

INSTRUCTION MANUAL

Serial Number _____



OSCILLOSCOPE CAMERA SYSTEM

MAR 22 1971
**C-59 Cameras
And Accessories**



WARRANTY

All Tektronix instruments are warranted against defective materials and workmanship for one year.

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

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 (or Part Number) and Serial or Model Number with all requests for parts or service.

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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.

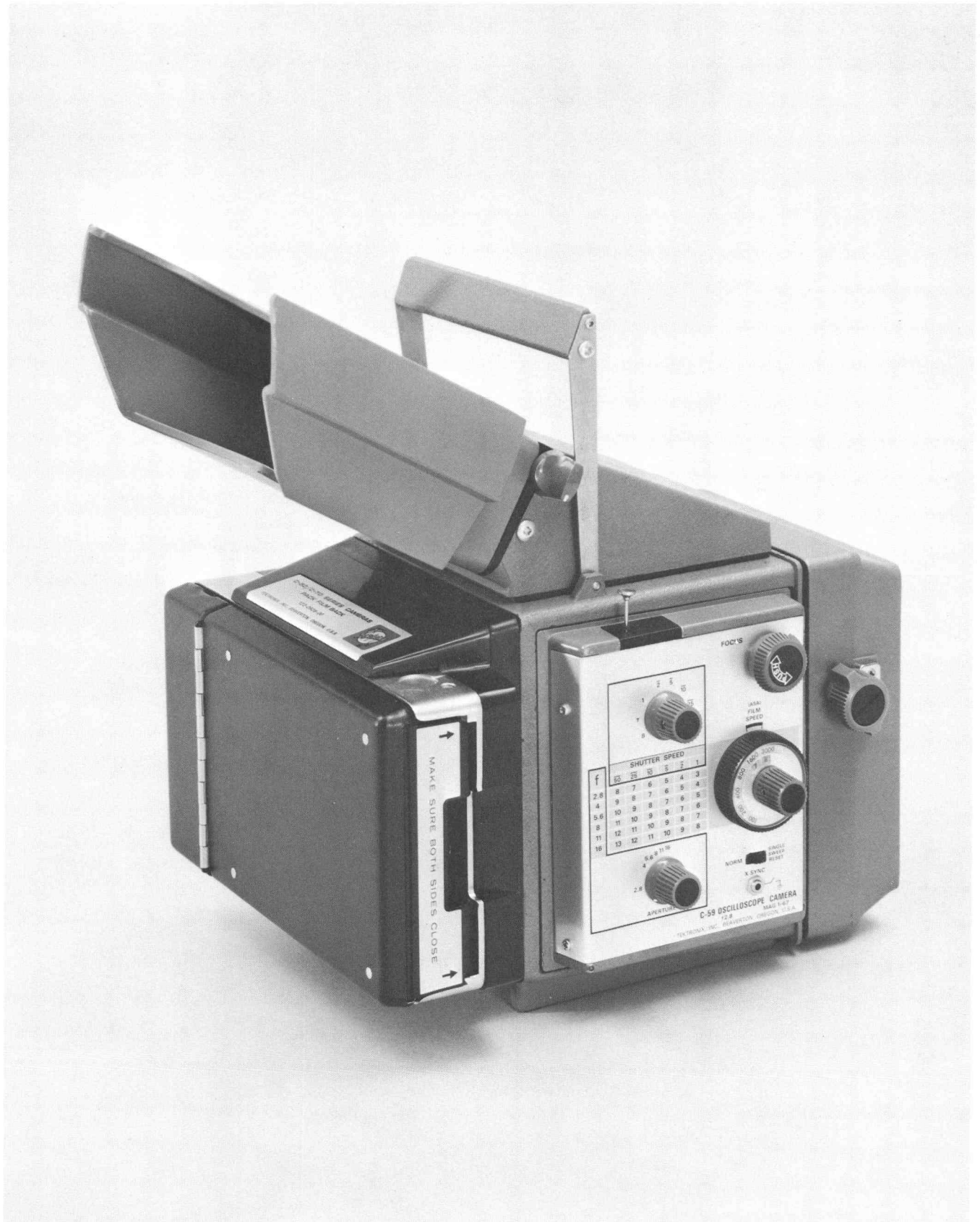


Fig. 1-1. C-59 Camera.

SECTION 1

SPECIFICATION

Change information, if any, affecting this section will be found at the rear of this manual.

General Information

The C-59 Camera is a compact, light-weight, trace-recording camera featuring an exposure aid that mechanically indicates the proper aperture and shutter speed for a wide range of film speed ratings and display luminance.

The C-59 Camera is designed for use with all Tektronix 7000-series oscilloscopes but will fit any oscilloscope that presently accommodates a Tektronix C-27 camera adapter. The camera housing will accommodate either a ¹Polaroid Land roll or pack, or a 4 inch X 5 inch film back.

When the C-59 Camera is used with the Tektronix 7000-series oscilloscopes, a 3-pin connector in the oscillo-

¹ Registered trademark of the Polaroid Corporation.

TABLE 1-1
OPTICAL CHARACTERISTICS

C-59 LENS

Characteristics	Performance Requirement
Maximum Relative Aperture at Infinity	f2.8
Focal Length	55.33 mm nominal
Coverage at Maximum Relative Aperture	At least 162.5 mm diameter in object plane
Magnification (Object: Image)	1:0.67 within 10%
Geometrical Distortion	0.2% or less
Relative Illumination	Illumination at an angle of 29 degrees from optical axis of the lens to be at least 30% of the illumination of the optical axis
Photographic Resolving Power	
Center Pattern	At least 10 lines/mm
Each Corner Pattern	At least 4 lines/mm

scope bezel applies power to the camera (an automatic circuit in the C-59 causes the camera to be powered from the oscilloscope rather than its internal battery pack when connected to a 7000-series oscilloscope) and receives from the camera a pulse for resetting the oscilloscope sweep when the oscilloscope and camera are both in single-sweep modes.

If the C-59 Camera is used on oscilloscopes other than Tektronix 7000-series oscilloscopes the automatic circuit in the C-59 causes the camera to be powered from its internal battery pack.

The electrical characteristics described in Table 1-3 are valid over the stated environmental range for instruments calibrated at an ambient temperature of +20°C to +30°C.

TABLE 1-2
MECHANICAL CHARACTERISTICS

C-59 SHUTTER (f2.8 LENS)

Characteristic	Performance Requirement
Speed (Normal) Range	1, 1/2, 1/5, 1/10, 1/25, and 1/50 second
Accuracy	Within 20% of exposure-time markings from 0°C to +40°C (In accordance with 4.3 of USA Standard PH 3.32-1959)
Relative Aperture (f-number) Range	2.8, 4.0, 5.6, 8, 11, 16
Accuracy	Within 1/3 of APERTURE (f) setting
Synchronization	Internal; X-type In all cases the shutter must be at least 80% open at the time of first switch contact. (In accordance with 3.1 of USA Standard PH 3.18-1957)

TABLE 1-3
ELECTRICAL CHARACTERISTICS
C-59 BATTERY PACK

Characteristic	Performance Requirement
Batteries	
Type	AA Alkaline cell
Number of Cells	8
Nominal Voltage per Cell	1.5 V
Capacity	1100 mAh
Power Supply Potential (No Load)	12 to 9 volts dependent upon battery condition.

TABLE 1-4
ENVIRONMENTAL CHARACTERISTICS

NOTE

The following environmental test limits apply when tested in accordance with the recommended test procedure. This instrument will meet all the performance requirements given in this section following an environmental test. Complete details on environmental test procedures, including failure criteria, etc., may be obtained from your local Tektronix, Inc., representative or field office.

C-59 CAMERA

Characteristic	Performance Requirement
Temperature	
Operating	0°C to +50°C
Non-Operating	–40°C to +55°C
Altitude	
Operating	15,000 feet
Non-Operating	50,000 feet and –55°C
Vibration	
Operating (Mounted on an instrument)	15 minutes along each axis at 0.010" within 0.002 (DA). 10 to 55 to 10 c/s in 1-minute sweeps. Three minutes at any resonant point, or if none, at 55 c/s

Characteristic	Performance Requirement
Shock	
Operating (Mounted on an instrument)	15 g's, 1/2 sine, 11 ms duration, 1 shock in each direction along 3 major axes, total of 6 shocks

TABLE 1-5
CAMERA ADAPTERS

Stock Number	Oscilloscope Style
016-0225-02	For oscilloscopes having 5-inch round CRT's.
016-0224-00	For oscilloscopes with 5-inch rectangular CRT's with 8 X 10 cm graticules. Will also fit some TV oscilloscopes. ²
016-0223-00	For oscilloscopes with 5-inch rectangular CRT's with 6 X 10 cm graticules.
016-0227-00	For some models of DuMont oscilloscopes. See your local Tektronix Field Engineer or representative.
016-0228-00	For some models of Hewlett-Packard oscilloscopes. See your local Tektronix Field Engineer or representative.
016-0240-00	For Tektronix Inc. Type 519 Oscilloscopes. ³
016-0249-03	For Tektronix Type 601, 602 Display Units, Type 528 Waveform Monitor and 7000-series oscilloscopes. ⁴

²Will not fit the Type 565 and RM565 oscilloscopes. For these oscilloscopes use Tektronix Part No. 016-0225-02.

³The Type 519 comes equipped with this camera adapter.

⁴Camera comes equipped with this camera adapter.

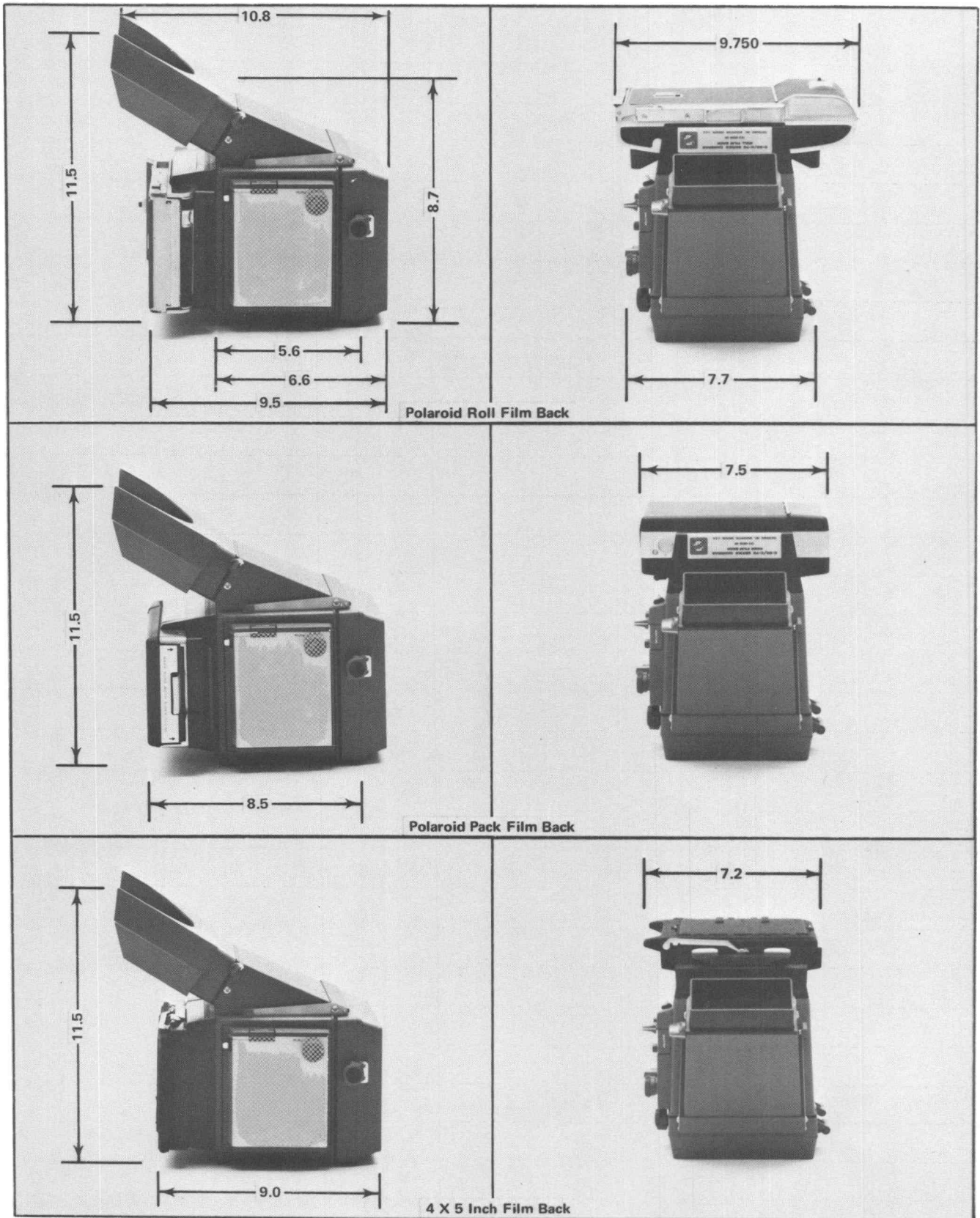


Fig. 1-2. Dimensions of a C-59 Camera.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

SECTION 2

OPERATING INSTRUCTIONS

Change information, if any, affecting this section will be found at the rear of this manual.

Operating Controls and Connectors (see Fig. 2-1)

Phosphor-Matching Filter	Normally supplied with a filter to match the photometer light spot to P31 phosphor, but can be factory supplied with a filter to match the photometer light spot to P1, P2 or P11 phosphor.		skirt of the secondary knob is compared with the table to obtain the proper shutter speed and aperture combination.
MODE	A two position switch that selects NORM or SINGLE SWEEP operation. The switch connects the X-sync contacts of the shutter between ground and either the sweep reset connector on the 3-pin, 7000-series bezel camera connector (SINGLE SWEEP) or the X-SYNC N.O. connector on the side of the camera (NORM).	SHUTTER	Actuates the camera shutter which admits light to the optical system for controlled periods.
		APERTURE	Controls the opening that limits the size of a bundle of light rays traversing the optical system.
FOCUS	A spring-loaded knob that, when pushed in, projects two vertical bars of light on the CRT. By turning the pushed in FOCUS control, the light bars can be aligned, indicating that the camera is properly focused. When the FOCUS control is released, the camera is locked into position and the focusing lamps are turned off.	SYNC	Miniature phone jack for access to NO (normally open) contacts of an internal switch that is actuated by the shutter. Accepts miniature phone plug (Tektronix Part No. 134-0079-00).
		Camera Power and Sweep Reset Connector (three pins located in front casting of camera)	A 3-pin connector that mates to a connector on the bezel of a Tektronix 7000-series oscilloscope for providing +15 volts DC from the oscilloscope to the camera and a sweep reset pulse from the camera to the oscilloscope
Photometer	Indicates the proper relationship between shutter speed and aperture for a selected ASA film speed and trace brightness. Operation: Depressing the photometer PUSH ON switch, located on the left side of the camera, turns on the photometer light spot whose intensity is then varied by the secondary knob on top of the ASA setting control, until the photometer light spot and the trace intensity are matched. After matching the spot and trace, the PUSH ON button is released and the reading indicated under the		An automatic circuit in the C-59 camera will always connect the camera circuitry to the 7000-series oscilloscope camera power source instead of the internal battery pack, when mounted on the instrument. Under all other conditions the automatic circuit will connect the camera circuitry to the internal battery pack power source.

FIRST-TIME OPERATION

The following procedure demonstrates the use of the control to the C-59 Camera. Both camera operating modes are described as it would be used on a Tektronix 7000-series oscilloscope. Instructions for mounting and using various parts of the camera will be found later in this section.

Procedure 1 (Set camera MODE control to NORM)

1. Attach a camera adapter to the oscilloscope.
2. Attach the camera to the camera adapter. Obtain the desired display on the CRT of the oscilloscope.
3. Swing the camera against the camera adapter and secure it with the mounting latch knob.
4. Press the FOCUS knob in and adjust it until the two light bars become aligned, then release FOCUS knob.
5. Set the photometer controls as follows:
 - a. Set the ASA FILM SPEED to speed of film being used.
 - b. Set the portion of interest of oscilloscope display to the center of the beam splitting mirror located at the upper center of the viewing tunnel vision area.
 - c. Push the photometer light control in. While observing the beam splitting mirror display, turn the photometer secondary control to match spot brightness

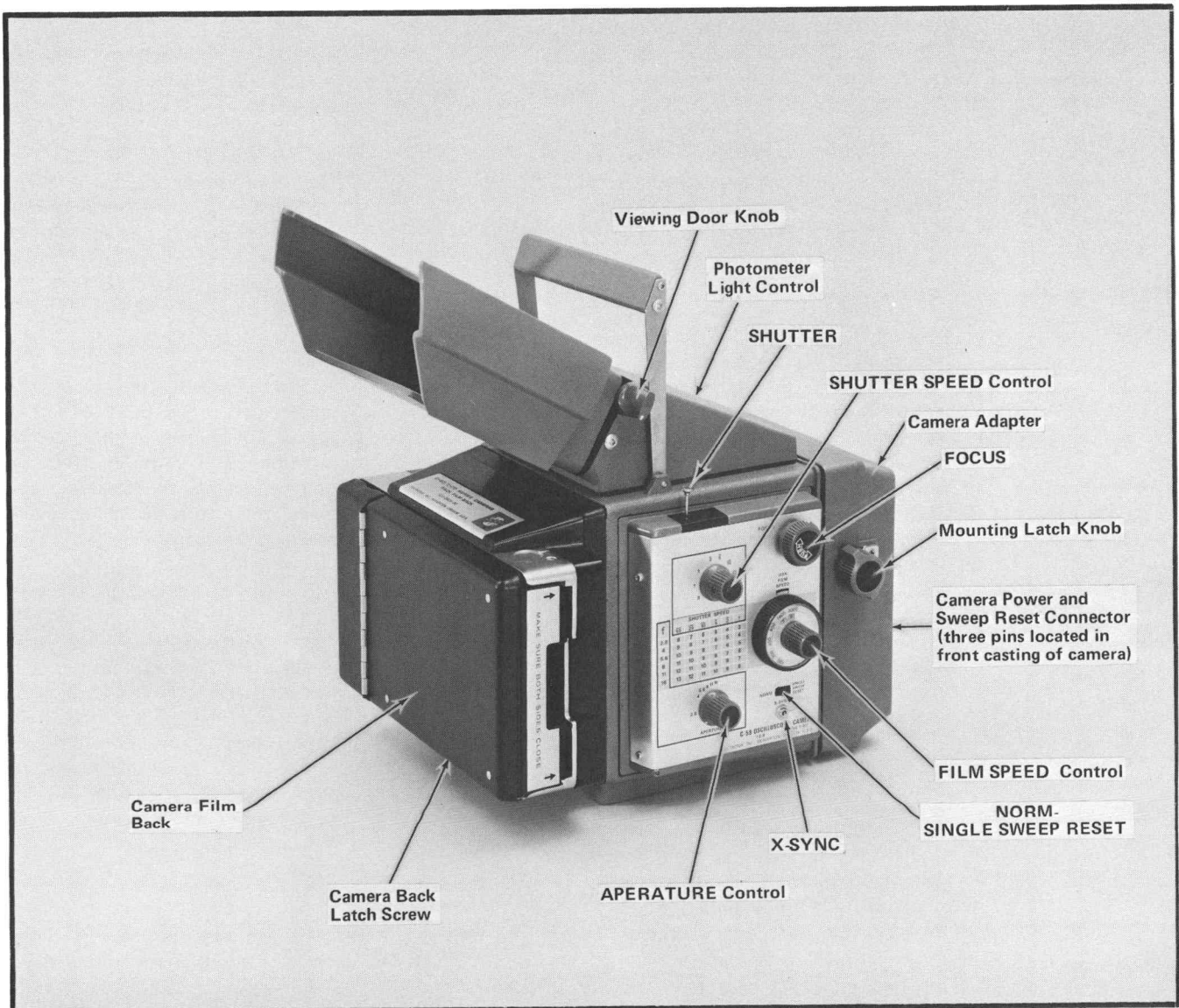


Fig. 2-1. C-59 Camera showing control and connector locations.

to CRT trace brightness, or adjust the CRT trace brightness to match spot brightness.

d. Release the photometer light control and select desired SHUTTER SPEED and APERTURE combination from the table using the number indicated under the skirt of the secondary knob.

6. Make sure camera back has been loaded with film and that it is ready for the first picture. Then, remove the dark slide from the camera back. Position the oscilloscope display as desired.

7. Press the SHUTTER control to take a photograph.

8. Develop the film and check the photograph. If the photograph contrast is not satisfactory, make a slight setting change in the SHUTTER SPEED or APERTURE control settings.

Procedure 2 (Set camera MODE control to SINGLE SWEEP)

1. Do steps 1 through 6 of procedure 1.

2. Set the SHUTTER SPEED to T (time).

3. Set the oscilloscope controls for single sweep operation and apply the signal to be photographed.

4. Press the SHUTTER control once then wait for the desired event to occur and sweep the oscilloscope. Five seconds after the event has swept the oscilloscope, press the SHUTTER control again to close the shutter.

5. Develop film and check photograph.

CAMERA ADAPTERS

Mounting the Camera (refer below for individual camera adapter mounting information).

A special mounting (camera adapter) is used to attach the camera to the oscilloscope. On some Tektronix oscilloscopes the camera adapter takes the place of the normal graticule cover.

Before mounting the camera adapter onto an oscilloscope it is recommended that any light filter be removed

and that the CRT protector plate or external graticule be checked for scratches and cleanliness. If an external graticule is used on the oscilloscope it should be placed so that the scribed or marked side is toward the CRT and the clear illumination slots are up.

When mounting a camera adapter onto an oscilloscope, make certain that the hinge fittings on the camera adapter are toward the left side of the instrument. Also, make certain that the camera adapter is securely mounted to the oscilloscope before attaching the camera.

The camera is now attached to the camera adapter by engaging the hinge pins on the camera frame with the hinge fittings on the camera adapter. The camera can be removed at any time by simply lifting it off the camera adapter. The hinge system also permits the camera to be moved against the oscilloscope or swung away.

A mounting latch knob located on the front-right-side of the camera frame is used to secure the camera tightly against the camera adapter. Rotating the mounting latch knob counterclockwise releases the camera from the camera adapter while clockwise rotation tightens the camera against the camera adapter. Before fastening the mounting latch knob, be sure to remove the plastic dust cover from the front opening of the camera frame. Now swing the camera against the camera adapter and tighten it by rotating the mounting latch knob clockwise.

NOTE

The camera must be modified if it is to be mounted on a low profile rackmount instrument whose top clearance is restricted. The modification required is removal of the viewing tunnel and the installation of a cover as follows:

1. Remove two screws located top-front of camera frame which hold viewing tunnel on.

2. Slide viewing tunnel forward and out from camera frame spring clip.

3. Install cover, camera frame top (Tektronix Part No. 200-1041-00) between camera frame and spring clip.

4. Re-install two screws removed in step 1 to secure cover.

Focusing once the cover is in place must be done with either the 4 X 5 inch film back or a focusing plate (see latest Tektronix catalog for part numbers) in the Polaroid film back since the focusing light bars cannot be seen. The exposure control also cannot be used with the cover in place since the light spot cannot be seen.

Mounting Camera Adapter 016-0249-03

Before mounting the camera adapter, locate a slotted rod at the bottom of the camera adapter; using a coin, turn this slotted rod fully counterclockwise.

Slide the camera adapter down over the instrument bezel until the rib on the upper inner part of the camera adapter engages the groove on the top of the instrument bezel. When the camera adapter and the instrument bezel are engaged, push the bottom of the camera adapter in toward the instrument as far as possible. Again using a coin, while holding the bottom of the camera adapter against the instrument, turn the slotted rod at the bottom of the camera adapter clockwise until the camera adapter is held securely to the instrument.

The camera can now be put in place by engaging the hinge pins on the camera frame with the hinge fittings on the camera adapter.

To remove the camera adapter, turn the slotted rod at the bottom of the camera adapter fully counterclockwise. Pull out slightly on the bottom of the camera adapter, then slide the camera adapter up until it is free of the oscilloscope.

Mounting Camera Adapters 016-0223-00, 016-0224-00, 016-0225-02

Remove the graticule cover from the oscilloscope by unscrewing the four knurled nuts. Remove the camera adapter from its package and place it on the four graticule-studs of the oscilloscope. Use the four graticule nuts supplied to attach the camera adapter to the oscilloscope. The new graticule nuts are slotted so that a screwdriver or coin can be used to tighten them.

The camera can now be put in place by engaging the hinge pins on the camera frame with the hinge fittings on the camera adapter.

To remove the camera adapter, reverse the installation procedure.

Special Information for 016-0224-00 Camera Adapter. A hard plastic insert in the camera adapter provides an ambient light seal for a glass-envelope rectangular CRT, but

it must be removed before attaching the camera adapter to an oscilloscope using a ceramic-envelope rectangular CRT.

CAUTION

Failure to remove the plastic insert before installing the camera adapter 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 camera adapter by using a small, blunt tool. Viewing the camera adapter from the camera side, insert the tool through the small opening near the center opening in the camera adapter and apply enough pressure to release the ears on the plastic insert.

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

CAMERA FILM BACKS

Mounting the Camera Back

Slide the front of the camera back down over the rear projection of the camera frame until the rib on the upper inner part of the camera back engages the groove on the top of the camera frame. When the camera back and the camera frame are engaged, push the bottom of the camera back in toward the camera frame until a click is heard, indicating that the bottom latch of the camera back has engaged the camera frame. Then, screw the camera back latch screw in as far as possible. Check that the camera back is securely attached by pulling out on it gently after it is mounted.

To remove the camera back, unscrew the camera back latch screw until it is possible to lift the bottom of the camera back out slightly from the camera frame. Then, slide the camera back up until it is free of the camera frame.

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 X 5 only) or conventional film is quite satisfactory. Both the Polaroid Land 4 X 5 film holder and the holders for conventional cut and roll film are used with the 4 inch X 5 inch film back in place.

With either Polaroid Land or conventional films, the size of the film 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 could be used with a 1:0.7 lens and a 10-cm wide oscilloscope display. This is because the image of the display is 7 centimeters wide and the long dimension of the film is about 8.25 centimeters. Thus, there is 1.25 centimeters of film area to safe-guard against any image cut off on 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.

4 X 5 INCH FILM BACK

Focusing With a 4 inch X 5 inch Film Back

If for some reason it is desired to focus the camera using the 4 inch X 5 inch film back it can be done by:

1. Obtain a sharply focused trace on the CRT using the oscilloscope Focus and Astigmatism controls.
2. Secure the camera in place on the oscilloscope.
3. Install the 4 inch X 5 inch film back onto the camera and press the release button on the 4 inch X 5 inch film back, See Fig. 2-2.
4. Press in the APERTURE knob and set it to the smallest number, then release the knob.
5. Set the MODE knob to T and press the SHUTTER RELEASE button once to open the shutter.
6. Observe the image on the ground glass screen of the 4 inch X 5 inch film back.
7. Push in the FOCUS knob and change the focus as desired, then release the knob.
8. Press the SHUTTER RELEASE button a second time to close the shutter.

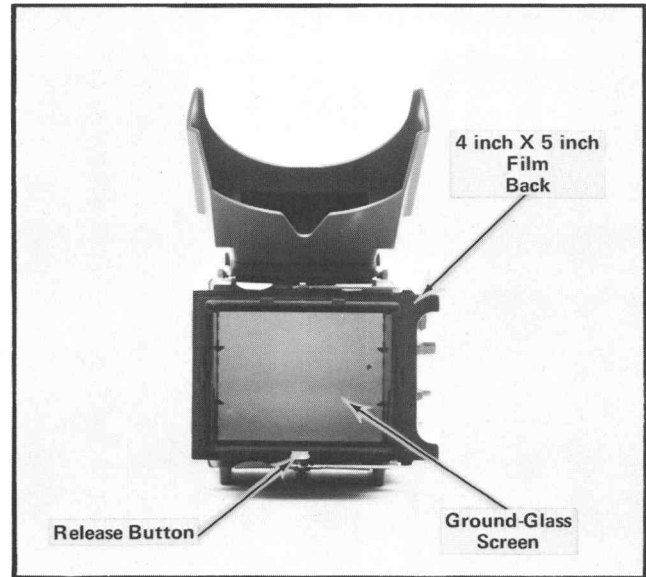


Fig. 2-2. The 4 inch X 5 inch Film Back installed to permit focusing.

When an oscilloscope has an external graticule, the camera is normally focused on the oscilloscope trace, rather than the external 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 external graticule will usually be quite satisfactory. The camera can, of course, be focused on the external 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.

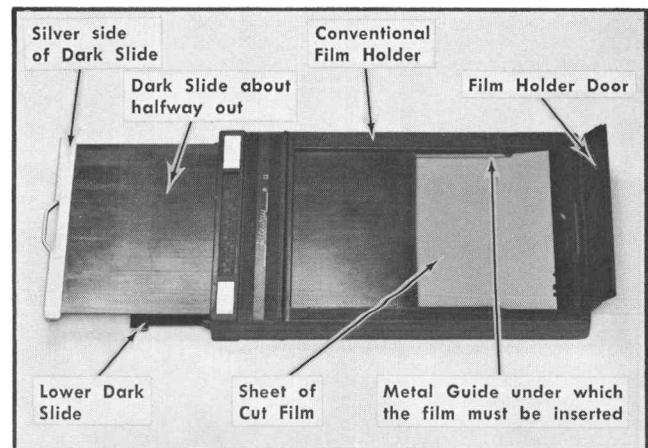


Fig. 2-3. Important points of film holder.

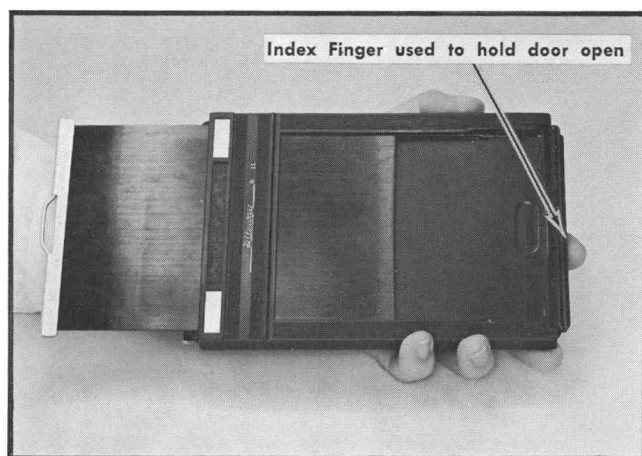


Fig. 2-4. Method used to hold film holder while loading the film.

In loading the film holder, the dark slide (see Fig. 2-3) should be pulled out about half way. Place the silver side of the dark slide handle, on 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 back side of the handle faces the outside when it is re-installed.

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. 2-4 for the method used.

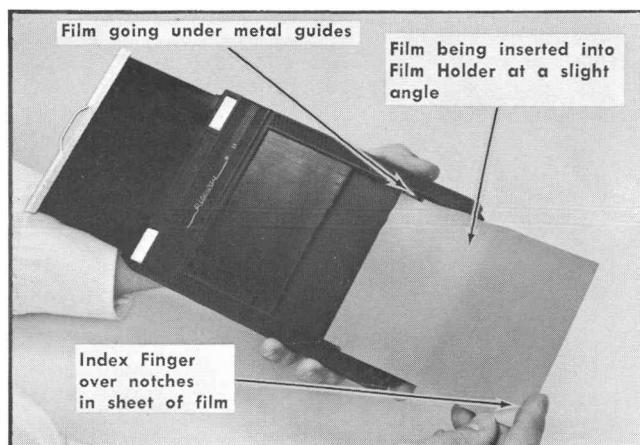


Fig. 2-5. Proper way to insert the film into the film holder. Note the position of the right index finger on the sheet of film.

With the right hand, hold the film so that the notches in the edge of the film are in the upper right corner. Fig. 2-5 shows the proper way to hold the film. In Fig. 2-5 it should be noted that the index finger of the right hand is resting on the notches in the film.

The film is inserted at a slight downward angle into the holder. In Fig. 2-5 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.

When the film is inserted into the holder, the far end of the film should be given a flick (Fig. 2-6) 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 (see Fig. 2-7). Push the slide all the way into the holder (toward the film door). The dark slide will fit 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.

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.

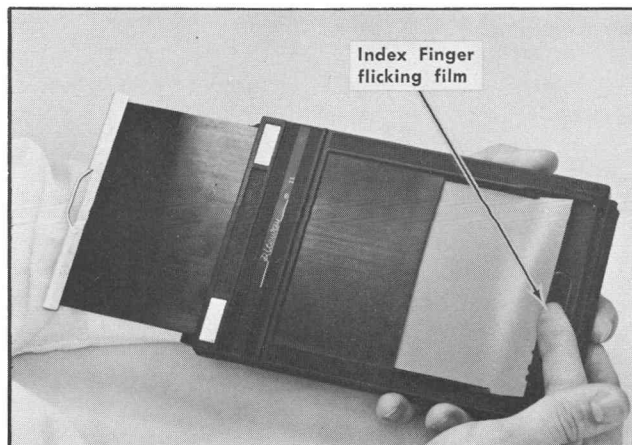


Fig. 2-6. Checking the sheet of film to insure that it has been inserted under the metal guides of the film holder.

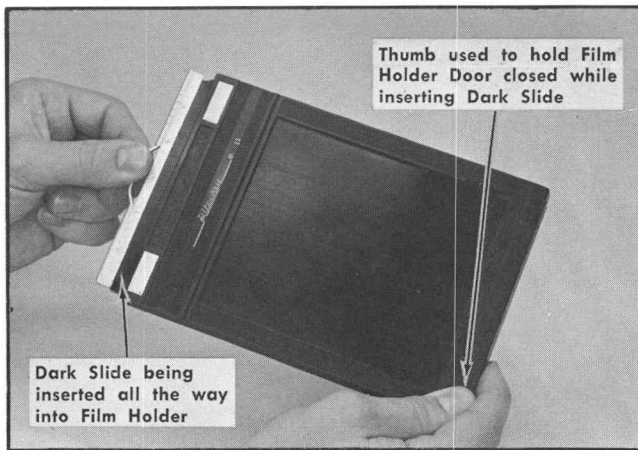


Fig. 2-7. Closing the film holder after loading the sheet of film. The film holder door is held closed with thumb while dark slide is installed.

Procedure Used to Expose Sheet Film

Obtain the desired waveform on the oscilloscope. With the Focus and Astigmatism controls, focus the display. The camera should now be attached to the oscilloscope and the 4 inch X 5 inch film back attached to the camera. Check that the camera is properly focused.

Now, with one hand take the film holder; with your free hand lift the hinged focusing panel on the 4 inch X 5 inch film back (see Fig. 2-8). Insert the film holder between the hinged focusing panel and the other part of the 4 inch X 5 inch back. The side of the film holder to be exposed should be installed toward the camera lens.

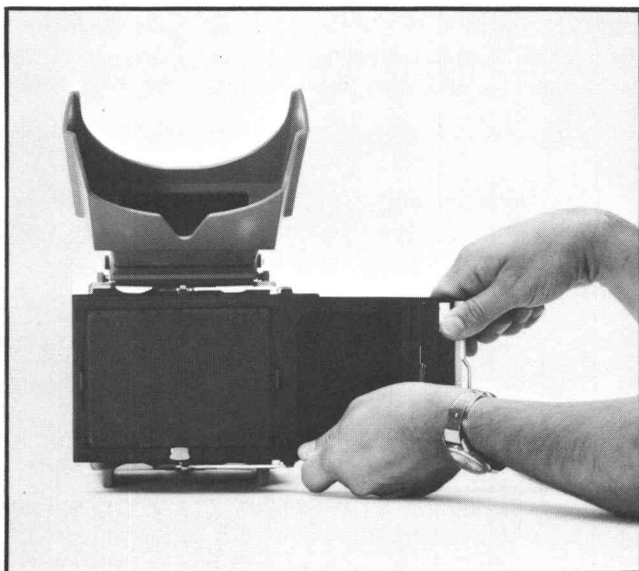


Fig. 2-8. Inserting the film holder in the 4 inch X 5 inch film back.

The film holder should be shoved firmly all the way into the 4 inch X 5 inch film back until the small ridge on the film holder is seated in the 4 inch X 5 inch film back. Test to see that the film holder is seated by giving it a slight tug.

Set the camera controls for the correct exposure. 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 4 inch X 5 inch film 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.

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. 2-9) may be used as a guide. Fig. 2-10 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 4 inch X 5 inch Film Back

The roll film holder should be loaded before installing it on the 4 inch X 5 inch film 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.

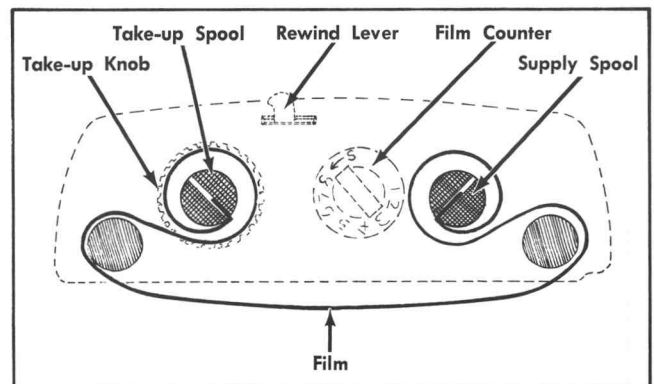


Fig. 2-9. Film threading path for a typical roll film holder.

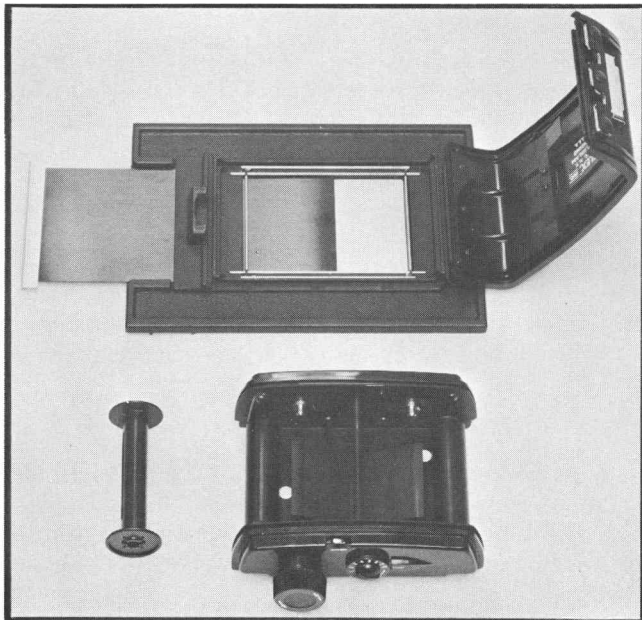


Fig. 2-10. Typical Roll Film Holder apart, ready to load film.

Install the 4 inch X 5 inch film back on the camera and install the camera on the oscilloscope.

Place one thumb on each of the hinges for the hinged focusing panel (refer to Fig. 2-11). Press the hinges in toward the oscilloscope, and at the same time, slide the hinged focusing panel toward the side in which the film holder would be inserted. The above procedure will remove the hinged focusing panel from the 4 inch X 5 inch film back.

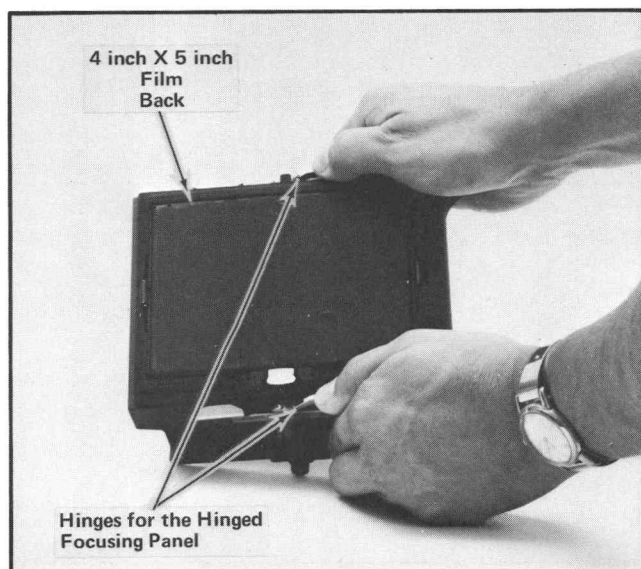


Fig. 2-11. Method used to remove the Hinged Focusing Panel.

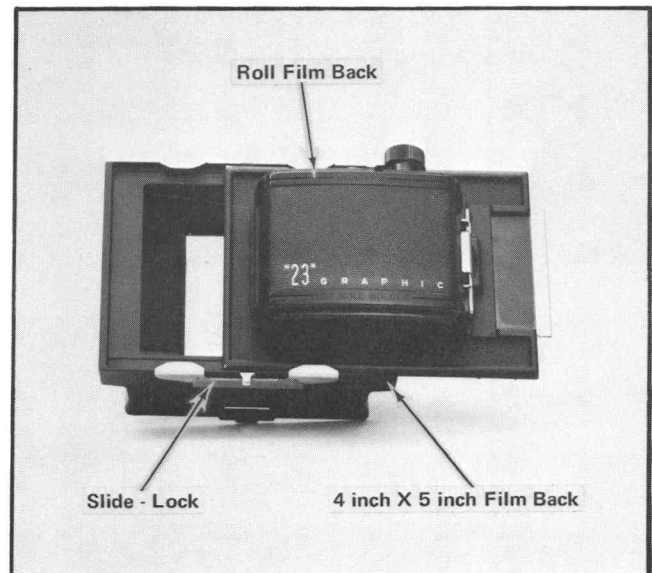


Fig. 2-12. Installing the roll film back on the 4 inch X 5 inch film back.

Slide the roll film holder under the slide locks and onto the 4 inch X 5 inch film back. Slide the roll film holder completely under the slide locks to insure a light-tight seal and a secure fit. The small ridge on the roll film holder should fit into the slot in the 4 inch X 5 inch film back. This is the same type of locking used on the sheet film holders.

One slide lock is located on each side of the long axis of the film (see Fig. 2-12).

Exposing Roll Film

Obtain the waveform on the oscilloscope and focus it properly. Check that the camera is still properly focused, then set the camera controls for the correct exposure. Remove the dark slide from the roll film holder and take the picture.

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.

MODELS 500 and 545 POLAROID LAND 4 X 5 FILM HOLDERS

Attaching the Polaroid Land 4 X 5 Film Holder to the 4 inch X 5 inch Film Back

Install the camera on the oscilloscope to be used and attach the 4 inch X 5 inch film back to the camera. The waveform should now be obtained and focused properly with the oscilloscope controls. The camera focus should be checked before proceeding.

To insert the film holder in the 4 inch X 5 inch film back, lift the hinged focusing panel and slide the film holder between the hinged focusing panel and the rest of the 4 inch X 5 inch film back. The film holder should be inserted so that the processing arm is facing away from the lens (see Fig. 2-13).

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 4 inch X 5 inch film back. There is a small ridge on the holder which will engage in a slot in the 4 inch X 5 inch film back. The film holder is automatically held securely in place by the slide locks engaging the slots in the film holder (refer to Fig. 2-13).

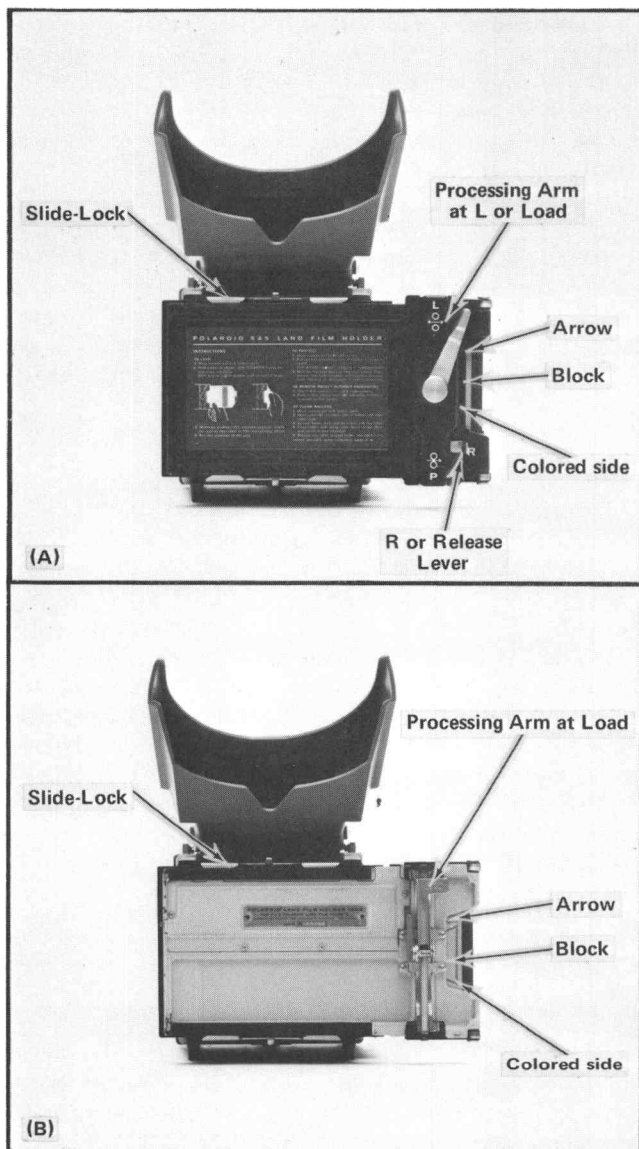


Fig. 2-13. (A) Model 545 Polaroid Land 4 X 5 film holder. (B) Model 500 Polaroid Land 4 X 5 film holder. Both film holders are shown properly installed in the 4 inch X 5 inch film back. With the film packet properly installed, it should be as shown.

Inserting and Exposing the Polaroid Land 4 X 5 Film Packet

When inserting the film packet, the processing arm on the Polaroid Land film holder must be in the L or LOAD (up) position. Before inserting, check the film packet for proper side toward the lens.

Hold the film packet 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. (Refer to Fig. 2-13.)

Now set the camera controls for the correct exposure. 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 film speed 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. 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

Developing the Picture Immediately. After the envelope has been reinserted into the film holder, swing the processing arm on the Polaroid Land 4 X 5 film holder to the P or 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 left in the P or PROCESS (down) position until it is desired to insert another film packet into the film holder.

Removing the Finished Picture. After the recommended development time, remove the envelope of the film packet, following the instructions given with the film.

Peel the picture away from the negative. For all Polaroid Land film types except Type 55 P/N, take the white sheet in one hand, the brown paper and negative in the other, and peel them apart rapidly. For Type 55 P/N Polaroid Land film, take the white sheet and brown paper in one hand, the 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 the Type 55 P/N Polaroid Land film has been used, the brown paper should be removed from the white sheet

(print) as soon as possible. From the negative remove the remainder of the envelope. The negative is perforated at the metal cap to aid in separating the envelope from the negative. 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.

Removing Exposed Film Packets For Later Development

Occasionally you may want to expose a series of pictures without developing each one right away. Expose the negative and reinsert the envelope all the way, making sure the processing arm is in the L or LOAD (up) position.

Model 545 film holder. Push the R or release lever, located near the P or PROCESS position of the processing arm, in as far as possible and hold it in. Carefully withdraw the entire film packet from the film holder. Do not let go of the release lever until the film packet is completely out of the film holder.

Model 500 film holder. 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.

Developing 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 P or PROCESS (down) position and proceed to develop your pictures in the manner outlined above.

POLAROID LAND ROLL FILM BACK

Loading and Exposing the Roll Film Back

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

To open the roll film back for loading, swing the latch lever out and down toward the bottom of the roll film

back. The roll film back should have opened slightly. Swing the back cover out until it is fully open. Inside the roll film back you will now see the inner panel. Swing the inner panel to its fully opened position.

Remove the empty spool from the roll film back. The processing rollers in the film back 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 roll film 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. 2-14.

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. 2-15). Be sure that the white paper of the positive roll lies smooth and flat, not tucked into the well.

Close the back cover, and squeezing it tightly shut, pick up the roll film back. Swing the latch lever all the way towards the bottom of the film 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 roll

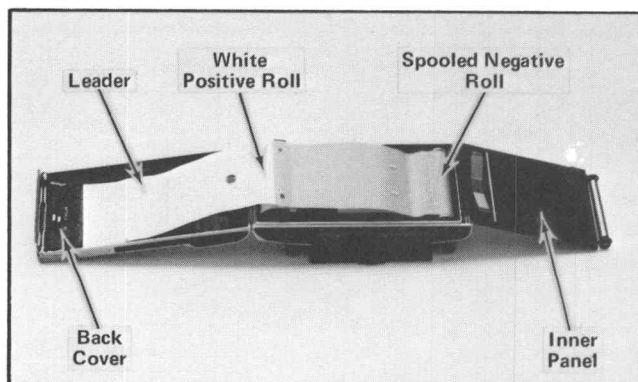


Fig. 2-14. The Polaroid Roll Film Back opened for loading. The white positive roll is dropped in the well at the left while the spooled negative roll is dropped in the well at the right.

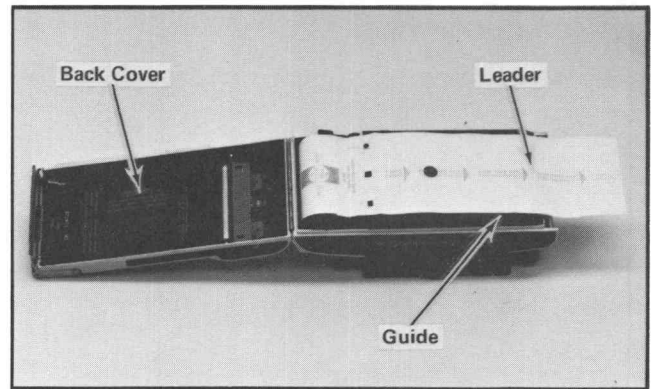


Fig. 2-15. The leader of the film roll must be brought around the roller on the inner panel. Care must be taken that the leader is aligned between the guides on the inner panel before the roll film back is closed.

film back). There should now be a short tab of paper extending beyond the cutter bar of the film back. The dark slide should now be installed in the film back. If it is not, the first picture may be exposed.

While holding the roll film 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.

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

The roll film back is now ready for the first picture. Mount the film back on the camera and set the camera for a correct exposure. 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

Operating Instructions—C-59 Camera

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 the 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.

Those black-and-white prints that require coating should be coated as soon 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 tap 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

Loading and Exposing the Polaroid Land Film Pack

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

To open the pack film back for loading, push the latch lever (on the bottom of the film back near the tripod socket), counterclockwise, see Fig. 2-16. The door should have opened slightly. Now swing the door out until it is fully open.

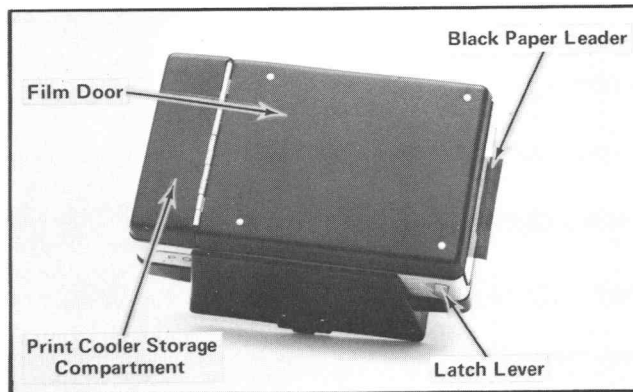


Fig. 2-16. Polaroid Land Pack Film Back.

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

The processing rollers in the pack film 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 film 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 film 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, see Fig. 2-17. Be sure that the indicated

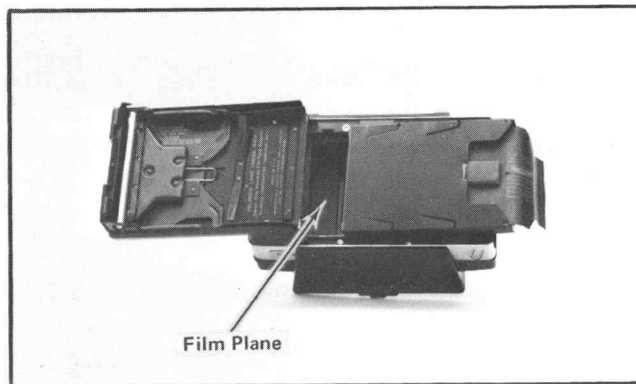


Fig. 2-17. Installing Film Pack into Pack Film Back.

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 pack film back.

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

While holding the pack film back with your left hand, pull the black paper leader all the way out. The film back 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.

Mount the pack film back on the camera and set the camera for a correct exposure. 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, (Fig. 2-18) 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 pack film back. The white tab should be the only tab visible when it is pulled.

Next pull the yellow tab (Fig. 2-18). This causes the positive and negative sheets to be pulled between and through the processing rollers, 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 a window shade; not slowly and hesitantly.

Wait the recommended 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

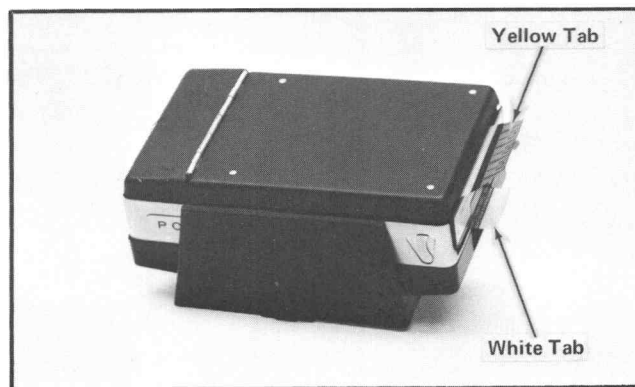


Fig. 2-18. Positive and negative sheets ready to be pulled out of pack film back.

varies for different types of film, and even the development 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.

Those black-and-white prints that require coating should be coated as soon as possible after separating them from the negatives. Prints may be coated by sticking the back of the print to a sticky area to hold them, then using the Polaroid print coater.

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 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 (Fig. 2-16) just to the left of the film loading door (bottom of camera back towards you). To open this 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.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

SECTION 3

PHOTOGRAPHIC TECHNIQUES

Change information, if any, affecting this section will be found at the rear of the manual.

CAMERA-OSCILLOSCOPE CONSIDERATIONS

Writing Speed

Writing speed 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 speed figure expresses the maximum spot speed (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 speed are required for low-repetition-rate displays at the fast oscilloscope sweep rates.

Fig. 3-1 shows one way in which writing speed 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 speed 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 speed in centimeters per microsecond is given approximately by:

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

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

It is inadvisable to speak of the absolute writing speed 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 speed under the same condi-

tions. 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 film speed (ASA) of a film doesn't tell you much about its effectiveness in recording single oscilloscope traces. This is because the film 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 film speed rating and maximum writing speed, however. Thus, it would be safe to assume that a film with a very high film speed rating would probably have a higher maximum writing speed than a film with a lower film 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 speed 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 is thus most suitable for photographic work.

In general, (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 phosphor which gives good results in both types of applications. This frequently results in the choice of a phosphor such as P2 and P31 where the emitted light has a large enough actinic value to give a good writing speed, and also has sufficient persistence to permit easy viewing.

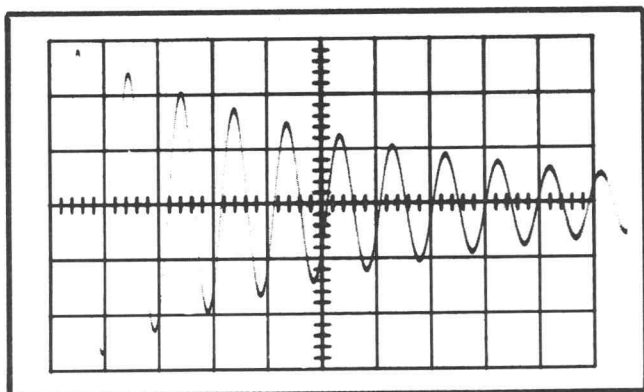


Fig. 3-1. A single-shot damped sinusoidal waveform which can be used to measure the maximum writing rate of an oscilloscope-camera combination.

It has been observed that the P11 phosphor has the highest comparative writing speed of any common phosphor, and is thus best for photographic work on most fast emulsions. 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 capability is required. Type P11 emits a medium short-duration, violet-blue light.

Since the Type P2 or P31 phosphors appear to be best for combined general purpose use and photographic applications, they are standard on most Tektronix oscilloscopes. Type P11 is standard 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 all of the film before developing a single photograph.

TABLE 3-1

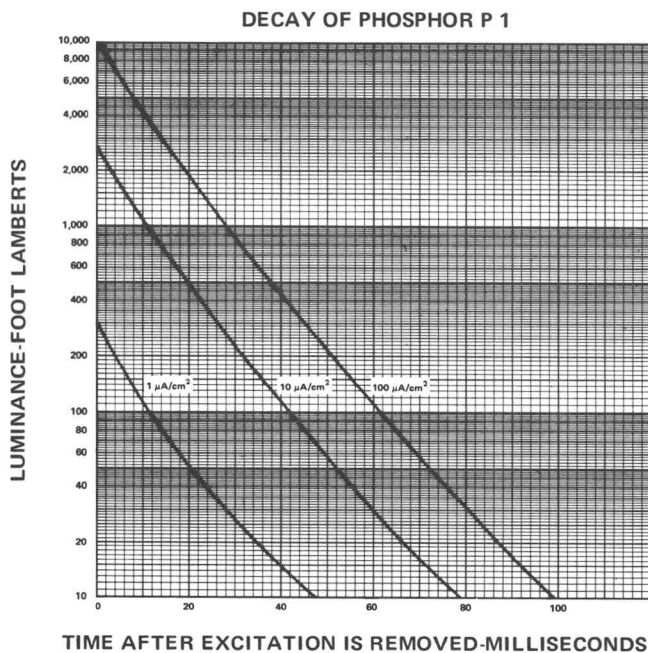
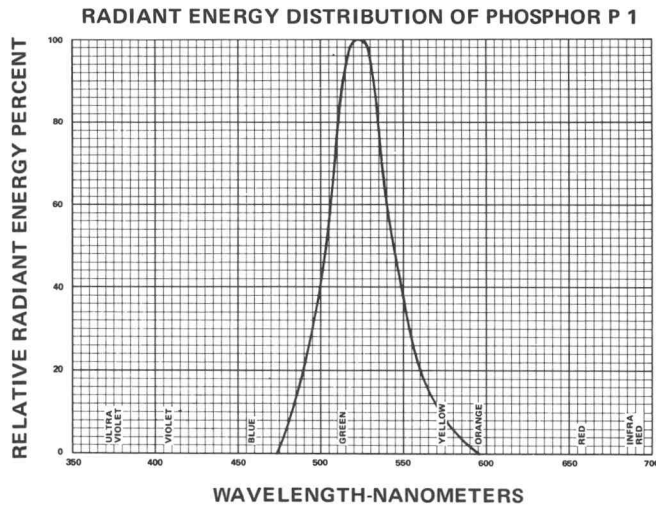
COMMON PHOSPHOR SUMMARY TABLE

Phosphor Type	Characteristic Graph Figures	¹ Relative Photo Writing Speed P11 Standard	² Relative Brightness 10 kV aluminized screen P31 Standard	Wavelength Peak Radiant Energy	Decay Time in ms to 10% of initial value	Color	
						Fluorescence	Phosphorescence
P1	3-2	20% as fast	50% as bright	520 nm ³	95	Yel-Grn	Yel-Grn
P2	3-3	40% as fast	55% as bright	510 nm ³	120	Blu-Grn	Yel-Grn
P7	3-4	75% as fast	35% as bright	450 nm ³	1500	Blu-Wht	Yel-Grn
P11	3-5	100%	15% as bright	450 nm ³	20	Vio-Blu	Vio-Blu
P31	3-6	50% as fast	100%	530 nm ³	32	Yel-Grn	Yel-Grn

¹ To achieve the writing speed comparisons the shutter of the test camera was left open five seconds to make use of the available light and Polaroid Land Type 410 film was used.

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

³ Specific value in nanometers.

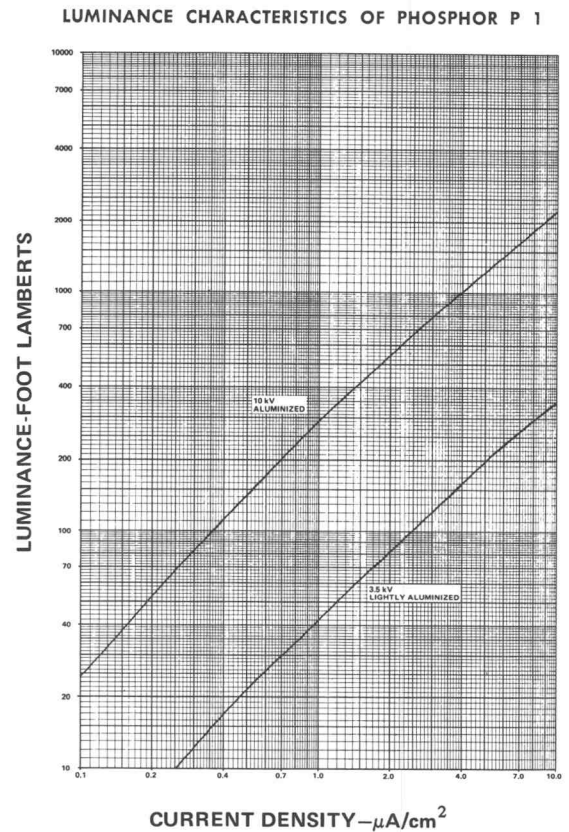


BUILDUP

Approximately 14 milliseconds to 90% at $10 \mu\text{A}/\text{cm}^2$.

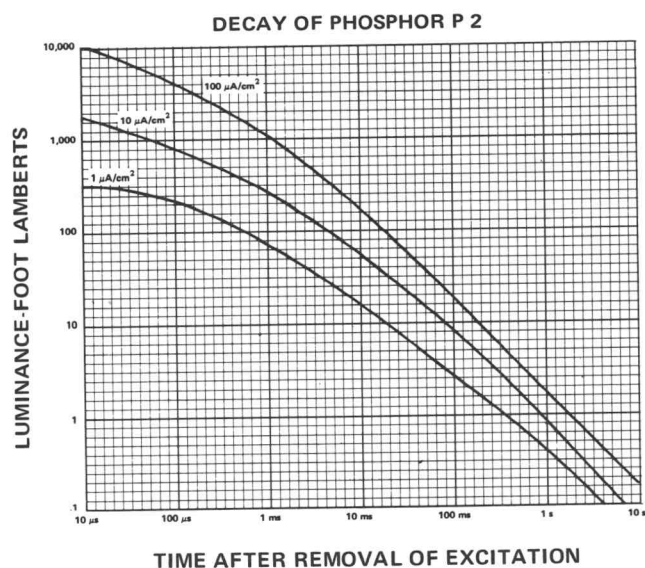
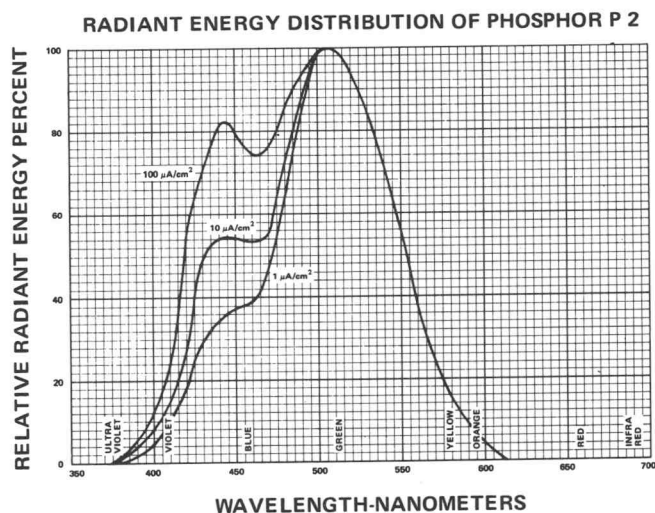
DECAY

Essentially exponential, largely independent of excitation conditions. Measured at 10 kV and with 50 millisecond excitation pulse.



Luminance measurements taken with a Spectra Brightness Spot Meter, observing a 0.250 inch diameter area of a 2 X 2 cm, 135 line, focused raster.

Fig. 3-2. Typical cathode ray tube P1 phosphor characteristics.



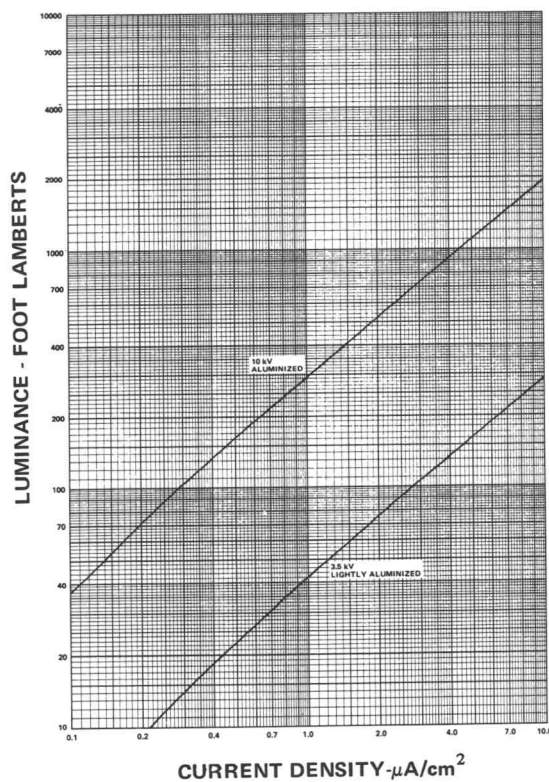
BUILDUP

Approximately 400 milliseconds to 90% at $10 \mu\text{A}/\text{cm}^2$.

DECAY

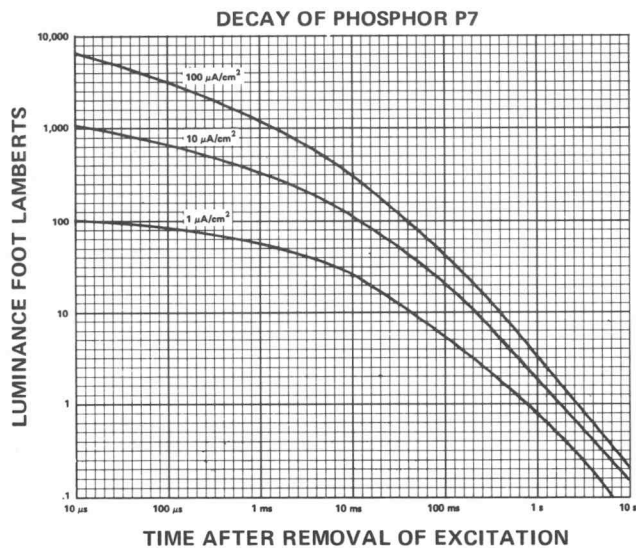
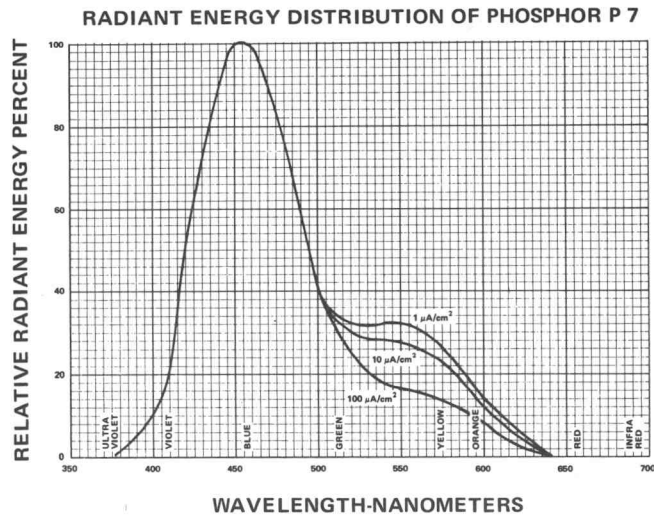
Essentially power law, somewhat dependent upon excitation conditions. Measured at 10 kV and with 5 millisecond excitation pulse.

LUMINANCE CHARACTERISTICS OF PHOSPHOR P 2



Luminance measurements taken with a Spectra Brightness Spot Meter, observing a 0.250 inch diameter area of a 2 X 2 cm, 135 line, focused raster.

Fig. 3-3. Typical cathode ray tube P2 phosphor characteristics.

**BUILDUP**

Approximately 1.5 milliseconds to 90% at $10 \mu\text{A}/\text{cm}^2$.

DECAY

Essentially power law, somewhat dependent upon excitation conditions. Measured at 10 kV and with 5 millisecond excitation pulse.

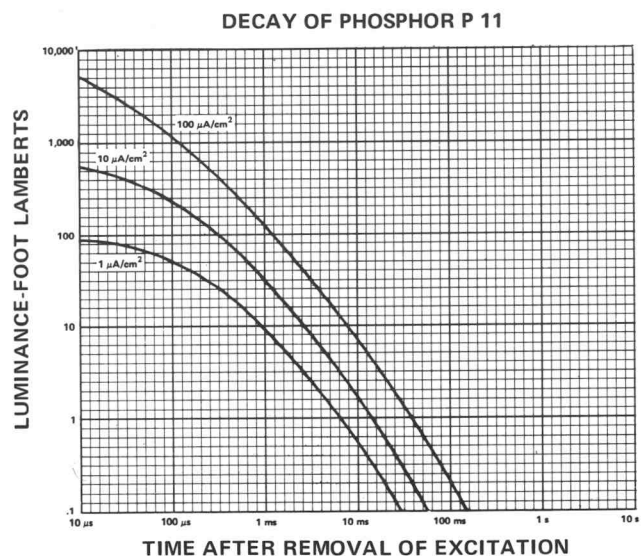
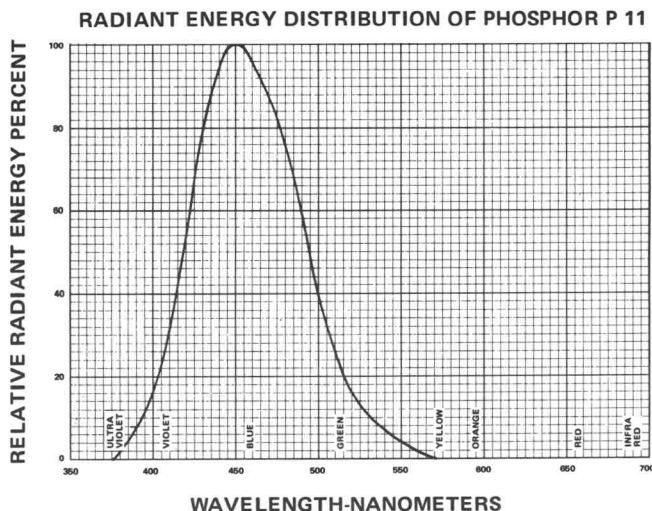
LUMINANCE CHARACTERISTICS OF PHOSPHOR P 7

LUMINANCE-FOOT LAMBERTS

CURRENT DENSITY- $\mu\text{A}/\text{CM}^2$

Luminance measurements taken with a Spectra Brightness Spot Meter, observing a 0.250 inch diameter area of a 2 X 2 cm, 135 line, focused raster.

Fig. 3-4. Typical cathode ray tube P7 phosphor characteristics.



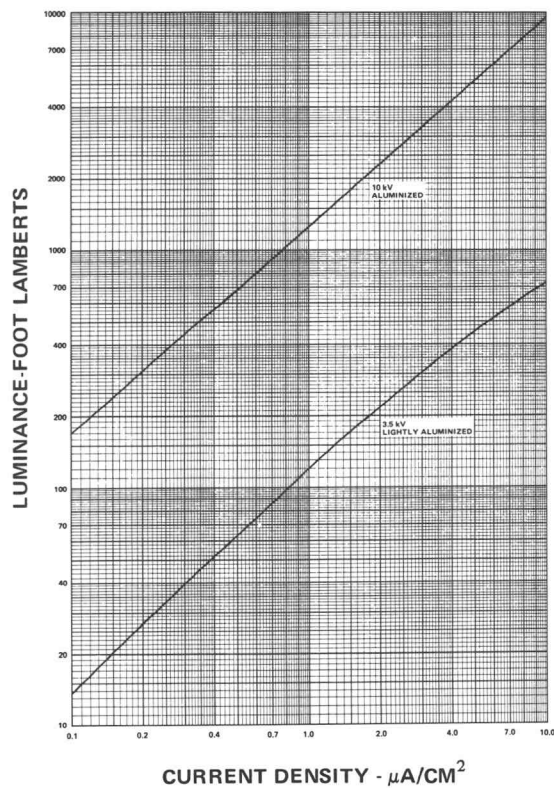
BUILDUP

Approximately 380 milliseconds to 90% at $10 \mu\text{A}/\text{cm}^2$.

DECAY

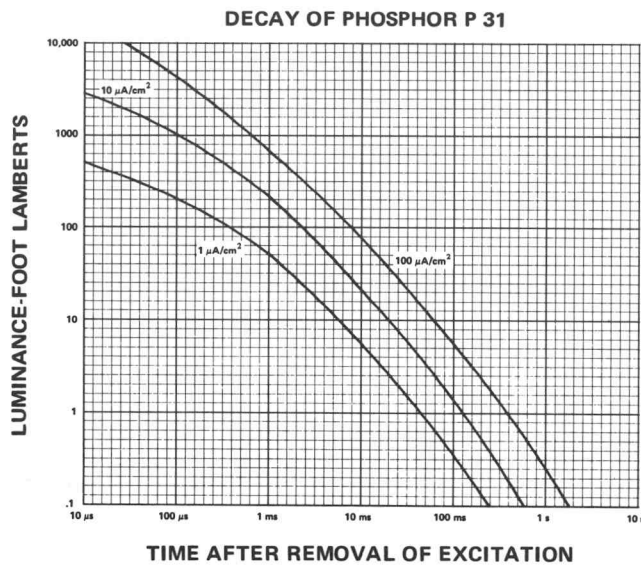
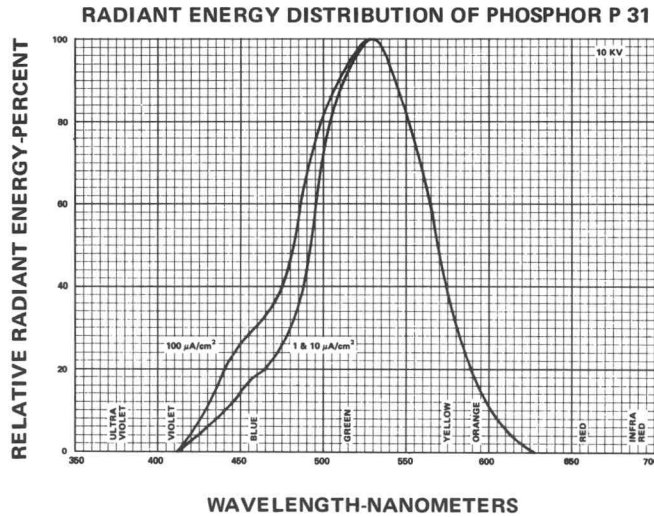
Essentially power law, somewhat dependent upon excitation conditions. Measured at 10 kV and with 5 millisecond excitation pulse.

LUMINANCE CHARACTERISTICS OF PHOSPHOR P 11



Luminance measurements taken with a Spectra Brightness Spot Meter, observing a 0.250 inch diameter area of a 2 X 2 cm, 135 line, focused raster.

Fig. 3-5. Typical cathode ray tube P11 phosphor characteristics.



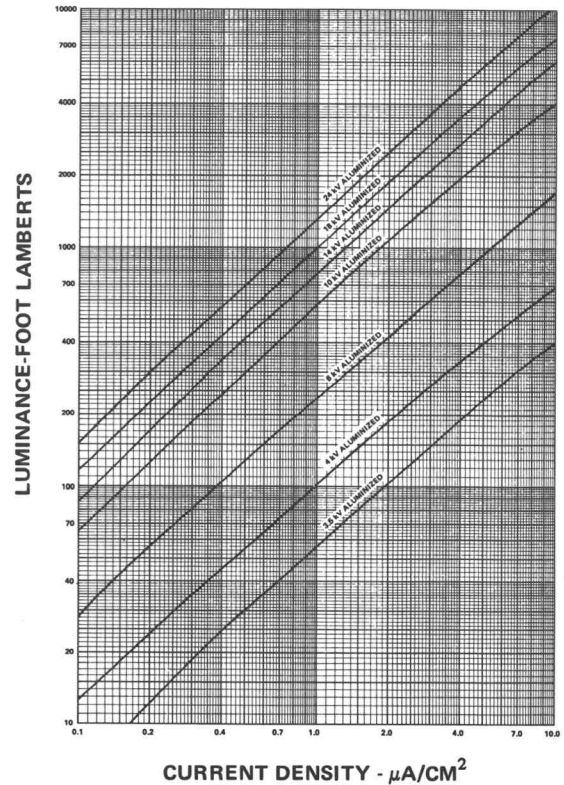
BUILDUP

Approximately 500 microseconds to 90% at $10 \mu\text{A}/\text{cm}^2$.

DECAY

Essentially power law, somewhat dependent upon excitation conditions. Measured at 10 kV and 5 millisecond excitation pulse.

LUMINANCE CHARACTERISTICS OF PHOSPHOR P 31



Luminance measurements taken with a Spectra Brightness Spot Meter, observing a 0.250 inch diameter area of a 2 X 2 cm, 135 line, focused raster.

Fig. 3-6. Typical cathode ray tube P31 phosphor characteristics.

The following table (Table 3-2) of Polaroid film types gives a brief outline of the available emulsions. The films recommended or films having equivalent characteristics may be used.

TABLE 3-2
POLAROID LAND FILM TYPE SUMMARY

Film Type	Approximate ASA Rating	Film Characteristic Graphs See Fig.:	Picture Size	Remarks
47 ⁴	3,000	3-9	3¼X4¼	Panchromatic type, Paper print. Roll film only. High-speed film with medium contrast.
107 ⁴	3,000	3-9	3¼X4¼	Panchromatic type. Film packs only. Paper print. Similar to Type 47.
410 ⁴	10,000	3-13	3¼X4¼	Roll only. Panchromatic type. Paper print. Extra high-speed film good for extremely fast waveforms.
46L ⁵	800	3-11	3¼X4¼	Roll form only. Yields positive transparency. Medium contrast. High speeds. Panchromatic type.
146L ⁴	125	3-12	3¼X4¼	Slower speed than type 46L. Faster development time. Roll film. Positive transparency. High contrast.
52 ⁴	200	3-7	4 X 5	Sheet form only. Panchromatic type. Yields paper print. Good general purpose film.
55 P/N ⁶	50	3-8	4 X 5	Positive paper print and reproducible negative. Sheet form. Panchromatic type. High resolution negative.
57 ⁴	3,000	3-9	4 X 5	Panchromatic type. Sheet form only. Paper print. Equivalent of Type 47 in sheet form.

TABLE 3-2 (cont)

Film Type	Approximate ASA Rating	Film Characteristic Graphs, See Fig. No.	Picture Size	Remarks
48 ⁷	75	3-10	3¼X4¼	Color film which yields a paper print. Available in roll film only. Requires no coating.
58 ⁷	75	3-10	4 X 5	Color film which yields a paper print. Available in sheet form only. Requires no coating.
108 ⁷	75	3-10	3¼X4¼	Color film which yields a paper print. Available in film packs only. Requires no coating.

⁴ Development time 10 seconds.

⁵ Development time 2 minutes.

⁶ Development time 20 seconds.

⁷ Development time 50-60 seconds.

The following table (Table 3-3) of conventional film types gives a brief outline of the available emulsions. The films recommended or films having equivalent characteristics may be used.

TABLE 3-3
CONVENTIONAL FILM TYPES

Manufacturer	Film Name	ASA Speed	Remarks
Eastman	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.

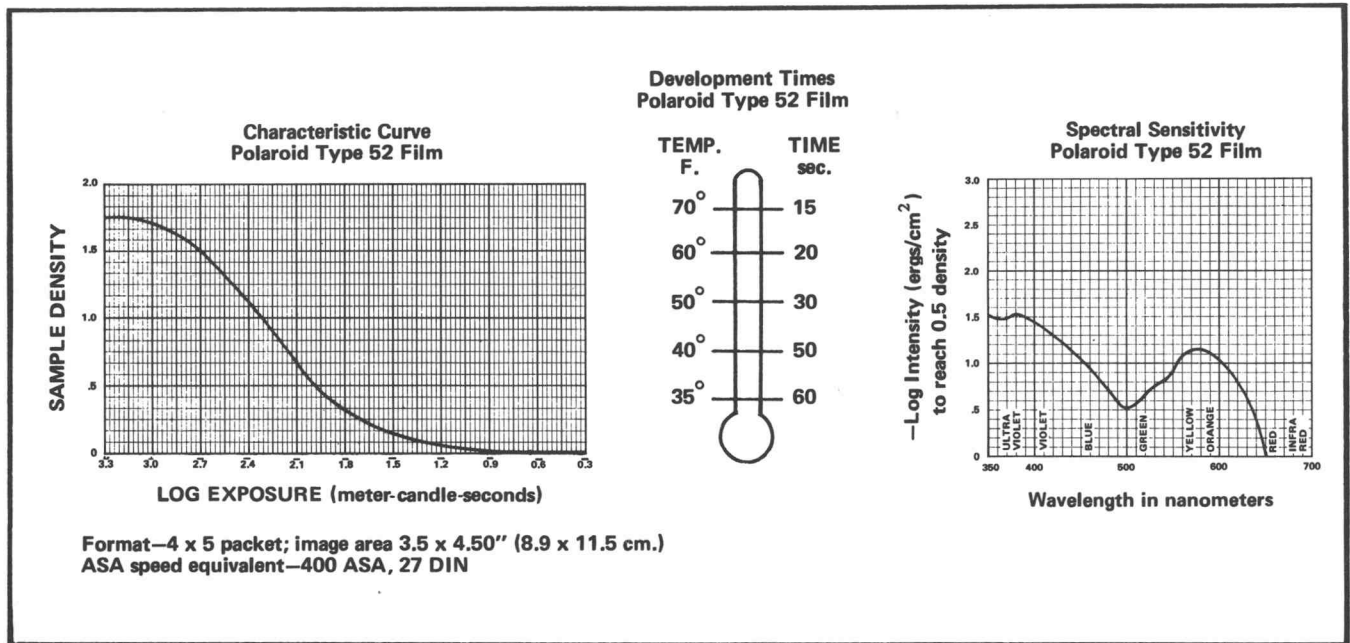


Fig. 3-7. Typical Polaroid Land Type 52 film characteristics.

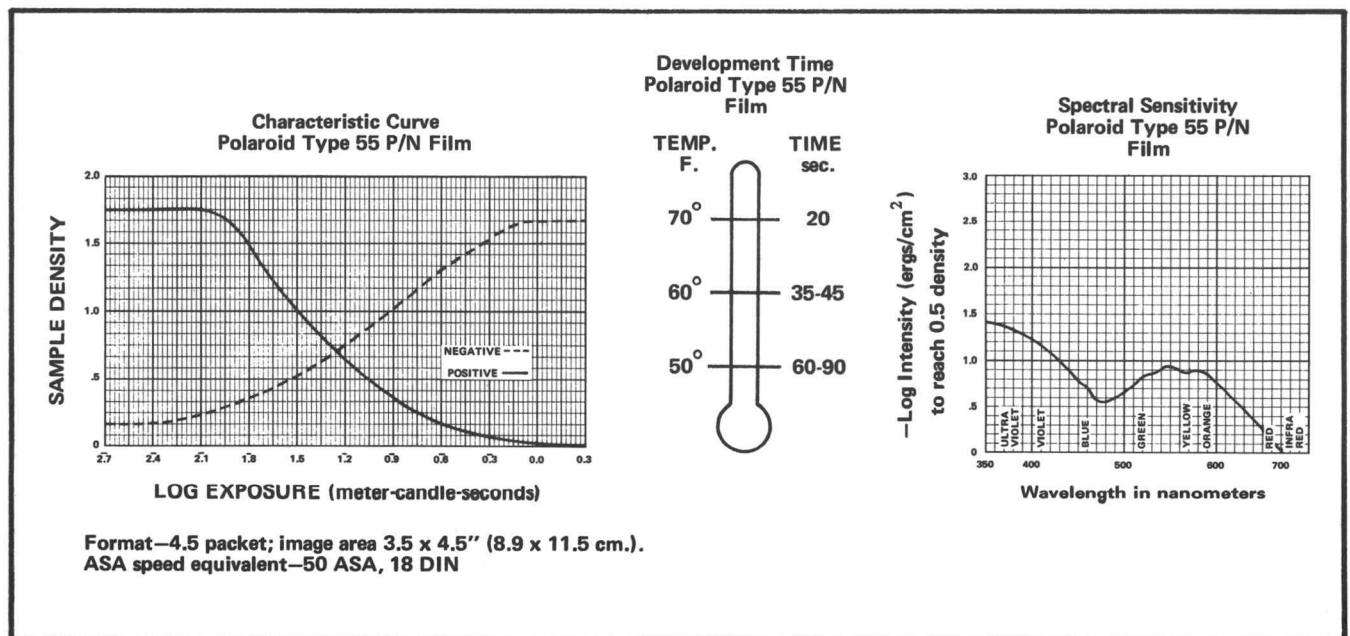


Fig. 3-8. Typical Polaroid Land Type 55 P/N film characteristics.

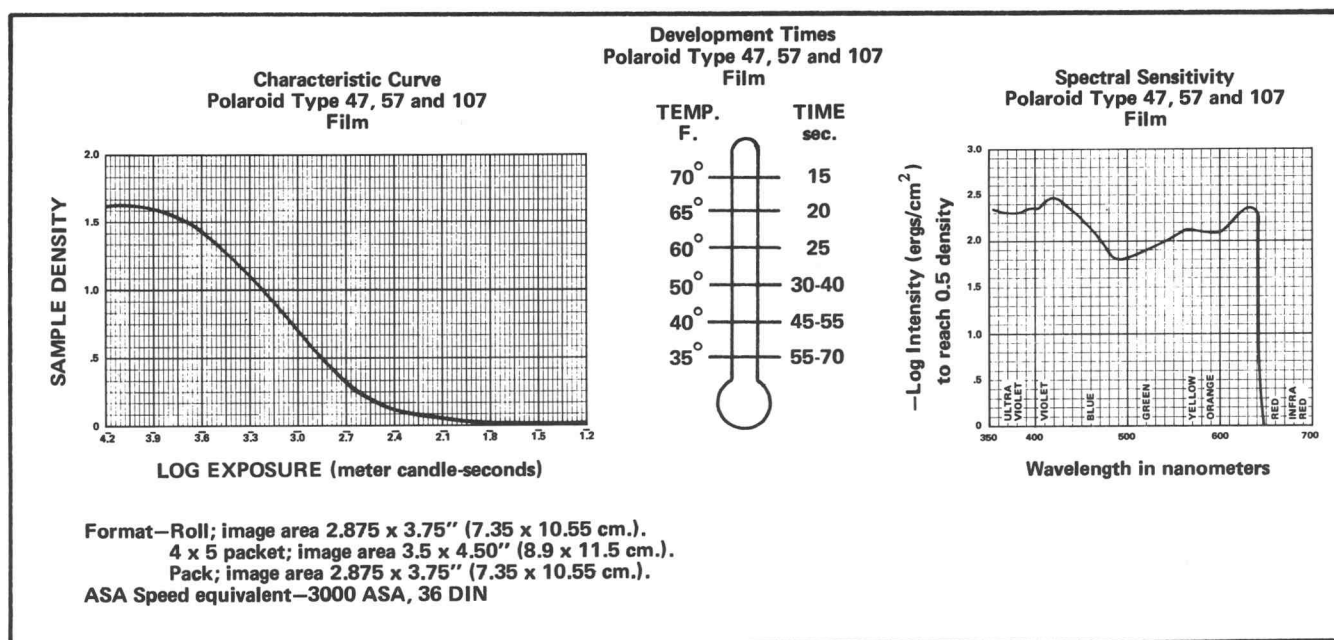


Fig. 3-9. Typical Polaroid Land Type 47, 57 and 107 film characteristics.

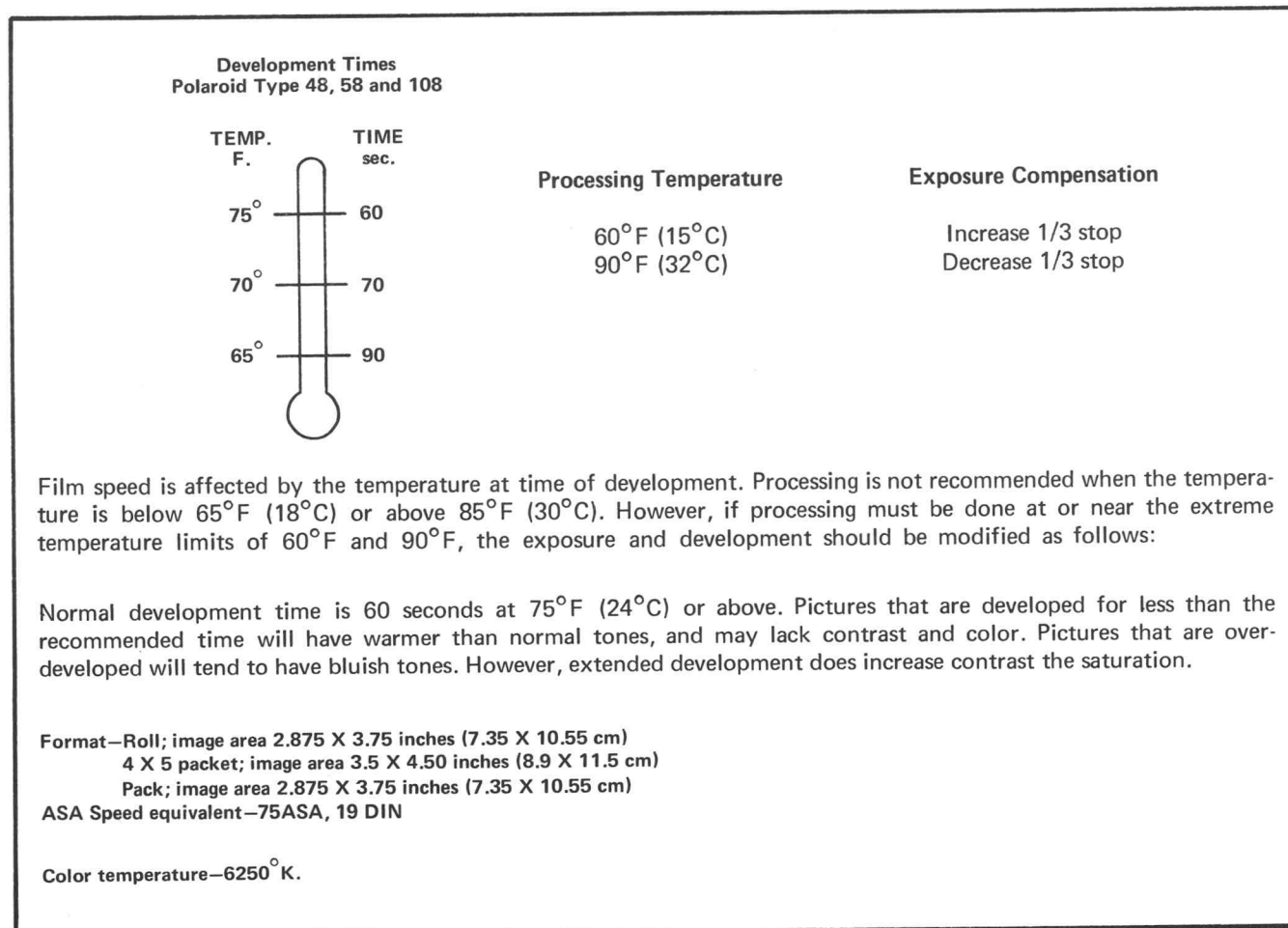


Fig. 3-10. Typical Polaroid Land Type 48, 58 and 108 film characteristics.

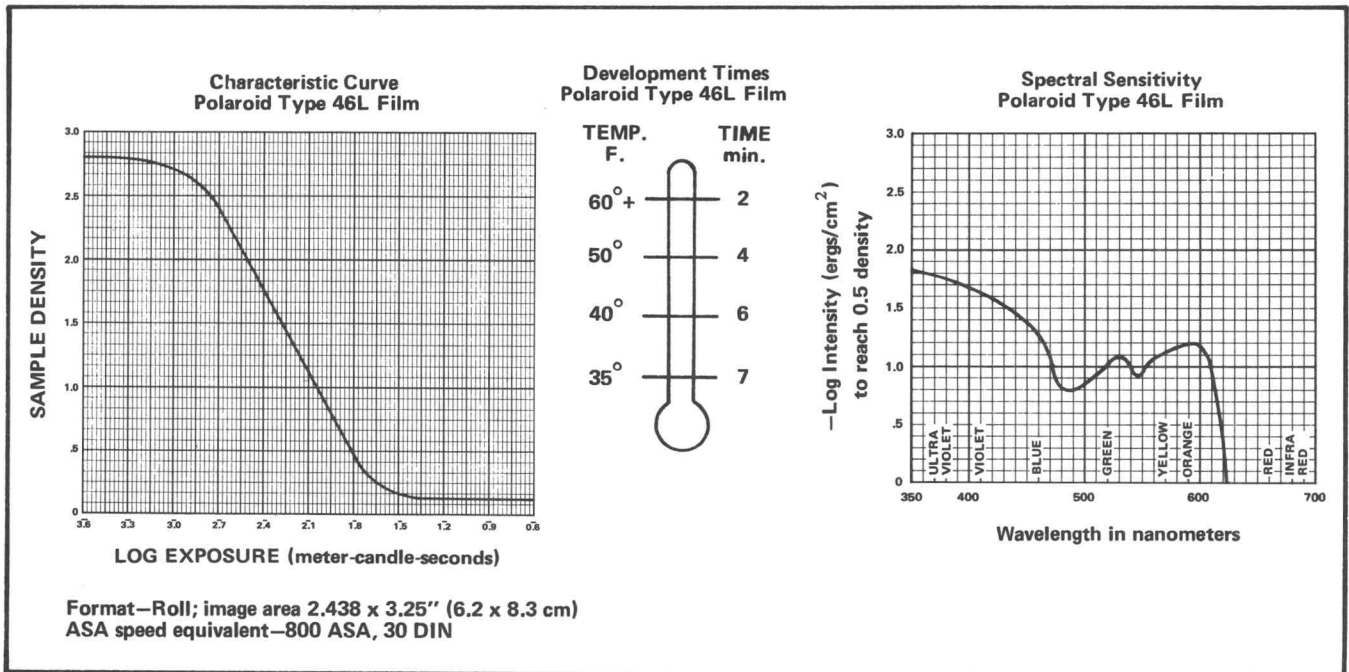


Fig. 3-11. Typical Polaroid Land Type 46B film characteristics.

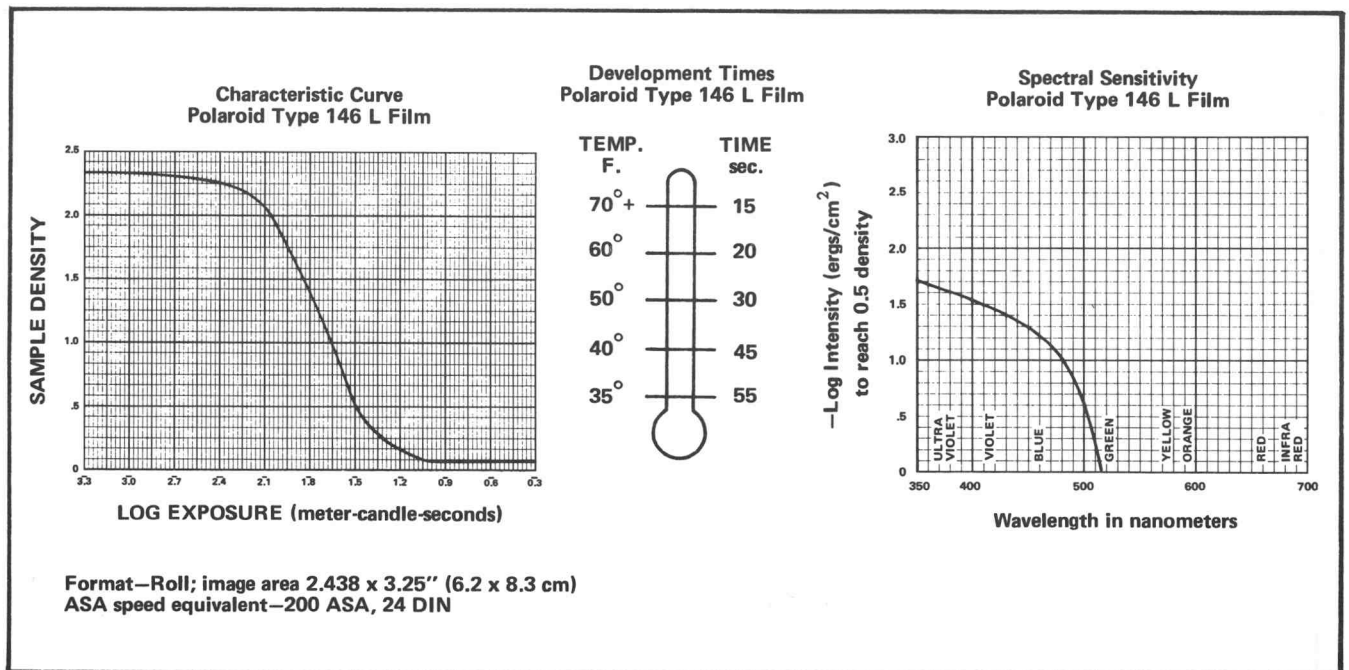


Fig. 3-12. Typical Polaroid Land Type 146L film characteristics.

TABLE 3-3 (cont)

Manu- facturer	Film Name	ASA Speed	Remarks
Eastman (cont)	Panchro- matic-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 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.

For greater contrast on Polaroid prints, use slightly longer development time. A decrease in development time will normally increase writing speed; 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.⁸ 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 just 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 speed of two or more times depending on film types, film condition, the nature of the prefogging light and other variables. Prefogging results in a slightly foggy background on the photographs and somewhat less contrast. This is sometimes a small price to pay for a large increase in writing speed.

Postfogging⁸ is very similar to prefogging. The difference is that the film is exposed to the controlled light source after exposure, rather than before. Postfogging produces very nearly the same increase in writing speed as prefogging.

Transillumination. While not strictly a means of improving writing speed 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, such as a light bulb, directly behind the print (see Fig. 3-14). 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 they have an opaque 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.

⁸ For details on prefogging or postfogging contact your local Tektronix, Inc. representative or field office.

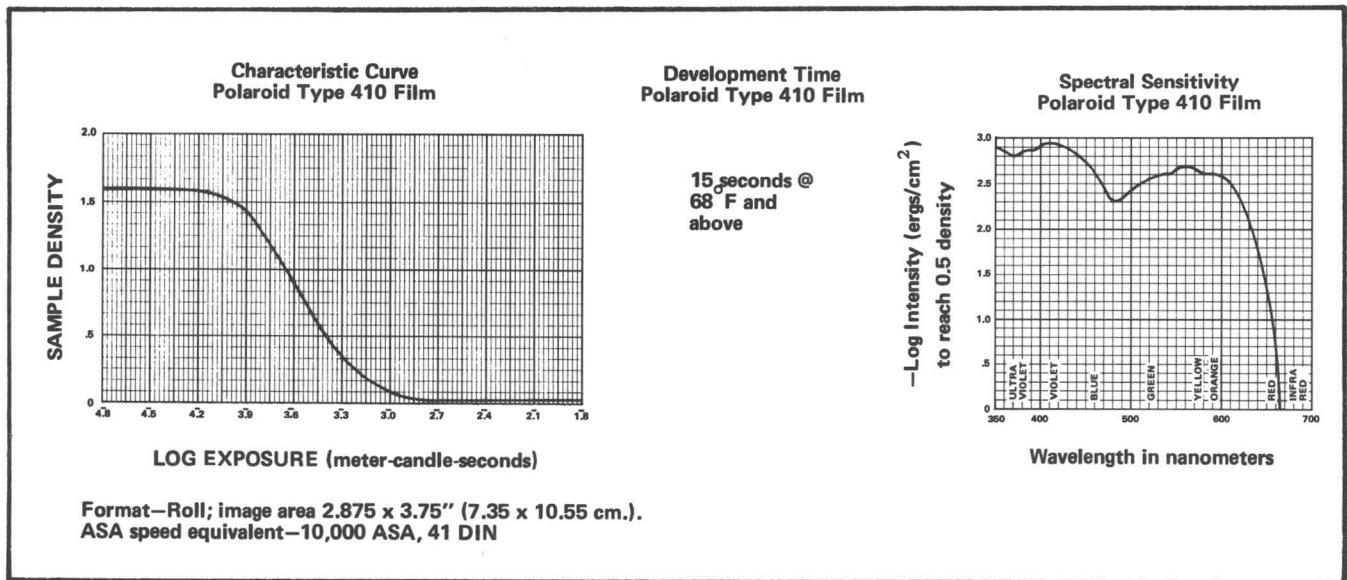


Fig. 3-13. Typical Polaroid Land Type 410 film characteristics.

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

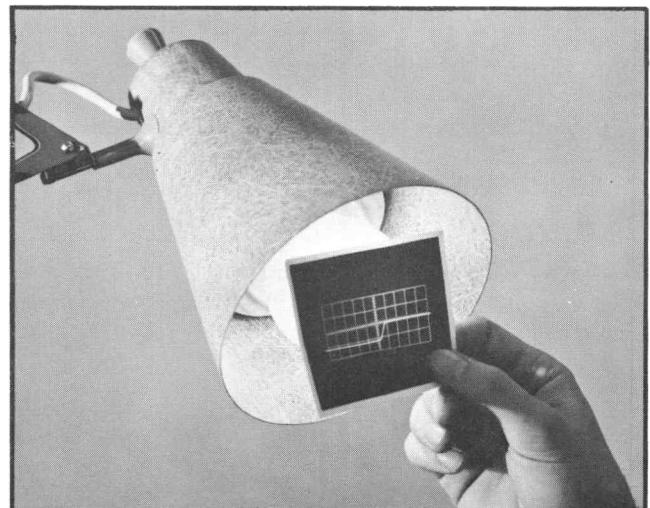


Fig. 3-14. Using transillumination to see otherwise invisible information.

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, removing 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 through 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 film clips must not be clipped onto an image area.

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 condi-

tions, 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-humidity (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 two months at 75°F, six months at 60°F, and twelve months at 50°F. The relative humidity 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-rays, and radioactive materials. Open packages of film should also be in an area with a humidity between 40% and 50%, 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 50%.

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 X 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 that came 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 X 5 film packet should be exposed and developed within 15 minutes after it is removed from the bag.

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 should not be used.

Air is one of the worst enemies of photographic solutions. Oxidation of a solution may take place even in a tightly sealed container if the solution level is low. It is 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 be impossible to redissolve the crystals. Repeated temperature changes shorten the life of solutions.

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.)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper appears to be a standard notebook page or a sheet of stationery. There is no handwriting or other markings on the page.

SECTION 4

PICTURE TAKING

Change information, if any, affecting this section will be found at the rear of the manual.

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 adapter on the oscilloscope.
3. Obtain the signal and adjust the controls for the desired display.
4. Attach the camera to the camera adapter and secure the camera to the camera adapter.
5. Adjust the oscilloscope Focus, Astigmatism and Intensity controls for a sharp trace.
6. Press the camera FOCUS control in and proceed to focus the camera.
7. Adjust the camera exposure controls as described in First Time Operation in Section 2 of this manual.
1. Use steps 1 through 6, under Photographing Repetitive Signals, to set up the camera.
2. Set the aperture control to the aperture desired. The exposure control can not be used for single shot operation. Where practical, use aperture settings higher than $f4$ if an external graticule is used. This will permit both trace and external graticule to be in focus.
3. Set the SHUTTER SPEED to T (time) or B (bulb) and the MODE switch to SINGLE SWEEP if the oscilloscope is a Tektronix 7000-series instrument.
4. Use the highest practical oscilloscope display intensity without causing defocus of the display.
5. Either adjust the graticule illumination so it exposes the film for the total shutter open time, or turn it off entirely.
6. Reset the single sweep circuitry in the instrument and open the camera shutter.
7. Take the waveform photograph and close the camera shutter.
8. If the graticule is being exposed separately, do it the same as would be done when taking photographs of repetitive waveforms.

Photographing Single-Sweep Displays

Single-sweep displays are formed when the oscilloscope spot sweeps across the screen only once. The actual exposure time is determined not by the shutter setting but by the duration of the sweep plus phosphor persistence, provided the shutter is open a sufficient length of time. 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.

9. Develop and check the picture.

It should be remembered that since the shutter open time is determined by the oscilloscope sweep, 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

1. No image appears on the picture
 - a. Dark slide still in camera back.
 - b. Inoperative shutter mechanism.

Picture Taking—C-59 Camera

c. Exposure controls incorrectly set, that is, aperture, shutter speed combination wrong.

2. Image barely appears on a picture

a. Use higher Intensity and Scale Illum settings.

b. Wrong phosphor filter for photometer.

c. Exposure controls incorrectly set. Wrong aperture if in bulb, time or single sweep.

d. See item 1c above.

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

3. Light streaks on picture

a. Light seal between camera adapter and oscilloscope 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 front of camera.

5. Fogging on pictures

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

b. Scale Illum control set too high.

c. Light-struck or bad film.

d. Film exposed to light during loading.

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

a. Use aperture numbers larger than $f4$.

7. Some portions of photographed signal appear brighter than others

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

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

a. 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.

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. (The phosphor absorbs energy from the ambient light.)

SECTION 5

FUNCTIONAL DESCRIPTION

Change information, if any, affecting this section will be found at the rear of this manual.

OPTICAL SYSTEM

Viewing 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 minimum parallax.

ELECTRICAL DESCRIPTION

General

The power to operate the camera is supplied from either an internal battery pack or a Tektronix 7000-series oscilloscope through its bezel.

Power Source Selection

When the camera is used with a Tektronix 7000-series oscilloscope, it will always supply the power for the camera rather than the internal battery pack.

Power from the 7000-series oscilloscope is supplied via the connection between the 3-pin connection on the oscilloscope bezel and the camera adapter to R1 and forward biased CR2 of the camera circuitry. CR1 is reverse biased at this time since the voltage at the CR1-CR2 junction is more positive than the battery BT1 voltage.

In the absence of a Tektronix 7000-series oscilloscope the camera power is furnished by the 8-cell, 12-volt internal battery pack BT1 via CR1.

Photometer

The photometer circuitry consists of a voltage regulator circuit Q1-Q2, light bulb DS3, and light intensity control R5.

The voltage across the series combinations of DS3-R5 and R3-R4 ($\cong 3$ volts) is determined by the amount of Q1 conduction. The biasing of Q1 is controlled by the amount of voltage dropped across R2, which is determined by the amount of Q2 conduction. The biasing of Q2 is determined by voltage divider R3-R4 and the voltage across it.

If the voltage across DS3-R5 drops, the bias voltage of Q2 will decrease and reduce the amount of Q2 conduction. A decrease in Q2 conduction will cause a decrease in the voltage drop of R2 and raise the bias voltage of Q1, increasing Q1 conduction. Q1 conduction increasing will bring the voltage across DS3-R5 back to its proper level.

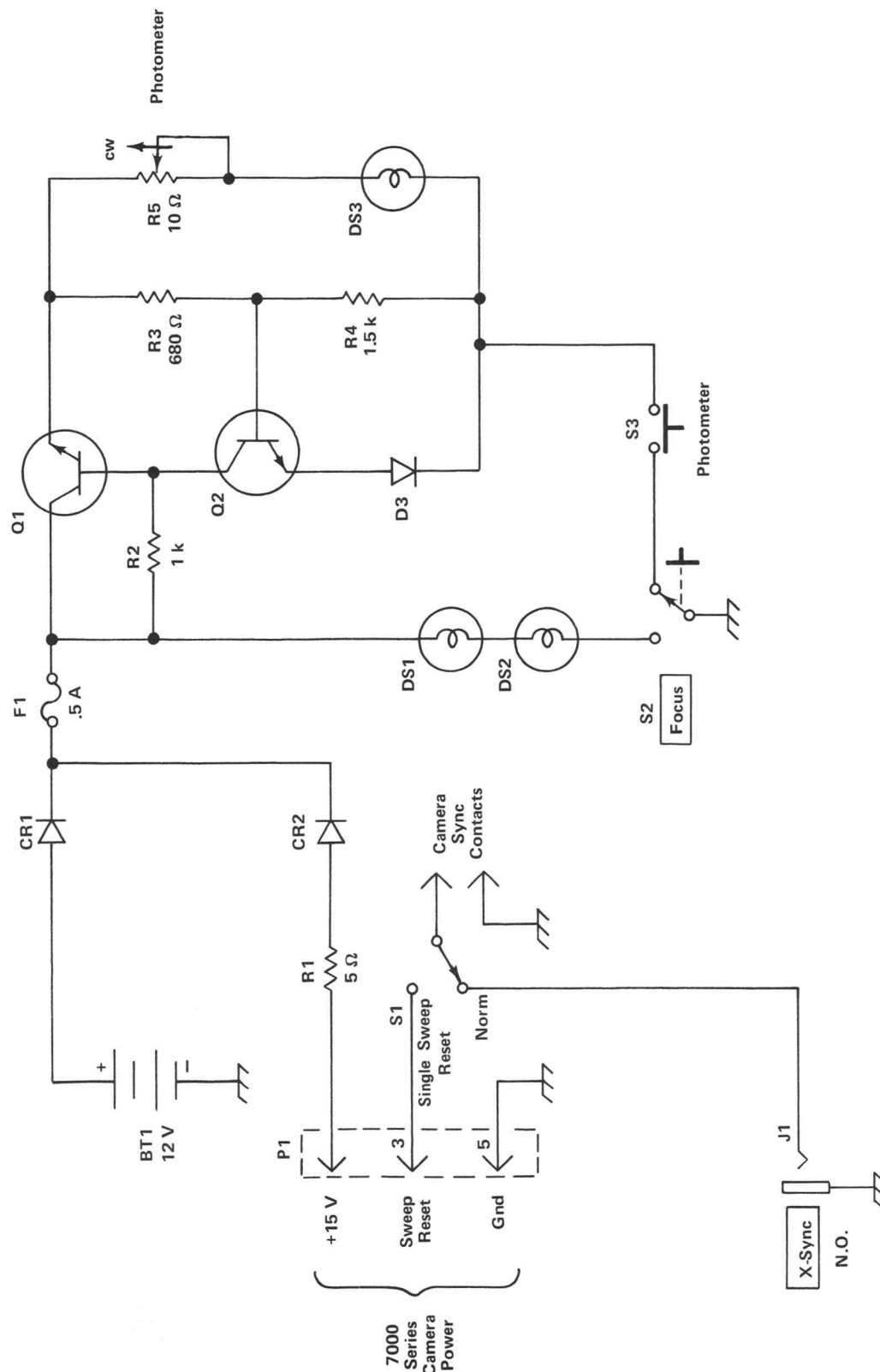
The voltage regulator corrects an increase in voltage across DS3-R5 in a manner similar to the voltage decrease described above.

Focus Light

The focus lights DS1 and DS2 are turned on by pressing the FOCUS knob, which activates switch S2. S2 is a SPDT switch which allows either the focus lights to be turned on or the Photometer to be used, but not both circuits at the same time.

Sync

The normally open sync contacts are located inside and actuated by the shutter mechanism. The Sync contacts are connected between ground and either the sweep reset contact in the camera adapter 3-pin connector, or an external SYNC connector on the camera, depending upon the MODE (S1) switch position.



C-59 Camera

Fig. 5-1. C-59 Camera circuit diagram.

SECTION 6

CAMERA SYSTEM MAINTENANCE

Change information, if any, affecting this section will be found at the rear of the manual.

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 insure that they are not damaged. The equipment should be kept covered when not in use to prevent dust accumulating on or in it.

Camera Frame

The mirror used in the camera frame requires a minimum of maintenance. Normally, the only maintenance required is to keep the mirror clean. The mirror 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.

Lenses

In order to obtain maximum use from your camera, care should be taken that the lenses are kept clean and are properly installed in the shutter. When lenses require cleaning, the front and rear lens elements are easily unscrewed from the shutter housing, after removal of the film back to gain access to the rear lens element. When replacing the Lens elements, do not cross-thread or force the parts together. If the parts are mated properly, they will fit together easily. When tightening the lens elements, do not over-tighten, hand tight is sufficient.

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.

Camera Backs

Polaroid film backs used with the Camera System should be inspected after each package of film is exposed and be-

fore 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.

Visual Inspection

You should visually inspect all the electrical circuitry in the instrument every few months for possible circuit defects. These defects may include such things as loose or broken connections, damaged connectors, scorched wires or components, or broken terminals. For most visible 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

Light Leak Sealing

Some of the parts used in critical light leak areas of the camera have been sealed to adjoining parts with a black, pliable, non-hardening, weather stripping adhesive in place of any other light sealing material. If a light leak occurs or if one of the previously sealed parts is being replaced it is recommended that No. 2 Permatex¹, 3M² weather strip adhesive No. 8011, or a material with similar characteristics be used as a light sealing material.

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.

Ceramic Terminal Strips

Fig. 6-1 shows an assembled ceramic terminal strip. Replacement strips with studs attached are supplied under a

¹Registered trademark of the Permatex Company, Inc.

²Registered trademark of the Minnesota Mining and Manufacturing Company.

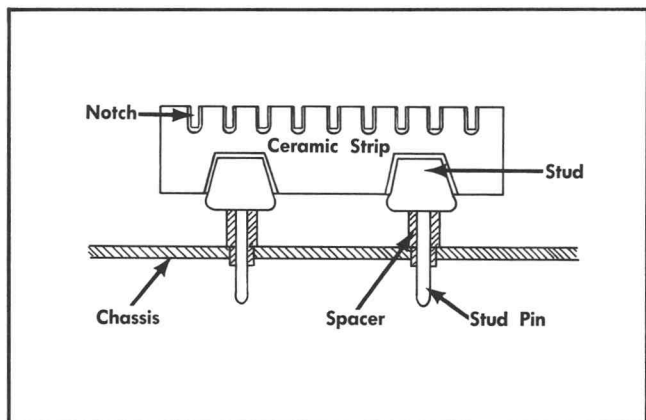


Fig. 6-1. Ceramic strip assembly.

single part number and spacers under another number. The original spacers may be reused if undamaged.

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 over the stud area of the strip.

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.

Soldering

WARNING

Disconnect the instrument from the power source and discharge capacitors C63 and C77 through a 100 Ω , 1/2 W resistor before soldering.

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

Observe the following precautions when soldering metal terminals:

1. Apply only enough heat to make the solder flow freely.
2. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.
3. If a wire extends beyond the solder point, clip the excess close to the joint.
4. Clean the flux from the solder joint with a flux-remover solvent to maintain good environmental characteristics.

Ceramic Strips. Special silver-bearing solder is used to establish a bond to the ceramic terminal strip. This bond can be broken by repeated use (especially if ordinary 60/40 solder is used) or by excessive heating. It is recommended that solder containing about 3% silver (Tektronix Part No. 251-0514-00) and a 40- to 75-watt rating soldering iron be used. The soldering iron tip should be about 1/8 inch wide with a chisel shape.

Observe the following techniques when soldering to ceramic strips:

1. Maintain a clean, properly tinned tip.
2. Use a hot soldering iron for a short time.
3. Avoid putting pressure on the strip with the soldering iron or other tools. Excessive pressure may crack or chip the ceramic strip.
4. Clean the flux from the solder joint with a flux remover solvent to maintain good environmental characteristics. Clip off any excessive lead length.

Packaging

Original Packaging. If the camera is to be shipped for long distances by commercial means of transportation, it is recommended that the camera be repackaged in the original manner for maximum protection. The original shipping carton can be saved and used for this purpose. Fig. 6-2 illustrates how to repackage the camera and gives the part numbers for the packaging components if new items are needed.

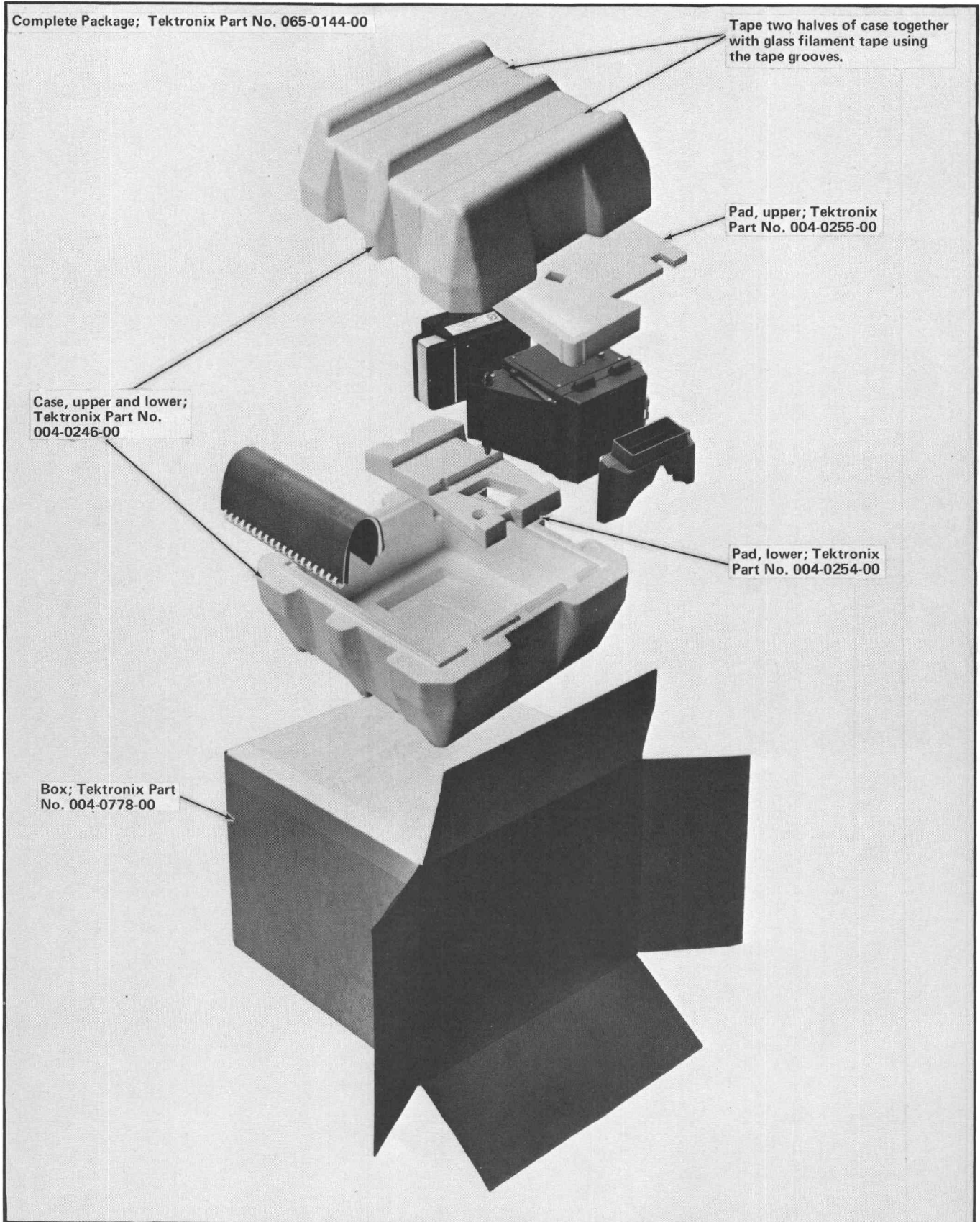


Fig. 6-2. Repackaging the C-59 Camera for shipment.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

PARTS LIST ABBREVIATIONS

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

×000	Part first added at this serial number
00×	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.

SECTION 7

ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff Disc	Description
Battery			
BT1	006-0513-00		Battery, 1.5 V
Semiconductor Device, Diodes			
CR1	152-0066-00	Silicon	1N3194
CR2	152-0066-00	Silicon	1N3194
CR3	*152-0185-00	Silicon	Replaceable by 1N4152
Bulbs			
DS1	150-0097-01		Incandescent, 6.2 V, 0.2 A
DS2	150-0097-01		Incandescent, 6.2 V, 0.2 A
DS3	150-0116-00		Incandescent, 222 clear, TL-3
Fuse			
F1	159-0025-00	0.5 A	3 AG Fast-Blo
Connector			
J1	131-0407-00		Jack, Telephone
Transistors			
Q1	151-0334-00	Silicon NPN	plastic power MJE 520
Q2	151-0223-00	Silicon NPN	TO-18 2N4275

ELECTRICAL PARTS LIST—C-59 CAMERA

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	No. Disc	Description
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Resistors

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

R1	308-0555-00	5 Ω	3 W	WW	5%
R2	315-0102-00	1 k Ω	1/4 W		5%
R3	315-0681-00	680 Ω	1/4 W		5%
R4	315-0152-00	1.5 k Ω	1/4 W		5%
R5	311-0001-00	10 Ω , Var			

Switches

Wired or Unwired

S1	260-0583-01	Slide, DPDT	MODE
S2	260-0612-00	Sensitive, SPDT	FOCUS
S3	260-0247-00	Pushbutton	PHOTOMETER

SECTION 8

MECHANICAL PARTS LIST

FIGURE 1 FRAME

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1	2	3	4	5	Description
		Eff	Disc							
1-1	337-0411-01			1						SHIELD, viewing hood
	122-0943-00			1						ASSEMBLY, occluder
	- - - - -			-						assembly includes:
-2	- - - - -			1						FRAME (not replaceable)
-3	- - - - -			1						SHIELD, door (not replaceable)
-4	- - - - -			1						PIN, hinge (not replaceable)
-5	366-0491-02			2						KNOB, charcoal
	- - - - -			-						knob includes:
	213-0153-00			1						SETSCREW, 5-40 x 0.125 inch, HSS
-6	344-0042-00			1						CLIP, spring
	- - - - -			-						mounting hardware: (not included w/clip)
-7	213-0088-00			2						SCREW, thread forming, #4 x 0.25 inch, PHS
	- - - - -			-						mounting hardware: (not included w/assembly)
-8	213-0104-00			2						SCREW, thread forming, #6 x 0.375 inch, THS
-9	103-0102-00			1						ADAPTER, viewing hood
	- - - - -			-						mounting hardware: (not included w/adapter)
-10	213-0088-00			3						SCREW, thread forming, #4 x 0.25 inch, PHS
-11	344-0194-00			1						CLIP, spring tension
-12	252-0550-00			ft						TAFFETA, black velvet, 25 inch long
-13	367-0119-00			1						HANDLE, carrying
	- - - - -			-						mounting hardware: (not included w/handle)
-14	211-0079-00			2						SCREW, 2-56 x 0.188 inch, PHS
-15	211-0537-00			2						SCREW, 6-32 x 0.375 inch, THS
-16	367-0118-00			2						PIVOT ARM, handle
	- - - - -			-						mounting hardware for each: (not included w/pivot arm)
-17	210-1108-00			2						WASHER, spring tension, 0.161 ID x 0.34 inch OD
-18	211-0621-00			2						SCREW, 2-56 x 0.188 inch, 82° csk, FHS
-19	426-0551-02			1						FRAME, camera
-20	352-0286-00			1						HOLDER, mirror
	- - - - -			-						mounting hardware: (not included w/holder)
-21	211-0087-00			2						SCREW, 2-56 x 0.188 inch, 82° csk, FHS
-22	122-0843-01			1						MIRROR
-23	200-1040-02			1						COVER, side
	- - - - -			-						mounting hardware: (not included w/cover)
-24	211-0014-00			4						SCREW, 4-40 x 0.50 inch, PHS

MECHANICAL PARTS LIST—C-59 CAMERA

FIGURE 1 FRAME (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1	2	3	4	5	Description
		Eff	Disc							
1-25	352-0031-00			1						HOLDER, fuse
	- - - - -			-						mounting hardware: (not included w/holder)
-26	211-0097-00			1						SCREW, 4-40 x 0.312 inch, PHS
-27	210-0406-00			1						NUT, hex., 4-40 x 0.188 inch
-28	260-0247-00			1						SWITCH, pushbutton--PHOTOMETER
	- - - - -			-						mounting hardware: (not included w/switch)
-29	210-1090-00			1						WASHER, flat, 0.266 ID x 0.696 inch OD
-30	210-0465-00			1						NUT, hex., 0.25-32 x 0.375 inch
-31	352-0136-00			1						HOLDER, spare fuse
	- - - - -			-						mounting hardware: (not included w/holder)
-32	211-0097-00			2						SCREW, 4-40 x 0.312 inch, PHS
-33	210-0406-00			2						NUT, hex., 4-40 x 0.188 inch
-34	348-0214-00			2						FOOT, camera
	- - - - -			-						mounting hardware for each: (not included w/foot)
-35	211-0504-00			2						SCREW, 6-32 x 0.25 inch, PHS
-36	348-0228-00			2						PAD, cabinet foot, front
-37	348-0215-00			2						PAD, cabinet foot
-38	384-0736-00			1						ROD, support, left
	- - - - -			-						mounting hardware: (not included w/rod)
-39	213-0091-00			1						SCREW, 0.312-18 x 0.50 inch, button HS
-40	210-0807-00			1						WASHER, flat, 0.312 ID x 0.625 inch OD
-41	214-1237-00			1						GEAR, bevel, 24 tooth
-42	354-0380-00			1						RING, retaining
-43	358-0381-00			4						BUSHING, sleeve
-44	384-0735-00			1						ROD, support, right
	- - - - -			-						mounting hardware: (not included w/rod)
-45	213-0091-00			1						SCREW, 0.312-18 x 0.50 inch, button HS
-46	210-0807-00			1						WASHER, flat, 0.312 ID x 0.625 inch OD
-47	426-0560-01			1						FRAME-ADAPTER
-48	214-0397-00			1						PIN, hinge, top
-49	214-0398-00			1						PIN, hinge, bottom
-50	131-0765-00			3						TERMINAL, feedthru
-51	352-0192-00			1						HOLDER, feedthru terminal
	- - - - -			-						mounting hardware: (not included w/holder)
-52	211-0122-00			2						SCREW, 2-56 x 0.375 inch, OHS
-53	391-0086-00			1						BLOCK, connector mounting, plastic

MECHANICAL PARTS LIST—C-59 CAMERA

FIGURE 1 FRAME (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Disc	Q t y	1	2	3	4	5	Description
-54	366-1154-00		1	1					1 KNOB, charcoal, latch
	- - - - -		-						mounting hardware: (not included w/knob)
-55	213-0223-00		1	1					1 SCREW, 10-32 x 0.43 inch, shouldered
-56	200-1118-00		1	1					1 COVER, camera
	016-0249-03		1	1					1 ADAPTER, camera to oscilloscope
	- - - - -		-						adapter includes:
-57	103-0083-06		1	1					1 ADAPTER
-58	214-0166-00		1	1					1 STRIKE LATCH
	- - - - -		-						mounting hardware: (not included w/strike latch)
-59	211-0009-00		2	2					2 SCREW, 4-40 x 0.25 inch, OHS
-60	122-0764-00		1	1					1 GASKET, light seal
-61	352-0193-00		1	1					1 HOLDER, feedthru terminal, plastic
-62	211-0012-00		2	2					2 SCREW, 4-40 x 0.375 inch, PHS
-63	131-0887-00		3	3					3 TERMINAL, feedthru, spring
-64	200-1028-00		1	1					1 COVER, terminal holder, plastic
-65	213-0257-00		1	1					1 THUMBSCREW, 10-32 x 0.81 inch
-66	210-1112-00		1	1					1 WASHER, insulator, plastic
-67	343-0301-00		1	1					1 CLAMP, rim clenching
-68	354-0324-00		1	1					1 RING, retaining
-69	380-0228-00		1	1					1 HOUSING, clamp
	- - - - -		-						mounting hardware: (not included w/housing)
-70	211-0007-00		2	2					2 SCREW, 4-40 x 0.188 inch, PHS
-71	386-2005-00		1	1					1 PLATE, battery holder
	- - - - -		-						mounting hardware: (not included w/plate)
-72	361-0426-00		2	2					2 SPACER, battery cover
-73	200-1243-00		1	1					1 COVER, battery holder
-74	006-0513-00		8	8					8 BATTERY, 1.5 V
-75	122-0926-00		1	1					1 CAMERA BACK ASSEMBLY (C-59P)
	122-0929-00		1	1					1 CAMERA BACK ASSEMBLY (C-59R)
	122-0931-00		1	1					1 CAMERA BACK ASSEMBLY (C-59G)

FIG 1 FRAME

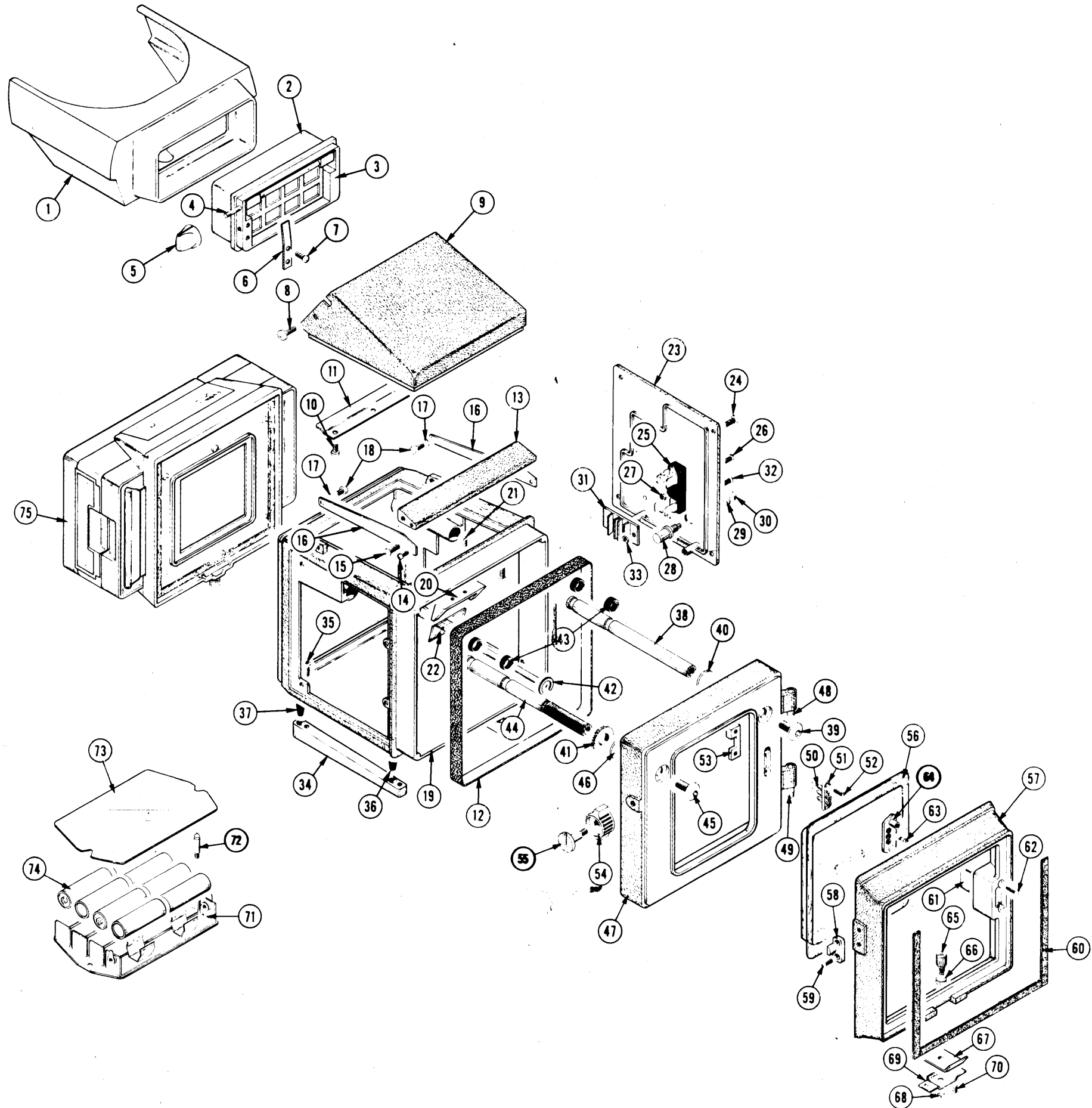
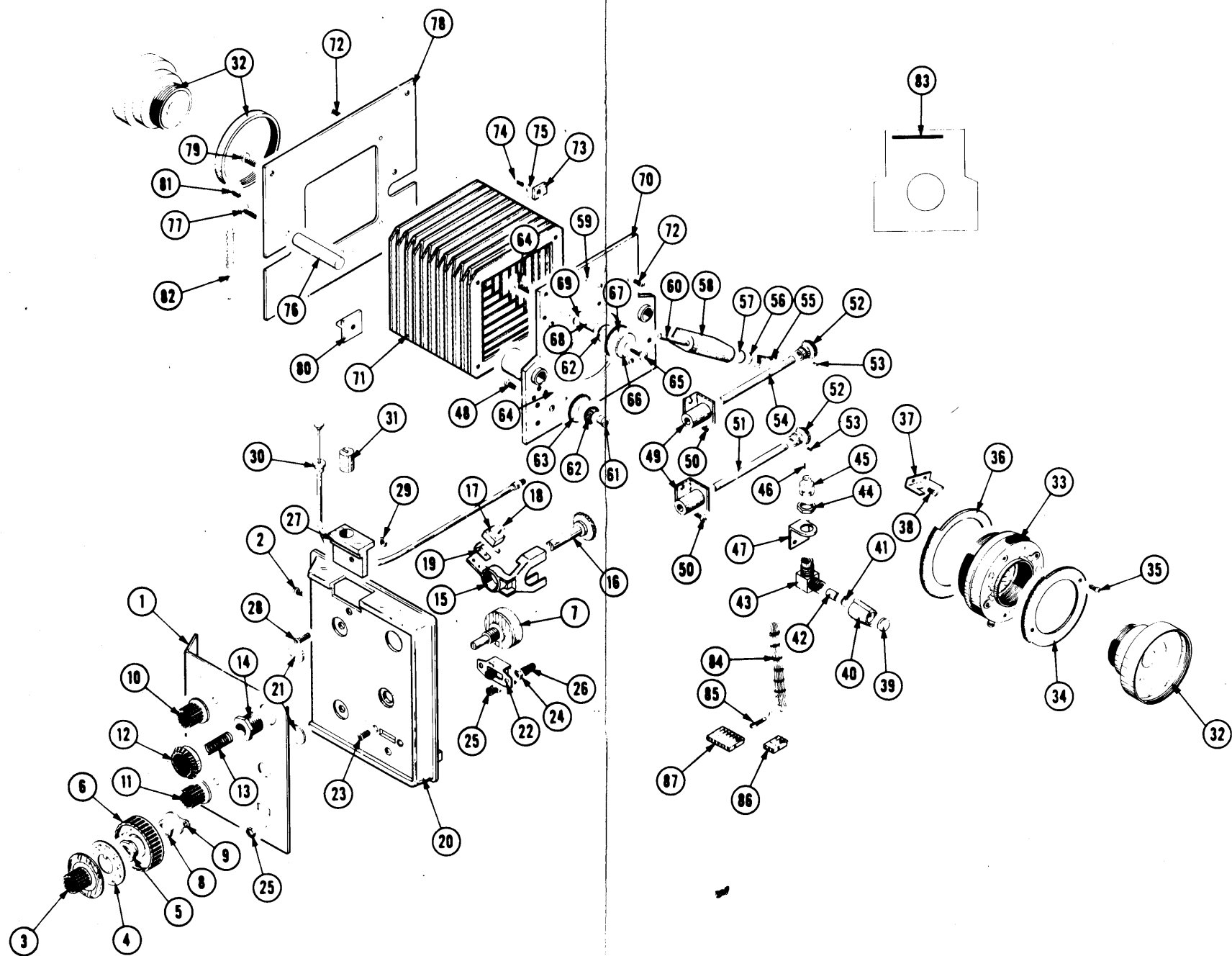


FIG 2 CHASSIS



MECHANICAL PARTS LIST—C-59 CAMERA

FIGURE 2 CHASSIS

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q † y	1	2	3	4	5	Description
		Eff	Disc							
2-1	333-1450-00			1						PANEL, side
	- - - - -			-						mounting hardware: (not included w/panel)
-2	211-0069-00			2						SCREW, 2-56 x 0.125 inch, PHS
-3	366-1356-00			1						KNOB, charcoal--SECONDARY
	- - - - -			-						knob includes:
	213-0153-00			1						SETSCREW, 5-40 x 0.125 inch, HSS
-4	331-0285-00			1						DIAL, knob
-5	220-0618-00			1						NUT, shouldered, 0.375-32 x 0.438 inch
-6	366-1149-00			1						KNOB, charcoal--ASA
-7	- - - - -			1						RESISTOR, variable
	- - - - -			-						mounting hardware: (not included w/resistor)
-8	210-0413-00			1						NUT, hex., 0.375-32 x 0.50 inch
-9	214-1592-00			1						SPRING, detent
-10	366-0496-00			1						KNOB, charcoal--SHUTTER SPEED
	- - - - -			-						knob includes:
	213-0153-00			2						SETSCREW, 5-40 x 0.125 inch, HSS
-11	366-0496-00			1						KNOB, charcoal--APERTURE (f)
	- - - - -			-						knob includes:
	213-0153-00			2						SETSCREW, 5-40 x 0.125 inch, HSS
-12	366-1153-00			1						KNOB, charcoal--FOCUS
	- - - - -			-						knob includes:
	213-0153-00			2						SETSCREW, 5-40 x 0.125 inch, HSS
-13	214-1249-00			1						SPRING, helical compression
-14	401-0066-00			1						BEARING
-15	343-0232-01			1						RETAINER, gear
-16	214-0263-00			1						GEARSHAFT, bevel, 24 tooth
-17	260-0612-00			1						SWITCH, sensitive--FOCUS
	- - - - -			-						mounting hardware: (not included w/switch)
-18	211-0089-00			2						SCREW, 2-56 x 0.375 inch, RHS
-19	214-1311-00			1						ACTUATOR, switch
-20	386-1646-02			1						SUBPANEL, side
-21	214-1288-00			2						GASKET, light seal
-22	260-0583-01			1						SWITCH, slide--MODE
	- - - - -			-						mounting hardware: (not included w/switch)
-23	211-0030-00			2						SCREW, 2-56 x 0.25 inch, 82° csk, FHS
-24	210-0405-00			2						NUT, hex., 2-56 x 0.188 inch
-25	131-0407-00			1						JACK, w/hardware;
-26	200-0655-00			1						NIPPLE, cable
-27	352-0275-00			1						HOLDER, cable release
	- - - - -			-						mounting hardware: (not included w/holder)
-28	211-0030-00			1						SCREW, 2-56 x 0.25 inch, 82° csk, FHS
-29	210-0406-00			1						NUT, hex., 2-56 x 0.188 inch

MECHANICAL PARTS LIST—C-59 CAMERA

FIGURE 2 CHASSIS

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q † y						Description
		Eff	Disc		1	2	3	4	5	
2-30	122-0914-00			1						CABLE RELEASE
-31	343-0325-00			1						RETAINER, cable release
-32	122-0952-00			1						LENS, camera
	- - - - -			-						lens includes:
-33	122-0724-02			1						SHUTTER, camera
-34	214-0617-00			1						GEAR, spur
	- - - - -			-						mounting hardware: (not included w/gear)
-35	211-0069-00			2						SCREW, 2-56 x 0.125 inch, PHS
-36	214-0616-00			1						GEAR, spur
-37	343-0324-00			1						RETAINER, shutter
	- - - - -			-						mounting hardware: (not included w/retainer)
-38	213-0136-00			2						SCREW, sheet metal, #4 x 0.188 inch, PHS
-39	122-0845-00			2						LENS, focusing
-40	352-0236-00			2						HOLDER, lens
-41	386-1632-00			2						PLATE, focusing
-42	122-0844-00			2						DIFFUSER, light
-43	352-0194-00			2						HOLDER, lamp lens
-44	210-0590-00			2						NUT, hex., 0.375-32 x 0.438 inch
-45	352-0188-00			2						HOLDER, lamp
-46	131-0856-00			4						CONTACT, light
-47	407-0688-00			2						BRACKET, focusing lamp
	- - - - -			-						mounting hardware for each: (not included w/bracket)
-48	211-0001-00			3						SCREW, 2-56 x 0.25 inch, RHS
-49	407-0943-00			2						BRACKET
	- - - - -			-						mounting hardware for each: (not included w/bracket)
-50	213-0138-00			2						SCREW, sheet metal, #4 x 0.188 inch, PHS
-51	386-1085-00			1						SHAFT, extension, 2.7 inch long
-52	214-0619-00			2						GEAR, mitre
	- - - - -			-						mounting hardware for each: (not included w/gear)
-53	214-0660-00			1						PIN, straight
-54	384-1084-00			1						SHAFT, extension, 2.88 inch long
-55	136-0458-00			1						LAMPHOLDER
-56	378-0688-01			1						FILTER, light, blue
-57	378-0688-00			1						FILTER, light, green
-58	352-0276-00			1						HOLDER, lamp
	- - - - -			-						mounting hardware: (not included w/holder)
-59	211-0001-00			2						SCREW, 2-56 x 0.25 inch, PHS

MECHANICAL PARTS LIST—C-59 CAMERA

FIGURE 2 CHASSIS

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1	2	3	4	5	Description
		Eff	Disc							
2-60	386-2008-00			1						LIGHT CONDUCTOR
-61	358-0278-00			1						BUSHING, gear
-62	214-0620-00			2						GEAR, mitre
-63	214-0615-00			1						GEAR, pinion
-64	211-0008-00			2						SCREW, 4-40 x 0.25 inch, PHS
-65	211-0007-00			1						SCREW, 4-40 x 0.188 inch, PHS
-66	210-1018-00			1						WASHER, plastic, 0.117 ID x 0.720 inch OD
-67	214-0618-00			1						GEAR, pinion
-68	129-0081-00			1						POST, gear pinion
-69	210-0938-00			1						WASHER, flat, 0.109 ID x 0.25 inch OD
-70	386-2006-00			1						PLATE, shutter mounting, front
-71	214-0627-00			1						BELLOWS, camera
-72	211-0123-00			-						mounting hardware: (not included w/bellows)
				8						SCREW, 1-72 x 0.188 inch, PHS
-73	- - - - -			1						TRANSISTOR
	- - - - -			-						mounting hardware: (not included w/transistor)
-74	213-0088-00			1						SCREW, thread forming, #4 x 0.25 inch, PHS
-75	210-1122-00			1						WASHER, lock, 0.120 ID x 0.375 inch OD
	210-0921-00			1						WASHER, mica, 0.125 ID x 0.50 inch OD
-76	384-0803-00			2						ROD, guide
-77	212-0533-00			-						mounting hardware for each: (not included w/rod)
				1						SCREW, 10-24 x 0.312 inch, THS
-78	386-2007-00			1						PLATE, shutter mounting, rear
-79	212-0507-00			-						mounting hardware: (not included w/plate)
				2						SCREW, 10-32 x 0.375 inch, PHS
-80	220-0617-00			1						NUT PLATE
-81	212-0585-00			-						mounting hardware: (not included w/nut plate)
				1						SCREW, 10-32 x 0.50 inch, OHS
-82	124-0178-00			1						STRIP, light seal
-83	124-0156-00			1						TERMINAL STRIP, 0.437 inch h, w/13 notches
	- - - - -			-						terminal strip includes:
	355-0082-00			2						STUD, plastic
	- - - - -			-						mounting hardware: (not included w/terminal strip)
	361-0007-00			2						SPACER, plastic, 0.188 inch long
-84	179-1666-00			1						CABLE HARNESS
	- - - - -			-						cable harness includes:
-85	131-0707-00			6						CONNECTOR, terminal
-86	352-0161-00			1						HOLDER, terminal connector, 3 wire
-87	352-0165-00			1						HOLDER, terminal connector, 7 wire
STANDARD ACCESSORIES										
	070-1174-00			1						MANUAL, instruction

