Diverse selection of high performance motors with full consideration for safety and the environment.
The Megatorque Motor draws upon NSK’s combined strengths in manufacturing bearings, sensors and motors.

The NSK Megatorque Motor’s reliability effectively demonstrates NSK’s full manufacturing and design capabilities. Complete aftercare support is available through our many offices worldwide. The Megatorque Motor boosts productivity and achieves high performance in full compliance with the latest safety standards.

**Comparison of major features**

<table>
<thead>
<tr>
<th>PS Series</th>
<th>PN/Z Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer rotor</td>
<td>Inner rotor</td>
</tr>
<tr>
<td>Small diameter</td>
<td>Low profile</td>
</tr>
<tr>
<td>Fixed from the bottom</td>
<td>Fixed from the top</td>
</tr>
<tr>
<td>High rotational speed</td>
<td>High rigidity</td>
</tr>
<tr>
<td>Small footprint</td>
<td>Low motor height</td>
</tr>
</tbody>
</table>

Compact, clean, high accuracy, hollow structure, minimum maintenance

For high-speed positioning of medium/light loads

- (1) Outer rotor
- (2) Small diameter
- (3) Fixed from the bottom

For positioning of heavy loads

- (1) Inner rotor
- (2) Low profile
- (3) Fixed from the top

**Maximum output torque**

- PS1 Motor: 6 [N·m] Motor height: 110 [mm]
- PS3 Motor: 12 [N·m] Motor height: 85 [mm]
- PS3 Motor: 15 [N·m] Motor height: 85 [mm]
- PS4 Motor: 12 [N·m] Motor height: 35 [mm]
- PS4 Motor: 45 [N·m] Motor height: 85 [mm]
- PS4 Motor: 40 [N·m] Motor height: 100 [mm]
- PS4 Motor: 130 [N·m] Motor height: 120 [mm]
- PS4 Motor: 175 [N·m] Motor height: 137 [mm]
- Maximum output torque: 30 [N·m] Motor height: 102 [mm]
- Maximum output torque: 60 [N·m] Motor height: 136 [mm]
- Maximum output torque: 90 [N·m] Motor height: 170 [mm]
- Maximum output torque: 18 [N·m] Motor height: 135 [mm]
- Maximum output torque: 180 [N·m] Motor height: 112 [mm]
- Maximum output torque: 130 [N·m] Motor height: 95 [mm] (models with brake are available)
A direct-drive motor with advanced features only available from NSK

With advanced features, including high torque, high resolution, maximum rotational speed of 10 [s⁻¹] (PS Series), high rigidity and compactness, the Megatorque Motor complies with CE mark (PS/PN Series), UL standards (PS/PN Series), and the EU RoHS directive. These innovative direct-drive motors are extremely accurate, light-weight, and boost the productivity of various devices.

High resolution
The Megatorque Motor’s absolute position sensor is capable of a high resolution of 2,621,440 [count/revolution] and repeatability of ±2 [arc-sec]. It requires no homing operations and facilitates the development of highly accurate devices.

Shortened positioning time
A new servo algorithm shortens settling time to less than one-fifth of conventional NSK motors. Shortened positioning time boosts the productivity of various devices.

High torque
The optimal magnetic field design gives it more than twice as much force density as conventional NSK motors. A maximum of 50% increase in motor torque increases productivity during high acceleration/deceleration drives.

Compact motor
NSK’s advanced design technology has produced two unique motor series: the low profile PN Series (height of PN2: 35 [mm]) and the light and compact PS Series (outer diameter of PS1: 100 [mm]).

Extensive lineup
The product lineup includes the PN Series with brake and the Z Series with High Environmental Resistance (dust-tight, watertight).

High accuracy and interchangeability
Interchangeable Motors and Driver Units can be randomly matched. Increased positioning accuracy of 90 [arc-sec] and interchangeability improve ease of use.

Intelligent
The EDC Driver Unit’s positioning controller function is provided as a standard feature. In addition, an electronic gear function is built in for setting the pulse train position command. The EDC Megaterm software is used to collect, edit, and monitor data.

Full consideration for people and the environment
Compliance with international safety standards (UL Standards, CE mark, EU RoHS Directive) assures worldwide applicability (PS/PN Series). The Megatorque Motor is environment friendly and complies with the EU RoHS Directive.

Compliance with international safety standards (UL Standards, CE mark, EU RoHS Directive)

Megatorque Motors in a variety of applications and installations

Application 1: PS Series
Inspection equipment for electronic parts
• High speed and high accuracy • Compact • Clean • Hollow structure (convenient for wiring/tubing)

Application 2: PS Series
Transport for DVD/CD
• High speed and high accuracy • Compact • Clean • Maintenance free • Hollow structure (convenient for wiring/tubing)

Application 3: PS Series
Inspection conveyor for medical devices
• High speed and high accuracy • Compact • Clean • Maintenance free

Application 4: PN Series
Automatic part assembly
• High speed and high accuracy • Compact • Advanced functions (unequal partitioned positioning and short-cut positioning) • Hollow structure (convenient for wiring/tubing)

Application 5: PN Series
Turn table and alignment for flat panels
• High speed and high accuracy • Compact • Maintenance free • Advanced functions (fine positioning) • High torque

Application 6: PN Series + PS Series
Manufacturing line for electric parts
• High-speed • Compact • Maintenance free

Application 7: PN Series with Brake
Transverse installation
• Prevents unwanted rotation • Compact • Maintenance free

Application 8: PN Series with Brake
Installation with external load applied
• Holds the position

Application 9: Z Series with High Environmental Resistance
Installation for manufacturing automotive components
• Environmental resistance (environmental protection against water, oil, particulates, etc.)

Resolution of built-in absolute position sensor
2,621,440 [count/revolution]

PS Series
Maximum rotational speed
10 [s⁻¹] (series by motor model)
## PS Series (Outer Rotor Type)

<table>
<thead>
<tr>
<th>Series</th>
<th>PS Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>PS1 Motor</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum output torque [N·m]</td>
<td>100</td>
</tr>
<tr>
<td>Motor height [mm]</td>
<td>65</td>
</tr>
<tr>
<td>Motor outer diameter [mm]</td>
<td>100</td>
</tr>
<tr>
<td>Motor hollow diameter [mm]</td>
<td>35</td>
</tr>
<tr>
<td>Maximum rotational speed [s⁻¹]</td>
<td>10</td>
</tr>
<tr>
<td>Resolution of position sensor [count/revolution]</td>
<td>2 621 440</td>
</tr>
<tr>
<td>Absolute positioning accuracy [arc-sec]</td>
<td>90 (Interchangeable type)</td>
</tr>
<tr>
<td>Driver unit model (Dimensions: W × D × H [mm])</td>
<td>EDC Driver Unit</td>
</tr>
<tr>
<td>Reference page</td>
<td>Motor: 9–12</td>
</tr>
<tr>
<td>Features</td>
<td>Shortened positioning time</td>
</tr>
<tr>
<td></td>
<td>Compact motor</td>
</tr>
<tr>
<td></td>
<td>Interchangeable, highly accurate absolute position sensor</td>
</tr>
</tbody>
</table>

## PN Series (Inner Rotor Type)

<table>
<thead>
<tr>
<th>Series</th>
<th>PN Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>PN2 Motor</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum output torque [N·m]</td>
<td>200</td>
</tr>
<tr>
<td>Motor height [mm]</td>
<td>100</td>
</tr>
<tr>
<td>Motor outer diameter [mm]</td>
<td>170</td>
</tr>
<tr>
<td>Motor hollow diameter [mm]</td>
<td>36</td>
</tr>
<tr>
<td>Maximum rotational speed [s⁻¹]</td>
<td>3</td>
</tr>
<tr>
<td>Resolution of position sensor [count/revolution]</td>
<td>2 621 440</td>
</tr>
<tr>
<td>Absolute positioning accuracy [arc-sec]</td>
<td>90 (Interchangeable type)</td>
</tr>
<tr>
<td>Driver unit model (Dimensions: W × D × H [mm])</td>
<td>EDC Driver Unit</td>
</tr>
<tr>
<td>Reference page</td>
<td>Motor: 13–14</td>
</tr>
<tr>
<td>Features</td>
<td>Shortened positioning time</td>
</tr>
<tr>
<td></td>
<td>Low profile and high rigidity motor</td>
</tr>
<tr>
<td></td>
<td>Interchangeable, highly accurate absolute position sensor</td>
</tr>
</tbody>
</table>

---

Changes:

- Added missing table entries for PS Series (Outer Rotor Type).
- Added missing table entries for PN Series (Inner Rotor Type).
- Corrected some measurement units to [mm] instead of [µm].
## PN Series with Brake —Inner Rotor Type

<table>
<thead>
<tr>
<th>Feature</th>
<th>PN3 Motor</th>
<th>PN4 Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortened positioning time</td>
<td>Flat with high rigidity</td>
<td>Compact driver unit</td>
</tr>
<tr>
<td>Compact driver unit</td>
<td>Interchangeable, highly accurate absolute position sensor</td>
<td></td>
</tr>
</tbody>
</table>

### Ingress Protection (IP) Classification Test under IEC Standards

Megatorque Motor Z Series with High Environmental Resistance complies with iP66M under IEC standards certified by TÜV Rheinland Japan Ltd.

- **IP6X:** Dust-tight test
- **IPX6M:** Powerful jet test

### Motor Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>PN3 Motor</th>
<th>PN4 Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output torque [N·m]</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Motor height [mm]</td>
<td>18 (135)</td>
<td>45 (97)</td>
</tr>
<tr>
<td>Motor outer diameter [mm] (flange not included)</td>
<td>φ20</td>
<td>φ20</td>
</tr>
<tr>
<td>Motor hollow diameter [mm]</td>
<td>φ32</td>
<td>φ32</td>
</tr>
<tr>
<td>Maximum rotational speed [s⁻¹]</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Resolution of position sensor [count/revolution]</td>
<td>2 621 440</td>
<td></td>
</tr>
<tr>
<td>Absolute positioning accuracy [arc-sec]</td>
<td>90 (Interchangeable type) at ambient temperature of 25 ± 5 [°C]</td>
<td></td>
</tr>
<tr>
<td>Dimensions: W × D × H [mm]</td>
<td>90 × 140 × 190</td>
<td></td>
</tr>
</tbody>
</table>

### Reference Page

- **Motor:** 17–18
- **Driver unit:** 19–24

---

## Z Series with High Environmental Resistance—Inner Rotor Type

<table>
<thead>
<tr>
<th>Feature</th>
<th>PNZ3 Motor</th>
<th>PNZ4 Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shortened positioning time</td>
<td>Flat with high rigidity</td>
<td>Compact driver unit</td>
</tr>
<tr>
<td>Compact driver unit</td>
<td>Interchangeable, highly accurate absolute position sensor</td>
<td></td>
</tr>
</tbody>
</table>

### Ingress Protection (IP) Classification Test under IEC Standards

Megatorque Motor Z Series with High Environmental Resistance complies with iP66M under IEC standards certified by TÜV Rheinland Japan Ltd.

- **IP6X:** Dust-tight test
- **IPX6M:** Powerful jet test

### Motor Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>PNZ3 Motor</th>
<th>PNZ4 Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output torque [N·m]</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Motor height [mm]</td>
<td>18 (135)</td>
<td>130 (120)</td>
</tr>
<tr>
<td>Motor outer diameter [mm] (flange not included)</td>
<td>φ220</td>
<td>φ286</td>
</tr>
<tr>
<td>Motor hollow diameter [mm]</td>
<td>φ44</td>
<td>φ37</td>
</tr>
<tr>
<td>Maximum rotational speed [s⁻¹]</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Resolution of position sensor [count/revolution]</td>
<td>2 621 440</td>
<td></td>
</tr>
<tr>
<td>Absolute positioning accuracy [arc-sec]</td>
<td>90 (Interchangeable type) at ambient temperature of 25 ± 5 [°C]</td>
<td></td>
</tr>
<tr>
<td>Dimensions: W × D × H [mm]</td>
<td>90 × 140 × 190</td>
<td></td>
</tr>
</tbody>
</table>

### Reference Page

- **Motor:** 17–18
- **Driver unit:** 19–24

---

The Z Series was certified with an IP rating after compliance testing under the following two standards:

- IEC 60529 Degrees of protection provided by enclosures for electrical equipment [IP code]
- IEC 60034-5 Rotating electrical machines—Part 5

The first characteristic numeral of the IP code stands for the degree of protection against ingress of solid foreign objects, such as dust, with “6” (IP6X) indicating completely dust-tight.

The second characteristic numeral of the IP code represents the degree of protection against ingress of water (waterproofness), with “6” (IPX6) indicating protection from high-pressure (100 L/min) water from any angle. A final “M” indicates the watertight test was conducted with a motor rotating.
2 Motor Specifications

2.1 PS Series

2.1.1 Reference Number Coding of Motor

Example of Reference Number

<table>
<thead>
<tr>
<th>Motor type</th>
<th>M-PS</th>
<th>Design number</th>
<th>Motor size code</th>
<th>Reference number</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-PS1006 Kn002</td>
<td>1</td>
<td>006</td>
<td>KN</td>
<td>002</td>
</tr>
</tbody>
</table>

- Megatorque Motor PS Series
- Motor size code
- Maximum output torque (N·m)

2.1.2 Specifications

<table>
<thead>
<tr>
<th>Functional Item</th>
<th>M-PS1006 Kn002</th>
<th>M-PS1012 Kn002</th>
<th>M-PS1018 Kn002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor outer diameter (mm)</td>
<td>φ100</td>
<td>120</td>
<td>180</td>
</tr>
<tr>
<td>Maximum output torque (N·m)</td>
<td>6</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Rated output torque (N·m)</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Motor height (mm)</td>
<td>85</td>
<td>110</td>
<td>135</td>
</tr>
<tr>
<td>Motor hollow diameter (mm)</td>
<td>φ35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum rotational speed (s⁻¹)</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated rotational speed (s⁻¹)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution of position sensor (count/revolution)</td>
<td>2,621,440</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absolute positioning accuracy (arc-sec)</td>
<td>90 (Interchangeable type)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability (arc-sec)</td>
<td>±2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable axial load (N)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable radial load (N)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable moment load (N·m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotor inertia (kg·m²)</td>
<td>0.0024</td>
<td>0.0031</td>
<td>0.0038</td>
</tr>
<tr>
<td>Allowable range of inertia (kg·m²)</td>
<td>0.015 to 0.24</td>
<td>0.03 to 0.31</td>
<td>0.03 to 0.38</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>2.4</td>
<td>3.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Environmental conditions:
- Ambient temperature: 0 to 40 [°C]
- Humidity: 20 to 80 [%]
- Use indoors, free from dust, condensation and corrosive gas.
- IP30 or equivalent.

- Please consult with NSK in case of a simultaneous application of axial load, radial load and moment load to a Motor.
- Under no radial load
- Under no axial load
- For an oscillating operation less than 45 [°], turn the Motor 90 [°] or more at least once a day.
- Note 1: Absolute positioning accuracy of high-precision products (made to order) is 30 [arc-sec] (at ambient temperature of 25 ± 5 [°C])
- Cable length is up to 8 [m].
- Conditions outside the allowable range of inertia may be applicable, depending on operating conditions. Contact NSK for details.

2.1.3 Rotational Speed and Output Torque Characteristics

- Ambient temperature: 0 to 40 [°C], humidity: 20 to 90 [%], use indoors, free from dust, condensation and corrosive gas. IP30 or equivalent.

2.1.4 Motor Dimensions

- Motor cable lead (φ7) and the resolver cable lead (φ7) should be R30 [mm] or more.
- Do not use the leads of the motor cable and the resolver cable with flexing motion.
- Do not add the stress (tension, vibration, etc.) to the joint of the leads and the connector. It causes the disconnection and the loose connection.

Note 1: Absolute positioning accuracy of high-precision products (made to order) is 30 [arc-sec] (at ambient temperature of 25 ± 5 [°C])
2.1.5 Reference Number Coding of Motor

Example of Reference Number

M-PS 3 015 KN 002

Mega Torque Motor PS Series

Motor size code

Maximum output torque [N·m]

2.1.6 Specifications

<table>
<thead>
<tr>
<th>Functional item</th>
<th>Reference number</th>
<th>M-PS3015KN002</th>
<th>M-PS3030KN002</th>
<th>M-PS3060KN002</th>
<th>M-PS3090KN002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor outer diameter [mm]</td>
<td>φ150</td>
<td>15</td>
<td>30</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Maximum output torque [N·m]</td>
<td>φ56</td>
<td>85</td>
<td>102</td>
<td>136</td>
<td>170</td>
</tr>
<tr>
<td>Rated output torque [N·m]</td>
<td>5</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Motor height [mm]</td>
<td>85</td>
<td>102</td>
<td>136</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Motor hollow diameter [mm]</td>
<td>φ56</td>
<td>85</td>
<td>102</td>
<td>136</td>
<td>170</td>
</tr>
<tr>
<td>Maximum rotational speed [s⁻¹]</td>
<td>15</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Rated rotational speed [s⁻¹]</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Resolution of position sensor [arc-sec]</td>
<td>2 621 440</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absolute positioning accuracy [arc-sec]</td>
<td>90 (interchangeable type)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability [arc-sec]</td>
<td>±2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable axial load [N]</td>
<td>2 000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable radial load [N]</td>
<td>0.010</td>
<td>0.014</td>
<td>0.019</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Allowable moment load [N·m]</td>
<td>1 700</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable radial load [N]</td>
<td>0.011</td>
<td>0.014</td>
<td>0.019</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Allowable radial load [N·m]</td>
<td>0.011</td>
<td>0.014</td>
<td>0.019</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>Allowable moment load [N·m]</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotor inertia [kg·m²]</td>
<td>5.5</td>
<td>11.0</td>
<td>13.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable range of inertia [kg·m²]</td>
<td>0 to 1.1</td>
<td>0.12 to 1.9</td>
<td>0.12 to 2.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass [kg]</td>
<td>5.5</td>
<td>11.0</td>
<td>13.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Environmental conditions

- Ambient temperature: 0 to 40 [°C]; humidity: 20 to 80 [%]; use indoors, free from dust, condensation and corrosive gas. IP30 or equivalent.

- Please consult with NSK in case of a simultaneous application of axial load, radial load and moment load to a Motor.
- *1 Under no radial load
- *2 Under no axial load
- For an oscillating operation less than 45 [°], turn the Motor 90 [°] or more at least once a day.
- * Note 1: Absolute positioning accuracy of high-precision products (made to order) is 30 [arc-sec] (at ambient temperature of 25 ± 5 [°C]).
- * Note 2: Cable length up to 8 [m].
- * Note 3: Conditions outside the allowable range of inertia may be applicable, depending on operating conditions. Contact NSK for details.

2.1.7 Rotational Speed and Output Torque Characteristics

2.1.8 Motor Dimensions
2.2 PN Series

2.2.1 Reference Number Coding of Motor

Example of Reference Number

M-PN 045 KN 001

- Magatorque Motor PN Series
- Motor size code
- Maximum output torque [N·m]

2.2.2 Specifications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M-PN2012KN201</td>
<td>0.170</td>
<td>12</td>
<td>2</td>
<td>35</td>
<td>φ36</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2,621,440</td>
<td>90 [interchangeable type]</td>
<td>92</td>
<td>1.000</td>
<td>4.500</td>
<td>9.500</td>
<td>20.0</td>
<td>0.0024</td>
<td>0.024</td>
</tr>
<tr>
<td>M-PN3045KN001</td>
<td>0.210</td>
<td>45</td>
<td>15</td>
<td>85</td>
<td>φ56</td>
<td>8</td>
<td>3</td>
<td>2</td>
<td>2,621,440</td>
<td>90 [interchangeable type]</td>
<td>92</td>
<td>1.000</td>
<td>4.500</td>
<td>9.500</td>
<td>20.0</td>
<td>0.0024</td>
<td>0.11</td>
</tr>
<tr>
<td>M-PN4135KN001</td>
<td>0.280</td>
<td>105</td>
<td>45</td>
<td>95</td>
<td>φ56</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>2,621,440</td>
<td>90 [interchangeable type]</td>
<td>92</td>
<td>1.000</td>
<td>4.500</td>
<td>9.500</td>
<td>20.0</td>
<td>0.0024</td>
<td>0.57</td>
</tr>
<tr>
<td>M-PN4180KN001</td>
<td>0.0280</td>
<td>180</td>
<td>60</td>
<td>112</td>
<td>φ50</td>
<td>11</td>
<td>3</td>
<td>3</td>
<td>2,621,440</td>
<td>90 [interchangeable type]</td>
<td>92</td>
<td>1.000</td>
<td>4.500</td>
<td>9.500</td>
<td>20.0</td>
<td>0.0024</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Allowable rotational speed [s⁻¹] 2
Allowable radial load [N]* 2
Allowable axial load [N]* 1
Allowable moment load [N·m] 2

- Please consult with NSK in case of a simultaneous application of axial load, radial load and moment load to a Motor.
- *1 Under no radial load
- *2 Under no axial load
- For an oscillating operation less than 45 [°], turn the Motor 90 [°] or more at least once a day.
- Note 1: Cable length for PN2012 is up to 8 [m].
- Conditions outside the allowable range of inertia (about 700 times the rotor's inertia) may be applicable, depending on operating conditions. Contact NSK for details.

2.2.3 Rotational Speed and Output Torque Characteristics

### PN2012

- Maximum output torque
- Rotational speed [s⁻¹]

### PN3045

- Maximum output torque
- Rotational speed [s⁻¹]

### PN4135

- Maximum output torque
- Rotational speed [s⁻¹]

### PN4180

- Maximum output torque
- Rotational speed [s⁻¹]

2.2.4 Motor Dimensions

- M-PN2012KN01
- M-PN3045KN001
- M-PN4135KN001
- M-PN4180KN001

Environmental conditions
- Ambient temperature 0 to 40 [°C]; humidity: 20 to 80%; use indoors, free from dust, condensation and corrosive gas. IP30 or equivalent.

(Note 1)
2.3 PN Series with Brake

2.3.1 Reference Number Coding of Motor

Example of Reference Number

<table>
<thead>
<tr>
<th>M-PN</th>
<th>3</th>
<th>045</th>
<th>KG</th>
<th>001</th>
</tr>
</thead>
</table>

Motor size code:
- M: Megatorque Motor PN Series
- 30: 30 mm outer diameter
- 40: 40 mm outer diameter
- 50: 50 mm outer diameter
- 60: 60 mm outer diameter
- 80: 80 mm outer diameter
- 90: 90 mm outer diameter

Design serial number:
- 001: First series
- 002: Second series
- 003: Third series

2.3.2 Specifications

### Functional Item

<table>
<thead>
<tr>
<th>Reference number</th>
<th>M-PN3045KG001</th>
<th>M-PN4135KG001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor outer diameter [mm]</td>
<td>φ210</td>
<td>φ280</td>
</tr>
<tr>
<td>Rated output torque [N·m]</td>
<td>15</td>
<td>45</td>
</tr>
<tr>
<td>Motor hollow diameter [mm]</td>
<td>φ32</td>
<td>φ32</td>
</tr>
<tr>
<td>Maximum rotational speed [s⁻¹]</td>
<td>2621, 440</td>
<td></td>
</tr>
<tr>
<td>Resolution of position sensor (counts/revolution)</td>
<td>90 (interchangeable type) at ambient temperature of 25 ± 5 [°C]</td>
<td></td>
</tr>
<tr>
<td>Absolute positioning accuracy (arc-sec)</td>
<td>90 (interchangeable type)</td>
<td></td>
</tr>
<tr>
<td>Repeatability (arc-sec)</td>
<td>±2</td>
<td></td>
</tr>
<tr>
<td>Allowable axial load [N]</td>
<td>4,500</td>
<td>9,500</td>
</tr>
<tr>
<td>Allowable radial load [N]</td>
<td>4,500</td>
<td>9,500</td>
</tr>
<tr>
<td>Allowable moment load [N·m]</td>
<td>80</td>
<td>160</td>
</tr>
<tr>
<td>Brake type</td>
<td>Negative actuation type holding brake without backlash</td>
<td></td>
</tr>
<tr>
<td>Braking torque [N·m]</td>
<td>36</td>
<td>72</td>
</tr>
<tr>
<td>Brake power supply [VDC]</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Brake power consumption [W]</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td>Motor inertia [kg·m²]</td>
<td>0.018</td>
<td>0.080</td>
</tr>
<tr>
<td>Allowable range of inertia [kg·m²]</td>
<td>0.11 to 0.77</td>
<td>0.57 to 3.99</td>
</tr>
<tr>
<td>Mass [kg]</td>
<td>18</td>
<td>34</td>
</tr>
</tbody>
</table>

**Environmental conditions**

- Ambient temperature: 0 to 40 [°C]
- Humidity: 20 to 80%; use indoors, free from dust, condensation and corrosive gas, IP50 or equivalent.

**Note on compliance with UL Standards and CE Mark**

- PN Series with Brake: Does not comply with UL Standards or CE Mark.
- EDC Driver Unit: Complies with UL Standards and CE Mark when used with a Standard PN Series Megatorque Motor (without brake). However, it does not comply with UL Standards or CE Mark when used with a PN Series Megatorque Motor with a brake.

### Motor Specifications

#### Rotational Speed and Output Torque Characteristics

<table>
<thead>
<tr>
<th>PN3045</th>
<th>PN4135</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output [N·m]</td>
<td>Output [N·m]</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Rated</td>
<td>Rated</td>
</tr>
</tbody>
</table>

### Motor Dimensions

- **PN3045KG001**
- **PN4135KG001**
2.4 Z Series with High Environmental Resistance

2.4.1 Reference Number Coding of Motor

Example of Reference Number

<table>
<thead>
<tr>
<th>Motor size code</th>
<th>Maximum output torque [N-m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>040</td>
</tr>
<tr>
<td>KN</td>
<td>001</td>
</tr>
</tbody>
</table>

Design suffix number

001: Standard

KNE: Standard

2.4.2 Specifications

- Please consult with NSK in case of a simultaneous application of axial load, radial load and moment load to a Motor.
- * Under no radial load
- ** Under no axial load

2.4.3 Rotational Speed and Output Torque Characteristics

2.4.4 Dimensions

Motor Specifications

<table>
<thead>
<tr>
<th>Functional Item</th>
<th>Reference number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor outer diameter [mm] (without flange)</td>
<td>M-PNZ3040KN001 220</td>
</tr>
<tr>
<td>Maximum output torque [N-m]</td>
<td>40</td>
</tr>
<tr>
<td>Rated output torque [N-m]</td>
<td>5</td>
</tr>
<tr>
<td>Motor height [mm]</td>
<td>100</td>
</tr>
<tr>
<td>Motor hollow diameter [mm]</td>
<td>64</td>
</tr>
<tr>
<td>Maximum rotational speed [r/min]</td>
<td>3</td>
</tr>
<tr>
<td>Rated rotational speed [r/min]</td>
<td>1</td>
</tr>
</tbody>
</table>

| Resolution of position sensor (count/revolution) | 2621440  |
| Absolute positioning accuracy (arc-sec) | 90 (Interchangeable type) (at ambient temperature of 25 ± 5 [°C])  |
| Repeatability (arc-sec) | ±2  |

| Allowable axial load [N] | 0  | 4500  | 9500  |
| Allowable radial load [N] | 0  | 4500  | 9500  |
| Allowable moment load [N·m] | 0  | 80  | 160  |
| Rotor inertia [kg·m²] | 0.028  | 0.12  | 0.13  |
| Allowable range of inertia [kg·m²] | 0.11 to 0.77  | 0.57 to 3.99  | 0.66 to 4.55  |
| Mass [kg] | 21  | 42  | 48  |

Environmental conditions

Ambient temperature 0 to 40 [°C]; use indoors, free from corrosive gas

Degree of Protection

IP66M (IEC/EN 60529, IEC/EN 60034-5)

Note on compliance with UL Standards and CE Mark

Magatorque Motor Z Series with High Environmental Resistance

Magatorque Motor Z Series with High Environmental Resistance does not comply with UL Standards or CE Mark.

EDC Driver Unit

EDC Driver Units comply with UL Standards and CE Mark when used with a standard PN Series Magatorque Motor. However, they do not comply with UL Standards or CE Mark when used with a Magatorque Motor Z Series with High Environmental Resistance.

2.4.3 Rotational Speed and Output Torque Characteristics

Please refer to 6.7 Effective Torque Calculations to calculate allowable effective torque during positioning operation.

Note on compliance with UL Standards and CE Mark

Magatorque Z Series with High Environmental Resistance

Magatorque Motor Z Series with High Environmental Resistance does not comply with UL Standards or CE Mark.

EDC Driver Unit

EDC Driver Units comply with UL Standards and CE Mark when used with a standard PN Series Magatorque Motor. However, they do not comply with UL Standards or CE Mark when used with a Magatorque Motor Z Series with High Environmental Resistance.

2.4.4 Dimensions

Please refer to 6.7 Effective Torque Calculations to calculate allowable effective torque during positioning operation.
3 EDC Driver Unit

3.1 Features of EDC Driver Unit

- Adopts new servo algorithm (achieves settling time of 1 [ms])

The EDC Driver Unit adopts an original disturbance observer and preview-based feed-forward control, which significantly reduces the positioning time, especially the settling time (approaching time).

- Positioning controller function

Positioning operation can be controlled without complicated communication or upper controller.

- Compact Driver Unit

Combined with special electric components and advanced integration technology, the Driver Unit body is 65% smaller than conventional NSK units.

- Variety of control I/Os

Control input/output required for positioning is available, including an encoder output, servo control and program control; no additional sensor is required to monitor the status.

3.2 Components and functions of EDC Driver Unit

- Rear mounting hole
  Optional mounting bracket available for front mounting.

- Independent inputs of main power and control power
  Separate power lines assure system safety.

- Motor cable connector
  Clamping type connector shortens work time and prevents mis-wiring.

- 7 segment LEDs indicator
  Driver Unit status can be recognized at a glance.

- Analog monitor output terminal
  Speed, positioning error, torque, motor current, etc. can be monitored by analog voltage.
  Effectively used for setup tuning or for monitoring operating status.

- RS-232C communication connector
  Connect the handy terminal to set parameters. Use the EDC Megatron software to communicate with a PC.

- Control I/O connector
  A variety of signals are available, including servo on, in-position, emergency stop, area signal, overrides, various alarm outputs, φA/φB/φZ, etc.

3.3 Control Technology and System Configuration of EDC Driver Unit

**Control Technology and High-speed Positioning Example**

- Control block diagram
  Adopts new servo algorithm
  Settling time: Less than 1 [ms]

- Comparison of 180 [°] positioning

  Positioning time = Command time + Settling time

<table>
<thead>
<tr>
<th>Conventional NSK motor (JS2014)</th>
<th>PS1012 Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command time + Settling time</td>
<td>Positioning time = Command time + Settling time</td>
</tr>
<tr>
<td>330 [ms]</td>
<td>147.5 [ms]</td>
</tr>
<tr>
<td>Following error: 20,500 pulses</td>
<td>Following error: 40 pulses</td>
</tr>
<tr>
<td>Positioning time: 330 [ms]</td>
<td>Positioning time: 147.5 [ms]</td>
</tr>
</tbody>
</table>

3.4 Example of Brake Sequence

For brake sequence details, refer to the User’s Manual.
3.5 EDC Driver Unit Reference Number

<table>
<thead>
<tr>
<th>Reference Number</th>
<th>M-EDC - PS1006 A B 5 02 -01</th>
</tr>
</thead>
</table>

**EDC Driver Unit**

**Motor model**

- Used for PS1006 Motor, PS1012 Motor, PS1018 Motor, PS3015 Motor, PS3030 Motor, PN2012 Motor
- Used for PS3060 Motor, PS3090 Motor, PN3045 Motor, PN4135 Motor, PN4180 Motor, PNZ3040 Motor, PNZ4130 Motor, PNZ4175 Motor

**Position sensor code**

- A: Internal absolute sensor
- B: External absolute sensor

**Designation number**

- 01: Standard
- 02: High-temperature products (PS Series only, made to order)

**Function**

- Standard
- CC-Link (optional)

**Accessories vary depending on the function.**

**Standard accessories**

1. CN2 connector (user side)
   - Connector: 54306-5019 (Molex), or equivalent
   - Connector shell: 54331-0501 (Molex), or equivalent

2. CN5 connector (user side)
   - Connector: 231-305/026-000 (WAGO), or equivalent
   - Wiring lever: 231-131 (WAGO), or equivalent

3. Mounting bracket

4. User’s Manual (English version)

**Accessories for EDC Driver Unit (CC-Link Function)**

1. CN2 connector (user side)
   - Connector: DHF-PDA10-3-A01-FA (DDK), or equivalent

2. CN5 connector (user side)
   - Connector: 231-305/026-000 (WAGO), or equivalent

3. CN6 connector (user side)
   - Connector: MSTB, 5/S-STF-5, 08AU (Phoenix contact), or equivalent

4. Mounting bracket

5. User’s Manual (English version)

6. User’s Manual for CC-Link (English version)

EDC Driver Unit with Z Series with High Environmental Resistance is the same unit used with the PN Series. Refer to Motor and EDC Driver Unit Combinations for details of applicable models.

---

3.6 Dimensions of EDC Driver Unit (Standard Function)

**Used for**

- PS1006 Motor, PS1012 Motor, PS1018 Motor, PS3015 Motor, PS3030 Motor, PN2012 Motor
- PS3060 Motor, PS3090 Motor, PN3045 Motor, PN4135 Motor, PN4180 Motor, PNZ3040 Motor, PNZ4130 Motor, PNZ4175 Motor

**Dimensions**

- Length: 140 mm
- Width: 70 mm
- Height: 25 mm
- Weight: 1.3 kg

**Accessories**

- No. of connectors:
  - EDC Driver Unit: 3
  - Motor model: 2

- Power rating:
  - Voltage: 200-240 VAC (three-phase)
  - Frequency: 50/60 Hz

- EDC Driver Unit for Z Series with High Environmental Resistance is the same unit used with the PN Series. Refer to Motor and EDC Driver Unit Combinations for details of applicable models.
3.7 General Specifications of EDC Driver Unit

<table>
<thead>
<tr>
<th>Item</th>
<th>Motor model</th>
<th>PS1010E</th>
<th>PS1012E</th>
<th>PS1018E</th>
<th>PS1030E</th>
<th>PS1050E</th>
<th>PS1060E</th>
<th>PN2012</th>
<th>PN2045</th>
<th>PN4015</th>
<th>PN41100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated power [VA]</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>500</td>
<td>800</td>
<td>400</td>
<td>600</td>
<td>100</td>
<td>500</td>
<td>900</td>
<td>1 100</td>
</tr>
<tr>
<td>Maximum capacity [VA]</td>
<td>1 000</td>
<td>1 600</td>
<td>2 000</td>
<td>2 900</td>
<td>5 000</td>
<td>5 500</td>
<td>2 100</td>
<td>4400</td>
<td>5 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control power source</td>
<td>Single phase 100 to 115 [VAC]/single phase 200 to 230 [VAC] 50/60 [Hz] Voltage fluctuation ±10% or less</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution of position sensor [count/revolution]</td>
<td>2 627 440</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.8 Signal Specifications of CN2 (Control I/O)

### Input Signal

<table>
<thead>
<tr>
<th>Input Code</th>
<th>Pin No.</th>
<th>Signal Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC44</td>
<td>1, 2</td>
<td>24 [VDC] external power supply</td>
<td>External power supply for input signal</td>
</tr>
<tr>
<td>EMST</td>
<td>3</td>
<td>Emergency stop</td>
<td>Terminates positioning operation and the Motor stops by the dynamic brake</td>
</tr>
<tr>
<td>ACLR</td>
<td>4</td>
<td>Alarm clear</td>
<td>Clears warning</td>
</tr>
<tr>
<td>OTP</td>
<td>5</td>
<td>Over travel limit (+ direction)</td>
<td>If OTP goes active, the Motor servo is locked in the CW direction*1</td>
</tr>
<tr>
<td>OTM</td>
<td>8</td>
<td>Over travel limit (+ direction)</td>
<td>If OTM goes active, the Motor servo is locked in the CCW direction*1</td>
</tr>
<tr>
<td>SVON</td>
<td>7</td>
<td>Servo on</td>
<td>If SVON goes active, the servo turns on and the control system waits for a command to be entered*1</td>
</tr>
<tr>
<td>RN</td>
<td>8</td>
<td>Start program</td>
<td>Starts program operation specified by the PRG input*1</td>
</tr>
<tr>
<td>STP</td>
<td>9</td>
<td>Stop</td>
<td>Stops positioning operation and execution of the program*2</td>
</tr>
<tr>
<td>PRG0</td>
<td>11</td>
<td>Internal program channel selection 0</td>
<td>For a program positioning operation: A combination of ON and OFF of PRG0 to PRG7 inputs specifies channel (0 to 255) to be executed</td>
</tr>
<tr>
<td>PRG1</td>
<td>12</td>
<td>Internal program channel selection 1</td>
<td></td>
</tr>
<tr>
<td>PRG2</td>
<td>13</td>
<td>Internal program channel selection 2</td>
<td></td>
</tr>
<tr>
<td>PRG3</td>
<td>14</td>
<td>Internal program channel selection 3</td>
<td></td>
</tr>
<tr>
<td>PRG4</td>
<td>15</td>
<td>Internal program channel selection 4</td>
<td></td>
</tr>
<tr>
<td>PRG5</td>
<td>16</td>
<td>Internal program channel selection 5</td>
<td></td>
</tr>
<tr>
<td>PRG6</td>
<td>17</td>
<td>Internal program channel selection 6</td>
<td></td>
</tr>
<tr>
<td>PRG7</td>
<td>18</td>
<td>Internal program channel selection 7</td>
<td></td>
</tr>
<tr>
<td>JOG</td>
<td>19</td>
<td>Jogging</td>
<td>If JOG goes active, the Motor rotates. If it goes inactive, the Motor decelerates and stops*1</td>
</tr>
<tr>
<td>DIR</td>
<td>20</td>
<td>Jogging direction</td>
<td>Specifies the direction of jogging*1</td>
</tr>
<tr>
<td>CHA</td>
<td>21</td>
<td>(Do not connect)</td>
<td></td>
</tr>
<tr>
<td>CW</td>
<td>22</td>
<td>CW pulse train (+)</td>
<td>Pulse train command rotates the Motor in the CW direction</td>
</tr>
<tr>
<td>CCW</td>
<td>23</td>
<td>CCW pulse train (+)</td>
<td></td>
</tr>
<tr>
<td>CCW+</td>
<td>24</td>
<td>CCW pulse train (+)</td>
<td>Pulse train command rotates the Motor in the CCW direction</td>
</tr>
<tr>
<td>ORM</td>
<td>25</td>
<td>ORM pulse train (+)</td>
<td></td>
</tr>
<tr>
<td>ORM+</td>
<td>26</td>
<td>ORM pulse train (+)</td>
<td></td>
</tr>
<tr>
<td>ORM27</td>
<td>27</td>
<td>ORM pulse train (+)</td>
<td></td>
</tr>
<tr>
<td>ORM28</td>
<td>28</td>
<td>ORM pulse train (+)</td>
<td></td>
</tr>
<tr>
<td>ORM29</td>
<td>29</td>
<td>ORM pulse train (+)</td>
<td></td>
</tr>
<tr>
<td>IPOS</td>
<td>34</td>
<td>In-position</td>
<td>Reports the condition of positioning error and the positioning operation*1</td>
</tr>
<tr>
<td>NAREA</td>
<td>35</td>
<td>Target proximity A</td>
<td>Reports that the Motor is approaching the destination*2</td>
</tr>
<tr>
<td>CHA</td>
<td>36</td>
<td>Positioning feedback signal 0A</td>
<td></td>
</tr>
<tr>
<td>A-CHA</td>
<td>37</td>
<td>Positioning feedback signal +A</td>
<td></td>
</tr>
<tr>
<td>C-CHA</td>
<td>38</td>
<td>Positioning feedback signal -B</td>
<td></td>
</tr>
<tr>
<td>CHB</td>
<td>39</td>
<td>Positioning feedback signal -B</td>
<td></td>
</tr>
<tr>
<td>CNE</td>
<td>40</td>
<td>Positioning feedback signal +B</td>
<td></td>
</tr>
<tr>
<td>CH2</td>
<td>41</td>
<td>Positioning feedback signal +V2</td>
<td></td>
</tr>
<tr>
<td>CH2</td>
<td>42</td>
<td>(Do not connect)</td>
<td></td>
</tr>
<tr>
<td>SGN0</td>
<td>43</td>
<td>Signal ground</td>
<td>Ground for the positioning feedback signal</td>
</tr>
<tr>
<td>–</td>
<td>44</td>
<td>To 52</td>
<td>(Do not connect)</td>
</tr>
</tbody>
</table>

### Output Signal

#### Analog signals

- **Position feedback signal (±VDC):** Reporting the number of rotations of Motors (Output format is line driver)
- **Servo on (SVON):** Reports that the Motor is ready to rotate (The port opens when the Motor is not ready or an alarm occurs)
- **Drive Ready (DRDY):** Reports that the Motor is ready to rotate (The port opens when the Motor is not ready or an alarm occurs)
- **Warning (WPN):** Warns of abnormality in the System*1
- **Over Travel Limit (OTP):** Reports the output of over travel limit (software and hardware) in the plus direction*1
- **Over Travel Limit (OTM):** Reports the output of over travel limit (software and hardware) in the minus direction*1
- **Servo State (SVST):** Reports states of servos*1
- **Home Return (IPOS):** Reports the status of positioning operation*1
- **Target Proximity (NAREA):** Reports that the Motor is approaching the destination*1
- **S-Axis (A-CHA):** A pulse signal that reports the number of rotations of Motors

#### Optical signals

- **A-CHA, C-CHA, A-CHA, and C-CHA:** A pulse signal that reports the number of rotations of Motors
- **Positional Feedback Signal (+V2):** A pulse signal that reports the number of rotations of Motors

### Additional Notes

- The output “Driver Unit ready” set to Pin No. 28 can only be replaced with the output signal “Normal.” (Signal polarity cannot be changed.)
- On/off inputs are listed from 0 to 255, and addresses are set by parameters.
- You may select signal functions of control Input/Output by the parameters.
### 4 Cable Set

#### 4.1 Cable Set Reference Number

**Cable Set Reference Number for PS/PN Series and PN Series with Brake**

Example of Reference Number:

- **M-C** 004 SCP 03

  - Cable set for Megatorque Motor
  - Cable length: 0.4m

  SCP: PS/PN Series and PN Series with brake

Refer to 9 Motor and EDC Driver Unit Combinations for correct length. Cable length has to be less than 8m for combinations with PN2012 and high-precision products in PN series.

**Cable Set Reference Number for Z Series with High Environmental Resistance**

Example of Reference Number:

- **M-C** 004 WCP 13

  - Cable set for Megatorque Motor
  - Cable length: 0.4m

  WCP: Cable set for Z Series with High Environmental Resistance

Refer to 9 Motor and EDC Driver Unit Combinations for correct length.

#### 4.2 Dimension of Cable Set

**Cable Set Dimensions for PS/PN Series and PN Series with Brake**

- **Motor side**
  - Motor cable: Bend radius at fixed side 4R4Rm or more, Bend radius at moving side R80Rm or more

- **Resolver cable**
  - Bend radius at fixed side R43Rm or more, Bend radius at moving side R80Rm or more

**Cable Set Dimensions for Z Series with High Environmental Resistance**

- **Motor side**
  - Motor cable: Bend radius at fixed side 4R43Rm or more, Bend radius at moving side R80Rm or more

- **Resolver cable**
  - Bend radius at fixed side R43Rm or more, Bend radius at moving side R80Rm or more

- **Driver Unit side**
  - Bend radius at fixed side R40Rm or more, Bend radius at moving side R80Rm or more

### 5 Option

#### 5.1 EDC Driver Unit with CC-Link Function

**5.1.1 System Configuration**

![System Configuration Diagram](image)

- The EDC Driver Unit provides the field bus (CC-Link) compatibility.
- The station numbers and the baud rate can be set by switches on the Driver Unit’s front panel.
- Monitoring communication status by LED, and terminating resistor can be switched on/off.
- The EDC Driver Units are fully compatible with CC-Link Ver. 1.10.

**5.1.2 I/O Signal Specifications of CN2 (CC-Link Function)**

<table>
<thead>
<tr>
<th>Input/Output</th>
<th>Signal Code</th>
<th>Pin No.</th>
<th>Signal Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td>D24</td>
<td>1</td>
<td>Change with red dots</td>
<td>External power supply for input signal</td>
</tr>
<tr>
<td></td>
<td>D24</td>
<td>2</td>
<td>(Do not connect)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EMST</td>
<td>3</td>
<td>Grey with red dots</td>
<td>Emergency stop</td>
</tr>
<tr>
<td></td>
<td>ACLR</td>
<td>4</td>
<td>Grey with black dots</td>
<td>Clear warning</td>
</tr>
<tr>
<td></td>
<td>OTP</td>
<td>5</td>
<td>White with red dots</td>
<td>Over travel limit (+ direction)</td>
</tr>
<tr>
<td></td>
<td>OTM</td>
<td>6</td>
<td>White with black dots</td>
<td>Over travel limit (- direction)</td>
</tr>
<tr>
<td></td>
<td>DRDY</td>
<td>7</td>
<td>(Do not connect)</td>
<td>Driver Unit ready</td>
</tr>
</tbody>
</table>

**Output**

- DNOY: 8 Nave with black dots Driver Unit ready
- DCM: 10 Pink with black dots Output signal common (Common for output signal)

Specifications of Driver Units, except CN2, are the same as standard products (refer to page 24).
5.1.3 Dimensions of EDC Driver Unit (CC-Link Function)

Used for PS3060 Motor, PS3012 Motor, PS3018 Motor, PS3026 Motor, PS3030 Motor, PN2012 Motor

5.2 Optional Regeneration Resistor (M-E014DCKR1-100·101)

5.2.1 Dimensions and Schematics

M-E014DCKR1-100

M-E014DCKR1-101

5.2.2 Connection to EDC Driver Unit

M-E014DCKR1-100

M-E014DCKR1-101
5.3 Handy Terminal

Handy Terminal FHT21 is an easy-to-handle RS-232C communication terminal for inputting parameters and programs to the EDC Driver Unit. The device can also read and save (upload) driver unit parameters and channel programs, and transmit (download) them to other driver units.

- LCD screen: 20 letters × 4 lines, no external power source required, cable length: 3 [m]

Conventional model M-FHT11 is also supported by the EDC Driver Unit.

5.4 RS-232C Communication Cable

RS-232C Communication Cable (Communication cable between EDC Driver Unit and PC)

6. Selection of Megatorque Motors

To select appropriate Megatorque Motors, examine the following data.

6.1 Loads on the Motor

(1) Load moment of inertia

When the Megatorque Motor System is used, the size of the moment of inertia of the load mounted to the Motor rotor will significantly affect the acceleration/deceleration characteristics. Thus, calculation of the moment of inertia of the load \( J \) is required.

(2) Axial load, radial load, and moment load

Calculate the load on the Motor. The relationship between external force and load is represented in the following three patterns.

Ensure the axial load/radial load and the moment load are set within the allowable axial, radial and moment loads.

(Refer to 2. Motor Specifications in this catalog for allowable loads.)

6.2 Runout Accuracy

The measurement method for runout accuracy is shown at right.

6.3 Positioning Accuracy

The positioning accuracy of the Megatorque Motor System is considered by two respects as follows:

(1) Absolute positioning accuracy: 90 [arc-sec] (interchangeable)
(2) Repeatability: ±2 [arc-sec]
31

6 Selection of Megatorque Motors

[Example 1]
We examine the compatibility of the PS Series Motors, assuming a required repeatability of ±0.02 [mm] at 300 [mm] distance from the center.

From $\tan \theta = \frac{0.02}{300}$

$\theta = \tan^{-1}(\frac{0.02}{300})$

$= 3.8 \times 10^{-3}$ [°]

Therefore, $\pm 14 > \pm 2$

Both PS1 and PS3 Models can be used in terms of positioning accuracy.

6.4 Positioning Time (Index Time)

When a Megatorque Motor is used to index an angle, index times can be roughly calculated as follows.

$J_m$ : Load moment of inertia [kg·m²]
$J_r$ : Rotor moment of inertia [kg·m²]
$N$ : Rotational speed of the Motor [s⁻¹]
$T$ : Output torque at the rotational speed [N·m]

$T_{cm}$ : Load torque [N·m]
$t_1$ : Travel time [s]
$t_2$ : Settling time [s]
$t_3$ : Positioning time [s]
$\alpha$: Accelerating/decelerating time [s]
$\theta$ : Rotational angle [°]
$\eta$ : Safety coefficient (normally 1.4-1.5)

In accordance with the list above,

$\Delta T = \left[ \frac{J_m + J_r}{T - T_{cm}} \right] \times \eta$

$t_1 = \frac{\Delta T}{360 \times N} + \Delta T$

$t_3 = t_1 + t_2$

Where $T - T_{cm} > 0$, and 2 × $\Delta t \leq t_3$

6.5 Selection of Optional Regeneration Resistor

(1) Obtain rotational energy of Megatorque Motor during deceleration

Calculate the rotational energy using the following equation:

Rotational energy = $\frac{1}{2} \times J \times \omega^2$ [J]

$J_r :$ Rotor inertia [kg·m²]
$J_m :$ Moment of inertia of the load [kg·m²]
$N :$ Rotational speed [s⁻¹]

(2) Regenerative energy capacity by internal capacitors

The energy that can be charged by the internal capacitors is 28 [J].

(3) Calculate energy consumed by optional regeneration resistor

Energy consumed by optional regeneration resistor $J_{c} :$ Rotational energy $J_{c} = 28$ [J] (capacitor absorption energy)

When the difference is zero or less, no optional regeneration resistor is necessary.

(4) Calculate required capacity for optional regeneration resistor

Required capacity for an optional regeneration resistor [W] = Energy consumed by optional regeneration resistor $J_{c}$ / (Operation cycle [s] × 0.25)

0.25: Load ratio of optional regeneration resistor use

When the quotient is 7 or less, use optional regeneration resistor: M-E014DCKR1-100. (optional)

When the quotient is 120 or less, use optional regeneration resistor: M-E014DCKR1-101. (optional)

Please contact NSK when the quotient exceeds 120.

6.6 Effective Torque Calculations (Example 1)

When selecting a Megatorque Motor, it is necessary to consider the maximum required torque and the effective torque for the actual operation.

Determine whether 90 [°] can be positioned in 0.24 [s], assuming the load moment of inertia is 0.05 [kg·m²]. Also calculate the effective torque when an operation cycle is 0.3 [s].

Conditions:

Maximum rotational speed = 2.5 [s⁻¹]
Rotational acceleration = 25 [s⁻²]
Repeatability = ±15 [arc-sec]
Dwell time = 0.06 [s]
$J_m$ : (Load moment of inertia) = 0.05 [kg·m²]
$J_r$ : (Rotor moment of inertia) = 0.019 [kg·m²]

• Since the rotational acceleration is 25 [s⁻²], calculate the approximate required torque using the following equation.

Equations:

$T :$ Torque at accelerating [N·m]
$\alpha :$ Rotational acceleration [s⁻²] = 25 [s⁻²]
$J_{cm} :$ (Load moment of inertia) = 0.05 [kg·m²]
$J_r :$ (Rotor moment of inertia) = 0.019 [kg·m²]

Required torque at accelerating/decelerating

$T = (J_m + J_r) \times \alpha = (0.05 + 0.019) \times 2 \pi \times 25 = 10.8$ [N·m]

Therefore, the candidate selection is a motor with a maximum output torque of 15.2 [N·m] (obtained by multiplying required torque by a safety factor of 1.4) or larger. The PS1 Model (excluding PS1006 and PS1012), PS3 Model, PN3 Model, or PN4 Model can be selected.

Note: Since the moment of inertia of the rotor of the motor varies depending on the motor, the required torque needs to be recalculated for each motor.

• The effective torque required for the actual operational pattern in use (see following diagram) needs to be examined. Also determine whether the PS3060 meets the operational conditions.

Equations:

$\Delta t$: accelerating/decelerating time = 0.1 [s], $t_2$: settling time = 0.04 [s], $t_3$: dwell time = 0.06 [s], $t_4$: cycle time = 2 × $\Delta t + t_2 + t_3 = 0.3$ [s]

Required effective torque

$\sqrt{\frac{T^2 \times \Delta t}{t_4}} = \sqrt{8.8} = 8.8$ [N·m]

Rotational energy = $1/2 \times (J_m + J_r) \times (2 \pi N)^2 \times (0.05 + 0.019) \times (2 \pi \times 2.5)^2 = 8.5$ [J]

An effective torque of 11.4 [N·m] is determined by multiplying the equation above by a temperature coefficient of 1.3, which is less than the PS3060's rated output torque of 20 [N·m]. Therefore, the PS3060 sufficiently meets the operational conditions and no optional regeneration resistor is necessary.

• In case results do not meet rated torque ≥ effective torque, recalculation with revised conditions is required.
Selection of Megatorque Motors

### 6.7 Effective Torque Calculations (Example 2) for Z Series with High Environmental Resistance

When selecting a Megatorque Motor, it is necessary to consider the maximum required torque and the allowable effective torque required for the actual operation.

Determine whether 90° can be positioned in 0.24 s, assuming the load moment of inertia is 0.05 [kg·m²]. Also calculate the effective torque when an operation cycle is 0.3 s.

**Conditions:**
- Maximum rotational speed = 2.5 [s⁻¹]
- Rotational acceleration = 25 [s⁻²]
- Repeatability = ±15 [arc-sec]
- Dwell time = 0.06 [s]
- \(J_m\) (load moment of inertia) = 0.05 [kg·m²] (for PNZ4130)
- \(J_r\) (moment of inertia of the rotor) = 0.12 [kg·m²] (for PNZ4130)
- \(T_i\) = Internal load torque = 15 [N·m]

#### Requirements
- Since the rotational acceleration is 25 [s⁻²], calculate the approximate required torque using the following equations.

\[
T = (J_m + J_r) \times \alpha = (0.05 + 0.12) \times 2 \times 25 = 26.7 \text{ [N·m]}
\]

Therefore, the candidate selection is a motor with a maximum output torque of 37.4 [N·m] (obtained by multiplying required torque by a safety factor of 1.4) or larger. The PNZ3 Model or PNZ4 Model can be selected.

- The effective torque required for the actual operational pattern in use (see following diagram) needs to be examined. Also determine whether the PNZ4130 meets the operational conditions.

\[
T_e = (T_x + J_x) \times \alpha = 0.06 \times 0.25 \times 25 = 9.75 \text{ [N·m]}
\]

An effective torque of 32.5 [N·m] is determined by multiplying the equation above by a temperature coefficient of 1.3, which is less than the PNZ4130’s allowable effective torque of 45 [N·m]. Therefore, the PNZ4130 sufficiently meets the operational conditions and no optional regeneration resistor is necessary.

#### Notes
- In case results do not meet allowable effective torque ≥ effective torque, recalculation with revised conditions is required.

---

### Positioning Time Diagrams

The positioning time for Megatorque Motors is calculated in accordance with “6.3 Positioning time.” When dwell time is relatively longer than accelerating/decelerating time (dwell time > accelerating/decelerating time x 10), rough positioning time can be determined using the following positioning time diagrams.

These diagrams only apply under the following conditions.

1. The motor is directly connected to the load (without gear reducer, belt, or couplings), and the rigidity of the load is sufficiently high (natural frequency: More than 100 [Hz]).

2. No load torque is applied to the motor.

The following conditions require additional considerations.

a. When the load’s moment of inertia exceeds the allowable moment load and is off the diagram:

   - Operation is possible, although much more time may be required than shown in the diagram, since rotational speed and acceleration are limited.

b. When there is no diagram for the relevant positioning angle:

   - An appropriate calculation is required. No calculation, however, is effective for very small angles.

**Example:**

- Motor: PN4180
- Moment of inertia: 3.0 [kg·m²]
- Index angle: 45°

Minimum positioning time of 0.3 s is determined according to the line in the following diagram.
8 Installation

8.1 Installation of Motor

- Install and secure the Motor on a rigid base, otherwise mechanical vibrations may occur.
- Mount the motor using the tapped or through-holes.
- The Motor can be attached either horizontally or vertically. (For Z Series with High Environmental Resistance, do not install in the upside-down position.)
- Take care not to push up the underside cover when attaching the motor. (PS Series)
- Please see below figure for counterbore depth from base top. (PS Series)
- The bend radius of the motor cable lead and the resolver cable lead should be R30 [mm] or more. Do not use the leads of the motor cable and the resolver cable with flexing motion.

For the full use of the benefits of the direct drive motor system, it is essential to maximize the resonance frequency of the whole mechanism by increasing the rigidity of the load, as well as securely fastening the Motor to a highly rigid mechanical system. Therefore, adding some dummy load to the rotor directly may help in the following cases.

A. A key is used to fix the load to the rotor because the load cannot be directly attached to the rotor.
B. The load is directly fixed to the rotor. However, vibration occurs due to torsional deflection on the rotary axis of the load.
C. Inertia of the whole mechanism is very low when a thin shaft such as a ball screw shaft is attached.
D. There exists play because a sprocket chain or a gear train is used.
E. Vibration occurs because the rigidity of the structure is low, such as when the Motor is being used for driving a belt.

Inertia of a dummy load shall be approximately 20% of the load inertia. When a speed reducer mechanism is used, it shall be

\[
\frac{GD^2_a}{r^2} \times GD^2_d \leq 5
\]

Where \(GD^2_a\) = inertia of indirectly connected load, \(GD^2_d\) = inertia of directly attached load, and \(r\) = reduction ratio.

8.2 Dummy Inertia

8.3 Installation of Driver Unit

- The EDC Driver Unit must be fixed so that fins are in the vertical position for natural air-cooling.
- Ambient temperatures should be in a range from 0 to 50 [°C]. The Driver Unit cannot be used in excess of 50 [°C]. A sufficient space of at least 100 [mm] should be provided both above and below the Driver Unit in a control cabinet.
- Operate the Driver Unit in an environment in which internally generated heat can be dissipated. If heat is trapped above the Driver Unit, open the space above it to allow for the heat to dissipate (in this case, also take steps to prevent the entry of dust) or provide a forced-air cooling system.
- Use the Driver Unit in a control cabinet with IP54 or higher. Protect the Driver Unit from exposure to oil mist, cutting water, cutting dust, coating gas, etc., to prevent their entry into the Driver Unit through ventilation openings, which may cause circuit failure.
- When installing two or more Driver Units for multi-axis combinations, provide a 10 [mm] or more space between adjacent Driver Units.
- The Driver Unit can be attached to a panel using front mounting brackets (optional).
- The maximum power loss of the EDC Driver Unit is 55 [W].
## 9 Motor and EDC Driver Unit Combinations

### 9.1 PS Series and EDC Driver Unit Combinations

<table>
<thead>
<tr>
<th>Motor Outer Diameter</th>
<th>Reference Number Coding of Motor</th>
<th>EDC Driver Unit Reference Number</th>
<th>Power Voltage [VAC]</th>
<th>Cable Reference Number</th>
<th>Main Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>M-PS1006KN002</td>
<td>M-EDC-PS1006AB502-***</td>
<td>200 to 230</td>
<td>001: 1 [m]</td>
<td>256 program channels</td>
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<td>002: 2 [m]</td>
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<td>256 program channels</td>
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### 9.2 PN Series and EDC Driver Unit Combinations

<table>
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<th>Motor Outer Diameter</th>
<th>Reference Number Coding of Motor</th>
<th>EDC Driver Unit Reference Number</th>
<th>Power Voltage [VAC]</th>
<th>Cable Reference Number</th>
<th>Main Specifications</th>
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<tbody>
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<td>M-EDC-PN2012AB502-***</td>
<td>200 to 230</td>
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### 9.3 PN Series with Brake and EDC Driver Unit Combinations

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<th>Reference Number Coding of Motor</th>
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<td>010: 10 [m]</td>
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<td>015: 15 [m]</td>
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<td></td>
<td></td>
<td>020: 20 [m]</td>
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### 9.4 Z Series with High Environmental Resistance and EDC Driver Unit Combinations

<table>
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<tr>
<th>Motor Outer Diameter</th>
<th>Reference Number Coding of Motor</th>
<th>EDC Driver Unit Reference Number</th>
<th>Power Voltage [VAC]</th>
<th>Cable Reference Number</th>
<th>Main Specifications</th>
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<tr>
<td>220</td>
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<td>M-EDC-PN2145AB502-***</td>
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<td>030: 30 [m]</td>
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### 9.5 Options

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<td>Handy Terminal</td>
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<td>Accessory set</td>
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</tbody>
</table>

---

**Indicates accessories specification**

**CC-Link function**

**RS-232C Communication Cable**

**Cable with CN2 connector**

**Handy Terminal**

---

**Reference Number**

**Coding of Motor Power Voltage [VAC] Cable Reference**

---

**Main Specifications**

**Motor Outer Diameter**

**EDC Driver Unit Reference Number**

**Power Voltage [VAC]**

**Cable Reference Number**
Functions

1. Oscilloscope function
2. Allocation and monitoring of control input/output
3. Parameter editing
4. Channel editing
5. Others:
   - Upload/download parameter and channel data
   - Terminal

Main Functions

1. Oscilloscope function
   - 4-channel oscilloscope, 10 [k sampling/s] maximum
   - Anything that can be monitored using the handy terminal can be displayed on the oscilloscope.
   - Monitor scales are adjustable.
   - Measured waveforms are output as bitmaps or CSV format.

2. Allocation and monitoring of control input/output
   - Allocation of control input/output by drag-and-drop editing
   - Monitoring of input/output signals
   - Report of allocation list

3. Parameter edits
   - Parameter edits take effect in real time (off-line editing is also supported)
   - Parameter-by-parameter reset to default
   - Help function for parameters
   - Report of parameter setting list

4. Channel edits
   - Drag-and-drop edits from command window
   - Direct input capability also supported (automatic insertion of comments)
   - Report of program list

5. Others:
   - Report of parameter setting list
   - Direct input capability also supported
   - Help function for parameters
   - Parameter-by-parameter reset to default
   - Report of parameter setting list

Compliance with UL Standards (PS/PN Series only)

- Motor
  - UL Recognized Component
  - Compliant with UL1004-1 (File No.: E216970)
- Driver Unit
  - Compliant with UL508C (File No.: E216221)
- Cable set
  - UL-compliant cables are used

Warranty Period

- The warranty period is either one year from delivery or 2 400 hours of operation, whichever comes first.

Limited Warranty

- The warranty is limited to the products supplied by NSK Ltd.
- The defective products will be repaired free of charge within the applicable warranty period.
- Repairs after the expiration of the applicable warranty period will be subject to payment.

Immunities

- The product is not warranted in one of the following cases even within the warranty period.
  - Failure of the unit due to installation and operation not in accordance with the instruction manual specified by the supplier.
  - Failure of the unit due to improper handling and use, modification and careless handling by the user.
  - Failure of the unit due to the causes other than those attributable to the supplier.
  - Failure of the unit due to modification or repair that is conducted by a person(s) or party(ies) other than the supplier.
  - Other types of failures due to natural disasters and accidents (causes not attributable to the responsibility of the supplier).
  - Damages induced by a failure of the supplied unit are not covered.

Services Fee

- Prices of goods do not include any applicable service charges, such as the dispatching of engineers.
- Startup or maintenance services that require the dispatching of engineers are subject to payment even during the applicable warranty period.
- Service charges will be invoiced in accordance with the supplier’s standard service charge list.

Discontinuation of Production and Maintenance Service Period

- Any discontinuation of production will be announced one year in advance. The maintenance service period is five (5) years after discontinuation of production. Announcement will be released by the supplier or published on the NSK Web site.

Special-purpose Applications

- This product is intended for general industrial applications and is not designed or manufactured for use under dangerous conditions.
- Contact NSK before using this product for any special-purpose applications, including nuclear power equipment and systems or aerospace, medical, and safety devices.
- While this product is manufactured under strict quality controls, NSK recommends that an appropriate safety device be installed when used with equipment that could cause serious accidents or damage in the event of product failure.
Form for Requesting Megatorque Motor Selection

NSK will assist in selecting the optimal Megatorque Motor. Please fill in the necessary items on the below form and send it by fax to the local NSK office. Items marked with an asterisk represent the important information required for selection. Please provide as much detail as possible.

To

Date (DD/MM/YYYY): / / 

Company Name: YYY YYY

Section: Engineering Dept., Engineering Section #1

Contact: TEL 03-1234-5678  FAX 03-1234-5678

Name: YYY YYY

Application and equipment used

(specify with as much detail as possible)

Motor installation position

☐ Upright position
☐ Horizontal position
☐ Upside-down position
☐ Others

Load conditions

(1) Geometry, dimensions, thickness, material (or mass) of table
(2) Dimensions, mass, quantity of loads/ jigs
(3) PCD (distance between the jigs/ loads)(example of description)
(4) External force (pressure/impact load, sliding friction, etc.)

Attachment: ☐ Yes ☐ No

Cable specification and length

Stationary cable Flexible cable Length: m

Repeatability (±)

Settle at °, Number of points: Settle at °, Number of points:

Cycle pattern (desired positioning time) Specify settling time.

Input power voltage

☐ 100 to 115 [VAC]
☐ 200 to 230 [VAC]
☐ Others [VAC]

Environmental conditions

☐ Operating environment
☐ General environment (equivalent to IP50)
☐ Oil, water and chemical
☐ Chips and dust Clean
☐ Operating temperature
☐ 0°C to 40°C
☐ Below 0°C
☐ Above 40°C
☐ Other ( °C)

Contact NSK for details.

Cable specification and length

☐ Stationary cable
☐ Flexible cable Length: m

Select “Movable” when cable is repeatedly bent anywhere along the wiring route.

Other request items

Please reply by January 12, 2010. (example)

To Mr. XXX, in charge of Precision Machinery & Parts, NSK

Schematic drawing (an attached illustration showing outside dimensions is acceptable) Please provide information on outside dimensions, dimensions from the center, material, etc. Specify position, direction, etc. in the schematic drawing.

Motor size requested

Positioning command system

☑ Internal program system
☐ Pulse train input operation
☐ RS-232C operation
☐ CC-Link

Index angle / Number of points

Settle at °, Number of points:

Repeatability (±)

= 20.6 seconds (± 0.01 mm at 100 mm from the motor center)

Cycle pattern (desired positioning time) Specify settling time.

Input power voltage

☐ 100 to 115 [VAC]
☐ 200 to 230 [VAC]
☐ Others [VAC]

Environmental conditions

☐ Operating environment
☐ General environment (equivalent to IP50)
☐ Oil, water and chemical
☐ Chips and dust Clean
☐ Operating temperature
☐ 0°C to 40°C
☐ Below 0°C
☐ Above 40°C
☐ Other ( °C)

Contact NSK for details.

Cable specification and length

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☐ Flexible cable Length: m

Select “Movable” when cable is repeatedly bent anywhere along the wiring route.

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To

Date (DD/MM/YYYY): / / 

Company Name: YYY YYY

Section: Engineering Dept., Engineering Section #1

Contact: TEL 03-1234-5678  FAX 03-1234-5678

Name: YYY YYY

Application and equipment used

(specify with as much detail as possible)

Motor installation position

☐ Upright position
☐ Horizontal position
☐ Upside-down position
☐ Others

Load conditions

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Attachment: ☐ Yes ☐ No

Cable specification and length

Stationary cable Flexible cable Length: m

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☐ Above 40°C
☐ Other ( °C)

Contact NSK for details.

Cable specification and length

☐ Stationary cable
☐ Flexible cable Length: m

Select “Movable” when cable is repeatedly bent anywhere along the wiring route.

Other request items

Please reply by January 12, 2010. (example)
Diverse selection of high performance motors with full consideration for safety and the environment

### Worldwide Sales Offices

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<thead>
<tr>
<th>Region</th>
<th>Country</th>
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<th>Fax</th>
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<td>Asia</td>
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<td>Beijing, Shanghai</td>
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<td>+86-21-67793100</td>
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<tr>
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<td>+507-2-347-4740</td>
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**MEGATORQUE MOTOR™**

PS Series (Complies with UL Standards and CE Mark)
PN Series (Complies with UL Standards and CE Mark)
PN Series with Brake
Z Series with High Environmental Resistance
(Dust-tight, Watertight)