5-Phase Stepping Motor and Driver Package

CSK Series
5-Phase Stepping Motor and Driver Package
CSK Series

The CSK Series combines a 5-phase stepping motor and a 24 VDC input board-level driver to provide high torque, high resolution and low vibration in a compact package.

Features

- **High torque**
The CSK Series features PK motors, designed to produce high torque in a compact frame size.

- **Low Vibration**
Smooth rotation is achieved with no noticeable resonance, allowing for low vibration and low noise.

- **Compact Package**
Both the motor and driver are compact in design, making them perfect for reducing the size and weight of any system.

- **High Resolution**
5-phase stepping motors move 0.72° per step in full-step mode and 0.36° per step in half-step mode, 2.5 times the resolution of a 2-phase stepping motor. This mechanically reduced step angle makes for extremely accurate positioning.

- **Tapered Hobbed (TH) Geared Type**
These low backlash geared stepping motors provide high permissible torque in a compact size. They are optimal for applications in which high torque is required in tight spaces.

Safety Standards and CE Marking

<table>
<thead>
<tr>
<th>Product</th>
<th>Standards</th>
<th>Certification Body</th>
<th>File No.</th>
<th>CE Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stepping Motor</td>
<td>UL1004, UL519, CSA C22.2 No.77, CSA C22.2 No.100</td>
<td>UL</td>
<td>E64199</td>
<td>EMC Directives</td>
</tr>
<tr>
<td>Driver</td>
<td>UL508C, CSA C22.2 No.14</td>
<td>UL</td>
<td>E171482</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UL1950, CSA C22.2 No.950</td>
<td>UL</td>
<td>E208200</td>
<td></td>
</tr>
</tbody>
</table>

- Approval conditions for UL1950: Class II equipment, SELV circuit, Pollution degree 2
- **CSK54**: Motor frame size; 1.65 in. sq (42 mm sq.) types do not comply with CSA standards.
- **CSK59**: Motor frame size; 3.35 in. sq (85 mm sq.) type is not recognized by UL and CSA.
- When the system is approved under various safety standards, the model names on the motor and driver nameplates are the approved model names.
- List of Motor and Driver Combinations ➝ Page C-134
- Details of Safety Standards ➝ Page G-2
- The EMC value changes according to the wiring and layout. Therefore, the final EMC level must be checked with the motor/driver incorporated in the user’s equipment.
System Configuration

An example of a single-axis system configuration with the EMP400 Series controller.

Product Number Code

Standard Type

<table>
<thead>
<tr>
<th>CSK</th>
<th>5</th>
<th>6</th>
<th>6 - N □ T A</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSK Series</td>
<td>5-Phase</td>
<td>Motor Case Length:</td>
<td>New Pentagon Drive</td>
</tr>
<tr>
<td>USA Version</td>
<td>Terminal Block Type</td>
<td>Shaft Type:</td>
<td>Single Shaft A: Double Shaft B:</td>
</tr>
<tr>
<td>Motor Frame Size:</td>
<td>1.65 in. sq. (42 mm sq.)</td>
<td>2.36 in. sq. (60 mm sq.)</td>
<td>3.35 in. sq. (85 mm sq.)</td>
</tr>
</tbody>
</table>

TH Geared Type

<table>
<thead>
<tr>
<th>CSK</th>
<th>5</th>
<th>6</th>
<th>4</th>
<th>A A - TG 7.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSK Series</td>
<td>5-Phase</td>
<td>Motor Case Length:</td>
<td>Gear Ratio</td>
<td></td>
</tr>
<tr>
<td>USA Version</td>
<td>TH Geared Type</td>
<td>Shaft Type:</td>
<td>Single Shaft A: Double Shaft B:</td>
<td></td>
</tr>
<tr>
<td>Motor Frame Size:</td>
<td>1.65 in. sq. (42 mm sq.)</td>
<td>2.36 in. sq. (60 mm sq.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Product Line

<table>
<thead>
<tr>
<th>Type</th>
<th>Power Supply Voltage</th>
<th>Maximum Holding Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 VDC</td>
<td>□ 1.65 in. (42 mm)</td>
</tr>
<tr>
<td>Standard Type</td>
<td>18.4 ~ 34 oz-in (0.13 ~ 0.24 N·m)</td>
<td>59 ~ 230 oz-in (0.42 ~ 1.66 N·m)</td>
</tr>
<tr>
<td>TH Geared Type</td>
<td>3 ~ 13.2 lb-in (0.35 ~ 1.5 N·m)</td>
<td>11 ~ 35 lb-in (1.25 ~ 4 N·m)</td>
</tr>
</tbody>
</table>
Specifications

- Model: Single Shaft
  - CSK543-NATA
  - CSK544-NATA
  - CSK545-NATA
  - CSK546-NATA
  - CSK564-NATA
  - CSK566-NATA
  - CSK569-NATA

- Double Shaft
  - CSK543-NBTA
  - CSK544-NBTA
  - CSK545-NBTA
  - CSK546-NBTA
  - CSK564-NBTA
  - CSK566-NBTA
  - CSK569-NBTA

- Maximum Holding Torque: oz-in (N·m)
  - CSK543-NATA: 18.4 (0.13)
  - CSK544-NATA: 25 (0.18)
  - CSK545-NATA: 34 (0.24)
  - CSK546-NATA: 59 (0.42)
  - CSK564-NATA: 117 (0.83)
  - CSK566-NATA: 230 (1.66)
  - CSK569-NATA: 350 (2.36)

- Rotor Inertia J: oz-in² (kg·m²)
  - CSK543-NATA: 0.191 (35×10⁻³)
  - CSK544-NATA: 0.3 (54×10⁻³)
  - CSK545-NATA: 0.37 (68×10⁻³)
  - CSK546-NATA: 0.96 (175×10⁻³)
  - CSK564-NATA: 1.53 (280×10⁻³)
  - CSK566-NATA: 3.1 (560×10⁻³)
  - CSK569-NATA: 6. (10⁻³)

- Rated Current: A/phase
  - CSK543-NATA: 0.75
  - CSK544-NATA: 0.72
  - CSK545-NATA: 1.4
  - CSK546-NATA: 1.4
  - CSK564-NATA: 1.4
  - CSK566-NATA: 1.4
  - CSK569-NATA: 1.4

- Basic Step Angle: °
  - CSK543-NATA: 1.65 in. (42 mm)
  - CSK544-NATA: 2.36 in. (60 mm)

- Power Source: 24 VDC ±10%
  - Current: 1.3 A
  - 24 VDC ±10%
  - Current: 2.1 A

- Excitation Mode:
  - Full Step (4 phase excitation): 0.72°/step
  - Half Step (4-5 phase excitation): 0.36°/step

- Weight:
  - Motor lb. (kg): 0.46 (0.21)
  - Driver lb. (kg): 0.59 (0.27)
  - Motor lb. (kg): 0.77 (0.35)
  - Driver lb. (kg): 1.3 (0.6)
  - Motor lb. (kg): 1.8 (0.8)
  - Driver lb. (kg): 2.9 (1.3)

- Dimension No.:
  - Motor: 1
  - Driver: 2

How to read specifications table → Page C-9

Speed — Torque Characteristics

- How to Read Speed-Torque Characteristics → Page C-10

Note:
The pulse input circuit responds up to approximately 100 kHz with a pulse duty of 50%.
### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Single Shaft</th>
<th>Double Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSK596-NATA</td>
<td>CSK596-NBTA</td>
<td>290 (2.1)</td>
</tr>
<tr>
<td>CSK599-NATA</td>
<td>CSK599-NBTA</td>
<td>14.8 (2700×10^{-2})</td>
</tr>
<tr>
<td>CSK5913-NATA</td>
<td>CSK5913-NBTA</td>
<td>7.7 (1400×10^{-2})</td>
</tr>
</tbody>
</table>

- **Maximum Holding Torque**: oz-in (N·m)
- **Rated Current**
- **Basic Step Angle**: 0.72°
- **Power Source**: 24 VDC ±10% 4 A
- **Excitation Mode**
  - Full Step (4 phase excitation): 0.72°/step
  - Half Step (4-5 phase excitation): 0.36°/step
- **Weight**
  - Motor: 3.7 (1.7) lb. (kg)
  - Driver: 6.2 (2.8) lb. (kg)
- **Dimension No.**
  - Motor: 7.6
  - Driver: 7.6

**Note:**
The pulse input circuit responds up to approximately 100 kHz with a pulse duty of 50%.

### Speed — Torque Characteristics

#### CSK596-NBTA

- **Power Input**: 24 VDC
- **Current**: 2.8 A/Phase (4 Phases ON)
- **With Damper D9CL-12.7F**: J = 4.8 oz-in² (870×10^{-2} kg·m²)
- **Pullout Torque**: 2.6 (470×10^{-2}) N·m

#### CSK599-NBTA

- **Power Input**: 24 VDC
- **Current**: 2.8 A/Phase (4 Phases ON)
- **With Damper D9CL-12.7F**: J = 4.8 oz-in² (870×10^{-2} kg·m²)
- **Pullout Torque**: 2.6 (470×10^{-2}) N·m

#### CSK5913-NBTA

- **Power Input**: 24 VDC
- **Current**: 2.8 A/Phase (4 Phases ON)
- **With Damper D9CL-12.7F**: J = 4.8 oz-in² (870×10^{-2} kg·m²)
- **Pullout Torque**: 2.6 (470×10^{-2}) N·m

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**Note:**
The pulse input circuit responds up to approximately 100 kHz with a pulse duty of 50%.
TH Geared Type Specifications

Motor Frame Size: □ 1.65 in. ( □ 42 mm)

<table>
<thead>
<tr>
<th>Model</th>
<th>Single Shaft</th>
<th>Double Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSK543AA-TG3.6</td>
<td>CSK543BA-TG3.6</td>
</tr>
<tr>
<td>Maximum Holding Torque</td>
<td>3.0 (0.35)</td>
<td>6.1 (0.7)</td>
</tr>
<tr>
<td>Rotor Inertia J</td>
<td>0.2°</td>
<td>0.1°</td>
</tr>
<tr>
<td>Rated Current</td>
<td>0.75 A/phase</td>
<td>0.75 A/phase</td>
</tr>
<tr>
<td>Basic Step Angle</td>
<td>0.2°</td>
<td>0.1°</td>
</tr>
<tr>
<td>Gear Ratio</td>
<td>3.6:1</td>
<td>7.2:1</td>
</tr>
<tr>
<td>Permissible Torque</td>
<td>3.0 (0.35)</td>
<td>6.1 (0.7)</td>
</tr>
<tr>
<td>Backlash</td>
<td>45 (0.7°)</td>
<td>25 (0.417°)</td>
</tr>
<tr>
<td>Permissible Speed Range (Gear Output Shaft Speed)</td>
<td>0—500</td>
<td>0—250</td>
</tr>
<tr>
<td>Power Source</td>
<td>24 VDC ±10% 1.3 A</td>
<td></td>
</tr>
<tr>
<td>Excitation Mode</td>
<td>Full Step: 0.2°/step</td>
<td>0.1°/step</td>
</tr>
<tr>
<td>Weight</td>
<td>Motor lb. (kg)</td>
<td>0.73 (0.33)</td>
</tr>
<tr>
<td></td>
<td>Driver lb. (kg)</td>
<td>0.73 (0.33)</td>
</tr>
<tr>
<td>Dimension No.</td>
<td>Motor: 4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Driver: 6</td>
<td>6</td>
</tr>
</tbody>
</table>

How to read specifications table ➔ Page C-9

Note:
- Direction of rotation of the motor and that of the gear output shaft are the same for models with gear ratios of 3.6:1, 7.2:1 and 10:1.
- It is opposite for 20:1 and 30:1 gear ratios.

Speed – Torque Characteristics

How to Read Speed-Torque Characteristics ➔ Page C-10

CSK543BA-TG3.6

Power Input: 24 VDC Current: 0.75 A/Phase (4 Phases ON)
With Damper: D4CL-5.0F  J = 0.186 oz-in² (34 × 10⁻⁶ kg·m²)

Permissible Torque

Driver Input Current

CSK543BA-TG7.2

Power Input: 24 VDC Current: 0.75 A/Phase (4 Phases ON)
With Damper: D4CL-5.0F  J = 0.186 oz-in² (34 × 10⁻⁶ kg·m²)

Permissible Torque

Driver Input Current

CSK543BA-TG10

Power Input: 24 VDC Current: 0.75 A/Phase (4 Phases ON)
With Damper: D4CL-5.0F  J = 0.186 oz-in² (34 × 10⁻⁶ kg·m²)

Permissible Torque

Driver Input Current

CSK543BA-TG20

Power Input: 24 VDC Current: 0.75 A/Phase (4 Phases ON)
With Damper: D4CL-5.0F  J = 0.186 oz-in² (34 × 10⁻⁶ kg·m²)

Permissible Torque

Driver Input Current

CSK543BA-TG30

Power Input: 24 VDC Current: 0.75 A/Phase (4 Phases ON)
With Damper: D4CL-5.0F  J = 0.186 oz-in² (34 × 10⁻⁶ kg·m²)

Permissible Torque

Driver Input Current

Note:
The pulse input circuit responds up to approximately 100 kHz with a pulse duty of 50%.
### Specifications

**Motor Frame Size:** 2.36 in. (60 mm)

#### Model and Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Single Shaft</th>
<th>Double Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSK564AA-TG3.6</td>
<td>CSK564AA-TG7.2</td>
</tr>
<tr>
<td>Maximum Holding Torque</td>
<td>11 (1.25)</td>
<td>22 (2.5)</td>
</tr>
<tr>
<td>Rotor Inertia J</td>
<td>oz-in² (kg·m²)</td>
<td>0.96 (175 x 10⁻⁴)</td>
</tr>
<tr>
<td>Rated Current</td>
<td>A/phase</td>
<td>1.4</td>
</tr>
<tr>
<td>Basic Step Angle</td>
<td>0.2°</td>
<td>0.1°</td>
</tr>
<tr>
<td>Gear Ratio</td>
<td>3.6:1</td>
<td>7.2:1</td>
</tr>
<tr>
<td>Permissible Torque</td>
<td>lb-in (N·m)</td>
<td>11 (1.25)</td>
</tr>
<tr>
<td>Backlash</td>
<td>Arc minute (degrees)</td>
<td>35 (0.584°)</td>
</tr>
<tr>
<td>Permissible Speed Range</td>
<td>(Gear Output Shaft Speed)</td>
<td>0–500</td>
</tr>
<tr>
<td>Power Source</td>
<td>24 VDC ±10%</td>
<td>2.1 A</td>
</tr>
<tr>
<td>Excitation Mode</td>
<td>Full Step</td>
<td>0.2°/step</td>
</tr>
<tr>
<td>Weight</td>
<td>Motor lb. (kg)</td>
<td>2.1 (0.95)</td>
</tr>
<tr>
<td>DIMENSIONS MOTOR lb. (kg)</td>
<td>0.31 (0.14)</td>
<td></td>
</tr>
<tr>
<td>DIMENSIONS DRIVER lb. (kg)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>DIMENSIONS DIMENSION No.</td>
<td>Motor</td>
<td>5</td>
</tr>
<tr>
<td>DIMENSIONS DRIVER</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

#### How to read specifications table

**Note:**
- Direction of rotation of the motor and that of the gear output shaft are the same for models with gear ratios of 3.6:1, 7.2:1 and 10:1.
- It is opposite for 20:1 and 30:1 gear ratios.

### Speed — Torque Characteristics

**CSK564BA-TG3.6**

- Power Input: 24 VDC
- Current: 1.4 A/Phase (4 Phases ON)
- With D6CL-8.0F
- \( J_e = 0.77 \text{ oz-in}^2 (140 \times 10^{-6} \text{ kg·m}^2) \)

**CSK564BA-TG7.2**

- Power Input: 24 VDC
- Current: 1.4 A/Phase (4 Phases ON)
- With D6CL-8.0F
- \( J_e = 0.77 \text{ oz-in}^2 (140 \times 10^{-6} \text{ kg·m}^2) \)

**CSK564BA-TG10**

- Power Input: 24 VDC
- Current: 1.4 A/Phase (4 Phases ON)
- With D6CL-8.0F
- \( J_e = 0.77 \text{ oz-in}^2 (140 \times 10^{-6} \text{ kg·m}^2) \)

**CSK564BA-TG20**

- Power Input: 24 VDC
- Current: 1.4 A/Phase (4 Phases ON)
- With D6CL-8.0F
- \( J_e = 0.77 \text{ oz-in}^2 (140 \times 10^{-6} \text{ kg·m}^2) \)

**CSK564BA-TG30**

- Power Input: 24 VDC
- Current: 1.4 A/Phase (4 Phases ON)
- With D6CL-8.0F
- \( J_e = 0.77 \text{ oz-in}^2 (140 \times 10^{-6} \text{ kg·m}^2) \)

**Note:**
- The pulse input circuit responds up to approximately 100 kHz with a pulse duty of 50%.

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**How to read Speed—Torque Characteristics**

- Page C-10

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**Before Using**

- 5-Phase Microstep
- 2-Phase Full/Half
- Closed Loop
- With Damper
- Encoder
- Without Damper
- With Encoder
- Motor & Driver Packages
- controllers
- Servo Systems
- Motion Control
- EMB01 EMB02
- SG8030U
- ORIENTAL MOTOR GENERAL CATALOG 2003/2004 C-125
## Common Specifications

<table>
<thead>
<tr>
<th>Input Signal Circuit</th>
<th>Motor Specifications</th>
<th>Driver Cooling Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse Signal</strong> (CW Pulse Signal)*</td>
<td>Photocoupler input, input resistance 220 Ω, input current 10 ~ 20 mA maximum Signal voltage Photocoupler ON: +4.5 ~ +5 V, Photocoupler OFF: 0 ~ +1 V (voltage between terminals)</td>
<td>Natural ventilation</td>
</tr>
<tr>
<td><strong>Rotation Direction Signal</strong> (CCW Pulse Signal)*</td>
<td>Rotation direction signal Photocoupler ON: CW, Photocoupler OFF: CCW CCW step command signal at 2-pulse input mode. Pulse width: 5 μs minimum, Pulse rise/fall: 2 μs maximum, pulse duty: Max. 50% Motor moves when the photocoupler state changes from ON to OFF. Maximum input frequency: 100 kHz (when a pulse duty is 50%)</td>
<td></td>
</tr>
<tr>
<td><strong>Step Angle Signal</strong></td>
<td>Full Step (0.72°) at 'photocoupler OFF' Half Step (0.36°) at 'photocoupler ON'</td>
<td></td>
</tr>
<tr>
<td><strong>All Windings Off Signal</strong></td>
<td>When in the 'photocoupler ON' state, the current to the motor is cut off and the motor shaft can be rotated manually. When in the 'photocoupler OFF' state, the current level set by the RUN switch is supplied to the motor.</td>
<td></td>
</tr>
<tr>
<td><strong>Automatic Current Cutback Release Signal</strong></td>
<td>When in the 'photocoupler ON' state, the 'Automatic Current Cutback' function at motor standstill is disabled. When in the 'photocoupler OFF' state, the 'Automatic Current Cutback' function at motor standstill is activated. (Approximately 100 ms after motor stops).</td>
<td></td>
</tr>
</tbody>
</table>

## General Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Motor</th>
<th>Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulation Class</strong></td>
<td>Class B [266°F (130°C)] [Recognized as Class A [221°F (105°C)] by UL and CSA standards.]</td>
<td></td>
</tr>
<tr>
<td><strong>Insulation Resistance</strong></td>
<td>100 MΩ minimum under normal temperature and humidity, when measured by a 500 VDC megger between the motor coils and the motor casing.</td>
<td></td>
</tr>
<tr>
<td><strong>Dielectric Strength</strong></td>
<td>Sufficient to withstand 1.5 kV (1 kV for CSK54 Package), 60 Hz applied between the motor coils and casing for one minute, under normal temperature and humidity.</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Environment</strong></td>
<td>Ambient Temperature 14°F ~ 122°F (−10°C ~ +50°C) (nonfreezing) 32°F ~ 104°F (0°C ~ +40°C) (nonfreezing)</td>
<td></td>
</tr>
<tr>
<td><strong>Ambient Humidity</strong></td>
<td>85% or less (non-condensing)</td>
<td></td>
</tr>
<tr>
<td><strong>Atmosphere</strong></td>
<td>No corrosive gases, dust, water or oil.</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature Rise</strong></td>
<td>Temperature rise of the coil measured by the Change Resistance Method is 144°F (80°C) or less. (at standstill, five phases energized)</td>
<td></td>
</tr>
<tr>
<td><strong>Static Angle Error</strong></td>
<td>± 3 arc minute (±0.05°)</td>
<td></td>
</tr>
<tr>
<td><strong>Shaft Runout</strong></td>
<td>0.002 inch (0.05 mm) T.I.R at top of output shaft</td>
<td></td>
</tr>
<tr>
<td><strong>Radial Play</strong></td>
<td>0.001 inch (0.025 mm) max. of 1.12 lb. (5 N)</td>
<td></td>
</tr>
<tr>
<td><strong>Axial Play</strong></td>
<td>0.003 inch (0.075 mm) max. of 2.2 lb. (10 N)</td>
<td></td>
</tr>
<tr>
<td><strong>Concentricity</strong></td>
<td>0.003 inch (0.075 mm) T.I.R</td>
<td></td>
</tr>
<tr>
<td><strong>Perpendicularity</strong></td>
<td>0.003 inch (0.075 mm) T.I.R</td>
<td></td>
</tr>
</tbody>
</table>

*1 This value is for full step under no load. (The value changes with size of the load.)
*2 Radial Play: Refers to the displacement in shaft position in the radial direction, when a 1.12 lb. (5 N) load is applied in the vertical direction to the tip of the motor’s shaft.
*3 Axial Play: Refers to the displacement in shaft position in the axial direction, when a 2.2 lb. (10 N) load is applied to the motor’s shaft in the axial direction.
*4 T.I.R. (Total Indicator Reading): Refers to the total dial gauge reading when the measured section is rotated one revolution centered on a reference axis.

### Note:
- Do not measure insulation resistance or perform the dielectric strength test while the motor and driver are connected.
## Permissible Overhung Load and Permissible Thrust Load

Unit = Upper values: lb./Lower values: N

<table>
<thead>
<tr>
<th>Model</th>
<th>Overhang Load Distance from Shaft End [inch (mm)]</th>
<th>Thrust Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (0)</td>
<td>0.2 (5)</td>
</tr>
<tr>
<td>CSK54-NATA</td>
<td>4.5</td>
<td>3.6</td>
</tr>
<tr>
<td>CSK56-NATA</td>
<td>14.1</td>
<td>16.8</td>
</tr>
<tr>
<td>CSK59-NATA</td>
<td>63</td>
<td>75</td>
</tr>
<tr>
<td>CSK543-TG</td>
<td>58</td>
<td>65</td>
</tr>
<tr>
<td>CSK56-TG</td>
<td>4.2</td>
<td>3.1</td>
</tr>
<tr>
<td>CSK564-TG</td>
<td>15.7</td>
<td>18</td>
</tr>
</tbody>
</table>

### Dimensions

#### Scale 1/4, Unit = inch (mm)

- **Motor**
  - **Standard Type**
  
  1. Motor Frame Size: □1.65 in. (□42 mm)
  
  * The length of machining on double shaft model is \(0.591 \pm 0.010\) (15.0 ± 0.25).

  2. Motor Frame Size: □2.36 in. (□60 mm)

  3. Motor Frame Size: □3.35 in. (□85 mm)

  - These dimensions are for double shaft models. For single shaft models, ignore the shaded areas.

---

**Note:**

- Dimensions and specifications are subject to change without notice. Please consult the latest product catalog for current information.

---

**Introduction**

- Stepping Motors

**Accessories**

- Controllers

**Motor & Driver Packages**

- Closed Loop Gear, DC Input
- AC Input
- Motor Frame Size
- Motor Lead
- Weight
- Thrust Load
- Overhung Load
**TH Geared Type**

4. **Motor Frame Size:** □ 1.65 in. (□ 42 mm)

- The length of machining on double shaft model is 0.591 ± 0.010 (15 ± 0.25).

5. **Motor Frame Size:** □ 2.36 in. (□ 60 mm)

- These dimensions are for double shaft models. For single shaft models, ignore the shaded areas.

**Driver**

6. CSD5807N-T, CSD5814N-T

   - **Weight:** 0.31 lb. (0.14 kg) [**DXF** B805U]

7. CSD5828N-T

   - **Weight:** 0.55 lb. (0.25 kg) [**DXF** B806U]

**Specifications**

- **Shaft Cross Section A-A’**
- **Weight:** 0.31 lb. (0.14 kg)
- **Step Motors**
  - No. 8-32 UNC, 0.375 inch (9.52 mm) length, 4 pieces

**Model**

- **Model**
- **Motor Model**
- **Weight**
- **DXF**

<table>
<thead>
<tr>
<th>Model</th>
<th>Motor Model</th>
<th>Weight</th>
<th>DXF</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSK543AA-TG</td>
<td>PKS43NAWA-T</td>
<td>0.73 (0.33)</td>
<td>B074U</td>
</tr>
<tr>
<td>CSK543BA-TG</td>
<td>PKS43NBWA-T</td>
<td>0.73 (0.33)</td>
<td>B074U</td>
</tr>
<tr>
<td>CSK564AA-TG</td>
<td>PKS64NAWA-T</td>
<td>2.1 (0.95)</td>
<td>B075U</td>
</tr>
<tr>
<td>CSK564BA-TG</td>
<td>PKS64NBWA-T</td>
<td>2.1 (0.95)</td>
<td>B075U</td>
</tr>
</tbody>
</table>

- Enter the gear ratio in the box (□) within the model number.
- Screws (included)
- No. 8-32 UNC, 0.75 inch (19.05 mm) length, 4 pieces

Additional Specifications:

- **Motors**
  - **Model**
  - **Motor Model**
  - **Weight**
  - **DXF**

<table>
<thead>
<tr>
<th>Model</th>
<th>Motor Model</th>
<th>Weight</th>
<th>DXF</th>
</tr>
</thead>
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<tr>
<td>CSK543AA-TG</td>
<td>PKS43NAWA-T</td>
<td>0.73 (0.33)</td>
<td>B074U</td>
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<tr>
<td>CSK543BA-TG</td>
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<td>0.73 (0.33)</td>
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<tr>
<td>CSK564AA-TG</td>
<td>PKS64NAWA-T</td>
<td>2.1 (0.95)</td>
<td>B075U</td>
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<tr>
<td>CSK564BA-TG</td>
<td>PKS64NBWA-T</td>
<td>2.1 (0.95)</td>
<td>B075U</td>
</tr>
</tbody>
</table>

- Enter the gear ratio in the box (□) within the model number.
- Screws (included)
- No. 8-32 UNC, 0.75 inch (19.05 mm) length, 4 pieces

**Dimensions**

- **Shaft Cross Section A-A’**
- **Motor Frame Size**
- **Motor Leads**
- **UL Style 3265, AWG26**

Additional Diagrams:

- Diagram showing the motor frame size and leads
- Diagram showing the shaft cross section
- Diagram showing the motor model details
- Diagram showing the motor weight and dimensions

**Features**

- **Motor Frame Size**
- **Motor Leads**
- **UL Style 3265, AWG26**

**System Configuration**

- **Shaft Cross Section A-A’**
- **Motor Frame Size**
- **Motor Leads**
- **UL Style 3265, AWG26**
**Connection and Operation**

**Standard Type:** CSK54\*, CSK56\*

**TH Geared Type:** CSK543\*, CSK564\*

---

### 1 Current Adjustment Potentiometers

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Switch Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN</td>
<td>Motor run current</td>
<td>Adjusts the motor running</td>
</tr>
<tr>
<td></td>
<td>potentiometer</td>
<td>current</td>
</tr>
<tr>
<td>STOP</td>
<td>Motor stop current</td>
<td>Adjusts the motor current</td>
</tr>
<tr>
<td></td>
<td>potentiometer</td>
<td>at standstill</td>
</tr>
</tbody>
</table>

### 2 Input/Output Signal

<table>
<thead>
<tr>
<th>Connector</th>
<th>Input/Output</th>
<th>Terminal No.</th>
<th>Signal Name</th>
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<tbody>
<tr>
<td>CN2</td>
<td>Input signals</td>
<td>1</td>
<td>Pulse Signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Rotation Direction Signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>All Windings Off Signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Step Angle Select Signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Current Cutback Release Signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Excitation Timing Signal</td>
</tr>
<tr>
<td></td>
<td>Output signals</td>
<td>11</td>
<td>POWER Green Power input display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>O.H. Red Overheat output display</td>
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</tbody>
</table>

### 3 Function Select Switches

<table>
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<tr>
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<th>Switch Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>2P/1P</td>
<td>Pulse input mode switch</td>
<td>Switches between 1-pulse input and 2-pulse input</td>
</tr>
<tr>
<td>A.C/OFF</td>
<td>Automatic current off function switch</td>
<td>When the heat sink temperature of the driver rises above 194°F (90°C), this function automatically switches the motor current off. Function can be set and released with this switch.</td>
</tr>
</tbody>
</table>

### 4 Input/Output Signal

<table>
<thead>
<tr>
<th>Connector</th>
<th>Input/Output</th>
<th>Terminal No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGNAL</td>
<td>Input signals</td>
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<td>Pulse Signal (CW Pulse Signal)</td>
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<td></td>
<td></td>
<td>2</td>
<td>Rotation Direction Signal (CCW Pulse Signal)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>All Windings Off Signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Step Angle Select Signal</td>
</tr>
<tr>
<td></td>
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<td>5</td>
<td>Current Cutback Release Signal</td>
</tr>
<tr>
<td></td>
<td>Output signals</td>
<td>11</td>
<td>Excitation Timing Signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>Overheat Signal</td>
</tr>
</tbody>
</table>
### Description of Input/Output Signals

#### Pulse Input Signal

“Pulse” signal is input to the PULSE—terminal. When the photocoupler state changes from “ON” to “OFF”, the motor rotates one step. The direction of rotation is determined by the rotation direction signal.

#### Rotation Direction Input Signal

The “Rotation Direction” signal is input to the DIRECTION—terminal. A “photocoupler ON” signal input commands a clockwise direction rotation. A “photocoupler OFF” signal input commands a counterclockwise direction rotation.

#### All Windings Off Input Signal

When the “All Windings Off” (A.W. OFF) signal is in the “photocoupler ON” state, the current to the motor is cut off and motor torque is reduced to zero. The motor output shaft can then be rotated freely by hand. This signal is used when moving the motor by external force or to the manual home position.

#### Step Angle Select Input Signal

When the “Step Angle Select” (FULL/HALF) signal is in the “photocoupler ON” state, half step mode has been selected; when the FULL/HALF signal is in the “photocoupler OFF” state, full step mode has been selected.

#### Current Cutback Release Input Signal

When the “Current Cutback Release” (C.D.INH) signal is in the “photocoupler ON” state, the “Automatic Current Cutback” function is not activated.

#### Excitation Timing Output Signal

The Excitation Timing signal is output once each time the excitation sequence returns to step “0” in synchronization with input pulses.

The excitation sequence is designed to complete one cycle as the motor shaft rotates 7.2°. A signal is output every 10 pulses in full step mode and every 20 pulses in half step mode. (When the “Excitation Timing” signal is output, the transistor turns ON.)

### Power Supply

Use an input power voltage of 24 VDC ± 10%. Use a power supply that can supply sufficient input current.

**Notes:**
- Keep the voltage Vo between 5 VDC and 24 VDC. When Vo is equal to 5 VDC, the external resistance R1 is not necessary. When Vo is above 5 VDC, connect R1 to keep the current below 10 mA.
- Use twisted-pair wire of AWG 24 or thicker and 6.6 feet (2 m) or less in length for the signal line.
- Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases. (→ Technical Reference Page F-36)
- Suitable wire size for the CN1, CN2 and CN3 connector is between AWG 20 and AWG 26. Use AWG 20 or thicker for motor lines (when extended) and power supply line.
- Signal lines should be kept at least 3.9 inches (10 cm) away from power lines (power supply lines and motor lines). Do not bind the signal line and power line together.
- Use spot grounding to ground the driver and external controller.
- If noise generated by the motor lead wire causes a problem, try shielding the motor lead wires with conductive tape or wire mesh.
- Incorrect connection of DC power input will lead to driver damage. Make sure that the polarity is correct before turning the power on.
**Description of Input/Output Signals**

**Pulse (CW) and Rotation Direction (CCW) Input Signal**

1-Pulse Input Mode  
**Pulse Signal**  
"Pulse" signal is input to the P/CW—terminal. When the photocoupler state changes from "ON" to "OFF", the motor rotates one step. The direction of rotation is determined by the rotation direction signal.

**Rotation Direction Signal**  
The "Rotation Direction" signal is input to D./CCW—terminal. A "photocoupler ON" signal input commands a clockwise direction rotation. A "photocoupler OFF" signal input commands a counterclockwise direction rotation.

2-Pulse Input Mode  
**CW Pulse Signal**  
"Pulse" signal is input to the P/CW—terminal. When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the clockwise direction.

**CCW Pulse Signal**  
"Pulse" signal is input to the D./CCW—terminal. When the photocoupler state changes from "ON" to "OFF", the motor rotates one step in the counterclockwise direction.

**All Windings Off Input Signal**  
When the "All Windings Off" (A.W. OFF) signal is in the "photocoupler ON" state, the current to the motor is cut off and motor torque is reduced to zero. The motor output shaft can then be rotated freely by hand. This signal is used when moving the motor by external force or to the manual home position.

**Step Angle Select Input Signal**  
When the "Step Angle Select" (FULL/HALF) signal is in the "photocoupler ON" state, half step mode has been selected; when the FULL/HALF signal is in the "photocoupler OFF" state, full step mode has been selected.

**Current Cutback Release Input Signal**  
When the "Current Cutback Release" (C.D.INH) signal is in the "photocoupler ON" state, the current to the motor is cut off and O.H.LED turns off. When the "Current Cutback Release" (C.D.INH) signal is in the "photocoupler OFF" state, the "Automatic Current Cutback" function is not activated.

**Excitation Timing Output Signal**  
The signal is output once each time the excitation sequence returns to step "0" in synchronization with input pulses.

The excitation sequence is designed to complete one cycle as the motor shaft rotates 7.2°. A signal is output every 10 pulses in full step mode and every 20 pulses in half step mode. (When the "Excitation Timing" signal is output, the transistor turns ON.)

**Overheat Output Signal**  
The Overheat signal is output to protect the driver from heat damage if the internal temperature of the driver rises above 194°F (90°C). At the same time this signal is output, the O.H.LED on the circuit board is lit up. The O.HEAT signal is automatically turned off when the temperature of the driver heat sink falls to below 194°F (90°C). (The O.HEAT signal returns to the "photocoupler OFF" state, and O.H.LED turns off.)

---

**Notes:**

- Keep the voltage Vo between 5 VDC and 24 VDC. When Vo is equal to 5 VDC, the external resistance R1 is not necessary. When Vo is above 5 VDC, connect R1 to keep the current between 10 mA and 20 mA, and connect R2 to keep the current below 10 mA.
- Use twisted-pair wire of AWG 24 or thicker and 6.6 feet (2 m) or less in length for the signal line.
- Note that as the length of the pulse signal line increases, the maximum transmission frequency decreases. (Technical Reference Page F-36)
- Suitable wire size for the ‘PWR’, ‘MOTOR’ and ‘SIGNAL’ connector is between AWG 20 and AWG 26. Use AWG 20 or thicker for motor lines (when extended) and power supply line.
- Signal Lines should be kept at least 3.9 inches (10 cm) away from power lines (power supply lines and motor lines). Do not bind the signal line and power line together.
- Use spot grounding to ground the driver and external controller.
- If noise generated by the motor lead wire causes a problem, try shielding the motor lead wires with conductive tape or wire mesh.
- Incorrect connection of DC power input will lead to driver damage. Make sure that the polarity is correct before turning the power on.
### Stepping Motors

- **10 µs min.**
- **300 µs min.**

#### Note:

- **10 µs or more is the standard interval time for switching from CW to CCW. Note that the interval time varies greatly depending on the motor and load inertia.**

- **1** Wait a period of time to allow the motor oscillations to end before inputting the “All Windings Off” signal. This time varies with the load inertia, the load torque and the starting pulse rate. The signal input must be stopped before the motor stops.

- **2** Never input a step pulse signal immediately after switching the “All Windings Off” signal to “photocoupler OFF” state or the motor may lose synchronism. In general, a minimum interval of 300 µs is required.

The shaded area indicates when the photocoupler is ON.

#### Note:

- **10 µs or more is the standard interval time for switching from CW to CCW. Note that the interval time varies greatly depending on the motor and load inertia.**

- **1** When the signal is in the “photocoupler ON” state, the “Automatic Current Cutback” function is deactivated. Always set it in the “photocoupler OFF” state when the pulse signal is stopped.

- **2** Wait a period of time to allow the motor oscillations to end before inputting the “All Windings Off” signal. This time varies with the load inertia, the load torque and the starting pulse rate. The signal input must be stopped before the motor stops.

- **3** Never input a step pulse signal immediately after switching the “All Windings Off” signal to “photocoupler OFF” state or the motor may lose synchronism. In general, a minimum interval of 300 µs is required.

- **4** The motor will not operate properly if a pulse signal is input when either the CW or CCW input “photocoupler ON” state.

The shaded area indicates when the photocoupler is ON.
Adjusting the Output Current

The rated output current is set at the factory. When it is necessary to change the current setting, follow the procedures described below.

Connecting an Ammeter

CSK54[A-TG], CSK56

CSK54[A-TG], CSK56[A-TG]

Connect a DC ammeter between the motor and terminal ① of CN3 connector as shown below.

Adjusting the Current at Motor Standstill

(1) Adjust the current at motor standstill with the STOP potentiometer.
Adjusting range
CSD5807N-T: 0.1 A/phase to 0.75 A/phase
CSD5814N-T: 0.1 A/phase to 1.4 A/phase
CSD5828N-T: 0.7 A/phase to 2.8 A/phase

(2) The motor operating current is set for rated current (CSD5807N-T: 0.75 A/phase, CSD5814N-T: 1.4 A/phase, CSD5828N-T: 2.8 A/phase) at the time of shipping, but it can be readjusted using the RUN potentiometer. The operating current can be lowered to suppress temperature rise in the motor/driver, or lower running current in order to allow a margin for motor torque or to reduce vibration.

Note:
• The motor RUN current should be less than the motor rated current.

Adjusting the Motor Running Current

Set the “Current Cutback Release” signal to the “photocoupler ON” state (SW: ON) when adjusting the RUN current.

(1) Adjust the motor RUN current with the RUN potentiometer.
Adjusting range
CSD5807N-T: 0.1 A/phase to 0.75 A/phase
CSD5814N-T: 0.1 A/phase to 1.4 A/phase
CSD5828N-T: 1.0 A/phase to 2.8 A/phase

(2) The motor operating current is set for rated current (CSD5807N-T: 0.75 A/phase, CSD5814N-T: 1.4 A/phase, CSD5828N-T: 2.8 A/phase) at the time of shipping, but it can be readjusted using the RUN potentiometer. The operating current can be lowered to suppress temperature rise in the motor/driver, or lower running current in order to allow a margin for motor torque or to reduce vibration.

Note:
• The motor RUN current should be less than the motor rated current.

Connecting an Ammeter

CSK59

Connect a DC ammeter between the motor and terminal ① of the “MOTOR” connector as shown below.

After connecting the DC ammeter to the motor, turn on the power. (The excitation status at this point is fixed.)

When the power is turned on, the motor enters a 4 phase excitation state, and +directional positive current flows through the CSK54-black, CSK56-blue motor lead wire. (Even if 4-5 phase excitation has been selected, the motor enters a 4 phase excitation state when the power is turned on. Adjust the current in this state.)

The value measured by the ammeter represents the total current in two phases. The current for one phase is equivalent to half of the ammeter value. (When setting the current to 1.0 A/phase, adjust the current level until the ammeter reads 2.0 A.)

Notes:
• Never input pulse signals.
• Select “photocoupler OFF” for “All Windings Off” signal. (Select “photocoupler OFF” when the switch is open.)
• When the RUN current is adjusted, the current at motor standstill also changes.

<table>
<thead>
<tr>
<th>Motor rated current [A]</th>
<th>Current at motor standstill [A]</th>
<th>Maximum holding torque [oz-in (N·m)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 A/phase to 0.75 A/phase</td>
<td>0.1 A/phase to 1.4 A/phase</td>
<td>0.7 A/phase to 2.8 A/phase</td>
</tr>
<tr>
<td>0.1 A/phase to 1.4 A/phase</td>
<td>0.7 A/phase to 2.8 A/phase</td>
<td>0.75 A/phase to 1.4 A/phase</td>
</tr>
<tr>
<td>0.7 A/phase to 2.8 A/phase</td>
<td>1.0 A/phase to 2.8 A/phase</td>
<td>0.75 A/phase to 1.4 A/phase</td>
</tr>
</tbody>
</table>

holding torque = \frac{\text{Current at motor standstill [A]}}{\text{Motor rated current [A]}} \times \text{Maximum holding torque [oz-in (N·m)]}
## List of Motor and Driver Combinations

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Motor Model</th>
<th>Driver Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSK543-NATA</td>
<td>PK543-NWA</td>
<td>CSD5807N-T</td>
</tr>
<tr>
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<td>CSK544-NATA</td>
<td>PK544-NWA</td>
<td>CSD5807N-T</td>
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<td>PK545-NWA</td>
<td>CSD5807N-T</td>
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<tr>
<td>Standard</td>
<td>CSK564-NATA</td>
<td>PK564-NWA</td>
<td>CSD5814N-T</td>
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<td>CSK566-NATA</td>
<td>PK566-NWA</td>
<td>CSD5814N-T</td>
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<td>CSD5814N-T</td>
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<td>PK5913-NWA</td>
<td>CSD5828N-T</td>
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<td>PK543WA-T3.6</td>
<td>CSD5807N-T</td>
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<td>PK543WA-T20</td>
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<td>CSK543A-TG30</td>
<td>PK543WA-T30</td>
<td>CSD5807N-T</td>
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<tr>
<td></td>
<td>CSK564A-TG3.6</td>
<td>PK564WA-T3.6</td>
<td>CSD5814N-T</td>
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<tr>
<td></td>
<td>CSK564A-TG7.2</td>
<td>PK564WA-T7.2</td>
<td>CSD5814N-T</td>
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<td>CSK564A-TG10</td>
<td>PK564WA-T10</td>
<td>CSD5814N-T</td>
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<td>PK564WA-T20</td>
<td>CSD5814N-T</td>
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<td></td>
<td>CSK564A-TG30</td>
<td>PK564WA-T30</td>
<td>CSD5814N-T</td>
</tr>
</tbody>
</table>

* Enter A (single shaft) or B (double shaft) in the box (□) within the model numbers.