

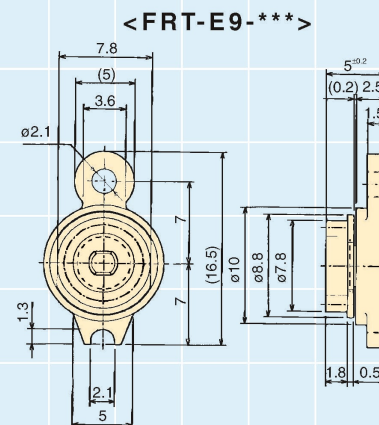
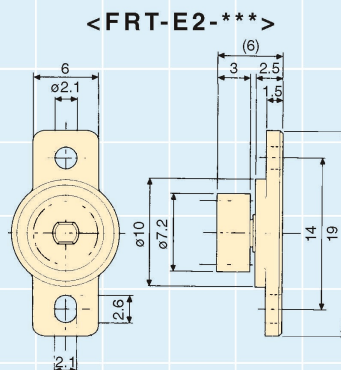
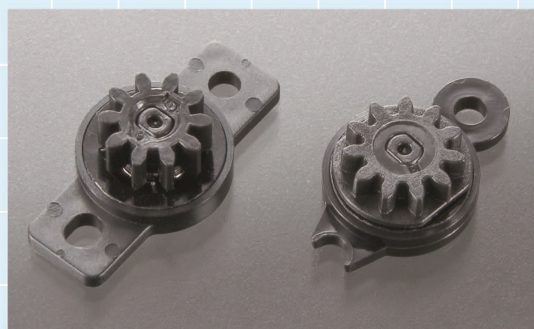


FRT-E2/E9 Series

RoHS Compliant

Rotary Damper [Bi-Directional]

Fixed



<Specifications>

Model	Rated torque
FRT-E2(E9)-100(G*)	$(1 \pm 0.5) \times 10^{-3} \text{ N} \cdot \text{m}$ $(10 \pm 5 \text{ gf} \cdot \text{cm})$
FRT-E2(E9)-200(G*)	$(2 \pm 0.7) \times 10^{-3} \text{ N} \cdot \text{m}$ $(20 \pm 7 \text{ gf} \cdot \text{cm})$
FRT-E2(E9)-300(G*)	$(3 \pm 0.8) \times 10^{-3} \text{ N} \cdot \text{m}$ $(30 \pm 8 \text{ gf} \cdot \text{cm})$
FRT-E2(E9)-400(G*)	$(4 \pm 1) \times 10^{-3} \text{ N} \cdot \text{m}$ $(40 \pm 10 \text{ gf} \cdot \text{cm})$

*Max. rotation speed	50rpm
*Max. cycle rate	10 cycle/min
*Operating temperature	0~50°C
*Weight	0.32g (with gear : 0.41g)
*Body and cap material	Polycarbonate (PC)
*Rotating shaft material	Polyacetal (POM)
*Gear material	Polyacetal (POM)
*Oil type	Silicone oil

Note 1) Rated torque measured at a rotation speed of 20rpm at 23°C

Note 2) Gear model number has G1 and G2 at the end

Note 3) Torque can be customized by changing the oil viscosity (see Customizable Torque Chart on page 52)

Note 4) Model E9 is a customized product with a one-sided mounting

Gear Specifications

	G1 (for E2)	G2 (for E9)
Type	Standard spur gear	Standard spur gear
Tooth profile	Involute	
Module	0.6	
Pressure angle	20°	
Number of teeth	10	11
Pitch circle diameter	ø6	ø6.6

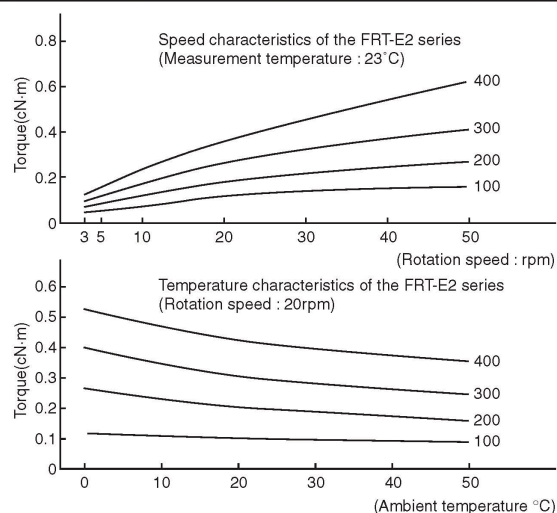
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.





FRT-G2 Series

RoHS Compliant

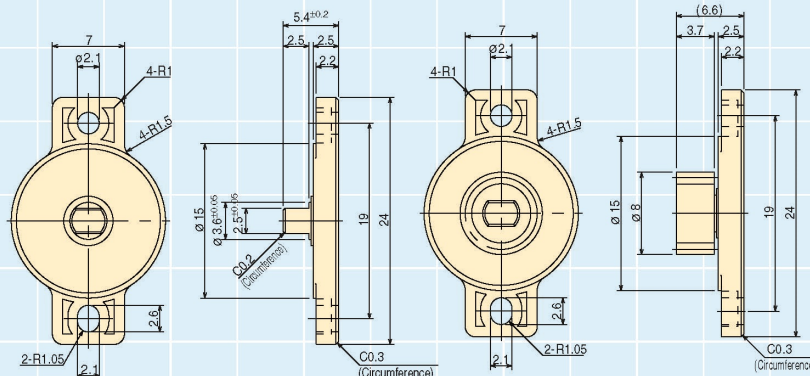
Rotary Damper [Bi-Directional]

Fixed



<Specifications>

Model	Rated torque
FRT-G2-200(G*)	$(2 \pm 0.7) \times 10^{-3} \text{ N} \cdot \text{m}$ (2 0 ± 7 g f · c m)
FRT-G2-300(G*)	$(3 \pm 0.8) \times 10^{-3} \text{ N} \cdot \text{m}$ (3 0 ± 8 g f · c m)
FRT-G2-450(G*)	$(4.5 \pm 1) \times 10^{-3} \text{ N} \cdot \text{m}$ (4 5 ± 1 0 g f · c m)
FRT-G2-600(G*)	$(6 \pm 1.2) \times 10^{-3} \text{ N} \cdot \text{m}$ (6 0 ± 1 2 g f · c m)
FRT-G2-101(G*)	$(10 \pm 2) \times 10^{-3} \text{ N} \cdot \text{m}$ (1 0 0 ± 2 0 g f · c m)



<FRT-G2-***G1>

- *Max. rotation speed 50rpm
- *Max. cycle rate 10 cycle/min
- *Operating temperature 0~50°C
- *Weight 0.6g (with gear : G1 : 0.8g G2 : 1.0g G3 : 0.9g)
- *Body and cap material Polycarbonate (PC)
- *Rotating shaft material Polyacetal (POM)
- *Gear material Polyacetal (POM)
- *Oil type Silicone oil

Note 1) Rated torque measured at a rotation speed of 20rpm at 23°C

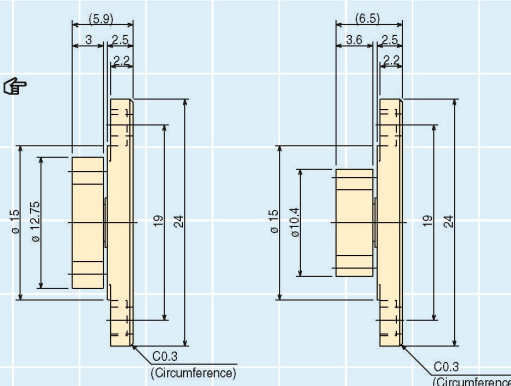
Note 2) Models with gear bears G1, G2, or G3 at the end of their model numbers

Note 3) Torque can be customized by changing the oil viscosity (see Customizable Torque Chart on page 52)

Note 4) The diagrams above are outline drawings of FRT-G2-****. Please refer to the diagrams at the right for G2 and G3.

Gear Specifications

	G1	G2	G3
Type	Standard spur gear	Profile shifted spur gear	Standard spur gear
Tooth profile	Involute		
Module	0.5	1.0	0.8
Pressure angle	20°		
Number of teeth	14	10	11
Pitch circle diameter	ø7	ø10	ø8.8
Addendum modification coefficient	—	+0.375	—



<FRT-G2-***G2>

<FRT-G2-***G3>

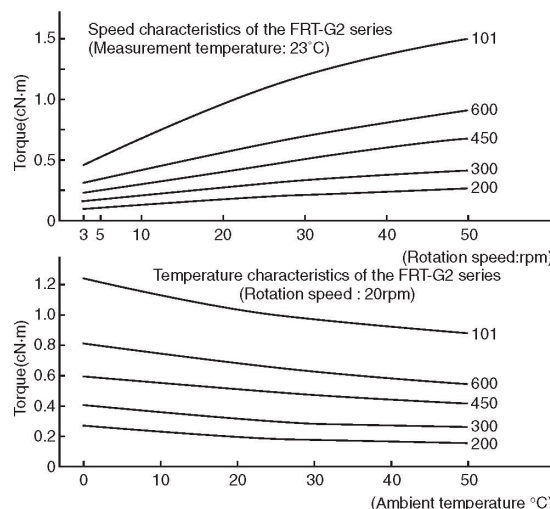
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.

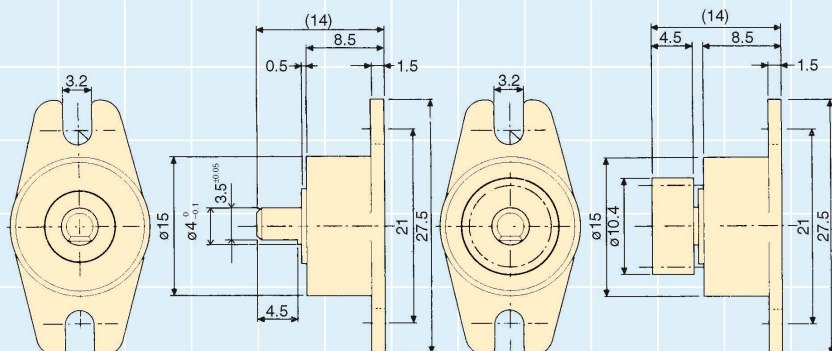
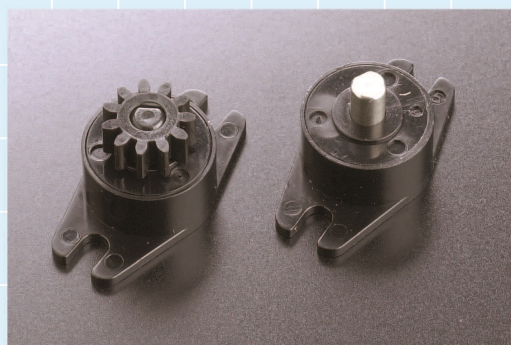




FRT/FRN-C2 Series

RoHS Compliant

Rotary Damper [Bi-Directional] [Uni-Directional] Fixed



<Specifications>

Model	Rated torque	Damping direction
FRT-C2-201(G1)	$(20 \pm 6) \times 10^{-3} \text{ N} \cdot \text{m}$ $(200 \pm 60 \text{ g} \cdot \text{cm})$	Both directions
FRT-C2-301(G1)	$(30 \pm 8) \times 10^{-3} \text{ N} \cdot \text{m}$ $(300 \pm 80 \text{ g} \cdot \text{cm})$	Both directions
FRN-C2-R301(G1)	$(30 \pm 8) \times 10^{-3} \text{ N} \cdot \text{m}$	Clockwise
FRN-C2-L301(G1)	$(300 \pm 80 \text{ g} \cdot \text{cm})$	Counter-clockwise

Note 1) Rated torque measured at a rotation speed of 20rpm at 23°C

Note 2) Gear model number has G1 at the end

Note 3) Torque can be customized by changing the oil viscosity (see Customizable Torque Chart on page 52)

*Max. rotation speed	50rpm			
*Max. cycle rate	10 cycle/min			
*Operating temperature	0~50°C			
*Weight	FRT-C2 : 2.1g, FRN-C2 : 3.2g (with gear : +0.3g)			
*Body and cap material	Polycarbonate (PC)			
*Rotating shaft material	Polycetal (POM), metal (only in FRN-C2-*301)			
*Gear material	Polycetal (POM)			
*Oil type	Silicone oil			

Gear Specifications

Type	Standard spur gear
Tooth profile	Involute
Module	0.8
Pressure angle	20°
Number of teeth	11
Pitch circle diameter	ø8.8

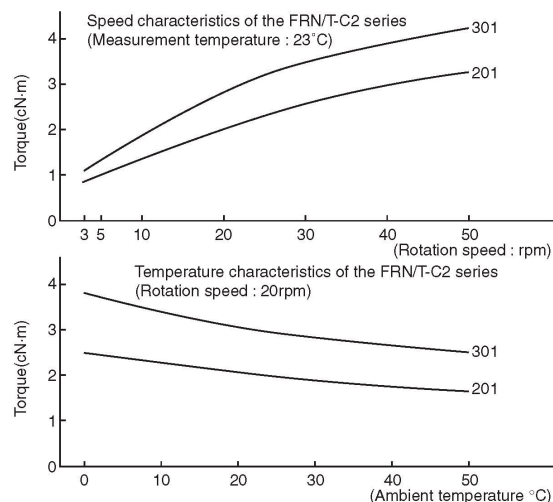
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.

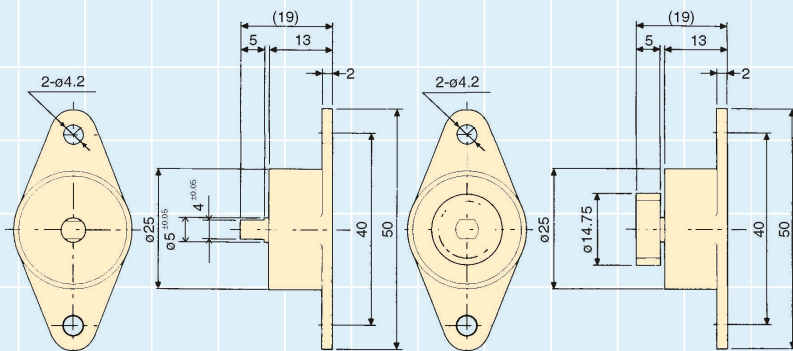
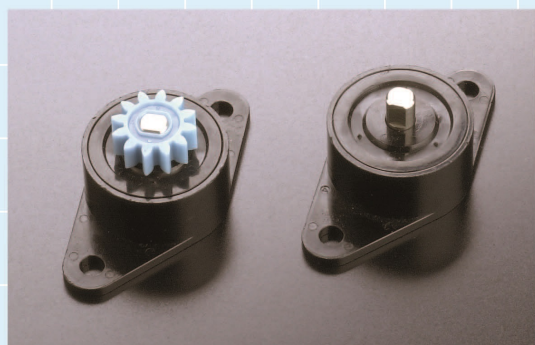




FRT/FRN-D2 Series

RoHS Compliant

Rotary Damper [Bi-Directional] [Uni-Directional] Fixed



<Specifications>

Model	Rated torque	Damping direction
FRT-D2-501(G2)	$(50 \pm 10) \times 10^{-3} \text{ N} \cdot \text{m}$ (500 ± 100 gf · cm)	Both directions
FRT-D2-102(G2)	$(100 \pm 20) \times 10^{-3} \text{ N} \cdot \text{m}$ (1000 ± 200 gf · cm)	Both directions
FRT-D2-152(G2)	$(150 \pm 30) \times 10^{-3} \text{ N} \cdot \text{m}$ (1500 ± 300 gf · cm)	Both directions
FRN-D2-R501(G2)	$(50 \pm 10) \times 10^{-3} \text{ N} \cdot \text{m}$ (500 ± 100 gf · cm)	Clockwise
FRN-D2-L501(G2)	$(50 \pm 10) \times 10^{-3} \text{ N} \cdot \text{m}$ (500 ± 100 gf · cm)	Counter-clockwise
FRN-D2-R102(G2)	$(100 \pm 20) \times 10^{-3} \text{ N} \cdot \text{m}$ (1000 ± 200 gf · cm)	Clockwise
FRN-D2-L102(G2)	$(100 \pm 20) \times 10^{-3} \text{ N} \cdot \text{m}$ (1000 ± 200 gf · cm)	Counter-clockwise
FRN-D2-R152(G2)	$(150 \pm 30) \times 10^{-3} \text{ N} \cdot \text{m}$ (1500 ± 300 gf · cm)	Clockwise
FRN-D2-L152(G2)	$(150 \pm 30) \times 10^{-3} \text{ N} \cdot \text{m}$ (1500 ± 300 gf · cm)	Counter-clockwise

Note 1) Rated torque measured at a rotation speed of 20rpm at 23°C

Note 2) Gear model number has G2 at the end

Note 3) Torque can be customized by changing the oil viscosity (see Customizable Torque Chart on page 52)

*Max. rotation speed	50rpm
*Max. cycle rate	10 cycle/min
*Operating temperature	0~50°C
*Weight	FRT-D2 : 8.3g, FRN-D2 : 11.8g (with gear : +0.6g)
*Body and cap material	Polycarbonate (PC)
*Rotating shaft material	Polyacetal, metal (FRT: POM, FRN: SUS)
*Gear material	Polyacetal (POM)
*Oil type	Silicone oil

Gear Specifications

Type	Profile shifted spur gear
Tooth profile	Involute
Module	1.0
Pressure angle	20°
Number of teeth	12
Pitch circle diameter	ø12
Addendum modification coefficient	+0.375

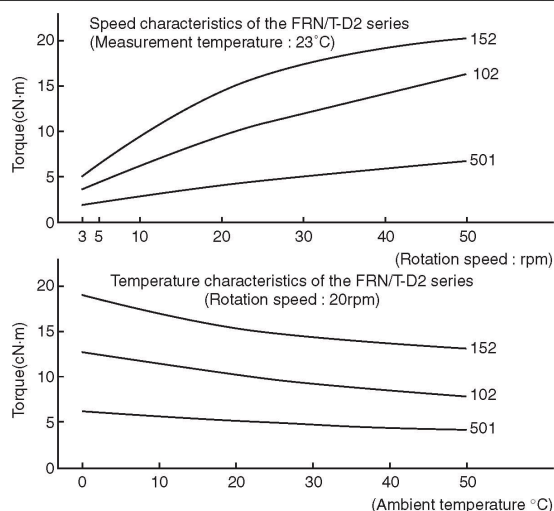
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.





Soft Silent Safety

FRT-S1 Series

RoHS Compliant

Rotary Damper [Bi-Directional]

Fixed



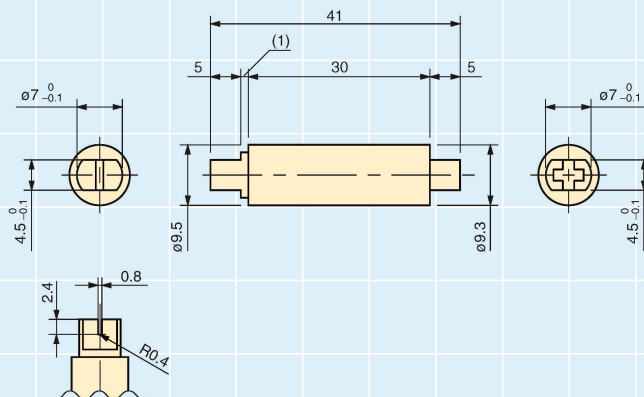
<Specifications>

Model	Rated torque
FRT-S1-201	$(20 \pm 6) \times 10^{-3} \text{ N} \cdot \text{m}$ (200 ± 60 gf · cm)
FRT-S1-301	$(30 \pm 8) \times 10^{-3} \text{ N} \cdot \text{m}$ (300 ± 80 gf · cm)

Note 1) Rated torque measured at a rotational speed of 20 rpm at 23°C

Note 2) Torque can be customized by changing the oil viscosity.

(See Customizable Torque Chart on page 52.)



*Max. rotational speed	50rpm
*Max. cycle rate	10 cycles/min
*Operating temperature	0~50°C
*Weight	3g
*Main body material	Polyacetal (POM)
*Rotating shaft material	Polyacetal (POM)
*Oil type	Silicone oil

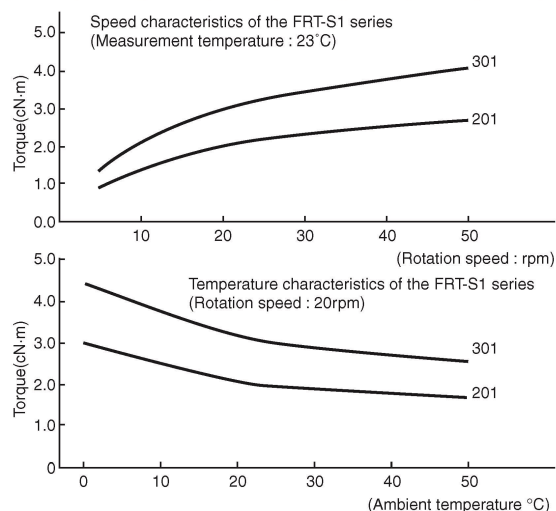
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.





FRT-N1 Series

RoHS Compliant

Rotary Damper [Bi-Directional]

Fixed



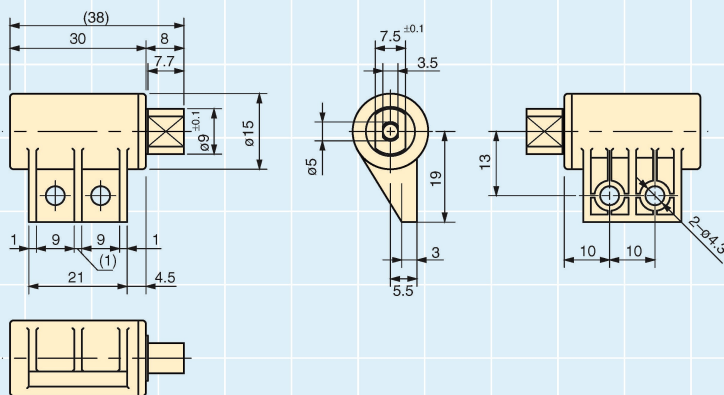
<Specifications>

Model	Rated torque
FRT-N1-102	$(100 \pm 20) \times 10^{-3} \text{ N} \cdot \text{m}$ $(1000 \pm 200 \text{ gf} \cdot \text{cm})$
FRT-N1-182	$(180 \pm 36) \times 10^{-3} \text{ N} \cdot \text{m}$ $(1800 \pm 360 \text{ gf} \cdot \text{cm})$

Note 1) Rated torque measured at a rotational speed of 20 rpm at 23°C

Note 2) Torque can be customized by changing the oil viscosity.

(See Customizable Torque Chart on page 52.)



*Max. rotational speed	50rpm
*Max. cycle rate	10 cycles/min
*Operating temperature	0~50°C
*Weight	8.2g
*Main body material	Polyacetal (POM)
*Cap material	Polyacetal (POM)
*Rotating shaft material	Polyacetal (POM)
*Oil type	Silicone oil

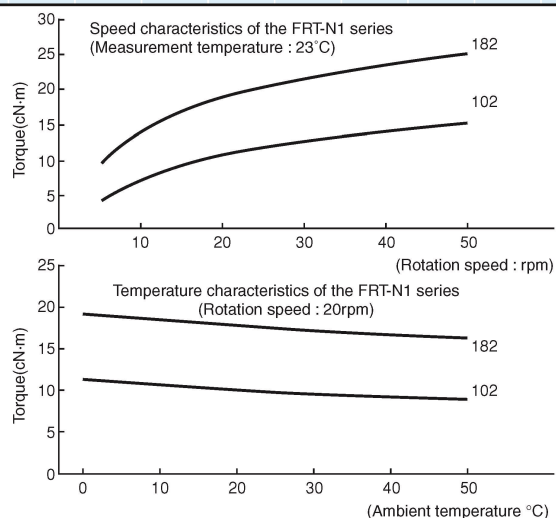
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

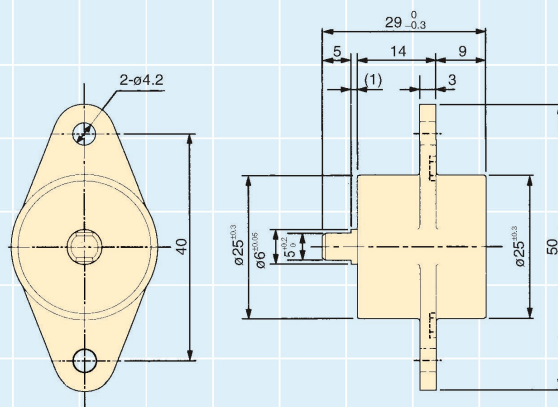
A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.





Rotary Damper [Bi-Directional]

Fixed



Model	Rated torque
FRT-L1-202	$(200 \pm 40) \times 10^{-3} \text{ N} \cdot \text{m}$ $(2000 \pm 400 \text{ gf} \cdot \text{cm})$
FRT-L1-302	$(300 \pm 60) \times 10^{-3} \text{ N} \cdot \text{m}$ $(3000 \pm 600 \text{ gf} \cdot \text{cm})$

Note 2) Torque can be customized by changing the oil viscosity
(see Customizable Torque Chart on page 52)

*Max. rotation speed	50rpm
*Max. cycle rate	10 cycle/min
*Operating temperature	0~50°C
*Weight	14.1g
*Body and cap material	Polycarbonate (PC)
*Rotating shaft material	Polyacetal (POM)
*Oil type	Silicone oil

Speed characteristics of the FRT-L1 series
(Measurement temperature : 23°C)

Rotation speed (rpm)	Torque (cN·m) at 302	Torque (cN·m) at 202
3	11	8
5	14	10
10	20	14
20	30	20
30	35	24
40	38	26
50	40	28

Temperature characteristics of the FRT-L1 series
(Rotation speed : 20rpm)

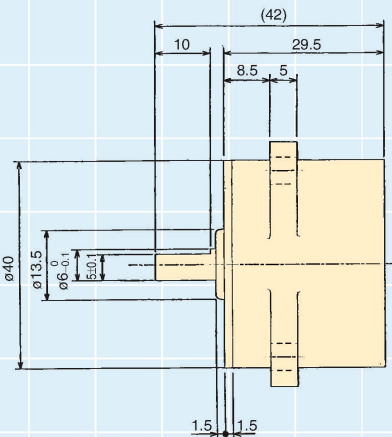
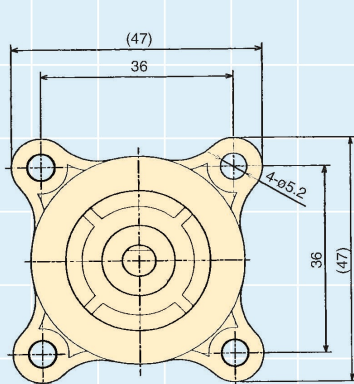
Ambient temperature (°C)	Torque (cN·m) at 302	Torque (cN·m) at 202
0	37	24
10	34	22
20	32	20
30	30	19
40	29	18
50	28	18



FRT/FRN-K2 Series

RoHS Compliant

Rotary Damper [Bi-Directional] [Uni-Directional] Fixed



<Specifications>

Model	Rated torque	Damping direction
FRT-K2-103	$1 \pm 0.2 \text{ N} \cdot \text{m}$ ($10 \pm 2 \text{ kgf} \cdot \text{cm}$)	Both directions
FRN-K2-R103	$1 \pm 0.2 \text{ N} \cdot \text{m}$	Clockwise
FRN-K2-L103	($10 \pm 2 \text{ kgf} \cdot \text{cm}$)	Counter-clockwise

Note 1) Rated torque measured at a rotation speed of 20rpm at 23°C

Note 2) Torque can be customized by changing the oil viscosity
(see Customizable Torque Chart on page 52)

Note 3) Dampers with gear can also be custom ordered.

Note 4) FRT/N-K2 series is a modified series of the FRT/N-K1 series to accommodate bearings

- *Max. rotation speed 50rpm
- *Max. cycle rate 10 cycle/min
- *Operating temperature 0~50°C
- *Weight FRT-K2 : 78.3g, FRN-K2 : 56.6g
- *Body and cap material Polycarbonate + glass fiber
- *Rotating shaft material Metal (SUS)
- *Oil type Silicone oil

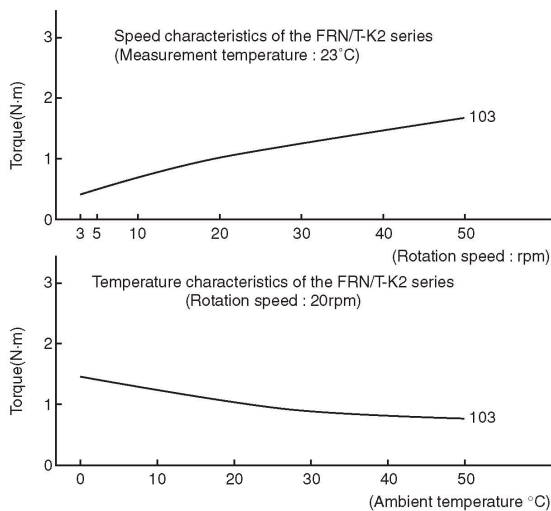
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.

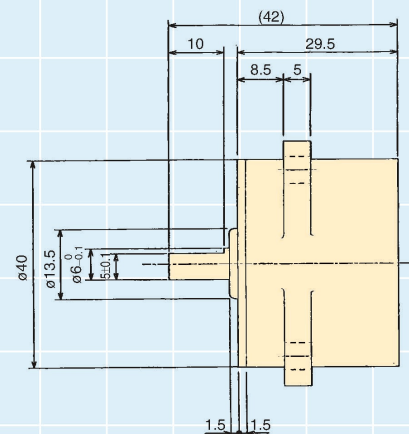
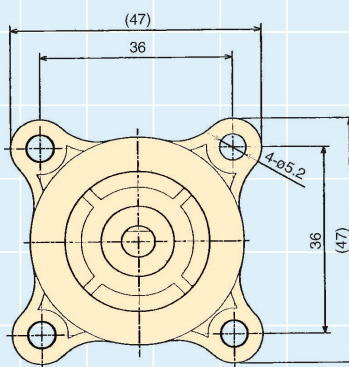




FRT/FRN-F2 Series

RoHS Compliant

Rotary Damper [Bi-Directional] [Uni-Directional] Fixed



<Specifications>

Model	Rated torque	Damping direction
FRT-F2-203	$2 \pm 0.4 \text{ N} \cdot \text{m}$ ($20 \pm 4 \text{ kgf} \cdot \text{cm}$)	Both directions
FRT-F2-303	$3 \pm 0.8 \text{ N} \cdot \text{m}$ ($30 \pm 8 \text{ kgf} \cdot \text{cm}$)	Both directions
FRT-F2-403	$4 \pm 1 \text{ N} \cdot \text{m}$ ($40 \pm 10 \text{ kgf} \cdot \text{cm}$)	Both directions
FRN-F2-R203	$2 \pm 0.4 \text{ N} \cdot \text{m}$ ($20 \pm 4 \text{ kgf} \cdot \text{cm}$)	Clockwise
FRN-F2-L203	$2 \pm 0.4 \text{ N} \cdot \text{m}$ ($20 \pm 4 \text{ kgf} \cdot \text{cm}$)	Counter-clockwise

*Max. rotation speed	50rpm
*Max. cycle rate	10 cycle/min
*Operating temperature	0~50°C
*Weight	FRT-F2 : 115.6g, FRN-F2 : 93.2g
*Body and cap material	Polycarbonate + glass fiber
*Rotating shaft material	Metal (SUS)
*Oil type	Silicone oil

Note 1) Rated torque measured at a rotation speed of 20rpm at 23°C

Note 2) Torque can be customized by changing the oil viscosity

(see Customizable Torque Chart on page 52)

Note 3) Dampers with gear can also be custom ordered.

Note 4) FRT/N-F2 series is a modified series of the FRT/N-F1 series to accommodate bearings

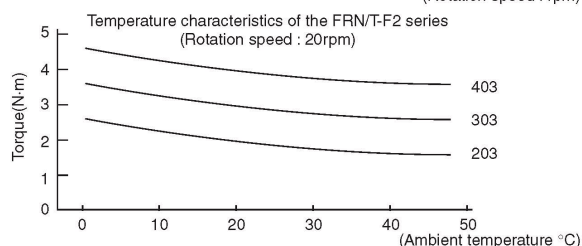
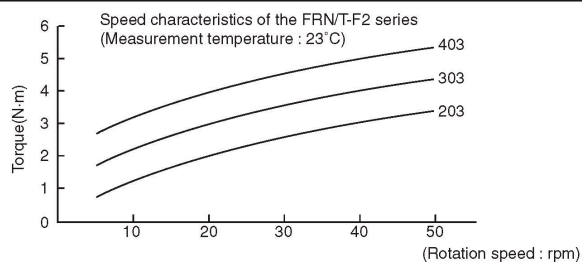
Damper Characteristics

1. Speed characteristics

A rotary damper's torque varies according to the rotation speed. In general, as shown in the graph to the right, the torque increases as the rotation speed increases, and the torque decreases as the rotation speed decreases. In addition, please note that the starting torque slightly differs from the rated torque.

2. Temperature characteristics

A rotary damper's torque varies according to the ambient temperature. In addition, as shown in the graph to the right, the torque decreases as the ambient temperature increases, and the torque increases as the ambient temperature decreases. This is because the viscosity of the silicone oil inside the damper varies according to the temperature. When the temperature returns to normal, the torque will return to normal as well.



FRT-SB1

RoHS Compliant

Rotary Damper [Bi-Directional]

Fixed

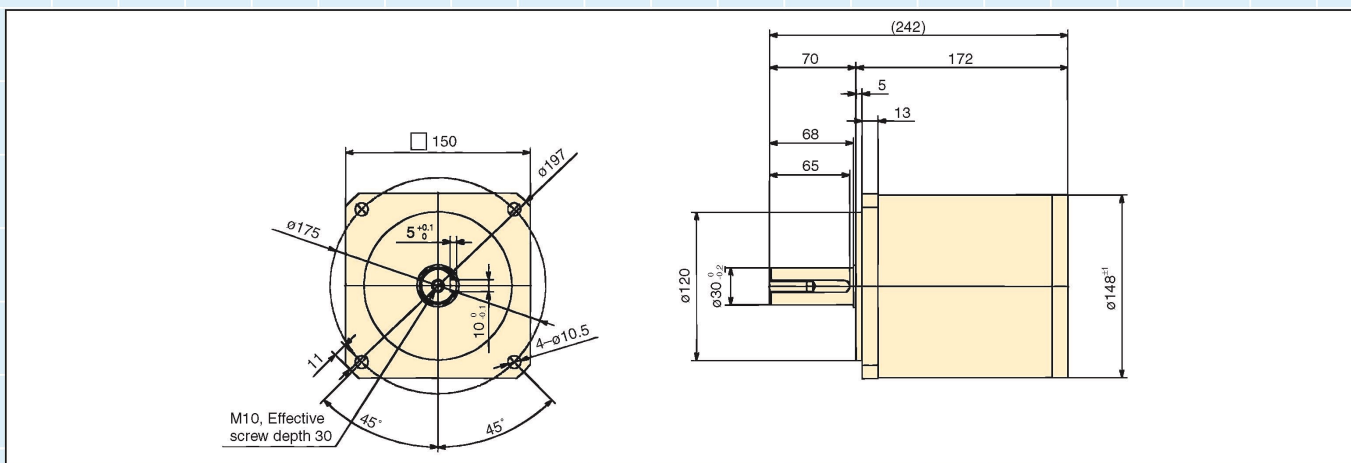


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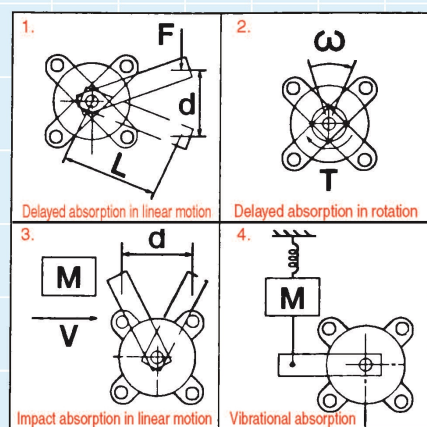
Model	Rated torque
FRT-SB1	360 ± 120 N·m/(rad/sec)

Note 1) Measured at 23°C±2°C

*Operating temperature	-20~60°C
*Weight	11.5 ± 0.5 kg
*Rotating shaft	Iron
*Cap, bottom	Aluminum
*Main body	Iron
*Oil type	Silicone oil



<How to Calculate the Damping Constant>



- 1. Delayed absorption in linear motion**
Formula (N·m/(rad/sec)) = $\frac{FL^2t}{d}$
F = Force or mass applied to the lever tip (N)
L = Distance between the centre of the damper shaft and the lever's point of application (m)
d = Distance travelled by lever (m)
t = Travelling time of the lever (sec)
- 2. Delayed absorption in rotation**
Formula (N·m/(rad/sec)) = $\frac{T}{\omega}$
T = Torque applied to shaft (N·m)
ω = Angular velocity (rad/sec)
- 3. Impact absorption in linear motion**
Formula (N·m/(rad/sec)) = $\frac{MVL^2}{d}$
M = Mass (kg)
V = Velocity (m/sec)
L = Distance between the centre of the damper shaft and the lever's point of application (m)
d = Distance travelled by lever (m)
- 4. Vibrational absorption**
Formula (N·m/(rad/sec)) = $\frac{MfL^2}{0.08}$
M = Mass (kg)
f = Vibrational frequency (Hz)
L = Distance between the centre of the damper shaft and the lever's point of application (m)

<Possible application>

Anti-vibration damper for Ferris wheel gondolas



Soft Silent Safety

FRN-P2 Series

RoHS Compliant

Rotary Damper [Uni-Directional] Adjustable



*Max. rotation speed	50rpm	*Body and cap material	PBT
*Max. cycle rate	10 cycle/min	*Rotating shaft material	SUS
*Operating temperature	0~50°C	*Gear, adjustment knob	POM
*Weight	64g	*Oil type	Silicone oil

<Specifications>

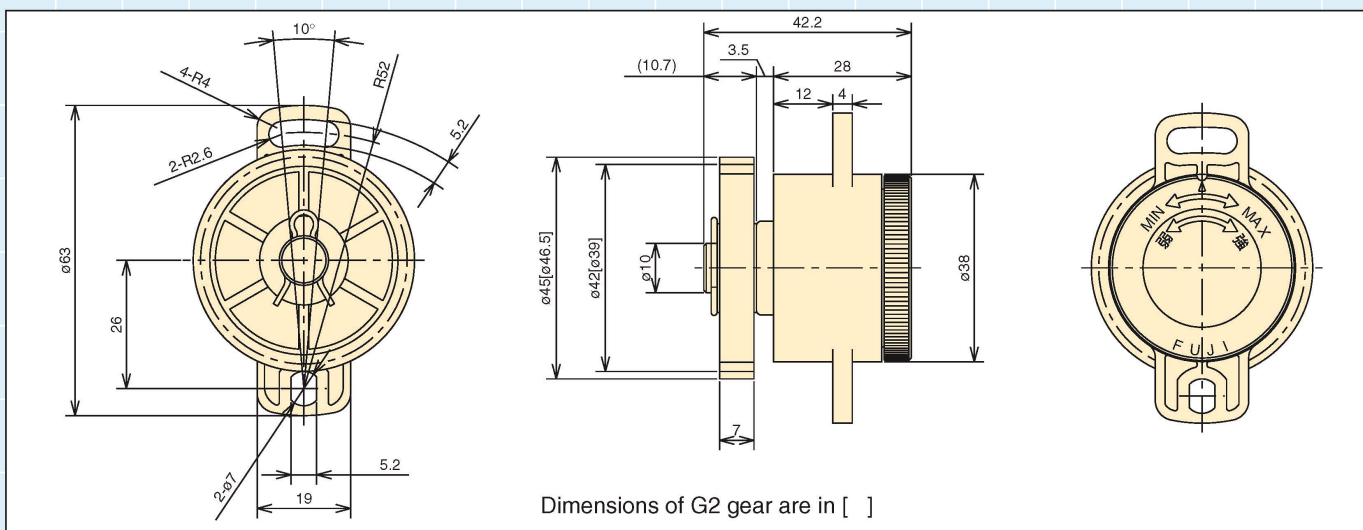
Model	Rated torque	Damping direction
FRN-P2-R202(G*)	0.20±0.04 N·m (2.0±0.4 kgf·cm)	Clockwise direction
FRN-P2-L202(G*)		Counter-clockwise direction
FRN-P2-R102(G*)	0.10±0.02 N·m (1.0±0.2 kgf·cm)	Clockwise direction
FRN-P2-L102(G*)		Counter-clockwise direction
FRN-P2-R501(G*)	0.05±0.01 N·m (0.5±0.1 kgf·cm)	Clockwise direction
FRN-P2-L501(G*)		Counter-clockwise direction

Note 1) Rated torque is measured at a rotation speed of 20rpm at 23°C (adjustment knob set at MAX)

Gear Specifications

	G1	*G2
Type	Standard spur gear	
Tooth profile	Involute	
Module	1.5	3.0
Pressure angle	20°	
Number of teeth	28	13
Pitch circle diameter	ø42	ø39
Addendum modification coefficient	—	+0.25

*G2 – Available soon



How to Adjust Torque

Range of Torque Adjustment

