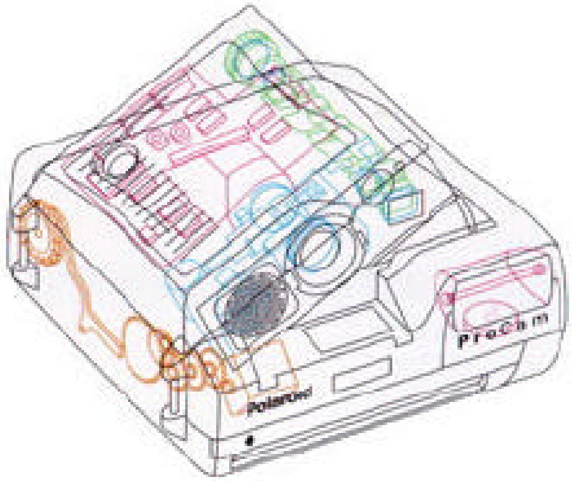
Polaroid

Repair Manual



ProCam

September 1996

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Polaroid ProCamera
Service Manual

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Purpose of this Manual

This Service Manual is intended as a training and reference guide for the Polaroid and Polaroid-authorized technical personnel servicing the Polaroid ProCam.

Organization of this Service Manual

Description & Theory of Operation. General information about camera capabilities and applications.

Aslo includes detailed explanations of various camera components and systems for help in diagnosing problems and performing other service.

Testin & Adjustments. Procedures for calibrating various camera components for solving problems detected in troubleshooting or setup after component replacement.

Parts Replacement. Step-by-step procedures for component replacement.

Schematic and Timing Diagrams. Electronic schematics for use as troubleshooting and re-assembly aids.

Other Documents Required for Service

Effective service for the Polaroid ProCam also requires familiarity with the Polaroid ProCam Parts Catalog.

1. Description & Theory of Operation

1. Description & Theory of Operation

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1. Description & Theory of Operation

This section of the service manual presents details of ProCam operation. The discussion is mainly limited to those areas which are new or unique to the ProCam.

The first part of the section is a general discussion of the new technology found in the ProCam, while the second part of the section details the interactions of ProCam parts in a sequence of operation. Next are timing and signal distribution diagrams. The final part of this section contains an engineering description of ProCam switches and signals.

It is strongly recommended that you have a background knowledge of Spectra technology before you read this section.

Unique ProCam Features

Here are the features unique to the ProCam:

- 10,000-cycle life, improved durability.
- 30 wattsecond (30 joule) strobe with 18 ft. (5.5m) range.
- Wider-angle optics: 52^{o} taking angle = 25% more subject in picture. Vertical field 43^{o}, horizontal field 52^{o}.
- Six-element f/10, 95mm focal length lens (more depth of field than Spectra).
- Date/time imprint in top left corner of picture.
- Full flash, 50/50, or fill flash strobe exposure.
- Accessory close-up lens focuses to 12" (305mm).

General ProCam Features

SPAR Thyristor Strobe

The ProCam strobe is a compact, highly efficient system. The flashtube is contained in a shock-resistant housing which occupies the right corner of the camera face (Figure 1-1). It is electrically connected to the Strobe PC Board Assembly located on the side of the Cone Assembly. This Board contains all the electronic components which are responsible for translating ProCam command signals into functions such as strobe charge, strobe fire, strobe quench, etc. A connector on this board ties the strobe electronics to the rest of the ProCam electronics. The Strobe Ready Lights (red - charging; green - ready to fire) are mounted on the interface PC board which is directly behind the system Control Panel at the rear of the ProCam.

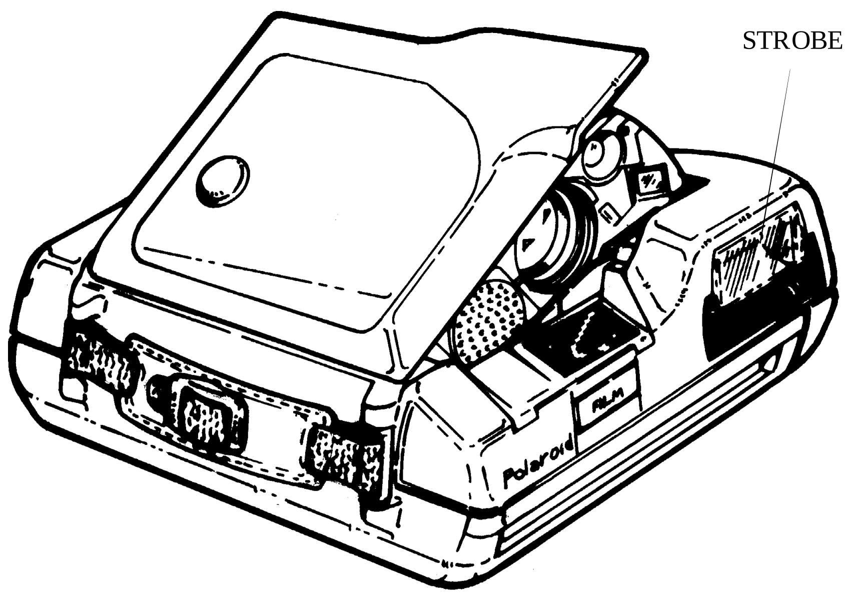


Figure 1-1. ProCam

The ProCam strobe system operates identically to the Spectra system strobe and uses many of the same components. ProCam has a SPAR Thyristor strobe (SPAR means Strobe Preferred Automatic Recharge). While the maximum charge time for the strobe is eight seconds, typically for reasons described below the charge time is much faster.

Like Spectra, the ProCam strobe features quenching with photocell light measurement to determine when to shut down the strobe, as well as variable strobe fire apertures. As in the Spectra system, when the strobe is directed to fire at less than full output, the thyristor circuit (TH1 and TH2) stops the discharge of energy from the strobe storage capacitor (C8). Instead of being dissipated, the energy remains stored and is saved for the next strobe fire. Thus during the recharge cycle, only the difference between the stored amount of energy and the full value of the strobe storage capacitor must be generated.

To reduce the recharge time even further, the ProCam strobe incorporates another feature called **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 strobe 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

Table 1-1 lists and describes the ProCam specifications.

Table 1-1. ProCam specifications

Specification	Description
Strobe range	1.5 to 18 feet (0.46 to 5.5m)
Charge Time	Maximum of 8 seconds
Stored Energy	30 wattseconds
Light Output	Maximum - 750 BCPS Nominal - 600 BCPS Minimum- 460 BCPS
Strobe Duration	1/666 to 1/20,000 sec.
Strobe Preferred Automatic Recharge - Charges or tops off when:	Camera is erected; new film is loaded and door closed; flash override switch is turned off; S1 is partially pressed; film frame is processed.

USE FOLDOUT

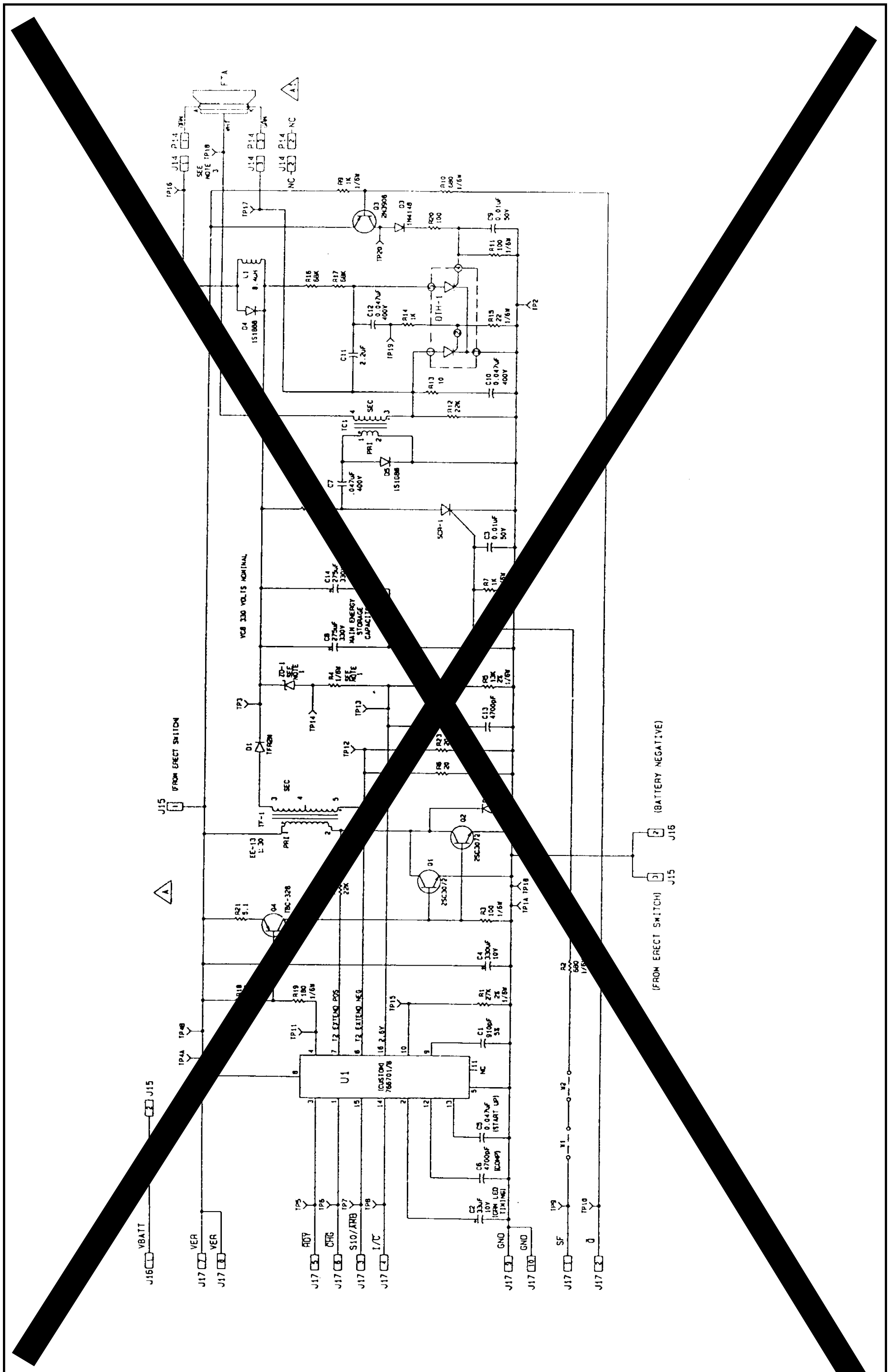


Figure 1-2. Schematic of ProCam Strobe

Viewfinder

The Viewfinder (Figure 1-3) in the ProCam is an erecting, telescopic, straight viewfinder. It is a self-contained assembly which may be removed from the ProCam in one piece. The entire viewfinder assembly moves with the cone as the ProCam is folded and unfolded; the eyepiece (turret) folds separately when the ProCam is closed.

The image presented in the eyepiece is within the confines of a sharp black border. This black border clearly frames the subject matter to assure capture of the desired subject matter. Additionally, the image is well-defined and distinct.

Even with these new features, the viewfinder is smaller than viewfinders used in previous camera models. The size reduction was necessary because of packaging constraints created by the size of the ProCam.

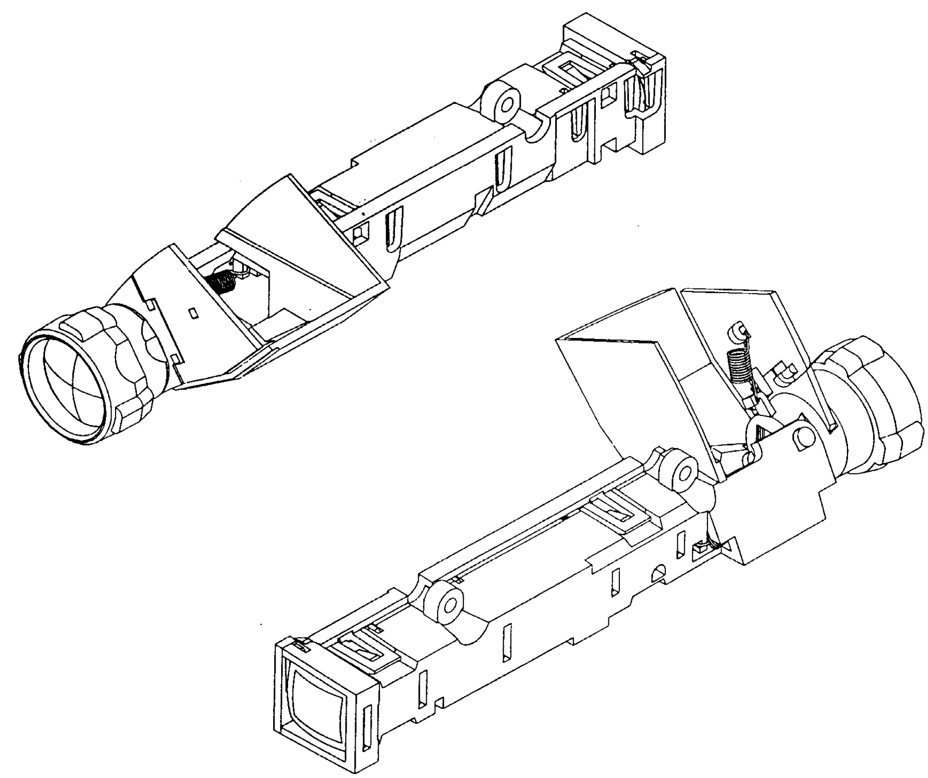


Figure 1-3. ProCam Camera Viewfinder Assembly

Figure 1-4 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 a black border which define the image and clearly show the extent of the image which will be captured on the film frame, and a plastic wedge which aligns the image relative to the eyepiece.

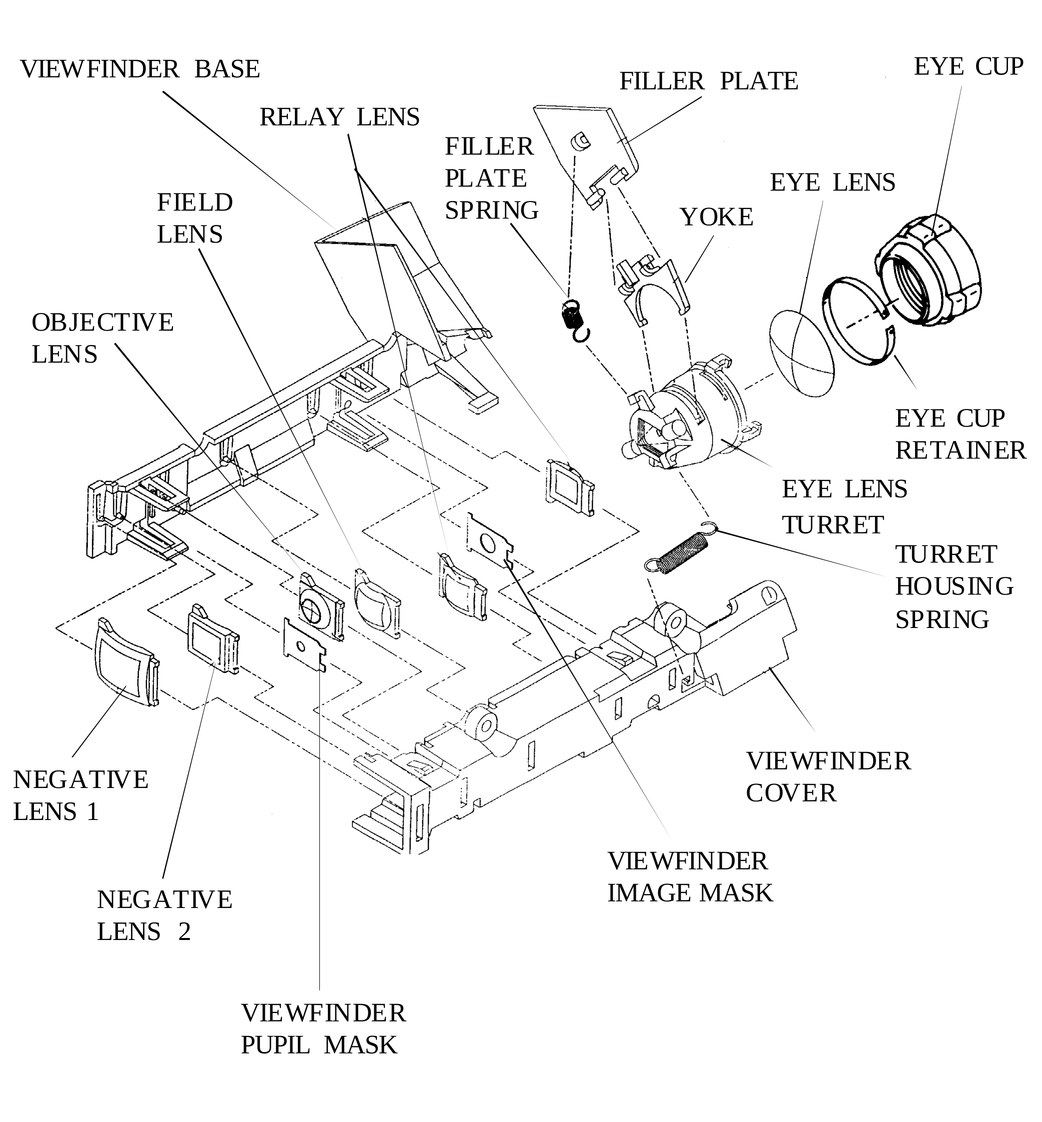


Figure 1-4. Viewfinder Components

Out -of -Film Audible Signal

After the tenth picture is processed, a three (3) second out-of-film chime will sound. If the empty film pack is left in the ProCam and the Shutter Release Button is pressed to the first stage, the chime will be repeated.

If the Shutter Release Button is pressed through to the second stage, it will go through a cycle and the chime will be repeated. Also, if the ProCam is closed and then opened, the chime will be repeated.

Quintic Lens System

The ProCam Quintic lens system has a rotating Quintic containing 10 zones of differing optical value, between Front and Rear Lens Assemblies (Figure 1-5, right side). The Quintic lens rotates until one of its segments (determined by ranging information from the transducer) is aligned behind the Front Lens Assembly. The combination of the lenses provides the proper focus for one of 10 zones, between 18" (0.47m) and infinity.

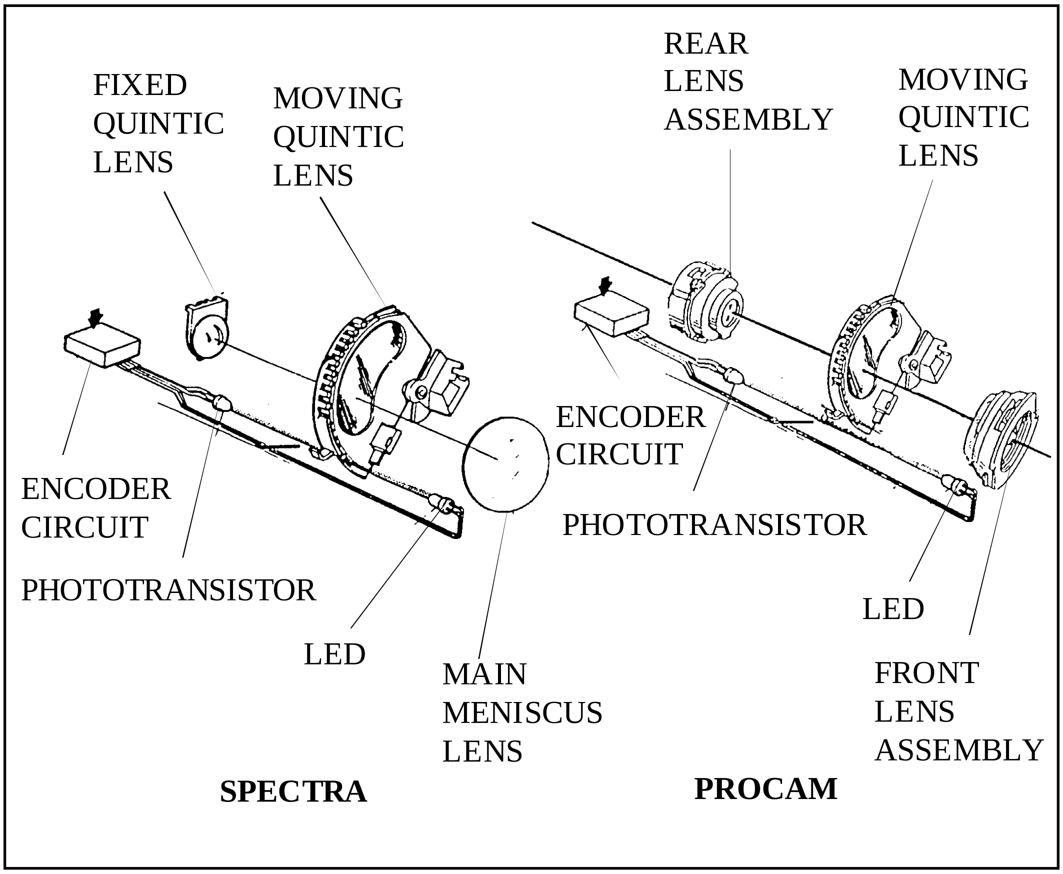


Figure 1-5. Comparison of Spectra and ProCam Quintic Lens Systems

ProCam focussing borrows from methods used in earlier Polaroid cameras. However, it goes well beyond matching lenses and is a unique technological achievement in camera optics. At the heart of the ProCam focus operation is the Quintic aspheric lens system. Figure 1-6 shows the difference between spherical and aspherical lenses.

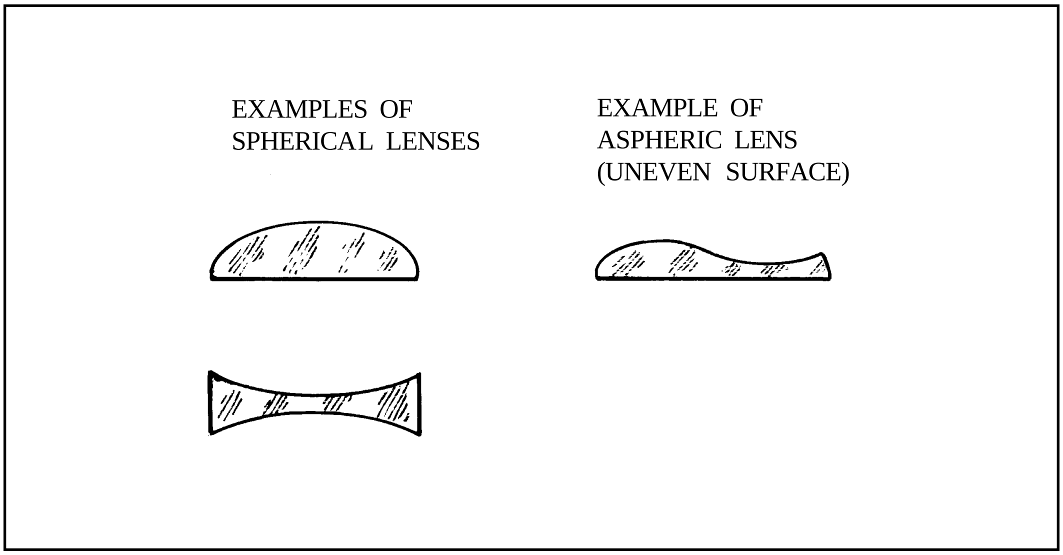


Figure 1-6. Comparison of Spherical and Aspherical lenses

To understand how the ProCam lenses work, you should first know about the characteristics of aspheric lenses. Figure 1-7 shows in simplified form the relationship between two aspheric lenses. In this representation you can see that by changing the position of the two lenses relative to each other, this theoretical lens system could focus on subjects between the extremes of two feet and infinity.

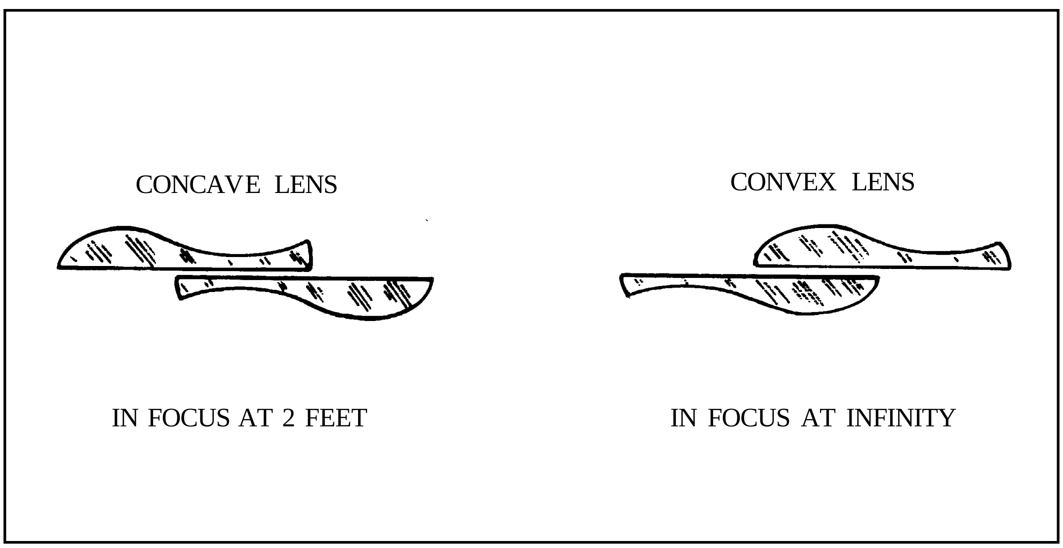


Figure 1-7. Interaction of Aspheric Lenses

Essentially, the ProCam system relies on the optical results of changing its Quintic aspheric lenses. Because of the way the aspheric lenses are shaped, the system can create ten (10) different zones.

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.

Figure 1-8 shows the components of the ProCam Quintic lens system. It is a six element, 95mm lens system. The front assembly contains two fixed lenses, one spheric and one aspheric. The rear assembly contains three fixed lenses, one spheric and two aspheric. The middle element, called the **Quintic sector**, pivots in an arc through the optical path of light leaving the front lens assembly. It is this movement of the Quintic sector that results in the actual focusing function.

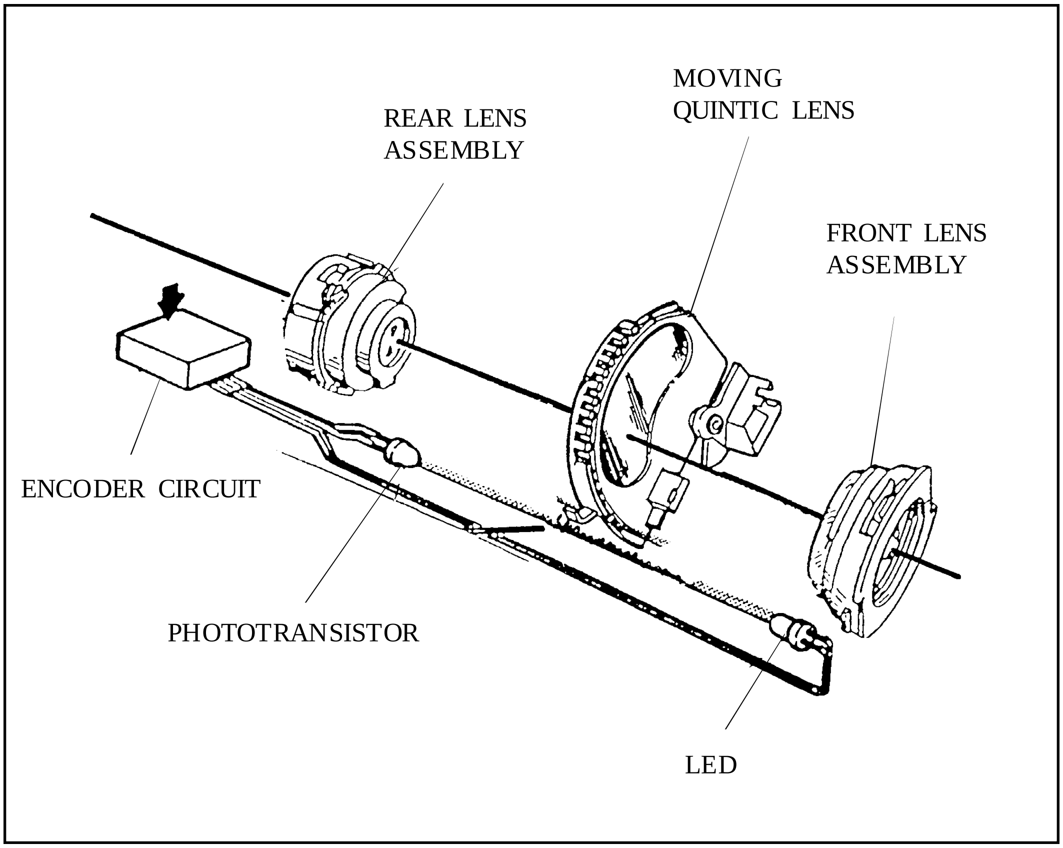


Figure 1-8. Components of ProCam Quintic Lens System

Refer to Figures 1-9 through 1-12 when reading the following description of Quintic lens operation. Also, refer to the sequence of operation portion of this section for a more detailed description of the sequence of events which move 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 is a series of teeth and cutouts in the plastic frame. On one side of the plastic frame is a LED and on the other side is a photo-transistor which detects light from the LED. These two devices are part of the encoder circuit. As the cutouts in the frame pass between these two devices, the encoder circuit counts the pulses resulting from the interruptions of the light beam between LED and photo-transistor. (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.

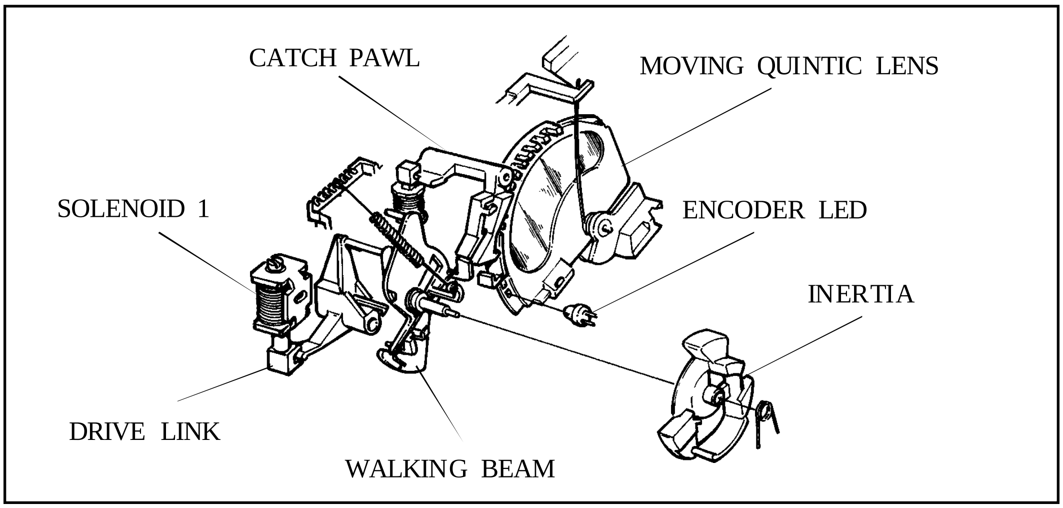


Figure 1-9. Quintic Lens System Starting Conditions

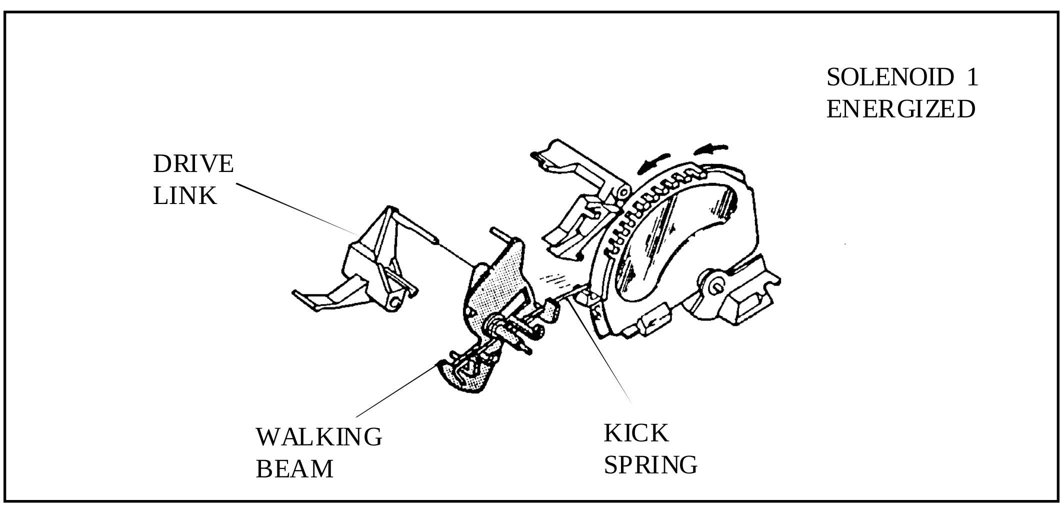


Figure 1-10. Kick Spring Starts Quintic Lens Motion

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 de-energized, 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 1 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 Pawl to engage the Walking Beam, latching it in position. Thus, when Solenoid 1 is de-energized, all the components are in the same position they were in before the exposure cycle started.

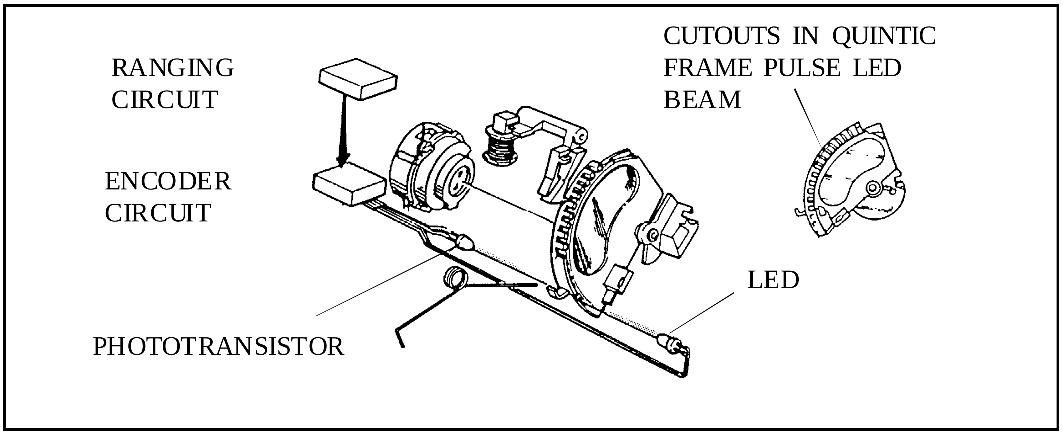


Figure 1-11. Encoder Circuit Detects LED Light Pulses

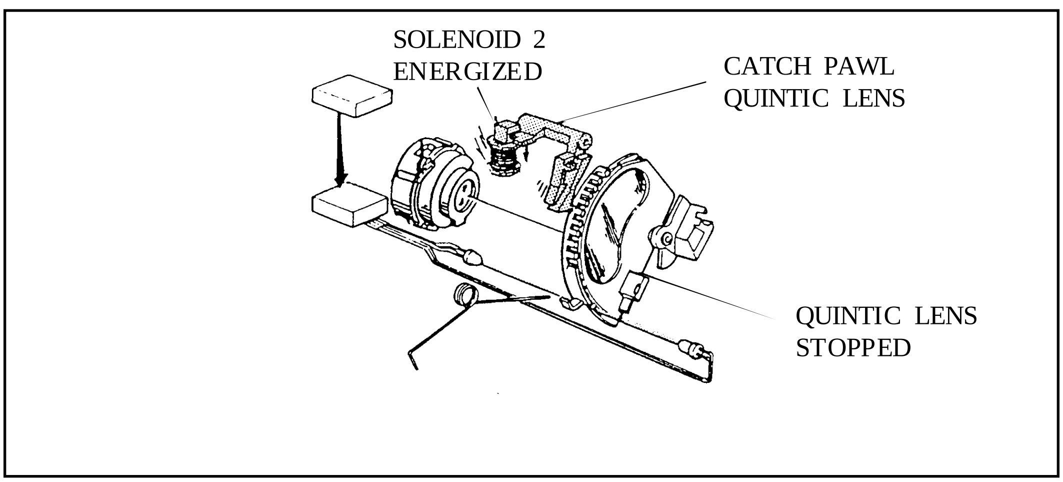


Figure 1-12. Catch Pawl Stops Quintic Lens rotation

Table 1 shows the corresponding subject distance for the ten zones of focus.

Table 1. ProCam Quintic Lens System Focus Zones

Zone	Subject Distance	
	Feet	Meters
1	19.9 - inf.	6.07 - inf.
2	9.92 -19.9	3.02 - 6.07
3	6.55 - 9.92	2.00 - 3.02
4	4.91 - 6.55	1.50 - 2.00
5	3.95 - 4.91	1.20 - 1.50
6	3.28 - 3.95	1.00 - 1.20
7	2.79 - 3.28	0.85 - 1.00
8	2.41 - 2.79	0.73 - 0.85
9	2.12 - 2.41	0.65 - 0.73
10	1.53 - 2.12	0.47 - 0.65

Exposure Control

ProCam uses the same basic exposure system as the Spectra camera. The camera controls exposure using a combination of visible and infrared light and distance measurements (Figure 1-13). The ProCam exposure system differs from Spectra in that it uses an upgraded version of the exposure IC's. These same upgraded IC's are used in the newest "One Board" Spectra cameras which have been redesigned without the exposure flex. New features present in the upgraded IC's are explained in the appropriate sections.

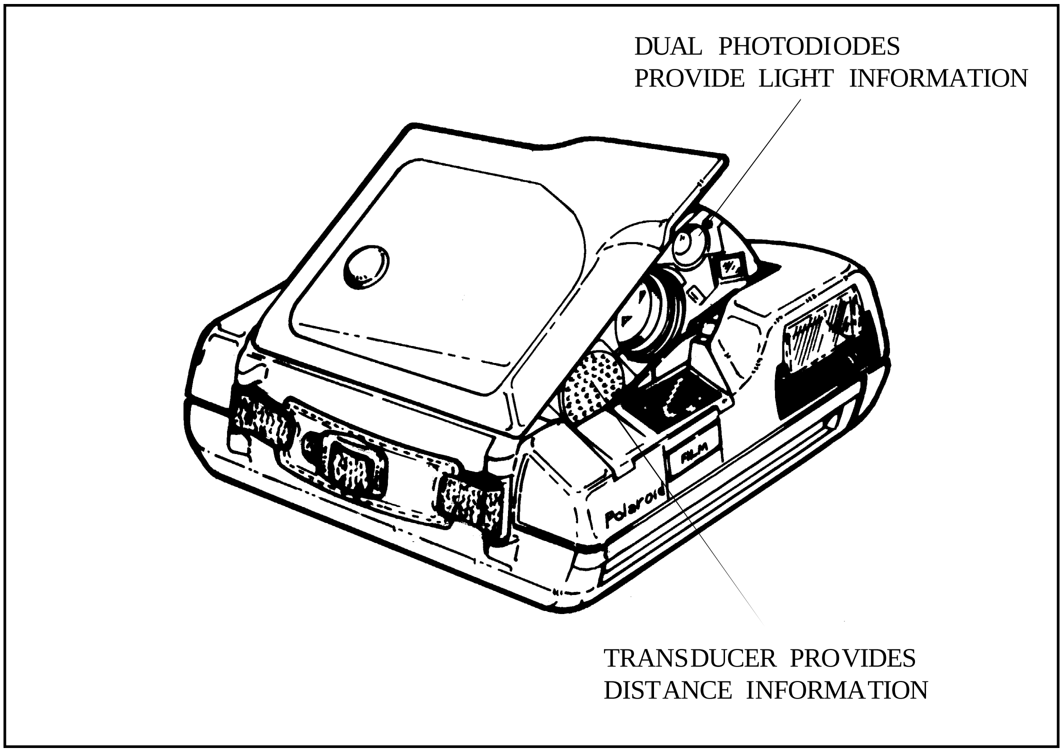


Figure 1-13. Hybrid Light and Distance Measurements

ProCam Light Measurements

As in the Spectra system, a brightness detect reading is taken by the exposure circuitry during Preview. Scene brightness is measured at this time and is categorized into:

High Brightness - above 12 cd/ft^2 or,

Low Brightness - below 12 cd/ft^2

This brightness information is used to determine strobe firing timing. A second brightness detect reading was added in the upgrade. During this second reading, the exposure system categorizes scene brightness into:

High Brightness: > 24 cd/ft^2

Mid Brightness: 8 to 24 cd/ft2

Low Brightness: < 8 cd/ft^2

The addition of this new mid-brightness mode provides a smoother transition between strobe exposures taken at different scene brightness.

High Brightness	=	Fill Flash
Mid Brightness	=	50% Flash/50% Ambient
Low Brightness	=	Full Flash

ProCam Low/Mid-Brightness Strobe Exposures

Low Brightness	=	Less than 17' time-out at 44ms or Integration
Mid Brightness	=	More than 17' time-out at 2.8 sec. or Integration

In low or mid-brightness conditions when subjects are under 17 feet from the camera (determined by the transducer), time-out 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/mid-brightness settings, exposure time-out occurs 2.8 +/- 0.3 seconds after first light, again, unless the exposure is terminated sooner by the integration of sufficient light.

Kick-Up

Another improvement to the exposure control system is Kick-Up brightness. This new exposure mode causes pictures taken in scene brightness above ~624 cd/ft^2 to be progressively overexposed.
Over exposure is accomplished by a minimum exposure time of 6.2 ms which is hand coded in the IC’s kick-up which gives exposures which are more in line with customer expectations.

First Light Detect

The first light detect takes place 25 +/- 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 1-14). This action gives the encoder circuitry one count and acts as a starting point for exposure time-outs as mentioned above.

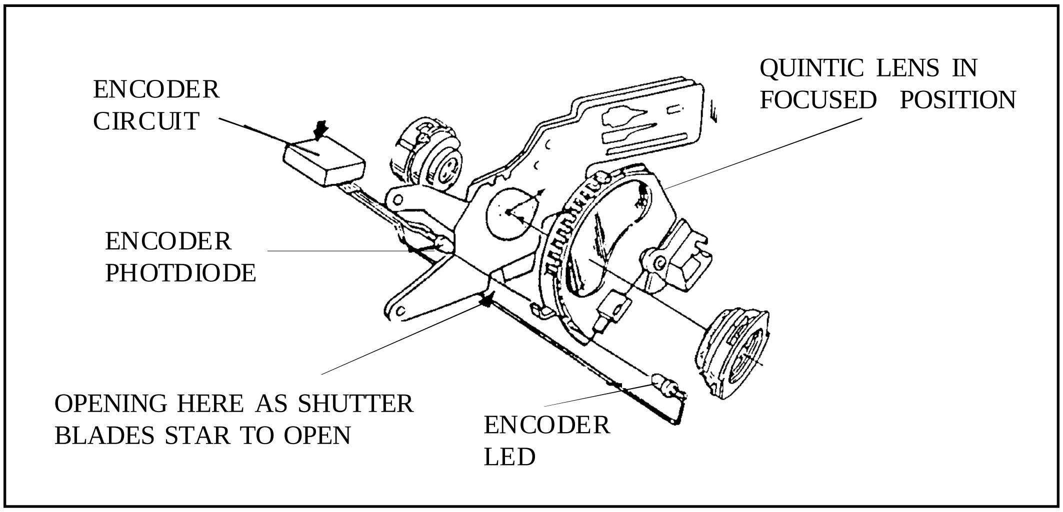


Figure 1-14. First Light Detect

Dual Photodiode

Light integration in the ProCam is determined by measurements taken through a dual photodiode (Figure 1-15).

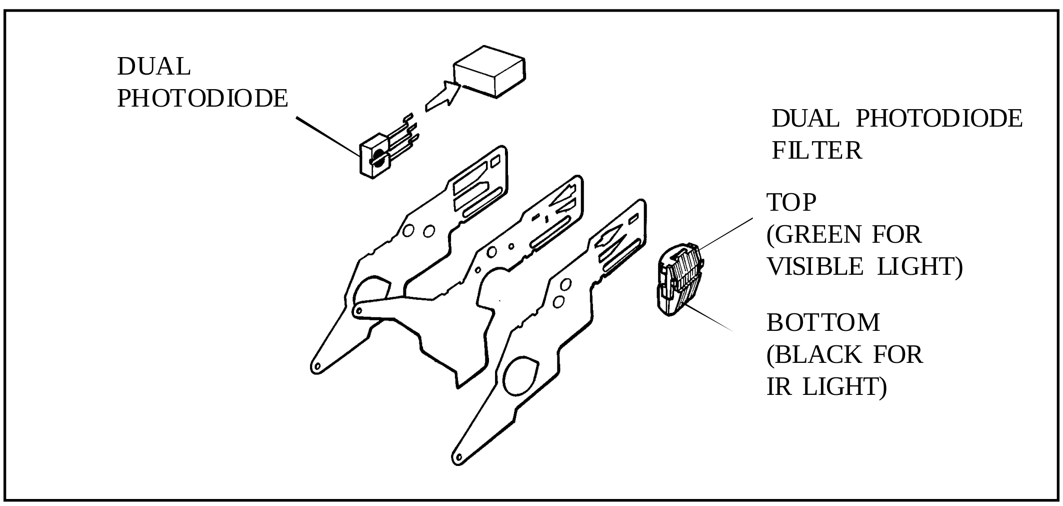


Figure 1-15. Dual Photodiode

The top half of the photodiode measures all visible light, while the bottom half measures the infrared portion of the spectrum. By utilizing a dual photodiode system, light measurements are more precise than 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).

ProCam System Autofocus

The transducer (Figure 1-16) 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. When the autofocus system is turned off, the blades open fully and the hyperfocal (infinity) lens position is chosen.

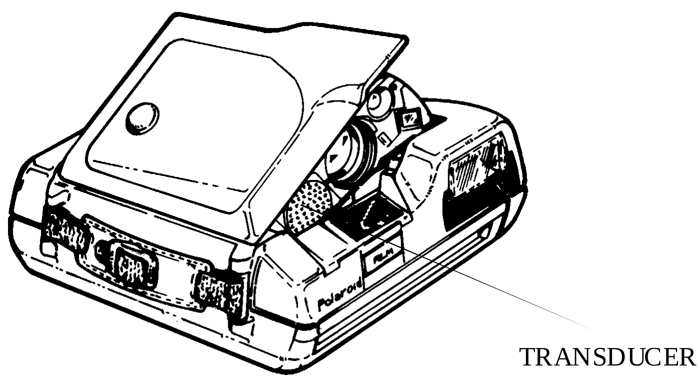


Figure 1-16. ProCam System Transducer

Electronic Trim

In previous camera models, trim has been achieved by sliding a shaded wedge over the photocell to fool it into causing longer or shorter exposures. In the ProCam system, trim is achieved electronically. Moving the Lighten/Darken Switch on the Control Panel affects the electronic circuit of the ProCam, causing exposure times to be increased or decreased by 0.65 +/- 0.25 stop. There are no gradations between fully lighten or fully darken. The change in exposure value is 0.65 +/- 0.25 stop from nominal in either direction.

Film Speed Switch

To compensate for minor differences in film speed from one pack to another, a Film Speed Switch is incorporated in the ProCam. This Switch is located in the film compartment of the ProCam and is actuated by a plastic tab (rail) on the side of the film pack (Figure 1-17).

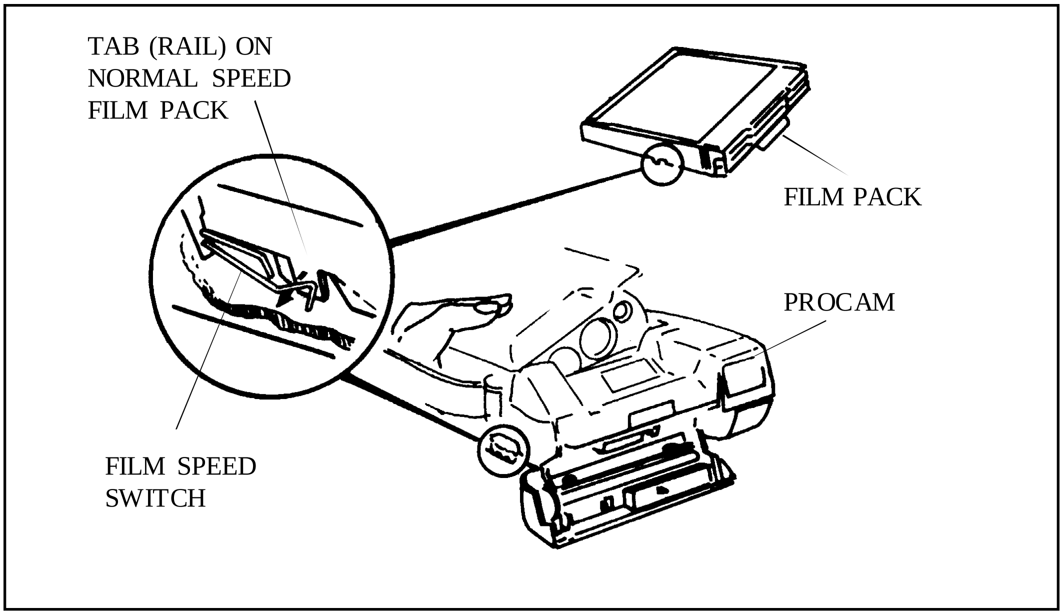


Figure 1-17. Film Speed Switch

When a pack of “normal” film is inserted into the ProCam, 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 +/- 0.15 stop to compensate for the slower film.

Camera Inhibits

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

- Strobe fire is inhibited during dark slide.
- ProCam cycling is inhibited during strobe charge.
- The strobe converter is inhibited during the ranging and processing cycles.

- Motor drive is inhibited when S10/S1 is closed; this is accomplished by holding the Shutter Button down after an exposure is made.
- ProCam cycling and Strobe charging are inhibited when the Out-of-Film chime is sounding.

Date Module

A Date Display Module in the ProCam imprints the date and/or time of day in the top left corner of the picture, using a backlit LCD. The Date Display Buttons (SET, SEL and MOD) on the Control Panel permit the user to select a Japanese, U.S. or European style date imprint; a day-time-minutes imprint; or an OFF mode (Figure 1-18).

A lithium battery with a life expectancy of about five years is provided in the ProCam, to supply back-up power to the Date Display Module.

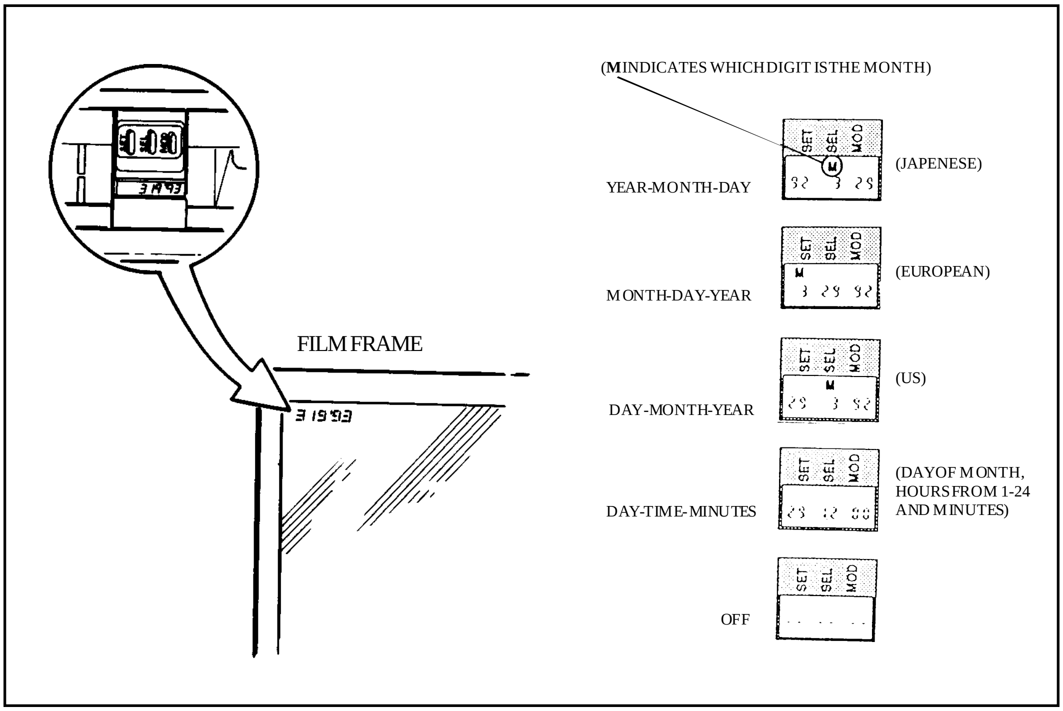


Figure 1-18. User-selectable Date and Time Imprints on ProCam Pictures

Sequence of Operation

Starting Conditions: Camera erect, Door open, No Film Pack Present

Figure 1-19 shows the Drive Assembly and Wireform Switch Block, Figure 1-22 the Erect/Door Switch Assembly, which together electromechanically control most ProCam functions. Note that the Wireform Switches are actuated by the rotation of both the Timing Gear and the Counter, while the Erect/Door Switch is actuated by ProCam erection and Door closure.

Table 2-3. Wireform Switches - Starting Condition

Switch	Function	Condition
S10/S1 (Shutter Button not shown)	Initiates strobe charging; supplies power for ranging and preview; initiates cycle.	OPEN
Erect/Door (Fig. 2-22)	Switches power to ProCam with Door closed and ProCam erected	OPEN
S9	Initiates darkslide cycle.	CLOSED
EOP	End-Of-Pack - activates End of Pack.	OPEN
EOC/S9	End-Of-Cycle - turns off Motor after darkslide chime or processing cycle.	OPEN
SPD	Film speed - opened by insertion of "normal speed" film pack; remains closed with "slow speed" film.	CLOSED

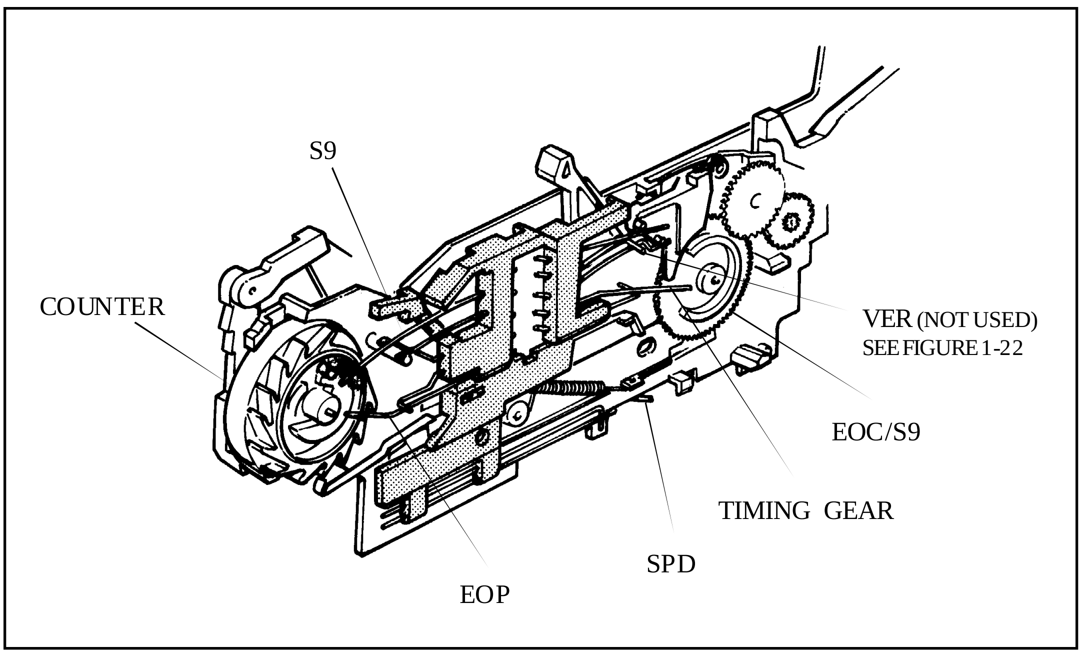


Figure 1-19. Wireform Switchblock and Drive Assembly

Film Pack Inserted and Darkslide

When the film pack is inserted, power is supplied from the battery to ProCam circuits through contacts in the film compartment. If the film speed falls within the "normal" ASA range, the pack has a projecting tab which opens the normally-closed film speed wireform switch in the film compartment (Figure 1-20). If the film speed is "slow", the tab is absent, the Switch remains closed and the exposure circuits increase all exposures by about 1/3 f/stop.

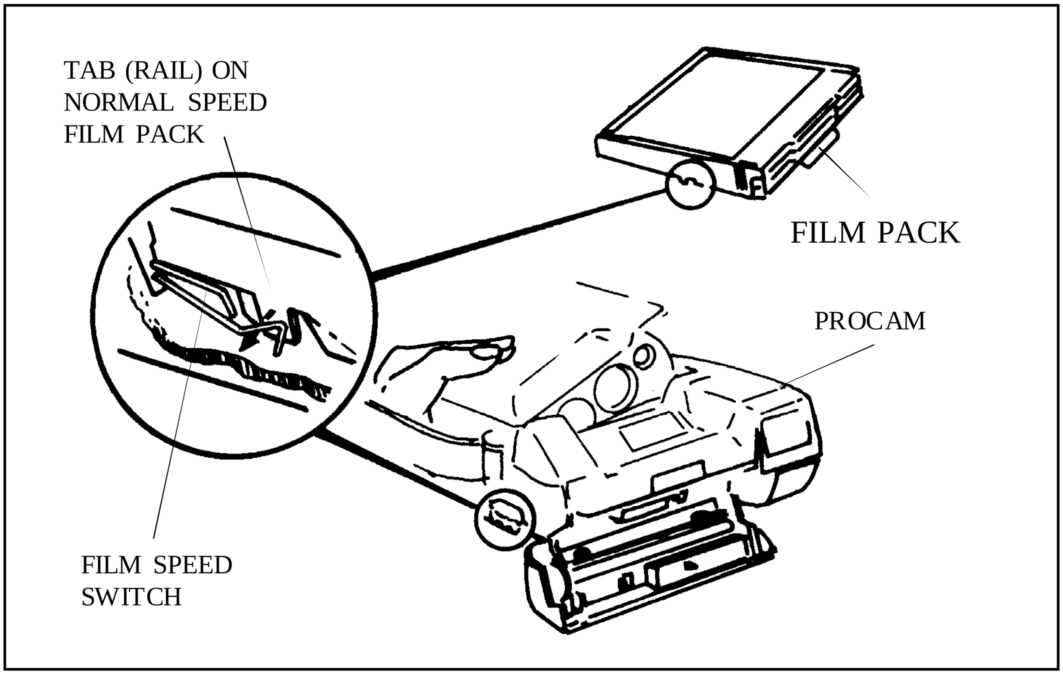


Figure 1-20. Film Speed Wireform Switch

Inserting the film pack also causes the Pack Pawl to engage the ratchet teeth of the Counter Wheel (Figure 1-21). The Pawl remains engaged until the pack is removed. It allows the Counter to turn in only one direction.

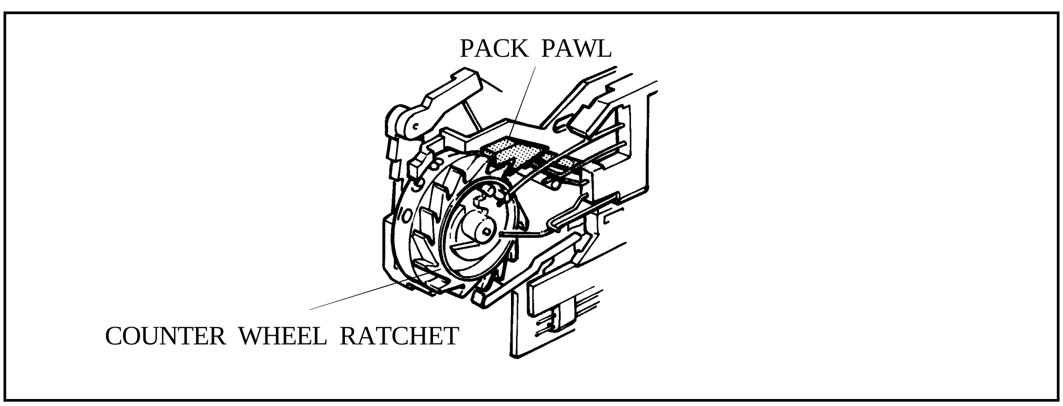
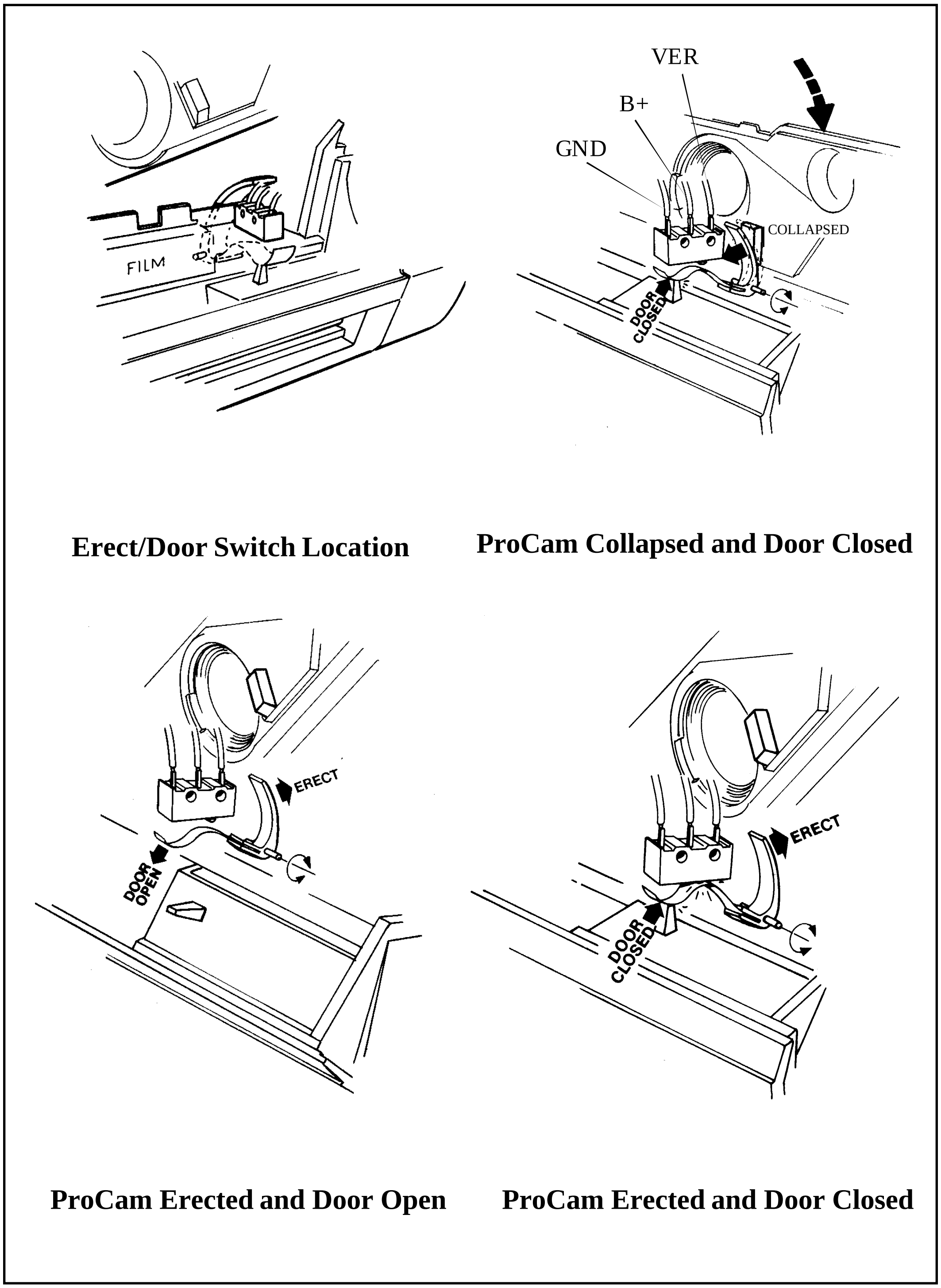


Figure 1-21. Pack Pawl Engaging Counter Wheel Ratchet

With the film pack inserted into the ProCam, the Door may now be closed and latched. This action causes the Erect/Door Switch to close, closing VER to B+ and supplying power to the ProCam electronics. Figure 1-22 shows the various stages of switch conditions.



Erect/Door Switch Location | **ProCam Collapsed and Door Closed**

ProCam Erected and Door Open | **ProCam Erected and Door Closed**

Figure 1-22. Door/Erect Switch Closure

With the Door/Erect Switch in this condition, electrical circuits are completed to all of the functions noted in Figure 1-23. The ProCam components thus receive power only when the Door is closed and latched, and the ProCam is erected.

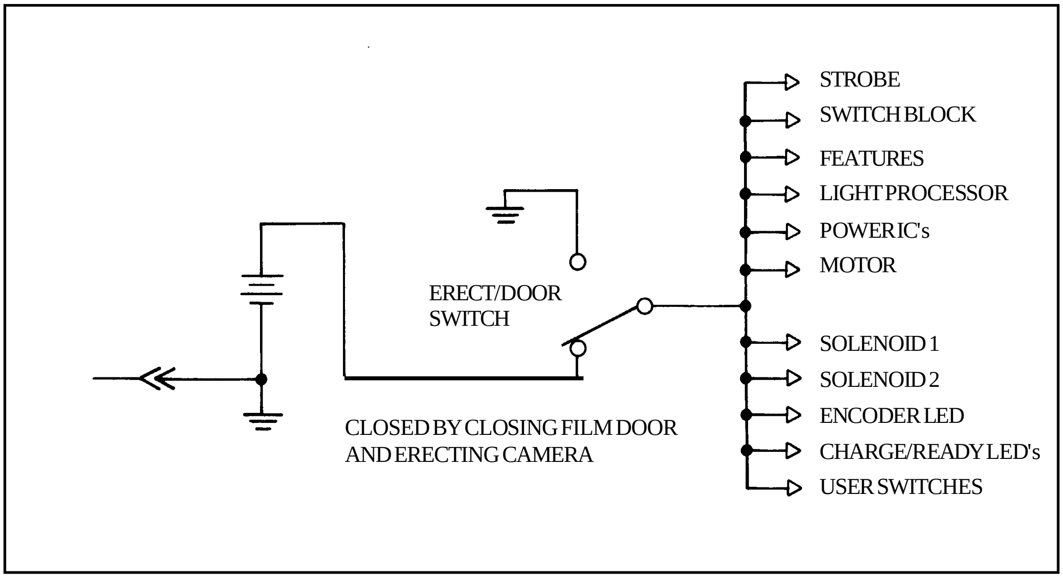


Figure 1-23. Electrical Circuits with Door Closed and Camera Erected

You will recall that Switch S9 is normally closed during the starting condition of the ProCam. Thus, when the ProCam 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 Figure 1-24A, 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 actuated by the Counter Wheel).

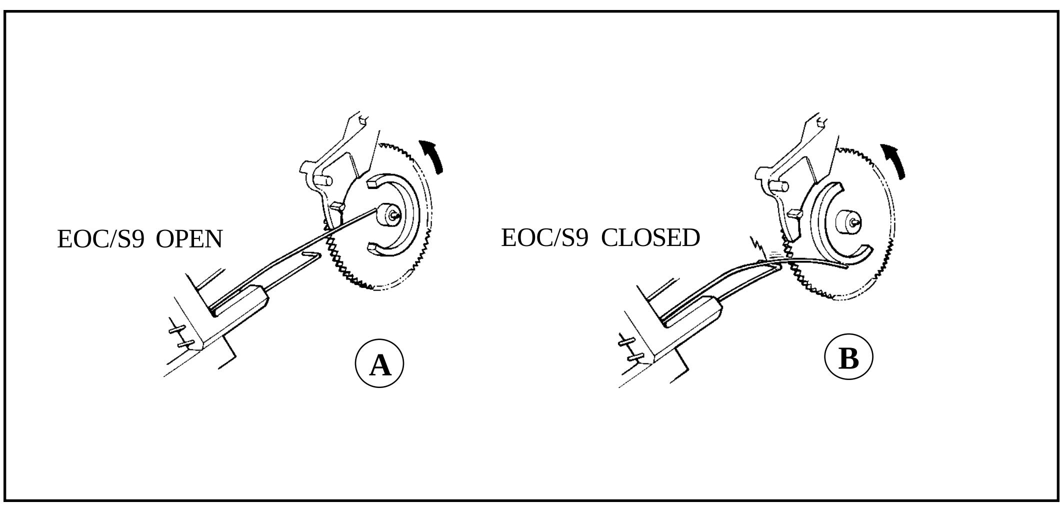


Figure 1-24. Timing Gear Closing EOC/S9

In of Figure 1-24B, the Motor drives the Timing Gear and the cam on the face of the Timing Gear forces EOC/S9 down, making contact 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 position shown in of Figure 1-24A.

Another 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 from 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 1-25).

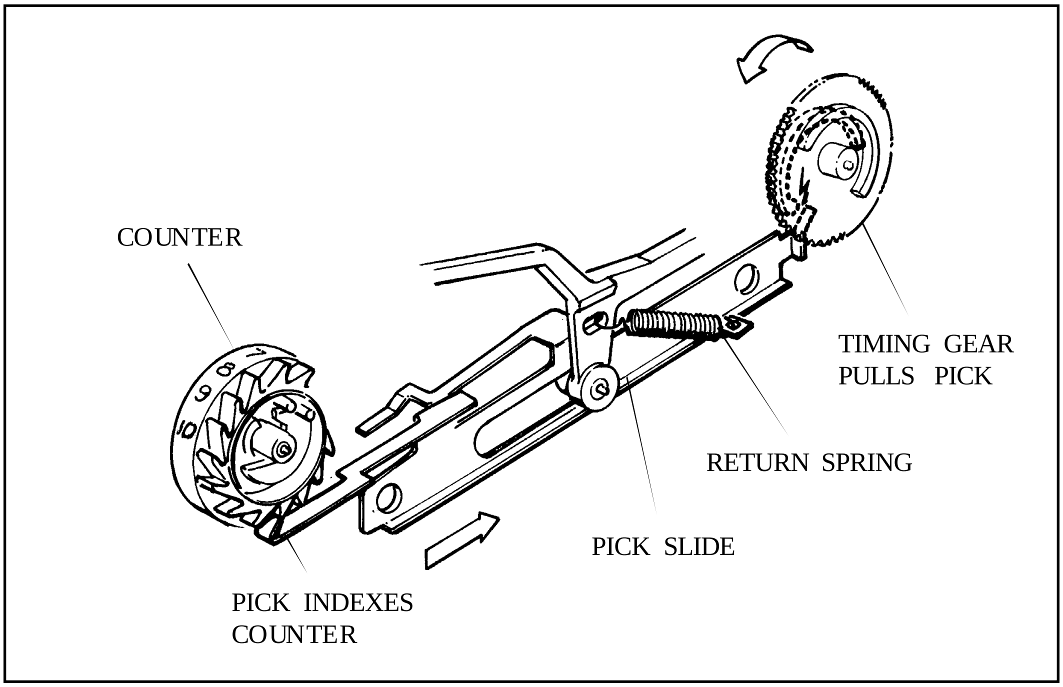


Figure 1-25. Pick Slide Ejecting Dark Slide and Indexing Counter

As the Counter Wheel indexes, a pin which holds S9 closed moves away from the Wireform Switch (Figure 1-26). (Note that this occurs while EOC/S9 is still closed). As a result, the Switch opens and stays open for the remainder of 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.

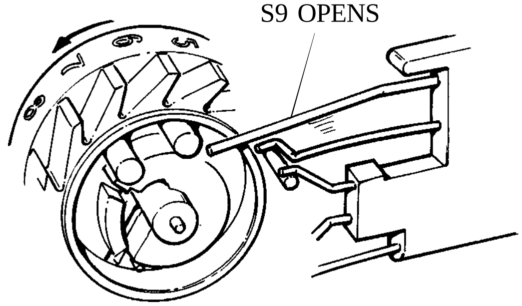


Figure 1-26. Counter Opening S9 Wireform

Exposure Mode

When the Shutter Button (S10/S1) is pressed all the way down, 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 informa- tion, the Strobe fires, film is exposed, light measurements determine when to shut down the Strobe and close the Shutter Blades, and the film frame is processed. The following describes how these actions take place.

Figure 1-27 shows the Quintic system in the starting condition, before an exposure is made. The Encoder Circuit (LED and photodiode) is on, ready to start reading Quintic lens movement. Solenoid 1 is turned on, holding the Shutter Blades closed in readiness for Quintic movement.

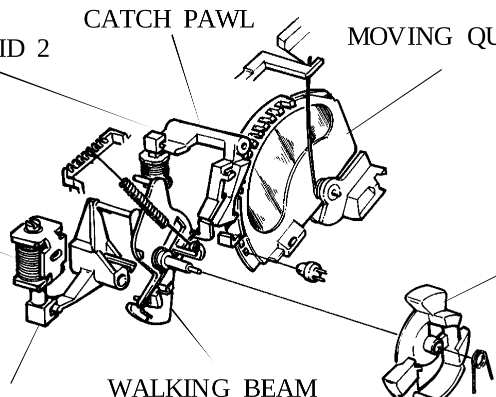


Figure 1-27. Quintic Lens System in Starting Condition

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 1-28). The Quintic lens thus starts to pivot counterclockwise.

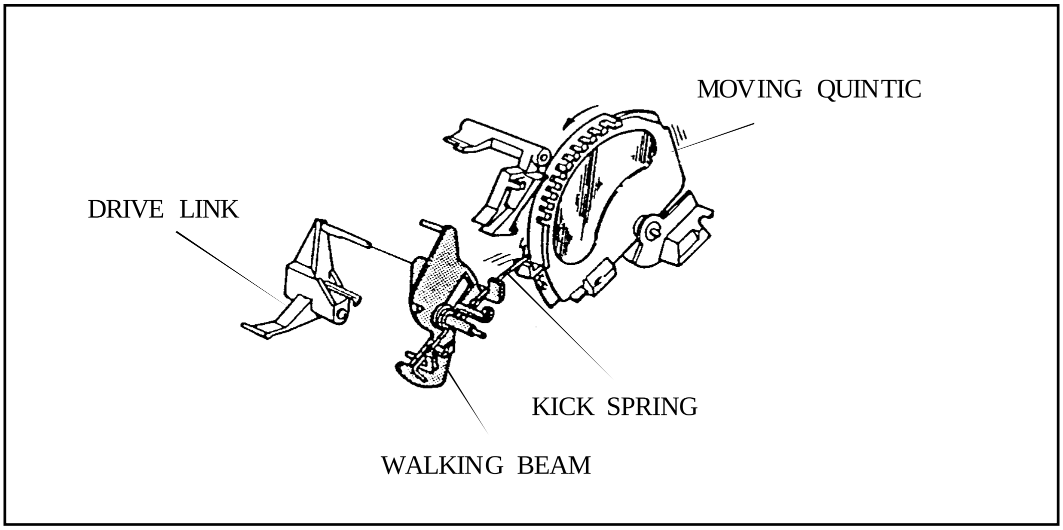


Figure 1-28. Kick Spring Starts Quintic Lens Movement

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 1-29). 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.

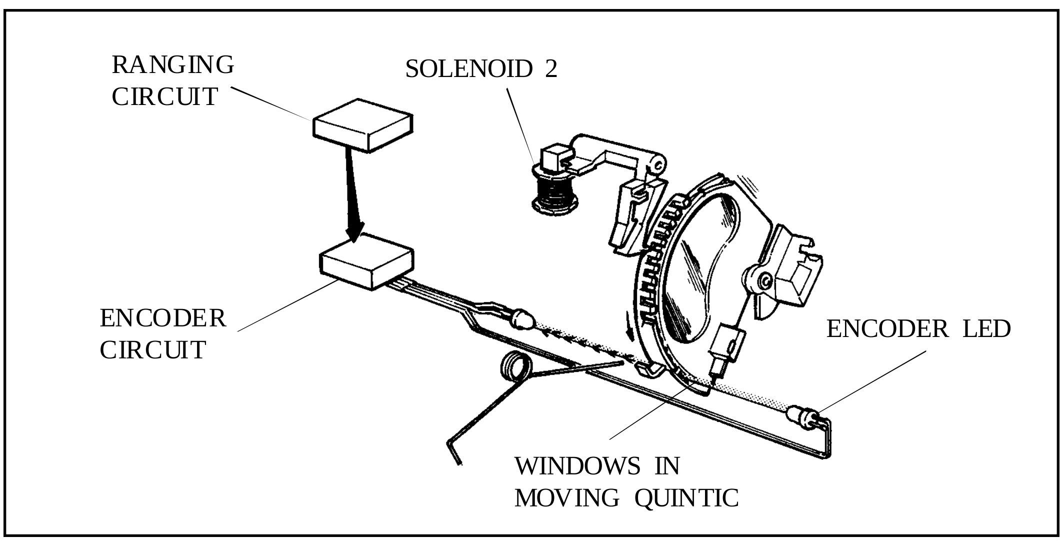


Figure 1-29. Encoder Circuit Reads Light Pulses

Energizing Solenoid 2 releases the Catch Pawl which swings down and engages one of the teeth along the periphery of the Quintic lens (Figure 1-30). The moving lens is thus halted at a point where, in combination with the taking lens and fixed Quintic lens, it is in proper focus for the subject distance as measured by the Transducer.

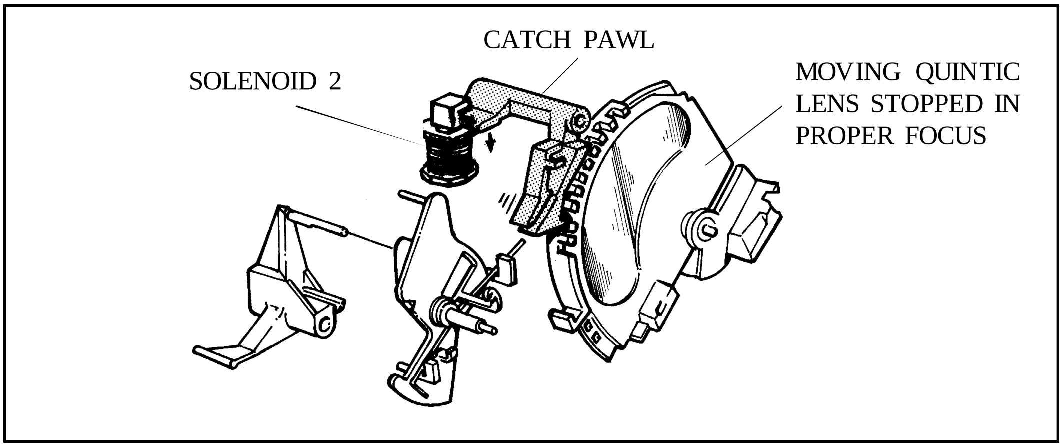


Figure 1-30. Catch Pawl Holds Quintic in Place

With the lens system now focussed, Solenoid 1 is de-energized. 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 de-energized (actually 20ms after it is deenergized), an opening created by the position of the three Shutter Blades allows light from the Encoder LED to again reach the Encoder photodiode (Figure 1-31). (The position of the Quintic lens in its focussed 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.

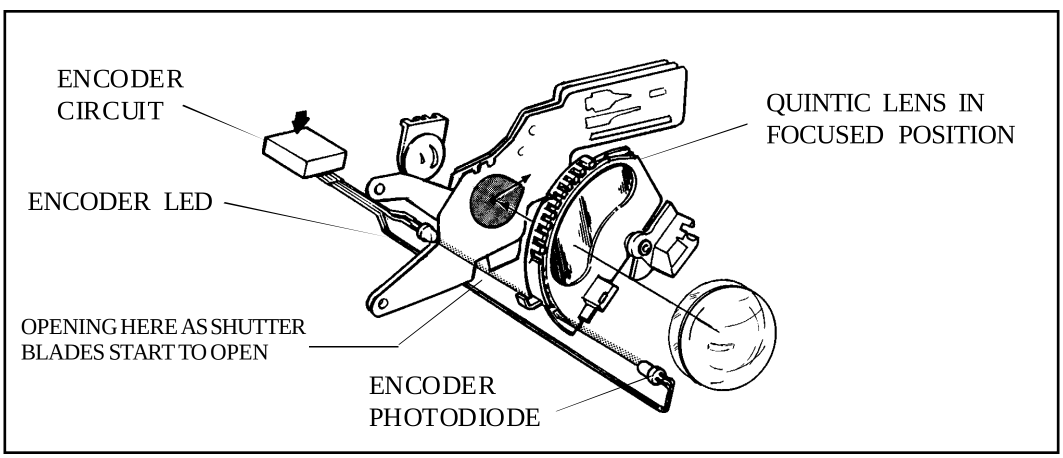


Figure 1-31. First Light Detect

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, ProCam exposure measurements are a combination of the best features of the Spectra system. 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 1-32). 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.

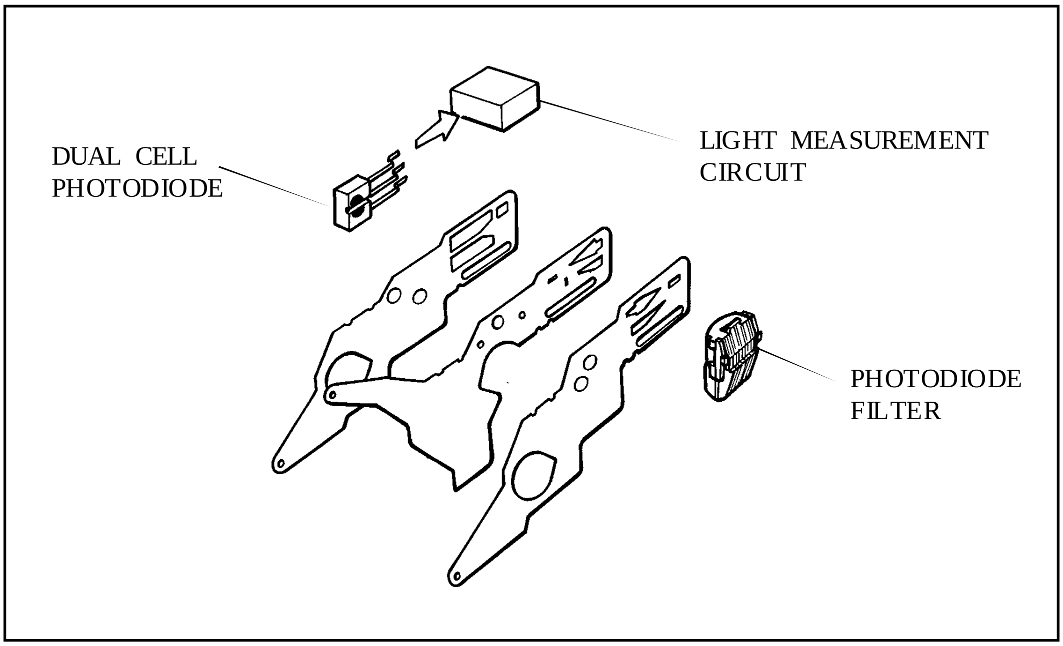


Figure 1-32. Measurement of Visible Light and Infrared Light

When the light measurement determines that the Strobe should be shut down, a pair of series thyristors in the Strobe circuit acts to save any unused energy remaining in the flash capacitor. This departure from previous Polaroid strobes results in a shorter recharge time for the succeeding exposure.
When the exposure cycle is completed, the logic circuits again energize Solenoid 1 (Figure 1-35).

The Solenoid pulls the Drive Link and rotates the Walking Beam clockwise to its original position, closing the Shutter Blades. Solenoid 2, which has been at a holding current level during the exposure, is now de-energized. 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 de-energized, 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 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.

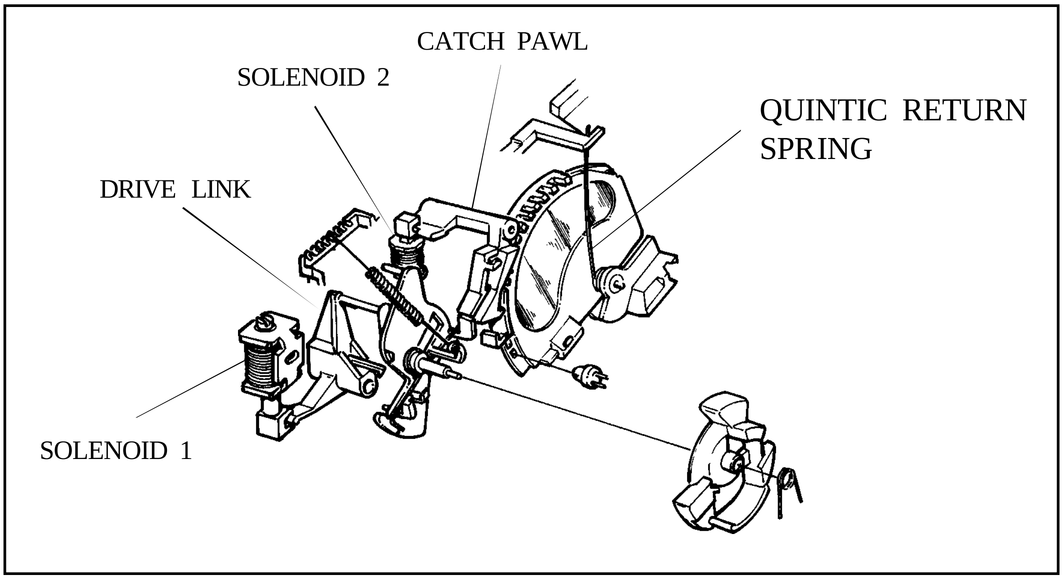


Figure 1-33. Shutter Components at End of Exposure Cycle

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 pulls the Pick Slide forward (Figures 1-34 and 1-35).

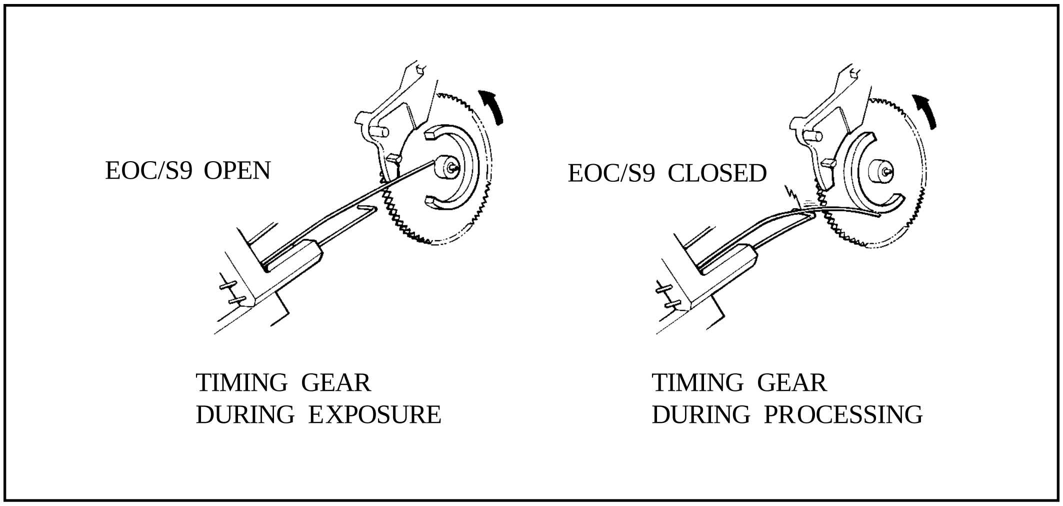


Figure 1-34. EOC/S9 Wireform Switch Closed by Timing Gear Cam

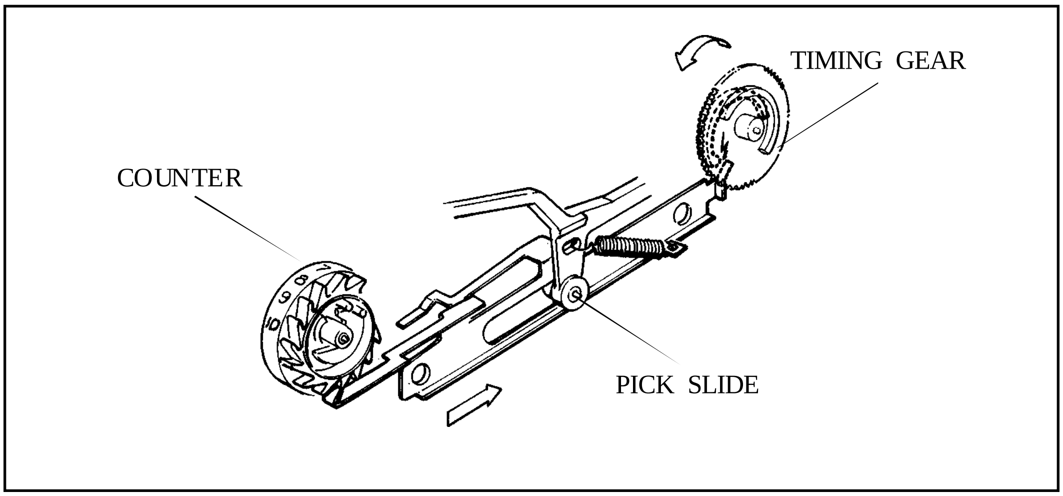


Figure 1-35. Film Processing

A hook on the Pick grabs the just-exposed film frame and pulls it into the developer rollers which are Motor-driven. These rollers break the developer pod and spread reagent throughout the frame. 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 1-36).

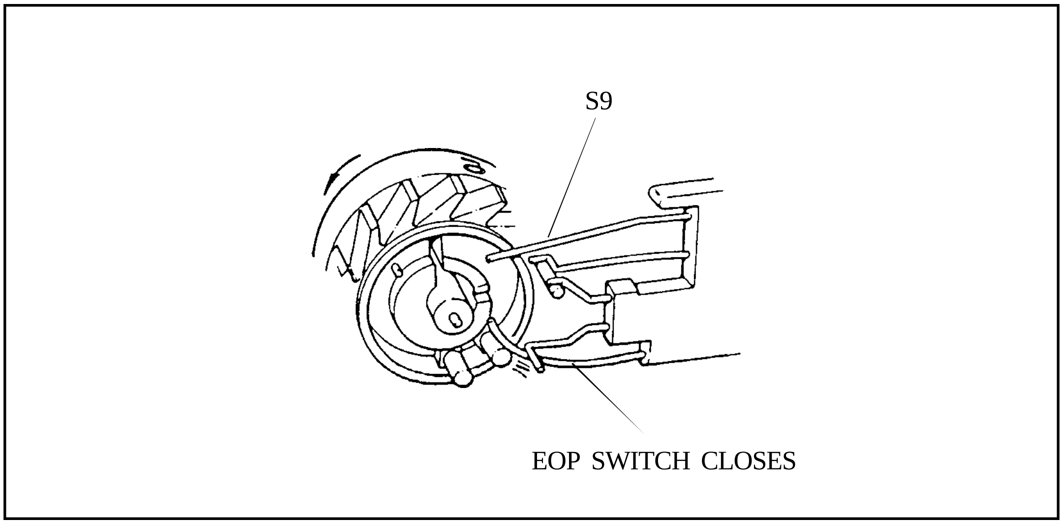


Figure 1-36. Closing the EOP (End Of Pack) Switch

With the EOP Switch closed, a repeating chime sounds three times, signalling that there is no film left in the pack. If the empty pack is left in the ProCam, the chime will sound whenever the Shutter Button is pressed. This chime will also sound if the ProCam is erected with an empty pack left inside.

Removing the empty pack disengages the Pack Pawl, causing the spring-tension 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 ProCam is now in the starting condition described at the beginning of this sequence of operations section.

ProCam Simplified Diagrams

- Figure 1-37 shows a graphic representation of the timing relationship of the ON/OFF states of all switches and signals during one complete ProCam cycle.

- Figure 1-38 shows an illustrated description of the sequence of operation.

- Figure 1-39 shows the signal and power connections between the ProCam PC Boards, electronic and electromechanical components, and switches.

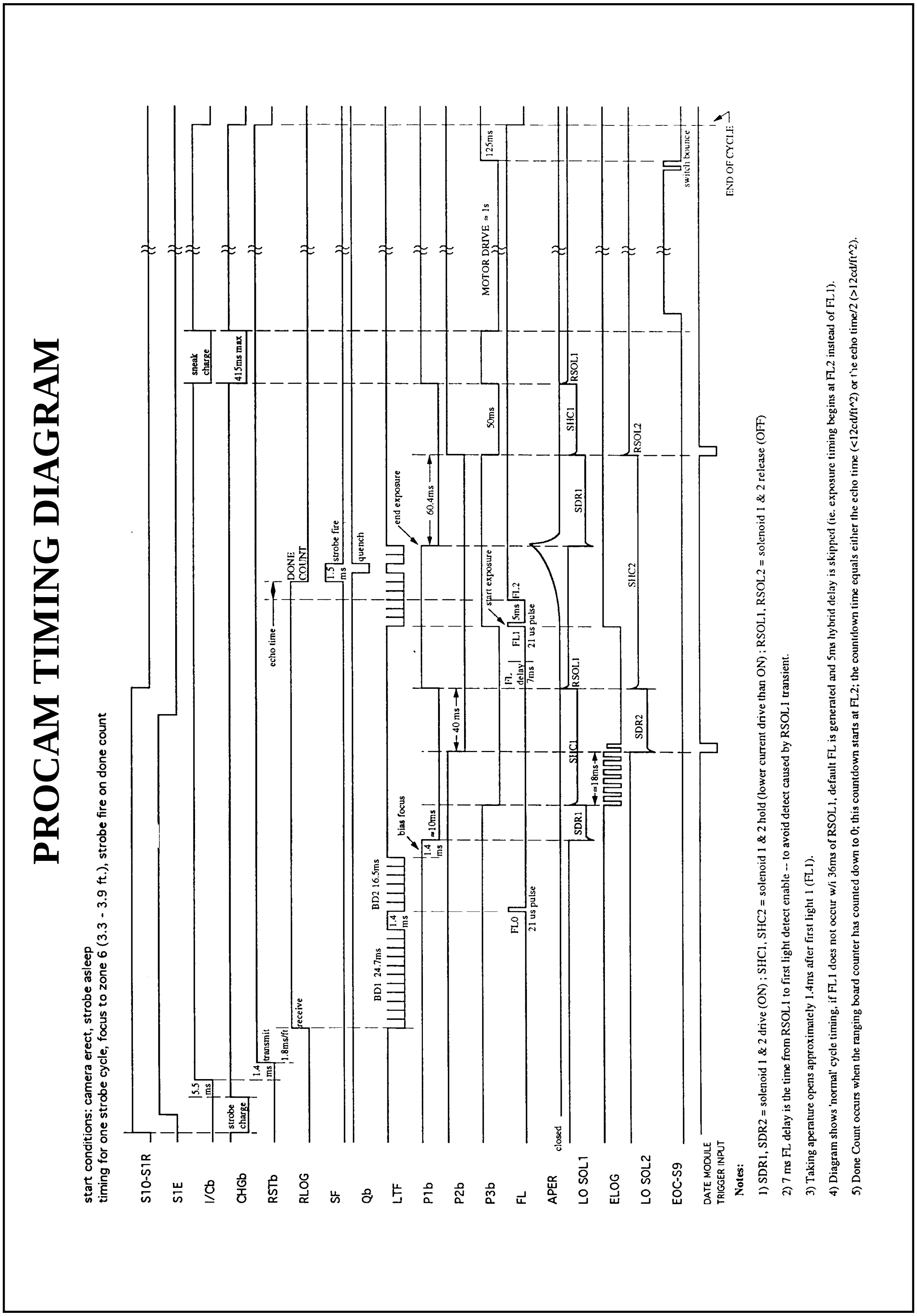


Figure 1-37. ProCam Timing Diagram

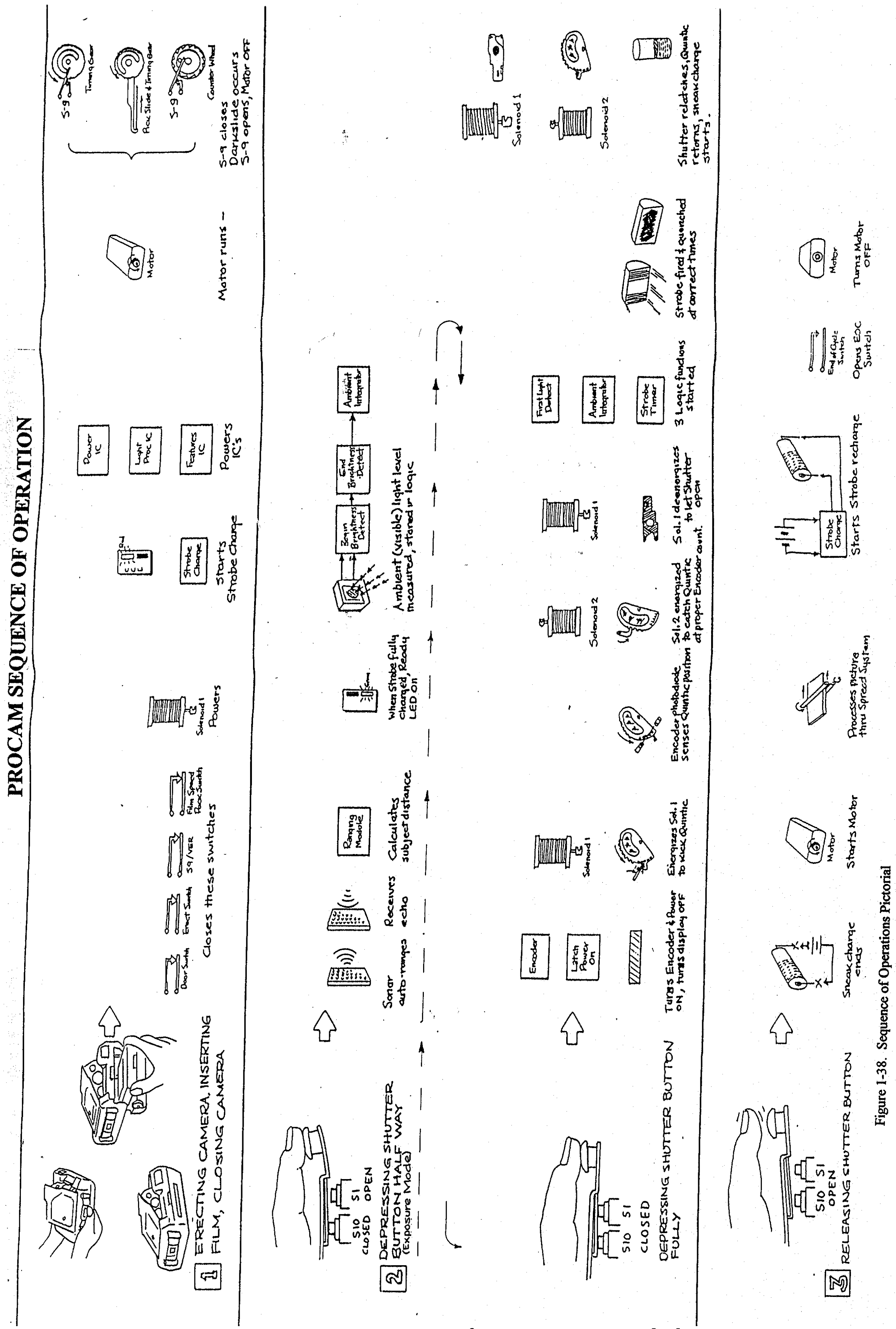


Figure 1-38. Sequence of Operations Pictorial Chart

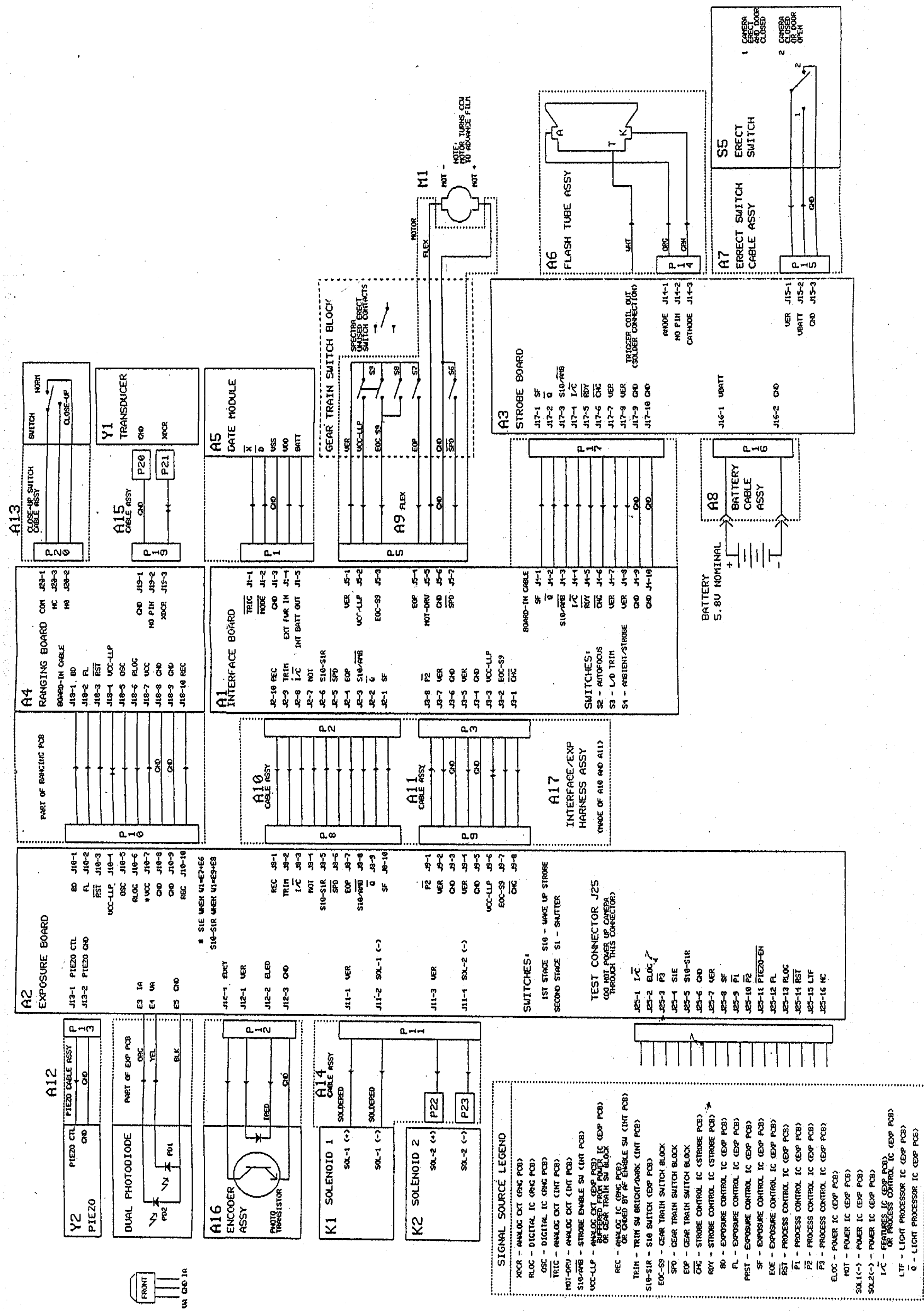


Figure 1-39. ProCam Signal Distribution Diagram

2. Testing & Adjustments

2. Testing & Adjustments

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2. Testing and Adjustments

STAR Tester

Basic Operation

The STAR Tester (Figure 2-1) is an upgrade of the Model 12650-2 (for 600-Series and other cameras. This model (12650-3) permits testing the ProCam and Spectra System Cameras for seven different exposure and timing related operating characteristics, as well as 600-Series and other cameras.

Except for a few name changes of Selector Switch positions, the model 12650-3 STAR Tester is outwardly identical to the earlier model 12650-2 STAR Tester.

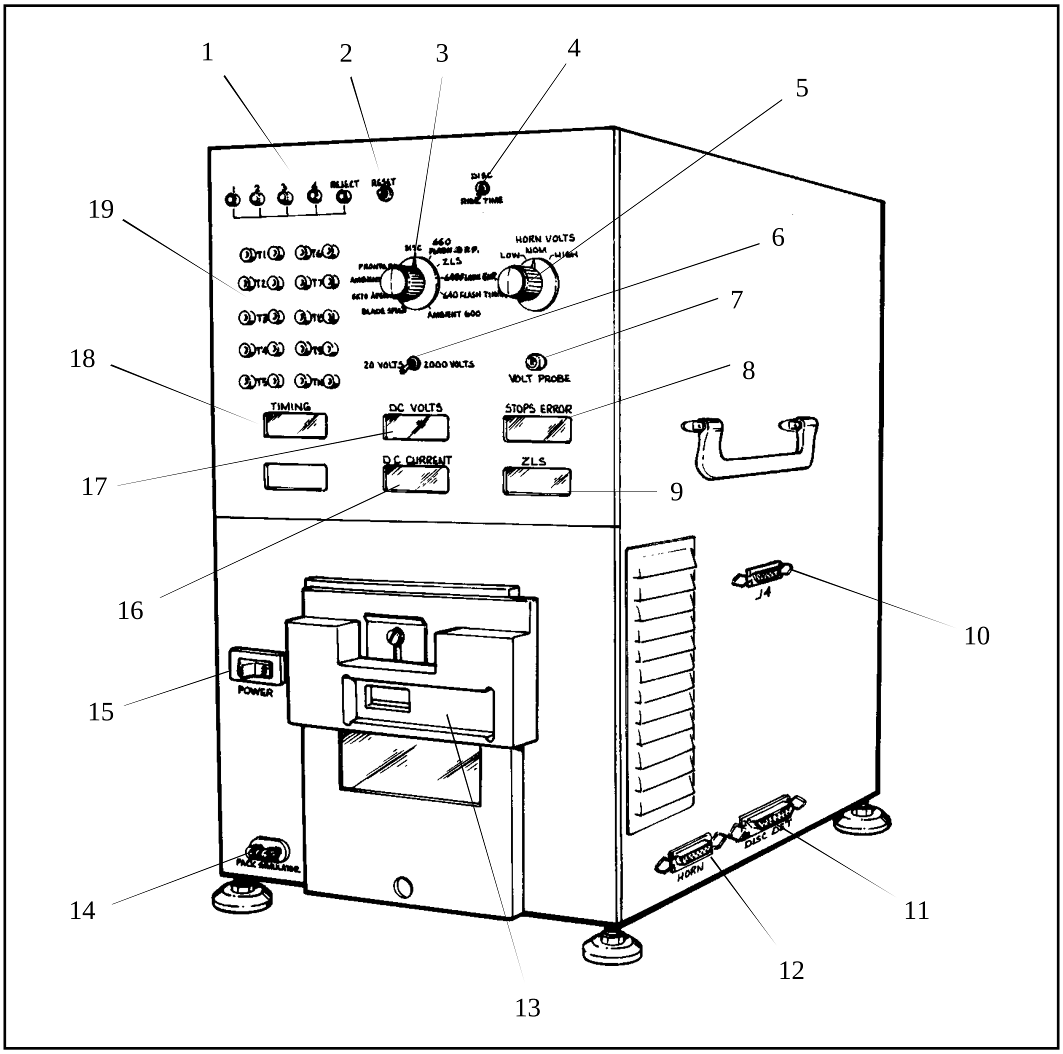


Figure 2-1. STAR Tester

Controls and Indicators

Table 2-1 lists and describes the controls and indicators of the model 12650-3 STAR Tester.

Table 2-1. STAR Tester Controls and Indicators

Key No.	Control and Indicator	Description
1	Disc Position Lamps	Not Used.
2	RESET Pushbutton	Clears electronics between tests.
3	TEST Selector	Selects Test Mode (7000 ZLS, Flash Exposure, Ambient and Blade Speed for ProCam.
4	DISC/RIDE TIME Switch	Selects disc catch or ride time mode for ProCam.
5	HORN VOLTS Selector	Selects 5V (Low), 6V (Nom), or 6.8V (High). Simulates film pack battery voltage.
6	20V/2000V Selector	With VOLT PROBE jack and DC Voltmeter, allows use of Tester as Voltmeter.
7	VOLT PROBE Jack	For checking DC voltages in ProCam under test, with standard probe.
8	STOPS ERROR Meter	Digital readout for Ambient, Hybrid, Strobe Exposure Tests.
9	ZLS Meter	Digital readout of Strobe light output in Zonal Lumen seconds.
10	J4 Connector *****	For future applications.
11	DISC DET Cable	Accepts cable from 660 Disc Detect/ Ride Time Fixture.

Table 2-1. STAR Tester Controls and Indicators (Con't)

Key No.	Control and Indicator	Description
12	HORN Cable Connection	Accepts plug on Horn cable.
13	Strobe Adapters (Two) *****	Aligns electronic flash of 600/680 camera under test to STAR Tester.
14	PACK SIMULATOR Jack	Connection for film pack simulation voltage. Lets Tester function as a power supply.
15	POWER Switch	AC line voltage On/Off to tester. Lights when Tester is powered.
16	DC CURRENT Meter	Digital readout of energy required to charge Strobe capacitor.
17	DC VOLTS Meter	Digital readout of circuit voltages; also use with probe in VOLT PROBE jack.
18	TIMING Meter	Digital readout of strobe recycle time or blade speed.
19	Test Point Connections (Not Shown)	For connections to oscilloscope. Also used for calibrating Tester.

***** Not used for testing ProCam.

Caution: When Tester is not in constant use, turn selector switch to **7000 ZLS** position. This saves wear on light source and keeps Tester in neutral state, ready for immediate resumption of testing.

Setup and Pre-test Checks

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

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

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

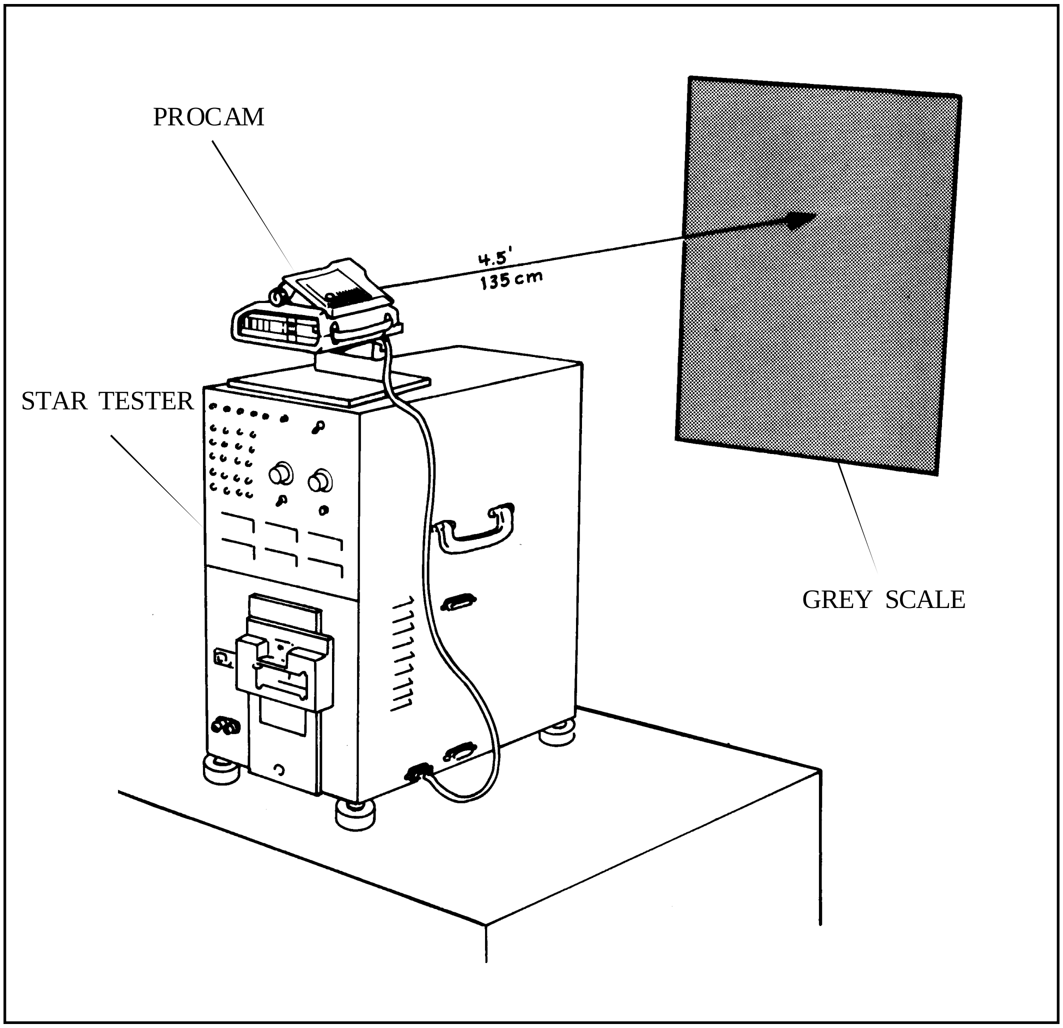


Figure 2-2. Locating Tester in Relation to Graywall Target

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

5. Mount the ProCam on the test horn and connect the cable from the horn to the HORN receptacle 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 any tests.

7. Open the ProCam door and then with tool # 13537 trip the door switch (Figure 2-3).

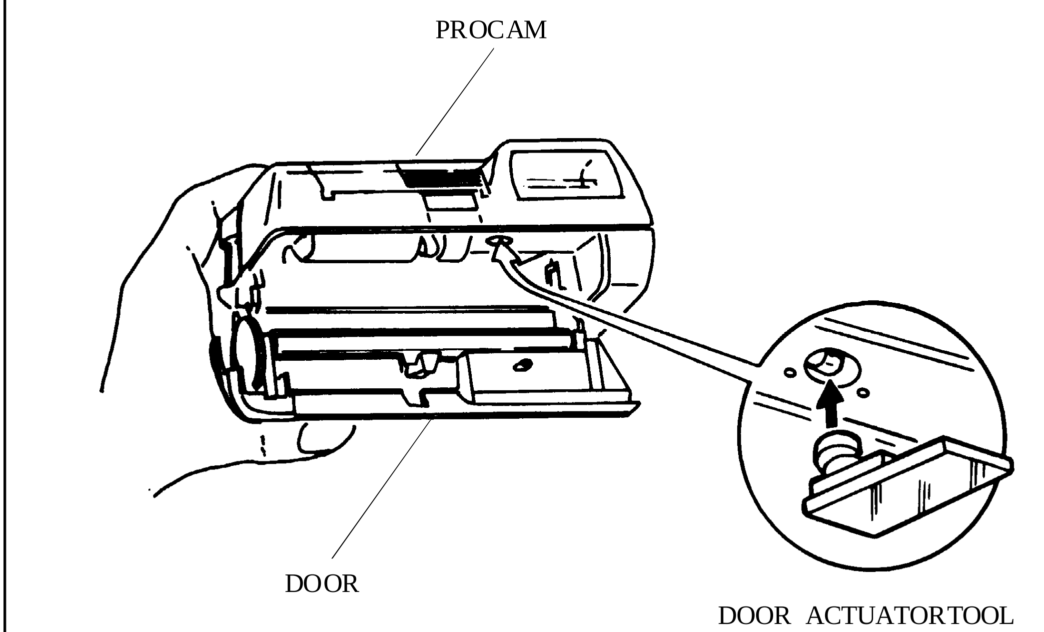


Figure 2-3. Trip ProCam Door Switch to Down Position

8. Position the test horn with the ProCam mounted on it against the front of the Tester, with the guide tab on the right side of the test horn against the right edge of the window mounting plate (Figure 2-4).

9. Fully depress the ProCam shutter button five times. Read the STOPS ERROR meter and check the ProCam specification for agreement.

10. Using a standard ProCam as a reference, perform, at least weekly, the Ambient Exposure Test to check that the Tester is operating properly.

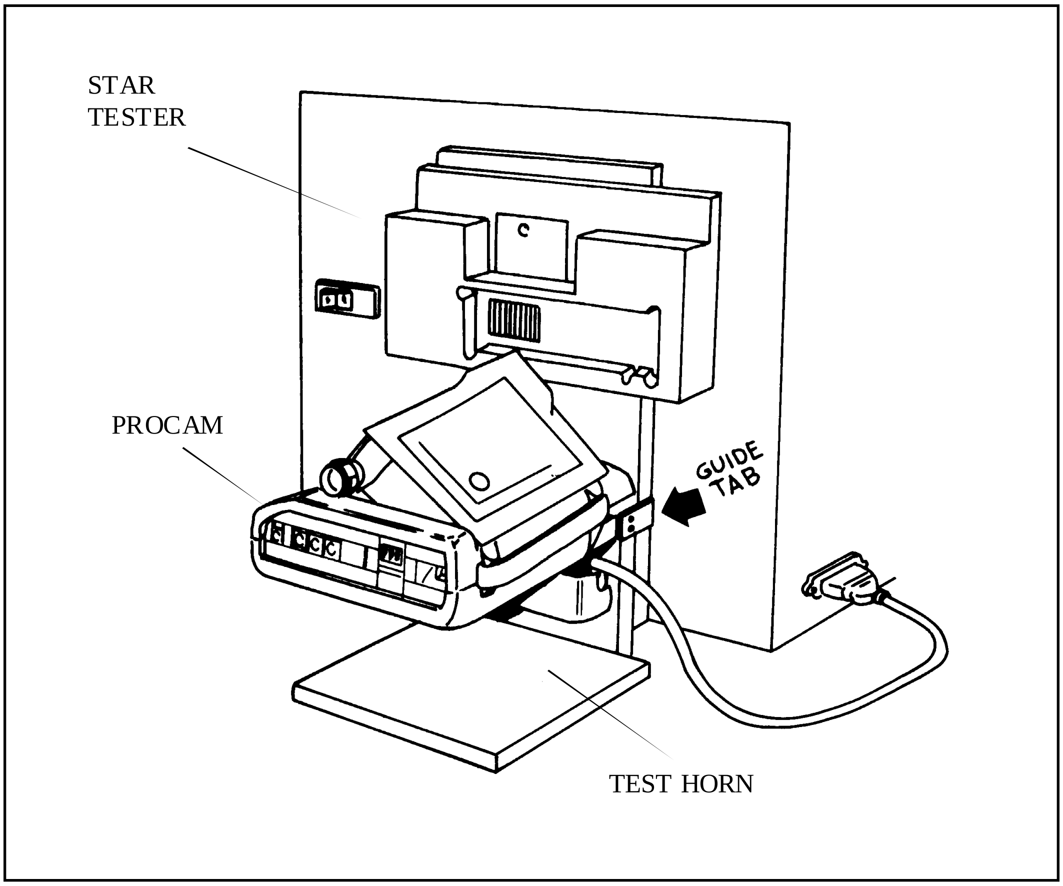


Figure 2-4. Positioning ProCam on Test Horn against Tester.

ProCam Tests

ProCam tests should be performed in the following order:

Mandatory Tests

- **Ambient Exposure at 100 C/FS**
- **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:

- **ZLS Graywall Test**

  If the ZLS Graywall Test is not within specification, replace the Strobe Board or the Flashtube Assembly as required.

  If the ZLS Graywall Test is within specification but the Strobe Exposure (Graywall) reading remains out-of-specification, perform the Hybrid Strobe/Blade Speed Test.

- **Hybrid (Strobe/Blade Speed Test**

  If the Hybrid Test reading is within specification but the Strobe Exposure Test reading remains out-of-specification, replace the Exposure Board and then retest.

  If the Hybrid Test reading is out-of-specification, perform the Hybrid Test Adjustment.

  If the Hybrid Adjustment fails to bring the reading within specification, perform the Blade Speed Test.

- **Blade Speed Test**

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

  If the Blade Speed Test reading is not within specification, perform the Blade Speed Adjustment.

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

- **Strobe Integrated Current Test**

  If battery drain is excessive, perform Strobe Integrated Current Test.

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

  If the Strobe takes too long to recharge, perform the Strobe Charge Time Test.

- **Strobe Charge Time Test**

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

Ambient Exposure Test

The Ambient Exposure Test measures the energy on the film plane during an ambient (visible) light exposure. The Tester light integrating sphere provides a constant scene brightness level of 100 candles/ft^2.

Setup

1. Using the Door Switch Actuator tool #13537, trip the door switch.
2. Place the ProCam on the Test Horn against the Tester window.
3. Slide the AF, Strobe and Audio (beeper) switches on the ProCam into the up (off) position.
4. Leave the Photocell on the ProCam uncovered.
5. Set the TEST selector to AMBIENT.

Test Procedure

1. Press the shutter button fully and record the STOPS ERROR meter reading.
2. Repeat the process two more times, recording all readings. Compare the readings to the specification.

   Note: If the readings are within specification, perform the Ambient Exposure Calibration Slide Adjustment.

3. If the test reading are not within specification, perform the Ambient Exposure Calibration Slide Adjustment and then retest.

   Note: If readings are now within specification, perform the Strobe Exposure (Graywall) Test.

4. If adjustment fails to bring the reading within specification, check that the :

   - Green ambient filter is in the proper position.

   - Photocell cap is in position.

   - Photocell is seated in the base block.

5. If test steps 1 through 4 do not bring the Ambient Exposure reading within specification, replace the Exposure Board and/or the shutter Assembly and then retest.

Strobe Exposure (Graywall) Test

The Strobe Exposure (Graywall) Test measures the resultant energy on the film plane during a 4.5-foot (135 cm) graywall exposure.

Setup

1. Using the Door Switch Activator tool, trip the door switch on the ProCam.

2. Place the ProCam on the Test Horn on top of the tester, with the lens 4.5 feet from the graywall.

   Note:
   - Front of the ProCam must be parallel to the graywall.
   - Area visible in the viewfinder must be clear of objects.

3. Slide all switches on the ProCam into the down (on) position. Keep the Lighten/Darken switch in the mid-point (normal) position.

4. Leave the Photocell on the ProCam uncovered.

5. Set the TEST selector to FLASH EXPOSURE.

Test Procedure

1. Press the shutter button fully and record the STOPS ERROR meter reading.

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

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

4. If adjustment fails to bring the reading within specification, check that the:

   - IR black filter is properly seated.
   - Photocell cap is properly seated.
   - Photocell is seated in the base block.

5. If test steps 1 through 4 does not bring the Strobe Exposure (Graywall) reading within specification, perform the ZLS Graywall Test.

ZLS (Zonal Lumen Seconds) Graywall Test

The ZLS Graywall Test measures the maximum strobe output. This accomplished by measuring the energy on the film plane during a 4.5-foot (135 cm) graywall exposure with the shutter blades fully open.

Setup

1. Using the Door Switch Activator tool, trip the door switch on the ProCam.

2. Place the ProCam on the Test Horn on top of the tester, with the lens 4.5 feet from the graywall.

   Note:
   - Front of the ProCam must be parallel to the graywall.
   - Area visible in the viewfinder must be clear of objects.

3. Slide all switches on the ProCam into the down (on) position, except for the AF and audio (OFF). Keep the Lighten/Darken switch in the mid-point (normal) position.

4. Cover the Photocell on the ProCam.

5. Set the TEST selector to 7000 ZLS.

Test Procedure

1. Press the shutter button fully and record the ZLS meter reading. Compare the reading to the specification.

2. If the test reading is not within specification, replace either the Flashtube Assembly or the Strobe Board and then retest.

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

Hybrid (ZLS/Blade Speed) Test

The Hybrid (ZLS/Blade Speed) Test measures the resultant 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 the maximum strobe output, blade speed and ranging are all functioning properly.

Setup

1. Using the Door Switch Activator tool, trip the door switch on the ProCam.

2. Place the ProCam on the Test Horn on top of the tester, with the lens 4.5 feet from the graywall.

   Note:
   - Front of the ProCam must be parallel to the graywall.
   - Area visible in the viewfinder must be clear of objects.

3. Slide all switches on the ProCam into the down (on) position.

4. Cover the Photocell on the ProCam.

5. Set the TEST selector to 7000 ZLS.

Test Procedure

1. Press the shutter button fully and record the ZLS meter reading.

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

   Note: If the readings are not within specification, perform the Hybrid Adjustment and then retest Ambient.

3. If the Hybrid Adjustment does not bring the Hybrid Test reading within specification, perform the Blade Speed Test.

4. If Hybrid Test reading is within specification but the Strobe Exposure (Graywall) reading is still out-of-specification, replace the ExposureBoard and then retest.

Blade Speed Test

The Blade Speed Test measures the time between first light detection and 95% blade opening.

Setup

1. Using the Door Switch Activator tool, trip the door switch on the ProCam.

2. Place the ProCam on the Test Horn against the Tester window.

3. Slide the AF and Strobe switches on the ProCam into the up (off) position.

4. Cover the Photocell on the ProCam.

5. Set the TEST selector to BLADE SPEED.

Test Procedure

1. Press the RESET pushbutton on the Tester, then press the shutter button. Disregard the meter reading (this sets up the Tester circuitry).

2. Press the shutter button again and the observe the TIMING meter.

   Note: The reading should remain constant for two (2) seconds. Compare this reading to the specification.

3. If the reading is not within specification, perform the Blade Speed Adjustment and then retest the Procam.

4. If the Blade Speed Adjustment did not bring the Blade Speed within specification, repair or replace the shutter Assembly and then retest.

5. If the Blade Speed is now within specification but the Strobe Exposure (Graywall) reading is still out-of-specification, replace the ExposureBoard and then retest.

Strobe Integrated Current and Strobe Charge Time Tests

Note: These tests are together because the ProCam and Tester settings are the same. Both tests can be performed together for convenience.

The Strobe Integrated Current Test measures the energy required to fully charge the strobe capacitor in the ProCam.

The Strobe Charge Time Test measures the maximum time required for strobe recycling.

Setup

1. Using the Door Switch Activator tool, trip the door switch on the ProCam.

2. Place the ProCam on the Test Horn on top of the Tester.

3. Slide all switches on the ProCam into the down (on) position, except for the AF.

4. Cover the Photocell on the ProCam.

5. Set the TEST selector 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 ProCam down (OFF) during the three (3) seconds that the blades are open (Maximum Time-out).

3. After the ProCam has cycled, press the RESET pushbutton on the Tester and then slide the ProCam strobe switch up (ON).

4. Read the strobe current value on the DC CURRENT meter and the maximum value displayed by the TIMING meter. Compare the readings to the specifications.

5. If either the Strobe Integrated Current or the Strobe Charge Time readings are not within specification, replace the Strobe Board.

   Note: There are no adjustments for the Strobe Integrated Current or the Strobe Charge Time.

ProCam Adjustments

Ambient Exposure Calibration Slide Adjustment

1. Remove the Top Cover from the ProCam.

   Note: Reference the Disassembly and Assembly procedures in Section 3 of this Service Manual to remove the Top Cover.

   Caution: High Voltage Exposure! Voltages up to 320 volts are present on the top flash tube terminal (Green wire) and at various other locations on the Strobe Board.

2. If the Ambient Exposure Test readings are to low, use a dental pick and slide the Ambient Calibration Slide (Figure 2-5) to the right, in proportion to the amount the reading is too low.

   Note: The Ambient Calibration Slide is the one next to the shutter Base Block (rear most slide), when the Base Block is viewed from the rear of the ProCam.

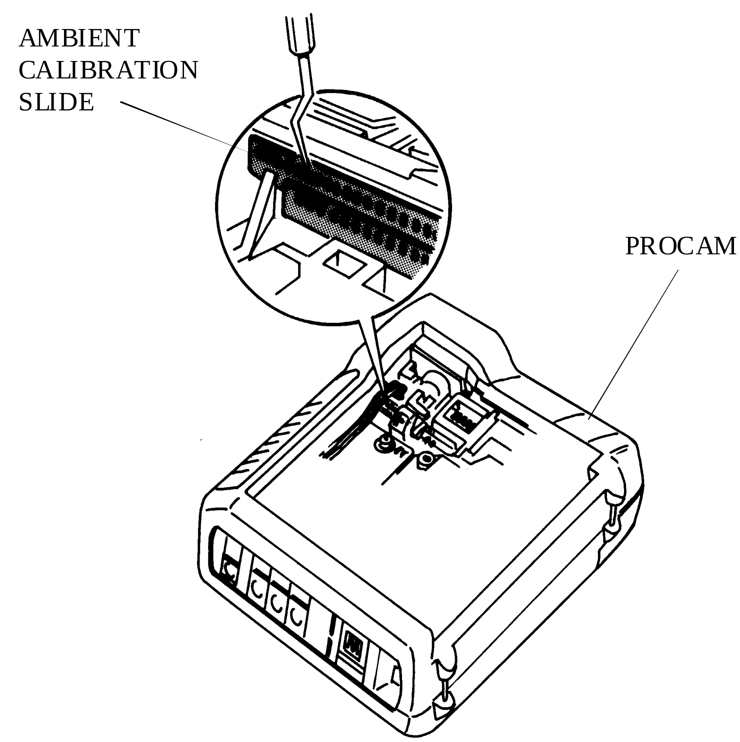


Figure 2-5. Adjusting Ambient (Visible Light) Exposure Calibration Slide

3. If the Ambient Exposure Test readings are to high, use a dental pick and slide the Ambient Calibration Slide (Figure 2-5) to the left, in proportion to the amount the reading is too high.

4. Put the Top Cover in place and then retest the ProCam. If necessary, re-adjust the Ambient Calibration Slide.

5. When the Ambient Exposure Test reading is within specification, replace the Top Cover.

   Note: If adjusting the Ambient Calibration Slide fails to bring the readings within specification, refer to the steps 3 through 5 of the Ambient Exposure Test procedure on page 2-10.

IR Strobe Exposure Calibration Slide Adjustment

1. Remove the Top Cover from the ProCam.

   Note: Reference the Disassembly and Assembly procedures in Section 3 of this Service Manual to remove the Top Cover.

   Caution: High Voltage Exposure! Voltages up to 320 volts are present on the top flash tube terminal (Green wire) and at various other locations on the Strobe Board.

2. If the Strobe Exposure Test readings are to low, use a dental pick and slide the IR Strobe Calibration Slide (Figure 2-6) to the right, in proportion to the amount the reading is too low.

   Note: The IR Strobe Calibration Slide is the nearer or the front most slide, when the Base Block is viewed from the rear of the ProCam.

3. If the Strobe Exposure Test readings are to high, use a dental pick and slide the IR Strobe Calibration Slide (Figure 2-6) to the left, in proportion to the amount the reading is too high.

4. Put the Top Cover in place and then retest the ProCam. If necessary, re-adjust the IR Strobe Calibration Slide.

5. When the Strobe Exposure Test reading is within specification, replace the Top Cover.

   Note: If adjusting the IR Strobe Calibration Slide fails to bring the readings within specification, refer to the steps 4 and 5 of the Strobe Exposure Test procedure on page 2-12.

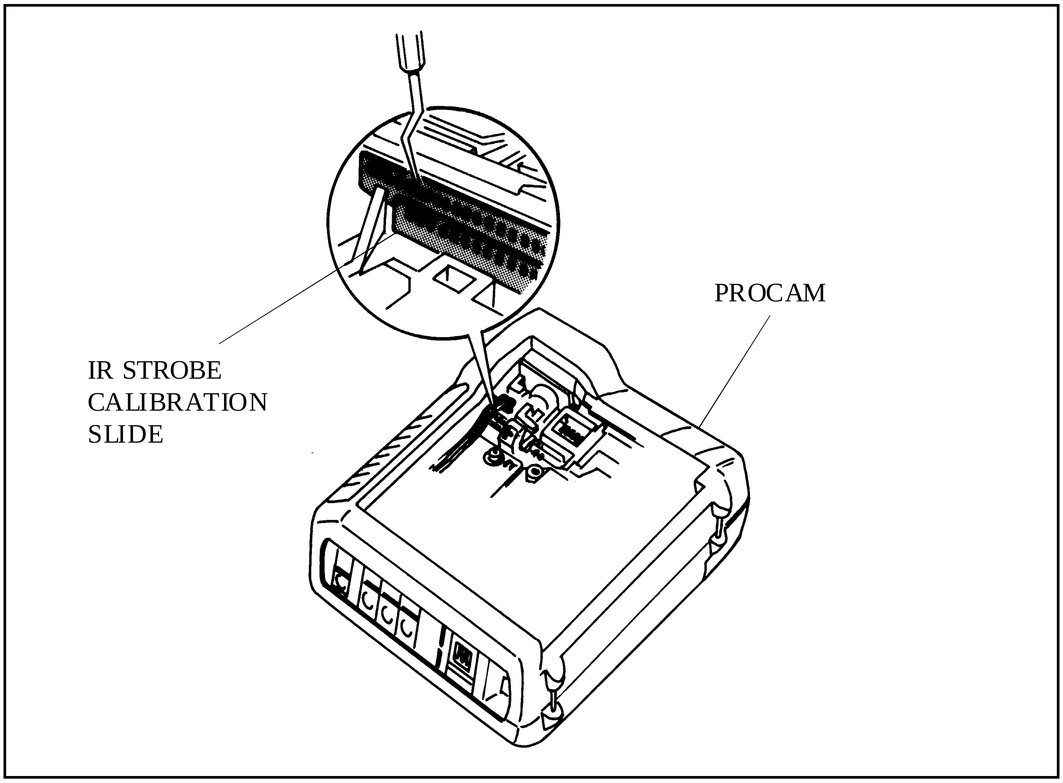


Figure 2-6. Adjusting IR Strobe Exposure Calibration Slide

Hybrid Adjustment (Opening Blade Spring)

1. Remove the Top Cover from the ProCam.

   Note: Reference the Disassembly and Assembly procedures in Section 3 of this Service Manual to remove the Top Cover.

   Caution: High Voltage Exposure! Voltages up to 320 volts are present on the 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 to low, increase the tension on the Opening Blade Spring (Figure 2-7) by moving it one notch to the right (when facing the back of the ProCam).

3. Put the Top Cover on the ProCam and then retest.

   Note: If necessary, repeat this procedure moving the Opening Blade Spring one notch at a time and replacing the Top cover each time before re-testing.

4. When the Hybrid Test reading is within specification, replace the Top Cover.

   Note: If changing the tension on the Opening Blade Spring fails to bring the readings into specification, refer to steps 3 and 4 of the Hybrid (ZLS/ Blade Speed) Test procedure on page 2-14.

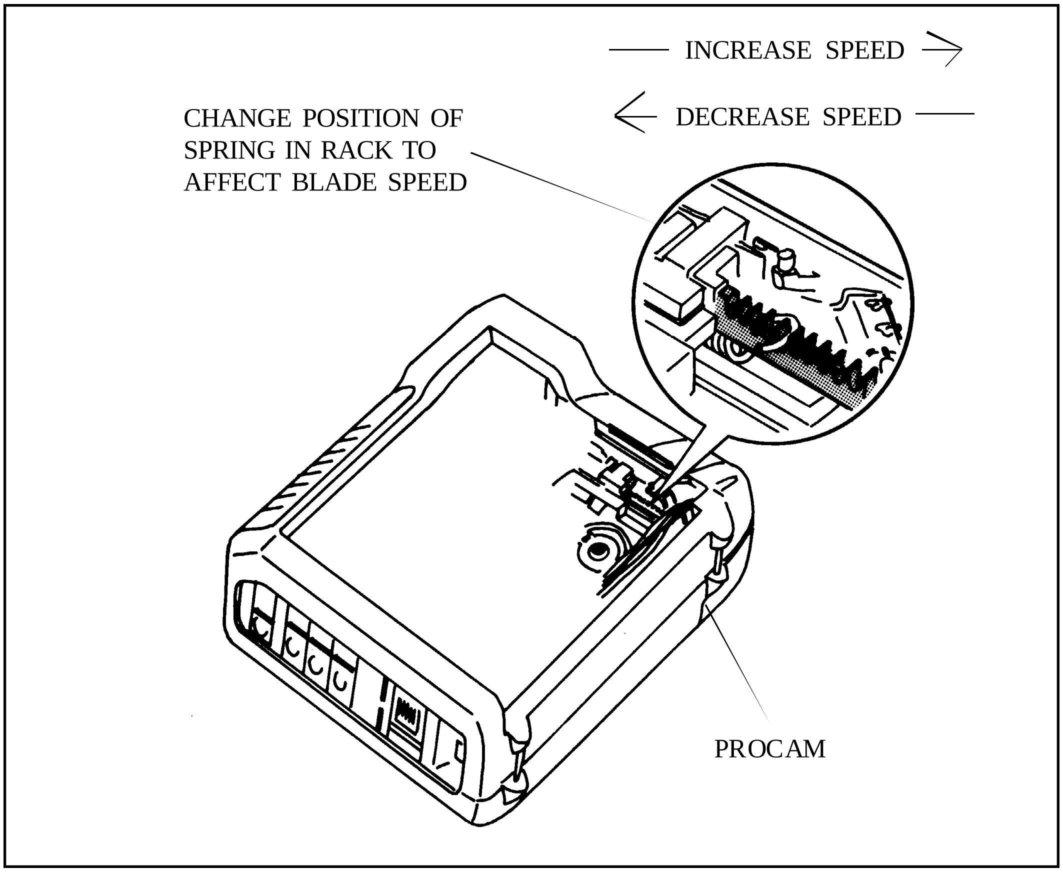


Figure 2-7. Hybrid Test Adjustment (Opening Blade Spring Tension Adjustment)

Blade Speed Adjustment (Opening Blade Spring)

1. Remove the Top Cover from the ProCam.

   Note: Reference the Disassembly and Assembly procedures in Section 3 of this Service Manual to remove the Top Cover.

   Caution: High Voltage Exposure! Voltages up to 320 volts are present on the top flash tube terminal (Green wire) and at various other locations on the Strobe Board.

2. Using tweezers, carefully lift the upper end of the Opening Blade spring out of its notch in the Shutter Base Block (Figure 2-7).

   Caution: Do not overstretch the Spring.

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

4. Put the Top Cover on the ProCam and then retest Blade Speed.

   Note: If necessary, readjust the spring tension.

5. When the Blade Speed is within specification, replace the Top Cover.

   Note:
   - If changing the Opening Blade Spring position will not bring the Blade Speed within specification, replace the Opening Blade Spring and then retest.
   - If the Opening Blade Spring is still out-of-Specification, disassemble the ProCam to the Shutter level. 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, re-assemble the ProCam and then retest Blade Speed. If necessary, re-adjust the Opening Blade Spring.

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 ProCam's sonar system.

For example, if the Quintic moves too fast, the Catch Pawl may not be able to stop it at the correct position.)

Quintic speed can be adjusted as follows:

1. Remove the Top Cover from the ProCam.

   Note: Reference the Disassembly and Assembly procedures in Section 3 of this Service Manual to remove the Top Cover.

   Caution: High Voltage Exposure! Voltages up to 320 volts are present on the top flash tube terminal (Green wire) and at various other locations on the Strobe Board.

2. Using small screwdriver, carefully turn the adjusting screw of Solenoid 1 (Figure 2-8) 1/2 turn at a time.

   Note: Turn the screw counter-clockwise to increase Quintic speed, clockwise to decrease Quintic speed.

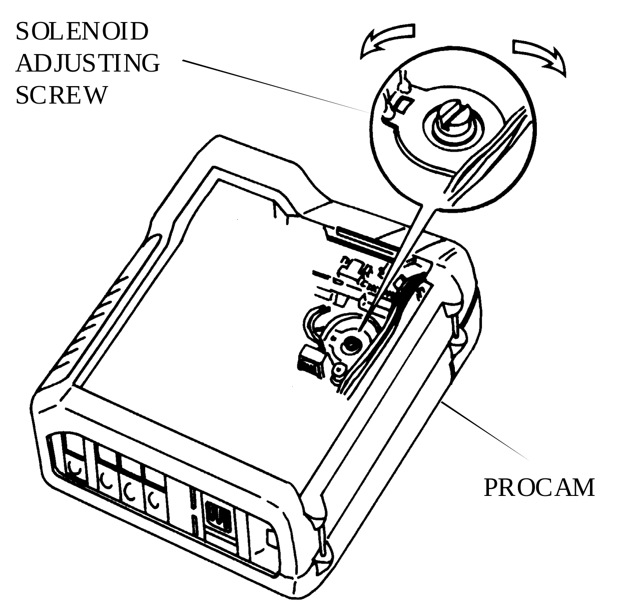


Figure 2-8. Adjusting Solenoid 1 to Change Quintic Speed

4. Put the Top Cover on the ProCam and then retest the ProCam to verify that the Catch Pawl catches (stops) the Quintic at the correct position.

   Note: If it does not stop at the correct position, re-adjust the adjusting screw of Solenoid 1, 1/2 turn at a time, until the quintic is caught by the Catch Pawl.

5. When the proper Quintic catch is achieved, replace the Top Cover.

6. If steps 1 through 3 fail to produce the correct Quintic catch, disassemble the ProCam to the Shutter level. Inspect the Solenoid 1plunger, the Catch Pawl, and the Quintic elements for dirt, binding parts and damage. Correct any problems found, re-assemble the Shutter and then retest the ProCam.

3. Disassembly & Reassembly

3. Disassembly & Reassembly

Table of Contents

3. Disassembly & Reassembly

General Instructions and Tools Required

Partial Verus Total Disassembly

The Disassembly and Reassembly procedures in the next section describes a total disassembly sequence for the ProCam, even though actual servicing will often require only partial ProCam disassembly.

> Note: At any point in the Disassembly and Reassembly instructions for removing and replacing all ProCam parts, it is assumed that all previous steps in this sequence have already been done — that is, you cannot usually remove a part without first having removed the parts preceding it in the disassembly sequence.

Before starting any disassembly procedure, you are urged to first study the exploded views of the Main Assembly, Mainframe Assembly, Shutter Assembly and Drive Assembly in the ProCam Parts Catalog, to determine the approximate location of the part or assembly needing service.

Instructions for replacing each major part removed during total disassembly follow each removal procedure, and generally involve doing the removal or disassembly steps in reverse order. Specific notes are included to aid in the more difficult replacement procedures.

Shock Hazard from Flash Capacitors

When removing the Mid Cover, use extreme care to keep fingers away from capacitor terminals and connection points on the Exposure PC Board (right side of Camera, viewed from the front). As soon as the capacitor terminals are accessible, discharge them with the Dump Probe (P/N 13119).

Electrostatic Discharge Damage

Sensitive components on the ProCam PC Boards can easily be damaged by static electricity. Use a wrist strap and grounded anti-static mat when working on or near PC boards.

Optical Parts Protection from Scratches and Smudges

When handling Viewfinder or Shutter Assemblies, wear finger cots or lintless gloves; also, use plastic tools (e.g., greenstick) or tools with coated jaws, rather than metal tools, whenever practical.

Tools Required for Disassembly and Reassembly

- Square Drive Tool (Handle - CPS 416, Bit - #13553)
- Dump Probe #13119
- Greenstick (Solder Aid Tool) #941168
- Wrist Strap and Grounded Anti-Static Mat
- Small Phillips and Flat Blade Jeweler's Screwdrivers
- Needlenose Pliers
- Tweezers
- Penlight Flashlight
- Dental Pick
- Finger Cots/Lintless Gloves

ProCam Disassembly and Reassembly Procedures

Top Cover and Mid cover

1. Removal

a. Peel off Top Cover Insert and remove adhesive with greenstick (Figure 3-1).

b. Remove four Phillips head screws from Top Cover; remove Top Cover.

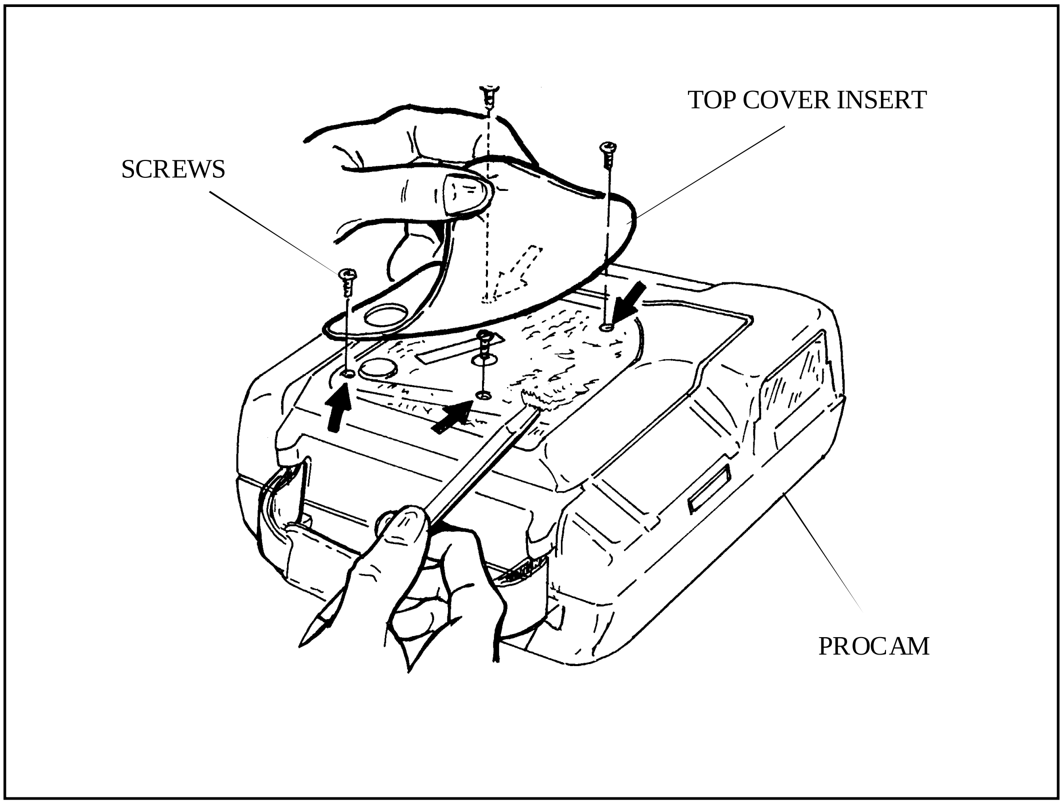


Figure 3-1. Removing Top Cover

c. Remove two square drive Hand Strap Lugs (screws) from Bottom Cover (Figure 3-2).

d. Remove Bottom Cover Insert and remaining two square drive lugs screws (Figure 3-3).

Caution: Keep fingers away from right (strobe) side of ProCam when lifting off the Mid Cover — Flash capacitor connections are exposed (Figure 3-4).

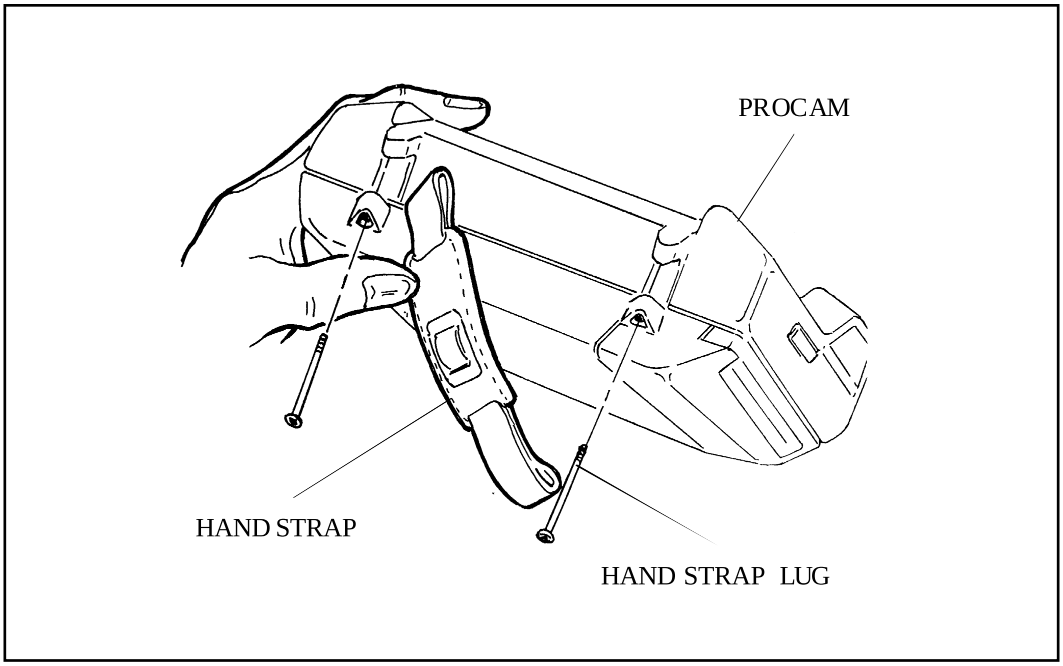


Figure 3-2. Removing Hand Strap

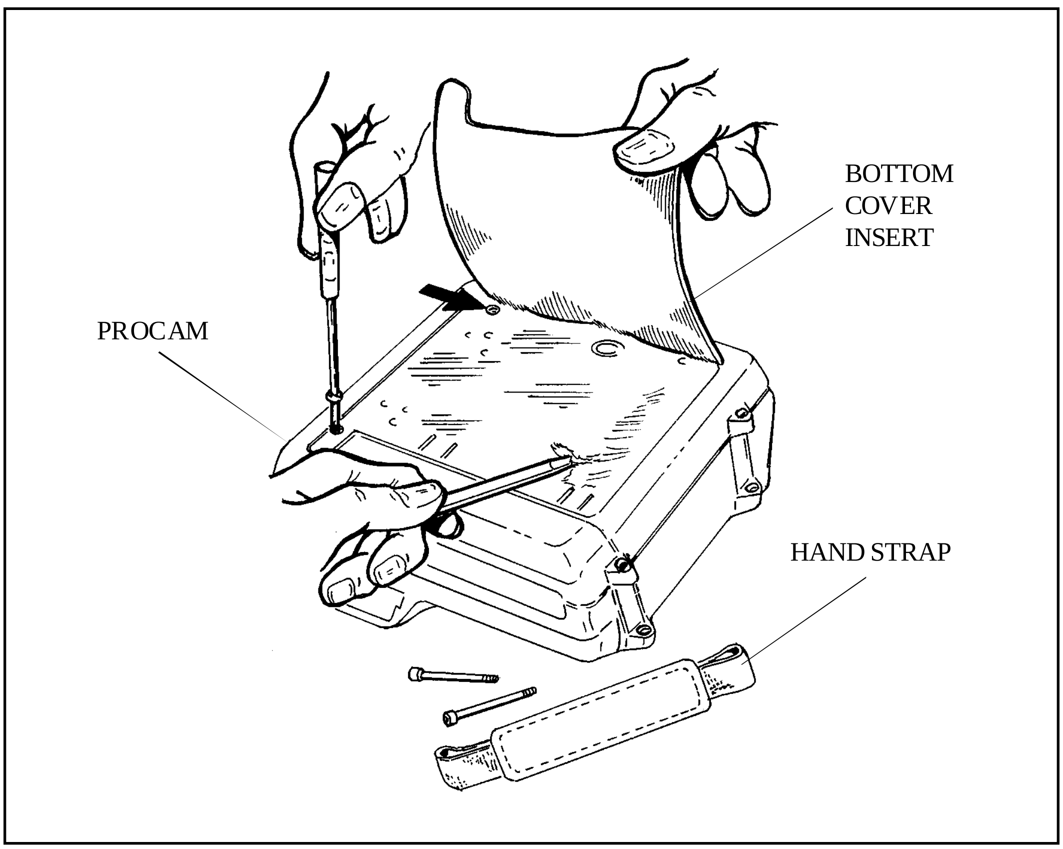


Figure 3-3. Removing Cover Inserts

e. Remove Mid Cover but leave Bottom Cover in place (Figure 3-4). Lift back of Mid Cover first; Push in button marked **FILM** (Door Latch) and lift off the Mid Cover.

Caution: AS SOON AS FLASH CAPACITOR TERMINALS ARE ACCESSIBLE, DISCHARGE BOTH CAPACITORS WITH DUMP PROBE #13119.

f. If Mid Cover Grip is loose or damaged, peel it off and replace it.

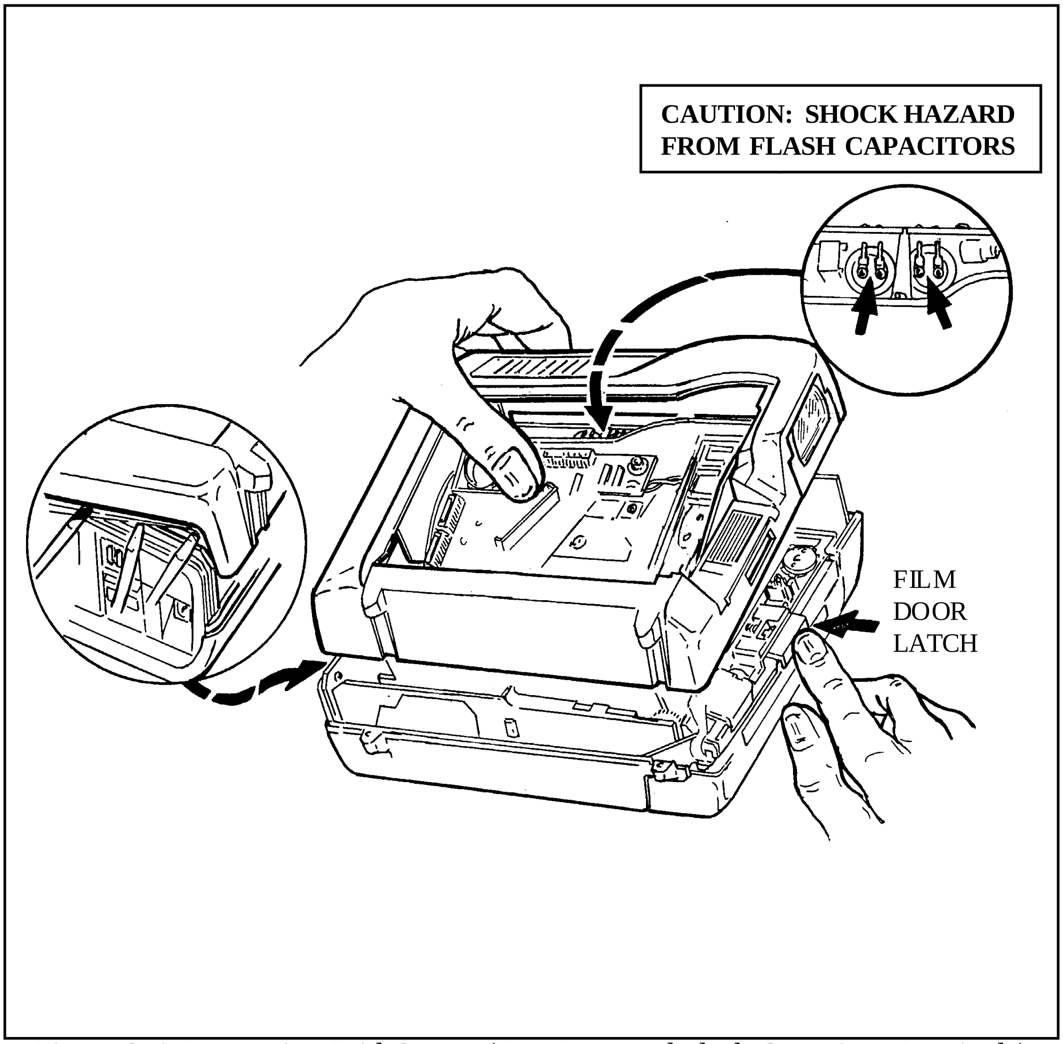


Figure 3-4. Removing Mid Cover (Note Exposed Flash Capacitor Terminals)

2. Replacement

Follow removal steps in reverse order.

Notes: • When replacing the Mid Cover, the spring-loaded lens assembly at the rear of the Viewfinder must be rotated 90^0 toward the front of the ProCam and kept tucked in under the VF Side Cover (Figure 3-5).

• Also, the molded vertical partition **A** on the Mid Cover (Figure 3-5) must slip down between this VF rear lens assembly and the vertical Interface PC Board.

• Also, using a greenstick, keep the lower leg of the spring-loaded Lens Cover actuating arm **B** (Figure 3-5) pushed forward and in frontof the Front Bezel, as the Mid Cover is lowered into place.

• Press in Door Latch (button marked **FILM**).

• Finally, slip the Strobe Insert **C** (Figure 3-5) on the front of the Strobe and Reflector Assembly into place in its Mid Cover recess.

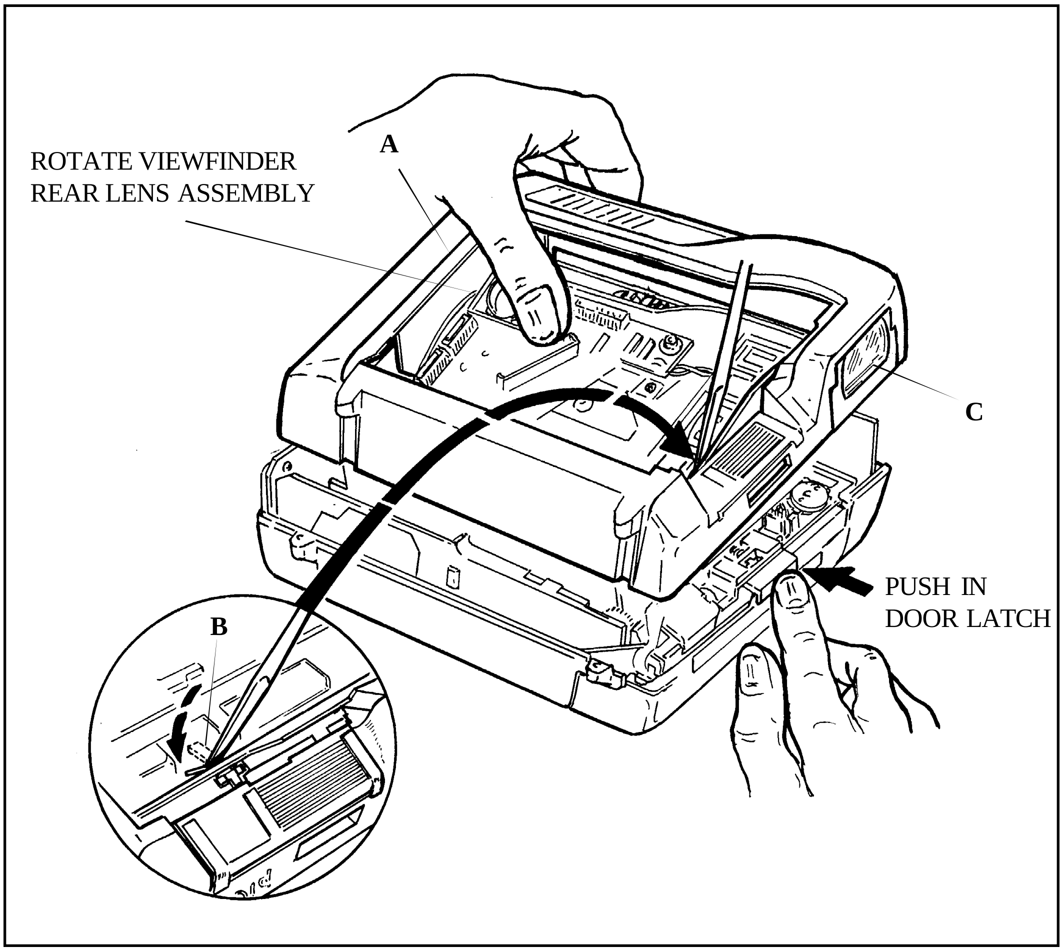


Figure 3-5. Replacing Top Cover and Mid Cover

Front Bezel

1. Removal

With ProCam erected, remove Front Bezel from Shutter Assembly by springing out the Viewfinder Side Cover, to release the tab on the end of the Bezel (Figure 3-6). Front Bezel also has two tabs along its bottom edge.

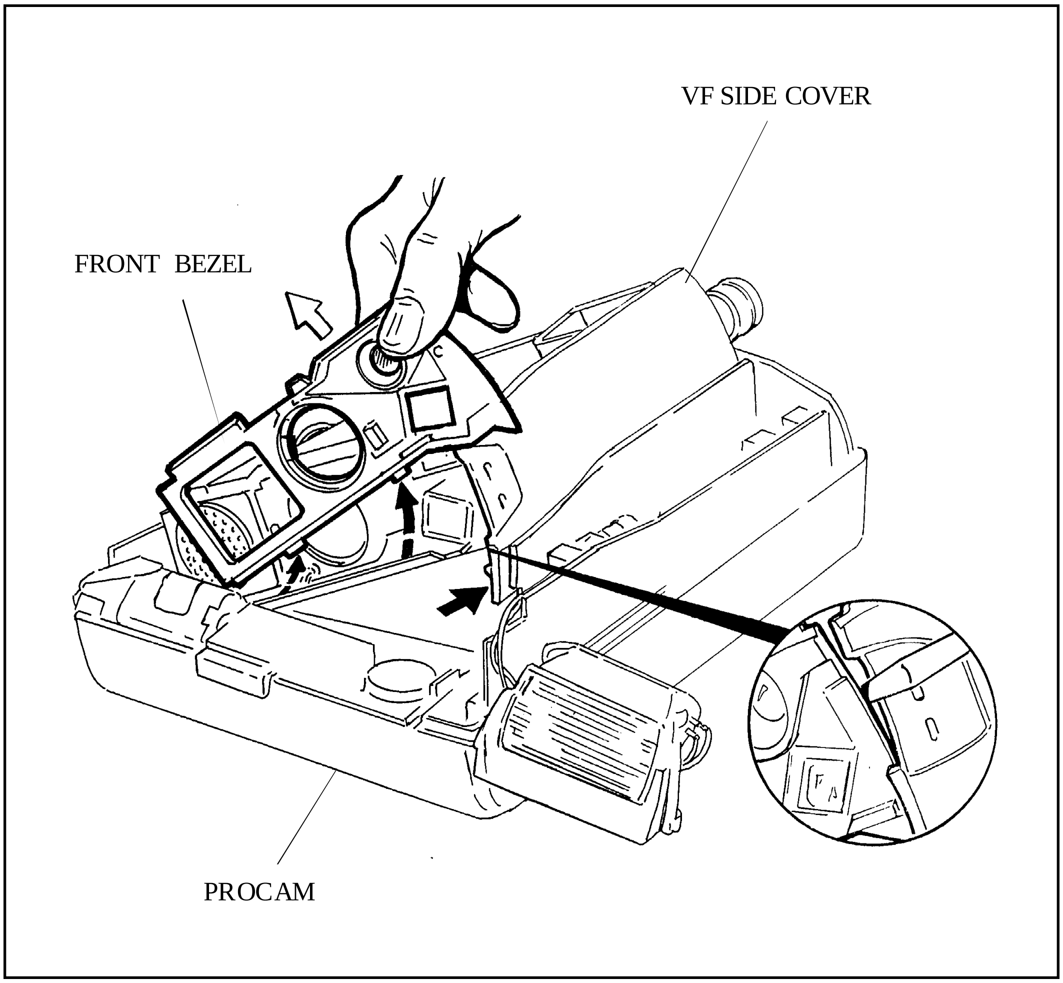


Figure 3-6. Removing Front Bezel

2. Replacment

With ProCam erected, spring out the Viewfinder Side Cover to accept the tab at the bottom right end of the Bezel (Figure 3-6), and at the same time locate the two tabs along the bottom edge of the Bezel into their openings in the front lip of the Bellows/Cone Assembly.

Viewfinder and Eyecup

1. Removal

a. Remove the Viewfinder by disengaging its front tab with a greenstick (Figure 3-7): insert the greenstick from the front between the metal finger on the Bellows/Cone Assembly and the slotted tab on the Viewfinder; pry upwards. Now slide the Viewfinder to the rear and lift it out.

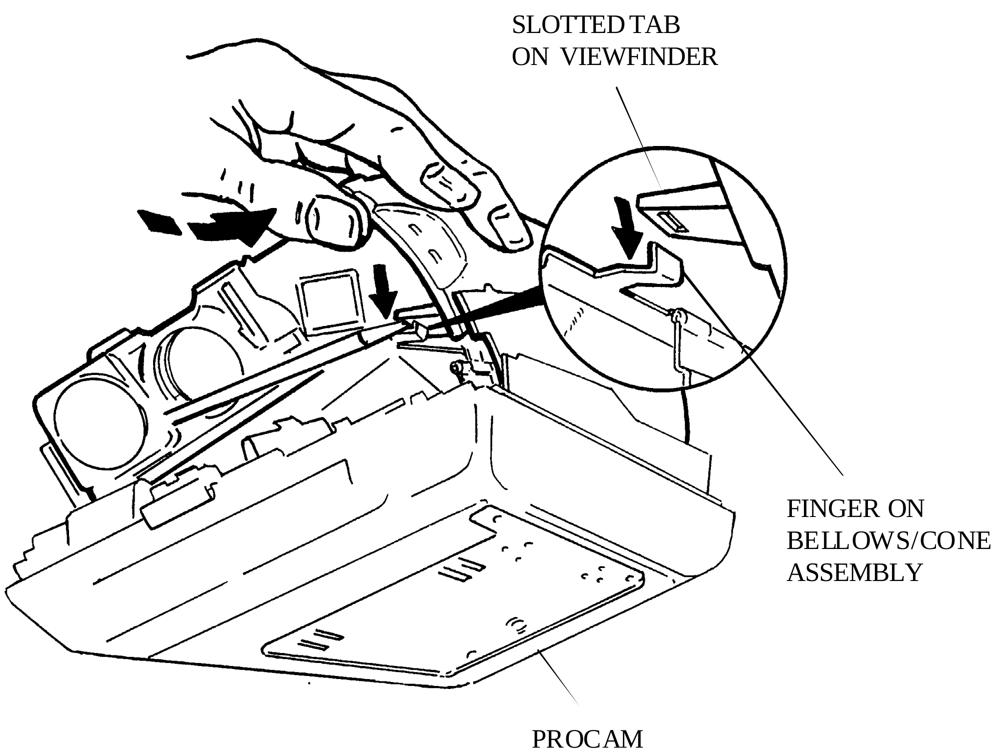


Figure 3-7. Removing Viewfinder Assembly

b. Remove the Viewfinder Eyecup by using tweezers to release the Eyecup Retainer band, then pulling the Eyecup off the Viewfinder (Figure 3-8).

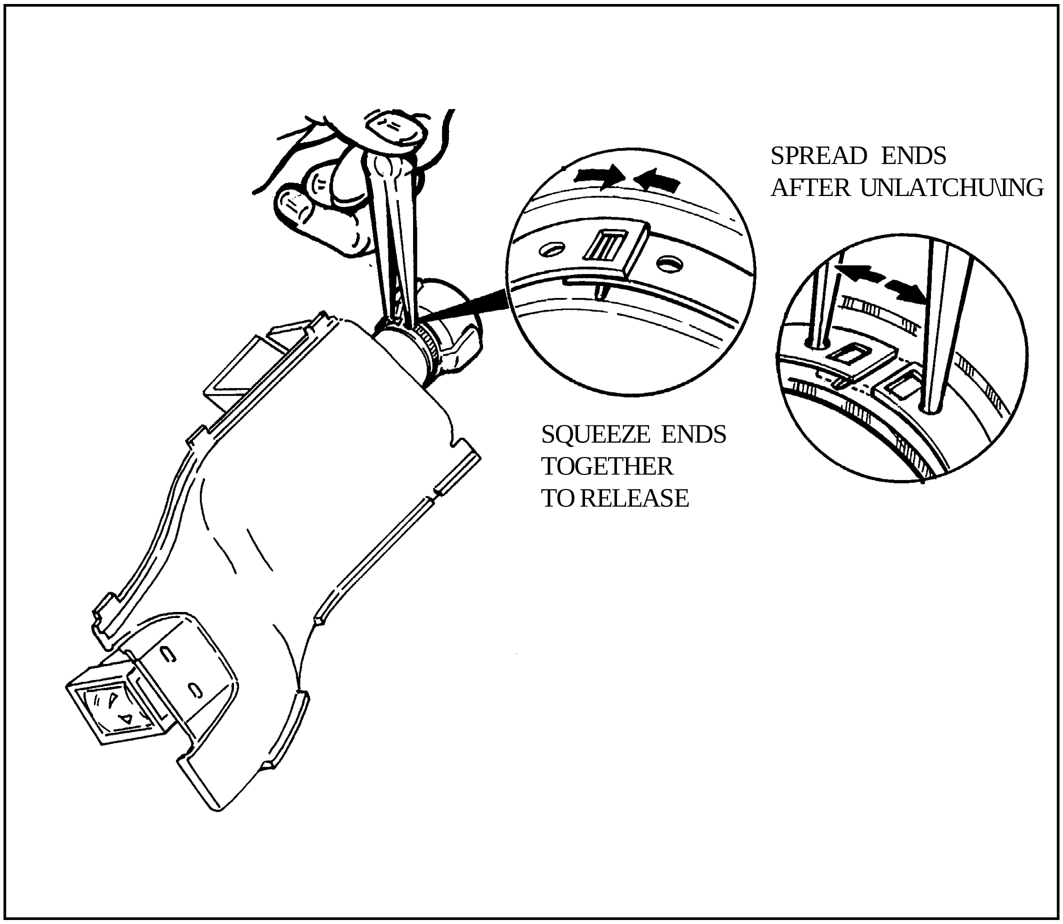


Figure 3-8. Removing Retainer and Eyecup from Viewfinder

2. Replacement

Follow removal steps in reverse order.

Close-Up Lens Switch

1. **Removal**

   Remove the Close-Up Lens Switch by springing out the catch at the bottom of the Lens Mounting Plate and separating the Retainer from the Switch (Figure 3-9).

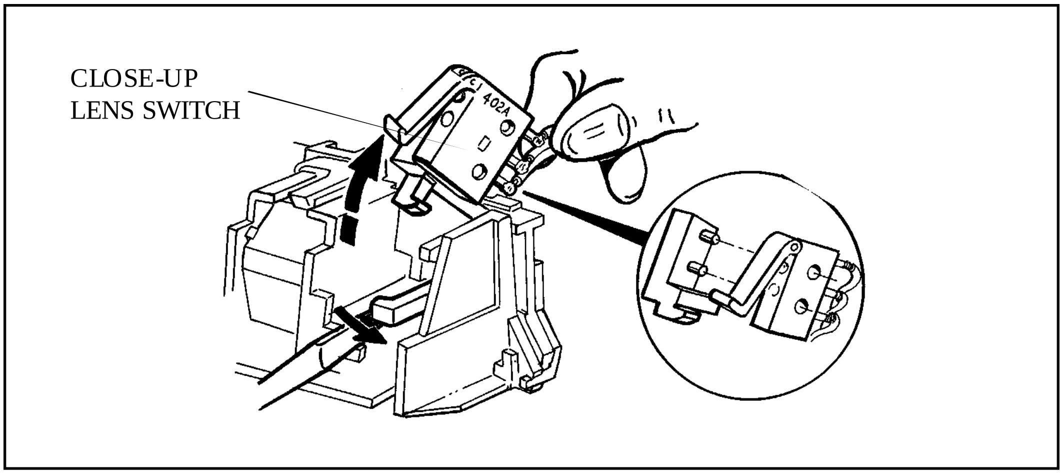


Figure 3-9. Removing Close-Up Lens Switch

2. **Replacement**

   Place the Close-Up Lens Switch Retainer and Switch together as shown in Figure 3-10, then slide them down into their cavity in the Lens Mounting Plate. Note that the tang **A** on the bottom of the Switch Retainer engages the catch **B** on the Mounting Plate, when the Retainer/Switch Assembly is fully seated.

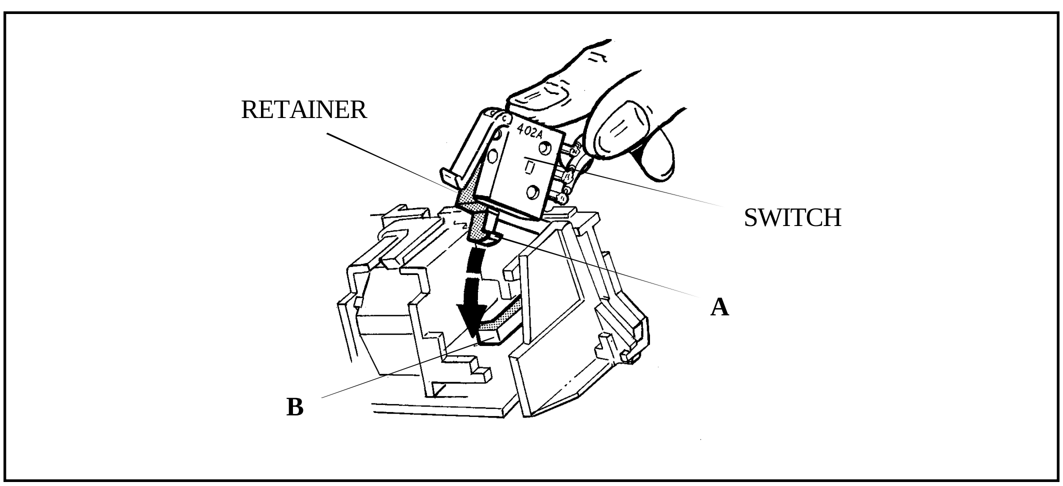


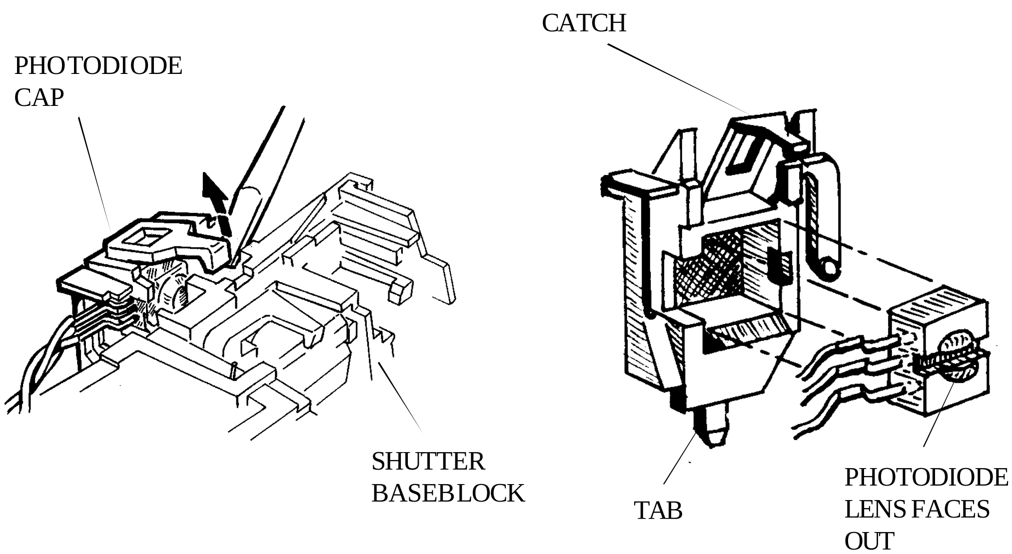
Figure 3-10. Replacing Close-Up Lens Switch/Retainer in the Lens Mounting Plate

Photodiode

1. **Removal**

    a. Remove the Photodiode Cap by gently prying up the catch finger on the top.

    b. Lift the Cap off the Shutter Baseblock and lift out the Photodiode with its cable assembly attached (Figure 3-11).



Removing Cap **Replacing Cap**

Figure 3-11. Removing and Replaceing Photodiode and Cap

2. **Replacement**

    a. Place the Photodiode in its cavity in Cap with lens facing out (Figure 3-11).

    b. Replace Cap with Photodiode by seating bottom tab of Cap into shoulder on Baseblock; then snap top finger catch closed.

Exposure Board

1. Disconnecting Encoder, Piezo and Solenoid 1/ 2

Unplug the Encoder (J12), Piezo (J13) and Solenoid 1/2 (J11) connectors from the Exposure PC Board (Figure 3-12).

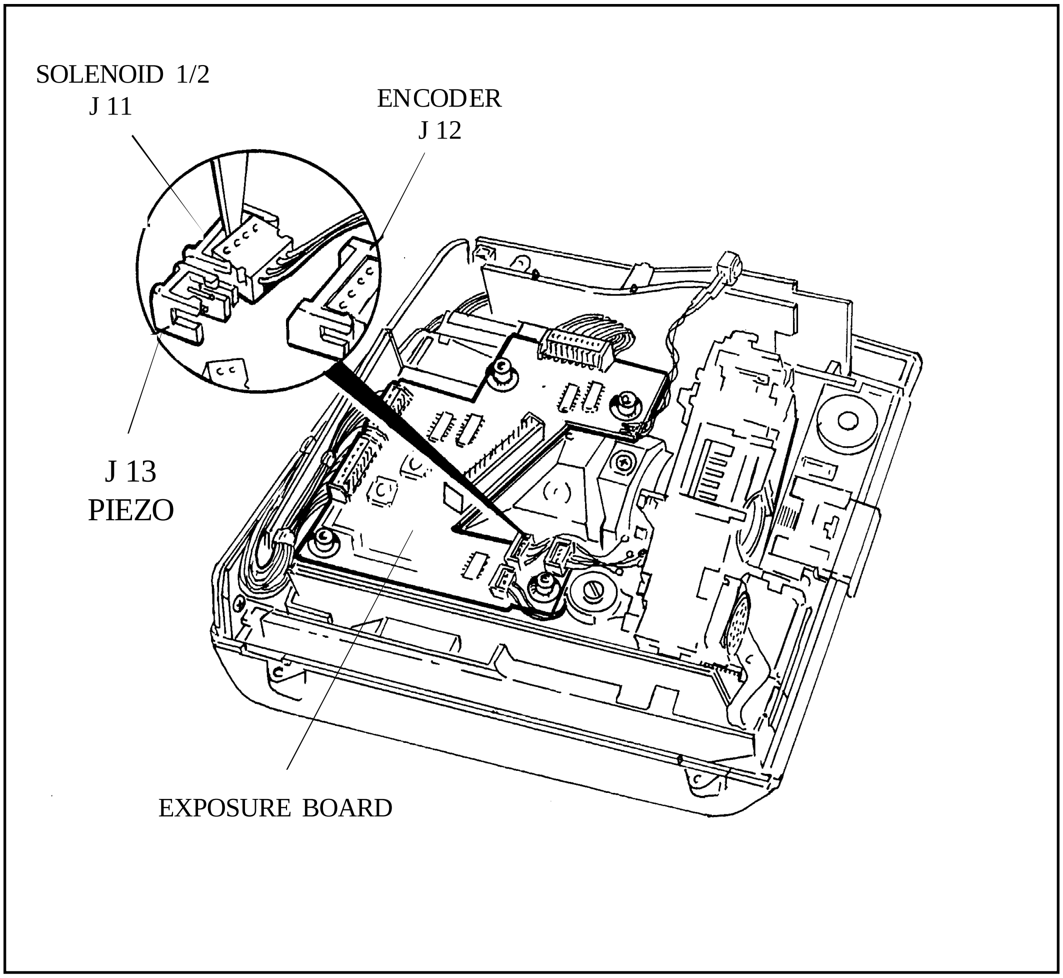


Figure 3-12. Encoder, Piezo and Solenoid 1/2 Connectors on Exposure Board

2. Reconnecting Encoder, Piezo and Solenoid 1/ 2

Reconnect cables to J12, J13 and J11 on the Exposure PC Board.

Transducer Housing Assembly and Transducer

1. Removal

Unlatch the top **T** leg of the Transducer Housing Assembly from the Lens Mounting Plate, then the bottom **T** leg, and lift it off the Lens Mounting Plate (Figure 3-13).

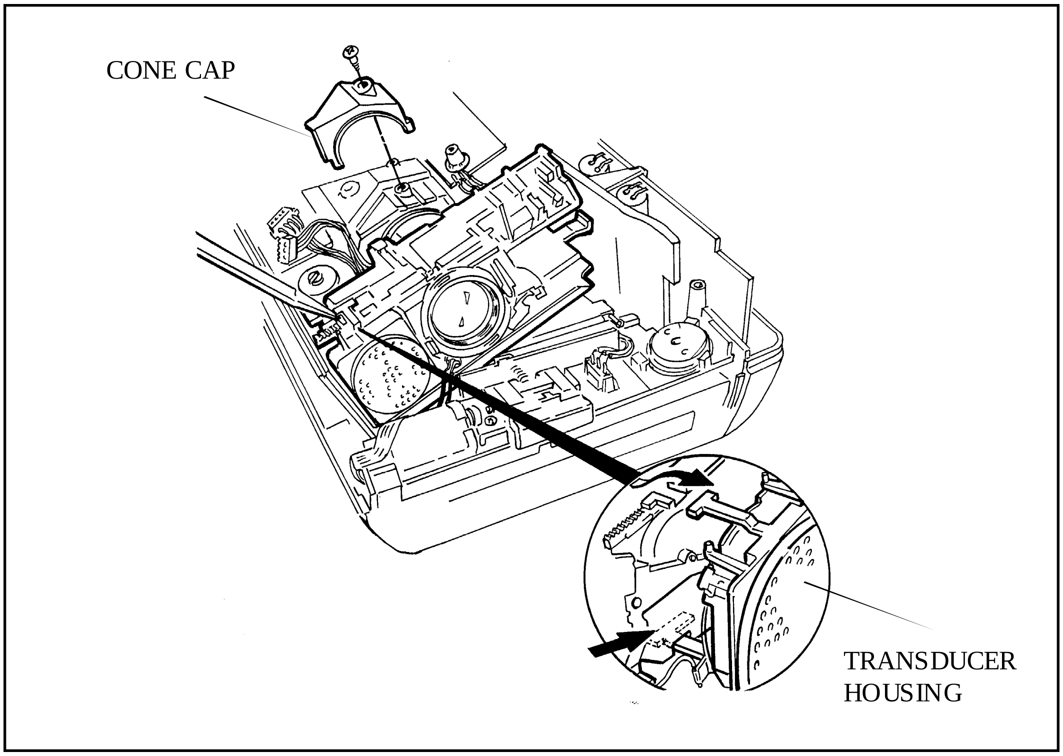


Figure 3-13. Removing Transducer from Shutter Assembly

2. Replacement

Locate the bottom **T** leg of Transducer Housing Assembly in the Lens Mounting Plate, then press the Assembly into place, latching the top **T** leg (Figure 3-13).

Cone Cap

1. Removal

Remove the Cone Cap screw and Cone Cap (Figure 3-13).

2. Replacement

Install the Cone Cap and screw (Figure 3-13).

Shutter Assembly

1. Removal

Note: Refer to Shutter Disassembly and Reassembly procedures on page 3- for instructions on how to disassemble and reassemble the Shutter Assembly.

a. Using a greenstick, gently pry out the catch **A** on the Bellows/Cone Assembly, just enough to release it from the tab **B** on the right (Strobe) end of the Shutter Baseblock (Figure 3-14). Gently lift up the right end of the Shutter Assembly until the locking catch **C** at the left end releases. Then lift the Shutter Assembly straight up and out of the Bellows/Cone Assembly.

b. Remove the Rear Lens Baffle (Figure 3-14), being careful not to let it fall down inside the Bellows/Cone Assembly.

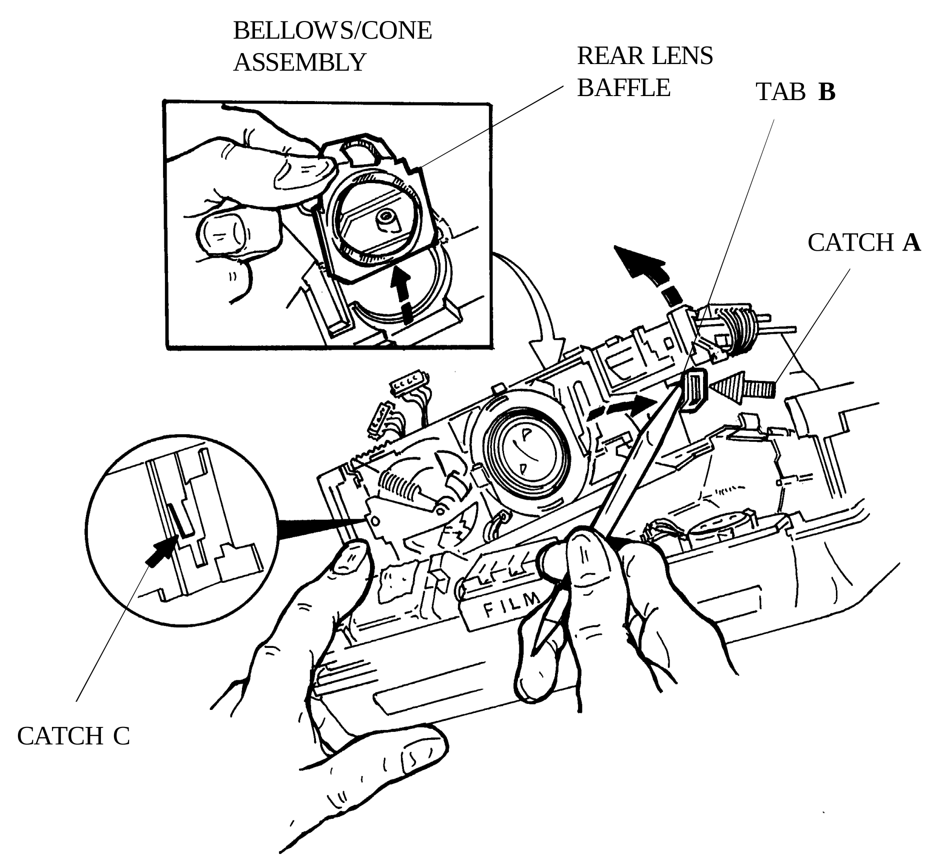


Figure 3-14. Removing Shutter Assembly from Bellows/Cone Assembly

2. Replacement

a. Replace the Rear Lens Baffle (Figure 3-14), then slide the Shutter Assembly straight down into the Bellows/Cone Assembly. Be sure that the locking catches at left and right ends engage the Shutter Baseblock.

b. Replace the Cone Cap over the Rear Lens Baffle and secure it with its flat head screw.

Exposure and Ranging PC Boards

1. Removal

a. Remove the four rubber Retainer rings from the molded studs on the Bellows/Cone Assembly, which secure the Exposure PC Board (Figure 3-15).

b. Disconnect the Ranging Board (J10) and two Interface Connectors (J9 and J8) from the Exposure Board and remove the Exposure Board (Figure 3-15).

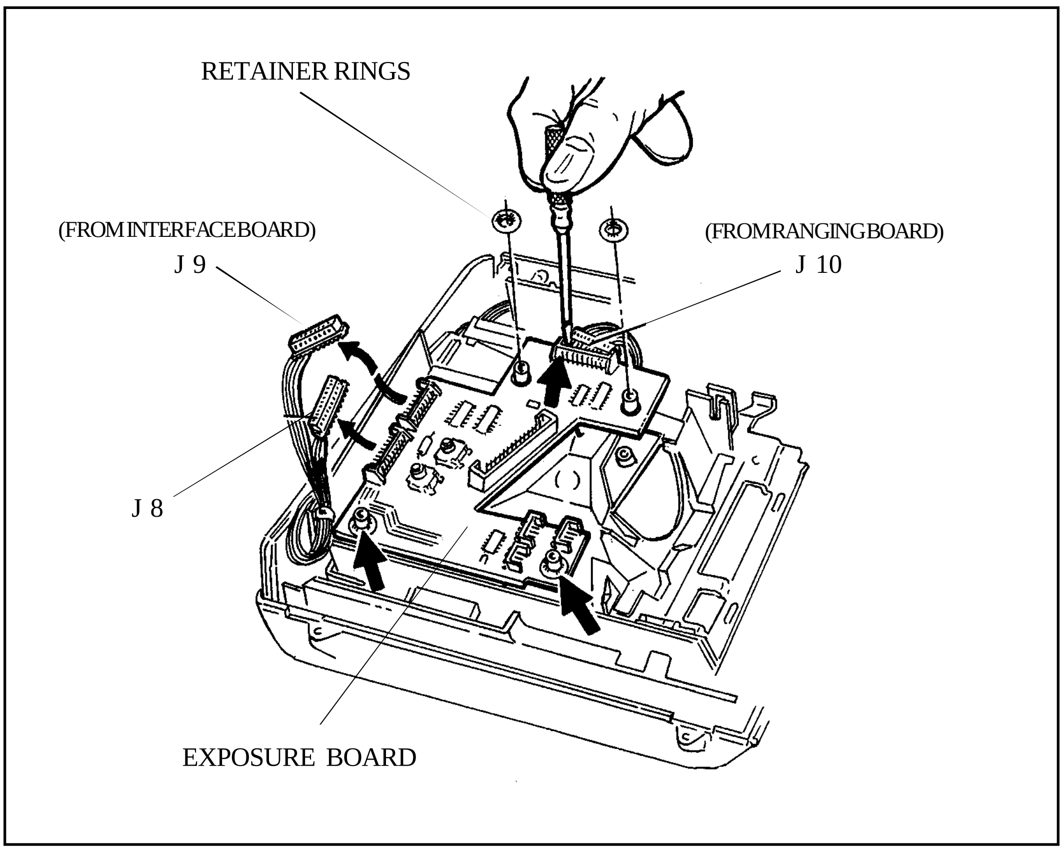


Figure 3-15. Removing Retainers and Connectors from Exposure Board

c. Remove the two tubular Spacers between the Exposure and Ranging Boards, and remove the Ranging Board with the Transducer connected to it (Figure 3-16).

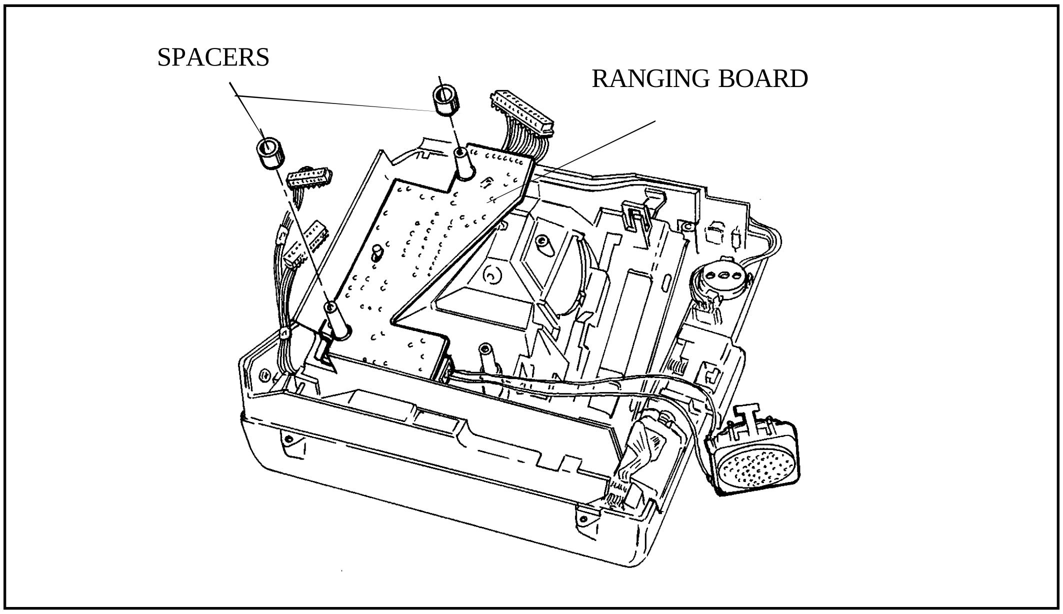


Figure 3-16. Removing Ranging PC board

d. Remove the three Bottom Cover Screws (Fig. 3-17), but leave Bottom Cover in place.

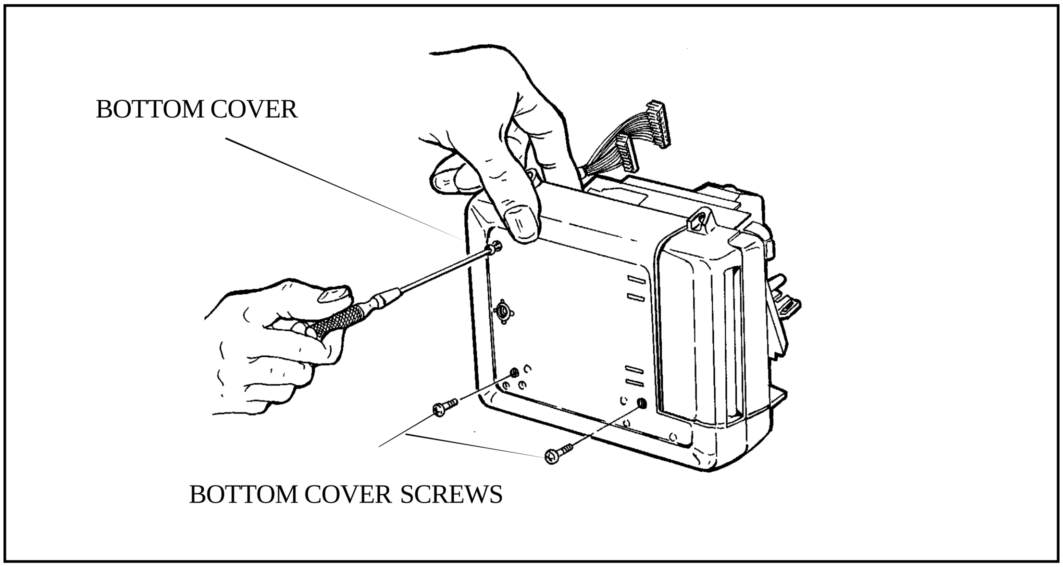


Figure 3-17. Removing Bottom Cover Screws

2. Replacement

Follow the removal steps in reverse order.

Door Assembly

1. Removal

a. Open the Door .

b. Remove the Door Assembly by springing out the right side plate to release it from its pivot pin (Figure 3-18).

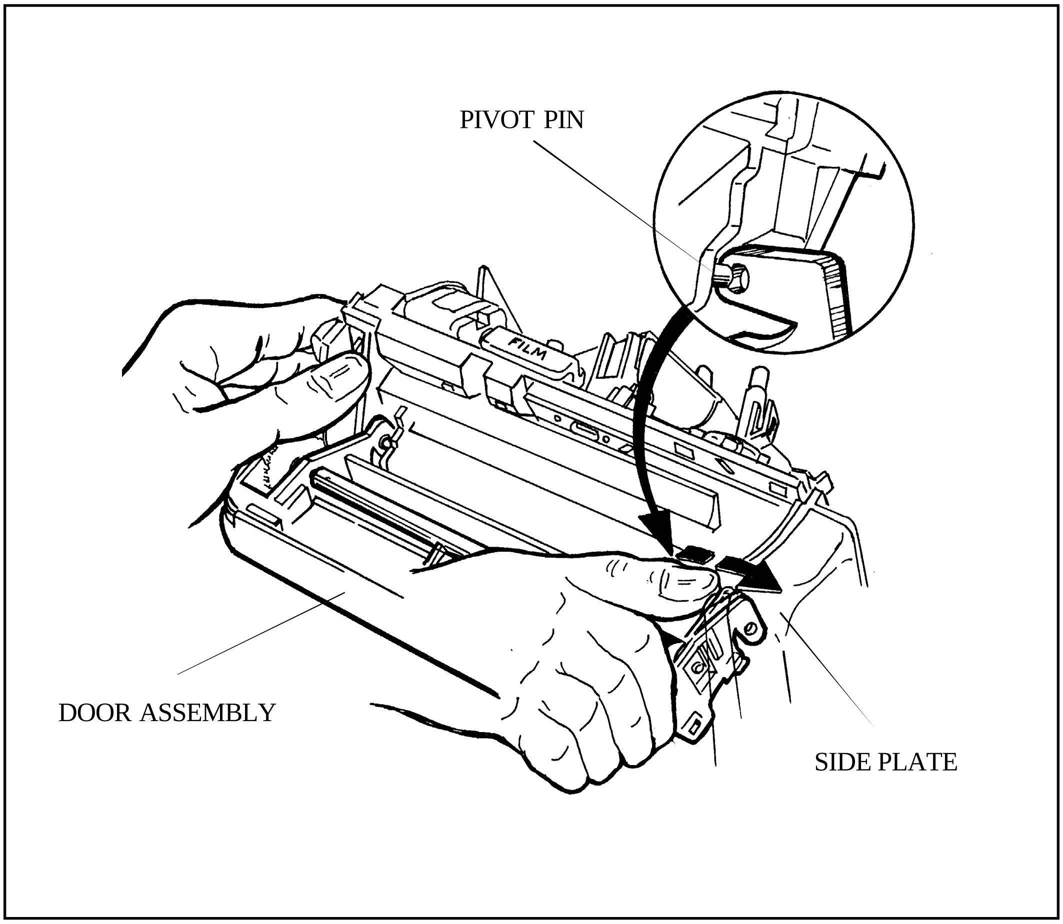


Figure 3-18. Removing Door Assembly

2. Replacement

a. Holding the Door Assembly in its down-most position (fully open), engage the right-hand side plate with its pivot pin on the Mainframe (Figure 3-18).

b. Now spring out the left-hand side plate slightly and engage it with its pivot pin. Check that Door operates freely and latches when closed.

Rear Panel

1. Removal

Using a greenstick, pry the Rear Panel upward, then tilt it backward to disengage the two locating pins on its inside surface from their holes in the Interface PC Board (Figure 3-19).

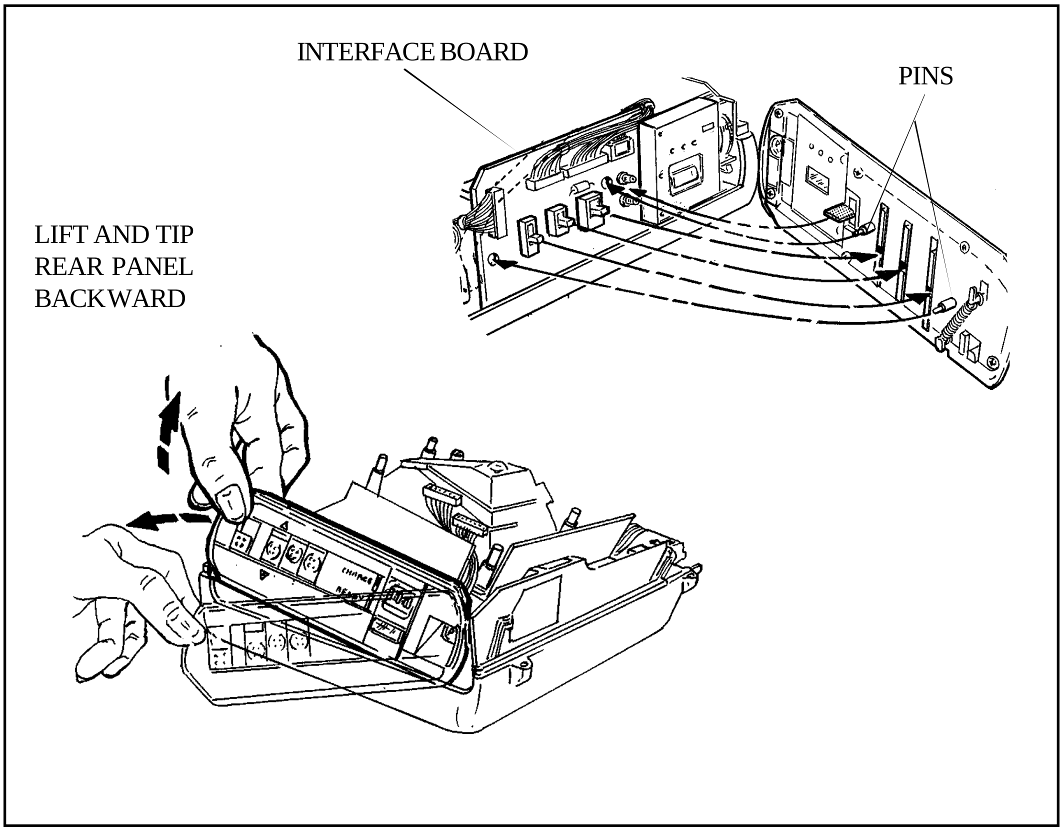


Figure 3-19. Removing Rear Panel Assembly

2. Replacement (Figure 3-20)

Note: Use care and do not force the Rear Panel into position: several components must be properly aligned before the Rear Panel can be correctly re-installed.

a. Set all three slide switches on the Interface PC Board in the DOWN position.

b. Align the two molded pins on the inside of the Rear Panel with their corresponding holes in the Interface PC Board.

c. Note the molded projecting fin on the inside of the Rear Panel, which shields CHARGE LED-1 from READY LED-2 on the Interface PC Board.

d. Slide the Rear Panel down into position, positioning the lip along its bottom edge on the inside of the Bottom Cover.

e. Check that the OPEN latch button and the three switch buttons operate properly.

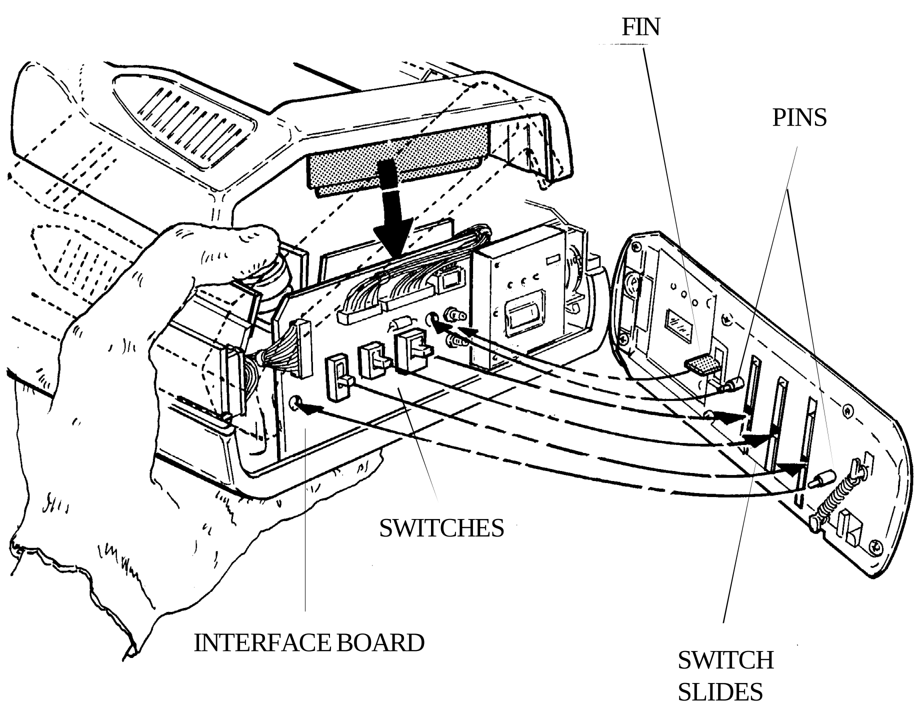


Figure 3-20. Replacing Rear Panel Assembly

Strobe Board, Erect Latch, and Cone Assembly

1. Removal

a. Lift the cabling from the Interface Board out of the way, to gain access to the Erect Latch Spring (Figure 3-21). Now unhook one end of the Erect Latch Spring from the Erect Latch.

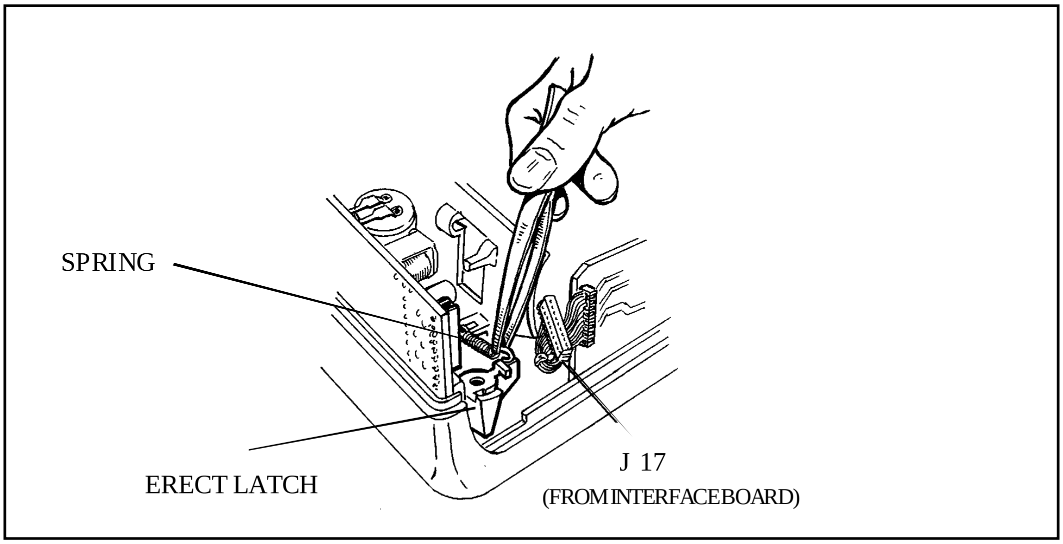


Figure 3-21. Unhooking Erect Latch Spring

b. Lift one end of the Strobe Board and disconnect the Erect Switch (J15), Interface Board (J17) and Battery connectors (J16) from the Strobe PC Board (Figure 3-22).

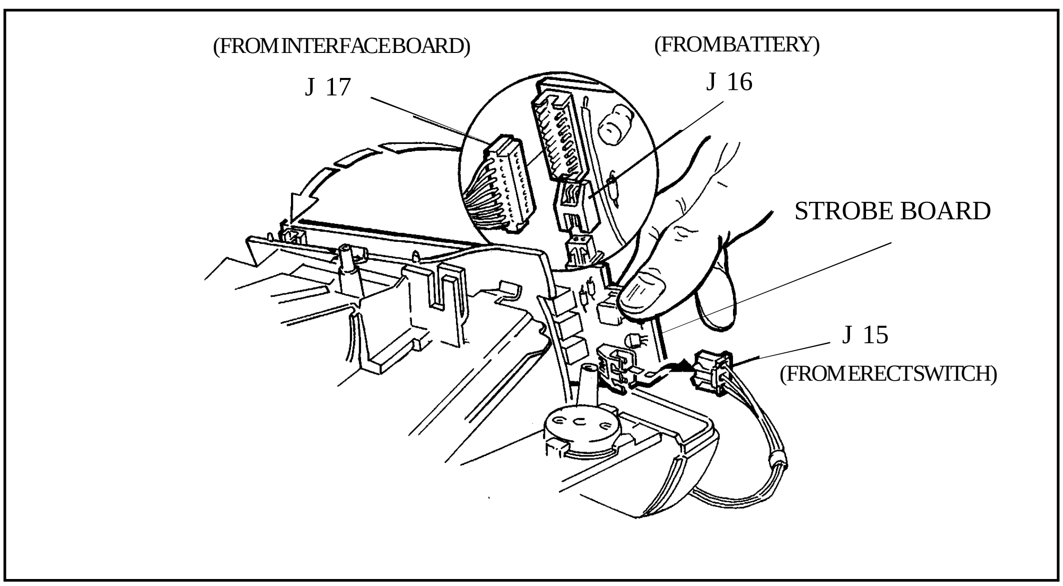


Figure 3-22. Disconnecting Erect Switch (J15), Interface Board (J17) and Battery cables (J16) from Strobe Board

c. Lift the Strobe Board out of the Camera and remove the Erect Latch Spring and Erect Latch.

d. Now lift the Cone Assembly off the Bottom Cover (Figure 3-23).

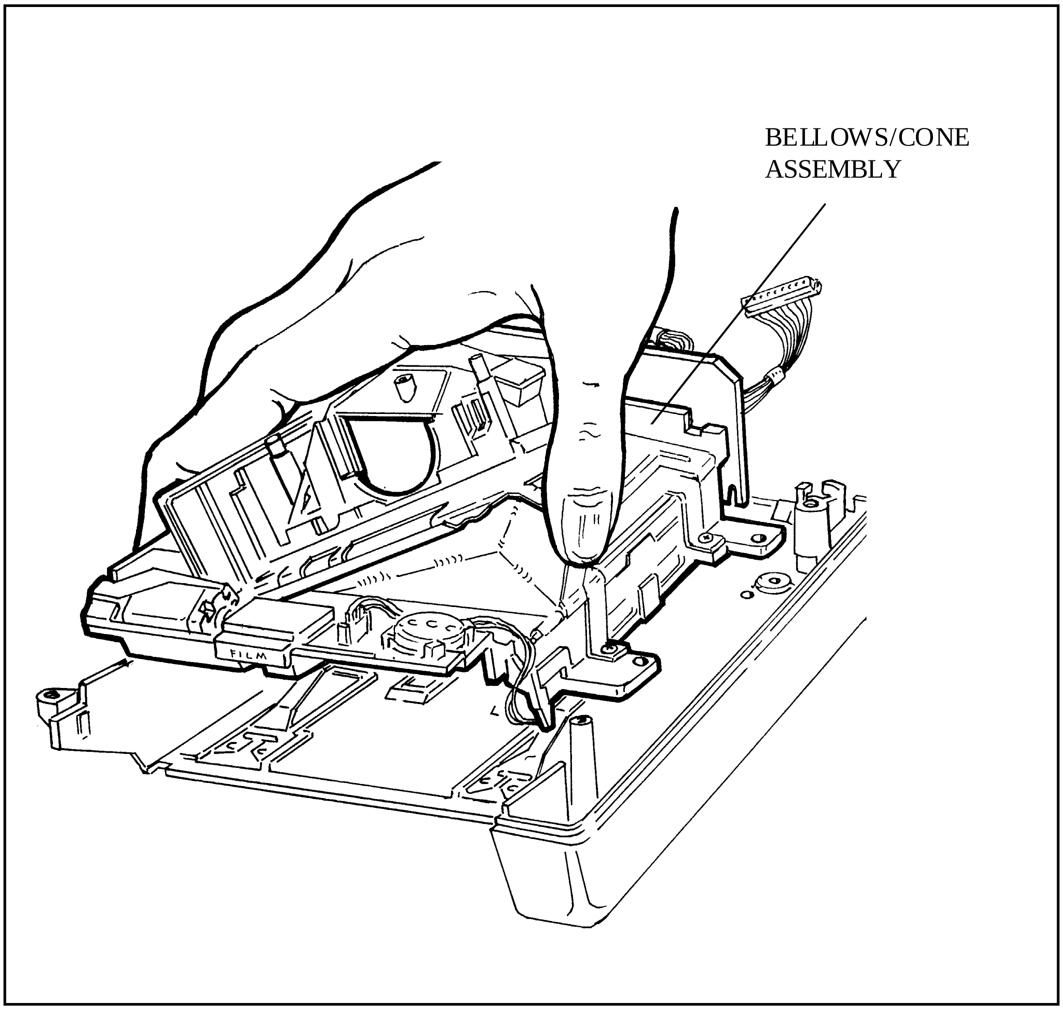


Figure 3-23. Removing Cone Assembly from Bottom Cover

2. Replacement

Follow the removal steps in reverse order.

Note: Be sure that the two molded pins **A** on the bottom of the Strobe Mounting Bracket seat in their holes **B** in the Mainframe tabs (Figure 3-24).

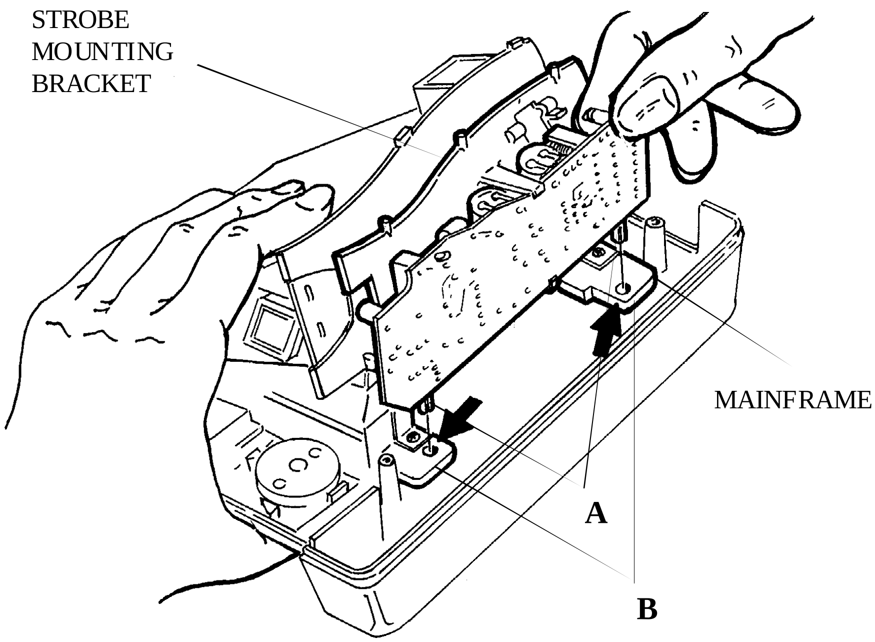


Figure 3-24. Seating Strobe Mounting Bracket

Interface Board and Date Module

1. Removal

a. Pull the end of the Flex out of J5 on the Interface Board (Figure 3-25).

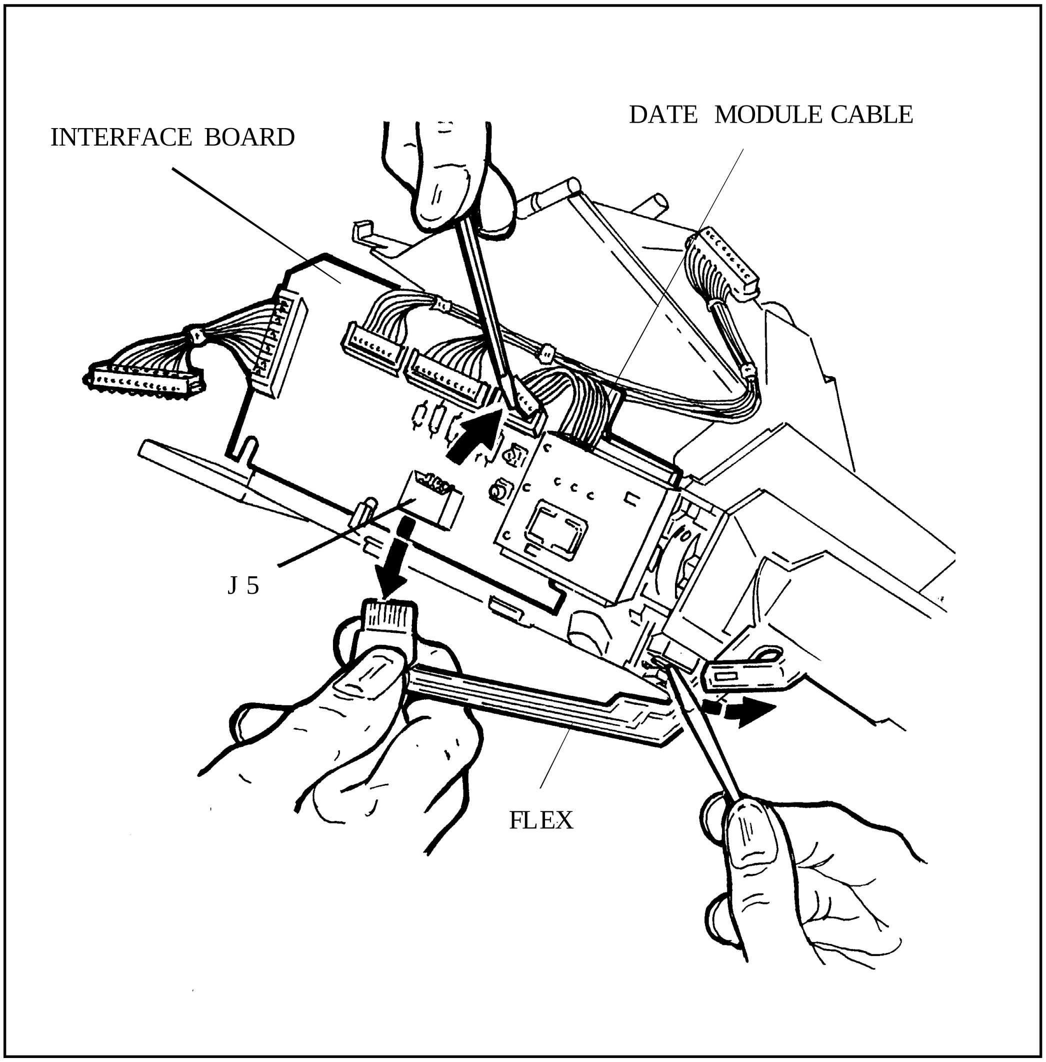


Figure 3-25. Removing Flex from Interface Board

b. Disconnect the Date Module cable from the Interface Board and lift out the Interface Board.

c. Remove Date Module from Mainframe by depressing the locking shoulder **A** in the Mainframe and sliding Module out (Figure 3-26).

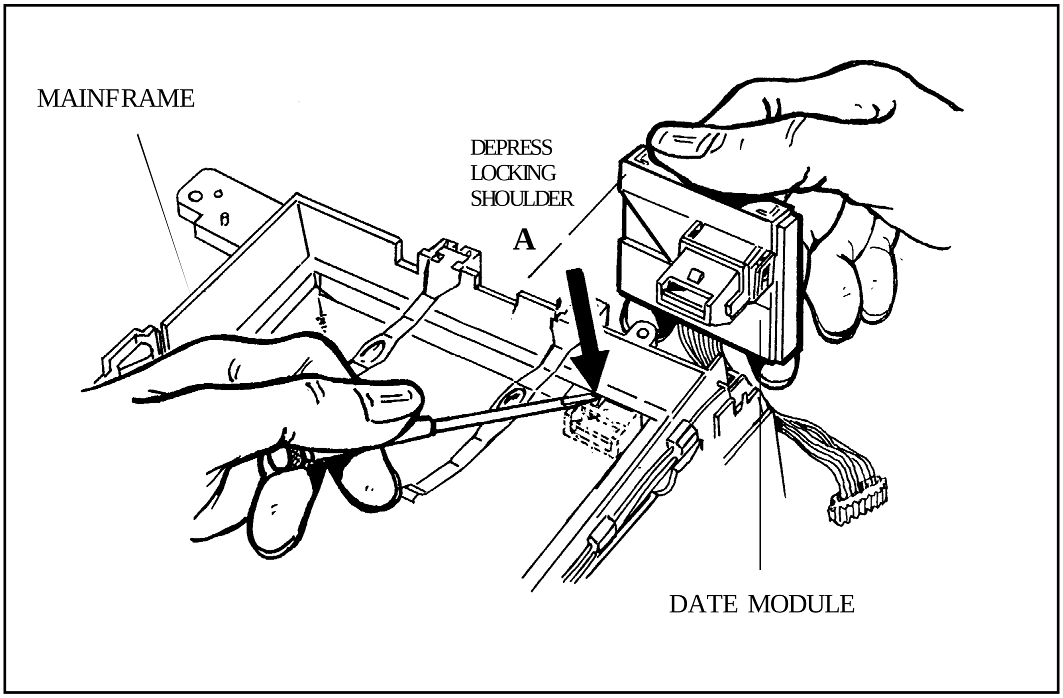


Fig. 3-26. Removing Date Module from Mainframe

2. Replacement

Follow removal steps in reverse order.

Motor Flex

1. **Removal**

   a. Remove the Motor Flex Retainer from the Gear Drive Cover (Figure 3-27) by releasing the two latching fingers: insert a narrow blade into openings **A** and **B** and turn blade in direction shown by arrows.

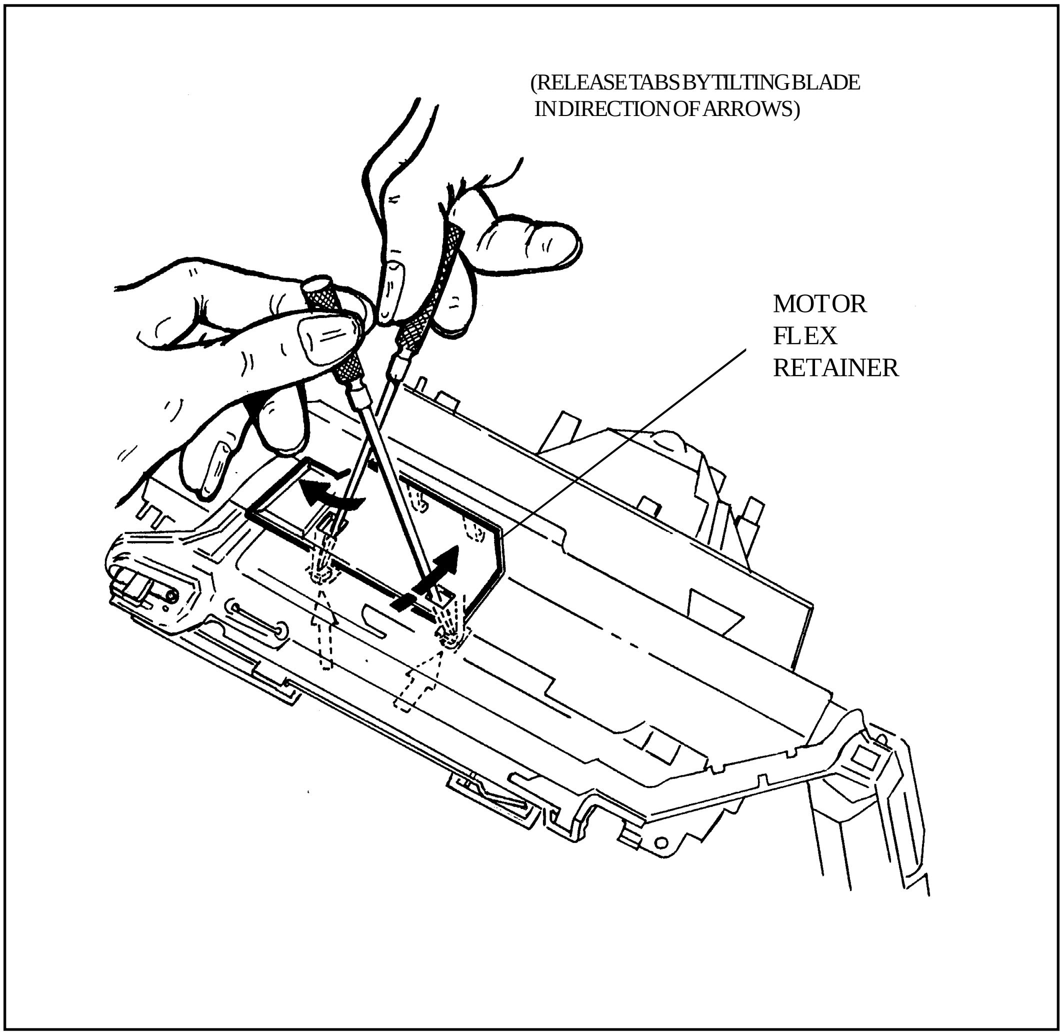


Figure 3-27. Removing Motor Flex Retainer from Gear Drive Cover

   b. Remove the Motor Flex, freeing it from the Speed Switch by depressing the Wireforms of the Switch and lifting the internal locking tang **A** out of the slot in the Flex (Figure 3-28). (If the internal locking tang **A** is not lifted, the Flex may be damaged during removal from the Speed Switch.)

   c. Remove the Flex from the Motor.

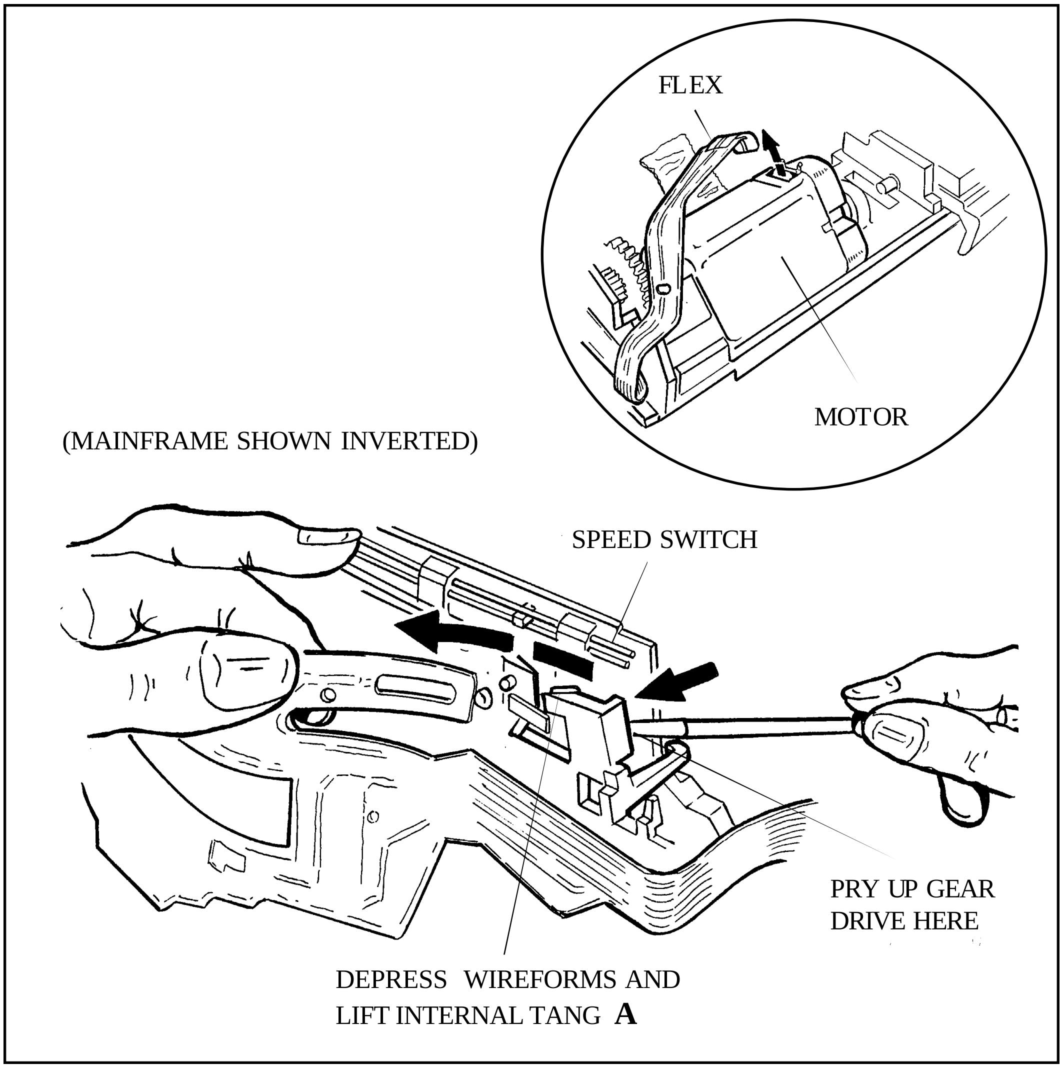


Figure 3-28. Removing Motor Flex from Mainframe and Motor

2. Replacment

Follow removal steps in reverse order.

Note: The silver (conductor) side of Flex faces rear of Motor when inserted into Motor.

Bellows/Cone Assembly

1. Removal

a. Remove the two screws holding the Erect System to the Mainframe (Figure 3-29).

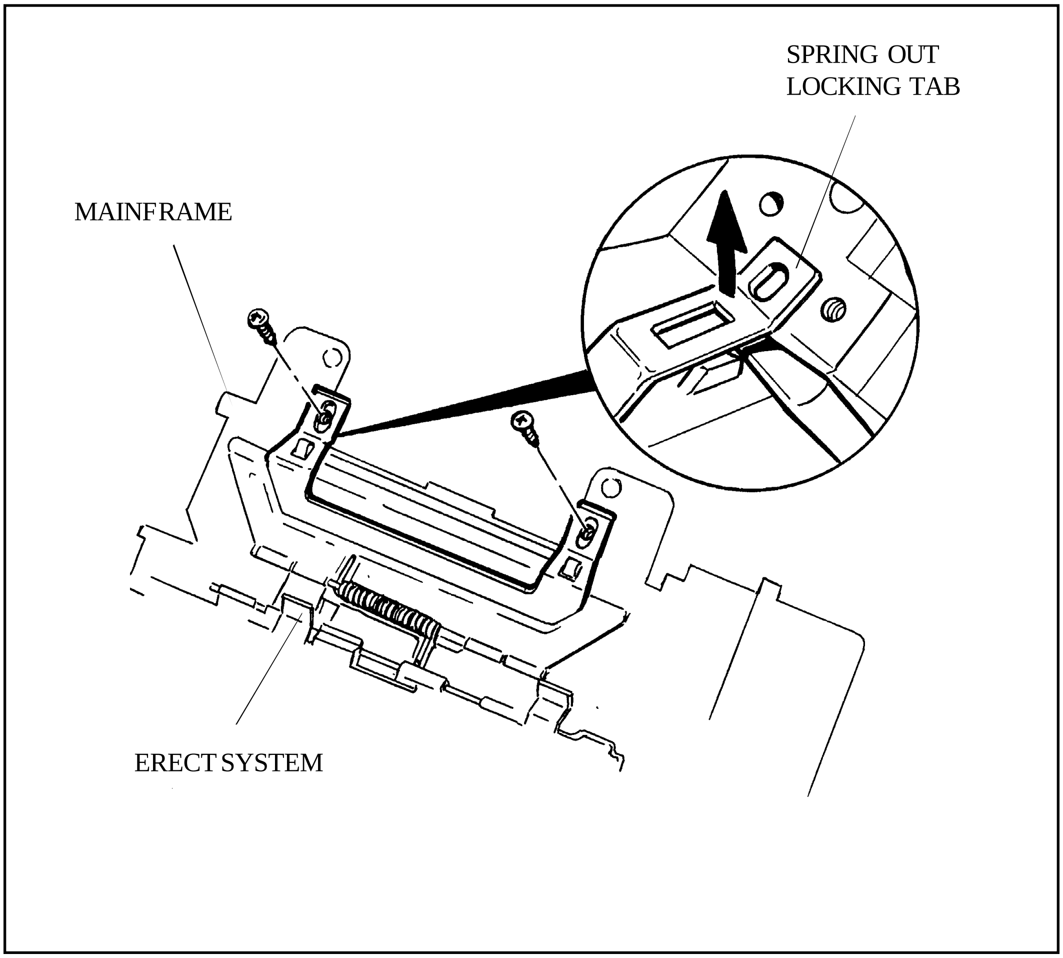


Figure 3-29. Removing Screws Holding Erect System

b. Remove the hold-down screw at the end of the Erect System hinge pin (Figure 3-30).

Note: Hold-down screw may not be present on some models.

c. With a greenstick, gently release the locking tabs on the base of the Bellows/Cone Assembly from the Mainframe (Figure 3-29).

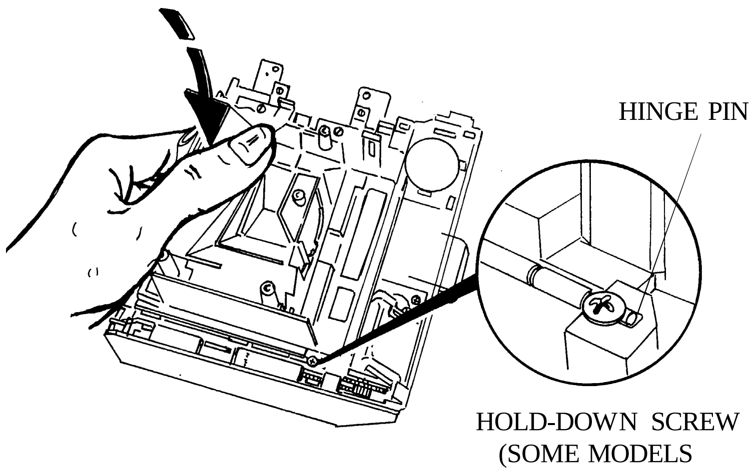


Figure 3-30. Removing Hold-Down Screws at End of Erect System

d. Lift the Bellows/Cone Assembly off the two locating pins on the Mainframe (Figure 3-31).

e. Using one hand to keep the Bellows/Cone Assembly collapsed, lift up the Erect Spring end of the Bellows/Cone Assembly and slide it out of the Mainframe (Figure 3-31). (There are two tabs on the Assembly which must be freed from their mounting slots on the back of the Drive System.) Re move the Booster Spring from the Bellows rail.

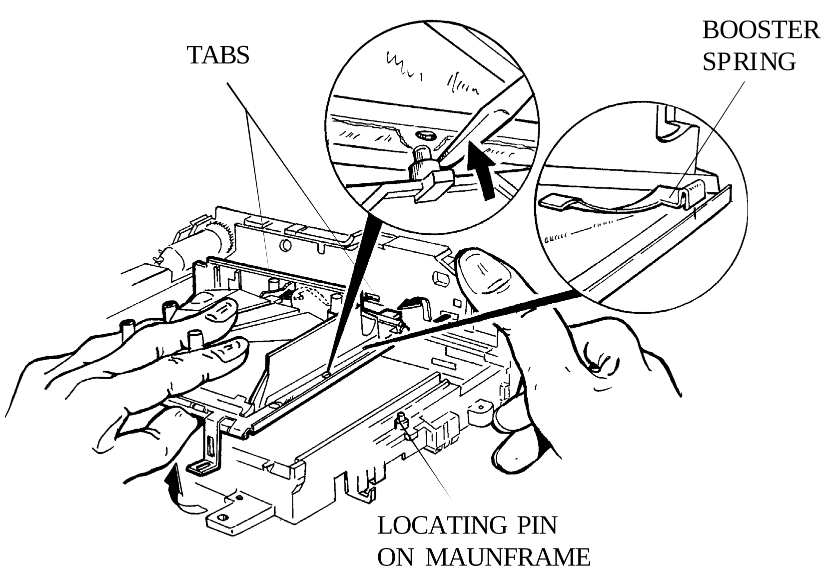


Figure 3-31. Removing Bellows/Cone Assembly from Mainframe

2. Replacement

a. Manually push in the spring-loaded erecting mechanism **A** and hold the Bellows/Cone Assembly down in a collapsed position (Figure 3-32).

b. Keeping the Assembly collapsed and at a slight angle to the Mainframe (Figure 3-32), insert the tabs **A** into slots **B** in the rear wall of the Gear Drive, and be sure the end of the hinge pin **C** seats in its recess **D**. (If a stop screw was present at the end of the hinge pin, replace it now.)

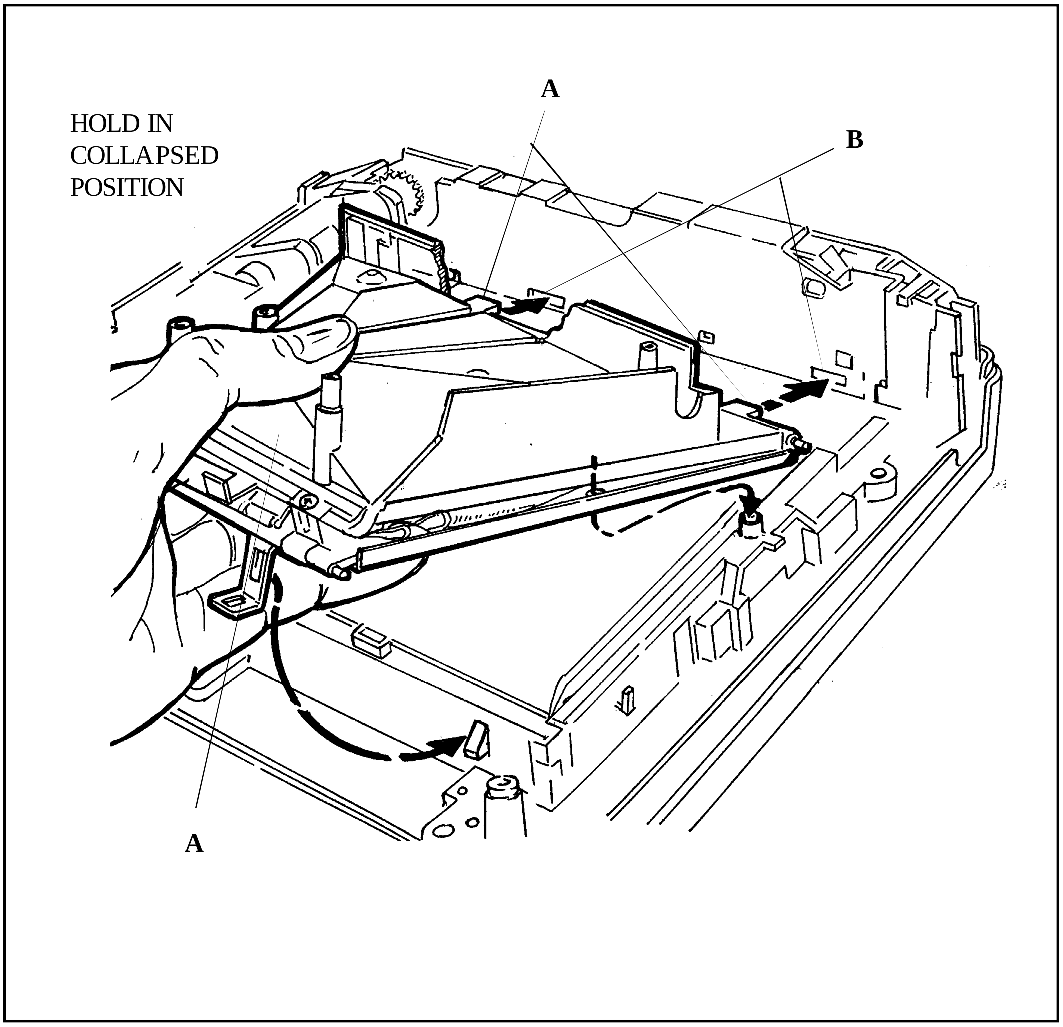


Figure 3-32. Bellows/Cone Assembly Ready for Installation in Mainframe

c. With the Assembly still held in a collapsed position, lower it onto Mainframe until it seats over the two locating pins **E** (Figure 3-33). Apply enough downward pressure until the legs **F** are fully engaged over their shoulders **G** and snap into place.

d. Replace the two screws attaching legs **F** to Mainframe (Figure 3-33).

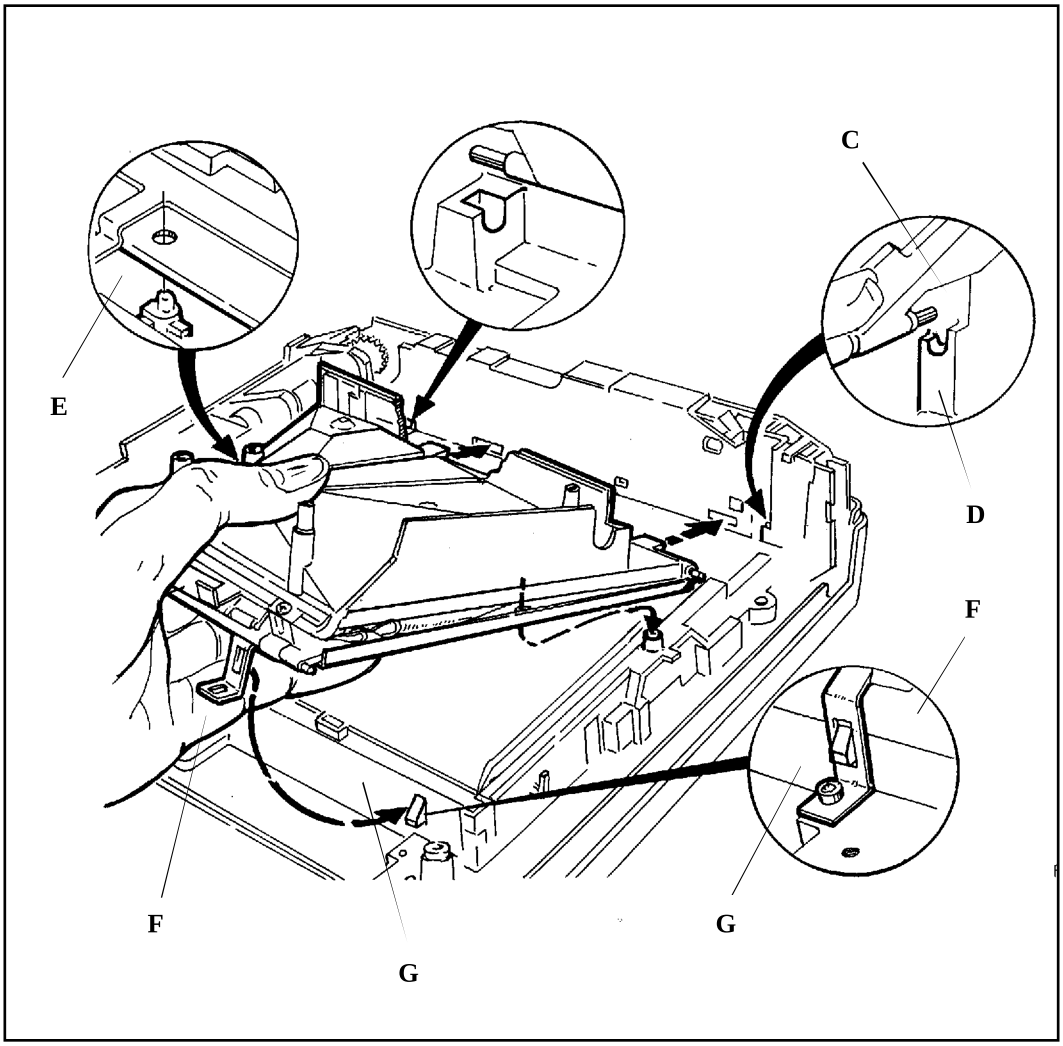


Figure 3-33. Aligning and Attaching Bellows/Cone Assembly to Mainframe

Piezo

1. **Removal**

   Remove Piezo from its Mainframe cavity by inserting the tips of needlenose pliers (or a spanner) into Cover sockets and rotating the Cover CCW slightly (Figure 3-34).

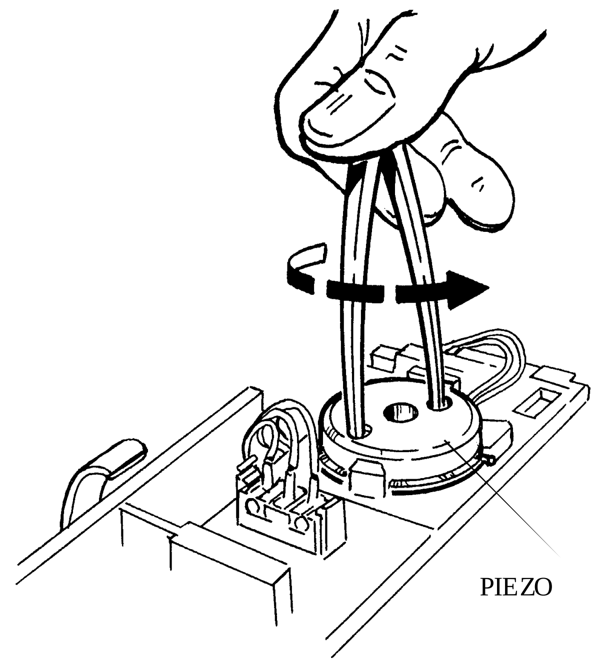


Figure 3-34. Removing Piezo from Mainframe

2. **Replacement**

   Follow removal steps in reverse order.

Door Latch/Erect Switch Assembly

1. Removal

a. Remove the three screws holding the Door Latch/Erect Switch Assembly to the Mainframe (Figure 3-35). This also frees the Erect Switch Retainer and cable hold-down; don't lose it.

b. The Erect microswitch and cable may be removed from the base of the Door Latch Assembly by gently springing out the catches at the front and back of the Switch body.

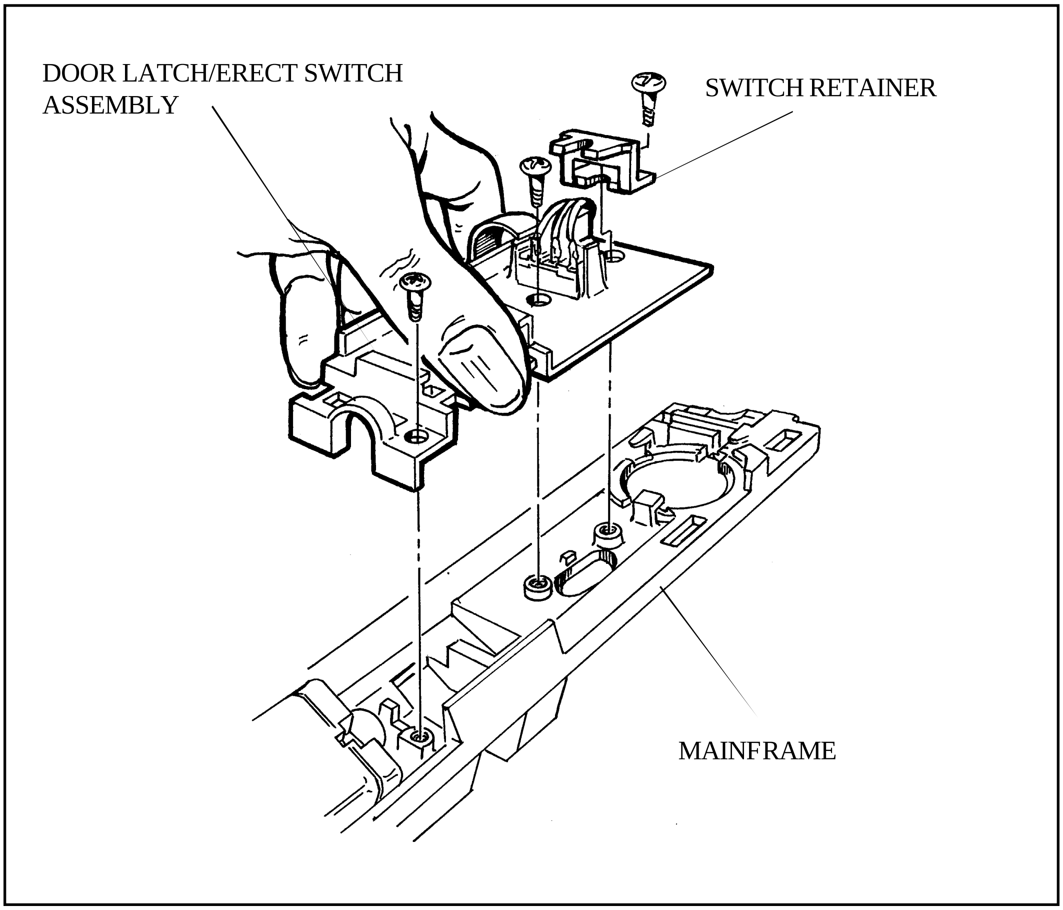


Figure 3-35. Removing Door Latch/Erect Assembly and Switch

2. Replacement

a. Attach to the Mainframe with three screws removed.

b. If Erect Switch is replaced, insert it with switch actuator on the underside to the rear; check that switch clicks when Door is closed.

Motor

1. Removal

Remove the Motor with mounted pinion gear by pushing it in the direction shown by the arrow in Figure 3-36 (to free the Motor hub), then lifting the Motor out of its Mainframe cavity.

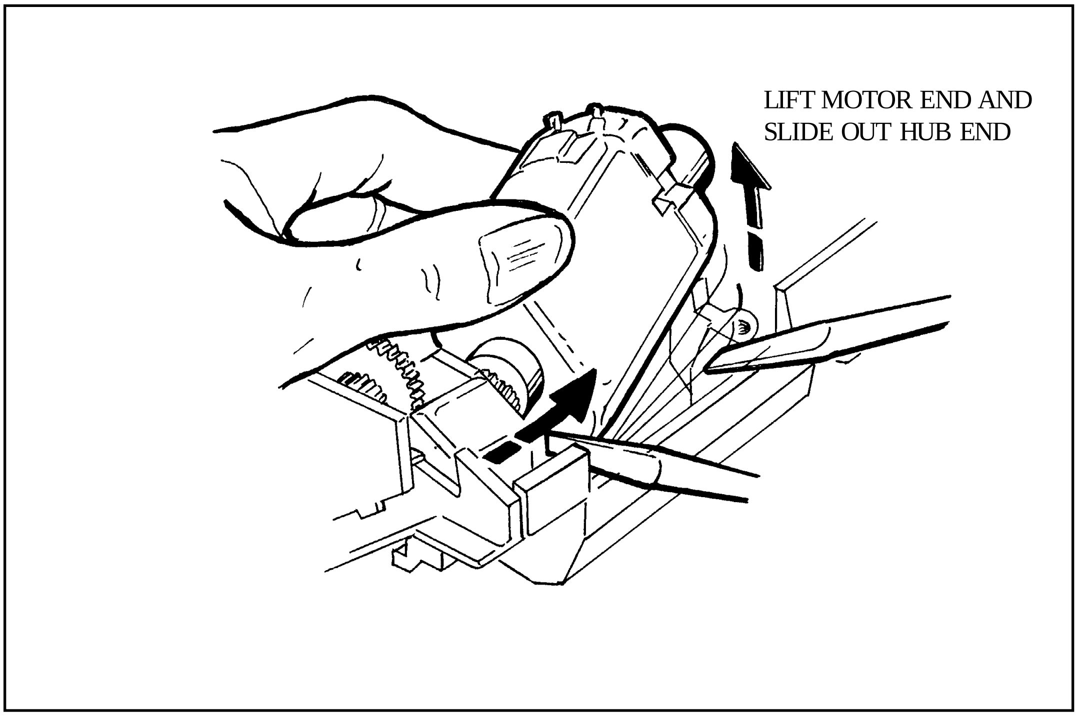


Figure 3-36. Removing Motor from Mainframe

2. Replacement

Follow removal steps in reverse order.

Shutter Assembly

1. Disassembly

Note: In the following steps, it is assumed that the Shutter Assembly has been removed from the Bellows/Cone Assembly (Figure 3-14), and the following parts have been removed/disconnected from the Shutter Assembly:

- Front Bezel (Figure 3-6)
- Close-Up Lens Switch (Figure 3-9)
- Photodiode and Cap (Figure 3-11)
- Transducer (Figure 3-13)

a. Using a greenstick, press tab **A** on the Lens Mounting Plate to the right (Figure 3-37), to release the Front Lens Assembly. Remove the Front Lens Assembly, being careful not to smudge or scratch the Lens (wearing lintless cotton gloves is recommended).

b. Remove the Encoder LED from the Lens Mounting Plate (it may be epoxied in place) (Figure 3-37).

c. With tweezers, unhook the upper end, then the lower end of the Opening Blade Spring and remove it (Figure 3-37).

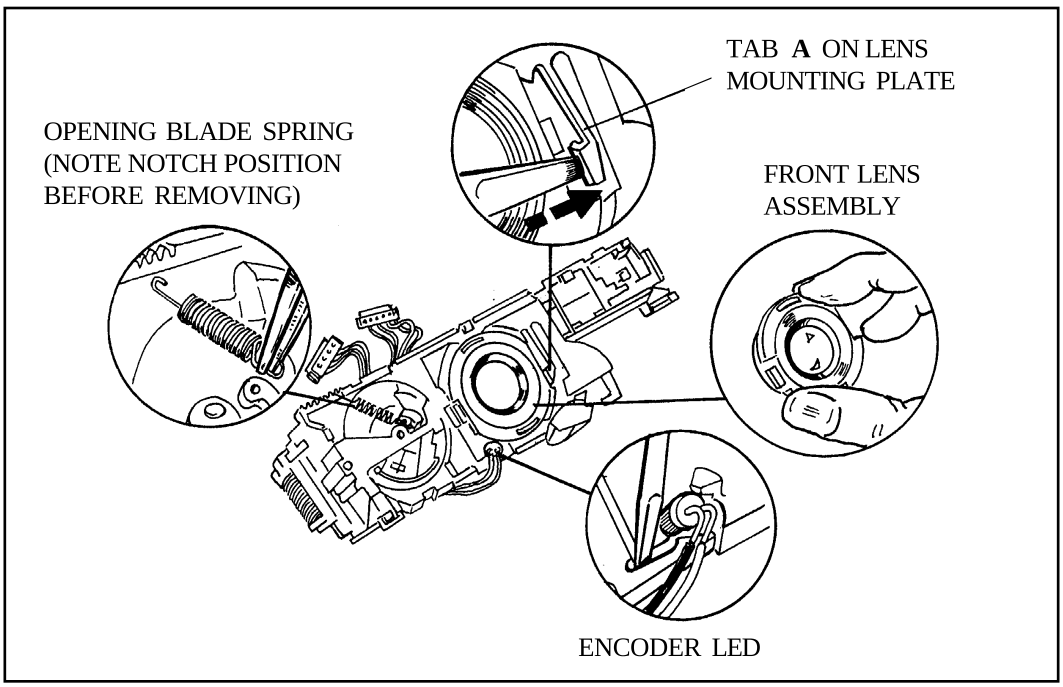


Figure 3-37. Removing Front Lens, Encoder LED and Opening Blade Spring

d. Remove the Lens Mounting Plate from the Baseblock by releasing locking fingers **A** - **E** in order, using a greenstick (Figure 3-38). A molded locating pin on the left end of the Baseblock makes it necessary to keep the Lens Mounting Plate level (kept in the same plane as the Baseblock) and lifted straight off.

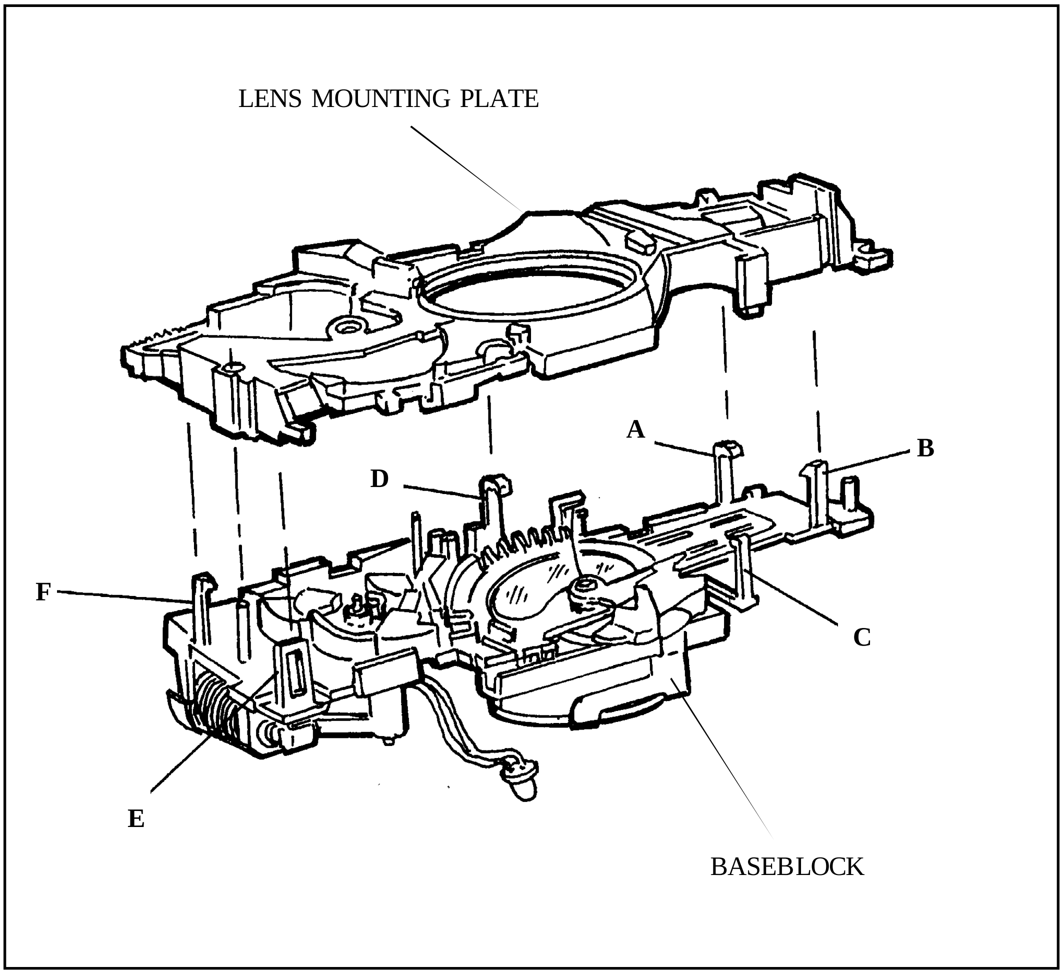


Figure 3-38. Releasing Baseblock Locking Fingers Holding Lens Mounting Plate

Caution: Keep Shutter Assembly facing upwards (Blade side up, Solenoids side down), to prevent parts from falling off.

e. Remove the Catch Pawl Spring (Figure 3-39).

f. Remove the Walking Beam/Inertia/Kick Spring as an Assembly (Figure 3-39).

g. Remove the Catch Pawl (Figure 3-39).

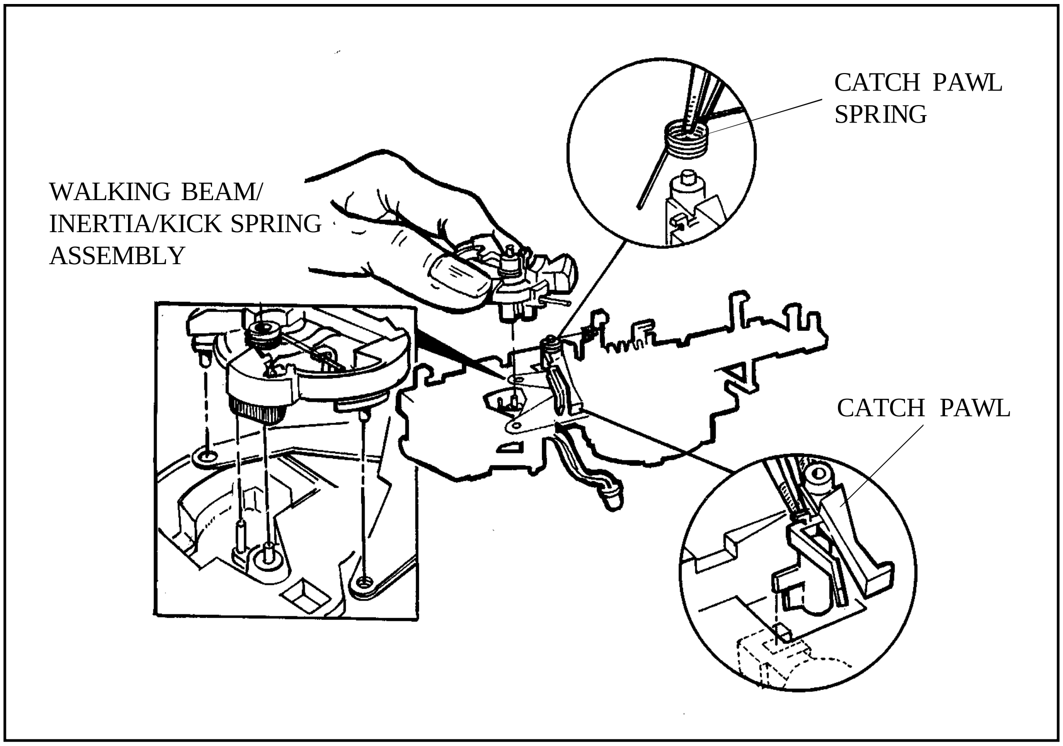


Figure 3-39. Removing Catch Pawl and Spring, and
Walking Beam/Inertia/Kick Spring Assembly

h. Unhook the upper leg of the Quintic Return Spring (Figure 3-40).

i. Remove (and disassemble, if necessary) the Quintic Moving Lens Assembly (wear lintless cotton gloves or finger cots) (Figure 3-40).

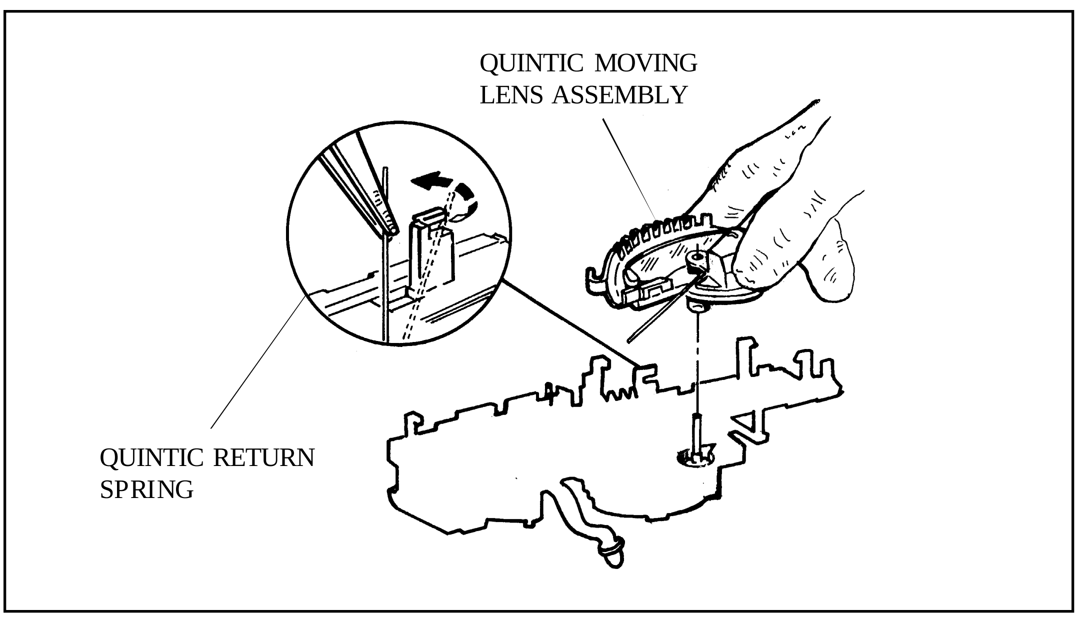


Figure 3-40. Removal and Disassembly of Quintic Moving Lens Assembly

j. Carefully remove the IR and Visible Light Calibration Slides, noting orientation and order for future reassembly (Figure 3-41).

k. Using tweezers and wearing lintless gloves or finger cots, carefully remove the shutter blades, noting orientation and order. Suggestion: put them aside on a clean surface, in the position and order removed (Figure 3-41).

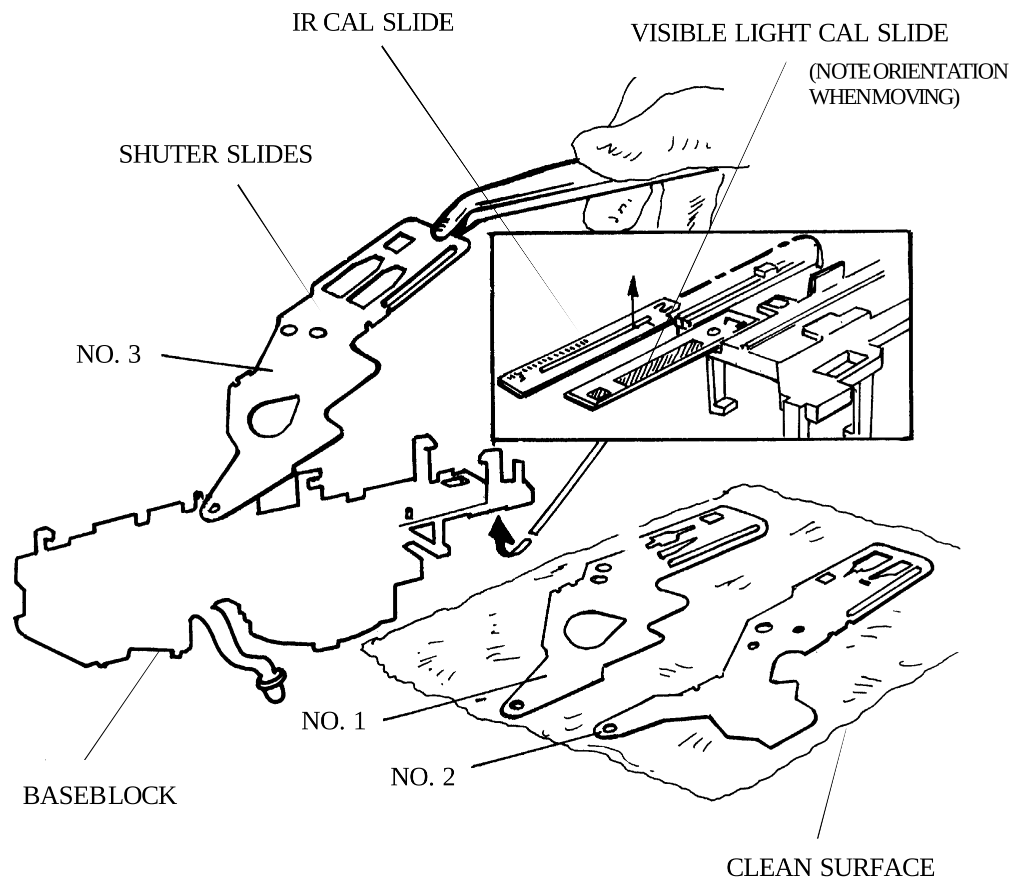


Figure 3-41. Removing Calibration Slides and Shutter Blades

l. To remove the Drive Link, use a greenstick or narrow screwdriver and work from the rear of the Baseblock: lift the catch finger on the Drive Link and remove it from the front (Figure 3-42). Keep Link from being caught under end of Solenoid 1 coil winding. Solenoid 1 plunger will drop out — don't lose it.

m. Using greenstick or small screwdriver, release the top spring tab of the Rear Lens Assembly Retainer and remove it and the Rear Lens Assembly (Figure 3-42).

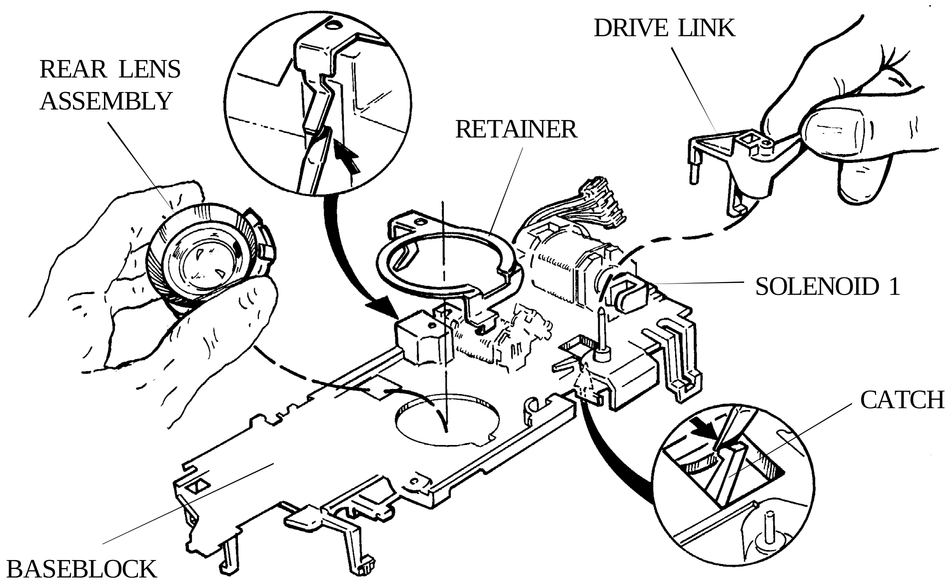


Figure 3-42. Removing Drive Link and Rear Lens Assembly from Baseblock

n. Remove Solenoid 1 by pushing it upwards out of the Baseblock. Depressing the locking finger slightly on the Baseblock will help (Figure 3-43).

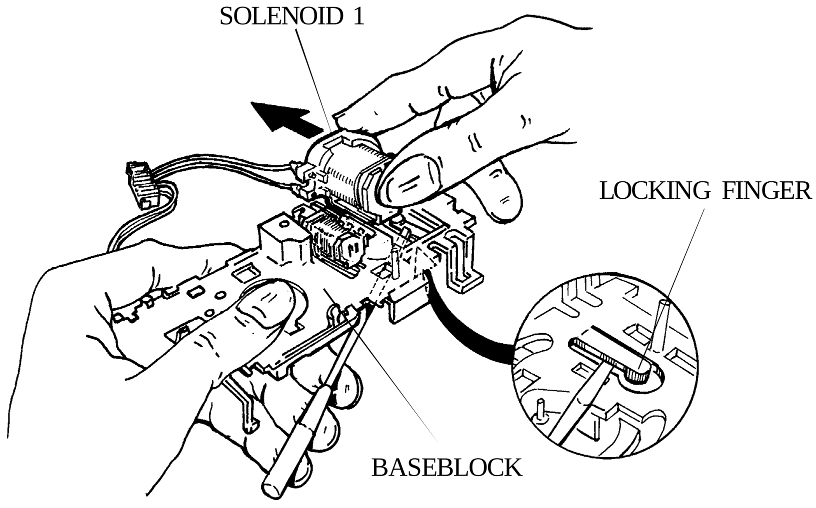


Figure 3-43. Removing Solenoid 1 from Baseblock

o. To remove Sol 2, depress the Baseblock locking tab “A” and simultaneously pry the Solenoid upward out of the Baseblock (Figure 3-44).

p. Remove the Encoder photodiode and Cable Assembly by springing tab **B** outward and then upward (Figure 3-44).

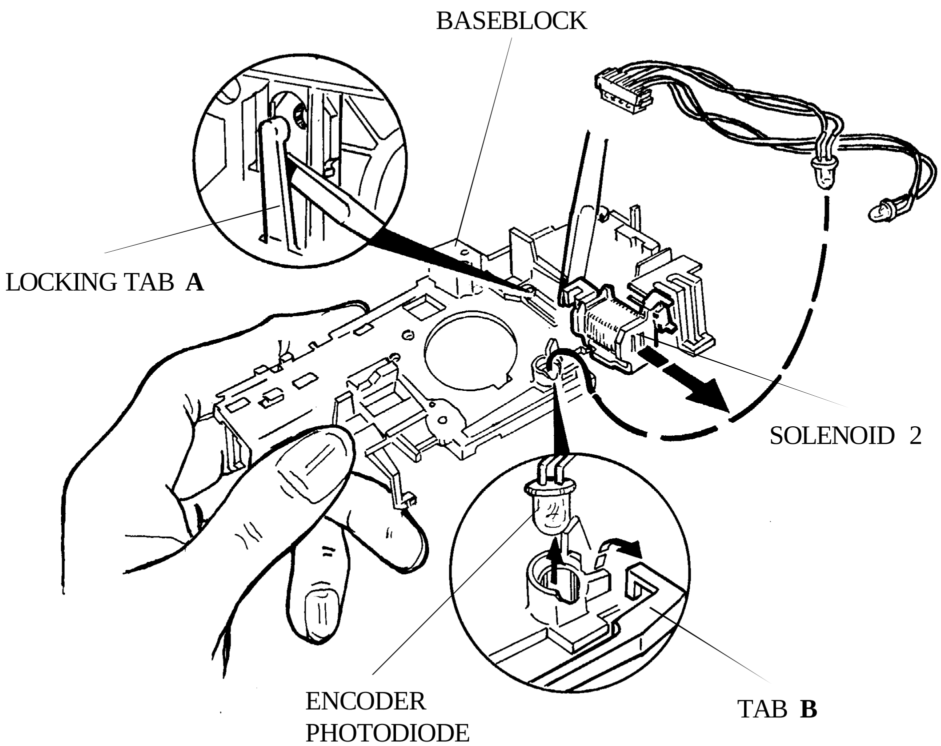


Figure 3-44. Removing Solenoid 2 and Photodiode from Baseblock

2. Reassembly

Follow disassembly steps in reverse order.

Notes:
- When replacing Shutter Blades in Baseblock, temporarily insert a 3/32" (.093") diameter metal dowel pin in Baseblock (Fig.ure3-45) to aid in locating the Blades.
- Remove pin after Walking Beam/Inertia/Kick Spring Assembly is in place.

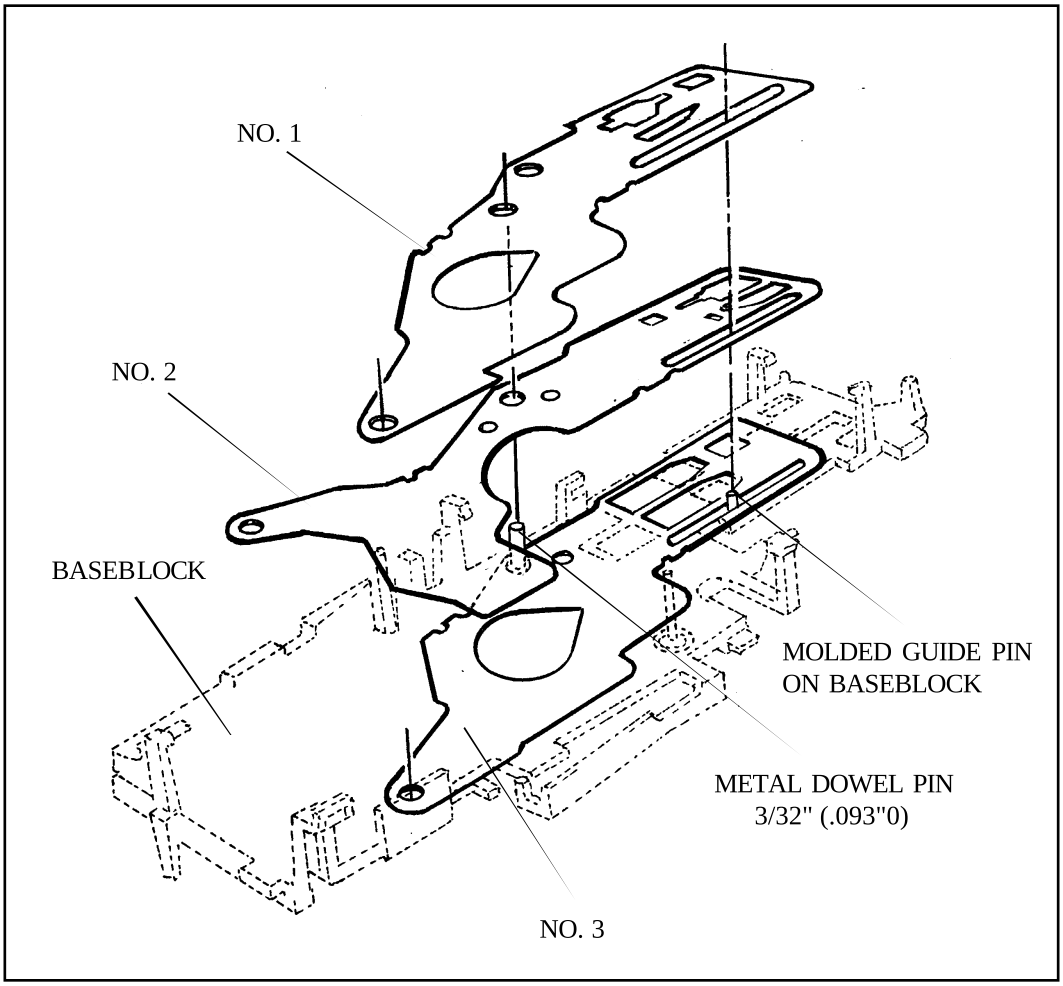


Figure 3-45. Replacing Shutter Blades in Baseblock

Drive Assembly

1. Disassembly

Note: The following steps assume that Motor Flex Retainer, Motor Flex Assembly and the Motor have already been removed from the ProCam.

a. Using a greenstick or small flat screwdriver, remove the Gear Drive Cover by releasing locking fingers at locations **A** through **D** in Figure 3-46.

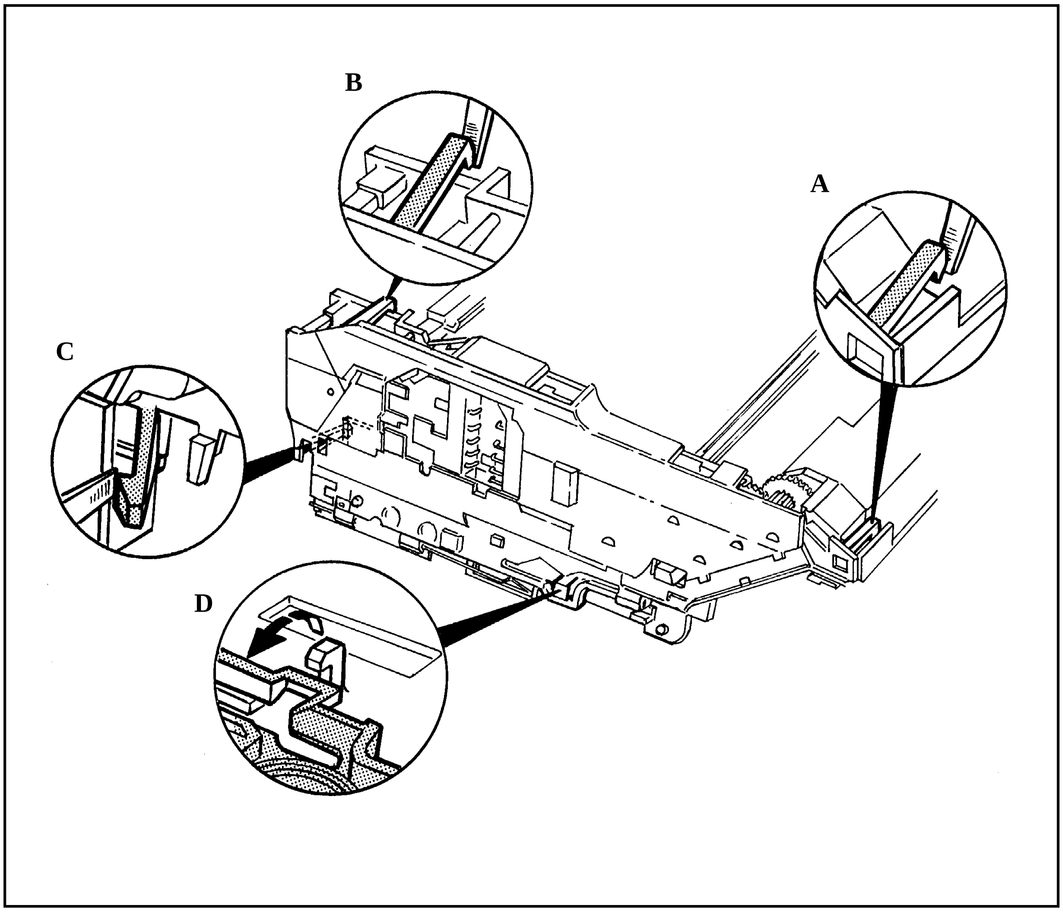


Figure 3-46. Removing Gear Drive Cover from Mainframe

b. Remove Washer from Gear #1 (Figure 3-47).

c. Lift off Wireform Switchblock.

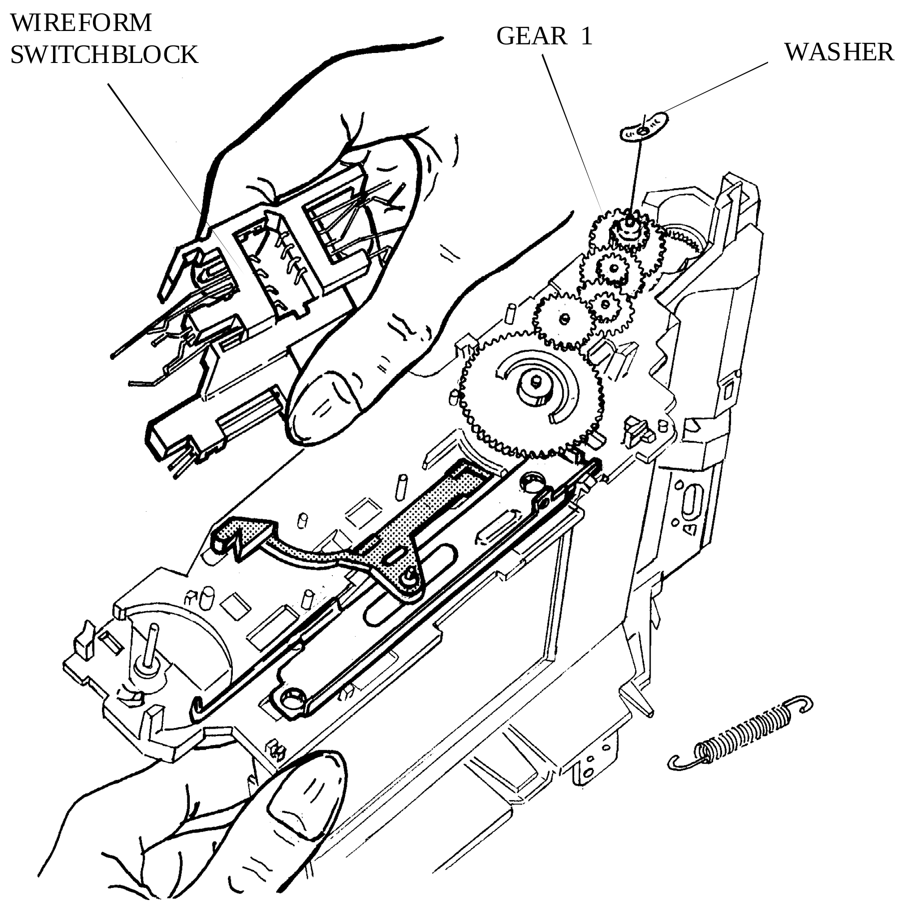


Figure 3-47. Washer and Gear removal from Gear Drive

d. Carefully lift off Counter Wheel, first freeing Counter Wheel Spring hook end from Mainframe (Figure 3-48).

e. Remove Pack Pawl Spring and Pack Pawl.

f. Remove, in this order, Gear #4, Gear #3, Gear #2, Gear #1 and Timing Gear (Figure 3-47).

g. Remove the Pick from the Mainframe.

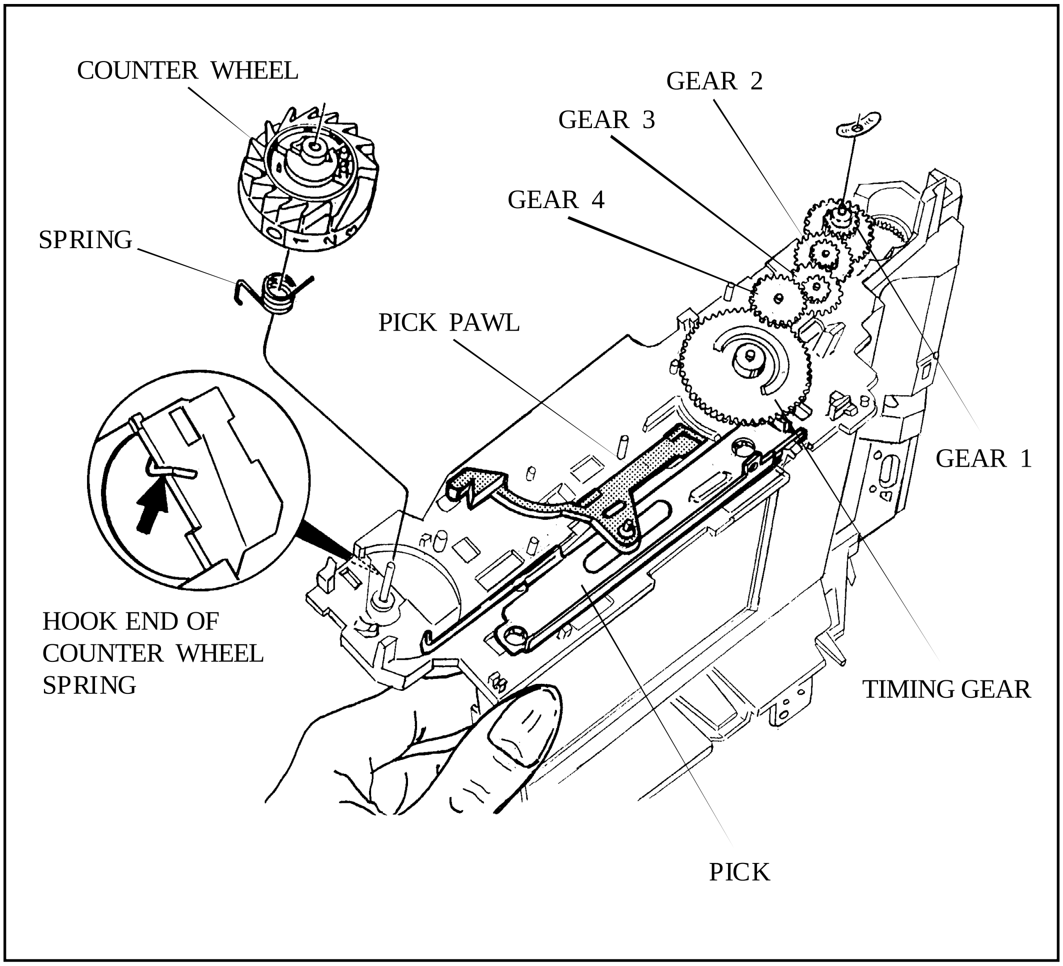


Figure 3-48. Removing Counter Wheel, Pack Pawl, Gears and Pick

2. Drive Reassembly

Follow disassembly steps in reverse order.