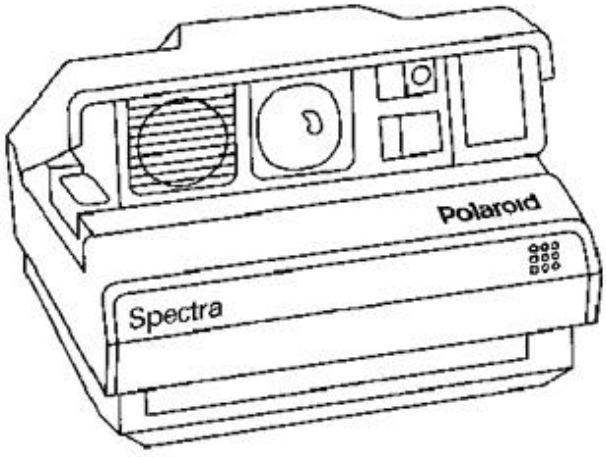
Polaroid

Repair Manual



Spectra/Image Cameras

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SECTION 1
GENERAL DESCRIPTION

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A. INTRODUCTION

The Spectra System represents the latest in photographic innovation from Polaroid. The system is composed of a folding, sonar rangefinding camera with built-in electronic flash, a new film, and a series of accessories designed exclusively for Spectra. Figure 1-1 shows the camera in the closed position. The external controls and indicators of the camera are shown in Figures 1-2 and 1-3. The accessories are shown in Figure 1-4.

Unlike other Polaroid models, the camera is held like a pair of binoculars during use. An adjustable strap along the side of the camera accommodates the user's left hand to provide stability during picture-taking. The right hand is free to manipulate the switches on the camera control panel and to press the shutter button. Controls and indicators which are unique to this camera will be discussed later in this section.

For the first time, silicon CMOS circuits are being extensively used in a Polaroid camera. Silicon CMOS IC technology allows increased functionality within a small package. In the case of the Spectra camera, it has allowed many added camera features such as an informative viewfinder which visually tells the user the distance to the subject, if conditions are not good for a picture, or if conditions are OK. Additionally, the camera audibly tells the user if conditions are not right for a picture (the camera "beeps") or if the camera has run out of film (the camera "chimes"). CMOS technology also permits a higher level of exposure compensation than in any previous Polaroid camera.

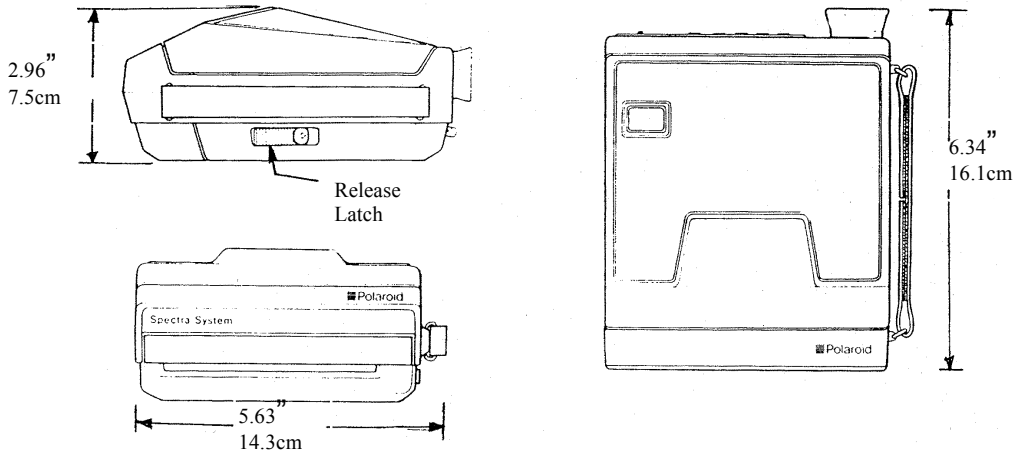

Figure 1-1 Spectra Camera in Closed (Folded) Position

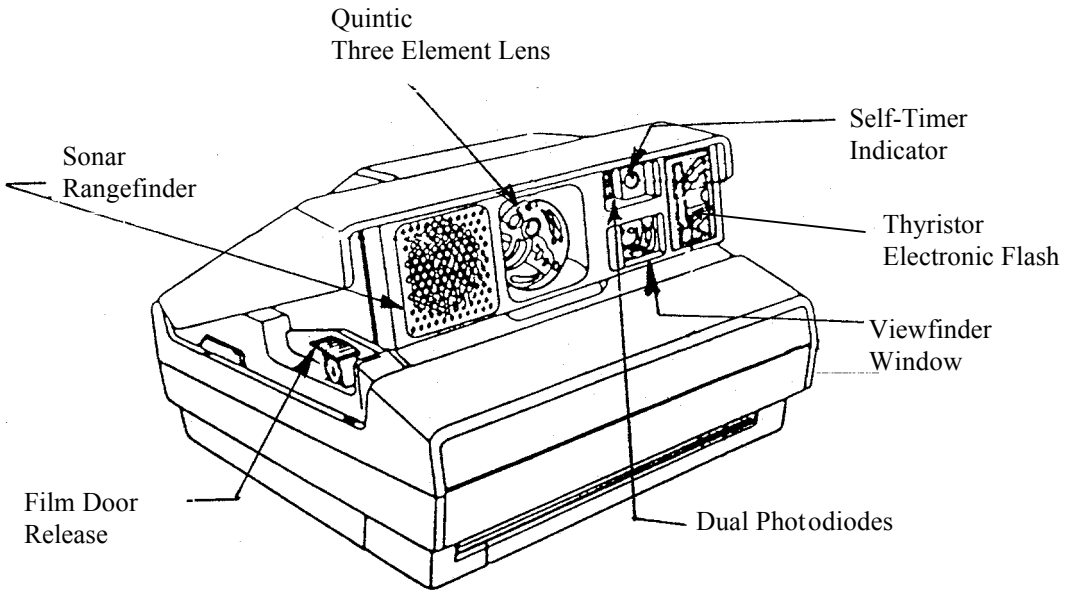

Figure 1-2 Spectra Camera in Open Position - Front View

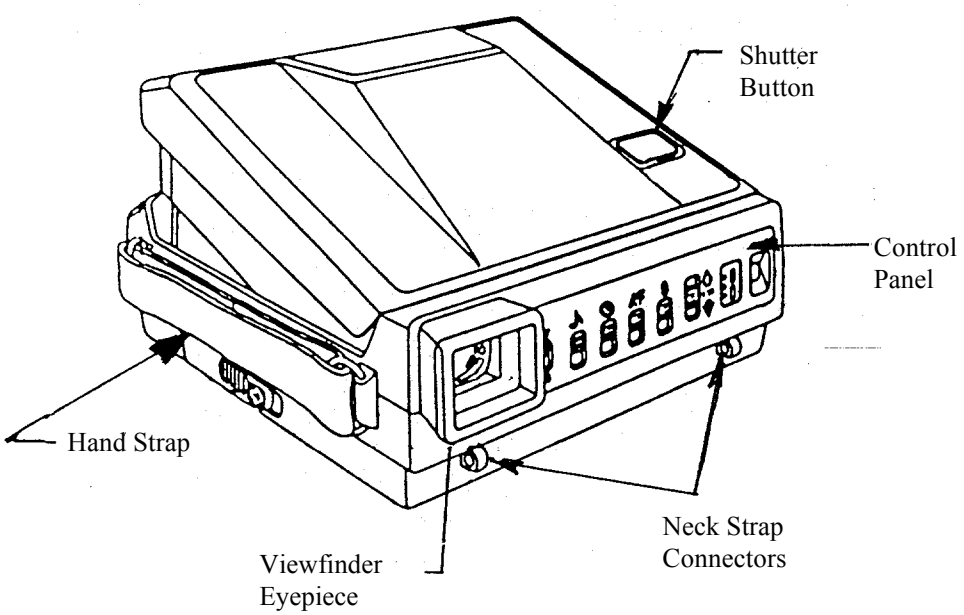

Figure 1-3 Spectra Camera in Open Position - Back View

B. ACCESSORIES

A large array of accessories is available for the Spectra camera. They include photo displays, a camera bag which also accommodates film and accessories, a tripod, a series of five filters, and a wireless remote.

A holder, which snaps over the camera lens, secures the filters during use. The various filters are used to provide: motion lines; a center spot surrounded by red vignetting; a starburst effect around candles, or lights; the multiplication of the image into three images side-by-side; or the multiplication of the image into five images, one in the center surrounded by four images in the corners of the photo.

The table-top tripod is secured into the tripod nut in the base of the camera. It may be used for shots employing the camera's built-in self-timer or for shots when the wireless remote accessory is being used.

The wireless remote is used to fire the camera from as far as 40 ft. (12.1 m) away. This accessory consists of a receiver which plugs into the camera remote socket and an FM transmitter. Since it is an FM system, a line-of-sight between camera and transmitter is not required.

C. SPECTRA FILM

Spectra System film has new dye molecule technology to produce more brilliant colors and more detailed reproductions than ever before in instant photography. The film uses an integral format like SX-70 (Time Zero) and 600 film. That is, development takes place within the sealed frame of the film with no external negative to discard. Each pack contains 10 frames and a P80 configuration, 6 volt battery. The battery powers all camera functions, including the electronic flash.

The most obvious difference between Spectra film and that of the SX-70 or 600 format are the dimensions of the film frame. Figure 1-5 provides a comparison of the two formats. As you can see, the Spectra format results in a horizontal picture, which is slightly larger than SX-70 or 600 pictures. (Obviously, if desired, the camera can be turned to change the picture format to vertical.)

Spectra System film is rated at ISO 600/29°.

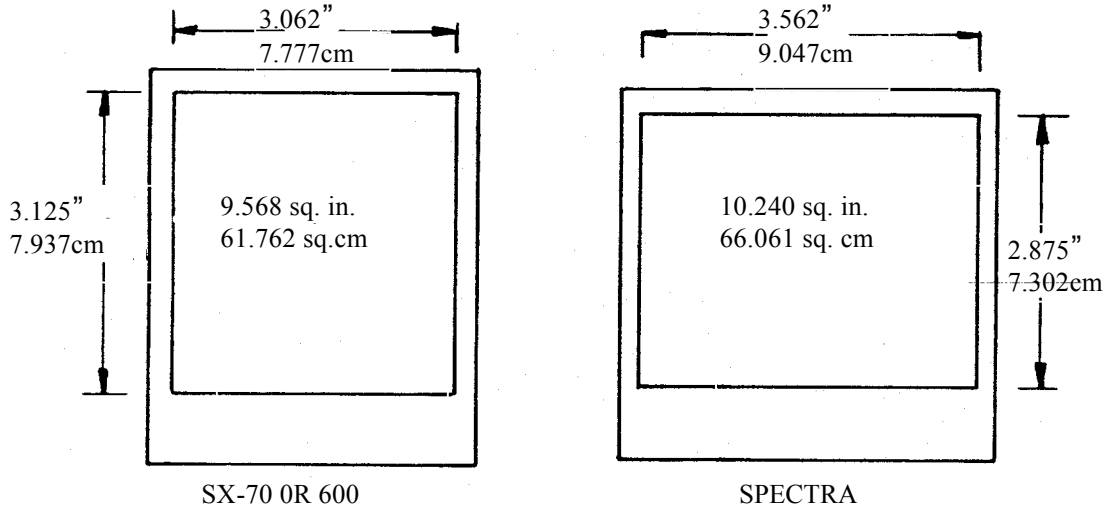

Figure 1-4 Spectra Film Dimensions vs SX-70 and 600 Film

D. CAMERA TECHNOLOGY

Spectra borrows from some of the proven features of earlier Polaroid models with which you are probably familiar. However, it also contains new innovative technology which sets it distinctly apart from all other photographic systems This section will explain some of the features of the camera. For a more detailed discussion of these features, refer to Section 2, Theory of Operation.

QUINTIC LENS SYSTEM

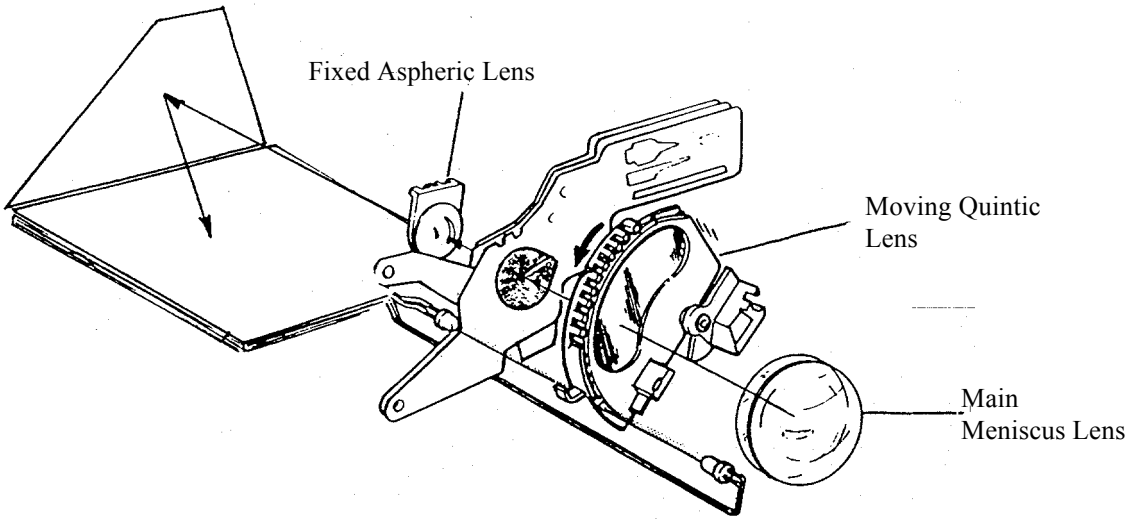

Figure 1-5 Spectra Camera Quintic Lens System

Perhaps the most innovative feature of the Spectra System camera is its Quintic lens system. Most cameras employ spherical (evenly shaped convex or concave) lenses. The Spectra camera relies on the relationship of aspherical (irregularly shaped) lenses. The camera has a three-lens system. The main meniscus lens is similar to those in other cameras. The second lens is a moving aspherical lens which swings in front of a fixed aspherical lens. The interaction of the moving and fixed aspherical lenses produces ten different zones of focus. The position at which the moving lens stops in front of the fixed lens is determined by ranging information produced by the sonar transducer.

THYRISTOR ELECTRONIC FLASH

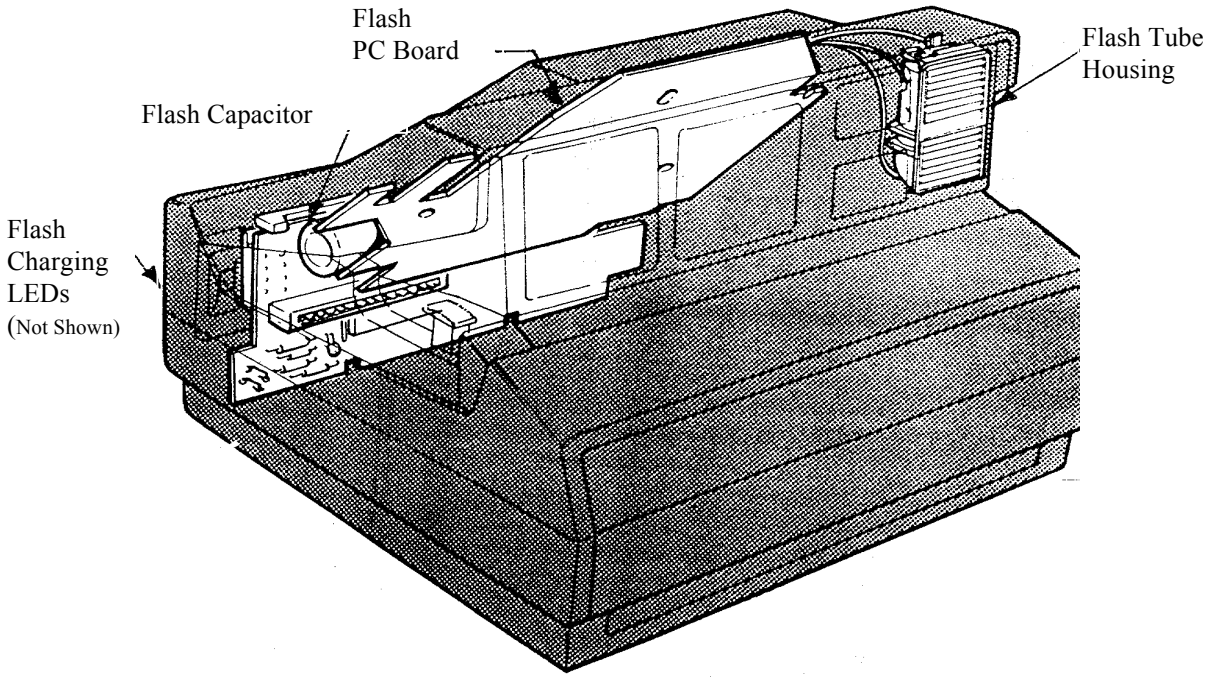

Figure 1-6 Thyristor Electronic Flash

The built-in electronic flash used in Spectra is the most efficient flash ever used in a Polaroid camera. It is highly compact, smaller than previous Polaroid electronic flash units, yet it delivers an output which allows flash pictures to be taken in a 2 foot to 15 foot range (.6 m to 4.6 m), The flash system is designed to be practically always ready, the worst case charge-time being less than three seconds. Typically, charge times are much less than that.

Fast charge times result from three features - 1) thyristor Circuitry, 2) SPAR, and 3) sneak charge. The thyristors halt the discharge of energy through the flash circuit when enough light has been produced to make a good exposure, Instead of being dissipated, the remaining energy is saved for the next flash. SPAR means Strobe Preferred Automatic Recharger. In effect, this means that the camera circuits are set up to always give preference to recharging the flash capacitors. Sneak Charge is a method employed to start charging the flash capacitor even before the camera cycle is completed. That is, the flash capacitor is partially charged at the end of one exposure in preparation for the next exposure.

After the film frame is ejected, the charging circuit tops off the flash capacitor. During the charging process, a red LED at the back of the camera warns that the camera is not ready for another exposure. When the capacitor has stored enough energy for another flash, the red LED goes out and a green LED lights, indicating that it is OK to take another flash picture.

SONAR RANGEFINDING

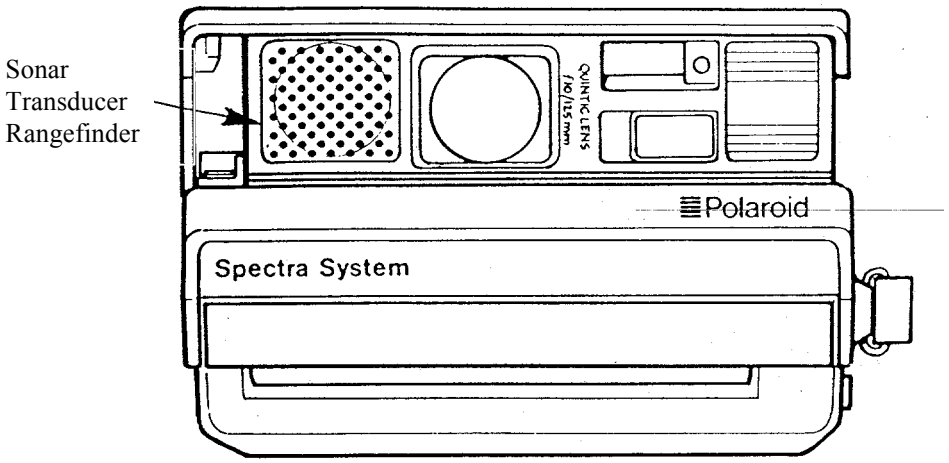

Figure 1-7 Spectra Sonar Rangefinder

Like earlier cameras (SX-70 Sonar, Pronto! Sonar, Model 660, Model 680) the Spectra uses sonar transducer ranging to determine subject distance. This information is used to set the lens position for proper focus. Unlike earlier cameras, the transducer on the Spectra is small, with an area surface measuring 1.1 square inches versus the 1.5 square inch surface of the earlier transducers.

EXPOSURE SYSTEM LIGHT MEASUREMENTS

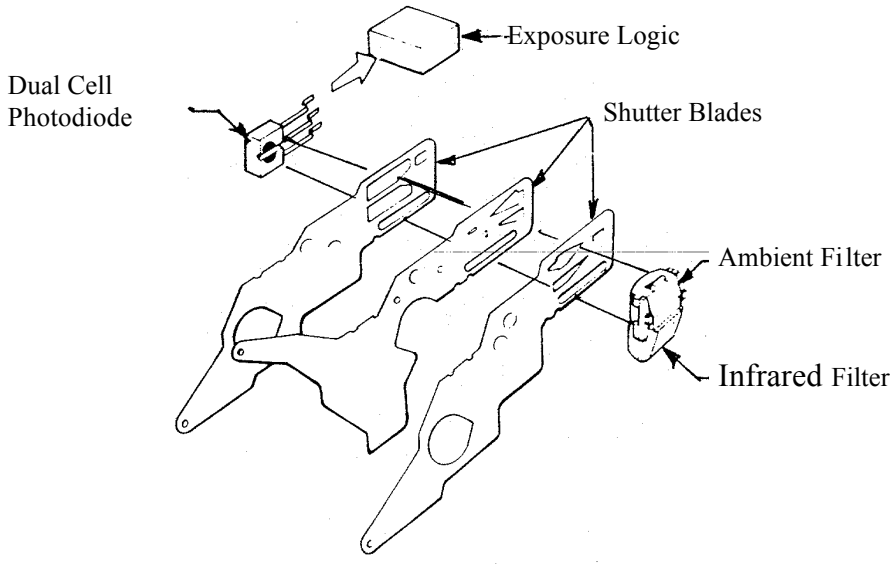

Figure 1-8 Spectra Dual Photocell System For Light Measur ements

Like the Model 640 and current LMS cameras, Spectra uses infrared light measurements coupled with the measurement of ambient, visible light to determine optimum exposures. However, Spectra goes one step further than the Model 640. Spectra incorporates the use of a dual cell photo diode. One cell reads only infrared and the other cell reads visible light. This unique dual photo-diode takes up no more space than the earlier single cell types, but provides a far more precise measurement of light. The light measurement is used to set lens aperture, shutter time-out, and to determine when the electronic flash is to be shut OFF.

ELECTRONIC TRIM

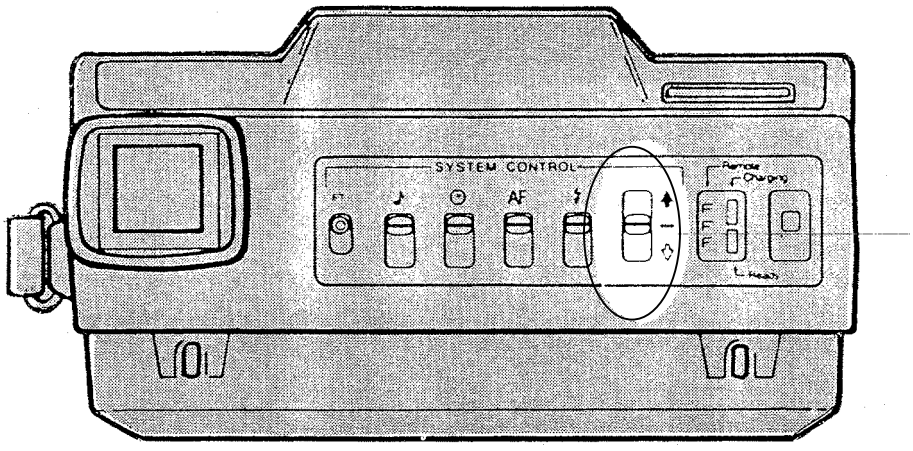

Figure 1-9 Electronic Trim Switch

A switch on the camera control panel allows the user to make exposures lighter or darker to suit personal tastes. In the past, trim (which may be defined as overriding the light measurement system to make pictures lighter or darker) was accomplished by moving a translucent wedge of graduated shading over the photocell. The wedge will fool the photocell into believing that the ambient scene light was lighter or darker, depending on the darkness of the shading over the photocell. The photocell would then order the exposure time-out according to the perceived scene light.

In the Spectra camera, trim is attained electronically. Moving the trim switch causes the exposure module to increase or decrease shutter time-outs 2/3 stop. Moving the switch to lighten increases the shutter time-out 2/3 stop. Moving the switch to darken decreases the exposure the equivalent of 2/3 stop. There are no graduations between these extremes. The exposures are either taken at nominal, are increased a full 2/3 stop, or are decreased a full 2/3 stop.

FILM SPEED SWITCH

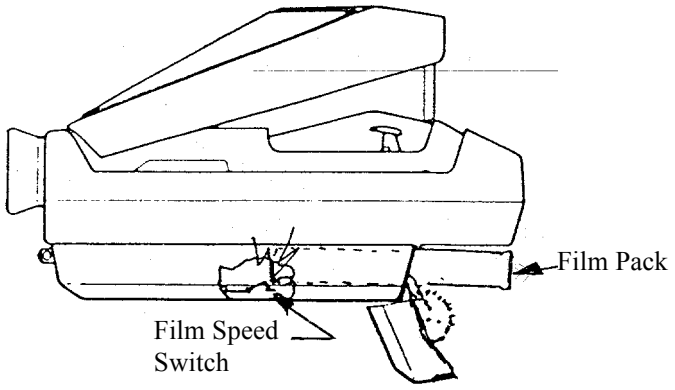

Figure 1-10 Film Speed Switch

A switch in the film compartment of the camera is used to compensate for minor differences in film speed from pack to pack. On normal film packs (600 ASA), a tab on the side of the film pack opens the switch. On slow film packs (below 600 ASA), there is no tab, so the switch stays closed. With the switch closed, exposures are increased by the equivalent of l/3rd of a stop.

BUILT-IN SELF-TIMER

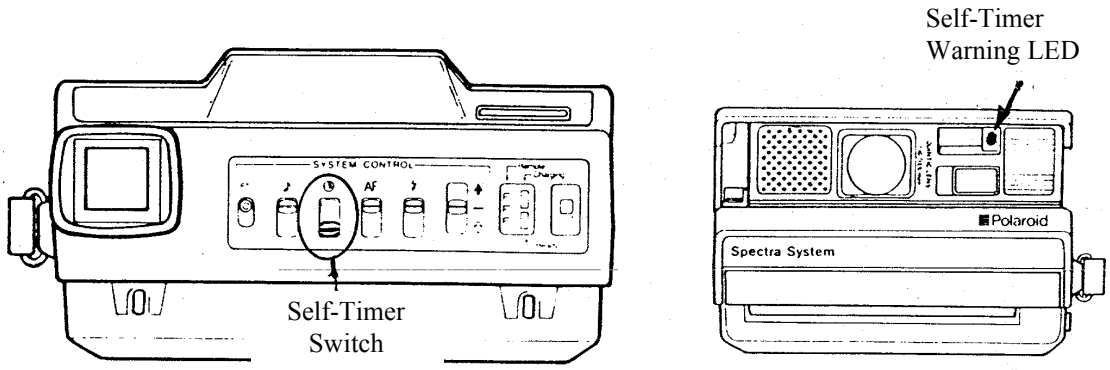

Figure 1-11 Self-Timer Switch And Warning LED

Incorporated into the Spectra camera is a self-timer. Controlled by a switch on the camera control panel, the self-timer delays an exposure for 12 seconds from the time the switch is set. To use the self-timer the scene is previewed and framed by pressing the shutter button halfway. Next the control panel switch is pushed down. For the next 10 seconds the camera will emit intermittent beeps and a red LED on the face of the camera will flash. The beeps and flashes quicken as the camera counts down. For the final two seconds of the timeout, the beep and the LED is steady.

ERECTING TELESCOPIC VIEWFINDER

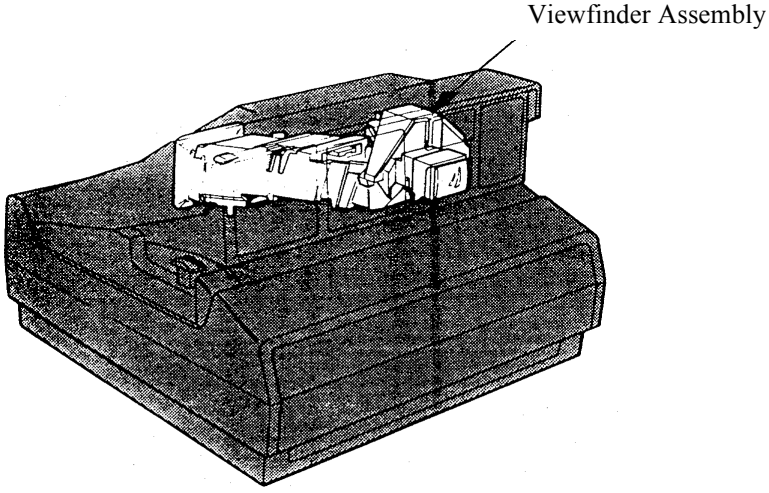

Figure 1-12 Erecting Telescopic Viewfinder

The viewfinder in the Spectra is not fixed in one position as in prior Polaroid cameras. It is located within the cone assembly and moves up (erects) as the camera is opened and moves down with the cone as the camera is closed. Another feature of the viewfinder is the fact that the image path is not in a straight line from the front window to the eyepiece. A bend has been designed into the viewfinder optics to accommodate the design of the camera. The eyepiece is at the rear corner to allow the user to comfortably hold it at his/her eye while the subject is being framed; the front window is close to the camera lens to reduce parallax problems. A series of lenses and mirrors bends the image from the front window to the eyepiece. Another characteristic of the viewfinder which differentiates it from earlier types is the magnification of the image. The Spectra viewfinder presents an image which is 20% larger than images seen in 600-line camera viewfinders.

INFORMATIVE VIEWFINDER

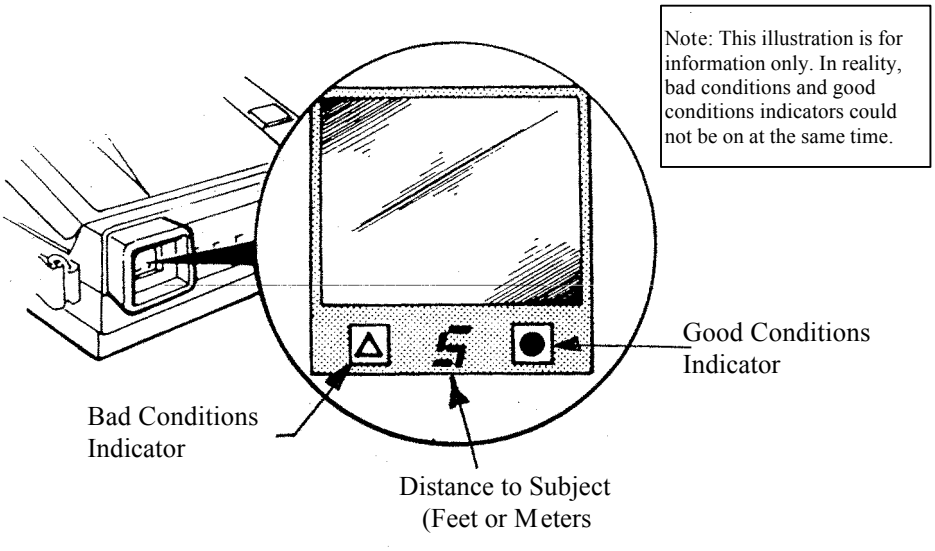

Figure 1-13 Spectra Camera Viewfinder Displays

In addition to the characteristics noted above there is one other feature which makes the Spectra viewfinder unique. That is the fact that the viewfinder is informative. When the shutter button is pressed halfway to preview the scene, a set of displays is visible in the viewfinder. The viewfinder displays will tell you what the distance is to the subject; they will tell you if conditions are good to take a picture; they will tell you if conditions are not good to take a picture. Additionally, you will hear warning beeps if scene conditions are not conducive to good pictures or you may hear chimes if you are out of film.

SPECTRA CAMERA CONTROL PANEL

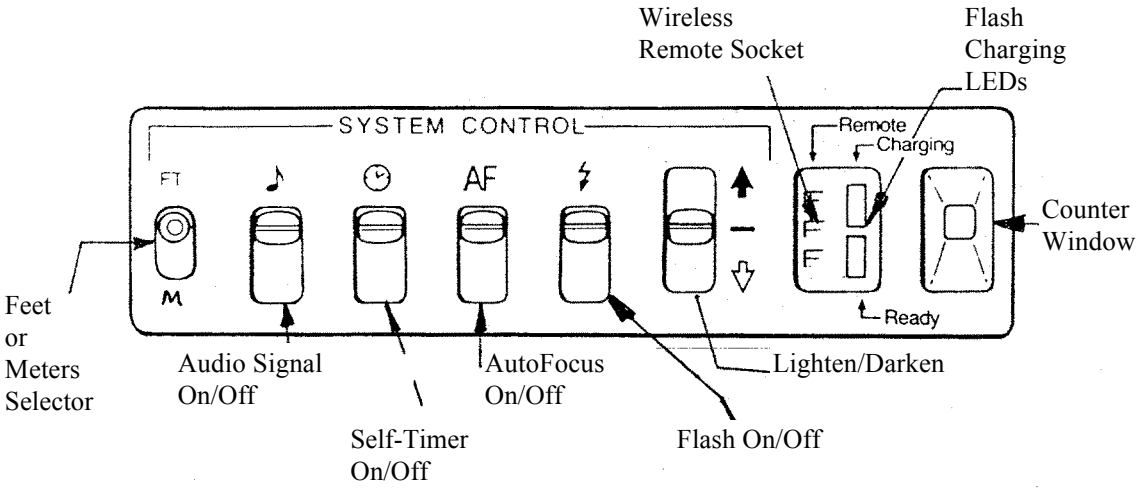

Figure 1-14 Spectra Camera Control Panel

On the back of the camera is a bank of controls and indicators which regulate many of the camera functions. From left-to-right the switch functions are as follows: the recessed switch sets the visible viewfinder distance display to either feet. or meters; the switch with the musical note symbol turns the audible indicators (beeps and chimes) on or off; the switch with the clock symbol turns the self-timer on or off; the switch labeled AP turns the sonar autofocus function on or off; the switch with the lightening symbol turns the electronic flash on or off; the last switch, with the white and black arrows is the electronic trim switch. In the raised position, it lightens exposures; in the lowered position, it darkens exposures; in the middle position, it has no effect on exposures. With the switches in the positions shown, camera operation is automatic. That is, the audible indicators (beeps and chimes) are on, the self-timer is off, the sonar autofocus function is on, the flash is on, and the electronic trim is set to the nominal position.

Also located on the control panel is the wireless remote socket. The remote receiver is plugged into this pocket. Next to the wireless remote socket are the two electronic flash LEDs. When the red LED is on, the flash is charging. When the green LED is on, the flash is ready for an exposure. The final position on the control panel is occupied by the frame counter window. The counter indexes down from “10” to “0” as each exposure is made. At 0, the chimes will sound to indicate that you are out of film.

E. SPECTRA SYSTEM SPECIFICATIONS

Camera type	Folding, rangefinder, integral strobe, electronic logic-controlled functions.
Aperture/Shutter System	f10 - f45 apertures; 1/245th second to 2.8 seconds shutter speeds.
Lens	Patented 3-element Quintic system; 10 focus zones; range - 2 ft. (0.6m) to infinity.
Strobe	Integral, programmed flash for use indoors and outdoors. Recharge time - 0.1 to 2.8 seconds flash duration - 1/3000th to 1/20,000th second. Flash range - 2 ft. to 15 ft. (0.6m to 4.6m). Override control available to turn off flash.
Focusing	Logic-controlled sonar signal automatically measures distance from camera to subject. Information is used to set lens system to proper range. Sonar ranging time is 0.010 to 0.050 second. Override control available to shut off ranging.
Light Measurement System	Dual cell silicon photodiode measures visible and infrared light (strobe reflection) as part of exposure determination. Electronic trim (lighten/darken) may be used to increase or decrease length of exposure.
Film Speed Switch	Used to automatically compensate for “slow” film. Activated by insertion of film pack.
Viewfinder	Erecting, telescopic type; 100% viewing (no parallax) at 6 ft. (1.8m). Six lenses, four mirrors, two prisms. 0.5X magnification. Field is defined within black border. Three-color LED display of subject distance and picture conditions visible in viewfinder eyepiece during preview mode.
Power Source	6 volt battery in Spectra film pack.
Camera Weight	1 lb, 12 1/2 oz (0.8kg) without film pack.

SECTION 2
THEORY OF OPERATION

CONTENTS

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A. INTRODUCTION

Presented in this section of the service manual are the details of Spectra System operation. The discussion is, for the most part, limited to those areas which are new or unique to Polaroid cameras. The first part of the section is a general discussion of new technology found in the camera while the second part of the section details the interactions of camera parts in a sequence of operation. Next are timing diagrams and a schematic of camera electronics. The final part of the theory section contains an engineering description of Spectra camera switches and camera signals.

It is strongly recommended that you have a background knowledge of Model 640 and Model 660 technology before you read this section.

B. NEW FEATURES

SPECTRA SYSTEM SPAR THYRISTOR STROBE

The Spectra System strobe is a compact, highly efficient System. The flashtube is contained in a shock-resistant housing which occupies the left corner of the camera face (Figure 2-1). It is electrically connected to the Strobe PC Board Assembly which is located on the top rear surface of the cone assembly. Found on this PC board are all the electronic components which are responsible for translating camera signal commands into functions such as strobe charge, strobe fire, strobe quench, etc.. A connector on this board ties the strobe electronics to the camera flex circuit. The strobe ready lights (red - charging; green - ready to fire) are mounted on the Ranging PC Board which is directly behind the system control panel at the rear of the camera.

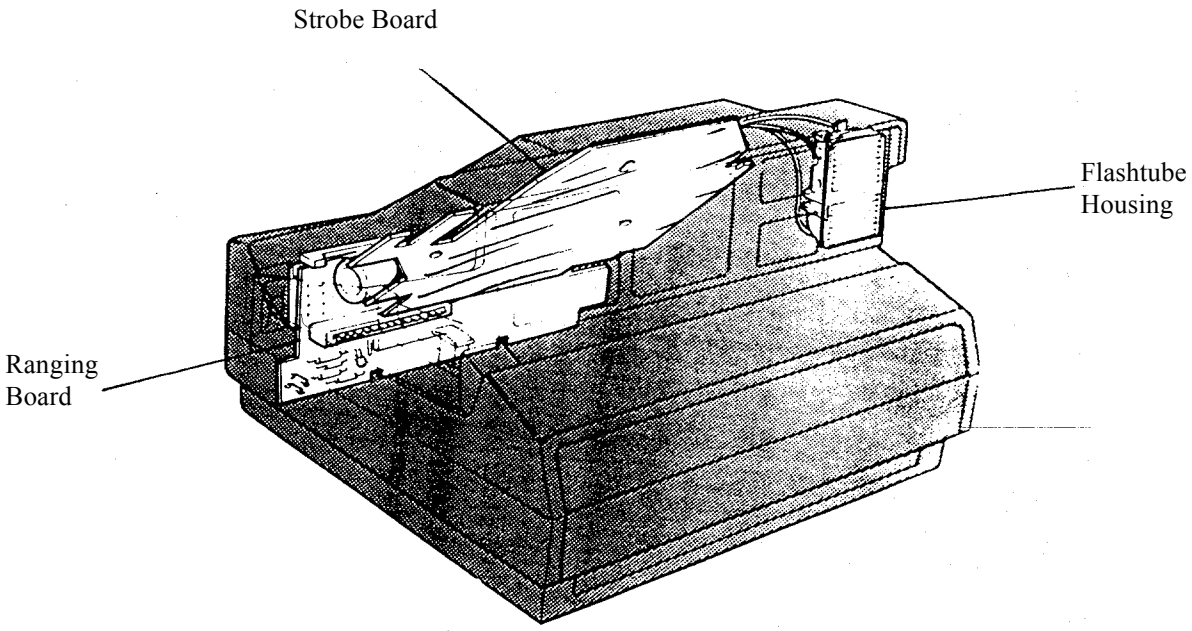


Figure 2-1 Spectra System Strobe

The strobe incorporates the best features of strobes previously used in Polaroid cameras and adds some new characteristics. The Spectra strobe is called a SPAR Thyristor strobe. SPAR is an acronym meaning “Strobe Preferred, Automatic Recharge.” Just as it sounds, the design of the system is geared toward a strobe which charges very quickly and is ready for use practically whenever the picture-taker is ready to shoot a picture. The maximum charge

time for the strobe is 3 seconds. Typically, for reasons described below, the charge time is much faster than 3 seconds.

The Spectra strobe incorporates the features from previous strobe Systems - the Model 640 quench Strobe with photocell light measurement which determines when to shut down the flash; and the Model 660 Camera with fixed output strobe and variable focus and shutter apertures. By Combining these features, the strobe is able to provide consistent strobe exposures at an extended strobe range.

Adding to these desirable characteristics is the thyristor quench. As you may recall, in the Model 640 camera when the flash fired at less than full output, the unused energy was directed to a quench tube where it was dissipated. In the Spectra System, when the flash is directed to fire at less than full output, the thyristor circuit (TH1 and TH2) stops the discharge of energy from the flash storage capacitor (C8). Instead of being dissipated, the energy remains stored and is saved for the next flash fire. Thus, during the recharge cycle only the difference between the stored amount and the full value of the flash storage capacitor must be generated.

To reduce recharge time even further, the Spectra System strobe incorporates another feature called the sneak charge, Actually occurring at the end of one exposure cycle in preparation for the next exposure, the sneak charge utilizes the period between shutter blade closure and the start of film processing. During this part of the cycle, the flash storage capacitor receives a small amount of energy, After film processing normal charging tops off the circuit with enough energy for the next flash exposure.

STROBE SPECIFICATIONS

VARIABLE HYBRID QUENCH - SERIES THYRISTORS

Strobe Range	2 To 15 Feet (.6 To 4.6M) (Indoors)
Charge Time	Maximum Of 3 Seconds
Stored Energy	21 Watt/Seconds
Light Output	Maximum - 350 Czls
	Minimum - 230 Czls
	Nominal - 265 Czls
Flash Duration	1.3,000 To 1.20,000 Sec.
Strobe Preferred Automatic Recharge - Charges Or Tops Off When:	Camera Is Erected
	New Film Is Loaded & Door Closed
	Flash Override Switch Is Turned Off
	S1 Is Partially Pressed
	Film Frame Is Processed

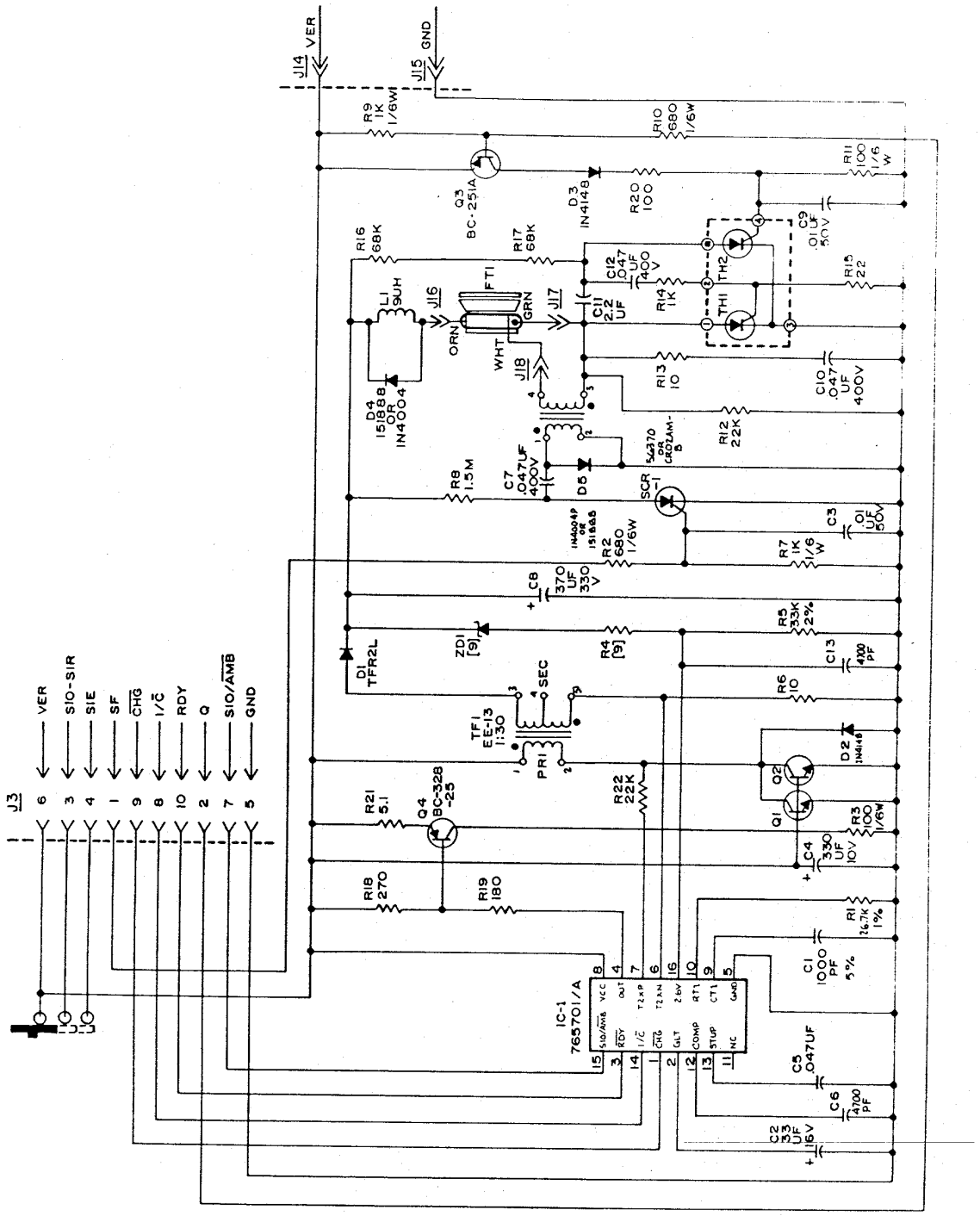


Figure 2-2 Schematic Of Spectra Strobe

SPECTRA SYSTEM FILM

The Spectra System camera uses a new film called Spectra System color film. Like its predecessors, SX-70 and 600 film, the new film uses an integral format with development taking place within the sealed frame. The new film uses dyes which provide more vibrant, brighter colors than before.

The most obvious difference between the Spectra System film and that of the SX-70 format are the dimensions of the film frame. Figure 2-3 provides a comparison of the two formats. You can see that the Spectra System film format results in a horizontal picture while the earlier format has a vertical picture format. (Obviously, the camera can be turned to change the format from horizontal to vertical.)

The film is housed in a pack along with a P80 configuration, 6V battery. There are ten frames in the pack

Spectra System film is rated at ISO 600/29°

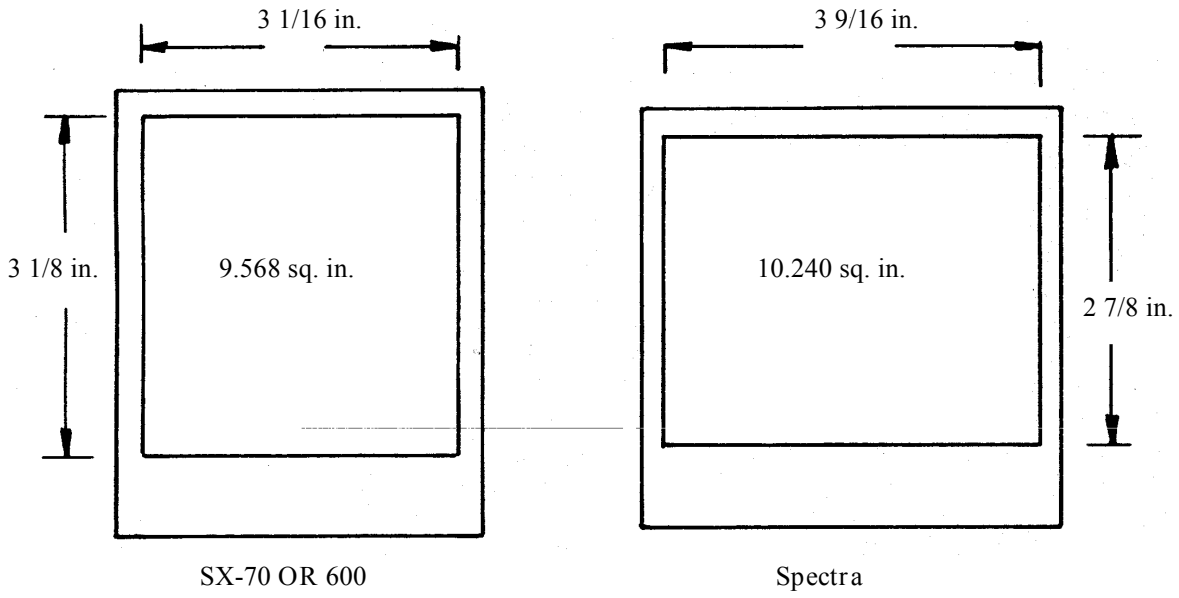


Figure 2-3 Comparison of Spectra and SX-70 Film Formats

VIEWFINDER

The viewfinder in the Spectra System camera is known as an erecting, telescopic, informational viewfinder. Its name is derived from the unique features which set it apart from traditional viewfinders found in earlier Polaroid cameras. The viewfinder is a self-contained assembly which may be removed from the camera in one piece.

The first of the features which make it different from earlier viewfinders, is the fact that it is not fixed in one position on the exterior of the camera. The entire viewfinder assembly moves with the cone as the camera is folded and unfolded. This departure from viewfinders in earlier models allows the external shape of the Spectra System camera to be more streamlined than it could be if the viewfinder did not erect with the cone.

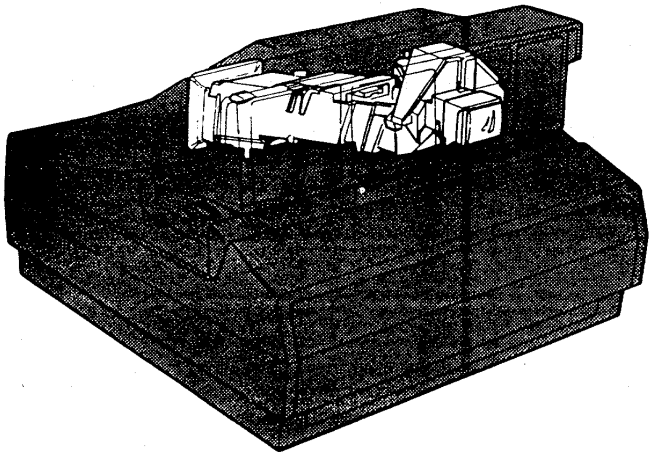
The second distinction from earlier viewfinders concerns magnification of the image. The Spectra System viewfinder provides greater magnification than viewfinders in previous Polaroid models. Magnification is 20% greater than viewfinders in 600 line cameras. Additionally, the image presented in the eyepiece is within the confines of a sharp black border. The black border clearly frames the subject matter meaning that the picture-taker can be more certain that he or she has captured precisely what is desired. Additionally, the image is well defined, meaning that it is sharper and more distinct.

Third, the viewfinder image is informative, providing visual displays of exposure conditions and subject distance. This feature is described in greater detail below.

Even with all the new features, the viewfinder is actually smaller than viewfinders used in previous camera models. The size reduction was necessary because of packaging constraints created by the size of the camera. These same packaging constraints resulted in having to design a jog in the optical path.

As can be seen in Figure 2-4, the front window of the viewfinder is not in direct line with the rear eyepiece. The jog requires the use of mirrors to “bend” the image to the eyepiece.

Front View



Top View

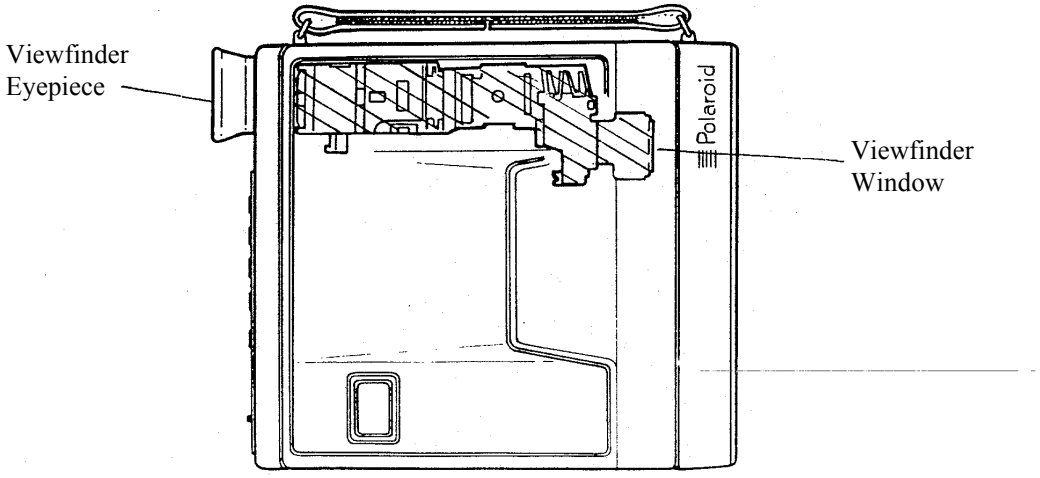


Figure 2-4 Spectra Camera Viewfinder Assembly

Figure 2-5 shows the components within the viewfinder which direct the image from the front window to the eyepiece. There are six plastic lenses, four mirrors, a mask and black border which define the image and which clearly show the extent of the image which will be captured on the film frame and a plastic wedge which is included to straighten the image to the eyepiece.

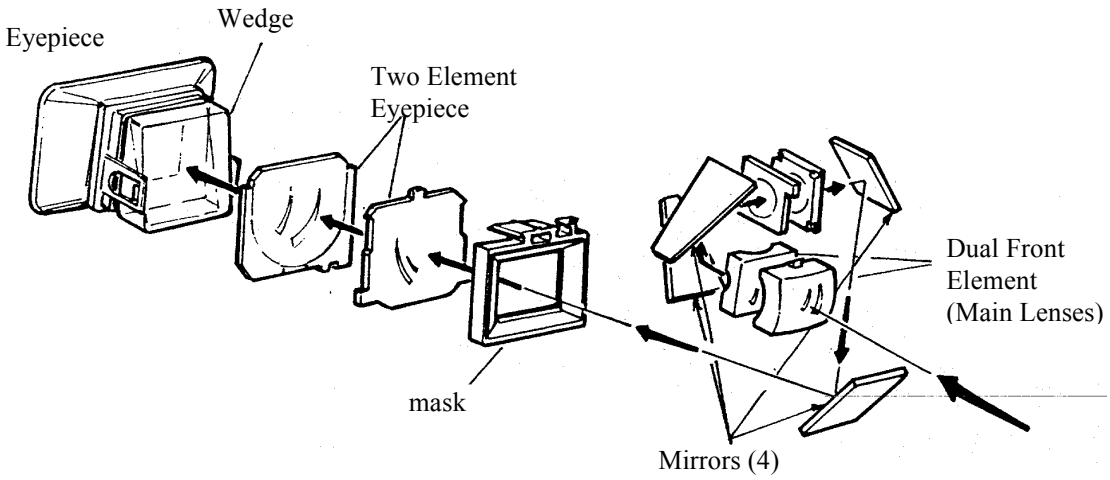


Figure 2-5 Viewfinder Components

VIEWFINDER DISPLAYS

Figure 2-6 shows the location of viewfinder displays as seen in the eyepiece.

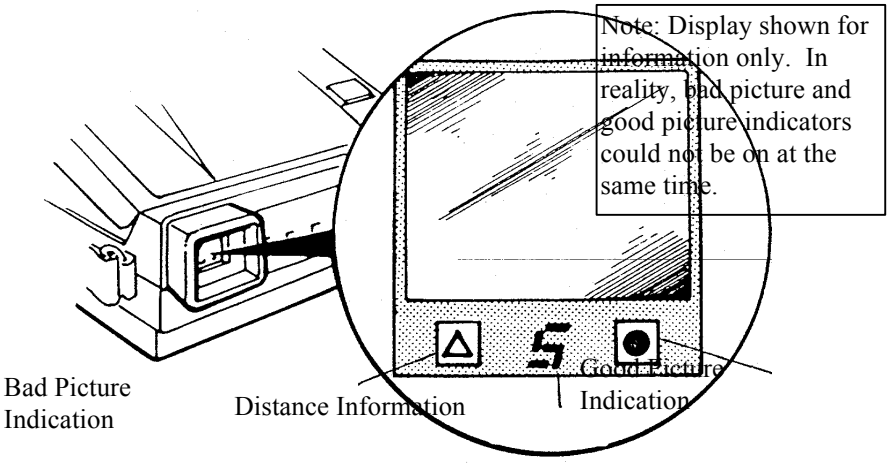


Figure 2-6 Viewfinder Displays

These displays originate from LEDs which are located on a printed circuit board below the viewfinder optical components. When illuminated the LEDS reflect off a prism mounted over the PC board and appear to be projected onto the base of the black border which frames the subject area (Figure 2-7). These displays appear during the preview mode, prior to the exposure cycle.

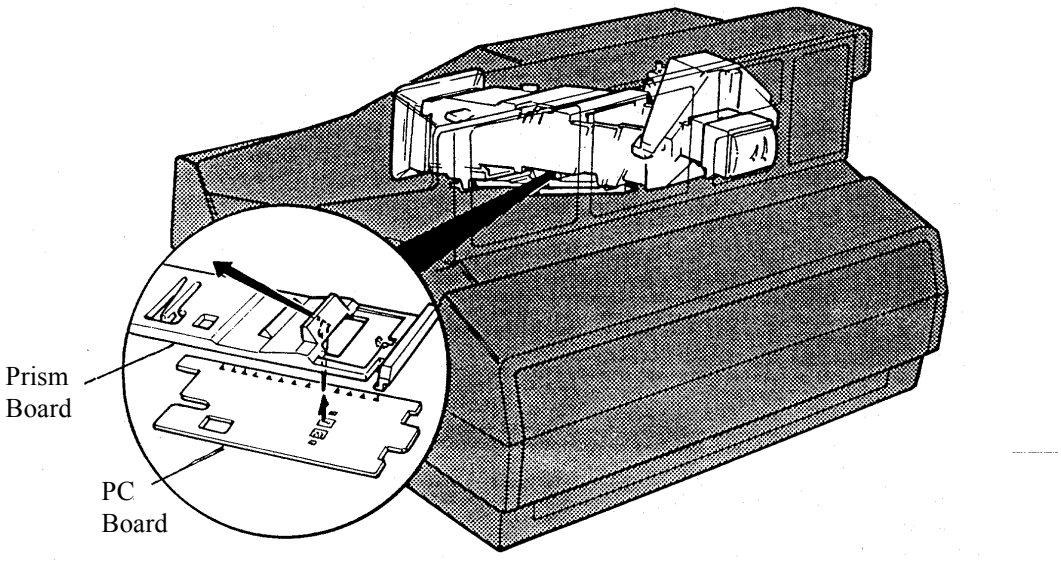


Figure 2-7 Viewfinder Displays PC Board And Prism

The purpose of the displays is to signal the following conditions:

SUBJECT DISTANCE - The distance, as measured by the transducer, is displayed in feet or meters, according to the setting on the control panel. If the subject is beyond 20.4 feet (6.29 meters), the distance display will be blank. If the subject is closer than 2 feet (0.60 meters), the display will show 1 foot or (0.1 meters).

GOOD PICTURE - If the camera electronics determine that light and distance requirements for a good picture are met, a green dot will be visible at the right side of the display. (If applicable, the distance figure will also be shown.)

LOWLIGHT - TURN ON STROBE - If the strobe switch on the control panel has been turned off and the camera electronics perceive a low light condition (less than 12 ±3 c/ft), a blinking yellow triangle will be seen at the left side of the display. Additionally, a 1/2 second tone will sound. (If the strobe switch is on, this warning will not occur.)

BEYOND STROBE RANGE - If the transducer measures a subject range of more than 15.5 feet (4.7 meters) coupled with a photocell light measurement of less than 12 ±3 c/ft, the blinking yellow triangle will appear together with the distance figure if it less than infinity. The 1/2 second tone will also sound.

TOO CLOSE - If the transducer measures the subject as being less than 2 feet (0.60 meter) away, the blinking yellow triangle will be shown together with a distance figure of 1 foot or (0.1 meters). The 1/2 second tone will also sound.
OUT OF FILM - After the tenth frame, a three second chime sounds indicating an out-of-film condition. If the empty pack is left in and the shutter button lightly pressed again, the three second chime will sound and a blinking 0 will appear. This display will occur again so long as the empty pack stays in the camera and the shutter button is pressed.

QUINTIC LENS SYSTEM

If you recall the Model 660 camera, you will note that it has a rotating disk containing four lenses of differing optical value and a fixed taking lens (Figure 2-8). The disk is turned until one of its lenses (determined by ranging information from the transducer) is set behind the fixed lens. The combination of the two lenses provides proper focus in one of four zones between two feet and infinity.

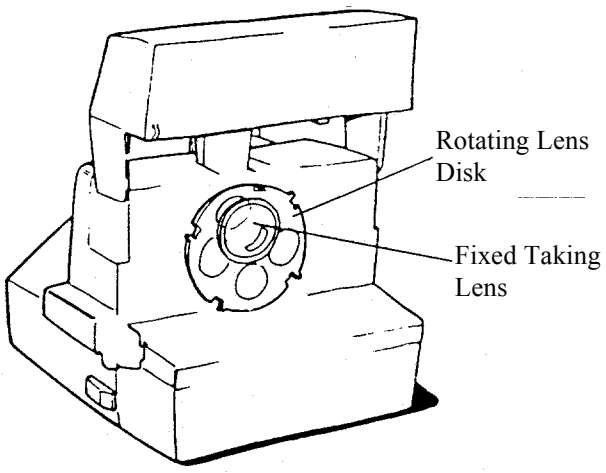


Figure 2-8 Model 660 Rotating Lens Disk

The method by which proper focus is achieved in the Spectra System camera borrows from this concept. However, it goes well beyond matching two lenses, and represents a unique technological achievement in optics. At the heart of the Spectra focus operation is the Quintic aspheric lens system. Figure 2-9 shows the difference between spherical and aspherical lenses.

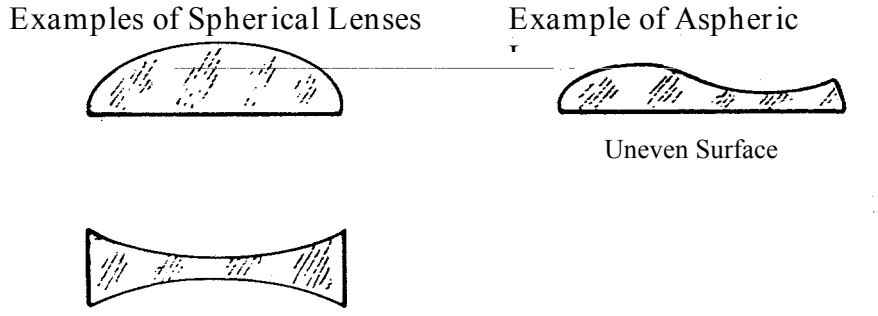


Figure 2-9 Comparison of Spherical and Aspherical Lenses

To understand how the Spectra System lenses work, you should first know about the characteristics of aspheric lenses. Figure 2-10 is a simplified drawing which represents the relationship of two aspheric lenses. In this representation you can see that by changing the position of the two lenses relative to the other as shown, this theoretical lens system could focus on subjects at extremes of two feet or infinity.

Figure 2-10 Interaction of Aspheric Lenses

Essentially, the Spectra System relies on the optical results of changing the relationship of its Quintic aspheric lenses rather than having a series of individual lenses (like the Model 660) to create different focus zones. Because of the way the aspheric lenses are shaped, the system can create ten different zones as opposed to the four zones for the Model 660.

The characteristics of the Quintic system are such that it has a greater focal length than lens systems in previous Polaroid cameras. This results in larger subject images being produced. That is, if you set a Model 680, for example, next to a Spectra camera, and took photographs of the same object at exactly the same distance, the Model 680 image would show a wider field of view, but the Spectra image would show a greater magnification of the center area of the subject. A tree in a distance shot would be larger in the Spectra image than in the Model 680 image.

Figure 2-11 shows the components of the Spectra System Quintic Lens system. It is a three element, 125mm lens system. The front element is the main meniscus lens which is similar to taking lenses found in other Polaroid cameras. The second and third elements are aspheric lenses. The first and third elements are fixed. The middle element, called the Quinticsector, pivots in an arc through the optical path of light entering the front lens. It is the movement of the Quinticsector that results in the actual focusing function.

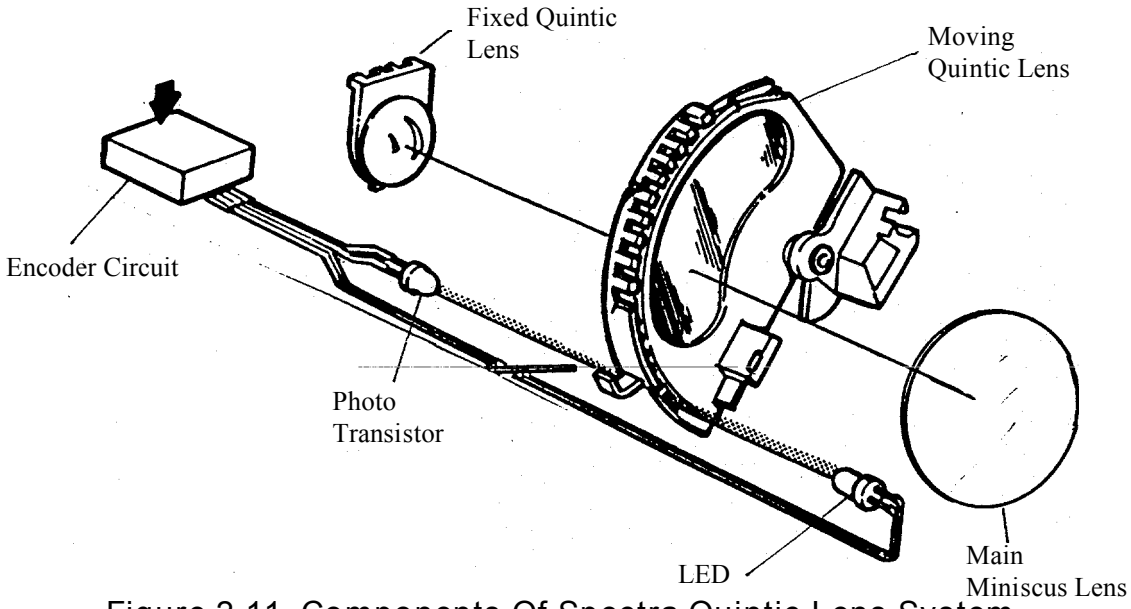


Figure 2-11 Components Of Spectra Quintic Lens System

Refer to Figures 2-12, 2-13, 2-14, and 2-15 when reading the description of Quintic Lens operation which follows. Also, refer to the Sequence of Operation portion of this section for a more detailed description of the sequence of events which moves the camera lenses into proper focus.

At the start of the exposure cycle, when solenoid 1 is energized, the walking beam releases the Quintic kick spring. This spring strikes the Quintic sector causing it to start its arc through the optical path. (Obviously, the shutter blades are still closed during the movement of the Quintic sector.)

Along the edge of the Quintic sector are a series of teeth and cutouts in the plastic frame. On one side of the plastic frame is an LED which emits light and on the other side is a phototransistor which “reads” the light. These two devices are part of the encoder circuit. As the cutouts in the frame pass between these two devices, the encoder circuit takes a count of the pulses which result from the frame cutouts breaking the light path between LED and phototransistor. (The first pulse is the First Light Detect which is the starting marker for all exposure calculations.) These pulses correspond to the ten focus zones created by the interaction of the aspheric lenses.

At the same time, the transducer ranging circuit is determining the distance from camera to subject. When the encoder count reaches a point which corresponds to the subject distance, a signal is sent to activate solenoid #2. Activation of solenoid #2 causes the catch pawl to engage the teeth along the edge of the Quintic sector. The Quintic sector is thus halted when the portion of the lens

which optically corresponds to the subject distance is positioned behind the taking lens. At this point, solenoid #1 is deenergized, releasing the walking beam. The opening blade spring pulls the walking beam in a counterclockwise direction and the shutter blades open.

When the exposure is completed, solenoid A1 is again energized, pulling in the walking beam and closing the shutter blades. Solenoid #2 then releases, allowing the Quintic return spring to force the Quintic sector to return to its original setting. This action also causes the catch paws to engage the walking beam, latching it in position. Thus, when solenoid #1 is deenergized, all the components are in the same position they were in before the exposure cycle started.

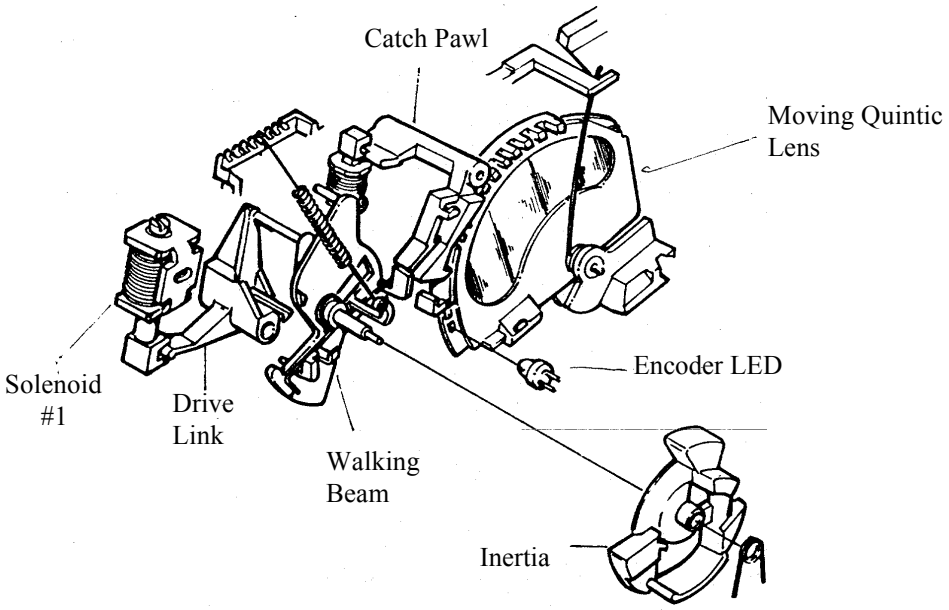


Figure 2-12 Quintic Lens System Starting Conditions

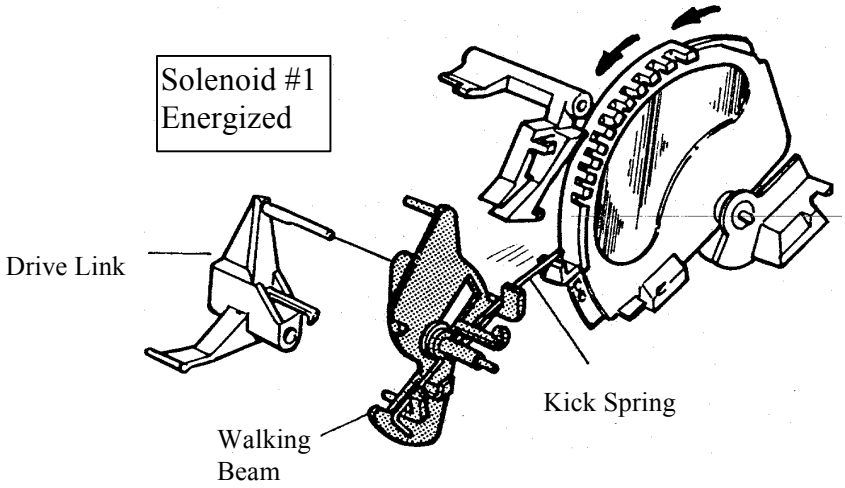


Figure 2-13 Kick Spring Starts Quintic Lens Motion

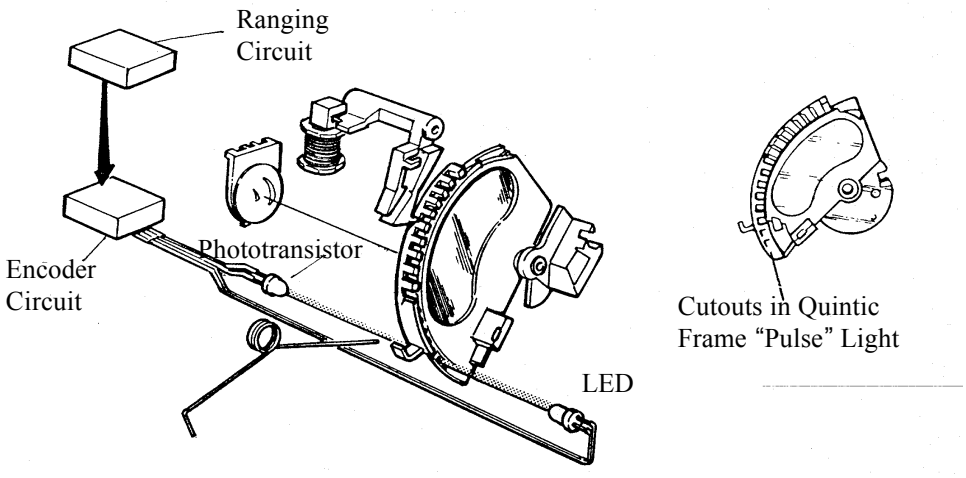


Figure 2-14 Encoder Circuit "Reads" Light Pulses

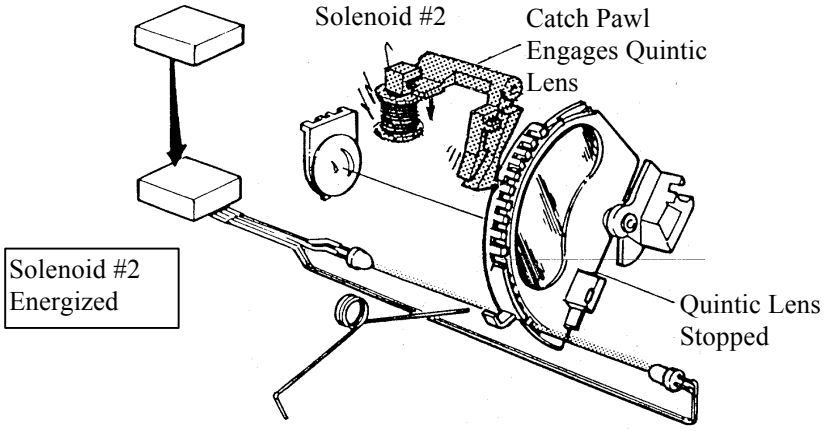


Figure 2-15 Catch Pawl Stops Quintic Lens

The chart which follows shows the corresponding subject distance for the ten zones of focus.

Spectra System
Quintic Lens
Focus Zones

ZONE	SUBJECT DISTANCE	
	Feet	Meters
1	20’ - Infinity	6.09 - Infinity
2	10’ - 20’	3.04m - 6.09m
3	6.62’ - 10.0’	2.02m - 3.04m
4	4.98’ - 6.62	1.50m - 2.02m
5	4.02’ - 4.98’	1.22m - 1.50m
6	3.35’ - 4.02’	1.02m - 1.22m
7	2.86’ - 3.35’	0.87m - 1.02m
8	2.48’ - 2.86’	0.76m - 0.87m
9	2.19’ - 2.48’	0.68m - 0.76m
10	1.53’ - 2.19’	0.47m - 0.68m

EXPOSURE CONTROL

Spectra Hybrid Exposures

The Spectra System uses a hybrid exposure system to regulate the amount of light reaching the film plane. Exposures are controlled by a combination of light measurements and distance measurements (Figure 2-16). The light measurements include both ambient and infrared information (similar to the Model 640 camera) and the distance measurements are derived from ranging information provided by a transducer ranging network (similar to the Model 660 camera). Although these methods have been employed in previous Polaroid cameras the manner in which they are combined in the Spectra System makes them unique.

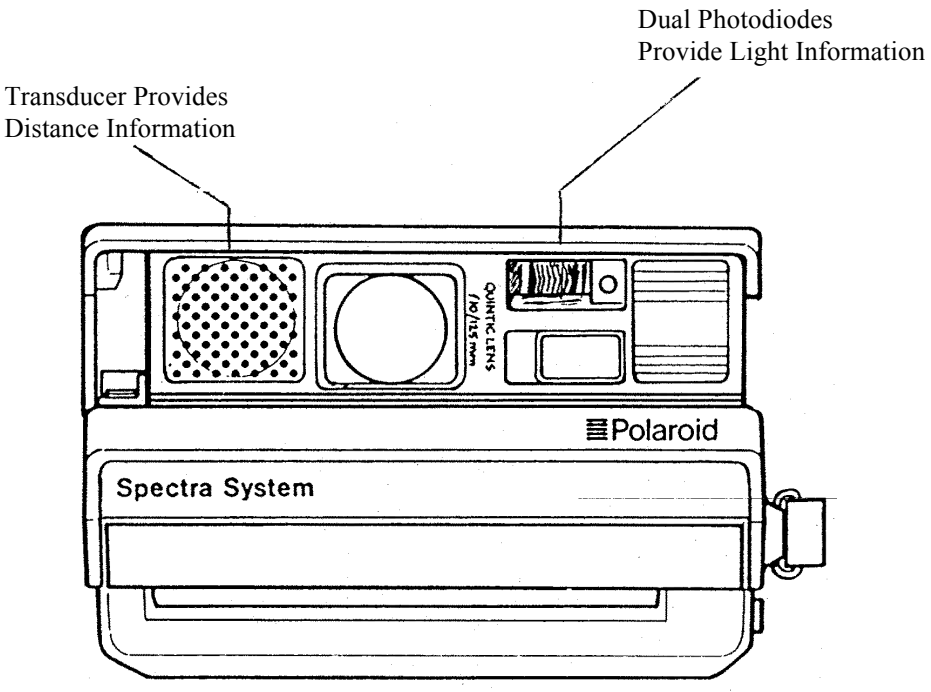


Figure 2-16 Hybrid Light and Distance Measurements

Polaroid Exposure Basics

Before delving into the Spectra exposure system, you should first understand some basics about exposure systems in other Polaroid strobe cameras. Basically, exposures can be controlled by varying the output of the strobe, or by firing the strobe at full output and varying the size of the shutter blade aperture to control the amount of light reaching the film. These methods can be related to the Model 640 and the Model 660 cameras.

Model 640 - Integrating Strobe

The Model 640 is a fixed focus camera which varies the output of the strobe to control exposures. Basically, the Model 640 uses either a light measurement alone to fire and shut down the flash or it uses a combination of light measurement and time measurement to fire and shut down the flash (Figure 2-17). The method it chooses depends on scene brightness.

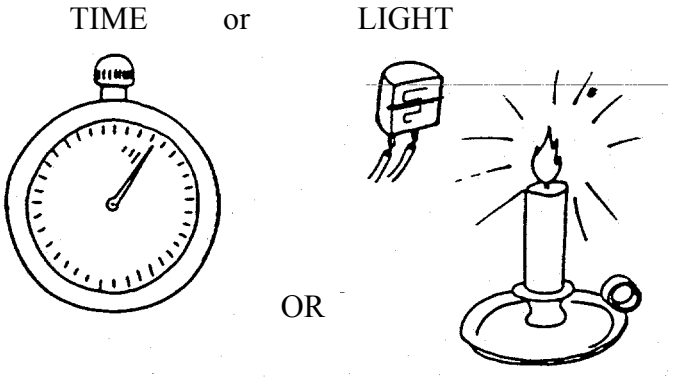


Figure 2-17 Model 640 Exposures

Under most conditions, the strobe fires when the shutter blade aperture is at its largest size. (Please note that this does not apply to fill flash situations). The exposure system then uses the infrared portion of the reflected strobe light as part of the measurement to determine when to quench the strobe. When enough strobe light is integrated into the measurement, the quench strobe command is given. The strobe is quenched and the shutter blades close. This is called an integrating strobe system.

Model 660 - Follow Focus

The Model 660 camera utilizes a variable focus and variable shutter aperture system. The strobe is always fired at full-output. Regulation of light for varying scene conditions is accomplished by firing the flash at varying shutter blade apertures (Figure 2-18). For subjects close to the camera, the flash fires with a small blade aperture; for subjects far from the camera, the flash fires when there is a large blade aperture. (Shutter blade aperture is also affected by scene brightness.) Since subject distance is the major factor in determining the aperture of the shutter blades, the amount of light reaching the film plane is thus dependent on the ranging information supplied by the transducer. The exposure control system on the Model 660 is called a follow-focus system.

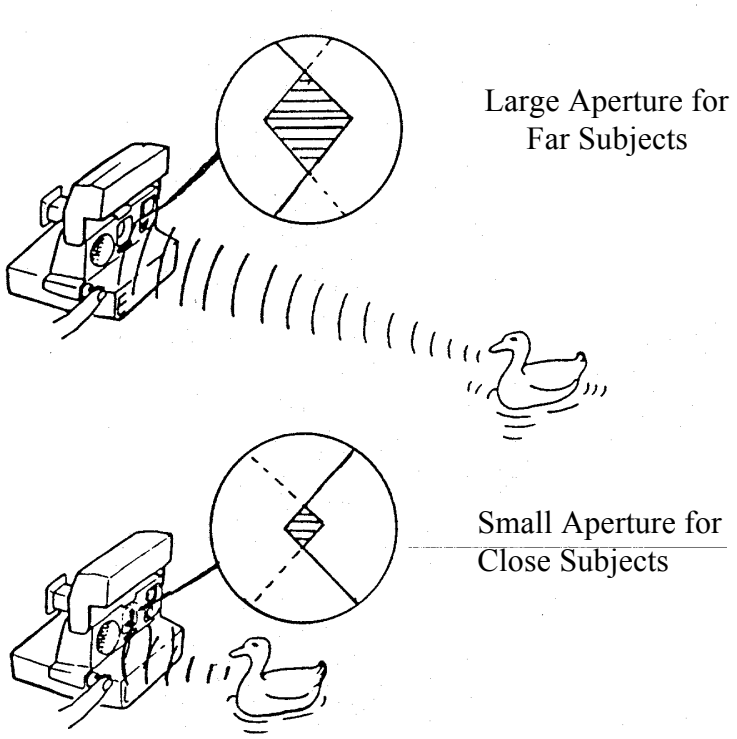


Figure 2-18 Model 660 Exposures

Advantages/Disadvantages

There are advantages and disadvantages associated with both systems. With the Model 640, strobe exposures are more consistent. But because of the characteristics of a quench circuit and because it is a fixed focus camera, the strobe range is limited (4' to 10'). Conversely, the Model 660 uses variable shutter apertures and has a lens System which can be focused. These features increase the strobe range to 2' to 14'. But because the strobe always operates at full output, the strobe exposures are not as consistent as exposures with the Model 640. The Spectra System borrows the best features of both these models to provide consistent strobe exposures at extended ranges.

Spectra System - Light Measurements

A brightness detect reading is taken by the exposure circuitry during the preview mode. Scene brightness is measured at this time and is categorized into:

high brightness - above 12 cd/ft2 or,

low brightness - below 12 cd/ft2.

In high brightness conditions, the strobe will fire as a fill flash.

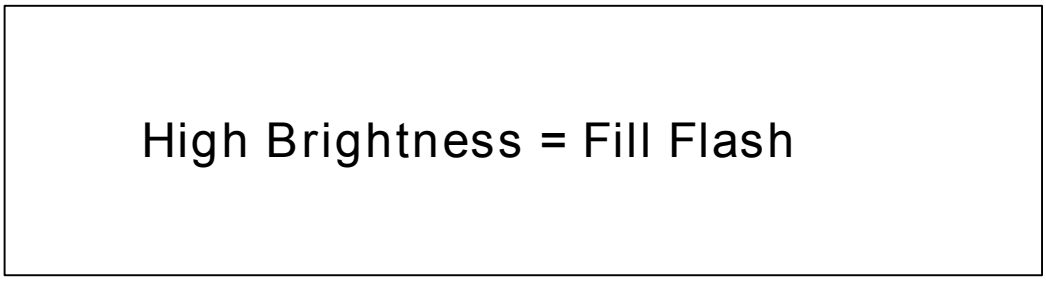


Figure 2-19 Spectra High Brightness Strobe Exposure

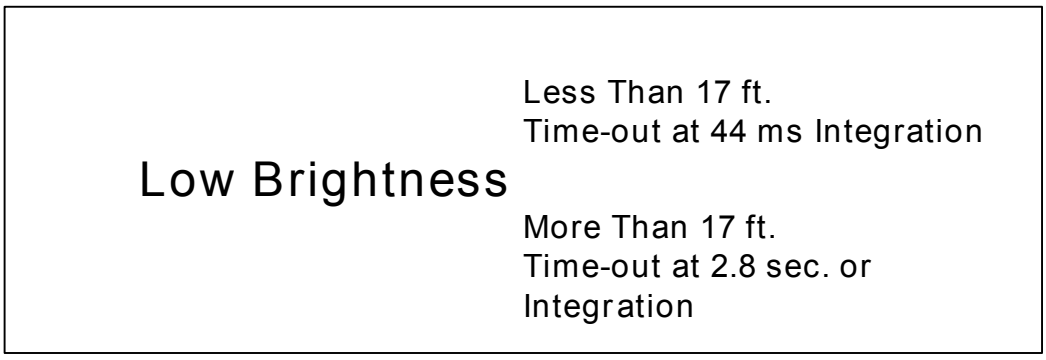


Figure 2-20 Spectra Low Brightness Strobe Exposures

In low brightness conditions when subjects are under 17 feet from the camera (determined by the transducer) timeout will occur 44 ± 5ms after first light unless the exposure is terminated earlier by the integration of enough light through the photocells.

For subjects beyond 17 feet in low brightness settings, exposure timeout occurs 2.8 ± 0.3 seconds after first light, again unless the exposure is terminated sooner by the integration of sufficient light.

FIRST LIGHT DETECT

The first light detect takes place 20 ± 3ms after solenoid #1 is released. An opening in the shutter blades allows light from the encoder LED to reach the phototransistor of the encoder pair (Figure 2-21). This action gives the encoder circuitry one count and acts as a starting point for exposure timeouts as mentioned above.

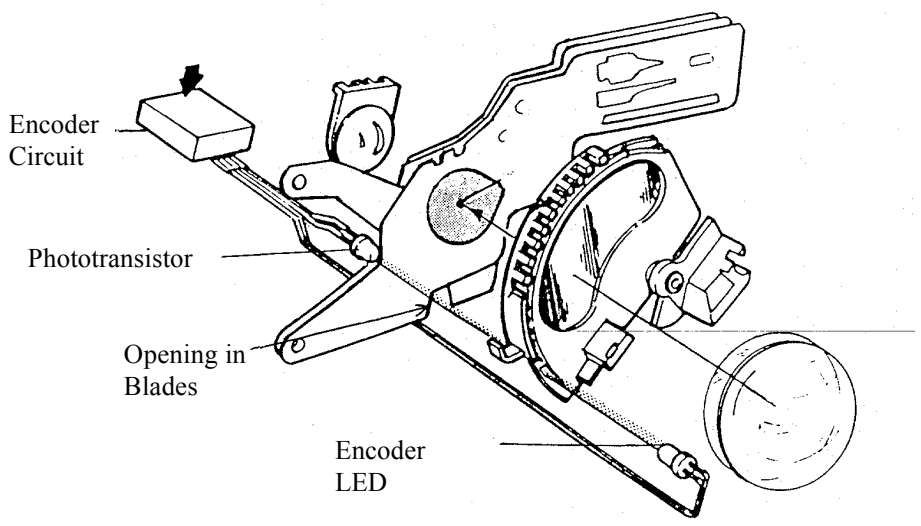


Figure 2-21 First Light Detect

DUAL PHOTODIODE

Light integration in the Spectra is determined by measurements taken through a dual photodiode (Figure 2-22).

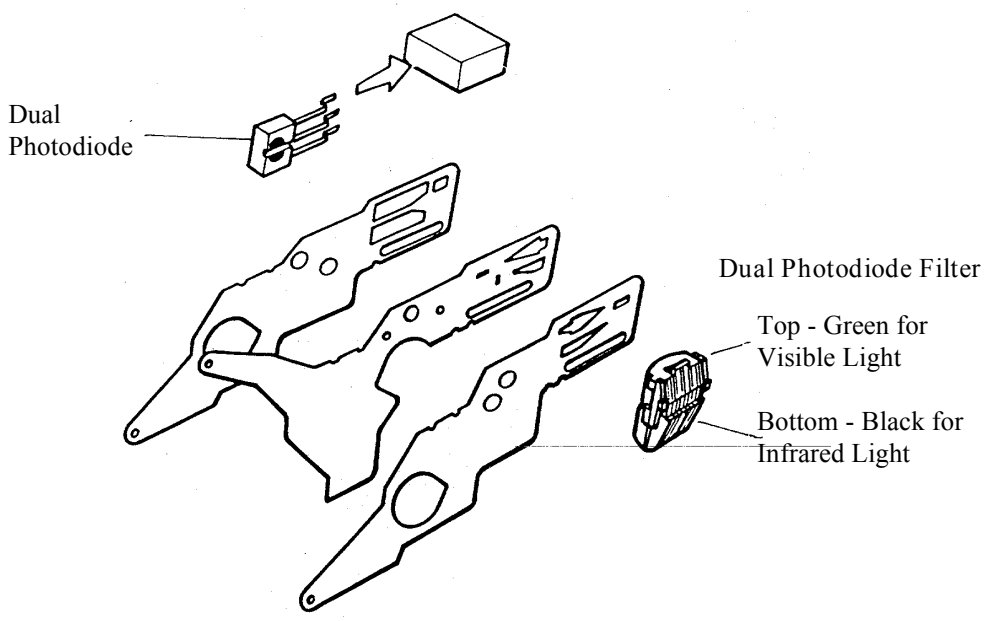


Figure 2-22 Dual Photodiode

The top half of the photodiode measures all visible light, while the bottom half measures the infrared portion of the light spectrum. By utilizing a dual photodiode system, light measurements are more precise than in previous cameras. These measurements determine whether the strobe is to fire at full output or if there is to be a partial strobe output (quenching).

VIEWFINDER DISPLAY BRIGHTNESS

The brightness reading taken during the exposure mode also serves to determine the brightness of the displays in the viewfinder. There are two intensities for the displays. In low light levels (below 12 cd/ft), the intensity of the viewfinder displays is diminished while the intensity is increased to offset high ambient scene brightness (above 12 cd/ft).

SPECTRA SYSTEM - AUTOFOCUS

Because of packaging constraints, the Spectra System transducer had to be made smaller than transducers used in previous Polaroid cameras (Figure 2-23). Earlier Polaroid transducers have a diameter of 1.5 inches; the transducer in the Spectra has a 1.1 inch diameter. Additionally, a plastic grill over the Spectra transducer gives it the appearance of being square.

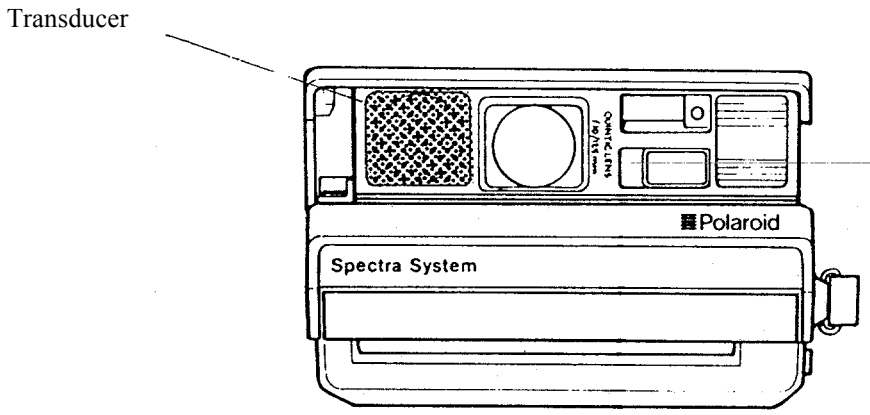


Figure 2-23 Spectra System Transducer

The transducer provides subject distance information to the encoder circuit. The distance information determines when the moving Quintic Lens should be stopped by the catch pawl for proper focus. It also provides information to determine when to stop the shutter blades for the appropriate aperture. Finally, it provides distance information for the viewfinder display. When the autofocus system is turned off, the blades open fully and the hyperfocal (infinity) lens position is chosen.

ELECTRONIC TRIM

In previous camera models, trim has been achieved by sliding a shaded wedge over the photocell to fool it into causing shorter or longer exposures. In the Spectra System, trim is achieved electronically. Moving the lighten/darken switch on the control panel actually affects the electronic circuit of the camera, causing exposures times to be increased or decreased the equivalent of 2/3 stop. There are no graduations between fully lighten or fully darken. The change in exposure value is a full 2/3 stop from nominal in either direction.

FILM SPEED SWITCH

To compensate for minor differences in film speed from pack to pack, a film speed switch is incorporated into the camera. This switch is located in the film compartment of the camera and is activated by a plastic tab on the side of the film pack (Figure 2-24).

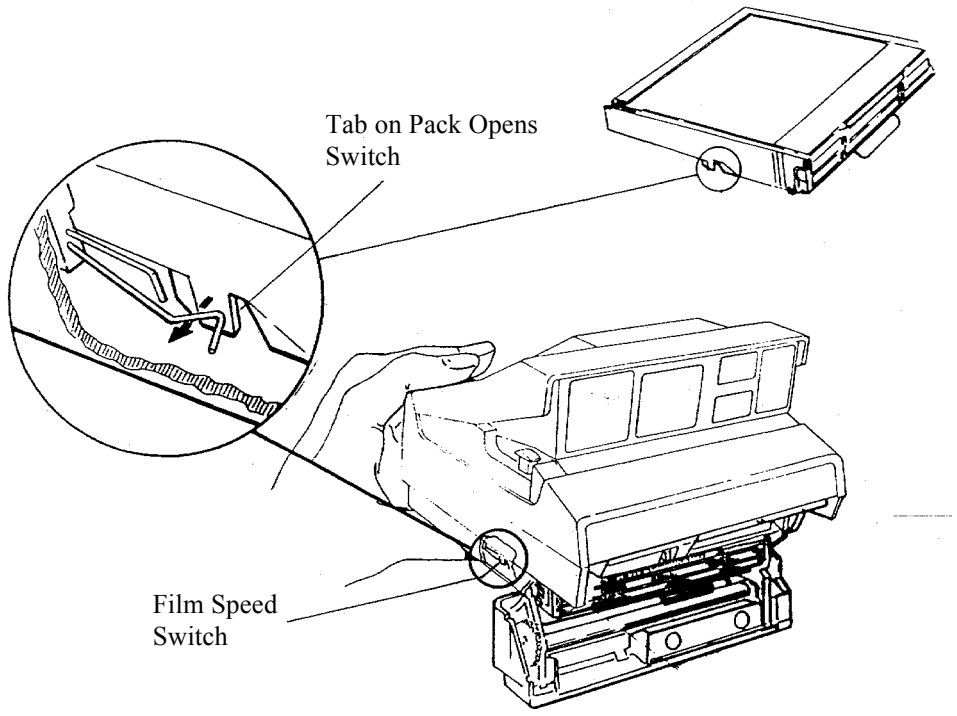


Figure 2-24 Film Speed Switch

When a pack of “normal” film is inserted into the camera, a tab on the pack opens the switch, This tab is not present on “slow” film packs. Therefore, when a pack of “slow” film is inserted, the switch stays closed. With the switch closed, the calibrated strobe and ambient exposures are increased by 0.33 $\pm$ 0.15 stop to compensate for the slow film.

CAMERA INHIBITS

The camera electronic circuits are designed to prevent certain types of camera operation while another function is taking place. These inhibits are:

Strobe fire is inhibited during dark slide.

Camera cycling is inhibited during strobe charge.

The strobe converter is inhibited during the ranging and processing cycles.

Motor drive is inhibited when SEE (known as the social switch) is closed. (This is accomplished by holding the shutter button down after an exposure is made.)

Camera cycling and strobe charging are inhibited during the self-timer mode and also when the out-of-film chime is sounding.

C. SEQUENCE OF OPERATION

STARTING CONDITIONS
CAMERA ERECT, DOOR OPEN, WITH NO FILM PACK

Figure 2-25 shows the drive assembly and wireform switch block. These two assemblies provide electromechanical control of most camera functions. Note that the wireform switches are activated by the rotation of both the timing gear and the counter. In the illustration, the switches are shown as they are in the starting condition. That is, the camera is erect, the door is open, and there is no film pack in the camera.

WIREFORM SWITCHES - STARTING CONDITION

Switch	Function	Condition
S10/S1	Initiates strobe charging; supplies power for ranging and preview; initiates cycle.	OPEN
VER	Switches power to camera when erect.	OPEN
S9	Initiates darkslide cycle.	CLOSED
EOP	End of Pack - indicates empty film pack in viewfinder display after 10th picture.	OPEN
EOC/S9	End of Cycle - turns off motor after darkslide or processing cycle.	OPEN
SPD	Film speed - opened by “normal” speed film; remains closed with “slow speed” film.	CLOSED

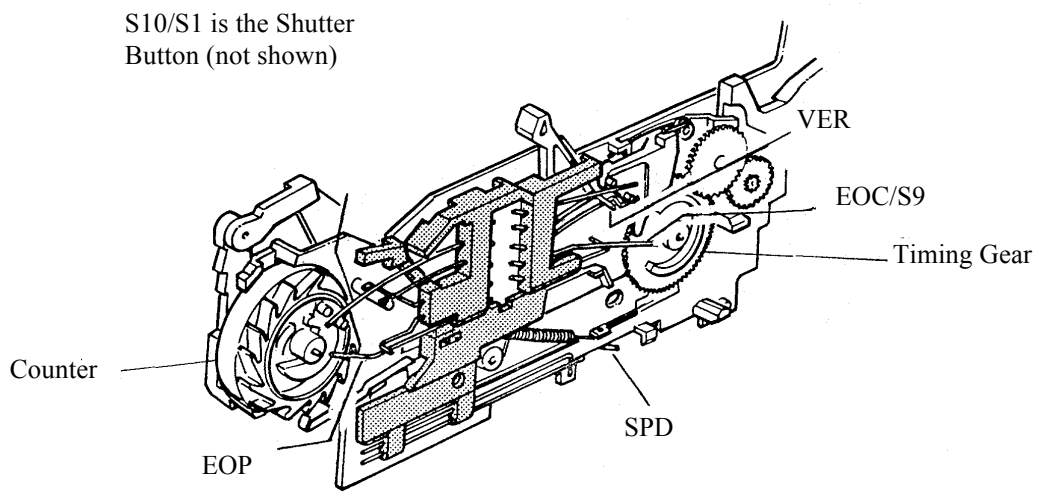


Figure 2-25 Wireform Switchblock and Drive Assembly

FILM PACK INSERTED AND DARK SLIDE

When the film pack is inserted into the camera, electrical connection from the battery to the camera is made through the two battery contacts in the camera film compartment. If the film speed falls within the “normal” ASA parameter there is a projecting tab on the pack. This tab opens a Film Speed wireform switch in the film compartment as shown in Figure 2-26. If the film speed is “slow” the tab is absent, the switch remains closed, and the exposure circuits increase all exposures by 1/3 f-stop.

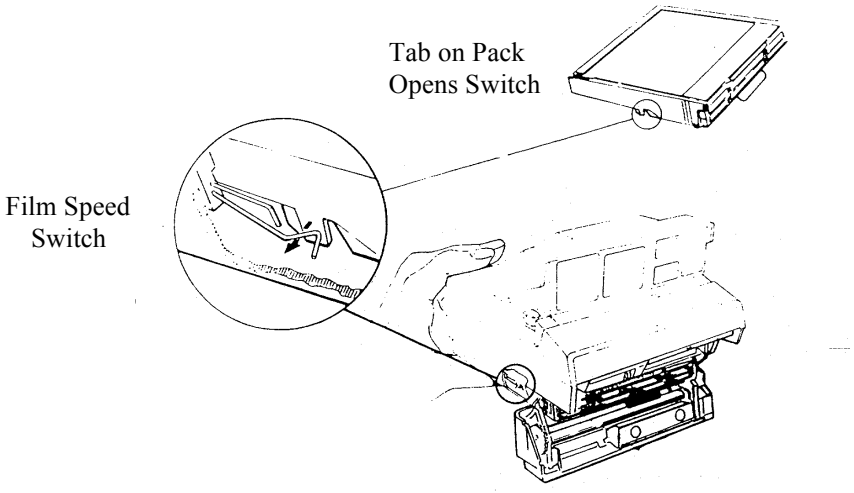


Figure 2-26 Film Speed Wireform Switch

Insertion of the film pack also causes the pack pawl to engage the ratchet teeth of the counter wheel (Figure 2-27). The pawl remains engaged until the pack is removed. It allows the counter to turn only in one direction.

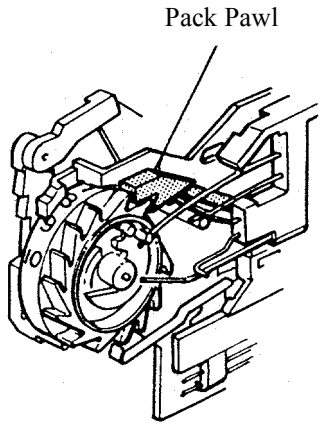


Figure 2-27 Pack Pawl Engaging Counter Wheel Ratchet

With the film pack inserted into the camera, the door may now be closed and latched. This causes the door link to pivot counterclockwise slightly (Figure 2-28). As seen in the illustrations, the upper pin on the door link pushes the +BAT wireform into contact with VER. The lower pin pushes GND away from VER.

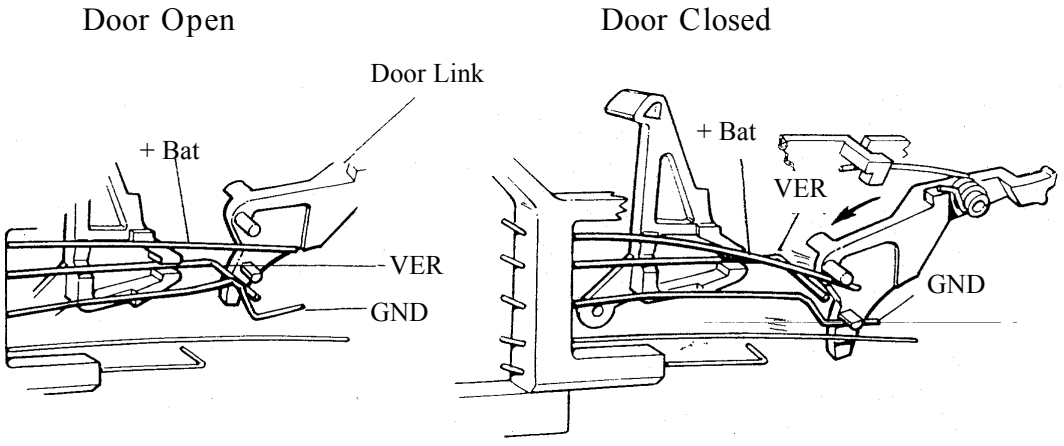


Figure 2-28 Door Link Closes VER Switch

With the switches in this condition, electrical circuits are completed to all of the functions noted in Figure 2-29. The camera components are thus able to receive power only when the door is closed and latched.

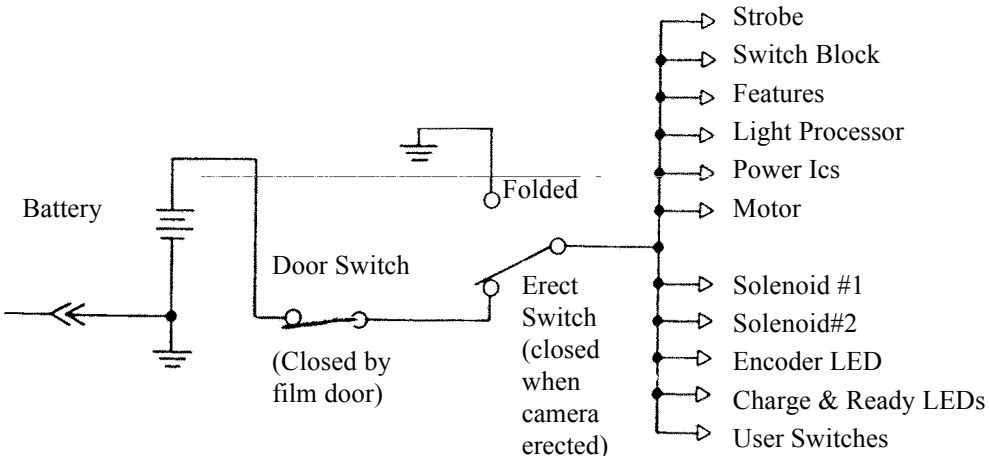


Figure 2-29 Electrical Circuits with Door Closed and Latched

You will recall that switch S9 is normally closed during the starting condition of the camera. Thus, when the camera door is closed, power is delivered through S9 to start the motor. The motor turns the timing gear which is now responsible for several actions. As seen in "A" of Figure 2-30, before the motor turns the timing gear switch EOC/S9 is open. (Note that this wireform switch is different from wireform switch S9 which is activated/deactivated by the counter wheel.)

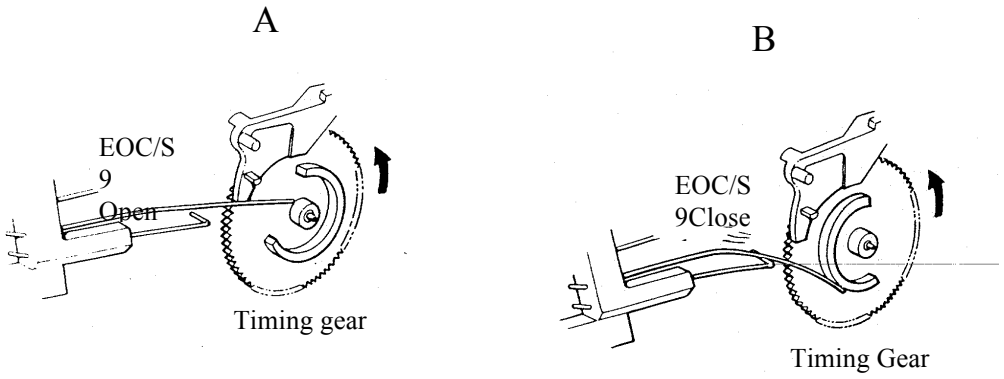


Figure 2-30 Timing Gear Closing EOC/S9

In “B” of Figure 2-30, the motor drives the timing gear and the cam on the face of the timing gear forces EOC/S9 down, to make with VER. With EOC/S9 closed, the motor will continue to run. Once the cam face moves away from EOC/S9, the switch contacts open, the motor shuts off and then coasts to bring the timing gear back to the condition shown in “A” of Figure 2-30.

Another cam, on the back of the timing gear, moves simultaneously with the cam on the face. The cam on the back of the timing gear actuates the pick slide which does two things. First, it engages the dark slide in the film pack and pulls it forward, into the motor-driven rollers. The rollers eject it out of the camera. Second, a hook on the left end of the pick engages one of the ratchet teeth on the counter. It indexes the counter from blank to “10” (Figure 2-31).

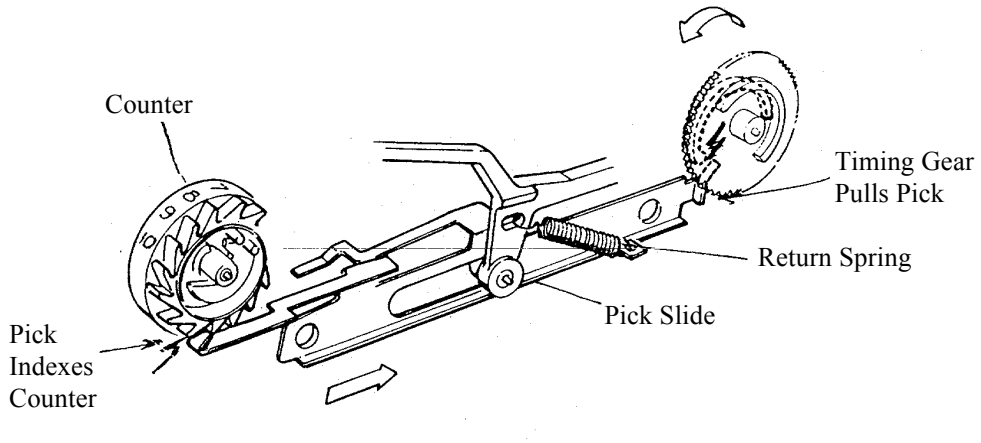


Figure 2-31 Pick Slide Ejecting Dark Slide and Indexing Counter

As the counter wheel indexes, a pin which holds S9 closed, moves away from the wireform switch (Figure 2-32). (Note that this occurs while EOC/S9 is still closed.) As a result, the switch opens and remains operational for the remainder of all the exposure cycles until the film pack is removed. When the pack is removed, the pack pawl disengages from the counter ratchet and spring action brings the counter back to its starting condition. In the starting condition, the pin again holds S9 closed, so it will be ready to divert power for the next dark slide cycle.

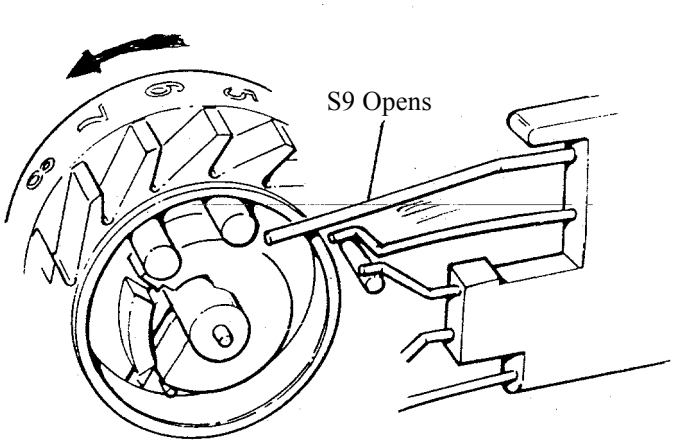


Figure 2-32 Counter Opening S9 Wireform

PREVIEW MODE

At this point in our sequence, there is a pack of film in the camera, the dark slide has been ejected, the counter has indexed to “10”, and the camera is ready to take a picture. Lightly pressing the S10/S1 (shutter) button causes the following events to occur:

If the strobe switch on the control panel is ON, a strobe charging cycle is initiated. A red LED on the control panel lights during the charging cycle (Figure 2-33). When the strobe is charged (within 2.8 seconds) the red LED extinguishes and the green LED lights. The green LED stays on for 30 seconds or until a picture is taken.

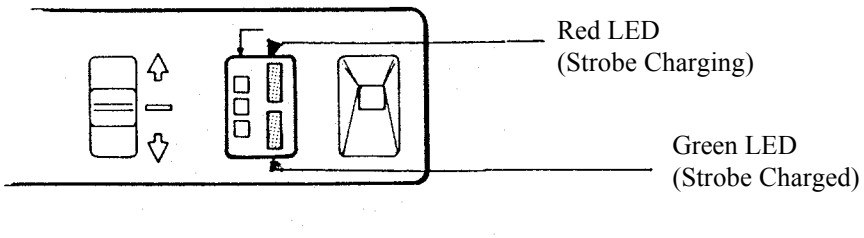


Figure 2-33 Strobe Charging/Strobe Charged Lights

During the Preview mode, an informative three-color display is visible in the viewfinder eyepiece as long as the shutter button is held half-way down. (Figure 2-34)

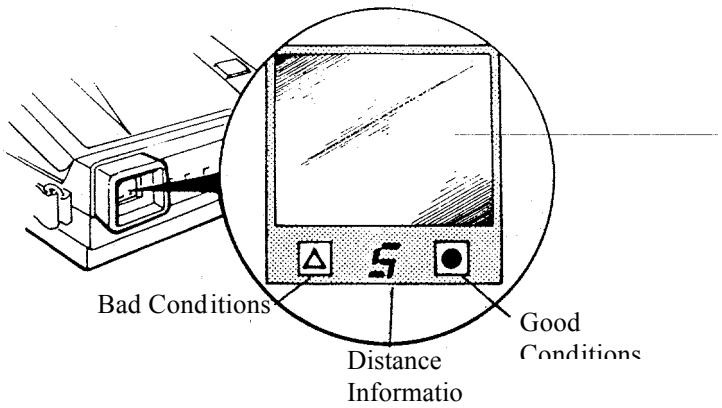


Figure 2-34 Viewfinder Display During the Preview Mode

The display is created from the logic circuits using signals from:

- the rangefinder circuit which calculates camera-to-subject distance based on the echo-return time of sonar pulses transmitted from the transducer;

- the brightness detect circuit which samples ambient scene light through one of the cells of a dual photodiode.

The display shows subject distance in feet or meters, depending on the setting of a selector switch on the camera control panel. The subject distance is displayed in red. A blinking yellow triangle indicates poor picture conditions (subject too close, subject beyond strobe range, not enough light (if strobe is turned off). The poor conditions visual symbol is accompanied by an audible beeping sound which is created by exciting a piezo. A green dot indicates that pictures conditions are good.

If all ten exposures have been made, a three-second chime will sound during the Preview mode to indicate that the camera is out of film. This chime also emanates from the piezo.

If the strobe has been turned off, the same functions take place during the Preview mode.

EXPOSURE MODE

When the shutter button (S10/S1) is pressed all the way down, the viewfinder display is turned off and the exposure mode is initiated. During this mode, the Quintic Lens is moved to the proper position based on ranging information, the shutter blades open to the proper aperture based on light measurements and ranging information, the strobe fires, film is exposed, light measurements determine when to shutdown the strobe and close the shutter blades, and the film frame is processed. The following describes how these actions take place.

Figure 2-35 shows the Quintic system in the starting conditions before an exposure is made. The encoder circuit (LED and photodiode) is on, in readiness to start reading Quintic Lens movement. Solenoid #1 is turned on, holding the shutter blades closed in readiness for Quintic movement.

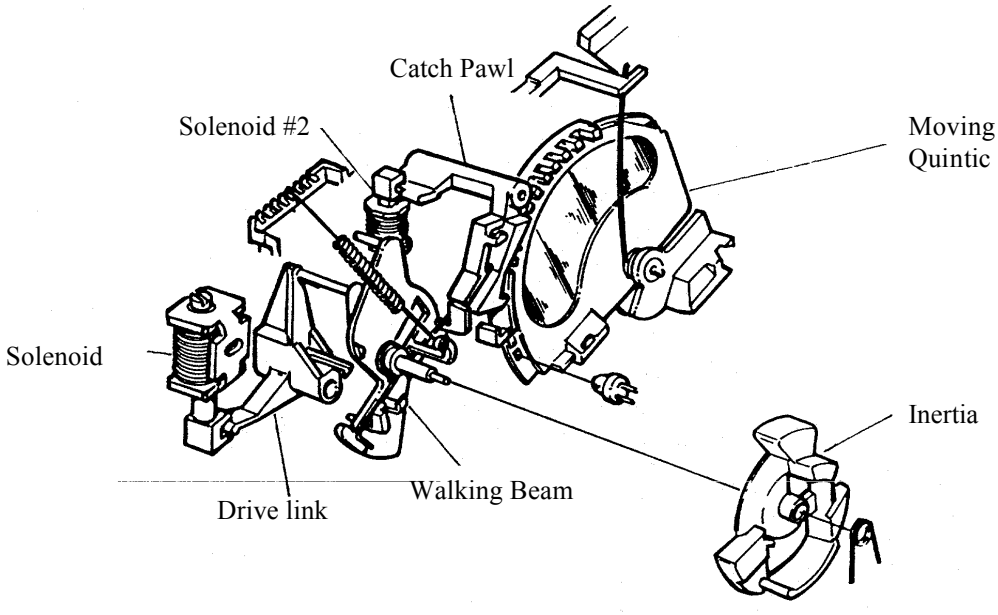


Figure 2-35 Quintic Lens System in Starting Condition

Energizing solenoid #1 causes the drive link and walking beam to pivot clockwise. This action releases the kick spring which strikes an arm on the Quintic Lens (Figure 2-36). The Quintic Lens thus starts to pivot counter-clockwise.

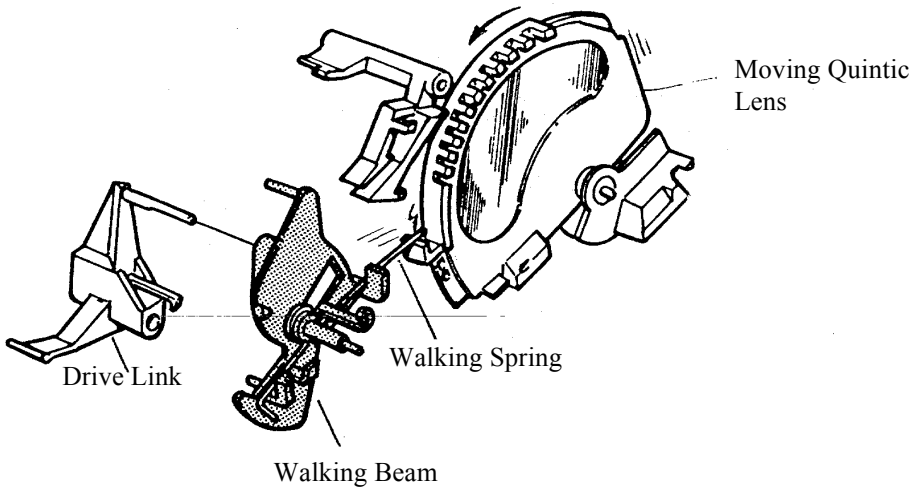


Figure 2-36 Kick Spring Starts Quintic Lens Movement

As the Quintic pivots counterclockwise, light from the encoder LED is alternately blocked and allowed to pass through to the encoder photodiode. These pulses of light are created by “windows” along the outer edge of the moving lens (Figure 2-37). The pulses are counted by the encoder circuit and are compared to the distance information already generated by the transducer circuit. When the pulse count corresponds to the distance information, solenoid #2 is energized.

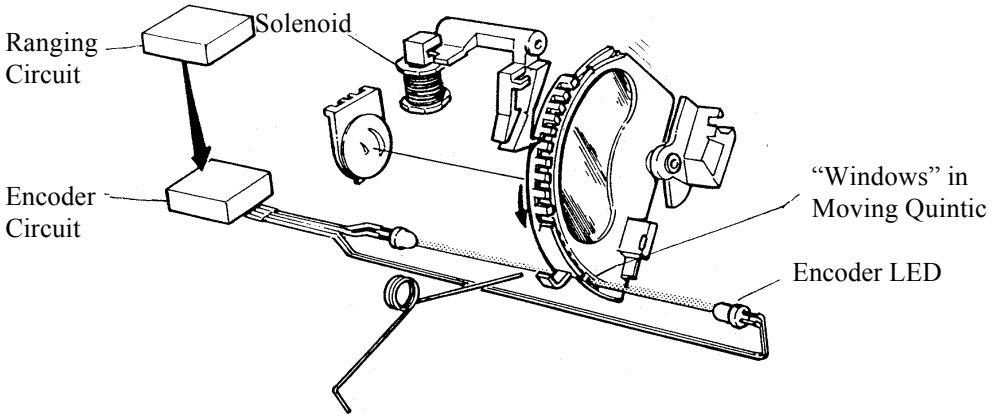


Figure 2-37 Encoder Circuit Reads Light Pulses

Energizing solenoid #2 releases the catch pawl which swings down and engages one of the teeth cutouts along the periphery of the Quintic Lens (Figure 2-38). The moving lens is thus halted at a point where, in combination with the taking lens and the fixed Quintic Lens, it is in proper focus for the subject distance as measured by the transducer.

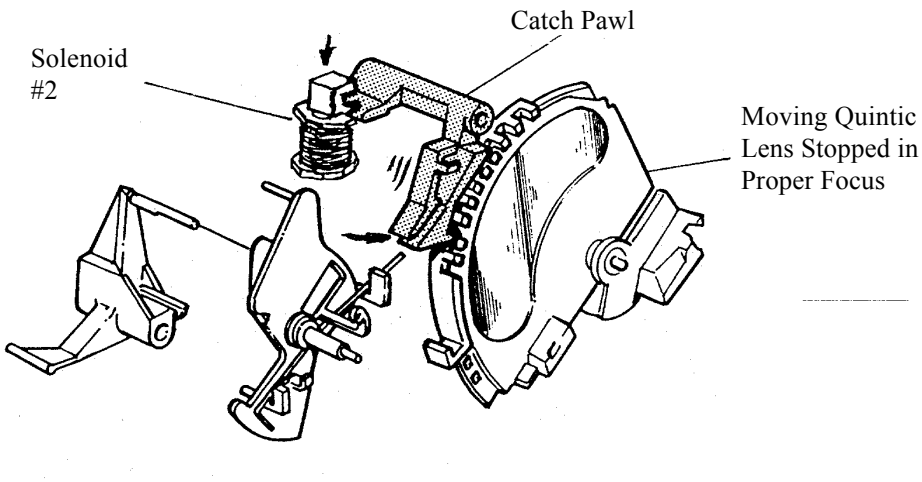


Figure 2-38 Catch Pawl Holds Quintic in Place

With the lens system now in focus, solenoid #1 is deenergized. Since the catch pawl moved out of the way in the previous step, the walking beam is free to pivot under spring action. This releases the shutter blades as in previous Polaroid shutter systems. At the first instant of shutter blade release after solenoid #1 is deenergized (actually 20ms after solenoid #1 is deenergized), an opening created by the position of the three shutter blades allows light from the encoder LED to again read the encoder photodiode (Figure 2-39). (The position of the Quintic Lens in its focused or stopped setting is such that a “window” is lined up between the encoder LED and the photodiode.) This light pulse is the First Light Detect and serves as the starting point for all exposure measurements.

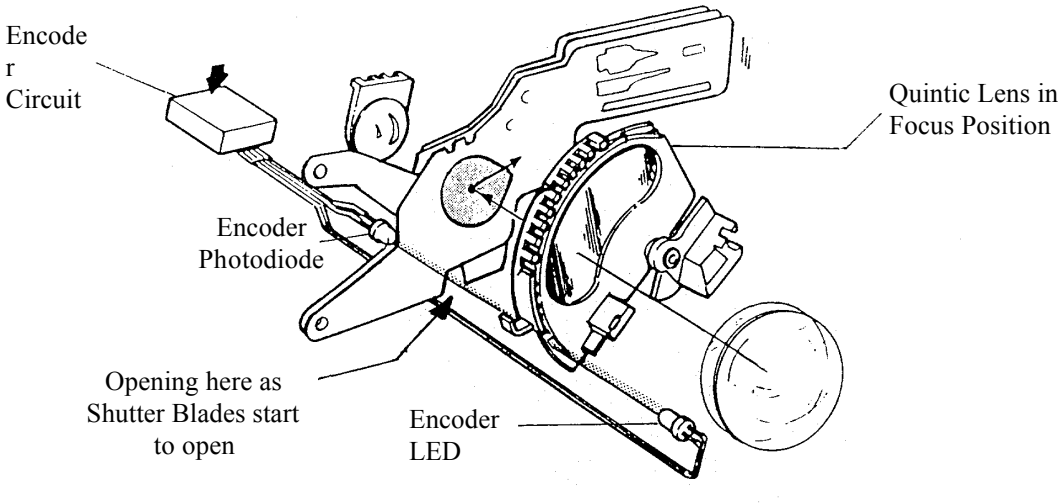


Figure 2-39 First Light Detect

With the shutter blades opened to the proper aperture, strobe firing now occurs. (If the strobe is turned off, exposure will be determined by light integration or a maximum time-out of 2.8 seconds.) Strobe fire duration is dependent on the integration of the transducer camera-to-subject distance information and light measurement information. If the subject is more than 14 feet away, the strobe may be fully discharged.

As previously mentioned, Spectra exposure measurements are a combination of the best features of the Model 640 and Model 660 cameras. The dual cell photodiode measures all visible white light which is the primary contributor to ambient exposure calculations. It also measures the infrared component of the reflected strobe light which is the primary contributor to strobe exposures (Figure 2-40). Electronic mixing of the proper amount of each of these light sources provides optimum film exposure by precisely determining when to fire the strobe, when to turn it off, and when to close the shutter blades.

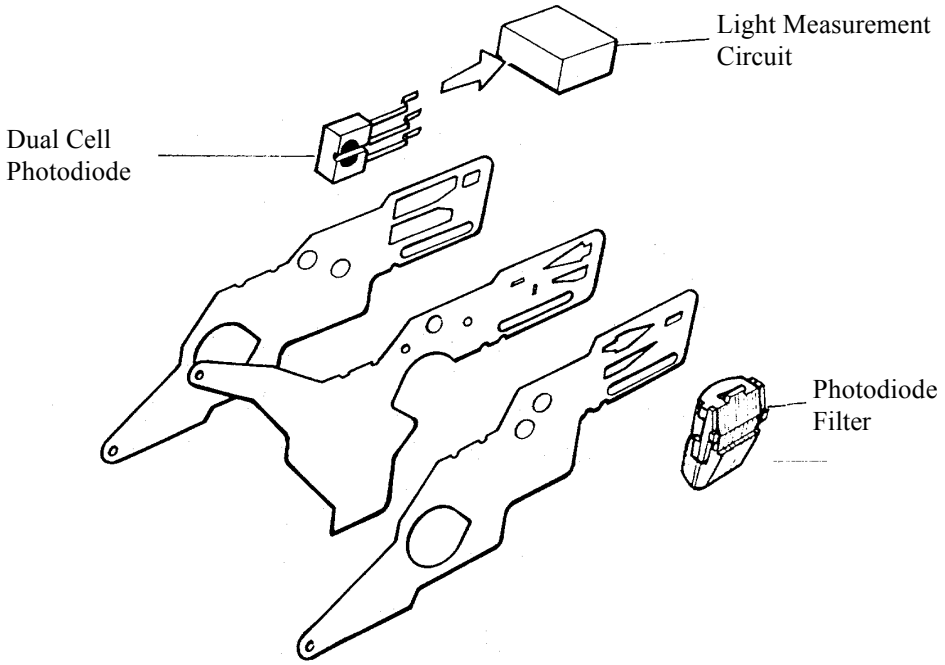


Figure 2-40 Measurement of Visible Light and Infrared Light

When the light measurement determines that the strobe should be shut down, a pair of series thyristors in the strobe circuit act to save any unused energy remaining in the flash capacitor. This departure from previous Polaroid flashes results in a shorter recharge time for the succeeding exposure.

When the exposure cycle is completed, the logic circuits again energize solenoid #1. (Figure 2-41)

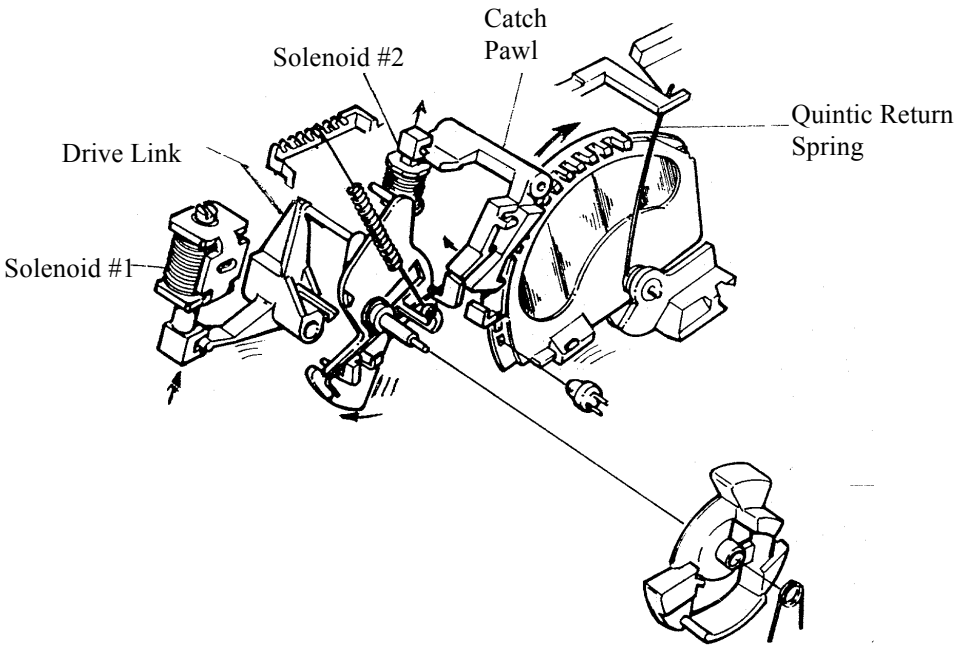


Figure 2-41 Shutter Components At End of Exposure Cycle

The solenoid pulls the drive link and rotates the walking beam clockwise back to its original position, closing the shutter blades. Solenoid #2, which has been at a holding current level during the exposure, is now deenergized. This disengages the catch pawl from the Quintic and allows the Quintic return spring to bring the lens back to its original position. The foot of the catch pawl is also now positioned to latch the walking beam. Thus, when solenoid #1 is deenergized, the walking beam cannot move. The exposure cycle is now completed.

Strobe recharging begins immediately after the shutter system is latched in the form of a brief sneak charge. Before the film frame is even processed, the sneak charge acts to top off the flash capacitor, either fully recharging it or partially recharging it. (This depends on how much strobe energy was expended during the exposure.) The purpose of the sneak charge is to minimize the time required to charge the strobe before the next exposure is made. The sneak charge ends when the shutter button is released.

FILM PROCESSING AND CYCLE ADVANCE

Motor drive starts when the shutter button (S10/S1) is released. The motor drives the timing gear the same way as described for the dark slide cycle. The timing gear closes EOC/S9 to keep the motor running and pull the pick slide forward (Figure 2-42 and 2-43).

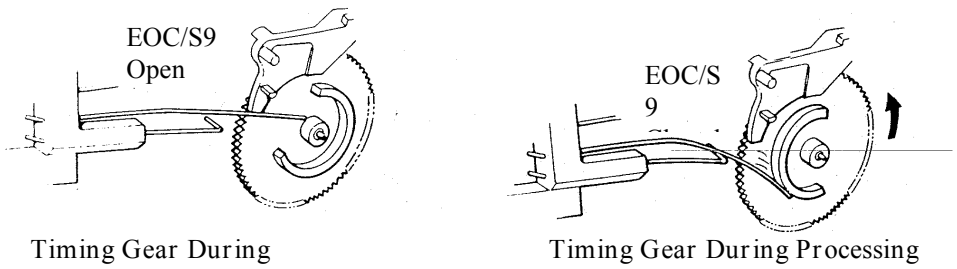


Figure 2-42 EOC/S9 Wireform Switch Closed by Timing Gear Cam

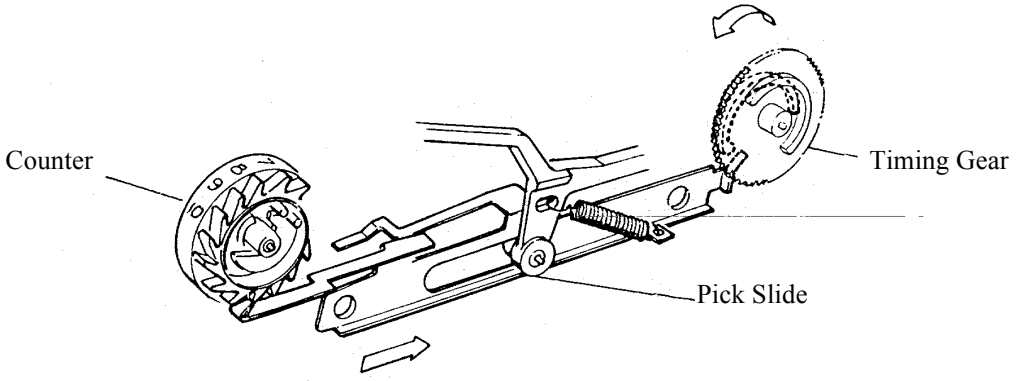


Figure 2-43 Film Processing

A hook on the pick grabs the just-exposed film frame and pulls it into the developer rollers which are motor-driven. The rollers break the developer pod and spread the reagent as the frame is fed through the rollers. The pick also pulls one of the counter wheel ratchets forward and the counter indexes from 10 to 9.

As the timing gear continues its rotation, the cam on its face loses contact with EOC/S9. As a result, EOC/S9 opens and turns the motor off. The motor then coasts and the timing gear returns to its starting position.

With motor power turned off, the strobe charging circuit then completes the process of charging the strobe capacitor.

After all 10 film frames have been exposed and processed, the counter indexes to a point where a “0” against a red background appears in the counter window, indicating that no film remains in the pack. At this point, a pin on the side of the counter closes the EOP (end-of-pack) switch (Figure 2-44).

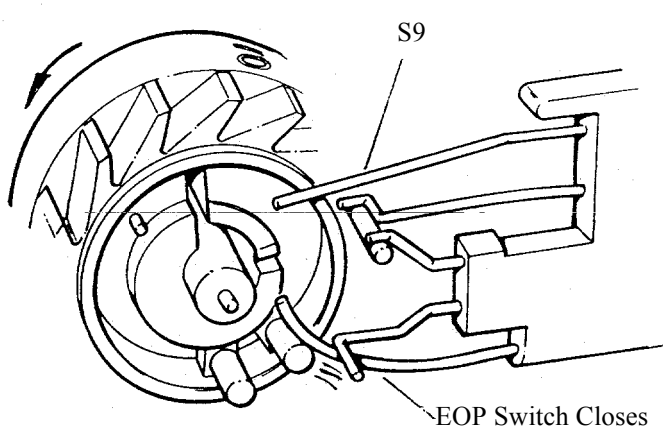


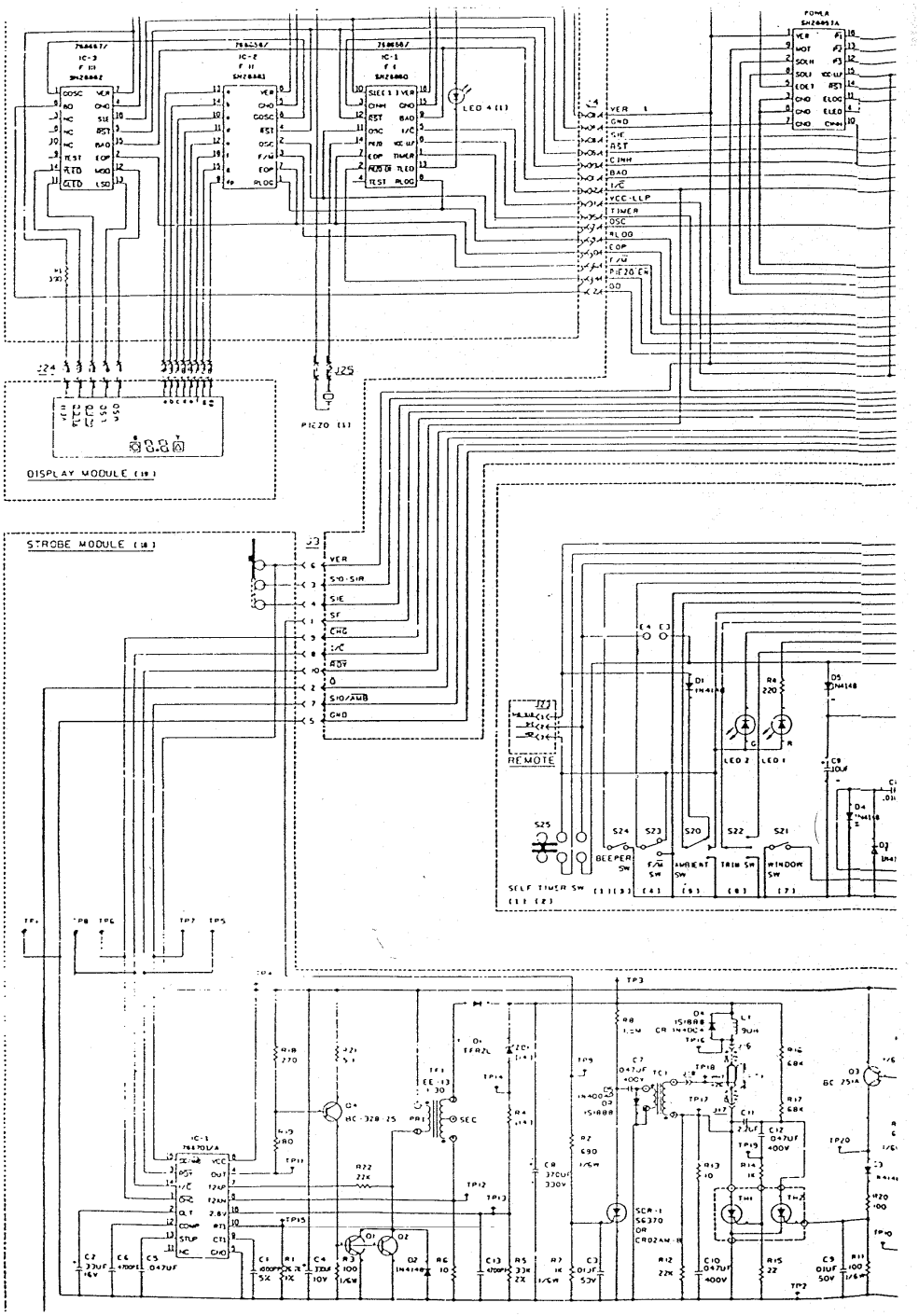
Figure 2-44 Closing The End-Of-Pack (EOP) Switch

With the EOP switch closed, a repeating chime sounds three times signaling that there is no film left in the pack. If the empty pack is left in the camera, the chime will sound whenever the shutter button is pressed. A flashing red “0” will also appear in the viewfinder. This chime will also sound if the camera is erected after it has been closed with an empty pack inside it.

Removing the empty pack disengages the pack pawl, causing the spring-tensioned counter wheel to return to its starting condition. A blank appears in the counter window, the EOP switch opens, and the S9 switch closes. The camera is now in the starting condition described at the beginning of this sequence section.

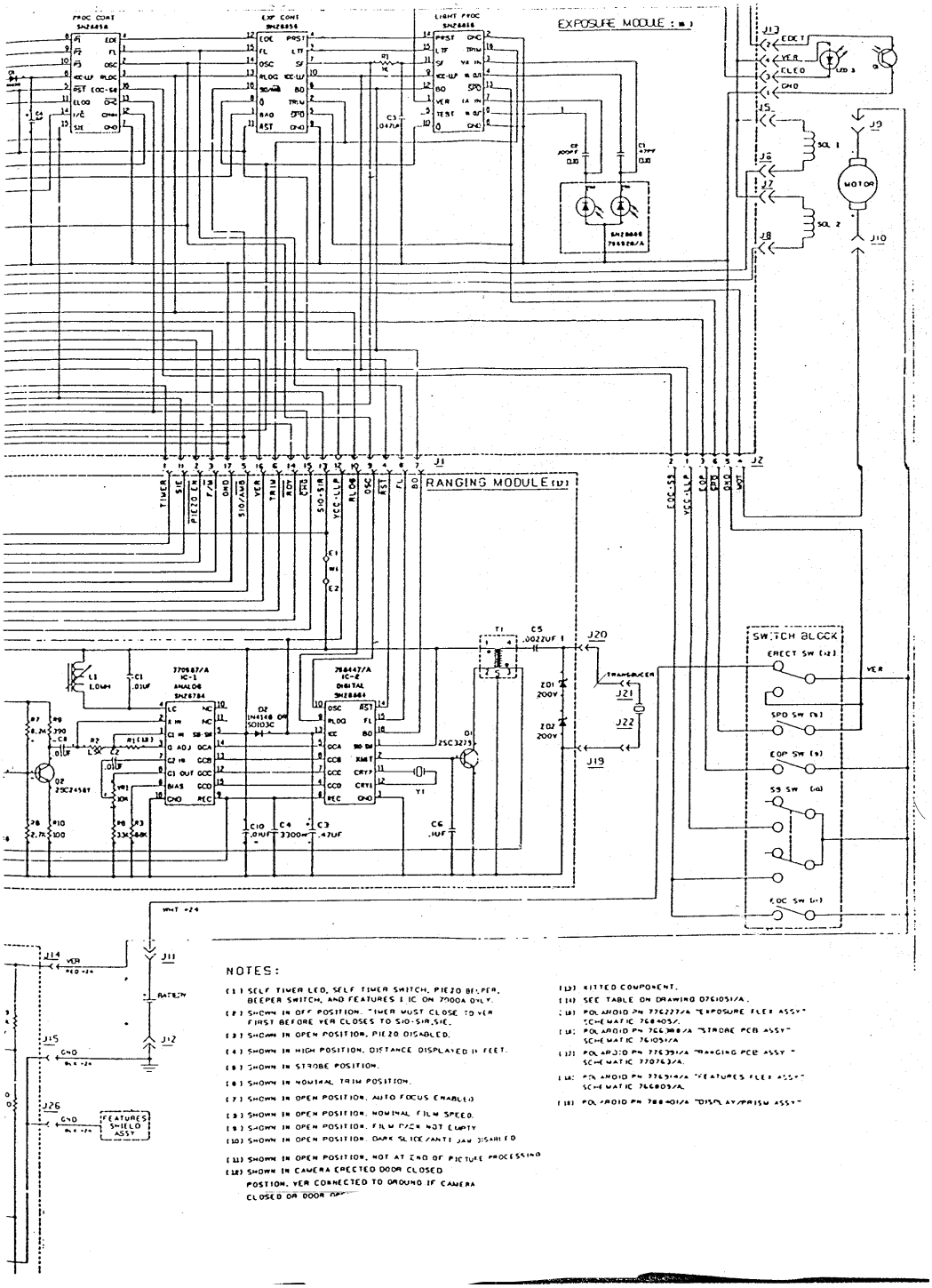
D. SCHEMATIC

The system schematic for the Spectra System camera is presented on the following pages.



Schematic joins here (in center)

Left Side of Schematic



Schematic joins here (in center)

Right Side of 8 1/2 x 11 inch Schematic

SECTION 3
TESTING AND ADJUSTMENTS

CONTENTS

A. SPECTRA CAMERA STAR TESTER SPECIFICATIONS

Covered ambient	-.10 to + .30 stops
Covered strobe exposure (graywall)	-.30 to + .20 stops

The following additional tests are required only if the strobe exposure (graywall) cannot be corrected by adjusting the I.R. exposure calibration slide. See “order of spectra system tests” in this section.

ZLS graywall	230 ZLS to 350 ZLS
Hybrid	(60 ZLS to 110 ZLS)
Blade speed	20 to 24 ms

CAUTION

The Spectra System camera uses silicon CMOS integrated circuit technology. CMOS integrated circuits are susceptible to damage created by static electricity. Static discharges are not always noticeable. Just because you don't notice a static shock doesn't mean that there hasn't been one. And, just as static is not always obvious, the damage it creates isn't always obvious - until it's too late. In fact, one or two static discharges may not cause enough damage to adversely affect camera operation. However, static discharge damage is cumulative. Enough static and you will undoubtedly damage the CMOS circuits.

THEREFORE,

Whenever you are working on the Spectra camera and any disassembly is required, you must wear a grounding wrist strap. The workbench surface must be dissipative. The workbench itself must be grounded. There should be no materials on the workbench which are conducive to the creation of static electricity. (Styrofoam coffee cups are prime villains.)

If it is necessary for you to carry a disassembled camera away from the grounded workbench to a tester, and you must disconnect your wrist strap, be certain that you reconnect your wrist strap to a ground at the tester before you place the camera on the tester horn.

B. SPECTRA SYSTEM FUNCTIONAL TEST

GENERAL

The purpose of the functional test is to determine if the camera is operating properly during various phases of simulated operation. In this test the camera is cycled through dark slide, strobe exposures, non-strobe exposures, and end-of-pack. The intent is to isolate problems for troubleshooting. If the camera does not operate as described below, consult the troubleshooting chart most closely allied with the problem.

EQUIPMENT REQUIRED

Film Pack Simulator #12467

Film Pack Simulator Adapter #13130

Power Supply - Power Mate #12531 or Lambda #12429

TEST SETUP

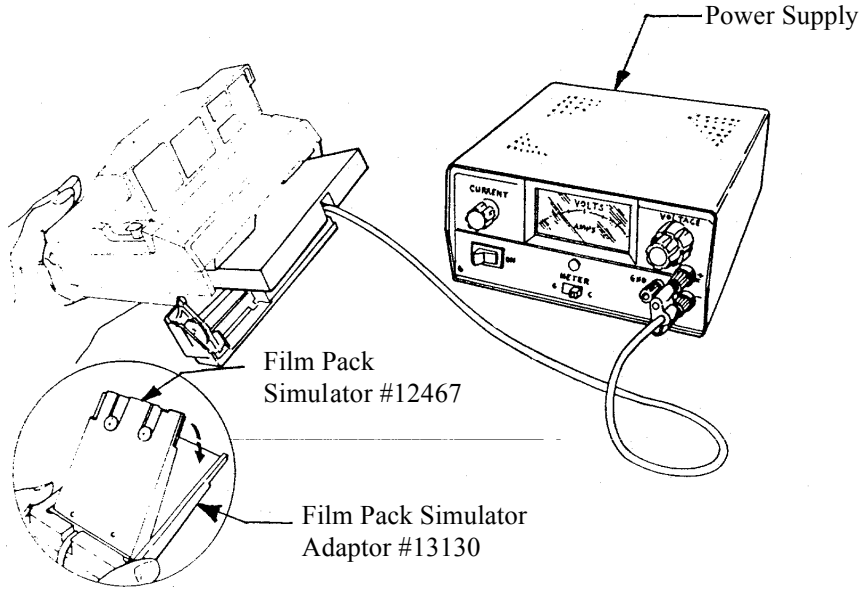


Figure 3-1 Test Setup for Spectra Functional Test

1. Except for the trim switch, set all the switches on the control panel at the rear of the camera to the UP position (automatic mode). Set the trim switch to the middle (normal) position.

2. Insert the Film Pack Simulator Adapter #13130 onto the Film Pack Simulator #12467.

3. Plug the Film Pack Simulator with adapter into the power supply (either Power Mate #12531 or Lambda #12429).

4. Plug the power supply into a 110 VAC power source.

5. Turn the power supply ON.

6. Adjust the power supply output voltage to 6 VDC.

TEST PROCEDURE

1. Erect the camera and open the film door.

2. Install the film pack simulator with the adapter into the camera. The camera should not cycle.

3. Remove the film pack simulator from the camera.

4. Using the tip of a solder aidee, close the camera door latch (Figure 3-2).

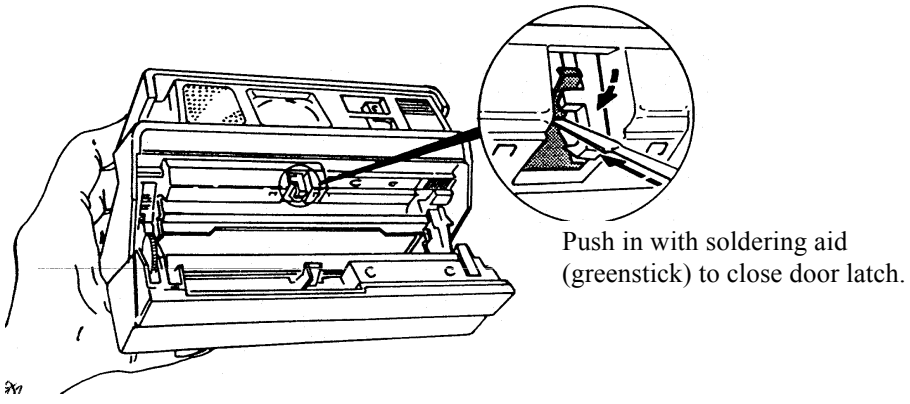


Figure 3-2 Close The Spectra Camera Door Latch

5. Install the film pack simulator into the camera again. The camera should go through a dark slide cycle with the following events happening:

The strobe should not fire.

The camera shutter blades should remain closed.

The strobe charging light (red) should come on and then go off.

The strobe ready light (green) should come on.

Note: The green ready light will stay on for approximately 30 seconds and will then extinguish if the camera is not used.

The counter should index from blank to “10”.

6. Aim the camera at an object less than one foot (.1 meter) away and press the S1/S10 button halfway down (preview mode). The following should happen:

   A warning tone (beep! beep!) will sound.

   A flashing yellow triangle within a yellow square will be visible in the viewfinder.

   A red figure “1” will be visible in the viewfinder.

7. On the camera control panel, slide the Feet/Meters selector switch to the down (meters) position. Again, aim the camera at a subject less than a foot away and press the S1/S10 button half way down. The following will happen:

   A warning tone (beep! beep!) will sound.

   A flashing yellow triangle within a yellow square will be visible in the viewfinder.

   A red figure “1” will be visible in the viewfinder.

8. Slide the Feet/Meters selector switch on the camera control panel back to the up (feet) position.

9. Aim the camera at an object exactly four feet (1.2 meters) away and press the S1/S10 button down half way. The following should happen:

   A green circle within a green square will be visible in the viewfinder.

A red figure “4” (feet) will be visible in the viewfinder. (A red figure “1.2” (meters) will show in the viewfinder if the Feet/Meters switch on the camera control panel is in the down (meters) position.)

10. Cover the transducer using the fingers or palm of your left hand as shown in Figure 3-3 or you can cover the transducer with photographic tape. Use care to prevent covering the photocell. Press the S10/S1 button half way down. (This simulates an infinity exposure.) The following should happen:

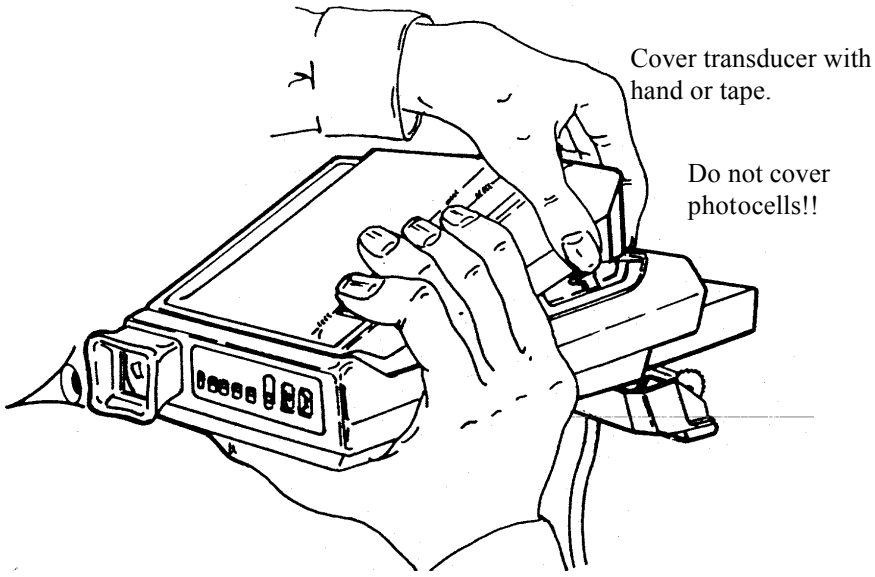


Figure 3-3 Covering the Transducer to Simulate an Infinity Exposure

No red figure should be visible in the viewfinder.

Depending on the ambient light available, a flashing yellow triangle within a yellow square (with warning beeps) or a green circle within a green square will be visible in the viewfinder. The warning yellow triangle will appear in low light level situations, while the green circle will appear if there is adequate light for a good exposure.

11. Now aim the camera at an object within the range of 2 feet (.6 meter) to 15 feet (4.5 meters) and press the S1/S10 button all the way. The following should happen:

The strobe should fire.

You should hear the camera go through an exposure cycle. (The blades should open and close, the Quintic Lens should move, and the motor should run.)

The counter should index from “10” to “9”.

The red strobe charging light should come on and then go off.

The green strobe ready light should come on.

12. Repeat the previous step six more times and observe that the camera operates as indicated above.

13. Move the strobe switch on the camera control panel to the down (OFF) position. Turn the front of the camera toward you. Cover the photocell with black photographic tape. Insert a soldering aide between the flapper door and the bottom of the shutter (Figure 3-4).

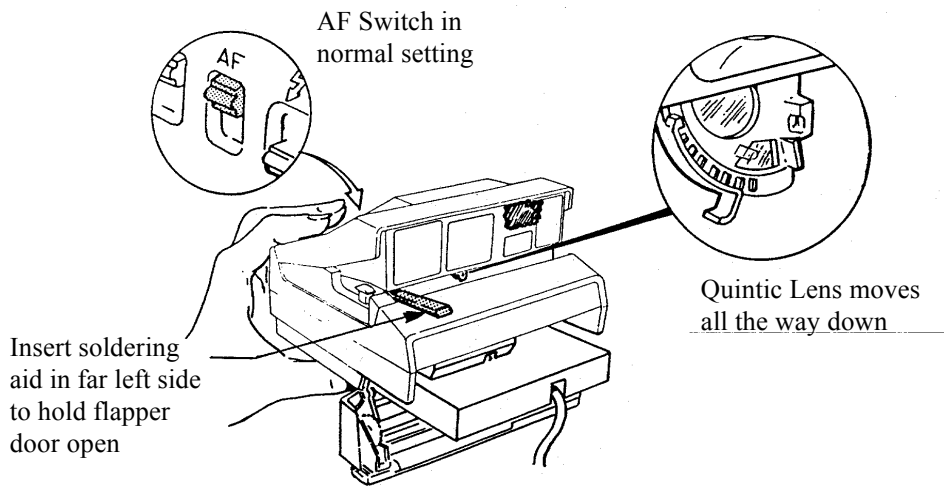


Figure 3-4 Quintic Lens Moves to Short-Distance Setting

With the camera aimed toward you, press the S1/S10 button all the way. The following should happen:

The warning beeps should sound.

There should be no strobe fire.

The moving Quintic frame should swing down below the level of the shutter during the exposure and should be visible through the open flapper door as seen in Figure 3-4. (This is the short distance Quintic position.)

The shutter blades should open and stay open for the maximum time-out period of 2.8 seconds.

The camera motor should run.

The counter should index down.

14. At the camera control panel, move the sonar autofocus override switch to the down (sonar off) position. The photocell should remain covered with the black photographic tape and the soldering aidee should still be inserted into the flapper door area. With the camera aimed toward you, press the S1/S10 button all the way. The following should happen:

    The warning beeps should sound.

    There should be no strobe fire.

    The moving Quintic Lens frame should swing down below the level of the shutter and should be visible through the open flapper door (Figure 3-5). This is the infinity Quintic position.

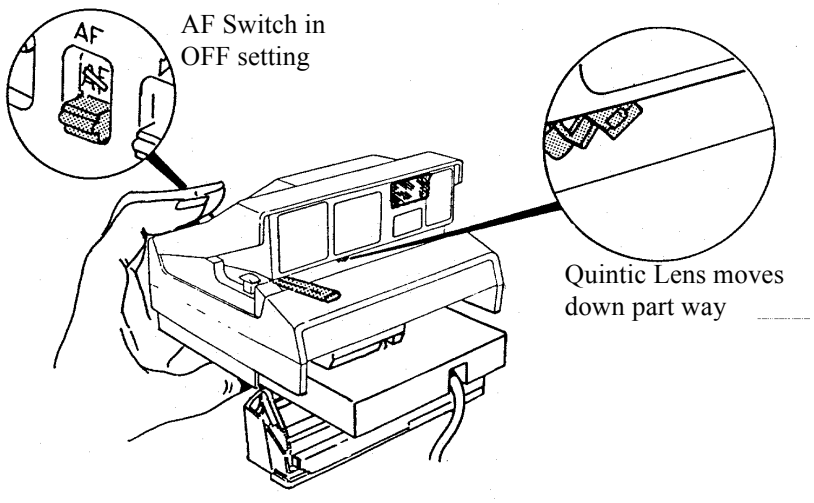


Figure 3-5 Quintic Lens Moves to Infinity Setting

The shutter blades should open and stay open for the maximum time-out of 2.8 seconds.

The camera motor should run.

The counter should index down.

15. Remove the soldering aide from the flapper door and remove the black photographic tape from the photocell. Return the strobe and sonar autofocus override switches on the camera control panel to the up (strobe and sonar ON) positions.

16. Slide the self-timer switch to the down (self-timer ON) position. (The camera exposure will be delayed for 12 seconds.) The following should happen:

    The warning tones (beep! beep!) should sound. The tones should get progressively faster until two seconds before the exposure when the tone becomes steady.

    At the front of the shutter, the red LED next to the photocells should flash. The flashing will get progressively faster until two seconds before the exposure when the LED stays on.

    At the end of 12 seconds, the strobe will fire, but the motor will <u>not</u> run.

    Return the self-timer switch to the up (self-timer OFF) position. The following will happen:

    The motor will run.

    The counter will index to a white “0” against a red background.

    The end-of-pack chimes will ring three times.

17. Press the SI/S10 button all the way down. The following should happen:

    The end-of-pack chimes will sound three times.

    The strobe will fire.

    Release the SI/S10 button.

    The camera will cycle.

The end-of-pack chimes will sound three times.

18. Look into the viewfinder and press the SI/S10 button half-way-down. The following should happen:

    A flashing “0” will be visible in the viewfinder.

    The end-of-pack chimes will ring three times.

NOTE: If the S1/S10 switch is pressed all the way down with an empty film pack, the strobe will fire. After the switch is released the camera will cycle. This is normal.

This completes the functional test of the spectra system camera. If the camera does not function as described, go to the troubleshooting section and refer to the chart which most closely corresponds to the malfunction.

C. STAR TESTER MODEL 12650-3

BASIC DESCRIPTION

This Star Tester is an upgrade of the Model 12650-2 (for 600 series and other cameras). The 12650-3 permits testing Spectra System cameras for seven different exposure and timing-related operating characteristics, as well as 600 series and other cameras.

Except for a new Horn #13146 for holding Spectra System cameras and a few name changes of Selector Switch positions (see Figure 3-6), the 12650-3 Tester is outwardly identical to the earlier Model 12650-2 Star Tester.

Model 12650-3 Controls & Indicators (see Figure 3-6)

Listed below are the Star Tester 12650-3 controls and indicators shown in Figure 3-6. The integrating light sphere and electronics required to compute and display exposure, timing and functional characteristics of the camera under test are all housed within the tester cabinet.

KEY	CONTROL/INDICATOR	FUNCTION
1	Disc Position Lamps*	Not used.
2	Reset Button	Clears electronics between tests.
3	Disc/Ride Time Switch*	Selects disc catch or ride time mode for 660.
4	Test Selector Switch	Selects Test mode (7000 ZLS, Flash Exposure, Ambient & Blade Speed for Spectra camera.)
5	Horn Volts Selector Switch	Selects 5V (low), 6V (nom) or 6.8V (high). Simulates film pack battery voltage.
6	20V/2000V Selector	With Volt Probe Jack & DC Voltmeter, allows use of Tester as voltmeter. For checking DC voltages in camera under test, with standard probe.

8	Timing Meter	Digital readout of strobe recycle time or blade speed.
9	DC Voltmeter	Digital readout of circuit voltages; also use with probe in Volt Probe Jack.
10	Stops Error Meter	Digital readout for Ambient, Hybrid, Strobe Exposure Tests
11	DC Current Meter	Digital readout of energy required. to charge strobe capacitor.
12	ZLS Meter	Digital readout of strobe light output in Zonal Lumen Seconds.
13	Power Switch	AC line voltage On/Off to Tester. Lights when Tester is powered.
14	Pack Simulator Jack	Connection for film pack simulation voltage. Lets Tester function as a power supply.
15	Strobe Adapters (two)*	Aligns electronic flash of 600/680 camera under test to Star Tester.
16	Horn Cable Connector	Accepts plug on Horn cable.
17	Disc Detector Connector*	Accepts cable from 660 Disc Detect/Ride Time Fixture.
18	J4 Connector*	For future applications.
19	Test Point Connectors	For connections to oscilloscope. Also used for calibrating Tester.

*Not used for testing Spectra System cameras.

CAUTION: WHEN TESTER IS NOT IN CONSTANT USE, TURN SELECTOR SWITCH TO 7000 ZLS POSITION. THIS SAVES WEAR ON LIGHT SOURCE, KEEPS TESTER IN NEUTRAL STATE, READY FOR IMMEDIATE RESUMPTION OF TESTING.

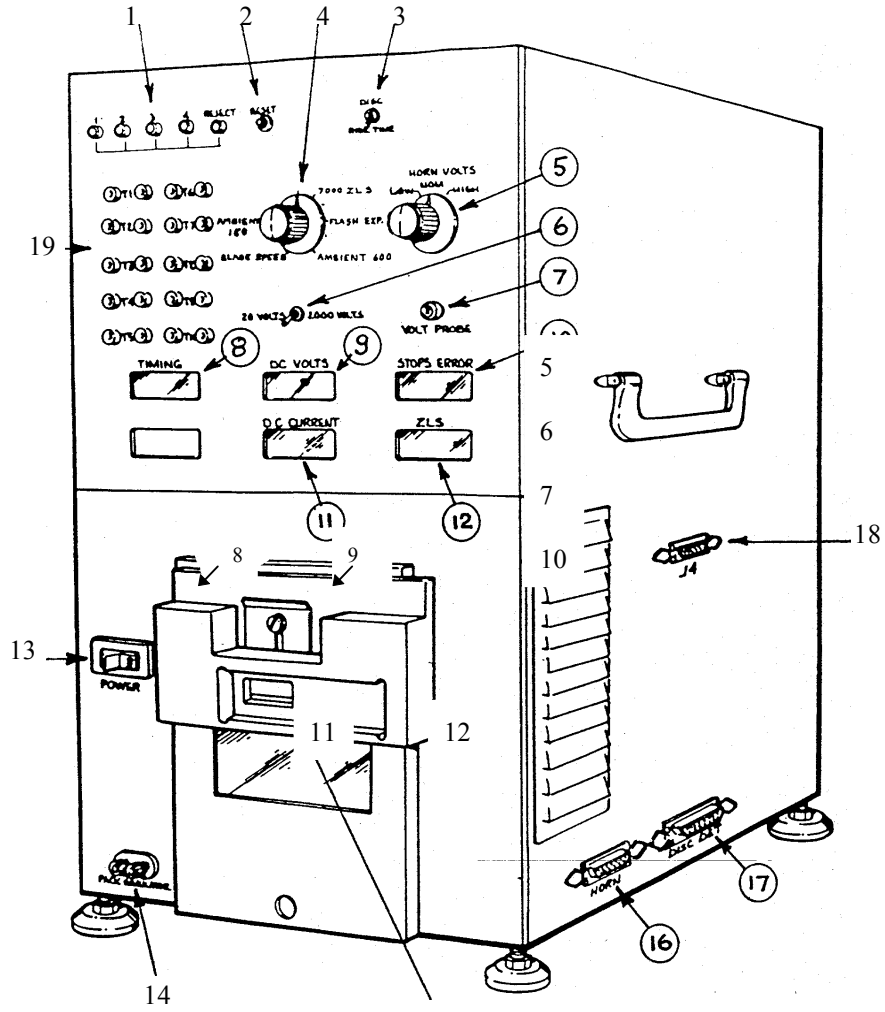


Figure 3-6 Star Tester 12650-3 Controls & Indicators

(See text for names & function of keyed 17 ıs)

16

15

STAR TESTER SETUP AND PRETEST CHECKS

1. Install Tester on level surface with clear area around Tester to allow sufficient air flow for cooling.

2. Locate the Tester on a bench or table so that when the Spectra on its Horn is placed on the top of the Tester, the Spectra lens will be exactly 4.5 feet (135 cm) from a graywall target. Also, be sure that the front of the camera is parallel to the graywall (or the long axis of the camera, front to back, is at right angles to the graywall). See Figure 3-7.

3. Be sure that the area between camera and graywall, for a width of approximately 4 feet (or what can be seen in the Spectra viewfinder) is clear of any objects. This will prevent erroneous readings caused by reflections from the sonar side lobes of the Spectra camera.

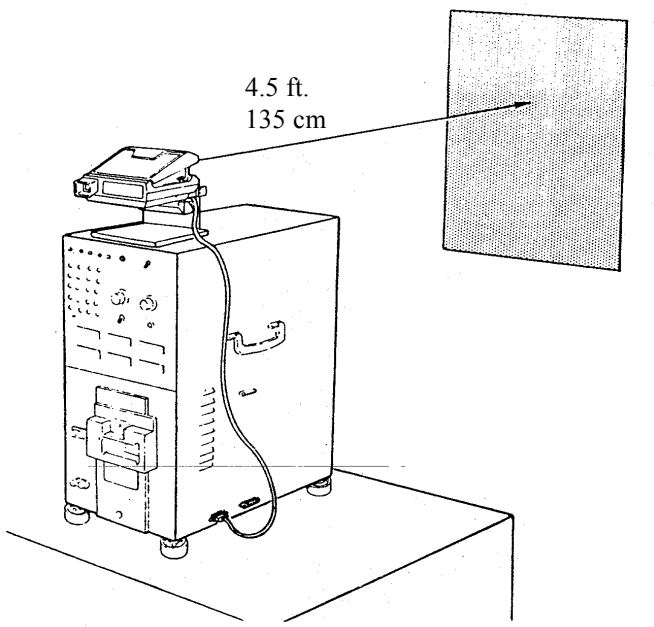


Figure 3-7 Locating Tester in Relation to Graywall Target

Pretest Checks

4. Connect the Tester to a 115 VAC, 50/60 Hz line.

5. Mount the camera on the Spectra Horn #13146 and connect the cable from Horn to the receptacle marked “horn” (key #16 in Figure 3-6) on the right side of the Tester.

6. Turn the Tester Power Switch ON (switch will illuminate if the Tester is receiving power). Let the Tester warm up a minimum of 10 minutes before performing tests.

7. Open the Front Door of the Spectra camera and with a greenstick (solder aide tool), trip the Door Switch into DOWN position. (See Figure 3-8.)

8. Position the Horn with the camera mounted on it against the front of the Tester, with the guide tab on the right side of the Horn against right edge of window mounting plate (see Figure 3-9.)

9. Fully depress the camera Shutter Button five times. Read the Stops Error Meter and check the Spectra Specification for agreement.

10. AT LEAST WEEKLY: Using a Standard Spectra Camera as a reference, perform the Ambient Exposure Test to check that the Star Tester is operating properly.

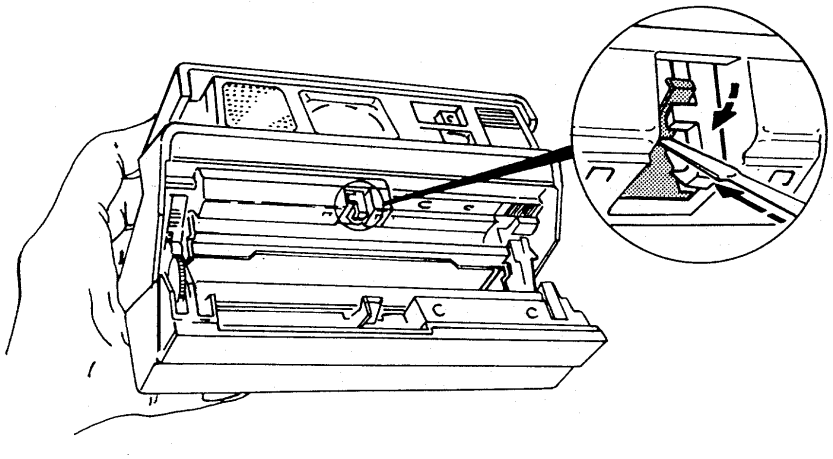


Figure 3-8 Trip Spectra System Door Switch to DOWN Position Before Doing Test

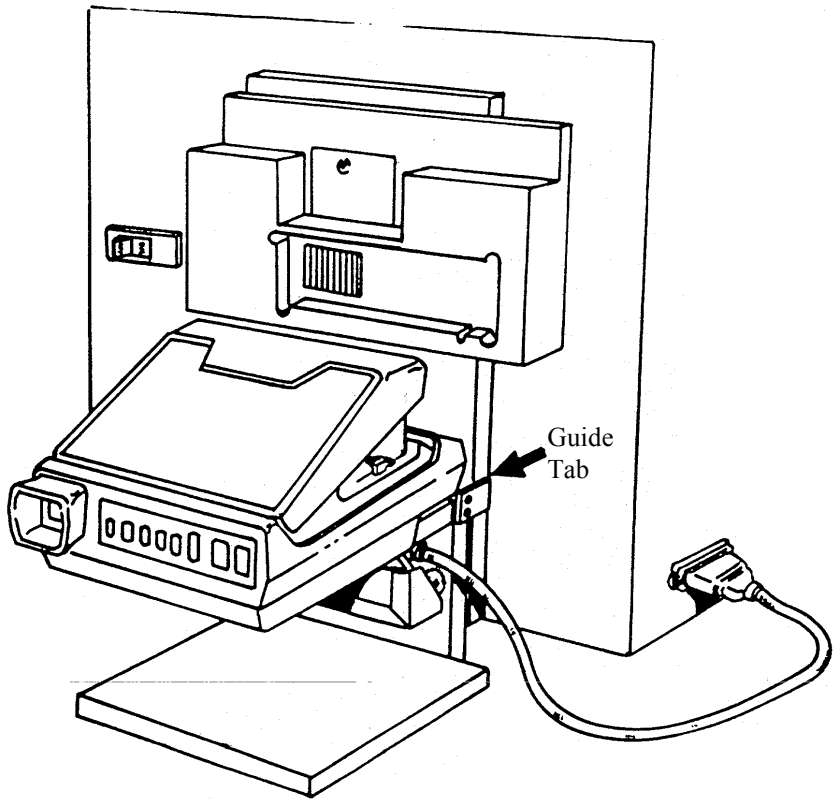


Figure 3-9 Positioning Camera on Horn Against Star Tester

ORDER OF SPECTRA SYSTEM TESTS

Tests on Spectra System Cameras should be performed in the following order:

Mandatory tests:

1. Ambient Exposure at 100 C/FS
2. Strobe Exposure (Graywall)

Additional test(s) required only if the Strobe Exposure (Graywall) test reading cannot be corrected by adjusting the IR Exposure Calibration Slide:

2a. ZLS Graywall Test
If the ZLS Graywall Test result is not within spec, replace the Strobe Board or the Flashtube Assembly as required.

If the ZLS Graywall Test is now within spec but the Strobe Exposure (Graywall) reading remains out-of-spec, perform the:

2b. Hybrid (Strobe/Blade Speed) Test

If the Hybrid Test reading is within spec but the Strobe Exposure Test reading remains out-of-spec replace the exposure flex and retest.

If the Hybrid Test reading is out-of-spec, perform the Hybrid Test Adjustment (see Adjustment 2B, next section).

If the Hybrid Adjustment fails to bring the reading within specification, perform the:

2c. Blade Speed Test

If the Blade Speed is within spec but the strobe Exposure Test reading remains out-of-spec, replace the exposure flex and retest.

If the Blade Speed Test reading is not within spec, perform the Blade Speed Adjustment (see adjustment 2C, next section).

If the Blade Speed Adjustment does not correct Blade Speed, repair or replace the Shutter Assembly and retest.

If battery drain is excessive, perform the:

3. Strobe Integrated Current Test

If this reading is out-of-spec, replace the Strobe Board.

If the strobe takes too long to recharge, perform the:

4. Strobe Charge Time Test

If this reading is out-of-spec, replace the Strobe Board.

SPECTRA SYSTEM TEST PROCEDURES

AMBIENT EXPOSURE

Purpose

This test measures the energy on the film plane during an ambient (visible) light exposure. The Star Tester light integrating sphere provides a constant scene brightness level of 100 candles/ft .

Test Setup

1. Trip the Door Switch on the camera into the down position.

2. Place the camera on the Horn against the Tester window.

3. Slide the AP, Strobe & Audio (beeper) switches on the camera into the down (OFF) position. Be sure the Trim Switch on the camera is in the normal position.

4. Leave the Photocell on the camera uncovered.

Test Procedure

1. Press the Shutter Button fully and record the Stops Error Meter reading. Compare the reading to the Specification.

2. Repeat the process two more times, recording all readings.

3. If the readings are within spec, proceed to the Strobe Exposure (Graywall) Test.

4. If the test readings are not within Specification, perform the Adjustment Procedure #1 for Ambient Exposure Calibration Slide and retest. If reading is now within spec, proceed to the next test (Strobe Exposure [Graywall] Test).

5. If adjustment fails to bring the reading within spec:

   - check that the green ambient filter is in the proper position;

   - check that the photocell cap is in position;

- check that the photocell is seated in the base block.

6. If the above steps do not bring the Ambient Exposure reading within spec, replace the Exposure Flex and/or the Shutter Assembly and retest.

STROBE EXPOSURE (GRAYWALL)

Purpose

This test measures the resultant energy on the film plane during a 4.5-foot (135 cm) graywall exposure.

Test Setup

1. Trip the Door Switch on the camera into the down position.

2. Place the camera on the Horn on top of the Tester, with the lens 4.5 ft. from the graywall. The front of the camera must be parallel to graywall, and the area visible in the view finder must be clear of objects.

3. Slide all camera switches up (ON), except for the Audio (beeper) switch. Keep the Lighten/Darken switch in the mid-point (normal) position.

4. Leave the Photocell on the camera uncovered.

5. Set the Test Selector Switch to FLASH EXPOSURE.

Test Procedure

1. Press the Shutter Button fully and note the reading on the Stops Error Meter.

2. Repeat the procedure two more times, noting the Stops Error Meter readings. Compare the readings to the Specification.

3. If the test readings are not within specification, perform the Adjustment Procedure 2 for IR Strobe Exposure Calibration Slide and retest.

4. If adjusting the IR Calibration Slide fails to bring the Strobe Exposure Test reading within specification:

   - check that the IR black filter is seated;

- check that photocell is seated in the baseblock;

- check that the photocell cap is seated properly.

5. If the above steps do not bring the Strobe Exposure (Graywall) reading within spec, proceed to the ZLS Graywall Test.

ZLS (ZONAL LUMEN SECONDS) GRAYWALL

Purpose

This test measures the maximum strobe output. This is done by measuring the energy on the film plane during a 4.5 feet (135cm) graywall exposure with the shutter blades fully open.

Test Setup

1. Trip the Door Switch on the camera into the down position.

2. Place the camera on the Horn on top of the Tester, with the lens 4.5 feet from the graywall. The front of the camera must be parallel to the graywall and the area visible in the viewfinder must be clear of objects.

3. Slide all switches up (ON), except for the AF and Audio (OFF). Set the Lighten/Darken switch to the NORMAL setting.

4. Cover the Photocell.

5. Set the Test Selector Switch to 7000 ZLS.

Test Procedure

1. Press the Shutter Button fully and note the reading on the ZLS Meter. Compare the reading to the Specification.

2. If the ZLS Test reading is out of Specification, replace either the Flashtube Assembly or the Strobe Board and retest.

3. If the ZLS Test reading is within Specification but the Strobe Exposure (Graywall) reading is still out-of-spec perform the Hybrid Test.

HYBRID (ZLS/BLADE SPEED) TEST

Purpose

This test measures the resultant energy on the film plane from full strobe output through partially open blades, to determine whether the blades open at the proper speed and the strobe fires at the proper time. If the results of this test are satisfactory, it means that maximum strobe output, blade speed and ranging are all functioning properly.

Test Setup

1. Trip the Door Switch on the camera into the down position.

2. Place the camera on the Horn on top of the Tester, with the lens 4.5 ft. from the graywall. The front of the camera must be parallel to the graywall and the area visible in the viewfinder must be clear of objects.

3. Slide all camera switches up (ON) except the Audio (OFF).

4. Cover the Photocell.

5. Set the Test Selector Switch to 7000 ZLS.

Test Procedure

1. Press the shutter button fully and note the reading on the ZLS meter.

2. Repeat the procedure two more times, noting each meter reading. Compare the readings to the Specification.

3. If the test readings are not within specification, perform the Hybrid Adjustment procedure and retest.

4. If this adjustment does not bring the Hybrid Test reading within specification, proceed to the Blade Speed Test.

5. If the Hybrid Test reading is within spec but the Strobe Exposure Test reading is still out-of-spec, replace the Exposure Flex and retest.

BLADE SPEED

Purpose

This Test measures the time between first light detection and 95% blade opening.

Test Setup

1. Trip the Door Switch on the camera into the down position.
2. Place the camera on the Horn against the Tester window.
3. Slide the AF, Strobe, and Audio (beeper) Switches on the camera down (OFF).
4. Cover the Photocell.
5. Set the Test Selector Switch to BLADE SPEED.

Test Procedure

1. Push the Reset button on the Tester, then depress the Shutter Button. Disregard the meter reading (this sets up Tester circuitry).
2. Press the Shutter Button again and watch the Timing Meter carefully. Note the reading that remains constant for two seconds. Compare this reading to the Specification.
3. If the reading is not within spec, perform the Blade Speed Adjustment Procedure and retest the camera.
4. If the adjustment did not bring the Blade Speed within specification, repair or replace the Shutter Assembly and retest.
5. If Blade Speed is now within specification but Strobe Exposure is still out-of-spec, replace the Exposure Flex and retest.

STROBE INTEGRATED CURRENT/STROBE CHARGE TIME

NOTE: These two tests are listed together because Camera and Tester settings are the same. Both tests can be performed together for convenience.

Purpose:

The Strobe Integrated Current test measures the energy required to fully charge the strobe capacitor (C8) in the camera. Strobe charge time measures the maximum time required for strobe recycling.

Test Setup

1. Trip the Door Switch on the camera into the down position.
2. Place the camera on the Horn on top of the Tester.
3. Slide all the camera switches up (ON), except the AF and Audio (beeper) Switches.
4. Cover the Photocell.
5. Set the Test Selector Switch to ZLS.

Test Procedure

1. Press the Shutter Button fully to fire the Strobe.
2. After the Strobe fires, slide the Strobe switch on the camera down (OFF) during the three seconds that the blades are open (maximum timeout).
3. After the camera has cycled, press the RESET button on the Tester and slide the camera Strobe switch up (ON).
4. Read the Strobe current value on the DC CURRENT Meter and the maximum value displayed by the TIMING Meter.
5. Compare these readings to the Specification.
6. If either Strobe Current or Strobe Charge Time readings are not within specification, replace the strobe board.

NOTE: There are no Adjustment Procedures for Strobe Integrated Current or Strobe Charge Time.

D. SPECTRA SYSTEM ADJUSTMENTS

AMBIENT EXPOSURE CALIBRATION SLIDE

Adjustment Procedure

1. Remove the Top Cover from the Camera (see Figure 3-10)

   CAUTION: HIGH VOLTAGE EXPOSURE! VOLTAGES UP TO 320V ARE PRESENT ON TOP FLASH TUBE TERMINAL (GREEN WIRE) AND AT VARIOUS OTHER LOCATIONS ON THE STROBE BOARD.

2. If the Ambient Exposure Test readings are too low, use a dental pick and slide the Ambient Calibration Slide to the right (see Figure 3-11) in proportion to the amount the reading is too low. The Ambient Calibration Slide is the one next to the Shutter Base Block (rearmost Slide, when Base Block is viewed from the rear of the camera).

3. If the Ambient Exposure Test readings are too high, slide the Ambient Calibration slide to the left, in proportion to the amount the reading is too high.

4. Put the Test Top Cover in place and retest the camera. Readjust the Ambient Calibration Slide if necessary.

5. When the Ambient Exposure Test reading is within specification, replace the Test Top Cover with the camera's own Top Cover.

NOTE: If adjusting the Ambient Calibration Slide fails to bring the readings within specification, refer to Steps 4, 5 & 6 of the Ambient Exposure test procedure.

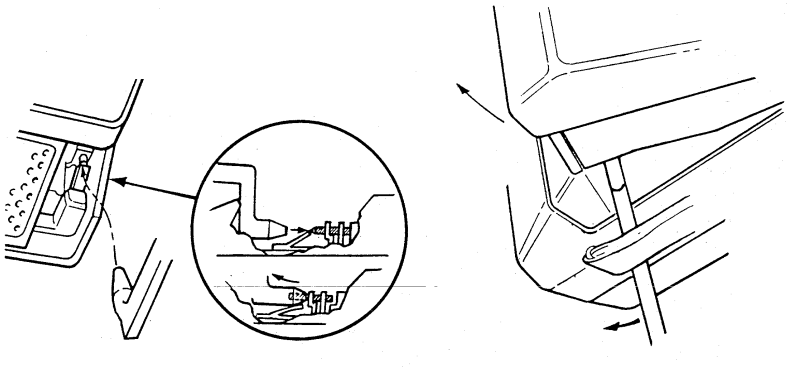


Figure 3-10 Removing Top Cover from the Spectra Camera

(See Spectra Disassembly/Reassembly Section for details)

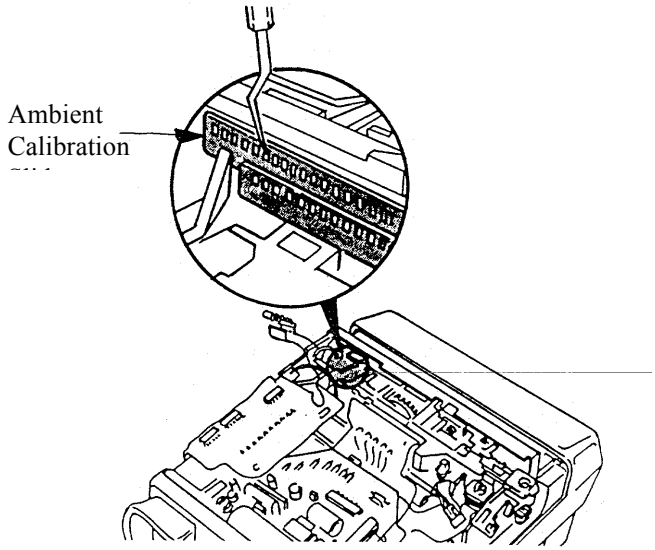


Figure 3-11 Adjusting Ambient (visible light) Calibration Slide

IR STROBE EXPOSURE CALIBRATION SLIDE

Adjustment Procedure

1. Remove the Top Cover from the camera (see Figure 3-10).

   CAUTION: HIGH VOLTAGE EXPOSURE! VOLTAGES UP TO 320V ARE PRESENT ON TOP FLASH TUBE TERMINAL (GREEN WIRE) AND AT VARIOUS OTHER LOCATIONS ON THE STROBE BOARD.

2. If the Strobe Exposure Test readings are too low, use a dental pick and slide the IR Strobe Exposure Calibration Slide to the right, in proportion to the amount the reading is too low (see Figure 3-12). The IR Strobe Exposure Calibration Slide is the nearer or front-most Slide, when the Base Block is viewed from the rear of the camera).

3. If the Strobe Exposure Test readings are too high, slide the IR Calibration Slide to the left, in proportion to the amount the reading is too high.

4. Put the Test Top Cover in place and retest the camera. Readjust the IR Strobe Exposure Calibration Slide if necessary, using the Test Top Cover.

5. When the Strobe Exposure Test reading is within specification, replace the Test Top Cover with the camera's own Top Cover.

NOTE: If adjusting the IR Calibration Slide fails to bring the readings within specification, refer to steps 4 & 5 of the Strobe Exposure test procedure.

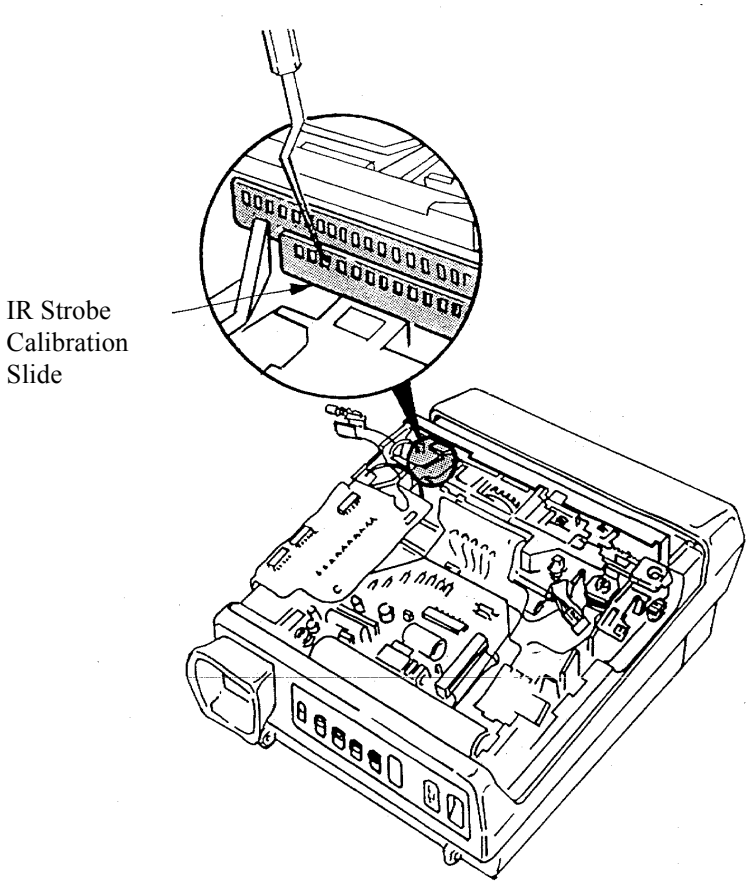


Figure 3-12 Adjusting the IR Strobe Exposure Calibration Slide

HYBRID ADJUSTMENT (OPENING BLADE SPRING)

Adjustment Procedure

1. Remove the Top Cover from the camera, see Figure 3-10.

   CAUTION: HIGH VOLTAGE EXPOSURE! VOLTAGES UP TO 320V ARE PRESENT ON TOP FLASH TUBE TERMINAL (GREEN WIRE) AND AT VARIOUS OTHER LOCATIONS ON THE STROBE BOARD.

2. If the Hybrid (ZLS/Blade Speed) Test readings are too low, increase the tension on the Opening Blade Spring by moving it one notch to the right (when facing the back of the Camera), See Figure 3-13.

3. If the Hybrid Test readings are too high, decrease the tension on the Opening Blade Spring by moving it one notch to the left (when facing the back of the camera), See Figure 3-13.

4. Put the Test Top Cover on the camera and retest. Repeat the procedure, if necessary, moving the Opening Blade Spring one notch at a time and replacing the Test Top Cover each time before retesting.

5. When the Hybrid Test Reading is within specification, replace the Test Top Cover with the camera's own Top Cover.

NOTE: If changing the tension on the Opening Blade Spring fails to bring the readings into specification, refer to steps 4 & 5 of the Hybrid (ZLS/Blade Speed) test procedure.

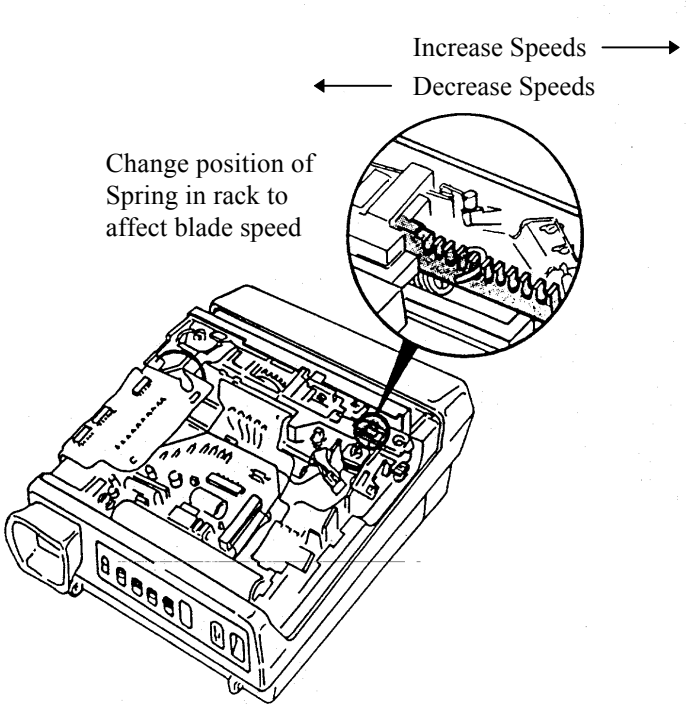


Figure 3-13 Hybrid Test Adjustment (Opening Blade Spring tension adjustment)

BLADE SPEED (OPENING BLADE SPRING)

Adjustment Procedure

1. Remove the Top Cover from the Spectra Camera (see Figure 3-10).

2. Using tweezers, carefully lift the upper end of the Opening Blade Spring out of its notch in the Shutter Base Block (see Figure 3-13).

   CAUTION: DO NOT OVERSTRETCH SPRING!

3. If the Blade Speed is too slow, reposition the Opening Blade Spring one notch to the right. If the speed is too fast, reposition the Spring one notch to the left.

4. Put Test Top Cover on camera and retest Blade Speed. Readjust the Spring position if necessary.

5. When Blade Speed is within specification, replace Test Top Cover with camera's own Top Cover.

6. If adjusting the Spring position will not bring the Blade Speed within specification, replace the Spring and retest.

7. If Blade Speed is still out of specification, disassemble the camera to the shutter level (see the Disassembly/Reassembly Section of this manual). Examine the blade-opening parts (Walking Beam/Inertia Assembly, Drive Link, etc.) and the Shutter Blades for dirt, binding parts and damage. Correct any problems found, reassemble the camera and retest Blade Speed. Readjust Opening Blade Spring if necessary.

SOLENOID 1 ADJUSTMENT FOR QUINTIC POSITION

If the movable Quintic Lens element travels at too high or too low a speed, its final (focused) position may not be correct for the distance measured by the camera's sonar system. (If the Quintic moves too fast, for example, the Catch Pawl may not be able stop it at the correct position.) Quintic speed can be adjusted as follows.

Adjustment Procedure

1. Remove the Top Cover from the camera (see Figure 3-10)

CAUTION: HIGH VOLTAGE EXPOSURE! VOLTAGES UP TO 320V ARE PRESENT ON TOP FLASH TUBE TERMINAL (GREEN WIRE) AND AT VARIOUS OTHER LOCATIONS ON THE STROBE BOARD.

2. Using a small screwdriver, carefully turn the adjusting screw of Solenoid 1 one-half turn at a time. Turn the screw counter-clockwise to increase Quintic speed, clockwise to decrease Quintic speed. (See Figure 3-14.)

3. Put Test Top Cover in place on camera.

4. Retest the camera to verify that the Catch Pawl catches (stops) the Quintic at the correct position. If it does not, readjust the Solenoid 1 adjusting screw, one-half turn at a time, until the Quintic is caught by the Catch Pawl.

5. When proper Quintic catch is achieved, replace Test Top Cover with camera's own Top Cover.

6. If steps 1 - 3 fail to produce correct Quintic catch, disassemble the camera to the shutter level and inspect the plunger of Solenoid 1, Catch Pawl and Quintic element for dirt, damage, binding, etc. Correct any problems that are found, reassemble the shutter and retest the camera.

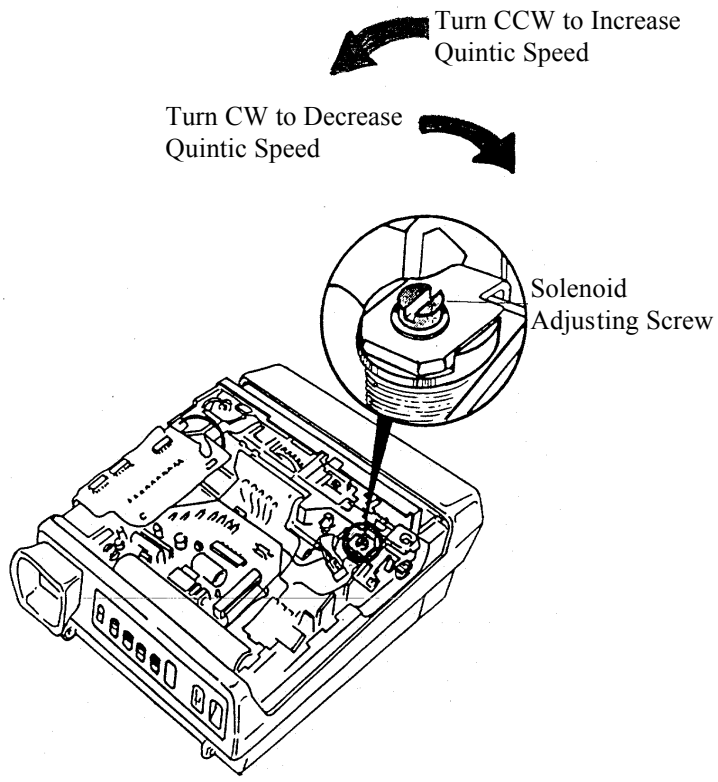


Figure 3-14 Adjusting Solenoid 1 to Change Quintic Speed.

E. SPECTRA TROUBLESHOOTING CHARTS

LOGIC PROBE OPERATION
(MODEL #PRB-50)

SAFETY PRECAUTIONS FOR OPERATING ELECTRONIC LOGIC PROBE:

1. Connect the black lead to ground (earth); connect the red lead to Vbat at power supply.

2. If Vbat is within legal operating limits, the pulse LED will blink once and turn off. The V+ will remain off.

3. If Vbat is too high, the pulse LED will remain on. REMOVE BLACK AND RED LEADS FROM THE POWER SUPPLY IMMEDIATELY.

4. If Vbat is too low, the logic LEDs will be off and both the V+ and V- LEDs will be on. REMOVE BLACK AND RED LEADS FROM THE POWER SUPPLY IMMEDIATELY.

When analyzing a 7000 camera, proceed as follows:

a. Set the TTL/CMOS switch to CMOS.

b. Place the probe tip onto the circuit test point.

c. Set the LATCH switch to the LATCH position.

d. Hold the probe in place until the pulse LED lights.

   CAUTION: A false signal may latch the logic probe if, during the test, the probe tip is removed from the test point or Vbat is removed from the camera or the probe.

e. Return the switch to the NORMAL position.

f. Retest to confirm the results.

"CHECKS-OK" PROCEDURE FOR ALL SPECTRA SERIES CAMERAS

Use all available failure information for camera analysis such as customer letter, repair tag, etc.

If the Customer complaint is "BLACK PICTURE"

Remove the Top cover and inspect the following areas:

Encoder pair wires on connector.
D1 Diode.
Defective Quintic.
Solenoid 2 connection.
IC1 lead lifted.
IC2 lead lifted.
Solenoid 1 connection.

If the Customer complaint is "NO DARK SLIDE"

Remove the Top and Bottom covers and inspect the following areas:

Motor flex to Wireform connection.
Defective or distorted Wireform switch.
Exposure module to Ranging board to Strobe board connections.
Counter hang-up.
D1 Diode.
Battery wire connection.
Cracked streaks on Exposure module or Motor flex.
Lifted leads on IC's.

If the Customer complaint is "NO STROBE FIRE"

Remove the Top Cover and inspect the following areas:

Flash tube assembly.
S10/S1 switch.
Ranging module switch block.
Exposure to Ranging module connections.

If the Customer complaint is "CONTINUOUS CYCLE".

Remove the Top and Bottom Covers and inspect the following areas:

Exposure module to Motor flex connection.
Defective or distorted Wireform switch.
Motor flex to Switch block connection.
Counter hang-up.
Exposure to Feature flex connection.

If the Customer complaint is "RANGING" related.

Remove the Top Cover and inspect the following areas:

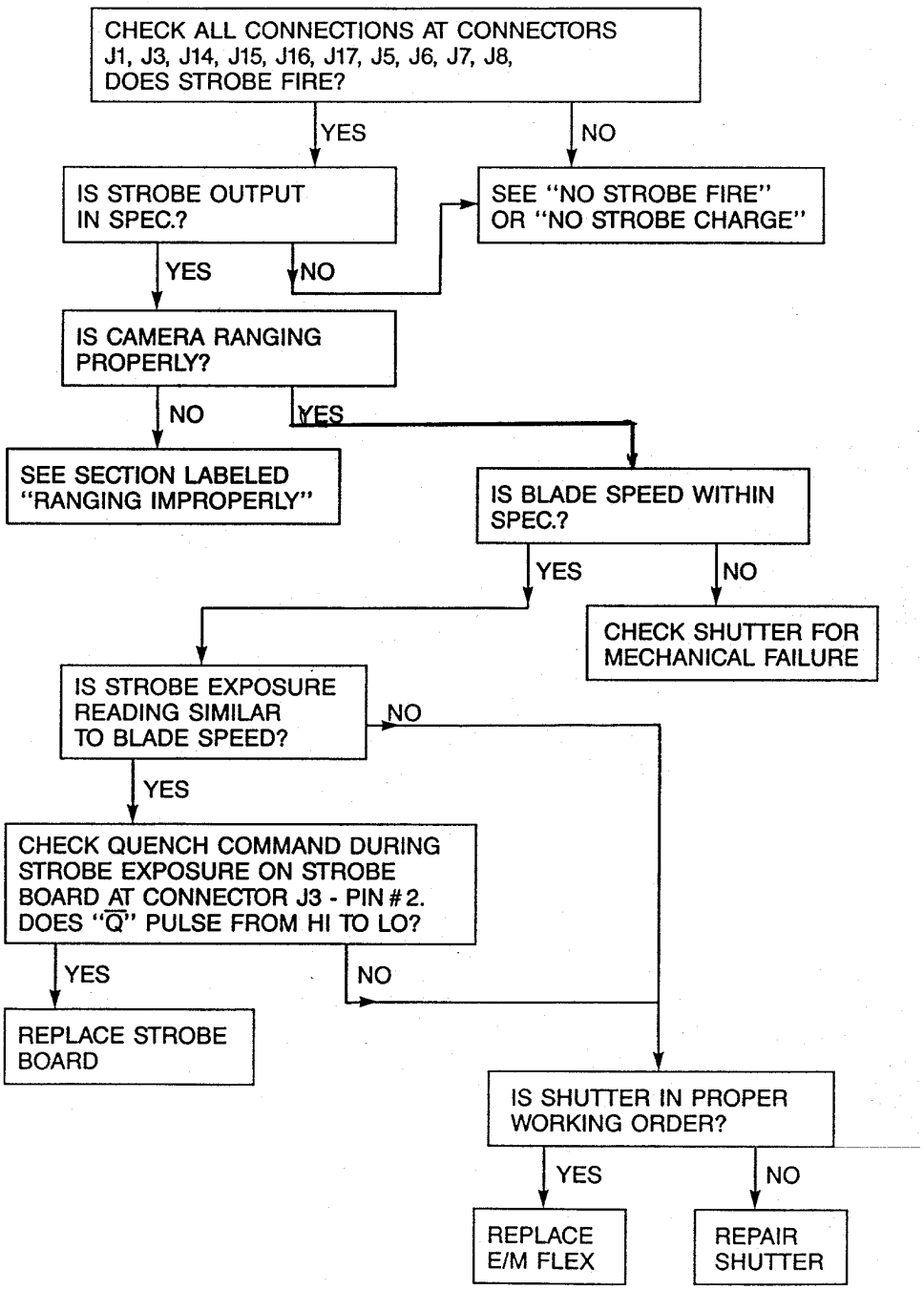
Feature flex broken.
VR1 on Ranging module broken or misadjusted.
Ranging module to Exposure module connection.
Transducer wire connection.

For those cameras where "NO INFORMATION" is available.

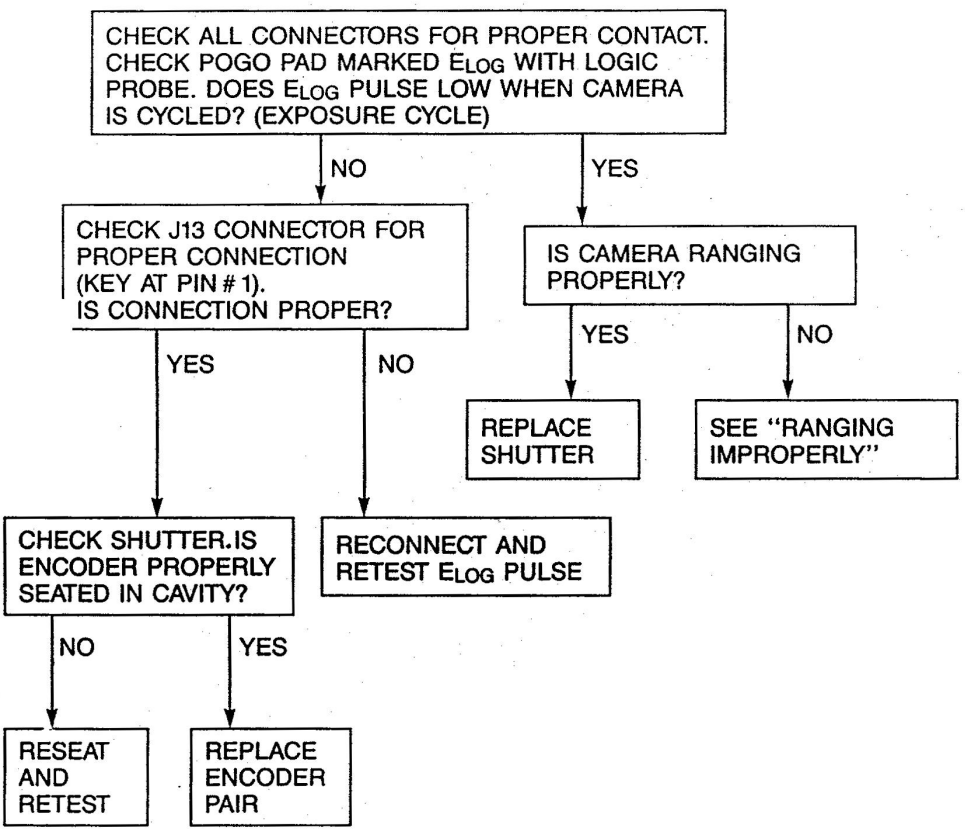
Remove both Top and Bottom Covers and inspect the following areas:

Solenoid 1 and 2 connections.
Encoder wire routing.
Exposure flex improperly soldered causing pressure sensitive shorts.
Strobe board connections.
Smooth Quintic operation.
Flex shorting in the Counter area.
Motor connector.

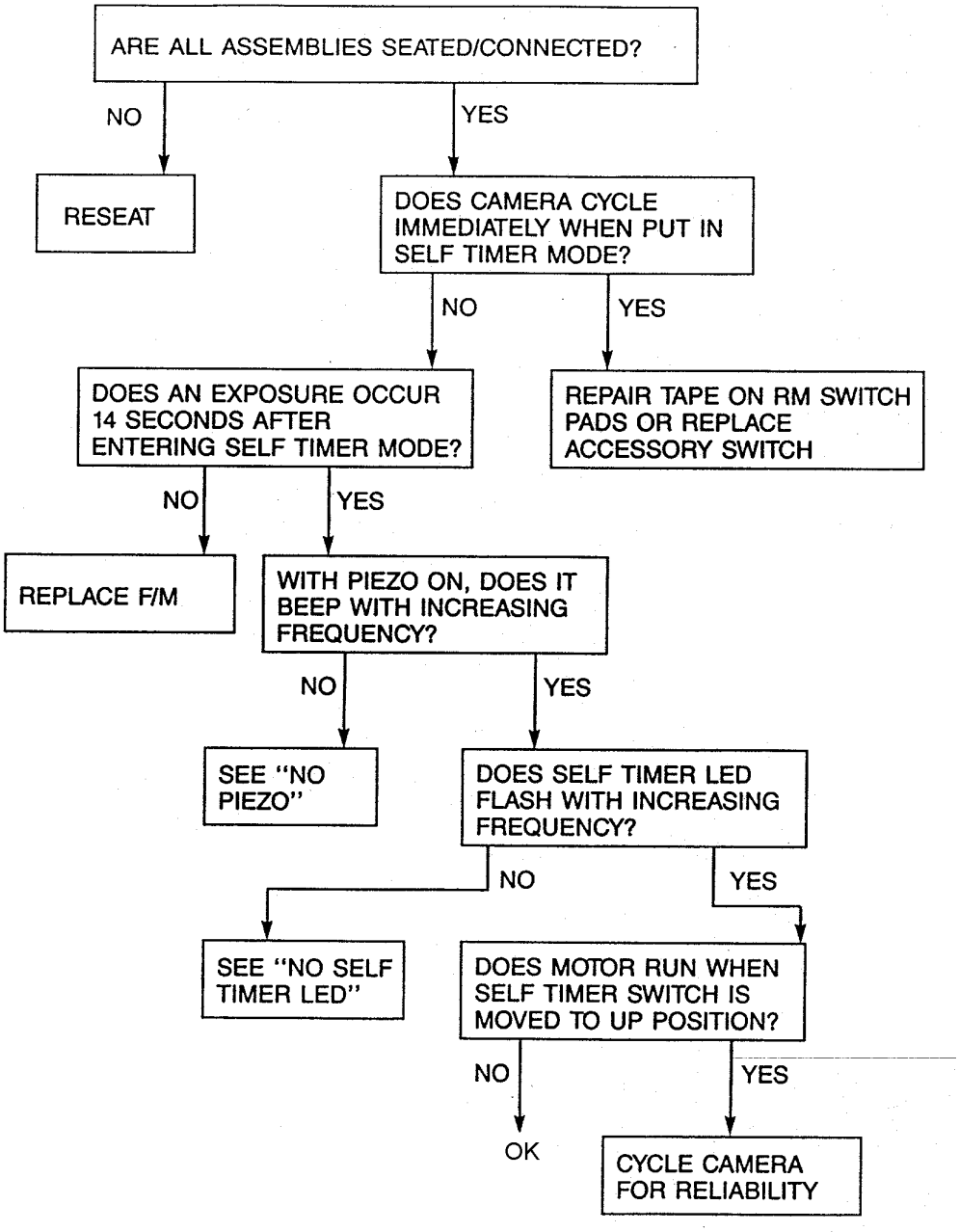
STROBE EXPOSURE
BLADES DON'T OPEN
BLADES SPEED



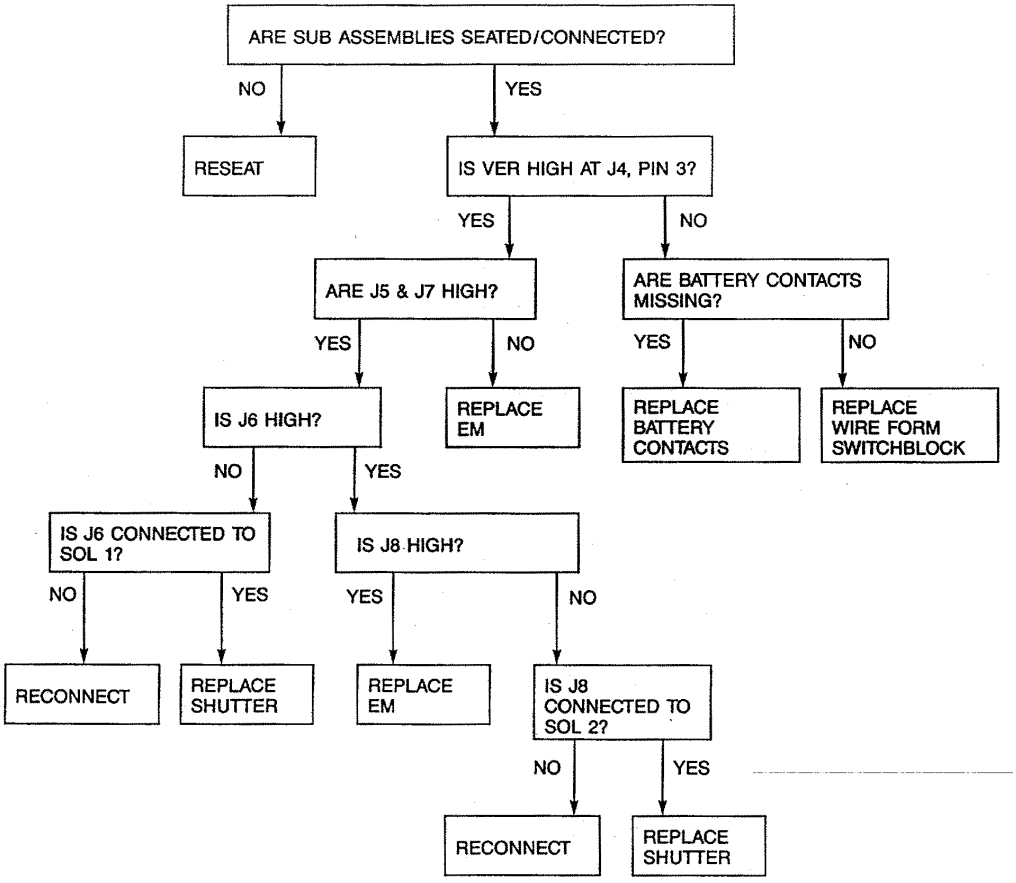
NO ENCODER


CHECK ALL CONNECTORS FOR PROPER CONTACT. CHECK POGO PAD MARKED ELOG WITH LOGIC PROBE. DOES ELOG PULSE LOW WHEN CAMERA IS CYCLED? (EXPOSURE CYCLE)
NO
YES
CHECK J13 CONNECTOR FOR PROPER CONNECTION (KEY AT PIN # 1). IS CONNECTION PROPER?
IS CAMERA RANGING PROPERLY?
YES
NO
YES
NO
REPLACE SHUTTER
SEE "RANGING IMPROPERLY"
CHECK SHUTTER. IS ENCODER PROPERLY SEATED IN CAVITY?
RECONNECT AND RETEST ELOG PULSE
NO
YES
RESEAT AND RETEST
REPLACE ENCODER PAIR

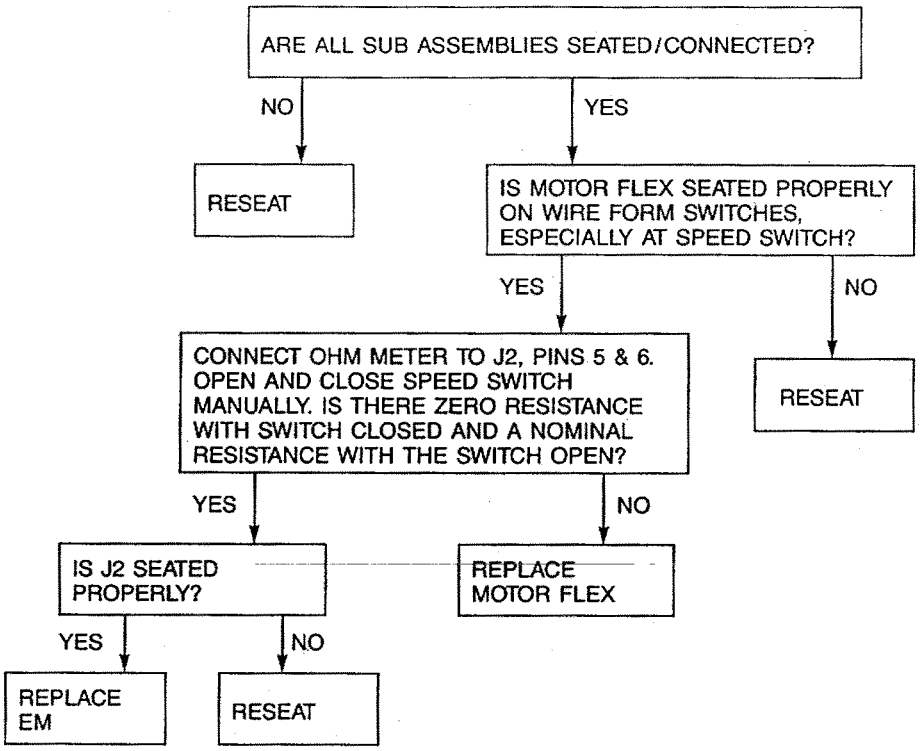
NO SELF-TIMER MODE



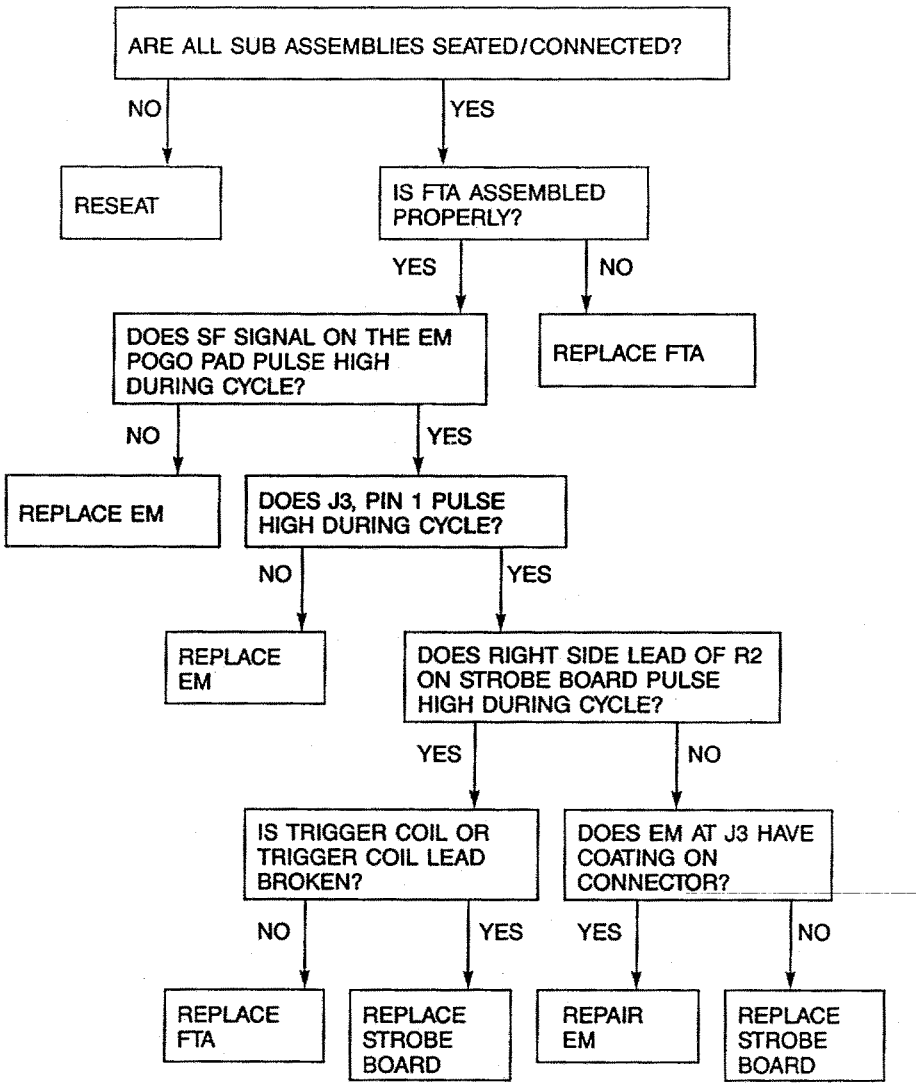
NO SOLENOID DRIVE



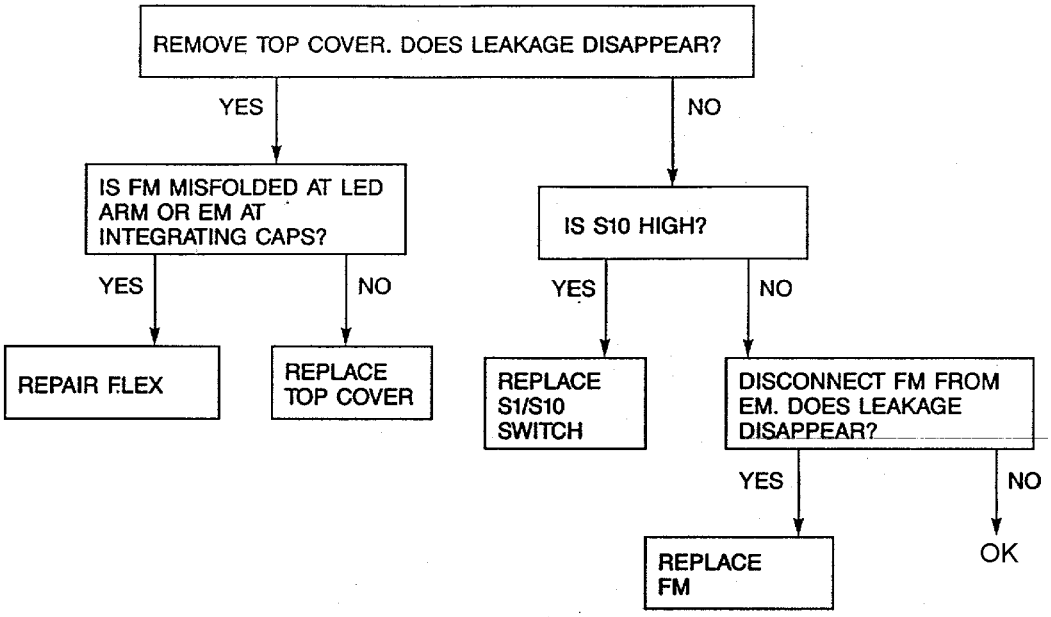
FILM SPEED SWITCH FAILURE



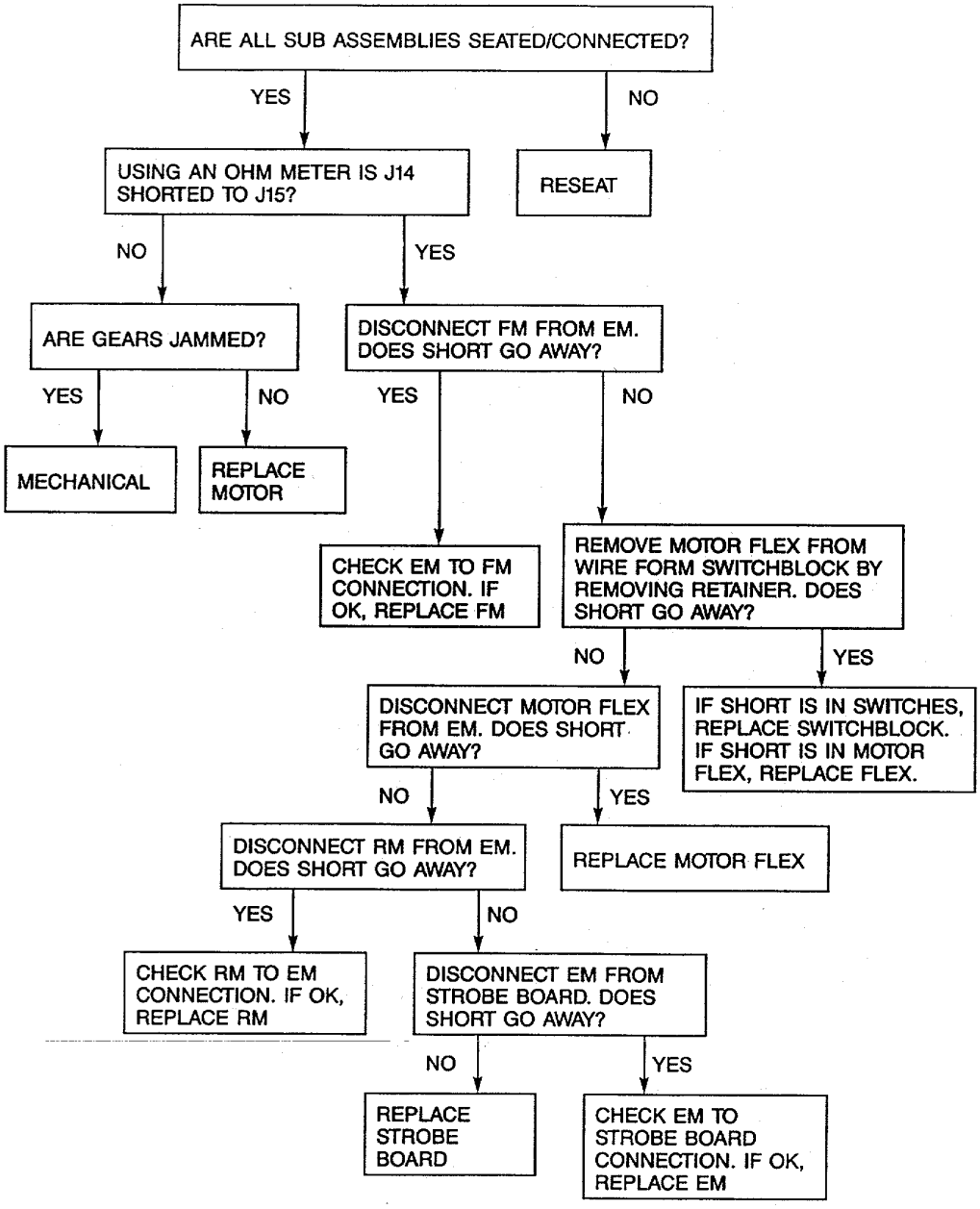
NO STROBE


ARE ALL SUB ASSEMBLIES SEATED/CONNECTED?
NO
YES
RESEAT
IS FTA ASSEMBLED PROPERLY?
YES
NO
REPLACE FTA
DOES SF SIGNAL ON THE EM POGO PAD PULSE HIGH DURING CYCLE?
NO
YES
REPLACE EM
DOES J3, PIN 1 PULSE HIGH DURING CYCLE?
NO
YES
REPLACE EM
DOES RIGHT SIDE LEAD OF R2 ON STROBE BOARD PULSE HIGH DURING CYCLE?
YES
NO
IS TRIGGER COIL OR TRIGGER COIL LEAD BROKEN?
DOES EM AT J3 HAVE COATING ON CONNECTOR?
NO
YES
YES
NO
REPLACE FTA
REPLACE STROBE BOARD
REPAIR EM
REPLACE STROBE BOARD

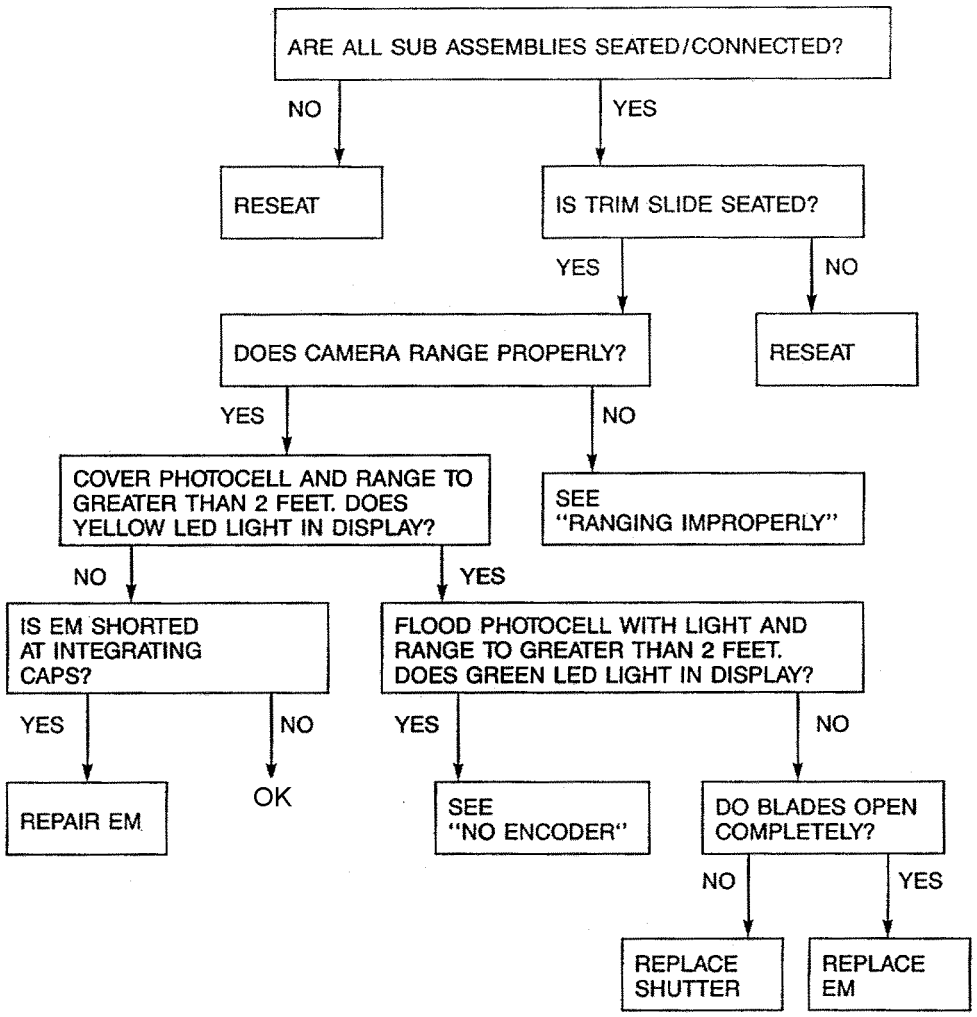
LEAKAGE


REMOVE TOP COVER. DOES LEAKAGE DISAPPEAR?
YES
NO
IS FM MISFOLDED AT LED ARM OR EM AT INTEGRATING CAPS?
IS S10 HIGH?
YES
NO
YES
NO
REPAIR FLEX
REPLACE TOP COVER
REPLACE S1/S10 SWITCH
DISCONNECT FM FROM EM. DOES LEAKAGE DISAPPEAR?
YES
NO
REPLACE FM
OK

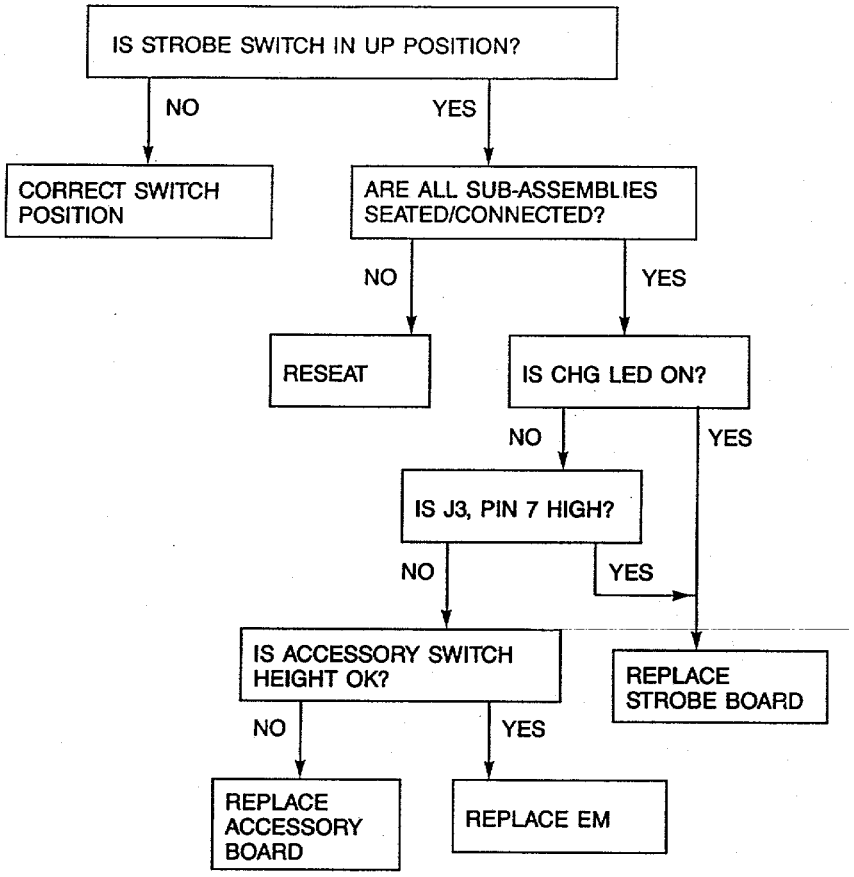
DRAWS HIGH CURRENT



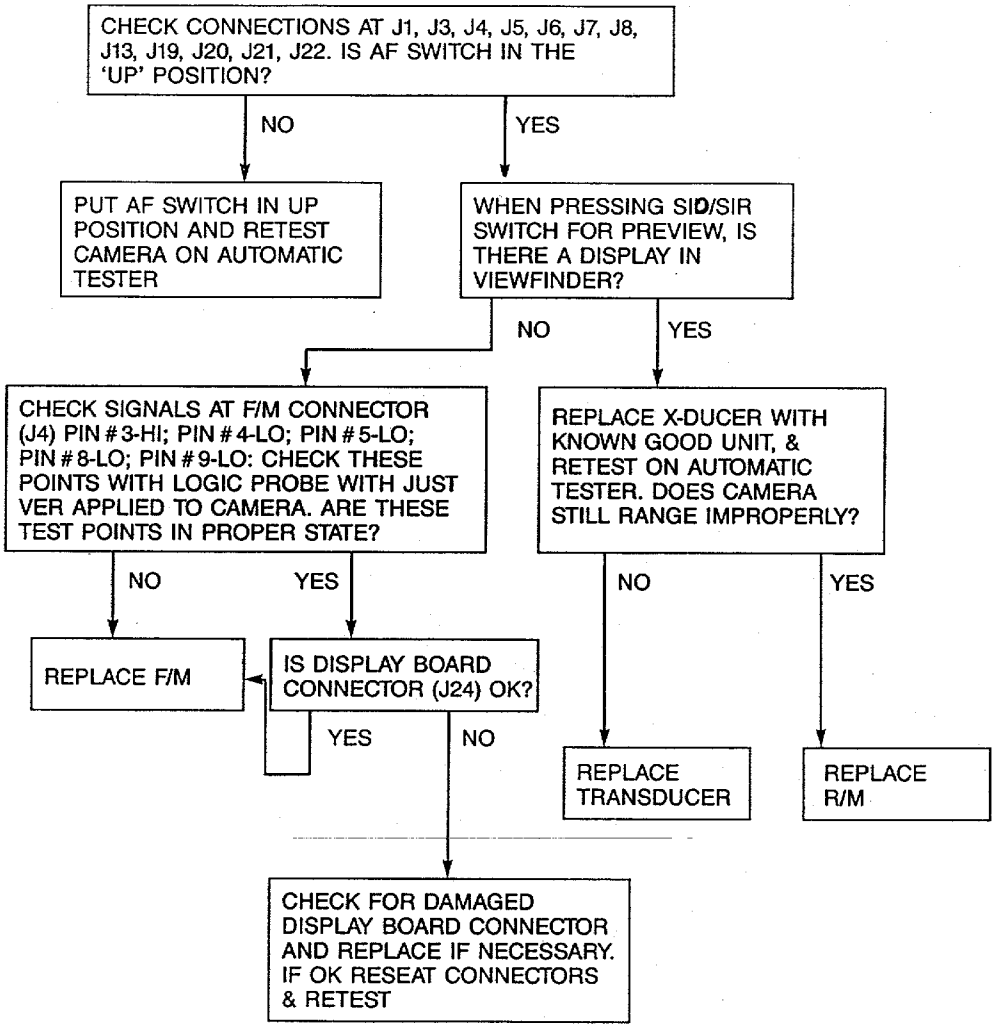
MEAN TIME-OUT (MTO) (AMBIENT)



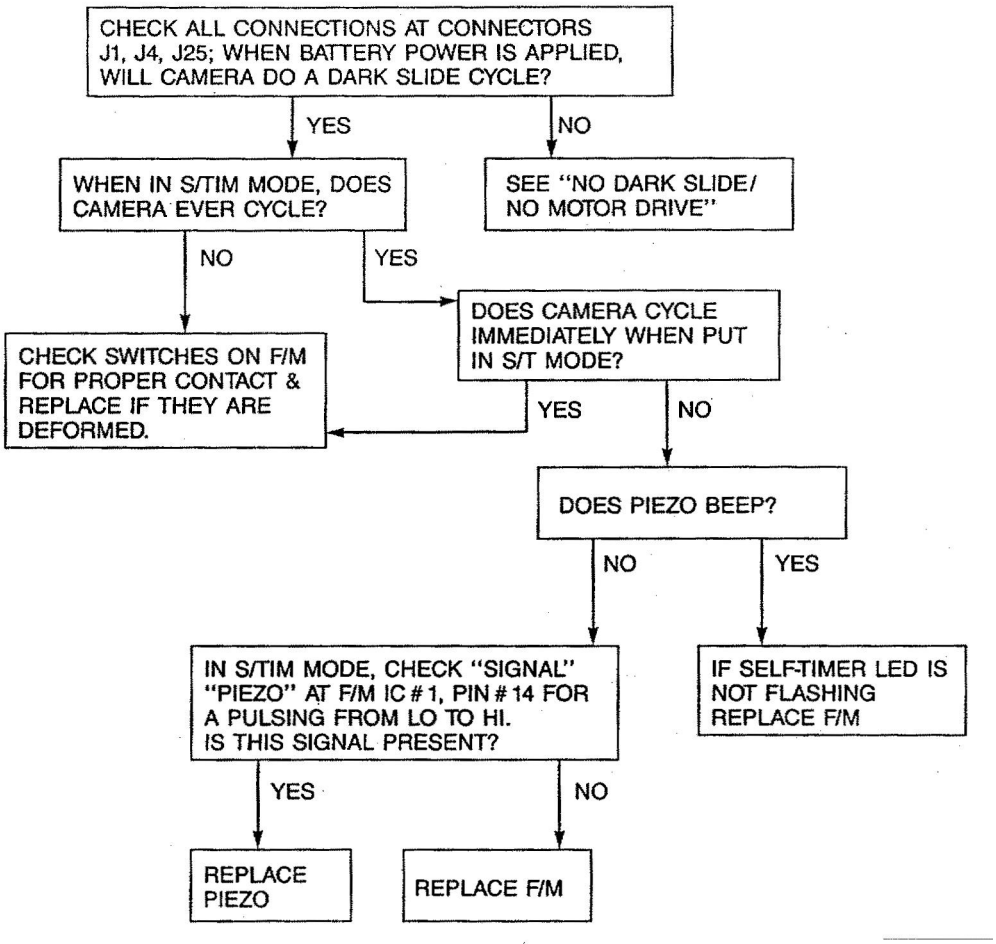
NO STROBE CHARGE



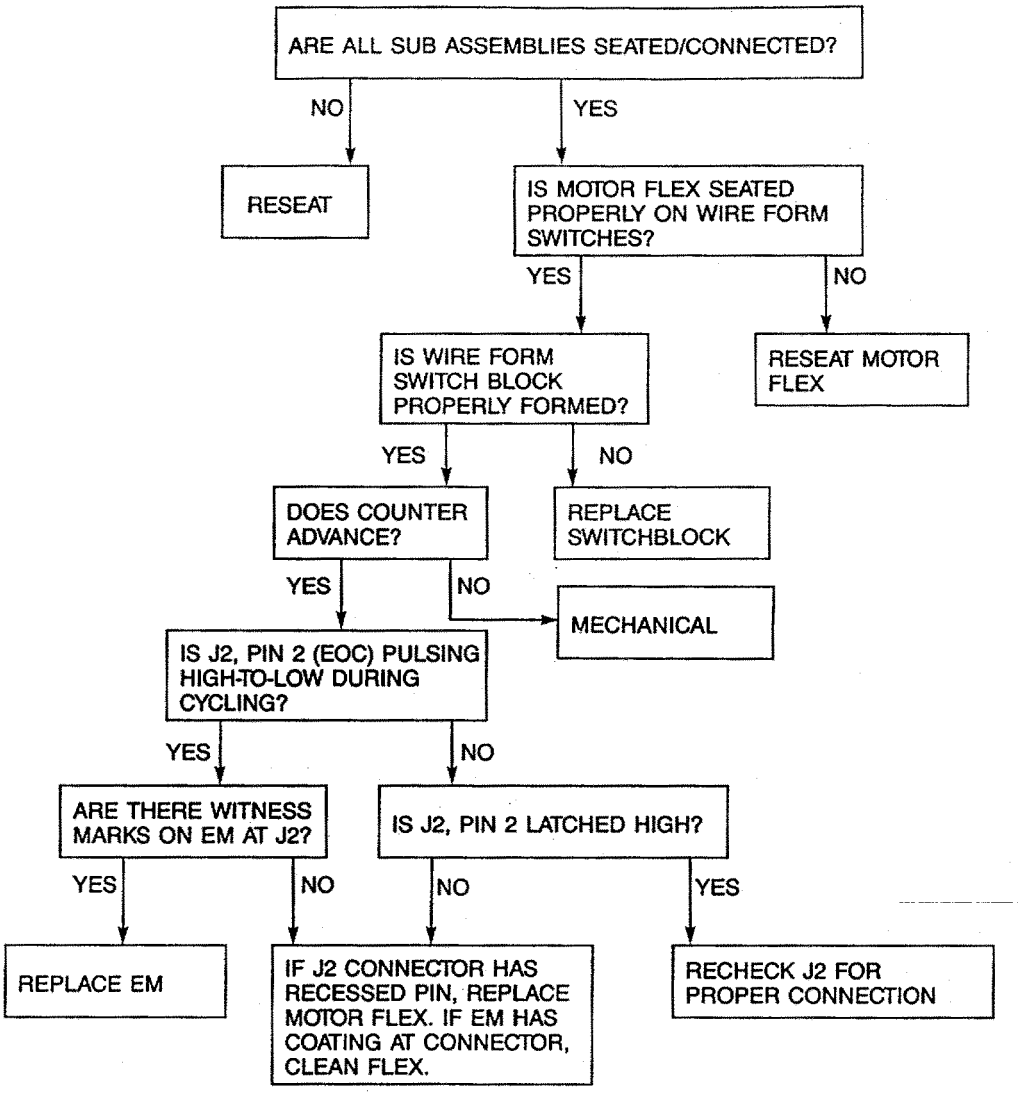
RANGING IMPROPERLY



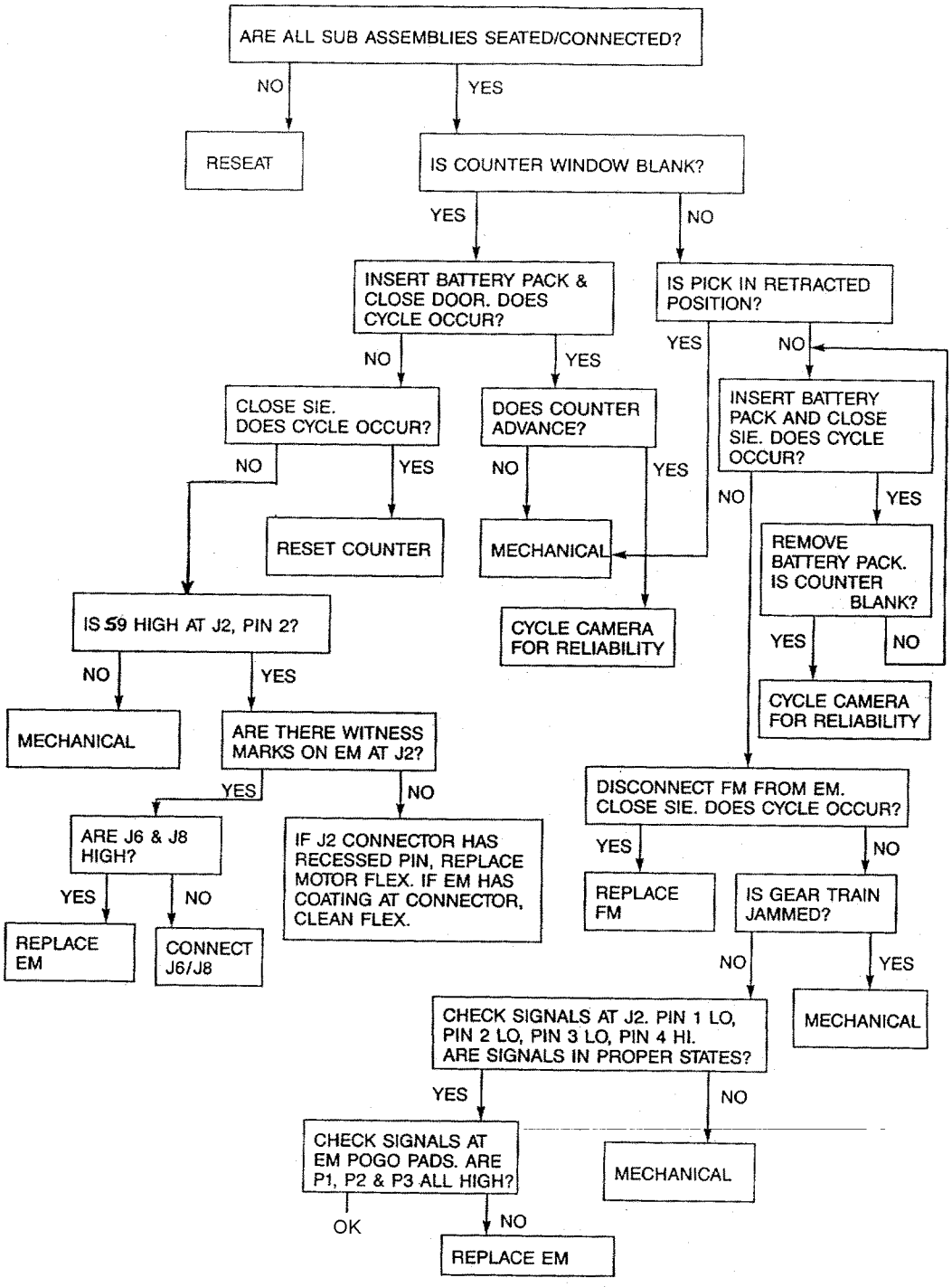
CONTINUOUS CYCLE



CONTINUOUS CYCLE



NO DARK SLIDE/NO MOTOR DRIVE



SECTION 4
DISASSEMBLY AND REASSEMBLY

CONTENTS

CAUTION

The Spectra System camera uses silicon CMOS integrated circuit technology. CMOS integrated circuits are susceptible to damage created by static electricity. Static discharges are not always noticeable Just because you don't notice a static shock doesn't mean that there hasn't been one. And, just as static is not always obvious, the damage it creates isn't always obvious - until it's too late. In fact, one or two static discharges may not cause enough damage to adversely affect camera operation. However, static discharge damage is cumulative. Enough static and you will undoubtedly damage the CMOS circuits.

Therefore...

Whenever you are working on the Spectra camera and any disassembly is required, you must wear a grounding wrist strap. The workbench surface must be dissipative. The workbench itself must be grounded. There should be no materials on the workbench which are conducive to the creation of static electricity. (Styrofoam coffee cups are prime villains.)

If it is necessary for you to carry a disassembled camera away from the grounded workbench to a tester, and you must disconnect your wrist strap, be certain that you reconnect your wrist strap to a ground at the tester before you place the camera on the tester horn.

A. GENERAL INSTRUCTIONS & CAUTIONS

The following procedures and illustrations cover complete disassembly of the Spectra System camera and virtually all Spectra sub-assemblies. Note however, that for many repairs, it is not necessary to completely disassemble the Camera: only certain covers, subassemblies or adjacent parts need to be removed to gain access to the part to be repaired/replaced. Reassembly instructions are provided for the more complex sub-assemblies (for example, the Gear Train and Shutter assemblies). To reassemble other Spectra assemblies, follow disassembly instructions in reverse order. At the beginning of each disassembly procedure, the statement “Parts which must be removed before doing this procedure: - - - - - -” lists what (if anything) must be disassembled or removed before doing the particular procedure.

Flexes - handle carefully and avoid sharp bending, crimping or scraping. Protect contacts from damage.

Technician Grounding - To prevent static charges from destroying the electrically-sensitive integrated circuits (chips) on many of the Spectra's flex circuits and boards, the technician should be properly grounded before starting disassembly or reassembly. Wrist strap must be in place and connected to workplace. (See also the special CAUTION notice at the front of this section).

Tools - In addition to the usual small flat-blade and Phillips head screwdrivers, solder aid tool ("greenstick"), tweezers and low-wattage soldering iron, the following will be needed for Spectra disassembly:

- Top Cover Pin Removal Tool (P/N 13109)
- Capacitor Discharge Dump Probe (P/N 13119)
- Camera Work Support Fixture (P/N 13123)
- Features Flex Removal Tool (P/N 13124)
- Long needle-nose pliers with coated jaws, uninsulated handles
- Right-angle needle-nose pliers with coated jaws, uninsulated handles
- Exacto knife with #11 blade
- Dental pick

Wire routing - When wires must be moved to allow removal of a part, carefully note their placement. They must be accurately replaced in their original position for the camera to function properly.

DANGER: SHOCK HAZARD

Immediately after removing top cover, ALWAYS DISCHARGE PHOTOFLASH CAPACITOR C-8 BEFORE PROCEEDING, to avoid shock. Insert Dump Probe (P/N 13119) so that pins positively contact capacitor terminals (Figure 4-2).

B. DISASSEMBLY OF SPECTRA SYSTEM CAMERA

1. REMOVING TOP COVER

(Parts which must be removed before doing this procedure: None)

a. With camera erect and Front Door closed, use Top Cover Pin Removing Tool
(P/N 13109) to remove pin. Holding camera inverted depress tab slightly with tool tip and engage pin in end of tool. Tilt tool handle backward slightly to grasp pin firmly and pull pin out.

b. Turn camera right side up. Insert greenstick between Top Cover and Cone on hand strap side, prying Top Cover slightly upward and outward to release detent on inside of cover. Close camera and lift cover off.

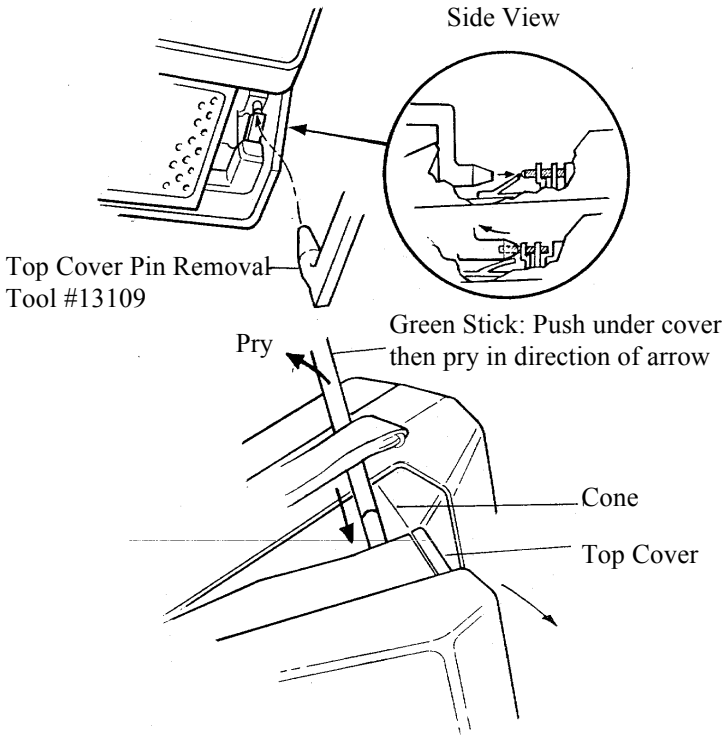


Figure 4-1 Removing Top Cover

2. DISCHARGING PHOTOFLASH CAPACITOR C-8

(Parts which must be removed before doing this procedure: Top Cover)

DANGER: SHOCK HAZARD

Immediately after removing Top Cover, ALWAYS DISCHARGE PHOTOFLASH CAPACITOR C-8 BEFORE PROCEEDING, to avoid shock. Insert Dump Probe (P/N 13119) so that pins positively contact Capacitor term inals. (Figure 4-2).

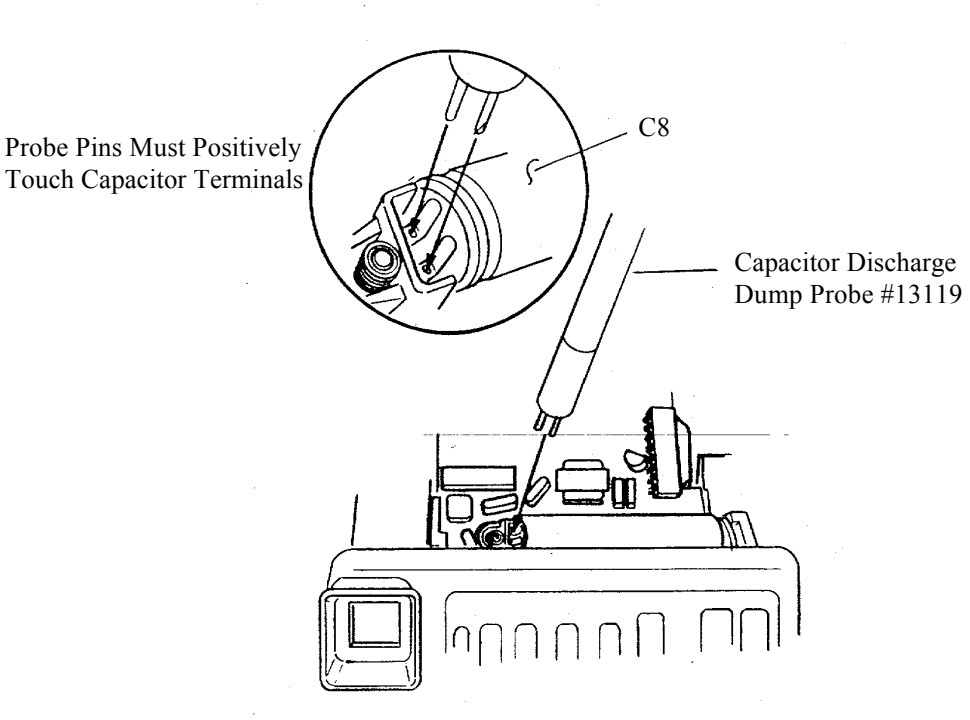


Figure 4-2 Discharging Capacitor C-8 with Dump

Probe P/N 13119

3. REMOVING MID-COVER

(Parts which must be removed before doing this procedure: Top Cover)

a. With needlenose pliers, remove two L-shaped hinge pins. (Rotate upward 1/4 turn if leg of pin is pointing down.)

b. Close camera if erected and open Front Door. Insert greenstick between Mid-Cover and side of Main Frame to release one side. Then insert greenstick at top center as shown, twisting stick while holding side of Cover out. Finally, insert greenstick on opposite side and pry outward.

c. Shut door and lay camera flat. Bend out sides slightly, pivot on the locating cutouts on the Bottom Cover as shown and lift off Mid-Cover.

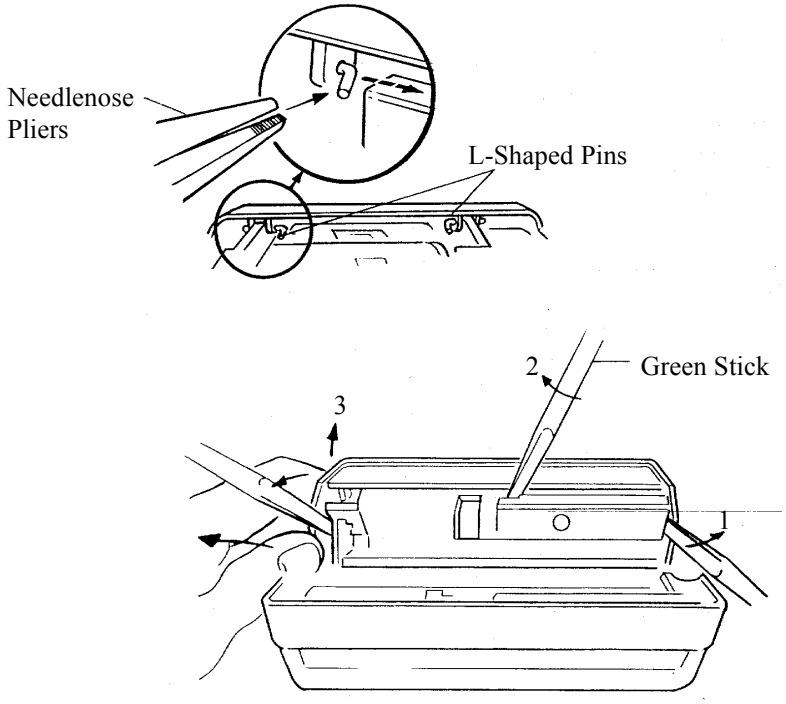


Figure 4-3 Removing Mid-Cover

3A. MID-COVER DISASSEMBLY

a. To remove Eye Cup, use greenstick to spring out tabs on Eye Wedge Retainer. Remove clear plastic Eye Wedge. Eye Cup can now be removed from Eye Wedge Retainer.

b. To remove Counter Window, use greenstick to gently unhook top tab of Window.

c. To remove the Rear Decorative Plate from Mid-Cover, pop it out from the inside of Mid-Cover and peel off. Or, carefully pry off from the outside with Exacto knife (two types).

d. To replace Front Decorative Plate, pry up with tool and peel off.

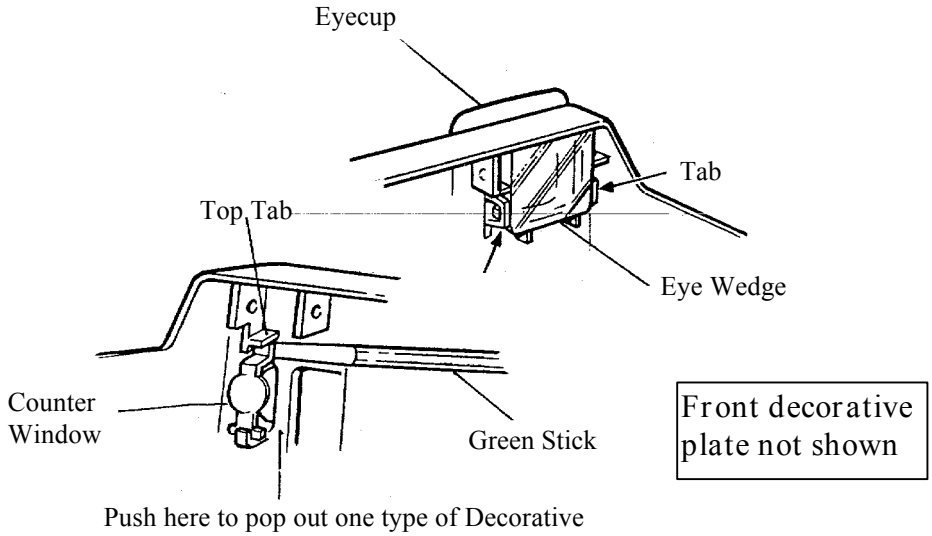


Figure 4-4 Removing Eye Cup and Counter Window from Mid-Cover

4. REMOVING BOTTOM COVER

(Parts which must be removed before doing this procedure: Top Cover and Mid-Cover)

a. With camera erect, pry off Erect Button with greenstick/screwdriver.

b. Carefully insert flat bladed screwdriver behind locking tab and bend tab slightly to unhook it. CAUTION: DO NOT LET SCREWDRIVER SLIP AND DAMAGE INDUCTOR COIL ON RANGING BOARD. Pull Bottom Cover away slightly.

c. Insert greenstick as shown. Using it as a lever, gently unsnap Bottom Cover.

d. To remove Cover, invert camera. Holding Cone with one hand, first slide Cover to rear about 1/2" with other hand. Then lift Cover up and off. (Lugs on inside of Cover must first slide back to clear retaining ramps on Cone.)

e. To remove Tripod Nut (if necessary), rotate Nut 1/4 turn clockwise with pliers to free internal lugs. Nut then lifts out.

f. To remove Film Pack Springs (if necessary), lift and bend legs slightly with pliers, then lift them out.

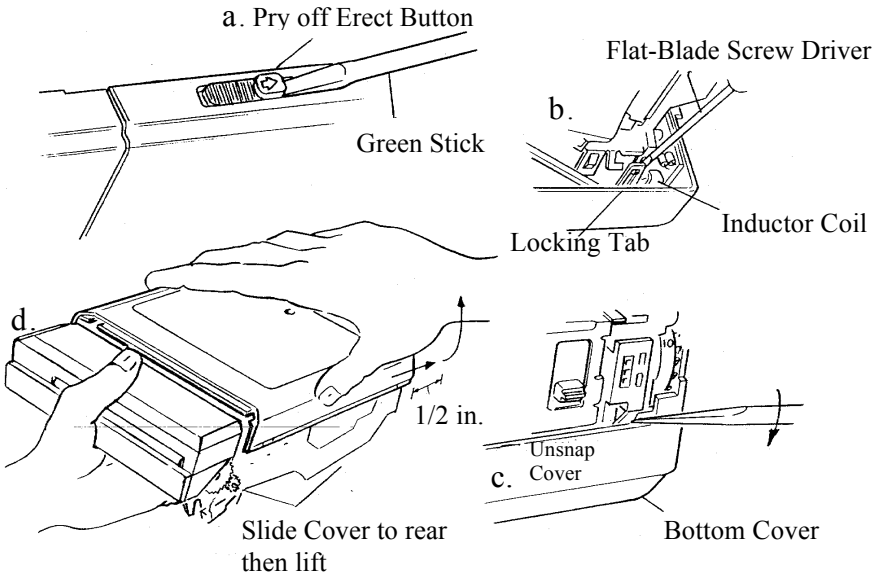


Figure 4-5 Removing Bottom Cover

5. REMOVING FRONT DOOR

(Parts which must be removed before doing this procedure: None)

a. Unhook hinge on side opposite gear train by bending side out slightly.

b. Next unhook hinge on gear train side and rotate cover downward to remove.

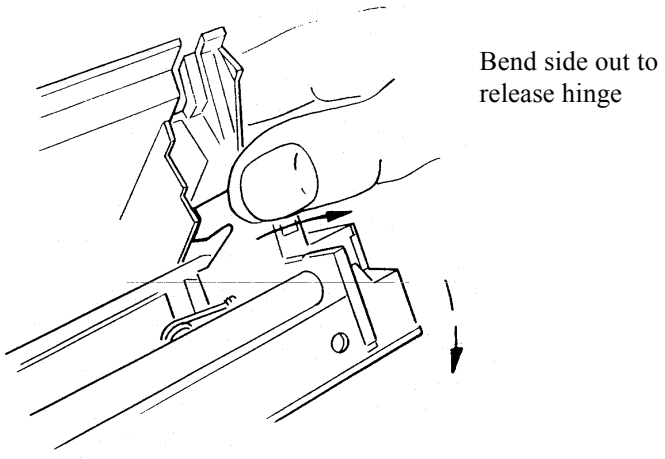


Figure 4-6 Removing Front Door

6. REMOVING SPREAD SYSTEM FROM FRONT DOOR

(Parts which must be removed before doing this procedure: Front Door)

a. Carefully insert an Exacto knife with a #11 blade in slot just below the lower spring leg on left (non-gear) side of door. Keep blade flat in same plane as rollers, with dull edge to your left. (Tape sharp edge to protect your fingers)

b. Insert blade so that tip is about halfway in between front and rear legs of spring. Push blade slightly to left (about 1/16'). Push hidden spring tab free of retaining shoulder. Left side of Spread bracket can then be pulled out slightly.

c. Repeat process on right side, inserting blade in slot just below lower leg of right spring. Push blade to right and release right side. Remove Spread Assembly.

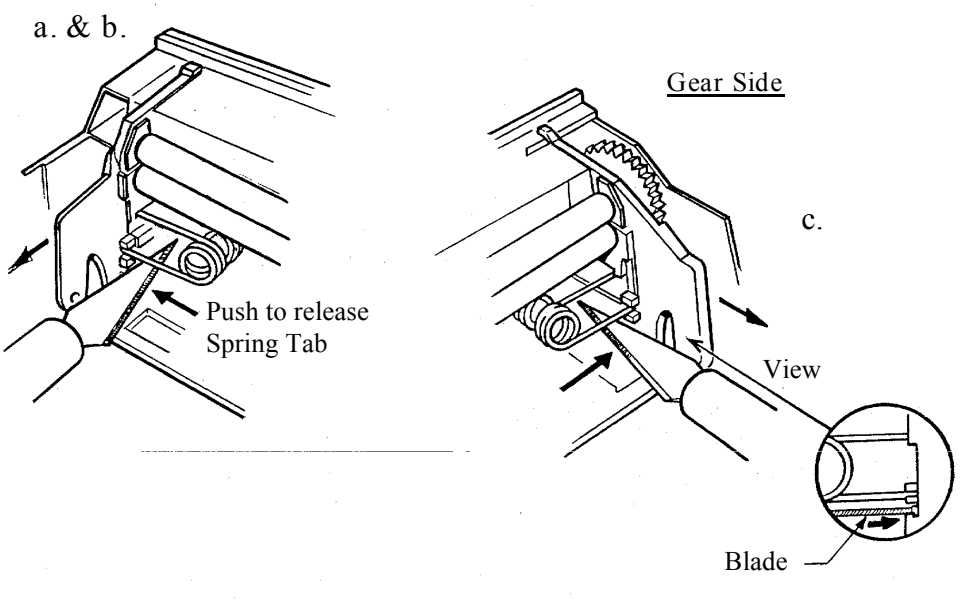


Figure 4-7 Removing Spread System from Door

7. REMOVING RANGING BOARD

(Parts which must be removed before doing this procedure: Top, Mid- and Bottom Covers, Strobe Board Retainer. Disengage S10/S1 assembly from tab, remove Exposure Flex from Strobe Board, place Strobe on Gear Train side and remove Insulating Shield.)

NOTE: BEFORE DOING THIS PROCEDURE, CAREFULLY NOTE THE POSITION OF ALL WIRES. ON REASSEMBLY, THEY MUST BE REPLACED IN THEIR ORIGINAL POSITIONS.

NOTE: THIS PROCEDURE IS DONE MOST EASILY AND QUICKLY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE PAN 13123.

a. Pull Board slightly to the left and then out from camera.

b. Remove Flex from connector using Flex Shim Tool or right-angle needlenose pliers.

c. Bend board downward and with pliers or tweezers straighten leads of transducer wires where they enter quick-disconnect terminals. Disconnect red wire first by straightening tip at end of connector. Remove black wire by pulling it out of quick-disconnect shell. (Wires may be soldered and require unsoldering.)

d. Remove Ranging Board.

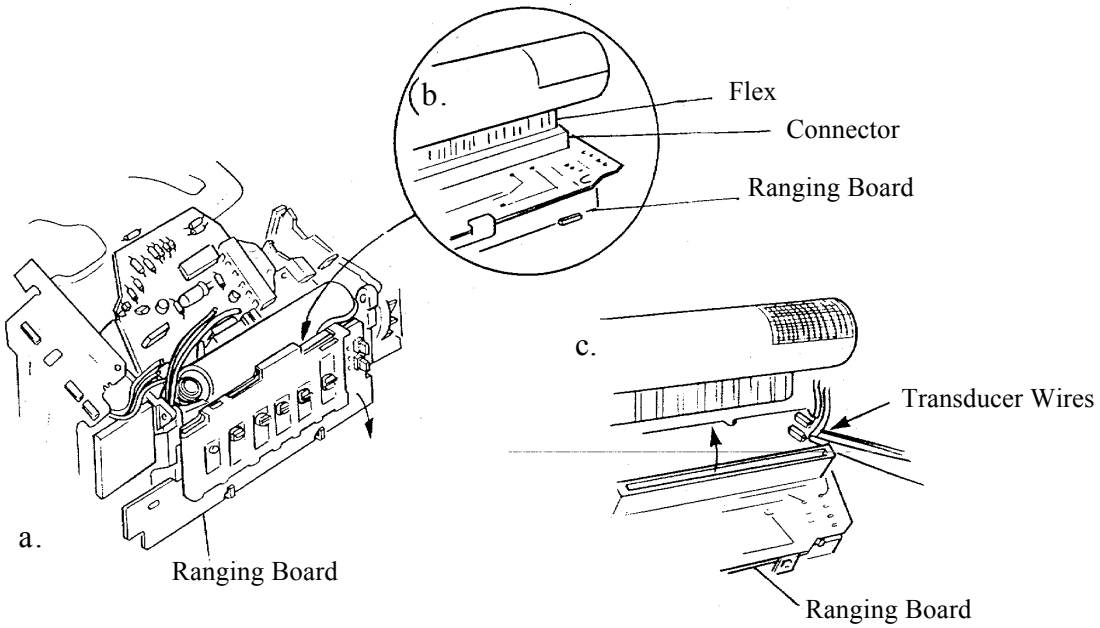


Figure 4-8 Removing Ranging Board

8. REMOVING SWITCH BLOCK FROM RANGING BOARD

(Parts which must be removed before doing this procedure: Ranging Board)

a. Insert screwdriver or greenstick under Control Panel Cover tab at top right and gently pry up.

b. Repeat for tab at top left of Control Panel Cover.

c. From component side of Ranging Board, push on the three Cover retaining tabs as shown.

d. Remove Control Panel Cover by pulling out and up from bottom of Cover.

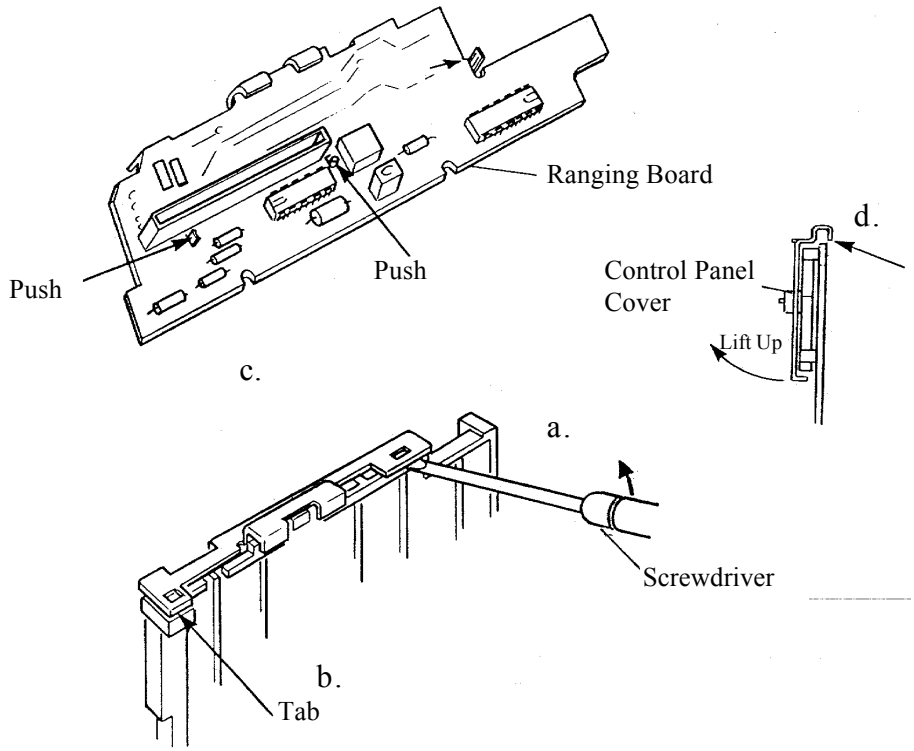


Figure 4-9 Removing Switch Block from Ranging Board

9. REMOVING STROBE BOARD

(Parts which must be removed before doing this procedure: Top Cover)

a. With tweezers, push up small plastic Strobe Board Retainer fitting, then lift out to free the Board.

b. With small screwdriver or greenstick, push tab forward just enough to free the Sl0/Sl assembly.

IMPORTANT: BEFORE PROCEEDING, MAKE MENTAL NOTE OF WIRE POSITIONS.

c. With needlenose pliers, gently pull off J14 (red) and J15 (black) wires from their Board connectors.

d. At bottom left corner of Board, remove J17 (green) and J16 (orange) wires. Next pull off or unsolder strobe wire (may be brown or white) from Board Trigger Coil.

e. Next remove Exposure Flex from its Board connector, carefully using right-angle needlenose pliers.

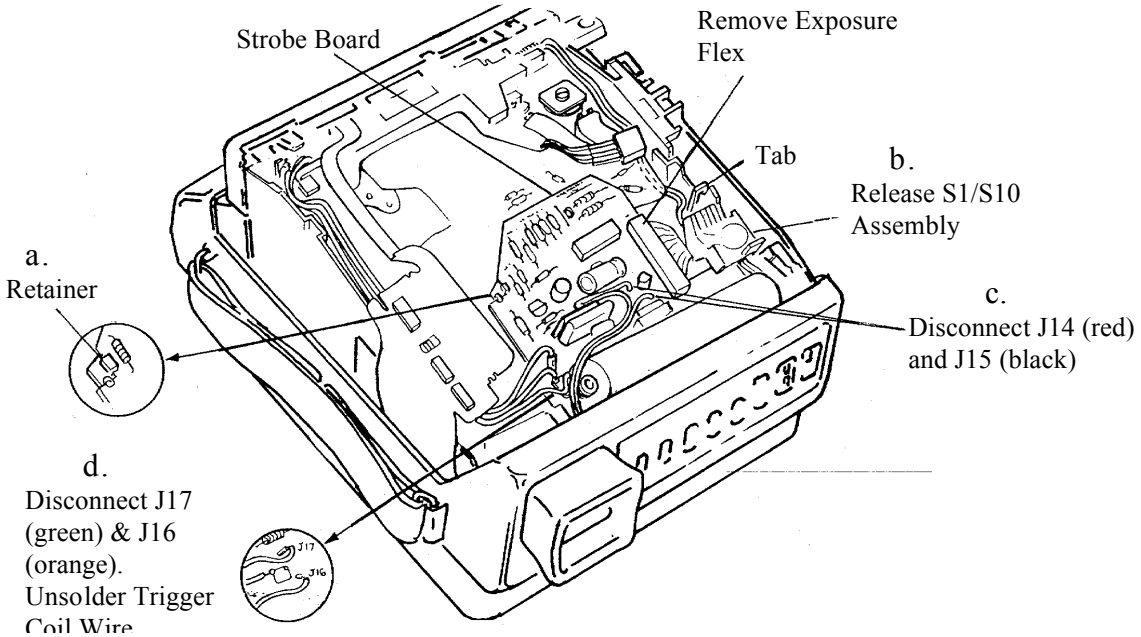


Figure 4-10 Removing Strobe Board

10. REMOVING DISPLAY/PRISM ASSEMBLY AND FEATURES FLEX

(Parts which must be removed before doing this procedure: Top, Mid- and Bottom Covers)

NOTE: THIS PROCEDURE IS DONE MOST EASILY AND QUICKLY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE P/N 13123.

a. Insert Features Flex Removal Tool (P/N 13124) into tracks in viewfinder to release spring fingers.

b. Insert tip of screwdriver as shown. Using it as a lever and the erecting spring as a fulcrum, gently pull out the Prism, to free the end of the Features Flex along with the Prism and Features Board.

c. Remove two Piezo wires from connector mounted on Flex. If push-on terminals are present, gently pull out wires with tweezers. Note that on some models, these wires may be soldered and removal requires unsoldering.

d. Remove Features Flex from Features Board, grasping Flex firmly with right-angle needlenose pliers.

e. If it is necessary to remove Features Flex with self-timer LED, remove Shutter Front Housing (see Step 14 & Figure 4-17) and gently lift Flex with LED connector out from under leg near LED.

f. Remove Features Flex from Exposure Flex with needlenose, right-angle pliers.

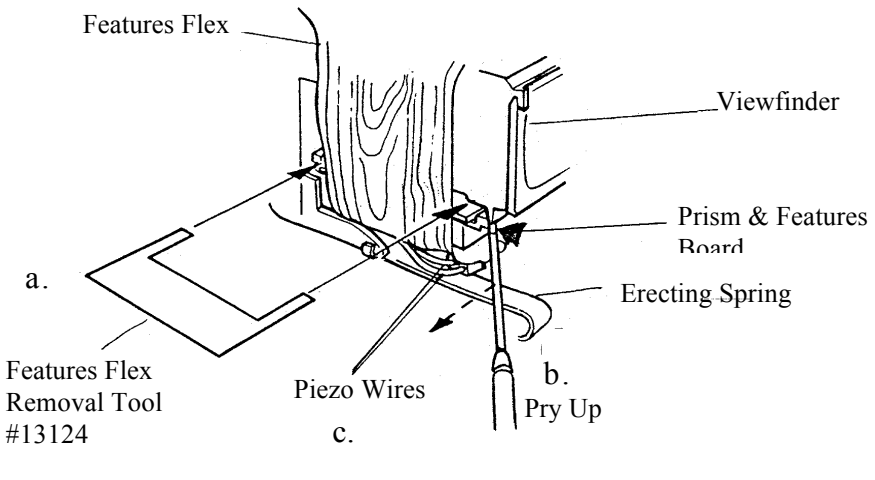


Figure 4-11 Removing Display/Prism Assy. & Features Flex

11. REMOVING EXPOSURE FLEX

(Parts which must be removed before doing this procedure: Top, Mid- & Bottom Covers)

NOTE: THIS PROCEDURE IS DONE MOST EASILY AND QUICKLY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE P/N 13123.

a. Remove Photodiode retainer from Shutter Baseblock, using tweezers.

b. Remove gray Encoder wires from 4-wire connector on Exposure Flex.

c. Remove Flex push-on connectors from Solenoid 2.

d. Remove Flex push-on connectors from Solenoid 1.

e. Disconnect Exposure Flex from Strobe Board and put aside (see Step 9).

f. Using right-angle needlenose pliers, disconnect Exposure Flex from Ranging Board. Let Ranging Board hang out of way.

g. Remove Insulating Shield.

h. Remove Exposure Flex from Features Flex with right-angle needlenose pliers.

i. Remove Flex from Motor and Gear Train Flex by lifting connector block out of its holder. Then use needlenose pliers to remove Exposure Flex from connector.

j. Remove Exposure Flex with its adhesive strip by prying the adhesive strip off the Cone.

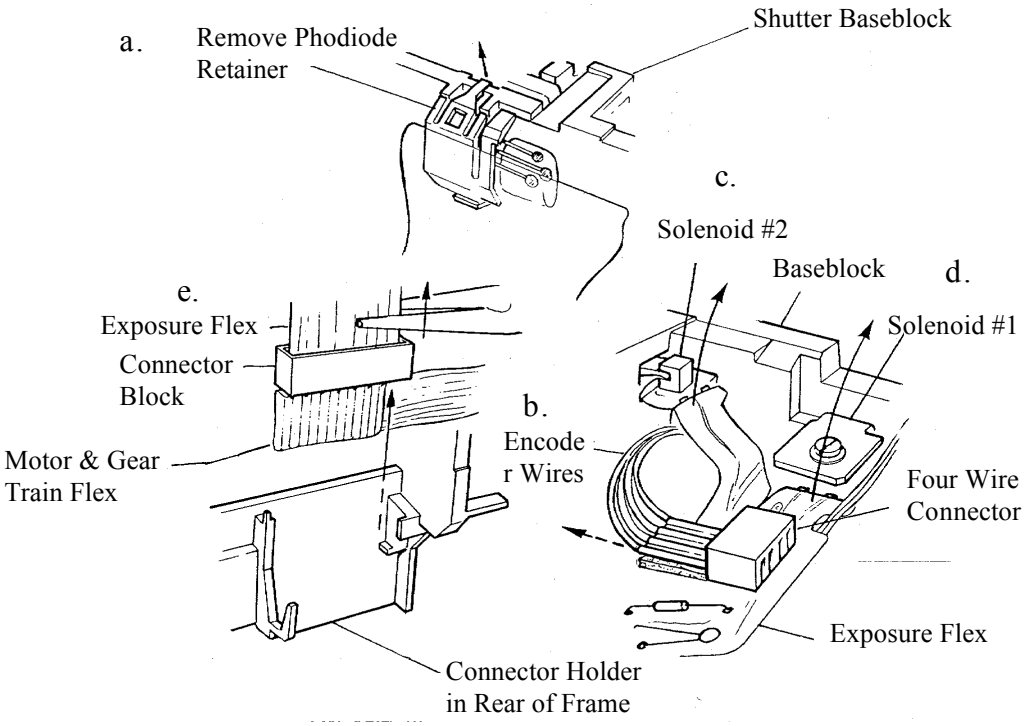


Figure 4-12 Removing Exposure Flex

12. REMOVING GEAR TRAIN COVER

(Parts which must be removed before doing this procedure: Top, Mid- & Bottom Covers)

NOTE: THIS PROCEDURE IS DONE MOST EASILY AND QUICKLY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE P/N 13123.

a. Remove Flapper Door (Figure 4-13a) by gently springing right pivot support arm of Main Frame away from Door pivot pin. CAUTION: Keep finger over Door spring (center) to prevent pop-out and loss of spring.

   (For steps b. through f., see Figure 4-13b.)

b. Remove Motor Gear Drive Flex Assembly from Motor with greenstick.

c. Free Flex from beneath retaining tabs on Gear Train Cover.

d. To remove Flex Retainer from Cover (see Figure 4-13c), insert small screwdriver in right-hand hole and tilt handle down so tip goes upward. Then insert in left hole and move handle to right. Lift out Flex Retainer.

e. Lift top left corner of Flex away from guide tab using flat blade.

f. Using tweezers, carefully disconnect Flex contacts from Film Switch.

g. Free the edge of the Flex from beneath the small tab by pushing Flex to left.

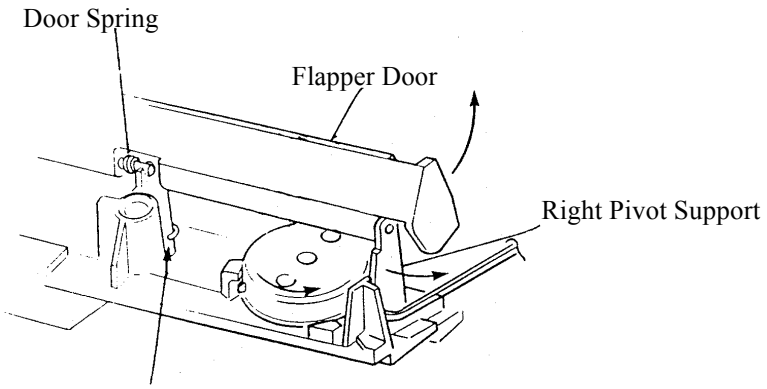


Figure 4-13a Flapper Door Removal

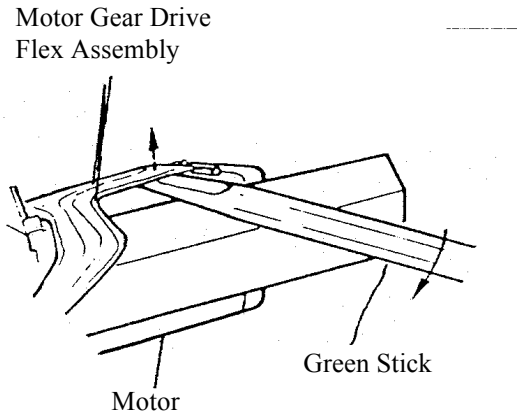


Fig. 4-13b Removing Motor/Gear Train Flex

h. Remove Door Release Button by pushing it forward and lifting up (Figure 4-13d).

i. Insert small screwdriver in slot at right end of Gear Train Cover and gently tilt handle down to release the Cover (see Figure 4-13d). Door latch must be in the "down" position: push down on end of Door Latch nearest gear #4.

j. Now free opposite end of the Gear Train Cover near the Counter Wheel by inserting a screwdriver at the two places shown in Fig. 4-14e. Gently pry the upper finger upward, the lower finger outward. Rotate the Cover outward, freeing the top first and then unhooking the bottom of the Cover from the tab next to the film switch.

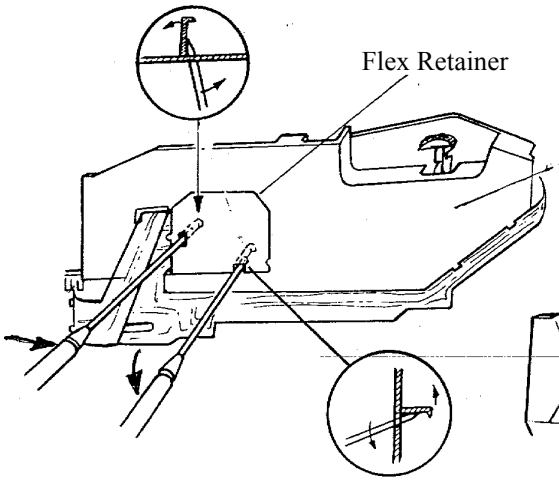


Figure 4-13c
Removing Flex Retainer Button

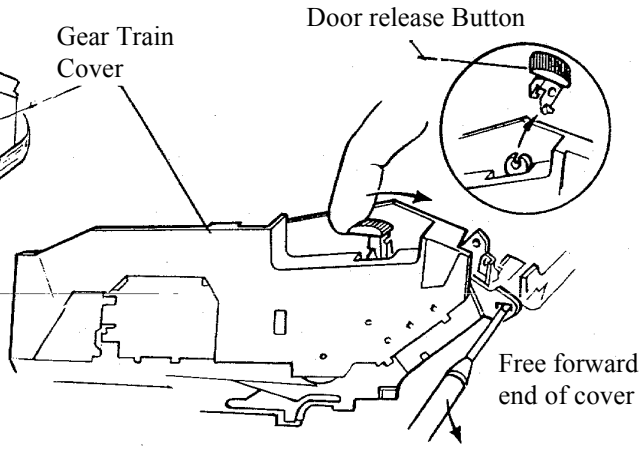


Figure 4-13d
Removing Door Release

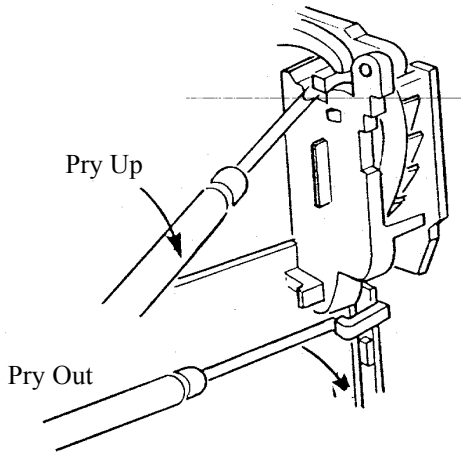


Figure 4-13e Removing Gear Train Cover

12A. GEAR TRAIN DISASSEMBLY

(Parts which must be removed before doing this procedure: All Covers, Gear Train Cover & Gear Train /Motor Flex)

NOTE: THIS PROCEDURE IS DONE MOST EASILY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE #13123. THE CAMERA SHOULD BE ERECTED AND THE DOOR SHOULD BE OPEN.

NOTE: AS AN AID TO REASSEMBLY, WHEN REMOVING PARTS, POSITION THEM ON THE BENCH IN THE ORDER IN WHICH THEY WERE REMOVED.

a. Carefully lift off the Wireform Switch Block from the gear train.

b. Remove the Noise Suppresser (washer) from Gear #1. See Figure 4-14a.

c. Remove Gear #4.

d. Release the Door Link Spring from under the tab and remove the Door Link with the spring.

e. Remove the Erect Switch Link.

f. Remove the Pack Counter Disc (if present).

g. Disconnect the Pick Spring from the Pack Pawl and remove the Pack Pawl.

h. Remove the Timing Gear.

i. Remove the Pick with the Pick Spring still attached.

j. Remove the Counter Wheel with the Counter Wheel Spring.

k. Remove Gear #3.

1. Referring to Figure 4-14b, remove the Door Latch.

m. Remove Gear #2.

n. Remove Gear #1.

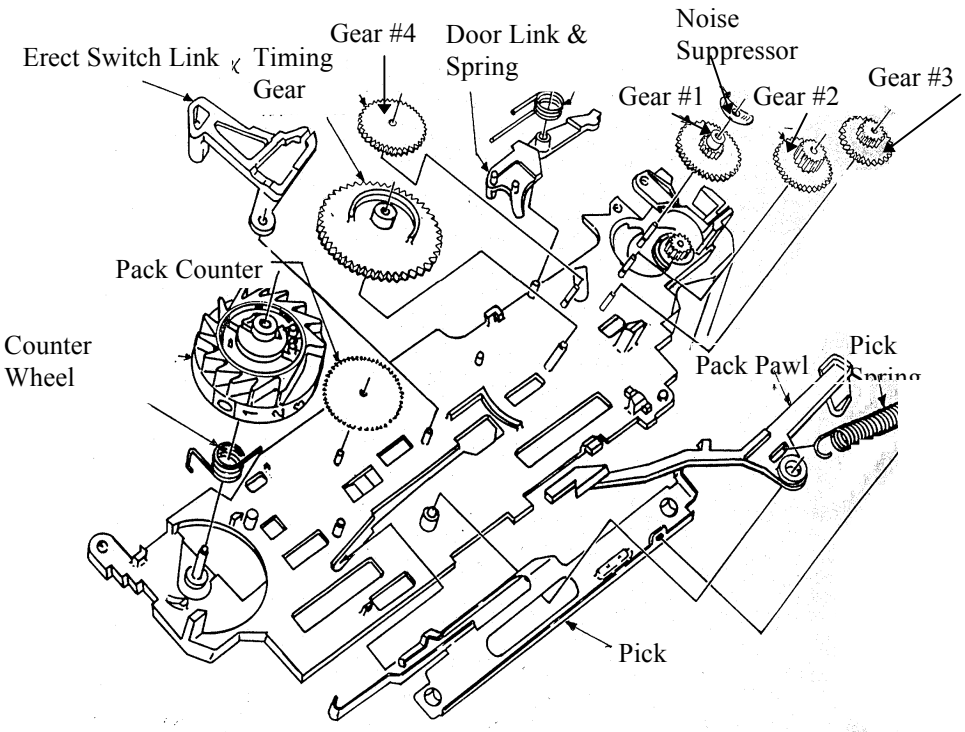


Figure 4-14a Gear Train Disassembly

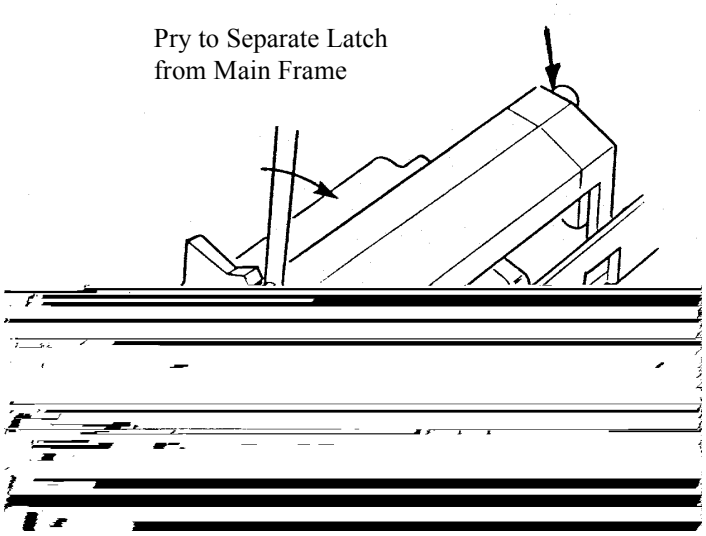


Figure 4-14b Removing the Door Latch

12B. GEAR TRAIN REASSEMBLY

CAUTION: IT IS EXTREMELY IMPORTANT THAT ALL PARTS ARE PROPERLY ALIGNED AFTER YOU HAVE REASSEMBLED THEM. THE POSITION OF THE WIREFORM SWITCHES IS ESPECIALLY CRITICAL. IF THE PARTS ARE NOT PROPERLY INSTALLED, THE CAMERA WILL NOT OPERATE CORRECTLY. BE CERTAIN THAT YOU REASSEMBLE ALL GEAR TRAIN PARTS ACCORDING TO THE INSTRUCTIONS. REFER TO FIGURES 4-14c AND 4-14e TO DOUBLE CHECK YOUR WORK.

a. Install Gear #1 and the Noise Suppresser (washer). Note that Gear #1 has a hub on the shaft above the small gear segment.

b. Orient the Door Latch over the Main Frame and Gear Train and install it by snapping the tabs into place to lock the latch to the frame. (Figure 4-14d). Be sure the lower tab of the latch is under the metal spring (as seen through the opening in the middle of the main frame - Figure 4-14d).

c. Install Gear #2.

d. Install Gear #3.

e. Load the Counter Wheel Spring into the cavity on the Counter Wheel and install the Counter over its shaft on the Gear Train. Rotate the Counter about one turn counter-clockwise. The Counter will rise over the tab and settle into position. When correctly installed, the two pins on the wheel will be at about the one and two o'clock positions (See Figure 4-14e).

f. Install the Pick.

g. Install the Pack Pawl (with the spring attached) onto the Gear Train. Attach the other end of the spring to the Pick.

h. Replace the Timing Gear, orienting it so that the ends of the cam segment are at the five and nine o'clock positions (Figure 4-14 e).

I. Replace the Pack Counter if one was removed at disassembly.

j. Install the Erect Switch Link so that the left edge is in the vertical position. The upper portion of the link sits in the cutout on the side of the cone.

k. Position the Door Link Spring on the Door Link and carefully install them on the Gear Train. The upper spring arm should be locked under the tab as indicated in Figure 4-14c. The Door Link must be in the up position. If it isn't, push down on the arm of the Door Latch to raise the Door Link.

l. Replace Gear #4.

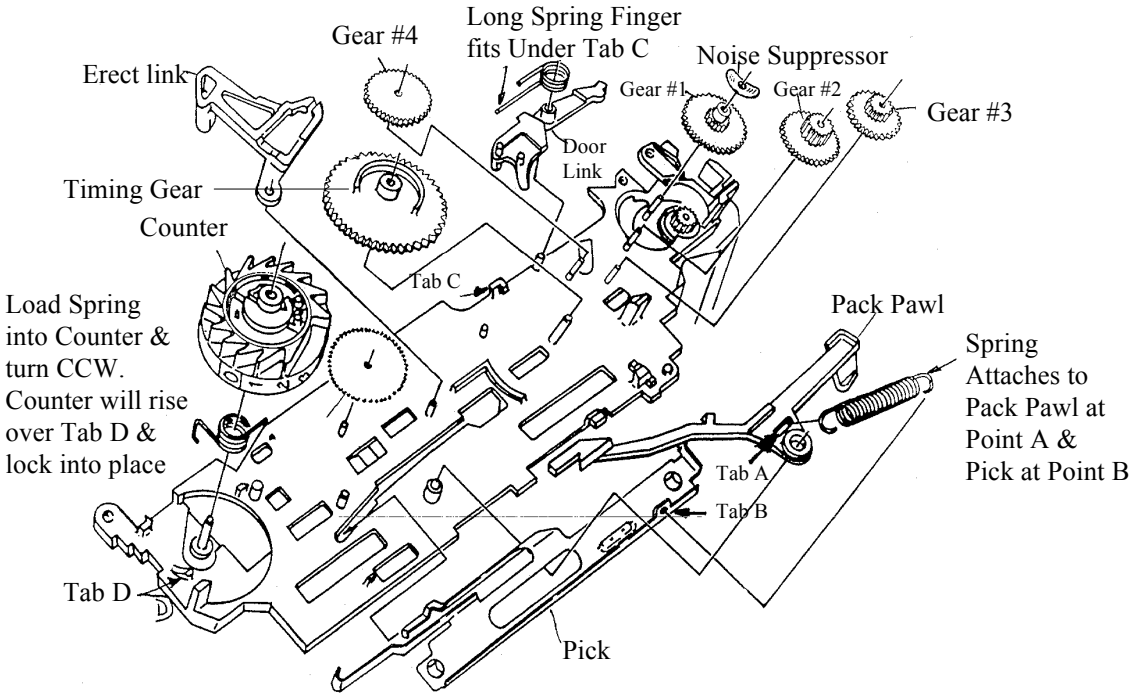


Figure 4-14c Gear Train Reassembly

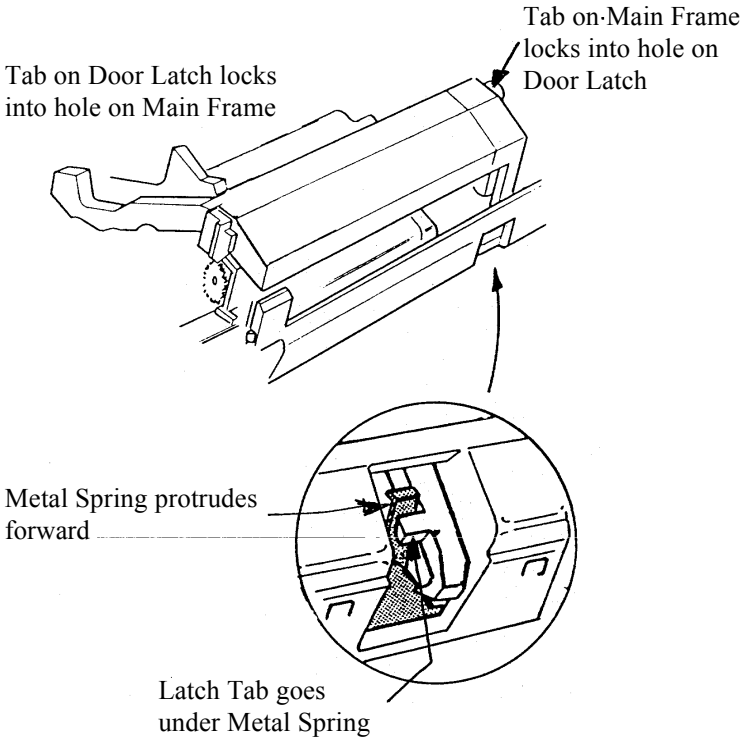


Figure 4-14d Installing the Door Latch

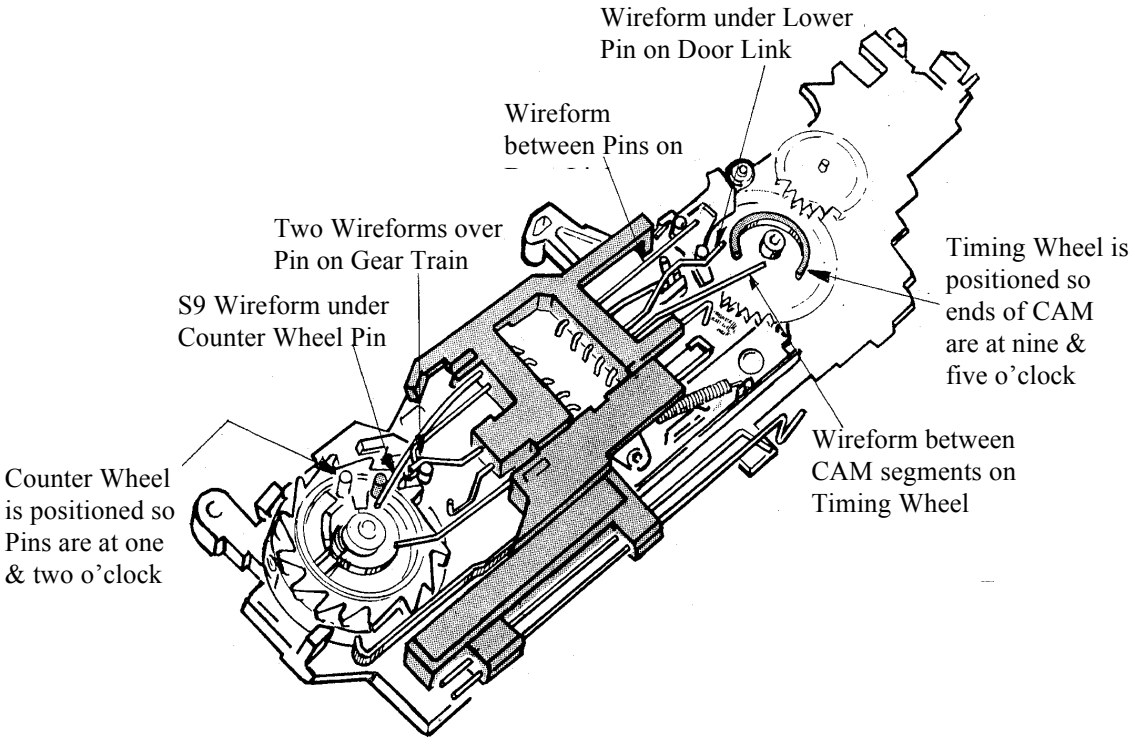


Figure 4-14e Wireform Switch Orientation

m. Referring to Figure 4-14e, carefully position the Wireform Switch Block over the assembled Gear Train. AGAIN, THE IMPORTANCE OF CORRECT POSITIONING OF ALL THE WIREFORM SWITCHES CANNOT BE OVER-EMPHASIZED. BE ABSOLUTELY CERTAIN THAT ALL WIREFORM SWITCHES ARE IN THE POSITIONS SHOWN IN FIGURE 4-14e.

n. Holding the Wireform Switch Block down with an index finger through the Flex Retainer opening, replace the Gear Train Cover. The tips of the four gear shafts should be visible at the right end of the Gear Train.

o. Replace the Gear Train/Motor Flex.

13. REMOVING DOOR LATCH, SPRING & MOTOR

(Parts which must be removed before doing this procedure; Top, Mid- & Bottom Covers. Gear Train need not be disassembled if Gear Train Cover is pried out slightly and Door Latch is gently lifted out.)

NOTE: THIS PROCEDURE IS DONE MOST QUICKLY AND EASILY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE P/N 13123.

a. Remove Motor/Gear Train Flex and Door Latch. Gently separate Door Latch from Main Frame: first, at Motor Pinion Gear end using a small screwdriver, then at the Door Latch Spring end.

b. Remove Door Latch Spring by first prying it off the Motor hub. Bend the Spring tab below the Motor hub away from the hub, then bend upper yoke of Spring away from hub. Next push in on the bottom tabs of the Spring by inserting a small screwdriver through holes in the bottom. Then lift Spring out. (NOTE: It may not be possible to remove Spring without deforming it. If so, replace with new Spring on reassembly.)

c. Gently pry Motor away from Main Frame by inserting small screwdriver between Main Frame and gear-end of Motor case.

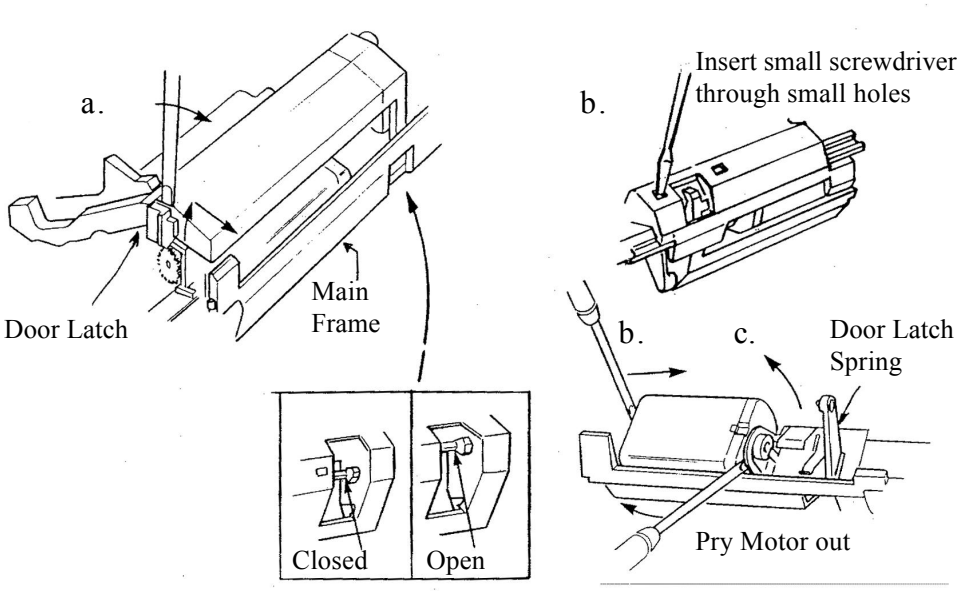


Figure 4-15 Removing Door Latch, Spring and Motor

14. REMOVING SHUTTER FRONT HOUSING

(Parts which must be removed before doing this procedure: Top Cover)

a. Keeping Flapper Door depressed, unsnap tab on Strobe side of Housing.

b. Now unsnap inside tab from detent, on Transducer side of Housing, with greenstick or small screwdriver.

c. Release outside tab from its catch, just behind Strobe. Remove Shutter Front Housing.

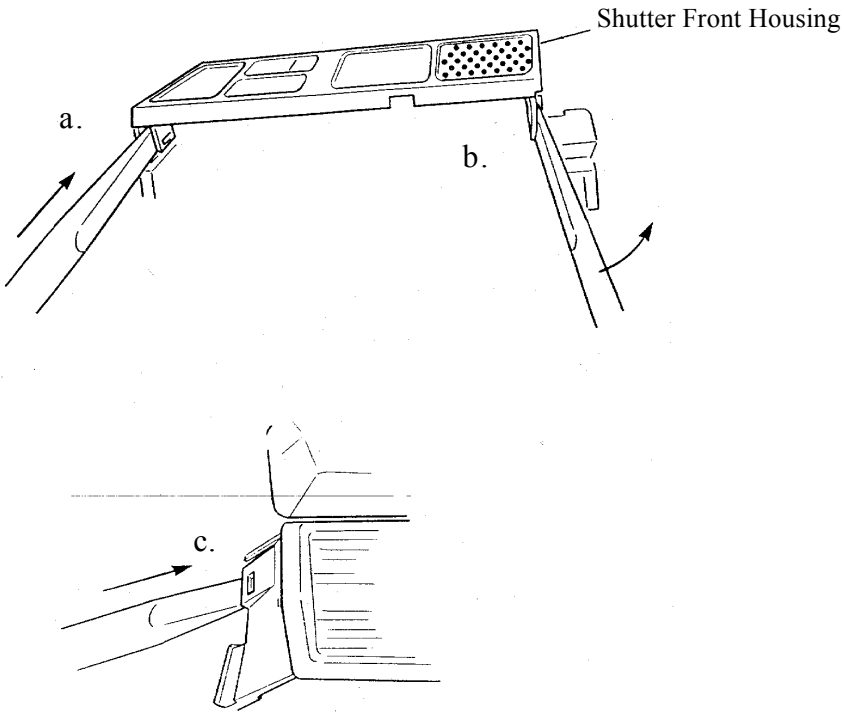


Figure 4-16 Removing Shutter Front Housing

15. REMOVING TRANSDUCER AND FLASH TUBE ASSEMBLIES

(Parts which must be removed before doing this procedure: Top Cover and Shutter Front Housing)

a. With greenstick or small screwdriver, lift up "T" tab at top of Transducer Housing and tilt Housing forward. Bottom tab will release. Carefully remove wires from Transducer by disconnecting them at their push-on terminals.

b. Remove Flash Tube by gently pulling it away from its adhesive-backed foam. Carefully free Flash Tube wire leads from Baseblock.

NOTE: If Flash Tube wires must be removed from camera, Features Flex will have to be removed from Exposure Flex, and Self-Timer will have to be removed from Shutter Front Housing. Remove three wires from the Strobe Board (Trigger Coil wire may be soldered.)

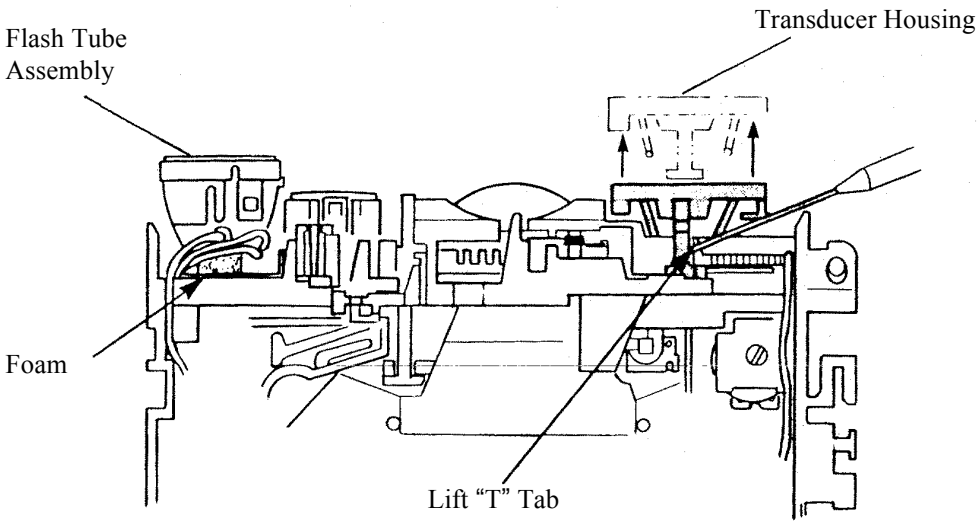


Figure 4-17 Removing Transducer Housing & Reflector Assemblies

16. REMOVING LENS MOUNTING PLATE

(Parts which must be removed before doing this procedure: All Covers, Shutter Front Housing. Transducer Housing Assembly and Reflector Assembly must also be lifted out)

a. Note which notch holds end of Opening Blade Spring: this is the notch in which it must be replaced on reassembly. Identify notch with light scratch made with Exacto knife. Remove Spring with tweezers.

b. Gently pry Long Encoder Wire with its LED attached, to remove LED from its hole in Baseblock. (On early versions of Camera, LED is cemented in place.)

c. If Meniscus Lens must be removed, free it by pushing spring finger on right side to the right, using greenstick. CAUTION: Keep fingers and tools from touching lens, to avoid fingerprints and scratches.

d. Press down on tab 6 at bottom right.

e. Lift up finger 5 at top right.

f. Unsnap mating catch 4 at bottom right center.

g. Lift up finger 3 at top center to release it.

h. Push down gently on finger 2 at bottom left to release it.

i. With Plate right side up and lens facing you, pry finger 1 at top left to the left slightly to release it.

j. Carefully lift Lens Mounting Plate off Baseblock, taking care not to disturb assemblies now exposed.

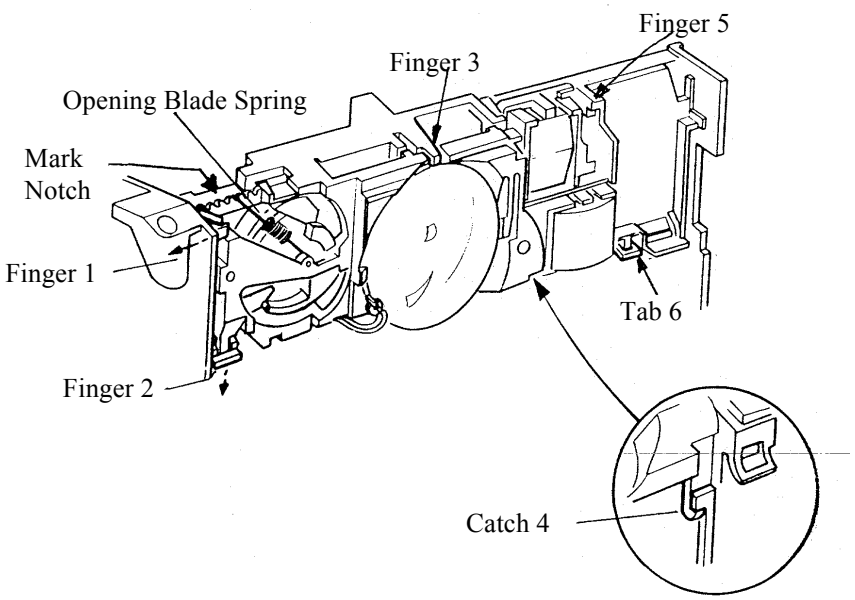


Figure 4-18 Removing Lens Mounting Plate

17. SHUTTER DISASSEMBLY

(Parts which must be removed before doing this procedure: All Covers, Shutter Front Housing, Transducer Housing Assembly, Reflector Assembly, and Lens Mounting Plate including Opening Blade Spring)

NOTE: THIS PROCEDURE IS DONE MOST EASILY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE #13123 AS SHOWN IN FIGURE 4-19.

CAUTION: WHEN DISASSEMBLING THE SHUTTER, BE SURE TO KEEP FINGERS AND TOOLS AWAY FROM THE OPTIC ELEMENTS.

a. Using tweezers, unhook the upper end of the Quintic Return Spring. Remove the Quintic Assembly (consisting of Counterweight, Return Spring, Frame and Lens) from the baseblock. See Figure 4-19a.

b. Using tweezers, unhook the upper end of the Catch Pawl Spring and remove the Catch Pawl from the baseblock. See Figure 4-19a.

c. Remove the Walking Beam/Inertia Assembly (which consists of the Kick Spring, Inertia, Inertia Spring, and Walking Beam from the shutter baseblock. See Figure 4-19a.

d. Wearing finger cots or gloves, remove the three shutter blades from the baseblock, Figure 4-19a. If the blades are to be re-used, exercise care to prevent scratching or getting body oil on the blades. Also note that the three blades must be re-installed as a set. Replacement blades are available as a three-part set. Do not intermix blades from one set to another.

NOTE: The Quintic Assembly may be further disassembled as shown in Figure 4-19b. The Walking Beam/Inertia Assembly may be further disassembled as shown in Figure 4-19c.

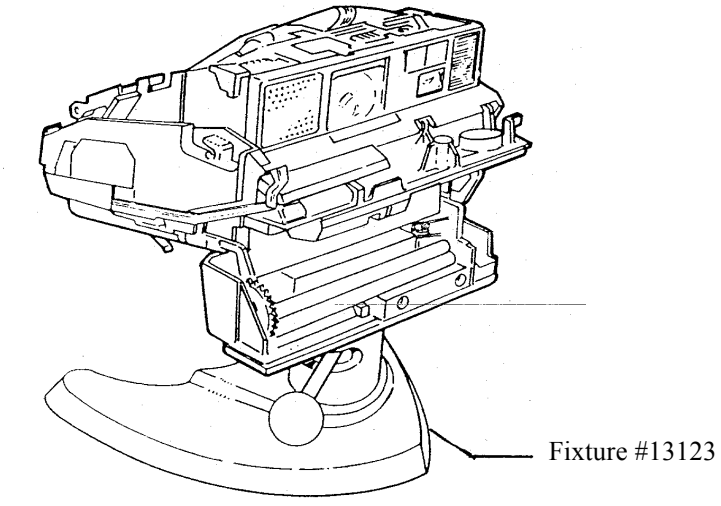


Figure 4-19

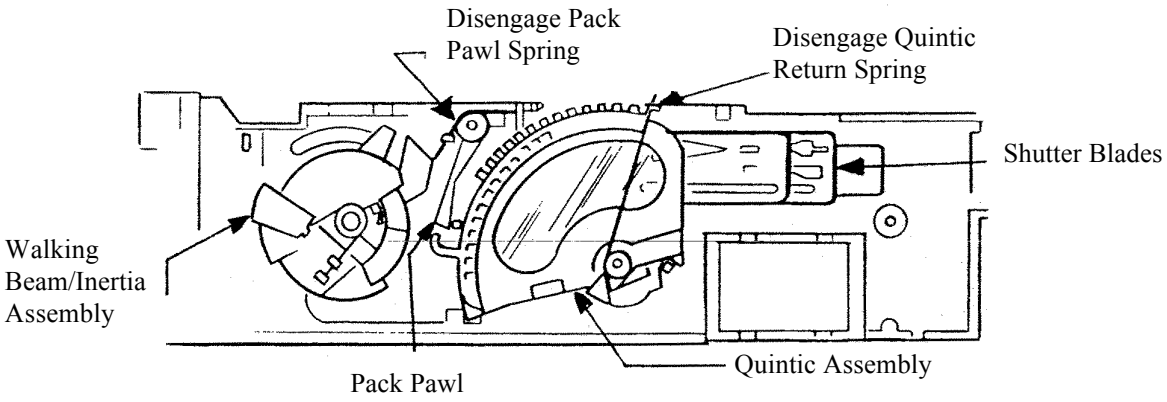


Figure 4-19a Removing Shutter Components

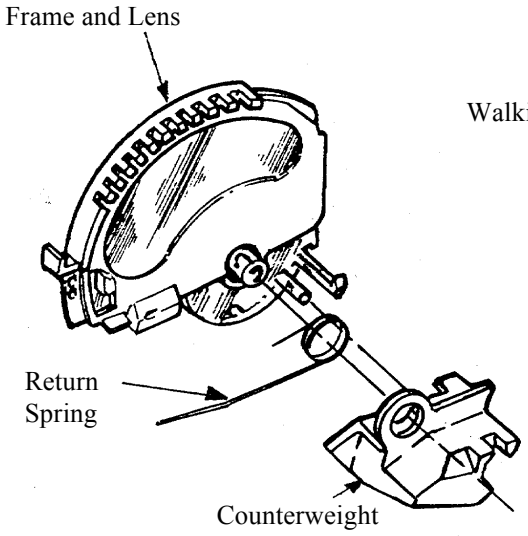


Fig. 4-19b
Disassembling the Moving
Quintic Lens

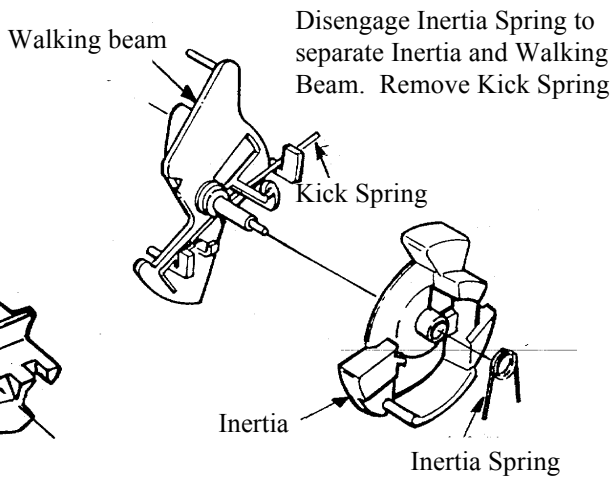


Fig. 4-19c
Disassembling the Walking
Beam/Inertia Assembly

17A. SHUTTER REASSEMBLY (WITH CAMERA ON FIXTURE)

NOTE: 3/32” dia. (.093) x .750” dowel pin needed for reassembly

a. With Shutter Baseblobk empty except for metal dowel pin in upper left hole above lens opening, replace bottom Shutter Blade with tweezers. (wear finger cots when handling Blades.) Align upper left hole in bottom Blade with dowel pin and lower elongated slot in Blade with plastic guide pin (see Figure 4-19d).

b. Similarly, replace middle and top Shutter Blades over dowel pin and guide pin. (In top Blade, dowel pin goes through upper right hole in Blade.)

c. Reassemble Inertia Assembly to Walking Beam, with Kick Spring and Inertia Springs in place (see Figure 4-19e).

d. Hold Drive Link from the rear so that its Walking Beam pin is at 12 o'clock. Place Walking Beam on its pivot pin on the Baseblock, and at the same time engage top and bottom shutter-actuating pins on the Walking Beam in the upper and lower Shutter Blade holes. (Hold Walking Beam so that both its shutter-actuating pins, when viewed from the rear, are vertically aligned -- i.e., at 6 and 12 o'clock. (See Figure 4-19f.)

e. Check that Walking Beam/Inertia Assembly has been correctly positioned by carefully removing dowel pin and rotating the Walking Beam Assembly slightly back and forth. If Assembly is correctly positioned, an aperture of varying size will appear in the Shutter Blades. IF VARYING APERTURE DOES NOT OCCUR, DISASSEMBLE AND TRY REASSEMBLY AGAIN: WALKING BEAM SHUTTER-ACTUATING PINS ARE NOT PROPERLY ENGAGED IN SHUTTER BLADE HOLES.

f. Replace Catch Pawl on its pivot pin. Be sure upper tab is engaged in slotted end of plunger of Solenoid 2 (Figure 4-19g).

g. Replace Catch Pawl Spring. First hook leg with right-angle bend at its tip under post on Baseblock. Then hook other leg of Spring under tab on Catch Pawl
(Figure 4-19h).

h. Replace Quintic Frame, Lens & Counterweight Assembly on its pivot pin. Bend long, vertical arm of Return Spring until it is hooked under tab at top of Baseblock (Fig. 4-19h).

i. Before replacing Lens Mounting Plate, check to be sure that lower front of the Walking Beam Assembly seats properly in its hole in the Lens Mounting Plate.

j. Replace the Lens Mounting Plate. Be sure the pivot pin on the front of the Walking Beam Assembly seats properly in its hole in the Lens Mounting Plate.

k. With tweezers, replace the Opening Blade Spring. First hook lower end of Spring to the Walking Beam. Then hook upper end in the notch it was in originally (identified by mark when Shutter was disassembled).

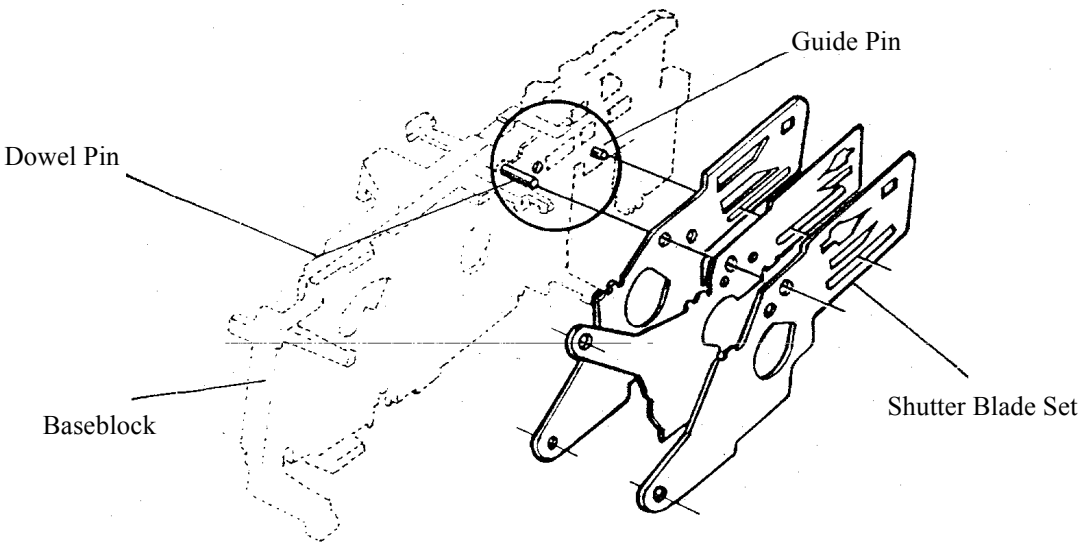


Figure 4-19d Reassembling Shutter Blades

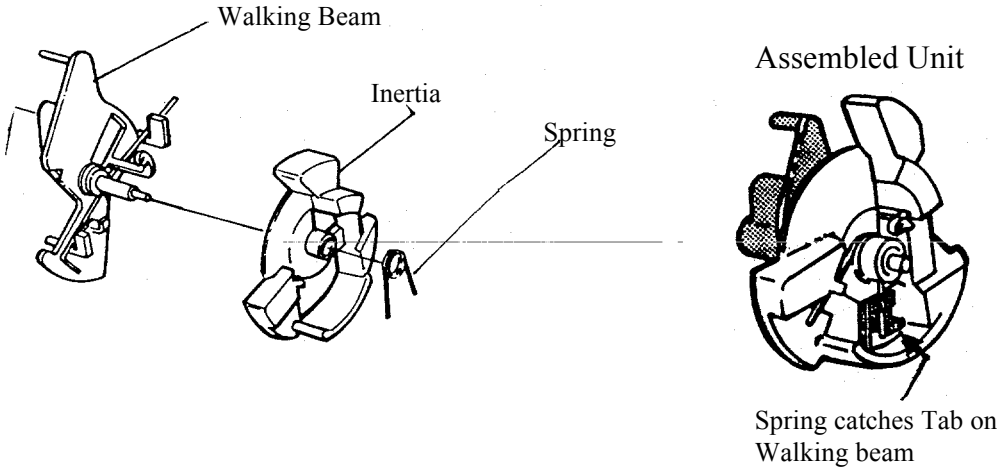


Figure 4-19e Reassembling Walking Beam & Inertia

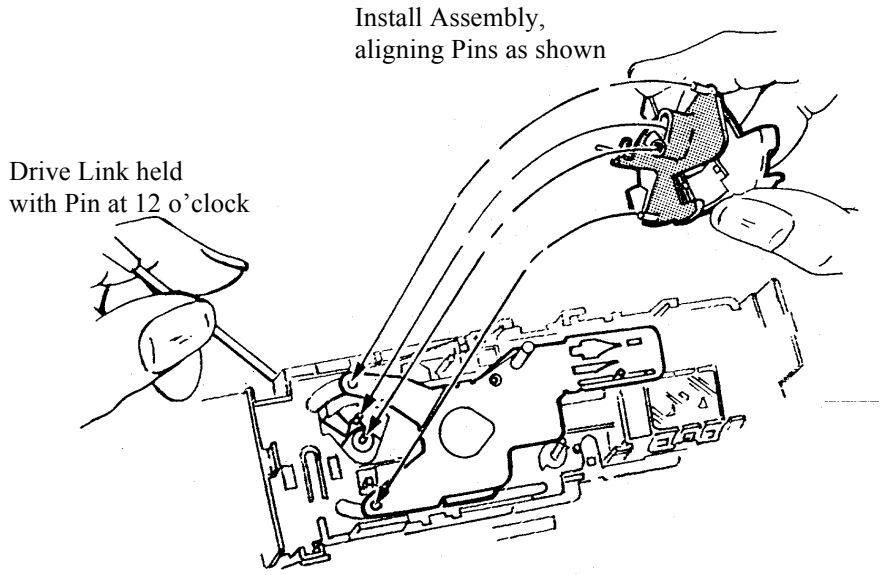


Figure 4-19f Reassembling Walking Beam to Drive Link & Shutter Blades

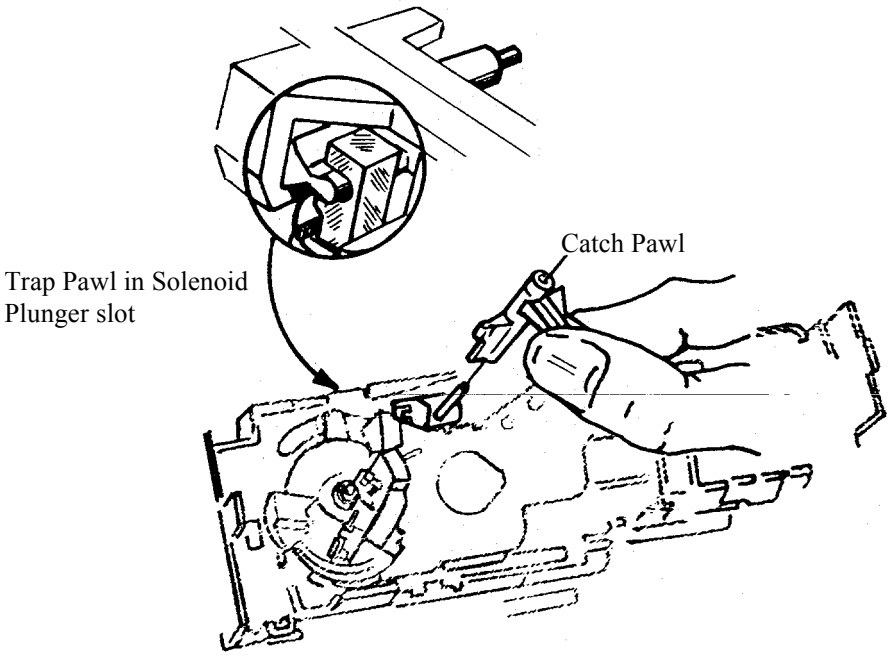


Figure 4-19g Shutter Assembly Components

l. Now check that all Shutter Assembly parts work properly:

- push Quintic frame down gently with finger

- engage Quintic with Catch Pawl by depressing plunger of Solenoid 2 with finger

- move Walking Beam Inertia Assembly back and forth to check that Shutter
Blades close and open.

m. Replace Encoder LED in Lens Mounting Plate.

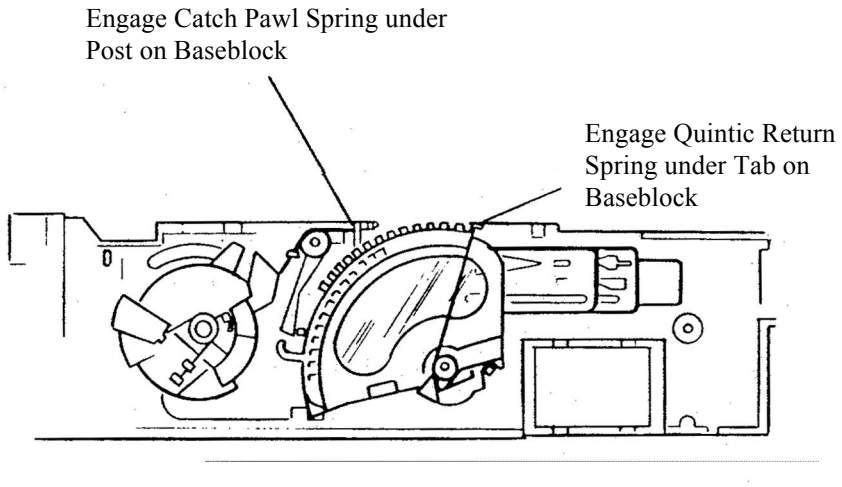


Figure 4-19h Install Catch Pawl & Quintic Lens

18. REMOVING SHUTTER ASSEMBLY AS A UNIT

(Parts which must be removed before doing this procedure: All Covers, Shutter Front Housing. Also, lift aside the Transducer Housing Assembly. and Reflector Assembly)

NOTE: THIS PROCEDURE IS DONE MOST EASILY AND QUICKLY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE P/N 13123.

a. Baseblock is held to Cone by four spring fingers: two visible on the top of the Baseblock which engage shoulders on the Cone, two more partially hidden on the bottom of Cone which engage shoulders on the bottom of the Baseblock (see locations 1, 2, 3 & 4 on Figure 4-20). Start removal with the top fingers, 1 & 2.

b. Remove Photodiode Cover on Exposure Flex from the back of Baseblock. Remove Exposure Flex connectors to Solenoid 2 and disconnect Encoder 4-wire ribbon cable from connector on Exposure Flex.

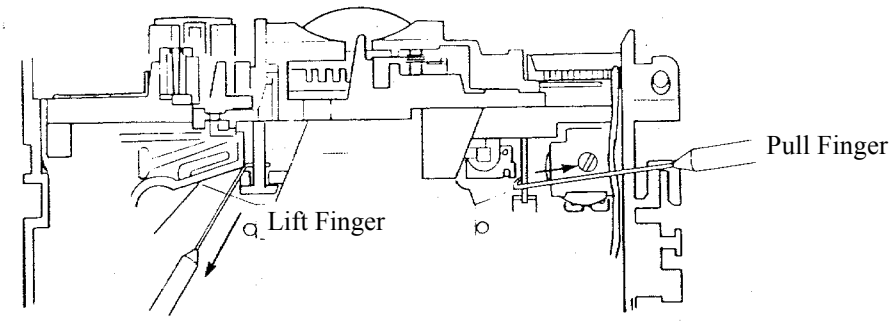
c. With camera facing away from you and looking directly down on it, insert greenstick or small screwdriver under “T” end of finger 1 slightly to release it.

d. With dental hook or greenstick, now push finger 2 to the right slightly to release it. Now pull Shutter Assembly slightly forward (away from Cone).

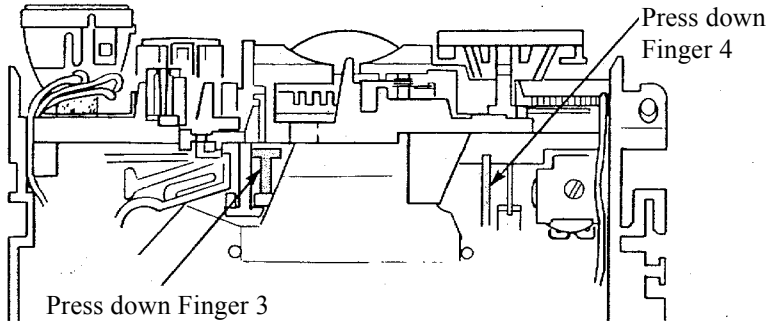
e. Insert narrow blade screwdriver at location 3. When tip is resting on finger 3, press down slightly to release it.

f. Repeat procedure for finger 4 at right by inserting blade at location 4 (approximately in line with the left rear pin of Solenoid 2) and pressing down slightly. (Finger 4 is all but hidden by Solenoid.) Baseblock with Lens Mounting Plate attached can now be freed from Cone.

CAUTION: Be sure the two Calibration Wedges (narrow plastic strips) don't fall out of Baseblock and become lost.



Releasing Fingers 1 and 2 - Steps b. &



Releasing Fingers 3 and 4 - Steps d. & e.

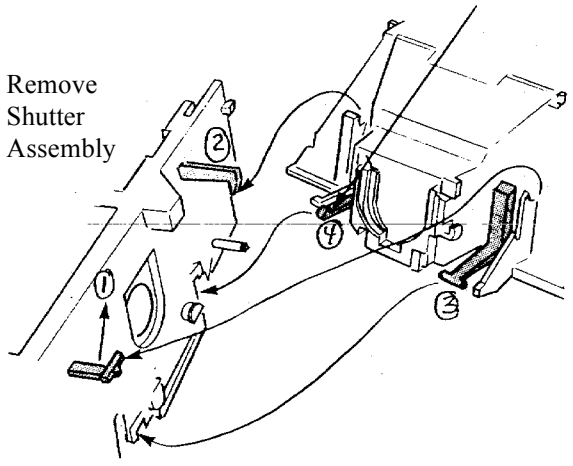


Figure 4-20 Removing entire Shutter Assembly as a unit

19. REMOVING PIEZO ASSEMBLY

(Parts which must be removed before doing this procedure: Top and Mid-Covers)

a. Unhook Flapper Door spring.

b. Spring out Door end support on Main Frame slightly (next to Piezo) and remove Flapper Door.

c. Use straight needlenose pliers to remove Piezo cover: engage tips in cover depressions, then twist pliers counter-clockwise to release Assembly from its mounting lugs on the Main Frame.

d. Carefully disconnect Piezo wires from Features Flex with tweezers. Gently pull wires from their routing within the Erect Spring side of the Main Frame.

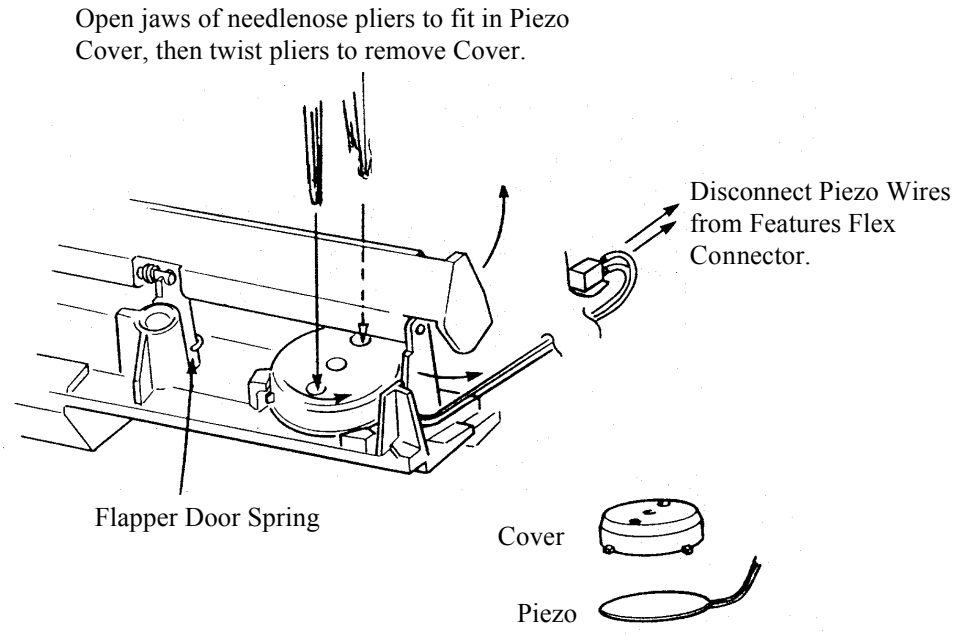


Figure 4-21 Removing Piezo Assembly and wires

20. REMOVING SOLENOIDS 1 AND 2

(Parts which must be removed before doing this procedure: All Covers, Shutter Assembly)

a. To remove Solenoid 1, first remove Drive Link (see step 2). Place right-angle tip of dental tool in hole in Solenoid bracket. Push in slightly to release spring detent finger.

b. While depressing detent finger, push up on Solenoid to slide it out of its bracket. Keep finger over base of Solenoid to prevent loss of plunger.

CAUTION: Solenoid #2 cannot be replaced individually. If Solenoid #2 is defective and must be replaced, you must also replace the Baseblock Assembly. The reason for this is that there are two tabs on the Baseblock which are destroyed if you remove Solenoid #2. Therefore, when replacing the Solenoid, you must first install a new Baseblock which has these tabs intact.

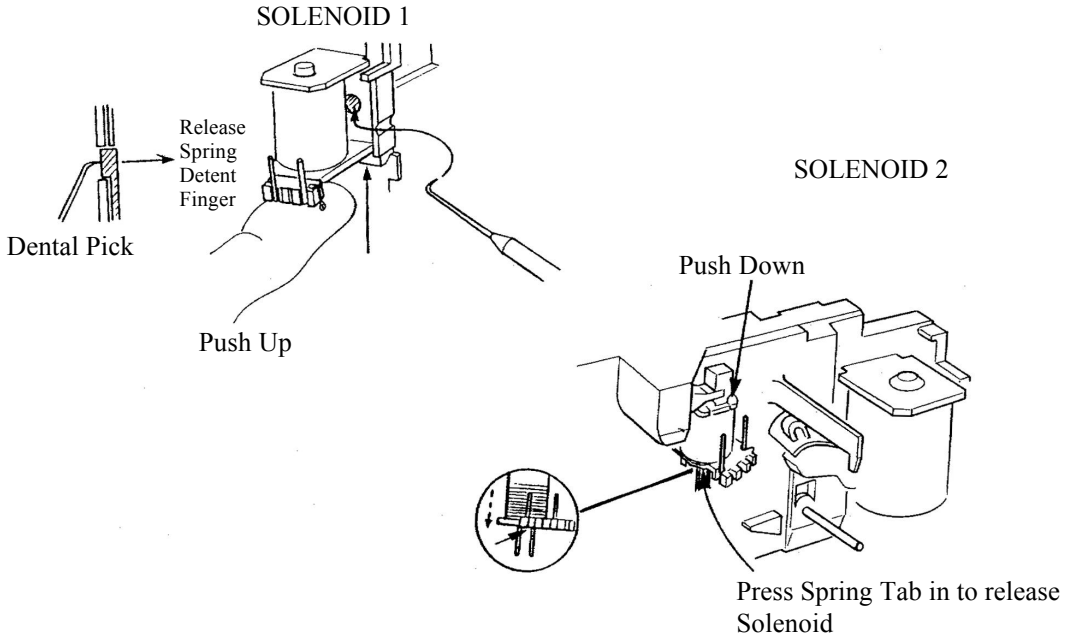


Figure 4-22 Removing Solenoids 1 & 2 from Baseblock

20A. INSTALLING SOLENOIDS 1 AND 2

CAUTION: SOLENOID #2 CANNOT BE REPLACED INDIVIDUALLY. If Solenoid #2 is defective and requires replacement, you must first replace the Baseblock assembly. There are two tabs on the Baseblock which are destroyed if you remove Solenoid #2. Therefore, if you must replace Solenoid #2, you must first install a new Baseblock which has these tabs intact. DO NOT ATTEMPT TO GLUE THE SOLENOID ONTO A DAMAGED BASEBLOCK.

CAUTION: If the spring tab breaks when installing Solenoid #1, you must replace the Baseblock. DO NOT ATTEMPT TO GLUE THE SOLENOID INTO POSITION IF THE LOCKING SPRING TAB BREAKS.

a. When installing Solenoid #1, trap the drive link in the Solenoid plunger and then slide the Solenoid into its mounting channel on the Baseblock until the spring tab on the Baseblock locks into the hole in the Solenoid bracket.

b. When installing Solenoid #2, first replace the Baseblock. Then guide the Solenoid into its mounting channel carefully to prevent damaging the spring tab on the Baseblock. Slide the Solenoid into position, locking the spring tab on the Baseblock into the hole in the Solenoid frame.

21. REMOVING DRIVE LINK

(Parts which must be removed before doing this procedure: All Covers, Shutter Assembly as a unit)

a. Press down edge of Baseblock next to Encoder LED to allow room for LED removal. Note position of Encoder wires: on reassembly, they must be positioned as they were originally free of Drive Link and Shutter Blades. Remove LED.

b. Insert small screwdriver in square hole at base of Drive Link. Push in slightly to release locking tab on Baseblock. Pry up slightly to remove Drive Link.

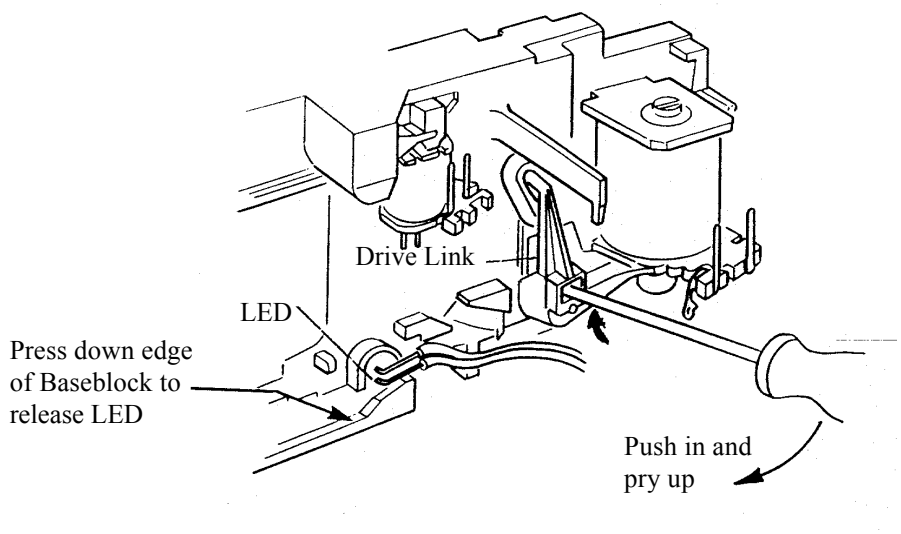


Figure 4-23 Removing Drive Link from Baseblock

22. REMOVING ERECTING LINKAGE

(Parts which must be removed before doing this procedure: All Covers, Flapper Door, Shutter Assembly, see Step 18)

NOTE: THIS PROCEDURE IS DONE MOST EASILY AND QUICKLY WITH CAMERA MOUNTED ON WORK SUPPORT FIXTURE P/N 13123.

a. With Cone facing you and right side up, use needlenose pliers to remove pivot pin from lower right side of Lower Erecting Link.

b. Grasp Upper Erecting Link as shown in Figure 4-24. Push left sideplate of Cone outward to free pivot socket from pivot pin on Cone.

c. Continue spreading left sideplate of Cone until Lower Erecting Link disengages.

d. Right side of Erecting Linkage may now be freed from Cone.

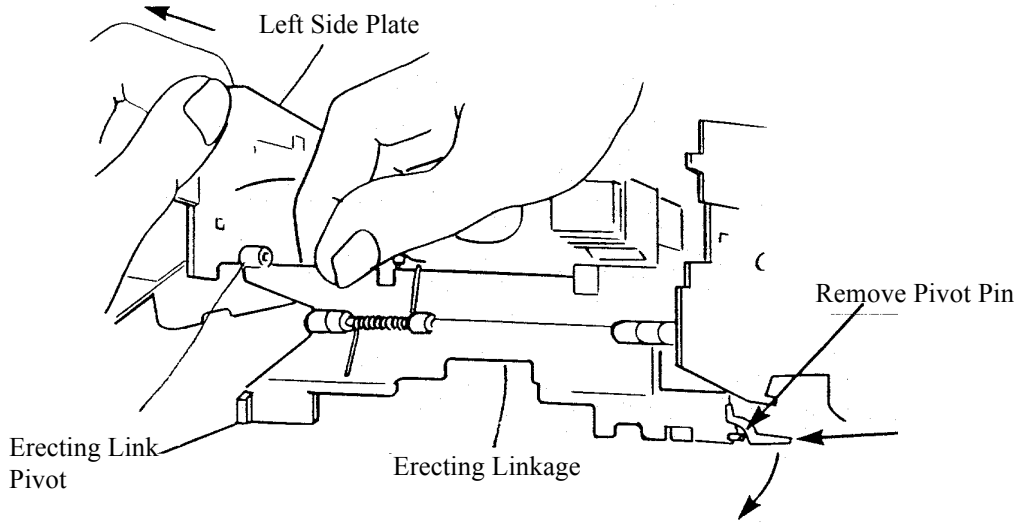


Figure 4-24 Removing Erecting Linkage from Main Frame

23. REMOVING ERECT BUTTON LATCH

(Parts which must be removed before doing this procedure: All Covers)

a. First remove Erect Spring by unhooking it from Cone then gently prying it out from the two retainers on the Main Frame (see Figure 4-25a).

b. Unhook Erect Button Return Spring.

c. Push Erect Button Latch to rear of Main Frame,

d. With hook-end dental tool or small screwdriver, lift up tab in bottom of cavity so that it clears and slides past the shoulder when Latch is pushed further to the rear (see enlargement, Figure 4-25b). When tab clears this shoulder and moves about 1/8” further to rear, Latch will be free and can be lifted out.

e. Remove Link Break.

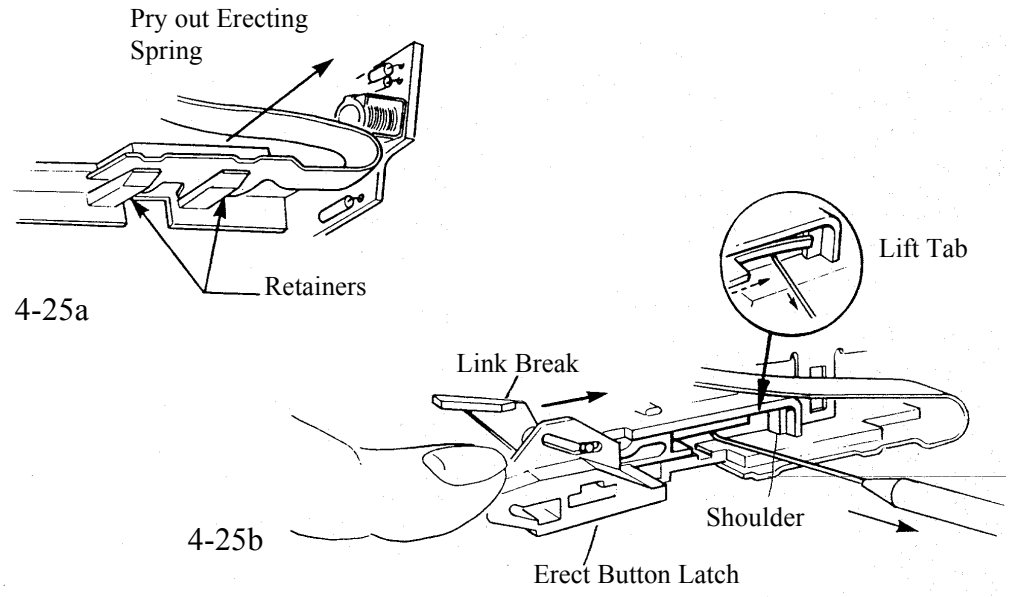


Figure 4-25 Removing Erect Spring, Button Latch & Link Break

24. REMOVING BELLOWS (BOOT)

(Parts which must be removed before doing this procedure: All Covers, Erecting Linkage, Erect Button Latch, Shutter Assembly., Features Flex, Strobe Board and Ranging Board. Place Strobe Board, Ranging Board & Exposure Flex aside)

a. With greenstick or screwdriver, unsnap the two metal tabs on Lower Bellows Retainer.

b. Pull Bellows toward you slightly to free the opposite side.

c. Remove Cone from Main Frame pivot posts.

d. Remove Bellows Retainer by inserting narrow blade screwdriver in each of five tab slots. Lift and release each tab on Bellows Retainer from wedge-shaped boss on inside of Cone, by moving blade as shown in enlarged view in Figure 4-26.

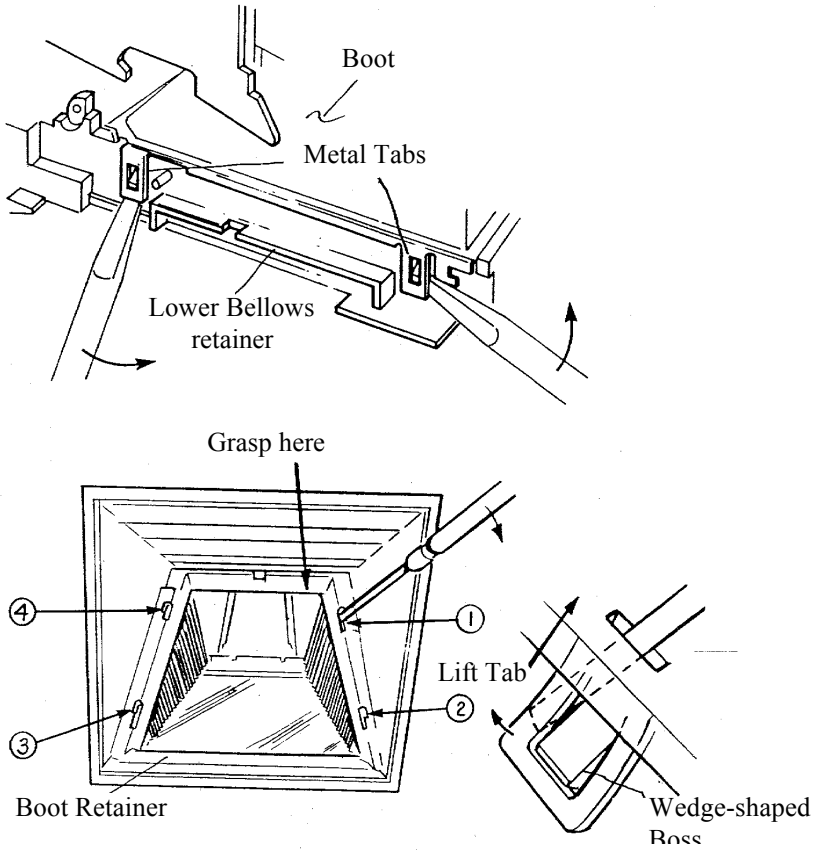


Figure 4-26 Removing Bellows (boot)

25. REMOVING VIEWFINDER ASSEMBLY

(Parts which must be removed before doing this procedure: All Covers, Erecting Linkage, Erect Button Latch, Shutter Assembly., Features Flex, Strobe Board and Ranging Board)

NOTE: THIS PROCEDURE IS DONE MOST EASILY AND QUICKLY WITH CAMERA MOUNTED ON WORK SUPPORT FIXTURE #13123.

a. Disconnect Cone from Main Frame.

b. With front of Camera facing away from you and looking down on it, press down with greenstick at point near top of X-shaped ribs shown in Figure 4-27 to release tab. Viewfinder will slide forward (toward front of camera).

c. Carefully pry out left side of Cone slightly.

d. With left side of Cone out, gently rotate the long axis of the Viewfinder Assembly counterclockwise, down and out of Cone.

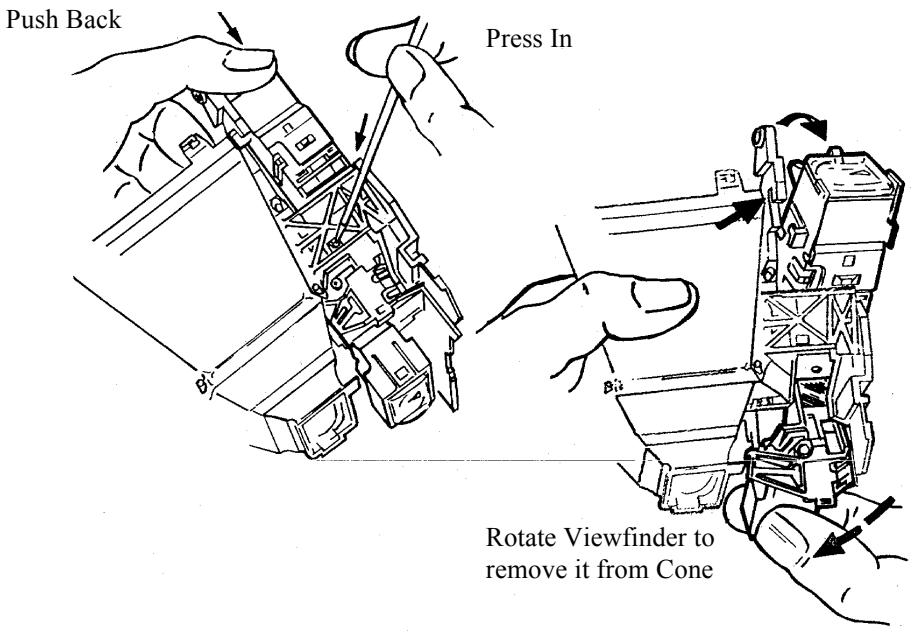


Figure 4-27 Removing Viewfinder Assembly

25A. VIEWFINDER REASSEMBLY

a. Start with the tab near the sighting end of the Viewfinder (V/F) Assembly.

b. Position V/F Assembly at an angle (see Figure 4-28) so that tab clears the pivot arm of the Cone.

c. Lift front of V/F Assembly until it is in a horizontal position and slide it back into place.

NOTE: THE VIEWFINDER MUST BE CHECKED FOR PROPER FRAMING AFTER IT HAS BEEN INSTALLED IN THE CAMERA. REFER TO THE TESTING AND ADJUSTMENTS SECTION.

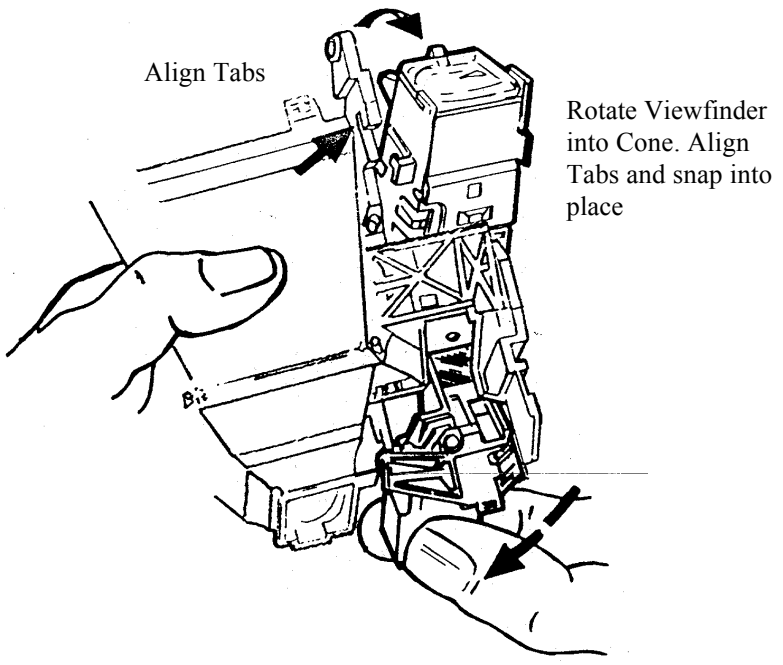


Figure 4-28 Installing Viewfinder Assembly

26. REPLACING A DEFECTIVE MIRROR

(Parts which must be removed. before doing this procedure: All Covers)

NOTE: THIS PROCEDURE IS DONE MOST EASILY WITH THE CAMERA MOUNTED ON WORK SUPPORT FIXTURE #13123.

a. Remove the Strobe Board Retainer.

b. Remove the S10/S1 Switch Assembly.

c. Disconnect the Flex Assembly from connector J3 on the Strobe Board.

d. Lift the Strobe Board and move it aside as shown.

e. Disconnect the Flex at the following points:

Release the Photocell Retainer
Release the Encoder wires from J13
Disconnect the Flex from Solenoid #1
Disconnect the Flex from Solenoid #2

f. Carefully lift the Flex Assembly and bend it back as shown in Figure 4-29.

g. Peel off and discard the adhesive-backed Light Seal from the Cone Cover and Cone Assembly.

h. Remove and discard the damaged Mirror.

   CAUTION: YOU MUST WEAR GLOVES WHEN HANDLING THE MIRROR. TRY TO KEEP THE WORK AREA AS CLEAN AND DUST-FREE AS POSSIBLE.

i. Install the new Mirror onto the Cone, orienting it properly. (Refer to Figure 4-29a)

j. Set the Cone Cover into position over the Cone Assembly.

k. Peel off the adhesive backing from the new Light Seal. Orient the Light Seal over the Cone Assembly, lining up the holes in the light seal with the two locating tabs at the top of the Cone. Carefully work the Light Seal into position as shown in Figure 4-29.

l. Reassemble the camera. Use care to be sure that the wiring conforms to the wiring diagrams which follow in the next section.

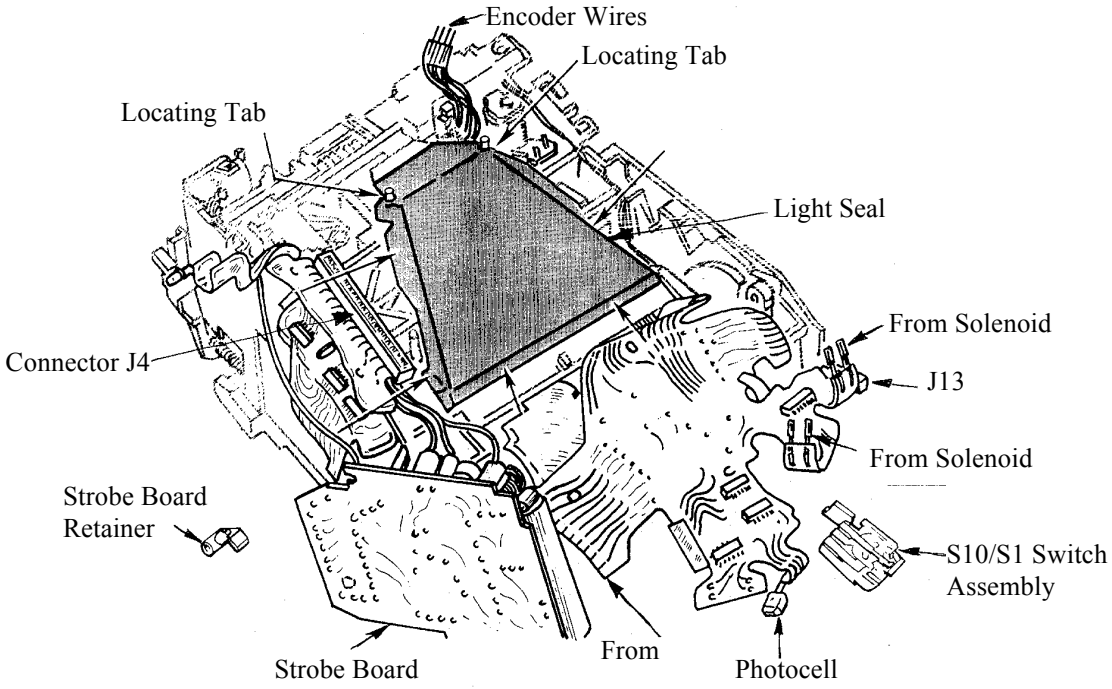


Figure 4-29 Replacing a Defective Mirror

Lightly hold pointed object against Mirror surface. If gap is seen between object and Mirror, that side of Mirror goes up, away from the film chamber. Side which shows no gap goes down, towards film chamber.

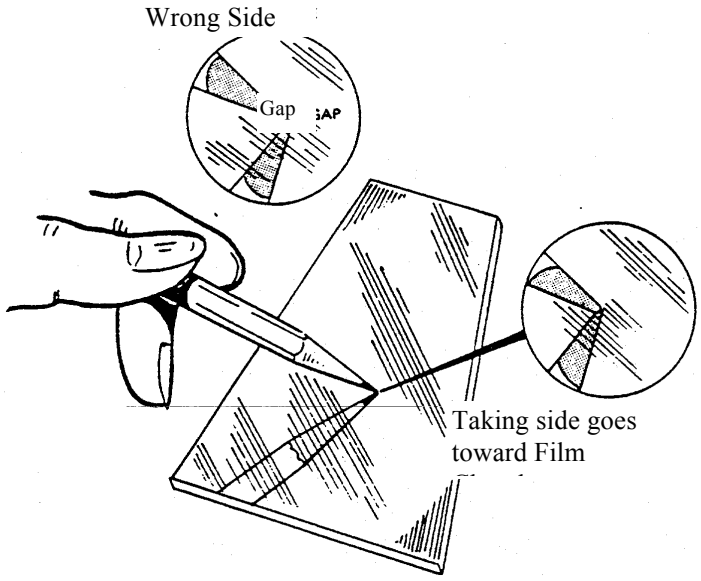


Figure 4-29a Determining Mirror Taking Side

C. WIRE ROUTING ILLUSTRATED INSTRUCTIONS

Presented on the following pages are a series of drawings which illustrate the proper routing for the various wires in the Spectra Camera. After reassembling any part of the camera which impacts wiring, be certain that the wire runs look like the wiring runs in the drawings.

Also presented in this section is an outline drawing of the exposure flex which shows the termination of all the connections.

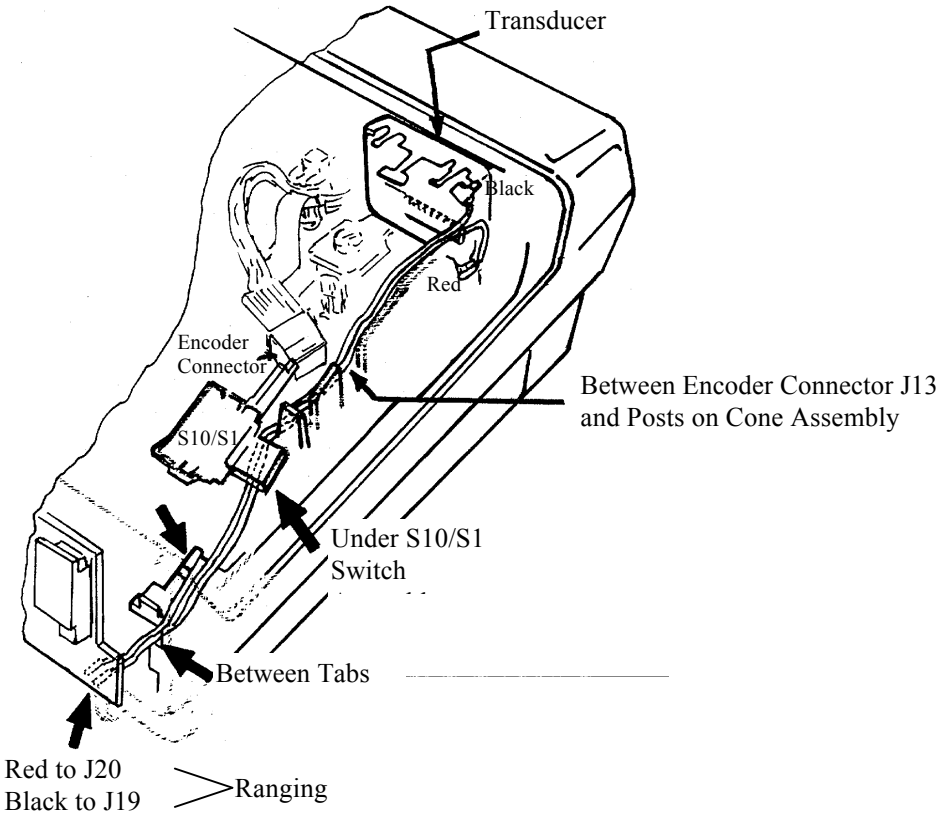


Figure 4-30 Routing Transducer Wires

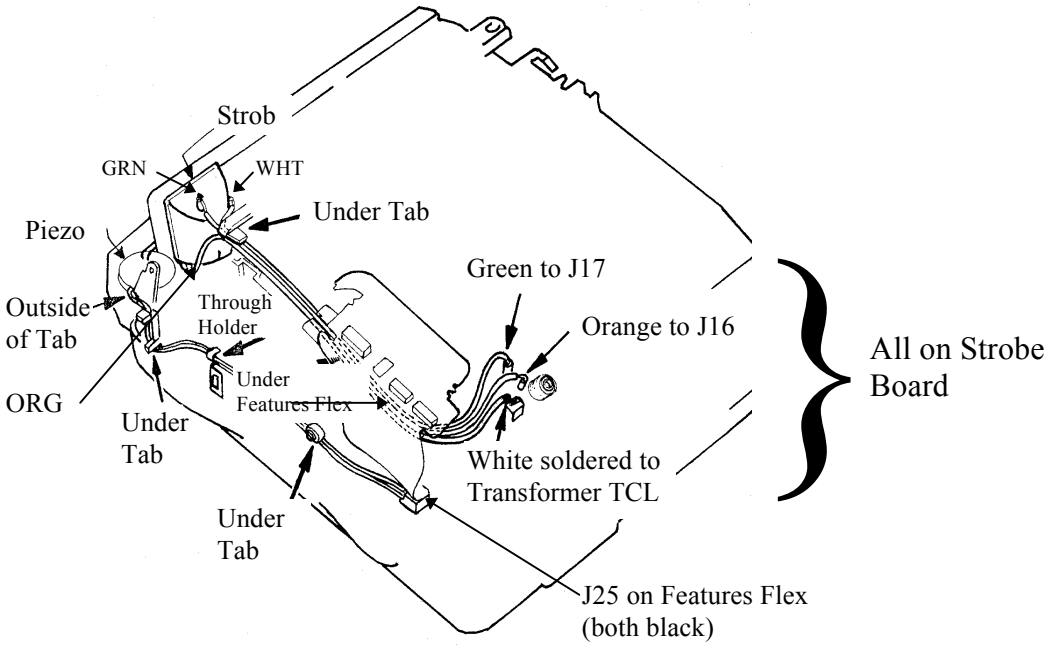


Figure 4-31 Routing Strobe Wires Routing Piezo Wires

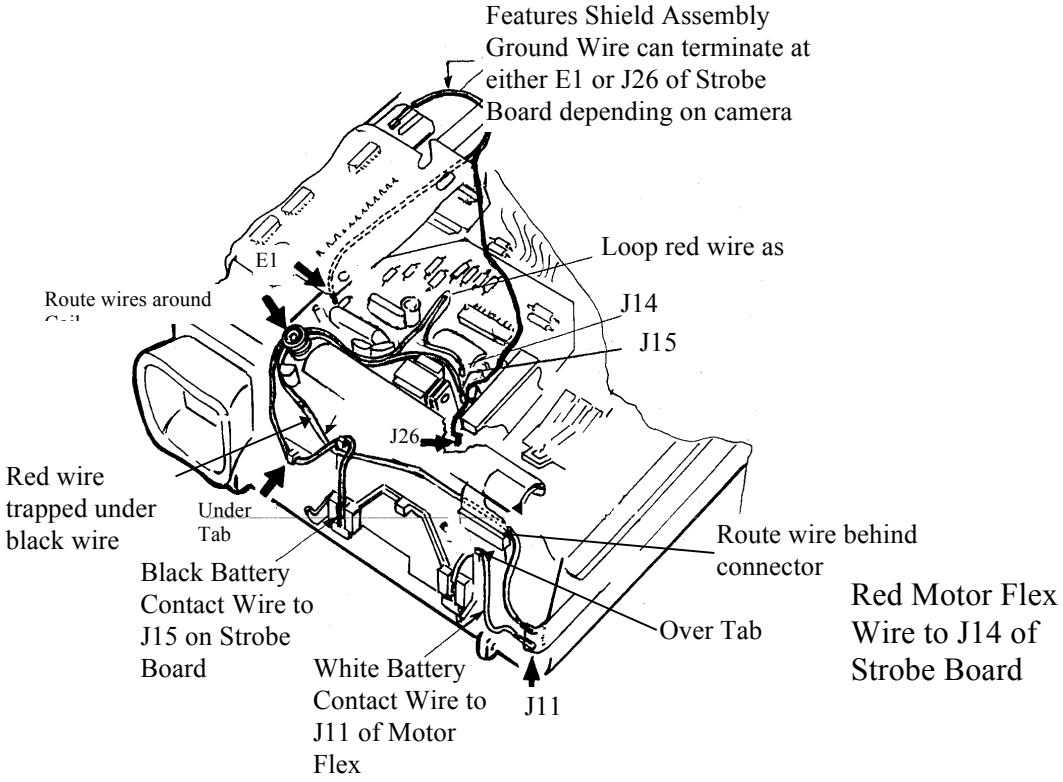


Figure 4-32 Routing Battery Contact Wires, Features Shield Wire Motor Flex Wire

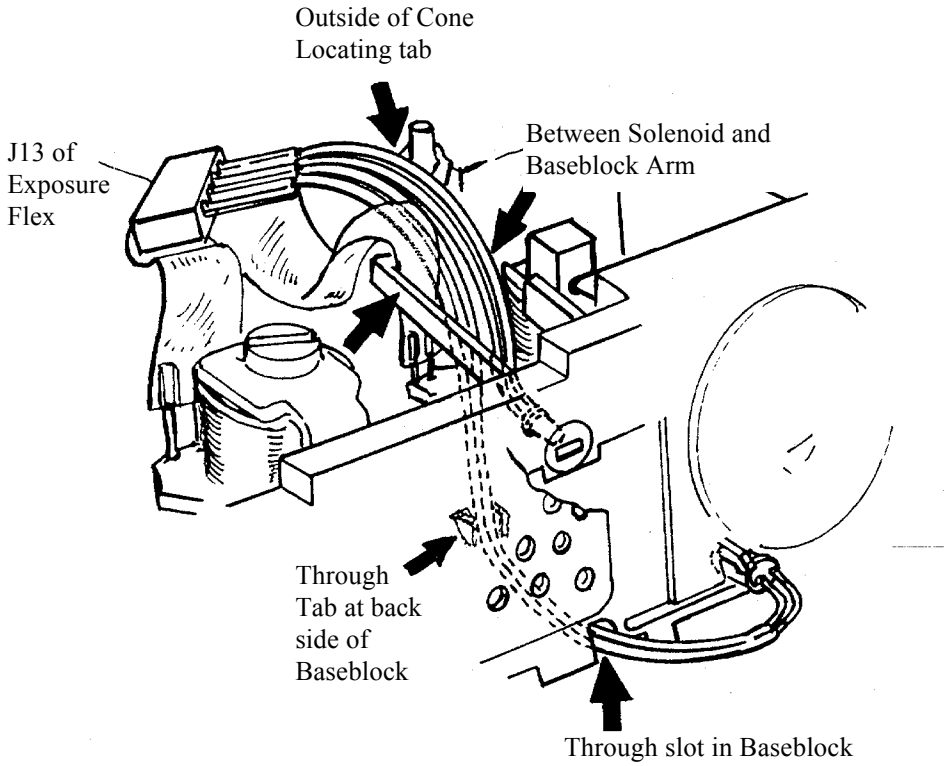


Figure 4-33 Routing Encoder Wires

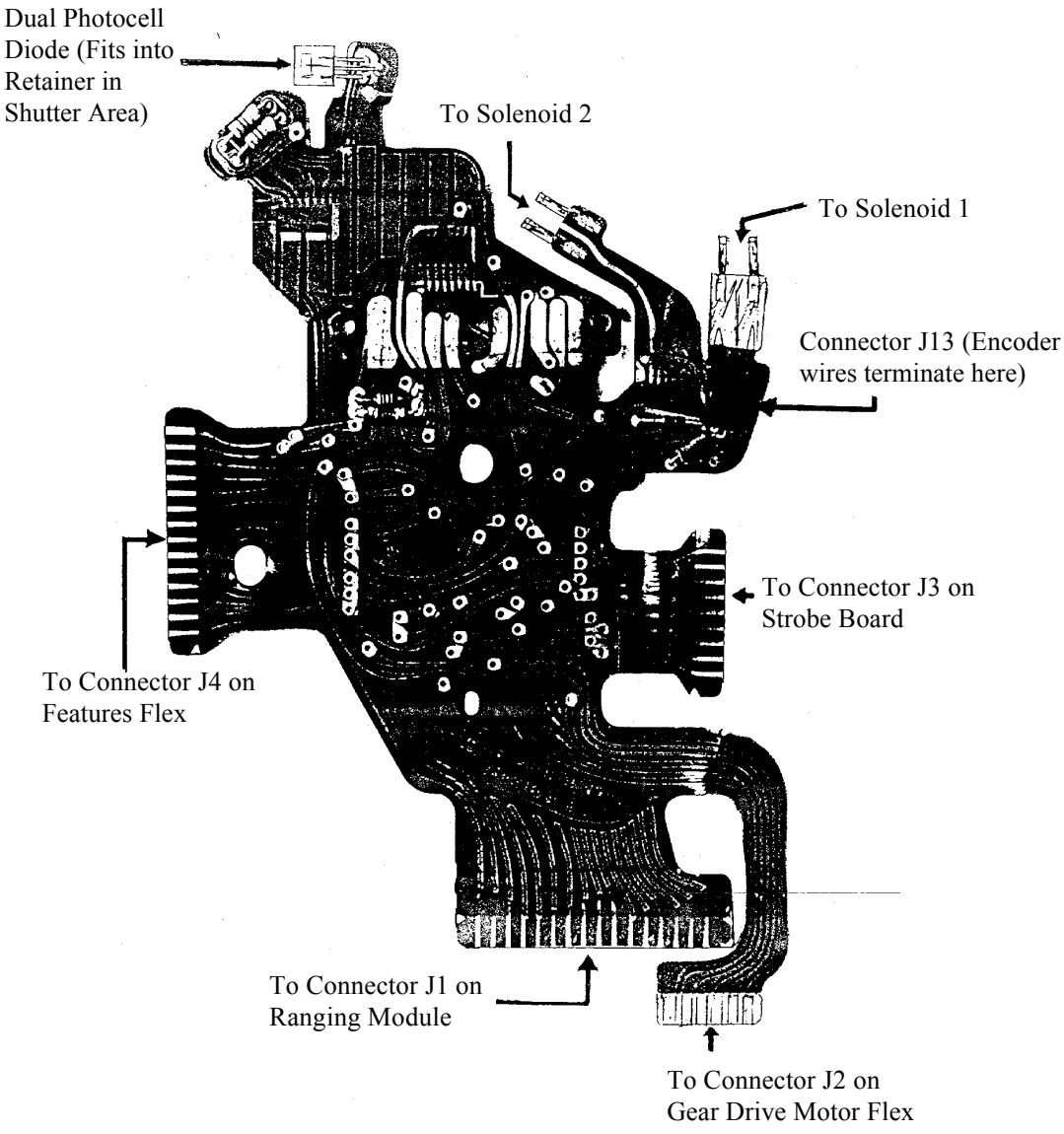


Fig. 4-34 Exposure Flex Connections