Canon

Service Manual

ENGLISH EDITION

CANON ZOOM LENS

EF80~200mm1:2.8L
(C21-9502)

EF20~35mm1:2.8L
(C21-9512)

CY8-1200-060

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TECHNICAL INFORMATION

1. Development Brief

The EF80-200mm f/2.8L lens is the first large-aperture telephoto zoom lens in the EF lens series. This L-series lens features high image quality and superior operability to meet he needs of professional photographers.

The maximum aperture remains constant during zooming, providing a constant brightness on a par with single focal length lenses, while providing coverage of all the most widely used long focal lengths: 85, 100, 105, 135, 180, and 200mm. With these features, the lens is ideal for a wide variety of applications from sports to studio.

2. Features

Optical system uses 3 lens elements made of UD glass to attain high image quality and compensate for chromatic aberrations (secondary spectrum) which often occur with large-aperture telephoto lenses.

Employs inner focusing system to realize high-speed, precision AF control.

The f/2.8 maximum aperture gives pleasing blur not obtainable with slower telephoto zooms.

Manual focusing operation features a smooth "feel" on a par with that of FD lenses.

Lens drive features quiet operation while providing high-speed, comfortable AF operation and smooth focusing with minimal shock.

3. Specifications

3-1	Format:	24 x 36mm
3-2	Focal length/aperture:	80 - 200mm; 1:2.8
3-3	Optical structure:	16 elements in 13 groups (including 3 UD glass elements: G-2, G-3, and G-9) Super spectra coating
3-4	Angle of view (at infinity):	
	Diagonal (43.2mm)	12° to 30°
	Vertical (24mm)	7° to 17°
	Horizontal (36mm)	10° to 25°
3-5	Autofocus	
	Drive system:	AFD
	Drive speed:	0.5s (lens drive speed between infinity and closest distance)
	Manual:	Manual mode set using AF/M switch; focusing by manual focusing ring.

3-6 Focus adjustment

Extension system: Internal focusing single helicoid system
Macro function: None
Range: Dual-range AF/M switch controls minimum focusing distance.
1.8m to infinity, or 3.5m to infinity

Rotation angle/
Extension amount:

Conditions	Rotation angle	Extension amount
1.8 m to infinity stop	106° 12'	14.16mm
Infinity overrun	4°00'	0.53mm

Distance scale:

6 7 8 10 12 15 20 30 50 ft (green)

1.8 2 2.5 3 4 5 7 10 20 m (gray)

Maximum magnification and field of view:

Condition	Magnification (power)		Field of view (mm)	
	WIDE	TELE	WIDE	TELE
Closest focusing distance 1.8m	0.054	0.127	224 x 338	94 x 141

3-7 Zoom

Zoom system: Rotation of zoom ring on lens barrel
Rotation angle: 70°00'
Focal length scale: 80 100 135 200

3-8 Mount

Type: Canon EF mount
Signal transfer: EOS system, with five signals as follows:
A) Lens condition
B) Lens Type
C) Photometry signal
D) Focal length
E) AF drive information

3-9 Diaphragm mechanism:

Diaphragm control: Automatic only using EMD (no manual ring)
Aperture range: f/2.8 to f/32 (no indication)
Diaphragm blades: Eight
Depth of field scale: None
Infrared Focusing Provided (focal length: 80mm)

3-10 Filter diameter, pitch 72mm; p = 0.75mm; (One filter only)

3-11	Dimensions & weight :	84mm (diameter) x 185.7mm; 1330g (1465g with tripod mount attached)
3-12	Related products	
	Tripod Mount	(Removable)
	Hood:	EW79 (Clip-on; reverse mounting possible)
	Lens cap:	E-72 (Clip-on type)
	Lens case:	LH-D23 (Hard case) (Storage: Lens w/ one filter, front and rear caps and tripod socket unit attached)
	Rear dust cap:	Common to all EF lenses

4. External Design

The basic design is the same as previous EF lenses, but the lens design also features a number of improvements in operability and "feel" in consideration of the fact that the lens will be used primarily by professionals and serious amateurs.

In detail, the design of the lens features a zoom ring and manual focusing ring positioned to provide optimal balance. The overall diameter front and rear has been held to the minimum possible, and the width of the control rings maximized from improved handling. The manual focusing ring operation is very smooth compared to other autofocusing lenses. Furthermore, the AF/M switch on the lens has been enlarged, making it easy to switch smoothly from automatic to manual focusing.

Tripod mount

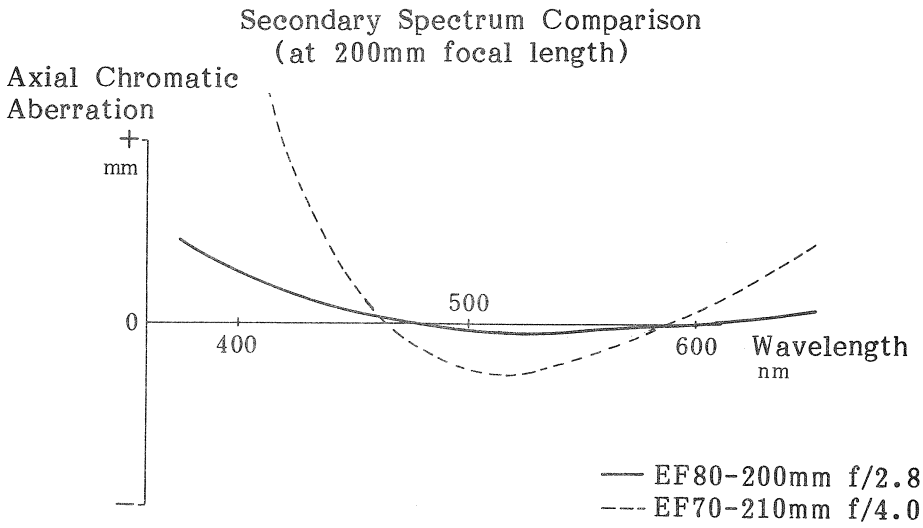
The tripod mount is designed so as to not interfere with hand-held operation, and radiusing of corners has been increased for a better aesthetic match with the body and to improve comfort.

5. Optical performance

5-1 Compensation of axial chromatic aberration

The EF 80-200mm f/2.8L contains three optimally arranged UD glass elements (G-2, G-3, and G-9) to compensate for residual aberrations such as axial chromatic aberration, and is provided with superior imaging characteristics as described below.

	Imaging characteristic
In-focus images	High contrast Faithful reproduction with no color blurring caused by axial chromatic aberrations No color shift caused by lateral chromatic aberrations
Blurred images	No color fringing in blurred images; pleasing blur effect
Viewfinder	Viewfinder image is clear and neutral



5-2 Inner focusing

1. Inner focusing system is effective in realizing high-speed AF operation, and has been employed in the EF135mm f/2.8, 200mm f/1.8, 300mm f/2.8, and 600mm f/4.0 single focal length lenses. However it is technically difficult to use in zoom lenses, and, until now, has only been used in one zoom lens, the FD150-600mm f/5.6L zoom lens. The reasons why it is difficult to use, and how the problems were overcome are:

   a. In most zoom lenses focusing is accomplished by extending the front lens group. With the inner focusing system, however, the focusing lens moves toward the rear for close distance shooting, making it difficult to compensate for distance-related changes in coma especially in zoom lenses which have complex lens construction.

   b. Autofocusing lenses, unlike manually focusing lenses, have severely limited torque making the reduction of mass in the focusing group very attractive. This can be accomplished by inner focusing, but because front lens focusing presented fewer optical problems, it was almost exclusively used in manually focusing zoom lenses giving no impetus to developing inner focusing zoom lens technology until autofocus became popular.

2. If front element focusing had have been used in the EF 80-200mm f/2.8L with its large front element, the result would have been very slow autofocusing, making it necessary for Canon to incorporate a high-speed AF inner focusing system. Using the following techniques, Canon was able to successfully design this zoom lens with inner focusing.

   a. To eliminate distance-dependent changes in coma which can result from the use of inner focusing, the glass used for the elements of the focusing doublet (G-4 and G-5) and the curve of their bonded surfaces are optimized.

   b. Good imaging characteristics throughout the entire shooting range were achieved by designing the variator, compensator, and relay systems to optimally match the focusing system.

3. The advantages of using inner focusing are as follows.

   a. High-speed AF operation: Mass of the focusing lens is about 1/3 that of the focusing group if a conventional design had been used.

   b. Improved durability, dust and moisture proofing: Components which move during focusing and zooming are completely enclosed.

   c. Quiet operation: Lens drive noise is isolated from the outside.

   d. Improved filter utilization: The filter attachment ring at the end of the lens does not rotate, facilitating the use of filters, especially circular polarization filters.

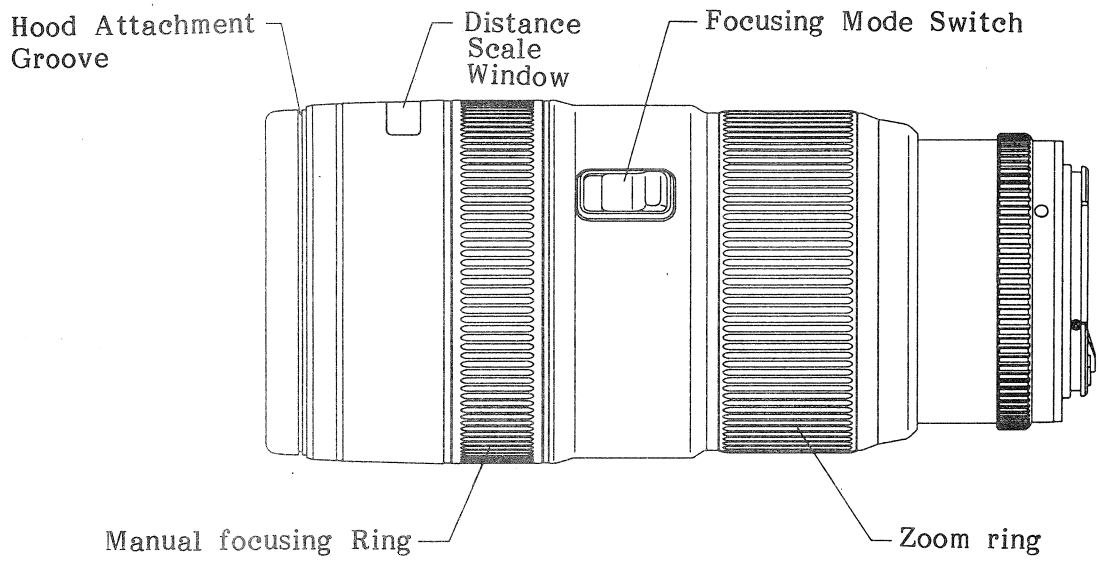
6. Mechanical Construction

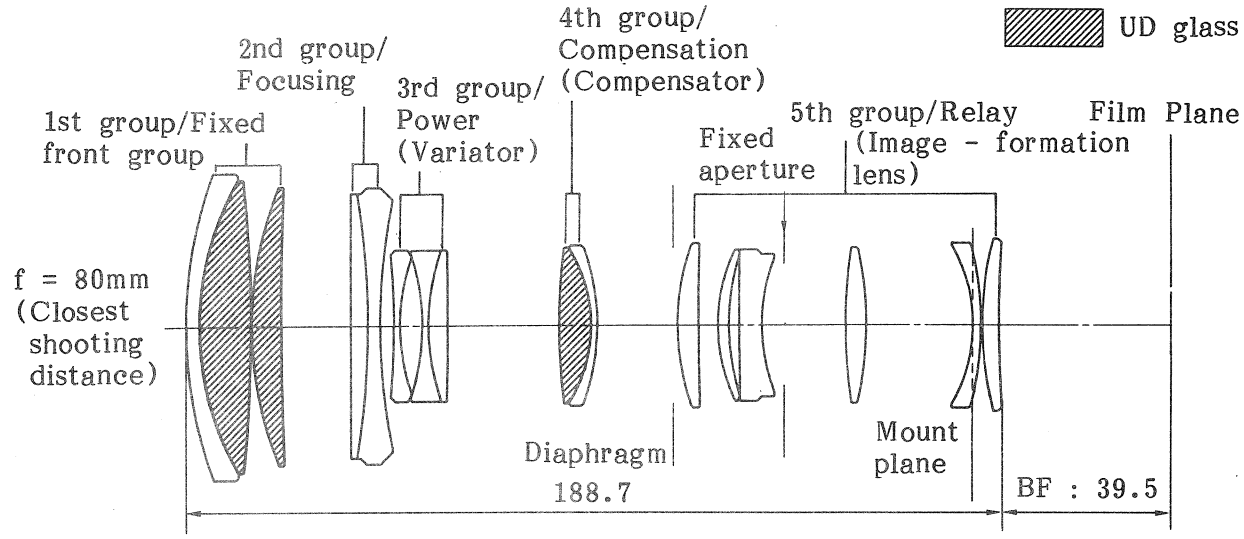
Manual focusing

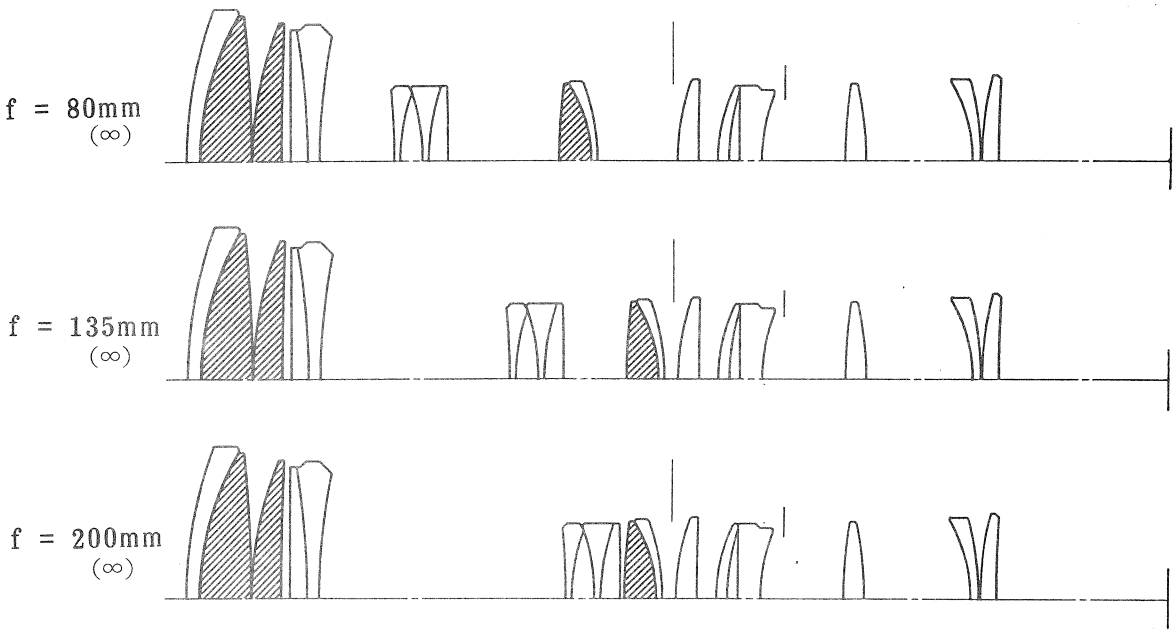
Considering the frequency of use of manual focusing by professional and advanced amateur photographers, the lens has been designed to provide a manual focusing operability on a par with FD lenses. The improvement in the manual focusing "feel" of the lens is explained by the following technical points, which have resulted from the knowledge and techniques accumulated during years of research.

	Item	Technical point and effect
(1)	Reduction in Weight of focusing lens	Due to the use of inner focusing, the weight of focusing system lens has been reduced to 1/3 that of the focusing lens used in previous lenses. This, together with the fact that the decrease in the weight of the focusing mechanism, enables the inner helicoid instead of the outer helicoid to be used for focusing movement results in light manual focusing.
(2)	Reduction in torque of the driven focusing system	The focusing drive section is supported by low -friction ball races and the backlash of the helicoid has been reduced to a level on a par with that of the EF 300mm f/2.8 L lens, resulting in light, smooth manual focusing operation.
(3)	Reduction in play of the manual focusing ring and focusing	Backlash is reduced due to 1 a change in the backlash adjustment method and gear train, 2 an improvement in the spacing precision of the gear axes, 3 efficient use of the center support of the gear axes, and 4 an increase in the precision of the bearing section, resulting in smooth focusing operation.
(4)	Reduction in difference in torque due to focusing direction	The layout of the gear train has been optimally rearranged, resulting in a reduction of the difference in torque due to focusing direction.
(5)	Reduction in torque variation during manual focusing ring operation (Reduction in choppy gear - rotation feeling during focusing	To reduce friction between gears, gear material was chosen so that gears that come into engagement with each other are made of different materials, and the surface of metal gears are processed to have a low - friction finish, resulting in smooth focusing with no choppy feeling.
(6)	Modification of manual focusing torque	Lubricant was selected to set the focusing torque equal to that of the corresponding FD lens.
(7)	Improvement in overall feeling of quality	In addition to (1) through (6), the engagement backlash of the manual focusing ring has been minimized by fabricating the focusing ring and the associated parts out of metal and by employing a sufficient length of engagement. Also, due to consideration over details such as including a thrust backlash adjustment of the manual focusing ring, the movement of the focusing lens is transmitted smoothly and directly to the manual focusing ring.

7. Controls and Optical Schematic





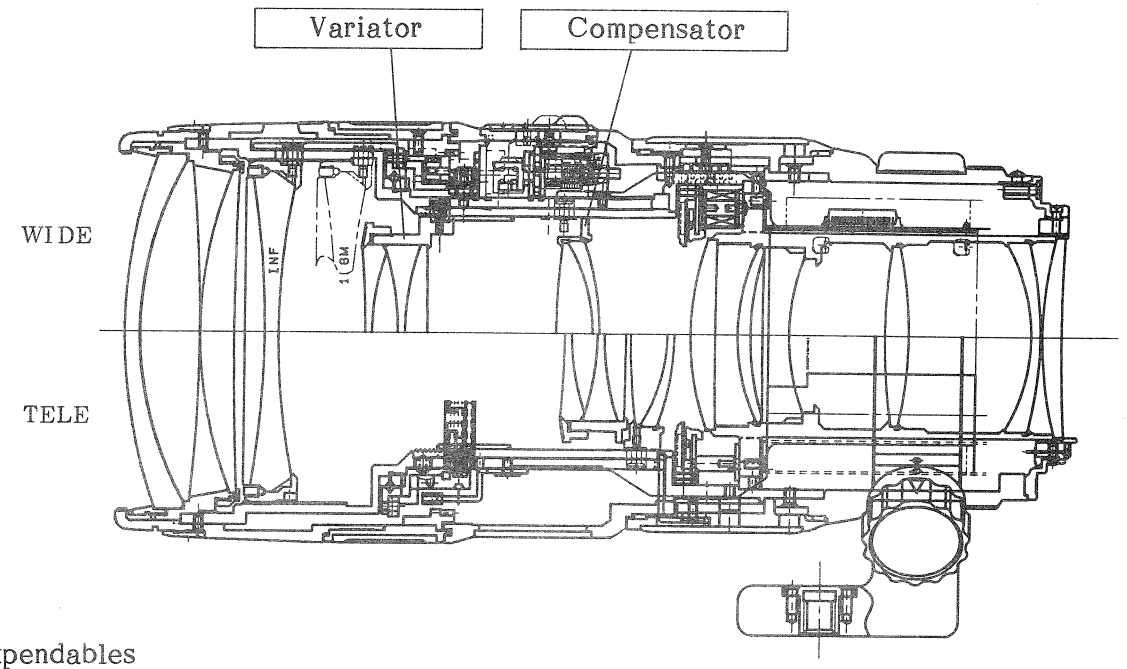


Special Optical Adjustments;

Centering	Yes	(No)	
Tilt	(Yes)	(No)	When zoom/focusing unit changed or user request

<!!> The tilt adjustment is accomplished with eccentric collars on the variator lens barrel. This unit is part of the special pre-adjusted service part, Zoom/Focus Unit. The variator and compensator barrels are aligned to within 1° 5'. Normally adjustment is not necessary, but check procedures are included to insure than telephoto standards can be maintained.

Lens elements G-1 through G-10 (compensator) can be removed from the front.

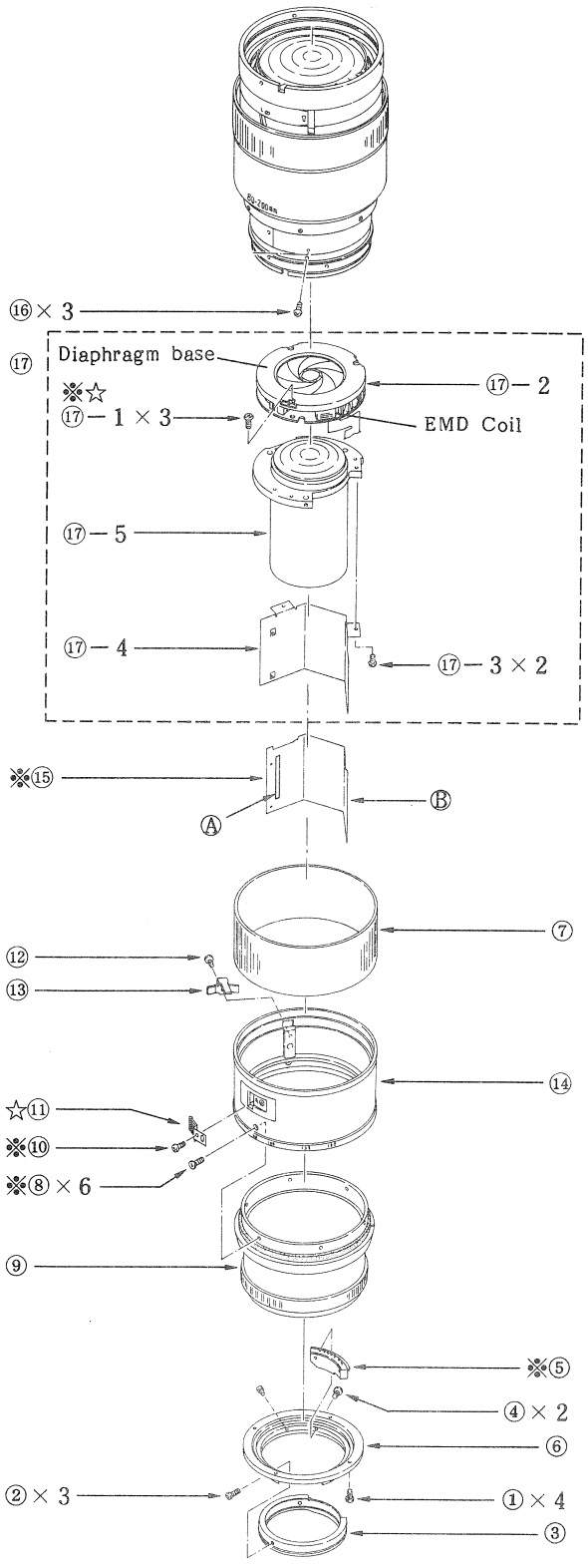


Expendables

Part No.	Name	Remarks	Plastic Safe ?
- ADHESIVES -			
CY4-9102	Acetate Cloth Tape	For holding flex	Yes
CY4-9303	Double-faced tape	For holding flex	Yes
CY9-8002	Bond G-103	For manual focus rubber ring	Yes
CY9-8008	Arontite L	For staking screw in metal	No
CY9-8009	Arontite R	For staking mount stopper screws	No
CY9-8011	Screw-lock	For staking screws in plastic, etc.	Yes
- LUBRICANTS -			
CY9-8045	GE-C4	Cam & Guide Barrel grooves, helicoid	Yes
CY9-8086	FF-10	Cam and Guide mating surfaces	Yes
CY9-8087	Lozoid 6308/31-F	Zoom Ring	Yes
CY9-8089	Elt-oil 190*	Zoom Flex Contact Pattern	Yes

*: Formerly called Electro-oil 190.

1. EMD UNIT REMOVAL



Dissembly

(5); The lead wire needs not be unsoldered unless the Contact Block is replaced (it is removed with the main flex).

(8); Remove three of the fixed barrel screws after setting the zoom ring to 80mm, and then turn it further to remove the reminding three screws.

(10); To facilitate adjustment procedure, scribe (11) position on (14) before removing the Zoom Brush attaching screw.

(15); When removing the Main Flex Unit, unsolder (A) and (B) comb connectors.

(17); Before removing the EMD Unit mounting screws, scribe the position on Relay Barrel Unit. Shift the protruded part of EMD coil to left and close the diaphragm to remove the three EMD Unit mounting screws.

Assembly

If the EMD Unit (17)-2 is not attached properly to (17)-5, the aperture will malfunction.

If you forgot to scribe the positions before disassembly, install screws (17)-1 x 3 temporarily and shake (17)-2 to align it and then tighten (17)-1.

If the position on the EMD Unit is not correct, the position of (17) in the barrel when it is installed and the screws have not yet been installed will be unstable.

(11); Zoom Brush attaching position is shown in figure 1, but, it actually is not visible, so refer to figure 2.

Fig. 1

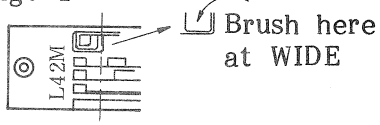
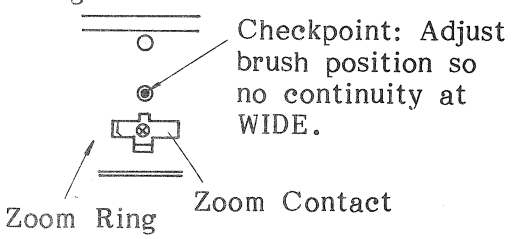
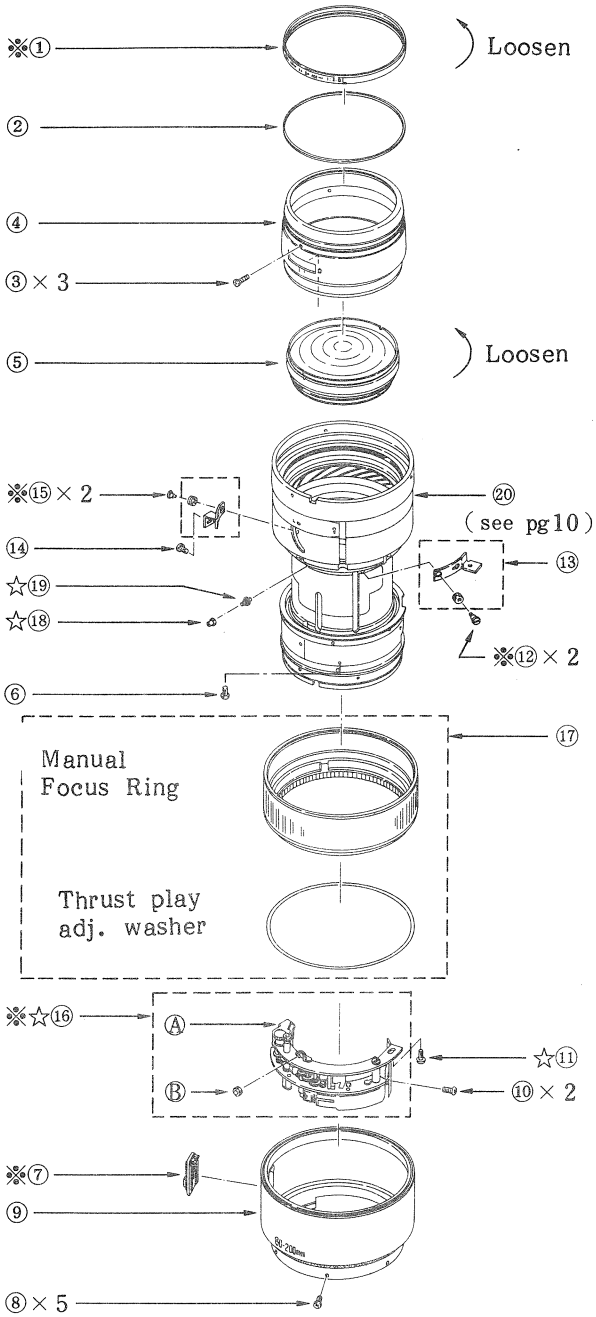


Fig 2



2. AFD UNIT REMOVAL



Dissembly

(1); To remove the Name Ring, run Fronsolve in and turn CCW.

<!!> (1), (3) and (4) are a single service part, Window Sleeve, to insure correct positioning of the name ring. When the Ring is attached, the letters "EF" should be aligned with the focusing index.

(7); To remove the AM Switch Unit, set it to 3.5m - inf., insert a screwdriver blade and pry it up.

(12), (15); When removing the AFD Unit mounting plate screw. To prevent the deformation of the Manual Focus Ring Gear, tilt it as necessary.

(16); Uncouple the AM Switch actuator at [A]. Tilt the AFD unit at [B] to clear the pin and remove the unit.

Assembly

(19); When installing the backlash adjustment shaft, apply Arontite R to the threads to prevent the adjustment nut (18) from loosening during operation.

(18); The nut is used to adjust backlash between AFD Unit Gear and the Manual Focus Ring Gear. When removing AFD Unit, turn the nut in clockwise to tighter it.
After adjustment, apply Bond G103.

Backlash Adjustment

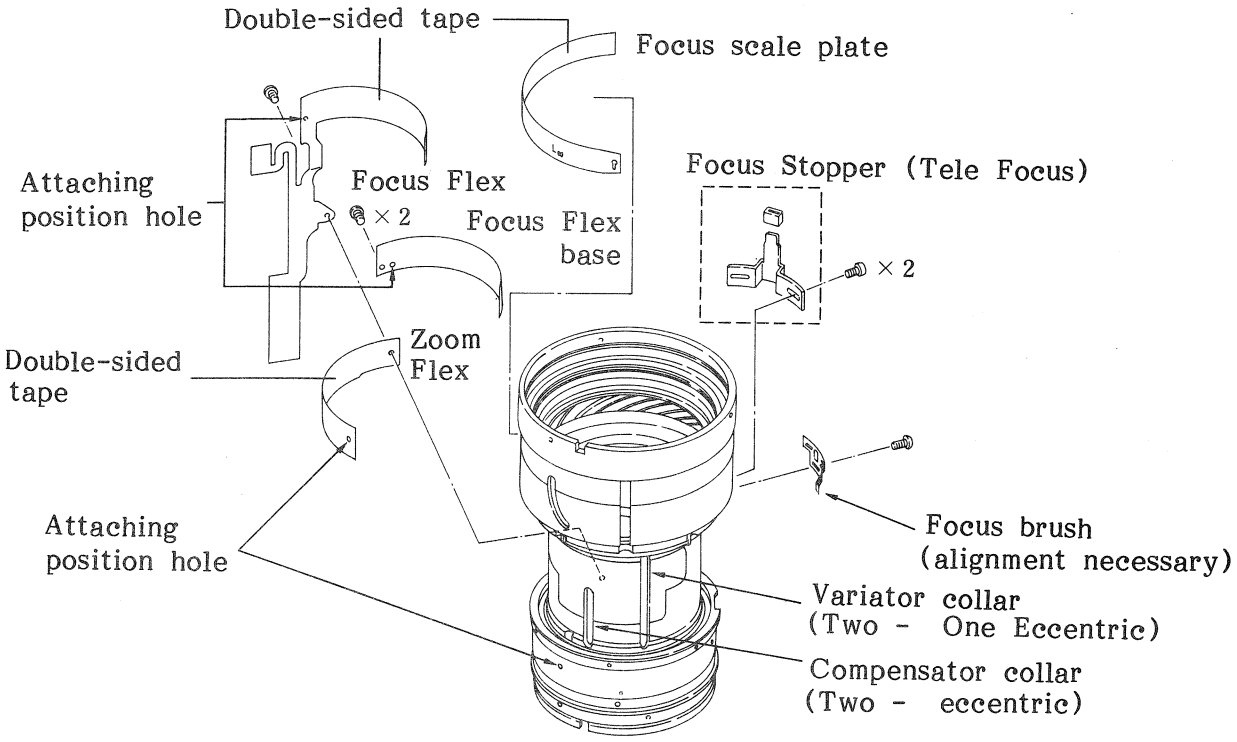
1. Assemble AFD Unit (16) and attach (11) through (15). Lightly tighten (11).
2. Attach (1) - (5), and check that the lens is set to AF.
3. Turn the nut (18) CCW, until the Manual drive gear of AFD Unit couples with the manual focus ring gear.
4. Pushing slightly the AFD Unit screw, which has been installed temporaly, tighten it completely.

Backlash Check

a. Manual Focus Ring turns smoothly.

b. When Focus Mode Switch is moved, the gear shaft which connects tothe switch changes over.

3. FOCUS STOPPER, FOCUS BRUSH REMOVAL



: Zoom Focus Unit

DISASSEMBLY NOTES

The Zoomn/Focus Unit, which is pre-adjusted, must not be disassembled, especially the varaitor and compensator collars.

Even when the pre-adjusted unit is used, there is a slight possibility that the resolution may not be satisfactory at Tele. If a consumer complains of uneven focus, readjust the tilt with the variator eccentric collars.

ASSEMBLY NOTES

The Focus Stopper, Focusing Scale and Focus Brush all must be adjusted when focus adjustment is necessary and when the Zoom/Focus Unit is replaced.

1. Assemble the lewns except for (1), (3), (4), (7), (8), (9), on the preceding page, and (3), (7), (10), and (11), in the EMD Removal.

2. For details, refer to the focus adjustment.

Mechanical and Optical Adjustments

Adjustment	Objective	Test Equipment	Location	Page
Zoom Brush	Zoom Position Info.	Ammeter	Zoom Brush	9
Backlash	AF. M Focus Proper Operation.	-	AFD Unit	10
Focus (Wide)	Infinity Focus Setting	800mm or 600mm Collimator & EOS camera	Lens Mount & Focus Washers	13
Focus (Tele)	as above	as above	Distance Scale Focus Stopper	13
Focus Brush	Focus zone	Magnifier	Focus Brush	13
Tilt	Even resolution	Lens Projector	Variator eccentric collar	14

Electrical Adjustments

Adjustment	Objective	Test Equipment	Location	Page
Best Focus	Align sensor focus with lens focus	-	ADJ-0, ADJ-1 ADJ-2, ADJ-3	15

1. FOCUS and FOCUS BRUSH POSITION ADJUSTMENT

A. 800mm Lens Focus Collimator Method
Install the EOS mount adaptor on the collimator and check several lenses from stock for an average. Adjust lenses to that average.

B. Camera Method
Use a known-good camera with a type B (split-image) screen and a magnifier. Check focus on a collimator or with an actual target at least $100f^2$ distant.

<!!> Checks and adjustment must be performed at wide angle first.

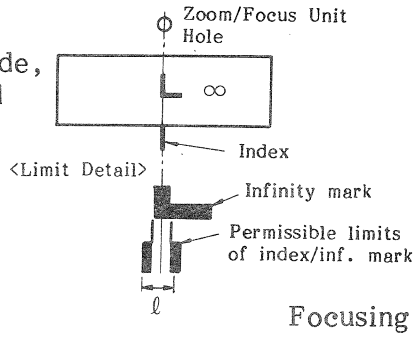
Purpose: To adjust infinity focus

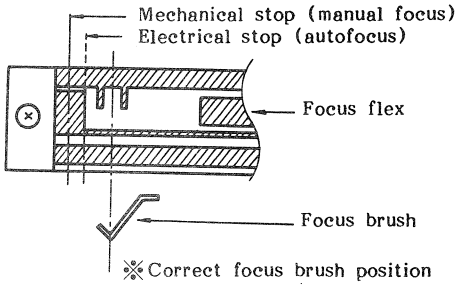
Tools:

800mm Lens Focus Collimator,
or shop-standard camera body
with B screen and magnifier
600mm collimator, or infinity target.

Standard:

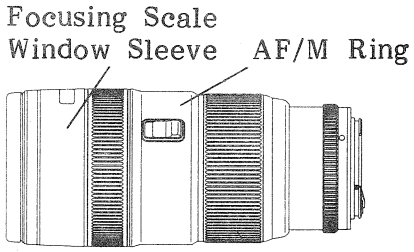
At both Tele and Wide, the infinity mark and index, and the focus brush should be positioned as shown below.





Preparation:

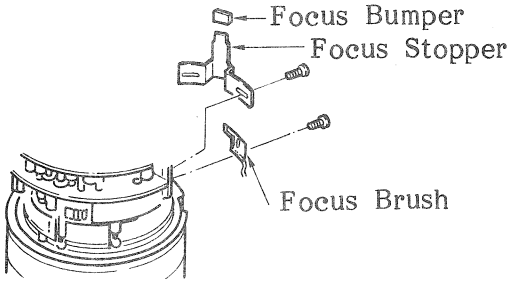
Remove the window sleeve and the AF/M ring. For the wide adjustment, the lens mount must also be removed.



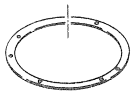
Adjustment:

<Wide Adjustment>
Special thin service mounts and focus washers are used. Do not use washers exceeding a total thickness of 0.07mm (Using more may cause a visible gap.)

<Tele Adjustment>
(1) With setting the lens to infinity side, attach the focusing scale so as to align the normal temperature infinity mark with the index.
(2) Set the infinity focus stopper and tighten the screw.



Service Focus Washers



Service Use Only.

A	SIZE
0.02mm	(002)
0.05mm	(005)

Service Mounts

A	SIZE	A	SIZE
1.9 mm	(190)	2.4 mm	(240)
2.0 mm	(200)	2.5 mm	(250)
2.1 mm	(210)	2.6 mm	(260)
2.2 mm	(220)	2.7 mm	(270)
2.3 mm	(230)		

2. OPTICAL TILT ADJUSTMENT

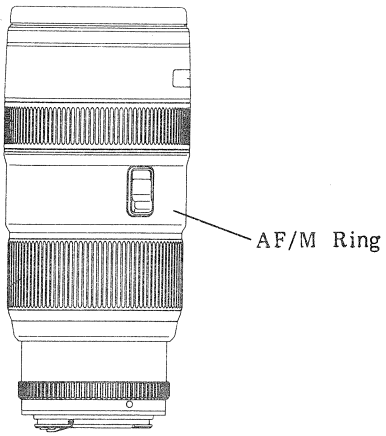
This adjustment is necessary only for claims of irregular resolution when the Zoom/Focus Unit is replaced.

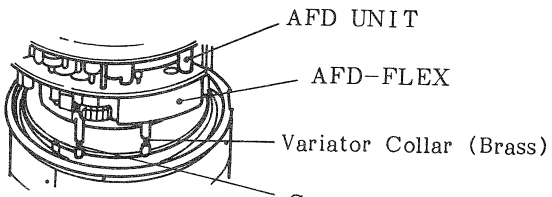
This adjustment requires a lens projector. If one is not available, this adjustment is impossible.

Purpose: To balance the resolution across the field.

Equipment: Lens projector

Preparation: Remove the AF/M Ring for access to the Variator eccentric collars.





※ Interior with AF/M Ring removed

Adjustment:

1. Mount the lens on the lens projector and check the resolution.
2. If the resolution is sub-standard, adjust the two variator eccentric collars.

STANDARD:

If centering is correct resolution will be good, but we recommend checking resolution as a final check.

Resolution Table

Image Height (mm)	0	4	8	12	16	20
S	100	100	100	100	100	40
80mm						
M		100	63	63	40	25
S	100	100	100	63	63	40
135mm						
M		100	63	40	40	25
S	100	100	100	63	63	40
200mm						
M		63	40	40	40	40

3. BEST FOCUS ADJUSTMENT

Purpose: To bring the automatic focus point as close as possible to the lens' actual best focus point buy rewriting the ROM.

Notes: The factory ROM adjustment tool is much too costly for field use, so service will use the following procedures instead.

1. This adjustment is required only if the Main Flex Unit is replaced. When the Main Flex is replaced, check the AF-ADJ pads on the old flex and bridge the pads on the new flex in the same way.

2. If a customer complains of poor resolution, adjust as outlined below. If the customer uses a Cross-BASIS equipped camera, use the customer's camera or the same type. All EOS's have horizontal sensors. The EOS-1 also has a vertical sensor for f/2.8 or faster lenses, so data for both sensor is necessary. (Since the sensors are located in different zones, the exact best focus point will be slightly different).

Adjustments:

No. 1. If front defocus, increase positive correction. If rear defocus, increase negative correction.

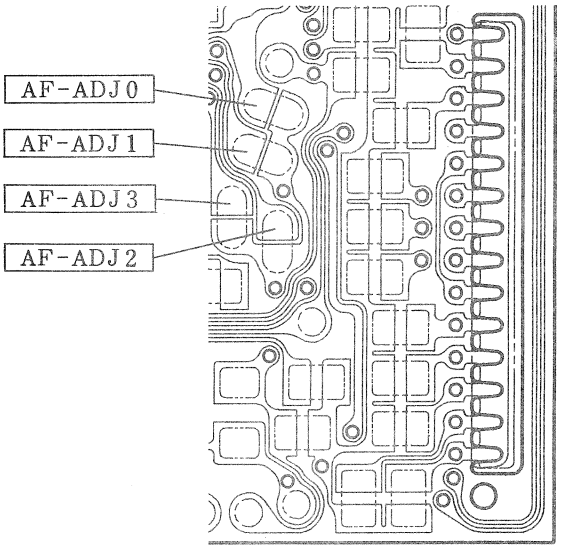
No. 2. Make photographic test with the H-BASIS pads bridged in all four possible combinations. Make five or six negatives for each combination. Repeat for the V-BASIS sensor pads. Examine the negatives closely to determine which combination is best.

Test Conditions:

Distance: 10m
Target: Casual Resolution Chart* with centered AF Standard Bar Chart
Settings: Maximum aperture and focal length
Focusing: Return lens to infinity after each exposure and autofocus on bar chart.
Camera: EOS with Aperture Priority (AV) Mode

*: A "Casual Resolution Chart" is a flat chart made up of newsprint, photographs, etc. Most service facilities have such a chart.

Best Focus Correction



	Horiz. Sensor		Vert. Sensor	
Correction	AF-ADJ 0	AF-ADJ 1	AF-ADJ 2	AF-ADJ 3
$-3/4F\delta$	1	0	1	0
$-1/4F\delta$	0	0	0	0
$+1/4F\delta$	1	1	1	1
$+3/4F\delta$	0	1	0	1

F : f/No. 0: Closed
δ :circle of confusion 1: Open

ELECTRIC CIRCUIT

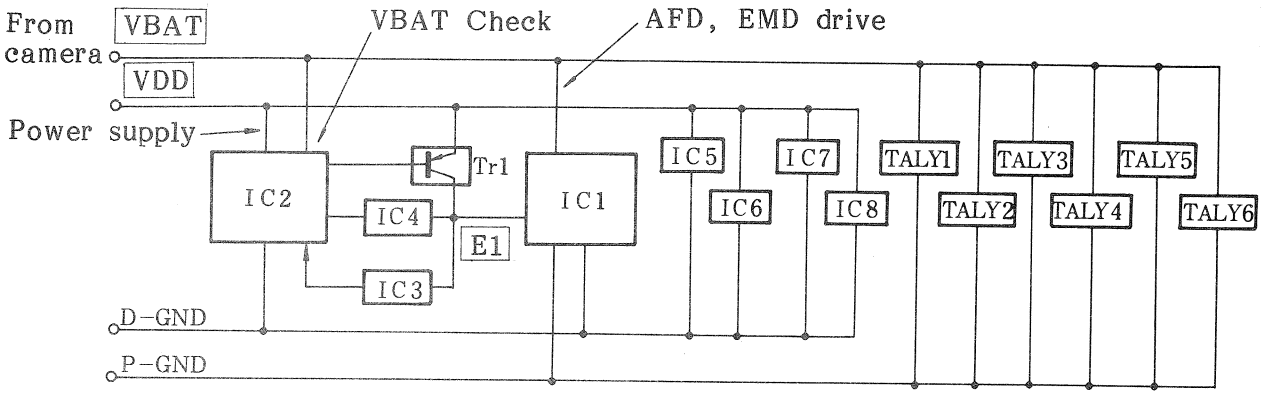
The electronics are basically the same as previous AFD type EF lens, but improved for use on several small-lot 'niche' lens. The operational sequence explained here is based on the 80-200mm. The 20-35mm differs only as follows:

A. Transistor Array (TALY) construction detail is different.
B. The 20-35mm has a single autofocus range.
C. The 80-200mm uses photo interrupter for AFD detection, while the 20-35mm uses a photo reflector.

1. Power Supply

The following voltages are used in the lens:

1) VDD supplied from camera (5.5 V)
2) VBAT supplied from camera (6.0 V)
3) E1 generated within the lens (5 V)



2. Switch Functions and Nomenclature

SW Nomenclature	Function	Note			
			Manual	AF	Limit
FOCUS MODE SW	Dual-range AF/M switch	1.8- Inf.	1	0	0
		3.5- Inf.	1	0	1
		M	0	1	1

			AF ZOOM	INF	Near
FOCUS SW	Stop position selector (ganged with Focus Mode)	Near	0	1	0
		3.5 m	0	1	1
		Infinity	1	0	1

		Focal Length		ZOOM				
ZOOM SW	Focal distance signal input (32 bit input)	80-200	20-35	4	3	2	1	0
		200 mm	35 mm	1	1	1	1	1
		135 mm	30 mm	1	0	1	1	1
		120 mm	28 mm	0	0	1	0	1
		100 mm	25 mm	0	1	0	1	0
		97 mm	24 mm	0	1	0	0	0
		80 mm	20 mm	0	1	1	1	1

3. Electrical Components

	Symbol	Function
	IC2	Camera communication, C-IC control, Switches input
	IC1	EMD AFD control
	IC4	C2 A/D convertor reference voltage
	IC3	VDD voltage detect
	IC6	Communication start switches
	IC7	
	IC5	
	IC8	
	OSC	CPU charging
1	TALY1	EMD drive
1	TALY2	
1	TALY3	AFD drive
1	TALY4	
1	TALY5	
1	TALY6	
	Tr1	E1 generation
1	Tr2	AFD photo interrupter output
	ZD1	LCLK line protection
	ZD2	DLC, DCL line protection
	C1	Noise prevention (VBAT-PGND)
	C2	Noise prevention (VDD-DGND)
	C3	IC3 output stabilizer
	C4	Tr1 output stabilizer
	C5	Noise prevention
	R1	DLC line pull up
	R2	LCLK line pull up
	R3	PC1 photo sensor pull up
	R4	VCAT voltage divider
	R5	
	R6	MPU reset line pull up
	R7	OSC charging
1	R10	AFD photo interrupter LED current restrict
	R11	SYNC line pull up
1	R12	Tr2 bias
1	R13	INT line pull up
	R14	Pull up

	Symbol	Function
	R15	Pull up
	R16	
	R17	
	R18	
	R19	
	R20	
	R21	
	R22	
	R23	
	R24	
	R25	
1	R26	
1	R27	
	PC1	Aperture open detect
1	PC2	AFD drive detect
2	TALY1	AFD drive
2	TALY2	
2	TALY3	
2	TALY4	
	TALY5	EMD drive
2	TALY6	
2	TALY7	
2	TALY8	
2	PC2	AFD drive detect
2	C6	AFD photo reflector output noise prevention
2	VR1	AFD photo reflector output changeable volume
2	R12	EMD photo reflector LED current limitter
2	R28	AFD photo reflector LED current limitter

Notes:

1: exclusive for 80-200 mm,
2: exclusive for 20-35 mm,
No marks: common components

4. IC Pin Assignments

C P U

PIN No.		I/O	A/D	voltage	Function	"L" "H"
5	INO	I	A	VBAT	VBAT check	Adj. lens speed
6	P-GND	V		0	VBAT check gnd.	
7	VREF	I	D	3V	IC2 A/D convertor reference voltage	
8	VDD	V		VDD	IC2 power supply	
9	CLK	O	D	0-VDD	IC1 comm. clock	
10	DB	I/O	D	0-VDD	IC1 data comm.	
11	CE	O	D	0-VDD	IC1 comm. control	
12	PSM	O	D	0-VDD	EMD control pulse	
13	DLC	O	D	0-VDD	Comm lens to camera	
14	INT	I	D	0-E1		
15	LCLK	I/O	D	0-VDD	Communication clock	
18	LCLK	I	D	0-VDD	Communication clock	
19	SOUT/IC8	O	D	0-VDD	Comm. start request	
20	DCL	O	D	0-VDD	Comm. camera to lens	
21	SYNC OUT	O	D	0-VDD	AFD reference clock	
22	LCLK	I/O	D	0-VDD	Communication clock	
23	E1ON	O	D	0-VDD	E1 generation	Generated Off
24	COM1	O	D	0-VDD	Common terminal	
25	INT	I	D	0-E1	AFD PC input	
26	DGND	V		0	Digital ground	
27	RESET	I	D	0-VDD	IC2 reset	
28	XIN	V			}	
29	XOUT	V			}	
30	DGND	V		0	Digital ground	
35	AF-ADJ3				} Vert. } Best	
36	AF-ADJ2				} Vert. } Best	
37	AF-ADJ1				} Horiz. } Focus Adjustment	
38	AF-ADJ0				} Horiz. } Focus Adjustment	
39	ZOOM0	I	D	0-VDD	} ZOOM SW (See "Switch Functions & Nomenclature")	
40	ZOOM1	I	D	0-VDD	} ZOOM SW (See "Switch Functions & Nomenclature")	
41	ZOOM2	I	D	0-VDD	} ZOOM SW (See "Switch Functions & Nomenclature")	
42	ZOOM3	I	D	0-VDD	} ZOOM SW (See "Switch Functions & Nomenclature")	
43	ZOOM4	I	D	0-VDD	} ZOOM SW (See "Switch Functions & Nomenclature")	
44	IC6	O	D		Comm start switch	
45	AF	I	D	0-VDD	} Focus Mode SW (See "Switch Functions & Nomenclature")	
46	MANUAL	I	D	0-VDD	} Focus Mode SW (See "Switch Functions & Nomenclature")	
47	A/M	I	D	0-VDD	} Focus Mode SW (See "Switch Functions & Nomenclature")	
48	NEAR-SW	I	D	0-VDD	} Focus SW ("Switch Functions & Nomenclature)	
49	INF-SW	I	D	0-VDD	} Focus SW ("Switch Functions & Nomenclature)	
74	EMDPC	I			EMD photo interruptor input	Max. aperture
75	VDD	V		VDD		
76	AFZOOM SW	I	D	0-VDD	Focus Switch N/A for 20-35mm	
77	LIMIT SW	I	D	0-VDD	Focus Mode SW N/A for 20-35mm	

C-IC

PIN No.	Pin Name	I/O	A/D	voltage	Function	"L"	"H"
1	DGND	V		0	Digital ground		
2	E1	V		E1	IC1 power supply		
3	SYNC				AFD reference clock		
4	N.C						
5	PSM				EMD control pulse		
7	/CE				IC1 & IC2 comm.		
8	DB				IC2 data comm.		
9	CLK				IC2 comm. clock		
10	SM8	O	D	0-E1			
11	SM5	O	D	0-E1			
12	SM6	O	D	0-E1			
13	SM7	O	D	0-E1	EMD driving transistor		
14	SM4	O	D	0-E1	array drive		
15	SM1	O	D	0-E1			
16	SM2	O	D	0-E1			
17	SM3	O	D	0-E1			
18	PGND	V		0	Power ground		
25	VBAT	V		VBAT			
26	M24	O	D	0-E1			
27	M21	O	D	0-E1			
28	M22	O	D	0-E1	AFD driving		
29	M23	O	D	0-E1	transistor array		
30	M14	O	D	0-E1	drive		
31	M11	O	D	0-E1			
32	M12	O	D	0-E1			
33	M13	O	D	0-E1			
34	HS11	I	A	0.9-1.5V	AFD Hall		
35	HS12	I	A	0.9-1.5V	elements		
36	HS21	I	A	0.9-1.5V	input		
37	HS22	I	A	0.9-1.5V			
38	KVC	V		1.2V	Hall elements ref. voltage		
41	LED-ADJ				LED current adj.		
43	LED	O	D	0-4.0V	LED emitter		
* 44		I	A	50mVp-p	AFD PC output		
* 6	PULSE	O	D	0-E1	AFD PC output		
* 40	LED-ADJ	I	A		LED current adj.		

* = Used only in 20-35mm.

5. ELECTRONIC CIRCUIT

Lens Mounted on Camera

(1) When the lens in mounted, VDD is applied to the lens MPU activating clock oscillator (OSC). The IC-2 is reset by the voltage sensor IC (IC-3). After initial communications, the PMU goes into HALT mode.

(2) The camera requests lens data from the lens through DCL line.

(3) When camera and lens communicate, the lens MPU applies a low to the E1ON (p23), generating E1.

(4) E1 is input to IC1 and IC4. IC4 outputs A/D convertor reference voltage VREF of 3V.

(5) The IC2 sends the data through DCL line, and the camera determines conditions (Diaphragm fully open, focal distance)

When the diaphragm is not open;
the camera sends diaphragm (EMD) drive command to the lens.
If the camera determines the diaphragm is still not fully open, the camera decides that the diaphragm is inoperative and initiates the BC warning signal when SW2 is closed.

Focus Mode Switch Operation

Normally IC2 is kept in inhibit mode. When Focus Mode SW is operated, lens CPU turns DLC to "low" regardless of 1LCLK, and sends communication request (WAKE UP), activating the camera DC/DC convertor. After this, procedure in the same as above from step 2.

Camera SW1 On

When camera SW1 goes on, the camera DC/DC convertor turns on so the lens CPU (MPU) receives VDD, and VBAT (for DC/DC convertor). Lens condition is detected by repeating same operation as above (2) to (5).

AFD drive

(7) The camera sends focus drive commands to the lens IC-2. With this, IC23 starts AFD drive operations.

(8) IC2 through the LCLK, DLC, and DLC lines, sends the AFD control and photo interrupter LED lighting commands to C-IC. (80-200mm lens lights both AFD and EMD LED, while 20-35mm lights only AFD LED.)

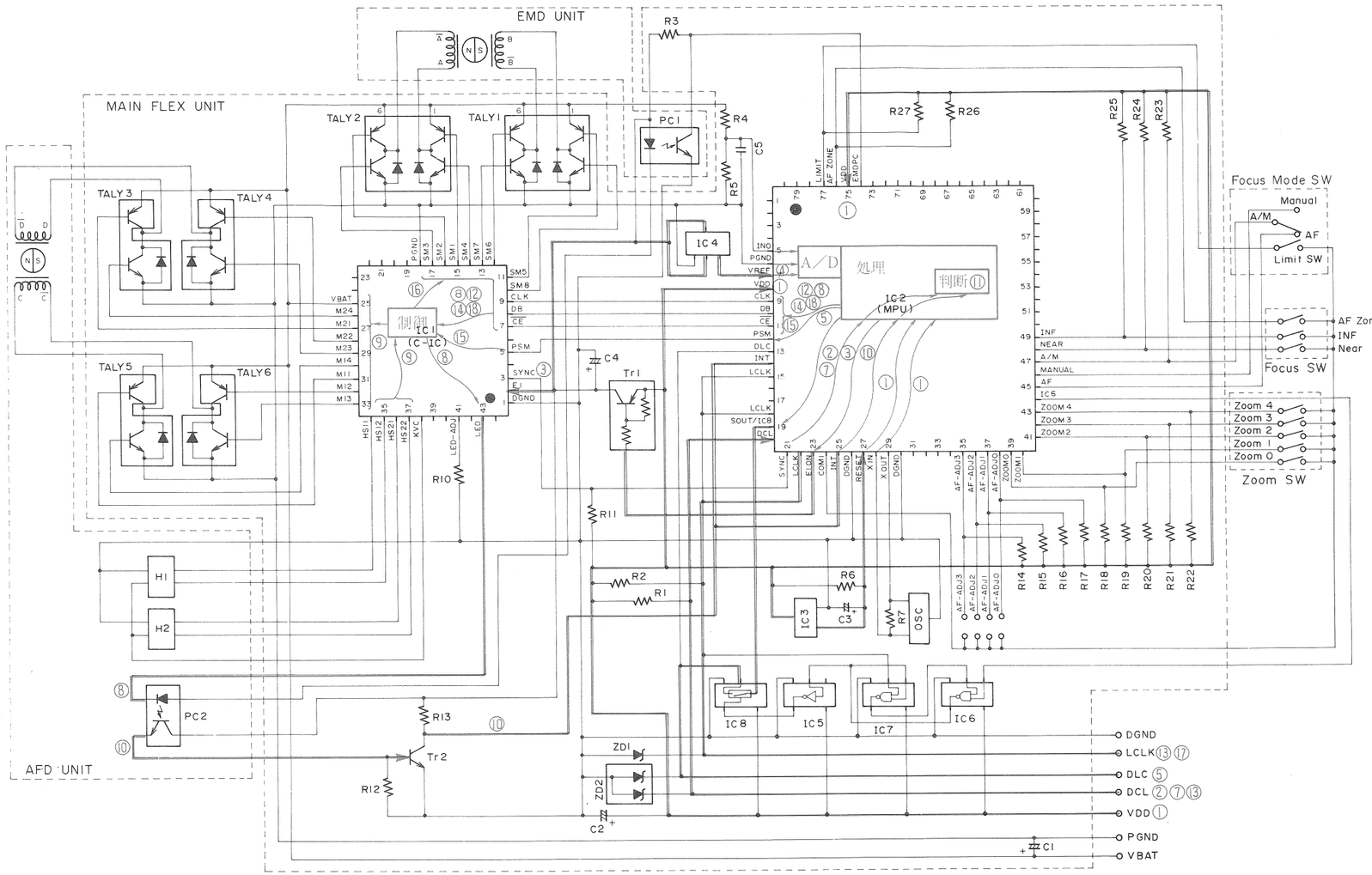
(9) IC-1 monitors the Hall elements conditions and sets the current direction of TALY3 through TALY6 to drive the focusing.

(10) With AFD drive, PC2 signal pulse is input to IC2 (INT, p14, 25). (20-35mm differs)

(11) IC2 repeats step 9 to step 11 until PC2 input and focusing drive count come to same point.

(12) IC2 sends AFD stop command to IC1, braking AFD.

Diaphragm (EMD) Drive



(13) With AF "In-Focus" (or manual mode) when SW2 is pressed, camera sends the aperture drive signal through DCL line.
When the lens receives the aperture drive signal from the camera CPU, the lens issues a "busy" (a low on the LCLK line) signal.

(14) IC2 sends EMD drive command to IC1 via the CE, CLK, and DB lines.

(15) IC2 sends the stepping pulse "PSM" on each clock pulse to IC-1.

(16) This changes the SM1 through SM8 signals which control the state of the transistors in TALY1 and 2 causing the current of coils to change and the diaphragm to stop down.

(17) A certain time after the last PSM pulse is sent from IC2 to IC1, the busy signal is removed from LCLK line.

(18) The camera sends the diaphragm stop signal to the lens CPU which sends it over the CE, CLK, and DB lines to remove the power from SM1 through SM8.

Focus (AFD) Control Details

The AFD control in 80-200mm and 20-35mm are basically the same as the 50mm f/1.8II lens, but they control the current flow to the coil by pulsing, not with voltage.

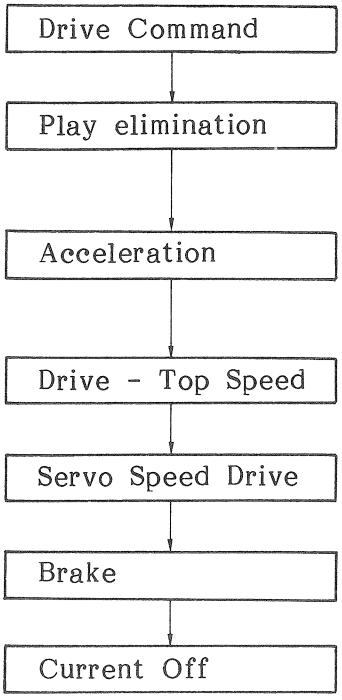
For AFD rotation sensing, 80-200mm uses photo interrupter, while 20-35 mm f/2.8L uses photo reflector. Differences are explained at the end.

(Circuit Explanations)

(1) With receiving the AFD drive command, IC1 monitors Hall elements H1 and H2.
(2) The output of the Hall elements, and therefore the output of TALY3 through TALY6, is dependent on the rotor position.
(3) TALY3 - 6 set the direction of the current flow to the coil.
(4) The output of the Halls is again checked, and the outputs of TALY3 - 6 varies.
(5) As the rotor turns a chopper wheel mounted on it also turns creating a pulse output from the photocoulper (The 80-200mm used a photo interrupter with LED and phototransistor located on opposite sides of the wheel. The 20-35mm uses a reflecting type wheel with both elements located on the same side, but the principle is the same.)
(6) The output of photo interrupter is entered to Tr2 and amplified, then input to IC2.
(7) Steps (2) through (6) repeat until the photocoupler count equals the number requested by autofocus ranging at which time the AFD stop signal is issued.

(Actual Control)

Focus Drive operation proceeds as follows.



IC2 requests IC1 to drive the AFD motor at the speed.

IC1 instructs TALY3 - 6 to drive at minimum speed. When the slack is removed from the gear train, drive stops and the PC feels this.

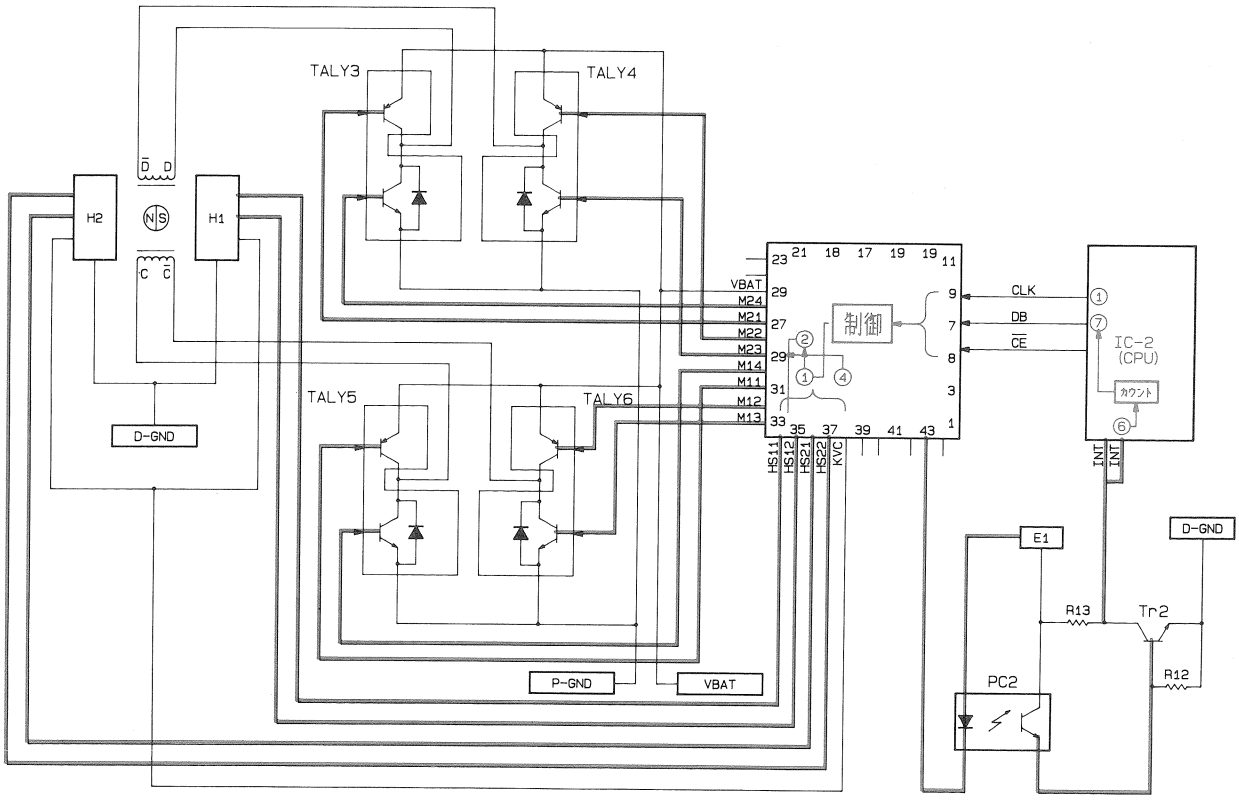
After play elimination, speed is increased one step at a time. (This step is skipped if adjustment distance is slight.)

The lens is driven at maximum speed. (This step is skipped if adjustment necessary is slight.)

As the stop point nears, the speed is controlled by steps to reach the stop quickly without overrun.

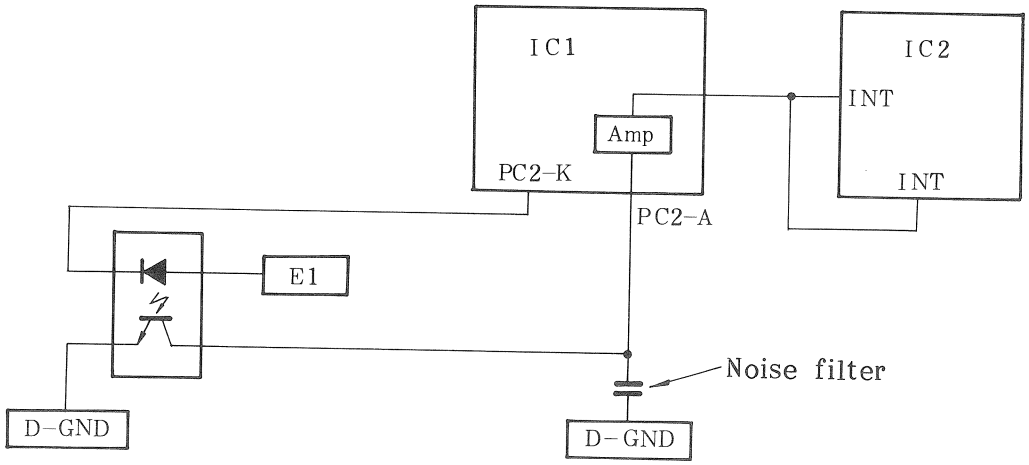
Brake the motor so as to stop at the expected position certainly. (To prevent overrun.)

80 − 200 mm ／ 2.8 L



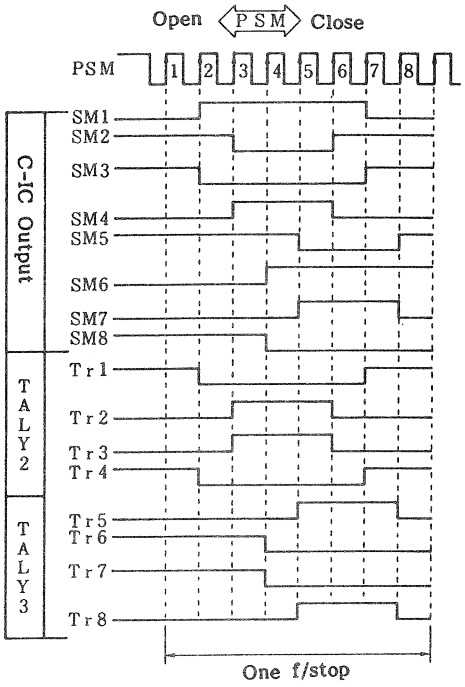
20 − 35 ml ／ 2.8 L

The 80-200mm used a photo interrupter with LED and phototransistor located on opposite sides of the wheel. The 20-35mm uses a reflecting type wheel with both elements located on the same side. The reflected energy received by the phototransistor is much weaker (about 50uA) than with the transmission type so an amplifier is incorporated into IC-1.

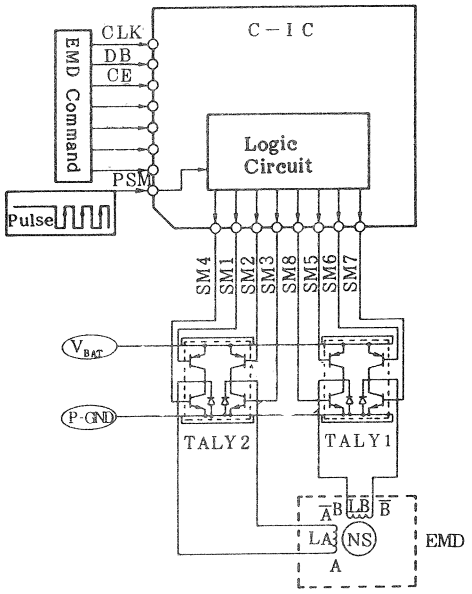


EMD control

The diaphragm (EMD) drive is controlled by the stepping pulse "PSM" sent from CPU. Each pulse produces a 1/8 step change in the aperture. (This is identical to the EF200 & 600 lenses).



Pulse	High Signal	Current Flow*
1	SM2, SM3	A ⟶ /A
	SM5, SM8	/B ⟶ B
2	SM1, SM2	OFF
	SM5, SM8	/B ⟶ B
3	SM1, SM4	/A ⟶ A
	SM5, SM8	/B ⟶ B
4	SM1, SM4	/A ⟶ A
	SM5, SM6	OFF
5	SM1, SM4	/A ⟶ A
	SM6, SM7	B ⟶ /B
6	SM1, SM2	OFF
	SM6, SM7	B ⟶ /B
7	SM2, SM3	A ⟶ /A
	SM6, SM7	B ⟶ /B
8	SM2, SM3	A ⟶ /A
	SM5, SM6	OFF



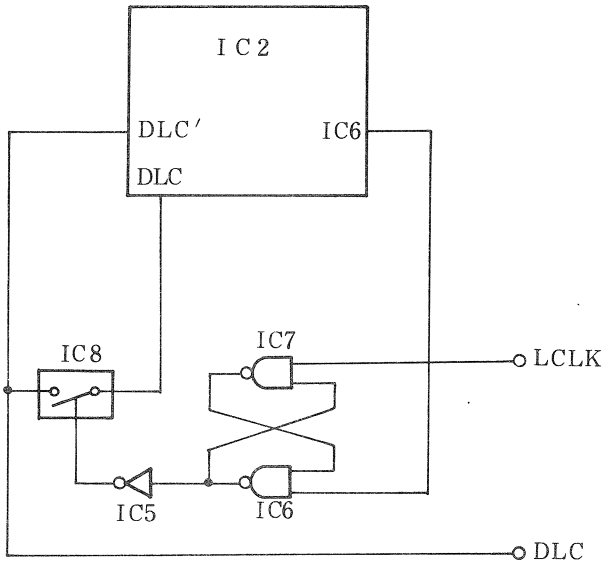
The above sequence moves the diaphragm through one f/stop. The process is repeated until the correct aperture is reached.

To open the diaphragm after the exposure, the procedure is reversed.

*: Conventional current flow

Communication Control

The circuit design used in these two lenses was designed especially for use in many different lenses. The reason is to make production of smaller numbers of lenses economically feasible. For this reason the flip-flop multivibrator which was incorporated into the CPU is a discrete circuit in this design.



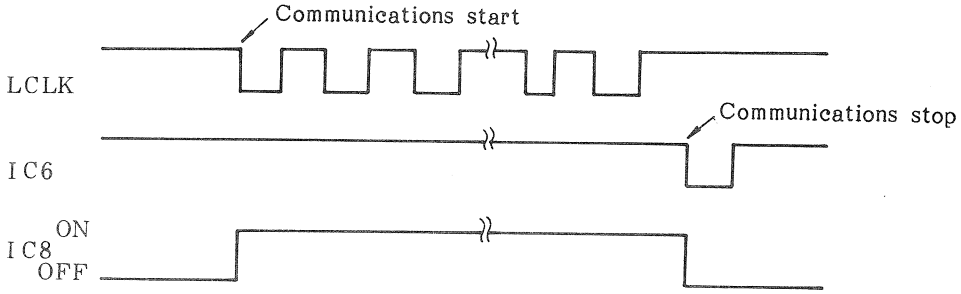
(1) Normally DLC line is connected to DLC'.

(2) With the start of camera communication, LCLK goes low, causing the flip-flop circuit composed of IC7 and IC6 to change states, turning IC8 on.

(3) Lens data is output to the camera through DLC line.

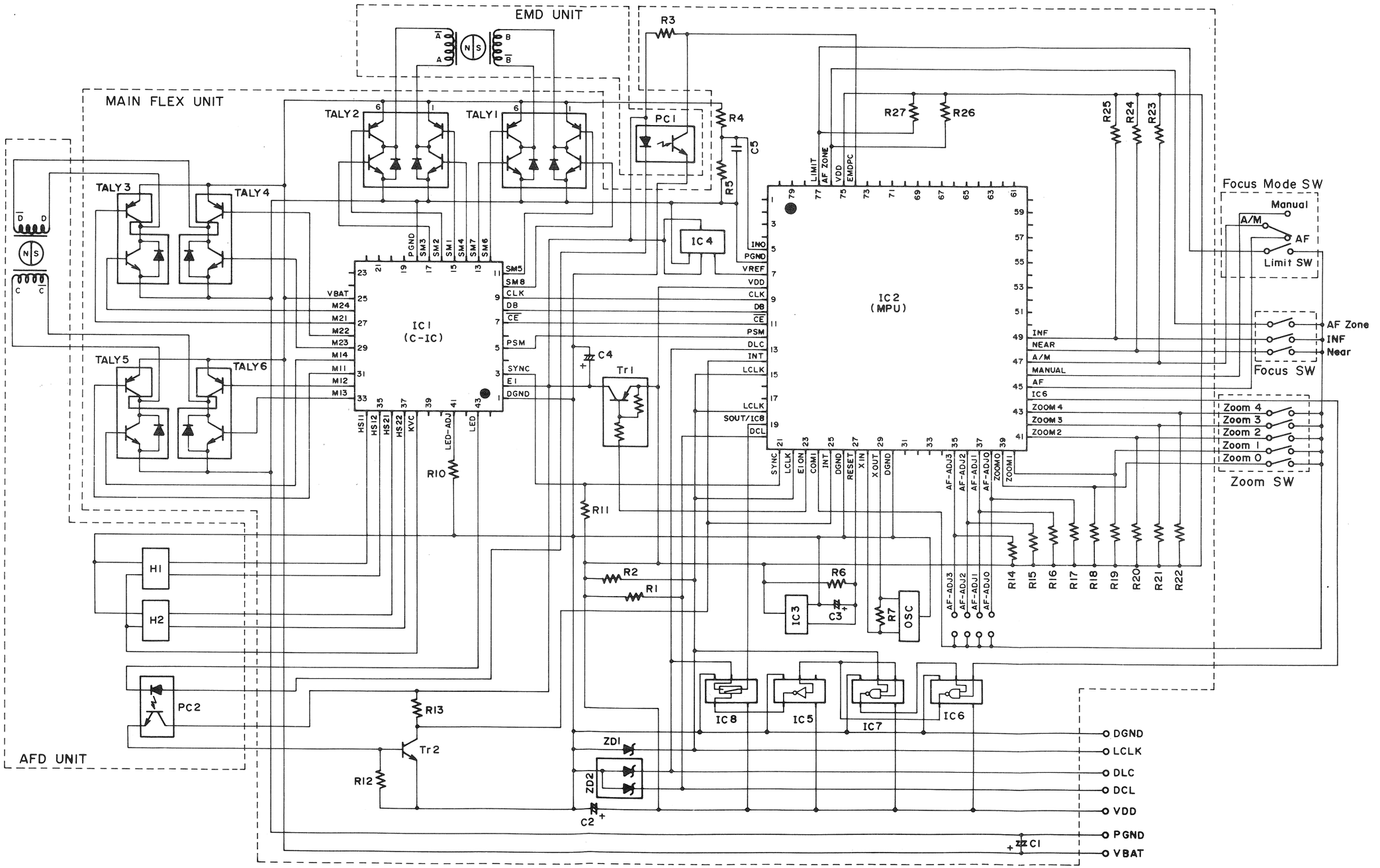
(4) With the end of the data communication, IC6 goes low temporarily, causing the flip-flop circuit to change again.

(5) When lens requests communication, DLC' goes low and with this camera determines communication.



SCHEMATIC DIAGRAM

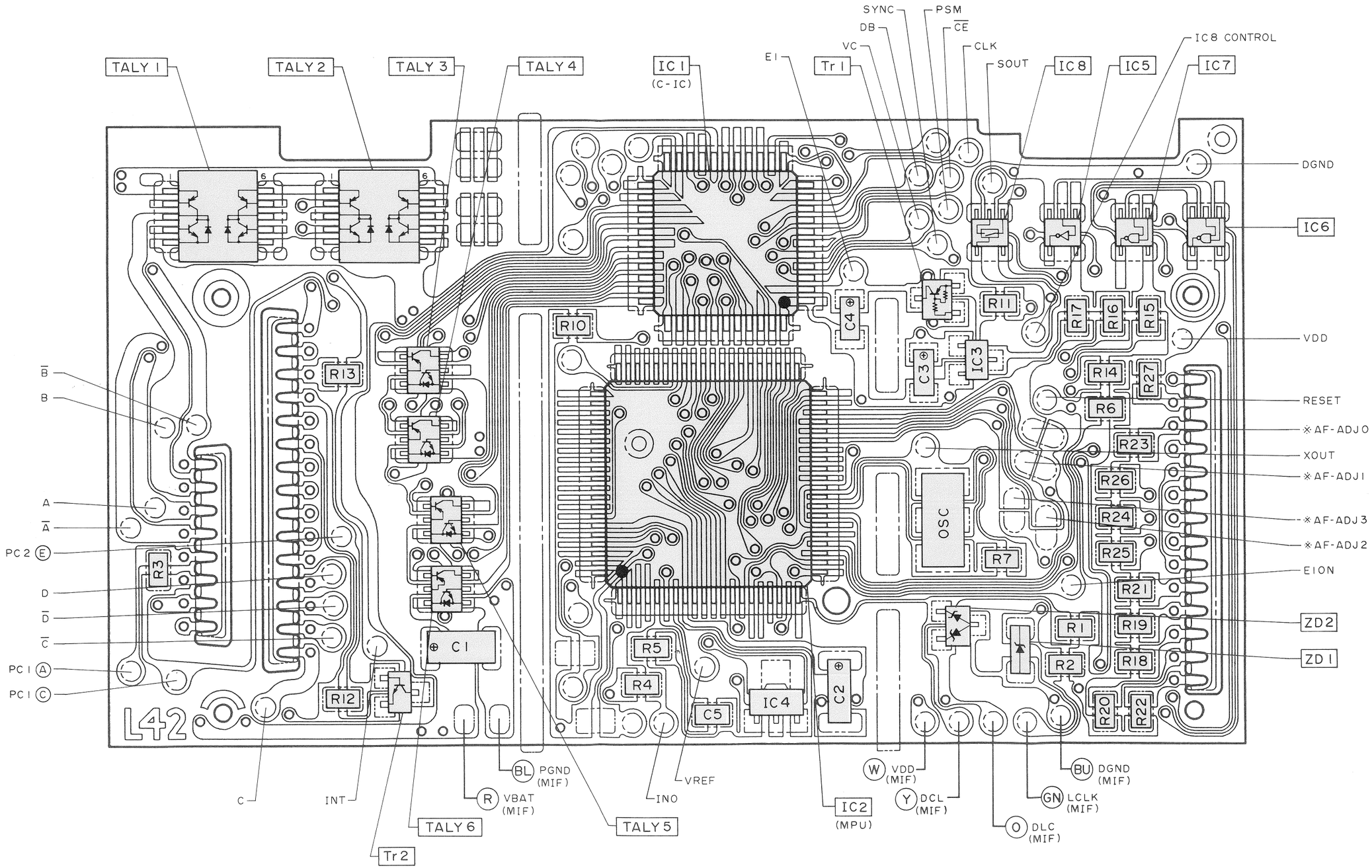
EF 80-200mm 1:2.8L
REF. NO. C21-9502



01 AUG, 1989

P.C.B. DIAGRAM
(MAIN FLEX)

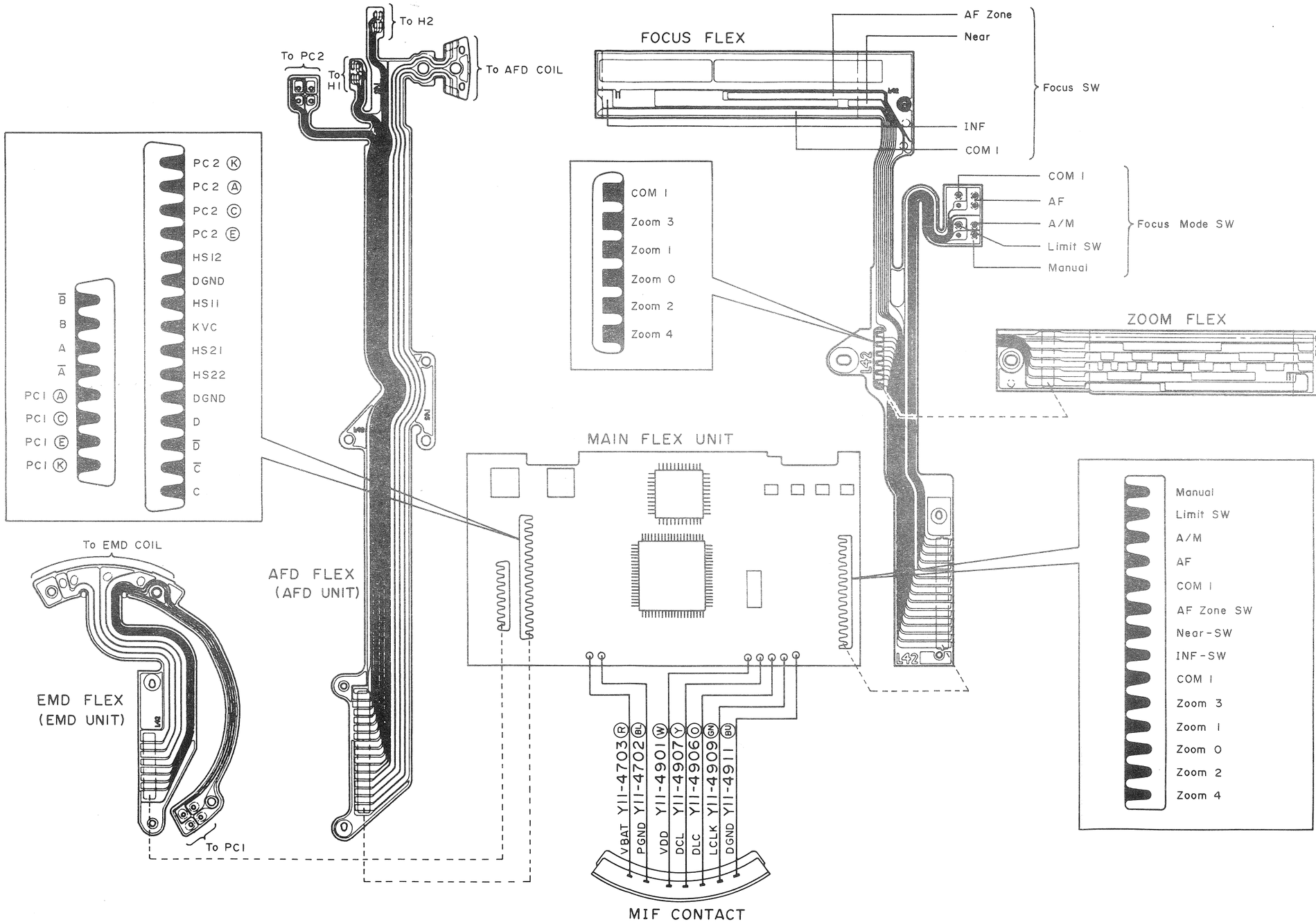
EF 80-200 mm 1:2.8L
REF. NO. C21-9502



01 AUG, 1989

WIRING & P.C.B. DIAGRAM

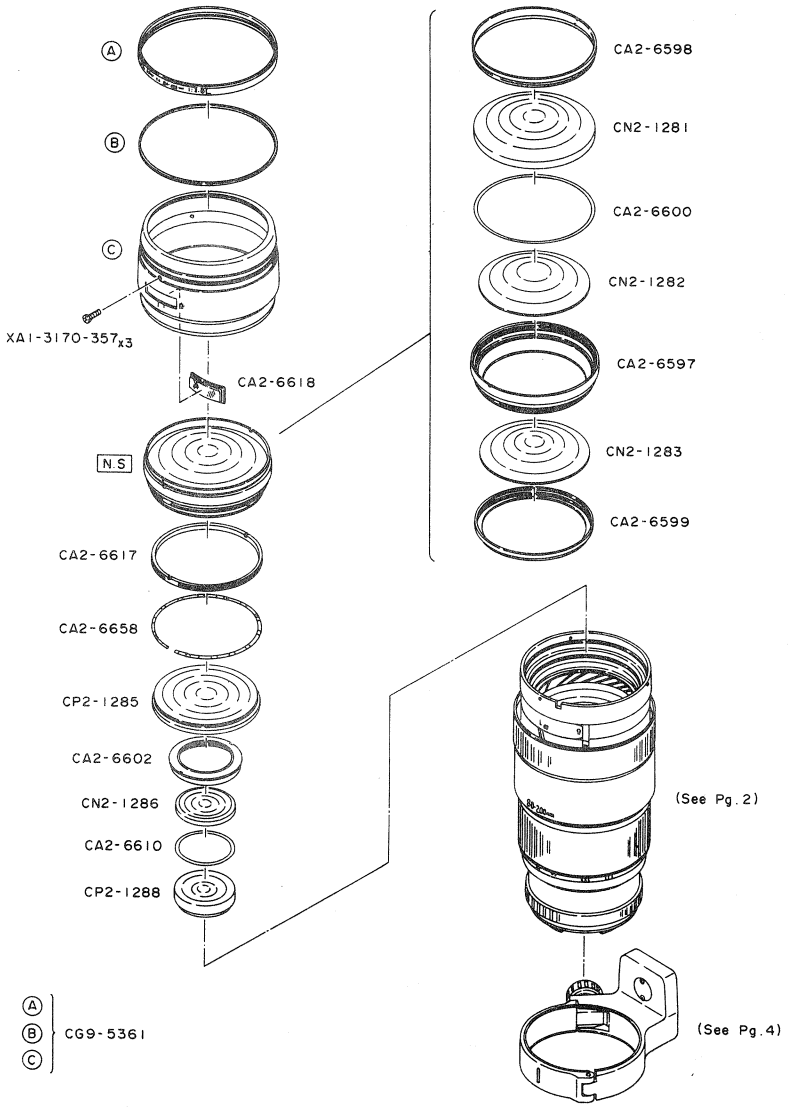
EF 80-200 mm 1: 2.8L
REF. NO. C21-9502



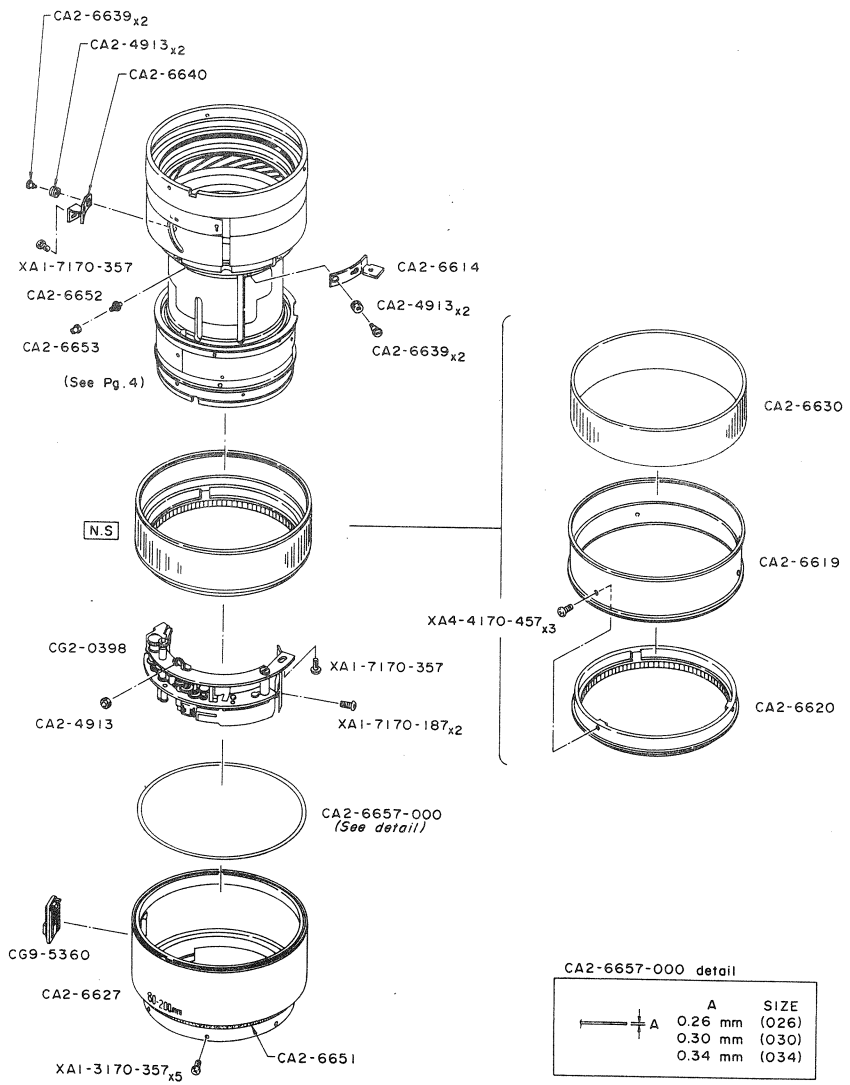
01 AUG, 1989

REF. NO. C21-9502

CANON LENS EF 80-200 mm 1:2.8 L



CANON LENS EF 80-200 mm 1:2.8 L

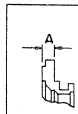


CA2-6657-000 detail

A	SIZE
0.26 mm	(026)
0.30 mm	(030)
0.34 mm	(034)

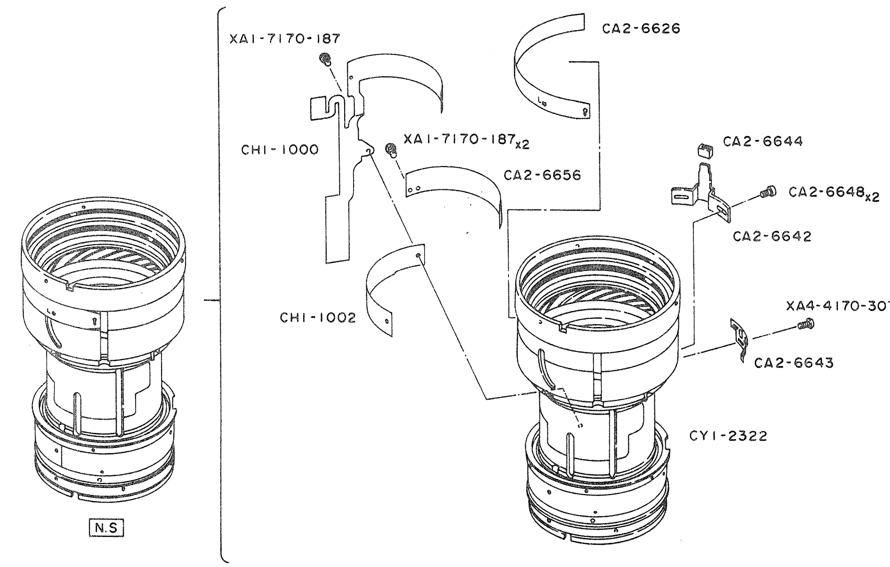
CANON LENS EF 80-200 mm 1:2.8 L

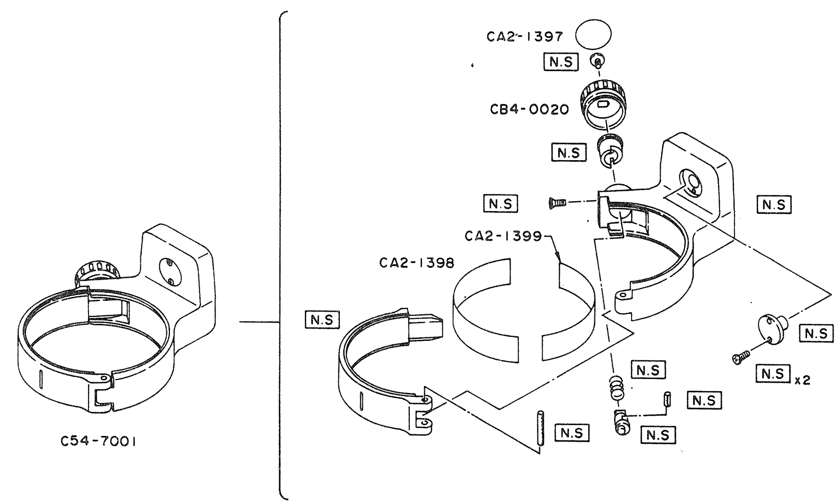
CY1-2324-000 detail



A	SIZE	A	SIZE
1.9 mm	(190)	2.4 mm	(240)
2.0 mm	(200)	2.5 mm	(250)
2.1 mm	(210)	2.6 mm	(260)
2.2 mm	(220)	2.7 mm	(270)
2.3 mm	(230)		

CANON LENS EF80-200mm 1:2.8L





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TECHNICAL INFORMATION

1. Development Brief

The EF 20-35mm f/2.8L is a large-aperture, wide-angle zoom lens which features high brightness and optical performance on a par with single focal length lenses and which covers focal lengths ranging from ultra-wide-angle 20mm to wide-angle 35mm. The lens was developed as a high-performance L-series lens with high image quality and superior operability to fulfill the needs of professional photographers. In addition, as a lens covering 20mm, 24mm, and 35mm focal lengths, the EF 20-35mm f/2.8 L enriches the EF series' wide-angle lens line-up.

2. Features

Uses an aspheric front element (G1) which allows wide-angle focal lengths while providing sharp, high-resolution images with minimal distortion.

Employs a floating system which improves image quality especially at close shooting distances and which realizes sharp images by minimizing various aberrations throughout the entire shooting distance range.

Employs inner focusing which allows a large maximum aperture while realizing high-speed, precision autofocusing.

Has an extremely bright f/2.8 maximum, which is quite unusual in a wide angle zoom of this range.

Features smooth manual focusing on a par with FD lenses.

Has quiet lens drive and a smooth, low-shock focusing operation providing quick and comfortable AF operation.

Features a design in which the total lens length remains unchanged and the front of the lens is stationary during focusing and zooming, providing superior operability. This feature is especially convenient when a circular polarizing filter is attached to the lens.

3. Specifications

3-1	Format:	24 x 36mm
3-2	Focal length/aperture:	20 - 35mm; 1:2.8
3-3	Optical structure:	15 elements in 12 groups (including one aspheric surfaces: G1R1) Super spectra coating
3-4	Angle of view	(at infinity):
	Diagonal (43.2mm)	63° to 94°
	Vertical (24mm)	38° to 62°
	Horizontal (36mm)	54° to 84°

3-5 Autofocus

Drive system:	AFD
Drive speed:	0.3s (lens drive speed between infinity and closest distance)
Manual:	Manual mode set using AF/M switch; focusing by manual focusing ring.

3-6 Focus adjustment

Extension system:	Inner focusing single helicoid system
Macro function:	None
Range:	0.5m to infinity

Rotation angle/ Extension amount:

Conditions	Rotation angle	Extension amount
0.5m to infinity	111° 35'	2.6mm

Distance scale:

1.75 2 2.5 3 5 10 ft (green)

0.5 0.6 0.8 1 1.5 3 m (gray)

Maximum magnification and field of view:

Condition	Magnification (power)		Field of view (mm)	
	20mm	35mm	20mm	35mm
Closest focusing distance 0.5m	0.052	0.085	476 x 738	283 x 426

3-7 Zoom

Zoom system:	Rotation of zoom ring on lens barrel
Rotation angle:	50°00'
Focal length scale:	20 24 28 35

3-8 Mount

Type:	Canon EF mount
Signal transfer:	EOS system, with five signals as follows:

A) Lens condition
B) Lens Type
C) Photometry signal
D) Focal length
E) AF drive information

3-9 Diaphragm mechanism:

Diaphragm control:	Automatic only using EMD (no manual ring)
Aperture range:	f/2.8 to f/22 (no indication)
Diaphragm blades:	Eight
Depth of field scale:	None
Infrared Focusing	Provided (at marked focal lengths)

3-10 Filter diameter/pitch 72mm; p = 0.75mm; (One filter only)

3-11	Dimensions & weight	79.2mm (diameter) x 89mm; 540g
3-12	Related products	
	Hood:	EW75 (Clip-on; reverse mounting possible)
	Lens cap:	E-72 (Clip-on type)
	Lens case:	LH-D13 (Hard case) Storage: Lens w/ one filter, front and rear caps and hood (install hood after lens).
	Rear dust cap:	Common to all EF lenses

4. External Design

The EF 20-35mm f/2.8L has been designed to give operability and quality "feel" worthy of an L-series lens, and has been given a smooth design with an generous rounded finish.

The focusing and zooming rings are optimally located for good balance, and sized for easy operation. The focusing ring, in particular, is designed for the greater use it is likely to get from professionals and advanced amateurs. It has a much smoother 'FD like' feel.

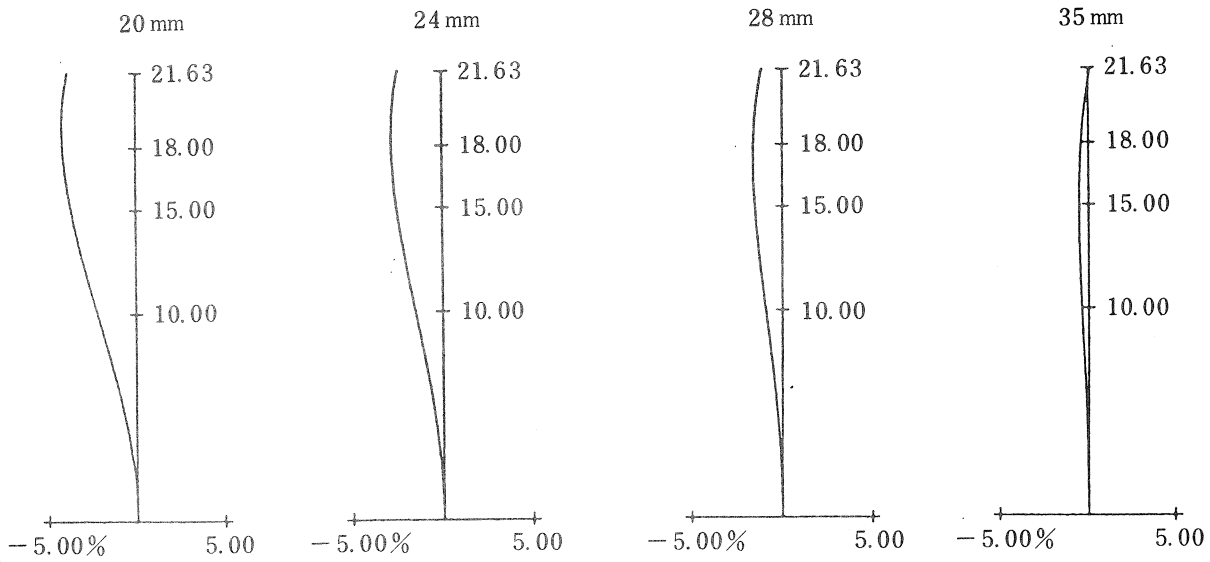
Handling is also improved because the total length of the lens does not change during focusing or zooming and the AF/M switch has been enlarged.

5. Optical performance

5-1 Distortion compensation through use of aspherical lens

Barrel distortion generated in a wide-angle lens is most efficiently compensated as far off axis as possible, so we decided to apply distortion correction by using an aspherical surface on the front surface of the front lens element - the largest element in the lens.

The following chart shows the distortion generated at various focal lengths.



5-2 Inner focus system with floating effect

The FD20-35mm f/3.5L was designed for improved optical performance at close distances by dividing the front focusing lens group into two and having the rear subgroup extend farther than the front subgroup during focusing.

In the EF20-35mm f/2.8L, this principle has been carried one step further. The first lens group is divided into front and rear subgroups, but only the rear one moves to focus. Not only does this give 'inner focusing' with its advantages, but it is in effect a floating element design which improves performance at close distances. For the lens to fully exhibit this floating effect, the front and rear surfaces of the front lens group are designed to optimize curvature and refraction, realizing superior definition throughout the entire shooting distance range.

The zoom system has four-group construction to allow for inner focusing and compact design to hold down any increase in front element size which normally accompanies a larger maximum aperture (f/2.8 vs f/3.5).

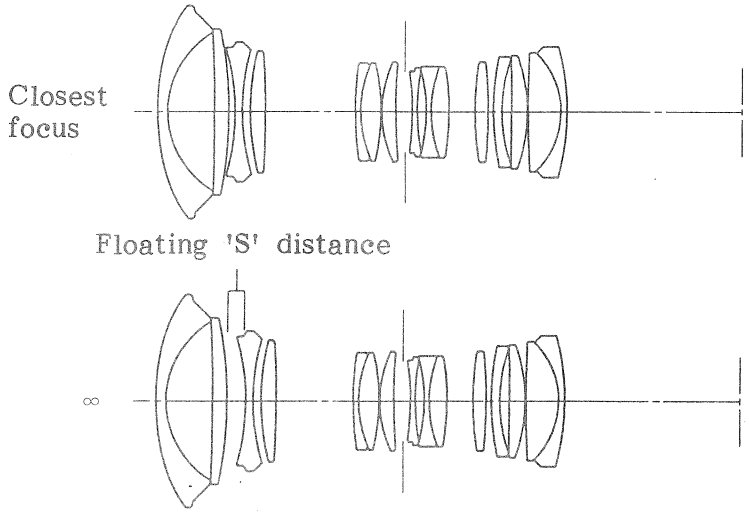
The use of the inner focus system provides the following merits.

(1) The weight of the focusing lens group is lighter (approx. 1/3) compared to front lens group focusing, enabling high speed, precise AF, and a larger maximum aperture.

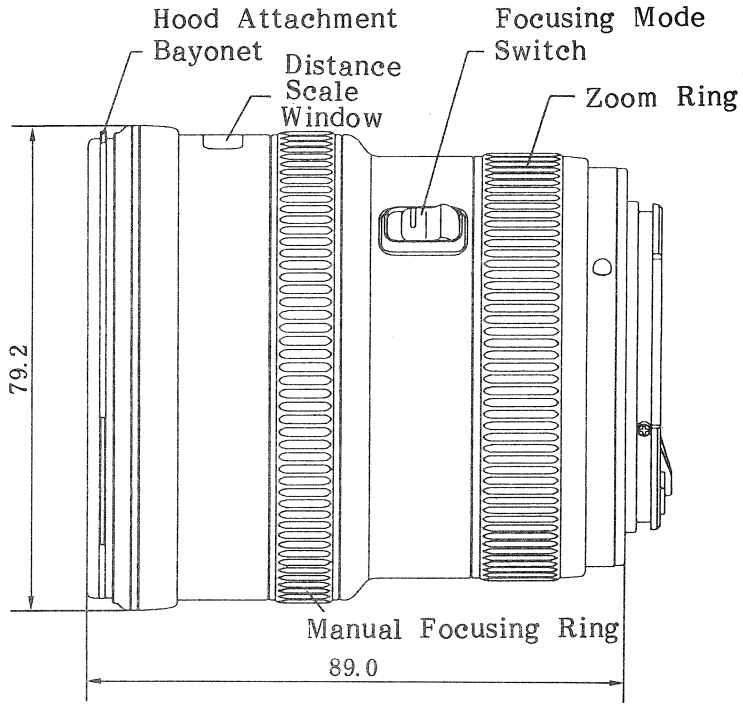
(2) Since it is not necessary to extend the front lens element, the diameter of the front lens element can be reduced while providing a large maximum aperture, enabling the attachment of the same 72mm filters used for the FD20-35mm f/3.5L.

(3) The front does not rotate, facilitating the use of position-dependent filters such as circular polarizing filters.

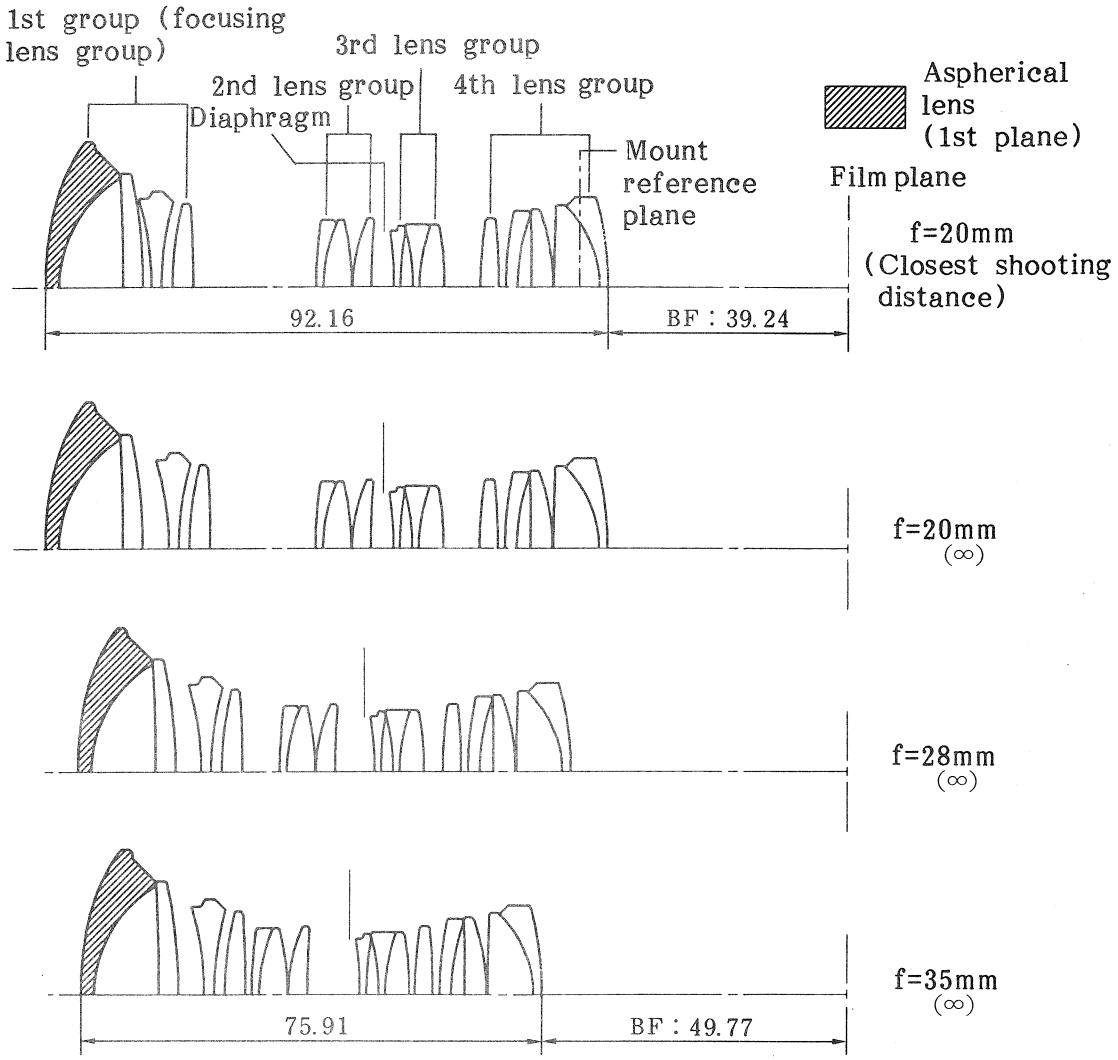
(4) Components which move during focusing and zooming are not exposed to the outside, providing improved durability, moisture and dust-proof characteristics. In addition, since lens drive noise can be cut off from the outside, lens operation is quiet.



6. Controls and Optical Schematic



* The 2nd and 4th lens groups move together.
* The diaphragm and the 3rd lens group move together.

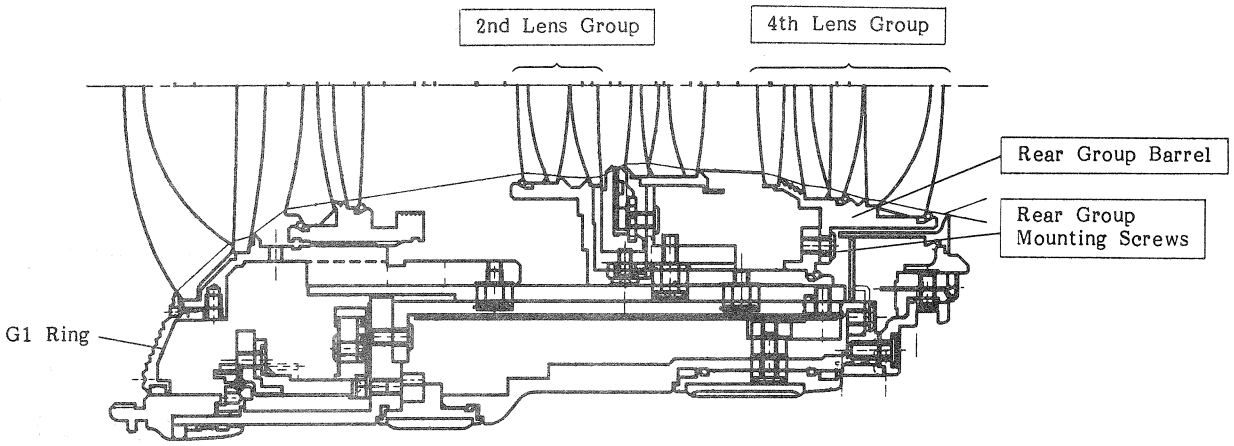


REPAIR INSTRUCTIONS

Centering	(Yes) No	Necessary if 2nd or 4th lens group disturbed
Tilt	Yes (No)	

<!!> Centering is accomplished by adjusting 4th lens group mounting.

<!!> If G1 ring is removed, elements G1 and G2 are free, so remove them before they fall out on the floor.



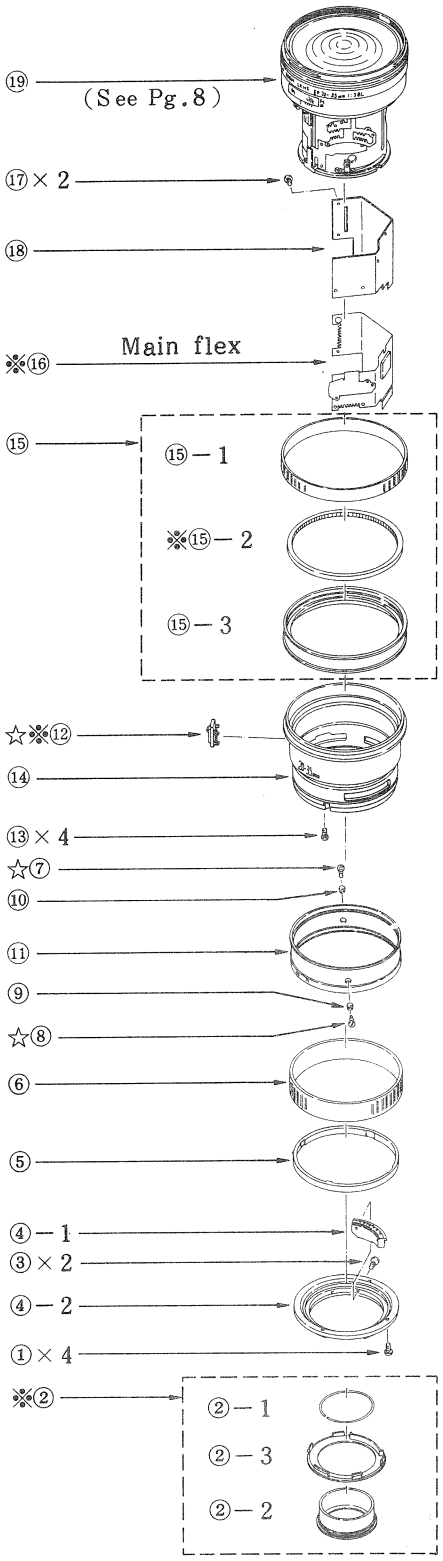
Expendables

Part No.	Name	Remarks	Plastic Safe?
- ADHESIVES -			
CY4-9102	Acetate Cloth Tape	For holding flex	
CY4-9303	Double-faced tape	For holding flex	
CY9-8007	Aron alpha	AF/M switch	
CY9-8009	Arontite R	For mount stopper screws	
CY9-8011	Screw-lock	For manual gear	
CY9-8091	SO-820	For name ring screws	
- LUBRICANTS -			
CY9-8044	GE-X8	Focus Helicoid	
CY9-8045	GE-C4	Can and Guide Barrel	
CY9-8087	Lozoid 6308/31-F	Zoom & Manual Focus Rings	
CY9-8089	Elt-oil 190*	Zoom Flex contact pattern	

*: Previously called Electro-oil 190

DISASSEMBLY & ASSEMBLY

1. MAIN FLEX REMOVAL



DISASSEMBLY NOTES

(2); When removing (2), press the hook claw (2)-3. (if (2)-2 is pressed, (2) may separate.)

(12); When removing (12), set it at manual and be careful not to scratch (14).

(15); (15)-(3) and (15)-3 are bonded with screw-lock completely around.

(16); When removing (16), unsolder the comb teeth connection with flex.

ASSEMBLY NOTES

(12); Before attaching (12), apply instantaneous bond to (14).

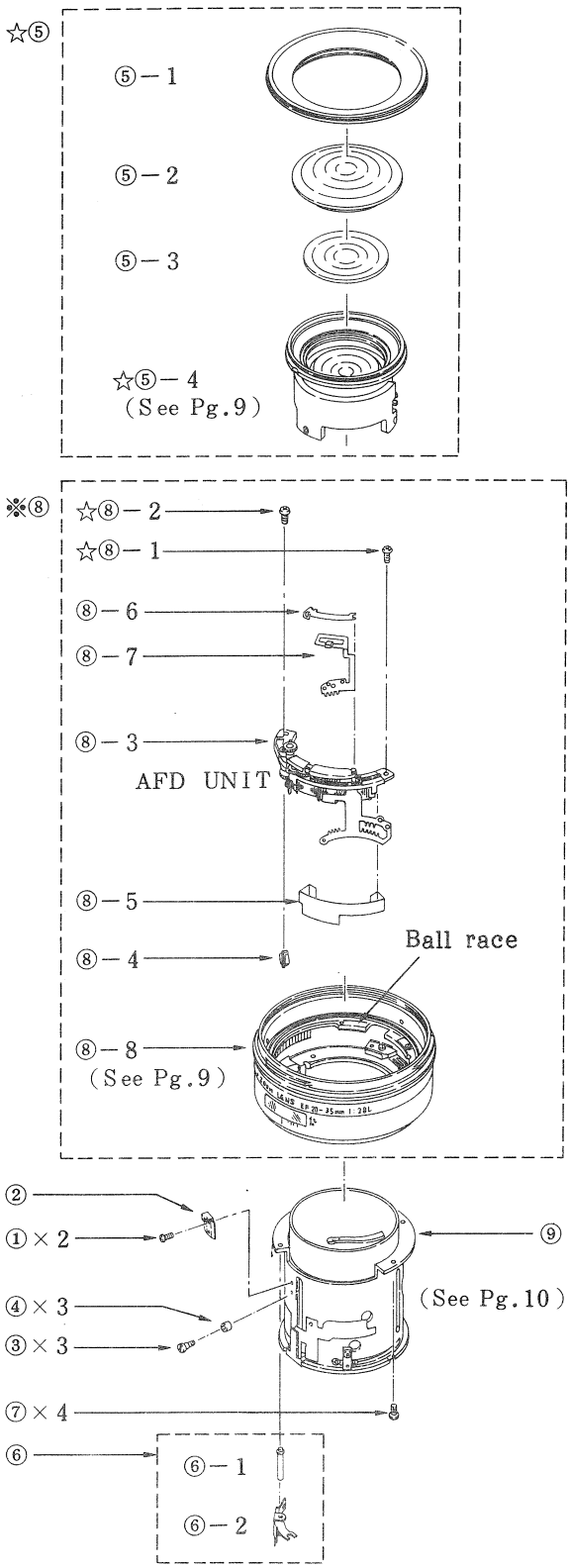
(8); Before installing screw (7), install (8) shoulder screw opposite the zoom brush. (If screw (7) is installed first, the Zoom Brush may slip out of position.)

<!!> Main Flex Unit Replacement <!!>

1. Bridge the AF adjustment pads (AF-ADJ 0, 1, 2, 3) as they are on the flex being replaced.

2. Do the Pulse adjustment.

2. AFD UNIT REMOVAL



DISASSEMBLY NOTES

(8); Before removing (8), unsolder the comb connection of the Focus and Zoom Flex, which are included in (8)-8.

ASSEMBLY NOTES

AFD Unit Assembly (Backlash adjustment):

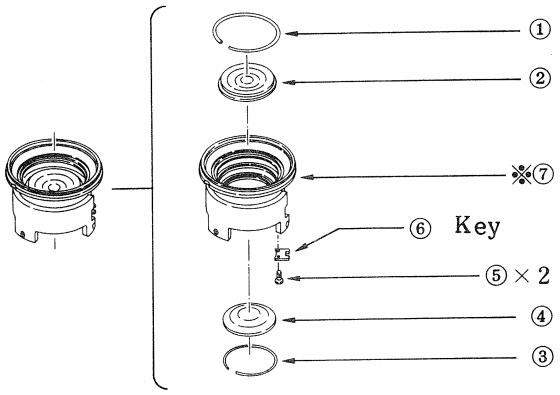
1. Loosen (8)-2.
2. Install (8)-1 temporarily.
3. With (8)-1 as the pivot, lightly press outward on the AFD unit, and tighten (8)-1.
4. While pressing inward on the tip of (8)-4, tighten (8)-2.
5. Check that the ball race revolves lightly. This check is possible by removing only (5)-1, (5)-2 and (5)-3.

(5); When installing (5),be sure to couple (5)-4 properly with the focus key in (8)-8.

<!!> AFD Unit Replacement <!!>

1. Adjust backlash as indicated above.
2. Do the Pulse adjustment.

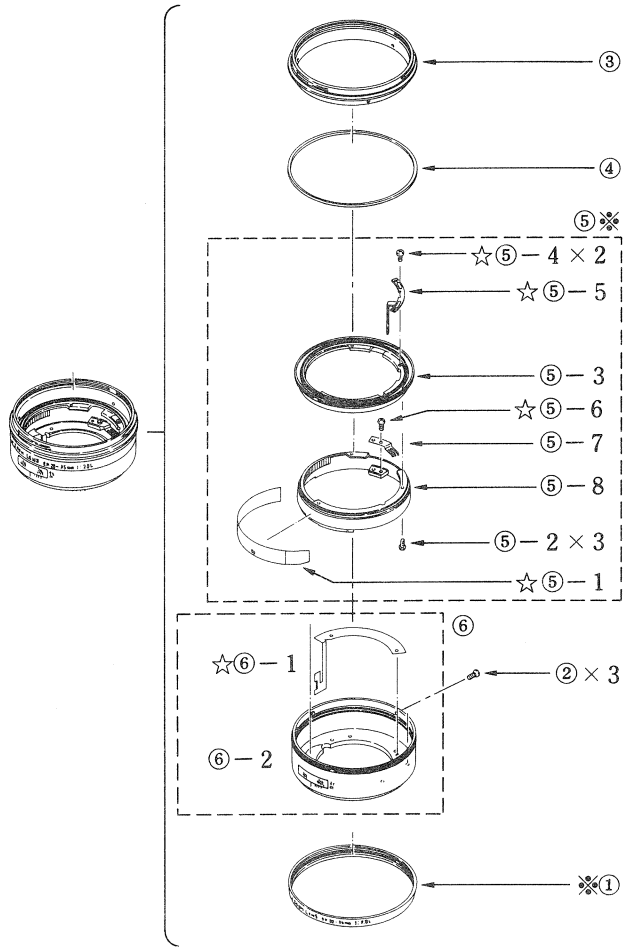
3. FOCUSING UNIT and NAME RING ASSY. DISASSEMBLY



DISASSEMBLY NOTES

(7); Before disassembling the helicoid within (7), mark the position.

(GE-X8 has been applied to threads).



DISASSEMBLY NOTES

(1); To facilitate disassemble procedure, pour alcohol into the hole in (6) to loosen bond before removing (1).

(SO-820 has been applied to the threads).

(5); When removing (5), use a pin spanner in (5)-3.

ASSEMBLY NOTES

(6); When attaching (6)-1, align the positioning hole in (6)-2.

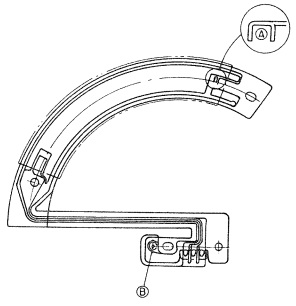
Tele Focus is adjusted by changing the setting of (5)-5.

(5); When attaching (5)-1, align to the index of 5-(8).

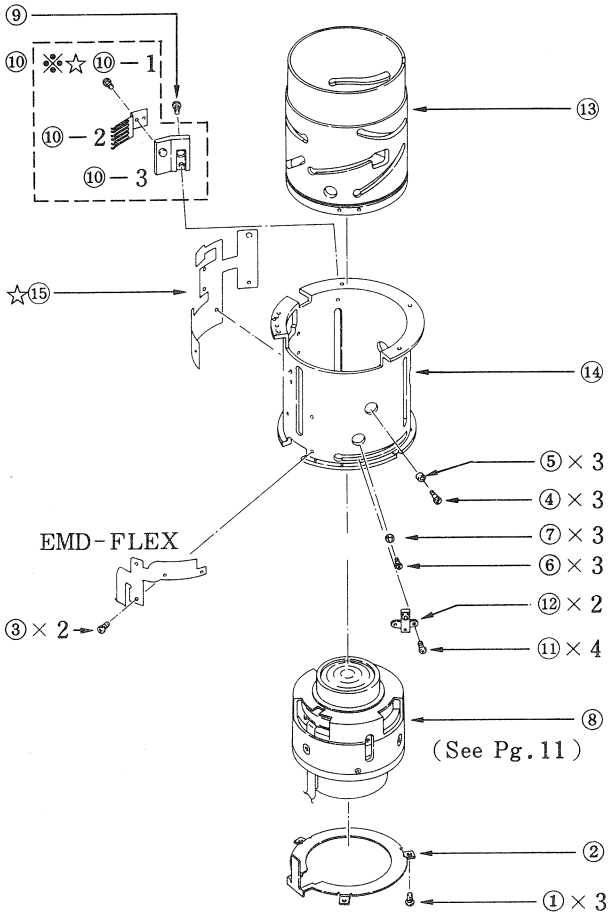
Focus Brush Position Adjustment

1. Set (5) against the infinity stop.
2. Adjust the brush (5)-7 so it contacts the pattern at (A). Tighten (5)-6.
3. Check for continuity between (B) and the brush (5)-7.

(This adjustment sets the autofocusing limits).



4. EMD UNIT REMOVAL 1



Lube: Cam and Guide grooves, friction surfaces, of (8), (13) and (14) with GE-C4

Dissembly

Remove screw (9) to remove (10). Do not remove (10)-1, because (10)-2 must then be aligned.

Assembly

Attach (15) aligned to the positioning hole in 14.

Zoom Brush Position Adjustment:

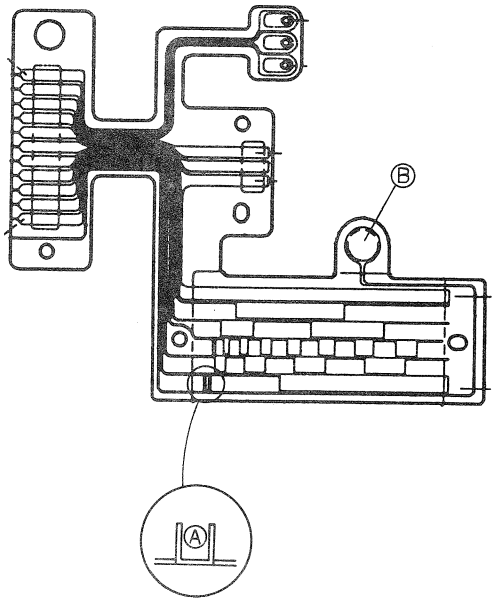
1. Preparation

   A. Install (10)-1 temporarily.

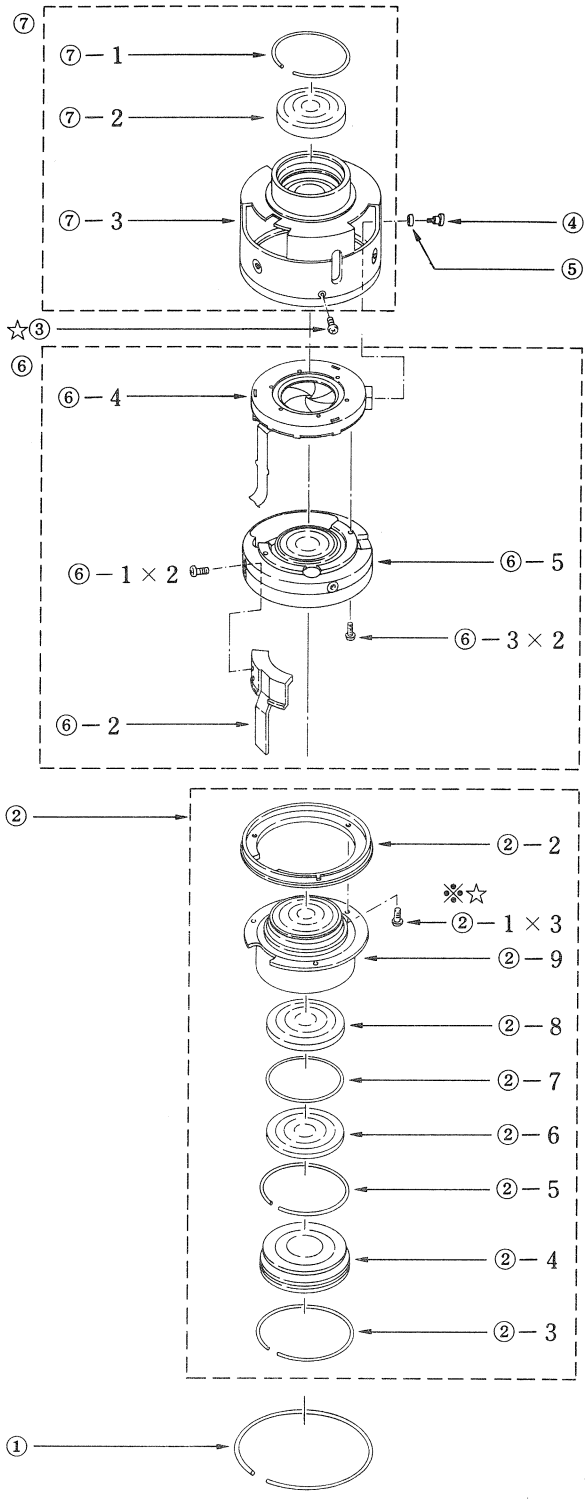
   B. Remove (1) - (12) in section 1 (Main Flex Removal) and reattach (8) and (9).

2. At the 35mm end, set brush (10)-2 so it contacts the (A) position on the pattern.

3. Check for continuity between (B) on the pattern and the brush.



5. EMD UNIT REMOVAL 2



Dissembly

If (3)-1 is removed, optical tilt must be adjusted. So, remove (3) as a set.

Assembly

(3); Screw (3) is the stopper for (2). It fits into the notch in (2)-2.

(2)-9 is the centering adjustment, but the adjustment can not be made at this point in assembly. Visually center it in (2)-2 and tighten screws (2)-1.

(See the centering adjustment).

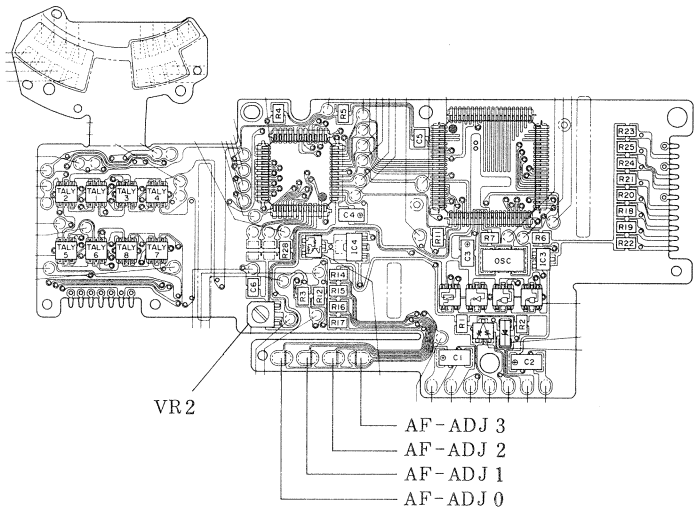
Mechanical and Optical Adjustments

Adjustment	Objective	Test Equipment	Location	Page
Zoom Brush	Zoom Position Info.	Ammeter	Zoom Brush	10
Focus Brush	Focus zone	Ammeter	Focus Brush	9
Backlash	AF. M Focus Proper Operation.	-	AFD Unit	8
Optical Centering	Align optical axis of all elements	800mm lens focus collimator	Rear lens group position	13
Focus (Wide)	Infinity Focus Setting	200mm T-type or 500mm Collimator & EOS camera	Lens Mount & Focus Washers	14
Focus (Tele)	as above	as above	Focus Key	14

Electrical Adjustments

Adjustment	Objective	Test Equipment	Location	Page
Pulse	To insure proper alignment of AFD pulse	Oscilloscope & Camera	VR1	15
Best Focus	Align sensor focus with lens focus	-	ADJ-0, ADJ-1 ADJ-2, ADJ-3	16

Electrical Adjustment Points on the Main Flex Unit



1. OPTICAL CENTERING

This adjustment is necessary when the rear barrel (4th Group), or G5, G6 or G7 (2nd group) are replaced. (G5, G6 and G7 are more effected).

This adjustment requires 800mm lens collimator. If one is not available, this adjustment is impossible.

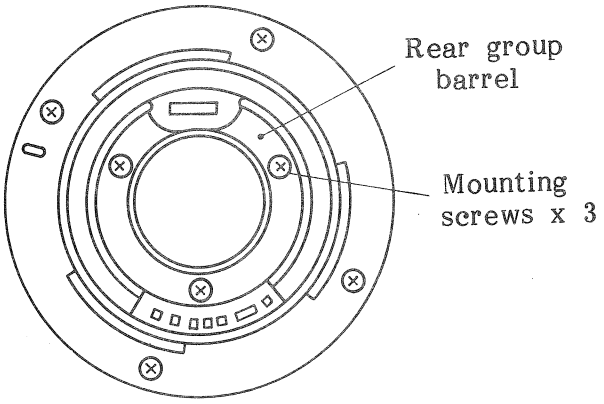
Purpose: To align the optical axes of the lens elements for maximum resolution.

Equipment: 800mm Lens Focus Collimator, Lens Projector (Resolution check)

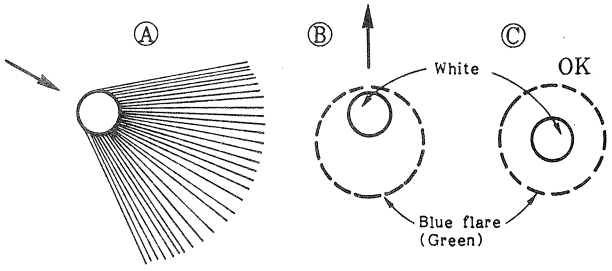
Preparation: Remove the back cover and Mount Flex Base. All other parts should be attached.

Adjustment:

1. Mount the lens on the 800LFC. Set to Tele and adjust the focus for slight blue (green) flare around the white center of the star image.
2. If the image appears as (A) or (B), adjust in the direction of the arrow so the image is as (C).
3. To adjust, remove the lens from the collimator, adjust the position of the rear barrel slightly, reinstall the lens unit and check. Repeat as necessary.



Rear view (w/o rear cover)



Example (A): Bad decentering

Example (B): Slight decentering

STANDARD:

If centering is correct resolution will be good, but we recommend checking resolution as a final check.

*: One step down in two quadrants, but must be very strong at that step.

Resolution Table

Image Height (mm)	0	4	8	12	16	20
S		100	63	*40	63	10
20mm	100					
M		100	63	*63	40	25
S		100	63	25	*40	10
24mm	100					
M		100	63	40	40	25
S		100	40	*40	*40	40
35mm	100					
M		63	63	40	25	10

2. FOCUS ADJUSTMENT

A. 200mm Lens Focus Collimator Method
Install the lens on an EOS camera with a mirror in the aperture. Place it on the collimator stand with the shutter open and check several lenses from stock for an average. Adjust lenses to this average. (The short focal lengths of this lens make it incompatible with the 800mm collimator normally used.

B. Camera Method
Use a known-good camera with a type B (split-image) screen and a magnifier. Check focus on the 500mm collimator or with an actual target at least $100f^2$ distant.

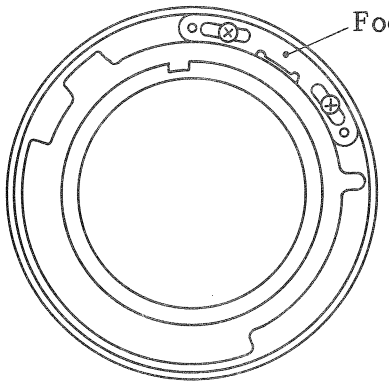
Standard: Infinity mark aligns correctly at both 35mm and 20mm focal lengths when manually focusing on an infinity ($100f^2$) target.

Adjustment:

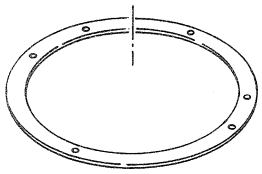
At the factory, the lens mounts are shaved to give the correct FFD; but this is impossible in the field. Special thin service mounts and focus washers are used. Do not use washers exceeding a total thickness of 0.07mm (Using more may cause a visible gap.)

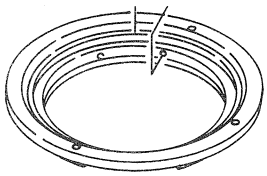
1. At 35mm, remove the G1 ring and adjust the focus key. (Be careful with G1 and G2 while the ring is removed.

2. At 20mm, adjust by changing the mount and/or focus washers.



〔TELE側〕


Service Focus Washers
CY1-2178-000 XXX
(EF50/1.8)


Service Lens Mounts
CY1-2227-000 XXX
(EF35-105/3.5-4.5)

〔WIDE側〕

5. PULSE ADJUSTMENT

Adjust if main flex unit, AFD unit or R flex unit is changed, or if operation is erratic at extreme temperatures. If not adjusted, the AFD may work correctly at normal temperatures but fail at high or low temperatures.

Purpose: To adjust the duty cycle for maximum power output

Equipment: Oscilloscope, EOS camera

Standard: On(T) and off(t) times should be equal, within 10%.

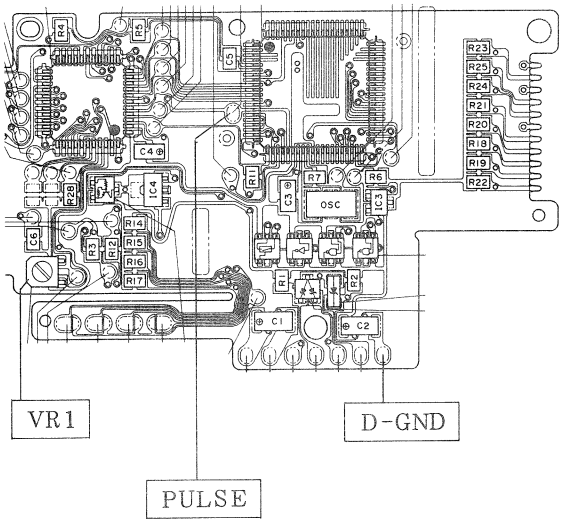
$0.9T \leq t \leq 1.1T$

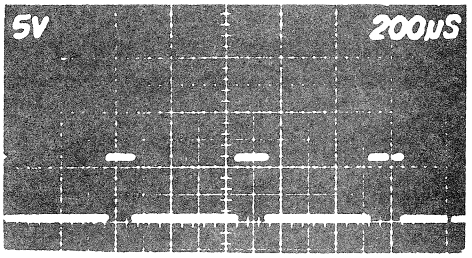
Preparation:

Remove item #s (1) through (15) in section 1 (Main Flex Removal) except the contact assembly must be connected to the lens mount. Attach the mount to a camera.

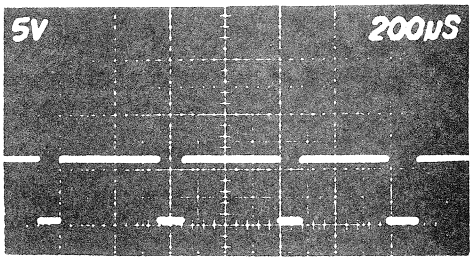
Adjustment:

1. Attach the Pulse and D-GND leads to the oscilloscope.
2. Set the lens to AF and the camera to One-shot. Press the shutter button and the AF will hunt, Adjust VR1 so the waveform matches the one shown in (c).

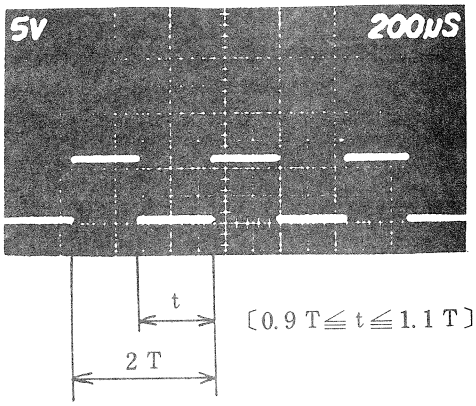




(a)
Turn CCW



(b)
Turn CW



(c)
OK

〔0.9 T≦ t ≦1.1 T〕

3. BEST FOCUS ADJUSTMENT

Purpose: To bring the automatic focus point as close as possible to the lens' actual best focus point buy rewriting the ROM.

Notes: The factory ROM adjustment tool is much too costly for field use, so service will use the following procedures instead.

1. This adjustment is required only if the Main Flex Unit is replaced. When the Main Flex is replaced, check the AF-ADJ pads on the old flex and bridge the pads on the new flex in the same way.

2. If a customer complains of poor resolution, adjust as outlined below. If the customer uses a Cross-BASIS equipped camera, use the customer's camera or the same type. All EOS's have horizontal sensors. The EOS-1 also has a vertical sensor for f/2.8 or faster lenses, so data for both sensor is necessary. (Since the sensors are located in different zones, the exact best focus point will be slightly different).

Adjustments:

No. 1. If front defocus, increase positive correction. If rear defocus, increase negative correction.

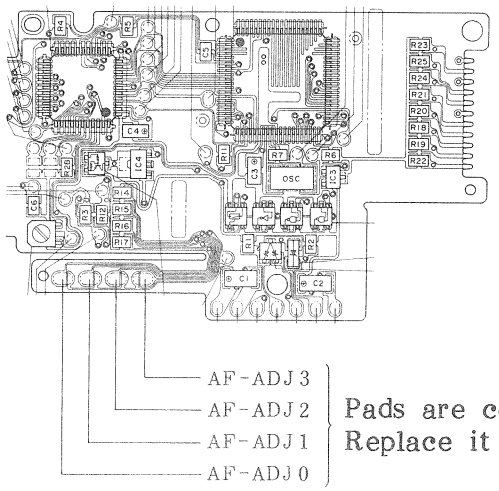
No. 2. Make photographic test with the H-BASIS pads bridged in all four possible combinations. Make five or six negatives for each combination. Repeat for the V-BASIS sensor pads. Examine the negatives closely to determine which combination is best.

Test Conditions:

Distance: 2m
Target: Casual Resolution Chart* with centered AF Standard Bar Chart
Settings: Maximum aperture and focal length
Focusing: Return lens to infinity after each exposure and autofocus on bar chart.
Camera: EOS with Aperture Priority (AV) Mode

*: A "Casual Resolution Chart" is a flat chart made up of newsprint, photographs, etc. Most service facilities have such a chart.

Best Focus Correction



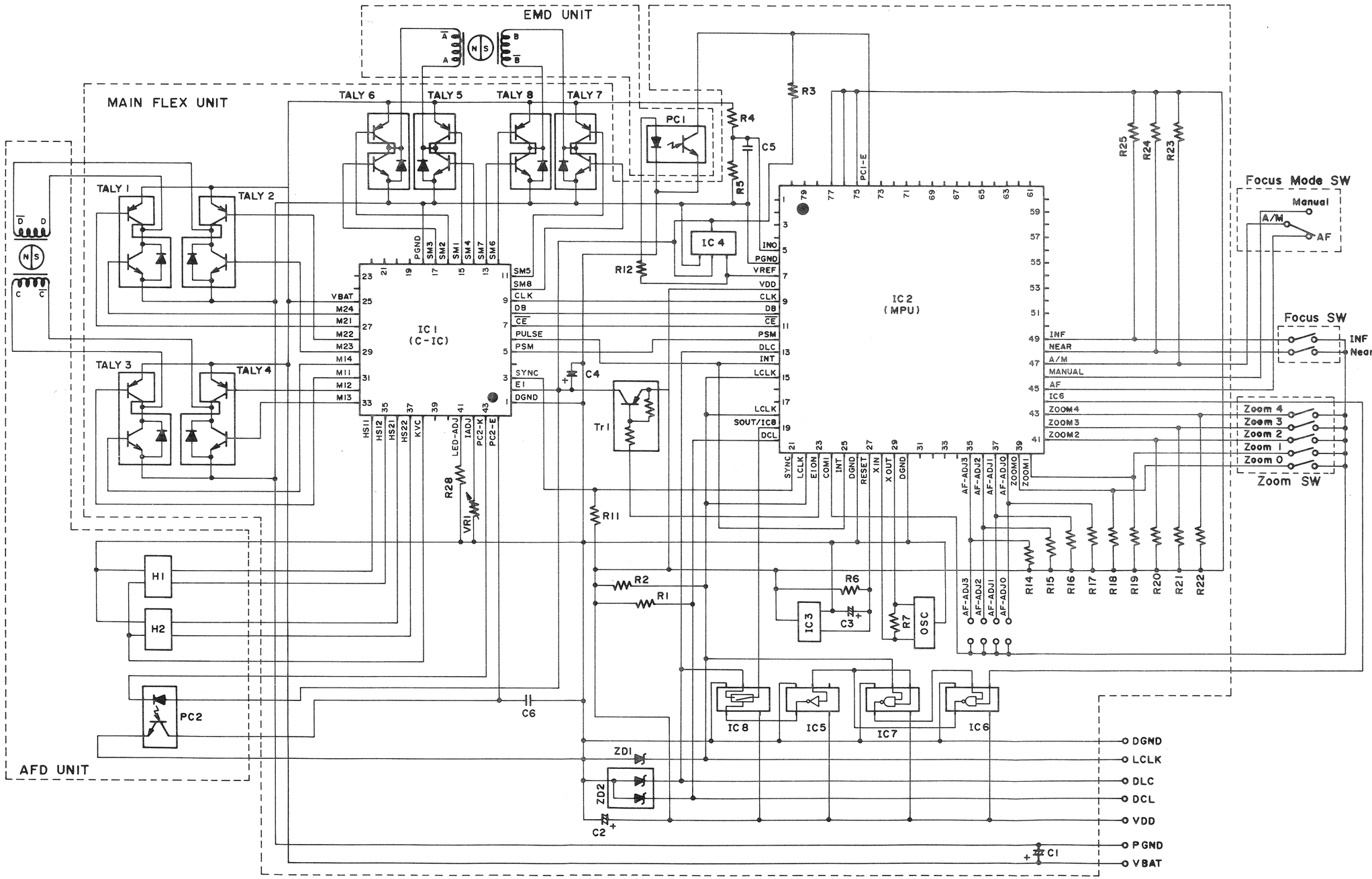
Pads are covered with cloth tape.
Replace it when finished.

	Horiz. Sensor		Vert. Sensor	
補正量	AF-ADJ 0	AF-ADJ 1	AF-ADJ 2	AF-ADJ 3
$-3/4F\delta$	1	0	1	0
$-1/4F\delta$	0	0	0	0
$+1/4F\delta$	1	1	1	1
$+3/4F\delta$	0	1	0	1

F : f/No. 0: Closed
δ : circle of confusion 1: Open

SCHEMATIC DIAGRAM

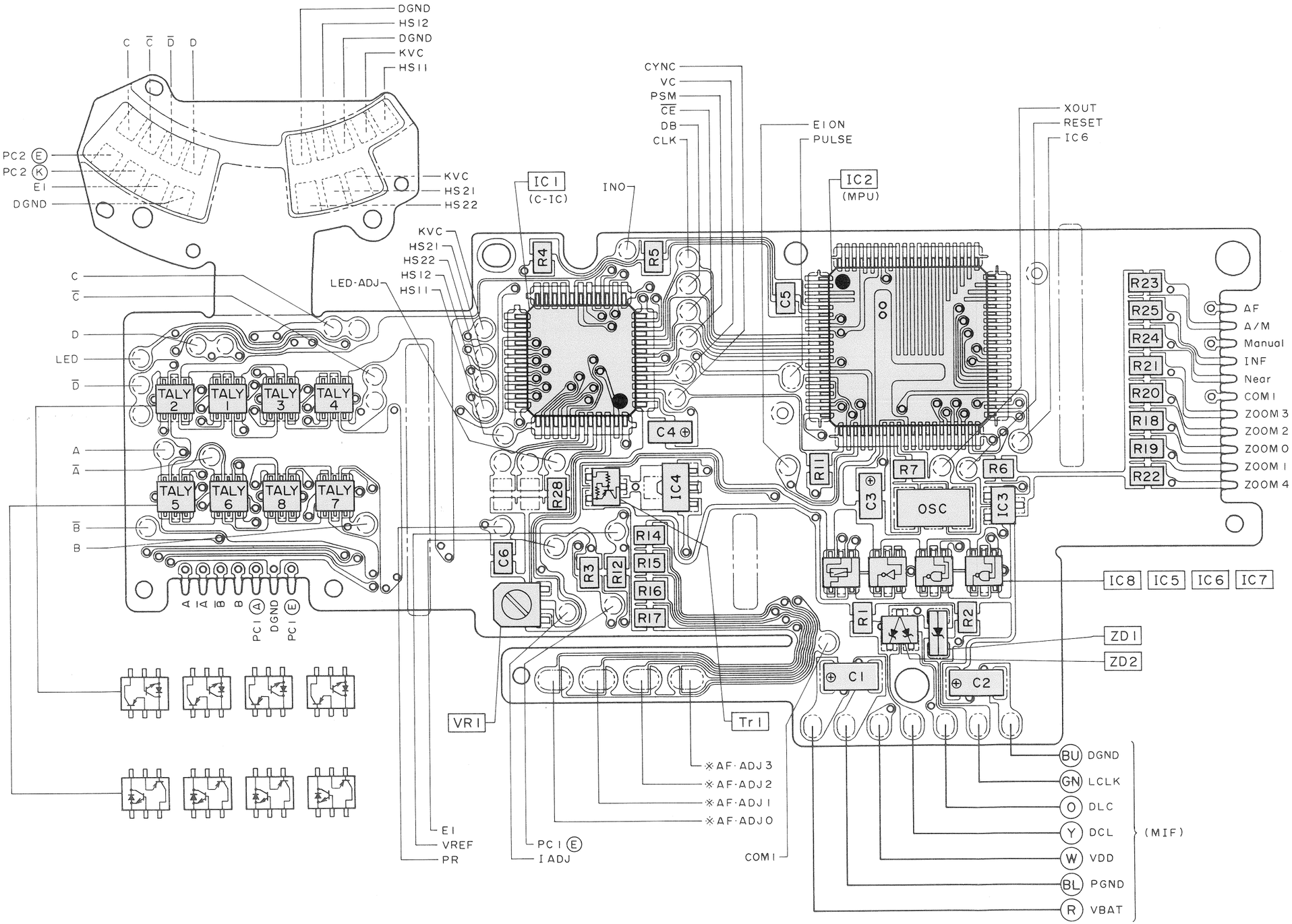
EF 20-35mm 1:2.8L
REF. NO. C21-9512



01 SEP, 1989

P.C.B. DIAGRAM
(MAIN FLEX)

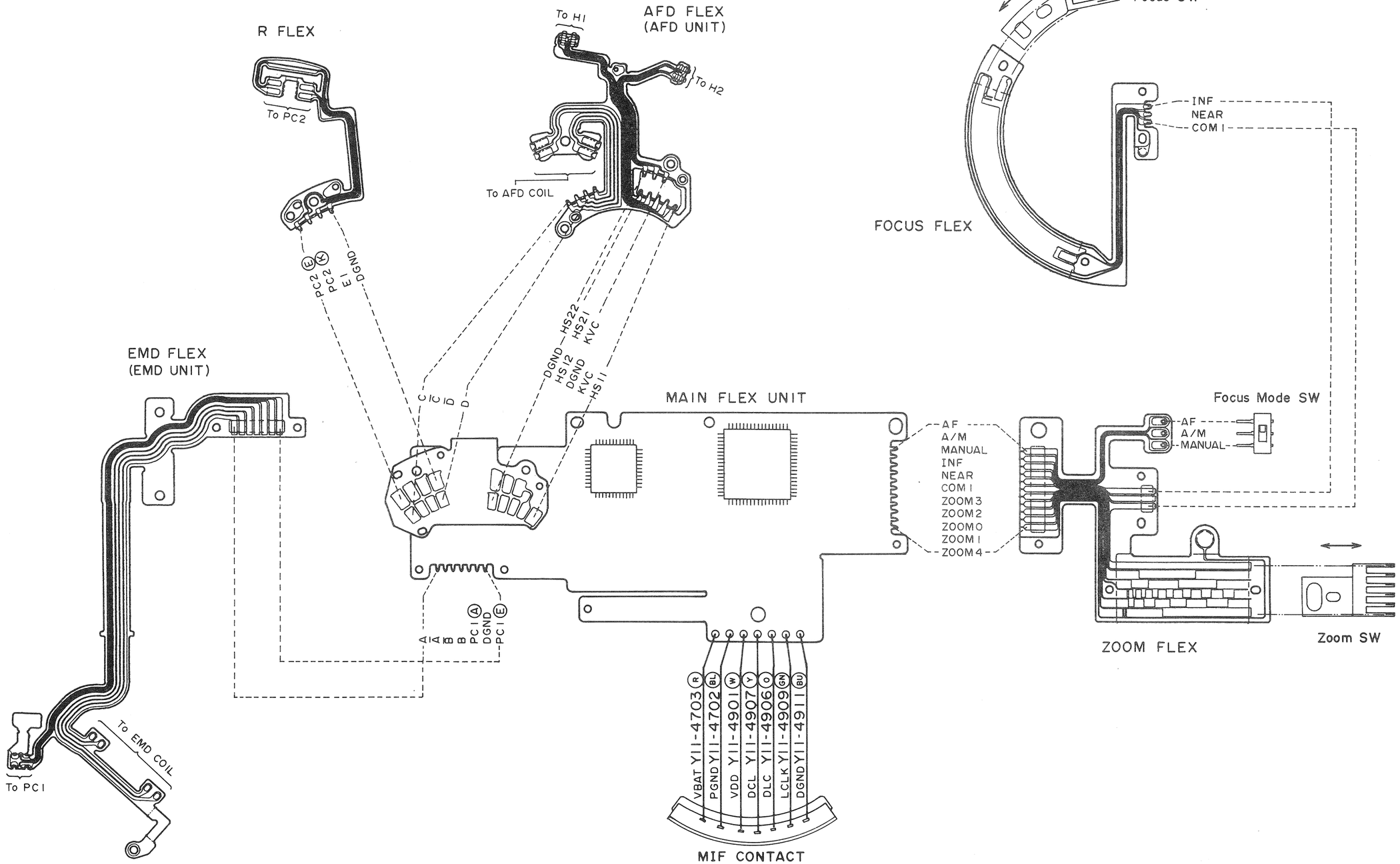
EF 20-35 mm 1:2.8L
REF. NO. C21-9512



01 SEP, 1989

WIRING & P.C.B. DIAGRAM

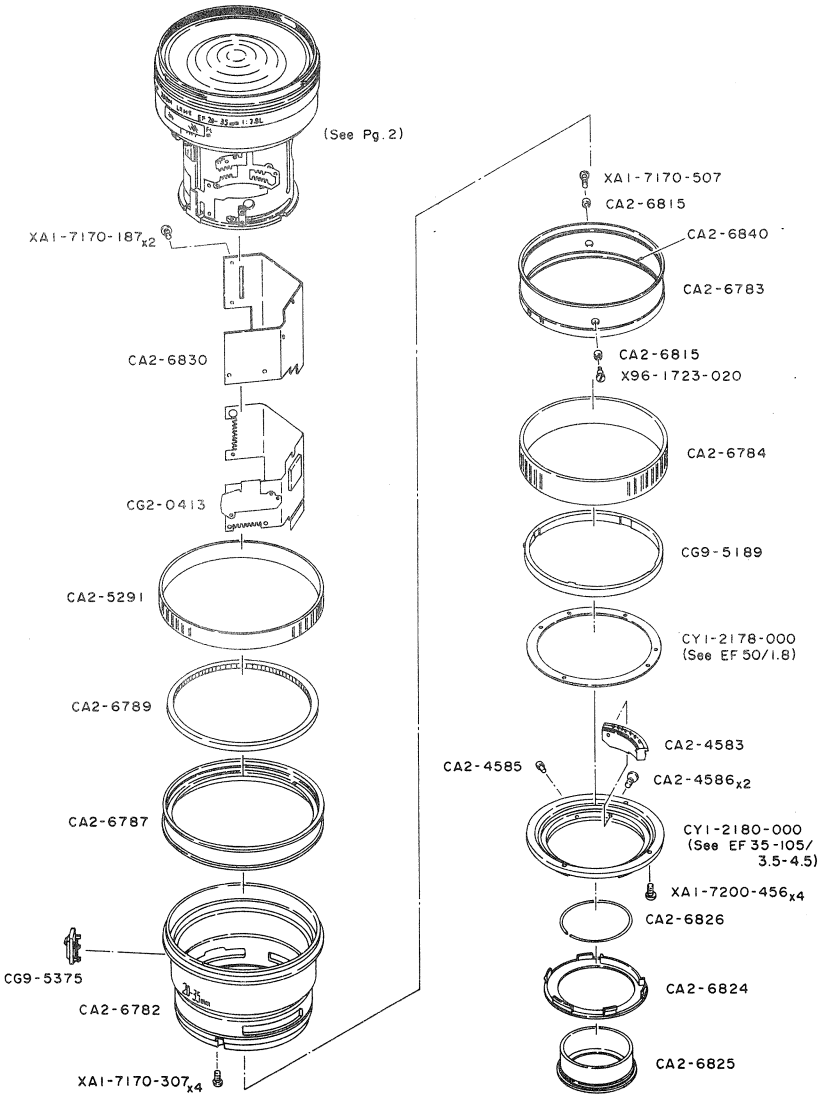
EF 20-35 mm 1:2.8L
REF. NO. C21-9512



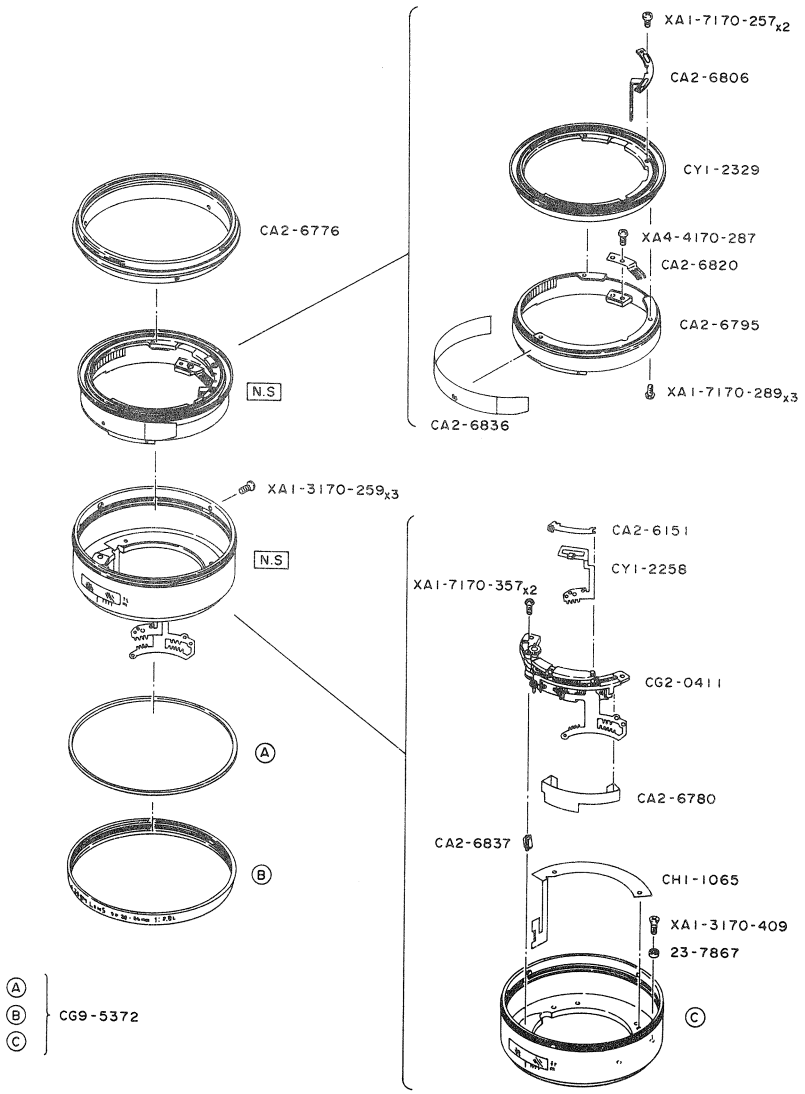
01 SEP, 1989

REF. NO. C21-9512

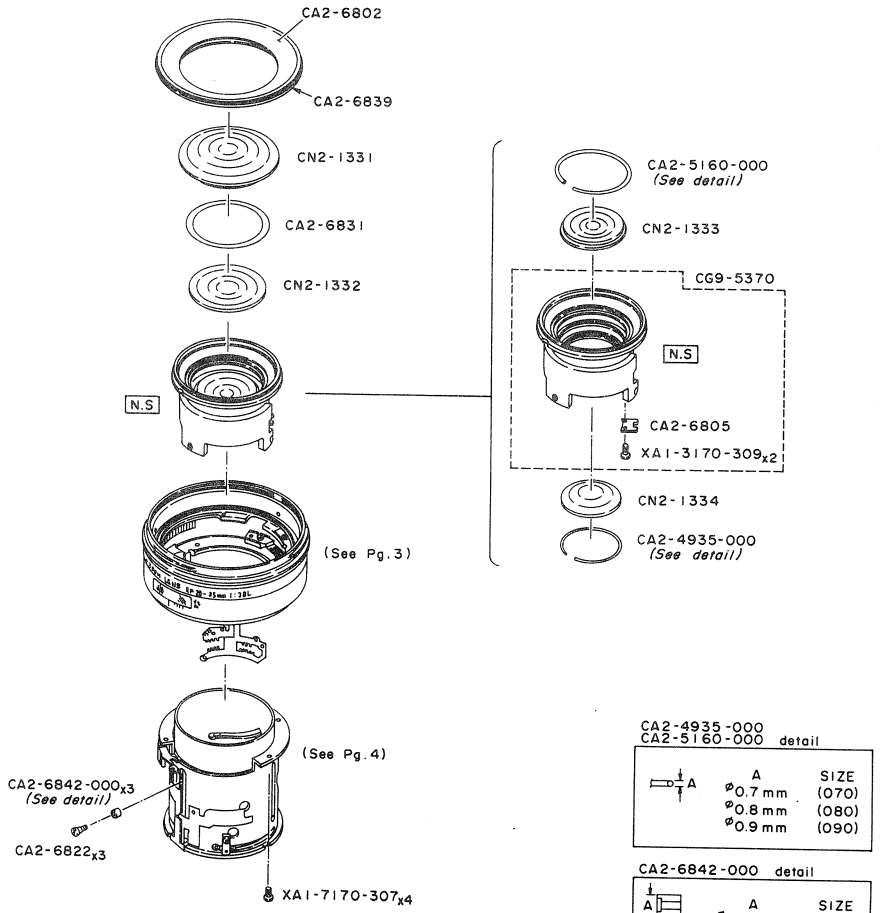
CANON LENS EF 20-35 mm 1:2.8L



CANON LENS EF 20-35 mm 1:2.8L



CANON LENS EF 20-35 mm 1:2.8L



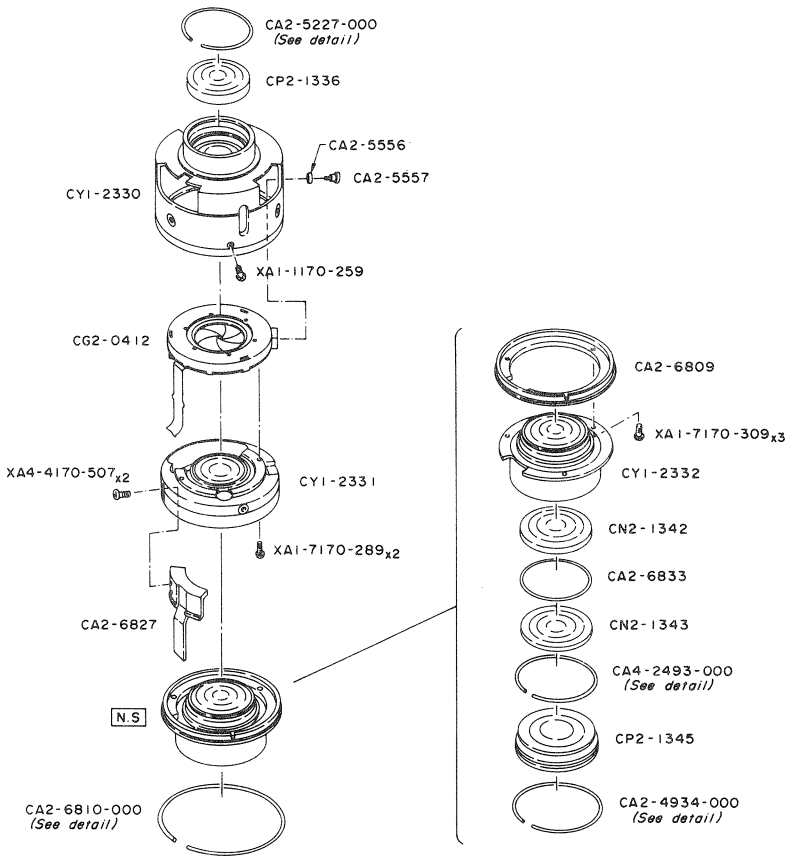
CA2-4935-000
CA2-5160-000 detail

A	SIZE
ø0.7 mm	(070)
ø0.8 mm	(080)
ø0.9 mm	(090)

CA2-6842-000 detail

A	SIZE
ø3.99 mm	(399)
ø4.00 mm	(400)
ø4.01 mm	(401)
ø4.02 mm	(402)

CANON LENS EF 20-35 mm 1:2.8L



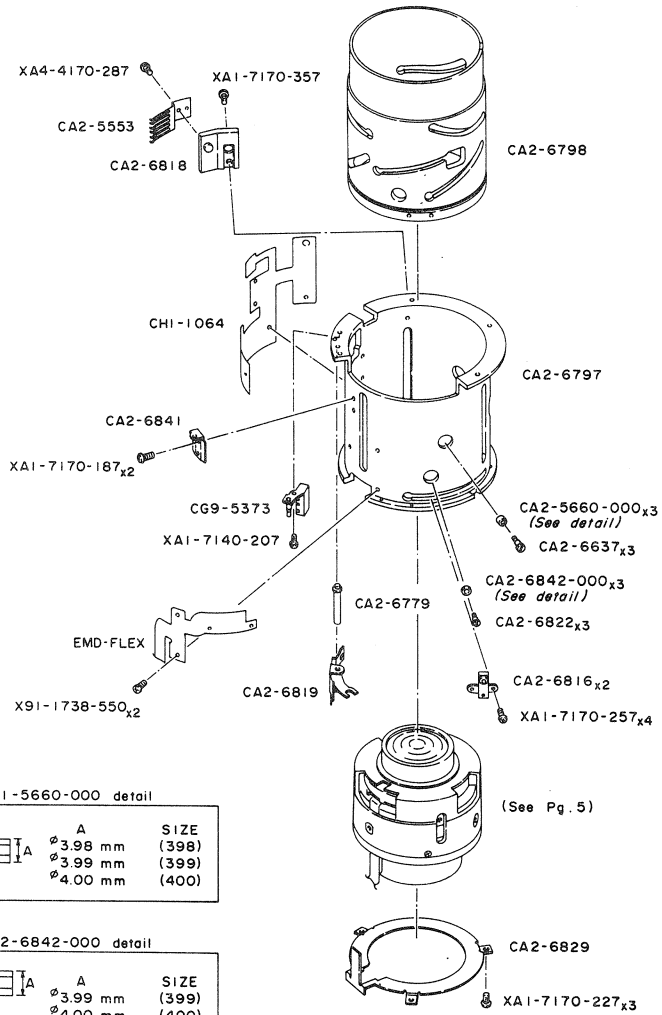
CA2-4934-000
CA2-5227-000
CA2-6810-000 detail

A	SIZE
ø0.7 mm	(070)
ø0.8 mm	(080)
ø0.9 mm	(090)

CA4-2493-000 detail

A	SIZE
ø0.6 mm	(060)
ø0.7 mm	(070)
ø0.8 mm	(080)

CANON LENS EF 20-35 mm 1:2.8L



CA1-5660-000 detail

A	SIZE
ø3.98 mm	(398)
ø3.99 mm	(399)
ø4.00 mm	(400)

CA2-6842-000 detail

A	SIZE
ø3.99 mm	(399)
ø4.00 mm	(400)
ø4.01 mm	(401)
ø4.02 mm	(402)