The S-series motors are Aerotech’s high-performance brushless, frameless torque motors. The motors feature neodymium iron boron magnets for maximum torque and acceleration in a compact assembly.

**High-Performance Design**

The S-series motors utilize a slotless stator design and high pole-count rotor to provide zero cogging for exceptional velocity stability. The laminations contain no slots, eliminating torque ripple and cogging torque that produces velocity disturbance. The S-series motors are well-suited for direct-drive applications such as printing and scanning where velocity ripple cannot be tolerated.

**Wide Range of Output Torque and Sizes**

The S-series slotless motors cover a wide range of torque and package sizes. Continuous torque ranges from 0.20 N-m to 29.09 N-m. Peak torque ranges from 0.82 N-m to 116.37 N-m. The open design of the S-series motors allows for custom winding or mechanical variations to meet any application need.

The S-series motors are designed for applications in OEM machines. The S-50 (50-mm diameter) motor is ideal for small, tight spaces such as spindles or small feed rolls. The S-180 (180 mm diameter) and S-240 (240 mm diameter) can accelerate large print drums or precision positioning tables.

**Easy Machine Integration**

All S-series motors are supplied as two pieces – a slotless stator coil and permanent magnet rotor. The stator is a standard 3-phase coil assembly with Hall-effect devices. They can be driven using a simple six-step or sinusoidal commutation algorithm. Aerotech’s NDrive series amplifiers are performance-matched to the S-series motors for easy integration. The hollow rotor mounts directly to a drive axis with no gearing required.

Custom variations can be engineered to your requirements with minimal lead time.

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**PRODUCT HIGHLIGHTS**

Slotless, brushless ring motors with high torque output and zero cogging

Frameless design for easy integration into OEM machines

Various winding options available

Includes Hall effect sensors for commutation

Follows the 2011/65/EU RoHS 2 Directive
## S Series Specifications

|-------|-------|---------|---------|---------|---------|---------|----------|

### Performance Specifications

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Stall Torque, Continuous</td>
<td>N·m</td>
<td>0.20</td>
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### Mechanical Specifications

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### Standards

2011/65/EU RoHS 2 Directive

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1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature.
2. All performance and electrical specifications ±10%.
3. Values shown @ 75°C rise above a 25°C ambient temperature, with housed motor mounted to a 250 mm x 250 mm x 6 mm aluminum heat sink.
4. Peak torque assumes correct rms current; consult Aerotech.
5. Torque constant and motor constant specified at stall.
6. All Aerotech amplifiers are rated A_{pk}; use torque constant in N·m/A_{pk} when sizing.
# S Series Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Units</th>
<th>S-130-39</th>
<th>S-130-60</th>
<th>S-130-81</th>
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<td>A&lt;sub&gt;phrms&lt;/sub&gt;</td>
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<td>Maximum Bus Voltage</td>
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<td><strong>Mechanical Specifications</strong></td>
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<td>Frameless Motor Weight</td>
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<td>Frameless Rotor Inertia</td>
<td>kg·m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.60×10&lt;sup&gt;-3&lt;/sup&gt;</td>
<td>3.00×10&lt;sup&gt;-3&lt;/sup&gt;</td>
<td>4.70×10&lt;sup&gt;-3&lt;/sup&gt;</td>
<td>6.20×10&lt;sup&gt;-3&lt;/sup&gt;</td>
<td>7.80×10&lt;sup&gt;-3&lt;/sup&gt;</td>
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<td>2011/65/EU RoHS 2 Directive</td>
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</tbody>
</table>

<sup>1</sup> Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature.
<sup>2</sup> All performance and electrical specifications ±10%.
<sup>3</sup> Values shown @ 75°C rise above a 25°C ambient temperature, with housed motor mounted to a 330 mm x 300 mm x 13 mm aluminum heat sink.
<sup>4</sup> Peak torque assumes correct rms current; consult Aerotech.
<sup>5</sup> Torque constant and motor constant specified at stall.
<sup>6</sup> All Aerotech amplifiers are rated A<sub>ph</sub>; use torque constant in N·m/A<sub>ph</sub> when sizing.
## S Series Specifications

|-------|-------|---------|---------|---------|---------|---------|----------|

### Performance Specifications

1. **Stall Torque, Continuous**
   - N·m
   - S-50-39: 5.99
   - S-50-52: 11.12
   - S-50-86: 15.93
   - S-76-35: 10.73
   - S-76-85: 19.71
   - S-76-149: 29.09

2. **Peak Torque**
   - N·m
   - S-50-39: 23.98
   - S-50-52: 44.47
   - S-50-86: 63.70
   - S-76-35: 42.90
   - S-76-85: 78.82
   - S-76-149: 116.37

3. **Rated Speed**
   - rpm
   - S-50-39: 500
   - S-50-52: 1,000
   - S-50-86: 500
   - S-76-35: 1,000
   - S-76-85: 250
   - S-76-149: 500

4. **Rated Power Output, Continuous**
   - W
   - S-50-39: 313.8
   - S-50-52: 627.7
   - S-50-86: 582.1
   - S-76-35: 1,164.3
   - S-76-85: 416.9
   - S-76-149: 833.8

### Electrical Specifications

1. **BEMF Constant (Line-Line, Max)**
   - Vpk/krpm
   - S-50-39: 268.7
   - S-50-52: 134.4
   - S-50-86: 263.9
   - S-76-35: 393.4
   - S-76-85: 196.7
   - S-76-149: 209.4

2. **Continuous Current, Stall**
   - A
   - S-50-39: 2.7
   - S-50-52: 5.4
   - S-50-86: 5.1
   - S-76-35: 4.9
   - S-76-85: 9.8
   - S-76-149: 6.2

3. **Peak Current, Stall**
   - A
   - S-50-39: 10.8
   - S-50-52: 21.6
   - S-50-86: 20.4
   - S-76-35: 40.8
   - S-76-85: 24.8
   - S-76-149: 49.6

4. **Torque Constant**
   - N·m/A
   - S-50-39: 2.22
   - S-50-52: 1.11
   - S-50-86: 2.18
   - S-76-35: 3.25
   - S-76-85: 1.73
   - S-76-149: 0.87

5. **Motor Constant**
   - N·m/V√W
   - S-50-39: 0.628
   - S-50-52: 1.053
   - S-50-86: 1.391
   - S-76-35: 0.845
   - S-76-85: 1.405
   - S-76-149: 1.893

   - Ω
   - S-50-39: 12.8
   - S-50-52: 4.4
   - S-50-86: 1.1
   - S-76-35: 5.6
   - S-76-85: 1.4
   - S-76-149: 4.3

7. **Inductance (Line-Line)**
   - mH
   - S-50-39: 3.40
   - S-50-52: 0.85
   - S-50-86: 1.70
   - S-76-35: 0.43
   - S-76-85: 2.60
   - S-76-149: 2.15

8. **Maximum Bus Voltage**
   - VDC
   - S-50-39: 340

9. **Thermal Resistance**
   - °C/W
   - S-50-39: 0.82
   - S-50-52: 0.67
   - S-50-86: 0.57
   - S-76-35: 0.47
   - S-76-85: 0.38
   - S-76-149: 0.32

10. **Number of Poles**
    - P
    - S-50-39: 18
    - S-50-52: 26

### Mechanical Specifications

1. **Frameless Motor Weight**
   - kg
   - S-50-39: 4.24
   - S-50-52: 8.10
   - S-50-86: 11.90
   - S-76-35: 5.80
   - S-76-85: 11.00
   - S-76-149: 16.20

2. **Frameless Rotor Inertia**
   - kg·m²
   - S-50-39: 7.40x10⁻²
   - S-50-52: 1.48x10⁻²
   - S-50-86: 2.20x10⁻²
   - S-76-35: 2.30x10⁻²
   - S-76-85: 4.50x10⁻²
   - S-76-149: 7.00x10⁻²

3. **Length of Winding, Frameless Motor**
   - mm
   - S-50-39: 43.2
   - S-50-52: 68.2
   - S-50-86: 93.2
   - S-76-35: 42.7
   - S-76-85: 62.7
   - S-76-149: 82.7

4. **Outside Diameter, Frameless Motor**
   - mm
   - S-50-39: 180.0
   - S-76-35: 239.2

5. **Max. Axial Load**
   - N
   - S-50-39: 86.4
   - S-76-35: 120.6

### Standards

- 2011/65/EU RoHS 2 Directive

---

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4 Peak torque assumes correct rms current; consult Aerotech.
5 Torque constant and motor constant specified at stall.
6 All Aerotech amplifiers are rated Apk; use torque constant in N·mApk when sizing.
S Series Motor Performance

- S-50-39-A Torque vs Speed
- S-50-39-B Torque vs Speed
- S-50-52-A Torque vs Speed
- S-50-52-B Torque vs Speed
- S-50-86-A Torque vs Speed
- S-50-86-B Torque vs Speed
S Series Motor Performance

- **S-76-35-A Torque vs Speed**
- **S-76-35-B Torque vs Speed**
- **S-76-85-A Torque vs Speed**
- **S-76-85-B Torque vs Speed**
- **S-76-149-A Torque vs Speed**
- **S-76-149-B Torque vs Speed**
S Series Motor Performance

S-130-39-A Torque vs Speed

S-130-39-B Torque vs Speed

S-130-60-A Torque vs Speed

S-130-60-B Torque vs Speed

S-130-81-A Torque vs Speed

S-130-81-B Torque vs Speed
S Series Motor Performance

- S-130-102-A Torque vs Speed
- S-130-102-B Torque vs Speed
- S-130-123-A Torque vs Speed
- S-130-123-B Torque vs Speed
- S-180-44-A Torque vs Speed
- S-180-44-B Torque vs Speed
S Series Motor Performance

S-180-69-A Torque vs Speed

S-180-69-B Torque vs Speed

S-180-94-A Torque vs Speed

S-180-94-B Torque vs Speed

S-240-43-A Torque vs Speed

S-240-43-B Torque vs Speed
S Series Motor Performance

S-240-63-A Torque vs Speed

S-240-63-B Torque vs Speed

S-240-83-A Torque vs Speed

S-240-83-B Torque vs Speed
### S Series Dimensions

#### Model No. A B C

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<td>68.8 [2.71]</td>
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</table>

Motor Coil Wires: 24 AWG
- 6 Leads, 0.3m [12 in]
- Minimum Length
- Phase A = Black - Blue
- Phase B = Red - Brown
- Phase C = White - Yellow

Hall Sensor Wires: 28 AWG
- 5 Leads, 0.3m [12 in]
- Minimum Length
- Common = Black
- +5V = Red
- Hall A = Blue
- Hall B = White
- Hall C = Orange

Thermistor Wires: 30 AWG
- 2 Leads, 0.3m [12 in]
- Minimum Length
- Red - Red

**Mounting Requirement**
- Ø3.18 [0.125] Ream X 7.6 [0.30] dp.
- 2 Holes Eq. Spaced on Ø13.77 [Ø0.542] b.c.

**Rotor Assembly**
- Ø46.6 [1.84] Max.
- Rotor Length
- 0.4 [0.02] Stator Length

**Stator Assembly**
- 8.0 [0.32] Max.
- Slack Length
- 9.8 [0.39] Max.
- Ø 9.56
- Ø 9.54
- Ø 3.77
- Ø 3.76

**Model Numbers**
- S-50-39
- S-50-52
- S-50-86

**Dimensions - millimeters [inches]**

- Ø50.80 [2.000]
- Ø50.75 [1.998]
- 0.03
- 0.001 B.C.
- 22.0°
- 90.0°
**S Series Dimensions**

### S-76

Dimensions - millimeters [inches]

<table>
<thead>
<tr>
<th>Model No.</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-76-36</td>
<td>17.2</td>
<td>18.8</td>
<td>35.6</td>
</tr>
<tr>
<td>S-76-85</td>
<td>67.0</td>
<td>68.6</td>
<td>84.8</td>
</tr>
<tr>
<td>S-76-149</td>
<td>131.0</td>
<td>135.0</td>
<td>148.8</td>
</tr>
</tbody>
</table>

- **Hall Sensor Wires 28 AWG**
  - 5 Leads, 0.3m [12 in]
  - Minimum Length
  - Common = Black
  - +5V = Red
  - Hall A = Blue
  - Hall B = White
  - Hall C = Orange

- **Motor Coil Wires 24 AWG**
  - 6 Leads, 0.3m [12 in]
  - Minimum Length
  - Phase A = Black - Blue
  - Phase B = Red - Brown
  - Phase C = White - Yellow

### S-130

Dimensions - millimeters [inches]

<table>
<thead>
<tr>
<th>Model No.</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-130-39</td>
<td>21.0</td>
<td>23.1</td>
<td>38.7</td>
</tr>
<tr>
<td>S-130-60</td>
<td>42.0</td>
<td>44.1</td>
<td>59.7</td>
</tr>
<tr>
<td>S-130-81</td>
<td>63.0</td>
<td>65.1</td>
<td>80.7</td>
</tr>
<tr>
<td>S-130-102</td>
<td>84.0</td>
<td>86.1</td>
<td>101.7</td>
</tr>
<tr>
<td>S-130-123</td>
<td>105.0</td>
<td>107.1</td>
<td>122.7</td>
</tr>
</tbody>
</table>

- **Hall Sensor Wires 28 AWG**
  - 5 Leads, 0.3m [12 in]
  - Minimum Length
  - Common = Black
  - +5V = Red
  - Hall A = Blue
  - Hall B = White
  - Hall C = Orange

- **Thermistor Wires 30 AWG**
  - 2 Leads, 0.3m [12 in]
  - Minimum Length
  - Red - Red

- **Motor Coil Wires 24 AWG**
  - 6 Leads, 0.3m [12 in]
  - Minimum Length
  - Phase A = Black - Blue
  - Phase B = Red - Brown
  - Phase C = White - Yellow

- **Hall Sensor Wires 28 AWG**
  - 5 Leads, 0.3m [12 in]
  - Minimum Length
  - Common = Black
  - +5V = Red
  - Hall A = Blue
  - Hall B = White
  - Hall C = Orange

- **Thermistor Wires 30 AWG**
  - 2 Leads, 0.3m [12 in]
  - Minimum Length
  - Red - Red
S Series Dimensions

**Model No.**

<table>
<thead>
<tr>
<th>Model No.</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-180-44</td>
<td>25.0</td>
<td>26.0</td>
<td>43.2</td>
</tr>
<tr>
<td>S-180-69</td>
<td>50.0</td>
<td>51.0</td>
<td>68.2</td>
</tr>
<tr>
<td>S-180-94</td>
<td>75.0</td>
<td>76.0</td>
<td>93.2</td>
</tr>
</tbody>
</table>

**Motor Coil Wires** 24 AWG
6 Leads, 0.3 m (12 in)
Minimum Length
Phase A = Black - Blue
Phase B = Red - Brown
Phase C = White - Yellow

**Hall Sensor Wires** 28 AWG
5 Leads, 0.3 m (12 in)
Minimum Length
Common = Black
+5V = Red
Hall A = Blue
Hall B = White
Hall C = Orange

**Thermistor Wires** 30 AWG
2 Leads, 0.3 m (12 in)
Minimum Length
Red - Red

**Stack Length**
7.7 [0.30] Max.
10.6 [0.42] Max.

**Mounting Requirement**
Ø82.59
Ø82.56
3.251
3.250

**M6 x 1 x 12.7 mm dp.**
4 Places Eq. Spaced on 102 [4.02] Dia. B.C.

**Mounting Dimension**
0.50 [0.02]

**Dimensions - millimeters [inches]**

- **Rotor Length**
- **Stator Length**
- **Hall Sensors**
- **Rotor Assembly**
- **Stator Assembly**
S Series Dimensions

S-240

- **Motor Lead Wires**: 24 AWG
  - 6 Leads, 0.3 m [12 in]
  - Minimum Length
  - Phase A = Black - Blue
  - Phase B = Red - Brown
  - Phase C = White - Yellow

- **Hall Sensor Wires**: 28 AWG
  - 5 Leads, 0.3 m [12 in]
  - Hall A = Blue
  - Hall B = White
  - Hall C = Orange

- **Thermistor Wires**: 30 AWG
  - 6 Leads, 0.3 m [12 in]
  - Motor Coil Wires: 24 AWG
  - Phase A = Black - Blue
  - Phase B = Red - Brown
  - Phase C = White - Yellow
  - Hall C = Orange

**Dimensions (mm [in])**

- **Ø 232.4 [9.15]** Max.
- **Ø 185.3 [7.30]**
- **7.7 [0.30] Max.**
- **12.0 [0.47] Max.**

**Nominal Air Gap**

- Between Rotor and Stator: 0.6 [0.024]
- Stack Length: 3.2 [0.126] x 7.6 [0.30] Dp.
- Typical 2 Holes
- Eq. Spaced on 152.4 [6.0] B.C.

**Mounting Requirement**

- Ø 204.2 [8.04]
- M6 x 1 x 12.7 [1/2] dp.
- Typ. 4 Holes
- Eq. Spaced on 152.4 [6.0] B.C.

**Stack Length**

- Ø 205.4 [8.09]
- Ø 204.2 [8.04]
- 0.05 [0.002]

**Rotor Length**

- Ø 120.7 [4.753]
- Ø 120.70 [4.752]

**Stator Length**

- 4.753
- 4.752

**Nominal Air Gap Between Rotor and Stator**

- 0.6 [0.024]

**Model No.**

- S-240
- S-240 (CAT)

**Approvals**

- SHEET 1 OF 1
- SCALE: 1:1
- ECN ZONE REV.
- DESCRIPTION DATE APPROVED
- MCN15025 A
  - INCLUDE "MAX." ON END WINDING DIMENSIONS
  - INCLUDE WIRE GAUGE FOR MOTOR, HALL SENSOR AND THERMISTOR WIRES
  - REMOVE DESCRIPTION TEXT FROM DIMENSIONS
  - USE "A" DIMENSION FOR STACK LENGTH AND "B" DIMENSION FOR ROTOR LENGTH
  - UPDATE TITLE BLOCK AND ECN TABLE
  - STANDARDIZE DRAWINGS ACROSS S-2 SERIES MOTORS
  - CHANGE MOUNTING REQUIREMENT TOLERANCE FROM CONCENTRICITY TO RUN OUT
  - INCLUDE STATOR OD AND ROTOR ID TOLERANCES
  - INCLUDE ROTOR TAPPED HOLE ANGULAR POSITION

**Date**

- 8/2/2013 RLYRA
- 3/31/2015 BHARROLD
S Series **Ordering Information**

**NEMA Brushless Slotless Rotary Servomotor**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-50-39</td>
<td>Slotless motor, rotor, and stator, 50 mm O.D., 39 mm length.</td>
</tr>
<tr>
<td>S-50-52</td>
<td>Slotless motor, rotor, and stator, 50 mm O.D., 52 mm length.</td>
</tr>
<tr>
<td>S-50-86</td>
<td>Slotless motor, rotor, and stator, 50 mm O.D., 86 mm length.</td>
</tr>
<tr>
<td>S-76-35</td>
<td>Slotless motor, rotor, and stator, 76 mm O.D., 35 mm length.</td>
</tr>
<tr>
<td>S-76-85</td>
<td>Slotless motor, rotor, and stator, 76 mm O.D., 85 mm length.</td>
</tr>
<tr>
<td>S-76-149</td>
<td>Slotless motor, rotor, and stator, 76 mm O.D., 149 mm length.</td>
</tr>
<tr>
<td>S-130-39</td>
<td>Slotless motor, rotor, and stator, 130 mm O.D., 39 mm length.</td>
</tr>
<tr>
<td>S-130-60</td>
<td>Slotless motor, rotor, and stator, 130 mm O.D., 60 mm length.</td>
</tr>
<tr>
<td>S-130-81</td>
<td>Slotless motor, rotor, and stator, 130 mm O.D., 81 mm length.</td>
</tr>
<tr>
<td>S-130-102</td>
<td>Slotless motor, rotor, and stator, 130 mm O.D., 102 mm length.</td>
</tr>
<tr>
<td>S-130-123</td>
<td>Slotless motor, rotor, and stator, 130 mm O.D., 123 mm length.</td>
</tr>
<tr>
<td>S-180-44</td>
<td>Slotless motor, rotor, and stator, 180 mm O.D., 44 mm length.</td>
</tr>
<tr>
<td>S-180-69</td>
<td>Slotless motor, rotor, and stator, 180 mm O.D., 69 mm length.</td>
</tr>
<tr>
<td>S-180-94</td>
<td>Slotless motor, rotor, and stator, 180 mm O.D., 94 mm length.</td>
</tr>
<tr>
<td>S-240-43</td>
<td>Slotless motor, rotor, and stator, 240 mm O.D., 43 mm length.</td>
</tr>
<tr>
<td>S-240-63</td>
<td>Slotless motor, rotor, and stator, 240 mm O.D., 63 mm length.</td>
</tr>
<tr>
<td>S-240-83</td>
<td>Slotless motor, rotor, and stator, 240 mm O.D., 83 mm length.</td>
</tr>
</tbody>
</table>

Note: S-Series torque ring motors include the stator w/flying leads, adjustable-phase Hall bd., and rotor w/magnets

**Winding Designation (Required)**

- **A**
  Motor winding
- **B**
  Motor winding; not available for BMS35

**Integration (Required)**

Aerotech offers both standard and custom integration services to help you get your system fully operational as quickly as possible. The following standard integration options are available for this system. Please consult Aerotech if you are unsure what level of integration is required, or if you desire custom integration support with your system.

- **TAS**
  Integration - Test as system
  Testing, integration, and documentation of a group of components as a complete system that will be used together (ex: drive, controller, and stage). This includes parameter file generation, system tuning, and documentation of the system configuration.

- **TAC**
  Integration - Test as components
  Testing and integration of individual items as discrete components. This is typically used for spare parts, replacement parts, or items that will not be used or shipped together (ex: stage only). These components may or may not be part of a larger system.