PICO ROTARY® Rack & Pinion Type

CTR Series

Registration of a Design

INDEX★

PICO ROTARY

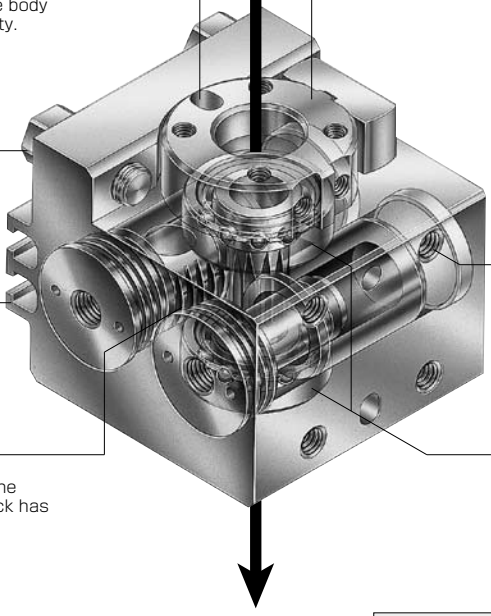
Rack & Pinion Type

CTR Series(06, 1, 2)

Two rolling bearings at the top and the bottom offering high rigidity.
Significant size reduction realized by our original structure.

Rolling Bearing

Rolling Bearing Used



Hollow Hole (CTRV)

Positioning

The reference and pin holes provided in the table and the body ensure mounting repeatability.

Table

On the table integrated with the output axis, a workpiece or a tool can be directly mounted.

Angle Adjustment

Angle adjustment of ±5° is possible at each of the oscillation ends.

Mounting in Three Directions

The compact cubic body allows mounting in three directions: top, bottom and back.

Switch

Switch position adjustment and angle adjustment can be made on the same plane.

Rack and Pinion

The overlap structure with the cylinder integrated in the rack has significantly reduced the longitudinal dimension.

Rolling Bearing

The rolling bearings at the top and the bottom allow large moment to be accommodated.

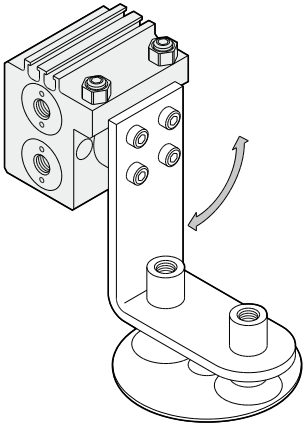
Countermeasure for Copper Parts

Copper parts are not used.

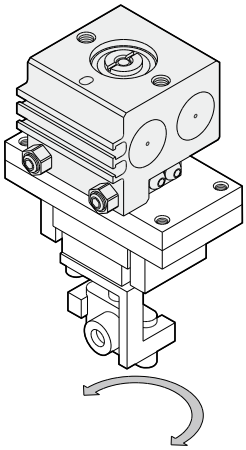
Summary of The PICO ROTARY

The rotary actuator of the rack-and-pinion type features the ultimate compactness, lightweight and high rigidity. Our original structure (overlap structure) with the cylinder integrated in the rack has significantly reduced the longitudinal dimension to provide an easy-to-use cubic body.The table accommodates a large moment by making use of the rolling bearings at the top and the bottom.

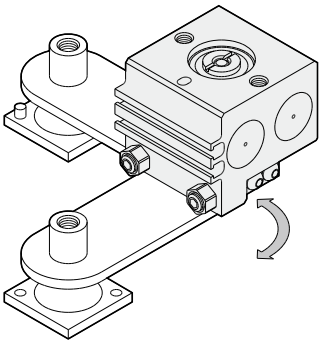
■Application Examples : PICO ROTARY



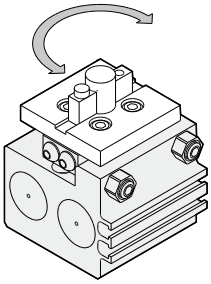
Arm Revolution



Chuck Reversal



Double Arm Movement

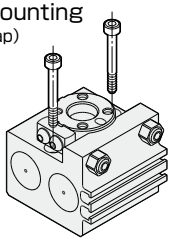


Stage Reversal

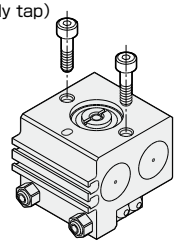
■MAIN BODY INSTALLATION

(Bolt as shown in the figure are not supplied with products)

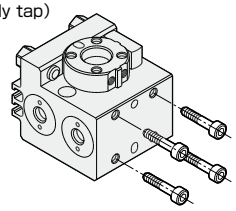
Top Mounting
(Body tap)



Bottom Mounting
(Body tap)



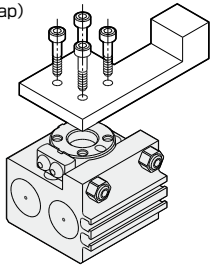
Rear Mounting
(Body tap)



■MOUNTING

(Bolt as shown in the figure are not supplied with products)

Bottom Mounting
(Body tap)



Model Code Example

CTRVS-SD06-TQ-RB12LA

Series Name

Code	Series
CTR	Standard Type
CTRV	Hollow Type

Magnet

No Code	None
S	With Magnet

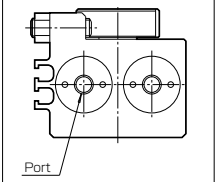
A magnet is required when mounting switches.

Size

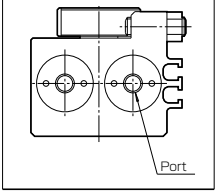
06
1
2

Port Position

SD	Basic

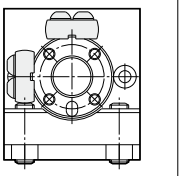


GT	Symmetric

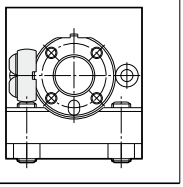


Rocking Angle

TQ	90°



TH	180°



Switch

No Code	None			
RB1	Straight	DC12～24V	2 Wires Reed Switch	With Indicator Light
RC1	Angle			
RB2	Straight			Without Indicator Light
RC2	Angle			
RB4	Straight	DC12～24V	2 Wires Solid State Switch	With Indicator Light
RC4	Angle			
RB5	Straight	DC5～24V	3 Wires Solid State Switch	
RC5	Angle			

Direction of Cable Outlet

RB····Straight Outlet Cable RC····Angle Outlet Cable

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Cable Length

No Code	1m
LA	3m

Number of Switches

1	1
2	2

SPECIFICATIONS

Size	06		1		2	
Drive System	Rack & Pinion					
Titubating Angle	90°	180°	90°	180°	90°	180°
Type of Operation	Double Acting					
Fluid	Air					
Maximum Operating Pressure	0.70MPa					
Minimum Operating Pressure	0.15MPa					
Proof Pressure	1.05MPa					
Operating Temperature	5～60℃					
Allowable Thrust Load	20N		20N		30N	
Allowable Moment	0.7N·m		0.7N·m		1.6N·m	
Allowable Energy	4mJ		8mJ		17mJ	
Cushioning	None					
Angle Adjustment	±5° at Each Titubating End					
Bore Size	φ8mm		φ10mm		φ12mm	
Pipe Bore	M5×0.8					
Lubrication	Not required					

Allowable Titubating Time Range

Titubating Angle	Allowable Titubating Time Range
90°	0.07～0.3s
180°	0.1～0.45s

Bearing Used (Rolling Bearing)

Model	Rolling Bearing Model No.
CTR06	697ZZ
CTR1	688ZZ
CTR2	6900ZZ

Hollow Part Specification

Size		06	1	2
Hollow Diameter		φ1.4㎜	φ2.2㎜	φ2.5㎜
Hollow Part Connection Pipe Size	Table Side	M3×0.5		
	Shaft Side	M5×0.8		

OPTIONAL PARTS CODES

Name	Switch Fixture
PARTS CODE Note PARTS CODE Note	BF(CTR) Screw, Nut
Content	

Reed Switch(2 Wires, with Indicator Light)

Straight Outlet Cable	Angle Outlet Cable
RB1(CTR) Cable Length:1m RB1LA(CTR) Cable Length:3m	RC1(CTR) Cable Length:1m RC1LA(CTR) Cable Length:3m
 with fixture	 with fixture

Reed Switch(2 Wires, without Indicator Light)

Straight Outlet Cable	Angle Outlet Cable
RB2(CTR) Cable Length:1m RB2LA(CTR) Cable Length:3m	RC2(CTR) Cable Length:1m RC2LA(CTR) Cable Length:3m
 with fixture	 with fixture

Solid State Switch(2 Wires, with Indicator Light)

Straight Outlet Cable	Angle Outlet Cable
RB4(CTR) Cable Length:1m RB4LA(CTR) Cable Length:3m	RC4(CTR) Cable Length:1m RC4LA(CTR) Cable Length:3m
 with fixture	 with fixture

Solid State Switch(3 Wires, with Indicator Light)

Straight Outlet Cable	Angle Outlet Cable
RB5(CTR) Cable Length:1m RB5LA(CTR) Cable Length:3m	RC5(CTR) Cable Length:1m RC5LA(CTR) Cable Length:3m
 with fixture	 with fixture

Stopper Catcher

SK(CTR□)

Fill in □ as bore size.
Before mounting, apply anaerodic adhesive to the screws.

with Fixing Screw

Repair Parts Set

HP(CTR□)

Fill in □ as bore size.

For details
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Adjuster Bolt with Lock Nut

Model	PARTS CODE
CTR06	AJ(M5−16)
CTR1	
CTR2	AJ(M6−22)

Lock Nut for Adjustment Bolt

Model	PARTS CODE
M5(M5×0.8)	NTA(M5)
M6(M6×1)	NTA(M6)

PRODUCT MASS

●MASS OF CTR

UNIT: g

Model	Titubating Angle	
	TQ	TH
CTR06	130	125
CTR1	170	160
CTR2	255	245

Note: The same mass for SD and GT.

●MASS OF SWITCH

UNIT: g

Switch Type	Mass
RB1, RB2, RB4, RB5	15
RC1, RC2, RC4, RC5	
RB1LA, RB2LA, RB4LA, RB5LA	35
RC1LA, RC2LA, RC4LA, RC5LA	

METHOD TO CALCULATE THE MASS

Ex. CTRS–SD06–TQ–RB42LA

Basic Mass····· 130g
Switch····· 35×2=70g
130+35×2=200g

Air Consumption (per Reciprocating Motion)

Unit: $\times 10^{-3}$ℓ(ANR)

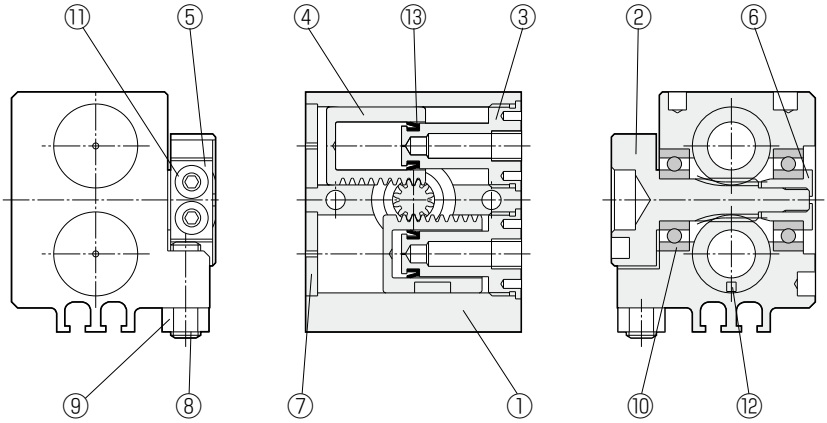
Model	Titubating Angle	Sum of Internal Volumes (cm^3)	Operating Pressure MPa						
			0.15	0.2	0.3	0.4	0.5	0.6	0.7
CTR06	100°	0.90	2.2	2.7	3.6	4.5	5.4	6.3	7.2
	190°	1.13	2.8	3.4	4.5	5.7	6.8	7.9	9.1
CTR1	100°	1.58	3.9	4.7	6.3	7.9	9.5	11.1	12.6
	190°	2.01	5.0	6.0	8.0	10.1	12.1	14.1	16.1
CTR2	100°	2.91	7.3	8.7	11.6	14.5	17.5	20.3	23.3
	190°	3.71	9.3	11.1	14.8	18.5	22.2	26.0	29.7

Calculation Formula

$$Q=V\times\left(\frac{P+0.1}{0.1}\right)\times 10^{-3}$$

Q: Air Consumption [ℓ(ANR)]
Consumption as converted into Standard Condition
V: Sum of Internal Volumes [cm^3]
P: Operating Pressure [MPa]

STRUCTURE AND PRINCIPAL COMPONENTS
CTR Sereis



PRINCIPAL COMPONENTS

No.	Name	Material	Remarks	No.	Name	Material	Remarks
1	Body	Aluminum Alloy	White Alumite	7	Plug	Synthetic Resin	
2	Table	Stainless Steel		8	Adjust Bolt	Steel (Heat Treatment)	Nickel Plating
3	Piston	Aluminum Alloy	White Alumite	9	Lock Nut	Steel	Nickel Plating
4	Rack	Stainless Steel		10	Rolling Bearing	Bearing Steel	
5	Stopper Catcher	Steel (Heat Treatment)	Electroless Nickel Plating	11	Bolt	Steel	Nickel Plating
6	Flange Nut	Stainless Steel		12	Magnet	Magnetic Material	Only with Magnet

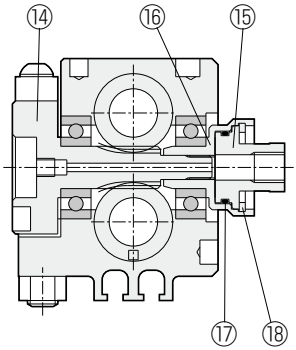
REPAIR PARTS (With special Greese)

No.	Name	Material	Qty	Remarks
13	Piston Seal	NBR	2	

CTRV Series

PRINCIPAL COMPONENTS

No.	Name	Material	Remarks
14	Hollow Table	Stainless Steel	
15	Hollow Cover	Aluminum Alloy	White Alumite
16	Hollow Flange Nut	Stainless Steel	
17	O-ring	NBR	
18	Snap Ring	Steel (Heat Treatment)	Nickel Plating



REPAIR PARTS (With special Greese)

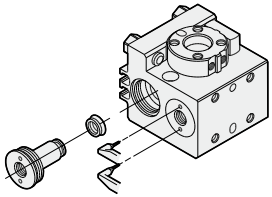
No.	Name	Material	Qty	Remarks
13	Piston Seal	NBR	2	

REPLACEMENT OF SEALS

⚠ Caution

Follow the procedure below to replace the seals using the repair parts set (piston seal and special grease) separately offered. Use of any other piston seal or grease may hinder satisfaction of the product specification.

No.	Step	Note
1	Use the snap ring pliers (with curved tips) to loosen a piston.	Make sure that no compressed air is supplied to the actuator and there is no residual pressure.
2	Pull out the piston and remove the piston seal.	Ensure that the housing is not scratched.
3	Clean the outer circumferential surface of the piston and the inner circumferential surfaces of the rack and the body.	Wipe off deteriorated grease and drain water thoroughly.
4	Apply grease of the entire area of the inner circumferential surfaces of the rack and the body, piston housing and piston seal.	Make sure that the special grease is adequately applied.
5	Mount a new piston seal on the piston.	Check the mounting orientation and ensure that there is no twisting.
6	Insert the piston into the rack that has been moved toward you by revolving the table.	Ensure that no foreign matter is attached or the piston seal is scratched.
7	Use the snap ring pliers (with curved tips) to tighten the piston.	Make sure that it is securely tightened. (Tightening Torque: 1 N·m)
8	Lower the supply pressure to start low-speed operation.	Make sure that the actuator moves smoothly and there is no air leakage.

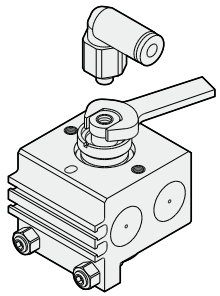


MOUNTING OF JOINT

⚠ Caution

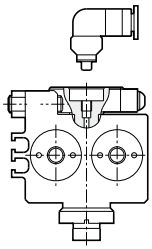
■Mounting of Joint on Hollow Cover

When mounting a rotary joint, etc. on the hollow cover, always set a spanner on the across flats of the hollow cover to prevent the torque from being applied to the flange nut.
Otherwise, actuator failure or damage may result.



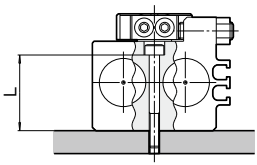
■Mounting of Joint on Hollow Table

When mounting a joint, etc. on the female thread in the table hollow part, either directly hold the table or move the table between the oscillation ends to press it against the stopper bolt of the body.
Mounting while holding the hollow cover or flange nut may cause actuator failure or damage.
Ensure that the tightening torque for the joint, etc. does not exceed the value recommended by the manufacturer.



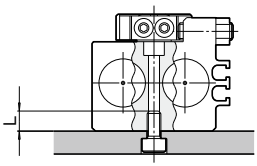
BODY INSTALLATION

Top Mounting(Thru Hole used)



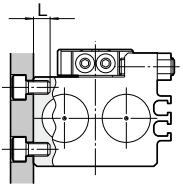
Model	Bolt Size	Thru Hole Length L(mm)	Fastening Torque (N·m)
CTR06	M3	22	1.1
CTR1	M3	24	1.1
CTR2	M4	27	2.5

Bottom Mounting(Body Tap)



Model	Bolt Size	Screw Depth L(mm)	Fastening Torque (N·m)
CTR06	M4×0.7	6	2.5
CTR1	M4×0.7	6	2.5
CTR2	M5×0.8	8	5.1

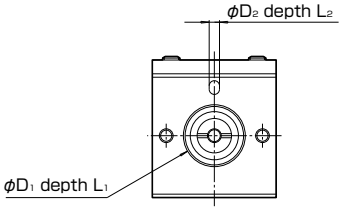
Rear Mounting(Body Tap)



Model	Bolt Size	Screw Depth L(mm)	Fastening Torque (N·m)
CTR06	M4×0.7	5	2.5
CTR1	M4×0.7	5	2.5
CTR2	M5×0.8	6	5.1

BODY POSITIONING

Bottom Positioning(Reference Hole, Pin Hole)

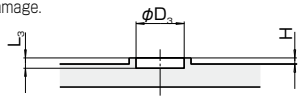


Model	Reference Hole Diameter D_1 (mm)	Reference Hole Depth L_1 (mm)	Pin Hole Width D_2 (mm)	Pin Hole Depth L_2 (mm)
CTR06	$18H9(^{+0.043}_{0})$	2	$3^{+0.060}_{+0.012}$	3
CTR1	$18H9(^{+0.043}_{0})$	2	$3^{+0.060}_{+0.012}$	3
CTR2	$22H9(^{+0.052}_{0})$	2	$4^{+0.060}_{+0.012}$	4

⚠ Caution

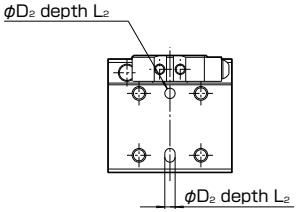
■Design of Boss for Reference Hole

When using the reference hole in the bottom side as mentioned above for positioning, the boss to set in the reference hole must have the dimensions and shape as shown below. If the boss is to high or the clearance hole is too small, the boss may come in contact with the rolling bearing or flange nut, causing actuator failure or damage.



Model	Boss Height H (mm)	Clearance Hole Diameter D_3 (mm)	Clearance Hole Depth L_3 (mm)
CTR06	1.8 or less	14 or more	Boss Height H or more
CTR1	1.8 or less	14 or more	Boss Height H or more
CTR2	1.8 or less	16 or more	Boss Height H or more

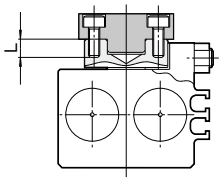
Rear Positioning(Pin Hole)



Model	Pin Hole Diameter, Width D_2 (mm)	Pin Hole Depth L_2 (mm)
CTR06	$3^{+0.060}_{+0.012}$	3
CTR1	$3^{+0.060}_{+0.012}$	3
CTR2	$4^{+0.060}_{+0.012}$	4

MOUNTING ON TABLE

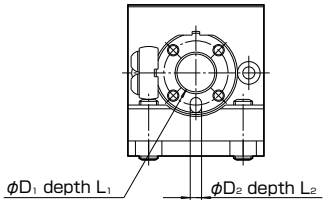
Top Mounting(Body Tap)



Model	Bolt Size	Screw Depth L(mm)	Fastening Torque (N·m)
CTR06	M3×0.5	4	1.1
CTR1	M3×0.5	4	1.1
CTR2	M4×0.7	5	2.5

LOAD POSITIONING

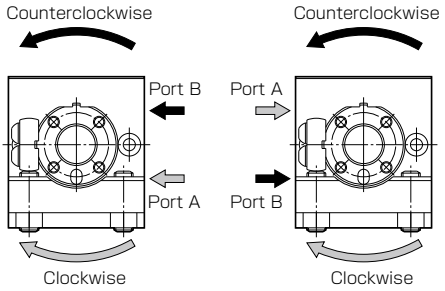
Top Positioning(Reference Hole, Pin Hole)



Model	Reference Hole Diameter D_1 (mm)	Reference Hole Depth L_1 (mm)	Pin Hole Width D_2 (mm)	Pin Hole Depth L_2 (mm)
CTR06	$10H9(^{+0.036}_{0})$	4	$3\,^{+0.060}_{+0.012}$	3
CTR1	$12H9(^{+0.043}_{0})$	4	$3\,^{+0.060}_{+0.012}$	3
CTR2	$12H9(^{+0.043}_{0})$	4	$4\,^{+0.060}_{+0.012}$	4

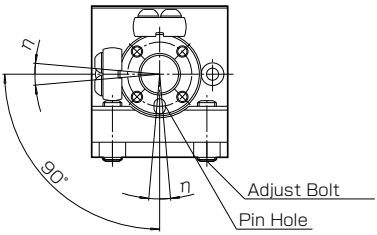
TITUBATING DIRECTION AND RANGE

Table rotates clockwise when pressure is applied through port A and counterclockwise when pressure is applied through port B.
The figure shows how it stops at the counterclockwise end.

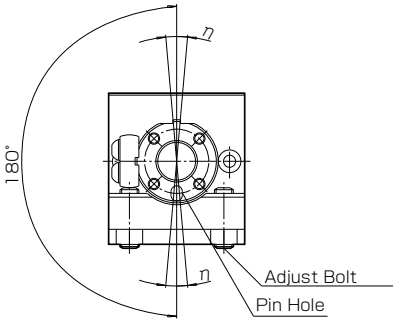


SD Type　　GT Type

The oscillation ends can be set in the range shown below by using the adjustment bolt. The adjustable range is $\eta = \pm 5^\circ$.
The figure shows the oscillation range of the pin hole.



90° Specifications



180° Specifications

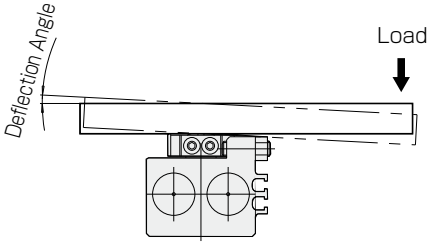
⚠ Caution

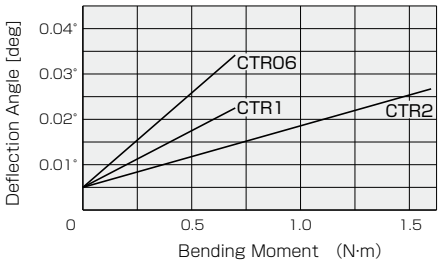
Avoid adjusting the position beyond the adjustable range or removing the adjustment bolt.
Otherwise, actuator failure or damage may result.
The table on the left shows the adjustment angle per rotation of the adjustment bolt.

Model	Adjustment Angle per Rotation of Adjustment Bolt
CTR06	3.6°
CTR1	3.3°
CTR2	3.8°

THEORETICAL DISPLACEMENT OF TABLE BY BENDING MOMENT

If an external force is applied to the table, the table inclines slightly because of elastic deformation of balls and races.
Refer to the following graph of theoretical angular displacement of the guide table for each moment shown below.



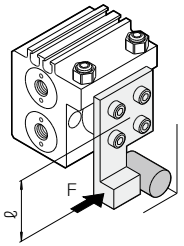
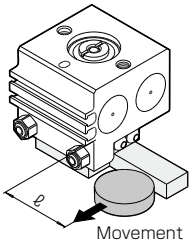
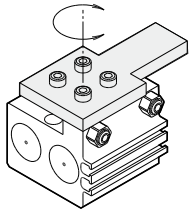


SIZE SELECTION

Make sure that the torque, oscillation time, kinetic energy, load and moment are in the allowable value ranges.

■Types of Load

Load can be classified into the following three types by the actuator mounting position, shape of the mounted load and usage. The inertial moment calculation formula depends on the shape of the mounted load. See "Calculation of Inertial Moment" on p. 766. Inertial load is in inverse proportion to the square of the rocking time and setting of the rocking time for calculation requires special attention.

Types of Load	Static Load: Ts	Resistance Load: Tr	Inertial load: Ta
Contents	Load generated by static pressing such as clamping.	Load generated by external force accompanying movement of an object such as the friction force in workpiece movement and gravity in oscillation on the vertical plane.	Load generated due to the inertial force accompanying oscillation of an object.
Calculating Formula	$Ts=F\cdot\ell$ (N·m)	$Tr=F\cdot\ell$ (N·m) (例) $F=\mu\cdot m\cdot g$	$Ta=I\frac{2\theta}{t^2}$ (N·m)
Example of use			

F: Required Pressing Force (N)
ℓ: Length from Center of Rotation to Point of Application (m)
μ: Friction Coefficient
m: Mass (kg)
g: Gravitational Acceleration (m/s^2)
I : Inertial Moment ($kg\cdot m^2$)
θ: Rocking Angle (rad)
t: Rocking Time (s)

Allowable Rocking Time ☞ page 765

■Torque

⚠ Caution

Select the actuator so that the torque calculated according to the type of load does not exceed the effective torque. The effective torque is a rough estimate of the output based on the theoretical output torque with the friction resistance taken into account.
When an article is statically pressed, oscillation of the mounted load such as a clamp arm generates inertial load. Resistance load may also be generated depending on the mounting position, which requires separate consideration. For static load, allow for a margin for selection and reduce the regulator pressure for use as required.
Operating conditions exceeding the allowable values may cause actuator failure or damage including accuracy deterioration, malfunction and shorter service life.

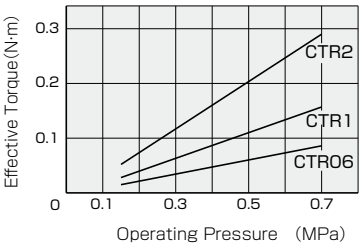
Object statically pressed	$Te \geqq Ts$
Object moved	$Te \geqq 5\cdot Tr+10\cdot Ta$
Object oscillated	$Te \geqq 10\cdot Ta$

Te: Effective Torque(N·m)
Ts: Torque required for Static Load(N·m)
Tr: Torque required for Resistance Load(N·m)
Ta: Torque required for Inertial Load(N·m)

Effective Torque

Unit: N·m

Model	Operating Pressure (MPa)						
	0.15	0.2	0.3	0.4	0.5	0.6	0.7
CTR06	0.015	0.022	0.035	0.047	0.060	0.073	0.086
CTR1	0.028	0.040	0.063	0.086	0.11	0.13	0.16
CTR2	0.052	0.074	0.12	0.16	0.20	0.25	0.29



■Allowable Titubating Time

Titubating Angle	Allowable Titubating Time Range
90°	0.07～0.3s
180°	0.1～0.45s

Make sure that the titubating time is within the allowable titubating time range. Use in a low-speed region out of the allowable titubating time range may cause a stick-slip phenomenon or stop.

■Allowable Kinetic Energy

Model	Allowable Kinetic Energy
CTR06	4mJ
CTR1	8mJ
CTR2	17mJ

⚠ Warning

Make sure that the kinetic energy calculated by using the formula below is smaller than the allowable kinetic energy. The formula for calculating inertial moment depends on the shape of the mounted load. See "Calculation of Inertial Moment" on p. 766.
The angular speed calculated is the terminal angular speed for uniformly accelerated motion. In cases such as downward movement of the mounted load, the angular speed increases due to the gravitational acceleration and more kinetic energy than expected is generated.
When it is expected to exceed the allowable value, provide a shock absorber externally to mitigate the impact. If the operating conditions exceed the allowable values, the actuator may be damaged, causing damage to human body and/or device/equipment.

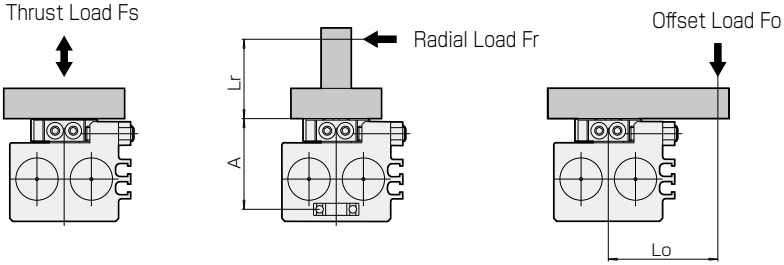
$$E=\frac{1}{2}I\omega^2\times10^3 \qquad \omega=\frac{2\theta}{t}$$

E: Kinetic Energy (mJ)
ω: Angular Speed (rad/s)
θ: Titubating Angle (rad)
t: Titubating Time (s)

■Allowable Load, Allowable Moment

⚠ Caution

Do not allow any load or moment exceeding the allowable value to be applied to the table. Operating conditions exceeding the allowable values may cause actuator failure or damage including accuracy deterioration, malfunction and shorter service life.



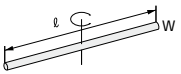
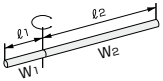
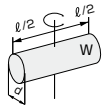
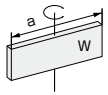
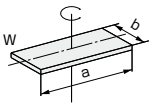
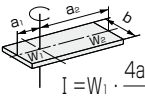
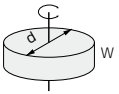
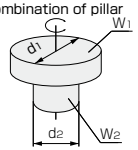
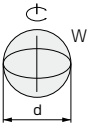
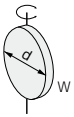
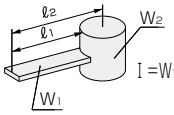
Moment: M=Fr×(Lr+A)

Moment: M=Fo×Lo

Model	Allowable Thrust Load (N)	Allowable Moment (N·m)	Distance A from Table End Face to Bearing (mm)
CTR06	20	0.7	29.5
CTR1	20	0.7	31.5
CTR2	30	1.6	36.0

CALCULATION OF INERTIA MOMENT

I : Moment of Inertia　　W : Mass

No.	Shape	Inertia moment	Rotational Radius
1	Thin bar 	$I = W \cdot \frac{\ell^2}{12}$	$K^2 = \frac{\ell^2}{12}$
2	Thin bar 	$I = W_1 \cdot \frac{\ell_1^2}{3} + W_2 \cdot \frac{\ell_2^2}{3}$	$K^2 = \frac{\ell_1^2}{3} + \frac{\ell_2^2}{3}$
3	Thick bar 	$I = W\left(\frac{\ell^2}{12} + \frac{d^2}{16}\right)$	$K^2 = \frac{\ell^2}{12} + \frac{d^2}{16}$
4	Thin rectangle board (cubic-rectangle) 	$I = W \cdot \frac{a^2}{12}$	$K^2 = \frac{a^2}{12}$
5	Rectangle board (cubic-rectangle) 	$I = W \cdot \frac{a^2+b^2}{12}$	$K^2 = \frac{a^2+b^2}{12}$
6	Rectangle board (cubic-rectangle) 	$I = W_1 \cdot \frac{4a_1^2+b^2}{12} + W_2 \cdot \frac{4a_2^2+b^2}{12}$	$K^2 = \frac{4a_1^2+b^2}{12} + \frac{4a_2^2+b^2}{12}$
7	Pillar (including a thin disk) 	$I = W \cdot \frac{d^2}{8}$	$K^2 = \frac{d^2}{8}$
8	Combination of pillar 	$I = W_1 \cdot \frac{d_1^2}{8} + W_2 \cdot \frac{d_2^2}{8}$	$K^2 = \frac{d_1^2}{8} + \frac{d_2^2}{8}$
9	Sphere 	$I = W \cdot \frac{d^2}{10}$	$K^2 = \frac{d^2}{10}$
10	Thin disk 	$I = W \cdot \frac{d^2}{16}$	$K^2 = \frac{d^2}{16}$
11	Concentrated load at the top of a bar 	$I = W_1 \cdot \frac{\ell_1^2}{3} + W_2 \cdot K^2 + W_2 \cdot \ell_2^2$	Calculation using the shape of W_2

PRECAUTIONS FOR DESIGN AND USE

⚠ Warning

Load Variation

If the resistance friction changes or the size of the load varies due to gravity applied to an object rocking on the vertical surface, the rocking speed may increase more than expected, causing damage to human body and/or device/equipment.
In this case, provide a shock absorber externally to mitigate the impact.

Impact Absorption

Kinetic energy may exceed the allowable value depending on the shape, mass or rocking speed of the oscillating object. If kinetic energy exceeding the allowable value is applied to the actuator, the actuator may be damaged, causing damage to human body and/or device/equipment.
In this case, provide a shock absorber externally to mitigate the impact.

Load Torque

Ensure that no torque exceeding the allowable value is applied to the actuator.
Otherwise, actuator failure or damage may result.

External Stopper

Mount the external stopper away from the axis of oscillation.
If it is close the axis of oscillation, the inertial force around the external stopper as the fulcrum increases, which may cause damage to human body and/or device/equipment.

⚠ Caution

Stopping Accuracy at Oscillation Ends

When high stopping accuracy at oscillation ends is required, directly stop the mounted load externally. The position adjustment mechanism of this product may not be capable of maintaining the stop position initially set.

Impact

When mounting or removing the actuator or load, ensure that large impact is not applied by hitting with a hammer, etc.
Otherwise, actuator failure or damage may result.

Flange Nut

Avoid turning the flange nut on the bottom side of the body.
Otherwise, actuator failure or damage may result.

Oiling

Oiling may render the product incapable of meeting the specification. Be sure to use without oiling.

Greasing

Special grease is applied when the product is assembled. For greasing the sliding part, wipe off any deteriorated grease and apply the special grease included in the repair parts set separately offered.
Use of other grease may cause actuator failure or damage due to lubrication performance degradation or chemical change.

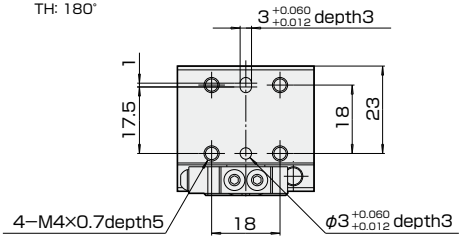
DIMENSIONS(mm) CTR06 BASIC

CTR(S)−SD06− TQ / TH

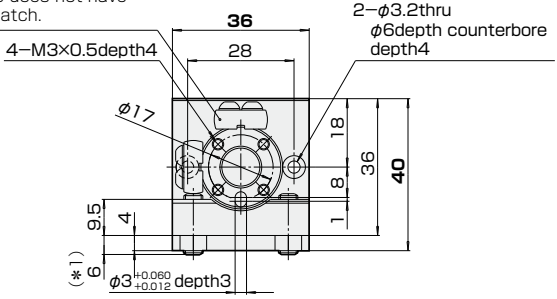
Port Position SD: Basic

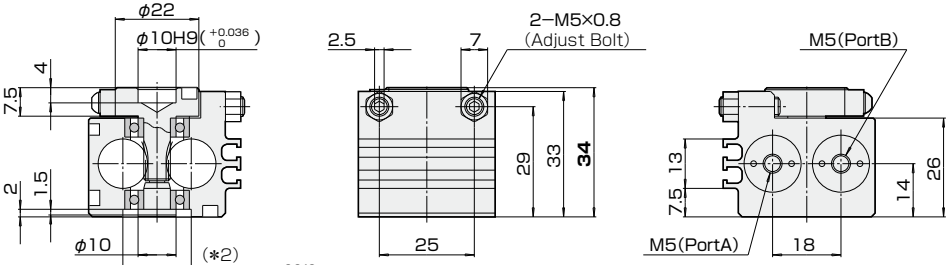
Size

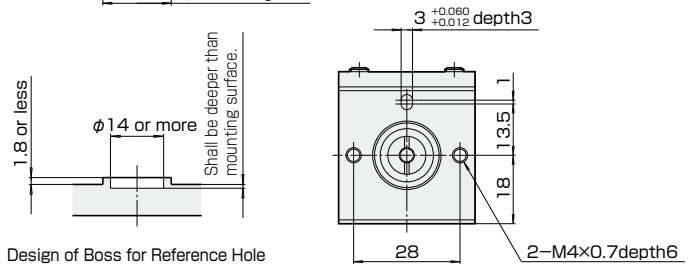
Titubating Angle
TQ: 90°
TH: 180°



The figure shows the 90° type.
The 180° type does not have this stopper catch.







Design of Boss for Reference Hole

●∗1 indicates the projection length of the adjustment bolt as it is adjusted to the maximum oscillation angle (100° for the 90° type, 190° for the 180° type) within the adjustable range.

●When using the reference hole ∗2 for positioning, the boss to set in the reference hole must have the dimensions and shape in "Design of Boss for Reference Hole."

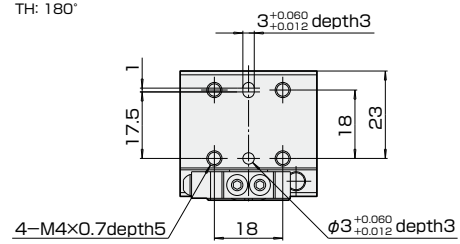
DIMENSIONS(mm) CTR06 SYMMETRIC

CTR(S)−GT06−TQ/TH

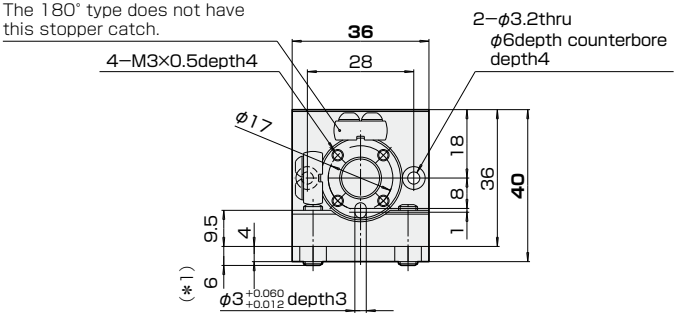
Port Position
GT: Symmetric

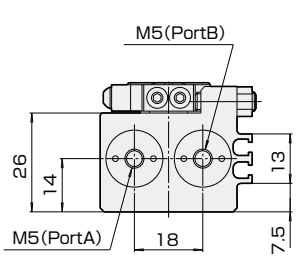
Size

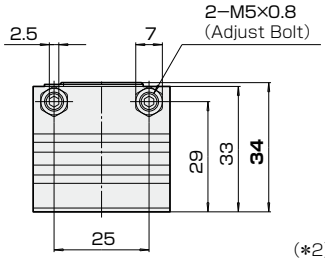
Titubating Angle
TQ: 90°
TH: 180°

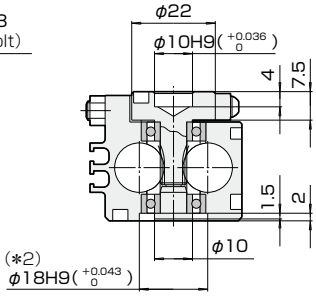


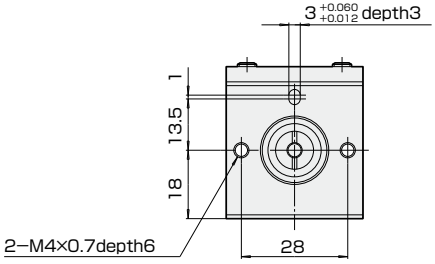
The figure shows the 90° type.
The 180° type does not have this stopper catch.

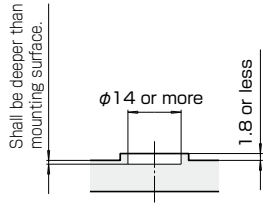












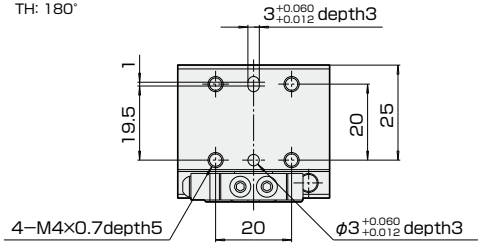
Design of Boss for Reference Hole

●∗1 indicates the projection length of the adjustment bolt as it is adjusted to the maximum oscillation angle (100° for the 90° type, 190° for the 180° type) within the adjustable range.
●When using the reference hole ∗2 for positioning, the boss to set in the reference hole must have the dimensions and shape in "Design of Boss for Reference Hole."

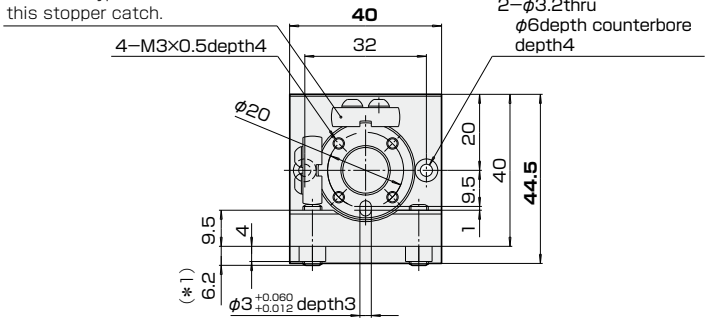
DIMENSIONS(mm) CTR1 BASIC

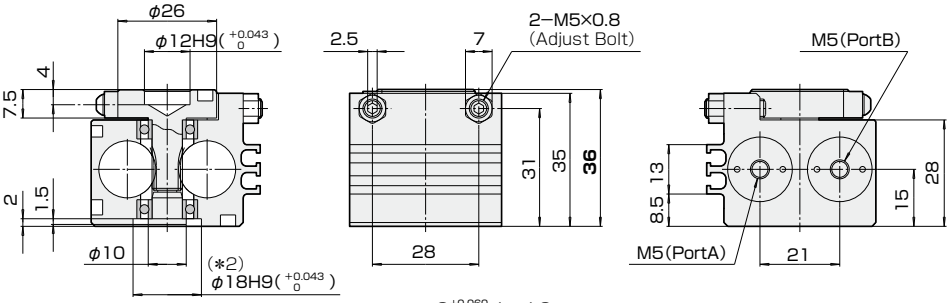
CTR(S)−SD1−TQ / TH

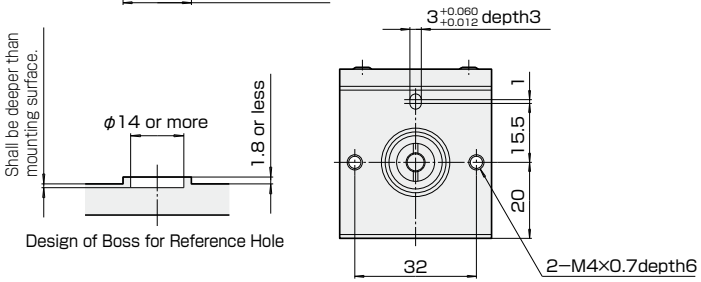
Port Position: SD: Basic
Size
Titubating Angle: TQ: 90° / TH: 180°



The figure shows the 90° type.
The 180° type does not have this stopper catch.





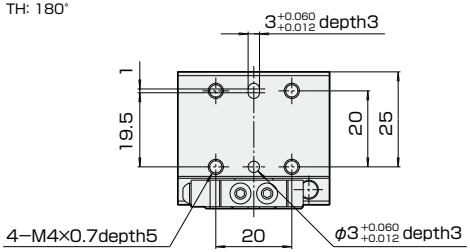


●∗1 indicates the projection length of the adjustment bolt as it is adjusted to the maximum oscillation angle (100° for the 90° type, 190° for the 180° type) within the adjustable range.
●When using the reference hole ∗2 for positioning, the boss to set in the reference hole must have the dimensions and shape in "Design of Boss for Reference Hole."

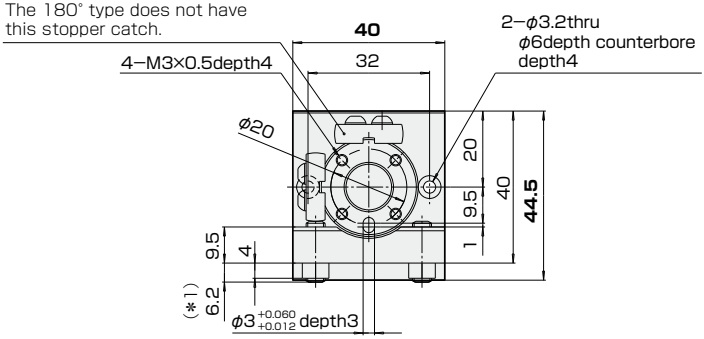
DIMENSIONS(mm) CTR1 SYMMETRIC

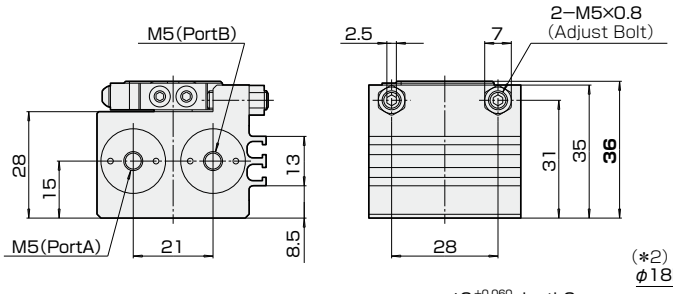
CTR(S)−GT1− TQ / TH

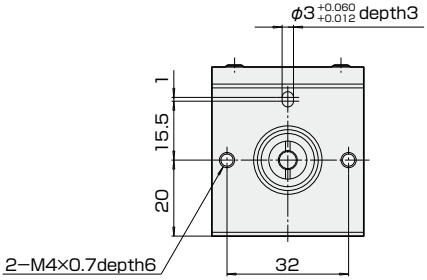
- Port Position: GT: Symmetric
- Size
- Titubating Angle: TQ: 90°, TH: 180°

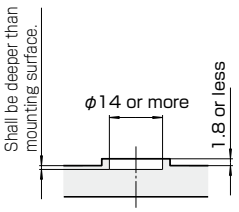


The figure shows the 90° type.
The 180° type does not have this stopper catch.









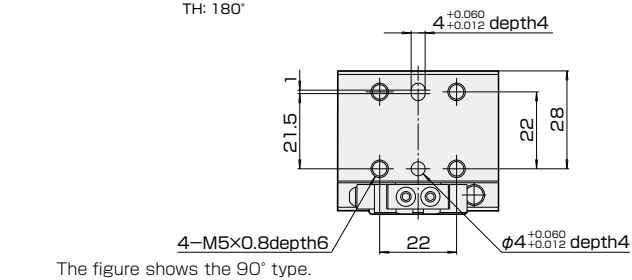
Design of Boss for Reference Hole

- ∗1 indicates the projection length of the adjustment bolt as it is adjusted to the maximum oscillation angle (100° for the 90° type, 190° for the 180° type) within the adjustable range.
- When using the reference hole ∗2 for positioning, the boss to set in the reference hole must have the dimensions and shape in "Design of Boss for Reference Hole."

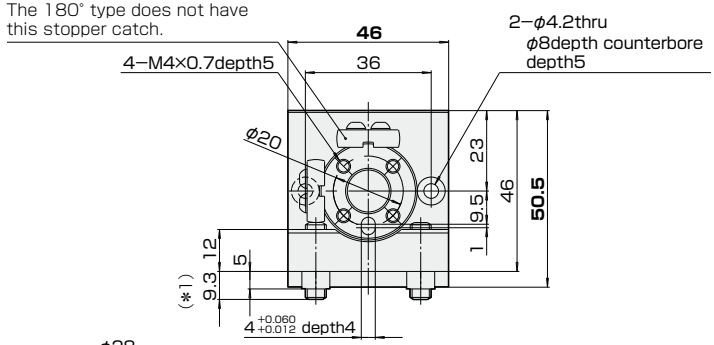
DIMENSIONS(mm) CTR2 BASIC

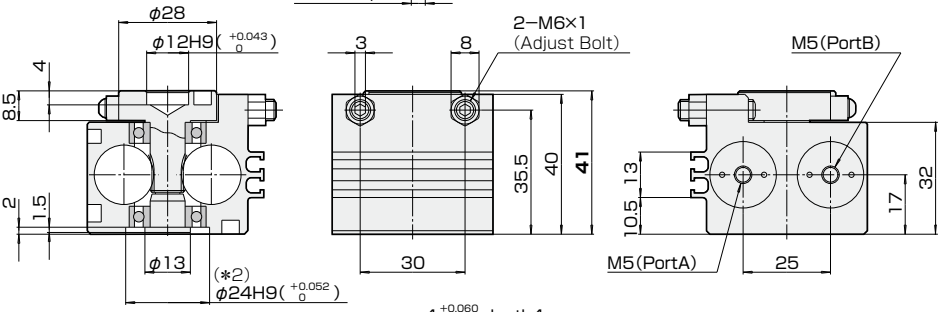
CTR(S)−SD2−TQ / TH

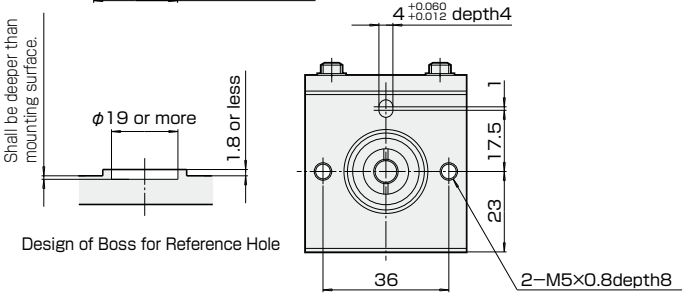
Port Position SD: Basic
Size
Titubating Angle TQ: 90° TH: 180°



The figure shows the 90° type.
The 180° type does not have this stopper catch.







Design of Boss for Reference Hole

●∗1 indicates the projection length of the adjustment bolt as it is adjusted to the maximum oscillation angle (100° for the 90° type, 190° for the 180° type) within the adjustable range.
●When using the reference hole ∗2 for positioning, the boss to set in the reference hole must have the dimensions and shape in "Design of Boss for Reference Hole."

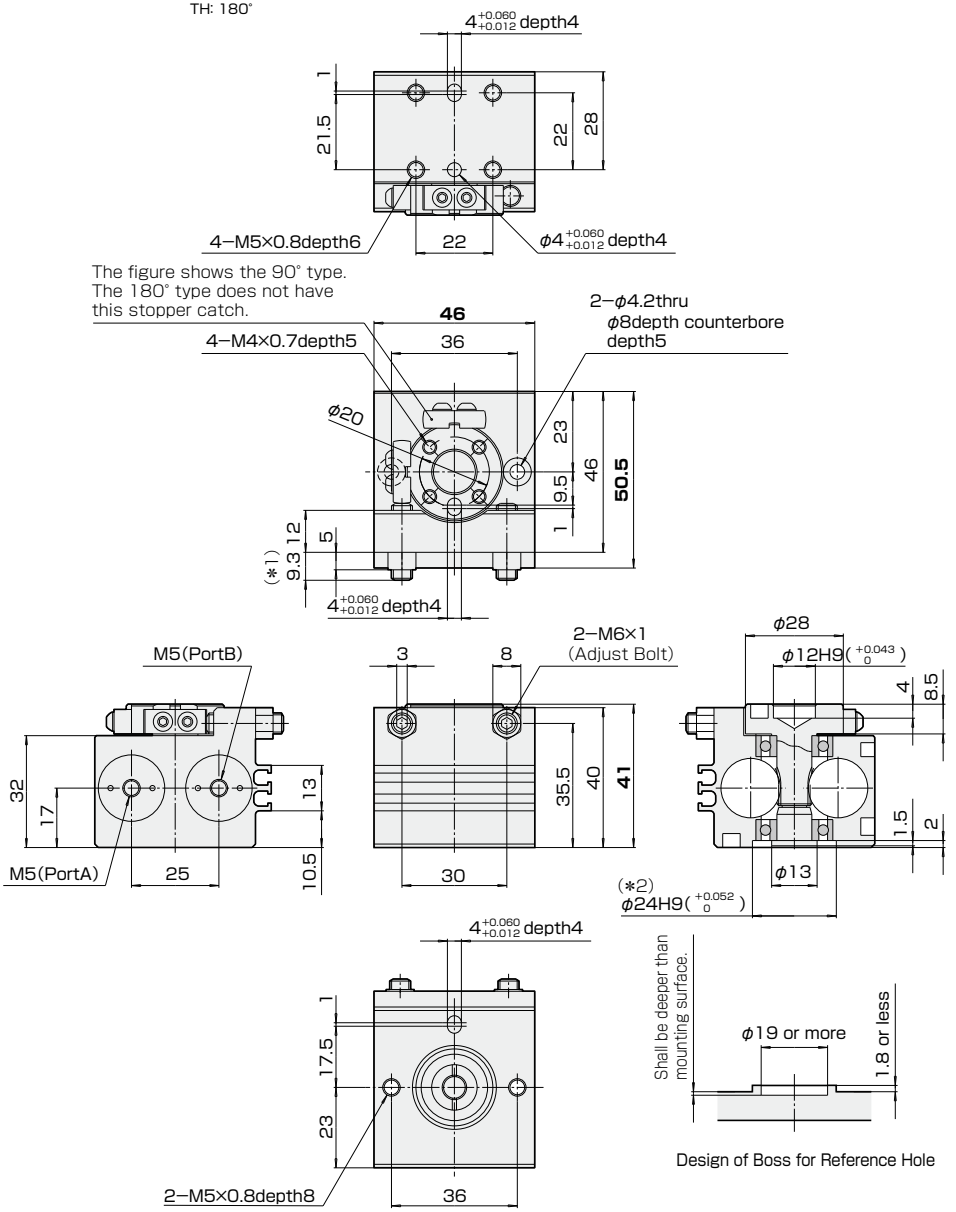
DIMENSIONS(mm) CTR2 SYMMETRIC

CTR(S)−GT2− TQ / TH

Port Position
GT: Symmetric

Size

Titubating Angle
TQ: 90°
TH: 180°



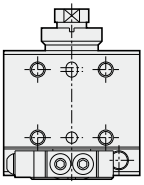
●∗1 indicates the projection length of the adjustment bolt as it is adjusted to the maximum oscillation angle (100° for the 90° type, 190° for the 180° type) within the adjustable range.

●When using the reference hole ∗2 for positioning, the boss to set in the reference hole must have the dimensions and shape in "Design of Boss for Reference Hole."

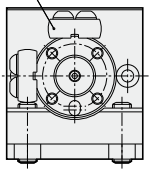
DIMENSIONS(mm) CTRV BASIC

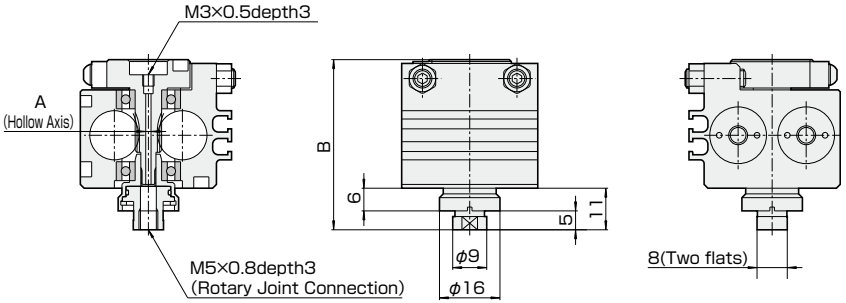
CTRV(S)−SD06−TQ

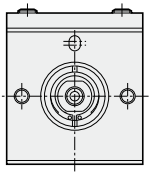
Port Position	Size	Titubating Angle
SD: Basic	06	TQ: 90°
	1	TH: 180°
	2	



The figure shows the 90° type.
The 180° type does not have this stopper catch.







Dimensions Unit: mm

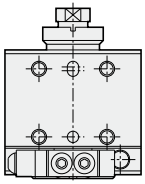
Model	A	B
CTRV06	ϕ1.4	45
CTRV1	ϕ2.2	47
CTRV2	ϕ2.5	52

Same as CTR for dimensions other than those shown on the left.

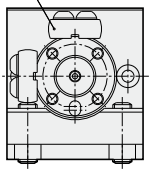
DIMENSIONS(mm) CTRV SYMMETRIC

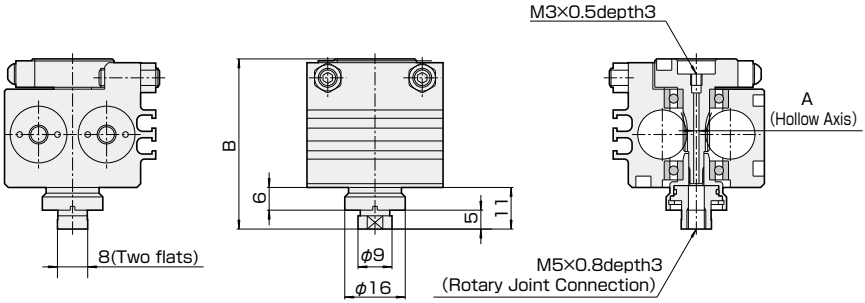
CTRV(S)−GT06−TQ

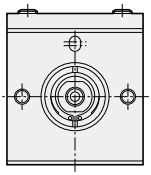
Port Position GT: Symmetric	Size 06 1 2	Titubating Angle TQ: 90° TH: 180°



The figure shows the 90° type.
The 180° type does not have this stopper catch.







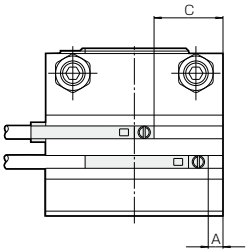
Dimensions Unit: mm

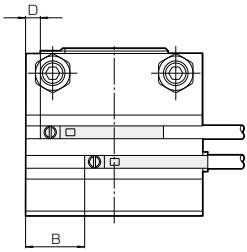
Model	A	B
CTRV06	ϕ1.4	45
CTRV1	ϕ2.2	47
CTRV2	ϕ2.5	52

Same as CTR for dimensions other than those shown on the left.

SWITCH SETTING POSITION

■Setting Position





RB(RC)1, 2 Switch

Unit: mm

Model	Titubating Angle	Mounting Position at Counterclockwise End		Mounting Position at Clockwise End	
		A	B	C	D
CTR06	90°	0	12	10	1
	180°			14	—
CTR1	90°	1	15	12	4
	180°			18	—
CTR2	90°	3	19	15	6
	180°			23	0

RB(RC)4, 5 Switch

Unit: mm

Model	Titubating Angle	Mounting Position at Counterclockwise End		Mounting Position at Clockwise End	
		A	B	C	D
CTR06	90°	3	13	11	6
	180°			15	0
CTR1	90°	5	15	13	7
	180°			19	2
CTR2	90°	6	20	16	11
	180°			23	3

Depending on the position of the oscillation end, the switch cannot be mounted in the mounting position A/D (may turn on before reaching the oscillation end).

■Operation and Hysteresis Angles

Model	RB(RC)1.2 Switch		RB(RC)4.5 Switch	
	Operation Angle α	Hysteresis Angle α	Operation Angle α	Hysteresis Angle α
CTR06	115°	10°	75°	10°
CTR1	100°	10°	60°	10°
CTR2	85°	10°	45°	10°

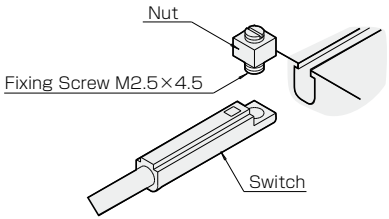
Explanation of hysteresis and on hold distance. ☞page 1084

Operation Angle α
Refers to the table oscillation angle between the point where the switch turns on by movement of the magnet and the point where it turns off by further movement in the same direction.

Hysteresis Angle β
Refers to the table oscillation angle between the point where the switch turns on by movement of the magnet and the point where it turns off by movement in the opposite direction.

■Installataion of Switch

Assemble the fixing screw with a nut to the switch.
Insert the switch into the groove.
After setting the position, fasten the screw by a screwdriver.
Fastening torgue of fixing screw must be 0.1 N·m.



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