INC

JAA80251-R.3723.A

作成承認印	配布許可印
ニコン映像カンパニー 品質保証部 GM	サービス 計画課 M

AF-S Zoom-Nikkor ED 24-70mm/F2.8G(IF)

JAA80251

REPAIR MANUAL

Nikon | NIKON CORPORATION
Tokyo, Japan

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※ Before Disassembly / Reassembly / Adjustment

When disassembling/(re)assembling, be sure to use the conductive mat (J5033) and wrist strap (J5033-5) for static protection of electrical parts.

When disassembling, make sure to memorize the processing state of wires, screws to be fixed and their types, etc.

When FPCs are connected to PCBs, etc, put the FPCs in connectors, etc, straightforward so that they are all the way seated.

Because prototypes are used for "Disassembly/(Re)assembly/Adjustment", they may differ from the actual products in forms, etc.

Because pictures are processed by a special method, they may differ from the actual ones in texture.

This lens will need the optical lens-alignment work in case of performing the below work. Therefore, after the work, adjust optical lens-alignment at service facilities where such work can be carried out.

- **Disassembly of 1-1 lens group unit, 4th lens group unit**
- **Replacement of 1-1 lens group unit, 1-2 lens group unit, 3rd lens group unit, 4th lens group unit, 1st lens-G lead ring, helicoid tube unit**

Points to notice for Lead-free solder products
・Lead-free solder is used for this product. ・For soldering work, the special solder and soldering iron are required. ・Do NOT mix up lead-free solder with traditional solder. ・Use the special soldering iron respectively for lead-free solder and lead solder. They cannot be used in common.

1. Disassembly

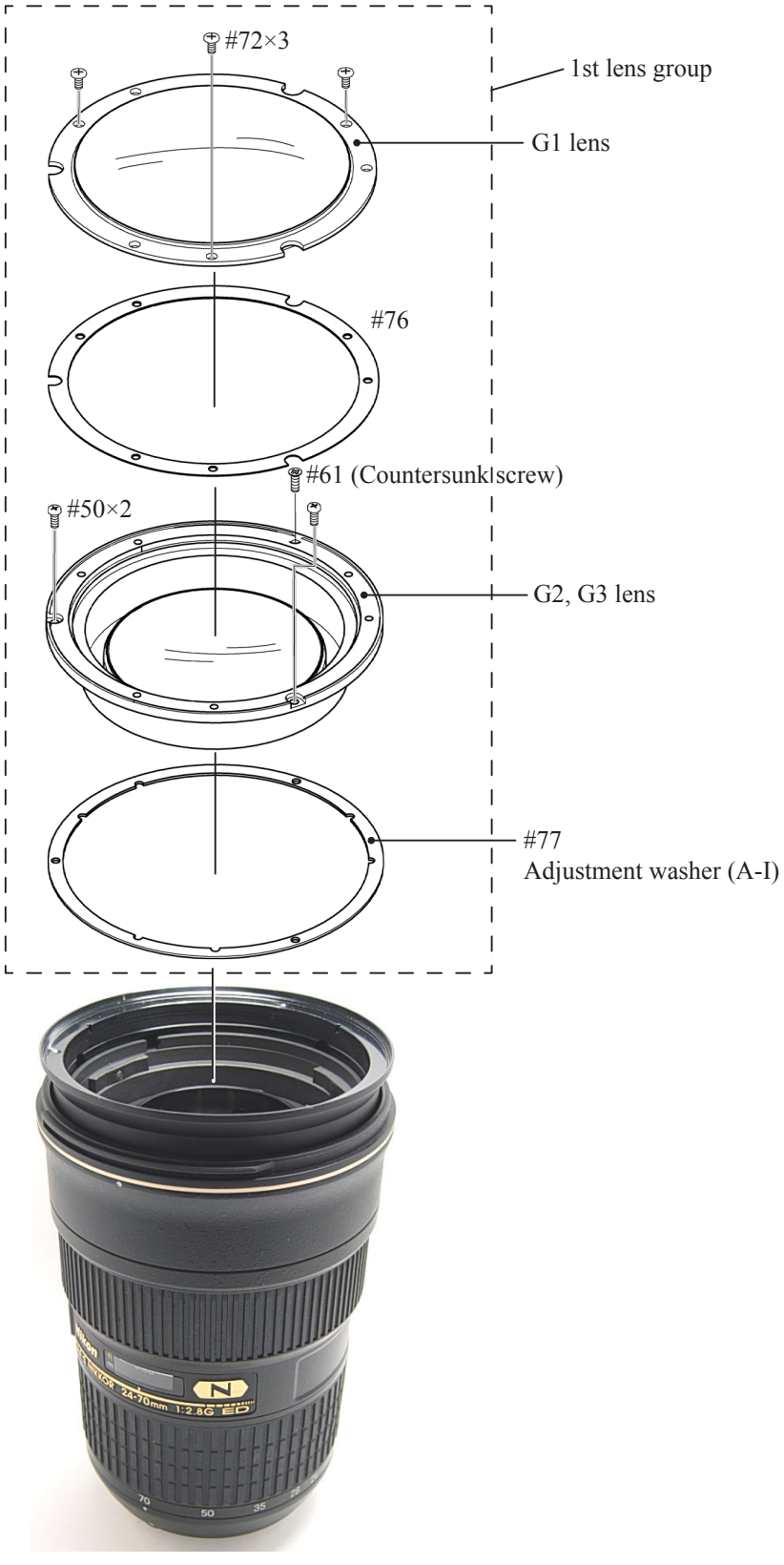
Filter ring

- Remove the sheet.
- Take out the two screws (#63) and the screw (#79), and remove the filter ring.

1st lens-G unit

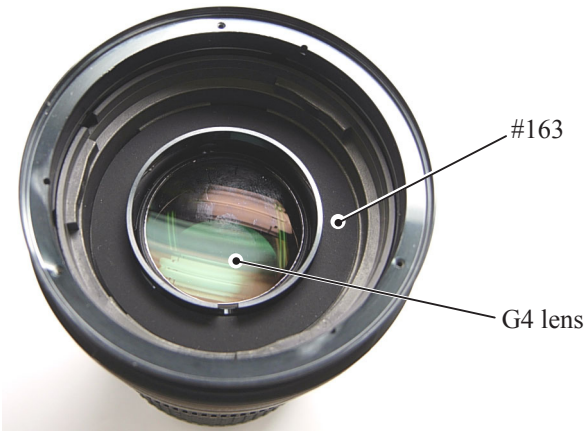
・Take out the two screws (#50) and the screw (#61), and remove the 1st lens-G unit.

Caution: If the G1 lens is removed, the lens alignment work will be necessary.



Sheet

・Remove the sheet (#163).



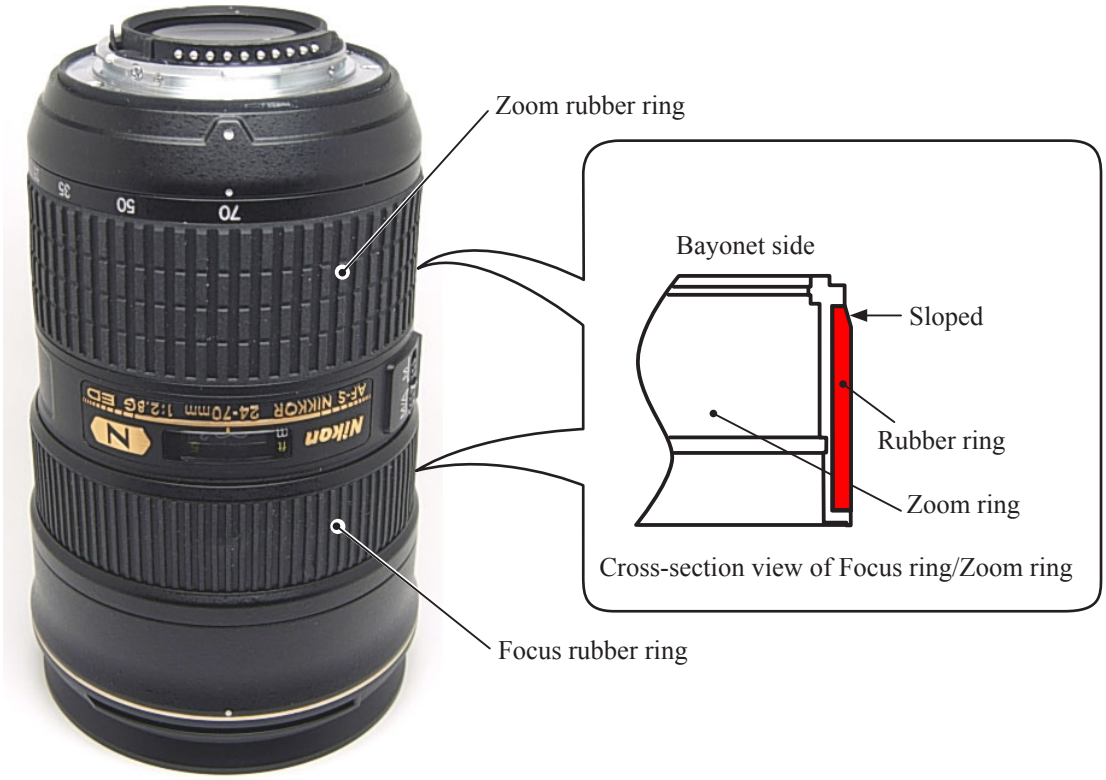
G4 lens is the hybrid aspheric lens.

R1-surface of G4 lens is plastic surface, so dip a wiping cloth (Savina Minimax) a little in ethanol, and wipe the surface lightly. If dust/dirt is attached, blow them away with a blower as much as possible.

Rubber ring

・Remove the zoom rubber ring.

・Remove the focus rubber ring.



Tape

・Peel off the four pieces of the tape (#193) of ① - ② , and remove the two cover plates (#194).

① Zoom brush

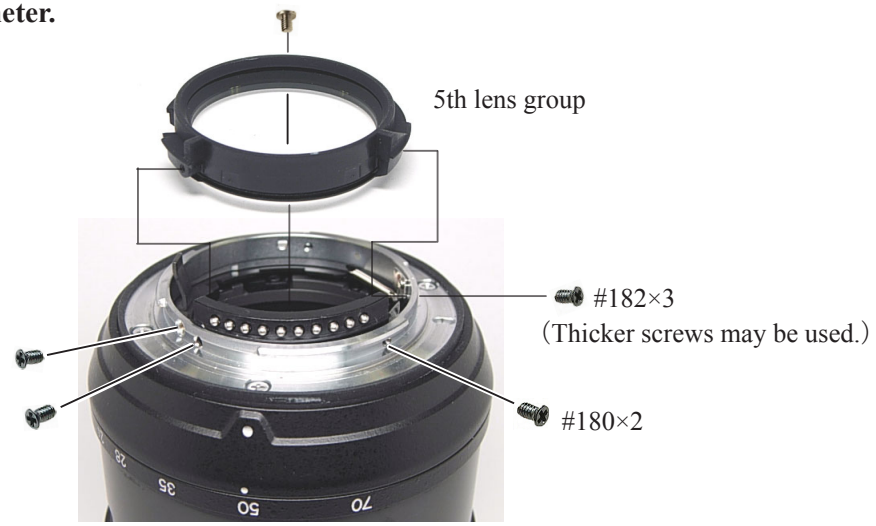
② M/A brush

5th lens Group

・Take out the three screws (#182) of the 5th lens group.

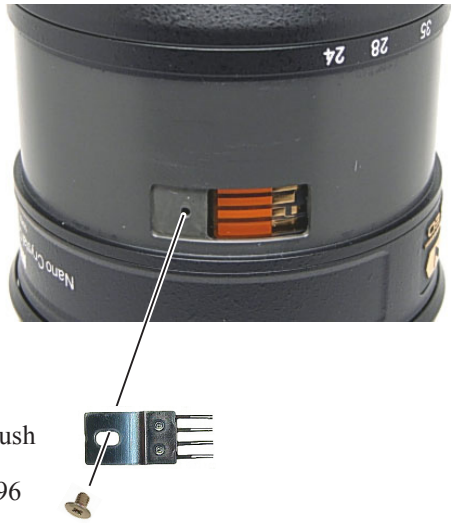
・Take out the two screws (#180) of the contacts unit.

Caution: For [#182], a thicker screw (1K010-343) may be used to fit with the larger screw hole caused by adjustments. So check the screw diameter. [#182] has M1.4-diameter, while [1K010-343] has M1.7-diameter.



Zoom brush

・Take out the screw (#96), and remove the zoom brush.



M/A brush

・Take out the screw (#100), and remove the M/A brush.

Bayonet mount unit

- Take out the four screws (#172).
- Remove the bayonet mount unit.
- Remove the Bf adjustment washer (#78).

Caution: Handle the blade actuating plate spring with care, because it can be easily deformed.

4th lens group

・Remove the 4th lens group.

Caution: Removing the 4th lens group needs the lens alignment work.

The hybrid aspheric lens is used for the bayonet side of the 4th lens group.

If dust/dirt is attached, blow them away with a blower as much as possible.

If such dust/dirt can not be removed, dip a wiping cloth (Savina Minimax) a little in ethanol, and wipe the surface lightly.

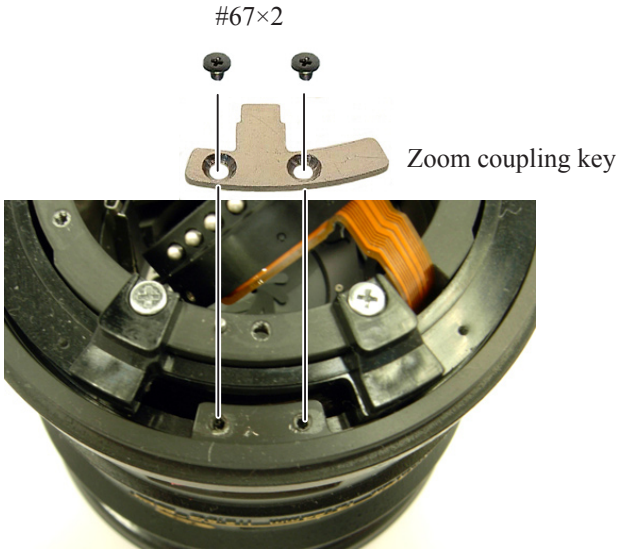
3rd lens group

・Remove the 3rd lens group with [J11346].

Rear fixed tube

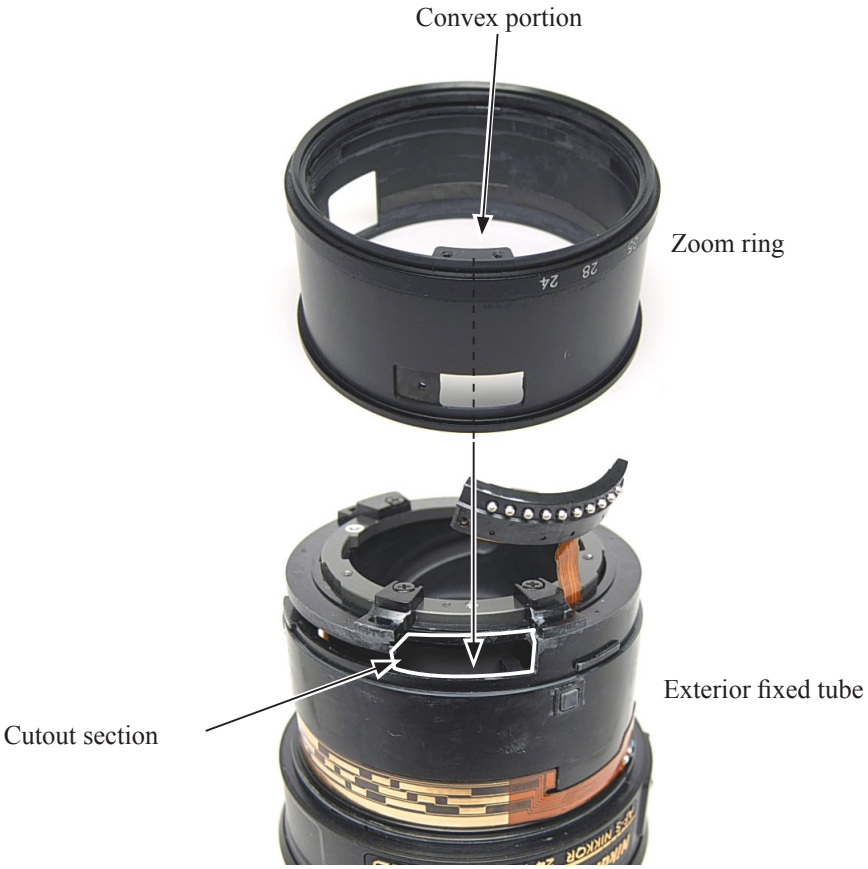
・Take out the five screws (#174), and remove the rear fixed tube.

・Set the cam tube to WIDE-end. Take out the two screws (#67) and remove the zoom coupling key.



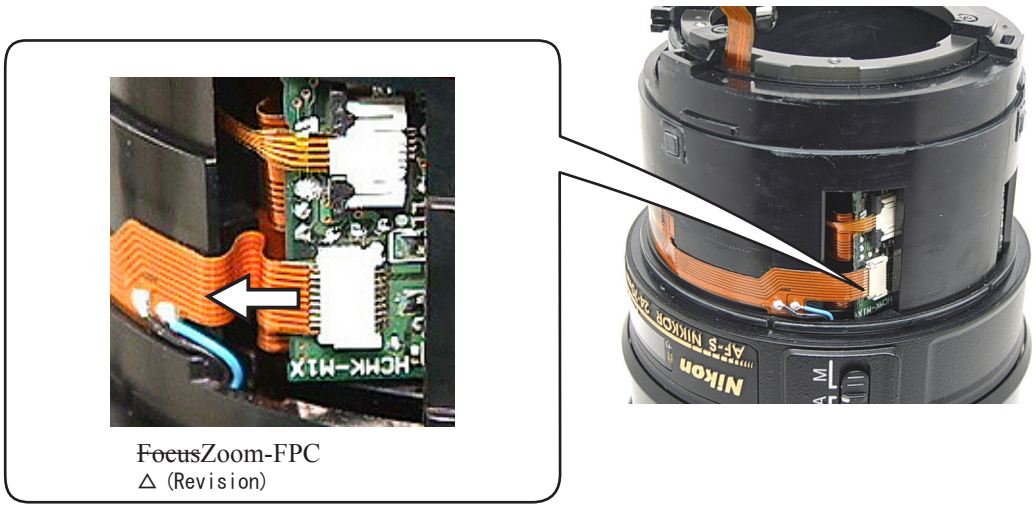
Zoom ring

・Align the cutout section of the exterior fixed tube with the convex portion of the zoom ring. Then detach the zoom ring.



△ (Revision)

・Disconnect the ~~focus~~ zoom-FPC from the connector of the main PCB.



サービス計画課 M

Exterior fixed tube

・Take out the four screws (#174) of the exterior fixed tube.

・Remove the exterior fixed tube.

Caution: When the exterior fixed tube is removed, be careful not to touch the main PCB and the focus index sheet.

MF ring

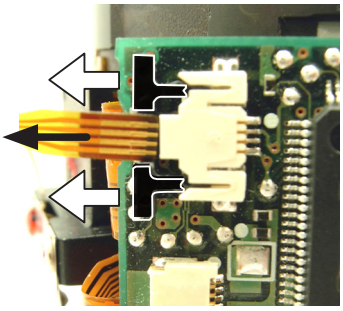
・Detach the MF ring and washer (#169) from the SWM unit.

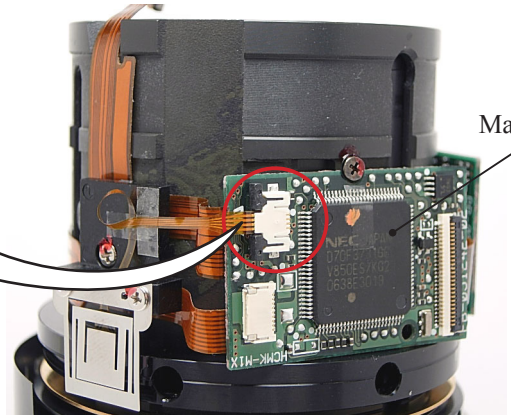
GMR unit

・Peel off the tape (#196).

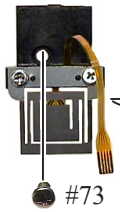
・Disconnect the GMR-FPC from the connector of the main PCB.

Slide the connector in the direction of the arrow, and remove the FPC.

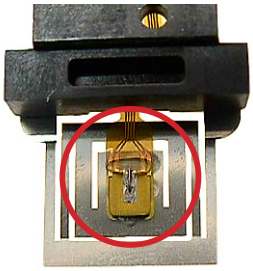




・Take out the screw (#73) and remove the GMR unit.



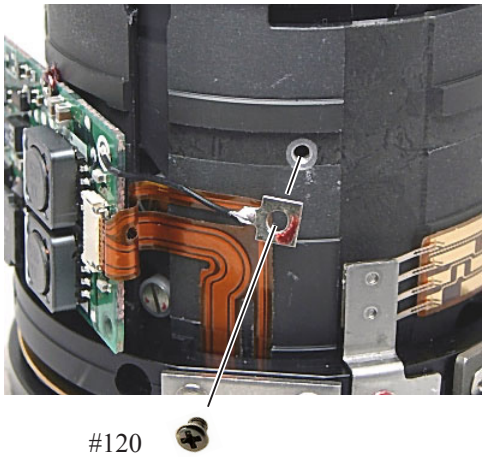
Back



Caution :
NEVER touch the sensor area directly by hand.

Main PCB unit

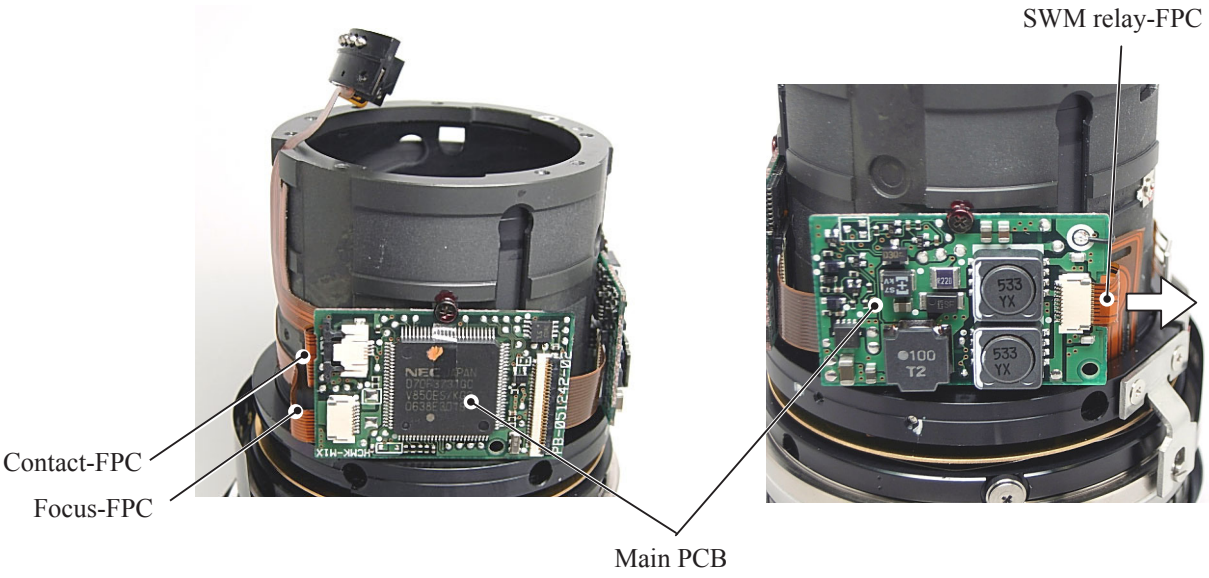
・Take out the screw (#120).



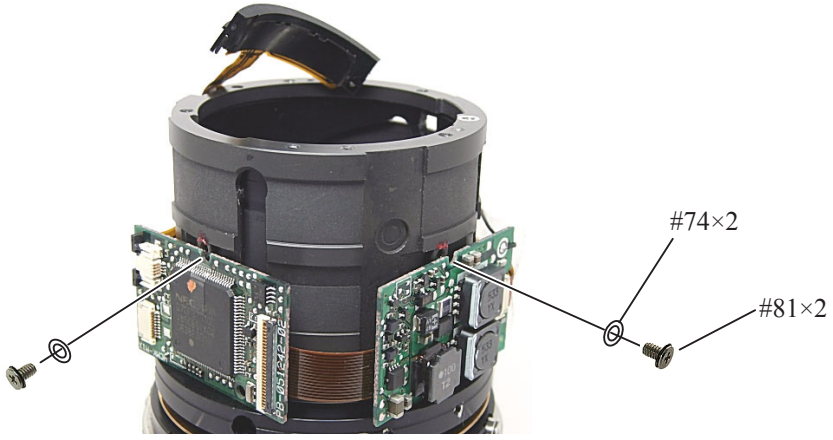
・Remove the contact-FPC from the main PCB.

・Remove the focus-FPC from the main PCB.

・Remove the SWM relay-FPC from the main PCB.

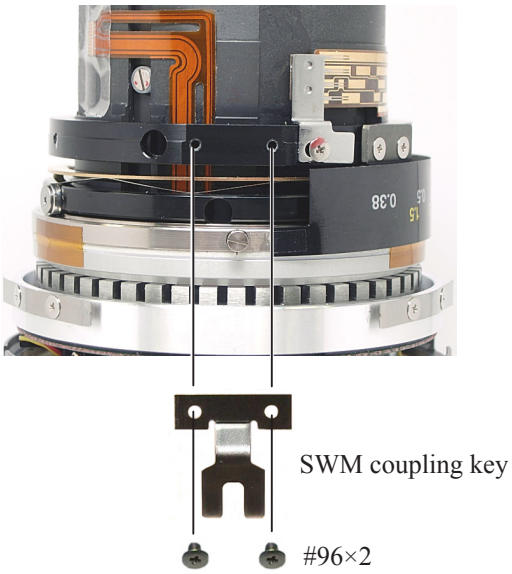


・Take out the two screws (#81) and two washers (#74), and remove the main PCB unit.



SWM coupling key

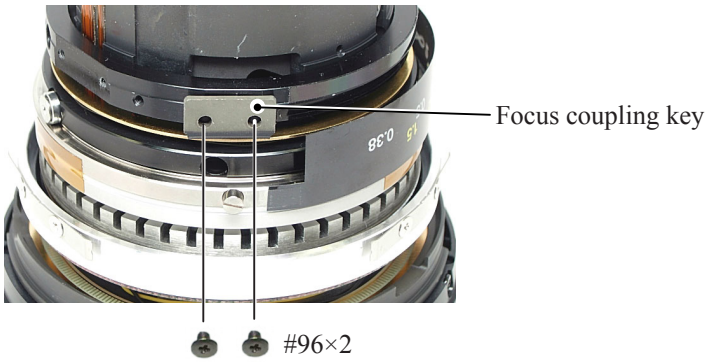
・Take out the two screws (#96) and remove the SWM coupling key.



Focus coupling key

△ (Deletion)

・Take out the two screws (#96)~~, and remove the focus coupling key~~.



Focus encoder brush

・Take out the screw (#96) and remove the focus encoder brush.

サービス計画課 M

Focus fixed tube

・Attach the protection tape to the SWM relay-FPC. (Do NOT attach the FPC-contacts area.)

・Remove the rollers from the focus fixed tube (by following the order from "Fig.1" to "Fig.3".)

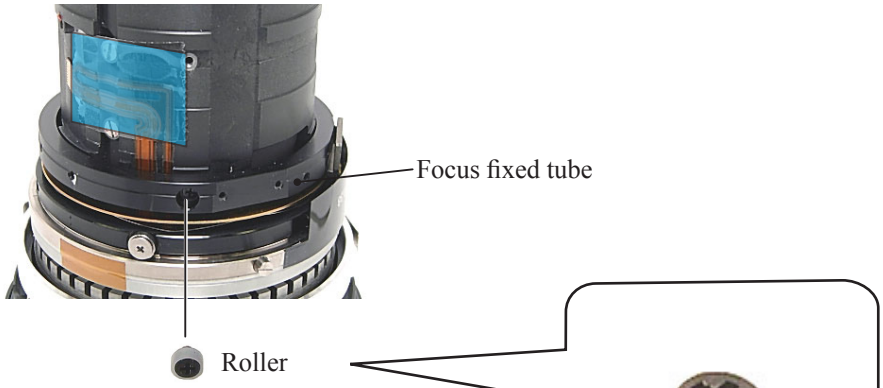


Fig.1

Fig.2

Fig.3

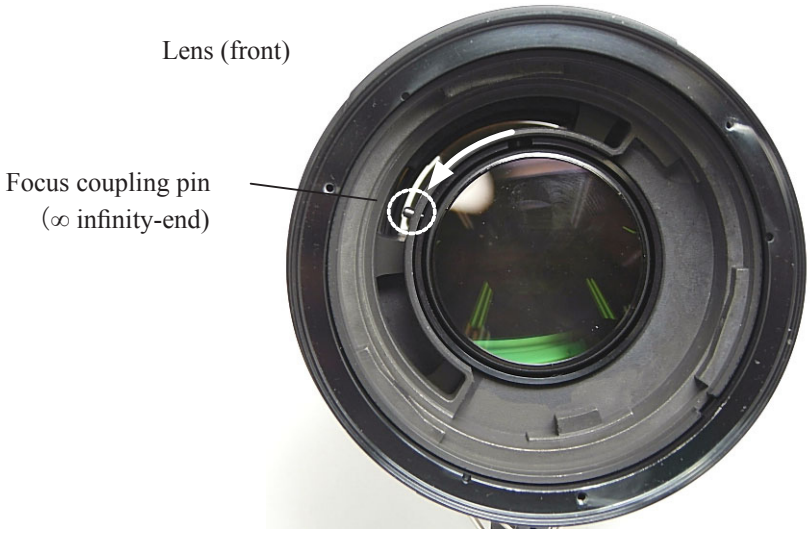
Focus fixed tube (continued)

・Remove the focus fixed tube from the inner fixed tube.

Be careful so that fingers or a screwdriver do NOT touch the magnetic surface.

Focus coupling key

・Set the zoom to TELE-end position, and disengage the focus coupling key from the focus coupling pin.



Zoom: TELE-end position

Removal of Washer

- With alcohol, remove each screw lock that was applied to the washers (#160) at three places.
- Push down the washer (#160) at the position of the concave portion of the inner fixed tube, and turn the washer rightwards. (Fig.1 ①)
- Align the convex portion of the washer with the grooved guide track (indicated by white dot lines), then remove the washer (#160) by pushing upwards. (Fig.1 ②)
- Remove the washers (#156 and #161).

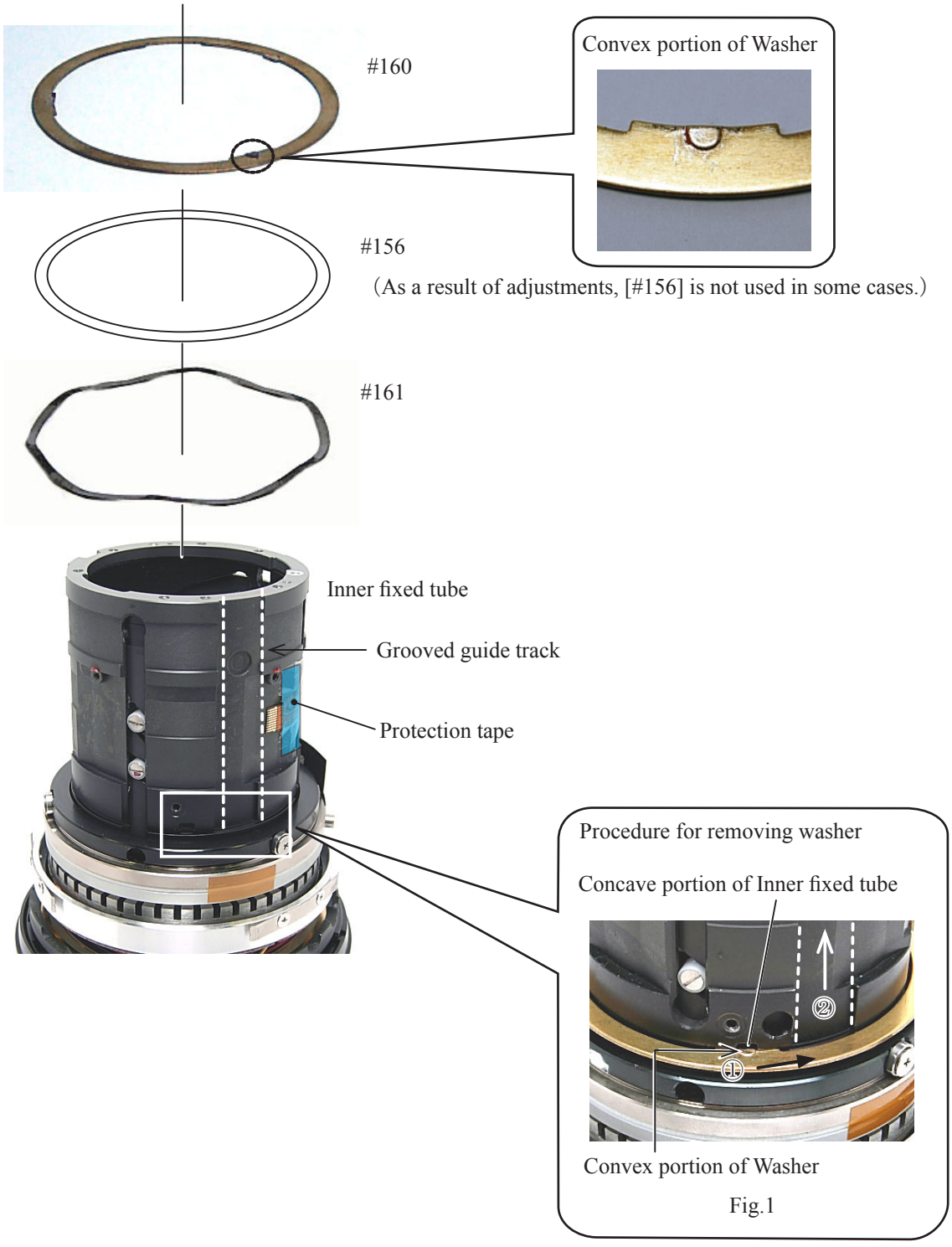
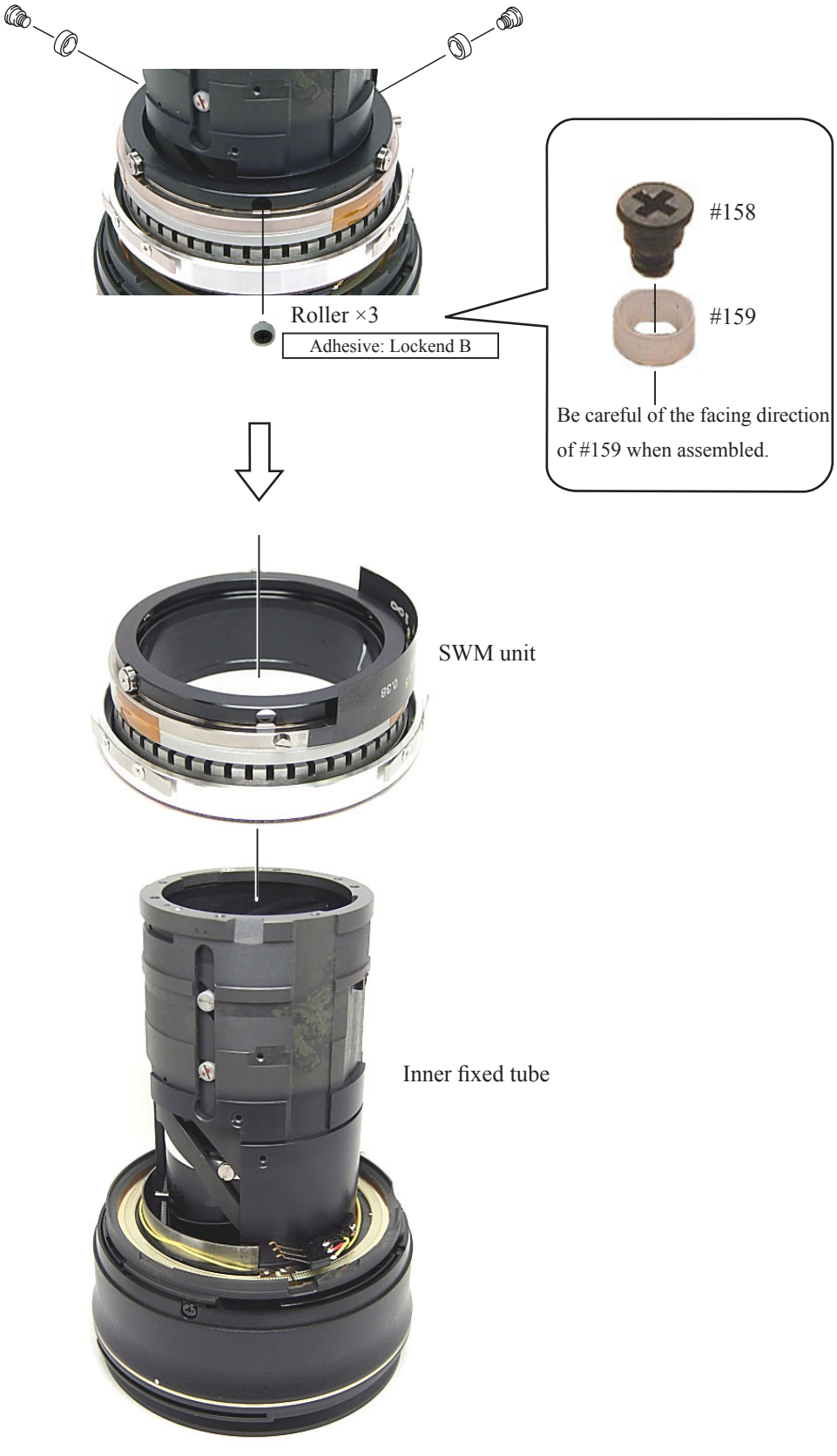


Fig.1

SWM unit

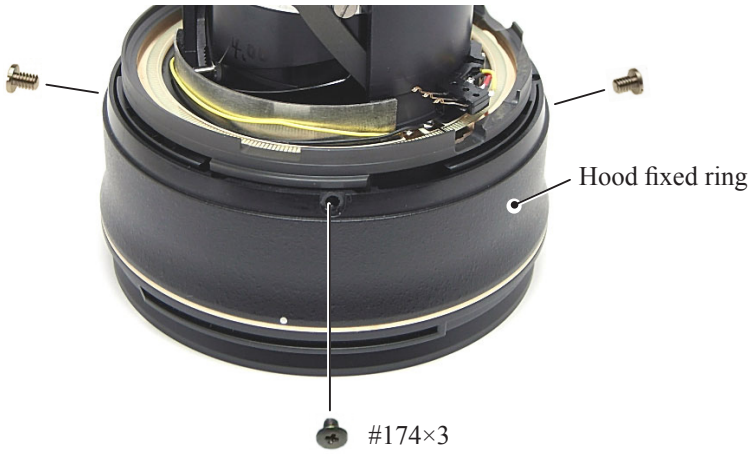
・Remove the three rollers of the SWM unit.

・Remove the SWM unit from the inner fixed tube.



Hood fixed ring

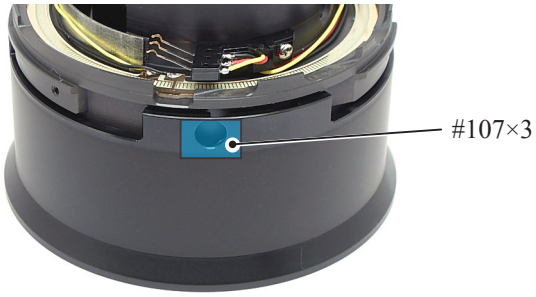
・Take out the three screws (#174).



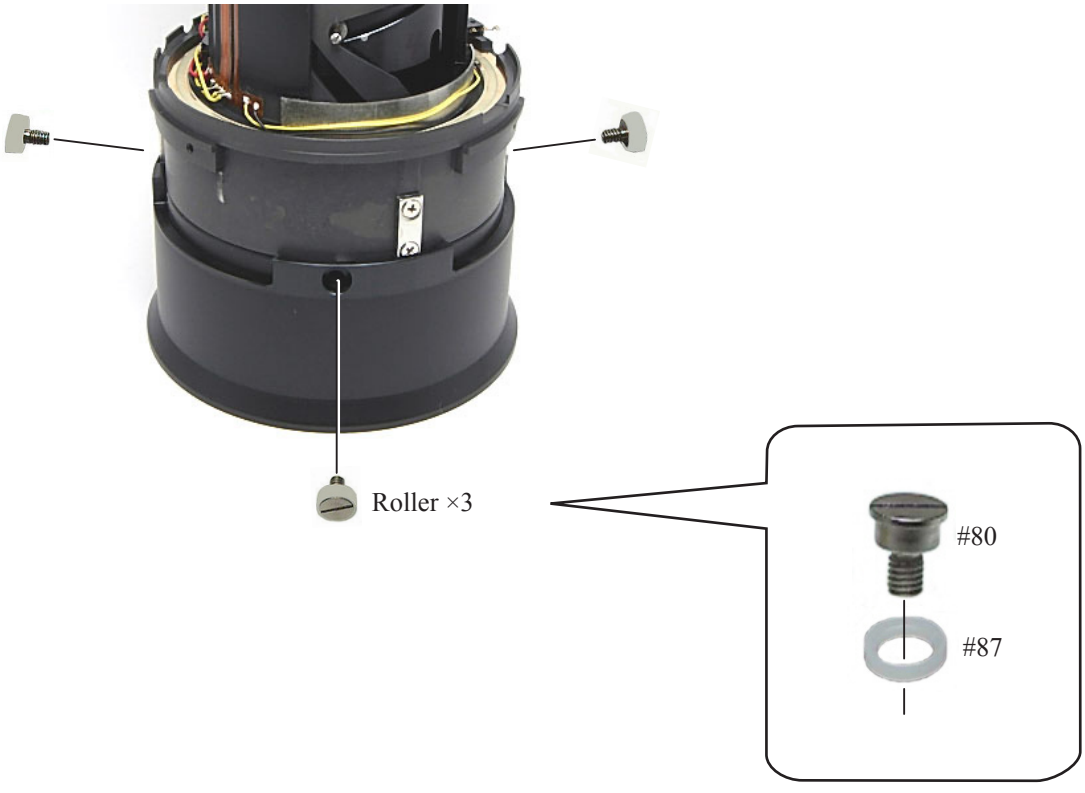
・Set the zoom to WIDE-end position, and remove the hood fixed ring from the inner fixed tube.

1st lens-G lead ring

・Peel off the three pieces of tape (#107).



・Remove the three rollers.

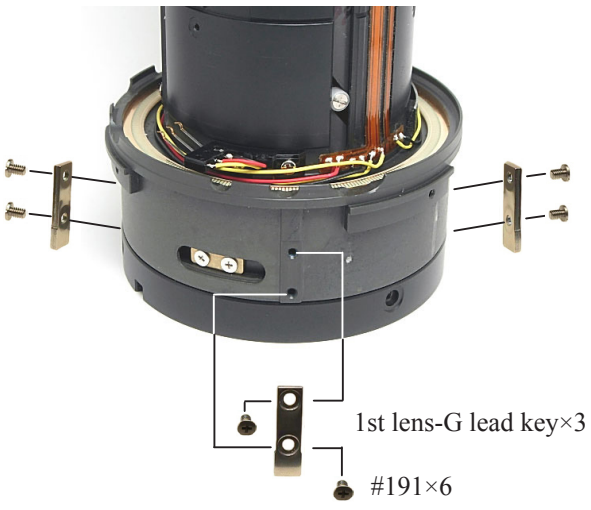


1st lens-G lead ring (continued)

・Detach the 1st lens-G lead ring by disengaging the three 1st lens-G lead keys from the key grooves.

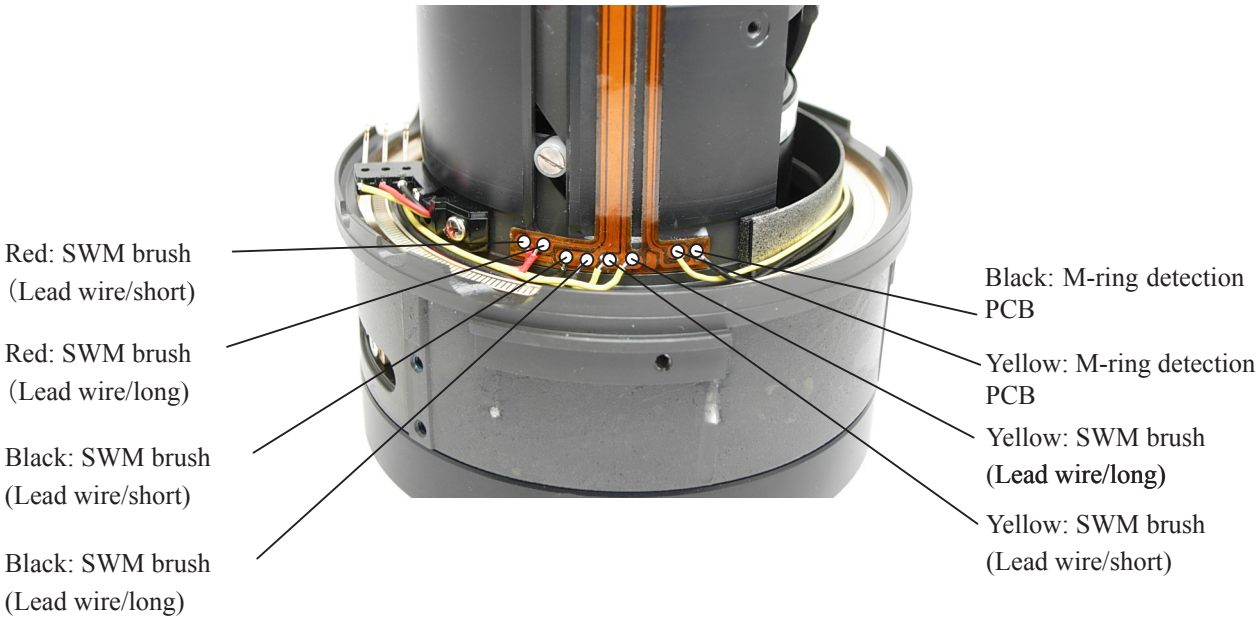
1st lens-G lead key

・Take out the two screws (#191) each at three places, and remove the three 1st lens-G lead keys.

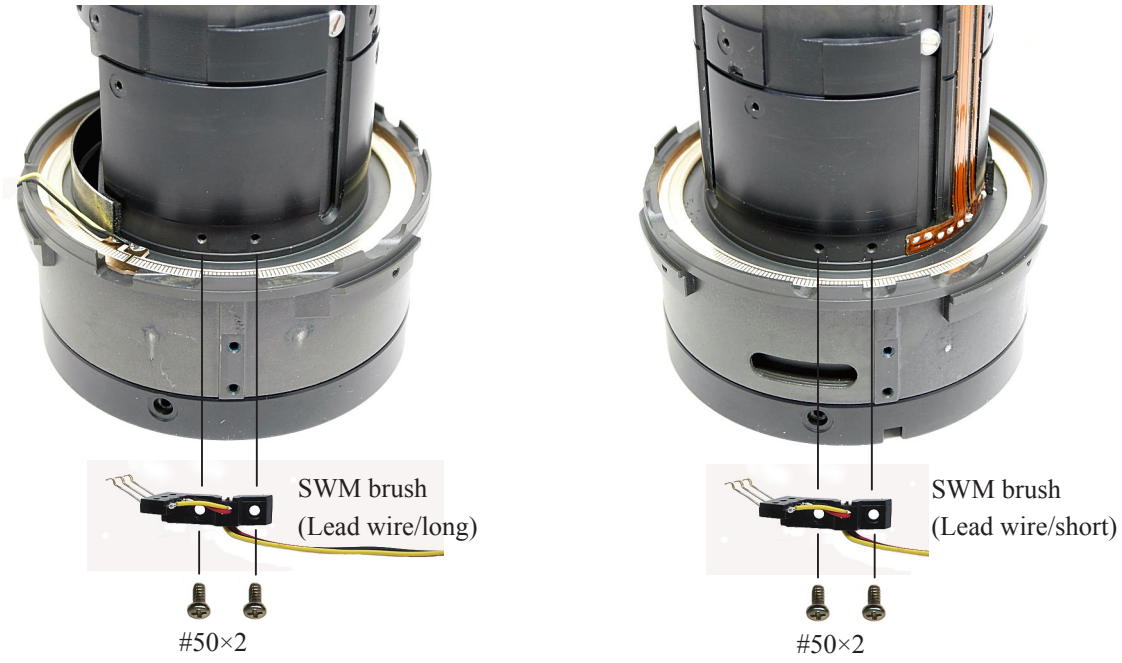


SWM brush

・Remove the solders of the eight lead wires (which are connected from the followings) from the SWM relay-FPC.



・Take out the two screws (#50) each at two places from the SWM brushes (lead wires/long and short).



Caution:
In order to maintain optical accuracy, the inner fixed tube (1C999-528) is set as assembled unit.
If disassembled, therefore, it will be unrepairable at repair service facilities.

Inner fixed tube (1C999-528)

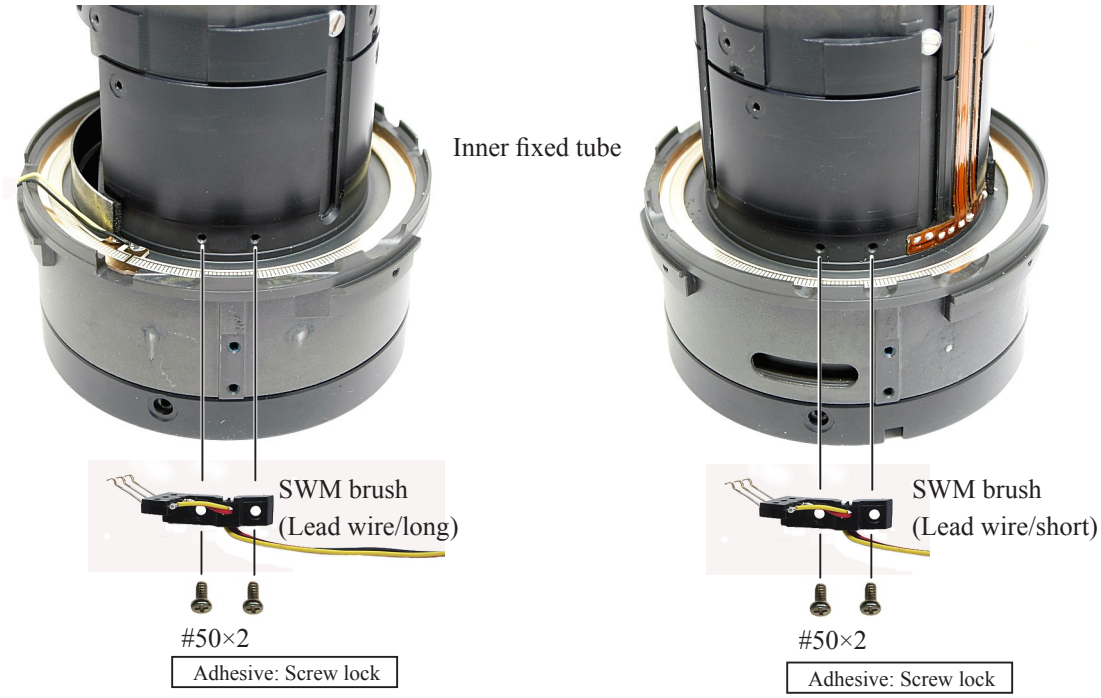
2. Assembly / Adjustment

SWM relay-FPC

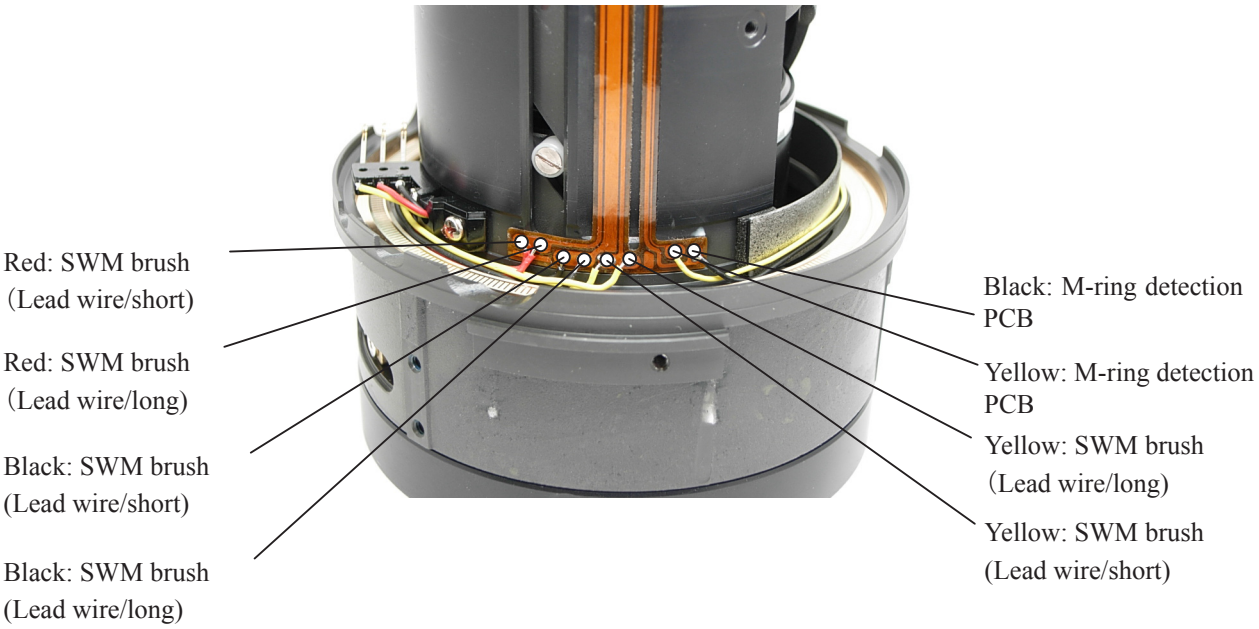
・Attach the SWM relay-FPC to the inner fixed tube, based on the reference position.

SWM brush

・Attach the SWM brushes (lead wires/long and short) to the inner fixed tube, and tighten two screws (#50) each at two places.

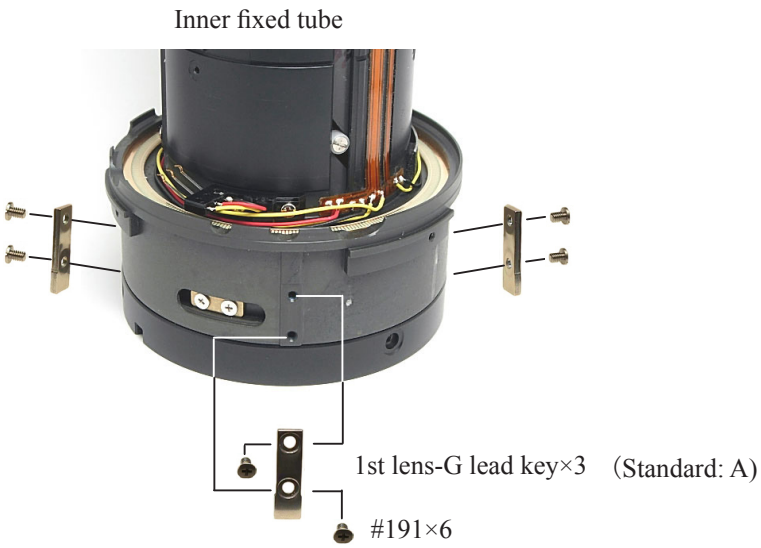


・Solder the eight lead wires on the SWM relay-FPC.



Selection and Temporary attachment of 1st lens-G lead key

- Select the 1st lens-G lead key from A to C, based on the groove width of the 1st lens-G lead key.
- Attach temporarily the three 1st lens-G lead keys to the inner fixed tube with two screws (#191) each at three places with the each 1st lens-G lead key being movable.

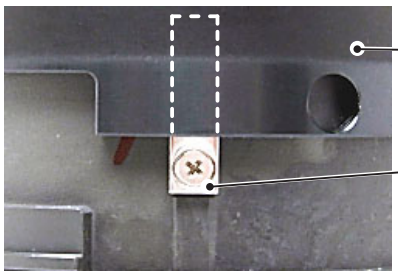


Temporary assembly of 1st lens-G lead ring

- Align the three 1st lens-G lead keys with the appropriate three grooves for the 1st lens-G lead key, then assemble the inner fixed tube and the 1st lens-G lead ring.

Adjustment and Firm attachment of 1st lens-G lead key

・As below, position the 1st lens-G lead key and the 1st lens-G lead ring.



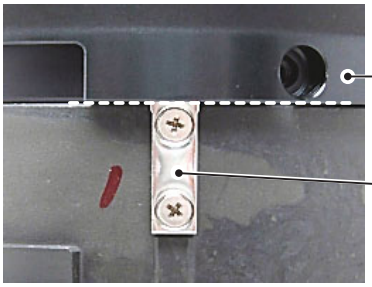
・Tighten three screws (#191) in numeric order from ① to ③ .

①

②

③

・As below, position the 1st lens-G lead key and the 1st lens-G lead ring along the white dot line.



・Tighten three screws (#191) in numeric order from ④ to ⑥ .

④

⑤

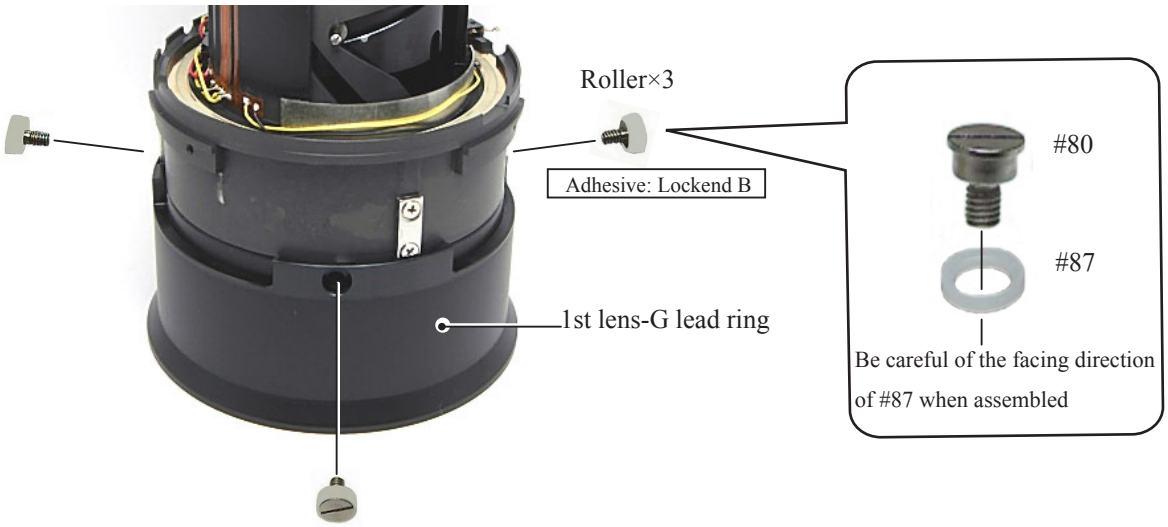
⑥

・Hold the 1st lens-G lead ring at the uppermost position, and confirm that the 1st lens-G lead ring drops by its own weight.

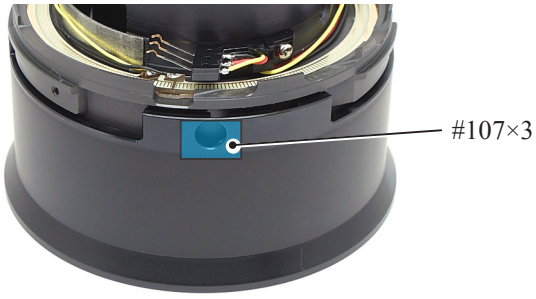
・If not, go back to Page A4 and make a readjustment.

1st lens-G lead ring

・Attach the 1st lens-G lead ring with three rollers.



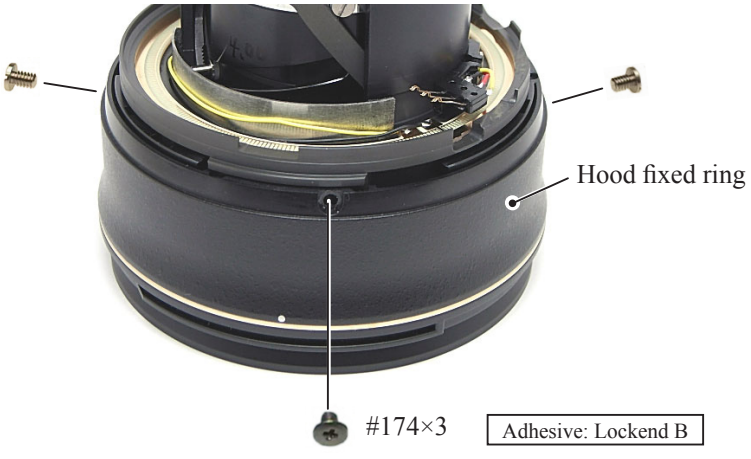
・Cover the holes of the 1st lens-G lead ring with three pieces of tape (#107).



Hood fixed ring

・Mount the hood fixed ring on the inner fixed tube, and align "**A**" and "**B**".

・Attach the hood fixed ring with three screws (#174).

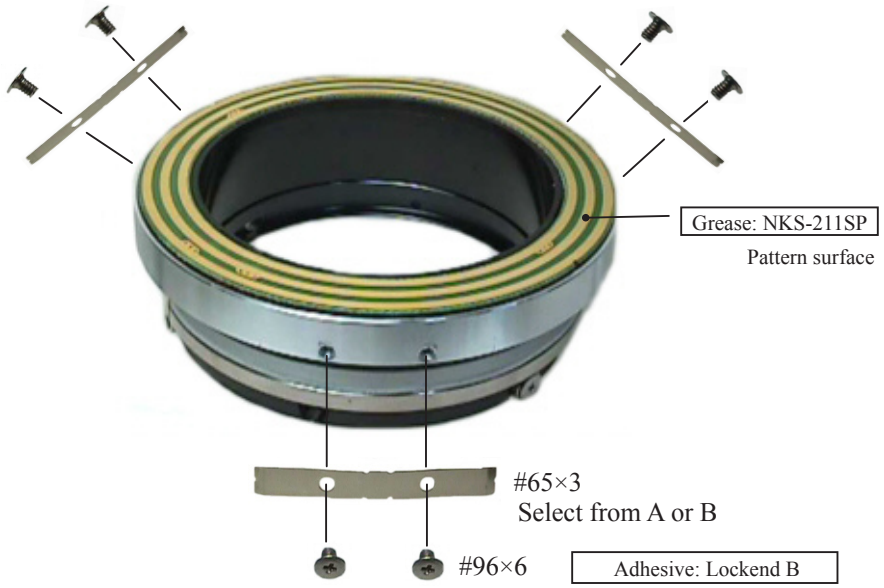


SWM

・Attach the three plate springs with two screws (#96) each at three places. [Select the plate spring (from A or B type) by checking the followings:]

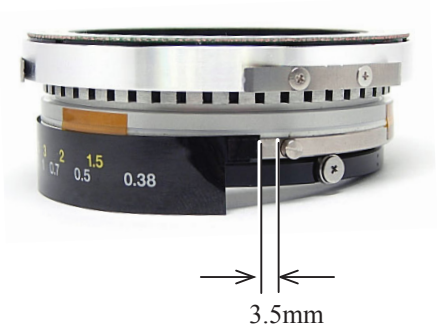
・When the MF ring is rotated slowly, check whether the focus index ring subsequently moves together. (If the focus index ring does not follow smoothly, change the spring to a thicker one.)

・When the MF ring is rotated all the way to ∞ (infinity)-end and close-end positions, check whether the only MF ring runs idle. (If it does not run idle, change the spring to a thinner one.)

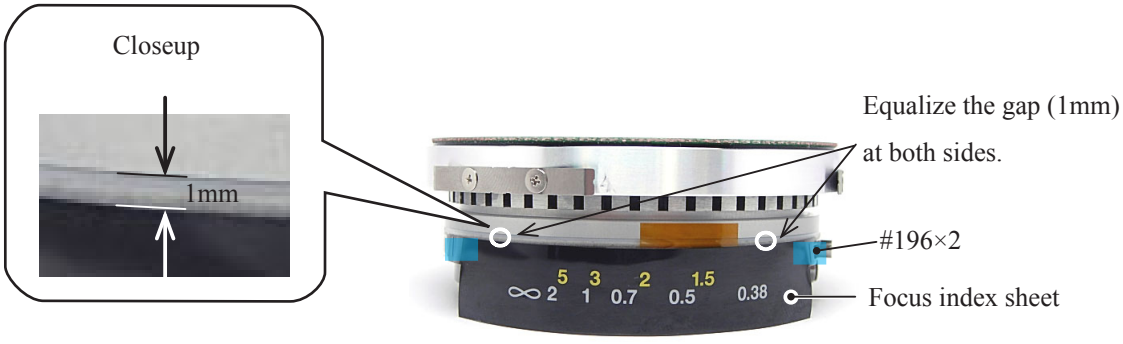


Positioning of Focus index sheet

・Position the focus index sheet as follows:



・Adhere the focus index sheet with the adhesive double coated-tape and two pieces of tape (#196).

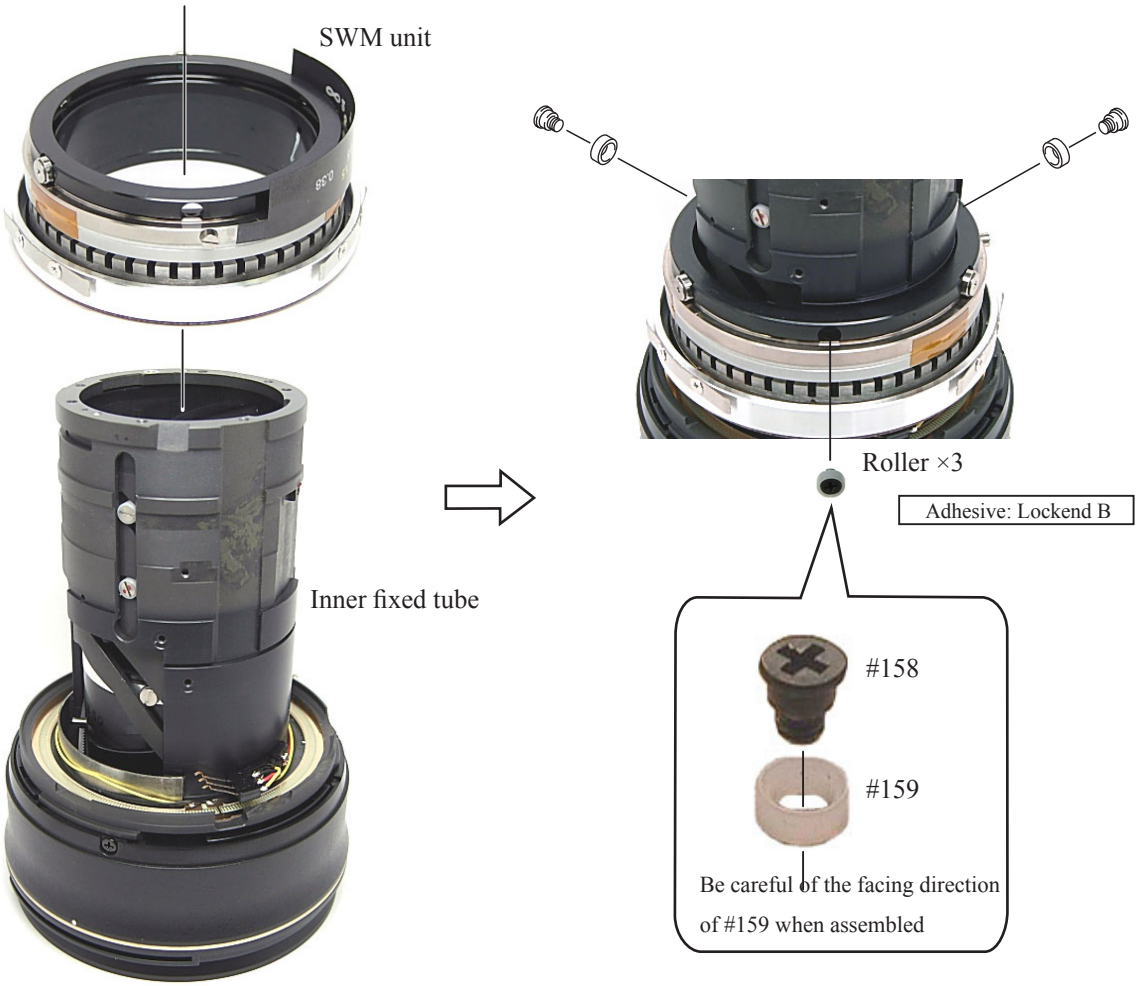


SWM unit

・Attach the protection tape to the SWM relay-FPC. (Do NOT attach to the FPC-contacts area.)

・Mount the SWM unit on the inner fixed tube.

・To attach the SWM unit firmly to inner fixed tube, tighten three rollers.



Putting of Washer

- Put the washers (#161 and #156) on the inner fixed tube.
- Fit the convex portion of the washer (#160) with the grooved guide track of the inner fixed tube, and put the washer. (Fig.1)
- Rotate the washer (#160) leftwards, and fit the convex portion of the washer in the concave portion of the inner fixed tube. (Fig.2)

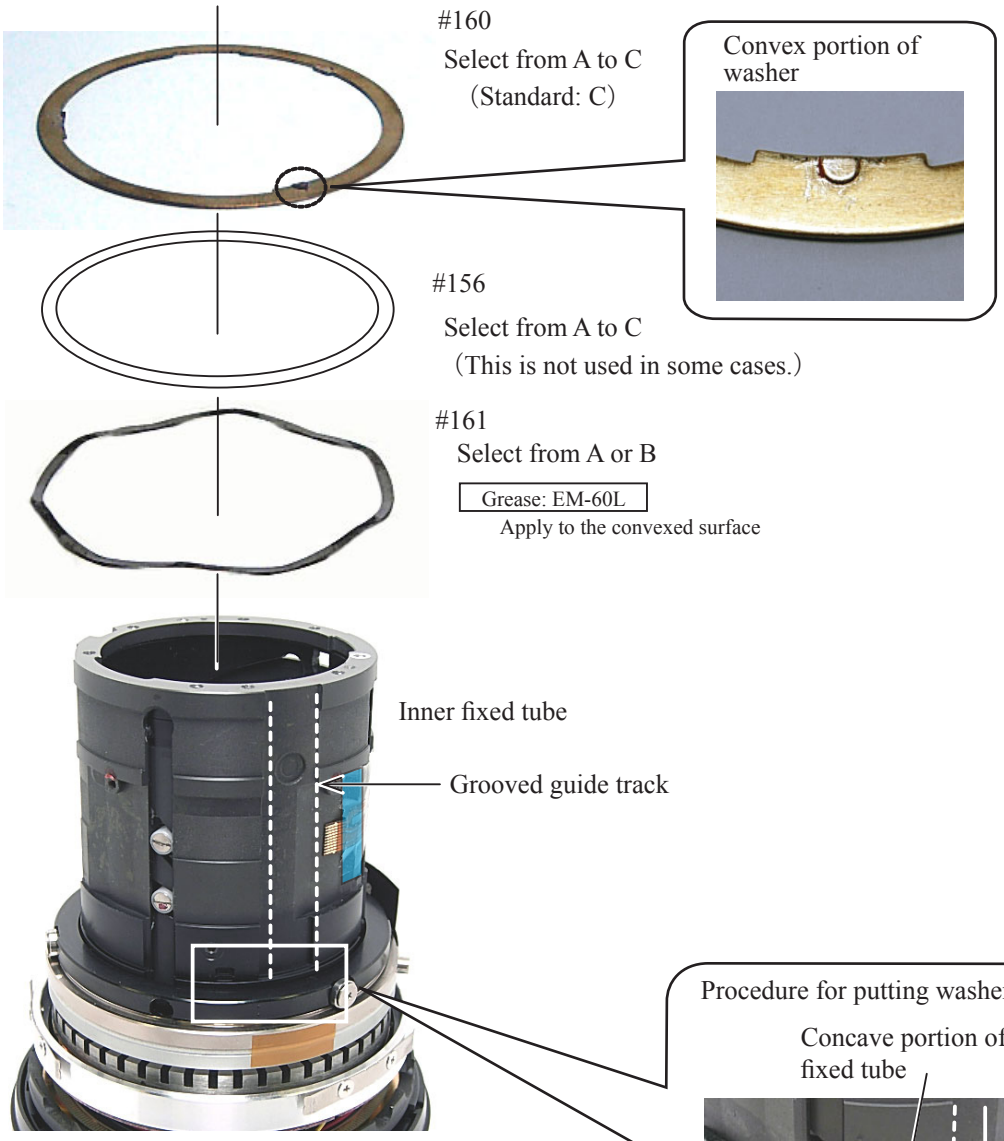


Fig.1

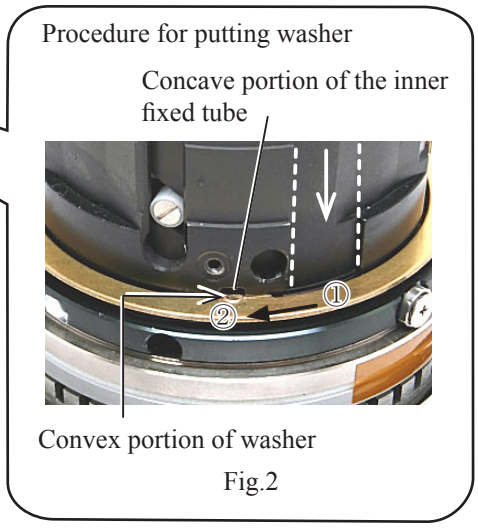


Fig.2

Fixing of Washer

・Apply the screw lock to the engaged areas of the inner fixed tube and the washers (#160) (in numeric order from "Fig.1" to "Fig.3".)

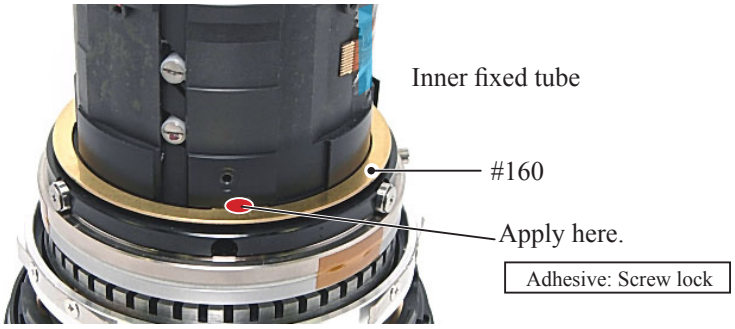


Fig.1

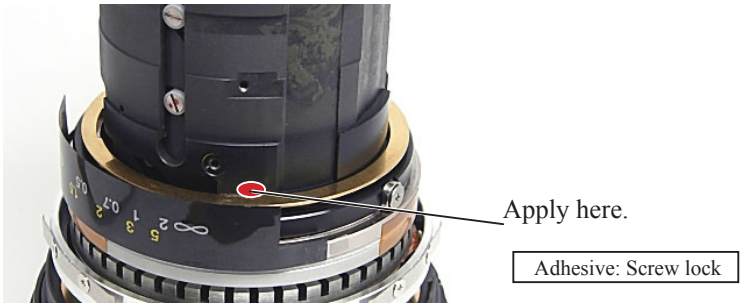


Fig.2

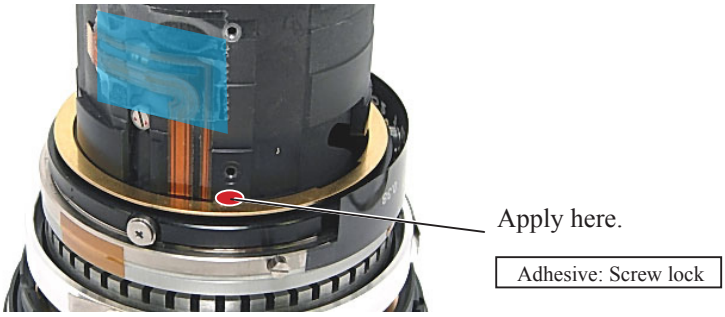
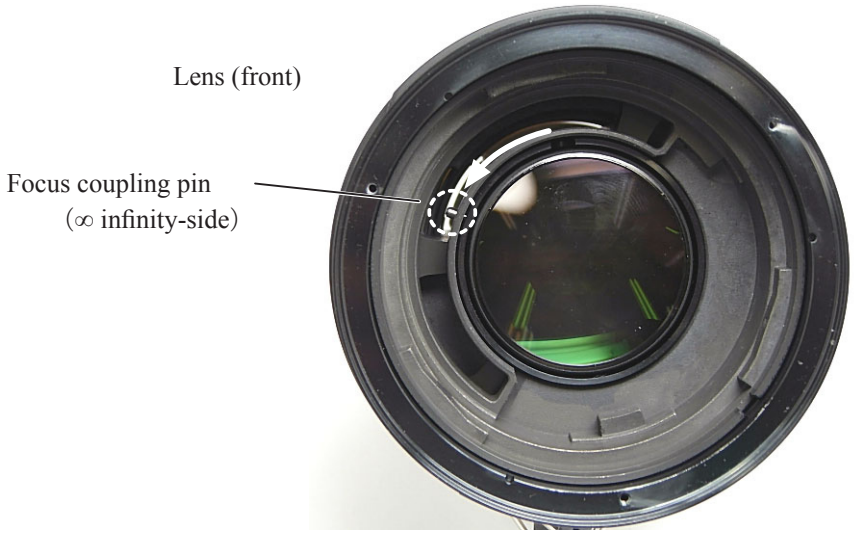


Fig.3

Focus coupling key

・Set the zoom to TELE-end position. Insert the focus coupling key, and put the focus coupling pin in the key groove.

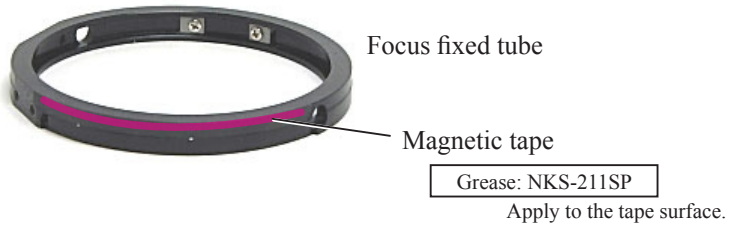
・Viewed from the front of the lens, confirm that the focus coupling pin and the focus coupling key are engaged with each other.



Zoom: TELE position

Focus fixed tube

・Put the focus fixed tube, with the magnetic tape facing upwards.



・Mount the focus fixed tube on the inner fixed tube.

Be careful so that fingers or a screwdriver do NOT touch the magnetic surface.

Focus fixed tube (continued)

・Attach three rollers to the focus fixed tube (in numeric order from "Fig.1" to "Fig.3".)

Roller

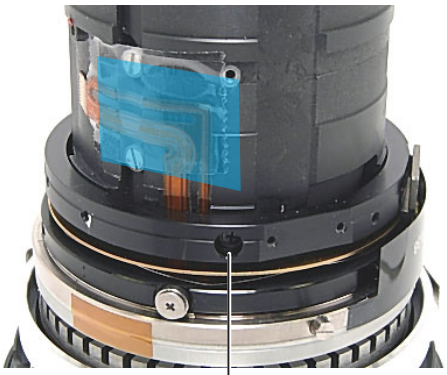
Adhesive: Lockend B

Fig.1

Roller

Adhesive: Lockend B

Fig.2



Roller

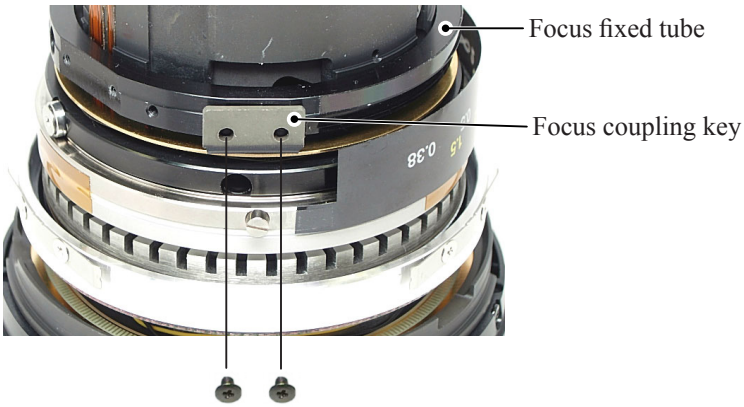
Adhesive: Lockend B

Fig.3

Focus fixed tube (continued)

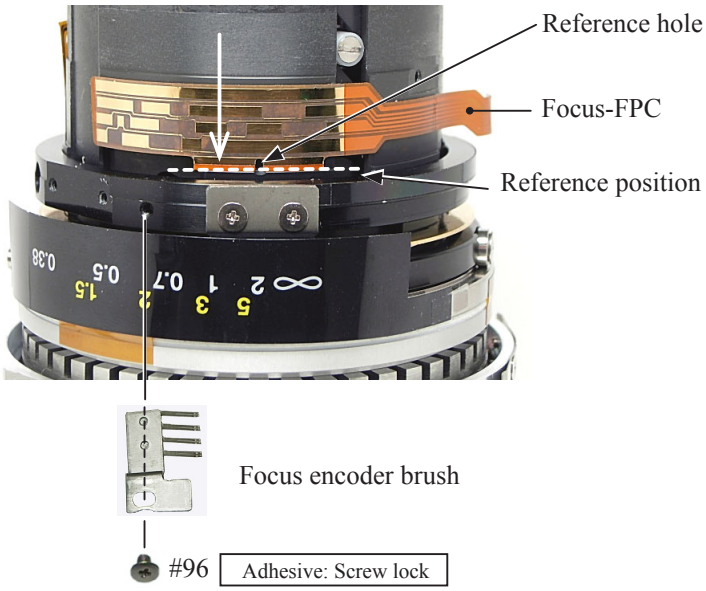
・Attach the focus coupling key to the focus fixed tube with two screws (#96).

Confirm that the focus coupling pin fits in the groove of the focus coupling key.



Focus-FPC / Focus encoder brush

・Attach the focus-FPC, based on the reference hole and reference position.
・Attach the focus encoder brush temporarily.



Positioning of Focus encoder brush

① Set the zoom to Middle position, and turn the focus turning-tube towards "∞"-side. (Fig.1)

② Insert the "∞" (infinity) positioning tool (★ J11347) into the tool hole. (Fig.2)

③ Position the focus encoder brush, and tighten the screw (#96). (Fig.3)

Fig.1

∞Positioning tool

★ : New tool

★ J11347

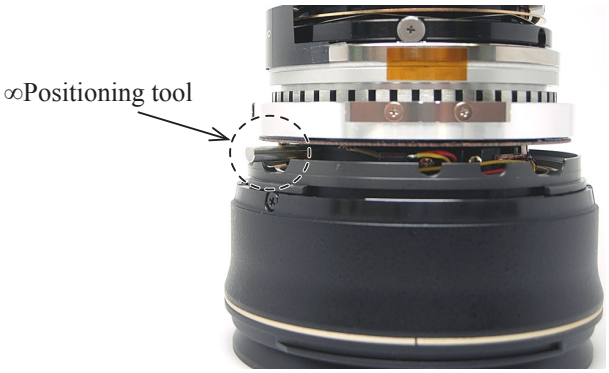


Fig.2

Positioning of Focus encoder brush

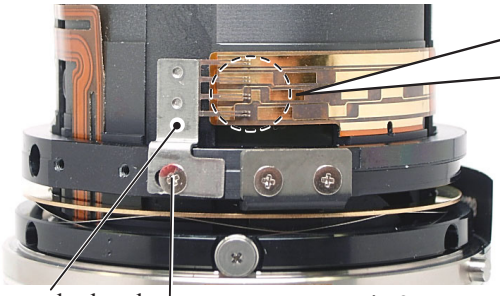
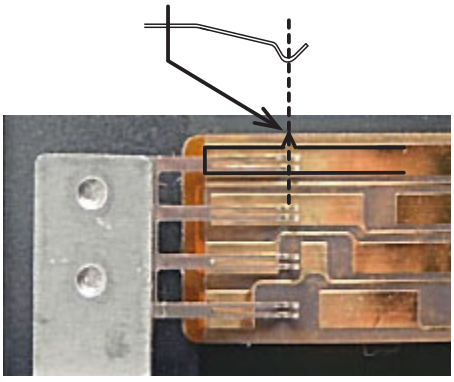


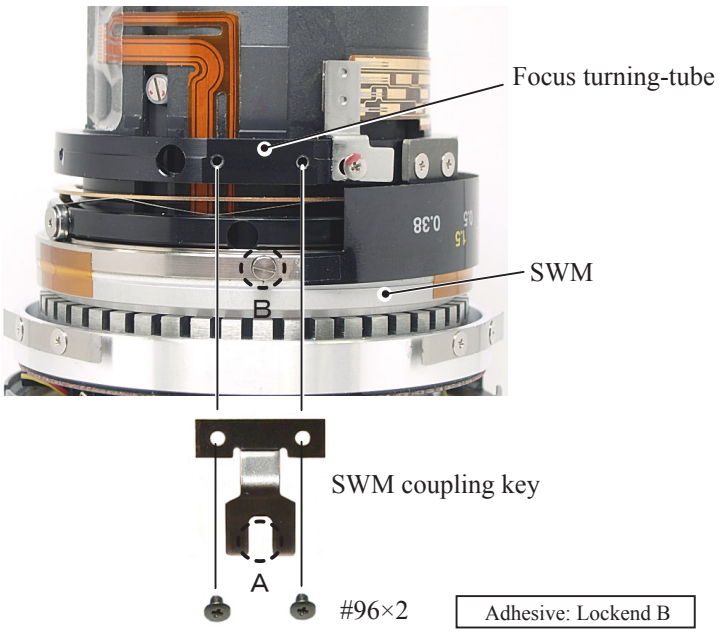
Fig.3

Align " △ " mark with the rounded bottom part of the brush.



SWM coupling key

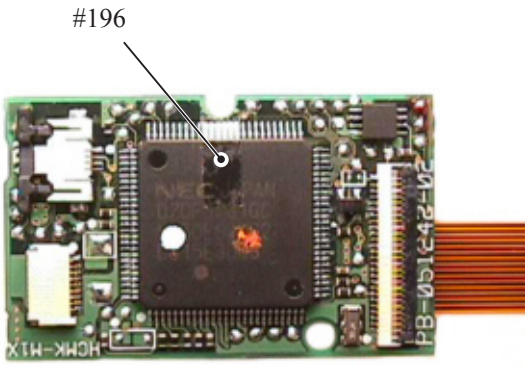
・As below, fit "B" of the SWM with "A" of the SWM coupling key .
・Attach the SWM coupling key to the focus turning-tube with two screws (#96).



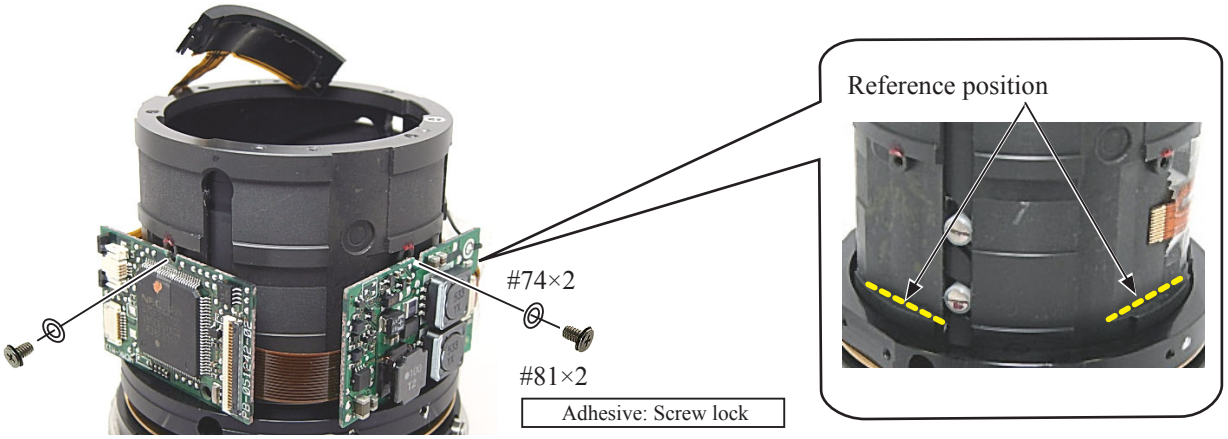
Main PCB unit

・Attach the tape (#196) to the main PCB.

Caution: To prevent short-circuit, attach the tape so that the pins of the CPU do not touch the screw.

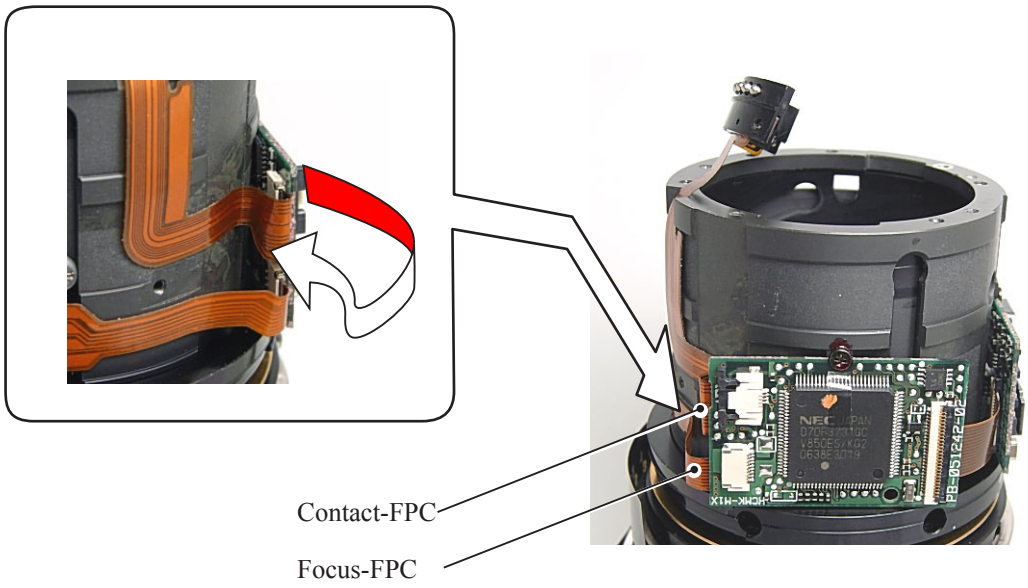


・Attach the main PCB based on the reference position, and stabilize with two screws (#81) and two washers (#74).

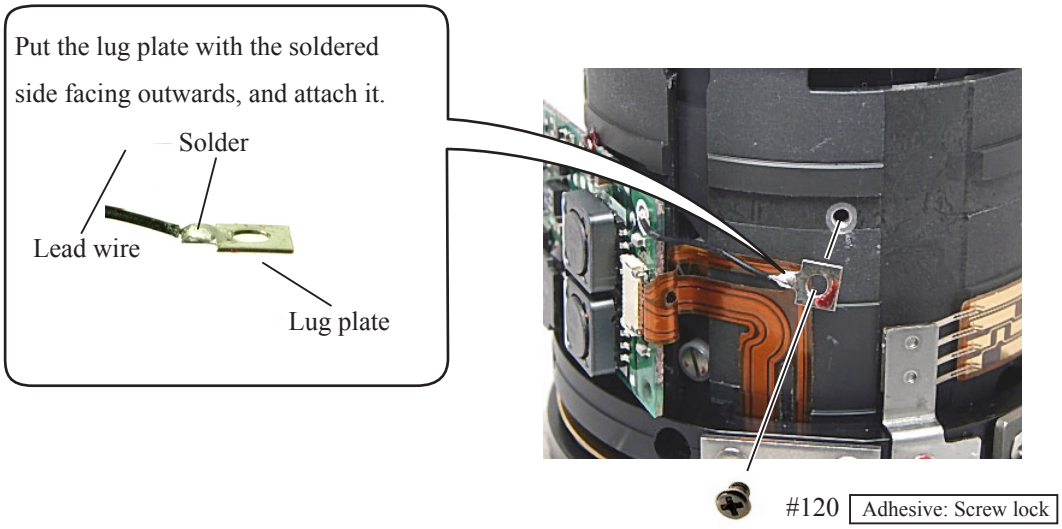


・Connect the contact-FPC and focus-FPC to each connector.

・Tuck the slackened portion of each FPC into the back of the main PCB.



・Attach the lug plate with the screw (#120).

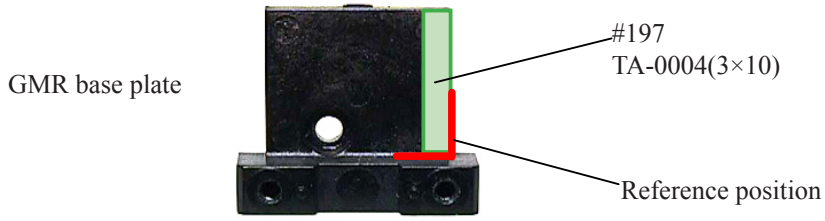


・Connect the SWM relay-FPC to the connector of the main PCB.

GMR unit

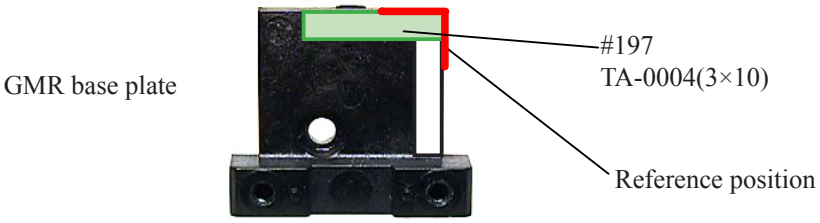
△ (Revision)

・Based on the following reference position, attach the tape (~~#190~~ #197) to the GMR base plate, and peel off a backing paper of the tape.



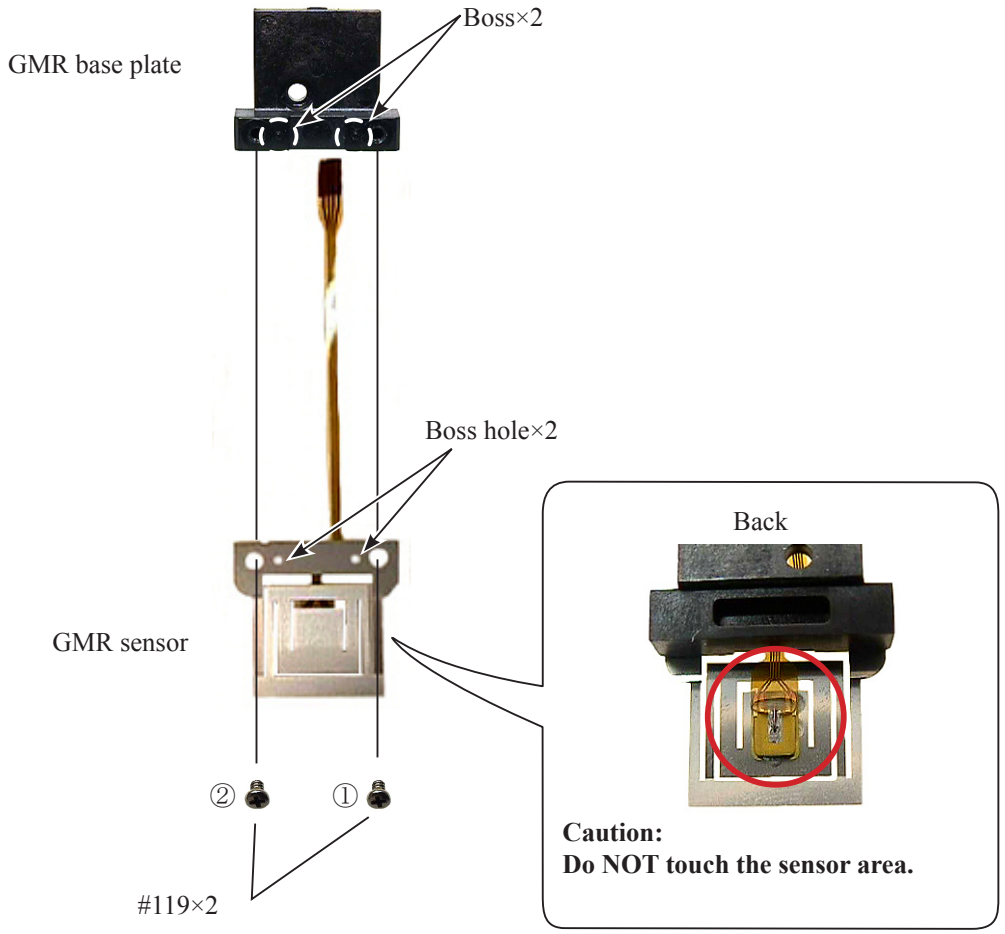
△ (Revision)

・Based on the following reference position, attach the tape (~~#190~~ #197) to the GMR base plate.



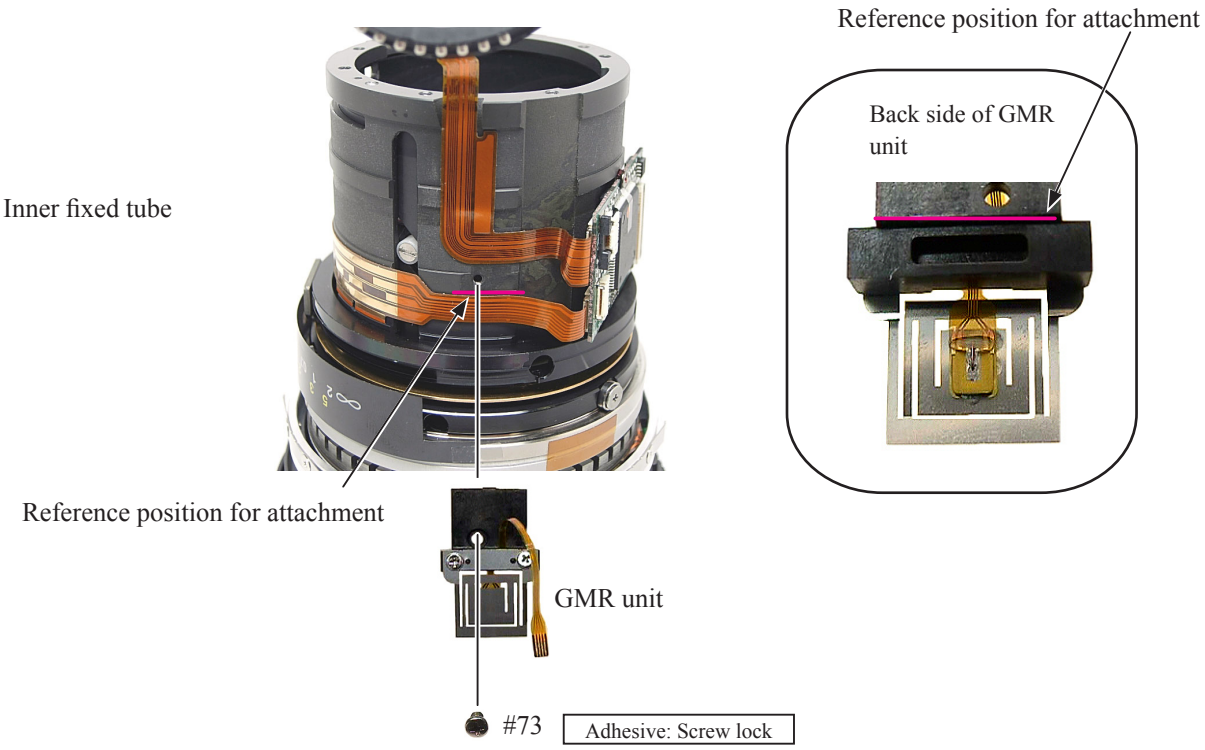
・Fit the bosses of the GMR base plate in the boss-holes of the GMR sensor.

・Tighten two screws (#119) in numeric order from ① to ② .



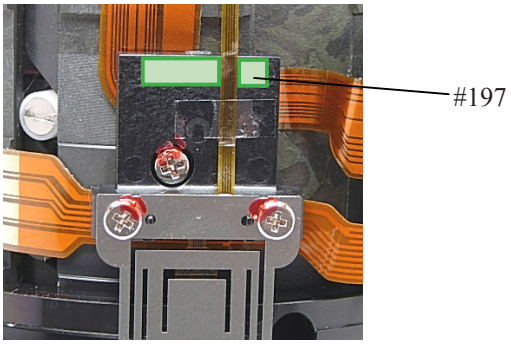
サービス計画課 M

・Align the reference position of the back side of the GMR unit with the reference position of the inner fixed tube. Then tighten the screw (#73).



・Peel off a backing paper of the tape (#197), and attach the GMR-FPC.

Caution: The GMR-FPC must be attached without being too tight or too loose.



Inspection and Adjustment of GMR output waveform

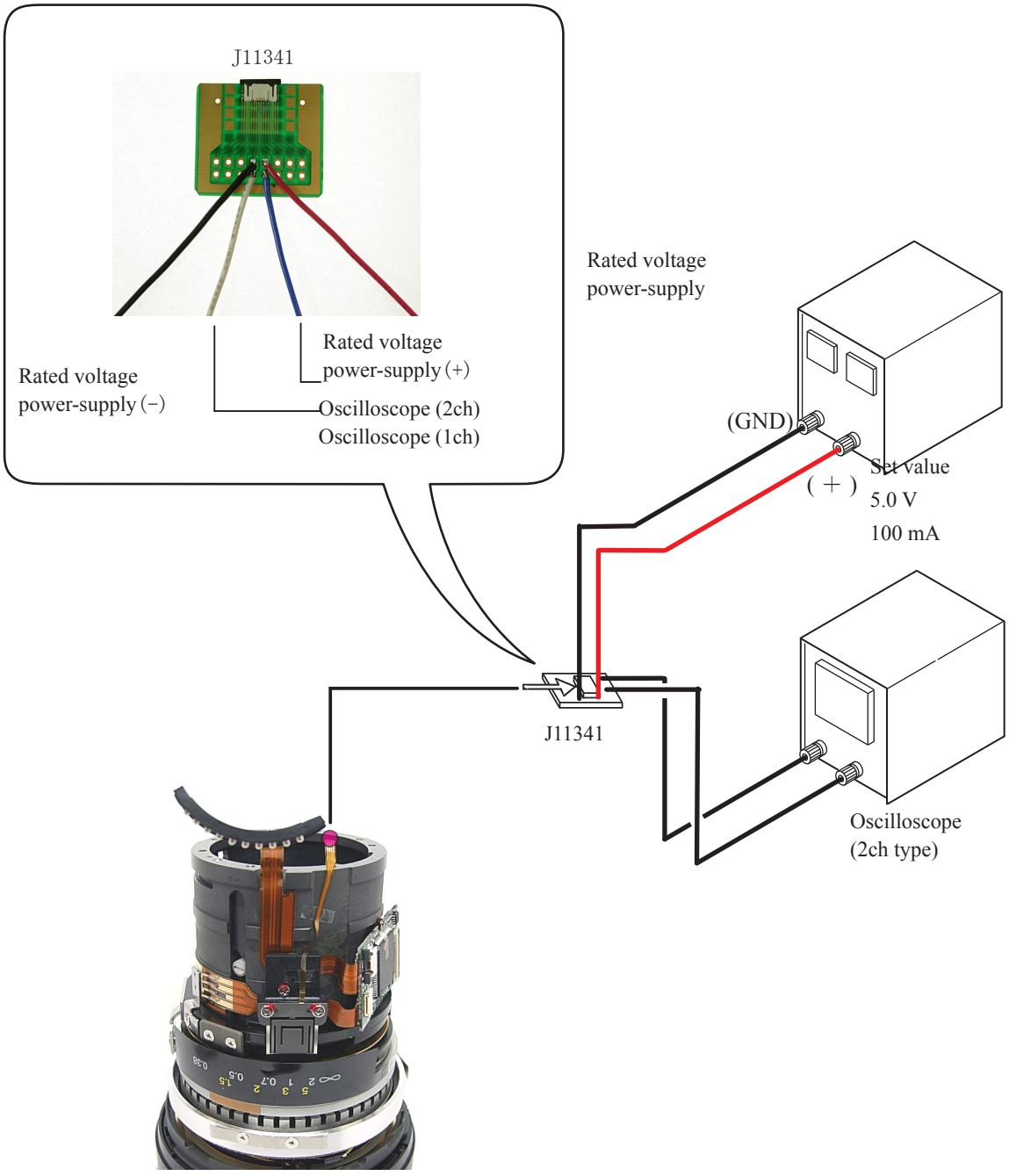
● When the GMR unit is disassembled and replaced, be sure to make the inspection and adjustment.

1. Device:
   - Single-output rated voltage power-supply 1 unit: 5V 100mA
   - Oscilloscope 1 unit
   - GMR output inspection tool 1 unit J11341

Caution:

If there is a problem with continuity between the contacts of the GMR output inspection tool (J11341) and the relay-FPC, the contacting surface of the relay FPC may be dirty, eroded, or oxidized. So polish the contacts and connect them.

2. Preparation of the lens for measurement
   - Connect the fixed tube, which has GMR unit assembled, to each measuring instrument.



3. How to inspect and adjust:

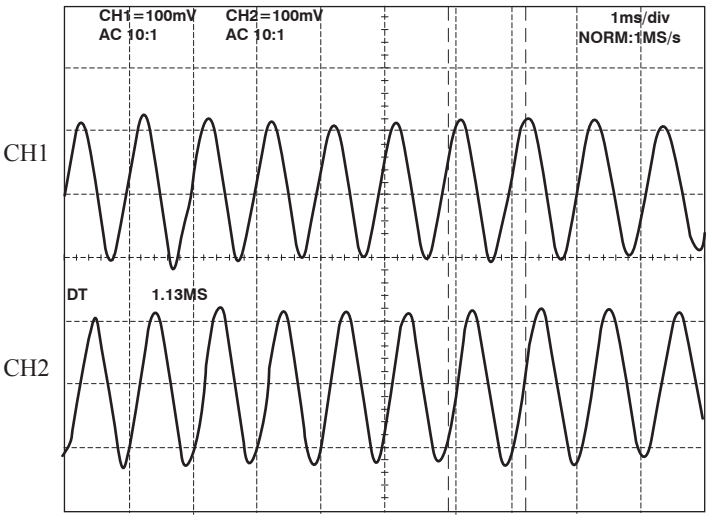
・Confirm that the electric current and voltage of the connected rated voltage power-supply are set values, then turn it ON.

・Set the oscilloscope, and turn the focus turning-tube (ref. Page A16) with hand.

・In case large waveform-noise is detected, use the FILTER function.

How to set FILTER function (e.g. DL1540 manufactured by YOKOGAWA)

1. Press the FILTER button.
2. Select “Smooth” of the menu on screen and turn it ON.



● Oscilloscope setting

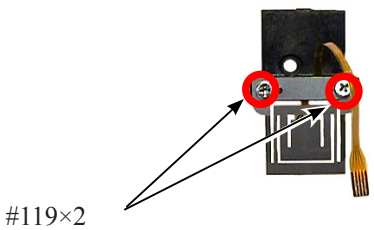
V/Div (ch1)	: 100 mV
V/Div (ch2)	: 100 mV
Coupling	: AC
Time/Div	: 1ms
Trigger Mode	: NORMAL
Trigger Coupling	: AC
Trigger Source :	: CH1
Trigger Position	: + 4 div
Trigger Type	: EDGE
Trigger Level	: 0V
INPUT (ch1)	: AC
INPUT (ch2)	: AC

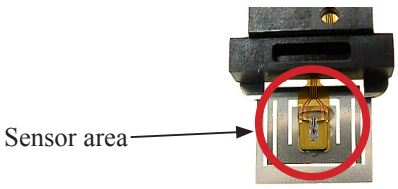
Standard: Amplitude of all pulses/waveforms is 180mV or more.

Note: Check the waveform by rotating the focus turning-tube all the way around back and forth.

In case the amplitude is small, adjust by loosening the two screws (#119) and moving the GMR sensor.

Caution: Do NOT touch the sensor area directly with hands during adjusting.





＜ Ref. ＞

● As shown in Fig. 1, if the amplitude of only either CH1 or CH2 is small, one of the 2 screws (#119) may be loosened, so check for it. If this is not the case, the GMR sensor may malfunction so replace it and make a readjustment.

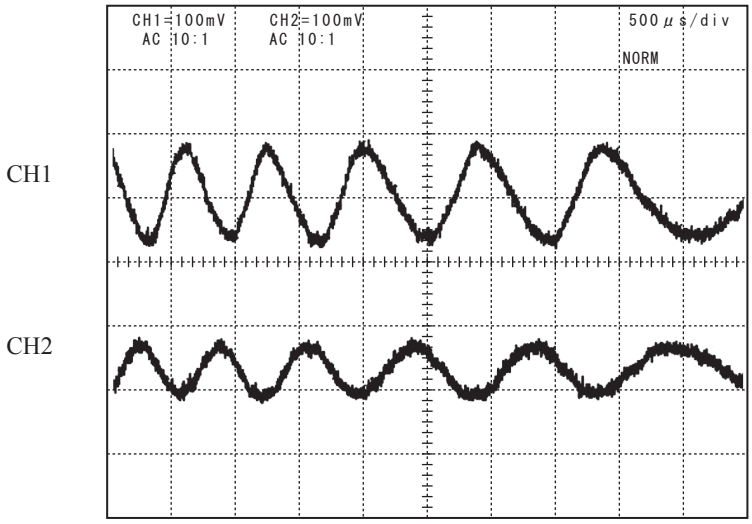


Fig.1

● As shown in Fig. 2, if the amplitude partially drops during the rotation, the magnetic data of the tape of the focus turning-tube unit may be damaged. So replace the focus turning-tube unit and make a readjustment.

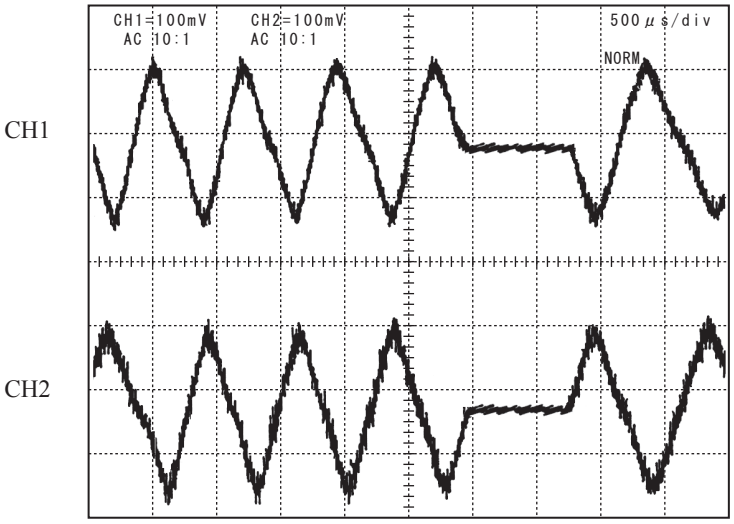


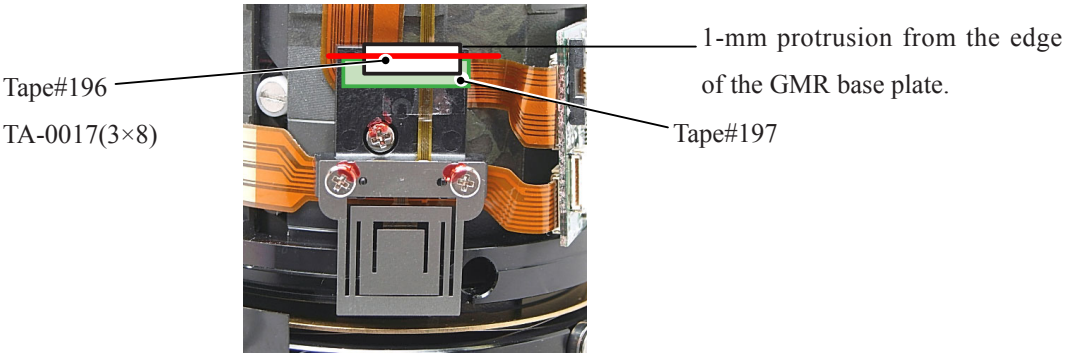
Fig.2

GMR unit

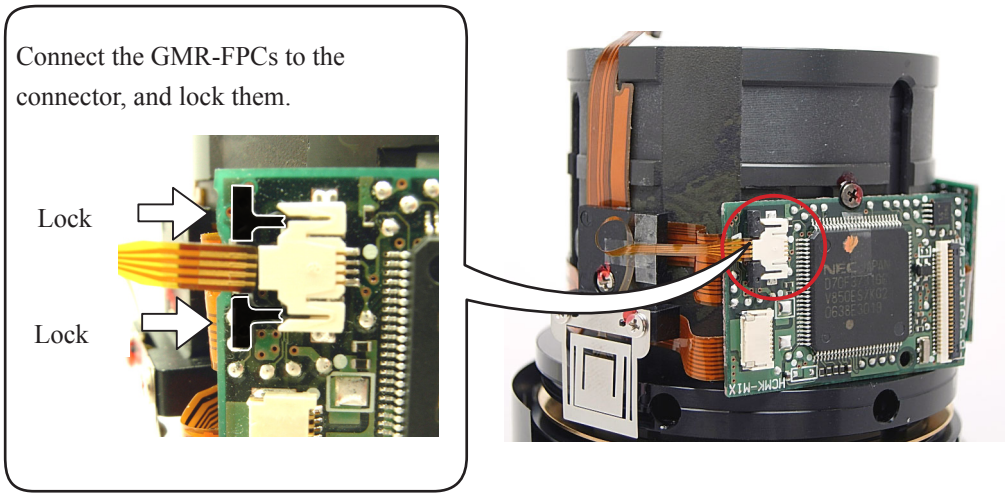
・Based on the reference position, fix the GMR-FPC with the tape (#196).

Attach [#196] so that its upper part protrudes from the edge of the GMR base plate by 1mm as below. Then push [#196] from above with the fingers.

Caution: Do NOT attach [#196] at the closer position to the GMR sensor than [#197].



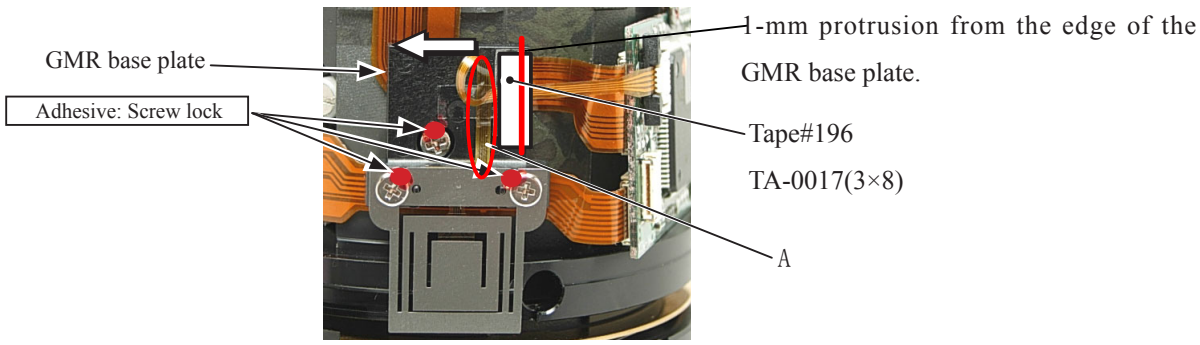
・Connect the GMR-FPCs to the connectors of the main PCB.



・Position the GMR-FPC towards the direction of the arrow.

・Attach [#196] so that part of it protrudes from the edge of the GMR base plate by 1mm as below. Then push [#196] from above with the fingers.

Caution: The tape [#196] must NOT touch the below "A" area of the FPC.

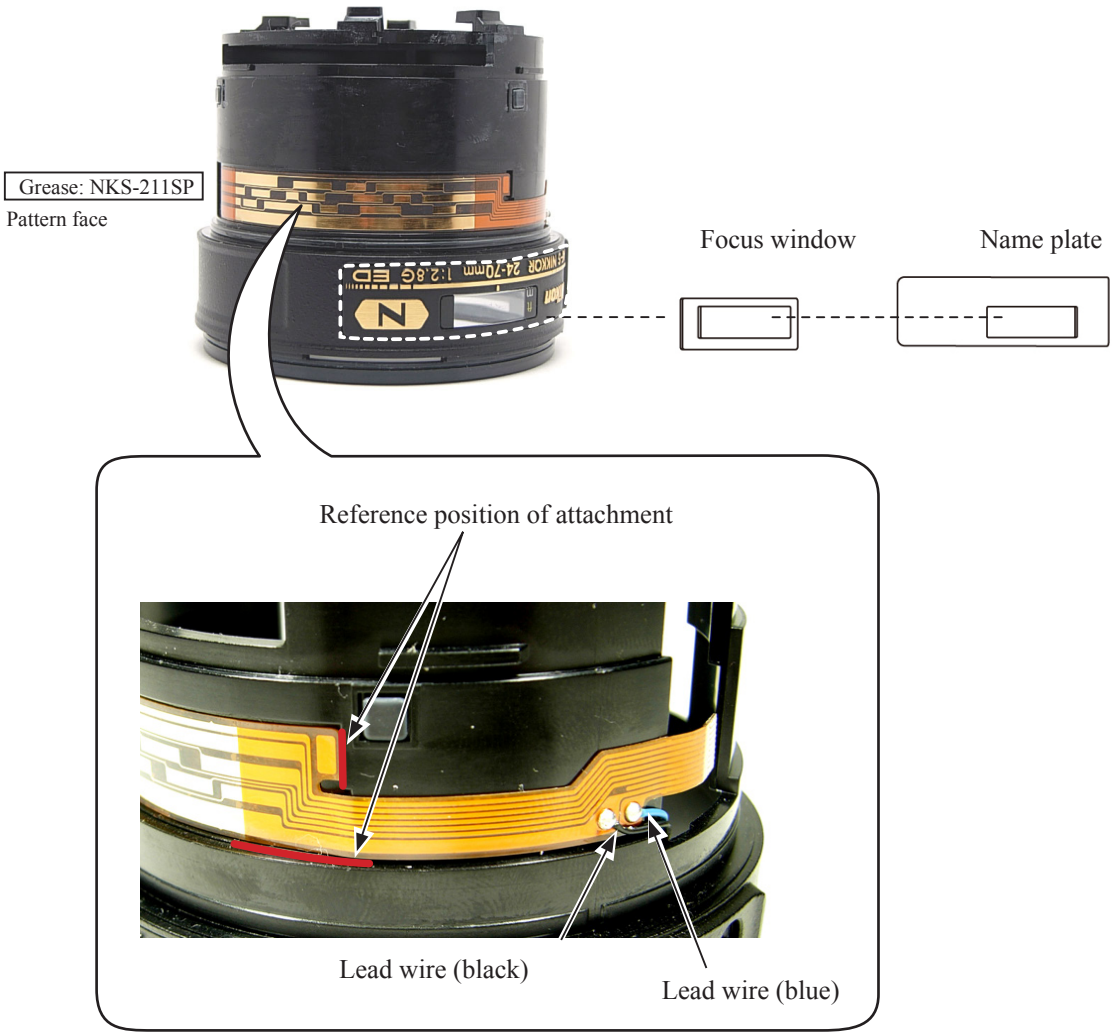


MF ring

・Mount the MF ring and washer (#169) on the SWM unit.

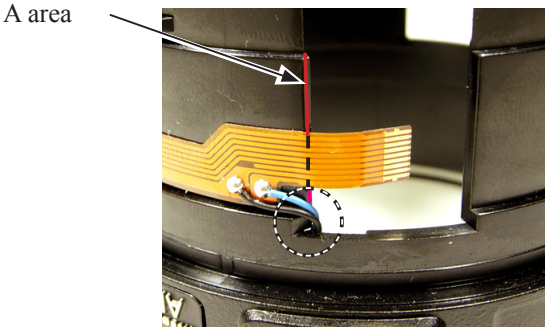
Zoom FPC

・Attach the zoom-FPC to the exterior fixed tube, based on the reference position.



・Bend the zoom-FPC slightly inwards at "A" area.

・Push the lead wire inwards as below.

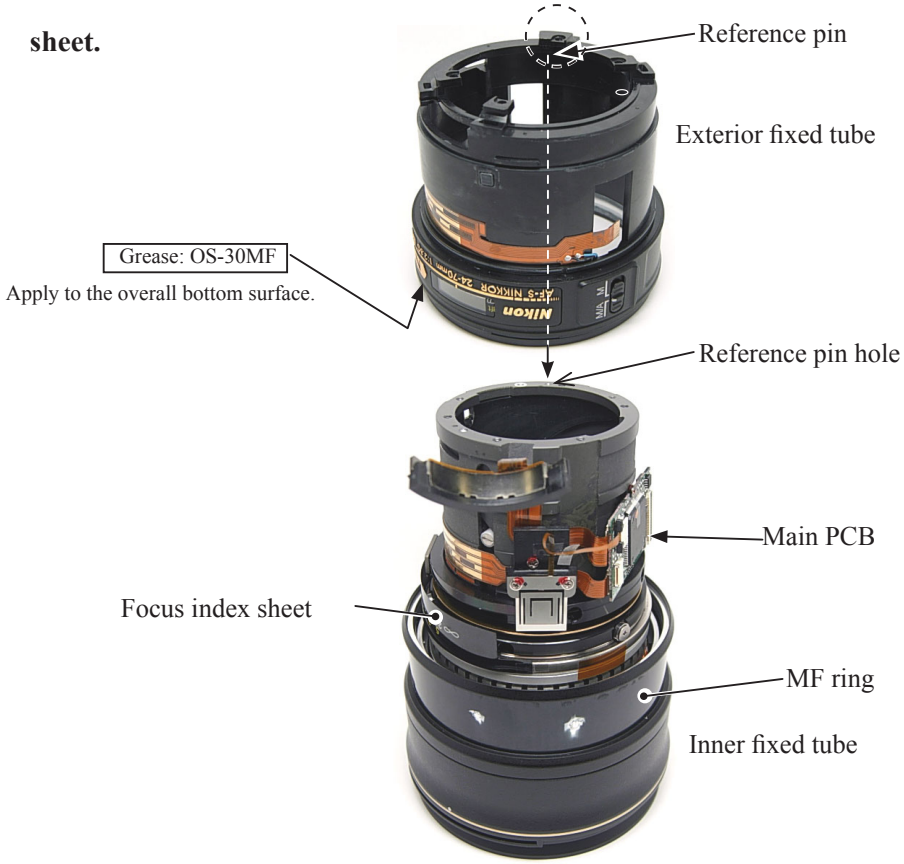


Exterior fixed tube

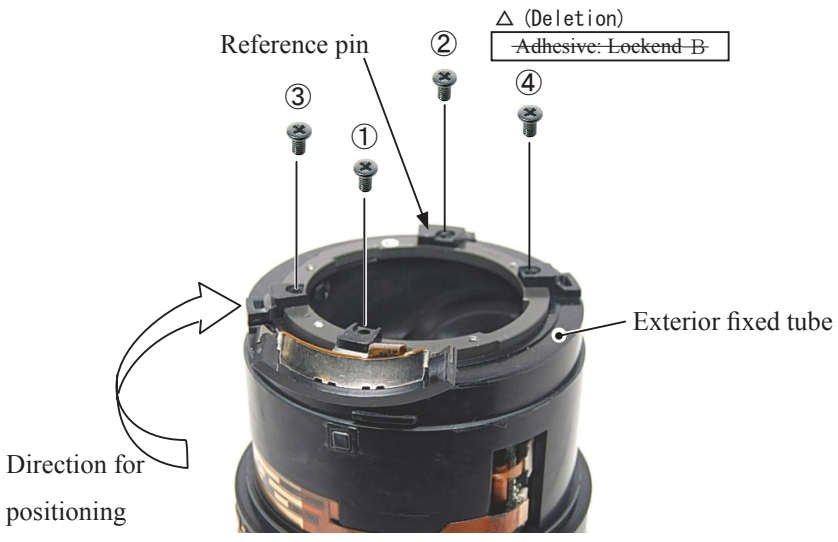
・Set the MF ring to the close-end.

・Fit the reference pin of the exterior fixed tube in the reference pinhole of the inner fixed tube, and mount on the inner fixed tube.

Caution: Mount the exterior fixed tube so that it does NOT touch the main PCB and focus index sheet.



Position the exterior fixed tube in the direction of the arrow, and tighten the screw from ① to ④ .



MF ring backlash adjustment

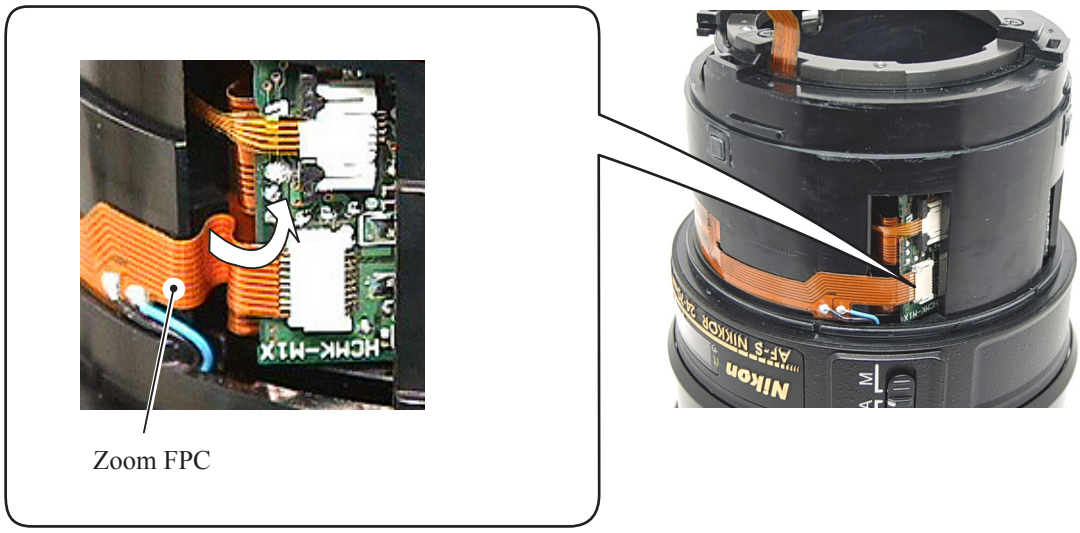
・With the exterior fixed tube being assembled, make the backlash adjustment of the MF ring.

・In case of a large backlash or heavy rotation of the MF ring, make the adjustment by using the washer (#169: select from A to C). (ref. Page A26)

サービス計画課 M

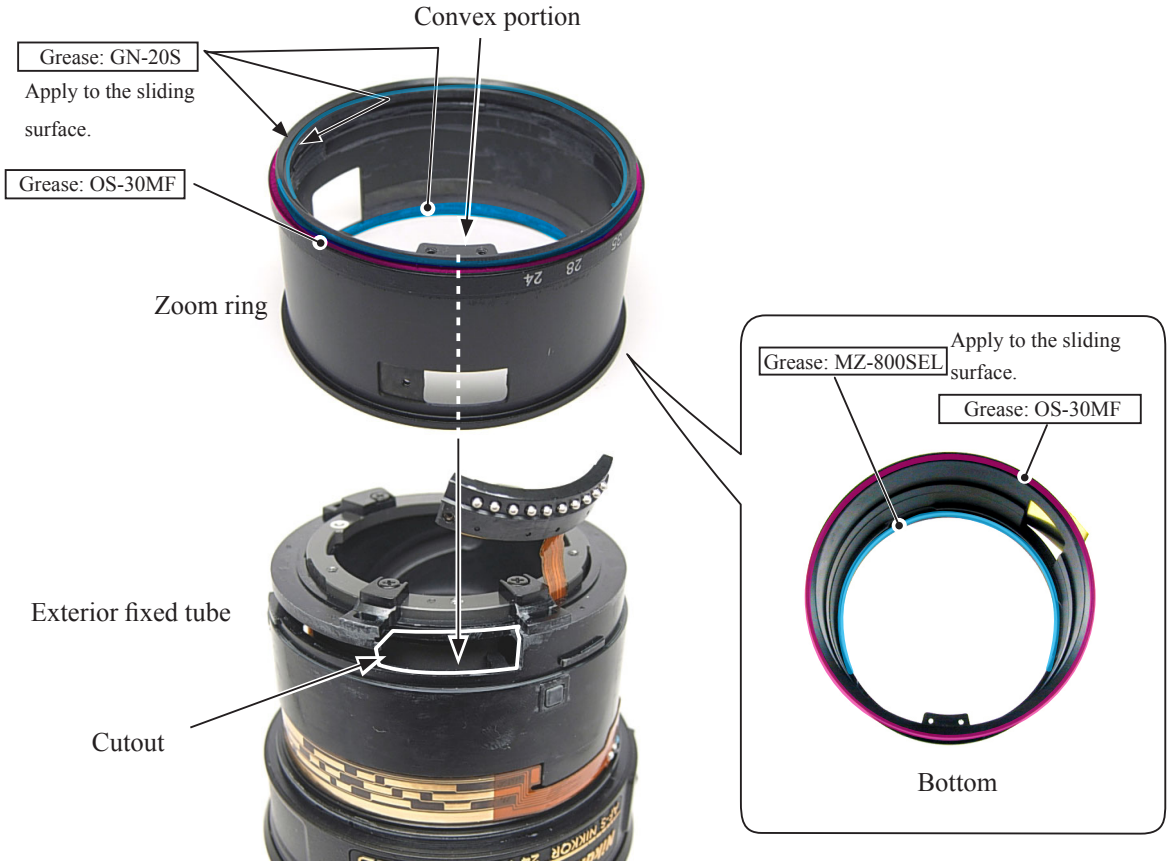
・Connect the zoom-FPC to the connector of the main PCB.

・Tuck the zoom-FPC inwards as below.

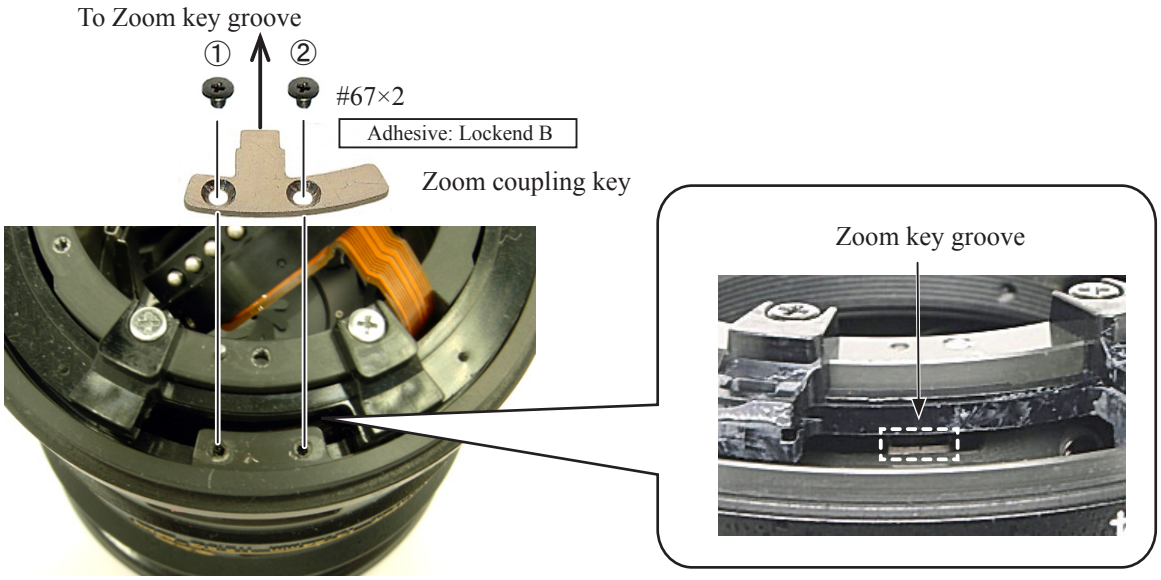


Zoom ring

・Fit the cutout of the exterior fixed tube unit with the convex portion of the zoom ring, then mount the zoom ring.



・Set the cam tube to WIDE-end. Put the zoom coupling key in the zoom key groove and tighten two screws (#67) in numeric order from ① to ② .



Rear fixed tube

・Tighten five screws (#174) in numeric order from ① to ⑤ .

サービス計画課 M

3rd lens group

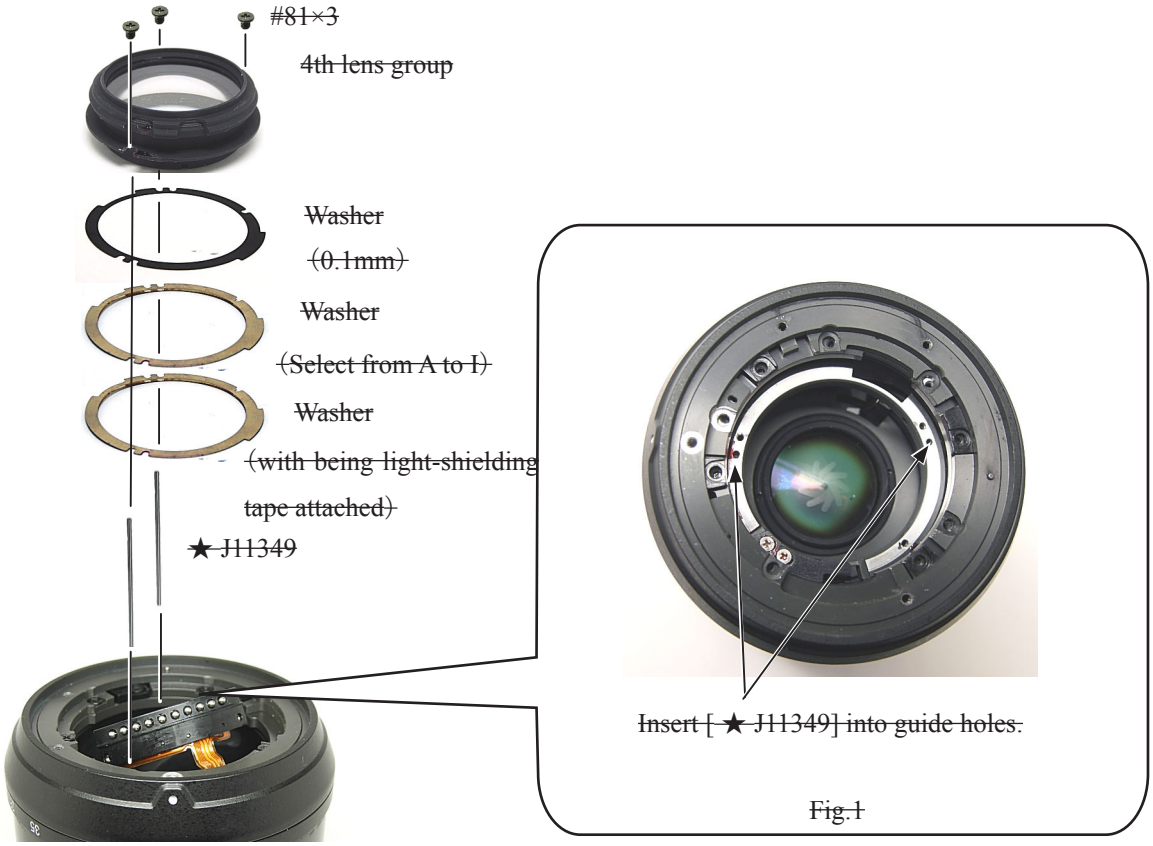
・Assemble the 3rd lens group with [J11346].

△ (Deletion)

~~4th lens group~~

・~~Set the zoom to WIDE-end position. By using two pins (J11349) as guide, insert them and put the washer and mount the 4th lens group. (Fig.1)~~

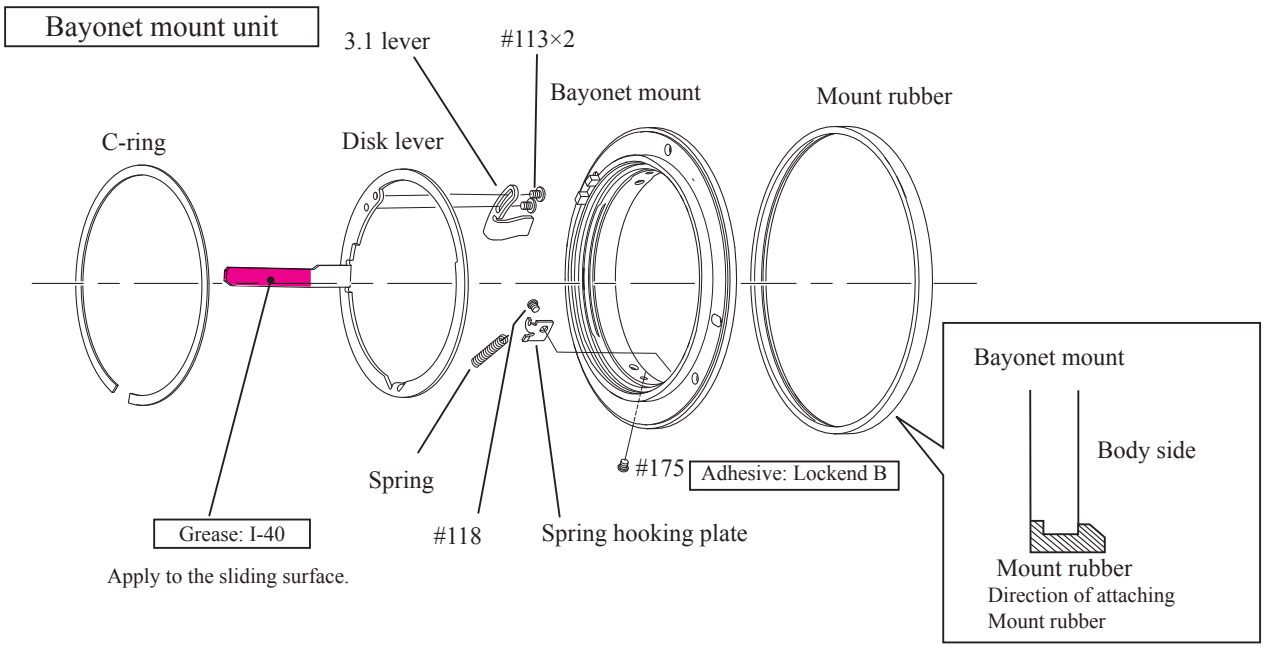
~~Caution: Removing the 4th lens group needs the lens alignment work.~~



~~Fig.1~~

~~The hybrid aspheric lens is used for the bayonet side of the 4th lens group.~~
~~If dust/dirt is attached, blow them away with a blower as much as possible.~~
~~If such dust/dirt can not be removed, dip a wiping cloth (Savina Minimax) a little in ethanol, and wipe the surface lightly.~~

サービス計画課 M

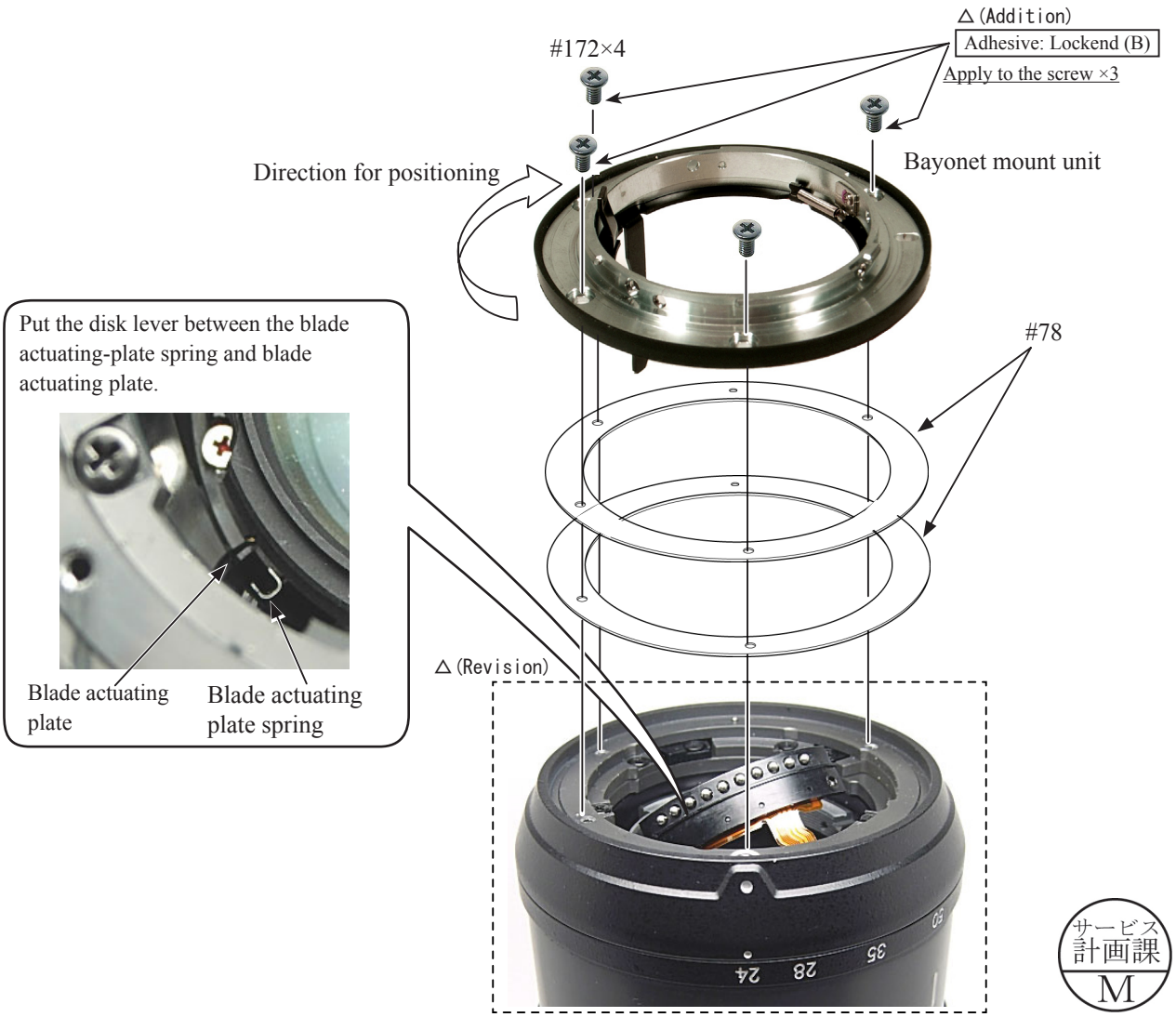


・Put the Bf adjustment washer (#78).

・Put the bayonet mount.

Caution: Handle the blade actuating-plate spring with care, because it is easily deformed.

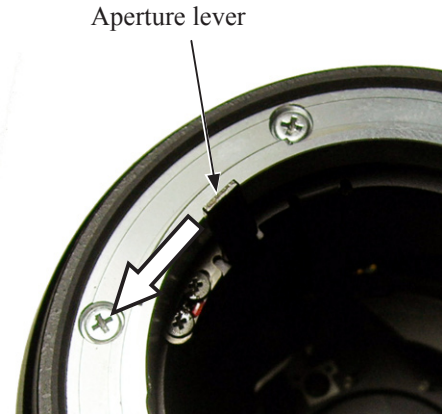
・Position the bayonet mount unit in the direction of the arrow, and tighten four screws (#72).



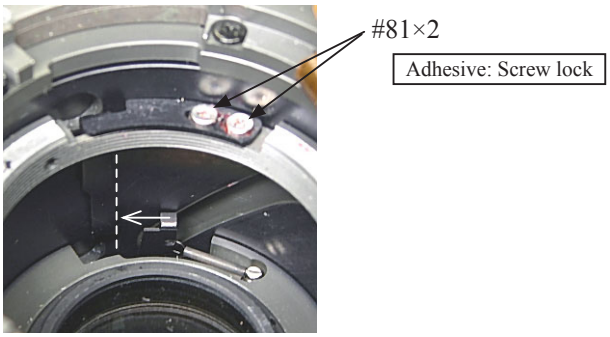
サービス計画課 M

Limit plate adjustment

- Set the zoom ring to TELE-end.
- Press the aperture lever all the way towards the direction for full aperture so that the aperture becomes full open by the blades.



- If the aperture does not get full open by the blades or the aperture blades are fully opened too quickly, remove the bayonet and adjust the position of the limit plate by two screws (#81).



4th lens group

・Set the zoom to WIDE-end position. By using two pins (J11349) as guide, insert them and put the washer and mount the 4th lens group. (Fig.1)

Caution: Removing the 4th lens group needs the lens alignment work.

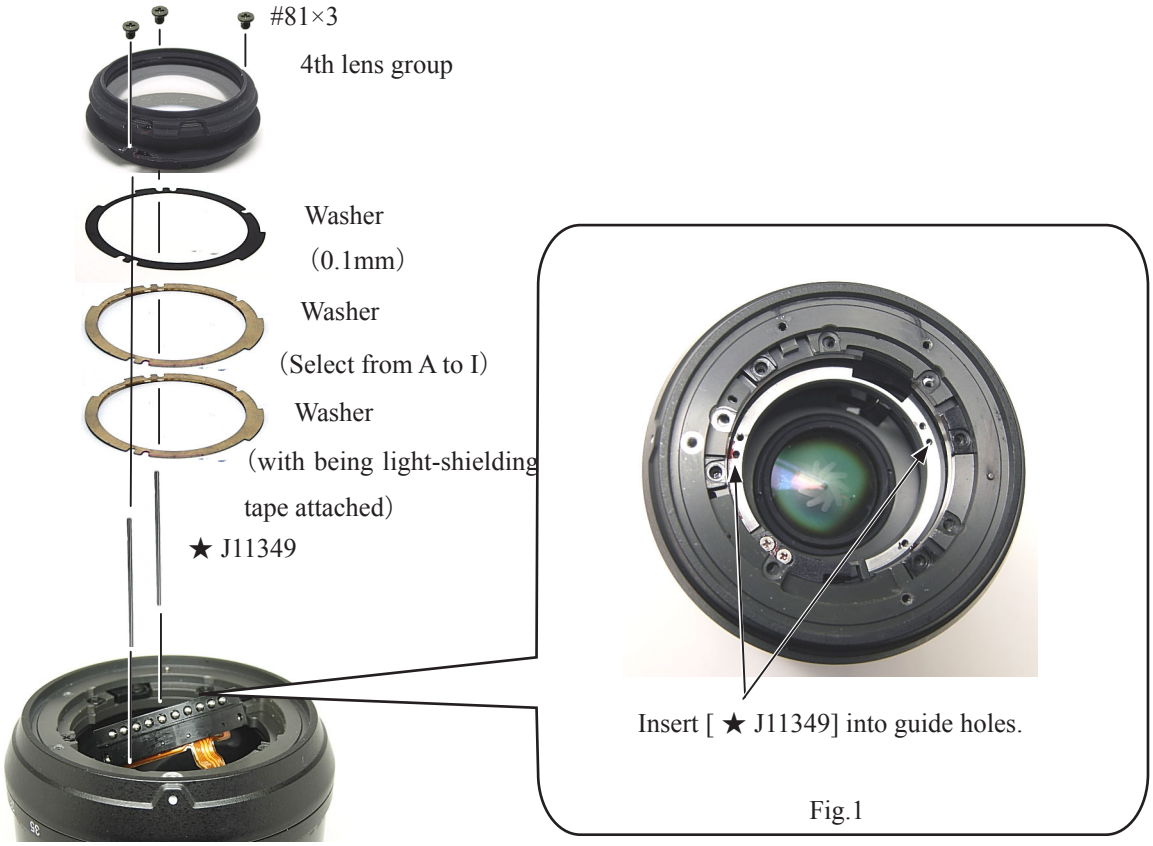


Fig.1

The hybrid aspheric lens is used for the bayonet side of the 4th lens group.

If dust/dirt is attached, blow them away with a blower as much as possible.

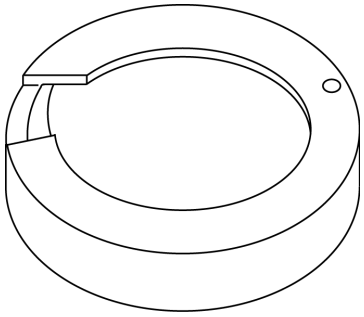
If such dust/dirt can not be removed, dip a wiping cloth (Savina Minimax) a little in ethanol, and wipe the surface lightly.

サービス計画課 M

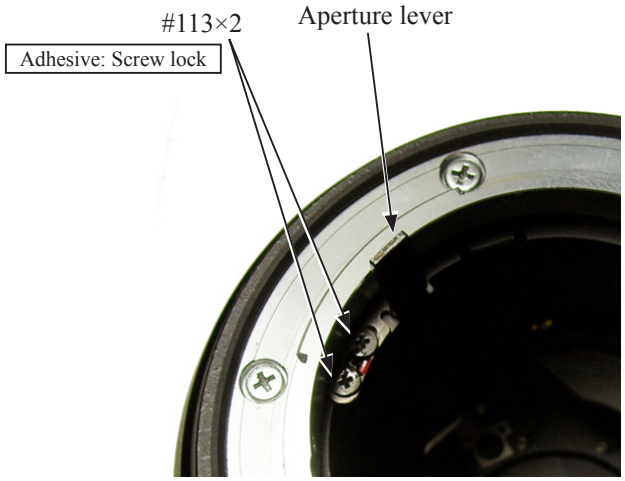
Aperture lever adjustment

- Set the zoom ring to TELE-end.
- Confirm that when the lock pin of "J18004-1" is put in the lock hole of the bayonet, the aperture becomes full open by the blades.

J18004-1

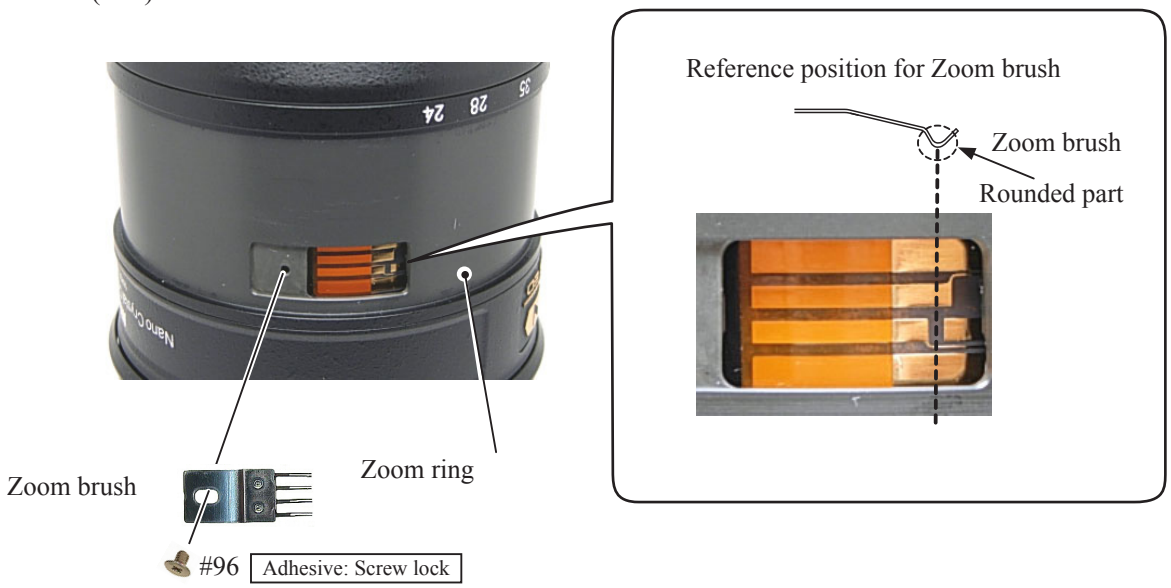


- If the aperture blades are fully opened too quickly or slowly, adjust the position of the aperture lever by two screws (#113).

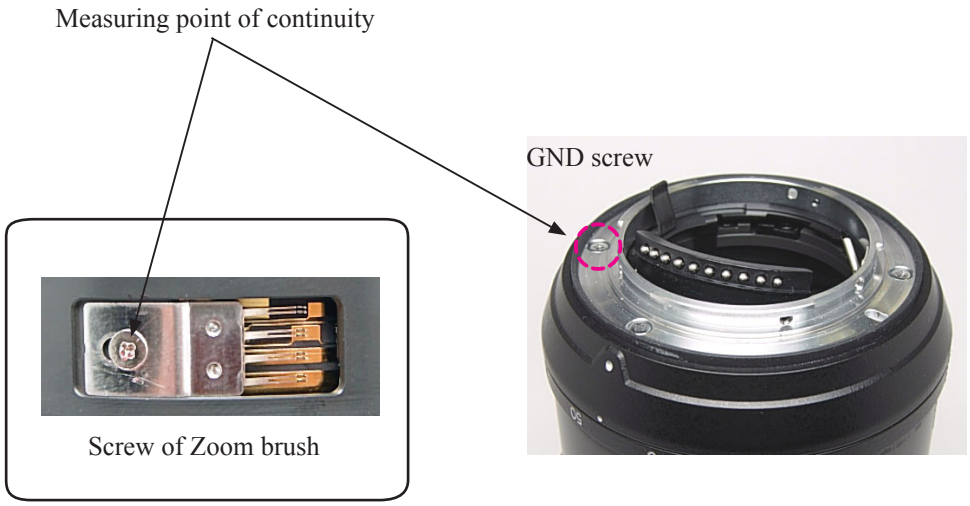


Zoom brush

- Set the zoom ring to TELE-end.
- Align the reference position for the zoom brush with the rounded part of the brush, and tighten screw (#96).



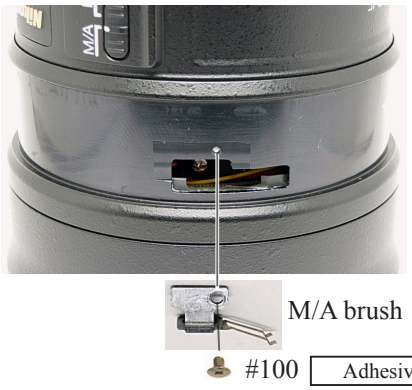
- Measure electrical continuity between the screw of zoom brush (#96) and the bayonet GND with a tester.
  Inspection standard: 1.0Ω or less
  In case the result is more than 1.0Ω, clean the screw of the GND line or the connector.



M/A brush

・Attach the M/A brush with the screw (#100).

・By visual check, confirm that the M/A brush touches the pattern surface.



Tape

・Cover the opening areas of ① and ② by attaching the two cover plates (#194) with two pieces of the tape (#193) for each.

① Zoom brush

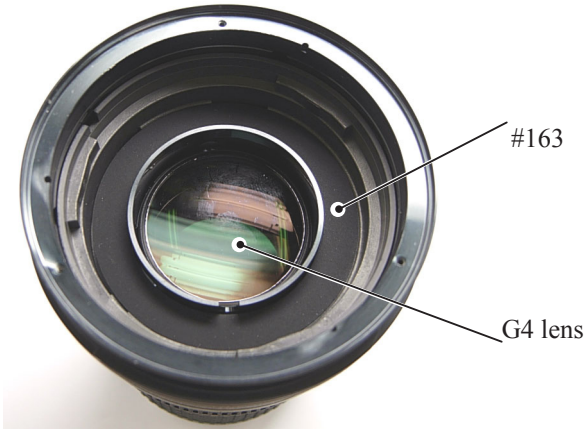
② M/A brush

Rubber ring

- Attach the focus rubber ring.
- Attach the zoom rubber ring.

Sheet

- Attach the sheet (#163).



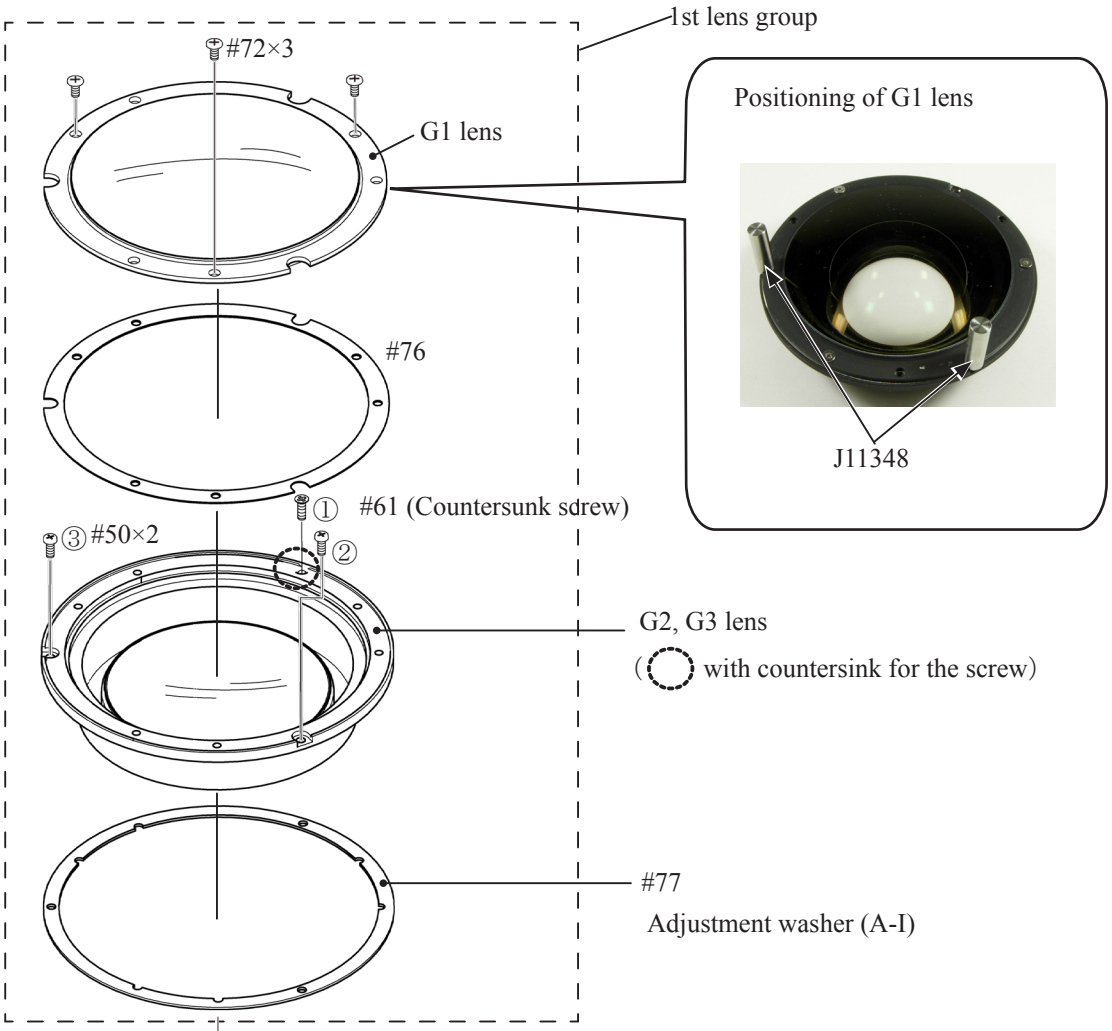
G4 lens is the hybrid aspheric lens.

R1-surface of G4 lens is plastic surface, so dip a wiping cloth (Savina Minimax) a little in ethanol, and wipe the surface lightly. If dust/dirt is attached, blow them away with a blower as much as possible.

1st lens-G unit

・Mount the 1st lens group, and tighten the two screws (#50) and the screw (#61) in numeric order from ① to ③ .

Caution: If G1 lens is removed, the lens alignment work will be necessary.



Filter ring

・Mount the filter ring, and tighten the two screws (#63) and the screw (#79) in numeric order from ① to ③ .

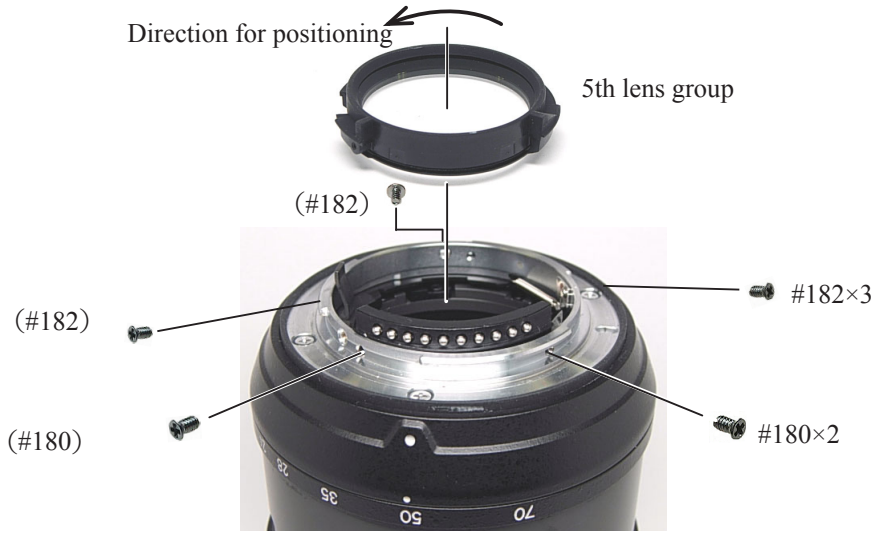
・Attach the sheet.

5th lens group

・Position the 5th lens group in the direction of the arrow, and tighten three screws (#182).

・Attach the contacts unit with two screws (#180).

If the screwhole for [#182] got larger, use the thicker screw (1K010-343) instead.
[#182] has M1.4-diameter, while [1K010-343] has M1.7-diameter.



Adjustment of Focus movement (T, W)

ref. Page A39

① Select "6. Infinity positioning for FFD adjustment" of AF-S24-70 inspection and adjustment software (J18427), and perform "∞" (infinity) adjustment.
② Fix the aperture lever so that the aperture is full open.
③ Read each value of WIDE or TELE sides.
④ Calculate as follows:

$[(A - B) / 3] - 0.02 = C$

A = Value at TELE side
B = Value at WIDE side
C = Adjustment amount (mm) of the washer (#77) of the 1st lens group

⑤ Increase/decrease the washers (#77) for adjusting the thickness by the above "C" value. If "C" is plus, increase the thickness of it, while it is minus, decrease the thickness of it.

Note: When the washer (#77) is put, place a thin washer between thick washers.

Adjustment of F.F.D (Infinity focus)

ref. Page A33

① Select "6. Infinity positioning for FFD adjustment" of "AF-S24-70 inspection and adjustment software (J18427), and perform "∞" (infinity) adjustment.
② Fix the aperture lever so that the aperture is full open.
③ Set the zoom ring to WIDE, and read the value.
④ Calculate as follows:

$B / 0.6 - 0.05 = C$

B = Value at WIDE side
C = Adjustment amount (mm) of the infinity focus adjusting washer (#78)

⑤ Remove the bayonet mount.
⑥ Increase/decrease the washers (#78) for adjusting the thickness by the difference from the standard value. If the difference is plus, increase the thickness of it, while it is minus, decrease the thickness of it.

Horizontal collimator

△ (Revision)

Focal length (f)	Standard (mm)	
24 mm	+0.00 ～ +0.08	~~+0.03 ～ +0.09~~
35 mm	-0.12 ～ +0.08	~~-0.07 ～ +0.08~~
70 mm	-0.10 ～ +0.15	~~-0.07 ～ +0.12~~

サービス計画課 M

Preparation for Inspection & Adjustment

● In case of replacing the main PCB, SWM unit, GMR sensor, or focus turning-tube, be sure to make the below inspection and adjustment.

1. Adjustment:

・Adjustment for Electrical Device

2. Inspection :

・Inspection of Lens switches and Lens condition
・Inspection of GMR-encoder Operations
・Inspection of Lens Driving Stop Accuracy
・Inspection Lens Driving Time

3. Required device:

・Single output rated voltage power supply: 1 unit (6.0V 3.0A)

・Oscilloscope: 1 unit Adjustment for electrical device, Inspection of lens driving time

・AF-I communication box (J15306-1): 1 unit

・AF-I communication adapter (J15307): 1 unit

AF-S 24-70 inspection and adjustment program (J18426)

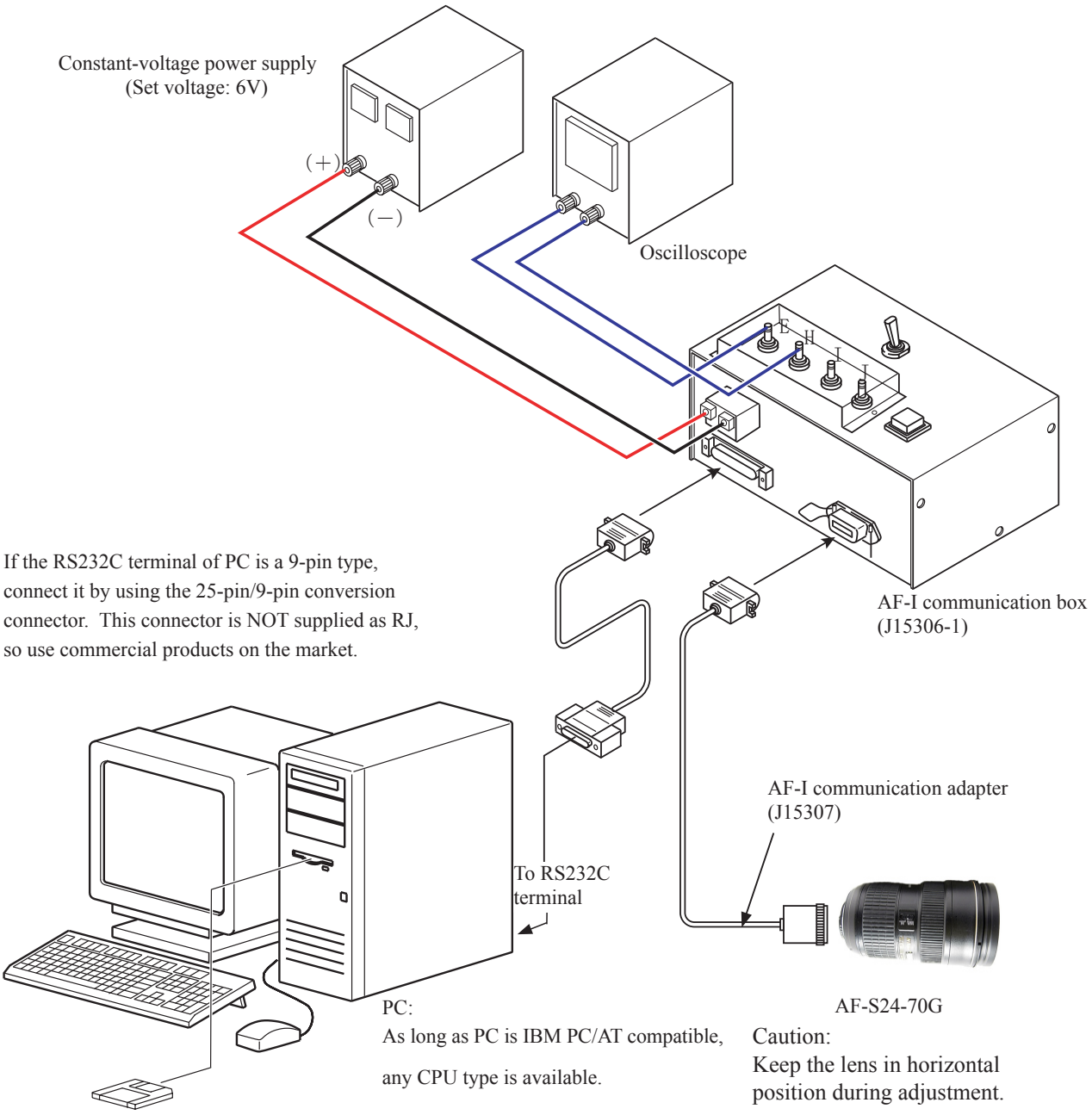
The below hardware requirements are necessary for installing the program on a computer.
Ensure them before installation.

PC	IBM PC/AT compatible
OS	Windows XP Home Edition, Windows XP Professional, Windows 2000,
CPU	Pentium Ⅱ 266MHz ～ Pentium Ⅳ 2GHz
RAM (Memory)	32MB or more
HD	6 MB-or-more free space is necessary when installation
Monitor resolution	800×600 or more pixels
Interface	Serial interface ※ USB interface cannot be used.

As long as the above requirements are met, either desktop or notebook PC is available.

【System configuration】

★ : New tool

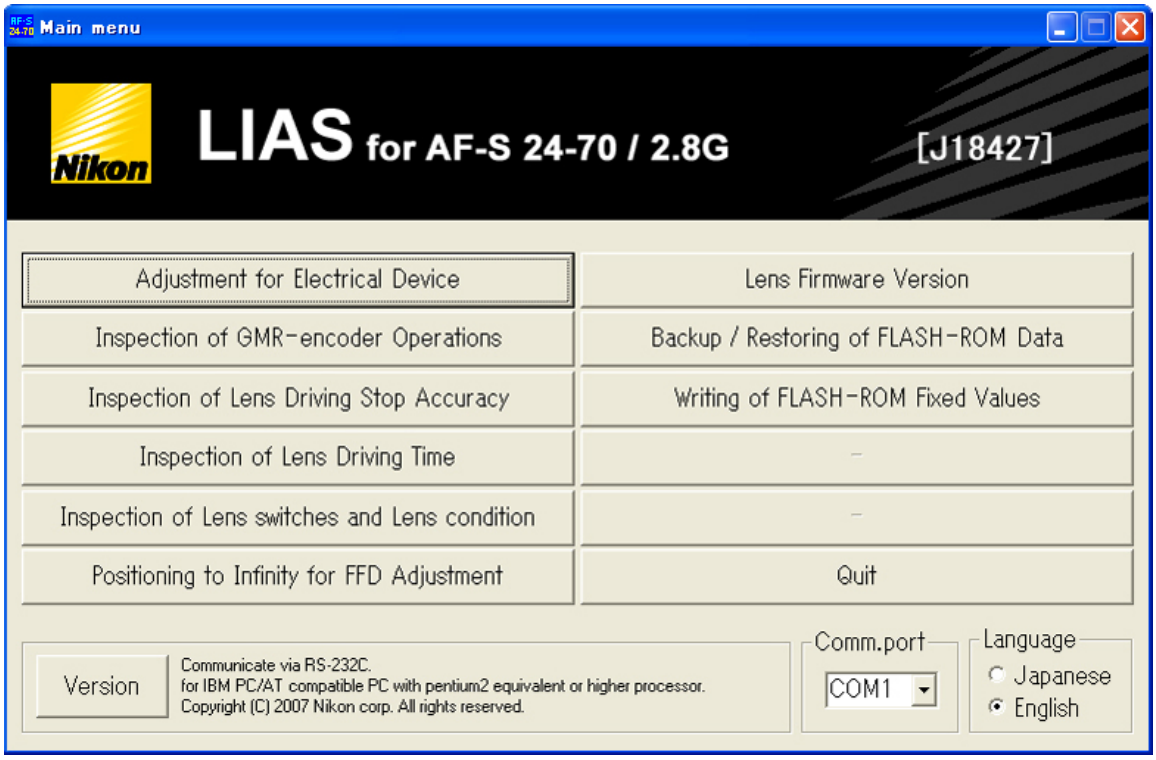


AF-S 24-70 inspection and adjustment software

(J18427)

● AF-S 24-70 inspection program

(1) Menu screen



・Menu items

Items 1 is used for "Adjustment for Electrical Device".

Items from 2 through to 5 are used for "Inspections".

Items 6 is used for positioning to become "Infinity" of the focus encoder when FFD adjustment is made.

Item 7 is used for reading "Lens Firmware Version".

Item 8 is used for "Backup/Restoring of FLASH-ROM Data".

Item 9 is used for "Writing of FLASH-ROM Fixed Values".

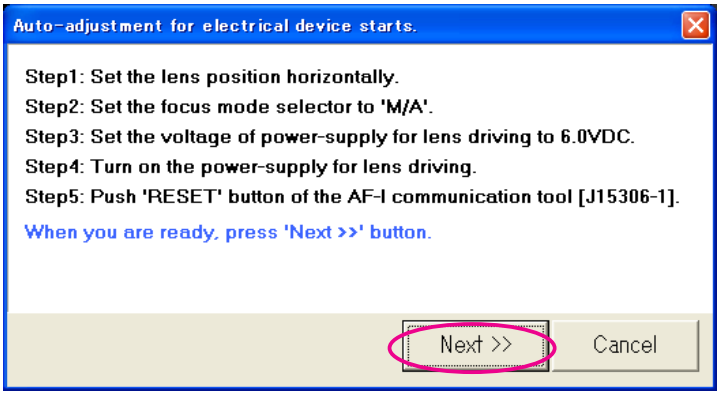
Caution:
Whenever FLASH-ROM fixed values are written, "Aberration compensation data writing adjustment" is necessary.

Adjustment for electrical device

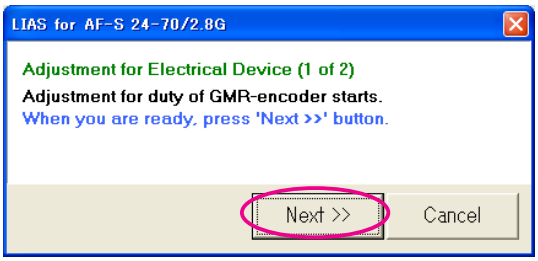
● In case of replacing the main PCB and SWM unit, GMR sensor or focus turning-tube, be sure to make adjustments.

・Select "Adjustment for Electrical Device" on the menu.

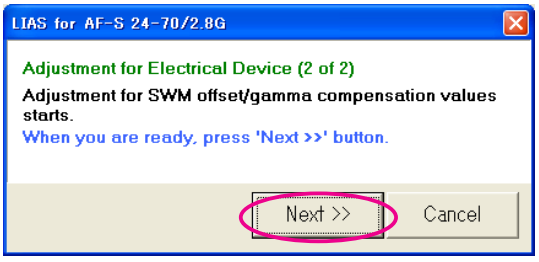
・Follow the instructions on the screen for preparation. Then click "Next".



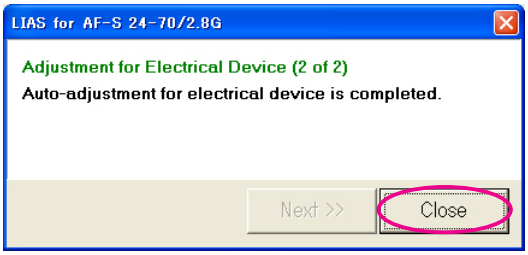
・ Click "NEXT" button .

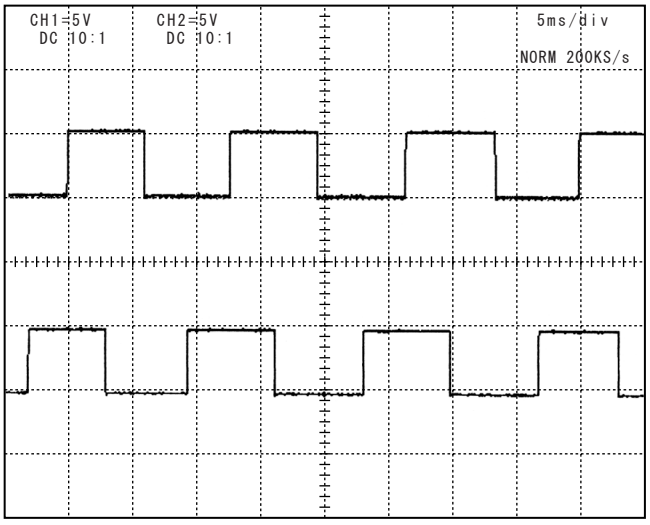


・ Click "NEXT" button .



・When the adjustment is completed, click "Close" to end the procedure.





● Oscilloscope setting

V/Div（CH1）	: 5V
V/Div（CH2）	: 5V
Coupling	: DC
Time/Div	: 1m Sec
Trigger Mode	: NORMAL
Trigger Coupling	: DC
Trigger Source	: CH1
Trigger Position	: ＋ 4div
Trigger Type	: EDGE
Trigger Level	: 2.5V

Inspection of Lens operations

Check the lens operations by using a PC after assembling.

○ Check on PC

● Inspection item:

1. GMR encoder operations
   - ・Perform the scanning-drive of lens and check the total number of pulses.
   - ・In case the GMR encoder is defective, the number of pulses becomes out of standard.

2. Lens driving stop accuracy
   - ・Check the number of overrun/underrun pulses (deviation of the stop position from the target position) per the specified lens driving amount.

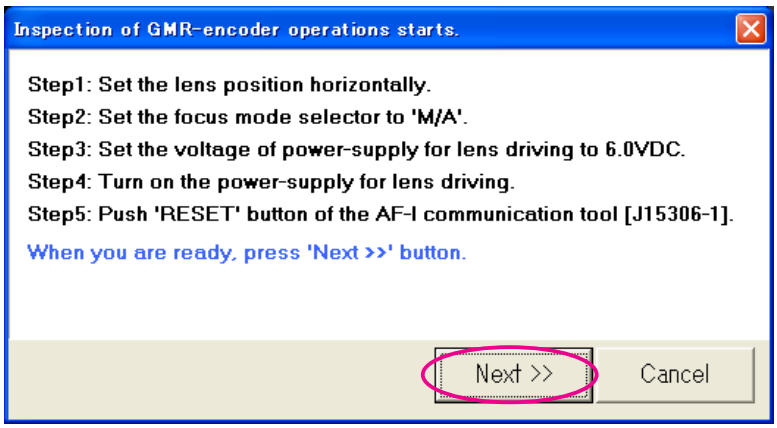
3. Lens driving time
   - ・Check the drive time (from starting and stopping the drive) by using the oscilloscope when the specified lens is driven.

4. Switches and lens condition
   - ・Check the positions of the focus encoder, zoom encoder, and focus mode.

(1) Inspection screen of GMR encoder operations

・Select "Inspection of GMR-encoder Operations" on the menu.

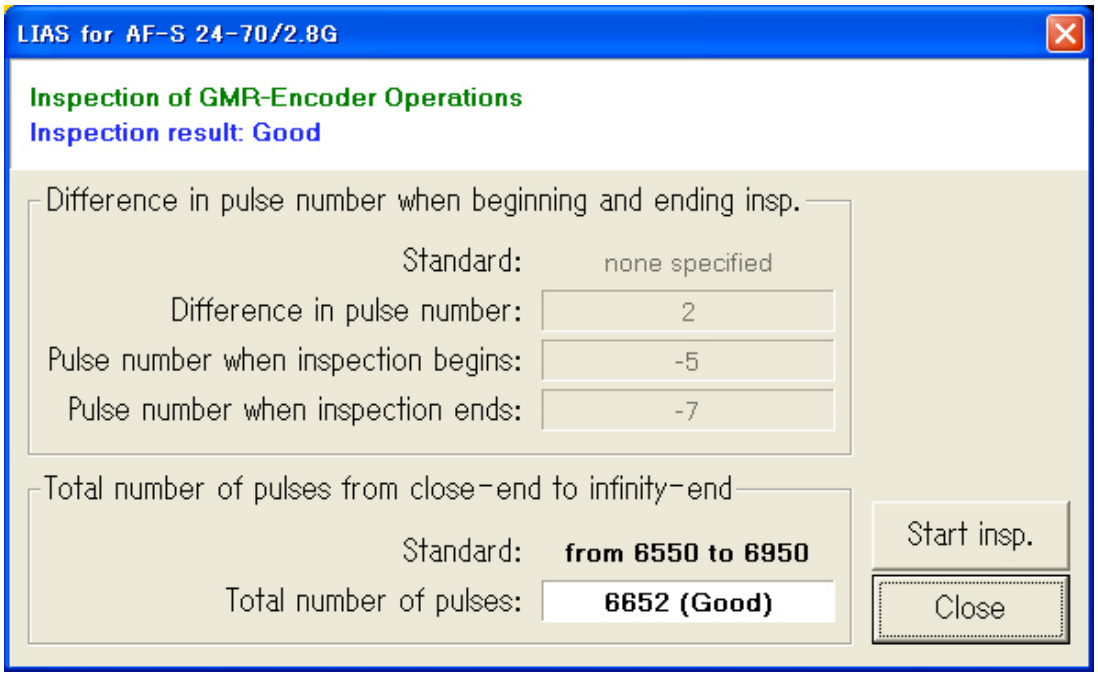
・Follow the instructions on the screen for preparation. Then click "Next".



・ Click "Start insp." button .

Caution : If the MF ring is rotated while the lens scanning is driven, the pulse shows an abnormal value. Do NOT touch the MF ring during operations.

・ If "Inspection result" shows "Good", click "Close" button.



< Standard > Total pulses : 6750 ± 200 PULSE(S)

(2) Inspection screen of lens driving stop accuracy

● Make inspections by focal length 24mm (W) or 70m (T) at the following five lens positions.

(Lens position in inspecting)
Horizontal lens position
Index 90° angle rightward (from horizontal position)
Index 90° angle leftward (ditto)
Front lens group 90° angle upward (ditto)
Front lens group 90° angle downward (ditto)

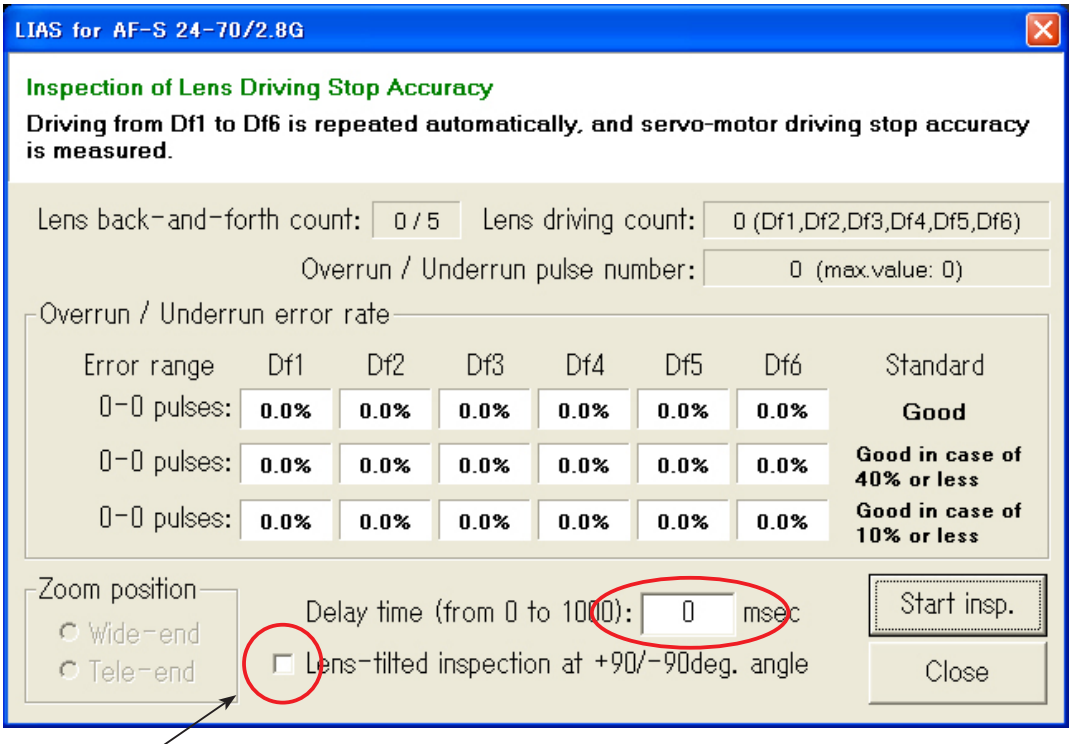
・Click "Inspection of Lens Driving Stop Accuracy" on the menu.

・Click "Start insp." button .

Caution: If the MF ring is rotated while the lens scanning is driven, the pulse shows an abnormal value. Do NOT touch the MF ring during operations.

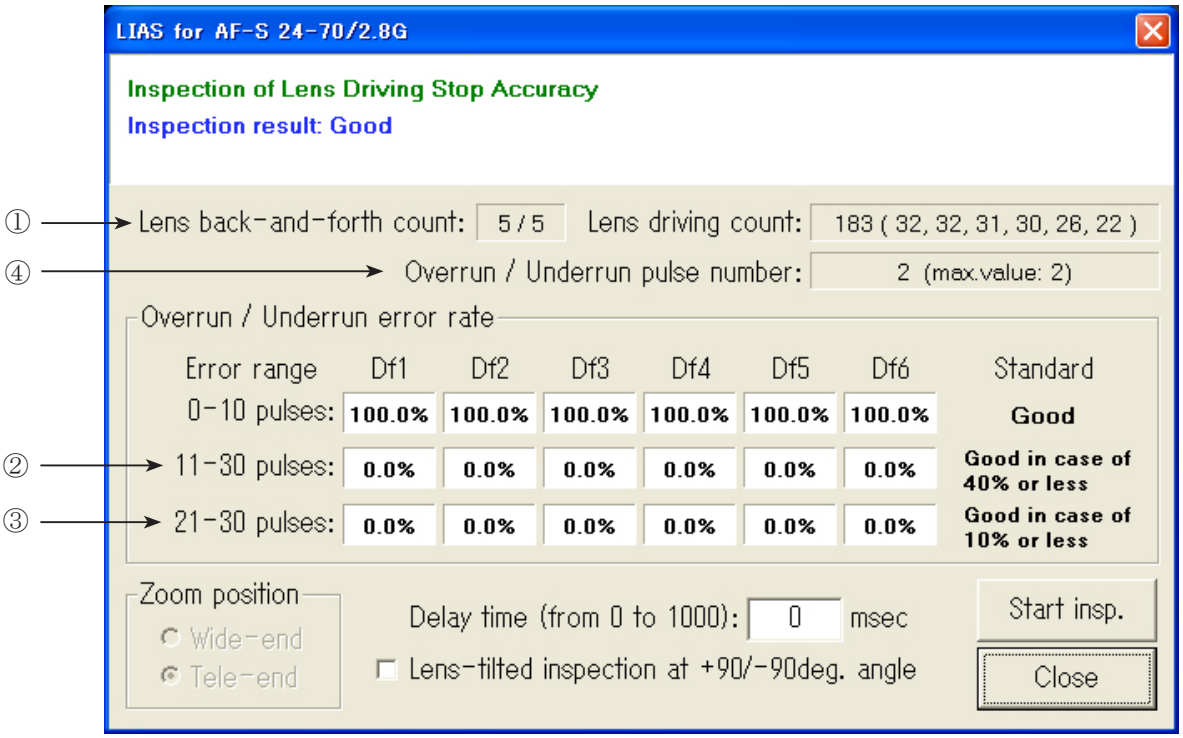
・If the lens stops in "Inspection of Lens Driving Stop Accuracy", input a numeric number into "Delay time (from 0 to 1000 msec.) so that the lens does NOT stop.

Caution: The value of "ADUST DELAY-TIME" is set by the adjustment software. So, as far as the lens does not stop during the inspection of "LENS DRIVING STOP ACCURACY", any value can be input without problem.
However, the larger the value of "ADJUST DELAY-TIME" gets, the longer the inspection time becomes.



Tick here except when the lens is positioned horizontally.

・When the inspection ends, the result will be indicated. If "Inspection result" shows "Good", click "Close" button.



The number of overrun/underrun pulses must be within the standards after the lens back-and forth driving 5-motion ("1/1TIME (S)." in ① of the display).

Standard 40% or less for Df1~Df6 ② of the screen

Lens position (horizontal): 11 - 30 pulse occurrence ratio
Lens position (others): 11 - 30 pulse occurrence ratio

10% or less for Df1~Df6 ③ of the screen

Lens position (horizontal): 21 - 30 pulse occurrence ratio
Lens position (others): 21 - 30 pulse occurrence ratio

Lens position (horizontal): 31 pulses or more ④ of the screen
Lens position (others): 31 pulses or more
(Only one occurrence is judged as defective.)

※ "Df1~Df6" shows the lens driving amount.

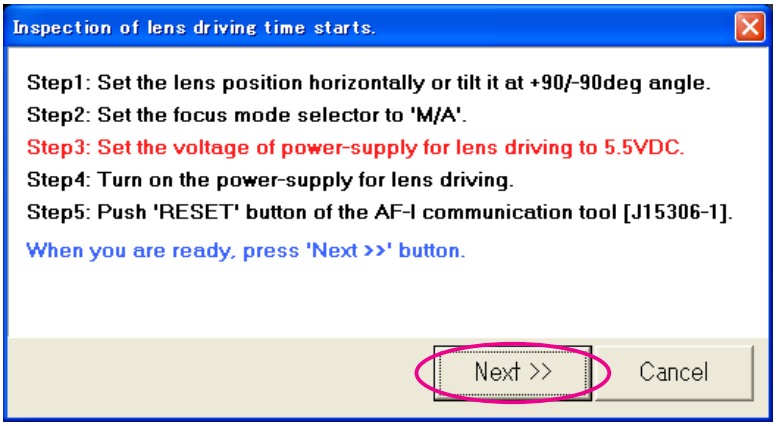
(3) Inspection screen of lens driving time

● Make inspections by focal length 24mm (W) or 70m (T) at the following five lens positions.

(Lens position in inspecting)
Horizontal lens position
Index 90° angle rightward (from horizontal position)
Index 90° angle leftward (ditto)
Front lens group 90° angle upward (ditto)
Front lens group 90° angle downward (ditto)

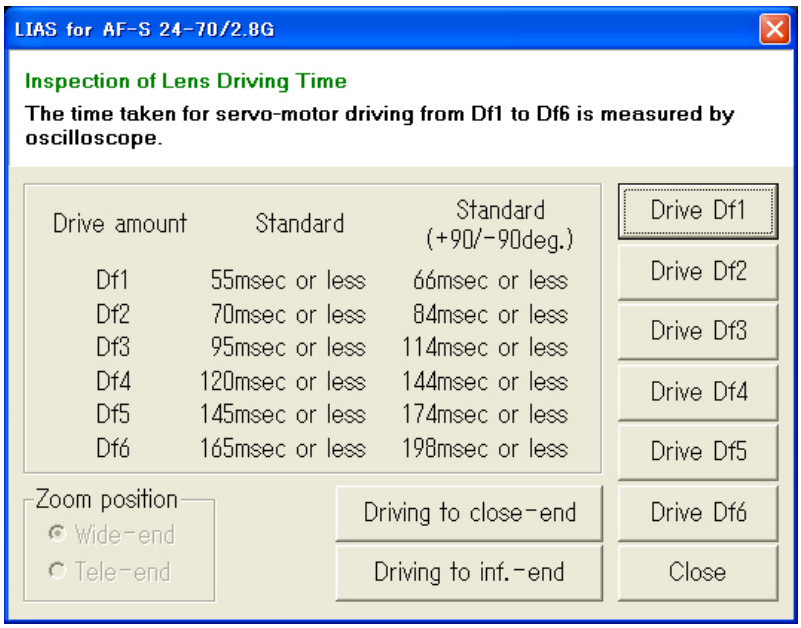
・Click "Inspection of Lens Driving Time" on the menu.

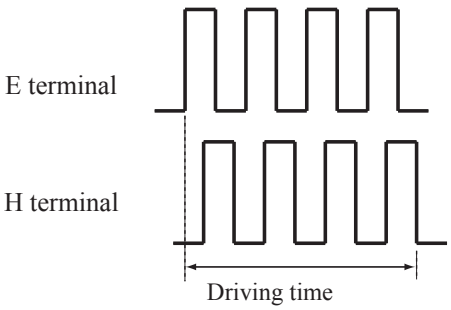
・Follow the instructions on the screen for preparation. Then click "Next".



・ Select the driving amount respectively. Each lens driving time must be within the standard.

Caution: If the MF ring is rotated during inspections, the waveform shows an abnormal value. Do NOT touch the MF ring during inspections.





●Oscilloscope setting

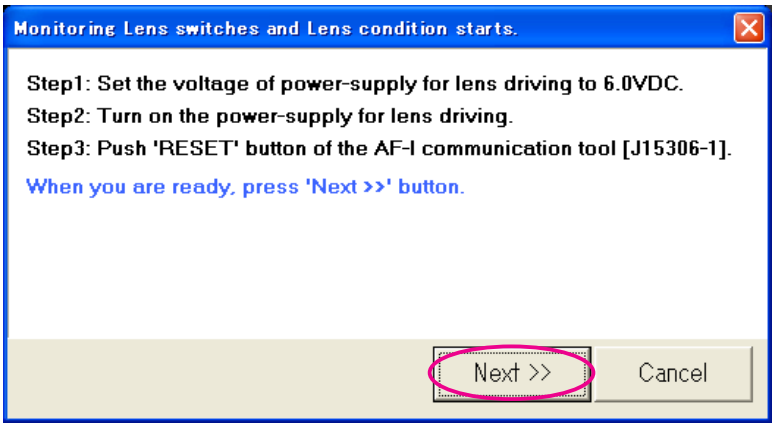
V/Div	: 5V
Coupling	: DC
Time/Div	: 20m Sec
Trigger Mode	: SGL (S)
Trigger Coupling	: DC
Trigger Source	: CH1

※ There are two types in shape of waveforms of E and H terminals:
Waveform (1) starts and goes up (2) starts and goes down.

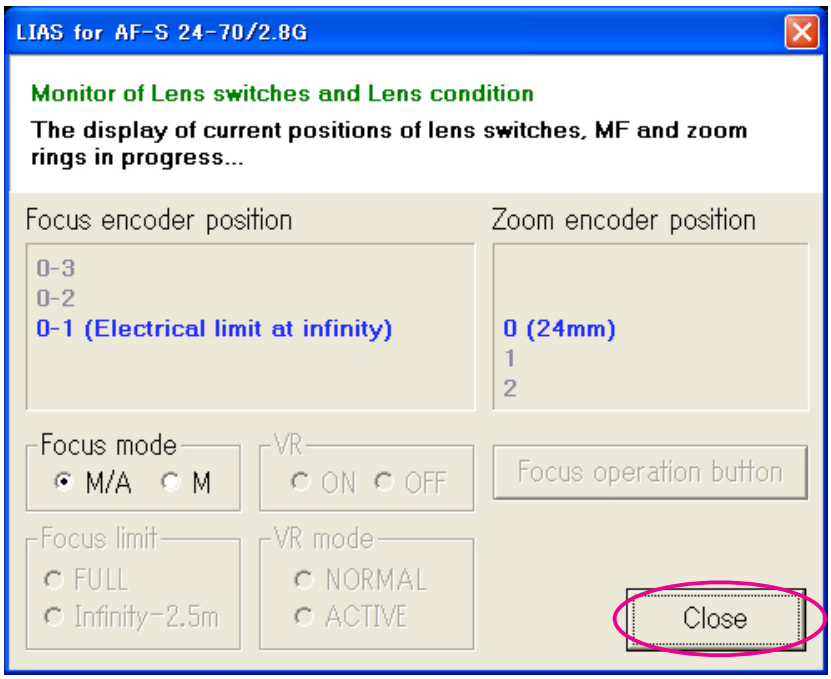
(4) Inspection of Switches and Lens conditions

・Select "Inspection of Lens switches and Lens condition" on the menu.

・Follow the instructions on the screen for preparation. Then click "Next".



・ If "Inspection result" shows "Good", click "Close" button.

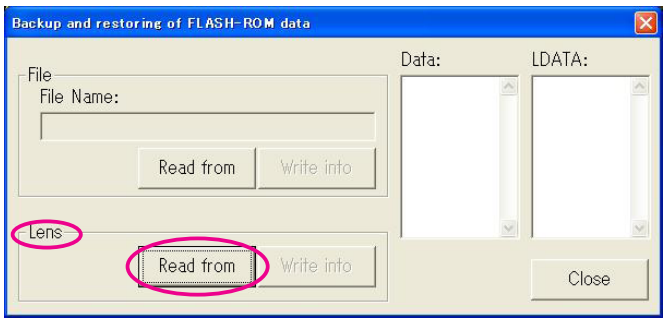


(5) Backup / Restoring of FLASH-ROM

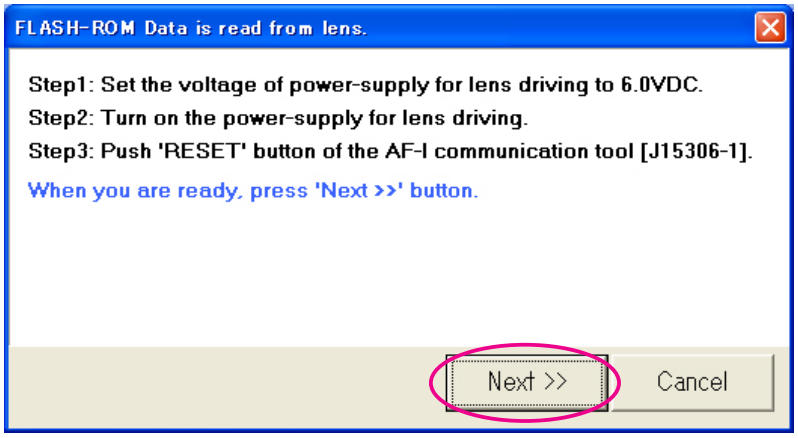
How to back up FLASH-ROM data

・Click "Backup / Restoring of EEP-ROM Data" button.

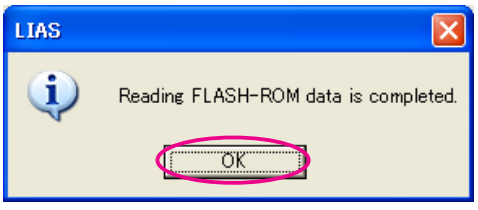
・Click ["Read from" Lens] button.



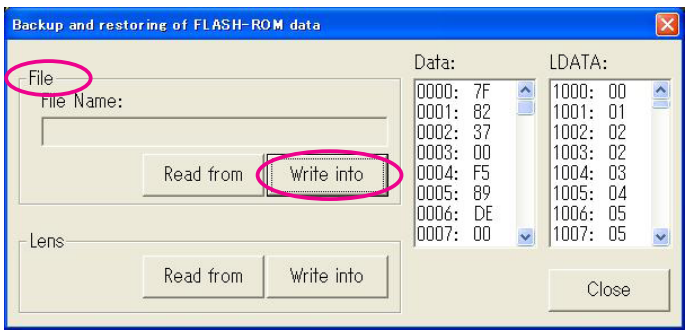
・Follow the instructions on the screen for preparation. Then click "Next".



・When reading FLASH-ROM data is completed, click "OK" button.

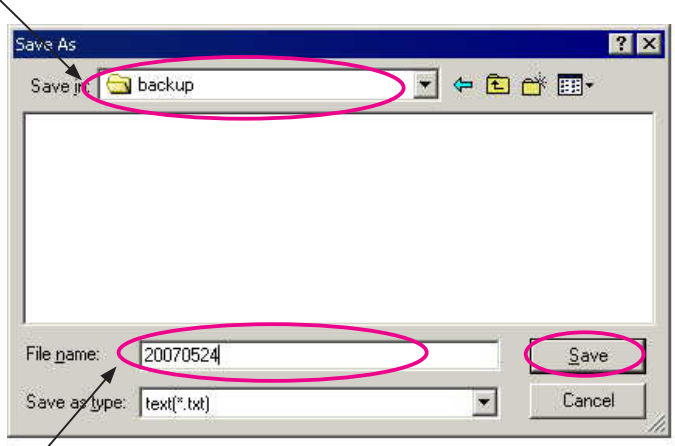


・Click ["Write into" File] button.



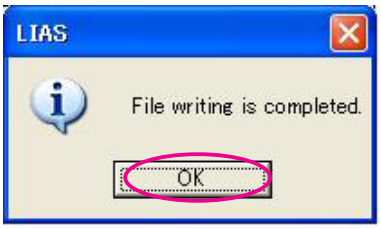
・Type the file name in any folder, and click "Save" button.

e.g.

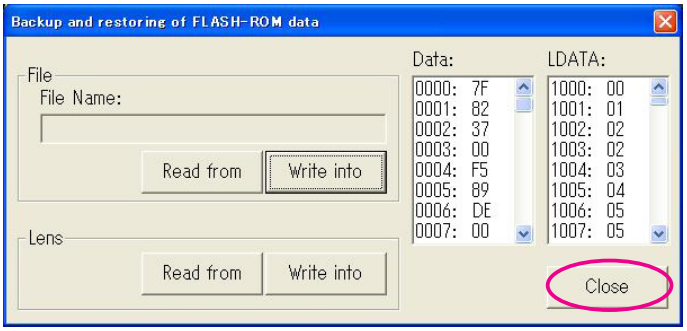


File name

・Click "OK" button.



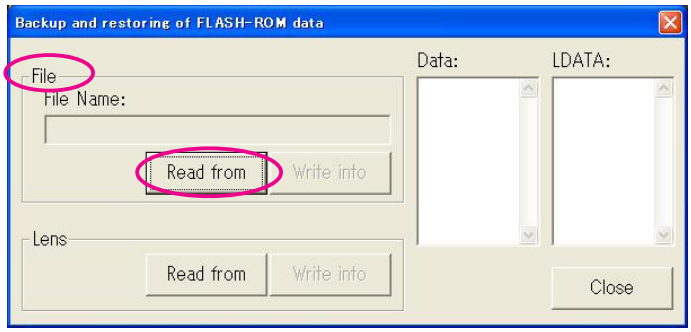
・Click "Close" button to end.



How to Restore FLASH-ROM data

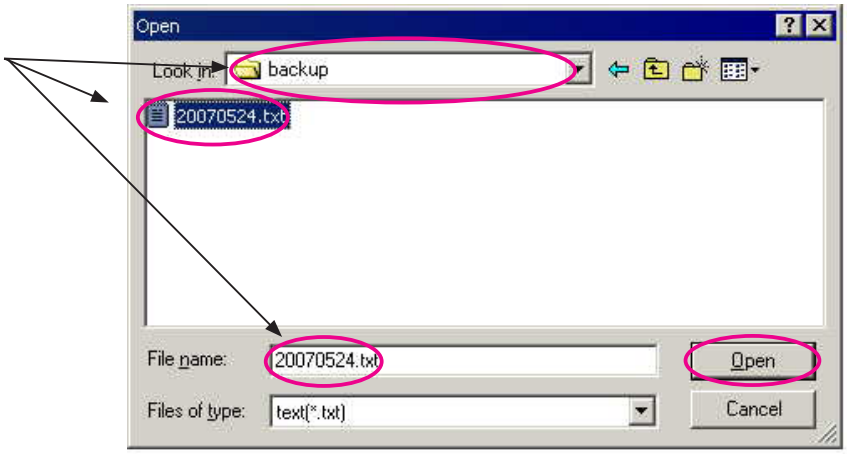
・Click "Backup / Restoring of FLASH-ROM Data" button.

・Click ["Read from" File] button.

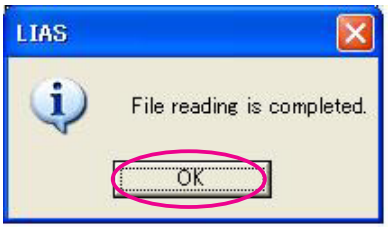


・Select the file name in the folder that was saved as backup, and click "Open" button.

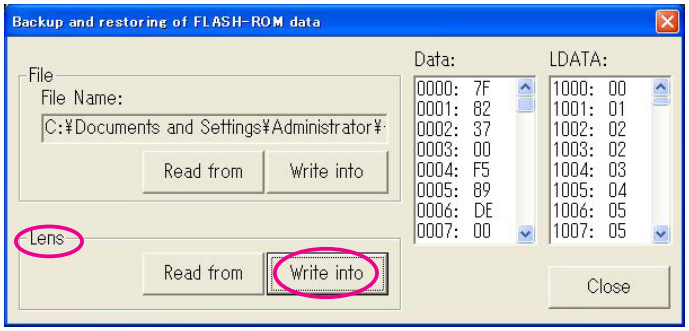
e.g.



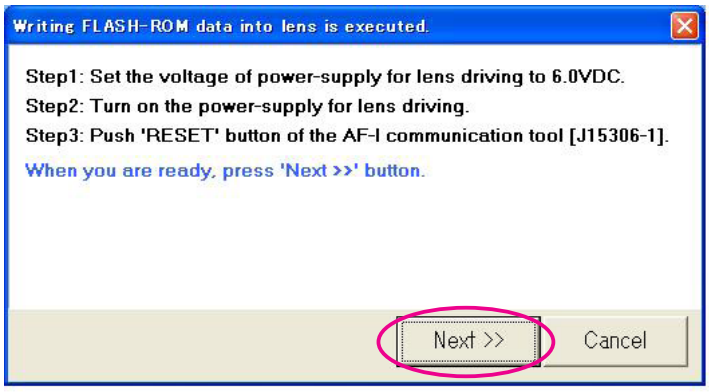
・When reading FLASH-ROM data is completed, click "OK" button.



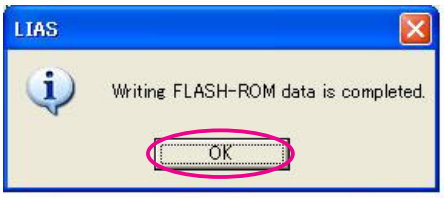
・Click ["Write into" Lens] button.



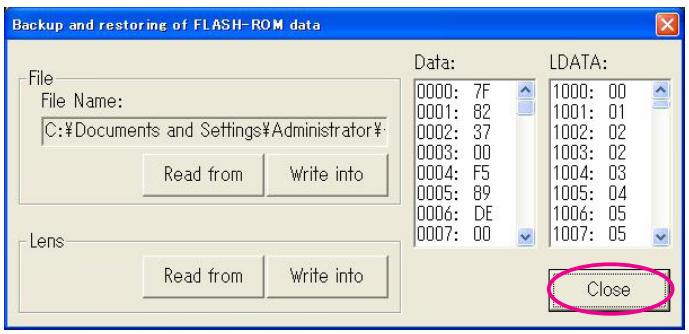
・Follow the instructions on the screen for preparation. Then click "Next".



・Click "OK" button.



・Click "Close" button.



Necessary adjustment when replacing parts

Adjustments / Parts to be replaced	Adjustment for electrical device	Lens alignment (incl. aberration compensation inspection)
Main PCB unit	○	○ (Aberration compensation inspection only)
SWM unit	○	
GMR sensor	○	
Focus turning-tube unit	○	
1-1 lens group unit		○
1-2 lens group unit		○
3rd lens group unit		○
4th lens group unit		○
1st lens-G lead ring		○
helicoid tube unit		○

Aberration compensation data writing adjustment

- This adjustment uses the software which calculates the aberration compensation data according to the feature of lens aberration and writes in FLASH-ROM of the lens, in order to improve the accuracy of autofocus.

Note: This adjustment is necessary when the main PCB and/or each lens part (glass, lens chamber) is replaced and/or when each lens part is disassembled. Be sure to make this adjustment after completing inspecting and adjusting the main PCB.

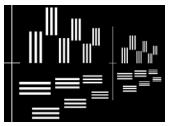
(1) Preparation

- Test chart (Self-made tool: ref. Procedure for how to create it.)
- Tripod
- Camera（D100 or D200）
- Personal computer
- USB cable（UC-E4）
- Adjustment software (LWM.exe：used for the lens optical alignment.)

(2) Procedure for how to create Test chart

- Photocopy the next page and cut out 1 target chart and 5 resolution charts.

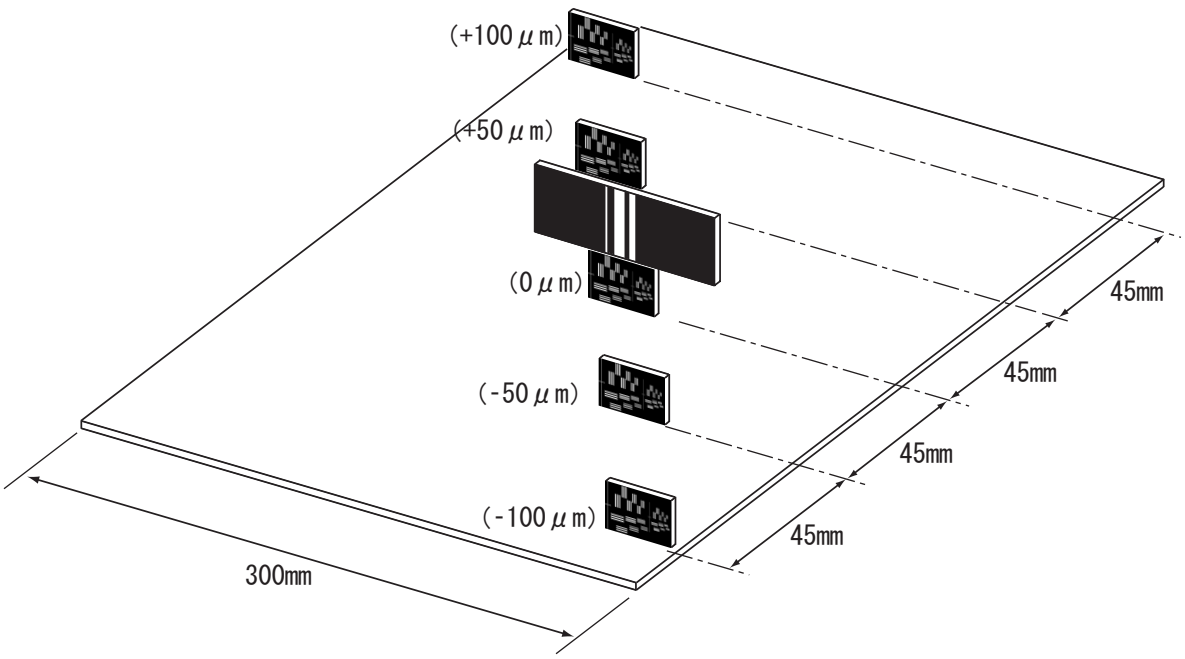
(Target chart)



(Resolution chart)

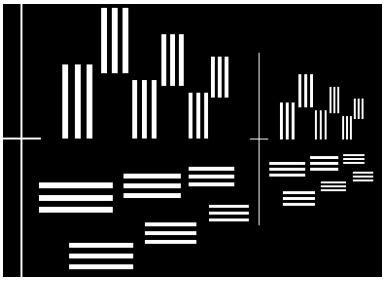
- As shown below, put each chart in position at the specified spacings.

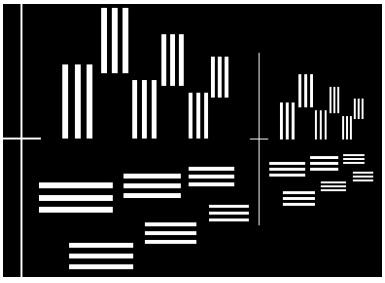
Note: Only in the center, put the target chart on the central resolution chart.

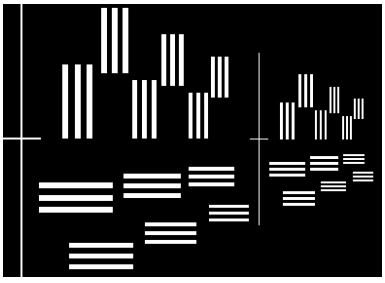


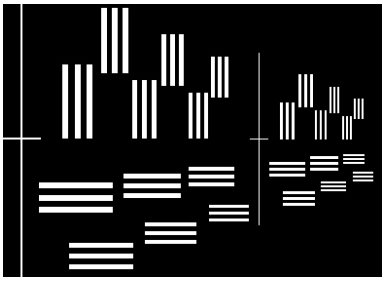
(Target chart)

(Resolution chart)





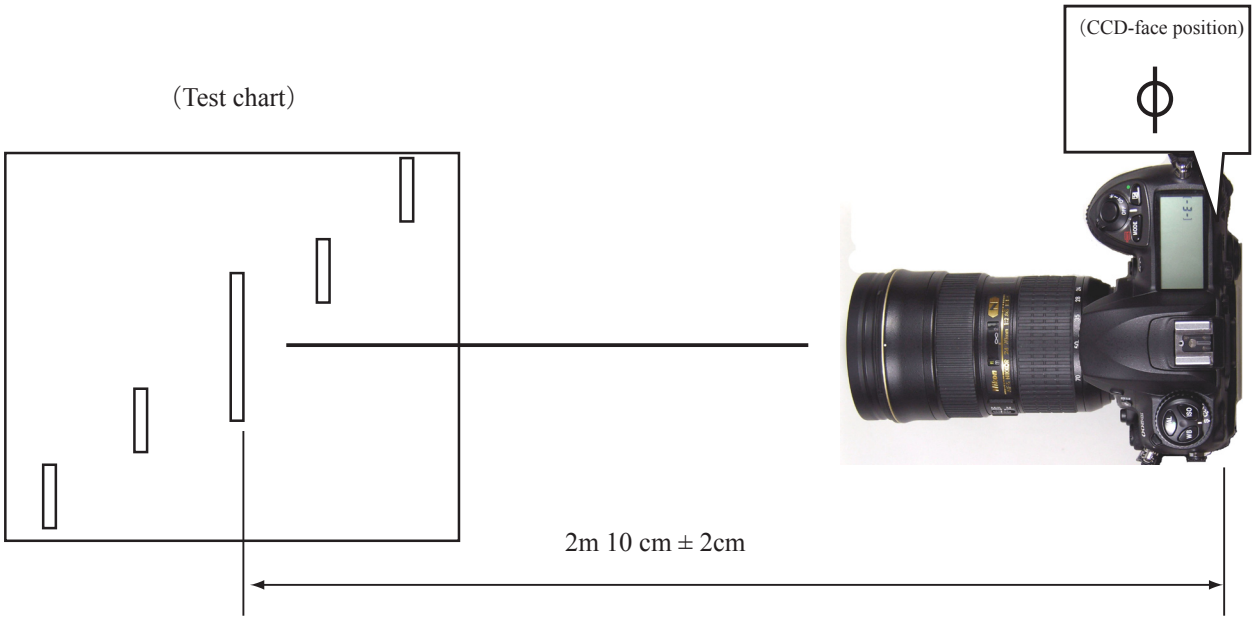




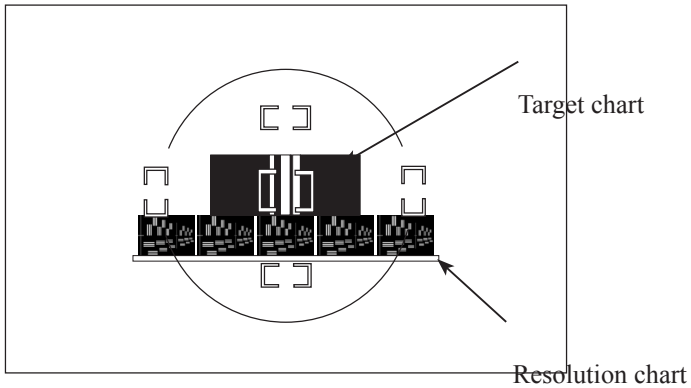
(3) Writing aberration compensation data

① Prepare a camera. Set the "Exposure mode" to "A", the aperture to "Full", and "Focus mode" to "S". On the shooting menu, set the "Image quality mode" to "FINE", "Image size" to"L", **"WB" to "Preset",** and "ISO" to "200".

② Set up the camera, in which the lens to be inspected is fit, on the tripod. Then, set the focal length of the lens to 70mm and also set the distance between the test chart and camera (CCD face) to 2m 10cm **±2 cm.**



③ As shown below, fit the target chart with the center of the focus area in viewfinder.

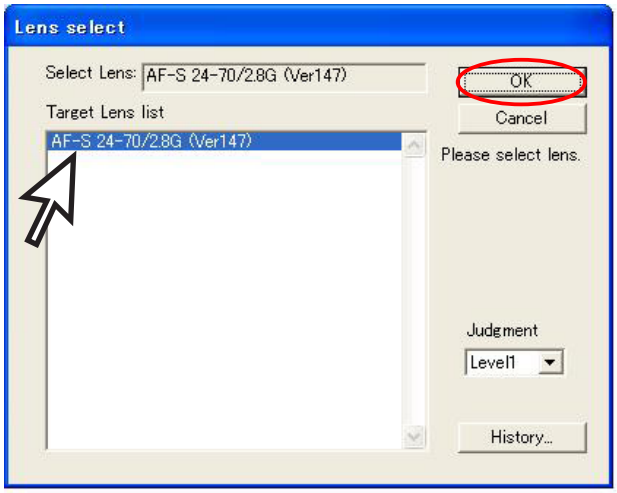


(In viewfinder)

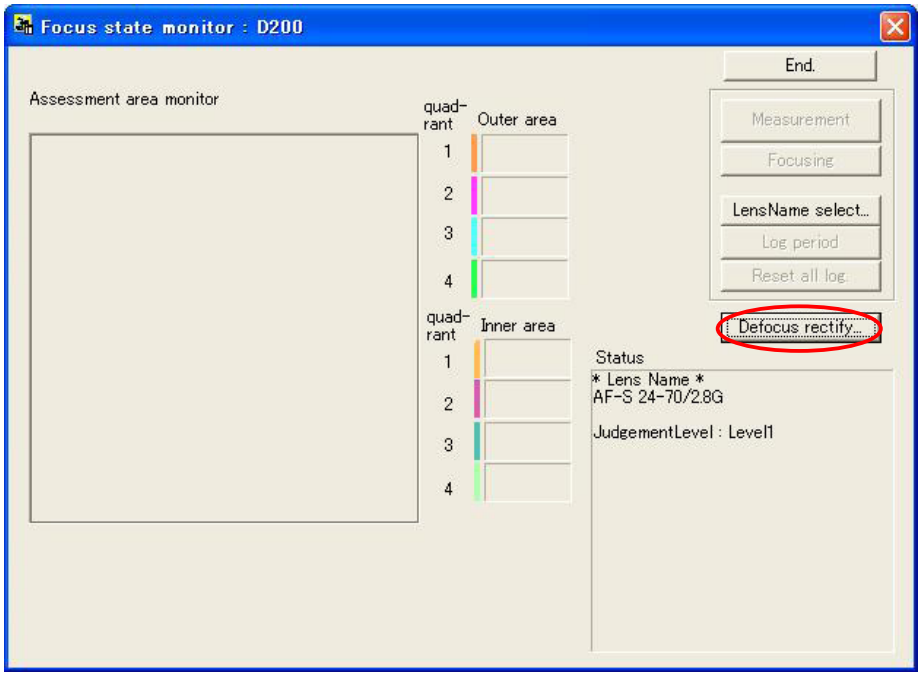
④ Connect the PC and camera via USB cable. (Camera setting: Mass storage)

⑤ Start the adjustment software (LWM.exe).

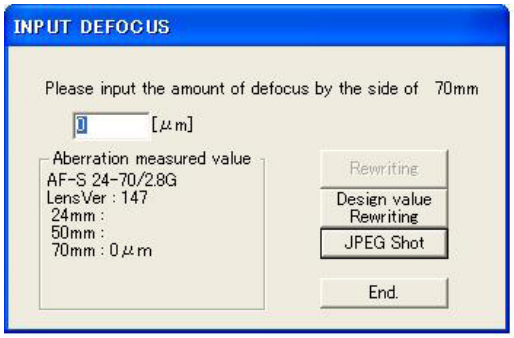
⑥ Confirm that "AF-S ~~14~~ 24-70/2.8G" is selected on "Lens select" screen. Click "OK". △ (Revision)



⑦ Click the "Defocus rectify..." .

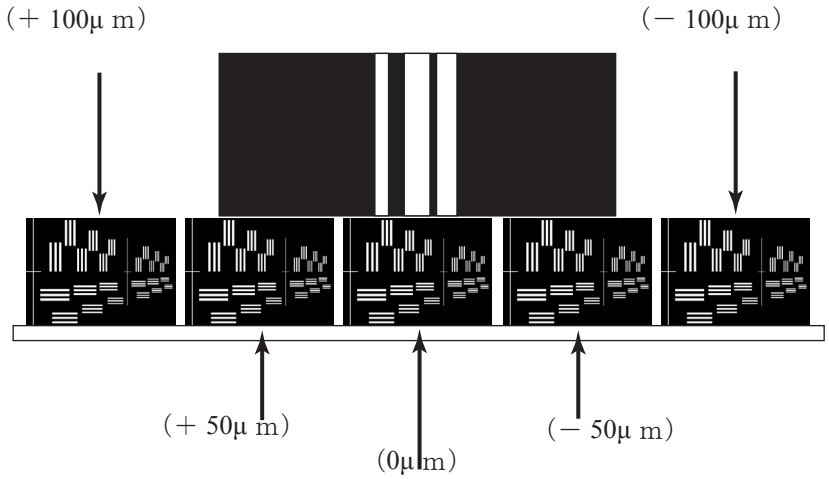


⑧ Click the "JPEG Shot".



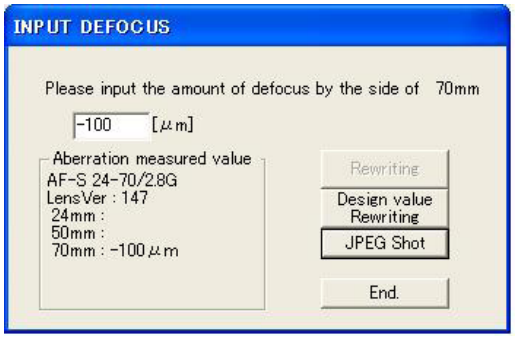
⑨ The shutter is released after the AF operation. The shot image is automatically displayed on the PC screen.

Scale the image to 100% and check which chart is in focus of the 5 resolution charts.



⑩ Input the value of the focused position into the entry field.

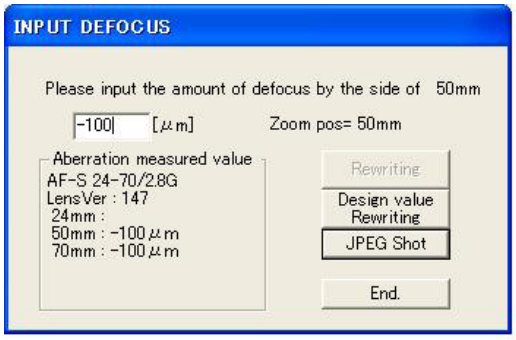
e.g.) Focus position is "-100μm" toward the front-focus side.



⑪ Set the focal length of the lens (to be inspected) to "50 mm", and also set the distance between the test chart and camera (CCD face) to 1m 50cm ± 2cm.

Caution: Confirm that the aperture is fully open.

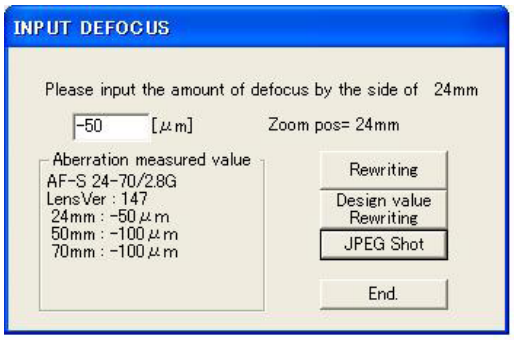
⑫ Perform the operations from ⑧ to ⑩ on the previous page.



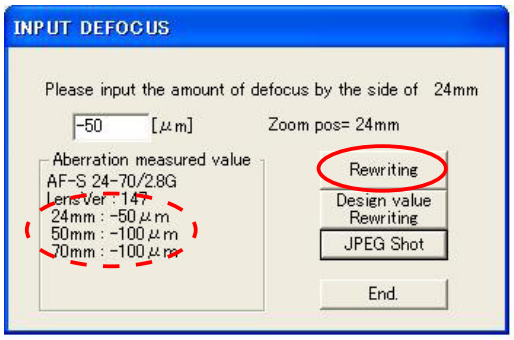
⑬ Set the focal length of the lens (to be inspected) to "24mm", and also set the distance between the test chart and camera (CCD face) to 72cm ± 2cm.

Caution: Confirm that the aperture is fully open.

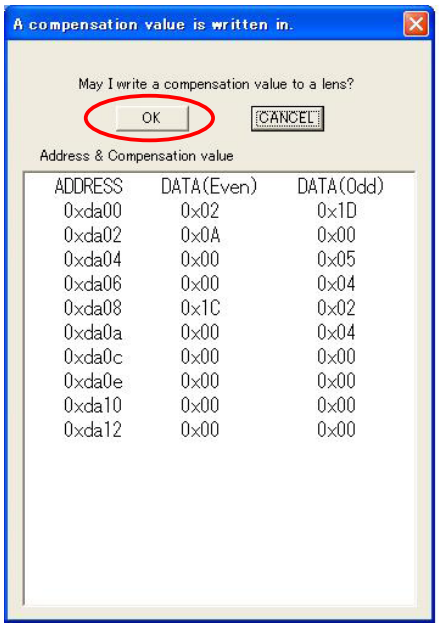
⑭ Perform the operations from ⑧ to ⑩ on the previous page.



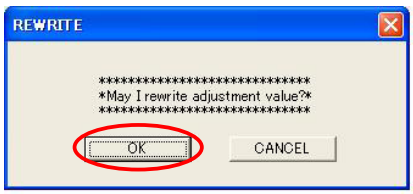
⑮ Confirm that all the values of focal lengths are indicated in a red dotted circle, and click "Rewriting".



⑯ When the following screen appears, click "OK".

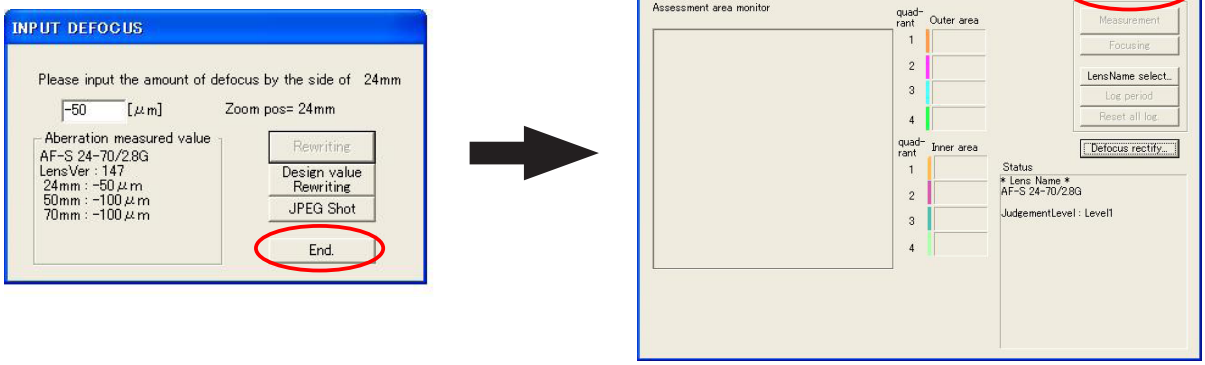


⑰ The reconfirmation screen is displayed. Click "OK".



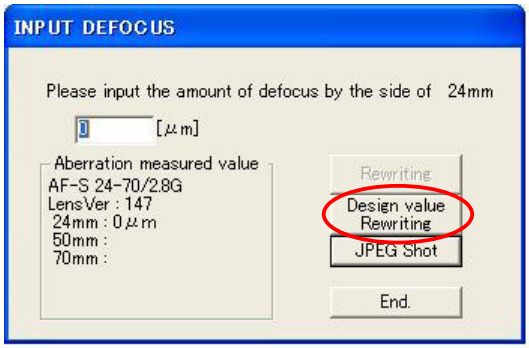
⑱ When the rewriting ends and the following screen appears, click "OK".

⑲ Click "END" twice to complete the adjustment software.



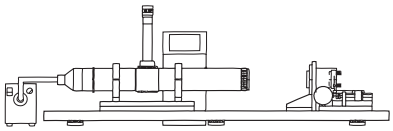
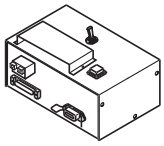
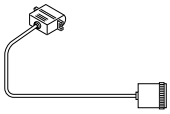
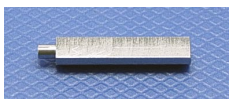
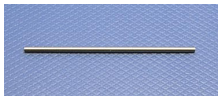
Note: Unless the camera is turned off once, the value that was written in FLASH-ROM is not reflected.

⑳ Check whether an object is in focus by actually taking pictures. If it is out of focus, make the readjustment. If this phenomenon does not improve even after repeating the procedure, some abnormal value may have been written in the FLASH-ROM. In this case, therefore, click "Design value Rewriting" and input the initial value, and then make the adjustment.



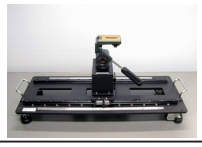
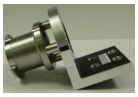
工具編 TOOLS

★：NEW TOOL

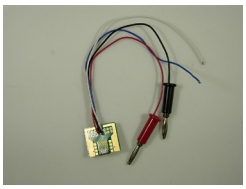
	RJ 番号 RJ No.	名称 NAME OF TOOL	備考 OTHERS
★	J15430 	横型焦点面検査器 AT-500H BACK FOCUS COLLIMATER	
	J9001-5N-1 	安定化電源５Ａ DC REGULATED POWER SUPPLY 5A	
	J15306-1 	ＡＦ－Ｉ通信ボックス AF-I LENS COMMUNICATION BOX(CE)	
	J15307 	ＡＦ－Ｉ通信アダプター COMMUNICATION ADAPTER FOR AF-I	
	J18004-1 	Ｊ１８００４用基準ゲージ STANDARD GAUGE FOR J18004	
★	J18427 	AF-S 24-70 点検・調整ソフト ADJ.FD FOR AF-S 24-70 (IBM 3.5)	
★	J18438 	AFS 24-70 調芯装置用調整ソフト（ＬWM） ADJ.FD (LWM)FOR 24-70 ALIGNMENT	
★	J11346 	AF-S 24-70/2.8G 3 群回螺器 WRENCH FOR 3G AF-S 24-70/2.8G	
★	J11347 	AF-S 24-70/2.8G 無限位置出しピン INFINITY POSITIONING PIN FOR AF-S 24-70/2.8G	
★	J11348 	AF-S 24-70/2.8G G1 位置決めピン G1 POSITIONING PIN FOR AF-S 24-70/2.8G	2 本必要 Two pins required. △（追加 /Addition）
★	J11349 	AF-S 24-70/2.8G 4 群ガイドピン 4G LENS GUIDE PIN FOR AF-S 24-70/2.8G	２本必要 Two pins required. △（追加 /Addition）
	工具設定なし RJNo.is not available 	鉛フリーはんだコテ LEAD FREE SOLDERING IRON	

サービス 計画課 M

★：NEW TOOL

	RJ 番号 RJ No.	名称 NAME OF TOOL	備考 OTHERS
	J5400 	鉛フリー糸はんだ RMA02(M705) 0.5MMX500G ECO SOLDER RMA02(M705) 0.5MMX500G	
★	J*****	調芯装置用チャート LENS ALIGNMENT CHART	
	J19128A 	ライトビューワー（J19128 用） LIGHT VIEWER (J19128)	
	J19129 	調芯装置用スライドレール LENZ ALIGNMENT EQUIP.SLIDE RAIL	
★	J19127S 	AF-S 24-70G 用ホルダー ATTACHMENT FOR HOLDER AF-S 24-70G	
	DL-1640 	オシロスコープ　ＤＬ－１６４０ OSCILLOSCOP　DL-1640	
	EM-60L	グリース　ＥＭ－６０Ｌ GREASE EM-60L	
	GN-20S	グリース　ＧＮ－２０Ｓ（ＳＱ用） GREASE GN-20S（SQ）	
	L-241	ロックタイト＃２４１（青） LOCTITE #241 (50ml)	
	NKS-211SP	接点潤滑剤 ＮＫＳ－２１１ＳＰ POINT OF CONTACT LUBRICANT NKS-211SP	FOR AF-S 18-135
	I-40	ＡＦレンズ用グリース（I-40） GREASE FOR AF LENS	
	EDB0011	ネジ゛ロック（赤）1401C SCREW LOCK 1401C	
	OS-30MEL	ドライサーフ　ＯＳ－３０ＭＥＬ DRY SERF OS-30MEL(OIL BARRIER)	

★：NEW TOOL

RJ 番号 RJ No.	名称 NAME OF TOOL	備考 OTHERS
MZ-800SEL	ドライサーフ　ＭＺ－８００ＳＥＬ DRY SURF MZ-800SEL	
GP-1RS	グリース　ＧＰ－１ＲＳ GREASE GP-1RS	FOR AF-S 18-135
M300S	ザヴィーナ ミニマックス SAVINA MINI MAX	
J11341 	ＧＭＲ出力点検工具 GMR output inspection tool	FOR AF-S 18-135