SERVICE INSTRUCTIONS

FOCUSMATIC SUPER-8 LOW-LIGHT MOVIE CAMERA

DESIGN 672/XL

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

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FACTORY SERVICE ADDRESSES

PRODUCT ONLY

CHICAGO

General Service Department
2200 Brummel Place
Evanston, Illinois 60202
Area Code: 312-673-3300

NEW YORK

General Service Department
200 Smith Street
E. Farmingdale, L.I., New York 11735
Area Code: 516-293-8910

GLENDALE

General Service Department
623 Rodier Drive
Glendale, California 91201
Area Code: 213-245-6631

PARTS ORDERS AND SERVICE INFORMATION

General Service Department
7100 McCormick Road
Chicago, Illinois 60645
Area Code: 312-673-3300

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Design 672XL Focus-Matic Low-Light Movie Camera

FEATURE DESCRIPTION LIST
(Design 672XL Focus-Matic Low-Light Movie Camera)

General Description	Cartridge-loading camera with power/manual zoom lens. Uses Super-8 film only. Film cartridge automatically sets correct A.S.A. setting.
Color	Black
Lens	Power/manual zoom, 8.5 to 24mm; focal length f/1.3
Focusing	4 feet to infinity with manual focus ring or manual "Focusmatic" system
Exposure Control	f/1.3 to f/38 with under/over exposure indicator
A.S.A. Control	Outdoor ("sun" mark) 25 - 100 Indoor ("lamp" mark) 40 - 160
Filter	Type A behind-the-lens filter, removed from position by actuating filter retracting knob
Viewfinder	Reflex, positive image, with under/over exposure indicator, battery test indicator and film transport indicator
Power Supply	Four AAA alkaline batteries
Film Speed	18 fps only
Run Control	Run button with separate on/off switch
Weight (less batteries, cartridge)	1.3 pounds
Overall Dimensions	2-3/4 by 3-7/8 by 8-5/8 inches

Introduction

GENERAL.

This Service Manual has been prepared to aid the serviceman in the overhaul and repair of the Bell & Howell Design 672/XL Focus-Matic Super 8 Low-Light Movie Camera. Special camera features and design specifications are listed in the Feature Description List preceding this section.

Four 1.5 volt Size AAA batteries (Mallory Type MN-2400) provide the power to drive a motor whose rear pinion meshes with the gear-toothed rim of the circular shutter (see Figure A). A stud protruding from the inner face of the shutter engages a slot in the shuttle to provide the motion for advancing the film at a constant 18 frames per second. The shutter teeth also mesh with a pinion at the front end of the take-up shaft. The rear end of the shaft engages the footage counter shaft which, in turn, meshes with and drives the take-up gear.

The front motor pinion provides the means for power-zooming the lens through the engagement of gears in the lens module; therefore, power-zooming can be accomplished only while the camera is running. The special shutter design, in combination with the ultra-fast f/1.3 lens, makes it possible to take movies under most low-light conditions. Refer to paragraph 11 (d and e) for exposure indicator operation.

This camera is equipped with the "Delta" type Focus-Matic system which automatically measures the distance from subject to camera lens. This system uses the principles of trigonometry to obtain the precise measurements. The user sights the camera at the feet of the subject or the base of the object being photographed; then presses and releases the FOCUS button on the side of the camera. The distance from subject to lens (in feet) is recorded on the Focus-Matic Scale. This distance must be set manually by rotating the lens distance ring.

An illustrated Replacement Parts section is included at the rear of the Service Manual to identify all replacement parts of the camera. The parts in the exploded view illustrations are indexed in a suggested order of disassembly and will serve as an aid to the serviceman during camera repairs.

SPECIAL MAINTENANCE PRECAUTIONS.

The removal and installation of camera parts can be accomplished with tools normally available in all photo repair shops. Special tools and gages necessary for camera test and adjustment are illustrated in Figure B.

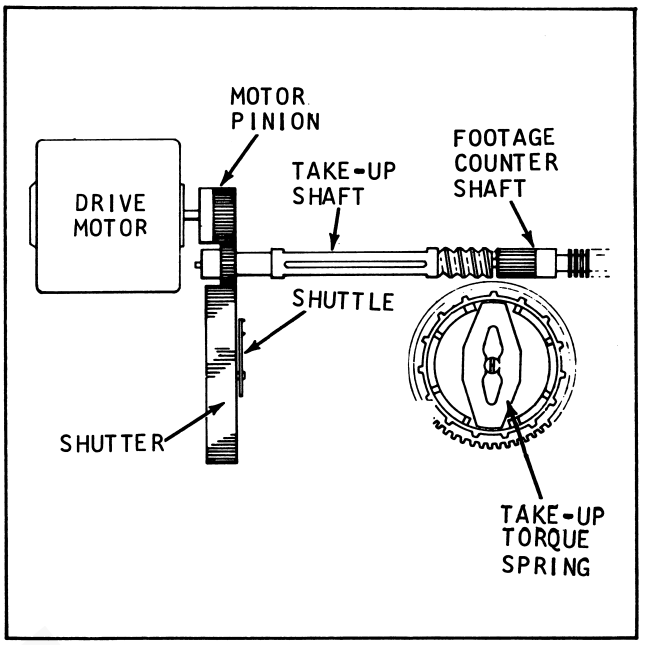


Figure A. Camera Motor and Drive Components

NOTE: BEFORE PROCEEDING WITH CAMERA REPAIRS:

(1) Check camera operation by performing the tests outlined in the Final Test section.

(2) Refer to Trouble Shooting Chart for probable causes and remedies for customer complaint.

When repairing equipment, be sure that the work table surface is clean. As parts are removed, group them in an orderly fashion to avoid confusion during reassembly. Remove dirt and old lubricant from parts (except electrical components and lenses) with a good cleaning solvent. Hardened film emulsion can be removed from the aperture plate by using alcohol and a sharpened orange stick. Do not use a knife, or other metal tool, to scrape away film emulsion.

During reassembly procedure, be sure to perform lubrication procedures noted in the instructions. Do not over-lubricate any part. Lubricant must be applied sparingly and special precautions must be taken to avoid getting oil and grease on optical elements (filters, lenses, etc.). Be sure to use only Bell & Howell grease (part no. 70468) and Bell & Howell oil (part no. 04979).

Always handle the meter and iris assembly with extreme care and keep the camera away from electrical equipment characterized by strong magnetic fields during repair operations.

After the camera has been repaired and adjusted, perform the inspections and test procedures outlined in the Final Test Section to insure satisfactory operation.

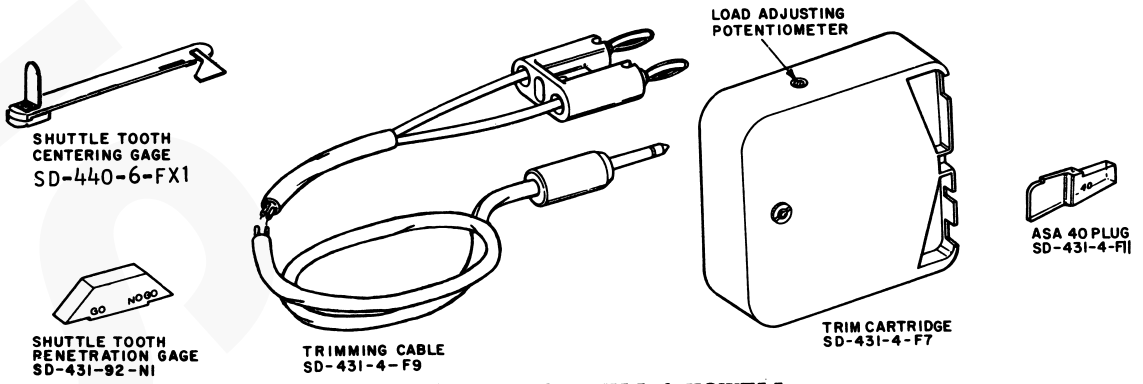
SPECIAL SERVICE TOOLS

TOOL NAME	B&H PART NO.	USE
Shuttle Centering Gage	SD-440-6-FX1	Check centering of shuttle tooth in aperture slot.
Shuttle Penetration Gage	SD-431-92-N1	Check height of shuttle tooth above aperture plate.
Trimming Cartridge	SD-431-4-F7	Trim calibration and adjustment.
Special Trimming Cable	SD-431-4-F9	Trim calibration and adjustment.
A.S.A. 40 Plug	SD-431-4-F10	Trim calibration and adjustment.
Dummy Batteries	(*)	Use with power supply for tests.
Lens Focus Tool	(*)	Focus camera prime lens.
Lens Focus Cartridge	(*)	Focus camera prime lens.
Pointing Mirror Block	(*)	Align viewfinder optics with zoom lens.
Pointing Tool	(*)	Align viewfinder optics with zoom lens.

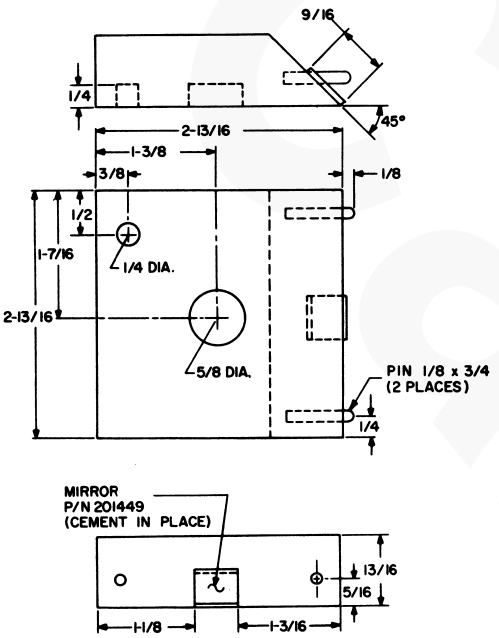
(*) Tools which can be made by service stations.

TEST EQUIPMENT REQUIRED FOR SERVICE

NAME	DESCRIPTION
AUTOCOLLIMATOR	Bell & Howell SER220-6 or high-grade commercial quality with a 12-mm focal length and focused at infinity.
AC-VTVM (VACUUM TUBE VOLTMETER)	High-grade commercial quality with 0.01-volt scale, 0.5 mv maximum noise level at 0.01-volt scale, ±5% accuracy; 1 megohm minimum input impedance at 1 kc. (Heathkit Model IMW-38 or equal).
LIGHT METER	High-grade quality light meter capable of f/1.3 to f/36 at A.S.A. 40.
DC MILLIAMMETER	High-grade quality portable type voltohm-milliammeter; 500 ma range with 5 percent accuracy.
DC POWER SUPPLY	Heathkit Power Supply IP-28, or see Figure G for recommended power supply.
LIGHT SOURCE	Diffused, uniformly bright surface with iris-adjustable light source of 24 foot-Lamberts and 600 foot-Lamberts at a color temperature of 2850°K (±200°K).
SIDE GUIDE TENSION GAGE	10-80 gram adjustable gage, Model GT1102 (Intra Corp., 151 Mystic, Medford, Mass. 02155).

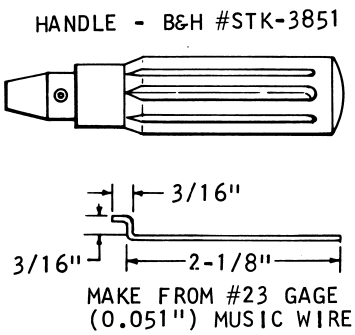


TOOLS AVAILABLE FROM BELL & HOWELL



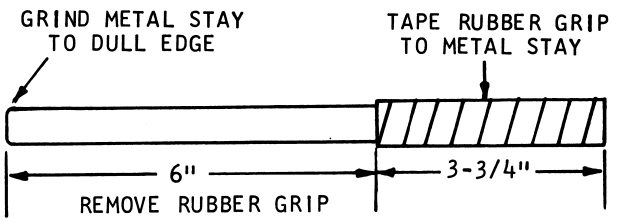
NOTE: MATERIAL ALUMINUM: REMOVE ALL SHARP EDGES

POINTING MIRROR BLOCK

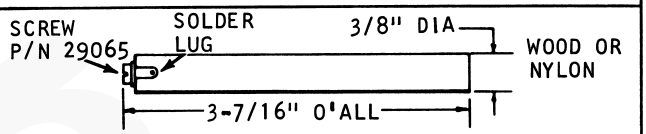


MAKE FROM #23 GAGE
(0.051") MUSIC WIRE

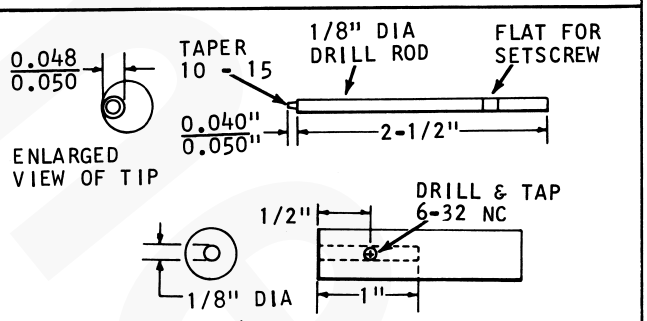
POINTING TOOL



SIDE NAMEPLATE REMOVAL TOOL
(Make from Projector Handle #46133)

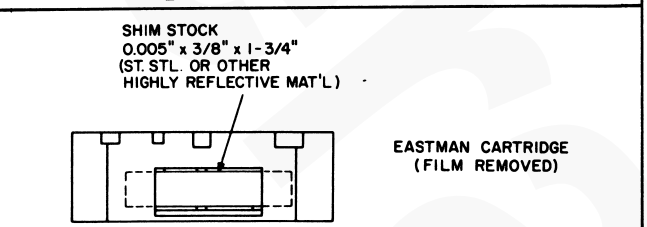


DUMMY BATTERY (2)REQ'D



HANDLE: 1/2" DIA ALUM OR NYLON

PRIME LENS FOCUS TOOL



LENS FOCUS CARTRIDGE

Figure B. Special Service Tools

Disassembly Procedure

1. GENERAL INSTRUCTIONS.

a. Remove the battery case with batteries before proceeding with disassembly.

b. Always handle the photocell and meter assembly with extreme care. Mishandling can easily bend or distort the iris blades. Keep the camera away from electrical equipment characterized by strong magnetic fields during repair operations.

c. Avoid leaving fingerprints on surfaces of optical components (lenses, viewfinder elements, etc.). Handle optical parts by their edges or metal holders and wrap them in tissue after removal to prevent damage.

d. When removing the staked parts, the staking points must be filed away before the part can be pressed from its assembled position. When removing riveted parts for replacement, the old rivet should be drilled out with a drill equal to, or slightly smaller than, the diameter of the rivet. Blow away filings or drill chips with a low-pressure jet of compressed air.

e. When the disassembly procedure calls for the unsoldering of leadwires, make a note of leadwire connections and refer to the wiring diagram, Figure 6.

NOTE: Repairs to the printed circuit board (Figure 5) should be attempted only as an emergency measure, and then only by qualified electronics repairmen. If the tests outlined in paragraph 6 indicate that the circuit board is faulty, it is recommended that the complete circuit board assembly be replaced. If emergency repairs are attempted, unsoldering of faulty components should be done with care. Use a pencil type soldering gun and a heat sink to avoid the direct transfer of heat to adjacent parts.

2. REMOVAL OF PARTS IN FIGURE 1. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. To disassemble the pistol grip (2) from the camera, carefully pry the trimplate (1) from the butt of the grip. Insert a screwdriver up through the body of the grip and loosen the screw which secures the grip to the camera.

b. Remove the battery case (3) and batteries from the battery housing. The long nameplate (4) must be removed before further disassembly can be accomplished. Insert the nameplate removal tool (Figure B) under the rear edge of the nameplate and slide the tool forward carefully in the nameplate recess until the nameplate can be lifted free. Move the "Delta" assembly (5) toward the rear of the camera until it can be lifted from the recess in the housing.

c. Use a pointed tool to pry the small trimplate (6) from the side cover assembly (8), thus exposing the side cover attaching screw (7). If bottom edge of the side cover is cemented to the mating edge of the camera cover (24), break this seal with a knife or razor blade and lift off the side cover assembly. The shank end of the filter button (8A) is staked to hold all filter actuating parts in place.

d. Use the eraser end of a pencil to force trimplates (9) and (10) from their recesses. If the lower plate (10) is replaced with a new one, it will be necessary to readjust electric eye trim as outlined in paragraph 11. Remove one screw (11) located at the upper front corner of chassis assembly. The second screw (11) can be removed inserting a screwdriver between the lens mounting plate and lens housing of the module assembly near the bottom of the module. Through the trimplate openings at the front of the lens module, remove the chrome screw (12) from the upper right-hand corner of the lens mounting plate and the two black screws (13) from the upper left-hand and lower right-hand corners. The upper left-hand screw is partially hidden by the filter arm actuator extension spring. Carefully lift off the lens module assembly, gently flexing the upper ledge of the camera cover (24), if necessary, to provide clearance for the filter key plate of the lens module.

e. Remove the single screw (15) and lift the trimplate (16) from the cartridge chamber. It will be necessary to depress the fingers of the cartridge tension spring to free the rear end of the trimplate.

f. Remove the screw (17) which attaches the run button (18) to the upper end of the run actuator and lift out the run button. Allow the upper end of the actuator to drop down out of the way. Remove the two screws (19) near the rear of the chassis assembly (20) and lift out the chassis assembly. This is accomplished by carefully flexing the upper rim of the camera cover (24) while tipping the upper edge of the

chassis outward. Note that the tip of the grip trigger actuator arm protrudes through a rectangular opening in the bottom of the camera cover. The chassis must be lifted out and up so that the arm clears this opening. When the chassis has been removed, lift the battery test button (21) from the opening in the camera cover.

g. To remove the viewfinder eyepiece assembly (23), remove the pilot screw (22) and withdraw the eyepiece from the camera cover (24). If the footage scale window (26) is damaged, the trimplate (25) must be pried from the camera cover.

h. The shank ends of the door latch button (27) and On-Off button (30) are staked, and the stakings must be filed away to disassemble these items from the camera door. New buttons must be used when the camera is reassembled. The cartridge window (29) is cemented in place and must be pried out with a pointed tool if replacement is necessary.

3. REMOVAL OF PARTS IN FIGURE 2. Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

CAUTION: Please note the tiny light emitting diode extending up from the rear lower corner of the printed circuit board. When handling the chassis assembly or the P. C. board, be careful not to bend or distort the legs of this diode. Also, be careful not to distort the blades of meter and photocell assembly (10).

a. Remove the three screws (1) and (1A) which secure P. C. board assembly (2) to the chassis. Note that the two meter/photocell terminals protrude through two P. C. board slots just below the four-blade switch at the front lower corner and that the motor terminals protrude through two slots just to the rear of the silicone diodes at the front upper corner. These terminals are soldered to the board and must be unsoldered before the board can be lifted free of the chassis. To remove the board completely for replacement, the red and black leads at the top of the board must be unsoldered from the two battery terminals. Refer to Figure 5 for P. C. board parts identification and wiring.

b. Note the manner in which the legs of the torsion spring (8) are engaged. Remove the screw (5) and flat washer (6) and disassemble the run actuator (7) and torsion spring (8) from the chassis.

c. The meter and photocell assembly (10) is secured to the chassis by two chrome screws (9) at the upper right and lower left corners of the meter frame. Gently hold the meter blades in a closed position while removing these screws, and lift the assembly from the chassis.

d. The motor assembly (11) is held firmly in position by means of two formed ears on the motor which fit into corresponding slots in the chassis. Insert a narrow-bladed screwdriver behind the motor and carefully pry the motor from the chassis. The motor pinions are not replaceable separately. If damaged, the complete motor must be replaced.

e. The wedge (12) is cemented into a recess in the floor of the chassis. Use a sharp pointed tool to pry the wedge free and disassemble the footage indicator spring (13) from the chassis.

f. Engage a Tru-arc ring pliers with the elongated center opening of the take-up spring (14), and rotate the spring clockwise until the ends of the spring are between the two adjustment rims of the take-up gear as shown in Figure C. Lift up one end of the spring with a tweezers and pull sharply in a lateral direction to disengage the formed center ears of the spring from the groove near the end of the take-up stud (16). Disassemble the take-up gear (15), stud (16) and pawl (17) from the chassis.

g. Unhook and remove the film indicator return spring (18) and disassemble the sleeve (19) and film indicator (20) from the chassis. Lift the shafts (21) and (22) from the recesses in the chassis.

h. Before removing the A. S. A. lever (23), note the manner in which the spring (24) is assembled. Disassemble the lever and spring from the chassis. The aperture plate assembly (25) and prime lens (26) must not be removed unless obviously in need of replacement. The aperture plate is a press-fit and must be pried from the chassis. To remove the prime lens, place a drop or two of acetone in the lens adjustment hole (lever side of the chassis) to loosen the adhesive on the lens barrel. Insert a pointed tool or small screwdriver blade into the adjustment hole and carefully pry the lens forward until it can be removed.

4. DISASSEMBLING THE LENS MODULE (Figure 3). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Note the manner in which the torsion spring (3) is assembled. Remove the retaining ring (1) and disassemble the A. S. A. -160 filter (2) and the torsion spring (3) from the stud (6). Remove the pivot screw (4) and the Type "A" filter (5).

b. Unscrew the threaded stud (6) from the mounting plate (11). Remove the two screws (7) and disassemble the zoom lens assembly (8) from the mounting plate and lens housing. Remove two screws (9) and lift off the lens housing (10).

c. Note the manner in which the two springs (12) and (13) are assembled; also, the manner in which the two pawls (17) and (18) are engaged. Unhook and remove the springs. Remove the retaining ring (14) and disassemble the washers (15), zoom knob (16), pawls (17) and (18), and eccentric gear (19) from the post in the mounting plate.

5. DISASSEMBLING THE CHASSIS (Figure 4). Remove parts, as necessary, in their indexed order of disassembly, noting the following special precautions.

a. Note the manner in which the torsion spring (1) is assembled before removing it.

b. If the cartridge tension spring (12) is to be replaced, drill out the two rivets (11).

c. The shutter pin (10) and take-up shaft bearing (18) are a press-fit, and the motor contact (19) is heat-staked in place. Do not remove these items,

d. The battery housing assembly (17) and light shields (13) through (16) are cemented in place. To remove, pry up carefully with a knife blade.

6. P.C. BOARD REPAIRS (Figure 5). Repairs to the printed circuit board should be attempted only as an emergency measure, and then only by qualified electronics repairmen. Follow standard circuit tracing techniques to locate the faulty component and, during soldering operations, use a heat sink to avoid application of heat to adjacent components. If qualified electronics personnel are not available, it is recommended that the complete circuit board be replaced.

Reassembly and Adjustment

6. GENERAL INSTRUCTIONS.

a. When the reassembly procedure includes the staking of rivets or other parts, such parts should be installed before continuing with other reassembly procedures. Be sure to support the casting squarely on a plastic block to prevent the distortion of parts during the staking operation.

b. Before reassembly, wash all metal parts (except electrical and optical components) in naphtha or other non-corrosive grease solvent. Dry parts with a clean, lint-free cloth or a low pressure jet of dry compressed air. Clean optical surfaces with lens cleaner and lens tissue.

c. When reassembling cemented parts, be sure that mating surfaces are clean and free of old, dried cement. When the adhesive is "tacky," press the part firmly and squarely in position until fully seated; then wipe away excess adhesive with a clean cloth. Adhesives to be used are listed in the following table by Bell & Howell specification number and commercial equivalent. Be sure to use the proper adhesive during reassembly.

Bell & Howell Spec. No.	Commercial Equivalent
327	3M Co. Adhesive EC-847
355	3M Co. Adhesive EC-524
987	
1758	General Cement Co. #32 Cement

d. Whether removed or assembled to the chassis, be very careful to avoid bending or distorting the iris blades of the photocell and meter assembly. During repair operations, keep this assembly away from equipment characterized by strong magnetic fields and do not leave fingerprints on the surfaces of the blades.

e. During reassembly, be sure to lubricate parts where noted, using the lubricants specified. Always lubricate sparingly, and avoid getting oil and grease on optical parts. Wipe away excess grease with a clean, lint-free cloth. Refer to the preceding chart for proper lubricants to be used.

f. Wiring for the printed circuit board is shown in Figure 5. When making wiring connections between the P.C. board and other camera components, refer to Figure 6.

7. REASSEMBLING THE CHASSIS Figure 4). Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. If the bearing (18) or the shutter pin (10) was replaced, press the new part into the appropriate hole in the chassis (20). Be careful not to distort the shuttle pin during this operation. Lightly grease the center hole and threaded portion of the shutter (9) and install the shutter on the shutter pin. Check to see that the shutter revolves smoothly and without binding. Place one drop of oil in the bearing and wipe away the excess.

b. Secure the battery housing assembly (17) to the top of the chassis with adhesive (B&H Spec. 1758).

The back end of the housing must be flush with the back end of the chassis and edge "X" (Figure 4) must be flush with edge "X-1" of the chassis.

c. If the cartridge tension spring (12) was replaced, secure the new spring to the chassis with the two rivets (11).

d. All light shields (13) through (16) are to be cemented in place with adhesive (B&H Spec. 327). Press firmly into place and wipe away excess adhesive with a clean cloth.

e. Fasten the shutter actuator (8) to the chassis with the two screws (5) and flat washers (6) and (7). Engage the bent leg of the torsion spring (1) into the hole at the lower end of the actuator; engage the straight leg of the spring into the hole at the upper end of the actuator arm (4). Secure the arm to the chassis with the screw (2) and washer (3). The small black pin protruding from the chassis must fit into the rectangular opening in the arm (4).

8. REASSEMBLING THE LENS MODULE (Figure 3). Reassemble parts as outlined in the following paragraphs, noting the following special precautions.

a. Lightly oil the gear stud of the lens mounting plate (20) and assemble the eccentric gear (19) to the stud, gear hub facing out. Assemble the pawls (17) and (18) to the large diameter hub of the gear, and install the washer (15) and retaining ring (14).

b. Assemble the zoom lever spring (13) to the rectangular boss of the mounting plate, with the long legs of the spring projecting outward from the plate. Assemble the zoom knob (16) to the gear stud, locating the long finger of the knob between the legs of the spring. Both spring legs must be in contact with the finger. Secure the knob with the second washer (15) and retaining ring (14). Hook the tension spring (12) between the spring tab in the upper corner of the mounting plate and bent ear "X" at the upper end of the filter arm actuator.

c. Assemble the lens housing (10) to the lens mounting plate (11), guiding the actuating finger of the knob through the opening in the nameplate (10A). Secure the housing to the mounting plate with the two screws (9) inserted at the upper right and lower left corners. Tighten the screws securely.

d. Carefully assemble the zoom lens (8) through the lens housing and seat it in the lens mounting plate, rotating the lens as necessary to align the tapped screw holes with those in the mounting plate. Rest the assembly on the front end of the lens with the top of the lens housing facing away from you and install the two screws (7) at the six o'clock and ten o'clock positions. Install the threaded stud (6) at the one o'clock position and tighten the stud and screws securely.

e. Assemble the torsion spring (3) to the threaded stud, longest leg in against the mounting plate. Engage the bent end of the spring into the small hole in the mounting plate, just to the right of the stud. Wind the outer leg of the spring clockwise and hold it at the ten to twelve o'clock position while assembling the A.S.A.-160 filter assembly to the stud. Carefully release the leg of the spring so that the bent end behind the left edge of the filter arm. Secure these parts with the retaining ring (1).

f. Hold the Type "A" filter assembly (5) with the bent finger (Y) projecting to the right. This finger must engage the elongated slot at the lower end of the filter arm actuator, the upper end of which is identified by (X) in Figure 3. Depress the actuator slightly until the finger can be engaged; then position the filter mounting hole over the tapped hole in the lens mounting plate and install and tighten the pivot screw (4). Press and release the actuator several times to make certain that the filter pivots smoothly.

9. REASSEMBLY OF PARTS IN FIGURE 2. Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Press the prime lens assembly (26) into the lens opening in the chassis until fully seated. The prime lens must be refocused after reassembly is completed.

b. The aperture plate assembly is a press fit in the chassis. Apply a light film of grease to the shuttle slot in the aperture plate. Assemble the aperture plate into the grooves of the chassis, guiding the pin-like boss on the inner face of the shutter into the shuttle slot of the aperture plate. Press the plate firmly into place until fully seated.

c. Lightly grease the friction surface of the A.S.A. lever (23). Note that one end of the spring (24) has an extending leg while the other end has a formed "U." Insert the rear end of the lever into the end of the spring with the extending leg until the lever passes through the formed "U." Slide the spring forward until the "U" is caught in front of the bent finger (Y) near the middle of the lever. Roll the lever slightly so that the extending spring leg can be caught underneath the ledge of the chassis just above the lever slot and drop the lever and spring down into place. The rear end of the lever should engage the notch-out (X) in the aperture plate (25).

d. Lightly grease the threads, pinion teeth and pin ends of the take-up shaft assembly (22). Assemble the shaft into the chassis, engaging the pinion teeth with the shutter gear. Assemble the film indicator (20) to the chassis with the indicator sleeve (19). Engage one end of the return spring (18) with the bent ear at the top of the indicator and the looped lower end over the chassis pin below the indicator.

e. Apply a thin film of grease to the teeth and inner face of the take-up gear (15) and to the shank of the take-up stud (16). Assemble the take-up pawl (17) to the stud and assemble these parts to the chassis while holding the film indicator (20) so that the inner pawl contacting finger is pivoted out of the way. Assemble the take-up gear (15) to the stud and hold the head of the stud with one finger while installing the take-up spring (14) as follows: Hold the spring so that the spring ends are lined up with notched out sections (A, Figure C) between the adjustment rims of the take-up gear. Assemble the larger opening (B) of the spring over the protruding end of the take-up stud and apply pressure while sliding the spring into place until the center formed ears engage the slot in the end of the stud. The adjustment rims have three increasingly raised sections, and the ends of the spring should be positioned at approximately the high end of the second rise for initial adjustment. With a needle nose or retaining ring pliers, rotate the spring counterclockwise to the approximate position. Final take-up torque adjustment is outlined in paragraph 12.

f. Lightly grease the threaded portion of the footage counter shaft (21). Assemble this shaft to the rear end of the take-up shaft (22) and lower it down into place in the chassis, engaging the threaded portion with the teeth of the take-up gear (15).

g. Assemble the coiled portion of the footage indicator spring (13) into the recess at the lower rear of the chassis, with the short, bent leg of the spring inserted through the vertical slot in the chassis wall. The long upper end of the spring must be slipped beneath the bent arm at the lower end of the film indicator (20). Apply a small amount of adhesive (B&H Spec. 355) into the groove in the floor of the chassis where the wedge (12) is to be installed, and allow the adhesive to become "tacky." Loop the bent lower end of the spring (13) around the wedge as shown in Figure D and press the assembled wedge and spring into the groove in the chassis floor.

h. Lightly grease the pinion teeth at both ends of the motor (11) and assemble the motor into the chassis with the two formed ears of the motor engaging corresponding slots in the chassis. The motor terminals must face to the right when looking down into the front of the chassis, and the rear pinion must engage the shutter gear.

i. Carefully assemble the meter and photocell assembly (10) to the chassis and gently hold the meter blades in the closed position while installing and tightening the two mounting screws (9).

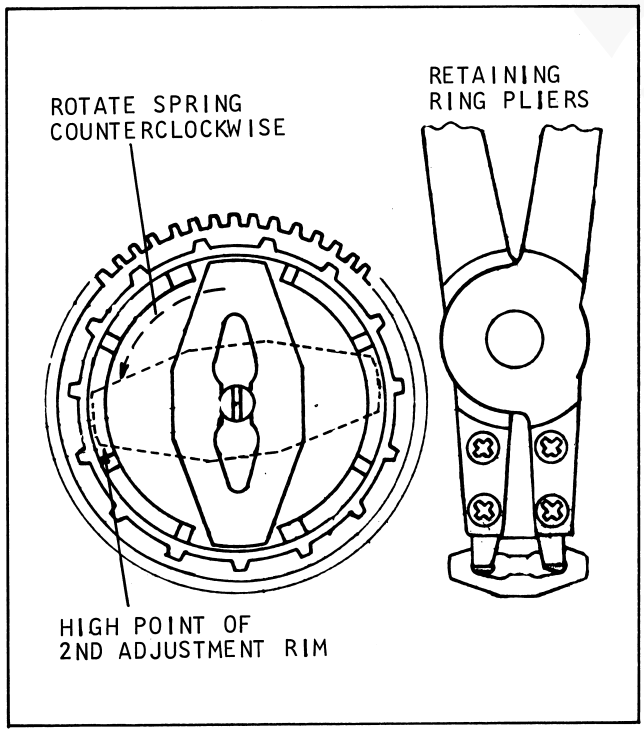


Figure C. Installing the Take-Up Spring

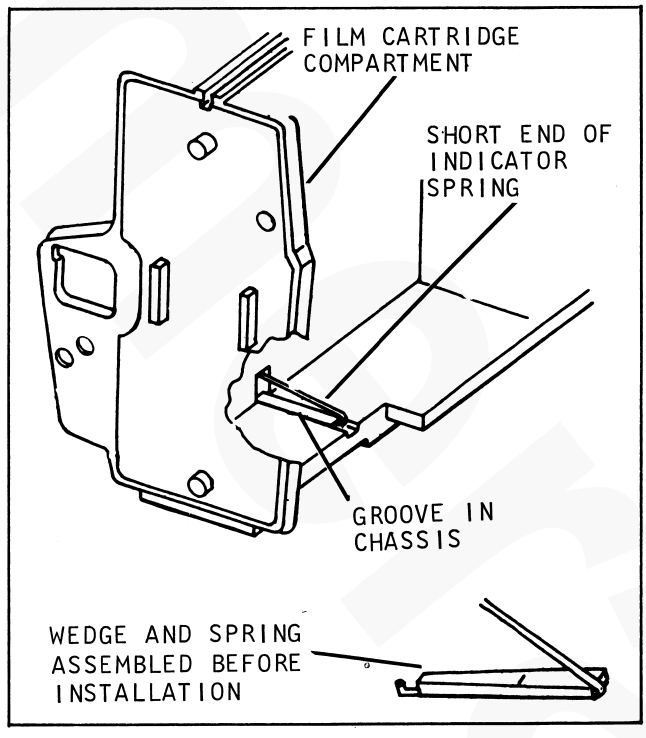


Figure D. Installing Indicator Spring and Wedge

j. Lightly grease the formed mounting pin for the run actuator assembly (7). Install the torsion spring (8) on this post with the short spring leg inward, and engage the short leg beneath the upper ledge of the chassis. With a tweezers, wind and hold the long outer leg of the spring clockwise while assembling the run actuator (7) to the post. Release the spring leg against the lip at the upper end of the actuator so that the spring will return the actuator in the "up" position when the actuator is depressed and released. Make certain that the lower tip of the actuator is bearing against the bent ear at the top of the actuator arm assembly (4, Figure 4) and install the washer (6) with screw (5) to serve as a guide for the lower end of the actuator.

k. Assemble the insulator (3) and printed circuit board assembly (2) to the chassis, guiding the terminals of the drive motor and the meter and photocell assembly through corresponding slots in the board. Secure the circuit board to the chassis with the three screws (1) and (1A). Carefully solder the protruding motor and photocell terminals to the board. Hook the spring (4) between the actuator arm assembly (4, Figure 4) and the tab at the lower front corner of the P. C. board. Apply a drop of solder to secure the spring end of the tab. Dress the black and red wires of the P. C. board along the top of the chassis behind the four transistors and through the notch behind the frontmost transistor. Solder the black lead to the inner battery post (closest to the P. C. board) and the red lead to the outer battery post.

NOTE: Before assembling the chassis assembly into the cover, perform the electric eye trim adjustment as outlined in paragraph 11, and the final take-up torque adjustment as outlined in paragraph 12.

10. REASSEMBLY OF PARTS IN FIGURE 1. Reassemble parts as outlined in the following paragraphs, noting any special precautions.

a. Apply a light film of grease to the inner face of the on-off button (30). Assemble the button to the camera cover and install the contact spring (31) on the protruding boss of the button. Stake the boss to secure these parts to the cover.

b. Apply a light film of grease to the inner face of the door latch button (27). Assemble the button to the cartridge door and install the door latch (28) on the proturding boss of the button. Stake the boss to secure these parts to the door. Apply a bead of adhesive (B&H Spec. 1758) around the seating edge of the cartridge window (29) and allow the adhesive to become "tacky." Press the window in place in the cartridge door, and wipe away the excess adhesive with a clean cloth.

c. Apply a bead of adhesive (B&H Spec. 1758) around the seating edge of the footage scale window (26) and allow the adhesive to become "tacky." Press the window in place in the camera cover with the rectangular indicator of the window toward the rear of the camera. Wipe away the excess adhesive with a clean cloth. Use adhesive (B&H Spec. 987) to secure the battery test trimplate (25) to the camera cover.

d. Lightly grease the barrel of the viewfinder eyepiece assembly (23). Assemble the eyepiece into its opening at the rear of the camera cover and rotate the eyepiece until the spiral groove is aligned with the hole for the pilot screw (22). Install and tighten the pilot screw.

e. Hold the camera cover assembly (24) with the open side facing up and the cartridge door open. Place the battery test button (21), button shaft facing up, in the square opening just above the footage scale window. Assemble the complete chassis assembly (20) into the camera cover, taking care not to dislodge the battery test button from its position. The bottom edge of the chassis must be slipped in first so that the lower tip of the run actuator arm (4, Figure 4) can be inserted down through the rectangular opening in the bottom of the cover. Install the two screws (19) near the rear of the chassis to hold the chassis in place.

f. With a tweezers, raise the free-swinging upper end of the run actuator (7, Figure 2) so that the run button (18) can be installed. Slide the run button into place behind the upper end of the run actuator, align the holes, and install and tighten the screw (17).

g. Slip the front edge of the cartridge chamber trimplate (16) into place; then, pressing lightly on the trimplate adjacent to the cartridge spring fingers, force the trimplate down into place. Secure the trimplate at the rear edge with the single screw (15).

h. Carefully assemble the lens module (14) to the front of the camera flexing the upper front ledge of the camera cover slightly so that the filter key plate at the top of the module will clear the casting. When the module is fully seated, install the three 3/8-inch screws (12) and (13). The chrome screw (12) is inserted at the upper right-hand corner. When installing the upper left-hand screw (13), the tension spring in that corner of the module must be held out of the way. Be careful not to disengage the ends of the spring. Lay the camera on its side with the magazine opening facing up. Insert one screw (11) at the lower front corner, between the lens mounting plate and lens housing, securing the fork-like tab of the mounting plate to the tapped boss of the camera cover. The remaining screw (11) is used to secure the upper front corner of the chassis to the camera cover.

i. Apply adhesive (B&H Spec. 987) to the ledges of the lens housing where the trimplates (9) and (10) will rest, and allow the adhesive to become "tacky." Slip the trimplates into place and press down firmly for a few seconds.

j. Cement the filter nameplate (8D) into the opening in the side cover with adhesive (B&H Spec. 987). The "flash bulb" symbol of the nameplate must be at the top. Lightly grease the inner surface of the filter spring (8C), and assemble the spring, the spacer (8B) and the filter button (8A) to the side cover. Stake the shank end of the button to secure all parts. The assembled side cover (8) is not to be installed until lens focus and camera pointing and tracking have been checked and adjusted (paragraphs 13 and 14). Before assembling the side cover to the camera, place the filter button in the "up" position so that the bent finger at the lower end of the spring (8C) will drop in place above the upper end of the filter arm actuator on the lens mounting plate. Secure the side cover with the screw (7), and cement (B&H Spec. 987) the small trimplate (6) into the square opening above the screw head.

k. Slip the "Delta" assembly (5) into position in the lens housing by tipping the front end in slightly and sliding the assembly forward in the formed guide rails. Do not install the long nameplate (4) until the "Focus-Matic" feature has been checked (paragraph 15).

l. Assemble the batteries into the battery case (3), observing the polarity markings on the case, and insert the case into the battery housing, front end first.

m. Before installing the pistol grip (2), check the upper (mounting surface) cavity of the grip as follows. There should be a shim in the front left-hand corner of the cavity and a drop of adhesive, clearly evident in each of the remaining corners. If this is not the case, and the customer has complained of trigger binding or loose grip, proceed as follows. Cement the shim (part no.) in place with adhesive (3M No. EC-880). In the remaining three corners, place a drop of G.E. No. RTV-103 adhesive. To prevent the grip from loosening in high-temperature areas, apply Nylok VC-3 adhesive to the threaded hole. Assemble the grip to the bottom of the camera while holding down the run button. Release the run button and insert a screwdriver up through the grip to tighten the mounting screw into the tripod socket of the camera. Secure the trimplate (1) to the butt of the camera with adhesive (B&H Spec. 987).

11. ELECTRICAL CHECKS AND ADJUSTMENTS.

a. Operating with Mechanism Removed from Housing. In order to operate the mechanism when removed from the housing, a connection must be made between the terminal pads of switch S3 on the printed circuit board. This is accomplished with a mesh-toothed clip as shown in Figure E. With batteries installed, the mechanism can now be run in the normal fashion with the run button.

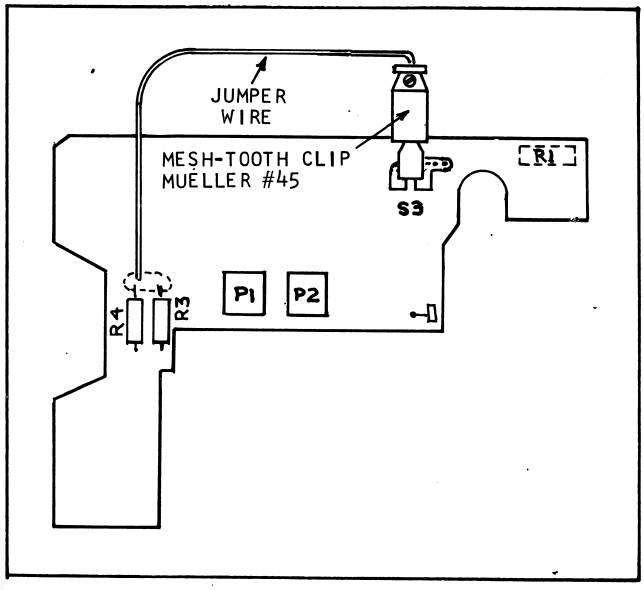


Figure E. Jumper Connection for Switch S3

b. Calibrating the Trim Cartridge. The trimming cartridge has been factory-calibrated, but correlating results must be established each time electric eye trim is checked. Calibration instructions are furnished with the trim cartridge.

c. Checking the Electric Eye System. In order to check the electric eye system, the lens module must be assembled to the camera and the window below the zoom lens must be in place. Equipment required includes the trimming cartridge, A.S.A. 40 plug and dummy batteries (Figure B) and the AC-voltmeter, DC power supply and light source (see "Test Equipment" chart, page 2). The output terminals of the trimming cartridge are to be connected to the voltmeter.

(1) Set light source light level at 600 foot-Lamberts (f/11 at A.S.A. 40). Insert A.S.A. 40 plug into the trimming cartridge and insert the cartridge into the film compartment.

(2) Connect the power supply to the camera battery terminals and place the camera in the light fixture. Apply 5 volts DC to the battery terminals and, with the camera running, note the reading on the voltmeter scale. This reading must be within the A.S.A. 40 limits of 2.2 to 4.9 millivolts.

(3) Remove the A.S.A. 40 plug from the trim-

ming cartridge and repeat step (2). The reading on the voltmeter scale must now be within the A.S.A. 160 limits of 0.55 to 1.3 millivolts.

NOTE: Temporarily, cameras which require readjustment of trim must be returned to the Bell & Howell Service Department or to authorized Factory Branches. Any adjustment of electric eye trim will alter the adjustment of the under and over exposure indicating system and further compound the existing problem. All service stations will be notified as soon as adequate tooling and trim adjustment information is available.

d. Checking the Under-Exposure Indicator. The under-exposure indicator (red warning light) should appear in the viewfinder field-of-view whenever the available light is insufficient for properly exposed pictures. In brief, the electrical operation is as follows (refer to schematic diagram, Figure 6).

As the light on the photocell decreases, the resistance of the photocell increases, reducing the current and voltage drop across trim pot P3. The positive voltage at the base of Q1 is reduced, thus increasing the forward conducting bias. As Q1 collector current increases, the positive collector voltage decreases. This, in turn, decreases the voltage across the under exposure adjustment pot P1 and reduces the forward bias on Q2. Current through Q2 decreases, and the positive voltage at the collector of Q2 causes forward conductive bias for Q5. When Q5 "conducts," the light emitting diode (LED) fires and produces the red light in the viewfinder.

To check the operation of the under-exposure circuit, insert the A.S.A. 40 plug into the trimming cartridge and place the cartridge in the film compartment. Point the camera at a scene of average brightness and, with the camera running, slowly cover up the photocell window below the zoom lens. As the light is cut off, the red exposure indicator in the viewfinder should light to indicate an under-exposed condition. Adjustment pot P1 can be adjusted to set the low-light level at which the light emitting diode (LED) will function to produce the red under-exposure signal in the viewfinder.

e. Checking the Over-Exposure Indicator. The over-exposure indicator should appear in the viewfinder whenever the light level is too high to produce properly exposed pictures. The electric operation is as follows (Figure 6).

When extreme high light strikes the photocell, its resistance is reduced, thereby increasing the current and voltage across trim pot P3. This decreases the forward conducting bias on Q1 which, in turn, increases the voltage across Q1 and P2, increasing the forward conducting bias of Q2. The voltage drop across Q2 then decreases, causing the forward bias of Q3 to decrease. This, in turn, causes the voltage drop across Q4 to increase and the forward conducting bias of Q5 to increase. When Q5 "conducts," the light emitting diode (LED) fires and produces the red light in the viewfinder, indicating an over-exposure condition.

To check the operation of the over-exposure circuit, remove the A.S.A. 40 plug from the trim cartridge (camera set for A.S.A. 160). Point the camera at a scene of average brightness and, with the camera running, slowly swing the camera toward a very bright light source. As the light increases toward the over-exposed level, the red exposure indicator in the viewfinder should light to indicate an over-exposed condition. Adjustment pot P2 can be adjusted to set the high-light level at which the light emitting diode (LED) will function to produce the over-exposure signal in the viewfinder.

f. Checking the Battery Test Indicator. When the battery test button (S1) is pressed (closed), a resistive load (R1) is applied across the camera batteries. Note in Figure 6 that Q5 and the light emitting diode (LED) are also across the batteries. Insert the dummy batteries into the camera and, while depressing the battery test button, set the power supply for 4.2 volts DC. The red indicator light in the viewfinder should now be on and the current drain should be 80 to 120 ma. Reset the power supply for 3.5 volts DC and the red light should now be out. If adjustment is necessary, remove the decal at the rear of the battery compartment to expose pot P4. Set the power supply at 4.2 volts DC and adjust P4 until the indicator light goes on in the viewfinder. Reduce power supply voltage to 3.5 volts DC, at which point the light should go off. Readjust as necessary and reinstall the decal.

12. TAKE-UP TORQUE ADJUSTMENT. The final check and adjustment of take-up torque should be made before the complete chassis is assembled into the camera cover. Proceed as follows.

a. Temporarily reassemble the run button to the upper end of the run actuator lever, and connect the jumper clip to the terminal pads of switch S3 as shown in Figure E. Install the dummy batteries and set the power supply at 5 volts DC.

b. Place a pencil mark on the film at the aperture of any regular film cartridge and insert the cartridge into the cartridge chamber.

c. Press the run button and run the mechanism for a few moments; then remove the film cartridge and check to see that the film has advanced. Take-up torque must be sufficient to pull the film smoothly but not so strong as to tear film perforations.

d. Take-up torque can be increased by rotating the take-up spring (Figure C) counterclockwise. If the torque cannot be increased sufficiently, even with the spring ends at the highest point on the adjustment rims the spring must be replaced.

13. PRIME LENS FOCUSING ADJUSTMENT. The prime lens must be adjusted whenever the prime lens has been replaced or its position disturbed. This adjustment requires the use of an autocollimotor (see Test Equipment chart in Introduction section) and the prime lens focus tool (Figure B).

a. Remove the camera side cover (items 6 through 8, Figure 1). Manually depress the filter arm actuator (Figure F) and insert a 1/4 to 9/32 inch square block of wood or eraser rubber into the gap (X) above the top finger of the actuator to hold the filters open. Use a small piece of tape to hold down the iris blade finger (Figure F).

b. With collimator focused and set at infinity, zoom the camera lens to wide angle and set the focusing side at infinity. Rotate shutter gear to "open" position with pointed tool, and insert focus cartridge (Figure B) into camera film compartment.

c. Place the camera in the collimator and check camera focus by observing the color banding on the reticle. If proper color compromise is observed (equal banding of red and green), the prime lens is in focus and no adjustment is necessary.

d. If the prime lens is not in focus, place a drop or two (no more) of acetone in the prime lens access hole (Figure F) to loosen the adhesive in the groove of the lens barrel. Insert the focus tool into the access hole and engage the eccentric tip of the tool with the lens barrel groove. Shift the position of the lens by turning the tool a bit at a time until equal banding of red and green is obtained. After adjusting, place one drop of adhesive (B&H Spec. 987) in the access hole to seal the lens in place.

NOTE: After the prime lens has been focused, camera pointing and tracking must be checked (paragraph 14, following). Therefore, leave the camera in its preset position, with side cover removed and filters and iris blades in the "open" position.

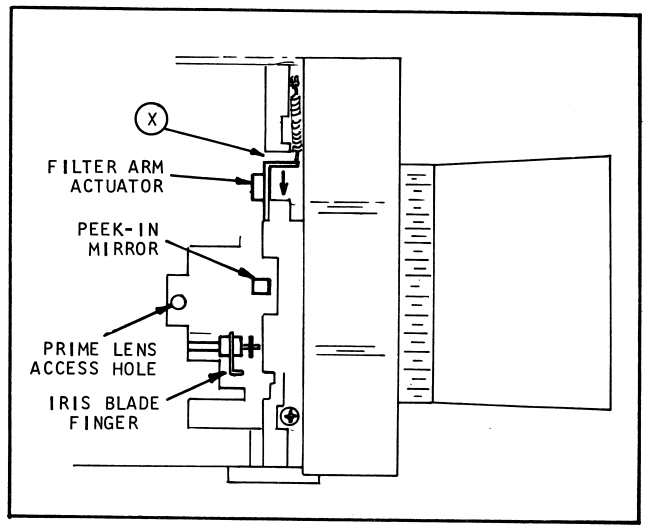


Figure F. Prime Lens Focusing Adjustment

14. CAMERA POINTING AND TRACKING ADJUSTMENT. If the lenses or viewfinder components were removed, it will be necessary to check camera pointing and realign the optical system. This check and adjustment requires the use of the mirror pointing block (Figure B) and the target initially furnished with Bell & Howell Service Manual P/N 70411. The horizontal and vertical bisecting lines of the target should be thickened to 1/4-inch wide.

a. Move the camera on a sturdy tripod and insert the mirror pointing block into the film compartment. Make certain the block is seated fully in place.

b. Secure the target to the wall at lens height and position the tripod so that the camera lens is exactly three feet from the target. Set the lens focus ring at three feet.

c. Zoom the lens to the "Telephoto" position and, while looking into the cartridge mirror, adjust the position of the camera and tripod until the aperture is centered on the target (Field-of-view encompasses an equal number of horizontal and vertical lines on either side of the target center cross-lines). This is the aperture field-of-view.

d. Without disturbing the position of the camera, look through the viewfinder, adjusting the eyepiece to obtain sharp focus. The viewfinder field-of-view must be square horizontally and vertically and entirely within the aperture field-of-view.

e. If pointing is necessary, insert a syringe needle into the access opening to the peek-in mirror (Figure

F) and place a drop of acetone on the mirror pivot post. When adhesive is loose, insert pointing tool (Figure B) into small hole in peek-in mirror and tilt the mirror horizontally and vertically until images are squared and viewfinder cross-hair superimposed on the target center line.

f. While looking through the viewfinder, carefully zoom the camera lens from telephoto to wide angle. The mask cross-hair must not shift up or down from the target center line more than 5/16-inch. If the tracking error exceeds 5/16 inch, readjust the peek-in mirror slightly and recheck camera tracking. Then seal the mirror pivot post with adhesive (Spec. No. 987), taking care not to get adhesive on the mirror.

g. Remove the block and tape used to hold the filters and iris blades open, and reinstall the camera side cover (items 6 through 8, Figure 1).

NOTE: The viewfinder pointing adjustment also may be made by projecting the aperture mask and viewfinder images on the target with the use of pilot lamps; then adjusting the peek-in mirror until the viewfinder image is squared within the area covered by the aperture mask image.

15. CHECKING FOCUS-MATIC OPERATION.

a. Place strips of tape on the floor exactly four feet, 10 feet and 25 feet from the base of a wall.

b. While standing at each marked distance and sighting through the viewfinder eyepiece, align the viewfinder cross-hair on the base of the wall and press and release the FOCUS button. Check to make certain that the Focus-Matic indicator needle registers the proper distances on the scale.

c. If the Focus-Matic system fails to register properly at the preset distances, the "Delta" assembly (item 5, Figure 1) must be replaced.

d. After checking Focus-Matic operation, the long nameplate (item 4, Figure 1) can be secured to the camera cover and lens housing with adhesive (B&H Spec. No. 987).

Final Test

16. GENERAL INSPECTION PROCEDURES.

a. Visually inspect the camera for obvious physical damage, for defaced nameplates and trimplates and for loose or missing parts.

b. Check for excessive play in the cartridge door with the latch closed. Open and close the cartridge door to check the hinging operation.

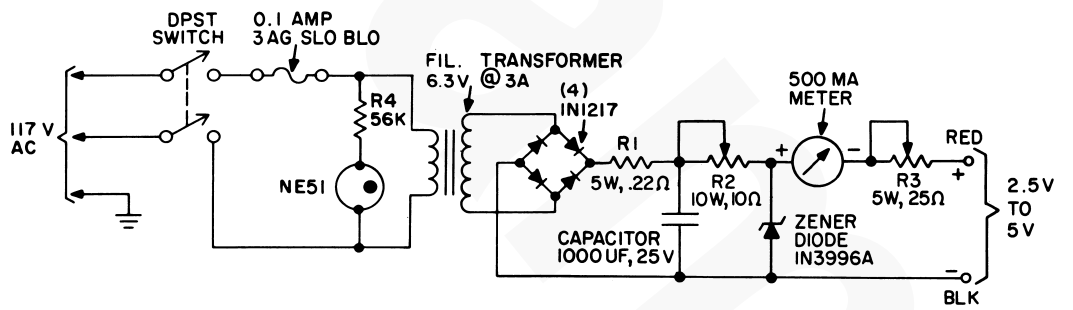
c. Point the camera at a bright light and look through the viewfinder, checking for flaws, stains, dirt or other foreign matter. The image should be bright and clear and the viewfinder horizontal hairline must be straight.

d. With the cartridge door open, direct a bright light into the film compartment while looking down into the zoom lens. Press the filter button down so that the "flash bulb" symbol is exposed while watching to see that the amber filters withdraw completely from in front of the lens opening. Press the filter button to the "up" position. The amber filters should now cover the lens opening completely.

e. Place the ON-OFF button in the ON position and, while pressing the run button, zoom the lens from wide angle to telephoto and back again. The lens must zoom smoothly and without hesitation or binding. While the camera is running, listen for any unusual noises not normally associated with camera operation.

f. Check the Focus-Matic operation as outlined in paragraph 15.

17. GENERAL OPERATIONAL TESTS. The following tests are to be performed with the dummy batteries and 5 volt DC power supply.



PARTS REQUIRED
SWITCH, DPST: Cutler-Hammer No. 7590K6 RESISTOR, 5W (±5%), 0.22 OHM: International Resistor Co., Type AS-5 RESISTOR, 10W, 10 OHM: Ohmite "Dividohm" POTENTIOMETER, 5W, 25 OHM: Centralab Type WN CAPACITOR, 1000 UF; 25V: Cornell-Dubilier No. 1000-25 PANEL METER, 500 MA: Simpson Electric Co. Model 1227, 0-500MA-DC
CALIBRATION PROCEDURE. Connect the 500 MA-DC meter in series with the Zener Diode and adjust the 10-ohm resistor (R2) for 400 ma. The battery test indicator test voltage (5V, 4.2V and 3.5V) can be preset in the following manner. Mark the settings on the front panel behind the 25-ohm potentiometer.

NOTE: The power supply illustrated is a "universal" power supply, designed for use with most Bell & Howell Electric Eye Cameras. The battery test voltages should be present and marked even though the camera being tested is not equipped with the battery test feature.

(1) Set the 25-ohm potentiometer (R3) to minimum resistance and mark the panel "5V" opposite the knob indicator.

(2) Connect a 25-ohm (±2%) load resistor across the output terminals and connect a voltmeter across the load resistor. Adjust the potentiometer (R3) for a reading of 4.2 volts and mark the panel; then adjust the potentiometer for a reading of 3.5 volts. When operating the camera for adjustments and tests, set the potentiometer at the 5-volt position.

Figure G. Power Supply for Camera Tests and Adjustments

a. Insert a test cartridge into the camera and start the camera with the run button. The shuttle should pull film smoothly and must not tear film perforations. If film is not transporting properly, check take-up torque (paragraph 18).

b. Insert a test film cartridge (film fully rewound) into the camera and check the footage counter scale. The footage indicator should be positioned at the far left end of the indicator scale. Run the camera and check to see that the indicator moves smoothly from left to right. When the film is completely "exposed," the indicator must have reached the center of the rectangular "end" mark at the right of the scale. Remove the film cartridge and check to see that the indicator returns to the mark below the letter "O."

c. Check all electrical functions of the camera as instructed in paragraph 11. It should be noted that the replacement of any components which have a direct affect on electric eye trim (zoom lens, prime lens, meter and photocell assembly, etc.) will necessitate retrimming of the system. At present, this can only be done at the factory or at authorized factory branches.

18. CHECKING TAKE-UP TORQUE. Place a pencil mark on the film at the aperture of a regular film cartridge and insert the cartridge into the camera. Run the camera for a few moments; then remove the cartridge and check to see if the film has advanced. Take-up torque must be sufficient to pull the film smoothly but not so strong as to tear film perforations. Refer to paragraph 13 for take-up torque adjustment.

19. MOTOR CURRENT DRAIN. Insert the dummy batteries and a test film cartridge into the camera. With the DC power supply (Figure G), apply 5.0 volts and operate the camera by pressing the run button and zooming the lens. Current drain should not exceed 210 milliamps.

20. CHECKING CAMERA SHUTTER SPEED. The normal shutter speed is 18 fps and is most accurately checked with a shutter strobe.

a. With the camera running, adjust the strobe until the shutter appears motionless and note the reading on the strobe dial. Nominal shutter speed is 1080 shutter rpm (18 fps) but a speed between 950 rpm (16 fps) and 1200 rpm (20 fps) is acceptable.

b. If shutter speed does not fall within the specified limits (16 fps minimum to 20 fps maximum) check for possible binding in the gear train.

21. CHECKING LENS FOCUS.

a. Focus the collimator and set the collimator at infinity.

b. Press the camera filter button down to expose the "flash bulb" symbol.

c. Insert the lens focus cartridge (Figure B) into the camera and place the camera in the collimator.

d. While actuating the collimator lever, observe the color fringe. If equal banding of red and green is observed, the prime lens is in focus. If proper color compromise cannot be obtained, refer to paragraph 13 for lens focus adjustment.

22. CHECKING SHUTTLE OPERATION (Figure H).

a. Shuttle Tooth Centering. Open the film compartment door and remove the right side cover (item 8, Figure 1). Hold the camera with the lens pointing down and place the shuttle tooth centering gage (Figure B) in the film channel of the aperture plate. The slot in the gage must be positioned over the slot in the aperture plate. Tilt the rear end of the camera to the left so that the heavier lower end of the gage tends to swing in toward the film compartment wall. Press the run button to run the camera. If the gage vibrates, the shuttle tooth is not centered in the shuttle slot and the complete aperture plate assembly (item 25, Figure 2) must be replaced.

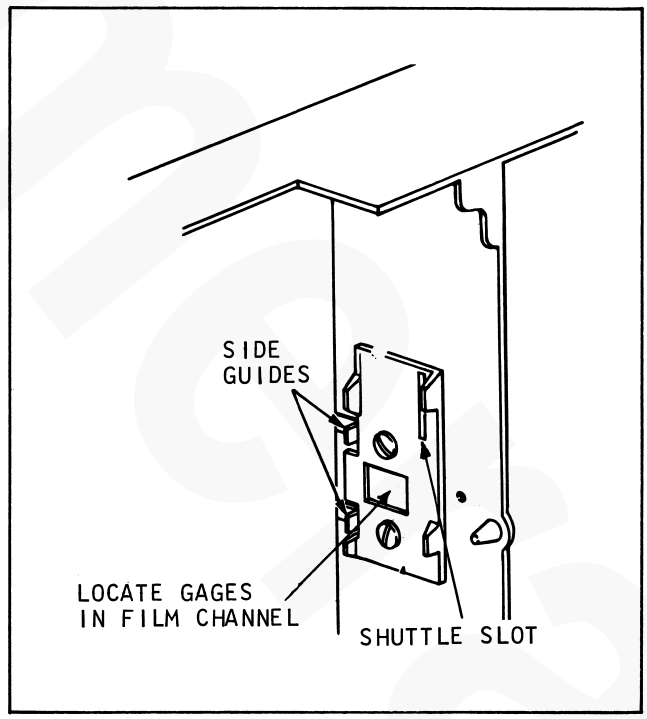


Figure H. Checking Shuttle and Side Guide Tension

b. Shuttle Tooth Protrusion. Remove right side cover (item 8, Figure 1) and rotate the shutter gear until the shuttle tooth is at its maximum protrusion through the slot in the aperture plate. Check the height of the shuttle tooth with the shuttle tooth penetration gage (Figure B). The shuttle tooth should clear the GO end of the gage but must not clear the NO GO end. If the shuttle tooth is too high or too low, replace the complete aperture plate assembly (item 25, Figure 2).

23. CHECKING SIDE GUIDE TENSION (Figure H). This adjustment requires the use of the side guide tension gage (see Test Equipment chart in Introduction section).

a. Set the gage at 100 grams and, with the tongue of the gage, press down on the exposed tip of the lower side guide (Figure H). The tongue of the gage should move before the side guide moves away from the edge of the aperture plate.

b. Reset the gage at 150 grams and repeat step a. At this gage setting, the lower side guide should move away from the edge of the aperture plate before the tongue of the gage moves.

c. If side guide tension does not meet the above requirements, the complete aperture plate assembly (item 25, Figure 2) must be replaced.

Trouble Shooting

TROUBLE	PROBABLE CAUSE	REMEDY
Camera will not run	1. Weak or dead batteries.	1. Replace batteries.
	2. Battery contacts corroded.	2. Clean or replace battery contacts.
	3. Bad solder connection on motor lead.	3. Resolder connection.
	4. Pinched wire causing short or ground.	4. Check wiring and correct condition.
	5. Drive motor "open" or has "dead spots."	5. Replace drive motor (item 3-11).
Camera runs but does not pull film, or tears perforations	1. Weak batteries.	1. Replace batteries.
	2. Batteries installed backwards.	2. Install batteries per etched markings on the battery case.
	3. Improper shuttle centering (paragraph 22).	3. Replace aperture assembly (item 2-25).
	4. Improper shuttle tooth height (paragraph 22).	4. Replace aperture plate assembly (item 2-25).
Developed films consistently over-exposed	1. Faulty meter assembly (item 2-10) or electric eye system out-of-trim.	1. See *NOTE.
	2. Over-exposure circuit out-of-adjustment.	2. Adjust pot P2 (paragraph 11, step e).

*NOTE: Until E.E. trim tooling is available, return camera to factory or authorized factory branches.

TROUBLE	PROBABLE CAUSE	REMEDY
Developed films consistently under-exposed	1. Iris blades stuck in near-closed position.	1. See *NOTE.
	2. Dirt or oil on optics.	2. Clean optics.
	3. Faulty meter assembly (item 2-10) or E.E. system out-of-trim.	3. See *NOTE.
	4. Under-exposure circuit out-of-adjustment.	4. Adjust pot P1 (paragraph 11, step d).
Footage indicator sticking or inoperative	1. Faulty footage indicator spring (item 2-13).	1. Replace footage indicator spring.
Camera speed too slow or too fast	1. Check camera speed (paragraph 20).	1. If speed is improper, replace motor assembly (item 2-11).
Scratches on film	1. Burr on aperture plate.	1. Replace aperture plate assembly (item 2-25).
Exposure warning indicator inoperative	1. Improper run button operation (should energize electric eye circuit in "run" position).	1. Check electrical circuit.
	2. Sticky meter assembly.	2. See *NOTE.

*NOTE: Until E.E. trim tooling is available, return camera to factory or authorized factory branches.

PARTS CATALOG

FOCUSMATIC SUPER-8 LOW-LIGHT MOVIE CAMERA

DESIGN 672/XL

CONSUMER PRODUCTS GROUP

BELL & HOWELL

GENERAL SERVICE DEPT.
7100 McCORMICK ROAD
CHICAGO, ILLINOIS 60645

PART NO. 72795-1 PRINTED IN U.S.A. MAY 1973

Replacement Parts

The following pages illustrate and list, by part number and description, all replacement parts for the Design 672/XL Focus-Matic Super 8 Low-Light Movie Camera. Parts are indexed in a suggested order of disassembly, with attaching parts immediately preceding those items which they attach. Items which are designated as "NP" (not procurable) in the Quantity column are not stocked as replacement parts. When such items are damaged, the assembly of which they are a part must be replaced in its entirety.

Batteries required for camera operation are Mallory Type MN2400 (size AAA) and can be obtained from Bell & Howell under part number 42882. The pistol grip provided with the Design 672/XL camera is not repairable and, if damaged, must be replaced as a complete unit.

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CAMERA MAIN ASSEMBLY		
1-1	46379	TRIMPLATE, Pistol grip (cement in place)	1	
-2	014231	GRIP ASSEMBLY, Pistol	1	
-3	436363	CASE, Battery	1	
-4	436539	NAMEPLATE, Design 672/XL	1	
-5	043424	DELTA ASSEMBLY	1	
-6	436536	TRIMPLATE, Side cover (cement in place)	1	
-7	436406	SCREW, Tapping, block, M3 by 9/32 inch	1	
-8	043428	COVER ASSEMBLY, Side.	1	
-8A	437046	. BUTTON, Type "A" filter	1	
-8B	436548	. SPACER, Filter button	1	
-8C	437043	. SPRING, Type "A" filter	1	
-8D	437151	. NAMEPLATE, Type "A" filter (cement in place). .	1	
-8E	No Number	. COVER, Side.	1	
-9	436537	TRIMPLATE, Front upper (cement in place)	1	
-10	437120	TRIMPLATE, Front lower (cement in place)	1	
-11	436367	SCREW, Tapping, black, M3 by 9/32 inch	2	
-12	437161	SCREW, Tapping, chrome, M2.6 by 3/8 inch	1	
-13	436090	SCREW, Tapping, black, M3 by 3/8 inch	2	
-14	043427	LENS MODULE ASSEMBLY (See Figure 3 for parts) .	1	
-15	436357	SCREW, Contact	1	
-16	437142	TRIMPLATE, Cartridge chamber	1	
-17	437144	SCREW, Binding head, M2 by 3/32 inch	1	
-18	043344	BUTTON ASSEMBLY, Run	1	
-18A	437154	. TRIMPLATE, Run button	1	
-19	436367	SCREW, Tapping, M3 by 9/32 inch long	2	
-20	No Number	CHASSIS ASSEMBLY, Complete (see Figure 2 for parts) . .	NP	
-21	436651	BUTTON, Battery test	1	
-22	437057	SCREW, Pilot	1	
-23	043205	EYEPIECE ASSEMBLY, Viewfinder	1	
-23A	436125	. EYESHIELD, Viewfinder	1	
-24	043343	HOUSING ASSEMBLY, Camera, complete (NOTE A) .	1	
-25	436535	. TRIMPLATE, Battery test (cement in place)	1	
-26	437029	. WINDOW, Footage scale (cement in place)	1	
-27	437014	. BUTTON, Door latch (staked)	1	
-28	38610	. LATCH, Cartridge door	1	
-29	437039	. WINDOW, Cartridge door (cement in place).	1	
-30	436650	. BUTTON, On-off (staked)	1	
-31	437026	. SPRING, Contact, on-off	1	

NOTE A: All viewfinder optics in the camera cover are cemented in place and can be cleaned in their mounted positions. If the optics are damaged and in need of replacement, the complete housing assembly (P/N 043343) must be replaced.

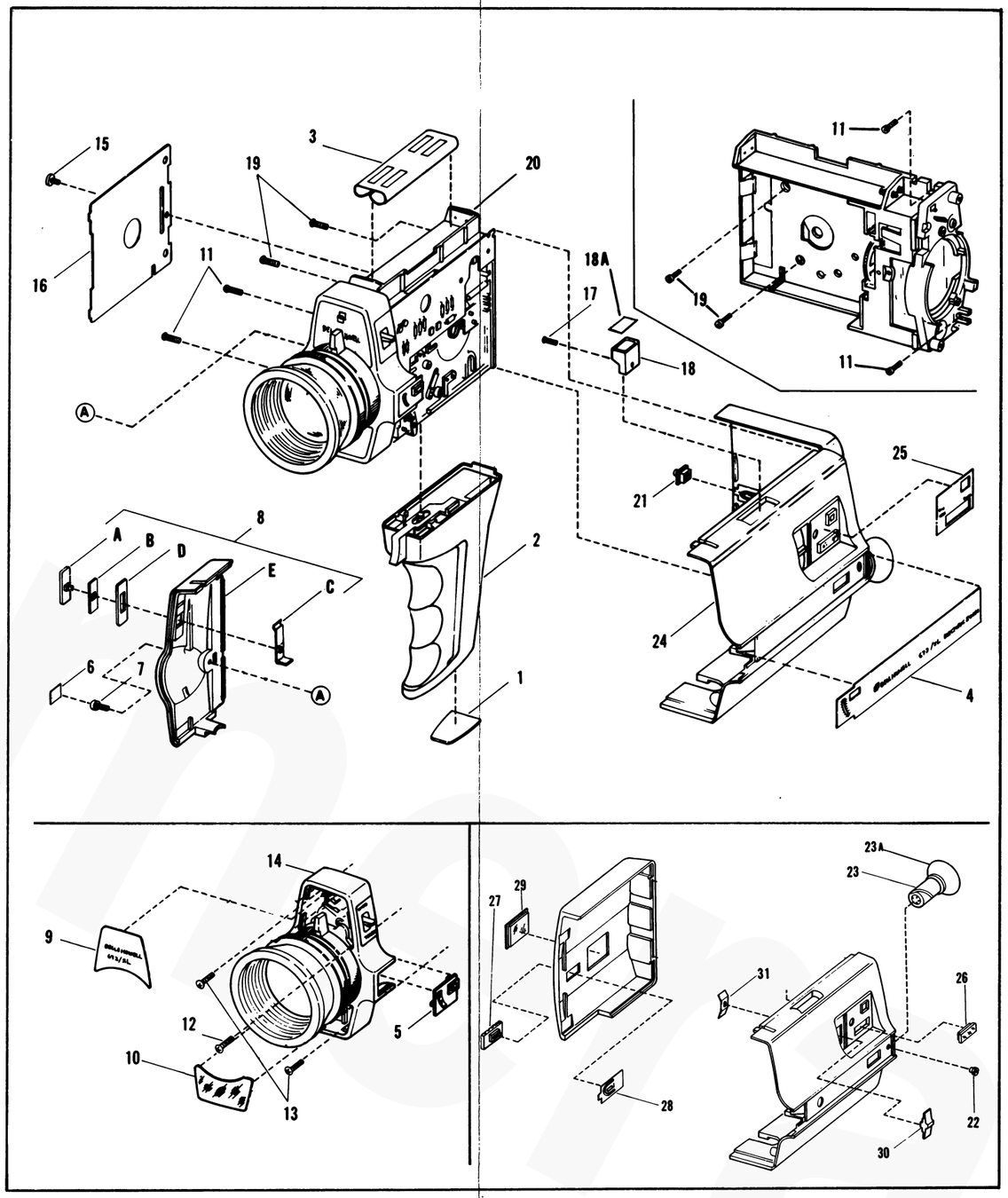


Figure 1. Camera Main Assembly

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CHASSIS ASSEMBLY COMPONENTS		
2-	No Number	CHASSIS ASSEMBLY, Complete	REF	
-1	436239	. SCREW, Tapping, black, M3 by 3/16 inch	2	
-2	043414	. P.C. BOARD ASSEMBLY (See Figure 5 for parts) .	1	
-3	436471	. INSULATOR, P.C. board	1	
-4	437157	. SPRING, Return, trigger actuator arm	1	
-5	436604	. SCREW, Tapping, black, M2 by 5/32 inch	1	
-6	436645	. WASHER, Flat	1	
-7	043437	. RUN ACTUATOR ASSEMBLY	1	
-8	437056	. SPRING, Torsion, run actuator	1	
-9	437161	. SCREW, Tapping, chrome, M2.6 by 7/16 inch . .	2	
-10	043417	. METER AND PHOTOCELL ASSEMBLY	1	
-11	043434	. MOTOR ASSEMBLY, Drive	1	
-12	436345	. WEDGE, Indicator spring (cement in place)	1	
-13	437058	. SPRING, Footage indicator	1	
-14	434419	. SPRING, Take-up	1	
-15	434418	. GEAR, Take-up	1	
-16	434415	. STUD, Take-up	1	
-17	436100	. PAWL, Take-up	1	
-18	436148	. SPRING, Return, film indicator	1	
-19	437147	. SLEEVE, Film indicator	1	
-20	437114	. INDICATOR, Film	1	
-21	434427	. SHAFT, Footage counter	1	
-22	042447	. SHAFT ASSEMBLY, Take-up	1	
-23	437163	. LEVER, A.S.A.	1	
-24	436646	. SPRING, A.S.A. lever	1	
-25	043406	. APERTURE PLATE ASSEMBLY (Press fit)	1	
-26	043418	. PRIME LENS ASSEMBLY	1	
-27	043404	. CHASSIS ASSEMBLY (See Figure 4 for parts) . . .	1	

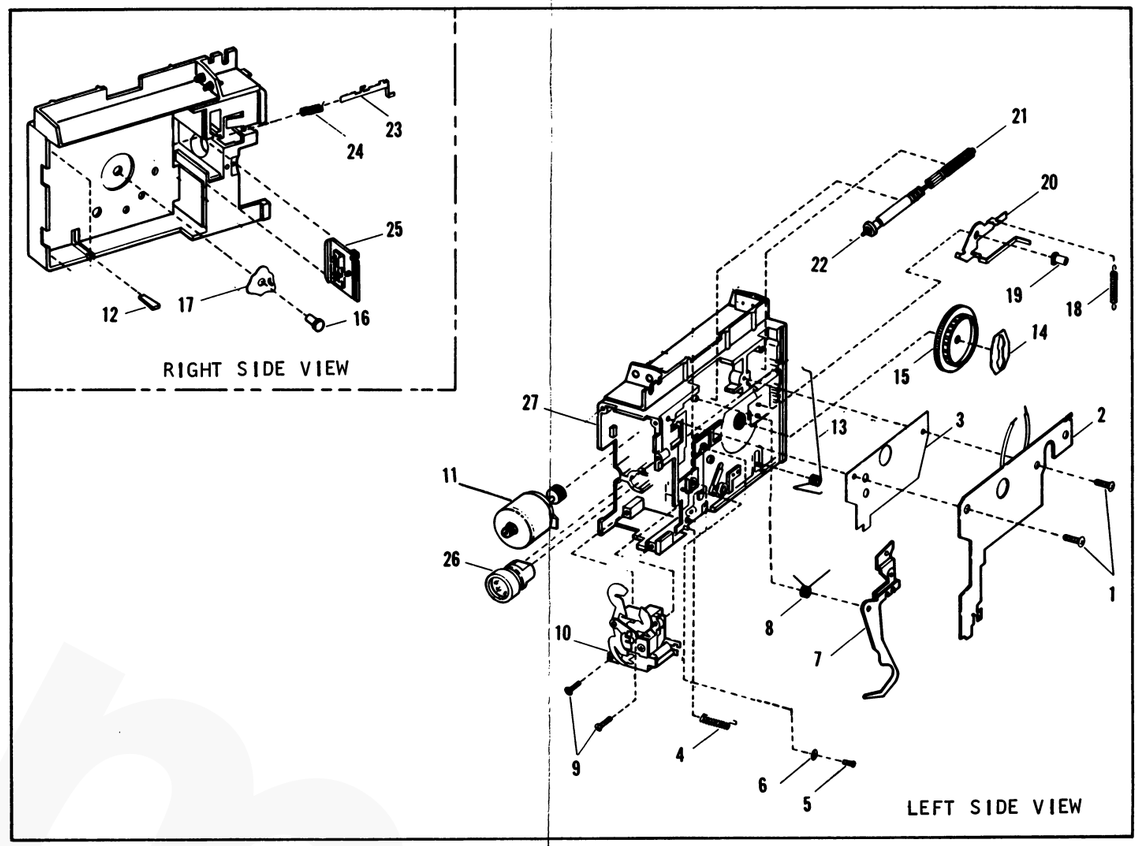


Figure 2. Chassis Assembly Components

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		LENS MODULE ASSEMBLY		
3-	043427	LENS MODULE ASSEMBLY	REF	
-1	437169	. RING, Retaining	1	
-2	043425	. FILTER ASSEMBLY, A.S.A.-160	1	
-3	437168	. SPRING, Torsion, A.S.A. arm	1	
-4	437109	. SCREW, Pivot, Type "A" filter	1	
-5	043426	. FILTER ASSEMBLY, Type "A"	1	
-6	437167	. STUD, Threaded, A.S.A. arm	1	
-7	437144	. SCREW, Binding head, black, M2	2	
-8	043423	. LENS ASSEMBLY, Zoom	1	
-9	436367	. SCREW, Tapping, black, M3 by 1/4 inch	2	
-10	043342	. HOUSING ASSEMBLY, Lens, 8.5 to 24mm, f/1.3 .	1	
-10A	436538	. NAMEPLATE, Wide Angle/Telephoto (adhesive backed)	2	
-11	043431	. PLATE ASSEMBLY, Lens mounting (NOTE A) . . .	1	
-12	437102	. . SPRING, Extension	1	
-13	437110	. . SPRING, Zoom lever	1	
-14	99828	. . RING, Retaining, external 0.062 inch ID (E) . .	2	
-15	38777	. . WASHER, Flat	2	
-16	043432	. . KNOB ASSEMBLY, Zoom	1	
-17	435203	. . PAWL, Front	1	
-18	435202	. . PAWL, Rear	1	
-19	436095	. . GEAR, Eccentric	1	
-20	No Number	. . PLATE SUBASSEMBLY, Lens mounting (NOTE A)	NP	

NOTE A: Sub-items 13 through 20 are available for replacement. However, if the lens mounting plate itself, or any staked parts of that plate are damaged, it is recommended that the complete assembly (item 11) be replaced.

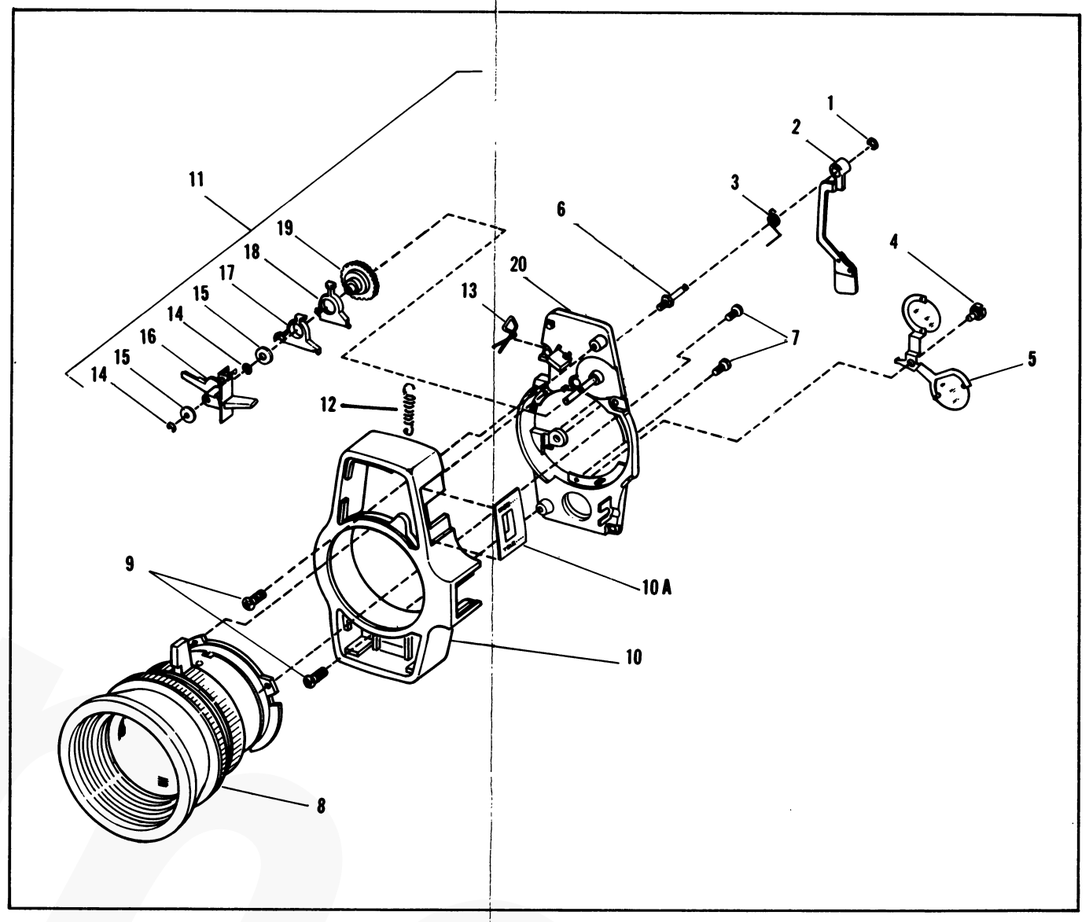
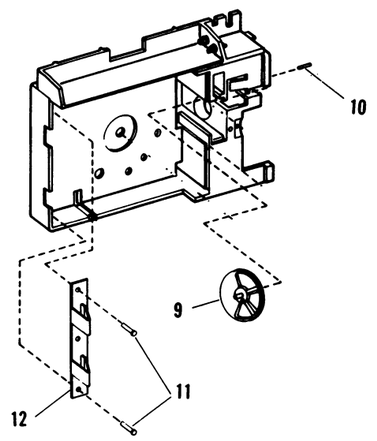


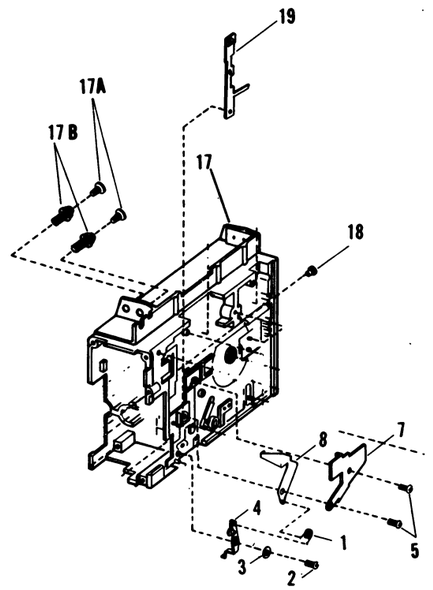
Figure 3. Lens Module Assembly Components

FIG. & INDEX NO.	PART NO.	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
		CHASSIS ASSEMBLY		
4-	043404	CHASSIS ASSEMBLY, Complete	REF	
-1	437158	. SPRING, Torsion, over-center	1	
-2	436604	. SCREW, Tapping, M2 by 5	1	
-3	436603	. WASHER, Flat	1	
-4	043415	. ARM ASSEMBLY, Actuator	1	
-5	436604	. SCREW, Tapping, M2 by 5	2	
-6	436603	. WASHER, Flat	2	
-7	436738	. PLATE, Stay	1	
-8	437017	. ACTUATOR, Shutter	1	
-9	043438	. SHUTTER ASSEMBLY	1	
-10	434439	. PIN, Shutter (press fit)	1	
-11	434845	. RIVET, Semi-tubular	2	
-12	436241	. SPRING, Cartridge tension	1	
-13	436484	. LIGHT SHIELD, Prime lens (cement in place)	1	
-14	436486	. LIGHT SHIELD, Bottom (cement in place)	1	
-15	436483	. LIGHT SHIELD, Upper (cement in place)	1	
-16	436485	. LIGHT SHIELD, Lower (cement in place)	1	
-17	043403	. HOUSING ASSEMBLY, Battery (cement in place)	1	
-17A	437170	. . CONTACT, Battery	2	
-17B	41402	. . SPRING, Battery contact	2	
-18	436314	. BEARING, Take-up shaft (press fit)	1	
-19	436143	. CONTACT, Motor (heat staked) (NOTE A)	1	
-20	437061	. CHASSIS, Camera (NOTE A)	1	

NOTE A: The motor contact (item 19) is heat-staked to two locating pins of the camera chassis (item 20), and should not be removed. If the camera chassis is damaged and in need of replacement, it is recommended that the complete chassis assembly P/N 043404 be replaced.



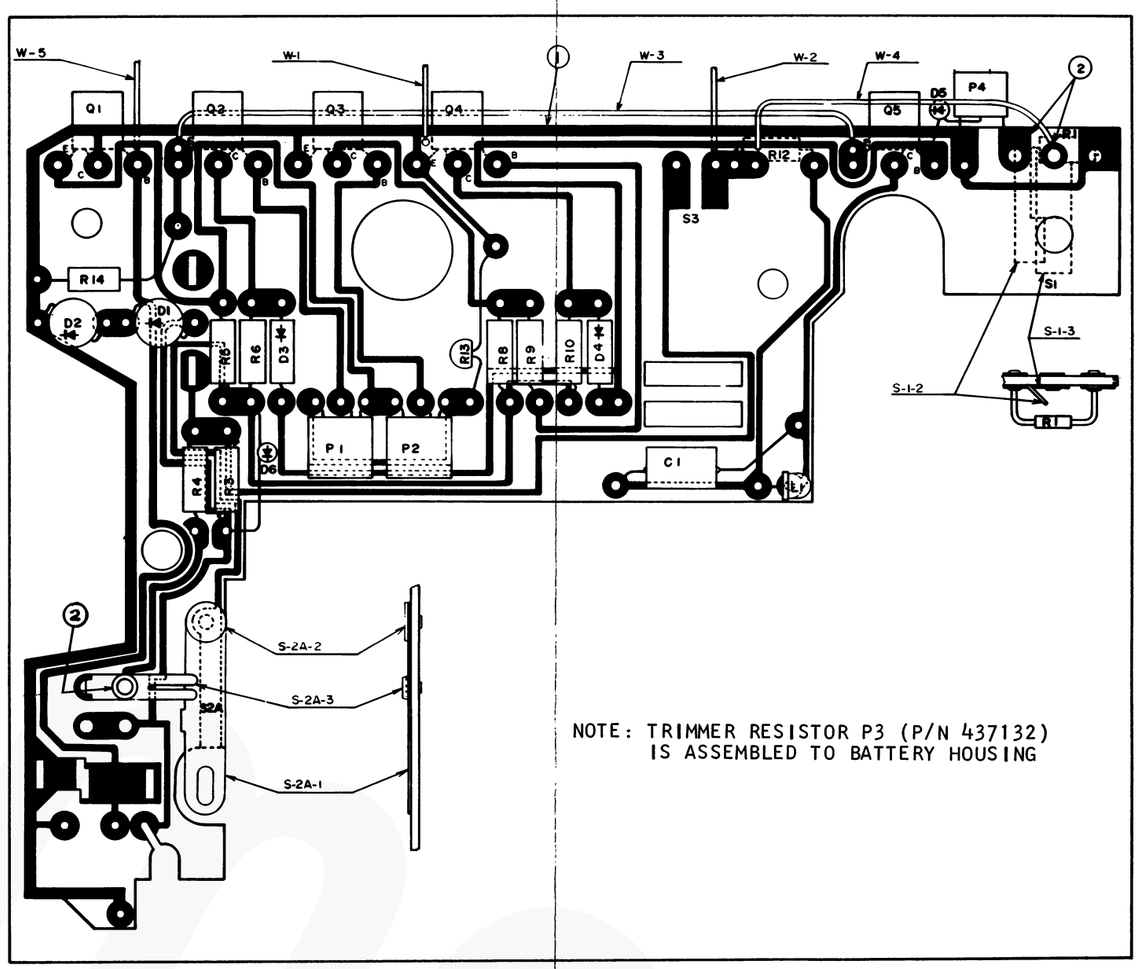
RIGHT SIDE VIEW



LEFT SIDE VIEW

Figure 4. Chassis Assembly

REFERENCE SYMBOL	PART NO.	DESCRIPTION
		P.C. BOARD ASSEMBLY (PART NO. 043414)
C1	437134	CAPACITOR, Tantalum, 68uf/3V ±20%
D1, D2	433872	DIODE, Silicon
D3, D4	434193	DIODE, Germanium
D5	433872	DIODE, Silicon
D6	435884	VARISTOR, Type MV2
L1	437133	DIODE, Light emitting, MV50
Q1	437139	TRANSISTOR, PNP (Type 2N6076 or equal)
Q2 thru Q5	437140	TRANSISTOR, NPN (Type 2N5172 or equal)
P1, P4	436514	RESISTOR, Variable, 10K ±30%, 1/10 watt
P2	437064	RESISTOR, Variable, 33K ±30%, 1/10 watt
R1	437136	RESISTOR, Fixed, carbon, 39 ohm ±5%, 1/2 watt
R3	100005	RESISTOR, Fixed, carbon, 6.8K ±10%, 1/4 watt
R4	100006	RESISTOR, Fixed, carbon, 1.2K ±10%, 1/4 watt
R5	430360	RESISTOR, Fixed, carbon, 680 ohm ±10%, 1/4 watt
R6, R8, R10	437135	RESISTOR, Fixed, carbon, 1.5K ±10%, 1/4 watt
R9	100073	RESISTOR, Fixed, carbon, 15K ±10%, 1/4 watt
R12	437137	RESISTOR, Fixed, carbon, 270 ohm ±10%, 1/4 watt
R13	436710	RESISTOR, Mini
R14	436711	RESISTOR, Solid



NOTE: TRIMMER RESISTOR P3 (P/N 437132) IS ASSEMBLED TO BATTERY HOUSING

Figure 5. Printed Circuit Board Assembly

Figure 6. Camera Wiring Diagram

NUMERICAL INDEX OF PARTS

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99828	3-14
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100006	5-R4
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430360	5-R5
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437169	3-1
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