

Tektronix®
COMMITTED TO EXCELLENCE

**C-30B
CAMERA**

INSTRUCTION MANUAL

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

Serial Number _____

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TABLE OF CONTENTS

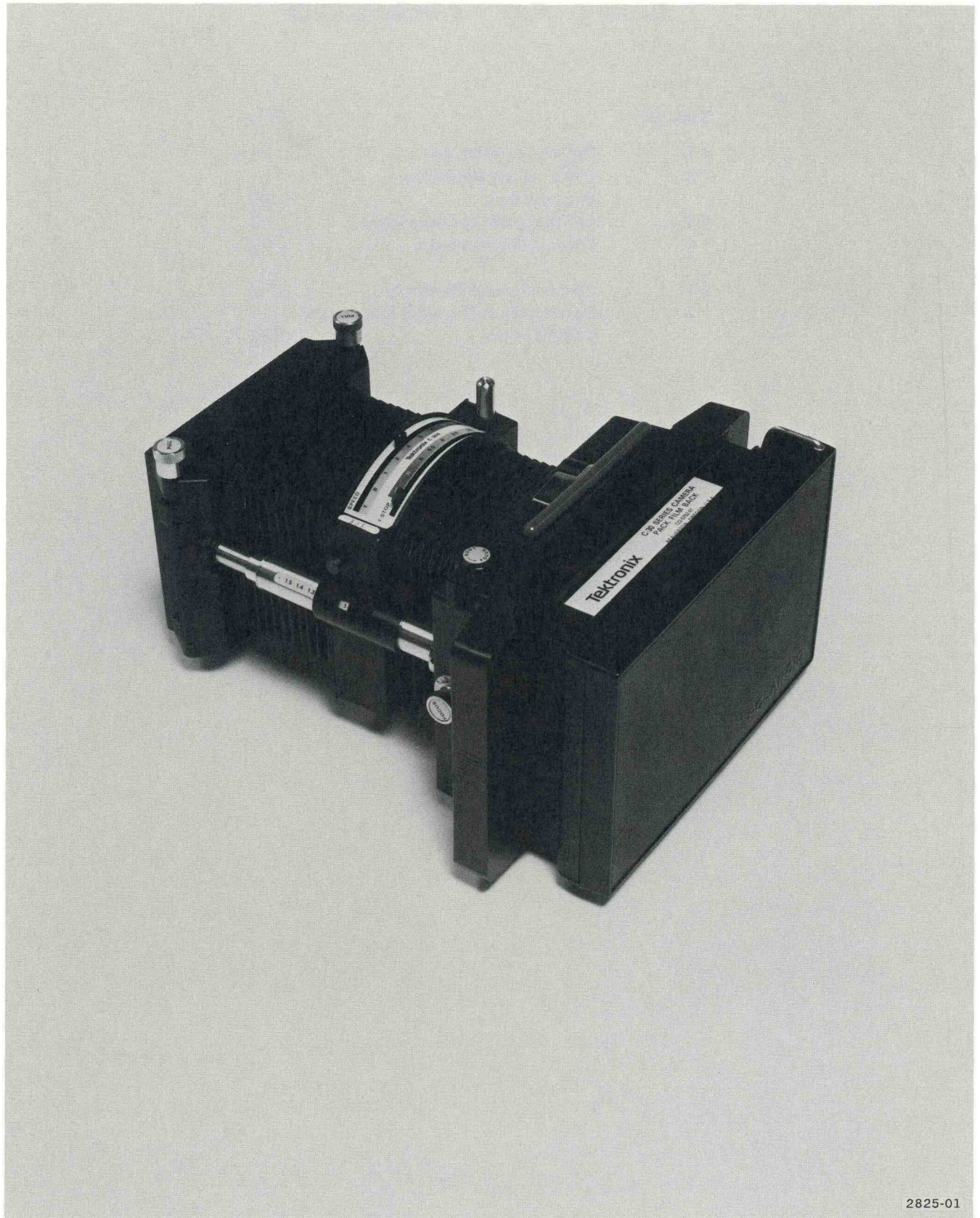
	Page		Page
LIST OF ILLUSTRATIONS	ii	SECTION 2 OPERATING INSTRUCTIONS (cont)	
LIST OF TABLES	iii	PICTURE TROUBLE	2-15
SECTION 1 GENERAL INFORMATION		Wide Trace	2-15
INTRODUCTION	1-1	No Image on Picture	2-15
SPECIFICATION	1-1	Light Streaks on Picture	2-16
SECTION 2 OPERATING INSTRUCTIONS		Fogging on Picture	2-16
DESCRIPTION OF CONTROLS		Trace or External Graticule in Focus,	
AND CONNECTORS	2-1	But Not Both	2-16
PREPARATION FOR USE	2-3	Some Portions of Photographed Signal	
MOUNTING THE CAMERA	2-3	Appear Brighter Than Others	2-16
Light Seal Replacement	2-3	ELIMINATING PARALLAX AND	
Camera Mounting	2-3	FOCUSING DIFFICULTIES	2-16
INSTALLING CAMERA BACKS	2-4	First Method	2-16
USING THE POLAROID PACK		Second Method	2-16
FILM BACK	2-5	EFFECTS OF THE f-STOP SETTING	
Focusing	2-5	ON THE DEPTH OF FIELD	2-16
Installing the Pack Film	2-6	EFFECTS OF CAMERA	
Advancing and Developing the		MAGNIFICATION ON	
Pack Film	2-7	EXPOSURE	2-17
USING THE POLAROID ROLL-FILM		RECIPROCITY	2-17
BACK	2-8	SECTION 3 MAINTENANCE	
Focusing	2-8	GENERAL CARE OF THE CAMERA	
Installing the Roll Film	2-9	SYSTEM	3-1
Advancing and Developing the		LENSES	3-1
Roll Film	2-9	SHUTTER	3-1
USING THE GRAFLOK BACK	2-10	CAMERA BACK ROLLERS	3-1
Focusing	2-10	LIGHT LEAK SEALING	3-1
Installing Loaded Film Holders	2-10	MAGNIFICATION ADJUSTMENTS	3-2
PHOTOGRAPHIC CONSIDERATIONS	2-11	COMPONENT REPLACEMENT	3-3
WRITING RATE	2-11	REPLACEMENT PARTS	3-3
CRT SELECTION	2-11	INSTRUMENT REPACKAGING	3-3
FILM SELECTION	2-12	Required Reshipment Information	3-3
HELPFUL TECHNIQUES WITH		SECTION 4 OPTIONS	
FILM	2-13	OPTION 1	4-1
Polaroid Film	2-13	SECTION 5 REPLACEABLE MECHANICAL PARTS	
Conventional Film	2-14	CHANGE INFORMATION	
PICTURE TAKING	2-15		
Photographing Repetitive Signals	2-15		
Photographing Single-Sweep			
Displays	2-15		

LIST OF ILLUSTRATIONS

Figure No.	Page
	The C-30B Camera. iv
1-1	Dimensional drawing with a Polaroid pack-film back attached. 1-3
2-1	Camera controls and connectors. 2-2
2-2	Mounting the camera and inserting the light seal. 2-3
2-3	Mounting the pack-film back to the camera. 2-4
2-4	Installing and using the focus plate in the pack-film back. 2-5
2-5	Installing the pack-film. 2-6
2-6	Developing the pack-film. 2-7
2-7	Opening the roll-film back. 2-8
2-8	Installing and using the focus plate in the roll-film back. 2-8
2-9	View hood attached to the Graflok back. 2-10
2-10	Installing the 4- by 5-inch cut film holder in the Graflok back. 2-10
2-11	Single trace of a damped waveform. 2-11
2-12	Using transillumination to see otherwise invisible information. 2-14
2-13	Depth of field for different aperture settings. 2-17
3-1	Sleeve lock collar location. 3-2

LIST OF TABLES

Table No.		Page
1-1	Optical Characteristics	1-1
1-2	Electrical and Mechanical Characteristics	1-2
1-3	Environmental Characteristics	1-2
1-4	Physical Characteristics.	1-2
2-1	Commonly-used Phosphors	2-12
2-2	Commonly-used Polaroid Film for the C-30B Camera.	2-13



2825-01

The C-30B Camera.

GENERAL INFORMATION

INTRODUCTION

The TEKTRONIX C-30B is a compact, variable-magnification, general-purpose camera designed primarily for photographing TEKTRONIX 400-series oscilloscope traces and monitor displays. Its lens magnification is manually variable from 0.7 to 1.5 in 10 steps. Three interchangeable camera backs can be accommodated by the C-30B Camera: a Polaroid Pack-Film back, a Polaroid Roll-Film back, and a 4- by 5-inch Graflok back. When the camera is mounted on the test instrument, dual swing-away hinges allow the camera to be swung out of the way, either to the left or to the right, for direct viewing of the crt display.

The standard C-30B Camera is shipped with an adapter that can mount directly to a TEKTRONIX 422, 450-series (except 455), 485, or 491 instrument. A listing of other camera adapters and the equipment for which they are used is found in the tabbed Accessories page at the rear of this manual.

The C-30B Camera is delivered with two light seals, one for the 8- by 10-division crt and the other for the 6- by 10-division crt. The 8- by 10-division light seal comes inserted in the mounting adapter and is used with TEKTRONIX 422, 453A, 454A, 485, and 491 instruments. The 6- by 10-division light seal is used with TEKTRONIX 453 and 454 instruments.

SPECIFICATION

The optical characteristics presented in Table 1-1 are valid only if the camera has been operating at an ambient temperature between 0° and +50° C (+32° to +122° F). Electrical and mechanical, environmental, and physical characteristics of the camera are listed in Tables 1-2, 1-3, and 1-4 respectively.

Table 1-1
Optical Characteristics

Characteristics	Performance Requirements
Lens	
Maximum Relative Aperture at Infinity	f/1.9.
Focal Length	56 mm nominal.
Coverage at Maximum Relative Aperture	At least 120 mm diameter in object plane.
Magnification (Object-to-Image Ratio)	1:1.5, 1:1.4, 1:1.3, 1:1.2, 1:1.1, 1:1, 1:0.9, 1:0.85, 1:0.8, and 1:0.7 $\pm 5\%$.
Geometrical Distortion	Not more than 0.2% as measured at 1:1.1 magnification. Not more than 0.75% as measured at 1:1.4 magnification and at 1:0.8 magnification.
Relative Illumination	20% at 120 mm diameter with a relative aperture of f/1.9.
Photographic Resolving Power at 1:1 Magnification	
Center Pattern	At least 25 lines/mm, with USAF target pattern 1951 on Plus X pan film, developed in 1:1 DK 50 for 6 minutes at 20° C.
At 120 mm Diameter	At least 10 lines/mm, with USAF target pattern 1951 on Plus X pan film, developed in 1:1 DK50 for 6 minutes at 20° C.

Table 1-2

Electrical and Mechanical Characteristics

Characteristics	Performance Requirements
Maximum X Sync Contact Rating	28 V dc, 750 mA (Common is connected to case of camera).
Shutter	
Speed (Normal) Range	1, 1/2, 1/4, 1/8, 1/15, 1/30, 1/60, and 1/125 second.
Accuracy	DIN 19015.
Relative Aperture (f-Number) Range	f/1.9, 2.8, 4, 5.6, 8, 11, and 16.
Accuracy	±1/3 of aperture (f) setting.
Synchronization	Internal; X type as describe in 3.1 of U.S.A. Standard PH 18-1957.

Table 1-3

Characteristics	Environmental Characteristics
	Description
Temperature	
Operating	0° to +50° C (+32° to +122° F).
Storage	−55° to +75° C (−67° to +167° F).
Relative Humidity	
Operating	75% at +50° C.
Altitude	
Operating	To 15,000 ft (4,500 m).
Storage	To 50,000 ft (15,000 m).
Vibration	15 minutes along each of the three major axes at a total displacement of 0.025 inch p-p with frequency varied from 10 to 55 to 10 Hz in one-minute sweeps, held for ten minutes at each resonant point, or if none, at 55 Hz.
Shock	Three shocks at 50 g, half-sine, 10-ms duration in each direction along each major axis, for a total of 18 shocks.
Transportation	Qualifies under National Safe Transit Committee Preshipment Test Procedures 1A-B-1 and 2.

Table 1-4

Physical Characteristics

Characteristics	Description
Weight (with adapter mounted, no film back)	3.25 lb (1.47 kg).
Length, Width, and Height (with Polaroid Pack-Film back)	See Figure 1-1.

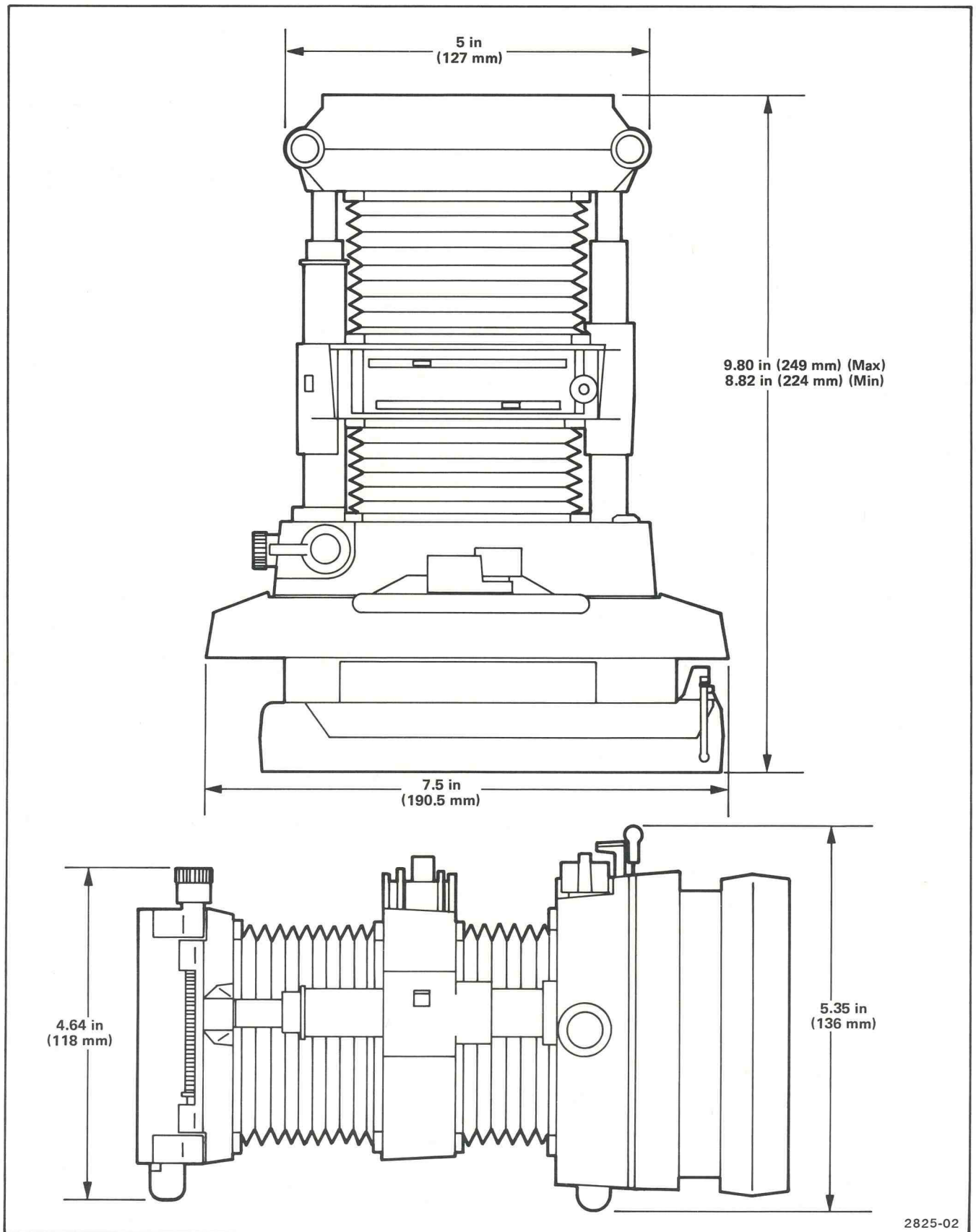


Figure 1-1. Dimensional drawing with a Polaroid pack-film back attached.

OPERATING INSTRUCTIONS

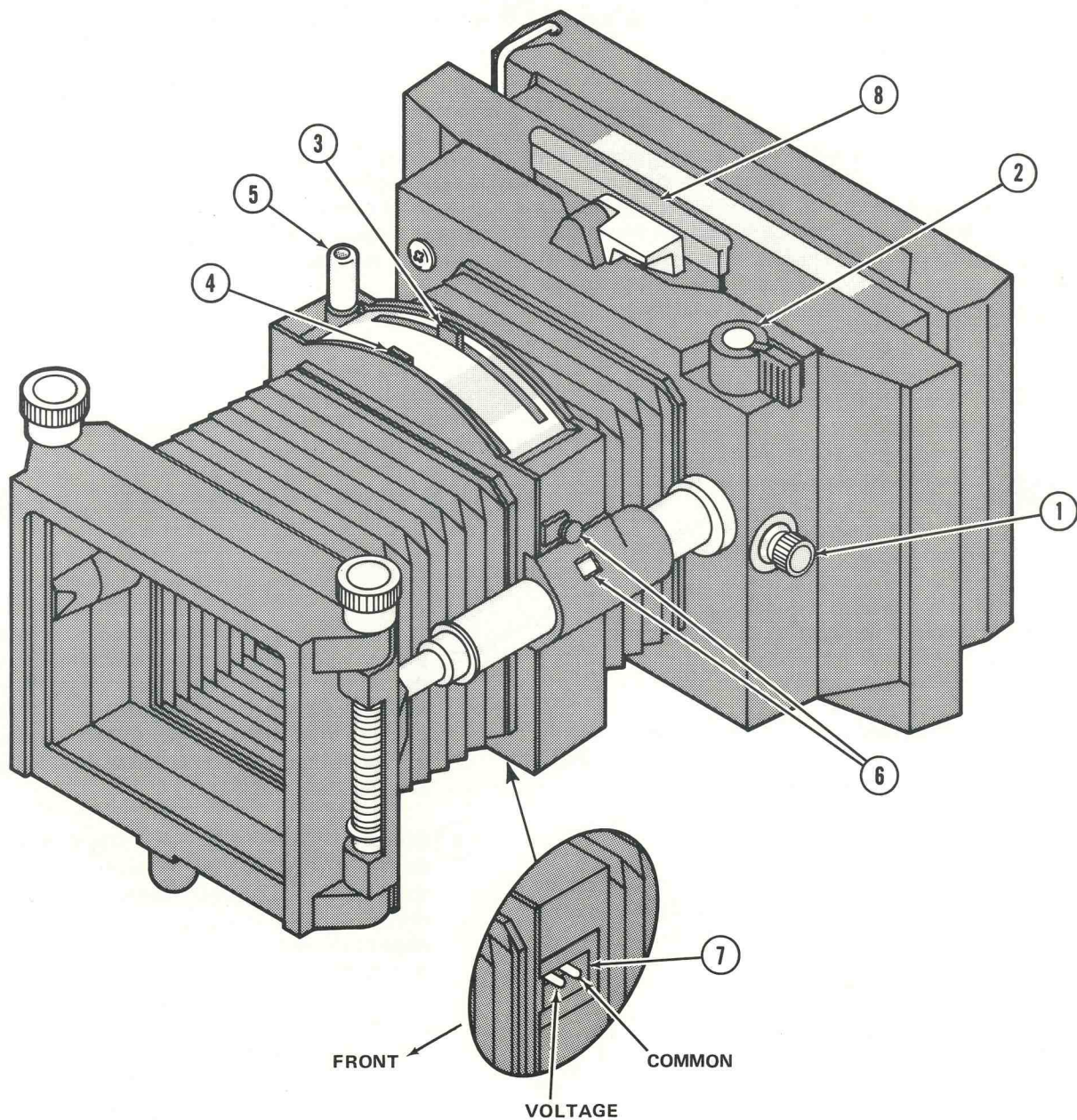
This section of the manual is intended to familiarize the operator with use of the C-30B Camera to record crt traces. Included is a description of controls and connectors, information for mounting the camera to the instrument, focusing instructions, film loading, and development information, photographic techniques, film selection criteria, and additional useful operating information.

The C-30B Camera is shipped in a carton along with its standard accessories. At installation time, save the shipping carton and packaging materials for reuse should reshipment become necessary. Refer to the end of the Maintenance section for repackaging instructions.

DESCRIPTION OF CONTROLS AND CONNECTORS

Refer to Figure 2-1 for location of camera controls and connectors.

- ① **FOCUS**—This control adjusts the distance from the front of the camera lens to the display being photographed and is used for focus alignment.
- ② **FOCUS LOCK**—Locks the FOCUS knob to a particular adjustment to prevent accidental changing of camera focus.
- ③ **f-STOP (Aperture)**—This control provides for continuous adjustment of the size of the lens opening. It is calibrated in seven f-stops from 16 to 1.9, with f/16 being the smallest aperture opening and f/1.9 the largest aperture opening.
- ④ **SPEED (Shutter)**—This selector controls the time period that the shutter remains open to admit light for exposing the film. There are eight selectable shutter speeds ranging from 1/125 to 1 second. In the B (bulb) position the shutter remains open as long as the shutter button is held down, and the shutter closes when the shutter button is released. In the T (time) position the shutter opens when the shutter button is first pushed down and will remain open until the shutter button is pushed down the second time.
- ⑤ **Shutter Button**—This button actuates the camera shutter when pushed down. The threaded center of the button permits installation of an ASA internal cable release for remote mechanical actuation of the camera shutter. Refer to the tabbed Accessories page in the rear of the manual for the cable release actuator part number.
- ⑥ **Object-to-Image Scale and Magnification Index Button**—To change magnification, push and hold in the Magnification Index button while sliding the shutter housing along its sleeve. When the desired object-to-image number appears in the window, release the Magnification Index button and slightly move the shutter housing until it engages the detent for the desired object-to-image number. When setting the camera for an object-to-image ratio of 1:0.85, the numerals 0.85 will not appear in the window; instead, a diamond-shaped symbol will appear.
- ⑦ **X Sync Output Terminals**—These two terminals are used to slave external equipment to the operation of the shutter. They are connected to a mechanical switch which is part of the shutter assembly. The continuity between terminals represents switch closure during the time that the shutter is open. A commercial two-connector X Sync cable, provided by the users, is required. The COMMON terminal is directly connected to the camera case.
- ⑧ **Dark Slide**—The dark slide is installed to prevent exposing unused film when the camera back is removed from the camera. A dark slide is furnished with both the Polaroid Roll- and Pack-Film backs. For the Graflok back, the dark slide may be part of the film holder used with the Graflok back.



2825-03

Figure 2-1. Camera controls and connectors.

PREPARATION FOR USE

MOUNTING THE CAMERA

The following mounting instructions are applicable for attaching the C-30B Camera and adapter to TEKTRONIX 422, 450-series (except 455), 485, and 491 instruments. Various mounting adapters are available for other Tektronix instruments and may be ordered as required. Data Sheets provided with other camera adapters contain appropriate mounting information.

Light Seal Replacement

The C-30B Camera is shipped with the 8- by 10-division light seal installed in the mounting adapter. If a 6- by 10-division light seal is required, unscrew and remove the

rubber foot from the mounting adapter (see Figure 2-2). Remove the 8- by 10-division light seal and replace it with the 6- by 10-division light seal. Reinstall the rubber foot to secure the light seal in place. For most photographic work, any mesh filter or colored light filter should be removed from the instrument.

Camera Mounting

The camera with attached adapter can be mounted to the instrument by sliding it onto the flange of the crt bezel. To remove the assembly, slide it up and off of the flange of the crt bezel.

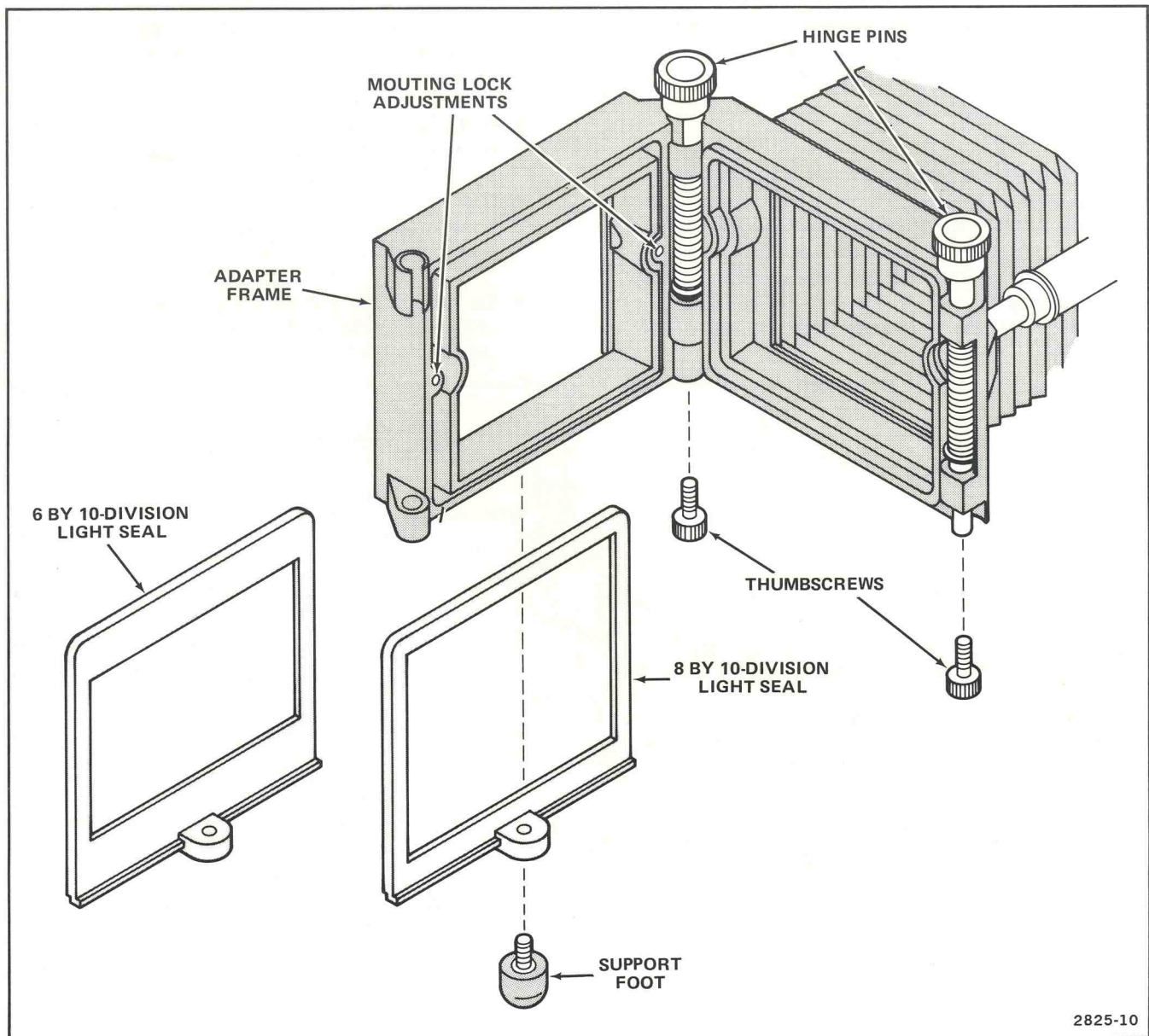


Figure 2-2. Mounting the camera and inserting the light seal.

Once it is mounted, the camera can be swung away from its adapter, to either side, by lifting the hinge pin on the opposite side. The camera may be totally removed from its adapter by first lifting one pin, swinging the camera to one side, then lifting the other pin. The adapter may also be detached from the camera by lifting both hinge pins simultaneously.

A slide on the adapter has been incorporated to provide for easy camera mounting and removal. If a more secure attachment is needed, tighten the two set screws (mounting lock adjustments) located in the half-round boss on each side of the adapter next to the light seal groove. Use a 5/64-inch hexagonal wrench for this purpose. To obtain access to the two set screws, swing the camera away from the adapter or remove the camera completely. These screws need only be lightly tightened clockwise to lock the adapter onto the oscilloscope bezel. To remove the adapter from the bezel, loosen both set screws by turning them counterclockwise until the adapter is free to slide off.

NOTE

To ensure that the hinge pins will remain engaged in the camera adapter when moving the instrument and attached camera about, install a thumb screw into the bottom of each hinge pin after mounting the camera. Before either or both camera hinge pins can be lifted for swinging the camera out or removing it from the adapter, the thumb screws must be completely removed.

INSTALLING CAMERA BACKS

The choice of a camera back will depend primarily on the intended use for the photograph, how quickly you want finished photographs, the area you wish to photograph, the magnification factor of the lens, and the size of the picture image desired.

Mounting procedures for each type of camera back (Pack-Film, Roll-Film, and Graflok) are identical. Use the following procedure to attach your camera back to the C-30B. Figure 2-3 shows the example of a Pack-Film back being mounted to the camera main frame.

1. Release the camera back latch by rotating it clockwise.
2. Tilt the camera back as shown in Figure 2-3 until the groove at its bottom is directly over the adapter clip on the main frame.
3. Push the top of the camera back forward until it snaps into place against the main frame.
4. Holding the camera back firmly against the main frame, rotate the camera back latch counterclockwise to secure the camera back.
5. To remove the camera back, release the latch by rotating it clockwise. Tilt the top of the camera back, then pull it out.

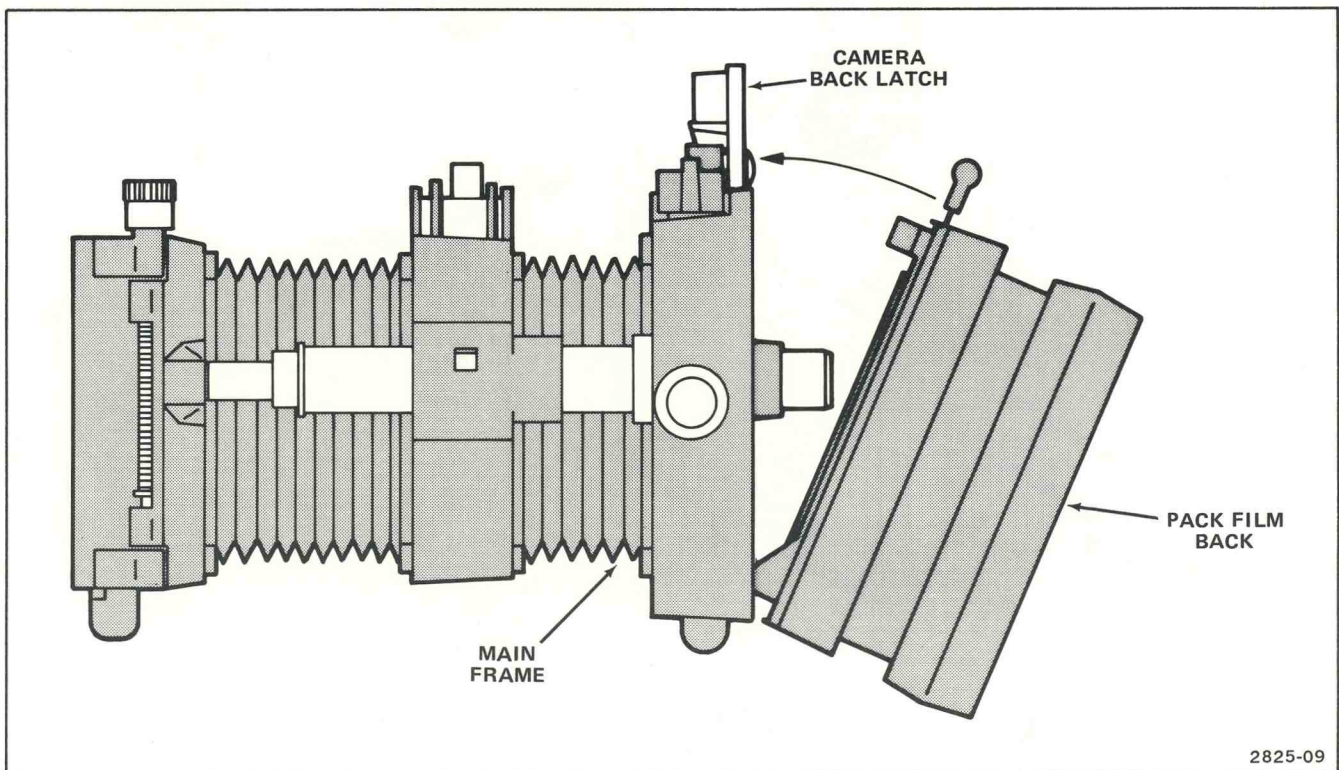


Figure 2-3. Mounting the pack-film back to the camera.

USING THE POLAROID PACK FILM BACK

Focusing

The following procedure describes how to focus the camera using the focus plate with a Pack-Film back.

1. Obtain a properly-adjusted trace on the crt.
2. Open the camera back by releasing the door latch and insert the focus plate where the pack film would normally be placed as shown in Figure 2-4(A).
3. Orient the frosted side of the focus plate towards the crt, inserting the left side under the door hinge and down next to the exposure window. The half-circle cutout in the plate provides a finger hole for easy removal of the focus plate.
4. Set the aperture for maximum opening (f/1.9) and set the SPEED selector to T. With the shutter open, you should observe the display on the biprism of the focus plate.

NOTE

Either the crt horizontal trace or the internal graticule line may be used to adjust focus.

5. Release the FOCUS LOCK knob and adjust the FOCUS knob until the trace (or graticule line) is aligned with itself. Refer to Figure 2-4(B) for an example of an in-focus display.
6. Tighten the FOCUS LOCK knob to ensure that the focus setting cannot be changed accidentally.

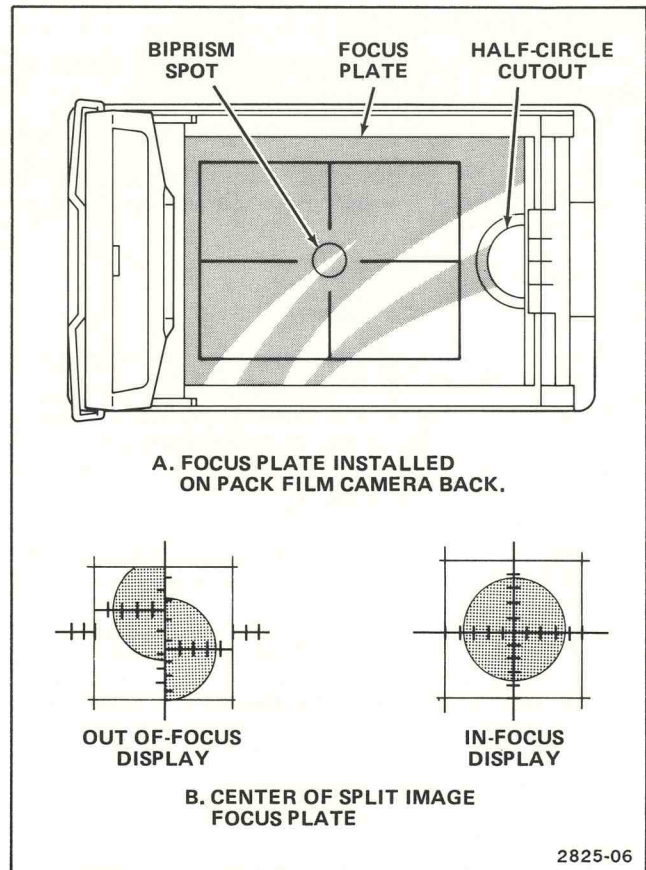


Figure 2-4. Installing and using the focus plate in the pack-film back.

Installing the Pack Film

The following procedure, when used with Figure 2-5, describes how to install the pack film.

1. Release the door latch and open the film door.
2. Remove the empty film container (if applicable) by lifting up on the pack film tab and pulling to the right.
3. Clean the rollers if necessary.

NOTE

For the camera to operate properly, the processing rollers in the film back must be clean. Check these rollers each time film is inserted. Instructions for removal of the rollers are displayed inside the film door. If the instructions are missing, refer to the Maintenance section of this manual.

4. Open the film box and carefully remove the foil-wrapped pack film. Retain the instruction sheet and print coater.
5. Remove the film from the foil; be sure to handle the film only by the edges.

6. Insert the pack film into the film plane, pushing it to the left and down until it snaps into place. Ensure that the black paper leader is hanging over the right end of the camera back and that the numbered white tabs are not caught between the pack film and film plane.
7. Close the film door, ensuring that the black paper leader and numbered white tabs are outside the door. Swing the door latch into place until it snaps into the locked position.
8. Pull the black paper leader completely out. This will expose the first white tab. The camera is now ready for taking the first picture. The numeral on the white tabs indicates the sequential number of the picture that is ready for exposure.

NOTE

Only a white tab should be showing when a picture is taken. If a yellow tab is showing, pull it completely out and proceed to step 3 of the next paragraph, Advancing and Developing the Pack Film.

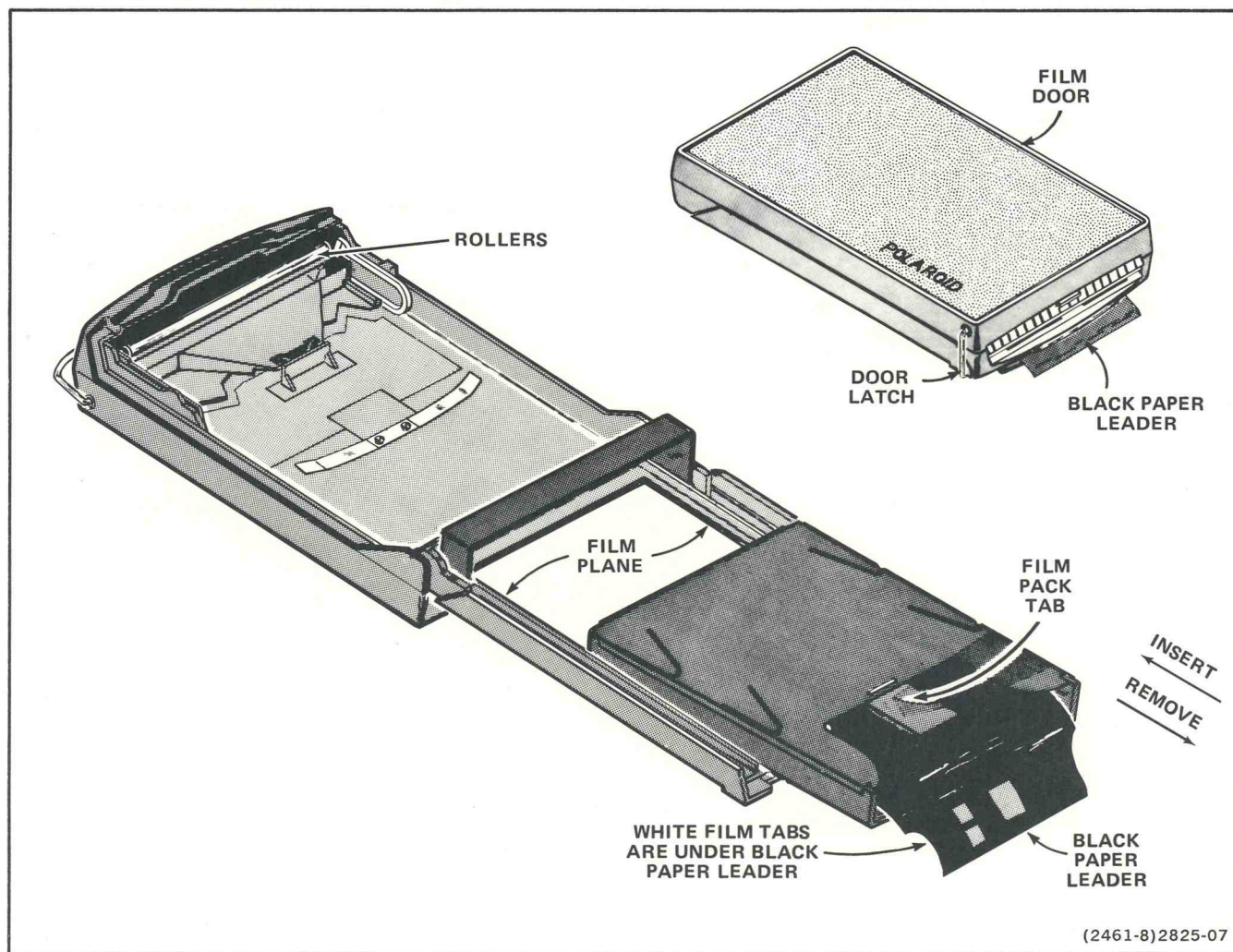


Figure 2-5. Installing the pack-film.

Advancing and Developing the Pack Film

After a picture is shot, advance and develop each exposure as follows (see Figure 2-6):

1. Pull the white tab completely out of the back film. A yellow tab with black arrows should appear.

NOTE

If the yellow tab does not appear after the white tab is pulled, take the camera to a darkened area, open the film back, and carefully remove the yellow tab that failed to pop out.

2. Smoothly pull the yellow tab completely out of the film back using one continuous motion.

NOTE

Development time for Type 084 film is approximately 15 seconds at an ambient temperature of 70° F or above. A slightly longer development time generally provides greater print contrast. Shorter development time will decrease print contrast, but may improve photographed details not otherwise visible. Refer to a later paragraph on Film Selection and accompanying Table 2-2 for specification on other films.

3. Wait for the proper development time. Follow the directions contained in the pack film instruction sheet for proper development times under various conditions.

WARNING

Many developing solutions contain a caustic substance which may cause chemical burns. If you accidentally get the solution on your skin, wipe it off immediately and wash the area thoroughly as soon as possible. Be extremely careful to keep the solution away from the eyes and mouth.

4. When the development time is up, carefully peel the print away from the negative. Do not allow the print to touch the damp negative after they have been separated.
5. Prints that require coating should be coated as soon as possible after separating them from the negative. Use six to eight overlapping strokes to apply the print coater along the entire length of the print, including edges, borders, and corners.

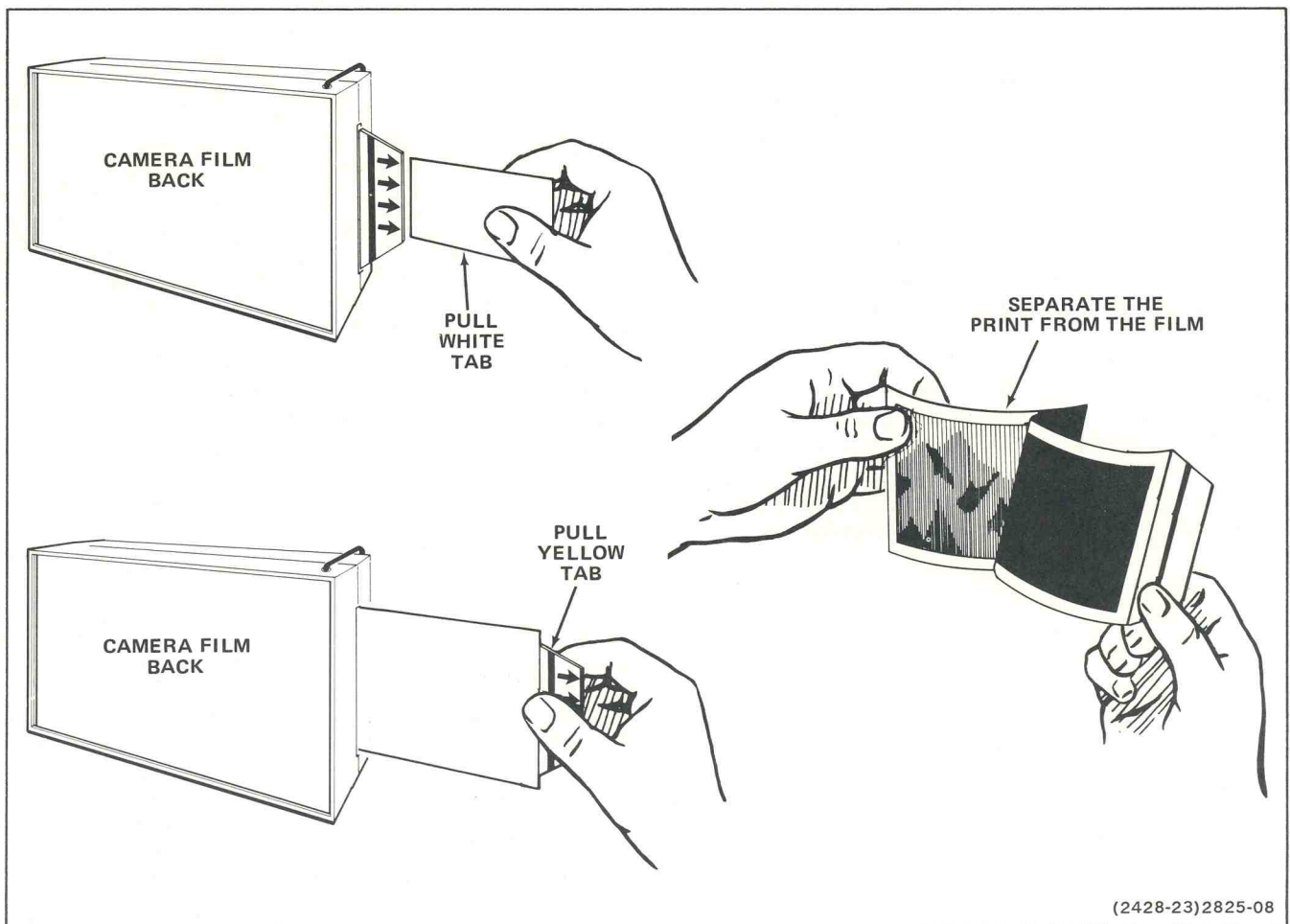


Figure 2-6. Developing the pack-film.

USING THE POLAROID ROLL-FILM BACK

Focusing

To focus the camera using the focus plate with a Polaroid Roll-Film back, perform the following procedure:

1. Obtain a properly-adjusted trace on the crt.
2. Open the camera by swinging the latch lever out and down from the top of the camera back as shown in Figure 2-7.
3. Open the back fully and swing out the inner panel.
4. Orient the frosted side of the focus plate toward the camera lens and insert the two bottom ears inside the edge of the camera-back film compartment. Gently press the upper mounting ears all the way into the film plane within the film compartment. The upper mounting ears must be compressed, and the focus plate inserted into the film compartment at the same time as shown in Figure 2-8(A). The half-circle cutout in the plate provides a finger hole for easy removal of the focus plate.
5. Set the aperture for maximum opening (f/1.9) and set the SPEED selector to T. With the shutter open, you should observe a display on the biprism of the focus plate.

NOTE

Either the crt horizontal trace or the internal graticule line may be used to adjust focus.

6. Release the FOCUS LOCK knob and adjust the FOCUS knob until the trace (or graticule line) is aligned with itself. Refer to Figure 2-8(B) for an example of an in-focus display.
7. Tighten the FOCUS LOCK knob to ensure that the focus setting cannot be changed accidentally.

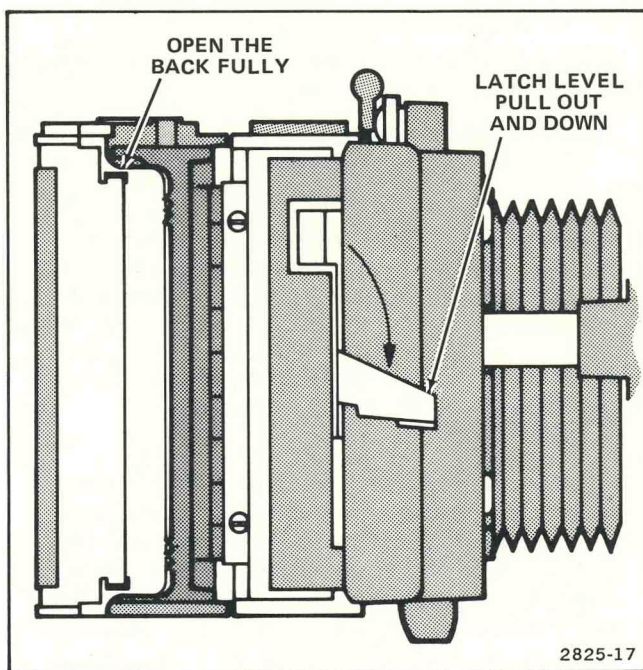


Figure 2-7. Opening the roll-film back.

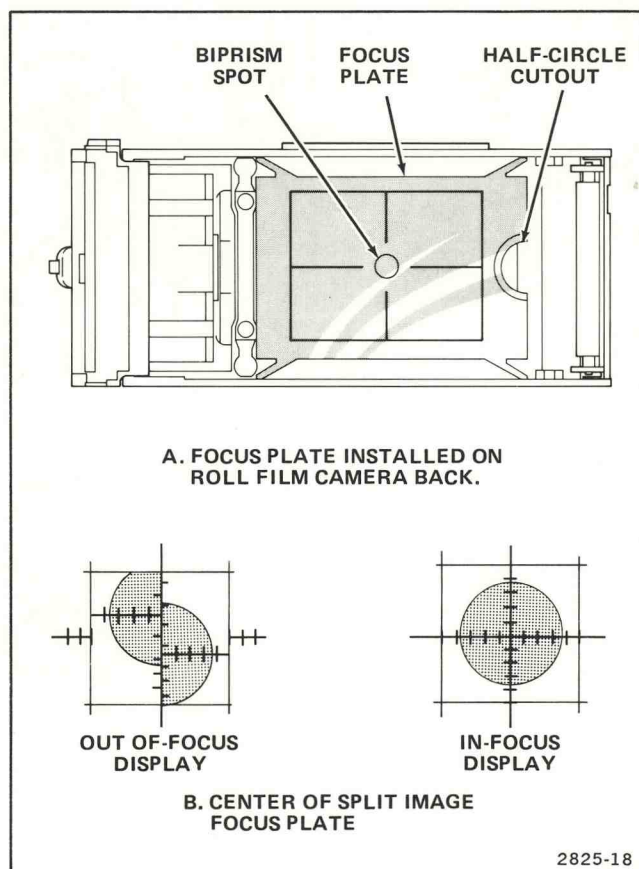


Figure 2-8. Installing and using the focus plate in the roll-film back.

Installing the Roll Film

1. To load the roll film pack, open the camera back by releasing the latch lever, and install the roll film by following the detailed instructions contained in the film box.
2. Close the back cover and hold it shut. Swing the latch lever all the way towards the bottom of the camera back to ensure that both sides of the back cover will latch, then swing the latch lever to the locked position (towards the top of the camera back). There should now be a short tab of paper extending beyond the cutter bar of the camera back.
3. Install the dark slide in the camera back to prevent exposing the first frame.
4. Hold the camera back and lift the cutter bar by raising up on the plastic edge. Once the cutter bar has been lifted, it will remain in the up (unlocked) position until it is pushed down.
5. Pull the film leader out of the camera back until it comes to a firm stop. About 15 inches of the film leader must be pulled out before it will stop in the proper position for the first exposure.
6. Lock the cutter bar with a gentle downward pressure. After it has latched, tear the film leader off and discard it.
7. The camera back is ready for the first picture. Mount the camera back on the camera main frame and make proper shutter and lens opening settings.
8. Remove the dark slide before taking a 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

After a picture is shot, advance and develop each exposure as follows:

1. Throw the red release switch in either direction to release the film. If you should throw it accidentally at any other time, don't worry—no harm is done.

2. Open the cutter bar by lifting the plastic edge and take a firm grip on the film tab. With a single motion pull the film tab straight out about seven inches. Pull it about as hard and rapidly as you might pull down a window shade; not hard enough to pull the shade off the roll (or the film off the spool), but not slowly and hesitantly. Remember, the film will stop automatically.

NOTE

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

3. Press down and latch the cutter bar. Tear off and discard the excess paper.
4. Wait the recommended development time. Follow the directions in the instruction sheet for development times under various conditions. It is important that you 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.
5. 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.

WARNING

Many developing solutions contain a caustic substance which may cause chemical burns. If you accidentally get the solution on your skin, wipe it off immediately and wash the area thoroughly as soon as possible. Be extremely careful to keep the solution away from the eyes and mouth.

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

USING THE GRAFLOK BACK

Focusing

To focus the camera with a Graflok back, perform the following procedure:

1. Obtain a properly-adjusted trace on the crt.
2. Set the aperture for maximum opening (f/1.9) and set the SPEED selector to T.
3. Press the release button on the bottom-rear side of the Graflok back to open the folding viewing hood as shown in Figure 2-9. With the shutter open, observe the image on the ground glass screen of the Graflok back.

NOTE

Either the crt horizontal trace or the internal graticule line may be used to adjust focus.

4. Release the FOCUS LOCK knob and adjust the FOCUS knob to produce a sharply-focused image of the crt trace (or internal graticule line) on the ground glass screen.
5. Tighten the FOCUS LOCK knob to ensure that the focus setting cannot be changed accidentally.

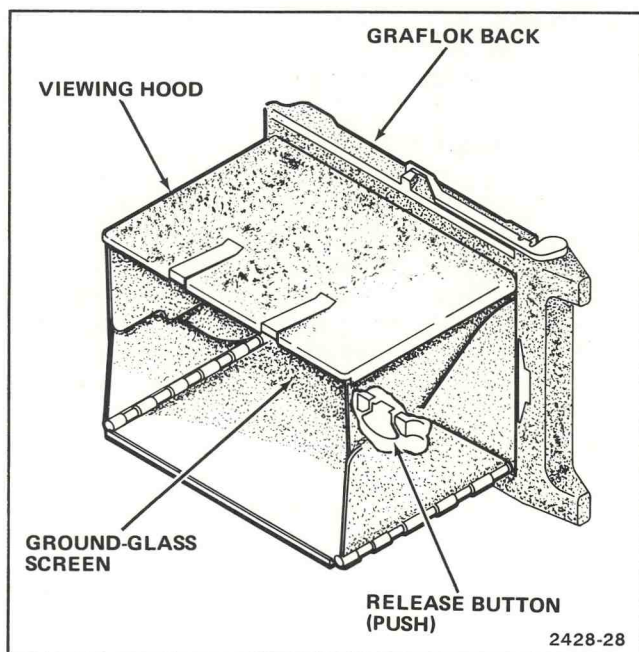


Figure 2-9. View hood attached to the Graflok back.

Installing Loaded Film Holders

Sheet film is available in a variety of types. Some sheet film requires prior loading into the film holder in a dark room, while others permit daylight loading. For loading conditions refer to the instructions contained with the particular film being used.

The following procedure can be helpful in installing most types of loaded film holders into the Graflok back. Figure 2-10 shows how to install a 4- by 5-inch film holder into a Graflok back.

1. Slide the top and bottom tab locks out to lift the locking mechanism away from the focusing panel.
2. Lift the hinged focusing panel on the adapter and insert the film holder into it.
3. Push the film holder into the Graflok back until it locks into place.
4. Check that the adapter is flush against the holder on all four sides.
5. Slide the top and bottom tab locks down to lock the film holder.
6. To remove the film holder from the adapter, slide the top and bottom tab locks up to unlock film holder. Lift the hinged focusing panel away from the camera slightly, grasp the film holder and lift it slightly, then pull outward.

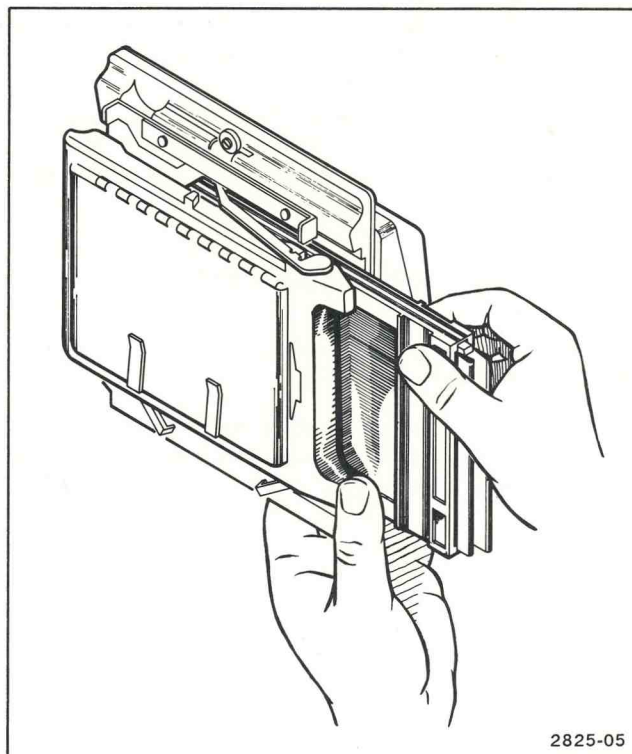


Figure 2-10. Installing the 4- by 5-inch cut film holder in the Graflok back.

PHOTOGRAPHIC CONSIDERATIONS

WRITING RATE

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

The faster the oscilloscope spot moves, the dimmer the trace becomes, since the electron beam strikes each point on the phosphor coating for a shorter period of time. A camera system and oscilloscope with a high writing rate are required for photographing low repetition rate displays at fast oscilloscope sweep rates, or single sweep displays.

Figure 2-11 shows one method of calculating writing speed. 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 two cycles fail to photograph. The writing rate of the system is found as follows. Starting from the left, find the first rapidly rising or falling portion of the damped sine wave that is photographed in its entirety. Let D represent the vertical distance (in centimeters) between the peaks connected by this portion. If D is three or more times as great as the horizontal distance occupied by one cycle (so that the horizontal component of velocity is small compared to the vertical component), the maximum writing rate (in centimeters per microsecond) is given approximately by:

$$\text{Maximum writing rate} = 3.14 Df$$

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

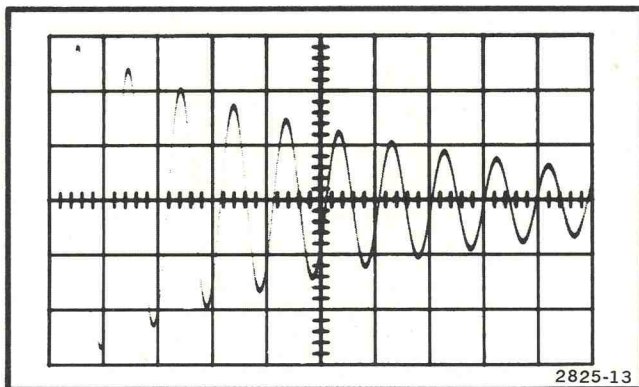


Figure 2-11. Single trace of a damped waveform.

Absolute writing speed of an oscilloscope and camera system is difficult to calculate because so many variables are involved. Among the variables are speed of the camera lens, type of crt phosphor, type of film, crt accelerating potential, camera lens, and development time of the film.

It is possible to compare the effectiveness of two films by measuring their writing speeds under identical conditions. In other words, the more effective of the two films under those particular conditions can be chosen without assigning a specific value to either film.

The rated ASA speed of a film reveals little about its effectiveness in recording single oscilloscope traces. This is because ASA speed rating is measured for 1/50 second exposure to light of normal daylight and spectral characteristics, while the very short exposures of fast crt traces are several orders of magnitude smaller and have different spectral distributions. There is usually some relationship between ASA rating and maximum writing rate, however. Thus it would be safe to assume that a film with a very high ASA speed rating would probably have a higher maximum writing rate than a film with lower ASA speed rating.

CRT SELECTION

There are a great number of crt phosphor types presently available. Each of these phosphors has certain advantages and disadvantages compared to the others. No single phosphor is best for all applications. Of the many types available, five are most commonly in use: 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 most often used, the following discussion is directed primarily toward them.

The most important single characteristic of a phosphor for photographic purposes is the color of its emitted light. A blue or violet fluorescence is the most suitable for photographic work. The shorter the wavelength of the visible peak-emitted light, the better the phosphor for photographic applications.

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

Most users of test and measurement instruments are concerned not only with photographing the oscilloscope trace but also in observing it directly. For such applications it is important to choose a phosphor such as P2 or P31, where the emitted light is bright enough to produce a good writing rate and persistence is sufficient to permit easy viewing.

For low-sweep-rate or repetitive-sweep applications, where a high writing rate is not required, most phosphor types are satisfactory. It is only for single-sweep or low-repetition-rate applications at the fast sweep rates that selection of a particular 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.

Since Types P2 and P31 appear best for combined general purpose and photographic applications, they are standard on most Tektronix oscilloscopes designed for extremely rapid sweeps. Other phosphors can be obtained on any of the Tektronix oscilloscopes.

Table 2-1 shows the relationship between the most commonly used phosphors.

FILM SELECTION

For most crt reading uses, Polaroid films are likely to be most convenient. They offer the advantages of development in seconds to a finished dry print with wide spectral response, good resolution, and high sensitivity. Many different types of Polaroid film are available in packs, rolls, and 4- by 5-inch single-sheet packets. Refer to Table 2-2 for the films most commonly used with the C-30B Camera.

Table 2-1
Commonly-used Phosphors

Phosphor Type	Relative Photographic Writing Speed ^a (P11 used as Standard)	Relative Brightness Representative of 10 kV Aluminized Screens ^b (P31 used as Standard)	Wavelength of Peak Radiant Energy (nanometers)	Decay Time to 0.1% of Initial Value (ms)	Color	
					Fluorescence	Phosphorescence
P1	20% as fast	50% as bright	520	95	Yellowish-green	Yellowish-green
P2	40% as fast	55% as bright	510	120	Bluish-green	Yellowish-green
P7	75% as fast	35% as bright	450	1500	Blue	Yellowish-green
P11	100%	15% as bright	450	20	Purplish-blue	Purplish-blue
P31	50% as fast	100%	530	32	Yellowish-green	Yellowish-green

^aTo achieve the writing rate comparisons the shutter of the test camera was left open five seconds to make use of the remaining phosphor decay.

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

Table 2-2
Commonly-used Polaroid Film for the C-30B Camera

Film Type	ASA Equivalent Speed	Development Time (Seconds at 75° F)	Format	Resolution (Line Pairs/mm)	Characteristics	CRT Recording Uses					
						Repetitive	Stored	TV Type (Gray Scale)	Scintillation Type Medical	Graphics Alpha-Numeric	Single Sweep
PACK FILMS 3¼ x 4¼ in — Actual image size 7.3 cm x 9.5 cm											
611 ^a	200	45	Positive Print	20	Low Contrast, wide gray scale			X			
665	75	30	Positive Print Negative	20-25 160-180	Medium Contrast, wide gray scale	X	X	X			
107	3,000	15	Positive Print	20	Medium Contrast	X	X				X
084 ^b	3,000	15	Positive Print	20	Medium Contrast	X	X	X	X		
667 ^{a, b}	3,000	30	Positive Print	16	Medium Contrast	X	X	X	X		
108 ^a	75	60	Positive Print	15-17	Color—Balanced for 5500° K	X		X			
668 ^a	75	60	Positive Print	15-17	Color—Balanced for Electronic Flash	X		X			
ROLL FILMS 3¼ x 4¼ in — Actual image size 7.3 x 9.5 cm (46L and 146L are 6.2 x 8.3 cm)											
42	200	15	Positive Print	25-28	Medium Contrast, wide gray scale	X	X	X			
42	3,000	15	Positive Print	20-22	Medium Contrast	X	X				X
410	10,000	15	Positive Print	20	High Contrast						X
46L	800	120	Positive Trans	35-40	Medium Contrast	X	X	X			
146L	200 ^c	30	Positive Trans	40-50	High Contrast, Blue Sensitive	X				X	
	100 Tungston										
SHEET FILMS 4 x 5 in — Actual image size 8.9 x 11.4 cm											
51	320 ^c	15	Positive Print	28-32	High Contrast, Blue Sensitive					X	
	115 Tungston										
52	400	15	Positive Print	35-40	Medium Contrast, wide gray scale	X	X	X			
55			Positive Print	22-25							
55 P/N	50	20	Negative	160	Medium Contrast, wide gray scale	X	X	X			
57	3,000	15	Positive Print	20	Medium Contrast	X	X			X	X
58 ^a	75	60	Positive Print	15-17	Color—Balanced to 5500° K	X		X			

^aNo coating required.^bPreferred for oscilloscope photography.^cDaylight rating.

HELPFUL TECHNIQUES WITH FILM

Polaroid Film

CAUTION

Polaroid recommends that spray-on matte finishes not be used as a method of note making on self coating Polaroid film.

MAKING NOTES. Several types of spray-on matte finishes are available which will enable you to make pencil or pen notes directly on non-self-coating Polaroid prints only. They can be obtained from any art or photographic 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 can then be used to write data on the print.

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.

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.

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 development time will sometimes bring out waveform details not otherwise visible.

PREFOGGING. A method which sometimes produces very good results with Polaroid Land films is prefogging. In prefogging, the film is first 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 rate of two or more times, depending on film types, film condition, the nature of the prefog light, and other variables. Prefogging results in a slightly foggy background on the photographs, with somewhat less contrast. This is sometimes a small price to pay for a large increase in writing rate. A writing speed enhancer is available to perform this function, see tabbed Accessories page at the rear of this manual.

POSTFOGGING. This 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 rate as prefogging. The writing speed enhancer can be used in postfogging to increase the writing rate.

TRANSILLUMINATION. While not strictly a means of improving writing rate, transillumination permits better viewing of the information 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 Figure 2-12). The light passing through the print brings out detail which would not otherwise be evident. The transillumination technique will not work on films, which have an opaque plastic base.

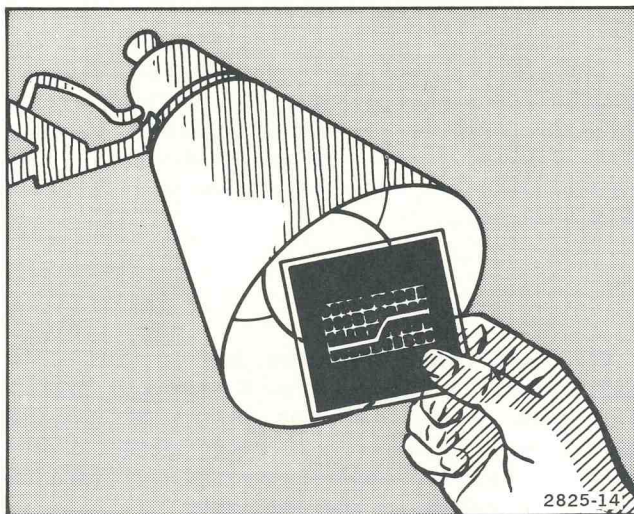


Figure 2-12. Using transillumination to see otherwise invisible information.

CONTINUOUS TONE (GRAY SCALE) DISPLAY.

Photographing a continuous tone (gray scale) display requires a technique different from that used for trace recording. In trace recording, it is necessary to record two levels of intensity—white for trace and graticule, black or gray for the background. In gray scale photography, it is important to record a whole range of tones that may be only slightly different from one another.

A common problem when taking photographs of a continuous tone display is that the print develops with a loss of detail in the dark and light areas. A contributing factor relates to the difference between the human eye and film print reproduction. The eye is extremely sensitive with a wide dynamic range that accommodates (within one scene) brightness intensity ranges approaching 1000:1. Polaroid Type 0847 or 667 film have a usable range of approximately 15:1. Polaroid Type 611 has a wide brightness intensity range and is recommended for gray scale photography.

There is quality gray scale tonal rendition when the film print renders information in both the darkest and lightest area of display presentation. Crt photography allows adjustment of camera shutter speed, aperture opening and instrument contrast to produce an acceptable photograph. Adjusting the instrument so that the display appears low in contrast, or "washed out" will merge the brightness (light intensity) of the display for better film reproduction. This adjustment compresses the display brightness within the recordable range of the film. Once this is set, adjust the camera shutter and aperture control to obtain details in the darkest areas of interest. Generally, this process will require experimentation to produce satisfactory results.

Conventional Film

The matte-finish sprays referred to previously for marking Polaroid film are also good for coating standard prints and negatives for marking purposes. 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 on prefogging, postfogging, and continuous tone display Polaroid film apply equally 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.

PICTURE TAKING

Photographing Repetitive Signals

The following procedure can be used as a guide to obtain an exposure of a repetitive signal trace:

1. Position the external graticule, if the instrument crt has one, for the white lines.
2. Mount the camera on the instrument with the proper camera adapter.
3. Obtain the signal and adjust the controls for the desired display.
4. Attach the camera to the adapter and secure the camera against the instrument.
5. Adjust instrument focus, astigmatism, and intensity controls to obtain a sharp trace.
6. Set the f-STOP selector for the largest lens opening (smallest f-STOP number) and carefully focus the camera.

NOTE

When using an instrument with an external graticule, focus the camera halfway between the trace and the external graticule and set the aperture to the highest f-number that will still allow adequate film exposure.

7. Set the instrument intensity control between one-third and one-half clockwise, Scale Illumination three-quarters clockwise, camera SPEED selector to 1/30, and f-STOP selector to f/5.6. The above control settings should be reasonably close for most film around 200 ASA and a waveform with a frequency near 1 kHz. For film with a 3000 ASA rating and a waveform with a frequency near 1 kHz, use a SPEED selector setting of 1/4 and an f-STOP selector setting of f/5.6.

Photographing Single-Sweep Displays

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

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

1. Use steps 1 through 6, under Photographing Repetitive Signals, to set up the camera.
2. Select a shutter speed which keeps the shutter open longer than the time of the event to be photographed (at least 10 seconds).
3. Use the highest practical intensity without causing defocusing of the trace. Photograph fast areas of a display at the center of the crt to make use of the light transmission characteristics of the lens. This prevents many defocusing problems caused by high intensity settings.
4. Where practical use an f-STOP setting higher than f/4 if an external graticule is used. This permits both the trace and the external graticule to be in focus.
5. Since the shutter speed has already been determined, the quality of the photographic reproduction will depend largely on the selection of lens opening. In single-sweep applications make camera settings for the trace intensity and duration; graticule illumination cannot be used as a reference.

PICTURE TROUBLE

Wide Trace

If the trace is too wide on the picture (defocused due to high light intensity), use either a higher f-STOP setting or a faster shutter speed. If the defocused trace cannot be improved by using either a higher f-STOP setting or a faster shutter speed, refocus the camera.

No Image on Picture

1. Use higher intensity and scale illumination settings.
2. Use a slower SPEED selector setting.
3. Set the f-STOP selector to a smaller number.
4. Leave the shutter open for 10 seconds after trace occurs so that all possible display light will be integrated (Single-Sweep Applications).
5. Use a film with a higher ASA rating.
6. Prefogging or postfogging may help. Refer to Helpful Techniques with Film (Single-Sweep Applications).
7. If Polaroid film is being used, try underdeveloping it; i.e., remove the print before full development time has expired (Single Sweep Applications).

Light Streaks on Picture

1. If light leaks in the bellows between the shutter box and camera back, see your local Tektronix Representative for repair.
2. The light seal between camera and oscilloscope may be faulty.
3. Rollers in the Polaroid camera back may be dirty.
4. Polaroid film pack was handled too roughly during loading.

Fogging on Picture

1. Scale illumination control is set too high.
2. Light-struck or bad film.
3. Film exposed to light during loading.

Trace or External Graticule in Focus, But Not Both

1. Use f-STOP setting larger than f/4 when photographing an external graticule.
2. Camera should be refocused because of object-to-image ratio change.

Some Portions of Photographed Signal Appear Brighter Than Others

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

ELIMINATING PARALLAX AND FOCUSING DIFFICULTIES

Tektronix instruments with the internal "no parallax" graticule and variable edge-lighting will have no parallax problems and therefore no focusing difficulties.

On some instruments the trace and graticule are not in the same plane, resulting in parallax. This makes it impossible to simultaneously obtain good focus on both the trace and graticule at f-STOP settings below f/4. Both of these difficulties can be eliminated by either of two methods. Both methods involve double exposing the film.

First Method

Set up the instrument display as usual and focus the camera on the trace. Turn the graticule intensity to minimum and make the first exposure on the trace only. Then increase graticule intensity to its former brightness and set the camera lens to its smallest lens opening (largest f-STOP number). Readjust the shutter speed to compensate for the smaller lens opening. Turn down the crt trace intensity and make a second exposure of the graticule only. The resulting photograph, due to the greater depth of field when making the graticule exposure, will have some parallax error between graticule and trace, but both the graticule and trace will be in proper focus. Care must be taken in using this method to ensure that the position of the film for the second exposure is exactly the same as for the first exposure.

Second Method

Set up the instrument display as usual and focus the camera on the trace. Turn the graticule intensity to minimum and make the first exposure on the trace only. Then increase the graticule intensity to its former brightness and refocus the camera on the graticule. Turn down the crt trace intensity and make a second exposure of the graticule only. The resulting photograph, due to refocusing between exposures, will have no parallax error between graticule and trace; both the graticule and trace will also be in proper focus. Care must be taken in using this method to ensure that the position of the film for the second exposure is exactly the same as for the first exposure.

EFFECTS OF THE f-STOP SETTING ON THE DEPTH OF FIELD

The depth of field defines the range of distance from the camera lens over which objects will still be in focus at the film plane. As shown in Figure 2-13(A), a wide aperture opening (corresponding to a small f-STOP setting) permits light rays to pass through the outer extremities of the lens. These peripheral rays converge rapidly to focus on the film plane. Consequently, when the distance from the lens to the object is changed slightly, the image on the film defocuses quite rapidly due to the sharp convergence of the light rays.

In Figure 2-13(B), the same lens is shown with a smaller aperture (corresponding to a larger f-STOP setting). Now when the object distance is changed, the image defocuses much more slowly due to the slower convergence of the light rays.

Accordingly, setting the f-STOP control to the largest number that will still provide sufficient film exposure will help provide the sharpest image.

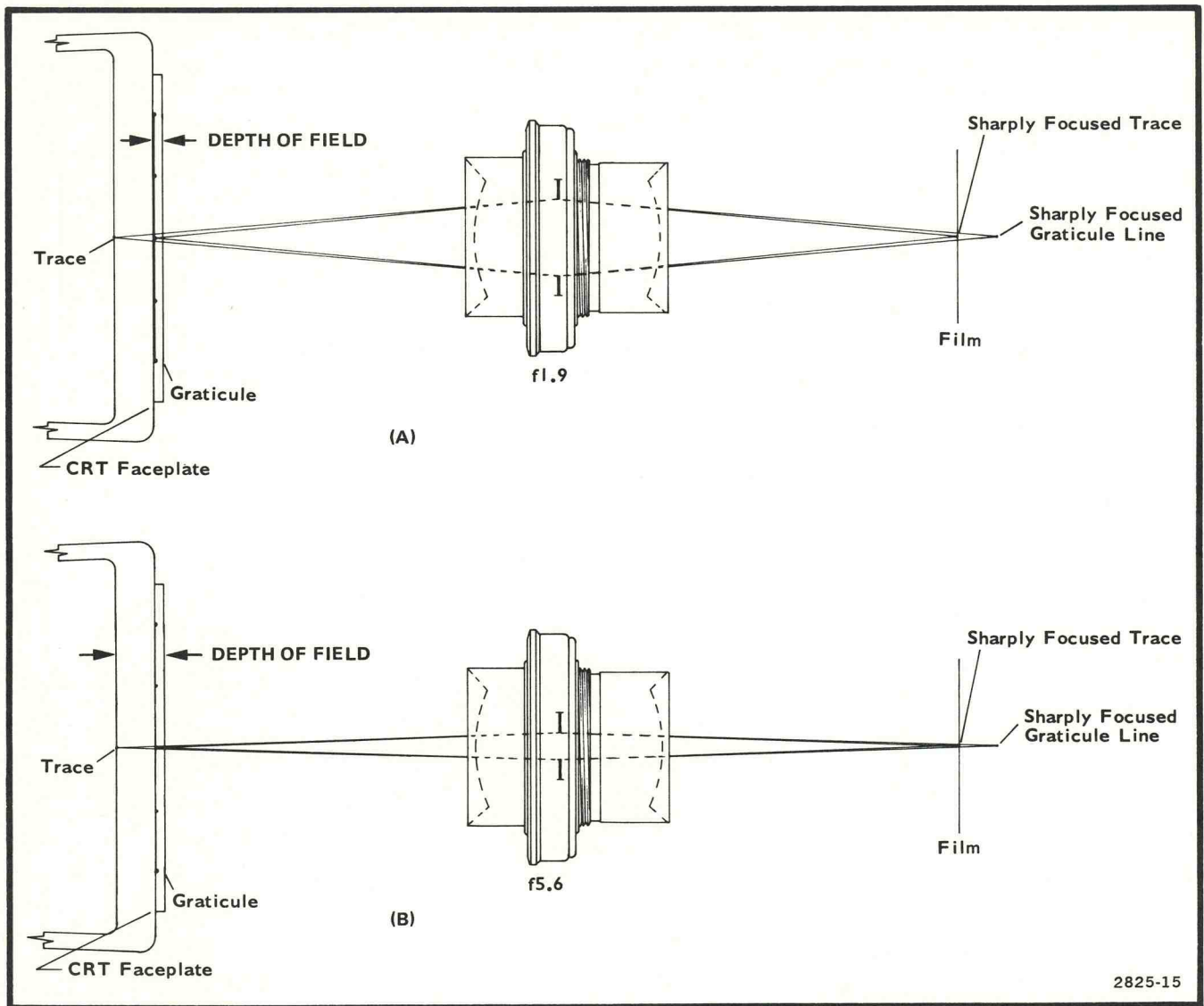


Figure 2-13. Depth of field for different aperture settings.

EFFECTS OF CAMERA MAGNIFICATION ON EXPOSURE

The camera or lens object-to-image ratio is the ratio of the object size to the image size. For example, a 1:1 setting is one whose object is the same size as the image. The object-to-image ratio of the camera lens has a definite effect on the exposures obtained. It affects the amount of light which will fall on a given point of the film. The smaller the image on the film, the greater the intensity of the light. Therefore, the larger the object-to-image ratio, the less time is required to obtain a good exposure on the film. With a 1.07 setting, slightly less exposure time is required to photograph a display than with a 1.09 setting. The difference in the exposure time required between the various settings is so slight, however, that it can usually be ignored.

It is important to note that a better writing rate can be obtained with a small object-to-image ratio than with a large object-to-image ratio. Here again, the difference is fairly small unless there is a wide difference in the ratio (e.g., 1.05 has a better writing rate than 1.2).

RECIPROCITY

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

MAINTENANCE

GENERAL CARE OF THE CAMERA SYSTEM

The C-30B Camera is designed to provide long, trouble-free service if given the same care as other precision optical devices. Care should be taken in handling the various mechanisms to assure that they are not damaged.

LENSES

NOTE

Do not attempt to disassemble lenses. The lens assemblies are sealed; therefore, dirt should not get on their inner surfaces.

To obtain maximum use from your camera, always keep the external lens surfaces clean. When required, remove loose dust with a soft camel-hair brush. Fingerprints and other smudges can be removed with clean, high-quality lens tissue. Avoid scratching the lenses while cleaning.

The front and rear lens surfaces may be cleaned by attaching the cleaning materials to a long rod. The rod is then inserted through either the front opening or the back opening of the camera to reach each side of the lens to be cleaned.

SHUTTER

NOTE

Do not attempt to disassemble the shutter mechanism. If the shutter does not perform properly, consult your local Tektronix representative.

During manufacture special lubricants have been added to the shutter, making further lubrication unnecessary during its lifetime. It is essential that neither oil nor graphite be used on the shutter mechanism, since either substance may ruin it. Sluggish shutter operation may be the result of continuous wear or extreme environmental conditions.

CAMERA BACK ROLLERS

Both the Pack-Film and Roll-Film backs contain two stainless steel rollers used in processing exposed film. These rollers may collect a buildup of film developing solution and therefore should be inspected each time a new film pack or film roll is inserted. If required, clean the rollers before inserting new film.

Instructions for cleaning the rollers are found inside the camera back door. Should these instructions be missing or faded, the rollers can be cleaned by using a damp cloth or cotton-tipped applicator to remove any deposits.

For the Pack-Film back, the rollers can be removed by lifting the rear of the roller assembly up and out of the camera back. To replace the assembly, set the rollers down into the camera back. Then gently push the rear of the roller assembly down into the camera back until the small plastic retaining latch on the roller assembly catches and hold the rollers in place.

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, nonhardening, weather-stripping adhesive. If a light leak occurs or if one of the previously sealed parts is being replaced, it is recommended that No. 2 Permatex, 3M weather-strip adhesive No. 8011 (or a material with similar characteristics) be used as a light-sealing material.

MAGNIFICATION ADJUSTMENTS

To verify that the camera magnification setting is correct, perform steps 1 through 4 of the following procedure. If there is a need for resetting the magnification, perform the remaining steps of the procedure.

1. With the camera mounted to the instrument, obtain a sharply-focused display of known amplitude on the crt.
2. Set the camera magnification to 1.
3. If a Pack-Film or a Roll-Film back is being used, install a focusing plate and focus the crt display. If a Graflok back is being used, press the viewing hood release button and focus the crt display on the frosted plate. Secure the focus setting by tightening the FOCUS LOCK knob.
4. Measure the image size on the focusing plate (or Graflok back) and compare it to the trace size on the crt display. The magnification ratio should be 1:1.
5. If the ratio is not 1:1, loosen the magnification sleeve lock collar set screw by using a 0.050-inch hexagonal wrench. Slowly slide the camera either toward the instrument to increase the image size or away from the instrument to decrease image size (see Figure 3-1).
6. Tighten the magnification sleeve lock collar set screw. Release the FOCUS LOCK knob and focus the camera.
7. Again determine the ratio between the crt trace and the image on the focusing plate (or Graflok back). It should be 1:1.
8. If a 1:1 ratio cannot be attained between the crt trace and the image on the focusing plate (or Graflok back), repeat steps 4 through 7 until the image size is correct.

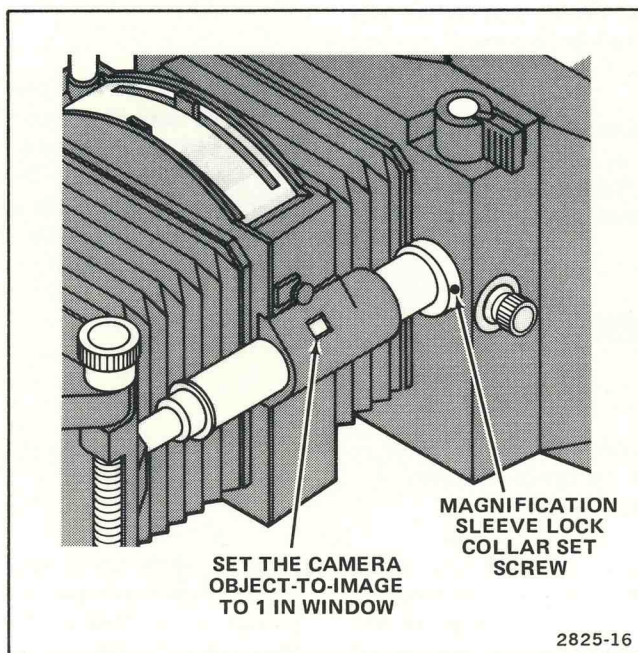


Figure 3-1. Sleeve lock collar location.

COMPONENT REPLACEMENT

REPLACEMENT PARTS

Most mechanical parts can be obtained through your local Tektronix representative. However, you should be able to obtain many of the standard parts from a commercial source in your area. Before you purchase or order a part from a source other than Tektronix, Inc., please check the parts list for the proper size, tolerance, and description.

When ordering replacement parts from Tektronix, Inc., it is imperative that all of the following information be included to ensure receiving the proper parts.

1. Camera type (C-30B Camera).
2. Camera serial number.
3. A description of the mechanical part.
4. Tektronix part number.

INSTRUMENT REPACKAGING

Should reshipment become necessary, reuse the original carton in which your instrument was shipped. If original packaging is unfit for use or is not available, repackage the instrument as follows:

1. Obtain a corrugated cardboard carton having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Use a carton having a test strength of at least 200 pounds.
2. Surround the instrument with protective polyethylene sheeting.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.
4. Seal carton with shipping tape or industrial stapler.

Required Reshipment Information

If the instrument is to be shipped to a Tektronix Service Center for service or repair, before packaging, attach a tag containing the following information:

1. Owner's name and address, with the name of an individual at your firm that can be contacted.
2. Complete instrument serial number.
3. Description of the services required.

OPTIONS

Your camera may be equipped with one or more camera options. A brief description of each option is given below. For further information relating to camera options see your Tektronix Products Catalog or contact your local Tektronix representative.

OPTION 1

The C-30B Option 1 is a C-30B Camera with the addition of an adapter frame/corrector lens which increases the camera's field of view so that it can photograph a full 8- by 10-cm crt display or an 8- by 10-division (1 division = 0.9 cm) crt display with no vignetting. To take full advantage of the corrector lens, set the C-30B Camera magnification to 1. This will yield an object-to-image ratio of 1:0.8.

REPLACEABLE MECHANICAL PARTS

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 number, and modification number if applicable.

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

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

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number
00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

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

```

1 2 3 4 5      Name & Description
Assembly and/or Component
Attaching parts for Assembly and/or Component
    --- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    --- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
    --- * ---
  
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol --- * --- indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICON	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EQPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BR	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCPT	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLEXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDNT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000CJ	BOYD INDUSTRIAL RUBBER	8033 NE HOLMAN	PORTLAND, OREGON 97218
000DF	KEN R HUMKE	2211 NW NICOLAI	PORTLAND, OREGON 97210
000EC	R.B. HOWELL	630 NW 10TH	PORTLAND, OREGON 97209
000FK	GEISS-AMERICA	7330 NILES CENTER RD.	SKOKIE, ILL 60076
000FL	MCGUIRE BEARING CO.	947 S.E. MARKET ST.	PORTLAND, ORE 97214
000FM	JML OPTICAL INDUSTRIES	850 HUDSON AVE.	ROCHESTER, NY 14621
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153

Replaceable Mechanical Parts—C-30B Camera

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	214-0647-01		2		HNG PIN-KNOB AS:	80009	214-0647-01
-2	214-0626-00		2		SPRING,HNG PIN:0.260 OD X 2.3 L	80009	214-0626-00
-3	210-1009-00		2		SHIM:0.2 ID X 0.014 THK	80009	210-1009-00
-4	354-0290-01		2		RING,RETAINING:EXT,TYPE E,U/O 0.172 DIA	79136	5133-X-17MD
-5	426-0284-03		1		ADAPTER,CAMERA:	80009	426-0284-03
	213-0204-00		2		THUMBSCREW:4-40 X 0.375,0.312 OD (ATTACHING PARTS)	80009	213-0204-00
-6	212-0573-00		2		SCREW,CAP:10-32 X 0.750,SCH,STL - - - * - - -	000DF	OBD
-7	214-0752-00		2		GASKET:LT SEAL,3.25 SQ X 0.125 THK (ATTACHING PARTS)	80009	214-0752-00
-8	211-0123-00		4		SCREW MACHINE:1-72 X 0.188,PNH,STL BK OXD - - - * - - -	77250	OBD
-9	214-0627-00		1		BELLOWS,CAMERA:3.038 SQ X 2.75 L	80009	214-0627-00
-10	352-0342-00		1		HOLDER,LENS:OUTER ADAPTER (ATTACHING PARTS)	80009	352-0342-00
-11	211-0025-00		3		SCREW,MACHINE:4-40 X 0.375 100 DEG,FLH STL - - - * - - -	83385	OBD
-12	214-0659-00		1		GASKET:LT SEAL,1.5 ID X 0.103 THK	000FL	8128
-13	200-2411-01		1		COVER,SHTR HSG: (ATTACHING PARTS)	80009	200-2411-01
-14	211-0119-00		1		SCREW,MACHINE:4-40X0.25" 100 DEG,FLH,STL - - - * - - -	83385	OBD
-15	361-0096-00		1		SPACER,POST:0.775 L W/4-40 THD ONE END	80009	361-0096-00
-16	214-0610-00		1		SPRING,MGF LOCK:0.464 X 3.03 MUSIC WIRE	80009	214-0610-00
-17	366-1817-00		1		PUSH BUTTON:0.31 DIA X 1.05 L	80009	366-1817-00
-18	361-0996-00		1		SPACER POST:1.5 L 2-56 INT THD ONE END	80009	361-0996-00
-19	214-2973-00		1		PLGR,SHTR RLSE:BRASS	80009	214-2973-00
-20	122-1024-00		1		LENS,CAMERA:F1.9,56MM	000FM	B55120-1
-21	122-1022-00		2		RING,F-STOP:SHUTTER SPEED	80009	122-1022-00
-22	122-1023-01		1		SHUTTER,PHOTO:	80009	122-1023-01
	-----		1		. RING,RETAINING:	000FK	0257-164
-23	361-0997-00		1		SPACER,POST:1.027 L,2-56 EXT THD ONE END	80009	361-0997-00
-24	386-0228-00		2		INSULATOR,PLATE:OUTLET POST,BLACK DELRIN (ATTACHING PARTS)	80009	386-0228-00
-25	214-0655-00		2		CONTACT,ELEC:CONNECTOR,STERLING SIL	80009	214-0655-00
-26	210-0259-00		2		TERMINAL,LUG:0.099"ID INT TOOTH,SE	80009	210-0259-00
-27	210-0405-00		2		NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS - - - * - - -	73743	2X12157-402
-28	214-0613-00		1		PIN,STR,HEADED:0.25 DIA X 0.603	80009	214-0613-00
-29	334-3685-00		1		PLATE,INSTR:	80009	334-3685-00
-30	380-0592-01		1		HSG,CAMR SHTR: (ATTACHING PARTS)	80009	380-0592-01
-31	211-0123-00		4		SCREW MACHINE:1-72 X 0.188,PNH,STL BK OXD	77250	OBD
-32	211-0119-00		1		SCREW,MACHINE:4-40X0.25" 100 DEG,FLH,STL - - - * - - -	83385	OBD
-33	122-1025-00		1		CA ASSY,SP,ELEC:3.75 L CAMERA FLASH X-SYNC CORD	80009	122-1025-00
-34	214-0635-00		1		BRG,SHTR BOX:HOUSING,LEFT SIDE (ATTACHING PARTS)	80009	214-0635-00
-35	211-0118-00		4		SCREW,MACHINE:2-56 X 0.250 INCH,PNH STL - - - * - - -	83385	OBD
-36	166-0411-00		1		SPACER,SLEEVE:3.209 L X 0.56 ID	80009	166-0411-00
-37	334-0967-00		1		MARKER,IDENT:MKD W/F-STOP NUMBERS	80009	334-0967-00
-38	214-0623-00		1		COLLAR,MGF ADJ:0.75 OD X 0.188 THK (ATTACHING PARTS)	80009	214-0623-00
-39	213-0022-00		1		SETSCREW:4-40 X 0.188 INCH,HEX SOC STL - - - * - - -	74445	OBD
-40	214-0752-00		2		GASKET:LT SEAL,3.25 SQ X 0.125 THK	80009	214-0752-00
-41	214-0627-00		1		BELLOWS,CAMERA:3.038 SQ X 2.75 L	80009	214-0627-00
-42	166-0416-00		1		TUBE,GUIDE:RIGHT,0.498 OD X 5.689 L,SST	80009	166-0416-00
-43	166-0412-00		1		TUBE,GUIDE:LEFT,0.498 ODX 5.689 L,SST	80009	166-0412-00
-44	384-0372-00		1		SPACER,POST:5.874 L X 0.375 OD STEEL	80009	384-0372-00
-45	384-0373-00		1		SPACER,POST:5.874 L X 0.375 OD STEEL	80009	384-0373-00
-46	214-0624-00		4		BRG,SPRT ROD:0.405 OD X 0.305 ID X 0.343	80009	214-0624-00
-47	252-0550-00		FT		TAFFETA:0.187 W,BLACKVELVET	000EC	OBD

Replaceable Mechanical Parts—C-30B Camera

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-48	214-0163-00		1		LATCH,CAMR BACK: (ATTACHING PARTS)	80009	214-0163-00
-49	212-0039-00		1		SCREW,MACHINE:8-32 X 0.375 INCH,TRH STL	83385	OBD
-50	210-0044-00		2		WSHR,SPR TNSN:0.23 ID X 0.375 OD,STL	78189	3502-12-01-0531
-51	358-0108-00		1		BUSHING,SLEEVE: - - - * - - -	80009	358-0108-00
-52	334-0969-00		1		MARKER,IDENT:MKD FOCUS LOCK	80009	334-0969-00
-53	366-0340-00		1		KNOB:BLK,0.252 ID X 0.72 OD X 1.172 L X 0.5 H (ATTACHING PARTS)	80009	366-0340-00
-54	213-0126-00		2		SETSCREW:6-32 X 0.25,STL BLK OXD,HEX - - - * - - -	74445	OBD
-55	210-1015-00		1		WASHER,SPR TNSN:0.254 ID X 0.01 THK,STL	78189	3502-14-47
-56	384-0370-00		1		EXTENSION SHAFT:1.46 L X 0.25OD SST	80009	384-0370-00
-57	358-0280-00		1		ADAPTER,BUSHING:0.375-32/0.25-20 X 0.54 L	80009	358-0280-00
-58	200-0829-00		1		CAP.,SHAFT END:0.302 OD X 0.475 L,NYLON	80009	200-0829-00
-59	334-0966-02		1		MARKER,IDENT:MKD FOCUS	80009	334-0966-02
-60	366-0338-00		1		KNOB:SST,0.127 ID X 0.5 OD X 0.335 H (ATTACHING PARTS)	80009	366-0338-00
-61	213-0048-00		1		SETSCREW:4-40 X 0.125 INCH,HEX SOC STL - - - * - - -	74445	OBD
-62	358-0279-00		1		BSHG,MACH THD:0.312-24 X 0.128 ID,SST,0.403 L	80009	358-0279-00
-63	384-0371-00		1		EXTENSION SHAFT:1.01 L X 0.188 OD	80009	384-0371-00
-64	334-0970-00		1		MARKER,IDENT:MKD FOCUS INDEX	80009	334-0970-00
-65	348-0187-00		2		FOOT,CABINET:0.780 X 1.650 INCH LONG (ATTACHING PARTS)	80009	348-0187-00
-66	211-0595-01		2		SCREW,CAP:6-32 X 0.250,SCH,STL - - - * - - -	000DF	OBD
-67	344-0039-00		1		CLIP,ADAPTER: (ATTACHING PARTS)	80009	344-0039-00
-68	211-0065-00		2		SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL - - - * - - -	77250	OBD
-69	212-0039-00		2		SCREW,MACHINE:8-32 X 0.375 INCH,TRH STL	83385	OBD
-70	122-0749-03		1		FRAME,CAMERA:REAR,BLACK (ATTACHING PARTS)	80009	122-0749-03
-71	211-0123-00		4		SCREW MACHINE:1-72 X 0.188,PNH,STL BK OXD - - - * - - -	77250	OBD
-72	124-0178-00		1		STRIP,LT SEAL:15.0 X 0.187 X 0.125	000CJ	OBD

Replaceable Mechanical Parts—C-30B Camera

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
										OPTION 1		
	016-0269-04			1						ADAPTER, CAMERA: TO SCOPE W/LENS	80009	016-0269-04
	352-0341-01			1						HOLDER, LENS: INNER W/LENS	80009	352-0341-01

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
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STANDARD ACCESSORIES

016-0306-01				1						ADAPTER, CAMERA:	80009	016-0306-01
062-4098-00				1						DATA SHEET:	80009	062-4098-00
070-2825-00				1						MANUAL, TECH: INSTRUCTION	80009	070-2825-00
122-0752-01				1						BACK, CAMERA: PACK FILM	80009	122-0752-01
-----				-						(STANDARD WITH P MODELS)		
122-0754-00				1						BACK, CAMERA: ROLL FILM	80009	122-0754-00
-----				-						(STANDARD WITH R MODELS)		

OPTIONAL ACCESSORIES

THE FOLLOWING ACCESSORIES ARE LISTED AS A CONVENIENCE TO HELP YOU MEET YOUR PHOTOGRAPHIC NEEDS. FOR INFORMATION AND PRICES, REFER TO THE TEKTRONIX PRODUCTS CATALOG OR CONTACT YOUR LOCAL TEKTRONIX REPRESENTATIVE.

012-0564-01				1						CA, ELCTD ADPTR: LEFT ARM 48.0 L	80009	012-0564-01
016-0246-02				1						AUX LENS KIT: PORTRAIT	80009	016-0246-02
016-0284-01				1						WRITING RT ENHA:	80009	016-0284-01
016-0487-00				1						ADPTR, CAMR BACK:	80009	016-0487-00
016-0587-00				1						CASE, CARRYING: CAMERA	80009	016-0587-00
122-0586-00				1						CA RLSE, PHOTO: 20.0 L W/EASTMAN THREAD	80009	122-0586-00

REFER TO THE FOLLOWING TABLE FOR A LISTING OF CAMERA ADAPTERS AVAILABLE FOR MOUNTING THE C-30B CAMERA ON TEKTRONIX INSTRUMENTS.

016-0306-01				1						ADAPTER, CAMERA:	80009	016-0306-01
-----				-						(USED WITH 422, 453, 453A, 454, 454A,		
-----				-						485 AND 491 INSTRUMENTS)		
016-0327-01				1						ADAPTER, CAMERA: EXTENSION	80009	016-0327-01
-----				-						(USED WITH 305, 314, 326, 335, 1502, 1503,		
-----				-						SC502 AND SC504 INSTRUMENTS)		
016-0301-01				1						ADAPTER, CAMERA: (PROVIDED WITH OPTION 1)	80009	016-0301-01
-----				-						(USED WITH 432, 434, 455, 464, 466, 465, 465B,		
-----				-						475 AND 475A INSTRUMENTS)		
016-0248-01				1						WRITING RT ENHA:	80009	016-0248-01
-----				-						(USED WITH 601, 602, 605, 606, 606A, 607		
-----				-						AND 607A INSTRUMENTS)		

MANUAL CHANGE INFORMATION

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

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

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107 108	PG 501 - Risetime less than 3.5 ns into 50 Ω . PG 501 - 5 V output pulse; 3.5 ns Risetime	107 - Risetime less than 3.0 ns into 50 Ω . 108 - 10 V output pulse 1 ns Risetime
PG 502 replaces 107 108 111	PG 502 - 5 V output PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay	108 - 10 V output 111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay
PG 508 replaces 114 115 2101	Performance of replacement equipment is the same or better than equipment being replaced.	
PG 506 replaces 106 067-0502-01	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V. PG 506 - Does not have chopped feature.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V. 0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B 191 067-0532-01	SG 503 - Amplitude range 5 mV to 5.5 V p-p. SG 503 - Frequency range 250 kHz to 250 MHz.	190B - Amplitude range 40 mV to 10 V p-p. 0532-01 - Frequency range 65 MHz to 500 MHz.
SG 504 replaces 067-0532-01 067-0650-00	SG 504 - Frequency range 245 MHz to 1050 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180, 180A 181 184 2901	TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time. TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time. TG 501 - Trigger output-slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously. 181 - Multiple time-marks 184 - Separate trigger pulses of 1 and 0.1 sec; 10, 1, and 0.1 ms; 10 and 1 μ s. 2901 - Separate trigger pulses, from 5 sec to 0.1 μ s. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

DESCRIPTION

TEXT ADDITION

Section 1, GENERAL INFORMATION, Specification,

Table 1-2, Page 1-2, Electrical and Mechanical Characteristics

Maximum X Sync Contact Rating, CHANGE INFORMATION UNDER Performance Requirements

TO READ: 28 V dc, 750 mA (Common is connected to case of camera).

Section 2, OPERATING INSTRUCTIONS, Description of Controls and Connectors,

Page 2-1, Item 7 X Sync Output Terminals, ADD AFTER LAST SENTENCE OF DESCRIPTION:

The COMMON terminal is directly connected to the camera case.

