Instruction Manual

Tektronix

C-9
Camera

070-8105-03

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Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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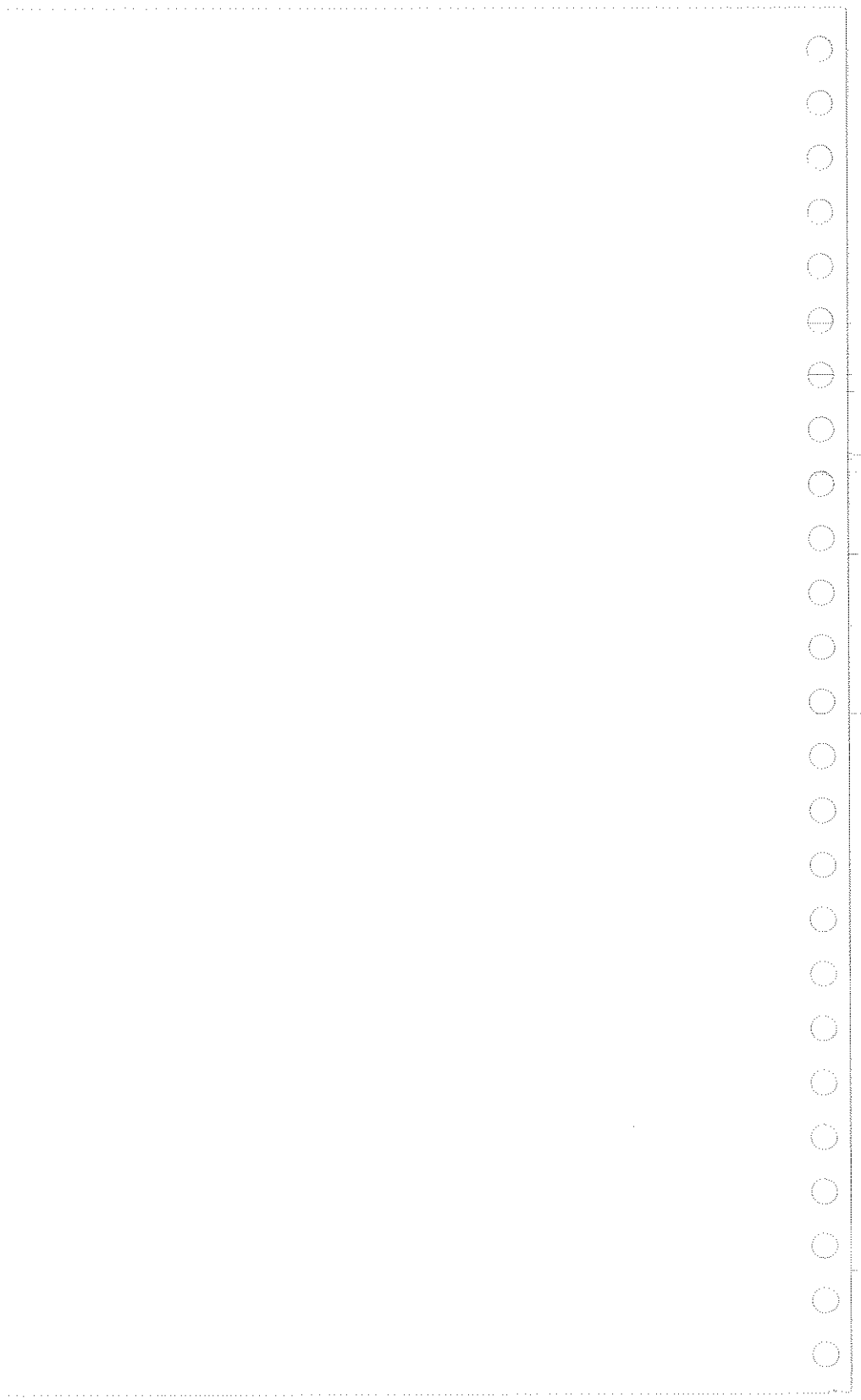

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Safety

Please exercise care when using the C-9 Camera. In addition to applying common sense, please read and understand the safety sections of this manual.

Two safety terms appear in this manual, each with a distinctive mark:

WARNING

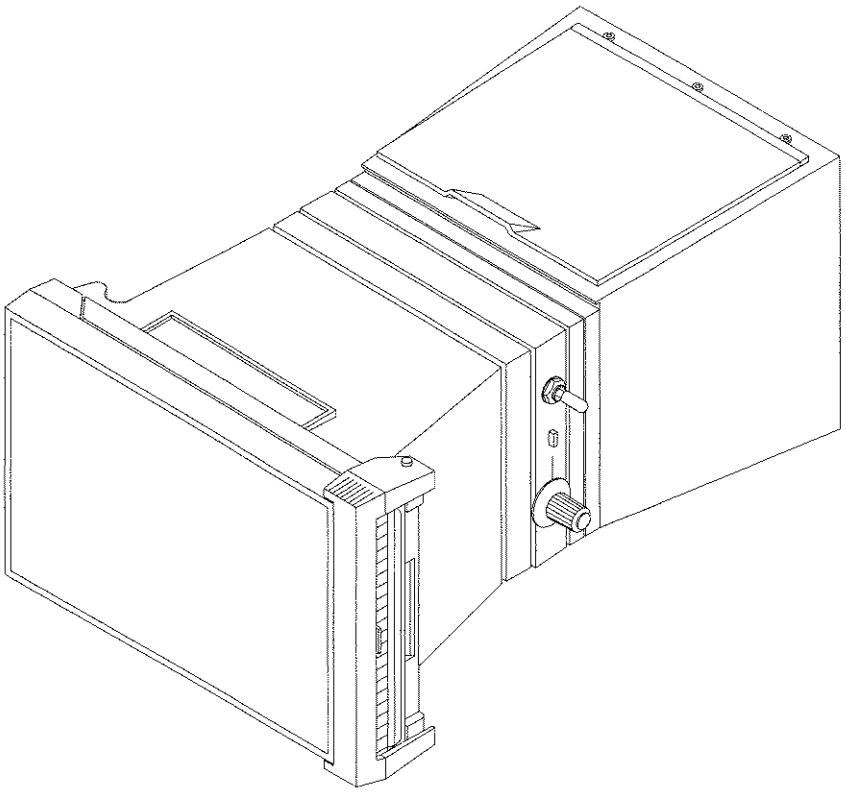
Warning statements alert you to conditions or practices that could result in personal injury or death.

CAUTION

Caution statements alert you to conditions or practices that could result in damage to the C-9 Camera or other property and equipment.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate the C-9 Camera or any of its accessories in an explosive atmosphere.



Introduction

The Tektronix C-9 Camera is a lightweight, fixed focus camera especially suited to recording images from the display screens of oscilloscopes and similar monitors. The C-9 camera uses Polaroid® film packs, which are widely available in a variety of film types, speeds, and purposes.

The C-9 camera can be used in a variety of applications.

Use your camera to record and preserve data displayed on an oscilloscope display. For single-shot events displayed in real time, a photograph may be the only method for retaining a waveform or image for later analysis. Even for digital oscilloscopes, where post-analysis of waveform data is possible, a photograph is a convenient way to document CRT displays.

Use your camera to record high-resolution images displayed on video monitors. A C-9 coupled with film providing good gray scale rendition, such as Polaroid Type 611, makes high-quality capture of video monitor displays possible. The C-9 is well suited to medical imaging tasks and, when used with the optional auto back, provides easy and sanitary film handling.

You can make color transparencies of anything imaged by the C-9 camera, using Polaroid Colorgraph Type 691 film. You can capture portions of display screens on film, develop the film, and mount the resulting transparency for overhead projection in about five minutes.

Standard features of the C-9 Camera are:

- **Standby Power** — You don't have to remember to turn your camera on, it's ready when you are.
- **Shutter Timing** — You can open and close the shutter manually, or use a variable shutter interval from 0.1 to 5 seconds.
- **Multiple Exposures** — Use multiple exposures to fog film (for greater sensitivity) or to combine multiple images on the same print.
- **Remote Shutter Control** — A connector allows you to operate the shutter remotely using an optional foot switch or pistol grip.
- **Battery Monitor** — A tri-state LED indicates battery condition whenever you actuate the camera shutter.
- **Polarity Protection** — Reverse polarity power will not damage your camera. When you restore the correct power polarity, your camera will operate normally.

Options

NOTE

The basic C-9 Camera does not include a hood. Be sure to order your camera with the option that provides the hood you need. Some hoods are available after you purchase your camera; see "Optional Accessories" on page 3.

The C-9 Camera is available with different camera backs, instrument hoods, and a flash attachment. Figure 1 on page 5 shows each of these options, and

the part numbers may be found on page 92. The following list describes the various options that you can order with the C-9 Camera:

Option 1A — replaces the manual camera back, shipped standard on the C-9 with an auto back. The auto back provides a dark slide ejection circuit, a shutter/eject circuit, a film eject button, an out-of-film indicator, and a Lemo power connector.

Option 1F — adds a flash unit that can be used with the Option 07 (7000 series) hood or the Option 20 (portable instrument) hood.

Option 1P — adds a pistol grip with shutter release cable.

Option 04 — adds a TDS 400 series hood.

Option 05 — adds a TDS 500 series hood.

Option 06 — adds a TAS 400 series hood.

Option 07 — adds a 7000 series hood. Use this hood also for Tektronix 11300 series oscilloscopes.

Option 11 — adds an 11000 series hood. *Do not order this hood for use with Tektronix 11300 series oscilloscopes; use the Option 07 hood instead.*

Option 20 — adds a portable instrument hood.

Optional Accessories

You can order optional accessories for your C-9 Camera at any time. Some accessories are the same as options you order with the camera, so you can configure your camera after the initial purchase. The part numbers may be found on page 92 in the Optional Accessories parts list.

Flash Unit, This flash unit can be used with Option 07 (7000 series hood) or Option 20 (portable instrument hood).

External DC Power Converter For use with the auto back only, this plugs into a wall outlet and provides power for the camera, eliminating the need for batteries.

Additional Auto Back Battery Pack For use with the auto back only, this provides a replacement battery pack to use as a spare, or for long photo sessions.

Pistol Grip with Shutter Release Cable Provides a convenient means of holding the camera by hand against the oscilloscope screen while operating the shutter.

Remote Foot Switch with Shutter Release Cable Provides a convenient means of operating the camera shutter with your foot.

TDS 400 series hood

TDS 500 series hood

7000 Series Hood Use this hood also for Tektronix 11300 series oscilloscopes.

11000 series hood *Do not order this hood for use with Tektronix 11300 series oscilloscopes; use the Option 07 hood instead.*

TAS 400 series hood

Portable hood

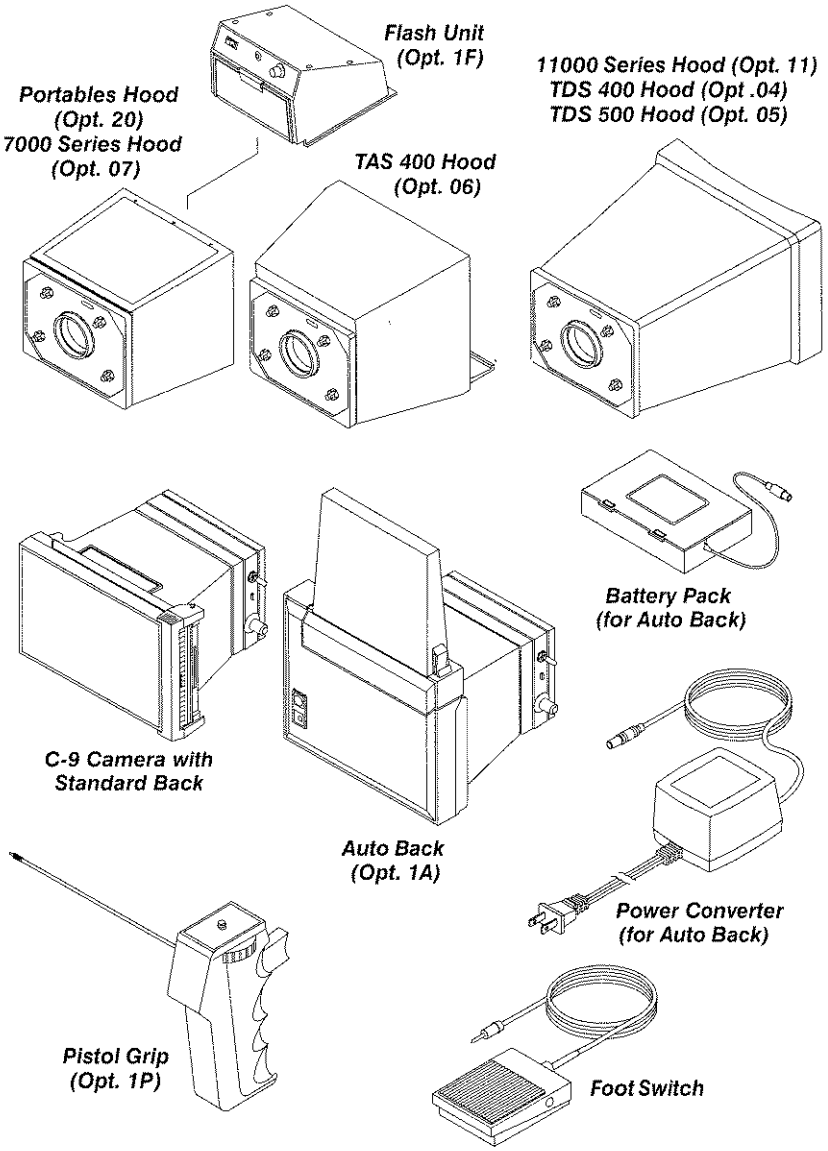


Figure 1: The C-9 Camera with Options and Accessories

Customer Support

Tektronix provides customer support for your C-9 Camera in several ways.

Service Support

If your C-9 Camera requires service, please contact your nearest Tektronix Service Center.

World-Wide Support

If you are outside North America, please contact the Tektronix office or distributor in your country for all matters concerning your C-9 Camera.

Film Support

For additional information and technical support for Polaroid films, call the Polaroid Hotline toll free between 8:00 am and 8:00 pm Eastern Time:

1-800-225-1618

Tektronix Customer Support

For other needs and questions, call the toll-free number below:

1-800-TEK-WIDE (1-800-835-9433)

Getting Started

Your C-9 Camera is assembled before it is shipped to you, but before you can use it you must attach a hood that properly fits the camera to your oscilloscope or monitor.

Before using your camera, you need to make sure the camera back has power. Power to operate the standard camera back comes from eight alkaline batteries mounted inside the camera body. Power to operate the auto back can be supplied by alkaline batteries in an external battery pack, or power can be supplied by an external power supply through a Lemo connector. Power to operate an optional flash comes from the same source as the power for the camera.

To use the camera, you must load film into the camera back.

Camera Hoods

Camera hoods automatically position the camera at the correct object-to-image distance. They also shield the film from light that otherwise might fog the image. On many oscilloscopes and monitors, a camera hood also provides a means to mount the camera/hood assembly to the instrument.

There are several different hoods available for the C-9 camera, to fit the instrument you want to record images from. The section "Optional Accessories" on page 3 lists the types of hoods that are available.

On some types of hoods, a small flange under the top lip of the hood rests in a corresponding groove or slot along the top of the oscilloscope (or other instrument)

faceplate bezel. Other types of hoods require you to hold the hood against the bezel of the monitor or oscilloscope as you make an exposure.

You can remove and install camera hoods without using tools. Attach hoods using expanding snap plungers as shown in Figure 2.

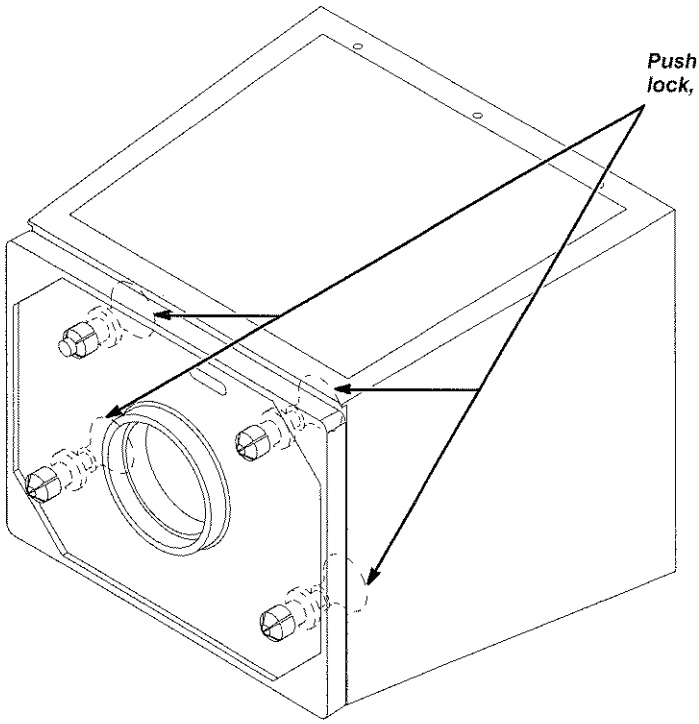


Figure 2: Snap Plungers

To install a hood, follow these steps:

☐ **Step 1:** Rest the camera on a secure surface, lens end up. Locate the plungers over the corresponding holes in the camera assembly. The holes will align only in the correct orientation.

☐ **Step 2:** Snap the plungers into place by reaching into the hood and pressing on the plunger heads.

Camera Power

Before you use your camera the first time, you need to make sure the camera back has power. Power to operate the standard camera back comes from eight alkaline batteries mounted inside the camera body. Power to operate the auto back can be supplied by alkaline batteries in an external battery pack, or by an external power supply through a Lemo connector.

Power to operate an optional flash comes from the same source as the power for the camera.

Installing Batteries (Standard Back)

Two battery holders are located inside the camera body. They are held in place by hook-and-loop fasteners.

WARNING

To avoid possible battery rupture and leakage, always observe and verify battery polarity during installation.

You will need eight alkaline batteries, size AA. Always replace all eight batteries at the same time. For reliable operation of the camera you must use alkaline batteries. Figure 3 shows the location of the batteries.

NOTE

If you have a film pack installed, you will expose one slide of film when you replace batteries. If you can't avoid this by changing batteries between film packs, discard one film slide after changing batteries.

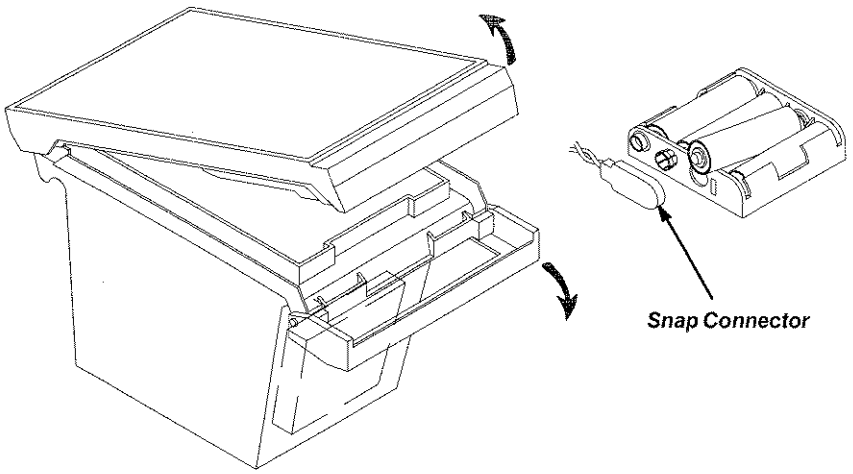


Figure 3: Installing Batteries (Standard Back)

☐ **Step 1:** Open the camera back by grasping both ends of the hinged door latch and pulling the latch away from the camera back. Raise the camera back and let it rest in the fully open position.

☐ **Step 2:** Locate the battery packs inside the camera body. (If a film pack is installed, you must first remove it.) Remove one battery holder by pulling it gently off the hook-and-loop fasteners. Take care not to disconnect the 12-pin connector that attaches to the camera control housing near the lens.

☐ **Step 3:** Locate the snap connector that attaches the wires to the battery pack. Disconnect the snap connector using your fingers. Do not use a screwdriver or other hard, sharp object.

☐ **Step 4:** Remove the spent batteries. Install new batteries following the polarity shown on the inside of the battery holder. For best results, first slip the negative (flat) end of the battery in against the spring, then press the positive end into place.

☐ **Step 5:** Snap the wire connector back in place. Taking care not to disconnect the wire assembly and connector inside the camera, replace the battery holder on the hook-and-loop fasteners.

☐ **Step 6:** Make sure that the battery holder wires are resting flat against the camera body and do not block the camera lens. Cable retaining clips are provided inside the camera body for this purpose.

☐ **Step 7:** Repeat steps 2 through 6 with the other battery holder.

☐ **Step 8:** Close the camera back and snap the hinged latch by rotating the latch toward the camera and pressing it firmly against the camera back.

Installing Batteries (Auto Back)

The battery pack for the auto back mounts on top of the camera body and is held in place with hook-and-loop fasteners.

You will need eight alkaline batteries, size AA. Always replace all eight batteries at the same time. For reliable operation of the camera you must use alkaline batteries. Figure 4 shows the location of the batteries.

CAUTION

To prevent damage to your C-9 camera, do not use a C-7 battery pack to operate the C-9. Despite their similar appearance, the battery packs and camera control circuits are not interchangeable.

WARNING

To avoid possible battery rupture and leakage, always observe battery polarity during replacement.

☐ **Step 1:** Disconnect, *at the camera end,* the cable that connects the battery pack to the camera. Pull the plug straight out from the Lemo connector in the camera body.

☐ **Step 2:** Remove the battery pack from the camera by gently lifting the pack, separating the hook-and-loop fasteners that hold it in place.

☐ **Step 3:** Open the battery pack cover by pressing the battery pack gently beneath the lid latches.

☐ **Step 4:** Remove the used batteries. Install the new batteries as shown in Figure 4.

First slip the negative (flat) end of the battery in against the spring, then press the positive end into place.

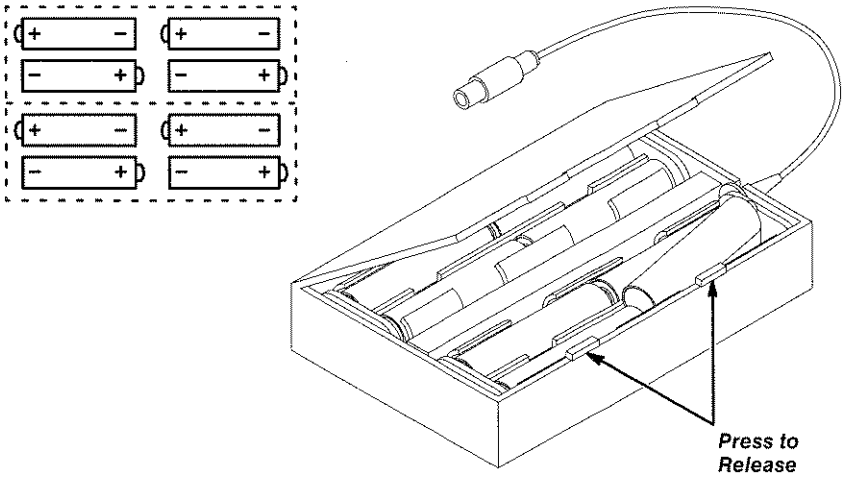


Figure 4: Installing Batteries (Auto Back)

☐ **Step 5:** Close the battery pack lid and snap the latches shut. Reconnect the battery pack cable to the camera.

External Power Connector (Auto Back)

The optional auto back camera accepts an optional external DC power converter for operation from a 110 volt source. Connect the power converter cable to the camera Lemo connector in place of the battery pack cable.

Loading Film

To use the camera, you must load film into the camera back. Several types of Polaroid film are available. Table 1 on page 34 describes the various film types available for the standard back and auto back.

Loading Film (Standard Back)

To install or replace the film pack in a standard back camera, follow this procedure. Figure 5 shows the procedure.

- ☐ **Step 1:** Open the camera back by grasping both ends of the hinged door latch and pulling the latch away from the camera back. Raise the camera back and let it rest in the fully open position.
- ☐ **Step 2:** To remove a spent film pack, grasp the pack at the latch end by the edges and lift it first up and then away from the film pack retainer.
- ☐ **Step 3:** Inspect the film roller that is visible. Rotate the roller with your finger to check the entire roller surface. If the roller is not completely clean and unmarked along its entire length and surface, stop now and read "Film Rollers (Standard Back)" on page 77.
- ☐ **Step 4:** Read the manufacturer's instruction sheet included in the film box. Carefully remove the wrapper from the film pack. Handle the film pack only by its edges; pressing the pack on the film surfaces can damage the film inside the pack.

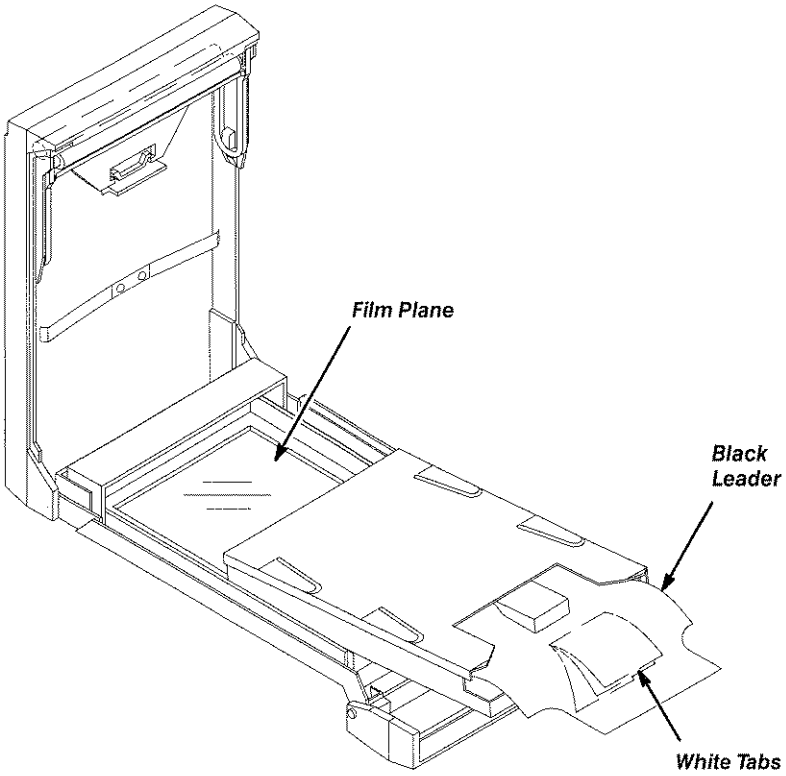


Figure 5: Loading Film (Standard Back)

☐ **Step 5:** Holding the new film pack with the film tab and black paper leader facing up, tilt the film pack into the film plane. Slide the film pack until it reaches the rear stop, then press the film pack down until it rests flat in the film plane. Visually verify that the white pull tabs, beneath the black paper leader, are not pinched between the film pack and its holder.

☐ **Step 6:** Close the camera back and snap the hinged latch by rotating the latch toward the camera and pressing it firmly against the camera back.

☐ **Step 7:** Remove the black paper leader by grasping it firmly and pulling briskly away from the camera back. Pull in a horizontal direction parallel to the back of the camera.

Loading Film (Auto Back)

To install or replace the film pack in an auto back camera, follow this procedure. Figure 6 shows the procedure.

☐ **Step 1:** Remove the development chamber if it is attached. Open the camera back by lifting the door latch and rotating the latch and roller assembly.

☐ **Step 2:** To remove a spent film pack, grasp the exposed pull tab and pull the pack straight out of the holder.

☐ **Step 3:** Inspect the film rollers. Rotate the rollers with your finger to check the entire roller surface. If the rollers are not completely clean and unmarked along their entire length and surface, stop now and read "Film Rollers (Auto Back)" on page 78.

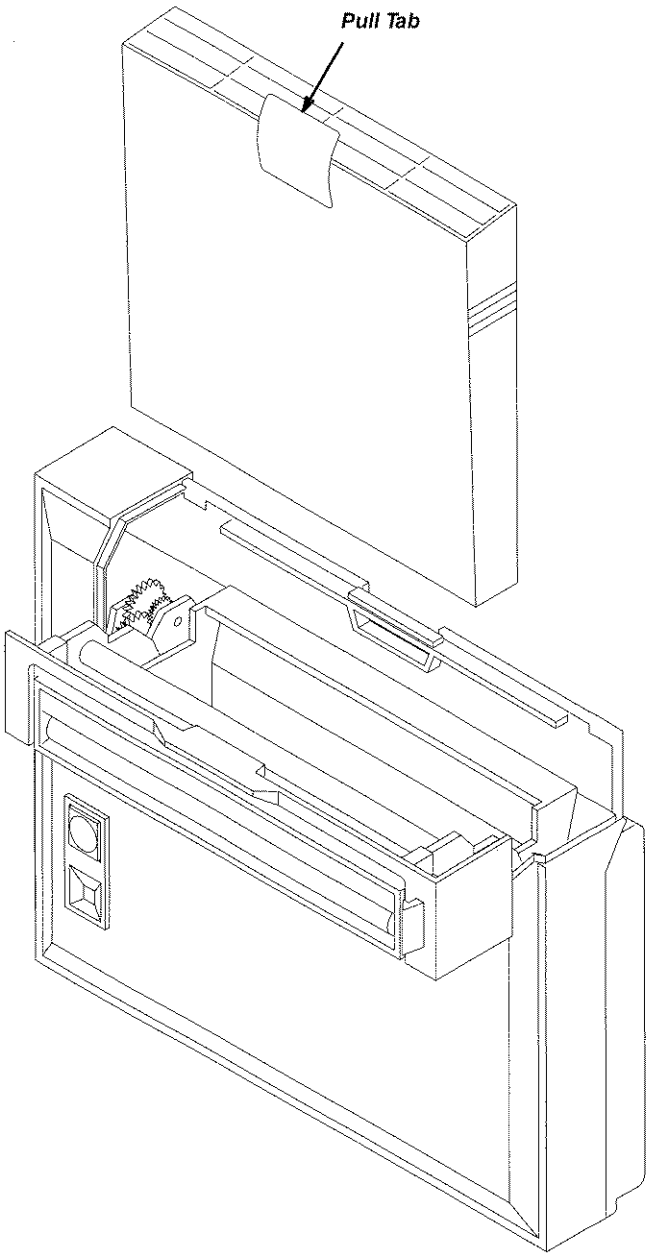


Figure 6: Loading Film (Auto Back)

☐ **Step 4:** Read the manufacturer's instruction sheet included in the film box. Carefully remove the wrapper from the film pack. Handle the film pack only by its edges; pressing the pack on the film surfaces can damage the film inside the pack.

☐ **Step 5:** Holding the new film pack with the pull tab facing the rear of the camera, drop the pack into the holder. Press firmly to seat the pack in the holder.

☐ **Step 6:** Close the camera back and snap the hinged latch by rotating the latch toward the camera and pressing it firmly against the camera back. Press the manual ejection button to eject the dark slide that protected the unexposed film.

Exposing Film

Plan to make several test exposures of representative signals before attempting to take a final photograph or sequence of photographs. Simulate the expected signal as closely as possible, using the instrument settings that you will use to take the final photograph. Experiment with graticule or flash illumination and shutter speeds. These practice photographs are a particularly important preparation for single-shot events because you may not have a second opportunity to capture the critical event.

☐ **Step 1:** Optimize the display by adjusting the display intensity, focus, and any other display controls, such as cursor position or readout. Signal and readout intensity should be equal.

- ☐ **Step 2:** Set the flash controls. The initial setting will depend on the length of your exposure, the brightness of your signal, and the type of film you are using. Try adjusting the flash intensity or instrument graticule illumination to mid-range if you want to include the graticule in your photograph. For flash exposures, wait until the flash unit ready indicator is blinking.
- ☐ **Step 3:** Set the shutter speed control if the exposure is for five seconds or less. The initial setting will depend on the brightness of the image you are displaying, and the type of film you are using. Try setting the speed control to 1.0 second if you are unsure of the initial setting.
- ☐ **Step 4:** Make an exposure. Toggle the shutter down for timed exposures, up for manually-timed open-shutter exposures. For manual exposures, return the shutter toggle to the center detent after timing the exposure.
- ☐ **Step 5:** Remove and develop the exposed film, using the procedure described in the following section. Develop the film following the film manufacturer's instructions.

Developing Film

Remove the exposed film slide from the film pack to begin the development process.

Developing Film (Auto Back)

For auto back cameras the process is very simple. As soon as you expose the film, the film slide ejects automatically. The film development process is self-timing.

You can set the auto back to prevent automatic development. This lets you make multiple-exposure prints, but it requires you to use the manual eject button after the last exposure. For complete information about using the auto back for multiple exposures, see Multiple Exposures on page 39.

Developing Film (Standard Back)

For the standard manual back camera, you need to remove the film yourself and time its development. Use the following procedure.

WARNING

To prevent chemical burns, avoid contact with the film-development chemicals used in the film packs. Follow the film manufacturer's instructions carefully. If you get film development chemicals on your skin, wash the area immediately and thoroughly. Keep film chemicals away from your eyes and mouth.

☐ **Step 1:** Grasp the exposed white pull tab and pull it straight out in the plane of the camera back with a firm, even motion. This action separates the film leader from the pack and threads the exposed film slide into the rollers. Discard the separated pull tab in an appropriate waste receptacle.

☐ **Step 2:** Grasp the newly visible film leader *(not another white pull tab)* and pull it straight out in the plane of the camera back with a firm, even motion. This action draws the exposed film through the rollers and begins the development process. Begin timing the development period now.

Film development times vary with the ambient temperature. Table 1 on page 34 lists the development times for each film type. Check the instructions packed with the film to make sure the film manufacturer has not changed the film specifications.

☐ **Step 3:** When the development period is complete, separate the film print from the film backing paper. Discard the film backing in an appropriate waste receptacle.

Read the film manufacturer's instructions to determine if the film print needs to be coated. Follow the manufacturer's instructions for coating prints.

Handling Prints

Different types of film require different handling. Some films require you to coat the image with a coating chemical that is included with the film pack. If a film requires coating, the image is not permanent if you don't coat it. Read the film manufacturer's instructions for information about the handling and care of developed film.

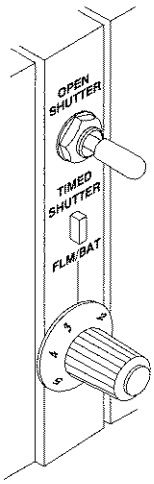
WARNING

Self-timing film prints (those used in the auto back camera) are constructed of several layers of different materials and may contain caustic chemicals. Never cut, puncture, or take apart self-timing film prints.

Operator Controls

In addition to the standard camera controls, this section discusses both the auto back and flash attachment controls. Refer to Figure 7 on page 24 to locate the controls discussed below.

Shutter Switch



The shutter switch controls the operation of the camera shutter. Power is always applied to the shutter circuit as long as the batteries are installed. The battery drain caused by shutter circuit in standby mode is negligible, so no on-off switch is required. The shutter operates in two modes, timed and open.

Timed — Push the shutter toggle down to make a timed-shutter exposure. After the shutter opens, it remains open for the time determined by the shutter speed dial. You can continue to hold the toggle down during the time the shutter is open, or you can press and release the shutter toggle.

If you have an auto back camera, the film slide automatically ejects when the timed exposure is complete.

NOTE

Wait several seconds between exposures. This allows the shutter circuit to reset. The green LED wil blink momentarily when the camera is ready again.

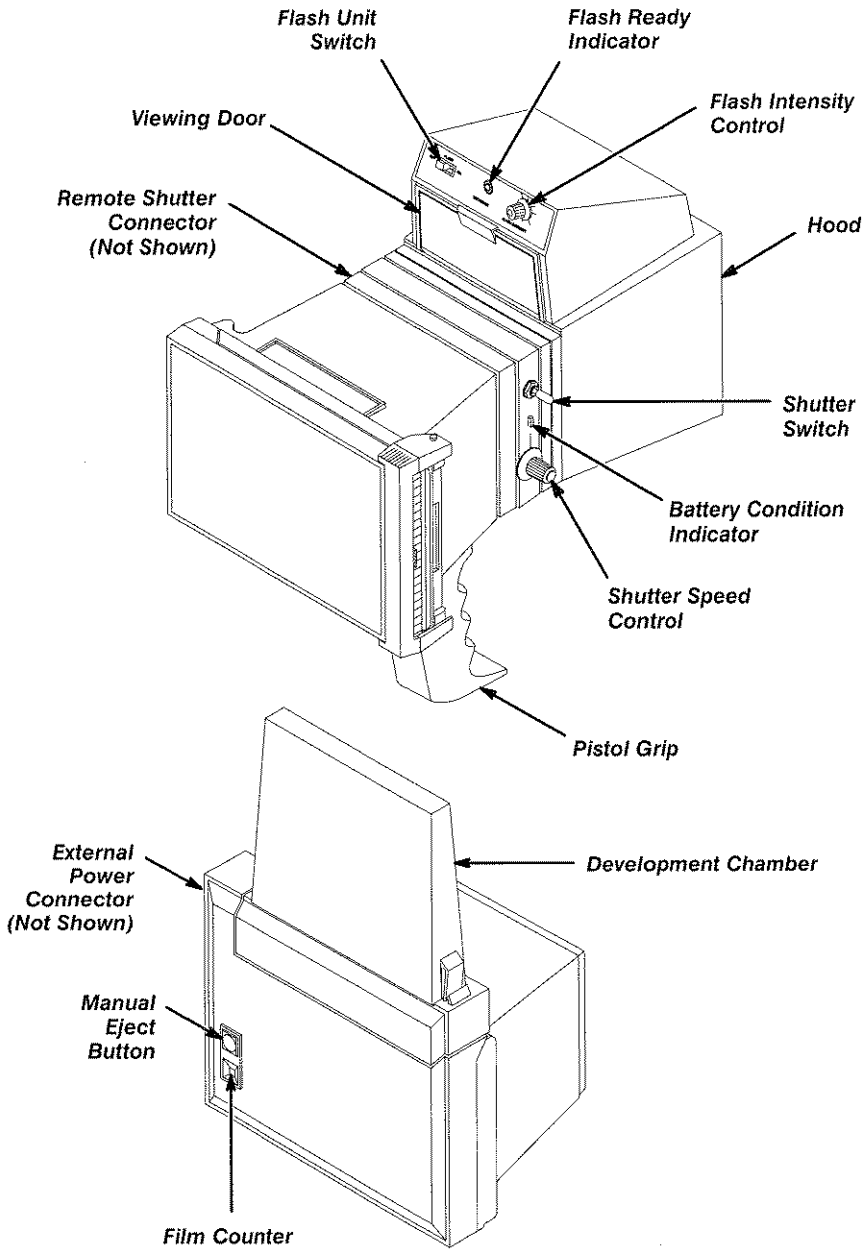


Figure 7: Camera Controls and Connectors

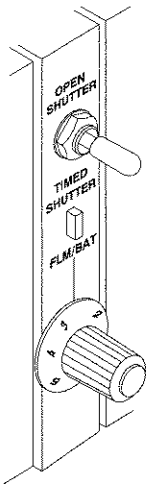
Open — Push the shutter toggle up to make a manually-timed exposure longer than five seconds. The shutter remains open until you return the shutter toggle to its center detent. The camera will time out and the shutter wil close after one hour.

If you have an auto back camera, the film slide automatically ejects when you return the shutter toggle to the center detent. If you want to make multiple exposures on the same film slide using the auto back camera, you can disable the automatic film ejection feature. See "Multiple Exposures" on page 39.

NOTE

Wait a few seconds between exposures. This allows the shutter circuit to reset. The green LED wil blink momentarily when the camera is ready again.

Shutter Speed Control



Set the shutter speed control to establish the time that the shutter remains open when triggered by the shutter switch. The shutter speed control is continuously variable from approximately 0.1 to 5 seconds.

To use the shutter speed control, rotate the knob until the index mark on the camera body aligns with the desired exposure time.

You should experiment to find the optimum exposure time for your photographs. Take into account the film type and speed being used, the amount of image light available, the duration of the image, the oscilloscope graticule illumination, and whether a flash unit is being used.

Film/Battery Condition Indicator

Check the film/battery condition indicator to determine if the camera batteries are sufficiently charged. The film/battery condition indicator uses an LED display (the single LED can emit either red or green light) to indicate whether the batteries have sufficient voltage to reliably power the camera. The possible film/battery indications are a green light, a red light, or an alternating red and green light.

Green light — indicates good battery voltage. The green light will remain lit for a few seconds after you actuate the shutter, and then extinguish.

Red light — indicates a low voltage condition. You should replace the camera batteries as soon as possible. (There is usually enough reserve battery power to expose an additional film pack, so you should be able to finish the film pack that is already loaded.) See "Camera Power" on page 9 for battery replacement information.

Alternating red and green light (auto back only) — Auto back cameras display alternating red and green lights and repeat a short beep tone if you operate the shutter after the film counter displays the out-of-film indicator. The film counter is described on page 31.

Hood

The hood serves a dual purpose. In addition to blocking stray light from images on oscilloscope and monitor screens, the hood provides an easy way to mount the camera to many instruments.

See "Hoods" on page 7 for information about installing a hood.

Development Chamber (Auto Back)

Prints ejected by the auto back camera collect in the development chamber.

Attach the film development chamber by tilting the pivot end of the chamber into the raised stop molded into the camera back and lowering the chamber into place. To secure the chamber, snap the molded fastener as shown in Figure 8. To remove the chamber, press the fastener and lift the chamber off the camera back.

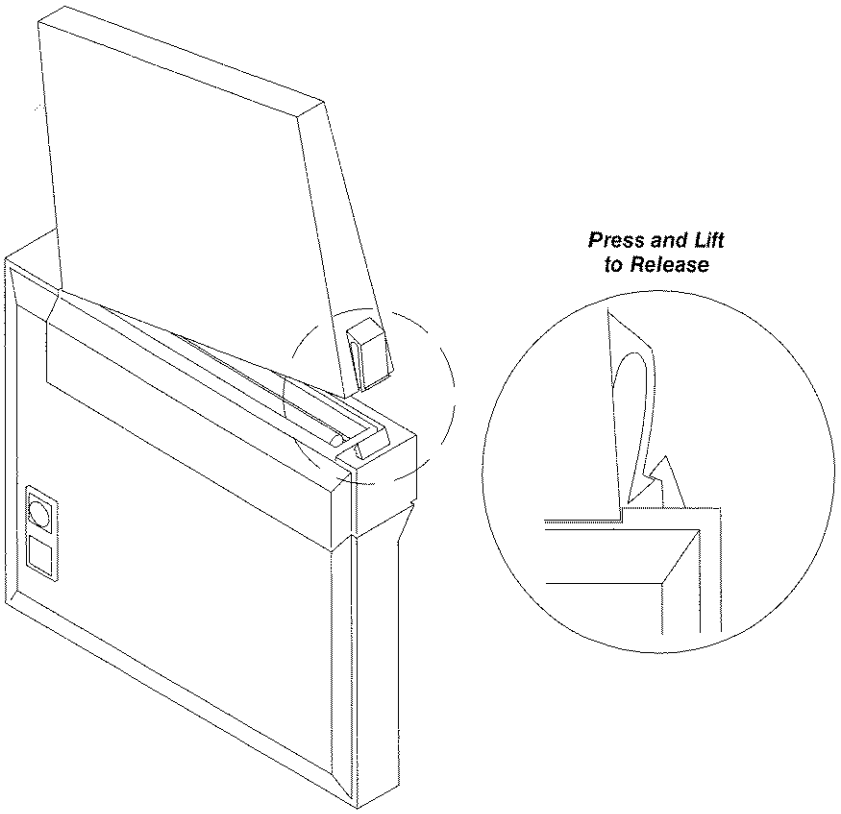


Figure 8: Attaching the Development Chamber

Although not required for self-developing prints, the chamber acts as a print collection area, allowing you to shoot an entire film pack without having to handle each print the camera ejects.

Viewing door

Viewing doors (Figure 9) are provided on the portable and 7000 series hoods and the optional flash unit. Other hoods do not have a viewing door. Use the viewing door to see your image source when the display is covered by the mounted camera.

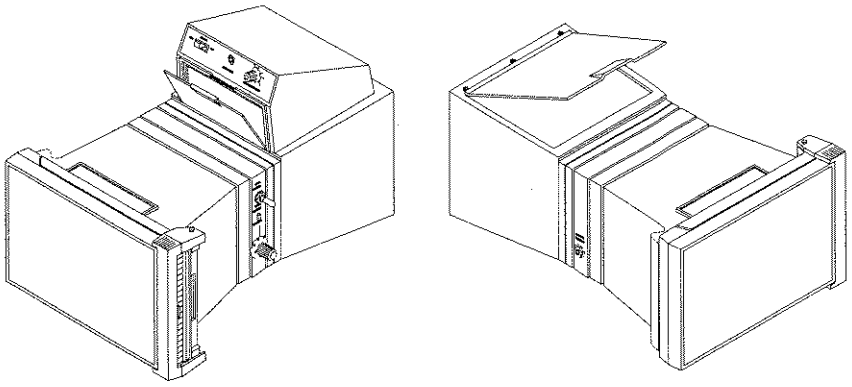
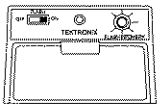


Figure 9: Viewing Doors

Pull the viewing door tab to see your monitor or oscilloscope display. Be certain to snap the door shut tight before you take a picture. Stray light leaking in through the door may cause bands of light or streaks to appear on your photographs.

Flash unit switch



On cameras equipped with a flash unit, set the flash unit switch to **ON** to enable the flash. To take photographs using only ambient and image light, set the flash unit switch to **OFF**. The flash unit can be used to light the graticule of an oscilloscope display. If your oscilloscope has a graticule illumination feature, you can increase camera battery life by using the oscilloscope graticule illumination instead of the flash unit.

To preserve battery power, turn the flash unit off when not in use.

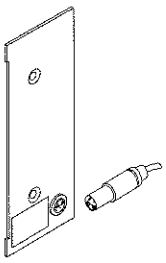
Flash Ready Indicator

When the flash unit switch is on, the ready indicator blinks to tell you that the flash lamp is charged. Wait until the ready indicator is blinking before taking a photograph.

Flash Intensity Control

Use the flash intensity adjustment to set the brightness of the flash. Experiment to determine the correct flash brightness for a given combination of film type and image brightness.

External Power Connector (Auto Back)

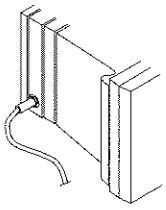


Use this receptacle to connect the battery pack to the auto back camera. If you have the optional external power converter, connect it to this external power input connector.

CAUTION

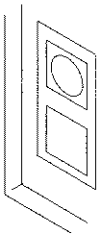
Use the external power converter designed for the C-9 camera. Otherwise, ensure that your power source does not exceed the specifications printed on the camera.

Remote Shutter Connector



You can use either the manual shutter control switch or an optional remote cable actuator to trigger the camera shutter. Connect the pin end of the optional pistol grip or foot switch cable to the remote shutter input connector. There is no provision for making manually-timed exposures using a remote shutter cable; however, the shutter control switch will work normally even when a remote shutter cable is attached.

Manual Eject Button (Auto Back)



Use the manual eject button to eject a film slide without operating the camera shutter. Press this button after loading a new film pack to eject the protective dark slide in the film pack. Use the button to eject exposed film if you have disabled the automatic film ejection feature, as you would if you were making multiple exposures. Refer to "Making Multiple Exposures" on page 39.

Film Counter (Auto Back)

The film packs supported by the auto back camera generally contain ten slides (standard film packs contain eight). The film counter indicates how many film slides you have used. The counter simply counts the number of times the film ejection mechanism *(not the shutter mechanism)* operates. The possible displays in the film counter window are a blank window, a number, and a white dot.

NOTE

The film counter is accurate only if you install full film packs and leave them installed until all prints have been ejected.

Blank — whenever you insert a new film pack into an auto back camera, whether or not the film pack is full, the film counter resets to display a blank window. If the film pack is unused, push the manual eject button to eject the protective dark slide. The number **1** should be displayed.

Number — indicates which of ten film prints will be exposed when you open the shutter. If the number reads **7**, there are four film slides left: **7**, **8**, **9**, and **10**.

White dot — indicates that ten film slides have been ejected and the film pack is empty.

Selecting Film

The film you choose significantly affects the quality of your recorded images. You should choose a film that matches your intended application. Table 1 on page 34 summarizes film characteristics.

Standard Back Film Packs

The following film packs support the standard back camera and produce a 3 × 2 inch finished image:

- 611
- 612
- 664
- 665
- 667
- 669
- 691

Auto Back Film Packs

The 331 film pack supports the auto back camera and produces a 4 × 3 inch finished image.

Film Characteristics

Table 1 lists several film characteristics that will help you choose a film pack for your C-9 camera. For additional information, call the Polaroid Hotline, Monday through Friday 8:00 am to 8:00 pm EST: 1-800-225-1618.

Table 1: Polaroid Film Characteristics

Type	Form	ISO	Development[2]	Application
331	b&w print	200/24°	self-timing (auto back)	**Video image recording:** extended dynamic range.
611	b&w print	n/a	45 sec	**Video image recording:** extended dynamic range and exposure latitude.
612	b&w print	20000/44°	30 sec	**High writing speed CRT trace recording:** ultra high speed, high contrast.
664	b&w print	100/21°	30 sec	**Proofing:** fine grain, wide tonal range, excellent detail.
665	b&w print plus negative	80/20°	30 sec	**General purpose:** negative requires bath in sodium sulfite solution, washing, and drying before use.
667	b&w print	3000/36°	30 sec	**General purpose:** high speed.
669	color print	80/20°	60 sec	**General purpose:** extended dynamic range, medium contrast, color balanced for daylight and flash.
691	color overhead transparency	80/20°	4 min	**Overhead projection:** enlargement possible with overhead projection stand.

Note 1: Polaroid Corporation reserves the right to change technical specifications without notice.

Note 2: Normal development time at 75°F (24°C)

Ordering Film

While Polaroid film packs are widely available, you may find it convenient and economical to order your film in quantity from Tektronix. You can order the following film types directly from Tektronix:

- 331 black and white print
- 612 black and white print
- 667 black and white print
- 669 color print
- 691 color transparency

To reach Tektronix from within the United States, call the following number:

1-800-TEK-WIDE (1-800-835-9433)

If you are outside North America, please contact the Tektronix office or distributor in your country for all matters concerning your C-9 Camera.

Recommended Films for Specific Uses

Certain types of film are recommended for use in photographing repetitive signals, single-sweep signals, or video signals.

Films for Repetitive Signals

Repetitive signals have a stable trigger over time. Examples of repetitive signals include 60 Hz line voltage, clock pulses, and periodic wave shapes.

Repetitive signals displayed within the bandwidth of the oscilloscope do not exhibit a wide tonal range (differing gray levels), and most areas of the trace have similar brightness. Recording such images does not require

gray scale capability: a print is generally satisfactory if the trace and graticule are distinguishable from the background.

A general purpose film is well suited to recording repetitive signals. Tektronix recommends black and white Polaroid film type 667

Films for Single-Sweep Signals

Pulses, abrupt step functions, and aberrations in repetitive signals may produce fast transient events that require a different film choice. These traces tend to mix slow, bright trace areas with fast, dim trace areas. Usually, the dim low-light portion of the trace is the area of interest.

To record these mixed bright-and-dim traces, choose a film with an extended dynamic range and good contrast and sensitivity. For this type of CRT recording, Tektronix recommends the following Polaroid film types:

- 612
- 331 (for use with auto back)

Single-sweep signals usually have low brightness levels. Because the only light available comes from a single sweep, with the electron beam usually moving at very high speed, you should choose a very fast, high contrast film. For most single-sweep applications, Tektronix recommends the following Polaroid film type:

- 612
- 331 (for use with auto back)

The C-9 is a fixed-aperture camera and may not be the best choice for high-speed single-sweep recording. If you have difficulty capturing single-sweep events using the C-9, see "Picture Problems" starting on page 53. If you still cannot capture a particular single-sweep event,

consider using a camera with a variable shutter aperture, such as the Tektronix C30BP series of high-performance cameras.

Films for Video Recording

Video image recording differs from oscilloscope photography primarily by the need for gray scale rendition. Video image light levels can be characterized as constant but with widely varying brightness. Contrast, dynamic range, and tonal rendition are film characteristics required for video image recording. For video applications, Tektronix recommends the following Polaroid film types:

- 611
- 664
- 331 (for use with auto back)

Multiple Exposures

To superimpose several images onto one film slide, make a multiple exposure. For best results, use graticule illumination or the flash unit for only *one* of the exposures.

Standard Back

For the standard camera, simply make several exposures by operating the shutter several times. Once the last exposure is made, process the film just as you do for a single-exposure image.

Auto Back

To make multiple exposures with an auto back camera you must first disable the automatic film ejection feature. This feature normally ejects and processes each film slide immediately after the shutter operates.

Once you disable the automatic film ejection mechanism, you must press the manual eject button to eject and process each film slide. If you are making multiple-exposure images, press the manual eject button only after the last exposure.

To disable the automatic film ejection mechanism, you must partially disassemble the camera. You will need a Torx® T10 screwdriver. Follow these steps:

☐ **Step 1:** If a flash unit is attached to an installed hood, reach inside the hood and disconnect the flash unit three-wire connector. Pull the connector straight up and out of the access slot.

Remove an installed hood by reaching inside the hood and pulling up on the snap plungers. The plungers are captive and do not separate from the hood.

☐ **Step 2:** With the camera resting on its back, use a #T-10 Torx-drive screwdriver to remove the four visible corner screws. These long screws pass through a spacer, the shutter and lens assembly, and another spacer. To avoid damaging any of the camera parts, exercise care after removing the screws.

☐ **Step 3:** Lift the top spacer to expose the top side of the shutter/eject control circuit board. Note the orientation of the spacer, particularly the position of the cable access slot for the flash unit, to help you re-orient the space upon reassembly.

☐ **Step 4:** Use Figure 10 to locate the two-pin jumper labelled **J9** on the circuit board. The jumper is a small plastic connector with no wires coming out from it. Its purpose is to connect two pins.

☐ **Step 5:** To disable the automatic film-ejection feature of the camera, remove the jumper. Be sure to store it in a safe place so that you can reinstall it later when you want to restore the automatic film-ejection feature.

To restore the automatic film-ejection feature, replace the jumper.

☐ **Step 6:** To reassemble the camera, reverse the disassembly procedure.

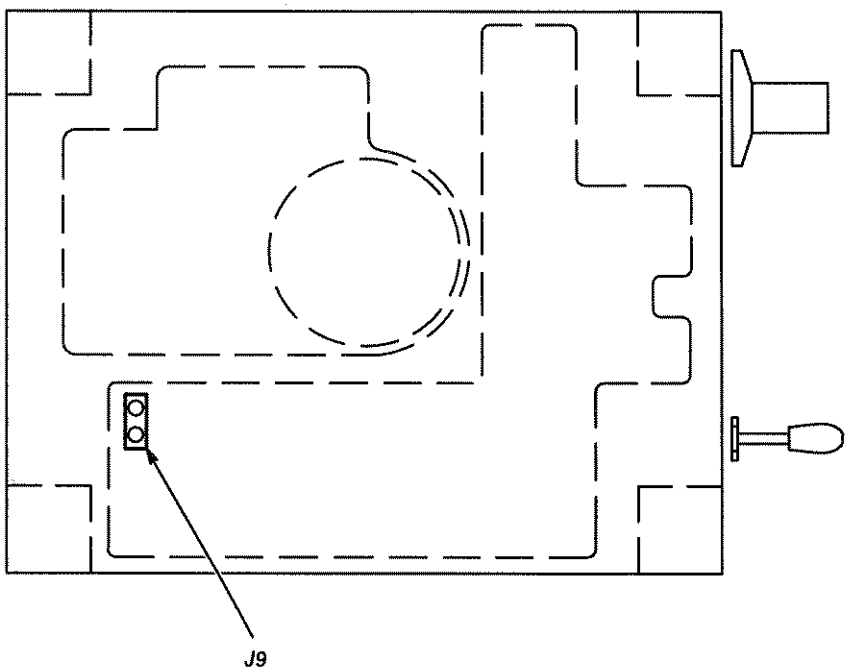


Figure 10: J9 Jumper Location

Examples

This section shows examples of how to use the C-9 camera. Reading the examples will give you a sense of how to proceed with your specific application. You may not be able to use the exact procedures described, but you should be able to adapt the example steps to your equipment.

Recording a Repetitive Signal

Repetitive signals displayed on an oscilloscope can be characterized as having a stable trigger over time. In this example, we use the square-wave calibrator output from a Tektronix portable instrument as a signal source.

You can simulate this example by overcompensating one of your own probes, or you can simply use a probe to look at your oscilloscope's calibrator output. Refer to your oscilloscope and probe manuals for information unique to your equipment.

Suppose you want to show how an uncompensated probe led to problems on a manufacturing line. You might want a photograph of the uncompensated probe output to show the excessive overshoot that caused the problem.

☐ **Step 1:** Connect an overcompensated probe to your oscilloscope input and attach the probe tip to the calibrator output. Adjust the oscilloscope to display the calibrator signal.

☐ **Step 2: (optional)** Use the oscilloscope cursor features to display ΔV, or voltage difference. Set the cursors so that the display readout indicates the peak voltage of the displayed waveform overshoot.

☐ **Step 3:** Adjust the oscilloscope signal and readout intensity to a moderate level. Both readout and signal should be equally bright and easily viewed, but not so bright that the trace blooms (grows very large) or shows a distinct fringe or halo.

☐ **Step 4:** Choose and load film. Because the signal is repetitive and does not require very high writing speed, you can use a general purpose film. Using Table 1 on page 34, we chose Polaroid type 667.

☐ **Step 5:** Choose and mount a hood as described in "Camera Hoods" on page 7.

☐ **Step 6:** Set the shutter speed control. Because you haven't made a test exposure yet, set the shutter speed control to one second as a starting point.

☐ **Step 7:** Make a test exposure. Make the exposure by pressing down on the shutter toggle switch. The shutter will open and close automatically.

☐ **Step 8:** Remove and develop the exposed film. At normal indoor temperatures, type 667 film will develop in about 30 seconds. Examine the developed film.

☐ **Step 9:** Make adjustments and repeat the test exposures until you obtain a satisfactory print. We doubled the exposure time to 2.0 seconds and doubled the development time to 60 seconds to obtain a better picture, as shown in Figure 11.

- If the film background is gray instead of black and lacks contrast, increase the development time.

- If the exposed part of the film (showing the trace) is dim, increase the exposure time or decrease the development time.

☐ **Step 10:** Make and develop a final exposure using the shutter speed and development time determined by Step 9.

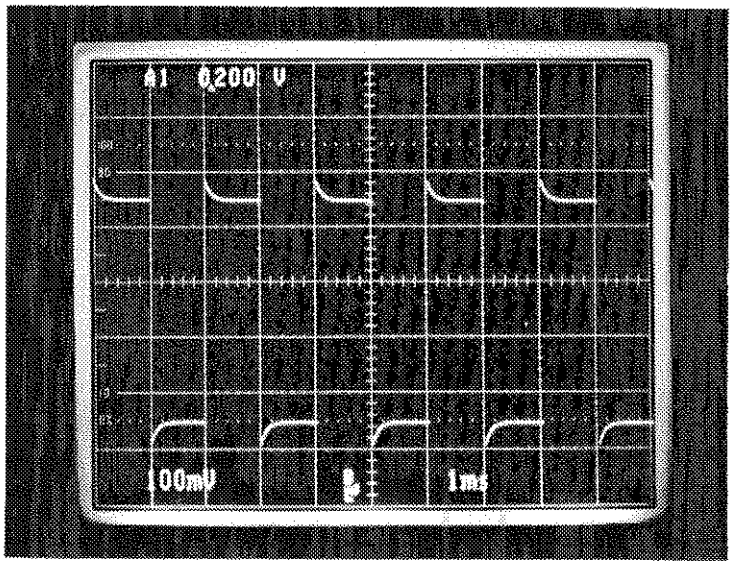


Figure 11: Photograph of a Repetitive Signal

Recording a Single-Sweep Signal

Some waveforms cannot be displayed on an oscilloscope as a repetitive signal because they occur infrequently, irregularly, or as a single event. Oscilloscopes usually have a special trigger mode called single-sweep that will display these "single-shot" signals for one sweep of the oscilloscope time base. Examples of

single-sweep events include transients caused by opening and closing switches, energy impulses, and glitches (sudden aberrations) occurring on an otherwise stable repetitive signal. With a C-9 camera you can capture many of these briefly displayed signals on film, making a permanent record of the event.

Suppose you want to know how long it takes for a circuit element to reach operating voltage after power is applied. You can make this time-constant measurement using a conventional oscilloscope, by operating the C-9 camera in open-shutter mode. This example uses the basic RC circuit shown in Figure 12.

NOTE

To follow this example using an auto back camera, you must first disable the automatic film-ejection mechanism as described in "Multiple Exposures" on page 39.

☐ **Step 1:** Adjust your oscilloscope vertical amplifier sensitivity to display both the initial and final DC voltage of the circuit. In the example shown, we adjusted the power supply so that the circuit switches between ground and five volts. Align the low voltage trace with a graticule line to make interpreting the measurement easier.

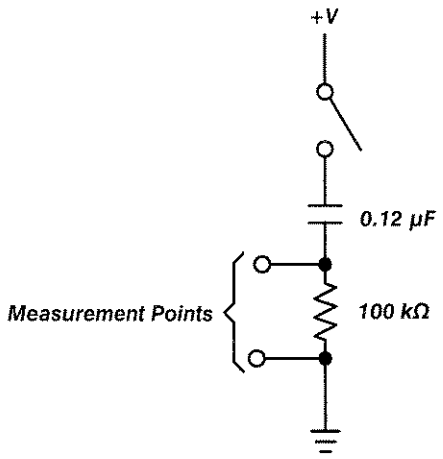


Figure 12: A Simple RC Circuit

☐ **Step 2:** Adjust the oscilloscope trigger to initiate a sweep at or very near zero volts. Adjust the oscilloscope time base so that the circuit switches from the low to the high voltage within one sweep. For the circuit described in this example, we chose a sweep speed of 10 ms / division.

☐ **Step 3:** Choose and load film. Although this signal is not repetitive, the sweep speed is relatively slow; we chose a general-purpose film, Polaroid type 667. Refer to Table 1 on page 34 for a list of film characteristics.

☐ **Step 4:** Choose and mount a hood. Snap the small portable hood into place as described in "Camera Hoods" on page 7.

☐ **Step 5:** Adjust the oscilloscope graticule illumination and readout intensity to approximately mid-range. Turn the signal intensity off.

☐ **Step 6:** Adjust the camera shutter speed control to be longer than the sweep period. For very long sweep periods, you may need to use open shutter mode.

☐ **Step 7:** Make and develop a test exposure. Adjust the shutter speed control or graticule and readout intensity as necessary, and repeat the test exposure until you obtain a clear image of the graticule and readout. Make a final exposure, *but do not remove the film.*

☐ **Step 8:** Turn the oscilloscope graticule illumination and readout intensity off. Adjust the signal intensity so that the trace is clearly visible each time you trigger a single sweep.

☐ **Step 9:** Adjust your oscilloscope so that a single-sweep begins each time you close the circuit switch. Leave the oscilloscope in the "armed" or ready mode for a single sweep.

☐ **Step 10:** Open the camera shutter for a manual exposure by lifting up the shutter toggle. Close the circuit switch to trigger the oscilloscope sweep. Close the camera shutter by returning the shutter toggle to the center position.

☐ **Step 11:** Remove and develop the film. The results should be similar to Figure 13.

The time required for the circuit element to reach a given voltage can be measured on the photograph by using the seconds / division value indicated by the oscilloscope controls or readout and the graticule lines in the photograph.

This technique is not be as straightforward for oscilloscopes that do not have graticules, because the photograph is not the same size as the oscilloscope display.

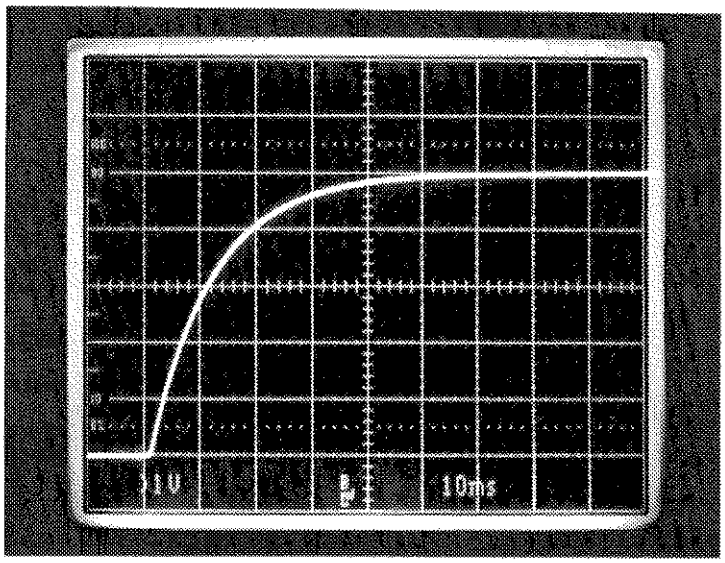


Figure 13: Photograph of a Single-Shot Signal

Recording a Gray Scale Video Image

Most oscilloscope displays resemble a line or bar graph, with the signal sketched bright against a dark background. Video images, however, are more pictorial and contain large amounts of information and detail about brightness, contrast, gray levels, and perhaps color. High resolution monitors are used to view and analyze gray scale images in areas as diverse as television, medicine, and research.

In this example a video image is captured from a high resolution monitor. An observatory provided a digital image that was subsequently processed by a computer and displayed on a gray scale monitor. You could use a VCR with still frame capability to display a comparable image.

This example assumes that you are already displaying a gray scale image on an appropriate monitor.

- ☐ **Step 1:** Adjust the monitor display for the sharpest possible focus of the displayed image. Adjust the display contrast and brightness as desired.
- ☐ **Step 2:** Choose and load film. Because a gray scale image requires a wider tonal range than oscilloscope photography, we chose Polaroid Type 331 film. Refer to Table 1 on page 34 for a list of film characteristics.
- ☐ **Step 3:** Choose and install a hood. In this example we are using a Tektronix 634 monitor. The 7000 Series hood provides the best fit. For instructions on removing and installing a hood, refer to "Camera Hoods" on page 7. Mount the hood on the monitor.
- ☐ **Step 4:** Set the shutter speed control. Because a gray scale video image usually contains much more light than an oscilloscope trace, begin by setting the shutter speed control to 0.1 seconds. If your display is very dim, you might try 0.5 seconds to start. Note that exposure time is very dependent on film type; if you are using a different film type, you may need to lengthen the exposure time dramatically.
- ☐ **Step 5:** Make a test exposure. Because the film used by the auto back camera is self-developing, wait a few minutes until the film appears to stop developing.
- ☐ **Step 6:** Study the resulting print. It should appear similar to Figure 14. If the print is uniformly overexposed, reduce either the shutter timing or the monitor intensity. If the print is uniformly underexposed, increase the shutter timing or the monitor intensity.

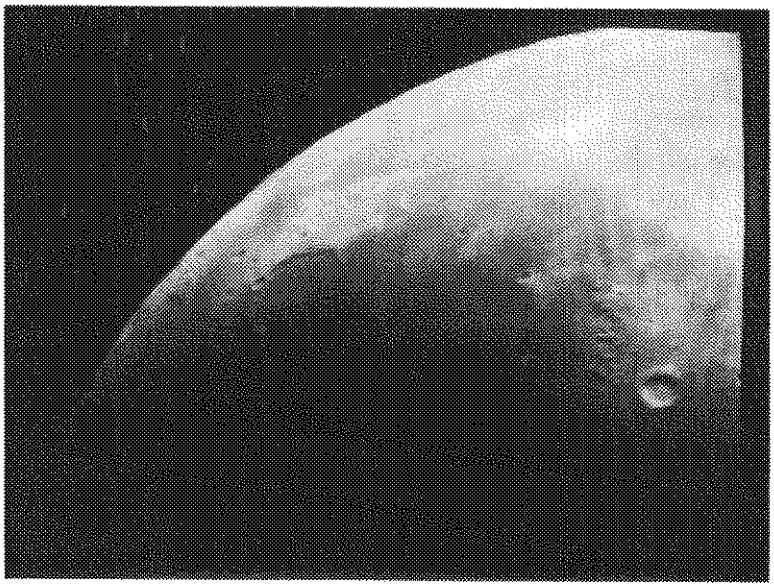


Figure 14: Photograph of a Video Signal

☐ **Step 7:** Continue adjusting the monitor controls and the exposure time until you obtain a satisfactory print.

Picture Problems

This section describes some common problems, and how to correct them.

Prints Too Light

Prints that are too light are usually overexposed or underdeveloped.

Overexposed or underdeveloped photographs have poor contrast between the image and the background. Detail in the light areas of the print is poor. Black and white films develop with a gray or white background. Significantly overexposed or underdeveloped film generally develops as a solid white print.

Consider whether any of the following conditions apply to your situation and take the recommended action.

Excessive Exposure Time

Try reducing the exposure duration by one-half for each of several successive exposures. Use the shutter speed control to set the exposure time.

Insufficient Development Time

Try doubling the development period for each of several successive exposures. Read the development time information supplied with the film pack. Development time is strongly affected by ambient temperature. Be certain that the film pack temperature is stabilized at the ambient temperature. Figure 15 shows a slightly under-developed print.

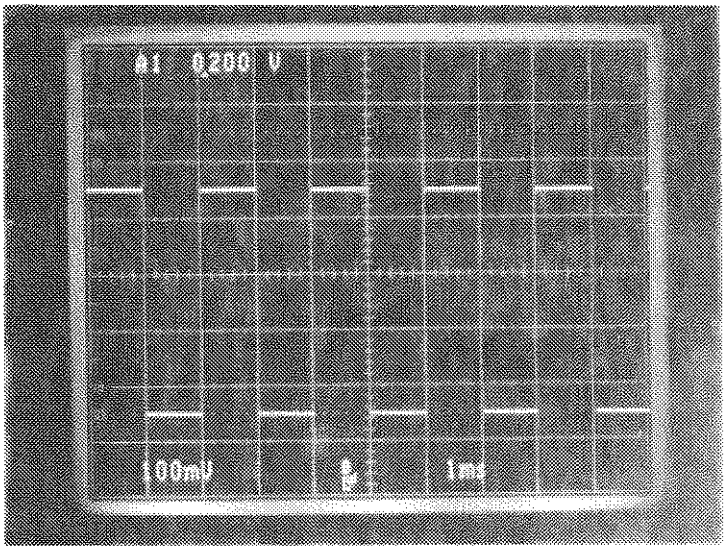


Figure 15: An Underdeveloped Print

Film Too Fast

For a given, constant level of light, films with higher ISO ratings require less exposure time than films with lower ratings. If your display does not have a high writing speed, consider using a film with a lower ISO rating.

Display Too Bright

Do not set your display intensity very bright except where writing speeds are very fast, or where the display is very dim. Blooming of oscilloscope traces and ghosting around light details in the image are signs that you may need to turn down the display intensity.

Flash Intensity Too High

If you are using the scale or graticule illumination feature of your oscilloscope, turn the flash unit off. If you need to use the flash unit, try reducing the flash intensity setting by one-half for each of several successive exposures.

Film Pack Damage

Use only film that has been properly stored and carefully handled. Use particular care when opening the film wrapper and while installing the film pack.

Prints Too Dark

Prints that are too dark are generally underexposed or overdeveloped.

Underexposed or overdeveloped photographs have poor contrast between the image (if visible) and the background. Detail in the dark areas of the print is poor. Black and white films develop with a deep black background; color prints develop a black or blue-black background.

Insufficient Exposure Time

Try doubling the exposure duration for each of several successive exposures. Use the shutter speed control to set the exposure time. Figure 16 shows a print that is slightly underexposed.

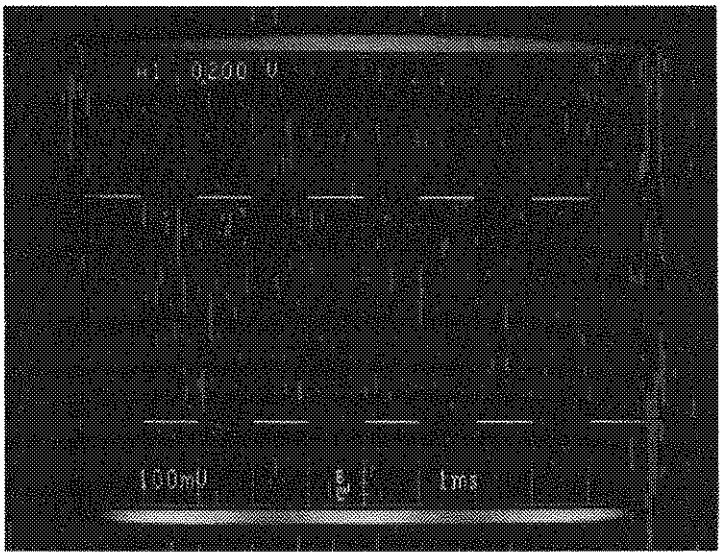


Figure 16: An Underexposed Print

Excessive Development Time

Try reducing the development period by one-half for each of several successive exposures. Read the development time information supplied with the film pack. Development time is strongly affected by ambient temperature. Be certain that the film pack is stabilized at the ambient temperature.

Film Too Slow

For a given, constant level of light, films with lower ISO ratings require more exposure time than films with higher ratings. If your display has a high writing speed, consider using a film with a higher ISO rating.

Display Too Dim

If your oscilloscope scale or graticule looks good on your print but the signal trace is too dim, increase the oscilloscope intensity control. However, remember that most displays do not appear sharp and well focused when the intensity is set too high.

Flash Intensity Too Low

If the signal portion of your print looks good but the oscilloscope scale or graticule appears dim, try doubling the flash intensity for each of several successive exposures.

Camera Aperture Too Slow

The C-9 has a fixed-aperture lens (f/11; f/16 with the 11000 series hood fitted). If you need to capture low-light, short-duration signals, you may need to use a camera capable of adjustment to a lower f-stop.

To extend the range of the C-9 camera you could "fog" the film before or after making an exposure. Briefly expose the undeveloped film to a uniform light source to increase the film sensitivity.

Be prepared to make many trial exposures when practicing this complex technique. Because you are operating beyond the normal limit of performance for the camera, the effects of exposure and development time become critical and results vary. For example, the light energy required to fog film may be as little as $^{1}/_{10,000}$ of that required for a normal exposure.

Prints Lack Detail

Poor contrast and lack of detail most often occur in gray scale images that contain a wide tonal range. If you have difficulty capturing detail in your images, consider whether any of the following apply to your situation.

Film Mismatch

Try using a film type specifically designed to capture a wide range of gray scales, or which has an extended color range. Refer to Table 1 on page 34 for a summary of selected film types and characteristics.

Gray Scale Compression

The human eye can detect a wider range of brightnesses than photographs can reproduce. Because of this, pictures sometimes cannot show all the features and details of a displayed image; fine bright details may become blank white areas, or fine details in dark areas become blank black areas.

Figure 17 shows an image where the film has caused gray scale limiting. There is less detail in the image than could be seen on the monitor being photographed.

You can sometimes compensate for this limitation by pre-compressing the displayed image. Lower the contrast and brightness of the display (the difference between light and dark areas in the image) until the overall image appears gray and flat. There should be no bright white or deep black anywhere in the image.

Figure 18 shows the same image as Figure 17, but the detail has been enhanced by reducing the contrast of the displayed image.

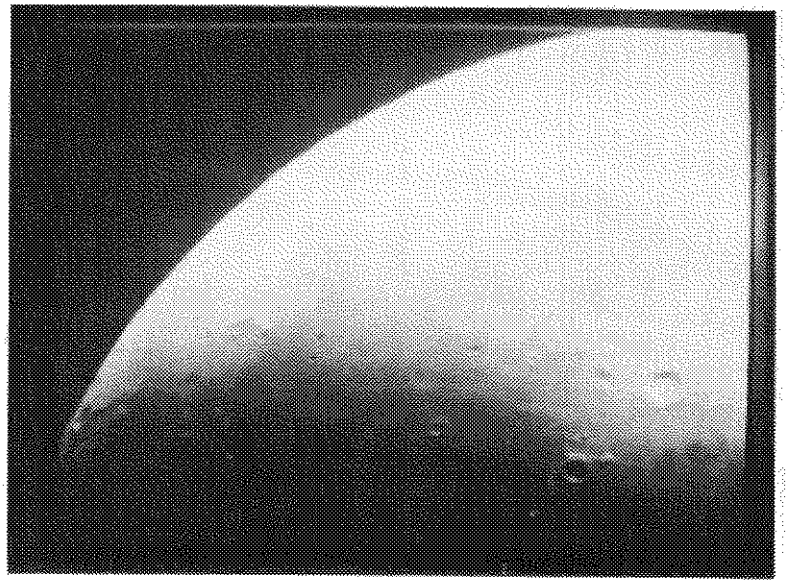


Figure 17: Image Gray Scale Limited by Film

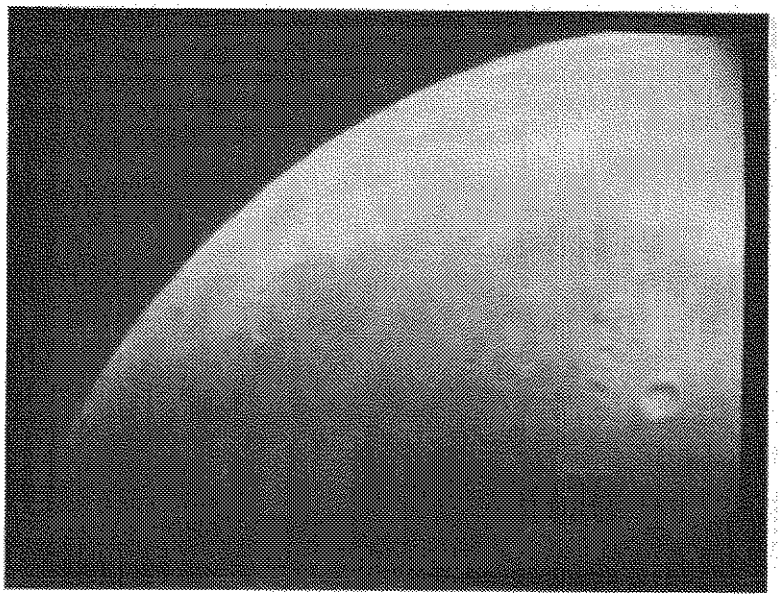


Figure 18: Detail Enhanced by Compressing Gray Scale

If you still cannot resolve all the detail in your display, you may have to adjust your display controls to highlight the detail in either the light or dark area and "throw away" detail in the opposite area. Using contrast control, you can control the image by emphasizing the important parts of the image and blanking out those details of less importance to you.

Expired Film

Film packs are date coded. Verify that the film you are using has not exceeded its expiration date. Follow the film manufacturer's instructions for handling and storing film.

Undeveloped Corners

The corners of prints remain undeveloped when the film processing chemicals contained in the print packet are not properly distributed across the entire print surface.

Consider whether any of the following conditions apply to your situation and take the recommended action.

Film Removal Technique (standard camera)

If you pull the film tab up or down while withdrawing the film tab from the camera back, the processing chemicals will not be evenly distributed. Pull the film tabs straight out, in the plane of the camera back.

Worn or Dirty Rollers

If the rollers that force the development chemicals over the print surface are worn or damaged, the corners may not develop. Visually inspect the rollers as described in "Cleaning" starting on page 77. Replace the rollers whenever necessary.

Expired Film

If your film pack has exceeded its expiration date, film packets may begin to delaminate, causing uneven development. Use only film that has not exceeded its expiration date.

Reflections and Light Leaks

Light leaks and reflections allow stray light to find its way onto the film during exposure. There are several potential sources of these uneven exposures.

Light Leaks

The design of the C-9 camera makes light leaks unlikely. However, if you repeatedly drop your camera or subject it to severe shocks, you may crack or loosen segments of the camera assembly. Visually inspect the camera for cracks or damage. If the camera assembly seems loose in the area of the shutter controls and spacers, remove the hood as described in "Camera Hoods" on page 7. Use a Torx T10 screwdriver to tighten the four visible corner screws.

You may experience light leaks if you use a hood that does not match the instrument faceplate bezel.

Verify that the viewing door on your hood or flash unit is securely closed before making exposures.

Light leaks can occur at the 12-pin connector between the shutter assembly and the camera back. Verify that the light-tight grommet around the connector is properly installed.

Reflections

Reflections may appear on your print in the form of multiple images, ghosting, or streaks of light. If your oscilloscope or monitor has plastic or glass filters or plates mounted in front of the display, you may need to remove them.

WARNING

Never remove a CRT implosion shield. Read your instrument manual to determine if the glass or plastic filters are removable. If you are unsure, do not remove the filter.

Damaged Film Pack

Rough handling while unwrapping or installing the film pack may result in light leaks, blotches, or streaks appearing on the finished print. Follow the film manufacturer's instructions for handling and storing film.

Streaks and Blobs

This general category of defects is primarily associated with uneven chemical distribution on exposed film, or with optical-path obstructions.

Dirty or Worn Rollers

Deposits of film-development chemicals can build up on rollers and cause uneven distribution of the chemicals on subsequent prints. Defects associated with dirty rollers are often repeated at intervals across the developed print. Worn rollers may produce streaks or a

top-to-bottom gradation of development caused by differences in roller spacing along the length of the rollers. Replace the roller assembly as described in "Cleaning" on page 77.

Film Removal Technique (Standard Back)

Be certain to follow the film plane when withdrawing exposed film from the camera. Pulling up or down while withdrawing the film can result in uneven chemical distribution, as well as premature separation of the film layers.

Dirty or Smudged Lens or Faceplate

Defects caused by dirt on the camera lens will be severely defocused. Smudges and dirt on the display faceplate will generally be more focused. Lens and faceplate defects will appear in the same position on successive photographs.

Examine both the display faceplate and the camera lens in reflected light to highlight optical surfaces that need to be cleaned. If you are using the 11000 series hood, remember to also inspect the corrector lens mounted in the hood. Clean the lens using a high-quality lens tissue. Follow the instrument manufacturer's instructions for cleaning the display faceplate.

Wire or Battery Shadows

Caused by internal wires or batteries blocking the camera optical path, wire and battery shadows are typically seen as defocused lines or streaks at the edges of photographs. Occasionally, wire shadows may appear as a bar or a loop passing through any part of the photograph.

On cameras equipped with a flash unit, verify that the flash unit wires are not blocking either the lens or the flash lamp.

On standard back cameras, unlatch and open the camera back and verify that the battery holder wires are dressed (positioned) against the camera body walls, and are not blocking the lens.

Verify that the battery holders are positioned forward against the lens housing, are centered on their hook-and-loop fasteners, and are securely fastened in place.

Operational Camera Problems

The C-9 camera uses a proven shutter design and advanced shutter/eject control circuits. The camera features modular construction and has many surface-mounted devices. Other than cleaning the camera and changing the batteries, there are no performance adjustments or service procedures that you should need to perform. (The auto back camera can be modified to disable the automatic film ejection feature.)

If you experience operational problems with your camera, replace the batteries before attempting to determine the trouble area of operation or before returning the camera to Tektronix for service. Refer to "Replaceable Parts" on page 85, for an exploded view of the camera and its accessories, and for information about obtaining replacement parts for your camera. "Maintenance" on page 77 explains how to replace the major camera assemblies.

For service information, please contact your nearest Tektronix Service Center.

Flash Unit

If your oscilloscope does not have graticule illumination, a flash unit will allow you to illuminate the display graticule during screen exposures.

The flash unit can only be installed on hoods that have a viewing door, such as the portable and 7000 Series hoods. The flash unit, which has its own viewing door, replaces the viewing door of the hood.

To install or replace the flash unit, use the following procedure and study figures 19 and 20 as necessary.

☐ **Step 1:** If the hood on which you are installing the flash unit is attached to the camera, remove it by unsnapping the plungers as described in "Camera Hoods" on page 7.

☐ **Step 2:** Unsnap the viewing door of the hood. Using a screwdriver with a POZIDRIV® tip, remove the three screws holding the door hinge in place. Hold one hand under each nut to catch the nut and washer as they fall. Remove the viewing door by withdrawing the door hinge from under the mounting holes.

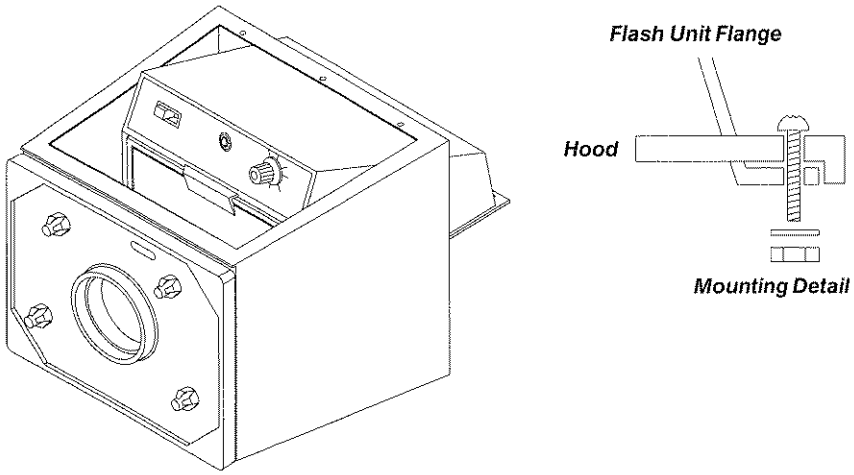


Figure 19: Inserting the Flash Unit Into the Hood Opening

☐ **Step 3:** Position the flash unit by inserting it into the open end of the hood and lifting it into place. To prevent the flash unit from falling, either hold the mounting flanges together with one hand or lay the assembly on its side.

☐ **Step 4:** Attach the flash unit by replacing the screws, nuts, and washers previously used to mount the hood viewing door.

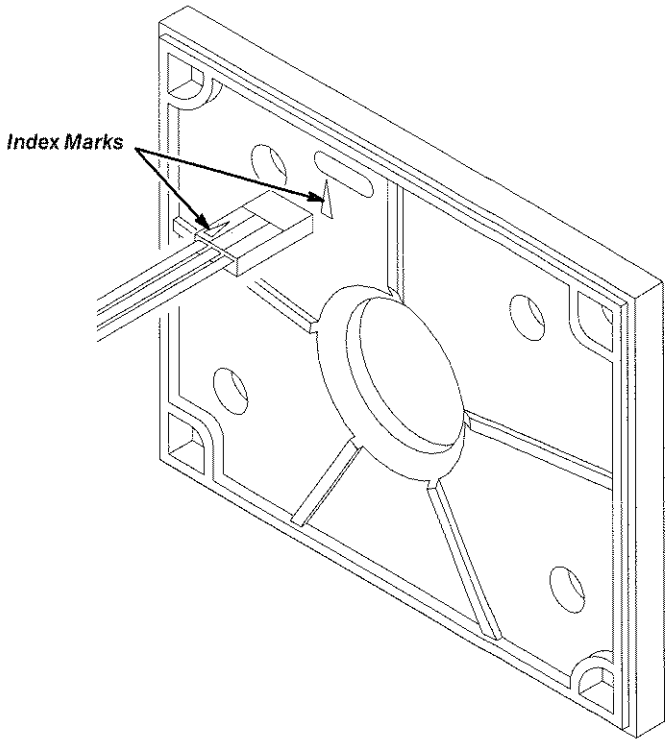


Figure 20: Connecting the Flash Unit Wire Connector

☐ **Step 5:** Connect the flash unit wire connector as shown in Figure 20. Take care to align the index mark on the connector to the mark next to the access slot in the hood. Position the wire so that it does not obstruct the flash lamp.

Pistol Grip

The pistol grip helps you hold the camera steady when taking pictures of image sources that don't fit a hood. Install the pistol grip using the following procedure. Figure 21 shows how the pistol grip attaches to the C-9 Camera.

- ☐ **Step 1:** Fit the pistol grip body onto the camera with the trigger facing forward. The threaded screw at the top of the pistol grip fits into a receptacle in the bottom of the camera back. Rotate the pistol grip thumb wheel counterclockwise as viewed from the top.
- ☐ **Step 2:** Screw the plunger end of the pistol grip cable into the side of the pistol grip.
- ☐ **Step 3:** Screw the mechanical-to-electrical adapter on to the pin end of the pistol grip cable.
- ☐ **Step 4:** Insert the mechanical-to-electrical adapter into the remote shutter connector on the camera body.

To remove the pistol grip, reverse the assembly steps.

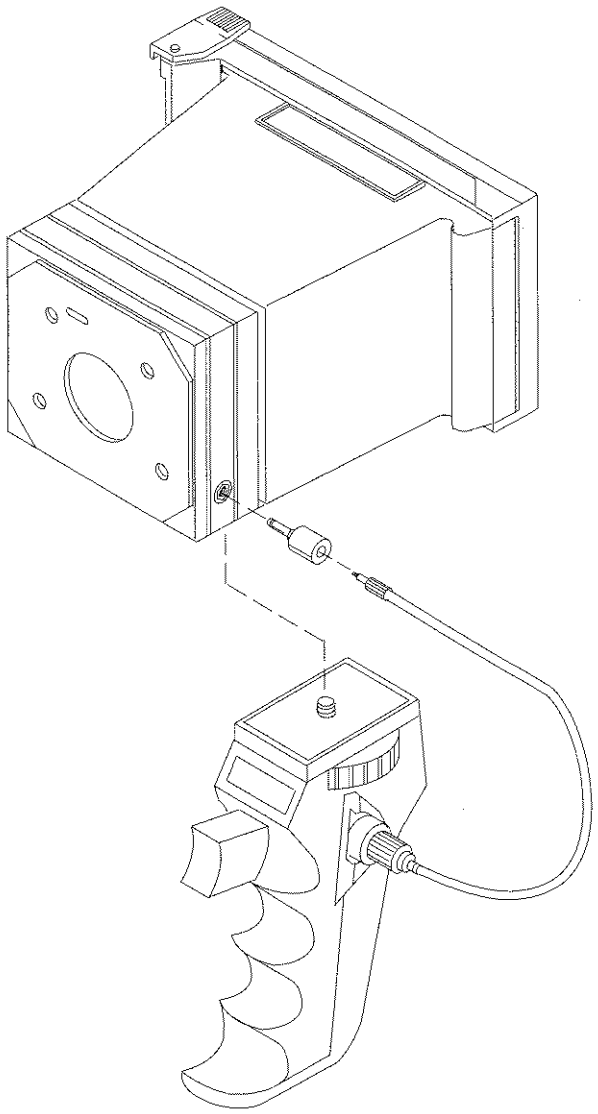


Figure 21: Installing the Pistol Grip

Foot Switch

Install the foot switch for hands-off operation of the camera shutter. To connect the foot switch, insert the pin end of the foot switch cable into the remote shutter connector on the camera body. See Figure 22.

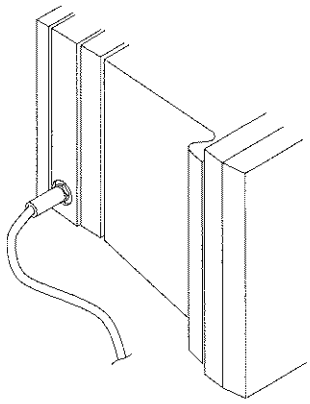


Figure 22: Connecting the Foot Switch

Characteristics

Tabes 2 through 5 list selected physical, electrical, optical, environmental, and performance characteristics of the C-9 camera.

Characteristics are subject to change. All characteristics are typical unless stated otherwise.

Table 2: Physical Characteristics

Characteristic	Standard Back	Auto Back
Length		
without hood	14.7 cm (5.8 in)	15.0 cm (5.9 in)
with portable hood	26.3 cm (10.35 in)	26.5 cm (10.45 in)
with 7000 hood	26.3 cm (10.35 in)	26.5 cm (10.45 in)
with 11000 hood	33.1 cm (13.05 in)	33.4 cm (13.15 in)
with TDS 500 hood	27.1 cm (10.65 in)	27.4 cm (10.77 in)
with TDS 400 hood	27.5 cm (10.83 in)	27.8 cm (10.95 in)
with TAS 400 hood	27.0 cm (10.61 in)	27.3 cm (10.73 in)
Height		
without pistol grip	11.8 cm (4.65 in)	15.2 cm (6.0 in)
with pistol grip	24.6 cm (9.7 in)	28.2 cm (11.1 in)
Width	17.1 cm (6.75 in)	17.8 cm (7.0 in)
Weight		
without hood	0.62 kg (1.4 lb)	0.76 kg (1.7 lb)
with portable hood	0.82 kg (1.8 lb)	0.95 kg (2.1 lb)
with 7000 hood	0.82 kg (1.8 lb)	0.95 kg (2.1 lb)
with 11000 hood	0.82 kg (1.8 lb)	0.95 kg (2.1 lb)
with TDS 500 hood	0.74 kg (1.7 lb)	0.88 kg (2.0 lb)
with TDS 400 hood	0.77 kg (1.7 lb)	0.91 kg (2.0 lb)
with TAS 400 hood	0.86 kg (1.9 lb)	1.00 kg (2.2 lb)

Table 3: Environmental Characteristics

Characteristic	Standard	Note
Temperature		
operating	0° C to +50° C (+32° F to +122° F)	12.7° C to 32° C recommended by Polaroid.
nonoperating	−30° C to +75° C (−67° F to +167° F)	Film and batteries removed.
Humidity		
nonoperating	0 to 75% relative humidity at +50° C (+122° F)	Test duration four hours. Film and batteries removed.
Altitude		
operating	4,500 m (15,000 ft)	
nonoperating	15,000 m (50,000 ft)	Film and batteries removed.
Vibration[1]	In each axis: 4 g constant acceleration sweep between 10 and 40 Hz; additional 5-minute dwells at each resonance, or at 30 Hz if there are no resonances.	
Shock	In each axis: three 50 g, one-half sine, 10-millisecond shocks. Repeat in two directions for each axis for a total of 18 shocks.	

[1]With standard camera back only

Table 4: Optical Characteristics

Characteristic	Standard	Note
Lens	Glass; three-element anastigmatic; anti-reflection coated; fixed focus.	
aperture with 11000 series hood	f/11 f/16	
Field of view (half-angle) with 11000 series hood	27° 26°	
Magnification with 11000 series hood	−0.7% −0.51%	
Effective focal length with 11000 series hood	63 mm 70 mm	
Object distance with 11000 series hood	139.14 mm 182.00 mm	
Depth of field at object plane	±6 mm	
Geometric distortion with 11000 series hood	<0.5% <1.0%	

Table 5: Electrical Characteristics

Characteristic	Standard	Note
Batteries		
number of cells	8	6 VDC total.
cell voltage	1.5 V	
size	AA	
type	alkaline	Duracell MN 1500, or equivalent.
External power converter		Optional, auto back only.
line voltage input	90–132 VAC	
output voltage	9.5 VDC	
output current	1.5 A, 3 A peak	
Camera voltage requirements		
battery voltage	5.5 to 6.0 VDC	
external power converter voltage	8 to 15 VDC	
ripple, RMS	100 mV_{p-p} max.	
Camera current requirements		Battery or voltage converter.
standby	50 µA	
quiescent active	20 mA	
peak, shutter actuation	3 A, 22 ms max.	
peak, ejection cycle	1 A, 3 seconds	Auto back only.

WARNING

The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all Safety Summaries before performing any service.

Maintenance

This section gives you the information you need to maintain your camera.

Cleaning

Clean your camera regularly to prevent build-up of dirt and to ensure trouble-free operation.

Exterior Camera Surfaces

Clean exterior camera surfaces with a soft lint-free cloth dampened with warm water. If necessary, use a mild soap solution.

Interior Camera Surfaces

Clean interior surfaces using only a dry, lint-free cloth or soft brush.

Lenses

Clean the camera lens frequently using a soft camel-hair brush. Remove fingerprints and smudges promptly with a clean, high-quality lens tissue.

Film Rollers (Standard Back)

To avoid a potentially damaging buildup of film development chemicals, inspect the film rollers every time you change a film pack, and clean the film rollers often. Replace the rollers when they become worn or damaged. To clean the film rollers, follow this procedure:

☐ **Step 1:** Rotate the door latch to the open position and open the camera back fully.

WARNING

To prevent chemical burns, avoid contact with the film-development chemicals used in the film packs. Follow the film manufacturer's instructions carefully. If you get film development chemicals on your skin, wash the area immediately and thoroughly. Keep film chemicals away from your eyes and mouth.

☐ **Step 2:** Lift the roller assembly flanges, as shown in the illustration on the inside of the camera-back door. The roller assembly will rotate out of its retaining clip. Once free, simply withdraw the roller assembly from the door.

☐ **Step 3:** Clean the rollers with a lint-free cloth dampened with water, or with a cotton-tipped applicator swab. Rotate the rollers while cleaning them to make sure the entire surface of each roller is clean. If the rollers show uneven wear or deep scratches, replace them with a new roller assembly.

☐ **Step 4:** Reinstall the rollers by inserting them fully against the end of the camera door and then pivoting the roller assembly flanges down into place.

Film Rollers (Auto Back)

To avoid a potentially damaging buildup of film development chemicals, inspect the film rollers every time you change a film pack, and clean the film rollers often. Replace the rollers when they become worn or damaged. To clean the film rollers, follow this procedure:

- [ ] **Step 1:** Open the film door by lifting and rotating the door latch.
- [ ] **Step 2:** Looking down from above the open film cavity, locate the door-hinge pivot points by rocking the door back and forth. The door pivots on pins passing through the flanges at each end of the roller assembly.
- [ ] **Step 3:** Holding the camera firmly, release one roller flange by gently pressing the flange outward, away from the film cavity and pivot pin. Lift the flange slightly to free it completely.
- [ ] **Step 4:** Release the other end of the roller assembly by gently pressing the flange outward, away from the film cavity and pivot pin. Lift the flange to free it completely.
- [ ] **Step 5:** Clean the rollers with a lint-free cloth dampened with water, or with a cotton-tipped applicator swab. Rotate the rollers while cleaning them to make sure the entire surface of each roller is clean. If the rollers show uneven wear or deep scratches, replace them with a new roller assembly.
- [ ] **Step 6:** To reinstall a roller assembly, reverse the procedure.

Camera Control Housing

Follow this procedure if you should ever have to replace the camera control housing. If you ever need to remove or replace the shutter assembly, you will need to remove the camera control housing first.

The procedure to remove and replace the camera control housing is the same for both standard back and auto back cameras.

☐ **Step 1:** If a flash unit is attached to an installed hood, reach inside the hood and disconnect the flash unit wires. Pull the wire bundle straight out of the access slot.

☐ **Step 2:** Remove any installed hood by reaching inside the hood and pulling up on the snap plungers. The plungers cannot be separated from the hood assembly.

☐ **Step 3:** Disconnect the external power supply or remove the batteries.

☐ **Step 4:** With the camera resting on its back, use a Torx T-10 screwdriver to remove the four visible corner screws. These long screws pass through a spacer, the shutter and lens assembly, and another spacer. To avoid damaging any of the camera parts, exercise care after removing the screws.

☐ **Step 5:** Lift the top spacer to expose the top side of the shutter/eject control circuit board. Note the orientation of the spacer, particularly the position of the flash unit cable access slot, to help you re-orient the spacer upon reassembly.

☐ **Step 6:** Remove the black light-tight grommet from the hole left from removing the connector. To maintain the light-tight properties of this connection, you should discard and replace this grommet each time you remove the connector.

☐ **Step 7:** Gently lift the camera control housing, taking care not to stress the cable assembly that connects to the bottom of the housing. If you tilt the housing on edge so that the cable assembly is at the bottom, you can study the orientation of the cable connector (Figure 23). Disconnect the cable by pulling it straight out from its access slot.

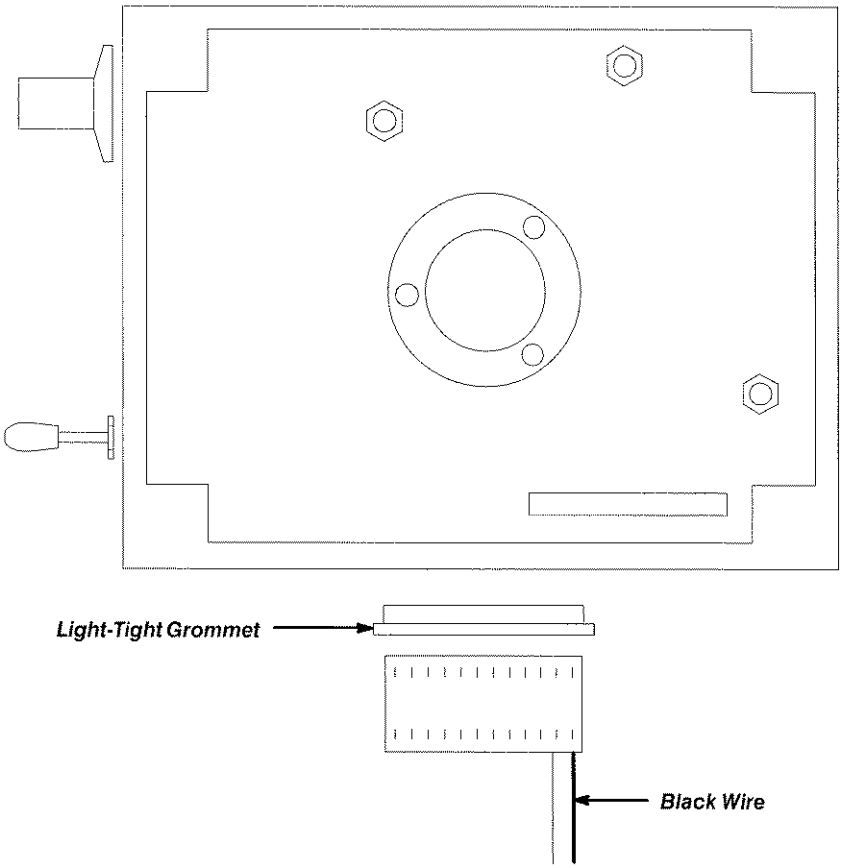


Figure 23: Cable Orientation

A new assembly can be installed, or the existing one replaced, by reversing the disassembly procedure. Study Figure 23 to reconnect the cable connector properly.

Shutter Assembly

Use this procedure to separate the shutter assembly from the control housing. Before removing the shutter, you must first complete the previous procedure to free the camera control housing.

- ☐ **Step 1:** Replace but do not fasten the spacer removed in step 3 of the previous procedure to remove the camera control housing. The spacer will protect the flash unit pins from being bent when the control housing is turned over.
- ☐ **Step 2:** Turn the control housing over and locate the three small nuts on the bottom of the housing.
- ☐ **Step 3:** (Refer to Figure 24.) Lay the housing on a flat surface and use a $^{3}/_{16}$ inch wrench or nut driver to remove the nuts and lock washers.
- ☐ **Step 4:** Flip the housing back over and remove the top spacer to expose the circuit board. Study Figure 25 and locate the three-wire shutter connector. Disconnect the shutter connector.
- ☐ **Step 5:** Taking care to avoid touching the lens, remove the shutter assembly from the control housing. If the assembly feels stuck, press evenly on all three mounting screws that protrude through the back of the camera control housing.

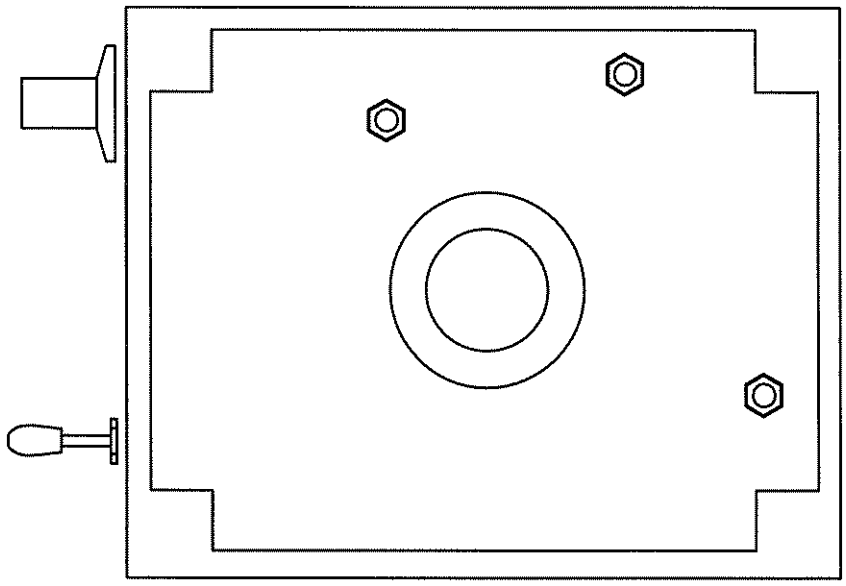


Figure 24: Shutter Mounting Screws

A new assembly can be installed, or the existing one replaced, by reversing the disassembly procedure. Study figures 23 and 25 to ensure that you reconnect the cable connectors properly.

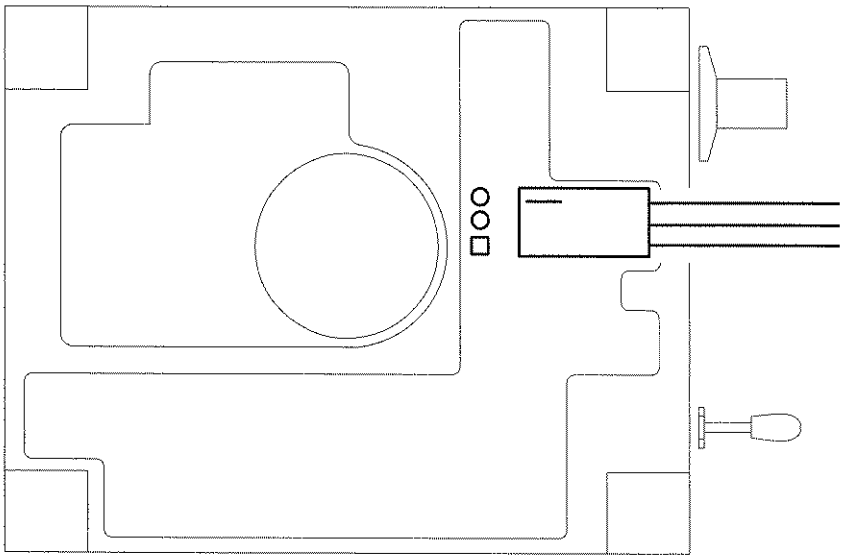


Figure 25: Shutter Connector

Replaceable Parts List

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.

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.

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
END ATTACHING PARTS

Detail Part of Assembly and/or Component
Attaching parts for Detail Part
END OF ATTACHING PARTS

Parts of Detail Part
Attaching parts for Parts of Detail Part
END OF ATTACHING PARTS

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.

Attaching parts must be purchased separately, unless otherwise specified.

Abbreviations

Abbreviations conform to American National Standards Institute Y1.1

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK WAY SUIT #2	VANCOUVER WA 98601
TK2480	WILLAMETTE PLASTICS	1111 NW 5TH PLACE	CANBY OR 97013
0DWW6	MICRO POWER ELECTRONICS	7973 SW CIRRUS DRIVE BLDG. #22	BEAVERTON OR 97005
29556	POLAROID CORP	549 TECHNOLOGY SQ	CAMBRIDGE MA 02139-3539
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
97918	LINEMASTER SWITCH CORP	74 PLAINE HILL RD	WOODSTOCK CT 06281

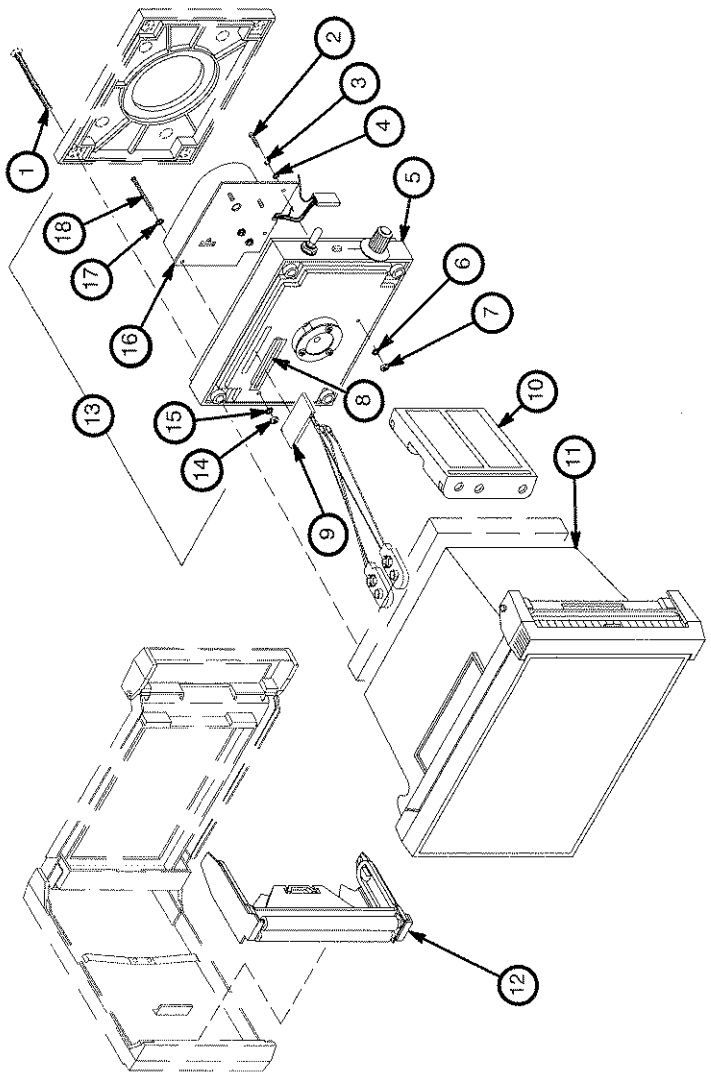


Figure 26: C-9 Camera Exploded View

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
26-1	----------			4	SCREW,MACHINE:6-32 X 1.75,FLH,100 DEG,BLK		
-2	----------			1	SCREW,CAP:2-56 X 0.375,SKT HD,STL CD PL		
-3	----------			1	WASHER,LOCK:#2 INTL,0.013 THK,STL		
-4	----------			1	TERMINAL LUG:0.099 ID,LOCKING,BRS CD PL		
-5	380-0470-15	B010100	B014999	1	HSG,LENS ASSY:W/BOARD	80009	380047015
	380-0470-17	B015000	B016114	1	HSG,LENS ASSY:W/BOARD	80009	380047017
	380-0470-19	B016115	B017029	1	HSG,LENS ASSY:W/BOARD	80009	380047019
	380-0470-21	B017030		1	HSG,LENS ASSY:W/BOARD	80009	380047021
-6	----------			1	WASHER,LOCK:#2 INTL,0.013 THK,STL		
-7	----------			1	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL		
-8	337-3793-00			1	SHIELD,LIGHT:LENS HOUSING	80009	337379300
-9	131-5306-01			1	CLIP,ELECTRICAL:BATTERY W/DIODES	TK2469	131-5306-01
-10	352-0511-00			2	HOLDER,BATTERY:CU BE	0DWW	ORDER BY DESC
	334-8288-00	B010919		2	MARKER,IDENT:MARKED WARNING	80009	334828800
-11	426-1294-08			1	FRAME,LT SHIELD:W/CAMERA BACK	80009	426129408
-12	401-0304-00			1	RLR,CAMERA BACK:TWO TONE GRAY	80009	401030400
-13	380-0470-16	B010100	B014999	1	HOUSING ASSY:W/SHUTTER ASSY	80009	380047016
-13	380-0470-18	B015000	B016114	1	HOUSING ASSY:W/SHUTTER ASSY	80009	380047018

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
-13	380-0470-20	B016115	B017029	1	HOUSING ASSY:W/SHUTTER ASSY (THIS PART NUMBER INCLUDES:26-2,3,4 5,6,7,14,15,16,17&18)	80009	380047020
-13	380-0470-22	B017030		1	HOUSING ASSY:W/SHUTTER ASSY (THIS PART NUMBER INCLUDES:26-2,3,4 5,6,7,14,15,16,17&18)	80009	380047022
-14	---------			2	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL		
-15	---------			2	WASHER,LOCK:#2 INTL,0.013 THK,STL		
-16	386-4275-02			1	PLATE,SHTR ASSY:	80009	386427502
-17	---------			2	WASHER,FLAT:0.093 ID X 0.281 OD X 0.02,STL		
-18	---------			2	SCREW,MACHINE:2-56 X 0.875,PNH,STL		
					STANDARD ACCESSORIES		
	070-8105-03			1	MANUAL,TECH:INSTRUCTION,C9	80009	070810503

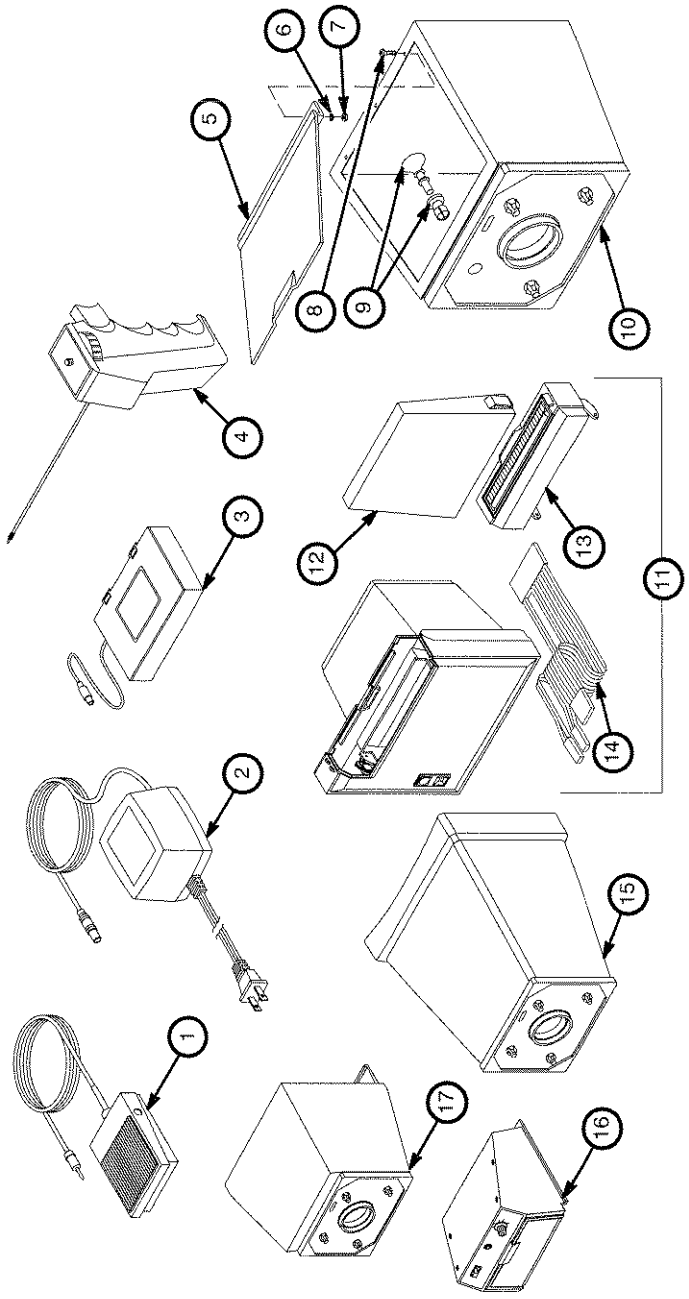


Figure 27: C-9 Options and Optional Accessories

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
27–					**OPTIONAL ACCESSORIES**		
–1	260–1189–02			1	SWITCH,FOOT:SPDT,7A,125VAC W/MICROPHONE PLUG	97918	SP–515–265–7
–2	119–1847–02			1	POWER SUPPLY:WALL MOUNT, PLUG IN, 110VAC 50–400HZ, 9.5VDC 1.5A	80009	119184702
–3	016–0799–03			1	BATTERY PACK:6 VOLT, W/LABEL	80009	016079903
–4	122–0186–01			1	PISTOL GRIP AS: (OPTION 1P ONLY)	80009	122018601
–5	200–1933–00			1	DOOR,CRT VIEW:W/O FLASH	80009	200193300
–6	––––––––			3	WASHER,LOCK:#2 INTL,0.013 THK,STL		
–7	––––––––			3	NUT,PLAIN,HEX:2–56 X 0.188,BLACK,CAD PL		
–8	––––––––			3	SCREW,MACHINE:2–56 X 0.312,PNH,BLACK,POZ		
–9	214–4419–01			1	FASTENER:8 EA,GROMMET AND PLUNGER	80009	214441901
–10	016–0359–03			1	ADPT,HOOD ASSY:PORTABLE (OPTION 20 ONLY–THIS PART NUMBER INCLUDES:27–5,6,7,8&9)	80009	016035903
	016–0357–03			1	ADPT,HOOD ASSY:7K (OPTION 07 ONLY–THIS PART NUMBER INCLUDES:27–5,6,7,8&9)	80009	016035703
–11	426–2041–04			1	FRAME,LT SHIELD:W/AUTO BACK (OPTION 1A ONLY–THIS PART NUMBER INCLUDES:27–12,13&14)	80009	426204104

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
-12	122-1039-00			1	HOLDER,FILM:IMBIBING CHAMBER	29556	761727
-13	122-1040-00			1	DOOR,ROLLER AS:	29556	761143
-14	174-2566-00			1	CA ASSY, SP, ELEC:10,26 AWG,9.25 L	TK2469	174-2566-00
-15	016-1099-01			1	HOOD ASSEMBLY:W/ADAPTER,11K (OPT 11-THIS PART NUMBER INCLUDES:27-9)	80009	016109901
	016-1154-00			1	HOOD,ASSY:TDS400 SERIES (OPT 04-THIS PART NUMBER INCLUDES:27-9)	TK2480	016-1154-00
	016-1145-00			1	HOOD,ASSY:TDS SERIES (OPT 05-THIS PART NUMBER INCLUDES:27-9)	80009	016114500
-16	016-0642-02			1	FLASH UNIT: (OPTION 1F ONLY)	80009	016064202
-17	016-1181-00			1	HOOD ASSY:TAS460 SERIES (OPT 06-THIS PART NUMBER INCLUDES:27-9)	80009	016118100

Glossary

Auto Back — a camera back that has an automatic film ejection mechanism to process film slides immediately after exposure.

Back, Camera Back — the part of the camera that holds and processes film.

Dark Slide — a protective black paper or cardboard placed over the film slides in a camera back, to protect the film slides from ambient light before the film pack is loaded. The film slide exposed by removing a partially full film pack from the camera is also called a dark slide.

Film Pack — a package of eight or ten film slides, prepared for loading into a camera back.

Film Slide — a single piece of film in a film pack.

Standard Back — a camera back that is manually operated to process film.

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