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 DX Zoom Nikkor 18-135/3.5-5.6G ED

JAA79651 (MADE IN THAILAND)

REPAIR MANUAL

Nikon | NIKON CORPORATION
Tokyo, Japan

Printed in Japan August 2006

Specifications

Type of lens:	G-type AF-S DX Zoom-Nikkor lens with built-in CPU and Nikon bayonet mount (Specially designed for use with Nikon digital SLR – Nikon DX format cameras)
Focal length:	18mm – 135mm
Maximum aperture:	f/3.5 - 5.6
Lens construction:	15 elements in 13 groups (1 ED and 2 aspherical lens elements)
Picture angle:	76° – 12°
Focal length scale:	18, 24, 35, 50, 70, 105, 135mm
Distance information:	Output to camera body
Zoom control:	Manually via separate zoom ring
Focusing:	Nikon Internal Focusing (IF) system (utilizing an internal Silent Wave Motor); manually via separate focus ring
Closest focus distance:	0.45m (1.5 ft.) at all zoom settings
No. of diaphragm blades:	7 pcs. (rounded)
Diaphragm:	Fully automatic
Aperture range:	f/3.5 to f/22 (at 18mm), f/5.6 to f/38 (at 135mm)
Exposure measurement:	Via full-aperture method
Attachment size:	67mm (P = 0.75mm)
Dimensions:	Approx. 73.5mm dia. x 86.5mm extension from the camera's lens-mount flange
Weight:	Approx. 385g (13.6 oz)

Specifications and designs are subject to change without any notice or obligation on the part of the manufacturer.

※ Before Disassembly / (Re)assembly / Adjustment

For this lens, when the 5th lens group housing unit is removed, the lens-aligning work becomes necessary after reassembling.
Therefore, at service facilities where this alignment work cannot be performed, do NOT remove the 5th lens group housing unit.

Caution:

① When disassembling, make sure to memorize the processing state of wires, screws to be fixed and their types, etc.

② Because prototypes are used for "Disassembly/(Re)assembly/Adjustment", they may differ from the actual products in forms, etc.

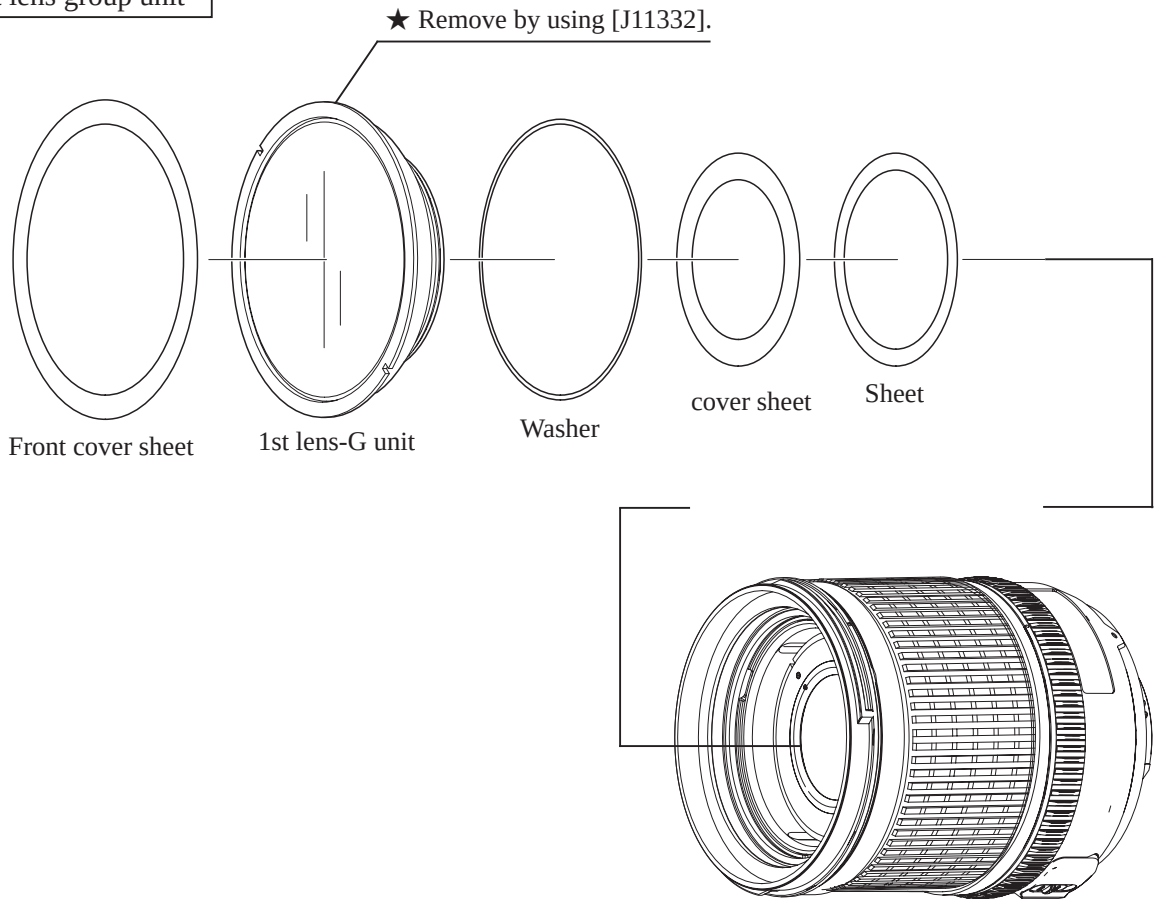
③ Because pictures are processed by a special method, they may differ from the actual ones in texture.

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.

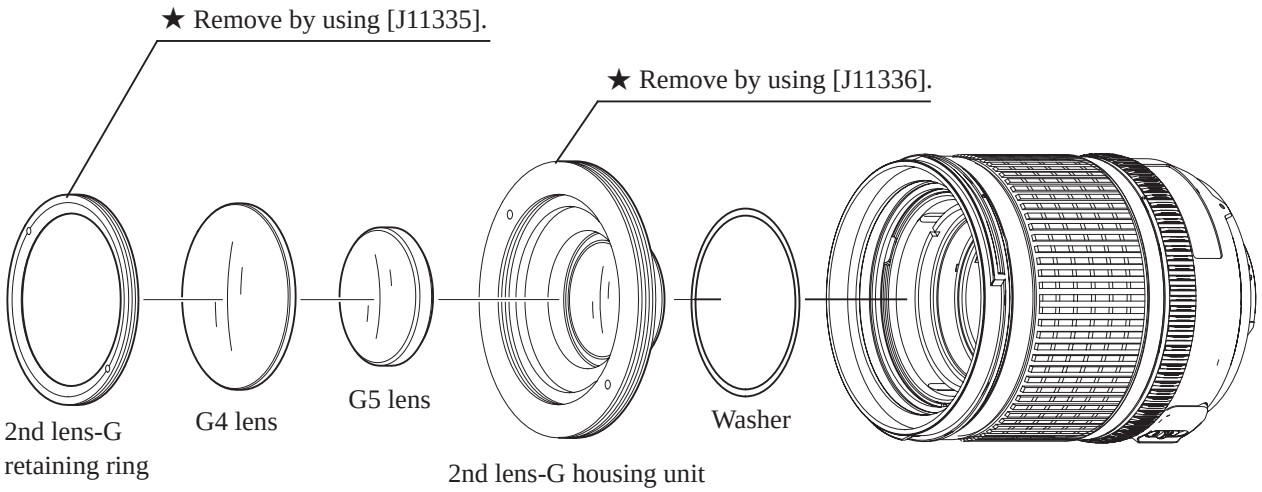
1. Disassembly

★ New tool

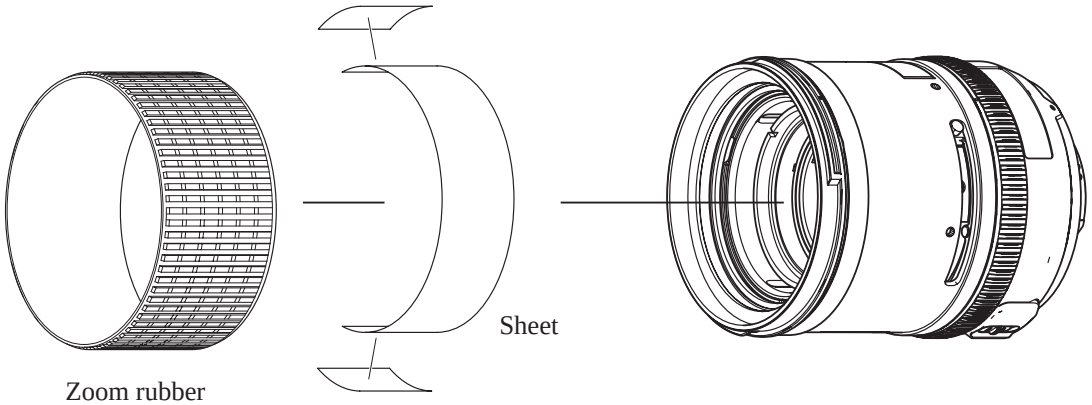
1st lens group unit



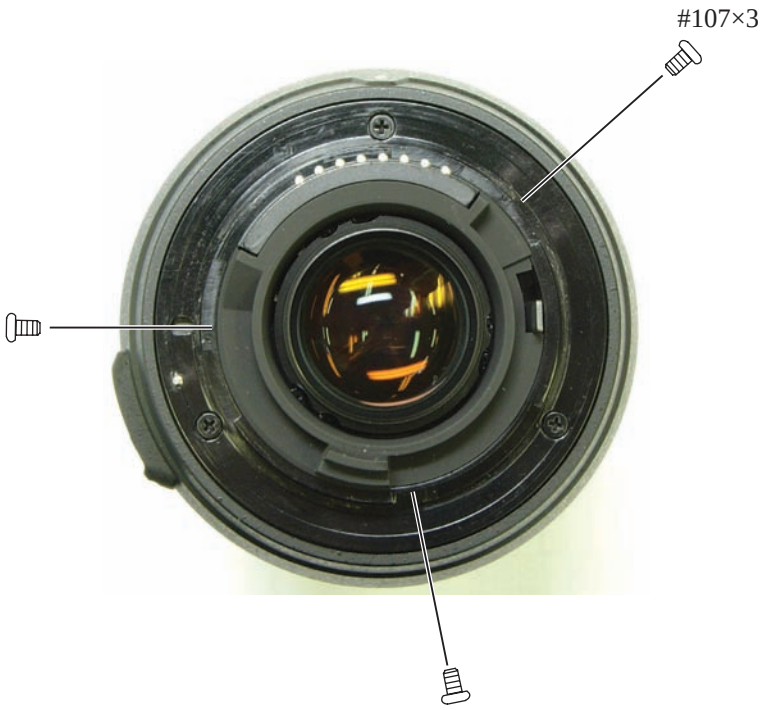
2nd lens group housing unit



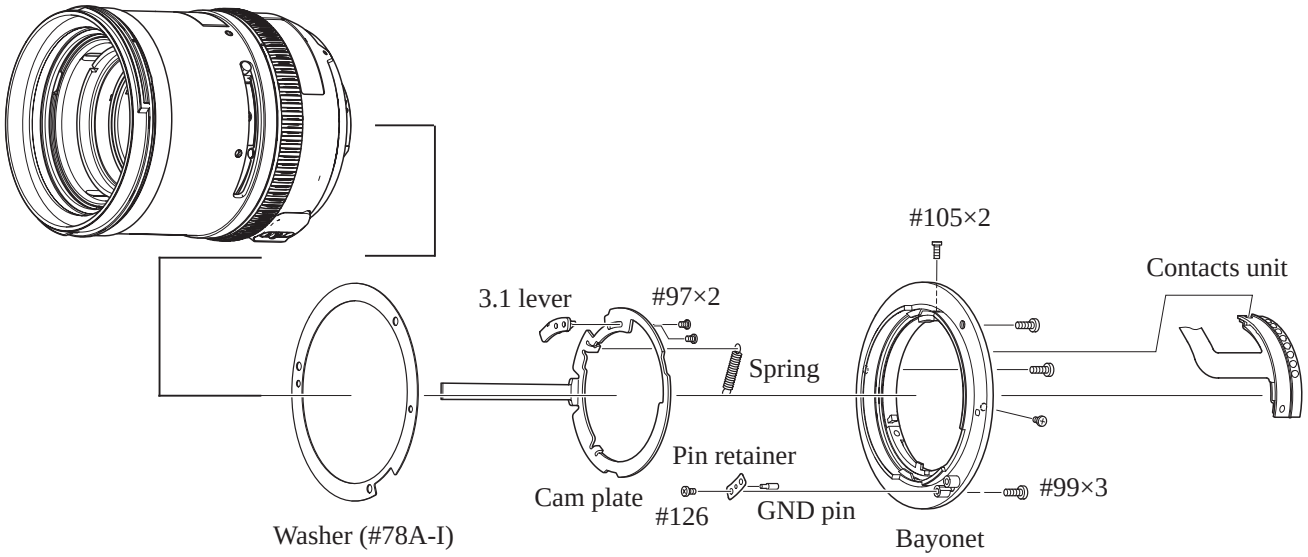
Zoom rubber



Rear cover ring



Bayonet



Outer fixed tube unit

・Lift the outer fixe tube unit up slowly.
・Unsolder three wires.

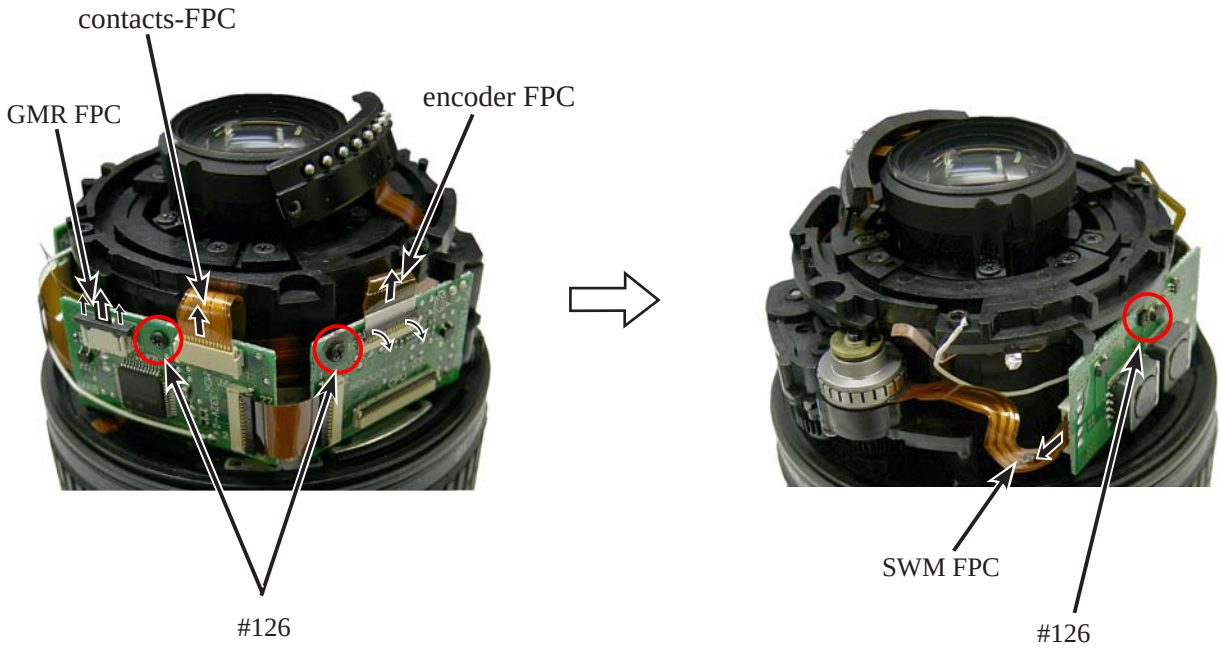
Focus ring

・ Remove the focus ring.

Main PCB unit

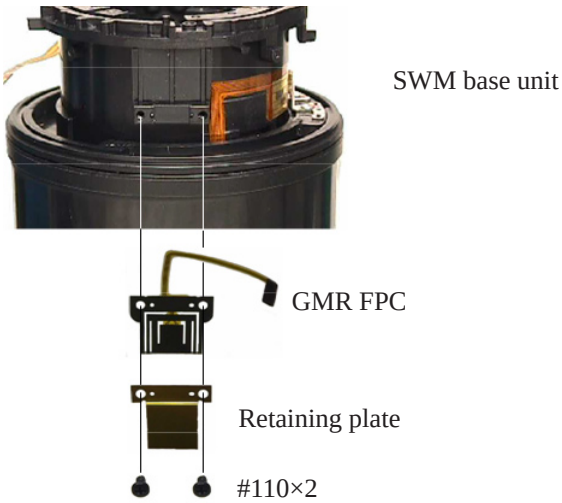
Caution : The main PCB consists of three boards which are combined based on electric properties.
Therefore, each PCB cannot be replaced as a single part.

・ Disconnect the GMR-FPC, contacts-FPC, encoder FPC and SWM-FPC from each connector.
・ Take out three screws (#126).



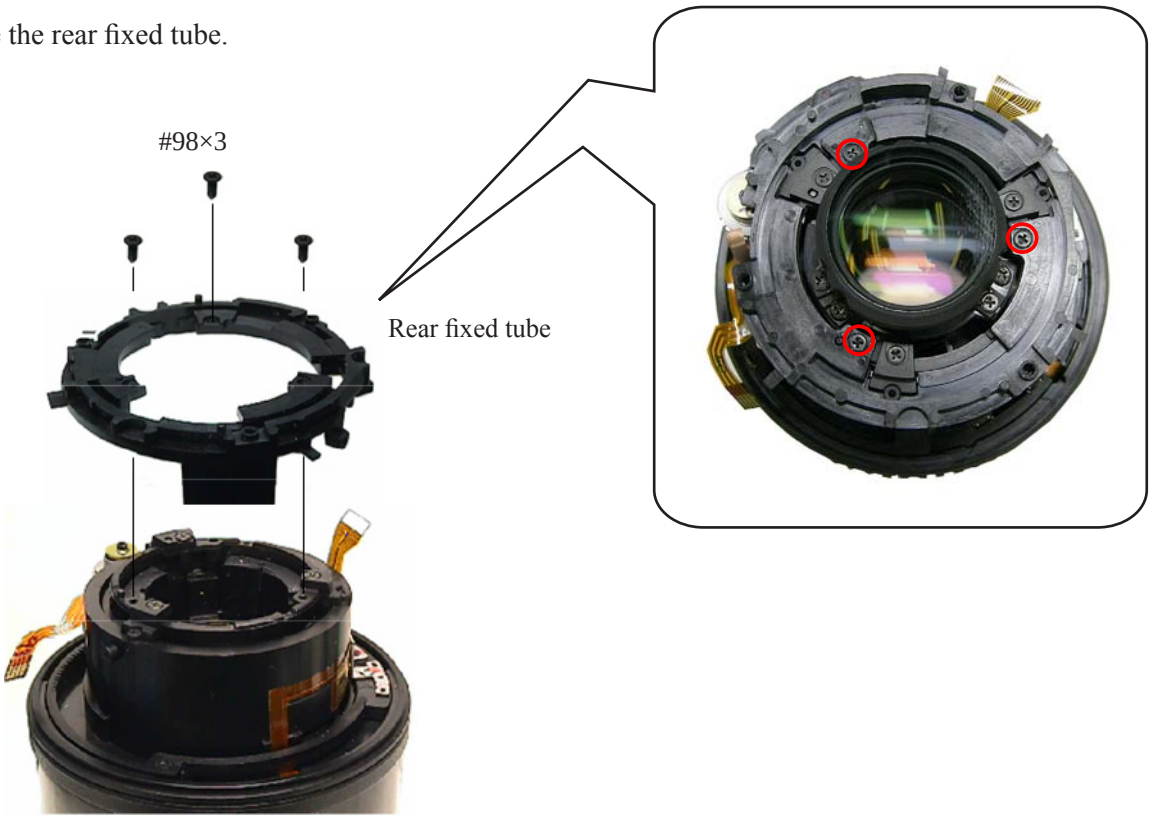
Contacts unit

GMR



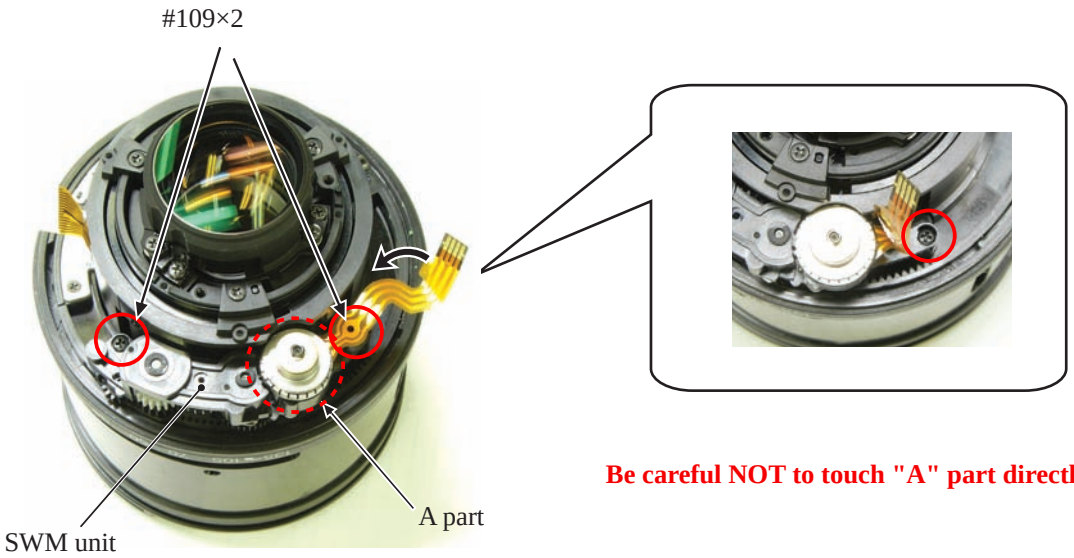
Rear fixed tube

- Take out three screws (#98).
- Remove the rear fixed tube.



SWM area

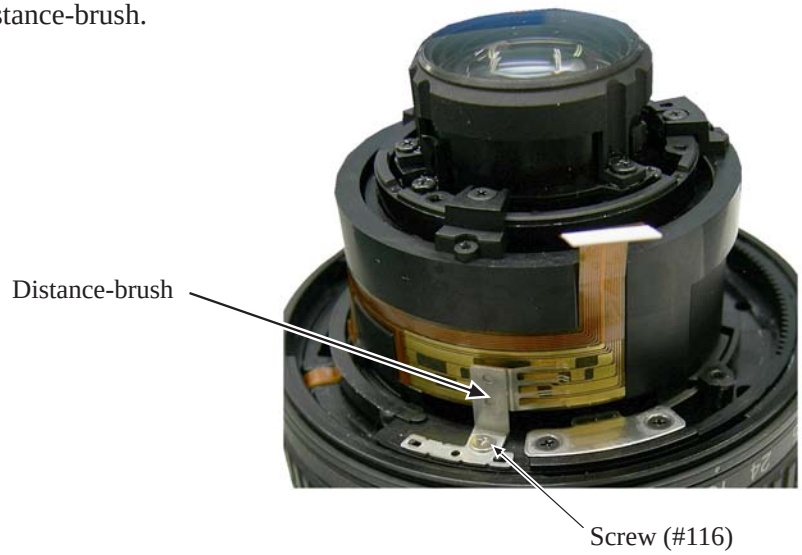
- Take out two screws (#109).



Be careful NOT to touch "A" part directly with hand.

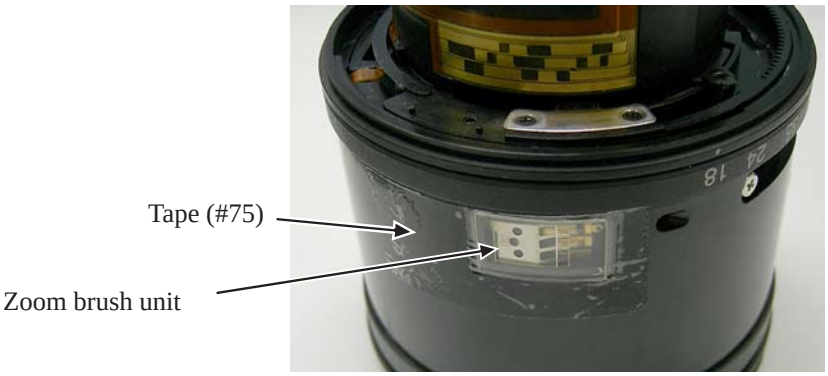
Distance-brush

- Take out the screw (#116).
- Remove the distance-brush.



Zoom brush unit

- Peel off the tape (#75).
- Remove the zoom brush unit.



Zoom coupling pin

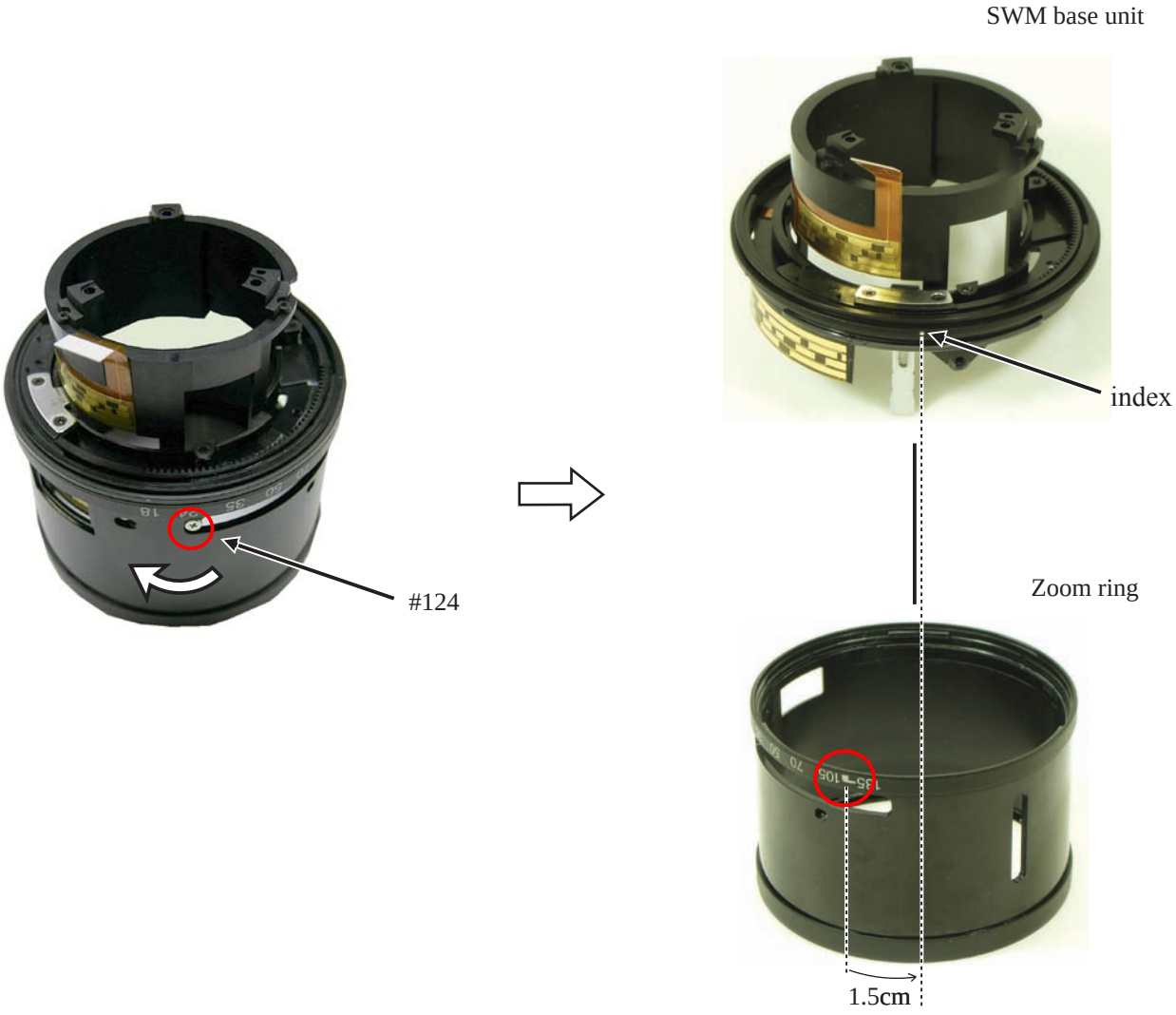
- Remove the zoom coupling pin.

Separation of Zoom ring unit from Fixed tube unit

- Take out three screws (#98).
- Separate the zoom ring unit from the fixed tube unit.

Separation of Zoom ring from the SWM base unit

- Take out the screw (#124).
- Rotate the zoom ring in the direction of the arrow until the index exceeds approx. 1.5 cm from "135". Then, remove the zoom ring.



Focus key

- Take out two screws (#122).
- Remove the focus key.

Segment gear ring

- Rotate the segment gear ring in the direction of the arrow all the way to the end. Then, remove it.

Focus sliding tube

・ Rotate the focus sliding tube in the direction of the arrow, and remove it.

Separation of 1st lens-G sliding tube unit from Inner-fixed tube unit

・ Rotate the filter ring and cover ring, and extend the inner-fixed tube unit.
・ Take out three screws (#84), and remove the inner-fixed tube unit from the 1st lens-G sliding tube unit.

1st lens-G sliding tube unit

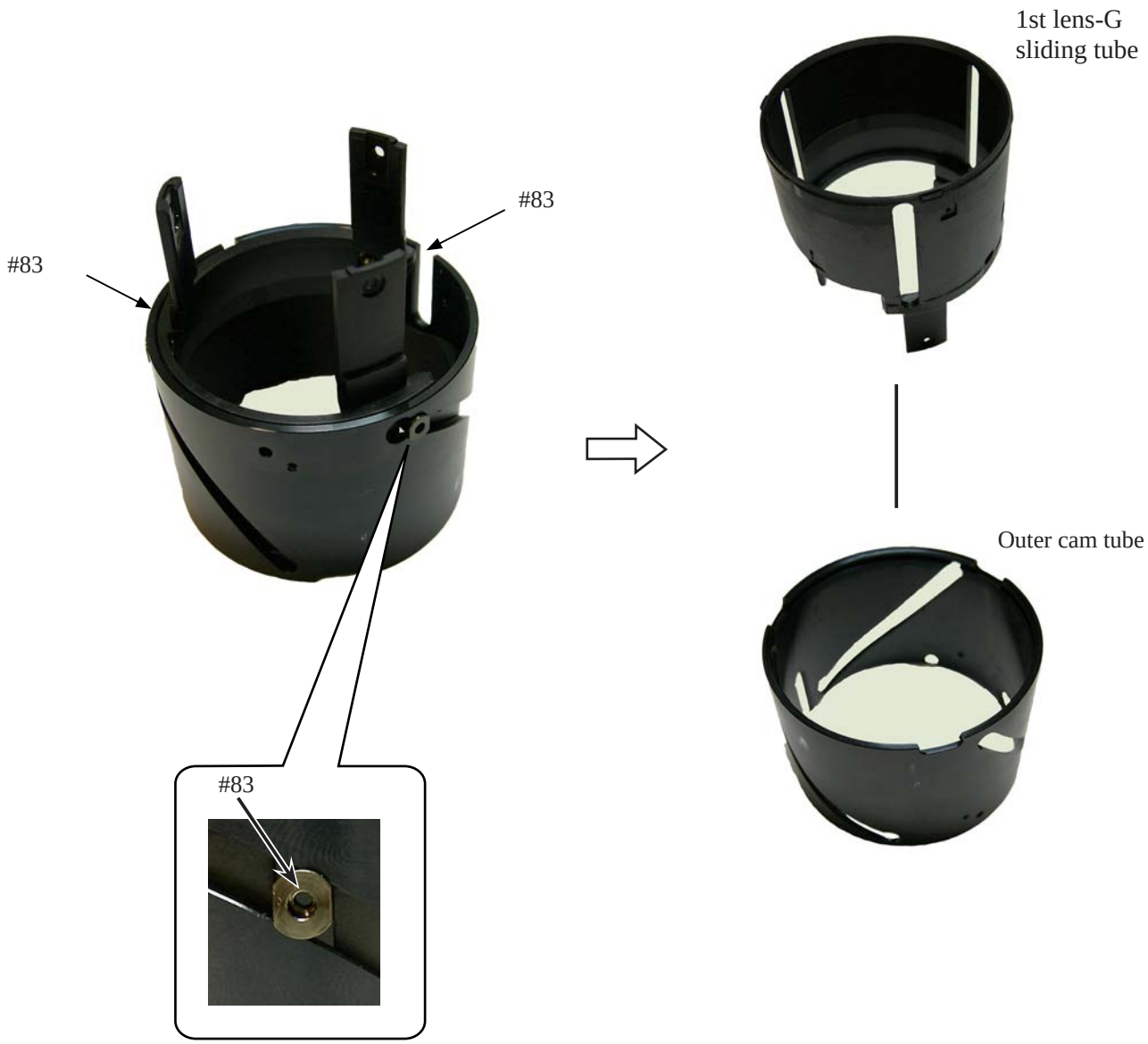
・ Take out three screws (#125).

Filter ring

・ Take out three screws (#81).

1st lens-G sliding tube

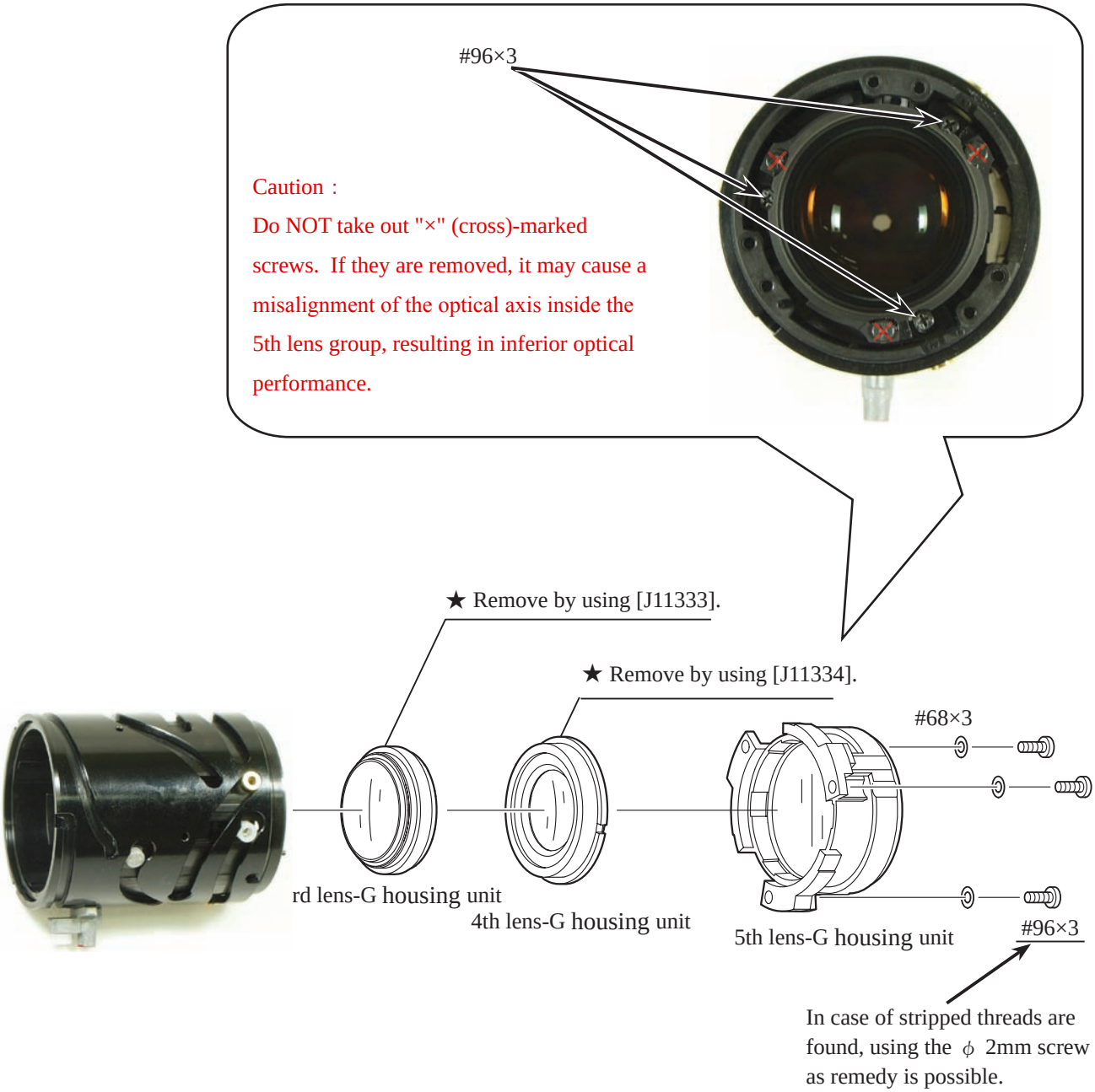
・ Remove three nuts (#83).



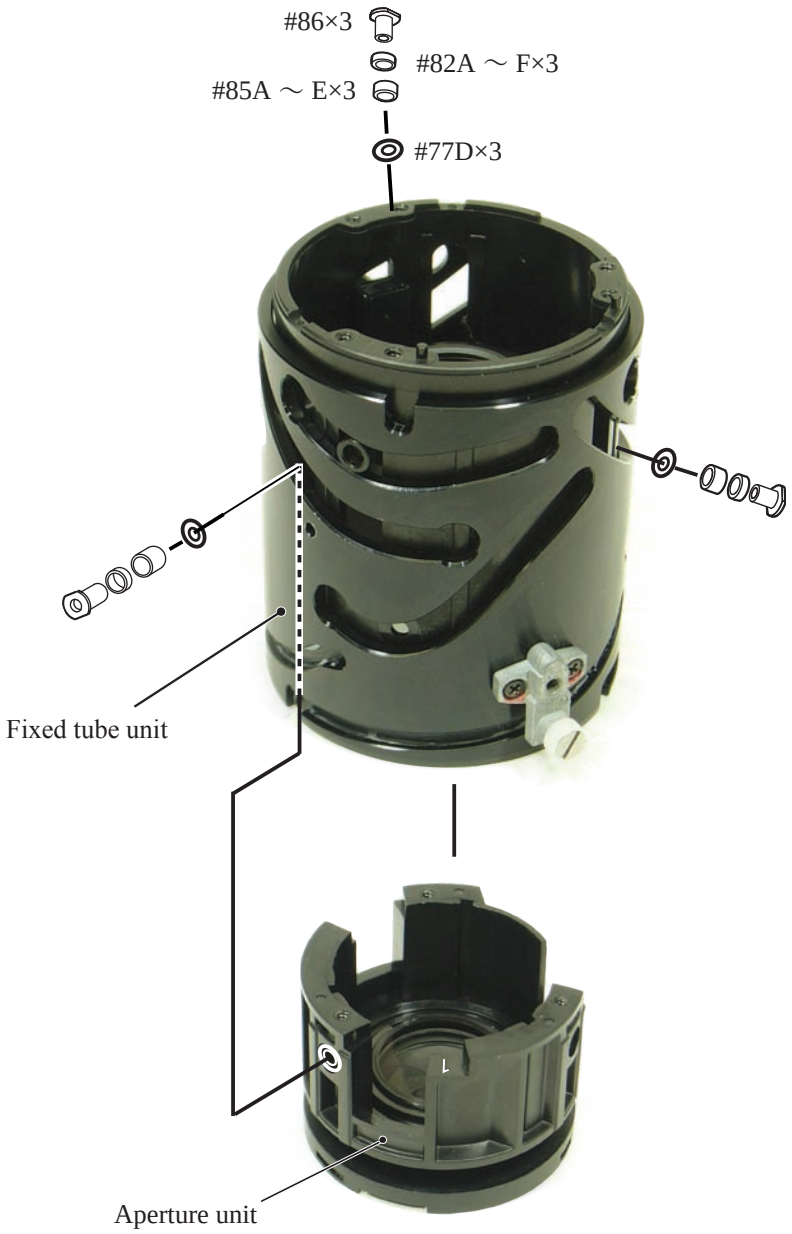
3rd lens- / 4th lens- /5th lens-group housing units

★ New Tool

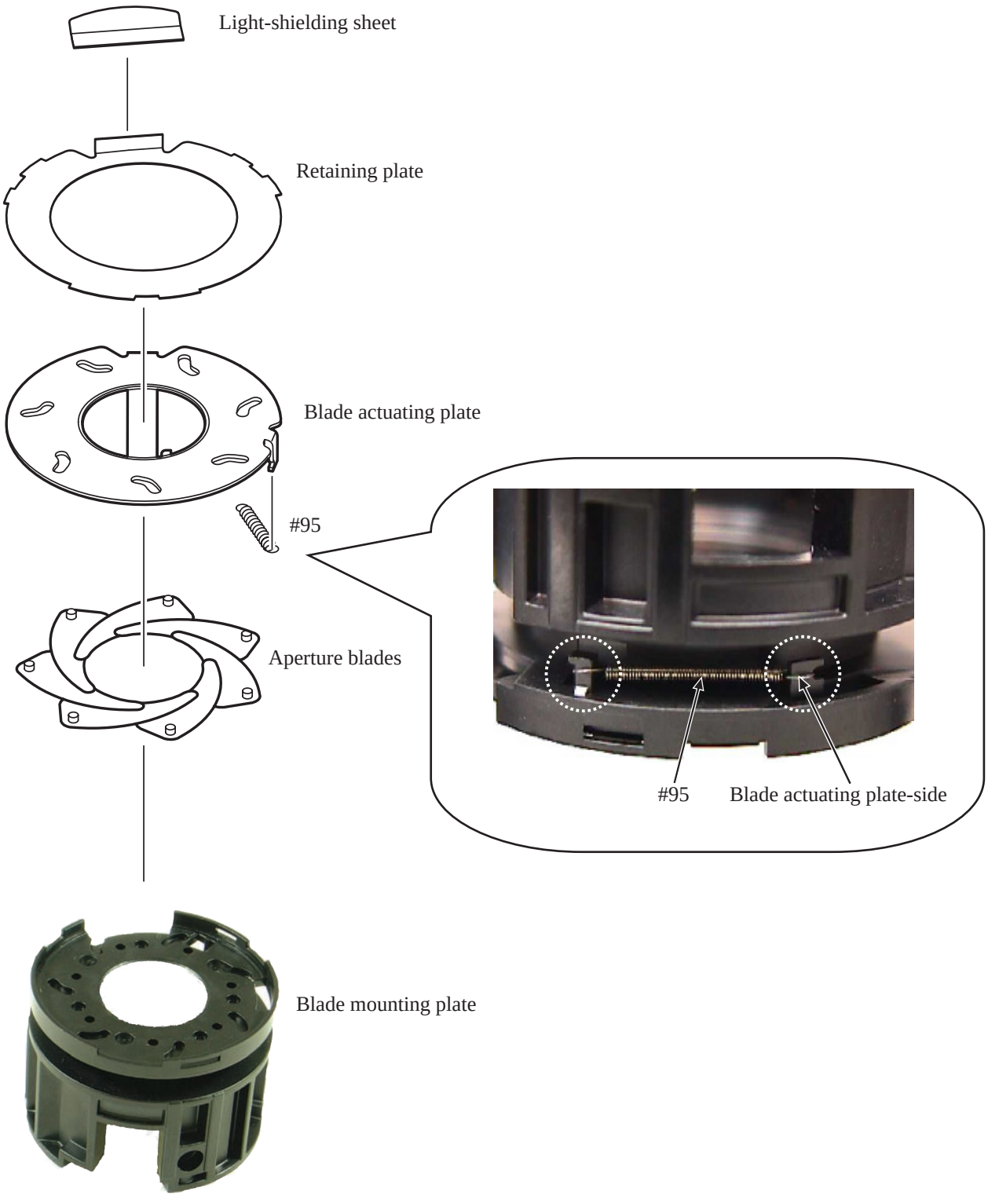
Caution: When the 5th lens group housing unit is removed, the lens-aligning work becomes necessary after reassembling.
Therefore, at service facilities where this alignment work cannot be performed, do NOT remove the 5th lens group housing unit.



Aperture unit



Aperture blade area



Zoom roller base unit

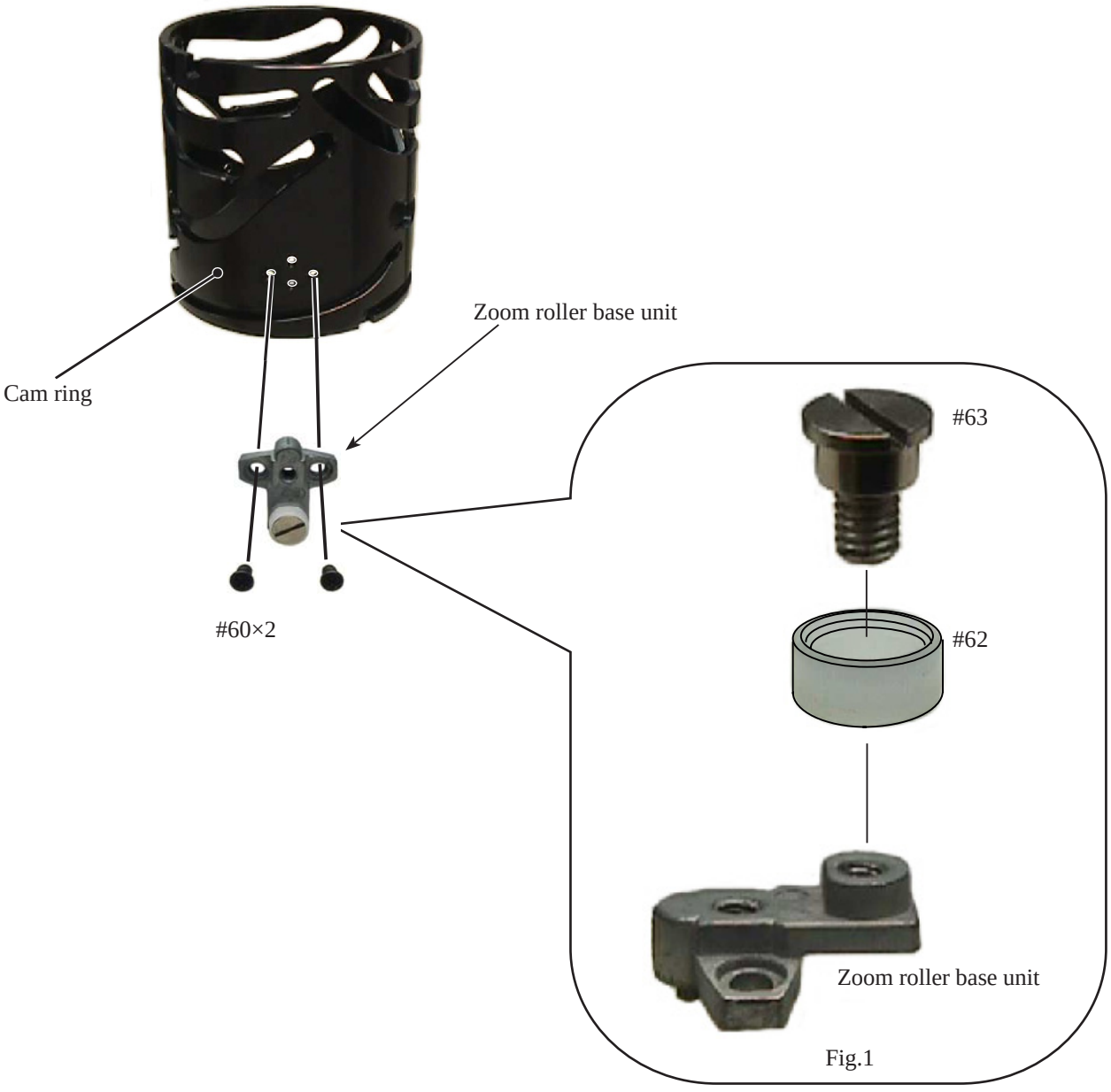


Fig.1

2. Assembly / Adjustment

Zoom roller base unit

① Fix the roller (#62 selected from A-D) on the zoom roller base unit with the screw (#63). (Fig. 1)

② Tighten two screws (#60).

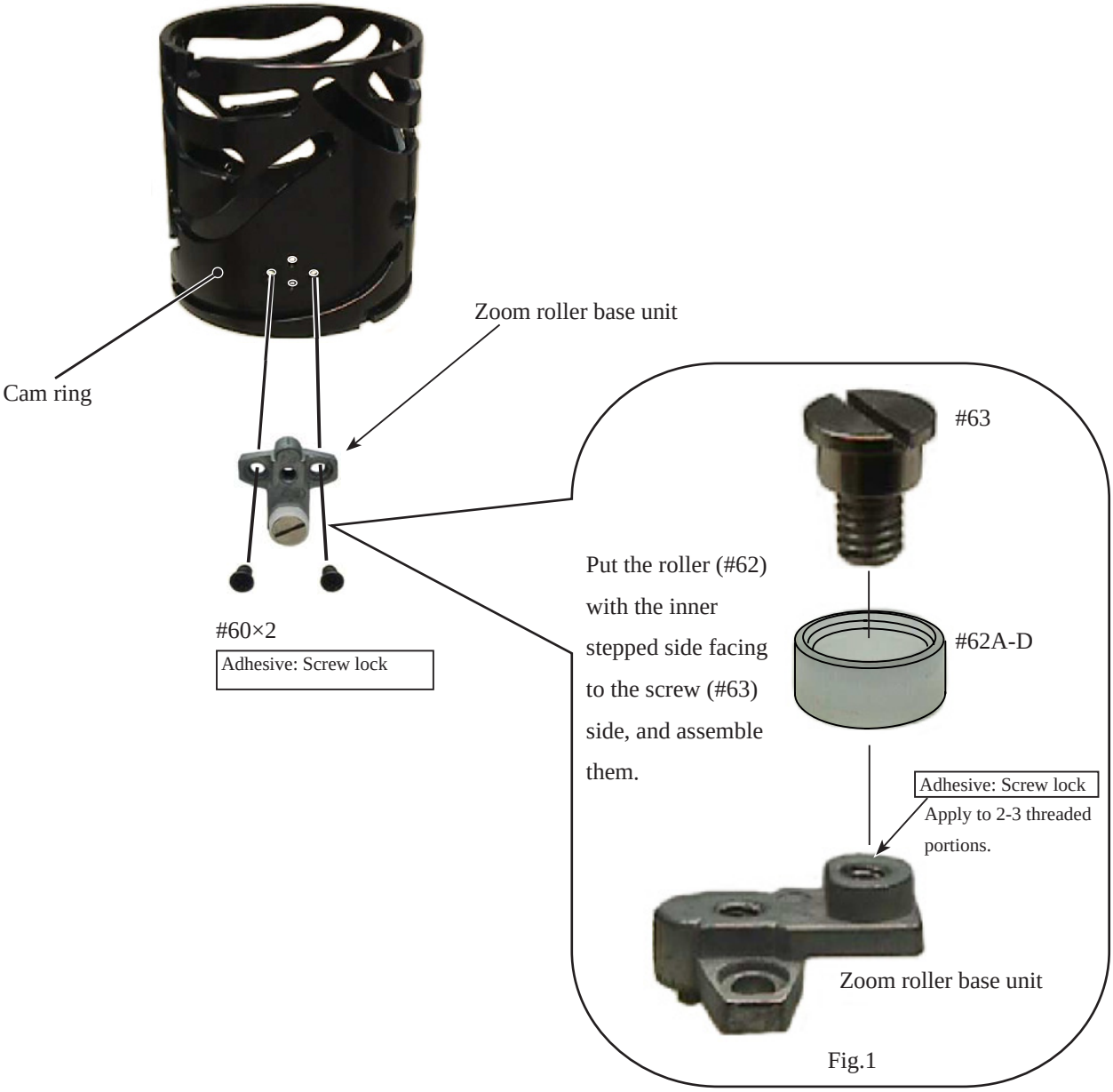


Fig.1

Aperture blade area

Light-shielding sheet

Retaining plate

Blade actuating plate

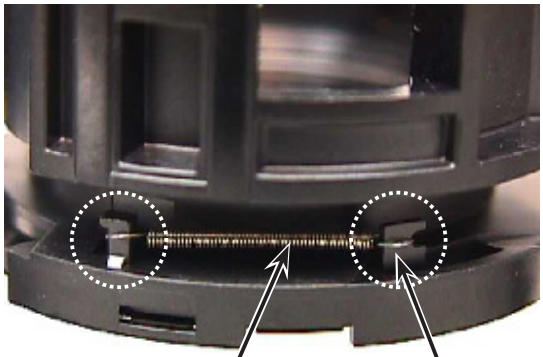
#95

Aperture blades

Blade mounting plate

・ Insert the convex portion of the retainig plate into the slit of the light-shielding sheet, and attach the light-shielding sheet on the retaining plate.

Light-shielding sheet



#95

Blade actuating plate-side

Aperture unit

① Position the "CAVNo." of the aperture unit coming to the front. Then displace the positoin of the zoom roller base of the fixed tube unit 1-cm away from the front. Then mount the fixed tube unit on the aperture unit.

② While aligning the three convex portions (Fig.1) with the grooves of the aperture unit (Fig.2), assemble them by using sticks, etc. Then stop at the position where the recess for roller can be seen through the cam groove.

③ Through the cam groove, put the three washers [#77D (t=0.1)], three rollers [#85 selected from A-E)], and rollers [#82 selected from A-F] into each hole of the aperture unit by screwing three nuts (#86).

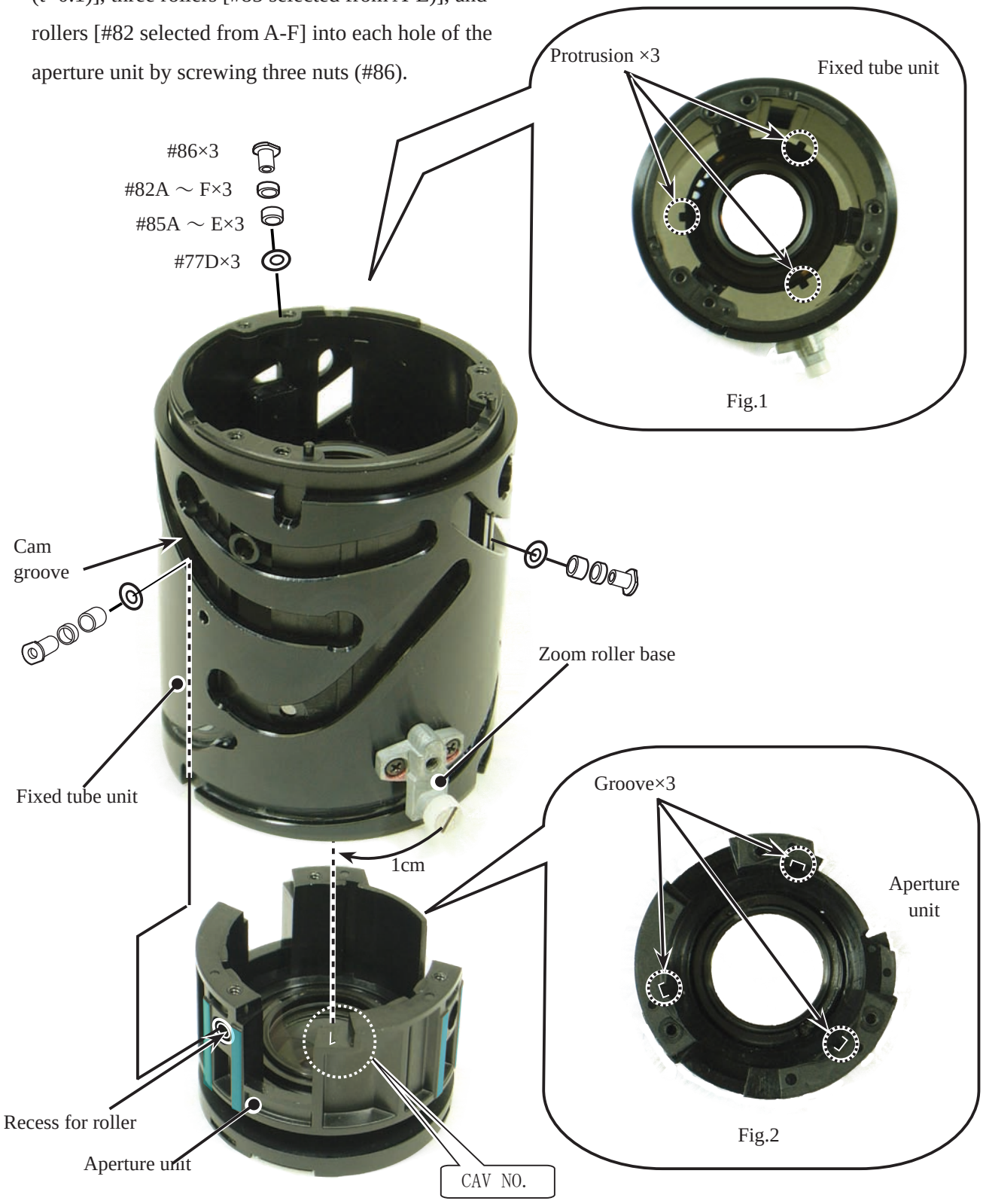


Fig.1

Fig.2

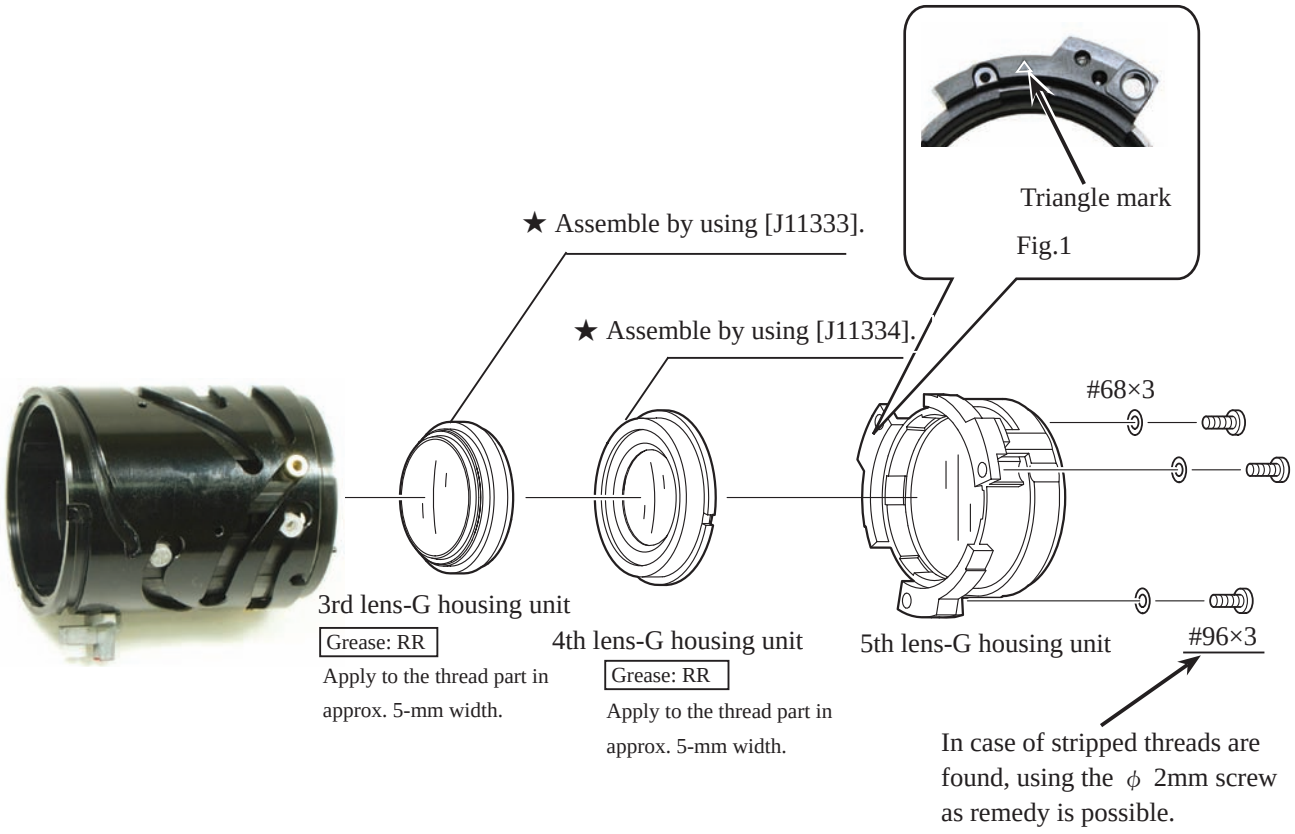
3rd lens- / 4th lens- /5th lens-group housing units

Caution:

When the 5th lens group housing unit is removed, the lens-aligning work becomes necessary after reassembling.
Therefore, at service facilities where this alignment work cannot be performed, do NOT remove the 5th lens group housing unit.

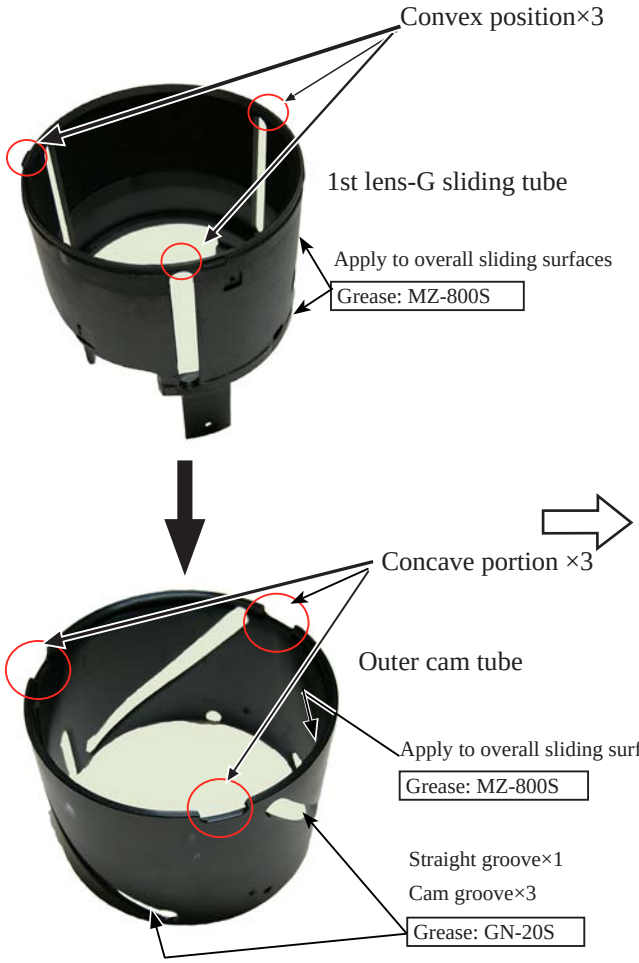
・ Assemble the 5th lens-G housing unit at the position where " △ " triangle mark (Fig.1) becomes as shown.

★ New tool



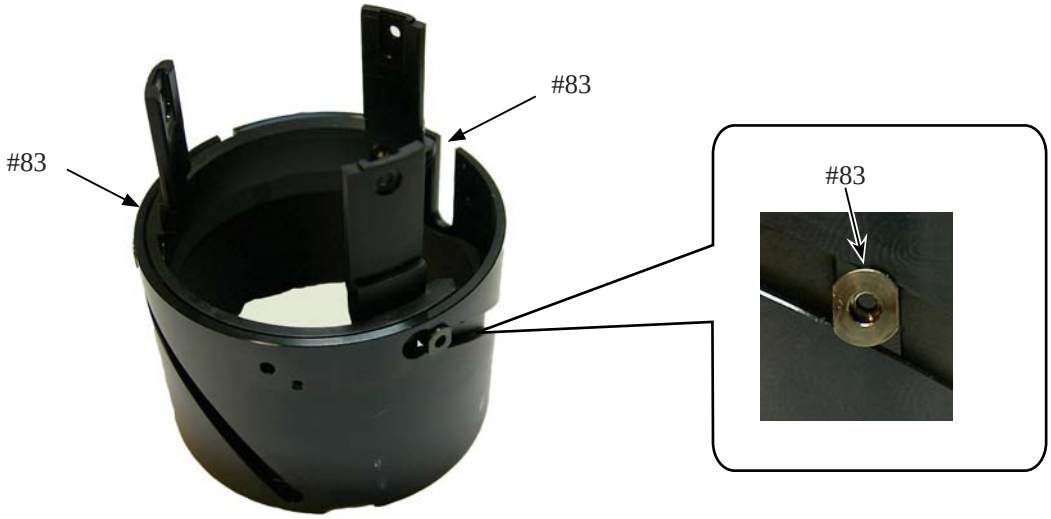
1st lens-G sliding tube

① Align the three convex positions of the 1st lens-G sliding tube with the three concave positions of the outer cam tube, then assemble them.



② Rotate the outer cam tube in the direction of the arrow so that the inner slope part of the 1st lens-G sliding tube fits in the U-groove (deep) of the outer cam tube.

③ Attach three nuts (#83).



Filter ring

- Assemble the 1st lens-G sliding tube unit and the filter ring at the position shown in "Fig. 1".
- Tighten three screws (#81). (Fig.2)。

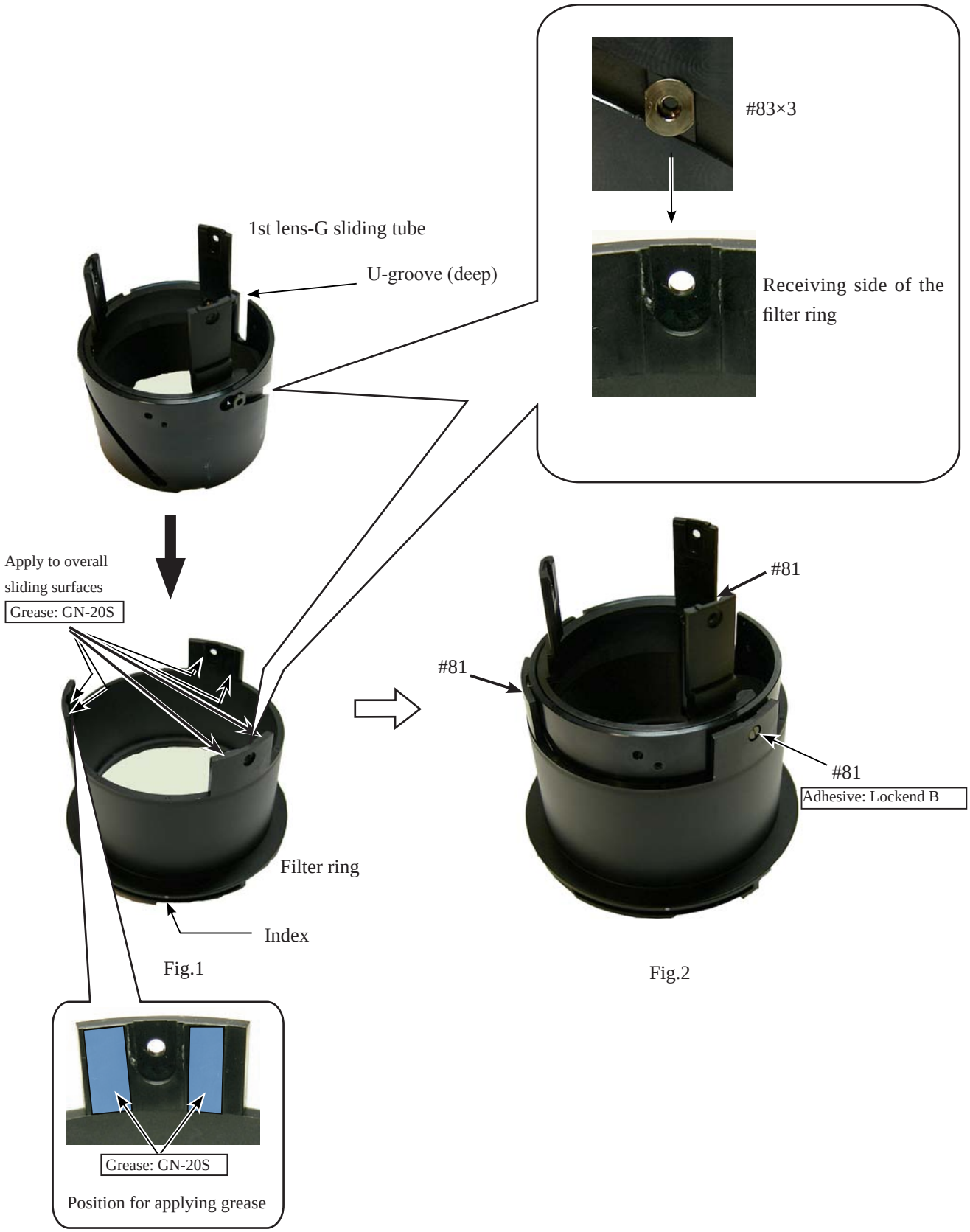
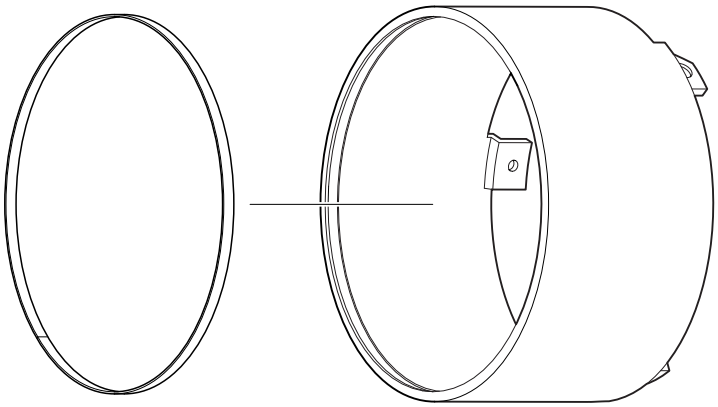


Fig.1

Fig.2

Cover ring



Drip-proof leather

Cover ring

1st lens-G sliding tube unit

- Assemble the cover ring and the 1st lens-G sliding tube unit at the position shown in "Fig.1".
- Tighten three screws (#125). (Fig.2)

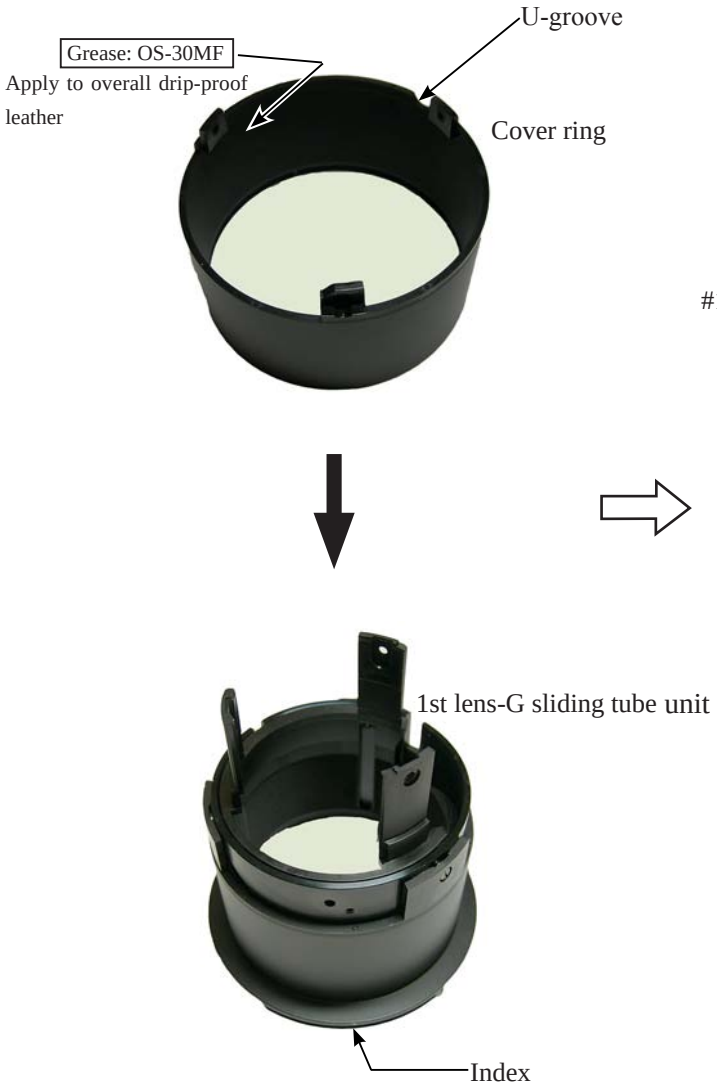


Fig.1

Fig.2

Reassembly of 1st lens-G sliding tube unit and Inner-fixed tube unit

① Assemble the inner-fixed tube unit and the 1st lens-G sliding tube unit at the position shown in "Fig.1".

② Tighten three screws (#84). (Fig.2)。

③ Rotate the cover ring in the direction of the arrow, and set to WIDE-end. (Fig.2)

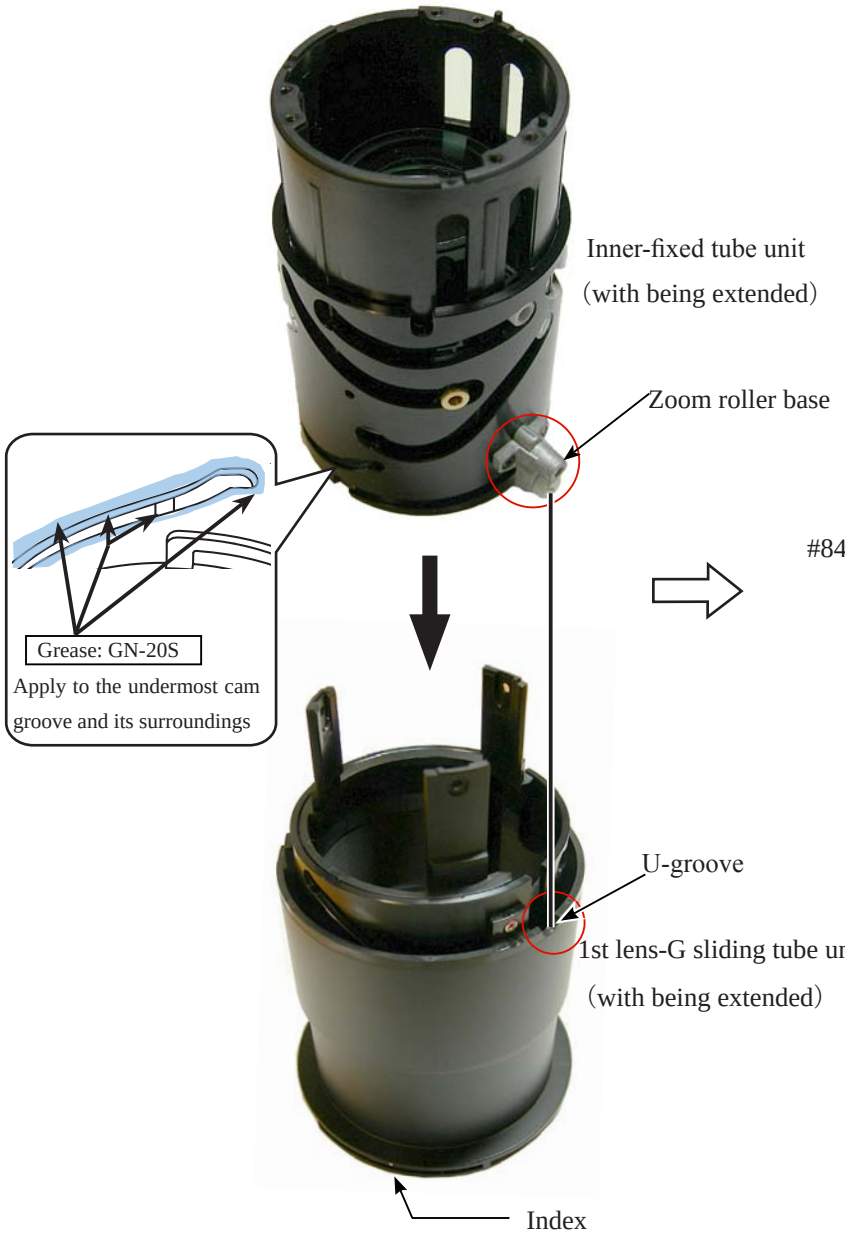


Fig.1

Fig.2

Focus sliding tube

① Fit position of the focus sliding tube and lens body as shown in "Fig.1", and align the three convex portions of the focus sliding tube with the three grooves of the cam ring, then assemble them.

② Rotate the focus sliding tube in the direction of the arrow, and stop it at the position where the coupled part of the focus key is positioned as shown in "Fig.2".

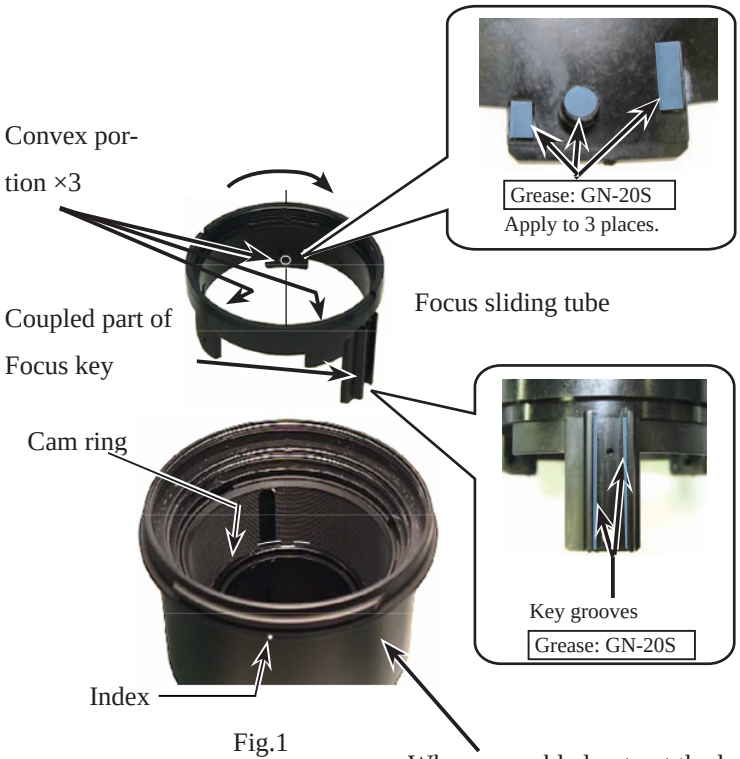
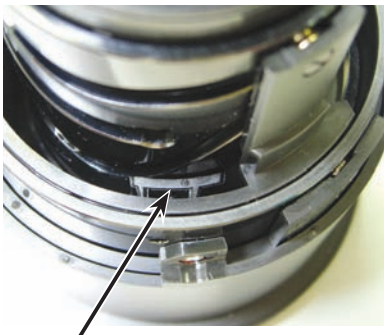
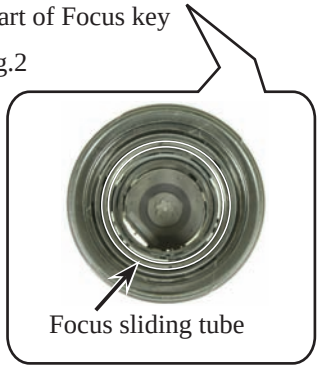


Fig.1

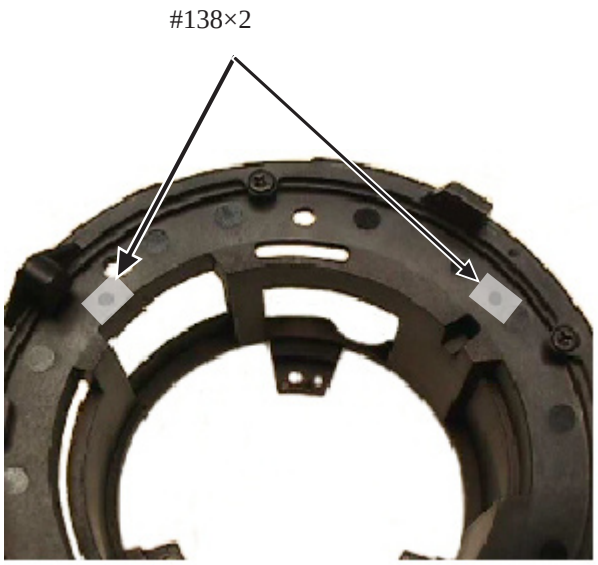


Coupled part of Focus key

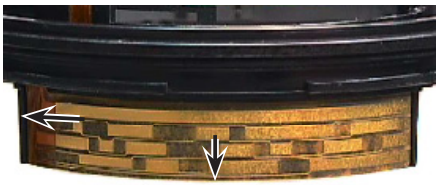
Fig.2



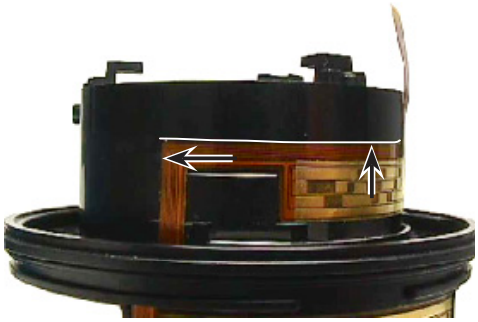
SWM base unit



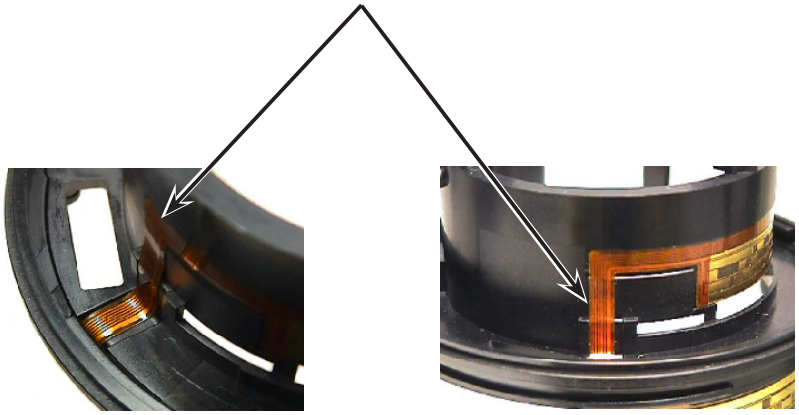
Reference position for attaching the zoom encoder

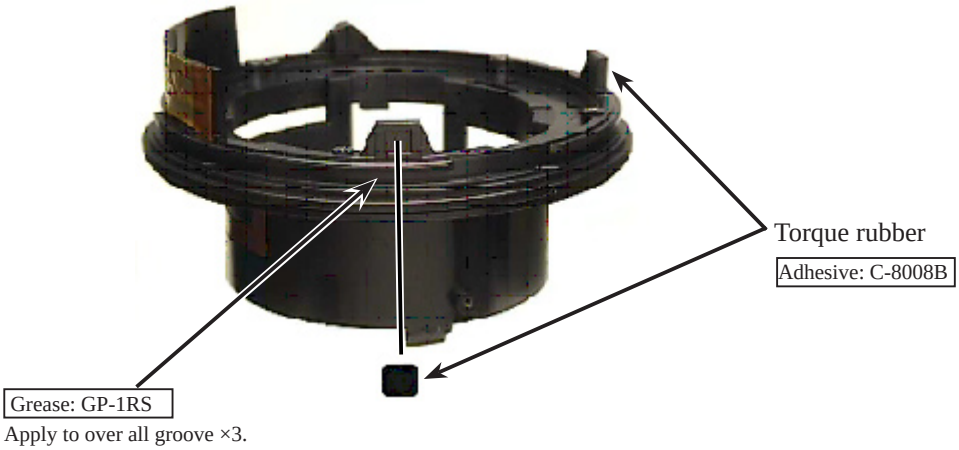


Reference position for attaching the distance encoder



No slackness

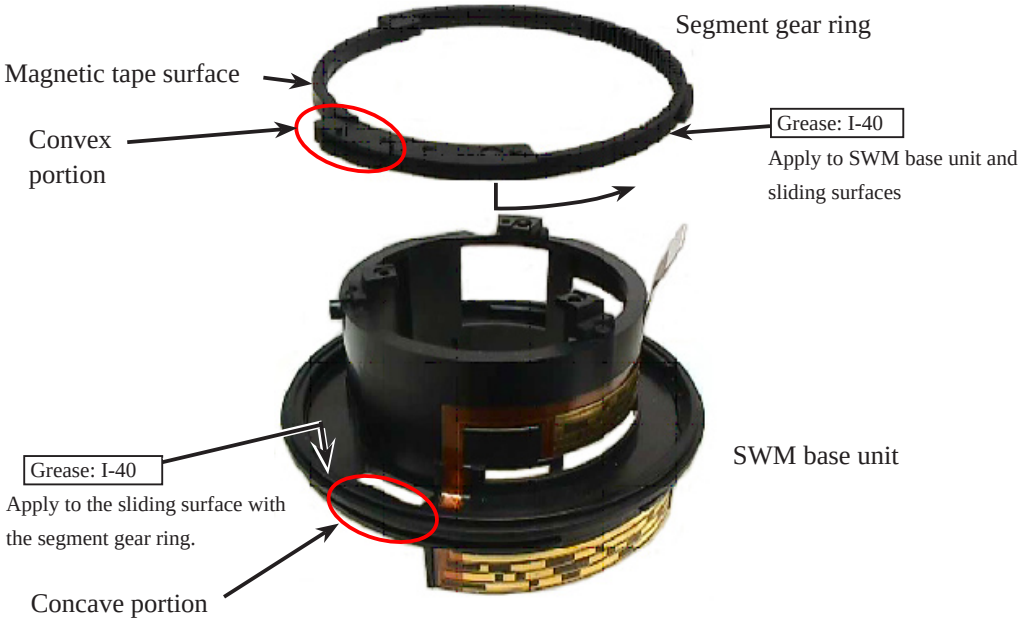




Segment gear ring

・ Fit the convex portion of the segment gear ring in the concave portion of the SWM base unit, and assemble them. Then rotate the segment gear ring in the direction of the arrow.

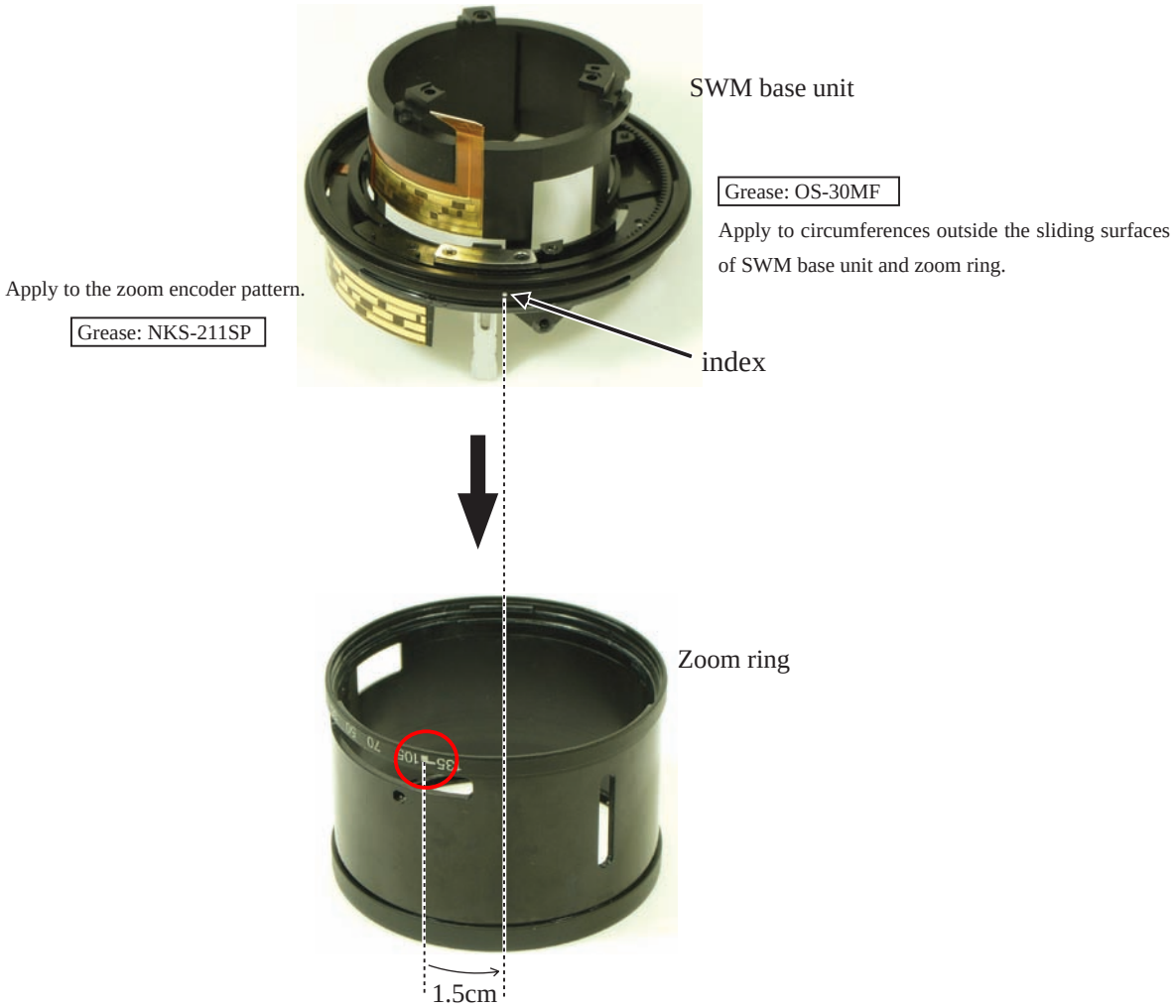
Caution: Do not touch the magnetic surface directly with hand/tool.



Focus key

Reassembly of Zoom ring from the SWM base unit

① Position the index of the SWM base unit to coming where it is approx. 1.5-cm away from "135" of the zoom ring, then assemble them.



② Tighten the screw (#124).

Reassembly of Zoom ring and Fixed tube unit

① Rotate the segment gear ring of the zoom ring unit in the direction of the arrow all the way to the end.

② Fit the boss of the fixed tube unit in the boss hole of the zoom ring unit, and assemble them. (Fig.1)

③ Tighten three screws (#98). (Fig.2)

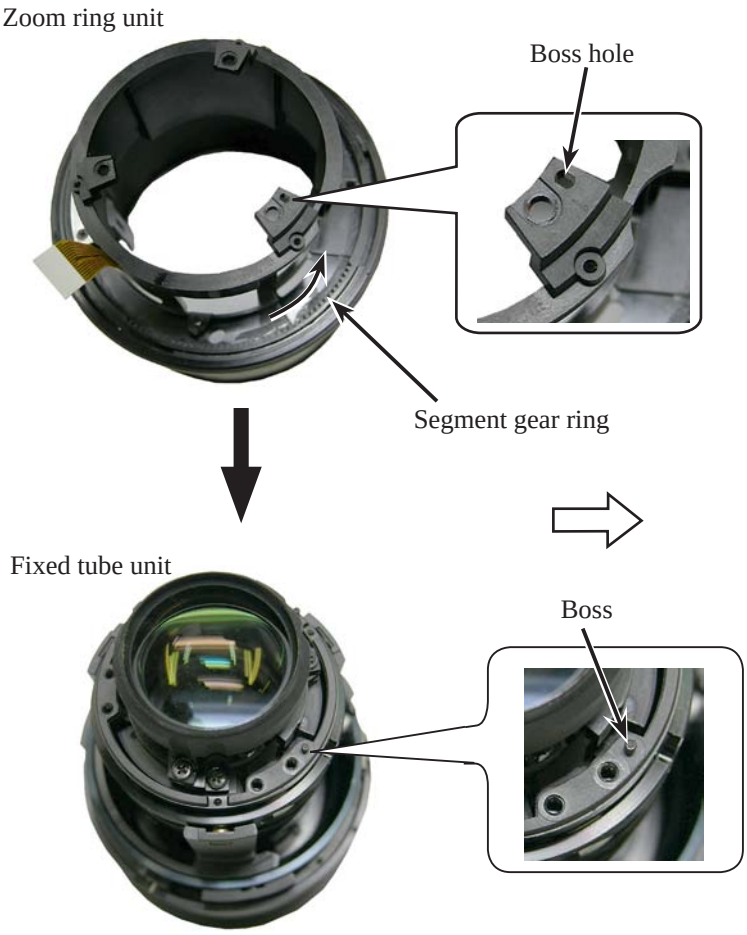


Fig.1

④ Confirm that when the segment gear ring is rotated, the focus sliding tube is turned coupled with the rotation.

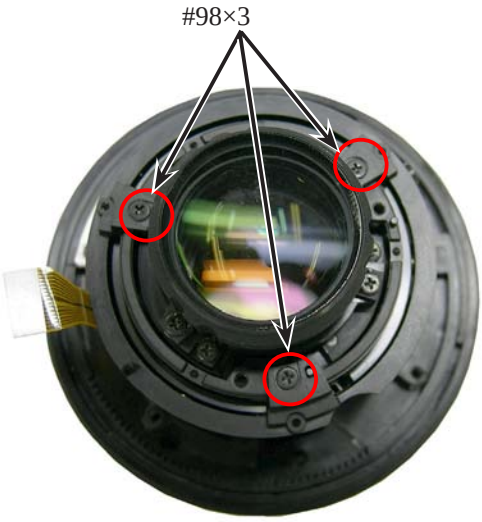


Fig.2

Zoom coupling pin

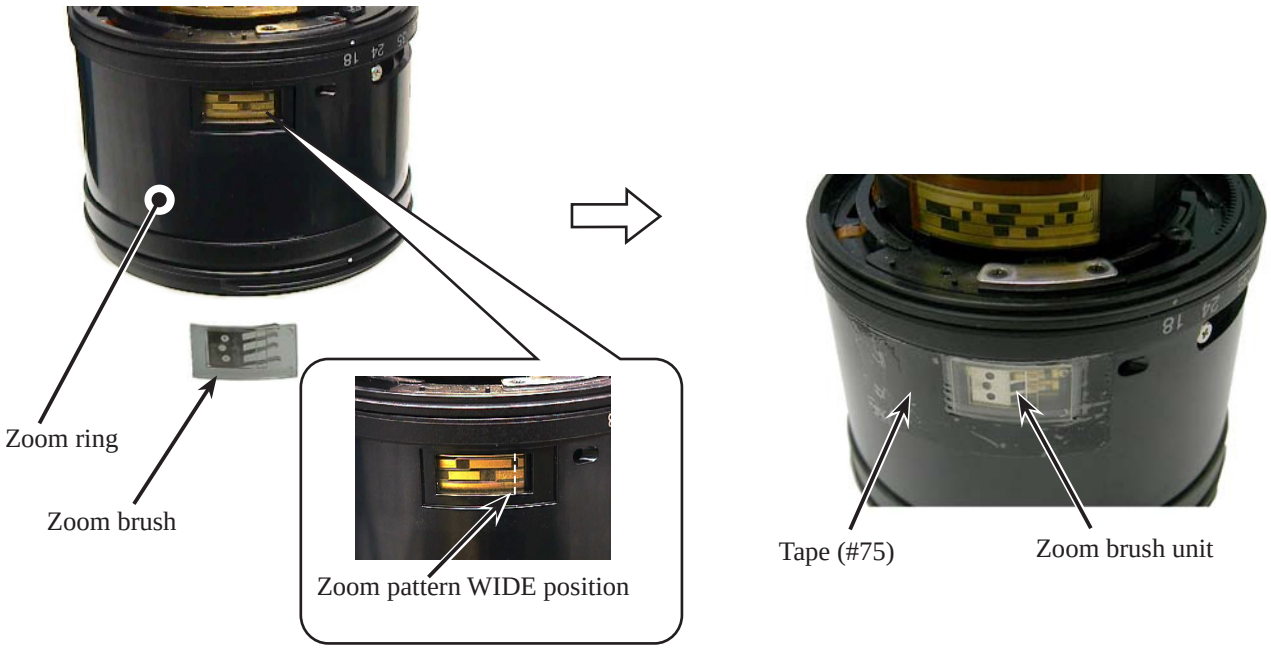
① Rotate the zoom ring in the direction of the arrow, and set to WIDE-end.

② Tighten the zoom coupling pin.

Zoom brush unit

① Rotate and set the zoom ring to WIDE-end.

② Set the zoom brush to the reference position of the FPC, and fix it with the tape (#75).



Distance-brush unit

★ New tool

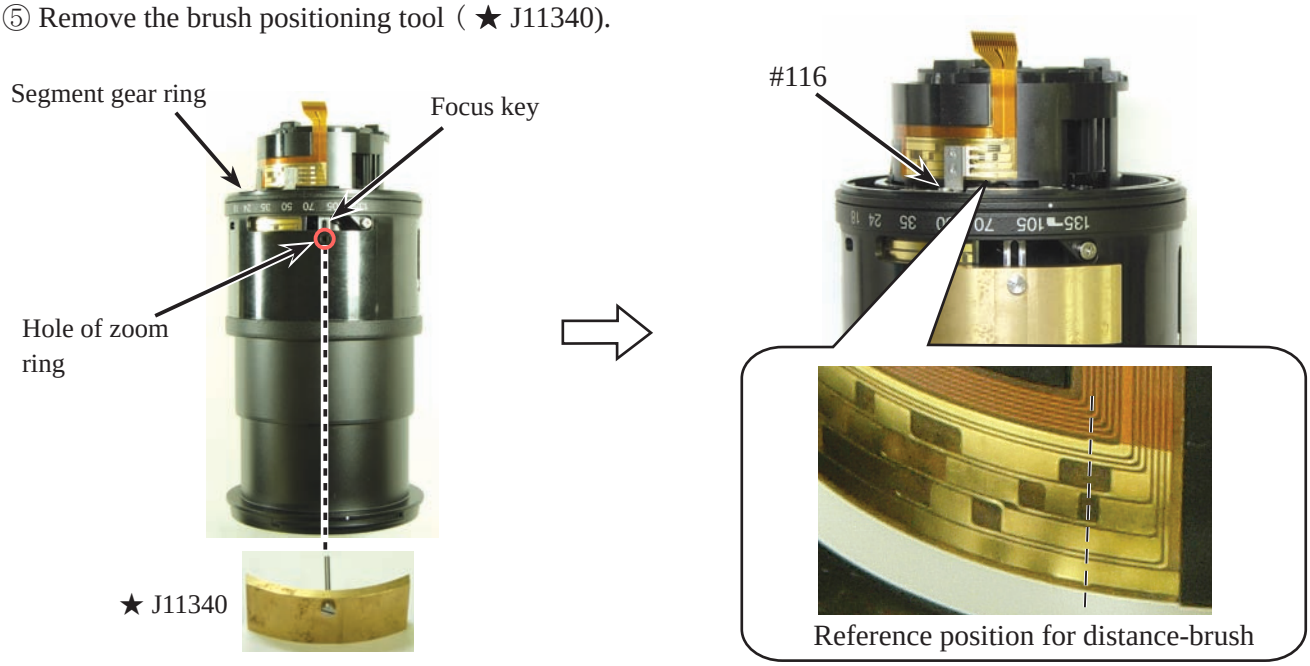
① Rotate and set the zoom ring to TELE-end (135mm).

② Rotate the segment gear ring, and stop it at the position where the groove of the focus key is aligned with the hole of the zoom ring.

③ Insert the brush positioning tool (★ J11340) through the hole of the zoom ring, and put it in the groove of the focus key.

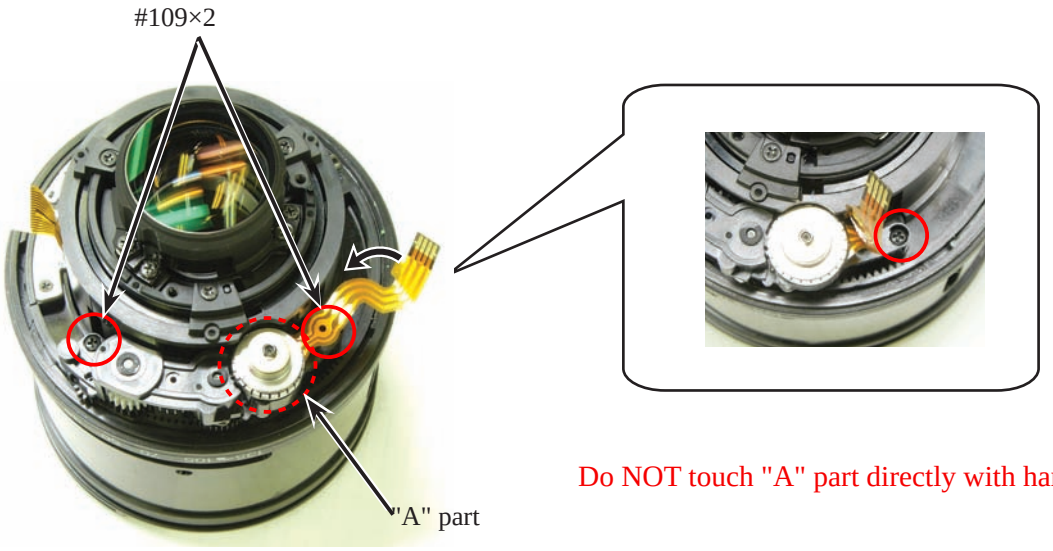
④ Set the distance-brush to the reference position of the FPC, and tighten the screw (#116).

⑤ Remove the brush positioning tool（ ★ J11340).

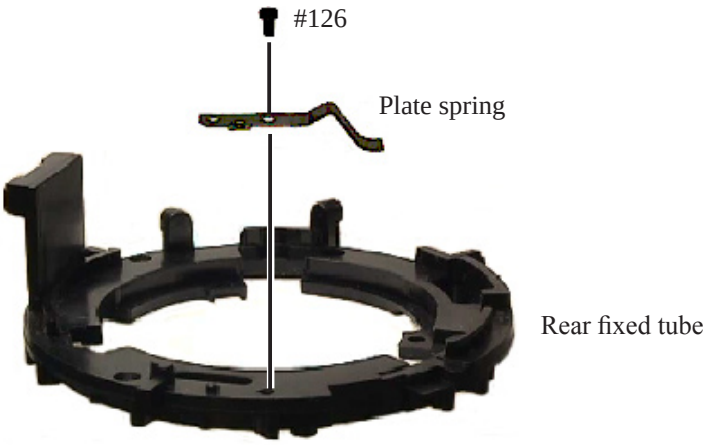


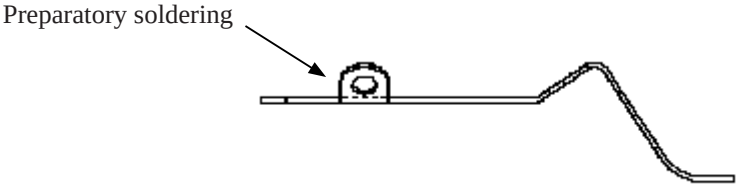
SWM area

・ Mount the SWM unit, and tighten two screws (#109).

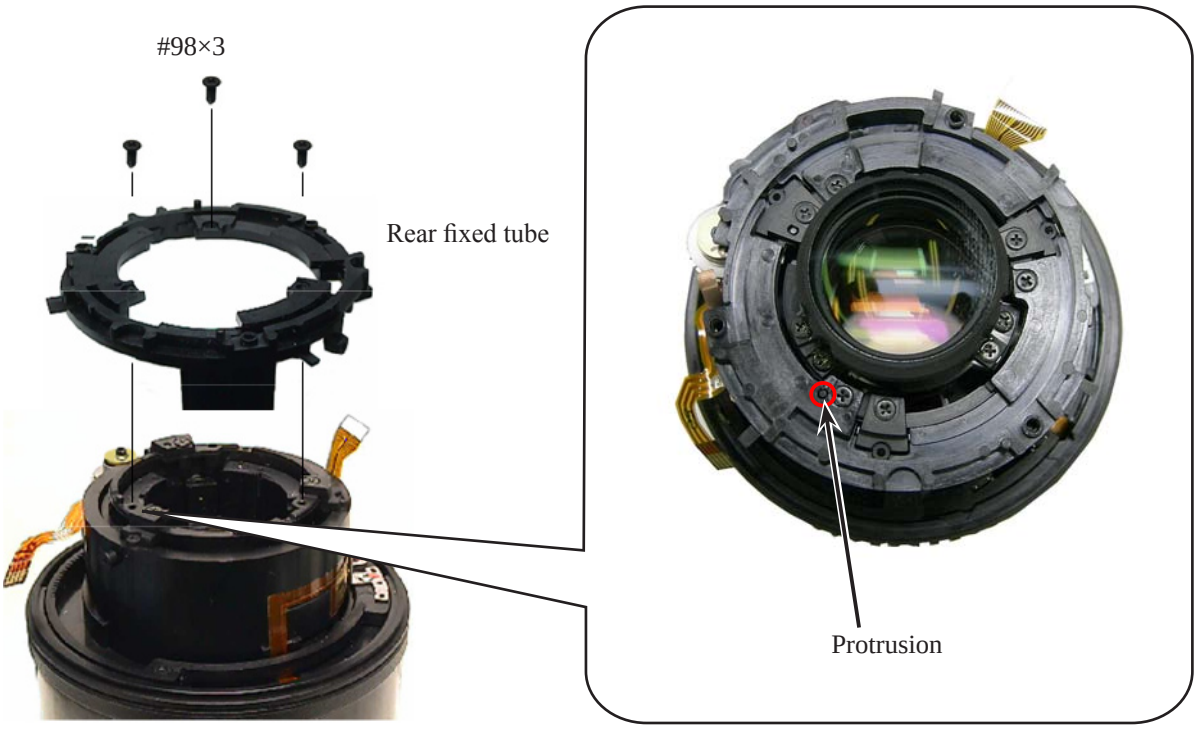


Rear fixed tube

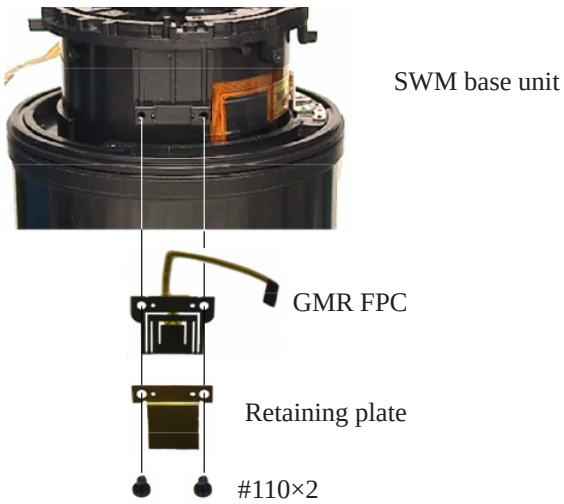




・ Mount the rear fixed-tube on the inner-fixed tube by fitting the protrusion.



GMR



GMR output check

★ New tool

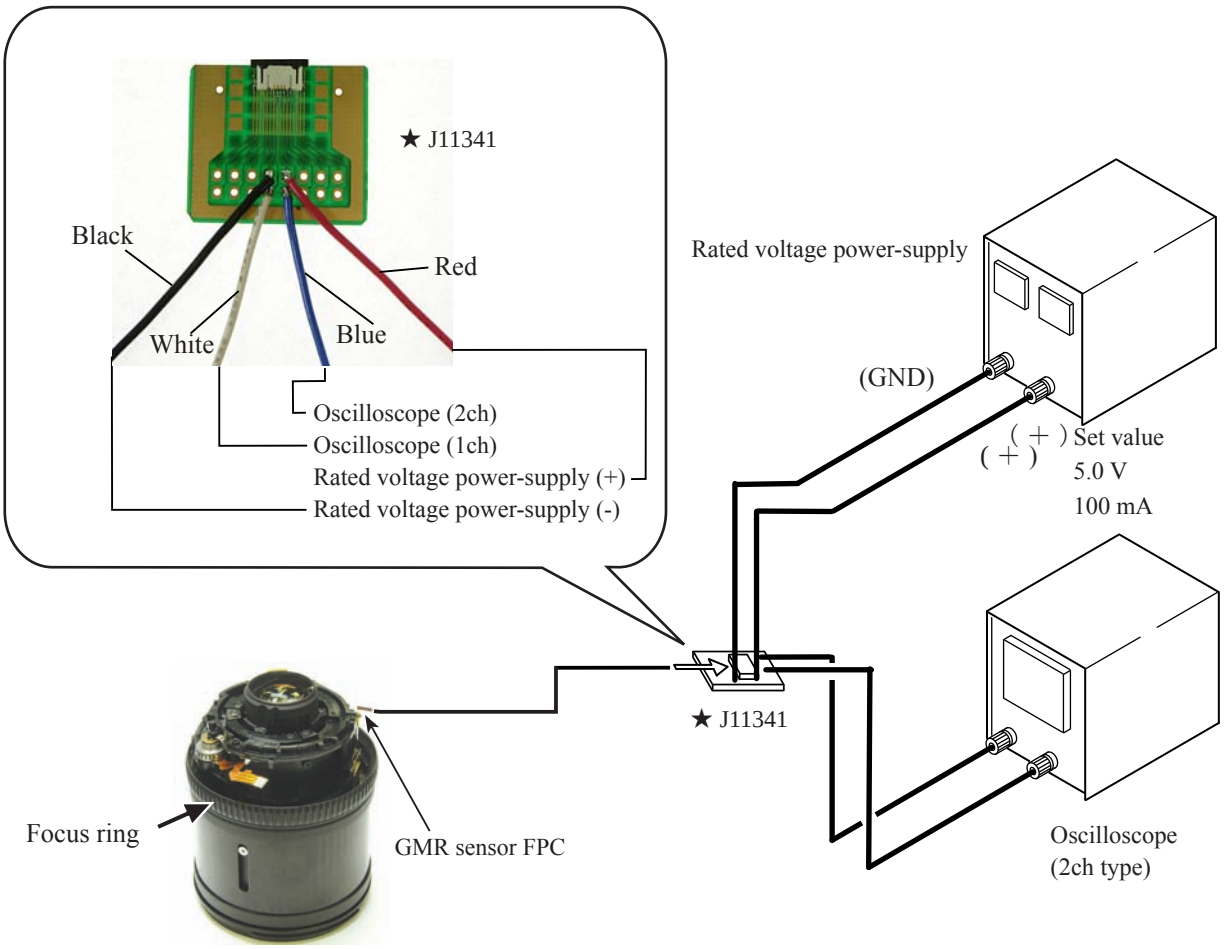
● When the GMR unit is disassembled and replaced, be sure to make an inspection.

1. Device:
   - Single-output rated voltage power-supply 1 unit: 5V 100mA
   - Oscilloscope
   - GMR output inspection tool ★ 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
   - Assemble the Focus ring into the lens body temporary. Then connect the assembled lens to each measuring machines as follows:

・【Attachment diagram】

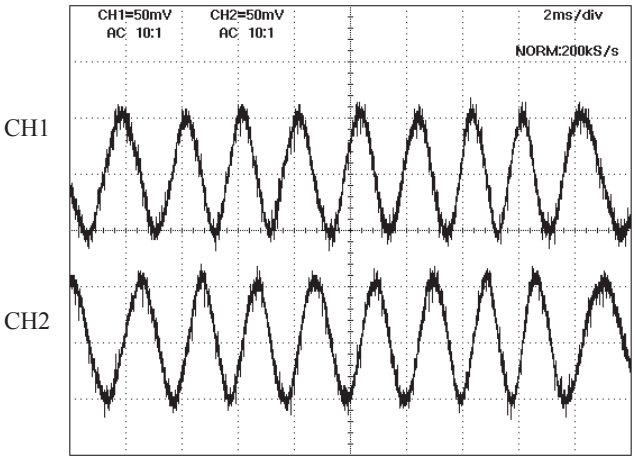


● How to inspect and adjust:

① Confirm that the electric current and voltage of the connected rated voltage power-supply are set values, then turn it ON.

② Set the oscilloscope, and turn the focus ring, which was temporarily attached.

Note: **The waveform varies according to the rotational speed. So change "Time/ Div" setting accordingly.**



● Oscilloscope setting

V/Div（CH1）: 20mv

V/Div（CH2）: 20mv

coupling : AC

Time/Div :5msec

Trigger Mode :NORMAL

Trigger Coupling :AC

Trigger Source :CH1

Trigger Position :+4div

Trigger Type :EDGE

Trigger Level :0V

INPUT(CH1) :AC

INPUT(CH2) :AC

Standard: Amplitude of all pulses/wave-forms is 100mV or more.

・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.

Note: Check the waveform by moving the focus ring back and forth from the infinity-end to the close-end positions entirely.

③ In case the amplitude is small, disassemble up to the stage of the GMR FPC and check the condition of the MR head.
If the deformation is detected, correct the deform of the MR head.
If, however, such correction is impossible or no deformation is detected, replace the GMR FPC. (Fig.1)

Fig.1

Note: When adjustments are made, prevent the magnetic surface and MR head from touching the magnetized driver bit. Otherwise, the magnetic data will be damaged.

< Ref. >

● As shown in Fig. 1, if the amplitude of only either CH1 or CH2 is small, one of the 2 screws (#110) may be loosened, so check for it. If this is not the case, the MR head may malfunction, so replace the GMR unit and make a readjustment.

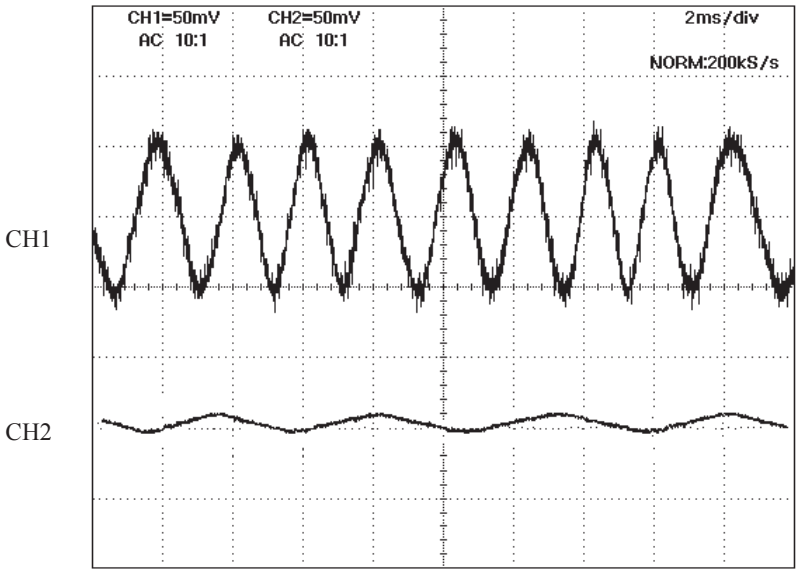


Fig.1

● As shown in Fig. 2, if the amplitude partially drops between the infinity and the close-distance, the magnetic data of the tape may be damaged. So replace the segment gear ring unit and make a readjustment. Replacing only the magnetic surface is impossible.

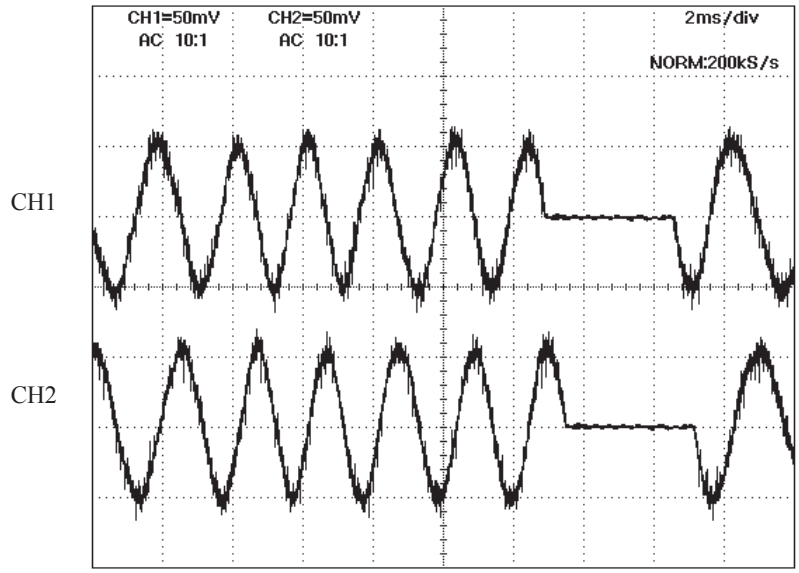
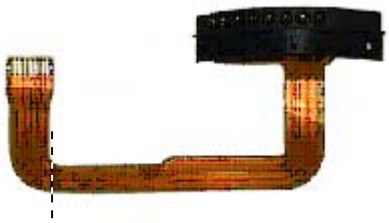


Fig.2

④ When the inspection is completed, remove the focus ring, which was temporarily attached.

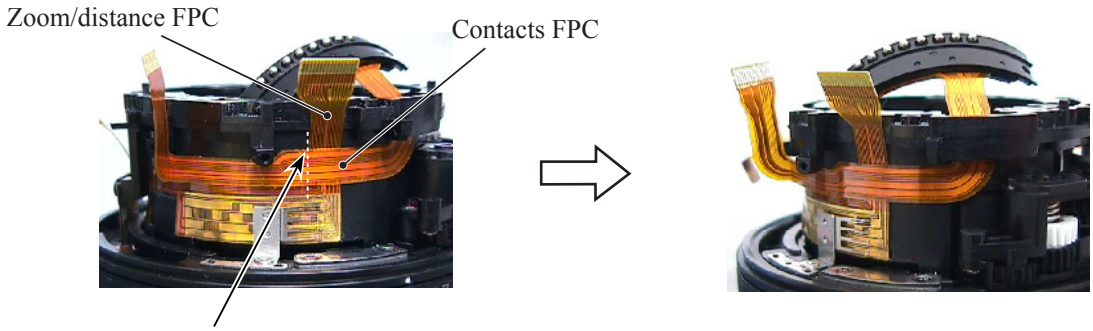
Contacts FPC



Contacts FPC (Valley fold along broken line)

① Pass the contacts-FPC through the hole of the rear fixed tube.

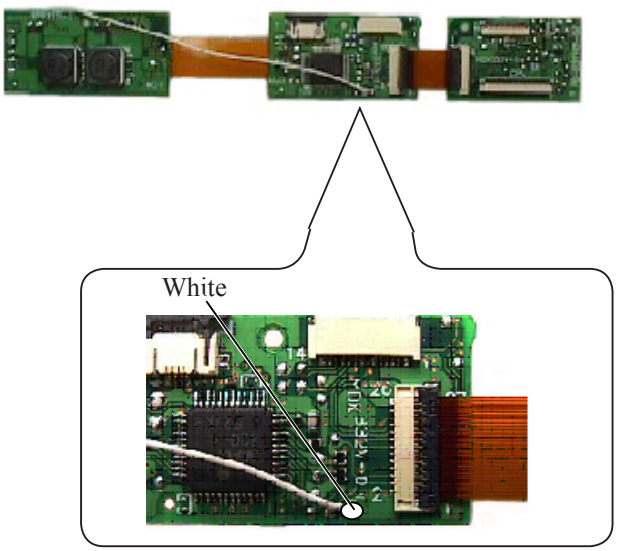
② Attach the contacts FPC by aligning with the edge of the zoom/distance FPC.



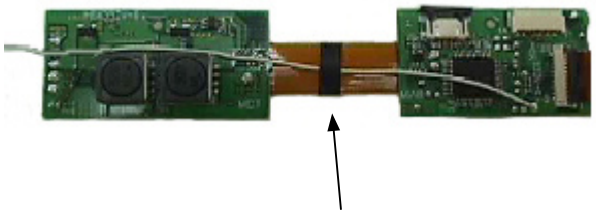
・ Align the triangle mark here of the contacts-FPC with the left edge of the zoom/distance FPC.

Main PCB unit

Caution : The main PCB consists of three boards which are combined based on electric properties.
Therefore, each PCB cannot be replaced as a single part.

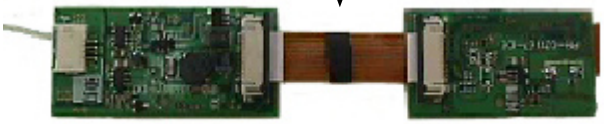


[Front]



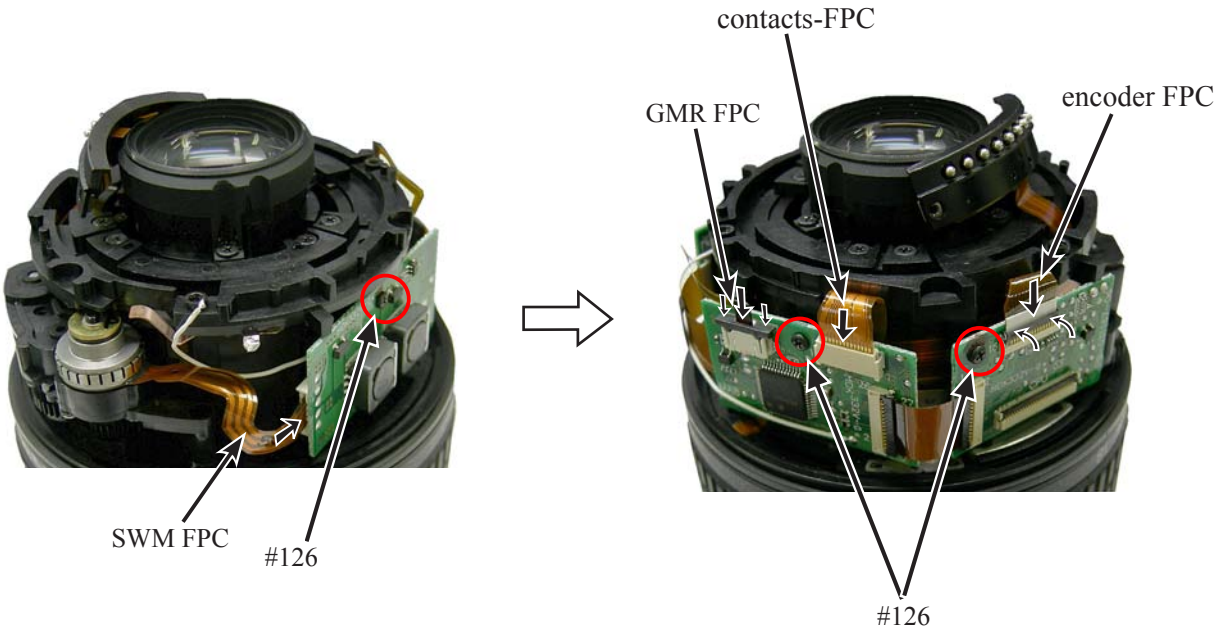
Lead wire fixing-tape

[Back]



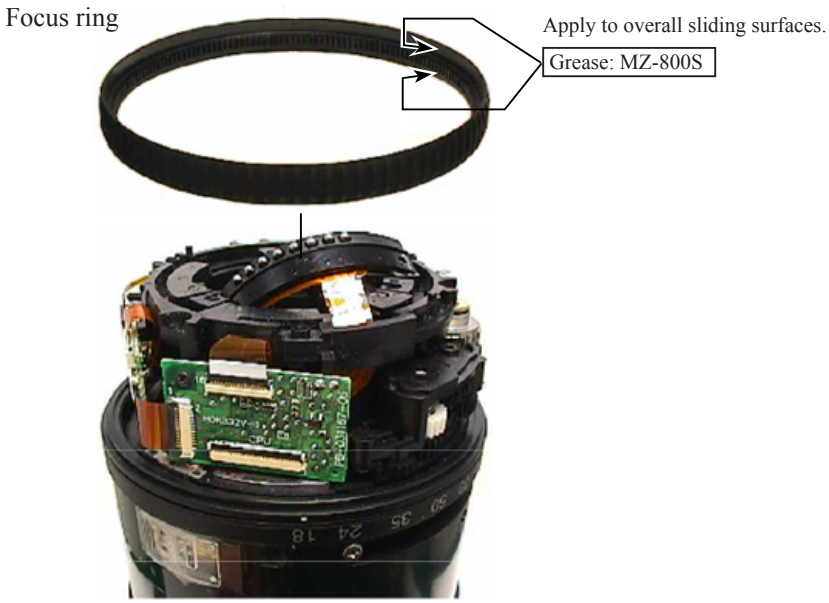
① Mount the main PCB on the lens barrel, and tighten three screws (#126).

② Connect the SWM-FPC, GMR-FPC, contacts-FPC and encoder FPC to each connector.



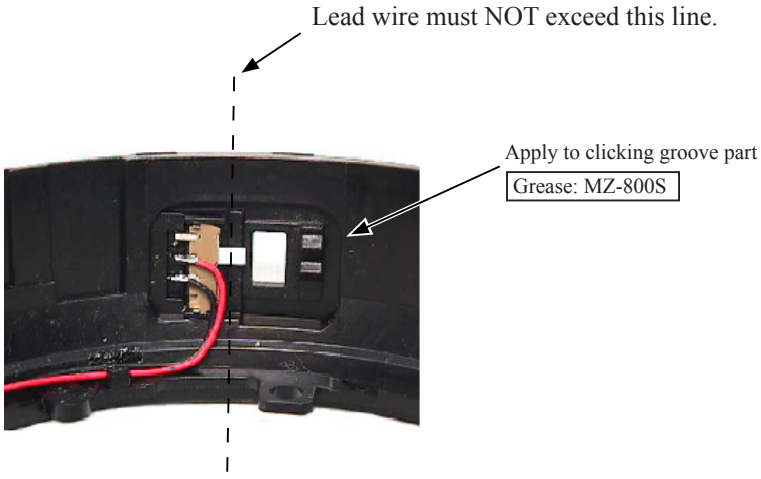
Focus ring

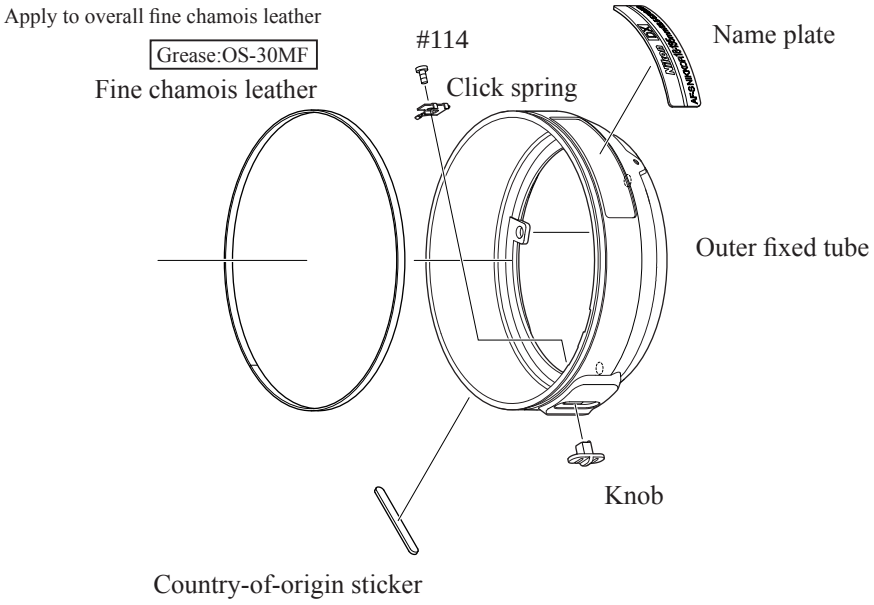
・ Mount the focus ring.

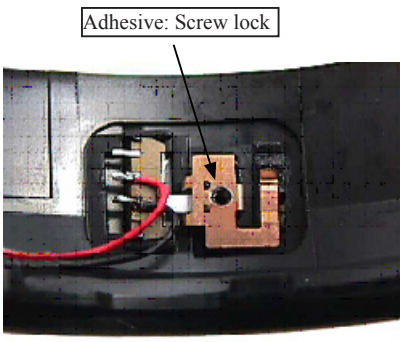


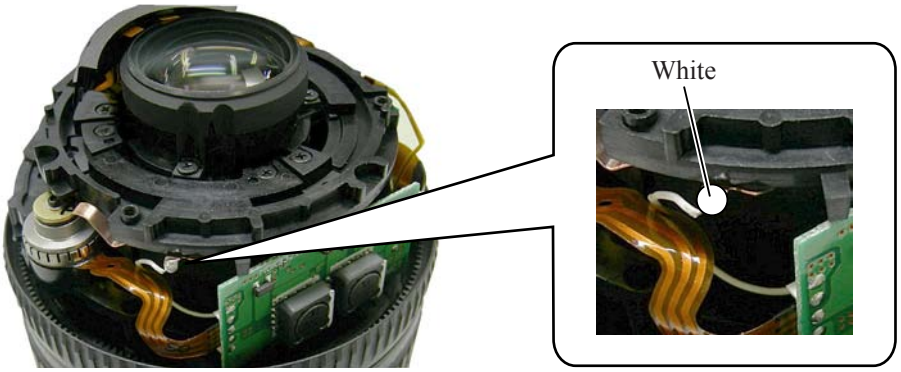
Outer fixed tube unit

① Assemble the outer fixed tube unit.





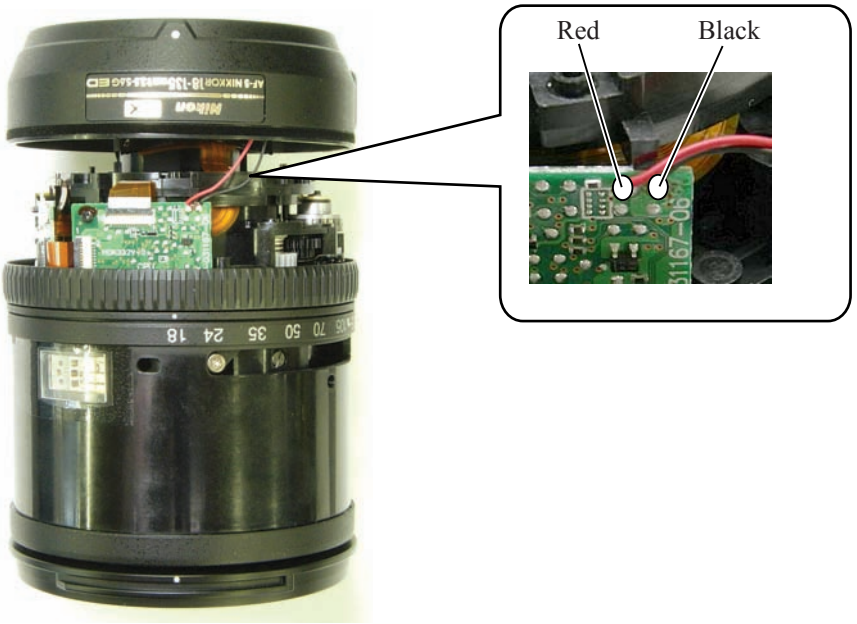




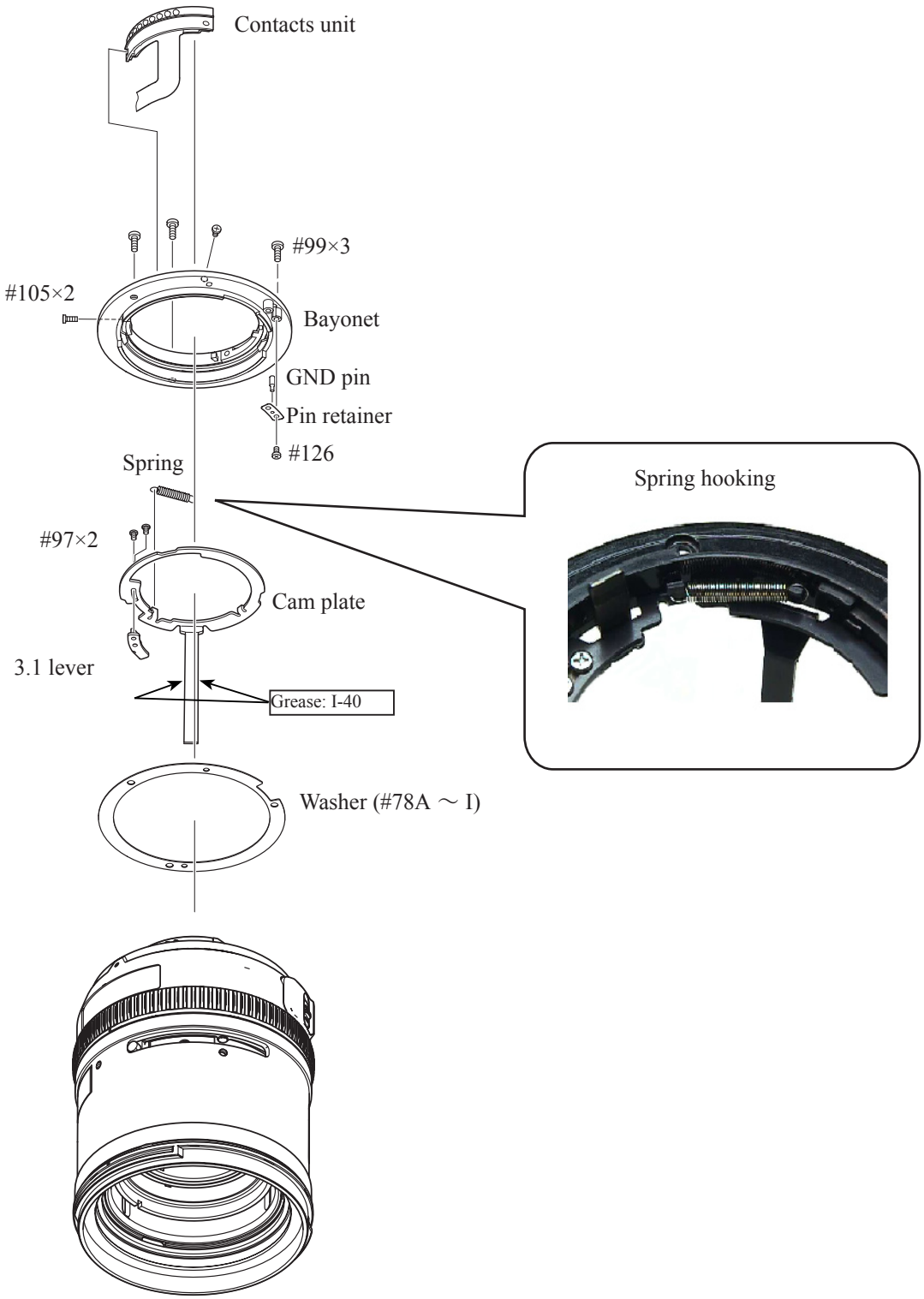
② Assemble the outer fixed tube unit.

Caution: When assembling, be careful NOT to pinch the lead wire.

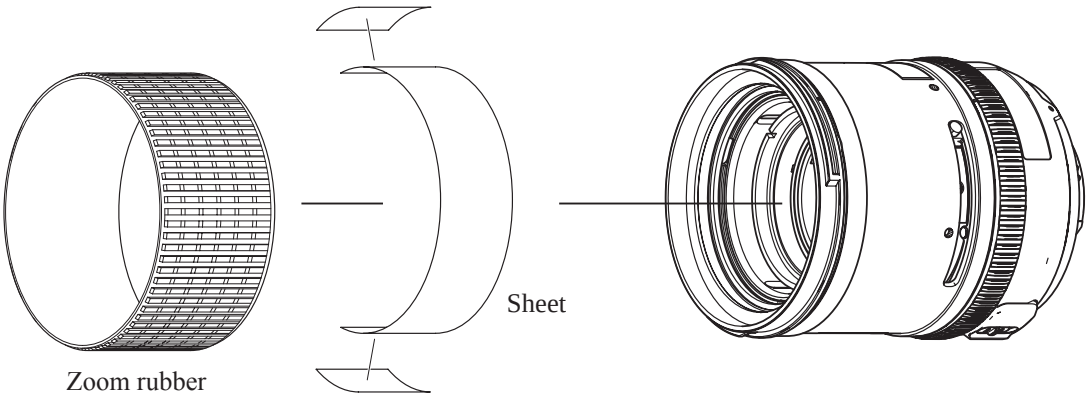
Outer fixed tube unit



Bayonet

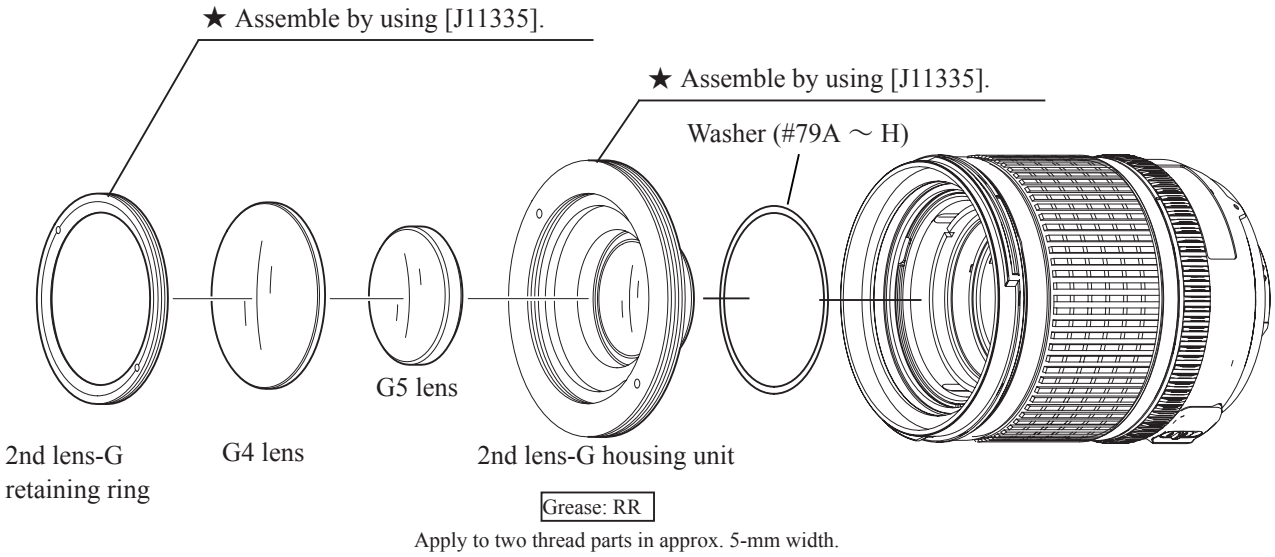

Contacts unit
#99×3
#105×2
Bayonet
GND pin
Pin retainer
#126
Spring
Spring hooking
#97×2
Cam plate
3.1 lever
Grease: I-40
Washer (#78A ～ I)

Zoom rubber



★ New tool

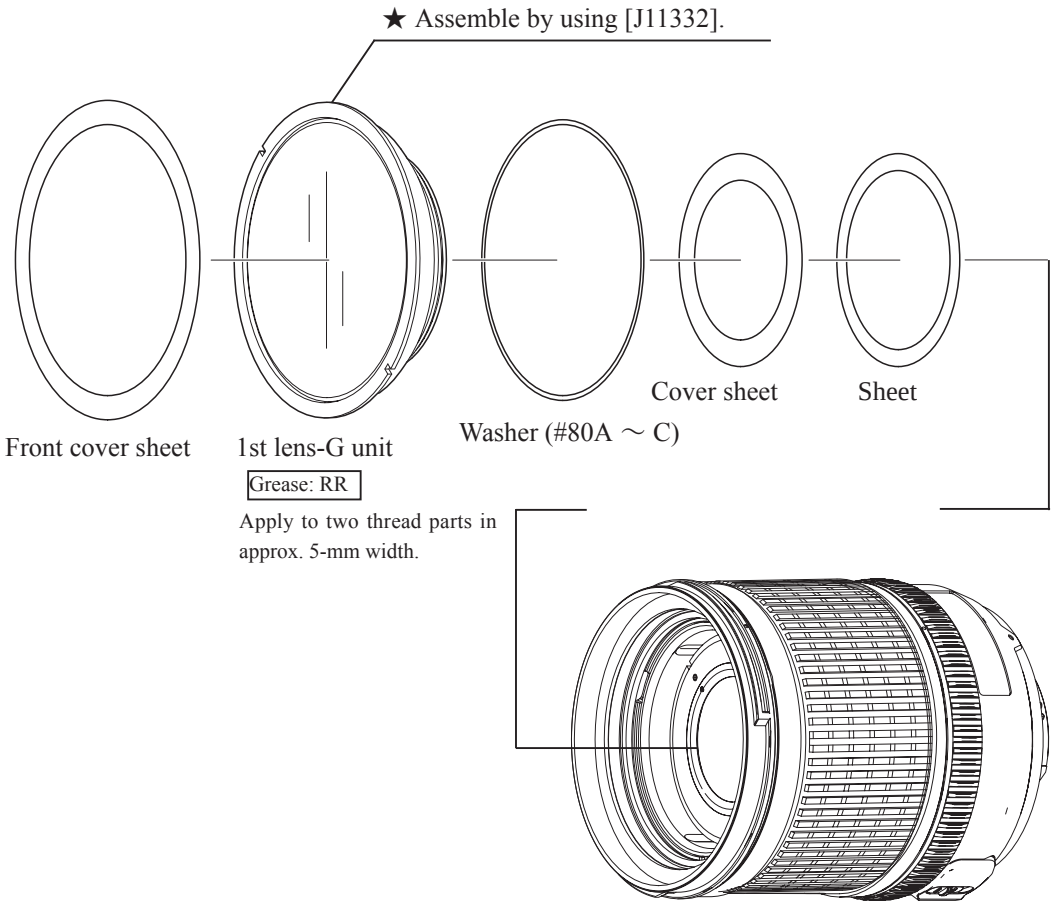
2nd lens group unit



Grease: RR

Apply to two thread parts in approx. 5-mm width.

1st lens group unit



Grease: RR

Apply to two thread parts in approx. 5-mm width.

Preparation for inspection & adjustment of main PCB

● In case of replacing the main PCB, SWM unit or MR encoder unit, be sure to make the necessary adjustments as follows:

1. Adjustments
   - ・Adjust the MR duty
   - ・Adjust the driving frequency and motor control

2. Equipment and tools to be required
   - ・Single output rated voltage power supply: 1 unit (6.0V 3.0A)
   - ・Oscilloscope: 1 unit For adjusting the MR duty, the driving frequency and motor control
   - ・AF-I communication box (J15306-1): 1 unit
   - ・AF-I communication adapter (J15307): 1 unit

● When the main PCB is replaced, be sure to perform "WRITING OF THE FIXED VALUES".

★ New tool

AF-S 18-135 inspection and adjustment program (★ J18411)

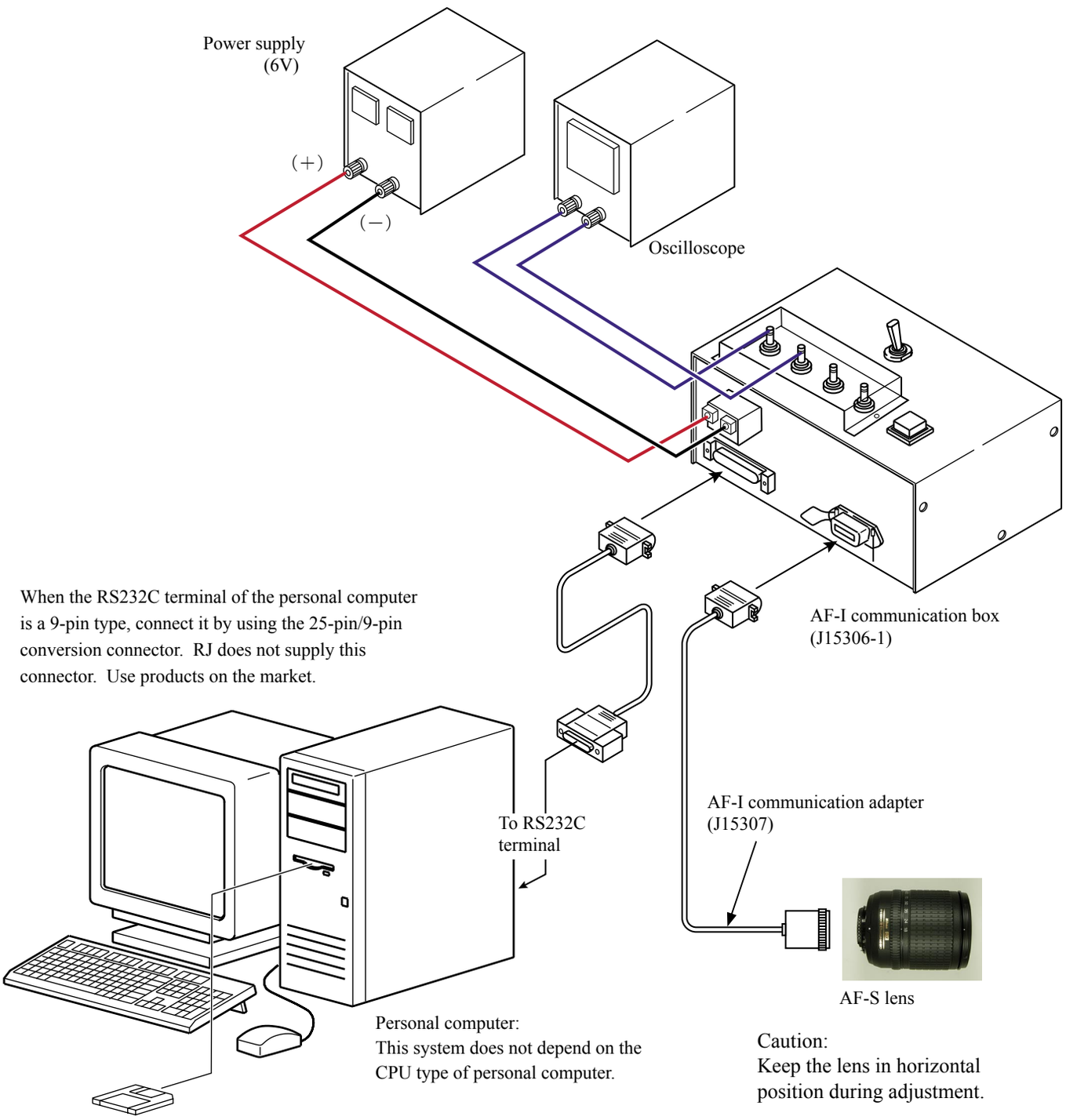
The below hardware requirements are necessary for installing the program on a computer.
Ensure them before installation.

PC	IBM PC/AT compatible
OS	Windows XP Home Edition, Windows XP Professional, Windows 2000, Windows 98 Second Edition (SE)
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



Adjustment of MR duty

●In case of replacing the main PCB, SWM unit and MR encoder unit, be sure to make adjustments.
●In case of replacing the main PCB, be sure to perform [READING AND REWRITING OF EEPROM DATA.] then [3.WRITING THE FIXED VALUES.]

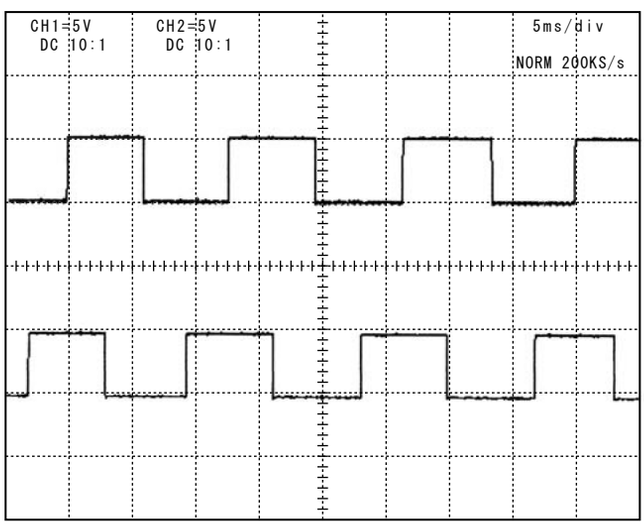
How to adjust

① Make sure that the electric current and voltage of the connected rated voltage power supply are set to the set values, which are instructed on the PC screen. Then, turn the rated voltage power supply ON.

② Select "Adustment for Electrical Device" in the menu of the AF-S 18-135 inspection program.

③ The confirmation screen for writing the fixed values in EEPROM appears. Select the appropriate item.

④ Following the instruction on the screen, rotate the focus ring automatic turns in the direction from the infinity to the close distance position. Make sure that the waveform on the oscilloscope has duty 50% .



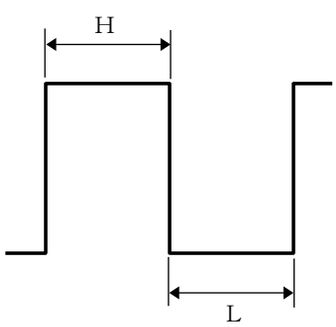
● Setting of oscilloscope

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

⑤ Following the instruction on the screen, rotate the focus ring automatic turns in the direction from the close distance to the infinity position. Make sure that the waveform on the oscilloscope has duty 50% .

Note : In case the waveform from infinity to close distance position or vice versa does not have duty 50%, recheck based on "GMR output check" on Page A19.

Standard H : L = 100 : 150 ～ 150 : 100（50% ±10.0%）



Adjustment of Driving frequency and Motor control

● In case of replacing the main PCB, SWM unit and MR encoder unit, be sure to make adjustments.

① The method of connection of the rated voltage power supply and measuring tools is the same as "ADJUSTMENT OF MR DUTY".

② Make sure that the electric current and voltage of the rated voltage power supply are set to the set values on the PC screen.

③ Turn the rated voltage power supply ON.

④ In the adjustment for Electrical Device of the AF-S 18-135 inspection program, after "Adjustment for MR-duty (Adjustment 1 of 2)", it automatically goes to "Adjustment for Frequency and Control (Adj. 2 of 2)". The lens automatically starts the driving of scanning.

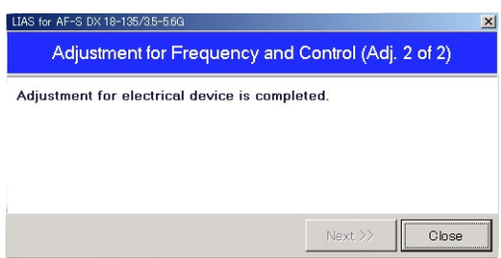


Fig.1

⑤ When the above Fig.1 is displayed, if the motor driving stops, select "Yes" to complete the adjustment.
In case the motor does not stop driving, select "No " to make adjustments again.
In case the motor does not stop driving even after the readjustments, adjust the MR duty again and repeat "ADJUSTMENT FOR DRIVING FREQUENCY & MOTOR CONTROL".
If the adjustment is not successful in spite of the above, the SWM unit, fix-tube unit, or MR head unit may be defective.

Inspection of Lens operations

Check the lens operations by using a personal computer after assembling.

○ Check by personal computer

● Check by the following considerations:

1. MR encoder operations

・Drive the scanning of lens and check the total number of pulses.

・In case the MR head of the MR encoder and the magnetic tape are misaligned, the number of pulses becomes out of standard.

2. Lens-servo stop accuracy

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

・In case the irregularity of mechanical operations does not take place in the focus ring driving unit, the underrun tends to occur if the rotation of the segment-gear ring unit is heavy, while the overrun tends to occur if it is light.

3. Lens-servo time

・Check the servo time (from starting and stopping the servo) when driving the specified lens by using the oscilloscope.

・In case the irregularity of mechanical operations does not take place in the focus ring driving unit, the servo-time tends to be long if the rotation of the segment-gear ring unit is heavy, while the servo-time tends to be short if it is light.

4. Switches and lenses

・Check the ON/OFF operations of switches and the operating condition of the zoom and distance encoder.

● After inspections

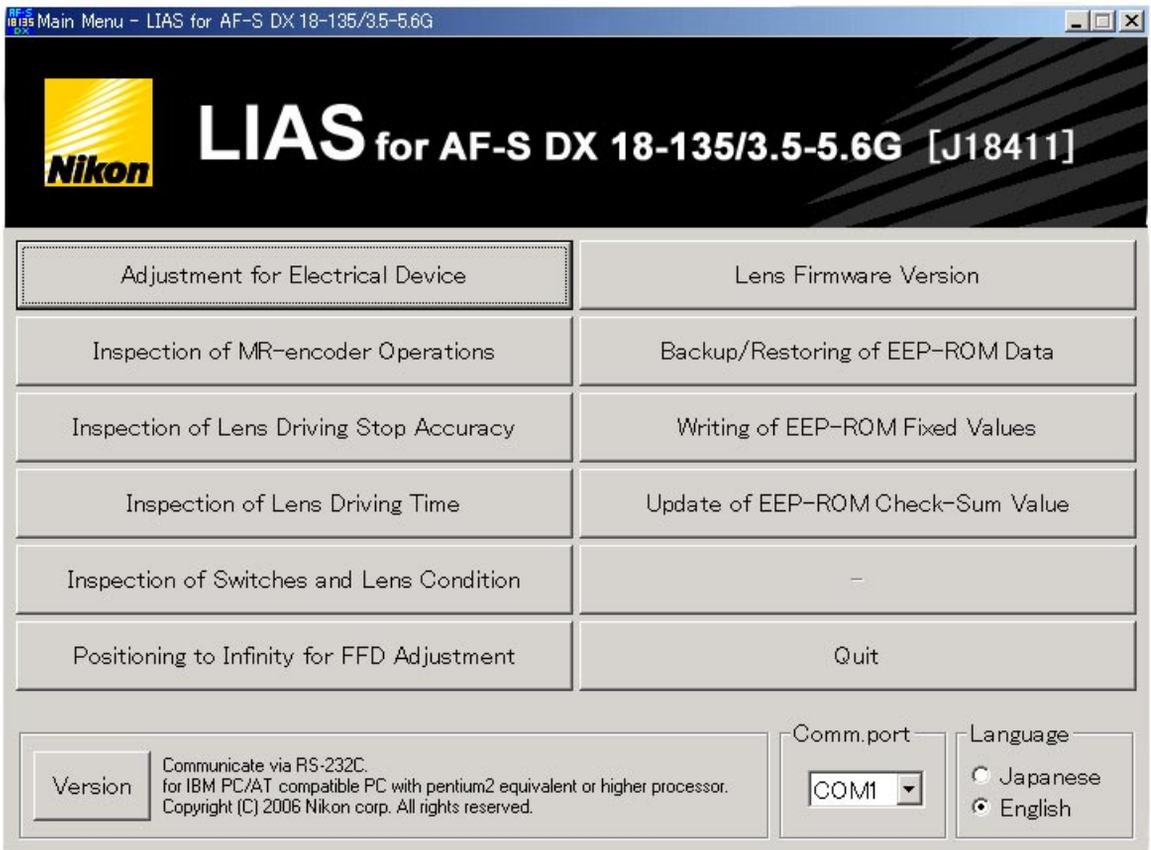
1. When the MR encoder operations are NOT up to the standard:
   Readjust the MR duty. (ref. Page A32.)
   In case the pulse is not up to the standard, recheck "GMR output check" (ref. Page A19).
   In case the pulse meets the standard, replace the SWM base unit, mechanical parts which drive the focus sliding tube, etc.

2. When the lens-servo stop accuracy is NOT up to the standard:
   Check the output waveform of the MR encoder. If it is normal, replace the SWM base unit, mechanical parts which drive the focus sliding tube, etc.

3. When the lens-servo time is NOT up to the standard:
   Readjust the driving frequency and motor control.
   In case the lens-servo time is not up to the standard even after the readjustment, replace the SWM base unit, mechanical parts which drive the focus sliding tube, etc.

●AF-S VR18-200 inspection program

(1) Menu screen



・Menu items

The items 1 and 2 are used for adjustments.

The item 3 is used for reading and writing EEPROM DATA.

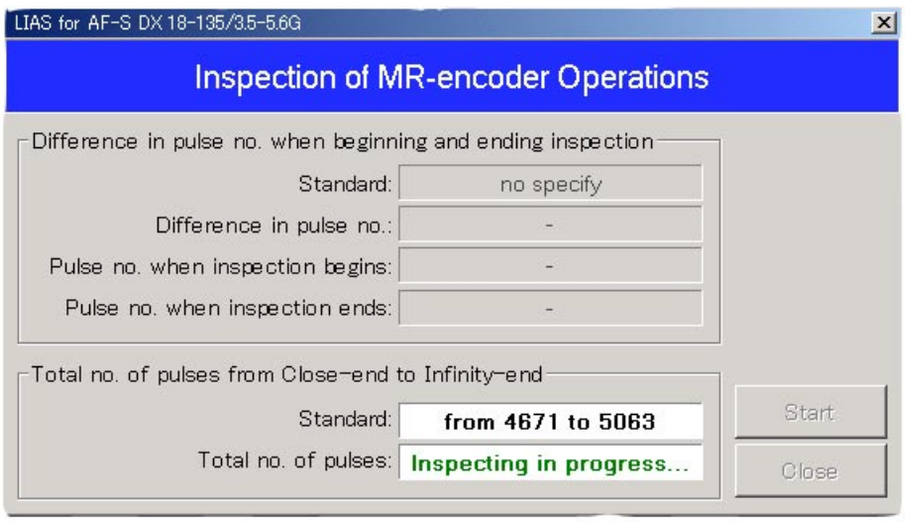
The items 4~7 are used for inspections.

・Selection items

After selecting items screens appear, such as the lens selection, the focal length selection, the voltage setting, the inspection mode start.

The screens depend on the items. Follow the instructions of the personal computer.

(2) Inspection of MR encoder operations

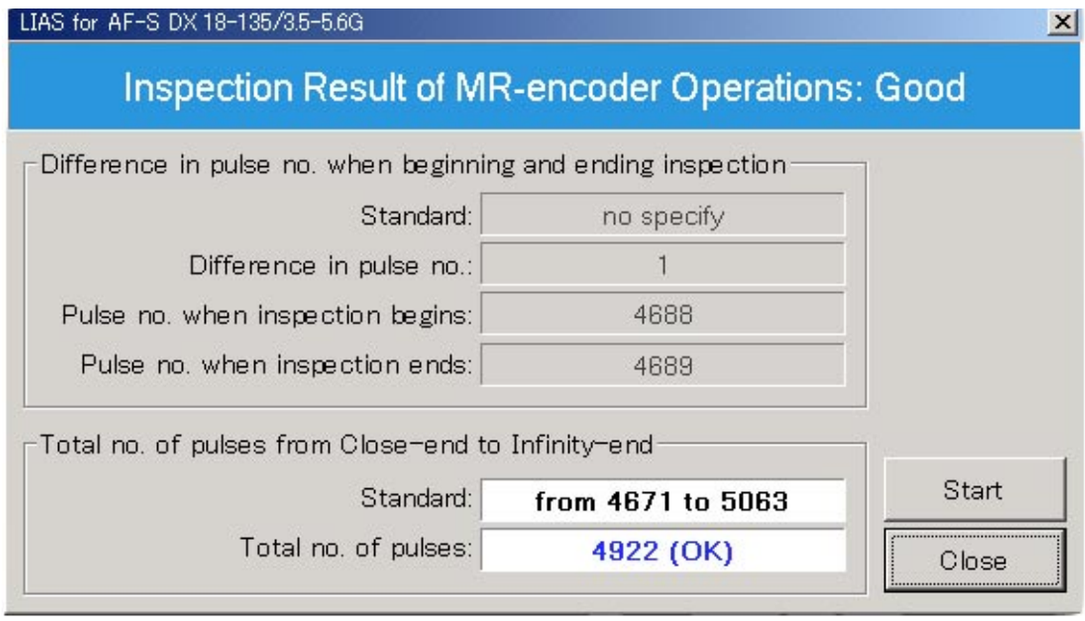


Caution : If the MF ring is rotated while the lens scanning is driven, the pulse shows an abnormal value.
Do NOT touch the MF ring during operations.

When the inspection ends, the result of the next page appears.

The difference in pulse before and after the inspection must be within the standard.

< Standard > Total pulses : 4867 ± 196 PULSE(S)



(3) Inspection of lens-servo stop accuracy

① Make this inspection on both focal length 18mm (W) and 135mm (T).

② If the lens stops while inspecting the lens-servo stop accuracy, input a figure in "ADJUST DELAY-TIME" of the below "Fig.1", from "0" to "1000" for the delay time (msec: millisecond) which prevents stopping the lens.

Note:
The value of "ADJUST DELAY-TIME" is set by the adjustment software. So, if 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.

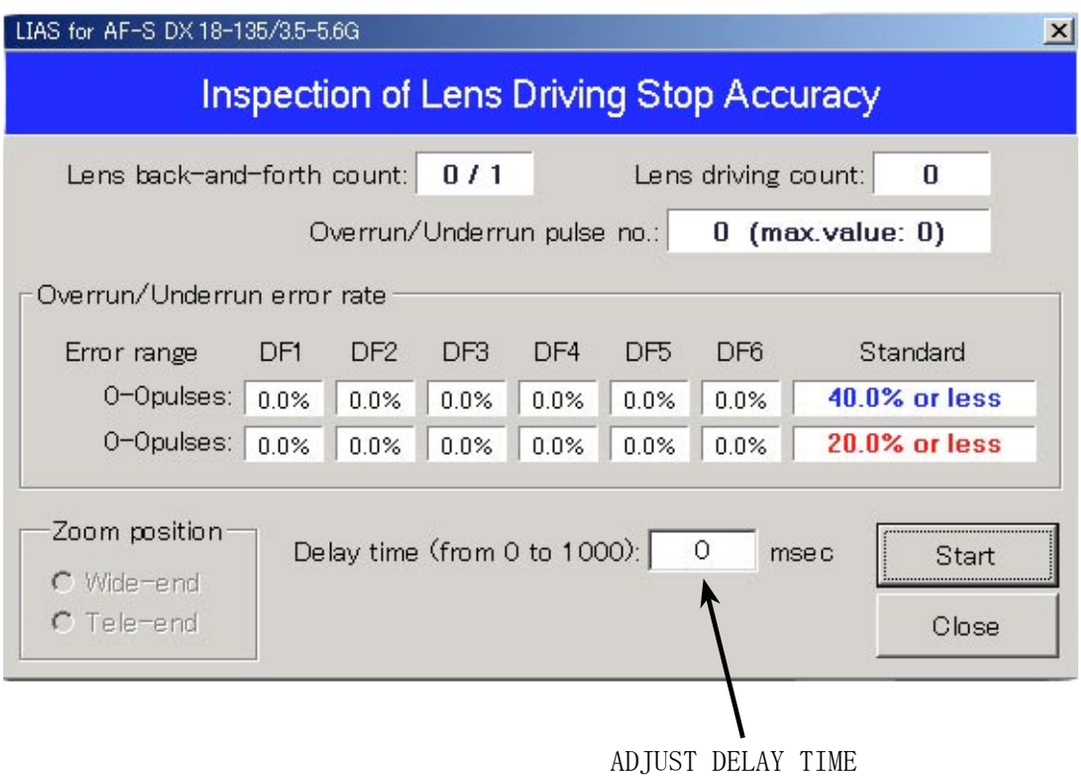
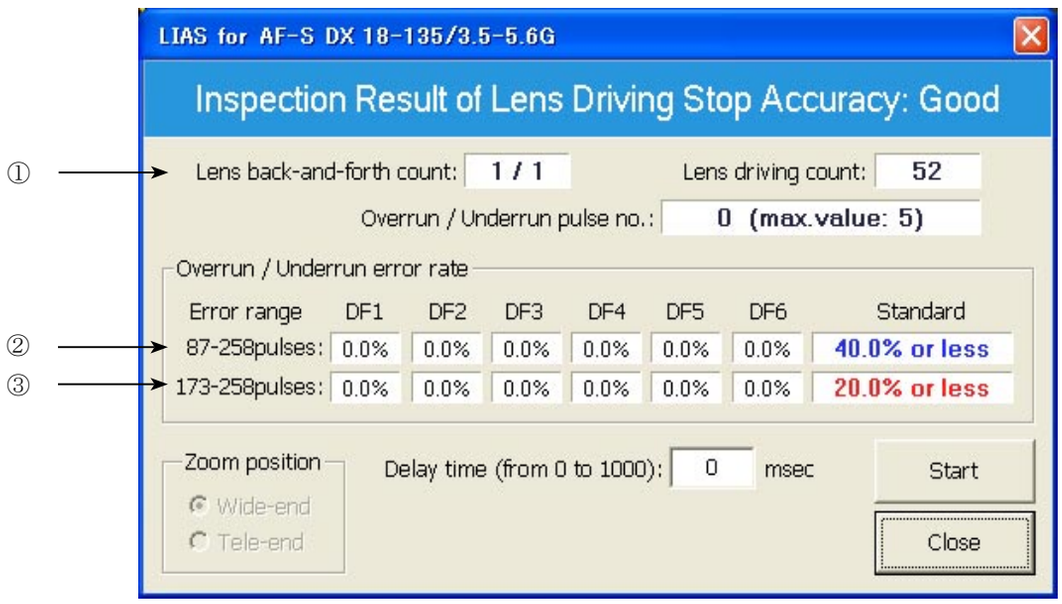


Fig.1



Caution : If the focus ring is rotated while the lens scanning is driven, the pulse shows an abnormal value. Do NOT touch the focus ring during operations.
During the lens driving, the above screen is displayed.

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

Standard RATIO (1) is 40% or less for Df1~Df6. ② of the screen

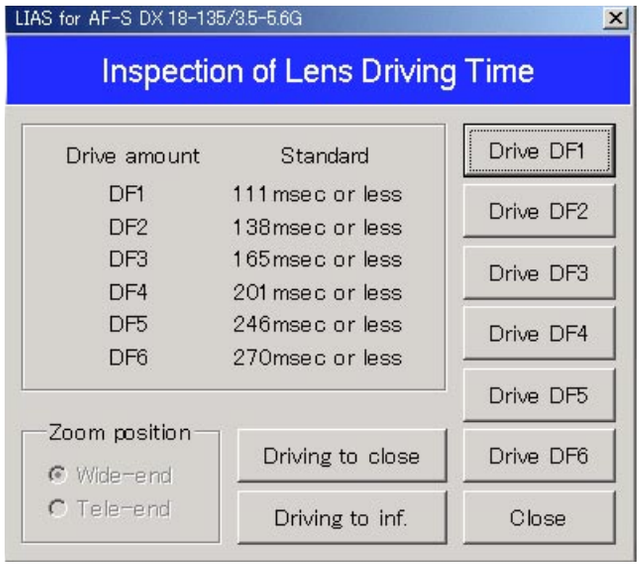
RATIO (2) is 20% or less for Df1~Df6. ③ of the screen

Even only one occurrence of defective pulse for Df1-Df6 indicates "Overrun/Underrun error max. permissible level over".

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

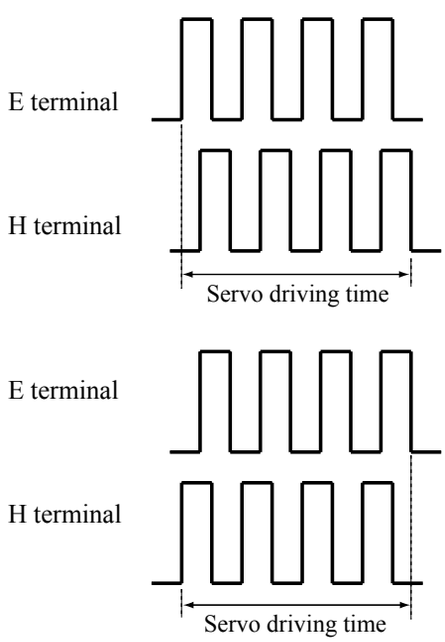
(4) Inspection of lens-servo time

Make this inspection on both focal length 18mm (W) and 135mm (T).



Select the servo driving amount respectively. Each lens-servo drive time must be within the standard.

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

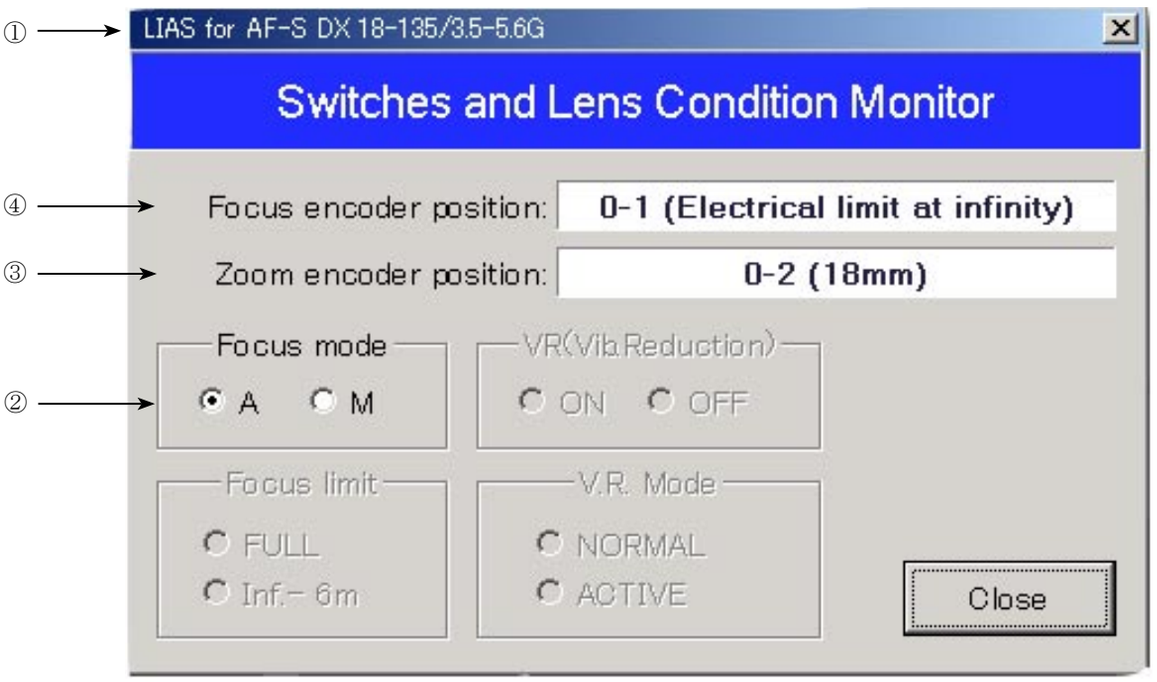


●Oscilloscope setting

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

※ The waveforms of E and H terminals have the forms for going up for start and going down for start.

(5) Inspection of switches and lens conditions



① Type of lens

② Status of Focus mode-change SW

③ Position of the zoom encoder
(Value changes by turning the zoom ring)

④ Signals of the distance encoder
(Value changes by turning the MF ring)

Necessary adjustment when replacing parts

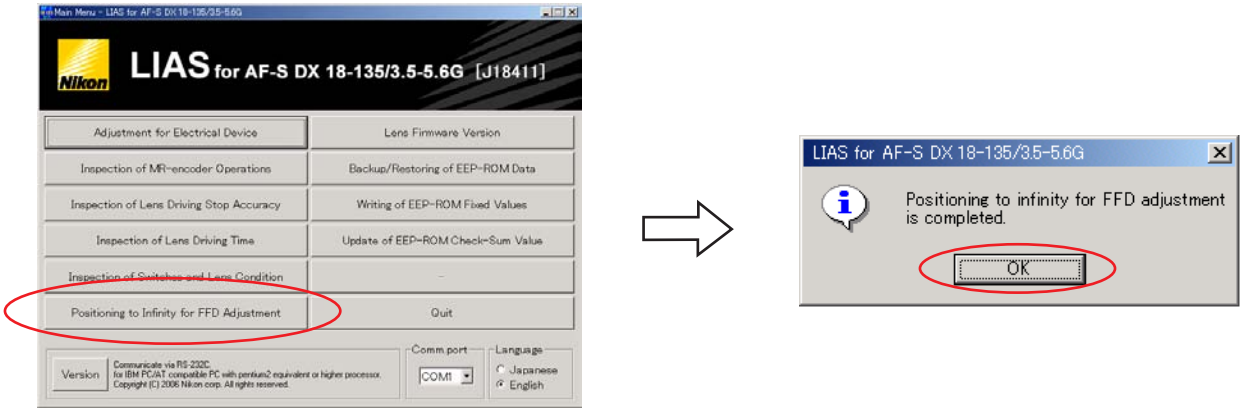
Adjustments / Parts to be replaced	Adjustment for MR duty (Necessary to write fixed value when the main PCB is replaced); driving frequency; motor control	Inspection & adjustment for MR encoder operations; lens-servo stop accuracy; lens-servo time; switches; lens condition
Main PCB unit	○	○
SWM unit	○	○
GMR-FPC	○	○
Segment gear ring unit	○	○
SWM base unit	○	○
Zoom/distance-FPC		○

Adjustment (Division) of Focus movement (T, W)

★ New tool

1. Rotate and set the zoom ring to TELE-end.
2. Rotate and set the focus ring to infinity-end, and attach the tape in appropriate length on the focus ring and the outer fixed-tube unit.

3. Start up the adjustment software (★ J18411), and perform "∞" positioning by "Positioning to Infinity for FFD Adjustment" of the main menu.



4. Fix the aperture lever so that the aperture becomes full.
5. Read each value of WIDE, MIDDLE (50 mm) and TELE sides.
6. Calculate as follows:

(C − B) ÷ 1.8 = E
(A − B) ÷ 2.2 = E

[Note: ÷ (divided by)]

A = Value at MIDDLE (50 mm)
B = Value at WIDE side
C = Value at TELE side
D = Adjustment amount (mm) of the washer (#79) of the 2nd lens group
E = Adjustment amount (mm) of the washer (#80) of the 1st lens group

7. Increase/decrease the washers (#79) for adjusting the thickness by the above "D" value. If "D" is plus, increase the thickness of it, while it is minus, decrease the thickness of it.
8. Increase/decrease the washers (#80) for adjusting the thickness by the above "E" value. If "E" is plus, increase the thickness of it, while it is minus, decrease the thickness of it.

Note 1: Regarding the 1st lens-G washer, the more-than 0.4-mm thickness in total cannot be put. If the washers in 0.4-mm thickness are already put, in addition, the result of "C-B" becomes "plus", it is necessary to select and adjust by using the 2nd lens-G washer. In this case, use the following formula.

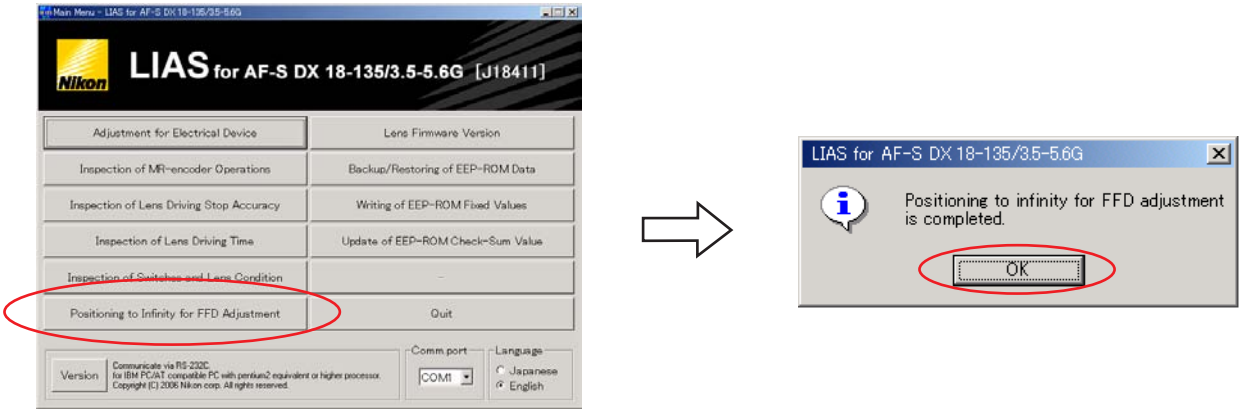
(C − B) ÷ 5 = D

Note 2: When the washers (#79 and #80) are put, place a thin washer between thick washers.

Adjustment of F.F.D (Back focus)

1. Rotate and set the zoom ring to TELE-end.
2. Rotate and set the focus ring to infinity-end, and attach the tape in appropriate length on the focus ring and the outer fixed-tube unit.

3. Start up the adjustment software (★ J18411), and perform "∞" positioning by "Positioning to Infinity for FFD Adjustment" of the main menu.



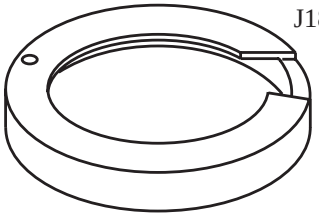
4. Mount the magnifier (DG-2) on the reference body (e.g. F3), which is for inspecting the infinity focus.
5. Mount the lens to be examined on the reference body.
6. At each position of WIDE, MIDDLE, and TELE, read the value by the horizontal-type collimator.
7. If the result is out of standard at each position, remove the bayonet mount.
8. 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. (ref. Page A27)

Focal length (f)	Standard (mm)
18 mm	+ 10″ ～+ 22″
50 mm	− 46″ ～+ 30″
135 mm	±1′20″

Ref. Adjust the thickness by calculating 30″ = 0.15 mm.

Position adjustment of Aperture lever

#105 × 2

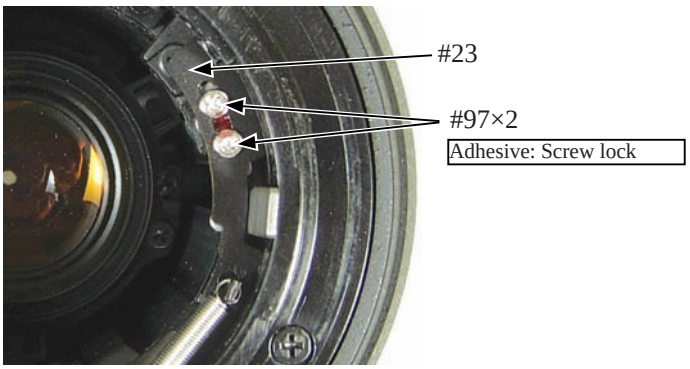


J18004-1

- Take out two screws (#105) of the contacts unit.
- Mount the tool (J18004-1), and check the aperture diameter.

Standard: Full aperture

- In case the result is out of standard, loosen the two adjustable screws (#97) of the aperture lever and make an adjustment by moving [#23].
- After the adjustment, tighten the two screws (#97) and fix with Screw lock.
- Tighten the two screws (#105) of the contacts unit.

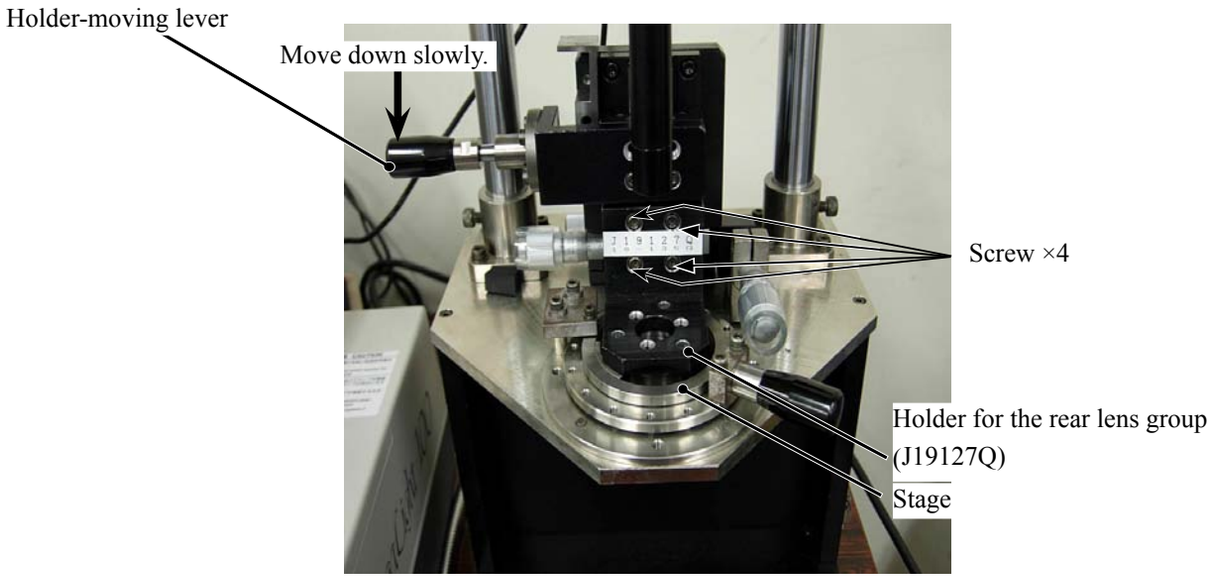


Lens Alignment

Note: This adjustment is required when the rear lens group (5th lens group) is removed.

(1) Preparation of Lens optical alignment equipment

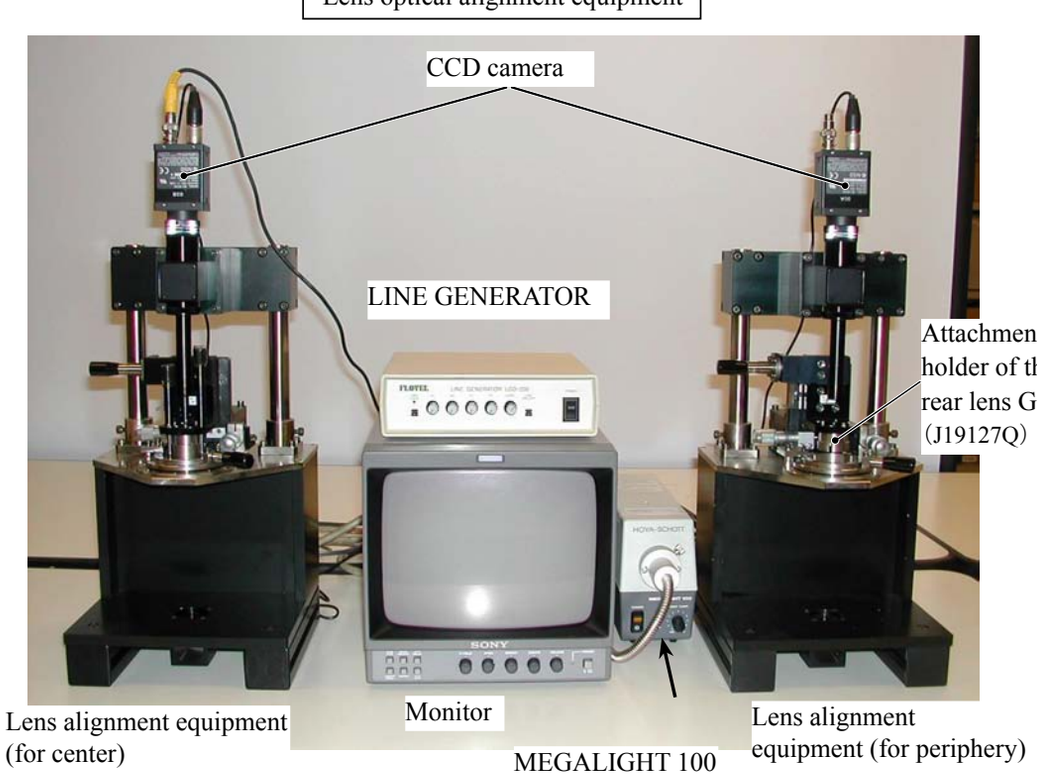
- Fix the attachment holder of the rear lens group (J19127Q) in the lens equipment.
  How to fix: Move down the holder-moving lever slowly so that the holder touches the stage. Then tighten four screws to fix it.



- Create the center positioning tool (ref. Page A60, 61 for how to create it).
- Create cardboards in which "Lens alignment chart" and "Viewers" are fit. (ref. Page A62, 63 for how to create them.)

※ As for AF-S 18-135/3.5-5.6G, the below equipment (left) for center is NOT used.

Lens optical alignment equipment



Back view of Lens optical alignment equipment

・ Connect each cable to the appropriate equipment with the same number. (e.g. Connect up ① to‘ ①)

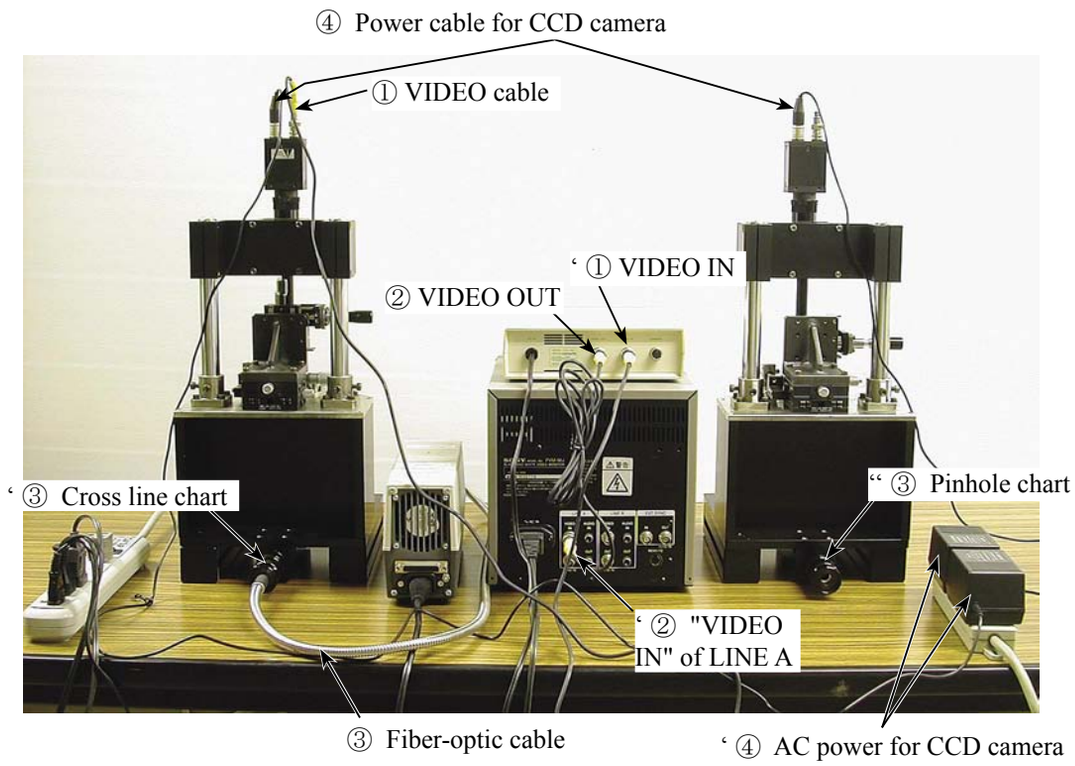
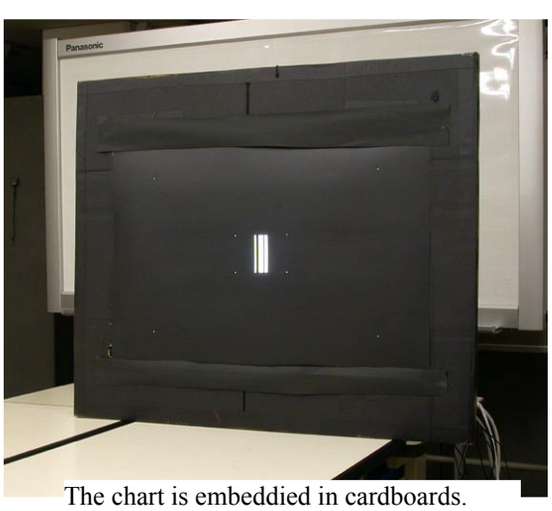


Chart shooting equipment for 3rd lens-group alignment

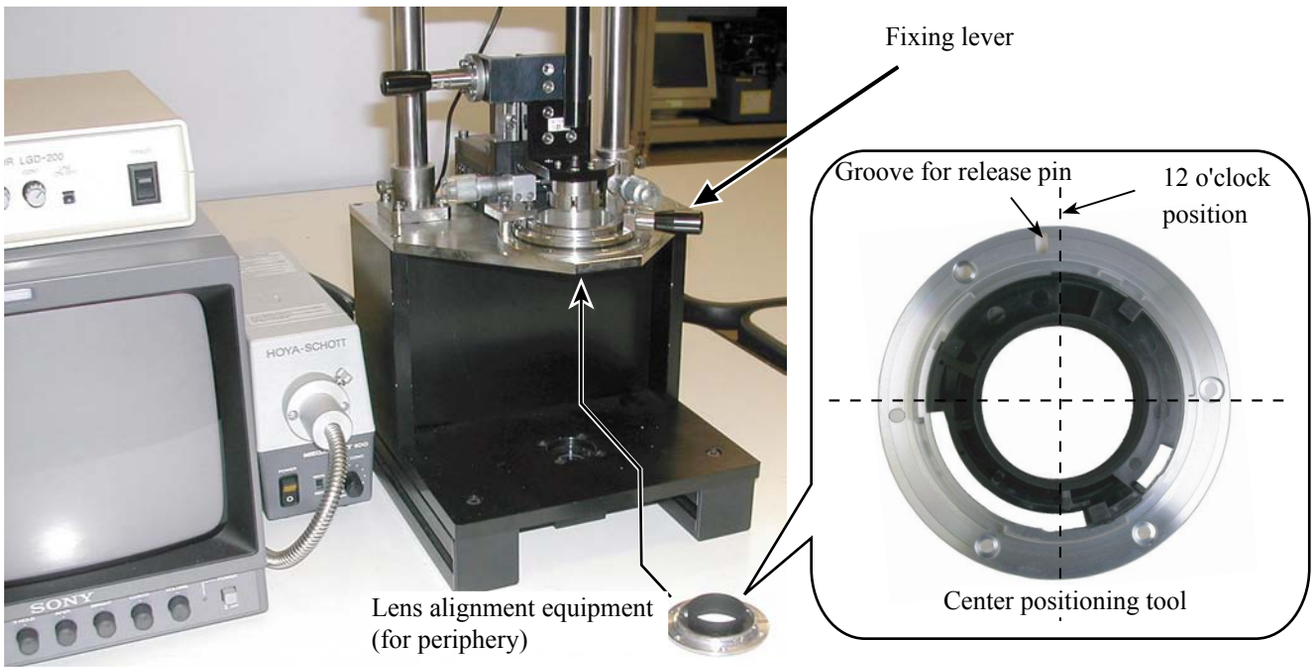
Slide rail for Lens alignment equipment



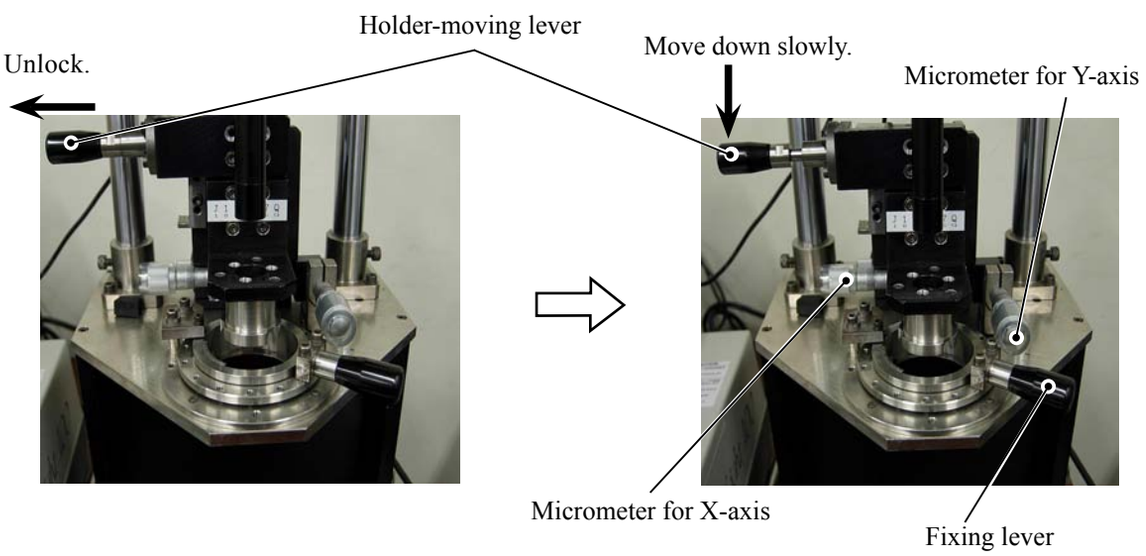
The chart is embeddied in cardboards.

(2) Temporary positioning of the rear lens group

① Mount the (self-made) center positioning tool on the lens alignment equipment (for periphery) by setting the groove in place slightly to the left (in a counterclockwise direction) from the below 12 o'clock position. Then turn the tool clockwise all the way to the right, and move the lever to the left to fix it.



② Unlock the holder-moving lever, and move the holder down slowly by the lever.



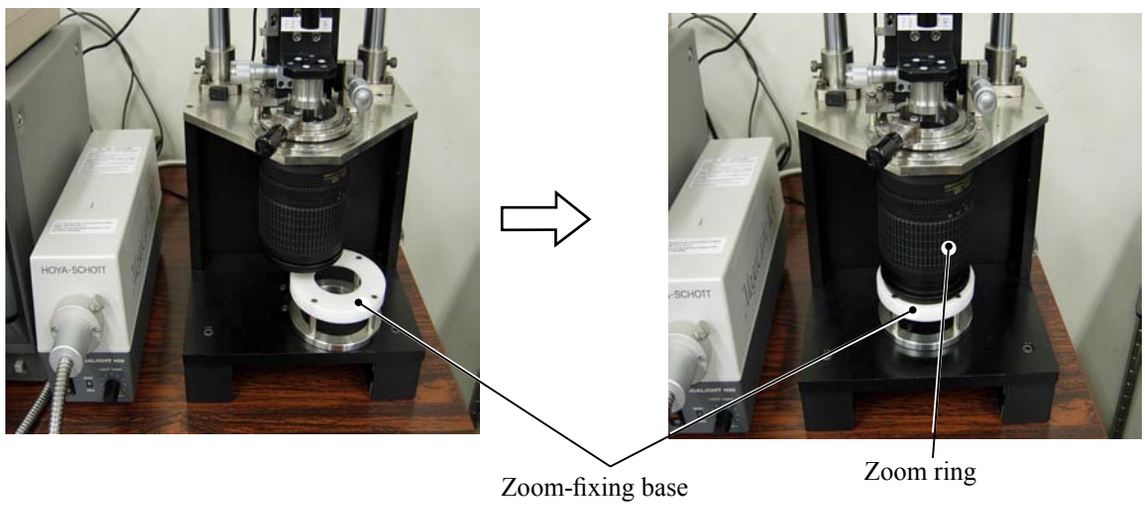
③ Adjust the holder's position by rotating the micrometers for X-axis or Y-axis so that the holder does not touch the protection ring of the center positioning tool.

Note) Without this alignment, the rear lens may be damaged by the holder.

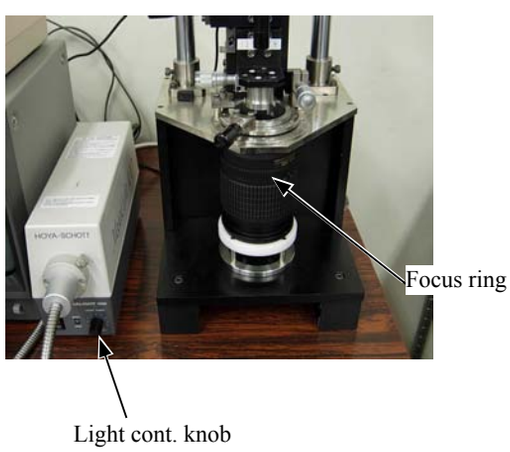
④ Move the holder-moving lever of the alignment equipment upwards, and remove the center positioning tool from the equipment by moving the fixing lever rightwards.

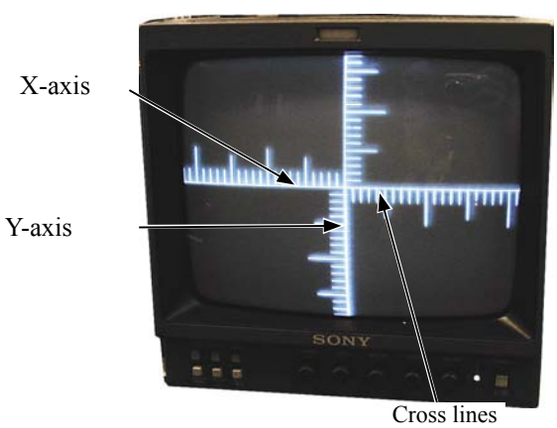
⑤ With the three screws of the rear lens chamber of the lens being loose, mount the lens to be examined on the equipment (for periphery alignment). (ref. ① for how to attach it.)

⑥ Set the lens to WIDE-end. Place the zoom-fixing base, then turn the zoom ring towards TELE until the lens touches the zoom fixing base.



⑦ Turn each power of the monitor, LINE GENERATOR, and MEGALIGHT 100 to ON. Adjust the cross lines by rotating the "LIGHT CONT." knob of "MEGALIGHT 100" and rotating the focus ring from "infinity"-end so that the calibration of the cross lines can be seen clearly.





Note) In case the cross lines are tilted, adjust them by turning the chart, which is screwed in the rear tube of the equipment.

⑧ Unlock the holder-moving lever, and move the holder down slowly by the lever.

Caution:

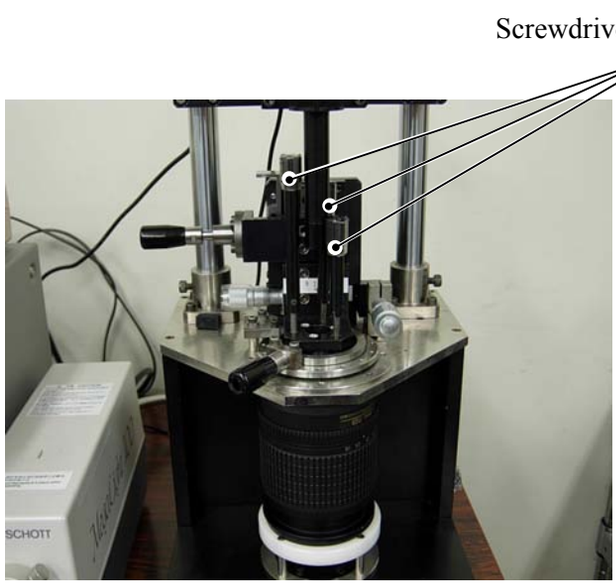
Move the holder down so that a load is not put on the lens body.

⑨ Rotate the knobs of the micrometer (X and Y-axes) so that the intersection point of the cross lines (calibrated) comes in the center of the Monitor.

Caution: If X-axis and Y-axis are unable to move, do not forcedly rotate the knobs.

⑩ When the cross lines come to the center position, insert the three alignment screwdrivers (long, middle, short) in the loosened screw holes of the rear lens chamber, and tighten the screws.

Note) Because the screws cannot be seen, when inserting the alignment screwdrivers, put them straight down in the screw holes so that the screws can be easily found.

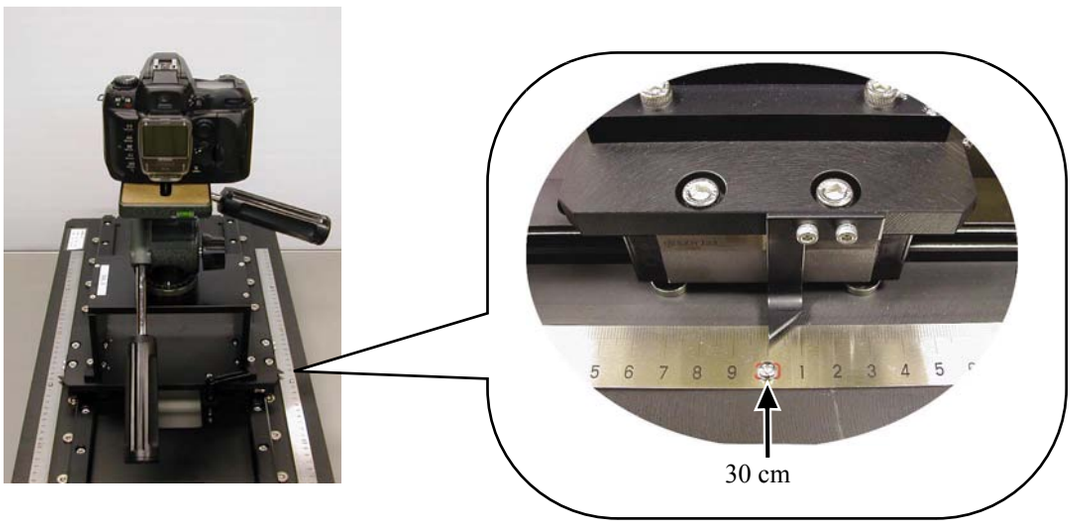


⑪ Move the holder-moving lever up slowly to lock the holder, and remove the lens from the equipment (for periphery).

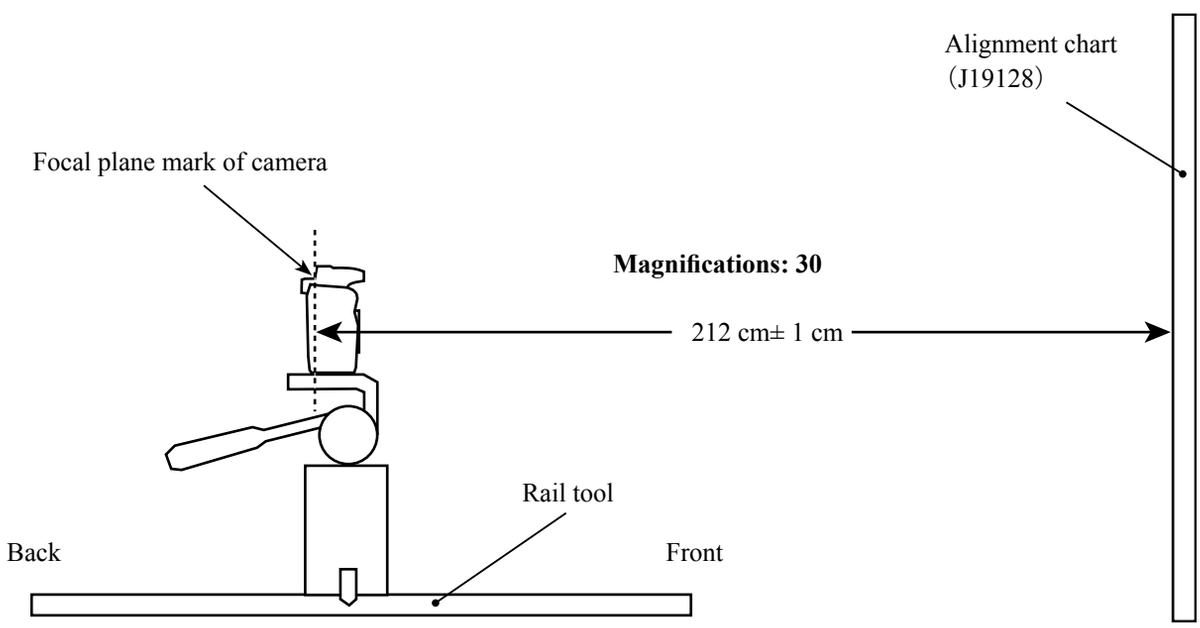
(3) Chart shooting for the rear lens group alignment

① Prepare a camera (D100). Set the shutter speed to "M1/60", the aperture to “full”, and the focus mode to "S". On the shooting menu, set "Image Quality" mode to "RAW", "WB" to "Preset" and "ISO" to "200".

② Set up the camera (D100) on a tripod on the slide rail. Set the indication pointer of the tripod to 30 cm.



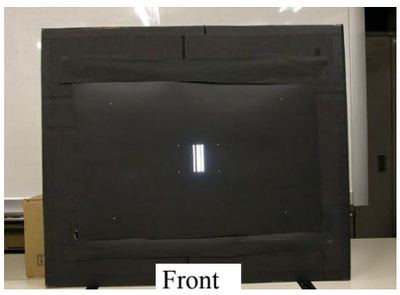
③ Set the alignment chart (J19128) as shown below.

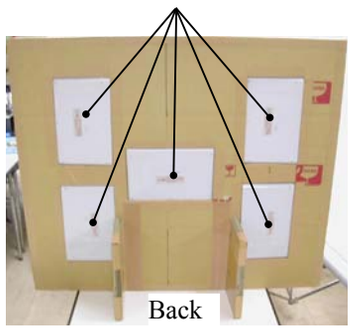


④ Turn the power of viewers (5 pcs.) to ON.

(Note: If the batteries of viewers are exhausted with decreased brightness, the shooting data cannot be obtained correctly.)

Viewer× 5 pcs.

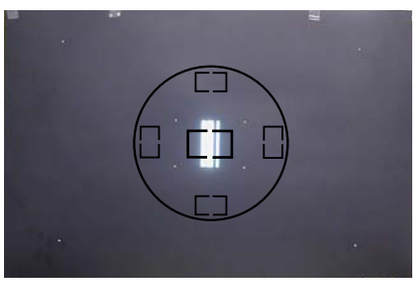




⑤ Fit the lens to be examined in the camera (D100). Set the zoom to (70 mm) and rotate the focus ring to focus on the chart.

⑥ By looking through the viewfinder, adjust the height and tilt to make the chart fill the entire finder field frame.

⑦ Adjust the tilt of the slide rail to make the three chart lines position in the center of the viewfinder, when the tripod is slid all the way to the front and back.

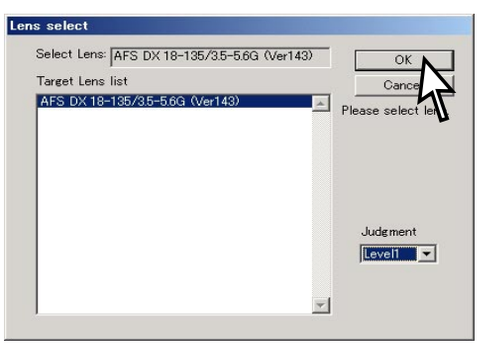


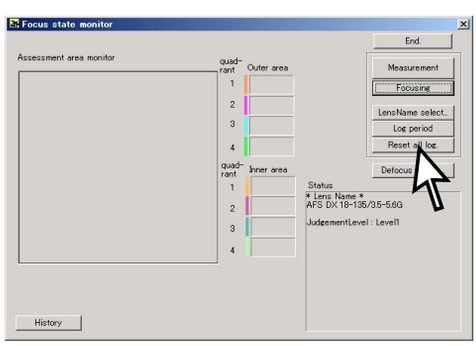
⑧ Connect the PC and camera via USB cable. (Camera setting: Mass Storage)

⑨ Start the adjustment software (LWM.exe).

⑩ "Lens Select" window opens. Select "AFS 18-135/3.5-5.6G", then click "OK" button.

⑪ Click the "Reset all log" button.

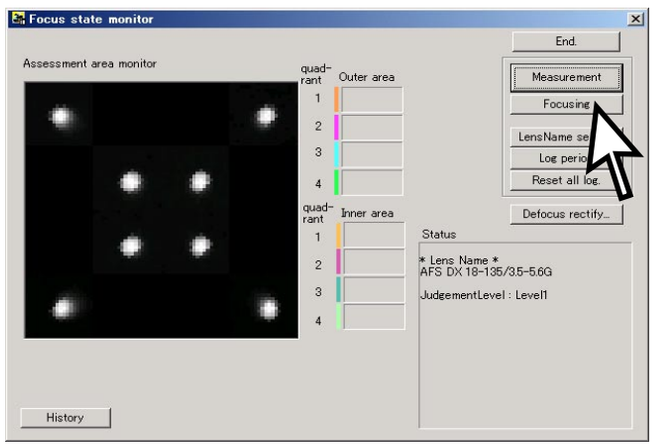




⑫ Set the indication pointer of the tripod to 30 cm. Then rotate the focus ring and set it to " ∞ "-end.

⑬ Darken the room.

⑭ Click "Focusing" button. AF is activated to focus and the shutter is released.



⑮ Set the focus mode of the camera (D100) to "M".

⑯ Slide the tripod to the front by 24 ± 0.1 cm.

⑰ Click the "measurement" button of the adjustment software.

⑱ When the shutter of the camera is released, slide the tripod to the back by 8 ± 0.1 cm and make a remeasurement.

⑲ Again, slide the tripod to the back by 8 ± 0.1 cm and make a remeasurement.
Repeat this operation four more times, totalling in seven measurements.
(The total sliding distance is 48 cm.)

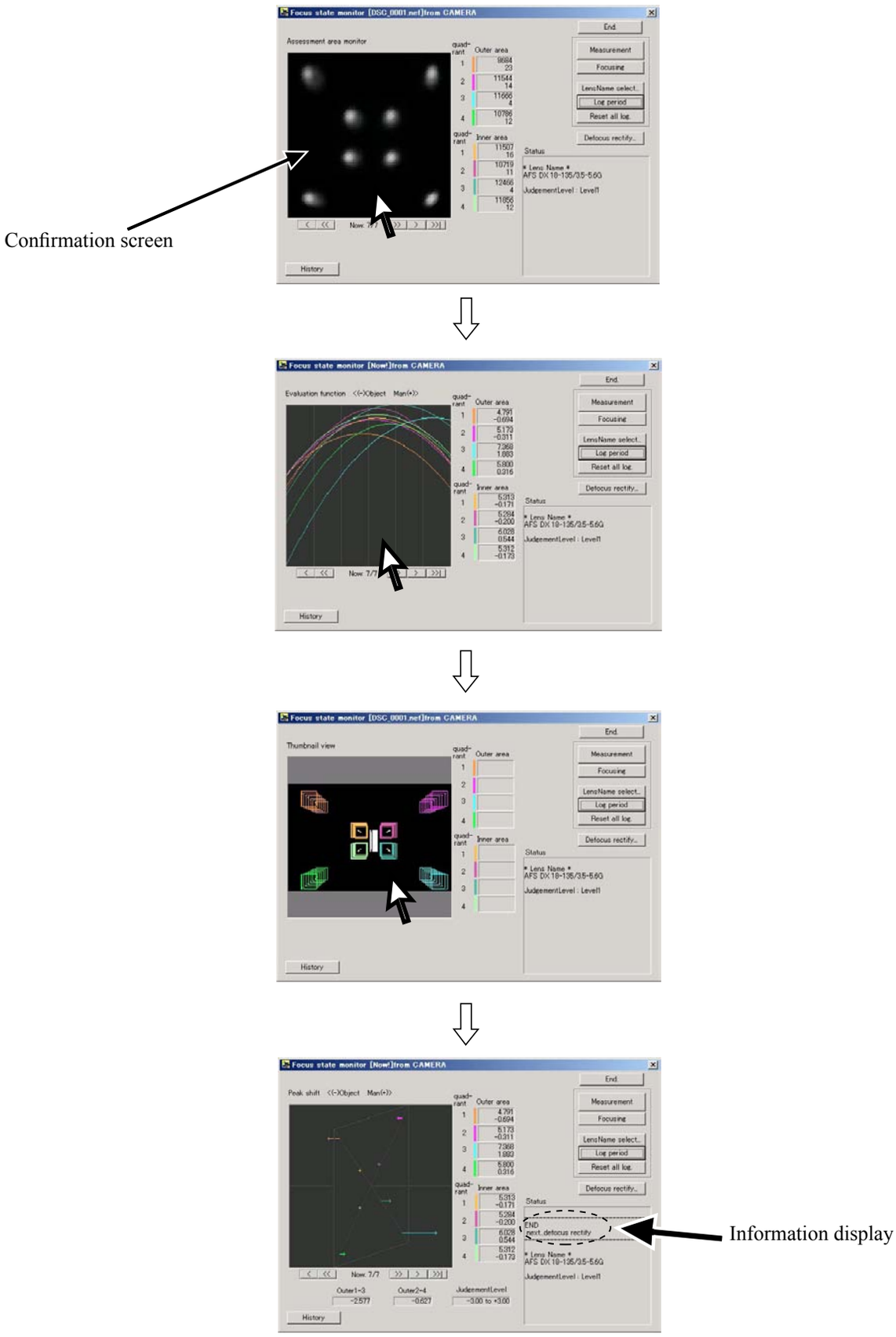
Note 1: When the below warning is given, there may be some defects in the brightness of the viewers and/or parallelism of the chart and camera, etc. So correct the above and make a remeasurement.

Note 2: When the below warning is given, recheck that the Quality mode of the camera is set to RAW.

⑲ After the seven measurements, point the cursor to the confirmation screen of the software. Click it three times, and

if "END" is displayed on the Information, the lens optical alignment is completed.

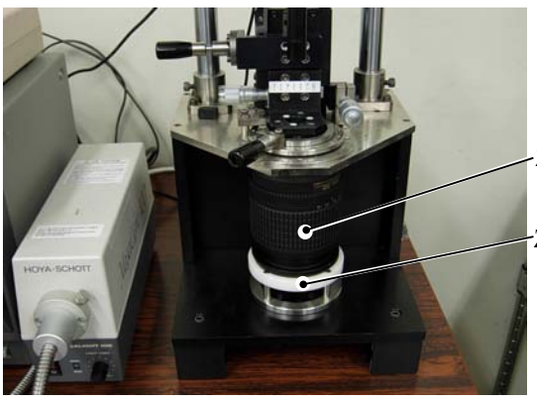
If "END" is NOT displayed (Adjust peripheral alignment by J19125 With below value), go to the next “(4) rear lens group alignment” to readjust.



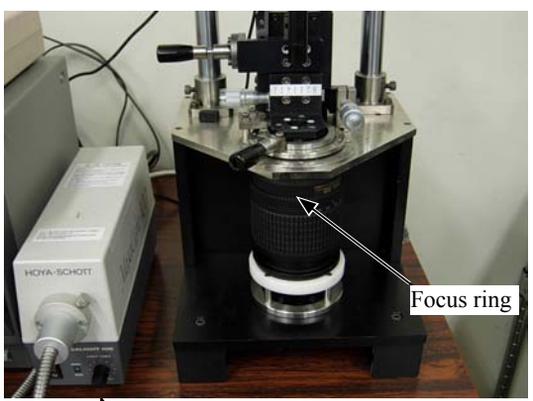
(4) Rear lens group alignment

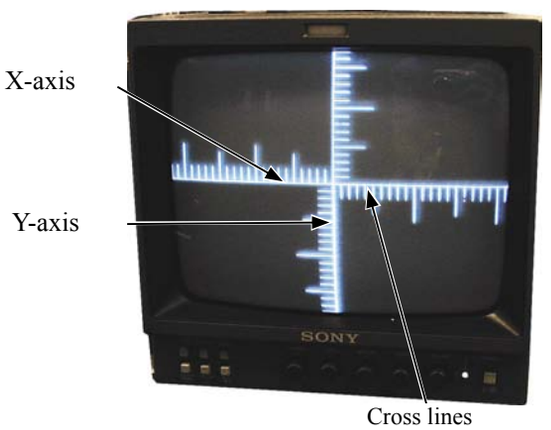
① Mount the lens on the equipment (for center). [ref. ① of (2) for how to fit in it.]

② Set the lens to WIDE-end. Put the zoom-fixing base, and rotate the zoom ring towards TELE until the lens touches the zoom-fixing base.



③ Adjust the cross lines by rotating the "LIGHT CONT." knob of "MEGALIGHT 100" and rotating the focus ring from "infinity"-end so that the calibration of the cross lines can be seen clearly.





Note) In case the cross lines are tilted, adjust them by turning the chart, which is screwed in the rear tube of the equipment.

④ Unlock the holder-moving lever, and move the holder down slowly by the lever.

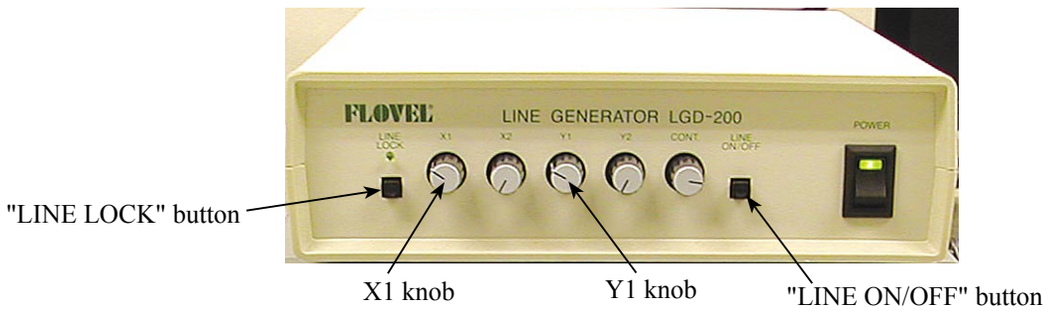
Caution:

Move the holder down so that a load is not put on the lens body.

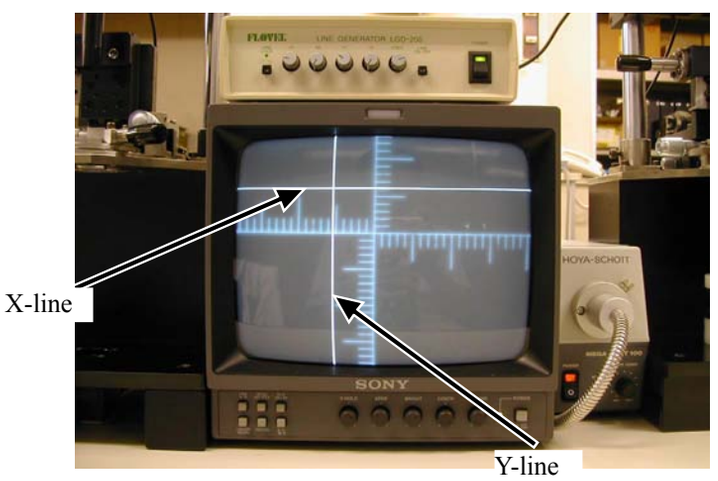
Also, adjust so that the cross lines remain unmoving, when the knobs of the micrometer (X and Y axes) are rotated and the holder is moved up and down.

⑤ Press the "LINE ON/OFF" button of LINE GENERATOR. Turn the knobs of “X1” and “Y1” until X- and Y-lines are displayed on the monitor.

Move these X- and Y-lines so that they coincide with the cross lines of the CCD camera. Then press "LINE LOCK" button to fix these X- and Y-lines.



LINE GENERATOR

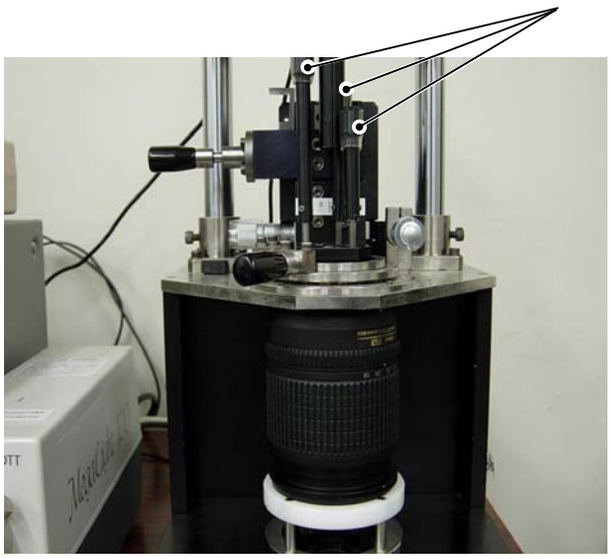


⇩

⑥ Insert the three alignment screwdrivers (long, middle, short) in the loosened screw holes of the rear lens chamber, and loosen the screws.

Note) Because the screws cannot be seen, when inserting the alignment screwdrivers, put them straight down in the screw holes so that the screws can be easily found.

Screwdrivers (long, middle, short)

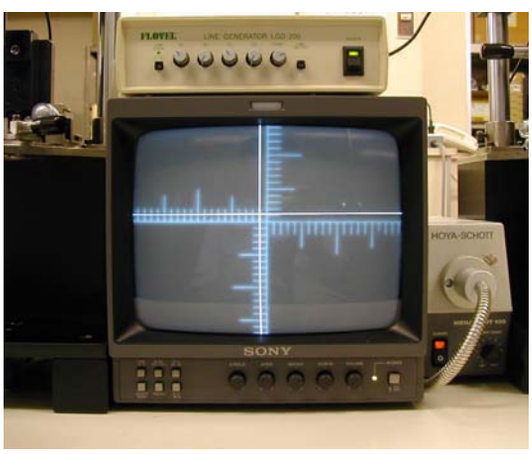


⑦ Rotate the knobs of the micrometer (X and Y axes), and shift the cross lines by the scales that were results of the chart shooting of the rear lens group alignment.

(e.g. Refer to "Pic.1" for the case of <X directions:+1, Y directions:-1>)

Caution:

When the knobs of the micrometer (X and Y axes) are rotated and the cross lines are unable to move, do not forcedly rotate them.



Pic. 1

⑧ After completing the above shifting of the cross lines, tighten three screws of the rear lens-G chamber with the alignment screwdriver.

Caution: The intersection point of the cross lines is misaligned when the holder is moved up. So adjust considering this misalignment.

⑨ Move the holder-moving lever up to lock the holder.

⑩ Check that a shift length caused by the cross lines and the X/Y lines is equal to the scales (1 = 1 scale of the calibrated cross lines) of the results of "Chart shooting of the rear lens group alignment". (ref. Pic.1)
Note: After fixing the three screws of the rear lens-G chamber, if a shift length is different from the results of the chart shooting, repeat the procedure from ④ to ⑨ until they become equal.

⑪ Turn each power of the monitor, LINE GENERATOR, and MEGALIGHT 100 to OFF. Remove the lens from the equipment (for periphery).
Then go back to “(3) Chart shooting of the rear lens group alignment” and repeat the procedure (3) and (4) until the result becomes "END".

Rear cover ring

How to create positioning tool of Rear lens-group holder for lens alignment (AF-S DX 18-135/3.5-5.6G)

1: Summary

1-1: This is a positioning tool of the rear lens group holder for lens alignment, in order to secure the position for attaching the rear lens group temporarily.

2: Preparation

2-1: The following is used:

- ＊ Rear cover ring (JAA79651- Part no. :1K631-773) X 1 pc.
- ＊ Bayonet mount (JAA79471- Part no.: 1K404-173) X 1 pc.
- ＊ Mount rotation stopper screw (JAA79471- Part no.: 1K120-012) X 1 pc.

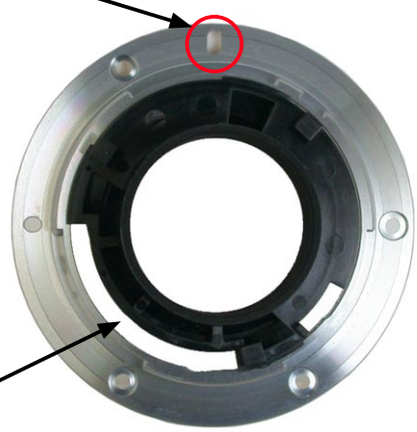
3-1: Put the bayonet mount as shown in "Fig. 1".

Put with the groove, in which the lock pin of camera body enters, just upward.

Fig. 1

3-2: Mount the reversed rear cover ring on the position of "Fig. 1", and attach them as shown in "Fig. 2".

Put with the groove, in which the lock pin of camera body enters, just upward.



Large notch of rear cover ring.

Fig. 2

3-3: Turn the rear cover ring clockwise, which was attached to the bayonet mount. Then stop at the position as shown in "Fig.3-1".

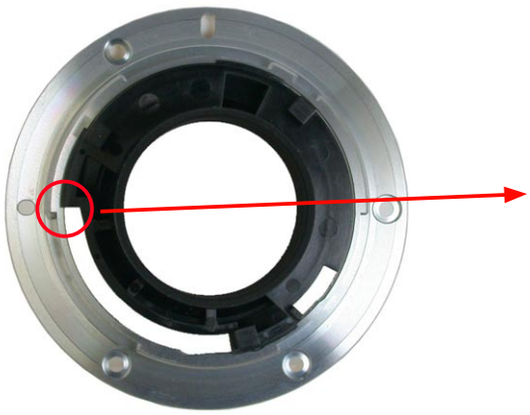


Fig. 3

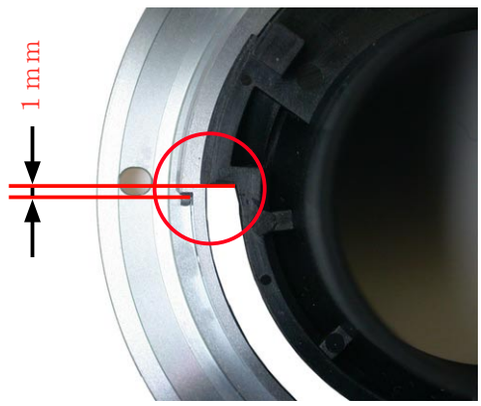


Fig. 3-1

3-4: Fix the three locations of "Fig. 4" of the rear cover ring with the instant glue.

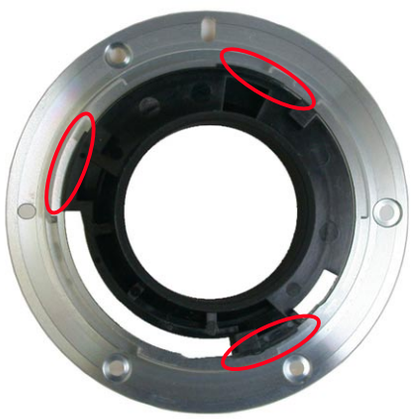


Fig. 4

3-5: Turn the bayonet mount over. Reinforce the three locations of "Fig. 5" with the adhesive to attach the bayonet mount and rear cover ring firmly.

Fig. 5

3-6: Attach the mount rotation stopper screw at the appropriate position.

How to create Setting board of "Lens alignment chart" and "Viewer"

1. Summary

1-1: In order to get necessary data for lens alignment, this board is created to use for setting a special chart and light viewers (for chart illumination), while taking pictures of the special chart with a digital camera.

2. Preparation

2-1:Prepare a board (760 x 880 x 20 mm) or 2 package cardboard boxes (size 2.33).

(Note) Because you have to cut out the shape to embed light viewers, choose package cardboard boxes (size 2.33) or material which can be easily cut. — ref. Fig. 1

3. Procedure (In this document, 2 package cardboards are used)

3-1: As for the 1st flattened cardboard box (size 2.33), check the positions for embedding the light viewers, and cut out the shape at 5 locations (shaded parts/size 154 x 245 mm) as shown below. — ref. Fig. 2

(Note) Cutting the shape slightly smaller than the actual size of viewers makes it easier to fit the positions of viewers tightly.

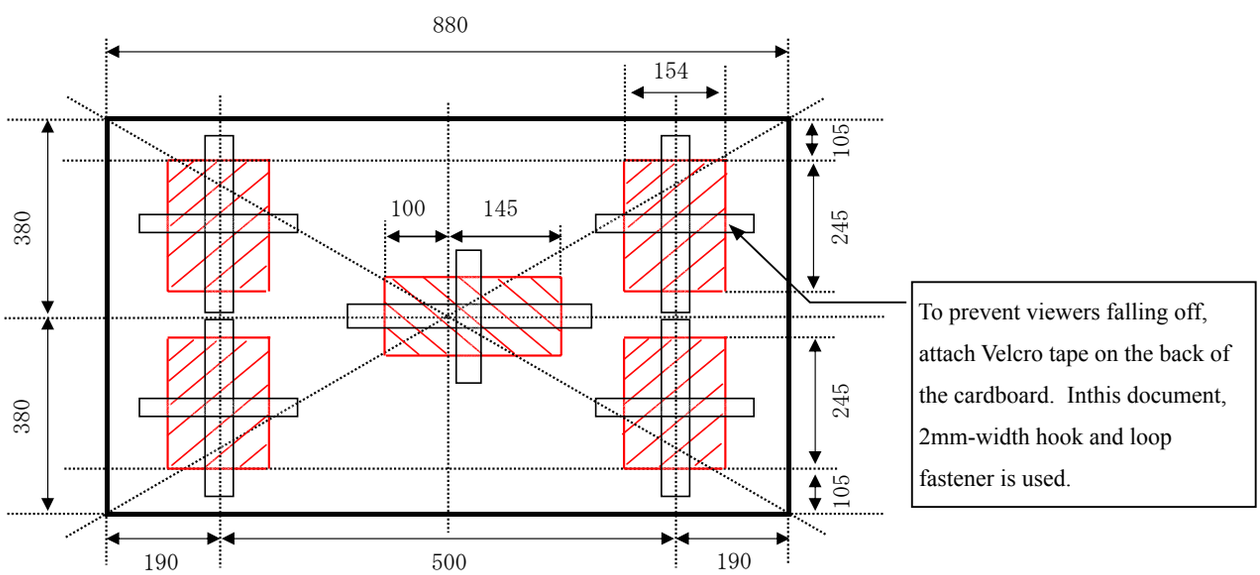
3-2:Put the 2nd flattened cardboard box (size 2.33) and the above cut-out 1st cardboard together as one, and fix them by taping at 4 sides. — ref. Fig. 3

3-3:Then as for the 2nd flattened cardboard box, cut out the shape again by matching the cut-out size of 3-1 for each viewer. — ref. Fig. 4

3-4:Reinforce the edges of cut-out parts with tape.

(Note) To prevent viewers falling off, secure them with tape around the edges. — ref. Fig. 5

3.5: Blacken around the setting board (with black spray, etc).



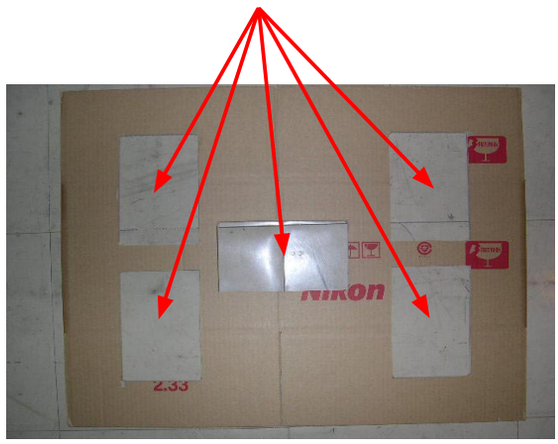
4. Prevent Viewers from falling off (In this document, 2-mm width Velcro tape is used.)

4-1: As shown above, when viewers are embedded, secure them with square pieces of Velcro tape (hook and loop fastener) on the back of the cardboard to prevent viewers falling off.

(Fig. 1- Prepare two package cardboard boxes, and flatten them as below.)

(Fig. 3- Package cardboard boxes)

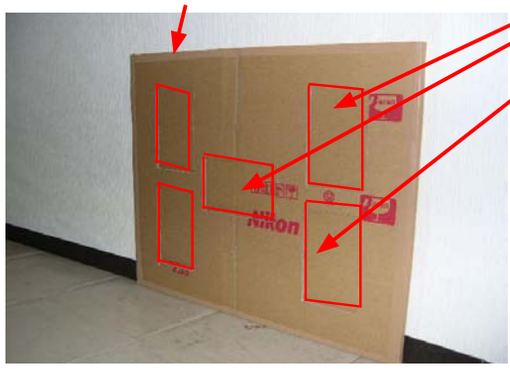
(Fig. 2 - As for the 1st flattened cardboard box, cut out the <154 x 245 mm sized> shape at 5 locations.)



(Fig. 4- As for the 2nd flattened cardboard box, cut out the shape in the same way as Fig.2. Allcardboards are cut out as below.
Cut out by matching the size of the 1st cutting.

Put the 2nd flattened cardboard boxe and the1st cut-out cardboard together as one as shown below.

Fix them by taping at 4 sides.



(Fig. 5- Light viewers are embedded.)

(Fig. 6- Setting board is blackened with the chart being attached.)

To prevent viewers falling off, secure the viewers with tape around the sdges.

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 EEPROM of the lens, in order to improve the accuracy of autofocus.

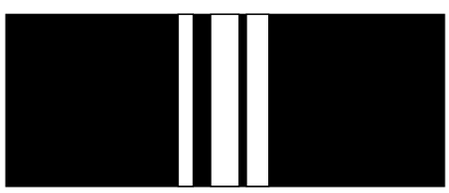
Note: This adjustment is necessary when the main PCB and/or each lens part (glass, lens chamber) is replaced or when each lens part is disassembled. Be sure to make this adjustment after completing inspecting and adjusting the main PCB.

(1) Preparation

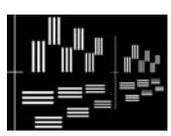
- Test chart (Self-made tool: ref. Procedure for how to create it.)
- Tripod
- D100
- Personal computer
- USB cable（UC-E4）
- Adjustment software (LWM.exe：used for the lens optical alignment.)

(2) Procedure for how to create Test chart

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



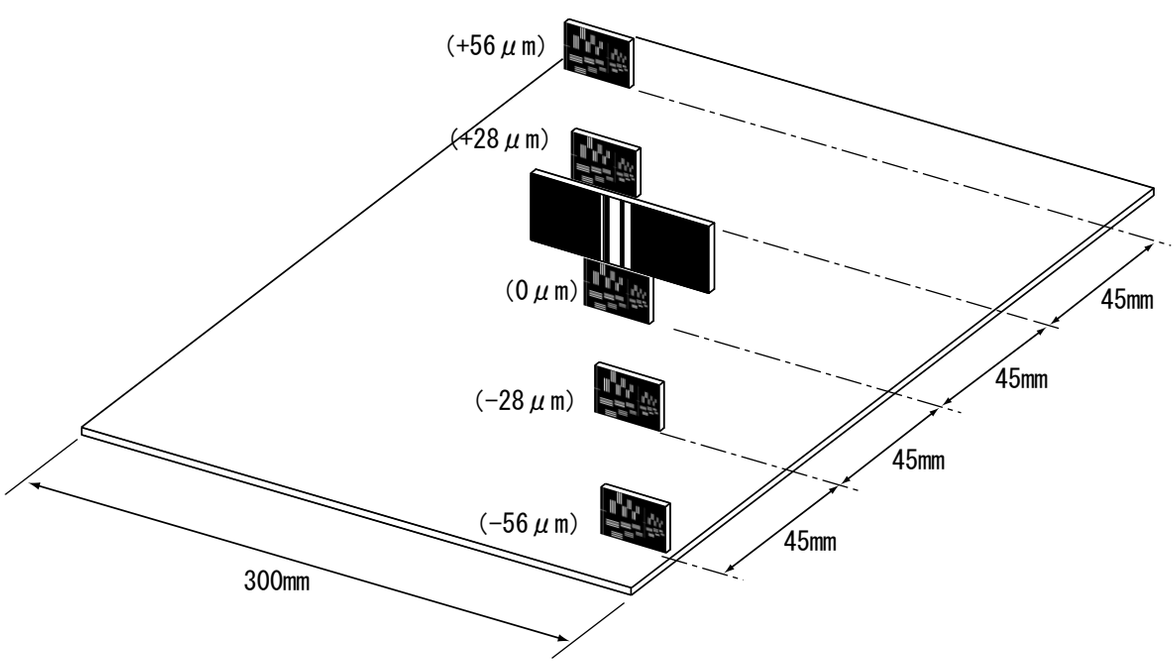
(Target chart)



(Resolution chart)

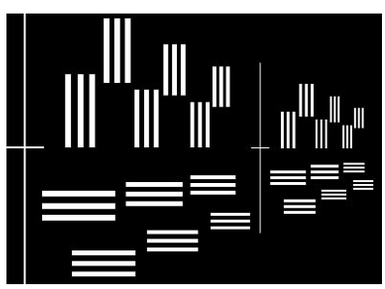
- As shown below, put each chart in position at the specified spacings.

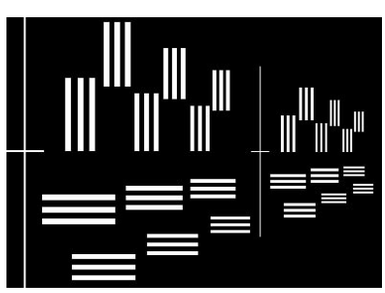
  Note: Only in the center, put the target chart on the central resolution chart.

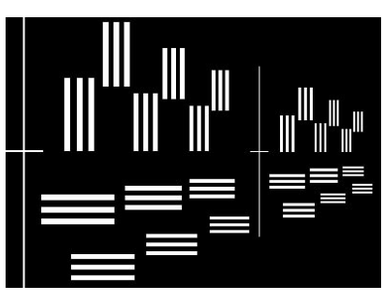


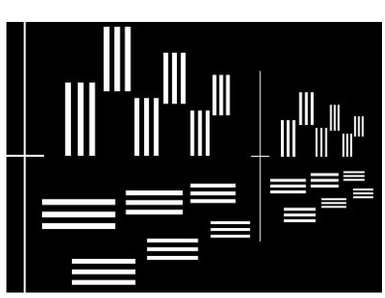
(Target chart)

(Resolution chart)







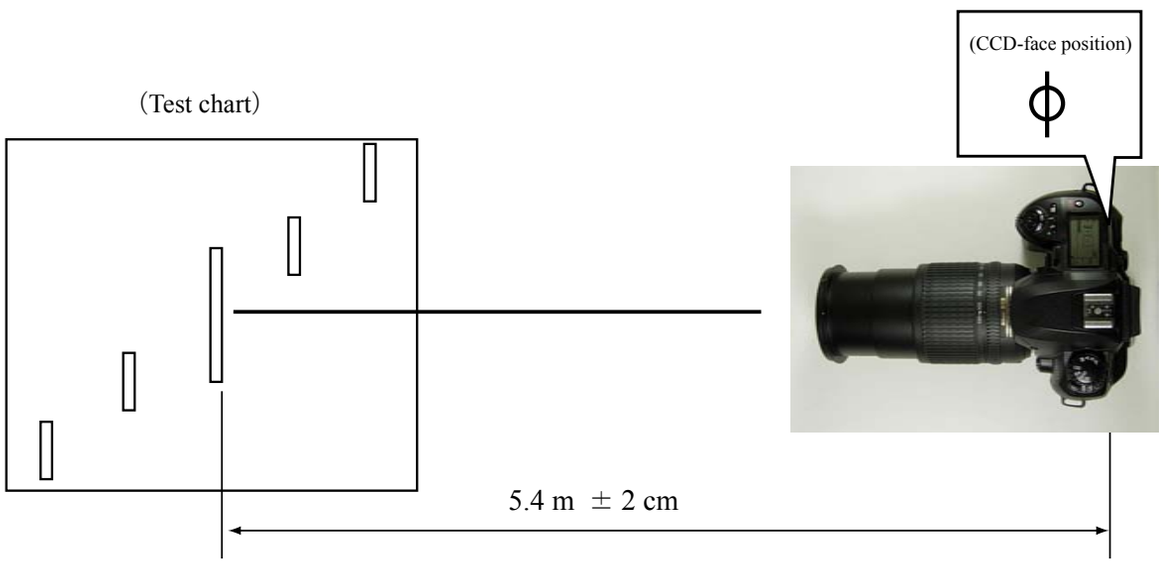


(3) Writing aberration compensation data

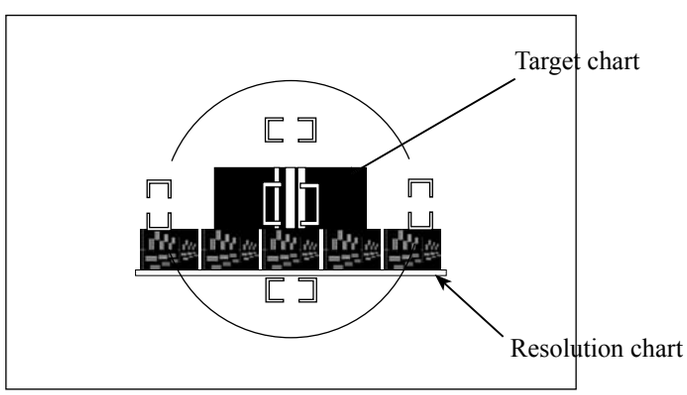
① Prepare a camera (D100). Set the "Exposure mode" to "A", the aperture to "full" and "Focus mode" to "S".

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 (D100), in which the lens to be inspected is fit, on the tripod. Set the focal length to 135 mm, and the distance between the test chart and camera (CCD face) to 5.4 m ±2 cm.



③ As shown below, set the center of the focus area on the chart within viewfinder.

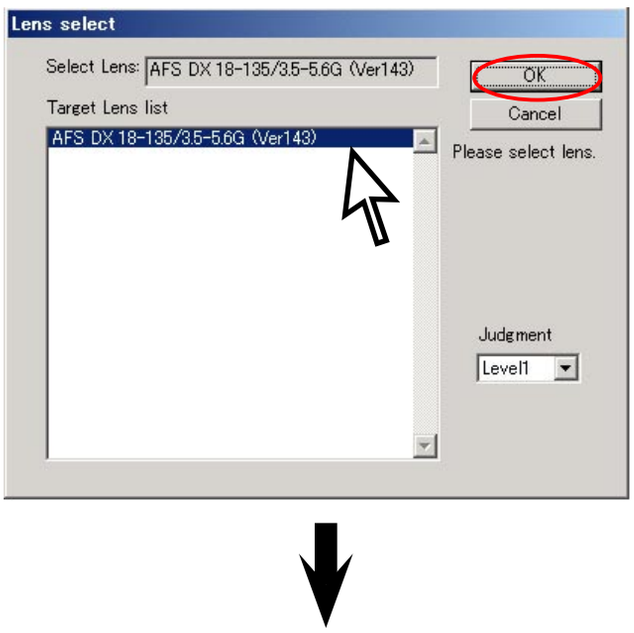


(Within viewfinder)

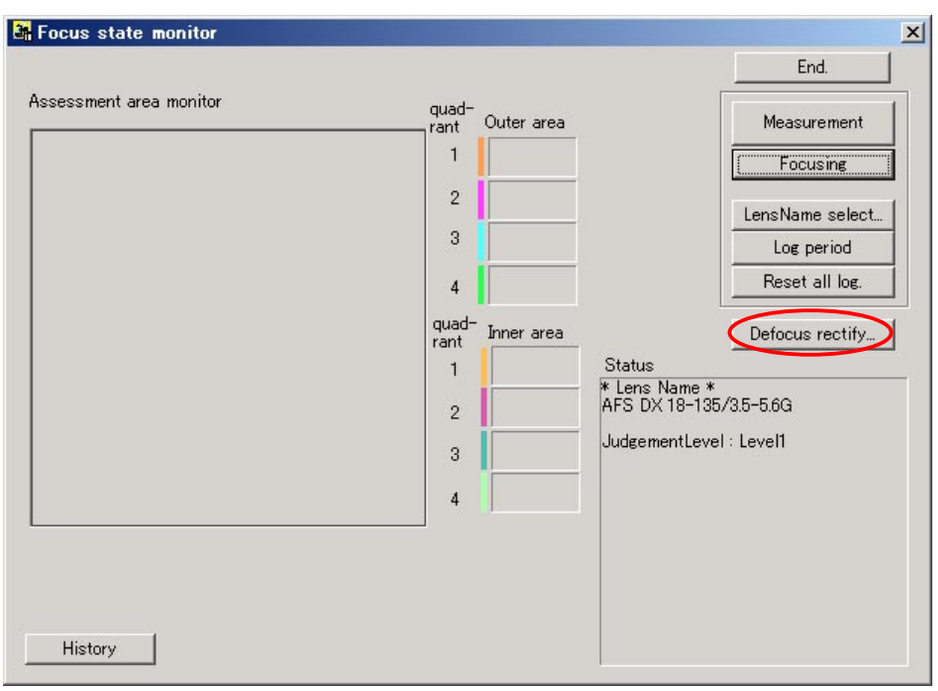
④ Connect the PC and camera via USB cable. (Camera setting: Mass storage)

⑤ Start the adjustment software (LWM.exe).

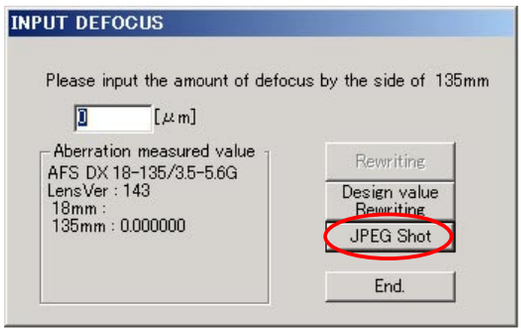
⑥ Confirm that "AF-S 18-135/3.5-5.6G" is selected on "Lens select" screen. Click "OK".



⑦ Click the "Defocus rectify..." button.



⑧ Click the "JPEG Shot" button.

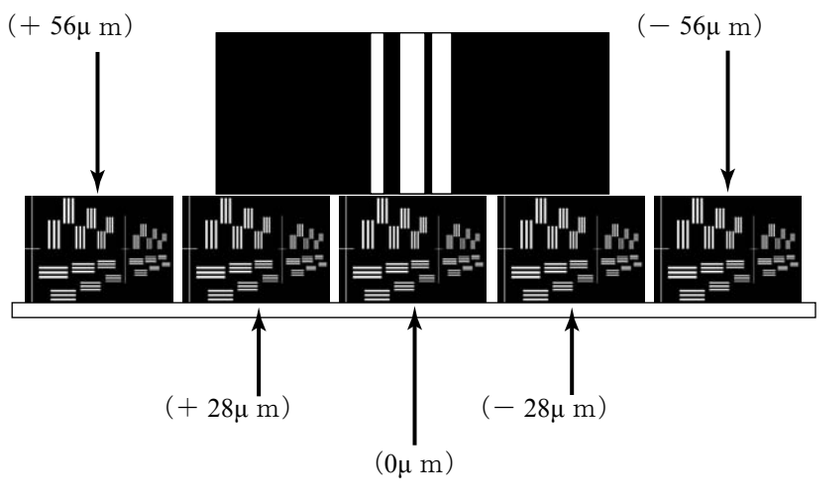


⑨ The shutter is released after the AF operation. The shot image is automatically displayed on the PC screen.

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

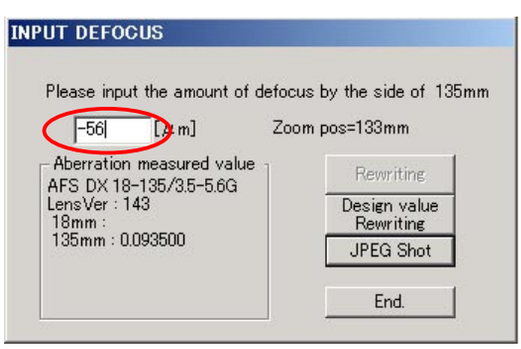
Caution:

Because this lens has a deep focal depth even if the aperture is fully open, when looking for the center of focus, compare two distant charts between which there are two or more charts.



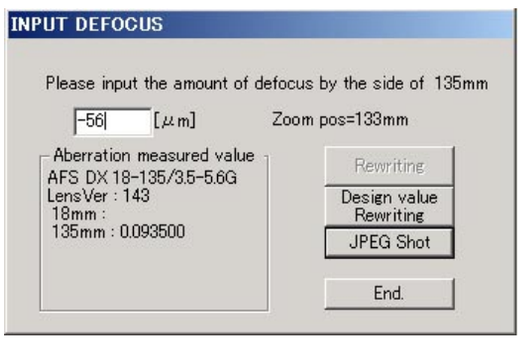
⑩ Input the value of the focused position into the entry field.

e.g. The below is the case when " − 56μm" of the front focus side is in focus.

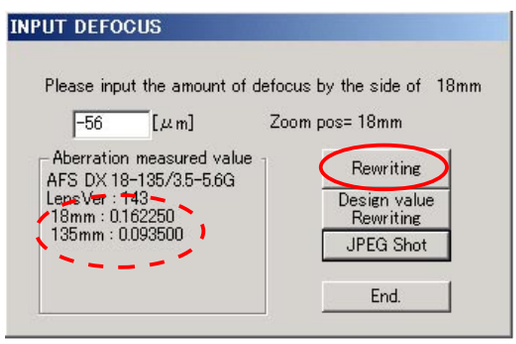


⑪ Set the focal length of the lens to 18 mm, and the distance between the test chart and camera (CCD face) to 72 ± 2 cm.

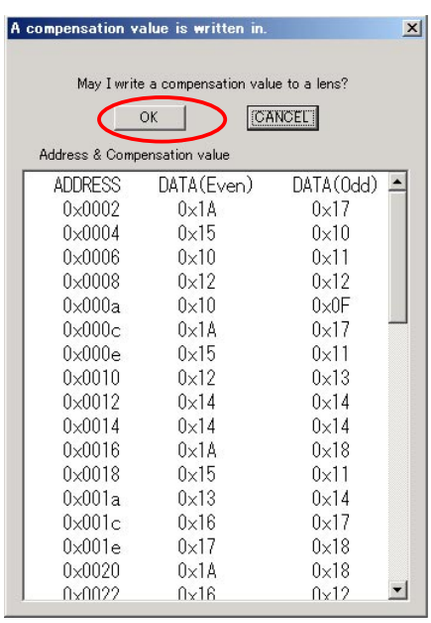
⑫ Perform the operations from ⑧ to ⑩ of the previous page.



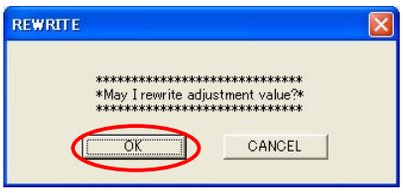
⑬ Check that the values of all the focal lengths are displayed within the dotted red circle. Then click on "Rewriting".



⑭ When "A compensation value is written in." is displayed, click "OK".



⑮ The reconfirmation screen is displayed. Click "OK".

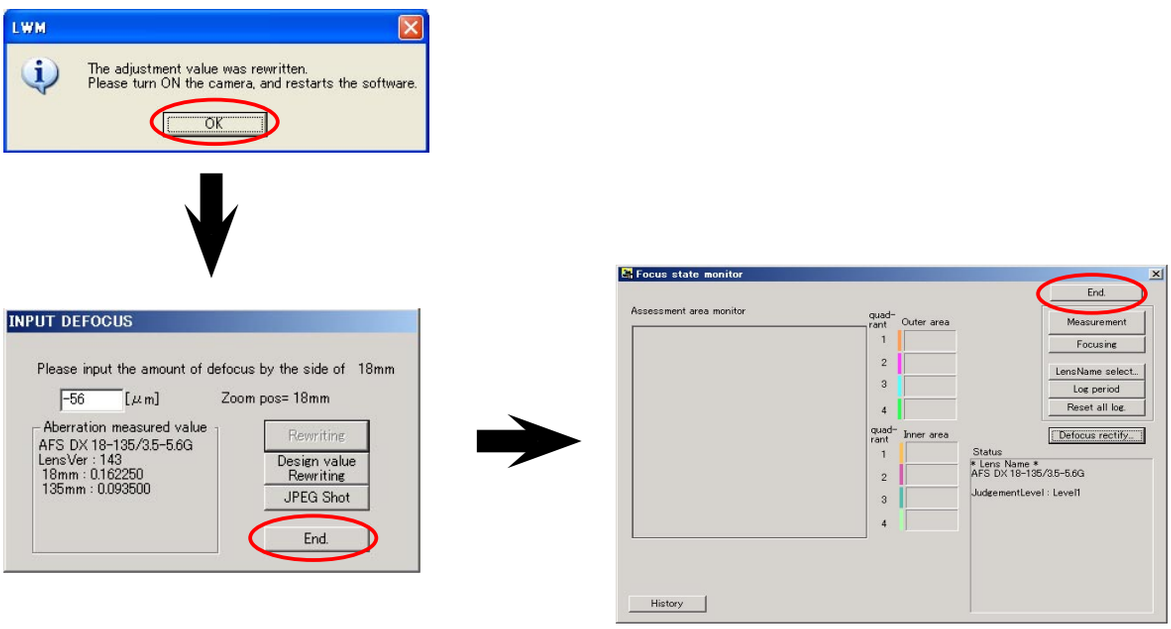


⑯ An hourglass is displayed on the screen, and writing starts.

The below screen is displayed after a few seconds. Turn camera OFF and turn it ON again.

Click "OK", and the adjustment software restarts.

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

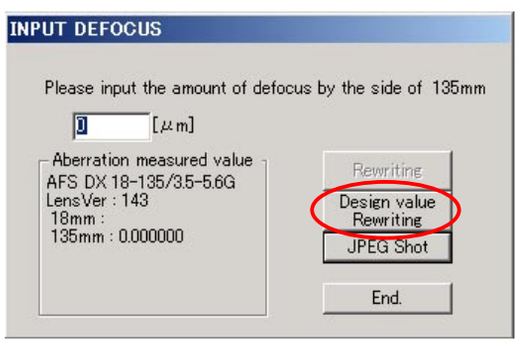


⑰ When the adjustment software restarts, perform the operations from ② to ⑫ again. Check that "0μm" of the AF position is in focus.

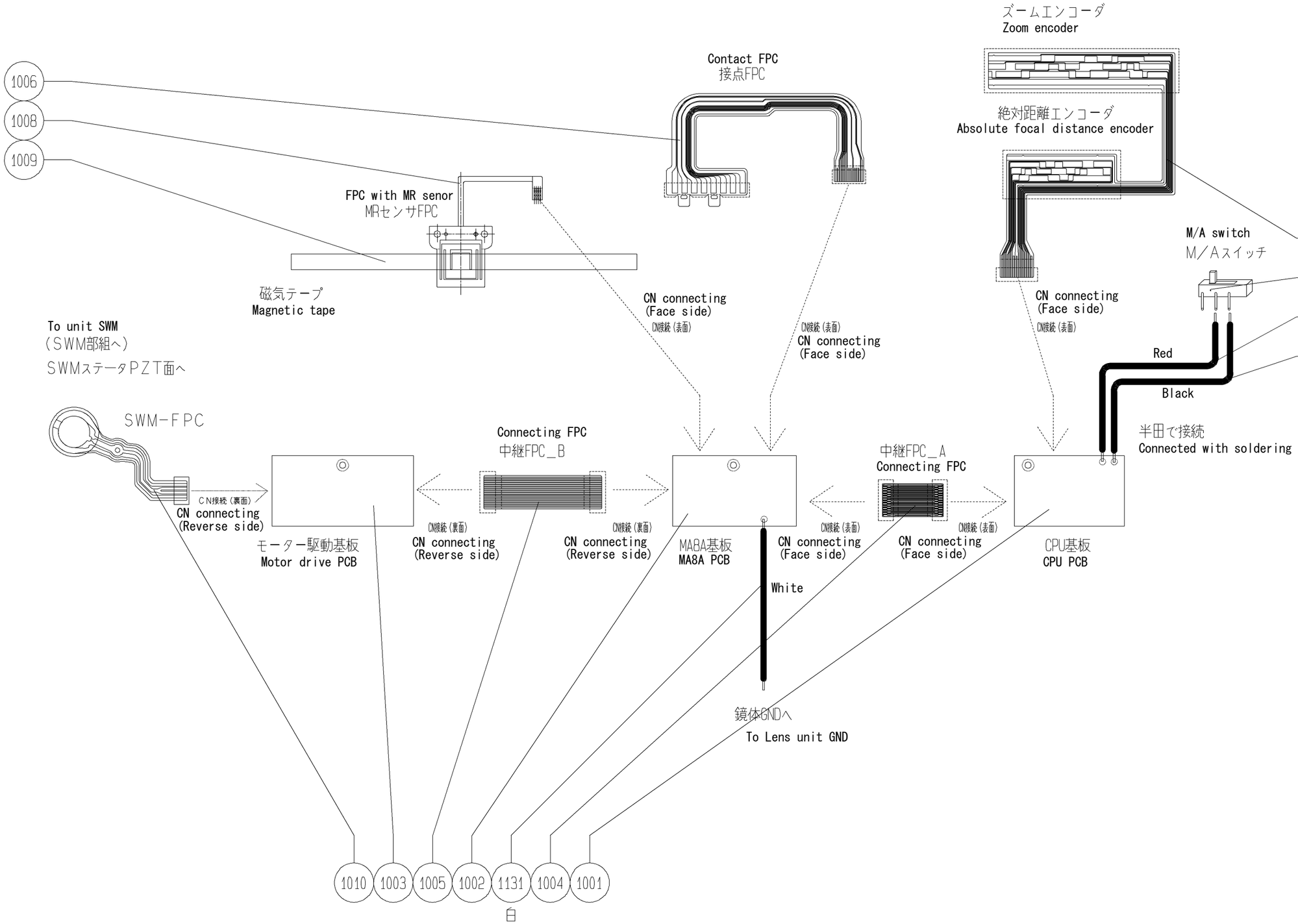
(It is also possible, after Wide-side shooting of ⑫ , to take the Tele-side shooting of ② .)

If "0μm" is not in focus, repeat the operations from ② to ⑰ .

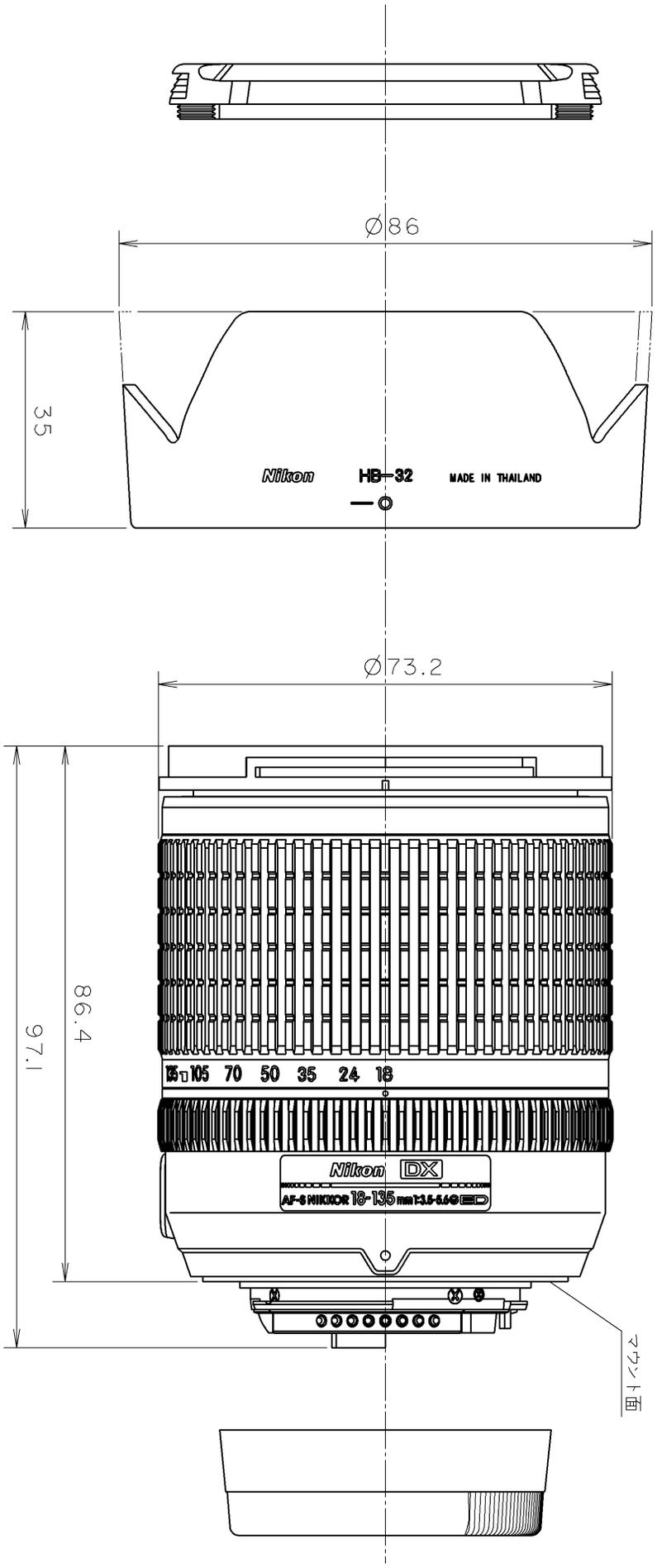
If it is not still in focus even after repetition, the written value in EEPROM may be abnormal. So click "Design value Rewriting" to write the initial value, then proceed with the operations.



実体配線図
WIRING DIAGRAM

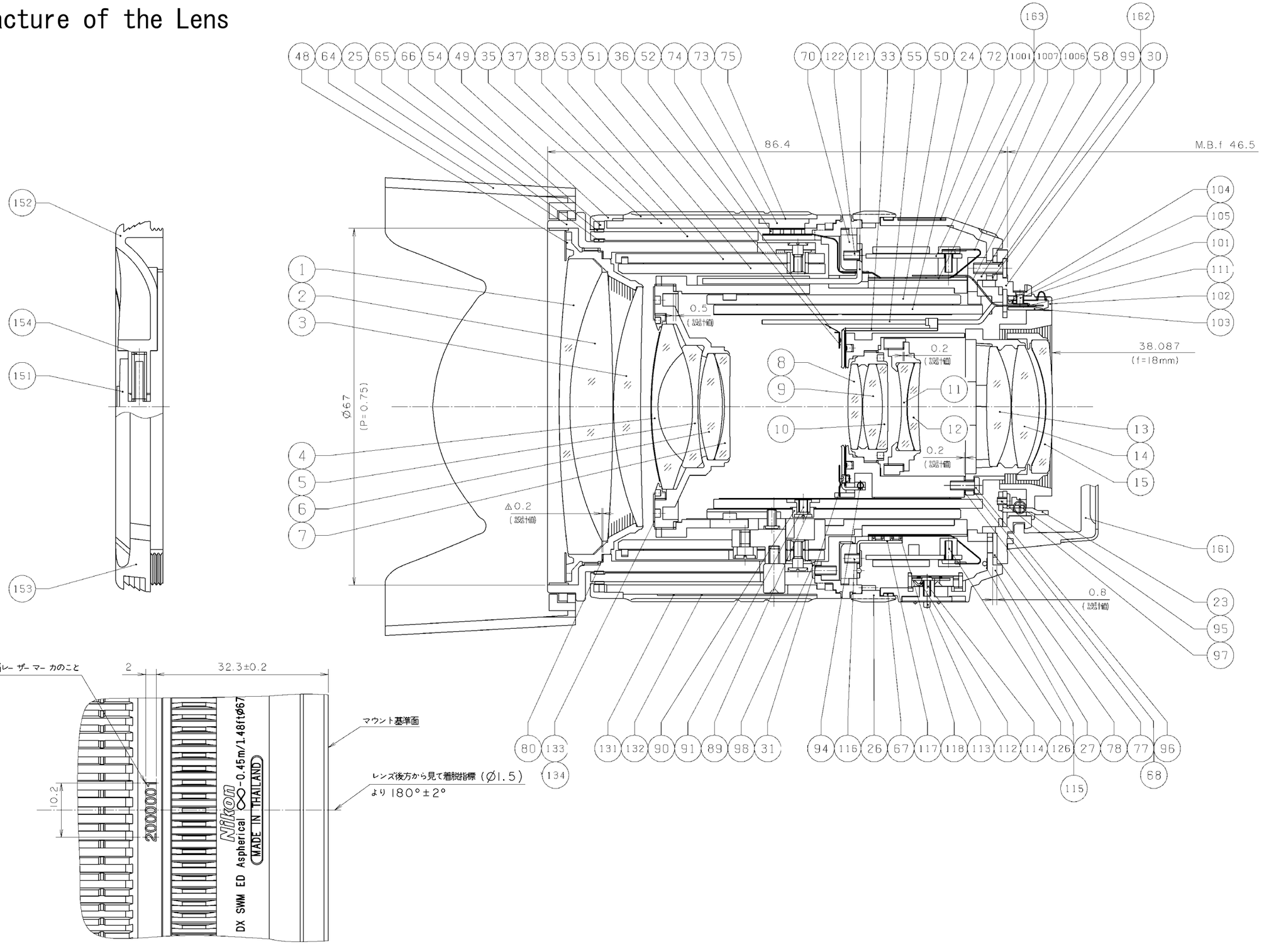


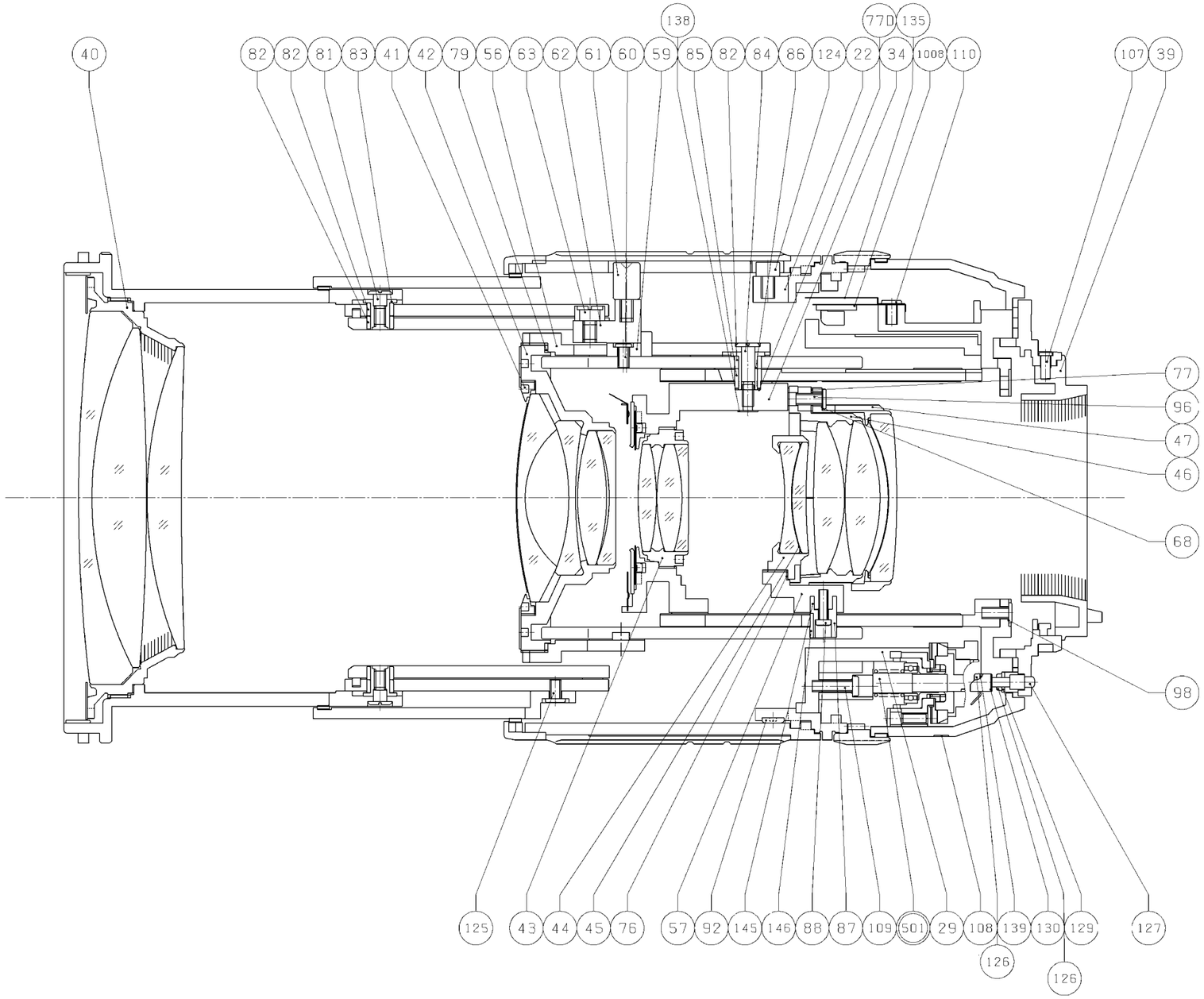
外観図 Sketch drawings



- F1･AF-S DX 18-135/3.5-5.6G -

組立図
Stracture of the Lens

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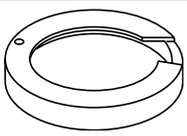
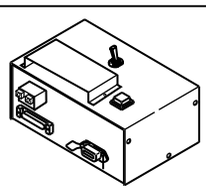
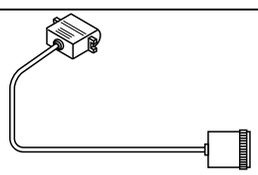
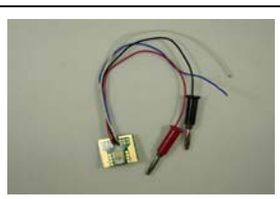
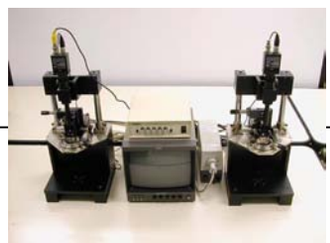
工具編 TOOLS

★：NEW TOOL

	RJ 番号 RJ No.	名称 NAME OF TOOL	備考 OTHERS
	J19002 	縦型焦点面検査器　ＬＴ－５００Ｓ BACK FOCUS COLLIMATER LT-500S	
	J18028 	Ｆ用レンズ受け台 LENS ADAPTER FOR FOCUS TESTER	
	J9001-5N	安定化電源５Ａ DC REGULATED POWER SUPPLY 5A	
★	J18411 	AF-S 18-135 点検・調整ソフト ADJ.FD FOR AF-S 18-135 (IBM 3.5)	
	J18004-1 	Ｊ１８００４用基準ゲージ STANDARD GAUGE FOR J18004	
	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	
★	J11341 	ＧＭＲ出力点検工具 GMR output inspection tool	
★	J11332 	1 群回螺器 WRENCH FOR 1G AF-SVR18-135	
★	J11336 	２群回螺器 WRENCH FOR 2G AF-SVR18-135	
★	J11335 	２群押え環回螺器 WRENCH FOR 2G RETAINNER RING AF-SVR18-135	

★：NEW TOOL

	RJ 番号 RJ No.	名称 NAME OF TOOL	備考 OTHERS
★	J11333 	3 群回螺器 WRENCH FOR 3G AF-SVR18-135	
★	J11334 	4 群回螺器 WRENCH FOR 4G AF-SVR18-135	
★	J18413 	調芯装置用調整ソフト（ＬWM）18-135 用 ADJ.FD (LWM)FOR 18-135 ALIGNMENT	Ver.1.00
	工具設定なし RJNo.is not available 	鉛フリーはんだコテ LEAD FREE SOLDERING IRON	
	J5400 	鉛フリー糸はんだ RMA02(M705) 0.5MMX500G ECO SOLDER RMA02(M705) 0.5MMX500G	
	J19125 	周辺用調芯装置 (モニター、光源付き) LENS ALIGNMENT EGNIP FOR PERIPHERY	
★	J19127Q 	18-135 用ホルダー ATTACHMENT FOR HOLDER 18-135	
	J19128 	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	
★	J11340 	ブラシ位置出し工具 BRUSH POSITION SOUP STOCK TOOL	
	工具設定なし RJNo.is not available	オシロスコープ OSCILLOSCOP	
	I-40	ＡＦレンズ用グリース（Ｉ－４０） GREASE FOR AF LENS	

★：NEW TOOL

	RJ 番号 RJ No.	名称 NAME OF TOOL	備考 OTHERS
	MZ-800S	ドライサーフ ＭＺ－８００Ｓ DRY SURF MZ-800S	
	OS-30MF	ドライサーフ ＯＳ－３０ＭＦ DRY SURF OS-30MF	
	G92KA	フロイル Ｇ９２ＫＡ G92KA	
★	GP-1RS	グリース ＧＰ－１ＲＳ GREASE GP-1RS	
	RR	ラバーグリース ＲＲ RUBBER GREASE RR	
★	NKS211SP	接点潤滑剤 ＮＫＳ２１１ＳＰ POINT OF CONTACT LUBRICANT NKS211SP	
	J19001 	横型コリメーター（ｆ =600mm） SIDE COLLIMATOR	
	工具設定なし RJNo.is not available 	基準ボディ STANDARD BODY	商品転用
	工具設定なし RJNo.is not available 	マグニファイヤー ＤＧ－２ MAGNIFYER DG-2	商品転用