CKD

Mechanical Indexer
Roller Gear Cam Unit
ZRS Series

INSTRUCTION MANUAL

SM-A74502-A

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

CKD Corporation

PREFACE

Thank you for purchasing CKD's **mechanical indexer "ZRS Series."**
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge about units, including machine assembly, electricity, and mechanisms. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application or usage, the product may not be able to exercise its full performance or an accident may occur.
  It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

Depending on the specifications, the product may be subject to the Export Trade Control Order.
Contact your local CKD sales office.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device, and the electric system that controls such mechanism is ensured.

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ DANGER	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ WARNING	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
CAUTION	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ DANGER

Do not use the product for the following applications:

- Medical devices involved in sustaining or managing people's lives or physical health.
- Mechanisms and mechanical devices used for the purpose of moving and transporting people.
- Important safety parts for mechanical devices.

⚠ WARNING

The product must be handled by a qualified person who has extensive knowledge and experience.

The product is designed and manufactured as a device or part for general industrial machinery.

Use the product within the specifications.

The product must not be used beyond its specifications. Also, the product must not be modified and additional work on the product must not be performed.

Use with load or speed exceeding the specifications range may result in damage, operation faults, or inaccurate operation.

The product is intended for use in devices or parts for general industrial machinery. It is not intended for use outdoors or in the conditions or environment listed below.

(Exception is made if the customer consults with CKD prior to use and understands the specifications of the product. However, even in that case, safety measures must be taken to avoid danger in case of a possible failure.)

- In applications for nuclear power, railroad system, aviation, ship, vehicle, medical equipment, and equipment that directly touches beverage or food.
- For special applications that require safety including amusement equipment, emergency shut-off circuit, press machine, brake circuit, and safety measures.
- For applications where life or properties may be adversely affected and special safety measures are required.

Do not handle the product or remove devices until confirming safety.

- Inspect and service the machine and devices after confirming the safety of the entire system. Also, turn off power to the facility that is the energy source and use extreme care to avoid electric leakage.

To ensure the safety of device design, observe organization standards and relevant laws.

- The Industrial Safety and Health Act, other safety rules, organization standards, and relevant laws.

CONTENTS

1. PRODUCT OVERVIEW

1.1 Model Number Indication

ZRS -05 X -006 120 S 1 S 1 - FLA123456 or NHFGHSB05C

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

Model No.
MECHANICAL
INDEXER

Symbol	Description
(1): Size	
04	Shaft interval 40 mm
05	Shaft interval 50 mm
06	Shaft interval 63 mm
08	Shaft interval 80 mm
11	Shaft interval 110 mm
14	Shaft interval 140 mm
(2): Operation	
X	Index
Y	Oscillator
(3): Index number and oscillating angle (Table 1) (Table 2)	
(4): Total index angle (Table 3)	
(5): Cam curve	
S	MS curve
(6): Spiral direction of the cam and orbit pattern	
1	Left helix/1 dwell (Figure 1)
2	Left helix/2 dwell (Figure 1)
5	Right helix/1 dwell (Figure 1)
6	Right helix/2 dwell (Figure 1)
T	Refer to Figure 2
S	Refer to Figure 2
(7): Shape of the output shaft	
S	Straight
F	Flange
(8): Installation position (Figure 3)	
1	First position
2	Second position
3	Third position
4	Fourth position
5	Fifth position
6	Sixth position
(9): Special specification No./model numbers with options	

*Refer to the general catalog (CC-1601) for model No. with options.

*Refer to the general catalog (CC-1601) for characteristic values, dimensions, static rated output torque, dynamic rated output torque, and accuracy.

Table 1: (3) Index number

Symbol	Description	Symbol	Description	Symbol	Description
002	2	009	9	020	20
003	3	010	10	024	24
004	4	012	12	030	30
005	5	015	15	032	32
006	6	016	16		
008	8	018	18		

*(2) X: Can only be selected when the index operation is selected.

Table 2: (3) Oscillating angle

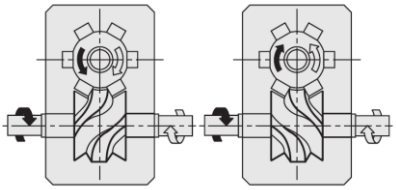
Symbol	Description
120	120°
090	90°
060	60°
045	45°
030	30°

*(2) Y: Can only be selected when the oscillating operation is selected.

Table 3: Total index angle

Symbol	Description	Symbol	Description	Symbol	Description
090	90°	210	210°	330	330°
120	120°	240	240°	360	360°
150	150°	270	270°		
180	180°	300	300°		

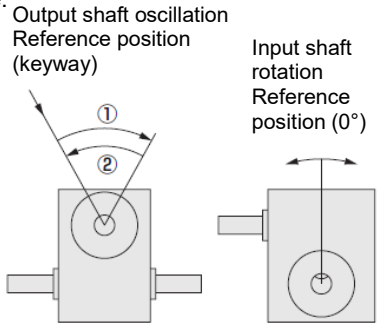
Figure 1: (6) Spiral direction of the cam



Left helix (Standard)　　Right helix

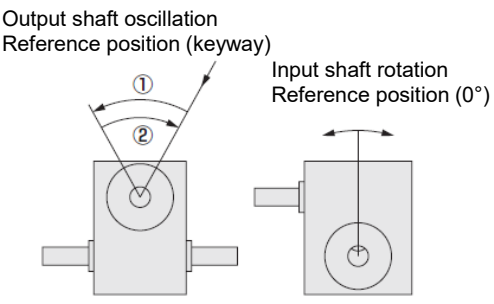
Figure 2: (6) Orbit pattern

When the input shaft starts to rotate from the rotation reference point, the output shaft rotates in sequence from 1 and 2 as in the figure.



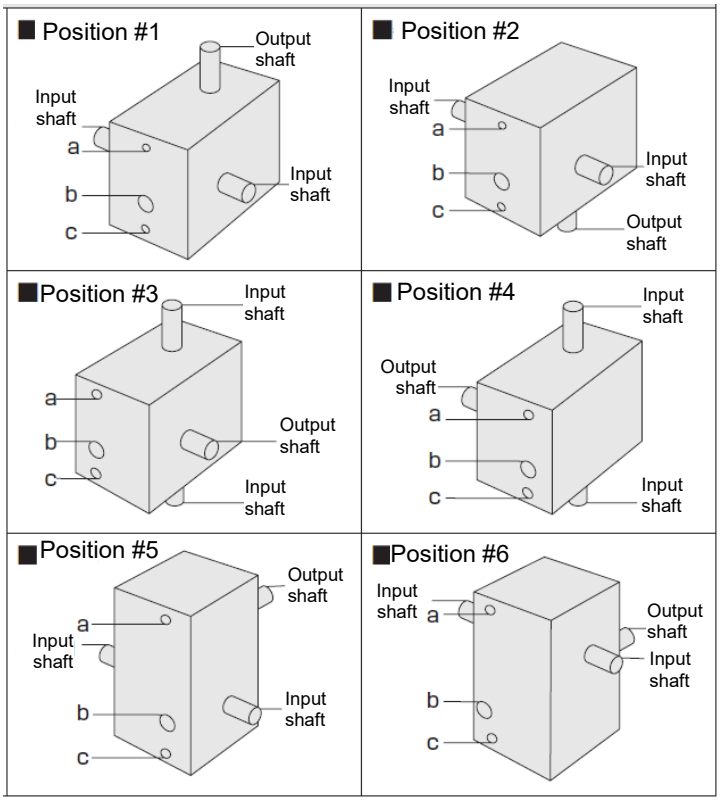
T(standard)

When the input shaft starts to rotate from the rotation reference point, the output shaft rotates in sequence from 1 and 2 as in the figure.



S

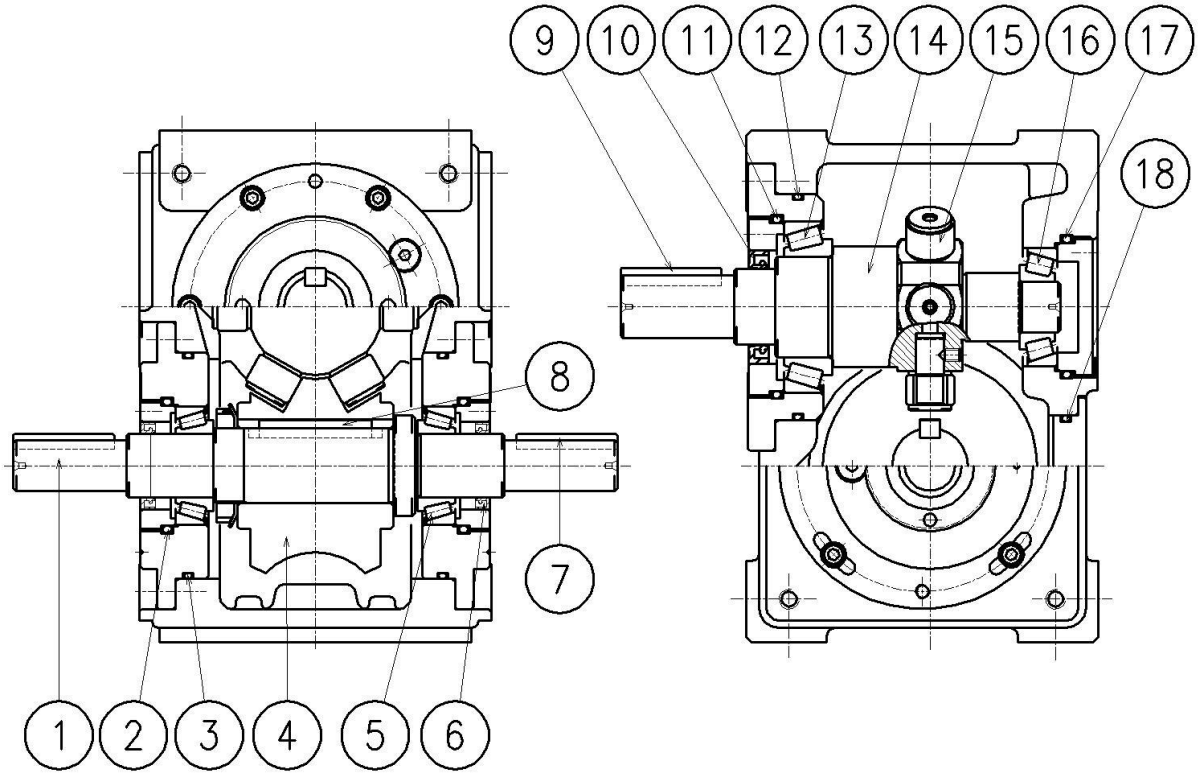
Figure 3: (8) Installation position



A: Oil filler port B: Oil level gauge C: Drain port

1.2 Internal Structure

■ **ZRS04 to ZRS14**



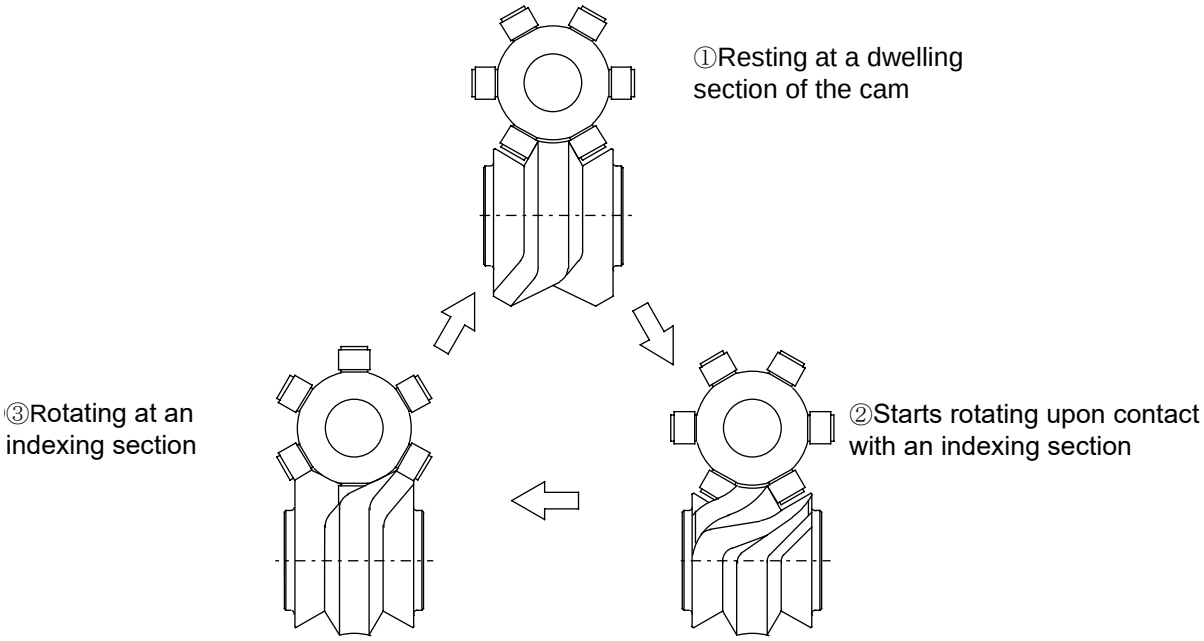
Part No.	Part name	Part No.	Part name	Part No.	Part name
1	Input shaft	7	Parallel key	13	Bearing
2	O ring	8	Parallel key	14	Output shaft
3	O ring	9	Parallel key	15	Cam follower assembly
4	Cam	10	Oil seal	16	Bearing
5	Bearing	11	O ring	17	O ring
6	Oil seal	12	O ring	18	O ring

*O ring, Oil seal, and Bearing are expendable parts.

•If repairs or replacement parts are required, please check the model number or the part number on the name plate before contacting your nearest business office or distributor.
•If you have any questions on handling this product, please contact your nearest business office or distributor.

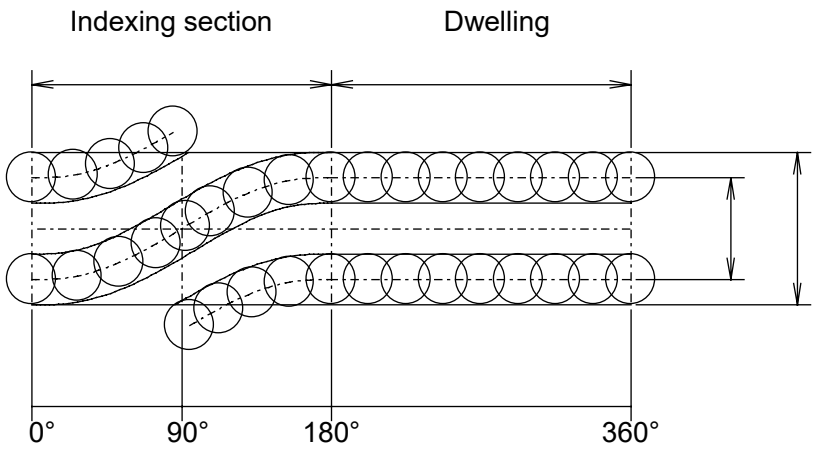
1.3 Description of Operation

1.3.1 Relative positions of the cam and the cam follower

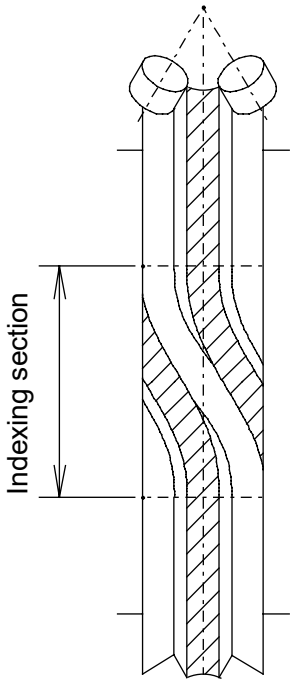


1.3.2 Cam indexing angle

Single turn (360 degrees) of the cam groove consists of dwelling (straight) and indexing (curved) sections.
The dwelling 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.



Development view of 6 stop indexing, angle of 180 degrees



Development view of cam

2. WHEN DESIGNING OR SELECTIONG

2.1 Selection

CAUTION

The load torque should be smaller than the dynamic rated output torque of the mechanical indexer.

Use the input shaft rpm within the specifications.

When you operate the input shaft at 200 rpm or faster, consult CKD.

- The installation adjustment procedure for high speed operation is required. (Special specifications)

The max. diameter of the table should be less than the allowable max. table diameter calculated when selecting the mechanical indexer.

- Contact CKD if it exceeds this.

When you operate the mechanical indexer intermittently using clutch/brake, check the motion time of the clutch/brake.

- The motion time of the clutch/brake varies depending on the characteristics of the clutch/brake itself and the rotation speed and moment of inertia of the shaft/pulley to be operated.

When you install a detection switch, check the response time of the detection switch.

- If the input shaft speed is fast, the detection switch may not be able to detect.

The mechanical indexer body should be used in the ambient temperature of 0°C to 40°C. (no condensation)

The input shaft torque of the mechanical indexer should be less than the allowable output shaft torque of the geared motor or the reducer.

When the mechanical indexer drive and stop are executed by an inverter, check that the sum of control time required for both are within the mechanical indexer dwelling time.

Select an inverter whose required capacity is more than the motor capacity.

Refer to each manufacturer's catalog for optionally mountable parts.

- Note that optionally mountable parts have specifications, characteristic values, and durability set by their manufacturers; in some cases, depending on the usage environment, speed, or frequency, they may not be available for use or may have shortened service lives.

Service life suggested by the manufacturers of optional components

Options	Approximate service life	Manufacturer
Motor with brake or with C/B	2,000,000 operating cycles	Oriental Motors

2.2 Mounting and Installation

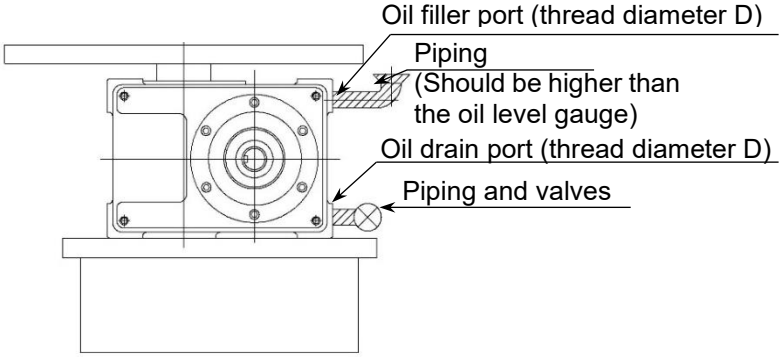
CAUTION

When you design the mounting and installation of the mechanical indexer, take into consideration that inspection, disassembly and assembly should be able to be easily conducted and the oil level gauge should be accessible.

When it is difficult to replace oil after installing the mechanical indexer in devices, we recommend you provide piping for draining and refilling oil.

- When you install the mechanical indexer in an automated machine, replacing oil may become impossible.

  In this case, we recommend you should provide piping for draining and refilling oil before installation so that you can replace it easily.

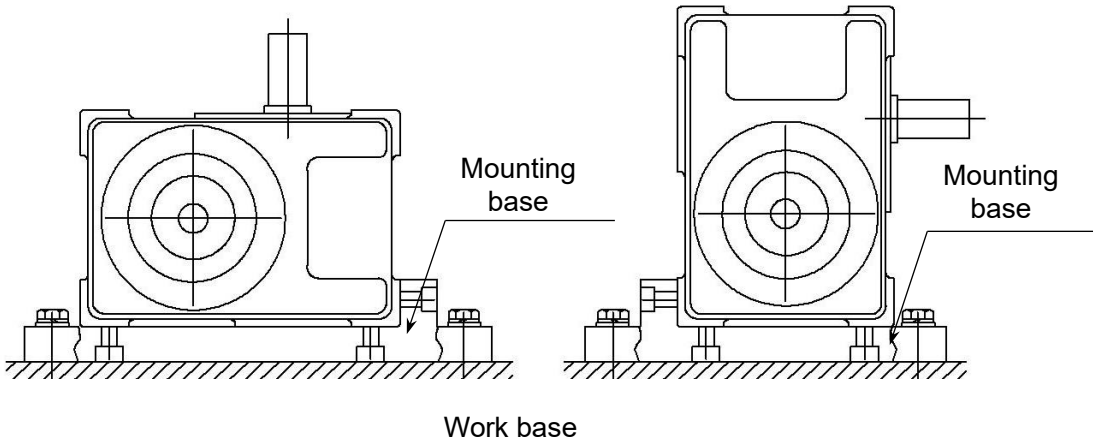


Model	D*
ZRS-04 to ZRS06	Rc 1/4
ZRS-08 to ZRS14	Rc 3/8

*Thread diameter of oil fill/drain ports

The mechanical indexer should be securely fastened not only vertically but also horizontally to the base.

- The mechanical indexer receives a large load.

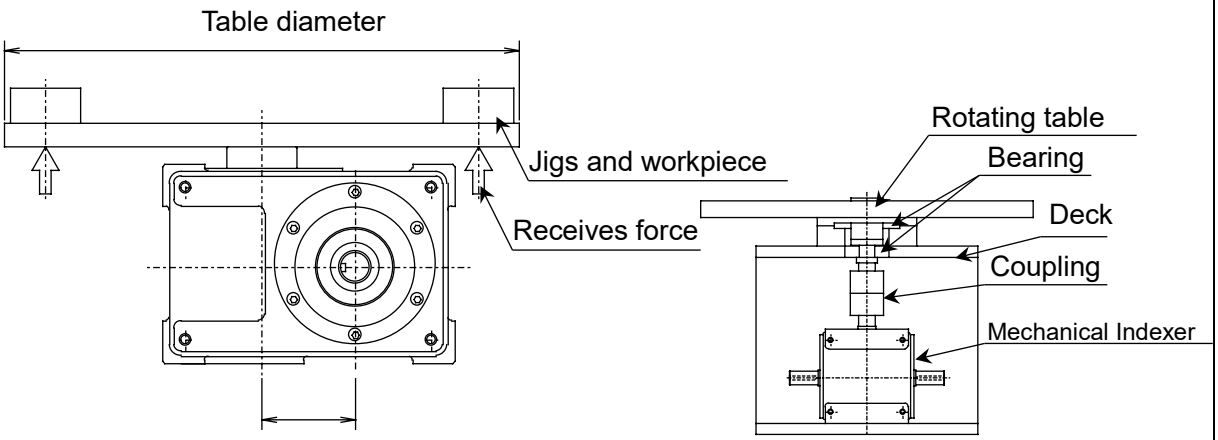


2.3 Output Shaft Section

CAUTION

Use the units within allowable thrust force.

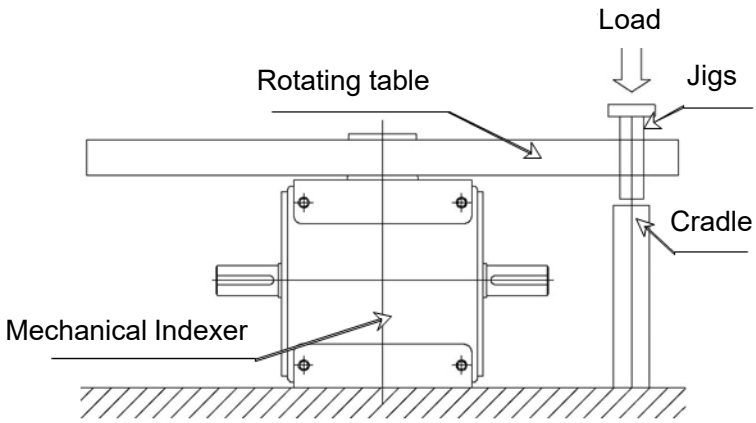
- When the thrust force on the output shaft exceeds the allowable thrust force while the load torque is within the rated dynamic output torque of the mechanical indexer, the rotating tables should be supported individually with thrust bearings or rollers.



Shaft interval of the mechanical indexer

Designing the rotating table jigs

- In order to reduce the load applying to the mechanical indexer, make the diameter of the rotation table, the pitch circle of the jig and the weight, as compact as possible.
- The rotating table should be aligned not only with the bolts but with 2 positioning pins so that the alignment can be accurately reproduced after disassembly. (Flange)
- When vertical load applies because of pressing, stamping, or caulking, never let the load apply directly to the rotating table or the mechanical indexer. Be sure to provide a cradle or an alternative unit.



Cradle example

2.4 Input Shaft Section

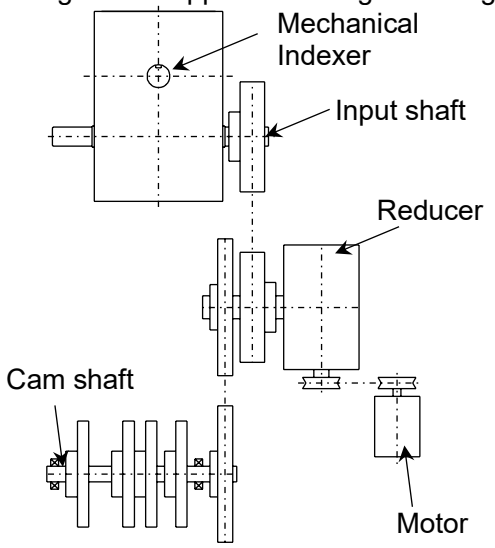
CAUTION

Minimize backlash in the driving system from the motor to the mechanical indexer, and give the driving system high rigidity.

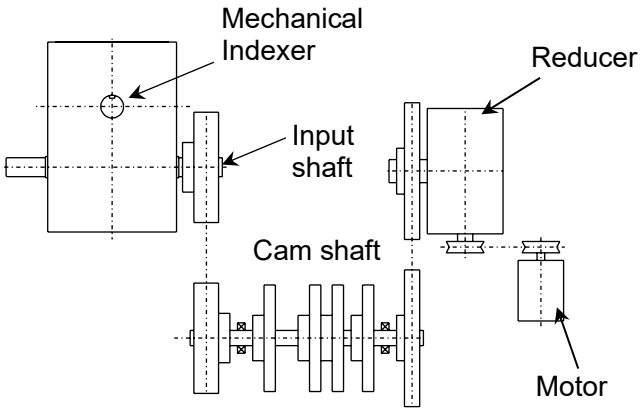
- In general, the input shaft of the mechanical indexer should be rotated at a constant speed. Backlash or uneven rotation of the driving system may cause vibration while the table is rotating, shorten the service life of the unit, and damage the components.

Avoid inserting an input shaft in series between the motor and the input shaft of the mechanical indexer.

- If the input shaft is started/stopped at a spot other than dwell section, load torque exceeding the design value applies resulting in damage.

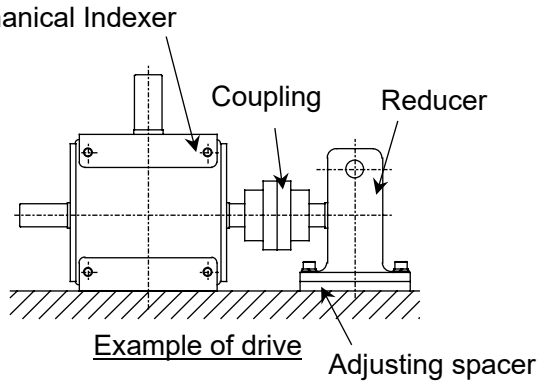


Good driving system example



Sample arrangement which induces shocks

When you connect the input shaft of the mechanical indexer directly to the output shaft of a reducer with a coupling, be sure to use a coupling which would not have backlash and which has a center adjusting mechanism.



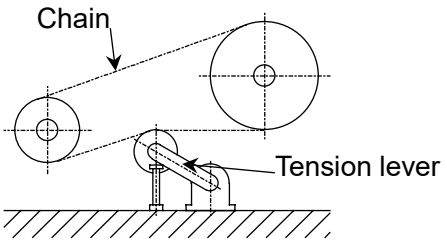
Example of drive

The frequency of starting and stopping of the brake motor is assumed to be five times per minute or less.

CAUTION

When you use a timing belt or a chain, be sure to install a tensioner.

- Without a tensioner, the slack may cause shock or vibration.

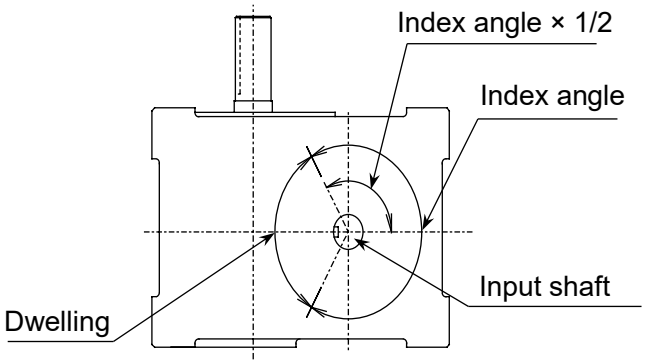


Tension lever example

When you use the input shaft for another attachment to synchronize, pay attention to the relationship between the keyway of the input shaft and the output shaft stop range.

(Refer to "Timing chart and keyway location" of the general catalog (CB-019S) for the description of motion.)

- When the keyway of the input shaft is within the index angle, the output shaft rotates; when it is in the dwell interval, the output shaft stops.
  (For single-dwell mechanical indexer series)

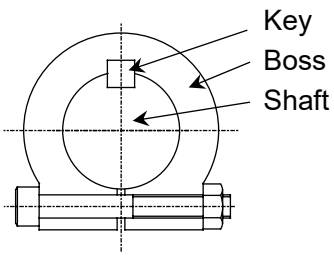


2.5 Coupling of Shafts

CAUTION

We recommend the following key materials below in the table.
You also should think of ensuring the fastening with split clamping or friction coupling in addition to the key.

- When you use a key to secure the shaft with a coupling, gear, sprocket, pulley, cam, or boss, shock or vibration occurs if the key is loose.



Model	Recommended standards
Standard (ZRS)	Standard (JIS B 1301-1996)

3. INSTALLATION

3.1 Installation

⚠DANGER

Do not install the product in a location where hazardous materials such as combustibles or explosives are present.

- It may cause fires or explosions.

⚠WARNING

Consider the possibility of power source device failure.

- Even if the power source device malfunctions, take measures to prevent personal injury or the unit failure.

Design safety circuits and safety devices to prevent damage to the unit or an accident causing injury or death when the machine is stopped due to an emergency stop or power outage, or when the machine is restarted after it has been stopped.

When it is necessary to ensure the safety of workers and equipment, such as when maintenance is performed or when the machine is stopped for a long time, a mechanical locking mechanism other than the brake shall be provided.

- Brakes cannot fully hold the input shaft in all cases, including when a force is applied that exceeds the holding capacity while stationary.

When carrying and installing the mechanical indexer, be careful not to drop or overturn the product.

- It may cause injury.

CAUTION

The installation of the unit to the machinery should be conducted by a qualified person who has knowledge of machine assembly.

- Incorrect installation may cause injury or damage of the unit.

Inspect for any loosened bolts and screws.

Procedure of water-proofing and rust-proofing.

The input and output shafts and installation faces are not treated against rusting. Depending on the storage condition or atmosphere, rusting may occur. Apply anti-rust oil or grease or anti-rust paint on the machined surfaces.

Do not use the products in the environment where water or oil may be splashed over the unit. (no condensation)

- The mechanical indexer is not water-proof nor splash-proof. If water or oil is splashed, it may malfunction or get damaged.

Mount a cover in dusty places or those exposed to water or oil drops, etc.

Refer to each manufacturer's catalog for optionally mountable parts.

- Note that optionally mountable parts have specifications, characteristic values, and durability set by their manufacturers; in some cases, depending on the usage environment, speed, or frequency, they may not be available for use or may have shortened service lives.

Service life suggested by the manufacturers of optional components

Options	Approximate service life	Manufacturer
Motor with brake or with C/B	2,000,000 operating cycles	Oriental Motors

When you connect the input and output shafts, align the centers of the shafts.

- If not aligned, the shaft may get broken.

Be sure to make the mechanical indexer start and stop within a dwell interval.

- (Refer to "Input shaft keyway position and index angle" of the general catalog (CB-019S).)
- Avoid emergency stopping, starting, or inching at an indexing section.
  Load which far exceeds the normal operational load would apply to the mechanical indexer resulting in malfunction or deterioration of accuracy.
  If the unit is stopped for emergency, be sure to turn the unit slowly by hand so that the output is in a dwell interval and then restart the system. (Generally, the mechanical indexer is driven with a worm reducer. Turn the input shaft of the reducer when you turn by hand.)
  When the rotation detection switch is installed on the input shaft, adjust the detection cam so that the input shaft stops within a dwell interval.

Never leave combustible materials around the motor.

Do not leave obstacles which may prevent ventilation around the motor.

Burning due to overheating or fire may occur.

Operate the inverter within the specified frequency.

When work torque such as eccentric load is applied, provide a safety unit on the machine.

Depending on the installation position of the mechanical indexer, the input shaft or the motor may run faster than the set speed tripping the inverter with regenerated power and the workpiece or table may drop.

CAUTION

When you install a pulley, sprocket, or table to the input/output shaft, do not apply impact with a hammer.

- When impacted, the mechanical indexer may be damaged or the accuracy may deteriorate.

Check for any loose connections in the input and output shaft connection.

- If any connections are loose, the table does not turn smoothly resulting in shocks.

Install the unit in the position specified in the specifications.

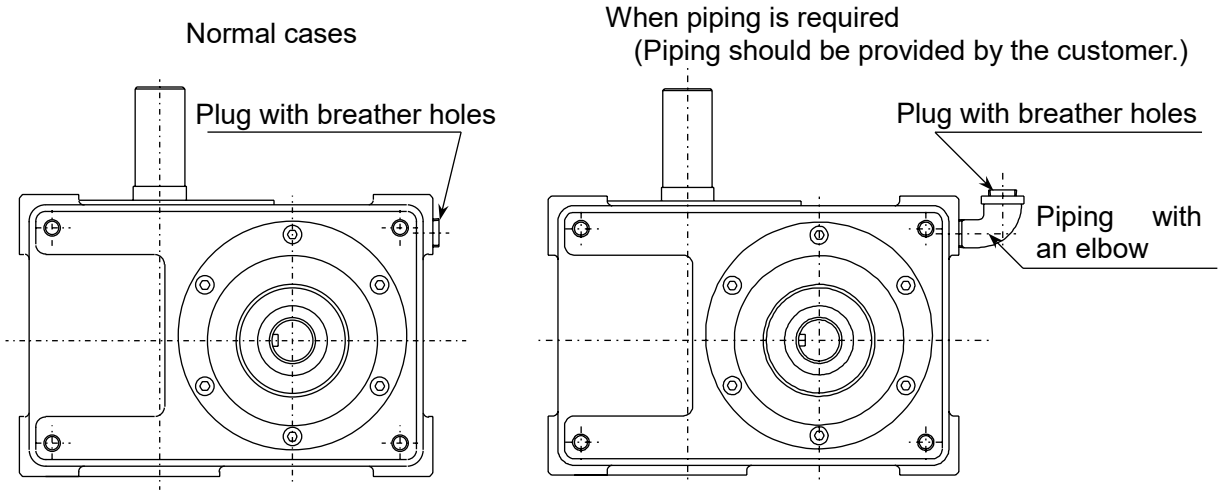
- The oil fill/drain ports and oil level gauge are placed according to the installation orientation.

Make sure the oil level comes around the center of the oil level gauge.

- The mechanical indexer is shipped with lubricating oil filled.

Before operation, replace the plug with the one with breather holes included in the shipment.

- If not replaced, oil leak may occur.
  When the internal pressure increases due to work speed or environment, oil may come out from the plug with breather holes. In this case, provide additional piping with an elbow so that oil does not spill over.



3.2 Environment

Do not use the product in an environment where:
- Ambient temperature is outside the range of 0°C to 40°C
- Water drop can splash onto the product
- Condensation may occur due to high humidity and temperature change
- Atmosphere contains corrosive gas, fluids, or chemicals
- It is exposed to direct sunlight, rain, wind, or water
- Places where large vibrations and shocks are transmitted.

3.3 Unpacking

CAUTION

Heavy products should not be carried by the worker alone.
Do not get on top of the packaging.
Do not load heavy items that deform the packaging or items that apply an uneven load.
When transporting or handling the product, take care not to let it get hit by falling, etc.

- Make sure that the model No. on your order and the model No. on the product are the same.
- If any problem such as a missing screw, oil leak, or bent shaft is found, contact your local CKD sales office.

4. USAGE

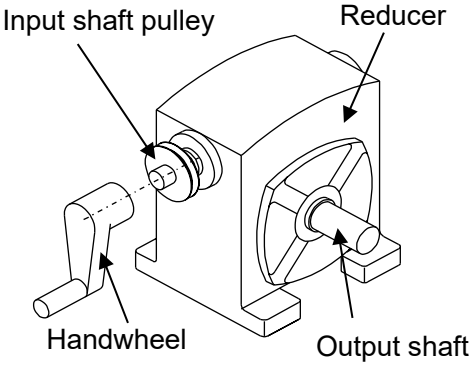
CAUTION

If any abnormal noise comes out, immediately stop the machine.
- The mechanical indexer may be damaged internally. Contact your dealer of CKD.

Do not touch any moving parts while the mechanical indexer is running.
- This would lead to injury.

Do not stop the input shaft abruptly while the output section is operating.
- If the input shaft is stopped abruptly with the clutch/brake, load torque exceeding the design value may apply causing the mechanical indexer to be damaged resulting in the table to overrun, which causes serious injury or damage on the entire unit.
- If a torque saver is provided, a sudden stop will release the torque saver resulting in the table to overrun, which causes serious injury or damage on the entire unit.
- If it should be stopped for emergency to ensure safety, think of a procedure to avoid abrupt stopping and select the mechanical indexer or torque savor of size that can withstand the load torque of an emergency stop.

If the unit is stopped for emergency, be sure to turn the unit slowly by hand so that the output is in a dwell interval and then restart the system.
- In case this procedure is needed, provide a manual handwheel in the driving system so that the input shaft can be turned manually.



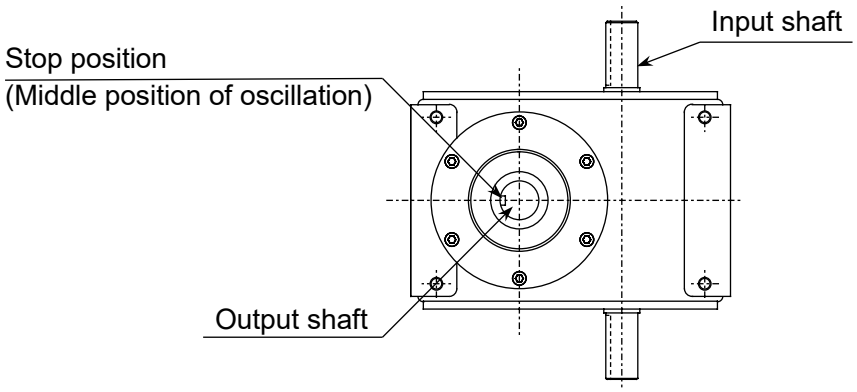
CAUTION

Be sure to make the mechanical indexer start and stop within a dwell interval.

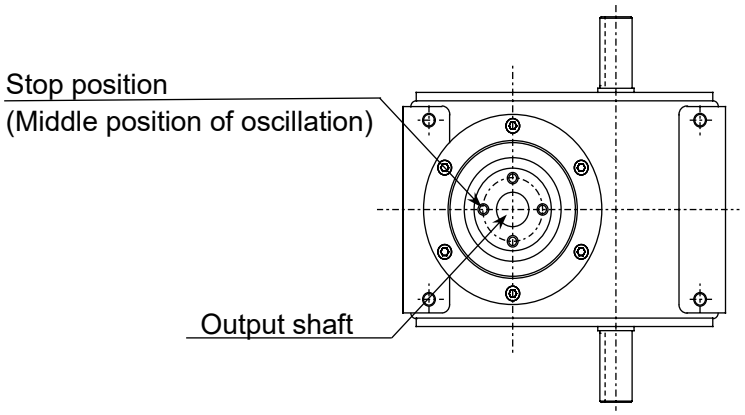
- If the input shaft is started/stopped at a spot other than dwell section, load torque exceeding the design value applies resulting in damage.

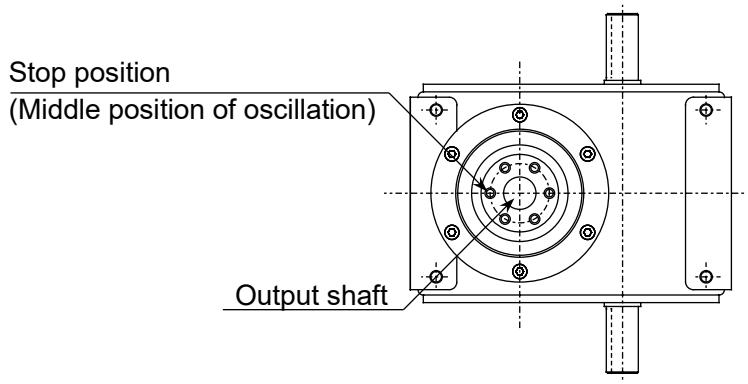
Output shaft stop position

Straight



Flange





5. MAINTENANCE

5.1 Maintenance

CAUTION

When maintaining, inspecting, or repairing, be careful not to let a third party inadvertently turn the power on.

Do not service or inspect the units while power is being supplied.

- It may sudden run due to an error or control circuit failure resulting in injury.

When the input shaft is equipped with a position detection cam, check its position periodically for any misalignment.

- If there is a misalignment due to a loosened screw, the unit may malfunction resulting in injury.

Conduct periodic inspection and provide countermeasures such as an oil drip pan if this may cause a product defect.

- The mechanical indexer is filled with lubricating oil. Oil may seep out of oil seal while being used.

Replacing lubricating oil

- Lubricating oil should be replaced after the initial 500 hours. After this, replace it at every 2,000 hour interval.
- Check the oil level every week. Refill as necessary. Be sure to use specified lubricating oil.

Type / Manufacturer	Lubricating oil		Grease
	Input shaft rotational speed less than 200 rpm	Input shaft rotational speed 200 rpm or more	
ENEOS (CKD standard products)	Bonnoc TS220	Gear Grand GL-5 80W-90	
Kyodo Yushi Co., Ltd. (CKD standard products)			Citrax EP No.2
ENEOS			Epnoc Grease AP2
Idemitsu Kosan CO., Ltd.	Daphne Super Gear oil 220	Apollo oil Wide Gear LW 80W-90	Daphne Eponex EP No.2
Showa Shell Sekiyu K.K.	Shell Omala Oil 220	Shell Gelco Power Gear 80W-90	Shell Alvania EP Grease R02
Exxon Mobil	Mobil Gear 600XP 220	Mobil Lube HD 80W-90	Mobilux EP2
Cosmo Oil Lubricants Co., Ltd.	Cosmo Gear SE 220	Cosmo Gear GL-5 80W-90	Cosmo Grease Dynamax EP No.2

Prepare the lubricant oil according to the following requirement.

Model No.	ZRS-04	ZRS-05	ZRS-06	ZRS-08	ZRS-11	ZRS-14
Oil level (ℓ)	0.1	0.5	0.8	1.2	3.8	6.0

The service life of expendable parts such as oil seals depends on the operational conditions, and it may sometimes expire faster than expected.
Regularly check any abnormal noise or oil leak in addition to checking the oil level.

5.2 Precautions on Product Disposal

CAUTION

When disposing of the product, comply with laws pertaining to disposal and cleaning of wastes and have an industrial waste disposal company dispose of the product.

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

6. TROUBLESHOOTING

If the product does not operate as intended, check the table below for a possible solution.

Problem			Solution
Rotary table generates a shock or does not stop at the proper position.	**The mechanical indexer body or driveline**	There is no shock at lower input shaft revolving speeds.	Output shaft torque is excessive. Reconsider the mechanical indexer unit model No.
		Continuous shock.	Applied torque or driving system may have a problem. Contact CKD for help.
		Internal unusual sound or temperature rise is suspected.	Internal damage is suspected. Contact CKD for replacement of the mechanical indexer.
	Driveline	Input shaft has a backlash between gears when driven.	Reduce backlash between gears.
		Key looseness when driven by gear.	Replace key to reduce looseness.
		Chain or timing belt is very slack 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 the mechanical indexer 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 the mechanical indexer is exceeded.	Calculate applied torque and contact CKD for countermeasures.
	Overload protector	Wrong torque setting.	Adjust torque setting.
		Poor repeatability	Replace.
The mechanical indexer does not rotate.	**The mechanical indexer body or driveline**	Internal failure of the mechanical indexer body.	Replace or contact CKD.
		Faulty motor	Replace.
		Brake has been applied.	Repair or replace.
		Lubricant viscosity has increased too much due to lower temperature.	Change lubricant oil (use a less viscous one listed in this manual).

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

7. TERMS AND CONDITIONS OF WARRANTY

7.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.
However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure because durability (number of times, distance, time, etc.) has been exceeded, and failures related to expendable parts.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failures resulting from natural disasters or accidents for which CKD is not liable.

The warranty covers the actual delivered product, as a single unit, and does not cover any damages resulting from losses induced by malfunctions in the delivered product.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

7.2 Warranty Period

The warranty period for the product is one (1) year from the date of delivery to the location specified by the customer.