



SMC



Mounting



* Flange mounting bracket assembly is available as an option. For details, refer to page 36.

Each of the units below for the CRB2 series can be mounted to the new CRB series.

- The vertical auto switch unit and angle adjustment unit are the same as those of the CRB2 series. Replacement of just the new CRB body can be done during maintenance.
- Each of the units for the CRB2 series can be mounted to the new CRB without auto switch (in the case of CRBW).



Refer to pages 30 and 38 to 41 for details on the angle adjustment method, auto switch mounting, and adjustment.

Series Variations

Model	Туре	Applicable auto	Vane type	Size	Rotating	Shaft type		Rotating angle range		
	switch		0.20	angle	Single shaft	Double shaft	shaft			
CRB	Standard (Without auto switch)	_						•	•	90°±10° (One side ±5°) 180°±10° (One side ±5°) (Sizes 20, 30, and 40 only)
CDRB	Standard (With auto switch)	D-M9□		10		•	_	90°±10° (One side ±5°) 180°±10° (One side ±5°) (Sizes 20, 30, and 40 only)		
CRB-A	With vertical auto switch unit (CRB2)	Refer to the applicable auto switches shown in the table above.*1	Single vane	10 15 20 30	90° 180°	•	_	$90^{\circ}\pm10^{\circ}$ (One side $\pm5^{\circ}$) $180^{\circ}\pm10^{\circ}$ (One side $\pm5^{\circ}$) (Sizes 20, 30, and 40 only)		
CRBD-B	With angle adjustment unit (CRB2)	_		40		•	_	0 to 85° (90° specification) 0 to 175° (180° specification) (For sizes 10 and 15) 0 to 100° (90° specification) 0 to 190° (180° specification) (For sizes 20, 30, and 40)		
CRBD-C	With vertical auto switch unit (CRB2) With angle adjustment unit (CRB2)	Refer to the applicable auto switches shown in the table above.*1				•	_	$\begin{array}{c} 0 \text{ to } 85^\circ \ (90^\circ \ \text{specification}) \\ 0 \text{ to } 175^\circ \ (180^\circ \ \text{specification}) \\ (For \ \text{sizes } 10 \ \text{and } 15) \\ 0 \text{ to } 100^\circ \ (90^\circ \ \text{specification}) \\ 0 \text{ to } 190^\circ \ (180^\circ \ \text{specification}) \\ (For \ \text{sizes } 20, \ 30, \ \text{and } 40) \end{array}$		

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• Vane Type Rotary Actuator

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Rotary Actuator Model Selection

Selection Procedures	Note	Selection Example			
List of Operating Conditions					
 Initially selected models Operating pressure [MPa] Mounting orientation Load type Static load Resistance load Inertial load Load dimensions [m] Load mass [kg] Rotation time [s] Rotating angle [rad] 	The unit for the rotating angle is radian. $180^\circ = \pi$ rad $90^\circ = \pi/2$ rad	Load 2 r = 10, 0.1 kg 0.15 kg 0.021 kg			
		Operating pressure: 0.4 MPa Mounting orientation: Vertical Load type: Inertial load Rotation time: 0.6 s Rotating angle: $\theta = \pi$ rad (180°)			
Calculation of Moment of	Inertia				
Calculate the inertial moment of load.	Loads are generated from multiple parts. The inertial moment of each load is calculated, and then totaled.	Inertial moment of load 1: I ₁ $I_1 = 0.15 \times \frac{0.06^2 + 0.03^2}{12} + 0.15 \times 0.025^2 = 0.00015$ Inertial moment of load 2: I ₂ $I_2 = 0.1 \times \frac{0.01^2}{2} + 0.1 \times 0.04^2 = 0.000165$ Total inertial moment: I $I = I_1 + I_2 = 0.000315 \text{ [kg·m^2]}$			
2 Calculation of Required T	orque				
Calculate the required torque for each load type and confirm whether the values fall in the effective torque range. • Static load (Ts) Required torque T = Ts • Resistance load (Tf) Required torque T = Tf x (3 to 5) • Inertial load (Ta) Required torque T = Ta x 10	When the resistance load is rotated, the required torque calculated from the inertial load must be added. Required torque T = Tf x (3 to 5) + Ta x 10	Inertial load: Ta Ta = 1· $\dot{\omega}$ $\dot{\omega} = \frac{2\theta}{t^2} [rad/s^2]$ Required torque: T T = Ta x 10 = 0.000315 x $\frac{2 x \pi}{0.6^2}$ x 10 = 0.055 [N·m] 0.055 N·m < Effective torque OK			
3 Confirmation of Rotation	Time				
Confirm whether the time falls in the rotation time adjustment range.	Consider the time after converted in the time per 90°. (0.6 s/180° is converted in 0.3 s/90°.)	0.04 ≤ t ≤ 0.5 t = 0.3 s/90° OK			
4 Calculation of Kinetic Ene	ergy				
Calculate the kinetic energy of the load and confirm whether the energy is below the allowable range.	If the energy exceeds the allowable range, a suitable cushioning mechanism such as a shock absorber must be externally installed.	Kinetic energy: E $E = \frac{1}{2} \cdot I \cdot \omega^{2}$ $\omega = \frac{2 \cdot \theta}{t}$ $E = \frac{1}{2} \times 0.000315 \times \left(\frac{2 \times \pi}{0.6}\right)^{2} = 0.01725 \text{ [J]}$ $0.01725 \text{ [J] < Allowable energy OK}$			
5 Confirmation of Allowable	e Load				
Confirm whether the load applied to the product is within the allowable range.	If the load exceeds the allowable range, a bearing or similar must be externally installed.	Thrust load: M 0.15 x 9.8 + 0.1 x 9.8 = 2.45 [N] 2.45 [N] < Allowable thrust load OK			
6 Calculation of Air Consur	nption and Required Air Flow Cap	pacity			
Air consumption and required air flow capacity are calculated when necessary.					

Rotary Actuator Model Selection

1 Calculation of Moment of Inertia

The moment of inertia is a value indicating the inertia of a rotating body, and expresses the degree to which the body is difficult to rotate, or difficult to stop.

It is necessary to know the moment of inertia of the load in order to determine the value of required torque or kinetic energy when selecting a rotary actuator.

Moving the load with the actuator creates kinetic energy in the load. When stopping the moving load, it is necessary to absorb the kinetic energy of the load with a stopper or a shock absorber.

The kinetic energy of the load can be calculated using the formulas shown in Fig. 1 (for linear motion) and Fig. 2 (for rotation motion).

In the case of the kinetic energy for linear motion, the formula (1) shows that when the velocity **V** is constant, it is proportional to the mass **m**. In the case of rotation motion, the formula (2) shows that when the angular velocity ω is constant, it is proportional to the moment of inertia.

Linear motion



 ω : Angular velocity **m**: Mass

r : Radius of rotation

Equation Table of Moment of Inertia

1. Thin shaft

Position of rotational axis: Perpendicular to the shaft through the center of gravity

$$I = \mathbf{m} \cdot \frac{\mathbf{a}^2}{12}$$

2. Thin rectangular plate

Position of rotational axis: Parallel to side b and through the center of gravity

$$I = \mathbf{m} \cdot \frac{\mathbf{a}^2}{12}$$

3. Thin rectangular plate (Including rectangular parallelepiped)

Position of rotational axis: Perpendicular to the plate through the center of gravity

$$I = \mathbf{m} \cdot \frac{\mathbf{a}^2 + \mathbf{b}^2}{12}$$

4. Round plate (Including column) Position of rotational axis: Through the center axis $I = \mathbf{m} \cdot \frac{\mathbf{r}^2}{2}$

5. Solid sphere

Position of rotational axis: Through the center of diameter

$$[=\mathbf{m}\cdot\frac{2\mathbf{r}^2}{5}]$$

As the moment of inertia is proportional to the squares of the mass and the radius of rotation, even when the load mass is the same, the moment of inertia will be squared as the radius of rotation grows bigger. This will create greater kinetic energy, which may result in damage to the product.

When there is rotation motion, product selection should be based not on the load mass of the load, but on the moment of inertia.

Moment of Inertia Formula

The basic formula for obtaining a moment of inertia is shown below.



This formula represents the moment of inertia for the shaft with mass \mathbf{m} , which is located at distance \mathbf{r} from the shaft. For actual loads, the values of the moment of inertia are calculated depending on configurations, as shown below.

I: Moment of inertia

m: Load mass

- \Rightarrow p. 8 Calculation example of moment of inertia
- \Rightarrow p. 9 Graph for calculating the moment of inertia



Calculation Example of Moment of Inertia

If the shaft is located at a desired point of the load:



If a lever is attached to the shaft and a cylinder and a gripper are mounted to the tip of the lever:



Example: 1) Obtain the lever's moment of inertia: $I_1 = \boldsymbol{m}_1 \cdot \frac{\boldsymbol{L}^2}{3}$ 2 Obtain the cylinder's moment of inertia: $I_2 = \mathbf{m}_2 \cdot \frac{(\mathbf{D}/2)^2}{2} + \mathbf{m}_2 \cdot \mathbf{L}^2$ ③ Obtain the gripper's moment of inertia:

④ Obtain the actual moment of inertia:

 $I = I_1 + I_2 + I_3$ m1: Mass of lever m₂: Mass of cylinder



If a load is rotated through the gears:



Calculation Example

$\label{eq:L} \begin{array}{l} L=0.2\ m,\ \varrho D=0.06\ m,\ a=0.06\ m,\ b=0.03\ m\\ m_1=0.5\ kg,\ m_2=0.4\ kg,\ m_3=0.2\ kg \end{array}$	
$I_1 = 0.5 \ x \ \frac{0.2^2}{3} = 0.67 \ x \ 10^{-2}$	kg∙m²
$I_2 = 0.4 \ x \ \frac{(0.06/2)^2}{2} + 0.4 \ x \ 0.2^2 = 1.62 \ x \ 10^{-2}$	kg∙m²
$I_3 = 0.2 \ x \ \frac{0.06^2 + 0.03^2}{12} + 0.2 \ x \ 0.2^2 = 0.81 \ x \ 10^{-2}$	kg∙m²
I = (0.67 + 1.62 + 0.81) x 10^{-2} = 3.1 x 10^{-2}	kg∙m²

Calculation Example

$ \begin{aligned} &d_1=0.1 m, d_2=0.05 m, D=0.04 m, a=0.04 m, b=0.02 m\\ &m_1=1 kg, m_2=0.4 kg, m_3=0.5 kg, m_4=0.2 kg, Ratio of the number of teeth=2 \end{aligned} }$				
$I_1 = 1 - x \frac{(0.1/2)^2}{2}$	= 1.25 x 10 ⁻³ kg·m ²			
$I_2 = 0.4 \text{ x} \frac{(0.05/2)^2}{2}$	= 0.13 x 10 ⁻³ kg·m ²			
$I_3 = 0.5 \text{ x} \frac{(0.04/2)^2}{2}$	$= 0.1 \times 10^{-3} \text{ kg} \cdot \text{m}^2$			
$I_4 = 0.2 \text{ x} \frac{0.04^2 + 0.02}{12}$	$r^{2} = 0.03 \text{ x } 10^{-3} \text{ kg} \cdot \text{m}^{2}$			
$I_B = (0.13 + 0.1 + 0.03)$	x) x 10 ⁻³ = 0.26 x 10 ⁻³ kg⋅m ²			
$I_A = 2^2 x \ 0.26$	$x \ 10^{-3} = 1.04 \ x \ 10^{-3} \ \text{kg} \cdot \text{m}^2$			
I = (1.25+1.04)	$x \ 10^{-3} = 2.29 \ x \ 10^{-3} \ \text{kg} \cdot \text{m}^2$			

m1: Mass of gear 1 m₂: Mass of gear 2 m₃: Mass of cylinder m₄: Mass of gripper

Rotary Actuator Model Selection



Graph for Calculating the Moment of Inertia

2 Calculation of Required Torque

Load Type

The calculation method of required torque varies depending on the load type. Obtain the required torque referring to the table below.

Load type							
Static load: Ts	Resistance load: Tf	Inertial load: Ta					
When the pressing force is necessary (clamp, etc.)	When friction force or gravity is applied to the rotation direction	When the load with inertia is rotated					
L F	Gravity acts	The center of rotation and the center of gravity are corresponding					
Ts = F·L Ts: Static load [N·m] F : Clamp force [N] L : Distance from the center of rotation to clamp [m]	When gravity acts to the rotation directionWhen friction force acts to the rotation directionTf = m·g·LTf = μ ·m·g·LTf: Resistance load [N·m] m: Load mass [kg] g : Gravitational acceleration 9.8 [m/s ²] L : Distance fraction to the	$\begin{aligned} \mathbf{Ta} &= \mathbf{I} \cdot \dot{\boldsymbol{\omega}} = \mathbf{I} \cdot \frac{2\theta}{t^2} \\ \mathbf{Ta}: \text{ Inertial load [N·m]} \\ \mathbf{I} &: \text{Moment of inertia [kg·m^2]} \\ \dot{\boldsymbol{\omega}}: \text{ Angular acceleration [rad/s^2]} \\ \theta &: \text{ Rotating angle [rad]} \\ \mathbf{t} &: \text{ Rotation time [s]} \end{aligned}$					
	gravity or friction force acting point [m] μ : Coefficient of friction						
Required torque T = Ts	Required torque $\mathbf{T} = \mathbf{T}\mathbf{f} \times (3 \text{ to } 5)^{*1}$	Required torque T = Ta x 10 ^{*1}					
 Resistance loads → Gravity or friction applies in Example 1) The axis of rotation is in a horizontal center of rotation and center of gravity of Example 2) The load slips against the floor The required torque equals the total of and inertial load. T = Tf x (3 to 5) + Ta x 10 	 the rotation direction. (lateral) direction, and the the load are not the same. while rotating. the resistance load Non-resistance loads → Example 1) The axis the axis center of the resistance load The required tor T = Ta x 10 	Gravity or friction does not apply in the rotation direction. is of rotation is in a perpendicular (vertical) direction. s of rotation is in a horizontal (lateral) direction, and the of rotation and center of gravity of the load are the same. rque equals the inertial load only.					

●Effective Torque



									[N∙m]
Size		Operating pressure [MPa]							
Size	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
10	0.03	0.06	0.09	0.12	0.15	0.18	—	—	—
15	0.10	0.17	0.24	0.32	0.39	0.46	—	—	_
20	0.23	0.39	0.54	0.70	0.84	0.99	—	_	_
30	0.62	1.04	1.39	1.83	2.19	2.58	3.03	3.40	3.73
40	1.21	2.07	2.90	3.73	4.55	5.38	6.20	7.03	7.86

3 Confirmation of Rotation Time

Rotation time adjustment range is specified for each product for stable operation. Set the rotation time within the rotation time specified below.

							Rotatio	n time adjustm	ent range [^s	^S /90°]					
Model	0.02	0.03	0.05	0.1	0.2	0.3	0.5	1	2	3	4	5	10	20	30
				Size: 10, 1	5, 20										
CRB				Size	: 30						-				
					Size: 40							i		-	

If the product is used in a low speed range which is outside the adjustment range, it may cause the stick-slip phenomenon, or the product to stick or stop.

Rotary Actuator Model Selection

4 Calculation of Kinetic Energy

Kinetic energy is generated when the load rotates. Kinetic energy applies on the product at the operating end as inertial force, and may cause the product to damage. In order to avoid this, the value of allowable kinetic energy is determined for each product. Find the kinetic energy of the load, and verify that it is within the allowable range for the product in use.

Kinetic Energy

Use the following formula to calculate the kinetic energy of the load.

$$\mathbf{E} = \frac{1}{2} \cdot \mathbf{I} \cdot \boldsymbol{\omega}^2$$

E: Kinetic energy [J]

I: Moment of inertia [kg·m²]

 ω : Angular velocity [rad/s]

Angular Velocity

$$\omega = \frac{2\theta}{t}$$

ω: Angular velocity [rad/s]
θ: Rotating angle [rad]
t: Rotation time [s]

 \Rightarrow Below Allowable kinetic energy and rotation time adjustment range \Rightarrow p. 12 Moment of inertia and rotation time

To find the rotation time when kinetic energy is within the allowable range for the product, use the following formula.

When the angular velocity is $\omega = \frac{2\theta}{t}$

$$t \ge \sqrt{\frac{2 \cdot I \cdot \theta^2}{E}}$$

t : Rotation time [s]

I : Moment of inertia [kg·m²]

θ: Rotating angle [rad]

E: Allowable kinetic energy [J]

Allowable Kinetic Energy and Rotation Time Adjustment Range

Allowable Kinetic Energy and Rotation Time Adjustment Range

Size	Allowable kinetic energy [J]	Adjustable range of rotation time safe in operation [\$/90°]
10	0.00015	
15	0.001	0.03 to 0.5
	0.000	

20	0.003	
30	0.020	0.04 to 0.5
40	0.040	0.07 to 0.5

Calculation Example



Calculation Example

*∕∕∕*SMC



Moment of Inertia and Rotation Time

How to read the graph

- Example 1) When there are constraints for the moment of inertia of load and rotation time. From "Graph (3)", to operate at the load moment of inertia 1 x 10⁻⁴ kg·m² and at the rotation time setting of 0.3 ^S/₉₀, the model will be CRB⊡30.
- Example 2) When there are constraints for the moment of inertia of load, but not for rotation time. From "Graph (3)", to operate at the load moment of inertia 1 x 10⁻⁵ kg·m²: (CRB15 will be 0.22 to 0.5 S /_{90°}) (CRB20 will be 0.13 to 0.5 S /_{90°})

[Remarks] As for the rotation times in "Graph (3)", the lines in the graph indicate the adjustable speed ranges. If the speed is adjusted towards the low-speed end beyond the range of the line, it could cause the actuator to stick, or, in the case of the vane type, it could stop its operation. Graph (3) Size: 10 to 40



5 Confirmation of Allowable Load

Provided that a dynamic load is not generated, a load in the axial direction can be applied up to the value that is indicated in the table below. However, applications in which the load is applied directly to the shaft should be avoided as much as possible.



Vane Type (Single, Double)

Corioo	Cizo	Load direction						
Series	Size	Fsa [N]	Fsb [N]	Fr [N]	M [N⋅m]			
	10	9.8	9.8	14.7	0.13			
	15	9.8	9.8	14.7	0.17			
CRB	20	19.6	19.6	24.5	0.33			
	30	24.5	24.5	29.4	0.42			
	40	40	40	60	1.02			



Rotary Actuator Model Selection

Calculation of Air Consumption and Required Air Flow Capacity 6

Air consumption is the volume of air which is expended by the rotary actuator's reciprocal operation inside the actuator and in the piping between the actuator and the switching valve, etc. This is necessary for selection of a compressor and for calculation of its running cost. Required air volume is the air volume necessary to make a rotary actuator operate at a required speed. It requires calculation when selecting the upstream piping diameter from the switching valve and air line equipment.

* To facilitate your calculation, the table below provide the air consumption volume (QcR) that is required each time an individual rotary actuator makes a reciprocal movement.

t

(1)Air consumption volume

For	mula				
Re	Regarding QCR: With vane type, use formula (1) because the inner vol- ume varies when ports A and B are pressurized.				
	$\mathbf{Q}_{CR} = \left(\mathbf{V}_{A} + \mathbf{V}_{B}\right) \mathbf{x} \left(\frac{\mathbf{P} + 0.1}{0.1}\right) \mathbf{x} 10^{-3} \cdots$	•• (1	I)		
	$Q_{CP} = 2 \times a \times L \times \left(-\frac{P}{0.1} \right) \times 10^{-6}$	(2	2)		
	Qc = Qcr + Qcp	·· (3	3)		
QCF	= Amount of air consumption of rotary actuator	[L	(ANR)]		
QCF	= Amount of air consumption of tube or piping	[L	(ANR)]		
VA	= Inner volume of the rotary actuator (when pressurized from A po	rt)	[cm ³]		
۷в	= Inner volume of the rotary actuator (when pressurized from B po	rt)	[cm ³]		
Р	= Operating pressure		[MPa]		
L	= Length of piping		[mm]		
а	= Inner sectional area of piping		[mm ²]		
Qc	= Amount of air consumption required for one cycle of the rotary actuator	[L	(ANR)]		
-		,			

To select a compressor, it is important to select one that has plenty of margin to accommodate the total air volume that is consumed by the pneumatic actuators that are located downstream. The total air consumption volume is affected by the leakage in the tube, the consumption in the drain valves and pilot valves, as well as by the reduction in air volume due to reduced temperature.

Formula $Q_{c2} = Q_c \times n \times No.$ of actuators x Safety factor...(4)

Qc2 = Amount of air from a compressor n = Actuator reciprocations per minute

Safety factor: From 1.5

2 Required air flow capacity

Formula

($\mathbf{Q}_{r} = \left\{ \mathbf{V}_{\mathbf{B}} \mathbf{x} \left(\frac{\mathbf{P} + 0.1}{0.1} \right) \mathbf{x} \ 10^{-3} + \mathbf{a} \mathbf{x} \mathbf{L} \mathbf{x} \left(\frac{\mathbf{P}}{0.1} \right) \mathbf{x} \ 10^{-6} \right\} \mathbf{x} \frac{60}{\mathbf{t}} \cdots$	(5)
($\mathbf{Q}_{r} = \left\{ \mathbf{V}_{\mathbf{A}} \times \left(\frac{\mathbf{P} + 0.1}{0.1} \right) \times 10^{-3} + \mathbf{a} \times \mathbf{L} \times \left(\frac{\mathbf{P}}{0.1} \right) \times 10^{-6} \right\} \times \frac{60}{t} \cdots$	(6)
Qr	= Consumed air volume for rotary actuator [L/min	(ANR)]
VA	= Inner volume of the rotary actuator (when pressurized from A port)	[cm ³]
۷в	= Inner volume of the rotary actuator (when pressurized from B port)	[cm ³]
Ρ	= Operating pressure	[MPa]
L	= Length of piping	[mm]
а	= Inner sectional area of piping	[mm ²]
t	= Total time for rotation	[S]

Internal Cross Section of Tubing and Steel Tube

Nominal	O.D. [mm]	I.D. [mm]	Internal cross section a [mm ²]
T□ 0425	4	2.5	4.9
T□ 0604	6	4	12.6
TU 0805	8	5	19.6
T□ 0806	8	6	28.3
1/8B	—	6.5	33.2
T🗆 1075	10	7.5	44.2
TU 1208	12	8	50.3
T🗆 1209	12	9	63.6
1/4B	—	9.2	66.5
TS 1612	16	12	113
3/8B	—	12.7	127
T🗆 1613	16	13	133
1/2B	—	16.1	204
3/4B	_	21.6	366
1B	—	27.6	598

 \Rightarrow p. 14 Air consumption calculation graph

Inner Volume and Air Consumption

												[L (ANR)
Cizo	Rotating angle	Inner volu	ume [cm ³]	e [cm ³] Operating pressure [MPa]								
Size	(degree)	Press. VA port	Press. Vв port	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
10	90	0.5	0.8	0.004	0.005	0.007	0.008	0.009	0.010	—	—	—
10	180	1.1	1.1	0.007	0.009	0.011	0.013	0.015	0.018	—	—	—
15	90	1.4	2.1	0.011	0.014	0.018	0.021	0.025	0.028	—	—	—
	180	2.8	2.8	0.017	0.022	0.028	0.034	0.039	0.045	—	—	—
00	90	3.6	5	0.026	0.034	0.043	0.052	0.060	0.069	—	—	—
20	180	6.5	6.5	0.039	0.052	0.065	0.078	0.091	0.104	—	—	—
20	90	10.1	13.3	0.070	0.094	0.117	0.140	0.164	0.187	0.211	0.234	0.257
30	180	17.4	17.4	0.104	0.139	0.174	0.209	0.244	0.278	0.313	0.348	0.383
40	90	21.9	30	0.156	0.208	0.260	0.311	0.363	0.415	0.467	0.519	0.571
40	180	37.5	37.5	0.225	0.300	0.375	0.450	0.525	0.600	0.675	0.750	0.825

[L/min (ANR)]

Air Consumption Calculation Graph

- Step 1
 Using Graph (4), air consumption volume of the rotary actuator is obtained. From the point of intersection between the inner volume and the operating pressure (slanted line) and then looking to the side (left side) direction, the air consumption volume for 1 cycle operation of a rotary actuator is obtained.

 Step 2
 Using Graph (5), air consumption volume of tubing or steel tube is obtained.

 (1) First determine the point of intersection between the operating pressure (slanted line) and the piping length, and then go up the vertical line perpendicularly from there.

 (2) From the point of intersection of an operating piping tube inside diameter (slanted line), then look to the side (left or right) to obtain the required air consumption volume for piping.
- Step 3
 Total air consumption volume per minute is obtained as follows:

 (Air consumption volume of a rotary actuator [unit: L (ANR)] + Tubing or steel tube's air consumption volume) x Cycle times per minute x Number of rotary actuators = Total air consumption volume

Example) When 10 units of a CRBS30-180 are used at a pressure of 0.5 MPa, what is the air consumption of their 5 cycles per minute? (Piping between the actuator and switching valve is a tube with an inside diameter of 6 mm and length of 2 m.)

- 1. Operating pressure 0.5 MPa → Inner volume of CRBS30-180 17.4 cm³ → Air consumption volume 0.21 L (ANR)
- 2. Operating pressure 0.5 MPa \rightarrow Piping length 2 m \rightarrow Inside diameter 6 mm \rightarrow Air consumption volume 0.56 L (ANR)
- 3. Total air consumption volume = (0.21 + 0.56) x 5 x 10 = 38.5 L/min (ANR)



Inner Volume		1 cycle [cm ³]				
Cine	Rotatin	Rotating angle				
Size	90°	180°				
10	0.8 (0.5)	1.1				
15	2.1 (1.4)	2.8				
20	5.0 (3.6)	6.5				
30	13.3 (10.1)	17.4				
40	30.0 (21.9)	37.5				

* Values inside () are inner volume of the supply side when A port is pressurized.

Graph (5) Air Consumption of Tubing, Steel Tube (1 cycle)



 "Piping length" indicates the length of steel tube or tubing which connects rotary actuator and switching valves (solenoid valves, etc.).
 Refer to page 13 for the size of tubing and steel tube (inside diameter

and outside diameter).

Vane Type Rotary Actuator **CRB** Series Size: 10, 15, 20, 30, 40







Shaft type

-						
Sumbol	Shoft turns	Shaft-end shape				
Буппроі	Shall type	Long shaft	Short shaft			
S	Single shaft*1	Single flat*2	—			
W	Double shaft	Single flat*2	Single flat			
J *3	Double shaft					
K *3	Double shaft	For details, refer to page 24.				
T *3	Single shaft*1					
Y *3	Double shaft					



B Rotating angle				
90	90°			
180	180°			

*1 When an auto switch is mounted to the rotary actuator, only S and T are available.

*2 Size 40 has a parallel key instead of the chamfered position. *3 J, K, T, and Y are produced upon receipt of order.

5 J, K, I, and F are produced upon receipt of

т

Z*1

5 Lead wire length

receipt of order.

Nil	Grommet/Lead wire: 0.5 r				
Μ	Grommet/Lead wire: 1 m				

*1 The 5 m lead wire is produced upon

Grommet/Lead wire: 3 m

Grommet/Lead wire: 5 m

6 Number of auto

SW	itches
Nil	2
S	1

Auto switch Nil Without a

Nil Without auto switch (Built-in magnet)

* For applicable auto switches, refer to the table below.

Applicable Auto	Switches/Refer to the Web Catalog or Best Pneumatics Catalog for further information on auto switches.

Γ	Туре	Electrical	light	Wiring		d voltogo			Le	ad wire	length [m]	Dro wirod		
		entry	Indicator	(Output)	Load Voltage		model	Lead wire type	0.5	1	3	5	connector	Applicable load	
		onay		(eupui)					(Nil)	(M)	(L)	(Z)	Connector		
	Solid state auto switch	Grommet		3-wire (NPN)		5 V, 12 V	M9N	Oilproof	۲	۲		0	0	IC	Delau
			Yes	3-wire (PNP)	24 V		M9P	heavy-duty	•	•	•	0	0	circuit	PIC
				2-wire		12 V	M9B	cord	•	•	•	0	0	_	

* Auto switches are shipped together, but not assembled.

 $\ast\,$ Auto switches marked with "O" are produced upon receipt of order.



Symbol



Refer to pages 38 to 41 for actuators with auto switches.

- · Auto Switch Proper Mounting Position (at Rotation End Detection)
- · Operating Angle and Hysteresis Angle
- · Operating Range and Hysteresis
- · How to Change the Auto Switch Detecting Position
- Auto Switch Mounting
- · Auto Switch Adjustment

Flange mounting bracket assembly is available as an option. For details, refer to page 36.

Specifications

	Size	10	15	20	30	40						
		90°+5°	90°±10°									
Rotating	g angle range	180°+5°	180°+4°	180°±10°								
Fluid		Air (Non-lube)										
Proof p	ressure [MPa]		1.05		1.	5						
Ambient a	and fluid temperatures	5 to 60°C										
Max. ope	rating pressure [MPa]		0									
Min. oper	ating pressure [MPa]	0.2										
Rotation time	e adjustment range [\$/90°]*1		0.03 to 0.5	0.04 to 0.5	0.07 to 0.5							
Allowabl	e kinetic energy [J]	0.00015	0.001	0.003	0.02	0.04						
Shaft load	Allowable radial load	15	15	25	30	60						
[N]	Allowable thrust load	10	25	40								
Port siz	е			M5 x 0.8								

*1 Operate within the specified rotation time range. Operation below 0.5 s/90° may cause stick slip or operation failure.

it is difficult to make adjustments during use if rotation time is changed to 0.5 s/90° or lower. Size 10 requires at least 0.35 MPa of operating pressure to reach the minimum rotation time (0.03 s/90°).

Chamfered Position and Rotation Range: Top View from Long Shaft Side Chamfered positions shown below illustrate the conditions of actuators when B port is pressurized.

Operate within the adjustment range shown below.



*1 For size 10, the tolerance of rotating angle of 90° and 180° will be $^{+5^{\circ}}_{0.2}$



CRB Series

Inner Volume

										[cm ³]
Size	10		15		20		30		40	
Rotating angle	90°	180°	90°	180°	90°	180°	90°	180°	90°	180°
Inner volume	0.8 (0.5)	1.1	2.1 (1.4)	2.8	5 (3.6)	6.5	13.3 (10.1)	17.4	30 (21.9)	37.5

* Values inside () are inner volume of the supply side when A port is pressurized.

Weight

										[g]	
Size	ze 10		15		2	0	3	0	40		
Rotating angle	90°	180°	90°	180°	90°	180°	90°	180°	90°	180°	
Basic type (S shaft)	26 (27)	25 (26)	46 (47)	45 (46)	107 (110)	105 (107)	198 (203)	192 (197)	366 (378)	354 (360)	
With auto switch	39	38	62	61	115	112	216	209	380	367	

(): For W shaft

Effective Output



Construction: Standard Type (Without Auto Switch)

• Following figures show actuators when B port is pressurized.





Size: 20, 30, 40







Component Parts

No.	Description	Material	Note
1	Body (A)	Aluminum alloy	Painted
2	Body (B)	Aluminum alloy	Painted
3	Vane shaft	Stainless steel	
4	Stopper	Resin	
5	Stopper for 90°	Resin	For 90°
6	Holding rubber	NBR	For 90°
7	Stopper seal	NBR	Special seal
8	Back-up ring	Stainless steel	
9	Bearing	Bearing steel	
10	O-ring	NBR	
11	Hexagon socket head cap screw	Chrome molybdenum steel	Special screw

Component Parts

No.	Description	Material	Note
1	Body (A)	Aluminum alloy	Painted
2	Body (B)	Aluminum alloy	Painted
3	Vane shaft	Stainless steel*1	
4	Stopper	Resin	
5	Stopper for 90°	Resin	For 90°
6	Holding rubber	NBR	For 90°
7	Stopper seal	NBR	Special seal
8	Back-up ring	Stainless steel	
9	Bearing	Bearing steel	
10	O-ring	NBR	
11	Seal washer	NBR	
12	Adjustment bolt	Chrome molybdenum steel	
13	Hexagon nut	Steel wire	
14	Hexagon socket head cap screw	Chrome molybdenum steel	Special screw

*1 The material is chrome molybdenum steel for sizes 30 and 40.

CRB Series

Construction: Standard Type (With Auto Switch)

• Following figures show actuators when B port is pressurized.

Size: 10, 15

Size: 20, 30, 40









Component Parts

		i
No.	Description	Material
1	Cover	Resin
2	Magnet holder	Resin
3	Magnet	Magnetic material
4	Body C	Resin
5	Switch plate	Aluminum alloy
6	Spring pin	Stainless steel
7	Cross recessed round head screw	Chrome molybdenum steel*1
8	Cross recessed round head screw	Chrome molybdenum steel

*1 The material is stainless steel for sizes 10 and 15.

Dimensions: Standard Type (Without Auto Switch) 10, 15

Single shaft/CRBS

• Following figures show actuators when B port is pressurized.



Chamfer

D3

øD1



F1

ø**A1**

																	[mm]
Cine		Α		Б			D				I			ĸ			
Size	A1	A2	A3	Б	D1 (g7)	D2	D3	D4	D5	D6	E1 (h9)	E2	E3	F1	F2	F3	~
10	29	30	37	15	4 ^{-0.004} -0.015	14	0.5	9	8	5	9_0.036	3	1	12	9.8	M5 x 0.8	3.6
15	34	39.5	47	20	5 ^{-0.004} -0.016	18	0.5	10	9	6	12 _{-0.043}	4	1.5	14	14.3	M5 x 0.8	7.6
Cine	LN					Q			_								
Size			мр		♦ Q1	Q 2	*	Q3									
10	19.8	14.6	24	M3 >	k 0.5 depth 6	6											
15	24	17.1	29	M3 x	0.5 depth 10	6	M3 x 0.	//3 x 0.5 depth 5									

CRB Series

Dimensions: Standard Type (Without Auto Switch) 20, 30, 40

Single shaft/CRBS

• Following figures show actuators when B port is pressurized.



For size 40

Parallel key dimensions









																[mm]	
Cine		Α		Б			D					E			F		
Size	A1	A2	A3	P	D1 (g7)	D2	2 D3	D4	D5	D6	E1 (h9)	E2	E3	F1	F2	F3	
20	42	50.5	59	29	$6^{-0.004}_{-0.016}$	20	0.5 10		10	7	14_0_0_043	4.5	1.5	13	18.3	M5 x 0.8	
30	50	64	75	40	8 ^{-0.005} -0.020	22	1 12		13	8	16 ⁰ _{-0.043}	5	2	14	26	M5 x 0.8	
40	63	79.5	90	45	10 ^{-0.005}	30	1	—	15	9	25 _{-0.052}	6.5	4.5	20	31.1	M5 x 0.8	
	J																
0:		J		V					Q								
Size	J1	J J2	J3	ĸ	L	Ρ	(21	Q ¢Q2	2	★Q3						
Size	J1 16	J J2 7.1	J3 27.4	- к -	L 28	P 36	♦ (M4 x 0.7	21 depth 10	Q • Q2) 11	2 M4	★Q3 x 0.7 depth 7.5						
Size 20 30	J1 16 19	J J2 7.1 11.8	J3 27.4 32.7	- K 5.5	L 28 31.5	P 36 43	●C M4 x 0.7 M5 x 0.8	21 depth 10 depth 15	Q • Q2 0 11 5 16.5	2 M4	★Q3 x 0.7 depth 7.5 x 0.8 depth 10	-					
Size 20 30 40	J1 16 19 28	J J2 7.1 11.8 15.8	J3 27.4 32.7 44.1	- K 5.5 9.5	L 28 31.5 40	P 36 43 56	▲ M4 x 0.7 M5 x 0.8 M5 x 0.8	21 depth 10 depth 15 depth 20	Q ♦ Q2) 11 5 16.5) 17.5	2 M4 M5 M5	★Q3 x 0.7 depth 7.5 x 0.8 depth 10 x 0.8 depth 10						

SMC

*1 J3-dimension is not the dimension at the time of shipment, since its dimension is for adjustment parts.

Dimensions: Standard Type (With Auto Switch) 10, 15

Single shaft/CDRBS

• Following figures show actuators when B port is pressurized.



																[mm]
Cine		Α	п		D			E			F		v			
Size	A1	A2	D	D1 (g7)	D2	D3	D4	E1 (h9)	E2	F1	F2	F3	ĸ	L	IVI	P
10	29	46	32	4 ^{-0.004} -0.015	14	0.5	9	9_0.036	3	12	9.8	M5 x 0.8	3.6	19.8	14.6	24
15	34	54.8	36.8	5 ^{-0.004} 5 ^{-0.016}	18	0.5	10	12_0_043	4	14	14.3	M5 x 0.8	7.6	24	17.1	29
0:	Q					S	1									
Size		♦ Q1		★Q2	S1	S2										
10	M3 x (0.5 depth	3	—	15	27	_									
15	M3 x 0	0.5 depth 1	0 M3 x	0.5 depth 5	19	32.2										
							-									~~

CRB Series

Dimensions: Standard Type (With Auto Switch) 20, 30, 40

Single shaft/CDRBS

• Following figures show actuators when B port is pressurized.



For size 40



Parallel key dimensions

	b b	
b (h9)	h (h9)	L1
4_0.030	4_0_0_0	20





																	[mm]
Cine		Α	Б			D			E		F			ĸ			
Size	A1	A2		D1 (g7)) [D2	D3	D4	E1 (h9)	E2	F1	F2	F3	J1	J2	J3	n n
20	42	55.6	35.6	6 ^{-0.004}	2	20	0.5	10	14_0_0_043	4.5	13	18.3	M5 x 0.8	16	7.1	27.4	—
30	50	70	48	8-0.005	2	22	1	12	16 _{-0.043}	5	14	26	M5 x 0.8	19	11.8	32.7	5.5
40	63	84.2	54.2	10-0.005	:	30	—	-	25 _{-0.052}	6.5	20	31.1	M5 x 0.8	28	15.8	44.1	9.5
						S											
Size	L	P		Q	S1	5	S2										
20	28	36	M4 x 0.7	depth 10	37	2	8.6										
30	31.5	43	M5 x 0.8	depth 15	42	4	0.1										
40	40	56	M5 x 0.8	depth 20	52	4	5.2										

SMC

*1 J3-dimension is not the dimension at the time of shipment, since its dimension is for adjustment parts.

Vane Type Rotary Actuator CRB Series



Size: 10, 15 Standard type

Double shaft/CRB**J**□



With auto switch

Single shaft/CDRBT



Size: 20, 30, 40 Standard type

Double shaft/CRBJ



With auto switch



Auto switch



Double shaft/CRBK□

(©

Δ

۵

Round shaft

Round shaft

 $(\bigcirc$

Single shaft/CRB $T\Box$



Double shaft/CRBY \square





The dimensions of the shaft and chamfer are the same as those of the standard type. Dimensions of parts different from the standard type conform to the general tolerance.

Single shaft/CRB**T**□



Double shaft/CRBY



A parallel key is used instead of chamfer for size 40.

			[mm]
Size	20	30	40
С	10	13	15
D	20	22	30

The dimensions of the shaft and chamfer (a parallel key for size 40) are the same as those of the standard type. Dimensions of parts different from the standard type conform to the general tolerance.

Vane Type Rotary Actuator With Vertical Auto Switch Unit **CRB - A Series** Size: 10, 15, 20, 30, 40



RoHS

Applicable Auto Switches/Refer to the Web Catalog or Best Pneumatics Catalog for further information on auto switches

Annlia				E.				j.				le	ad w	re ler	nath [ml			
cable	Type	Special	Electrical	atorli	Wiring		Load vo	oltage	Auto swit	ch model	Lead wire	0.5	1	3	5	None	Pre-wired	Applic	cable
size	71	tunction	entry	Indic	(Output)		DC	AC	Perpendicular	In-line	type	(Nil)	(M)	(Ľ)	(Z)	(N)	connector	loa	ad
					3-wire (NPN)		5 V,		M9NV	M9N				٠	0	—	0	IC	
	Solid				3-wire (PNP)		12 V		M9PV	M9P	0			٠	0	—	0	circuit	
	state			V	2-wire		12 V	1	M9BV	M9B	Oliproof			•	0	_	0		
E.u.	auto			res	3-wire (NPN)		5 V,	- 1	S99V	S99	neavy-duty		—	۲	0	_	0	IC	
For	switch		Crommet		3-wire (PNP)	04 V	12 V		S9PV	S9P	Cord	•	—	۲	0	—	0	circuit	Relay,
10,			Grommet		2-wire	24 V	12 V	1	T99V	T99	1		—	۲	0	—	0	_	PLC
15	Deed			NIa			5 V, 12 V	5 V, 12 V, 24 V	_	90	Vinyl parallel cord		—	۲		—		IC	
	auto switch			INO	0 miro		5 V, 12 V, 100 V	5 V, 12 V, 24 V, 100 V		90A	Oilproof heavy-duty cord Vinyl parallel cord		—	۲	•	-	_	circuit	
		-		Voc	2-wire			—	_	97			—	۲		—			
				res			_	100 V	_	93A	Oilproof heavy-duty cord		—	۲		—		—	
					3-wire (NPN)		5 V,		M9NV	M9N	-			۲	0	—	0	IC	
	Colid				3-wire (PNP)		12 V		M9PV	M9P				۲	0	—	0	circuit	
	state		Grommot		2-wire		12 V		M9BV	M9B				۲	0	—	0	—	
For	auto	—	Grommer	Yes	3-wire (NPN)		5 V,	_	—	S79]		—	۲	0	—	0	IC	
20	ewitch				3-wire (PNP)		12 V		—	S7P	Oilproof		—	•	0	—	0	circuit	Polov
20,	Switch				2-wire	24 V	12 V		_	T79	heavy-duty		—	•	0		0		PI C
30,			Connector		2 1110		12 V		_	T79C	cord		—	•			—		1 20
40	Reed		Grommet	Yes			_	100 V		R73			—		0	—		_	
	auto		Connector	100	2-wire				—	R73C			—				_		
	switch		Grommet	2-wire		48 V, 100 V	0 V 100 V	_	R80			—		0	-		IC circuit		
	onnon		Connector	140			—	24 V or less	—	R80C			—	۲					

* Auto switches are shipped together, but not assembled.

 $\ast\,$ Auto switches marked with "O" are produced upon receipt of order.

Vane Type Rotary Actuator With Vertical Auto Switch Unit **CRB** - **A** Series

Weight

Specifications, rotation range, inner
volume, and effective output are the
same as those of the standard type.
(→ p. 16, 17)

										[g]	
Size	1	0	1	5	2	0	3	0	40		
Rotating angle	90°	180°	90°	180°	90°	180°	90°	180°	90°	180°	
Basic type	27	26	47	46	110	107	203	197	378	360	
Vertical auto switch unit	1	5	2	0	2	8	3	8	4	3	

Flange mounting bracket assembly is available as an option. For details, refer to page 36.

Construction: With Vertical Auto Switch Unit

• Components other than those specified below are the same as those found on page 18.



* For size 10, there are 2 pcs. of 1 cross recessed round head screws.

Aluminum alloy

Resin

11

5 Holding block (B)

6 Switch block (A)

Stainless steel

Stainless steel

Cross recessed round head screw

12 Cross recessed round head screw

CRB - A Series

Dimensions: With Vertical Auto Switch Unit (10, 15)

• Following figures show actuators when B port is pressurized.



*1 The angle is 60° when any of the following are used: D-90/90A/97/93A The angle is 69° when any of the following are used: D-S99(V)/T99(V)/S9P(V)

																	[mm]
Cine		Ā	Б	_		D			E			F		ĸ			•
Size	A1	A2	В		D1 (g7)	D2	D3	D4	E1 (h9)	E2	F1	F2	F3	r	L	IVI	Р
10	29	58	15	29	4 ^{-0.004} -0.015	14	0.5	9	9_0_0	3	12	9.8	M5 x 0.8	3.6	19.8	14.6	24
15	i 34 67 20			29	5 ^{-0.004} -0.016	18	0.5	10	12 _{-0.043}	4	14	14.3	M5 x 0.8	7.6	24	17.1	29
Size		Q		w	Y												
10	M3 x	0.5 dep	th 6	35	18.5												
15	M3 x	0.5 dep	th 5	35	18.5												
27																	

SMC

Dimensions: With Vertical Auto Switch Unit (20, 30, 40)

• Following figures show actuators when B port is pressurized.



	∾↓
4-0.030	

Parallel key dimensions



ax.	
J 3) M	

D-M9□

D-S/T79□, S7P, R73/80□

																		[mm]
Size		4	Б	<u> </u>			D			E	E					J		K
Size	A1	A2			D1	(g7)	D2	D3	D4	E1 (h9)	E2	F1	F2	F3	J1	J2	J3	r.
20	42	79	29	30	6_	6-0.004 -0.016		0.5	10	14_0_0_043	4.5	13	18.3	M5 x 0.8	16	7.1	27.4	—
30	50	93	40	31	8_	B ^{-0.005} _0.020 22		1	12	16 _{-0.043}	5	14	26	M5 x 0.8	19	11.8	32.7	5.5
40	63	106	45	31	10_	10 ^{-0.005} -0.020		—	—	25_0_025_0	6.5	20	31.1	M5 x 0.8	28	15.8	44.1	9.5
Size	L	Р		Q		w	Y	_										
20	28	36	M4 x	0.7 de	oth 7	19.5	25	_										
30	31.5	43	M5 x (0.8 dep	th 10	19.5	25											
40	40	56	M5 x (0.8 dep	th 10	22.5	31											



Short shaft

СМ	angle adjustment unit (Built-in magnet)	-	→
. D.4.	n te me ne 07 % eithern unit is me eile de en enstelle		

Refer to page 39.

Refer to page 37 if either unit is needed separately.

Applicable Auto Switches/Refer to the Web Catalog or Best Pneumatics Catalog for further information on auto switches.

Appli-		Crossial	Electrical	light	Miring		Loodyr		Auto owit	ob model	Loodwire	Le	ad w	ire ler	ngth [m]	Dro wirod	Annlie	aabla
cable	Туре	function	entry	cator	(Output)		LUau V	Jilaye	Auto Swit	unnouer	tvne	0.5	1	3	5	None	connector		ad
size		unouon	onay	Indi	(Output)		DC	AC	Perpendicular	In-line	,ypo	(Nil)	(M)	(L)	(Z)	(N)	Connoctor	100	
					3-wire (NPN)		5 V,		M9NV	M9N			۲	۲	0	_	0	IC	
	Solid				3-wire (PNP)		12 V		M9PV	M9P	Oilproof		۲	۲	0	—	0	circuit	
	state			Vac	2-wire		12 V		M9BV	M9B	boowy duty		۲	۲	0	—	0	—	
For	auto	—		les	3-wire (NPN)		5 V,	_	S99V	S99	cord		—	۲	0	—	0		
10	switch		Grommot		3-wire (PNP)	24.11	12 V		S9PV	S9P			—	۲	0	—	0	circuit	Relay,
15			Giommer		2-wire	24 V	12 V		T99V	T99			—	۲	0		0	—	PLC
13	Pood			No			5 V, 12 V	5 V, 12 V, 24 V	—	90	Vinyl parallel cord		—	۲				IC	
	auto switch			140	2-wiro		5 V, 12 V, 100 V	5 V, 12 V, 24 V, 100 V	_	90A	Oiproof heavy-duty cord Vinyl parallel cord		—	۲			_	circuit	
				Voc	2-wire		_		_	97			—	۲					
				103				100 V	—	93A	Oilproof heavy-duty cord		—	۲					
					3-wire (NPN)		5 V,		M9NV	M9N				۲	0		0	IC	
	Solid				3-wire (PNP)		12 V		M9PV	M9P				۲	0		0	circuit	
	state		Grommet		2-wire		12 V		M9BV	M9B			٠	٠	0		0	—	
For	auto	—	Gronnier	Yes	3-wire (NPN)		5 V,	-	—	S79			—	۲	0		0	IC	
20	ewitch				3-wire (PNP)		12 V		—	S7P	Oilproof		—	٠	0		0	circuit r	Polov
20,	Switch				2-wire	24 V	12 V		_	T79	heavy-duty		_		0		0	_	PLC
40			Connector		2 1010		12 V		_	T79C	cord		_						1 20
40	Road		Grommet	Vac			_	100 V	_	R73			_		0			_	
	auto		Connector	103	2-wire			<u> </u>	—	R73C			—						
	switch		Grommet	No	2-wile		48 V, 100 V	100 V	_	R80				٠	0			IC circuit	
	Switch		Connector	140				24 V or less	_	R80C			—	٠				—	

* Auto switches are shipped together, but not assembled.

 $\ast\,$ Auto switches marked with "O" are produced upon receipt of order.

Rotating Angle with Angle Adjustment Unit

- Drawings below are viewed from the long shaft side.
- Chamfered positions illustrate the conditions of actuators when B port is pressurized.
- Operate within the adjustment range.

Rotating angle with angle adjustment unit

Size: 10, 15



The shaded area shows the rotation adjustment range.

Rotating Angle with Angle Adjustment Unit

Deteting angle (Dedu)	Size						
Rotating angle (Body)	10	15					
90°	0 to	85°					
180°	0 to 175°						



The shaded area shows the rotation adjustment range.

\nearrow	Adjustment range	For 90°	For 180°
1	Angle adjustment unit	0° to 80°	0° to 170°
2	Adjustment bolt	90°±10° (One side ±5°)	180°±10° (One side ±5°)

The rotating angle can be adjusted by moving the stopper blocks (A)

• Fig. 1 shows the default position of the angle adjustment unit.

* Make adjustments when pressure is not being applied.

Rotating Angle Adjustment Method



Fig. 1 Default position

Specifications, inner volume, and effective output are the same as those of the standard type. (→ p. 16, 17)

Weight

										[g]	
Size	1	0	1	5	2	20	3	0	40		
Rotating angle	90°	180°	90°	180°	90°	180°	90°	180°	90°	180°	
Basic type	27	26	47	46	110	107	203	197	378	360	
Vertical auto switch unit	1	5	2	20	28		;	38	43		
Angle adjustment unit	3	30	4	7	g	0	1	50	203		

and (B) shown in Fig. 1.

• Fig. 1 shows size 20.

Flange mounting bracket assembly is available as an option. For details, refer to page 36.

CRB -B/CRB -C Series

Construction: With Angle Adjustment Unit, With Vertical Auto Switch Unit and Angle Adjustment Unit

• Components other than those specified below are the same as those found on page 18.

With angle adjustment unit Size: 10, 15, 20, 30, 40

With vertical auto switch unit and angle adjustment unitSize: 10, 15Size: 20, 30, 40

A parallel key is used instead of chamfer for size 40. 1 9 5 4 1 1 1 2 7 8









Component Parts

No.	Description	Material	Note
1	Stopper ring	Aluminum alloy	
2	Stopper lever	Chrome molybdenum steel	
3	Lever retainer	Rolled steel	Zinc chromated
4	Rubber bumper	NBR	
5	Stopper block	Chrome molybdenum steel	Zinc chromated
6	Block retainer	Rolled steel	Zinc chromated
7	Сар	Resin	
8	Hexagon socket head cap screw	Stainless steel	Special screw
9	Hexagon socket head cap screw	Stainless steel	Special screw
10	Hexagon socket head cap screw	Stainless steel	Special screw
11	Joint		
10	Hexagon socket set screw	Stainless steel	Hexagon nut will be
12	Hexagon nut	Stainless steel	used for size 10 only.
13	Cross recessed round head screw	Stainless steel	
14	Magnet lever	_	
~ 1			

Dimensions: With Angle Adjustment Unit (10, 15)

• Following figures show actuators when B port is pressurized.









																	[mm]
Cine	A		в	C	;		D			E			F		v		БЛ
Size	A1	A2	В	С	C1	D1 (g7)	D2	D3	D4	E1 (h9)	E2	F1	F2	F3	n –	L .	IVI
10	29	48.5	15	19.5	3	4 ^{-0.004} -0.015	14	0.5	9	9_0.036	3	12	9.8	M5 x 0.8	3.6	19.8	14.6
15	34	59	20	21	3	5 ^{-0.004} -0.016	18	0.5	10	12_0.043	4	14	14.3	M5 x 0.8	7.6	24	17.1
Size	Р		Q														
10	24	M3 x 0.	5 depth	n 6													
15	29	M3 x 0.	5 depth	า 5													

CRB - B Series

Dimensions: With Angle Adjustment Unit (20, 30, 40)

• Following figures show actuators when B port is pressurized.











Parallel key dimensions

L1	b, b,	
b (h9)	h (h9)	L1
4_0,030	4_0,030	20



																	[mm]
Size	A R C		;		D			E			F			J			
Size	A1	A2	В	С	C1	D1 (g7)	D2	D3	D4	E1 (h9)	E2	F1	F2	F3	J1	J2	J3
20	42	74	29	25	4	6 ^{-0.004} -0.016	20	0.5	10	14_0 _0.043	4.5	13	18.3	M5 x 0.8	16	7.1	27.4
30	50	91	40	29	4.5	8 ^{-0.005} -0.020	22	1	12	16 _{-0.043}	5	14	26	M5 x 0.8	19	11.8	32.7
40	63	111.3	45	36.3	5	10 ^{-0.005} -0.020	30	—	—	25_0 _0.052	6.5	20	31.1	M5 x 0.8	28	15.8	44.1
Size	к	L	Р		Q												
20	—	28	36	M4 x 0	.7 dept	n 7											
30	5.5	31.5	43	M5 x 0.	8 depth	10											
40	9.5	40	56	M5 x 0.	8 depth	10											

Dimensions: With Vertical Auto Switch Unit and Angle Adjustment Unit (10, 15)

• Following figures show actuators when B port is pressurized.



D-97/93A, 90/90A

AS

*1 The angle is 60° when any of the following are used: D-90/90A/97/93A The angle is 69° when any of the following are used: D-S99(V)/T99(V)/S9P(V)

																[mm]
0:=0		Α	Б	6			D			E			F		v	
Size	A1	A2	В		D1 (g7)		D2	D3	D4	E1 (h9)	E2	F1	F2	F3		-
10	29	74.5	15	45.5	4_0	.004 .015	14	0.5	9	9_0.036	3	12	9.8	M5 x 0.8	3.6	19.8
15	34	85	20	47	5 ⁻⁰	.004 .016	18	0.5	10	12_0.043	4	14	14.3	M5 x 0.8	7.6	24
Size	м	P		Q	w	Y										
10	14.6	24	M3 x 0.	5 depth 6	35	18.5										
15	17.1	29	M3 x 0.	5 depth 5	35	18.5										

CRB -C Series

Dimensions: With Vertical Auto Switch Unit and Angle Adjustment Unit (20, 30, 40)

• Following figures show actuators when B port is pressurized.



D-M9□







L1	b	
b (h9)	h (h9)	L1
4_0_0_0	4_0_0_0	20



ø**A1** øE1

øD1

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h

A2

D-S/T79[,] S7P, R73/80[,]

																						[mm]
Sizo		Α	ь	<u> </u>		D	D		E	E		F	-		J		ĸ		Б	0	w	v
Size	A1	A2	Р		D1 (g7)	D2	D3	D4	E1 (h9)	E2	F1	F2	F3	J1	J2	J3	r.			u u	VV	T
20	42	100	29	51	6 ^{-0.004} -0.016	20	0.5	10	14_0_0_143	4.5	13	18.3	M5 x 0.8	16	7.1	27.4	—	28	36	M4 x 0.7 depth 7	19.5	25
30	50	117.5	40	55.5	8 ^{-0.005} -0.020	22	1	12	16 _{-0.043}	5	14	26	M5 x 0.8	19	11.8	32.7	5.5	31.5	43	M5 x 0.8 depth 10	19.5	25
40	63	137.2	45	62.2	10 ^{-0.005} -0.020	30	-	—	25_0 _0.052	6.5	20	31.1	M5 x 0.8	28	15.8	44.1	9.5	40	56	M5 x 0.8 depth 10	22.5	31

Vane Type Rotary Actuator CRB Series

Flange Dimensions/Part Nos.

Flange assembly for size 10 Part no.: P211070-2



Flange assembly for size 15 Part no.: P211090-2



Flange assembly for size 20 Part no.: P211060-2



Flange assembly for size 30 Part no.: P211080-2



CRB Series Component Unit With Vertical Auto Switch Unit, Angle Adjustment Unit

With Vertical Auto Switch Unit and Angle Adjustment Unit

CRB Series Various units can be mounted to a vane type rotary actuator.





* The combination of the auto switch unit and angle adjustment unit is available as standard.

The items marked with ★ are additional parts required for connection (joint unit parts), and the items marked with ◆ are unnecessary. * Use a unit part number when ordering joint unit separately.

Part Number for Vertical Auto Switch Unit

	For D	-M9□	Excluding D-M9						
Size	Vartical auto switch unit*1	Switch block unit	Vortical auto gwitch unit	Switch block unit*2					
	vertical auto switch unit	Common to right-hand and left-hand	vertical auto switch unit	Right-hand	Left-hand				
10	P611070-1M	D911010 9M	P611070-1	B611070.8	B611070.0				
15	P611090-1M	FOLIDIO-OW	P611090-1	F611070-8	F611070-9				
20	P611060-1M	D911020 9M	P611060-1	De11	11060.9				
30	P611080-1M	F611030-6W	P611080-1	FOIL	000-8				
40	P611010-1M	P811010-8M	P611010-1	P611010-8	P611010-9				

Part Number for Angle Adjustment Unit

Cine	Angle edivetreent wit	Vertical auto switch unit,	Angle adjustment unit*1	laint unit*3
Size	Angle adjustment unit	For D-M9□	Excluding D-M9	
10	P811010-3	P811010-4M	P811010-4	P211070-10
15	P811020-3	P811020-4M	P811020-4	P211090-10
20	P811030-3	P811030-4M	P811030-4	P211060-10
30	P811040-3	P811040-4M	P811040-4	P211080-10
40	P811050-3	P811050-4M	P811050-4	P211010-10

*1 An auto switch will not be included, please order it separately.

*2 Auto switch unit comes with one right-hand and one left-hand switch blocks that are used for addition or when the switch block is damaged. Since the solid state auto switch for sizes 10 and 15 requires no switch block, the unit part number will be the P211070-13.

*3 The joint unit is necessary when adding an angle adjustment unit to a vertical auto switch unit, or when adding a vertical auto switch unit to an angle adjustment unit.

CRB Series Auto Switch Mounting

Auto Switch Proper Mounting Position (at Rotation End Detection)

CDRB10, 15 Size: 10, 15 CDRB20, 30 Size: 20, 30, 40





	Solid state auto switch	
Size	D-M9	
	Α	
10	6	
15	6	
20	6	
30	6	
40	6	

Since the figures in the table on the left are provided as a guideline only, they cannot be guaranteed. Adjust the auto switch after confirming the operating conditions in the actual setting.

Proper tightening torque: 0.05 to 0.15 [N·m]

Operating Range and Hysteresis

[mm]

* Operating range: θ m

The range is between the position where the auto switch turns ON as the magnet inside the auto switch unit moves rotationally and the position where the auto switch turns OFF as the magnet moves rotationally in the same direction.

* Hysteresis range: θ d

The range is between the position where the auto switch turns ON as the magnet inside the auto switch unit moves rotationally and the position where the auto switch turns OFF as the magnet moves rotationally in the opposite direction.



D-M9□

Size	θ m: Operating range	θ d: Hysteresis range
10, 15	170°	20°
20, 30	100°	15°
40	86°	10°

D-S/T99(V), S9P(V), S/T79□, S7P, D-97/93A, 90/90A, R73/80□

Size	θ m : Operating range	θ d: Hysteresis range
10, 15	110°	10°
20, 30	90°	10
40	52°	8 °

* Since the figures in the table above are provided as a guideline only, they cannot be guaranteed. Adjust the auto switch after confirming the operating conditions in the actual setting.

Operating Angle and Hysteresis Angle



	Solid state auto switch					
Size	D-M9					
	Operating angle $[\theta m]$	Hysteresis angle				
10	36°	5°				
15	36°	5°				
20	20°	5°				
30	20°	5°				
40	20°	5°				

Since the figures in the table on the left are provided as a guideline only, they cannot be guaranteed. Adjust the auto switch after confirming the operating conditions in the actual setting.

Proper tightening torque: 0.05 to 0.15 [N·m]

How to Change the Auto Switch Detecting Position

* When setting the detecting position, loosen the cross recessed round head screw a bit and move the auto switch to the preferred position and then tighten again and fix it. At this time, if tightened too much, screw can become damaged and unable to fix position.

Proper tightening torque: 0.4 to 0.6 [N·m] When tightening the cross recessed round head screw, take care that the auto switch does not tilt.



D-S/T99(V), S9P(V), S/T79□, S7P, D-97/93A, 90/90A, R73/80□

CRB - A/C Series

Auto Switch Mounting: Sizes 10 to 40 (D-M9⁻)

External view and descriptions of auto switch unit



3. Switch holder securing

- After the actuated position has been adjusted with the cross recessed round head screw, use the auto switch.
- $\ast\,$ When tightening the screw, take care that the auto switch does not tilt.

3. Switch holder securing

After the actuated position has been adjusted with the cross recessed round head screw, use the auto switch.

* When tightening the screw, take care that the auto switch does not tilt.

Auto Switch Mounting CRB -A/C Series

Auto Switch Mounting: Sizes 10, 15 (D-S/T99(V), S9P(V), 97/93A, 90/90A)

External view and descriptions of auto switch unit

The following shows the external view and typical descriptions of the auto switch unit.



Solid state auto switch

<Applicable auto switch>

3-wire type.....D-S99(V), S9P(V) 2-wire type.....D-T99(V)

1. Switch block detaching

Remove the cross recessed round head screw (1) to detach the switch block.



2. Auto switch mounting

- Secure the auto switch with the cross recessed round head screw (1) and holding block. Proper tightening torque: 0.4 to 0.6 [N-m]
- Since the holding block moves inside the groove, move it to the mounting position beforehand.
 After the actuated position has been adjusted with the cross recessed round head screw (1), use the auto switch.



Reed auto switch

<Applicable auto switch> D-97/93A (With indicator light) D-90/90A (Without indicator light)

1. Preparations

Loosen the cross recessed round head screw (2) (About 2 to 3 turns).

 This screw has been secured temporarily at shipment.



- 2. Auto switch mounting Insert the auto switch until it is in contact with the switch block hole.
 - For the D-97/93A, insert the auto switch in the direction shown in the figure on the right.
 Since the D-90/90A is a round

type, it has no directionality.



3. Auto switch securing

Tighten the cross recessed round head screw (2) to secure the auto switch. Proper tightening torque: 0.4 to

0.6 [N·m] · After the actuated position has

been adjusted with the cross recessed round head screw (1), use the auto switch.



CRB - A/C Series

Auto Switch Mounting: Sizes 20 to 40 (D-S/T79, S7P, R73/80)

Reed auto switch

D-R73, R73C

D-R80, R80C

External view and descriptions of auto switch unit



Mounting Procedure

<Applicable auto switch> Solid state auto switch D-S79, S7P D-T79, T79C

1. Auto switch mounting Loosen the cross recessed round head screw (2), and insert the arm of the auto switch.

2. Auto switch securing

Set the auto switch so that it is in contact with the switch block, and tighten the cross recessed round head screw (2).

* Proper tightening torque: 0.4 to 0.6 [N·m]

3. Switch holder securing

After the actuated position has been adjusted with the cross recessed round head screw (1), use the auto switch.

∗ Proper tightening torque: 0.4 to 0.6 [N·m]





Auto Switch Adjustment

Rotation range of the output shaft with single flat (key for size 40 only) and auto switch mounting position <Applicable models/Size: 10, 15, 20, 30, 40>

Rotating angle: 90°



- * Solid-lined curves indicate the rotation range of the output shaft with single flat (key). When the single flat (key) is pointing to the END ① direction, the switch for rotation END ① will operate, and when the single flat (key) is pointing to the END 2 direction, the switch for rotation END 2 will operate.
- Broken-lined curves indicate the rotation range of the built-in magnet. Operating angle of the switch can be decreased by either moving the switch for rotation END ① clockwise or moving the switch for rotation END 2 counterclockwise. Auto switch in the figures on the left is at the most sensitive position.
- * Each auto switch unit comes with one right-hand and one left-hand switches.

END 2

Prior to Use Auto Switch Connections and Examples

Sink Input Specifications



Source Input Specifications

Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

Examples of AND (Series) and OR (Parallel) Connections

When using solid state auto switches, ensure the application is set up so the signals for the first 50 ms are invalid. Depending on the operating environment, the product may not operate properly.

3-wire AND connection for NPN output

(Using relays)



3-wire AND connection for PNP output (Using relays)



2-wire AND connection





Example: Power supply is 24 VDC Internal voltage drop in auto switch is 4 V.

(Performed with auto switches only)





2-wire OR connection



(Solid state) When two auto switches are connected in parallel, malfunction may occur because the load voltage will increase

when in the OFF state.

Load impedance = 1 mA x 2 pcs. x 3 kΩ = 6 V

Example: Load impedance is 3 kΩ. Leakage current from auto switch is 1 mA.

3-wire OR connection for NPN output



3-wire OR connection for PNP output



(Reed)

Because there is no current leakage, the load voltage will not increase when turned OFF However, depending on the number of auto switches in the ON state, the indicator lights may sometimes grow dim or not light up, due to the dispersion and reduction of the current flowing to the auto switches



CRB Series **Specific Product Precautions**

Be sure to read this before handling the products. Refer to the back cover for safety instructions. For rotary actuator and auto switch precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" on the SMC website: http://www.smcworld.com

How to Mount Loads

How to connect a load directly to a single flat shaft

To secure the load, select a bolt of an appropriate size from those listed in tables 1 and 2 by taking the shaft's single flat bearing stress strength into consideration.

Table 1 Directly Fixed with Bolts (Refer to Fig. 1.)

Size	Shaft dia.	Bolt size					
10	4	M4 or larger					
15	5	ME or lorger					
20	6	ivis or larger					
30	8	M6 or larger					

Table 2 Fixed with a Holding Block (Refer to Fig. 2.)

Size	Shaft dia.	Bolt size Plate thickness		
10	4	MO or lorger	2 or wider	
15	5	MS OF larger	2.3 or wider	
20	6	M4 or larger	3.6 or wider	
30	8	M5 or larger	4 or wider	

The plate thickness (t) in the table above indicates a reference value when a carbon steel is used. Besides, we do not manufacture a holding block.



Holding block

Mounting

Refer to the table below when tightening the mounting bolts.

Mounting 1



Size	Bolt	Recommended tightening torque [N·m]
10	M3	0.63
15	M3	0.63
20	M4	1.50
30	M5	3.0
40	M5	3.0

* Refer to the Dimensions for Q1 and Q3 dimensions.

Mounting 2



Size	Bolt	Recommended tightening torque [N·m]
10	M2.5	0.36
15	M2.5	0.36
20	M3	0.63
30	M4	1.50
40	M4	1.50

Refer to the Dimensions for Q1 and Q2 dimensions.

Only for standard CRB without auto switch

Adjustment

Do not apply a load when adjusting the rotating angle.

Example) For 180 degrees

- 1. Set the adjustment bolt B while supplying pressure from the A port.
- pressure from the B port. Chamfe

B port

2. Set the adjustment bolt A while supplying





Body mounting 2 (Body through-hole)

A port 43



A Safety Instructions Be sure to read the "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" before use.

U	ΝI	Т	С	0	Ν	۷	Е	R	S	I	0	N S	S
---	----	---	---	---	---	---	---	---	---	---	---	-----	---

	unit	conversion	result
length	m	x 3.28	ft
	mm	x 0.04	in
mass	g	x 0.04	ΟZ
volume	cm ³	÷ 16.387	in ³
	L	x 61.024	in ³
speed	mm/s	÷ 25.4	in/s
pressure	MPa	x 145	psi
	kPa	÷ 6.895	psi
temperature	°C	x1.8 then add 32	°F
torque	N∙m	x 0.738	ft-lb
force	Ν	÷ 4.448	lbf
flow	L/min	÷ 28.317	cfm

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