CKD

SMB−04E

INSTRUCTION MANUAL

INDEXMAN
PARALLEL CAM UNIT

PCIS·PCOS Series

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

Ver. 4
CKD Corporation

⚠ To Safely Use This Product

Read this manual carefully before use.

The designer should confirm the safety of the mechanism and of the electric control devices.
To ensure the safe use of this product, it is important to correctly select, use, handle, and maintain the product.
The precautions indicated WARNING or CAUTIONS must be observed.

⚠ **WARNING :** **When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.**

⚠ **CAUTION :** **When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.**

Note that some items described as "CAUTION" may lead to serious results depending on the situation.

In any case, important information that must be observed is explained.

When custom specifications, product specifications may differ from descriptions on this instruction manual. Refer to Drawing for Approval etc. per product.

⚠ WARNING :

- Use the product within the range of specifications. A load and/or r.p.m. exceeding the specifications may result in a damage, a malfunction and/or accuracy deterioration of the index unit.
- Don't touch any moving part during the operation of the index unit.
- Don't suddenly stop the input shaft revolution during the output section is working.

① A sudden stop of the input shaft by clutch brake etc. will apply the overload to the unit. This may cause an overrun of the dial plate on the unit.

② If a torque saver is provided, a sudden stop will release the torque saver. This may cause an overrun of the dial plate on the unit.

③ If the emergency stop is necessary, install the safety measure to prevent a sudden stop, and select the larger torque saver enduring the overload.

- Shut off the power before maintenance or inspection. A sudden movement caused by malfunction or control circuit failure may result in personal injury.
- Do not use the product in an explosive or ignitable atmosphere.

⚠ CAUTION :

- The product must be assembled by a person with a basic knowledge about the assembly.
- Start and stop the index unit at a dwell section. A start or stop other than the dwell section will cause the overload. This may result in a damage of the unit.
- If a position detection cam is provided on the input shaft, check the cam at the proper position periodically. A misalignment of the cam caused by a loose set screw may result in malfunction.
- Don't use the product where wet or oily environment. The product is not water-proof or drip-proof.
  Where the product is subject to splashes of water or oil, it must be protected with a cover or such.
- The index unit contains lubricant oil, which may ooze out through the oil packing or another part during use. Check the packing periodically, and install the oil pan if necessary.

Terms of warranty

Conditions related to the warranty and scopes are as follows.

1) Period
The warranty period of the product is one year since the date of delivery.
(However, the period assumes eight hours of operation per day.
As well, if the durability limit is reached within one year, the period to the durability limit is the warranty period.)

2) Scope
If failure is caused in the above warranty period due to poor workmanship of our product, we will repair the product without charge without delay.
However, the scope of warranty shall not cover the following cases.

① Operation under the conditions or in the environment derailing from those specified in the product specifications

② Failure caused by lack of attention or erroneous control

③ Failure caused by other than the delivered product

④ Failure caused by operation derailing from the purposes for which the product is designed

⑤ Failure caused by modification in the structure, performance, specification or other features made by other than us after delivery, or failure caused by repairs done by other than our designated contractor

⑥ Loss in our product assembled to your machine or equipment, which would be avoided if your machine or equipment were provided with general functions, structures or other features common in the industry

⑦ Failure caused by reason that is unforeseeable with technology put into practical use at the time of delivery

⑧ Failure caused by fire, earthquake, flood, lightning, or other acts of God, earth shock, pollution, salt hazard, gas intoxication, excessive voltage, or other external causes

⑨ When it is caused by the part which is provided by a customer or a part used by the appointment of the customer.

⑩ When the consumption parts such as bearing or the oil seal used for our product were worn and deteriorated.

About optional parts (switch, drive parts etc.) we make the guarantee that followed the guarantee ranges of each maker because life is different by driving condition.

The warranty mentioned here covers the discrete delivered product.
Only the scope of warranty shall not cover losses induced by the failure of the delivered product.

3) Warranty of product exported outside Japan

① We will repair the product sent back to our factory or company or factory designated by us. Work and cost necessary for transportation shall not be compensated for.

② The repaired product will be packed according to the domestic packing specification and delivered to a designated site inside Japan.

This warranty terms describe basic items.
Priority will be given to specification drawings and specification sheets if warranty description given on such specification drawings or specification sheets is different from the warranty terms given herein

I N D E X

INDEX MAN　Parallel Cam Unit

PCIS, PCOS

Manual No.　SMB-04E

作成　2011.6.06

[SMB-04E]

INTRODUCTION

Thank you for choosing our parallel cam unit.
This unit has a simple construction consisting of a precise parallel cam and a turret w/cam follower. Due to parallel shafts, it is the appropriate unit for conveyer drive.
This manual shows precautions and service/inspection items below. Please carefuly read this manual before use or maintenance

1. UNPACKING

Check that the product is as ordered

1) Model No.

2) Check for damage caused during transportation.
If any failure such as a missing screw, oil leak, or bent shaft is found, contact the branch, sales office, or agency from which the product was purchased.

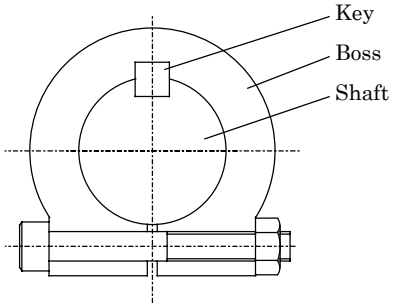
2. HOW TO ASSEMBLE AND INSTALL

⚠ CAUTION: The product must be assembled by a person with a basic knowledge about the assembly.

1) Install the product as the attitude according to the specifications.
The oil supply/drain ports and oil level gage are placed according to the installation attitude.

2) Install the product where it can be easily inspected, overhauled, and reassembled and the oil level gauge read.

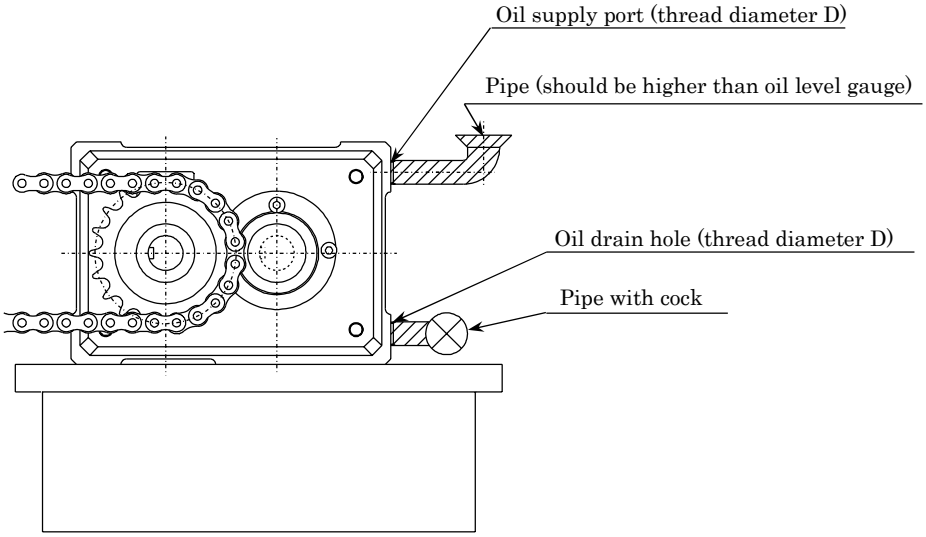
3) Key way are often used to secure the dial plate, coupling, gear, sprocket, pulley, cam, boss, or another part to the shaft. A chattering key way always leads to shock or vibration. The use of standard key, JIS B 1301-1996 is recommended. The methods fixing certainly should be conducted for fixing important section not only using key but using split model and friction fasteners, etc.



(split model)

4) Piping for easier lubricant oil exchange
Assembling the index unit into an automatic machine sometimes prevents the lubricant oil exchange. In this case, it is recommended to extend the oil supply/drain ports at the index unit to exchange the lubricant easily

Model	Thread diameter of oil supply/drain hole, D
PCIS･PCOS 040	Rc1/4
〃 050	
〃 063	
〃 080	Rc3/8
〃 100	
〃 125	
〃 160	Rc1/2
〃 200	
〃 250	



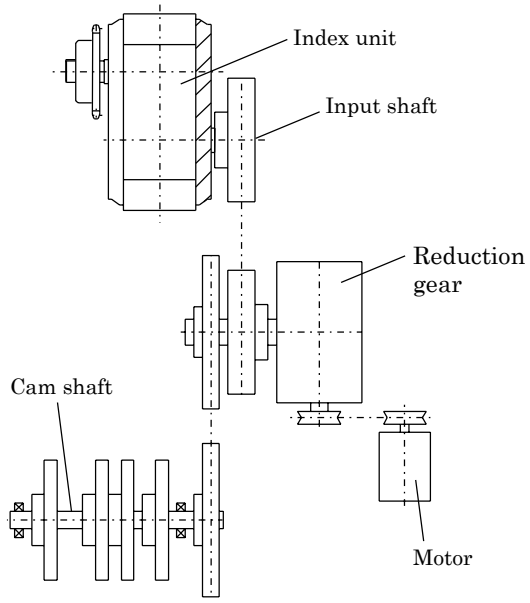
5) Designing of dial plate fixture
(1) The dial plate diameter and the fixture mounting pitch diameter and mass should be as small as possible. The applied torque increases with the square of dial plate diameter.
The smaller diameter dial plate also has the advantage in manufacturing and transportaions.

(2) The dial plate must be secured with two dowel pins in addition to fixing bolts to repeat the proper mounting position when reassembling.

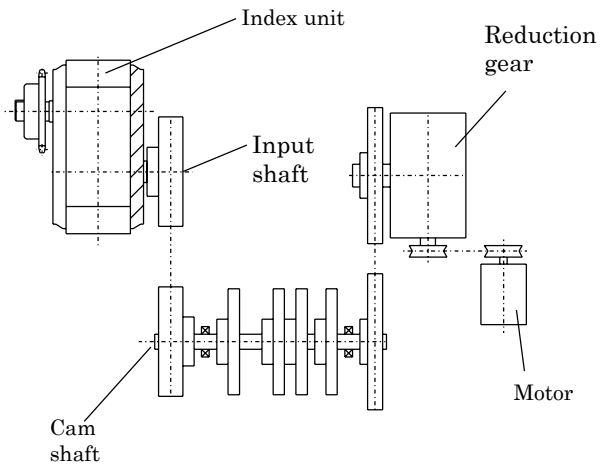
(3) If a vertical load is applied to the unit when automatic process on the plate such as press, marking or caulking, avoid directly applying the load to the dial plate or index unit and provide a support or such.

6) The driveline from the motor to the index unit input shaft should be rigid and no backlash. A backlash may cause a shock during the dial plate rotation, shorten the service life of the unit, and/or damage parts.

(1) Do not use another input shaft in series between the motor and the index unit input shaft. If used, it should be sufficiently rigid.

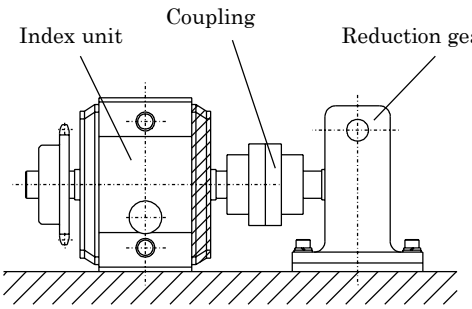


Good example



Bad example (causes a shock)

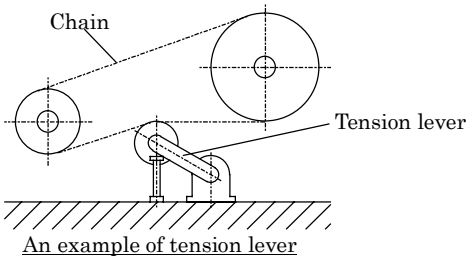
(2) When directly connecting the index unit input and reduction shafts with a coupling, use a coupling of no backlash and easier to adjust alignment.
(If the space permits, a model that the index unit and reducer are integrated may be used.)



An example of driveline

(3) A brake motor can be used when the unit is used for continuous rotation or with a smaller load and the starting/stopping frequency does not exceed five cycles per minute.
In other cases, use a clutch brake unit or motor w/clutch brake.

(4) Correctly install a tension adjuster for the timing belt or chain if used.
The lack of the tension adjuster may lead to shock or vibration.



An example of tension lever

7) Center the shafts.
Center the shafts when connected with a coupling. Eccentric shafts may be broken.

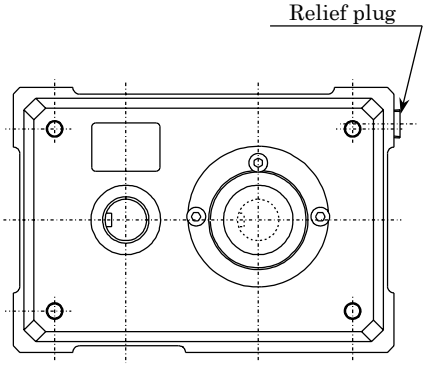
3. BEFORE THE OPERATION

Before the operation:

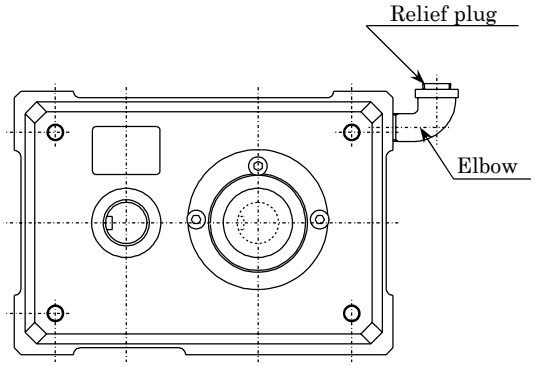
1) Check for loose bolts and screws.

2) Check the input and output shafts for loose or chattering connections.
A loose or chattering connection may lead to shock or stiff table motion.

3) Lubrication
PCIS and PCOS series, lubricant oil is contained in the body. Check that the oil level is higher than the middle of the oil level gauge. Exchange with the plug w/air hole provided before starting the operation. Failure to do this may lead to oil leak.
Lubricant oil may overflow through the plug w/air hole due to a higher revolving speed or internal temperature rise as a result of an environmental effect. In this case, extend the piping using an elbow to prevent the overflow.



Normal piping

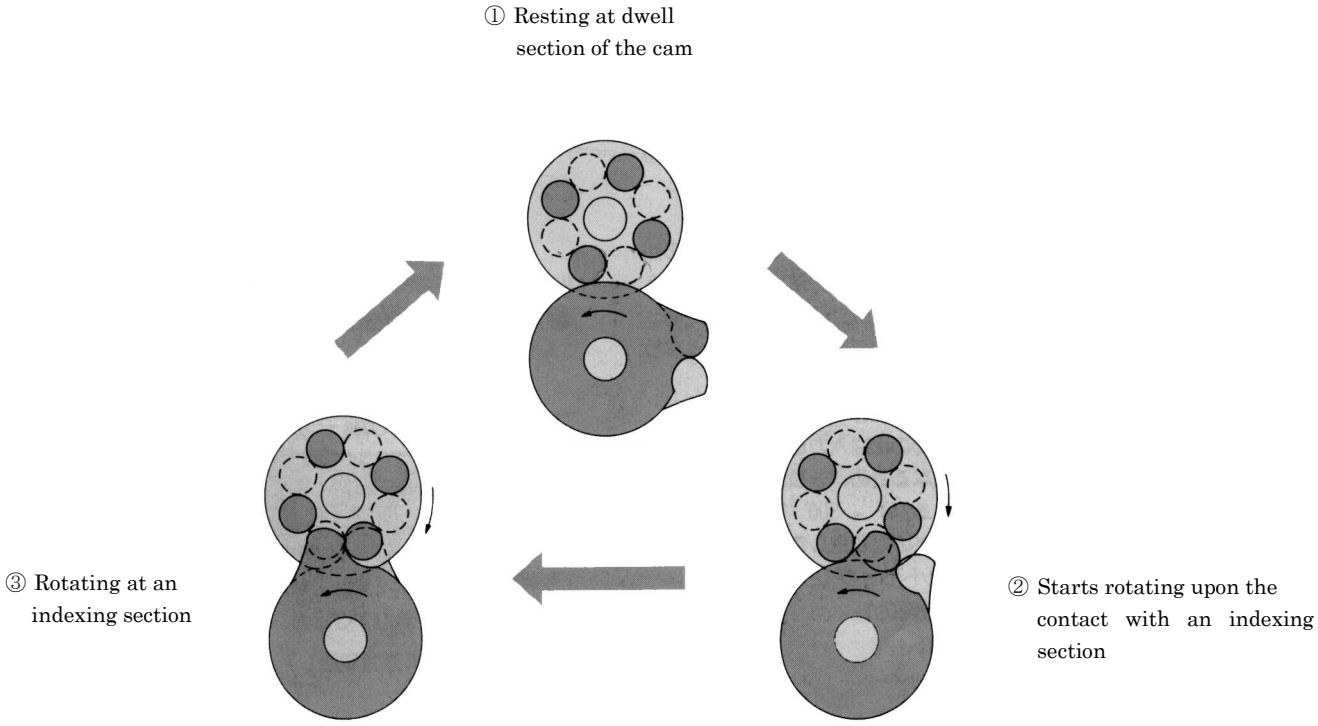


Additional piping (to be prepared by the customer)

4. ADEQUATE OPERATION

1) Explanation of operation

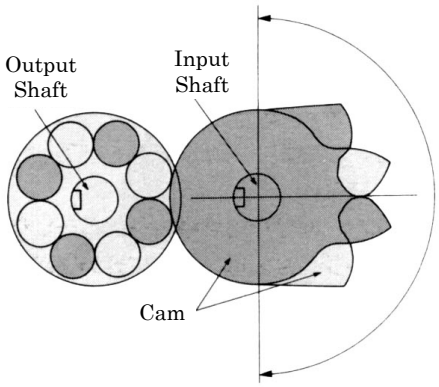
(1) Relative positions of the parallel cam and turret w/cam follower are illustrated below.



(2) Cam indexing angle

A turn (360 degrees) of the cam groove consists of dwell (straight) and indexing (curved) sections.

The dwell section rotates the cam but not the output shaft. With the cam follower at an indexing section, the output shat rotates with the cam. The cam rotating angle for output shaft rotation is referred to as indexing angle.



2) Adequate operation

⚠ WARNING: **Use the product within the range of specifications. A load and/or r.p.m. exceeding the specifications may result in a damage, a malfunction and/or accuracy deterioration of the index unit.**

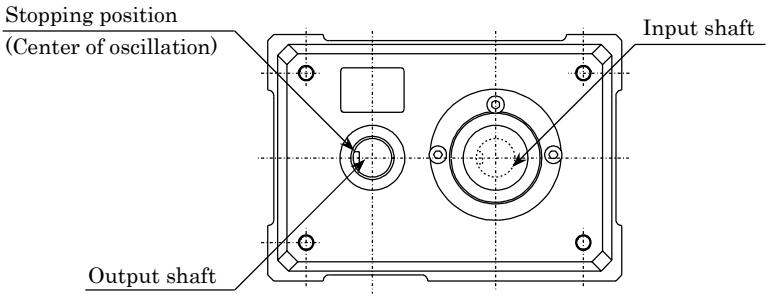
(1) Adjust the applied torque (output torque) below the rated dynamic output torque. (See catalogue.)

⚠ WARNING: **Don't touch any moving part during the operation of the index unit.**

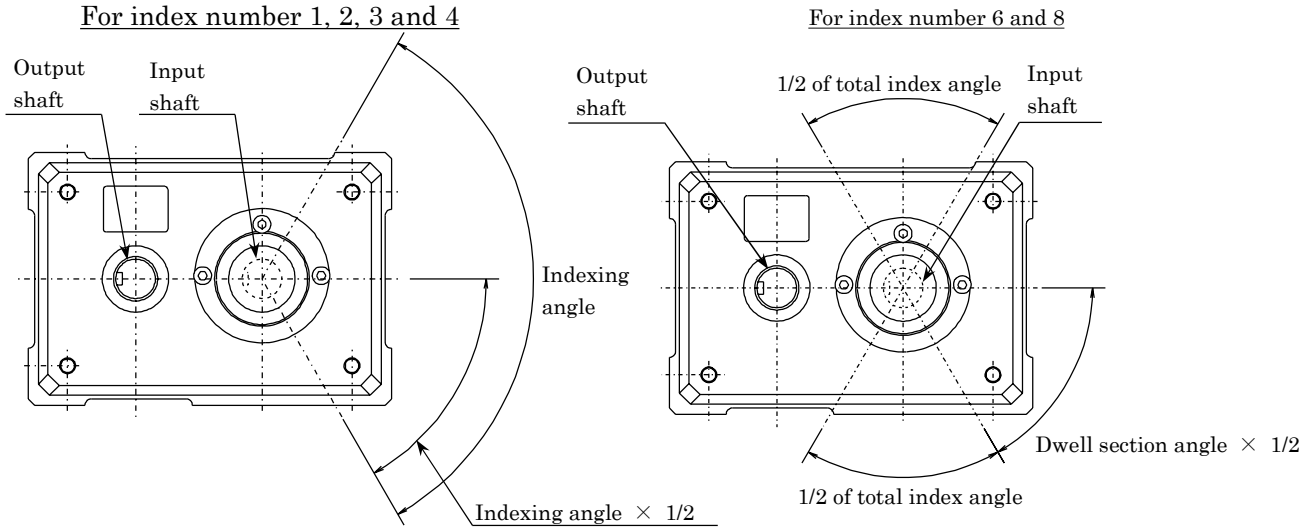
(2) Input shaft revolving speed
Use the r. p. m. of input shaft within the specifications. At 200 r. p. m. or higher, the pre-load and other parameters should be adjusted. Please contact us.

⚠ CAUTION: **Start and stop the index unit at a dwell section. A start or stop other than the dwell section will cause the overload. This may result in a damage of the unit.**

(3) Stopping position of output shaft



(4) Input shaft key way and output shaft stopping range
This relationship should be noted in adjusting the timing of another attachment by the input shaft key way. The output shaft rotates with the input shaft key way within the indexing angle as shown below and stops with the key way within the dwell section



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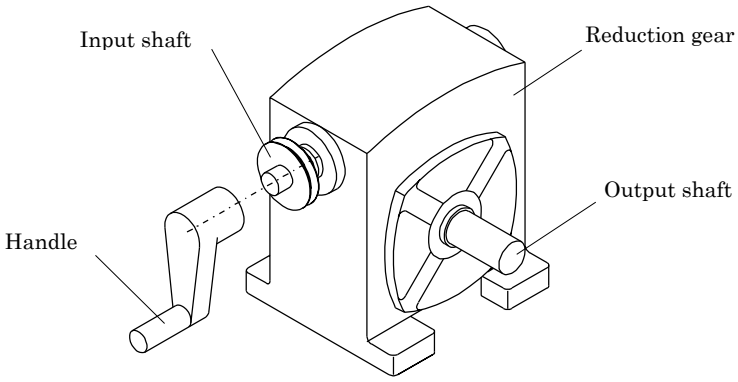
⚠ WARNING: **Don't suddenly stop the input shaft revolution during the output section is working.**

① A sudden stop of the input shaft by clutch brake etc. will apply the overload to the unit. This may cause an overrun of the dial plate on the unit.

② If a torque saver is provided, a sudden stop will release the torque saver. This may cause an overrun of the dial plate on the unit.

③ If the emergency stop is necessary, install the safety measure to prevent a sudden stop, and select the larger torque saver enduring the overload.

(5) After emergency stop, manually rotate the shaft to the dwell section and start again.
A handle should be provided with the driving system to permit the manual rotation of the input shaft in such a case.



(6) Check for unusual sound.
If any unusual sound is heard during use, immediately stop the operation. The cam follower or an internal part may have been failed. Contact the nearest sales agency or factory.

⚠ WARNING: **Do not use the product in an explosive or ignitable atmosphere.**

⚠ CAUTION: **Don't use the product where wet or oily environment.**
The product is not water-proof or drip-proof.
Where the product is subject to splashes of water or oil, it must be protected with a cover or such.

(7) Prevention of water intrusion and corrosion
The index unit input and output shafts and mounting surfaces are not protected from corrosion. They may be corroded depending on the storing conditions or the operating atmosphere.
Always apply a coat of rust-preventive oil, grease, or rust proof paint over the machined surfaces.

5. MAINTENANCE

⚠WARNING: Shut off the power before maintenance or inspection. A sudden movement caused by malfunction or control circuit failure may result in personal injury.

⚠CAUTION: If a position detection cam is provided on the input shaft, check the cam at the proper position periodically. A misalignment of the cam caused by a loose set screw may result in malfunction.

⚠CAUTION: The index unit contains lubricant oil, which may ooze out through the oil packing or another part during use. Check the packing periodically, and install the oil pan if necessary.

1) Exchange of lubricant

Exchange lubricant oil 500 hours after the start of operation and every 2000 hours afterwards.
Check the oil level every week and refill if necessary.
Use the recommended oil listed below

Type / Manufacture	Lubricant oil		Grease
	For less than 200 rpm input shaft speeds	For 200 rpm or more input shaft speeds	
JX Nippon Oil & Energy (standard for CKD)	BONNOC M 220	Gear Grand GL-5 80W-90	
Japan Energy (standard for CKD)	JOMO REDUCTUS 220	JOMO Gear 5 80W-90	
Kyodo Yushi (standard for CKD)			Citrax EP No.2
JX Nippon Oil & Energy (standard for CKD)			EPONEX Grease AP2
Idemitsu Kosan	DAPHNE Super Gear Oil 220	APOLLOIL Wide Gear LW 80W-90	DAPHNE Eponex EP No. 2
Showa Shell	Shell OMALA Oil 220	Shell GELCO Power Gear 80W-90	Shell ALVANIA EP Grease RO2
Exxon Mobil	Mobil Gear 600XP 220	MOBILUBE HD 80W-90	Mobilux EP2
Cosmo Sekiyu	Cosmo Gear SE 220	Cosmo Gear GL-5 80W-90	Cosmo Grease DYNAMAX EP No. 2

Prepare the following lubricant oil.

Series		Oil capacity (liters)
PCIS･PCOS	040	0.12
〃	050	0.2
〃	063	0.4
〃	080	0.6
〃	100	1.2
〃	125	2.5
〃	160	4
〃	200	7
〃	250	13

6. TROUBLE SHOOTING

Symptom			Remedy
Rotary table generates a shock or does not stop at the proper position	index unit body	There is no shock at lower input shaft revolving speeds.	Check index unit model No. and output shaft for excessive torque.
		Continuous shock	Applied torque or driving system may have a problem. Contact us for remedy.
		Internal Unusual sound or temperature rise is suspected.	Internal damage is suspected. Contact us for replacement of index unit.
	Driveline	Input shaft has a backlash between gear when driven.	Reduce backlash between gear.
		Key chatters when driven by gear.	Replace key to reduce chatter.
		Chain or timing belt is significantly deflected when driven.	Tighten with tension adjuster.
		Input shaft angular position sensor switch is out of place.	Relocate input shaft angular position sensor switch.
		Faulty input shaft angular position sensor.	Replace.
		Backlash at worm reduction gear	Overhaul worm reduction gear.
		Overload on geared motor reduction gear	Prevent output shaft overload or use worm reduction gear
		Clutch release error	Check clutch.
		Frequent emergency stops	Remove cause(s) of emergency stop.
	Mounting of index unit body	Incomplete mounting or securing	Firmly secure.
	Mounting of subsidiary table	Insufficient tightening torque or loose knock pins	Check and tighten.
	Unusual load	Rated dynamic output torque for index unit is exceeded.	Calculate applied torque and contact us for countermeasures.
	Overload protector	Wrong torque setting	Adjust torque setting.
		Poor repeatability	Replace.
Index unit does not rotate.	Index unit body or driveline	Internal failure of index unit body	Replace or contact us.
		Faulty motor	Replace.
		Brake has been applied.	Repair or replace.
		Lubricant viscosity has increased too much due to a lower temperature.	Exchange lubricant oil （use a less viscous one listed in this manual）

7. WASTE

Metal, rubber and lubricant are used for this product. Since this product can not be burned, this must be disposed as industrial waste.

8. PRODUCT SPECIFICATIONS

1) How to order

PCIS ① 125 ② – 004 ③ 300 ④ S ⑤ 1 ⑥ 1 ⑦ 1 ⑧ –X 123456 ⑨

① Series	② Size		③ Number of Stops(PCIS) Oscillating angle(PCOS)		④ Total Index angle		⑤ Cam curve		⑥ dwell number of cam (PCIS) Oscillation pattern (PCOS)		⑦ Output shaft shape	
PCIS PCOS	040 050 063 080 100 125 160 200 250	40mm 50mm 63mm 80mm 100mm 125mm 160mm 200mm 250mm	001 ∫ 008 (PCIS) 015 030 045 (PCOS)	1indexes ∫ 8indexes (PCIS) 15° 30° 45° (PCOS)	090 ∫ 330 (PCIS) 060 ∫ 360 (PCOS)	90° ∫ 330° (PCIS) 360° ∫ 330° (PCOS)	S C	MS MC	1 1 dwell 2 2 dwell (PCIS) T Oscillation pattern details T S details S (PCOS)		1 S1 2 S2 3 S3 4 R1 5 R2 6 R3	

⑧ Installation position/housing material (The drawing of installation position is for shaft layout S1.)					⑨ Custom specifications No.
1	First position/ FC housing	First position	Second position	Third position	6 digits after "X"
2	Second position/ FC housing				
3	Third position/ FC housing				
4	Fourth position/ FC housing	Fourth position	Fifth position	Sixth position	
5	Fifth position/ FC housing				
6	Sixth position/ FC housing				

a : oil supply b : oil level gauge c : oil drain port

Refer to catalog for mode No. with options.

2) Characteristic chart

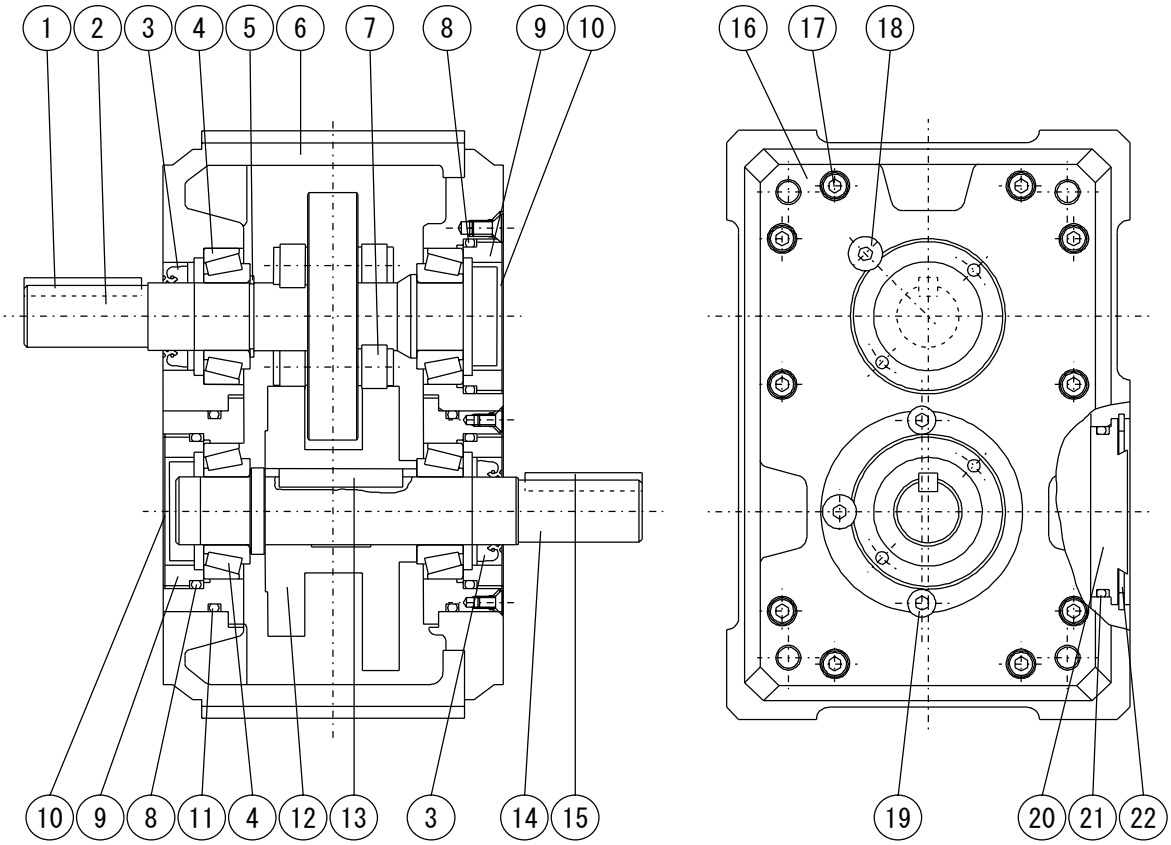
Size		040	050	063	080	100	125	160	200	250
Number of input shaft revolution(rpm)		1～500								1～400
Index accuracy(sec)	1 dwell	±90	±60							
	2 dwell	±180	±140	±90						
Repeatability(sec)		90	60							
Allowable thrust force (N)	Output shaft	480	1100	2500	3500	5000	5800	8000	14000	18000
	Input shaft	280	650	1800	2500	3500	4000	6200	10000	15000
Allowable radial force (N)	Output shaft	350	780	1800	2700	3800	5200	6500	11000	15000
	Input shaft	200	520	1400	1800	2500	3200	4000	7500	12000
Allowable bending moment(N・m)	Output shaft	18	25	52	110	190	260	340	1200	2100
Moment of inertia ($kg・m^2$)	Output shaft	1.09×10^{-4}	3.51×10^{-4}	8.01×10^{-4}	2.23×10^{-3}	7.04×10^{-3}	1.86×10^{-2}	0.084	0.19	0.51
	Input shaft	1.29×10^{-4}	3.18×10^{-4}	1.27×10^{-3}	3.73×10^{-3}	1.04×10^{-2}	3.06×10^{-2}	0.11	0.32	0.73
Inside friction torque (N・m)		1.1	1.7	3.1	4.9	7.7	12	20	31	48
Mass(kg)		3	6	11	19	32	62	130	240	400
Oil capacity (liters)		0.12	0.2	0.4	0.6	1.2	2.5	4	7	13

Note: Input shaft maximum rotational speed may vary per specification such as dwell number and index number, etc. (Check the specifications with dynamic rated output torque table on the catalog.)

3) Others

- Refer to catalogs for static rated output torque, dynamic rated output torque and accuracy.
- Refer to catalogs for dimensions

9. INTERNAL STRUCTURE DRAWIND



Part No.	Part name	Part No.	Part name
1	Parallel key	12	Cam
2	Output shaft	13	Parallel key
3	Oil seal	14	Input shaft
4	Tapered roller bearings	15	Parallel key
5	C type snap ring for shaft	16	Housing plate
6	Housing	17	Hexagon Socket Head Cap Screw
7	Cam follower assembly	18	Hexagon Socket Countersunk Head Screw
8	O ring	19	Hexagon Socket Countersunk Head Screw
9	Bearing retainer	20	Cover
10	Seal cap	21	O ring
11	O ring	22	Retaining Rings-C Type

Note: Deep groove ball bearing is provided for ④ tapered roller bearing of PCIS/PCOS040 to 050.
⑨ bearing holder is not available for PCIS/PCOS040 to 050.
⑤ C type snap ring for shaft may not be available per specification.
O ring , Oil seal , Bearing are consumable parts

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10. OTHERS

Please observe the matters mentioned above to maintain this product in normal operation. When trouble occurs, please check model No. (refer to 8.1) and part No. (refer to 9.) before contacting to your nearest business office or distributors to ask replacement or to place order of repair part.

If you have any questions on handling, please consults with CKD.