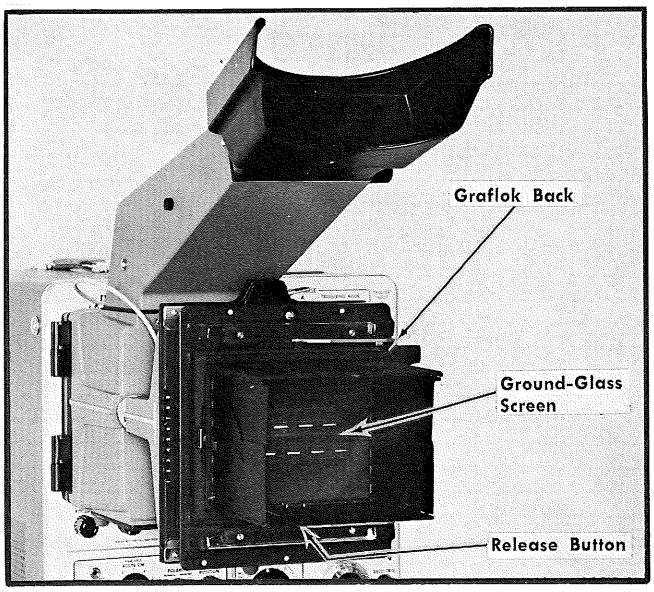


Fig. 2-6. The Graflok Back installed to permit focusing.

Release the Focus knob lock and adjust the Focus knob on the Main Frame to produce a sharply focused image of the oscilloscope trace on the ground glass screen.

The camera is normally focused on the oscilloscope trace, rather than the graticule, since it is usually most desirable to photograph the fine detail of the trace. Even with the camera focused on the oscilloscope trace, the focus of the graticule will usually be quite satisfactory. The camera can, of course, be focused on the graticule if desired.

CONVENTIONAL FILM HOLDERS

Loading the Sheet Film Holder

Sheet film is available in a variety of types. Some types of film require that the film holders be loaded in complete darkness while others permit the use of a safe light. See the instruction sheet with the film; it will state whether a safe light can be used or not.

In loading the film holder, the dark slide (see Fig. 2-7) should be pulled out about half way. Place the silver side of the dark slide handle in the empty film holder to be loaded, towards the closest outside surface. Later, when the sheet of film has been exposed, turn the slide over so that the black side of the handle faces the outside when it is reinstalled.

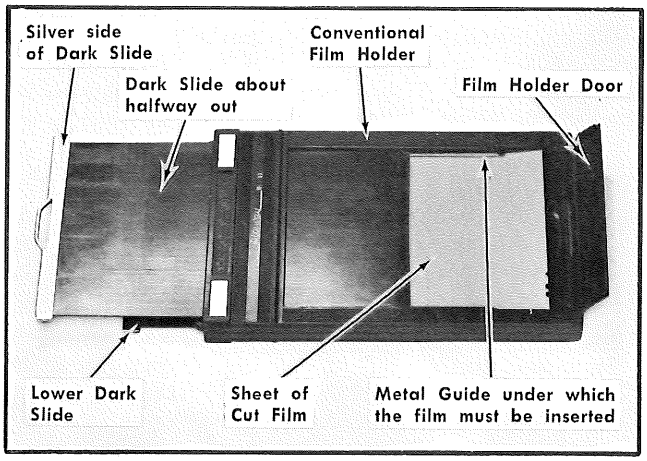


Fig. 2-7. Important points of film holder.

The following procedure should be practiced several times outside the darkroom before attempting to load the film holders in the dark.

Set the lighting conditions of the darkroom as described in the information sheet which came with the film. Now hold the film holder in your left hand with the side which is to be loaded up and the dark slide toward your body. The index finger of the left hand is used to hold the film holder door open. Refer to Fig. 2-8 for the method used.

With the right hand, hold the film so that the notches in the edge of the film are in the upper right corner. Fig. 2-9 shows the proper way to hold the film. In Fig. 2-9 it should be noted that the index finger of the right hand is resting on the notches in the film.

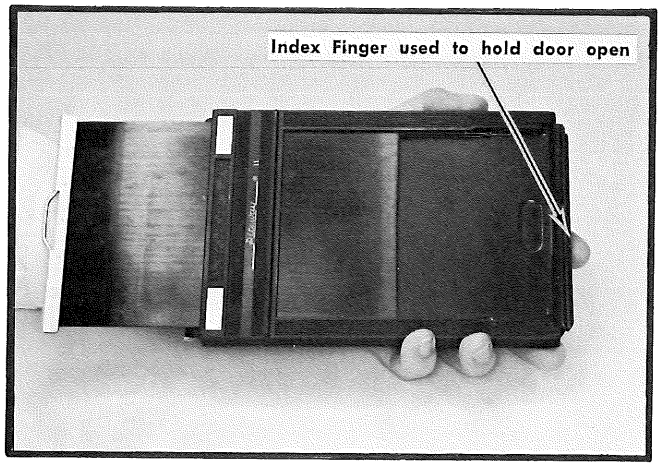


Fig. 2-8. Method used to hold film holder while loading the film.

The film is inserted at a slight downward angle into the holder. In Fig. 2-9 it can be seen how the film must be inserted under the two metal guides inside the film holder. After the film is started under the metal guides, it should be shoved all the way forward in the holder (toward the body). If the film is not shoved all the way forward, the complete image may not appear on the film.

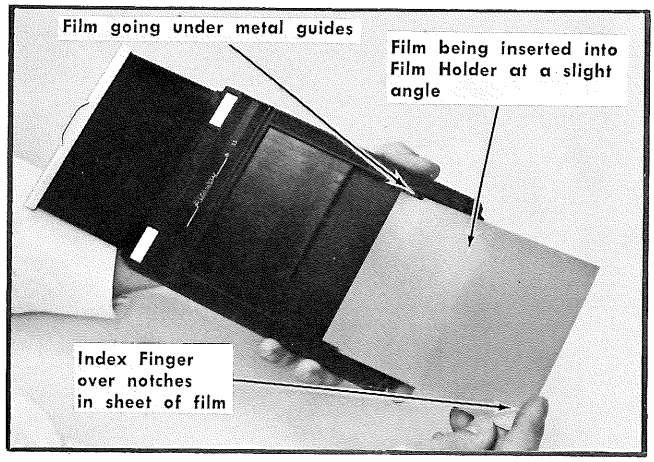


Fig. 2-9. Proper way to insert the film into the film holder. Note the position of the right index finger on the sheet of film.

When the film is inserted into the holder, the far end of the film should be given a flick with the index finger of the right hand. This will indicate whether the film is under the film holder guides or not. Now that the film is properly installed in the film holder, the film holder door may be closed.

Release the index finger of the left hand from holding the door open, and with the right thumb close and hold the door in the closed position. Now push the slide all the way into the holder (toward the film door). The dark slide will slide into a slot in the film holder door when it is shoved all the way into the holder. One side of the film holder is now loaded. The film holder door will remain closed by itself once the dark slide has been inserted all the way.

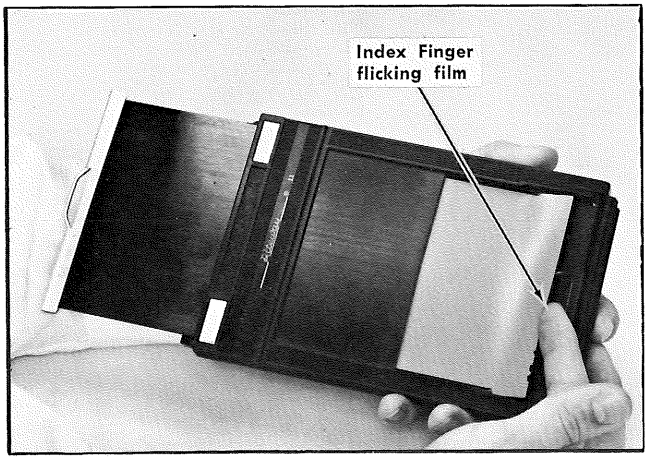


Fig. 2-10. Checking the sheet of film to insure that it has been inserted under the metal guides of the film holder.

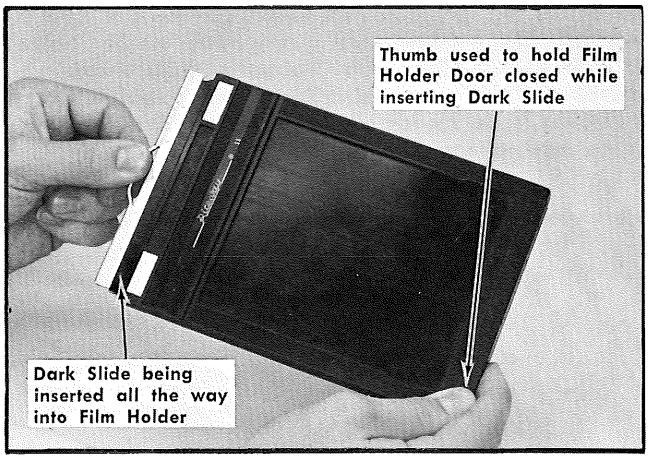


Fig. 2-11. Closing the film holder after loading the sheet of film. The film holder door is held closed with thumb while dark slide is installed.

The dark slide may now be locked in place by turning the right angle pin located on the end of the film holder toward your body.

Procedure Used to Expose Sheet Film

Obtain the desired waveform on the oscilloscope and, with the Focus and Astigmatism controls, focus the display. The camera should now be attached to the oscilloscope and the Graflok back attached to the camera.

Set the APERTURE selector for the largest lens opening and the SHUTTER SPEED selector to the (T) position. Now depress the SHUTTER RELEASE lever to open the shutter. Open the ground glass viewing doors and check the focus of the camera.

Now with one hand take the film holder, and with your free hand lift the hinged focusing panel on the Graflok back (see Fig. 2-12). Insert the film holder between the hinged focusing panel and the other part of the Graflok back. The

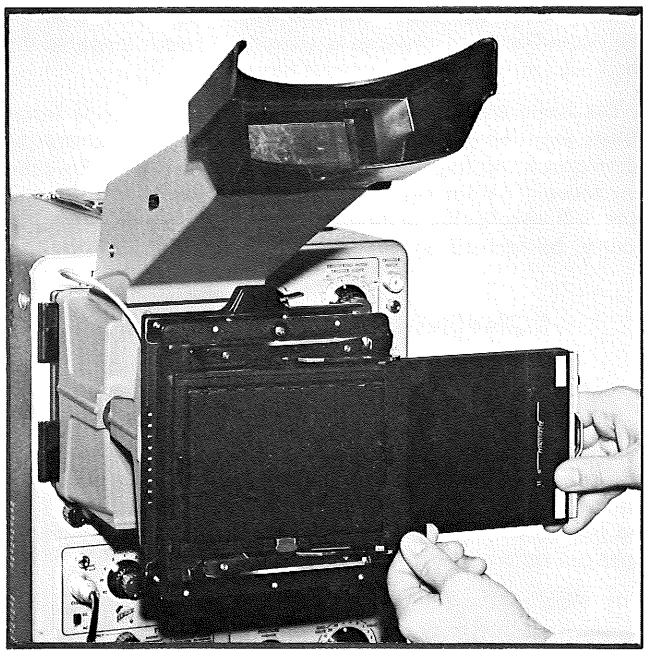


Fig. 2-12. Inserting the film holder in the Graflok back.

side of the film holder to be exposed should be installed toward the camera lens.

The film holder should be firmly shoved all the way into the Graflok back until the small ridge on the film holder is seated in the Graflok back. Test to see that the film holder is seated by giving it a slight tug.

Close the shutter and set the APERTURE selector and SHUTTER SPEED selector to the desired settings. Remove the dark slide from the side of the film holder facing the lens. Expose the film and replace the dark slide in the film holder so that the black side of the handle is toward the camera lens. The black side of the dark slide toward the nearest outside edge of the film holder indicates exposed film.

To remove the film holder from the Graflok back, the hinged focusing panel must be lifted away from the camera slightly. With the hinged focusing panel lifted, take hold of the film holder, lift it slightly and pull outward.

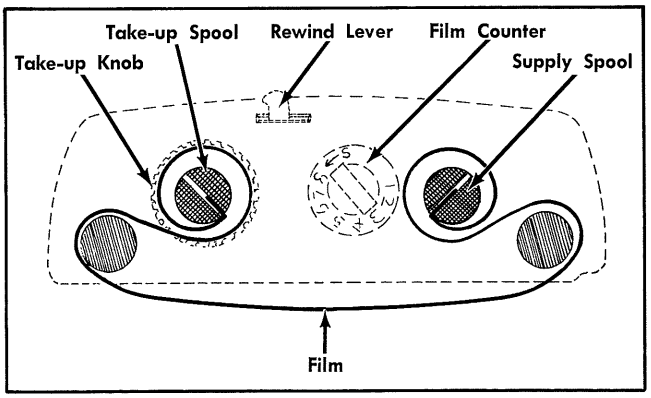


Fig. 2-13. Film threading path for a typical roll film holder.

To remove the sheet film from the film holder, reverse the loading procedure as described above.

Loading the Roll Film Holder

If the directions for loading the roll film holder have been lost, the sectional drawing (Fig. 2-13) may be used as a guide. Fig. 2-14 shows the various parts of a 120 film size roll film holder. Make sure the dark slide is installed in the roll film holder before advancing the film for the first exposure.

Attaching the Roll Film Holder to the Graflok Back

The roll film holder should be loaded before installing it on the Graflok back. After the roll film holder is loaded and the film advanced to the first exposure (dark slide still installed), it can be laid aside.

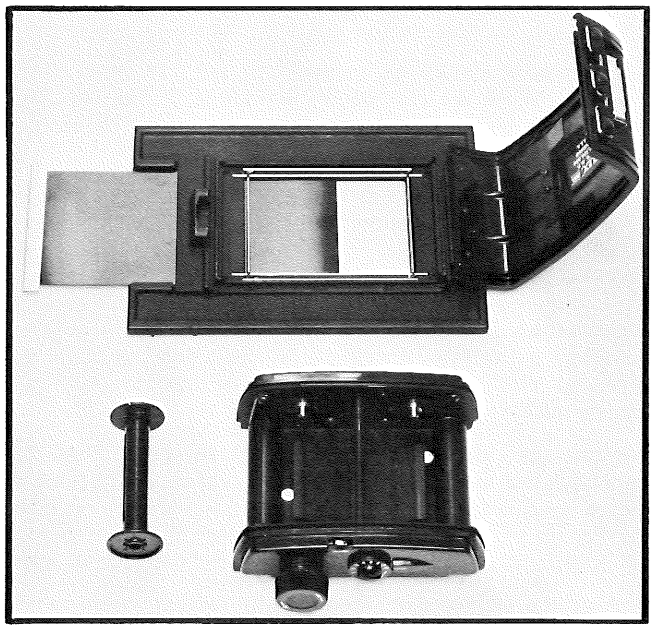


Fig. 2-14. Typical Roll Film Holder apart, ready to load film.

Install the Graflok back on the camera and install the camera on the oscilloscope.

Now place one thumb on each of the hinges for the hinged focusing panel (refer to Fig. 2-15). Press the hinges in toward the oscilloscope, and at the same time, slide the hinged would be inserted. The above procedure will remove the hinged focusing panel from the Graflok back.

Slide the roll film holder onto the Graflok back. Sliding the roll film holder on will insure a light-tight seal. The small ridge on the roll film holder should fit into the slot in the Graflok back. This is the same type of locking used on the sheet film holders.

With one hand hold the roll film holder on the Graflok back, use the other hand to engage the two slide locks.

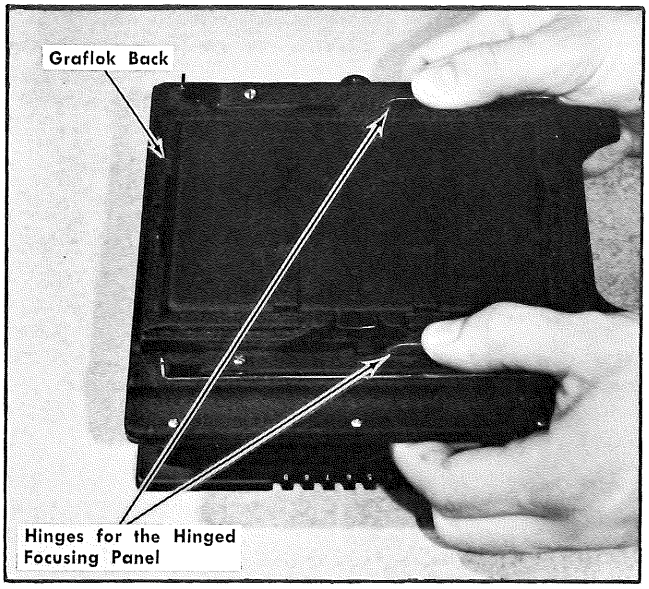


Fig. 2-15. Method used to remove the Hinged Focusing Panel.

One slide lock is located on each side of the long axis of the film (see Fig. 2-16).

Exposing Roll Film

Obtain the waveform on the oscilloscope and focus it properly. The camera should already be in focus. If it is not, the hinged focusing panel must be reinstalled for focusing. Remove the dark slide from the roll film holder, set the SHUTTER SPEED selector and APERTURE selector to the proper settings and take the picture.

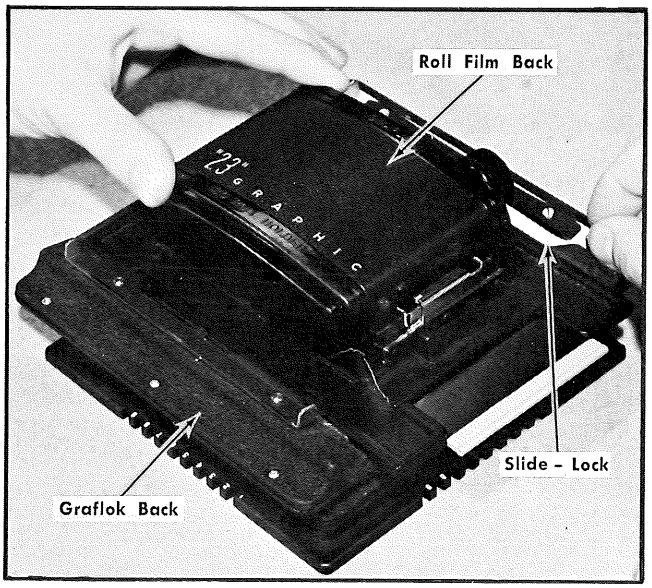


Fig. 2-16. Installing the roll film back on the Graflok back.

To advance the film press the film release lever and turn the knob until it stops. The roll film holder is now ready for the next exposure.

POLAROID LAND 4×5 FILM HOLDER

Attaching the Polaroid Land 4×5 Film Holder to the Graflok Back

Install the camera on the oscilloscope to be used and attach the 4 × 5 Garflok back to the camera. The waveform should now be obtained and focused properly with the oscilloscope controls. Check the camera focus with the aid of the ground glass in the Graflok back.

To insert the film holder in the Graflok back, lift the hinged focusing panel and slide the film holder between the hinged focusing panel and the rest of the Graflok back. The film holder should be inserted so that the processing arm is facing away from the Lens (see Fig. 2-17).

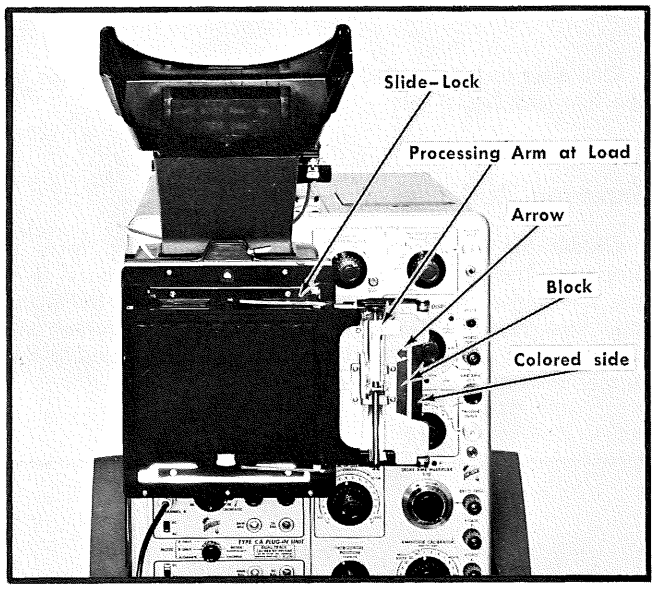


Fig. 2-17. Polaroid Land 4 × 5 film holder properly installed in the 4 × 5 Garflok back. With the film packet properly installed, it should be as shown.

When the film holder has been shoved all the way into the back, give a small tug outward to see if the unit is firmly locked in the Graflok back. There is a small ridge on the holder which will engage in a slot in the Graflok back. Now lock the film holder in place by engaging the slide locks into the slots in the film holder (refer to Fig. 2-17).

NOTE

The weight of this film holder makes it advisable to use the slide locks in addition to the spring back to prevent light leaks and to hold the film holder securely.

Inserting and Exposing the Polaroid Land 4×5 Film Packet

When inserting the film packet, the processing arm on the Polaroid Land film holder must be in the LOAD (up) position. Before inserting, check the film packet for the proper side toward the Lens. The packet should be inserted into the film holder so that the colored block and the arrow are on the side of the film packet that faces you (away from the Lens).

Hold the film packet at about its center and insert the metal-capped end into the holder. Push the film packet gently (without buckling) into the film holder. After the metal-capped end has been pushed past the rubber roller, you should shift your hold to the far end (colored block and arrow end) of the packet.

NOTE

Do not press on the pod area of the film packet. The pod contains developing chemicals and premature rupture will damage the picture.

The packet should be pushed into the film holder until it stops. When the film packet is inserted all the way into the film holder the arrow and the colored block should just show (refer to Fig. 2-17).

Now set the SHUTTER SPEED selector and the APERTURE selector to the proper settings for the picture. When you are ready to take the picture, gently pull the film packet envelope out of the holder until it stops. The envelope acts as a dark slide. A slight resistance will be felt as the envelope detaches from the metal end cap as you start to pull the envelope out of the film holder. To avoid fogging the negative, the envelope should not be withdrawn for a longer period of time than necessary.

Make your exposure as you would normally. The ASA rating of the film along with other directions will be found inside the film box. When the film packet envelope is pulled out for an exposure, take care not to bend the envelope out of its natural position. Such a bend could cause light leaks.

After the exposure has been made, reinsert the envelope all the way into the film holder. Using the colored block and arrow, the envelope may be checked to insure that it is all the way inserted. If the envelope will not reinsert all the way, withdraw it and try again. Forcing of the film envelope can cause buckling and creasing of the print.

The picture may now be developed right away or at a later time. If ambient humidity is high, development should not be delayed.

Developing the Film Packet

How to Develop the Picture Immediately. After the envelope has been reinserted into the film holder, swing the processing arm on the Polaroid Land 4×5 film holder to the PROCESS (down) position. This will cause the processing rollers to come together. Now when you pull the packet out of the film holder, the rollers will crush the pod and spread the developing reagent between the positive and negative sheets inside the packet.

To start development of the film packet, pull the film packet all the way out of the film holder with a confident and fairly rapid motion. A slight resistance will be encountered as the metal cap enters the rollers, but keep right on pulling without hesitation. The picture is now developing. Refer to the directions packed with the film for the recommended development time.

Extremes of pulling speed should be avoided in pulling the film packet out of the film holder to start development. A slow, inching pull may cause mottle or streaks to appear on the print, while too fast a pull may result in an uneven spread of the developing reagent.

Care should be taken to prevent the film packet from bending or buckling during the development time. If possible, the film packet should be laid on a flat surface. Once the film packet has been pulled out to start development, the processing arm should be thrown to the LOAD (up) position. The film holder may now be reloaded for the next picture.

How to Remove the Finished Picture. After the recommended development time, remove the envelope of the film packet by hooking the tips of your fingers under the edge of the metal cap while you give the envelope a moderate tug with the other hand, from the colored block and arrow end. Use the finger tips only, and let the thumb rest along the edge of the metal cap. Do not try to pry off or bend the metal cap.

Now peel the picture away from the negative. Take the white sheet in one hand, the brown paper and negative in the other, and peel them apart rapidly. Do not let the print fall back on the damp negative. Black-white pictures should be coated as soon as possible, using print coaters supplied with each box of packets. Follow coating instructions found on the instruction sheet in the film box.

If Type 55 P/N Polaroid Land film has been used, the brown paper should be removed from the negative as soon as possible. From the negative also remove the metal cap, developer pod and the black paper tab. The negative must now be washed in water or a solution of sodium sulfite and then dried. Refer to the instruction sheet in the film box for complete directions.

How to Remove Exposed Film Packet for later Development. Occasionally you may want to expose a series of pictures without developing each one right away. Here's how to remove the film packet without developing.

After exposing the negative and reinserting the envelope all the way, make sure the processing arm is in the LOAD (up) position.

Push the release lever on the far end of the film holder (end away from loading end) as far down as it will go (about $^3/_8$ inch) and hold it down. Briskly pull the film packet out of the film holder. Do not let go of the release lever until the film packet is completely out of the film holder.

To identify the exposed but unprocessed packets, bend over one corner (away from the metal cap). This will prevent mix-ups when shooting fast.

How to Develop Exposed Film Packets at a Later Time. With the processing arm in the LOAD (up) position, insert the exposed packet into the film holder as described previously. Make sure the packet is fully inserted into the film holder. Swing the processing arm to the PROCESS (down) position and proceed to develop your pictures in the manner outlined above.

POLAROID LAND ROLL FILM BACK

Focusing the Camera with the Focusing Plate

To use the focusing plate, the Polaroid Land Camera back must be opened and the focusing plate inserted where the film normally rests. Fig. 2-18 shows the focusing plate properly installed.

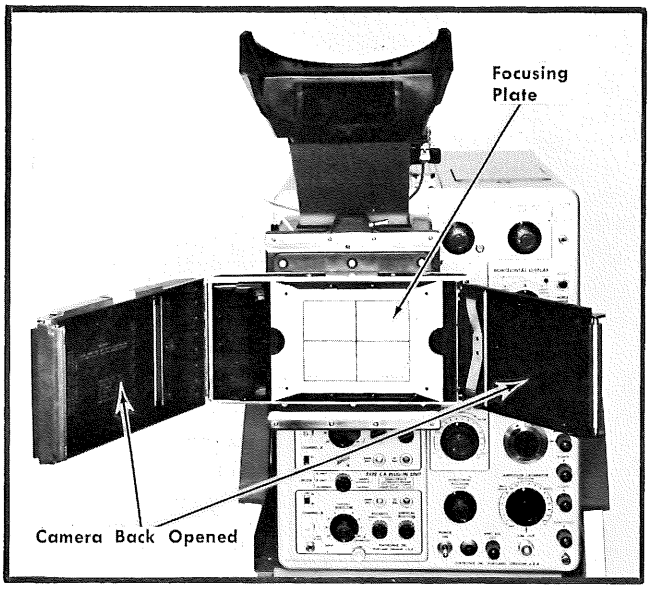


Fig. 2-18. Focusing Plate placed in the proper position for focusing.

When installing the focusing plate, insert the two bottom ears inside the edge of the camera-back film compartment. With nothing more than finger pressure, gently press the upper mounting ears into the film compartment. The upper mounting ears will have to be compressed and the focusing plate inserted into the film compartment at the same time.

NOTE

For the focusing plate to operate properly, the frosted side must be towards the camera Lens and flush with the normal film position.

When focusing the camera be sure to set the Lens for maximum aperture (f/1.4, f/1.9, etc. depending on the Lens) and set the SHUTTER SPEED selector on (T). Obtain a sharply focused trace on the CRT using the oscilloscope Focus and Astigmatism controls. Then secure the camera in place on the oscilloscope. Open the camera shutter and observe the image on the focusing plate. Adjust the Focus knob on the camera to produce a sharply focused image of the oscilloscope trace on the focusing plate.

The camera is normally focused on the oscilloscope trace rather than the graticule since it is usually most desirable to photograph the fine detail of the trace. Even with the camera focused on the oscilloscope trace, the focus of an external graticule will usually be quite satisfactory. The camera can, of course, be focused on the external graticule if desired.

Loading and Exposing the Roll Film Back

When a new box of film is opened, the instruction sheet and print coater should be saved.

To open the camera back for loading, swing the latch lever out and down from the bottom of the camera back. The back should have opened slightly. Now swing the back cover out until it is fully open. Inside the camera-back you will now see the inner panel. Swing the inner panel to its fully opened position.

Remove the empty spool from the camera back. The processing rollers in the camera should be inspected and cleaned if necessary. A damp cloth may be used to clean the rollers. It is important to keep these rollers clean to spread the developer evenly between the negative and positive components of the film.

In the following procedure it is assumed that the camera back is lying face down on a table, with the dark slide protruding from the right side (tripod socket hole toward you).

Remove the film rolls from the foil wrapper by tearing the wrapper at the indicated point. Break the first seal at the end of the roll. The film actually contains two rolls: a large white positive roll and a smaller spooled negative roll. When you unwrap the film, be careful not to break the seals on the top of the negative roll and the underside of the positive roll. Drop the rolls into the wells in the camera back as shown in Fig. 2-19.

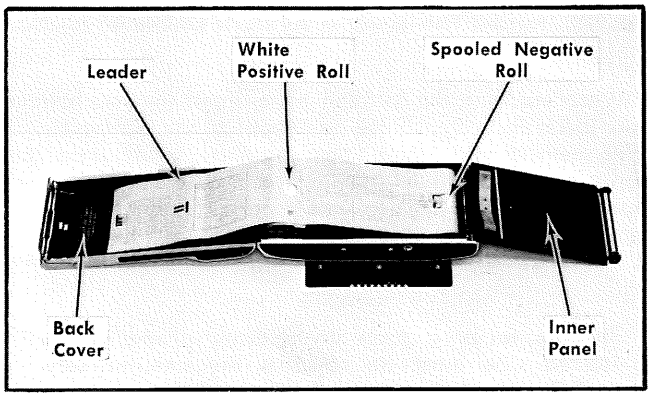


Fig. 2-19. The Polaroid Roll Film Camera Back opened for loading. The white positive roll is dropped in the well at the left while the spooled negative roll is dropped in the well at the right.

Now close the inner panel, bringing the film leader around the steel roller on the edge of the inner panel. Lay the leader flat between the guides at the outer edge of the panel (see Fig. 2-20). Be sure that the white paper of the positive roll lies smooth and flat, not tucked into the well.

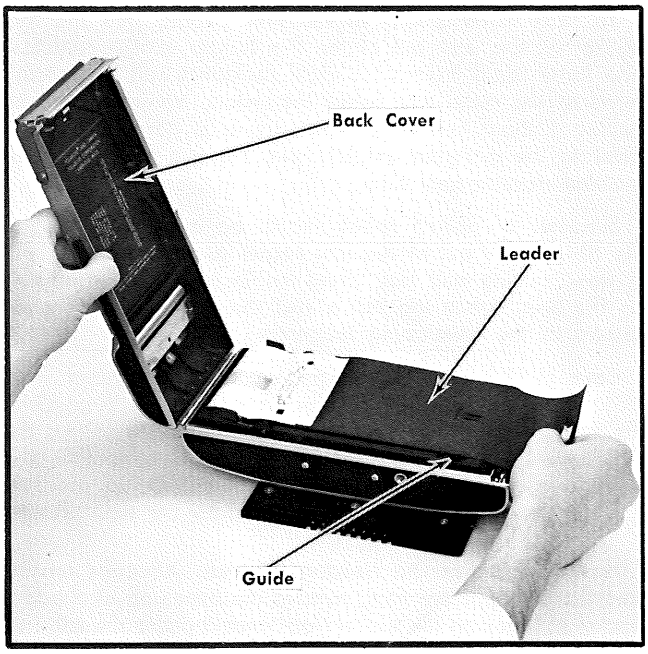


Fig. 2-20. The leader of the film roll must be brought around the roller on the inner panel. Care must be taken that the leader is aligned between the guides on the inner panel before the back is closed.

Close the back cover, and squeezing it tightly shut, pick up the camera back. Swing the latch lever all the way towards the bottom of the camera back. This will insure that both sides of the back cover will latch. Now swing the latch lever to the locked position (towards the top of the camera back). There should now be a short tab of paper extending beyond the cutter bar of the camera back. The dark slide should now be installed in the camera back. If it is not, the first picture may be exposed.

While holding the camera back with your left hand, lift the cutter bar with your right hand. The cutter bar is lifted by raising up on the plastic edge. Once the cutter bar has been lifted it will remain in the up or unlocked position until it is pushed down. Pull the film leader out of the camera back until it comes to a firm stop. About 15 inches of film leader must be pulled out before it will stop, but this will occur automatically when the film is in the proper position for the first exposure.

Now lock the cutter bar with a gentle downard pressure. After it has latched you can tear the film leader off and discard it.

The camera back is now ready for the first picture. Mount the camera back on the rotating slide adapter and make the proper shutter and lens opening settings. Remove the dark slide and take the picture. The number of exposures remaining on the roll is indicated on the film tab under the cutter bar.

Advancing and Developing the Roll Film

Throw the red release switch in either direction to release the film. If you should throw it accidentally at any time,

don't worry—no harm is done. Open the cutter bar by lifting the plastic edge, and take a firm grip on the film tab.

Pull the film tab straight out about 7 inches with a single motion. Pull it about as hard and rapidly as you might pull down a window shade; not hard enough to pull the shade off the roll (or the film off the spool), but not slowly and hesitantly. Remember, the film will stop automatically.

NOTE

If the film tab will not pull easily, throw the red release switch again.

After you pull the film tab, press down and latch the cutter bar. Tear off and discard the excess paper.

Wait the recommended development time. Pulling the film tab has started development process and advanced the film into position for the next picture. Follow the instructions in the instruction sheet for development times under various conditions. It is important for you to check the instruction sheet for exact development time. This time varies for different types of film, and even the development time for a particular film may change.

When the development time is up, slide back the latch on the print door and open the door. Lift the print out carefully, starting with the cutout. Don't let the print fall back on the damp negative. Then close and relatch the print door.

Coat each black-and-white print as soon after removal from the back as possible. First remove the curl by drawing the print face up, over a straight edge, such as the edge of the cutter bar.

Apply the print coater along the entire length of the print, including edges, borders and corners, with 6 to 8 firm overlapping strokes. For the last two or three pictures in each roll, press the coater down hard against the tab end of the print (not the image) for a moment to release extra liquid; then spread the liquid smoothly across the print.

POLAROID LAND PACK FILM CAMERA BACK

Focusing the Camera with the Focusing Plate

To use the focusing plate, the Polaroid Land pack film camera back must be opened and the focusing plate inserted where the film normally rests. Refer to the paragraphs under Loading and Exposing the Polaroid Land Film Pack for directions on how to open the camera back. Fig. 2-21 shows the focusing plate properly installed.

When installing the focusing plate, insert the two ears under the door hinge and down next to the exposure window. With nothing more than finger pressure, gently press the focusing plate in the direction of the hinge, at the same time pressing the focus plate in toward the film plane. The half-moon cutout in the opposite end from the ears provides a finger hole for easy removal of the focusing plate.

NOTE

For the focusing plate to operate properly, the frosted side must be towards the camera Lens and pressed all the way into the film plane.

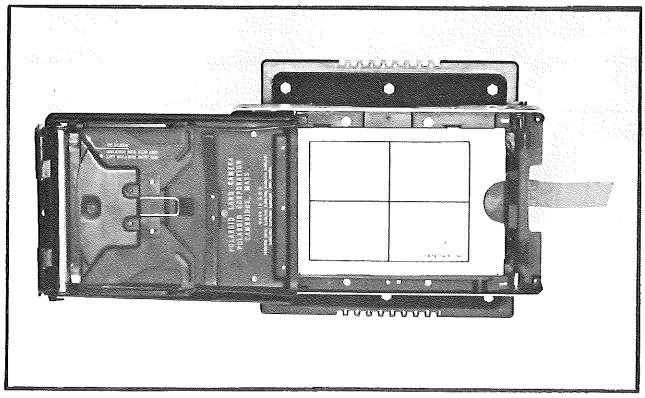


Fig. 2-21. Focusing Plate installed in Pack Film Camera Back.

When focusing the camera be sure to set the lens for maximum aperture (f/1.4 f/1.9, etc. depending on the lens) and set the SHUTTER SPEED selector on (T). Obtain a sharply focused trace on the CRT using the oscilloscope Focus and Astigmatism controls. Then secure the camera in place on the oscilloscope. Open the camera shutter and observe the image on the focusing plate. Adjust the Focus knob on the camera to produce a sharply focused image of the oscilloscope trace on the focusing plate.

Loading and Exposing the Polaroid Land Film Pack

When the film box is opened, the instruction sheet, film box, and print coater should be saved.

To open the camera back for loading, push the latch lever (on the bottom of the camera back near the tripod socket), counterclockwise. The door should have opened slightly. Now swing the door out until it is fully open.

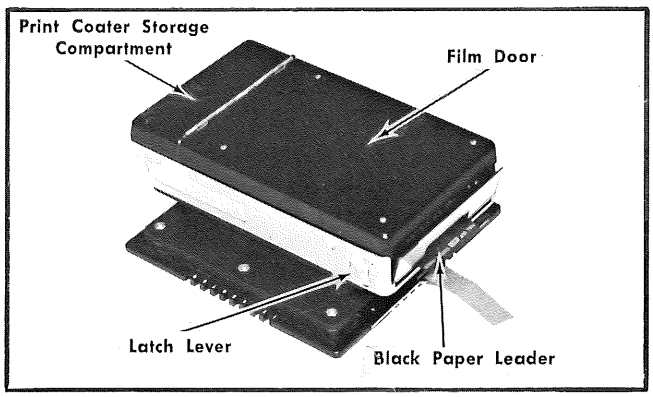


Fig. 2-22. Polaroid Land Pack Film Camera Back.

Remove the empty film container from the camera back by lifting up and pulling it out from under the door hinge.

The processing rollers in the camera back should be inspected and cleaned if necessary. Directions inside the door indicate how to release the stainless steel rollers from

their normal position in the camera back. A damp cloth may be used to clean the rollers. It is important to keep these rollers clean to spread the developing reagent evenly.

In the following procedure it is assumed that the camera back is lying face down on a table, with the dark slide protruding from the right side (tripod socket toward you).

Remove the film pack from the foil wrapper by tearing the wrapper at the indicated point. When you unwrap the film, be careful to handle the film pack by the edges only.

Insert the film pack under the back door hinge, and push it toward the hinge and down into the film plane until it snaps into place. Be sure that the indicated side of the film pack is correctly oriented toward the lens, or the dark slide in this case. The black paper leader should be allowed to hang over the right end of the camera back.

Close the door by squeezing it until both sides snap shut. Make sure the black paper leader is now extending outside the camera back. The dark slide should be pushed in all the way.

While holding the camera back with your left hand, pull the black paper leader all the way out. The camera is now ready for the first picture. If the dark slide has not been pushed in all the way, the first exposure may be fogged.

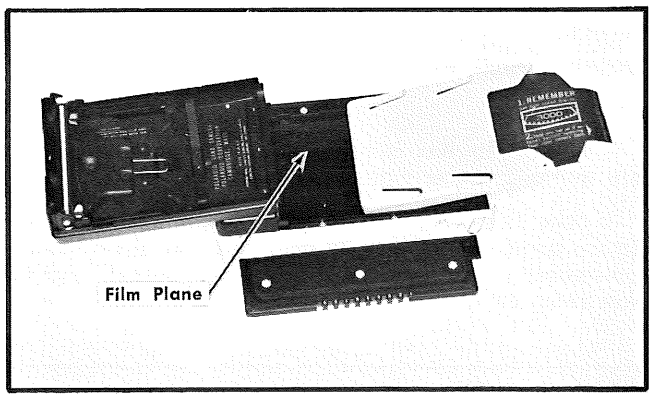


Fig. 2-23. Installing Film Pack into Camera Back.

Mount the camera back on the rotating slide adapter and make the proper shutter and lens opening settings. Remove the dark slide and take the picture. The number of the negative ready for exposure is indicated on the white tab protruding from the camera back.

Advancing and Developing the Film

After taking the picture, pull the white tab which extends from the camera back, all the way out. Pulling the white tab does two things: first, it positions the positive and negative sheets together; and second, it causes the yellow tab (marked PULL) to pop out.

NOTE

Do not pull another white tab if a yellow tab is extending from the camera back. The white tab should be the only tab visible when it is pulled.

Next pull the yellow tab. This causes the positive and negative sheets to be pulled between and through the processing rolers, spreading the developing reagent between the two sheets to start the development process.

Pull the yellow tab completely out of the camera back in one smooth, fairly rapid motion. Pull about as hard and rapidly as you might pull down a window shade; not slowly and hesitantly.

Wait the recommend development time. Follow the directions in the instruction sheet for development times under various conditions. It is important for you to check the instruction sheet for exact development time. This time varies for different types of film, and even the developement time for a particular film is subject to change.

When the development time is up, peel the print away from the negative rapidly. Do not let the print fall back on the damp negative.

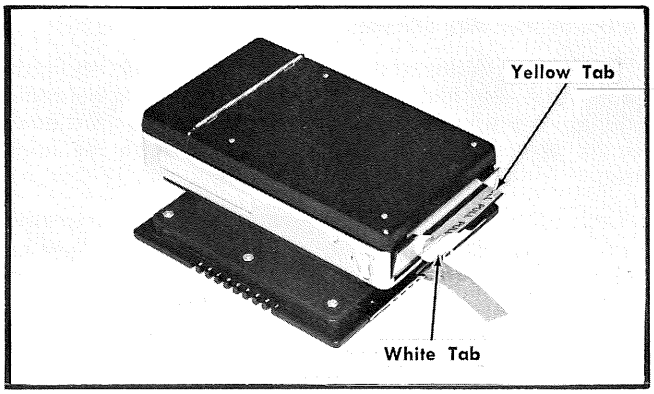


Fig. 2-24. Positive and negative sheets ready to be pulled out of camera back.

Coat each print as soon as possible after separating it from the negative. Prints may be coated by sticking the back of the print to a sticky area to hold them, then using the Polaroid print coater (see instructions on film box).

Apply the print coater along the entire length of the print, including edges, boarders and corners, with 6 to 8 firm overlapping strokes. For the last two or three pictures in each film pack, press the coater down hard against a non-image surface for a moment to release extra liquid; then spread the liquid smoothly across the print as before.

Storage of Print Coater

The print coater can be stored in the compartment just to the left of the film loading door (bottom of camera back towards you). To open the compartment, grasp the black cover area to the left of the hinge and lift up. If the compartment is difficult to open, pry with your fingernails between the black cover and the aluminum casting on the left side of the body.

TYPE 350 CAMERA ATTACHMENT

Mounting the Type 350

First screw the two locking nuts (see Fig. 2-25) in toward the Main Frame as far as possible. Insert the supports of the Main Frame into the two cups provided for them in the casting of the Type 350. Screw the locking nuts toward the Type 350 until the nuts are holding the Lens barrel of the Type 350 snugly against the Main Frame. Moderate finger pressure will provide adequate holding.

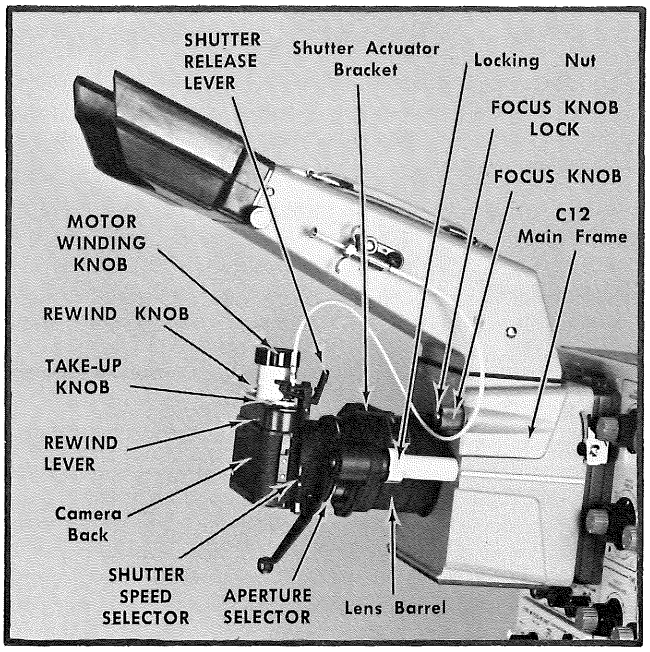


Fig. 2-25. Type 350 Camera Attachment mounted on a C-12 Main Frame.

Check to see that the O-ring light seal is correctly positioned in its groove.

Selecting the Position of the Camera Back When Using Type 350

The camera back may be rotated so that the film will run from the left to right, right to left, top to bottom or bottom to top.

To rotate the film from the horizontal running position to the vertical, it is necessary to lossen the camera from the Main Frame. It is not necessary to remove the Type 350 entirely from the Main Frame. It only needs to be loosened enough to allow the O-ring to slip when the camera is turned.

Next loosen the screws (use a $1/16$-inch hexagonal wrench) which will be found in the center top and bottom of the bracket which attaches the Type 350 to the Main Frame. Now turn the camera in a counterclockwise direction (as seen from the rear of the camera) until the camera back is in a vertical position.

If it is desired to have the film read vertically from top to bottom, it will be necessary to rotate the camera in a clockwise direction to the vertical film-running position. To rotate the camera back clockwise, it is necessary to first remove the shutter actuator bracket. The rotation, after removal of the bracket, is the same as that for counterclockwise rotation.

Small white index marks will be found on the bracket which attaches the Type 350 to the Main Frame. These index marks indicate when the camera is in the straight vertical or horizontal position. The index mark on the bracket should line up with the index mark for APERTURE selector, when the camera is in the proper position. Re-tighten the screws when the camera is in position.

The two locking nuts on the Main Frame Assembly should now be tightened to hold the Type 350 snugly against the Main Frame.

To rotate the camera back to the horizontal position, the same procedure as above may be used.

Focusing with the Type 350

Swing the Main Frame away from the oscilloscope and obtain a stable display on the oscilloscope. Use the Focus and Astigmatism controls to obtain the best trace focus. Swing the Main Frame back into position against the oscilloscope, and latch.

Set the SHUTTER SPEED selector to (B) and depress the SHUTTER RELEASE lever. While holding it down, shift the rewind lever to the red dot. This will lock the shutter open. Set the APERTURE selector to f/1.9. Open the camera back by pulling out the bar on the left side of the camera.

Take the focusing magnifier supplied with the Type 350 and insert the frosted-glass end into the opening behind the lens. Now loosen the Focus knob lock on the Focus knob of the Main Frame and, while observing the image through the focusing magnifier, adjust the Focus knob until the image is sharp and clear.

The Type 350 may be focused on the trace, the graticule, or halfway between the trace and graticule. If the camera is focused halfway between the trace and graticule, the pictures will show both the trace and graticule clearly if f-stops from 4 to 16 are used.

Loading 35-mm Film

Open the camera back by pulling out the bar found on the left side of the camera. Push the rewind lever as far left as possible before proceeding. The rewind knob if extended, is retracted by turning the knob counter-clockwise.

Now install the new film cassette with the projection on the cassette toward the bottom of the camera. The top (flat) end of the cassette must be inserted first. Pull the film leader toward the take-up holder.

When a take-up spool is used, turn the take-up knob until the spring on the take-up spool is toward the rear of the camera. Insert the film between the spring and the core of the take-up spool.

Now turn the take-up knob until the perforated part of the film toward the top of the camera engages the sprocket

wheel. Close the camera back and advance the film two frames with the SHUTTER RELEASE lever. The film is now in position for the first exposure.

With your fingernail, turn the knurled wheel on the right side of the camera until the film counter reads 0. Then turn the motor winding knob until fully wound. The camera is now ready for the first exposure.

Rewinding Film

To rewind, place the rewind lever under the R, i.e., as far right as the lever will go.

Lift up the take-up knob and give it a turn clockwise while holding it up. It will now remain in this position.

Now rotate the rewind knob in a clockwise direction (this automatically causes the knob to extend and engage the cassette) and continue winding until a resistance is felt. This indicates that the film is rewound. The camera back must now be opened and the film leader disengaged from the take-up spool.

Unloading Film

Open the camera back by pulling the bar on the left side of the camera out. Then retract the rewind knob by turning it counterclockwise. Remove the film leader from the take-up spool by pulling on the leader until it tears out of the hook on the take-up spool.

After the film has been unloaded, it is well to check that the rewind lever is in the far left position and that the take-up knob has been engaged into the slot of the take-up spool.

NR Cassette

The NR cassette is a light-tight cassette which may be used in the take-up holder in place of the take-up spool. With the NR cassette, it is not necessary to rewind the film after the last exposure is made. It will allow a small number of exposures to be made and developed.

In loading the Type 350, the new film cassette is installed just as outlined in the loading instructions. The take-up spool is then removed by lifting up on the take-up knob and pulling the spool out. Now remove the cover pieces and the NR cassette, and insert the film leader between the spring and the core of the NR cassette. Reassemble the cassette and install it in the take-up holder. The slotted end of the NR cassette must be toward the top of the camera. After the NR cassette is installed, the take-up knob should be turned until it engages the slotted part on top of the NR cassette.

To unload the Type 350, open the camera back as explained in the unloading instructions, after the desired number of exposures have been obtained plus two more. The film is then cut in two with the exposed film in the NR cassette being developed, while the film remaining in the film supply cassette has a new leader formed on it and is rethreaded onto another NR cassette or take-up spool.

Miscellaneous Information

If fewer than 20 to 36 exposures are needed, they may be obtained one of two ways. The first is by bulk loading the number of exposures wanted into a cassette. The Type 350 is then used with the take-up spool and the rewind process. The second way is to load a standard 20- or 36-exposure cassette into the film supply holder and to equip the take-up holder with a NR cassette. By use of the NR cassette, the number of exposures wanted may be taken, then two or more exposures run through the camera. After this, without rewinding, the camera back may be opened and the film cut off. The remaining film from the film supply cassette may then be fed onto another NR cassette or take-up spool. The exposed film in the NR cassette is then developed.

To prevent an accidental exposure being made, the rewind lever may be set under the red dot. Do not push it any further to the right (camera in horizontal position) as this is the rewind position.

With the rewind lever set under the red dot, the SHUTTER RELEASE lever cannot be depressed. On the other hand, if the SHUTTER SPEED selector has been set to (B), the SHUTTER RELEASE lever depressed and the rewind lever set under the red dot, the result will be that the shutter will stay open until the rewind lever is removed from under the red dot. This method will allow time exposures to be made with the Type 350.

If the camera is to be operated from a distance, either a cable release or Shutter Actuator Model 2 or 3 should be used. The cable release is connected to the threaded hole on the top part of the SHUTTER RELEASE lever. If the Shutter Actuator Model 2 or 3 is used, the solenoid part is mounted on the shutter actuator bracket so that the plunger will contact the SHUTTER RELEASE lever. The box style power supply may then be mounted to the camera using the tripod mounting hole on the bottom of the Type 350. See Shutter Actuator Model 2 or 3 information in this section.

On the left side (camera in horizontal position) of the camera and on top of the rewind knob will be found a film reminder. The U is for reversal type film while the N is to denote negative film. The red dot on the rewind knob is set to indicate the ASA or DIN speed of the film so that proper exposure settings may be set.

BEZELS

Rectangular CRT Bezel 8 × 10 cm (560-Series), All Main Frames

A hard plastic insert in the bezel provides an ambient light seal for the glass-envelope rectangular CRT, but it must be removed before attaching the bezel to an oscilloscope using a ceramic-envelope rectangular CRT.

CAUTION

Failure to remove the plastic insert before installing the Bezel on an oscilloscope using a ceramic envelope CRT can cause dangerous pressure to be exerted against the CRT face plate.

The plastic insert may be easily removed from the Bezel by using a small, blunt tool. Viewing the bezel from the camera side, insert the tool through the small opening near the center opening in the bezel and apply enough pressure to release the ears on the plastic insert.

The plastic insert can be reinstalled into the bezel if it is desired to use the bezel on a glass-envelope CRT.

ACCESSORIES

Projected Graticule

Mounting the Projected Graticule on the Main Frame

In mounting the Projected Graticule on the C-12, remove the camera back, rear casting and Lens as a unit. Turn the Main Frame on its side and remove the plate on the bottom of the Main Frame by unscrewing the two rubber feet and two screws. Pull the plate away from the Main Frame making sure to remove the gasket with the plate. Save the plate and two rubber feet for later use.

Remove the Projected Graticule from its shipping package and pull the graticule slide out of it. Turn the knurled nut, found between and above the POWER PUSH ON and GRATICULE BRIGHTNESS controls, counterclockwise until you are able to slide the Main Frame bracket forward and off the remaining part of the Projected Graticule. Place the Main Frame bracket over the hole in the bottom of the Main Frame, so that the knurled nut is facing the rear of the camera assembly, and the felt on the bracket is against the Main Frame.

Insert four screws for the Projected Graticule into the Main Frame bracket and screw the bracket tightly against the Main Frame. Slide the remaining part of the Projected Graticule back onto the Main Frame bracket and turn the knurled nut clockwise until the nut is snug. Do not tighten the knurled nut excessively.

The bottom part of the Projected Graticule (power supply and light pipe) should be installed or removed when the Main Frame is not mounted on an instrument.

Reinstall the camera back, rear casting and Lens unit onto the Main Frame. Install the proper graticule film into the graticule slide and install the slide into the Projected Graticule.

External Graticule

Before mounting the camera bezel onto the oscilloscope, the removal of the external graticule should be considered. If the external graticule is left in place, the graticule lines may show up on the exposed picture as shadows cutting the trace. On the other hand, if the graticule is removed, the waveform alignment must be done through the viewing tunnel of the Main Frame since there won't be any reference lines when the Main Frame is swung away from the oscilloscope.

CAUTION

If the external graticule is removed, an implosion shield such as an unruled graticule should be installed in front of the CRT. Failure to install a shield may result in serious injury to operating personnel.

In either case above, the Scale Illum control must be turned to extinguish the graticule lamps.

In swinging the camera away from the oscilloscope with the Projected Graticule mounted on the Main Frame, the power cord for the Projected Graticule will contact the side panel of the oscilloscope, or a rubber bumper on the Projected Graticule will connect with the feature strip of the oscilloscope to prevent damage to either instrument. Do not force the camera to swing any closer to the oscilloscope than it will go easily.

Graticule Slide

Hold the graticule slide so the outside end (end with a long bar) is in your left hand and the clips of the slide are on top. Take the graticule film in your right hand with the dull side up and the notch in the upper left corner. Insert the graticule film in the clips near the outside end of the graticule slide. Buckle the graticule film in the middle by pushing on the right end of the graticule with your thumb. Allow the graticule to slide flat again while guiding it under the spring clamps near the inside end of the holder. Push the graticule film towards the right bottom corner of the graticule slide until it is snugly in the corner. If no write-in area is to show in the pictures, the graticule mask should be installed on top of the graticule film. The mask is installed in the graticule slide in the same manner as the graticule film.

With the proper graticule in the slide, insert the slide (noting that the side so marked should be down) into the Projected Graticule with the spring clamps on top.

To add data to your pictures, first remove the graticule mask, then add the data using translucent paper, a grease pencil, or a sign pen. If translucent paper is to be used, it should be cut into a strip the same width as the clear window in the graticule film. On this strip of paper write the data that is to appear on the picture. Take the strip of paper and turn it over so that the writing is toward the graticule film. With the paper in this position, insert each end of it under a spring clamp on the graticule slide.

To apply data with a grease pencil or a sign pen, it is necessary to turn the graticule slide over so that the graticule film is on the bottom. On the plastic surface over the clear windows in the graticule film write the data from left to right making sure that the outside end of the graticule slide is on your left. The top write-in area will be the top of the picture. Turn the graticule slide over and insert it into the Projected Graticule.

Graticule slides are available with amber, blue or green plastic in them. The color holders have the effect of producing a colored graticule. Among the uses for a colored slide are:

1. To make the graticule color more closely match the phosphor for exposure determination.

2. To make the graticule color contrast more sharly with the trace for clarity.

3. To color code pictures for easier identification when color film is used.

Graticule Vertical Positioning

The graticule image of the Projected Graticule can be positioned to move the image on the CRT up and down about 0.100 inch from a mechanical center position on the face of the CRT. This positioning is accomplished by turning the knurled nut on the Projected Graticule. (This same nut used to secure the bottom part of the Projected Graticule to the Main Frame.) This adjustment is very useful for aligning the graticule with the usable vertical scan area of the CRT.

Operation of Front-Panel Controls

To illuminate the Projected Graticule it is necessary to first connect the power cord to the unit, and then to a source of proper line voltage. With power applied to the unit, push the button marked POWER PUSH ON. The red button on the switch should now glow. Turn the GRATICULE BRIGHTNESS control clockwise while observing the graticule image through the viewing system of the Main Frame. The scale of the GRATICULE BRIGHTNESS control is calibrated in photographic step, i.e., moving the GRATICULE BRIGHTNESS control from 16 to 17 increases the light intensity of the Projected Graticule by a factor of $\times 1.4$ (½ f-stop).

Power Requirements

Unless otherwise indicated, this instrument is connected for 117-volt operation. To connect the instrument for 234-volt operation, remove the red and blue transformer leads from the power connector and switch, respectively. Solder the red and blue leads together, insulating the connection with a suitable material.

To convert the instrument from 234 volts to 117 volts, disconnect the red lead from the blue lead. Connect the red lead to the power connector along with the yellow lead. The blue lead is connected to the switch along with the black lead.

Table 2-1 shows lead connections for 117- and 234-volt operation.

TABLE 2-1

Wire Color	117-Volt Connections	234-Volt Connections
Black	Connects to switch	Connects to switch
Blue	Connects to wire above and switch	Connects to red lead
Yellow	Connects to power connector	Connects to power connector
Red	Connects to wire above and power connector	Connects to blue lead

Shutter Actuator Model 1

Equipment Connections

When the oscilloscope and camera are set up for the desired display, prepare the Shutter Actuator Model 1 for operation as follows:

1. Connect the remote trigger leads as desired.

2. Screw the solenoid into the cable release mount on the shutter. With some lenses on the Type C-27 it will be necessary to rotate the lens 90° and remove the viewing hood and tunnel before attaching the solenoid.

3. Insert the phone plug from the solenoid into the output jack on the panel of the Power Supply.

4. Connect the Power Supply unit to the power line.

5. Turn on the POWER switch. The instrument is now ready for operation.

Repetition Rate

The solenoid-energizing capacitor requires approximately three seconds to completely recharge, but a full charge is not required for operation of the unit. It is recommended that triggering of the Shutter Actuator Model 1 be spaced at least two seconds apart.

Shutter Delay

The length of time required for the camera shutter to become fully open after the trigger switch has been operated is approximately 15 to 20 milliseconds, depending primarily on the type of shutter used.

Normal Exposure

To operate the camera shutter on a short exposure using the timing mechanism of the shutter:

1. Set the SHUTTER SPEED selector and the APERTURE selector as desired.

2. Position the film for exposure.

3. Press the MANUAL TRIGGER button (or remote trigger switch), then release it. The shutter will open when the button is pressed, remain open for the preset exposure time, then close.

Time Exposure

To operate the camera shutter on an exposure of longer duration than provided by the shutter timing mechanism:

1. Set the SHUTTER SPEED selector at (T) and the APERTURE selector as desired.

2. Position the film for exposure.

3. Press the MANUAL TRIGGER button (or Remote Trigger switch), then release it. The shutter will open when the button is pressed and will remain open when the button is

released. Leave the shutter open for the desired exposure time.

4. Press the MANUAL TRIGGER button and release it. The shutter will close when the button is pressed and remain closed when the button is released.

NOTE

(B) setting of the shutter should not be used with Shutter Actuator Model 1. The solenoid cannot be kept in an energized state by the power supply due to the fact that the actuating signal from the trigger circuit is in the form of a pulse. Therefore, when the SHUTTER SPEED selector control is set at (B), the Shutter Actuator Model 1 will open the shutter, then allow it to close immediately. The shutter open-time will be uncalibrated, with the duration depending on the amount of charge stored in the actuating capacitor and upon the mechanical speed action of the solenoid and the shutter.

Multiple Shutter Operation

For simultaneous operation of more than one camera shutter, Model 1 Shutter Actuators may be parallel-connected in the following ways:

1 Connect the remote trigger terminals of two or more Power Supply units in parallel, operating from a common trigger switch.

2. Connect two or more solenoid units in parallel, operating from a single Power Supply unit.

IMPORTANT

The number of solenoids that can be operated from a single Power Supply unit depends on the power-line voltage. See Table 2-2.

3. Connect Power Supply units and solenoids in parallel, using both of the previous methods.

Instructions given for single actuator operation also apply for units wired in parallel.

TABLE 2-2

Shutter Type	Line Voltage			
	130 260	120 240	110 220	100 200
Alphax No. 3	7	6	5	4
Illex (Elgeet) No. 3× Universal	5	4	3	2
Alphax No. 4	5	4	3	2

Power Requirements

Unless otherwise indicated, this instrument is connected for 117-volt operation. To connect the instrument for 234-volt operation, remove the jumper wires between terminals 1 and 2, 3 and 4. Connect a jumper wire between terminals 2 and 3.

Shutter Actuator Model 2 or 3

Mounting

Power Supply Frame

Refer to Rear Frame information in this section.

Power Supply Model 2 or 3 and Power Supply Mounting Bracket

Grasp the Power Supply so that the front panel is toward you and the top of the Power Supply is down. With the Power Supply in this position, remove the two bottom screws. Lay the mounting bracket on the supply so the flat surface of the bracket is against the supply and the plastic knob is toward you. Line up the slots in the bracket so they are over the holes in the Power Supply 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 Power Supply cabinet. Do not tighten the screws at this time.

Power Supply Model 2 or 3 (box style) is mounted on a cemera back by inserting the screw supplied with the Power Supply 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 Power Supply mounting bracket to the camera back is shown in Fig. 2-26.

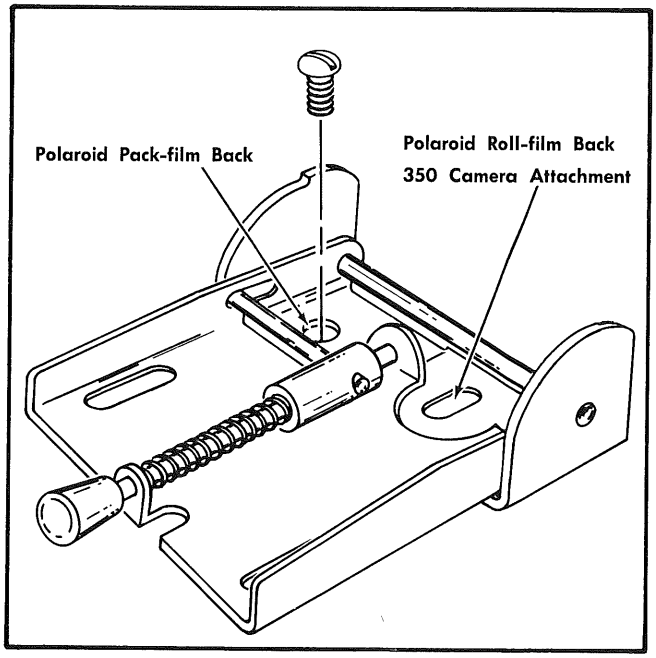


Fig. 2-26. Selecting proper mounting hole in Power Supply Mounting Bracket.

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

When it is necessary to open the camera back, the Power Supply may be rotated out of the way. The Power Supply is unlocked from its position by pulling back the plastic knob. Keep the knob pulled back (away from the camera back) and rotate the Power Supply out and down. Release the knob and allow the Power Supply to rotate into its down position. After the camera back is closed again, the Power Supply is rotated back to normal position by pushing it up and in toward the camera. The Power Supply locks into position automatically.

Shutter Actuator Solenoid

Using Lens and Rear Frame

Remove the cable release from the shutter. Now take the Shutter Actuator solenoid and loosen both of the set screws found between the main part of the body and the knurled nut. The set screw should be loosened only enough to allow the knurled nut to turn freely.

Hold the Shutter Actuator solenoid directly above the cable release connector on the shutter. Turn the knurled nut to screw the Shutter Actuator solenoid onto the cable release socket, or as an alternative method, loosen the set screws enough to permit the knurled nut to be removed from the Shutter Actuator solenoid body. The knurled nut is then screwed onto the cable release socket. After screwing the nut portion onto the cable release socket, remount the Shutter Actuator body onto the knurled nut. If the Shutter Actuator body will not remount onto the knurled nut portion, refer to the note below. After remounting the Shutter Actuator body onto the knurled nut, one or both of the two set screws used to retain the knurled nut must be tightened.

NOTE

It may be necessary to partly rotate the Lens to allow the Shutter Actuator solenoid to be mounted. The slight unscrewing of the Lens should not exceed ½ turn. This small amount will not materially affect the object-to-image ratio of the Lens, but will affect the focus of the camera; therefore, the camera will have to be refocused. When it is necessary to rotate a Lens of the type that is mounted with a locking ring, the locking ring may be loosened slightly and the Lens rotated 180°. A Lens using the locking ring will not show any change in the object-to-image ratio or focus after the Lens rotation.

CAUTION

If the camera system is to be subjected to shock in excess of 10 g for 10 to 20 milliseconds, the Shutter Actuator solenoid should be removed from the shutter. Failure to remove the Shutter Actuator solenoid will cause damage to the shutter.

Special Instructions for Ilex (Elgeet) No. 3× Universal Shutters

The SHUTTER RELEASE lever, on early lenses using the Ilex (Elgeet) No. 3× Universal shutter, can come in contact with the knurled nut that attaches the Shutter Actuator solenoid to the shutter. This interference will prevent operation of the shutter. To correct this difficulty, bend the SHUTTER RELEASE lever to provide clearance between it and the knurled nut. Care should be exercised in bending the SHUTTER RELEASE lever to ensure that it is bent only enough to obtain clearance between it and the knurled nut, and the SHUTTER RELEASE lever has free operation over its full travel.

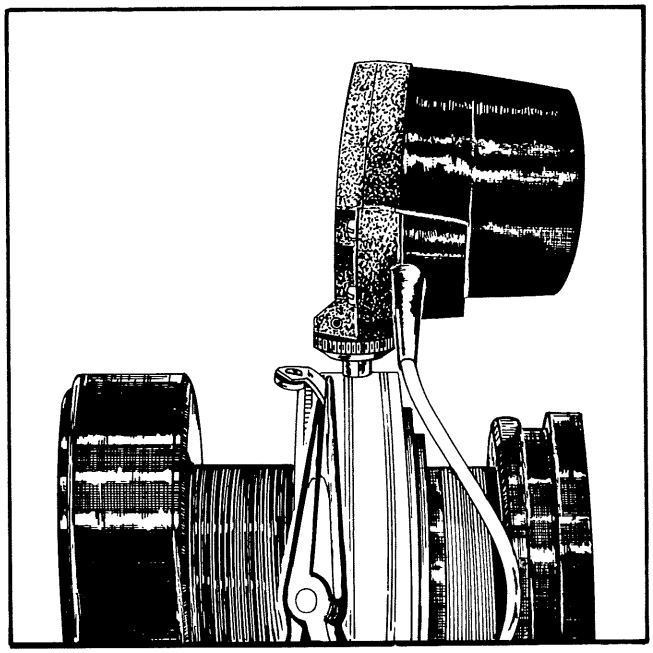


Fig. 2-27. Placing of long nose pliers prior to bending Shutter Release Lever on Ilex (Elgeet) No. 3× Universal shutter.

To bend the SHUTTER RELEASE lever, grip it with long-nose pliers adjacent to the shutter housing, see Fig. 2-27. Bend the SHUTTER RELEASE lever over the long-nose pliers using finger pressure only.

Type 350 Shutter Actuator Solenoid Bracket

Remove the button-head screws and washers from the Shutter Actuator solenoid. Mount the Shutter Actuator solenoid so that the knurled nut is toward the SHUTTER RELEASE lever of the Type 350 camera. Attach the Shutter Actuator solenoid to the Shutter Actuator bracket. Do not tighten the screws.

With the Shutter Actuator solenoid loosely mounted, energized the Shutter Actuator solenoid and adjust the forward and back travel from the SHUTTER RELEASE lever until the Shutter Actuator plunger causes the Type 350 camera shutter and advance mechanism to function properly. With the Shutter Actuator solenoid in this position, tighten the button-head screws with a hexagonal wrench.

De-energize and re-energize the Shutter Actuator solenoid several times to insure that the Shutter Actuator solenoid has been properly positioned. If necessary, loosen the button-head screws and adjust the position of the Shutter Actuator solenoid until operation is satisfactory.

CAUTION

Do not position the Shutter Actuator solenoid so far forward on the bracket as to prevent the plunger from extending to its full travel. Preventing the plunger from fully extending will cause damage to the Shutter Actuator solenoid and Power Supply.

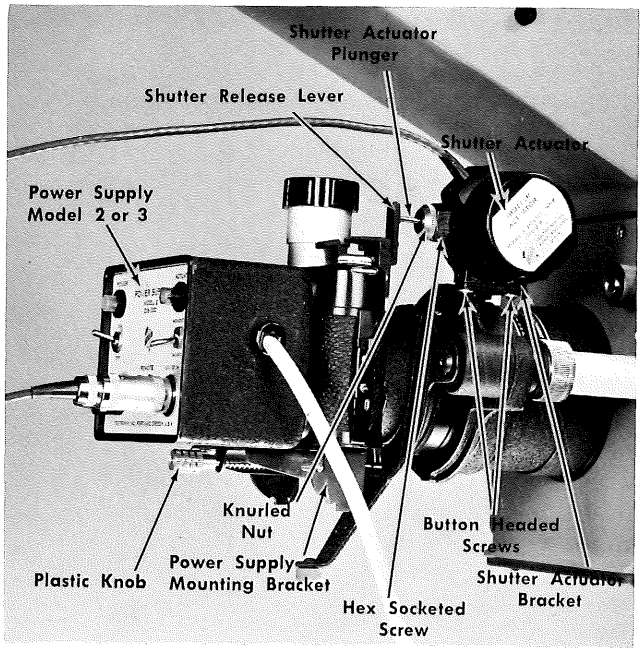


Fig. 2-28. Mounting the Shutter Actuator on the Type 350 camera.

Operating Controls and Connectors

ACTUATOR (Indicator Lamp) — Lights when the Shutter Actuator solenoid is energized. The lamp will stay lit as long as the actuator is held energized. The lamp is an indicator that the shutter is open if the SHUTTER SPEED selector is set on (B). The lamp is not, however, an indicator that the shutter is open if the SHUTTER SPEED selector is set on (T).

The ACTUATOR lamp mounted on the Power Supply Frame can be remotely located. To remotely locate the lamp, unplug the neon assembly and make an extension cord.

ON-OFF — Turns the line voltage to the Power Supply on or off.

POWER — Indicator lamp lights when line-voltage is applied to the Power Supply.

MOMENTARY-OFF-MAINTAIN — Causes the Shutter Actuator solenoid to be energized in the MOMENTARY or MAINTAIN positions. The MOMENTARY is a spring return to OFF position while the MAINTAIN position allows the Shutter Actuator solenoid to be held in the energized position indefinitely.

REMOTE — MODEL 3—Applying 24 VDC to the + and — pins of the REMOTE connector will energize an internal relay whose normally open contacts are connected across the MOMENTARY-OFF-MAINTAIN switch. The energizing of the internal relay will cause its normally open contacts to close, which will simulate holding the MOMENTARY-OFF-MAINTAIN switch in its MOMENTARY position. As long as 24 VDC is applied to the + and — pins of the REMOTE connector the Shutter Actuator solenoid will remain energized.

NOTE

Voltage polarity should be observed when several Shutter Actuator units are being triggered simultaneously from the same 24 VDC source.

REMOTE 115 (230) VDC + and — Pin Jacks — Model 2—Shorting the + and — pin jacks together causes the Shutter Actuator solenoid to energize. It is possible, by connecting a switch between these two pin jacks, to energize the Shutter Actuator solenoid from a remote location.

WARNING

When the ON-OFF switch is ON, the MOMENTARY-OFF-MAINTAIN switch is OFF and the line-power and the Shutter Actuator solenoid are connected to the power supply; LETHAL VOLTAGE appears beween the REMOTE 115 (230) VDC + and — pin jacks.

Power Cord — The power cord to the power supply is permanently attached. In the case of the Power Supply Frame, this allows the power cord connection to be made light tight.

Actuator 115 (230) VDC 1A (.5 A) — Receptacle into which the connector from the Shutter Actuator solenoid connects to obtain power to operate the Shutter Actuator solenoid.

Operating Shutter Actuator Model 2 or 3

NOTE

To prevent a misleading display on the oscilloscope, the leads of the Shutter Actuator 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 Shutter Actuator solenoid is energized.

Repetitive Waveforms

Mount the Shutter Actuator solenoid and Power Supply on the camera as described under Mounting, then mount the camera on the oscilloscope.

1. Apply line voltage to the Power Supply after connecting the Shutter Actuator solenoid to the Power Supply, then set the SHUTTER SPEED selector to (B).

2. Energize the Shutter Actuator solenoid by turning the ON-OFF switch to ON and the MOMENTARY-OFF-MAINTAIN switch to MAINTAIN.

3. Focus the camera.

4. After focusing the camera, return the MOMENTARY-OFF-MAINTAIN switch to OFF.

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 MOMENTARY-OFF-MAINTAIN switch to MOMENTARY and release.

To photograph a repetitive waveform using a shutter setting of (T), the MOMENTARY-OFF-MAINTAIN switch must be pushed twice to the MOMENTARY position. The first time the switch is operated to MOMENTARY, the shutter will open. The second operation will close the shutter.

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

Non-repetitive Waveforms

Mount and focus the camera system as outlined above under Repetitive Waveforms.

When photographing a non-repetitive waveform using a shutter setting of (T), set the ocilloscope for single-sweep operation so that the display, when presented, will not have jitter. Push the MOMENTARY-OFF-MAINTAIN switch to MOMENTARY and release. Wait for the waveform to occur, then push the MOMENTARY-OFF-MAINTAIN switch to MOMENTARY again and release. This last action closes the shutter.

When using a shutter setting of (B) to photograph a non-repetitive waveform, set the oscilloscope for single-sweep operation. Then set the MOMENTARY-OFF-MAINTAIN switch to MAINTAIN. After the waveform has occurred, the MOMENTARY-OFF-MAINTAIN switch is set to OFF to close the shutter.

NOTE

The Shutter Actuator System Model 2 or 3 may be left in the MAINTAIN (energized) position for an indefinite period without damaging the equipment.

SECTION 3
PHOTOGRAPHIC TECHNIQUES

CAMERA-OSCILLOSCOPE CONSIDERATIONS

Writing Rate

Writing rate is a figure of merit which roughly describes the ability of a particular camera system mounted on a particular oscilloscope to photograph fast-moving traces. The writing rate figure expresses the maximum spot rate (usually in centimeters per microsecond) which can be photographed satisfactorily.

The faster the oscilloscope spot moves, the dimmer the trace becomes. This is because the electron beam strikes each point on the phosphor coating for a shorter period of time. A camera system and oscilloscope which have a high writing rate are required for low-repetition-rate displays at the fast oscilloscope sweep rates.

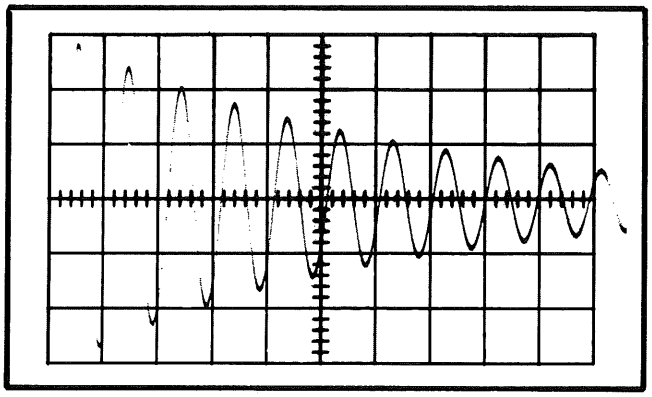


Fig. 3-1. A single-shot damped sinusoidal waveform which can be used to measure the maximum writing rate of an oscilloscope-camera combination.

Fig. 3-1 shows one way in which writing rate can be calculated. A single trace of a damped sine wave is displayed. The frequency of the damped waveform is such that the rapidly rising and falling portions of the first cycle or two fail to photograph. The writing rate of the system is found as follows: Starting from the left, find the first rapidly rising or falling portion of the damped sine wave which is photographed in its entirety. Let D represent the vertical distance in centimeters between the peaks which are connected by this portion. If D is three or more times as great as the horizontal distance occupied by one cycle (so that the horizontal component of velocity is small compared to the vertical component), the maximum writing rate in centimeters per microsecond is given approximately by:

$$\text{Maximum writing rate} = \pi \text{ Df}$$

where f is the frequency of the damped wave in megahertz.

It is inadvisable to speak of the absolute writing rate of any oscilloscope or camera, because so many variables are involved. Among the variables which must be considered are the speed of the camera lens, the type of CRT phosphor, the type of film, the CRT accelerating potential, the camera optical arrangement, the object-to-image ratio of the camera lens, and development time of the film.

It is possible to compare the effectiveness of two films by measuring their writing rate under the same conditions. In other words, you can determine which of the two films is the more effective under those particular conditions without being able to assign a specific value to either film.

The rated ASA speed of a film doesn't tell you much about its effectiveness in recording single oscilloscope traces. This is because the ASA speed rating is measured for 1/50 second exposure to light of normal daylight and spectral characteristics, while the very short exposures of fast CRT traces are several orders of magnitude smaller and have various spectral distributions. There is usually some relationship between ASA rating and maximum writing rate, however. Thus, it would be safe to assume that a film with a very high ASA speed rating would probably have a higher maximum writing rate than a film with a lower ASA speed rating.

CRT SELECTION

Selecting the CRT Phosphor

There are a great number of phosphor types presently available to the purchaser of a cathode-ray oscilloscope. Each of these phosphors has certain advantages and disadvantages compared to the others. There is no one phosphor which is best for all applications. Of the many types of phosphors available, five are most commonly in use. They are the P1, P2, P7, P11 and P31. Other phosphor types are usually restricted to special applications. Since the P1, P2, P7, P11 and P31 phosphors are the ones most commonly used, information contained in this portion of the manual will primarily concern these phosphors.

For low sweep rate or repetitive-sweep applications where a high writing rate is not required, practically any type of phosphor is satisfactory. It is only for single-sweep or low-repetition-rate applications at the fast sweep rates where selection of the CRT phosphor is important. In low-repetition-rate applications at the fast sweep rates, use of the proper phosphor can mean the difference between getting a good photograph and not getting one at all.

Probably the most important single characteristics of a phosphor for photographic purposes is the color of its emitted light. A blue or violet fluorescence has the highest actinic value, and, thus, is most suitable for photographic work. In general, it can be stated that (all other things being equal) the shorter the wavelength of the visible peak emitted light, the better the phosphor for photographic applications.

Most users of oscilloscopes are concerned not only with photographing the oscilloscope trace but in observing it directly as well. For such applications, it is important to have a phoshpor which gives good results in both types of applications. This frequently results in the choice of a phosphor such as P2 or P31 where the emitted light has a large enough actinic value to give a good writing rate, and also has sufficient persistance to permit easy viewing.

TABLE 3-1

COMMON PHOSPHOR TABLE

Phosphor Type	[1]Relative Photographic Writing Speed P11 Used as the standard.	[2]Relative Brightness Representative of 10 kV aluminized screens. P31 is standard.	Wavelength of Peak Radiant Energy	Decay Time in ms to 10% of initial value	Color	
					Fluorescence	Phosphorescence
P1	20% as fast	50% as bright	520 nanometers	95	Yellowish-Green	Yellowish-Green
P2	40% as fast	55% as bright	510 nanometers	120	Bluish-Green	Yellowish-Green
P7	75% as fast	35% as bright	450 nanometers	1500	Blue-White	Yellow-Green
P11	100%	15% as bright	450 nanometers	20	Purplish-Blue	Purplish-Blue
P31	50% as fast	100%	530 nanometers	32	Yellowish-Green	Yellowish-Green

[1]To achieve the writing rate comparisons the shutter of the test camera was left open five seconds to make use of the available light.

[2]Taken with a Spectra Brightness Spot Meter, which incorporates a C.I.E. Standard Eye Filter.

TABLE 3-2

POLAROID LAND FILM TYPES

Film Type	Approximate ASA Rating	Picture Size	Remarks
47[3]	300	3¼ ×4¼	Panchromatic type. Paper print. Roll film only. High-speed film with medium contrast.
107[3]	3000	3¼ ×4¼	Panchromatic type. Film packs only. Paper print. Similar to Type 47.
410[3]	10,000	3¼ ×4¼	Roll only. Panchromatic type. Paper print. Extra high-speed film good for extremely fast waveforms.
46L[4]	800	3¼ ×4¼	Roll form only. Yields positive transparency. Medium contrast. High speed. Panchromatic type.
146L[3]	125	3¼ ×4¼	Slower speed than type 46L. Faster development time. Roll form. Positive transparency. High contrast.
52[3]	200	4 × 5	Sheet form only. Panchromatic type. Yields paper print. Good general purpose film.
55 P/N[5]	50	4 × 5	Positive paper print and reproducible negative. Sheet form. Panchromatic type. High resolution negative.
57[3]	300	4 × 5	Panchromatic type. Sheet form only. Paper print. Equivalent of Type 47 in sheet form.
48[6]	75	3¼ ×4¼	Color film which yields a paper print. Available in roll form only. Requires no coating.
58[6]	75	4 × 5	Color film which yields a paper print. Available in sheet form only. Requires no coating.

TABLE 3-2 *(cont'd)*

Film Type	Approximate ASA Rating	Picture Size	Remarks
108[6]	75	3¼ ×4¼	Color film which yields a paper print. Available in film packs only. Requires no coating.

[3]Development time 10 seconds.

[4]Development time 2 minutes.

[5]Development time 20 seconds.

[6]Development time 50-60 seconds.

It has been observed that the P11 phosphor has the highest comparative writing rate of any common phosphor, and is thus best for photographic work. The medium short persistence of the phosphor is somewhat undesirable for general purpose work, but the disadvantages of this are slight. Type P11 should be chosen whenever the ultimate in photographic ability is required. Type P11 emits a medium short-duration blue light.

Since the Type P2 or P31 phosphors appears to be best for combined general purpose use and photographic applications, they are standard on most Tektronix oscilloscopes. Type P11 is standrad on Tektronix oscilloscopes where extremely rapid sweeps make it possible to obtain maximum benefit from the advantages of this phosphor. Other phosphors can be obtained on any of the Tektronix oscilloscopes.

FILM SELECTION

Selecting the Proper Film

For most oscilloscope work you will find Polaroid Land film the most convenient. This film permits you to see the picture very soon after taking it, and makes it unnecessary to expose part or all of the film before developing it.

The following table of Polaroid film types gives a brief outline of the available emulsions. The films recommended or films having equivalent characteristics may be used.

The following table of conventional films gives a brief outline of the films available. Film recommended or films having equivalent characteristics may be used.

TABLE 3-3
CONVENTIONAL FILM TYPES

Manufacturer	Film Name	ASA Speed	Remarks
Eastman Kodak	Tri-X	400	High speed, medium contrast. Roll film.
	R S Pan	650	Similar to Tri-X, in sheet form.
	Royal-X Pan Recording	1250	Ultra-fast roll film with low contrast.
	Royal-X Pan	1250	Same as Royal-X Pan Recording, in sheet form.
	Plus-X Pan	125	Medium speed film with good contrast. Both sheet and roll film.
	Panatomic-X	64	Slow speed, extremely fine grain and resolution. Both sheet and roll film.
Agfa	Isopan Record	1000	High-speed film with low contrast. Both sheet and roll film.
Ansco	Super Hypan	400	Medium-speed film with medium contrast. Both sheet and roll film.

Helpful Techniques with Film

Polaroid Land Film

CAUTION

Polaroid recommends that spray-on matte finishes not be used as a method of note marking on the self-coating Polaroid Land Film.

Several types of spray-on matte finishes are available which will enable you to make pencil or pen notes directly on the non-self coating Polaroid prints only. It can be obtained from any art or photo supply store.

Another method of note marking on non-self coating Polaroid prints is to use an ink eraser to rub the emulsion off the areas to be written on. Pen or pencil is then used to write the data on the print.

For self coating Polaroid prints the above method is changed to rubbing the emulsion off the areas to be written on wtih a damp cloth, being careful that the emulsion area removed is remote from the waveform area.

Still another method is to scratch the desired data onto the print with a sharp pointed instrument. The data should be scratched onto the print before it is coated. If the data is to be scratched onto a self coating Polaroid print, it must be done within 10 to 15 seconds after the print is separated from the negative.

For greater contrast on Polaroid prints, use slightly longer development time. A **decrease** in development time, on the other hand, will normally **increase** writing rate, with, however, a consequent lowering of print contrast. Shorter time will sometimes bring up waveform details not otherwise visible.

A method which sometimes produces very good results with Polaroid Land films is prefogging. In prefogging, the film is exposed to a predetermined amount of light for a definite period. The intensity of the light and the period of the exposure are so chosen that the film is brought right to the threshold of being exposed. A lesser amount of light is then required to expose the film. The prefogging technique can produce an increase in maximum writing rate of two or more times depending on film type, film condition, the nature of the prefog light and other variables. Prefogging results in a slightly foggy background on the photographs and somewhat less contrast. This is a small price to pay for a large increase in writing rate, however.

Additional information on prefogging will be found later in this section under the paragraphs headed Prefogging with Projected Graticule.

Postfogging is very similar to prefogging. The difference is that the film is exposed to the controlled light source after the exposure,, rather than before. Postfogging produces very nearly the same increase in writing rate as prefogging.

Miscellaneous Uses for Projected Graticule

Making Custom Graticules, Waveforms, etc. It is possible to display custom graticules, check points or custom forms using the Projected Graticule.

A picture of the graticule, waveform or checkpoints is taken from an oscilloscope or drawing. The image on the picture must be the same size as you wish to display on the CRT. If the graticule or waveform is taken with an oscilloscope camera, the camera should be equipped with a 1:1 object-to-image ratio lens.

Polaroid prints must first be coated on the image side and allowed to dry. The one-hundred series or colored Polaroid film will not work for this application since it is on a plastic base. If a conventional print is to be used, it is best to use one with a glossy finish.

Take the conventional or Polaroid paper print and rub light machine oil on the back side (side without the image) with a paper towel, cotton pad, etc. After the oil has been rubbed completely over the backside of the image area, coat the back of the print with Polaroid print coater, or plastic spray. Do not use a print coater to coat the image side of a Polaroid print after it has been used to coat over the oil.

Cut the paper print to fit in place of the graticule film. The graticule film can be used as a template to do this. The paper print must now be inserted into the graticule slide face down (image against plastic window in the slide). The slide is then installed and the Projected Graticule used in the normal manner.

Prefogging with Projected Graticule. The Projected Graticule can be used as a light source to effect prefogging of films for cases where extremely high-writing rate is required. Data on the exact control settings for the Projected Graticule and camera lens for the various films are available from your local Tektronix Field Engineer or representative.

Transillumination

While not strictly a means of improving writing rate, transillumination permits you to better see information which is recorded on prints. In the technique of transillumination, the print is observed with a source of bright diffused light,

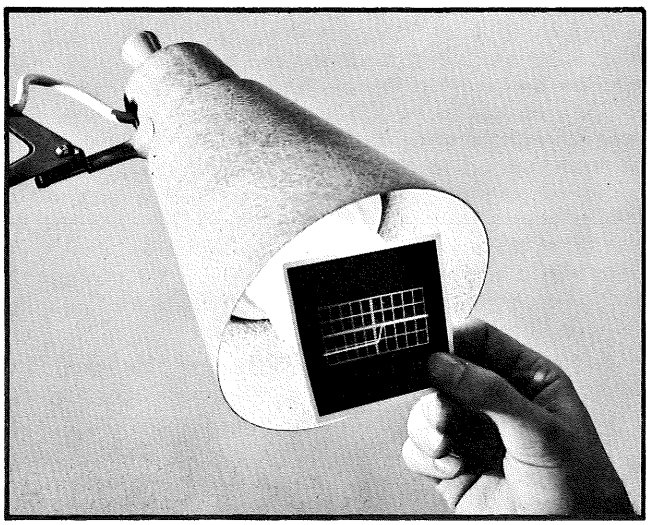


Fig. 3-2. Using transillumination to see otherwise invisible information.

such as a light bulb, directly behind the print (see Fig. 3-2). The light passing through the print brings out detail which would otherwise not be evident.

The transillumination technique will not work on the one-hundred series or colored Polaroid film since it is on a plastic base.

Conventional Film

The matte-finish sprays referred to previously are also good to coat standard prints and negatives on which you wish to mark. Remember that any mark on the negative may appear on the print. This suggests the idea of marking notes on the negative prior to printing.

The paragraphs under Polaroid Land film, on prefogging and postfogging, apply equally well to conventional films.

To increase the contrast of conventional films, the film may be left in the developer longer or the temperature of the developer may be raised; however, this may result in increased grain and fog.

The transillumination technique can be used with conventional-film negatives and prints. It is a method by which you may see information that might not ordinarily be seen. Refer to the paragraph on transillumination.

Negative Film Development

Equipment Needed

The bare essentials for the development of negative film are listed below:

1. Developer (If speed or contrast is more important than grain do not use a fine grain developer.)
2. Hypo (Rapid fixer is most convenient.)
3. Three glass, hard rubber, polyethylene, enameled steel, or stainless steel trays or a development tank. (A daylight loading tank for 35-mm film is a very convenent item.)
4. Thermometer
5. Graduated measure
6. Two containers of glass, hard rubber, polyethylene, enameled steel, or stainless steel to store the chemicals. The containers should block light from reaching the chemicals. For long-term storage, use brown glass bottles.
7. Timing device (Must be readable or audible in a dark room if one is used.)

Additional equipment which will ease the development of the negative film:

1. Stop-bath (Stops development and prevents contamination of Hypo.)
2. Hypo clearing agent (Allows a shorter wash period.)
3. Photo Flo (Stops water spotting and speeds drying.)
4. Film clips (Plastic clothes pins will do.)
5. Funnel

Procedure

Sheet and Roll Film. (Tank or Tray Development.) Mix the chemicals as directed. Once the chemicals are mixed and at the proper temperature, pour each one into a separate tank or tray. If no stop-bath is available, then substitute water in this tray.

Arrange the tanks or trays with the developer first, stop-bath or water second, and hypo last. Turn out the lights and be sure room is light tight. Remove the film sheet from the film holder and attach a film clip to it; or undo the roll of film, remove the film from the paper backing, and attach a film clip to each end of the film roll.

Start the timing device and immerse the film in the developer. Agitate the film at 30-second intervals, being sure that the developer covers the complete image area of the film. If roll film is being developed, see-saw it back and forth through the tank for the development period. Make sure all portions of the roll film receive the same time in the developer.

When the development time is up, switch the film to the stop-bath or water tank. Leave it in the stop-bath for about one minute. Roll film should be see-sawed back and forth throught the stop-bath to insure that the stop-bath covers all areas of the film.

Remove the film from the stop-bath at the end of one minute and immerse it in the fixing bath. Roll film should be see-sawed back and forth through the hypo tank in such a way that all parts of the film come into contact with the hypo solution. The length of time in the fixer will depend upon the solution and the type of film. (See the directions packed with the film.)

Place the film into a container in the sink and allow running water to rinse it for about 30 minutes. The water in the container should have one complete change at least every five minutes.

If the hypo clearing agent is used, the washing procedure in the paragraph above becomes:

1. Wash one minute in water.
2. Treat film with hypo clearing agent for 2 minutes.

3. Wash film in water for five minutes.

When the washing is complete, hang the film up to dry using the film clips. Make sure that the film touches nothing while it is drying. The flim clips must not be clipped onto an image area.

35-mm Daylight Tank Development. Daylight tank development allows 35-mm film in cassettes to be loaded into the tank and developed in normal room light.

Load the film into the tank as per instructions accompanying the tank. Mix the developer, stop-bath (if one is to be used), and fixer. Remove the empty cassette from the daylight tank. Pour the developer into the tank and start the timing device. Agitate the film at 30-second intervals throughout the development time.

At the end of the development time, pour out the developer and pour in the stop-bath or water. Allow the stop-bath or water to remain in the tank one to two minutes. During this time agitate the film several times.

When the time is up, pour out the stop-bath or water and pour in the fixer. Leave the fixing bath in the tank for the recommended time, agitating the tank at one-minute intervals during the time.

Pour out the hypo when the time is up and loosen the cover on the tank. Allow running water to wash the film for about thirty minutes. (See above for procedure used when hypo clearing agent is used.) Be sure that the water is at the proper temperature and that a total water change in the tank occurs every five minutes.

Connect a film clip to one end of the film and remove it from the daylight tank. Hang the film up to dry in a dust-free place, making sure that it touches nothing. By connecting a film clip to the bottom end of the film, it can be kept from curling up.

Storage of Supplies

Conventional Film. Do not open a film package until it is to be used. The vapor tight packaging will protect the film against high humidities. Under high-humidity conditions, film should be exposed and processed as soon as possible. Do not store open packages of film in damp basements, ice boxes, or refrigerators because of the high humidities in these places. If it is desirable to refrigerate an open package of film, it should be placed inside a can or jar which can be tightly sealed to keep out the moisture.

If an open package of film has been stored in a relatively high humity (above 60%) it should be dried before using, by means of a desiccating agent such as silica gel.

When storing film, the temperature in the area should be about 70°F. If a cool storage place is not available, the film may be stored in a refrigerator. Film may be stored for 2 months at 75°F, 6 months at 60°F, and 12 months at 50°F. The relative humity of storage area should be from 40% to 60%. To avoid moisture condensation on cold film surfaces, the unopened packages of film should be allowed about 30 minutes to 2 hours to come up to room temperature before opening, after they have been removed from cold storage.

Open packages of film should be kept away from chemical fumes, x-ray, and radioactive materials. Open packages of film should also be in an area with a humidity between 40% and 60%, with 40% preferred. It is better to keep open film in an area of 80°F at 40% humidity than in an area of 65° F at 70% humidity.

The developed film should ideally be stored in an area with a temperature between 60°F and 80°F with a humidity not over 60%.

Polaroid Film. The wrappers on Polaroid film will protect it against humidity through the expiration date. Once the film is taken out of its wrapper in high relative humidity areas, it must be exposed as soon as possible.

If it is necessary to store opened rolls or packets of Polaroid Land film, approximately the same conditions apply as with conventional film.

Polaroid film can be used at temperatures from about 40°F to 100°F. However, open film will keep longer in a temperature of 90°F at 50% humidity than it will in a temperature of 70°F at 80% humidity.

Polaroid 4 × 5 film packets are quite sensitive to humidity. The packets can be damaged rapidly when exposed to a humidity above 75%. To protect the packets, insert them into the plastic bag with the film immediately upon removing the foil wrapper. Fold over the end of the bag several times to keep out the moisture.

Developing Solutions. When you are through using the solutions, they should be poured into air-tight containers. The screw tops should be free from rust or other foreign material and have liners or gaskets. Cork and glass stoppers present sticking problems, and, therefore, should not be used.

Air is one of the worst enemies of photgraphic solutions. Oxidation of a solution may take place even in a tightly sealed container if the solution level is low. It is, therefore, advisable to store solutions in a container no larger than necessary.

The storage temperature of the solutions should be about 65°F to 70°F. Temperatures above this may cause rapid oxidation. On the other hand, too low a temperature (below 55°F) can cause the solutions to crystallize. Once a solution has crystallized, it may not be possible to redissolve the crystals. Repeated temperature changes cause photograpic solutions to have shorter life.

Most photographic solutions will remain good for about two months if they are stored in air tight containers of the right size and at a temperature of 60°F to 80°F. Each use of the solutions shortens the storage period.

All photographic solutions become weaker as they process additional film. All have a maximum amount of film area that can be run through them, after which they are considered of no further use. (See developer instructions.)

In high humidity areas the 4 × 5 film packet should be exposed and developed within 15 minutes after it is removed from the bag.

Polaroid film can be used at temperatures from about 40°F to 100°F. However, open film will keep longer in a temperature of 90°F at 50% humidity than it will in a temperature of 70°F at 80% humidity.

Polaroid 4 × 5 film packets are quite sensitive to humidity. The packets can be damaged rapidly when exposed to a humidity above 75%. To protect the packets, insert them into the plastic bag with the film immediately upon removing the foil wrapper. Fold over the end of the bag several times to keep out the moisture.

In high humidity areas the 4 × 5 film packet should be exposed and developed within 15 minutes after it is removed from the bag.

SECTION 4
PICTURE TAKING

Photographing Repetitive Signals

The following procedure can be used to obtain an exposure for both Polaroid and conventional film.

1. Position the external graticule, if the oscilloscope has one, for white lines.

2. Mount the camera bezel on the oscilloscope.

3. Obtain the signal and adjust the controls for the desired display.

4. Attach the camera to the bezel and secure the camera against the oscilloscope with the Mounting Latch.

5. Adjust the Focus, Astigmatism and Intensity controls for a sharp trace.

6. Set the APERTURE selector for the largest Lens opening (smallest f-stop number) and carefully focus the camera on the trace or halfway between the trace and graticule.

NOTE

When using an external graticule and both clear trace and external graticule are desired, the camera should be focused halfway between the trace and the external graticule.

7. Set the Intensity to midrange, Scale Illum three-quarters clockwise, SHUTTER SPEED to 1/5 second and APERTURE selector to f/5.6. The above control settings should be reasonably close for most film around 400 ASA and a waveform with a frequency near 1 kHz. For film with a 3000 ASA rating and a waveform with a frequency near 1 kHz, use a SHUTTER SPEED of 1/5 second and an APERTURE selector setting of f/4.5.

Photographing Single-Sweep Displays

Single-sweep displays are formed when the oscilloscope spot sweeps across the screen only once. The actual exposure time is, thus, determined not by the shutter setting but by the duration of the sweep plus phosphor persistence, provided the shutter is open sufficiently long. In one type of single-sweep photography, the graticule exposes the film for the time set by the shutter while the spot on the screen exposes the film for only the duration of the sweep. It is, therefore, not usually possible to adjust the trace and graticule for the same intensity and obtain good pictures, since the effective exposure times for the two are different.

Success in obtaining good photographs of single-sweep displays will come only with experience. A few tips, however, may reduce the amount of experimenting required.

1. Use steps 1 through 6, under Photographing Repetitive Signals, to set up the camera.

2. Select a shutter speed which is of a longer time than the event which is to be photographed.

3. Use the highest practical intensity without causing defocus of the trace.

4. Where practical, use f-stops higher than f/4, if an external graticule is used. This will permit both trace and external graticule to be in focus.

It should be remembered that since the shutter speed has already been determined, the selection of Lens opening will determine how well the trace photographs. In single-sweep applications you must make your camera settings for the trace intensity and duration. You cannot use the graticule as a reference.

Picture Troubles

If the trace is too wide (defocused) on the picture, this may be corrected by either using a higher f-stop number or a faster shutter speed. It is possible to adjust the APERTURE selector for any opening, even one between the marked numbers. The SHUTTER SPEED selector, however, must be set to a marked number.

1. No image appears on the picture

a. Dark slide still in camera back.

b. Inoperative shutter mechanism.

2. Image barely appears on a picture

a. Use higher Intensity and Scale Illum settings.

b. Use slower SHUTTER SPEED setting.

c. Set APERTURE selector for smaller f-stop number.

d. Use film with higher ASA rating.

e. Prefogging or postfogging may help. Refer to section on Photographic Techniques.

3. Light streaks on picture

a. Light seal between bezel and osciloscope faulty.

b. Dirty rollers in camera back.

c. Film handled too roughly during loading.

4. Picture apparently cut by dark lines

a. Dust cover still in Main Frame.

b. If Projected Graticule is used, the external graticule still in place.

5. Fogging on pictures

a. Viewing door has been open allowing graticule or CRT to reflect light.

b. Scale Illum control or GRATICULE BRIGHTNESS control of Projected Graticule set too high.

c. Light-struck or bad film.

d. Film exposed to light during loading.

6. Either trace or graticule in focus with the other out of focus

Use f-stop numbers larger than f/4 or Projected Graticule attachment.

7. Some portions of photographed signal appear brighter than others

Use an exposure long enough to allow several sweeps to occur.

8. Portion of photographed signal cut off by edge of film

1. Make sure film size is sufficient to record the entire signal for the object-to-image ratio lens and the oscilloscope display size being photographed.

2. Adjust rotating slide adapter, if adjustable style rotating slide adapter is being used.

Eliminating Parallax and Focusing Difficulties

The Tektronix oscilloscopes with the internal no parallax graticule and variable edge-lighting will have no parallax problems and, hence, no focusing difficulties.

The fact that on some oscilloscopes the trace and graticule are not in the same plane results in some parallax. This also makes it possible to obtain good focus simultaneously on both the trace and graticule at f-stop numbers below f/4. Both of these difficulties can be eliminated, where necessary by either of two methods.

The first method involves double exposing the film. First, set up the oscilloscope display as usual and focus the camera on the trace. Turn down the graticule intensity to minimum and make the first exposure of the trace only. Then, turnup the graticule to its former brightness and refocus the camera on the graticule. Turn down the oscilloscope trace and make a second exposure of the graticule only. The resulting photograph, due to refocusing between exposures, will have no parallax between graticule and trace, and will also have both the graticule and trace in proper focus. Care must be taken in using this method that the position of the film for the second exposure is the same as for the first exposure.

The second method involves the use of the Projected Graticule attachment. Here a virtual image of the graticule is projected on the oscilloscope screen in the same plane as the trace. Photographs taken will, therefore, have no parallax between the trace and graticule and both will be properly focused.

Effects of Camera Magnification on Exposure

The camera or Lens object-to-image ratio is the ratio of the object size to the image size. For example, a 1:1 Lens is one whose object is the same size as the image. The object-to-image ratio of the camera Lens has a definite effect on the exposures obtained.

The object-to-image ratio affects the amount of light which will fall on a given point of the film. The smaller the image on the film, the greater the intensity of the light. Therefore, the larger the object-to-image ratio of the Lens, the less time required to obtain a good exposure on the film. With a 1:0.2 Lens, slightly less exposure time is required to photograph a display than is required with a 1:0.9 Lens. The difference in the exposure time required with the various Lenses is so slight, however that they can usually be ignored.

There is less than one camera stop difference between 1:1 and a 1:0.2 Lens.

It is important to note that a slightly better writing rate can be obtained with a larger object-to-image ratio than with a smaller object-to-image ratio. Here again, the difference is fairly small unless there is a wide difference in the ratio.

Precautions for High Ambient Light Photographic Work

When the camera system is used in areas of high ambient light (such as outdoors in bright sunlight), some special precautions should be taken to insure good results. Make certain that the viewing hood door is closed (or that your face blocks the light) before taking the picture. Allow sufficient time after the door is closed to permit phosphorescence of the CRT screen to decay.

Reciprocity

Decreasing the f-stop number by one unit (e.g., from f/8 to f/5.6) doubles the area through which light can pass and expose film in the camera. Theoretically, such a decrease in the f-stop number requires that the exposure time be halved to produce the same exposure as obtained previously. This results in what is known at the Law of Reciprocity. The Reciprocity Law works quite well for medium intensity light at medium shutter speeds. The law fails, however, for very short exposures from bright light or for very long exposures from dim light. It is only for exposures in the range of approximately 1/250 to 1 second that the Reciprocity Law can be used.

SECTION 5

OPTICAL AND ELECTRICAL DESCRIPTION

MAIN FRAMES

C-12

Optical System

The viewing system used in the Main Frame consists of a viewing hood and two mirrors. Light from the oscilloscope screen strikes the beam-splitting mirror where a portion of the light is transmitted to the camera Lens and another portion is reflected to the second mirror.

A virtual image of the oscilloscope display is formed by the beam-splitting mirror. The virtual image acts as the object for the second mirror surface. The second mirror then forms a virtual image which is viewed by the observer. Due to the 45-degree arrangement of the beam-splitting mirror, the observer views the oscilloscope display as though he were looking directly toward the oscilloscope screen on a line perpendicular to the screen. This orthogonal view is full size, but the image appears approximately 20 inches away. In all cases, the Lens is considerably closer to the oscilloscope screen. The difference in the two distances produces a small amount of parallax between the viewed and photographed images. The small amount of parallax can usually be ignored.

C-13

Optical System

The viewing system of the Main Frame consists of a viewing door, which, when raised, allows part of the CRT display to be viewed. The Lens photographs the waveforms directly from the CRT with no mirrors in the light-ray path.

C-19

Optical System

Two viewing mirrors permit the oscilloscope display to be observed through the viewing hood. The mirrors, however, do not interfere in any way with the light-ray path to the Lens.

C-27

Optical System

The viewing system of the Main Frame consists of a viewing door, viewing tunnel and viewing hood. The CRT display is viewed at an angle resulting in some parallax of the viewed display. The Lens, however, photographs the display directly, with no parallax.

LENSES

Aperture Selection

There are basically 4 different Lenses which are available for the Camera System. They are the low-cost f/4.5, the general-purpose f/1.9, the high-speed f/1.4 and the extra high-speed f/1.3.

Of the four Lenses, the low-cost f/4.5 has the smallest maximum aperture. Although not as fast as the other Lenses, it is well suited for applications where the oscilloscope trace is moderately bright. These applications include work involving repetitive signals and work at slow sweep rates. The three Lens elements used in the Lens system produce a high degree of Lens correction.

The general-purpose f/1.9 Lens has a much greater maximum aperture than the f/4.5 Lens, and is used in applications where a very fast Lens is required. This includes single-sweep applications at the fast oscilloscope sweep rates. The f/1.9 Lens is approximately 5½ times as fast as the general-purpose f/4.5 Lens. The Lens system was specifically designed for oscilloscope applications. The high amount of correction designed into the Lens system provides faithful reproduction of the oscilloscope display on the film of the camera.

The high-speed f/1.4 Lens is intended for applications involving extremely dim oscilloscope traces. The f/1.4 Lens is approximately 1½ times as fast as the f/1.9 Lens and 8¼ times as fast as the f/4.5 Lens. This Lens includes a high degree of correction to produce images which are faithful reproductions of the orginal oscilloscope display. It also has been designed specially for oscilloscope applications. The focal length of the f/1.4 Lens is slightly different from the other two types, being 88 mm instead of 75 mm.

The extra high-speed f/1.3 Lens has been designed for single-sweep photography of very fast sweep rates. The f/1.3 is approximately 5 times as fast as the f/1.4 Lens and 12 times as fast as the f/4.5 Lens. This Lens was specially designed by Tektronix for extremely fast oscilloscope waveforms.

All the Lenses provide negligible distortion of the image. Their essential differences are in their ability to photograph extremely dim traces such as those produced in single-sweep applications at the highest sweep rates.

REAR FRAMES AND ROTATING SLIDE ADAPTER

The physical length of the various Lenses is quite different. In order to allow for this, and also to compensate for manufacturing tolerances, a special Lens-mounting system is used. This mounting system consists of the supports protruding from the front portion of the camera frame and the two locking nuts. The supports and the locking nuts permit Lenses of virtually any reasonable length to be installed in the camera.

The various Lenses used with the camera system are installed in appropriate Lens mounts which give the proper object and image distances, and, thus, the desired object-to-image ratio. The Lens mount automatically assures the proper image distance when the lens assembly is installed in the Rear Frame. The proper object distance is then automatically obtained when the camera is focused.

All of the camera backs used with the camera system provide the same image distance. This means that any two backs can be interchanged without affecting either the magnification of the Lens system or the focus of the image.

ACCESSORIES

Shutter Actuator Model 1

Circuit Description

The solenoid unit screws directly into the cable-release mount on the shutter[1], and the cord from the solenoid plugs into a jack on the panel of the Power Supply unit. A 350-volt pulse from C610 in the Power Supply energizes the solenoid, causing the actuating bayonet to operate the shutter. A spring in the solenoid unit immediately returns the bayonet to its normal position.

The Power Supply unit contains the power transformer and the triggering circuit of the instrument. The transformer primary consists of two windings, permitting operation on either 117 volts (parallel-connected) or 234 volts (series connected).

One secondary winding of T601 supplies six volts AC for operation of the pilot light and the switching relay. The other secondary winding delivers 250 volts AC which operates through the diodes to charge capacitor C610 to 350 volts, when the relay is in its normal position. The capacitor is kept at full charge until the trigger switch is operated, closing the discharge circuit. The resistor R610 discharges C610 when the instrument is not in use.

Relay K610 is electrically triggered either by depressing the MANUAL TRIGGER switch, SW610, or by closing the remote circuit connected to the remote trigger terminals. When the relay is triggered, C610 discharges through the output circuit, energizing the solenoid.

[1]**Use only the following shutters: Alphax No. 3, Ilex No. 3 × Universal, Alphax No. 4.**

Shutter Actuator Model 2 or 3

Circuit Description

Line voltage is applied to a bridge rectifier made up of D2, D3, D4 and D5. The rectified output voltage is then applied to the Shutter Actuator solenoid via pins 1 and 3 of J19.

Closing SW9 causes the Shutter Actuator solenoid to start energizing. As the actuator energizes, its plunger trips SW19, thus connecting pins 1 and 6 of J19 together and causing B15 to light. After SW19 has been tripped, the current path for the actuator is through the parallel combination of R10, R11, R12 and R13 and pin 2 of J19. R10, R11, R12 and R13 reduce the DC output voltage of the power supply to allow the actuator to remain energized indefinitely without damage.

D12 has been installed to suppress the arc which will occur when SW19 switches. Pin 4 of J19 grounds the Shutter Actuator solenoid and power supply-cases to the third wire ground.

SECTION 6

CAMERA SYSTEM MAINTENANCE

General Care of the Camera System

The Camera System should be given the same care as other precision optical devices. Care should be taken in handling the various mechanisms to assure that they are not damaged. The equipment should be kept covered when not in use to prevent dust accumulating on or in it.

Main Frames

The mirrors used in the Main Frames require a minimum of maintance. Normally, the only thing required is to keep the mirrors clean. The mirrors can be cleaned in the same manner as the Lenses. A soft, camel-hair brush can be used to remove loose dust after which fingerprints and smudges can be removed with clean, high-quality lens tissue.

NOTE

The mirror in the viewing tunnel may be cleaned by attaching the cleaning materials to a long rod. The rod is then inserted through the viewing door opening.

Lenses

In order to obtain maximum use from your camera, care should be taken that the Lens are kept clean and are properly installed in the instrument. When Lenses require cleaning, the entire Lens assembly can be removed from the camera by first loosening the locking nuts, then separating the rear of the camera from the front, and, finally, unscrewing the Lens from the rear of the camera frame. When replacing the Lens, do not force the parts together. If the parts are mated properly, they will fit together easily.

Loose dust on Lenses should be removed with a soft, camel-hair brush. Fingerprints and other smudges can be removed with clean, high-quality lens tissue. Be careful that you do not scratch the Lenses when cleaning them.

Do not attempt to disassemble the Lenses. The Lens assemblies are sealed; therefore, dirt should not get on the inner surfaces of the Lenses. Each Lens is individually adjusted at the factory to obtain the correct magnification factor. If the lenses are disassembled and then reassembled, the magnification factor of the Lens will probably be altered.

Special lubricants have been added to the shutter during manufacture which makes further lubrication unnecessary during its lifetime. It is essential that neither oil nor graphite be used on the shutter, as either may ruin it. If the shutter acts sluggish it may be the result of continuous wear or extreme atmospheric conditions. Dust should present no problems since the shutter is sealed inside the Lens system.

Camera Backs

Polaroid film backs used with the Camera System should be inspected after each package of film is exposed and before more film is put in the camera. Any reagent on the rollers or other parts of the back should be removed immediately using a moist rag. If reagent is left on the rollers of the back, it may ruin some of the pictures.

Electrical Visual Inspection

You should visually inspect the entire electrical instrument every few months for possible circuit defects. These defects may include such things as loose or broken connections, damaged banana jacks, scorched wires or components, or broken terminal strips. For the most visual troubles, the remedy is apparent; however, particular care must be taken when heat-damaged components are detected. Overheating of parts is often the result of other, less apparent defects. It is essential that you determine the cause of overheating before replacing heat-damaged parts, in order to prevent further damage.

Component Replacement

Standard Parts

Many components in the instrument are standard electronic parts available locally. However, all parts can be obtained through your Tektronix Field Engineer or Field Office. Before purchasing or ordering, consult the parts list to determine the value, tolerance and rating required.

Special Parts

Some parts are manufactured or selected by Tektronix to satisfy particular requirements, or are manufactured for Tektronix to our specifications. These and most mechanical parts should be ordered directly from your Tektronix Field Engineer or Field Office. See Parts Ordering Information and Special Notes and Symbols at the front of Section 7.

Disassembly of Main Frame

a. Remove the support casting from the camera and lay it aside.

b. Remove the lens and camera from the main frame, as a unit, by unscrewing the two locking nuts.

c. Remove the focus shaft hex nut with a $7/16$ inch socket wrench. Use a $3/8$ inch open-end wrench to prevent the focus shaft from turning.

NOTE

The threads are treated with a locking compound at the time of original assembly and will require a large torque to turn.

d. Remove the focus shaft group by turning the Focus knob counterclockwise.

e. Remove the support casting from front casting assembly.

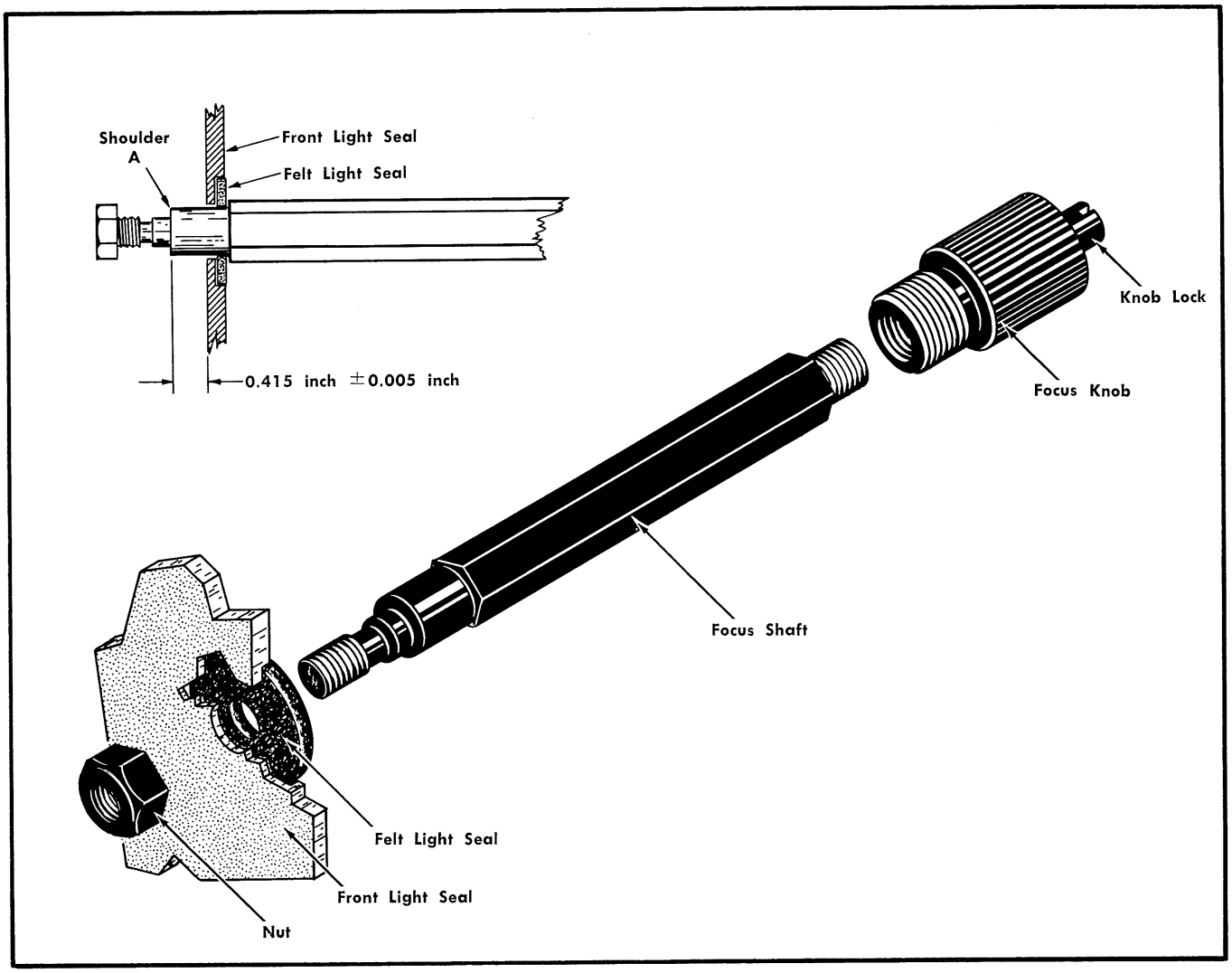


Fig. 6-1. Illustration showing focus shaft group assembled into the Main Frame.

Reassembly of Main Frame (refer to Fig. 6-1)

a. Loosen the Focus knob lock.

b. Insert the new focus shaft group into front casting assembly, guiding the focus shaft through the hole in the light shield.

c. Screw in the Focus knob until it seats in front casting assembly.

d. Hold the Focus knob trom turning and screw the focus shaft in or out of the Focus knob until it protrudes 0.415 inch ±0.0005 inch through the light shield as measured from light shield to shoulder 'A' on focus shaft (use calipers with depth feeler).

e. Replace the support casting.

f. Use a 3/8 inch open-end wrench to prevent the focus shaft from turning, replace and tighten focus shaft nut with 7/16 inch socket wrench.

g. Reassemble the camera. Check for proper operation and range of focus adjustment.

Soldering

Special silver-bearing solder is used to establish a bond to the ceramic terminal strips in Tektronix instruments. This bond may be broken by repeated use (especially if ordinary tin-lead solder is used) or by excessive heating. We recommend solder containing about 3% silver. Silver-bearing solder is usually available locally or may be purchased in one-pound rolls through your Tektronix Field Engineer or Field Office. Order by part number 251-0514-00.

Soldering to Ceramic Strips

1. Use a wedge-shaped soldering iron tip about 1/8-inch wide. This will allow you to apply heat directly to the solder in the terminal without touching the ceramic material, thereby reducing the amount of heat required.

2. Maintain a clean, properly tinned tip.

3. Use a hot iron for a short time. A 50- to 75-watt iron with good heat storage and transfer properties is adequate.

4. Avoid putting pressure on the strip with the soldering iron or other tools. Excessive pressure may cause the strip to crack or chip.

Soldering to Circuit Boards

The circuit boards have been constructed of the finest materials using the best construction techniques known. Each compartment hole is through plated to the oppsite side of the board, giving it unusual strength and resoldering durability. Components can be removed and replaced on the circuit board numerous times with no fear of lifting the etched circuit from the glass laminate.

1. Use a 50- to 75-watt soldering iron with a small wedge-shaped tip.

2. Use needle nose pliers to grip the component lead next to its body before applying heat.

3. 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. It may help to heat the mounting hole solder to a liquid state and shake out the excess.

Tin the prepared leads of the new part, then heat the mounting hole and install the new part.

Do not apply excessive heat. Use sufficient heat, however, along with a small amount of new solder, to establish a full-flow clean joint.

Ceramic Terminal Strips

Fig. 6-2 shows an assembled ceramic terminal strip. Replacement strips with studs attached are supplied under a single part number and spacers under another number. The original spacers may be reused if undamaged.

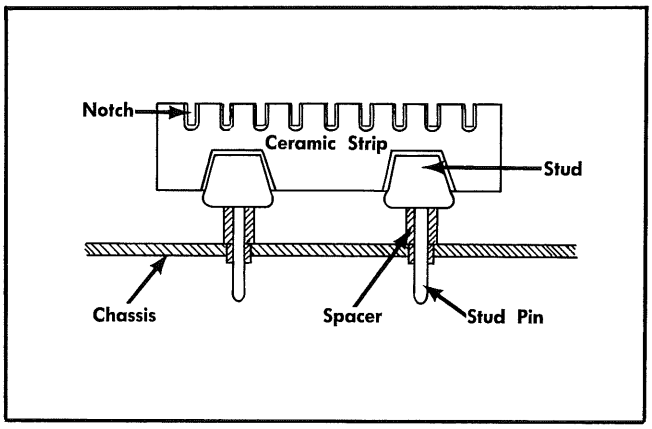


Fig. 6-2. Ceramic strip assembly.

Usually, a strip can be pried out of the chassis or pulled out with a pair of pliers. In some cases, you may choose to use a hammer and punch to drive out the studs from the opposite side of the chassis.

When the damaged strip has been removed, place new or used (but undamaged) spacers in the chassis holes. Then, carefully force the studs of the new strips into the spacers until they are completely seated. If necessary, use a soft-faced mallet, tapping lightly directly over the stud area of the strip.

NOTES

PARTS LIST ABBREVIATIONS

BHB	binding head brass
BHS	binding head steel
cap.	capacitor
cer	ceramic
comp	composition
conn	connector
CRT	cathode-ray tube
csk	countersunk
DE	double end
dia	diameter
div	division
elect.	electrolytic
EMC	electrolytic, metal cased
EMT	electrolytic, metal tubular
ext	external
F & I	focus and intensity
FHB	flat head brass
FHS	flat head steel
Fil HB	fillister head brass
Fil HS	fillister head steel
h	height or high
hex.	hexagonal
HHB	hex head brass
HHS	hex head steel
HSB	hex socket brass
HSS	hex socket steel
ID	inside diameter
incd	incandescent
int	internal
lg	length or long
met.	metal
mtg hdw	mounting hardware
OD	outside diameter
OHB	oval head brass
OHS	oval head steel
PHB	pan head brass
PHS	pan head steel
plstc	plastic
PMC	paper, metal cased
poly	polystyrene
prec	precision
PT	paper, tubular
PTM	paper or plastic, tubular, molded
RHB	round head brass
RHS	round head steel
SE	single end
SN or S/N	serial number
SW	switch
TC	temperature compensated
THB	truss head brass
thk	thick
THS	truss head steel
tub.	tubular
var	variable
w	wide or width
WW	wire-wound

PARTS ORDERING INFORMATION

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

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

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

SPECIAL NOTES AND SYMBOLS

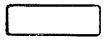
X000	Part first added at this serial number
00X	Part removed after this serial number
*000-0000-00	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components.
Use 000-0000-00	Part number indicated is direct replacement.
	Screwdriver adjustment.
	Control, adjustment or connector.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations which appear on the pullout pages immediately following the Diagrams section of this instruction manual.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the Description column.

Assembly and/or Component
Detail Part of Assembly and/or Component
mounting hardware for Detail Part
Parts of Detail Part
mounting hardware for Parts of Detail Part
mounting hardware for Assembly and/or Component

Mounting hardware always appears in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Mounting hardware must be purchased separately, unless otherwise specified.

PARTS ORDERING INFORMATION

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

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

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

Change information, if any, is located at the rear of this manual.

ABBREVIATIONS AND SYMBOLS

For an explanation of the abbreviations and symbols used in this section, please refer to the page immediately preceding the Electrical Parts List in this instruction manual.

INDEX OF MECHANICAL PARTS LIST ILLUSTRATIONS

SECTION 7

MECHANICAL PARTS LIST

FIG. 1 STANDARD C-12

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5 Description
1-	122-0635-00			1	ASSEMBLY, main frame
	- - - - - -			-	assembly includes:
	122-0563-00	101	1897	1	ASSEMBLY, viewing tunnel
	122-0589-00	1898		1	ASSEMBLY, viewing tunnel
	- - - - - -			-	assembly includes:
	122-0588-00			1	ASSEMBLY, occluder
	- - - - - -			-	assembly includes:
-1	- - - - - -			1	FRAME, (not replaceable)
-2	- - - - - -			1	SHIELD, door (not replaceable)
-3	- - - - - -			1	ROD, shaft (not replaceable)
-4	366-0123-00			1	KNOB, small black
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-5	334-0819-00			1	TAG, index
-6	253-0044-00			FT	TAPE, sponge, 3/8 x 1/2 inch (1/2 inch long)
-7	344-0042-00			2	CLIP, spring
	- - - - - -			-	mounting hardware for each: (not included w/clip)
-8	213-0088-00			2	SCREW, thread forming, #4 x 1/4 inch, PHS
	- - - - - -			-	mounting hardware: (not included w/occluder assembly)
-9	213-0104-00			2	SCREW, thread forming, #6 x 3/8 inch, THS
-10	211-0080-00	X1334		1	SCREW, plastic, 1/4-20 x 5/32 inch
-11	122-0554-00	101	140X	1	ASSEMBLY, timer
-12	213-0017-00	X141	179	1	SCREW, set, 1/4-20 x 3/16 inch, HSS
	211-0080-00	180	1333X	1	SCREW, plastic, 1/4-20 x 15/32 inch
-13	134-0031-00	101	1897X	1	PLUG
	122-0587-00	X1334		1	ASSEMBLY, release cable adapter
	- - - - - -			-	assembly includes:
-14	211-0517-00			1	SCREW, 6-32 x 1 inch, PHS
-15	366-0176-00			1	KNOB, black
-16	210-0844-00			2	WASHER, rubber, 7/32 ID x 3/8 inch OD
-17	358-0179-00			1	BUSHING
-18	204-0118-00			1	BODY, release cable clamp
-19	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-20	213-0108-00			1	SCREW, 1/4-20 x 3/8 inch, RHS
-21	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
-22	367-0029-00	101	1897	1	ASSEMBLY, handle
	- - - - - -			-	assembly includes:
	367-0019-00			1	HANDLE, grip, 1 inch wide x 6 inches long
	346-0011-00			1	STRAP, handle
	381-0156-00			2	BAR, handle
	214-0116-00			2	LINK, handle
	213-0045-00			2	SCREW, self tapping, 4-40 x 5/16 inch, PHS
	212-0507-00			2	SCREW, 10-32 x 3/8 inch, PHS
	- - - - - -			-	mounting hardware: (not included w/handle assembly)
	210-0010-00	101	1897	2	LOCKWASHER, internal #10

FIG. 1 STANDARD C-12 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
1-23	367-0011-00	1898		1	HANDLE, 5/12 inches, blue vinyl
	- - - - - -			-	mounting hardware: (not included w/handle)
	343-0073-00	1898		2	COVER, clamp, chrome
	210-0006-00	1898		4	LOCKWASHER, internal #6
	211-0504-00	1898		4	SCREW, 6-32 x 1/4 inch, PHS
-24	337-0410-00	101	1897	1	SHIELD, viewing tunnel
	337-0523-00	1898		1	SHIELD, viewing tunnel
-25	334-0799-00			1	TAG, name plate
-26	334-0679-00			1	TAG, blank insert
-27	406-0667-00			1	BRACKET, mirror
	- - - - - -			-	mounting hardware: (not included w/bracket)
-28	212-0069-00			2	SCREW, 8-32 x 1/4 inch, THS
-29	122-0515-00			1	MIRROR, viewing tunnel
-30	214-0168-00			1	GASKET, light seal, rubber
	- - - - - -			-	mounting hardware: (included w/viewing tunnel assembly)
-31	211-0574-00			4	SCREW, 6-32 x 3/8 inch, 82° csk, FHS
	122-0570-00			1	ASSEMBLY, front casting
	- - - - - -			-	assembly includes:
	122-0738-00			1	ASSEMBLY, front casting frame
	- - - - - -			-	assembly includes:
-32	- - - - - -			1	FRAME, front casting (not replaceable)
-33	- - - - - -			2	ROD, support (not replaceable)
-34	- - - - - -			2	NUT, draw (not replaceable)
-35	366-0122-00	101	2257	1	KNOB, focus
	366-0186-00	2258		1	KNOB, focus
-36	214-0251-00	X2258		1	LOCK, focus
-37	354-0113-00			1	RING, light seal, "O" ring
-38	200-0271-00			1	COVER, bottom
	- - - - - -			-	mounting hardware: (not included w/cover)
-39	211-0574-00			2	SCREW, 6-32 x 3/8 inch, 82° csk, FHS
-40	348-0036-00	101	3893	2	FOOT, rubber, blue
	348-0048-00	3894		2	FOOT, rubber, black
-41	122-0533-00	101	210	1	MIRROR, beam-splitting
	122-0561-00	211		1	MIRROR, beam-splitting
	- - - - - -			-	mounting hardware: (not included w/mirror)
-42	344-0041-00			2	CLIP, mirror retainer
-43	211-0005-00			2	SCREW, 4-40 x 1/8 inch, PHS
-44	210-0919-00			2	WASHER, plastic, 0.093 ID x 1/2 inch OD
-45	211-0070-00			2	SCREW, 2-56 x 1/4 inch, OHS
-46	210-0405-00			2	NUT, hex., 4-40 x 3/16 inch
-47	337-0408-00	101	1888	1	SHIELD, light seal, front
	- - - - - -			-	mounting hardware: (not included w/shield)
-48	211-0105-00	101	1888	8	SCREW, 4-40 x 3/16 inch, 82°, csk, FHS
-49	214-0171-00	101	1888	1	GASKET, light seal, focus rod
-50	214-0170-00	101	1888	2	GASKET, light seal, support rod

FIG. 1 STANDARD C-12 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-51	124-0151-00	101	1888	1		SEAL, light, black velvet ribbon
	122-0737-00	1889		1		ASSEMBLY, shield, light seal
	- - - - - -			-		assembly includes:
	- - - - - -			1		SHIELD, light seal (not replaceable)
	214-0171-00			1		GASKET, light seal, focus rod
	214-0170-00			2		GASKET, light seal, support rod
	124-0151-00			1		SEAL, light, black velvet ribbon
	- - - - - -			-		mounting hardware: (not included w/shield assembly)
	211-0105-00	1889		8		SCREW, 4-40 x 3/16 inch, 82° csk, FHS
-52	384-0580-00	101	2257	1		ROD, shaft focus
	384-0600-00	2258		1		ROD, shaft focus
	- - - - - -			-		mounting hardware: (not included w/rod)
-53	210-0412-00			1		NUT, hex., 1/4-28 x 7/16 inch
-54	384-0577-00			2		ROD, support
	- - - - - -			-		mounting hardware for each: (not included w/rod)
-55	211-0072-00			1		SCREW, 5/16-24 x 3/4 inch, socket cap screw
-56	426-0114-00	101	1888	1		FRAME, support
-57	214-0164-00	101	1888	1		PIN, hinge, top
-58	214-0165-00	101	1888	1		PIN, hinge, bottom
-59	367-0020-00	101	1888	1		LATCH, front
	- - - - - -			-		mounting hardware: (not included w/latch)
-60	212-0068-00	101	1888	1		SCREW, 8-32 x 5/16 inch, THS
-61	355-0067-00	101	1888	1		STUD, latch
	122-0742-00	1889		1		ASSEMBLY, support frame
	- - - - - -			-		assembly includes:
	426-0155-00			1		FRAME, support
	214-0164-00			1		PIN, singe, top
	214-0165-00			1		PIN, hinge, bottom
	367-0020-00			1		LATCH, front
	- - - - - -			-		mounting hardware: (not included w/latch)
	212-0068-00			1		SCREW, 8-32 x 5/16 inch, THS
	355-0067-00			1		STUD, latch
-62	200-0274-00			1		COVER, dust
-63	122-0568-00	101	4570X	1		ASSEMBLY, camera mount (see data sheet)
-64	122-0566-00	101	3585	1		ASSEMBLY, rotating slide adapter (see data sheet)
	122-0602-00	3586	13207	1		ASSEMBLY, rotating slide adapter (see data sheet)
	122-0739-00	13208		1		ASSEMBLY, rotating slide adapter (see data sheet)
-65	122-0565-00	101	4799	1		ASSEMBLY, rear casting (see data sheet)
	122-0591-00	4800		1		ASSEMBLY, rear casting (see data sheet)
-66	122-0548-00	101	12299	1		ASSEMBLY, lens (see data sheet)
	122-0692-00	12300		1		ASSEMBLY, lens (see data sheet)

FIG. 1 STANDARD C-12 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty 1 2 3 4 5	Description
					STANDARD ACCESSORIES
1-67	122-0557-00	101	2512	1	ASSEMBLY, Graflok back (see data sheet)
-68	387-0460-00	2516	7155	1	PLATE, focus (Polaroid roll film back)
	387-0893-00	7156		1	PLATE, focus (Polaroid pack film back)
-69	122-0556-00	101	3185	1	ASSEMBLY, Polaroid back (see data sheet)
	122-0603-00	3186	7155	1	ASSEMBLY, Polaroid back (see data sheet)
	122-0671-00	7156		1	ASSEMBLY, Polaroid packback (see data sheet)
-70[1]	337-0411-00	101	12011	1	SHIELD, rubber, viewing hood
	337-0411-01	12012		1	SHIELD, rubber, viewing hood
-71[1]	122-0546-00	101	1333	1	ASSEMBLY, release cable
	- - - - - -			-	assembly includes:
	122-0513-00			1	RELEASE, cable
	210-0537-00			2	NUT, hex., 5-44 x 3/16 inch
[1]	122-0586-00	1334	12565	1	CABLE, release
[1]	122-0586-01	12566		1	CABLE, release
-72[2]	385-0153-00	101	7331	1	ROD, hex., 1/2 x 1.937 inch, long
[2]	385-0177-00	7332		1	ROD, hex., 1/2 x 2.281 inches, long
-73[2]	348-0036-00	101	3493	1	FOOT, rubber, blue
[2]	348-0048-00	3494		1	FOOT, rubber, black
[1]	070-0383-01			2	MANUAL, instruction (not shown)

[1]NOTE: Standard accessories for main frame when purchased separately.

[2]NOTE: Standard accessories for rear casting when purchased separately.

FIG. 2 STANDARD C-13

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
2-	122-0564-00	101	353	1	ASSEMBLY, main frame
	122-0609-00	354		1	ASSEMBLY, main frame
	- - - - - -			-	assembly includes:
	122-0738-00	101	353	1	ASSEMBLY, front casting frame
	122-0738-01	354		1	ASSEMBLY, front casting frame
	- - - - - -			-	assembly includes:
-1	- - - - - -			1	FRAME, front casting (not replaceable)
-2	- - - - - -			2	ROD, support (not replaceable)
-3	- - - - - -			2	NUT, draw (not replaceable)
-4	366-0122-00	101	177	1	KNOB, focus
	366-0186-00	178		1	KNOB, focus
-5	214-0251-00	X178		1	LOCK, focus
-6	354-0113-00			1	RING, light seal, "O" ring
-7	200-0271-00			1	COVER, bottom
	- - - - - -			-	mounting hardware: (not included w/cover)
-8	211-0574-00			2	SCREW, 6-32 x 3/8 inch, 82° csk, FHS
-9	348-0036-00	101	275	2	FOOT, rubber blue
	348-0048-00	276		2	FOOT, rubber, black
-10	200-0481-00	X354		1	COVER, top
	- - - - - -			-	mounting hardware: (not included w/cover)
-11	211-0079-00	X354		2	SCREW, 2-56 x 3/16 inch, PHS
	210-0405-00	X354		2	NUT, hex., 2-56 x 3/16 inch (not shown)
-12	214-0331-00	X354		1	HINGE, cover
	- - - - - -			-	mounting hardware: (not included w/hinge)
-13	211-0069-00	X354		2	SCREW, 2-56 x 1/8 inch, PHS
-14	214-0330-00	X354		1	SPRING, cover
	- - - - - -			-	mounting hardware: (not included w/spring)
-15	211-0079-00	X354		2	SCREW, 2-56 x 3/16 inch, PHS
-16	334-0783-00	X354		1	TAG, name plate
-17	334-0679-00	X354		1	TAG, blank insert
-18	337-0569-00	X354		2	SHIELD
	- - - - - -			-	mounting hardware for each: (not included w/shield)
-19	211-0001-00	X354		2	SCREW, 2-56 x 1/4 inch, RHS
-20	210-0405-00	X354		2	NUT, hex., 2-56 x 3/16 inch
-21	406-0968-00			1	BRACKET, light seal
-22	337-0408-00	101	157	1	SHIELD, light seal, front
	- - - - - -			-	mounting hardware: (not included w/shield)
-23	211-0105-00	101	157	8	SCREW, 4-40 x 3/16 inch, 82° csk, FHS
-24	214-0171-00	101	157	1	GASKET, light seal, focus rod
-25	214-0170-00	101	157	2	GASKET, light seal, support rod
-26	124-0151-00	101	157	1	SEAL, light, black velvet ribbon
	122-0737-00	158		1	ASSEMBLY, shield, light seal
	- - - - - -			-	assembly includes:
	- - - - - -			1	SHIELD, light seal, (not replaceable)
	214-0171-00			1	GASKET, light seal, focus rod
	214-0170-00			2	GASKET, light seal, support rod
	124-0151-00			1	SEAL, light, black velvet ribbon

FIG. 2 STANDARD C-13 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
2-	- - - - - -			-	mounting hardware: (not included w/shield assembly)
	211-0105-00	158	353	8	SCREW, 4-40 x 3/16 inch, 82° csk, FHS
	211-0105-00	354		6	SCREW, 4-40 x 3/16 inch, 82° csk, FHS
-27	384-0580-00	101	177	1	ROD, shaft, focus
	384-0600-00	178		1	ROD, shaft, focus
	- - - - - -			-	mounting hardware: (not included w/rod)
-28	210-0412-00			1	NUT, hex., 1/4-28 x 7/16 inch
-29	384-0577-00			2	ROD, support
	- - - - - -			-	mounting hardware: (not included w/rod)
-30	211-0072-00			1	SCREW, 5/16-24 x 3/4 inch, socket cap screw
-31	426-0114-00	101	157	1	FRAME, support
-32	214-0164-00	101	157	1	PIN, hinge, top
-33	214-0165-00	101	157	1	PIN, hinge, bottom
-34	367-0020-00	101	157	1	LATCH, front
	- - - - - -			-	mounting hardware: (not included w/latch)
-35	212-0068-00	101	157	1	SCREW, 8-32 x 5/16 inch, THS
-36	355-0067-00	101	157	1	STUD, latch
	122-0742-00	158		1	ASSEMBLY, support frame
	- - - - - -			-	assembly includes:
	426-0155-00			1	FRAME, support
	214-0164-00			1	PIN, hinge, top
	214-0165-00			1	PIN, hinge, bottom
	367-0020-00			1	LATCH, front
	- - - - - -			-	mounting hardware: (not included w/latch)
	212-0068-00			1	SCREW, 8-32 x 5/16 inch, THS
	355-0067-00			1	STUD, latch
-37	200-0274-00			1	COVER, dust
-38	200-0315-00	101	353X	1	COVER, top
	- - - - - -			-	mounting hardware: (not included w/cover)
-39	213-0093-00	101	353X	4	SCREW, thread cutting, 6-20 x 1/2 inch, FHS
-40	334-0783-00	101	353X	1	TAG, name plate
-41	334-0679-00	101	353X	1	TAG, blank insert
-42	214-0168-00	101	353X	1	GASKET, light seal, rubber
-43	122-0568-00	101	329X	1	ASSEMBLY, camera mount (see data sheet)
-44	122-0566-00	101	292	1	ASSEMBLY, rotating slide adapter (see data sheet)
	122-0602-00	293		1	ASSEMBLY, rotating slide adapter (see data sheet)
-45	122-0565-00	101	149	1	ASSEMBLY, rear casting (see data sheet)
	122-0591-00	150		1	ASSEMBLY, rear casting (see data sheet)
-46	122-0550-00			1	ASSEMBLY, lens (see data sheet)

FIG. 2 STANDARD C-13 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
					STANDARD ACCESSORIES
2-47	387-0460-00	101	579	1	PLATE, focus (Polaroid roll film back)
	387-0893-00	580		1	PLATE, focus (Polaroid pack film back)
-48	122-0556-00	101	212	1	ASSEMBLY, Polaroid back (see data sheet)
	122-0603-00	213	579	1	ASSEMBLY, Polaroid back (see data sheet)
	122-0671-00	580		1	ASSEMBLY, Polaroid packback (see data sheet)
-49[1]	122-0546-00	101	149	1	ASSEMBLY, release cable
	- - - - - -			-	assembly includes:
	122-0513-00			1	RELEASE, cable
	210-0537-00			2	NUT, hex., 5-44 x 3/16 inch
[1]	122-0586-00	150		1	CABLE, release
-51[2]	385-0153-00	101	599	1	ROD, hex., 1/2 x 1.037 inches, long
[2]	385-0177-00	600		1	ROD, hex., 1/2 x 2.281 inches, long
-51[2]	348-0036-00	101	275	1	FOOT, rubber, blue
[2]	348-0048-00	276		1	FOOT, rubber, black
[1]	122-0587-00	X150		1	ASSEMBLY, release cable adapter (installed)
	- - - - - -			-	assembly includes:
-52	211-0517-00			1	SCREW, 6-32 x 1 inch, PHS
-53	366-0176-00			1	KNOB, black
-54	210-0844-00			2	WASHER, rubber, 7/32 ID x 3/8 inch, OD
-55	358-0179-00			1	BUSHING
-56	204-0118-00			1	BODY, release cable clamp
-57	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-58	213-0108-00			1	SCREW, 1/4-20 x 3/8 inch, RHS
-59	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch, OD
[1]	070-0383-01			2	MANUAL, instruction (not shown)

[1]NOTE: Standard accessories for main frame when purchased separately.

[2]NOTE: Standard accessories for rear castings when purchased separately.

FIG. 3 STANDARD C-19

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5 Description
3-	122-0636-00			1	ASSEMBLY, main frame
	- - - - - -			-	assembly includes:
	122-0567-00	101	287	1	ASSEMBLY, viewing tunnel
	122-0590-00	288		1	ASSEMBLY, viewing tunnel
	- - - - - -			-	assembly includes:
	122-0588-00			1	ASSEMBLY, occluder
	- - - - - -			-	assembly includes:
-1	- - - - - -			1	FRAME (not replaceable)
-2	- - - - - -			1	SHIELD, door (not replaceable)
-3	- - - - - -			1	ROD, shaft (not replaceable)
-4	366-0123-00			1	KNOB, small black
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-5	334-0819-00			1	TAG, index
-6	253-0044-00			FT	TAPE, sponge, 3/8 x 1/2 inch (1/2 inch long)
-7	344-0042-00			2	CLIP, spring
	- - - - - -			-	mounting hardware for each: (not included w/clip)
-8	213-0088-00			2	SCREW, thread forming, #4 x 1/4 inch, PHS
	- - - - - -			-	mounting hardware: (not included w/occluder assembly)
-9	213-0104-00			2	SCREW, thread forming, #6 x 3/8 inch, THS
-10	211-0080-00	X716		1	SCREW, plastic, 1/4-20 x 15/32 inch
-11	134-0031-00	101	288X	1	PLUG
	122-0587-00	X176		1	ASSEMBLY, release cable adapter
	- - - - - -			-	assembly includes:
-12	211-0517-00			1	SCREW, 6-32 x 1 inch, PHS
-13	366-0176-00			1	KNOB, black
-14	210-0844-00			2	WASHER, rubber, 7/32 ID x 3/8 inch OD
-15	358-0179-00			1	BUSHING
-16	204-0118-00			1	BODY, release cable clamp
-17	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-18	213-0108-00			1	SCREW, 1/4-20 x 3/8 inch, RHS
-19	210-0046-00			1	LOCKWASHER, internal 1/4 ID x 0.400 inch OD
-20	367-0029-00	101	287	1	ASSEMBLY, handle
	- - - - - -			-	assembly includes:
	367-0019-00			1	HANDLE, grip, 1 inch wide x 6 inches long
	346-0011-00			1	STRAP, handle
	381-0156-00			2	BAR, handle
	214-0116-00			2	LINK, handle
	213-0045-00			2	SCREW, self tapping, 4-40 x 5/16 inch, PHS
	212-0507-00			2	SCREW, 10-32 x 3/8 inch, PHS
	- - - - - -			-	mounting hardware: (not included w/handle assembly)
	210-0010-00	101	287	2	LOCKWASHER, internal, #10
-21	367-0011-00	288		1	HANDLE, 5 1/2 inches, blue vinyl
	- - - - - -			-	mounting hardware: (not included w/handle)
	343-0073-00	288		2	COVER, clamp, chrome
	210-0006-00	288		4	LOCKWASHER, internal, #6
	211-0504-00	288		4	SCREW, 6-32 x 1/4 inch, PHS
-22	337-0459-00	101	287	1	SHIELD, viewing tunnel
	337-0524-00	288		1	SHIELD, viewing tunnel

FIG. 3 STANDARD C-19 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty 1 2 3 4 5	Description
3-23	334-0786-00			1	TAG, name plate
-24	334-0679-00			1	TAG, blank insert
-25	406-0708-00			1	BRACKET, mirror
	- - - - - -			-	mounting hardware: (not included w/bracket)
-26	212-0069-00			1	SCREW, 8-32 x 1/4 inch, THS
-27	122-0562-00			2	MIRROR, viewing tunnel
-28	406-0709-00			1	BRACKET, mirror
	- - - - - -			-	mounting hardware: (not included w/bracket)
-29	212-0069-00			2	SCREW, 8-32 x 1/4 inch, THS
-30	214-0168-00			1	GASKET, light seal, rubber
	- - - - - -			-	mounting hardware: (included w/viewing tunnel assembly)
-31	211-0574-00			4	SCREW, 6-32 x 3/8 inch, 82° csk, FHS
	122-0564-00			1	ASSEMBLY, front casting
	- - - - - -			-	assembly includes:
	122-0738-00			1	ASSEMBLY, front casting frame
	- - - - - -			-	assembly includes:
-32	- - - - - -			1	FRAME, front casting (not replaceable)
-33	- - - - - -			2	ROD, support (not replaceable)
-34	- - - - - -			2	NUT, draw (not replaceable)
-35	366-0122-00	101	301	1	KNOB, focus
	366-0186-00	302		1	KNOB, focus
-36	214-0251-00	X302		1	LOCK, focus
-37	354-0113-00			1	RING, light seal, "O" ring
-38	200-0271-00			1	COVER, bottom
	- - - - - -			-	mounting hardware: (not included w/cover)
-39	211-0574-00			2	SCREW, 6-32 x 3/8 inch, 82° csk, FHS
-40	348-0036-00	101	603	2	FOOT, rubber, blue
	348-0048-00	604		2	FOOT, rubber, black
-41	337-0408-00	101	242	1	SHIELD, light seal, front
	- - - - - -			-	mounting hardware: (not included w/shield)
-42	211-0105-00	101	242	8	SCREW, 4-40 x 3/16 inch, 82° csk, FHS
-43	214-0171-00	101	242	1	GASKET, light seal, focus rod
-44	214-0170-00	101	242	2	GASKET, light seal, support rod
-45	124-0151-00	101	242	1	SEAL, light, black velvet ribbon
	122-0737-00	243		1	ASSEMBLY, shield, light seal
	- - - - - -			-	assembly includes:
	- - - - - -			1	SHIELD, light seal, front (not replaceable)
	214-0171-00			1	GASKET, light seal, focus rod
	214-0170-00			2	GASKET, light seal, support rod
	214-0151-00			1	SEAL, light, black velvet ribbon
	- - - - - -			-	mounting hardware: (not included w/shield assembly)
	211-0105-00	243		8	SCREW, 4-40 x 3/16 inch, 82° csk, FHS
-46	384-0580-00	101	301	1	ROD, shaft, focus
	384-0600-00	302		1	ROD, shaft, focus
	- - - - - -			-	mounting hardware: (not included w/rod)
-47	210-0412-00			1	NUT, hex., 1/4-28 x 7/16 inch

FIG. 3 STANDARD C-19 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5 Description
3-48	384-0577-00			2	ROD, support
	- - - - - -			-	mounting hardware for each: (not included w/rod)
-49	211-0072-00			1	SCREW, $^5/_{16}$-24 x $^3/_4$ inch, socket cap screw
-50	426-0114-00	101	242	1	FRAME, support
-51	214-0164-00	101	242	1	PIN, hinge, top
-52	214-0165-00	101	242	1	PIN, hinge, bottom
-53	367-0020-00	101	242	1	LATCH, front
	- - - - - -			-	mounting hardware: (not included w/latch)
-54	212-0068-00	101	242	1	SCREW, 8-32 x $^5/_{16}$ inch, THS
-55	355-0067-00	101	242	1	STUD, latch
	122-0742-00	243		1	ASSEMBLY, support, frame
	- - - - - -			-	assembly includes:
	426-0155-00			1	FRAME, support
	214-0164-00			1	PIN, hinge, top
	214-0165-00			1	PIN, hinge, bottom
	367-0020-00			1	LATCH, front
	- - - - - -			-	mounting hardware: not included w/latch)
	212-0068-00			1	SCREW, 8-32 x $^5/_{16}$ inch, THS
	355-0067-00			1	STUD, latch
-56	200-0274-00			1	COVER, dust
-57	122-0568-00	101	829X	1	ASSEMBLY, camera mount (see data sheet)
-58	122-0566-00	101	567	1	ASSEMBLY, rotating slide adapter (see data sheet)
	122-0602-00	568		1	ASSEMBLY, rotating slide adapter (see data sheet)
-59	122-0565-00	101	848	1	ASSEMBLY, rear casting (see data sheet)
	122-0591-00	849		1	ASSEMBLY, rear casting (see data sheet)
-60	122-0555-00	101	358	1	ASSEMBLY, lens (see data sheet)
	122-0549-00	359		1	ASSEMBLY, lens (see data sheet)

FIG. 3. STANDARD C-19 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
					STANDARD ACCESSORIES
3-61	122-0557-00	101	358	1	ASSEMBLY, Graflok back (see data sheet)
-62	387-0460-00	359	1335	1	PLATE, focus (Poloroid roll film back)
	387-0893-00	1336		1	PLATE, focus (Poloroid pack film back)
-63	122-0556-00	101	648	1	ASSEMBLY, Poloroid back (see data sheet)
	122-0603-00	649	1335	1	ASSEMBLY, Poloroid back (see data sheet)
	122-0671-00	1336		1	ASSEMBLY, Poloroid packback (see data sheet)
-64[1]	337-0411-00			1	SHIELD, rubber, viewing hood
-65[1]	122-0546-00	101	175	1	ASSEMBLY, release cable
	- - - - - -			-	assembly includes:
	122-0513-00			1	RELEASE, cable
	210-0537-00			2	NUT, hex., 5-44 x 3/16 inch
[1]	122-0586-00	176		1	CABLE, release
-66[2]	385-0153-00	101	1450	1	ROD, hex., 1/2 x 1.937 inches, long
[2]	385-0177-00	1451		1	ROD, hex., 1/2 x 2.281 inches, long
-67[2]	348-0036-00	101	6053	1	FOOT, rubber, blue
[2]	348-0048-00	6054		1	FOOT, rubber, black
[1]	070-0383-01			2	MANUAL, instruction (not shown)

[1]NOTE: Standard accessories for main frame when purchased separately.

[2]NOTE: Standard accessories for rear casting when purchased separately.

FIG. 4 STANDARD C-27

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
4-	122-0676-00			1	ASSEMBLY, main frame
	- - - - - -			1	assembly includes:
	122-0717-00			1	ASSEMBLY, occluder
	- - - - - -			1	assembly includes:
-1	- - - - - -			1	FRAME (not replaceable)
-2	- - - - - -			1	SHIELD, door (not replaceable)
-3	- - - - - -			1	ROD, shaft (not replaceable)
-4	366-0123-00			1	KNOB, small black
	- - - - - -			-	knob includes:
	213-0004-00			1	SCREW, set, 6-32 x 3/16 inch, HSS
-5	334-0819-00			1	TAG, index
-6	253-0045-00			FT	TAPE, sponge, 3/8 x 1/4 (1 inch long)
-7	344-0042-00			2	CLIP, spring
	- - - - - -			-	mounting hardware for each: (not included w/clip)
-8	213-0088-00			2	SCREW, thread forming, #4 x 1/4 inch, PHS
	- - - - - -			-	SCREW, thread forming, #6 x 3/8 inch, THS
-9	213-0104-00			2	mounting hardware: (not included w/occluder assembly)
	122-0714-00			1	ASSEMBLY, front casting frame
	- - - - - -			-	assembly includes:
-10	- - - - - -			1	FRAME, front casting (not replaceable)
-11	- - - - - -			2	ROD, support (not replaceable)
-12	- - - - - -			2	NUT, draw (not replaceable)
-13	334-0877-00			1	TAG, name plate
-14	334-0829-00			1	TAG, blank insert
-15	200-0547-00			1	COVER, bottom
	- - - - - -			-	mounting hardware: (not included w/cover)
-16	211-0541-00			4	SCREW, 6-32 x 1/4 inch, 100° csk, FHS
	122-0720-00			1	ASSEMBLY, handle
	- - - - - -			-	assembly includes:
-17	162-0032-00			FT	TUBE, blue, 7/16 inch, ID (5 inches long)
-18	381-0238-00			1	BAR, 9/16 diameter x 5 inches long
	- - - - - -			-	mounting hardware: (not included w/bar)
-19	212-0561-00			2	SCREW, 12-24 x 1/2 inch, OHS
-20	210-0969-00			2	WASHER, 0.675 diameter x 0.187 inch long
-21	214-0429-00			1	ARM, handle
-22	355-0097-00			1	STUD, 3/8 x 0.915 inch long
-23	366-0272-00			1	KNOB, 1 1/16 inch
-24	214-0428-00			1	SPRING
-25	407-0006-00			1	BRACKET
-26	355-0096-00			1	STUD, index
-27	220-0417-00			1	NUT, hex., 10-32 x 3/4 inch
	- - - - - -			-	mounting hardware: (not included w/handle assembly)
-28	211-0565-00			3	SCREW, 6-32 x 1/4 inch, THS
-29	366-0186-00			1	KNOB, focus
-30	214-0251-00			1	LOCK, focus
-31	348-0025-00	100	5019	2	FOOT, rubber, black
	348-0138-00	5020		2	FOOT, rubber

FIG. 4 STANDARD C-27 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
4-32	384-0626-00			1		ROD, shaft, focus
	- - - - - -			-		mounting hardware: (not included w/rod)
-33	210-0455-00			1		NUT, hex., 1/4-28 x 3/8 inch
	122-0718-00			1		ASSEMBLY, shield, light seal
	- - - - - -			-		assembly includes:
-34	- - - - - -			1		SHIELD, light seal (not replaceable)
-35	214-0171-00			1		GASKET, light seal, focus rod
-36	214-0170-00			2		GASKET, light seal, support rod
-37	252-0550-00			FT		SEAL, light, black velvet ribbon (18 inches long)
	- - - - - -			-		mounting hardware: (not included w/shield assembly)
-38	211-0105-00			8		SCREW, 4-40 x 3/16 inch, 82° csk, FHS
	122-0715-00			1		ASSEMBLY, support housing frame
	- - - - - -			-		assembly includes:
-39	426-0213-00			1		FRAME, support housing
-40	384-0577-00			2		ROD, support
	- - - - - -			-		mounting hardware for each: (not included w/rod)
-41	211-0072-00			1		SCREW, 5/16-24 x 3/4 inch, socket cap screw
-42	134-0072-00			3		PLUG, light seal
-43	252-0549-00			YD		SEAL, light, black velvet ribbon (23 inches long)
	122-0716-00			1		ASSEMBLY, support frame
	- - - - - -			-		assembly includes:
-44	426-0215-00			1		FRAME, support
-45	214-0397-00			1		PIN, hinge, top
-46	214-0398-00			1		PIN, hinge, bottom
-47	367-0020-00			1		LATCH, front
	- - - - - -			-		mounting hardware: (not included w/latch)
-48	212-0068-00			1		SCREW, 8-32 x 5/16 inch, THS
-49	355-0067-00			1		STUD, latch
	- - - - - -			-		mounting hardware: (not included w/frame support assembly)
-50	211-0584-00			4		SCREW, 6-32 x 1 1/4 inches, button head socket
-51	200-0572-00			1		COVER, dust
-52	122-0602-00	100	3222	1		ASSEMBLY, rotating slide adapter (see data sheet)
	122-0739-00	3222		1		ASSEMBLY, rotating slide adapter (see data sheet)
-53	122-0591-00			1		ASSEMBLY, rear casting (see data sheet)
-54	122-0692-00			1		ASSEMBLY, lens (see data sheet)

FIG. 4 STANDARD C-27 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
					STANDARD ACCESSORIES
4-55	387-0893-00			1	PLATE, focus
-56	122-0671-00			1	ASSEMBLY, Polaroid packback (see data sheet)
[1]	122-0719-00			1	ASSEMBLY, viewing tunnel and hood
	- - - - - -			-	assembly includes:
-57	337-0411-00			1	SHIELD, rubber, viewing hood
-58	337-0604-00			1	SHIELD, rubber, viewing tunnel
-59[1]	122-0586-00	100	2732	1	CABLE, release
[1]	122-0586-01	2733		1	CABLE, release
[1]	122-0587-00			1	ASSEMBLY, release cable adapter (installed)
	- - - - - -			-	assembly includes:
-60	211-0517-00			1	SCREW, 6-32 x 1 inch, PHS
-61	366-0176-00			1	KNOB, black
-62	210-0844-00			2	WASHER, rubber, 7/32 ID x 3/8 inch OD
-63	358-0179-00			1	BUSHING
-64	204-0118-00			1	BODY, release cable clamp
-65	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-66	213-0108-00			1	SCREW, 1/4-20 x 3/8 inch, RHS
-67	210-0046-00			1	LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
-68[2]	385-0177-00			1	ROD, hex., 1/2 x 2.281 inches, long
-69[2]	348-0048-00			1	FOOT, rubber, black
[1]	070-0383-01			2	MANUAL, instruction (not shown)

[1]NOTE: Standard accessories for main frame when purchased separately.

[2]NOTE: Standard accessories for rear casting when purchased separately.

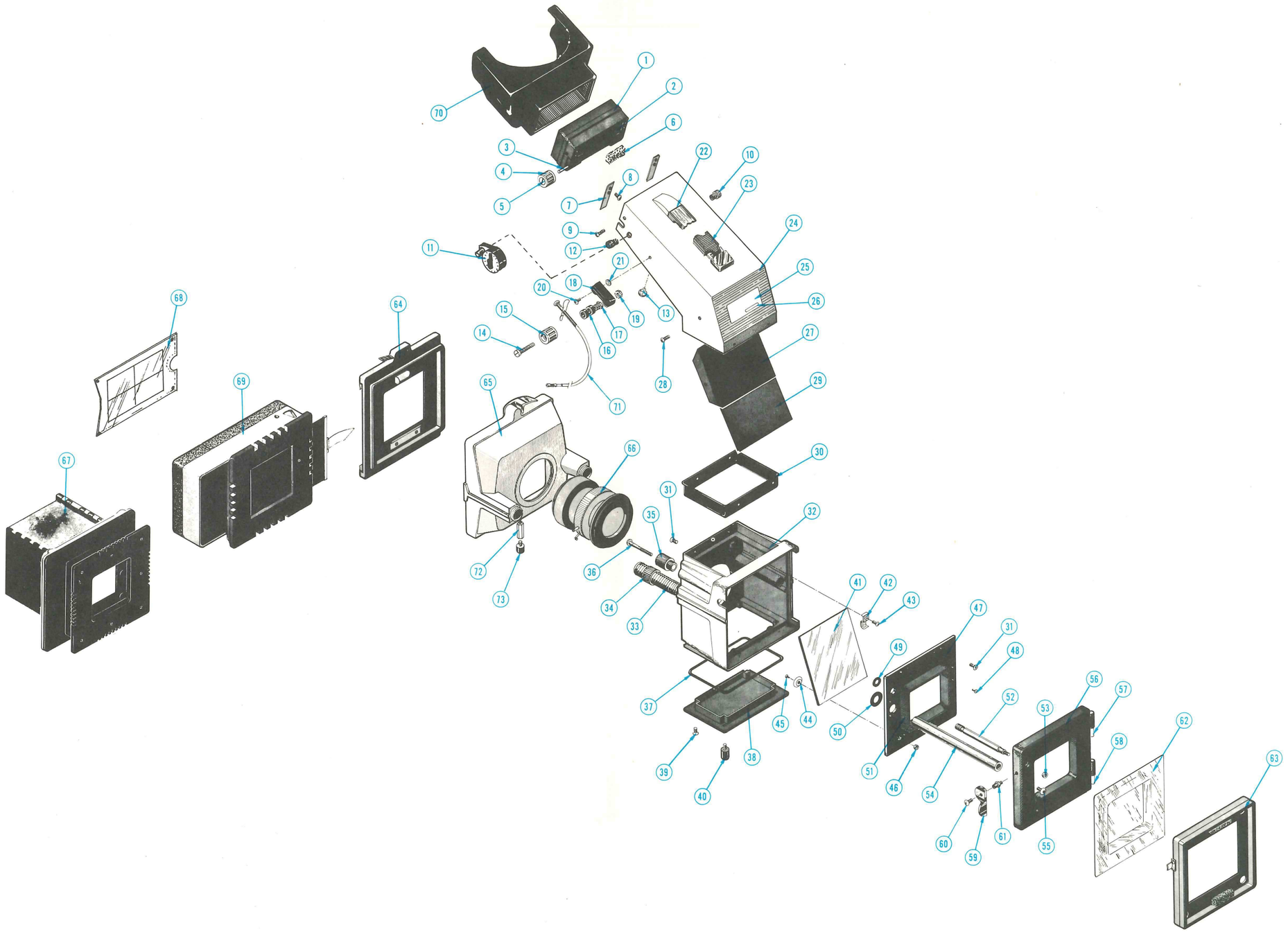
FIG. 5 STANDARD 350/C-12, 350/C-13, 350/C-19, 350/C-27

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
						350/C-12
5-1	- - - - - -			1		TYPE 350 CAMERA ATTACHMENT (see data sheet)
-2	122-0635-00			1		ASSEMBLY, main frame (see STANDARD C-12)
						STANDARD ACCESSORIES
-3	122-0630-00			1		ASSEMBLY, magnifier
-4	337-0411-00			1		SHIELD, rubber, viewing hood
5	122-0586-00			1		CABLE, release
	070-0383-01			2		MANUAL, instruction (not shown)
						350/C-13
-6	- - - - - -			1		TYPE 350 CAMERA ATTACHMENT (see data sheet)
-7	122-0609-00			1		ASSEMBLY, main frame (see STANDARD C-13)
						STANDARD ACCESSORIES
-8	122-0640-00			1		ASSEMBLY, magnifier
-9	122-0586-00			1		CABLE, release
	122-0587-00			1		ASSEMBLY, release cable adapter
	- - - - - -			-		assembly includes:
-10	211-0517-00			1		SCREW, 6-32 x 1 inch, PHS
-11	366-0176-00			1		KNOB, black
-12	210-0844-00			2		WASHER, rubbber, 7/32 ID x 3/8 inch OD
-13	358-0179-00			1		BUSHING
-14	204-0118-00			1		BODY, release cable clamp
-15	210-0457-00			1		NUT, keps, 6-32 x 5/16 inch
-16	213-0108-00			1		SCREW, 1/4-20 x 3/8 inch, RHS
17	210-0046-00			1		LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
	070-0383-01			2		MANUAL, instruction (not shown)
						350/C-19
-18	- - - - - -			1		TYPE 350 CAMERA ATTACHMENT (see data sheet)
-19	122-0636-00			1		ASSEMBLY, main frame (see STANDARD C-19)
						STANDARD ACCESSORIES
-20	122-0640-00			1		ASSEMBLY, magnifier
-21	337-0411-00			1		SHIELD, rubber, viewing hood
22	122-0586-00			1		CABLE, release
	070-0383-01			2		MANUAL, instruction (not shown)

FIG. 5 STANDARD 350/C-12, 350/C-13, 350/C-19, 350/C-27 *(Cont)*

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
						350/C-27
5-23	- - - - - -			1		TYPE 350 CAMERA ATTACHMENT (see data sheet)
-24	122-0676-00			1		ASSEMBLY, main frame (see STANDARD C-27)
						STANDARD ACCESSORIES
-25	122-0640-00			1		ASSEMBLY, magnifier
	122-0719-00			1		ASSEMBLY, viewing tunnel and hood
	- - - - - -			-		assembly includes:
-26	337-0411-00			1		SHIELD, rubber, viewing hood
-27	337-0604-00			1		SHIELD, rubber, viewing tunnel
-28	122-0586-00			1		CABLE, release
	122-0587-00			1		ASSEMBLY, release cable adapter
	- - - - - -			-		assembly includes:
-29	211-0517-00			1		SCREW, 6-32 x 1 inch, PHS
-30	366-0176-00			1		KNOB, black
-31	210-0844-00			2		WASHER, rubber, 7/32 ID x 3/8 inch OD
-32	358-0179-00			1		BUSHING
-33	204-0118-00			1		BODY, release cable clamp
-34	210-0457-00			1		NUT, keps, 6-32 x 5/16 inch
-35	213-0108-00			1		SCREW, 1/4-20 x 3/8 inch, RHS
-36	210-0046-00			1		LOCKWASHER, internal, 1/4 ID x 0.400 inch OD
	070-0383-01			2		MANUAL, instruction (not shown)
						OPTIONAL ACCESSORIES
						350/C-12 350/C-13 350/C-19 350/C-27
	016-0222-00			1		SPOOL, supply, NR cassette

FIG. 1 STANDARD C-12



CAMERA SYSTEM—5 INCH

FIG. 1

FIG. 2 STANDARD C-13

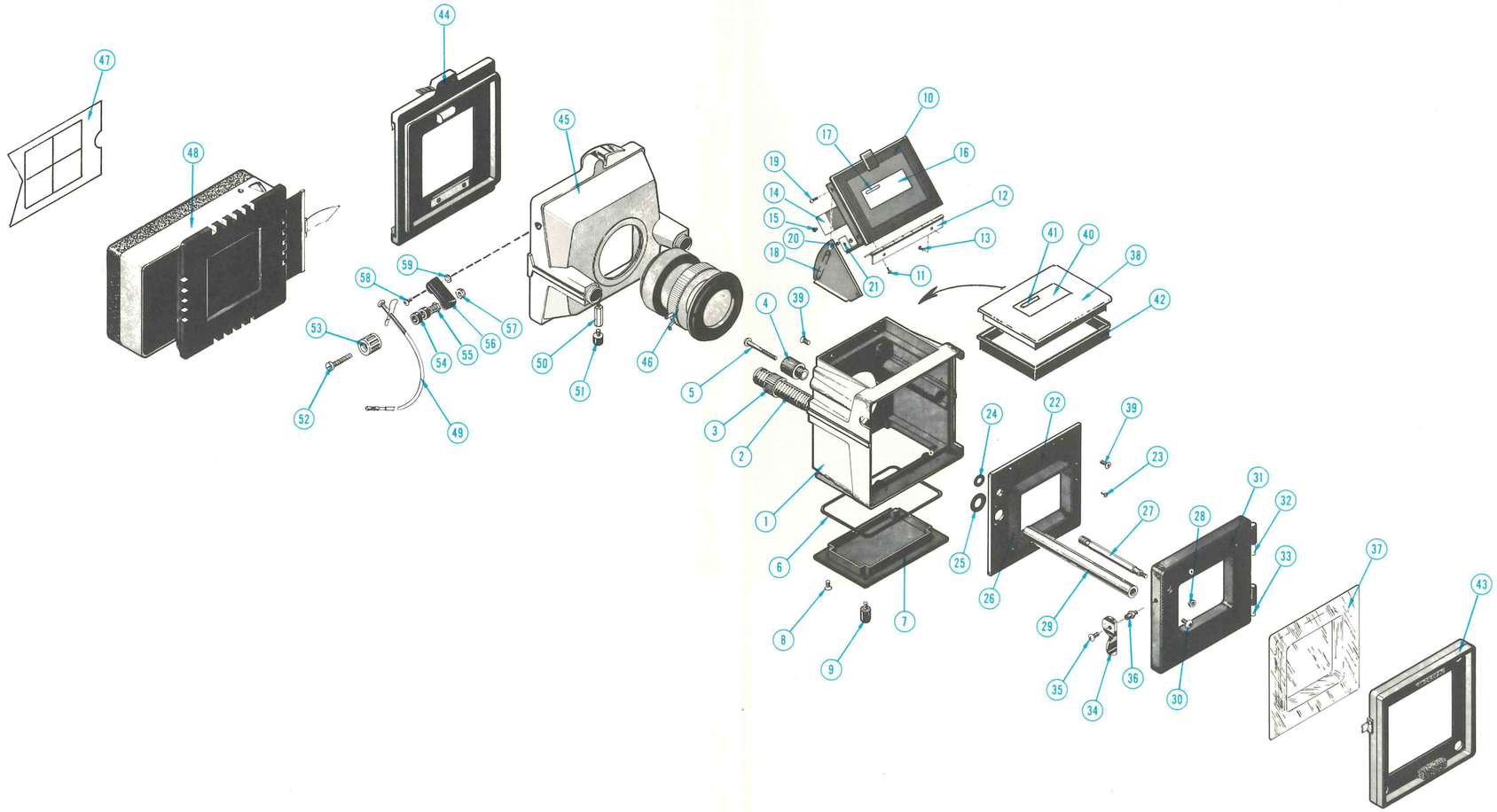
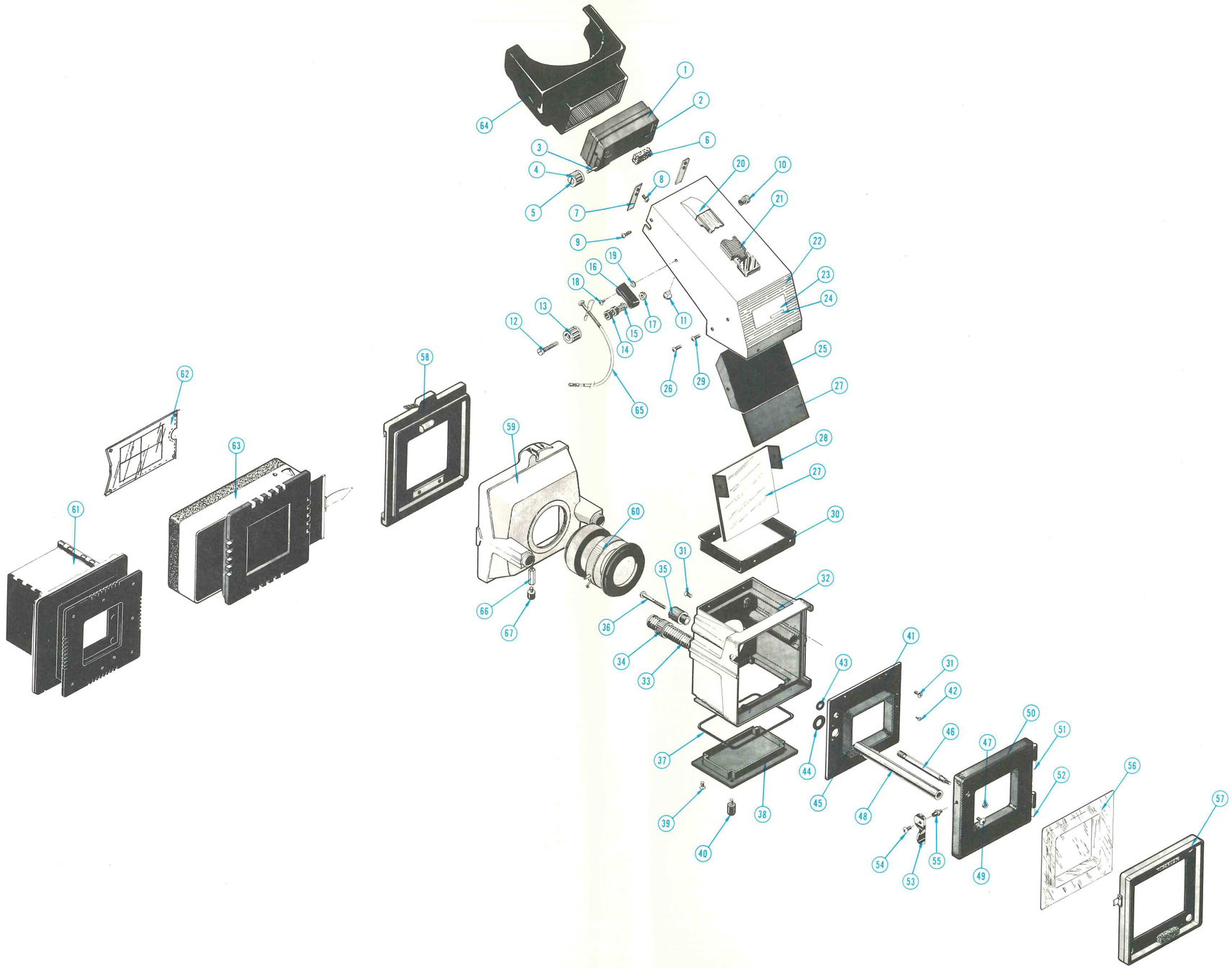
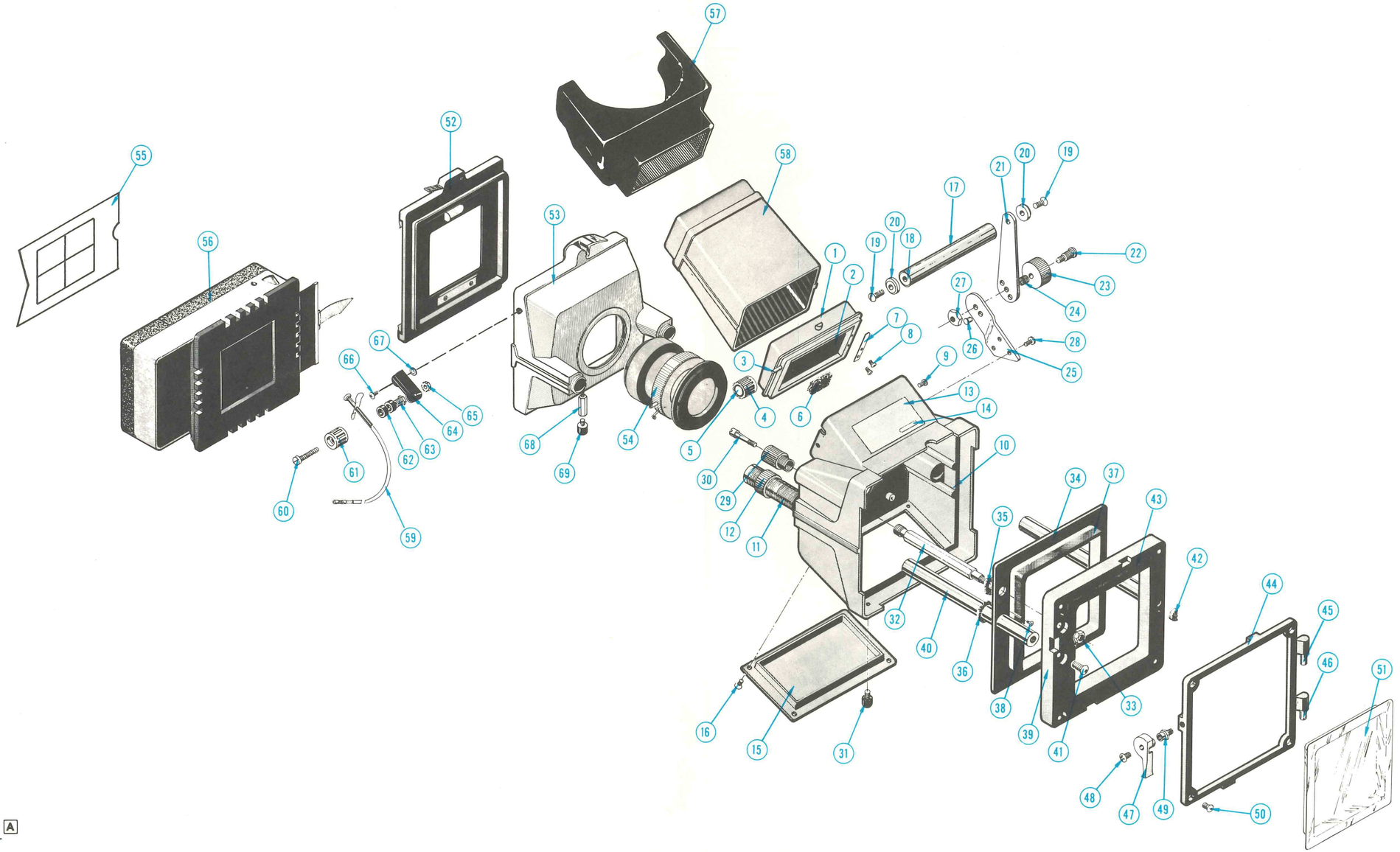


FIG. 3 STANDARD C-19



CAMERA SYSTEM—5 INCH

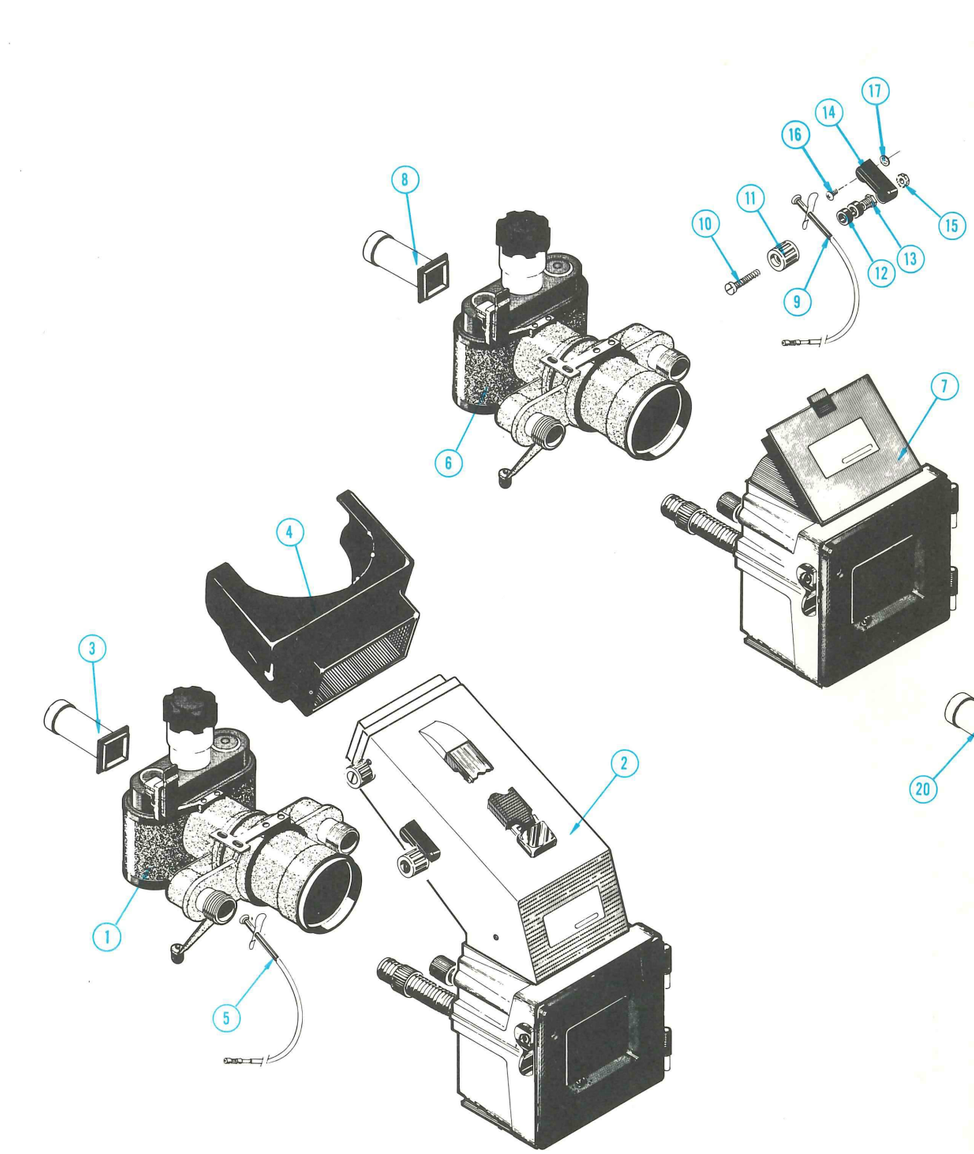
FIG. 4 STANDARD C-27

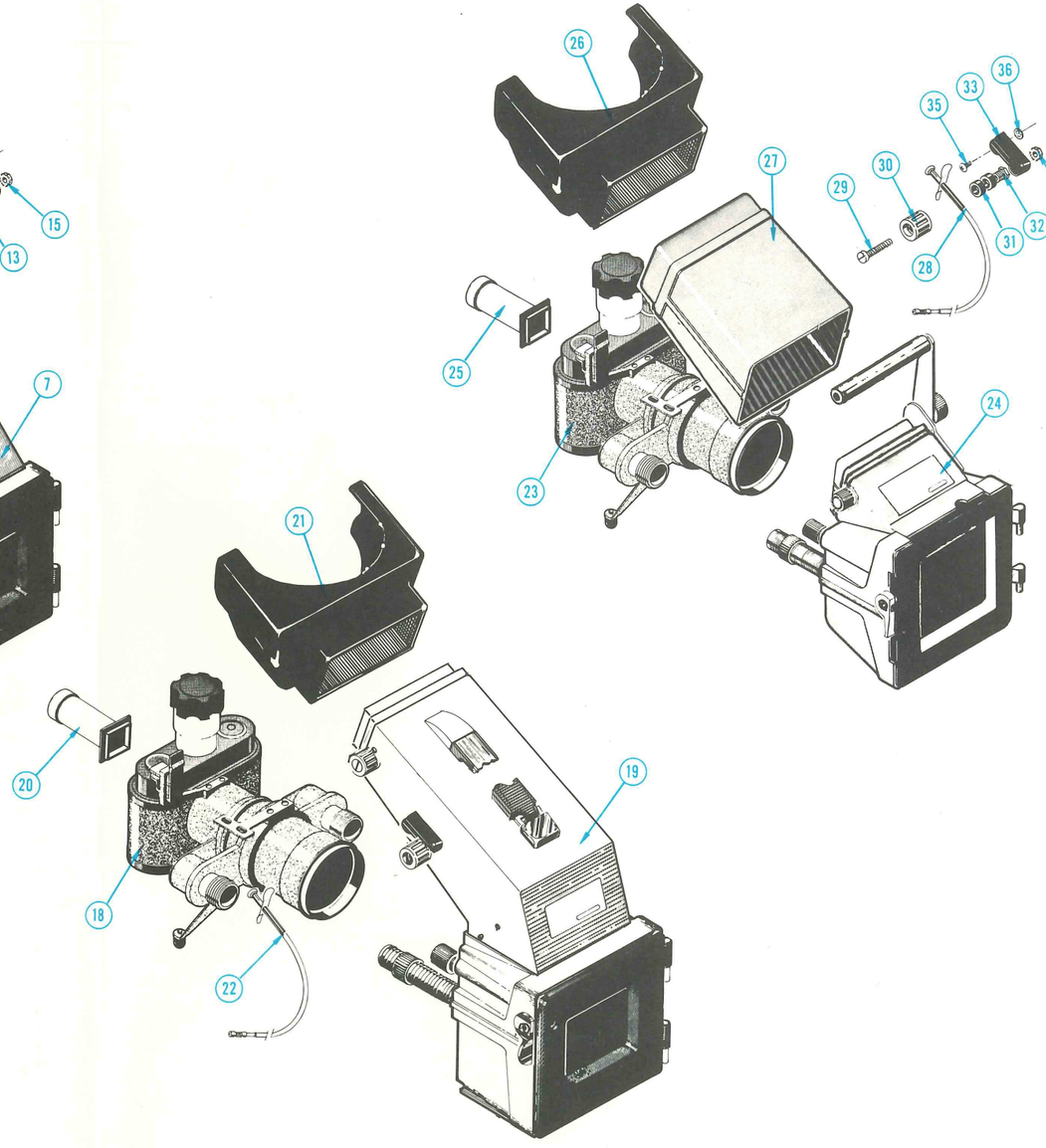


CAMERA SYSTEM—5 INCH

FIG. 4

FIG. 5 STANDARD 350/C-12, 350/C-13, 350/C-19, 350/C-27





A

INSTRUCTION MANUAL

Serial Number _____

No. 3 ELECTRIC SHUTTER AND SPEEDCOMPUTER

Tektronix, Inc.
S.W. Millikan Way ● P. O. Box 500 ● Beaverton, Oregon 97005 ● Phone 644-0161 ● Cables: Tektronix

070-0909-00 1168

CONTENTS

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 Speedcomputer[1] 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 shuter 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 and 1/60 second
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.)
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
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.
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.

[1]**Registered trademark of the Ilex Optical Company.**

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

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

NOTES

SECTION 2
OPERATING INSTRUCTIONS

Mounting Lens Elements to Electric Shutter Assembly[1]

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 in 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.

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

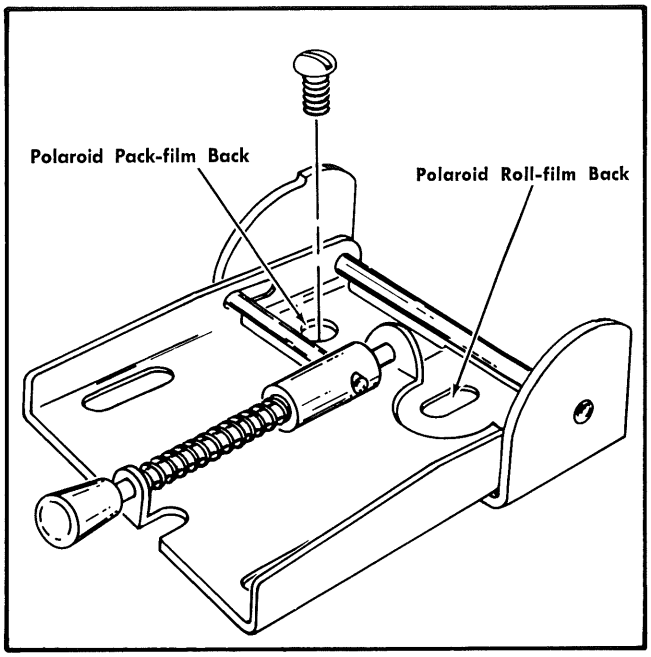


Fig. 2-1. Selecting proper mounting hole in mounting bracket for Speedcomputer (Tektronix Part No. 122-0713-00).

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

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.
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.
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.
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.
Power Cord	The power cord is permanently attached.
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.
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.

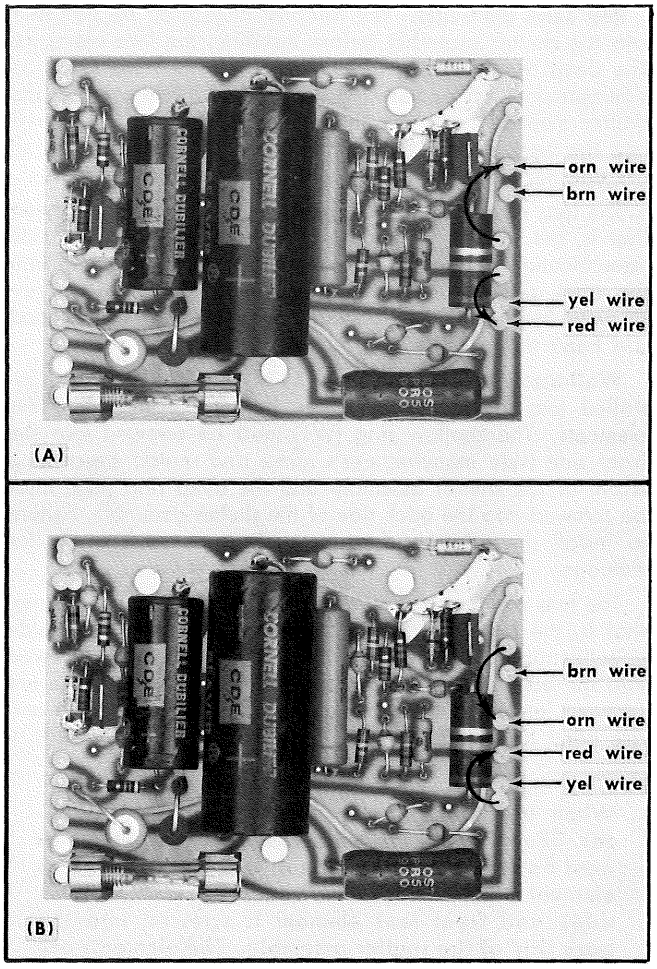


Fig. 2-2. Transformer primary connections for: (A) 105-130 VAC operation. (B) 210-260 VAC operation.

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 $\overline{2}$ ($1/2$ 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 Speedcomputer Speed setting other than (T), first obtain a stable display of the described 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 blades will open. The second push will close the shutter blades.

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.

NOTE

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

NOTES

SECTION 3
PHOTOGRAPHIC TECHNIQUES

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

SECTION 4
PICTURE TAKING

Refer to section 3 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 All Exposure-time Settings Except Time (T)

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.

NOTES

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.

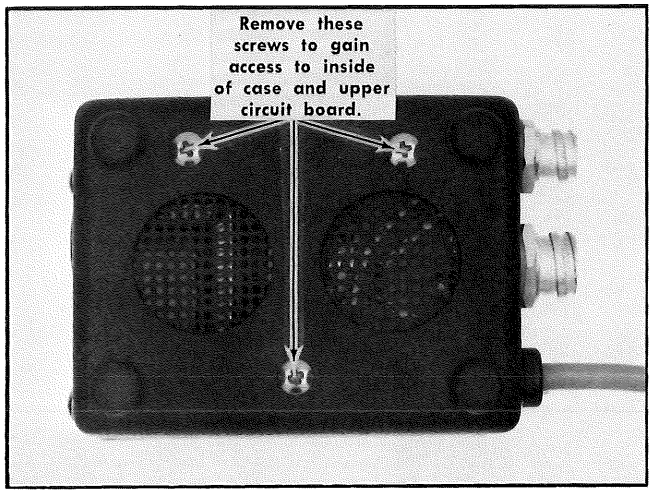


Fig. 6-1. Screw removal for Speedcomputer.

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.

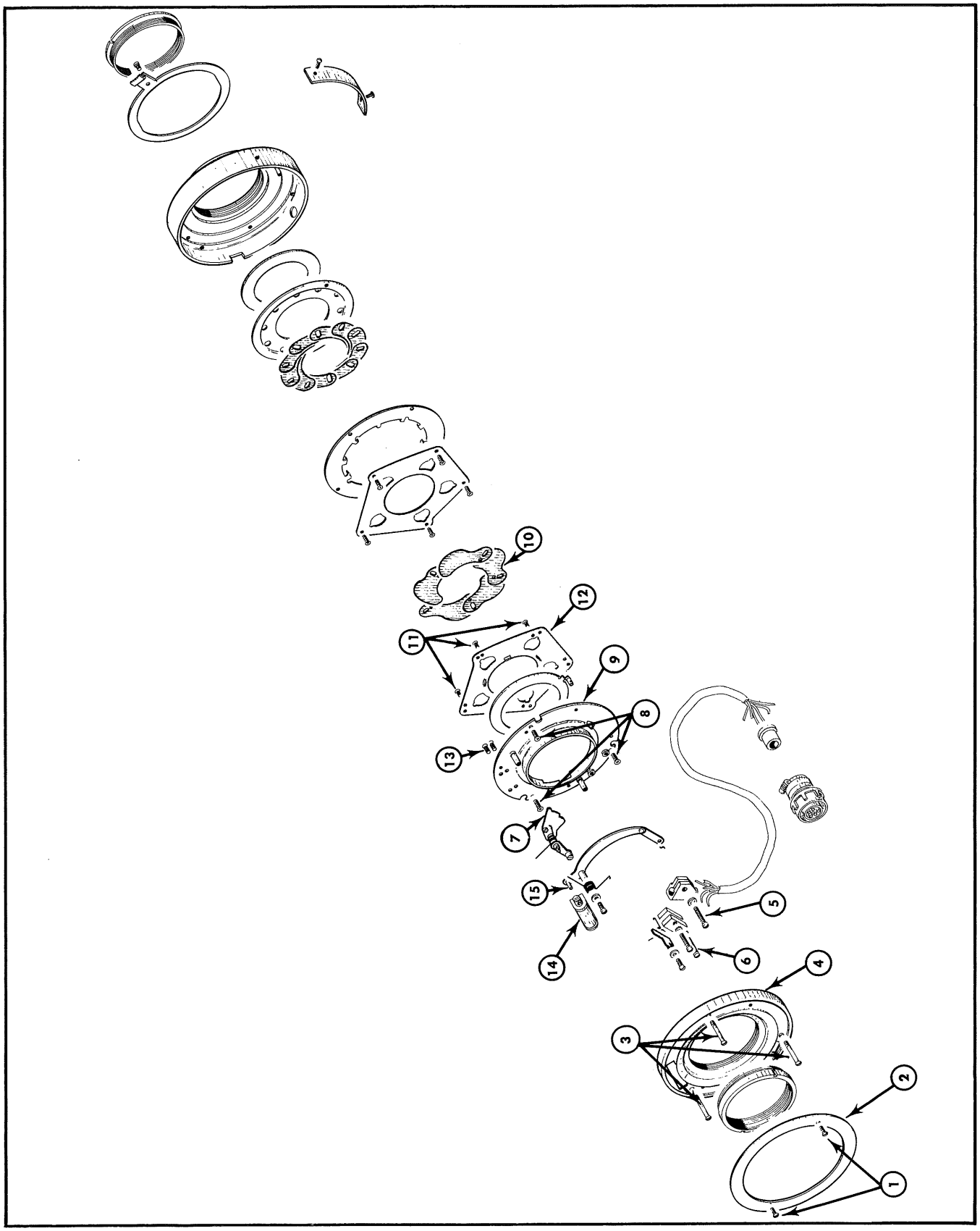


Fig. 6-2. Exploded illustration of the Electric Shutter.

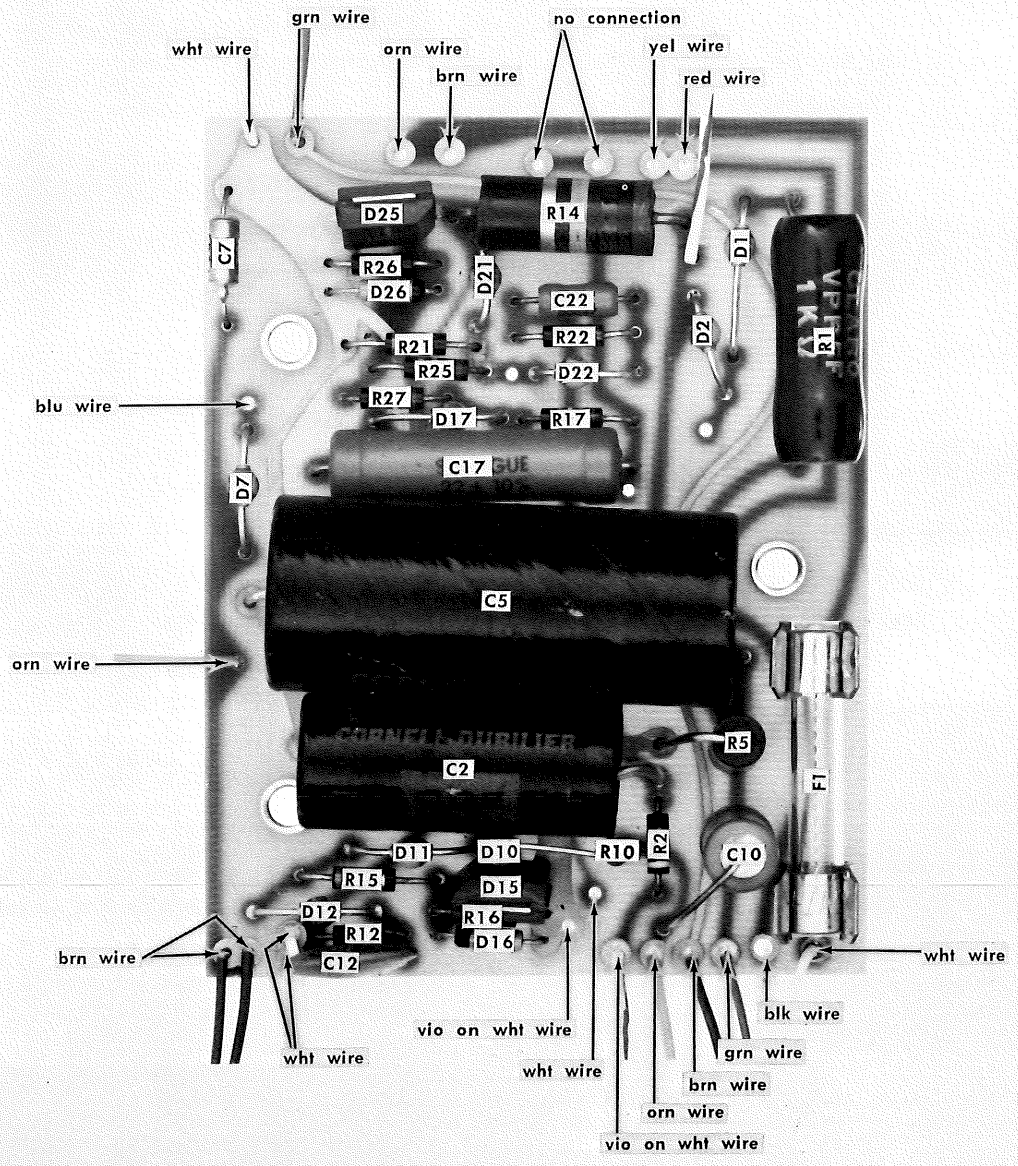


Fig. 6-3. Speedcomputer lower circuit board components and wire color codes.

SECTION 7
ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. 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 ±20% unless otherwise indicated.							
C2	290-0431-00			4 μF	PTM	250 V	
C5	290-0430-00			30 μF	PTM	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			0.001 μF	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		0.75A	
D22	152-0066-01			Silicon		0.75A	
D25	151-0506-00			Silicon controlled rectifier, C106B			
D26	152-0025-00			Germanium			
D38	152-0417-00			Zener	1N3047B, 1 W, 130 V, 5%		
				Fuse			
F1	159-0028-00			1/4 A 3AG Fast-Blo 115 V			
	159-0033-00			1/8 A 8AG Fast-Blo 230 V			

Connectors

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
J10	131-0425-00			Receptacle, electrical
J20	131-0424-00			Receptacle, electrical

Sync Posts

P5	122-0822-00			Sync Posts

Resistors

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

R1	308-0106-00	1 kΩ	5 W	WW	5%
R2	316-0473-00	47 kΩ	1/4 W		
R3	316-0473-00	47 kΩ	1/4 W		
R5	304-0473-00	47 kΩ	1 W		
R12	316-0105-00	1 MΩ	1/4 W		
R14	306-0153-00	15 kΩ	2 W		
R15	316-0222-00	2.2 kΩ	1/4 W		
R16	316-0221-00	220 Ω	1/4 W		
R17	316-0274-00	270 kΩ	1/4 W		
R21	316-0562-00	5.6 kΩ	1/4 W		
R22	316-0105-00	1 MΩ	1/4 W		
R25	316-0223-00	22 kΩ	1/4 W		
R26	316-0562-00	5.6 kΩ	1/4 W		
R27	316-0274-00	270 kΩ	1/4 W		
R29	316-0223-00	22 kΩ	1/4 W		
R31		Selected			
R32		Selected			
R33		Selected			
R34		Selected			
R35		Selected			
R36		Selected			
R37		Selected			
R38		Selected			
R39		Selected			
R40	316-0824-00	820 kΩ	1/4 W		

Transformer

T1	122-0823-00	Transformer	

Switches

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description	
	Wired or Unwired				
SW1	260-0834-00			Toggle	ON-OFF
SW14	122-0821-00			Lever	ACTUATE
SW30	122-0820-00			Rotary	EXPOSURE TIME
K50	122-0802-00				SOLENOID
K50A	260-0612-00			Micro	SHUTTER
K50B	260-0612-00			Micro	SYNC

Circuit Boards

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

SECTION 8
MECHANICAL PARTS LIST

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

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
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	211-0786-00			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 No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
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	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
2-	122-0767-00			1		SPEEDCOMPUTER®
	- - - - - -			-		speedcomputer includes:
-1	122-0826-00			1		KNOB
-2	122-0825-00			1		PANEL, front
-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/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

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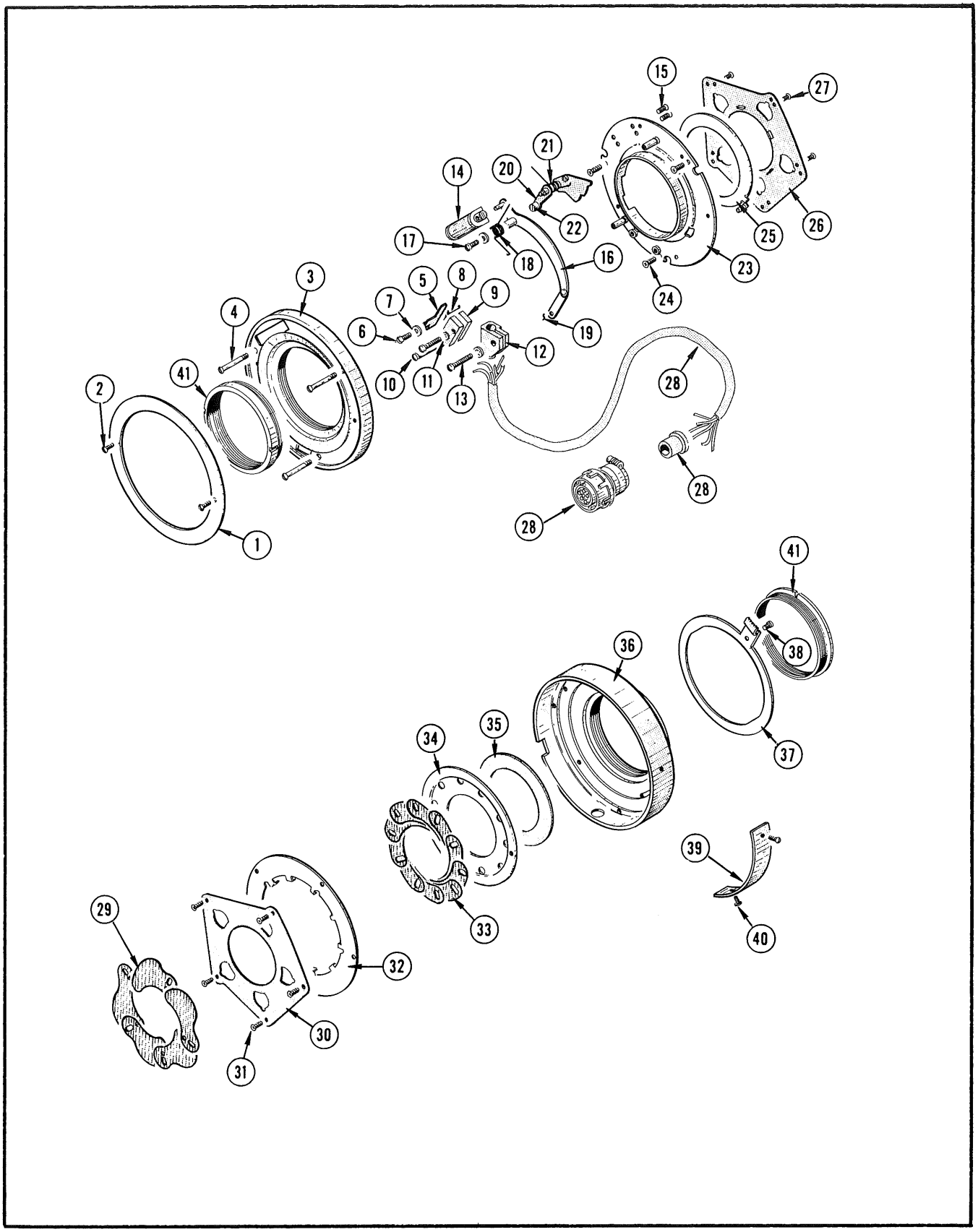


Fig. 1 No. 3 Electric Shutter

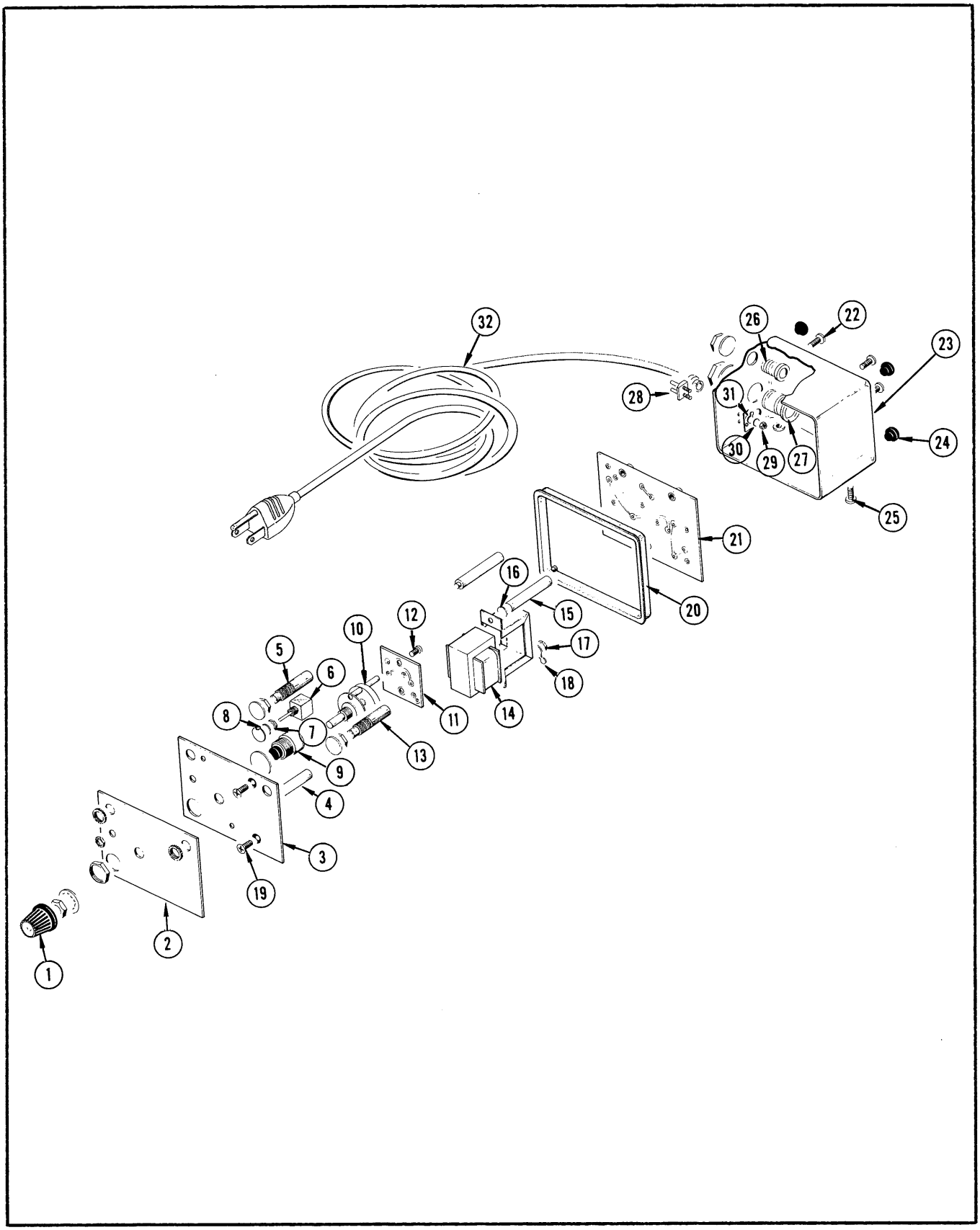
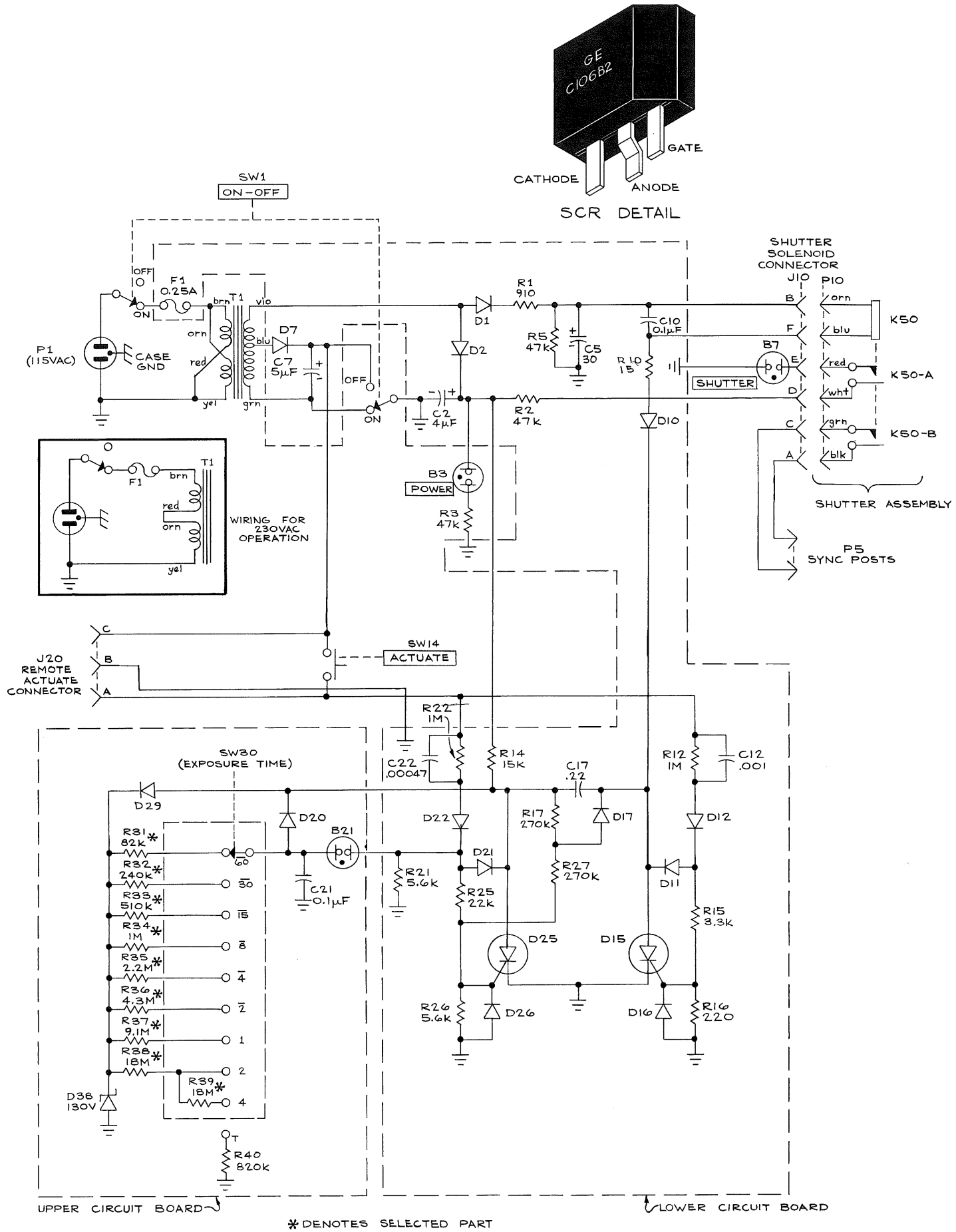


Fig. 2 Speedcomputer



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SPEEDCOMPUTER

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Sections of the manual are often printed at different times, so some of the information on the change pages may already be in your manual. Since the change information sheets are carried in the manual until ALL changes are permanently entered, some duplication may occur. If no such change pages appear in this section, your manual is correct as printed.

TOCS 5-inch

TEXT CORRECTION

Section 3 Photographic Techniques

Page 3-3

REPLACE: the first two paragraphs after the title Polaroid Land Film with the following:

CAUTION

Polaroid recommends that spray-on matte finishes not be used as a method of note marking on the self coating Polaroid Land Film.

Several types of spray-on matte finishes are available which will enable you to make pencil or pen notes directly on the non-self coating Polaroid prints only. It can be obtained from any art or photo supply store.

Another method of note marking on non-self coating Polaroid prints is to use an ink eraser to rub the emulsion off the areas to be written on. Pen or pencil is then used to write the data on the print.

For self coating Polaroid prints the above method is changed to rubbing the emulsion off the areas to be written on with a damp cloth, being careful that the emulsion area removed is remote from the waveform area.

Still another method is to scratch the desired data onto the print with a sharp pointed instrument. The data should be scratched onto the print before it is coated. If the data is to be scratched onto a self coating Polaroid print, it must be done within 10 to 15 seconds after the print is separated from the negative.

TEXT CORRECTION

Section 2 Operating Instructions

Page 2-1

ADD: the following information after the paragraphs on Mounting C-27 016-0249-00 Bezel:

Mounting C-12/C-27 016-0264-00 Bezel

Remove the lens assembly from its storage place in the camera bezel by, pushing the release latch lever either way and pulling out slightly on the portion of the lens assembly nearest the release latch. Slide the lens assembly down and out until it is free of the camera bezel.

Install a dark slide in the camera then, simultaneously unscrew the two locking nuts holding the front and rear portions of the camera frame together. Now, install the lens assembly over the front of the present camera lens with the slotted end toward the camera bottom (convex side away from camera lens) and reassemble the camera.

Install the 016-0264-00 camera bezel onto the instrument by sliding the side without studs on the camera bezel down over the instrument bezel until the rib on the upper inner part of the camera bezel engages the groove on the top of the instrument bezel. When the camera bezel and the instrument bezel are engaged push the bottom of the camera bezel in toward the instrument until the click is heard, indicating that the bottom latch of the camera bezel has engaged the instrument bezel. Check that the camera is firmly attached by pulling on it gently after it is mounted.

Install a 016-0226-01 or 016-0225-02 camera bezel onto the side with studs on the 016-0264-00 camera bezel using the four slotted graticule nuts supplied with the 016-0226-01 or 016-0225-02 camera bezel.

The camera can now be put in place by engaging the hinge pins on the camera frame with the hinge fitting on the 016-0226-01 or 016-0225-02 camera bezel. The camera can be removed at any time by simply lifting it off the camera bezel. The hinge system permits the camera to be moved against the oscilloscope screen or swung away.

To remove the 016-0264-00 camera bezel, lift out on the release latch lever at the bottom of the camera bezel while pulling out slightly on the bottom of the camera bezel. Slide the camera bezel up until it is free of the oscilloscope.

To remove the 016-0226-01 or 016-0225-02 camera bezel from the 016-0264-00 camera bezel, remove the four slotted graticule nuts and lift it off the studs.

To store the lens assembly in the 016-0264-00 camera bezel, insert the end of the lens assembly opposite the slotted end in the groove running across the inner top side of the camera bezel. Now push the bottom of the lens assembly in until a click is heard, indicating that the lens assembly is latched into the camera bezel.

No. 3 Electric Shutter

ELECTRICAL PARTS LIST CORRECTION

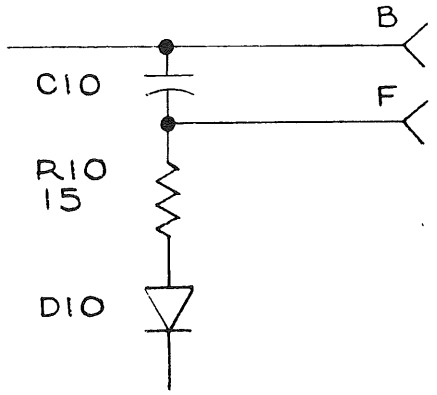
ADD:

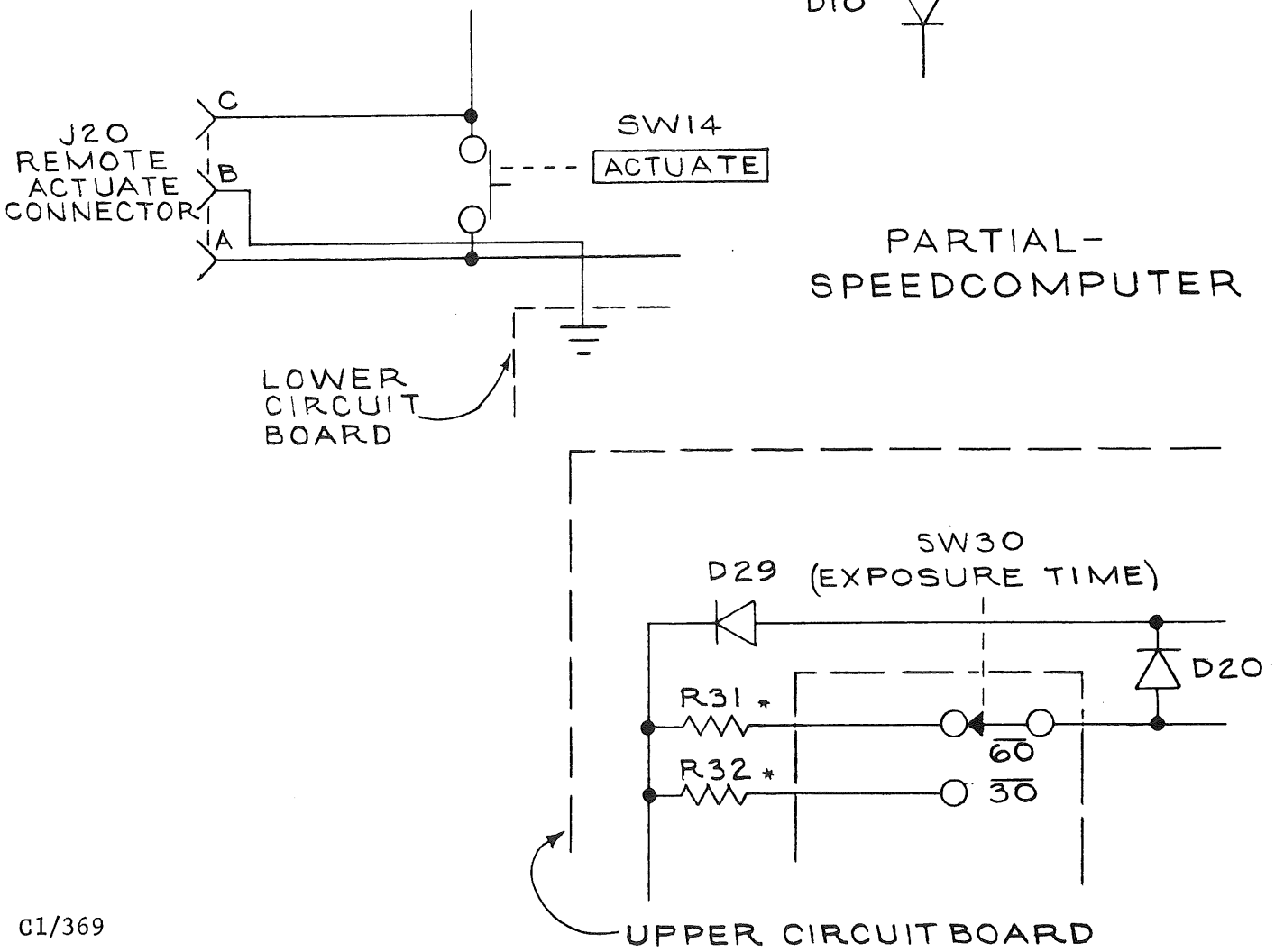
D29	152-0066-01	Silicon	400 V	0.75 A
R10	316-0150-00	15 Ω	1/4 W	

REMOVE:

R29	316-0223-00	22 kΩ	1/4 W

SCHEMATIC CORRECTION





No. 3 Electric Shutter

TEXT CORRECTION

Section 1 Characteristics

Page 1-1 TABLE 1-4, Environmental Characteristics

ADD: the following before Vibration:

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.

ADD: the following after Shock:

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%.

ADD: the following footnote after footnote [3].

[4]Applies to Speedcomputer only.

C2/669