

# INSTRUCTION MANUAL

Serial Number 20343



## OSCILLOSCOPE CAMERA SYSTEM

**C-10 Series Cameras  
And Accessories**

*Tektronix, Inc.*

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## WARRANTY

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

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

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

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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.

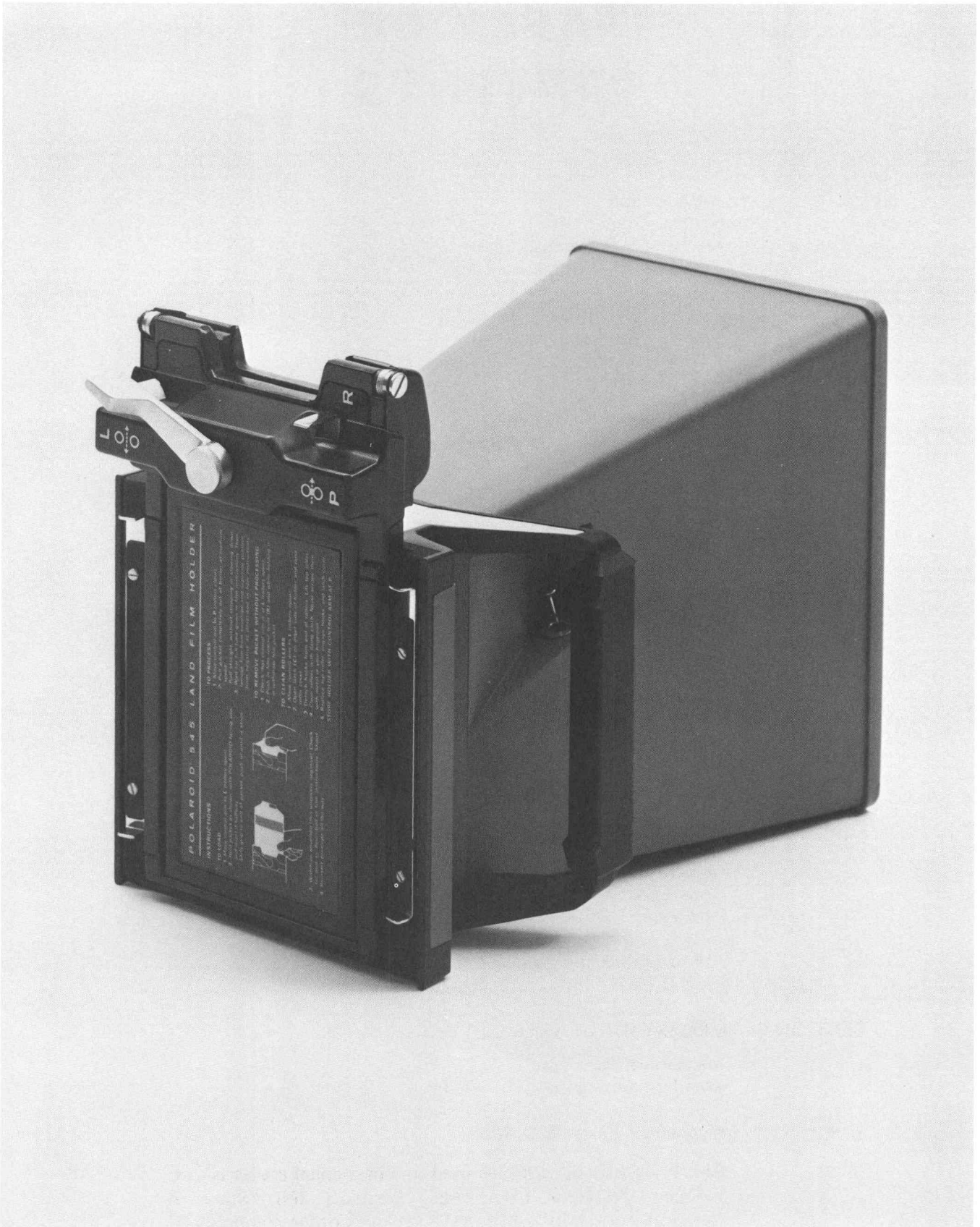


Fig. 1-1. C-10 Camera.

# SECTION 1

## SPECIFICATION

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

### Introduction

The C-10 Camera is a fixed-focus, light-weight, trace-recording camera designed for use with any Tektronix instrument utilizing the Tektronix 11-inch, direct view storage tube. The C10 Camera is provided with hand grips and an  $f8$  lens with sufficient depth-of-field to allow the camera to be hand-held against the CRT of an instrument without sacrificing the picture quality. A standard 4" X 5" Graflok

film back without the hinged focusing panel has been attached to the C-10 Camera housing. The hinged focusing panel is available as an optional accessory.

A Polaroid Land<sup>1</sup> 4" X 5" film holder is supplied with the C-10 Camera. This film holder can be used without the hinged focusing panel part of the Graflok<sup>2</sup> film back and provides pictures almost immediately after being taken. Other types of film holders that will adapt to a 4" X 5" Graflok film back can of course be used.

TABLE 1-1  
OPTICAL CHARACTERISTICS  
LENS

Characteristic	Performance Requirement
Maximum Relative Aperture at Infinity	$f8$
Focal Length	64.40 mm within 0.5 mm
Coverage at Maximum Relative Aperture	At least 269 mm diameter
Magnification (Object-to-image)	1:0.5 within 2%
Faceplate to Image Distance	295.89 mm within 4 mm
Geometrical Distortion	0.2% or less
Relative Illumination	Illumination at an angle of 20 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 75 lines/mm
Each Corner Pattern	At least 20 lines/mm

<sup>1</sup>Registered trademark of Polaroid Corporation.

<sup>2</sup>Registered trademark of Graflok, Inc.

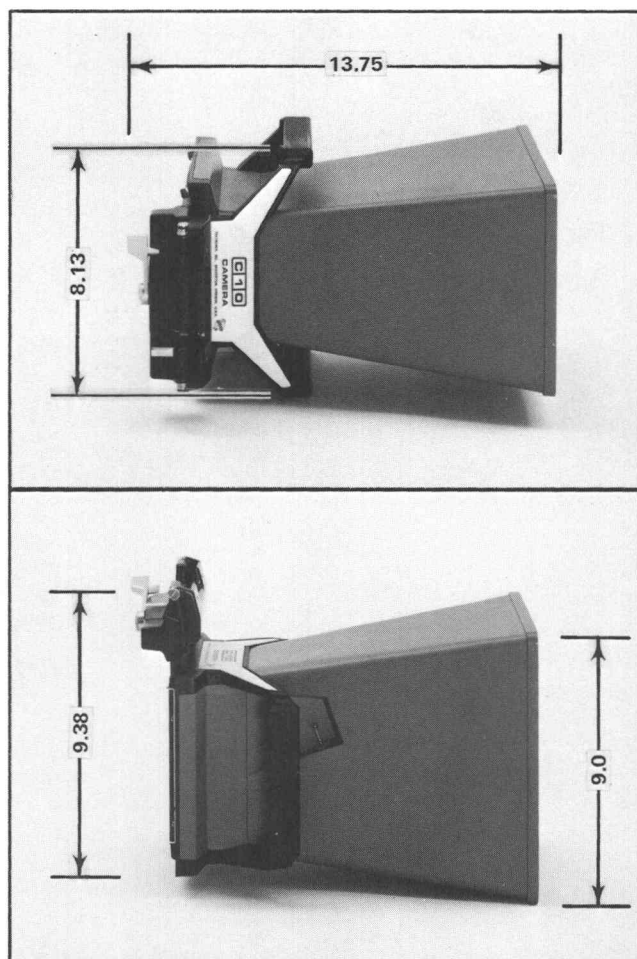


Fig. 1-2. Dimensions of a C-10 Camera.

**TABLE 1-2**  
**MECHANICAL CHARACTERISTICS**  
**SHUTTER**

Characteristic	Performance Requirement
Speed (Normal)	1, 1/2, 1/4, 1/8, 1/15, 1/30, 1/60, and 1/125 second within 15% (Time and bulb operating modes are also provided).
Relative Aperture Range	8, 11, 16, 22
Accuracy	Within 10% of setting

**Table 1-3**

**ENVIRONMENTAL CHARACTERISTICS**

The following environmental tests 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 Tektronix, Inc. Contact your local Tektronix, Inc. representative or field office.

**C-10 CAMERA**

Characteristic	Performance Requirement
Temperature	
Operating Range	0°C to +50°C
Storage Range	-55°C to +55°C
Altitude	
Operating Range	15,000 feet
Storage Range	50,000 feet and -55°C
Vibration Range	To 0.010 inch at 55 c/s
Shock Range	To 30 g's, 1/2 sine, 11 ms duration
Humidity	
Storage Range	To 90%
Transportation	Not specified. Tested to National Safe Transit Committee test procedure 1A, Category 1 (18" drop)

# SECTION 2

## OPERATING INSTRUCTIONS

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

### MAIN FRAME

#### Mounting Camera

The camera must be hand held tightly against the front-panel of the instrument to prevent light leak streaks. The camera should also be held in such a position as to be square to the top of the instrument to obtain pictures with the display properly centered on them.

### LENS

#### Adjusting Lens Aperture

Under normal operating conditions no adjustment of the aperture should be made; it should remain set to  $f8$ .

When adjustment of the exposure must be made, it should be done by selecting the shutter speed (see Fig. 2-1) that will provide satisfactory pictures.

#### Selecting Shutter Speed

With the aperture opening fixed, the shutter speed will have to be adjusted to the desired picture results; shutter speeds between  $1/15$  and  $1/8$  second will usually provide satisfactory pictures. A slower shutter speed will result in a lighter picture while a faster shutter speed will result in a darker picture.

### CAMERA BACK

#### Selecting the Camera Back

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

With either Polaroid Land or conventional films, the size of the film used by the selected back should 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 instrument display. For example, roll film backs for 120 or 620 film do not permit full screen photographs when used with the C-10 1:0.5 Lens and the Type 611 16.3 cm wide display. This is because the image of the display is 8.15 centimeters wide and the width dimension of the film is only about 5.56 centimeters. Thus, at least 25.9 mm would be cut off of the photograph.

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

### CONVENTIONAL FILM HOLDERS

#### Loading the Sheet Film Holder

#### NOTE

*The hinged focusing panel part of the Graflok film back must be used with 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 supplied with the film; it will state whether a safe light can be used or not.

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

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 side toward your body. The index finger of the left hand is used to hold the film holder door open. Refer to Fig. 2-3 for the method used.

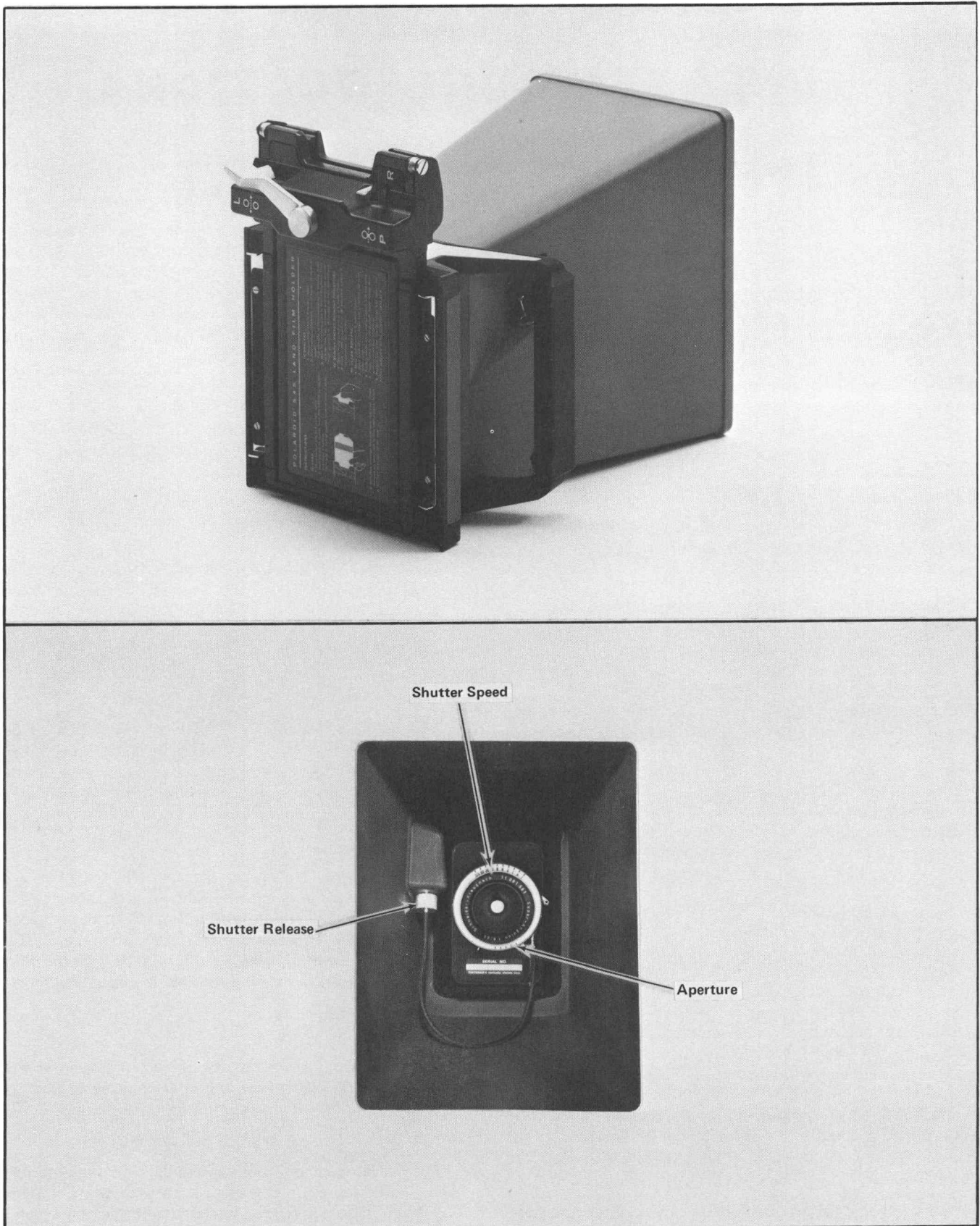


Fig. 2-1. C-10 Camera operating control locations.



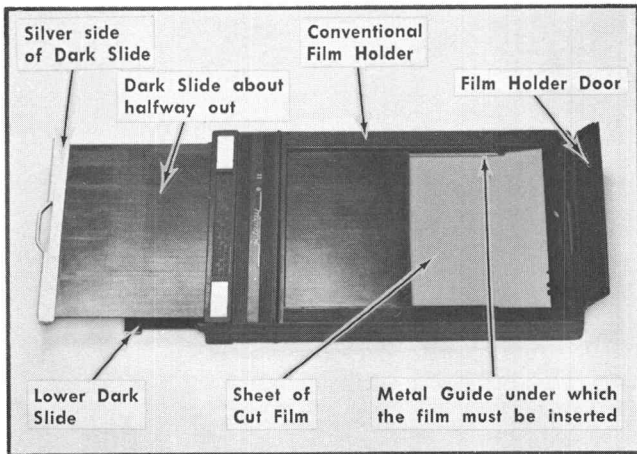


Fig. 2-2. Important points of film holder.

With the right hand, hold the film so that the notches in the edge of the film are in the upper right corner. Fig. 2-4 shows the proper way to hold the film. In Fig. 2-4 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. 2-4 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 with the index finger of the right hand, see Fig. 2-5. This will indicate whether the film

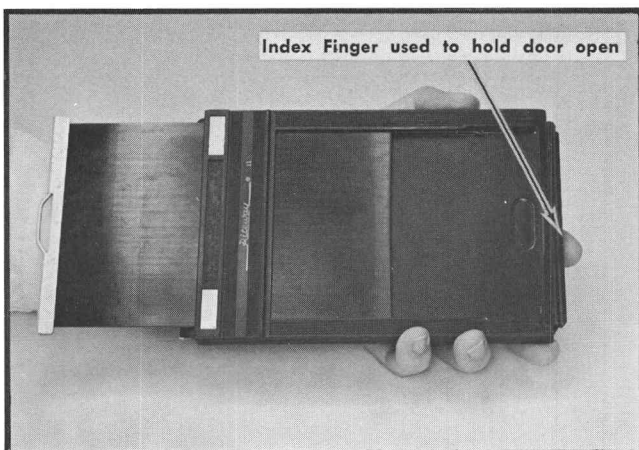


Fig. 2-3. Method used to hold film holder while loading the film.

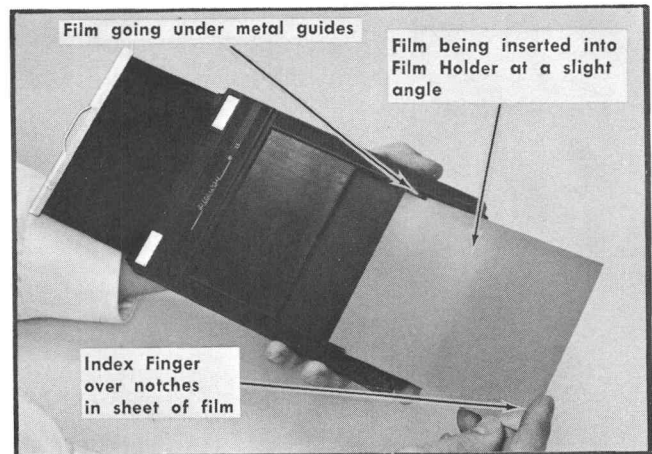


Fig. 2-4. Proper way to insert the film into the film holder. Note the position of the right index finger on the sheet of film.

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. 2-6. Now push the slide all the way into the holder (toward the film door). The dark slide will slide into a slot in the film holder door when it is shoved all the way into the holder. One side of the film holder is now loaded. The film holder door will remain closed by itself once the dark slide has been inserted all the way.

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.

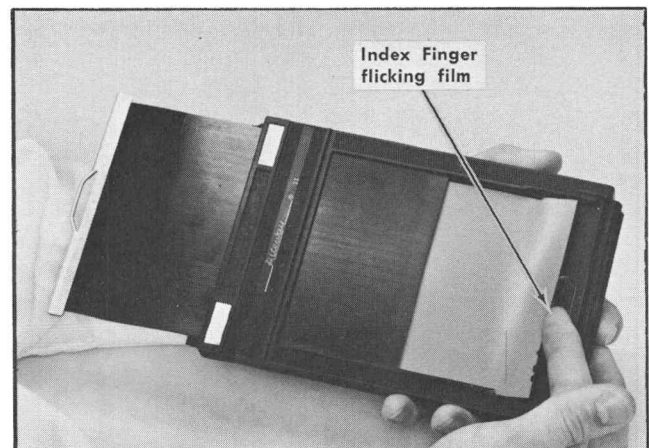


Fig. 2-5. Checking the sheet of film to insure that it has been inserted under the metal guides of the film holder.

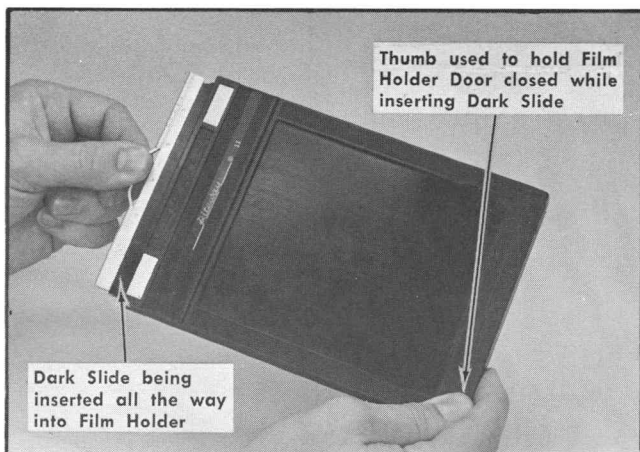


Fig. 2-6. Closing the film holder after loading the sheet of film. The film holder door is held closed with thumb while dark slide is inserted.

### Procedure Used to Expose Sheet Film

Obtain the desired display on the instrument and focus the display. The camera should now be set with its front opening down on a flat surface and the hinged focusing panel attached to the Graflok film back by placing one hinge up against the open end of the hooks on the Graflok film back (see Fig. 2-10). Now press the hinges in and under the hooks.

With one hand take the film holder, and with your free hand lift the hinged focusing panel on the Graflok film back (see Fig. 2-7). Insert the film holder between the hinged focusing panel and the other part of the Graflok film back. The side of the film holder to be exposed should be installed toward the camera lens.

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

Set the APERTURE selector and SHUTTER SPEED selector to the desired settings. Remove the dark slide from the side of the film holder facing the lens. Hold the camera against the instrument and expose the film, then replace the dark slide in the film holder so that the black side of the handle is toward the camera lens. The black side of the dark slide toward the nearest outside edge of the film holder indicates exposed film.

To remove the film holder from the Graflok 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.

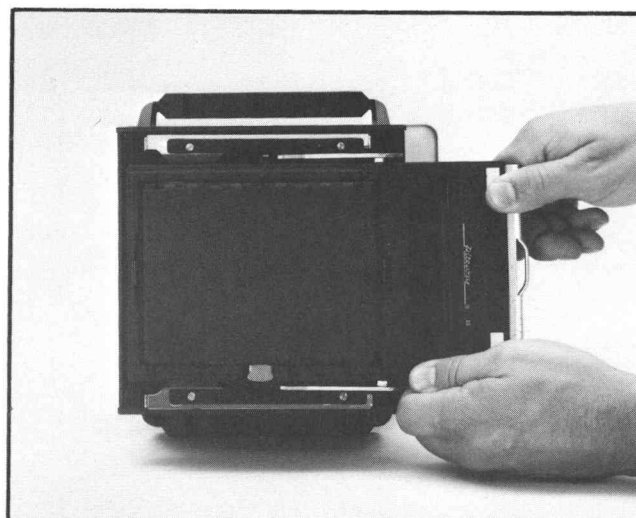


Fig. 2-7. Inserting the film holder in the Graflok film back having hinged focusing panel.

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

### Loading the Roll Film Holder

#### NOTE

*The hinged focusing panel part of the Graflok film back is not needed when using the roll film holder.*

If the directions for loading the roll film holder have been lost, the sectional drawing (Fig. 2-8) may be used as a guide. Fig. 2-9 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.

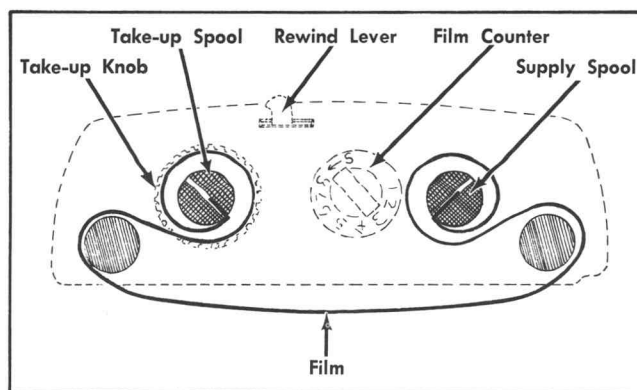


Fig. 2-8. Film threading path for a typical roll film holder.

### Attaching the Roll Film Holder to the Graflok Film Back

The roll film holder should be loaded before installing it on the Graflok 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.

Set the camera on a flat surface with its front opening down. Now place one thumb on each of the hinges for the hinged focusing panel (refer to Fig. 2-10). Press the hinges in toward the instrument, 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 Graflok film back.

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

With one hand hold the roll film holder on the Graflok film back, use the other hand to engage the two slide locks. One slide lock is located on each side of the long axis of the film (see Fig. 2-11).

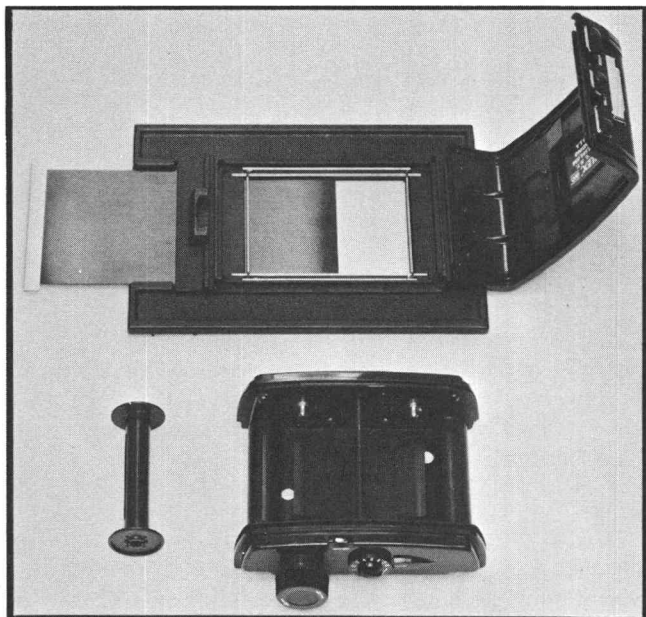


Fig. 2-9. Typical Roll Film Holder apart, ready to load film.

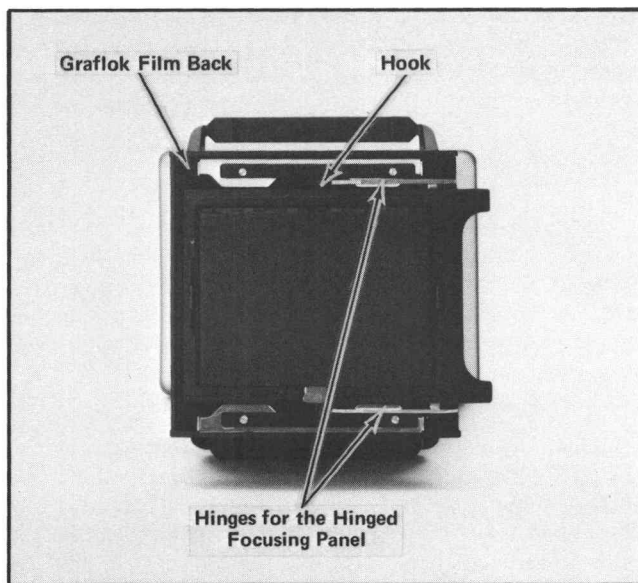


Fig. 2-10. Method used to remove or install the Hinged Focusing Panel.

### Exposing Roll Film

Obtain the display on the instrument and focus it properly. Remove the dark slide from the roll film holder, set the SHUTTER SPEED selector and APERTURE selector to the proper settings. Hold the camera against the instrument 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

*NOTE*

*The Polaroid Land 4 X 5 film holder can be used with or without the hinged focusing panel part of the Graflok film back.*

### Attaching the Polaroid Land 4 X 5 Film holder to the Graflok Film back

Set the camera on a flat surface with its front opening down. To insert the film holder in the Graflok back without the hinged focusing panel, set the film holder in the

## Operating Instructions—C-10 Camera

Graflok film back so that the small ridge on the holder will engage in the slot in the Graflok film back. Hold the film holder in position and engage the slide locks into the slots in the film holder to lock the film holder in place, see Fig. 2-12.

To insert the film holder in the Graflok film back with the hinged focusing panel, lift the hinged focusing panel and slide the film holder between the hinged focusing panel and the rest of the Graflok film back. The film holder should be inserted so that the processing arm is facing away from the lens (see Fig. 2-12).

When the film holder has been shoved all the way into the back, give a light tug outward to see if the unit is firmly locked in the Graflok film back. There is a small ridge on the holder which will engage in a slot in the Graflok film back. Now lock the film holder in place by engaging the slide locks into the slots in the film holder (refer to Fig. 2-12).

### NOTE

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

## Inserting and Exposing the Polaroid Land 4 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

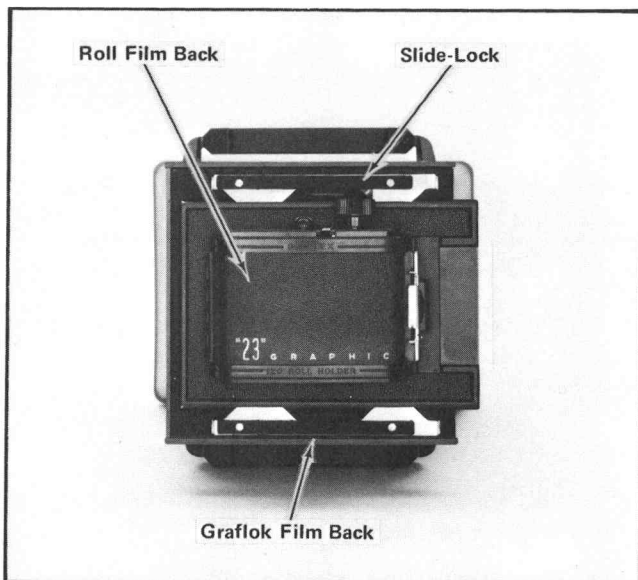


Fig. 2-11. Installing the roll film back on the Graflok film back.

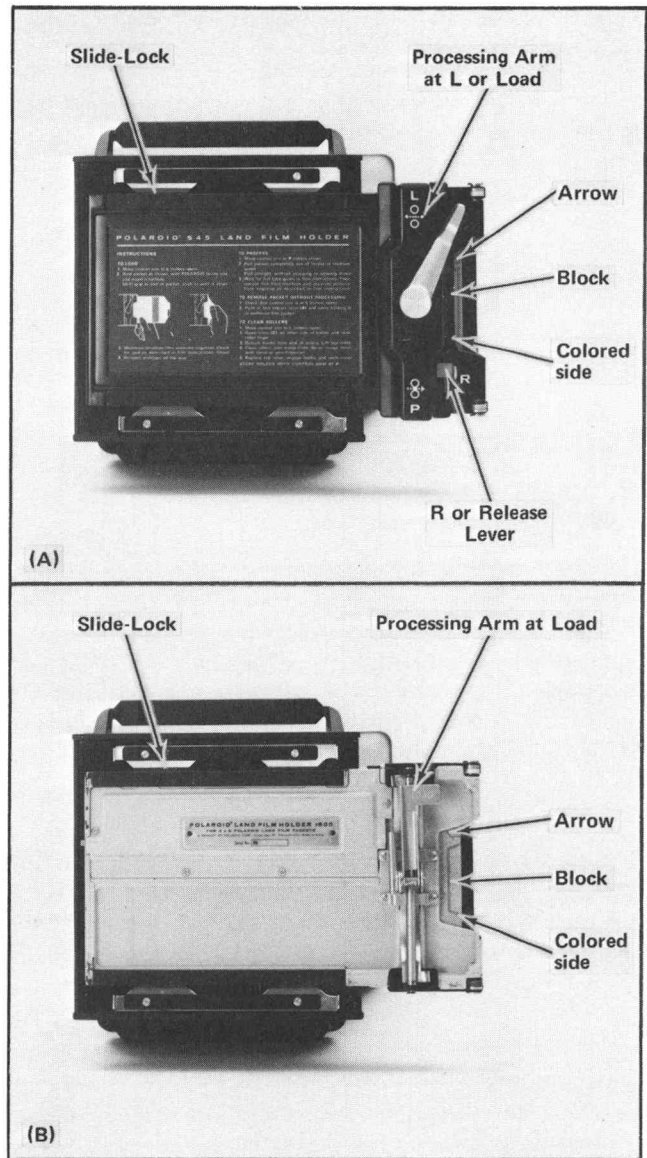


Fig. 2-12. (A) Model 545 Polaroid Land 4 X 5 film holder. (B) Model 500 Polaroid Land 4 X 5 film holder. Both film holders are shown properly installed in the 4 X 5 Graflok film back. With the film packet properly installed, it should be as shown.

(up) position. Before inserting, check the film packet for proper side toward the lens. The packet should be inserted into the film holder so that the colored block and the arrow are on the side of the film packet that faces you (away from the lens).

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

**NOTE**

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

The packet should be pushed into the film holder until it stops. When the film packet is inserted all the way into the film holder, the arrow and the colored block should just show (refer to Fig. 2-12).

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

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

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

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

**Developing the Film Packet**

**Developing the Picture Immediately.** After the envelope has been reinstated 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 position 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 by hooking the tips of your fingers under the edge of the metal cap while you give the envelope a moderate tug with the other hand, from the colored block and arrow end. Use the finger tips only, and let the thumb rest along the edge of the metal cap. Do not try to pry off or bend the metal cap.

Now peel the picture away from the negative. For all Polaroid Land film types except Type 55P/N, take the white sheet in one hand, the brown paper and negative in the other, and peel them apart rapidly. For Type 55P/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 Type 55P/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 metal cap, developer pod, and the black paper tab. The negative is perforated at the metal cap to aid in separating the metal cap 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 Packet for Later Development**

Occasionally you may want to expose a series of pictures without developing each one right away. Here's how to remove the film packet without developing:

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

## Operating Instructions—C-10 Camera

If you are using a 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.

If you are using a 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  $\frac{3}{8}$  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.

# 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 photographing low-repetition-rate displays at the faster 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 conditions. In other words, you can determine which of the two films is the more effective under those particular conditions without being able to assign a specific value to either film.

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

### CRT SELECTION

#### Selecting the CRT Phosphor

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

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

Probably the most important single characteristics of a phosphor for photographic purposes is the color of its emitted light. A blue or violet fluorescence has the highest

## Photographic Techniques—C-10 Camera

actinic value and thus, is most suitable for photographic work. In general; it can be stated that (all other things being equal) the shorter the wavelength of the visible peak emitted light, the better the phosphor for photographic applications.

Most users of oscilloscopes are concerned not only with photographing the oscilloscope trace but in observing it directly as well. For such applications, it is important to have a 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 rate, and also has sufficient persistence to permit easy viewing.

It has been observed that the P11 phosphor has the highest comparative writing rate of any common phosphor, and is thus best for photographic work 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 ability is required. Type P11 emits a medium short-duration purplish-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.

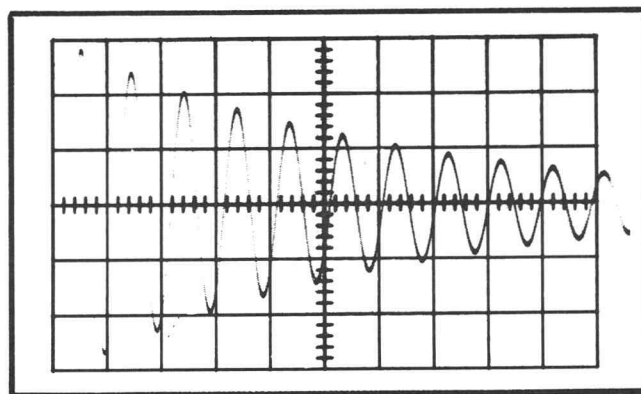


Fig. 3-1. A single-shot damped sinusoidal waveform which can be used to measure the maximum writing rate of an oscilloscope-camera combination.

## 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 it.

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

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 3-1

COMMON PHOSPHOR SUMMARY TABLE

Phosphor Type	Characteristic Graph Figures	<sup>1</sup> Relative Photo Writing Speed. P11 Standard	<sup>2</sup> 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 <sup>3</sup>	95	Yel-Grn	Yel-Grn
P2	3-3	40% as fast	55% as bright	510 nm <sup>3</sup>	120	Blu-Grn	Yel-Grn
P7	3-4	75% as fast	35% as bright	450 nm <sup>3</sup>	1500	Blu-Wht	Yel-Grn
P11	3-5	100%	15% as bright	450 nm <sup>3</sup>	20	Vio-Blu	Vio-Blu
P31	3-6	50% as fast	100%	530 nm <sup>3</sup>	32	Yel-Grn	Yel-Grn

<sup>1</sup>To achieve the writing rate 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.

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

<sup>3</sup>Nanometers.



Table 3-2  
Polaroid Land Film Type Summary

Film Type	Approximate ASA Rating	For Film Characteristic Graphs, See Fig.	Characteristic Picture Size	Remarks
52 <sup>4</sup>	200	3-7	4 X 5	Sheet form only. Panchromatic type. Yields paper print. Good general purpose film.
55 P/N <sup>5</sup>	50	3-8	4 X 5	Positive paper print and reproducible negative. Sheet form. Panchromatic type. High resolution negative.
57 <sup>4</sup>	3000	3-9	4 X 5	Panchromatic type. Sheet form only. Paper print. Equivalent of Type 47 in sheet form.
58 <sup>6</sup>	75	3-10	4 X 5	Color film which yields a paper print. Available in sheet form only. Requires no coating.

## 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.*

**Writing On Photographs.** 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. They can be obtained from most art or photo supply stores.

Another method of note making 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.

<sup>4</sup>Development time 10 seconds.

<sup>5</sup>Development time 20 seconds.

<sup>6</sup>Development time 50-60 seconds.

For self-coating Polaroid prints, rub 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.

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.

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

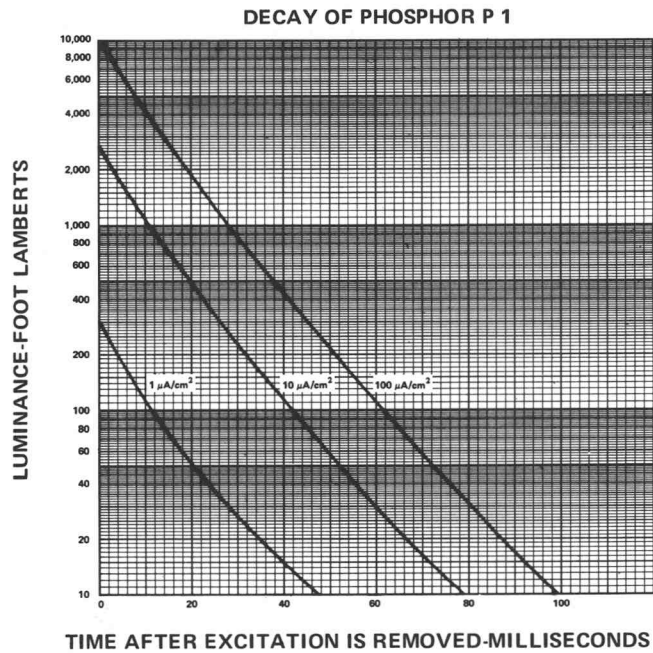
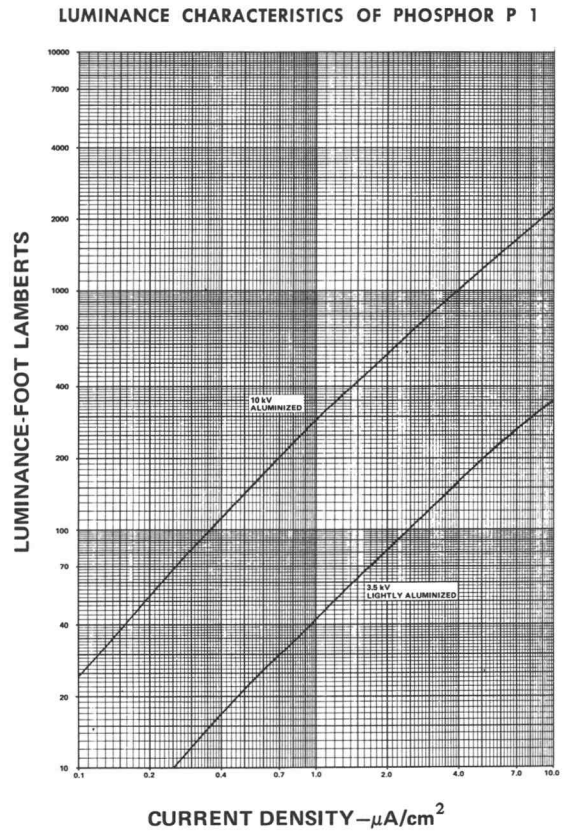
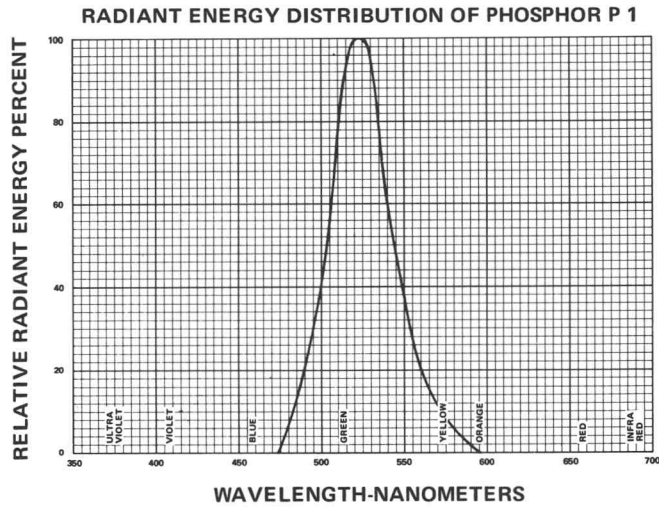
**Increasing Writing Speed.** A method which sometimes produces very good results with Polaroid Land films is pre-fogging.<sup>7</sup> In pre-fogging, the film is exposed to a predetermined amount of light for a definite period. The intensity of the light and the period of the exposure are so chosen 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 pre-fogging technique can produce an increase in maximum writing rate of two or more times depending on film types, film condition, the nature of the pre-fog light and other variables. Pre-fogging 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 rate.

Post-fogging<sup>7</sup> is very similar to pre-fogging. The difference is that the film is exposed to the controlled light source after exposure, rather than before. Post-fogging produces very nearly the same increase in writing rate as pre-fogging.

**Transillumination.** While not strictly a means of improving writing rate, transillumination permits you to better see information which is recorded on prints. In the technique of transillumination, the print is observed with a source of bright diffused light, such as a light bulb, directly behind the print (see Fig. 3-11). The light passing through the print brings out detail which would otherwise not be evident.

The transillumination technique will not work on colored Polaroid film since they have an opaque plastic base.

<sup>7</sup>For details on pre-fogging or post-fogging, contact your local Tektronix, Inc. representative or field office.

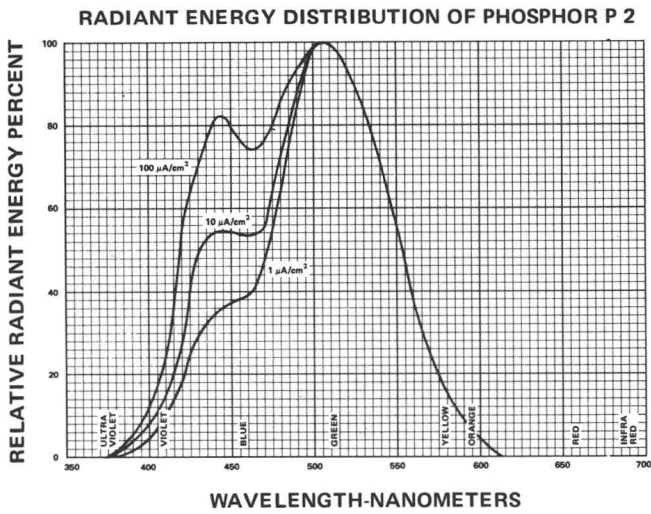


Luminance measurements taken with a Spectra Brightness Spot Meter, observing a 0.250 inch diameter area of a 2 X 2 cm, 135 line, focused raster.

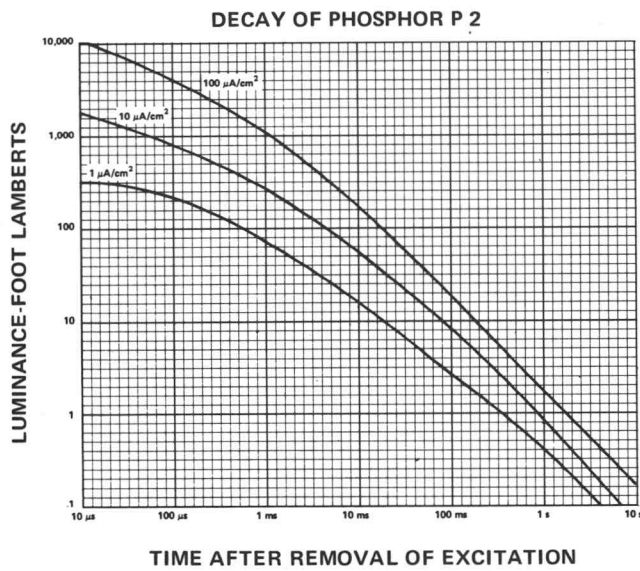
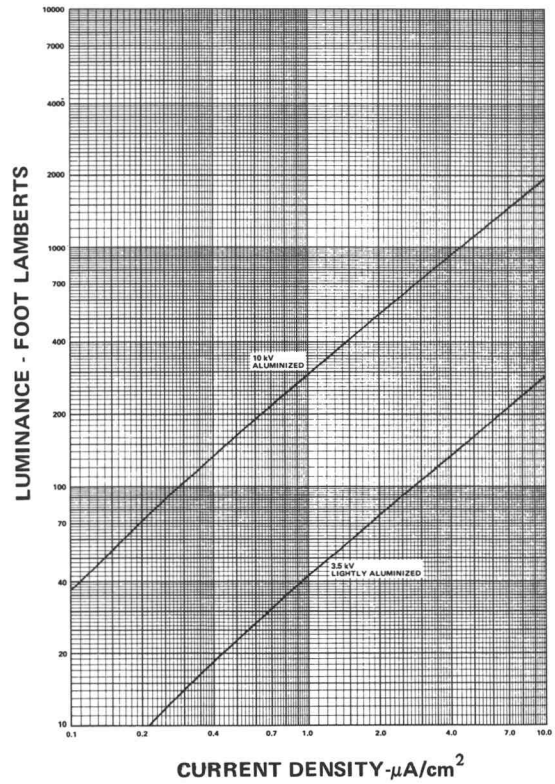
**BUILDUP**  
Approximately 14 milliseconds to 90% at  $10 \mu\text{A}/\text{cm}^2$ .

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

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



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.

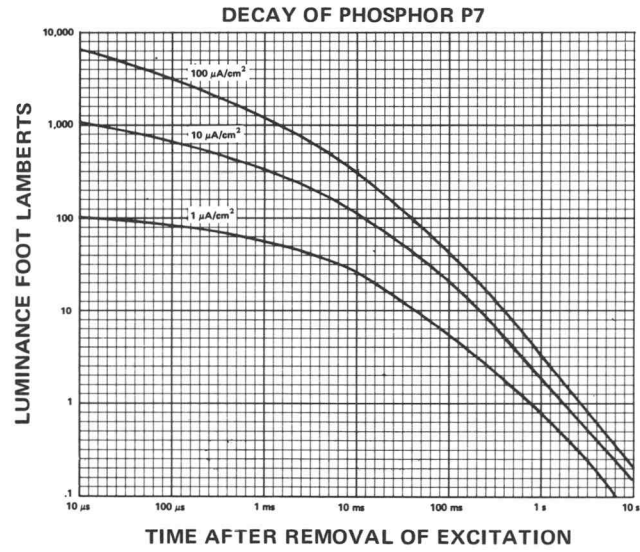
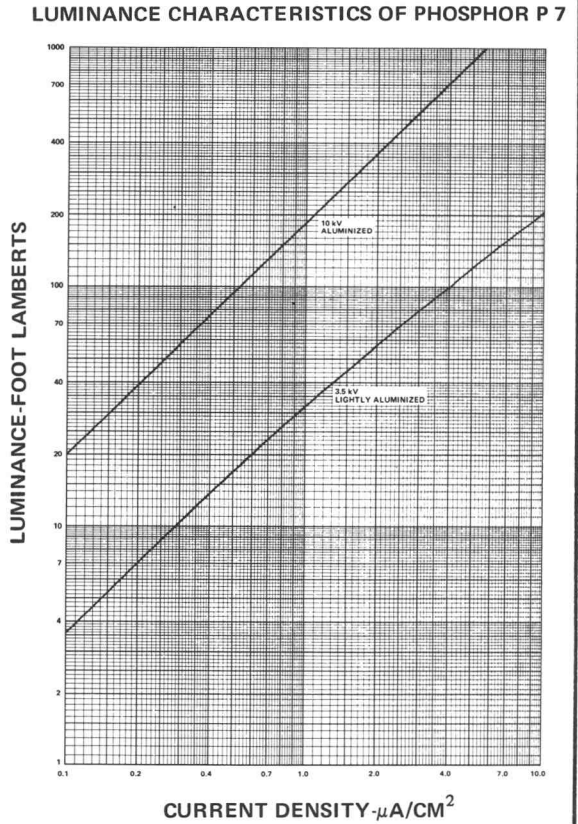
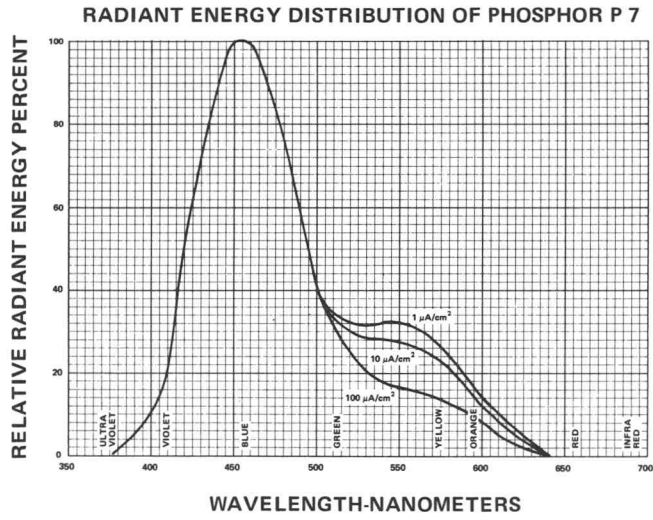
**BUILDUP**

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.

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



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.

**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.

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

# SECTION 6 MECHANICAL PARTS LIST

Fig. 1 EXPLODED

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	Description
		Eff	Disc		
1-1	426-0618-00			1	ASSEMBLY, frame-light shield assembly includes:
2	358-0380-00			1	BUSHING, 0.437-20 X 0.516 inch OD
3	124-0225-01			1	STRIP, trim, marked C-10
4	124-0225-00			1	STRIP, trim
5	122-0914-00			1	CABLE RELEASE
6	358-0405-00			1	BUSHING, cable release
7	220-0554-00			1	NUT, knurled, 0.437-20 X 0.395 inch
8	122-0915-01			1	LENS
9	122-0511-01			1	BACK
10	213-0079-00			4	SCREW, thread cutting, 4-24 X 9/16 inch, FHS
11	016-0201-01			1	FILM HOLDER
12	252-0603-00			ft	PLASTIC STRIP, foam, 2 feet long

## STANDARD ACCESSORIES

070-0988-00				2	MANUAL, instruction (not shown)
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