Minertia Motor P Series
SMALL SIZE DC SERVOMOTORS
WITH TACHOMETER GENERATOR
TYPE P09S3, P12S3, P12H3
P Series Minertia Motors are disc-armature DC motors. The principle of disc armature DC motors was developed by SEA in France. They feature epochmaking armature construction—"flat" armature—.

In 1964, Yaskawa achieved technological breakthroughs and gained success by manufacturing the highly-reliable, highly-durable armatures of stabilized performance in quantity. P Series motors incorporating these armatures have been widely used throughout the world for both general and special industrial applications including robots, X-Y tables and computer peripherals.

FEATURES

- Small-size tachometer generator directly mounted on motor permits easy brush replacement, without disassembly.
- Low inertia of tachometer generator
- Strong permanent alnico magnets
- Quick response and accurate positioning
- Very low ripples; no cogging
- Compatible with conventional flat armature motors
- Ferrite type also available
- Available with analog tachometers and optical encoders
- Fast-reacting service centers in U.S.A. for maintenance and repair service
- 100% Quality control testing

The Deming Application Prize Medal Awarded to Yaskawa in 1984 for Exceptional Achievement in Industrial Performance
## RATINGS AND SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Motor Type</th>
<th>P09S3</th>
<th>P12S3</th>
<th>P12H3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Rated Torque</td>
<td>oz·in</td>
<td>256</td>
<td>642</td>
<td>889</td>
</tr>
<tr>
<td>Rated Torque</td>
<td>oz·in</td>
<td>51.1</td>
<td>128.2</td>
<td>177.8</td>
</tr>
<tr>
<td>Torque Constant</td>
<td>oz·in/amp</td>
<td>6.56</td>
<td>15.63</td>
<td>24.10</td>
</tr>
<tr>
<td>Armature Winding Resistance (at 25°C)</td>
<td>Ω</td>
<td>0.65</td>
<td>0.61</td>
<td>0.61</td>
</tr>
<tr>
<td>Armature Inductance</td>
<td>mH</td>
<td>&lt; 0.1</td>
<td>&lt; 0.1</td>
<td>&lt; 0.1</td>
</tr>
<tr>
<td>Peak Current</td>
<td>A</td>
<td>39.5</td>
<td>41</td>
<td>37.1</td>
</tr>
<tr>
<td>Voltage Constant</td>
<td>V/1000rpm</td>
<td>4.85</td>
<td>11.55</td>
<td>17.80</td>
</tr>
<tr>
<td>Viscous Damping Coefficient</td>
<td>oz·in/1000rpm</td>
<td>1.00</td>
<td>3.19</td>
<td>5.70</td>
</tr>
<tr>
<td>Friction Torque</td>
<td>oz·in</td>
<td>2.20</td>
<td>3.47</td>
<td>3.47</td>
</tr>
<tr>
<td>Inertia</td>
<td>oz·in·sec²×10⁻³</td>
<td>5.4</td>
<td>20.1</td>
<td>20.4</td>
</tr>
<tr>
<td>Mechanical Time Constant</td>
<td>millisec</td>
<td>11.3</td>
<td>7.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Electrical Time Constant</td>
<td>millisec</td>
<td>&lt; 0.15</td>
<td>&lt; 0.16</td>
<td>&lt; 0.16</td>
</tr>
<tr>
<td>Power Rate</td>
<td>kW/sec</td>
<td>3.4</td>
<td>5.8</td>
<td>10.7</td>
</tr>
<tr>
<td>Torque Inertia Ratio</td>
<td>rad/sec²</td>
<td>9400</td>
<td>6400</td>
<td>8900</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>deg C/watt</td>
<td>1.3</td>
<td>1.27</td>
<td>1.27</td>
</tr>
<tr>
<td>Max Allowable Armature Temperature</td>
<td>°C</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Rated Speed</td>
<td>rpm</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>Max Safe Operating Speed</td>
<td>rpm</td>
<td>4000</td>
<td>4000</td>
<td>4000</td>
</tr>
</tbody>
</table>

The data in the above table are obtained under the following conditions:
- Time Rating: Continuous
- Dielectric Strength: 500 VAC
- Enclosure: Totally-enclosed self-cooled type
- Ambient Temperature: −10°C to 25°C
SPEED-TORQUE CHARACTERISTICS

TYPE P09S3

TYPE P12S3

TYPE P12H3

A: Area of safe continuous operation without air cooling.
Note: Curves are for motors mounted on 8'' × 16'' × 3/8'' heat sinks and armature temperature of 125°C.
## DC Tachometer Generator Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Tachometer Generator Type</th>
<th>G3VCX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Sensitivity*</td>
<td>(V/1000rpm)±10%</td>
<td>3.0</td>
</tr>
<tr>
<td>Ripple Voltage†</td>
<td>%P-P(at 1000 rpm)</td>
<td>1.5</td>
</tr>
<tr>
<td>Ripple Frequency</td>
<td>cycles/rev.</td>
<td>13</td>
</tr>
<tr>
<td>Linearity†</td>
<td>%</td>
<td>1.0</td>
</tr>
<tr>
<td>Direction Deviation†</td>
<td>%</td>
<td>1.0</td>
</tr>
<tr>
<td>Armature Inertia</td>
<td>oz-in-sec²X10⁻³</td>
<td>0.125</td>
</tr>
<tr>
<td>Armature Resistance</td>
<td>g-cm-sec²X10⁻³</td>
<td>9.0</td>
</tr>
<tr>
<td>Stability (Temperature Coefficient)</td>
<td>%/°C</td>
<td>0.05</td>
</tr>
<tr>
<td>Effective Speed Range</td>
<td>rpm</td>
<td>200-4000</td>
</tr>
<tr>
<td>Max Safety Speed</td>
<td>rpm</td>
<td>5000</td>
</tr>
<tr>
<td>Min Load Impedance</td>
<td>k Ω</td>
<td>5.1</td>
</tr>
<tr>
<td>Insulation Resistance with a 500V Megger</td>
<td>M Ω</td>
<td>10</td>
</tr>
<tr>
<td>Withstand Voltage for 1 Minute</td>
<td>VAC</td>
<td>500</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>0-60</td>
</tr>
<tr>
<td>Humidity (without a Drop of Water)</td>
<td>%</td>
<td>20-80</td>
</tr>
<tr>
<td>Rated Operating Life at 1000rpm</td>
<td>Hours</td>
<td>5000</td>
</tr>
</tbody>
</table>

*Terminal Open
†Filter
‡Linearity
\[
\text{Linearity at } Nk (\text{rpm}) = \left|\frac{E_k - Nk \cdot E_a}{Nk \cdot E_a}\right| \times 100\%
\]
\[
E_a = \frac{E_1 + E_2 + \cdots + E_n}{N_1 + N_2 + \cdots + N_n}
\]

#Direction Deviation
\[
\text{Direction Deviation} = \left|\frac{E_{cw} - E_{ccw}}{E_{cw}}\right| \times 100\%
\]

**Note:**
1. Connecting OUTPUT terminal with resistance, total load impedance may exceed 5.1 kΩ.
2. In case of motor drive source with no transformer, tachogenerator winding to be isolated from motor drive source.
**DIMENSIONS** in inches

**TYPE P09S3**

- NO. 8-32 UNC-2A THD
- 3.656 DIA
- 0.51 DIA
- 30 BENDING SECTION
- 126 TERMINAL DETAIL (T. G)
- 250 FASTON 187 SERIES TAB.
- NO. 8-32UNC-2A THD
- ROTATION
- 0.87 DIA
- 3.07 DIA
- 1.575 DIA
- TACHOMETER GENERATOR
- TYPE: G3VD
- MOTOR LEADS 7.87 LONG
- RED: (POS),
- BLACK: (NEG).

Approximate Weight: 5.51 lb

**TYPE P12S3**

- NO. 10-32 UNF-2B X 21 DEEP
- 4 HOLES ON 4.875 ±0.005 DIA BSC
- FLAT.01 ±0.01 DEEP X.50 LONG
- 0.010 DIA
- TACHOMETER GENERATOR
- TYPE: G3VD
- NO. 6-32 UNC-2A THD
- 2 TERMINALS WITH NUTS

Approximate Weight: 7.1 lb
TYPE P12H3

Note:
1. Shaft dia - A - runout not to exceed 0.001 inch per inch.
2. Pilot dia - B - concentric to - A - within 0.003 inch T.I.R.
3. Mounting surface - S - perpendicular to - A - within 0.005" for Type P09S3; 0.007" for Types P12S3 and P12H3.
4. Shaft end play 0.001" max under a thrust in the direction shown of: 10 lb.
5. Maximum pure radial load, 1" from surface "S": 25 lb for Type P09S3.
6. Maximum pure axial load is 11 lb for Type P09S3; 55 lb for Types P12S3 and P12H3.
7. Tachometer generator output voltage at 3 V/1000 rpm terminal No.1 (positive) and No.2 (negative).

ORDERING INFORMATION

- Application
- Type
- Ratings: output, voltage, current, torque, speed
- Environmental conditions: ambient temperature, location
- Others to be specified
Minertia Motor P Series
SMALL SIZE DC SERVOMOTORS
WITH TACHOMETER GENERATOR
TYPE P09S3, P12S3, P12H3

TOKYO OFFICE Ohtemachi Bldg, 1-6-1 Ohtemachi, Chiyoda-ku, Tokyo, 100 Japan
Phone (03) 3284-9111 Telex YASKAWA J33530 Fax (03) 3284-9034
SEUL Office 8th Floor Seoul Center Bldg, 91-1, Sogong-Dong, Chung-ku, Seoul, Korea 100-070
Phone (02) 776-7844 Fax (02) 753-2629
TAIPEI OFFICE Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan
Phone (02) 563-0010 Fax (02) 567-4677
YASKAWA ELECTRIC AMERICA, INC.
Chicago-Corporate Headquarters 2942 MacArthur Blvd. Northbrook, IL 60062-2028, U.S.A.
Phone (708) 291-2340 Fax (708) 496-2430
Chicago-Technical Center 3160 MacArthur Blvd. Northbrook, IL 60062-1917, U.S.A.
Phone (708) 291-0411 Fax (708) 291-1018
MOTOMAN INC.
808 Liberty Lane West Carrollton, OH 45449, U.S.A.
Phone (513) 847-6200 Fax (513) 847-6277
YASKAWA ELECTRIC EUROPE GmbH
Niedermöchinger Straße 73, 61476 Kronberg-Oberhöchstadt, Germany
Phone (06173) 9360 Telex 415660 YASE D Fax (06173) 98421
YASKAWA ELÉTRICO DO BRASIL COMÉRCIO LTDA.
Rúa Conde Do Pinhal B-5, Andar Sala 51 CEP 01501-São Paulo-SP, Brasil
Phone (011) 35-1911 Fax (011) 37-7375
YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
Head Office: CPF Bldg, 79 Robinson Road #13-05, Singapore 0106, SINGAPORE
Phone 221-7530 Telex (87) 24950 YASKAWA RS Fax 224-5854
Service Center: 221 Henderson Road, #07-20 Henderson Building Singapore 0315, SINGAPORE
Phone 276-7407 Fax 276-7406
YATEC ENGINEERING CORPORATION
Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan
Phone (02) 563-0010 Fax (02) 567-4677

© Printed in Japan June 1994 85-10 1RY ©
596-99