

CULTURE MICROSCOPES

CKX31/CKX41

REPAIR MANUAL

OLYMPUS

SCIENTIFIC EQUIPMENT DIVISION

MARKETING DEPARTMENT

INTRODUCTION

The CKX31/CKX41 is a culture microscope newly adopting the UIS optical system and is placed as the successor to conventional CK30/CK40. In electrical unit, the circuit board is used, which corresponds to world-wide voltage by built-in voltage changeover switch.

This manual has been written on the premise that the service engineer already has experience repairing the CK30/40 and observation tube, CH3-BI45. If not, it is necessary to read thoroughly the procedures of optical axis adjustment in CK30/40 and CH3-BI45 repair manuals because the explanation of these parts are omitted as a common repair skill. In optical adjustment section, parfocality adjustment is mainly explained on D-6 and D-12. The parfocality is required to adjust precisely due to severe standard compare with CK30/40.

- 1) For overview of optical adjustment, refer to D-1 and D-2 in the section of repair procedure.
- 2) Before optical adjustment, refer to jigs used in CKX31/ CKX41 on D-4, D-9 and D-10.
- 3) Since the optical axis adjustment for binocular tube of CKX31 is basically the same as that of CK30, the adjustment procedure is not written in this manual. Therefore, it is referred to CK30/CK40 repair manual.
- 4) The above matter is also applied to CKX41. Therefore, this manual instructs the reference page in CH3-BI45 repair manual when U-CBI30-2 is repaired.
In case where the other observation tube, which can be combined with CKX41 frame, is repaired, refer to each corresponding repair manual.
- 5) Since the descriptions of disassembling and assembling procedures are simplified, start disassembling according to the order of steps from (A) and assemble in reversed order while taking care to follow the applied locations of grease/adhesive and remarks. The "remark" column provides important notes and supplemental information.
(The applied locations of grease/adhesive and adjustment part on components of assembly are shown in exploded diagram.)
- 6) Voltage adjustments will be needed when replacing the rheostat ass'y (DZ308500) or circuit board (DZ308400) respectively. These adjustments can be made by following the instructions given in this manual.

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1. Outline

- (1) CKX31: Inverted culture microscope with fixed observation tube
(successor to CK30)
CKX41: Inverted culture microscope with interchangeable observation tube
(successor to CK40)
Reflected light fluorescence attachment mountable
- (2) Target market and applications
Tissue culture routine market represented by culture, growth, immunity and pharmacy.
- (3) External standards acquired
The product complies with UL. The CE mark was self-declared.
 - (a) IEC1010-1
 - (b) UL3101-1
 - (c) EN55011 Group 1 class B
 - (d) EN50082-2(1995)
- (4) Service life
8 years

2. Features

CKX31/CKX41

- (1) UIS optical system is adopted and it brings drastic improvement in image flatness as well as excellent clarity right to the edge, even in the case of wide field-of-view images.
- (2) Use of a phase slider makes it possible to achieve high contrast images(active cell).
 - 1) Common phase contrast ring slit(RS) is provided for 10X-40X to enable phase contrast observation of 10X-40X simply by changing the objective.(when combined with IX2-SLP)
 - 2) No centering is necessary for phase contrast ring slit (RS) and phase membrane in objective.
(Applicable when the CKX31/CKX41 is combined with the IX2-SLP.)

Slider	Magnification				RS adjustment
	4X	10X	20X	40X	
IX2-SLP	dedicated RS (built-in)	Common to 10X - 40X (built-in)			Unnecessary
IX2-SL	PHL (built-in)	IX2-SLPH1 IX2-SLPHC		IX2-SLPH2 (RS adjustment: unnecessary)	Necessary

- (3) Main switch and light intensity adjustment knob are located on the front of microscope frame.
- (4) Specimen in various types of containers can be observed by selecting effective observation methods.
 - 1) Observation can be made by using various observation methods.

Observation method	Application
Brightfield observation	Observation of suspended cells
Phase contrast observation	Observation of adhering cells (Observation of the internal structure)
Fluorescence observation	Observation of GFP appearance

- (5) The working distance(W.D.) is 72mm with condenser and 150mm without condenser.
Therefore, various containers from petri dishes to roller bottle and squareflasks can be used for observing specimens.
- (6) Designed with the minimum necessary footprint, working space can be secured even in confined space like a clean bench.

- (7) Attaching a sub-stage(CK2-SS) to the plane stage, the necessary stage area can be set and working space can be secured easily.

CKX31

- (1) Observation is possible in F.N.20.

CKX41

- (1) A low-priced tilting observation tube is provided to facilitate observation in the standing or sitting position.
 (2) Fluorescence observation can be made by mounting a reflected light fluorescence attachment (B-excitation, G-excitation). As option, it is applicable to U-excitation.
 (3) The digital camera(DP12) can be attached to the trinocular tube, as can various types of video camera.
 (4) Observation is possible in F.N.20 to 22.

3. Using conditions**CKX31/CKX41**

- (1) Ambient temperature:
 Temperature: 0 - 40 degrees C(32-104 degrees F), Humidity: 30-90%
 (2) Range of combination: As indicated by the CKX41/CKX31 system chart.
 (3) Applicable objective

- 1) Phase contrast observation:

Applicable slider	IX2-SLP	IX2-SL
Applicable objective	UPLFL4XPHP	UPLFL4XPH (PHL)
	CACH10XPHP	CPL10XPH(PHC), PL10XPH(PH1)
	LCACH20XPHP	LCACH20XPH(PHC), LCPLFL20XPH(PH1)
	LCACH40XPHP	LCACH40XPH(PH2), LCPLFL40XPH(PH2)

*If a combination of slider and objective is changed, phase contrast effectiveness can not be obtained.

*In a combination of IX2-SL, objective other than the above applicable objective is possible to use as long as the objective corresponds to PHL/PHC/PH1/PH2.

- 2) Brightfield observation:

PLC4X, PLC10X, ACH20X, LCPLFL40X

*Since illumination does not cover the N.A. of LCPLFL40X objective, resolution is not fully obtained in this objective.

*In brightfield observation, objective other than the above ones can not be used.

If used, visibility is deteriorated because N.A. of objective is larger than the above applicable objective.

- (4) Applicable container sizes

When a ULWCD is mounted (phase contrast observation):

70mm or less in overall height

When no ULWCD is mounted (brightfield observation):

148mm or less in overall height

CKX31

- (1) Since the observation tube is fixed with the frame, it can not be changed.

CKX41

- (1) Applicable observation tube

F.N.20: U-CBI30-2, U-CTR30-2, CKX-TBI

F.N.22: U-TBI-3, U-TR30-2, U-BI30-2

- (2) Applicable eyepiece

WHB10X/10X-H(F.N.20), WH10X/10X-H(F.N.22)

(when WHC10X is used, visibility on the periphery is not clear.)

(3) A intermediate attachment can not be attached.

When U-EPA is used in CKX40 a peripheral light intensity becomes slightly insufficient in the following combinations.

*Binocular observation in F.N.22 with U-TBI-3 and 4X (or10X) objective.

*Large format: photography with 4X(or10X) objective and 2.5X photo eyepiece.

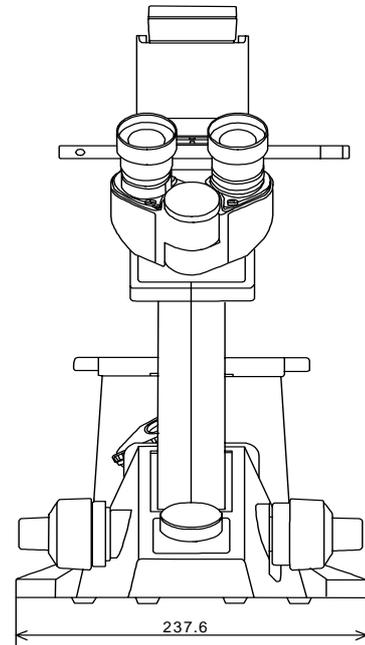
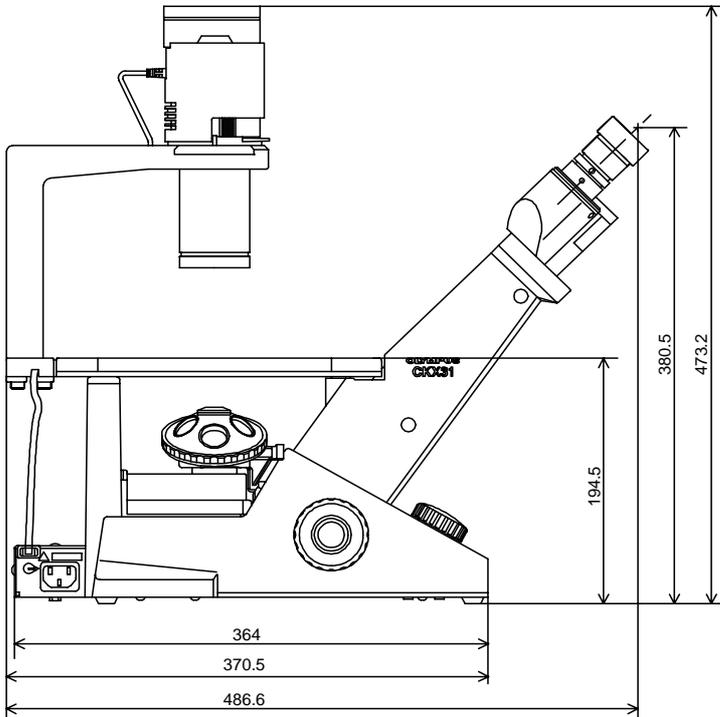
(4) When photographed in the transmitted illumination, it is recommended that a optional absorbing filter(45HA) be used because appropriate exposure can be obtained.

4. Specifications

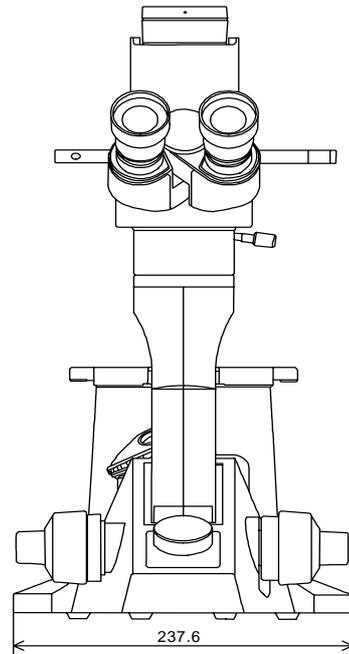
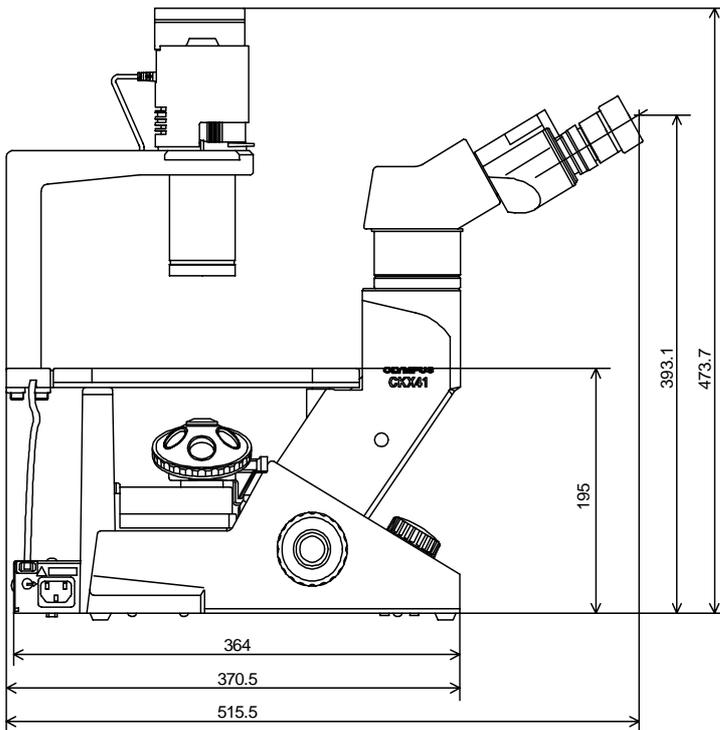
Item		CKX41	CKX31
1	Optical system	UIS optical system (infinity corrected compensation-free)	
2	Focus	Vertical nosepiece movement (stage is fixed), Coaxial coarse and fine focus with tension adjustment, Roller guide mechanism Stroke: 7mm down and 2mm up from focus position (1mm) which is under the stage Stroke per rotation: coarse adjustmet; 36.8mm fine adjustmet; 0.2mm	
3	Revolving nosepiece	Quadruple	
4	Stage	Plane stage: 160mm(L) X250mm(W), stage clips attachable exchangeable insert plate (diameter: 25mm) incorporated	petri dish holder stage (diameter: 35mm) incorporated
		Mechanical stage: Right low drive coaxial controls Stage movement: X=120mm, Y=78mm, with three dish/sample holder	
		Substage: 70(L)X180(W)mm	
		Auto X/Y stage (spot scan) mountable	
5	Illumination system	Light source: 6V30W halogen bulb (6V30WHAL) Average life time of bulb: 100 hours Lamp socket: U-LS30-3-2	
		Filter holder : Detachable filter holder 45mm filters can be inserted up to 11mm in thickness	
		Aperture diaphragm: lever control type diameter 3mm - 44mm (minimum - maximum)	
		Slider insertion: With phase slider pocket Built-in click for slider positioning	
6	Condenser	Detachable ultra-long working distance condenser (N.A. 0.3, W.D. 72mm)	
7	Observation tube	Interchangeable	Fixed
		Binocular tube: U-CBI30-2, U-BI30-2 Circular dovetail attachment	inclined 45 degree, interpupillary distance range: 48-75mm, diopter adjustment by helicoid on right sleeve
		Triocular tube: U-CTR30-2, U-TR30-2 Circular dovetail attachment	
		Tilting binocular tube: U-TBI-3 Circular dovetail attachment Variable inclination angles: 5 - 35 degrees	
8	Eyepiece	WHB10X, WHB10X-H (F.N. 20)	10X (F.N.20)
		WH10X, WH10XH, 35WH10X, PWH10X (F.N.22)	<equivalent to WHC10X>
9	Power supply	Continuous intensity adjustment Built-in voltage changeover switch (100/120V, 220/240V), 0.45A Frequency 50/60Hz, halogen bulb: 6V30W	
10	Weight	7.0kg	7.3kg

5. Dimensions

1) CKX31



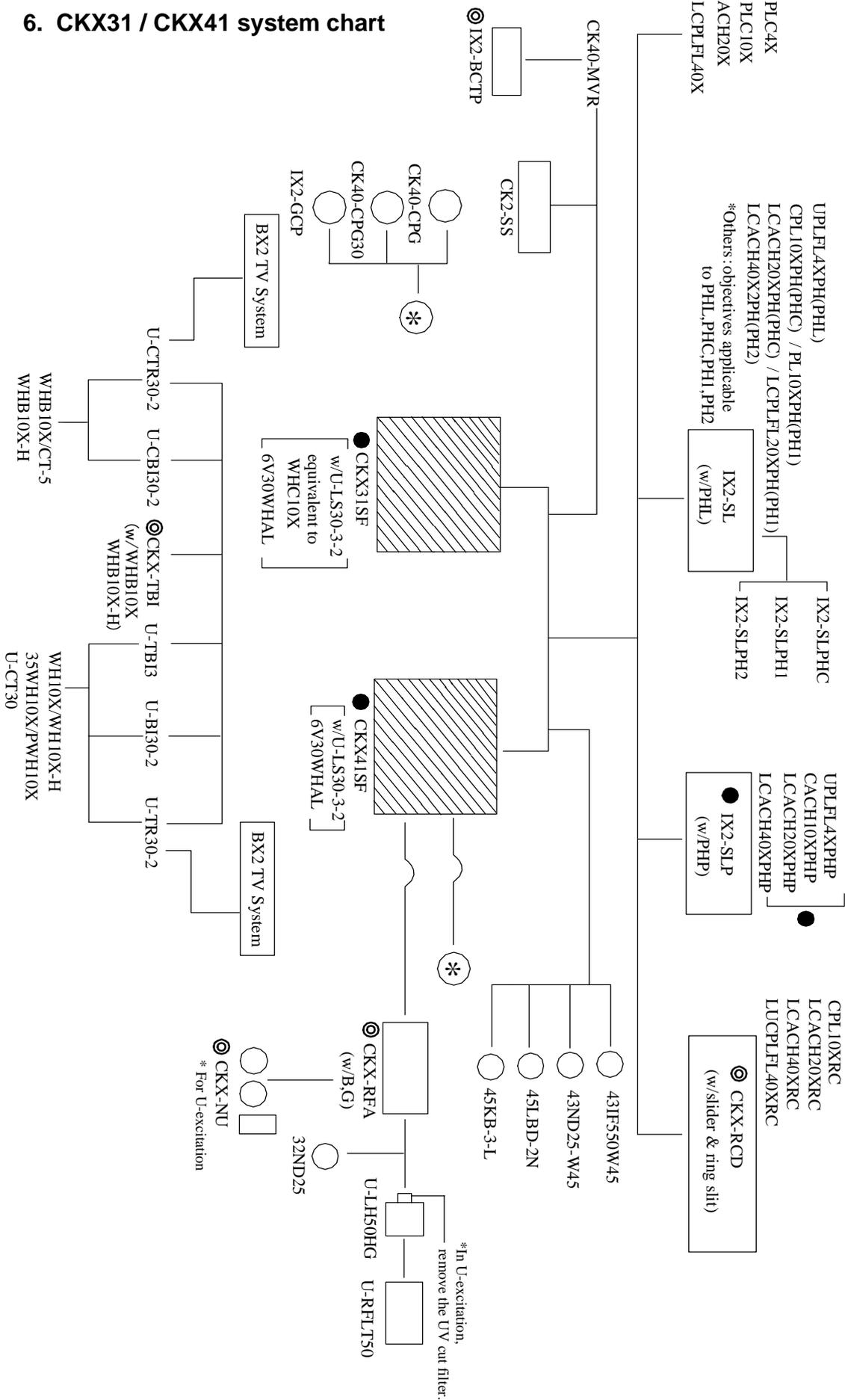
1) CKX41



UNIT: mm

- : New unit (primary)
- ◎ : New unit (second)

6. CKX31 / CKX41 system chart



1. Inspection items and Methods

<CKX31>

Part	Item	Standard	Method
Binocular tube	Interpupillary distance adjustment range	48mm - 75mm	In the observation state, insert a thin sheet of a paper with graduations at the eye point position and measure the interpupillary distance.
	Interpupillary distance working force	5N - 15N (500g - 1500gf)	Put a string on the sleeve and measure the working force to actuate the interpupillary distance using a tension gauge. Tension gauge (30N): OT3223
	Revolving axis	0.1mm or less on the image surface	Using the standard eyepiece (KN0048; with adapter-1) and an objective (PlanC10X), observe a specimen whose center can be identified (ex. concentric circles) on the stage. By moving the stage, match the specimen center and the visual field center in the right sleeve. Open and close the interpupillary distance, and read the movement of the image using the reticle scale (1 graduation = 0.1mm) of KN0048.
	Left / right optical axis	On image surface: 0.2mm or less in vertical direction 0.2mm or less in outward direction 0.4mm or less in inward direction	Using the standard eyepiece (KN0048; with adapter-1) and an objective (PlanC10X), observe a specimen whose center can be identified (ex. concentric circles) on the stage. Taking the right sleeve as the reference, read the displacement between the specimen center and the visual field center in the left sleeve using the reticle scale (1 graduation = 0.1mm) of the KN0048.
	Absolute optical axis (center of standard objective)	0.1mm or less on the image surface	Combining the standard eyepiece (KN0048; with Adapter-1), a microscope frame (product), the standard objective (KN0041), read the displacement between specimen center in KN0041 and the visual field center in the right sleeve using the reticle scale (1 graduation = 0.1mm) of the KN0048.
	Exit pupil center	Within 30% of objective's exit pupil diameter	Combining the centering telescope (KN0029), an objective (PlanC10X), and microscope frame (product), read the displacement between the exit pupil center of the objective and cross hairs center of centering telescope (KN0029).
	Parfocality	+ / - 0.3mm	Combine the standard eyepiece (KN0048; with adapter-1), the focusing telescope (FT-36), the microscope frame (Product), the standard objective (KN0041). In the left sleeve, focus on the specimen in KN0041 and check the parfocality using the helicoid scale (1 graduation = 0.1mm) of the KN0048.

- * 1) Since the binocular section of CKX31 is the same as that of CK30, the procedure of optical axis adjustment is performed in the same manner as CK30. (Refer to the adjustment part of D-3 - D-14 in CK30/40 repair manual.)
- 2) Necessary jigs are partially different because UIS optical system is adopted in CKX. (Refer to the above description.)
- 3) Difference between CK30 and CKX31 in parfocality adjustment: CK30 uses the spacer (selection : 3pcs. available), While CKX31 uses the washer (selection: 6 pcs. available) when adjusted and it requires more precise standard.

<CKX31/CKX41>

Part	Item	Standard	Method
Coarse / fine focus adjustment knob	Coarse focus adjustment knob tension	6N - 25N (600g - 2500gf)	Tie a string around the knob and then measure the tension when the knob is rotated. Tension gauge (30N): OT3223
	Fine focus adjustment knob tension	0.3N - 1.2N (30g - 120gf)	Tie a string around the knob and then measure the tension when the knob is rotated. Tension gauge (3N): OT3225
	Coarse / fine adjustment knob movement		Confirm that there is no rough feeling.
Focusing guide unit	Working force	0.2N - 0.5N (20g - 50gf)	Confirm the working force while pushing inner guide. Tension gauge (3N): OT3225
	Working force difference in moving range	0.2N (20gf)	Confirm the working force difference in moving range.
	Movement		Cashing or roller should not be stopped. There is no play between the inner guide and the outer guide.
Stage	Squareness against optical axis	0.3/75mm	Set the SKN0003 to the revolving nosepiece and confirm the front-back, left-right squareness of the stage. (Not go through 0.3mm thickness) Thickness gauge: OT1949

<CKX41>

Part	Item	Standard	Method
Frame section	Exit pupil center	Within 10% of objective's exit pupil diameter	Combining the centering telescope (KN0023), an objective (PlanC10X), UIS observation tube (BXKN001) and microscope frame (product), read the displacement between the exit pupil center of the objective and cross hairs center of centering telescope (KN0023).
	Parfocality	+ / - 0.3mm	Combine the standard eyepiece (KN0048; with adapter-1and adapter-2), 3mm ring adapter (KC2040), the focusing telescope (FT-36), the standard objective(KN0041), BXKN001 and microscope frame (product). Focus on the specimen in KN0041 and check the parfocality using the helicoid scale (1 graduation = 0.1mm) of the KN0048.
	Absolute optical axis	0.1mm or less on the image surface	Combine the standard eyepiece (KN0048; with adapter-1and adapter-2), 3mm ring adapter (KC2040), the standard objective (KN0041), BXKN001 and microscope frame (product). Read the displacement between specimen center in KN0041 and the visual field center using the reticle scale (1 graduation = 0.1mm) of KN0048.

* In parfocality adjustment, the washer (selection: 6 pcs. available) is used for CKX41 (same as CKX31).

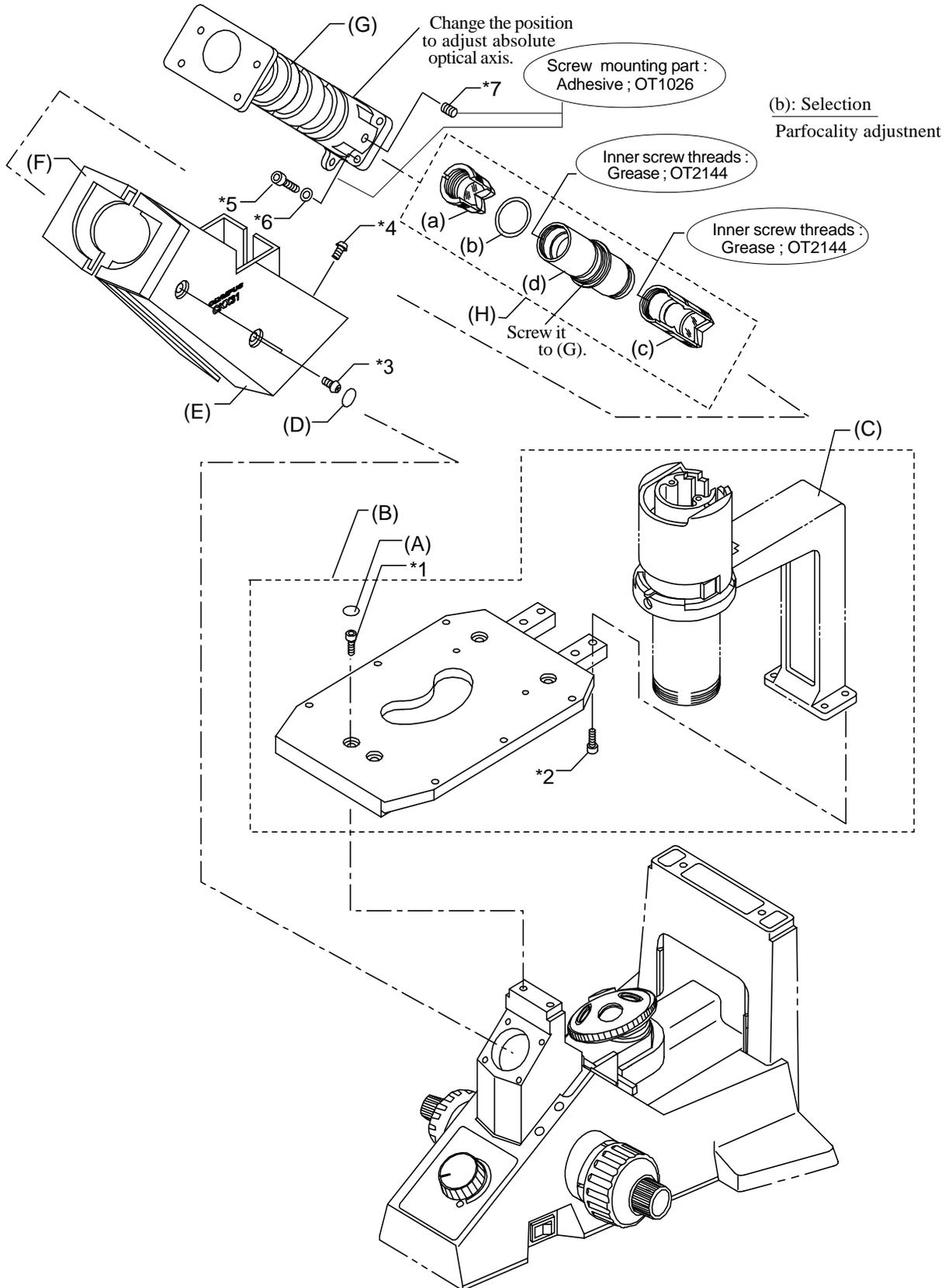
<CKX41>

Part	Item	Standard	Method
Binocular tube	Optical axis, exit pupil center	CH3-BI45 repair manual (Refer to E-2 - E-12 of repair procedure)	Set the following jigs to the microscope frame and check the optical axis and exit pupil center. referring the CH3-BI45 repair manual. (1) Revolving axis 1) Standard eyepiece: KN0048 (with adapter-1) 2) Objective: PlanC10x 3) Test plate: concentric circles (KN0003) or cross micrometer (OB-M1/100SQ) (2) Left/right optical axis Same as the above (3) Absolute optical axis 1) Standard eyepiece: KN0048 (with adapter-1) 2) Standard objective: KN0041 (4) Exit pupil 1) Centering telescope (KN0029) 2) Objective: PlanC10x
	Parfocality	CH3-BI45 repair manual (Refer to E-13 - E-16 of repair procedure)	Set the following jigs to the microscope frame and check the parfocality referring the CH3-BI45 repair manual. 1) Standard eyepiece: KN0048 (with adapter-1) 2) Standard objective: KN0041 3) Focusing telescope: FT-36 or U-FT

* 1) Since the binocular section of CKX41 is the same as that of CX31, basic procedure of optical axis adjustment is performed in the same manner as CX31, which is referred to CH3-BI45 repair manual regarding the adjustment method.

2) Necessary jigs are partially different because UIS optical system is adopted in CKX. (Refer to the above description.)

1. CKX31 frame



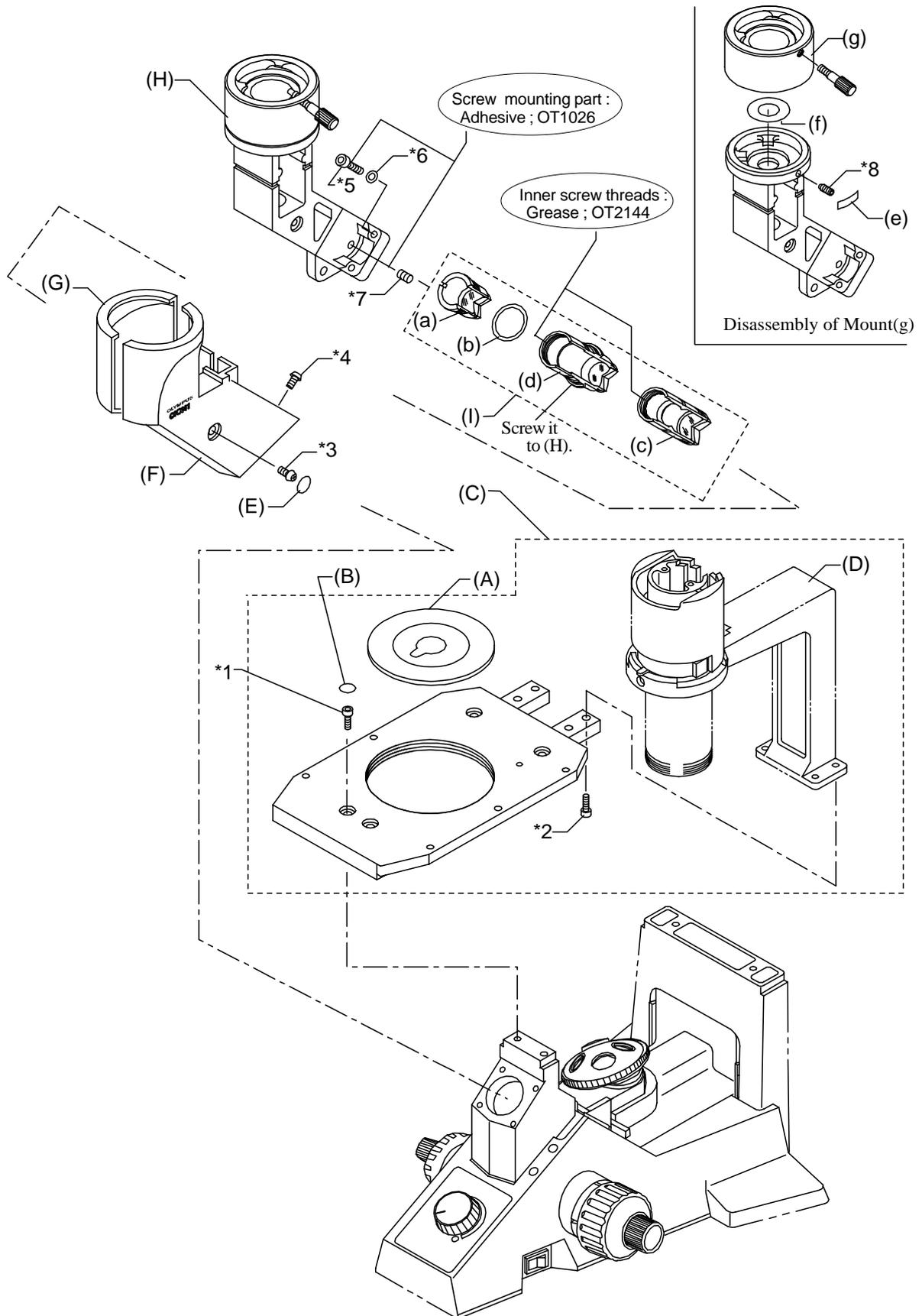
No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	CAP				
(B)	STAGE PART	AB5X15SA, 4pcs. (*1)			
(C)	CK4 -ILL30	AB6X12SA, 4pcs. (*2)			For disassembly, refer to C-15.
(D)	CAP				
(E)	COVER	CUKSK3X8SA, 4pcs. (*3)			
(F)	COVER	3PUTB2X4SA, 1pc. (*4)			
(G)	BI TUBE	AB3X14SA, 4pcs. (*5) BNW3SA, 4pcs. (*6)		OT1026	Adjust absolute optical axis.
(H)	RELAY LENS PART	ACU3X6SA, 1pc. (*7)	OT2144		For parfocality adjustment, refer to D-6.

*Relay lens part: when adjusting parfocality, remove the lens frame-1(a) and insert the selected washer under it. If necessary, remove the lens frame-3(c) from the frame-2(d).

Washer selection;

AE092300(t=1mm) standard, AE092100(t=0.5mm), AE092200(t=0.7mm), AB129900(t=0.05mm)
AB130000(t=0.1mm), AB130200(t=0.3mm)

2. CKX41 frame



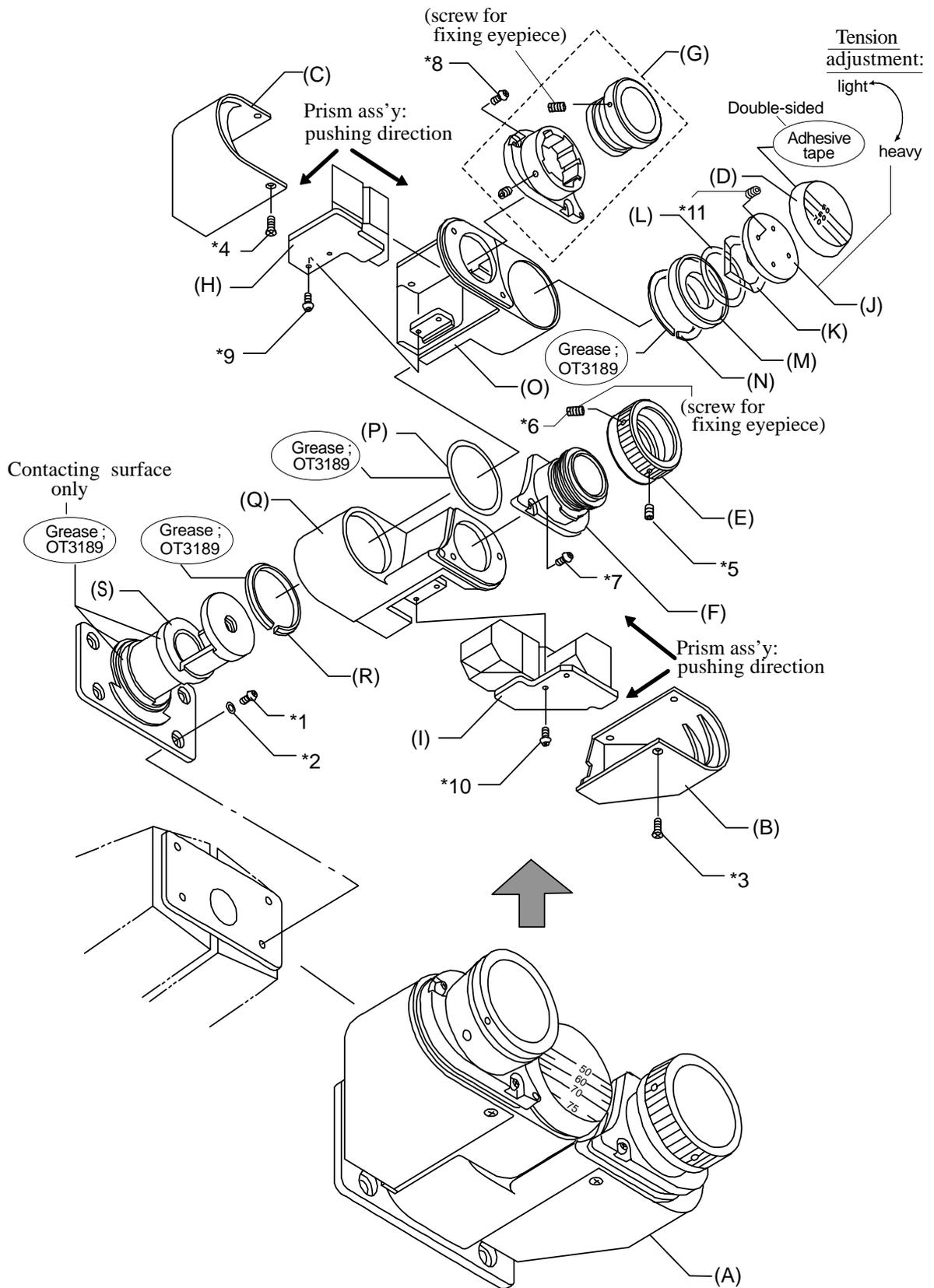
No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	INSERT PLATE				
(B)	CAP				
(C)	STAGE PART	AB5X15SA, 4pcs. (*1)			
(D)	CK4 -ILL30	AB6X12SA, 4pcs. (*2)			For disassembly, refer to C-15.
(E)	CAP				
(F)	COVER	CUKSK3X8SA, 2pcs. (*3)			
(G)	COVER	3PUTB2X4SA, 1pc. (*4)			
(H)	LENS FRAME ASS'Y	AB3X14SA, 4pcs. (*5) BNW3SA, 4pcs. (*6)		OT1026	Adjust absolute optical axis.
(I)	RELAY LENS PART	ACU3X6SA, 1pc. (*7)	OT2144		For parfocality adjustment, refer to D-12.

*Relay lens part(I): when adjusting parfocality, remove the lens frame-1(a) and insert the selected washer under it. If necessary, remove the lens frame-3(c) from the lens frame-2(d).

Washer selection;

AE092200(t=0.7mm) standard, AE092100(t=0.5mm), AE092300(t=1mm), AB129900(t=0.05mm)
AB130000(t=0.1mm), AB130200(t=0.3mm)

3. Binocular tube of CKX31 frame



No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	BINOCULAR TUBE	CUK3X6SA, 4pcs. (*1) KNW3SA, 4pcs. (*2)			
(B)	COVER	3PUTB2X4SA, 3pcs. (*3)			
(C)	COVER	3PUTB2X4SA, 3pcs. (*4)			
(D)	INDICATOR PLATE				Attach it with double coated adhesive tape.
(E)	DIOPTER RING	ACU3X3SA, 2pc. (*5) HU3X4SA, 1pc. (*6)			Refer to D-1.
(F)	HELICOID ASS'Y	CUK3X6SB, 2pcs. (*7)			<u>Revolving axis:</u> Follow the adjustment procedure on D-3.
(G)	SLEEVE ASS'Y	CUK3X6SB, 2pcs. (*8)			<u>Left/right optical axis:</u> Follow the adjustment procedure on D-3.
(H)	PRISM ASS'Y	CUK3X8SA, 2pcs. (*9)			Push it in the arrow directions during assembling. <u>Exit pupil center:</u> Follow the adjustment procedure on D-3.
(I)	PRISM ASS'Y	CUK3X8SA, 2pcs. (*10)			Same as the above
(J)	TORQUE PLATE	AWU3X4SA, 2pcs. (*11)			<u>Tension:</u> standard 5-15N (OT3223)
(K)	SPRING WASHER				
(L)	WASHER				
(M)	MOUNT				
(N)	RING		OT3189		
(O)	PRISM MOUNT-L		OT3189		
(P)	WASHER				
(Q)	PRISM MOUNT-R				
(R)	RING		OT3189		
(S)	SHAFT		OT3189		Apply grease to the contacting surface only. <u>Absolute optical axis:</u> Follow the adjustment procedure on D-3.

*Procedure for mounting indicator plate(D):

- 1) Set the interpupillary distance to the minimum (48mm).
- 2) Affix the indicator plate(D) such that the indicator plate line may become parallel to the position indicated by the round convex of helicoid ass'y(F) and the round convex of sleeve ass'y(G).

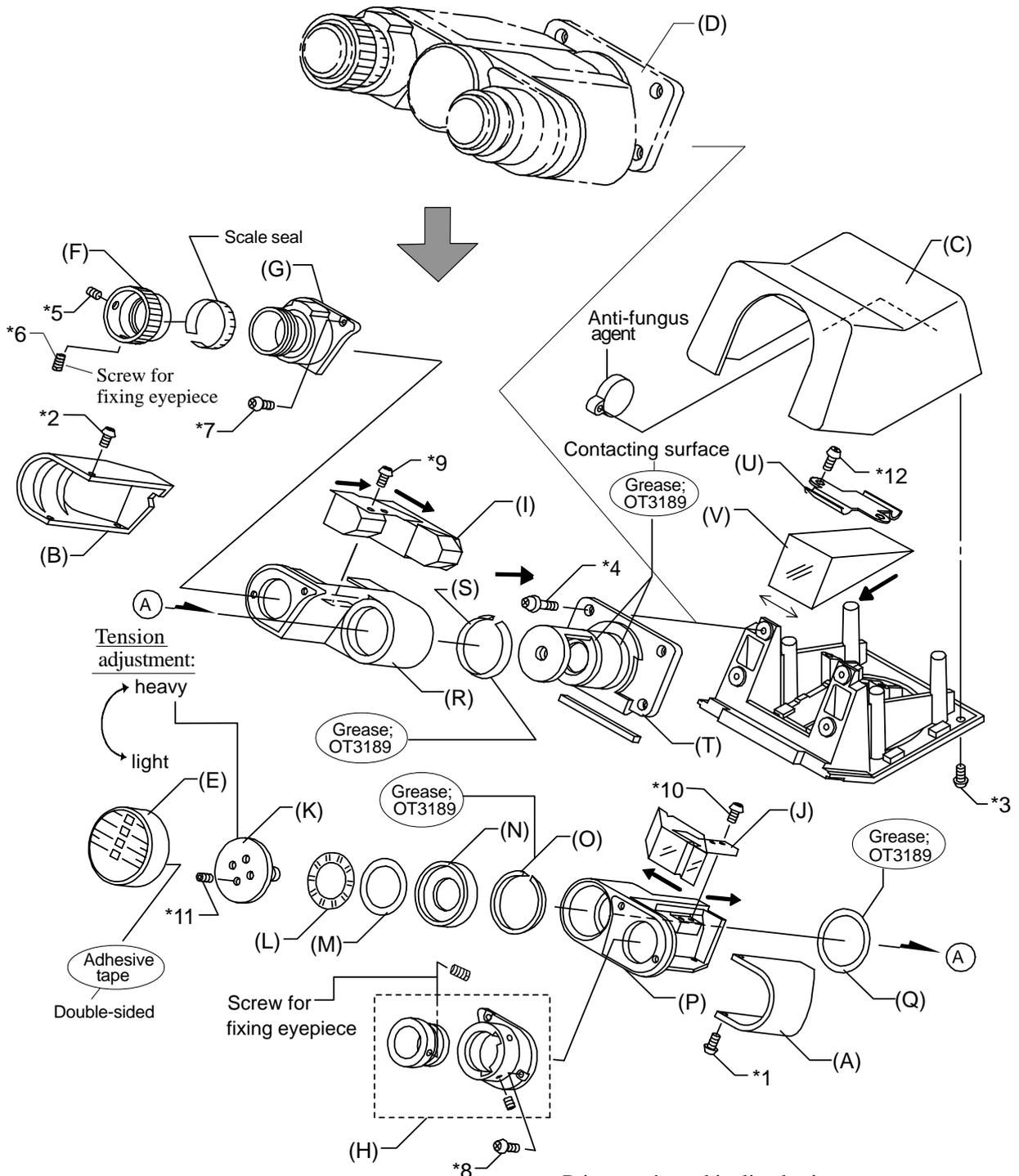
*Tension adjustment (moving force of interpupillary distance):

- 1) Loosen the two screws(*11) that fix the torque plate(J).
- 2) The tension is increased by turning the torque plate(J) clockwise. It is decreased by turning it counterclockwise. (refer to the figure on the previous page.)
- 3) Measure the tension using a tension gauge.

Standard: Tension 5 - 15N (OT3223)

* In this manual, left (right) sleeve indicates the left (right) side with the observed condition.

4. Binocular tube (U-CBI30-2) for CKX41



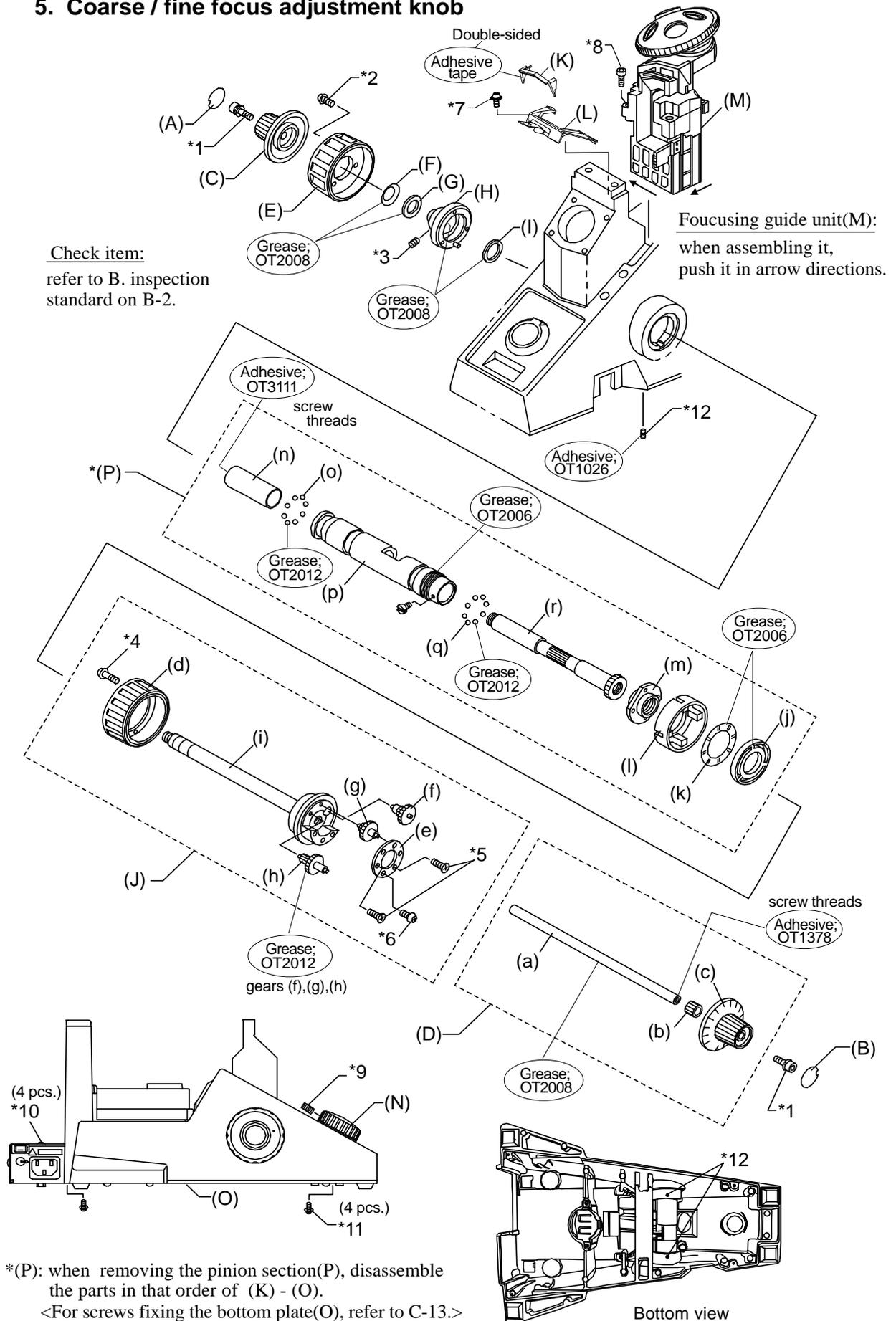
*6: When removing diopter ring (F);
Loosen the screws (*5) and remove the
screw (*6) for fixing eyepiece.

Prism ass'y and inclined prism:
: Pushing direction when assembling
↔ : Making it even in left and right direction

No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	COVER	3PUTB2X4SB, 3pcs. (*1)			
(B)	COVER	3PUTB2X4SB, 3pcs. (*2)			
(C)	COVER	CUTB3X10SA, 2pcs. (*3)			
(D)	BINOCULAR TUBE	CUKK3X6SA, 4pcs. (*4)			
(E)	INDICATOR PLATE				Attach it with double coated adhesive tape. Since the mounting procedure is the same as that of CKX31, refer to C-6.
(F)	DIOPTER RING	ACU3X3SA, 2pc. (*5) HU3X4SA, 1pc. (*6)			Refer to D-2.
(G)	HELICOID ASS'Y	CUK3X6SB, 2pcs. (*7)			<u>Left/right optical axis:</u> Follow the adjustment procedure on D-8.
(H)	SLEEVE ASS'Y	CUK3X6SB, 2pcs. (*8)			<u>Revolving axis:</u> Follow the adjustment procedure on D-8.
(I)	PRISM ASS'Y	CUK3X8SA, 2pcs. (*9)			Push it in the arrow directions during assembling. <u>Exit pupil center:</u> Follow the adjustment procedure on D-8.
(J)	PRISM ASS'Y	CUK3X8SA, 2pcs. (*10)			Same as the above
(K)	TORQUE PLATE	AWU3X4SA, 2pcs. (*11)			<u>Tension:</u> standard 5-15N (OT3223) Since the adjustment is the same as that of CKX31, refer to C-6.
(L)	SPRING WASHER				
(M)	WASHER				
(N)	MOUNT				
(O)	RING		OT3189		
(P)	PRISM MOUNT-R				
(Q)	WASHER		OT3189		
(R)	PRISM MOUNT-L				
(S)	RING		OT3189		
(T)	SHAFT		OT3189		Apply grease to the contacting surface only. <u>Absolute optical axis:</u> Follow the adjustment procedure on D-8.
(U)	FIXING PLATE	CUK3X6SA, 2pcs. (*12)			
(V)	PRISM				

* In this manual, left (right) sleeve indicates the left (right) side with the observed condition.

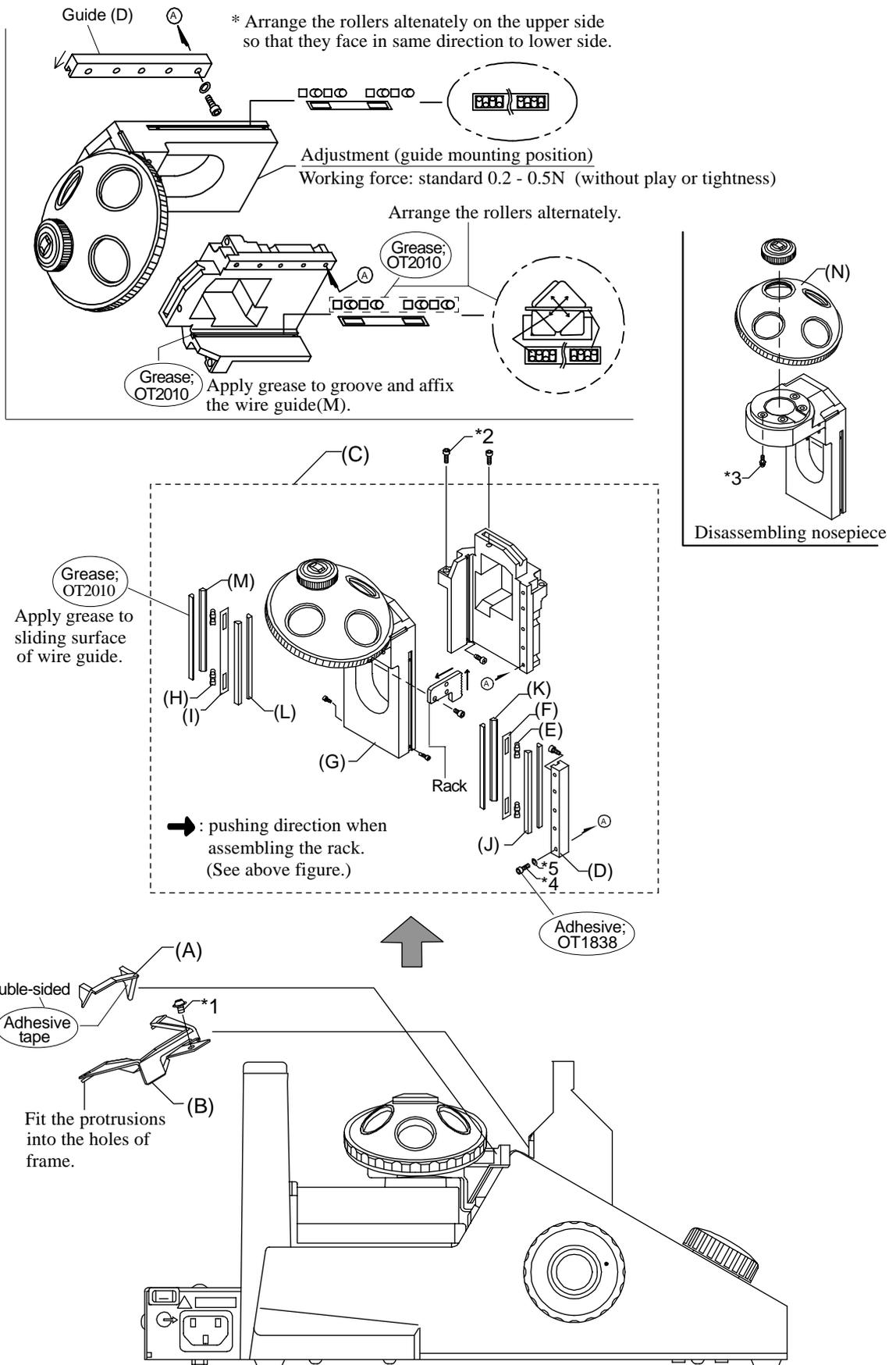
5. Coarse / fine focus adjustment knob



* (P): when removing the pinion section(P), disassemble the parts in that order of (K) - (O).
<For screws fixing the bottom plate(O), refer to C-13.>

No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	PLATE	ABS3X8SA, 2pcs. (*1)			
(B)	PLATE				
(C)	FINE ADJ. KNOB				Rotating tension: Standard: 0.3N -1.2N(OT3225)
(D)	FINE ADJ. KNOB ASS'Y		OT2008	OT1378	Apply grease to the circumference of the shaft(a).
(E)	COARSE ADJ. KNOB	CWK3X6SA, 3pcs. (*2)			Rotating tension: Standard: 6N -25N(OT3223)
(F)	SPRING WASHER		OT2008		Apply grease to the outer surface.
(G)	WASHER		OT2008		Apply grease to the outer surface.
(H)	FINE SHAFT MOUNT	ACU3X4SA, 2pcs. (*3)	OT2008		Apply grease to the shaft hole.
(I)	WASHER		OT2008		Apply grease to the outer surface.
(J)	COARSE FOCUS ADJ. KNOB ASS'Y	CWK2.6X6SA, 3pcs. (*4) CSK2.6X6SA, 2pcs. (*5) CUK2.6X5SA, 1pc. (*6)	OT2012		While holding the coarse adj. knob ass'y , screw the fine shaft mount into it. Check that the gears moves smoothly.
(K)	COVER				Attach it with double coated adhesive tape.
(L)	COVER	CUKK3X6SA, 1pc. (*7)			Fit the protrusions into the holes of frame.
(M)	FOCUSING GUIDE UNIT	AB4X14SA, 3pcs. (*8)			Push it in the arrow directions when assembling it. (Refer to C-9.)
(N)	KNOB	ACU3X10SA, 1pc. (*9)			Also remove the four screws(*10) of cover. (Refer to the figure on C-9.)
(O)	BOTTOM PLATE	CTK3X6SA, 4pcs. (*10) CUKS3X8SA, 4pcs. (*11)			The screw on the right back is with HWB3SA. For screw positions, refer to C-13.
(P)	PINION SECTION	ACU3X6SA, 2pcs. (*12)	OT2006 OT2012	OT1026 OT3111	When removing the Pinion section, it is necessary to remove the focusing guide unit(M) and bottom plate(O). Fixing screw: ACU3X6SA(*12)

6. Focusing guide unit



No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	COVER				Attach it with double coated adhesive tape.
(B)	COVER	CUKK3X6SA, 1pc. (*1)			Fit the protrusions into the holes of frame.
(C)	FOCUSING GUIDE UNIT	AB4X14SA, 3pcs. (*2) CUKSK2.6X10SA, 4pcs. (*3)			Mount it while pushing it to front and left directions. (Refer to the figure on C-9.)
(D)	GUIDE	AB3X12SA, 5pcs. (*4) KNW3SA, 5pcs. (*5)	OT2010	OT1838	Press it down to adjust the working force, and fix it. <u>Check item</u> working force: 0.2N - 0.5N (OT3225) Movement: without play or tightness *Apply adhesive to fixing screws.
(E)	ROLLER		OT2010		Apply grease to rollers. Arrange the rollers alternately.
(F)	CASING		OT2010		
(G)	NOSEPIECE MOUNT ASS'Y		OT2010		Mount the rack while pushing it in the arrow directions when replaced. (Refer to the figure on C-11.)
(H)	ROLLER		OT2010		Apply grease to rollers. Arrange the rollers alternately.
(I)	CASHING				
(J)	WIRE GUIDE		OT2010		Check the sliding surface of wire guide. If there is a dent on it, replace the wire guide. Grease: applied part: each groove attached wire guide, sliding surface of wire guide
(K)	WIRE GUIDE		OT2010		Same as the above
(L)	WIRE GUIDE		OT2010		Same as the above
(M)	WIRE GUIDE		OT2010		Same as the above

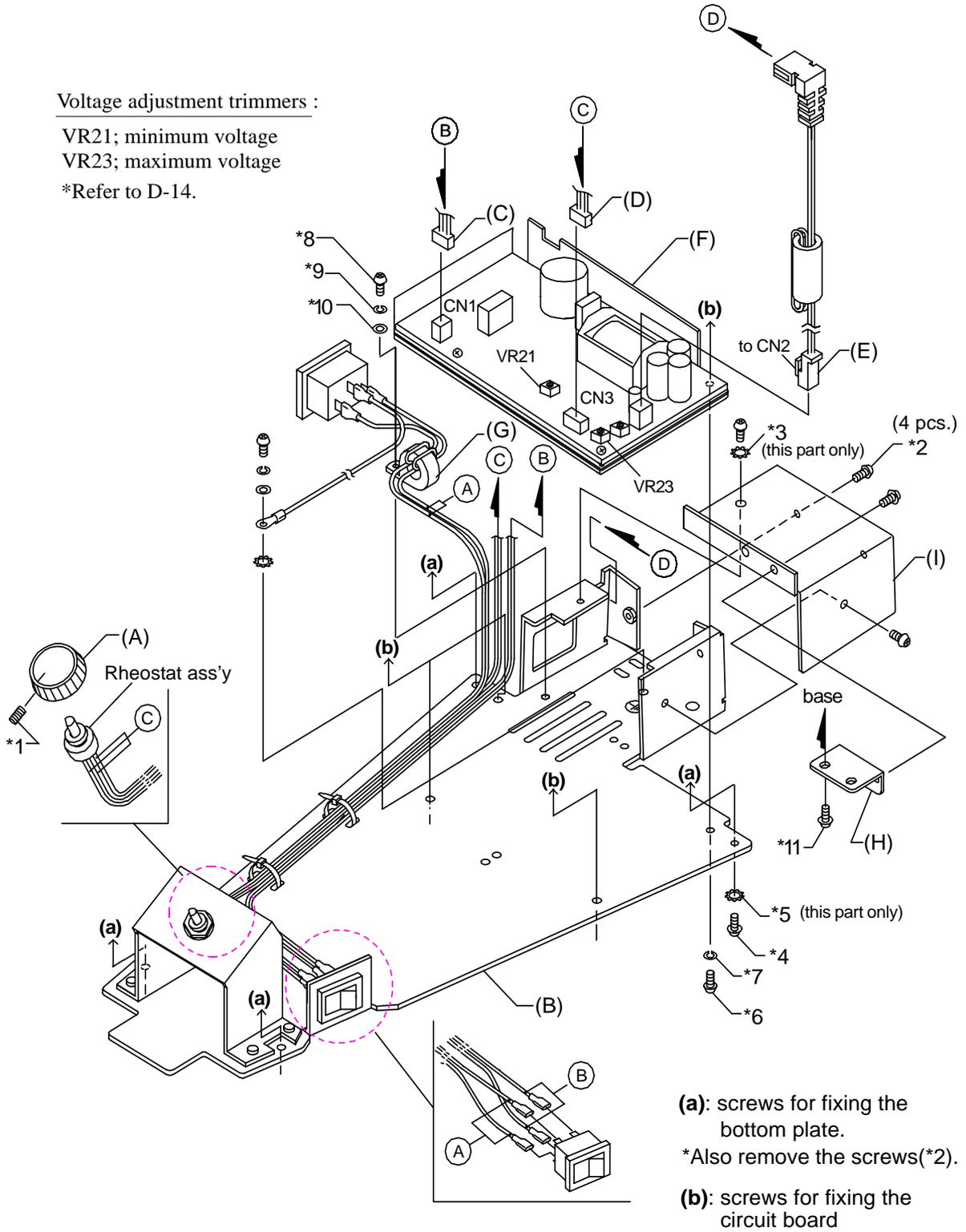
7. Electrical unit

Voltage adjustment trimmers :

VR21; minimum voltage

VR23; maximum voltage

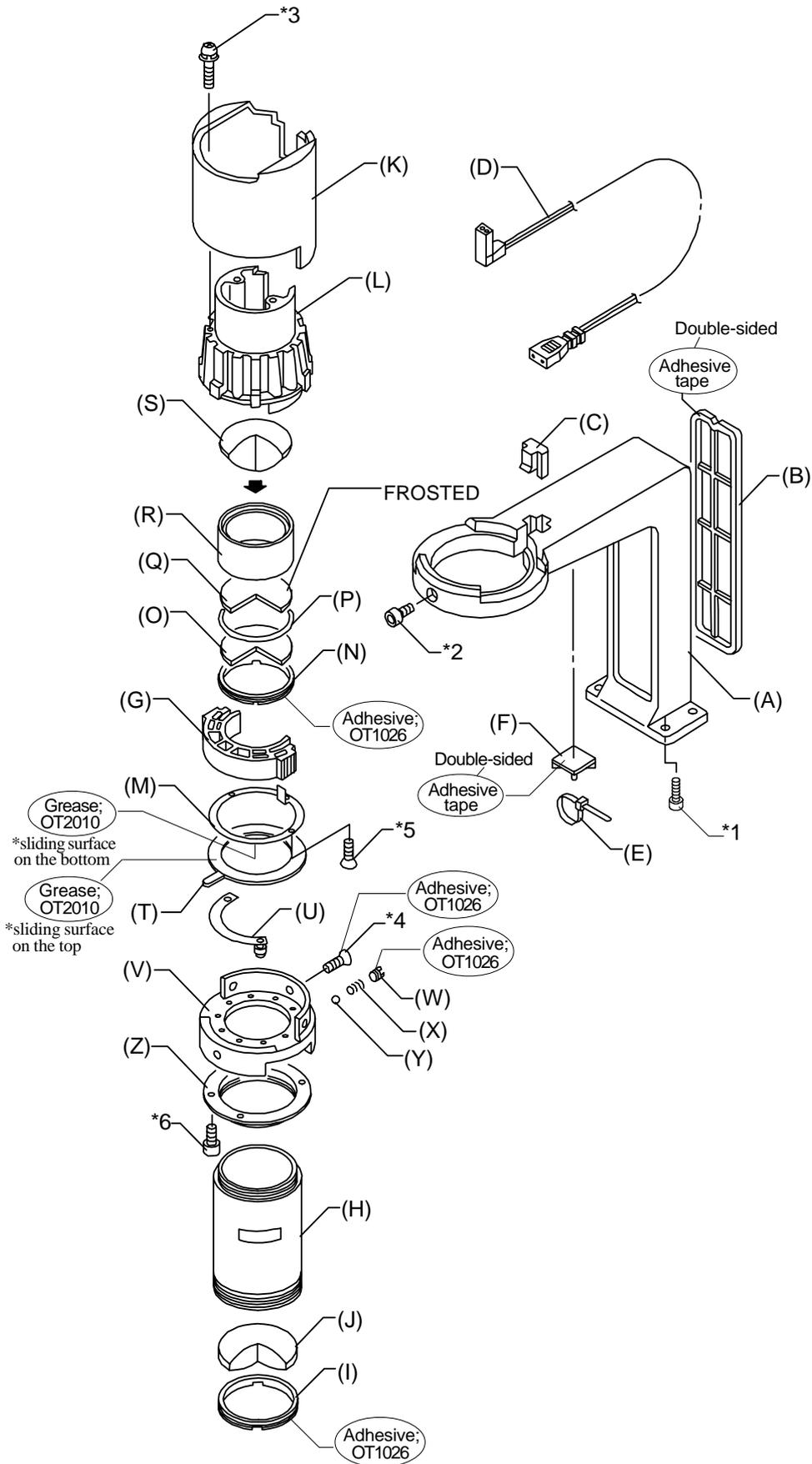
*Refer to D-14.



No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	KNOB	ACU3X10SA, 1pc. (*1)			
(B)	BOTTOM PLATE	CTK3X6SA, 4pcs. (*2) HWB3SA, 1pc. (*3) CUKS3X8SA, 4pcs. (*4) HWB3SA, 1pc. (*5)			
(C)	CABLE ASS'Y				Connection to CN1 (output side connector)
(D)	CABLE ASS'Y				Connection to CN3 (rheostat ass'y connector)
(E)	CABLE ASS'Y				Connection to CN2 (lamp connector)
(F)	CIRCUIT BOARD	CUK3X6SA, 4pcs. (*6) SW3SA, 4pcs. (*7)			Voltage adjustment: it is necessary to adjust it if the rheostat ass'y or circuit board (F) is replaced individually. (Refer to D-14.)
(G)	FERRITE CORE	CUK3X6SA, 1pc. (*8) SW3SA, 1pc. (*9) KNW3SA, 1pc. (*10)			
(H)	PLATE	CUKK3X5SA, 2pcs. (*11)			It is used to fix the cover (I) to the base of frame.
(I)	COVER				

* Be sure to turn off power during disassembly and reassembly.

8. Transmitted illuminator



No.	Parts name	Screw	Grease	Adhesive	Remark
(A)	ARM	AB6X12SA, 4pcs. (*1) AB4X10SA, 1pc. (*2)			
(B)	COVER				Attach it with double coated adhesive tape.
(C)	CAP				
(D)	CORD				
(E)	BAND				
(F)	CORD HOLDER				Attach it with double coated adhesive tape.
(G)	FILTER FRAME				
(H)	LENS TUBE				
(I)	RING			OT1026	
(J)	LENS				
(K)	LAMP TUBE	CUKSK3X8SA, 2pcs. (*3)			
(L)	LENS FRAME	CSK3X6SA, 3pcs. (*4)		OT1026	
(M)	RING	PSK2X4SA, 3pcs. (*5)	OT2010		Apply grease to the sliding surface on the bottom.
(N)	RING			OT1026	Apply adhesive to 2 points.
(O)	45FHG				
(P)	RING				
(Q)	FROSTED FILTER				
(R)	SPACER				
(S)	LENS				
(T)	KNURLED RING		OT2010		Apply grease to the sliding surface on the top.
(U)	DIAPHRAGM BLADE				Mount it in the correct directions. (Refer to the figure on C-15.)
(V)	DIAPHRAGM FRAME				
(W)	SCREW			OT1026	
(X)	SPRING				
(Y)	BALL				
(Z)	RING	ABK2.6X8SA, 4pcs. (*6)			

1. Overview of optical adjustment

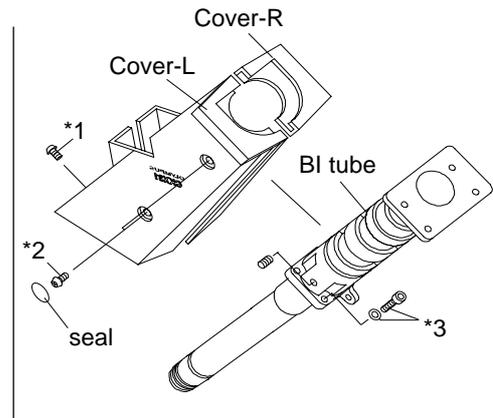
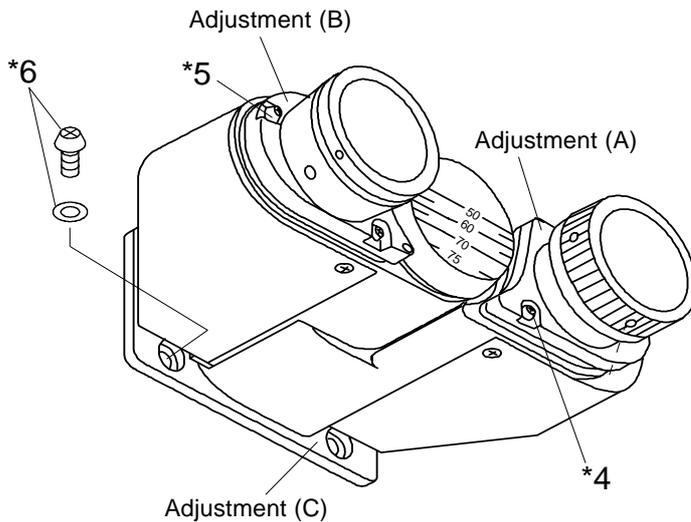
(1) Optical axis (CKX31)

<Fig.1>

1) After removing the stage, peel off the seals and remove the screws (*1,*2).

Screws: 3PUTB2X4SA 1pc. (*1), CUKSK3X8SA 4pcs.(*2)

2) Separate the cover-L and cover-R.



<Fig.1>

Adjustment (A) : Loosen the screws(*4) and adjust the revolving axis by moving the right sleeve.

Screw: CUK3X6SB 2pcs. (*4)

Adjustment (B) : Loosen the screws(*5) and adjust the left /right optical axis by moving the left sleeve. (the right sleeve is taken as a standard)

Screw: CUK3X6SB 2pcs. (*5)

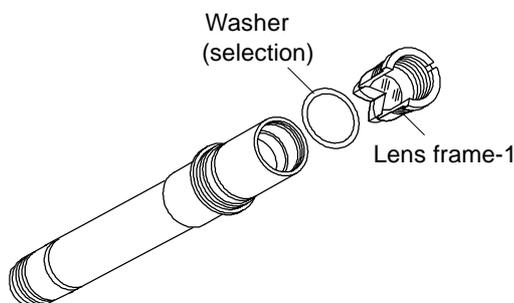
Adjustment (C) : Loosen the screws(*6) and adjust the absolute optical axis in the right sleeve by moving the binocular unit attached to the BI tube.

Screw: CUK3X6SA 4pcs. , Washer: KNW3SA 4pcs. (*6)

*When removing the BI tube, adjust the absolute optical axis by changing a mounting position of BI tube.

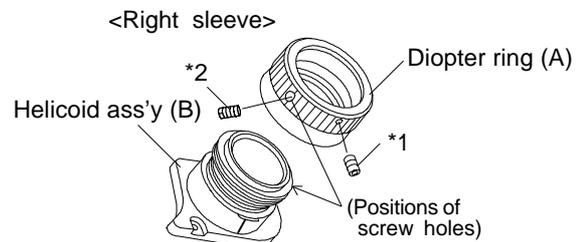
Screw : AB3X14SA ,Washer:BNW3SA 4pcs(*3) <Fig.1>

(2) Parfocality <CKX31>



Adjust the parfocality by inserting washer under the lens frame-1.

(Check the parfocality in the left sleeve.)



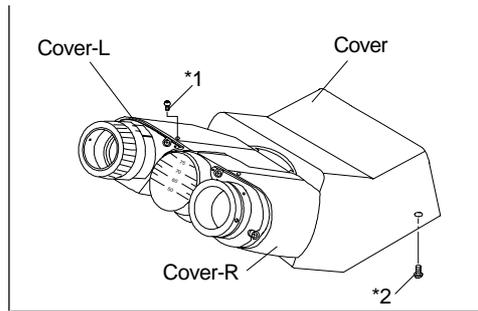
After checking it in the left sleeve, turn the helicoid to focus on the specimen in KN0041, then loosen the screws(*1), only move the diopter ring and fix it at the position where moving range from focusing point is equal in screwing -in /out directions.

Note: When using the screw(*2) for fixing eyepiece; mount the diopter ring with (A) and (B) screw hole positions aligned without the above adjustment.

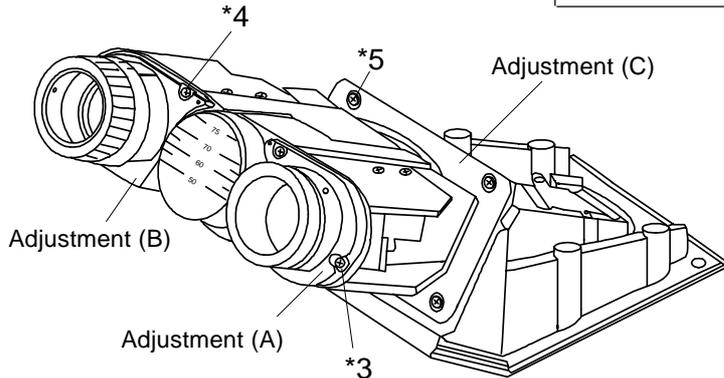
(3) Optical axis (CKX41)

<Fig.2>

- 1) Remove the cover-L and cover-R.
Screw: 3PUTB2X4SB 3pcs. each (*1)
- 2) Remove the cover.
Screw: CUTB3X10SA 2pcs. (*2)



<Fig.2>



Adjustment (A) : Loosen the screws(*3) and adjust the revolving axis by moving the right sleeve.

Screw: CUK3X6SB 2pcs. (*3)

Adjustment (B) : Loosen the screws(*4) and adjust the left /right optical axis by moving the left sleeve. (the right sleeve is taken as a standard)

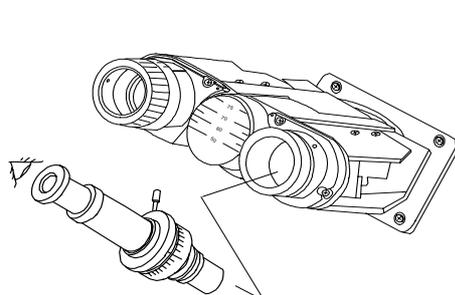
Screw: CUK3X6SB 2pcs. (*4)

Adjustment (C) : Loosen the screws(*5) and adjust the absolute optical axis in the right sleeve by moving the position of binocular unit.

Screw: CUKK3X6SA 4pcs. (*5)

(4) Parfocality <CKX41>

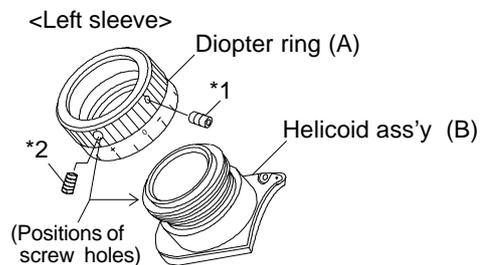
*In the same manner as CKX31, adjust the parfocality by inserting washer under the lens frame-1. (For adjustment procedure, refer to D-12.)



Insert the jigs in the right sleeve and check the parfocality.

Jigs:

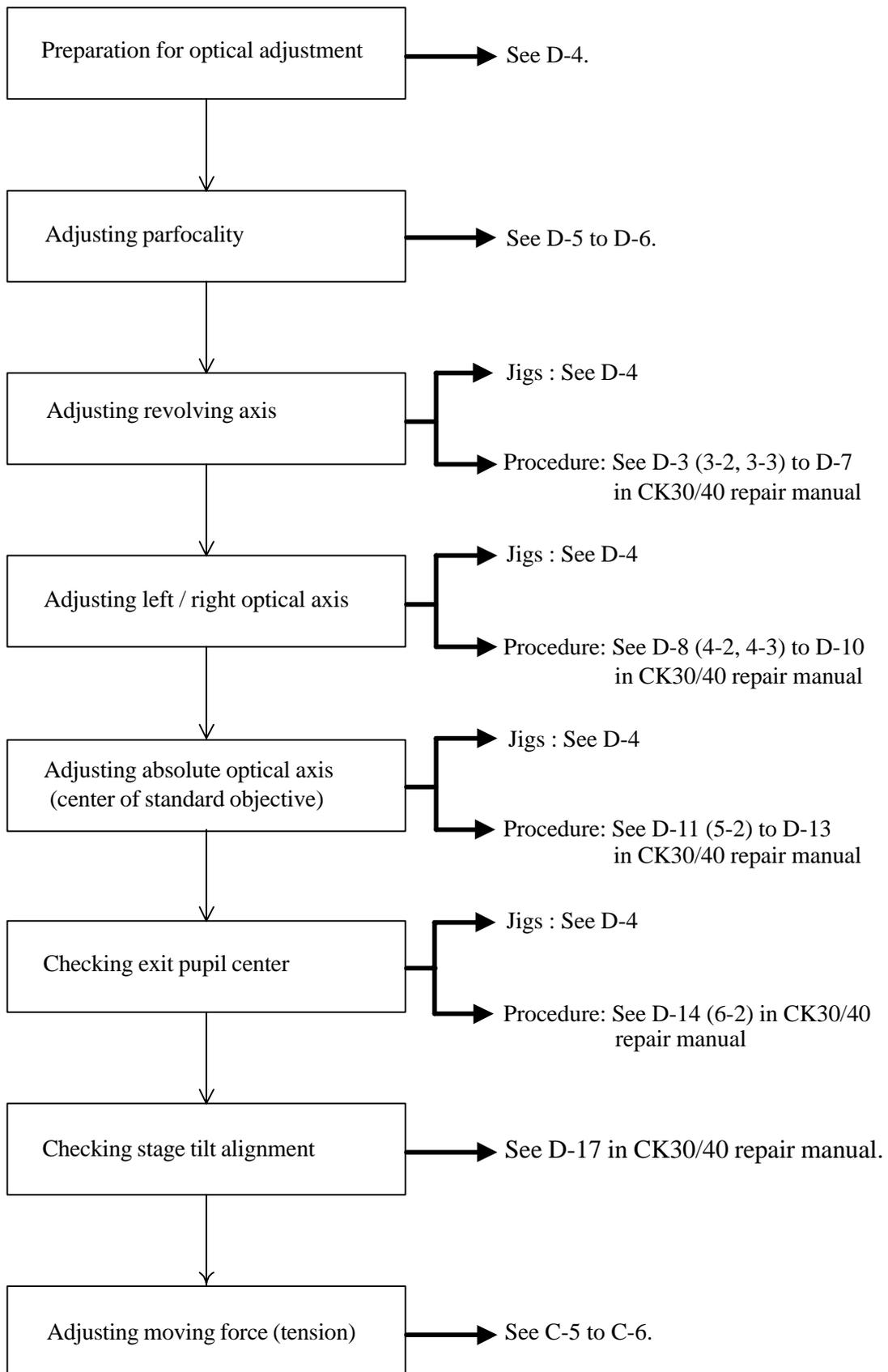
- 1) Focusing telescope (FT-36 or U-FT)
- 2) Standard eyepiece (KN0048; Adapter-1)
- 3) Standard objective (KN0041)



After checking it in the right sleeve, turn the helicoid to focus on the specimen in KN0041, then loosen the screws(*1), only move the scale ring and fix it at the position where scale "0" is aligned to the index.

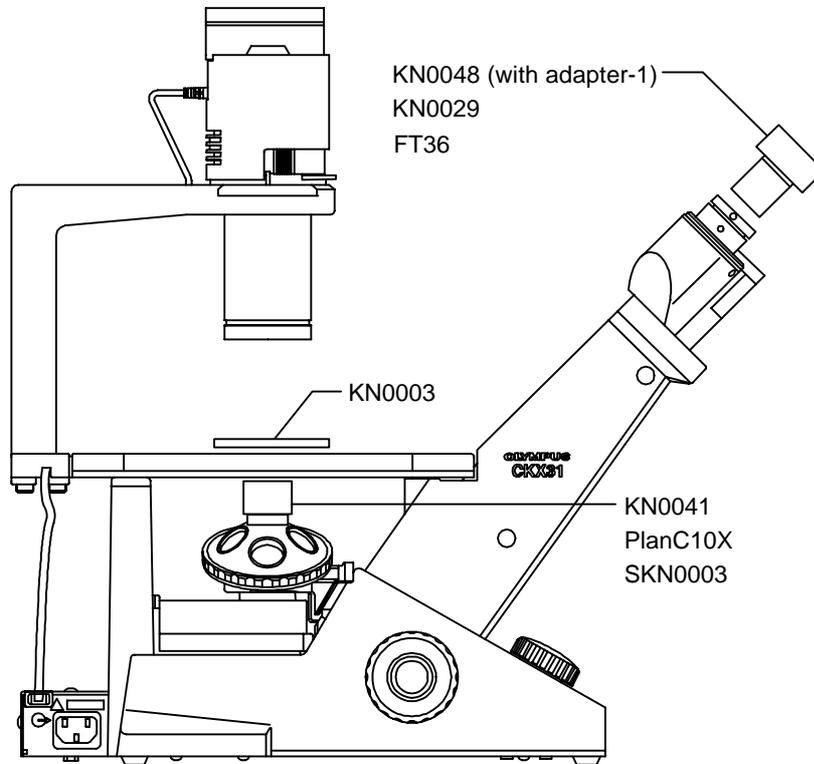
Note: When using the screw(*2) for fixing eyepiece; mount the diopter ring with (A) and (B) screw hole positions aligned without the above adjustment.

2. Adjustment procedure (CKX31)



*In adjustment of revolving axis and left/right optical axis, it is necessary to use CK40-MVR (and supplied slide-glass holder) when moving a specimen. If not available, move it by hand.

2-1 Preparation for optical adjustment (CKX31)



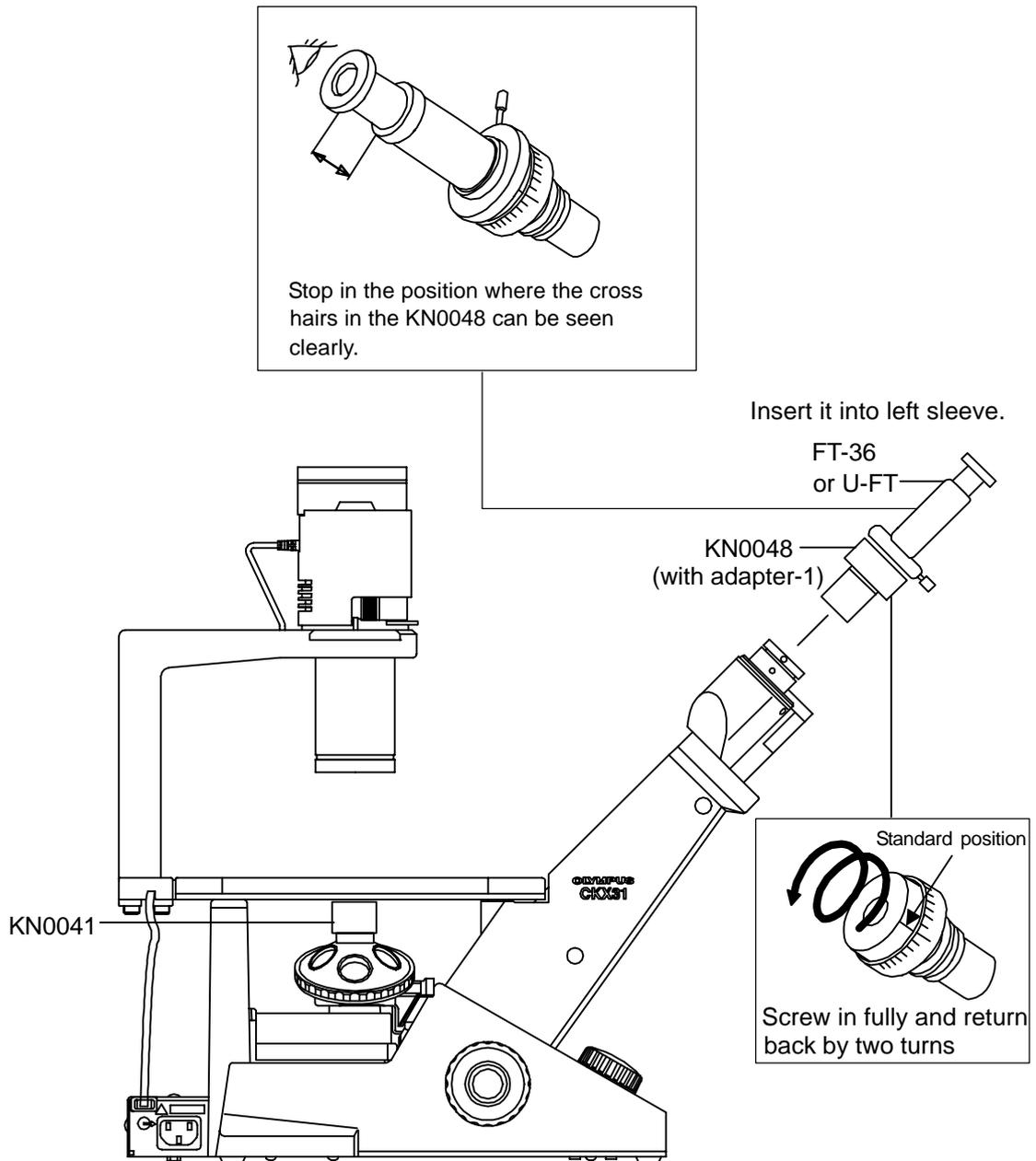
Adjustment item	Eyepiece(Jig)	Objective(Jig)	Jigs and tools
1. Revolving axis (right sleeve)	1) Standard eyepiece (KN0048; Adapter-1)	2) PlanC10X	3) Test plate : concentric circles (KN0003) or cross micrometer (OB-M1/100SQ)
2. Left/right optical axis (left sleeve)	1) Standard eyepiece (KN0048; Adapter-1)	2) PlanC10X	3) Test plate : concentric circles (KN0003) or cross micrometer (OB-M1/100SQ)
3. Absolute optical axis (right sleeve)	1) Standard eyepiece (KN0048; Adapter-1)	2) Standard objective (KN0041)	_____
4. Exit pupil center	1) Centering telescope (KN0029)	2) PlanC10X	_____
5. Parfocality	1) Standard eyepiece (KN0048; Adapter-1) 2) Focusing telescope (FT-36 or U-FT)	3) Standard objective (KN0041)	_____
6. Stage squareness		1) Stage for checking stage tilt alignment (SKN0003)	2) Thickness gauge 0.3mm (OT1949)

2-2 Checking parfocality for CKX31

Set the following jigs as illustrated below to check the parfocality.

Necessary jigs :

- 1) Focusing telescope (FT-36 or U-FT)
- 2) Standard eyepiece (KN0048; Adapter-1)
- 3) Standard objective (KN0041)



*If it does not meet the standard, adjust the parfocality referring to D-6.

Standard: $\pm 0.3\text{mm}$
(within 3 graduations)

2-3 Parfocality adjustment for CKX31

Relay lens ass'y consists of three parts, lens frame-1(A), frame-2(B) and lens frame-3(C).
 (For the composition of lenses, refer to the Fig.1 and Fig.2.)

Set the jigs to the microscope and check the parfocality. (Refer to D-5.)

Adjustment procedure:

(1) Remove the stage part, and take off the covers. (refer to the disassembly on C-1.)

(2) Remove the screws(*1) and remove the part of relay lens ass'y and BI tube.

Screw: AB3X14SA(*1), Washer: BNW3SA 4pcs. each

(3) Loosen the screw(*2) and turn the relay lens ass'y counterclockwise to remove it.

Screw: ACU3X6SA(*2) 1pc.

(4) Remove the lens frame-1 ass'y(A) and insert appropriate washer(selection).

(5) Assemble the parts in reverse order of disassembly.

(6) Set the jigs, focus on the reticle of KN0048 and the specimen in KN0041.

At this time, read the difference from the index on the helicoid scale.

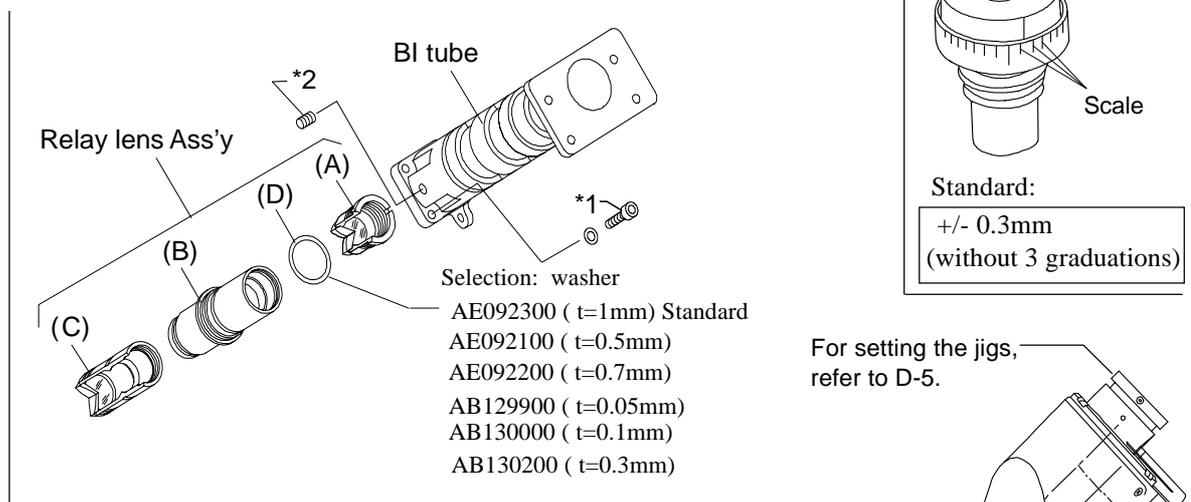


Fig. 1

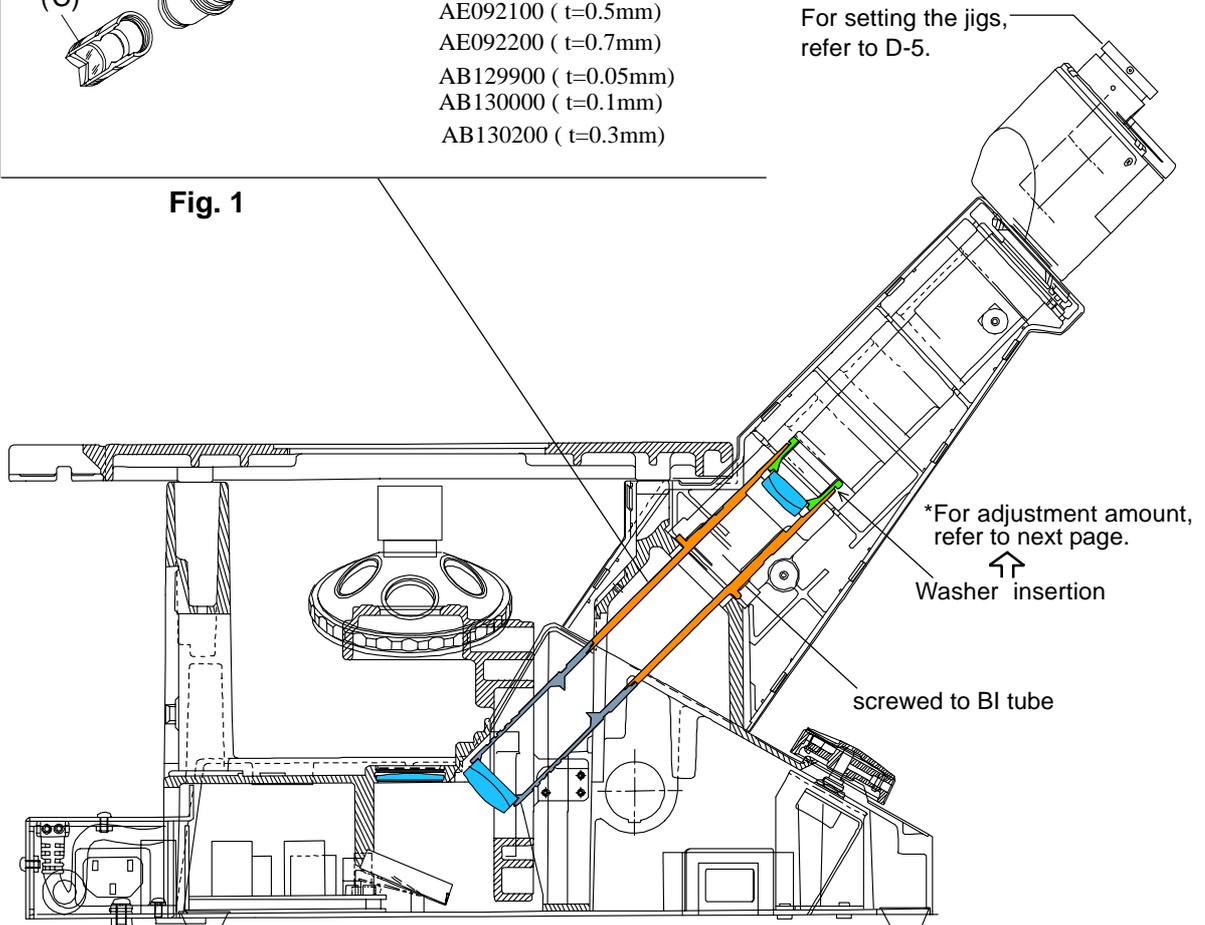


Fig. 2

Parfocality adjustment amount (CKX31: reference value)

Unit: mm

Reading value (before adjustment)	Washer selection < standard : 1.0 >						Total washer thickness	Reading value (after adjustment)
	AB129900	AB130000	AB130200	AE092100	AE092200	AE092300		
	0.05	0.1	0.3	0.5	0.7	1.0		
2.0	1				1	1	1.75	0.03
1.9					1	1	1.70	0.06
1.8					1	1	1.70	-0.04
1.7	1	1		1		1	1.65	0.00
1.6		1		1		1	1.60	0.03
1.5	1			1		1	1.55	0.06
1.4	1			1		1	1.55	-0.04
1.3				1		1	1.50	-0.01
1.2	1	1	1			1	1.45	0.02
1.1		1	1			1	1.40	0.05
1.0		1	1			1	1.40	-0.05
0.9	1		1			1	1.35	-0.02
0.8			1			1	1.30	0.01
0.7	1	2				1	1.25	0.04
0.6	1	2				1	1.25	-0.06
0.5		2				1	1.20	-0.02
0.4	1	1				1	1.15	0.01
0.3		1				1	1.10	0.04
0.2		1				1	1.10	-0.06
0.1	1					1	1.05	-0.03
0.0						1	1.00	0.00
-0.1	1	2			1		0.95	0.03
-0.2		2			1		0.90	0.06
-0.3		2			1		0.90	-0.04
-0.4	1	1			1		0.85	-0.01
-0.5		1			1		0.80	0.02
-0.6	1				1		0.75	0.06
-0.7	1				1		0.75	-0.04
-0.8					1		0.70	-0.01
-0.9		2		1			0.70	-0.11
-1.0		1		1			0.60	0.05
-1.1		1		1			0.60	-0.05
-1.2	1			1			0.55	-0.02
-1.3				1			0.50	0.01
-1.4				1			0.50	-0.09
-1.5	1	1	1				0.45	-0.06
-1.6		1	1				0.40	-0.03
-1.7	1		1				0.35	0.00
-1.8			1				0.30	0.04
-1.9			1				0.30	-0.06
-2.0		2					0.20	0.10

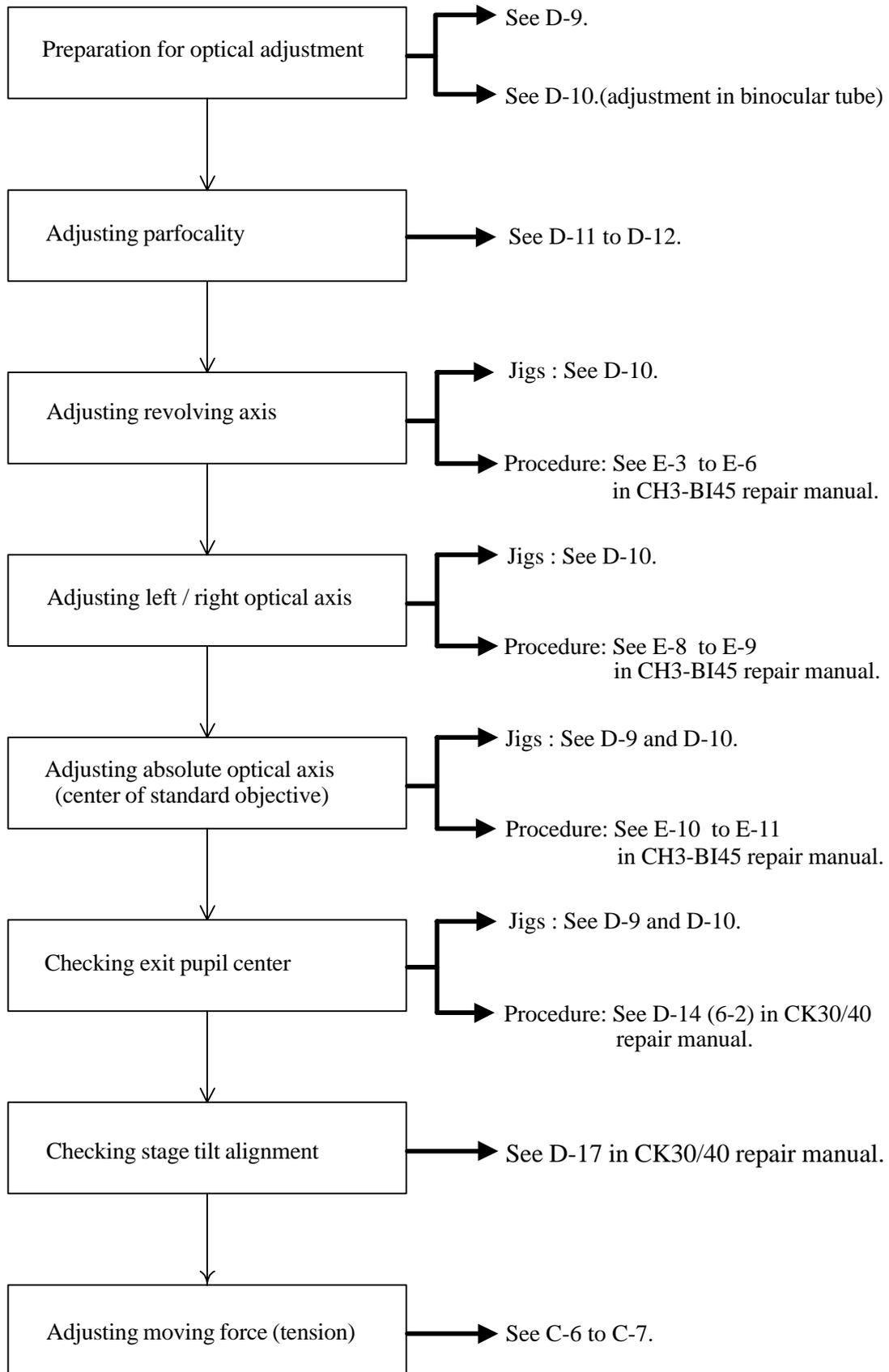
Reading value (before adjustment): Reading value of parfocality difference on the helicoid scale of standard eyepiece

Reading value (after adjustment): Theoretical reading value of parfocality difference after adjustment

Ex.) Parfocality difference is 1.9 mm: when the total thickness (1.70mm) of washers, (0.7mm: 1pc.) and (1mm: 1 pc.), are inserted, parfocality difference becomes 0.06mm reading value.

* Numeric character (1 or 2) in the column of washer selection shows the number of washers.

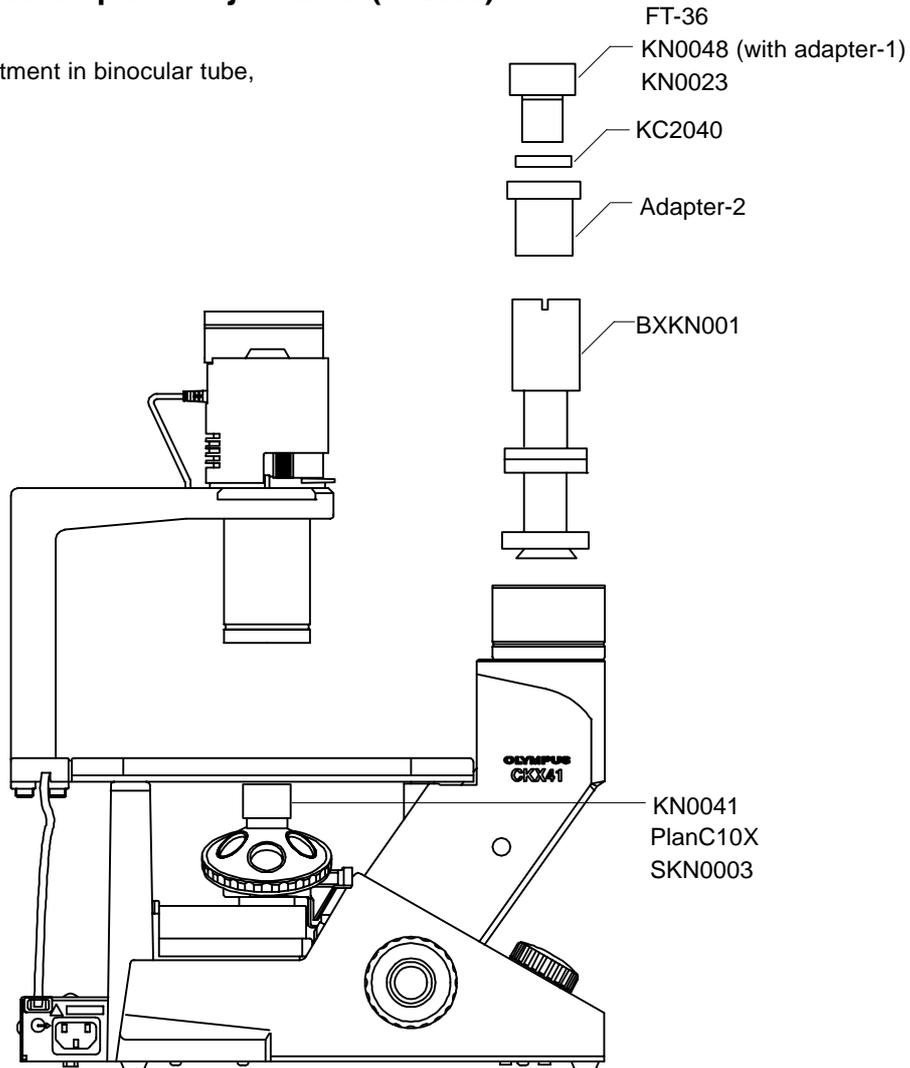
3. Adjustment procedure (CKX41)



*In adjustment of revolving axis and left/right optical axis, it is necessary to use CK40-MVR (and supplied slide-glass holder) when moving a specimen. If not available, move it by hand.

3-1 Preparation for optical adjustment (CKX41)

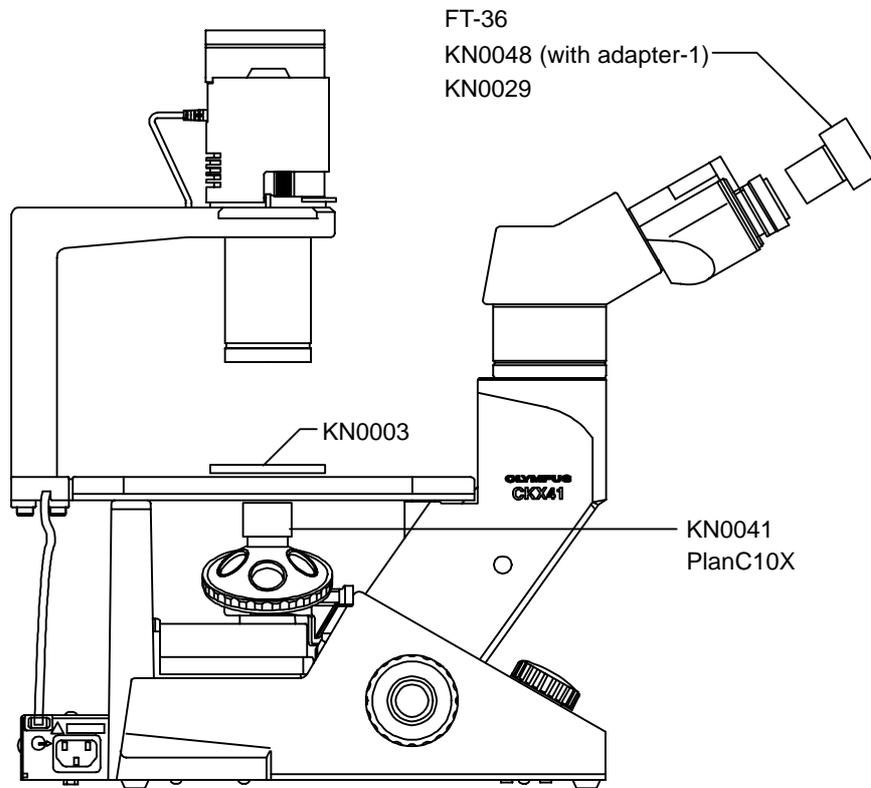
* For optical adjustment in binocular tube, refer to D-10.



Adjustment item	Eyepiece(Jig)	Objective(Jig)	Jigs and tools
1. Absolute optical axis	1) Standard eyepiece (KN0048; Adapter-1 and adapter-2) 2) 3mm adapter ring (KC2040)	3) Standard objective (KN0041)	4) UIS standard observation tube (BXKN001)
2. Exit pupil center	1) Centering telescope (KN0023)	2) PlanC10X	3) UIS standard observation tube (BXKN001)
3. Parfocality	1) Standard eyepiece (KN0048; Adapter-1 and adapter-2) 2) 3mm adapter ring (KC2040) 3) Focusing telescope (FT-36 or U-FT)	4) Standard objective (KN0041)	5) UIS standard observation tube (BXKN001)
4. Stage squareness	—	1) Stage for checking stage tilt alignment (SKN0003)	2) Thickness gauge 0.3mm (OT1949)

* Exit pupil center: If it fails to meet the standard, it is suspected that there is a problem in inclination of mirror or a defect in parts.

<Optical adjustment in binocular tube>



Adjustment item	Eyepiece(Jig)	Objective(Jig)	Jigs and tools
1. Revolving axis (right sleeve)	1) Standard eyepiece (KN0048; Adapter-1)	2) PlanC10X	3) Test plate : concentric circles (KN0003) or cross micrometer (OB-M1/100SQ)
2. Left/right optical axis (left sleeve)	1) Standard eyepiece (KN0048; Adapter-1)	2) PlanC10X	3) Test plate : concentric circles (KN0003) or cross micrometer (OB-M1/100SQ)
3. Absolute optical axis (right sleeve)	1) Standard eyepiece (KN0048; Adapter-1)	2) Standard objective (KN0041)	—
4. Exit pupil center	1) Centering telescope (KN0029)	2) PlanC10X	—
5. Parfocality	1) Standard eyepiece (KN0048; Adapter-1) 2) Focusing telescope (FT-36 or U-FT)	3) Standard objective (KN0041)	—

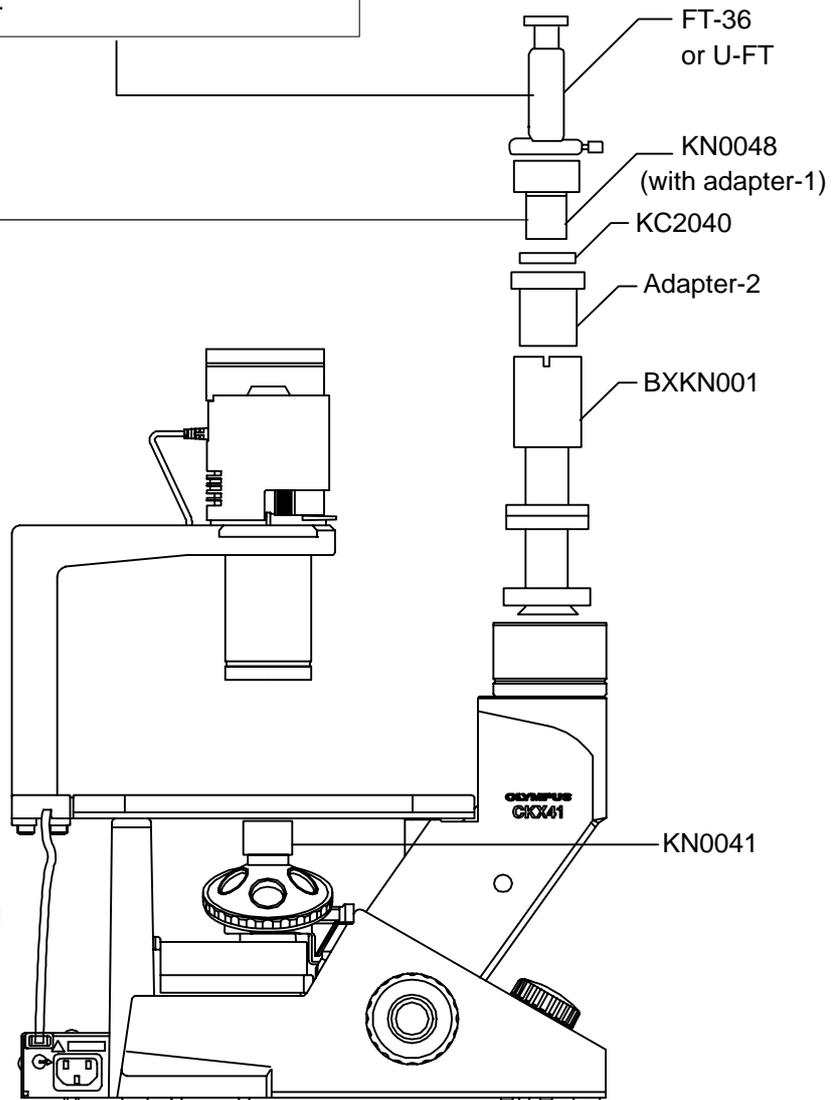
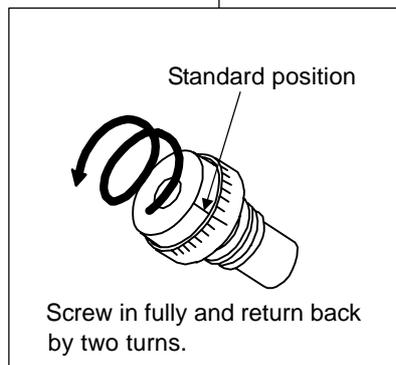
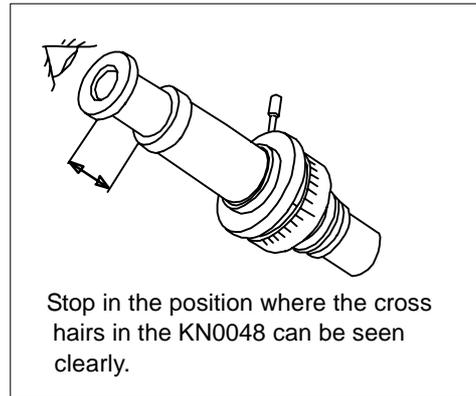
* Parfocality: Check the parfocality in right sleeve. If not meet the standard, confirm that the screws fixing the sleeve is not loosened. (In case where the screw is loosened, adjust the parfocality by moving the sleeve vertically because the sleeve is possible to be displaced.)

3-2 Checking parfocality for CKX41

Set the following jigs as illustrated below to check the parfocality.

Necessary jigs :

- 1) Focusing telescope (FT-36 or U-FT)
- 2) Standard eyepiece (KN0048; Adapter-1 and Adapter-2)
- 3) 3mm ring adapter (KC2040)
- 4) UIS standard observation tube (BXKN001)
- 5) Standard objective (KN0041)



*If it does not meet the standard, adjust the parfocality by inserting washer. (refer to D-12.)

Standard: +/-0.3mm
(within 3 graduations)

3-3 Parfocality adjustment for CKX41

Relay lens ass'y consists of three parts, lens frame-1(A), lens frame-2(B) and lens frame(C).
 (For the composition of lenses, refer to the Fig.1 and Fig.2.)

Set the jigs to the microscope and check the parfocality. (refer to D-11.)

Adjustment procedure:

- (1) Remove the stage, and take off the covers. (refer to the disassembly on C-3.)
- (2) Remove the screws(*1) and remove the part of relay lens ass'y and TR body ass'y.
 Screw: AB3X14SA(*1), Washer: BNW3SA 4pcs. each
- (3) Loosen the screw(*2) and turn the relay lens ass'y counterclockwise to remove it.
 Screw: ACU3X6SA(*2) 1pc.
- (4) Remove the lens frame-1 ass'y(A) and insert appropriate washer(selection).
- (5) Assemble the parts in reverse order of disassembly.
- (6) Set the jigs, focus on the reticle of KN0048 and the specimen in KN0041.
 At this time, read the difference from the index on the helicoid scale.

Standard: +/- 0.3mm (without 3 graduations)

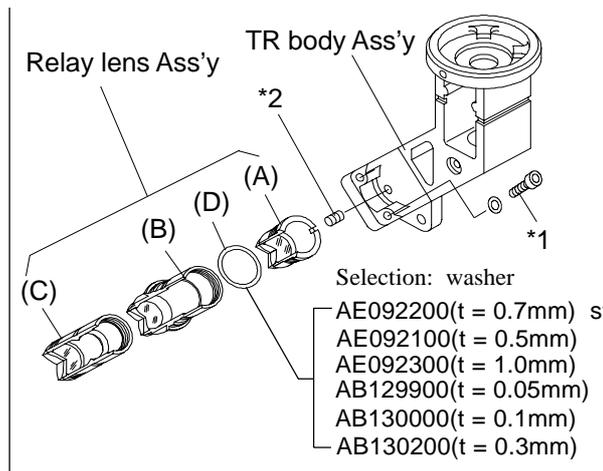
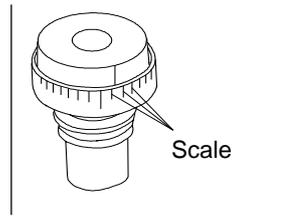


Fig. 1

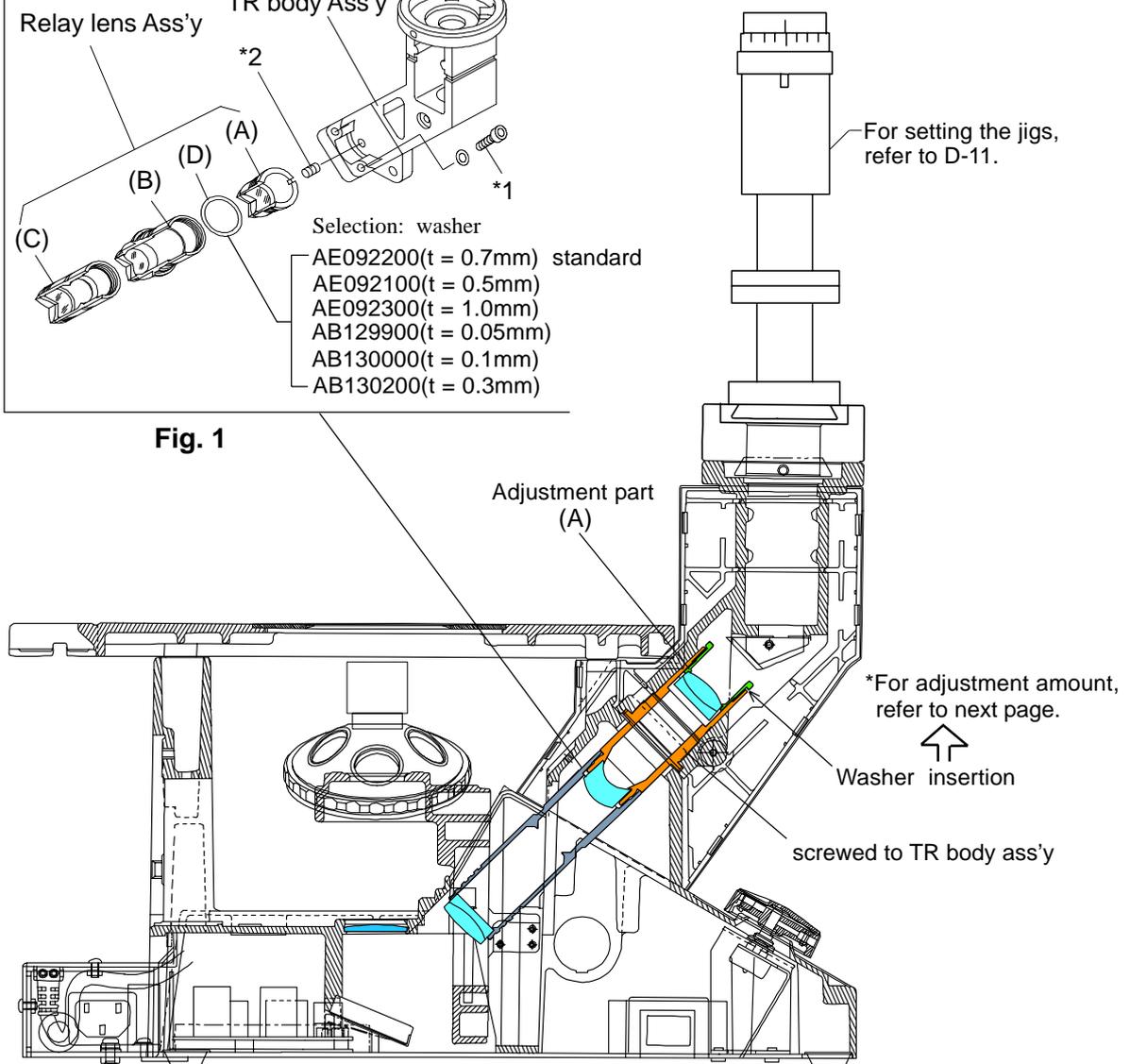


Fig. 2

Parfocality adjustment amount (CKX41: reference value)

Unit: mm

Reading value (before adjustment)	Washer selection < standard : 0.7 >						Total washer thickness	Reading value (after adjustment)
	AB129900	AB130000	AB130200	AE092100	AE092200	AE092300		
	0.05	0.1	0.3	0.5	0.7	1.0		
2.0	1					1	1.05	-0.03
1.9	1					1	1.05	-0.13
1.8						1	1.00	0.06
1.7						1	1.00	-0.04
1.6						1	1.00	-0.14
1.5	1	2			1		0.95	0.05
1.4	1	2			1		0.95	-0.05
1.3		2			1		0.90	0.14
1.2		2			1		0.90	0.04
1.1		2			1		0.90	-0.06
1.0	1	1			1		0.85	0.13
0.9	1	1			1		0.85	0.03
0.8	1	1			1		0.85	-0.07
0.7		1			1		0.80	0.12
0.6		1			1		0.80	0.02
0.5		1			1		0.80	-0.08
0.4	1				1		0.75	0.11
0.3	1				1		0.75	0.01
0.2	1				1		0.75	-0.09
0.1					1		0.70	0.10
0.0					1		0.70	0.00
-0.1					1		0.70	-0.10
-0.2	1	1		1			0.65	0.09
-0.3	1	1		1			0.65	-0.01
-0.4	1	1		1			0.65	-0.11
-0.5		1		1			0.60	0.08
-0.6		1		1			0.60	-0.02
-0.7		1		1			0.60	-0.12
-0.8	1			1			0.55	0.07
-0.9	1			1			0.55	-0.03
-1.0	1			1			0.55	-0.13
-1.1				1			0.50	0.06
-1.2				1			0.50	-0.04
-1.3				1			0.50	-0.14
-1.4	1	1	1				0.45	0.05
-1.5	1	1	1				0.45	-0.05
-1.6		1	1				0.40	0.14
-1.7		1	1				0.40	0.04
-1.8		1	1				0.40	-0.06
-1.9	1		1				0.35	0.13
-2.0	1		1				0.35	0.03

Reading value (before adjustment): Reading value of parfocality difference on the helicoid scale of standard eyepiece

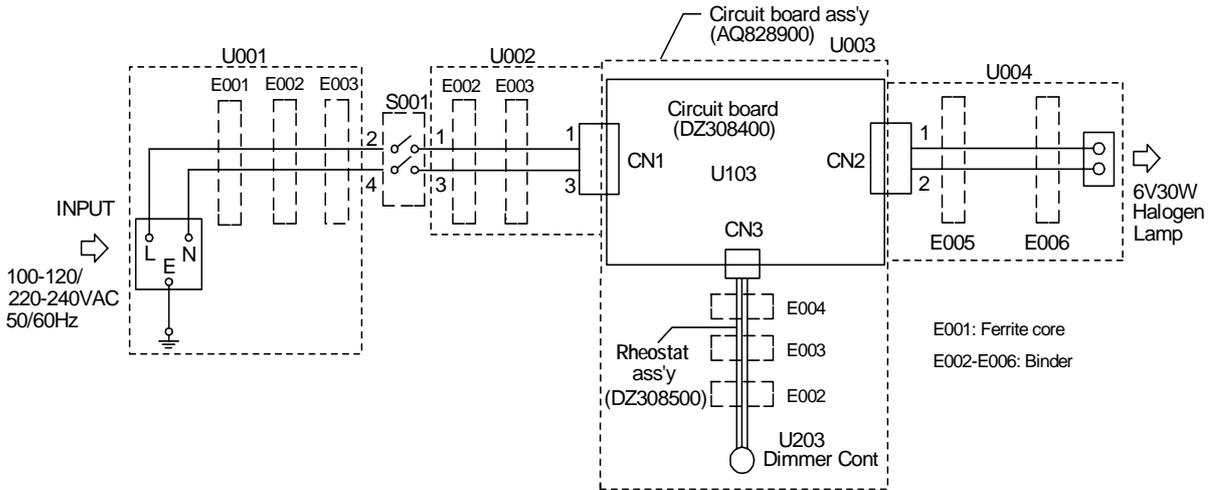
Reading value (after adjustment): Theoretical reading value of parfocality difference after adjustment

Ex.) Parfocality difference is 2.0 mm: when the total thickness (1.05mm) of washers, (0.05mm: 1pc.) and (1mm: 1 pc.), are inserted , parfocality difference becomes -0.03mm reading value.

* Numeric character (1 or 2) in the column of washer selection shows the number of washers.

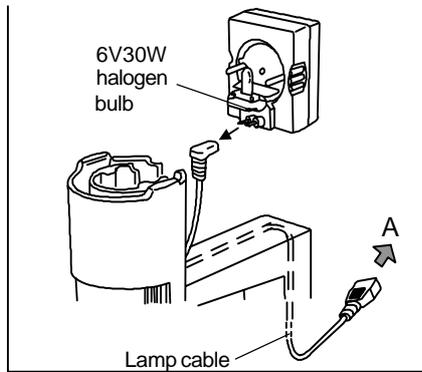
4. Electrical Unit

4-1 CKX31/CKX41 connecting diagram



The circuit board ass'y (AQ828900) consists of the circuit board(DZ308400) and rheostat ass'y (DZ308500). In case where the above parts are replaced as AQ828900, the voltage adjustments for the circuit board ass'y are not necessary. However, voltage adjustments are necessary when individually replacing either the circuit board(DZ308400) or rheostat ass'y(DZ308500). The following explains procedures for voltage adjustments. For replacing circuit board/rheostat ass'y, refer to disassembly and assembly procedures on C-13 to C-14.

4-2 Voltage adjustment



Minimum voltage adjustment

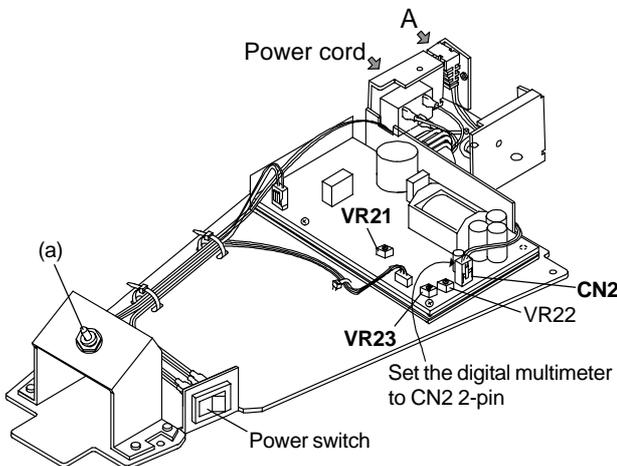
- 1) Turn ON the power. Turn the light intensity control part (a) counterclockwise to lower lamp brightness to its lowest level.
- 2) Rotate the circuit board's trimmer VR21 to adjust so that the lamp output voltage between the CN2's 1 and 2 pins is within the standard shown below using a digital multimeter.

Standard: DC1.10 - 1.15V
(adjustment target: 1.123V)

Maximum voltage adjustment

- 1) Turn ON the power. Turn the light intensity control part (a) clockwise to increase lamp brightness to its highest level.
- 2) Rotate the circuit board's trimmer VR23 to adjust so that the lamp output voltage between the CN2's 1 and 2 pins is within the standard shown below using a digital multimeter.

Standard: DC5.65 - 5.75V
(adjustment target: 5.70V)



* Do not turn the trimmer VR22 mounted on circuit board because it is adjusted to the prescribed current value. (overcurrent protection)

1. List of jigs and tools

No.	Description	Page
BKN001	UIS standard observation tube	B-2, D-9,11,12
FT36(or U-FT)	Focusing telescope	B-1,2,3, D-4,5,9,10,11
KC2040	3mm ring adapter	B-2, D-9,11
KN0003 (or OB-M1/100SQ)	Test plate (5/100mm concentric circles)	B-1, 3, D-4,10
KN0023	Centering telescope	B-2, D-9
KN0029	Centering telescope	B-1, 3, D-4,10
KN0041	Standard objective	B-1,2,3, D-4,5,6,9,10,11,12
KN0048	Standard eyepiece (including adapter-1 and 2)	B-1,2,3, D-4,5,6,9,10,11,12
OT1949	Thickness gauge	B-2, D-4,9
OT3223	Tension gauge (30N)	B-1,2, C-6,8,10
OT3225	Tension gauge (3N)	B-2, C-10,12
SKN0003	Gauge for checking stage tilt alignment	B-2, D-4,9
	Digital multimeter	D-14

1. List of greases

No.	Description	Page
OT2006	Grease (heavy)	C-10
OT2008	Grease (medium)	C-10
OT2010	Grease (light)	C-12,16
OT2012	Mo grease	C-10
OT2144	Grease (light)	C-2,4
OT3189	Silicone grease	C-6,8

2. List of adhesives

No.	Description	Page
OT1026	Solvent-based adhesive (red)	C-2,4,10,16
OT1378	Solvent-based adhesive (transparent)	C-10
OT1838	Cyanoacrylate adhesive	C-12
OT3111	Cyanoacrylate adhesive	C-10