ACE rotary dampers are sealed maintenance-free units. They are available with fixed or adjustable damping rates. The damping can be clockwise, anticlockwise or in both directions. The outer body is either plastic or metal depending upon model size. The output connection can be direct onto the keyed output shaft or indirect via a plastic gear (available with 4 standard modules). Plastic racks with modules of 0.5 to 1 are also available. Applications include office machinery, lids and flaps, floppy disc drives, piano lids, CD players, auto glove-boxes, vending machines, medical equipment, furniture industry and a multitude of other uses.

Function: ACE rotary dampers guarantee the smooth controlled opening and closing of small lids, covers and flaps. They can be mounted directly on the pivot axis or can be used to provide linear damping by using a plastic gear and rack. They enable mechanisms to operate with a smooth controlled motion giving that “touch of quality” to whatever product they are used on. ACE rotary dampers are filled with a special high viscosity fluid (silicone type) and sealed for life. The fluid is passed through an orifice or groove by a rotating vane to provide damping resistance. The damping torque generated is determined by the fluid viscosity and by the orifice configuration.

Note: With a max. rotational speed of 50 revs/min and a maximum of 10 cycles/min (12 cycles/min with the FDT/FDN types) the rotary dampers still provide more than 80% of their damping torque after a working life of 50 000 cycles.
**Rotary Dampers FRT-E2 and FRT-G2**

### FRT-E2

**Damping in both Directions of Rotation**

<table>
<thead>
<tr>
<th>Without Gear</th>
<th>With Gear</th>
<th>Damping Torque Ncm (Nominal 20 rpm. 23 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRT-E2-100</td>
<td>FRT-E2-100-G1</td>
<td>0.10 +/- 0.05</td>
</tr>
<tr>
<td>FRT-E2-200</td>
<td>FRT-E2-200-G1</td>
<td>0.20 +/- 0.07</td>
</tr>
<tr>
<td>FRT-E2-300</td>
<td>FRT-E2-300-G1</td>
<td>0.30 +/- 0.08</td>
</tr>
<tr>
<td>FRT-E2-400</td>
<td>FRT-E2-400-G1</td>
<td>0.40 +/- 0.10</td>
</tr>
</tbody>
</table>

Material: Polycarbonate plastic  
Operating temperature range: 0 °C to 50 °C  
Tooth: Involute  
Module: 10.6  
Pressure angle: 20 °  
No. of teeth: 10  
P.C.D.: 6 mm

---

1 A 250 mm long plastic rack is available for use with this part see page 110.

### FRT-G2

**Damping in both Directions of Rotation**

<table>
<thead>
<tr>
<th>Without Gear</th>
<th>With Gear</th>
<th>Damping Torque Ncm (Nominal 20 rpm. 23 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRT-G2-200</td>
<td>FRT-G2-200-G1</td>
<td>0.20 +/- 0.07</td>
</tr>
<tr>
<td>FRT-G2-300</td>
<td>FRT-G2-300-G1</td>
<td>0.30 +/- 0.08</td>
</tr>
<tr>
<td>FRT-G2-450</td>
<td>FRT-G2-450-G1</td>
<td>0.45 +/- 0.10</td>
</tr>
<tr>
<td>FRT-G2-600</td>
<td>FRT-G2-600-G1</td>
<td>0.60 +/- 0.12</td>
</tr>
<tr>
<td>FRT-G2-101</td>
<td>FRT-G2-101-G1</td>
<td>1.00 +/- 0.20</td>
</tr>
</tbody>
</table>

Material: Polycarbonate plastic  
Operating temperature range: 0 °C to 50 °C  
Tooth: Involute  
Module: 10.5  
Pressure angle: 20 °  
No. of teeth: 14  
P.C.D.: 7 mm

---

1 A 250 mm long plastic rack is available for use with this part see page 110.
FRT-C2 and FRN-C2

<table>
<thead>
<tr>
<th>Bidirectional Damping</th>
<th>Right-Hand Damping (clockwise)</th>
<th>Left-Hand Damping (anti-clockwise)</th>
<th>Model</th>
<th>Damping Torque Ncm (Nominal 20 rpm, 23 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRT-C2-201</td>
<td>FRN-C2-R201</td>
<td>FRN-C2-L201</td>
<td>without gear</td>
<td>2 +/- 0.6</td>
</tr>
<tr>
<td>FRT-C2-201-G1</td>
<td>FRN-C2-R201-G1</td>
<td>FRN-C2-L201-G1</td>
<td>with gear</td>
<td>2 +/- 0.6</td>
</tr>
<tr>
<td>FRT-C2-301</td>
<td>FRN-C2-R301</td>
<td>FRN-C2-L301</td>
<td>without gear</td>
<td>3 +/- 0.8</td>
</tr>
<tr>
<td>FRT-C2-301-G1</td>
<td>FRN-C2-R301-G1</td>
<td>FRN-C2-L301-G1</td>
<td>with gear</td>
<td>3 +/- 0.8</td>
</tr>
</tbody>
</table>

Material: Polycarbonate plastic

Operating temperature range: 0 °C to 50 °C

Tooth: Involute

Module: 1.0

Pressure angle: 20 °

No. of teeth: 11

P.C.D.: 8.8 mm

1 A 170 mm long flexible plastic rack and a 250 mm long rigid rack are available for use with this part see page 110.

FRT-D2 and FRN-D2

<table>
<thead>
<tr>
<th>Bidirectional Damping</th>
<th>Right-Hand Damping (clockwise)</th>
<th>Left-Hand Damping (anti-clockwise)</th>
<th>Model</th>
<th>Damping Torque Ncm (Nominal 20 rpm, 23 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRT-D2-102</td>
<td>FRN-D2-R102</td>
<td>FRN-D2-L102</td>
<td>without gear</td>
<td>10 +/- 2</td>
</tr>
<tr>
<td>FRT-D2-102-G1</td>
<td>FRN-D2-R102-G1</td>
<td>FRN-D2-L102-G1</td>
<td>with gear</td>
<td>10 +/- 2</td>
</tr>
<tr>
<td>FRT-D2-152</td>
<td>FRN-D2-R152</td>
<td>FRN-D2-L152</td>
<td>with gear</td>
<td>15 +/- 3</td>
</tr>
<tr>
<td>FRT-D2-152-G1</td>
<td>FRN-D2-R152-G1</td>
<td>FRN-D2-L152-G1</td>
<td>with gear</td>
<td>15 +/- 3</td>
</tr>
<tr>
<td>FRT-D2-501</td>
<td>FRN-D2-R501</td>
<td>FRN-D2-L501</td>
<td>without gear</td>
<td>5 +/- 1</td>
</tr>
<tr>
<td>FRT-D2-501-G1</td>
<td>FRN-D2-R501-G1</td>
<td>FRN-D2-L501-G1</td>
<td>with gear</td>
<td>5 +/- 1</td>
</tr>
</tbody>
</table>

Material: Polycarbonate plastic

Operating temperature range: 0 °C to 50 °C

Tooth: Involute

Module: 1.0

Pressure angle: 20 °

No. of teeth: 12

P.C.D.: 12 mm

1 A 250 mm and 500 mm long plastic rack are available for use with this part see page 110.
Rotary Dampers FYN-P1 and FYN-N1

FYN-P1

<table>
<thead>
<tr>
<th>Right-Hand Damping</th>
<th>Left-Hand Damping</th>
<th>Damping Torque Ncm</th>
<th>Return Damping Torque Ncm</th>
</tr>
</thead>
<tbody>
<tr>
<td>FYN-P1-R103</td>
<td>FYN-P1-L103</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>FYN-P1-R153</td>
<td>FYN-P1-L153</td>
<td>150</td>
<td>50</td>
</tr>
<tr>
<td>FYN-P1-R183</td>
<td>FYN-P1-L183</td>
<td>180</td>
<td>80</td>
</tr>
</tbody>
</table>

Material: Polycarbonate plastic

Operating temperature range: -5 °C to 50 °C
Weight: 0.010 kg
Max. rotation angle: 115°

Do not use damper as final end stop.
Fit external mechanical stops at each end of travel.

“Coloured shaft for identification of the damping direction!”

FYN-N1

<table>
<thead>
<tr>
<th>Right-Hand Damping</th>
<th>Left-Hand Damping</th>
<th>Damping Torque Ncm</th>
<th>Return Damping Torque Ncm</th>
</tr>
</thead>
<tbody>
<tr>
<td>FYN-N1-R103</td>
<td>FYN-N1-L103</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>FYN-N1-R203</td>
<td>FYN-N1-L203</td>
<td>200</td>
<td>40</td>
</tr>
<tr>
<td>FYN-N1-R253</td>
<td>FYN-N1-L253</td>
<td>250</td>
<td>40</td>
</tr>
<tr>
<td>FYN-N1-R303</td>
<td>FYN-N1-L303</td>
<td>300</td>
<td>80</td>
</tr>
</tbody>
</table>

Material: Polycarbonate plastic

Operating temperature range: -5 °C to 50 °C
Weight: 0.012 kg
Max. rotation angle: 110°

Do not use damper as final end stop.
Fit external mechanical stops at each end of travel.

“Coloured end cap for identification of the damping direction!”
Rotary Dampers FYN-U1 and FYN-K1

**FYN-U1**

- **Right-Hand Damping (clockwise)**
  - FYN-U1-R203
  - FYN-U1-R253
  - FYN-U1-R303

- **Left-Hand Damping (anti-clockwise)**
  - FYN-U1-L203
  - FYN-U1-L253
  - FYN-U1-L303

- **Damping Torque Ncm**: 200, 250, 300
- **Return Damping Torque Ncm**: 40, 40, 80

**Material**: Zinc diecast
**Operating temperature range**: -5 °C to 50 °C
**Weight**: 0.04 kg
**Max. rotation angle**: 115°

Do not use damper as final end stop.
Fit external mechanical stops at each end of travel.

**FYN-K1**

- **Right-Hand Damping (clockwise)**
  - FYN-K1-R

- **Left-Hand Damping (anti-clockwise)**
  - FYN-K1-L

- **Damping Torque Ncm**: 400

**Material**: Polycarbonate plastic
**Operating temperature range**: -5 °C to 50 °C
**Max. rotation angle**: 108°
**Return Damping Torque**: 100 Ncm
**Weight**: 0.035 kg

Do not use damper as final end stop.
Fit external mechanical stops at each end of travel.
**FRT/FRN-K2 and FRT/FRN-F2**

Bidirectional Damping

<table>
<thead>
<tr>
<th>Type</th>
<th>Right-Hand Damping (clockwise)</th>
<th>Left-Hand Damping (anti-clockwise)</th>
<th>Damping Torque Nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRT-K2-502</td>
<td>FRN-K2-R502</td>
<td>FRN-K2-L502</td>
<td>50 +/- 10</td>
</tr>
<tr>
<td>FRT-K2-103</td>
<td>FRN-K2-R103</td>
<td>FRN-K2-L103</td>
<td>100 +/- 20</td>
</tr>
<tr>
<td>FRT-F2-203</td>
<td>FRN-F2-R203</td>
<td>FRN-F2-L203</td>
<td>200 +/- 40</td>
</tr>
<tr>
<td>FRT-F2-303</td>
<td></td>
<td></td>
<td>300 +/- 80</td>
</tr>
</tbody>
</table>

Material: Polycarbonate plastic

Operating temperature range: 0 °C to 50 °C

Weight: max. 0.116 kg

**FFD**

Material: Polycarbonate plastic

Operating temperature range: -10 °C to 60 °C

Rotational speed max.: 30 rpm

Cycle rate max.: 13 cycles per minute

Recommended shaft details: Ø +0.03

**Ordering Example**

Friction Damper

Body Ø

Mounting Style (Flange = F, Standard = S)

Damping Option (S or W)

Damping Direction (right = R, left = L)

Damping Torque see chart

<table>
<thead>
<tr>
<th>Type</th>
<th>Damping Torque Nm</th>
<th>Damping Option 1</th>
<th>Dimensions</th>
<th>Flange Type</th>
<th>Standard Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFD-25</td>
<td>0.1 / 0.5 / 1.0</td>
<td>Type S</td>
<td>D1  d1 h1  L1</td>
<td>L2 h2 d2  t</td>
<td></td>
</tr>
<tr>
<td>FFD-28</td>
<td>0.1 / 0.5 / 1.0</td>
<td>Type S</td>
<td>25  8  13  3  42  34  21</td>
<td>6.2  16  4  4</td>
<td></td>
</tr>
<tr>
<td>FFD-28</td>
<td>0.1 / 0.5 / 1.0</td>
<td>Type W</td>
<td>28  8  13  3  44  36  26</td>
<td>8.2  16  4  4</td>
<td></td>
</tr>
<tr>
<td>FFD-25</td>
<td>1.0 / 1.5 / 2.0</td>
<td>Type W</td>
<td>25  8  19  3  42  34  21</td>
<td>6.2  22  4  4</td>
<td></td>
</tr>
<tr>
<td>FFD-30</td>
<td>1.5 / 2.0 / 3.0</td>
<td>Type W</td>
<td>30  10  19  3  46  38  26</td>
<td>10.2  22  4  4</td>
<td></td>
</tr>
</tbody>
</table>

1 Damping clockwise or anti-clockwise.
Rotary Dampers FYT/FYN-H1 and -LA3

**FYT-H1 and FYN-H1**

Model Adjustable

<table>
<thead>
<tr>
<th>Bidirectional Damping</th>
<th>Right-Hand Damping (clockwise)</th>
<th>Left-Hand Damping (anti-clockwise)</th>
<th>Damping Torque Nm (adjustable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FYT-H1</td>
<td>FYN-H1-R</td>
<td>FYN-H1-L</td>
<td>2...10</td>
</tr>
</tbody>
</table>

Material: Zinc diecast, steel shaft

Operating temperature range: -5 °C to 50 °C

Max. rotation angle: 105°

Return Damping Torque: 0.5 Nm

Maximum side load: 50 N

Weight: 0.24 kg

A play of approx. 5° can occur at the beginning of movement.

Do not use damper as final end stop.

Fit external mechanical stops at each end of travel.

**FYT-LA3 and FYN-LA3**

Model Adjustable

<table>
<thead>
<tr>
<th>Bidirectional Damping</th>
<th>Right-Hand Damping (clockwise)</th>
<th>Left-Hand Damping (anti-clockwise)</th>
<th>Damping Torque Nm (adjustable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FYT-LA3</td>
<td>FYN-LA3-R</td>
<td>FYN-LA3-L</td>
<td>4...40</td>
</tr>
</tbody>
</table>

Material: Zinc diecast, steel shaft

Operating temperature range: -5 °C to 50 °C

Max. rotation angle: 210°

Return Damping Torque: 4 Nm

Maximum side load: 200 N

Weight: 1.75 kg

A play of approx. 5° can occur at the beginning of movement.

Do not use damper as final end stop.

Fit external mechanical stops at each end of travel.
Rotary Dampers FDT/FDN-47 to 70

### FDT-47 to 70

Damping in both Directions of Rotation

<table>
<thead>
<tr>
<th>Type</th>
<th>Damping Torque Nm (at 20 rpm, 23 °C)</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDT-47</td>
<td>2.0 +/- 0.3</td>
<td>A: 65, B: 56, C: 8, D: 4.5, E: 47, F: 42.8, G: 1.6, H: 10.3, R: 4.5, V: 10</td>
</tr>
<tr>
<td>FDT-57</td>
<td>4.7 +/- 0.5</td>
<td>A: 79, B: 68, C: 10, D: 5.5, E: 57, F: 52.4, G: 1.6, H: 11.2, R: 5.5, V: 13</td>
</tr>
<tr>
<td>FDT-63</td>
<td>6.7 +/- 0.7</td>
<td>A: 89, B: 76, C: 12.5, D: 6.5, E: 63, F: 58.6, G: 1.6, H: 11.3, R: 6.5, V: 17</td>
</tr>
<tr>
<td>FDT-70</td>
<td>8.7 +/- 0.8</td>
<td>A: 95, B: 82, C: 12.5, D: 70, E: 65.4, G: 1.6, H: 11.3, R: 6.5, V: 17</td>
</tr>
</tbody>
</table>

**Material:** Steel. Output shaft sleeve: Nylon

**Operating temperature range:** -10 °C to 50 °C

**Rotational speed max.:** 50 rpm

**Cycle rate max.:** 12 cycles per minute

**Weight max.:** 0.1 kg

There is no support for the output shaft within the damper structure. External support must be provided for the shaft.

### FDN-47 to 70

<table>
<thead>
<tr>
<th>Right-Hand Damping (clockwise)</th>
<th>Left-Hand Damping (anti-clockwise)</th>
<th>Damping Torque Nm (at 20 rpm, 23 °C)</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDN-47-R</td>
<td>FDN-47-L</td>
<td>2.0 +/- 0.3</td>
<td>A: 65, B: 56, C: 6, D: 4.5, E: 47, F: 42.8, G: 1.6, H: 10.3, R: 4.5</td>
</tr>
<tr>
<td>FDN-57-R</td>
<td>FDN-57-L</td>
<td>5.5 +/- 0.3</td>
<td>A: 79, B: 68, C: 10, D: 5.5, E: 57, F: 52.4, G: 1.6, H: 14, R: 5.5</td>
</tr>
<tr>
<td>FDN-63-R</td>
<td>FDN-63-L</td>
<td>8.5 +/- 0.8</td>
<td>A: 89, B: 76, C: 12.5, D: 6.5, E: 63, F: 58.6, G: 1.6, H: 13.9, R: 6.5</td>
</tr>
<tr>
<td>FDN-70-R</td>
<td>FDN-70-L</td>
<td>10.0 +/- 1.0</td>
<td>A: 95, B: 82, C: 12.5, D: 70, E: 65.4, G: 1.6, H: 13, R: 6.5</td>
</tr>
</tbody>
</table>

**Material:** Steel. Output shaft sleeve: Nylon

**Operating temperature range:** -10 °C to 50 °C

**Rotational speed max.:** 50 rpm

**Cycle rate max.:** 12 cycles per minute

**Weight max.:** 0.12 kg

There is no support for the output shaft within the damper structure. External support must be provided for the shaft.

**Recommended shaft details:**

- for FDN-47: Ø 6 ±0.03
- for FDN-57 to FDN-70: Ø 10 ±0.03

Hardness > HRC55, surface smoothness R₂ < 1 μm
Calculation of Rotary Damper for a Lid

m  Mass of lid (kg)
L  Length of lid from pivot (cm)
n  Rotation speed (r.p.m.)
g  Acceleration due to gravity (= 9.81)

Calculation Steps
1) Calculate max. torque damper will be exposed to (with example shown max. torque is at $\alpha = 0$).
2) Decide upon rotation speed desired.
3) Choose a rotary damper from catalogue that can handle the torque calculated above.
4) With the aid of the damper performance curves, check if the r.p.m. given at your torque corresponds to the desired closing speed of the lid.
5) If the r.p.m. is too high – choose a damper with a higher torque rating.
   If the r.p.m. is too low – choose a damper with a lower torque rating.

Mountings to Avoid
The output shaft should not be exposed to side loading.

Toothed Rack M0.5, M0.6, M0.8, M1.0

Damping Direction
right hand damping = damping action in clockwise direction when looking onto the output shaft

Accessories
Toothed plastic rack with modules 0.5 to 1 available.

Models Available

<table>
<thead>
<tr>
<th>Toothed Rack</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0.5</td>
<td>250</td>
<td>4</td>
<td>4,5</td>
<td>rigid, milled</td>
</tr>
<tr>
<td>M0.6</td>
<td>250</td>
<td>6</td>
<td>8</td>
<td>rigid, milled</td>
</tr>
<tr>
<td>M0.8</td>
<td>170</td>
<td>8</td>
<td>4,1</td>
<td>flexible, milled</td>
</tr>
<tr>
<td>M0.8P</td>
<td>500</td>
<td>9</td>
<td>9</td>
<td>rigid, milled</td>
</tr>
<tr>
<td>M1.0</td>
<td>500</td>
<td>10</td>
<td>10</td>
<td>rigid, milled</td>
</tr>
</tbody>
</table>

Metal racks available on request.
ACE rotary dampers ensure the quiet shuffling of playing cards. Software controlled playing card shuffling machines such as this one are used throughout the world and are equipped with the FRT-G2-101-G1 type rotary dampers. Maintenance-free and ready to install. Before inserting the set of cards, you can ensure the quiet stopping of the plastic wedge in the equipment when it is driven upwards. The dampers can be applied to suit your requirements; clockwise, anticlockwise or in both directions; and they are just as reliable as the open and close slides in high quality DVD or CD players.

Playing cards are shuffled simply and quietly

ACE rotary dampers protect the keyboard. To provide long term protection in arduous and often dirty industrial applications (and also to protect against unauthorised access) the machine keyboard is installed in a lockable and pivoted housing cabinet. ACE rotary dampers type FRN-F1 were installed on the pivot axis to provide a smooth controlled motion to the keyboard as it is pulled down into its operating position. The damper also prevents overloading the hinge system and prevents damage to the keyboard, the housing cabinet and the hinges.

Damping lever motions

Pivoted machine keyboard