Canon

Service Manual

ENGLISH EDITION

EF 100-400mm 1:4.5-5.6L IS C21-9961
(USM)

CY8-1200-181

Canon

EF 100-400mm 1:4.5-5.6L IS (USM)

REF.NO.C21-9961

SERVICE MANUAL

Application

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PREFACE

This manual contains information on servicing the product. It has the following sections.

Part 1 General Information

Provides the basic information needed to understand the product.
(Operating instructions are not included. Refer to the products instruction book if necessary.)

Part 2 Technical Information

Provides technical information about the mechanism and electronics of the product.

Part 3 Repair Information

Provides information about the tools and expendables required for disassembly, reassembly, adjustment and measurement of the product, and their locations and method of use.

Part 4 Parts Catalog

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Part 1

General Information

1. FEATURES

- L-series telephoto zoom lens with Image Stabilizer.
- The Image Stabilizer gives the equivalent effect of a shutter speed two stops faster.
- 4× zoom ratio (100-400mm).
- Fluorite and Super UD lens elements correct secondary spectrum chromatic aberrations for high image quality at all focal lengths.
- The first EF zoom lens to have both rear focusing and a floating system to obtain high image quality at all focal lengths.
- Minimum focusing distance of 1.8 meter at all focal lengths.
- Ring USM for silent AF.
- Manual focusing possible in the AF mode (full-time mechanical manual focusing).
- Compatible with Extender EF 1.4× and EF 2×. With the EOS 3, autofocusing (at the center focusing point only) is possible while the EF 1.4× is attached to the lens.
- Like the EF 35-350 f/3.5-5.6 USM, this lens has a wide rubberized tension-adjustable push-pull zoom ring.

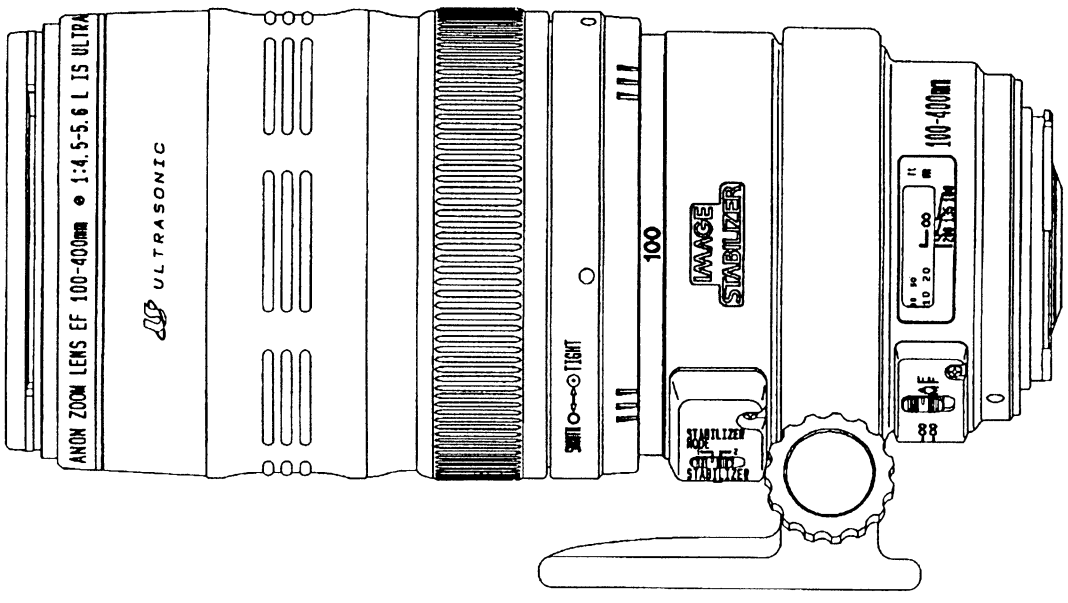


Fig. 1-1 External View (with Tripod Collar Attached).

2. DESIGN SPECIFICATIONS

1. Picture size — 24 mm × 36 mm

2. Focal length and aperture — 100-400mm 1:4.5-5.6

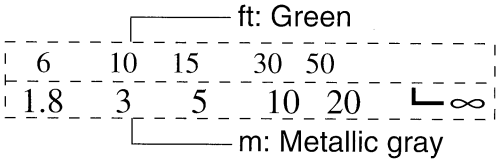
3. Optical construction
   - 3-1 Lens construction — 17 elements in 14 groups (fluorite element for G3, Super UD glass for G7)
   - 3-2 Coating — Super Spectra coating

4. Angle of view at infinity

Diagonal extent (43.2 mm)	24° - 6°10'
Vertical extent (24 mm)	14° - 3°30'
Horizontal extent (36 mm)	20° - 5°10'

5. AF Feature
   - 5-1 Driving system — Ring USM
   - 5-2 Driving speed — H/0.54 to L/1.67 sec. or shorter (lens drive speed from infinity to min. focusing distance)
   - 5-3 Drive noise — 40 dB or lower (Based on Canon's measuring standards.)
   - 5-4 Manual focusing — Enabled with focus mode switch and focusing ring (full-time mechanical manual focusing provided).
   - 5-5 Focusing distance limiting switch — Two focusing distance ranges can be set: 1) 1.8 m - infinity 2) 6.5 m - infinity

6. Focusing
   - 6-1 Extension mechanism — Rear focusing driven by a focus camera to move groups 4 and 6 (floating system).
   - 6-2 Macro feature — None
   - 6-3 Focusing range — 1.8 m to infinity (at all focal lengths)
   - 6-4 Rotating angle — 62°
   - 6-5 Distance scale



   - 6-6 Maximum magnification and picture field

Min. Focusing Distance	Magnification (×)		Picture field (mm)	
	At 100mm	At 400mm	At 100mm	At 400mm
1.8 m/5.9 ft	0.06	0.20	393×591	119×177

7. Zooming Feature		
	7-1 Type	6-group linear zoom (zoom extension: 79.6 mm) Front of lens barrel moves.
	7-2 Focal length scale	100 135 150 200 250 300 350 400 (Marked on fixed lens barrel)
8. Mount		
	8-1 Type	Canon EF mount
	8-2 Signal transmission	5 items of EOS-dedicated information (absolute distance information included): 1) Lens mode 2) Lens type 3) Metering information 4) Focal length 5) AF drive information
9. Aperture Mechanism		
	9-1 Aperture control	Pulse control with EMD (enabled simultaneously during autofocusing)
	9-2 Aperture setting and markings	Max. aperture: f/4.5-5.6 (marked on lens barrel), Min. aperture: f/32-38 (f/32-40 for cameras with 1/3-stop indications)
	9-3 Aperture blades	8
	9-4 Depth-of-field scale	None
	9-5 Infrared mark	Provided
10. Filter size		77 mm, P = 0.75 mm (Up to 1 filter attachable)
11. Dimensions and weight		92 dia. × 189 mm, 1360 g (3.6 dia. × 7.4 in., 48 oz)
12. Accessories		
	12-1 Hood	ET-83C (Dedicated two-lug bayonet cylindrical hood attachable in reverse.)
	12-2 Lens cap	E-77U
	12-3 Lens case	Soft case: LZ1324 Hard case: None (Accommodates the lens with one filter, both front and rear lens caps, and hood attached in reverse.)
	12-4 Rear lens cap	Lens Dust Cap E
	12-5 Standard accessories	Tripod collar (Weight: 150 g/5.3 oz)

13.Miscellaneous

13-1 Attachable extenders See table below.

Extender		With EF 1.4×	With EF 2×
Focal Length		140mm - 560mm	200mm - 800mm
Angle of View	Diagonal extent	17° 34' - 6° 10'	12° - 3° 6'
	Vertical extent	9° 48' - 3° 22'	7° - 1° 40'
	Horizontal extent	14° 39' - 5° 05'	10° - 2° 35'
Max. Magnification		0.28	0.41
Focusing		Manual focus (AF enabled*)	Manual focus
Aperture	1/2-stop indications	At 100mm: f/6.7- f/45, At 400mm: f/8- f/54	At 100mm: f/9.5- f/64 At 100mm: f/11- f/76
	1/3-stop indications	At 100mm: f/6.3- f/45, At 400mm: f/8- f/57	At 100mm: f/9.0- f/64 At 100mm: f/11- f/81
Image Stabilizer		See page 2-20	See page 2-20

* With the EOS-3, AF is possible only with the center focusing point. Also, the AF speed will be 67% of the normal AF speed of the prime lens.

13-2 Extension Tubes EF 12 and EF 25 Compatible

Setting		Min. Focusing Distance Range (mm)		Magnification (×)		Picture Field (mm)	
		At 100mm	At 400mm	At 100mm	At 400mm	At 100mm	At 400mm
EF12	Near Distance	755	1569	0.19	0.25	126×190	95×142
	Far Distance	1122	13224	0.12	0.03	201×301	755×1124
EF25	Near Distance	544	1393	0.35	0.31	69×104	77×115
	Far Distance	666	6491	0.27	0.07	91×136	341×508

14. Image Stabilizer

14-1 Image stabilizer mechanism	Parallel shifting of Image Stabilizer lens group (group 2)
14-2 Max. eccentricity	±1.0mm
14-3 Max. correctable angle	±0.5° (At infinity)
14-4 Shake detection	Via gyro sensors (1 sensor each for yaw and pitch)
14-5 Image stabilizer activation	Turned on with the IS ON/OFF sliding switch and activated by pressing the shutter button halfway.
14-6 Centering/locking	While the Image Stabilizer is unused, the image-stabilizing lens group is centered and locked in position.
14-7 Mode Selection:	1) Stabilizer Mode 1: Normal image stabilization. 2) Stabilizer Mode 2: Image stabilization in one direction only.

3. EXTERNAL VIEW, CROSS SECTION, AND SCHEMATIC

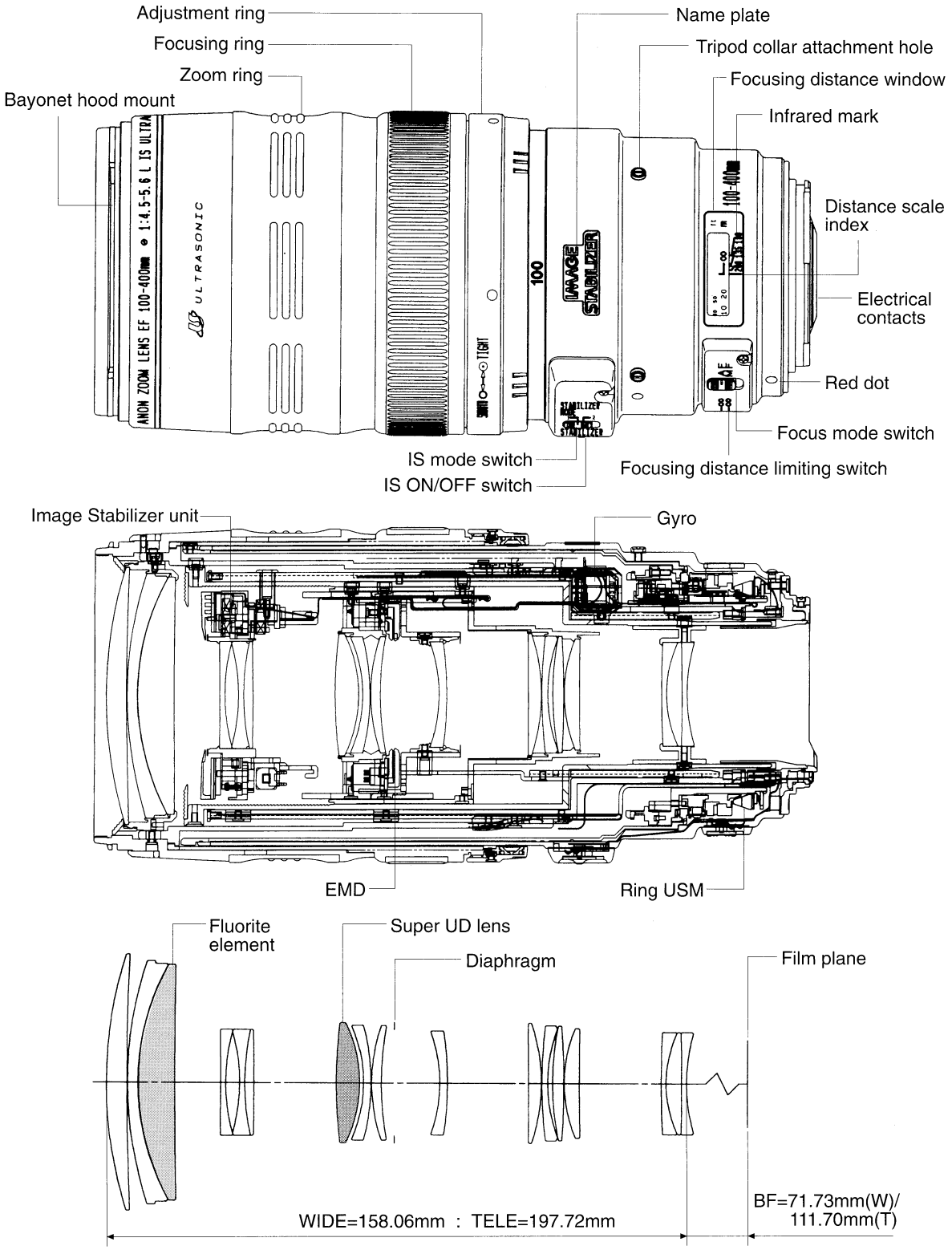


Fig. 1-2 External View, Cross Section, and Optical System Diagram

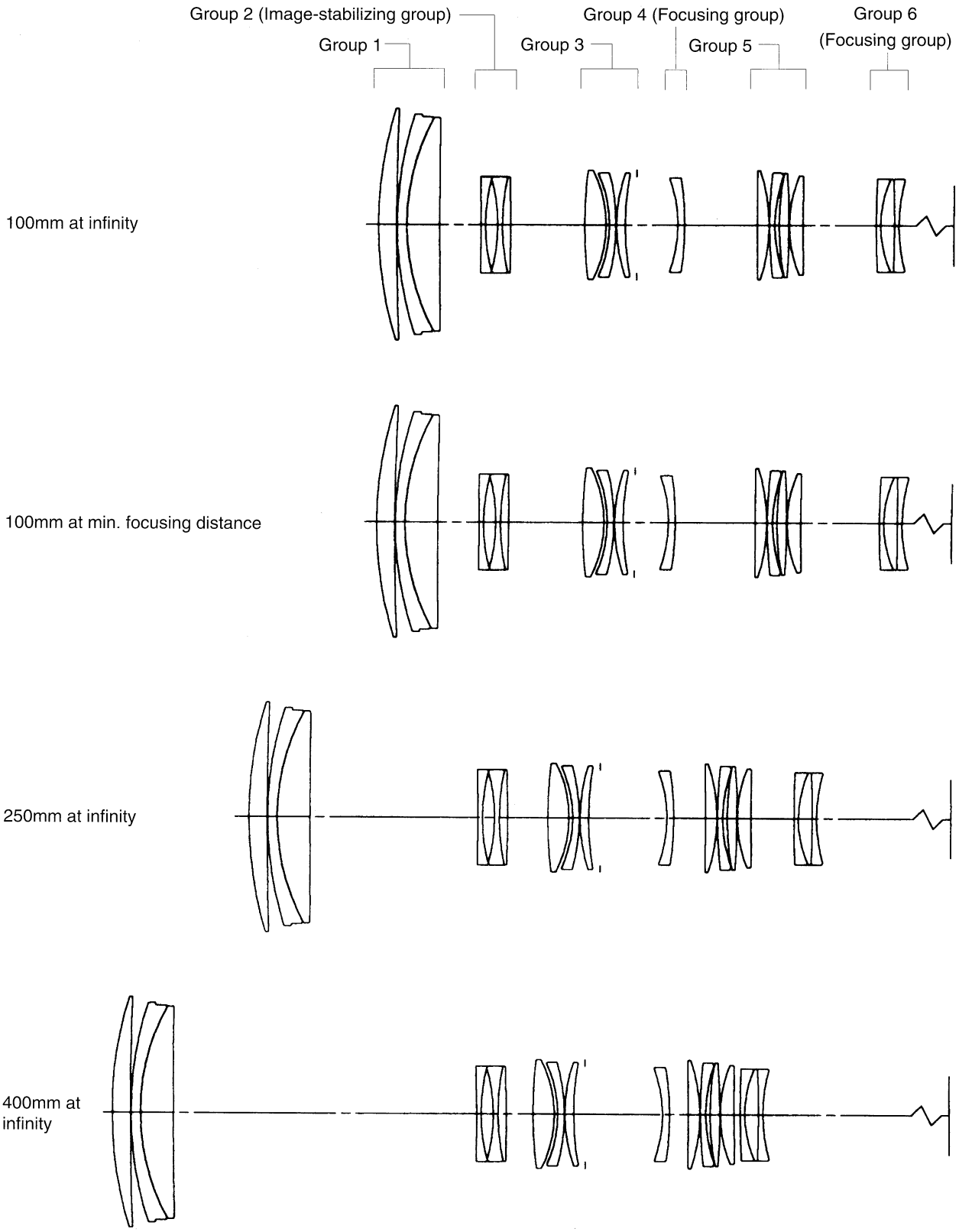


Fig. 1-3 Lens Movement during Zooming.

4. PRECAUTIONS

4.1 During Normal Use

- When using the focusing distance limiting switch for focusing distances from 6.5 m to infinity, note the following:
  If the focusing distance scale's index is between 1.8 m and 6.5 m when the focusing distance limiting switch is used to switch the focusing distance range, autofocusing will function as follows when the shutter button is pressed halfway:
  1) In the prediction mode, autofocusing will first stop at 6.5 m before autofocusing begins.
  2) In the search mode, autofocusing will stop at 6.5 m. In this case, press the shutter button halfway again to resume normal autofocus operation.
     If the focusing distance scale's index is already between 6.5 m and infinity when the focusing distance range is switched, autofocusing will function normally.
- If Extender 1.4× or 2× is attached, manual focus will be set automatically. However, with the EOS-3 and Extender 1.4× attached to the lens, autofocusing is possible with the center focusing point only.
- When attaching an Extender, attach it to the lens before attaching the extender to the camera.
- If the lens is used with the camera's built-in flash, flash vignetting may occur. Therefore, an external flash should be used.
- Before attaching a polarizing filter, remove any hood from the lens.
- Depending on its position, the tripod collar can make it difficult to access the IS ON/OFF switch or IS mode switch.

4.2 During Image Stabilizer Operation

- Except with certain cameras (See Table 2-1 on page 2-23), the Image Stabilizer operates normally with either Extender 1.4× or 2× attached to the lens.
- If the camera is mounted on a tripod, be sure the Image Stabilizer is OFF. If the Image Stabilizer is ON while the camera is on a tripod, the gyro sensor output's offset during slow shutter speeds may cause Image Stabilizer misoperation. Also, during medium or fast shutter speeds, camera shake while the camera is on a tripod may cause Image Stabilizer misoperation.
- Before pressing the shutter button, look through the viewfinder and check that the image shake is being corrected. After the IS ON/OFF switch is turned on, it takes about one second before the Image Stabilizer starts operating.
- After the picture is taken, the image in the viewfinder may shake a lot. This has no effect on the picture taken. (See Table 2-1 on page 2-23 for details.)
- While the camera's built-in flash recycles immediately after flash is used, the image in the viewfinder may shake depending on the camera model. This has no effect on the picture taken. However, the camera's built-in flash may cause flash vignetting (see 4-1). (See Table 2-1 on page 2-23 for details.)
- Turn off the Image Stabilizer before taking a bulb exposure. (With certain cameras, effective Image Stabilizer effects cannot be attained or the Image Stabilizer cannot function during bulb exposures.)

- The Image Stabilizer will not operate with the EOS EF-M camera. (The EF-M cannot send the Image Stabilizer ON/OFF signal when the shutter button is pressed halfway.)
- With the EOS 3/ELAN II(E)/50(E)/IX/IX Lite/IX 7, the Image Stabilizer does not work with the self-timer. (The Image Stabilizer turns off automatically if the self-timer is used.)

4.3 Image Stabilizer ON/OFF and Stabilizer Modes

The Image Stabilizer is turned ON or OFF with the IS ON/OFF switch. (| to turn it ON and ○ to turn it OFF.)

Like the EF 300mm f/4L IS USM lens, the lens has two Stabilizer modes. The Stabilizer Mode is set with the Stabilizer Mode switch.

Part 2

Technical Information

1. COMPONENTS AND FUNCTIONS

Main PCB

Code	Spec./Mfg. #	Function
IC1	HD6433032ST05X	Overall lens control
IC2	MPC17A33SVM	EMD drive
IC3	MB3776APNF	USM DC/DC converter (step-up)
IC4	MB3864PNF	USM drive
IC5	NJM2903V	USM A and S phase detection
IC6	BU2207FV	USM VCO output control
IC7	S-80727SN-DQ-T1	Reset control
IC8	XC62AP4002MR	VD1 (4V) output
IC9	S-29220AFJA	Lens adjustment data setting (EEPROM)
IC10	TC74VHC14FT	Voltage level conversion
IC11	NJM064V	Gyro-sensor output amplifier
IC12	NJM2100V	Gyro-sensor output amplifier
IC13	TC4W66FU	Gyro-sensor output high-pass switching
IC14	XC62AP4502MR	VD3 (4.5V) output
IC15	TC7W08FU	Mechanical lock, USM drive switching
IC16	TC7W74FU	Busy control when microcomputer sleep is canceled
CF	FAR-C4CG 10MHz	Microcomputer system clock supply
MOS1	µPA502T	LCLK, DLC output control
MOS2	µPA502T	VD2, VD3 output control
MOS3	µPA502T	VD4 output, USM DC/DC start control
Q1	2SD1624	USM DC/DC switching
Q2	DTC144E	Retention magnet drive
Q3	DTC143TU	Focus pulse output control
Q4	FP1J3P	VD3 output control
Q5	FP1J3P	VD2 output control
Q6	GN1L3N	VD4 output control
Q7	GN1L3N	Photointerrupter power switch
D1	MA736	USM DC/DC rectification
D2	1SS302	IC pin protection
D3	SB01-05CP	IC pin protection
D4	MAZK075D	IC pin protection
D5	UDZ7.5B	IC pin protection
D6	UDZ7.5B	IC pin protection
D7	IMN10	ZOOM0/ZONE0/IS MODE SW detection
D8	IMN10	ZOOM1/ZONE1/IS SW detection
D9	IMN10	ZOOM2/ZONE2/LIMIT SW detection
D10	IMN10	ZOOM3/ZONE3/EXT0 detection
D11	IMN10	ZOOM4/ZONE4/EXT1 detection

Code	Spec./Mfg. #	Function
PS	P4035	Focus pulse detection photointerrupter
PI	TLP810	Maximum aperture detection photointerrupter
L1	12µH	USM-DC/DC step-up voltage drive
L2	1.5mH	USM step-up voltage drive
L3	1.5mH	USM step-up voltage drive
VR1	2kΩ	Pulse adjustment
VR2	10kΩ	USM-VCO frequency adjustment
GR1	CG-16CL0	Deflection detection
GR2	CG-16CL1	Deflection detection
C1	22µF/10V	VBAT smoothing
C2	3.3µF/10V	VDD smoothing
C3	1.5µF/50V	USM-DC/DC output smoothing
C4	150pF/50V	USM-DC/DC output stabilization
C5	4700pF/50V	USM-DC/DC oscillation frequency setting
C6	0.047µF/25V	USM-DC/DC phase correction setting
C7	0.047µF/16V	VB detection voltage smoothing
C8	3300pF/25V	USM-S phase bias voltage noise elimination
C9	4700pF/25V	USM-S phase input
C10	6.8µF/7V	VD1 output smoothing
C11	0.1µF/16V	VD3 output smoothing
C12	0.1µF/16V	VD2 output smoothing
C13	0.1µF/16V	VD4 output smoothing
C14	0.1µF/16V	IC10 power noise elimination
C15	0.1µF/16V	IC16 power noise elimination
C16	1.0µF/10V	IC6 power noise elimination
C17	330pF/50V	USM-VCO frequency setting
C18	0.1µF/16V	IC2 power noise elimination
C19	0.1µF/16V	Photo interrupter noise elimination
C20	0.1µF/16V	IC1 power noise elimination
C21	0.1µF/16V	IC1 power noise elimination
C22	0.1µF/16V	IC9 power noise elimination
C23	0.1µF/16V	IC1 power noise elimination
C24	0.01µF/25V	Reset time setting
C25	0.01µF/50V	Shift system output low-pass setting
C26	0.01µF/50V	Shift system output low-pass setting
C27	0.01µF/50V	Shift system output low-pass setting
C28	0.01µF/50V	Shift system output low-pass setting
C29	0.047µF/16V	VBAT detection voltage smoothing
C30	4.7µF/4V	Gyro sensor reference voltage smoothing
C31	4.7µF/4V	Gyro sensor reference voltage smoothing
C32	0.1µF/16V	IC11 power noise elimination

Code	Spec./Mfg. #	Function
C33	22µF/4V	Gyro-sensor output high-pass setting
C34	22µF/4V	Gyro-sensor output high-pass setting
C35	8200pF/25V	Gyro-sensor output low-pass setting
C36	22µF/4V	Gyro-sensor output high-pass setting
C37	22µF/4V	Gyro-sensor output high-pass setting
C38	8200pF/25V	Gyro-sensor output low-pass setting
C39	6800pF/25V	Gyro-sensor output low-pass setting
C40	6800pF/25V	Gyro-sensor output low-pass setting
C41	0.1µF/16V	IC12 power noise elimination
C42	0.015µF/25V	Gyro-sensor output low-pass setting
C43	0.015µF/25V	Gyro-sensor output low-pass setting
C44	0.1µF/16V	IC13 power noise elimination
C45	0.1µF/16V	EMD power noise elimination
C46	3900pF/200V	USM A phase bias voltage noise elimination
C47	3900pF/200V	USM B phase bias voltage noise elimination
C48	0.1µF/16V	IC15 power noise elimination
C49	470pF50V	Pulse noise elimination
C50	2200pF/50V	Pulse noise elimination
CJ21	0.22µF/16V	Gyro-sensor power smoothing
CJ22	0.22µF/16V	Gyro-sensor power smoothing
R1	41.2kΩ/0.1W	USM-DC/DC output voltage setting
R2	750Ω/0.063W	USM-DC/DC output voltage setting
R3	820Ω/0.063W	USM-DC/DC current limiting
R4	2.2kΩ/0.063W	USM DC/DC oscillation frequency setting
R5	27kΩ/0.063W	EMD control voltage setting
R6	24kΩ/0.063W	EMD control voltage setting
R7	27kΩ/0.063W	VB detection voltage setting
R8	2kΩ/0.063W	VB detection voltage setting
R9	18kΩ/0.063W	USM S phase comparison voltage setting
R10	18kΩ/0.063W	USM S phase comparison voltage setting
R11	20kΩ/0.1W	USM A phase division voltage setting
R12	100kΩ/0.063W	USM A phase comparison voltage setting
R13	12kΩ/0.063W	USM A phase comparator output pull-up
R14	12kΩ/0.063W	USM S phase comparator output pull-up
R15	10kΩ/0.063W	LCLK input pull-up
R16	10kΩ/0.063W	DCL input pull-up
R17	51kΩ/0.063W	DCL control pull-up
R18	51kΩ/0.063W	Busy control pull-up
R19	15kΩ/0.063W	USM-VCO frequency setting
R21	24kΩ/0.063W	PI phototransistor output level setting
R22	110Ω/0.063W	Photointerrupter current setting
R23	3kΩ/0.063W	PS phototransistor output level setting
R24	12kΩ/0.063W	Photointerrupter output pull-up
R25	10kΩ/0.063W	EEP-DT signal control

Code	Spec./Mfg. #	Function
R26	51kΩ/0.063W	EEP-CS control pulldown
R27	100kΩ/0.063W	Reset time setting
R28	51kΩ/0.063W	AF/MAN switch pull-up
R29	7.5kΩ/0.063W	Shift system output low-pass setting
R30	7.5kΩ/0.063W	Shift system output low-pass setting
R31	7.5kΩ/0.063W	Shift system output low-pass setting
R32	7.5kΩ/0.063W	Shift system output low-pass setting
R33	51kΩ/0.063W	Reset output pull-up
R34	30kΩ/0.063W	VBAT detection voltage setting
R35	30kΩ/0.063W	VBAT detection voltage setting
R36	1kΩ/0.063W	Gyro-sensor output high-pass setting
R37	24kΩ/0.063W	Gyro-sensor output amplification setting
R38	24kΩ/0.063W	Gyro-sensor output amplification setting
R39	1kΩ/0.063W	Gyro-sensor output high-pass setting
R40	24kΩ/0.063W	Gyro-sensor output amplification setting
R41	24kΩ/0.063W	Gyro-sensor output amplification setting
R42	680kΩ/0.063W	Gyro-sensor output high-pass setting
R43	1.8kΩ/0.063W	Gyro-sensor output high-pass amplification setting
R44	36kΩ/0.063W	Gyro-sensor output high-pass amplification setting
R45	680kΩ/0.063W	Gyro-sensor output high-pass setting
R46	1.8kΩ/0.063W	Gyro-sensor output high-pass amplification setting
R47	36kΩ/0.063W	Gyro-sensor output high-pass amplification setting
R48	10kΩ/0.063W	Gyro-sensor output amplification setting
R49	20kΩ/0.063W	Gyro-sensor output amplification setting
R50	10kΩ/0.063W	Gyro-sensor output amplification setting
R51	20kΩ/0.063W	Gyro-sensor output amplification setting
R52	180kΩ/0.063W	EEP-DT control pull-up
R53	51kΩ/0.063W	VD2, VD3 power control pulldown
R54	51kΩ/0.063W	USM DC/DC start control pulldown

Shift PCB (IS unit)

Code	Spec./Mfg. #	Function
ICS6	MPC1731VM	Shift system drive
ICS15	MM1071XVF	Shift system position detection
ICS16	MM1071XVF	Shift system position detection
PSD1	S3274-05	Shift system position detection
PSD2	S3274-05	Shift system position detection
IRED1	L4378	Shift system position detection
IRED2	L4378	Shift system position detection
QS8	2SD1624T/U	Mechanical lock magnet drive
QS14	µPA502T	Shift system position detection output switching

Code	Spec./Mfg. #	Function
DS2	SB05-05CP	Mechanical lock magnet drive
CS1	0.1µF/16V	IC15 noise elimination
CS2	0.1µF/16V	IC16 noise elimination
CS3	0.047µF/16V	Shift system position detection output switching/stabilization
CS4	0.047µF/16V	Shift system position detection output switching/stabilization
CS5	1000pF/50V	Shift system position detection output low-pass setting
CS6	1000pF/50V	Shift system position detection output low-pass setting
CS7	0.022µF/50V	Shift system driver step-up voltage setting
CS8	0.022µF/50V	Shift system driver step-up voltage setting
CS9	0.022µF/50V	Shift system driver step-up voltage setting
CS10	0.1µF/25V	IC6 protector
RS1	4.7kΩ/0.063W	Shift system reference voltage setting
RS2	4.7kΩ/0.063W	Shift system reference voltage setting
RS3	36kΩ/0.063W	Shift system reference voltage setting
RS4	36kΩ/0.063W	Shift system reference voltage setting
RS5	510Ω/0.063W	Shift system reference voltage setting
RS6	510Ω/0.063W	Shift system reference voltage setting
RS7	20kΩ/0.063W	Shift system position detection output amplification
RS8	20kΩ/0.063W	Shift system position detection output amplification
RS9	30kΩ/0.063W	Shift system position detection output amplification
RS10	30kΩ/0.063W	Shift system position detection output amplification
RS11	20kΩ/0.063W	Shift system position detection output amplification
RS12	20kΩ/0.063W	Shift system position detection output amplification
RS13	82kΩ/0.063W	Shift system position detection output amplification
RS14	82kΩ/0.063W	Shift system position detection output amplification
RS15	18kΩ/0.063W	Shift system position detection output level setting
RS16	18kΩ/0.063W	Shift system position detection output level setting
RS17	12kΩ/0.063W	Shift system position detection output level setting
RS18	12kΩ/0.063W	Shift system position detection output level setting
RS19	15kΩ/0.063W	Shift system position detection output level setting
RS20	15kΩ/0.063W	Shift system position detection output level setting
RS21	1MΩ/0.063W	Shift system driver step-up voltage setting
RS22	1.1kΩ/0.063W	Mechanical lock driver current limiting
JP4		Mechanical lock driver VBAT connection

2. IC PIN TABLE

IC1

No.	Symbol	I/O	A/D	Voltage	Function
1	PWMY	O	D	0/4V	Shift system (yaw) PWM drive control
2	PB1	O	D	0/4V	Gyro high-pass filter time constant switching control
3	PWMP	O	D	0/4V	Shift system (pitch) PWM drive control
4	PB3	O	D	0/4V	Camera communication busy control
5	TP12	O	D	0/4V	EMD A phase forward direction drive control
6	TP13	O	D	0/4V	EMD A phase reverse direction drive control
7	TP14	O	D	0/4V	EMD B phase forward direction drive control
8	TP15	O	D	0/4V	EMD B phase reverse direction drive control
9	TxD	O	D	0/4V	DCL transmission data output
10	RxD	I	D	0/4V	DCL reception data reverse output
11	SCK	I	D	0/4V	LCLK input
12	Vss			0	Logic power supply (–)
13	MANU	O	D	0/4V	AF/MF change switch control
14	AUTO	O	D	0/4V	AF/MF change switch control
15	P32	O	D	0/4V	Shift system (yaw) position detection switching control
16	P33	O	D	0/4V	Shift system (pitch) position detection switching control
17	P34	O	D	0/4V	Unlock retention magnet drive control
18	P35	O	D	0/4V	Camera communication busy control
19	DIRY	O	D	0/4V	Shift system (yaw) drive direction control
20	DIRP	O	D	0/4V	Shift system (pitch) drive direction control
21	Vcc			4V	Logic power supply (+)
22	P10	O	D	0/4V	USM VCO control data output (LSB)
23	P11	O	D	0/4V	USM VCO control data output
24	P12	O	D	0/4V	USM VCO control data output
25	P13	O	D	0/4V	USM VCO control data output
26	P14	O	D	0/4V	USM VCO control data output
27	P15	O	D	0/4V	USM VCO control data output
28	P16	O	D	0/4V	USM VCO control data output
29	P17	O	D	0/4V	USM VCO control data output (MSB)
30	Vss			0	Logic power supply (–)
31	P20	I	D	0/4V	Focusing/Zooming position/IS MODE SW detection
32	P21	I	D	0/4V	Focusing/Zooming position/IS SW detection
33	P22	I	D	0/4V	Focusing/Zooming position/LIMIT SW detection
34	P23	I	D	0/4V	Focusing/Zooming position/Extender detection
35	P24	I	D	0/4V	Focusing/Zooming position/Extender detection
36	P25	I	D	0/4V	Zooming position detection common
37	P26	I	D	0/4V	Focusing position detection common
38	P27	I	D	0/4V	Maximum aperture signal detection
39	P50	O	D	0/4V	Aperture signal detection power control
40	P51	O	D	0/4V	VD2, VD3 power control

No.	Symbol	I/O	A/D	Voltage	Function
41	P52	I	D	0/4V	IS Switch/Extender detection common
42	P53				Open
43	P60				Open
44	MD0	I	D	0	Microcomputer operation mode setting
45	MD1	I	D	4V	Microcomputer operation mode setting
46	Ø	O	D	0/4V	Microcomputer system clock output
47	$\overline{\text{STBY}}$	I	D	4V	Standby control input
48	$\overline{\text{RES}}$	I	D	0/4V	Reset input
49	NMI	I	D	4V	Interrupt input
50	Vss			0	Logic power supply (–)
51	EXTAL	I			Oscillator input
52	XTAL	I			Oscillator input
53	Vcc			4V	Logic power supply (+)
54	P63	I/O	D	0/4V	EEPROM data input/output
55	P64	O	D	0/4V	EEPROM SK control
56	P65	O	D	0/4V	EEPROM CS control
57	$\overline{\text{RESO}}$	O	D	0/4V	Reset output
58	AVss			0	A/D signal power supply (–)
59	GYROY	I	A	0-4V	Gyro (yaw) A/D conversion input
60	SHIFTY	I	A	0-4V	Shift system (yaw) center A/D conversion input
61	SHIFTYE	I	A	0-4V	Shift system (yaw) end A/D conversion input
62	VBATH	I	A	0-4V	VBAT A/D conversion input
63	GYROP	I	A	0-4V	Gyro (pitch) A/D conversion input
64	SHIFTP	I	A	0-4V	Shift system (pitch) center A/D conversion input
65	SHIFTPE	I	A	0-4V	Shift system (pitch) end A/D conversion input
66	VBH	I	A	0-4V	VB A/D conversion input
67	AVcc			4V	A/D signal power supply (+)
68	Vref	I	A	4V	A/D reference power supply (+)
69	$\overline{\text{IRQ0}}$	I	D	0/4V	AF/MAN change switch input
70	$\overline{\text{IRQ1}}$	I	D	0/4V	LCLK input
71	$\overline{\text{IRQ2}}$	I	D	0/4V	Focus pulse signal input
72	$\overline{\text{IRQ3}}$	I	D	0/4V	Focus pulse signal reverse input
73	FIN	I	D	0/4V	USM VCO clock signal input
74	PA1	O	D	0/4V	VD4 power, USM DC/DC control
75	PA2	O	D	0/4V	Unlock drive control
76	PA3	O	D	0/4V	USM A phase drive control
77	TIOCA1	O	D	0/4V	Unlock/USM A phase PWM drive control
78	BOUT	O	D	0/4V	USM B phase drive control
79	BIN	I	D	0/4V	USM B phase pulse control
80	SIN	I	D	0/4V	USM S phase pulse control

IC2

No.	Symbol	I/O	A/D	Voltage	Function
1	FO1	O		3-7V	EMD B phase coil forward drive output
2	VD1			3-7V	Power system power supply (+)
3	FI1	I	D	0/4V	EMD B phase forward drive control input
4	RI1	I	D	0/4V	EMD B phase reverse drive control input
5	VC			4V	Logic power supply (+)
6	$\overline{OE}$	I	D	0	Enable control signal input
7	DGND			0	Logic power supply (–)
8	RO1	O		3-7V	EMD B phase coil reverse drive control input
9	PGND			0	Power system power supply (–)
10	RO2	O		3-7V	EMD A phase coil reverse drive control input
11	VD2			3-7V	Power system power supply (+)
12	VFG			15V	Gate control power supply (+)
13	RI2	I	D	0/4V	EMD A phase reverse drive control input
14	FI2	I	D	0/4V	EMD A phase forward drive control input
15	FO2	O		3-7V	EMD A phase coil forward drive input
16	PGND			0	Power system power supply (–)

IC3

No.	Symbol	I/O	A/D	Voltage	Function
1	-IN	I	A		Error amplifier input
2	CTL	I	D		DC/DC start control
3	Vcc			3-7V	Power system power supply (+)
4	IB		A		Output drive current limiting
5	OUT	O	A		Switching transistor drive output
6	GND			0	Power system power supply (–)
7	OSC		A		Oscillation frequency setting
8	FB	O	A		Error amplifier output

IC4

No.	Symbol	I/O	A/D	Voltage	Function
1	1A	I	D	0/4V	USM A phase drive control input
2	VCC			40V	DC/DC step-up voltage power supply (–)
3	1Y	O		0/40V	USM A phase drive output
4	GND			0	Power system power supply (–)
5	GND			0	Power system power supply (–)
6	2Y	O		0/40V	USM B phase drive output
7	VCC			40V	DC/DC step-up voltage power supply (+)
8	2A	I	D	0/4V	USM B phase drive control input

IC5

No.	Symbol	I/O	A/D	Voltage	Function
1	AOUT	O	D	0/4V	USM B phase signal comparison output
2	A-IN	I	A	0-4V	USM B phase signal input
3	A+IN	I	A	2V	USM B phase signal comparison voltage input
4	GND			0	Logic power supply (–)
5	B+IN	I	A	2V	USM S phase signal comparison voltage input
6	B-IN	I	A	0-4V	USM S phase signal input
7	BOUT	O	D	0/4V	USM S phase signal comparison output
8	V+			4V	Logic power supply (+)

IC6

No.	Symbol	I/O	A/D	Voltage	Function
1	D7	I	D	0/4V	VCO control data input (MSB)
2	D6	I	D	0/4V	VCO control data input
3	D5	I	D	0/4V	VCO control data input
4	D4	I	D	0/4V	VCO control data input
5	D3	I	D	0/4V	VCO control data input
6	D2	I	D	0/4V	VCO control data input
7	GND			0	Logic power supply (–)
8	D0	I	D	0/4V	VCO control data input (LSB)
9	D1	I	D	0/4V	VCO control data input
10	Thresh	I			Oscillation input
11	Discharge	O			Oscillation capacity discharge output
12	Control	O			Control voltage output
13	Out	O	D		Oscillation output
14	VDD			4V	Logic power supply (+)

IC11

No.	Symbol	I/O	A/D	Voltage	Function
1	AOUT	O	A		Gyro (yaw) initial stage amplification output
2	A-IN	I	A		
3	A+IN	I	A	2.4V	Gyro (yaw) reference voltage input
4	V+			4.5V	Signal power supply (+)
5	B+IN	I	A		Gyro (yaw) high-pass signal input
6	B-IN	I	A		
7	BOUT	O	A		Gyro (yaw) high-pass signal amplification output
8	COUT	O	A		Gyro (pitch) high-pass signal amplification output
9	C-IN	I	A		
10	C+IN	I	A		Gyro (pitch) high-pass signal input
11	V-			0	Signal power supply (–)
12	D+IN	I	A	2.4V	Gyro (pitch) reference voltage input
13	D-IN	I	A		
14	DOUT	O	A		Gyro (pitch) initial stage amplification output

IC12

No.	Symbol	I/O	A/D	Voltage	Function
1	AOUT	O	A		Gyro (yaw) rear stage amplification output
2	A-IN	I	A		
3	A+IN	I	A	2.4V	Gyro (yaw) reference voltage input
4	V-			0	Signal power supply (–)
5	B+IN	I	A	2.4V	Gyro (pitch) reference voltage input
6	B-IN	I	A		
7	BOUT	O	A		Gyro (pitch) rear stage amplification output
8	V+			4V	Signal power supply (+)
14	EN2	I		0/4V	Shift system (pitch) PWM drive control input
15	VD2			3-7V	Power system power supply (+)
16	EN1	I		0/4V	Shift system (yaw) PWM drive control input
17	DIR1	I		0/4V	Shift system (yaw) drive direction control input
18	OC1	I		4V	Shift system (yaw) drive control input
19	2A	O		3-7V	Shift system (pitch) coil forward drive output
20	GND			0	Logic/power system power supply (–)

IC13

No.	Symbol	I/O	A/D	Voltage	Function
1	XA	I	A		Gyro (yaw) high-pass signal input
2	YA		A	2.4V	Gyro (yaw) reference voltage input
3	BON	I	D	0/4V	Gyro (yaw) high-pass time constant switching control
4	V-			0	Digital power supply (–)
5	XB	I	A		Gyro (pitch) high-pass signal input
6	YB		A	2.4V	Gyro (pitch) reference voltage input
7	AON	I	D	0/4V	Gyro (pitch) high-pass time constant switching control
8	V+			4V	Digital power supply (+)

ICS6

No.	Symbol	I/O	A/D	Voltage	Function
1	1A	O		3-7V	Shift system (yaw) coil forward drive output
2	C1L	I			Charge pump capacitor connection
3	C1H	I			Charge pump capacitor connection
4	C2L	I			Charge pump capacitor connection
5	C2H	I			Charge pump capacitor connection
6	VD1			3-7V	Power system power supply (+)
7	VG			11V	Charge pump capacitor connection
8	VC			4V	Logic power supply
9	1B	O		3-7V	Shift system (yaw) coil reverse drive output
10	GND			0	Logic/Power system power supply (–)
11	2B	O		3-7V	Shift system (pitch) coil reverse drive output
12	OC2	I		4V	Shift system (pitch) drive control input
13	DIR2	I		0/4V	Shift system (pitch) drive direction control input

ICS15, ICS16

No.	Symbol	I/O	A/D	Voltage	Function
1	A	O	A		PSD current-voltage conversion output
2	PSDA	I	A		PSD current input
3	B	O	A		PSD current-voltage conversion output
4	PSDB	I	A		PSD current input
5	A+B	O	A		PSD current-voltage conversion addition output
6	IRP	I	A	3.5V	PSD current setting reference voltage input
7	IRN	I	A		
8	IRC	I	A		IRED current detection input
9	IRA	O	A		IRED current drive output
10	GND			0	Signal power supply (–)
11	OUTG	O	A		Shift system position detection center output
12	ING	I	A		
13	OUTF	O	A		Shift system position detection end output
14	OFS	I	A		Shift system detection switching control input
15	OUTE	O	A		Shift system position detection output
16	INE	I	A		
17	OUTD	O	A		PSD current-voltage conversion subtraction output
18	VCOUT	O	A	2V	Shift system position reference voltage output
19	VCIN	I	A		Shift system position reference voltage input
20	Vcc			4V	

3. CIRCUIT EXPLANATION

3.1 Lens Mounted on Camera

1) When the lens is mounted, the power is supplied to each IC in the lens through VDD at the mount contact pin. Each logic circuit operates on VD1 (4V) that is produced by regulating the VDD voltage with IC9.

2) When the CPU (IC1) receives power from VD1, internal oscillation starts with the set frequency (10MHz) by a ceramic oscillator (CF). When the reset signal is received from the voltage detection circuit (IC7), the program execution begins.

3) The CPU sets the LCLK communication line with the camera to the "Lo" level, outputs a busy signal to the camera, stores the contents of the EEPROM (IC9), including lens adjustment data, in the RAM, and initializes the internal registers and RAM.

4) After the initialization, the CPU cancels the busy signal, sets both the LCLK and DLC pins to the "Lo" level, and outputs the request signal to the camera to set the HALT state (the CPU stops).

5) When the camera sends a response to the request signal, the CPU leaves the HALT state, and starts operation according to the response from the camera.

6) When VD2 (4V) turns ON, the output from the shift system position detection circuit (ICS15, ICS16) is checked to see that the shift system is not in the locked position, and the shift system is locked correctly through the shift system driver (ICS6). (Automatic shift system locking operation when the lens is mounted)

7) When the prescribed time elapses after the above operation, the HALT command from the camera sets the CPU to the HALT state again.

3.2 AF/MF Switch Operationn

1) When the lens AF/MF switch is operated, the CPU recovers from the HALT state, outputs a request signal to the camera, and returns to the HALT state.

2) When the camera sends a response to the request signal, the CPU leaves the HALT state immediately, and starts operation according to the response from the camera.

3.3 Focusing (USM) Drive

1) When SW1 on the camera turns on, the lens CPU leaves the HALT state immediately, and starts operation.

2) When the focusing drive command is received from the camera, the CPU enters the USM drive sequence, activates the DC/DC converter (consisting of IC3 and other components), and turns the USM signal processing system power VD4 (4V) on.

3) The VCO circuit (IC6) determines the USM drive frequency, divides it to produce two signals AOUT and BOUT, whose phases differ 90 degrees, and drives the USM via the USM driver (IC4) by outputting these signals.

4) The B and S phase signals from the USM are detected by the comparator (IC5), and fed back to the AOUT and BOUT signals according to the relationships between these signals to maintain the optimum drive characteristics.

5) As the focusing moves, the pulse signals from the photointerrupter (PS) are counted, and a check is made to see whether the count matches the drive amount from the camera. When they match, the USM drive stops.

6) The DC/DC converter for USM drive stops and VD4 turns off.

3.4 Diaphragm (EMD) Drive

1) When the diaphragm setting of the camera is not maximum aperture and SW2 turns on or the diaphragm switch turns on, the lens CPU leaves the HALT state immediately according to the signal from the camera, and starts operation.

2) When the diaphragm drive command is received from the camera, LCLK is set to the "Lo" level to output a busy signal to the camera. At the same time, the USM DC/DC converter is activated (to supply the EMD driver gate drive voltage VG (15V)), and VD4 turns on to control the EMD driver circuit (IC2).

3) The diaphragm is driven by the EMD driver by the number of diaphragm steps corresponding to the diaphragm drive quantity from the camera. When the control for the specified number of steps is complete, the drive stops and the busy signal is canceled.

4) When the diaphragm drive stop signal is received from the camera, the USM DC/DC converter stops immediately and VD4 turns off.

5) When SW2 or the diaphragm switch turns off, the diaphragm open command is received from the camera, a busy signal is output to the camera in the same way as for the above diaphragm operation, the USM DC/DC converter is activated and VD4 turns on.

6) The diaphragm is opened by the EMD driver. When the diaphragm is open, as detected by the diaphragm open switch, the drive stops and the busy signal is canceled.

7) When the diaphragm drive stop signal is received from the camera, the USM DC/DC converter stops immediately and VD4 turns off.

3.5 IS Drive

1) When SW1 on the camera turns on, the lens CPU leaves the HALT state immediately according to the signal from the camera, and starts operation.

2) When the SW1 ON signal is received from the camera with the lens IS ON/OFF switch in the ON position, the CPU turns on VD (4V) and power VD3 (4.5V) from the constant-voltage circuit (IC14) and supplies power to the shift system and gyro processing circuits.

3) The CPU PWM-drives the lock magnet coil for the prescribed time (70 msec) with the transistor (QS8) and diode (DS2), and releases the mechanical lock of the shift system.

4) When this operation begins, power (2mA) is supplied to the magnet for keeping the unlock state with the transistor (Q2) to keep the unlock state after stopping power to the lock magnet coil.

5) When the above unlock operation is carried out, the shift system is PWM-driven with the system driver, its position output is received by the A/D converter in the CPU at 1-kHz sampling intervals, and the shift system feedback control is executed.

6) Unwanted noise components are eliminated from the gyro-sensor indication signal output by the gyro signal processing circuit (IC11 and IC12), and the amplified output is received by the A/D converter in the CPU at 1-kHz sampling intervals, calculated by the CPU, and the shift system is driven according to the calculation results.

7) If the focus position changes with this condition, the shift system is corrected according to the sensitivity for correction.

8) If a large movement signal, such as panning, is input, the shift system is controlled so that it does not exceed the prescribed stroke.

9) When SW2 on the camera turns on and the SW2 ON signal is received from the camera, the drive characteristics of the shift system are changed according to the shutter speed set by the camera.

10) To make correction for the shutter movement on the camera, the correction signal is added to the movement signal from the gyro-sensor immediately before the shutter, and the shift system is driven according to the results.

11) When the SW2 ON signal is received from the camera, the shutter release mode returns to its original setting.

12) When SW1 on the camera turns off and the SW1 ON signal is received from the camera, the power to the retention magnet is interrupted, and the shift system is mechanically locked after the prescribed time (about 1.5 seconds).

13) If the shift system is unlocked, SW1 is on, and the lens IS ON/OFF switch is set to the OFF position, the shift system is mechanically locked immediately, and the power to VD2 and VD3 is cut off.

4. DESCRIPTION OF MECHANISM

4.1 Zoom Lens Optical System

The lens' optical system has been newly designed to accommodate the new focal length range of 100-400mm and the Image Stabilizer while attaining high image quality expected from an L-series lens. The optical features are as follows:

- Six lens groups with 5 moving groups for zooming. High zoom ratio of 4×.
- With fluorite (G3) and Super UD (G7) lens elements, secondary spectrum chromatic aberrations are suppressed to an absolute minimum. The result is high-resolution and high-contrast images with no muddied colors along the subject's edges.
- This is the first EF zoom lens to have both rear focusing and a floating system. Aberrations which are especially apparent at closer focusing distances are effectively corrected to obtain high image quality at all distances. Also, the minimum focusing distance of 1.8 m applies to all focal lengths.
- During zooming, the Image Stabilizer group is stationary as group 2. Thus, the equivalent effect of a shutter speed two stops faster is obtained at all focal lengths.

4.2 Mechanical Features

Although the lens looks like the EF 35-350mm f/3.5-5.6L USM, the inside is totally different due to moving lens groups, the Image Stabilizer, rear focusing and floating system, SIC, etc. It has the following mechanical features:

- To attain the high 4× zoom ratio, the zoom extension length had to be long (79.6 mm). Therefore, the same linear zooming system found in the EF 35-350mm f/3.5-5.6L USM was incorporated. When a lens' zoom extension length is long, there are many mechanical parts between the front and rear lens group. As a result, during zooming the front lens group tilts with respect to the rear lens group. Optical performance thereby suffers. To resolve this problem, the number of mechanical parts has been minimized in the EF 100-400mm f/4.5-5.6L IS USM lens barrel to minimize the tilting of the front lens group.
- With the rear focusing and floating system, the extension length varies according to the focal length. Therefore, an SIC (Super Inner Cam) has been incorporated to mechanically control the extension length of lens groups 4 and 6 at all focal lengths. It also keeps the focusing rotational angle fixed at all focal lengths.
- Behind the zoom ring is the adjustment ring, the same type found on the EF 35-350mm f/3.5-5.6L USM. By turning the adjustment ring, the zoom ring's linear movement can be tightened or loosened. The adjustment ring can also lock the zoom ring at any focal length. The adjustment ring is used in the same way as with the EF 35-350mm f/3.5-5.6L USM's adjustment ring.
- For faraway subjects, the focusing distance limiting switch can be set to limit the focusing distance range to 6.5 m and beyond to reduce the AF search time. In this case, AF search is not executed in the 1.8 m - 6.5 m range.
- The Image Stabilizer unit is the same type as the EF 300mm f/4L IS USM's.
- The tripod collar is the same one used by the EF 35-350mm f/3.5-5.6L USM. It attaches securely and revolves smoothly. It is attached and detached in the same way as with the EF 35-350mm f/3.5-5.6L USM.
- Rear focusing and ring USM make autofocusing silent.

- Since the front lens element does not rotate during zooming or focusing, a polarizing filter or gelatin filter holder can be used without any readjustment.
- The dedicated two-lug bayonet cylindrical hood (ET-83C) has a velvety surface on the inside for effective blockage of unwanted light.

5. IMAGE STABILIZER

5.1 Principle

The image stabilizer of the EF 100-400mm f/4.5-5.6L IS USM is based on the shift system that moves the stabilizer optical system (group 2: G4 to G6) in parallel. The image stabilizer's operation principle is the same as with the EF 75-300mm f/4-5.6 IS USM.

5.2 Image Stabilizer Control

The Image Stabilizer of the EF 100-400mm f/4.5-5.6L IS USM is controlled almost in the same way as with the other IS USMs. Since the optical system's sensitivity is different between the lenses, the image stabilizing characteristics have been optimized for the lens.

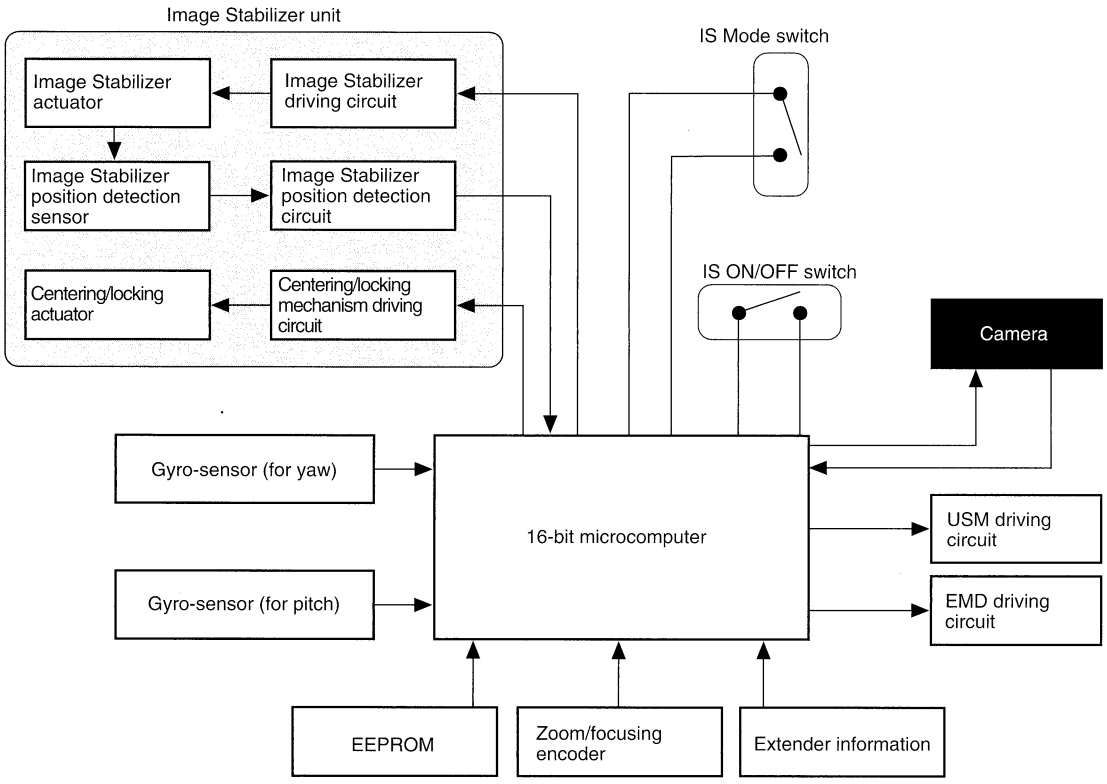
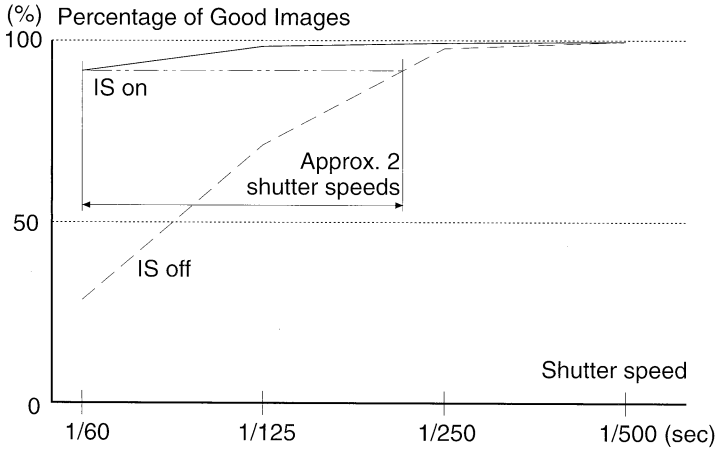


Fig. 2-1 Image Stabilizer System Block Diagram

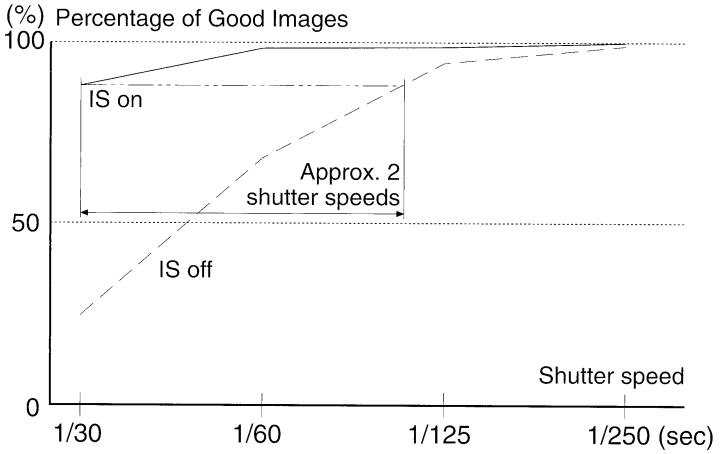
5.3 Image Stabilizer Effects

As with the other IS USMs, the Image Stabilizer of the EF 100-400mm f/4.5-5.6L IS USM gives the equivalent effect of having a shutter speed two stops faster. See Fig. 2-2 on the next page for the effects in each zoom range.

At 400mm focal length



At 200mm focal length



At 100mm focal length

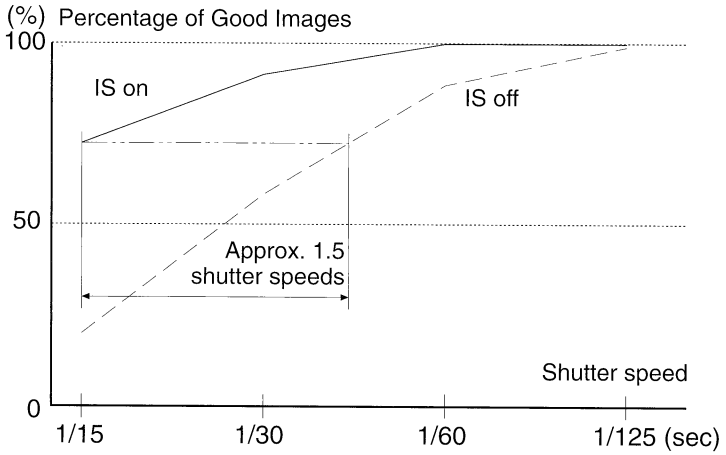


Fig. 2-2 Image Stabilizer Effects at Different Focal Lengths
(Prototype data)

5.4 Image Stabilizer Unit

The Image Stabilizer unit of the EF 100-400mm f/4.5-5.6L IS USM is the same as that of the EF 75-300mm f/4-5.6 IS USM.

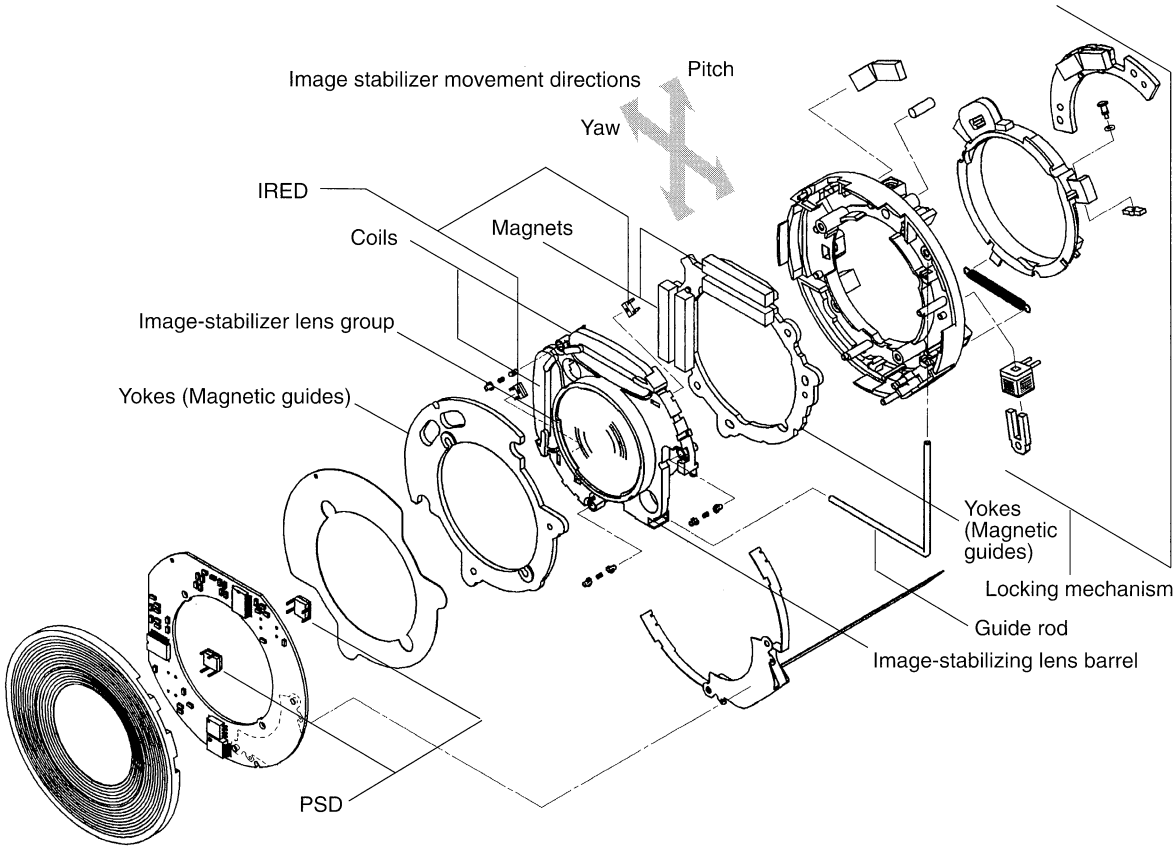


Fig. 2-3 Image Stabilizer Unit Structure

5.5 Image Stabilizer Sequence

The Image Stabilizer sequence of the EF 100-400mm f/4.5-5.6L IS USM is shown on the following page. The time it takes for the image stabilizing lens groups to be driven after the shutter button (SW1) is pressed halfway depends on the following:

1. When the shutter button is pressed halfway while the exposure meter is off, the image stabilizing lens groups is driven 0.9 sec. later and 80-percent image stabilization is achieved. 100-percent image stabilization is achieved in 3.4 sec.
2. When the shutter button is pressed halfway while the exposure meter is still on, the image stabilizing lens groups is driven 0.9 sec. later and 100-percent image stabilization is achieved at the same time.

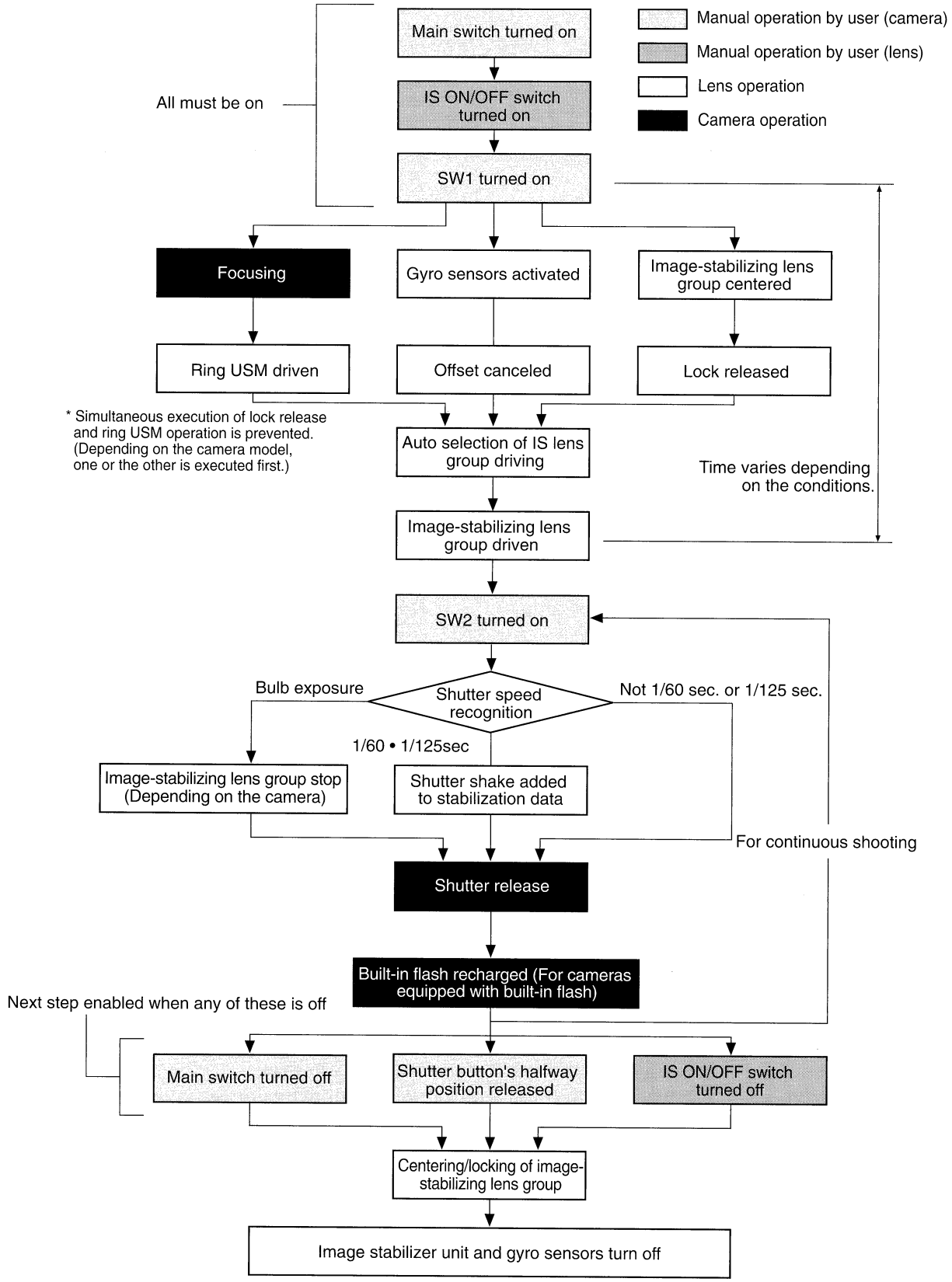


Fig. 2-4 Image Stabilizer System Sequence Diagram

5.6 Operational Differences with Different Camera

Depending on the EOS camera, image shake may be seen in the viewfinder in the following cases:

1. After the shutter is released.
2. While the built-in flash is recycling.
3. When the DEP mode is used.

Also, during bulb exposures or with Extender EF 1.4× or 2× attached, Image Stabilizer operation differs depending on the camera model. See the table below.

Table 2-1 Image Stabilizer Operation with Different Cameras

EOS Model	After Shutter Release	During Built-in Flash Recycling	In DEP Mode	During Bulb Exposure	With an Extender Attached
630/600	▲	–	▲	Image Stabilizer stops immediately after exposure starts	×
650	▲	–	▲	Image Stabilizer stops immediately after exposure starts	×
RT	▲	–	▲	Image Stabilizer stops immediately after exposure starts	×
620	▲	–	–	Image Stabilizer stops immediately after exposure starts	×
700	○	▲	○	Image stabilization continues	×
750	○	▲	○	–	×
850	○	–	○	–	×
1	○	–	▲	Image Stabilizer stops immediately after exposure starts	×
1N	○	–	▲	×	Compatible
1N RS	○	–	–	×	Compatible
3	○	–	○	×	Compatible
5/A2(E)	○	○	▲	Image stabilization continues	×
10(S)	▲	▲	▲	Image Stabilizer stops immediately after exposure starts	×
ELAN II(E)/50(E)	○	○	○	×	Compatible
100/ELAN	▲	▲	▲	Image Stabilizer stops immediately after exposure starts	×
100P	▲	▲	▲	Image Stabilizer stops immediately after exposure starts	×
1000/REBEL	○	△	○	Image stabilization continues	
1000FN/REBEL(S)II	○	△	○	Image stabilization continues	×
EOS REBEL XS/500	○	○	○	Image stabilization continues	Compatible
REBEL G/500 N	○	○	○	×	Compatible
888/5000	○	○	–	×	Compatible
IX	○	○	○	×	Compatible
IX Lite/7	○	○	○	×	Compatible

○ : No shaky image. ▲ : Very shaky image. △ : Sightly shaky image. × : Image Stabilizer inoperative.

6. IS MODES

6.1 Stabilizer Modes 1 and 2 Selection

The EF 100-400mm f/4.5-5.6L IS USM allows selection between Stabilizer Modes 1 and 2 in the same way as for the EF300mm f/4-5.6 IS USM.

6.2 Stabilizer Mode 2's Image Stabilizer Control

When Stabilizer Mode 2 is set, Image Stabilizer control works as follows:

- Image stabilization is executed immediately when the shutter button is pressed halfway. However, the image stabilization angle is half (±0.25°) that of Stabilization Mode 1.
- If the gyro sensors detect an accelerating movement in the horizontal or vertical direction with respect to the viewfinder frame, it stops image stabilization in the direction of accelerating movement.
- Image stabilization continues along the axis perpendicular to the accelerating movement. (For a horizontal accelerating movement, image stabilization continues along the vertical axis. For a vertical accelerating movement, image stabilization continues along the horizontal axis.)
- If the panning movement is not horizontal nor vertical, image stabilization stops.
- When the camera movement stops, normal image stabilization starts after 2 or 3 sec.

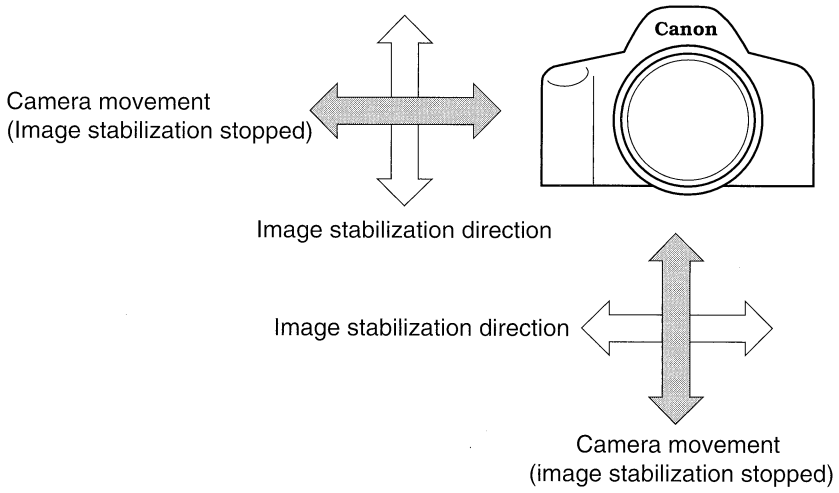


Fig. 2-5 Stabilizer Mode 2's Image Stabilization

6.3 Stabilizer Mode 2 Effects

Stabilizer Mode 2 obtains the following effects:

- The image in the viewfinder during panning movement is steadied, making subject frame easier.
- Panning at slow shutter speeds (like 1/8 or 1/15 sec.) still maintains image stabilization along the axis perpendicular to the panning movement.

6.4 Image Stabilizing Characteristics of Stabilizer Modes 1 and 2

The two modes are designed to suit different shooting conditions as described below.

- Stabilizer Mode 1
  This is for still subjects where the maximum effect of image stabilization can be attained. With low-frequency camera shake, the Image Stabilizer performance is slightly better than that of the EF 75-300mm f/4-5.6 IS USM.
- Stabilizer Mode 2
  This is for moving subjects, to allow easy subject framing. Image Stabilizer performance is slightly lower than that of the EF 75-300mm f/4-5.6 IS USM during low-frequency camera shake.
  Note that the Image Stabilizer performance difference is still very slight, and that either mode can still give the effect of having a shutter speed two stops faster.

Part 3

Repair Information

1. PRELIMINARY INSTRUCTIONS

1.1 Disassembly, Reassembly, and Adjustment Notes

1) Disassembly and reassembly

a) If the group 2 lens unit (IS unit) or group 3 lens unit is disassembled or replaced, the tilt and centering adjustments must be performed.
Before collars are removed, note their locations and directions.

b) The rotation angle for tightening the adjust ring can be adjusted. However, the adjust ring cannot be disassembled. (The ring contains 516 steel balls.)

2) Adjustment

Tilt adjustment	**Necessary**	Group 2/3 lens unit	Lens projector
Centering adjustment	**Necessary**	Group 2/3 lens unit	Lens projector

* The tilt and centering adjustments are performed by placing the lens on the lens projector and turning the eccentric collars of the group 2 and 3 lens units. Adjust the group 2 and 3 lens units repeatedly until the standard is satisfied.

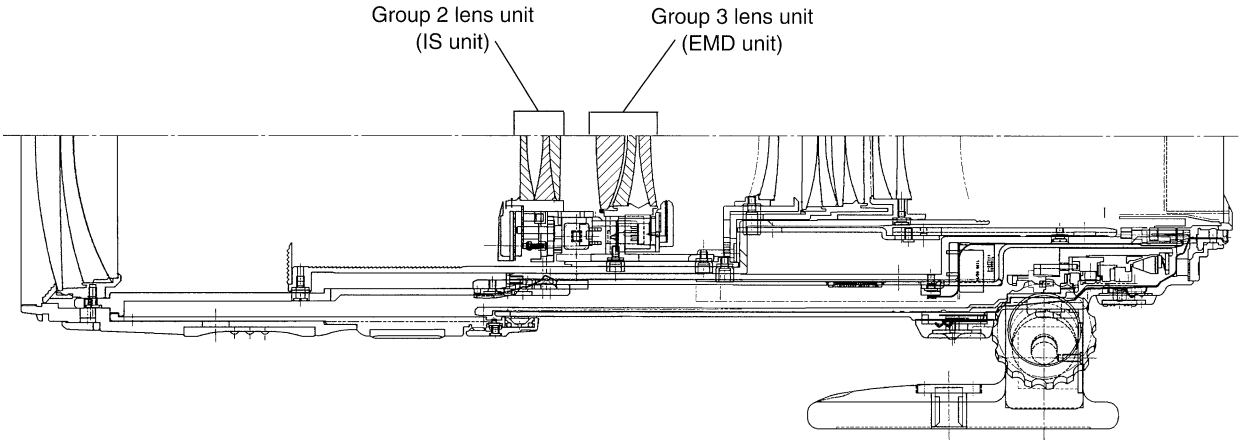


Fig. 3-1 Adjustment Point

1.2 Tools and Expendables

1) Service tools and measuring equipment

New	Tool/equipment name	Part number	Adjustment item
	Lens projector	CY9-7109-000 (100, 220)	Centering and tilt adjustments
	EOS camera (EOS KISS or EOS IN)		All adjustments
	HS/IF unit	CY9-7082-000	Electrical adjustment
	Vibrating table	CY9-2030-000	IS adjustment
	Oscilloscope		Pulse (PS current) adjustment
	Frequency counter		USM reference frequency adjustment
	EF lens electronic ring mount adapter	CY9-2001-004	Pulse (PS current) adjustment USM reference frequency adjustment
	Lens communication tool		Pulse (PS current) adjustment USM reference frequency adjustment

2) Expendables

New	Expendable name	Part number	Location
	Screwlock	CY9-8011	Fix screws and holding rings
	Arontite R	CY9-8008	Prevent loosening of screws
	Floil G31KB	CY9-8092	Sliding and cam surfaces
	Hanar RX-405	CY9-8111	Sliding surfaces (collars, etc.)
	Water-soluble bond	CY9-8015	Rubber ring adhesion
	Cloth tape	CY9-4026	Main PCB solder
	Double-sided adhesive tape	CY9-4034	Fix flexes

1.3 Adjustments

Adjustment item	Purpose	Description	Page
Centering	Make resolution at the center of the field uniform.	Perform this adjustment when the group 2 lens unit (IS unit) or group 3 lens unit (EMD) is disassembled and replaced.	3-20
Tilt	Make resolution at the periphery of the field uniform.	Perform this adjustment when the group 2 lens unit (IS unit) or group 3 lens unit (EMD) is disassembled and replaced.	3-20
Focus	Achieve infinity focus.	Check and adjust the focus when the unit is disassembled and parts (especially, the lens or lens barrel) are replaced.	3-22
Zoom brush position	Correctly read zoom information	Check and adjust when you disassemble and replace the zoom brush and Z-FLX.	3-24
Adjust ring	Adjust the angle for tightening the adjust ring.	Perform this adjustment when the adjust ring or fixed barrel is replaced.	3-25
Pulse	Achieve accurate USM drive data.	Perform this adjustment when the focusing unit or main flex unit is replaced.	3-26
USM reference frequency	Set reference frequency.	The USM reference frequency does not need to be adjusted because it is set on the main flex unit.	3-34
Gyro rank data input	Enter gyro-sensor rank.	Perform this adjustment when the gyro sensor or main flex unit is replaced.	3-36
Shift unit sensitivity data adjustment input	Enter shift unit sensitivity data.	Perform this adjustment when the IS unit or main flex unit is replaced.	3-37
Mechanical lock position correction data	Enter IS unit mechanical lock position correction data.	Perform this adjustment when the IS unit or main flex unit is replaced.	3-38
Mechanical lock centering	Center the mechanical lock.	Perform this adjustment when the IS unit or main flex unit is replaced.	3-39
IS adjustment	Achieve the best vibration insulating effect.	Perform this adjustment when the IS unit or main flex unit is replaced.	3-40
Focus compensation	Achieve the best autofocus at very large apertures.	When the main flex unit is replaced, set the focus as before. (Service measure)	3-42

* The USM reference frequency is shown here for reference because it may be checked or adjusted for repair.

2. DISASSEMBLY AND REASSEMBLY

2.1 Removing the Focusing Ring Unit

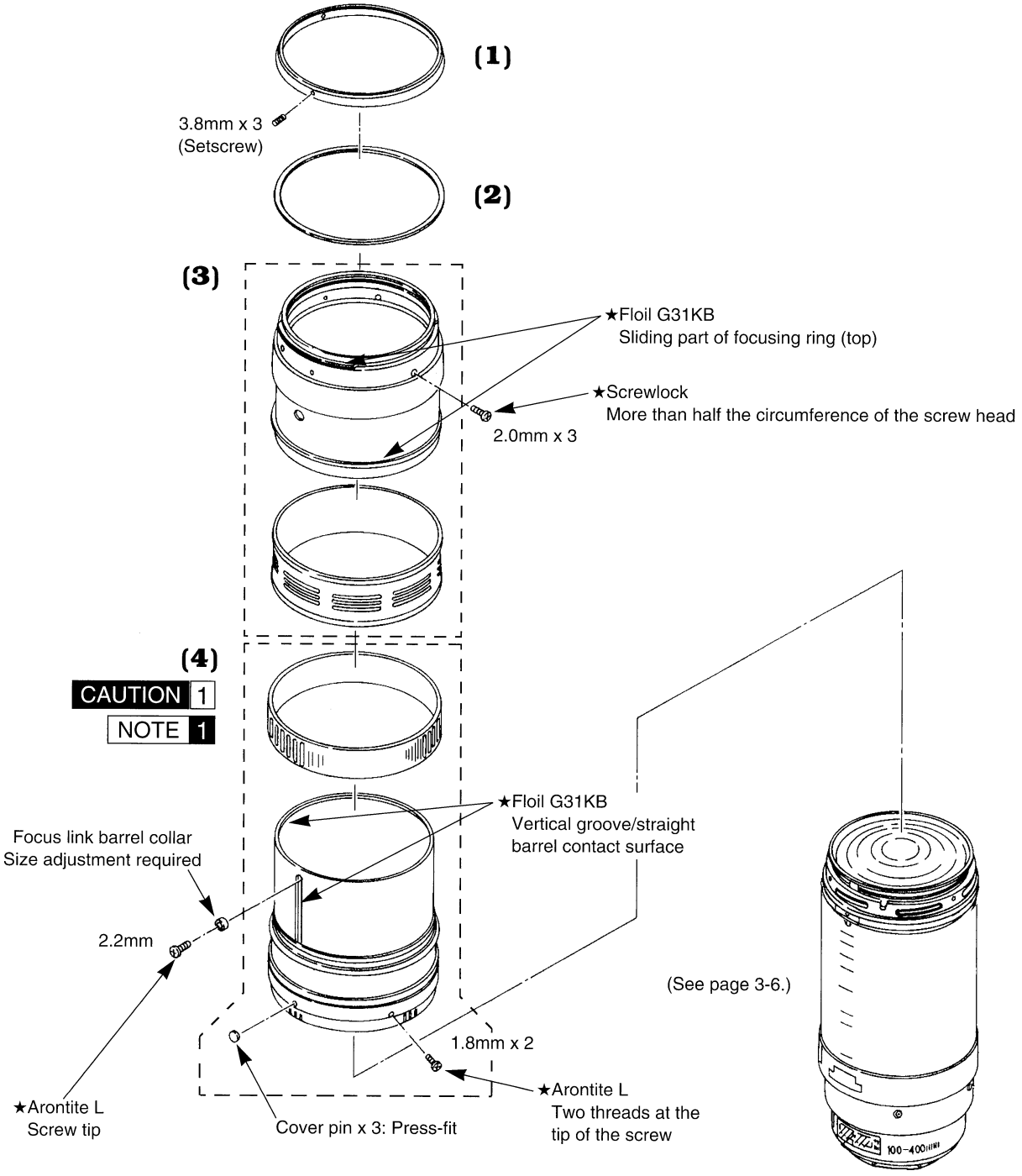


Fig. 3-2 Focus Ring Unit Disassembly

Disassembly/reassembly notes

1. Remove the name ring (1). (Three screws)

- Before removing the name ring, check its location so that it can be reinstalled in its original position. (Letters "100-400mm" are on the top, i.e., on the index line.)

2. Remove the L ring (2).

3. Remove the zoom operation ring (3). (Three screws)

- Before removing the ring, check its location so that it can be reinstalled in its original position. (Letters "ULTRASONIC" are on the top, i.e., on the index line.)

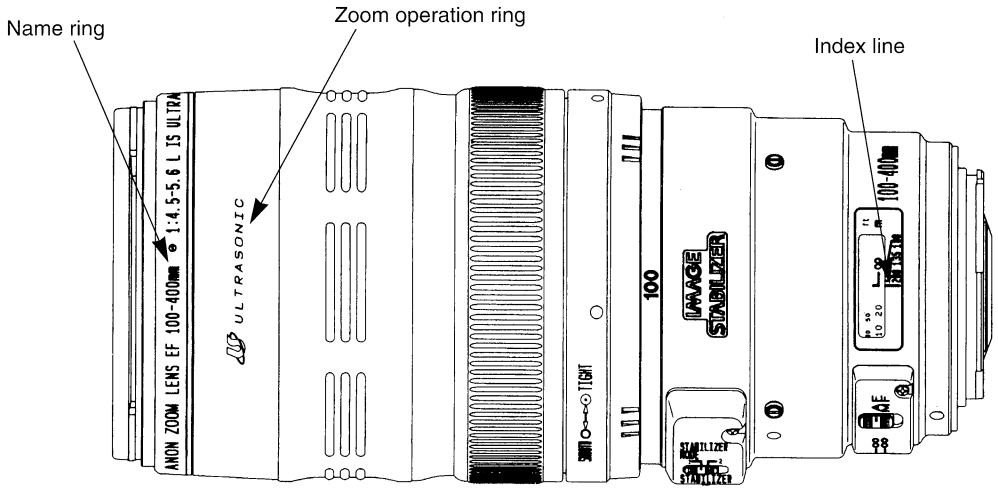


Fig. 3-3 Name Ring/Operation Ring Installation Position

4. Remove the focusing ring unit (4).

- Remove the focus link barrel collar. (One screw)
- Loosen the adjust ring and pull it out.

CAUTION 1

- Do not attempt to disassemble the adjust ring of the focusing ring unit because it contains many steel balls.

NOTE 1

- After the focusing unit is replaced, the adjust ring tightening angle must be adjusted. (See Adjustment on page 3-25.)
- When the focusing unit or focus link collar is replaced, use a new focus link barrel collar that has no play but moves smoothly.

2.2 Removing the Fixed Barrel

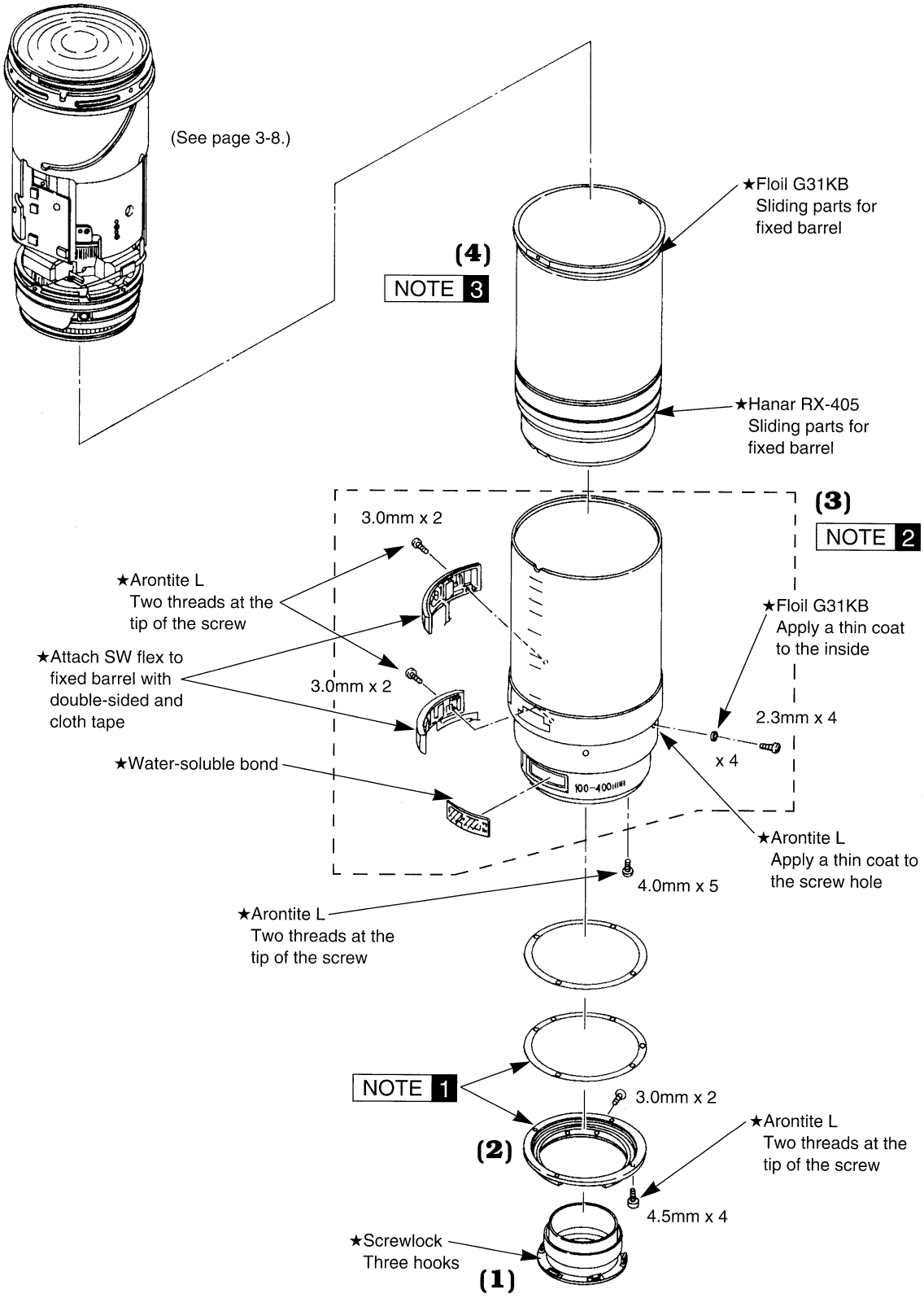


Fig. 3-4 Fixed Barrel Disassembly

Disassembly/reassembly notes

1. Remove the back cover (1). (Two screws holding the contact block)

2. Remove the lens mount (2). (Four screws)

NOTE 1

- The focus is adjusted by machining the lens mount at the factory. Measure the mount thickness with a micrometer and use the service mount so that the mount thickness equals the original one. (See Adjustment on page 3-22.)

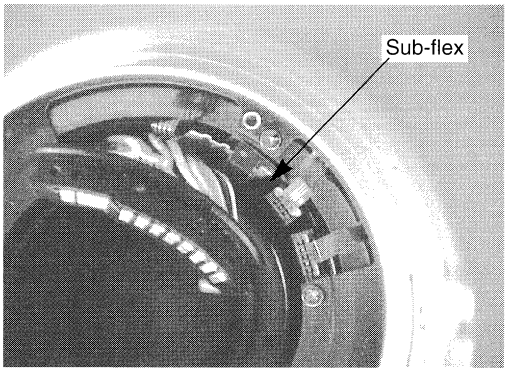


Fig. 3-5 Fixing Sub-flex

3. Remove the fixed barrel (3). (Five screws)

- Remove the flexes of the IS switch and AF/MF switch from the subconnectors.

NOTE 2

- Take care not to damage the switch flex and sub-flex or break the soldered part of the connector.
- After installing the fixed barrel, fix the sub-flex inside the USM unit using double-sided adhesive tape as shown in Fig. 3-5.
- Do not remove the three screws on the bottom of the fixed barrel (see Fig. 3-6). (These screws hold the focusing unit.)

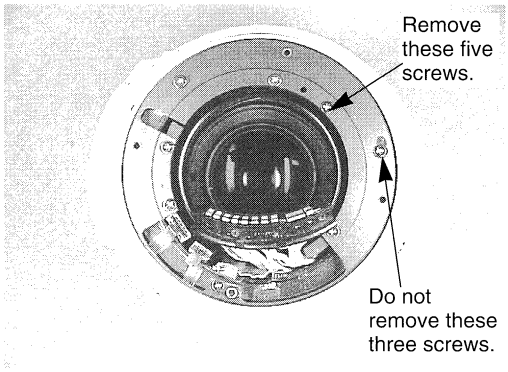


Fig. 3-6 Fixed Barrel Bottom

4. Remove the focus link barrel (4).

NOTE 3

- Before installing the link barrel, wind a polyester tape around the barrel to secure each flex. (See Fig. 3-7.)
- When installing the link barrel, connect it with the focusing unit correctly.

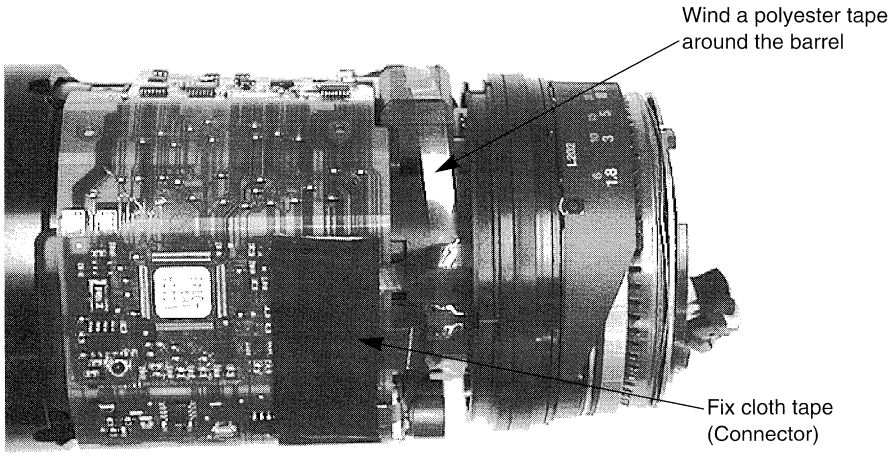


Fig. 3-7 Fixing Flex

2.3 Removing the Focusing Unit and Main Flex Unit

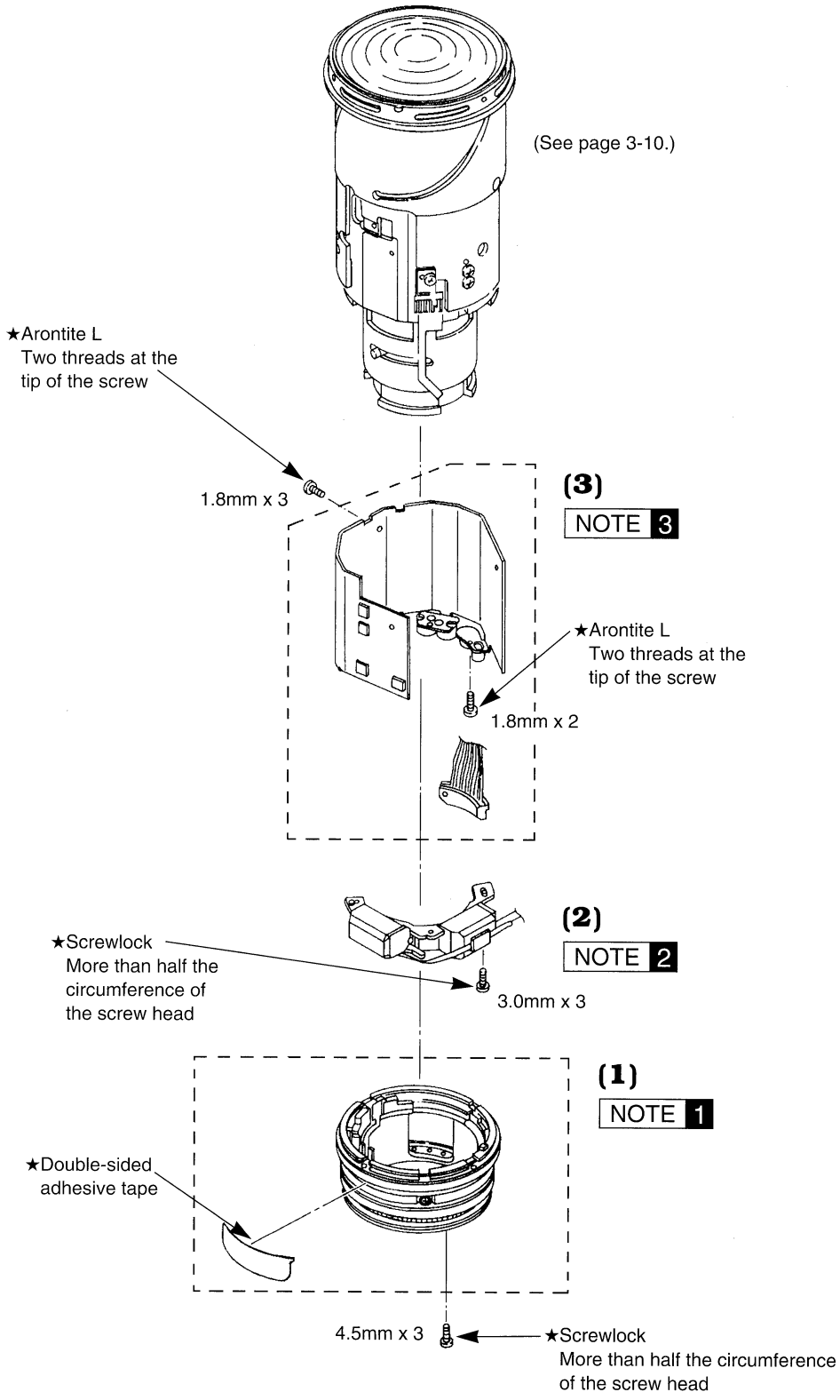


Fig. 3-8 Main Flex Unit Disassembly

Disassembly/reassembly notes

1. Remove the focusing unit (1).

- Remove the sub-flex and main flex connectors. (See Figs. 3-9 and 3-10.)
- Remove the three screws.

NOTE 1

- If the focusing unit is replaced, the pulse adjustment must be carried out. (See page 3-26.)
- Engage the focus key with the focus pin correctly during reassembly.
- Do not get the contact block lead caught between the parts.

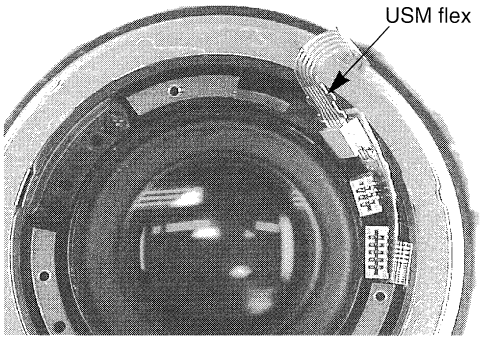


Fig. 3-9 Sub-flex Connection

2. Remove the gyro-sensor unit.

- Disconnect the connector from the flex.
- Remove the three screws.

NOTE 2

- Do not drop or impact the gyro-sensor unit.
- Enter the gyro-sensor rank data shown on the flex into the EEPROM on the main board after replacing the gyro-sensor unit. (See page 3-36.)

3. Remove the main board unit.

- Remove all flex connectors. (See Fig. 3-10.)
- Remove the three screws holding the side of the flex. (The main flex mount is detached from the lens barrel.)
- When the two screws at the coil are removed, the main board unit is removed from the flex mount.

NOTE 3

- The data in the EEPROM on the old PCB must be saved before replacement and then transferred to the EEPROM on the new PCB.
- Pulse adjustment must be carried out. (See page 3-26.)
- IS adjustment must be carried out. (See page 3-40.)

* If the data in the EEPROM on the old PCB cannot be saved, all electrical adjustments must be performed.

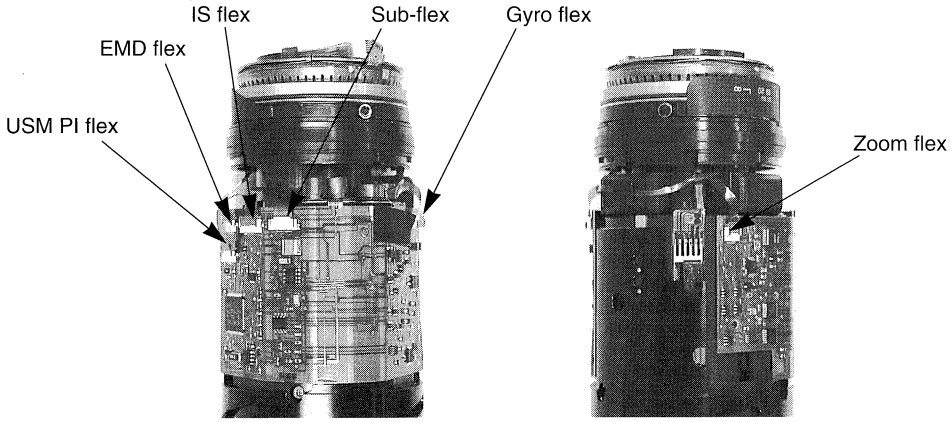


Fig. 3-10 Main Flex Connection

2.4 Removing the Straight Barrel

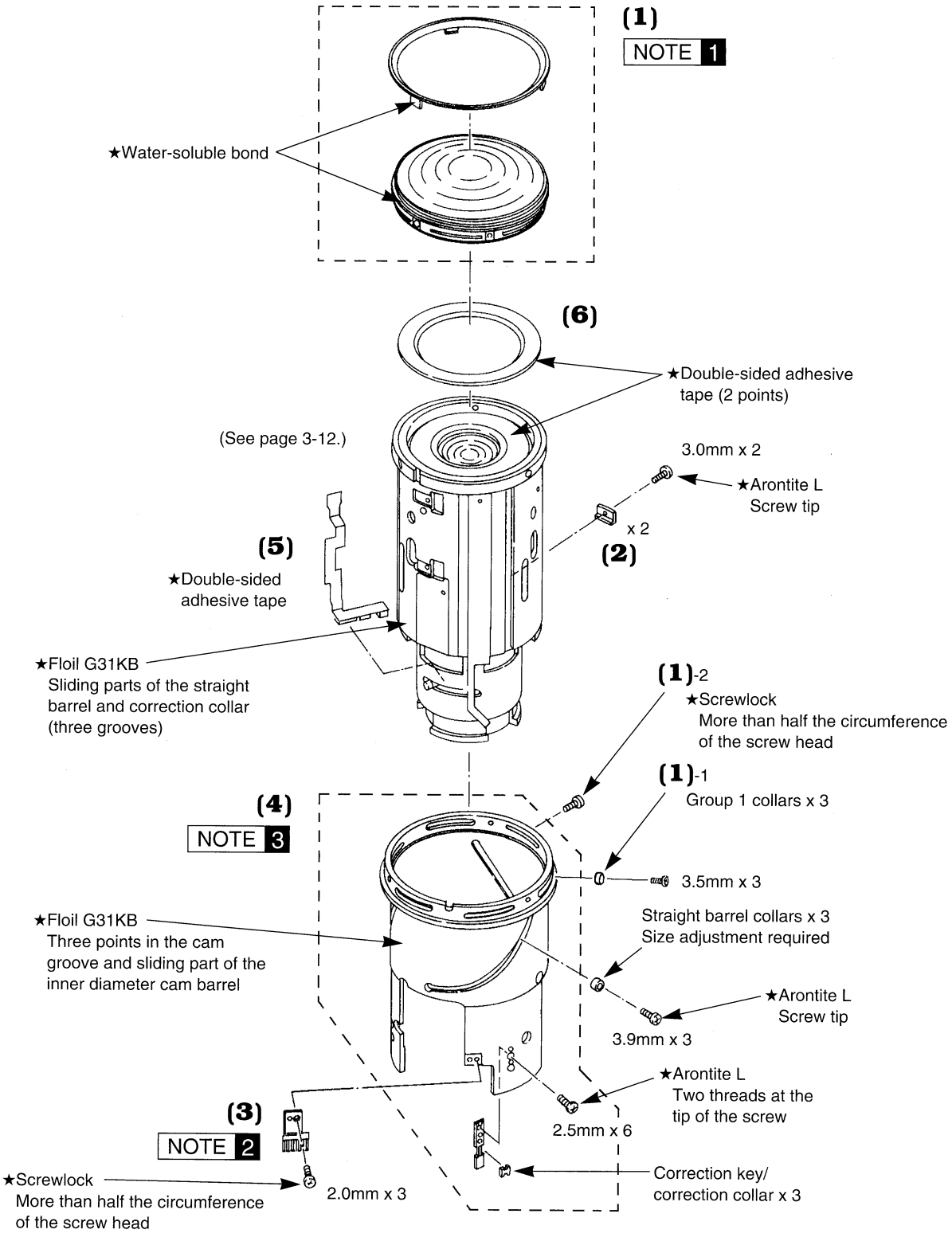


Fig. 3-11 Straight Barrel Disassembly

Disassembly/reassembly notes

1. Remove the group 1 lens unit (1).

- Remove the three group 1 collars (1)-1. (Three screws)
- Remove the three screws (1)-2.

NOTE 1

- Before removing the group 1 lens unit, mark its position.
- When replacing the group 1 lens unit, the focus at TELE end must be adjusted. (See page 3-22.)

2. Remove the two zoom stopper collars. (Two screws)

3. Remove the zoom brush (3). (One screw)

NOTE 2

- When reinstalling the zoom brush, the position must be adjusted. (See page 3-24.)

4. Remove the straight barrel (4).

- Remove the three straight barrel collars. (Three screws)

NOTE 3

- When the straight barrel or its collar is replaced, use a new collar that has no play and moves smoothly.
- When the straight barrel is replaced, install the correction key/collar that moves smoothly.

2.5 Removing the Group 2 to 5 Lens Units

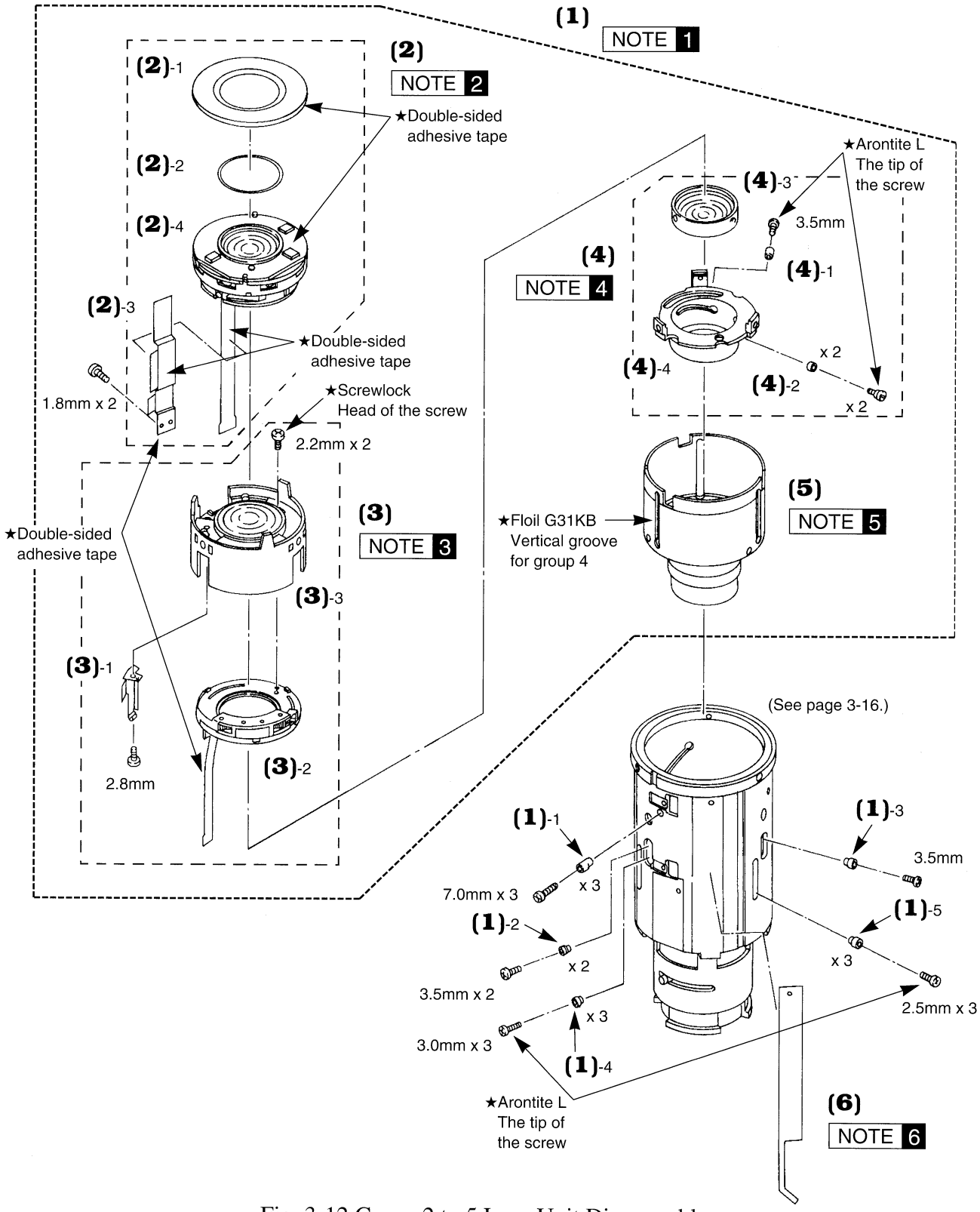


Fig. 3-12 Group 2 to 5 Lens Unit Disassembly

Disassembly/reassembly notes

1. Remove the group 2 to 5 lens units (1).

- Set the cam barrel to Wide end. (Contract)
- * Mark the positions of the cam barrel and guide barrel. (Installation positions of group 2 to 5 group lens units)
- Remove the three group 2 eccentric collars (1)-1. (Three screws)
- Remove the two group 3 eccentric collars (1)-2. (Two screws)
- Remove the one group 3 collar (1)-3. (One screw)
- Remove the three group 4 collars (1)-4. (Three screws)
- Remove the three group 5 collars (1)-5. (Three screws)
- Remove the two screws holding the I-FLEX holder (1)-6.
- Pull out the group 2 to 5 lens units.

NOTE 1

- Before the collars are removed, note their locations. Before removing eccentric collars, note their locations and directions.
- Take care not to damage or deform collars during removal. If any collar is damaged or deformed, replace it with a new one.
- When a collar is replaced, use a new collar that has no play and moves smoothly.
- When reassembling the lens units, insert the group 2 to 5 lens units into the cam barrel as a set (see Fig. 3-13.). Then, install the group 4 collars (1)-4, group 3 collars (1)-2/(1)-3, group 5 collars (1)-5, I-FLEX holder, and group 2 eccentric collars (1)-1 in the order listed. The floating collar of the group 4 lens unit must be engaged with the floating key in the cam barrel. (See Fig. 3-14.)

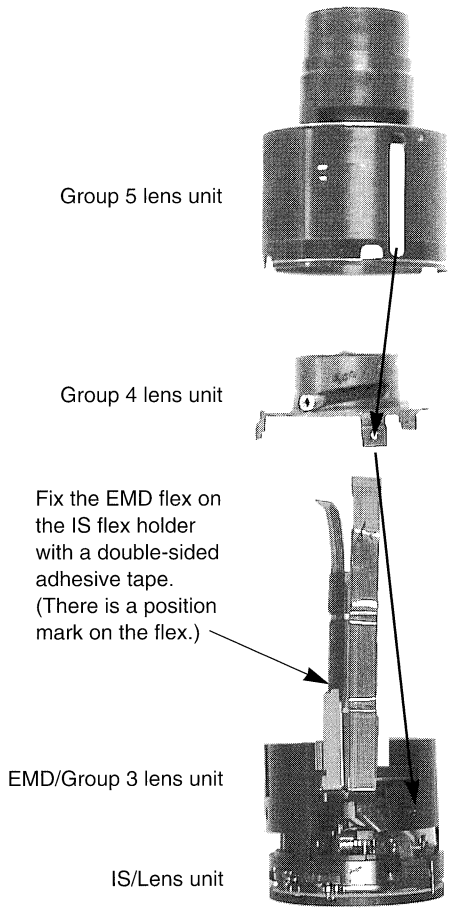


Fig. 3-13 Group 2 to 5 Lens Units

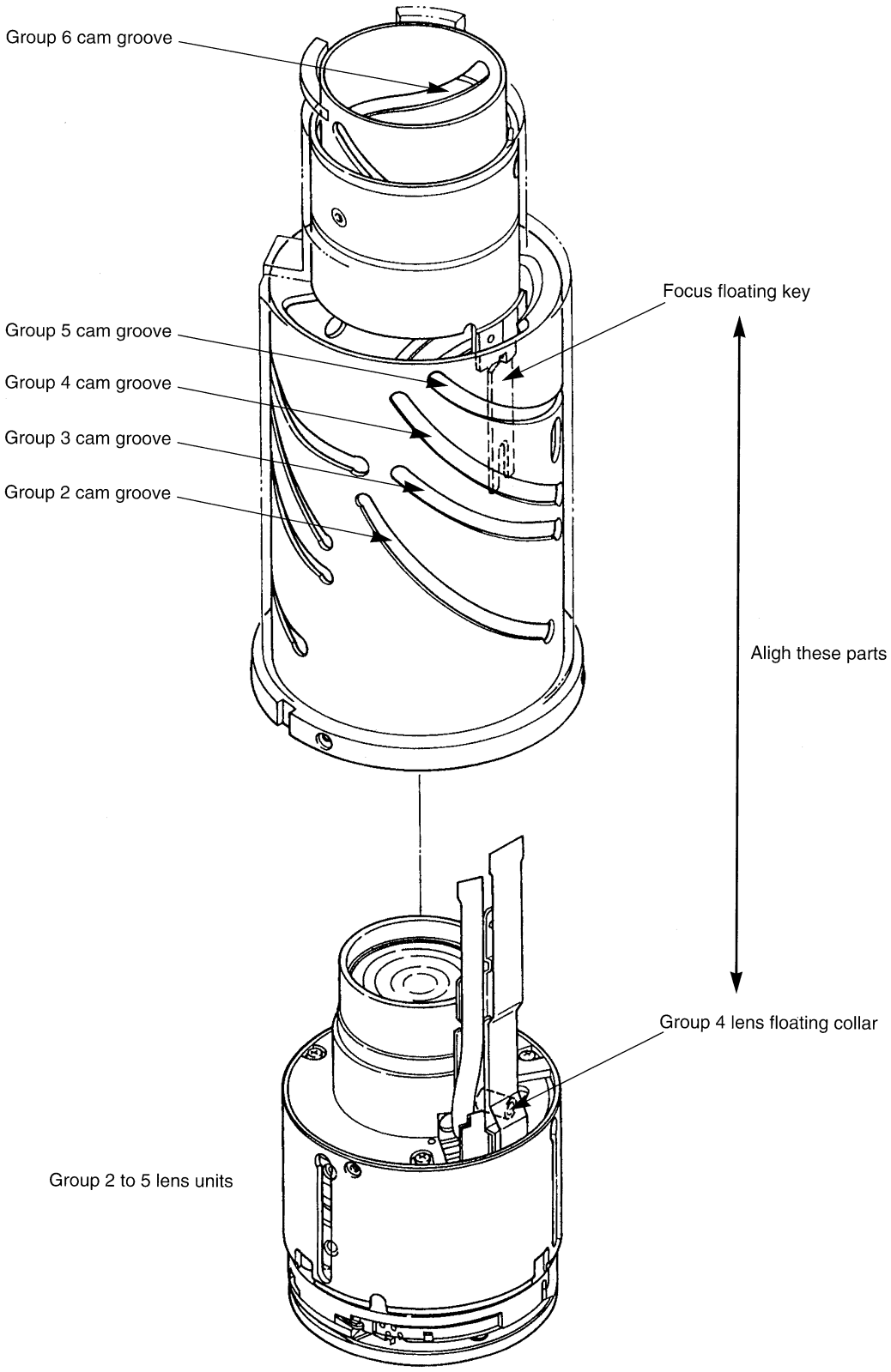


Fig. 3-14 Lens Unit Reassembly

2. Remove the IS/lens unit (2)-4.

- Remove the group 2 cover (2)-1. (Double-sided adhesive tape)
- Remove the IS face plate (2)-2.
- Remove the I-FLEX holder (2)-3 from the I-FLEX (IS flex).

NOTE 2

- Take care not to damage the flex during disassembly and reassembly.
- If the IS unit is removed, the tilt and centering adjustments (check) must be performed. (See page 3-20.)
- When the IS unit is replaced, enter the shift unit sensitivity data and mechanical lock position correction data supplied with the service part into the EEPROM. (See pages 3-37 and 3-38.)
- IS adjustment must be performed. (See page 3-40.)

* If mechanical lock data is input, the mechanical lock position adjustment may not be performed.

3. Remove the EMD unit (3)-2 from the group 3 lens unit (3)-3.

- Remove the two screws holding the EMD unit.
- Lift the EMD unit and remove the E-FLEX holder. (One screw)
- Remove E-FLEX from the E-FLEX holder.

NOTE 3

- If the group 3 lens unit is removed, the tilt and centering adjustments must be performed. (See page 3-20.)
- If the EMD unit is replaced, the E-FLEX must be set on the E-FLEX holder, being careful not to break the flex.

4. Remove the group 4 lens unit (4)-3.

- Remove the floating collar (4)-1. (One screw)
- Remove the two group 4 collar (4)-2. (Two screws)
- Remove the group 4 lens unit from the group 4 cam barrel (4)-4.

NOTE 4

- When the group 4 cam barrel or floating collar/group 4 collar is replaced, use a new collar that has no play but moves smoothly.

5. Group 5 lens unit (5)

NOTE 5

- The group 5 lens unit cannot be disassembled because centering adjustment was performed for the whole unit.

6. Zoom Flex (6)

NOTE 6

- If the zoom flex is disturbed, the Zoom Brush Adjustment is necessary. (See page 3-24.)

2.6 Removing the Focusing Barrel

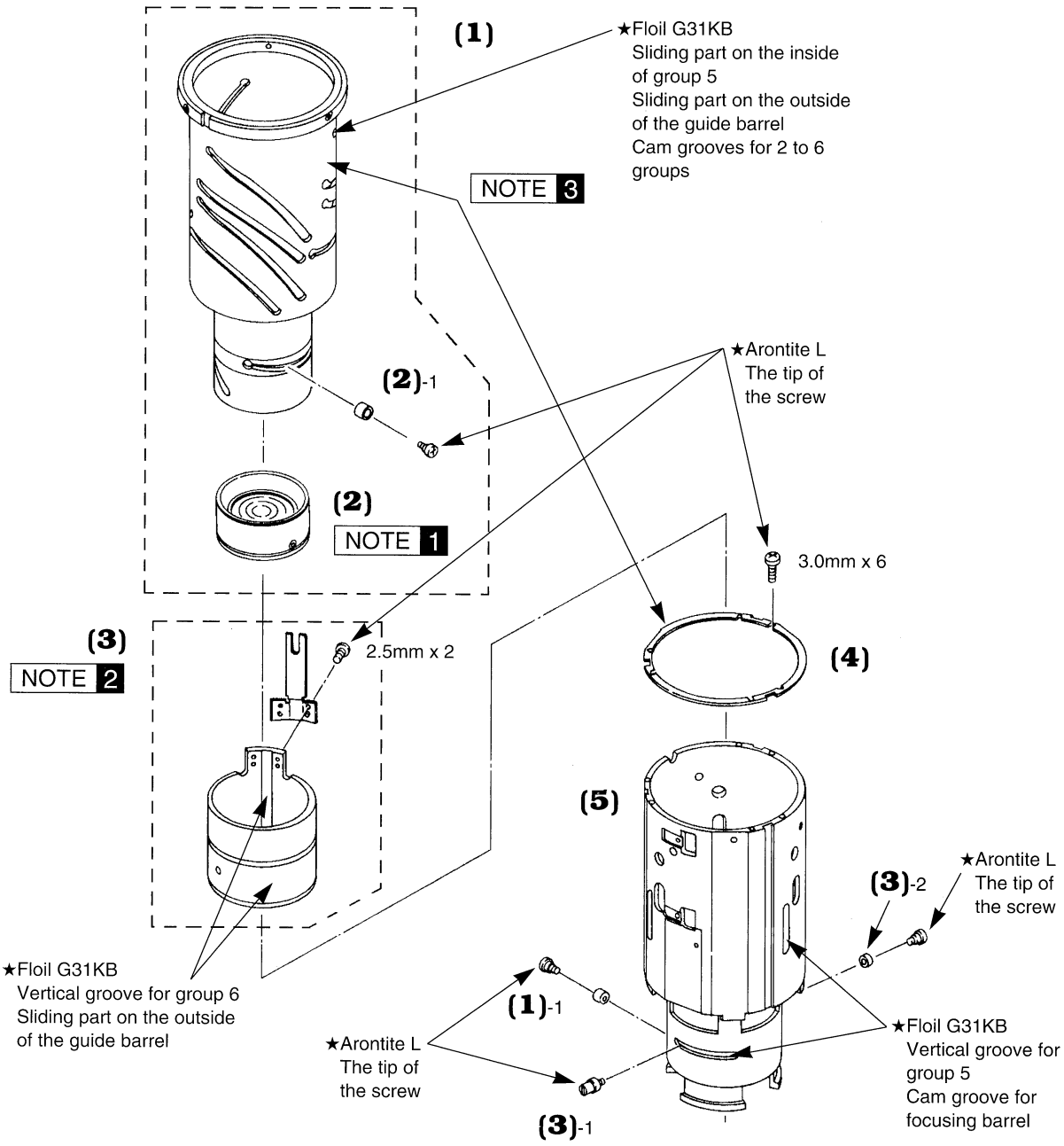


Fig. 3-15 Focusing Barrel Disassembly

Disassembly/reassembly notes

1. Remove the cam barrel (1).

- Remove the group 6 collar 1 (1)-1. (One screw)
  Remove the focus pin by sliding it until the group 6 collar comes into view.
- Remove the cam barrel and group 6 lens unit (2) from the guide barrel.

2. Remove the group 6 lens unit (2).

- Remove the group 6 collar 2 (2)-1. (One screw)

NOTE 1

- When group 6 collar 1 or 2 is replaced, use a new collar that has no play but moves smoothly. (Group 6 collar 1: t = 3.0mm; group 6 collar 2: t = 1.6 mm)
- Install group 6 collar 2 at the place shown in Fig. 3-16.
- Install group 6 collar 1 after installing the cam barrel (including the group 6 lens unit) in the guide barrel.

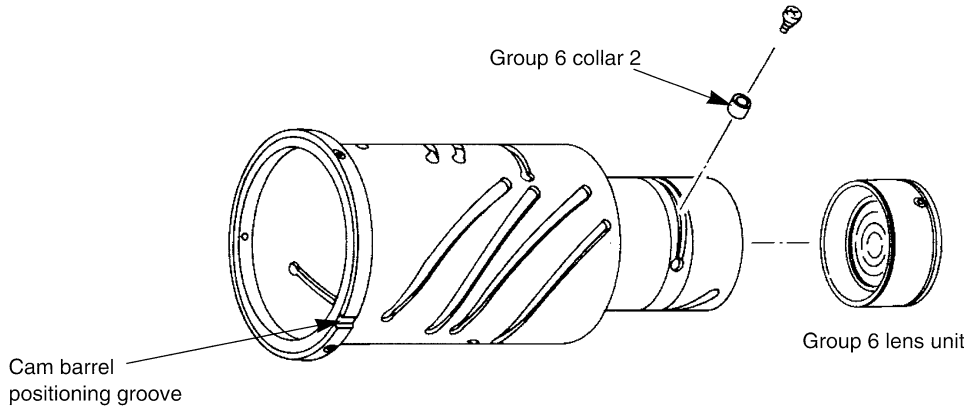


Fig. 3-16 Group 6 Lens Unit Installation

3. Remove the focusing barrel (3).

- Remove the focus pin (2)-1.
- Remove the focusing barrel collar (2)-2. (One screw)

NOTE 2

- When the focusing barrel collar is replaced, use a new collar that has no play but moves smoothly.
- The focus pin is installed on the side of the guide barrel where the zoom flex is attached. (Opposite the focus floating key)

4. Remove the zoom stopper (4). (Six screws)

5. Guide barrel (5) and cam barrel (2)

NOTE 3

- The precision of mating the guide barrel and cam barrel is guaranteed as a set. Therefore, the guide barrel and cam barrel must be replaced together.

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3. ADJUSTMENT

3.1 Before Adjustment

- Like EF75-300/4.0-5.6ISU, this lens uses an EEPROM for adjustment.
- The adjustment items for the lens are described in Section 1.3, Adjustment Items.
- The adjustments can be classified into mechanical and electrical adjustments.
  Mechanical adjustments: These adjustments are normally performed mechanically. They include tilt, centering and focus adjustments.
  Electrical adjustments: The adjustment software and personal computer are used for adjustment and adjustment data is written into the EEPROM.
- The USM reference frequency adjustment is a mechanical adjustment with a VR, but it is including in the electrical adjustments because communication with the camera is required before and after the adjustment.

Hint for adjustment

- Due to the lens program, the EEPROM data is read into the CPU only when the lens is installed. If the data is not read correctly during adjustment or the lens cannot be adjusted, remove and reinstall the lens.

Connection of the lens/camera with the HS-IF and multiple tool II

- Only an EOS KISS/REBEL X/500 or EOS-1N can be connected with the lens and HS-I/F.
- If the EOS KISS/REBEL X/500 is used, the HS-IF or multiple tool II can be used for adjustment. If the EOS-1N is used, only the HS-IF can be connected.

*: The EOS-1N cannot communicate with the multiple tool II.

3.2 Adjustment Procedure

The adjustment items and steps are listed below. The details of the adjustment required when replacing the main board are given in Section 3.4, Electrical Adjustments.

Table 3-1 Flow of Adjustments

	Mechanical adjustment					Electrical adjustment						
Adjustment order→	1	2	3	4	5	6	7	8	9	10	11	12
Adjustment item / Main replacement parts	Tilt/ centering	Focus	Zoom brush	Adjust ring	Pulse adjustment	USM reference frequency	Gyro rank data input	Shift unit sensitivity data input	Mechanical lock position correction data input	Mechanical lock centering	IS adjustment	Focus compensation
Optical part replacement (including disassembly)	○	○	○	–	–	–	–	–	–	–	–	○
Main board replacement (Data can be read.)	–	–	–	–	○	△	–	–	–	–	–	–
Main flex (Data cannot be read.)	–	–	–	–	○	△	○	○	○	○	○	○
IS unit replacement (Group 2 lens)	○	○	○	–	–	–	–	○	○	○	○	○
Gyro sensor unit replacement	–	–	–	–	–	–	○	–	–	–	○	–
USM unit replacement (focusing unit)	–	–	–	–	○	△	–	–	–	–	–	–
EMD replacement (aperture unit)	○	○	○	–	–	–	–	–	–	–	–	○

3.3 Mechanical Adjustments

1) Tilt/centering adjustments

CAUTION

- Adjust the tilt when you disassemble or replace the IS lens unit (group 2 lens unit) or group 3 lens unit.

Purpose:

- Make the resolution at the edges of the field uniform.

Standard:

Table 3-2 Projection Resolution Standard

Unit: lines/mm

Image height		0mm	4mm	8mm	12mm	16mm	20mm
WIDE (100mm)	S	100	63	63	63	63*	40
	M		63	63*	40	40*	40
MIDDLE (200mm)	S	100	63	63	63	63	40
	M		63	63	40	40	40
TELE (400mm)	S	100	63	63	63	63	63
	M		63	63	63*	63*	40

*: The resolution may be one level lower in two adjacent quadrants only, providing that the center clarity is good.
This standard applies when the distance is 50 times the focal length (5 m - 20 m).

Tools:

- Lens projector
- Fixed Barrel Tool (Hand-made tool: See page 3-48.)

Preparation:

1. Remove the zoom operation ring, focusing ring unit, fixed barrel unit, focus link barrel, mount and focusing unit.
2. Install the Fixed Barrel Tool (hand-made tool).
3. Install the mount.
4. Make the group 2 and 3 eccentric collars non-eccentric. (See Fig. 3-17.)
   If the eccentric position was marked before disassembly, set the collars at their original positions.

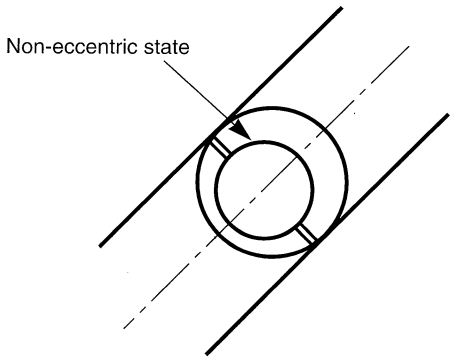


Fig. 3-17 Adjustment Collar Setting

Adjustment method:

1. Mount the lens on the projector.
2. The distance between the lens projector and projected image must be about 10 m (or 5 m). (Ideally, 50 times longer than the focal length = 20 m)
3. Set the lens to Tele end. (Use the focus pin to focus the lens.)
4. Observe the direction of the flare of the projected image at the center. (See Fig. 3-18.)
5. In the direction of the central flare, check the marginal focus (image height 16 or 20 mm). If front defocus, adjust the tilt with the group 3 eccentric collar. (See Fig. 3-19.)
6. If rear defocus, adjust the tilt with the group 2 eccentric collar.
7. When the focus at the center and periphery is balanced, this adjustment is complete.

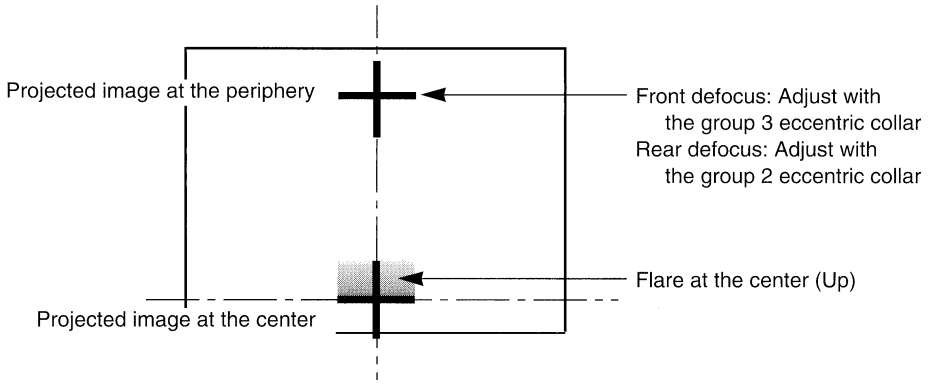


Fig. 3-18 Projected Image

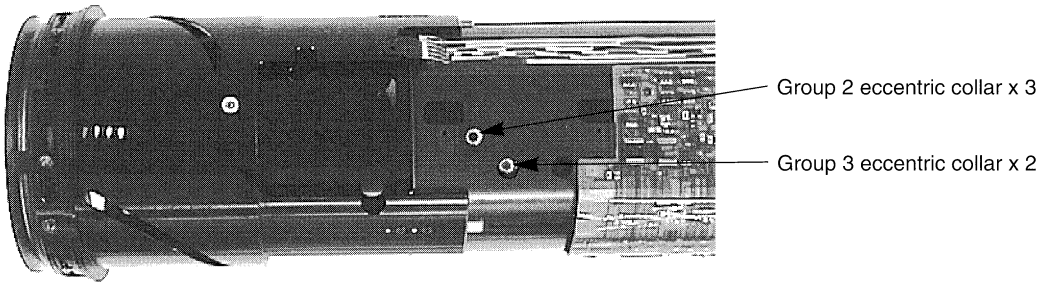


Fig. 3-19 Eccentric Collars for Adjustment

8. Set the lens to Wide end and check the resolution. (5m projection)
9. The resolution must meet the standard. If defocus occurs at the Wide end, reset the eccentric collar to a position symmetrical with a line perpendicular to the cam groove as shown in Figure 3-20.

* The Tele end projection resolution standard listed in Table 3-2 assumes that the projection distance is 20 m. If the projection distance is short, the resolution decreases. Therefore, adjustment is performed so that the difference between the resolutions at the right, left, and top and bottom and the center flare are minimized.

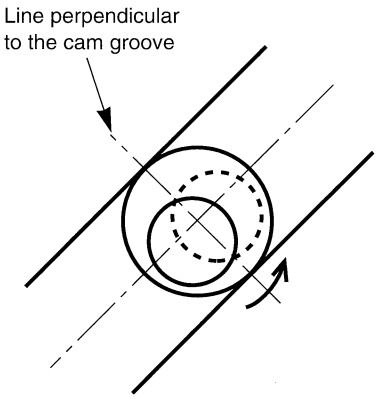


Fig. 3-20 Eccentricity Adjustment for Wide NG

2) Focus adjustment

CAUTION

- Check and adjust the focus when you disassemble and replace any of the optical components.

Purpose:

- Achieve infinity focus.

Tools:

- Split type focusing screen camera
- General-purpose 600mm collimator
- Magnifier

Standard:

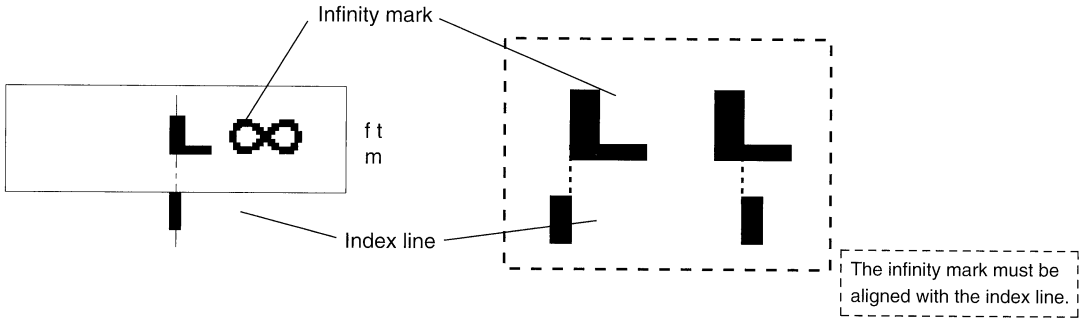


Fig. 3-21 Focus Adjustment Standard

Adjustment method:

(1) Wide end focus adjustment

1. Mount the lens on the camera.
2. Set the lens to Wide end and set the focus to infinity.
3. Check the difference between the index line and infinity mark.
4. If the focus does not meet the standard, adjust it by combining the lens mount (CY1-2497) with focus washers (CY1-2178).
   If many focus washers are used, the clearance between the fixed barrel and the lens mount increases. The maximum thickness of focus washers must be 0.07 mm.

* Hint

- If the focus is not correct unless the focus ring is rotated toward the infinity end →**Reduce the mount thickness**.
- If the focus is not correct unless the focus ring is rotated toward the near-distance end →**Increase the mount thickness**.
- Service focusing washer (CY1-2178-000 xxx): Use this washer if the focus cannot be adjusted by fine adjustment or by using the service lens mount.
- Service lens mount (CY1-2428-000 xxx): Use to perform coarse focus adjustment.
- When adjusting the wide end, the 1st group lens unit should be positioned near the center. (Exact adjustment is not critical at this point.)

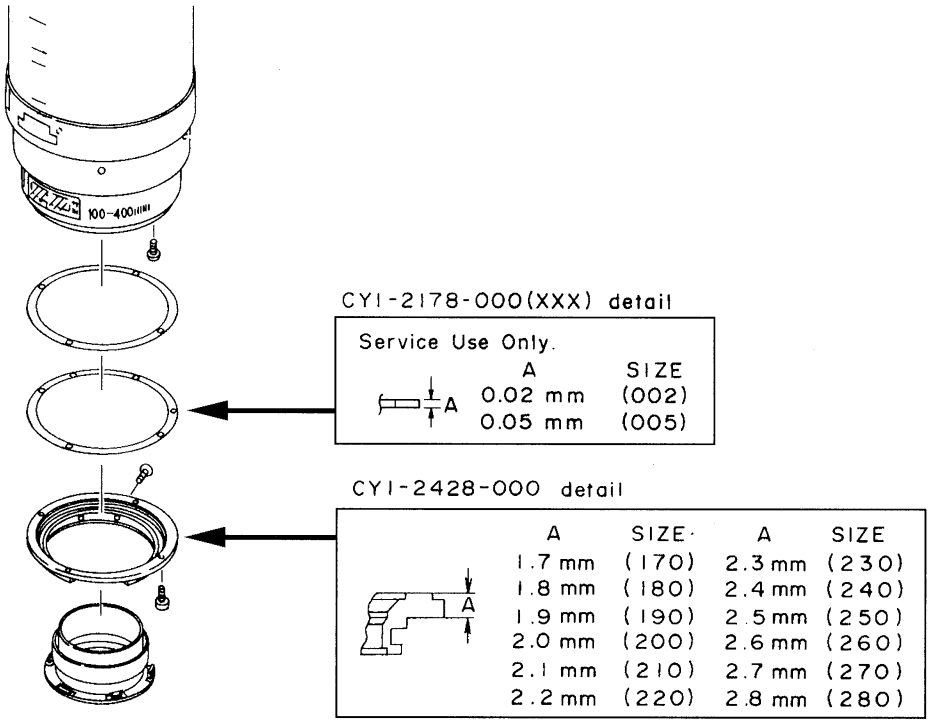


Fig. 3-22 Wide End Focus Adjustment

(2) Tele end focus adjustment

1. Mount the lens on the camera.
2. Set the lens to Tele end and focus on an infinity target.
3. Observe the shift between the index line and infinity mark.
4. If it does not meet the standard, loosen the screws holding the group 1 lens unit and group 1 collar, move the group 1 lens unit to the left or right, and adjust the focus.

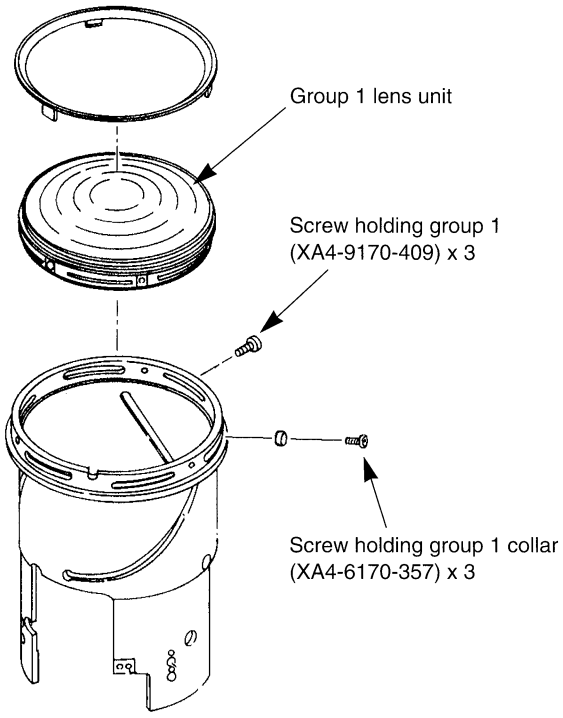


Fig. 3-23 Wide End Focus Adjustment

3) Zoom Brush Position Adjustment

CAUTION

- Check and adjust the zoom brush position when you replace the zoom brush or zoom flex.

Purpose:

- Read the zoom position accurately.

Tools:

- Continuity tester (Ohmmeter)

Preparation:

- Expose the zoom brush and zoom flex. (Remove the fixed barrel and focusing guide barrel.)

Adjustment method:

1. Set the lens to Wide end.
2. Adjust the zoom brush position as shown below.
3. Check that there is no continuity between the zoom brush and the pattern.
4. After adjustment, apply Screwlock to the head of the screw.

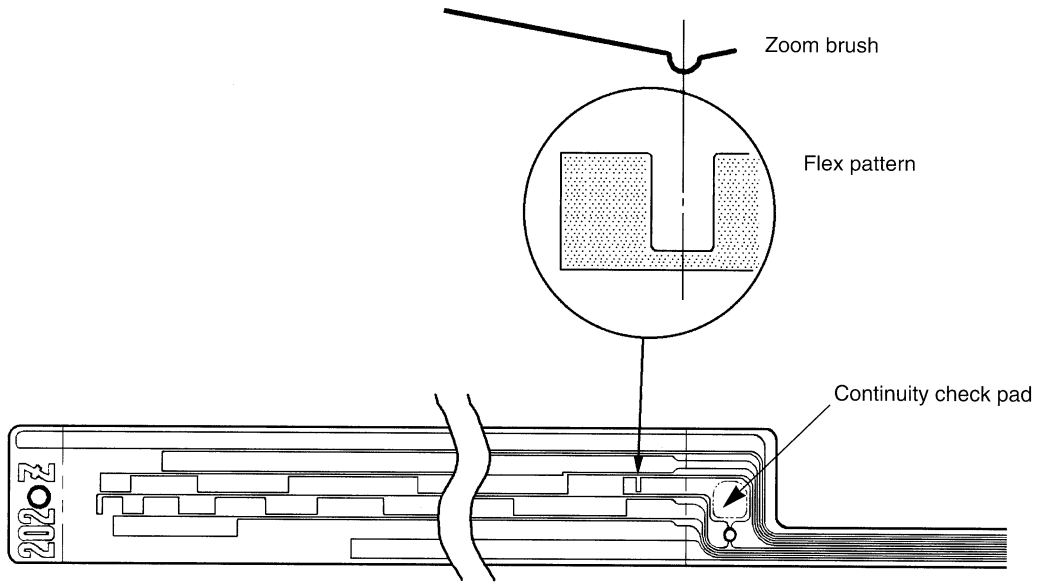


Fig. 3-24 Zoom Brush Adjustment

4) Adjust ring adjustment

CAUTION

- Check and adjust the adjust ring when replacing the focusing ring unit and fixed barrel.

Purpose:

- Adjust the force of tightening (clamping) the adjust ring.

Standard:

At the "free" position, the zoom should move smoothly. When turned about 90°, the zoom should not move under its own weight.

Adjustment method:

1. Remove the three cover pins with tweezers or a screwdriver (No.1). (Take care not to damage the external surface.)
   * The focusing ring unit supplied as a service part does not include cover pins (YA2-0932).
2. Remove the two screws securing the adjust ring.
3. Install the focusing ring unit on the fixed barrel, and secure the adjust ring on the retention collar with a screw, checking the clamping force.
   * Adjust the clamping force by using the three screw holes in the retention collar and the five screw holes in the adjust ring.
4. Secure the adjust ring with a screw, then install the cover pins in the remaining three holes.
5. With the retaining screws removed, do not loosen the Adjust Ring more that two turns. (It contains about 500 loose bearing balls.)

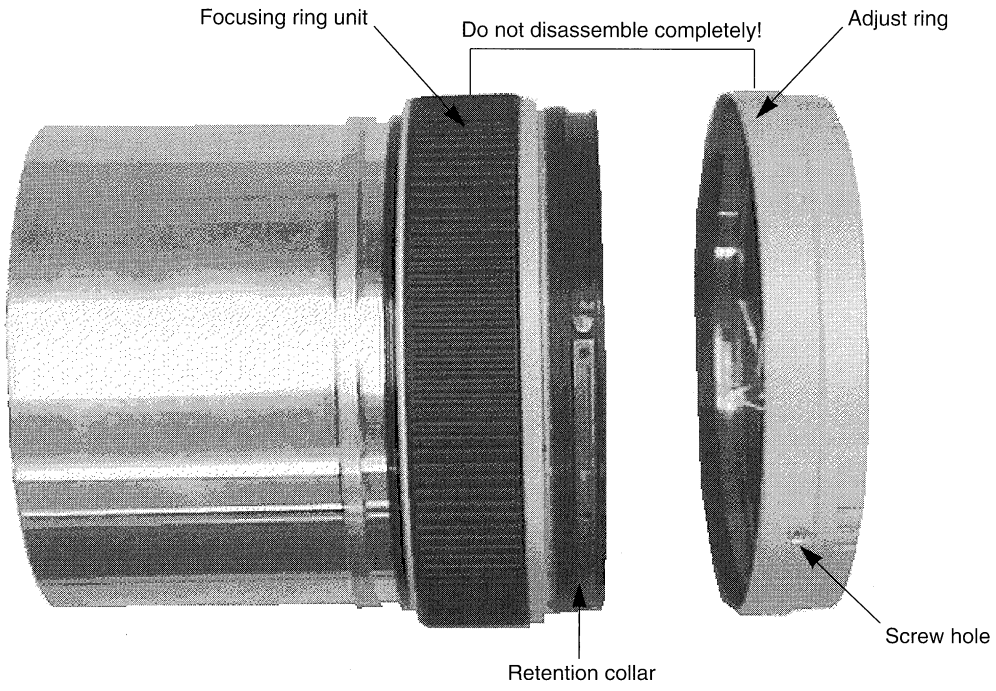


Fig. 3-25 Adjust Ring Adjustment

5) Pulse adjustment

CAUTION

- Adjust the pulses when you replace the USM (focusing) unit or main flex unit.

Purpose:

- Adjust the phase to receive USM drive data accurately and efficiently.
- Perform this adjustment if the USM moves erratically (or skips).

Tools:

- Oscilloscope
- EOS camera
- EF lens electronic ring mount adapter or lens communication tool

Standard:

A (high) : B (low) = 5:5 to 6:4

Preparation:

1. Remove the fixed barrel and focusing guide barrel.
2. Solder a lead to each of the PULSE and DGND lands shown below. (DGND is the same as DGND used for USM frequency adjustment.)
3. Install the fixed barrel, lens mount and contact block.
4. Mount the adapter or communication tool, and draw the leads out through the inside.
   If the adapter or communication tool is not available, remove the A/M switch panel and draw the leads out. (The A/M switch flex must be installed on the main board.)

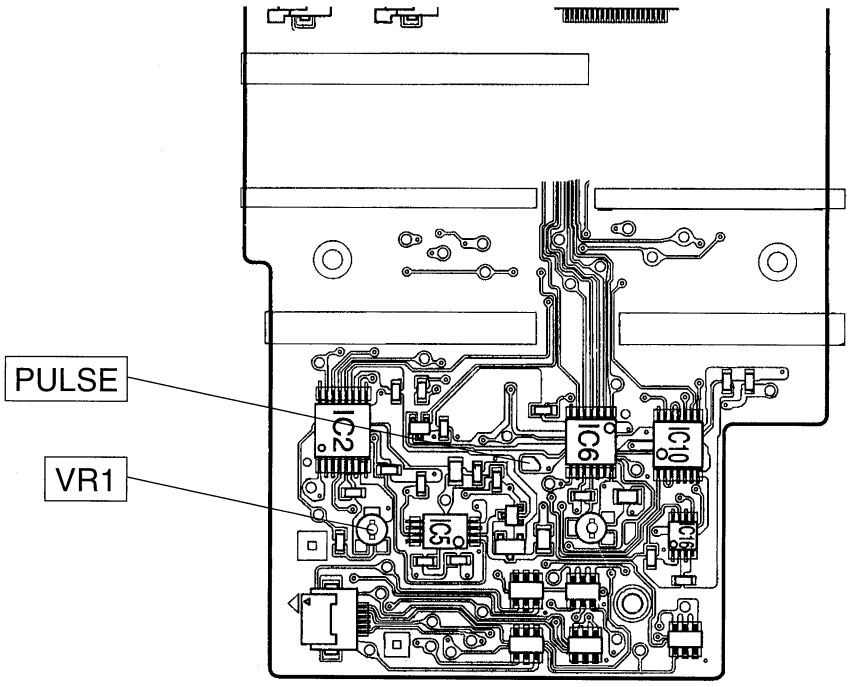
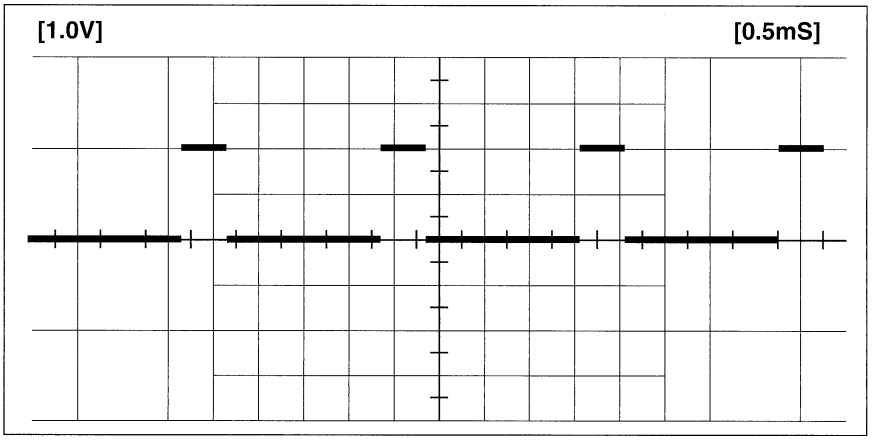


Fig. 3-26 Pulse Adjustment Locations

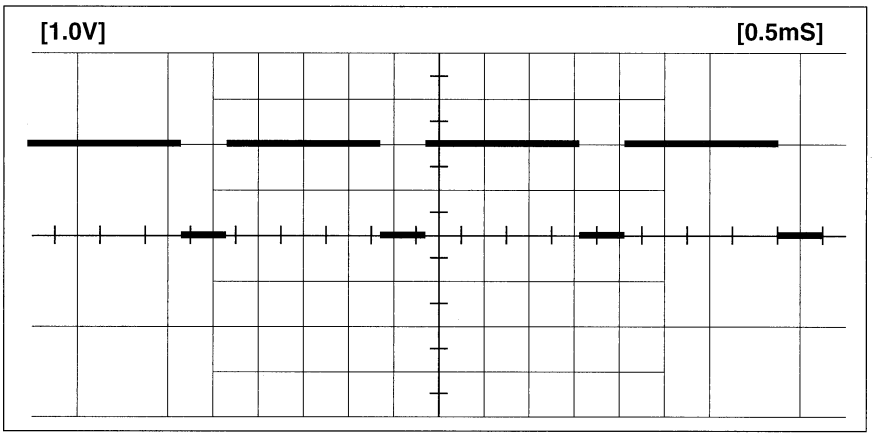
Adjustment method:

1. Connect the leads to the oscilloscope.
2. Press the shutter button (SW-1 only) and observe the waveform. (The waveform appears when the USM is driven.)
3. If the waveform does not conform to the standard, turn VR1 and measure the waveform again.

①NG
Adjust CW



②NG
Adjust CCW



③OK

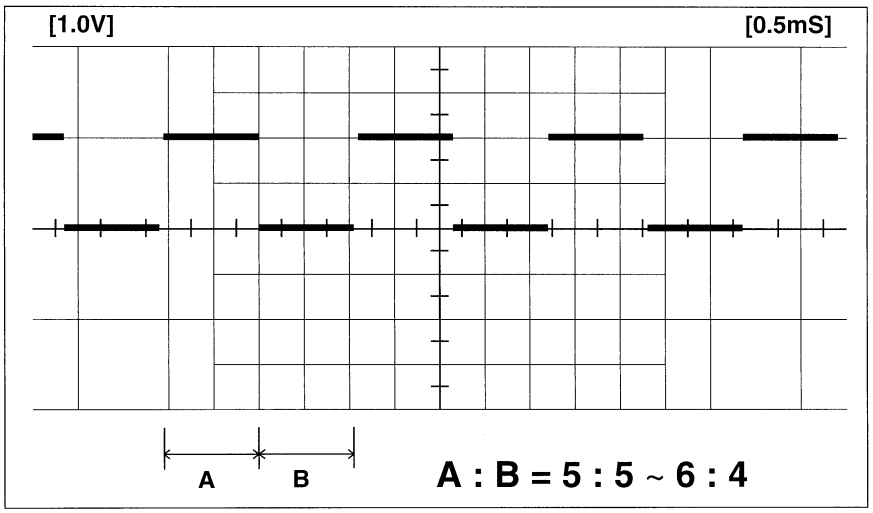


Fig. 3-27 Pulse Waveforms

3.4 Electrical Adjustments

1) Electrical adjustments

CAUTION

- If the adjustment software is used, the EOS KISS or EOS-1N can be used.

• USM reference frequency adjustment	Set the USM reference frequency.
• Gyro rank data input	Enter the gyro sensor rank into the EEPROM. The data is shown on the gyro sensor unit (CY1-2838).
• Shift unit sensitivity adjustment gain input	Enter the IS unit sensitivity gain into the EEPROM. The data is shown on the IS lens unit (YG2-0369).
• Mechanical lock position correction data input	Enter the IS unit mechanical lock center value into the EEPROM. The data is shown on the IS lens unit (YG2-0369).
• Mechanical lock adjustment	Adjust the IS unit mechanical lock if the center value of the mechanical lock of the IS unit is not available.
• IS adjustment	Obtain the best anti-vibration effect.
• Focusing compensation	Set the AF focusing position to the best focusing position.
• Initialize	Write basic data.
• Data save	Save the lens EEPROM data on a disk.
• Data transfer	Transfer the EEPROM data on the disk back to the lens.

2) IS adjustment when replacing electrical components

- The conditions for determining whether IS adjustment is required or not when replacing the main board only are shown below. (The USM reference frequency and focusing compensation are omitted because they are check items.)
- IS adjustment is required regardless of whether IS unit data and gyro sensor data exists. It is not required if all data in the EEPROM on the old board is transferred.

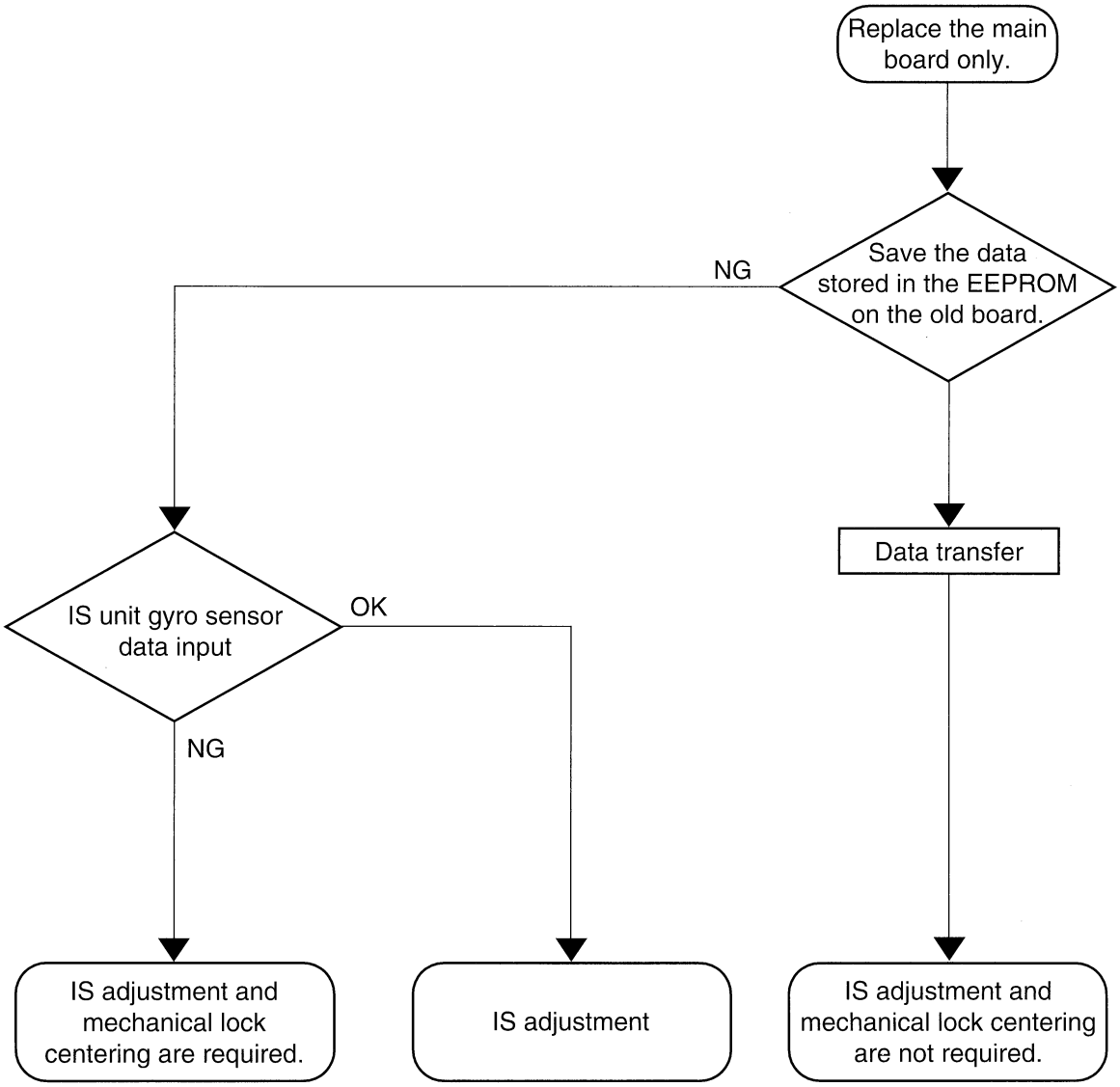


Fig. 3-28 Adjustment when Replacing The Main Flex

3) Lens adjustment software

Starting adjustment software

- The adjustment software file is named "C21-9961.EXE". If a working disk is created, the program can be executed automatically by using AUTOEXEC.BAT.

Adjustment software operations

- The adjustment software can be controlled by pressing the Return (Enter) key, space bar, and cursor keys. Follow the instructions shown on the screen.

Connecting the lens/camera with the HS-I/F or multiple tool II

- EOS KISS/REBEL X/500 or EOS-1N can be connected with the lens and the HS-I/F.
- If the EOS KISS/REBEL X/500 is used, the HS-I/F or multiple tool II can be used for adjustment. If the EOS-1N is used, the HS-I/F must be connected for adjustment.

*: The EOS-1N cannot communicate with the multiple tool II.

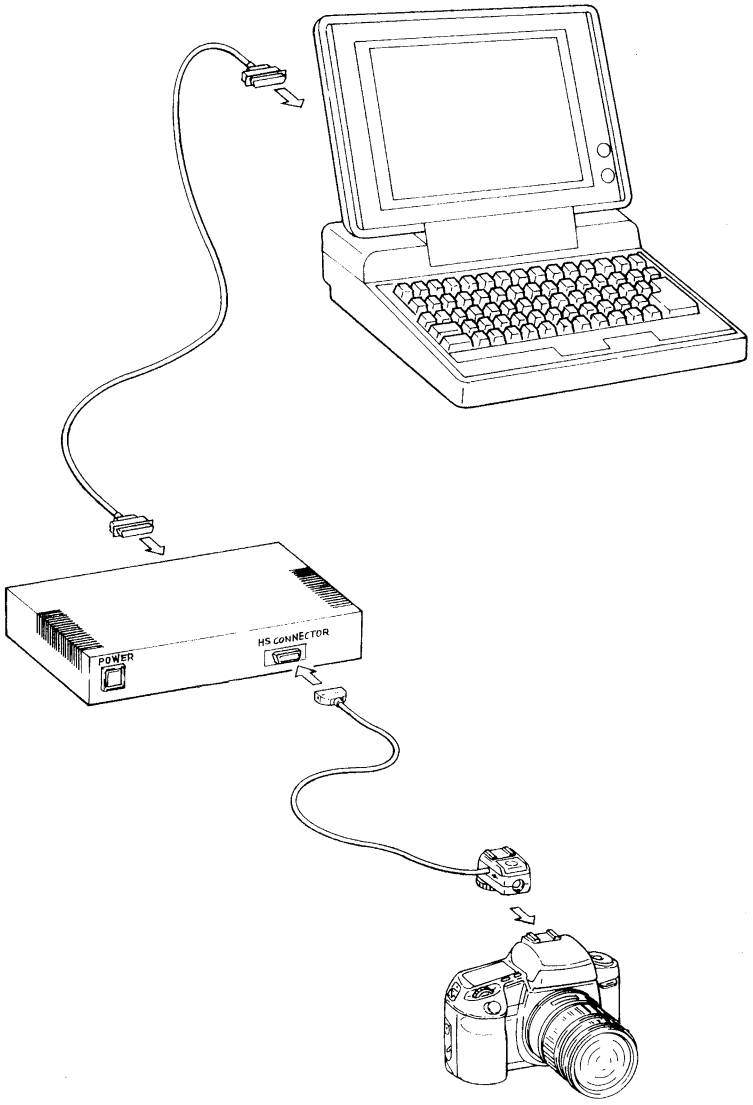


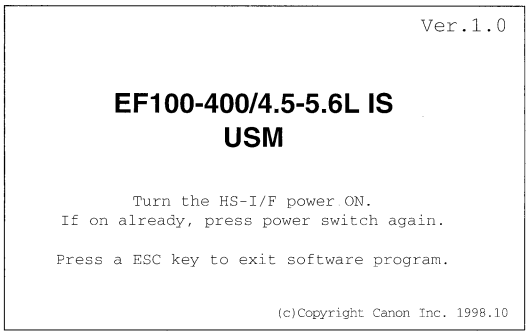
Fig. 3-29 Connecting the Lens/Camera with The Personal Computer

Start of operation

1) Insert the working disk into the disk drive of the personal computer. The screen shown at the right appears.

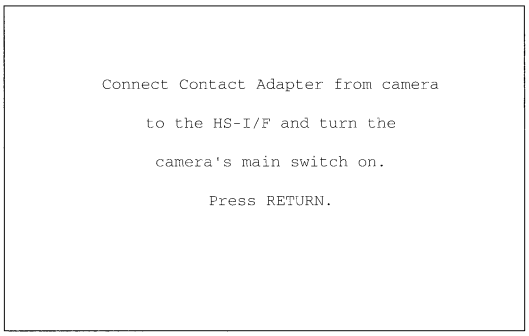
2) Turn the power to the HS-I/F on according to the instructions shown on the screen. If the power is already on, turn it off and on again.

POWON



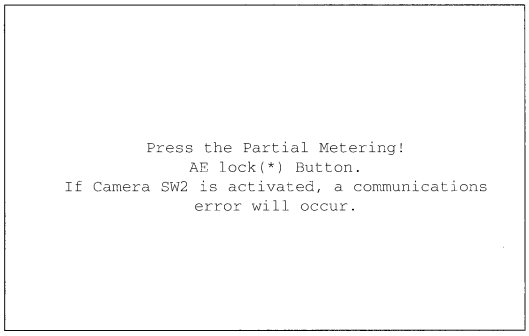
3) After communication has been established between the computer and Multiple Tool II, HS-I/F, the screen shown at right appears. Connect the camera to the Multiple Tool II, HS-I/F as indicated, then turn on the main switch on the camera. When the connection is complete, press the Return key.

SET



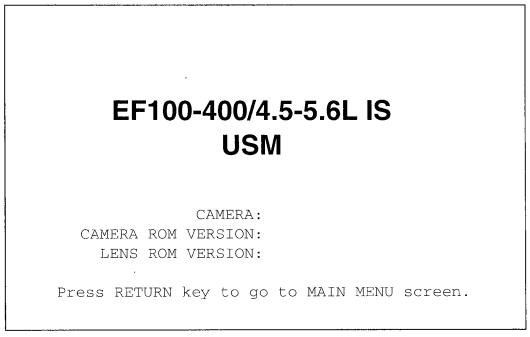
4) It may be necessary to turn the camera's AE lock button ON to communicate with the camera. Follow the instructions given on the screen by the adjustment software. An error occurs if the AE lock button is not pressed within about one minute. An error occurs if the lens is not mounted on the camera.

WakeUP



5) The adjustment software checks communication with the camera. After communication, the camera and lens ROM versions are displayed as shown in the figure at the right.

POWON2



6) The HS-I/F ROM Version 1.1 or later is required to perform electrical adjustments of this lens.
If the HS-I/F ROM version is not 1.1 or later, the adjustment software shows the message shown in the figure at the right.

ERRHSVER

HS-I/F ROM is not Ver. 1.1.

This software does not operate with HS-I/F ROM Versions earlier than 1.1.

Press any key to exit software program.

7) If the camera is not compatible, or the wrong ROM is installed in the lens, the adjustment software shows one of the messages shown at the right.

ERRCAM

The camera is not an EOS Rebel X, 500 or EOS1N.
This software is for the EOS Rebel X, 500 or EOS1N only.

Press any key to exit software program.

ERRLVER

The ROM in the connected
EF100-400/4.5-5.6L IS USM
is the wrong Version.

This software cannot be used to adjust a lens with this ROM version.

Press any key to exit software program

Adjustment software menu configuration

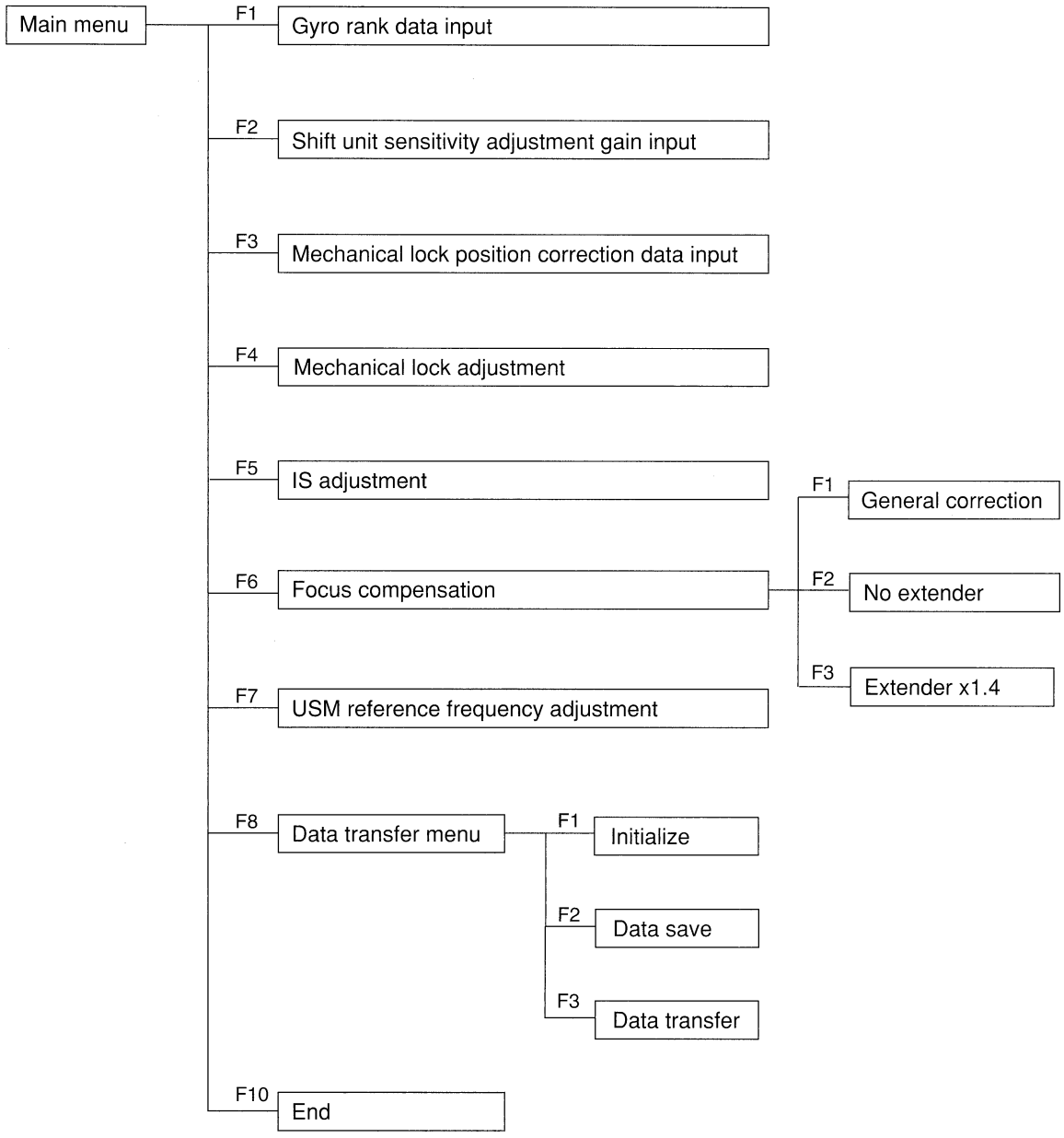


Fig. 3-30 Adjustment Software Menu Configuration

4) USM reference frequency adjustment

CAUTION

- This adjustment is performed when the main flex unit is adjusted. This adjustment is presented below for reference.
- If the focus speed is different from that of other products or if abnormal sound is heard at low or high temperature, check the USM reference frequency.

Purpose:

- Gain the USM drive reference frequency.

Tools:

- HS-I/F
- EOS KISS/REBEL X/500 or EOS-1N
- Adjustment software working disk
- Frequency counter
- EF lens electronic ring mount adapter or lens communication tool

Standard:

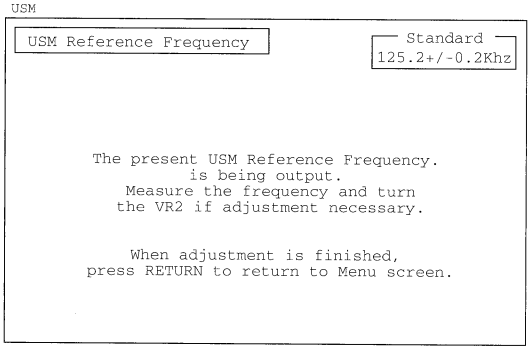
125.2 ± 0.2 kHz

Preparation:

1. Remove the fixed barrel and focusing guide barrel.
2. Solder a lead to each of the FIN and DGND lands shown in Fig. 3-29.
3. Install the fixed barrel, lens mount and contact block.
4. Mount the adapter and communication tool and draw the leads out through the inside.
   If the adapter or communication tool is not available, draw the lead from the switch cover unit.

Adjustment method:

1. Select [F7] USM Reference Frequency Adjustment from the adjustment menu.
2. Turn the USM drive ON. (The screen shown at the right appears and indicates the reference frequency.)
3. Connect the leads to the frequency counter.
4. Measure the frequency.
5. If the frequency does not conform to the standard, turn VR2 and measure the frequency again.
6. Measure the frequency, adjust, then measure the frequency again. Repeat this process until the frequency conforms to the standard.
7. When adjustment is complete, press the Return key.



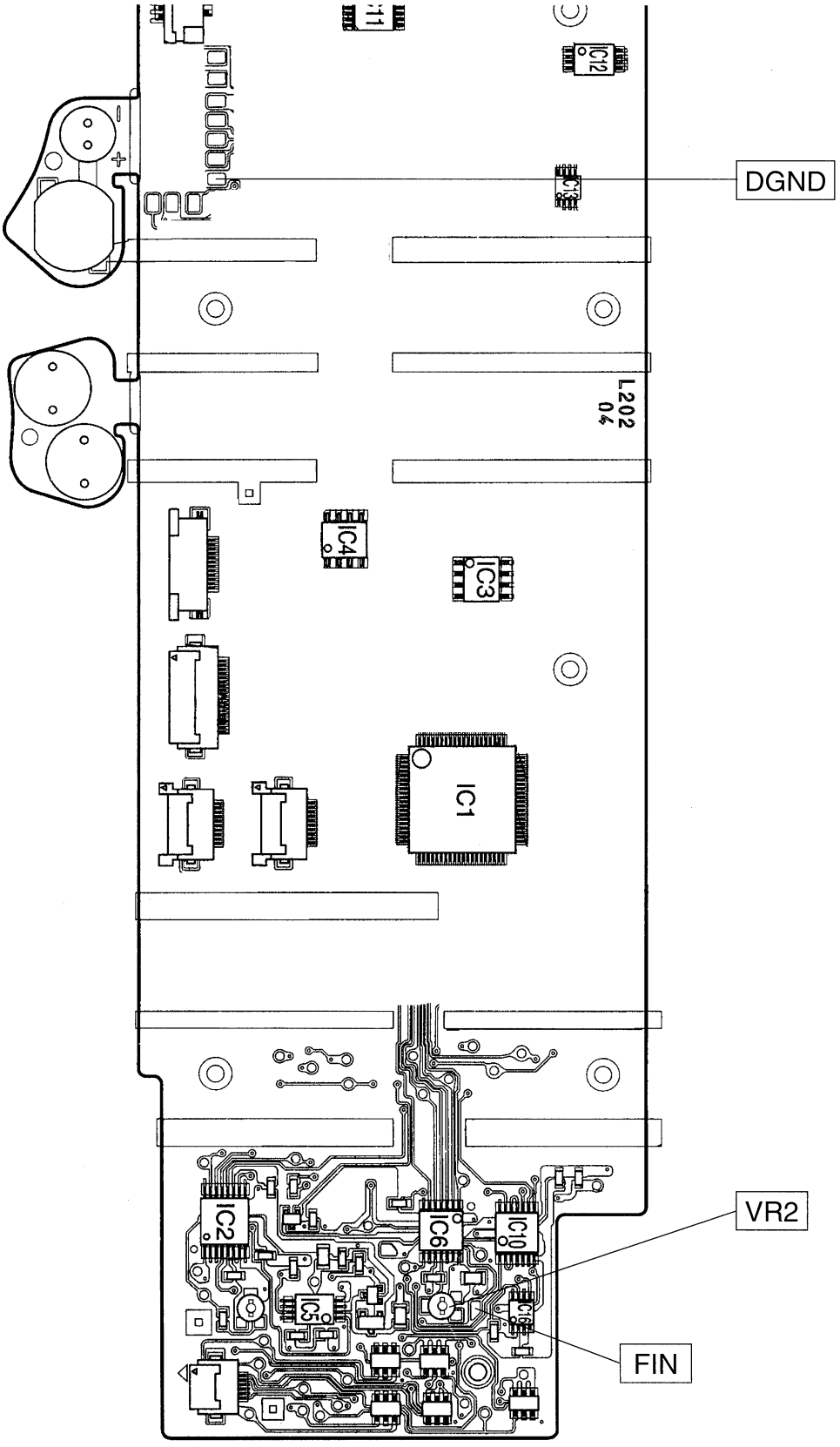


Fig. 3-31 USM Reference Frequency Adjusting Points

5) Gyro rank data input

CAUTION

- Enter the gyro rank data when you replace the main flex unit or gyro sensor unit.
- If the old main flex data cannot be stored when the main flex is replaced, the data must be checked and input.

Purpose:

- Enter the gyro sensor rank into the EEPROM. Rank data is shown on the gyro sensor flex.

Tools:

- HS-I/F
- EOS KISS/REBEL X/500 or EOS-1N
- Adjustment software working disk

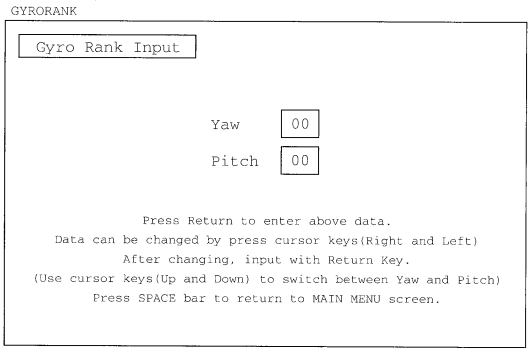
Preparation:

1. Run the adjustment software, connect the camera with the HS-I/F, and select [F1] Gyro Rank Data Input from the main menu.
2. Check gyro rank data.

Input:

1) Input data using the cursor keys.
When the Return key is pressed, the computer communicates with the camera and writes data into the camera.
(When the space bar is pressed, data is not input, and the main menu returns.)

2) After communication, the main menu returns.



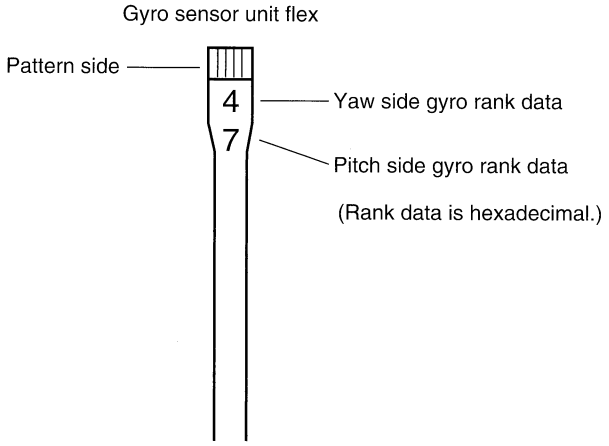


Fig. 3-32 Gyro Sensor Data Location

6) Shift unit sensitivity data input

CAUTION

- Enter the shift unit sensitivity data when you replace the main flex unit or IS lens unit.
- If the data cannot be read from the old main board unit, the mechanical lock position correction and IS adjustment must be performed.

Purpose:

- Enter the gain for shift unit sensitivity adjustment into the EEPROM.

Tools:

- HS-I/F
- EOS KISS/REBEL X/500 or EOS-1N
- Adjustment software working disk

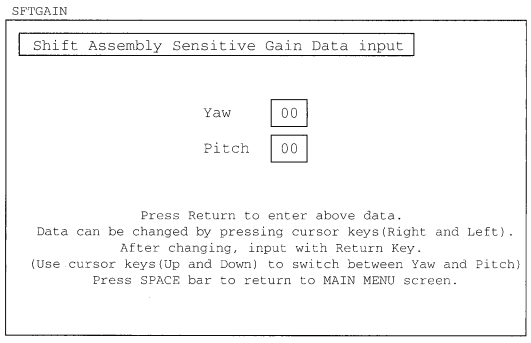
Preparation:

1. Run the adjustment software, connect the camera with the HS-I/F, and select [F2] Shift Unit Sensitivity Data Input from the main menu.
2. Check shift unit sensitivity data.

Input:

1) Input data using the cursor keys.
When the Return key is pressed, the computer communicates with the camera and writes data in the camera.
(When the space bar is pressed, data is not input, and the main menu returns.)

2) After communication, the main menu returns.



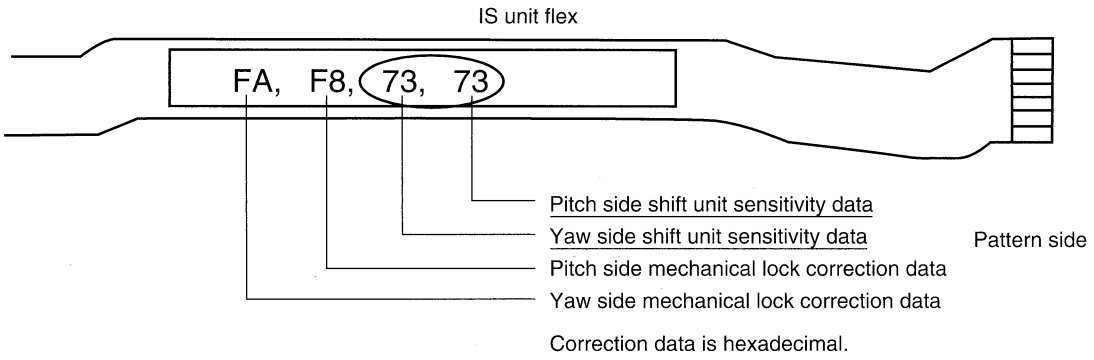


Fig. 3-33 Shift Unit Sensitivity Data Location

7) Mechanical lock position correction data input

CAUTION

- Enter the mechanical lock position correction data when you replace the main flex unit or IS lens unit.
- If the data cannot be read from the old main board unit, the mechanical lock position correction and IS adjustment must be performed.

Purpose:

- Enter the mechanical lock position correction data into the EEPROM. Obtain the center when the anti-vibration function turns on. When the camera is fixed on the tripod and the anti-vibration function turns on, the image does not shake if the lens is good.

Tools:

- HS-I/F
- EOS KISS/REBEL X/500 or EOS-1N
- Adjustment software working disk

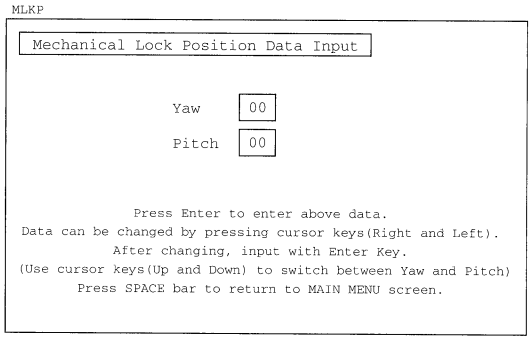
Preparation:

1. Run the adjustment software, connect the camera with the HS-I/F, and select [F3] Mechanical Lock Position Correction Data from the main menu.
2. Check the mechanical lock position correction data.

Input:

1) Input data using the cursor keys.
When the Return key is pressed, the computer communicates with the camera and writes data in the camera.
(When the space bar is pressed, data is not input and the main menu returns.)

2) After communication, the main menu returns.



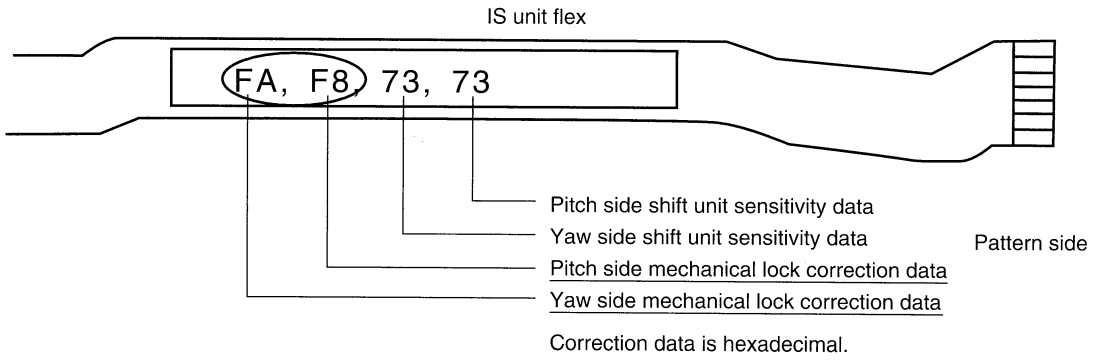


Fig. 3-34 Mechanical Lock Position Correction Data Location

8) Mechanical lock position adjustment

CAUTION

- This adjustment is required when the main flex unit or the IS Lens Unit is replaced.
- If the EEPROM data from the old main flex cannot be saved, both this and the following IS adjustment must be done.

Purpose:

- Obtain the center when the anti-vibration function turns on. When the camera is fixed on the tripod and the anti-vibration function turns on, the image does not shake if the lens is good. If the image shakes greatly, this adjustment is required.

Tools:

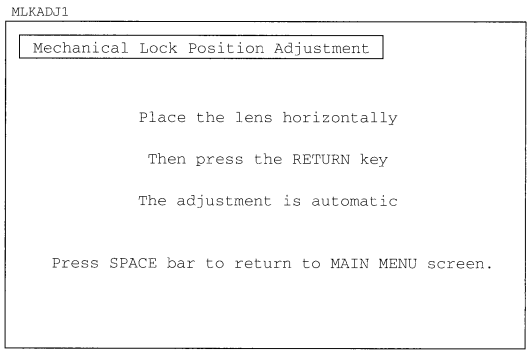
- HS-I/F
- EOS KISS/REBEL X/500 or EOS-1N
- Adjustment software working disk
- EF lens electronic ring mount adapter or lens communication tool

Standard:

- Fix the lens on the tripod and see the viewfinder. When the anti-vibration function turns on, the image must not move.

Preparation:

1. Install the mount adapter or lens communication tool on the lens.
2. Run the adjustment software, connect the camera with the HS-I/F, and select [F4] Mechanical Lock Adjustment from the main menu.
3. Place the lens horizontally. (See Fig. 3-35.)
4. Turn the IS switch ON and set IS mode to 1.



Adjustment:

1) Set the lens and press the Return key. The computer carries out adjustment automatically. (It takes about one minute to complete the adjustment.)
2) After adjustment, remove the lens from the camera and reinstall it to reset the lens.
The main menu returns.

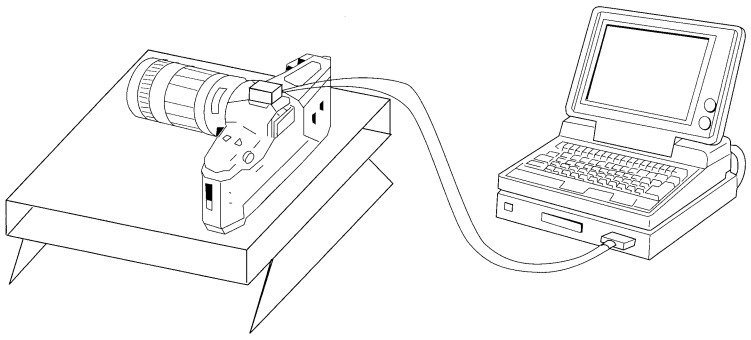


Fig. 3-35 Mechanical Lock Adjustment

9) IS adjustment

CAUTION

- Perform IS adjustment when you replace the main flex unit or IS lens unit.
- The IS adjustment is required regardless of whether gyro rank data, shift unit sensitivity adjustment gain data, and mechanical lock correction data are available.
- If shift unit sensitivity adjustment gain data and mechanical lock correction data are not available and no improvement is performed by this adjustment, the IS unit must be replaced.

Purpose:

- Find the peak anti-vibration effect to achieve the best anti-vibration effect.

Tools:

- HS-I/F
- EOS KISS or EOS-1N (EOS-1N cannot be installed directly on to the vibration table. Use a tripod head.)
- Vibration table
- Penlight

Standard:

- Perform adjustment so that the penlight movement is minimized (within the viewfinder frame). Reduce the shake to 1/4 or less visually when the anti-vibration function turns on.

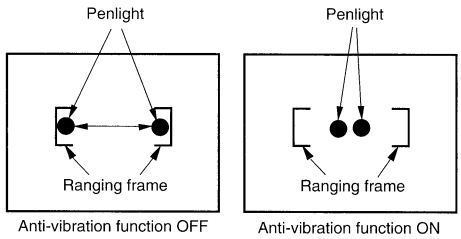
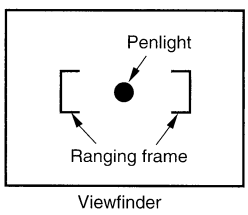


Fig. 3-36 Anti-vibration Effect

Preparation:

1. Set the lens as shown below. (Set the pen light at the center of the ranging frame.) Set the IS switch to ON, the IS mode to 1, and the A/M switch to MF. If the vibration table is not available, adjustment can be performed by shaking the camera manually.
2. Run the adjustment software, connect the camera with the HS-I/F, and select [F5] IS Adjustment from the main menu.

Distance to the penlight: 2.5 m
View angle: 0.1 degree (Adjust with the control on the vibration table.)
Frequency: 5 Hz (Apply 9 V to the vibration table.)
Final check is performed with a frequency of 5 Hz. Adjustment can be easily performed with a lower frequency (3 Hz, 6 V).



Adjust so that the penlight and the ranging frame move at the same time.

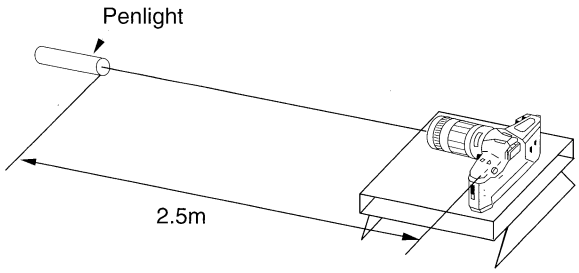
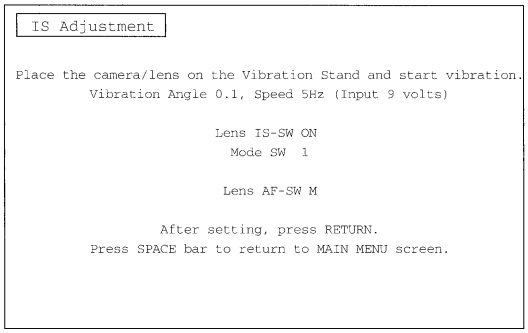


Fig. 3-37 IS Adjustment

Adjustment:

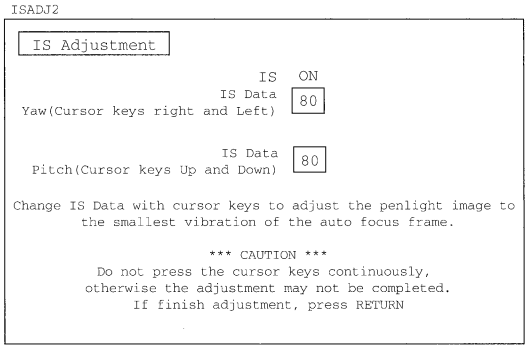
1) Supply power to the vibration table and apply vibration to the camera and lens. Apply 9 V to the vibration table (5 Hz) and set the view angle to 0.1 degree. (Adjustment can be easily performed at 5 Hz or less.)

ISADJ1



2) When the Return key is pressed, the lens activates the hand-shake prevention function. The gyro sensitivity can be set using the cursor keys. Maximize the hand-shake prevention effect.
Adjust the yaw (horizontal) direction with the right and left cursor keys. Adjust the pitch (vertical) direction with the up and down cursor keys.

ISADJ2



Note

When the sensitivity is changed by one step, wait for two or three seconds and check the IS effect.
(If cursor keys are pressed continuously, adjustment may not be performed. Terminate the adjustment, remove and reinstall the lens while the main menu is displayed, and perform adjustment again.)

3) When the Return key is pressed, the IS menu returns.

Note

The lens is set to the special mode after IS adjustment, so the IS does not work. To operate the IS, remove and reinstall the lens while the lens reset screen is displayed.

10) Focus compensation

CAUTION

- Do this adjustment when the optical system is replaced, or when the user requests it.
- Do this adjustment when the main flex unit is replaced or the data on the old main flex cannot be stored.
- Extender EF1.4 compensation is possible only when using the EOS-3 camera. (AF will not operate with other EOS cameras.)

Purpose:

- To align the autofocus point as closely as possible to the lens' actual best focus point.
- At the factory, the differences of focus points are detected and adjusted with a special tool. Field service should use the following procedures instead.
  1. When the main flex unit is replaced, no adjustment is necessary regardless of whether it contains data.
  2. If there is any customer complaint, adjust the focus by using one of the following two methods:

Adjustment method 1:

- If front defocus, increase plus correction. If rear defocus, increase negative correction.

Adjustment method 2:

- Select [F6] Focusing Correction on the adjustment software, enter four data items, perform shooting, and select the data item that gives the best focus.
-

Tools:

- HS-I/F
- EOS KISS or EOS-1N
- Adjustment software working disk
- 3D chart (hand-made)
- Reference body (AF and flange-back are adjusted correctly.)

Preparation:

1) Run the adjustment software, connect the camera with the HS-I/F, and select [F6] Focus Correction from the main menu.
2) All items are adjusted in general correction. Select general correction for a normal claim. If the user specifies special conditions (an extender is used or not used), select that item.

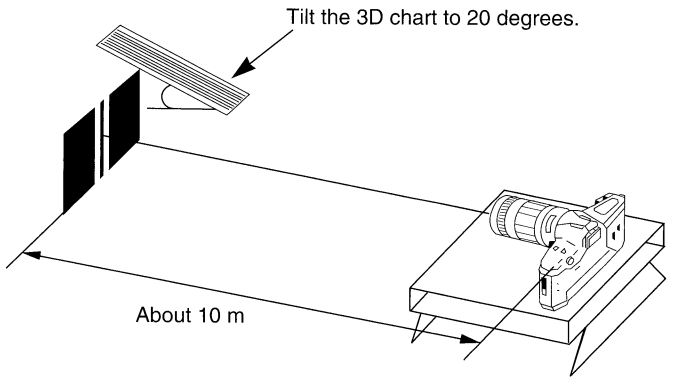
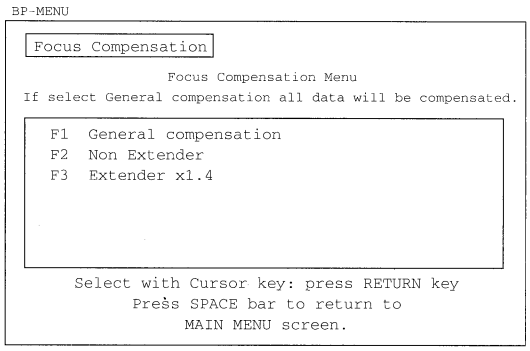
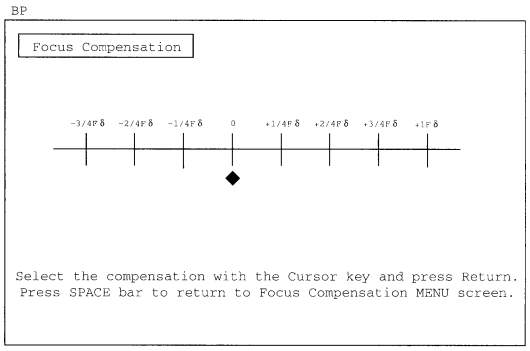


Fig. 3-38 3D Chart Shooting

Input:

1) Enter data using the cursor keys.





Test conditions:

- Shooting distance: About 20 m. The distance increases when an extender is used. (Basically, 50 times the focal length)
- Target: AF reference chart and 3D chart (Shown at the end of this manual. Attach charts to a flat plate, etc.)
  The brightness of the AF reference chart must be about EV 12. A video light should be used. (Do not use an fluorescent lamp.)
- Aperture: Maximum aperture with priority on AV
- Focusing: AF metering from infinity (or closest end) after each exposure (Range the AF reference chart.)
- Number of shoots: 2 to 3 with four correction values. (Monochrome films should be used.)
- Check the 3D chart with a 30 to 50 x magnifier or microscope and correct the focus.
- The chart is seen as shown below through the viewfinder.

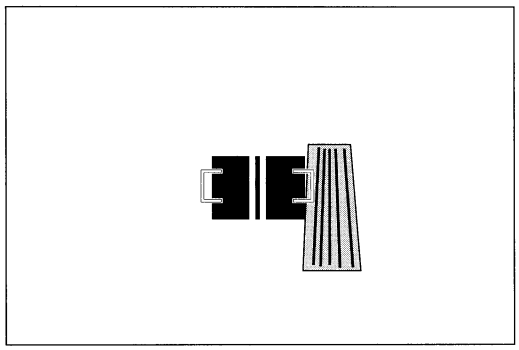


Fig. 3-39 Viewfinder when The 3D Chart is Shot

11) Data transfer

CAUTION

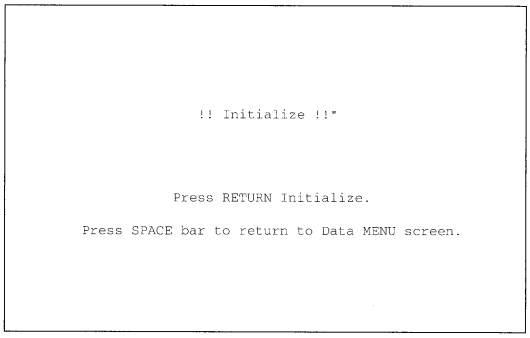
- When you replace the main flex unit, the data stored in it must be saved.
- After the data transfer, return to the main menu and remove and reinstall the lens.

One of the following two options can be selected to transfer data.
1. nitialize: Initialize the main flex.
2. Data Save: Save camera data.
3. Data Transfer: Transfer the saved data.

Initialize

When you select Initialize, the screen shown in the figure at the right appears. Press the Return key to initialize the main flex. Press the space bar to return to the main menu.

INIT



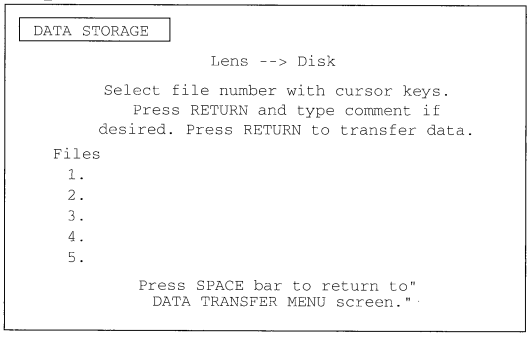
Note

After the data transfer, return to the main menu and remove and reinstall the lens.

Data Save

When you select Data Save, the screen shown at the right appears. Select a file using the ↑ and ↓ keys, and press the Return key. Enter a comment. After entering a comment, press the Return key to save the camera data.

DATC_T



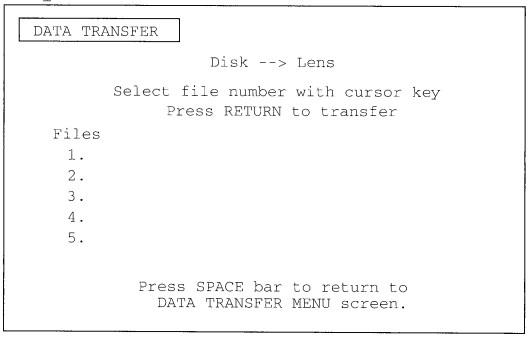
Data Transfer

When you select Data Transfer, the screen shown at the right appears. Select a file using the ↑ and ↓ keys, and press the Return key. The camera data will be transferred.

Note

After the data transfer, return to the main menu and remove and reinstall the lens.

DATT_C



4. OTHERS

4.1 Lens Communication Tool Creation

Uses:

- The lens communication tool is used in place of the service tool "EF lens electronic ring mount adapter".
- It is used to adjust the mechanical lock position and USM reference frequency. (This tool cannot be used for optical adjustment that requires a lens projector or collimator.)

Preparation:

- Obtain the following parts from EF 50mm 1:1.8II.

YA2-0121-000	Contact block holding screws (2)
YA2-0425-000	Main unit
YA2-0442-000	Contact block

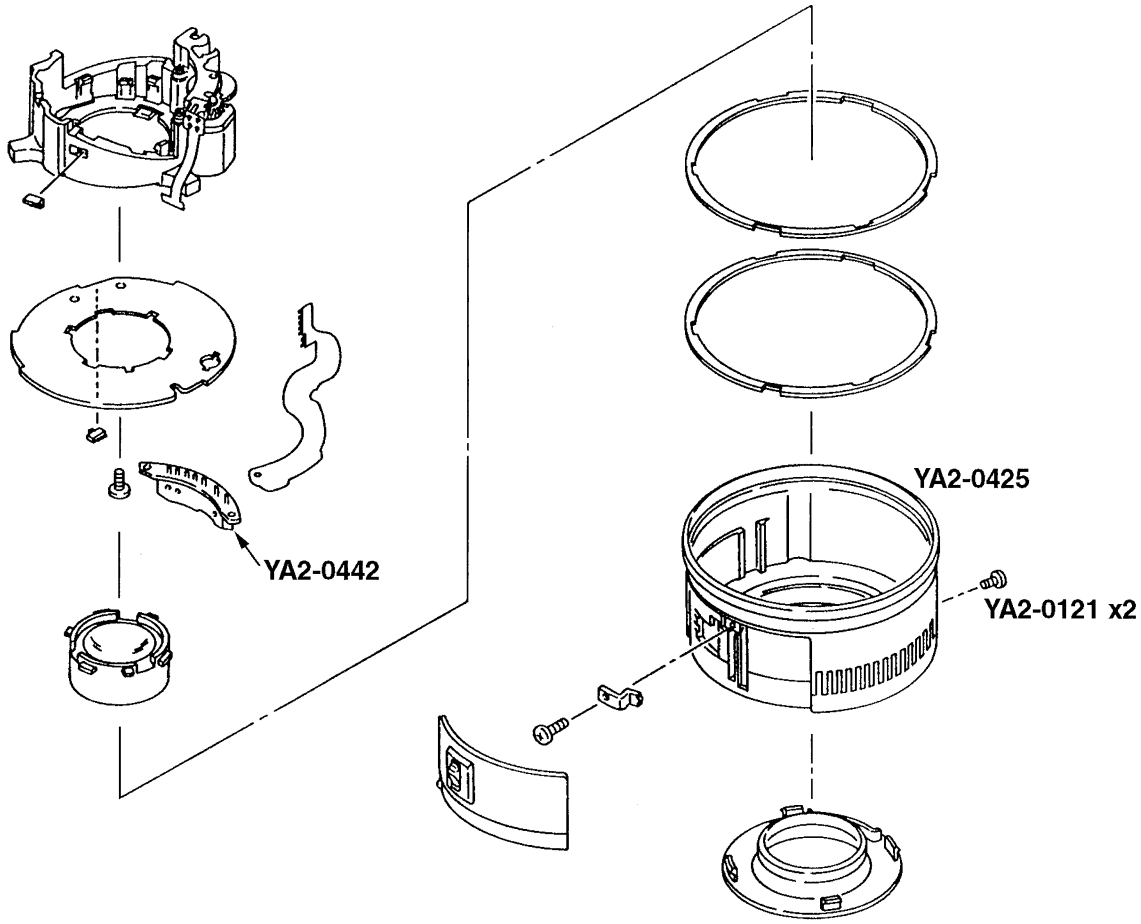


Fig. 3-40 Removing Parts from EOS KISS/REBEL X/500

- Obtain the following components from the EOS KISS (REBEL X/500).

CB1-1142-000	Mount holding screws (5)
CB1-3441-000	Mount
CB1-3442-000	MIF spring
CF1-1948-000	Lock pin unit
CG1-1381-000	Contact seat unit
CS2-5020-000	Lock pin spring
CY1-1610-000	Front panel unit
XA4-9170-509	Two

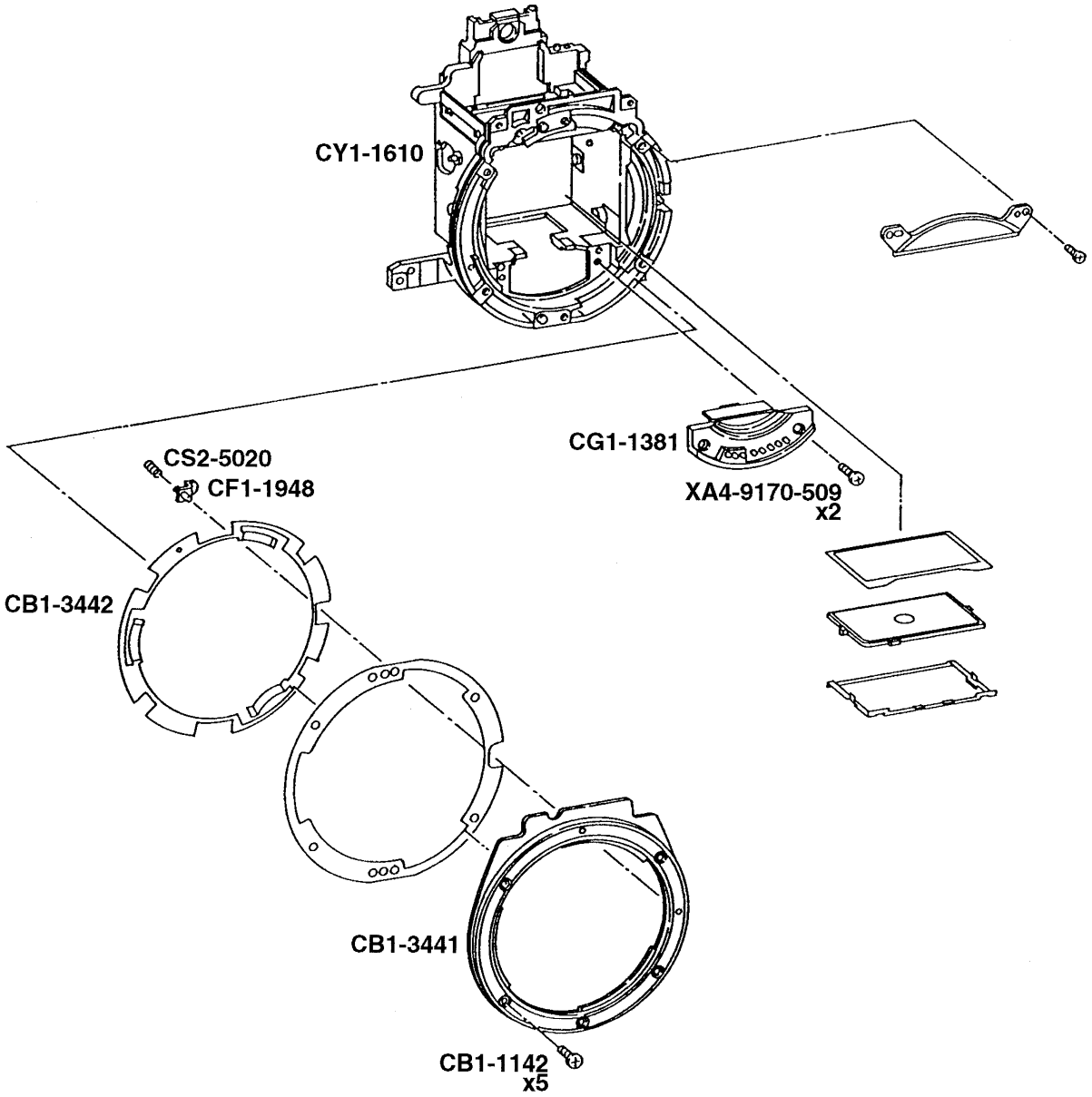


Fig. 3-41 Removing Parts from EOS KISS/ REBEL X/500

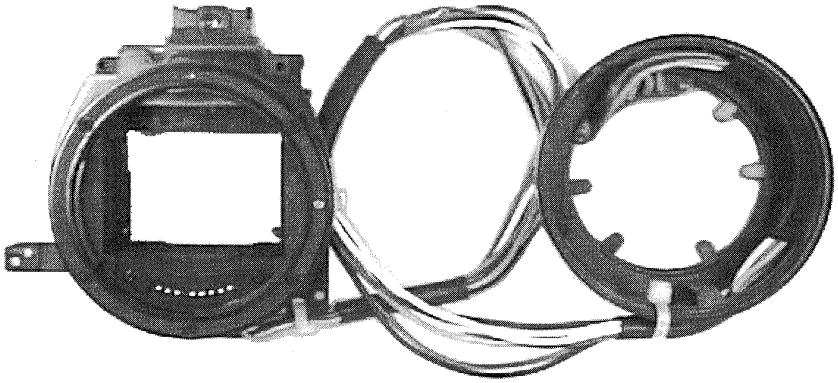


Fig. 3-42 Lens CommunicAtion Tool

Creation method:

- Connect the camera contact seat with the lens contact block with leads.
- Use seven leads 30 to 40 cm long.

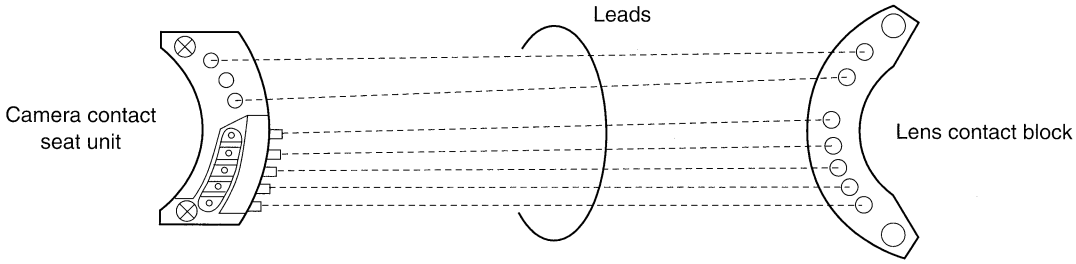


Fig. 3-43 Lead Connection

- Install the contact seat on the front panel unit and install the mount.
- Install the contact block on the main unit.
- Cut off the projection of the front panel unit so that its height is the same as the height of the shutter unit installation surface of the front panel unit. (See Fig. 3-34.)

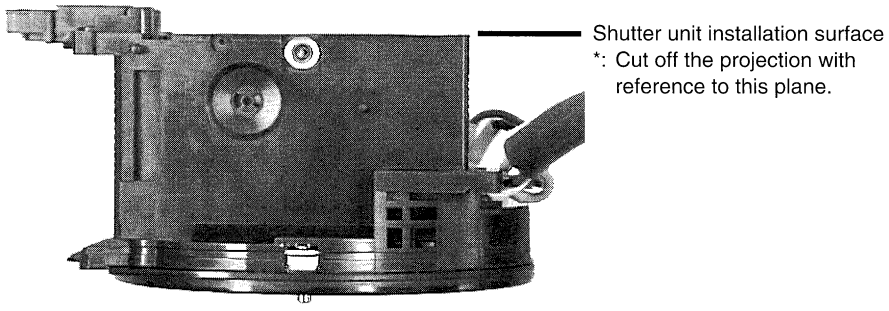


Fig. 3-44 Front Panel Unit Cutting

4.2 Creation of Fixed Barrel Tool

Use:

- During tilt/centering adjustment, attach the fixed barrel tool on the lens, set the lens to Tele end, and turn the eccentric pins of the IS unit (group 2 lens) and the group 3 lens unit to perform adjustment.

Creation method:

- Cut off the base of the fixed barrel (CY1-2837) as shown below.

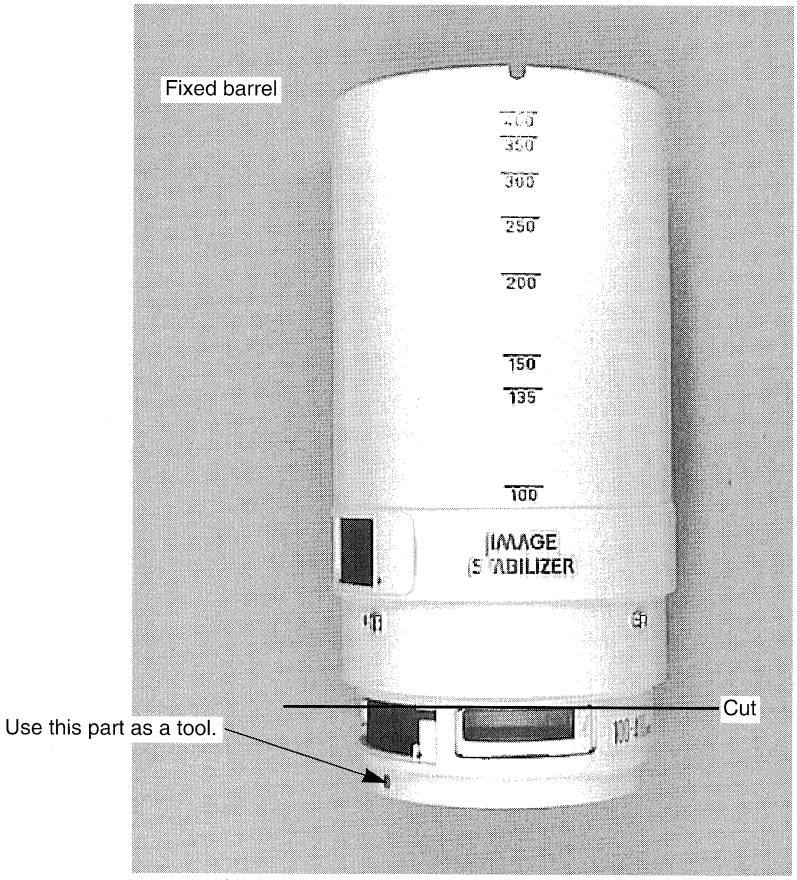


Fig. 3-45 Fixed Barrel Modification

Part 4

Parts Catalog

Canon

EF 100-400 mm 1:4.5-5.6L IS USM

REF. NO. C21-9961

PARTS CATALOG

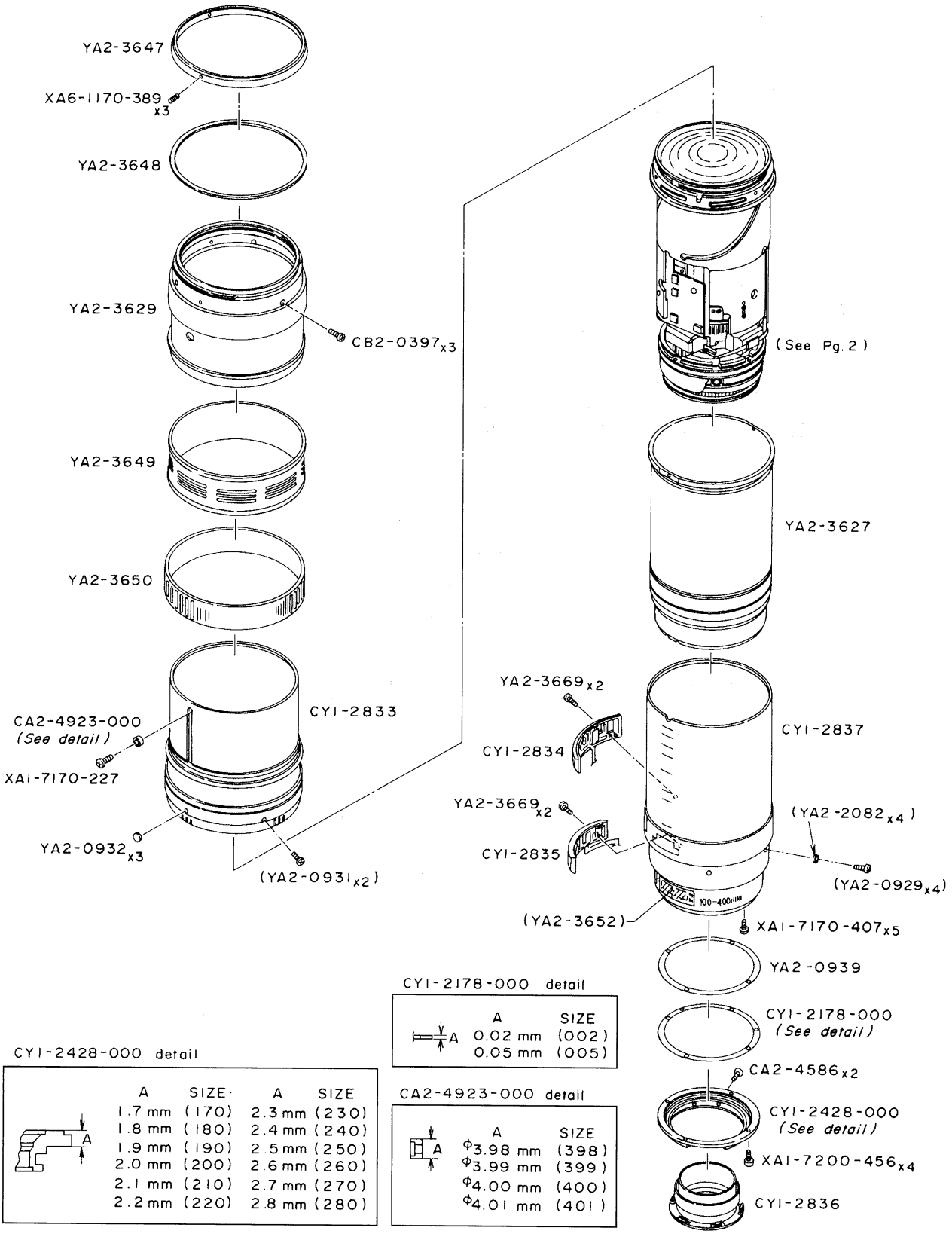
＜正式版＞

[OFFICIAL]

1998/October

CANON LENS EF 100-400 mm 1:4.5-5.6L IS USM

REF. C21-9961



CY1-2178-000 detail

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

CY1-2428-000 detail

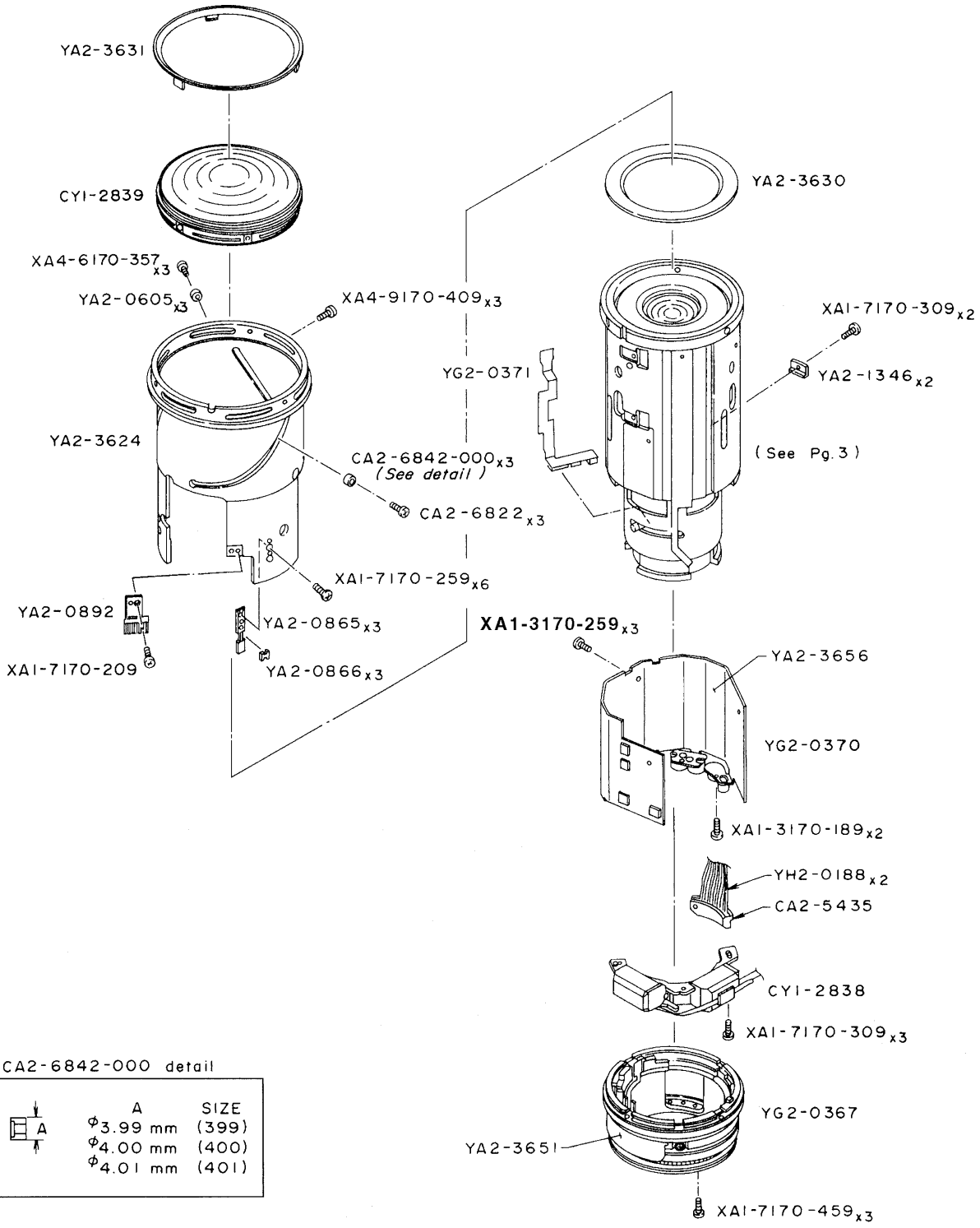
A	SIZE	A	SIZE
1.7 mm	(170)	2.3 mm	(230)
1.8 mm	(180)	2.4 mm	(240)
1.9 mm	(190)	2.5 mm	(250)
2.0 mm	(200)	2.6 mm	(260)
2.1 mm	(210)	2.7 mm	(270)
2.2 mm	(220)	2.8 mm	(280)

CA2-4923-000 detail

A	SIZE
Φ3.98 mm	(398)
Φ3.99 mm	(399)
Φ4.00 mm	(400)
Φ4.01 mm	(401)

CANON LENS EF 100-400 mm 1:4.5-5.6L IS USM

REF. C21-9961

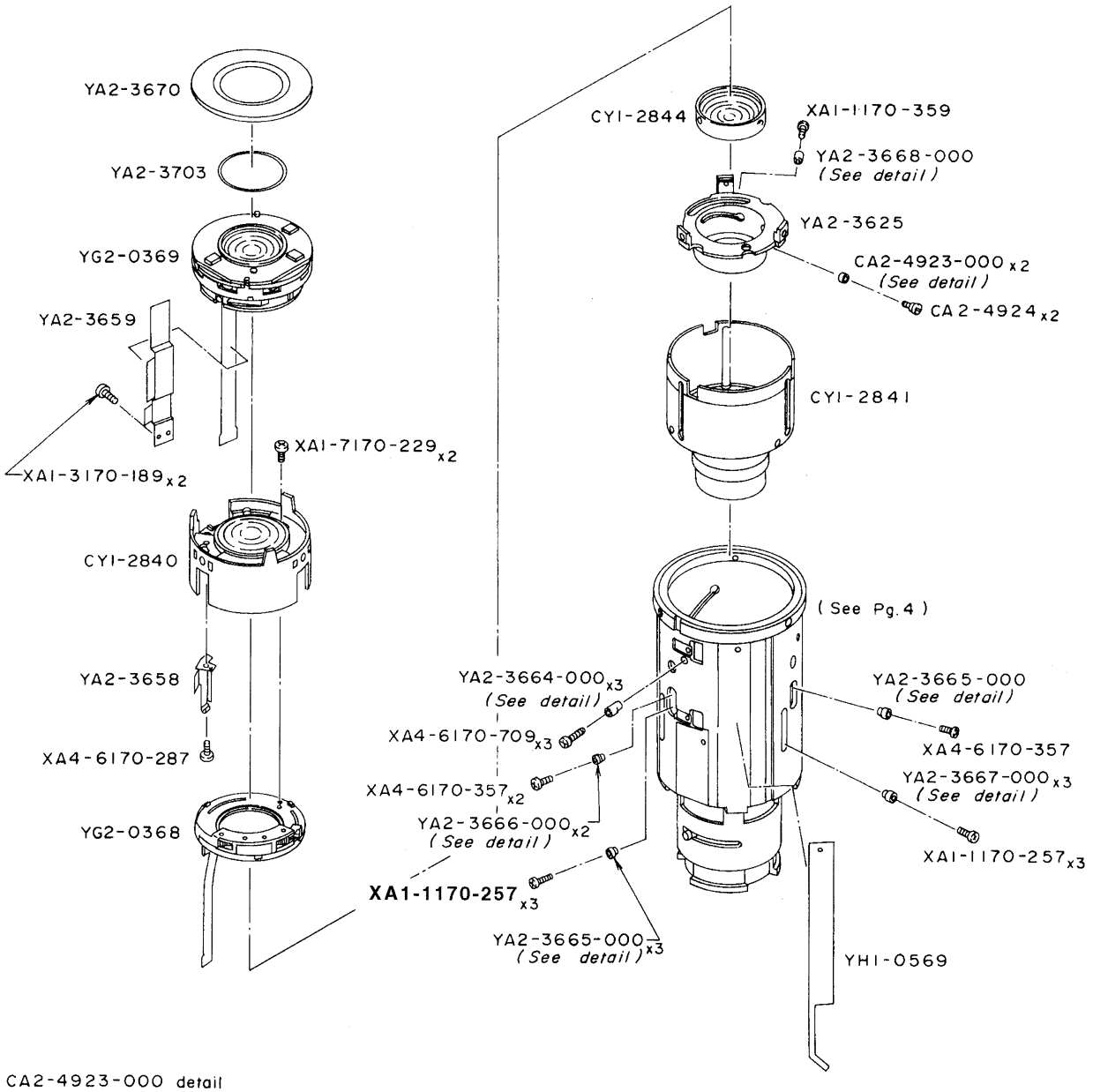


CA2-6842-000 detail

	A	SIZE
A	Φ3.99 mm	(399)
	Φ4.00 mm	(400)
	Φ4.01 mm	(401)

CANON LENS EF 100-400 mm 1:4.5-5.6L IS USM

REF. C21-9961



CA2-4923-000 detail

A	SIZE
Φ3.98 mm	(398)
Φ3.99 mm	(399)
Φ4.00 mm	(400)
Φ4.01 mm	(401)

YA2-3664-000 detail

A	SIZE
Φ4.00 mm	(400)
Φ4.01 mm	(401)
Φ4.02 mm	(402)

YA2-3665-000 detail

A	SIZE
Φ4.00 mm	(400)
Φ4.01 mm	(401)
Φ4.02 mm	(402)

YA2-3666-000 detail

A	SIZE
Φ4.00 mm	(400)
Φ4.01 mm	(401)
Φ4.02 mm	(402)

YA2-3667-000 detail

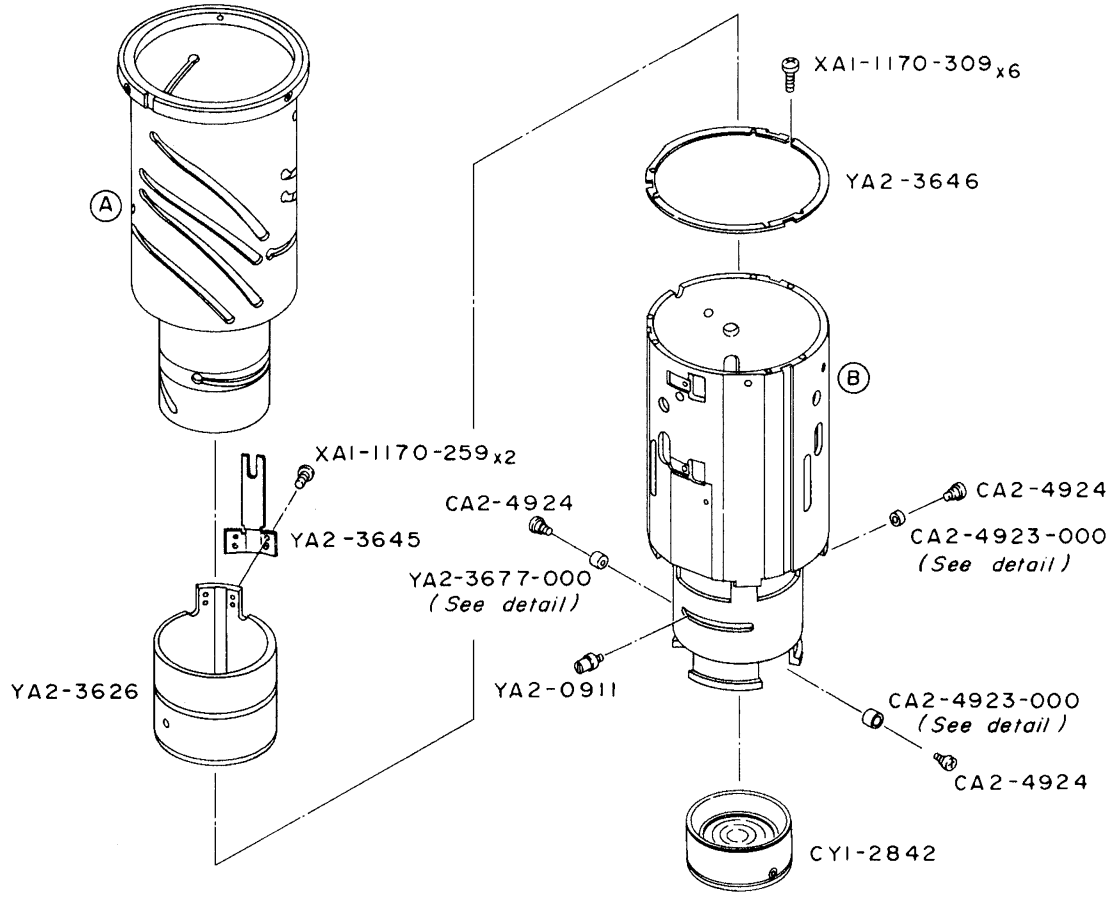
A	SIZE
Φ4.00 mm	(400)
Φ4.01 mm	(401)
Φ4.02 mm	(402)

YA2-3668-000 detail

A	SIZE
Φ3.99 mm	(399)
Φ4.00 mm	(400)
Φ4.01 mm	(401)

CANON LENS EF 100-400 mm 1:4.5-5.6L IS USM

REF. C21-9961



CA2-4923-000 detail

A	SIZE
φ3.98 mm	(398)
φ3.99 mm	(399)
φ4.00 mm	(400)
φ4.01 mm	(401)

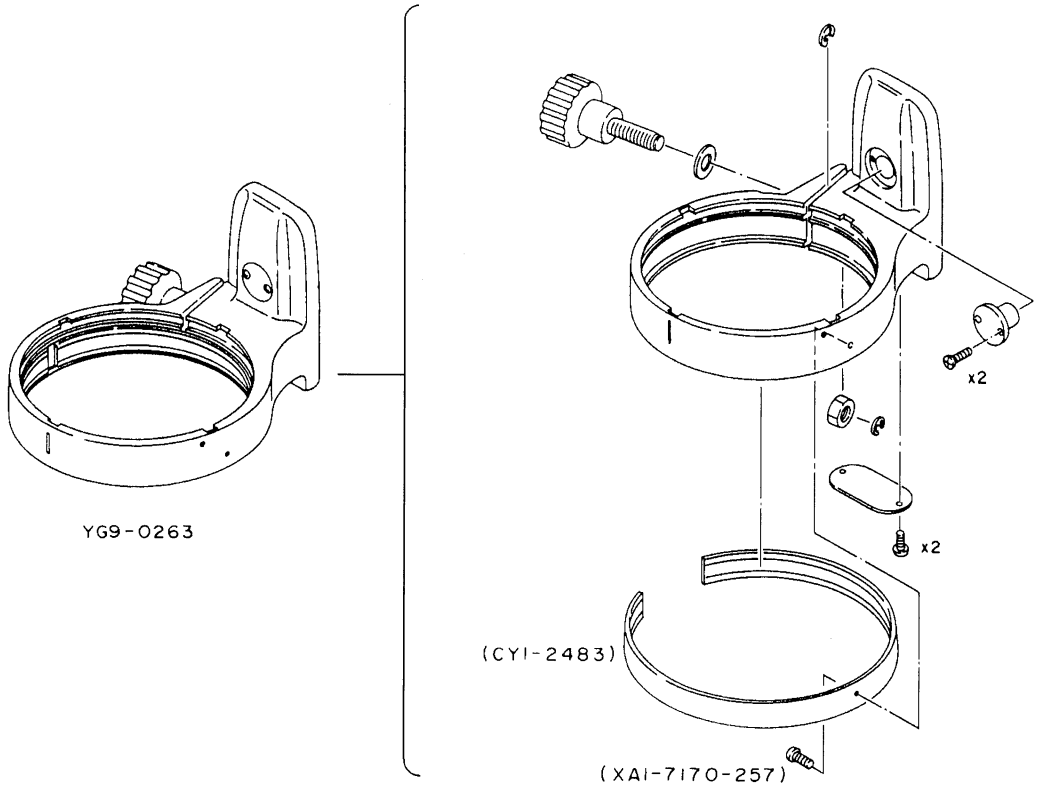
YA2-3677-000 detail

A	SIZE
φ4.00 mm	(400)
φ4.01 mm	(401)
φ4.02 mm	(402)

A, B } YG9-0616

CANON LENS EF 100-400 mm 1:4.5-5.6L IS USM

REF. C21-9961



PARTS LIST

REF.NO. C21-9961

NEW	PARTS NO.	CLASS	QTY	DESCRIPTION		PAGE
	CA2-4586-000		2	SCREW,		1
	CA2-4923-000(xxx)	D	5	COLLAR	4/6群/ﾌｫｰｶｽ筒コロ	1,3,4
	CA2-4924-000		5	SCREW,		3,4
	CA2-5435-000	C	1	CONTACT ASS'Y	接点ブロック	2
	CA2-6822-000		3	SCREW,		2
	CA2-6842-000(xxx)	D	3	COLLAR	直進筒コロ	2
	CB2-0397-000		3	SCREW,		1
	CY1-2178-000(xxx)	D	N	WASHER, MOUNT	マウントワッシャー	1
	CY1-2428-000(xxx)	C	1	MOUNT, LENS	レンズマウント	1
	CY1-2483-000	D	1	BELT	ベルト	5
*	CY1-2833-000	C	1	FOCUS RING UNIT	フォーカスリングユニット	1
*	CY1-2834-000	C	1	IS SWITCH ASS'Y	ISスイッチユニット	1
*	CY1-2835-000	C	1	A/M SWITCH ASS'Y	A/Mスイッチユニット	1
*	CY1-2836-000	B	1	COVER, BACK	裏蓋	1
*	CY1-2837-000	C	1	BARREL ASS'Y, FIXED	固定筒ユニット	1
*	CY1-2838-000	C	1	GYRO SENSOR UNIT	ジャイロセンサーユニット	2
*	CY1-2839-000	C	1	LENS ASS'Y, 1ST GROUP	1群レンズユニット	2
*	CY1-2840-000	D	1	LENS ASS'Y, 3RD GROUP	3群レンズユニット	3
*	CY1-2841-000	D	1	LENS ASS'Y, 5TH GROUP	5群レンズユニット	3
*	CY1-2842-000	D	1	LENS ASS'Y, 6TH GROUP	6群レンズユニット	4
*	CY1-2844-000	D	1	LENS ASS'Y, 4TH GROUP	4群レンズユニット	3
	XA1-1170-257		6	SCREW, CROSS-RECESS, PH		3
	XA1-1170-259		2	SCREW, CROSS-RECESS, PH		2,4
	XA1-1170-309		6	SCREW, CROSS-RECESS, PH		4
	XA1-1170-359		1	SCREW, CROSS-RECESS, PH		3
	XA1-3170-189		4	SCREW, CROSS-RECESS, PH		2,3
	XA1-3170-259		3	SCREW, CROSS-RECESS, PH		2,3
	XA1-7170-209		1	SCREW, CROSS-RECESS, PH		2
	XA1-7170-227		1	SCREW, CROSS-RECESS, PH		1
	XA1-7170-229		2	SCREW, CROSS-RECESS, PH		3
	XA1-7170-257		1	SCREW, CROSS-RECESS, PH		5
	XA1-7170-259		6	SCREW, CROSS-RECESS, PH		2
	XA1-7170-309		5	SCREW, CROSS-RECESS, PH		2
	XA1-7170-407		5	SCREW, CROSS-RECESS, PH		1
	XA1-7170-459		3	SCREW, CROSS-RECESS, PH		2
	XA1-7200-456		4	SCREW, CROSS-RECESS, PH		1
*	XA4-6170-287		1	SCREW, CROSS-RECESS, PH		3
	XA4-6170-357		6	SCREW, CROSS-RECESS, PH		2,3
	XA4-6170-709		3	SCREW, CROSS-RECESS, PH		3
	XA4-9170-409		3	SCREW, CROSS-RECESS, PH		2

PARTS LIST

REF.NO. C21-9961

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	XA6-1170-389		3	SETSCREW, SLOTTED, HLCP		1
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	YA2-0865-000	D	3	KEY	補正キー	2
	YA2-0866-000	D	3	SPACER	補正コマ	2
	YA2-0892-000	C	1	BRUSH, ZOOMING	ズームブラシ	2
	YA2-0911-000	D	1	PIN, FOCUSING	フォーカスピン	4
	YA2-0929-000		4	SCREW, CROSS-RECESS, PH		1
*	YA2-0931-000		2	SCREW, CROSS-RECESS, PH		1
	YA2-0932-000	B	3	PIN, COVER	カバーピン	1
	YA2-0939-000	D	1	SPACER, MOUNT	マウントスペーサー	1
	YA2-1346-000	D	2	KEY, ZOOMING STOPPER	ズームストッパーコマ	2
	YA2-2082-000	D	4	COLLAR	三脚座カラー	1
*	YA2-3624-000	D	1	BARREL, ZOOMING	直進筒	2
*	YA2-3625-000	D	1	BARREL, 4TH LENS CAM	4群カム筒	3
*	YA2-3626-000	D	1	BARREL, FOCUS	フォーカス筒	4
*	YA2-3627-000	D	1	EXTENSION GUIDE, FOCUS	フォーカス連絡筒	1
*	YA2-3629-000	C	1	RING, ZOOMING	操作環	1
*	YA2-3630-000	D	1	RING, LIGHT SHIELD	遮光リング	2
*	YA2-3631-000	C	1	RING, FRONT	化粧環	2
*	YA2-3645-000	D	1	KEY, FOCUS	フローティングキー	4
*	YA2-3646-000	D	1	RING, ZOOM STOPPER	ズームストッパー	4
*	YA2-3647-000	C	1	RING, NAME	ネームリング	1
*	YA2-3648-000	D	1	RING, RED	Lリング	1
*	YA2-3649-000	D	1	RING, ZOOM RUBBER	ズームゴム	1
*	YA2-3650-000	D	1	RING, FOCUS RUBBER	フォーカスゴム	1
*	YA2-3651-000	D	1	SCALE, FOCUSING	距離目盛シート	2
*	YA2-3652-000	C	1	WINDOW, SCALE	目盛窓	1
*	YA2-3656-000	D	1	HOLDER, MAIN FPC	メインフレキ台	2
*	YA2-3658-000	D	1	HOLDER, E-FLEX	E-FLEX押え板	3
*	YA2-3659-000	D	1	HOLDER, I-FLEX	I-FLEX押え板	3
*	YA2-3664-000(xxx)	D	3	COLLAR, ECCENTRIC	2群偏芯コロ	3
*	YA2-3665-000(xxx)	D	4	COLLAR	3/4群コロ	3
*	YA2-3666-000(xxx)	D	2	COLLAR, ECCENTRIC	3群偏芯コロ	3
*	YA2-3667-000(xxx)	D	3	COLLAR	5群コロ	3
*	YA2-3668-000(xxx)	D	1	COLLAR	フローティングコロ	3
*	YA2-3669-000	D	4	SCREW, CROSS-RECESS, PH		1
*	YA2-3670-000	D	1	RING, IS COVER	2群カバー	3
*	YA2-3677-000(xxx)	D	1	COLLAR	6群コロ	4
*	YA2-3703-000	D	1	SHEET, LIGHT SHIELD	IS化粧板	3
*	YG2-0367-000	C	1	FOCUSING UNIT	フォーカスユニット	2

PARTS LIST

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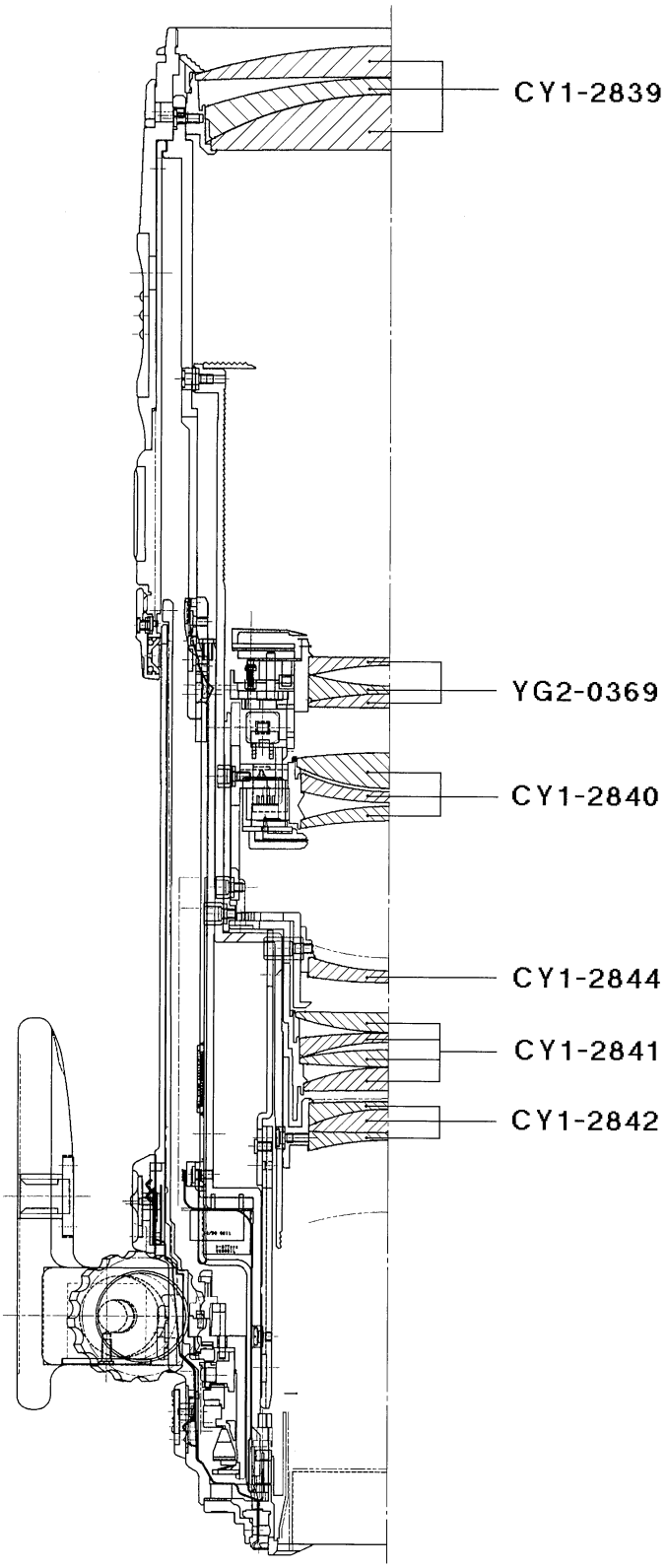
NEW	PARTS NO.	CLASS	QTY	DESCRIPTION		PAGE
*	YG2-0368-000	C	1	POWER DIAPHRAGM UNIT	EMDユニット	3
*	YG2-0369-000	C	1	IS LENS UNIT	IS/レンズユニット	3
*	YG2-0370-000	C	1	FPC ASS'Y, MAIN	メインフレキユニット	2
*	YG2-0371-000	C	1	FPC ASS'Y, SUB	サブフレキユニット	2
	YG9-0263-000	D	1	TRIPOD SOCKET UNIT	三脚座ユニット	5
*	YG9-0616-000	D	1	BARREL ASS'Y, CAM/GUIDE	案内筒・カム筒ユニット	4
*	YH1-0569-000	D	1	FPC, ZOOM	ズームフレキ	3
*	YH2-0188-000	D	2	CABLE, FLAT	フラットケーブル	2

CANON LENS EF 100-400 mm 1:4.5-5.6L IS USM

REF. C21-9961

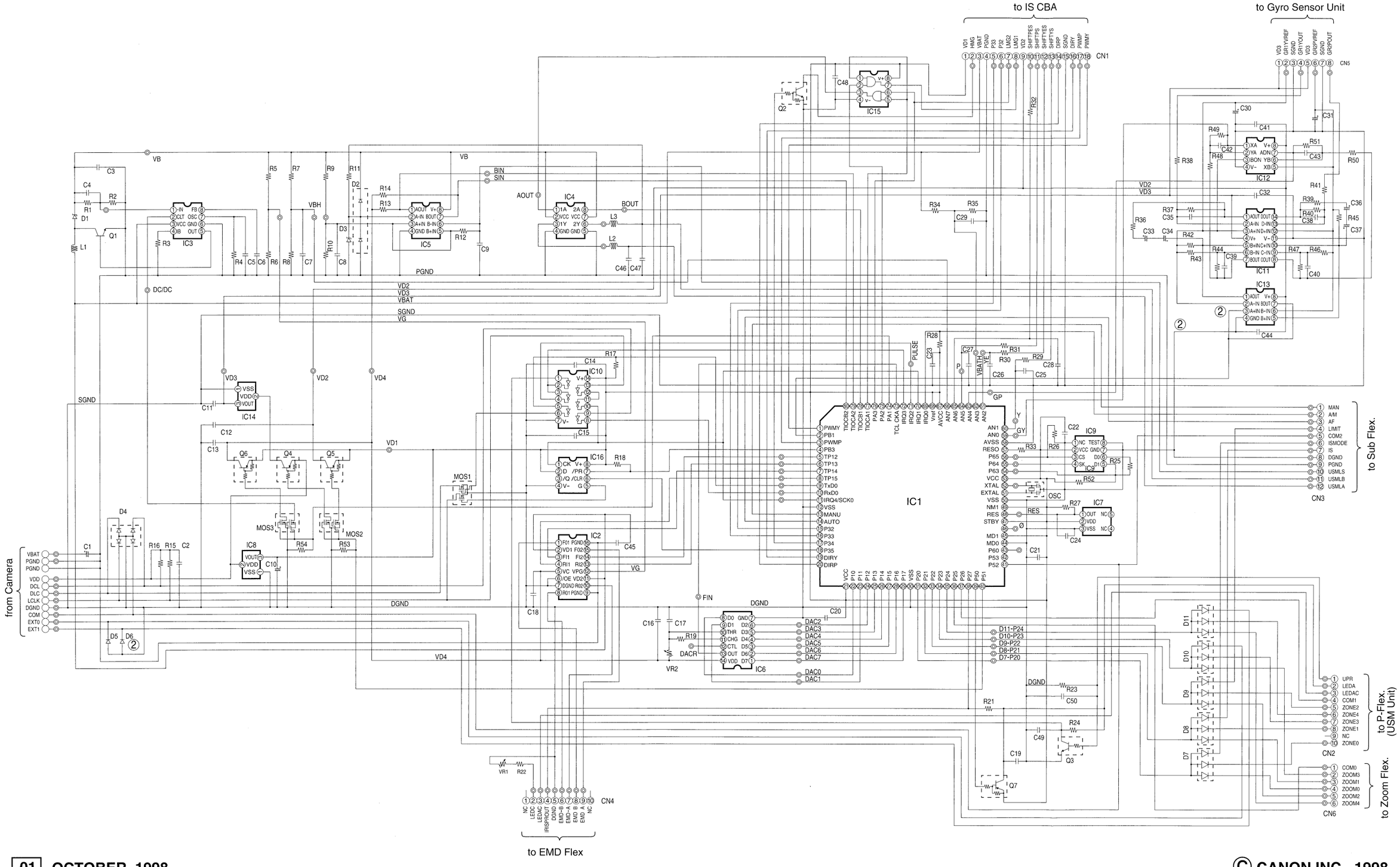


Part 5

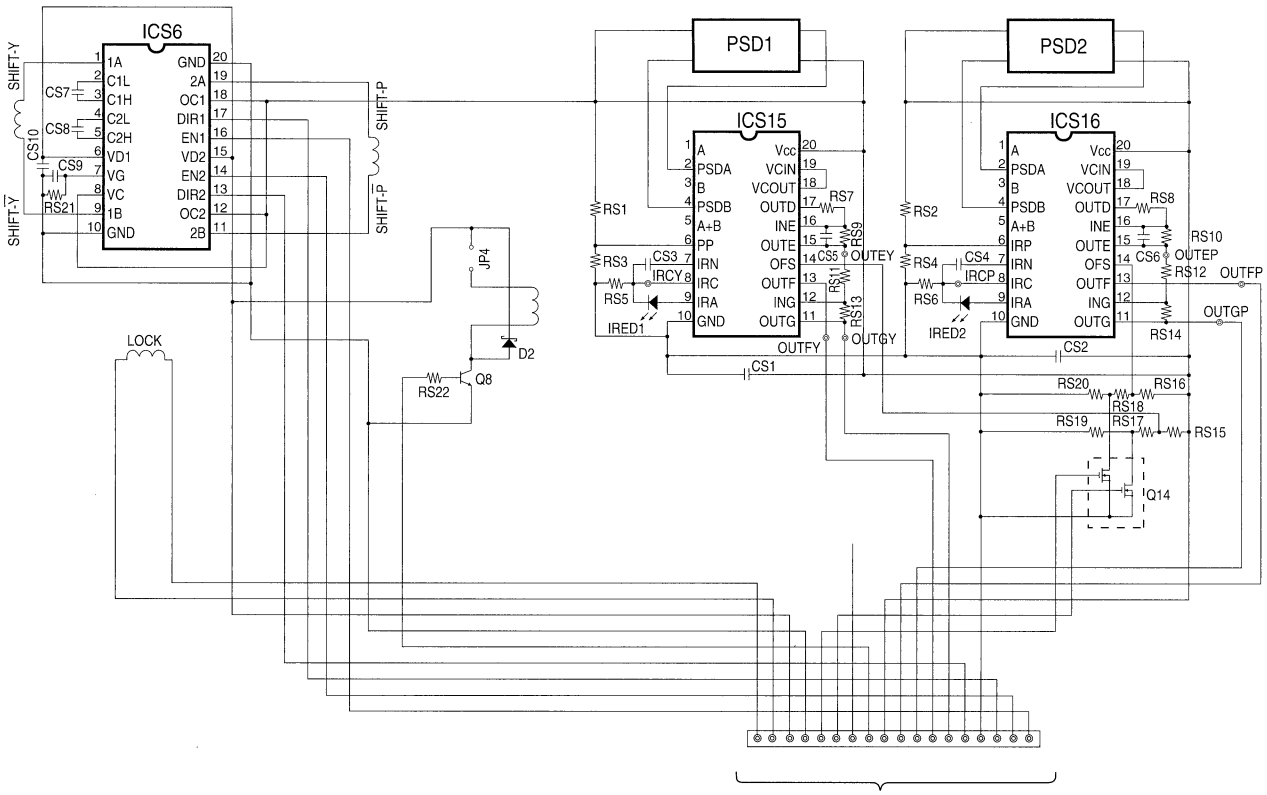
Electrical Diagrams

1. SCHEMATIC DIAGRAM
1.1 MAIN FPC ASS'Y

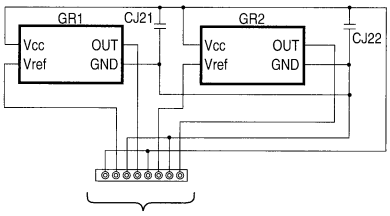
EF 100-400mm 1:4.5-5.6L IS USM
REF.NO.C21-9961

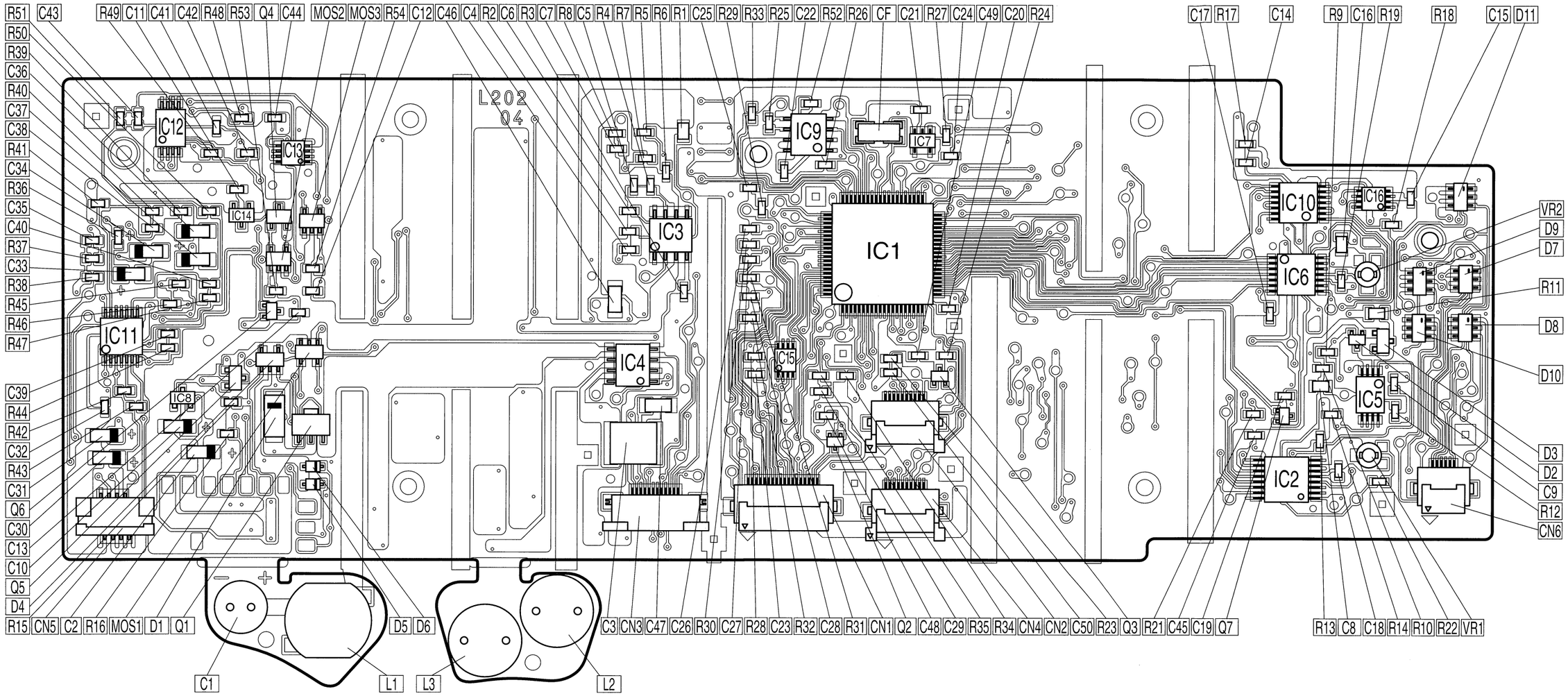


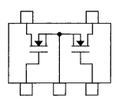
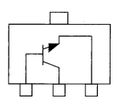
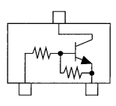
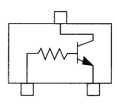
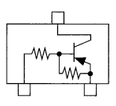
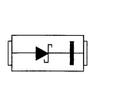
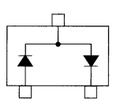
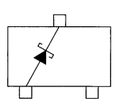
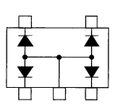
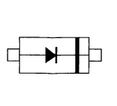
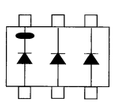
1.2 IS PCB ASS'Y



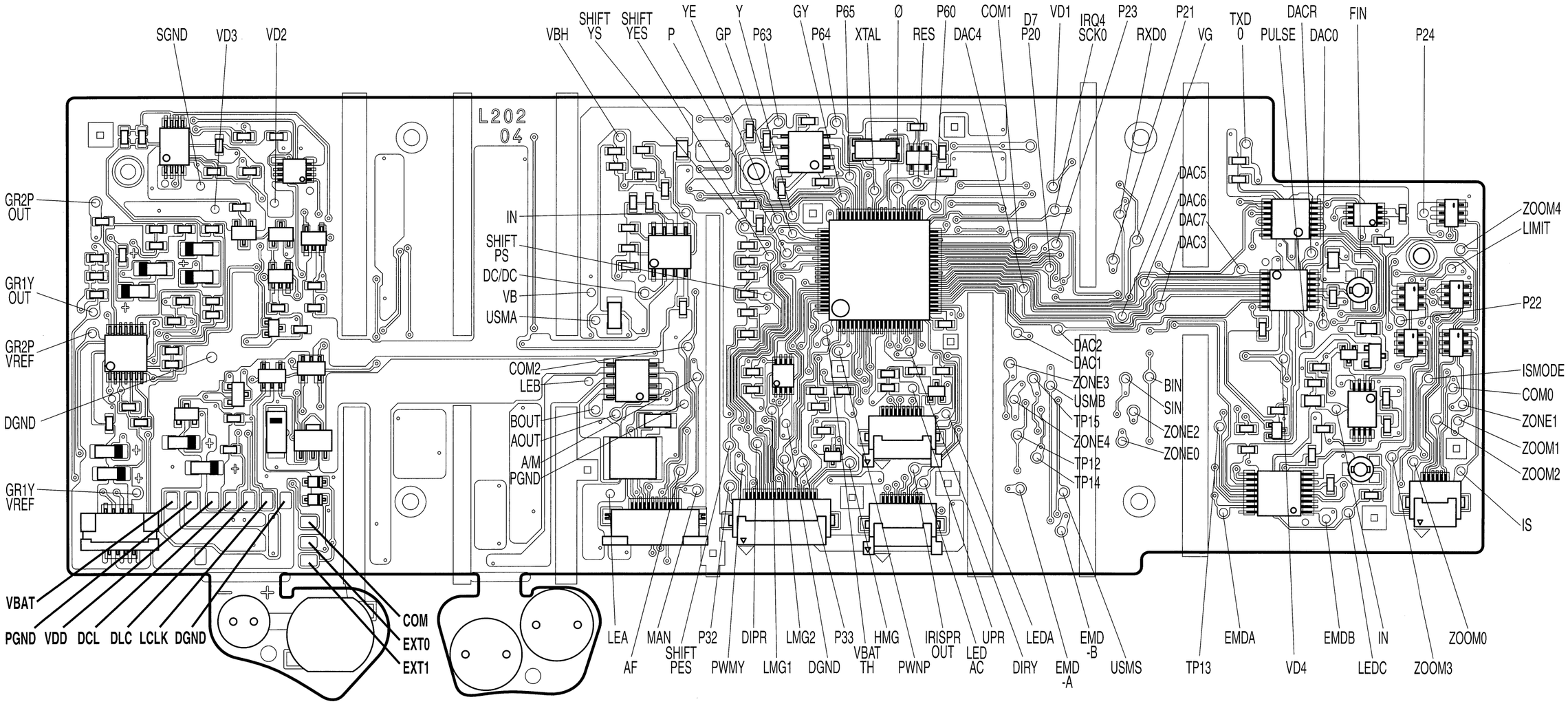
1.3 GYRO SENSOR UNIT





MOS1, 2, 3	Q1	Q2	Q3	Q4, Q5, Q6, Q7	D1	D2	D3	D4	D5, D6	D7, 8, 9, 10, 11
										

2.2 MAIN FPC ASS'Y-2



2-3. IS PCB ASS'Y