AE1P

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Service Tools List

Canon AE-1 Program

(Ref. No. C12-1421, 2)

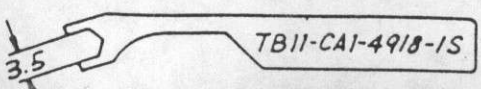
TEST EQUIPMENT (USE)	(NAME OF TEST EQUIPMENT)
1. Shutter	Shutter Tester (Model 7J-18C) or PA-16 Transistorized Shutter Tester or Simplified Shutter Tester
2. Exposure Meter	2.1 D.C Voltage Tester (Digital Tester Model VOAC 707 or VOAC 77) (Measuring Exposure Meter Accuracy Voltage Measuring Unit 1 mV)
	2.2 Standard Brightness Checker (CdS) or Canon Luminance Meter (S.B.C)
	2.3 Oscilloscope (Electric Circuit General Check)
3. Range-Viewfinder	Universal Range-Viewfinder Collimator (SU-006-2) or Universal Range-finder Collimator
4. Mirror for 45°	Universal Type 90° Collimator
5. Field of View	Universal Range-Viewfinder Collimator (SU-006-2) or Universal Parallax Collimator
6. Flange - Focal Distance	42.14mm Dial Gauge
7. Adjustment	7.1 Torque Gauge (2000 ∿ 7000 gcm) (SC-004)
	7.2 Depth Gauge (Check the Max. Aperture Correction Pin)
	7.3 Torque Gauge Head ST42-C12-1401-1S (SE-138)
	7.4 Retaining Ring Plier AOG (SE-142)
8. Electrical Adjustment	Precision Variable Resistors 1. 200 KΩ 2. 10 KΩ (Local Purchase)

9. Special Screwdrivers

Tightening, Winding Lever — TB39-CA1-4977-1S (Common to A-Series)

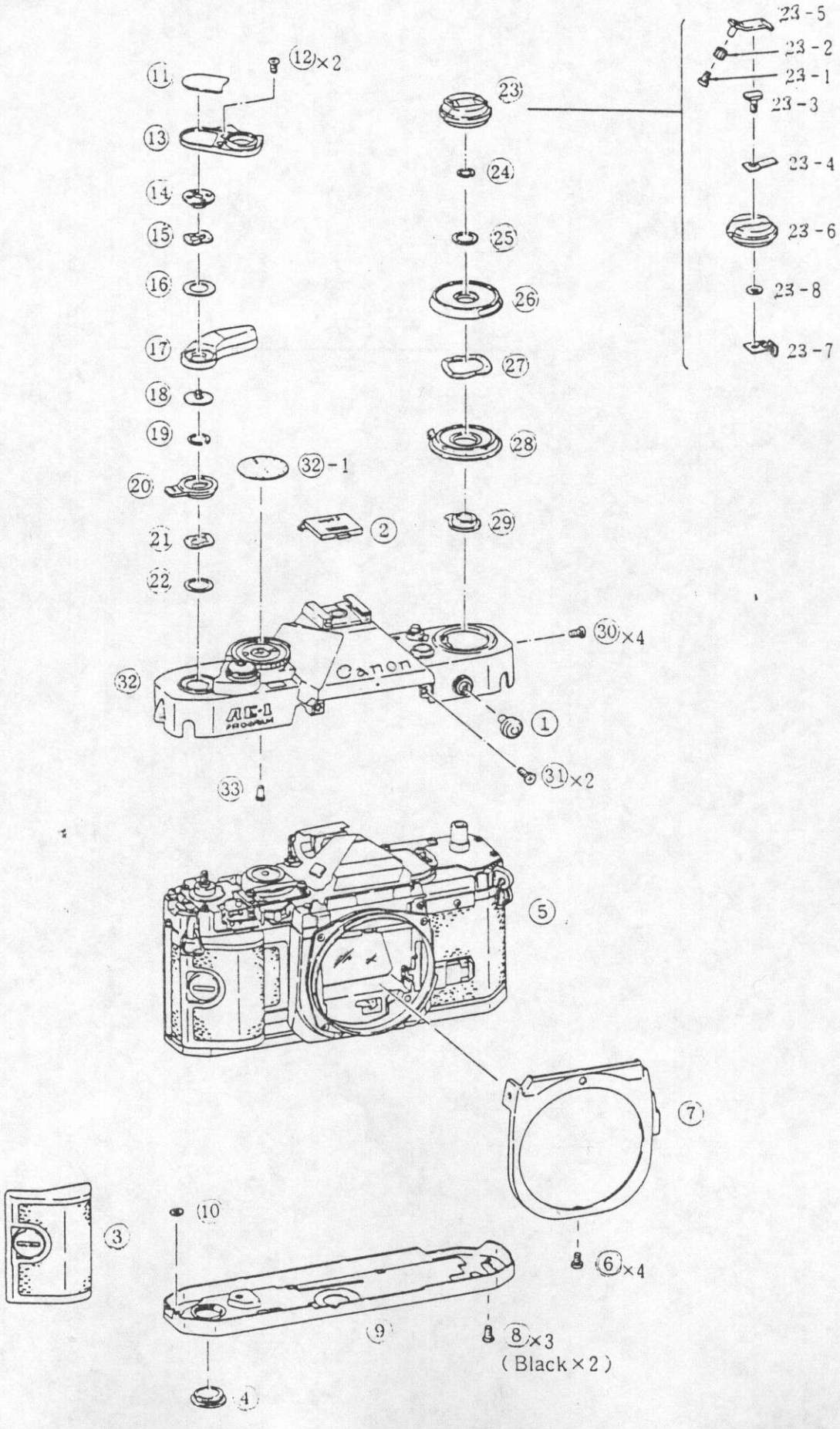


Mirror 45 Degrees Adjusting Spanner — TB11-CA1-4918-1S (Common to A-Series)



1. ASSEMBLY AND DISASSEMBLY

1.1 EXTERNAL PARTS



1. ASSEMBLY AND DISASSEMBLY

1.1 EXTERNAL PARTS

Disassembly Notes

1. Remove the PC terminal cap (1), hot-shoe cover (2), action grip (3), winder coupling cover (4) and strap triangles (5) as necessary to effect the repair.

2. Remove the screws (8) holding the base cover (9). (Three screws for chrome covers, two for black covers).

3. Washer (10) is bonded to the base cover (9) with diabond.

4. When removing the ASA dial cover (26) and dial (28), set the ASA to 100 first.

5. The shutter speed dial (32)-1 is bonded to the dial with diabond.

6. Don't lose the shutter button shaft (33) when removing the top cover (32).

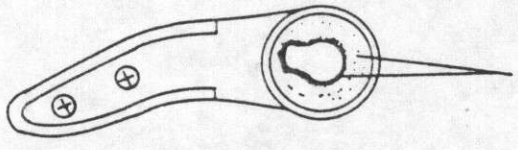
Assembly and Adjustment Notes

1. Lubricate (33) with GS-1000 before installing. (33) is available in three lengths.

2. When installing the top cover (32), set the shutter dial to PROGRAM.

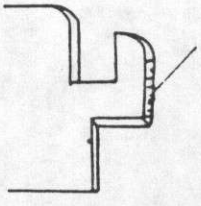
3. When installing the ASA dial (28) set it to ASA 100.

4. Apply FLÁ lube to the winding lever (17) when reinstalling.



5. Lube the rewind shaft light Lozoid No. 72090

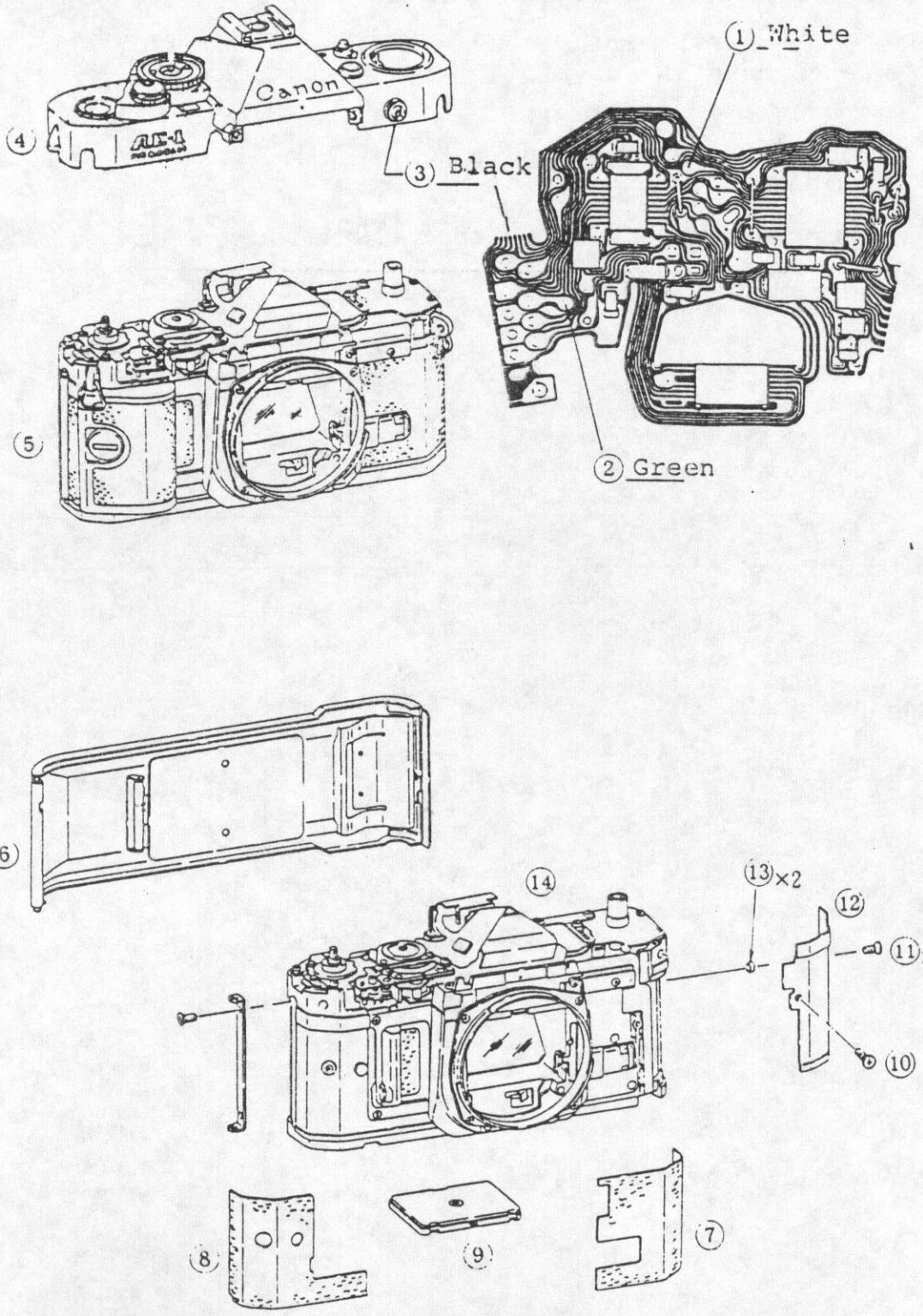
6. Lube the back cover hook with LTSH.



Note: Numbers in parentheses in the text correspond to circled numbers on the facing page. Disassemble in normal order and reassemble in reverse order.

1. ASSEMBLY AND DISASSEMBLY

1.2 COVERS



Numbers ① ~ ③ unsolder

④ ~ ⑭ disassemble

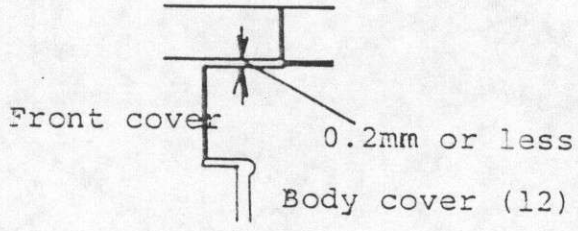
1.2 COVERS

Disassembly Notes

1. Unsolder three wires connecting the top cover and flex.
   Unsolder the white and green wires at the flex end.
   Unsolder the black wire from the PC terminal.
2. Remove the back cover and focusing screen as necessary. (Unnecessary removal of the focusing screen is not recommended, because of dust problems).
3. Be careful not to lose collars (13) when removing body cover (12)

Assembly and Adjustment Notes

1. The space between the body cover (12) and the band around the body must be kept within the limits shown



2. Resolder the three wires (see disassembly) after cleanig the solder points with flux.
3. Lead Dress

3.1 Slip the black wire under the beeper.

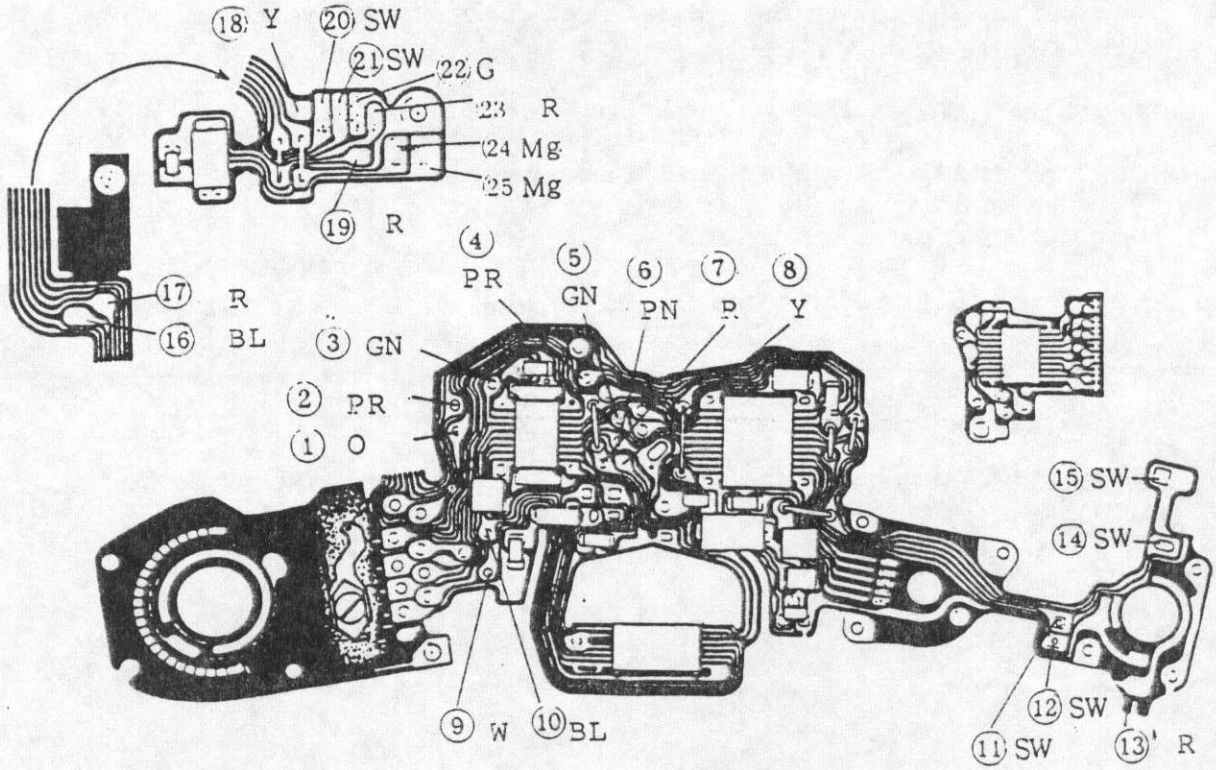
3.2 Dress the green and white leads on the left side of the pentaprism so they do not interfere with the battery check switch or ASA contacts.

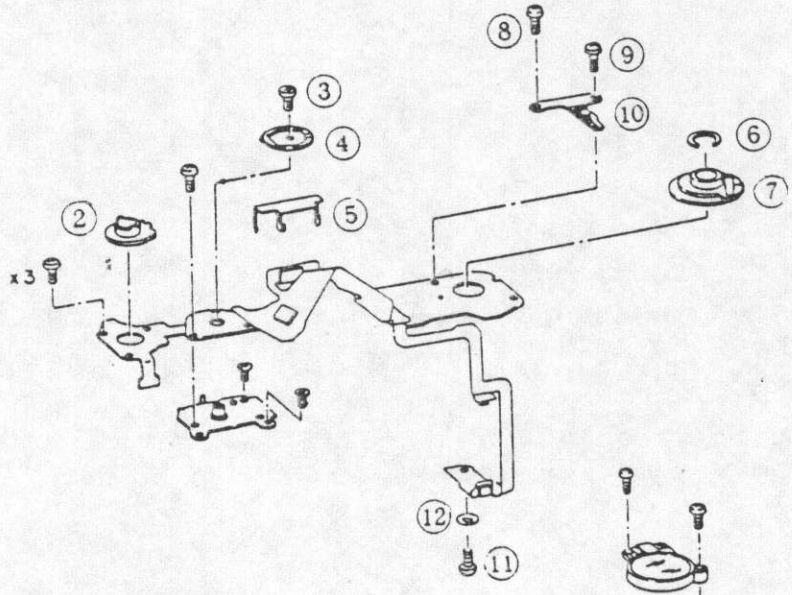
4. Set the shutter speed to the PROGRAM position so the top cover couples properly when installed.

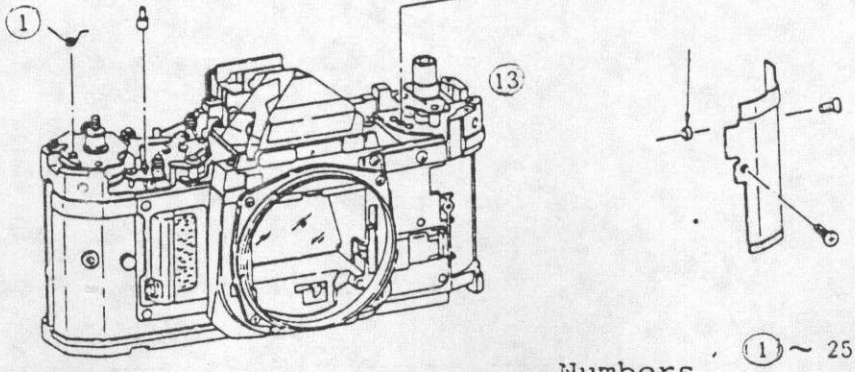


Note: Numbers in parentheses in the text correspond to circled numbers on the facing page.

1.3 FLEX AND RELATED PARTS (1)







Numbers ① ~ 25 (upper No.s) unsolder
① ~ 13 (lower No.s) disassemble

Disassembly Notes

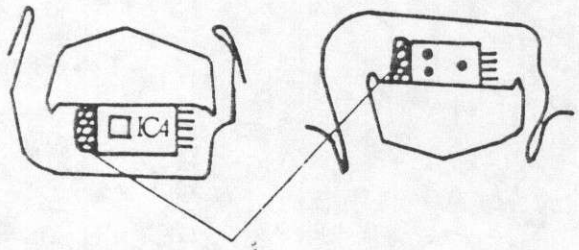
On the facing page, there are two sets of disassembly numbers, one for mechanical disassembly and another for lead desoldering.

Assembly and Adjustment Notes

Flex Unit Installation

1. When installing the flex unit in the camera, all the switch patterns should be wiped with lens tissue wetted with Fronsolve. Clean in the order of ASA, shutter speed, (TV) and film speed (SL) patterns.

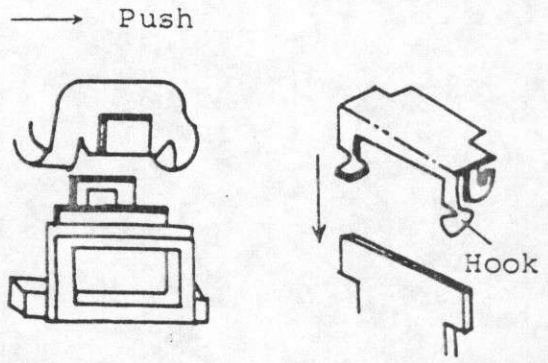
2. Apply moisture proofing Peligan F to the area of IC4 shown below.



Peligan F

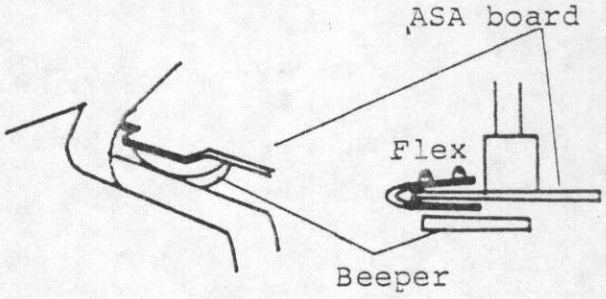
3. When installing IC4 in the SPC bracket assy., make sure that it is properly positioned between the two small bosses on the inner rear surface of the bracket. When installing the SPC cover (5), apply some pressure toward the right as you press it down. If it is installed too far to the right, there is a possibility of tearing the flex. (Note: The SPC bracket assy. contains the SPC fresnel lens. Don't touch it).

Assembly and Adjustment Notes

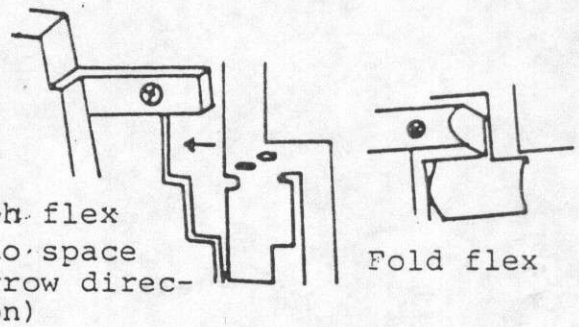


4. Flex Positioning

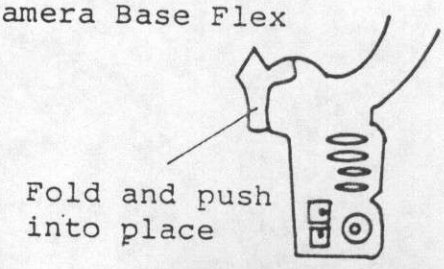
(1) Place the portion of the flex leading down from the pentaprism section between the ASA circuit board and the beeper.



(2) Front Panel Connection

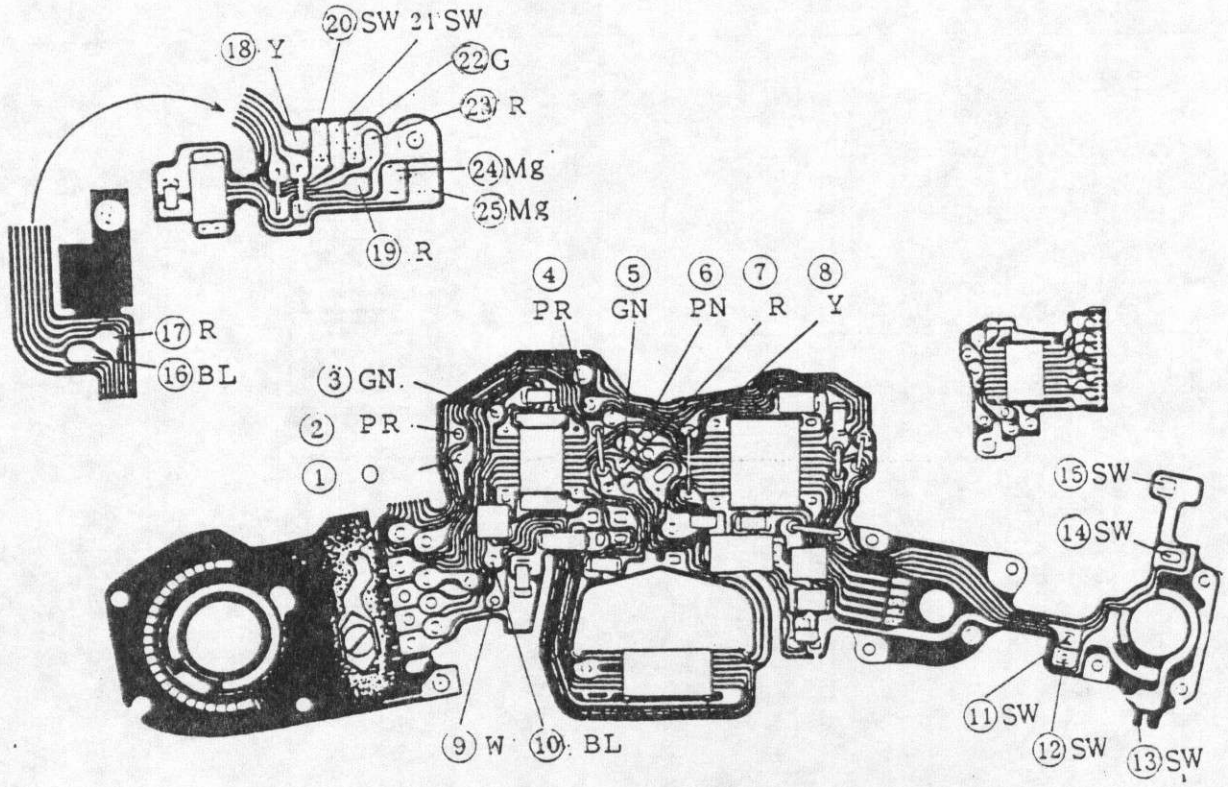


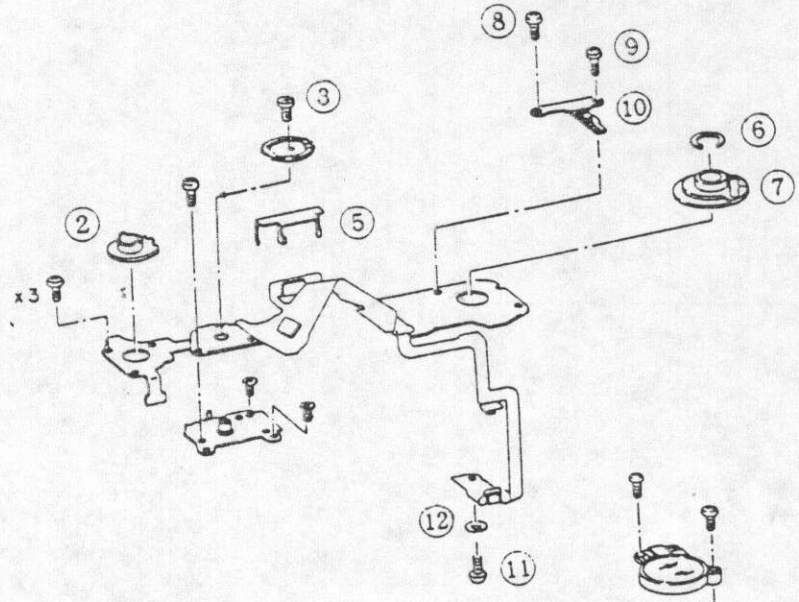
(3) Camera Base Flex

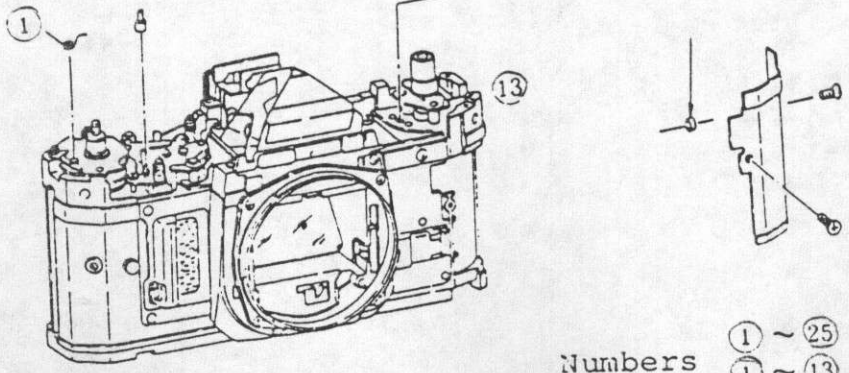


Note: Numbers in parentheses in the text correspond to circled numbers on the facing page.

1.3 Flex and Related Parts (2)



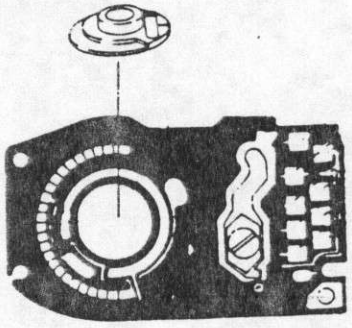




Numbers ① ~ ㉕ (upper No.s) unsolder
① ~ ⑬ (loewr No.s) disassemble

5. Before installing the ASA (7), TV (4) and SL (main switch) (2) wipers, wipe their respective patterns with keton (MEK)

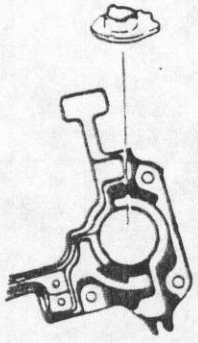
(1) ASA Pattern



ASA Pattern

Caution: Wipe only the contact part of the wiper (7).

(2) TV (Shutter Speed) Pattern



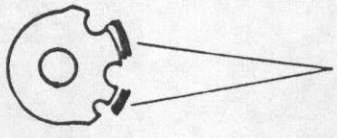
Caution: Wipe only the contact part of the wiper (4).

(3) SL (Main Switch) Pattern



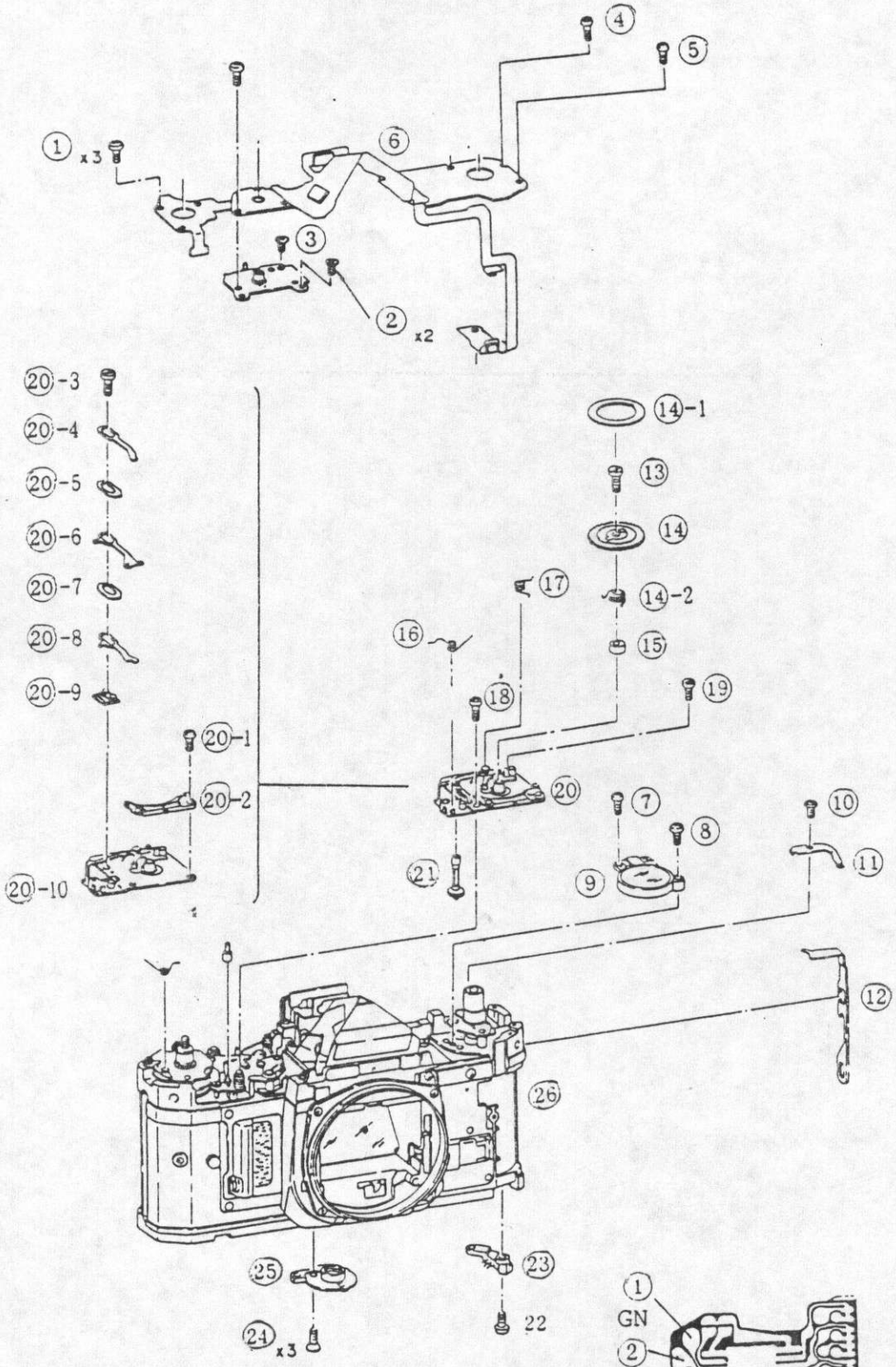
Caution: Wipe only the contact part of the wiper (2).

6. Apply a little FLA lube to the switch cam lobes on the SL Wiper (2).

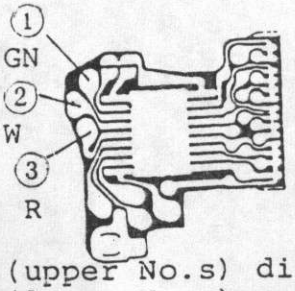


Note: Numbers in parentheses in the text correspond to circled numbers on the facing page. Disassemble in normal order and reassemble in reverse order.

1.4 FLEX, FILM COUNTER, BEEPER



Note: Remove (16) before unsoldering.



Number ① ~ ㉖ (upper No.s) disassemble
① ~ ③ (lower No.s) unsolder

Disassembly Notes

1. Remove the flex unit (6).

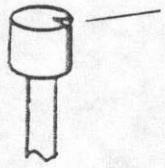
By removing two screws (2) and screw (3), the TV pattern can be removed with the flex.

Note: Unless either the shutter unit or film counter is faulty, it is advisable not to remove screws (2) and (3).

2. The film counter (14) is installed with two revolutions on its return spring (14)-2. Take care not to lose the collar (15).

3. Unhook spring (16) before doing the desoldering work.

4. When removing the film counter unit, be careful not to scratch the head of the counter drive gear (21).



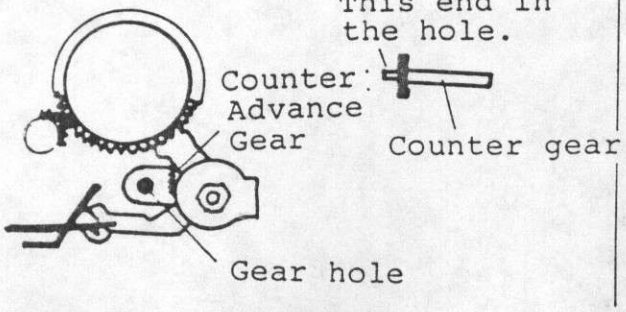
Don't scratch the circumference of the gear. (Scratches can cause extra counting).

5. Desolder leads (1) through (3)

Assembly and Adjustment Notes

1. Install the film counter gear in the hole in the body with the counter advance gear up.

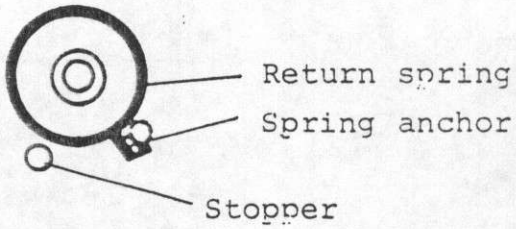
Note: Check that the X contact is in good shape before proceeding.



Assembly and Adjustment Notes

2. When installing the film counter base, don't scratch the film counter advance gear.

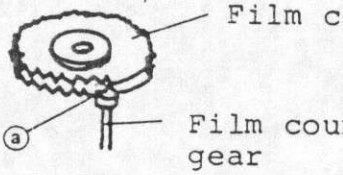
3. When installing the film counter gear and spring, give it two turns clockwise to tension the spring and hook the spring anchor as shown below.

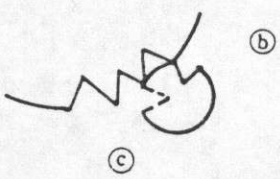


Note: Check that it returns correctly to the "S" position when the back cover is opened.

4. Film Counter Advance Gear (21) Positioning

Use the tweezers only on the middle shaft portion of (21), not on the advance head or the journal. Engage the lever and turn three times. At the end of the third time the advance lever should be as shown either in "b" or "c".



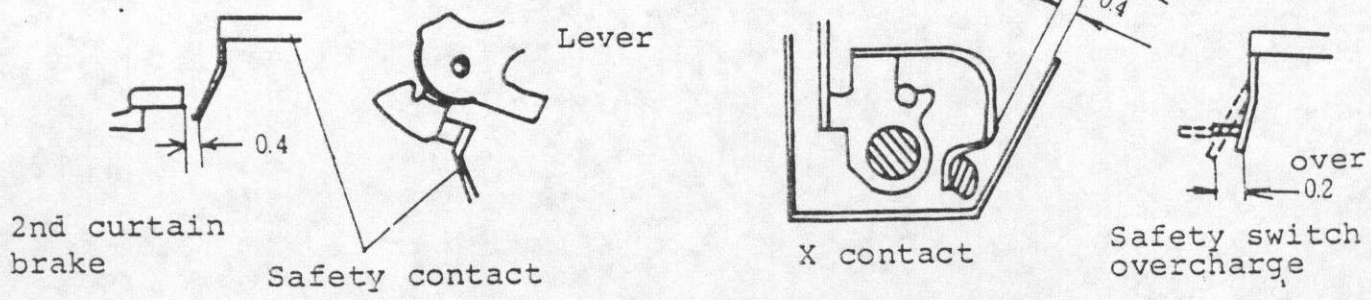


Assembly and Adjustment

1. Safety Contact and X Contact

In the released condition, there should be at least 0.4 mm space between the safety switch contact and the second curtain brake (A). At this time the X contact should be closed. As winding progresses, the X contact should open and then the safety contact should close. When the safety contact closes, the X contact should have at least a 0.4 mm gap (B). At the end of the winding cycle, the safety contact should have been pushed at least 0.2 mm from the contact position (C).

Adjust by bending the safety contact.

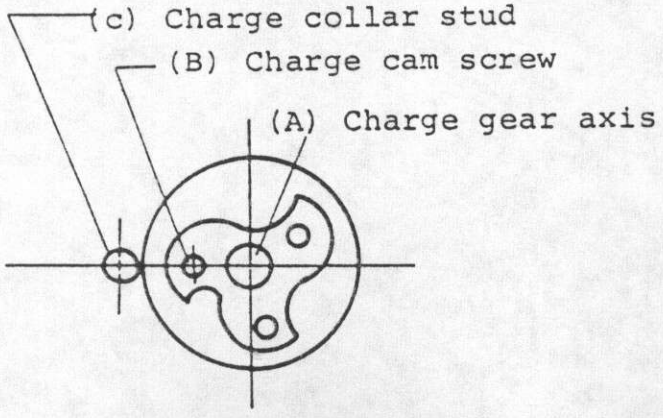


Note: After making the adjustments, wipe all contacts clean.

2. Second Curtain Latch Adjustment

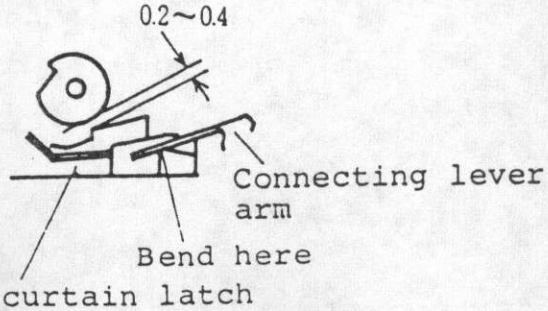
The 2nd curtain latch in this model is similar to the A-1 and AV-1. It is different from the AE-1 and AT-1. It is a "minus latch", which means that it is in contact in the cocked position. In the AE-1 there is a slight gap between the latch and cam in the cocked position (this is called a "plus latch" in Japanese). Wind the film until the axis of the charge gear (A), one of the screws in the charge cam (B), and stud (C) for the charge collar (on the underside of the connecting lever) are aligned as shown. At this point the gap between the latch and the latch cam should be 0.2 to 0.4 mm. If not adjust by bending the arm on the connecting lever.

〔A〕



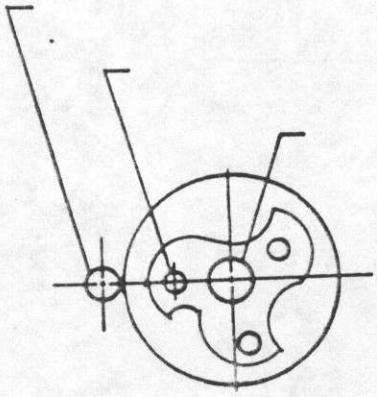
Align A - B - C

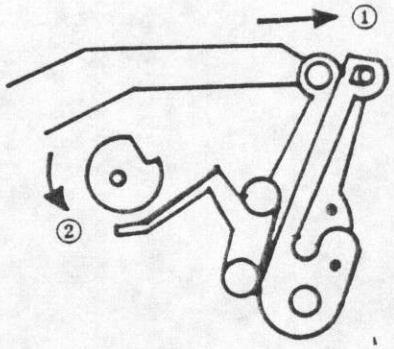
〔B〕



3. Connecting Lever Return Timing

Wind the camera very slowly watching the connecting lever closely. Just before the end of the stroke, the end of the lever (1) should move slightly in the arrow marked direction (a slight click will also be heard concurrently) just before the 2nd curtain latch (2) latches up in the arrow marked direction. (Simultaneous movement or (2) before (1) cannot be tolerated).

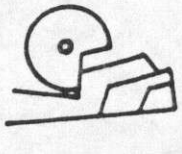




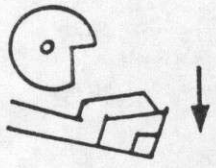
Note: If winding is not done slowly, it is impossible to tell which action occurs first.
If a large collar is installed during the f/1.4 overcharge adjustment, this timing may be upset and readjustment may be necessary.

4. Second Curtain Latch Position

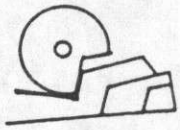
After winding, the 2nd curtain latch and latch cam should be as shown in "A". With tweezers, disengage the latch (arrow) and then let it go "B". It should return to the same position "C" that it was in "A".



Wound

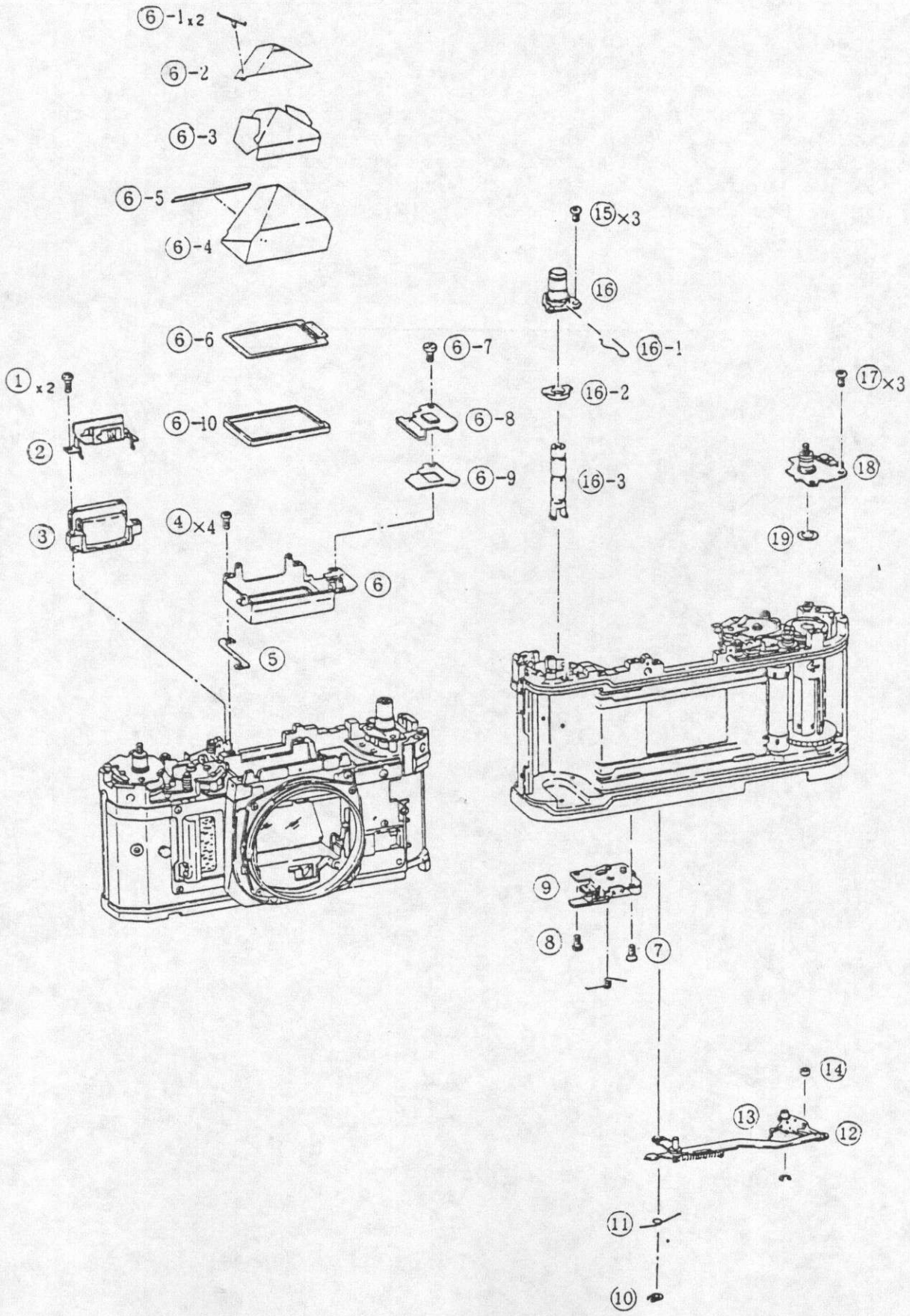


Disengaged



Returned to wound "A" position

1.6 Pentaprism Unit, Connecting Lever (1)



Numbers 1 - 19

1.6 Pentaprism Unit, Connecting Lever (1)

Disassembly Notes

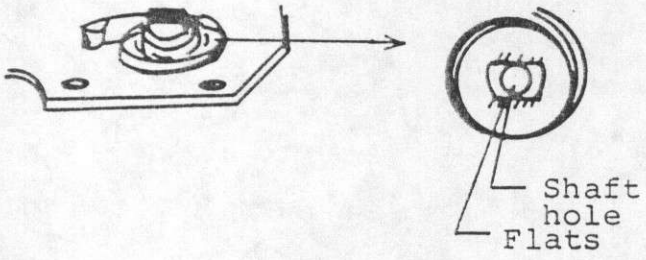
1. Remove the four screws (4) and the pentaprism and display assemblies can be removed.

2. The finder focus washers can be removed by loosening the screws and lifting the prism assembly.

3. When removing the connecting lever, take care not to lose the charge collar (14).

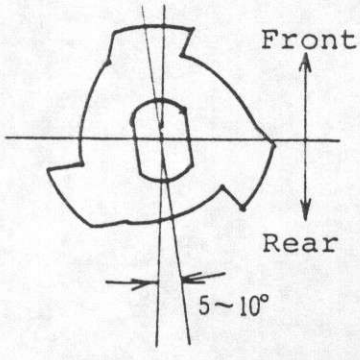
Assembly and Adjustment Notes

1. Apply Lozoid 72090 to the spring and flats of the winding plate (18) as shown below.



2. Clutch Cam Alignment

Set the clutch cam as shown below by turning it clockwise with tweezers to the position shown below.



3. Install the winding plate (18).

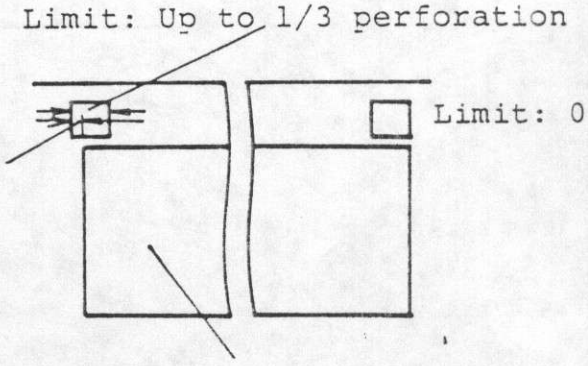
Put in the return spring, align the flats of the clutch cam and

Assembly and Adjustment Notes

winding plate and install. (Place the red battery cord at the rear).

4. Perforation Alignment

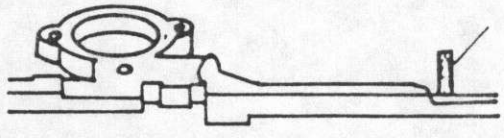
With a test film strip inserted, the winding mechanism fully advanced, and back pressure applied to the filmstrip, check to see that the film perforations are aligned with the film aperture as shown.



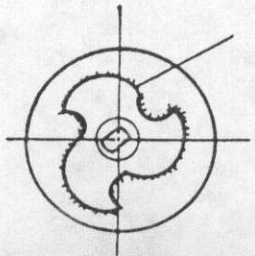
The adjustment is the same as for the AE-1. The Charge Gear comes in two sizes, (010) and (050)(See ACF-206E for details). To adjust, use the size that is not installed. The adjustment outlined in the AE-1 Repair Guide, section 2.17 may also be used.

5. Connecting Lever Installation

5.1 Grease the stud on the connecting lever with Lozoid 82090 before installing it.

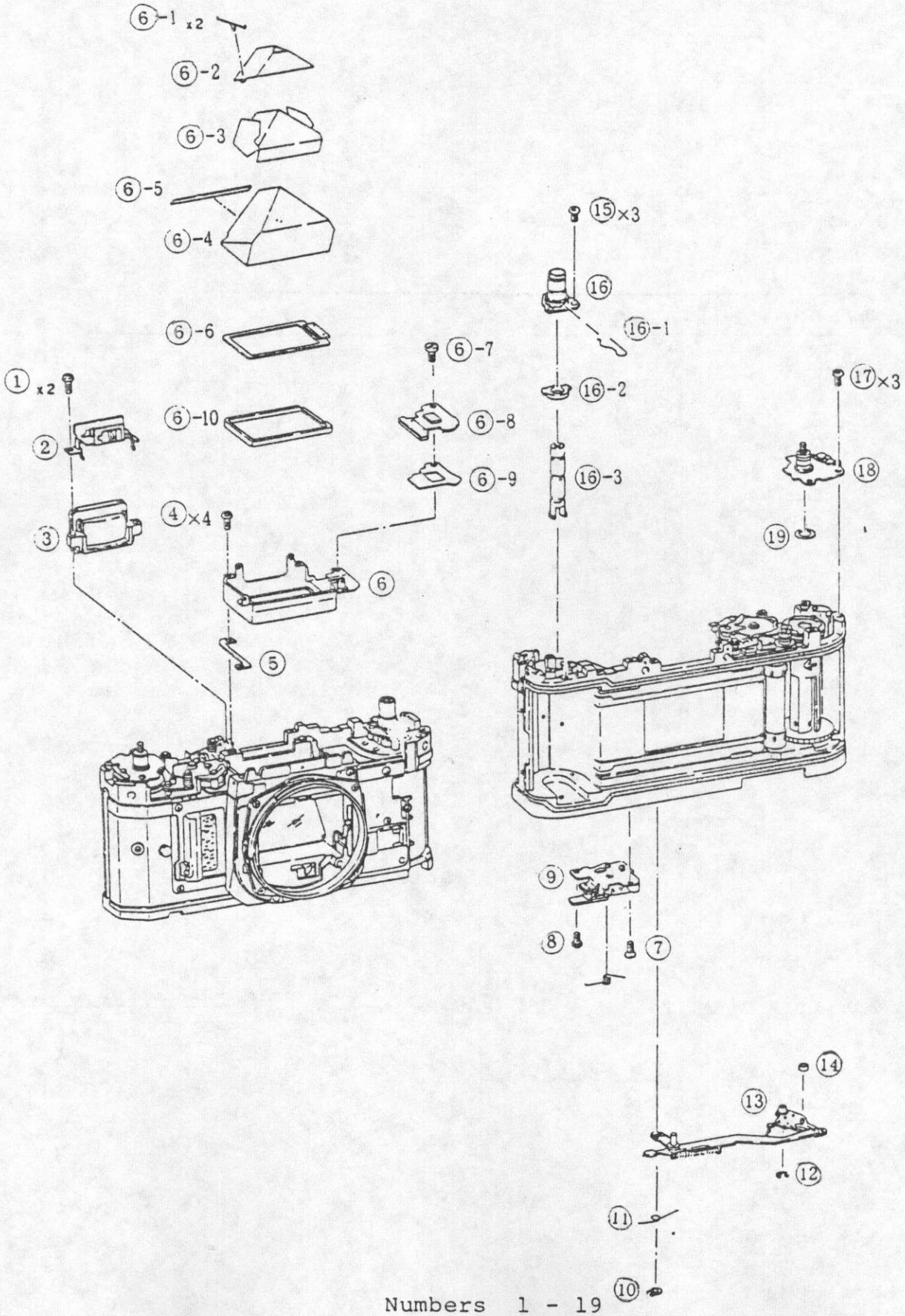


5.2 Lubricate the charge cam lobes with Lozoid 72090 also.



Note: Numbers in parentheses in the text correspond to circled numbers on the facing page.

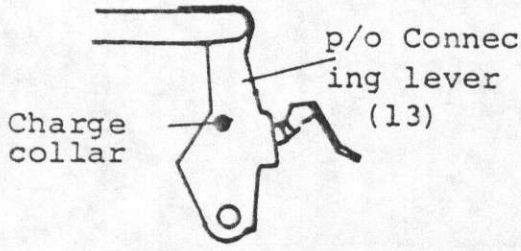
1.6 Pentaprism Unit, Connecting Lever (2)



Numbers 1 - 19

Assembly and Adjustment Notes

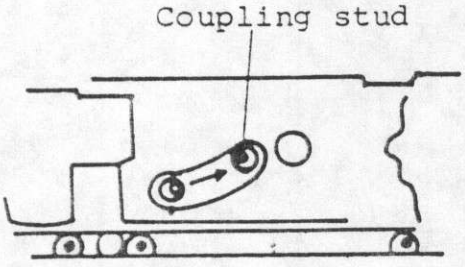
5.3 Lubricate the inside of the charge collar (14) with Lozoid 72090 and put it on the connecting lever (13).



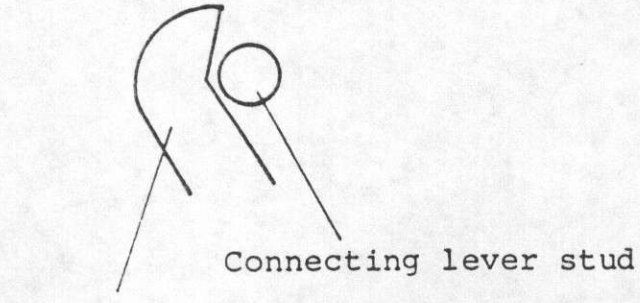
Note: The charge collar is an adjusting part.

5.4 Install the connection lever (13) into the body watching the following points.

1. Coupling stud position



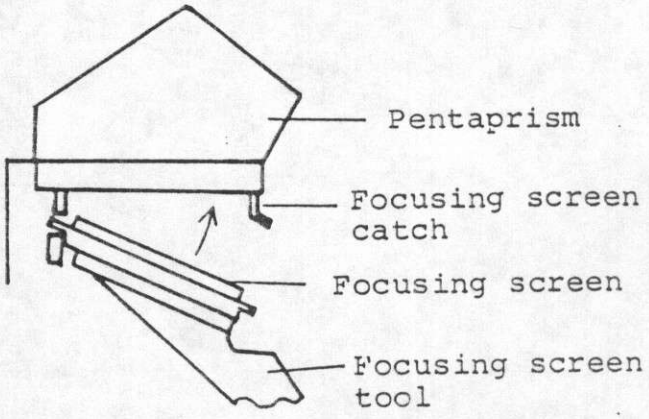
2. Connecting Lever and Main Charge Lever Coupling



6. Pentaprism Unit Installation

If the pentaprism unit has been removed, the finder focus must be adjusted.

6.1 Install the focusing screen unit

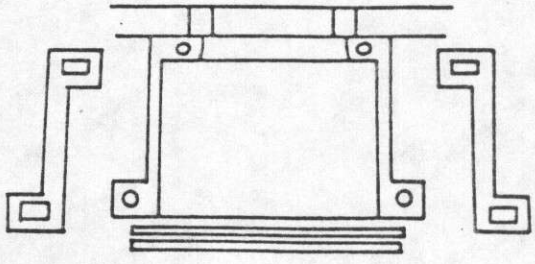


6.2 Adjust so the focusing surface is 42.03mm from the lens flange.

6.3 The user's lens must also be correctly adjusted.

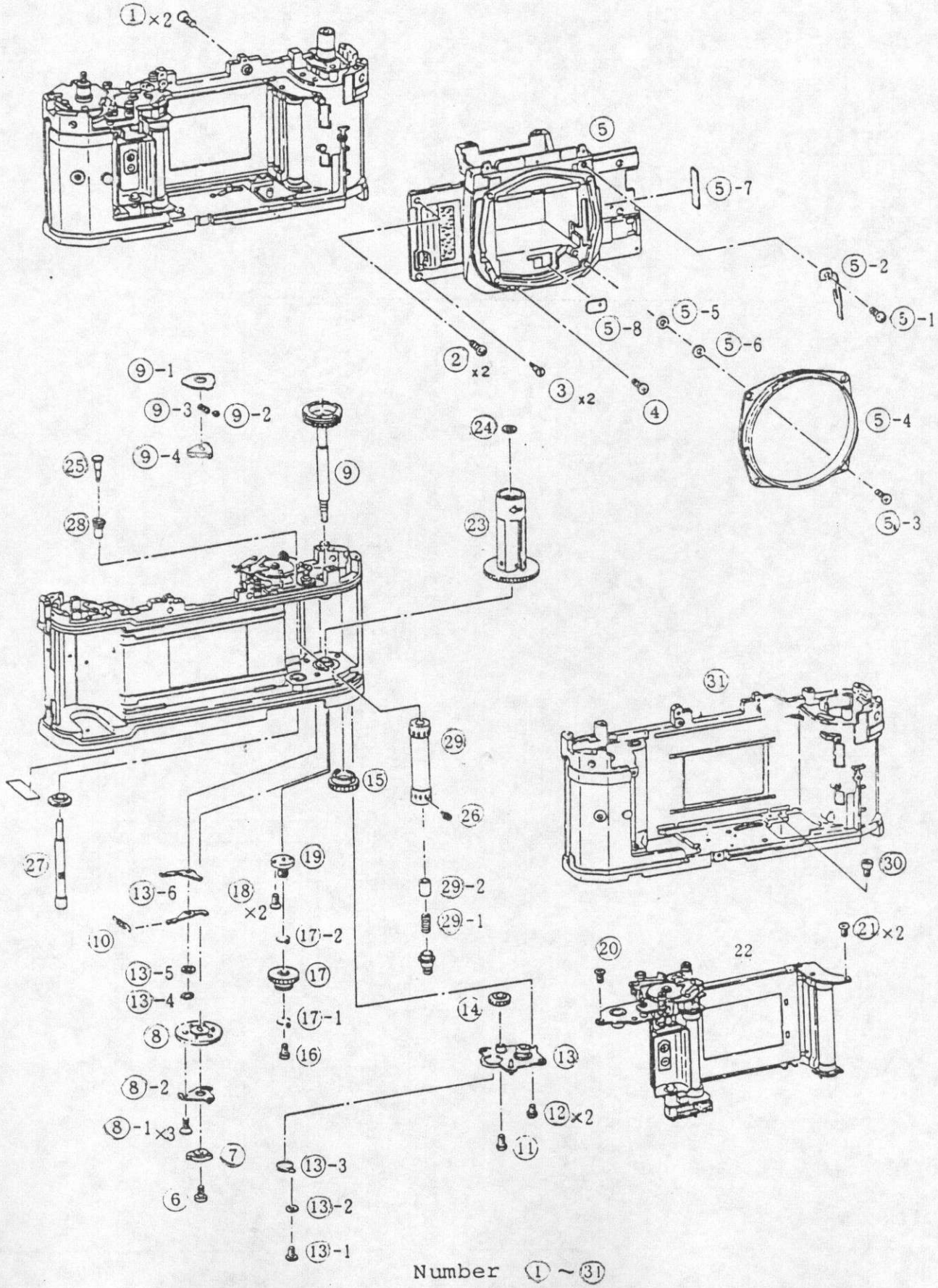
6.4 Check infinity focus on the collimator.

If the finder will not focus to infinity, use a thicker washer. If it focuses past infinity, use a thinner washer.



Note: Lift the pentaprism unit to install and remove the washers.

Note: Numbers in parentheses in the text correspond to circled numbers on the facing page.
Disassemble in normal order and reassemble in reverse order.


①×2
⑤
⑤-7
⑤-2
⑤-1
⑤-8
⑤-5
⑤-6
②×2
③×2
④
⑤-4
⑤-3
⑨-1
⑨-3
⑨-2
⑨-4
⑨
㉔
㉕
㉘
㉓
㉙
⑮
㉖
㉗
⑲
⑱×2
⑬-6
⑩
㉙-2
㉙-1
⑰-2
⑰
⑬-5
⑬-4
⑰-1
⑧
⑯
⑭
⑬
⑧-2
⑧-1×3
⑦
⑫×2
⑥
⑬-3
⑬-2
⑬-1
㉛
㉚
⑳
㉒
㉑×2

Number ① ~ ㉛

1.7 Front Panel, Shutter Unit and Lower Body Parts (1)

Disassembly Notes

1. The MD coupler (7) screw (6) and the charge cam '(8-2)'s three (8-1) are staked with Arontite Red.

2. Take care not to lose the RA spring (10).

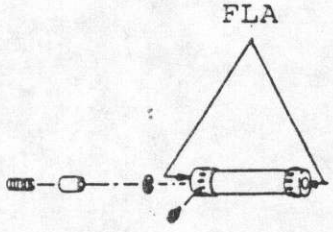
3. By removing the lower winding base (13), the idler gear (14) and spool friction spring (15) can be removed.

4. Compound gear (17) has eleven loose bearing balls on either side (17-1) & (17-2).

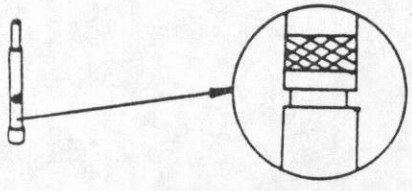
5. Lift slightly on the battery box end of the shutter unit (22) to remove it.

Assembly and Adjustment Notes

1. Install collar (29-2) and spring (29-1) in the sprocket (29). Lubricate both ends with FLA grease.



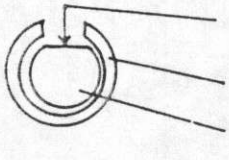
2. Lubricate the sprocket shaft with LT-SH as shown.



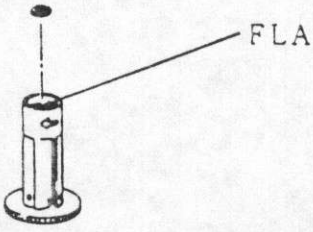
Note: Do not use substitute for LT-SH. The mating part is plastic.

Assembly and Adjustment Notes

3. Install the sprocket shaft in the sprocket so that the flat is aligned with the screw slot.



4. Lubricate the spool with FLA



Lubrication Note: A complete lubrication chart is included in this guide. Refer to section 3.

5. Before installing the shutter unit, perform the following checks.

5.1 Check the winding bushing.

5.2 Check the body light shields.

5.3 Wind the shutter and check:

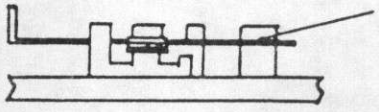
1. the curtains for imperfections, overlap and evenness (Overlap: 1.5-3.0mm; Parallelism: Within 0.2mm, other limits: Within 0.3mm)

2. the count switch operation, i.e. that it closes when it should and opens when the 2nd curtain is released.

5.4 Check that the red and black electrical leads are attached.

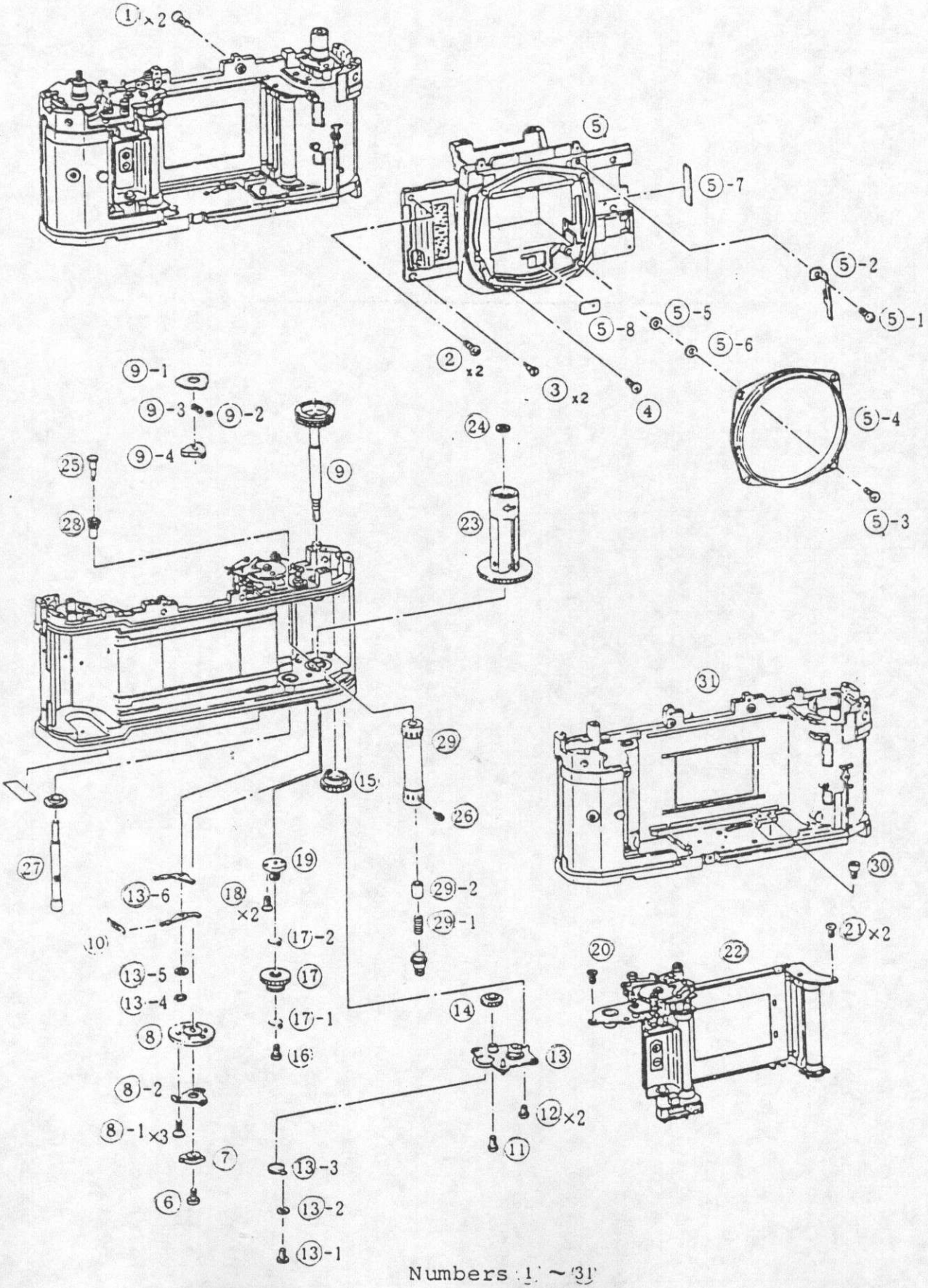
5.5 Check that the 2nd Curtain magnet spring is not bent out of the correct shape.

5.6 Check all switches for cleanlines and proper shape.



Note: Numbers in parentheses in the text correspond to circled numbers on the facing page.
Disassemble in normal order and reassemble in reverse order.

1.7 Front Panel, Shutter Unit and Lower Body Parts (2)



Numbers 1 ~ 31

Assembly and Adjustment Notes

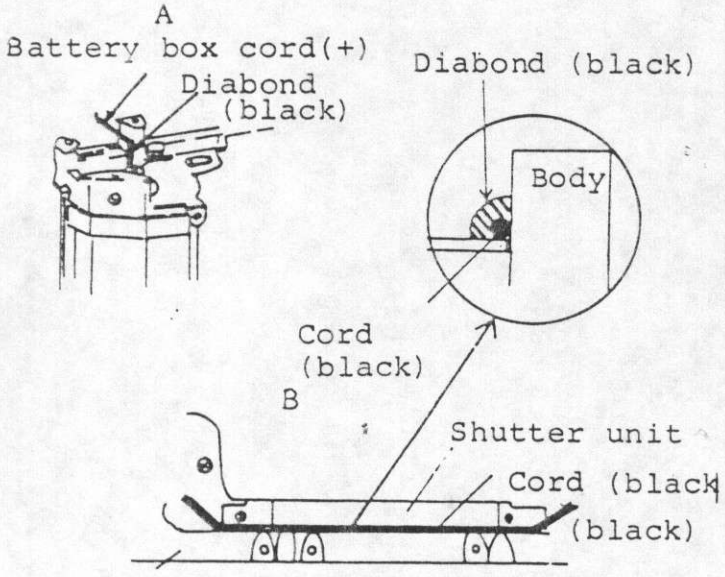
6. Shutter Unit (22) installation

The best way to hold the shutter unit is by the battery box and 2nd curtain drum on the other end.

6.1 Put the winding shaft end in first with the other end tipped up about 3-8 mm.

6.2 Mate the shutter unit and spool and drop the shutter into position. Make sure the unit and positioning screw are mated correctly.

6.3 Dress the battery leads as shown below.



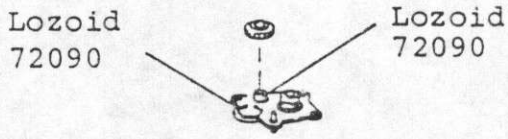
7. Lubricate the ball races of the compound gear (17) with Lozoid 72090 and install eleven balls in each race.



12 balls 11 balls 10 balls

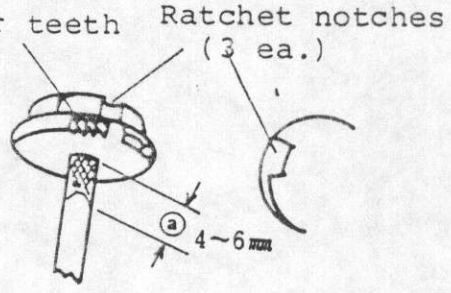
8. When installing the spool gear (15) turn the spool (23) until the spool and gear are correctly seated.

9. When assembling the lower plate (13) lubricate the idler gear pivot and the spring anchor with Lozoid 72090.



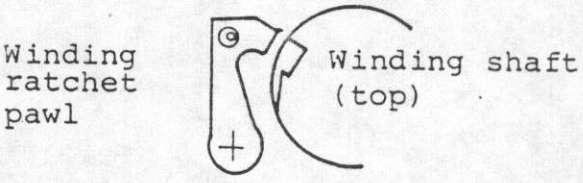
There is a positioning dowel on the body for the lower plate. Be sure they are correctly mated. Check the thrust play of the spool. It should be between 0.15 - 0.4 mm.

10. Lubricate the winding shaft at the points shown.

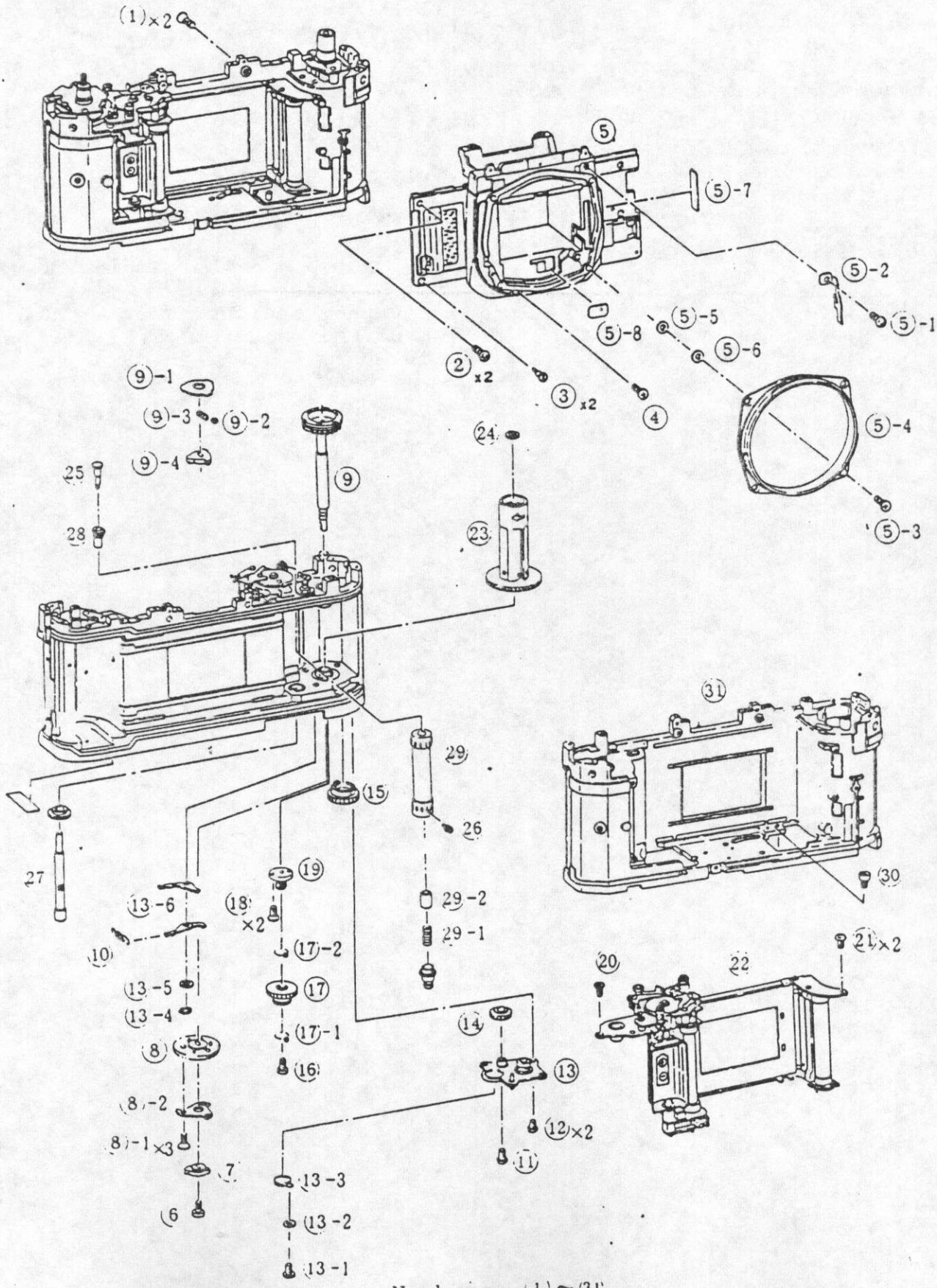


Note: "A" is the winding shaft bushing surface.

Install the shaft in the bushing and turn so that the winding ratchet pawl fits in one of the notches.



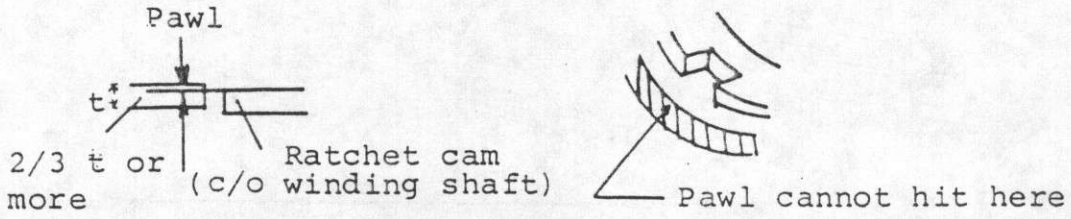
1.7 Front Panel, Shutter Unit, and Lower Body Parts (3)



Numbers (1)~(31)

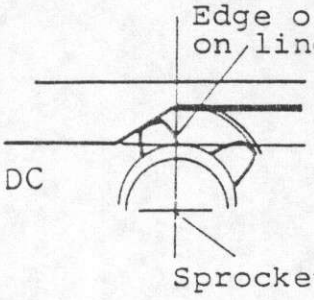
Assembly and Adjustment Notes

11. Check that the vertical mesh between the winding ratchet pawl and the ratchet cam portion of the winding shaft (9) is at least 2/3 of the thickness of the pawl, but the pawl must not be low enough to hit the gear portion of the winding shaft.



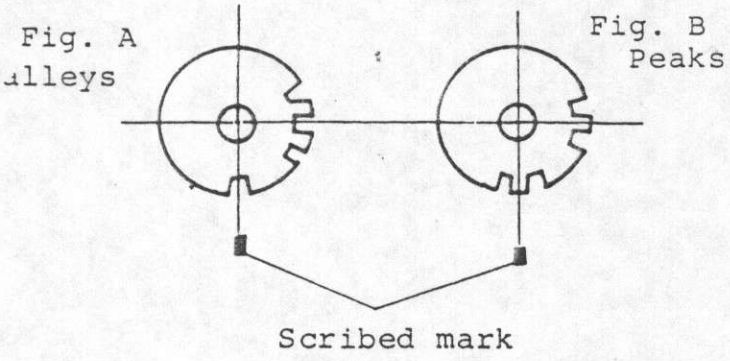
12. Charge gear (8) installation

12.1 Wind the camera and adjust the sprocket position as shown below.



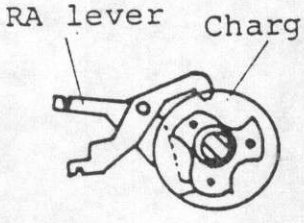
Turn the sprocket clockwise and align the edge of a tooth with a line from the axis of the sprocket to angle formed by the lip on the body. (This amounts to a line perpendicular to the body centerline).

Note: The sprocket normally turns clockwise only.



If the right angle lines of the compound gear (17) intersect the valleys of the teeth, use the 010 size charge gear (8) (Fig. A) If the lines intersect the gear teeth peaks, use the 050 size gear. (Fig. B)

12.2 Open the RA levers (13-6) and mesh the charge gear (8) with the compound gear (17) while paying attention to the correct orientation of the flats on the winding shaft as shown in the drawing.

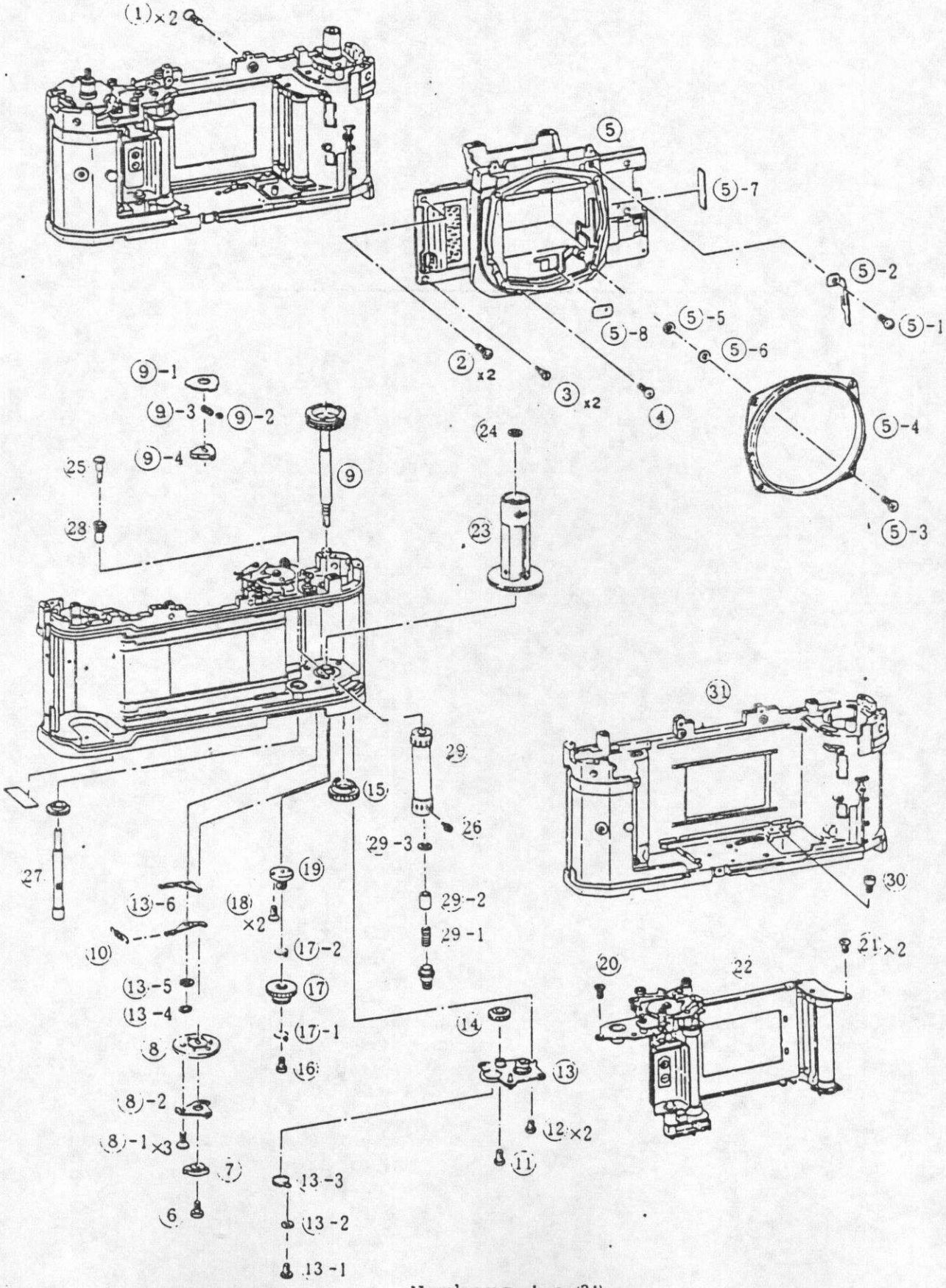


Note: Stake the MD coupler screw (6) and the charge cam screws with Arontite Red. RA Lever

Note: Lubricate the cam on the charge gear with Lozoid 72090.

Note: Numbers in parentheses in the text correspond to circled numbers on the facing page.

1.7 Front Panel, Shutter Unit, and Lower Body Parts (4)



Numbers 1 ~ 31

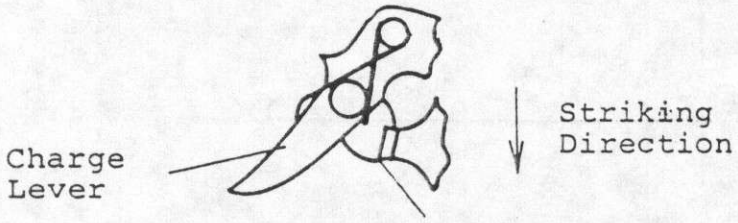
Assembly and Adjustment Notes

13. Front Panel Pre-Installation Checks

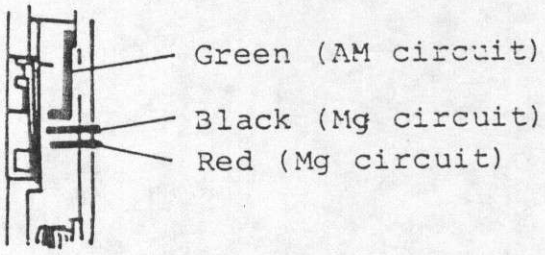
13 1 Check the operation of all the coupling levers and pins.

13.2 Check that all springs are installed and properly locked.

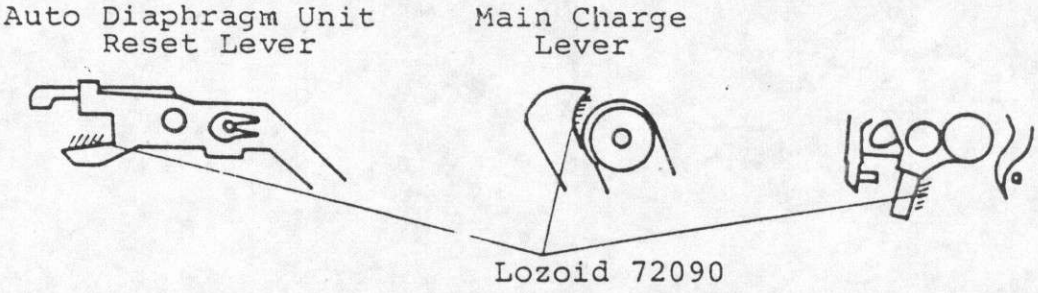
Note: Check the mirror governor sound.



14. Check the electrical lead dress.

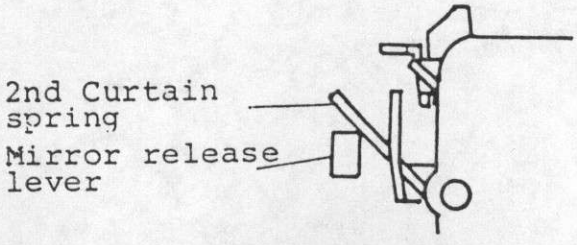


15. Apply Lozoid 72090 abundantly to the following points.



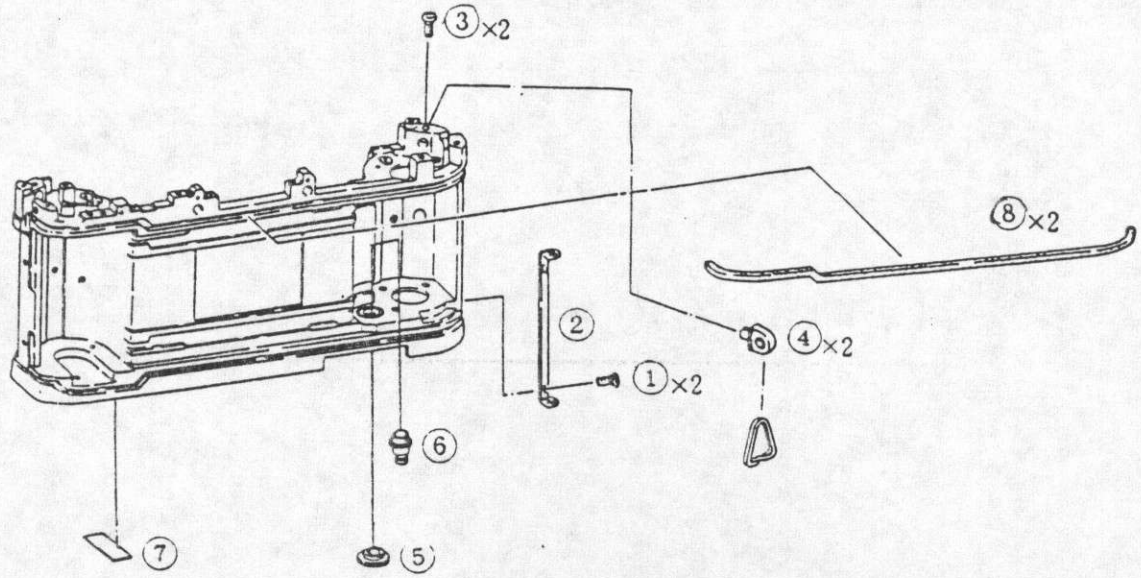
16. Install the front panel (5)

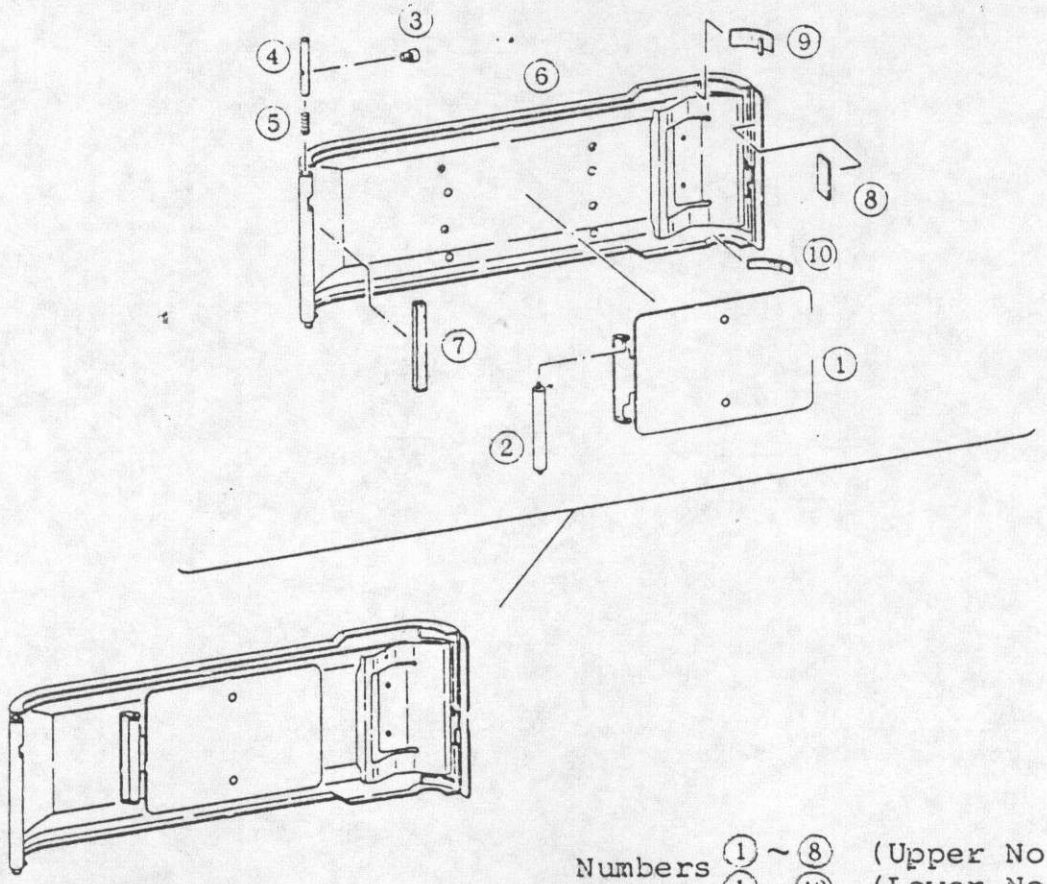
The mirror release lever and 2nd curtain charge spring should be related as shown below.



Note: Numbers in parentheses in the text correspond to circled numbers on the facing page.
Disassemble in normal order and reassemble in reverse order.

1.8 Body and Back Cover





Numbers ① ~ ⑧ (Upper No.s) Body
① ~ ⑩ (Lower No.s) Back Cover

1.8 Body and Back Cover

Disassembly Notes

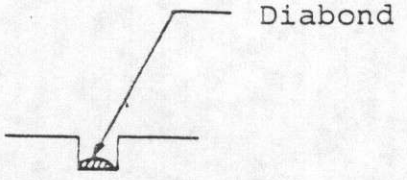
The neck strap lug screw (3) is staked with Arontite Red.

Assembly and Adjustment Notes

1. Body Check

   Check for scratches, warp, riveted parts, etc. Install the magnet insulator.

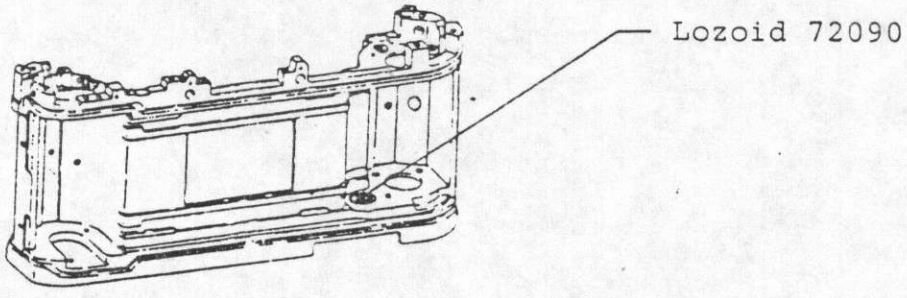
2. When the light shields are installed, the diabond must not overflow the grooves.



3. Apply Arontite Red bond to the end (2mm) of the neck strap lug screws (3) when installing them.

4. Apply Lozoid 72090 to the sprocket bushing.

   Note: The quantity should be rather large.



5. The play between gear (5) and sprocket clutch (6) should be between 0.05 and 0.15 mm.

1. There are three distinct actions, and resulting click sounds near the end of the winding/shutter cocking cycle.

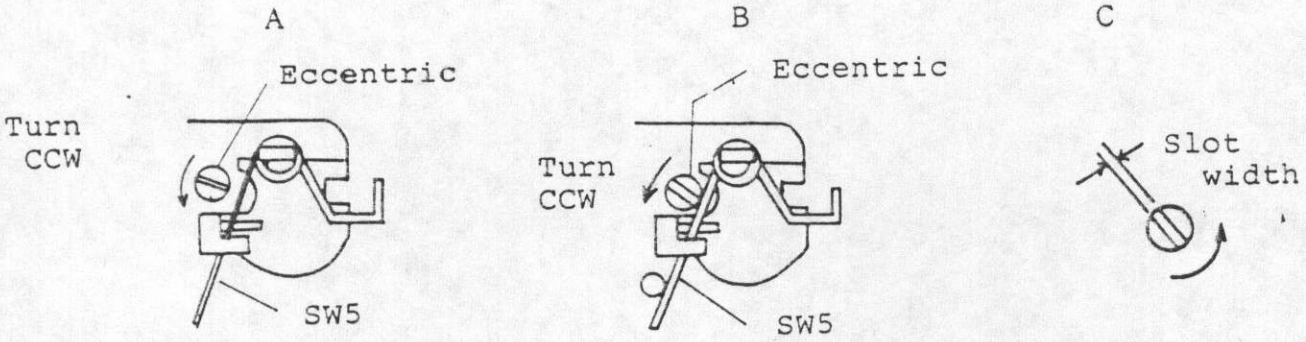
   A. Connecting Lever sets.

   B. The 2nd curtain latch sets.

   C. SW5 opens. (Until SW5 opens shutter release is not possible even though the shutter is set).

2. Carefully and slowly wind the camera until A and B are set, but stop before SW5 opens. (In this condition the shutter will not fire).

3. Turn the eccentric next to SW5 in a counterclockwise (CCW) direction until the eccentric and SW5 just make contact. From this point, turn the eccentric the width of the slot in the same direction.



3.1 Be sure that SW5 does not open before the connecting lever and 2nd curtain latch set. In other words, the A - B - C order is the only correct order.

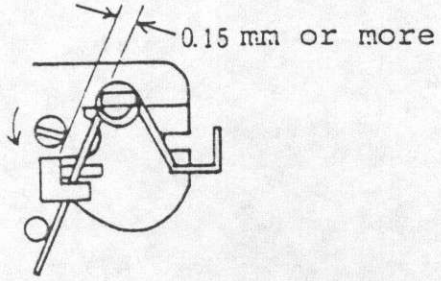
3.2 If the order is incorrect, continuous mode motor drive is impossible.

3.3 Check that the release will not release after A and B but before C.

Note: Make all checks three times. (The winding shaft only rotates 1/3 revolution per cycle.)

4. Shutter Cocked Check

In the fully wound condition, the movable wire contact of SW5 should be separated from the eccentric by at least 0.15 mm.



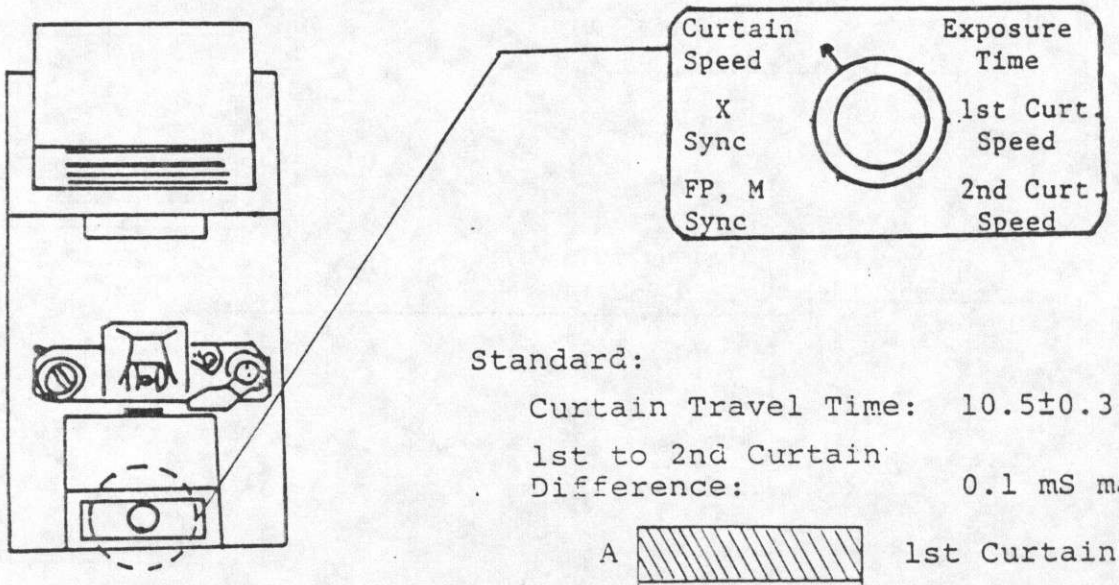
Notes:
1. Make sure release is possible.
2. Always turn the eccentric CCW, but not more than 360°.

5. Forcefully wind the camera and check to make sure that SW5 is open.

6. Repeat all checks at least three times, because the winding shaft only turns 1/3 revolution per cycle. If the adjustment cannot be made correctly, return the eccentric CW and start over again.

2.2 Curtain Travel Time

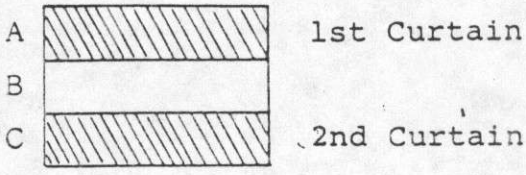
Test Equipment: Shutter Tester



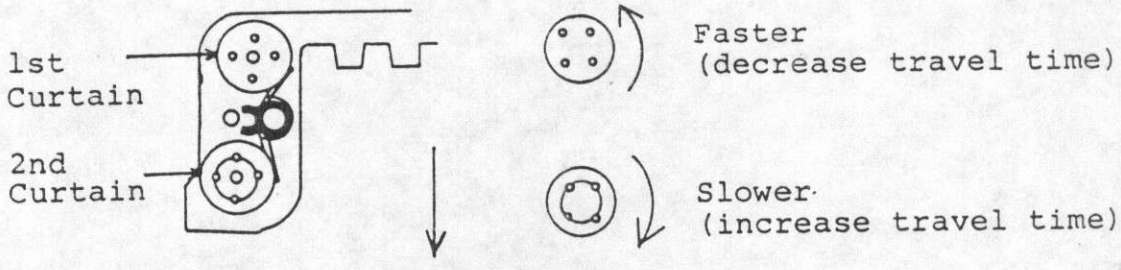
Standard:

Curtain Travel Time: 10.5±0.3 mS

1st to 2nd Curtain Difference: 0.1 mS maximum



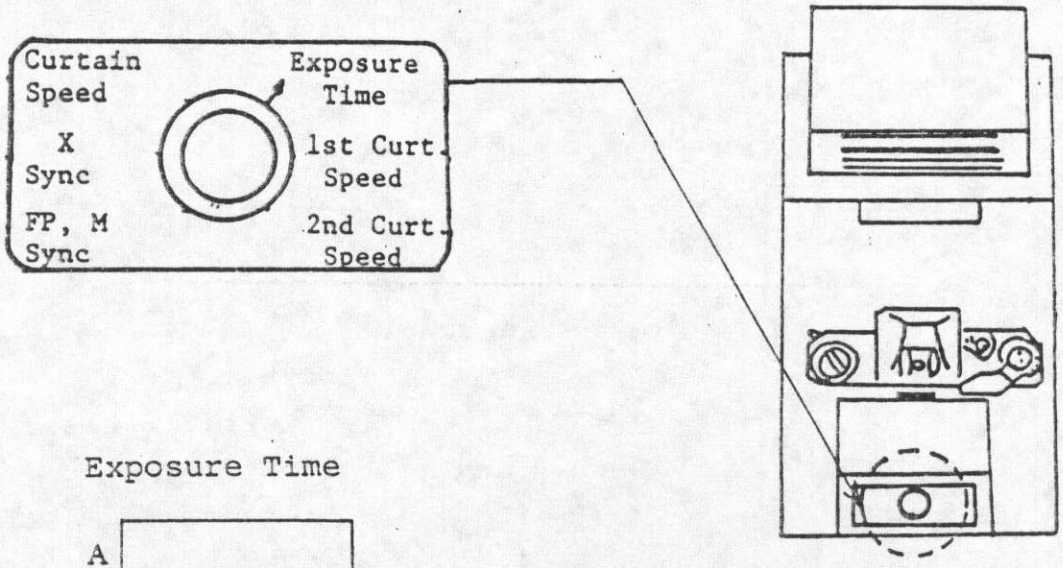
Adjustment:



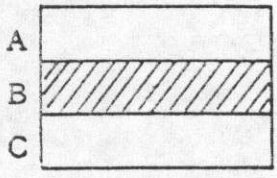
Procedure:

1. Set the shutter speed to 1/1000.
2. Check the shutter curtain travel time.
3. Only "normal unevenness" is allowable.
   Normal unevenness means the 1st curtain is faster than the 2nd curtain.

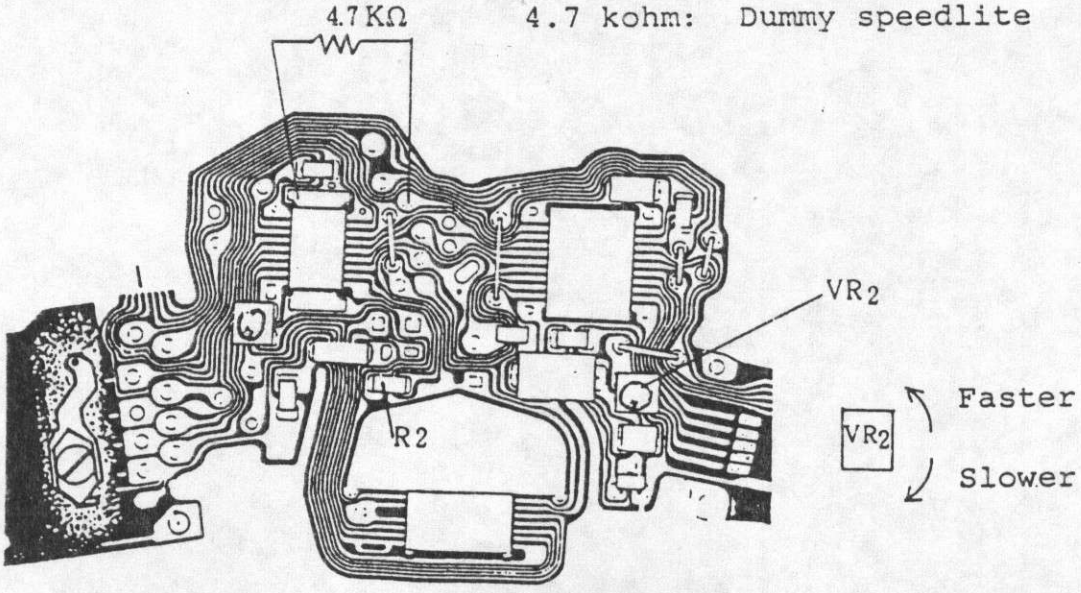
2.3 Exposure Time (Shutter Speed)



Exposure Time



4.7 kohm: Dummy speedlite



2.3 SHUTTER SPEED AND DEDICATED FLASH SPEED CHANGE

Test Equipment: Shutter Tester

Shutter Speed Limits:

Shutter dial	Limits	Slow limit	Std.	Fast limit	Adj.
1/1000	±0.3EV	1.20	1.04 - 1.09	0.98	VR2
1/500	±0.2EV	2.24	1.95	1.70	
1/250	±0.2EV	4.49	3.91	3.40	
1/125	±0.2EV	8.97	7.81	6.80	
1/60	±0.2EV	18.0	15.6	13.6	
1/30	±0.2EV	35.9	31.3	27.2	
1/15	±0.2EV	71.8	62.5	54.1	
1/8	±0.2EV	144	125	109	
1/4	±0.2EV	287	250	218	
1/2	±0.2EV	574	500	435	
1S	±0.2EV	1150	1000	871	
2S	±0.2EV	2290	2000	1790	
EF	±0.2EV	19.9	-	15.6	

Procedure:

1. Shutter Speed Adjustment (1/1000 sec.)

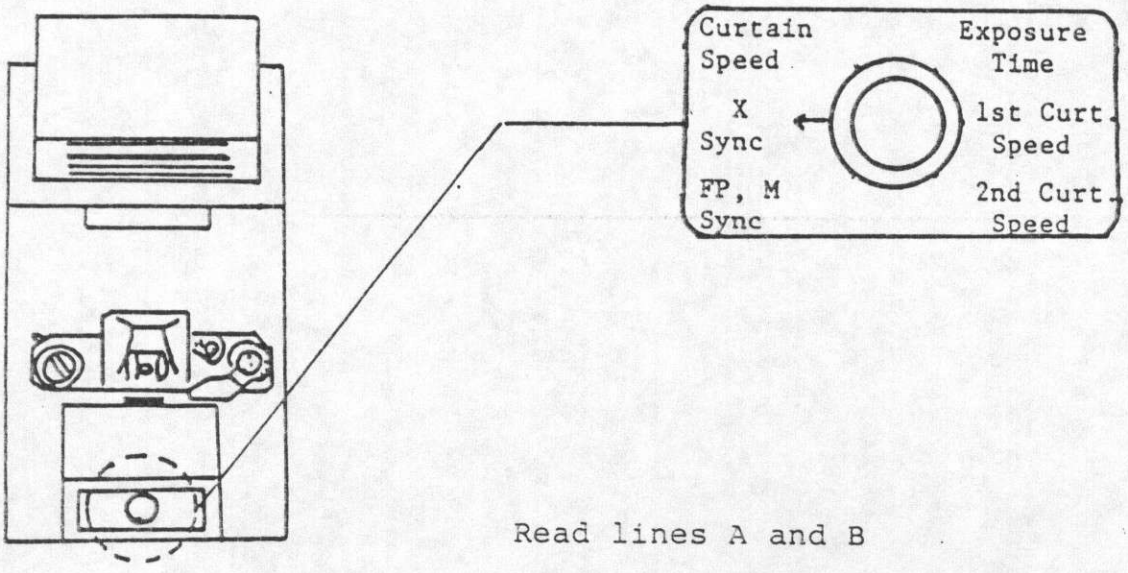
   The Shutter speeds are controlled by the clock pulse and the count start switch timing. The only actual shutter speed adjustment is VR2 for the 1/1000.
   Set the 1/1000 shutter speed and adjust VR2.
   (In colder climates the 1/1000 speed should be adjusted slightly on the slow side (abt. 1.08 ms)).

2. Check the other shutter speeds. If they are not within tolerances, adjust the clock pulse oscillator (Sect. 2.10). If the oscillator is adjusted, the 1/1000 speed adjustment must be rechecked.

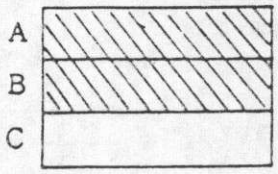
3. Dedicated Speedlite Changeover

3.1 Install a Canon Speedlite in the hotshoe and let it charge. When it is charged, the shutter speed should be 15.6 to 19.9, regardless of the position of the shutter speed dial (except "B").

3.2 If a speedlite is not available, or the camera is not completely assembled, install the 4.7KOhm dummy speedlite resistor as shown at the left.



Read lines A and B



2.4 X TIMELAG

Test Equipment: Shutter Tester

Limits:

	Line	Limit	Adjustment
1/60 sec.	A	Over 0.5 mS	X contact (bend)
	B	Over 1.5 mS	

Contact Efficiency: 70% or better (1 mS contact) at 1/60 sec.

Procedure:

1. Set the shutter speed to 1/60 sec.
2. Connect the X contact to the shutter tester.
3. If the tolerances are not met, bend the X contact.
4. Check that the X contact circuit is not complete during winding. (If it is adjust the safety switch contact.)

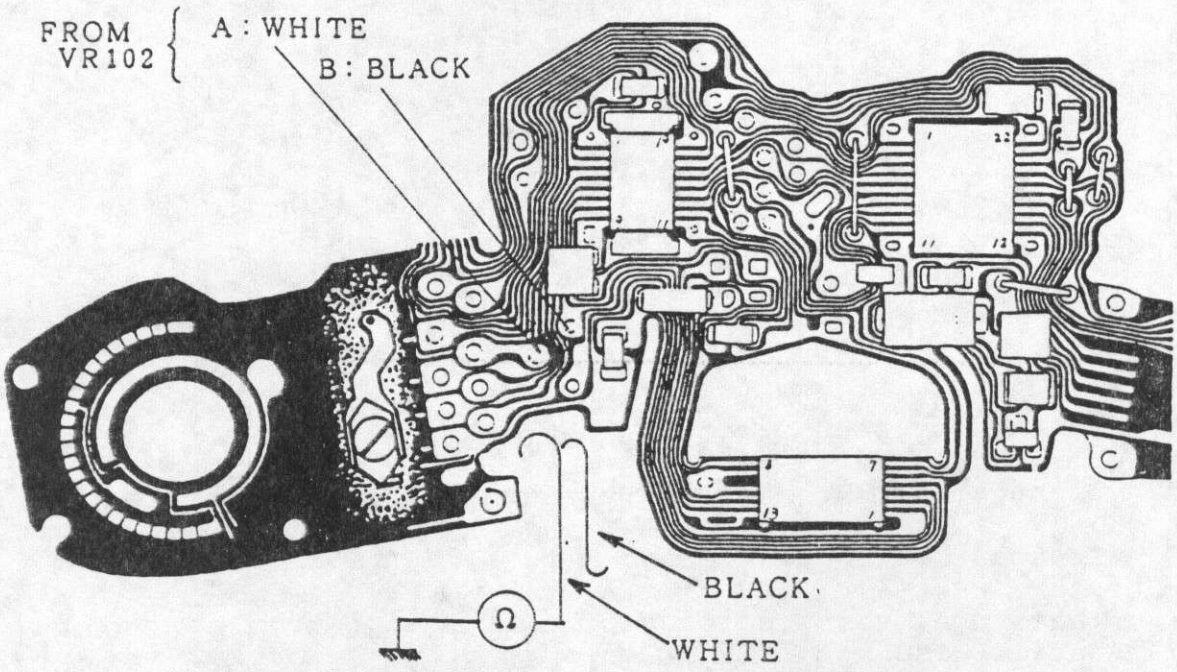
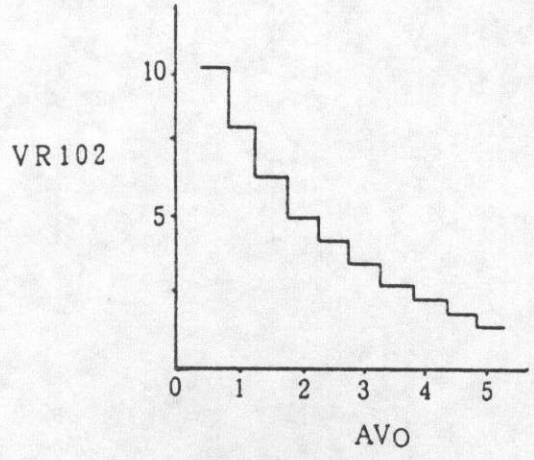


Table 1. VR102 (values are for R108=1.5 Kohm)

AVO	0.5	1	1.7	2	2.63	3	3.6	4	4.33	5
F NO	1.2	1.4	1.8	2.0	2.5	2.8	3.5	4.0	4.5	5.6
VR102(Kl) ±5%	11.03	9.32	8.06	7.11	6.35	5.75	5.21	4.82	4.46	4.16
Pin height ±0.05mm	8.38	8.10	7.72	7.46	7.15	6.90	6.57	6.30	6.00	5.70

Note: The exact value for VR102 depends on the exact value of R108. See the procedure for the method of determining the exact value.



VR102 varies as shown at the left depending on the maximum aperture pin height.

2.5 Maximum Aperture Pin Adjustment (AVo)

Test Equipment: Digital Multimeter (DMM) (Ω Range)
Depth Gage (or three FD lenses of different maximum apertures)

Standards and Limits:

See Table in frame at left.

Adjustment: The setscrew in the max. aperture pin.

Procedures:

The adjustment can be performed either on the assembled camera or the front panel unit.

Note: The setscrew inside the max. aperture pin is bonded tightly. Loosen the bond with keton (MEK) to free it to make the adjustment.

1. Unsolder the white (A) and black (B) leads shown at the left.

2. Measure and record the resistance across the leads (the standard is 1.5 Kohm) with the DDM.

3. Determine the correction constant for the variation from the standard.

$$\frac{\text{R108 actual value (X Ω)}}{\text{R108 standard value (1.5KΩ)}} = \text{Constant (K)}$$

Ex: R108 = 1.45KΩ

$$\frac{1.45\text{KΩ}}{1.5\text{KΩ}} = K \qquad K = 0.966$$

4. Reconnect the DMM to the white lead and body earth (Ω range). Set the depth gage to the depth for the aperture to be checked (Ex. f/1.4 = 8.10 mm) and put it on the lens flange so it bears on the maximum aperture pin.

With the depth gage in place, read the resistance value on the DMM. If R108 is exactly 1.5KΩ, the value for VR102 is in Table 1 in the frame to the left. If 108's value is not exactly 1.5KΩ, the correct value for VR102 is:

Vr102 value (from table) x K (step 3)

Ex: Aperture = f/1.4; VR102 = 9.32KΩ
R108 = 1.45KΩ : K = 0.966

9.32KΩ x 0.966 = 0.01KΩ
VR102 = 9.01KΩ

5. Remove the depth gage and adjust the setscrew inside the max. aperture pin if the value is not correct. Recheck and repeat until the value is correct.

6. Repeat the check and adjustment for two other aperture (f/5.6, f/1.2) until all three values fall within the limits (±5%).

This adjustment is to correctly position the ASA wiper on the contact pattern. It only need be performed if the top cover, ASA dial or ASA contact pattern has been changed.

Test Equipment: DMM (Ω range)

Standards and Limits: The standard is that the wiper touches the correct pattern bit and no others.

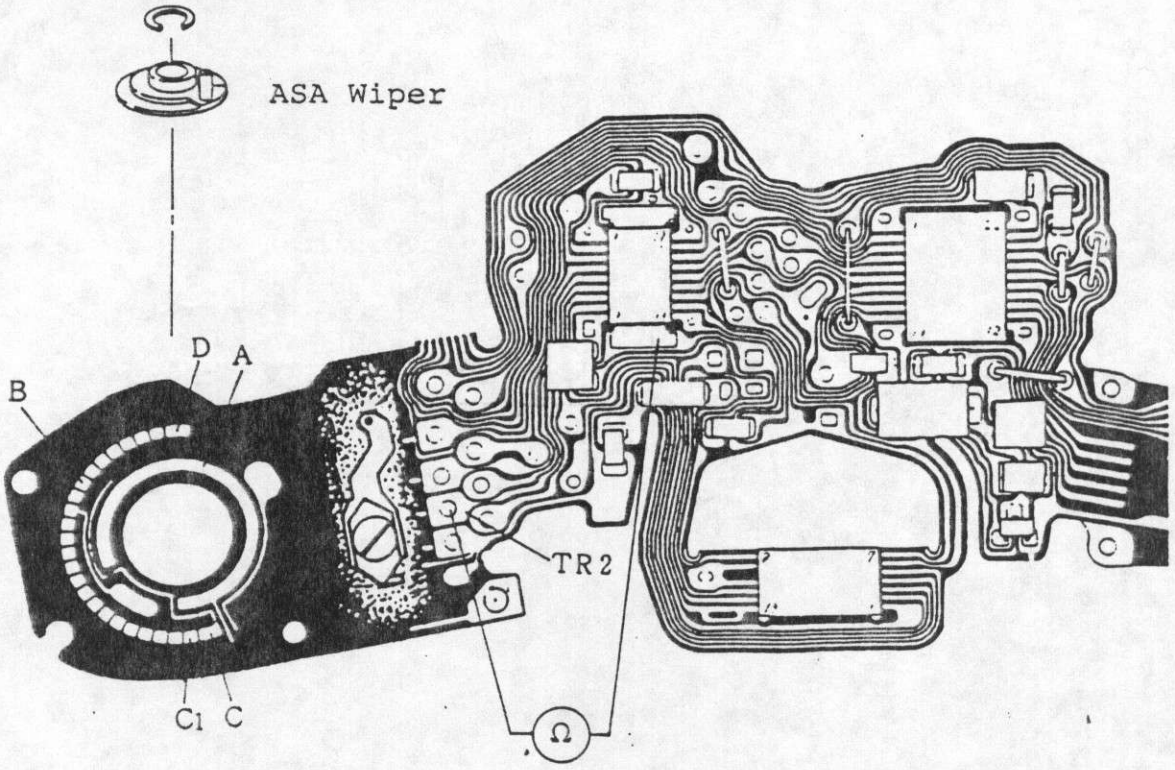
Adjustment: ASA Wiper eccentric

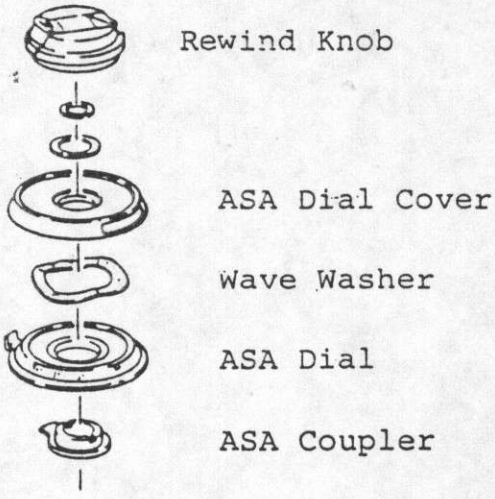
Procedures:

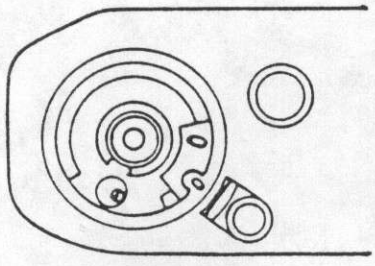
I. Check

Note: Camera power must be off because the DMM is used on the ohm range.

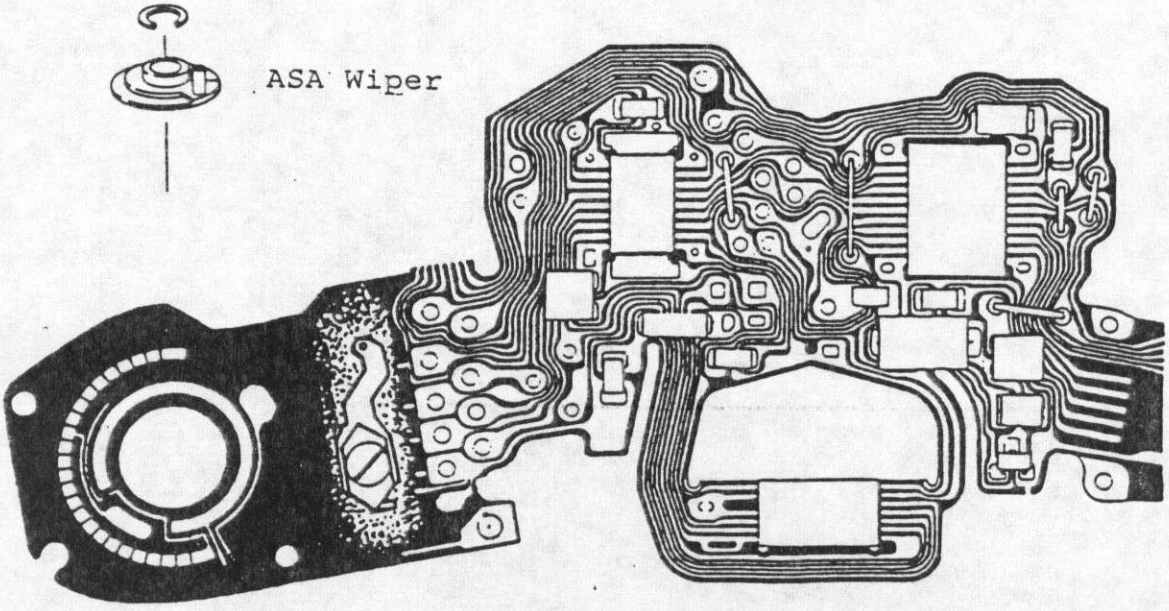
1. Attach the DMM as shown at the left and reinstall the top cover temporarily.
2. If the ASA wiper is making contact with the outer contact ring (B) somewhere between (C) and (D) the DMM will read between 2.5 and 3 Kohm. If it leaves this area, the resistance will jump to about 4.5Kohm
3. Read and record the resistance at C (ASA 3200) and D (ASA 12).
4. Install the ASA dial, dial cover and rewind crank.
5. Set the dial to ASA 3200 and hold it against the stop. Even when pushing against the stop the resistance should be the same as recorded for C in step 3. Turn to the other extreme (ASA 12) and repeat the procedure. The value should be the same as recorded for D in step 3. Then set the ASA dial to an intermittent value (ASA 200 for example) and read the DMM. Moving the dial as far as the play allows without pushing the release button should not produce a change in the DMM reading.
6. Set and lock the dial at ASA 3200. Move it to the maximum play in both directions. If the DMM reading changes, the adjustment is not correct.







Eccentric Position



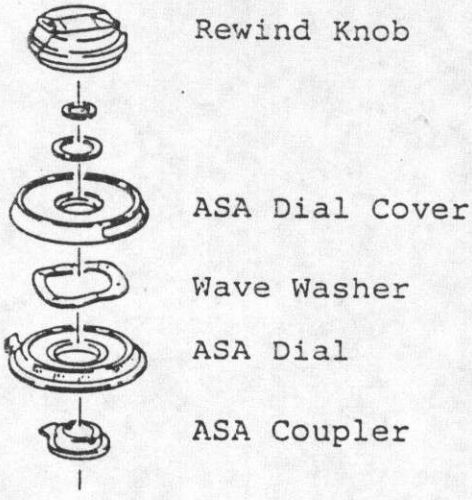
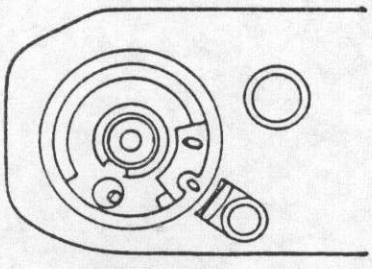


Fig. B

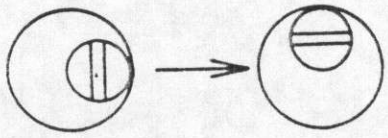


Eccentric position

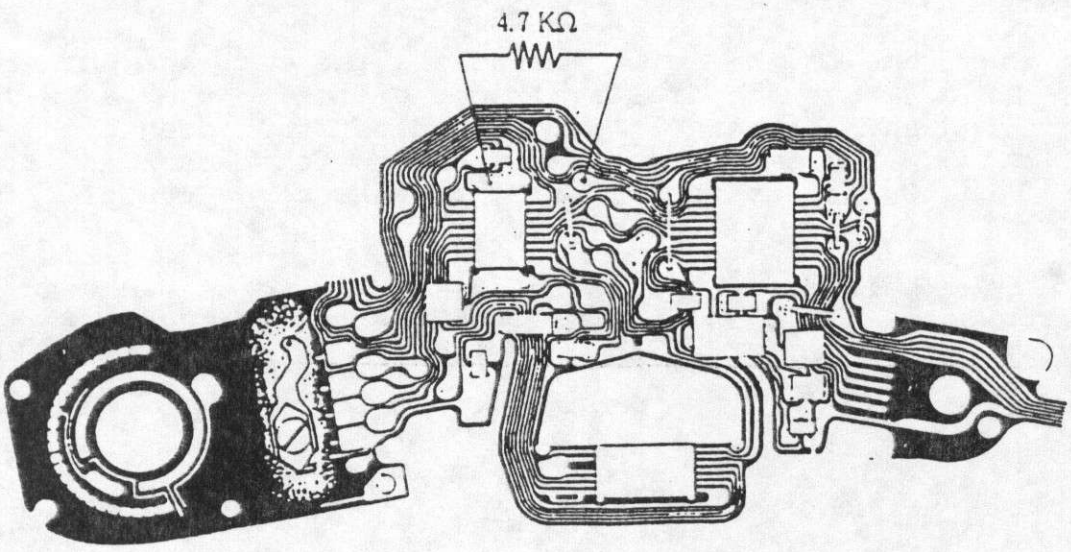
II. Adjust

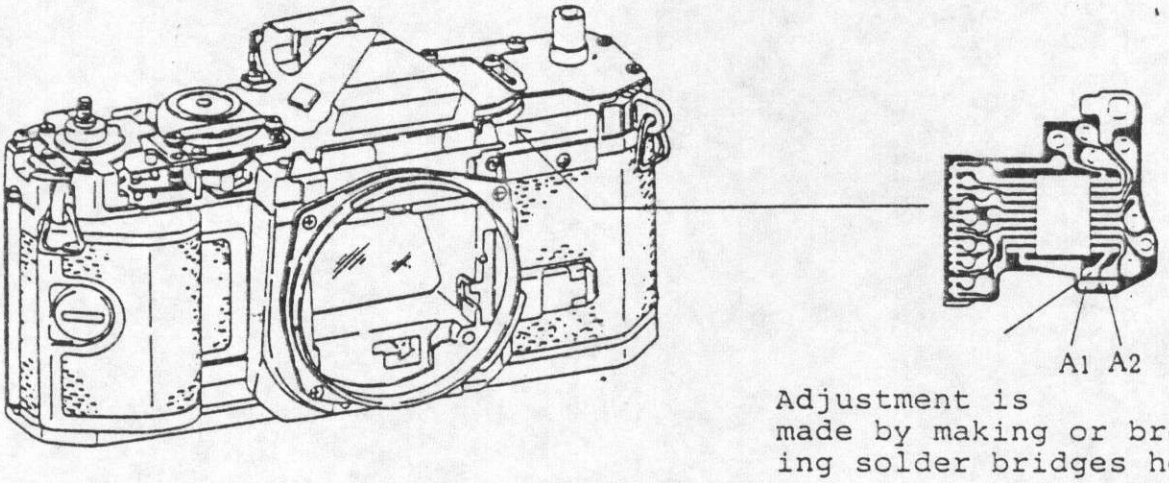
1. Remove the dial and set the eccentric in the position shown in the frame to the left. Reinstall the dial and set to ASA 3200. Move the dial against the lock to the maximum. Removing and replacing the dial, adjust the eccentric in slight CCW increments until the DMM switches back and forth from the C resistance to the C' resistance as the dial is moved.

2. When the point is found where it just switches back and forth between the two values, rotate the eccentric an additional 90° CCW, as shown below.



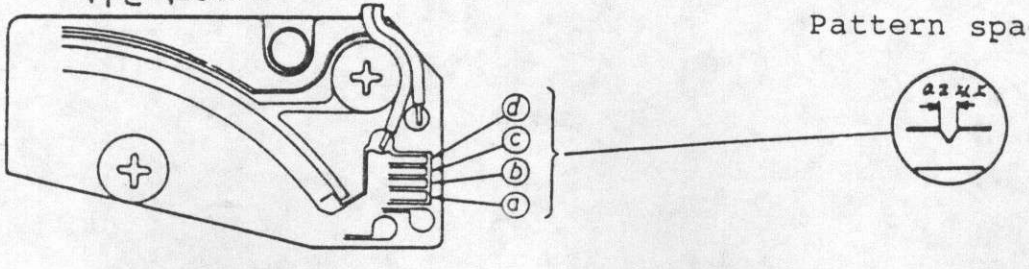
3. Repeat the check steps outlined in section I.





Adjustment is made by making or breaking solder bridges here.

AE Board - Side of Mirror Cage



2.7 AE Pattern Adjustment

This adjustment is necessary if a new AE Pattern board is installed. It affects the aperture selected in both the AE and AE Flash modes so it should be done before the AE adjustment when it is necessary. The 4.7 Kohm resistor simulated the f/4 signal from a dedicated speedlite, so the adjustment is sometimes called the EF (electronic flash) adjustment.

Test Equipment: Service Standard Lens (FD50mm 1:1.4)
4.7 Kohm resistor

Standard and limits: f4.0 ±0.5f

Procedures:

Check:

1. Install the 4.7 Kohm resistor as shown. Release the shutter and determine which aperture the lens was set to by the camera.
2. If the aperture was set to f/4 ±0.5f, no adjustment is necessary.

Adjustment:

There are two different methods for making the adjustment. If only a slight adjustment is necessary, the pads marked A1 and A2 at the left can be used.

1. Underexposure:

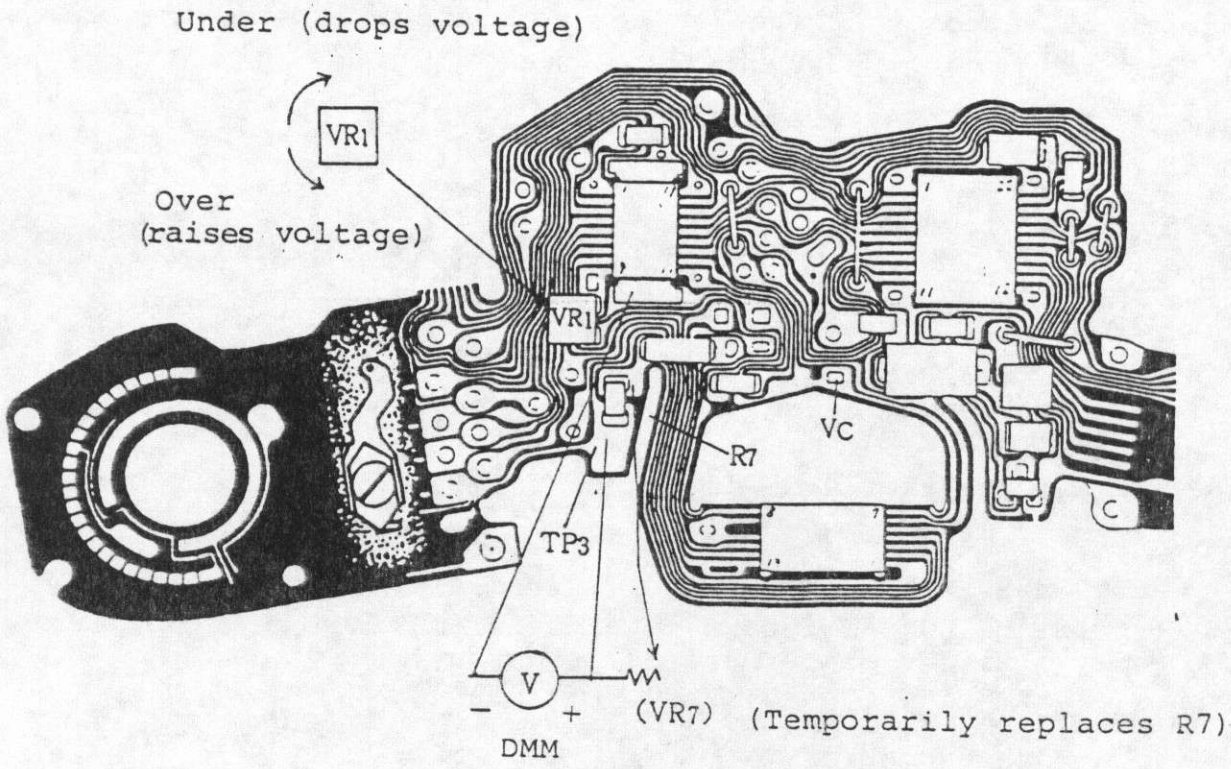
   To open the aperture 1/8 f/stop, connect A1 to the pad directly above it with a solder bridge. If a 1/4 f/stop adjustment is necessary, connect both A1 and A2 to the pads just above them.

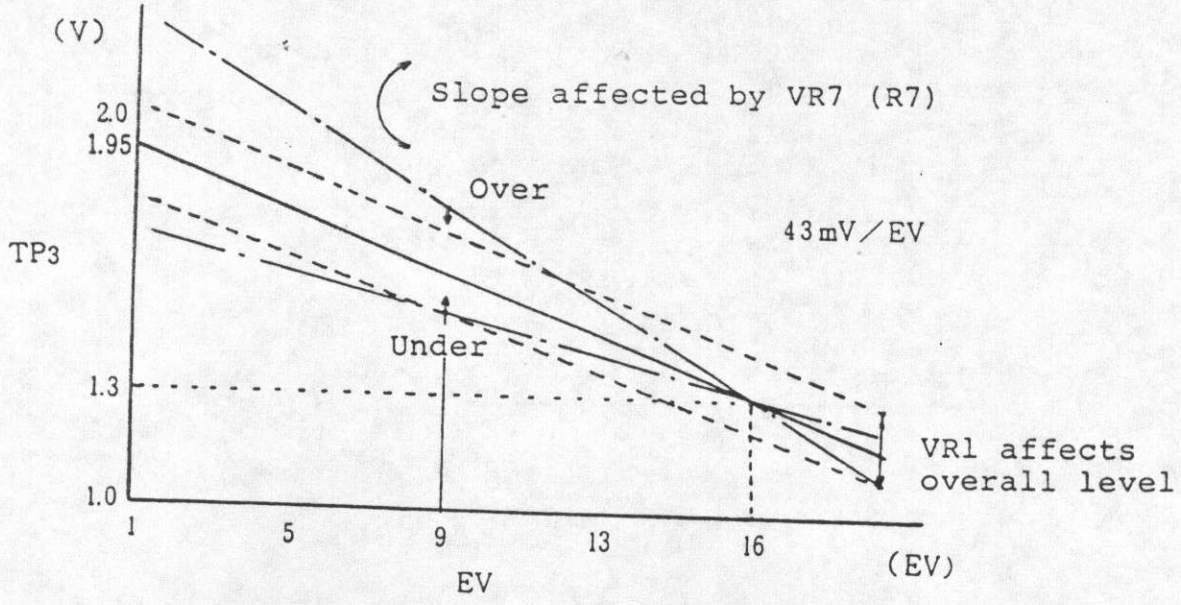
2. Overexposure:

   If only a 1/8 f/stop aperture reduction is necessary, connect only A2 to the pad directly above it.

   If more than a 1/8 f/stop reduction is necessary, cut the pattern on the AE pattern board at the point indicated below.

Aperture Reduction	Cut at
-1/8	a
-1/4	b
-3/8	c
-1/2	d





TP3 OUT (50/1.4 ASA 100)

Test Equipment: EE Camera Tester
DMM (volt range)
Tool Cover*
10Kohm variable resistor

*: The tool cover can be made almost identical to the AE-1 tool cover. The hole should be located above VR1 and can be smaller than the AE-1 cover.

Standard and Limits: EV6 to 14, ±0.7EV (ASA100)

Procedure:

I. If the entire range is off in the same direction of if the difference between EV9 and EV15 is less than 1EV, the adjustment can be made with VR1, the level adjustment, only without installing the variable resistor to replace R7, the gain adjustment resistor.

II. If the error is greater than in "I", use the following procedure.

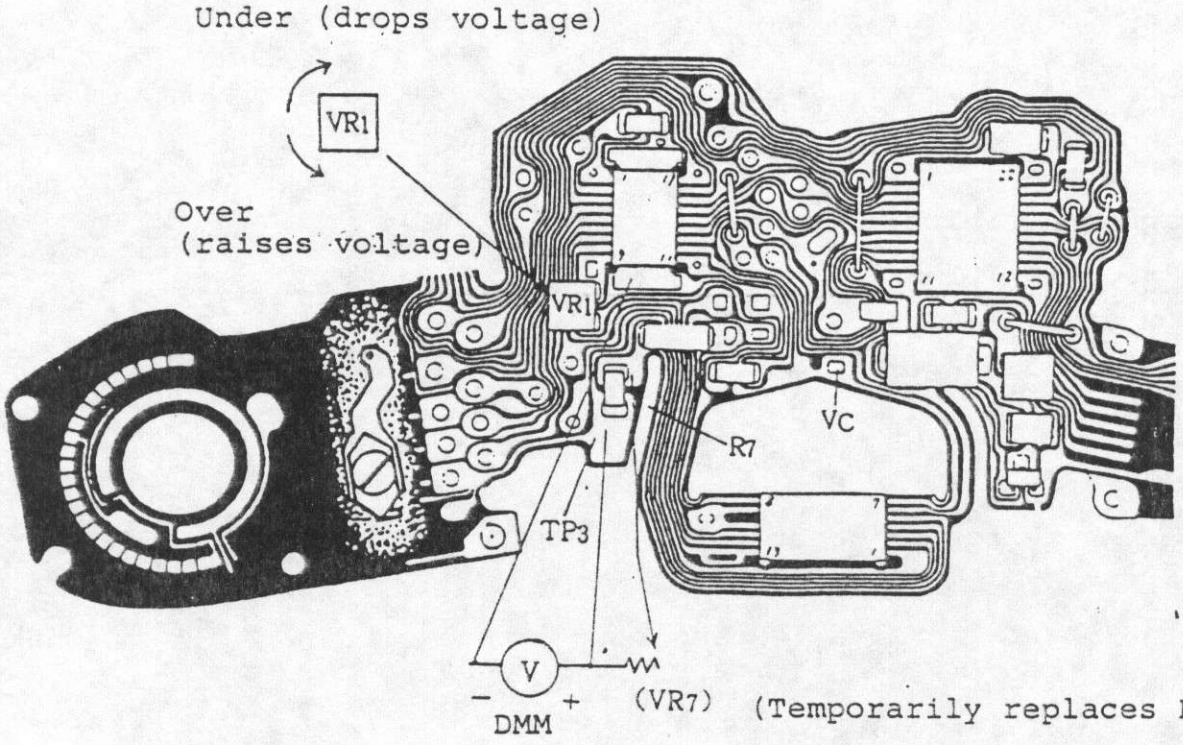
1. Set the ASA to 100 and remove the top cover. Don't change the ASA wiper position after removing the cover.

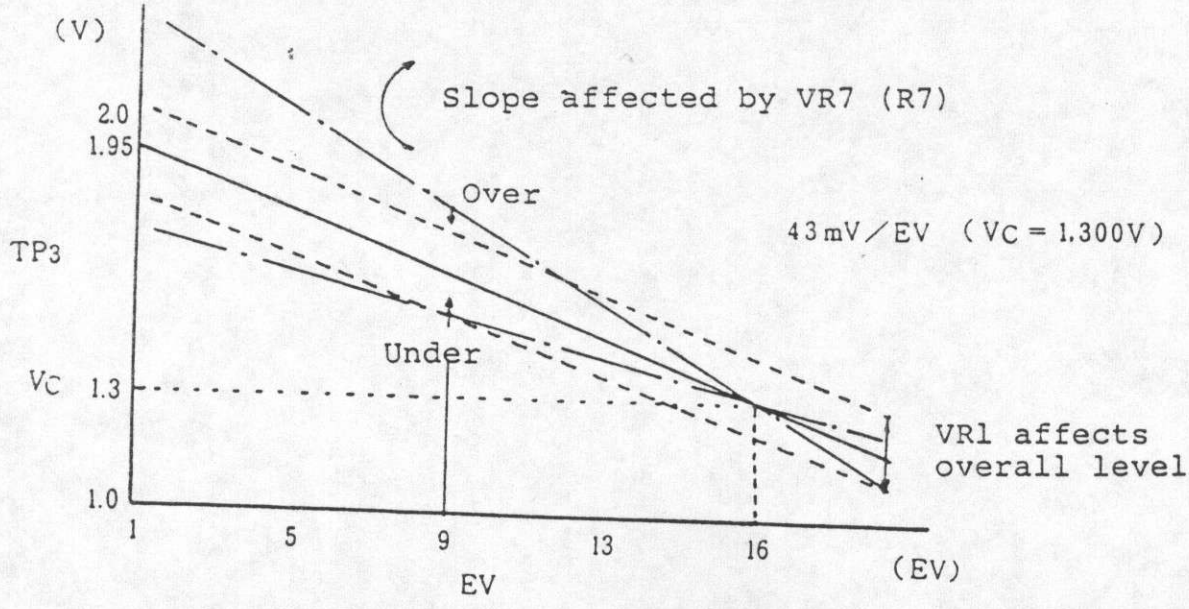
2. Accurately measure and record Vc.

3. Remove R7 and install the variable resistor (VR-7). It should be set to about 4.8 Kohm and should be capable of fine adjustment in the 4 to 6 Kohm range. The leads should be less than 10 cm long.

4. Connect the DMM, set to the voltage range, as shown at the left.

5. Install the tool cover and standard lens.





TP3 OUT (50/1.4 ASA 100)

6. Set the EV Tester for EV15, ASA100, K=12.50.

7. Repeatedly release the shutter and adjust VR1 until the EV Tester reads as close to 0 error as possible.

8. Record the DMM reading for 0EV error at EV15. This voltage is V1.

9. Reset the EV Tester to EV9 and record the DMM reading. This voltage is V2.

10. The correct difference is:

$$V2 - V1 = \frac{Vc}{30} \times 6$$

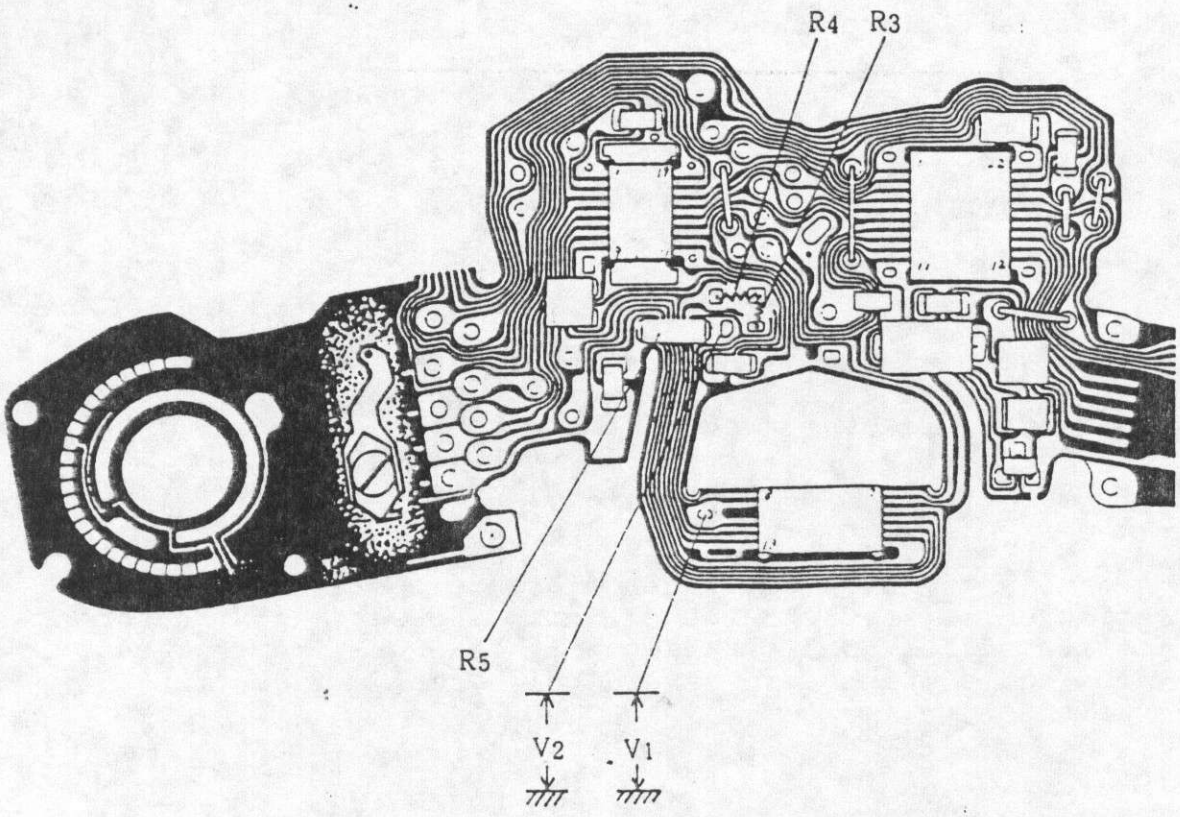
$$V2 = \frac{Vc}{5} + V1$$

11. Adjust VR7 so that V2 is as close to the calculated value as possible.

12. Release the shutter and read the EV Tester. If the reading is under, fine tune VR7 to increase the output voltage. If the reading is over, reduce the output.

13. Recheck EV15. If it has shifted, repeat steps 6 through 12.

14. When both the EV9 and 15 readings are correct, remove the variable resistor without changing its setting. Measure its resistance and install the R7 fixed resistor nearest in value to it (there are several different values of R7 available).


R4
R3
R5
V2
V1

2.9 OFFSET ADJUSTMENT

This adjustment is necessary if IC4 is changed.

Test Equipment: DMM (Voltage Range)
200 Kohm variable resistor

Standards and Limits: $IC4_{p}10 - IC4p11 = 0 \begin{smallmatrix}+5\\-0\end{smallmatrix}$ mV

Procedure:

Offset Voltage Check

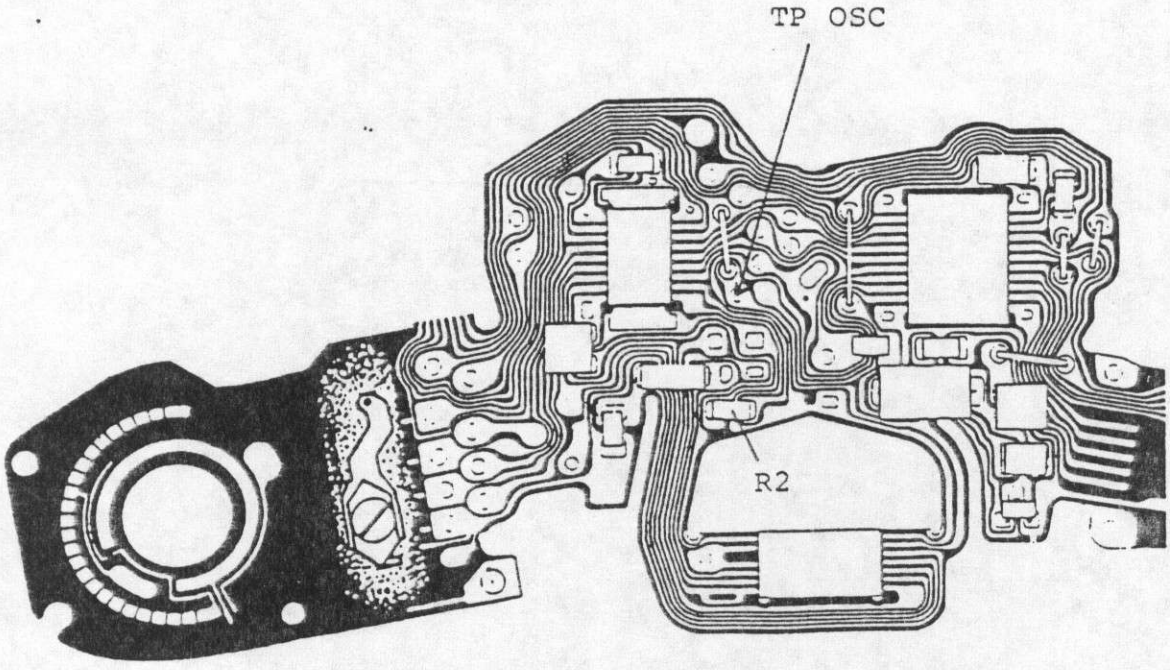
1. Unsolder on end of resistor R5.
2. Short IC4 pin 9 to pin 11.
3. Measure the voltage from IC4p10 to ground (V1).
4. Measure the voltage from IC4p11 to ground (V2).
5. If V2 is the same as, or no more than 5mV less than V1, no adjustment is necessary.

Offset Adjustment

1. Resistors R3 and R4 are the offset adjustment resistors. Either or neither one may be installed. Remove it and install the 200Kohm variable in the R4 position.
2. Adjust the variable resistor until V2 is within 0 to -5mV of V1. If the limit cannot be met with the variable resistor in the R4 position, put it in the R3 position.
3. Disconnect the variable resistor and read its resistance.
4. Install a fixed resistor in place of the variable. The fixed resistor should have a value as near as possible to the variable resistor.
5. Recheck with the fixed resistor installed.

Post-Adjustment Procedures

1. Remove the short from IC4p9 to IC4p11.
2. Resolder R5.
3. Recoat IC4 pins with moister proofing compound.


TP OSC
R2

2.10 Oscillator Adjustment

This adjustment is necessary if IC1 has been changed. It adjust the oscillator which provides the clock pulse.

Test Equipment: Frequency Counter or Shutter Tester
200 Kohm Variable Resistor

Standards and Limits:

Frequency Counter Method: 30,117 to 34,134 Hz

Shutter Tester Method: 476 to 525 mS

Procedure: Self Timer 9 to 11 sec

1. Check

There are two check methods for checking the oscillator depending on the test equipment available. A frequency counter preferred, but a shutter tester can be used in a frequency counter is not available.

Frequency Counter Method

1) Attach the frequency counter between the camera ground (body earth) and TPOSC and read the oscillator frequency.

2) The limits are 30,117 to 34,134 Hz. If it is within the limits, on adjustment is necessary.

Shutter Tester Method

1) Set the shutter to 1/2 sec.

2) Check the shutter speed. If it is within the range of 476 to 525 mS (1 mm slit width tester), no adjustment is necessary.

2. Adjustment

1) Remove R2 and replace it temporarily with an approximately with an 200 Kohm variable resistor.

Note: ~~X64-4511-000, used in the Repeatcorder L, is suitable~~ N/A

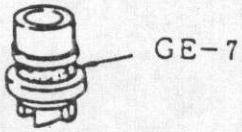
2) Adjust the variable resistor until the oscillator is with the frequency limits. Remove the variable and measure it. Install a fixed resistor with a resistance as near as possible to the resistance of the variable.

3) Recheck the frequency with the new resistor installed.

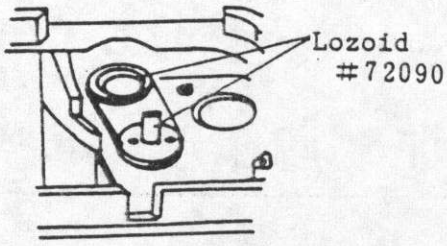
3. LUBRICATION AND ADHESIVES CHARTS

3.1 Body Parts (1)

Sprocket Clutch



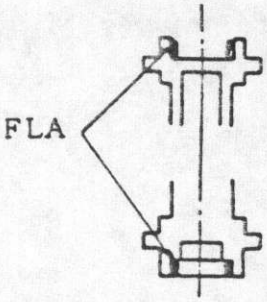
Compound Gear Pivot



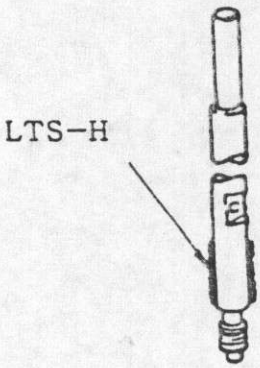
Sprocket Gear



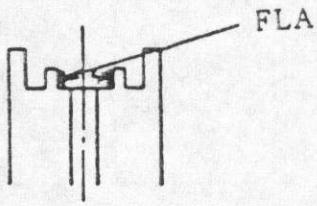
Sprocket



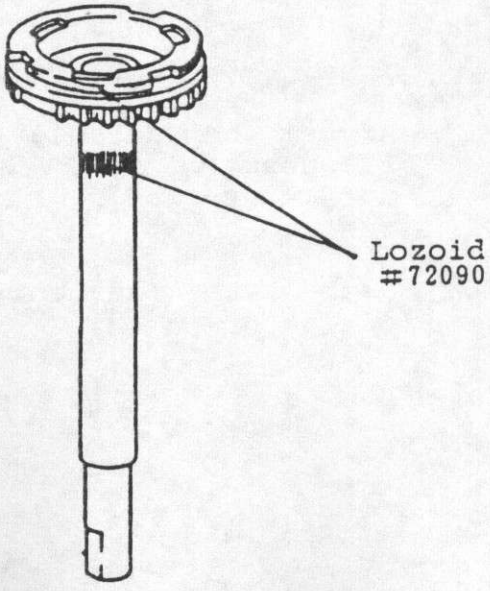
Sprocket Shaft



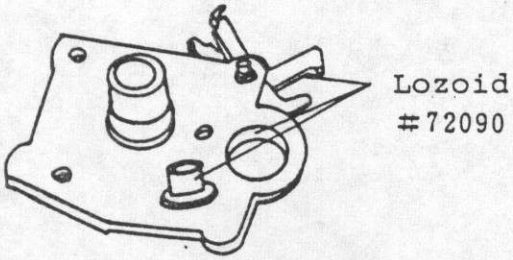
Spool



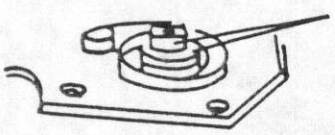
Winding Shaft



Lower Winding Base



Winding Base



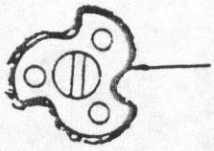
Lozoid
#72090

Spring



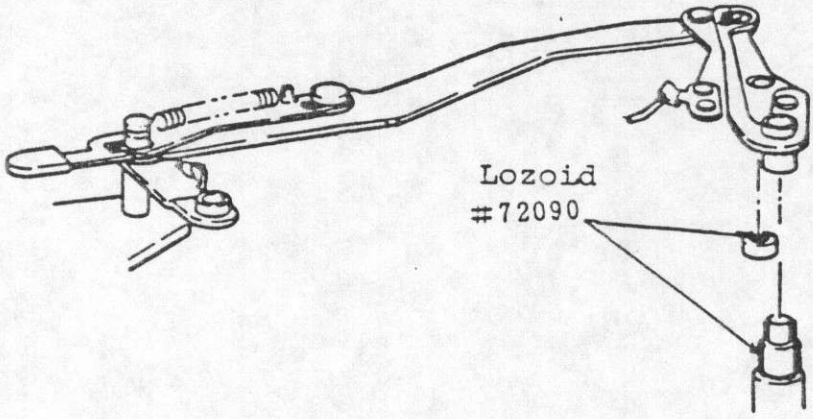
Lozoid
#72090

Change Cam

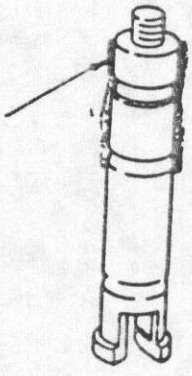


Lozoid
#72090

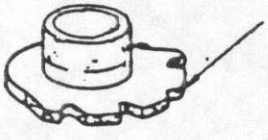
Connecting Lever



Lozoid
#72090

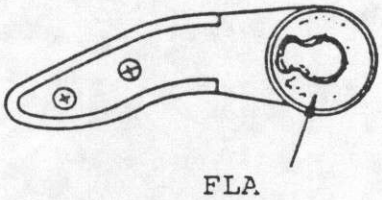


SL Wiper



FLA

Winding Lever

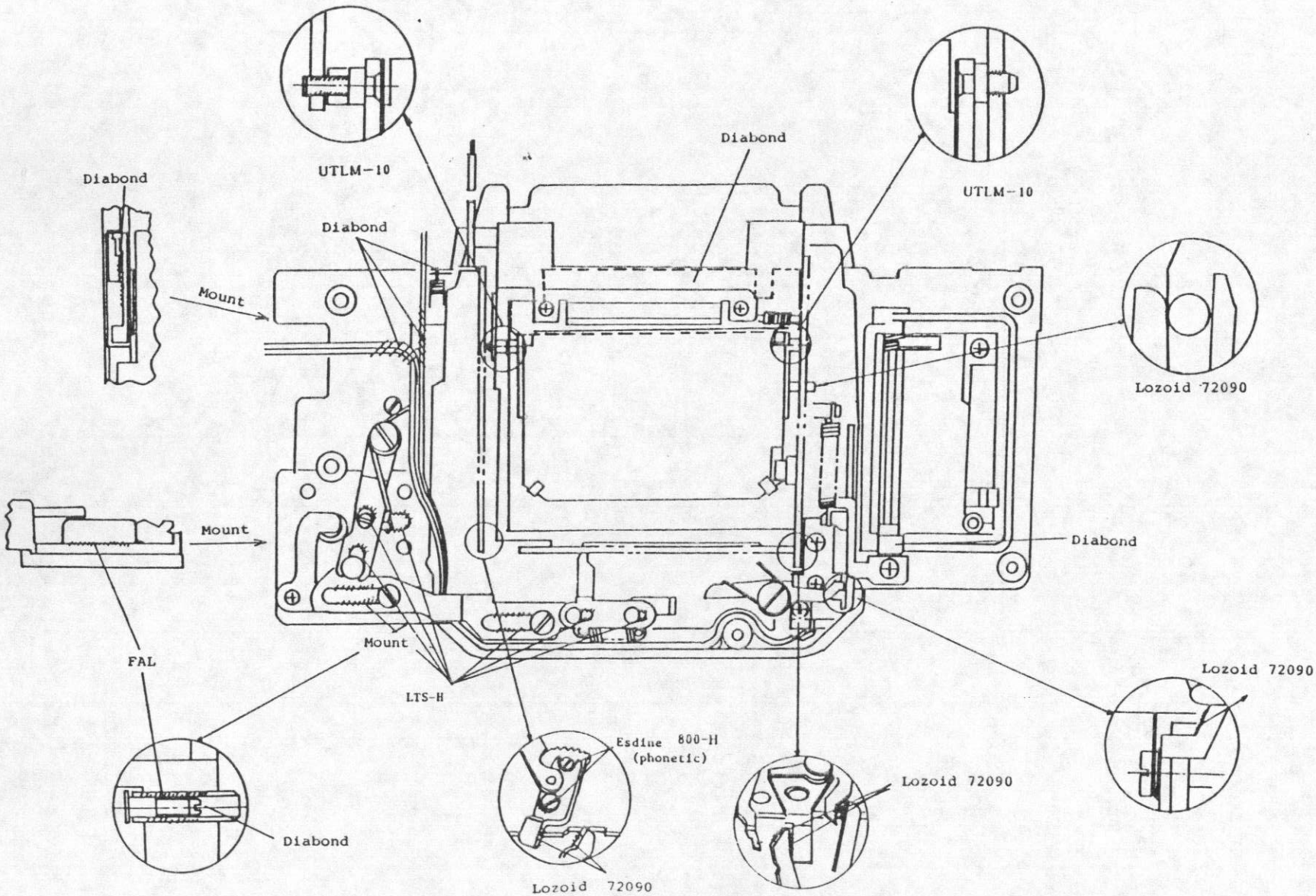


FLA

The shutter unit has 80% of its parts in common with the AE-1 and 15% with the AV-1.

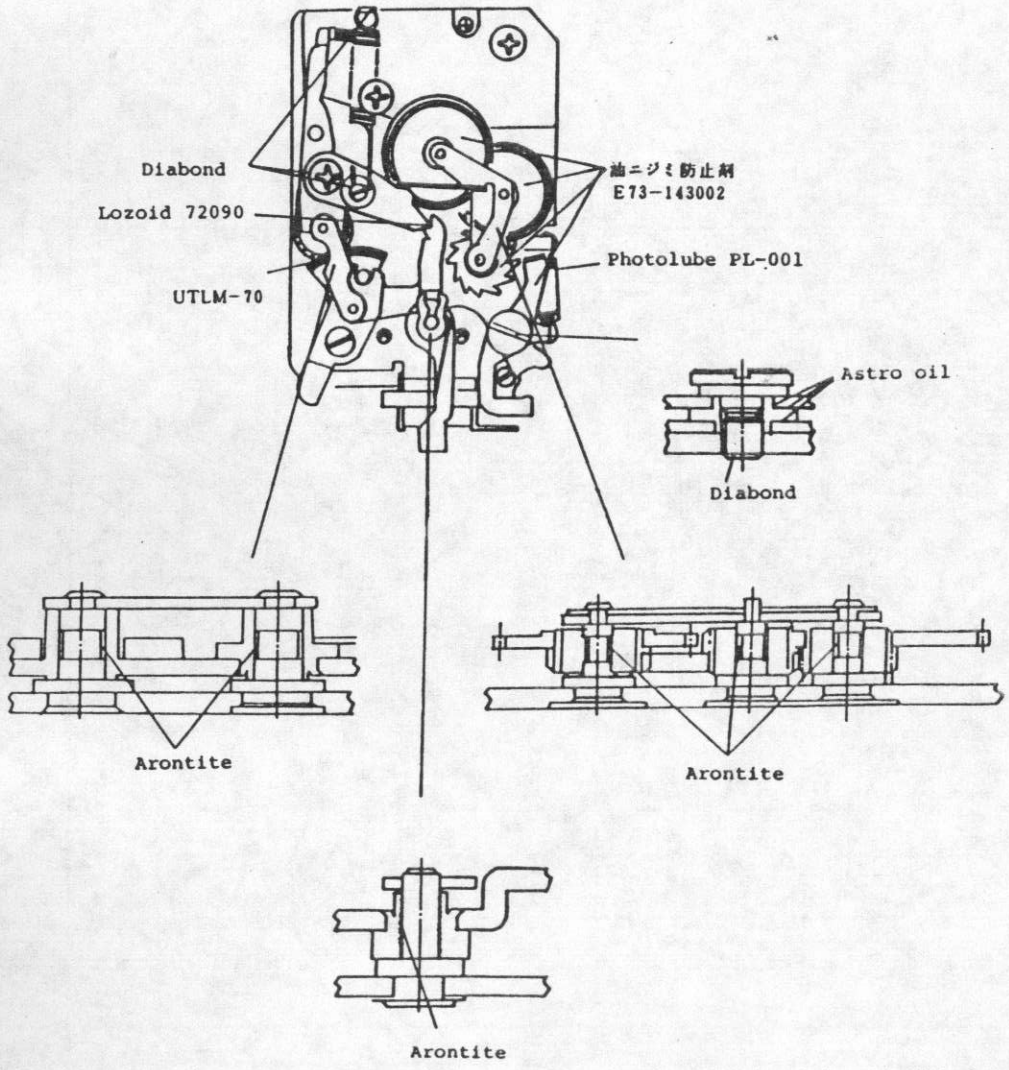
Refer to the AE-1 and AV-1 Repair Guides.

3.2. Front Panel Parts

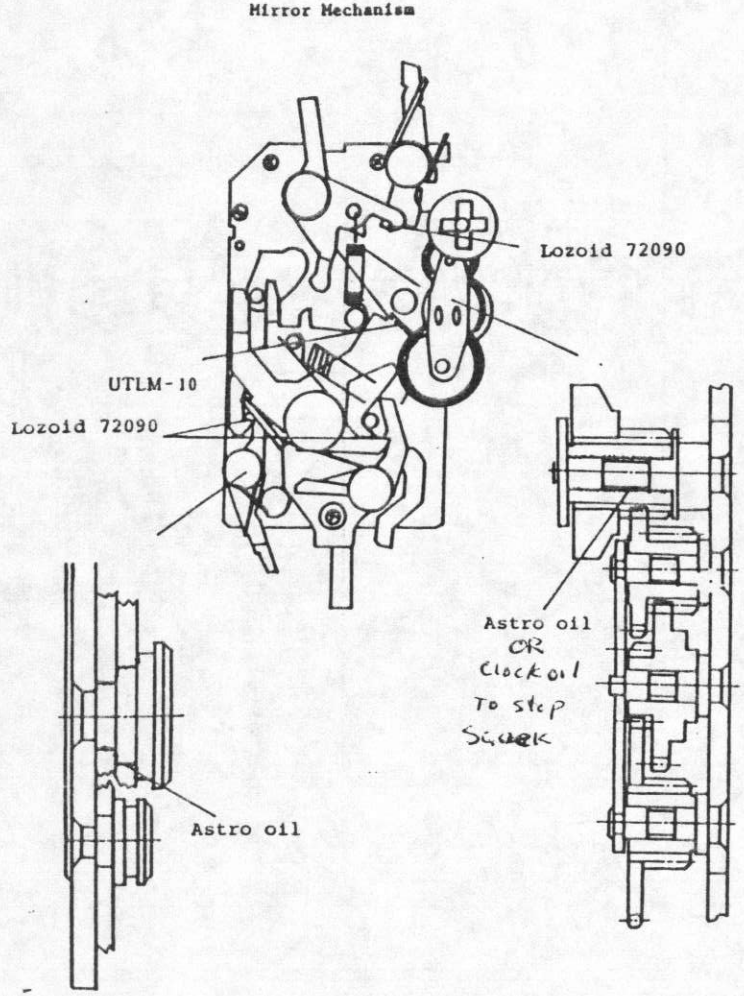


3.2 Front Panel Parts

AE Unit

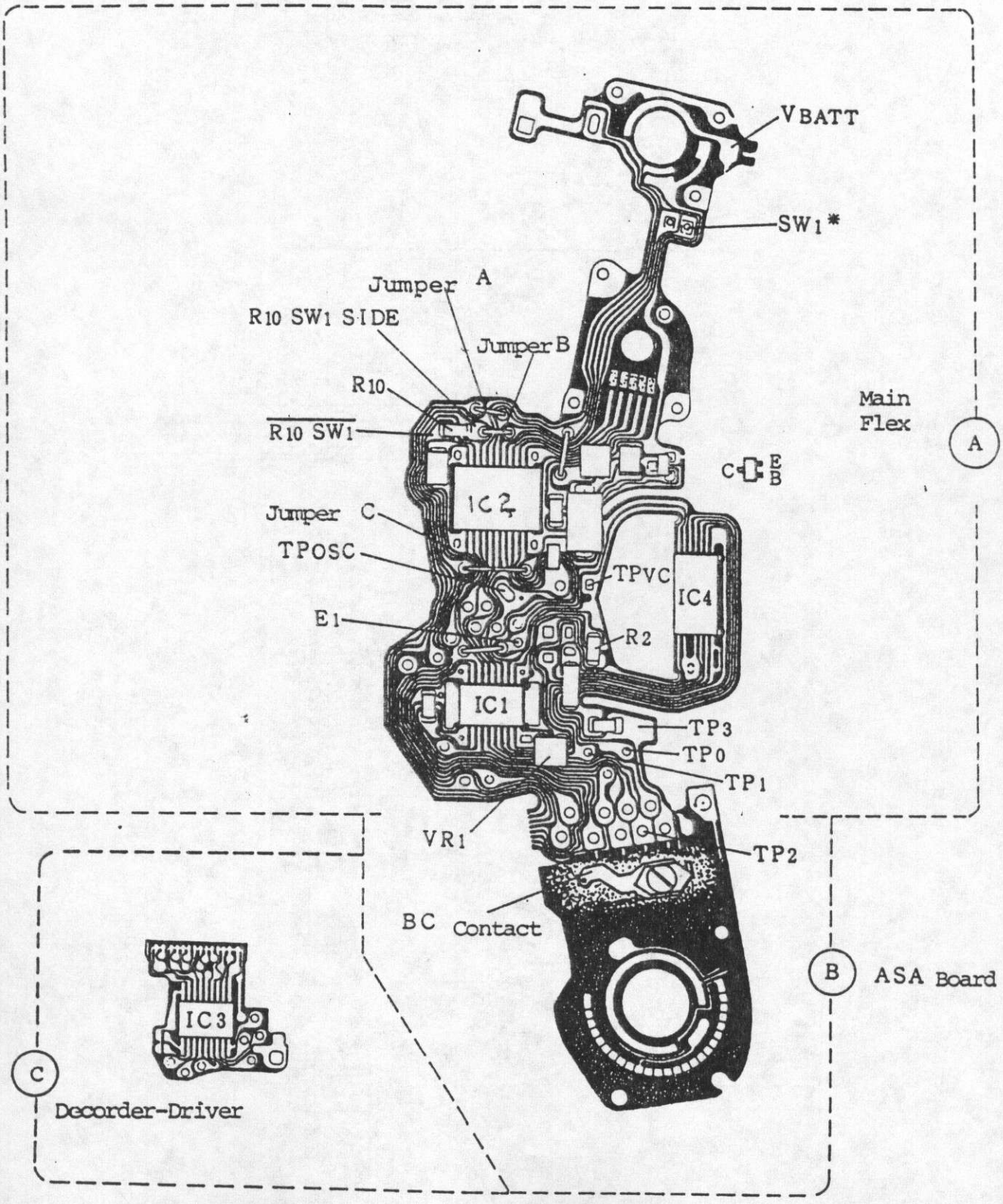


Mirror Mechanism



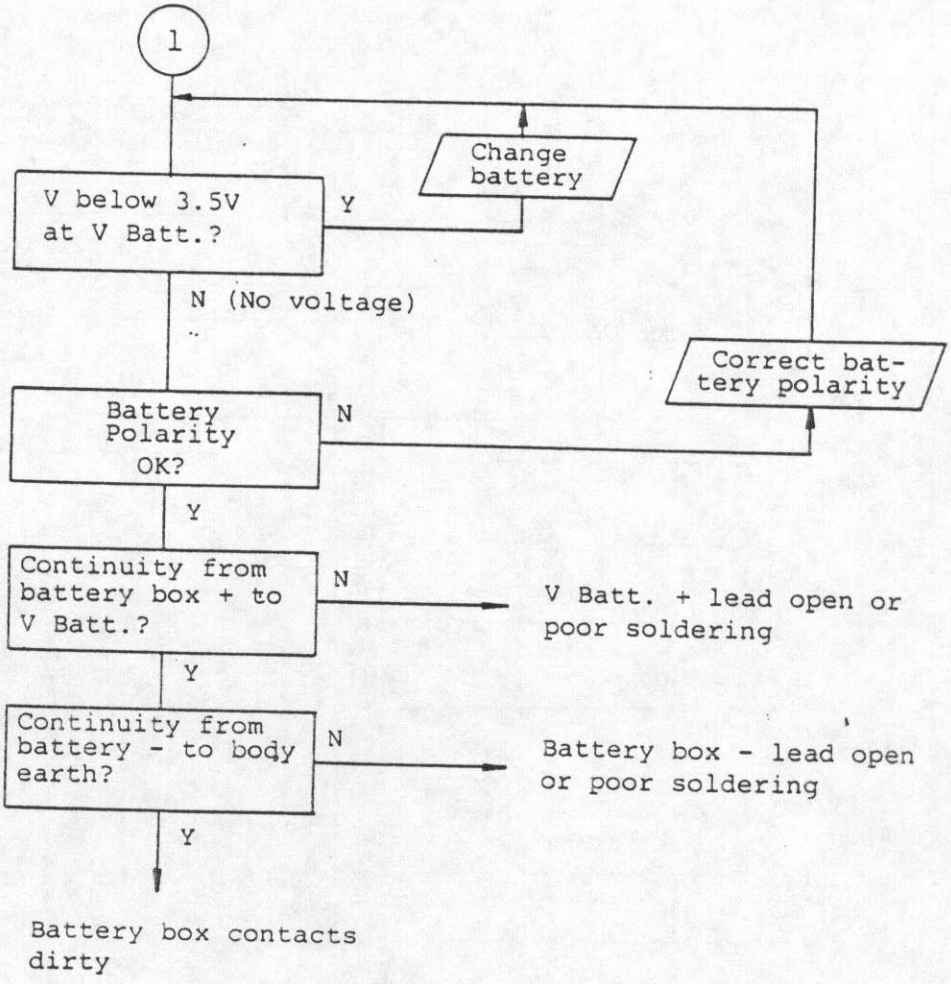
Note: Automatic Diaphragm unit librication is the same for all A-series cameras.

TROUBLESHOOTING CHECKPOINTS



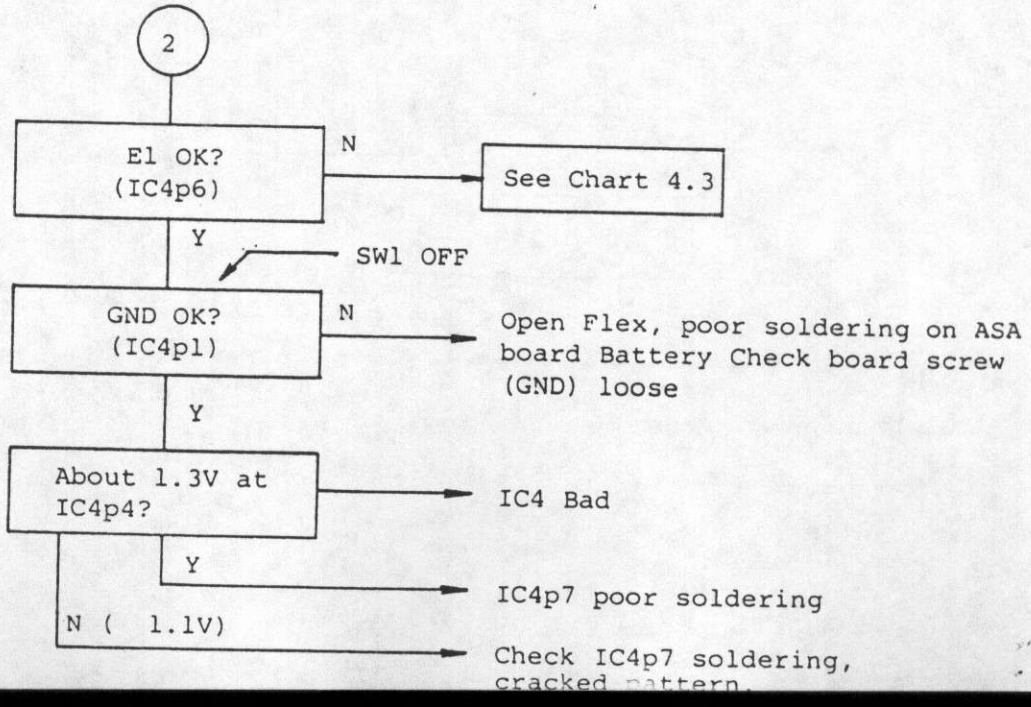
No Rebase, steady tone on Batt ✓, No Display - IC-2

4.1 No. V BATT. (SEE CHECKPOINT DRAWING)

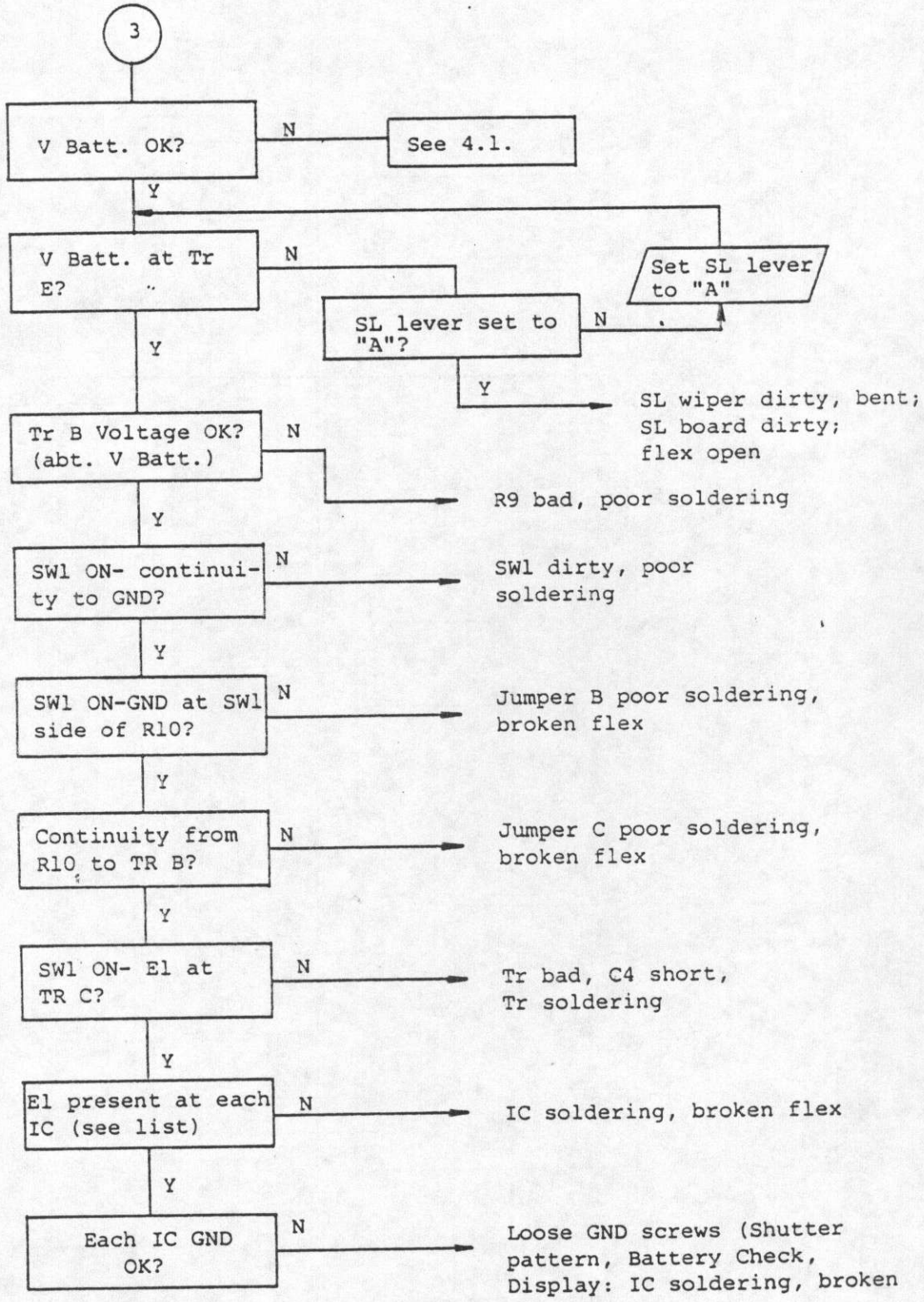


4.2 No. Vc

El ≈ V Batt. - 0.3V



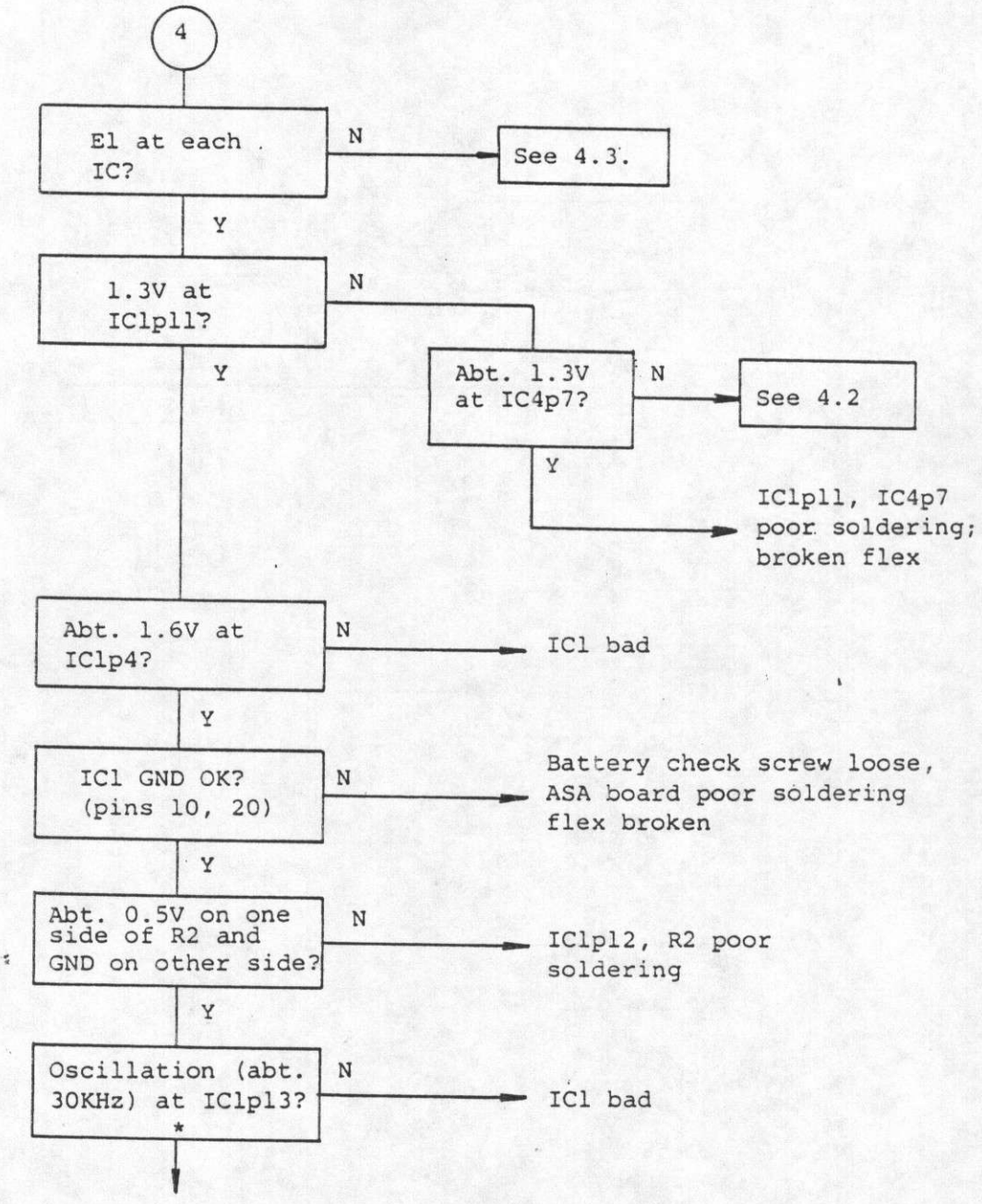
4.3 No El



El:
- IC1p17
- IC2p3
- IC3p9
- IC4p6

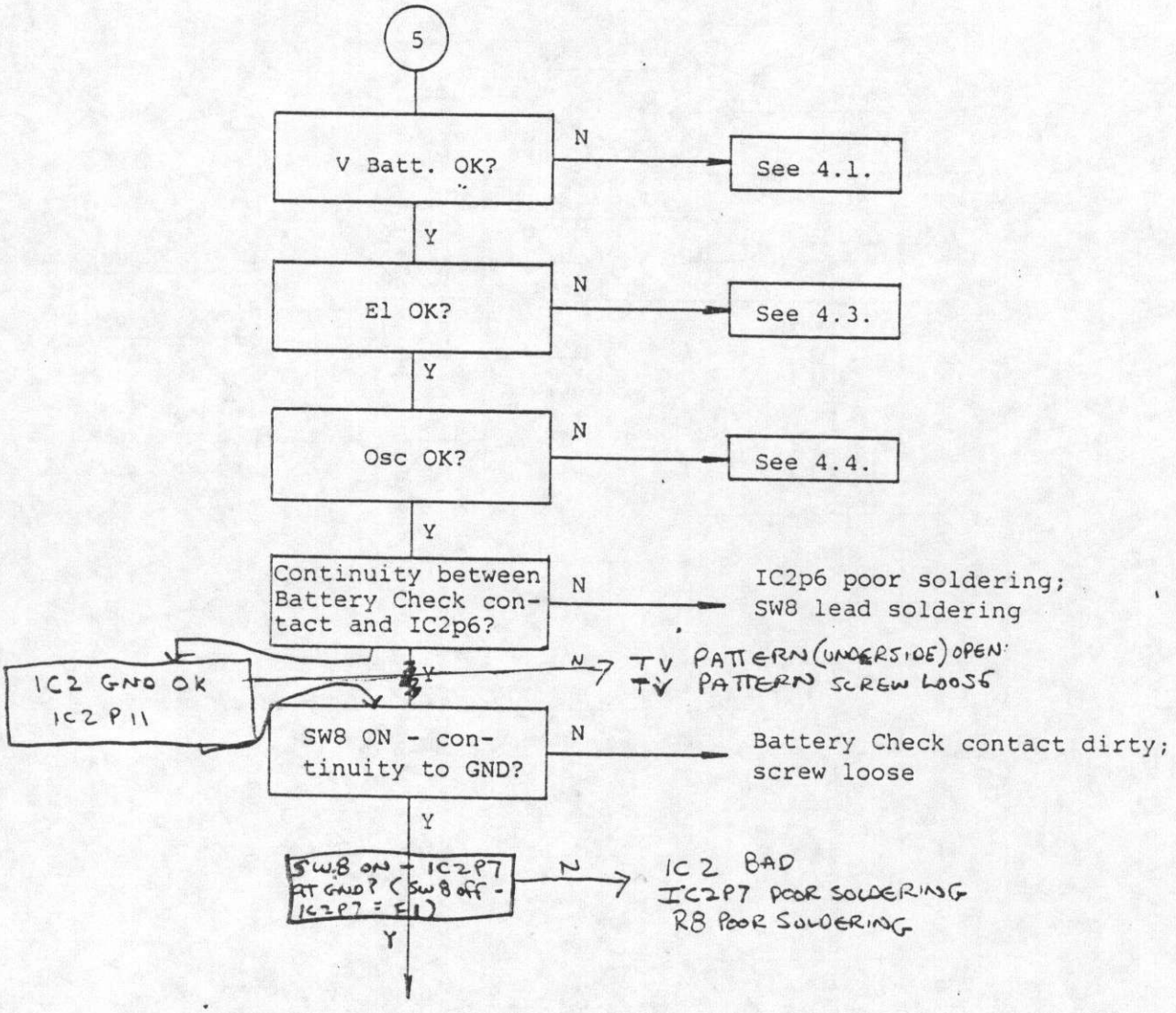
GND:
- IC1p11,20
- IC2p11
- IC3p18
- IC4p1

4.4 No Clock Pulse



*: Use oscilloscope if possible. If oscilloscope is not available, abt. 0.7V on DMM indicates oscillation.

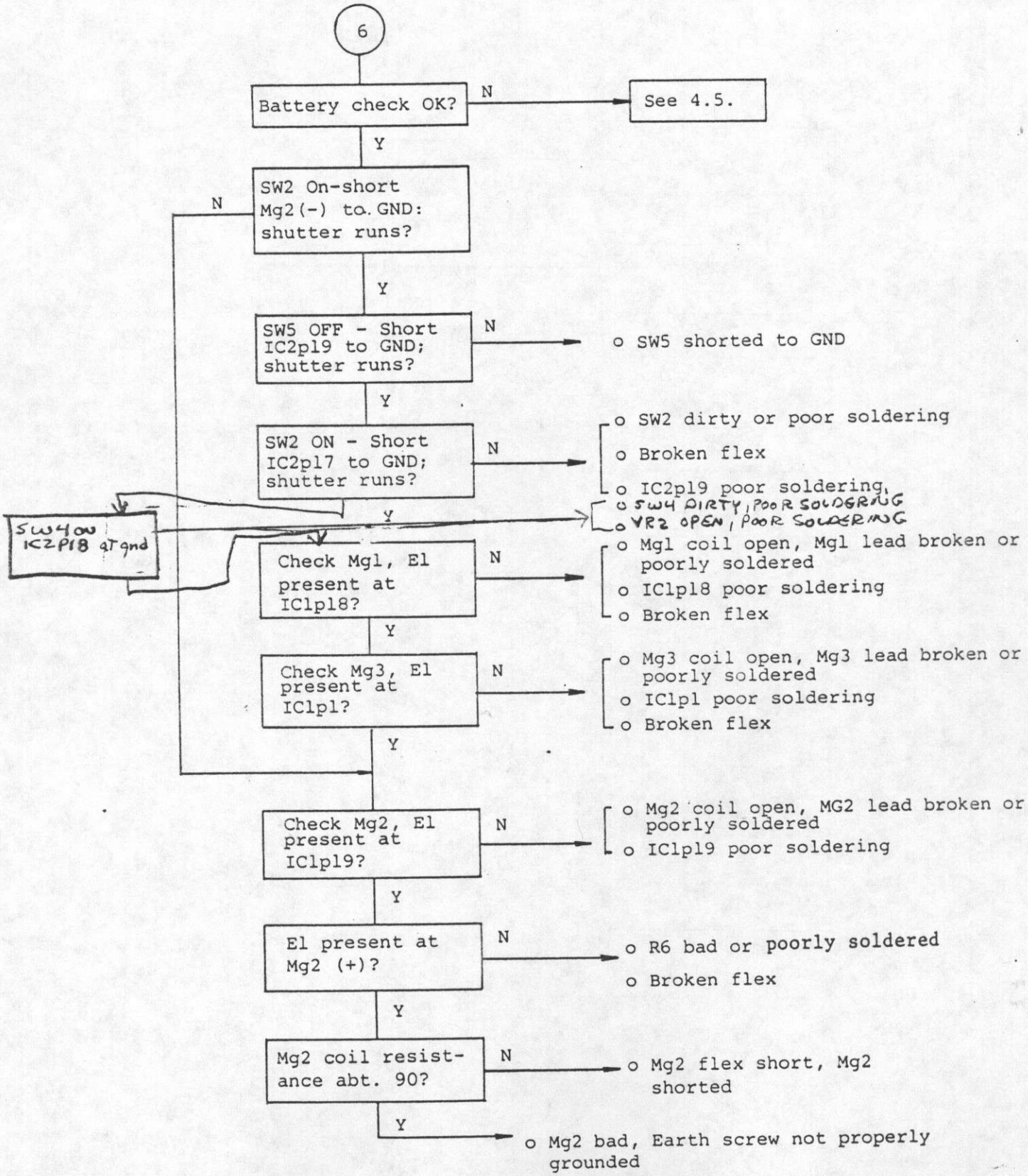
4.5 Battery Check doesn't Work



Beeper lead broken, poorly soldered;
Beeper bad

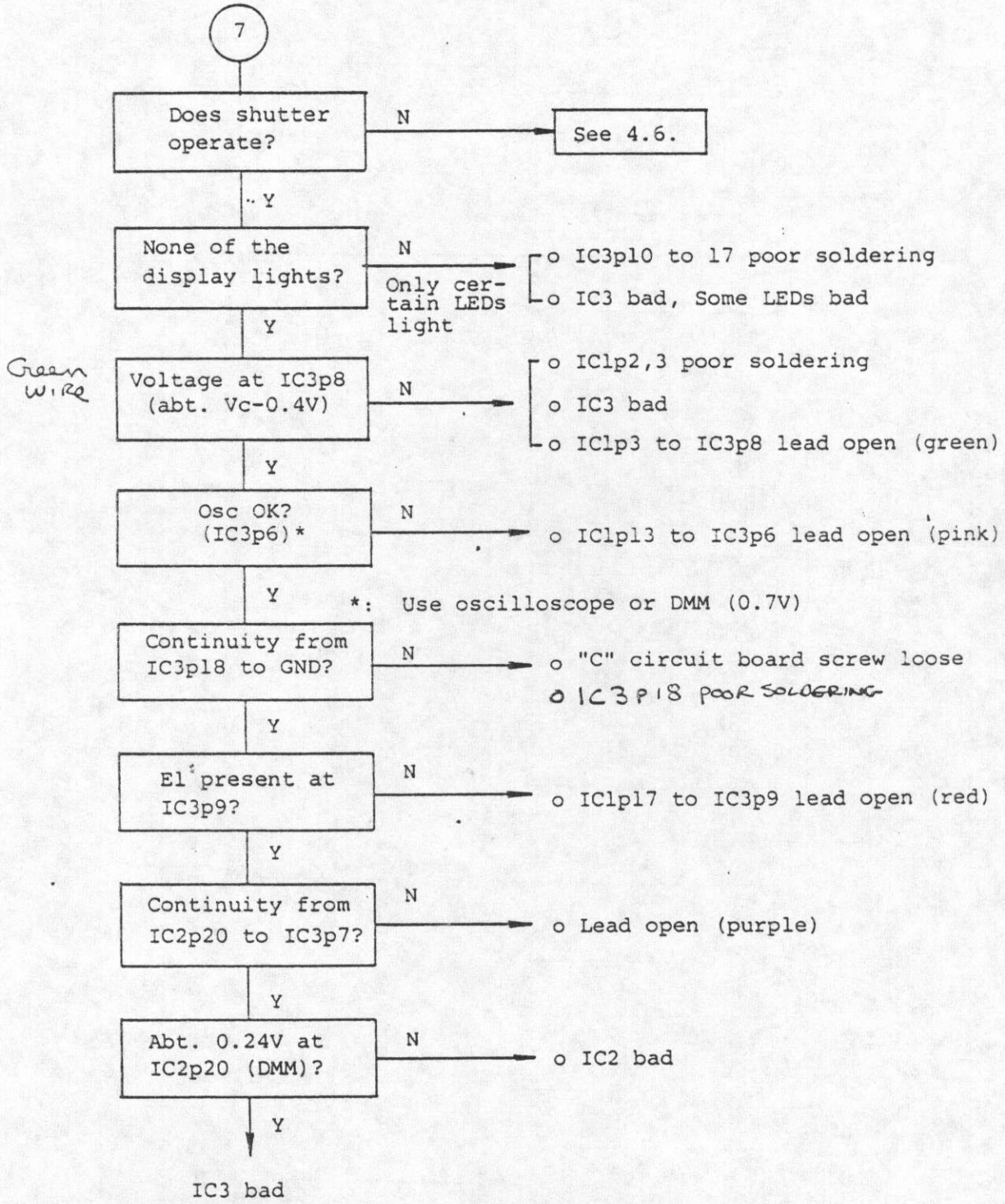
If beep is weak, Earth screw may be loose.

4.6 SHUTTER DOESN'T OPERATE

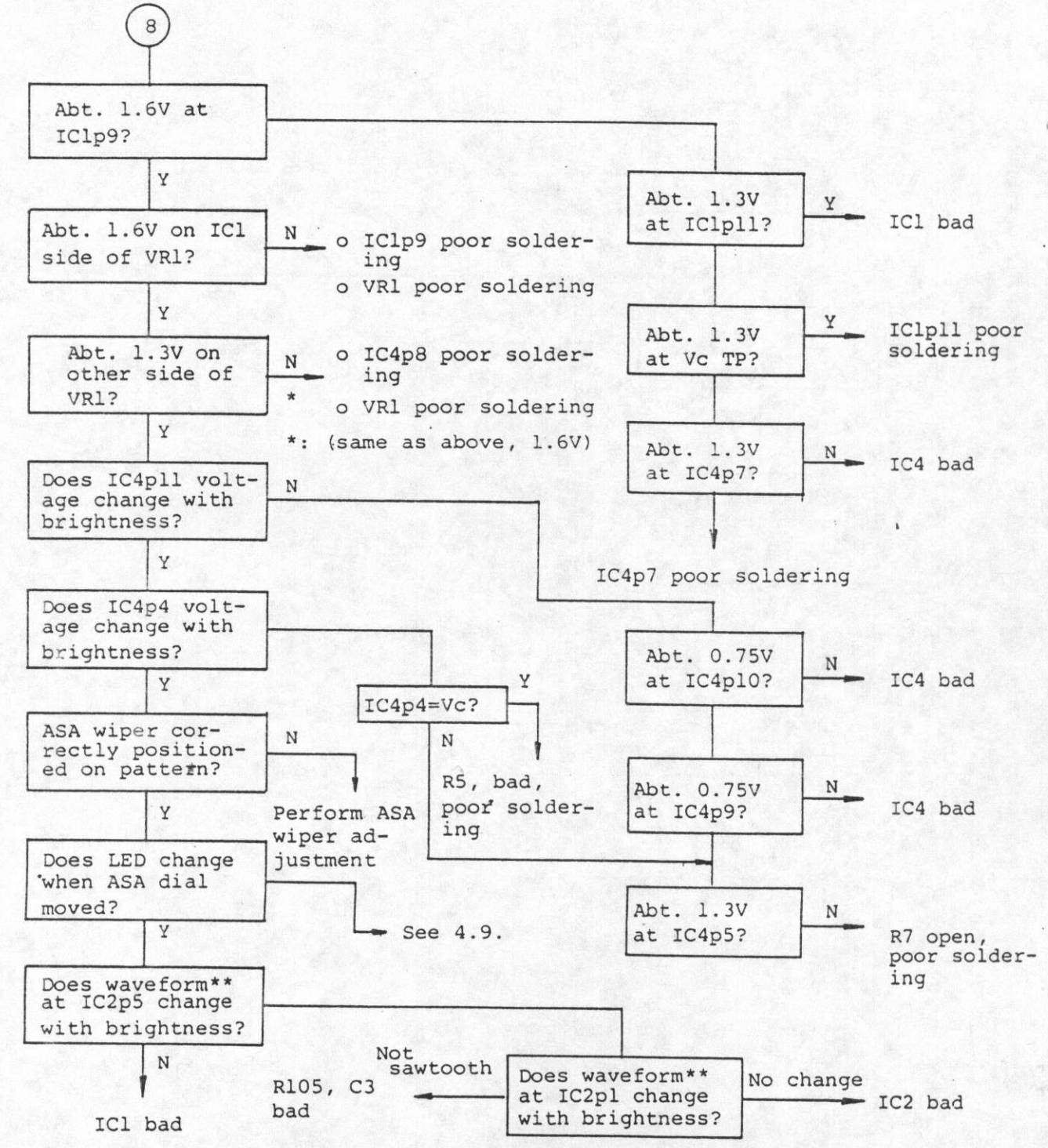


SHUTTER WONT RELEASE WITH S2, WILL RELEASE IC1 P19 TO ⏚, BEEPER (BATT & TIMER) OK - IC1 BAD

4.7 No Display

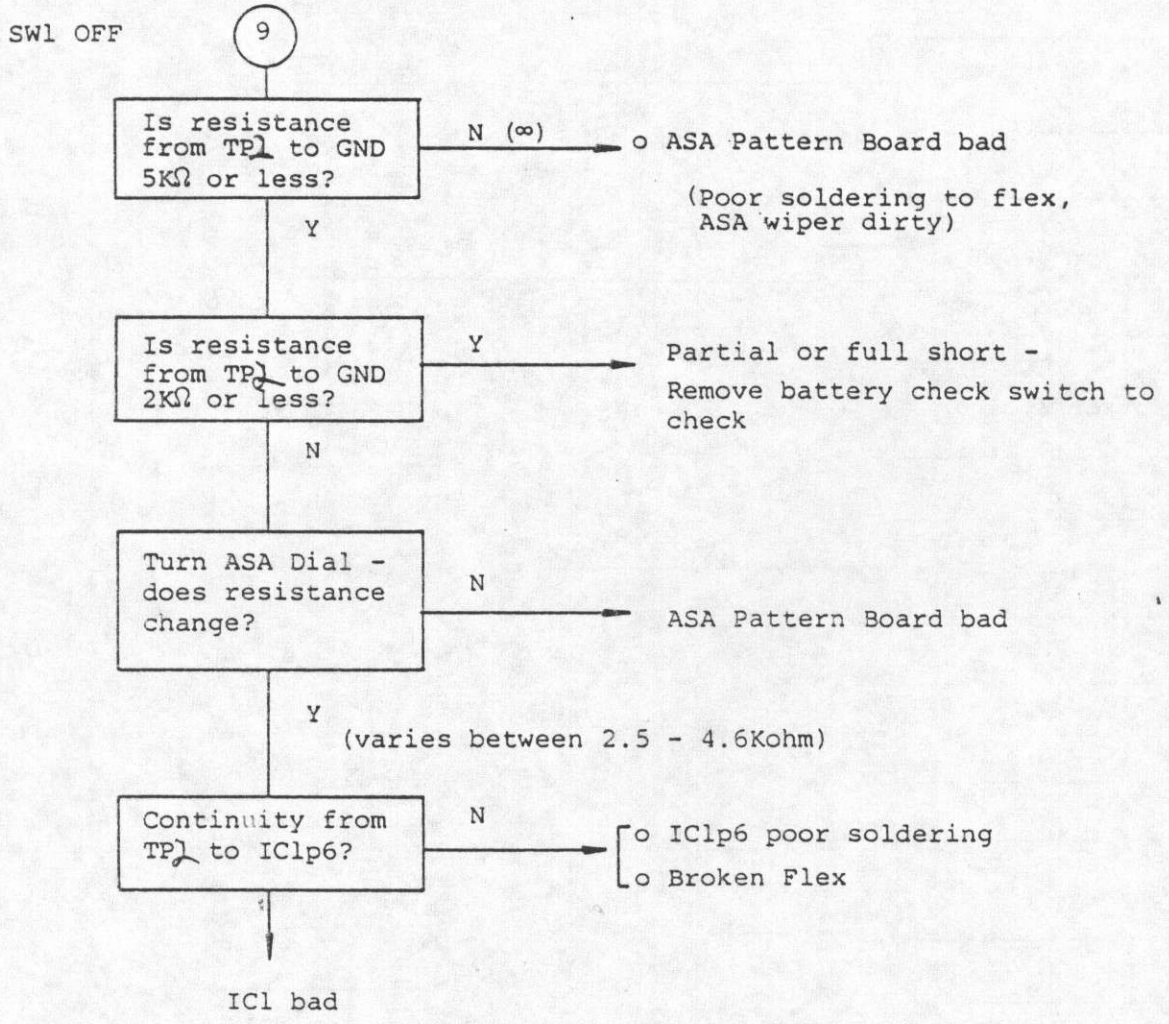


4.8 DISPLAY DOESN'T CHANGE WITH BRIGHTNESS

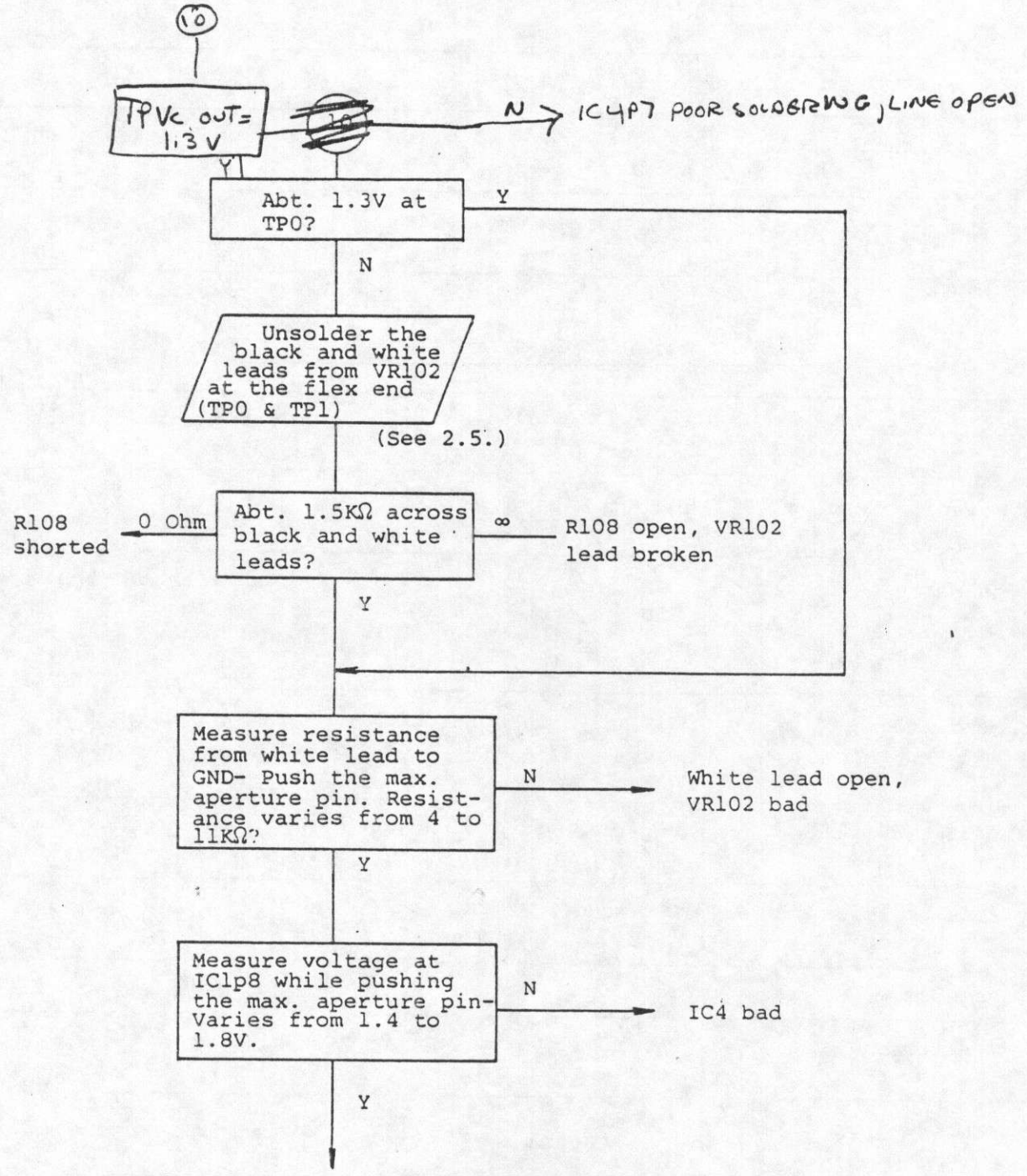


**: Use oscilloscope

4.9 DISPLAY DOESN'T WITH ASA



4.10 Maximum Aperture Correction Defective



4.11 Other Troubles

Trouble	Cause	Checkpoint
Shutter runs without opening	Mg3 shorted, Mg3 poor holding power	(If open shutter doesn't operate)
Diaphragm doesn't operate	Mg1 shorted, Mg1 poor holding power	
Shutter releases at SW1	SW2 shorted (leak current) SW1 & SW2 shorted (leak current)	Release contacts, MD terminal
Display on continuously	SW1 or SW1' shorted (leak current)	Release contact, SW1'
Shutter doesn't close on "B"	SW1 or SW1' shorted (leak current)	
Shutter operates as if set to "B" every time	SW4 shorted to GND or doesn't open	SW4 (If shutter button is released quickly, shutter speed will be 1 sec. instead of "B"
Shutter runs at end of the winding stroke	SW1 and SW2 shorted to GND (leak current), Mg2 doesn't hold	Release Contacts, MD terminal
Improper Shutter Speed	TV wiper bad, not adjusted	Any shutter speed may happen
Shutter runs at release of SW1 or B.C. button	IC2 bad	
Uneven exposure	Mg3 dirty	Clean Mg3
Shutter won't work with drive in "C" mode	SW5 misadjusted, dirty or poorly soldered	SW5
Continuous tone instead of beep	IC2 bad VC SHORT TO GND IC2 P20&P21 SHORT TOGETHER	
Camera remains in AE mode even with lens off of A	IC2 bad SW11 BAD	
Osc waveform riding a positive voltage. Valleys are too high	IC3 bad	If Osc. lead is removed from IC3, it returns to normal
"P" MARK DOESNT LIGHT "P" MARK CONTINUOUSLY LIT	IC3 BAD	