GRC

Table type rotary actuator

Oscillation/rotational drive

Size 5/10/20/30/50/80

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Overview

The table rotary actuator with rack and pinion realizes high load direct mounting and high position accuracy due to bearing guide.

CONTENTS

CKD

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

High load/high accuracy positioning

The table rotary actuator GRC series realizes high load, direct mounting and high position accuracy thanks to a bearing guide.

1 Flexible design

Comes with an angle adjustment bolt with rubber cushion for adjusting the oscillation angle.

● The industry's first compact type GRC-5 Torque 5 (0.5 N·m)

Unprecedented miniature sizes
5/10/20/30/50/80 sizes available.

● Standard and high accuracy are available with the same dimension

Model changes for lines (standard or high accuracy) can be conducted quickly.
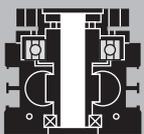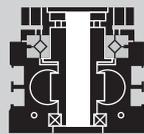
Basic **GRC**	High accuracy **GRC-K**
Reliable operation with radial bearing	Cross roller bearing used for high accuracy / high load

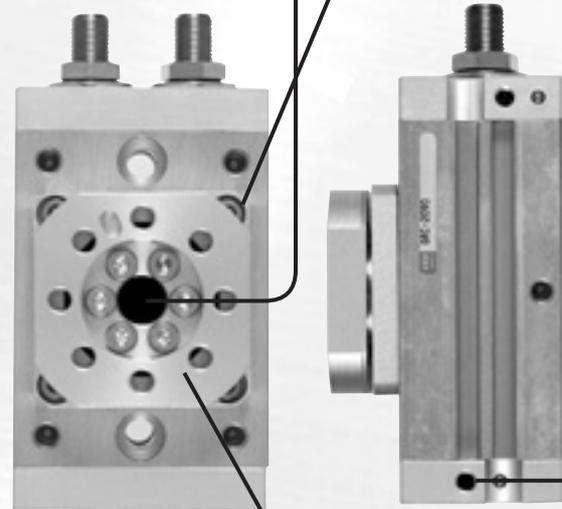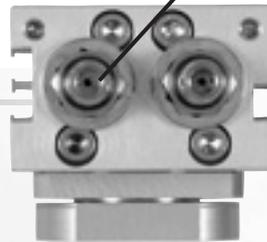● **90° and 180° specifications are available separately.**

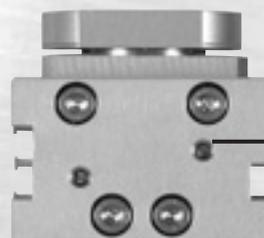A more compact form can be achieved by selecting a 90° oscillation angle.

Rotary table enabling direct mount of load

GRC SERIES variations

	Basic GRC	High accuracy GRC-K
With switch	●	●
Size (torque value at 0.5 MPa)		
5 (0.5 N·m)	●	-
10 (1.0 N·m)	●	●
20 (2.0 N·m)	●	●
30 (3.0 N·m)	●	●
50 (5.2 N·m)	●	●
80 (8.1 N·m)	●	●
Oscillating angle		
90°	●	●
180°	●	●

CKD

GRC Series

TABLE TYPE ROTARY ACTUATOR

Rack and pinion
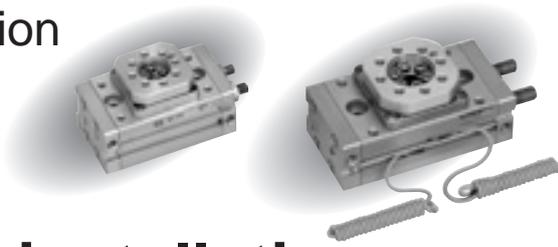
2 Easy installation

● Piping port direction can be selected from 3 sides.

● Large hollow diameter keeps piping and wiring simple.

Hollow diameter ø 4 to ø 17 is available.

● Positioning spigots for the table top (4 positions) and the body bottom (1 position) are available.
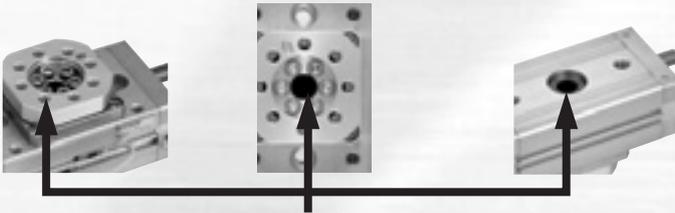
Socket and spigot for positioning

3 Easy operation

● Low speed operation of **1.5** seconds/90°

Low speed operation realized due to large pinion diameter and long piston stroke length.

Long piston stroke length

Large pinion diameter

Applications

Cassette reverse rotation

Hand reverse rotation

Parts supply

GRC Series

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Variation and option selection table

◎ : Option variation (check category 2)
○ : C5 compatible (check category 3)
△ : Available depending on conditions (estimation)
▨ : Not available

			Clean room specifications	
			Vacuum treatment	Vacuum treatment
		Code	P73	P53
Variation	Basic	Blank	◎	○
	High accuracy	K	◎	○
	Fine speed	F	◎	
Port thread	NPT (50, 80)	N	○	○
	G (50, 80)	G	○	○

CKD

MEMO

SCPD3

SCM

SSD2

MDC2

SMG

LCM

LCR

LCG

LCX

STM

STG

STR2

MRL2

GRC

Cylinder switch

MN3E
MN4E

4GA/B

M4GA/B

MN4GA/B

F.R (module unit)

Clean F.R

Precision R

Press gauge
Diff. press gauge

Electro-pneumatic R

Speed controller

Auxiliary valve

Fitting/tube

Clean air unit

Pressure sensor

Flow rate sensor

Valve for air blow

Ending

Table rotary actuator
Basic/high accuracy

GRC/GRC-K Series

● Size: 5/10/20/30/50/80

JIS symbol

RoHS CAD

Structure and material restriction

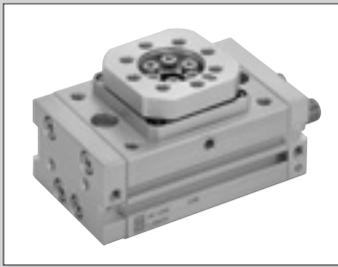| Structure		Material restriction			Model No.
P7 Series	Vacuum treatment				**P73**
P5 Series (custom order product)	Vacuum treatment	Copper-based materials prohibited	Silicon-based materials prohibited	Halogen-based materials prohibited (fluorine, chlorine, bromine)	**P53**

Specifications

Descriptions			GRC-5	GRC-10 GRC-K-10	GRC-20 GRC-K-20	GRC-30 GRC-K-30	GRC-50 GRC-K-50	GRC-80 GRC-K-80
Size			5	10	20	30	50	80
Theoretical torque [1]		N·m	0.5	1.0	2.0	3.0	5.2	8.1
Actuation			Rack and pinion mechanism					
Working fluid			Compressed air					
Max. working pressure		MPa	1.0					
Min. working pressure [2]	Basic		0.1					
MPa	High accuracy		−	0.15			0.1	
Proof pressure		MPa	1.6					
Ambient temperature		°C	0 (32°F) to 60 (no freezing)					
Port size			M5				Rc1/8	
Port size (relief port)			M5					
Cushion			Rubber cushion					
Allowable energy absorption J	Basic/high accuracy		0.005	0.008	0.03		0.04	0.11
Lubrication			Not available					
Volumetric capacity [3]	cm³	90°	1.3	3.5	7.0	10.5	18.1	28.3
		180°	3.4	6.6	13.4	20.0	34.4	53.7
Oscillating angle adjusting range [4]		90°	0° to 100°					
		180°	90° to 190°					
Oscillating time adjusting range [5]		s/90°	0.2 to 1.5					
Table deflection (reference value) [6]		Basic	±0.17°			±0.23°	±0.26°	±0.32°
		High accuracy	−	±0.026°				

*1: The theoretical torque is for the working pressure of 0.5 MPa.
*2: To push through the rubber cushion in the basic and high accuracy type, the working pressure of 0.3 MPa or greater is required.
*3: Volumetric capacity is for the maximum oscillating angle within the adjusting range.
*4: The oscillating angle adjusting range indicates the values when adjusted by the stopper bolts on both sides.
*5: The oscillating time adjusting range is for the working pressure of 0.5 MPa.
*6: Displacements of the table at 100 mm away from the center of rotation are shown on the technical data (page 302).

CKD

Switch specifications

● 1-color/2-color display

Descriptions	Proximity 2-wire				Proximity 3-wire			
	T1H/T1V	T2H/T2V	T2YH/T2YV	T2WH/T2WV	T3H/T3V	T3PH/T3PV	T3YH/T3YV	T3WH/T3WV
Applications	Programmable controller, relay, small solenoid valve	Programmable controller			Programmable controller, relay			
Output method	-				NPN output	PNP output	NPN output	
Power supply voltage	-				10 to 28 VDC			
Load voltage	85 to 265 VAC	10 to 30 VDC		24 VDC ±10%	30 VDC or less			
Load current	5 to 100 mA	5 to 20 mA (*2)			100 mA or less		50 mA or less	
Indicator lamp	LED (Lit when ON)	LED (Lit when ON)	Red/green LED (Lit when ON)	Red/green LED (Lit when ON)	LED (Lit when ON)	Yellow LED (Lit when ON)	Red/green LED (Lit when ON)	
Leakage current	1 mA or less with 100 VAC 2 mA or less with 200 VAC	1 mA or less			10 μA or less			
Weight g	1 m: 33 3 m: 87 5 m: 142	1 m: 18 3 m: 49 5 m: 80	1 m: 33 3 m: 87 5 m: 142	1 m: 18 3 m: 49 5 m: 80	1 m: 18 3 m: 49 5 m: 80		1 m: 33 3 m: 87 5 m: 142	1 m: 18 3 m: 49 5 m: 80

*1: Refer to page 309 for detailed switch specifications and dimensions.
*2: Max. load current: 20mA at 25°C.The current is lower than 25 mA if the operating ambient temperature around the switch is higher than 20°C.
    (60 to 5 mA at 10°C)

Minimum oscillating angle with switch

Size	5	10	20	30	50	80
T proximity T 2-color display	20°	15°	17.5°	12.5°	12.5°	12.5°

Theoretical torque table

(Unit: N·m)

Size	Working pressure (MPa)									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
5	-	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
10	-	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
20	-	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
30	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0
50	1.0	2.1	3.1	4.1	5.2	6.2	7.3	8.3	9.3	10.4
80	1.6	3.2	4.9	6.5	8.1	9.7	11.3	13.0	14.6	16.2

Product weight

(Unit: kg)

Oscillating angle / Model No.	90°		180°		Outer mount shock absorber weight	Switch weight (per switch)
	Basic	High accuracy	Basic	High accuracy		
GRC- 5	0.39	-	0.43	-	0.20	0.02
GRC-10	0.48	0.50	0.56	0.58	0.30	
GRC-20	0.78	0.80	0.88	0.90	0.40	
GRC-30	1.05	1.30	1.25	1.50	0.50	
GRC-50	1.80	2.10	2.10	2.40	0.60	
GRC-80	2.30	2.60	2.70	3.00	0.70	

GRC/GRC-K Series

How to order

● Without switch (Magnet for switch incorporated)

GRC - 10 - 90 ———————— P73

● With switch (Magnet for switch incorporated)

GRC - 30 - 180 - T2H* - R - P73

- Ⓐ Model No.
- Ⓑ Size
- Ⓒ Oscillating angle
- Ⓓ Switch model No.
- Ⓔ Switch quantity
- Ⓕ Clean room Specifications

Code	Content
Ⓐ Model No.	
GRC	Basic
GRC-K	High accuracy

Ⓑ Size (0.5 MPa)			
Model No.	Theoretical torque	GRC	GRC-K
5	0.5 [N·m]	●	-
10	1.0 [N·m]	●	●
20	2.0 [N·m]	●	●
30	3.0 [N·m]	●	●
50	5.2 [N·m]	●	●
80	8.1 [N·m]	●	●

Ⓒ Oscillating angle	
90	90°
180	180°

Ⓓ Switch model No.						
Lead wire straight	Lead wire L-shaped	Contact	Voltage AC	Voltage DC	Display	Lead wire
T1H*	T1V*	Proximity	●		1-color display	2 wires
T2H*	T2V*	Proximity		●	1-color display	2 wires
T3H*	T3V*	Proximity		●	1-color display	3 wires
T3PH*	T3PV*	Proximity		●	1-color display	3 wires
T2WH*	T2WV*	Proximity		●	2-color display	2 wires
T2YH*	T2YV*	Proximity		●	2-color display	2 wires
T3WH*	T3WV*	Proximity		●	2-color display	3 wires
T3YH*	T3YV*	Proximity		●	2-color display	3 wires

***** Lead wire length	
Blank	1m (standard)
3	3 m (option)
5	5 m (option)

Ⓔ Switch quantity	
R	1 With clockwise rotation
L	1 With counterclockwise rotation
D	2

Ⓕ Clean room specifications		
	Structure	Material restriction
P73	Vacuum treatment	-
P53	Vacuum treatment	Copper-based/silicon-based/halogen-based materials (fluorine, chlorine, bromine) are prohibited

⚠ Precautions for model No. selection

*1: Port position of basic high accuracy is provided on side surface. Other ports are plugged.
*2: "P53" is a custom order product.
*3: Refer to page 284 for combination of variations/options.

[Example of model No.]
GRC-10-180-T2V-D-P73
Double acting
Ⓐ Model No. : Basic
Ⓑ Size : 10
Ⓒ Oscillating angle : 180°
Ⓓ Switch model No. : Proximity/2 wires
Radial lead wire with 1 m lead wire
Ⓔ Switch quantity : 2
Ⓕ Clean room specifications: Vacuum treatment

CKD

MEMO

GRC/GRC-K Series

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
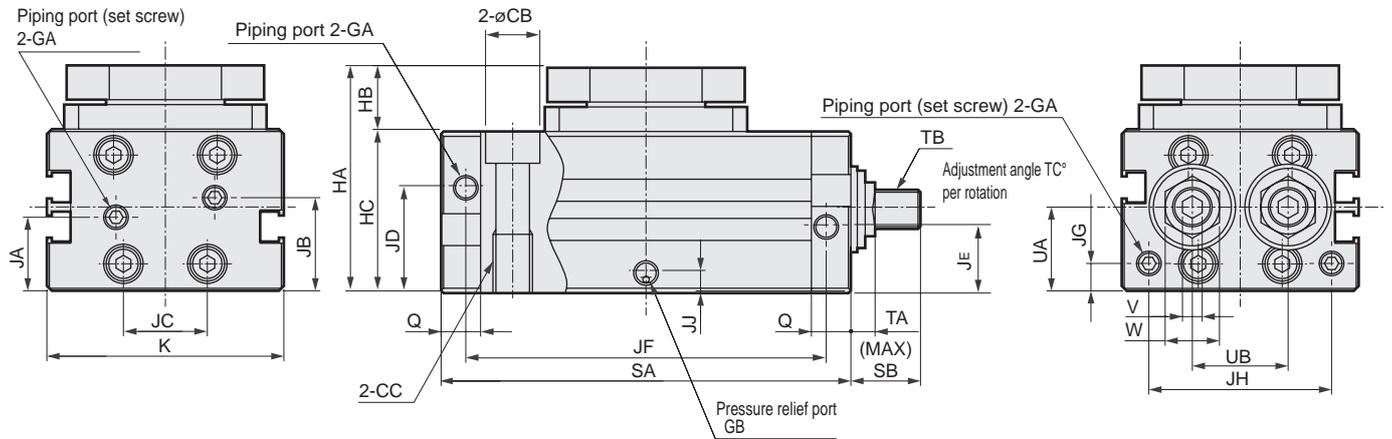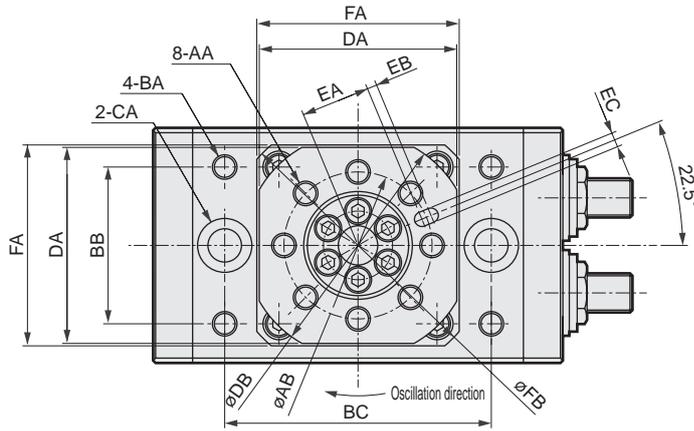Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
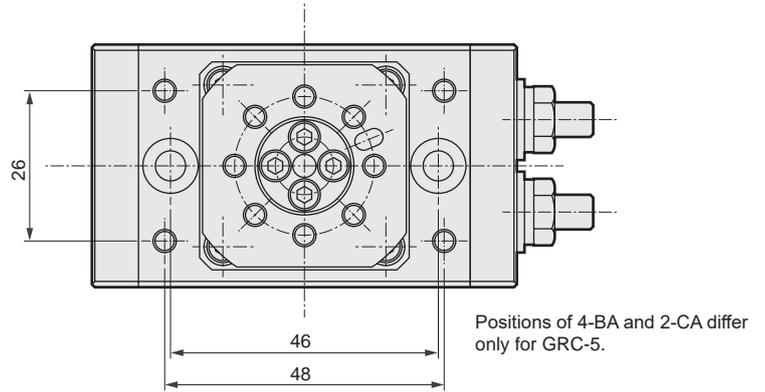Valve for air blow
Ending

Dimensions (size 5, 10 N·m)

● GRC-5, 10 basic
● GRC-K-5, 10 high accuracy

Size	AA	AB	BA	BB	BC	CA	CB	CC	DA	DB	EA	EB	EC	FA	FB	GA
5	M4 Depth 7	24	M4 Depth 6.5	26	48	Spot face ø9.5 depth 5.4	5.2	M6 Depth 12	35	42	11	2	3 $^{+0.07}_{+0.02}$ depth 3.5	36	48h9	M5 depth 4
10	M5 Depth 7	30	M5 Depth 7	32	54	Spot face ø11 depth 6.5	6.6	M8 Depth 12	40	46	14	2	3 $^{+0.07}_{+0.02}$ depth 3.5	41	54h9	M5 depth 4

Size	PA	PB	Q	SA 90°	SA 180°	SB	TA	TB	TC	UA	UB	V	W	X
5	12H9	3.5	8	73	90	14	6.5	M6 × 1	8.7	16.6	16	3	10	12.6
10	18H9	2.5	8	83	107	15	4.9	M8 × 0.75	4.9	17.1	19.4	4	11	13.1

CKD

Dimensions (size 5, 10 N·m)

SCPD3

SCM

SSD2

MDC2

SMG

LCM

LCR

LCG

LCX

STM

STG

STR2

MRL2

GRC

Cylinder Switch

MN3E MN4E

4GA/B

M4GA/B

MN4GA/B

F.R.(module unit)

Clean F.R

Precision R

Press gauge Diff. press gauge

Electro-pneumatic R

Speed controller

Auxiliary valve

Fitting/ tube

Clean air unit

Pressure sensor

Flow rate sensor

Valve for air blow

Ending

26

46

48

Positions of 4-BA and 2-CA differ only for GRC-5.

● GRC-5, 10 basic
● GRC-K-5, 10 high accuracy

A

B

øMA

øNA

MB

NB

NC

A section details

PB

øPA

B section details

8

X

RD

LD

Switch mounting position

	GB	HA	HB	HC	JA	JB	JC	JD	JE	JF		JG	JH	JJ	K	MA	MB	NA	NB	NC
										90°	180°									
	M5 depth 4	43	13	30	15	18	16	21	11.5	65	82	5.6	29	4.1	42	17H9	2	4H9	5.5	2.4
	M5 depth 3.5	46	13	33	15	19	20	21.5	12	75	99	5.6	37	4.1	48	22H9	2	8H9	5.5	2.4

LD		RD	
90°	180°	90°	180°
21.5	25.5	22.5	25.5
24.5	30.5	26	30.5

CKD

291

GRC/GRC-K Series

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Dimensions (size 20 - 80 N·m)

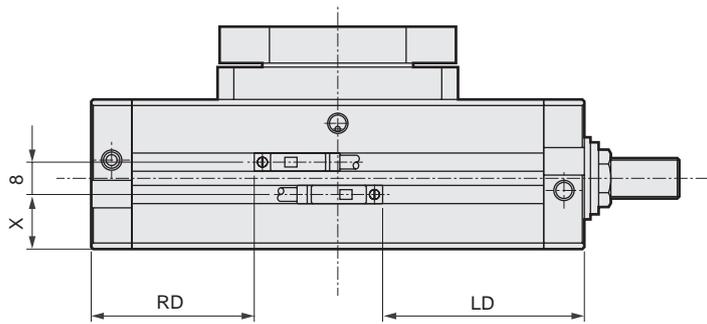● GRC-20 to 80 basic
● GRC-K-20 to 80 high accuracy

Size	AA	AB	BA	BB	BC	CA	CB	CC	DA	DB	EA	EB	EC	FA	FB	GA	
20	M6 Depth 9	36	M6 Depth 8	42	62	Spot face ø11 depth 6.5	6.9	M8 Depth 12	47	55	17	2	4 +0.07 +0.02 depth 4.5	48	64h9	M5 depth 4	
30	M6 Depth 9	44	M6 Depth 8	52	74	Spot face ø14 depth 8.6	8.7	M10 Depth 15	58	67	21	2	4 +0.07 +0.02 depth 4.5	59	78h9	M5 depth 4	
50	M8 Depth 13	50	M8 Depth 12	60	88	Spot face ø17.5 depth 10.8	10.5	M12 Depth 18	66	74	24	2	5 +0.07 +0.02 depth 5.5	69	92h9	Rc1/8	
80	M8 Depth 13	54	M8 Depth 12	66	94	Spot face ø17.5 depth 10.8	10.5	M12 Depth 18	69	80	26	2	5 +0.07 +0.02 depth 5.5	76	101h9	Rc1/8	

Size	PA	PB	Q	SA 90°	SA 180°	SB	TA	TB	TC	UA	UB	V	W	X
20	20H9	2.5	10	96	125	17	6.1	M10 × 1	5.7	17.6	24	5	13	13.6
30	26H9	2.5	10	121	165	25	6.1	M10 × 1	3.8	17.6	34	5	13	13.6
50	28H9	4.5	15	144	192	29.5	7	M12 × 1	3.5	24.6	35	6	14	20.6
80	36H9	3.5	15	150	198	29.5	7	M12 × 1	3.5	27.1	36	6	14	23.1

CKD

Dimensions (size 20 - 80 N·m)

● GRC-20 to 80 basic
● GRC-K-20 to 80 high accuracy

Position of GB differs only for GRC-30 and GRC-K-30.

GRC-30/GRC-K-30
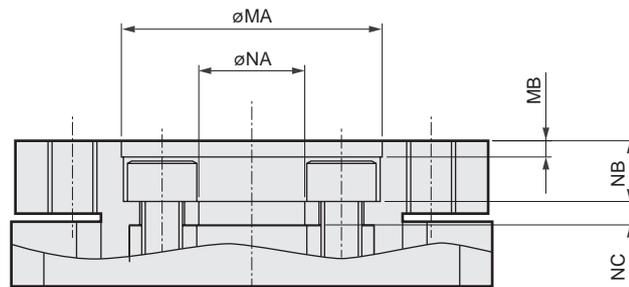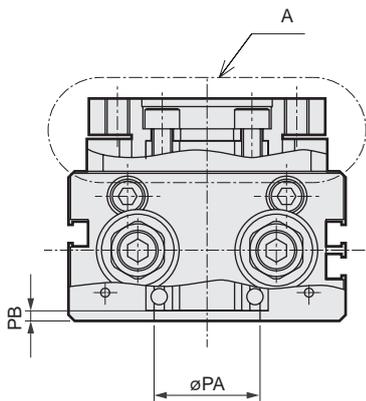
A section details

Switch mounting position

GB	HA	HB	HC	JA	JB	JC	JD	JE	JF 90°	JF 180°	JG	JH	JJ	K	MA	MB	NA	NB	NC
M5 depth 4	53	16	37	14.5	20.5	27	22	13	86	115	5.6	47	5.8	58	27H9	2	11H9	6.5	3.9
M5 depth 4	55	18	37	14.5	20.5	37	22	13	111	155	5.6	57	6.2	68	32H9	2	13H9	7.5	2.9
M5 depth 4	71	23	48	21.5	27.5	36	32.5	17.5	129	177	8.1	58	8.5	75	37H9	4	14H9	10.5	5.3
M5 depth 4	80	25	55	24	30	40	35	19	135	183	8.1	58	12.9	80	40H9	3	17H9	9.5	4.4

LD 90°	LD 180°	RD 90°	RD 180°
31	37.5	31	37.5
38.5	49.5	40	49.5
48.5	61	51	61
51.5	64	54	64

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending
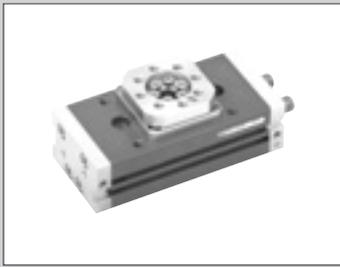
Table type rotary actuator
Fine speed/high accuracy fine speed

GRC-F/GRC-KF Series

● Size: 5/10/20/30/50/80

JIS symbol

RoHS CAD

Structure and material restriction

	Structure	Model No.
P7 Series	Vacuum treatment	P73

Specifications

Descriptions			GRC-F-5	GRC-F-10 GRC-KF-10	GRC-F-20 GRC-KF-20	GRC-F-30 GRC-KF-30	GRC-F-50 GRC-KF-50	GRC-F-80 GRC-KF-80
Size			5	10	20	30	50	80
Theoretical torque *1		N·m	0.5	1.0	2.0	3.0	5.2	8.1
Actuation			Rack and pinion mechanism					
Working fluid			Compressed air				
Max. working pressure		MPa	1.0				
Min. working pressure	Basic		0.1				
MPa	High accuracy		–	0.15			0.1	
Proof pressure		MPa	1.6				
Ambient temperature		°C	5 to 60				
Allowable absorbed energy		J	0.005	0.008	0.03		0.04	0.11
Cushion	Basic high accuracy		Rubber cushion				
Oscillating angle adjusting range *2	Basic high accuracy	90° specifications	0° to 100°				
		180° specifications	90° to 190°				
Oscillating time adjusting range		s/90°	0.2 to 25				
Port size			M5				Rc1/8	
Port size (relief port)			M5				
Lubrication			Lubrication not possible				

*1: The theoretical torque is for the working pressure of 0.5 MPa.
*2: The angle adjusting range applies when adjusted with the stopper bolts (shock absorbers) on both sides.
     If a shock absorber is provided, the fine speed specifications will not apply to the shock absorber section.

Switch specifications

● 1-color/2-color display

Descriptions	Proximity 2-wire				Proximity 2-wire			
	T1H/T1V	T2H/T2V	T2YH/T2YV	T2WH/T2WV	T3H/T3V	T3PH/T3PV	T3YH/T3YV	T3WH/T3WV
Applications	Programmable controller, relay, small solenoid valve	Programmable controller			Programmable controller, relay			
Output method	-				NPN output	PNP output	NPN output	
Power supply voltage	-				10 to 28 VDC			
Load voltage	85 to 265 VAC	10 to 30 VDC		24 VDC ±10%	30 VDC or less			
Load current	5 to 100 mA (*2)	5 to 20 mA (*2)			100 mA or less		50 mA or less	
Indicator lamp	LED (Lit when ON)	LED (Lit when ON)	Red/green LED (Lit when ON)	Red/green LED (Lit when ON)	LED (Lit when ON)	Yellow LED (Lit when ON)	Red/green LED (Lit when ON)	
Leakage current	1 mA or less with 100 VAC 2 mA or less with 200 VAC	1 mA or less			10 µA or less			
Weight g	1 m: 33 3 m: 87 5 m: 142	1 m: 18 3 m: 49 5 m: 80	1 m: 33 3 m: 87 5 m: 142	1 m: 18 3 m: 49 5 m: 80	1 m: 18 3 m: 49 5 m: 80		1 m: 33 3 m: 87 5 m: 142	1 m: 18 3 m: 49 5 m: 80

*1: Refer to page 309 for detailed switch specifications and dimensions.
*2: Max. load current: 20mA at 25°C.The current is lower than 25 mA if the operating ambient temperature around the switch is higher than 20˚C.
     (60 to 5 mA at 10°C)

CKD

How to order

● Without switch (Magnet for switch incorporated)

(GRC-F)-(10)-(90)————————(P73)

● With switch (Magnet for switch incorporated)

(GRC-F)-(30)-(180)-(T2H*)-(R)-(P73)

Ⓐ Model No.

Ⓑ Size

Ⓒ Oscillating angle

Ⓓ Switch model No.

Ⓔ Switch quantity

Ⓕ Clean room specifications

Code	Content
Ⓐ Model No.	
GRC-F	Basic
GRC-KF	High accuracy

Ⓑ Size			
Model No.	Theoretical torque	GRC-F	GRC-KF
5	0.5 [N·m]	●	-
10	1.0 [N·m]	●	●
20	2.0 [N·m]	●	●
30	3.0 [N·m]	●	●
50	5.2 [N·m]	●	●
80	8.1 [N·m]	●	●

Ⓒ Oscillating angle	
90	90°
180	180°

Ⓓ Switch model No.						
Lead wire straight	Lead wire L-shaped	Contact	Voltage AC	Voltage DC	Indicator	Lead wire
T1H*	**T1V***		●			2 wires
T2H*	**T2V***			●	1-color display	2 wires
T3H*	**T3V***	Proximity		●	1-color display	3 wires
T3PH*	**T3PV***			●		3 wires
T2WH*	**T2WV***			●	2-color display	2 wires
T2YH*	**T2YV***			●	2-color display	2 wires
T3WH*	**T3WV***			●	2-color display	3 wires
T3YH*	**T3YV***			●		3 wires

***** Lead wire length**	
Blank	1 m (standard)
3	3 m (option)
5	5 m (option)

Ⓔ Switch quantity	
R	1 With clockwise rotation
L	1 With counterclockwise rotation
D	2

Ⓕ Clean room specifications		
	Structure	Material restriction
P73	Vacuum treatment	-

⚠ Precautions for model No. selection

*1: Port position of basic high accuracy is provided on side surface. Other ports are plugged.
*2: Refer to page 284 for combination of variations/options.

[Example of model No.]
GRC-F-10-180-T2V-D-P73
Double acting

Ⓐ Model No.   : Fine speed
Ⓑ Size   : 10
Ⓒ Oscillating angle : 180°
Ⓓ Switch model No. : Proximity/2 wires radial lead wire/ lead wire 1 m
Ⓔ Switch quantity : 2
Ⓕ Clean room specifications: Vacuum treatment

Dimensions

Dimensions are the same as the basic GRC Series or the high load GRC-K Series. Refer to pages 290 to 293.

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

GRC Series

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R (module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

Selection method

Select based on the following procedures.

Step 1 Oscillating time confirmation

↓

Step 2 Select the size (torque).
    (1) Static load
    (2) Resistance load
    (3) Inertia load

↓

Step 3 Allowable energy confirmation

↓

Step 4 Allowable load confirmation
    (1) Thrust load
    (2) Radial load
    (3) Moment load

Step 1 Oscillating time confirmation

If the oscillating time is set outside of the specified range, the actuator's operation may become unstable, or the actuator could be damaged. Always set the oscillating time within the specified oscillating time adjusting range.

	Using with 90°	**Using with 180°**
Oscillating time (s)	0.2 to 1.5	0.4 to 3.0

Step 2 Size (torque) selection

Selection method is roughly categorized into three load.
In each case, the required torque must be calculated. If the load is a compound load, add each torque to calculate the required torque.
Select size from theoretical torque table or actual torque diagram per working pressure to meet required torque.

(1) Static load (Ts)
    When static pushing force is required for clamp, etc.

$$T_s = F_s \times L$$

    Ts   : Required torque (N·m)
    Fs   : Required force (N)
    L   : Length from center of rotation to pressure cone apex (m)

(2) Resistance load (TR)
    When forces caused by frictional force, gravity and another external force are applied.

$$T_R = K \times F_R \times L$$

    TR   : Required torque (N·m)
    K   : Margin factor with $\lbrace$ no load fluctuation: K = 2
                           with $\lbrace$ load fluctuation: K = 5
    FR   : Required force (N)
    L   : Length from center of rotation to pressure cone apex (m)

(3) Inertia load (TA)
    to rotate object

$$T_A = 5 \times I \times \dot{\omega}$$
$$\dot{\omega} = \frac{2\theta}{t^2}$$

    TA   : Required torque (N·m)
    I   : Moment of inertia (kg·m^2)
    $\dot{\omega}$: Maximum angular speed (rad/s^2)
    θ   : Oscillating angle (rad)
    t   : Oscillating time (s)

Calculate moment of inertia using moment of inertia and oscillating time (page 299) or the figure for moment of inertia calculation (page 300).

Step 3 Allowable energy confirmation

When using an inertial load, if the load's kinetic energy exceedsthe allowable value at the oscillating end, the actuator could bedamaged. Select one within allowable energy according to Table 1.
If energy is too large, stop load with external shock absorber, etc.

$$E = \frac{1}{2} \times I \times \omega^2$$
$$\omega = \frac{2\theta}{t}$$

    E   : Kinetic energy (J)
    I   : Moment of inertia (kg·m^2)
    ω   : Angular speed at the end of oscillation (rad/s)
    θ   : Oscillating angle(rad)
    t   : Oscillating time (s)

Calculate moment of inertia using moment of inertia and oscillating time (page 299) or the figure for moment of inertia calculation (page 300).

CKD

Selection method

Step 4 Allowable load confirmation

If the load directly applies to the table, it should be within the allowable range in Table 2.

If a combined load applies, the total of the ratio for allowable value per load should be 1.0 or smaller.

Load can be grouped into the following three types.

(1) Thrust load (axial load)
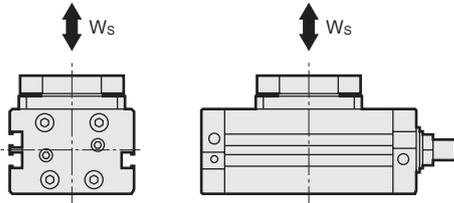
(2) Radial load (lateral load)
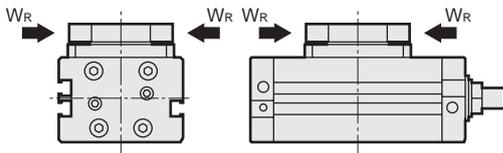
(3) Moment load
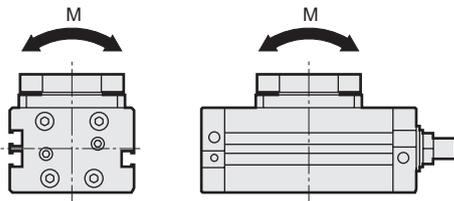
Calculate each type. Then, assign the values into the following formula.

$$\frac{W_s}{W_{smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}} \leqq 1.0$$

W_s	: Thrust load (N)
W_R	: Radial load (N)
M	: Moment load (N·m)
W_{smax}	: Allowable thrust load (N)
W_{Rmax}	: Allowable radial load (N)
M_{max}	: Allowable moment load (N·m)

Allowable absorbed energy and allowable load are shown in the following table.

Table 1 Allowable absorbed energy value (J)

Size	5	10	20	30	50	80
Basic/high accuracy	0.005	0.008	0.03	0.04	0.11	

Table 2 Allowable load $W_{Smax.}$ $W_{Rmax.}$ M_{max}

Size		5	10	20	30	50	80
Thrust load W_{smax} [N]	Basic	50	80	140	200	450	580
	High accuracy	-	120	220	440	550	650
Radial load W_{Rmax} [N]	Basic	30	80	150	200	320	400
	High accuracy	-	100	160	240	380	480
Moment load M_{max} [N·m]	Basic	1.5	2.5	4.0	5.5	10.0	13.0
	High accuracy	-	3.0	5.0	7.0	12.0	15.0

GRC Series

| SCPD3 |
| SCM |
| SSD2 |
| MDC2 |
| SMG |
| LCM |
| LCR |
| LCG |
| LCX |
| STM |
| STG |
| STR2 |
| MRL2 |
| **GRC** |
| Cylinder switch |
| MN3E MN4E |
| 4GA/B |
| M4GA/B |
| MN4GA/B |
| F.R (module unit) |
| Clean F.R |
| Precision R |
| Press gauge Diff. press gauge |
| Electro-pneumatic R |
| Speed controller |
| Auxiliary valve |
| Fitting/tube |
| Clean air unit |
| Pressure sensor |
| Flow rate sensor |
| Valve for air blow |
| Ending |

Selection example

When rectangular parallelepiped load is applied

Rectangular parallelepiped
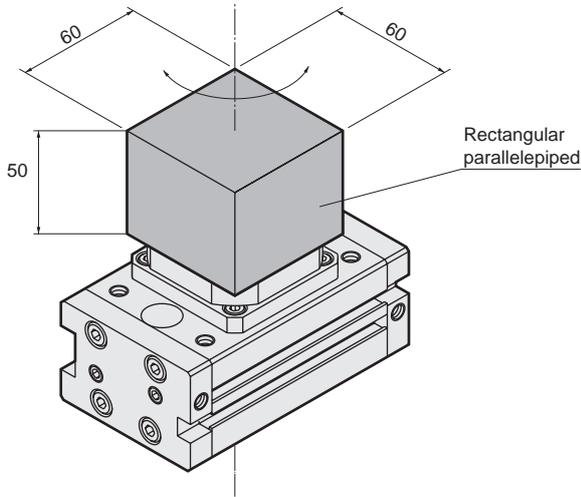
[Operation conditions]
Pressure : 0.5 MPa
Oscillating angle : 90°
Oscillating time : 0.6 s
Load (material : aluminum alloy)
[Rectangular parallelepiped] : 0.5 kg

Step 1 Oscillating time confirmation

Oscillating time is 0.6 (s/90°) according to operation conditions.
Since oscillating time is within adjusting range 0.2 to 1.5 (s/90°),
go to next step.

Step 2 Select the size (torque)

First, calculate the moment of inertia (I) due to inertia load.
[Rectangular parallelepiped]

$$I = 0.5 \times \frac{0.06^2}{6} = 3 \times 10^{-4} \text{ (kg·m}^2) \quad \text{……(1)}$$

Then, calculate the maximum angular speed ($\dot{\omega}$).

Based on the conditions $\theta = 90° = \frac{\pi}{2}$(rad), t = 0.6 (s)

Therefore,

$$\dot{\omega} = \frac{2\theta}{t^2} = \frac{\pi}{0.6^2} = 8.73 \text{ (rad/s}^2) \quad \text{………(2)}$$

Therefore, inertia load (T_A) from (1) and (2)

$T_A = 5 \times 3 \times 10^{-4} \times 8.73$
   = 0.0131 (N·m)……………………..…(3)

According to (3) value and operational conditions and torque

at 0.5 (MPa)

GRC-5-90 ……………………………..……(A) is selected.

Step 3 Allowable energy confirmation

Calculate the kinetic energy. Check if the value is within the
allowable energy range.
Calculate the angular speed at the end of oscillation ω.

Based on the conditions $\theta = 90° = \frac{\pi}{2}$(rad), t = 0.6 (s)

Therefore,

$$\omega = \frac{2\theta}{t} = \frac{\pi}{0.6} = 5.24 \text{ (rad/s)}$$

Therefore, kinetic energy (E) is

$$E = \frac{1}{2} \times 3 \times 10^{-4} \times 5.24^2$$

   = 0.00412 (J) ……………………(4)

From (4) and (A) selected in Step 2
GRC-5-90 …………………………………..…(B) can be
selected.

Step 4 Allowable load confirmation

Finally, calculate the load applied to the table. Check if the value
is within the allowable range.
[Thrust load]
   Thrust load (W_s),
   $W_s = 0.5 \times 9.8 = 4.9$ (N) ……………………(5)
[Radial load]
   Since no radial load exists,
   $W_R = 0$ (N) …………………………………..(6)
[Moment load]
   Since no moment load exists,
   M = 0 (N·m) …………………………………(7)
According to (5), (6), (7), and (B)

$$\frac{W_s}{W_{smax}} + \frac{W_R}{W_{Rmax}} + \frac{M}{M_{max}}$$

$$= \frac{4.9}{50} + \frac{0}{30} + \frac{0}{1.5} = 0.098 \leqq 1.0 \quad \text{……(C)}$$

the total load value is within the allowable load range
according to (B) and (C). Hence,

GRC-5-90 is selected.

CKD

1. Energy absorbing performance and oscillating time

(1) For rubber cushion, the relationship between the moment of inertia and the oscillating time is shown in the diagram below. Always use the product within the lower right range of the graph as the shaft may break otherwise. Refer to this when you select a model.

● Basic high accuracy
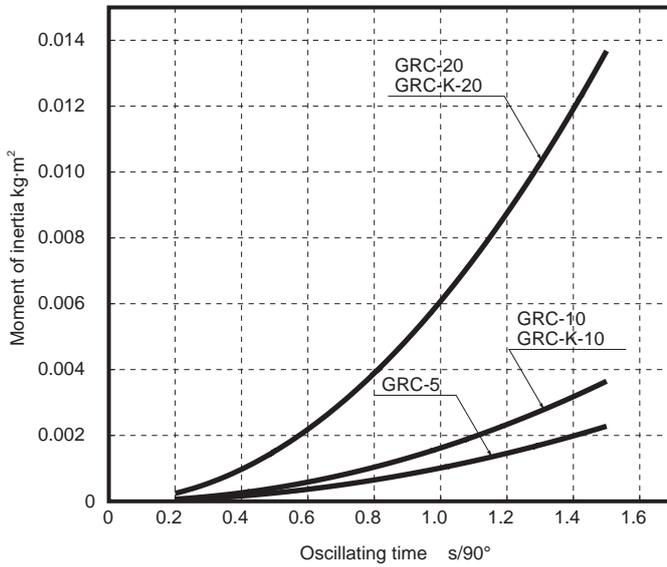
Size 5, 10, 20
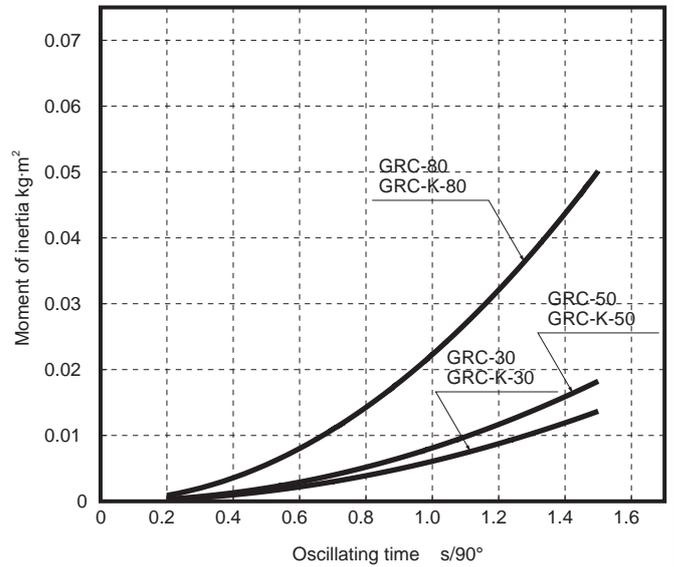
Size 30, 50, 80

2. Figure for moment of inertia calculation

When the rotational axis goes through the workpiece

Shape	Sketch	Requirements	Moment of inertia I kg·m^2	Radius of gyration K$_1^2$	Remarks
Dial plate		● Diameter d (m) ● Weight M (kg)	$I = \dfrac{Md^2}{8}$	$\dfrac{d^2}{8}$	● No mounting direction ● For sliding use, contact CKD.
Circular stepped plate		● Diameter d_1 (m), d_2 (m) ● Weight d_1 section M_1 (kg), d_2 section M_2 (kg)	$I = \dfrac{1}{8}(M_1 d_1^2 + M_2 d_2^2)$	$\dfrac{d_1^2 + d_2^2}{8}$	● Ignore when d_2 section is extremely small compared to d_1 section.
Bar (center of rotation at end)		● Bar length R (m) ● Weight M (kg)	$I = \dfrac{MR^2}{3}$	$\dfrac{R^2}{3}$	● When this is horizontally mounted. ● If this is vertically mounted, the oscillating time changes.
Thin rod		● Bar length R_1, R_2 ● Weight M_1, M_2	$I = \dfrac{M_1 \cdot R_1^2}{3} + \dfrac{M_2 \cdot R_2^2}{3}$	$\dfrac{R_1^2 + R_2^2}{3}$	● When this is horizontally mounted. ● If this is vertically mounted, the oscillating time changes.
Bar (center of rotation is center of gravity)		● Bar length R (m) ● Weight M (kg)	$I = \dfrac{MR^2}{12}$	$\dfrac{R^2}{12}$	● No mounting direction
Thin rectangle plate (rectangular parallelepiped)		● Plate length a_1, a_2 ● Side length b ● Weight M_1, M_2	$I = \dfrac{M_1}{12}(4a_1^2 + b^2) + \dfrac{M_2}{12}(4a_2^2 + b^2)$	$\dfrac{(4a_1^2 + b^2) + (4a_2^2 + b^2)}{12}$	● When this is horizontally mounted. ● If this is vertically mounted, the oscillating time changes.
Rectangular parallelepiped		● Side length a (m), b (m) ● Weight M (kg)	$I = \dfrac{M}{12}(a^2 + b^2)$	$\dfrac{a^2 + b^2}{12}$	● No mounting direction ● For sliding use, contact CKD.
Concentrated load		● Shape of concentrated load ● Length to center of gravity of concentrated load R_1 ● Arm length R_2 (m) ● Concentrated load weight M_1 (kg) ● Arm weight M_2 (kg)	$I = M_1(R_1^2 + k_1^2) + \dfrac{M_2 R_2^2}{3}$	Calculate K_1^2 according to shape of concentrated load	● When this is horizontally mounted. ● When M_2 is extremely small compared to M_1, you can assume $M_2 = 0$.

How to convert load J_L to rotary actuator shaft rotation when using with gears

Shape	Sketch	Requirements	Moment of inertia I kg·m^2	Radius of gyration K$_1^2$	Remarks
Gear		● Rotary side gear (number of teeth) a Load side gear (number of teeth) b ● Load inertia Moment N·m	Moment of inertia of load rotary shaft rotation $I_H = \left(\dfrac{a}{b}\right)^2 I_L$		● When the size of the gear wheel is increased, its moment of inertia should be taken into consideration.

CKD

● When the rotational axis is off the workpiece

Shape	Sketch	Requirements	Moment of inertia I kg·m²	Remarks
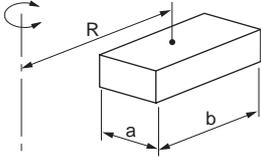
Rectangular parallelepiped		● Side length a (m)
		 ● Distance from the b (m)
		    rotational axis to R (m)
		    the load center
		 ● Weight M (kg)
			$I = \dfrac{M}{12}(a^2 + b^2) + MR^2$	● Same for cube

Hollow rectangular parallelepiped		● Side length h_1 (m)
		              h_2 (m)
		 ● Distance from the
		    rotational axis to R (m)
		    the load center
		 ● Weight M (kg)
			$I = \dfrac{M}{12}(h_1{}^2 + h_2{}^2) + MR^2$	● Cross section is for cube only
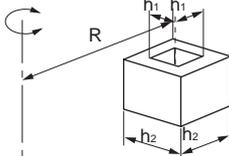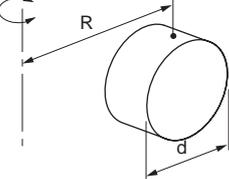
Cylinder		● Diameter d (m)
		 ● Distance from the
		    rotational axis to R (m)
		    the load center
		 ● Weight M (kg)
			$I = \dfrac{Md^2}{16} + MR^2$	
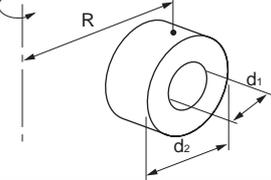
Hollow cylinder		● Diameter d_1 (m)
		               d_2 (m)
		 ● Distance from the
		    rotational axis to the R (m)
		    load center
		 ● Weight M (kg)
			$I = \dfrac{M}{16}(d_1{}^2 + d_2{}^2) + MR^2$	

* To find moment of inertia, first convert load, jig, etc., to simple shapes with modeling, then calculate values. For the combined load, calculate each inertial moment and their total.

3. Table deflection (reference value)

The displacement (reference value) of the table at 100 mm away from the center of rotation when moment load is applied to GRC is shown below. (It is assumed that the table is stationary and not rotating.)

Measuring method

Table deflection

100 mm

Moment load

Displacement
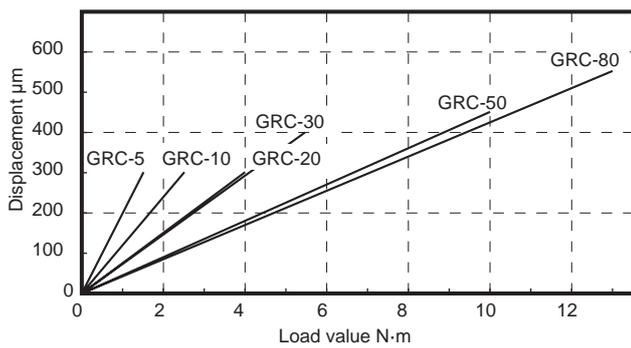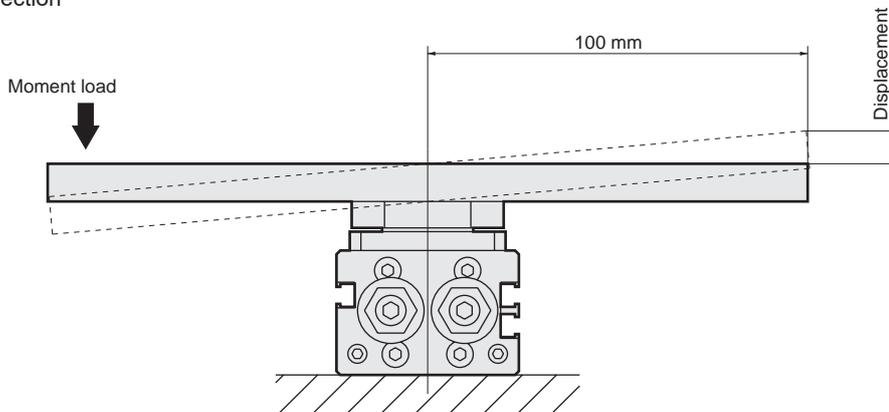
Table deflection of GRC (basic)
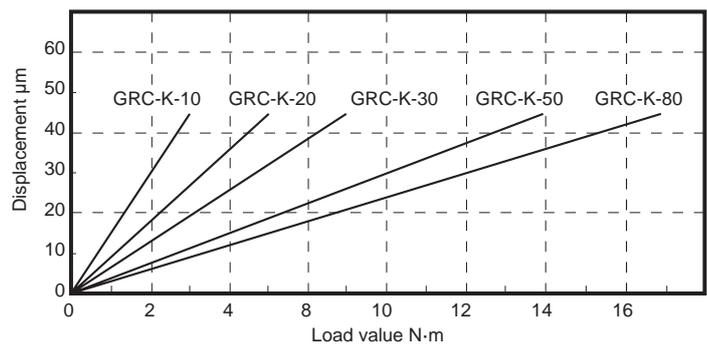
Table deflection of GRC-K (high accuracy)

CKD

4. Effective torque diagram

Note that the torque at the oscillation end is half of the value in the following graph.

GRC-80

GRC-50

GRC-30

GRC-20

GRC-10

GRC-5

Torque (N·m)

Pressure   MPa

SCPD3
SCM
SSD2
MDC2
SMG
LCM
LCR
LCG
LCX
STM
STG
STR2
MRL2
GRC
Cylinder Switch
MN3E MN4E
4GA/B
M4GA/B
MN4GA/B
F.R.(module unit)
Clean F.R
Precision R
Press gauge Diff. press gauge
Electro-pneumatic R
Speed controller
Auxiliary valve
Fitting/ tube
Clean air unit
Pressure sensor
Flow rate sensor
Valve for air blow
Ending

CKD   303

5. Oscillating angle adjustment method

● Basic high accuracy

180° specifications

90° specifications

CKD

CKD

Safety Precautions

Be sure to read this section before use.
Refer to page 2 for general information of the cylinder, and to page 320 for general information of the cylinder switch.

Rotary actuator GRC Series

Design & selection

1. Common

⚠ CAUTION

■ Generally, select a model so that the output torque exceeds twice the torque required by the load.
The GRC Series uses a double piston, so if the oscillation angle is adjusted by the stopper bolt, torque at the oscillation end will be half the effective torque.

■ Even if the torque required by the load for the oscillation is small, the inertia of the load may break the actuator. Upon consideration of moment of inertia, kinetic energy and oscillating time, be sure to use with the allowable energy or less.

2. Fine speed GRC-F

⚠ CAUTION

■ Use without lubrication. (Lubrication not possible)
Applying lubrication may cause changes in characteristics.

■ Assemble the speed control valve near the rotary actuator.
When installed at a distant place from the rotary actuator, the adjustment becomes unstable.
Use SC-M3/M5, SC3W, SCD-M3/M5, or SC3U Series speed control valve.

■ At the higher air pressure and the lower load factor, the speed generally becomes more stable.
The load factor should be 50% or less.

■ Stable speed control is achieved with a meter-out circuit.

PUSH: Meter-out
PULL : Meter-out
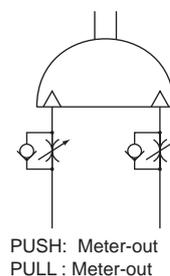
■ Avoid use in places subject to vibrations.
The product will be adversely affected by vibration and operation will be unstable.

## Mounting, installation & adjustment

1. Common

⚠ CAUTION

■ Do not apply additional processing to the product.
If modified, the product's strength will decrease, possibly causing product damage. This may result in injury or damage to operator, components, or equipment.

■ Do not widen the fixed orifice on the piping port by re-machining, etc. If the fixed orifice is widened, the actuator operation speed and impact will increase, damaging the actuator. Moreover, be sure to attach a speed controller during piping before use.

■ Select among 3 surfaces for piping port. Ports other than the side piping port are plugged when the product is shipped. When changing the piping port, interchange these plugs. When changing ports for the GRC-5 to 30, apply the recommended adhesive to plugs. When changing ports for GRC- 50 or 80, apply recommended adhesive or wrap sealing tape around plugs. Failure to do so may lead to air leakage.
[Recommended threadlocker]
LOCTITE 222 [Locktite Japan Corp.]
Three Bond 1344 [Three Bond Corp.]

Plug (port)   Port   Plug (port)
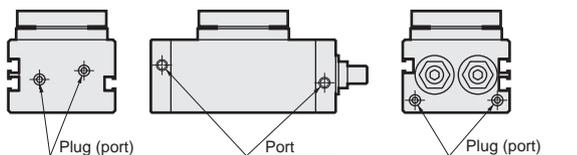
■ The relationship of piping ports and oscillation direction is shown below.
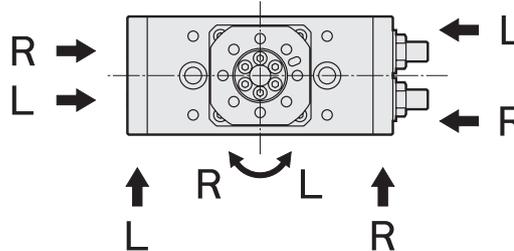
R : Clockwise rotation
L : Counter-clockwise rotation

■ An angle adjustment screw (stopper bolt or shock absorber) for adjustment of the oscillating angle is provided as standard equipment. When the product is shipped, the angle adjustment screw is adjusted randomly within the oscillation adjusting range. Readjust this to the required angle before use.

■ Adjust the angle to within the adjustment range specified for the product.
If adjusted beyond the adjusting range, the product may be damaged. Refer to "Product specifications" (page 286) and "Oscillation angle adjustment" (page 304).

CKD

■ The adjustment angle per rotation of the angle adjusting screw (stopper bolt) is shown below.
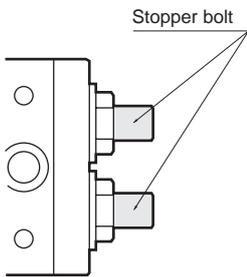
Basic high accuracy

Stopper bolt

Table 1

Size	Stopper bolt adjustment angle per rotation	Shock absorber adjustment angle per rotation
5	8.7°	1.1°
10	4.9°	1.0°
20	5.7°	1.1°
30	3.8°	0.9°
50	3.5°	0.7°
80	3.5°	0.9°

■ Observe steps (1) to (5) when adjusting the angle. If adjustments are not made this way, the seal washer will be damaged after one or two adjustments.

[How to adjust the angle]

(1) First loosen the hexagon nut as shown in Fig.1.

Seal washer
Stopper bolt
Hexagon nut
Head cover
Fig. 1

(2) Next, remove the seal washer from the head cover by hand as shown in Fig. 2.

Fig. 2

(3) Turn the stopper bolt, hexagon nut, and seal washer together as shown in Fig. 3, and adjust the angle. Make sure that the rubber section of the seal washer does not get caught in the thread.

Fig. 3

(4) After adjusting the angle, move the seal washer closer to the head cover by hand as shown in Fig. 4.

Fig. 4

(5) Tighten the lock nut as shown in Fig. 5. Make sure that the rubber section of the seal washer does not get caught in the thread.

Fig. 5
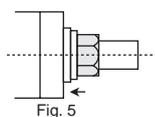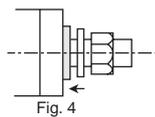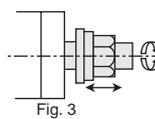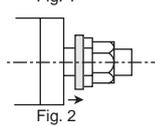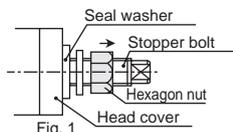
After adjusting the angle, securely tighten the hexagon nut up to the tightening torque in Table 2. Be sure to tighten the nut up to the specified torque. Otherwise, it will become loose leading to external leak.

Table 2

| Size	Tightening torque (N·m)
5	5.9 ±10%
10	9.4 ±10%
20	11.8 ±10%
30	11.8 ±10%
50	22.1 ±10%
80	22.1 ±10%

■ When you replace the seal washer which seals the angle adjusting stopper bolt, be sure to tighten the hexagon nut up to the tightening torque specified in the Table 2. Failure to do so may lead to air leakage.
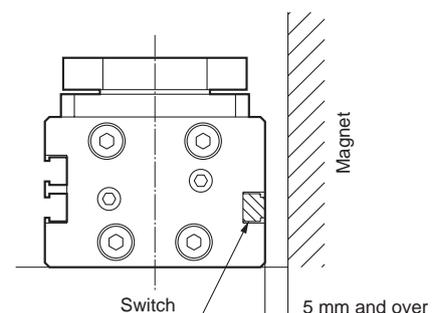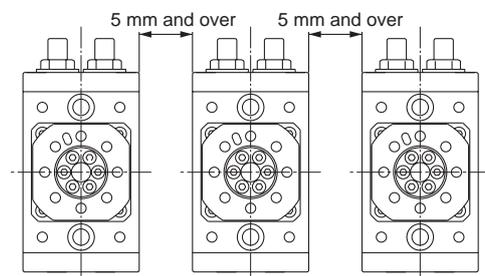
Basic high accuracy

Hexagon nut
Seal washer
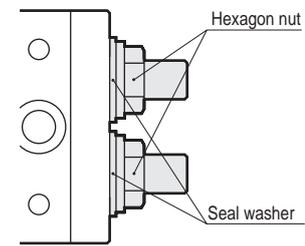
■ A rubber cushion is placed inside GRC. (Basic and High accuracy) If less than 0.3 MPa of pressure is used, the rubber cushion may not function correctly. If oscillating end accuracy is required, use at pressure of 0.3 MPa or higher.
Back pressure may remain if using with all ports closed, potentially failing to push fully against the rubber cushion.

Not fully compressed with a pressure of 0.3 MPa or lower
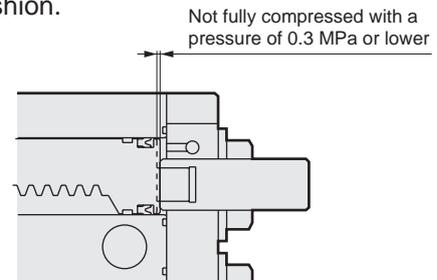
■ Pay attention to the proximity of cylinders, etc. When installing two or more rotary actuators with switches in parallel, or if there is a magnetic substance such as a steel plate nearby, provide the following distances from the cylinder body surface. (The dimensions are the same for all sizes.) Mutual magnetic interference may cause the switch to malfunction.

5 mm and over   5 mm and over

Magnet

Switch   5 mm and over

⚠ CAUTION

■ As compatible fittings for the relief port are limited, refer to the table below to select the fitting.

GRC-5, 10

GRC-20 to 80

øB
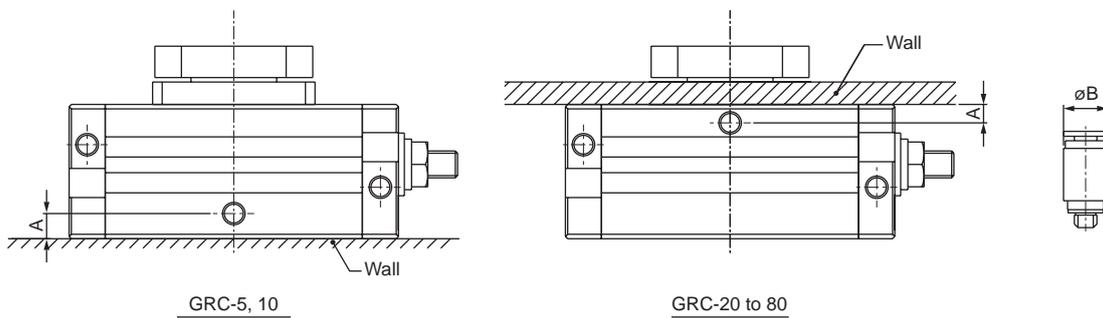
Descriptions	Port size	Port location dimensions	When there is a wall			When there is no wall and a 2-color switch is used		
Model No.		A	Applicable fittings	Fitting O.D. øB	Inapplicable fittings	Applicable fittings	Fitting O.D. øB	Inapplicable fittings
GRC-5	M5 depth 4	4.1	GWS3-M5-S-P7* GWS4-M5-S-P7* FTS4-M5-P80 FTS6-M5-P80	ø8.2 or smaller	GWS6-M5-S GWS*-M5	GWS3-M5-S-P7* GWS4-M5-S-P7* FTS4-M5-P80 FTS6-M5-P80	ø9 or smaller	GWS6-M5-S GWS*-M5
GRC-10	M5 depth 3.5	4.1	GWS3-M5-S-P7* GWS4-M5-S-P7* FTS4-M5-P80 FTS6-M5-P80	ø8.2 or smaller	GWS6-M5-S GWS*-M5	GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø10 or smaller	GWS6-M5
GRC-20	M5 depth 4	5.8	GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø11.6 or smaller	GWS6-M5	GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø11.6 or smaller	GWS6-M5
GRC-30	M5 depth 4	6.2	GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø12.4 or smaller (ø10.4 or smaller)	GWS6-M5	GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø10.4 or smaller	GWS6-M5
GRC-50	M5 depth 4	6.5	GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* GWS6-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø17 or smaller (ø13.8 or smaller)		GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* GWS6-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø13.8 or smaller	
GRC-80	M5 depth 4	12.9	GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* GWS6-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø25.8 or smaller (ø14 or smaller)		GWS3-M5-S-P7* GWS4-M5-S-P7* GWS6-M5-S-P7* GWS4-M5-P7* GWS6-M5-P7* FTS4-M5-P80 FTS6-M5-P80	ø14 or smaller	

* The fitting O.D. in parenthesis ( ) is for the case when a 2-color switch is used.
* There is no specific restriction when there is no wall and a 1-color switch is used.

* Joints Refer to page 946 of this catalog.
  For FTS4 and FTS6, copper-based materials are used.

CKD