

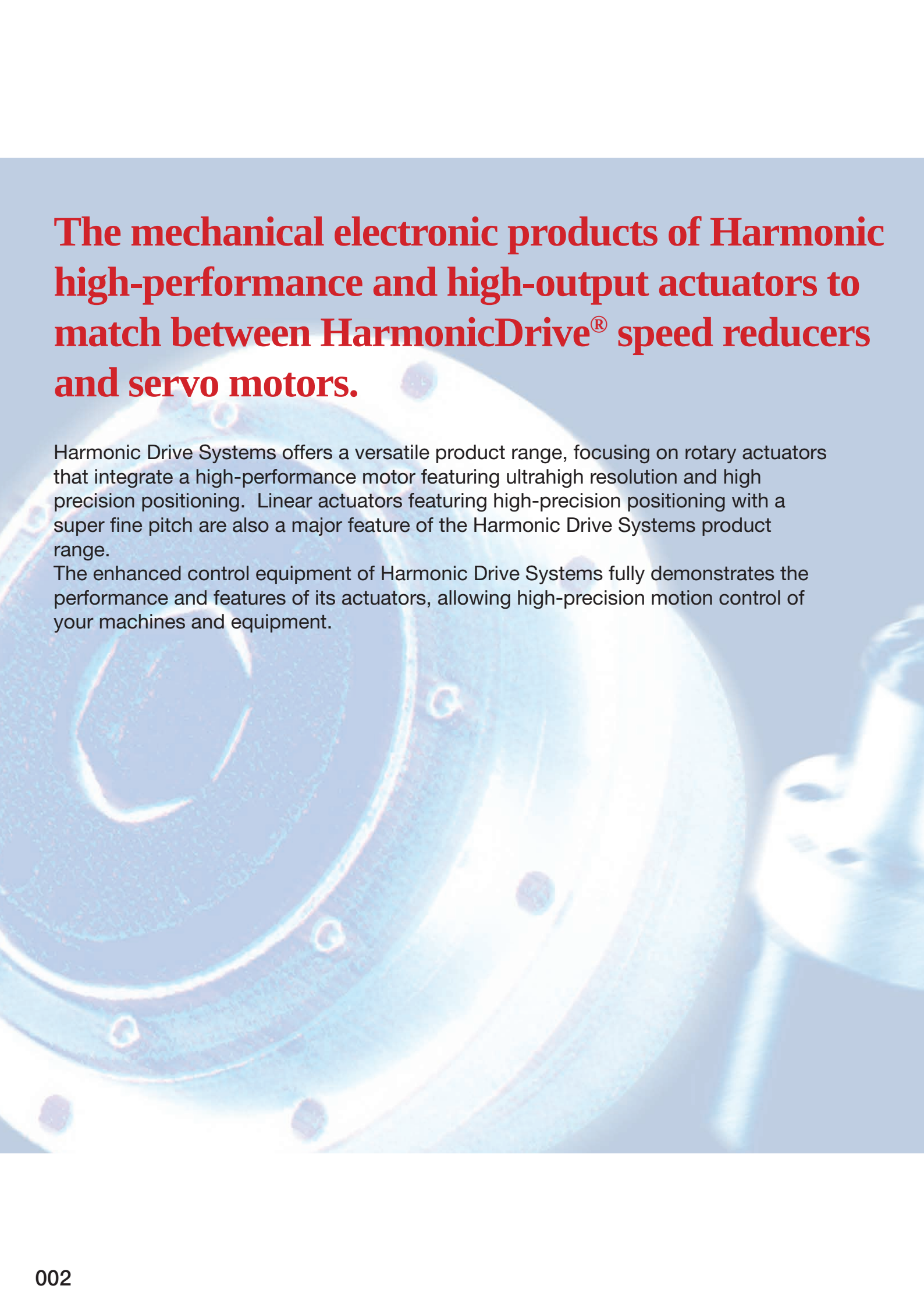
# Harmonic Drive®

FINE MECHANICS & TOTAL *Motion* CONTROL

## ***MECHATRONICS***

**General Catalog for  
Mechanical Electronic Products**





## **The mechanical electronic products of Harmonic high-performance and high-output actuators to match between HarmonicDrive® speed reducers and servo motors.**

Harmonic Drive Systems offers a versatile product range, focusing on rotary actuators that integrate a high-performance motor featuring ultrahigh resolution and high precision positioning. Linear actuators featuring high-precision positioning with a super fine pitch are also a major feature of the Harmonic Drive Systems product range.

The enhanced control equipment of Harmonic Drive Systems fully demonstrates the performance and features of its actuators, allowing high-precision motion control of your machines and equipment.

## Drive Systems are guarantee the best for precision control



### Rotary Actuators

|                                          |     |    |
|------------------------------------------|-----|----|
| SHA Series .....                         | 016 | AC |
| FHA-C mini Series .....                  | 037 | AC |
| FHA-C Series .....                       | 049 | AC |
| RKF Series .....                         | 060 | AC |
| RSF supermini Series .....               | 065 | AC |
| RSF-B mini Series .....                  | 071 | AC |
| RSF Series .....                         | 077 | AC |
| RH Series .....                          | 085 | DC |
| Tips for selecting rotary actuator ..... | 092 |    |

### Direct Drive Motors

|                  |     |     |
|------------------|-----|-----|
| KDU Series ..... | 096 | DDM |
|------------------|-----|-----|

### Optical Galvano Scanners

|                  |     |            |
|------------------|-----|------------|
| LSA Series ..... | 102 | Opti. Scan |
| PSM Series ..... | 104 | Driver     |

### Liner Actuators

|                                                                 |     |               |
|-----------------------------------------------------------------|-----|---------------|
| LA Series .....                                                 | 108 | Ultra precise |
| LAH-46 Series .....                                             | 111 | M drive force |
| LBC Series .....                                                | 114 | H drive force |
| Tips for Evaluating Performance<br>of the Linear Actuator ..... | 116 |               |

### Servo drivers compatible with the open field network

|                       |     |    |
|-----------------------|-----|----|
| HA-800B Series .....  | 120 | AC |
| HA-800C Series .....  | 129 | AC |
| HA-680ML Series ..... | 138 | AC |

### Servo Drivers

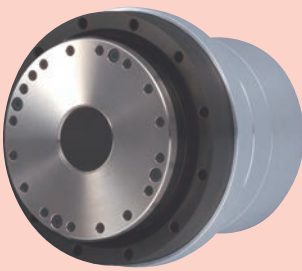
|                      |     |    |
|----------------------|-----|----|
| HA-800A Series ..... | 146 | AC |
| HA-680 Series .....  | 155 | AC |
| HA-770 Series .....  | 160 | AC |
| HS-360 Series .....  | 166 | DC |

### Sensor Systems *Harmonicsyn®*

|                                                 |     |             |
|-------------------------------------------------|-----|-------------|
| Micro Encoders Series .....                     | 172 | Incremental |
| What is HarmonicDrive®? .....                   | 014 |             |
| Structure of HarmonicDrive® .....               | 094 |             |
| Operating Principles<br>of HarmonicDrive® ..... | 106 |             |
| Actuators Embedded<br>with HarmonicDrive® ..... | 118 |             |
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| Company Profile .....                           | 179 |             |

# Rotary Actuator

High-torque actuators combining a Harmonic Drive® that features excellent angle transmission  
It provides you with a servo system featuring precise rotational and positional

|                 | Series | Features                                                                                                                                                                                                  | Product                                                                             | Model No. | Reduction ratio | Max. rotational speed (r/min) | Max. torque (N·m)      |
|-----------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------|-----------------|-------------------------------|------------------------|
| Rotary Actuator | SHA-SG | <ul style="list-style-type: none"> <li>● Hollow shaft</li> <li>● Flat shape</li> <li>● High torque</li> <li>● High resolution</li> <li>● Extensive variation</li> <li>● Compact</li> </ul>                |    | 20        | 51              | 117.6                         | 73                     |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 81              | 74.1                          | 96                     |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 101             | 59.4                          | 107                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 121             | 49.6                          | 113                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 161             | 37.3                          | 120                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 25        | 11              | 509.1                         | 26                     |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 51              | 109.8(94.1) <sup>*5</sup>     | 127                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 81              | 69.1(59.3) <sup>*5</sup>      | 178                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 101             | 55.4(47.5) <sup>*5</sup>      | 204                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 121             | 46.3(39.7) <sup>*5</sup>      | 217                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 161             | 34.8(29.8) <sup>*5</sup>      | 229                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 32        | 11              | 436.4                         | 62                     |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 51              | 94.1                          | 281                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 81              | 59.3                          | 395                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 101             | 47.5                          | 433                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 121             | 39.7                          | 459                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 161             | 29.8                          | 484                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 40        | 51              | 78.4                          | 340(523) <sup>*4</sup> |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 81              | 49.4                          | 560(675) <sup>*4</sup> |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 101             | 39.6                          | 686(738) <sup>*4</sup> |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 121             | 33.1                          | 802                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 161             | 24.8                          | 841                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 58        | 81              | 37.0                          | 1924                   |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 101             | 29.7                          | 2067                   |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 121             | 24.8                          | 2236                   |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 161             | 18.6                          | 2392                   |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 65        | 81              | 34.6                          | 2400                   |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 101             | 27.7                          | 2990                   |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 121             | 23.1                          | 3263                   |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 161             | 17.4                          | 3419                   |
|                 | SHA-CG | <ul style="list-style-type: none"> <li>● Hollow shaft</li> <li>● Flat shape</li> <li>● High torque</li> <li>● High resolution</li> <li>● Extensive variation</li> <li>● High accuracy Features</li> </ul> |  | 20        | 50              | 120                           | 73                     |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 80              | 75                            | 96                     |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 100             | 60                            | 107                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 120             | 50                            | 113                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 160             | 37.5                          | 120                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 25        | 50              | 112(96) <sup>*5</sup>         | 127                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 80              | 70(60) <sup>*5</sup>          | 178                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 100             | 56(48) <sup>*5</sup>          | 204                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 120             | 46.7(40) <sup>*5</sup>        | 217                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 160             | 35(30) <sup>*5</sup>          | 229                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 32        | 50              | 96                            | 281                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 80              | 60                            | 395                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 100             | 48                            | 433                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 120             | 40                            | 459                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 160             | 30                            | 484                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     | 40        | 50              | 80                            | 333(523) <sup>*4</sup> |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 80              | 50                            | 548(675) <sup>*4</sup> |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 100             | 40                            | 686(738) <sup>*4</sup> |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 120             | 33.3                          | 802                    |
|                 |        |                                                                                                                                                                                                           |                                                                                     |           | 160             | 25                            | 841                    |

\* 1: The mass values in parentheses for the SHA-SG type are values obtained when combined with the HPF series hollow planetary speed reducer with the reduction ratio of 1/11.

\* 2: The combined drivers in parentheses for the SHA series actuators are the models used when combined with actuators with 100 V input voltage.

\* 3 The output shaft resolution is (motor shaft encoder resolution x 4) x (reduction ratio) for the incremental encoder, and (motor shaft encoder resolution) x (reduction ratio) for the absolute encoder.

\* 4: The maximum torque values in parentheses for the SHA series actuators are values obtained when combined with HA-800□-24D/E (rated output current: 24 A).

\* 5: The max. rotational speed values in parentheses for the SHA series actuators are values obtained when combined with a driver with 100 V input voltage.



accuracy and rotational accuracy, and a servo motor with superior control characteristics.  
accuracies by combining a dedicated servo driver that maximizes actuator performance.

| Resolution <sup>*3</sup><br>(Pulse/rev) | Mass<br>(kg)                                 | Drive motor           | Combined driver                                                                                                                                                      | Input voltage                                                                                                                 | Page in catalog | Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |         |
|-----------------------------------------|----------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 6,684,672                               | 2                                            | AC servo              | HA-800A-3D/E-200<br>HA-800B-3D/E-200<br>HA-800C-3D/E-200                                                                                                             | 200 VAC                                                                                                                       | 016             | <b>Semi-conductor, flat panel display manufacturing system</b><br>● Carrier robot<br>● Index table<br>● Inching feed<br><br><b>Robot</b><br>● Indirect drive<br>● Hand drive<br>● Peripheral equipment<br><br><b>Metal-cutting machine</b><br>● ATC drive<br>● Turret Indexing<br>● Index table<br>● Loader/unloader<br>● Axes drive<br>● Work table drive<br><br><b>Measurement and inspection equipment</b><br>● Probe drive<br>● Index table<br>● X-Y-Z table<br><br><b>Medical equipment</b><br>● Table drive<br>● Sensor positioning<br>● Manipulator<br>● Index table<br><br><b>Optical equipment</b><br><b>Space and aviation related</b><br><b>Electrical circuit manufacturing equipment</b><br><b>Other FA peripheral equipment</b> |         |
| 10,616,832                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 1,441,792                               | Without brake<br>2.95<br>(5.0) <sup>*1</sup> |                       | HA-800A-3D/E-200<br>(HA-800A-6D/E-100) <sup>*2</sup><br>HA-800B-3D/E-200<br>(HA-800B-6D/E-100) <sup>*2</sup><br>HA-800C-3D/E-200<br>(HA-800C-6D/E-100) <sup>*2</sup> | 200 VAC<br>(100 VAC)                                                                                                          |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              | With brake<br>3.1<br>(5.1) <sup>*1</sup>     |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 1,441,792                               |                                              |                       | Without brake<br>5.9<br>(9.4) <sup>*1</sup>                                                                                                                          | HA-800A-6D/E-200<br>HA-800B-6D/E-200<br>HA-800C-6D/E-200                                                                      |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 200 VAC |
| 6,684,672                               |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              | With brake<br>6.2<br>(9.7) <sup>*1</sup>     |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               |                                              |                       | Without brake<br>9.9                                                                                                                                                 | HA-800A-6D/E-200<br>(HA-800A-24D/E-200)<br>HA-800B-6D/E-200<br>(HA-800B-24D/E-200)<br>HA-800C-6D/E-200<br>(HA-800C-24D/E-200) |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 200 VAC |
| 10,616,832                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | Without brake<br>9.9                         |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>37.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,238,272                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 15,859,712                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 21,102,592                              |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 6,684,672                               | With brake<br>10.7                           |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 10,616,832                              |                                              | Without brake<br>29.5 | HA-800A-24D/E-200<br>HA-800B-24D/E-200<br>HA-800C-24D/E-200                                                                                                          | 200 VAC                                                                                                                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |
| 13,23                                   |                                              |                       |                                                                                                                                                                      |                                                                                                                               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |

# Rotary Actuator

High-torque actuators combining a Harmonic Drive® that features excellent angle transmission  
It provides you with a servo system featuring precise rotational and positional

|                 | Series          | Features                                                                                                                                                             | Product                                                                             | Model No. | Reduction ratio | Max. rotational speed (r/min) | Max. torque (N·m) |
|-----------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------|-----------------|-------------------------------|-------------------|
| Rotary Actuator | FHA-C mini      | <ul style="list-style-type: none"> <li>● Hollow shaft</li> <li>● Flat shape</li> <li>● Compact size</li> <li>● High torque</li> <li>● Absolute-compatible</li> </ul> |    | 8         | 30              | 200                           | 1.8               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 120                           | 3.3               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 60                            | 4.8               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 11        | 30              | 200                           | 4.5               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 120                           | 8.3               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 60                            | 11                |
|                 |                 |                                                                                                                                                                      |                                                                                     | 14        | 30              | 200                           | 9.0               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 120                           | 18                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 60                            | 28                |
|                 | FHA-C           | <ul style="list-style-type: none"> <li>● Hollow shaft</li> <li>● Flat shape</li> <li>● High torque</li> <li>● High resolution</li> </ul>                             |    | 17        | 50              | 96                            | 39                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 48                            | 57                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 160             | 27                            | 64                |
|                 |                 |                                                                                                                                                                      |                                                                                     | 25        | 50              | 90                            | 150               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 230               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 160             | 28                            | 260               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 32        | 50              | 80                            | 281               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 40                            | 398               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 160             | 25                            | 453               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 40        | 50              | 70                            | 500               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 35                            | 690               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 160             | 22                            | 820               |
|                 | RKF             | <ul style="list-style-type: none"> <li>● Compact size</li> <li>● High torque</li> </ul>                                                                              |   | 20        | 50              | 90                            | 56                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 82                |
|                 |                 |                                                                                                                                                                      |                                                                                     | 25        | 50              | 90                            | 98                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 157               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 32        | 50              | 90                            | 220               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 330               |
|                 | RSF supermini   | <ul style="list-style-type: none"> <li>● Ultra-compact size</li> <li>● High torque</li> </ul>                                                                        |  | 3         | 30              | 333                           | 0.13              |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 200                           | 0.21              |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 100                           | 0.3               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 5         | 30              | 333                           | 0.5               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 200                           | 0.9               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 100                           | 1.4               |
|                 | RSF-B mini      | <ul style="list-style-type: none"> <li>● Compact size</li> <li>● High torque</li> </ul>                                                                              |  | 8         | 30              | 200                           | 1.8               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 120                           | 3.3               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 60                            | 4.8               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 11        | 30              | 200                           | 4.5               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 120                           | 8.3               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 60                            | 11                |
|                 |                 |                                                                                                                                                                      |                                                                                     | 14        | 30              | 200                           | 9.0               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 50              | 120                           | 18                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 60                            | 28                |
|                 | RSF             | <ul style="list-style-type: none"> <li>● Compact size</li> <li>● High torque</li> </ul>                                                                              |  | 17        | 50              | 90                            | 34                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 54                |
|                 |                 |                                                                                                                                                                      |                                                                                     | 20        | 50              | 90                            | 56                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 82                |
|                 |                 |                                                                                                                                                                      |                                                                                     | 25        | 50              | 90                            | 98                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 157               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 32        | 50              | 90                            | 220               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 45                            | 330               |
|                 | RH <sup>5</sup> | <ul style="list-style-type: none"> <li>● Compact size</li> <li>● High torque</li> </ul>                                                                              |  | 5         | 50              | 180                           | 0.39              |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 80              | 110                           | 0.59              |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 90                            | 0.69              |
|                 |                 |                                                                                                                                                                      |                                                                                     | 8         | 50              | 100                           | 2.7               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 50                            | 3.5               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 11        | 50              | 100                           | 4.9               |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 50                            | 7.8               |
|                 |                 |                                                                                                                                                                      |                                                                                     | 14        | 50              | 100                           | 14                |
|                 |                 |                                                                                                                                                                      |                                                                                     |           | 100             | 50                            | 20                |

\*1: The resolution and mass values in parentheses for the FHA-C mini series actuators are values for absolute encoder models.

\*2: FHA-C series actuators with 100 V input voltage are optionally available. Note that the combined driver may change.

\*3: The output shaft resolutions for the FHA-C mini series and FHA-C series actuators are (motor shaft encoder resolution x 4) x (reduction ratio) for the incremental encoder, and (motor shaft encoder resolution) x (reduction ratio) for the absolute encoder.

\*4: The resolution values are (motor shaft encoder resolution when multiplied by 4) x (reduction ratio).

\*5: When an RH series actuator is used in combination with an HS-360 series servo driver, a line driver type actuator is used.

\*6: Actuators with 24 VDC input voltage are compatible with servo drivers HA-680 series and RF2H21A0AHD manufactured by SANYO DENKI CO., LTD.

accuracy and rotational accuracy, and a servo motor with superior control characteristics.  
accuracies by combining a dedicated servo driver that maximizes actuator performance.

| Resolution <sup>*1</sup> <sup>*3</sup> <sup>*4</sup><br>(Pulse/rev) |  | Mass <sup>*1</sup><br>(kg)                    | Drive motor    | Combined driver                                                                                                                             | Input voltage <sup>*6</sup>        | Page in catalog                | Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                |                |         |     |               |                |         |     |
|---------------------------------------------------------------------|--|-----------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------|---------|-----|---------------|----------------|---------|-----|
| 240,000<br>(3,932,160)                                              |  | 0.40<br>(0.50)                                | AC servo       | HA-800*-1C-100<br>HA-800*-1C-200<br>HA-800*-1D-100<br>HA-800*-1D-200<br>HA-680-4-24<br>HA-680ML-4-24<br>RF2H21A0AHD by SANYO DENKI CO., LTD | 100 VAC<br>200 VAC<br>24 VDC       | 037                            | <b>Semi-conductor, flat panel display manufacturing system</b><br>● Carrier robot<br>● Index table<br>● Inching feed<br><br><b>Robot</b><br>● Indirect drive<br>● Hand drive<br>● Peripheral equipment<br><br><b>Metal-cutting machine</b><br>● ATC drive<br>● Turret Indexing<br>● Index table<br>● Loader/unloader<br>● Axes drive<br>● Work table drive<br><br><b>Measurement and inspection equipment</b><br>● Probe drive<br>● Index table<br>● X-Y-Z table<br><br><b>Medical equipment</b><br>● Table drive<br>● Sensor positioning<br>● Manipulator<br>● Index table<br><br><b>Optical equipment</b><br><b>Space and aviation related</b><br><b>Electrical circuit manufacturing equipment</b><br><b>Other FA peripheral equipment</b> |                                |                |         |     |               |                |         |     |
| 400,000<br>(6,553,600)                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 800,000<br>(13,107,200)                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 240,000<br>(3,932,160)                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000<br>(6,553,600)                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 800,000<br>(13,107,200)                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 240,000<br>(3,932,160)                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000<br>(6,553,600)                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 800,000<br>(13,107,200)                                             |  | 0.62<br>(0.75)                                | AC servo       | HA-800*-1C-100 / HA-800*-1C-200<br>HA-800*-1D-100 / HA-800*-1D-200<br>HA-680-6-24 / HA-680ML-6-24<br>RF2H21A0AHD by SANYO DENKI CO., LTD    | 200 VAC<br>(100 VAC) <sup>*2</sup> | 049                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 240,000<br>(3,932,160)                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000<br>(6,553,600)                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 800,000<br>(13,107,200)                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 500,000                                                             |  | 2.5                                           | AC servo       | HA-800*-3C-100<br>HA-800*-3C-200<br>HA-800*-6C-100                                                                                          | 200 VAC<br>(100 VAC) <sup>*2</sup> | 049                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,000,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,600,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 500,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,000,000                                                           |  | 4.0                                           |                | AC servo                                                                                                                                    | HA-800*-6C-100<br>HA-800*-6C-200   | 200 VAC                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 060                            |                |         |     |               |                |         |     |
| 1,600,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 500,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,000,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,600,000                                                           |  | 6.5                                           | AC servo       | HA-800*-6C-100<br>HA-800*-6C-200                                                                                                            | 200 VAC                            | 065                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 500,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,000,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,600,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 500,000                                                             |  | 12                                            | AC servo       | HA-800*-6C-100<br>HA-800*-6C-200                                                                                                            | 200 VAC                            | 065                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,000,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 1,600,000                                                           |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 2.9                                           |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | AC servo                       | HA-800*-3B-200 | 200 VAC | 060 |               |                |         |     |
| 800,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 5.0                                           | HA-800*-3B-200 | 200 VAC                                                                                                                                     | 060                                |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 800,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 9.5                                           | HA-800*-6B-200 |                                                                                                                                             |                                    | 200 VAC                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                | 060            |         |     |               |                |         |     |
| 800,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 24,000                                                              |  | 0.031                                         | AC servo       |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | HA-680-4B-24<br>HA-680ML-4B-24 |                | 24 VDC  | 065 |               |                |         |     |
| 40,000                                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 80,000                                                              |  | Without brake<br>0.066<br>With brake<br>0.086 |                | AC servo                                                                                                                                    | HA-680-4B-24<br>HA-680ML-4B-24     |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     | 24 VDC        | 071            |         |     |
| 60,000                                                              |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 100,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 120,000                                                             |  | 0.3                                           | AC servo       |                                                                                                                                             |                                    | HA-680-4B-24<br>HA-680ML-4B-24 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 24 VDC                         | 071            |         |     |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 0.5                                           |                | AC servo                                                                                                                                    | HA-680-6B-24<br>HA-680ML-6B-24     |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                | 24 VDC  | 071 |               |                |         |     |
| 120,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 120,000                                                             |  | 0.8                                           | AC servo       |                                                                                                                                             |                                    | HA-680-6B-24<br>HA-680ML-6B-24 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 24 VDC                         | 071            |         |     |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 2.1                                           |                | AC servo                                                                                                                                    | HA-800*-3B-200                     |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                | 200 VAC | 077 |               |                |         |     |
| 120,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 200,000                                                             |  | 2.9                                           |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     | AC servo      | HA-800*-3B-200 | 200 VAC | 077 |
| 400,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 800,000                                                             |  | 4.7                                           | AC servo       |                                                                                                                                             |                                    | HA-800*-3B-200                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 200 VAC                        | 077            |         |     |               |                |         |     |
| 800,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 8.7                                           |                | AC servo                                                                                                                                    | HA-800*-6B-200                     |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                | 200 VAC | 077 |               |                |         |     |
| 800,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 100,000                                                             |  | 0.09                                          |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     | DC servo      | HS-360-1A-100  | 100 VAC | 085 |
| 160,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 200,000                                                             |  | 0.3                                           | DC servo       |                                                                                                                                             |                                    | HS-360-1B-100                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 100 VAC                        | 085            |         |     |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 0.5                                           |                | DC servo                                                                                                                                    | HS-360-1C-100                      |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                | 100 VAC | 085 |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  | 0.77                                          |                |                                                                                                                                             |                                    |                                | DC servo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                |                |         |     | HS-360-1D-100 | 100 VAC        | 085     |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 400,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |
| 200,000                                                             |  |                                               |                |                                                                                                                                             |                                    |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |                |         |     |               |                |         |     |

The rotation direction of our rotary actuators are defined as follows: the clockwise rotation viewed from the output shaft is CW and the rotation in the opposite direction is CCW.

## Direct Drive Motor

A super high resolution of 11,840,000 pulses per revolution planar runout through the high torque and high machining

|                     | Series | Feature                                                                                                                                                                                                              | Product                                                                           | Model No. | Resolution (Pulses/Revolution) | Max. Rotational Speed (r/min) |
|---------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------|--------------------------------|-------------------------------|
| Direct Drive Motors | KDU    | <ul style="list-style-type: none"> <li>● Super high resolution</li> <li>● High accuracy</li> <li>● Stopping stability</li> <li>● High torque</li> <li>● Large hollow dia.</li> <li>● Mechanical precision</li> </ul> |  | KDU-13SB  | 11,840,000                     | 127                           |
|                     |        |                                                                                                                                                                                                                      |                                                                                   | KDU-13WB  |                                | 127                           |

## Optical Galvano Scanners

The optical scanners of the galvano mirror type featuring highly magnet motor. Combining a dedicated driver, operations controllable smoothly performed.

|                          | Series | Feature                                                                                                                                                                          | Product                                                                           | Model No. | Maximum Angular Runout (Mechanical Angle) |
|--------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------|-------------------------------------------|
| Optical Galvano Scanners | LSA    | <ul style="list-style-type: none"> <li>● High-speed response</li> <li>● Temperature stability</li> <li>● Resistant to external ambience</li> <li>● Resistant to noise</li> </ul> |  | 10        | ±15                                       |

## Linear Actuators

The linear actuators compactly combining a precision screw and HarmonicDrive®. measuring instruments, optical equipment, semiconductor and liquid crystal panel positioning up to a level of 10kN level.

|                  | Series | Feature                                                                                                 | Product                                                                             | Mounting Flange Size (mm) | Resolution (μm) | Stroke (mm) | Max. Driving Force (N) |
|------------------|--------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------|-----------------|-------------|------------------------|
| Linear Actuators | LA     | <ul style="list-style-type: none"> <li>● High resolution</li> <li>● High positional accuracy</li> </ul> |  | □28                       | 0.0174          | 10          | 49                     |
|                  |        |                                                                                                         |                                                                                     | □36                       | 0.0174          | 30          | 49                     |
|                  | LAH-46 | <ul style="list-style-type: none"> <li>● High resolution</li> <li>● High positional accuracy</li> </ul> |  | □47                       | 0.069           | 10          | 390                    |
|                  |        |                                                                                                         |                                                                                     |                           | 0.069           | 30          | 390                    |
|                  | LBC    | <ul style="list-style-type: none"> <li>● High driving force</li> </ul>                                  |  | φ136                      | 0.32            | 50          | 6,000                  |
|                  |        |                                                                                                         |                                                                                     |                           | 0.16            |             | 12,000                 |

\* 1: In the event the LA/LAH series and servo driver HS-360 are combined, the actuator specification will change to that of the line driver.

\* 2: In case the drive motor is a stepping motor, the motor will be sold in combination with a driver.

enables high precision positioning accuracy. HarmonicDrive®s unique motor structure minimizes accuracy of each part. Two types are available in accordance with output torque.

| Maximum Torque<br>(N·m) | Repeatability<br>arc sec | Mass<br>(kg) | Combined Driver | Power Supply<br>Voltage | Page in<br>Catalog | Application                                                                                                                                                                                              |
|-------------------------|--------------------------|--------------|-----------------|-------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.0                     | ±0.5                     | 4.0          | HA-770-2        | AC100V<br>AC200V        | 096                | Semiconductor and FPD manu-<br>facturing equipment and systems<br>● Index tables ● Micro feeding<br>Measuring and inspection<br>equipment and systems<br>● Probe drives ● Index tables<br>● X-Y-Z tables |
| 15.0                    |                          | 5.0          |                 |                         |                    |                                                                                                                                                                                                          |

accurate and rapid light scanning of lights employing a newly developed optical sensor and unique movable according to customer command signals such as continuous scanning and random accessing functions are

| Rotor Moment of Inertia<br>(g·cm <sup>2</sup> ) | Mass<br>(kg) | Power Supply<br>Voltage | Combined Driver | Page in<br>Catalog | Application                                                                                                        |
|-------------------------------------------------|--------------|-------------------------|-----------------|--------------------|--------------------------------------------------------------------------------------------------------------------|
| 1.9                                             | 0.18         | DC24V                   | PSM-130         | 102                | ● Laser markers<br>● Laser meters<br>● Laser machines<br>● Laser medical equipment<br>● Optical inspection systems |

A versatile range available for ultra precision positioning within inspection equipment, manufacturing equipment and other equipment and systems and for high driving force

| Repeatability<br>(μm/Stroke mm) | Mass<br>(kg) | Drive Motor | Combined Driver | Power<br>Supply Vol. | Page in<br>Catalog | Application                                                                                                                    |
|---------------------------------|--------------|-------------|-----------------|----------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------|
| ±0.1<br>or less/mm              | 0.32         | DC servo    | HS-360-1A-100   | AC100V               | 108                | ● Semiconductor wafer<br>positioning<br>● Optical focusing systems<br>● High precision stages                                  |
|                                 | 0.55         |             |                 |                      |                    |                                                                                                                                |
| ±0.5<br>or less/1mm             | 0.81         | DC servo    | HS-360-1A-100   | AC100V               | 111                | ● Alignment of liquid crystal<br>panel<br>● Inspection equipment and<br>measuring instruments<br>● Image measuring instruments |
|                                 | 0.85         |             |                 |                      |                    |                                                                                                                                |
| ±5<br>or less/1mm               | 12.5         | AC servo    | HA-800A-3B      | AC200V               | 114                | ● Machine tools<br>● Press-fitting, drawing and<br>caulking work                                                               |



## Servo Driver Compatible with the Open Field Network

|                  | Series                                                                                        | Product                                                                           | Power Supply Voltage | Control Mode                                        | Combined Encoder                        |
|------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------|-----------------------------------------------------|-----------------------------------------|
| AC servo Drivers | HA-800B<br>  |  | AC100V<br>AC200V     | Position control<br>Speed control<br>Torque control | Incremental encoder<br>Absolute encoder |
|                  | HA-800C<br>  |  | AC100V<br>AC200V     | Position control<br>Speed control<br>Torque control | Incremental encoder<br>Absolute encoder |
|                  | HA-680ML<br> |  | DC24V                | Position control                                    | Incremental encoder                     |

## Servo Drivers

|                  | Series  | Product                                                                             | Power Supply Voltage | Control Mode                                        | Combined Encoder                        |
|------------------|---------|-------------------------------------------------------------------------------------|----------------------|-----------------------------------------------------|-----------------------------------------|
| AC servo Drivers | HA-800A |  | AC100V<br>AC200V     | Position control<br>Speed control<br>Torque control | Incremental encoder<br>Absolute encoder |
|                  | HA-680  |  | DC24V                | Position control<br>Speed control<br>Torque control | Incremental encoder                     |
|                  | HA-770  |  | AC100V<br>AC200V     | Position control only                               | Incremental encoder                     |
| DC servo Driver  | HS-360  |  | AC100V               | Position control only                               | Incremental encoder                     |

| Parameter Operation                                                                                                                                           | Communication Function | Combined Actuator/Direct Drive Motor                                        | Page in Catalog |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------|-----------------|
| <ul style="list-style-type: none"> <li>• Operation key of the driver panel</li> <li>• Special communication software on PC</li> <li>• MECHATROLINK</li> </ul> | Available              | SHA series<br>FHA-C mini series<br>FHA-C series<br>RSF series<br>RKF series | 120             |
| <ul style="list-style-type: none"> <li>• Operation key of the driver panel</li> <li>• Special communication software on PC</li> <li>• CC-Link</li> </ul>      | Available              | SHA series<br>FHA-C mini series<br>FHA-C series<br>RSF series<br>RKF series | 129             |
| <ul style="list-style-type: none"> <li>• Special communication software on PC</li> <li>• MECHATROLINK</li> </ul>                                              | Available              | FHA-C mini series<br>RSF supermini series<br>RSF-B mini series              | 138             |

| Parameter Operation                                                                                                                   | Communication Function | Combined Actuator/Direct Drive Motor                                           | Page in Catalog |
|---------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------------------------------------------------------------------|-----------------|
| <ul style="list-style-type: none"> <li>• Operation key of the driver panel</li> <li>• Special communication software on PC</li> </ul> | Available              | SHA series<br>FHA-C mini series<br>FHA-C series<br>RSF series<br>RKF series    | 146             |
| <ul style="list-style-type: none"> <li>• Special communication software on PC</li> </ul>                                              | Available              | FHA-C mini series<br>RSF supermini series<br>RSF-B mini series                 | 155             |
| <ul style="list-style-type: none"> <li>• Operation key of the driver panel</li> <li>• Special communication software on PC</li> </ul> | Available              | KDU series                                                                     | 160             |
| <ul style="list-style-type: none"> <li>• Operation key of the driver panel</li> <li>• Special communication software on PC</li> </ul> | Available              | RH series<br>LA series<br>LAH series (Line driver specification)<br>RHS series | 166             |

Harmonicsyn®

## Sensor Systems

The micro encoder series features ultra small incremental encoders with outside diameters of  $\phi 7.5$  and  $\phi 13$ mm.

|                | Series        | Feature                                                                                                    | Product                                                                           | Outside Diameter (mm) | Detection System | Resolution                                               |
|----------------|---------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------|------------------|----------------------------------------------------------|
| Sensor Systems | Micro Encoder | <ul style="list-style-type: none"> <li>● High resolution</li> <li>● High reliability, long life</li> </ul> |  | $\phi 7.5$            | Incremental      | 100, 200<br>300, 360<br>(Pulses/revolution)              |
|                |               |                                                                                                            |                                                                                   | $\phi 13$             | Incremental      | 100, 200<br>300, 360<br>500, 1000<br>(Pulses/revolution) |

## Overseas Standard Compliance



|          | Product Name   | Safety Standard |                           | Marking                                                                               |                                                                                       |
|----------|----------------|-----------------|---------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Actuator | SHA            | UL standard     | UL1004-1 (File No.243316) |  |                                                                                       |
|          |                | CSA standard    | C22.2 No.100              |                                                                                       |                                                                                       |
|          |                | EN standard     | EN60034-1:2010, EN60034-5 |  |  |
|          | RSF super mini | EN standard     | EN60034-1:2010, EN60034-5 |  |  |
|          | FHA-C          | UL standard     | UL1004-1 (File No.243316) |  |                                                                                       |
|          |                | CSA standard    | C22.2 No.100              |                                                                                       |                                                                                       |
|          |                | EN standard     | EN60034-1:2010            |  |                                                                                       |
|          | FHA-C mini     | EN standard     | EN60034-1:2010            |  |                                                                                       |

\* The above chart is a list of standard products of Harmonic Drive Systems.

\* Some of the RSF-mini series in special specifications conform to the UL standard and TÜV certification.

\* 1: Because they are small products, no marking is put on them.

| Output Signal Mode                   | Permissible Max. Speed<br>(r/min) | Mass<br>(g) | Application                                                                                                                                                                                                                          | Page in Catalog |
|--------------------------------------|-----------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Square wave<br>Open collector output | 6000                              | 5           | <ul style="list-style-type: none"> <li>● Humanoid robots</li> <li>● Semiconductor manufacturing systems</li> <li>● Measurement, analysis and test systems</li> <li>● Optical equipment</li> <li>● Communication equipment</li> </ul> | 172             |
| Square wave<br>Open collector output | 6000                              | 10          |                                                                                                                                                                                                                                      |                 |

|        | Product Name | Safety Standard |                         | Marking                                                                               |                                                                                       |
|--------|--------------|-----------------|-------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Driver | HA-800A/B/C  | UL standard     | UL508C (File No.229163) |  |                                                                                       |
|        |              | CSA standard    | C22.2 No.14             |                                                                                       |                                                                                       |
|        |              | EN standard     | EN61800-5-1,EN61800-3   |  |  |
|        | HA-655       | UL standard     | UL508C (File No.229163) |  |                                                                                       |
|        |              | CSA standard    | C22.2 No.14             |                                                                                       |                                                                                       |
|        |              | EN standard     | EN50178,EN61800-3       |  |  |
|        | HA-680*2     | EN standard     | EN50178,EN61800-3       |  |                                                                                       |

\* The above chart is a list of standard products of Harmonic Drive Systems.

There are two types of TÜV mark.

\*2 Note that -ML/-CL of HA-680 series are not applicable.

## What is the HarmonicDrive®?

The HarmonicDrive® is operated based on a unique operating principle applying the elasticity dynamics of metals and is composed of only three basic parts, namely: a wave generator, and flex and circular splines respectively. The HarmonicDrive® features excellent properties, unmatched by competing speed reducers.

### Feature

- **High rotational and positional accuracies**  
Many working teeth mesh simultaneously and the working teeth contact in two areas that symmetrically 180° opposite. This means any impacts occurring as a result of teeth or cumulative pitch errors relating to rotational accuracy are leveled, assuring high rotational and positional accuracy.
- **Compact and light weight**  
The cubic volume and weight of a HarmonicDrive® are less than 1/3 and 1/2 compared to other speed reducers, yet guarantee equivalent torque capacity and reduction ratio.
- **High reduction ratio**  
Features a high reduction ratio of 1/30 to 1/320 in a single-stage coaxial axle.
- **High torque capacity**  
Unlike other speed reducers, about 30% of all teeth mesh simultaneously. These teeth make planar contact and yield high torque capacity.
- **Non-backlash**  
The unique operating principle eliminates backlash during the meshing process. This feature is a must in control mechanism.
- **High efficiency**  
The degree of skidding occurring in the meshing areas of the teeth is extremely slight, resulting in only small motive power losses caused by friction. This helps to maintain high efficiency, even though the reduction ratio is high and also allows a smaller drive motor to be connected.
- **Quiet operation**  
The low peripheral speed of the tooth meshing and a good balance between forces assures quiet operation and minimal vibration.

● ● ● Continued on page 094 "Structure of HarmonicDrive®"



# Rotary Actuator

## AC Servo Actuators

|                            |     |
|----------------------------|-----|
| SHA Series .....           | 016 |
| FHA-C mini Series .....    | 037 |
| FHA-C Series .....         | 049 |
| RKF Series .....           | 060 |
| RSF supermini Series ..... | 065 |
| RSF-B mini Series .....    | 071 |
| RSF Series .....           | 077 |

## DC Servo Actuators

|                 |     |
|-----------------|-----|
| RH Series ..... | 085 |
|-----------------|-----|

## Tips for selecting rotary actuator

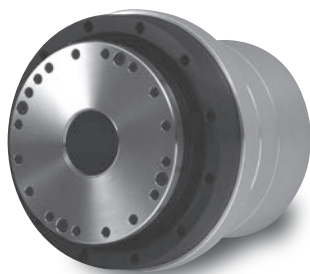




# SHA series

AC Servo Actuators that combine a ultra-thin HarmonicDrive® and a specially designed ultra-flat AC servo motor. This series features a flat, hollow bore structure. A through-hole is provided at the center of the actuator, through which wirings, pipes, and even laser beams can be passed. This feature can simplify the overall structure of machinery and equipment. Two types of actuators are available for the SHA series: The SHA-SG type that features a compact shape and the SHA-CG type with an improved output shaft surface runout accuracy.

## SHA-SG



In addition to its unmatched compact shape, the SHA-SG actuators feature a hollow bore structure, which simplifies the design of machinery and equipment.

## SHA-CG



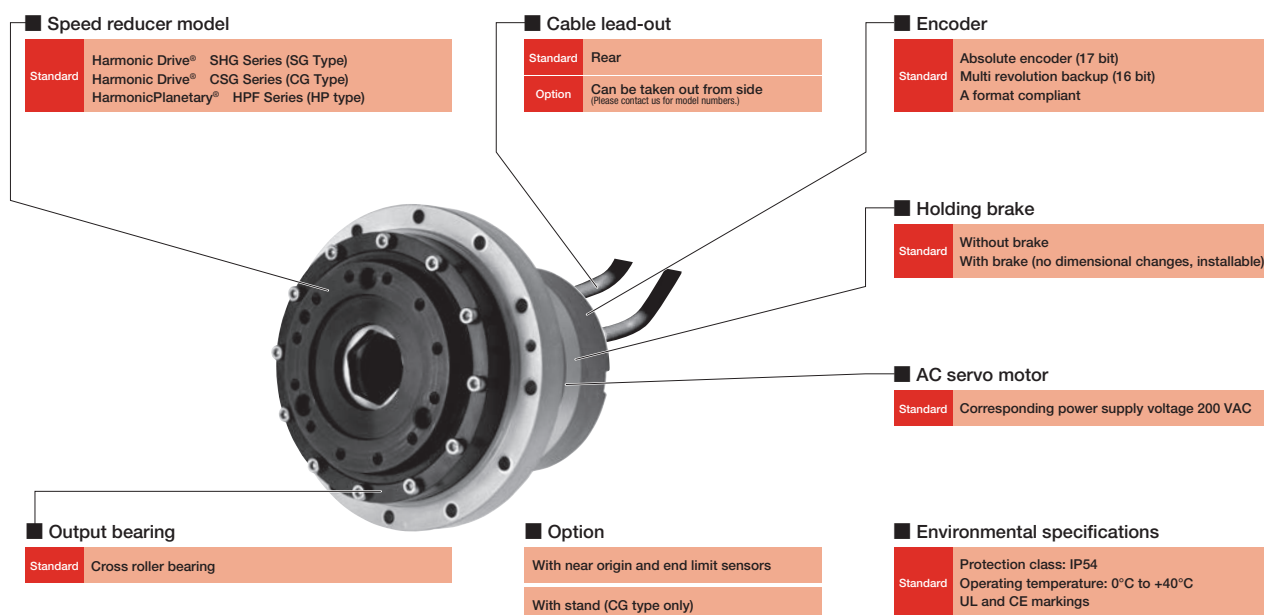
With SHA-CG actuators, the output shaft surface runout accuracy has been greatly improved by changing the model of the HarmonicDrive® to combine.

These actuators provide a high degree of accuracy needed by a table swivel drive section or alignment adjusting mechanism, which requires mechanical accuracy.

## Features

- Compared to direct drive motors, the SHA series actuators have almost the same accuracy and resolution but are significantly smaller and lighter. (Torque/volume ratio is five times that of the direct drive motor \*According to HDS materials)
- The torque values for the SHA series actuators range from 26 N·m to 3419 N·m.
- Hollow structure (max. hollow diameter:  $\phi 65$  mm), flat structure (max. outer diameter:  $\phi 284$  mm, total length: 222 mm) \*Both for SHA65SG.
- The hollow structure achieves a simplified equipment design utilizing a through-hole at the center. (piping, wiring, etc.)
- The flat shape achieves a compact equipment design.
- Uni-directional positional accuracy: Excellent accuracy with a reduction ratio 1/50 = 40 sec. (0.011 degrees) and a reduction ratio 1/80 or more = 30 sec. (0.008 degrees) (SHA32/40CG types)
- By using a dedicated driver, you can control your actuator on a MECHATROLINK-II or CC-Link network.

## Configuration

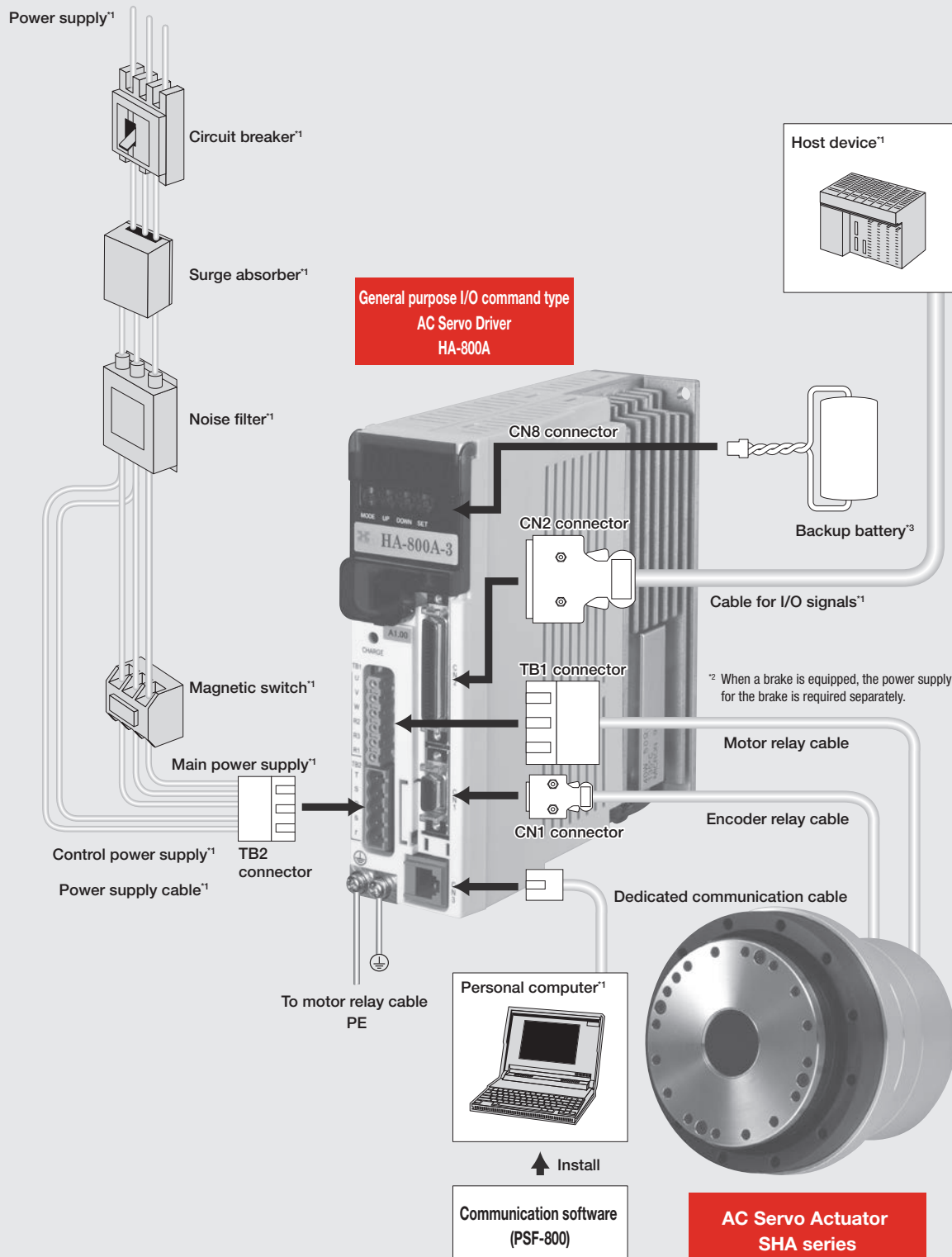


\* A backup battery is not included with the HA-800 servo driver. (Backup battery model: HAB-ER17/33-2)

## Example of system configuration

A basic configuration of SHA actuators, HA-800 drivers, and relay cables is shown below:

### System configuration of General purpose I/O command type



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## Models and symbols

## AC Servo Actuator

|     |     |     |     |     |   |     |     |     |     |   |      |      |      |   |      |      |   |      |
|-----|-----|-----|-----|-----|---|-----|-----|-----|-----|---|------|------|------|---|------|------|---|------|
| SHA | 32  | A   | 101 | SG  | - | B   | 12  | A   | 200 | - | 10   | S17b | A    | - | C    | □    | - | SP   |
| (1) | (2) | (3) | (4) | (5) |   | (6) | (7) | (8) | (9) |   | (10) | (11) | (12) |   | (13) | (14) |   | (15) |

(1) Model: AC Servo Actuator  
SHA series

(2) Model No.

|    |                      |
|----|----------------------|
| SG | 20,25,32,40,45,58,65 |
| HP | 25,32                |
| CG | 20,25,32,40          |

(3) Version symbol

(4) Reduction ratio (indicated by R in 1/R format)

| SG  |                   | CG  |       |
|-----|-------------------|-----|-------|
| 51  | 1/51              | 50  | 1/50  |
| 81  | 1/81              | 80  | 1/80  |
| 101 | 1/101             | 100 | 1/100 |
| 121 | 1/121             | 120 | 1/120 |
| 161 | 1/161             | 160 | 1/160 |
| HP  |                   |     |       |
| 11  | 1/11 <sup>1</sup> |     |       |

(5) Speed reducer type

|    |            |
|----|------------|
| SG | SHG Series |
| CG | CSG Series |
| HP | HPF Series |

(6) Motor version symbol

|   |                      |
|---|----------------------|
| A | Model Nos 58, 65     |
| B | Model Nos 25, 32, 40 |
| C | Model No. 20         |
| D | Model No. 45         |

<sup>1</sup>: When an actuator with the reduction ratio of 1/11 is selected, it will be combined with an HPF series hollow planetary speed reducer. Model numbers for these actuators are 25 and 32 and the compatible power supply voltage is 200 VAC only.  
<sup>2</sup>: When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## Specifications (SG/HP types)

| Model                                   |                    |                      | SHA20A                                                                                                                                                                                                                                                                               |          |          |          |          | SHA25A                 |                      |             |             |             | SHA32A      |                      |                     |          |          |          |          |  |
|-----------------------------------------|--------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|------------------------|----------------------|-------------|-------------|-------------|-------------|----------------------|---------------------|----------|----------|----------|----------|--|
|                                         |                    |                      | 51                                                                                                                                                                                                                                                                                   | 81       | 101      | 121      | 161      | 11                     | 51                   | 81          | 101         | 121         | 161         | 11                   | 51                  | 81       | 101      | 121      | 161      |  |
| Max. torque <sup>2</sup>                | N·m                |                      | 73                                                                                                                                                                                                                                                                                   | 96       | 107      | 113      | 120      | 26                     | 127                  | 178         | 204         | 217         | 229         | 62                   | 281                 | 395      | 433      | 459      | 484      |  |
|                                         | kgf·m              |                      | 7.4                                                                                                                                                                                                                                                                                  | 9.8      | 10.9     | 11.5     | 12.2     | 2.7                    | 13                   | 18.2        | 20.8        | 22.1        | 23.4        | 6.3                  | 28.7                | 40.3     | 44.2     | 46.8     | 49.4     |  |
| Max. rotational speed                   | r/min              |                      | 117.6                                                                                                                                                                                                                                                                                | 74.1     | 59.4     | 49.6     | 37.3     | 509.1                  | 109.8 (94.1)         | 69.1 (59.3) | 55.4 (47.5) | 46.3 (39.7) | 34.8 (29.8) | 436.4                | 94.1                | 59.3     | 47.5     | 39.7     | 29.8     |  |
| Torque constant                         | N·m/A              |                      | 16.5                                                                                                                                                                                                                                                                                 | 27       | 33       | 40       | 53       | 4.2                    | 19 (11.1)            | 31 (17.9)   | 39 (22)     | 46 (27)     | 62 (36)     | 4.5                  | 21                  | 33       | 42       | 50       | 66       |  |
|                                         | kgf·m/A            |                      | 1.7                                                                                                                                                                                                                                                                                  | 2.7      | 3.4      | 4.1      | 5.4      | 0.43                   | 2.0 (1.1)            | 3.2 (1.8)   | 4.0 (2.3)   | 4.7 (2.7)   | 6.3 (3.6)   | 0.46                 | 2.1                 | 3.4      | 4.2      | 5.1      | 6.8      |  |
| Max. current <sup>2</sup>               | A                  |                      | 6.0                                                                                                                                                                                                                                                                                  | 4.9      | 4.5      | 4.0      | 3.4      | 8.9                    | 8.6 (14.9)           | 7.5 (13.0)  | 7.0 (12.1)  | 6.3 (10.9)  | 5.2 (9.0)   | 19                   | 17.3                | 15.2     | 13.5     | 12.2     | 9.9      |  |
| Inertia moment (without brake)          | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.23                                                                                                                                                                                                                                                                                 | 0.58     | 0.91     | 1.3      | 2.3      | 0.029                  | 0.56                 | 1.42        | 2.2         | 3.2         | 5.6         | 0.092                | 2.0                 | 5.1      | 8.0      | 11       | 20       |  |
|                                         | J                  | kgf·cms <sup>2</sup> | 2.4                                                                                                                                                                                                                                                                                  | 6.0      | 9.3      | 13       | 24       | 0.296                  | 5.7                  | 14.4        | 22          | 32          | 57          | 0.939                | 21                  | 52       | 81       | 117      | 207      |  |
| Inertia moment (with brake)             | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.26                                                                                                                                                                                                                                                                                 | 0.65     | 1.0      | 1.4      | 2.6      | 0.034                  | 0.66                 | 1.66        | 2.6         | 3.7         | 6.6         | 0.107                | 2.3                 | 5.9      | 9.2      | 13       | 23       |  |
|                                         | J                  | kgf·cms <sup>2</sup> | 2.6                                                                                                                                                                                                                                                                                  | 6.6      | 10       | 15       | 26       | 0.347                  | 6.7                  | 17          | 26          | 38          | 67          | 1.087                | 24                  | 60       | 94       | 135      | 238      |  |
| Permissible moment load                 | N·m                |                      | 187                                                                                                                                                                                                                                                                                  |          |          |          |          | 410                    | 258                  |             |             |             |             | 932                  | 580                 |          |          |          |          |  |
|                                         | kgf·m              |                      | 19.1                                                                                                                                                                                                                                                                                 |          |          |          |          | 41.8                   | 26.3                 |             |             |             |             | 95                   | 59.1                |          |          |          |          |  |
| Moment stiffness                        | N·m/rad            |                      | 25.2×10 <sup>4</sup>                                                                                                                                                                                                                                                                 |          |          |          |          | 37.9×10 <sup>4</sup>   | 39.2×10 <sup>4</sup> |             |             |             |             | 86.1×10 <sup>4</sup> | 100×10 <sup>4</sup> |          |          |          |          |  |
|                                         | kgf·m/arc-min      |                      | 7.5                                                                                                                                                                                                                                                                                  |          |          |          |          | 11.3                   | 11.6                 |             |             |             |             | 25.7                 | 29.6                |          |          |          |          |  |
| Encoder type                            |                    |                      | 17-bit absolute encoder <sup>6</sup>                                                                                                                                                                                                                                                 |          |          |          |          |                        |                      |             |             |             |             |                      |                     |          |          |          |          |  |
| Encoder resolution per motor revolution |                    |                      | 2 <sup>17</sup> (131072)                                                                                                                                                                                                                                                             |          |          |          |          |                        |                      |             |             |             |             |                      |                     |          |          |          |          |  |
| Motor multi revolution detection        |                    |                      | 2 <sup>16</sup> (65536)                                                                                                                                                                                                                                                              |          |          |          |          |                        |                      |             |             |             |             |                      |                     |          |          |          |          |  |
| Resolution of output shaft              | Pulse/rev          |                      | 6684672                                                                                                                                                                                                                                                                              | 10616832 | 13238272 | 15859712 | 21102592 | 1441792                | 6684672              | 10616832    | 13238272    | 15859712    | 21102592    | 1441792              | 6684672             | 10616832 | 13238272 | 15859712 | 21102592 |  |
| Input power supply                      | V                  |                      | 200 VAC                                                                                                                                                                                                                                                                              |          |          |          |          | 200 VAC                | 100 VAC or 200 VAC   |             |             |             |             | 200 VAC              |                     |          |          |          |          |  |
| Mass (without brake)                    | kg                 |                      | 2.0                                                                                                                                                                                                                                                                                  |          |          |          |          | 5                      | 2.95                 |             |             |             |             | 9.4                  | 5.9                 |          |          |          |          |  |
| Mass (with brake)                       | kg                 |                      | 2.1                                                                                                                                                                                                                                                                                  |          |          |          |          | 5.1                    | 3.1                  |             |             |             |             | 9.7                  | 6.2                 |          |          |          |          |  |
| Protection structure                    |                    |                      | Totally enclosed self-cooled type<br>(Protection class IP54: For details on protection classes, see the manual.)                                                                                                                                                                     |          |          |          |          |                        |                      |             |             |             |             |                      |                     |          |          |          |          |  |
| Environmental conditions                |                    |                      | Operating temperature: 0 to 40°C/Storage temperature: -20 to 60°C, Operating humidity/Storage humidity: 20 to 80%RH (no condensation), no dust, metal powder, corrosive gas, inflammable gas, or oil mist, to be used indoors, no direct sunlight, less than 1,000 m above sea level |          |          |          |          |                        |                      |             |             |             |             |                      |                     |          |          |          |          |  |
| Mounting direction                      |                    |                      | Can be installed in any direction.                                                                                                                                                                                                                                                   |          |          |          |          |                        |                      |             |             |             |             |                      |                     |          |          |          |          |  |
| Safety standard compliance              |                    |                      | CE marking, UL certification, TUV certification                                                                                                                                                                                                                                      |          |          |          |          |                        |                      |             |             |             |             |                      |                     |          |          |          |          |  |
| Combined servo driver                   |                    |                      | HA-800□-3                                                                                                                                                                                                                                                                            |          |          |          |          | HA-800□-3<br>HA-800□-6 |                      |             |             |             | HA-800□-6   |                      |                     |          |          |          |          |  |

\* 1: The table above shows the typical values for the output shaft.

\* 2: The values are obtained when combined with an HA-800 driver.

\* 3: The values in parentheses for the SHA25 actuators are values obtained when the input power supply is 100 VAC.

\* 4: The values in parentheses for the SHA40 actuators are values obtained when combined with HA-800□-24 (rated output current: 24 A)

\* 5: See the manual for details on rotation directions of actuators.

\* 6: When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## (7) Motor size

|    |                  |
|----|------------------|
| 08 | Model No. 20     |
| 09 | Model No. 25     |
| 12 | Model No. 32     |
| 15 | Model No. 40     |
| 16 | Model No. 45     |
| 21 | Model Nos 58, 65 |

## (8) Brake

|   |               |
|---|---------------|
| A | Without brake |
| B | With brake    |

## (9) Motor input voltage

|     |         |
|-----|---------|
| 200 | 200 VAC |
| 100 | 100 VAC |

(100 V is compatible with model No. 25 only.)

## (10) Encoder format

|    |                                                             |
|----|-------------------------------------------------------------|
| 10 | A format, transmission rate:<br>2.5 Mbps, 1-on-1 connection |
|----|-------------------------------------------------------------|

## (11) Encoder type, resolution

|      |                                                                  |
|------|------------------------------------------------------------------|
| S17b | 17-bit absolute encoder<br>131072 pulses/revolution <sup>2</sup> |
|------|------------------------------------------------------------------|

## (12) Encoder phase angle:

Phase difference between voltage induced in motor phase U and absolute home

|   |    |
|---|----|
| A | 0° |
|---|----|

## (13) Connector specifications

|   |                                                        |
|---|--------------------------------------------------------|
| C | With standard connector                                |
| N | Without connector                                      |
| D | With special connector (special specification product) |

## (14) Option symbol

|   |                                                              |
|---|--------------------------------------------------------------|
| L | Near origin and end limit sensors                            |
| Y | Cable taken out from side                                    |
| V | With stand (CG type only)                                    |
| S | Output shaft single revolution absolute model (CG type only) |

## (15) Special specifications

|                |                               |
|----------------|-------------------------------|
| No description | Standard product              |
| SP             | Special specification product |

|  | SHA40A                                                                                                                                                                                                                                                                                  |                |              |          |          | SHA45A                |          |          |          |          | SHA58A              |          |          |          | SHA65A              |          |          |          |  |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------|----------|----------|-----------------------|----------|----------|----------|----------|---------------------|----------|----------|----------|---------------------|----------|----------|----------|--|
|  | 51                                                                                                                                                                                                                                                                                      | 81             | 101          | 121      | 161      | 51                    | 81       | 101      | 121      | 161      | 81                  | 101      | 121      | 161      | 81                  | 101      | 121      | 161      |  |
|  | 340<br>(523)                                                                                                                                                                                                                                                                            | 560<br>(675)   | 686<br>(738) | 802      | 841      | 650                   | 918      | 982      | 1070     | 1147     | 1924                | 2067     | 2236     | 2392     | 2400                | 2990     | 3263     | 3419     |  |
|  | 34.7<br>(53.4)                                                                                                                                                                                                                                                                          | 57.1<br>(68.9) | 70 (75.3)    | 81.8     | 85.8     | 66.3                  | 93.6     | 100      | 109      | 117      | 196                 | 211      | 228      | 244      | 245                 | 305      | 333      | 349      |  |
|  | 78.4                                                                                                                                                                                                                                                                                    | 49.4           | 39.6         | 33.1     | 24.8     | 74.5                  | 46.9     | 37.6     | 31.4     | 23.6     | 37.0                | 29.7     | 24.8     | 18.6     | 34.6                | 27.7     | 23.1     | 17.4     |  |
|  | 25                                                                                                                                                                                                                                                                                      | 41             | 51           | 61       | 81       | 25                    | 41       | 51       | 61       | 81       | 54                  | 68       | 81       | 108      | 54                  | 68       | 81       | 108      |  |
|  | 2.6                                                                                                                                                                                                                                                                                     | 4.1            | 5.2          | 6.2      | 8.2      | 2.6                   | 4.1      | 5.2      | 6.2      | 8.2      | 5.5                 | 6.9      | 8.3      | 11.0     | 5.5                 | 6.9      | 8.3      | 11.0     |  |
|  | 18 (26.7)                                                                                                                                                                                                                                                                               | 18 (21.8)      | 18 (19.4)    | 17.9     | 14.6     | 36.5                  | 29.9     | 25.9     | 24.5     | 19.3     | 45                  | 39       | 36       | 30       | 55                  | 55       | 51       | 41       |  |
|  | 5.0                                                                                                                                                                                                                                                                                     | 13             | 20           | 28       | 50       | 6.8                   | 17       | 27       | 38       | 68       | 96                  | 149      | 214      | 379      | 110                 | 171      | 245      | 433      |  |
|  | 51                                                                                                                                                                                                                                                                                      | 130            | 202          | 290      | 513      | 69                    | 175      | 272      | 390      | 690      | 980                 | 1520     | 2180     | 3870     | 1120                | 1740     | 2500     | 4420     |  |
|  | 6.1                                                                                                                                                                                                                                                                                     | 15             | 24           | 34       | 61       | 7.9                   | 20       | 31       | 45       | 79       | 106                 | 165      | 237      | 420      | 120                 | 187      | 268      | 475      |  |
|  | 62                                                                                                                                                                                                                                                                                      | 157            | 244          | 350      | 619      | 81                    | 204      | 316      | 454      | 804      | 1090                | 1690     | 2420     | 4290     | 1230                | 1910     | 2740     | 4850     |  |
|  | 849                                                                                                                                                                                                                                                                                     |                |              |          |          | 1127                  |          |          |          |          | 2180                |          |          |          | 2740                |          |          |          |  |
|  | 86.6                                                                                                                                                                                                                                                                                    |                |              |          |          | 115                   |          |          |          |          | 222                 |          |          |          | 280                 |          |          |          |  |
|  | 179×10 <sup>4</sup>                                                                                                                                                                                                                                                                     |                |              |          |          | 257 × 10 <sup>4</sup> |          |          |          |          | 531×10 <sup>4</sup> |          |          |          | 741×10 <sup>4</sup> |          |          |          |  |
|  | 53.2                                                                                                                                                                                                                                                                                    |                |              |          |          | 76.3                  |          |          |          |          | 158                 |          |          |          | 220                 |          |          |          |  |
|  | 17-bit absolute encoder <sup>6</sup>                                                                                                                                                                                                                                                    |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | 2 <sup>17</sup> (131072)                                                                                                                                                                                                                                                                |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | 2 <sup>16</sup> (65536)                                                                                                                                                                                                                                                                 |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | 6684672                                                                                                                                                                                                                                                                                 | 10616832       | 13238272     | 15859712 | 21102592 | 6684672               | 10616832 | 13238272 | 15859712 | 21102592 | 10616832            | 13238272 | 15859712 | 21102592 | 10616832            | 13238272 | 15859712 | 21102592 |  |
|  | 200 VAC                                                                                                                                                                                                                                                                                 |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | 9.9                                                                                                                                                                                                                                                                                     |                |              |          |          | 12.4                  |          |          |          |          | 29.5                |          |          |          | 37.5                |          |          |          |  |
|  | 10.7                                                                                                                                                                                                                                                                                    |                |              |          |          | 13.2                  |          |          |          |          | 32                  |          |          |          | 40                  |          |          |          |  |
|  | Totally enclosed self-cooled type<br>(Protection class IP54: For details on protection classes, see the manual.)                                                                                                                                                                        |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | Operating temperature: 0 to 40°C/Storage temperature: -20 to 60°C, Operating humidity/Storage humidity: 20 to 80%RH (no condensation),<br>no dust, metal powder, corrosive gas, inflammable gas, or oil mist, to be used indoors, no direct sunlight, less than 1,000 m above sea level |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | Can be installed in any direction.                                                                                                                                                                                                                                                      |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | CE marking, UL certification, TUV certification                                                                                                                                                                                                                                         |                |              |          |          |                       |          |          |          |          |                     |          |          |          |                     |          |          |          |  |
|  | HA-800□-6<br>HA-800□-24                                                                                                                                                                                                                                                                 |                |              |          |          | HA-800□-24D/E-200     |          |          |          |          | HA-800□-24          |          |          |          | HA-800□-24          |          |          |          |  |

## Specifications (CG type)

| Model                                   |                    |                      | SHA20A                                                                                                                                                                                                                                                                                        |          |          |          |          | SHA25A                                 |            |            |            |           |  |
|-----------------------------------------|--------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------------------------------------|------------|------------|------------|-----------|--|
|                                         |                    |                      | 50                                                                                                                                                                                                                                                                                            | 80       | 100      | 120      | 160      | 50                                     | 80         | 100        | 120        | 160       |  |
| Item                                    |                    |                      |                                                                                                                                                                                                                                                                                               |          |          |          |          |                                        |            |            |            |           |  |
| Max. torque <sup>2</sup>                | N·m                |                      | 73                                                                                                                                                                                                                                                                                            | 96       | 107      | 113      | 120      | 127                                    | 178        | 204        | 217        | 229       |  |
|                                         | kgf·m              |                      | 7.4                                                                                                                                                                                                                                                                                           | 9.8      | 10.9     | 11.5     | 12.2     | 13                                     | 18.2       | 20.8       | 22.1       | 23.4      |  |
| Max. rotational speed                   | r/min              |                      | 120                                                                                                                                                                                                                                                                                           | 75       | 60       | 50       | 37.5     | 112 (96)                               | 70 (60)    | 56 (48)    | 46.7 (40)  | 35 (30)   |  |
| Torque constant                         | N·m/A              |                      | 16                                                                                                                                                                                                                                                                                            | 26       | 33       | 39       | 53       | 19 (10.9)                              | 31 (17.7)  | 38 (22)    | 46 (27)    | 61 (35)   |  |
|                                         | kgf·m/A            |                      | 1.7                                                                                                                                                                                                                                                                                           | 2.7      | 3.4      | 4        | 5.4      | 1.9 (1.1)                              | 3.1 (1.8)  | 3.9 (2.3)  | 4.7 (2.7)  | 6.3 (3.6) |  |
| Max. current <sup>2</sup>               | A                  |                      | 6.1                                                                                                                                                                                                                                                                                           | 5        | 4.6      | 4.1      | 3.4      | 8.7 (15.1)                             | 7.6 (13.2) | 7.0 (12.2) | 6.3 (11.0) | 5.2 (9.0) |  |
| Inertia moment (without brake)          | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.21                                                                                                                                                                                                                                                                                          | 0.53     | 0.82     | 1.2      | 2.1      | 0.50                                   | 1.3        | 2          | 2.9        | 5.1       |  |
|                                         | J                  | kgf·cms <sup>2</sup> | 2.1                                                                                                                                                                                                                                                                                           | 5.4      | 8        | 12       | 22       | 5.1                                    | 13         | 20         | 29         | 52        |  |
| Inertia moment (with brake)             | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.23                                                                                                                                                                                                                                                                                          | 0.6      | 0.94     | 1.3      | 2.4      | 0.60                                   | 1.5        | 2.4        | 3.4        | 6.1       |  |
|                                         | J                  | kgf·cms <sup>2</sup> | 2.4                                                                                                                                                                                                                                                                                           | 6.1      | 9.6      | 14       | 24       | 6.1                                    | 16         | 24         | 35         | 62        |  |
| Permissible moment load                 | N·m                |                      | 187                                                                                                                                                                                                                                                                                           |          |          |          |          | 258                                    |            |            |            |           |  |
|                                         | kgf·m              |                      | 19.1                                                                                                                                                                                                                                                                                          |          |          |          |          | 26.3                                   |            |            |            |           |  |
| Moment stiffness                        | N·m/rad            |                      | 25.2×10 <sup>4</sup>                                                                                                                                                                                                                                                                          |          |          |          |          | 39.2×10 <sup>4</sup>                   |            |            |            |           |  |
|                                         | kgf·m/arc·min      |                      | 7.5                                                                                                                                                                                                                                                                                           |          |          |          |          | 11.6                                   |            |            |            |           |  |
| Encoder type                            |                    |                      | 17-bit absolute encoder <sup>6</sup>                                                                                                                                                                                                                                                          |          |          |          |          |                                        |            |            |            |           |  |
| Encoder resolution per motor revolution |                    |                      | 2 <sup>17</sup> (131072)                                                                                                                                                                                                                                                                      |          |          |          |          |                                        |            |            |            |           |  |
| Motor multi revolution detection        |                    |                      | 2 <sup>16</sup> (65536)                                                                                                                                                                                                                                                                       |          |          |          |          |                                        |            |            |            |           |  |
| Resolution of output shaft              | Pulse/rev          |                      | 6553600                                                                                                                                                                                                                                                                                       | 10485760 | 13107200 | 15728640 | 20971520 | 6553600                                | 10485760   | 13107200   | 15728640   | 20971520  |  |
| Input power supply                      | V                  |                      | 200 VAC                                                                                                                                                                                                                                                                                       |          |          |          |          | 100 VAC or 200 VAC                     |            |            |            |           |  |
| Mass (without brake)                    | kg                 |                      | 2.6                                                                                                                                                                                                                                                                                           |          |          |          |          | 3.95                                   |            |            |            |           |  |
| Mass (with brake)                       | kg                 |                      | 2.7                                                                                                                                                                                                                                                                                           |          |          |          |          | 4.1                                    |            |            |            |           |  |
| Protection structure                    |                    |                      | Totally enclosed self-cooled type<br>(Protection class IP54: For details on protection classes, see the manual.)                                                                                                                                                                              |          |          |          |          |                                        |            |            |            |           |  |
| Environmental conditions                |                    |                      | Operating temperature: 0 to 40°C/Storage temperature: -20 to 60°C,<br>Operating humidity/Storage humidity: 20 to 80%RH (no condensation),<br>no dust, metal powder, corrosive gas, inflammable gas, or oil mist, to be used indoors,<br>no direct sunlight, less than 1,000 m above sea level |          |          |          |          |                                        |            |            |            |           |  |
| Mounting direction                      |                    |                      | Can be installed in any direction.                                                                                                                                                                                                                                                            |          |          |          |          |                                        |            |            |            |           |  |
| Safety standard compliance              |                    |                      | CE marking, UL certification, TUV certification                                                                                                                                                                                                                                               |          |          |          |          |                                        |            |            |            |           |  |
| Combined servo driver                   |                    |                      | HA-800□-3D/E-200                                                                                                                                                                                                                                                                              |          |          |          |          | HA-800□-3D/E-200<br>(HA-800□-6D/E-100) |            |            |            |           |  |

\* 1: The table above shows the typical values for the output shaft.

\* 2: The values are obtained when combined with an HA-800 driver.

\* 3: The values in parentheses for the SHA25 actuators are values obtained when the input power supply is 100 VAC.

\* 4: The values in parentheses for the SHA40 are values obtained when combined with HA-800□-24D/E-200 (rated output current: 24 A)

\* 5: See the manual for details on rotation directions of actuators.

\* 6: When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

|  | SHA32A                                                                                                                                                                                                                                                                                     |          |          |          |          | SHA40A                                |             |           |           |             |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|---------------------------------------|-------------|-----------|-----------|-------------|
|  | 50                                                                                                                                                                                                                                                                                         | 80       | 100      | 120      | 160      | 50                                    | 80          | 100       | 120       | 160         |
|  | 281                                                                                                                                                                                                                                                                                        | 395      | 433      | 459      | 484      | 333 (523)                             | 548 (675)   | 686 (738) | 802       | 841         |
|  | 28.7                                                                                                                                                                                                                                                                                       | 40.3     | 44.2     | 46.8     | 49.4     | 34 (53.4)                             | 55.9 (68.9) | 70 (75.3) | 81.8      | 85.8        |
|  | 96                                                                                                                                                                                                                                                                                         | 60       | 48       | 40       | 30       | 80                                    | 50          | 40        | 33.3      | 25          |
|  | 20                                                                                                                                                                                                                                                                                         | 33       | 41       | 49       | 66       | 25                                    | 40          | 50        | 60        | 80          |
|  | 2.1                                                                                                                                                                                                                                                                                        | 3.4      | 4.2      | 5        | 6.7      | 2.5                                   | 4.1         | 5.1       | 6.1       | 8.2         |
|  | 17.7                                                                                                                                                                                                                                                                                       | 15.4     | 13.7     | 12.2     | 10       | 18 (27.2)                             | 18 (22)     | 18 (19.6) | 17.6 (18) | 14.3 (14.7) |
|  | 1.7                                                                                                                                                                                                                                                                                        | 4.3      | 6.7      | 9.7      | 17       | 4.8                                   | 12          | 19        | 27        | 49          |
|  | 17                                                                                                                                                                                                                                                                                         | 44       | 68       | 99       | 175      | 49                                    | 124         | 194       | 280       | 497         |
|  | 2                                                                                                                                                                                                                                                                                          | 5.1      | 7.9      | 11       | 20       | 5.8                                   | 15          | 23        | 33        | 59          |
|  | 20                                                                                                                                                                                                                                                                                         | 52       | 81       | 116      | 207      | 59                                    | 150         | 235       | 338       | 601         |
|  | 580                                                                                                                                                                                                                                                                                        |          |          |          |          | 849                                   |             |           |           |             |
|  | 59.2                                                                                                                                                                                                                                                                                       |          |          |          |          | 86.6                                  |             |           |           |             |
|  | 100×10 <sup>4</sup>                                                                                                                                                                                                                                                                        |          |          |          |          | 179×10 <sup>4</sup>                   |             |           |           |             |
|  | 29.6                                                                                                                                                                                                                                                                                       |          |          |          |          | 53.2                                  |             |           |           |             |
|  | 17-bit absolute encoder <sup>®</sup>                                                                                                                                                                                                                                                       |          |          |          |          |                                       |             |           |           |             |
|  | 2 <sup>17</sup> (131072)                                                                                                                                                                                                                                                                   |          |          |          |          |                                       |             |           |           |             |
|  | 2 <sup>16</sup> (65536)                                                                                                                                                                                                                                                                    |          |          |          |          |                                       |             |           |           |             |
|  | 6553600                                                                                                                                                                                                                                                                                    | 10485760 | 13107200 | 15728640 | 20971520 | 6553600                               | 10485760    | 13107200  | 15728640  | 20971520    |
|  | 200 VAC                                                                                                                                                                                                                                                                                    |          |          |          |          |                                       |             |           |           |             |
|  | 7.7                                                                                                                                                                                                                                                                                        |          |          |          |          | 13.0                                  |             |           |           |             |
|  | 8.0                                                                                                                                                                                                                                                                                        |          |          |          |          | 13.8                                  |             |           |           |             |
|  | Totally enclosed self-cooled type<br>(Protection class IP54: For details on protection classes, see the manual.)                                                                                                                                                                           |          |          |          |          |                                       |             |           |           |             |
|  | Operating temperature: 0 to 40°C/Storage temperature: -20 to 60°C, Operating humidity/Storage humidity: 20 to 80%RH (no condensation),<br>no dust, metal powder, corrosive gas, inflammable gas, or oil mist, to be used indoors,<br>no direct sunlight, less than 1,000 m above sea level |          |          |          |          |                                       |             |           |           |             |
|  | Can be installed in any direction.                                                                                                                                                                                                                                                         |          |          |          |          |                                       |             |           |           |             |
|  | CE marking, UL certification, TUV certification                                                                                                                                                                                                                                            |          |          |          |          |                                       |             |           |           |             |
|  | HA-800□-6D/E-200                                                                                                                                                                                                                                                                           |          |          |          |          | HA-800□-6D/E-200<br>HA-800□-24D/E-200 |             |           |           |             |

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

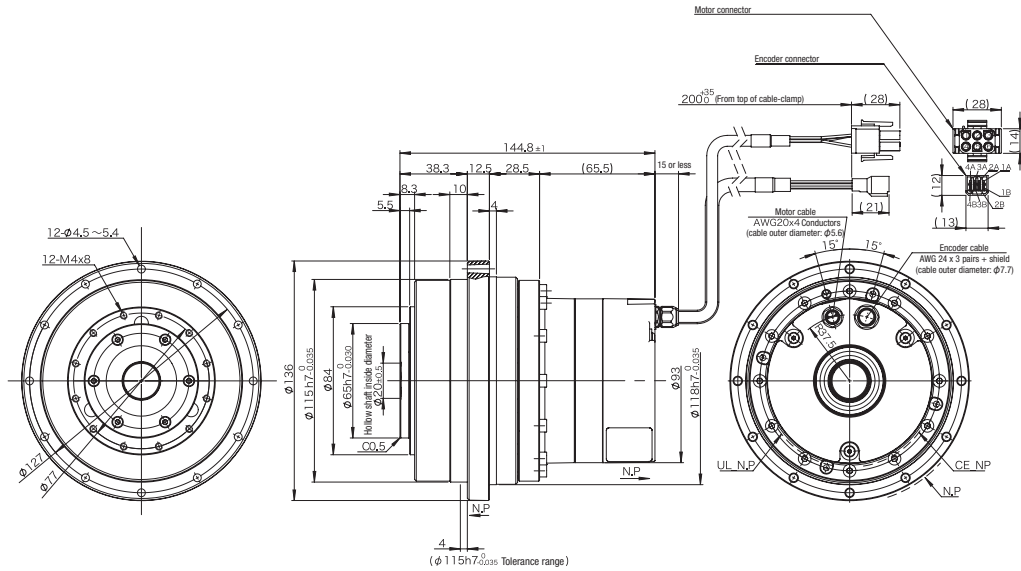




## SHA25A

(Speed Reducer Model: HP type)

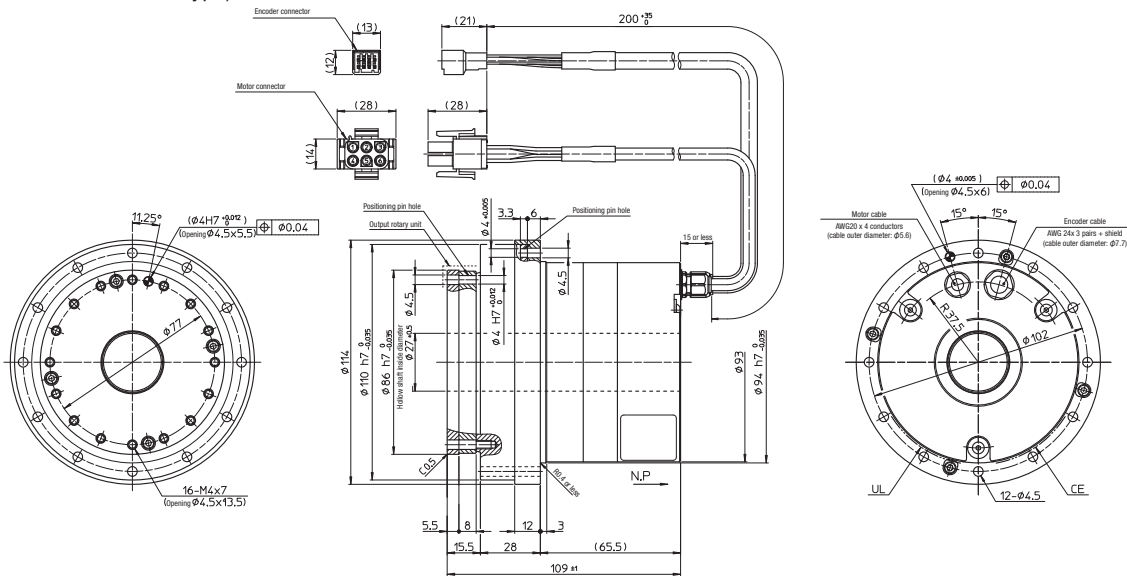
Unit: mm



## SHA25A

(Speed Reducer Model: SG type)

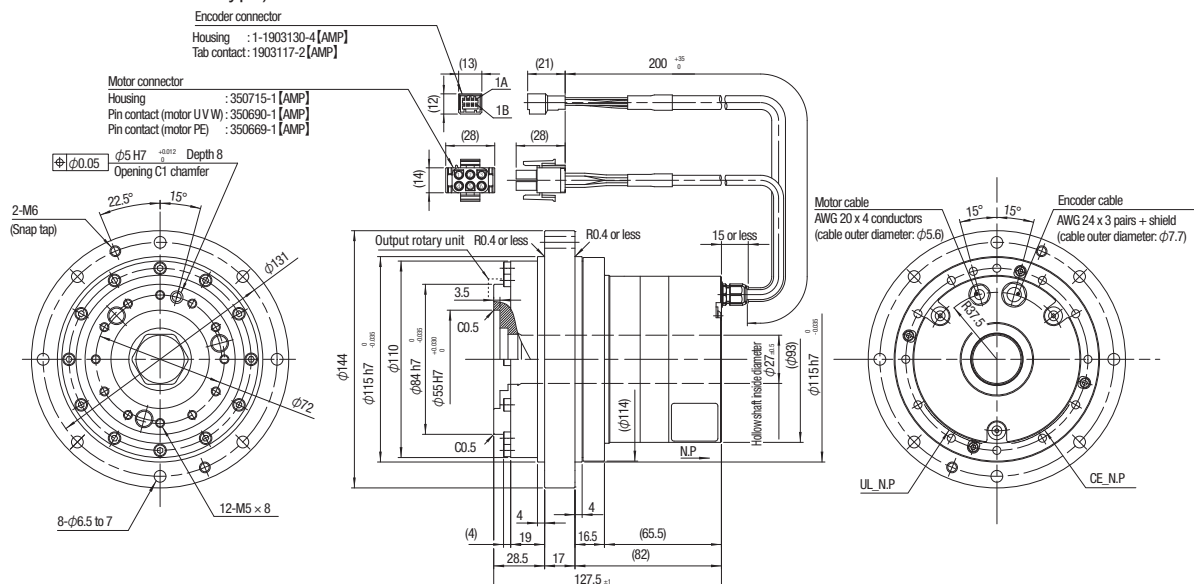
Unit: mm



## SHA25A

(Speed Reducer Model: CG type)

Unit: mm



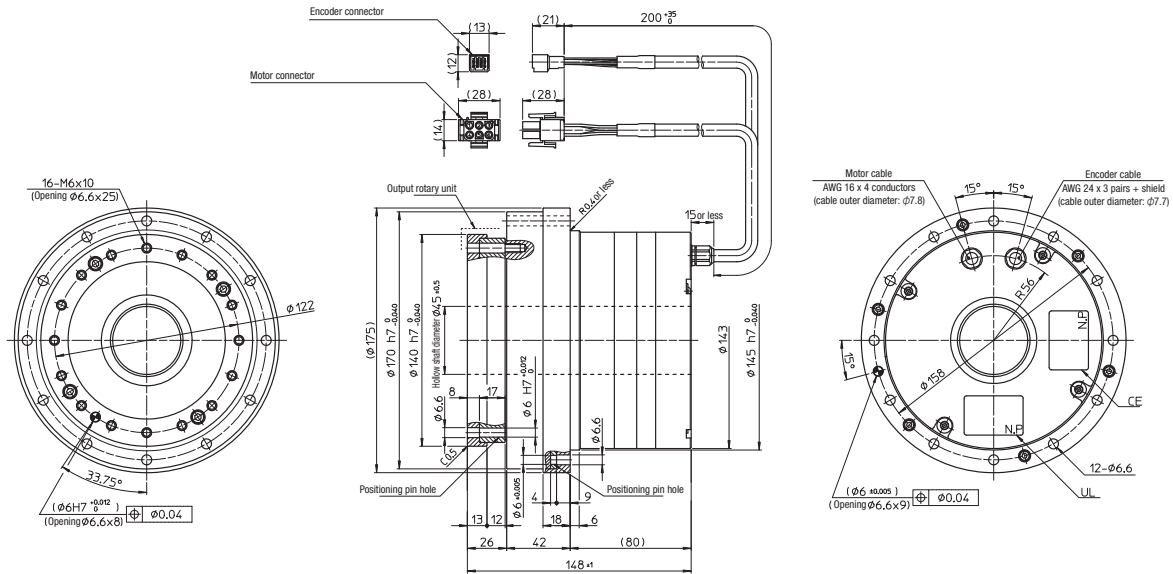
Note: For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.  
Tolerances may vary due to product manufacturing method (foundry piece, machine-finished good).  
Please contact us for the tolerance when it is not indicated in the dimensions.



## SHA40A

(Speed Reducer Model: SG type)

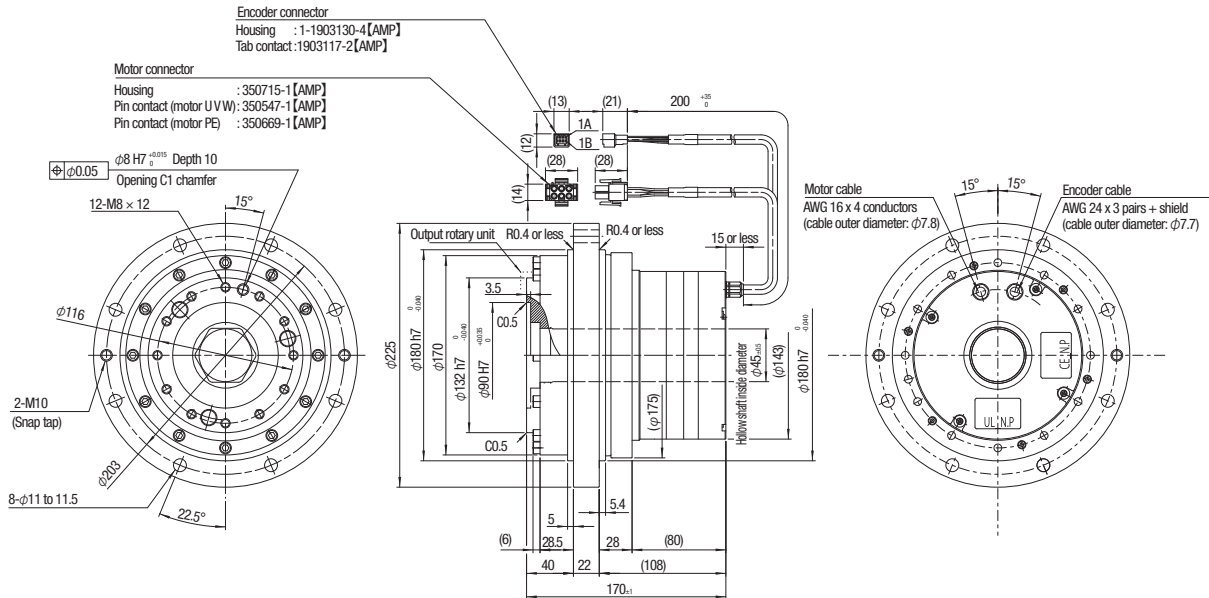
Unit: mm



## SHA40A

(Speed Reducer Model: CG type)

Unit: mm



Note: For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.  
Tolerances may vary due to product manufacturing method (foundry piece, machine-finished good).  
Please contact us for the tolerance when it is not indicated in the dimensions.

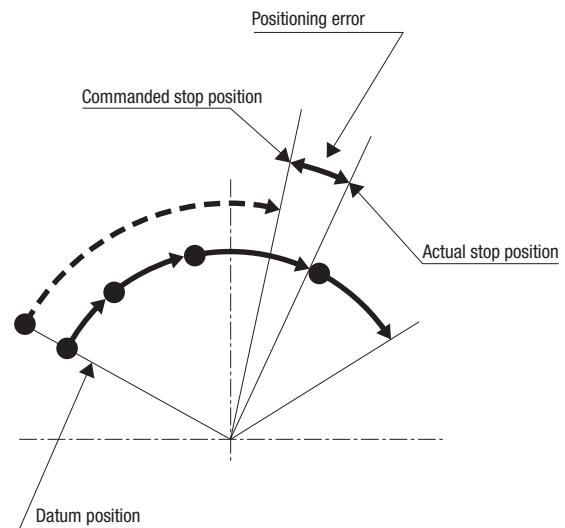


## Uni-directional positional accuracy

The uni-directional positional accuracy means the maximum positional difference between the actual rotated angle from the datum position and its theoretical rotational angle in one revolution when a series of positionings are performed in the same rotation direction. (JIS B-6201-1987) SHA series actuators house speed reducer HarmonicDrive® or HPF series hollow planetary speed reducer for precision control, so the positioning error of the motor shaft is compressed by the reduction ratio.

The uni-directional positional accuracy for each model is shown in the table below:

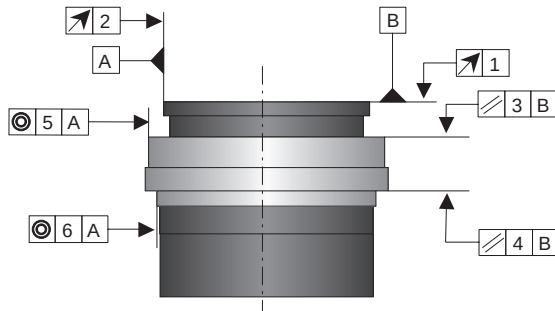
|                    |                 | Model | SHA20A | SHA25A | SHA32A | SHA40A | SHA58A | SHA65A |
|--------------------|-----------------|-------|--------|--------|--------|--------|--------|--------|
| Speed reducer type | reduction ratio |       |        |        |        |        |        |        |
| HP type            | 1:11            | —     | 120    | 120    | —      | —      | —      | —      |
| SG type            | 1:51            | 60    | 50     | 50     | 50     | —      | —      | —      |
|                    | 1:81 or more    | 50    | 40     | 40     | 40     | 40     | 40     | 40     |
| CG type            | 1:50            | 60    | 50     | 40     | 40     | —      | —      | —      |
|                    | 1:80 or more    | 50    | 40     | 30     | 30     | —      | —      | —      |



## Mechanical accuracy

The mechanical accuracies of the output shaft and mounting flange are shown below for SHA series actuators:

### SHA-SG/HP type



| Item                                                        | SHA20A | SHA25A        | SHA32A        | SHA40A | SHA58A | SHA65A |
|-------------------------------------------------------------|--------|---------------|---------------|--------|--------|--------|
| 1. Output shaft surface runout                              | 0.030  | 0.035         | 0.040         | 0.045  | 0.050  | 0.050  |
| 2. Deflection of output shaft                               | 0.030  | 0.035 (0.020) | 0.040 (0.020) | 0.045  | 0.050  | 0.050  |
| 3. Parallelism between the output shaft and mounted surface | 0.030  | 0.035         | 0.040         | 0.045  | 0.050  | 0.050  |
| 4. Parallelism between the output shaft and mounted surface | 0.055  | 0.050         | 0.055         | 0.060  | 0.070  | 0.070  |
| 5. Concentricity between the output shaft and fitting part  | 0.030  | 0.035         | 0.040         | 0.045  | 0.050  | 0.050  |
| 6. Concentricity between the output shaft and fitting part  | 0.045  | 0.060         | 0.065         | 0.070  | 0.080  | 0.080  |

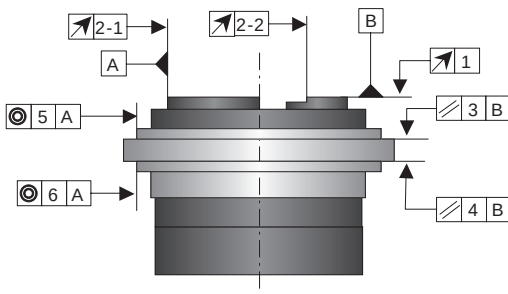
(Unit: mm)

Note: See the manual for the measurement method.

Note: All values are T.I.R. (Total Indicator Reading).

Note: The values in parentheses are values obtained when the speed reducer type is combined with the HP type (hollow planetary speed reducer).

### SHA-CG type



| Item                                                        | SHA20A | SHA25A | SHA32A | SHA40A |
|-------------------------------------------------------------|--------|--------|--------|--------|
| 1. Output shaft surface runout                              | 0.010  | 0.010  | 0.010  | 0.010  |
| 2-1. Deflection of output shaft (outside fitting)           | 0.010  | 0.010  | 0.010  | 0.010  |
| 2-2. Deflection of output shaft (inside fitting)            | 0.015  | 0.015  | 0.015  | 0.015  |
| 3. Parallelism between the output shaft and mounted surface | 0.030  | 0.030  | 0.035  | 0.035  |
| 4. Parallelism between the output shaft and mounted surface | 0.040  | 0.040  | 0.045  | 0.045  |
| 5. Concentricity between the output shaft and fitting part  | 0.050  | 0.050  | 0.055  | 0.060  |
| 6. Concentricity between the output shaft and fitting part  | 0.060  | 0.060  | 0.065  | 0.070  |

(Unit: mm)

Note: See the manual for the measurement method.

Note: All values are T.I.R. (Total Indicator Reading).

## Operable range

The diagram below shows how to read the operable ranges of the SHA series actuators (combined with HA-800 servo drivers).

### 50% duty motion range

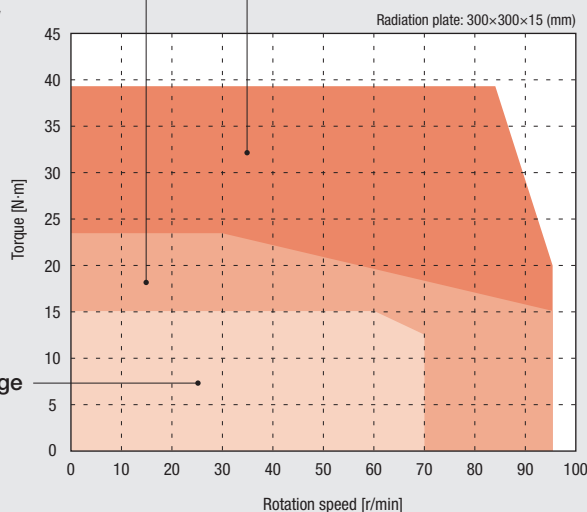
This range indicates the torque rotation speed at which the actuator can be operated at 50% duty operation (the ratio of operating time and delay time is 50:50).

### Continuous motion range

This range indicates the torque rotation speed at which the actuator can be operated continuously.

### Motion range during acceleration and deceleration

This range indicates the torque rotation speed at which the product can be operated at this instant. The range is typically used for acceleration or deceleration.

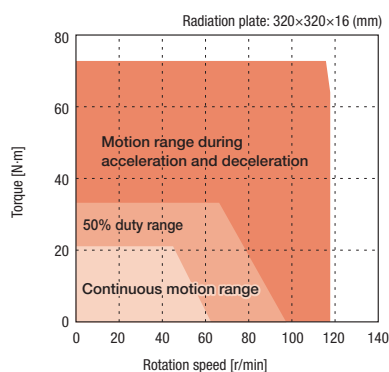


Note 1: Values in the continuous and 50% duty motion ranges are measured on the condition where the radiation plate specified in the graph is installed.  
Note 2: See the manual for details on model number selection.

## SHA20-SG type 《combined driver: HA-800-3D -200》

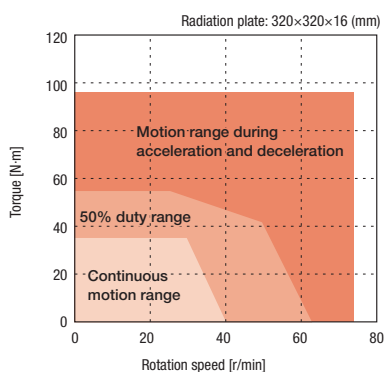
### SHA20A51SG

Input voltage: 200 V



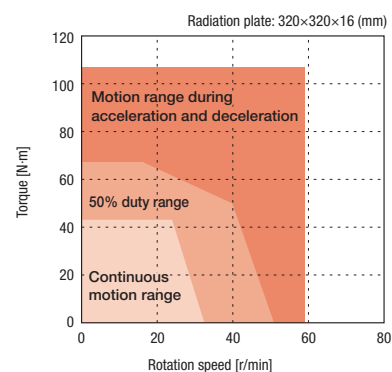
### SHA20A81SG

Input voltage: 200 V



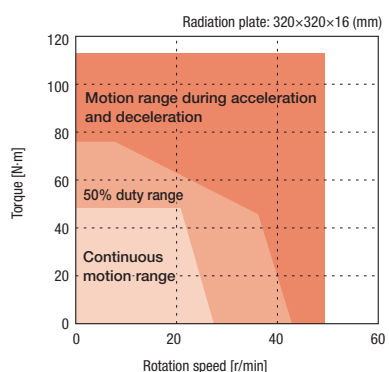
### SHA20A101SG

Input voltage: 200 V



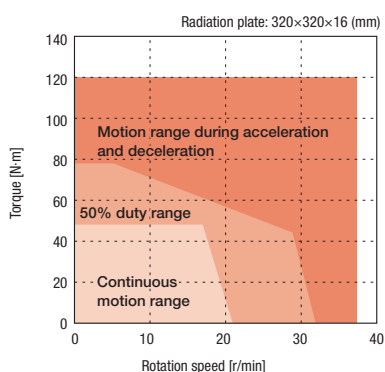
### SHA20A121SG

Input voltage: 200 V

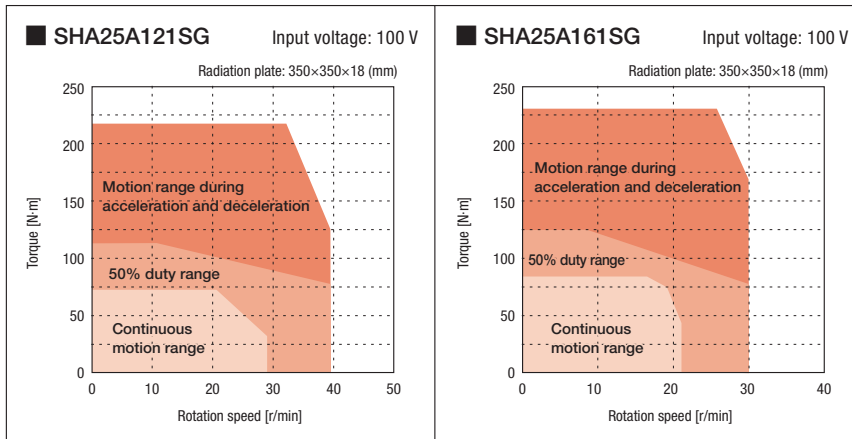
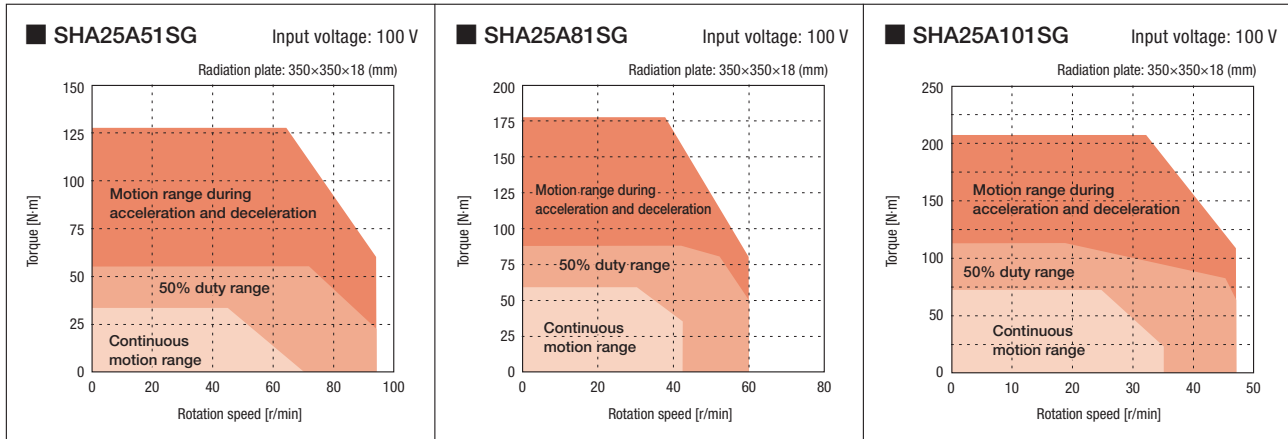


### SHA20A161SG

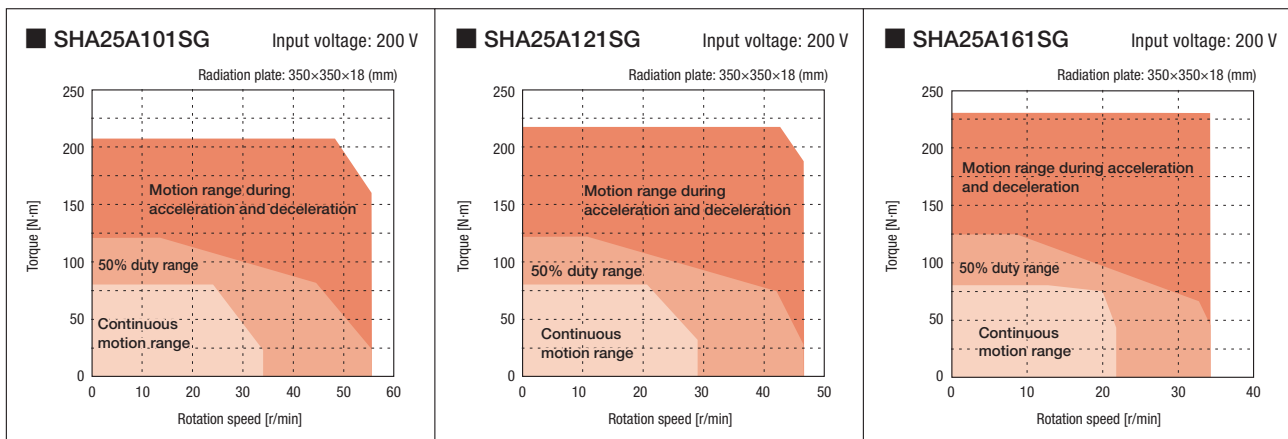
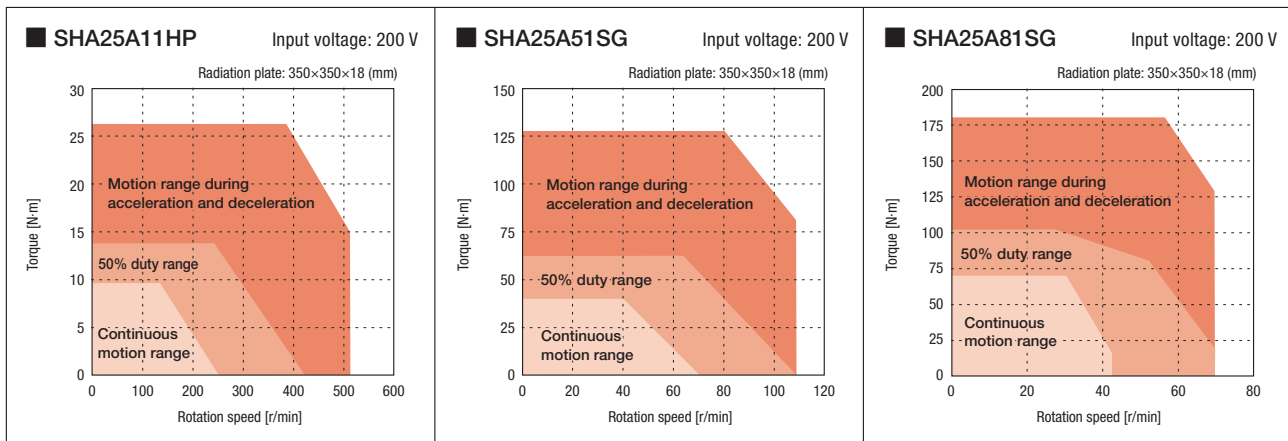
Input voltage: 200 V



## ■ SHA25-SG type (100 VAC model) 《combined driver: HA-800□-6D -100》



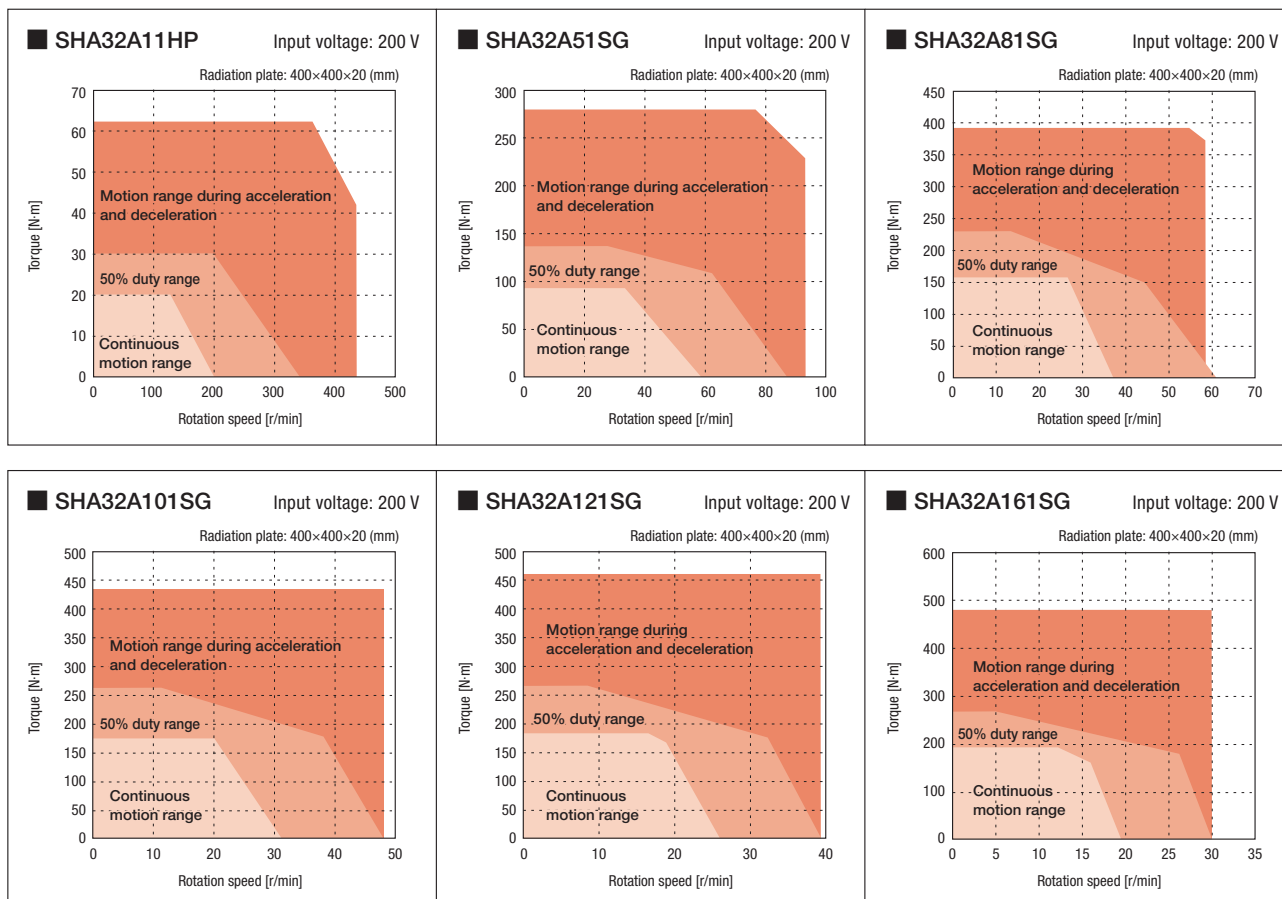
## ■ SHA25-SG/HP type (200 VAC model) 《combined driver: HA-800□-3D -200》



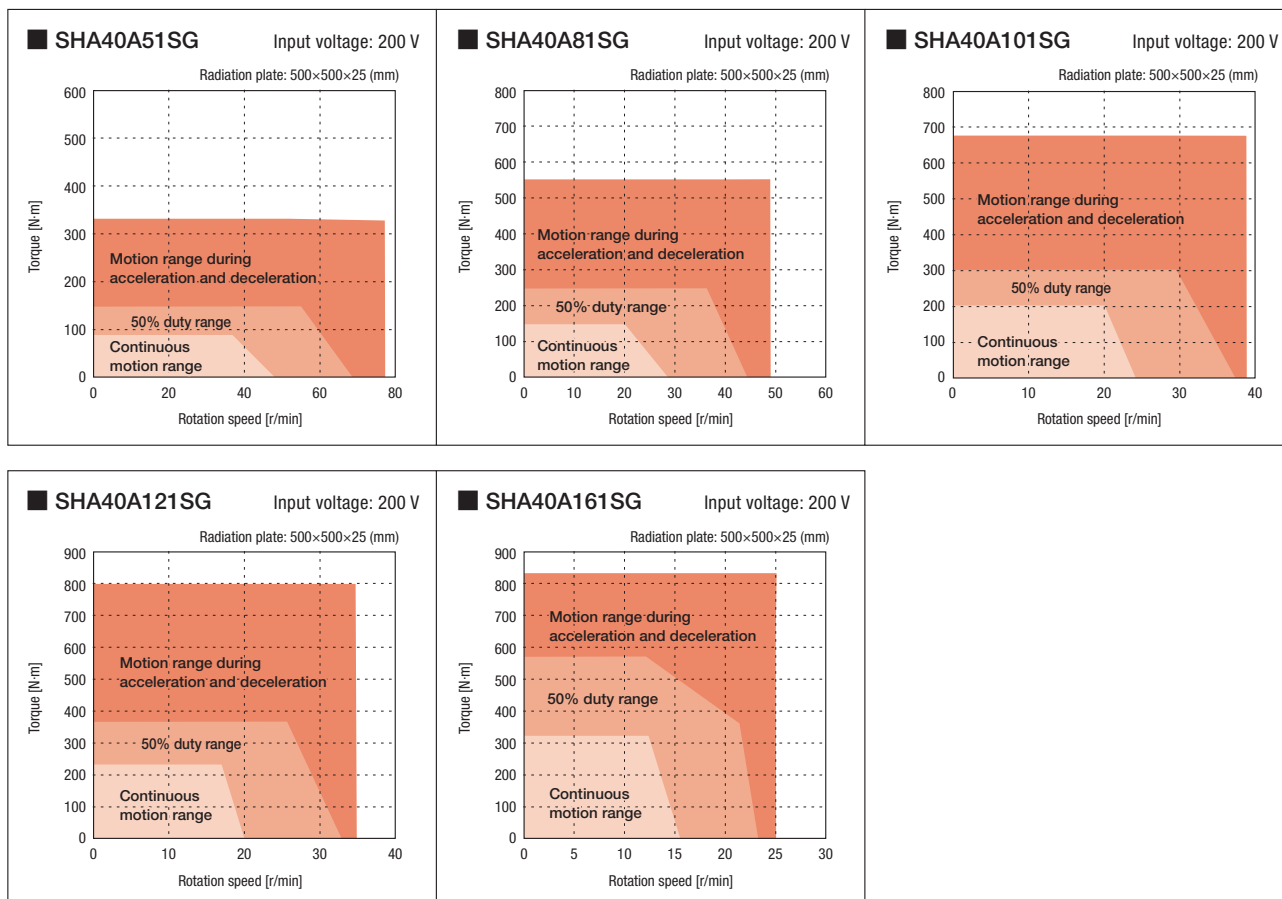


## Operable range

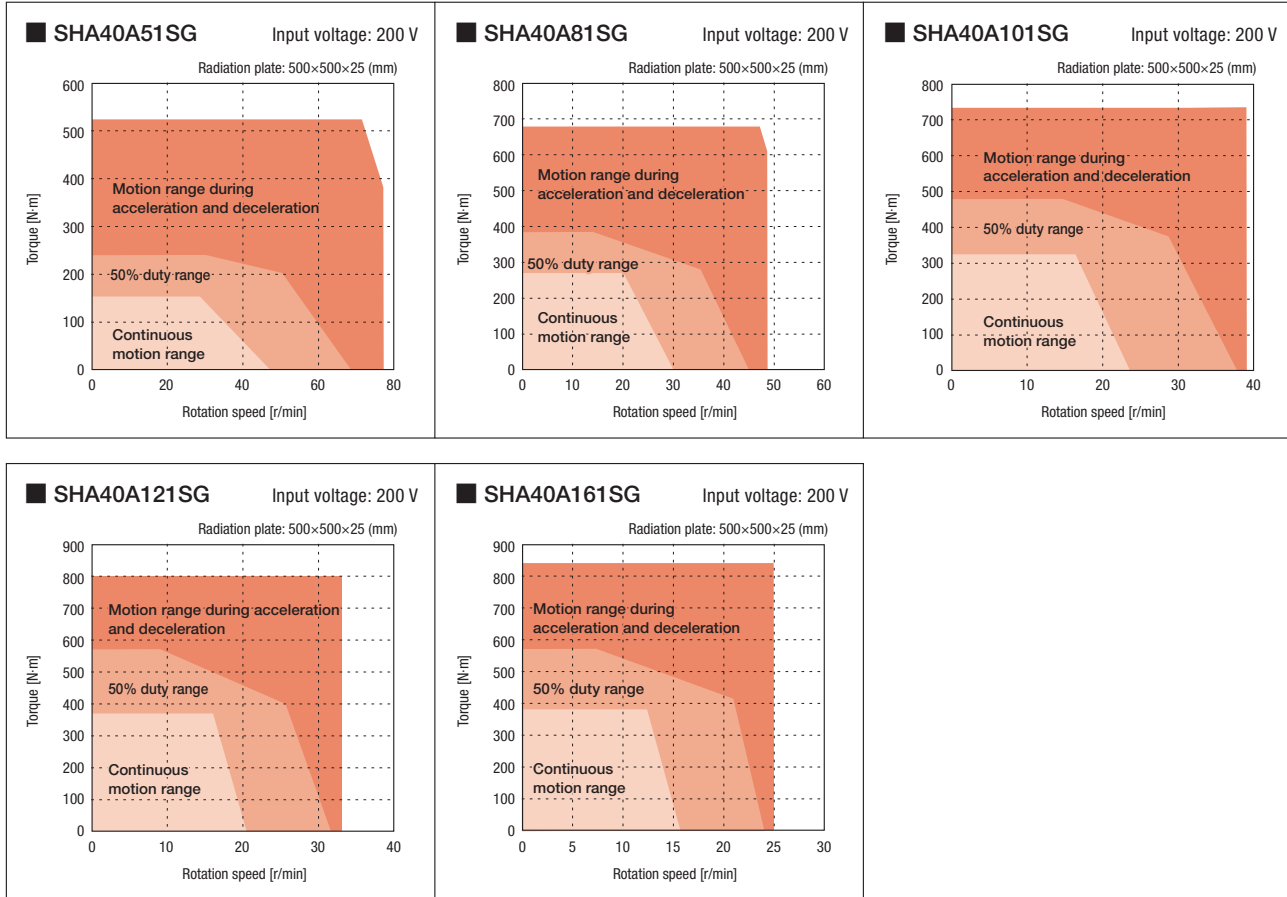
### SHA32-SG/HP type 《combined driver: HA-800□-6D -200》



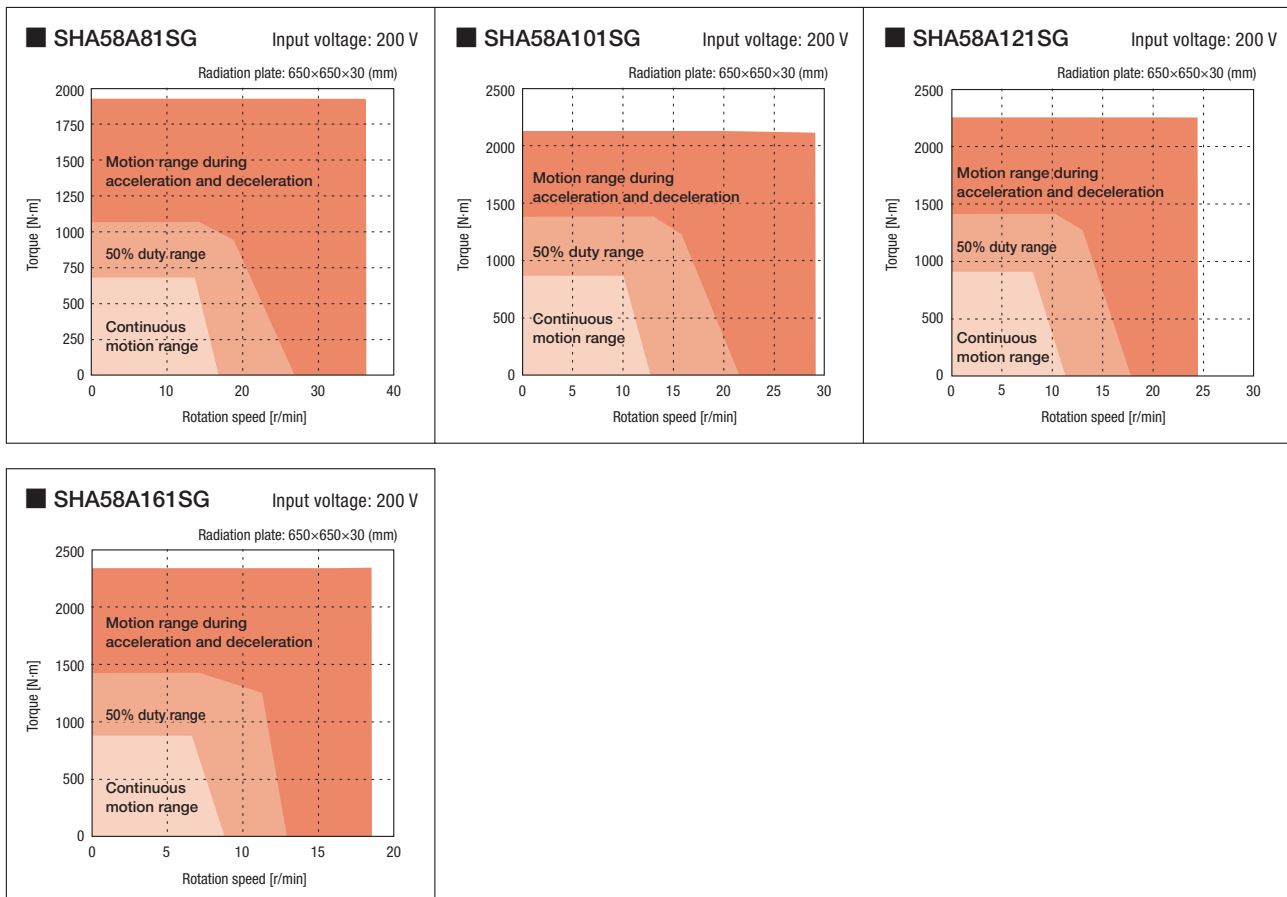
### SHA40-SG type 《combined driver: HA-800□-6D -200》



## ■ SHA40-SG type 《combined driver: HA-800□-24D -200》

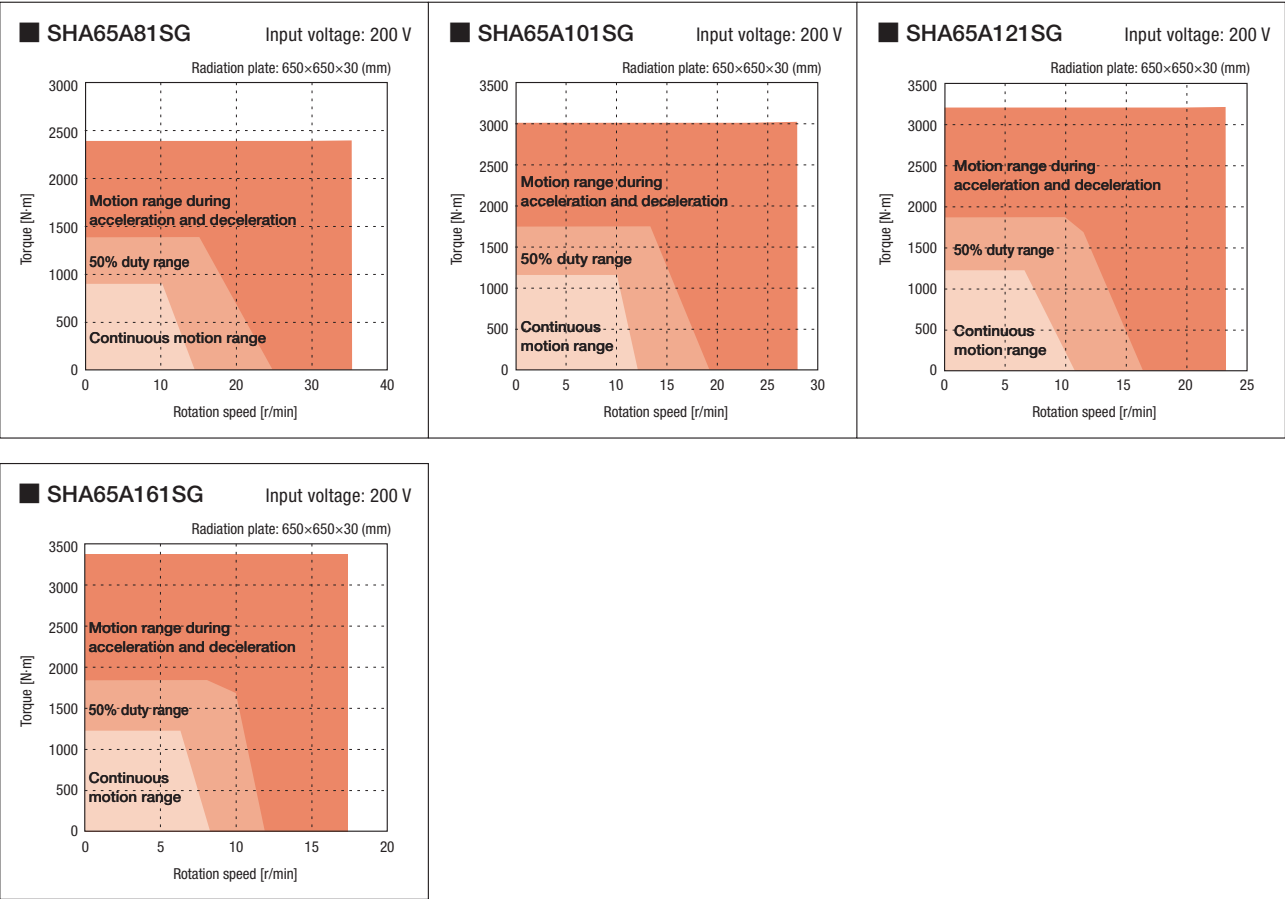


## ■ SHA58-SG type 《combined driver: HA-800□-24D -200》

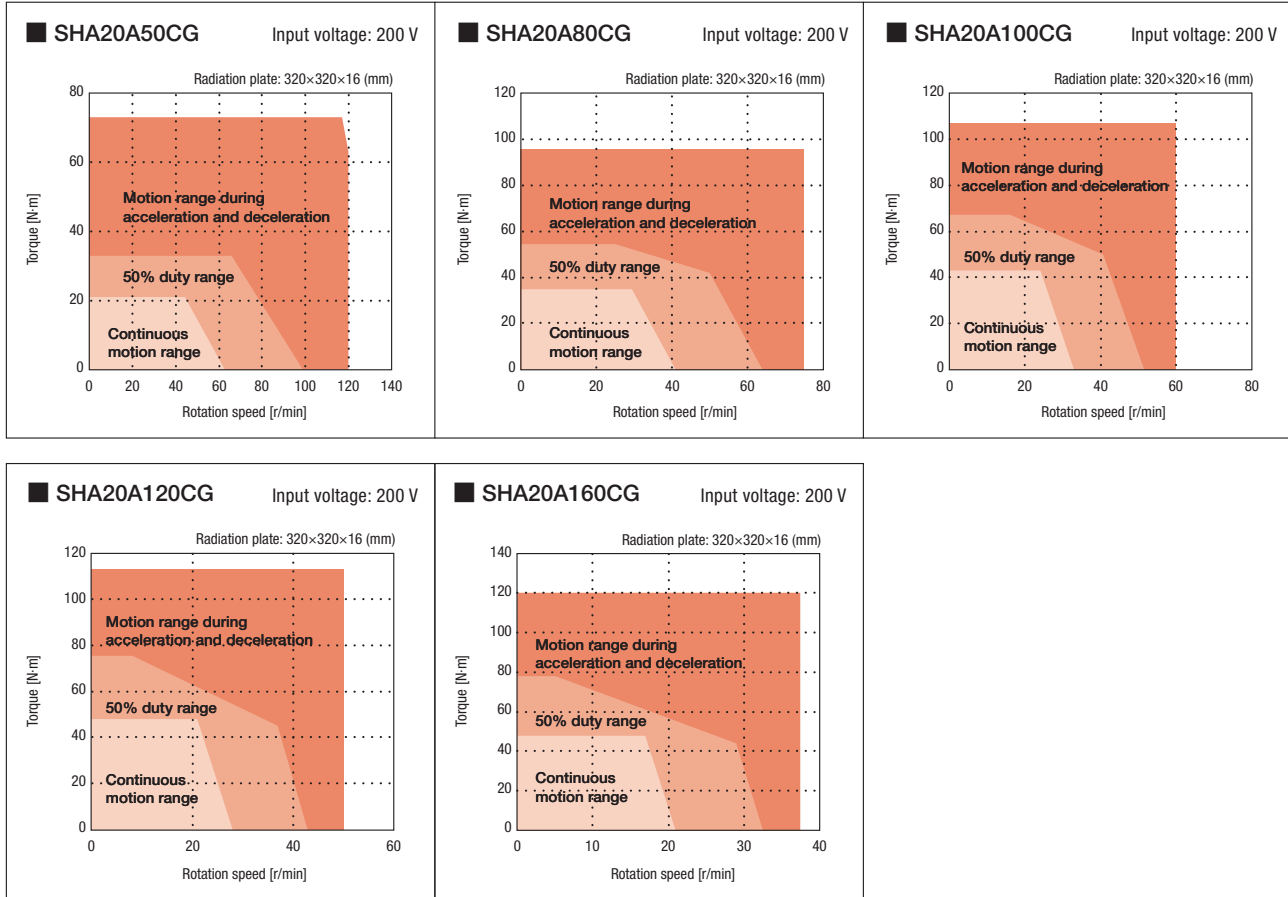


Operable range

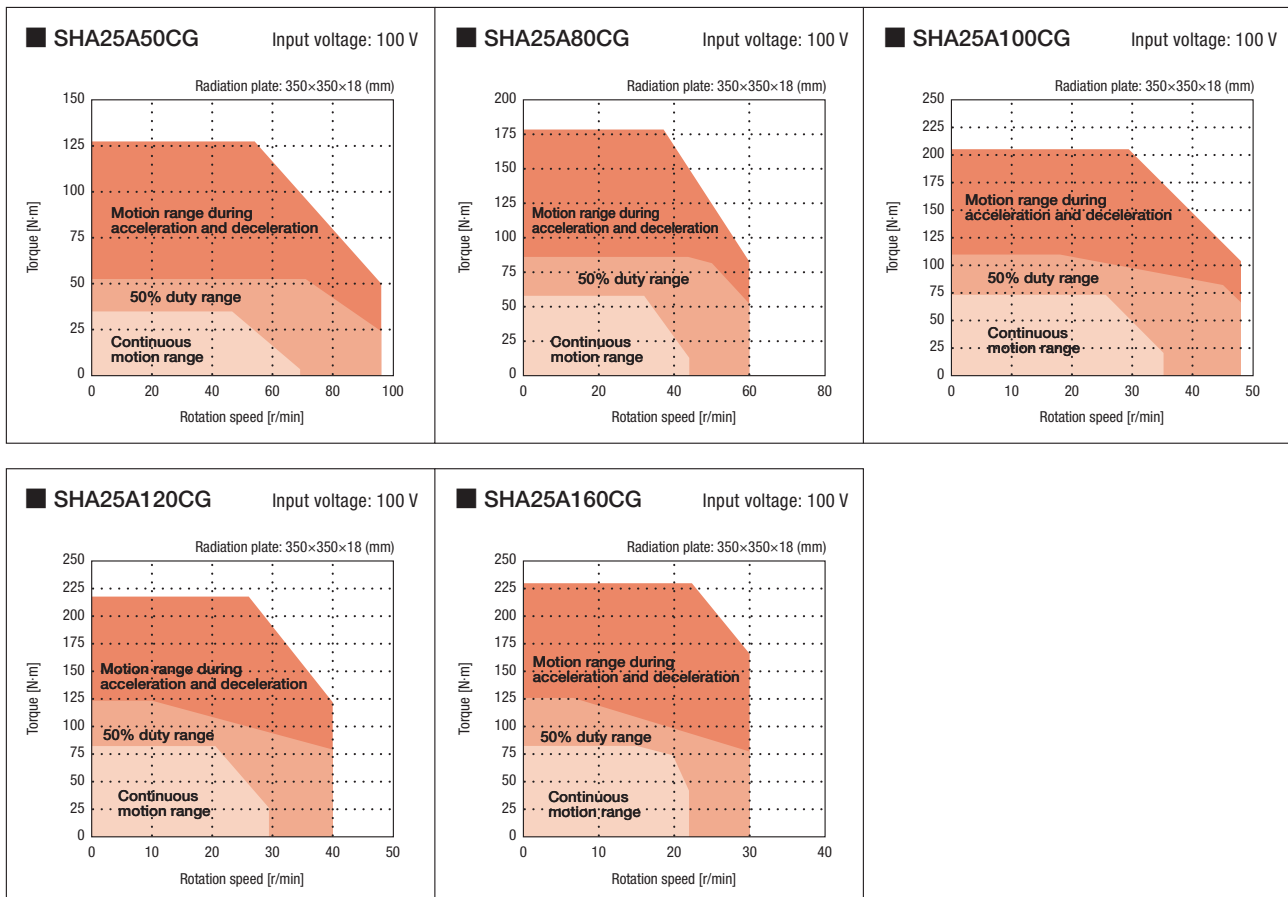
SHA65-SG type 《combined driver: HA-800□-24D -200》



## SHA20-CG type 《combined driver: HA-800□-3D/E -200》

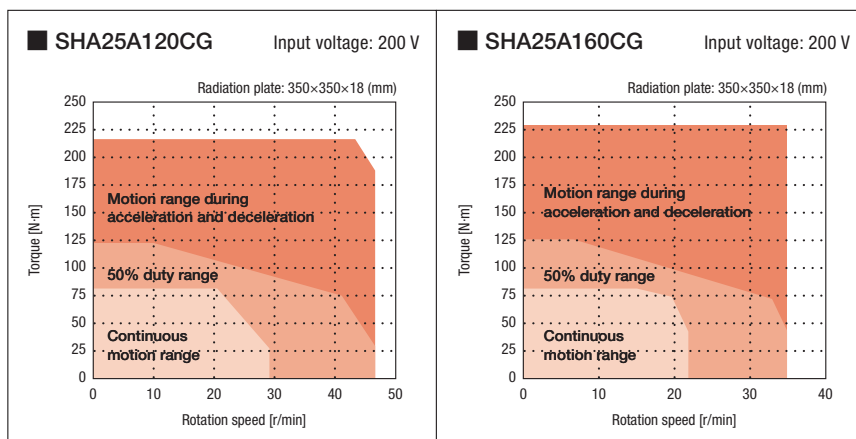
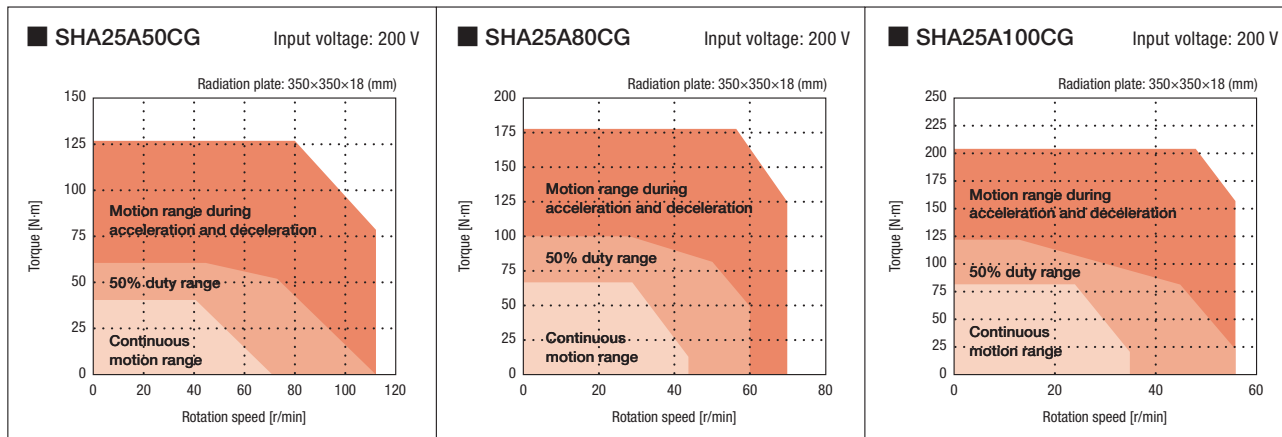


## SHA25-CG type (100 VAC model) 《combined driver: HA-800□-6D/ E -100》

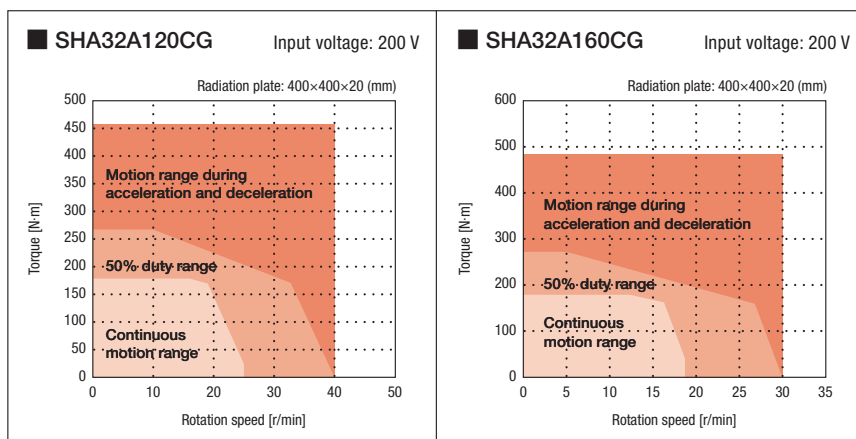
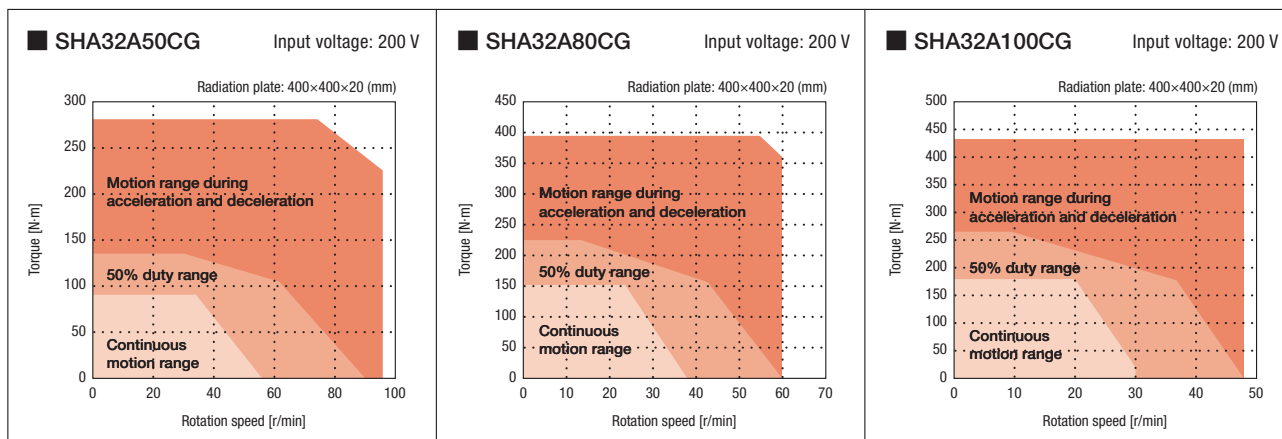


## Operable range

### SHA25-CG type (200 VAC model) 《combined driver: HA-800□-3D/ E -200》

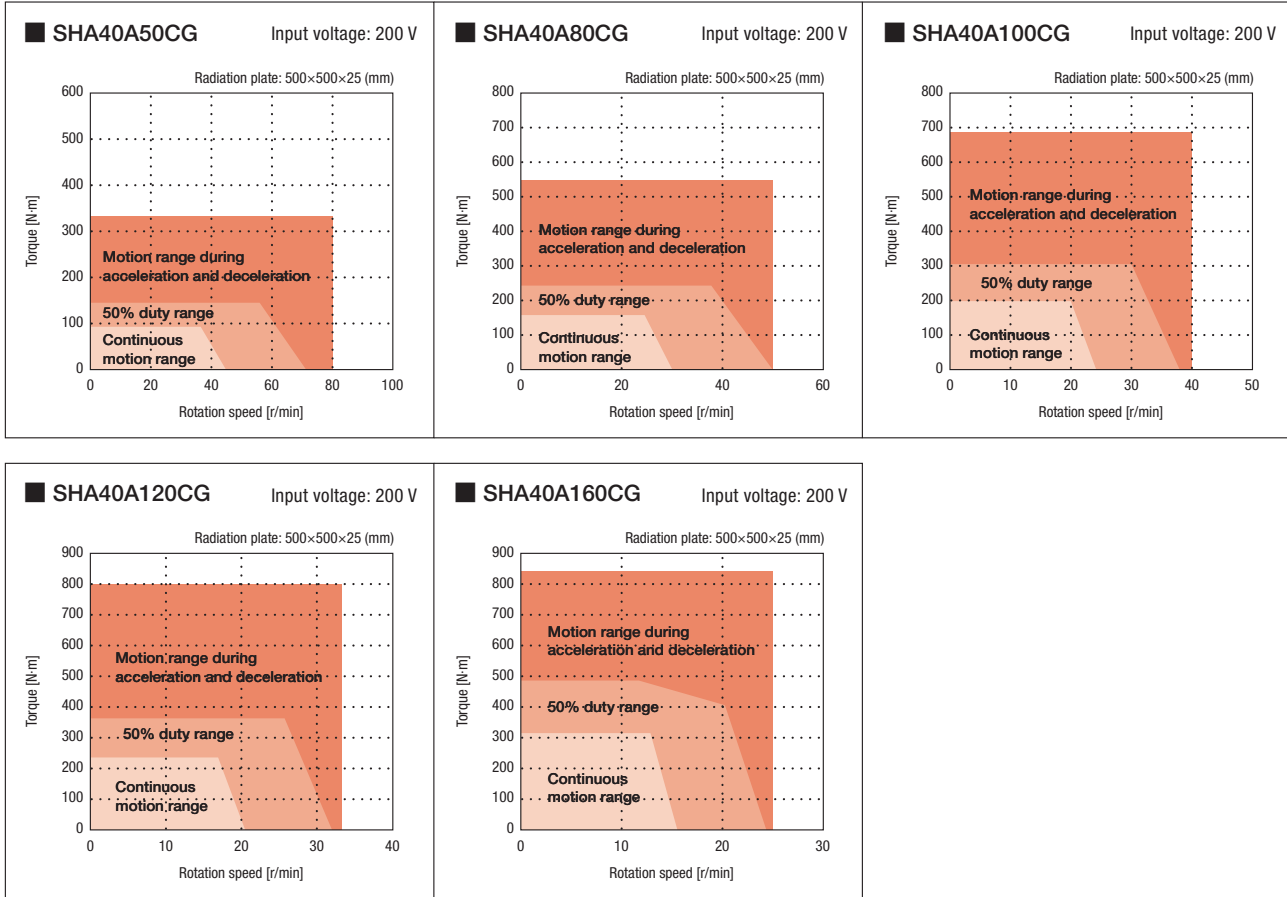


### SHA32-CG type 《combined driver: HA-800□-6D/ E -200》

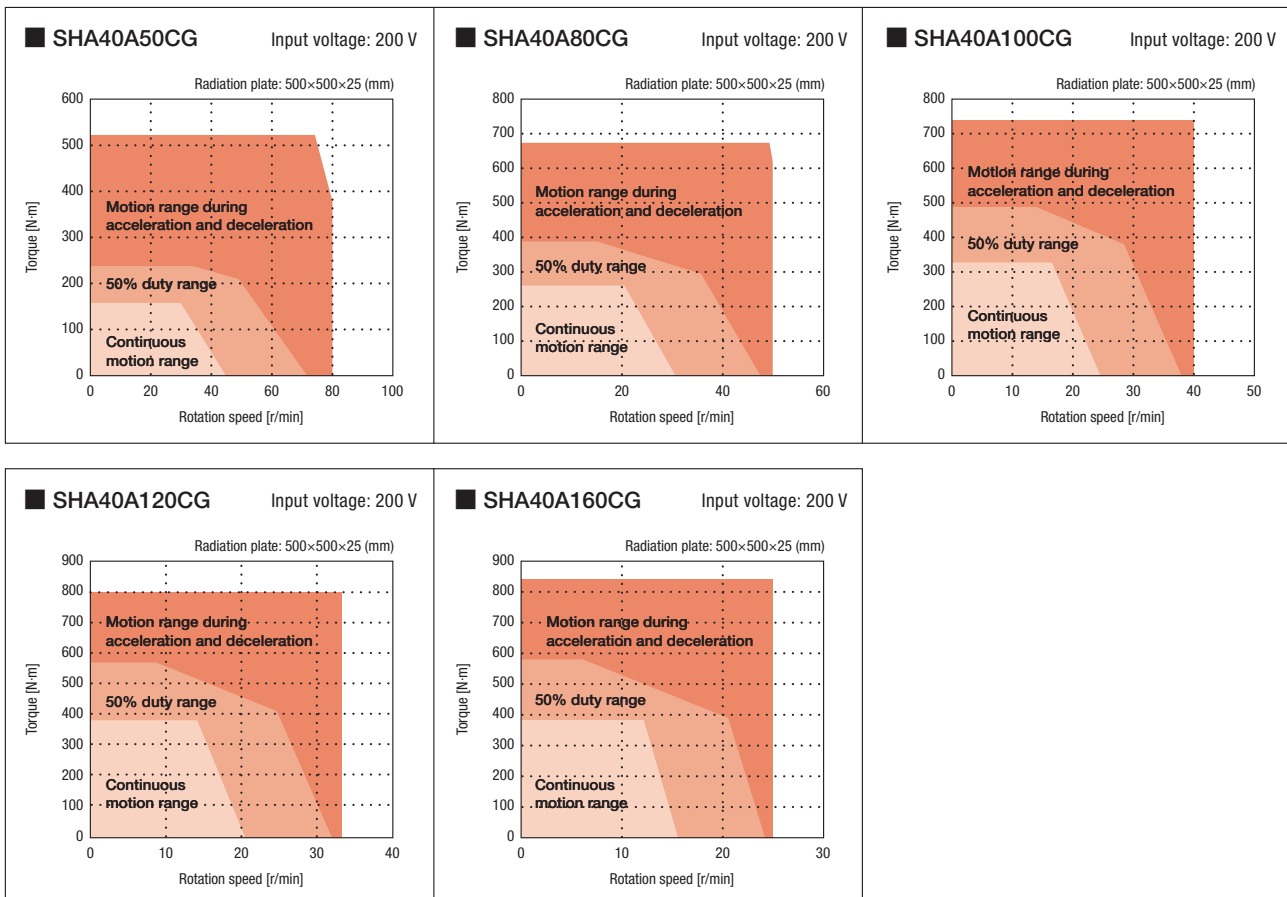


## Operable range

### ■ SHA40-CG type 《combined driver: HA-800□-6D/ E -200》



### ■ SHA40-CG type 《combined driver: HA-800□-24D/ E -200》



## Options

### Relay Cable (for motors)

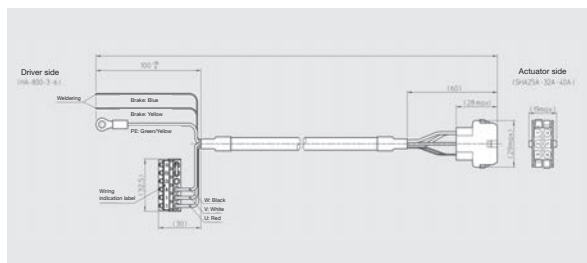
Actuator model Nos. 20, 25, 32, 40 (Model No. 40 is applicable when combined with HA-800-6D/E.)

Order Code Example: EWD-MB \* \* -A06-TN3

The cable for connecting SHA series to HA-800 driver.

There are two types of relay cable; for motor (including brake wire) and for absolute encoder. The relay cable is required for connecting SHA series to HA-800 driver.

Standard cable lengths are 3, 5 and 10m.

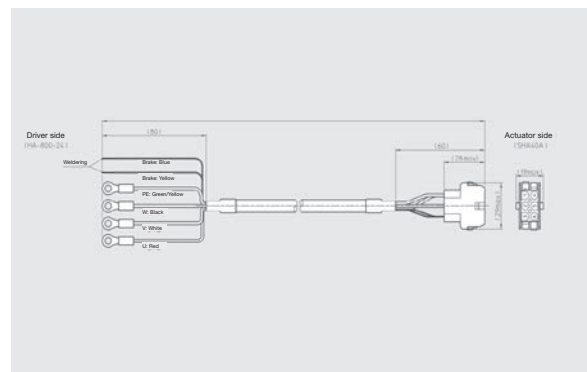


### Relay Cable (for motors)

Actuator model No. 40 (when combined with HA-800-24D/E)

Order Code Example: EWD-MB \* \* -A06-TMC

Standard cable lengths are 3, 5 and 10m.

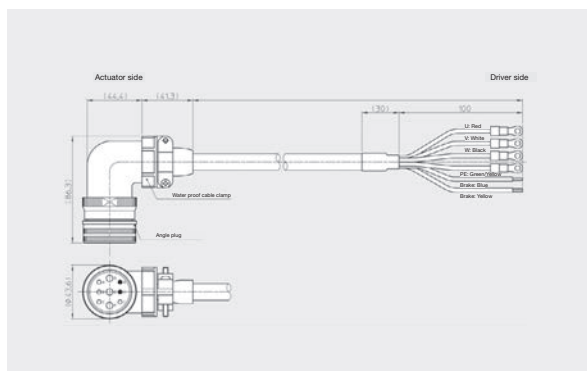


### Relay Cable (for motors)

Actuator model No. 58, 65 (SG type)

Order Code Example: EWD-MB \* \* -D09-TMC

Standard cable lengths are 3, 5 and 10m.

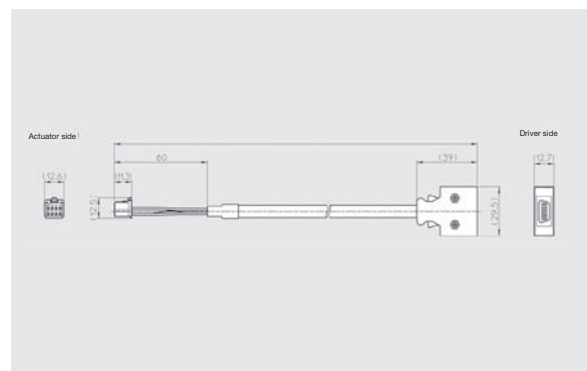


### Relay Cable (for absolute encoders)

Actuator model No. 20, 25, 32, 40

Order Code Example: EWD-S \* \* -A08-3M14

Standard cable lengths are 3, 5 and 10m.

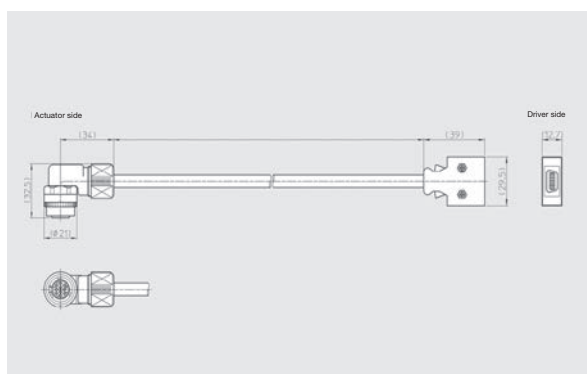


### Relay Cable (for absolute encoders)

Actuator model No. 58, 65 (SG type)

Order Code Example: EWD-S \* \* -D10-3M14

Standard cable lengths are 3, 5 and 10m.



### Stand (CG type, option code: V)

A stand is available for purchase to use the CG type for table drive.

For details, contact our sales office.



### Output shaft single revolution absolute model (CG type, option code: S)

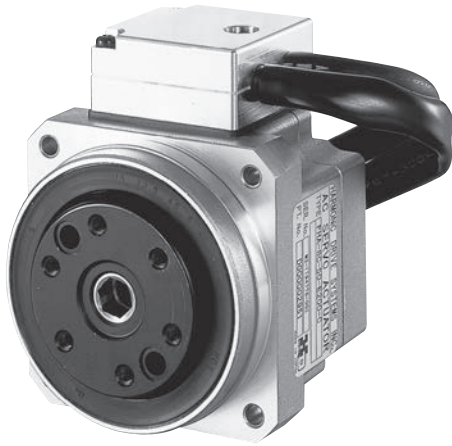
With the standard encoder, when it continues to rotate in just one direction, the absolute encoder eventually exceeds the number of revolutions that can be detected with multi-revolution detection and it becomes impossible to manage position information accurately.

To use this function, it is necessary to setup a driver. Refer to "HA-800 Series AC Servo Driver Manual".

This model is compatible with CG type only.



# FHA-C mini Series



The FHA-C mini series comprises AC servo actuators that integrate a thin speed reducer HarmonicDrive® for precision control and a super flat AC servo motor. Input power supply voltage DC24V specification is newly added.

The FHA-C mini series features an unmatched thin and compact hollow body. Entire machine and equipment structures can be simplified by passing wires, pipes and laser beams through a hole in the center of the actuator.

The dedicated drivers in the HA-800 and HA-680 series represent servo drivers for positional and speed control developed exclusively for driving the FHA-C mini series. The compact and multi-functional dedicated driver controls the motions of the FHA-C mini series with high levels of accuracy and precision.



## Features

### ■ Slim line body

The slim line body is achieved by integrating a thin speed reducer HarmonicDrive® for precision control and an ultra flat AC servo motor uniquely developed by Harmonic Drive Systems. The length from the face of the mounting flange to the end of an actuator is less than 1/3 that of a conventional AC servo actuator of Harmonic Drive Systems. This reduced thickness drastically downsizes the machine or equipment that is driven.

### ■ Hollow Structure

Wires, pipes and laser beams can be passed through a hole in the center of the actuator allowing an energy supply and the exchange of signals with the operating units of machines and equipment in order to simplify their structures. (Hollow configuration is not compatible with absolute encoder specification.)

### ■ High output torque

The thin speed reducer HarmonicDrive® for precision control assures a very high torque output when compared with a direct drive motor of the same size.

### ■ High positional accuracy

High accuracy positioning. Detector resolution 800,000 pulses (Incremental encoder)/revolution (0.00045°/pulse), uni-direction positional accuracy 90s or less (FHA-14C-100).

### ■ High torsional stiffness

HarmonicDrive® CSF mini series featuring high stiffness is integrated.

## Structure



### Speed reducer HarmonicDrive® for precision control

Precision positioning and high efficiency.  
Unmatched compactness and high torque capacity.

### High-precision hollow shaft rotary encoder

High reliability through a module with an integrated light injector/detector and generally resistant design.

### Flat AC servo motor with a hollow shaft

A totally flat body has been achieved by developing a motor containing a high-density, optimum magnetic circuit. (Absolute encoder type is no hollow shafted).

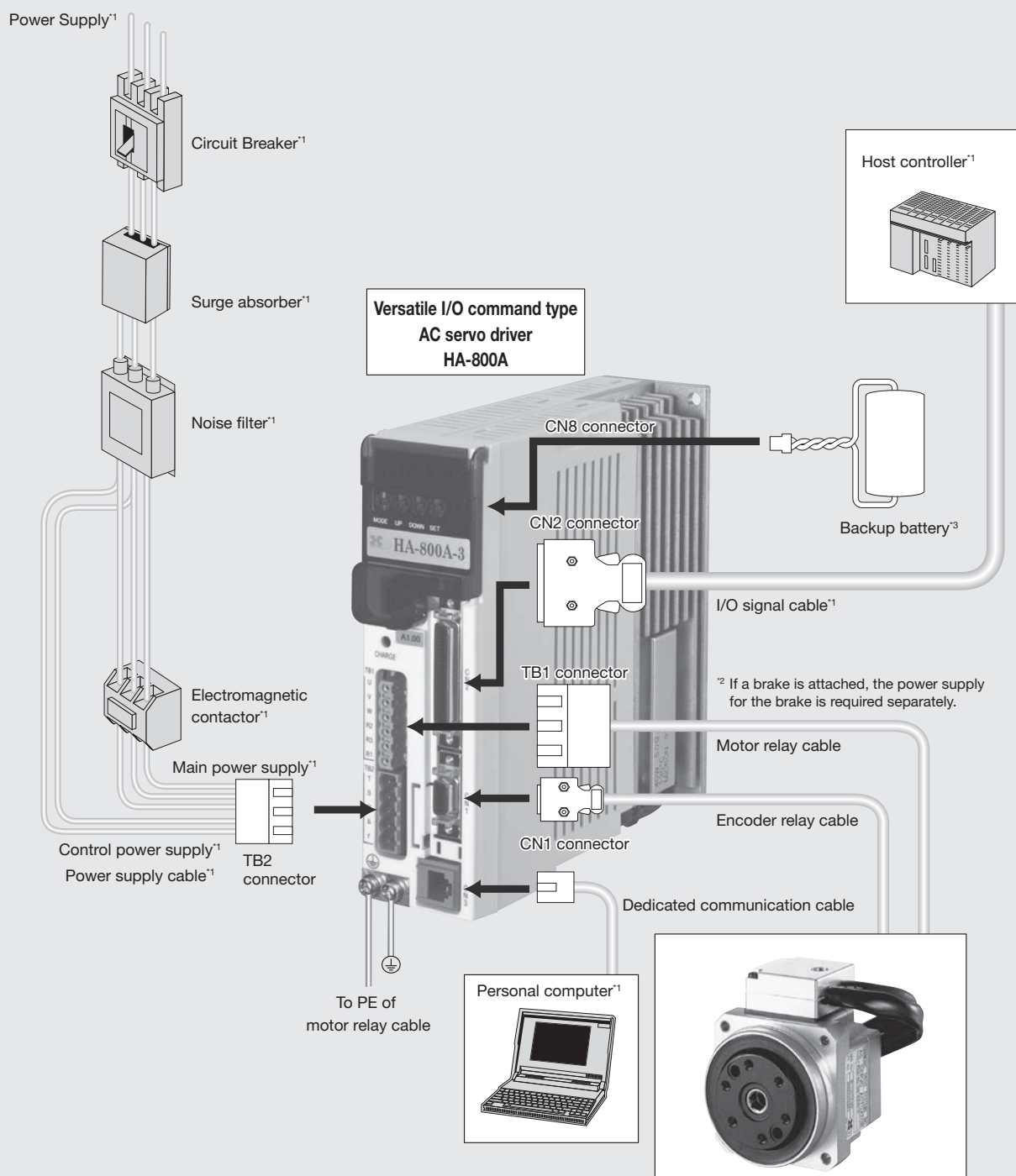
### High-precision, high load sustaining bearing

A crossed roller bearing integrated with an output shaft directly sustains a large load. High precision is assured to guard against surface and axial runouts.

## Example of System Configuration

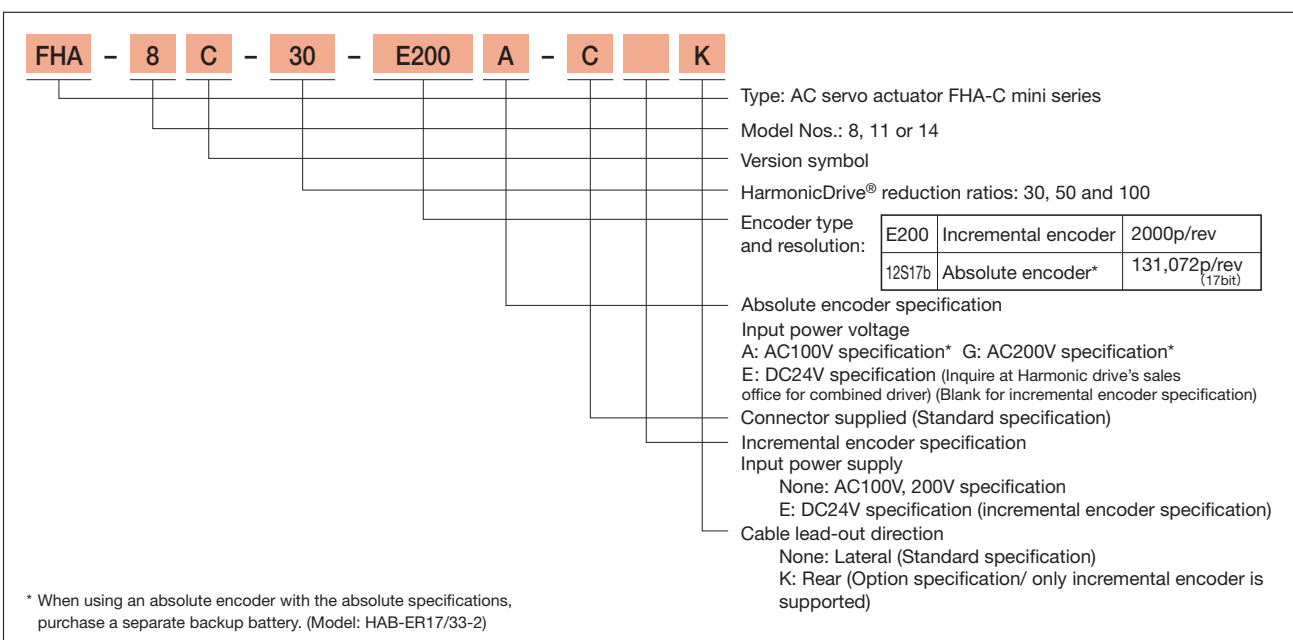
An example of system configuration of FHA-C actuator, HA-800 driver, and relay cable is illustrated.

### Versatile I/O command type System configuration





## Models and Symbols



## Specification

| Model<br>Item                             |      |                         | FHA-8C             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |         | FHA-11C  |                   |         | FHA-14C  |                   |             |          |       |
|-------------------------------------------|------|-------------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----------|-------------------|---------|----------|-------------------|-------------|----------|-------|
|                                           |      |                         | 30                 | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 100     | 30       | 50                | 100     | 30       | 50                | 100         |          |       |
| Maximum Torque <sup>*2、5</sup>            |      | N·m                     |                    | 1.8                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3.3     | 4.8      | 4.5               | 8.3     | 11       | 9.0 (8.5)         | 18 (15.5)   | 28       |       |
|                                           |      | kgf·m                   |                    | 0.18                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.34    | 0.49     | 0.46              | 0.85    | 1.1      | 0.92 (0.87)       | 1.8 (1.6)   | 2.9      |       |
| Max. Rotational Speed                     |      | r/min                   |                    | 200                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 120     | 60       | 200               | 120     | 60       | 200               | 120         | 60       |       |
| Torque Constant                           |      | 100V·200V               | N·m/A              | 3.9                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6.7     | 14       | 3.8               | 6.6     | 13       | 4.2               | 7.2         | 15       |       |
|                                           |      |                         | kgf·m/A            | 0.4                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.68    | 1.4      | 0.39              | 0.67    | 1.4      | 0.43              | 0.74        | 1.5      |       |
|                                           |      | 24V                     | N·m/A              | 0.8                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1.3     | 2.7      | 0.8               | 1.3     | 2.6      | 0.8               | 1.4         | 2.9      |       |
|                                           |      |                         | kgf·m/A            | 0.08                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.13    | 0.28     | 0.08              | 0.13    | 0.27     | 0.08              | 0.14        | 0.30     |       |
| Maximum Current <sup>*2、5</sup>           |      | 100V·200V               | A                  | 0.61                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.64    | 0.48     | 1.5               | 1.6     | 1.1      | 2.9               | 3.2         | 2.4      |       |
|                                           |      | 24V                     | A                  | 3.0                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3.3     | 2.4      | 7.8               | 8.2     | 5.6      | 14.8 (14.1)       | 16.4 (14.1) | 12.3     |       |
| Moment of Inertia <sup>*3</sup>           |      | INC                     | GD <sup>2</sup> /4 | kg·m <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.0026  | 0.0074   | 0.029             | 0.0060  | 0.017    | 0.067             | 0.018       | 0.050    | 0.20  |
|                                           |      |                         | J                  | kgf·cms <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.027   | 0.075    | 0.30              | 0.061   | 0.17     | 0.68              | 0.18        | 0.51     | 2.0   |
|                                           |      | ABS                     | GD <sup>2</sup> /4 | kg·m <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.0026  | 0.0073   | 0.029             | 0.0062  | 0.017    | 0.069             | 0.019       | 0.054    | 0.215 |
|                                           |      |                         | J                  | kgf·cms <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.027   | 0.0747   | 0.298             | 0.063   | 0.176    | 0.705             | 0.197       | 0.547    | 2.189 |
| Reduction Ratio                           |      |                         |                    | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50      | 100      | 30                | 50      | 100      | 30                | 50          | 100      |       |
| Permissible Moment Load                   |      | N·m                     |                    | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |          | 40                |         |          | 75                |             |          |       |
|                                           |      | kgf·m                   |                    | 1.5                                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |          | 4.1               |         |          | 7.7               |             |          |       |
| Moment Stiffness                          |      | N·m/rad                 |                    | 2×10 <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |          | 4×10 <sup>4</sup> |         |          | 8×10 <sup>4</sup> |             |          |       |
|                                           |      | kgf·m/arc·min           |                    | 0.59                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |          | 1.2               |         |          | 2.4               |             |          |       |
| Detector Resolution (At x4) <sup>*4</sup> | INC  | Pulses/revolution       |                    | 240000                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 400000  | 800000   | 240000            | 400000  | 800000   | 240000            | 400000      | 800000   |       |
|                                           | ABS  |                         |                    | 3932160                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 6553600 | 13107200 | 3932160           | 6553600 | 13107200 | 3932160           | 6553600     | 13107200 |       |
| Input Power Supply                        |      | V                       |                    | DC24V or AC100 or AC200                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |          |                   |         |          |                   |             |          |       |
| Mass                                      | INC  | kg                      |                    | 0.40                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |          | 0.62              |         |          | 1.2               |             |          |       |
|                                           | 0.50 |                         |                    | 0.75                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |          | 1.3               |         |          |                   |             |          |       |
| Protection Structure                      |      |                         |                    | Totally enclosed self-cooled type                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |          |                   |         |          |                   |             |          |       |
| Environmental Conditions                  |      |                         |                    | Operating temperature 0 to 40℃, storage temperature -20 to 60℃ Operating humidity / storage humidity 20 to 80% RH (Do not expose to condensation) No dust, no metal powder, no corrosive gas, no inflammable gas and no oil mist Indoor use only No exposure to direct sunshine Altitude 1000m or less Insulation resistance 100M ohm or higher (DC500V), dielectric strength AC1500V/1 min, insulation class B Absolute encoder Anti-magnetism noise: 0.01 tesla |         |          |                   |         |          |                   |             |          |       |
| Mounting Direction                        |      |                         |                    | All directions                                                                                                                                                                                                                                                                                                                                                                                                                                                    |         |          |                   |         |          |                   |             |          |       |
| Safety Standard Compliance                |      |                         |                    | CE Marking                                                                                                                                                                                                                                                                                                                                                                                                                                                        |         |          |                   |         |          |                   |             |          |       |
| Combined Driver                           |      | 100V·200V <sup>*7</sup> |                    | HA-800-1                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |          |                   |         |          |                   |             |          |       |
|                                           |      | 24V(INC)                |                    | HA-680-4-24                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |          |                   |         |          | HA-680-6-24       |             |          |       |
|                                           |      | 24V(ABS)                |                    | RF2H21A0AHD by SANYO DENKI CO., LTD                                                                                                                                                                                                                                                                                                                                                                                                                               |         |          |                   |         |          |                   |             |          |       |

\* 1: The aforementioned values are those at the output shaft.

\* 2: Values in combination with HA-800, HA-680, or RF2H21A0AHD by SANYO DENKI CO., LTD servo driver.

\* 3: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the HarmonicDrive®.

\* 4: Output resolution for incremental encoder is calculated by (Motor shaft encoder resolution) x 4 x (Reduction ratio) and for absolute encoder, it is calculated by (Motor shaft encoder resolution) x (Reduction ratio).

\* 5: The value in parentheses ( ) is the value in combination with an RF2H21A0AHD by SANYO DENKI CO., LTD servo driver.

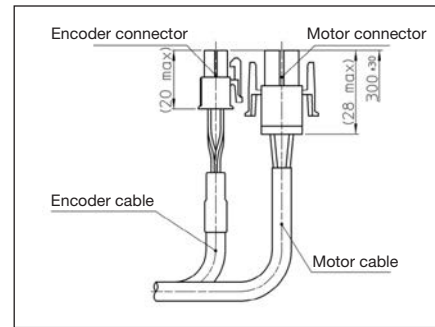
\* 6: Please check the actuator rotation direction in our technical data sheet.

\* 7: When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2) (INC indicates incremental encoder and ABS indicates absolute incoeder)

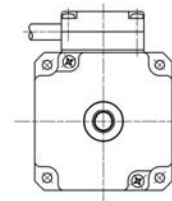
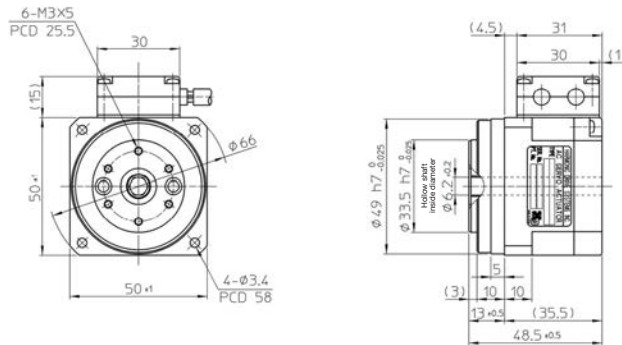
## External Dimensions (Incremental encoder specification)

Unit: mm

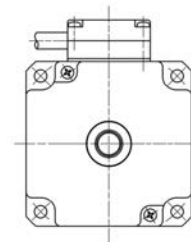
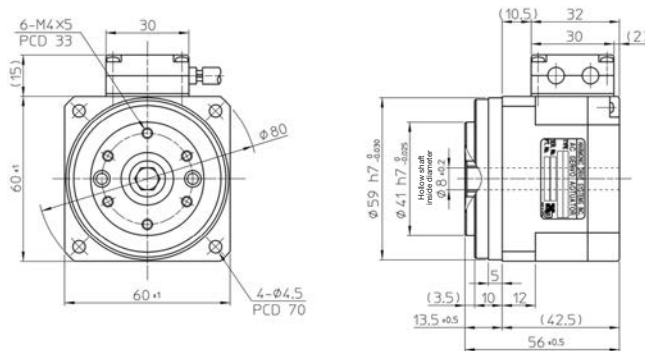
Motor Encoder Cable  
(Same for all models)



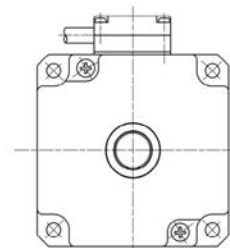
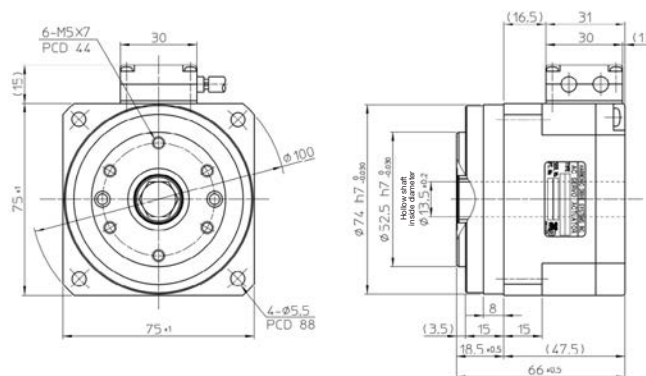
### ■FHA-8C



### ■FHA-11C



### ■FHA-14C



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).

Contact us for the differential range of the size that is not described.

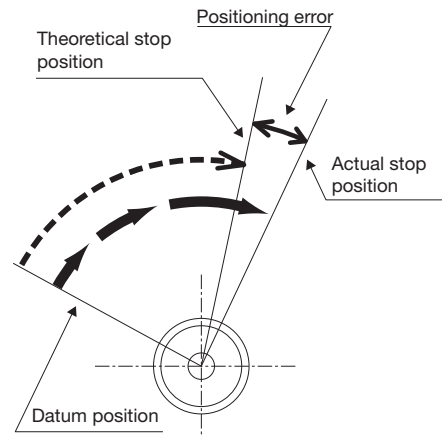




## Uni-directional Positional Accuracy

The “uni-directional positional accuracy” represents the maximum difference in one revolution among differences between an angle actually rotated from the datum position and an angle that is supposed to turn in each position by repeating positioning sequentially in a preset rotational direction. (Source: JIS [Japanese Industrial Standards] B 6201-1987).

The FHA-C mini series contains a speed reducer HarmonicDrive® for precision control, meaning positioning errors of the motor shaft are therefore compressed to 1/30, 1/50 or 1/100 by speed reduction. In reality, angular transmission errors of the speed reducer determine the uni-directional positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown in terms of the uni-directional positional accuracy of the FHA-C mini series.



## “Uni-directional Positional Accuracies” of Models

| Model                               |         | FHA-8C                |                       |                       | FHA-11C               |                       |                       | FHA-14C               |                       |                       |
|-------------------------------------|---------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                     |         | 30                    | 50                    | 100                   | 30                    | 50                    | 100                   | 30                    | 50                    | 100                   |
| Uni-directional Positional Accuracy | arc-sec | 150                   | 120                   | 120                   | 120                   | 90                    | 90                    | 120                   | 90                    | 90                    |
|                                     | rad     | $7.27 \times 10^{-4}$ | $5.82 \times 10^{-4}$ | $5.82 \times 10^{-4}$ | $5.82 \times 10^{-4}$ | $4.37 \times 10^{-4}$ | $4.37 \times 10^{-4}$ | $5.82 \times 10^{-4}$ | $4.37 \times 10^{-4}$ | $4.37 \times 10^{-4}$ |

## Angle Correction Function during Horizontal Indexing

The driver of the FHA-C mini series has an angle correction function. This function enhances the uni-directional positional accuracy by analyzing the angular transmission error of the HarmonicDrive® and correcting this error in advance. This function boosts the uni-directional positional accuracy by about 30% compared with the aforementioned values. Use this function after checking the effect of this function if load fluctuations are large. (Refer to the instruction manual of HA-800 or HA-680 for usage of this function.)

## Mechanical Accuracy

The mechanical accuracies of the output shaft and mounting flange of the actuators in the FHA-C mini series are as follows.

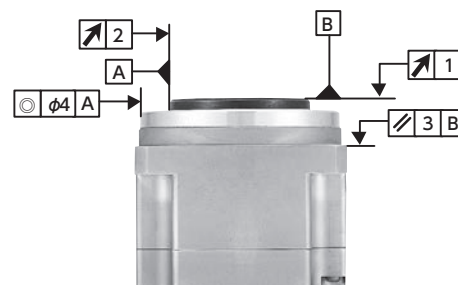
### Mechanical Accuracy

Unit: mm

| Accuracy Item                                              | FHA-8C | FHA-11C | FHA-14C |
|------------------------------------------------------------|--------|---------|---------|
| 1 Output shaft surface runout                              | 0.010  |         |         |
| 2 Output shaft axial runout                                | 0.010  |         |         |
| 3 Parallelism between the output shaft and mounted surface | 0.040  |         |         |
| 4 Concentricity between the output shaft and fitting part  | 0.040  |         |         |

\* The aforementioned values are T.I.R (total indicator reading) values.

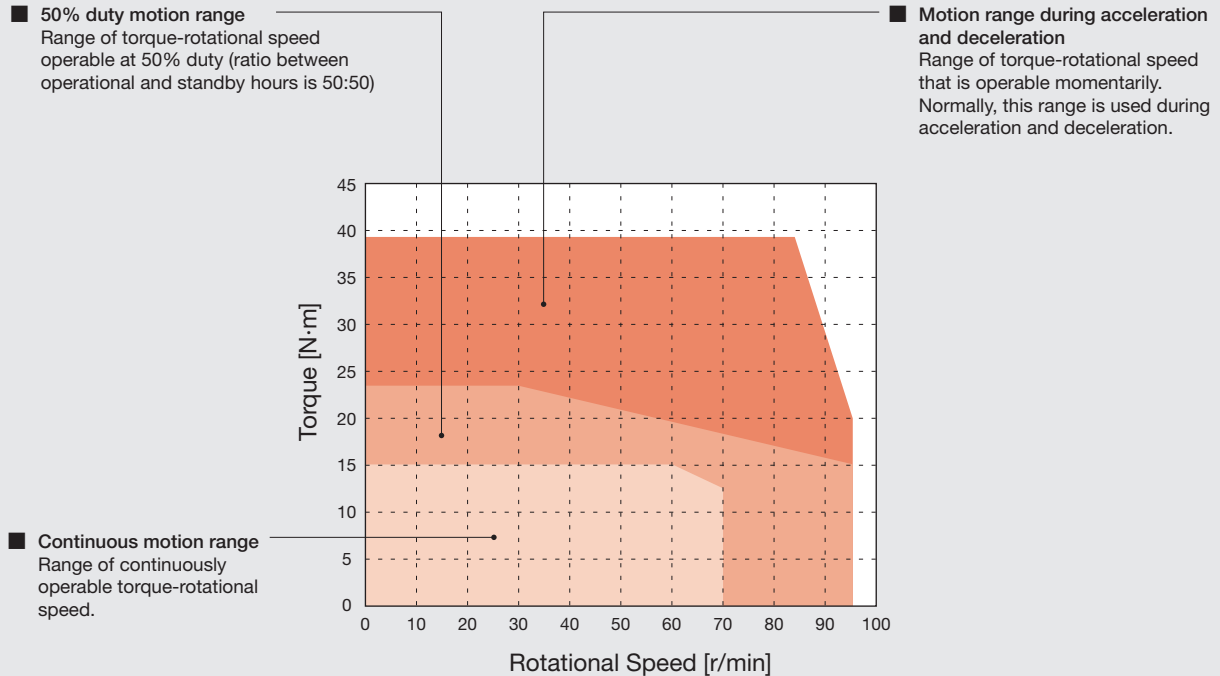
\* See the technical information for the measuring method.





## Operable Range

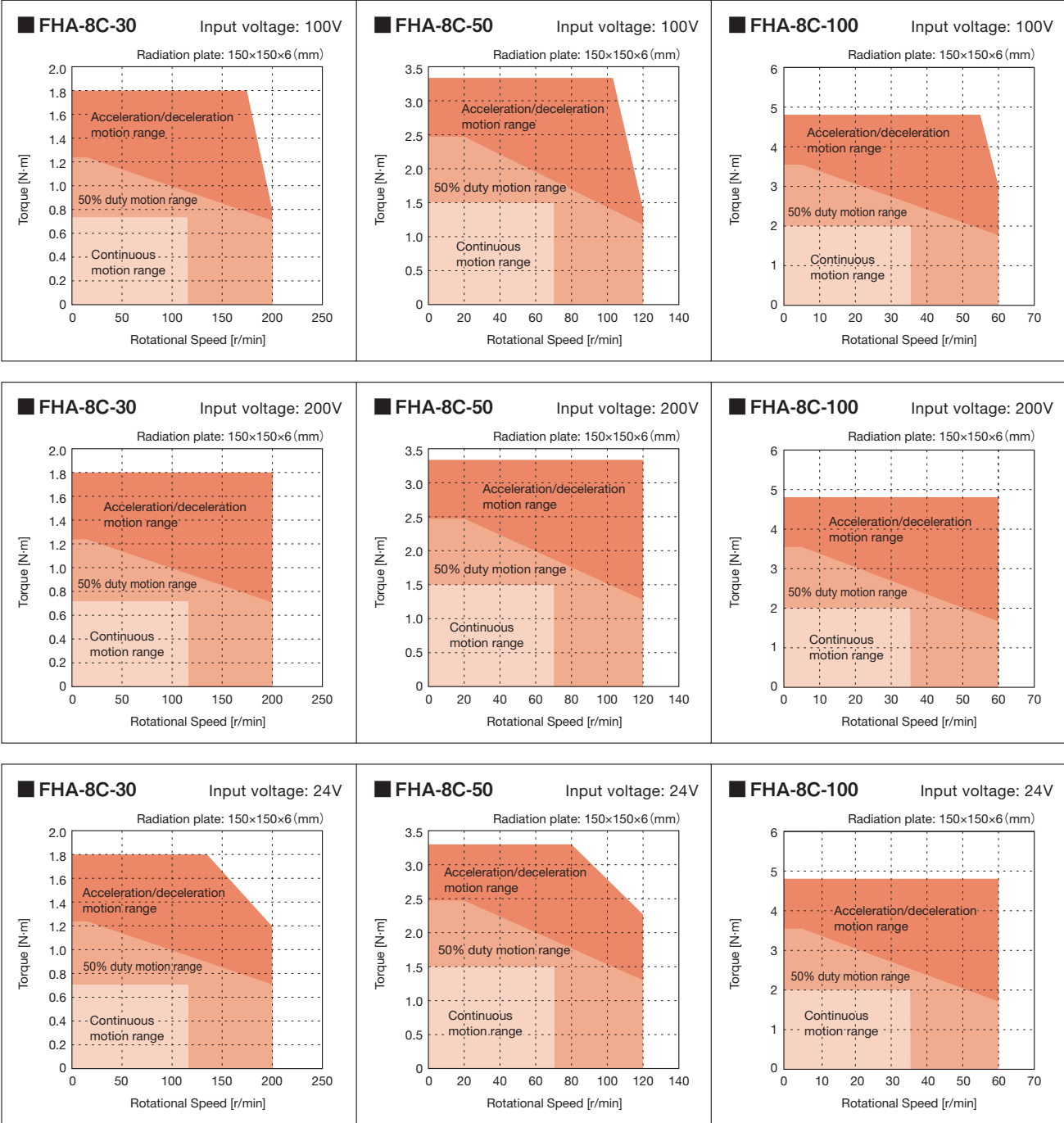
This graph plots operable ranges when an HA-800 servo driver (input power voltage AC100V or AC200V) or an HA-680 servo driver (input power voltage DC24V) for the FHA-C mini series is combined.



Note 1: Motion ranges for continuous motion and that at 50% duty are the values when the radiation plate mentioned in the graphs is mounted.

Note 2: See the technical information for selection of a model No.

## Operable Range



## Operable Range

Rotary Actuator

DirectDrive motor

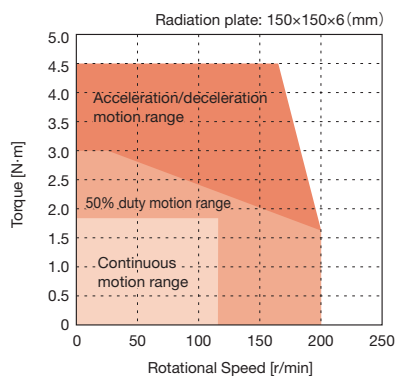
Galvanometer Scanner System

Linear Actuator

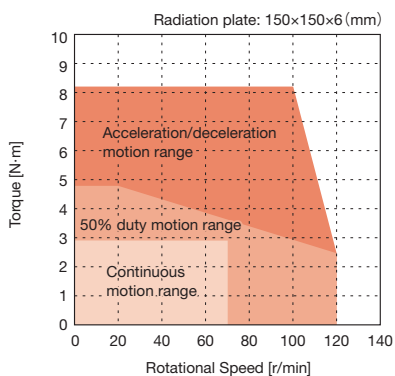
Servo Driver

Sensor System

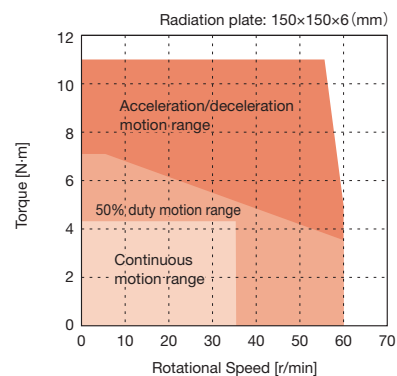
■ **FHA-11C-30** Input voltage: 100V



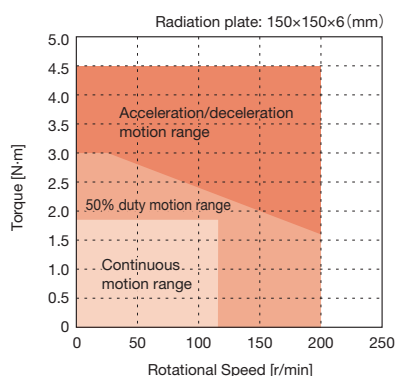
■ **FHA-11C-50** Input voltage: 100V



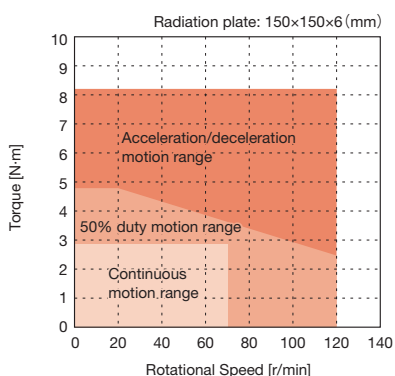
■ **FHA-11C-100** Input voltage: 100V



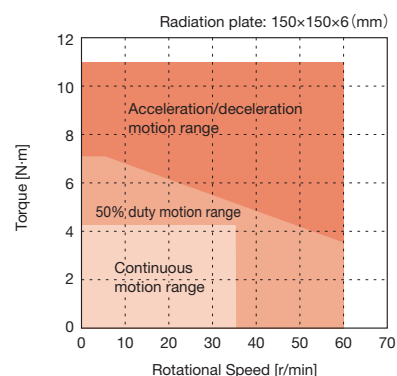
■ **FHA-11C-30** Input voltage: 200V



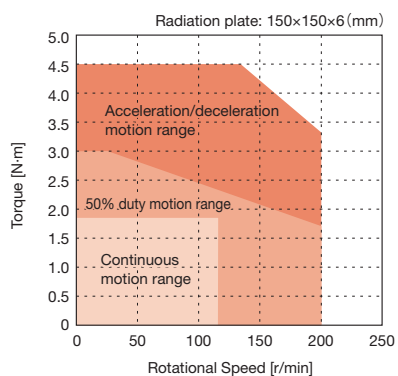
■ **FHA-11C-50** Input voltage: 200V



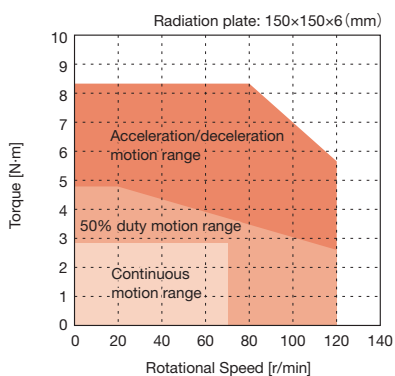
■ **FHA-11C-100** Input voltage: 200V



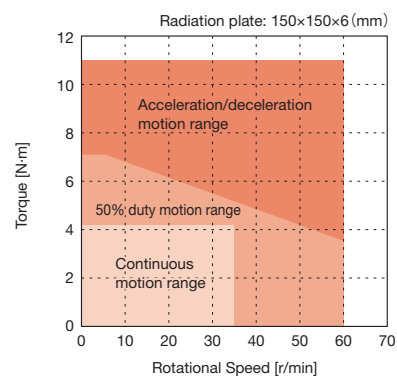
■ **FHA-11C-30** Input voltage: 24V



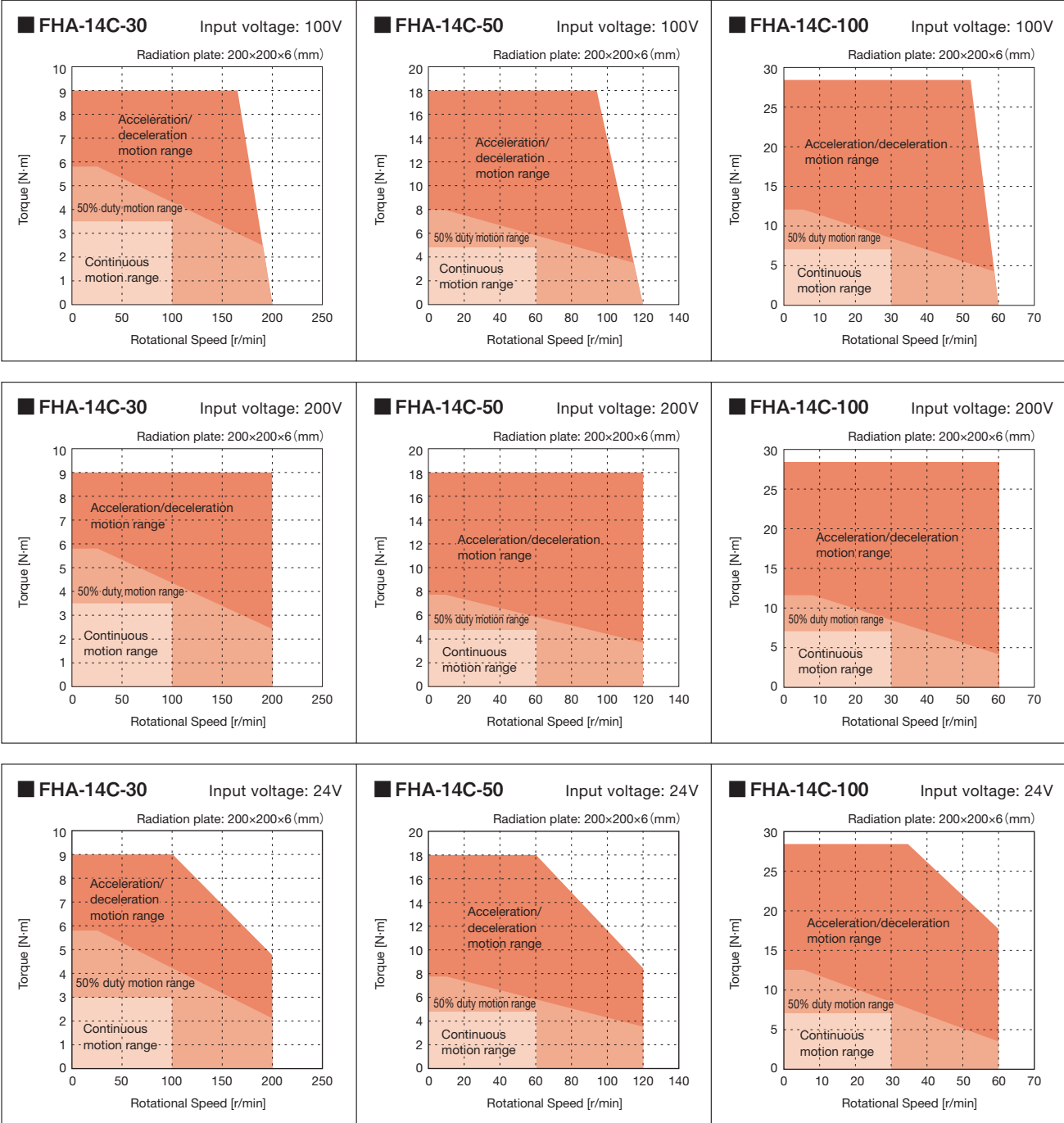
■ **FHA-11C-50** Input voltage: 24V



■ **FHA-11C-100** Input voltage: 24V



## Operable Range



Rotary Actuator

Direct Drive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

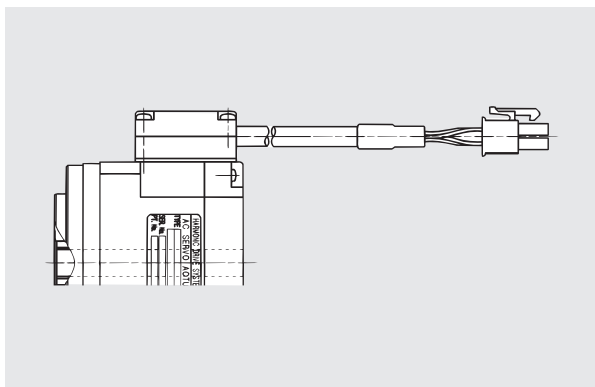
## Options

### Rear Lead-out of Cable

Order Code Example:

FHA-11C-50-E200-CK

The cable lead-out direction of the actuator can be changed to the rear.



### Relay Cable

Order Code Example:

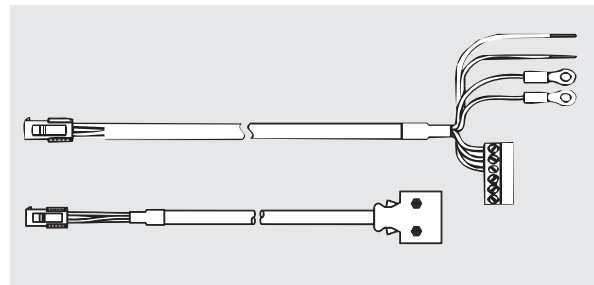
EWC-M \* \* -A06-TN3 (For motor HA-800)

EWC-MB \* \* -A06-TN2 (For motor HA-680)

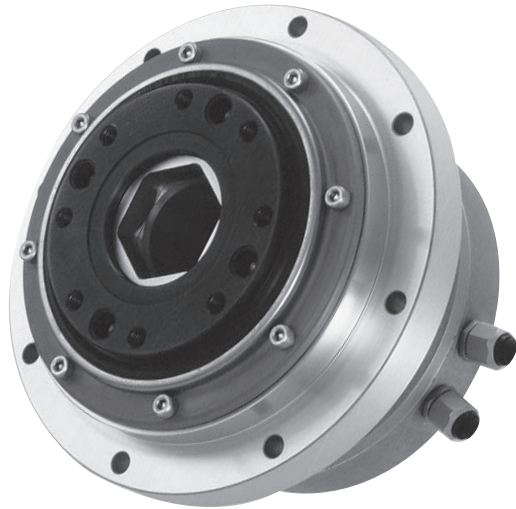
EWC-E \* \* -M06-3M14 (For incremental encoder)

EWD-S \* \* -A08-3M14 (For absolute encoder)

The cable for connecting the actuator to the servo driver. Standard cable lengths are 3, 5 and 10m.



# FHA-C Series



The FHA-C series comprises AC servo actuators that integrate a thin speed reducer HarmonicDrive® for precision control and a super flat AC servo motor. The FHA-C series features a thin and compact hollow body unmatched by rivals. The structures of entire machines and equipment can be simplified by passing wires, pipes and laser beams through a hole in the center of the actuator.

The dedicated drivers in the HA-800 series are the servo drivers for positional and speed control developed exclusively for driving the FHA-C series. The FHA-C series is an optimum selection for driving robot articulation, alignment mechanisms of semiconductor and liquid crystal panel manufacturing systems, ATC drive of machine tools, printing rollers and factory automation equipment.



## Features

### ■ Slim line body

The slim line body is achieved by integrating a thin speed reducer HarmonicDrive® for precision control and an ultra flat AC servo motor. The length from the face of the mounting flange to the end of an actuator is less than 1/2 and about 30% shorter in terms of total length compared with the conventional AC servo actuator included in Harmonic Drive Systems. This thin thickness drastically downsizes the machine or equipment that is driven.

### ■ Hollow Structure

Wires, pipes and laser beams can be passed through the hole in the center of the actuator for the supply of energy to and exchange of signals with operating units of machines and equipment to simplify their structures.

### ■ High output torque

The thin speed reducer HarmonicDrive® for precision control assures a very high output torque compared with direct drive by a motor of the same size. The FHA-C series boosts the maximum torque further compared with conventional models.

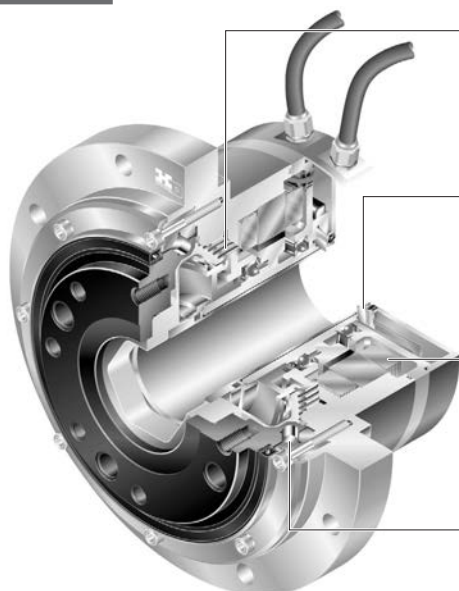
### ■ High positional accuracy

Ultra high accuracy. Detector resolution 1600000 pulses/revolution (0.000225°/pulse), uni-direction positional accuracy 40s (FHA-17C-100/160) and 30s (FHA-25C/32C/40C-100/160).

### ■ High torsional stiffness

HarmonicDrive® CSD series featuring high stiffness is integrated.

## Structure



### Speed reducer HarmonicDrive® for precision control

Precision positioning and high efficiency. Unmatched compactness and high torque capacity.

### High-precision hollow shaft rotary encoder

High reliability through a module with an integrated light injector/detector and ambience-resistance design.

### Flat AC servo motor with a hollow shaft

A totally flat body has been achieved by developing a motor containing a high-density, optimum magnetic circuit.

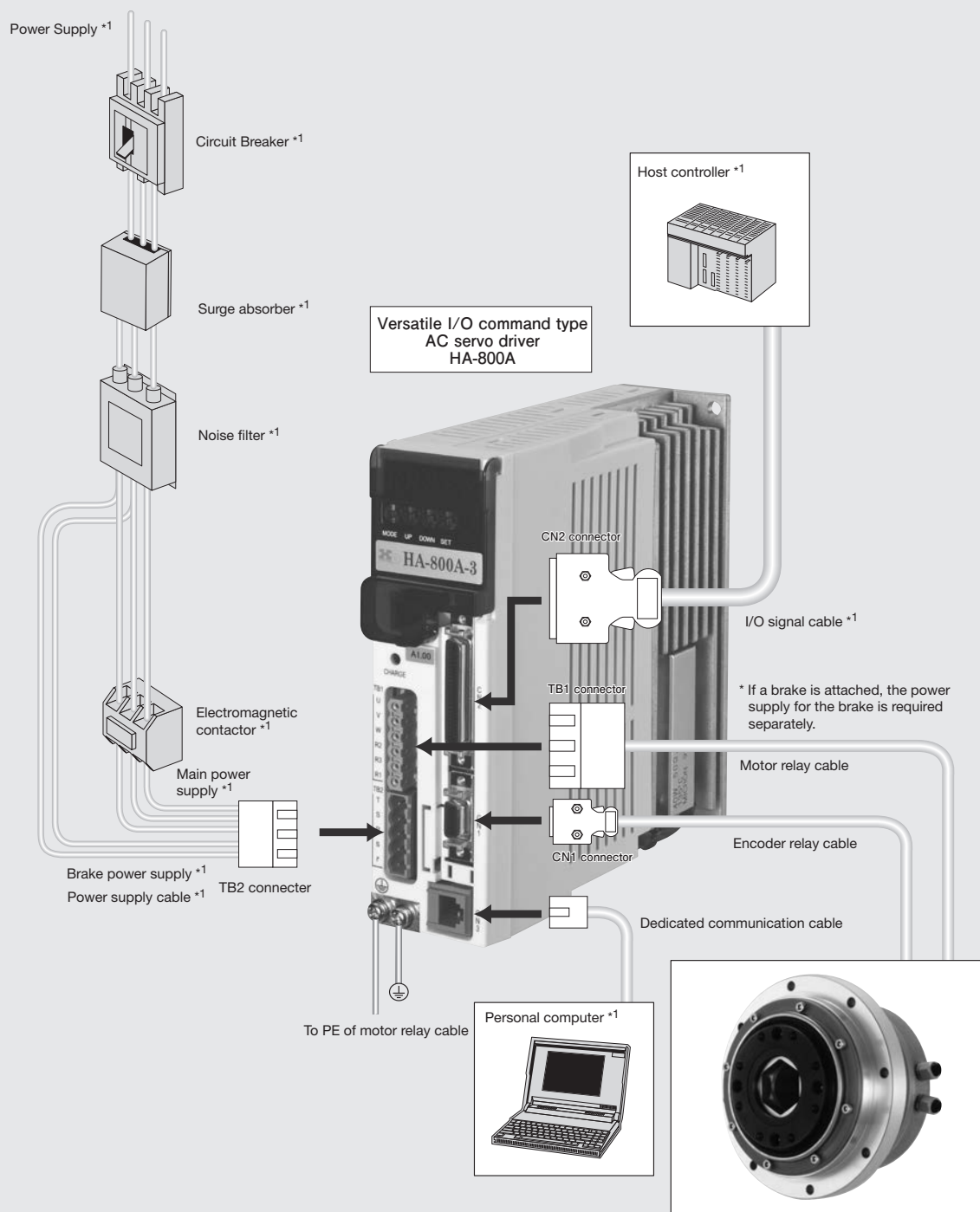
### High-precision, high load sustaining bearing

A crossed roller bearing directly integrated with an output shaft sustains a large load. High precision is assured through surface and axial runouts.

## Example of System Configuration

Examples of system configuration of FHA-C actuator, HA-800 driver, and relay cable are illustrated.

### Versatile I/O command type System configuration



#### Notes:

Starred ( \*1 ) items are to be supplied by the customer.

\* See the technical information for the details of configuration related to power supply.



## Models and Symbols

**FHA** - **17** **C** - **50** - **E250** - **□**

Type: AC servo actuator FHA-C series

Model Nos.: 17, 25, 32 or 40

Version symbol

HarmonicDrive® reduction ratios: 50, 80, 100, 120 and 160

Encoder type and resolution

|      |                     |           |
|------|---------------------|-----------|
| E250 | Incremental encoder | 2500p/rev |
|------|---------------------|-----------|

Option symbols: see page 57 for details of option symbols

Note: Please contact Harmonic Drive Systems when the options are combined.

## Specification

| Model<br>Item                                 |                    |                      | FHA-17C                                                                                                                                                                                                                                                                                                                                                                                                   |         |         |         |                     | FHA-25C |         |         |         |                     | FHA-32C   |         |         |         |                      | FHA-40C |         |         |         |       |      |
|-----------------------------------------------|--------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|---------------------|---------|---------|---------|---------|---------------------|-----------|---------|---------|---------|----------------------|---------|---------|---------|---------|-------|------|
|                                               |                    |                      | 50                                                                                                                                                                                                                                                                                                                                                                                                        | 80      | 100     | 120     | 160                 | 50      | 80      | 100     | 120     | 160                 | 50        | 80      | 100     | 120     | 160                  | 50      | 80      | 100     | 120     | 160   |      |
| Maximum Torque <sup>-2</sup>                  |                    |                      | N·m                                                                                                                                                                                                                                                                                                                                                                                                       | 39      | 51      | 57      | 60                  | 64      | 150     | 213     | 230     | 247                 | 260       | 281     | 364     | 398     | 432                  | 453     | 500     | 659     | 690     | 756   | 820  |
|                                               |                    |                      | kgf·m                                                                                                                                                                                                                                                                                                                                                                                                     | 4.0     | 5.2     | 5.8     | 6.1                 | 6.5     | 15.3    | 21.7    | 23.5    | 25.2                | 26.5      | 28.7    | 37.1    | 40.6    | 44.1                 | 46.2    | 51.0    | 67.2    | 70.4    | 77.1  | 83.7 |
| Max. Rotational Speed                         |                    |                      | r/min                                                                                                                                                                                                                                                                                                                                                                                                     | 96      | 60      | 48      | 40                  | 30      | 90      | 56      | 45      | 37                  | 28        | 80      | 50      | 40      | 33                   | 25      | 70      | 43      | 35      | 29    | 22   |
| Torque Constant                               |                    |                      | N·m/A                                                                                                                                                                                                                                                                                                                                                                                                     | 21      | 33      | 42      | 50                  | 67      | 22      | 36      | 45      | 54                  | 72        | 27      | 43      | 54      | 64                   | 86      | 31      | 51      | 64      | 76    | 102  |
|                                               |                    |                      | kgf·m/A                                                                                                                                                                                                                                                                                                                                                                                                   | 2.1     | 3.4     | 4.3     | 5.1                 | 6.8     | 2.3     | 3.7     | 4.6     | 5.5                 | 7.3       | 2.8     | 4.4     | 5.5     | 6.5                  | 8.8     | 3.2     | 5.2     | 6.5     | 7.8   | 10.4 |
| Maximum Current <sup>-2</sup>                 |                    |                      | A                                                                                                                                                                                                                                                                                                                                                                                                         | 2.1     | 1.7     | 1.6     | 1.4                 | 1.1     | 7.3     | 6.4     | 5.6     | 5.0                 | 4.0       | 11.4    | 9.2     | 8.0     | 7.4                  | 5.9     | 17.3    | 14.0    | 11.8    | 10.9  | 9.0  |
| Moment of Inertia <sup>-3</sup>               | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.17                                                                                                                                                                                                                                                                                                                                                                                                      | 0.43    | 0.67    | 0.97    | 1.7                 | 0.81    | 2.1     | 3.2     | 4.7     | 8.3                 | 1.8       | 4.5     | 7.1     | 10.2    | 18.1                 | 4.9     | 12.5    | 19.5    | 28.1    | 50    |      |
|                                               | J                  | kgf·cms <sup>2</sup> | 1.7                                                                                                                                                                                                                                                                                                                                                                                                       | 4.4     | 6.9     | 10      | 17                  | 8.3     | 21      | 33      | 48      | 85                  | 18        | 46      | 72      | 104     | 185                  | 50      | 128     | 200     | 287     | 510   |      |
| Reduction Ratio                               |                    |                      | 1:50                                                                                                                                                                                                                                                                                                                                                                                                      | 1:80    | 1:100   | 1:120   | 1:160               | 1:50    | 1:80    | 1:100   | 1:120   | 1:160               | 1:50      | 1:80    | 1:100   | 1:120   | 1:160                | 1:50    | 1:80    | 1:100   | 1:120   | 1:160 |      |
| Permissible Radial Load                       | kN                 | 2.9                  |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 4.9                 |         |         |         |         | 9.5                 |           |         |         |         | 14.7                 |         |         |         |         |       |      |
|                                               | kgf                | 300                  |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 500                 |         |         |         |         | 970                 |           |         |         |         | 1500                 |         |         |         |         |       |      |
| Permissible Thrust Load                       | kN                 | 9.8                  |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 14.7                |         |         |         |         | 24.5                |           |         |         |         | 39.2                 |         |         |         |         |       |      |
|                                               | kgf                | 1000                 |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 1500                |         |         |         |         | 2500                |           |         |         |         | 4000                 |         |         |         |         |       |      |
| Permissible Moment Load                       | N·m                | 188                  |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 370                 |         |         |         |         | 530                 |           |         |         |         | 690                  |         |         |         |         |       |      |
|                                               | kgf·m              | 19                   |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 38                  |         |         |         |         | 54                  |           |         |         |         | 70                   |         |         |         |         |       |      |
| Moment Stiffness                              | N·m/rad            | 220×10 <sup>3</sup>  |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 490×10 <sup>3</sup> |         |         |         |         | 790×10 <sup>3</sup> |           |         |         |         | 1400×10 <sup>3</sup> |         |         |         |         |       |      |
|                                               | kgf·m/arc·min      | 6.5                  |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 15                  |         |         |         |         | 23                  |           |         |         |         | 42                   |         |         |         |         |       |      |
| Output shaft Resolution (At x4) <sup>-4</sup> | Pulses/revolution  | 500000               | 800000                                                                                                                                                                                                                                                                                                                                                                                                    | 1000000 | 1200000 | 1600000 | 500000              | 800000  | 1000000 | 1200000 | 1600000 | 500000              | 800000    | 1000000 | 1200000 | 1600000 | 500000               | 800000  | 1000000 | 1200000 | 1600000 |       |      |
| Input Power Supply Voltage                    | V                  | AC200                |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | AC200               |         |         |         |         | AC200               |           |         |         |         | AC200                |         |         |         |         |       |      |
| Mass                                          | kg                 | 2.5                  |                                                                                                                                                                                                                                                                                                                                                                                                           |         |         |         | 4.0                 |         |         |         |         | 6.5                 |           |         |         |         | 12                   |         |         |         |         |       |      |
| Protection Structure                          |                    |                      | Totally enclosed self-cooled type (IP44)                                                                                                                                                                                                                                                                                                                                                                  |         |         |         |                     |         |         |         |         |                     |           |         |         |         |                      |         |         |         |         |       |      |
| Environmental Conditions                      |                    |                      | Operating temperature 0 to 40°C / storage temperature -20 to 60°C    Operating / storage humidity 20 to 80% RH (do not expose to condensation). Insulation resistance 100MΩ (DC500V), dielectric strength AC1500V/1 min<br>Never expose to dust, metal powder, corrosive gas, inflammable gas or oil mist.<br>For indoor use only. Do not expose to direct sunlight. Use at an altitude of 1000m or less. |         |         |         |                     |         |         |         |         |                     |           |         |         |         |                      |         |         |         |         |       |      |
| Mounting Direction                            |                    |                      | All directions                                                                                                                                                                                                                                                                                                                                                                                            |         |         |         |                     |         |         |         |         |                     |           |         |         |         |                      |         |         |         |         |       |      |
| Safety Standard Compliance                    |                    |                      | CE Marking and UL standards                                                                                                                                                                                                                                                                                                                                                                               |         |         |         |                     |         |         |         |         |                     |           |         |         |         |                      |         |         |         |         |       |      |
| Combined Driver                               |                    |                      | HA-800-3C                                                                                                                                                                                                                                                                                                                                                                                                 |         |         |         |                     |         |         |         |         |                     | HA-800-6C |         |         |         |                      |         |         |         |         |       |      |

\* 1: The aforementioned values are those at the output shaft.

\* 2: Values in combination with HA-800 servo driver.

\* 3: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the HarmonicDrive®.

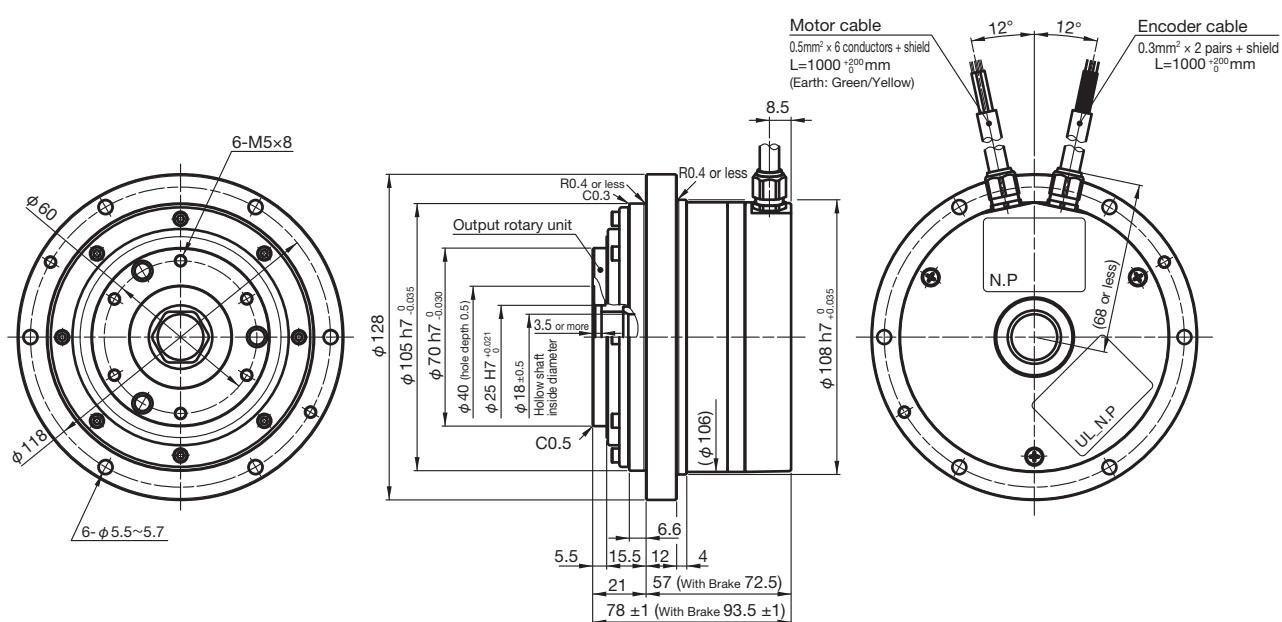
\* 4: Detector resolution is calculated by (Motor shaft encoder resolution) x 4 x (Reduction ratio).

\* 5: Please check the actuator rotation direction in our technical data sheet.

## External Dimensions

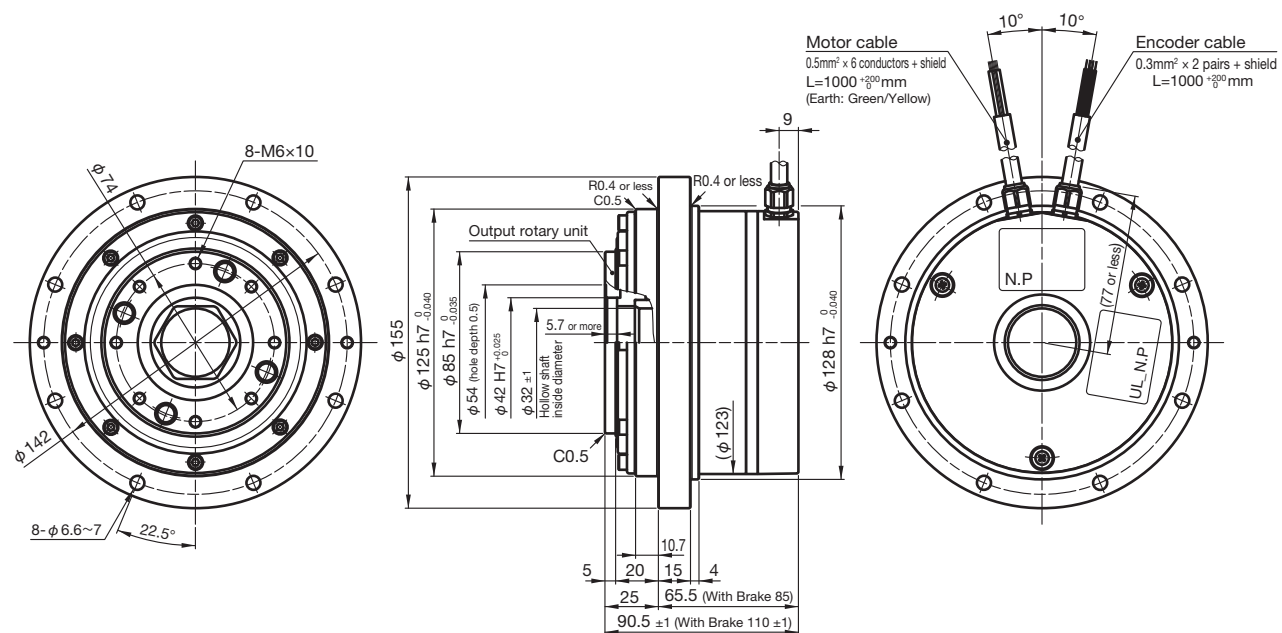
### ■FHA-17C

Unit: mm



### ■FHA-25C

Unit: mm



Note: The motor cable (6 conductors) contains yellow and blue wires for the brake.

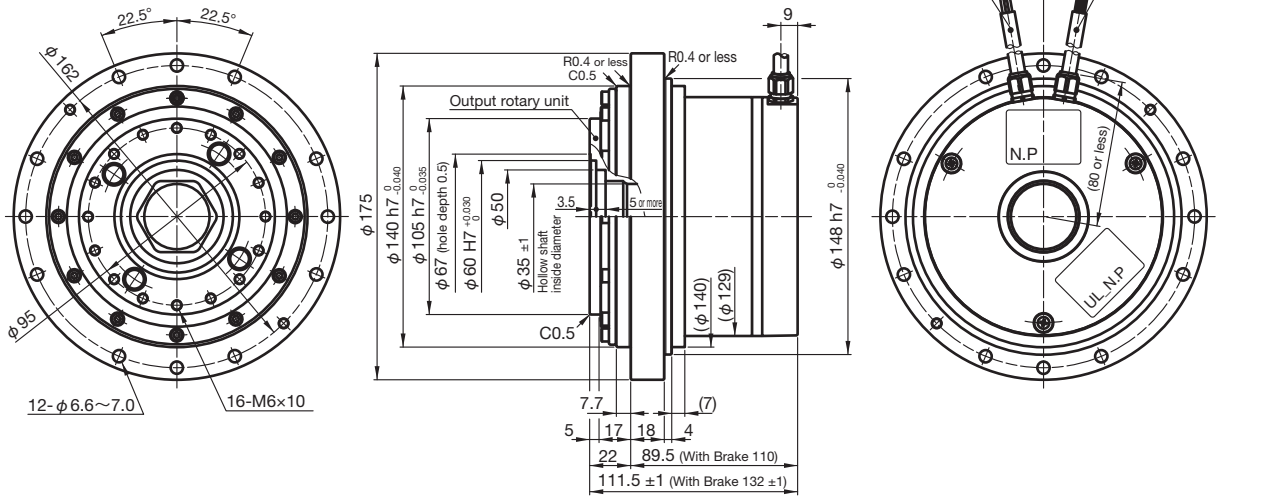
\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles). Contact us for the differential range of the size that is not described.

## External Dimensions

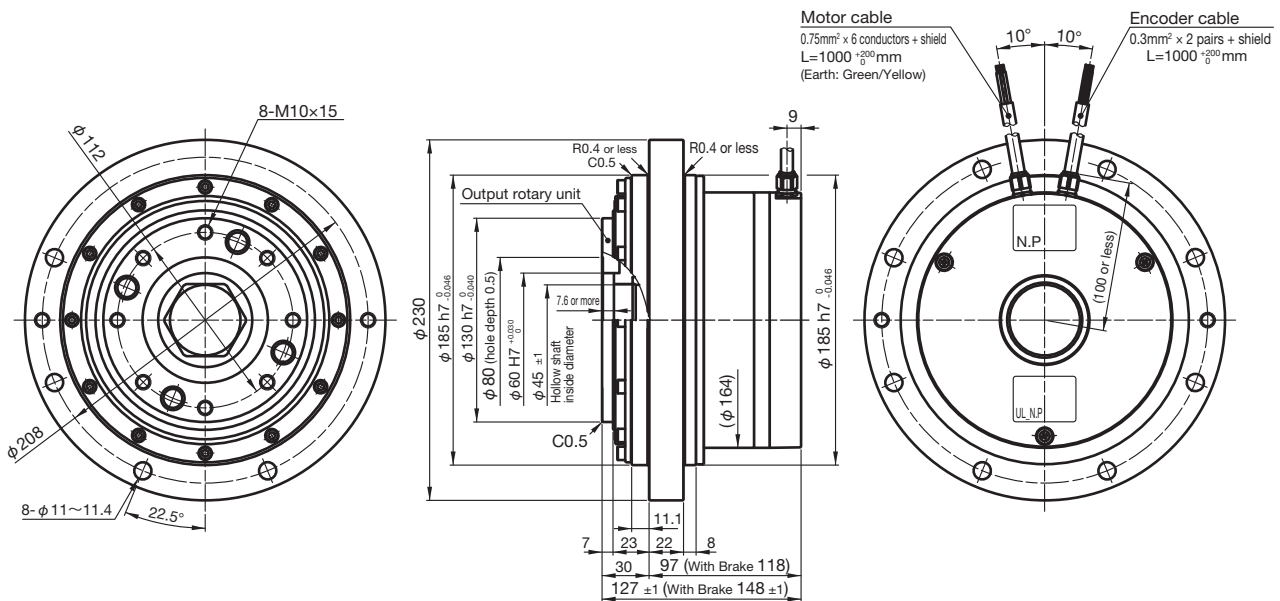
### ■FHA-32C

Unit: mm



### ■FHA-40C

Unit: mm



Note: The motor cable (6 conductors) contains yellow and blue wires for the brake.

\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

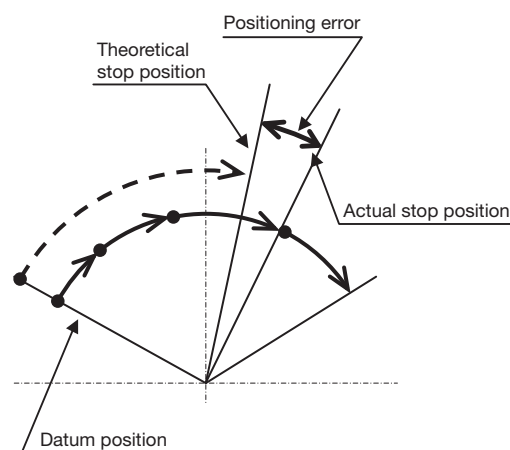
\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).

Contact us for the differential range of the size that is not described.

## Uni-directional Positional Accuracy

The “uni-directional positional accuracy” represents the maximum difference in a single revolution among differences between an angle actually rotated from the datum position and one that is supposed to turn in each position by repeating sequential positioning in a preset rotational direction. (Source: JIS [Japanese Industrial Standards] B-6201-1987).

The FHA-C series contains a speed reducer HarmonicDrive® for precision control and positioning errors of the motor shaft are therefore compressed to 1/50 to 1/160 by speed reduction. In reality, angular transmission errors of the speed reducer determine the uni-directional positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown as the uni-directional positional accuracy of the FHA-C series.



## “Uni-directional Positional Accuracies” of Models

| Model                               |         | FHA-17C               |                       |                       |                       |                       | FHA-25C               |                       |                       |                       |                       | FHA-32C               |                       |                       |                       |                       | FHA-40C               |                       |                       |                       |                       |
|-------------------------------------|---------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                     |         | 50                    | 80                    | 100                   | 120                   | 160                   | 50                    | 80                    | 100                   | 120                   | 160                   | 50                    | 80                    | 100                   | 120                   | 160                   | 50                    | 80                    | 100                   | 120                   | 160                   |
| Uni-directional Positional Accuracy | arc-sec | 60                    | 40                    | 40                    | 40                    | 40                    | 40                    | 30                    | 30                    | 30                    | 30                    | 40                    | 30                    | 30                    | 30                    | 30                    | 40                    | 30                    | 30                    | 30                    | 30                    |
|                                     | rad     | $2.91 \times 10^{-4}$ | $1.94 \times 10^{-4}$ | $1.94 \times 10^{-4}$ | $1.94 \times 10^{-4}$ | $1.94 \times 10^{-4}$ | $1.94 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.94 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.94 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ | $1.46 \times 10^{-4}$ |

## Mechanical Accuracy

The mechanical accuracies of the output shaft and mounting flange of the actuators in the FHA-C series are as follows.

### Mechanical Accuracy

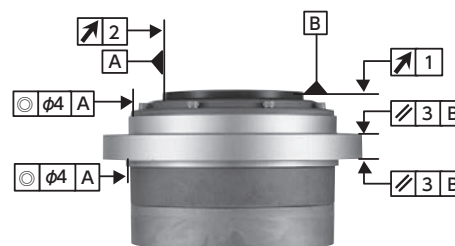
Unit: mm

| Accuracy Item                                              | FHA-17C | FHA-25C | FHA-32C | FHA-40C |
|------------------------------------------------------------|---------|---------|---------|---------|
| 1 Output shaft surface runout                              | 0.010   | 0.012   | 0.012   | 0.014   |
| 2 Output shaft axial runout                                | 0.010   | 0.012   | 0.012   | 0.014   |
| 3 Parallelism between the output shaft and mounted surface | 0.040   | 0.050   | 0.050   | 0.060   |
| 4 Concentricity between the output shaft and fitting part  | 0.040   | 0.050   | 0.050   | 0.060   |

Note:

See the technical information for the measuring method.

The aforementioned values are T.I.R (total indicator reading) values.



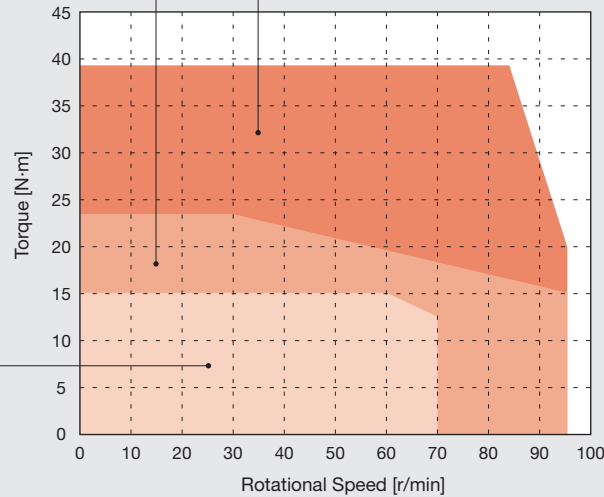
## Operable Range

The following diagrams show the operable range of the FHA-C series (combined with HA-800 servo driver).

■ **50% duty motion range**  
Range of torque-rotational speed operable at 50% duty (ratio between operational and standby hours is 50:50)

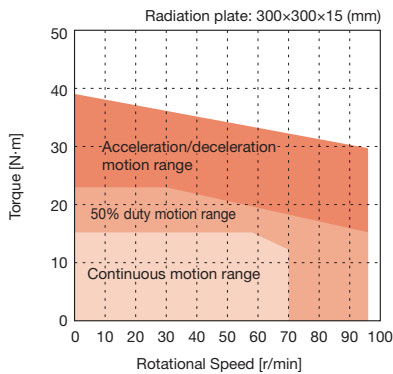
■ **Motion range during acceleration and deceleration**  
Range of torque-rotational speed that is operable momentarily. Normally, this range is used during acceleration and deceleration.

■ **Continuous motion range**  
Range of continuously operable torque- rotational speed.

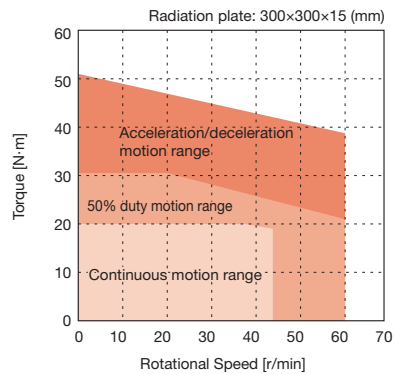


Note 1: Motion ranges for continuous motion and that at 50% duty are the values when the radiation plate mentioned in the graphs is mounted.  
Note 2: See the technical information for selection of a model No.

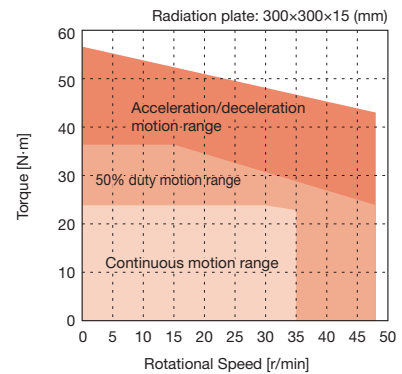
■ **FHA-17C-50** Input voltage: 200V



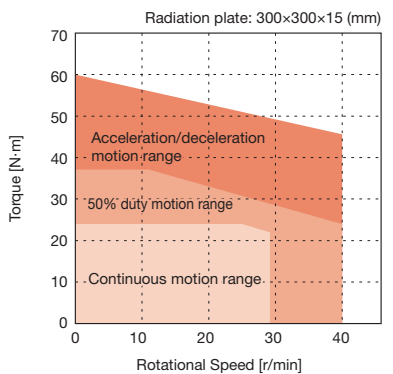
■ **FHA-17C-80** Input voltage: 200V



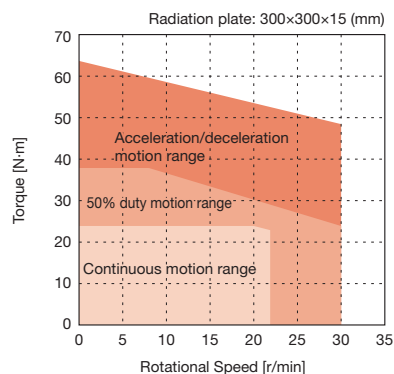
■ **FHA-17C-100** Input voltage: 200V



■ **FHA-17C-120** Input voltage: 200V

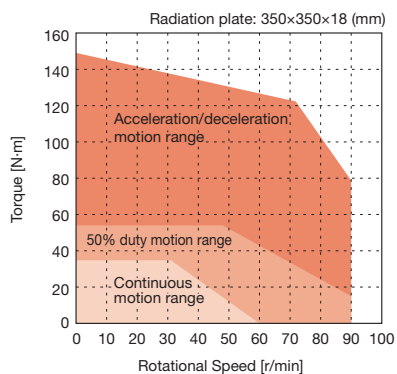


■ **FHA-17C-160** Input voltage: 200V

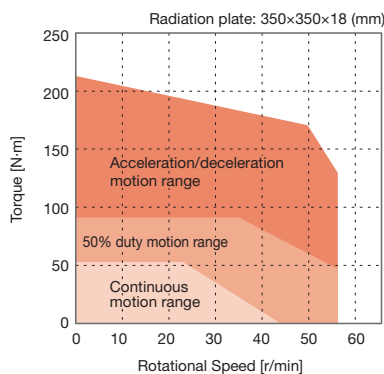


\* Refer to the manual for information on the operable range for the 100 VAC input voltage model.

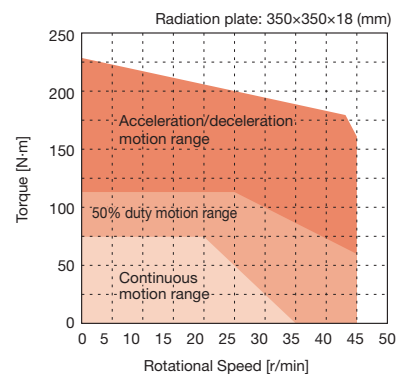
**FHA-25C-50** Input voltage: 200V



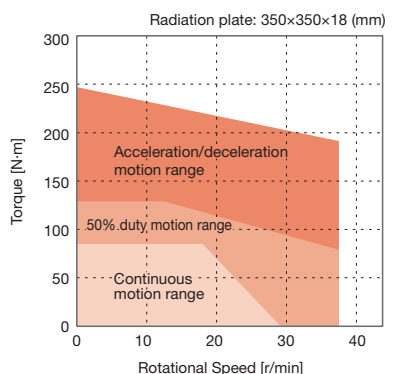
**FHA-25C-80** Input voltage: 200V



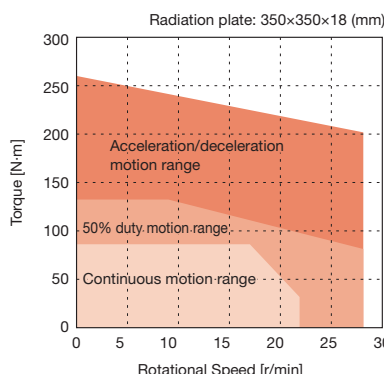
**FHA-25C-100** Input voltage: 200V



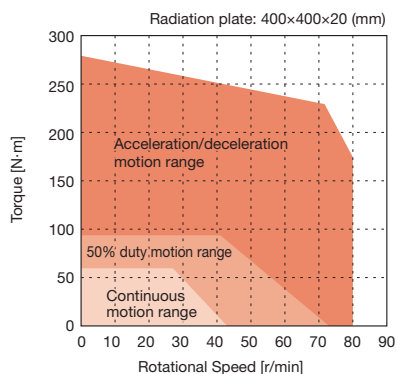
**FHA-25C-120** Input voltage: 200V



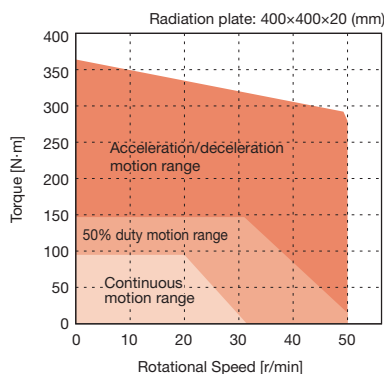
**FHA-25C-160** Input voltage: 200V



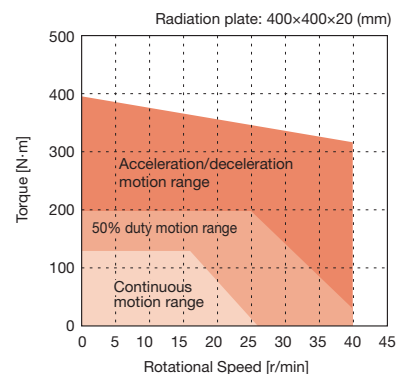
**FHA-32C-50** Input voltage: 200V



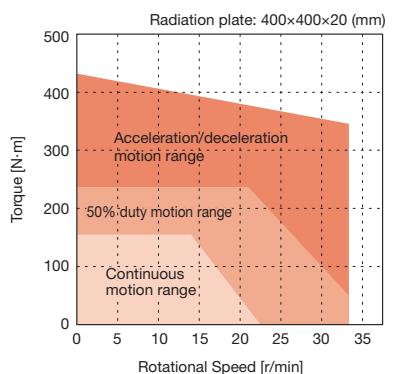
**FHA-32C-80** Input voltage: 200V



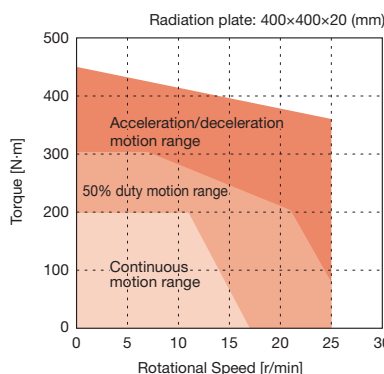
**FHA-32C-100** Input voltage: 200V



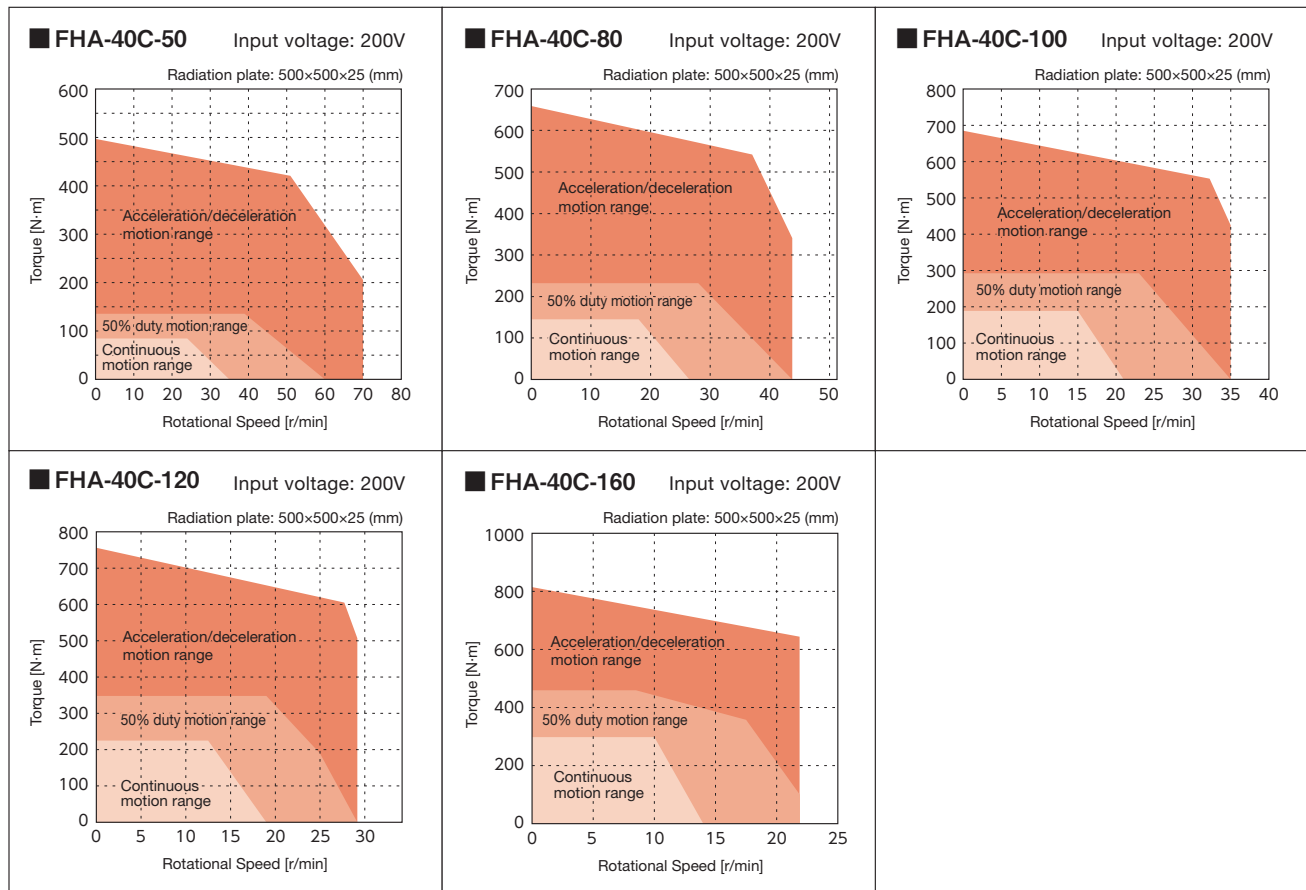
**FHA-32C-120** Input voltage: 200V



**FHA-32C-160** Input voltage: 200V



\* Refer to the manual for information on the operable range for the 100 VAC input voltage model.



\* Refer to the manual for information on the operable range for the 100 VAC input voltage model.



## Options

| Option                     |                                        | Model Symbol | FHA-17C | FHA-25C | FHA-32C | FHA-40C |
|----------------------------|----------------------------------------|--------------|---------|---------|---------|---------|
| Power Supply               | AC100V specification                   | A            | ○       | ○       | ○       | —       |
| Motor shaft brake *        | For holding                            | B            | ○       | ○       | ○       | ○       |
| Connector *                | For motor (IP-20), for encoder (IP-40) | C            | ○       | ○       | ○       | ○       |
| Cable lead-out direction * | Rear                                   | K            | ○       | ○       | ○       | ○       |
| Revolution sensor *        | Near origin and end limit sensors      | L            | ○       | ○       | ○       | ○       |
| Extension Cable            | Cable length 5m                        | F5           | ○       | ○       | ○       | ○       |
| Relay cable                | For motor                              | *            | ○       | ○       | ○       | ○       |
|                            | For encoder                            | *            | ○       | ○       | ○       | ○       |
|                            | For serial port                        | *            | ○       | ○       | ○       | ○       |

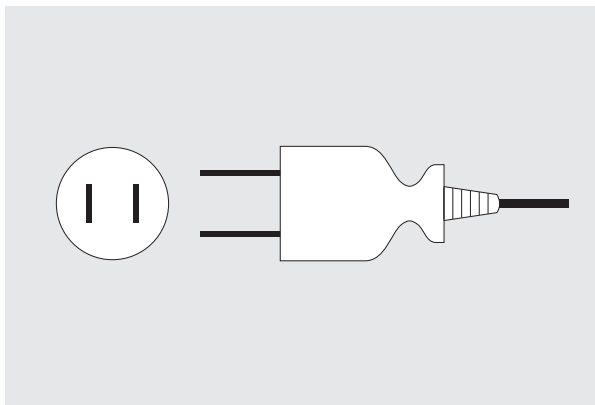
Note 1: See the following order code examples for options marked \*.

Note 2: Please contact Harmonic Drive Systems when options marked \* are combined.

### Power supply AC100V

Order Code Example: FHA-25C-50-E250-A

Actuator models FHA-17C, FHA-25C and FHA-32C can select AC100V as power supply.



### Motor Shaft Brake

Order Code Example: FHA-25C-50-E250-B

The motor shaft holding brake. The brake is a deenergized activation brake using DC24V (non-polarity) as a power supply. The holding torque at the actuator output is as follows

| Actuator Type<br>Reduction Ratio |     | FHA-17C |    |     |     |     |  | FHA-25C |    |     |     |     |  |
|----------------------------------|-----|---------|----|-----|-----|-----|--|---------|----|-----|-----|-----|--|
|                                  |     | 50      | 80 | 100 | 120 | 160 |  | 50      | 80 | 100 | 120 | 160 |  |
| Holding Torque                   | N·m | 24      | 39 | 49  | 59  | 78  |  | 49      | 79 | 98  | 118 | 157 |  |

| Actuator Type<br>Reduction Ratio |     | FHA-32C |     |     |     |     |  | FHA-40C |     |     |     |     |  |
|----------------------------------|-----|---------|-----|-----|-----|-----|--|---------|-----|-----|-----|-----|--|
|                                  |     | 50      | 80  | 100 | 120 | 160 |  | 50      | 80  | 100 | 120 | 160 |  |
| Holding Torque                   | N·m | 75      | 120 | 150 | 180 | 240 |  | 108     | 173 | 216 | 259 | 345 |  |

\* Cannot be used as a control brake.

### Motor Cable Color

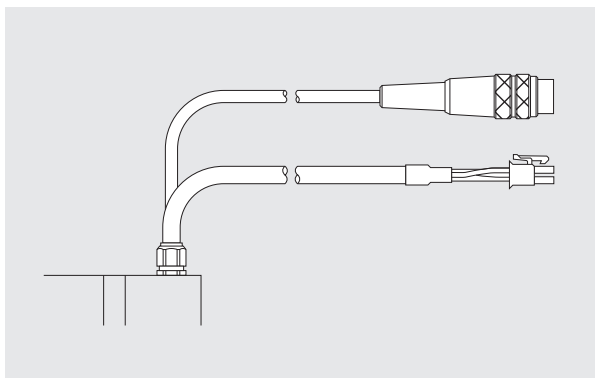
|            |              |
|------------|--------------|
| Brake wire | Yellow       |
| Brake wire | Blue         |
| U phase    | Red          |
| V phase    | White        |
| W phase    | Black        |
| PE (earth) | Green/Yellow |

The brake wires are contained in the motor cable.

### Connector

Order Code Example: FHA-25C-50-E250-C

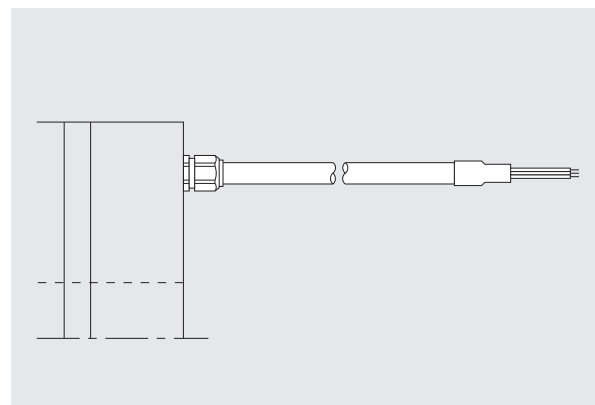
Connect a connector at the tip of the actuator cable. Use this connector with the relay cable to facilitate connection to HA-800 driver.



### Cable Rear Lead-out

Order Code Example: FHA-25C-50-E250-K

Use this option if the outside diameter for actuator mounting is insufficient.



## Options

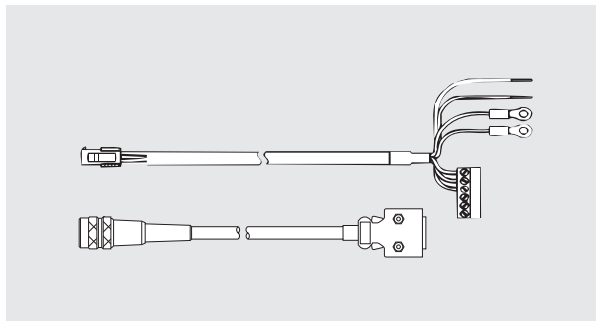
### Relay Cable

Order Code Example:

EWC-MB \*\* -M08-TN3 (For HA-800 motor)

EWC-E \*\* -B04-3M14 (For incremental encoder)

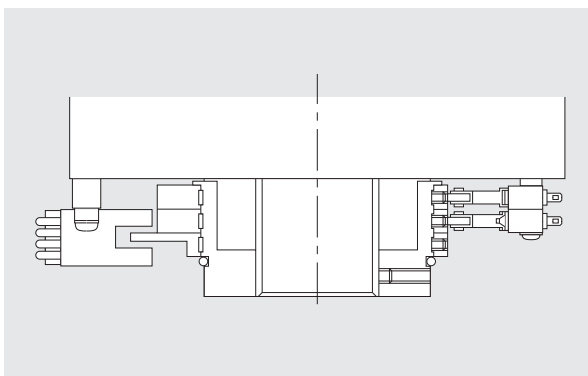
The cable for connecting the FHA-C actuator to the servo driver.  
Standard cable lengths are 3, 5 and 10m.



### Revolution Sensor (Near Origin and End Limit)

Order Code Example: FHA-25C-50-E250-L

Use this option when origin of machine operation is required and when fixation of operation range is required to take safety measures. Revolution sensor is directly coupled to the output shaft and mounted to the non-output side.



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

# RKF Series



The RKF series is compact and includes high-torque AC servo actuators with high rotational accuracy and flange output combining a speed reducer HarmonicDrive® for precision control and an AC servo motor. This is combined with a dedicated servo driver that fully demonstrates the performance of this RKF series of implements; compact machines and equipment with a high rotational accuracy.

## Features

### ■ High resolution

High resolution of maximum 800,000 pulses / revolution (0.00045°/pulse) using a HarmonicDrive®.

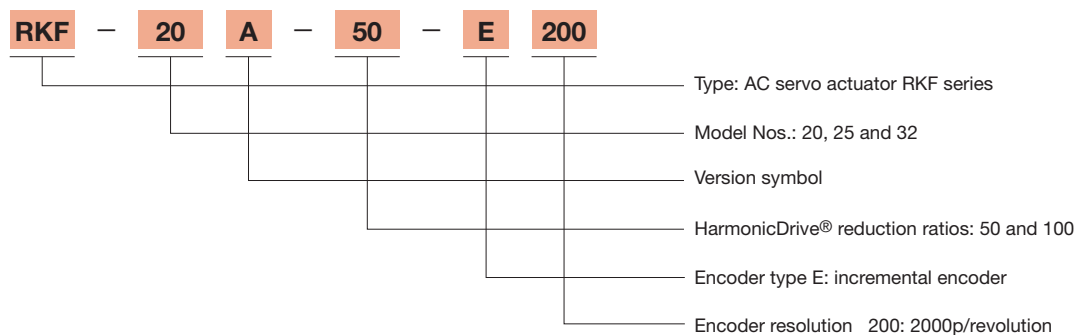
### ■ High positional accuracy

The HarmonicDrive® eliminates backlash caused by gear play, ensuring high-accuracy positioning.

### ■ Easy-to-operate dedicated driver

A dedicated driver is set with parameters for a combined actuator. Host system parameters and control parameters can be easily set on a 7-segment LED display.

## Models and Symbols



## Specification

|                      |                  |                        |                               |                   |                                        |
|----------------------|------------------|------------------------|-------------------------------|-------------------|----------------------------------------|
| Time rating:         | Continuous       | Insulation resistance: | DC500V 100M ohm or higher     | Ambient humidity: | 20 to 80% (no condensation)            |
| Excitation method:   | Permanent magnet | Structure:             | Totally enclosed, self-cooled | Lubricant:        | Grease (Harmonic grease <sup>®</sup> ) |
| Insulation class:    | Class B          | Ambient temperature:   | 0 to 40°C                     |                   |                                        |
| Dielectric strength: | AC1000V/min      | Storage temperature:   | -20°C to +60°C                |                   |                                        |

| Item                                      |                    | Model                | RKF-20A       |        | RKF-25A       |        | RKF-32A       |        |
|-------------------------------------------|--------------------|----------------------|---------------|--------|---------------|--------|---------------|--------|
|                                           |                    |                      | 50            | 100    | 50            | 100    | 50            | 100    |
| Rated Output <sup>-3</sup>                | W                  |                      | 120           | 111    | 180           | 190    | 310           | 310    |
| Input Power Supply <sup>-3</sup>          | V                  |                      | AC200         |        |               |        |               |        |
| Rated Torque <sup>-3</sup>                | N·m                |                      | 19            | 35     | 29            | 59     | 49            | 98     |
|                                           | kgf·cm             |                      | 190           | 360    | 300           | 600    | 500           | 1000   |
| Rated Rotational Speed <sup>-3</sup>      | r/min              |                      | 60            | 30     | 60            | 30     | 60            | 30     |
| Continuous Stall Torque <sup>-3</sup>     | N·m                |                      | 19            | 35     | 29            | 59     | 49            | 98     |
|                                           | kgf·cm             |                      | 190           | 360    | 300           | 600    | 500           | 1000   |
| Maximum Momentary Torque <sup>-3</sup>    | N·m                |                      | 56            | 82     | 98            | 157    | 220           | 330    |
|                                           | kgf·cm             |                      | 570           | 840    | 1000          | 1600   | 2200          | 3400   |
| Max. Rotational Speed <sup>-3</sup>       | r/min              |                      | 90            | 45     | 90            | 45     | 90            | 45     |
| Moment of Inertia <sup>-4</sup>           | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.098         | 0.39   | 0.19          | 0.77   | 0.67          | 2.7    |
|                                           | J                  | kgf·cms <sup>2</sup> | 1.0           | 4.0    | 2.0           | 7.9    | 6.9           | 27     |
| Reduction Ratio                           |                    |                      | 50            | 100    | 50            | 100    | 50            | 100    |
| Permissible Radial Load                   | N                  |                      | 2000          |        | 2500          |        | 3900          |        |
|                                           | kgf                |                      | 200           |        | 250           |        | 400           |        |
| Permissible Thrust Load                   | N                  |                      | 880           |        | 1100          |        | 1600          |        |
|                                           | kgf                |                      | 90            |        | 110           |        | 160           |        |
| Detector Resolution (At x4) <sup>-5</sup> | Pulses/revolution  |                      | 400000        | 800000 | 400000        | 800000 | 400000        | 800000 |
| Mass                                      | kg                 |                      | 2.9           |        | 5.0           |        | 9.5           |        |
| Combined Driver                           |                    |                      | HA-800-3B-200 |        | HA-800-3B-200 |        | HA-800-6B-200 |        |

\* 1: The aforementioned values are those at the output shaft including the HarmonicDrive<sup>®</sup> efficiency.

\* 2: The actuator specification is the value when mounted on the following aluminum radiation plate:

RKF-20: 250 x 250 x 12mm

RKF-25, RKF-32: 300 x 300 x 15mm

\* 3: The values are those on temperature rise saturation. The other values are those at 20°C.

\* 4: The moment of inertia is the total of the inertia moments of the motor shaft and HarmonicDrive<sup>®</sup> converted into the output shaft side.

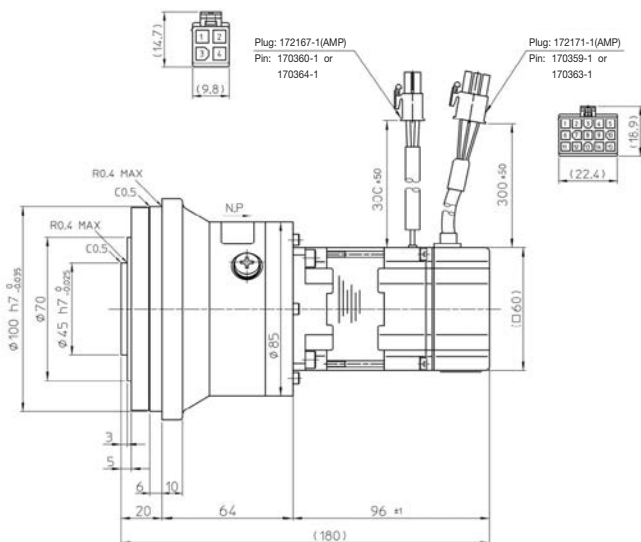
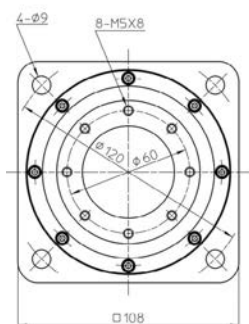
\* 5: Output shaft resolution is calculated using (Motor shaft encoder resolution) 4 x (Reduction ratio).

\* 6: Please check the actuator rotation direction in our technical data sheet.

## External Dimensions

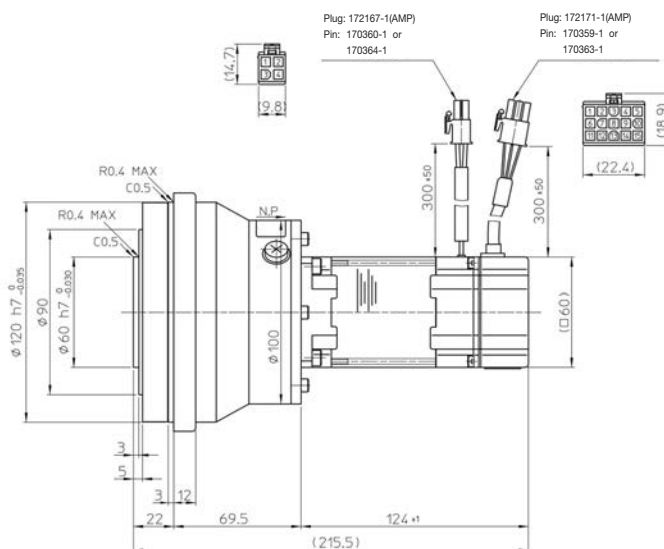
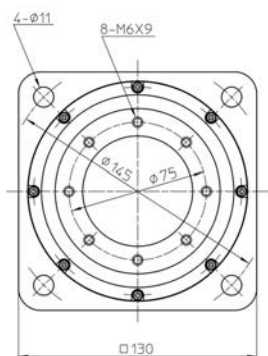
### ■ RKF-20A

Unit: mm



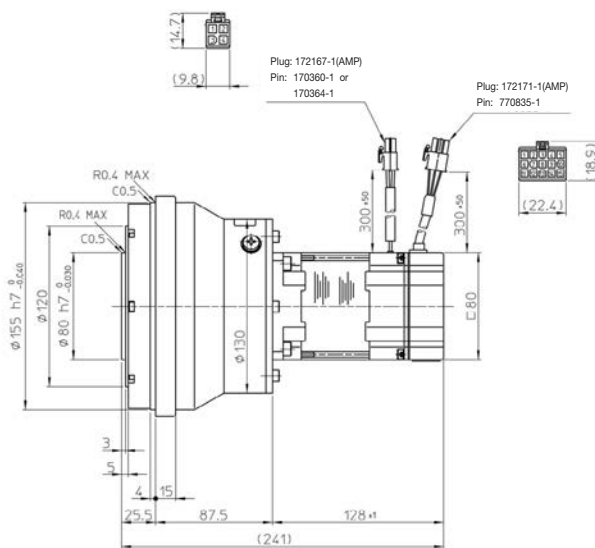
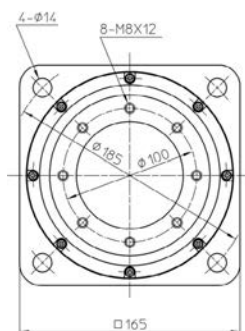
### ■ RKF-25A

Unit: mm



### ■ RKF-32A

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
Contact us for the differential range of the size that is not described.

## Positional Accuracy

The “uni-directional positional accuracy” and “repeatability” are shown below. The following values represent typical values. (Source: JIS [Japanese Industrial Standards] B-6201-1987).

The RKF series contains a speed reducer HarmonicDrive® for precision control and positioning errors of the motor shaft are therefore compressed to 1/50 or 1/100 through speed reduction. In reality, angular transmission errors of the speed reducer determine the positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown as the positional accuracies of the RKF Series.

| Model                               |         | RKF-20A                   | RKF-25A                   | RKF-32A                   |
|-------------------------------------|---------|---------------------------|---------------------------|---------------------------|
| Uni-directional Positional Accuracy | arc-sec | 90                        | 90                        | 90                        |
|                                     | rad     | $4.35 \times 10^{-4}$     | $4.35 \times 10^{-4}$     | $4.35 \times 10^{-4}$     |
| Repeatability                       | arc-sec | ±30                       | ±25                       | ±20                       |
|                                     | rad     | $\pm 1.46 \times 10^{-4}$ | $\pm 1.21 \times 10^{-4}$ | $\pm 0.97 \times 10^{-4}$ |

<Measurement conditions, Load: no load, rotational speed: rated value>

## Mechanical Accuracy

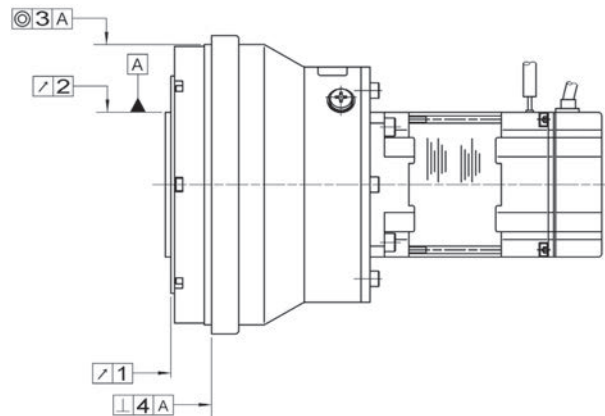
The mechanical accuracies of the output shaft and mounting flange of the RKF series are as follows.

### Mechanical Accuracy

(Unit: mm)

| Accuracy Item                                                          | RKF-20A | RKF-25A | RKF-32A |
|------------------------------------------------------------------------|---------|---------|---------|
| 1 Output shaft surface runout                                          | 0.04    | 0.04    | 0.04    |
| 2 Output shaft end runout                                              | 0.04    | 0.04    | 0.04    |
| 3 Eccentricity of flange fitting outside diameter                      | 0.06    | 0.06    | 0.06    |
| 4 Perpendicularity between surface of mounting flange and output shaft | 0.06    | 0.06    | 0.06    |

Note: The aforementioned values are T.I.R (total indicator reading) values.

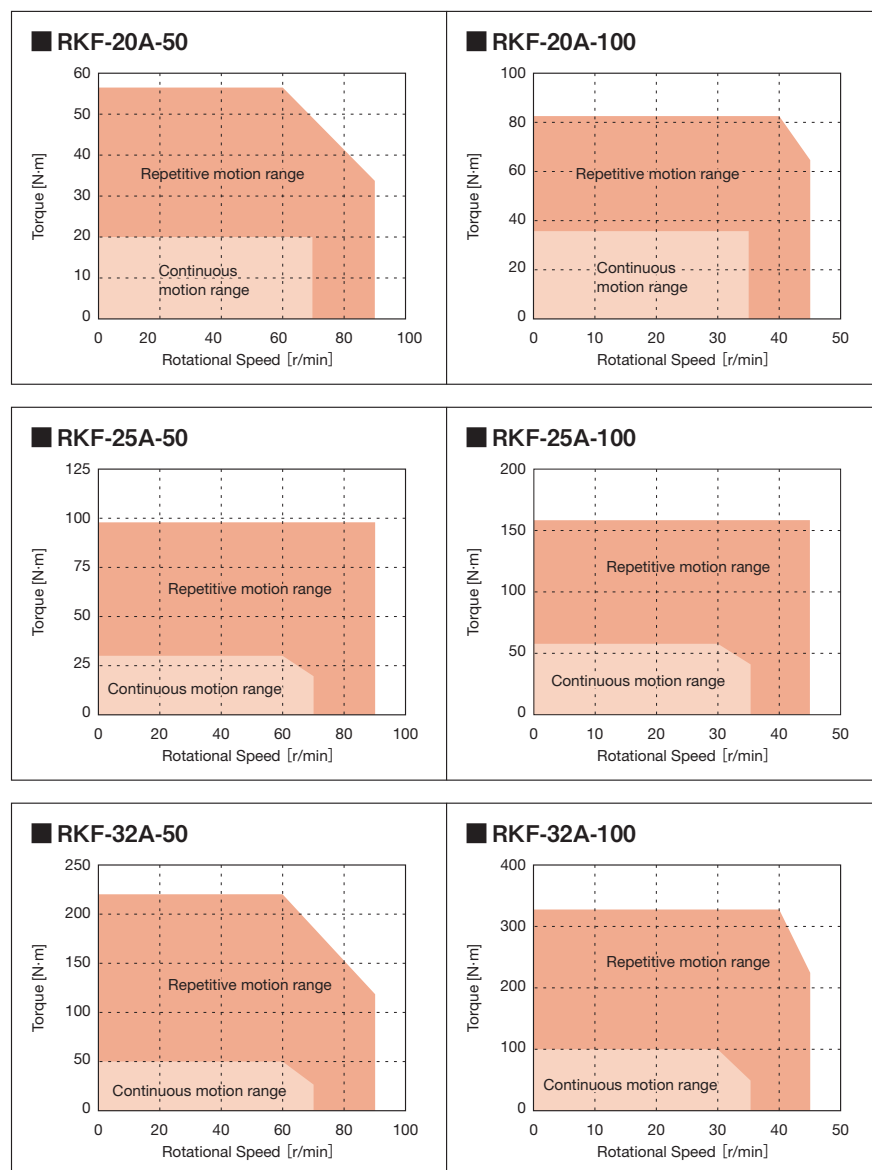


## Operable Range

The following diagrams show the operable range of the RKF series combined with an AC servo driver (HA-800).

Continuous motion range: Range of continuously operable torque-rotational speed.

Repetitive motion range: Range of "rotational speed - torque" that can be operated momentarily. Normally, this range is used during acceleration and deceleration.



Note 1: The values in the graphs are those when one of the following aluminum radiation plates is mounted.  
 RKF-20: 250x250x12 (mm)  
 RKF-25, RKF-32: 300x300x15 (mm)

## Options

### Relay Cable (For HA-800)

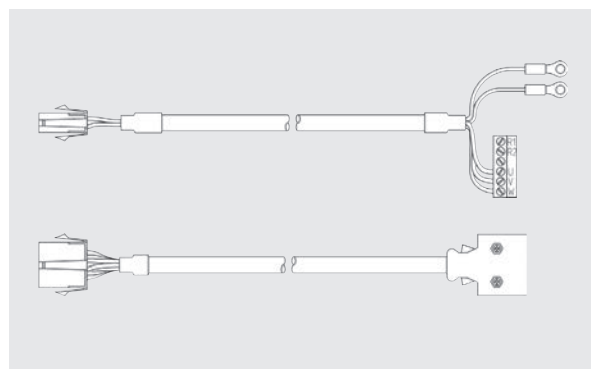
Order Code Example:

EWA-M \*\* -A04-TN3 (For motor)

EWA-E \*\* -A15-3M14 (For incremental encoder)

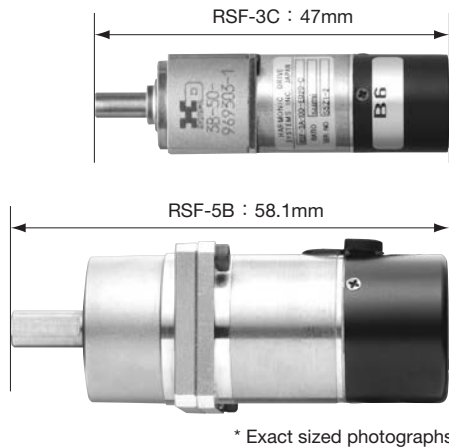
The cable for connecting the actuator to the servo driver HA-800A.

Standard cable lengths are 3, 5 and 10m.





# RSF supermini Series



The RSF supermini series are ultra-small AC servo actuators combining ultra-precision control deceleration device HarmonicDrive® that provides precision rotation operation at a high torque with ultra-small AC servo motor developed to make use of the performance of the decelerator.

RSF-5B with an electromagnetic brake are also included in the lineup. They can meet fail-safe requirements of equipment to prevent accidents upon power supply failure.

The dedicated servo driver HA-680 is an AC servo driver for DC24V power supply. The small and multi-functional HA-680 driver is equipped with position control, speed control, and torque control as standard to control operation of the RSF supermini series correctly and precisely.

The RSF supermini series can contribute to downsizing of driving of robot joints, semiconductor/LCD panel manufacturing equipment, machine tools, and other FA equipment. By utilizing its small and high-torque characteristics, it can also be used for small equipment and for research.



## Features

### ■ Compact, light weight and high torque

With built-in Speed Reducer for precision control HarmonicDrive®, RSF supermini Series has much higher output torque to its external dimensions, compared to direct-drive method by high capacity motor itself. Also, it realizes miniaturization and lightening by combination with proprietary AC Servo motor.

### ■ Advanced Positioning Accuracy

Scarce backlash and advanced positioning accuracy as a characteristics to HarmonicDrive®, a speed reducer for precision control realizes high-precision precision structure.

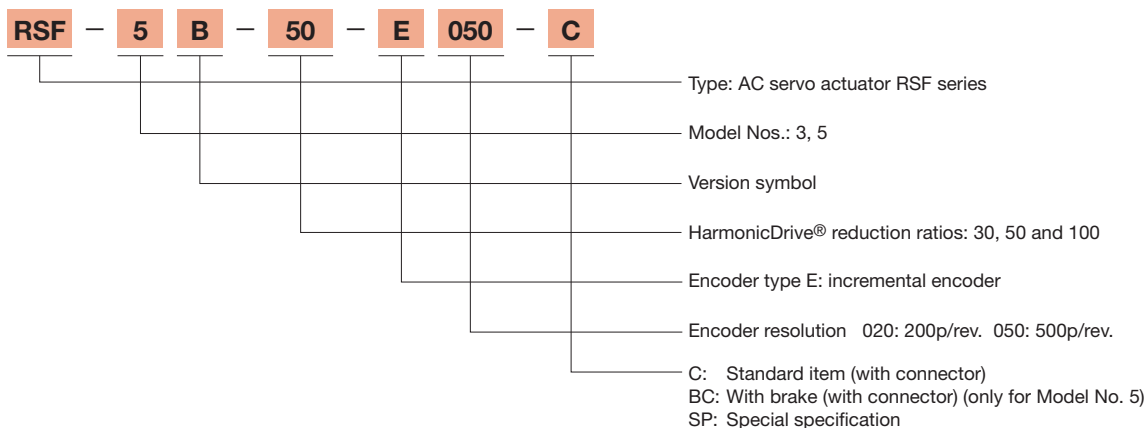
### ■ Stable Controllability

By high reduction ratio of Speed Reducer for precision control HarmonicDrive®, stable controllability is gained against change in load inertia moment.

### ■ Wide operation range

The newly developed servo motor features a maximum rotational speed of the motor itself to 10,000r/min., thereby expanding the operational range of an actuator.

## Models and Symbols



## Specification

|                      |                  |                        |                               |                   |                                        |
|----------------------|------------------|------------------------|-------------------------------|-------------------|----------------------------------------|
| Time rating:         | Continuous       | Insulation resistance: | DC500V 100M ohm or higher     | Ambient humidity: | 20 to 80%RH<br>(no condensation)       |
| Excitation method:   | Permanent magnet | Structure:             | Totally enclosed, self-cooled | Lubricant:        | Grease (Harmonic grease <sup>®</sup> ) |
| Insulation class:    | Class B          | Ambient temperature:   | 0 to 40°C                     |                   |                                        |
| Dielectric strength: | AC500V /min      | Storage temperature:   | -20°C to +60°C                |                   |                                        |

| Actuator                                                                                      |                        |                     | RSF-3C                     |                       |                        | RSF-5B                                            |                                                   |                                                   |
|-----------------------------------------------------------------------------------------------|------------------------|---------------------|----------------------------|-----------------------|------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
|                                                                                               |                        |                     | 30                         | 50                    | 100                    | 30                                                | 50                                                | 100                                               |
| Power Supply Voltage (driver)                                                                 | V                      |                     | DC24±10%                   |                       |                        | DC24±10%                                          |                                                   |                                                   |
| Permissible Continuous Current                                                                | A                      |                     | 0.65                       | 0.66                  | 0.56                   | 1.11                                              | 0.92                                              | 0.76                                              |
| Permissible Continuous Torque<br>(during operation at allowable<br>continuous rotation speed) | N·m                    |                     | 0.03                       | 0.07                  | 0.11                   | 0.18                                              | 0.29                                              | 0.44                                              |
|                                                                                               | kgf·cm                 |                     | 0.31                       | 0.68                  | 1.08                   | 1.83                                              | 2.95                                              | 4.48                                              |
| Permissible Continuous Rotation<br>Speed (output shaft)                                       | r/min                  |                     | 150                        | 90                    | 45                     | 150                                               | 90                                                | 45                                                |
| Permissible Continuous Stall Torque                                                           | N·m                    |                     | 0.04                       | 0.08                  | 0.12                   | 0.28                                              | 0.44                                              | 0.65                                              |
|                                                                                               | kgf·cm                 |                     | 0.41                       | 0.82                  | 1.22                   | 2.85                                              | 4.48                                              | 6.62                                              |
| Instantaneous Maximum Current                                                                 | A                      |                     | 1.5                        | 1.4                   | 1.1                    | 2.3                                               | 2.2                                               | 1.7                                               |
| Maximum Torque                                                                                | N·m                    |                     | 0.13                       | 0.21                  | 0.3                    | 0.5                                               | 0.9                                               | 1.4                                               |
|                                                                                               | kgf·cm                 |                     | 1.27                       | 2.05                  | 2.94                   | 5.10                                              | 9.17                                              | 14.3                                              |
| Maximum Speed                                                                                 | r/min                  |                     | 333                        | 200                   | 100                    | 333                                               | 200                                               | 100                                               |
| Torque Constant                                                                               | N·m/A                  |                     | 0.11                       | 0.18                  | 0.40                   | 0.30                                              | 0.54                                              | 1.1                                               |
|                                                                                               | kgf·cm/A               |                     | 1.12                       | 1.84                  | 4.08                   | 3.06                                              | 5.51                                              | 11.22                                             |
| EMF Constant                                                                                  | V/(r/min)              |                     | 0.015                      | 0.025                 | 0.050                  | 0.04                                              | 0.07                                              | 0.13                                              |
| Phase Resistance (at 20°C)                                                                    | Ω                      |                     | 1.34                       |                       |                        | 0.82                                              |                                                   |                                                   |
| Phase Inductance                                                                              | mH                     |                     | 0.18                       |                       |                        | 0.27                                              |                                                   |                                                   |
| Moment of Inertia <sup>3</sup>                                                                | GD <sup>2</sup> /4     | kg·m <sup>2</sup>   | 0.11×10 <sup>-4</sup>      | 0.29×10 <sup>-4</sup> | 1.17×10 <sup>-4</sup>  | 0.66×10 <sup>-4</sup><br>(0.11×10 <sup>-3</sup> ) | 1.83×10 <sup>-4</sup><br>(0.31×10 <sup>-3</sup> ) | 7.31×10 <sup>-4</sup><br>(1.23×10 <sup>-3</sup> ) |
|                                                                                               | J                      | kgf·cm <sup>2</sup> | 1.07×10 <sup>-4</sup>      | 2.98×10 <sup>-4</sup> | 11.90×10 <sup>-4</sup> | 0.67×10 <sup>-3</sup><br>(1.13×10 <sup>-3</sup> ) | 1.87×10 <sup>-3</sup><br>(3.15×10 <sup>-3</sup> ) | 7.45×10 <sup>-3</sup><br>(12.6×10 <sup>-3</sup> ) |
| Reduction Ratio                                                                               |                        |                     | 30                         | 50                    | 100                    | 30                                                | 50                                                | 100                                               |
| Permissible Radial Load<br>(output shaft central value)                                       | N                      |                     | 36                         |                       |                        | 90                                                |                                                   |                                                   |
|                                                                                               | kgf                    |                     | 3.6                        |                       |                        | 9.1                                               |                                                   |                                                   |
| Permissible Thrust Load                                                                       | N                      |                     | 130                        |                       |                        | 270                                               |                                                   |                                                   |
|                                                                                               | kgf                    |                     | 13.2                       |                       |                        | 27.5                                              |                                                   |                                                   |
| Encoder Pulses (motor shaft)                                                                  | Pulse                  |                     | 200                        |                       |                        | 500                                               |                                                   |                                                   |
| Encoder Resolution (output shaft:<br>when multiplied by 4) <sup>4</sup>                       | Pulses/<br>revolution  |                     | 24000                      | 40000                 | 80000                  | 60000                                             | 100000                                            | 200000                                            |
| Motor Shaft Brake                                                                             | Input Power<br>Voltage | V                   | —                          |                       |                        | DC24±10%                                          |                                                   |                                                   |
|                                                                                               | Retention<br>Torque    | N·m                 | —                          |                       |                        | 0.18                                              | 0.29                                              | 0.44                                              |
|                                                                                               |                        | kgf·cm              | —                          |                       |                        | 1.83                                              | 2.95                                              | 4.48                                              |
| Mass <sup>5</sup>                                                                             | Without Brake          | g                   | 31.0 (except clamp filter) |                       |                        | 66.0 (except clamp filter)                        |                                                   |                                                   |
|                                                                                               | With Brake             | g                   | —                          |                       |                        | 86.0 (except clamp filter)                        |                                                   |                                                   |
| Combined Driver                                                                               |                        |                     | HA-680-4B-24               |                       |                        | HA-680-4B-24                                      |                                                   |                                                   |

\*1: The table shows typical output values of actuators.

\*2: The values in the table above are obtained when it is combined with the combined driver (HA-680-4B-24).

\*3: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the HarmonicDrive<sup>®</sup>. The values in parentheses are for equipment with a brake.

\*4: The encoder resolution is (motor shaft encoder resolution when multiplied by 4) x (reduction ratio).

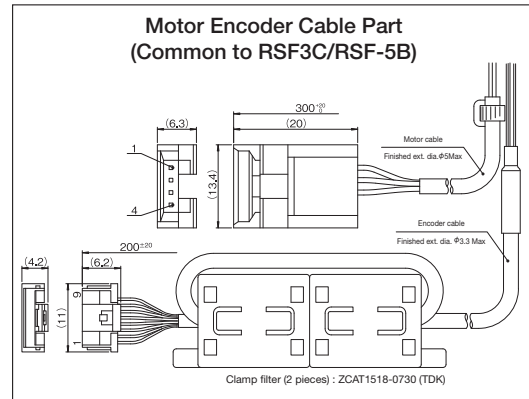
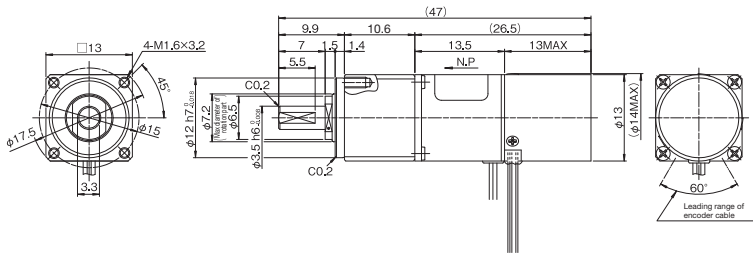
\*5: The mass of clamp filter is 6g each.

\*6: Please check the actuator rotation direction in our technical data sheet.

## External Dimensions

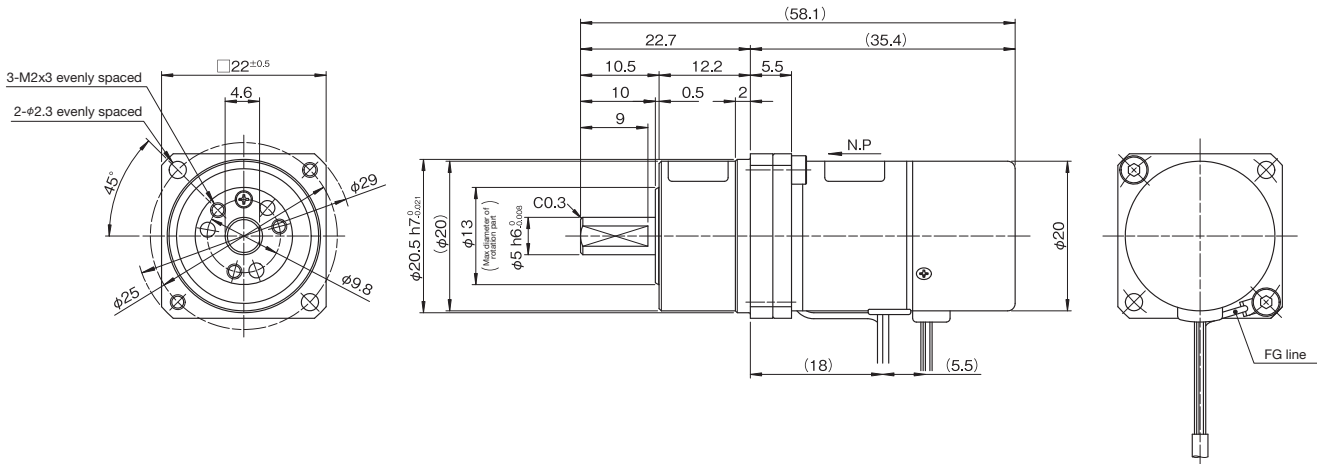
### ■ RSF-3C

Unit: mm



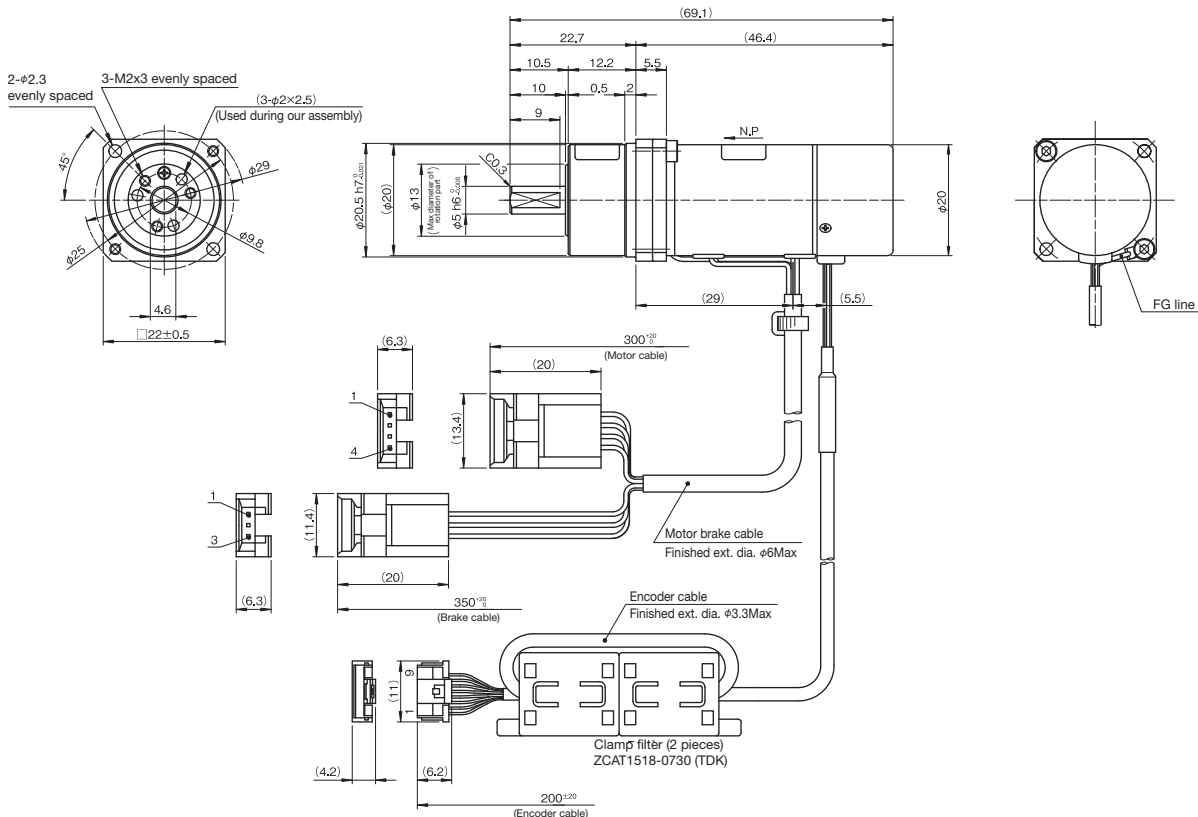
### ■ RSF-5B

Unit: mm



### ■ RSF-5B (With brake)

Unit: mm

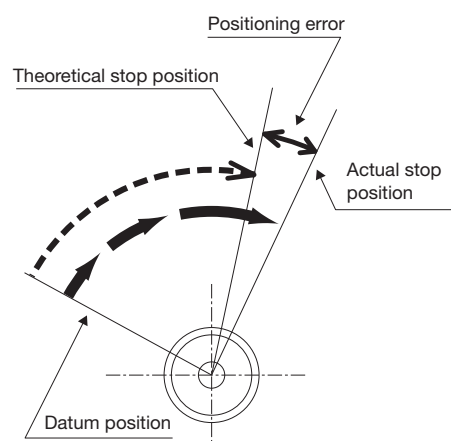


\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.  
 \* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
 Contact us for the differential range of the size that is not described.

## Uni-directional Positional accuracy

The “uni-directional positional accuracy” represents the maximum difference in a single revolution among differences between an angle actually rotated from the datum position and one that is supposed to turn in each position by repeating sequential positioning in a preset rotational direction. (Source: JIS [Japanese Industrial Standards] B-6201-1987).

The RSF supermini series contains a speed reducer HarmonicDrive® for precision control and positioning errors of the motor shaft are therefore compressed to 1/30, 1/50 or 1/100 by speed reduction. In reality, angular transmission errors of the speed reducer determine the uni-directional positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown as the uni-directional positional accuracy of the RSF supermini series.



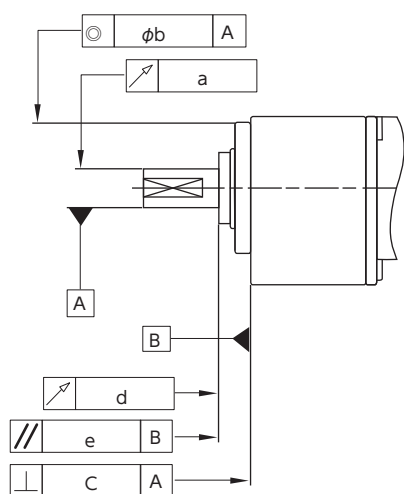
## “Uni-directional Positional Accuracies” of Models

| Model                               |         | RSF-3C               |                      |                      | RSF-5B               |                       |                       |
|-------------------------------------|---------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|
|                                     |         | 30                   | 50                   | 100                  | 30                   | 50                    | 100                   |
| Uni-directional Positional accuracy | arc-min | 10                   | 10                   | 10                   | 4                    | 3                     | 3                     |
|                                     | rad     | $2.9 \times 10^{-3}$ | $2.9 \times 10^{-3}$ | $2.9 \times 10^{-3}$ | $1.2 \times 10^{-3}$ | $0.87 \times 10^{-3}$ | $0.87 \times 10^{-3}$ |

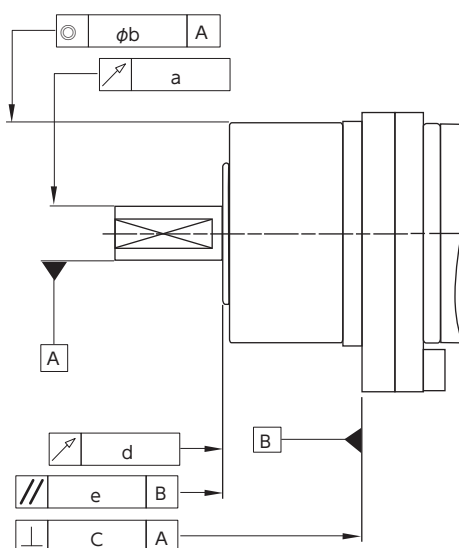
## Mechanical Accuracy

The mechanical accuracies of the output shaft and mounting flange of the actuators in the RSF supermini series are as follows.

### ■ RSF-3C



### ■ RSF-5B



## Mechanical Accuracy

Unit: mm

| Accuracy Item                                           | RSF-3C | RSF-5B |
|---------------------------------------------------------|--------|--------|
| 1 Runout of the tip of the output shaft                 | 0.03   | 0.03   |
| 2 Concentricity of installed spigot joint               | 0.02   | 0.04   |
| 3 Squareness of installation surface                    | 0.02   | 0.02   |
| 4 Output flange surface contact                         | 0.005  | 0.005  |
| 5 Parallelism of installation surface and output flange | 0.015  | 0.015  |

Note: T.I.R (total indicator reading): Indicates the total amount of dial gage reading when the measurement unit is rotated once.

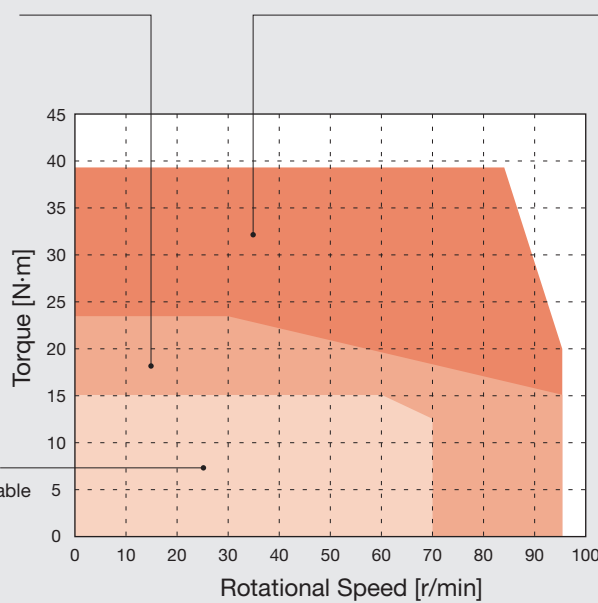
## Operable Range

This graph plots operable ranges when an AC servo actuator RSF-3C or RSF-5B is combined with an AC servo driver HA-680 for DC24V power supply.

■ **50% duty motion range**  
Range of torque-rotational speed operable at 50% duty (ratio between operational and standby hours is 50:50)

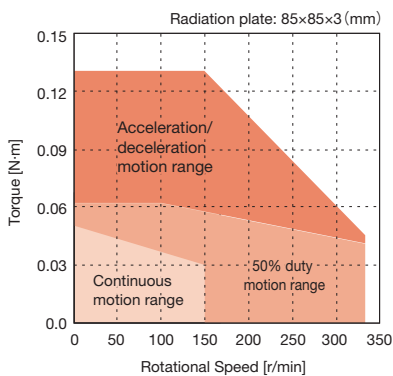
■ **Continuous motion range**  
Range of continuously operable torque-rotational speed.

■ **Motion range during acceleration and deceleration**  
Range of torque-rotational speed that is operable momentarily. Normally, this range is used during acceleration and deceleration.

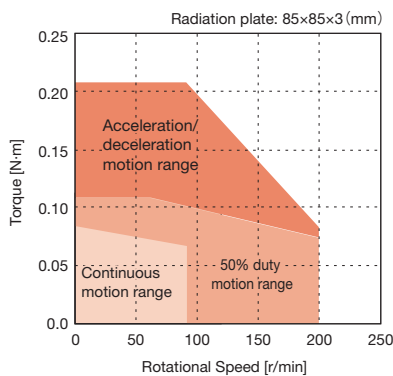


Note 1: Motion ranges for continuous motion and that at 50% duty are the values when the radiation plate mentioned in the graphs is mounted.  
Note 2: See the technical information for selection of a model No.

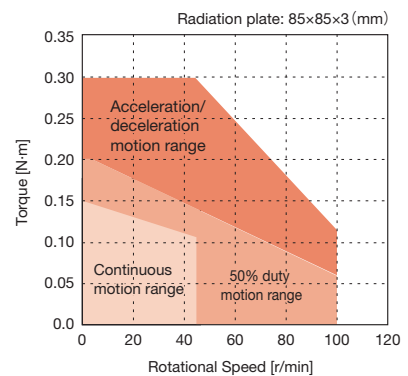
### ■ RSF-3C-30-E020-C



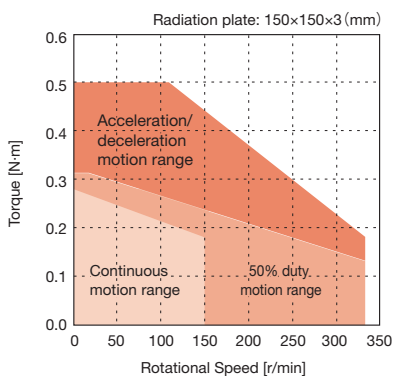
### ■ RSF-3C-50-E020-C



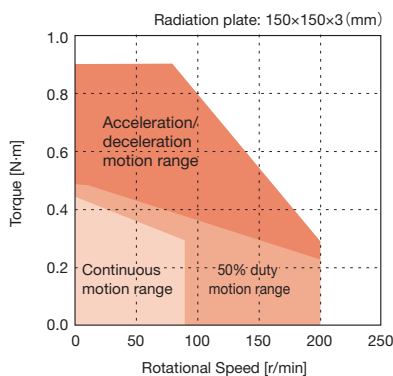
### ■ RSF-3C-100-E020-C



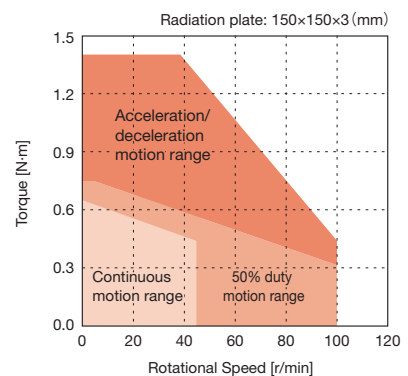
### ■ RSF-5B-30-E050-C, RSF-5B-30-E050-BC



### ■ RSF-5B-50-E050-C, RSF-5B-50-E050-BC



### ■ RSF-5B-100-E050-C, RSF-5B-100-E050-BC



Note:  
The values of the graph are obtained when the aluminum radiation plate shown at the upper right of the graph. Even in the continuous range, if it is used continuously in one direction, please consult with us.

## Options

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

### Relay Cable (For HA-680)

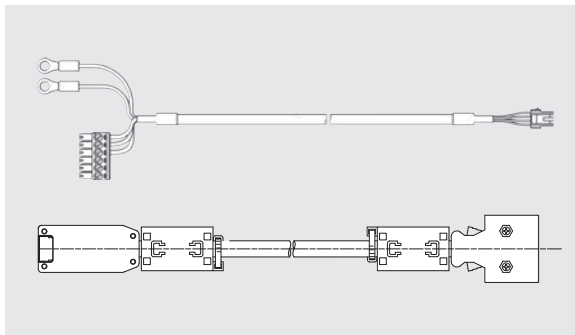
Order Code Example:

EWA-M \*\* -JST04-TN2 (For motor)

EWA-E \*\* -JST09-3M14 (For incremental encoder)

EWA-B \*\* -JST03-TMC (For Brake/Only for RSF-5B)

The cable for connecting the actuator to the servo driver HA-680.  
Standard cable lengths are 3, 5 and 10m.

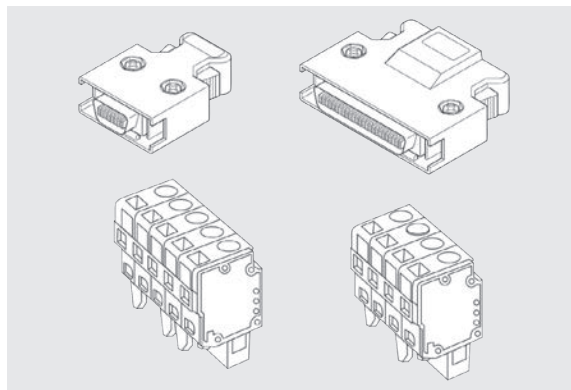


### Connector

Reference model: CNK-HA68-S1 (All set of four)

CNK-HA68-S2 (Power supply • I/O signal)

Connectors to connect the power supply, motor line, encoder line and I/O signals

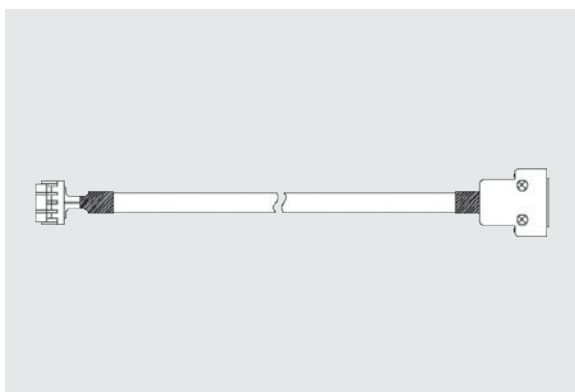


### EIA-232 (RS-232C) Communication Cable

Order Code Example: HDM-RS232C

The cable to connect the PC and servo driver.

Cable length (1.5m).

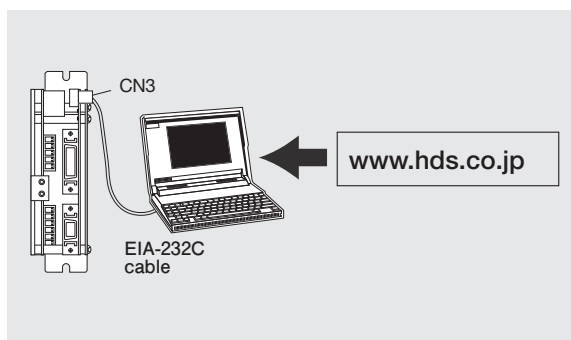


### Servo Parameter Setting Software (Free delivery)

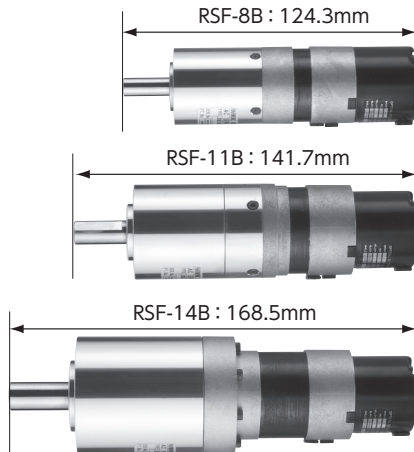
Reference model: PSF-520

The software is used to set various servo parameters from your PC to the servo driver. You can download the software from our home page (<https://www.hds.co.jp/>).

EIA-232C cable is required to connect your PC to the servo driver.



# RSF-B mini Series



RSF-B mini series are AC servo actuators combined with a precision control reduction gear HarmonicDrive® that provides high-torque and accurate rotation operation and a high-speed and high-response AC servo motor.

Use RSF-B mini series for robot joint drive, semi-conductor, liquid crystal panel manufacturer, machine tools and other various types of FA devices.



## Features

### ■ Compact, light weight and high torque

The RSF-B mini series with the precision-control deceleration device HarmonicDrive® realizes a small, light weight, high torque and has a very high output torque for the outer dimensions compared to the direct driving method with a high-capacity motor alone.

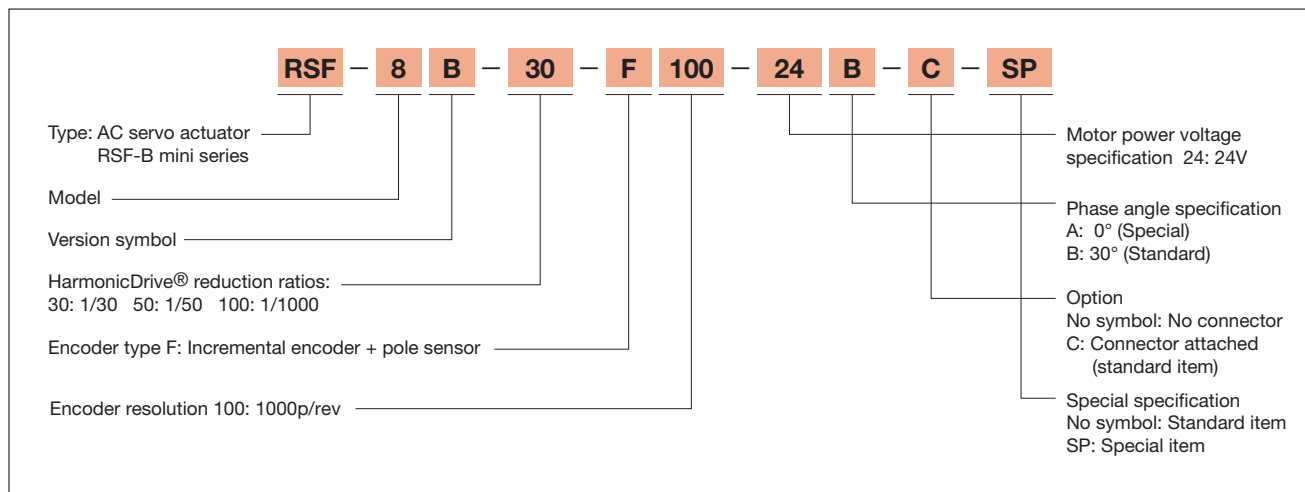
### ■ Superior positioning precision

The characteristics of the control deceleration device HarmonicDrive® such as non-backlash and superior positioning precision realize high-precision mechanisms.

### ■ Stable Controllability

The high deceleration gear ratio of the control deceleration device HarmonicDrive® provides stable controllability for large variations of load moment of inertia.

## Models and Symbols





## Specification

|                      |                  |                        |                               |                   |                                        |
|----------------------|------------------|------------------------|-------------------------------|-------------------|----------------------------------------|
| Time rating:         | Continuous       | Insulation resistance: | DC500V 100M ohm or higher     | Ambient humidity: | 20 to 80%RH<br>(no condensation)       |
| Excitation method:   | Permanent magnet | Structure:             | Totally enclosed, self-cooled | Lubricant:        | Grease (Harmonic grease <sup>®</sup> ) |
| Insulation class:    | Class B          | Ambient temperature:   | 0 to 40°C                     |                   |                                        |
| Dielectric strength: | AC500V /min      | Storage temperature:   | -20°C to +60°C                |                   |                                        |

| Item                                                                                       |                    |                      | Actuator              | RSF-8B                |                       |                       | RSF-11B               |                      |                       | RSF-14B              |                      |     |
|--------------------------------------------------------------------------------------------|--------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|-----------------------|----------------------|----------------------|-----|
|                                                                                            |                    |                      |                       | 30                    | 50                    | 100                   | 30                    | 50                   | 100                   | 30                   | 50                   | 100 |
| Power Supply Voltage (driver)                                                              |                    | V                    | DC24±10%              |                       |                       |                       |                       |                      |                       |                      |                      |     |
| Permissible Continuous Current                                                             |                    | A                    | 2.0                   | 2.0                   | 1.5                   | 5.0                   | 4.9                   | 4.9                  | 4.9                   | 4.7                  | 4.7                  |     |
| Permissible Continuous Torque<br>(during operation at allowable continuous rotation speed) |                    | N·m                  | 0.78                  | 1.4                   | 2.0                   | 1.1                   | 2.0                   | 4.0                  | 1.7                   | 3.0                  | 6.0                  |     |
|                                                                                            |                    | kgf·cm               | 7.8                   | 14                    | 20                    | 11                    | 20                    | 41                   | 17                    | 31                   | 61                   |     |
| Permissible Continuous Rotation Speed<br>(output shaft)                                    |                    | r/min                | 100                   | 60                    | 30                    | 100                   | 60                    | 30                   | 100                   | 60                   | 30                   |     |
| Permissible Continuous Stall Torque                                                        |                    | N·m                  | 0.95                  | 1.7                   | 3.5                   | 1.7                   | 3.0                   | 5.7                  | 2.5                   | 4.5                  | 9.0                  |     |
|                                                                                            |                    | kgf·cm               | 9.3                   | 17                    | 36                    | 17                    | 31                    | 58                   | 26                    | 46                   | 92                   |     |
| Instantaneous Maximum Current                                                              |                    | A                    | 3.8                   | 3.9                   | 2.9                   | 14.4                  | 15.8                  | 9.4                  | 14.4                  | 17.2                 | 12.3                 |     |
| Maximum Torque                                                                             |                    | N·m                  | 1.8                   | 3.3                   | 4.8                   | 4.5                   | 8.3                   | 11                   | 9.0                   | 18                   | 28                   |     |
|                                                                                            |                    | kgf·cm               | 18                    | 34                    | 49                    | 46                    | 85                    | 112                  | 92                    | 184                  | 286                  |     |
| Maximum Speed                                                                              |                    | r/min                | 200                   | 120                   | 60                    | 200                   | 120                   | 60                   | 200                   | 120                  | 60                   |     |
| Torque Constant                                                                            |                    | N·m/A                | 0.62                  | 1.1                   | 2.1                   | 0.40                  | 0.66                  | 1.5                  | 0.76                  | 1.3                  | 2.6                  |     |
|                                                                                            |                    | kgf·cm/A             | 6.3                   | 11                    | 21                    | 4.1                   | 6.7                   | 15                   | 7.8                   | 13                   | 27                   |     |
| EMF Constant                                                                               |                    | V/(r/min)            | 0.07                  | 0.11                  | 0.22                  | 0.04                  | 0.07                  | 0.15                 | 0.08                  | 0.13                 | 0.28                 |     |
| Phase Resistance (at 20°C)                                                                 |                    | Ω                    | 0.93                  |                       |                       | 0.19                  |                       |                      | 0.26                  |                      |                      |     |
| Phase Inductance                                                                           |                    | mH                   | 0.45                  |                       |                       | 0.10                  |                       |                      | 0.19                  |                      |                      |     |
| Moment of Inertia <sup>3</sup>                                                             | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.06×10 <sup>-2</sup> | 0.16×10 <sup>-2</sup> | 0.65×10 <sup>-2</sup> | 0.18×10 <sup>-2</sup> | 0.49×10 <sup>-2</sup> | 2.0×10 <sup>-2</sup> | 0.41×10 <sup>-2</sup> | 1.1×10 <sup>-2</sup> | 4.5×10 <sup>-2</sup> |     |
|                                                                                            | J                  | kgf·cms <sup>2</sup> | 0.60×10 <sup>-2</sup> | 1.7×10 <sup>-2</sup>  | 6.6×10 <sup>-2</sup>  | 1.8×10 <sup>-2</sup>  | 5.0×10 <sup>-2</sup>  | 20×10 <sup>-2</sup>  | 4.1×10 <sup>-2</sup>  | 11×10 <sup>-2</sup>  | 46×10 <sup>-2</sup>  |     |
| Reduction Ratio                                                                            |                    |                      | 1:30                  | 1:50                  | 1:100                 | 1:30                  | 1:50                  | 1:100                | 1:30                  | 1:50                 | 1:100                |     |
| Permissible Radial Load<br>(output shaft central value)                                    |                    | N                    | 196                   |                       |                       | 245                   |                       |                      | 392                   |                      |                      |     |
|                                                                                            |                    | kgf                  | 20                    |                       |                       | 25                    |                       |                      | 40                    |                      |                      |     |
| Permissible Thrust Load                                                                    |                    | N                    | 98                    |                       |                       | 196                   |                       |                      | 392                   |                      |                      |     |
|                                                                                            |                    | kgf                  | 10                    |                       |                       | 20                    |                       |                      | 40                    |                      |                      |     |
| Encoder Pulses (motor shaft)                                                               |                    | Pulse                | 1000                  |                       |                       |                       |                       |                      |                       |                      |                      |     |
| Encoder Resolution (output shaft: when multiplied by 4) <sup>4</sup>                       |                    | Pulse/revolution     | 120000                | 200000                | 400000                | 120000                | 200000                | 400000               | 120000                | 200000               | 400000               |     |
| Mass                                                                                       |                    | g                    | 300                   |                       |                       | 500                   |                       |                      | 800                   |                      |                      |     |
| Combined Driver                                                                            |                    |                      | HA-680-4B-24          |                       |                       | HA-680-6B-24          |                       |                      |                       |                      |                      |     |

\*1: The table shows typical output values of actuators.

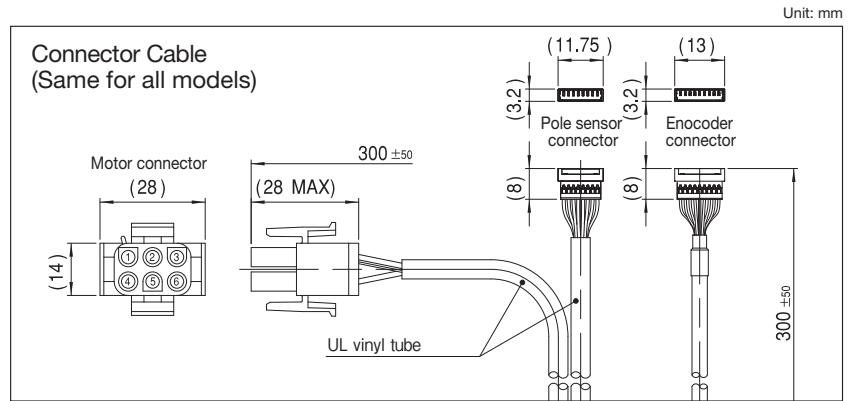
\*2: The values in the table above are obtained when it is combined with the combined driver (HA-680).

\*3: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the HarmonicDrive<sup>®</sup>. The values in parentheses are for equipment with a brake.

\*4: The encoder resolution is (motor shaft encoder resolution when multiplied by 4) x (reduction ratio).

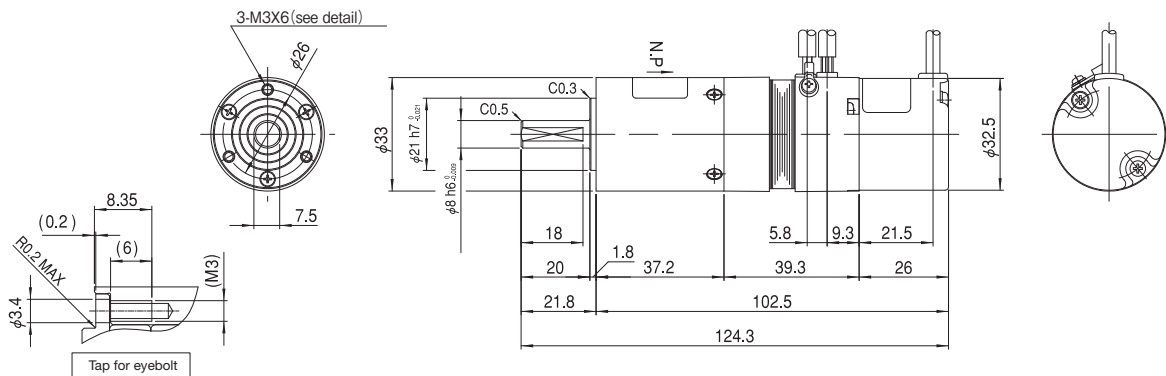
\*5: Please check the actuator rotation direction in our technical data sheet.

## External Dimensions



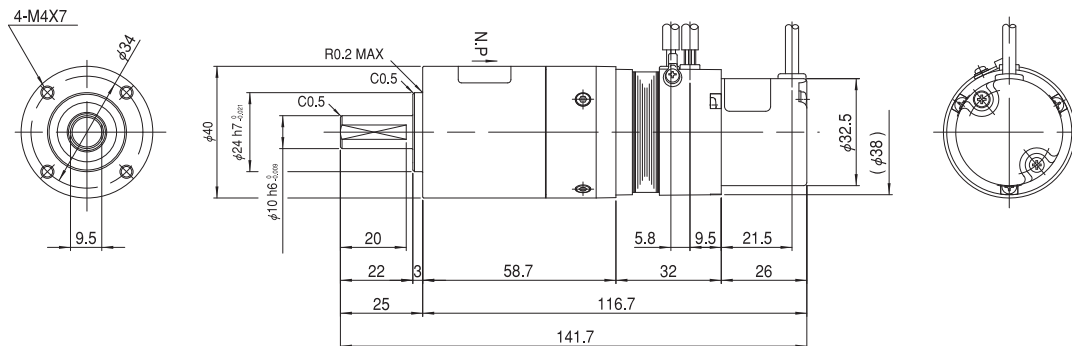
### RSF-8B

Unit: mm



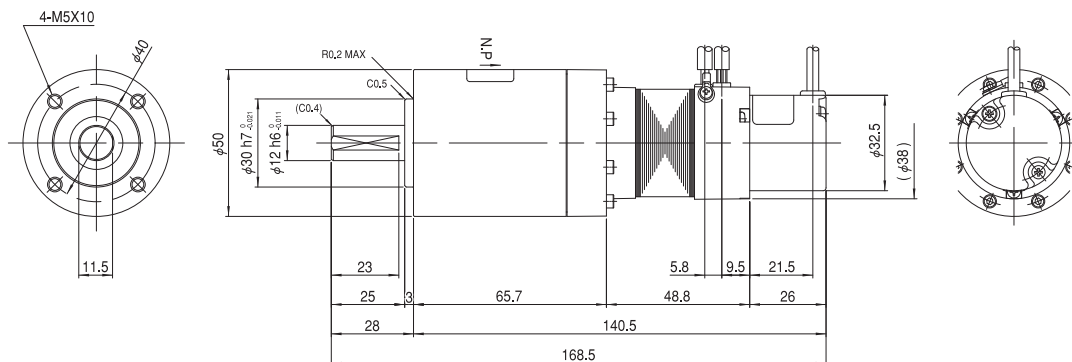
### RSF-11B

Unit: mm



### RSF-14B

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).

Contact us for the differential range of the size that is not described.

## Positional Accuracy

The following table shows the “one-way positioning accuracy”. The following table contains representing values. (JIS B-6201-1987)  
The RSF-B mini series contains HarmonicDrive® and positioning errors of the motor shaft are therefore compressed. In reality, angular transmission errors of the speed reducer determine the positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown as the positional accuracies of the RSF-B mini series. The accuracy for each gear ratio is shown below.

### “Uni-directional Positional Accuracies” of Models

| Model                               |         | RSF-8B                |                       |     | RSF-11B               |                       |     | RSF-14B               |                       |     |
|-------------------------------------|---------|-----------------------|-----------------------|-----|-----------------------|-----------------------|-----|-----------------------|-----------------------|-----|
|                                     |         | 30                    | 50                    | 100 | 30                    | 50                    | 100 | 30                    | 50                    | 100 |
| Uni-directional Positional Accuracy | arc-min | 3                     | 2.5                   |     | 2.5                   | 2                     |     | 2.5                   | 2                     |     |
|                                     | rad     | $8.73 \times 10^{-4}$ | $7.27 \times 10^{-4}$ |     | $7.27 \times 10^{-4}$ | $5.82 \times 10^{-4}$ |     | $7.27 \times 10^{-4}$ | $5.82 \times 10^{-4}$ |     |

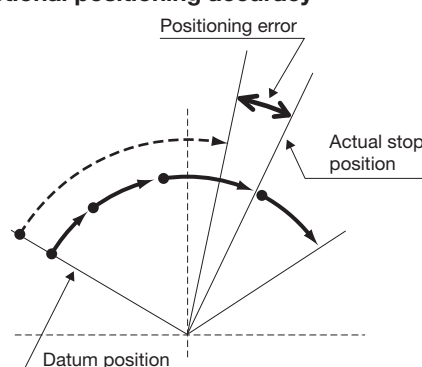
#### Reference

(Accuracy display and measurement method according to JIS B-6201-1987)

#### ● One-way positioning of rotation shaft motion

First, perform positioning at any one position in a fixed direction. This position is the reference position. Next, perform positioning in succession in the same direction, and measure the difference between the angle actually rotated from the reference position and the desired angle at each position. The maximum difference in one rotation among these values is taken as the measurement value. Measurement of equipment with the continuous positioning function for rotational motion shall be done once per 30 degrees or 12 positions throughout the entire rotation range as a rule.

### Uni-directional positioning accuracy



## Mechanical Accuracy

The mechanical accuracies of the output shaft and mounting flange of the actuators in the RSF-B mini series are as follows.

### Mechanical Accuracy

Unit: mm

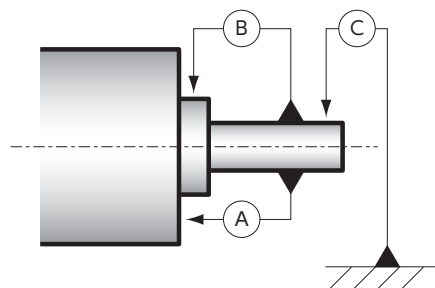
| Accuracy Item | A    | B    | C    |
|---------------|------|------|------|
| RSF-8B        | 0.04 | 0.04 | 0.03 |
| RSF-11B       | 0.04 | 0.04 | 0.03 |
| RSF-14B       | 0.04 | 0.04 | 0.03 |

Note: The aforementioned values are T.I.R (total indicator reading) values.

A: Squareness of the output shaft and the mounting surface

B: Coaxial degree of the output shaft and the mounting connection

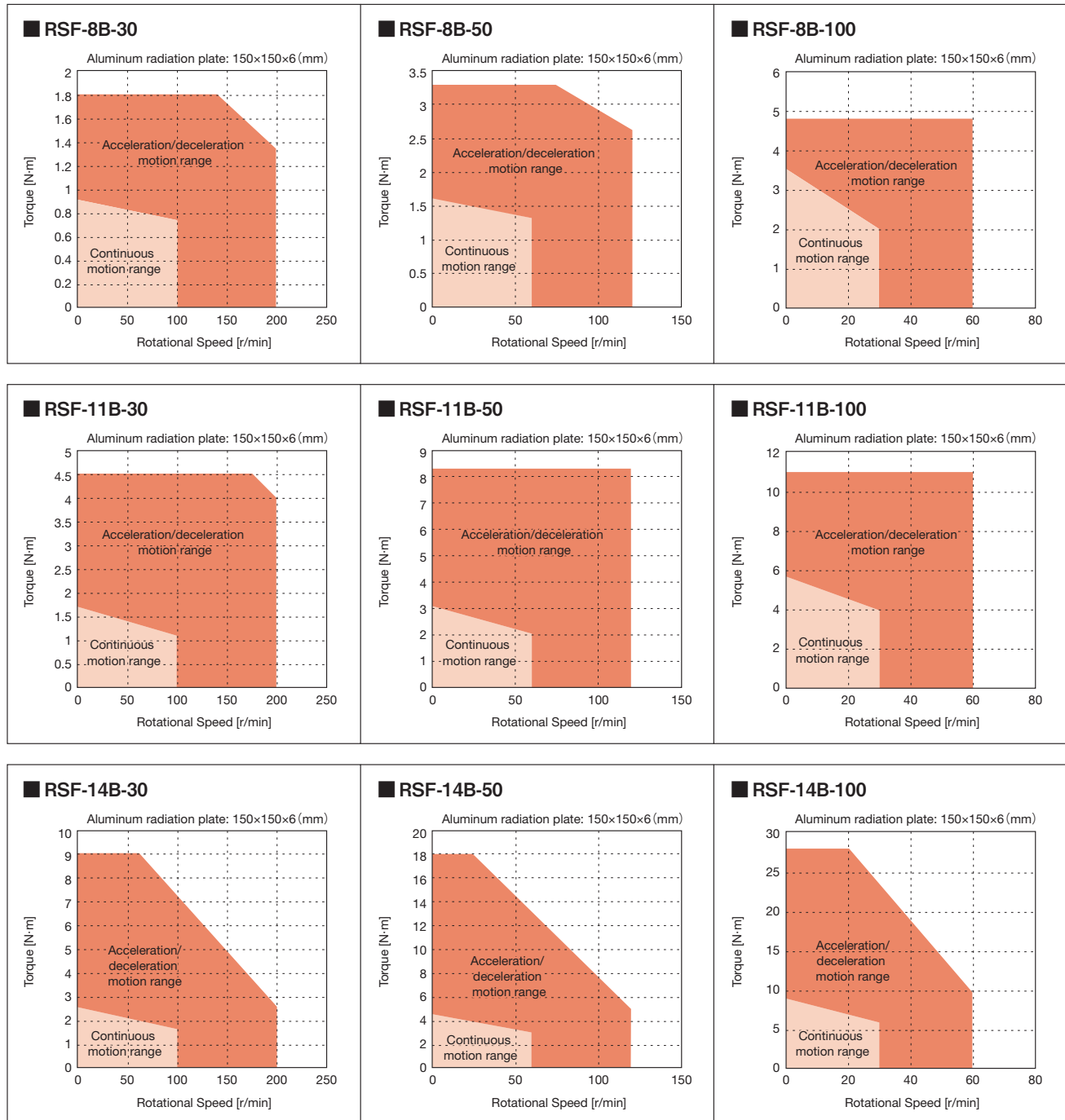
C: Deflection of the output shaft end



## Operable Range

The following graphs show the usable ranges of the RSF-B mini series actuators combined with the dedicated AC servo driver HA-680 by the power voltage DC24V input.

- Continuous motion range: Range of continuously operable torque-rotational speed.
- Repetitive motion range: Range of “rotational speed - torque” that can be operated momentarily.



## Options

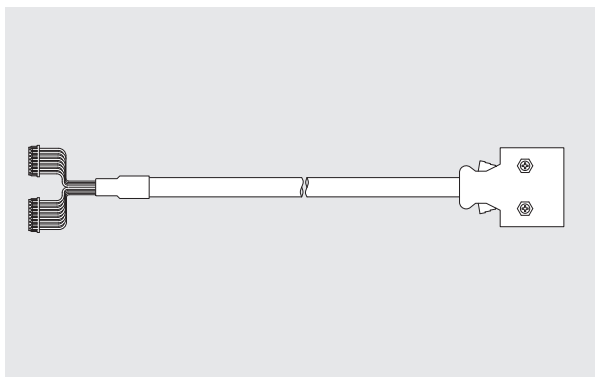
### Encoder + Pole Sensor Cable

Order Code Example: EWB-F \*\* -M0809-3M14

The cable to connect the encoder + pole sensor and servo driver.

\*\*\*\* in code indicates the cable length (03:3m, 05:5m, 10:10m).

Note: This cable is mandatory for the connection between motor and servo driver.



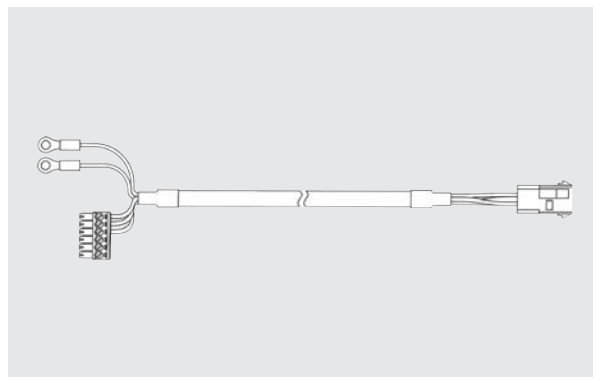
### Relay Cable for Motor

Order Code Example: EWC-MB \*\* -A06-TN2

The cable to connect the motor and servo driver.

\*\*\*\* in code indicates the cable length (03:3m, 05:5m, 10:10m).

Note: This cable is mandatory for the connection between motor and servo driver.

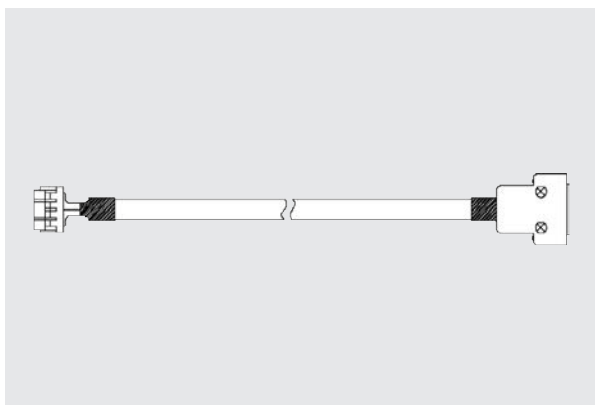


### EIA-232 (RS-232C) Communication Cable

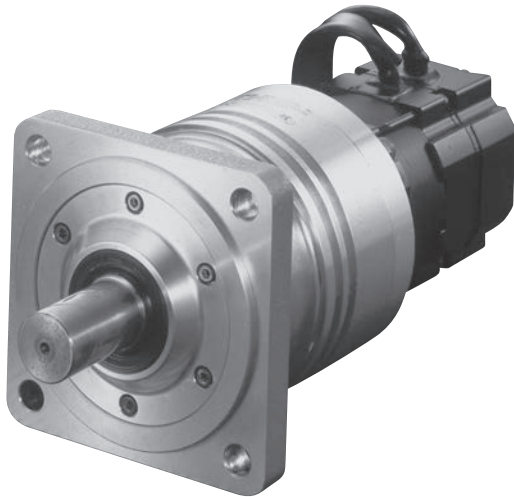
Order Code Example: HDM-RS232C

The cable to connect the PC and servo driver.

Cable length (1.5m).



# RSF Series



The RSF series includes compact and high-torque AC servo actuators with a high rotational accuracy, a shaft output combining a speed reducer HarmonicDrive® for precision control and an AC servo motor. Combined with a dedicated servo driver that fully demonstrates the performance of this RSF series of implements; compact machines and equipment with a high rotational accuracy.

## Features

### ■ High resolution

High resolution of maximum 800,000 pulses/revolution (0.00045°/pulse) using a HarmonicDrive®.

### ■ High positional accuracy

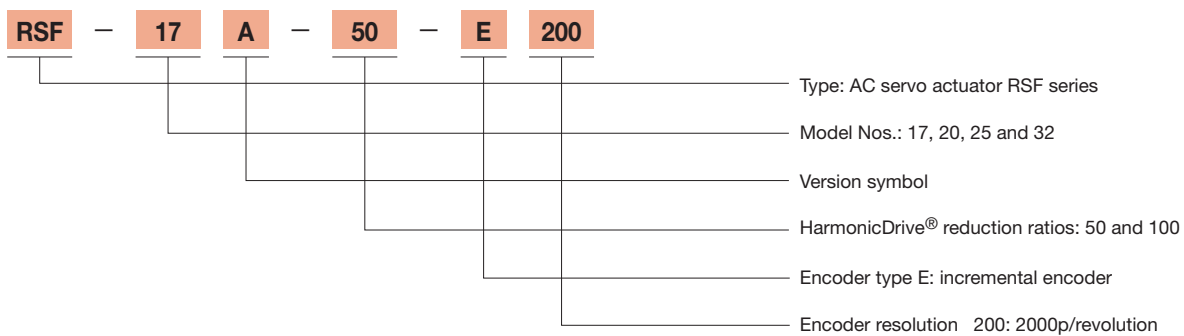
The HarmonicDrive® eliminates backlash caused by gear play, assuring high-accuracy positioning.

### ■ Easy-to-operate dedicated driver

A dedicated driver is set with parameters for a combined actuator.

Host system parameters and control parameters can be easily set on a 7-segment LED display.

## Models and Symbols



## Specification

|                      |                  |                        |                               |                   |                                        |
|----------------------|------------------|------------------------|-------------------------------|-------------------|----------------------------------------|
| Time rating:         | Continuous       | Insulation resistance: | DC500V 100M ohm or higher     | Ambient humidity: | 20 to 80%RH<br>(no condensation)       |
| Excitation method:   | Permanent magnet | Structure:             | Totally enclosed, self-cooled | Lubricant:        | Grease (Harmonic grease <sup>®</sup> ) |
| Insulation class:    | Class B          | Ambient temperature:   | 0 to 40°C                     |                   |                                        |
| Dielectric strength: | AC1000V /min     | Storage temperature:   | -20°C to +60°C                |                   |                                        |

| Model                                     |                    | RSF-17A              |        | RSF-20A       |        | RSF-25A       |        | RSF-32A       |        |
|-------------------------------------------|--------------------|----------------------|--------|---------------|--------|---------------|--------|---------------|--------|
|                                           |                    | 50                   | 100    | 50            | 100    | 50            | 100    | 50            | 100    |
| Rated Output <sup>*3</sup>                | W                  | 62                   | 62     | 120           | 111    | 180           | 190    | 310           | 310    |
| Input Power Supply <sup>*3</sup>          | V                  | AC200V               |        |               |        |               |        |               |        |
| Rated Torque <sup>*3</sup>                | N-m                | 9.8                  | 20     | 19            | 35     | 29            | 59     | 49            | 98     |
|                                           | kgf-cm             | 100                  | 200    | 190           | 360    | 300           | 600    | 500           | 1000   |
| Rated Rotational Speed <sup>*3</sup>      | r/min              | 60                   | 30     | 60            | 30     | 60            | 30     | 60            | 30     |
| Continuous Stall Torque <sup>*3</sup>     | N-m                | 9.8                  | 20     | 19            | 35     | 29            | 59     | 49            | 98     |
|                                           | kgf-cm             | 100                  | 200    | 190           | 360    | 300           | 600    | 500           | 1000   |
| Maximum Momentary Torque <sup>*3</sup>    | N-m                | 34                   | 54     | 56            | 82     | 98            | 157    | 220           | 330    |
|                                           | kgf-cm             | 350                  | 550    | 570           | 840    | 1000          | 1600   | 2200          | 3400   |
| Max. Rotational Speed <sup>*3</sup>       | r/min              | 90                   | 45     | 90            | 45     | 90            | 45     | 90            | 45     |
| Moment of Inertia <sup>*4</sup>           | GD <sup>2</sup> /4 | kg-m <sup>2</sup>    | 0.047  | 0.19          | 0.098  | 0.39          | 0.19   | 0.77          | 0.67   |
|                                           | J                  | kgf-cms <sup>2</sup> | 0.48   | 1.9           | 1.0    | 4.0           | 2.0    | 7.9           | 6.9    |
| Reduction Ratio                           |                    | 50                   | 100    | 50            | 100    | 50            | 100    | 50            | 100    |
| Permissible Radial Load                   | N                  | 780                  |        | 1400          |        | 2900          |        | 4400          |        |
|                                           | kgf                | 80                   |        | 140           |        | 300           |        | 450           |        |
| Permissible Thrust Load                   | N                  | 780                  |        | 1370          |        | 2900          |        | 4400          |        |
|                                           | kgf                | 80                   |        | 140           |        | 300           |        | 450           |        |
| Detector Resolution (At x4) <sup>*5</sup> | Pulses/revolution  | 400000               | 800000 | 400000        | 800000 | 400000        | 800000 | 400000        | 800000 |
| Mass                                      | kg                 | 2.1                  |        | 2.9           |        | 4.7           |        | 8.7           |        |
| Combined Driver                           |                    | HA-800-3B-200        |        | HA-800-3B-200 |        | HA-800-3B-200 |        | HA-800-6B-200 |        |

\*1: The aforementioned values are those at the output shaft including the HarmonicDrive<sup>®</sup> efficiency.

\*2: The actuator specification is the value when mounted on the following aluminum radiation plate:

RSF-17, RSF-20 250 x 250 x 12mm

RSF-25, RSF-32 300 x 300 x 15mm

\*3: The values are those recorded during temperature rise saturation, while the other values are those at 20°C.

\*4: The moment of inertia is the total of moments of inertia of the motor shaft and HarmonicDrive<sup>®</sup> converted into the output shaft side.

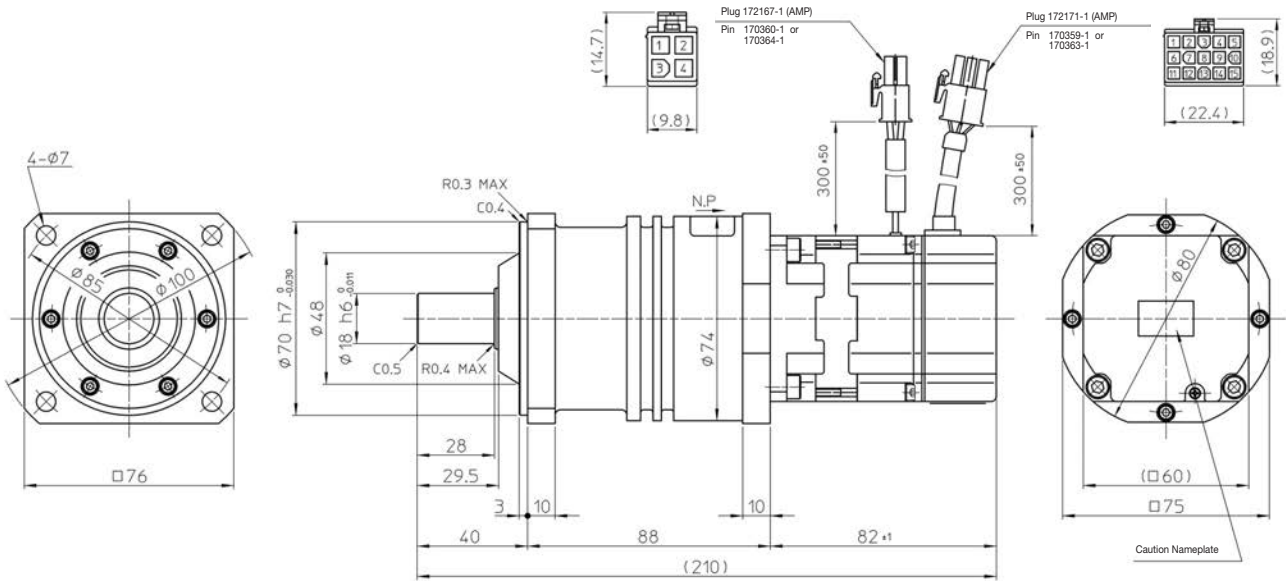
\*5: Detector resolution is calculated by (Motor shaft encoder resolution) x 4 x (Reduction ratio).

\*6: Please check the actuator rotation direction in our technical data sheet.

## External Dimensions

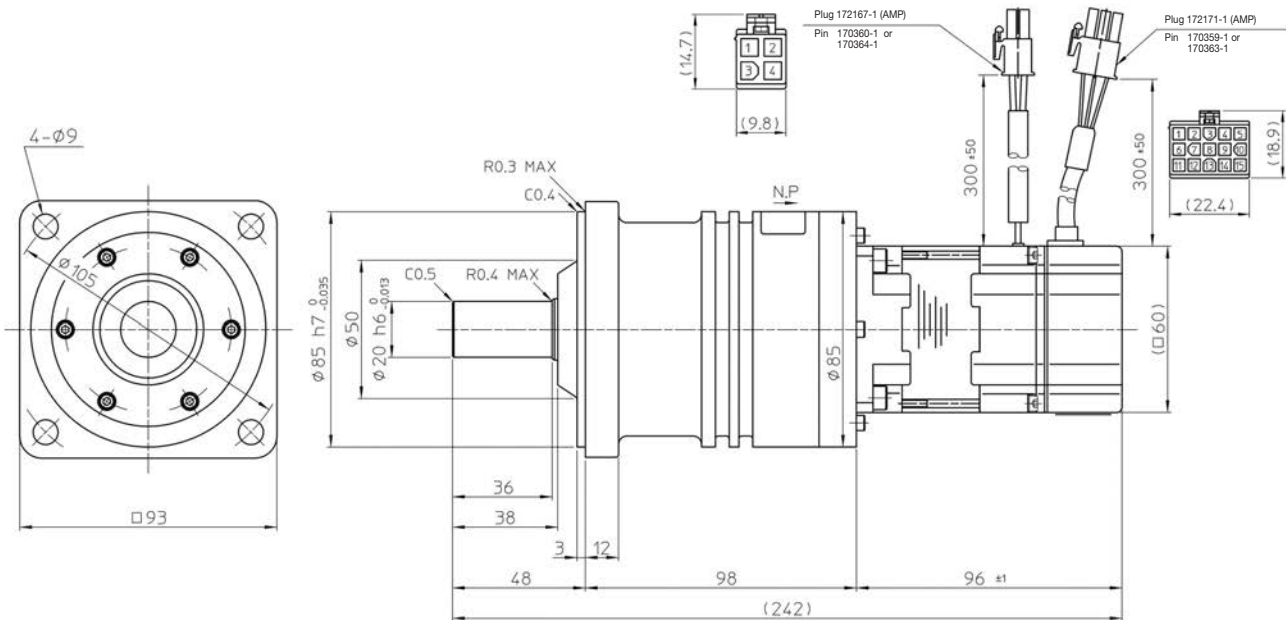
### ■ RSF-17A

Unit: mm



### ■ RSF-20A

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

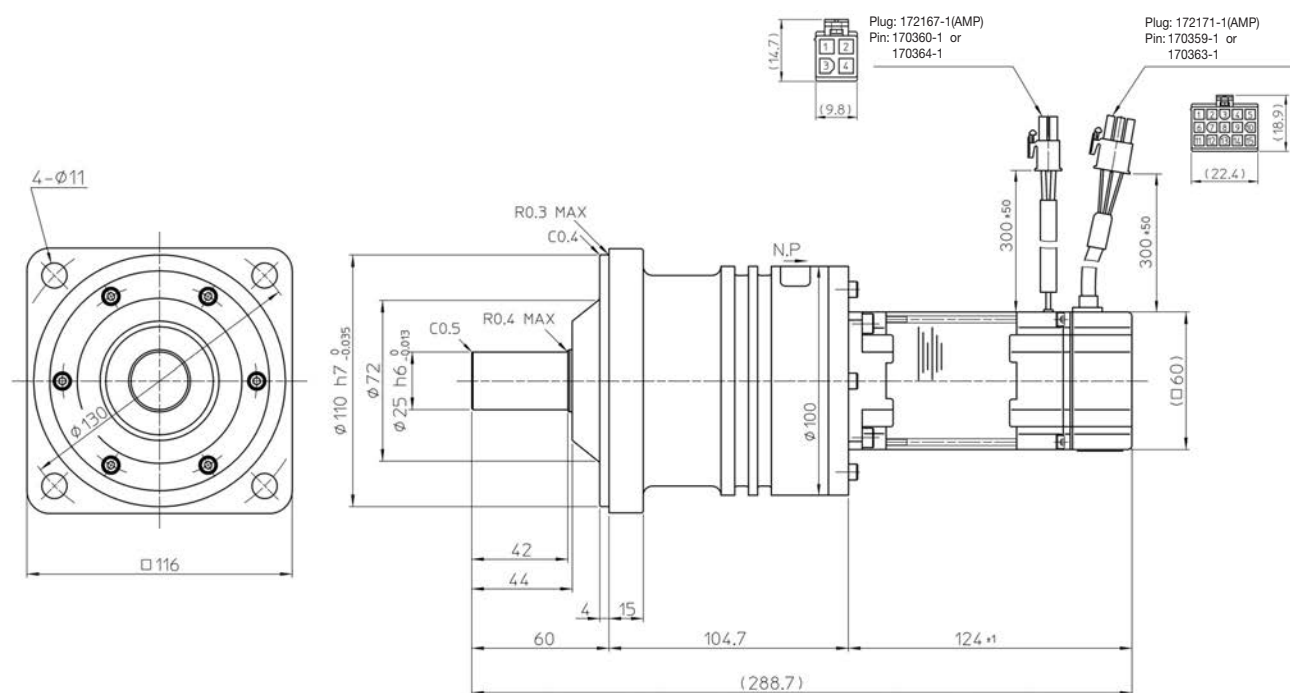
\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
Contact us for the differential range of the size that is not described.



## External Dimensions

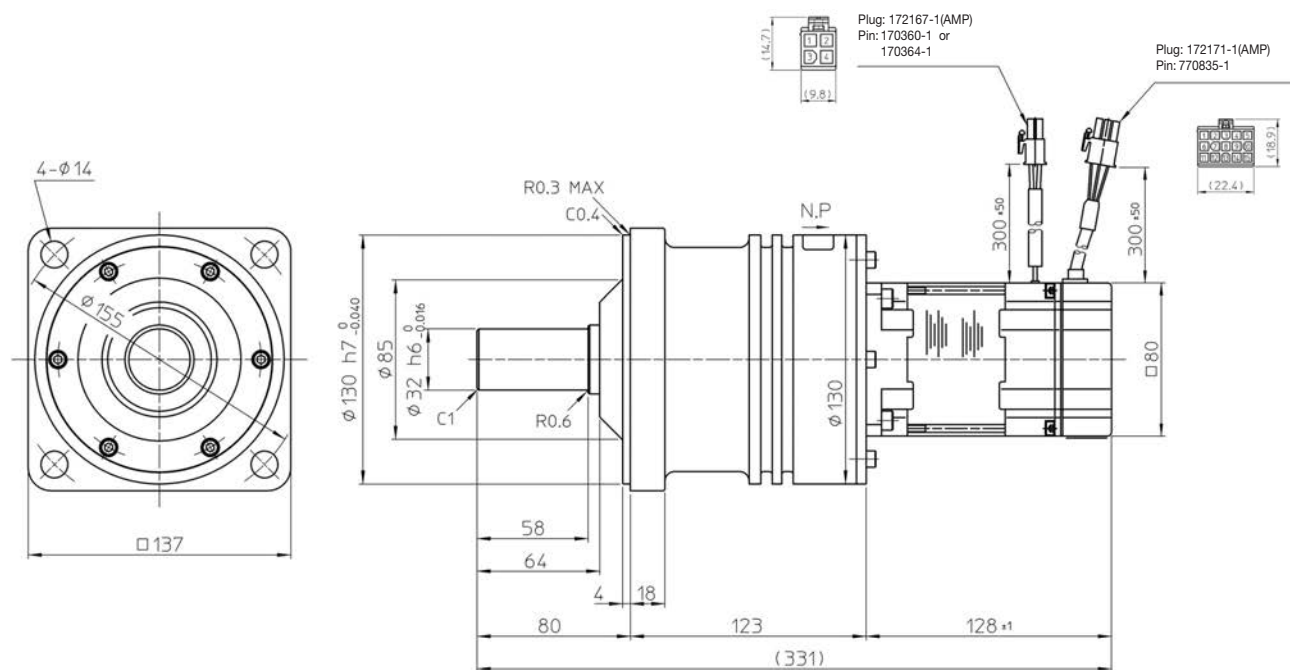
### ■ RSF-25A

Unit: mm



### ■ RSF-32A

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
Contact us for the differential range of the size that is not described.

## Positional Accuracy

The “uni-directional positional accuracy,” “repeatability” and “reverse positional accuracy” are shown below. The following values represent typical values. (Source: JIS [Japanese Industrial Standards] B-6201-1987).

The RSF series contains a speed reducer HarmonicDrive® for precision control and positioning errors of the motor shaft are therefore compressed to 1/50 or 1/100 by speed reduction. In reality, angular transmission errors of the speed reducer determine the positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown as the positional accuracies of the RSF Series.

The accuracies of the individual models are shown below.

| Model                               |         | RSF-17A                   | RSF-20A                   | RSF-25A                   | RSF-32A                   |
|-------------------------------------|---------|---------------------------|---------------------------|---------------------------|---------------------------|
| Uni-directional Positional Accuracy | arc-sec | 120                       | 90                        | 90                        | 90                        |
|                                     | rad     | $5.82 \times 10^{-4}$     | $4.35 \times 10^{-4}$     | $4.35 \times 10^{-4}$     | $4.35 \times 10^{-4}$     |
| Repeatability                       | arc-sec | ±30                       | ±30                       | ±25                       | ±20                       |
|                                     | rad     | $\pm 1.46 \times 10^{-4}$ | $\pm 1.46 \times 10^{-4}$ | $\pm 1.21 \times 10^{-4}$ | $\pm 0.97 \times 10^{-4}$ |

<Measurement conditions, Load: no load, rotational speed: rated value>

## Mechanical Accuracy

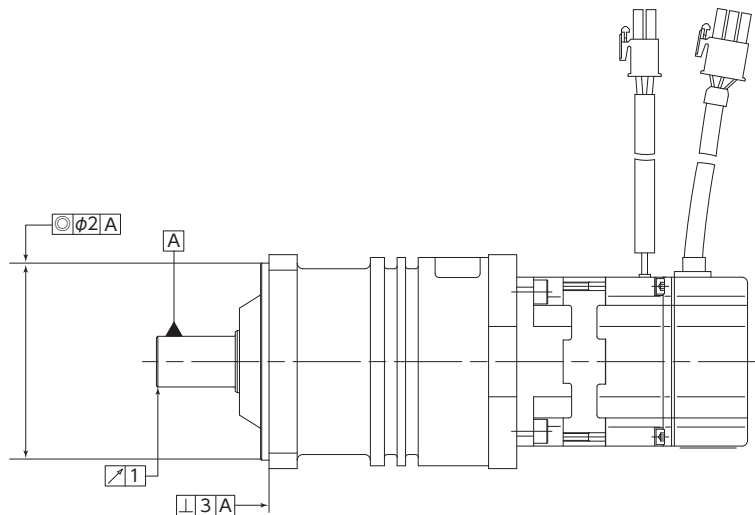
The mechanical accuracies of the output shaft and mounting flange of the RSF series are as follows.

### Mechanical Accuracy

Unit: mm

| Accuracy Item                                                    | RSF-17A | RSF-20A | RSF-25A | RSF-32A |
|------------------------------------------------------------------|---------|---------|---------|---------|
| 1 Output shaft surface runout                                    | 0.04    | 0.04    | 0.04    | 0.04    |
| 2 Concentricity of output shaft and fitting part                 | 0.06    | 0.06    | 0.06    | 0.06    |
| 3 Perpendicularity between the output shaft and mounting surface | 0.06    | 0.06    | 0.06    | 0.06    |

\* The aforementioned values are T.I.R (total indicator reading) values.

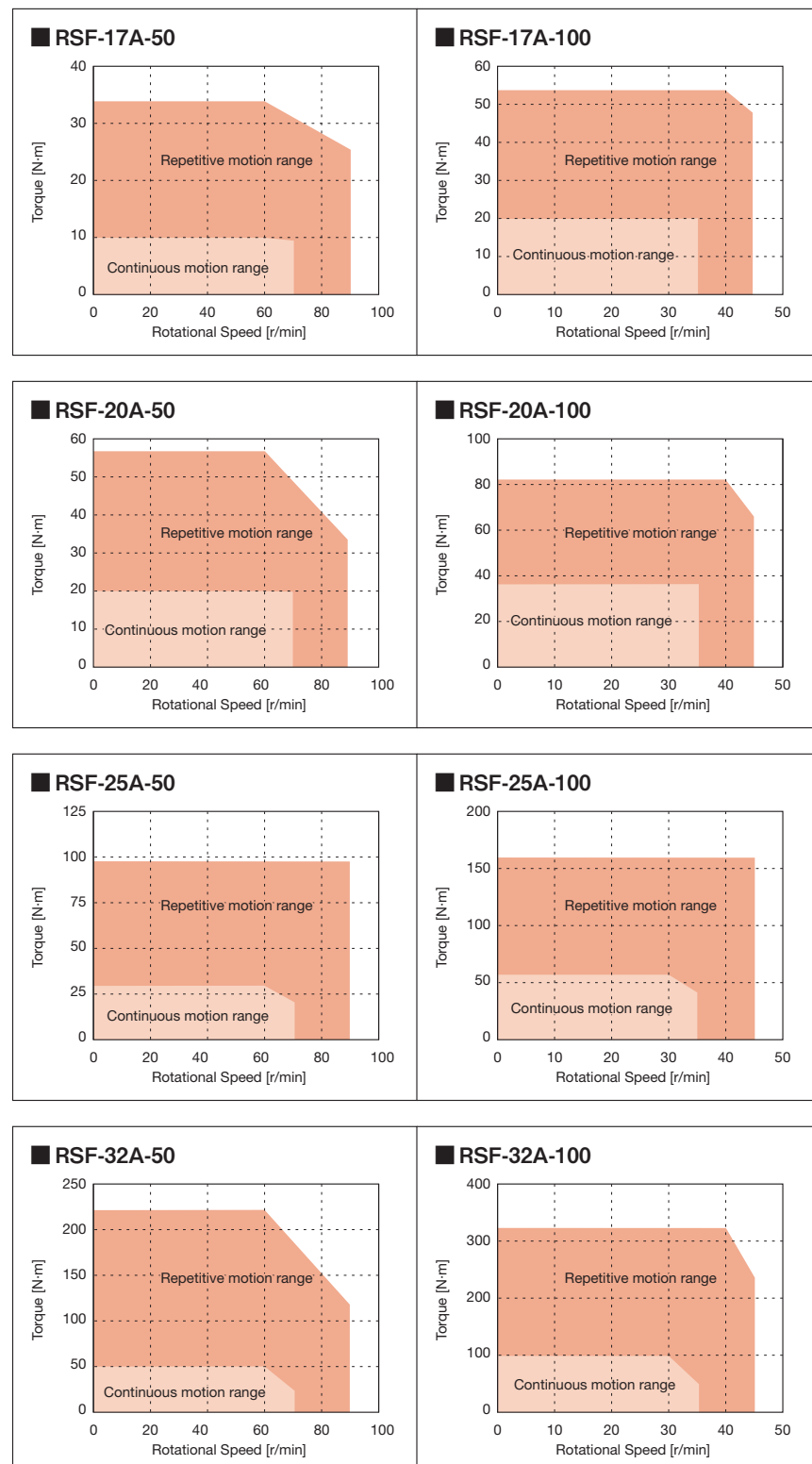


## Operable Range

The following diagrams show the operable range of the RSF series combined with an AC servo driver (HA-800).

Continuous motion range: Range of continuously operable torque-rotational speed .

Repetitive motion range: Range of "rotational speed - torque" that can be operated momentarily. Normally, this range is used during acceleration and deceleration.



Note 1: The values in the graphs are those when mounted on the following aluminum radiation plate:

RSF-17 : 250×250×12 (mm)

RSF-20 : 250×250×12 (mm)

RSF-25, RSF-32 : 300×300×15 (mm)

Note 2: Please consult Harmonic Drive Systems if your mode of motions is uni-directional continuous motion also in the continuous motion range.

## Options

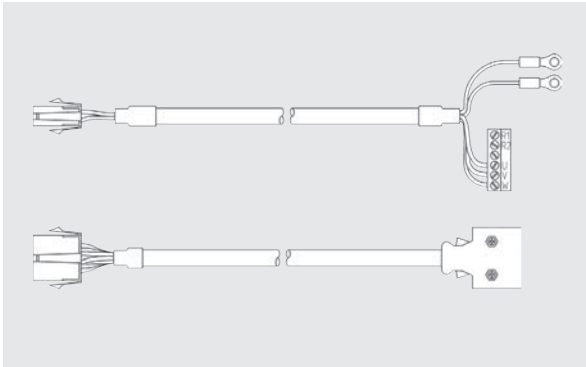
### Relay Cable (For HA-800)

Order Code Example:

EWA-M \*\* -A04-TN3 (For motor)

EWA-E \*\* -A15-3M14 (For incremental encoder)

The cable for connecting the actuator to the servo driver HA-800A.  
Standard cable lengths are 3, 5 and 10m.



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

[illegible]

# RH Series



The RH series includes compact and high-torque DC servo actuators with a high rotational accuracy combining a speed reducer HarmonicDrive® for precision control and a DC servo motor. A combination with a dedicated servo driver that fully demonstrates the performance of this RH series of implements; compact machines and equipment with a high rotational accuracy.

## Features

### ■ High resolution

High resolution of maximum 400,000 pulses/revolution (0.0009°/pulse) combining a HarmonicDrive®.

### ■ High positional accuracy

The HarmonicDrive® eliminates backlash caused by gear play, assuring high-accuracy positioning.

### ■ Compact body and high-output torque

High output. 0.69N·m (maximum momentary torque achieved) by the smallest model RH-5A with outside dimensions of  $\phi 20$ mm in diameter x 89mm.

## Structure

### ● Compact and speed reducer HarmonicDrive® for precision control

Features a high resolution and positional accuracy. Unmatched light weight and compact properties.

### ● High-precision optical encoder

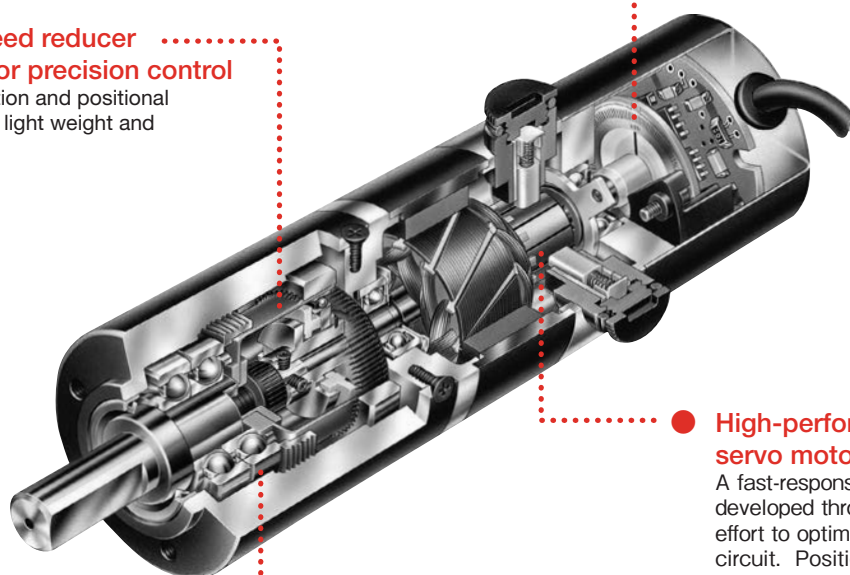
Rectangular output signal is dissolved up to x 4.

### ● High-performance DC servo motor

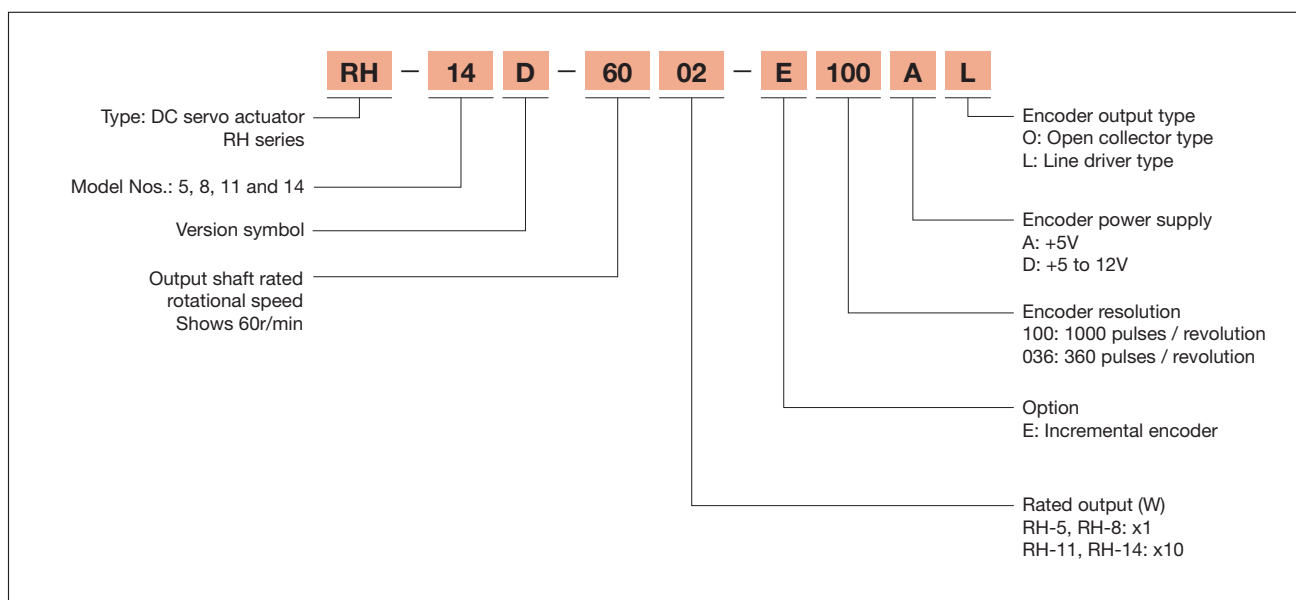
A fast-response DC servo motor developed through constant effort to optimize magnetic circuit. Positioning time is shortened.

### ● Output shaft bearing with high stiffness

The output shaft is supported by a high-precision bearing. A large load is supported directly.



## Models and Symbols



## Specification (With an Incremental Encoder)

Time rating: Continuous

Protection: Totally enclosed self-cooled

Ambient temperature: 0 to 40°C

Ambient humidity: 35 to 80% RH  
(Do not expose to condensation.)

| Item                            |                    | Model                | RH-5A                |                     |                     | RH-8D               |                      | RH-11D               |                      | RH-14D               |                      |
|---------------------------------|--------------------|----------------------|----------------------|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                                 |                    |                      | 8802                 | 5502                | 4402                | 6006                | 3006                 | 6001                 | 3001                 | 6002                 | 3002                 |
| Rated Output                    | W                  |                      | 1.5                  | 1.7                 | 1.4                 | 8.6                 | 6.2                  | 13.6                 | 12.3                 | 20.3                 | 18.5                 |
| Rated Voltage                   | V                  |                      | 12                   |                     |                     | 24                  |                      | 24                   |                      | 24                   |                      |
| Maximum Momentary Torque        | N·m                |                      | 0.39                 | 0.59                | 0.69                | 2.7                 | 3.5                  | 4.9                  | 7.8                  | 14                   | 20                   |
|                                 | kgf·cm             |                      | 4.0                  | 6.0                 | 7.0                 | 27                  | 36                   | 50                   | 80                   | 140                  | 200                  |
| Max. Continuous Stall Torque    | N·m                |                      | 0.24                 | 0.39                | 0.43                | 1.5                 | 2.3                  | 2.5                  | 4.4                  | 5.4                  | 7.8                  |
|                                 | kgf·cm             |                      | 2.4                  | 4.0                 | 4.4                 | 15                  | 23                   | 25                   | 45                   | 55                   | 80                   |
| Rated Torque                    | N·m                |                      | 0.16                 | 0.29                | 0.29                | 1.4                 | 2.0                  | 2.2                  | 3.9                  | 3.2                  | 5.9                  |
|                                 | kgf·cm             |                      | 1.6                  | 3.0                 | 3.0                 | 14                  | 20                   | 22                   | 40                   | 33                   | 60                   |
| Max. Rotational Speed           | r/min              |                      | 180                  | 110                 | 90                  | 100                 | 50                   | 100                  | 50                   | 100                  | 50                   |
| Rated Rotational Speed          | r/min              |                      | 88                   | 55                  | 44                  | 60                  | 30                   | 60                   | 30                   | 60                   | 30                   |
| Maximum Momentary Current       | A                  |                      | 0.83                 | 0.78                | 0.77                | 1.6                 | 1.1                  | 2.4                  | 2.1                  | 5.4                  | 4.1                  |
| Rated Current                   | A                  |                      | 0.5                  | 0.5                 | 0.5                 | 1.0                 | 0.8                  | 1.3                  | 1.3                  | 1.8                  | 1.8                  |
| Torque Constant                 | N·m/A              |                      | 0.69                 | 1.11                | 1.38                | 2.1                 | 4.2                  | 2.46                 | 4.91                 | 2.92                 | 5.76                 |
|                                 | kgf·cm/A           |                      | 7.06                 | 11.3                | 14.1                | 21.4                | 42.9                 | 25.1                 | 50.1                 | 29.8                 | 58.8                 |
| Moment of Inertia <sup>*5</sup> | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 6.3×10 <sup>-4</sup> | 16×10 <sup>-4</sup> | 25×10 <sup>-4</sup> | 37×10 <sup>-4</sup> | 150×10 <sup>-4</sup> | 110×10 <sup>-4</sup> | 430×10 <sup>-4</sup> | 210×10 <sup>-4</sup> | 810×10 <sup>-4</sup> |
|                                 | J                  | kgf·cms <sup>2</sup> | 0.007                | 0.016               | 0.026               | 0.04                | 0.15                 | 0.11                 | 0.44                 | 0.21                 | 0.83                 |
| Permissible Radial Load         | N                  |                      | 59                   |                     |                     | 196                 |                      | 245                  |                      | 392                  |                      |
|                                 | kgf                |                      | 6.0                  |                     |                     | 20                  |                      | 25                   |                      | 40                   |                      |
| Permissible Thrust Load         | N                  |                      | 29                   |                     |                     | 98                  |                      | 196                  |                      | 392                  |                      |
|                                 | kgf                |                      | 3.0                  |                     |                     | 10                  |                      | 20                   |                      | 40                   |                      |
| Reduction Ratio                 |                    |                      | 50                   | 80                  | 100                 | 50                  | 100                  | 50                   | 100                  | 50                   | 100                  |
| Mass                            | kg                 |                      | 0.09                 |                     |                     | 0.3                 |                      | 0.5                  |                      | 0.77                 |                      |
| Combined Driver                 |                    |                      | HS-360-1A            |                     |                     | HS-360-1B           |                      | HS-360-1C            |                      | HS-360-1D            |                      |

\*1: Values shown in the table above indicate representative values on the output shaft.

\*2: This is the value when the actuator is combined with the HS-360 driver.

\*3: If you use the actuator by combining it with the HS-360 driver, choose an encoder that satisfies the line driver specification.

\*4: The actuator specification shows values when the actuator is installed on the following aluminum radiator plates.

RH-5A : 150×150×3(mm)

RH-8D : 150×150×6(mm)

RH-11D : 150×150×6(mm)

RH-14D : 150×150×6(mm)

\*5: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the HarmonicDrive®.

\*6: The resolution of the detector is the value obtained from ((motor shaft encoder resolution multiplied by 4) X (reduction ratio)).

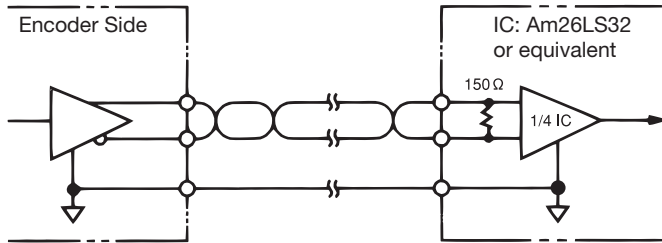
\*7: The brush in DC servo motors requires replacement.

\*8: Please check the actuator rotation direction in our technical data sheet.

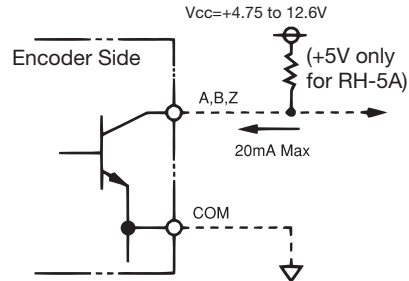
## Encoder Specification

| Item                             | Model | RH-5A       |                | RH-8D,11D,14D |                  |
|----------------------------------|-------|-------------|----------------|---------------|------------------|
| Output Circuit                   |       | Line Driver | Open Collector | Line Driver   | Open Collector   |
| Resolution (Pulses / revolution) |       | 360         |                | 1000          |                  |
| Power Supply (V)                 |       | DC+5V±5%    |                | DC+5V±5%      | DC+4.75 to 12.6V |
| Current Consumption (mA)         |       | 170max.     | 60max.         | 170max.       | 60max.           |
| Response Frequency (kHz)         |       | 100         |                | 125           |                  |

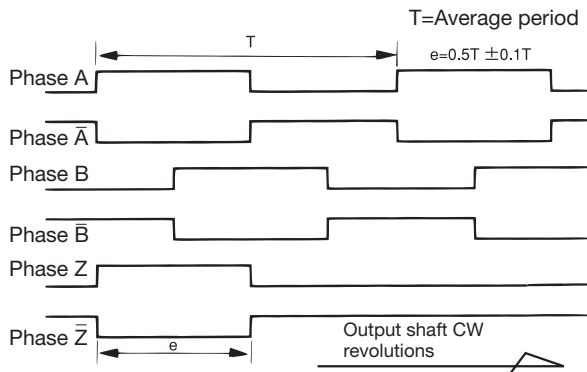
### Line Driver Output Circuit



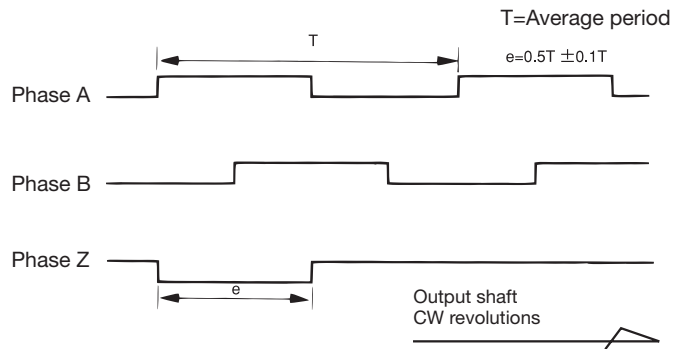
### Open Collector Output Circuit



### Line Driver Output Waveform



### Open Collector Output Waveform



### Colors of Encoder Cables

| Model       | RH-5A            |                | RH-8D,11D,14D    |                |
|-------------|------------------|----------------|------------------|----------------|
| Cable Color | Line Drive       | Open Collector | Line Drive       | Open Collector |
| Brown       | Signal A         | Signal A       | Signal A         | Signal A       |
| Blue        | Signal $\bar{A}$ | —              | Signal $\bar{A}$ | COM            |
| Red         | Signal B         | Signal B       | Signal B         | Signal B       |
| Green       | Signal $\bar{B}$ | —              | Signal $\bar{B}$ | COM            |
| Yellow      | Signal Z         | Signal Z       | Signal Z         | Signal Z       |
| Orange      | Signal $\bar{Z}$ | —              | Signal $\bar{Z}$ | COM            |
| White       | Power Supply     | Power Supply   | Power Supply     | Power Supply   |
| Black       | Ground (COM)     | Ground (COM)   | Ground (COM)     | Ground (COM)   |
| Shield      | Floating         | Floating       | Floating         | Floating       |

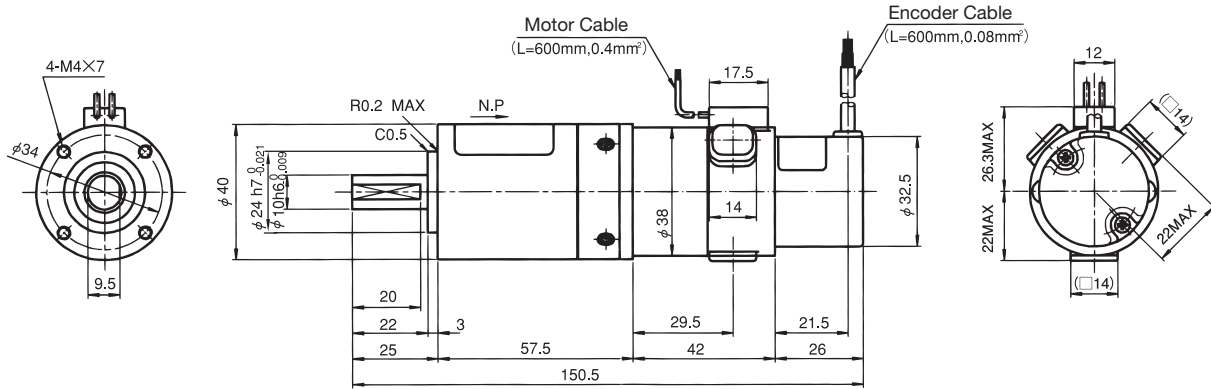




## External Dimensions

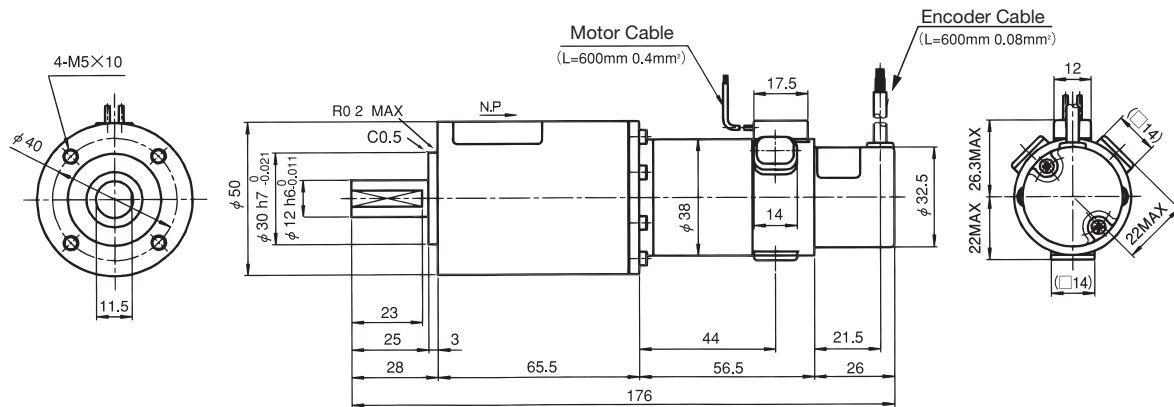
### ■ RH-11D (With incremental encoder)

Unit: mm



### ■ RH-14D (With incremental encoder)

Unit: mm



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## Positional Accuracy

The “uni-directional positional accuracy,” “repeatability” and “reverse positional accuracy” are shown below. The following values represent typical values. (Source: JIS [Japanese Industrial Standards] B-6201-1987).

The RH series contains a speed reducer HarmonicDrive® for precision control and positioning errors of the motor shaft are therefore compressed to 1/50 or 1/100 by speed reduction. In reality, angular transmission errors of the speed reducer determine the positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown as the positional accuracies of the RH Series. The accuracies of the individual models are shown below.

| Model                               |         | RH-5A                     | RH-8D                     | RH-11D                    | RH-14D                    |
|-------------------------------------|---------|---------------------------|---------------------------|---------------------------|---------------------------|
| Uni-directional Positional Accuracy | arc-sec | 290                       | 150                       | 120                       | 120                       |
|                                     | rad     | $1.31 \times 10^{-3}$     | $7.27 \times 10^{-4}$     | $5.82 \times 10^{-4}$     | $5.82 \times 10^{-4}$     |
| Repeatability                       | arc-sec | ±90                       | ±60                       | ±60                       | ±60                       |
|                                     | rad     | $\pm 4.36 \times 10^{-4}$ | $\pm 2.91 \times 10^{-4}$ | $\pm 2.91 \times 10^{-4}$ | $\pm 2.91 \times 10^{-4}$ |
| Reverse Positional Accuracy         | arc-sec | 150                       | 60                        | 60                        | 60                        |
|                                     | rad     | $7.27 \times 10^{-4}$     | $2.91 \times 10^{-4}$     | $2.91 \times 10^{-4}$     | $2.91 \times 10^{-4}$     |

<Measurement conditions, Load: no load, rotational speed: rated value>

## Mechanical Accuracy

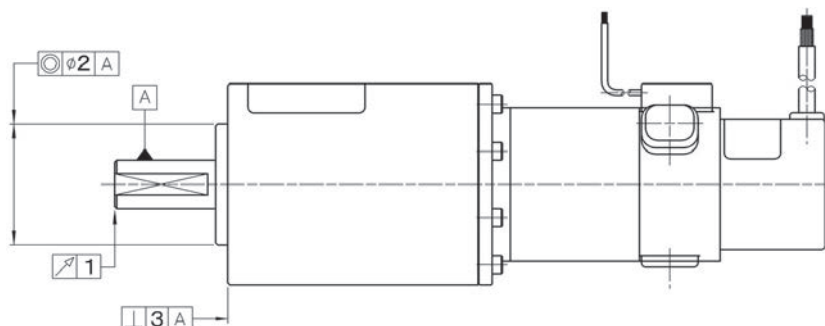
The mechanical accuracies of the output shaft and mounting flange of the RH series are as follows.

### Mechanical Accuracy

Unit: mm

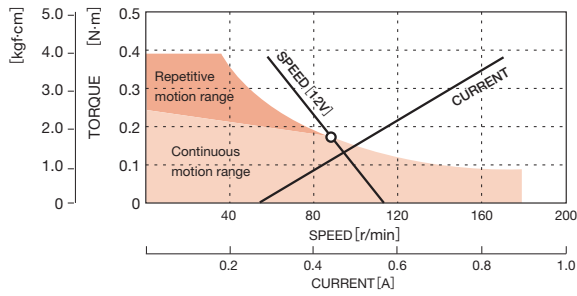
| Accuracy Item                                                    | RH-5A | RH-8D | RH-11D | RH-14D |
|------------------------------------------------------------------|-------|-------|--------|--------|
| 1 Output shaft surface runout                                    | 0.03  | 0.03  | 0.03   | 0.03   |
| 2 Concentricity of output shaft and fitting part                 | 0.04  | 0.04  | 0.04   | 0.04   |
| 3 Perpendicularity between the output shaft and mounting surface | 0.04  | 0.04  | 0.04   | 0.04   |

Note: The aforementioned values are T.I.R (total indicator reading) values.

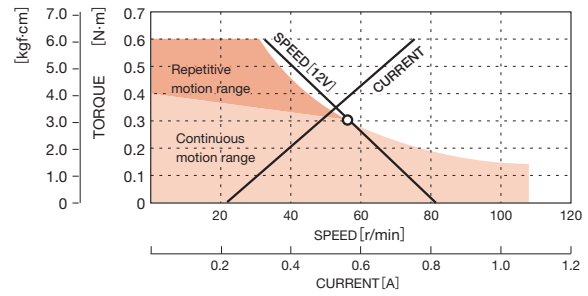


## Operable Range

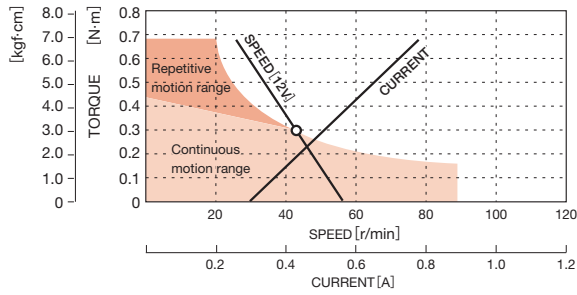
■ RH-5A-8802



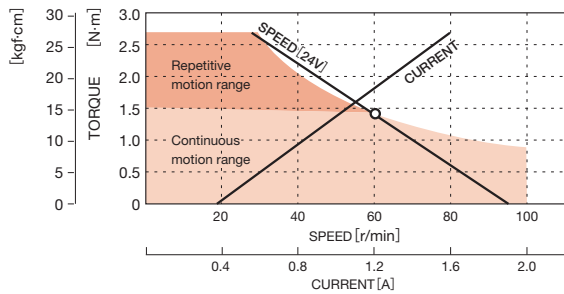
■ RH-5A-5502



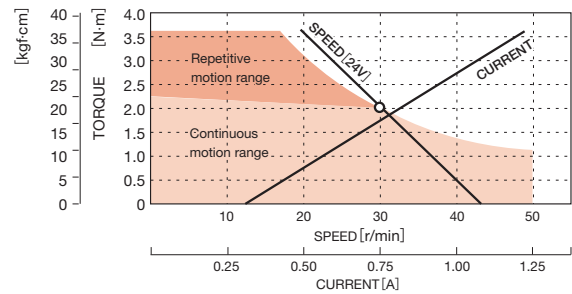
■ RH-5A-4402



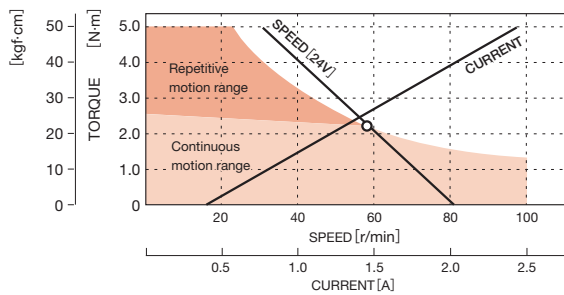
■ RH-8D-6006



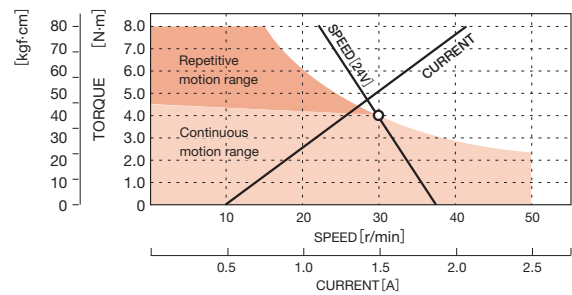
■ RH-8D-3006



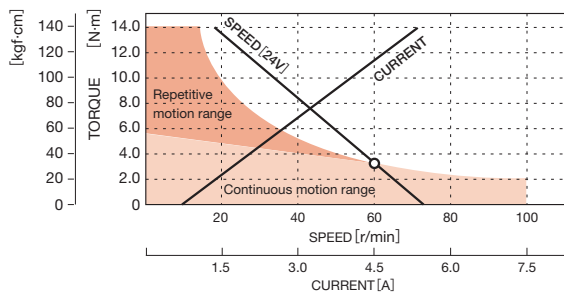
■ RH-11D-6001



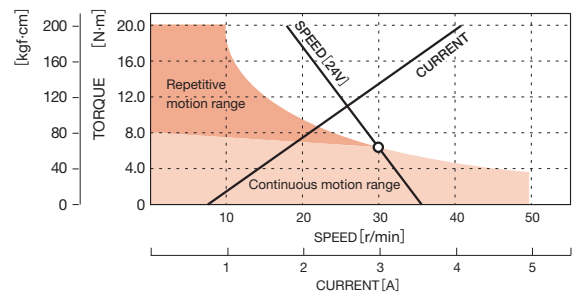
■ RH-11D-3001



■ RH-14D-6002



■ RH-14D-3002



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

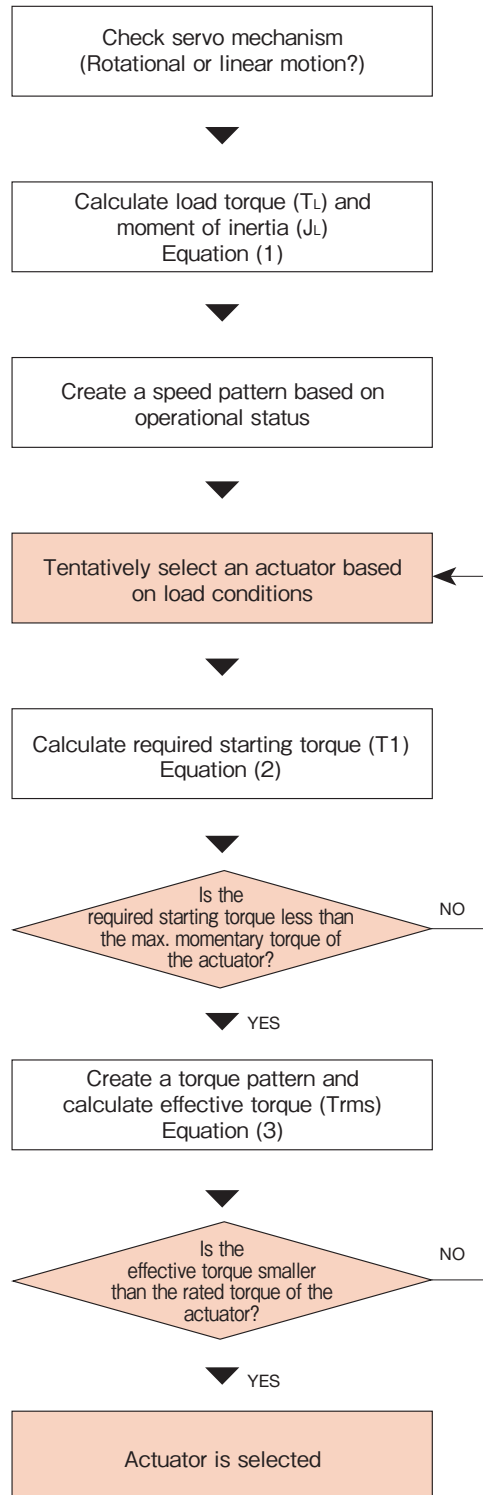
Servo Driver

Sensor System

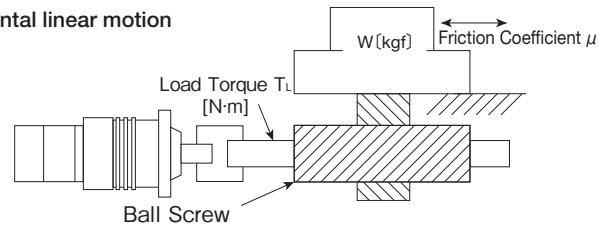
# Tips for Selecting the Rotary Actuator

Select an actuator after checking the detailed specifications in the technical information of actuators and drivers.

## Flowchart for Actuator Selection



### ● For horizontal linear motion

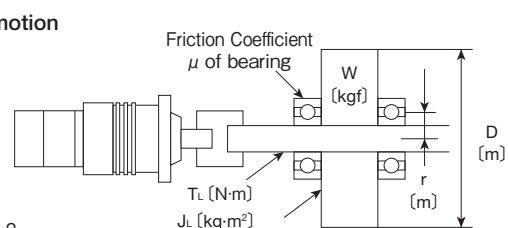


Equation (1)-1

$$J_L = J_s + w \left( \frac{P}{2\pi} \right)^2 \text{ [kg·m}^2\text{]}$$

$$T_L = \frac{\mu W \cdot P}{2\pi \cdot \eta} \text{ [N·m]}$$

### ● Rotation motion

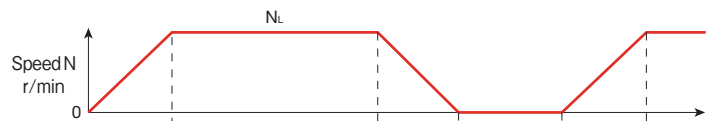


Equation (1)-2

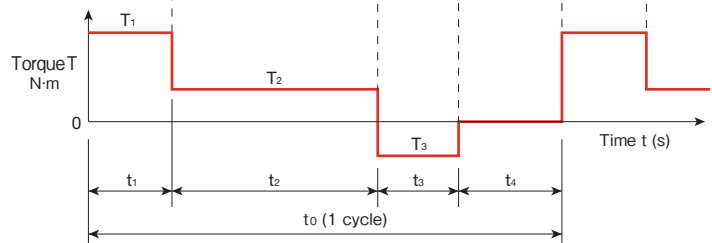
$$J_L = J_s + \frac{W}{8} D^2 \text{ [kg·m}^2\text{]}$$

$$T_L = \mu W \cdot r \text{ [N·m]}$$

### ● Speed pattern



### ● Torque pattern



Note:  $t_1$  is assumed to be equal to  $t_3$

### ● Tentative selection conditions

| Load Condition                      | Check         | Catalog Value                | Unit              |
|-------------------------------------|---------------|------------------------------|-------------------|
| Load torque $T_L$                   | $\leq$        | Rated torque $T_R$           | N·m               |
| Max. rotational speed of load $N_L$ | $\leq$        | Rated rotational speed $N_R$ | r/min             |
| Moment of inertia of load $J_L$     | $\leq 3J_A^*$ | Moment of inertia $J_A$      | kg·m <sup>2</sup> |

\*  $J_1 \leq J_A$  is desirable for a system requiring high servo stiffness (fast response and high precision)

$$\text{Equation (2)} \quad T_1 = T_L + \frac{2\pi}{60} \cdot \frac{(J_A + J_L) \cdot N_L}{t_1}$$

Equation (3)

$$T_2 = T_L$$

$$T_3 = T_L - (T_1 - T_L)$$

$$T_{rms} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3}{t_0}}$$

## Actuator Selection Example

An example of the actuator selection is shown below.

Tentatively select an actuator based on the load conditions. RSF-11B-100 satisfies the tentative selection conditions based on catalog values (page 056: Specification)

$$\begin{aligned} T_L &= 2\text{N}\cdot\text{m} < T_R = 4.0\text{N}\cdot\text{m} \\ N_L &= 25\text{r/min} < T_R = 30\text{r/min} \\ J_L &= 0.02\text{kg}\cdot\text{m}^2 < J_A = 0.02\text{kg}\cdot\text{m}^2 \end{aligned}$$

Calculate required starting torque ( $T_1$ )  
Equation (1)

$$\begin{aligned} T_1 &= 2 + \frac{2\pi}{60} \cdot \frac{(0.02+0.02) \times 25}{0.1} \\ &= 3.0\text{N}\cdot\text{m} \end{aligned}$$

Check if the required starting torque is smaller than the maximum momentary torque of the actuator.  
 $T_1 = 3.0\text{N}\cdot\text{m} < T_p = 11\text{N}\cdot\text{m}$  will result. Yes

Calculate effective torque ( $T_{\text{rms}}$ ) Equation (3)

$$\begin{aligned} T_1 &= 3.0\text{N}\cdot\text{m} \\ T_2 &= T_L = 2\text{N}\cdot\text{m} \\ T_3 &= T_L - (T_1 - T_L) = 1\text{N}\cdot\text{m} \end{aligned}$$

$$\begin{aligned} T_{\text{rms}} &= \sqrt{\frac{3^2 \times 0.1 + 2^2 \times 0.2 + 1^2 \times 0.1}{1}} \\ &= 1.3\text{N}\cdot\text{m} \end{aligned}$$

Check if the effective torque is smaller than the rated actuator torque.  
 $T_{\text{rms}} = 1.3\text{N}\cdot\text{m} < T_R = 4.0\text{N}\cdot\text{m}$  will result. Yes

Therefore, the actuator model is decided to be RSF-11B-100

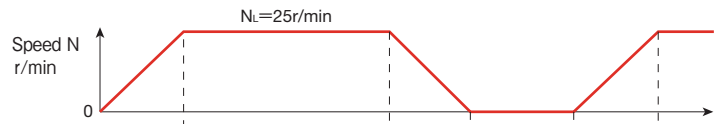
### Load Conditions

Preconditions: The servo mechanism involves horizontal linear motion and the actuator is of a shaft type (RSF series)

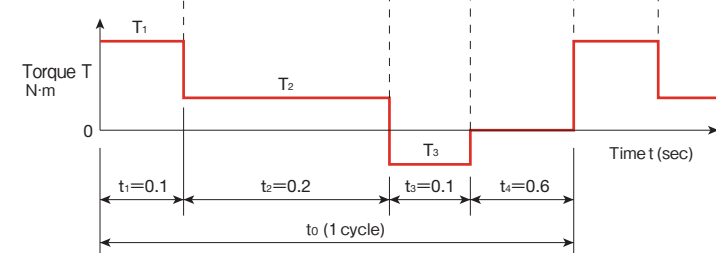
|                        |             |                        |
|------------------------|-------------|------------------------|
| Load rotational speed  | $N_L$       | :25r/min               |
| Load torque            | $T_L$       | :2N·m                  |
| Moment of load inertia | $J_L$       | :0.02kg·m <sup>2</sup> |
| Speed pattern          | $t_1 = t_3$ | :0.1sec                |
|                        | $t_2$       | :0.2sec                |
|                        | $t_4$       | :0.6sec                |

Note: Use characteristic values that are converted into those for the actuator output shaft.

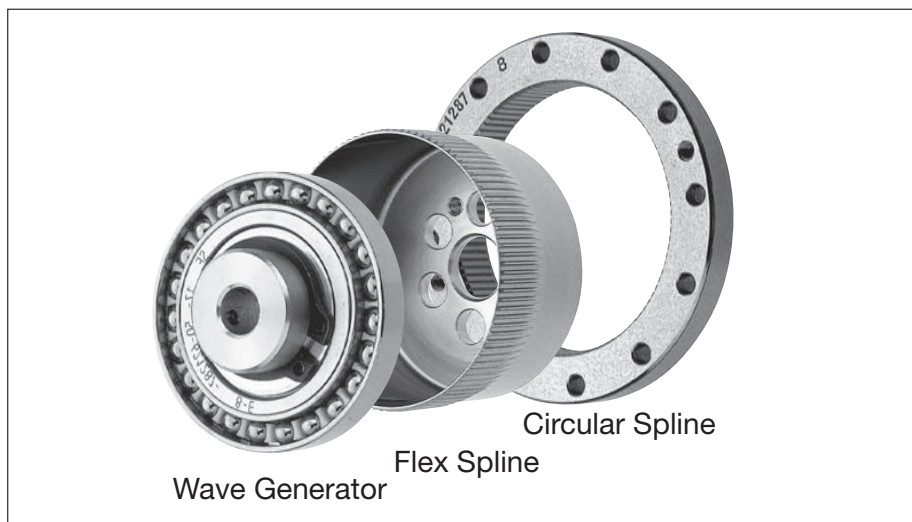
### Speed pattern



### Torque pattern



## Structure of HarmonicDrive®



### ● Wave Generator:

A ball bearing with thin-walled construction is fitted onto the outer circumference of an oval cam. The entire structure is oval. The inner ring of the bearing is fixed onto the oval cam and the outer ring elastically deforms through a ball. The wave generator can be mounted on a motor shaft.

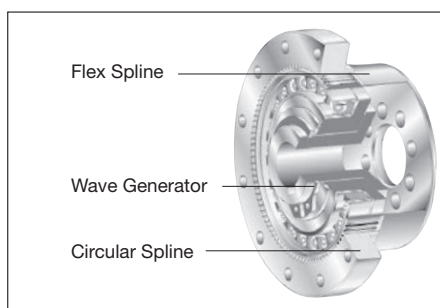
### ● Flex Spline:

A cup-like elastic metal part with thin wall thickness. Teeth are cut into the outer circumference of the opening of the cup, from where the output is usually extracted.

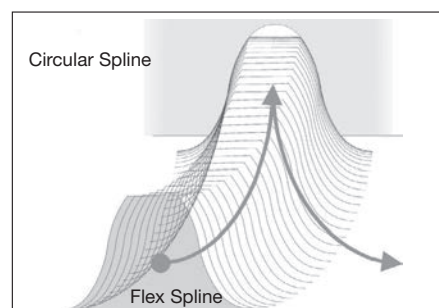
### ● Circular Spline:

The inner gear of the rigid body, with teeth of equivalent size to those on the flex spline cut into the inner circumference. The circular spline has two more teeth than the flex spline and is normally fixed onto the gear casing.

### Three basic components are assembled



### Teeth meshing



Continued on page 106



# Direct Drive Motor

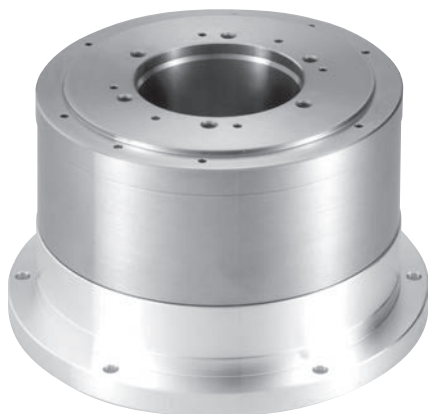
**High precision, high resolution**

KDU Series ..... 096





# KDU Series



Persistence to extra-high resolution and high precision  
Resolution: 11.84 million divisions/revolution (0.11arc-sec/pulse)  
direct drive motor

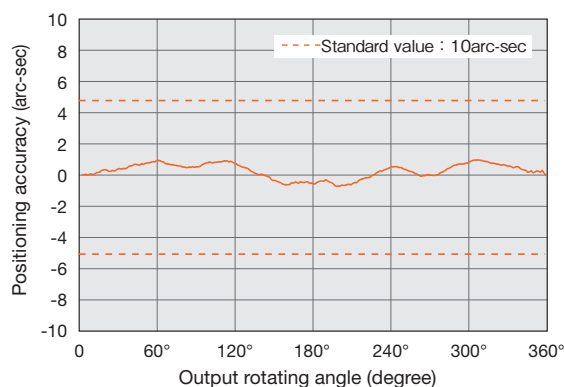
## Features

### High precision

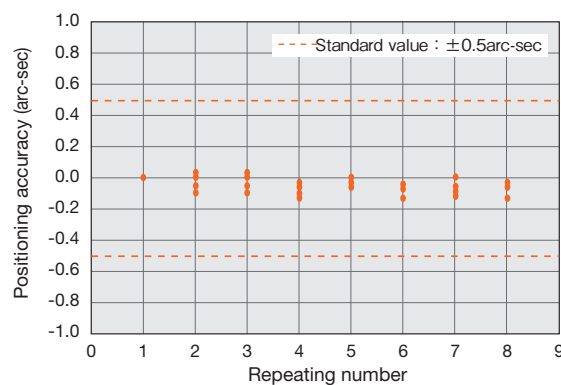
Absolute position accuracy: 10arc-sec

Repetitive positioning accuracy:  $\pm 0.5$ arc-sec

Absolute position accuracy  $\pm 10$ arc-sec

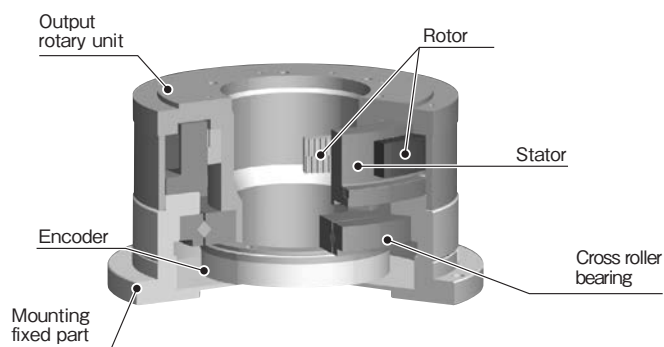
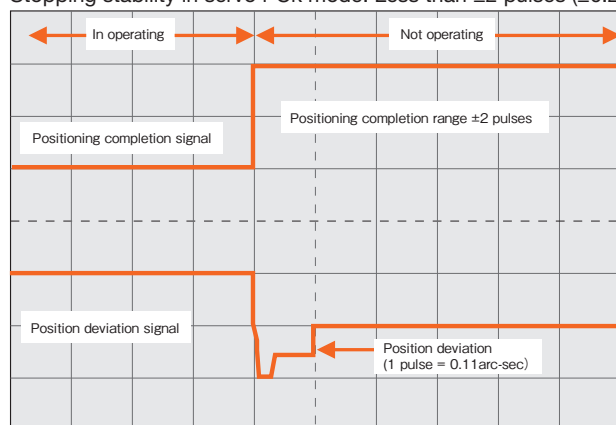


Repetitive positioning accuracy  $\pm 0.5$ arc-sec



### Stopping stability

Stopping stability in servo I°Ck mode: Less than  $\pm 2$  pulses ( $\pm 0.22$  arc-sec)



### Large hollow opening diameter

Motor outside diameter:  $\phi 130$ mm

Hollow opening diameter:  $\phi 50$ mm

### Mechanical accuracy

Runout on output side: 2 $\mu$ m

## Models and Symbols

The direct drive motor KDU series is a set that functions in combination with an AC servo driver HA-770. The following table gives guidance how to find a set model name and symbol.

|                 |                                           |   |                           |   |                                |   |          |
|-----------------|-------------------------------------------|---|---------------------------|---|--------------------------------|---|----------|
|                 | <b>KDU-13SB</b>                           | — | <b>D3</b>                 | — | <b>100</b>                     | — | <b>□</b> |
|                 | (1)                                       |   | (2)                       |   | (3)                            |   | (4)      |
| (1) Motor type: | Direct driver motor KDU series            |   | (3) Power voltage         |   | 100: AC100V                    |   |          |
|                 | KDU-13-SB: KDU-13SB-E10                   |   |                           |   | 200: AC200V                    |   |          |
|                 | KDU-13WB: KDU-13WB-E10                    |   | (4) Specification symbol: |   | No mark: Standard item         |   |          |
| (2) System:     | Combination with AC servo driver HA-770-2 |   |                           |   | SP: Special specification item |   |          |

### Motor single type

**KDU** — **13S** **B** — **E** **10** — **□**

(1) (2) (3) (4) (5) (6)

(Motor single type)

- |                               |                                   |
|-------------------------------|-----------------------------------|
| (1) Model name                | Direct drive motor KDU series     |
| (2) Model number              | 13S, 13W                          |
| (3) Version symbol            | B: Version symbol                 |
| (4) Encoder type              | E: Incremental encoder            |
| (5) Resolution of the encoder | 10: 1184000p/rev                  |
| (6) Specification symbol      | No symbol: Standard specification |
|                               | SP: Special specification         |

### Driver single type

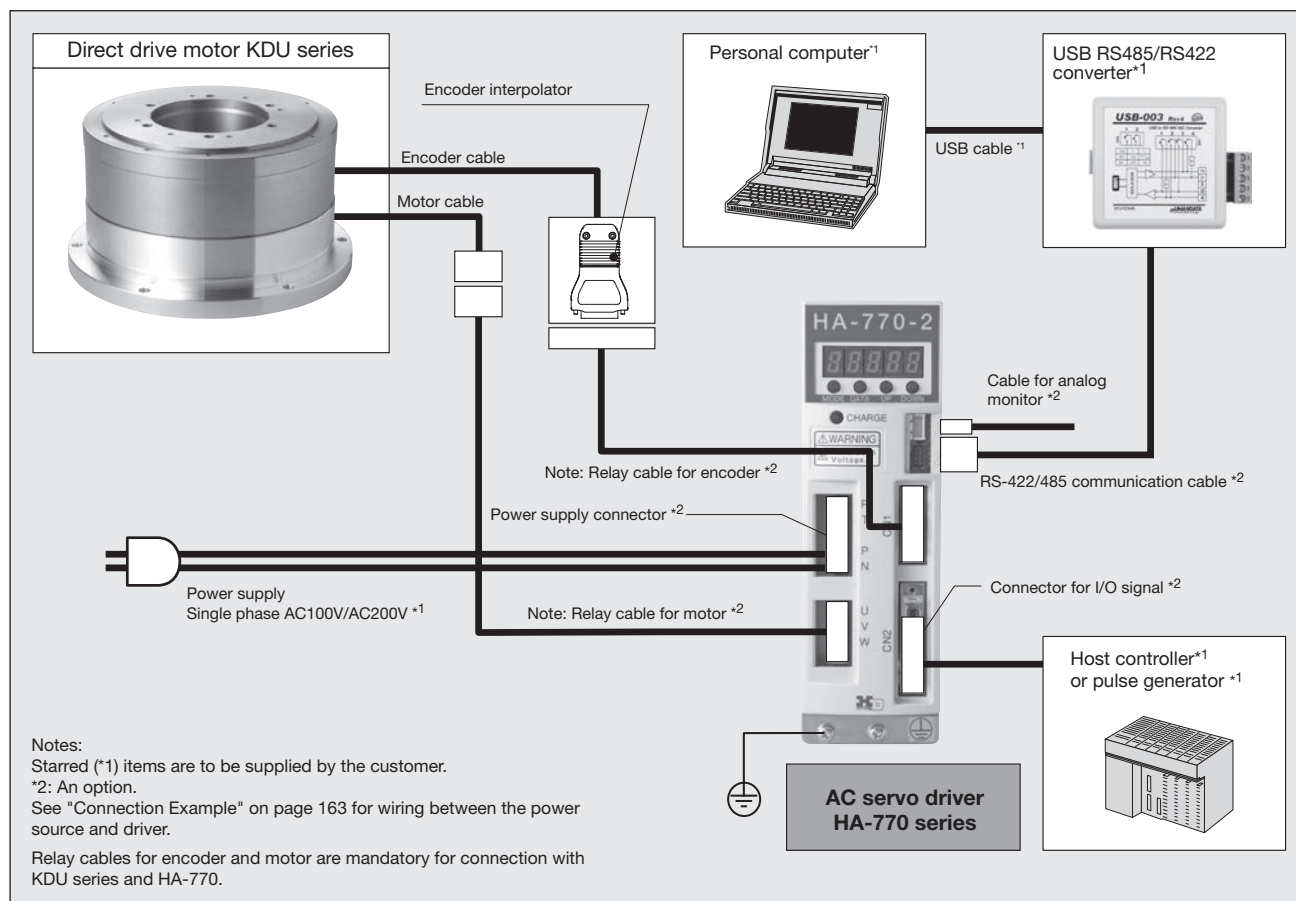
**HA** — **770** — **2** — **□**

(1) (2) (3) (4)

(Motor single type)

- |                          |                                   |
|--------------------------|-----------------------------------|
| (1) Model                | AC servo driver                   |
| (2) Series name          | 770 series                        |
| (3) Rated output current | Rated output current: 2:1.8       |
| (4) Specification symbol | No symbol: Standard specification |
|                          | SP: Special specification         |

## Example of System Configuration



## KDU Series Specification

| Item                                        |                    | Model                | KDU                                                                                                                                                                                                                                                                                                                      |        |
|---------------------------------------------|--------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|                                             |                    |                      | -13SB                                                                                                                                                                                                                                                                                                                    | -13WB  |
| Maximum Torque <sup>*2</sup>                | N·m                |                      | 7.0                                                                                                                                                                                                                                                                                                                      | 15.0   |
|                                             | kgf·m              |                      | 0.7                                                                                                                                                                                                                                                                                                                      | 1.5    |
| Maximum Rotational Speed                    | r/min              |                      | 127                                                                                                                                                                                                                                                                                                                      | 127    |
| Torque Constant                             | N·m/A              |                      | 3.1                                                                                                                                                                                                                                                                                                                      | 6.5    |
|                                             | kgf·m/A            |                      | 0.32                                                                                                                                                                                                                                                                                                                     | 0.66   |
| Input Power Supply Voltage                  | V                  |                      | AC100 / AC200                                                                                                                                                                                                                                                                                                            |        |
| EMF Constant                                | V / (r/min)        |                      | 0.33                                                                                                                                                                                                                                                                                                                     | 0.68   |
| Line Resistance                             | Ω (20°C)           |                      | 9.1                                                                                                                                                                                                                                                                                                                      | 14.0   |
| Line Inductance                             | mH                 |                      | 19                                                                                                                                                                                                                                                                                                                       | 35     |
| Moment of Inertia                           | GD <sup>2</sup> /4 | kg·m <sup>2</sup>    | 0.0047                                                                                                                                                                                                                                                                                                                   | 0.0065 |
|                                             | J                  | kgf·cms <sup>2</sup> | 0.048                                                                                                                                                                                                                                                                                                                    | 0.066  |
| Moment of Rigidity                          | N·m/rad            |                      | 2.4×10 <sup>5</sup>                                                                                                                                                                                                                                                                                                      |        |
|                                             | kgf·m/arc-min      |                      | 7.1                                                                                                                                                                                                                                                                                                                      |        |
| Motor Position Sensor                       | pulse/rev          |                      | Incremental encoder Rectangular wave of Phases A and B: 11,840,000 Pulse signal of Phase Z                                                                                                                                                                                                                               |        |
| Repeatability <sup>*3</sup>                 | arc-sec            |                      | ±0.5                                                                                                                                                                                                                                                                                                                     |        |
| Absolute Positioning Accuracy <sup>*3</sup> | arc-sec            |                      | 10 (Angular position corrected) <sup>*4</sup>                                                                                                                                                                                                                                                                            |        |
| Mass                                        | kg                 |                      | 4.0                                                                                                                                                                                                                                                                                                                      | 5.0    |
| Protective Structure                        |                    |                      | Totally-enclosed self-cooled type (IP40 or equivalent)                                                                                                                                                                                                                                                                   |        |
| Ambient Conditions                          |                    |                      | Operating temperature: 10 to 30°C/ Storage temperature: -10 to 60°C <sup>(*)</sup><br>Operating humidity/storage humidity: 20 to 80% RH (no condensation)<br>No powder or dust, metal powder, corrosive gases, flammable gases, or oil mist, etc.<br>To be used indoors. No direct sunlight.<br>Altitude: 1000m or lower |        |
| Motor Insulation                            |                    |                      | Insulation resistance: 100m ohm or more (DC 500V)<br>Dielectric strength: AC 1500V/1min<br>Insulation class: Class B                                                                                                                                                                                                     |        |
| Mounting Direction                          |                    |                      | Output shaft to face upward                                                                                                                                                                                                                                                                                              |        |
| Combined Driver                             |                    |                      | HA-770-2                                                                                                                                                                                                                                                                                                                 |        |

\*1: The table above shows output values of output shaft.

\*2: The values in the table above are obtained when connected to HA-770 servo driver.

\*3: The repeatability and absolute repeatability are the values measured in an environment of 23 ±0.3°C in temperature, 50% RH in humidity and with output shaft facing upward in mounting direction. Please operate the product after checking "Precautions for Maintaining Accuracy" on page 100.

\*4: Value after angular position of the HA-770 servo driver is corrected.

## Mechanical Accuracy

The mechanical accuracies of the output shaft and mounting flange of the KDU series are as follows.

### Mechanical Accuracy

Unit: mm

| Accuracy Item                                          | KDU-13 |
|--------------------------------------------------------|--------|
| 1 Output shaft surface runout                          | 0.002  |
| 2 Runout of output shaft                               | 0.040  |
| 3 Parallelism between output shaft and mounted surface | 0.040  |

Note: The aforementioned values are T.I.R (total indicator reading) values.

The measuring method is described below.

#### (1) Output shaft surface runout

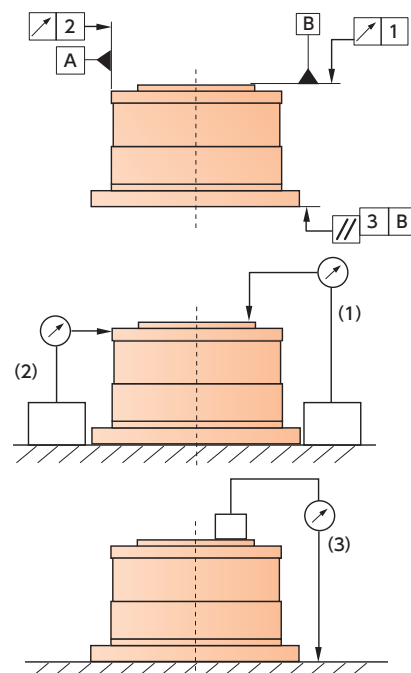
The axial runout (maximum runout width) of the outermost part of the output shaft when the output rotating part is turned one turn is measured using a dial gauge mounted on the fixed part.

#### (2) Runout of output shaft

The radial runout (maximum runout width) of the output shaft when the output rotating part is turned one turn is measured using a dial gauge mounted on the fixed part.

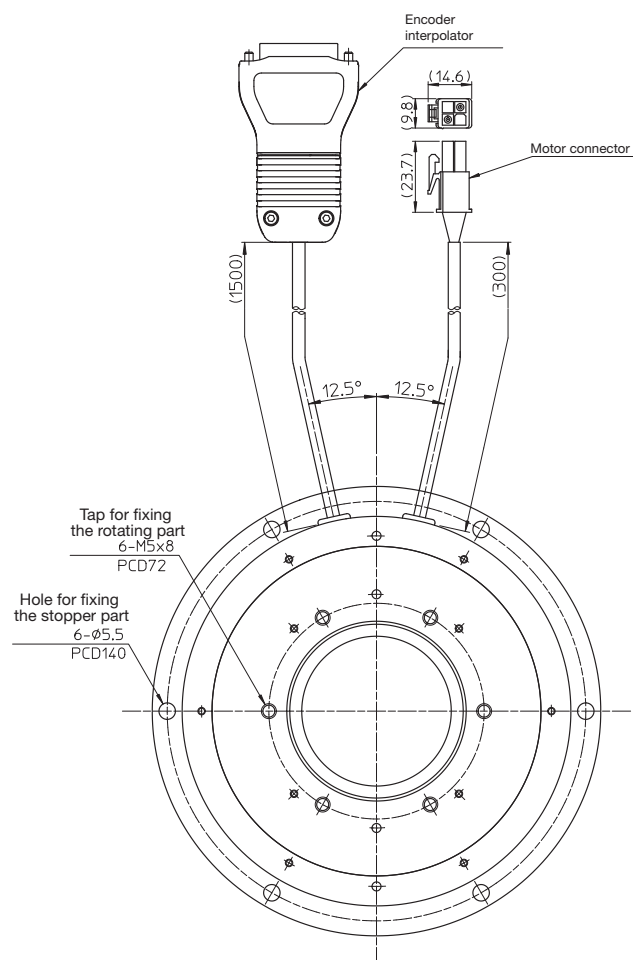
#### (3) Parallelism between output shaft and mounted surface

The axial runouts (maximum runout widths) of the outermost parts of the mounted surface (output shaft side and anti-output shaft side) when the output rotating part is turned one turn are measured using the dial gauge mounted on the output rotating part.



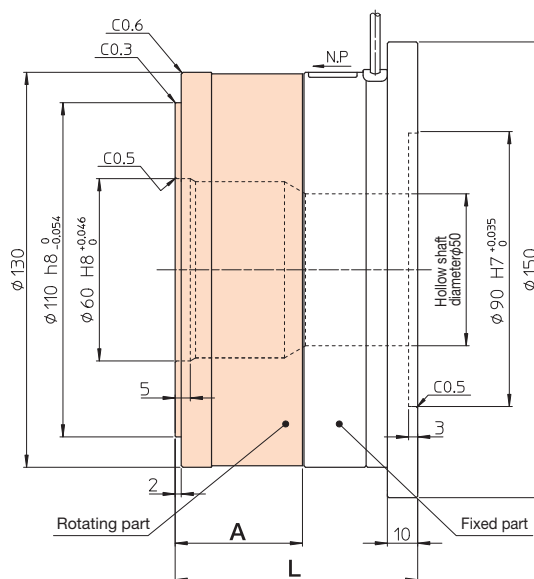
## External Dimensions

### ■ KDU-13SB-E08-100·KDU-13WB-E08-100

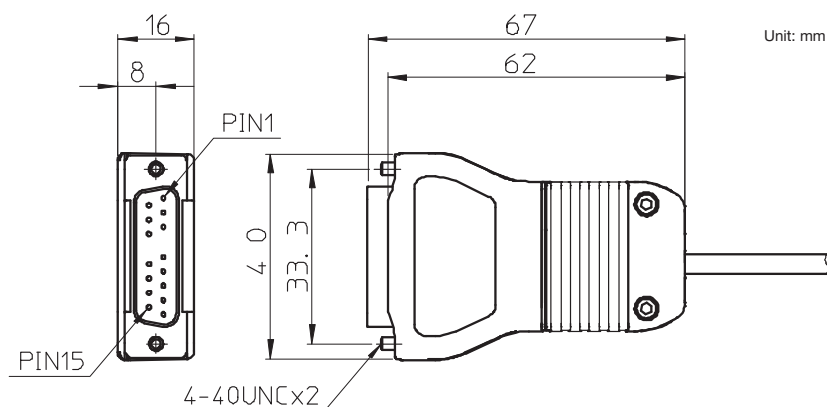


Unit: mm

|   | KDU-13SB | KDU-13WB |
|---|----------|----------|
| A | 42       | 56       |
| L | 80       | 94       |



### ■ Encoder interpolator (mass: 130g)



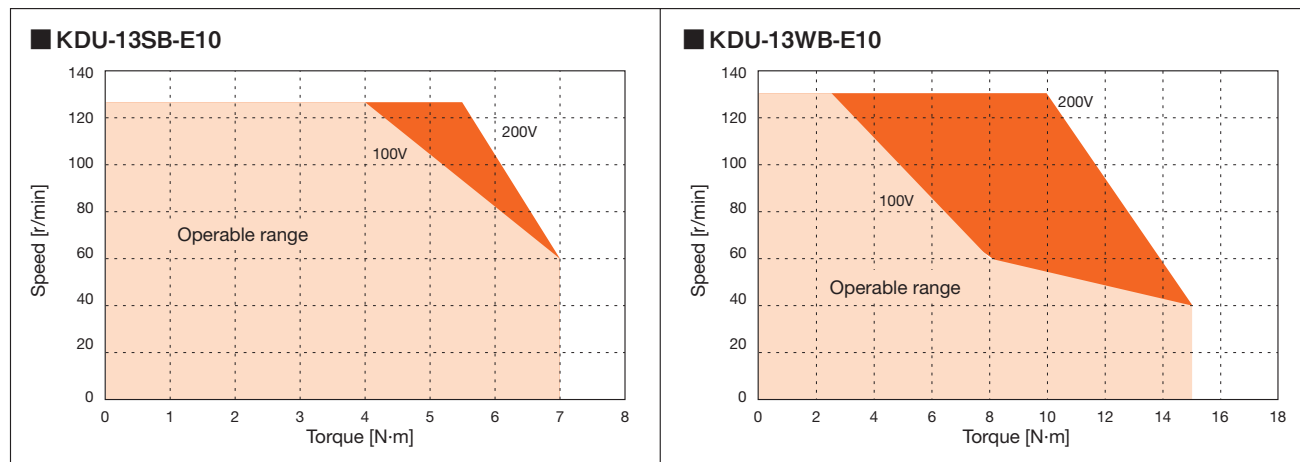
\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles). Contact us for the differential range of the size that is not described.

## Standard Combination Table of Relay Cables (option)

| Relay cable model name for incremental encoder | Total cable length (except connector)  |
|------------------------------------------------|----------------------------------------|
| Relay cable model name for motor               |                                        |
| EWA-E015-OM15-3M14                             | Encoder cable: 3m<br>Motor cable: 3.3m |
| EWA-M03-A04-WG04-01                            |                                        |
| EWA-E035-OM15-3M14                             | Encoder cable: 5m<br>Motor cable: 5.3m |
| EWA-M05-A04-WG04-01                            |                                        |

## Operable Range



## Precautions for Maintaining Accuracy

Strictly follow the precautions written below in the use of the product to obtain years of built-in accuracy.

### Checking the operating environment.

Harmonic Drive Systems Inc. measures accuracy at  $23 \pm 0.3^\circ\text{C}$  in temperature and 50% RH in humidity. When operating in a system that requires a high repeatability, operate after carefully examining the mechanism stiffness, expansion coefficients of the components, external vibration and other factors within temperature variations of less than  $\pm 3^\circ\text{C}$ .

### Periodically rotate the output shaft $90^\circ$ or more.

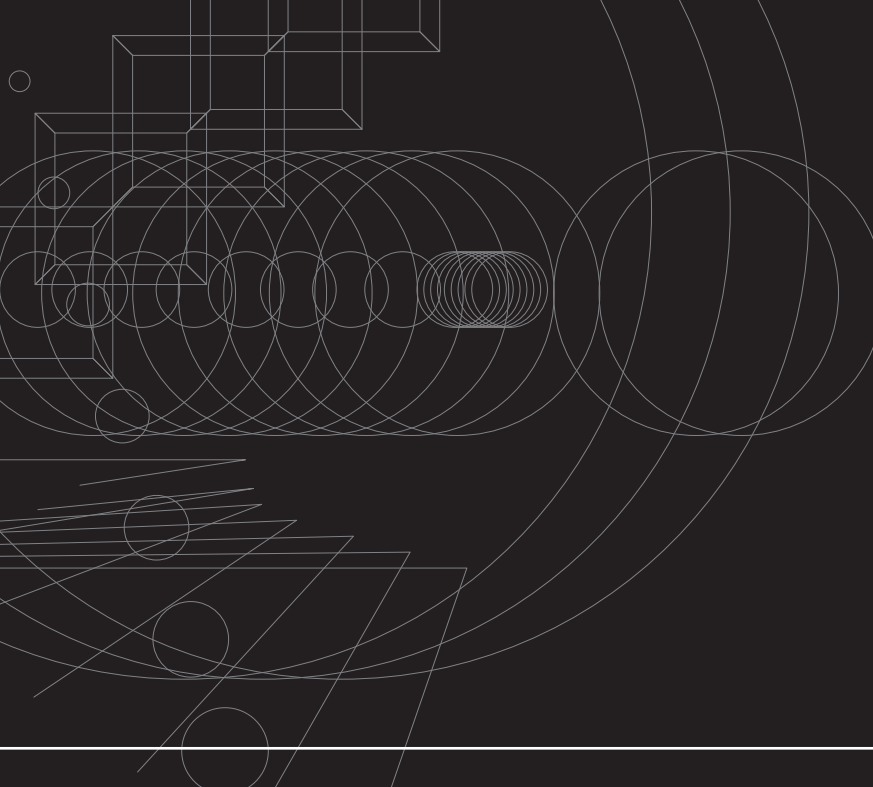
Where the system operating environment requires fine motions, periodically rotate the output shaft more than  $90^\circ$  to maintain the accuracy in order to prevent uneven wear of the crossed roller bearing due to depletion of grease.

### Checking mounting direction.

The condition of Harmonic Drive Systems Inc. for measurement of accuracies is that the output shaft is facing upward. Please contact Harmonic Drive Systems Inc. if you would like to install the output shaft other than facing upward.

### Accuracy cannot be guaranteed if the installation environment is subjected to vibration or shocks.

The resistance to vibration and shocks specified in the specification are the values anticipating carrying and mounting. Be cautious and prevent applying vibration or shocks to the product while carrying or mounting it. Operate the product in an environment that is free of vibration and shocks to ensure a high accuracy of the product.



# Optical Galvano Scanners

|                         |     |
|-------------------------|-----|
| <b>LSA Series</b> ..... | 102 |
| <b>PSM Series</b> ..... | 104 |



# LSA Series

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System



The optical galvanometer scanners in the LSA series capable of rapid response and high-accuracy light scanning have been introduced to the market based on the compact motor technology that has been a traditional feature of Harmonic Drive Systems and its unique optical sensor technology.

When combined with a dedicated driver, continuous scanning, random accessing and other scanning modes can be accomplished optimally in accordance with command signals.

## Features

### ■ High-speed and stable driving of large loads

A unique movable magnet motor assures a high torque-inertia ratio, meaning even a relatively large mirror can be driven stably at a high speed.

### ■ Excellent temperature characteristics without heater

The core structure containing iron achieves a sensor with a very low temperature rise and small temperature drift, featuring high temperature stability.

### ■ Angle sensor resilient to environmental conditions

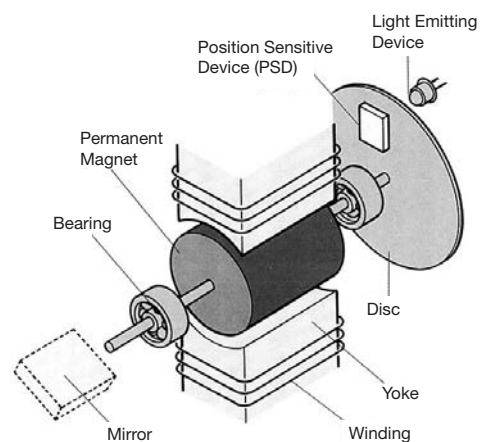
The angle sensor is an optical sensor almost immune to environmental conditions such as external humidity and gas atmosphere.

### ■ Noise-resistant stable operation

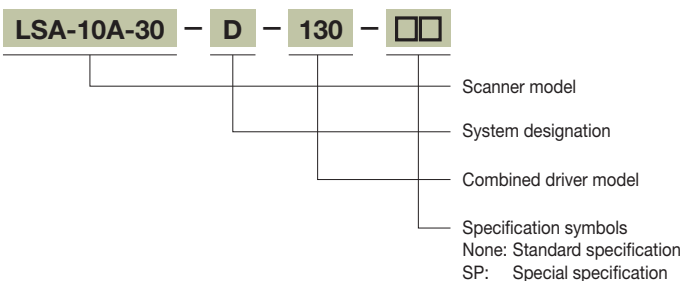
The angle sensor converts a rotor rotational angle by converting it into optical displacement via a position sensitive device (PSD) through a slit pattern of the rotary disc. By increasing the signal-to-noise ratio (S/N ratio), stable operation is assured even when the distance between the scanner and driver is 10m.

### ■ Excellent linearity

An excellent reproducibility and high signal processing technology of the angle sensor enables excellent linearity between the output voltage and angle.

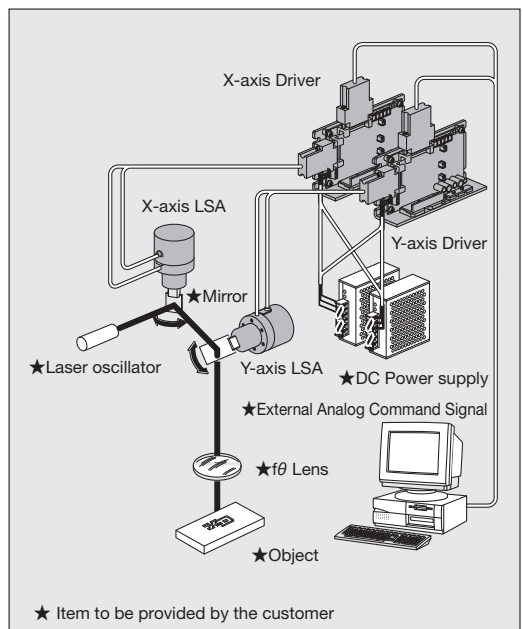


## Models and Symbols



| Actuator model | Combined driver model |
|----------------|-----------------------|
| LSA-10A-30     | PSM-130               |

## System Configuration



## Specification

| Item                                                                     |         | Model             | LSA-10A-30                                |
|--------------------------------------------------------------------------|---------|-------------------|-------------------------------------------|
| Maximum Angular Runout                                                   |         | deg.              | ±15                                       |
| Moment of Inertia of Rotor                                               |         | g·cm <sup>2</sup> | 1.9                                       |
| Torque Constant                                                          |         | N·m/A             | 0.0077                                    |
| Coil Resistance                                                          |         | Ω                 | 0.28                                      |
| Coil Inductance                                                          |         | mH                | 0.098                                     |
| Sensor Linearity (On Full Scale)                                         |         | %                 | ±0.06                                     |
| Sensor Angular Sensitivity                                               |         | V/rad             | 16                                        |
|                                                                          |         | V/deg.            | 0.275                                     |
| Offset Drift                                                             |         | μrad/°C           | 25                                        |
| Scale Drift                                                              |         | %/°C              | 0.005                                     |
| Position Reproducibility (Offset and scale drift excluded) <sup>*1</sup> |         | μrad              | 5                                         |
| 1° Step Response <sup>*2</sup>                                           |         | ms                | 0.5 (Load condition: 1g·cm <sup>2</sup> ) |
| Sensor Power Supply Voltage                                              |         | V                 | 5±5%, -15±5%                              |
| Sensor Current Consumption                                               | 5V±5%   | mA                | 90 (Max)                                  |
|                                                                          | -15V±5% | mA                | 120 (Max)                                 |
| Mass                                                                     |         | g                 | 180                                       |
| Model for Set of Scanner and Driver                                      |         |                   | LSA-10A-30-D-130                          |

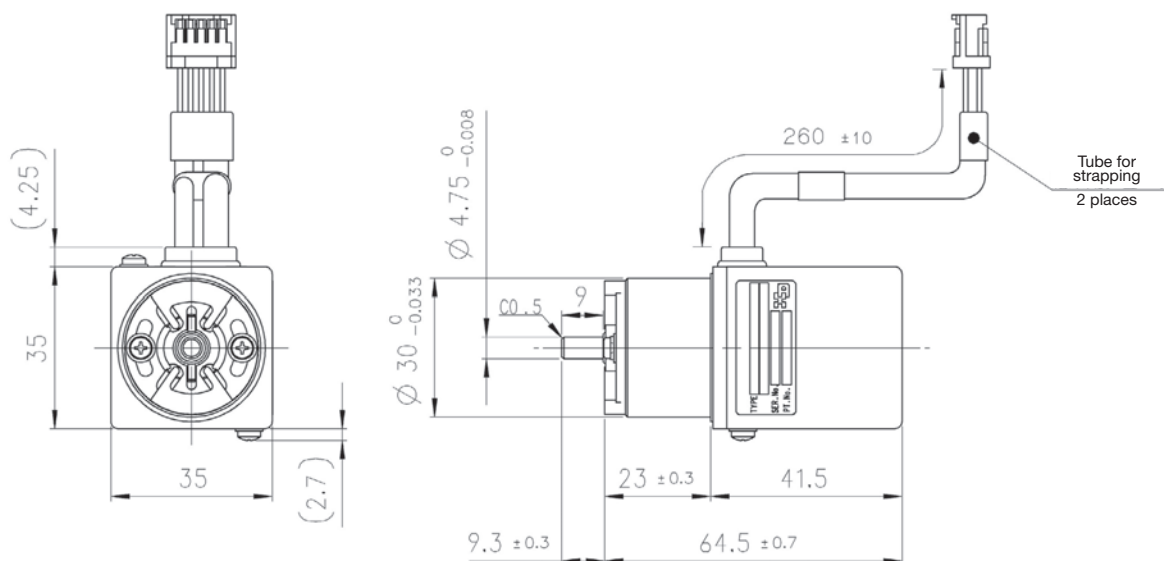
\* 1: All angles are mechanical angles.

\* 2: Values when combined with a standard driver of Harmonic Drive Systems.

## External Dimensions

### LSA-10A-30

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
Contact us for the differential range of the size that is not described.



## PSM Dedicated Driver Series: Specifications and Dimensions

The scanning performance of the PSM driver series for driving the optical galvano scanners in the LSA series is maximized through optimum circuit configuration.

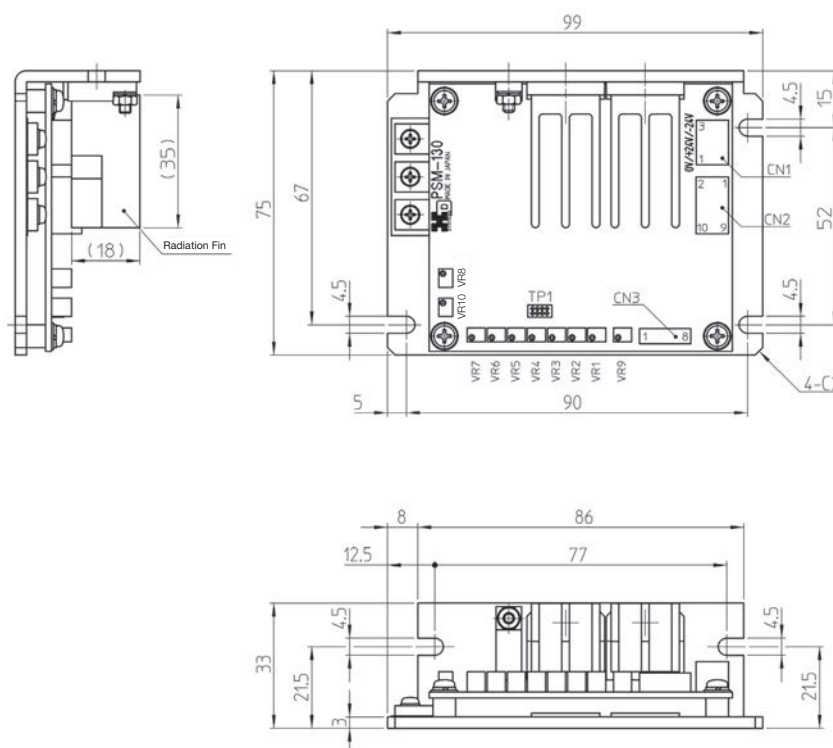
### Principal Specification

| Item                         |                     | Model | PSM-130                                                                               |
|------------------------------|---------------------|-------|---------------------------------------------------------------------------------------|
| Power Supply                 |                     |       | DC±24V±10%                                                                            |
| Current Supply               |                     |       | 5Arms                                                                                 |
| Max. Momentary Current       |                     |       | 25A                                                                                   |
| Position Command Input Volt. |                     |       | ±10V (Input impedance: 10kΩ)                                                          |
| Monitor Output Signals       |                     |       | Positional command, sensor and error signals                                          |
| Functions                    | Adjusting Functions |       | Offset and scale adjustment                                                           |
|                              | Input signal        |       | Position command input, servo enable                                                  |
|                              | Output signal       |       | Overposition, overheat                                                                |
|                              | Protec. Func.       |       | Protection during enable OFF → ON, power OFF protection, power IC overheat protection |
| Mass                         |                     |       | 160g                                                                                  |

### External Dimensions

#### PSM-130

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.  
 \* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
 Contact us for the differential range of the size that is not described.

### Planning and Ordering Information

Adjustment of a dedicated driver in the PSM series is required to ensure operation of the LSA series with an optimum response. Please supply the following operating and load conditions for adjustment of dedicated drivers in the PSM series.

#### Operating and load conditions required

- Operation patterns: Square wave (steps), trapezoidal wave, triangular wave, saw-tooth wave, sine wave and others  
 \* Follow-up conditions are required in case the patterns include saw-tooth and sine waves.
- Cycle times of operation patterns and scanner tracking time in seconds
- Angular Runout: Angle (Mechanical angle unit: °)
- Moment of inertia of load:  $GD^2/4$  (unit:  $g \cdot cm^2$ )

When planning to purchase or order the LSA series, please complete the "Form for Drive Conditions of Optical Scanner LSA Series" and forward it to Harmonic Drive Systems. Internal part(s) may need to be changed depending on the customer conditions.

## Form for Drive Conditions of Optical Scanner LSA Series

Date Sent:

|                                                                                                              |                                                                                                                                                                                                                              |               |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Name of Your Company                                                                                         |                                                                                                                                                                                                                              |               |
| Your Organization and Position                                                                               |                                                                                                                                                                                                                              |               |
| Name                                                                                                         |                                                                                                                                                                                                                              |               |
| Company Address                                                                                              | Zip Code                                                                                                                                                                                                                     |               |
| Telephone and Facsimile                                                                                      | Telephone No.                                                                                                                                                                                                                | Facsimile No. |
| E-mail address                                                                                               |                                                                                                                                                                                                                              |               |
| Your application<br><br>Please check intended application and describe your intended application in details. | Classification<br><input type="checkbox"/> Laser machining<br><input type="checkbox"/> Measurement<br><input type="checkbox"/> Image processing<br><input type="checkbox"/> Laser display<br><input type="checkbox"/> Others | Details       |

Harmonic Drive Systems will specify an adjustment specification including model selection. However, Harmonic Drive Systems will not be able to present an appropriate adjustment specification unless the necessary drive conditions are supplied. Please write the drive conditions in the following columns. Optimum characteristics including selection of a suitable model will be studied.

## Drive Conditions

| No. | Item                                                                       | Specification                                                                                                                                                                                         | Remarks                                                                                    |
|-----|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| ①   | Input command waveform (Fundamental waveform)                              | <input type="checkbox"/> Square wave <input type="checkbox"/> Trapezoidal wave<br><input type="checkbox"/> Saw-tooth wave <input type="checkbox"/> Triangular wave <input type="checkbox"/> Sine wave | Please attach information concerning grade if waveforms contain grades.                    |
| ②   | Adjustment priority amplitude                                              | [°]                                                                                                                                                                                                   | Sine wave condition                                                                        |
| ③   | Drive frequency                                                            | [Hz]                                                                                                                                                                                                  | Sine wave condition                                                                        |
| ④   | Convergence judgment condition (Positional accuracy)                       | [°] or [arc-sec]                                                                                                                                                                                      |                                                                                            |
| ⑤   | Settling time                                                              | [ms] or [μs]                                                                                                                                                                                          | Time after input becomes constant when trapezoidal wave is driven.                         |
| ⑥   | Isokinetic range                                                           | [%]                                                                                                                                                                                                   | Please also write target grade when saw-tooth wave is driven.                              |
| ⑦   | Position delay                                                             | [ms] or [μs]                                                                                                                                                                                          | Sine wave condition                                                                        |
| ⑧   | Amplitude error                                                            | [%]                                                                                                                                                                                                   | Output / input amplitude error, sine wave condition                                        |
| ⑨   | Moment of inertia of load ( $GD^2/4$ )                                     | [g·cm <sup>2</sup> ]                                                                                                                                                                                  | Material drawing may be attached instead                                                   |
| ⑩   | Maximum amplitude                                                          | [°]                                                                                                                                                                                                   |                                                                                            |
| ⑪   | Voltage on full scale                                                      | Amplitude at input voltage of $V_{p-p}$ [°]                                                                                                                                                           |                                                                                            |
| ⑫   | Cable extension distance between scanner and driver                        | [m]                                                                                                                                                                                                   | If unspecified, no extension                                                               |
| ⑬   | Power capacity (Priority on performance or power source capacity)          | [W]                                                                                                                                                                                                   | If unspecified, 240W. Please write priority as performance or power capacity               |
| ⑭   | Priority characteristic                                                    |                                                                                                                                                                                                       | Please write prioritized characteristic                                                    |
| ⑮   | Working (optical scanning) range                                           | [mm]                                                                                                                                                                                                  | Typical value                                                                              |
| ⑯   | Distance between work piece and mirror                                     | [mm]                                                                                                                                                                                                  | Typical value                                                                              |
| ⑰   | Cable length between power source and driver                               | [mm]                                                                                                                                                                                                  | Typical value                                                                              |
| ⑱   | Others, including information on nameplate concerning adjustment procedure |                                                                                                                                                                                                       | If this space is insufficient, please supply information by attaching an additional sheet. |

\* Please write all angles in mechanical angles.

\* Please copy this page when you complete the information.

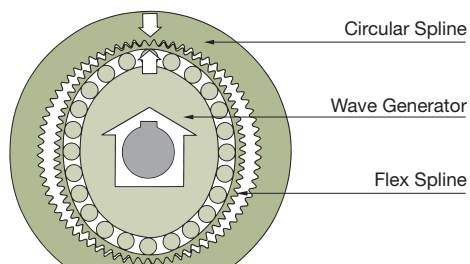
\* Please refer to the technical information for details of the drive conditions.

&lt;&lt;HDS Control No.: &gt;&gt;

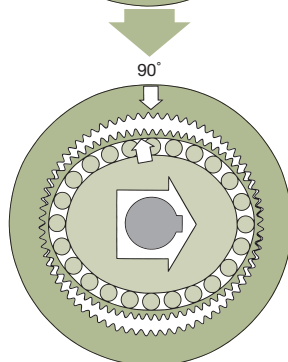
&lt;&lt;HDS Sales Office: &gt;&gt;

&lt;&lt;HDS Salesperson: &gt;&gt;

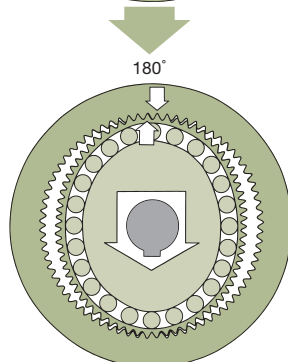
## Operating Principles of HarmonicDrive®



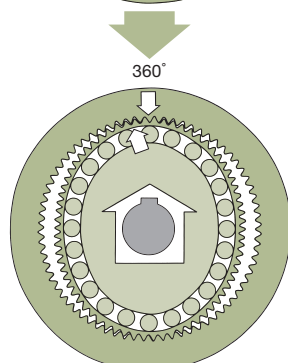
The flex spline is bent into an oval shape by the wave generator. Teeth on the long axis of the oval therefore mesh with the circular spline, while the teeth on the short axis of the oval perfectly detach from the circular spline.



Fixing the circular spline and rotating the wave generator clockwise will elastically deform the flex spline, sequentially moving the tooth meshing positions with the circular spline.



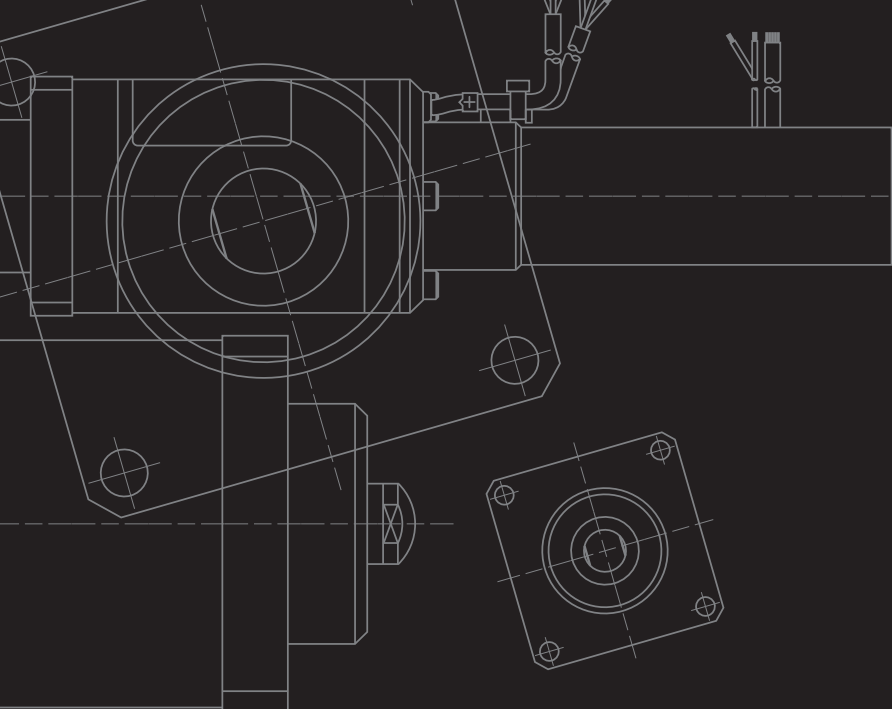
Rotating the wave generator through 180° in a clockwise direction will move the flex spline counterclockwise by one tooth as a difference in the number of teeth.



When the wave generator rotates through one turn (360°), the flex spline moves counterclockwise by two teeth based on the difference in the number of teeth because the flex spline has two teeth fewer than the circular spline. Normally, this motion is taken out as output.



Continued on page 118 "Actuator Embedded with HarmonicDrive®"



# Linear Actuator

|                                                  |            |
|--------------------------------------------------|------------|
| <b>Ultra Precision Positioning</b>               |            |
| LA Series .....                                  | 108        |
| <b>Medium Driving Force</b>                      |            |
| LAH-46 Series .....                              | 111        |
| <b>High Driving Force</b>                        |            |
| LBC Series .....                                 | 114        |
| <b>Tips for evaluating the performance .....</b> | <b>116</b> |



# LA Series

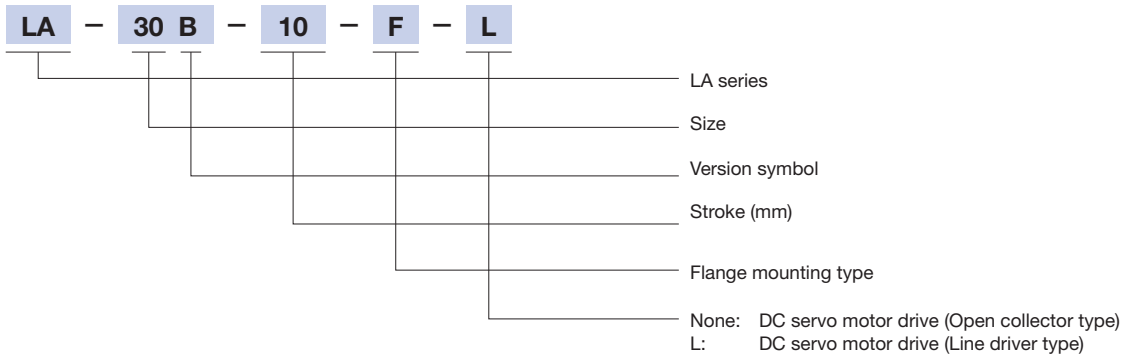


The LA series includes linear actuators featuring compactness, high resolution, a high driving force of 49N maximum, resolution of 0.0174μm and high accuracy.

### Features

- Maximum driving force      49N (5kgf)
- Resolution                      0.0174μm
- Stroke                            10mm, 30mm
- Maximum feed speed        0.9mm/s
- Repeatability                  ±0.1μm/1mm stroke
- Lost motion                    5μm/1mm stroke
- The drive motor can be changed to a stepping motor.

### Models and Symbols



## Specification

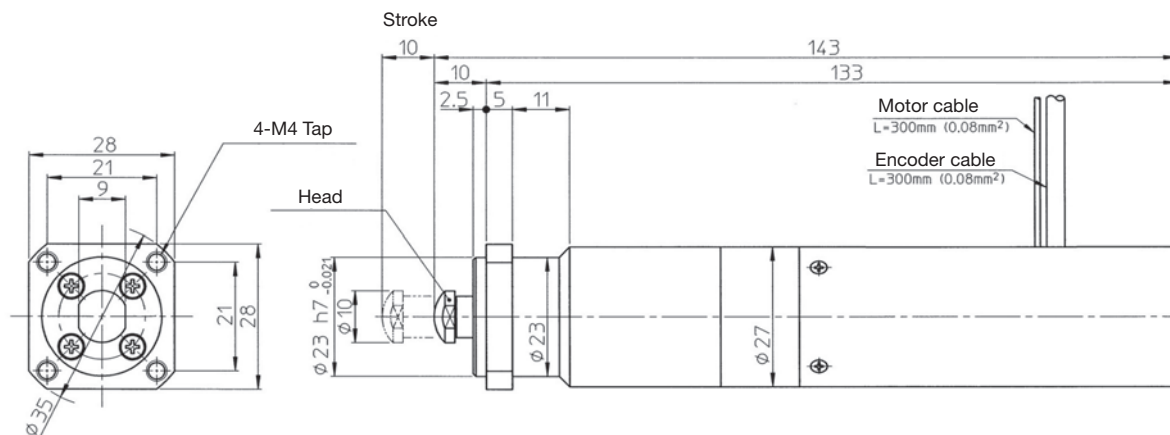
| Item \ Model                                  | LA-30B-10-F                                                                                                   | LA-32-30-F   |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------|--------------|
| Resolution                                    | 0.0174μm                                                                                                      |              |
| Stroke <sup>*1</sup>                          | 10mm                                                                                                          | 30mm         |
| Rated Feed Speed                              | 0.5mm/s                                                                                                       |              |
| Maximum Feed Speed                            | 0.9mm/s                                                                                                       |              |
| Maximum Driving Force <sup>*2</sup>           | 49N                                                                                                           |              |
|                                               | 5kgf                                                                                                          |              |
| Repeatability <sup>*3</sup>                   | ±0.1μm or less/1mm stroke                                                                                     |              |
| Positional accuracy <sup>*3</sup>             | 2μm or less/stroke 40μm                                                                                       |              |
| Full Stroke Positional accuracy <sup>*3</sup> | 10μm or less                                                                                                  | 15μm or less |
| Lost motion <sup>*3</sup>                     | 5μm or less/1mm stroke                                                                                        |              |
| Load Condition                                | Apply 10N or more to the shaft end to ensure accuracy                                                         |              |
| Drive Motor                                   | DC servo motor MDC02-1C22                                                                                     |              |
|                                               | Rated voltage 12V                                                                                             |              |
|                                               | Rated current 0.5A                                                                                            |              |
|                                               | Encoder                                                                                                       |              |
|                                               | Output circuit Open collector or line driver                                                                  |              |
|                                               | Resolution 360 pulses/revolution                                                                              |              |
|                                               | Output signals Open collector: A, B, Z                                                                        |              |
|                                               | Line driver: A, A, B, B, Z, Z                                                                                 |              |
|                                               | Power supply DC+5V±5%, 170mA Max.                                                                             |              |
|                                               | * The encoder will be a line driver encoder if combined with a servo driver (HS-360).                         |              |
| Combined Driver                               | DC servo driver HS-360-1A                                                                                     |              |
|                                               | Power supply AC100V±10%, 50/60Hz                                                                              |              |
|                                               | Control system Incremental pulse command input                                                                |              |
|                                               | Permissible maximum input frequency 100kp/s                                                                   |              |
|                                               | Can be connected to an encoder of line driver type only.<br>(Cannot be connected to the open collector type.) |              |
| End Limit Sensor                              | Not contained                                                                                                 |              |
| Installation Direction                        | Horizontal, vertical upright                                                                                  |              |
| Mass                                          | 320g                                                                                                          | 550g         |
| Operating Conditions                          | Current can be transmitted continuously                                                                       |              |
| Ambient Temperature                           | 10°C to 25°C                                                                                                  |              |
| Lubrication                                   | Grease                                                                                                        |              |

- \* 1: Detectors are not contained at both ends of the stroke. Motions must be limited within ejection and retraction limits, since any outside these limits will result in failures, performance degradation and shortened lifespan. Do not place any pad on the output rod, otherwise performance degradation and shortened lifespan may result.
- \* 2: The tip of the ejector rod of the actuator is spherical in shape and the ejector must be used only in the ejection direction. Move the work piece in a retraction direction within a range between 10N and the maximum driving force using the restorative force of an air cylinder or spring.
- \* 3: The actuators in the series conform to JIS B 6201 under measurement temperature of 20±1°C and load carrying capacity of 10N to maximum driving force.
- \* 4: Continuous micro jogging motions may cause local wear due to inadequate lubrication. Operate your actuators referring to technical information to obtain years of integral reliability and protection.
- \* 5: The brush in DC servo motors requires replacement.

## External Dimensions

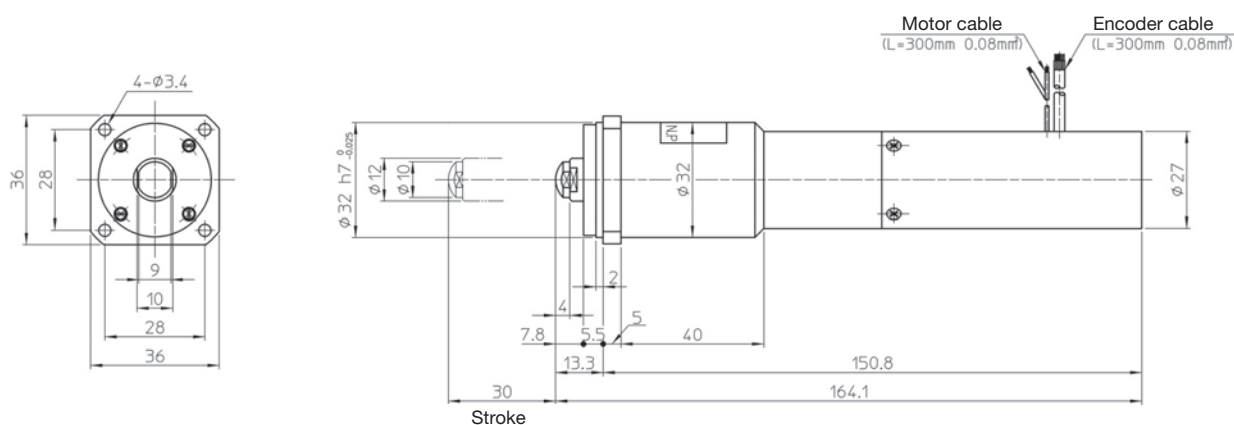
### LA-30B-10-F

Unit: mm



### LA-32-30-F

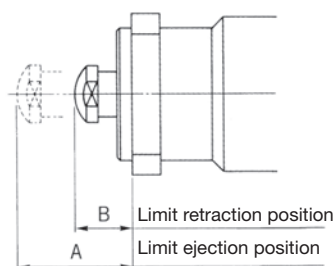
Unit: mm



- \* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.
- \* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles). Contact us for the differential range of the size that is not described.

## Operational Precautions

Limit rod ejection and retraction to within the mechanical limit positions illustrated on the right.



Unit: mm

| Model       | Dimension A | Dimension B |
|-------------|-------------|-------------|
| LA-30B-10-F | 21.5        | 8.5         |
| LA-32-30-F  | 44.3        | 12.3        |

# LAH-46 Series

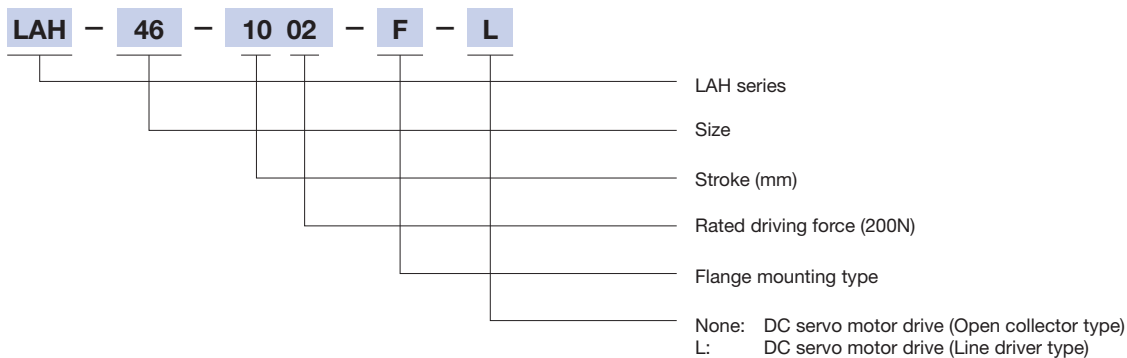


The LAH-46 series includes linear actuators featuring a maximum driving force of 390N and resolution of 0.069μm. DC servo motor or a stepping motor can be selected as the drive motor.

## Features

- **Maximum driving force** 390N (40kgf)
- **Resolution** 0.069μm
- **Stroke** 10mm, 30mm
- **Maximum feed speed** 3.7mm/s
- **Repeatability** ±0.5μm/1mm stroke
- **Lost motion** 5μm/1mm stroke
- **The drive motor can be changed to a stepping motor.**

## Model and Symbols



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System



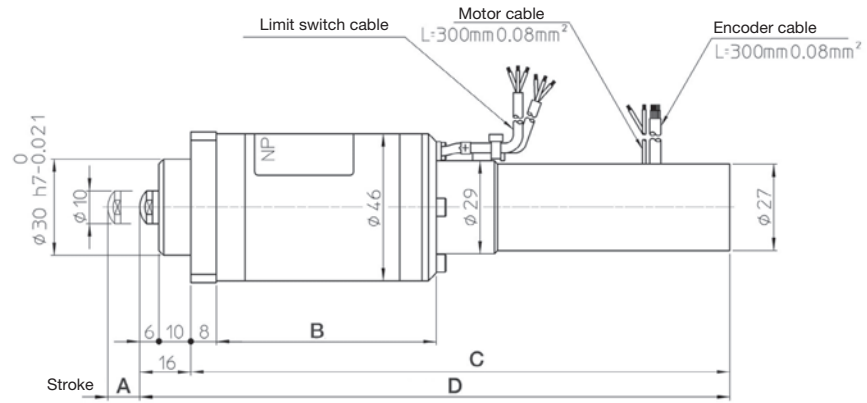
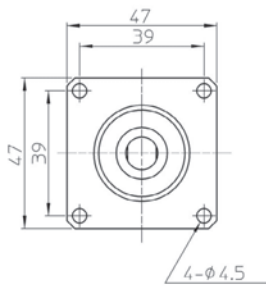
## Specification

| Model                                        | LAH-46-1002-F                                                                                                |                                 | LAH-46-3002-F                 |  |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------|--|
| Item                                         |                                                                                                              |                                 |                               |  |
| Resolution                                   | 0.069μm                                                                                                      |                                 |                               |  |
| Stroke <sup>1</sup>                          | 10mm                                                                                                         |                                 | 30mm                          |  |
| Rated Feed Speed                             | 2mm/s                                                                                                        |                                 |                               |  |
| Maximum Feed Speed                           | 3.7mm/s                                                                                                      |                                 |                               |  |
| Rated Driving Force <sup>2</sup>             | 200N                                                                                                         |                                 |                               |  |
|                                              | 20kgf                                                                                                        |                                 |                               |  |
| Maximum Driving Force <sup>2</sup>           | 390N                                                                                                         |                                 |                               |  |
|                                              | 40kgf                                                                                                        |                                 |                               |  |
| Repeatability <sup>3</sup>                   | ±0.5μm or less/1mm stroke                                                                                    |                                 |                               |  |
| Positional accuracy <sup>3</sup>             | 4μm or less/0.2mm stroke                                                                                     |                                 |                               |  |
| Full Stroke Positional accuracy <sup>3</sup> | 7μm or less                                                                                                  |                                 | 10μm or less                  |  |
| Lost motion <sup>3</sup>                     | 5μm or less/1mm stroke                                                                                       |                                 |                               |  |
| Load Condition                               | Apply 50N or more to the shaft end to ensure accuracy                                                        |                                 |                               |  |
| Drive Motor                                  | DC servo motor                                                                                               | MDB02-IC22                      |                               |  |
|                                              |                                                                                                              | Rated voltage                   | 12V                           |  |
|                                              |                                                                                                              | Rated current                   | 0.5A                          |  |
|                                              | Encoder                                                                                                      | Output circuit                  | Open collector or line driver |  |
|                                              |                                                                                                              | Resolution                      | 360 pulses / revolution       |  |
|                                              |                                                                                                              | Output signals                  | Open collector: A, B, Z       |  |
| Combined Driver                              |                                                                                                              | Line driver:                    | A, A, B, B, Z, Z              |  |
|                                              |                                                                                                              | Power supply                    | DC+5V±5%, 170mA Max.          |  |
|                                              | * The encoder will be a line driver encoder if combined with a servo driver (HS-360).                        |                                 |                               |  |
|                                              | DC servo driver                                                                                              | HS-360-1A                       |                               |  |
|                                              | Power supply                                                                                                 | AC100V±10%, 50/60Hz             |                               |  |
|                                              | Control system                                                                                               | Incremental pulse command input |                               |  |
|                                              | Permissible maximum input frequency                                                                          | 100kp/s                         |                               |  |
|                                              | Can be connected to an encoder of line driver type only.<br>(Cannot be connected to the open collector type) |                                 |                               |  |
| End Limit Switch                             | FU switch AV4024 manufactured by Panasonic contained                                                         |                                 |                               |  |
| Installation Direction                       | All directions. (Must have adequate downward force when installed vertically)                                |                                 |                               |  |
| Mass                                         | 810g                                                                                                         |                                 | 850g                          |  |
| Operating Conditions                         | Current can be transmitted continuously                                                                      |                                 |                               |  |
| Ambient Temperature                          | 10°C to 25°C                                                                                                 |                                 |                               |  |
| Lubrication                                  | Grease                                                                                                       |                                 |                               |  |

- \* 1: Although detectors are included, mechanical stoppers are not contained at both ends of the stroke. Consequently, motions must be limited to ejection and retraction limits even when no load is applied. Any motion outside these limits may result in failures, performance degradation and shortened lifespan.
- \* 2: The tip of the ejector rod of the actuator is spherical in shape. The ejector must be used only in the ejection direction. Move the work piece in a retraction direction within the range of 10N and the maximum driving force using the restorative force of an air cylinder or spring.
- \* 3: The actuators in the series conform to JIS B 6201 under a measurement temperature of 20±1°C and a load carrying capacity of 49N to maximum driving force.
- \* 4: Continuous micro jogging motions cause local wear due to inadequate lubrication. Operate your actuators referring to the technical information to obtain years of built-in reliability and protection.
- \* 5: The brush in DC servo motors requires replacement.

## External Dimensions

Unit: mm

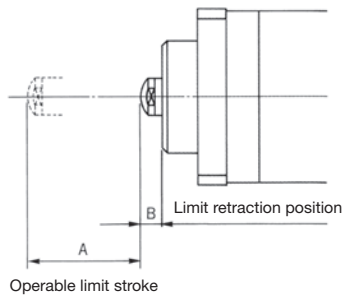


| Model         | Symbol | A    | B    | C     | D     | Mass   |
|---------------|--------|------|------|-------|-------|--------|
| LAH-46-1002-F |        | 10mm | 69mm | 169mm | 185mm | 0.81kg |
| LAH-46-3002-F |        | 30mm | 88mm | 188mm | 204mm | 0.85kg |

\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.  
 \* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
 Contact us for the differential range of the size that is not described.

## Operational Precautions

Limit rod ejection and retraction to within the operable limit stroke illustrated on the right.



Unit: mm

| Model         | Dimension A | Dimension B |
|---------------|-------------|-------------|
| LAH-46-1002-F | 12          | 5           |
| LAH-46-3002-F | 32          | 5           |

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

# LBC Series

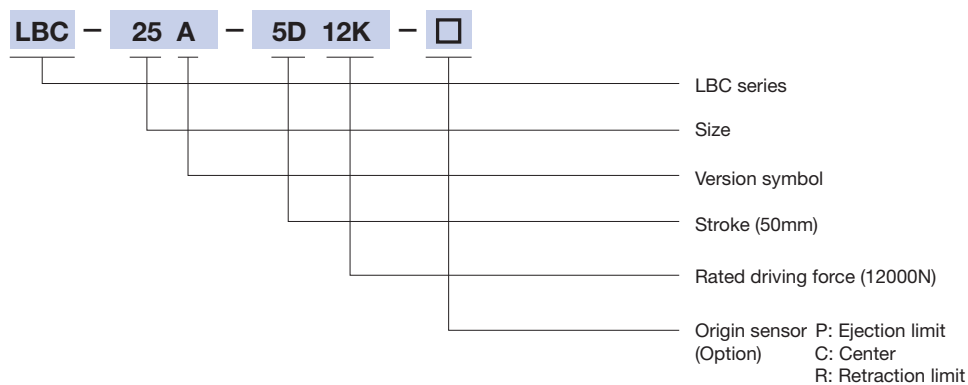


The LBC series includes linear actuators featuring compactness, high resolution and a large driving force. This series comes in two types, “LBC-25A-5D6K” featuring a maximum driving force of 6000N and resolution of 0.32μm and “LBC-25A-5D12K” featuring a maximum driving force of 12000N and resolution of 0.16μm respectively.

## Features

- **High driving force:** Maximum driving force 12000N (1220kgf)  
6000N (612kgf)
- **High accuracy: Repeatability** ±5μm
- **High axial stiffness**
- **Compact design**

## Model and Symbols

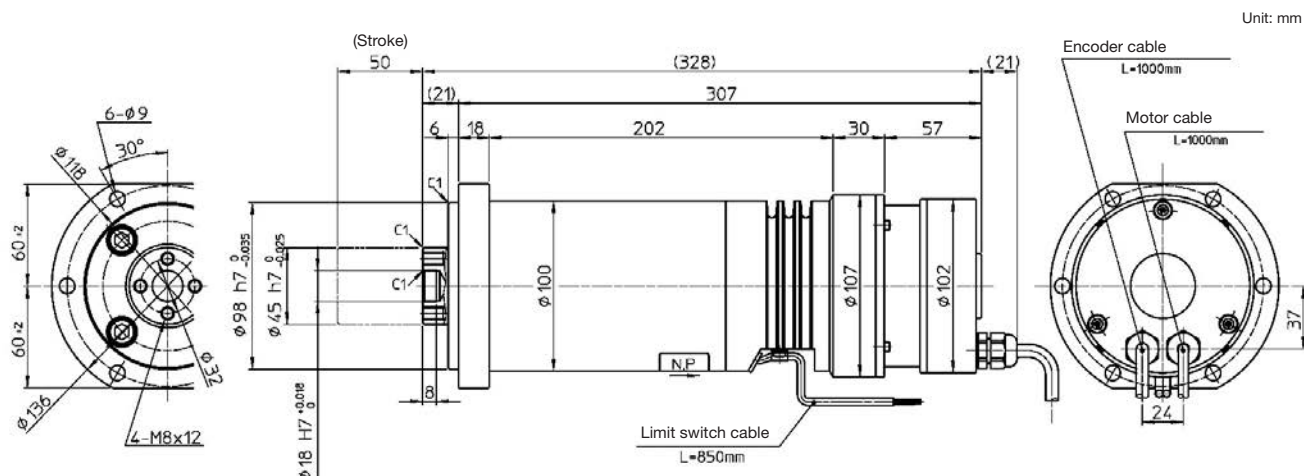


## Specification

| Item                   | Model | LBC-25A-5D6K                                          | LBC-25A-5D12K   |
|------------------------|-------|-------------------------------------------------------|-----------------|
| Resolution             |       | 0.32μm (0.08μm)                                       | 0.16μm (0.04μm) |
| Stroke                 |       | 50mm                                                  |                 |
| Maximum Feed Speed     |       | 20mm/s                                                | 10mm/s          |
| Maximum Driving Force  |       | 6000N                                                 | 12000N          |
|                        |       | 612kgf                                                | 1220kgf         |
| Load Condition         |       | Apply 10N or more to the shaft end to ensure accuracy |                 |
| Repeatability          |       | ±5μm or less                                          |                 |
| Thrust Stiffness       |       | 180N/μm                                               |                 |
| Self Holding           |       | Possible                                              |                 |
| Protection Structure   |       | Totally enclosed, self-cooled                         |                 |
| Lubrication            |       | Grease                                                |                 |
| Operating Temperature  |       | 0°C to +40°C                                          |                 |
| Installation Direction |       | All directions                                        |                 |
| Mass                   |       | 12.5kg                                                |                 |
| End Limit Sensor       |       | Contained                                             |                 |
| Origin Sensor          |       | Option                                                |                 |
| Drive Motor            |       | AC servo motor                                        |                 |
| Combined Motor         |       | HA-800A-3B                                            |                 |

\* The value in the parentheses ( ) of the resolution indicates the value at x4 (the configuration set at the shipment of the driver).

## External Dimensions



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

\* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).  
Contact us for the differential range of the size that is not described.

## Options

### Relay Cable

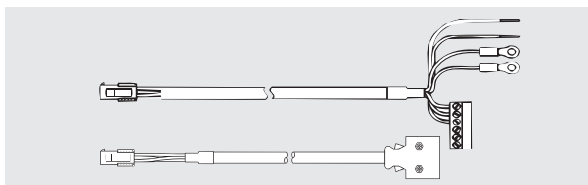
Order Code Example:

EWA-MB \*\* -M06-TN (For motor)

EWA-E \*\* -M16-3M14 (For incremental encoder)

The cable for connecting the LBC actuator to the servo driver.

Standard cable lengths are 3, 5 and 10m.

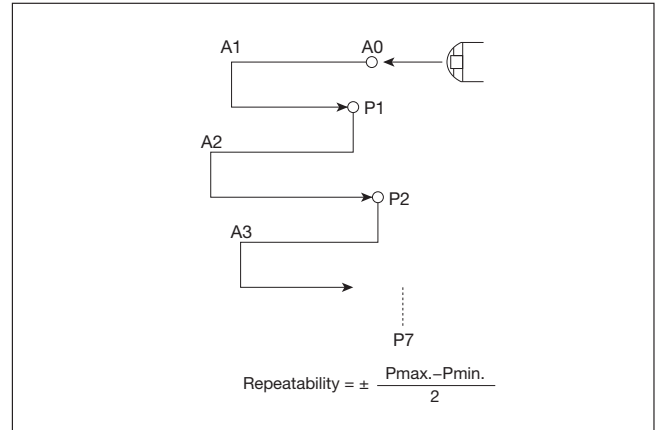


# Tips for Evaluating Performance of the Linear Actuator

## Repeatability

Represents a certain degree of positions when positioning is repeated at a target point under the same conditions.

- (1) An output rod or a stage is moved in an ejection (+) direction and is stopped in almost the center (A0) of the movable stroke.
- (2) The output rod or the stage is moved in an ejection (+) direction from Point A0 by a motion signal corresponding to the specified stroke. The stationary position is set as A1.
- (3) The output rod or the stage is moved in a retraction (-) direction from Point A1 by a motion signal corresponding to the specified stroke. The stationary position is set as P1.
- (4) The output rod or the stage is moved in the (+) direction again from Point P1 by the same distance (Point A2) and is similarly moved in the (-) direction again by the same distance (Point P2).
- (5) Repeat this process seven times in total to obtain Points P1 to P7. Mark "±" at 1/2 of the maximum difference and set it as the repeatability.



## Positional Accuracy (Fine Stroke)

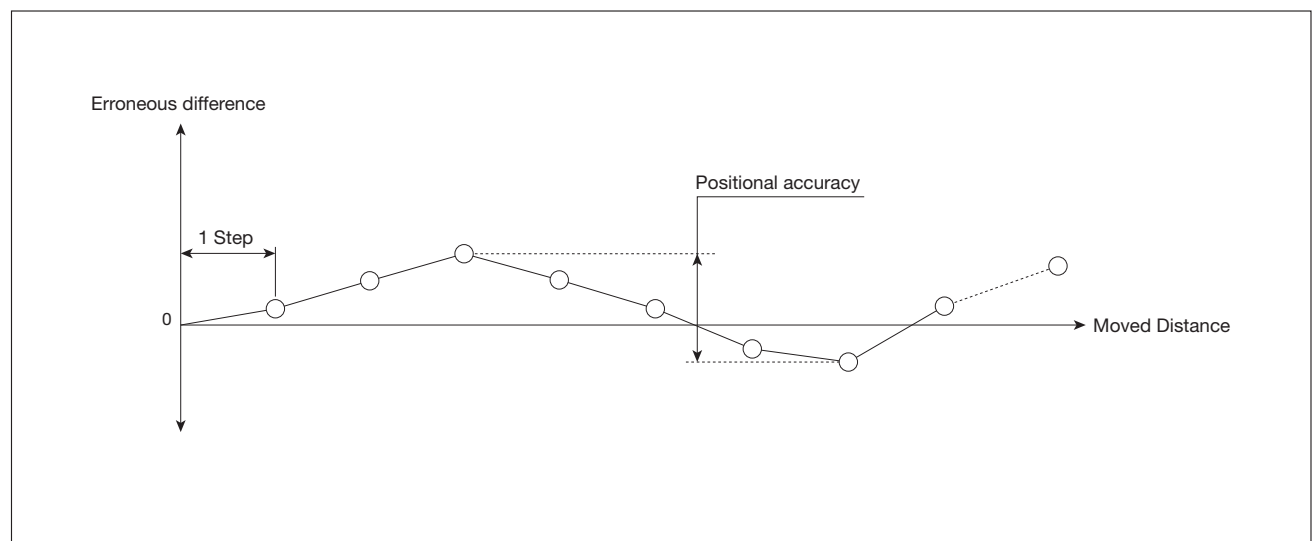
Represents a degree of coincidence between a position actually moved and a position commanded to move in a fine stroke.

- (1) An output rod or a stage is moved in a (+) direction and is stopped in almost the center of the movable stroke. This position is set as a datum position.
- (2) Feed 100 steps in succession from the datum position in a (+) direction by a motion signal corresponding to the moving distance for the specified step. Measure the individual positions.
- (3) Determine the difference in terms of the degree of error between the distance actually moved from the datum position and commanded distance in each position and set the maximum difference of errors as a positional accuracy.

## Full Stroke Positional Accuracy

Represents the degree of coincidence between a position actually moved and a position commanded to move within a full stroke range.

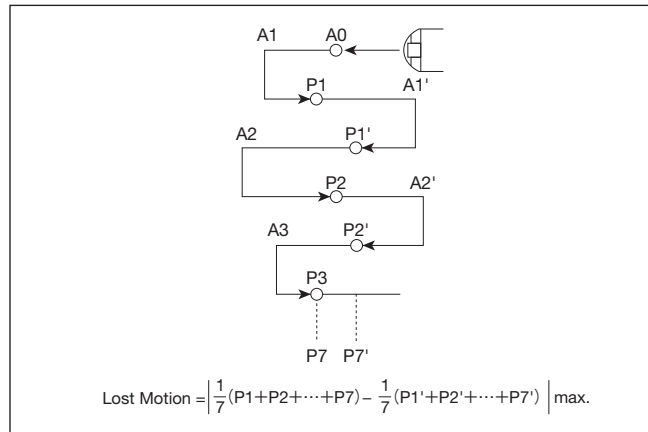
- (1) An output rod or a stage is moved to a position beyond the limit for the stroke on the retraction side, moved in an ejection (+) direction from there and is stopped near the stroke limit position. This position is set as a datum position.
- (2) Feed in succession from the datum position to the stroke limit in a (+) direction by a motion signal corresponding to a specified moving distance (1/100 of a stroke). Measure the individual positions.
- (3) Determine the difference in terms of the degree of error between the distance actually moved from the datum position and the commanded distance respectively in each position and set the maximum erroneous difference as a positional accuracy.



## Lost Motion

Represents the difference between a stationary position during positioning while moving to a position in a positive (+) direction and a stationary position during positioning while moving in a negative (-) direction.

- (1) An output rod or a stage is moved in an ejection (+) direction and is stopped almost in the center (A0) of the movable stroke.
- (2) The output rod or the stage is then moved in a (+) direction from Point A0 by a motion signal corresponding to the specified stroke. The stationary position is set as A1.
- (3) The output rod or the stage is moved in a retraction (-) direction from Point A1 by a motion signal corresponding to the specified stroke. The stationary position is set as P1.
- (4) The output rod or the stage is moved in the (-) direction again from Point P1 by the same distance (Point A') and is then similarly moved in the (+) direction again by the same distance (Point P1'). Measure this position.
- (5) Repeat this process seven times in total and set the difference between the average of Points P1 to P7 and average of Points P1' to P7' as the lost motion.



## Actuator Embedded with HarmonicDrive®?

Speed reducers embedded in control motors such as servo and stepping motors must have a high torque/mass ratio, high angular transmission accuracy, low backlash and other characteristics in order to maintain excellent control characteristics of these motors. Thanks to excellent characteristics of HarmonicDrive®, actuators embedded with HarmonicDrive® feature a high reduction ratio and high resolution without damaging the control characteristics of the motors as described below.

### Feature

#### ● Compact Body, High Torque

The output torque of an actuator embedded with a speed reducer is calculated by multiplying the motor output torque by the reduction ratio. When the motor and actuator are compared in terms of output torque, the actuator can be rendered compact (light weight) when the output torque is equal. If the external dimensions are the same, the actuator yields a high torque compared with the motor. Harmonic Drive Systems produces cylindrical type and flat hollow type actuators. Why not reduce the time required for the mechanism design by suitably selection of actuators embedded with HarmonicDrive® matching your requirements ?

#### ● Resilient to Load Fluctuations (High Stiffness)

The servo stiffness of a motor influences the positional accuracy. Impacts are especially large if the load fluctuates.

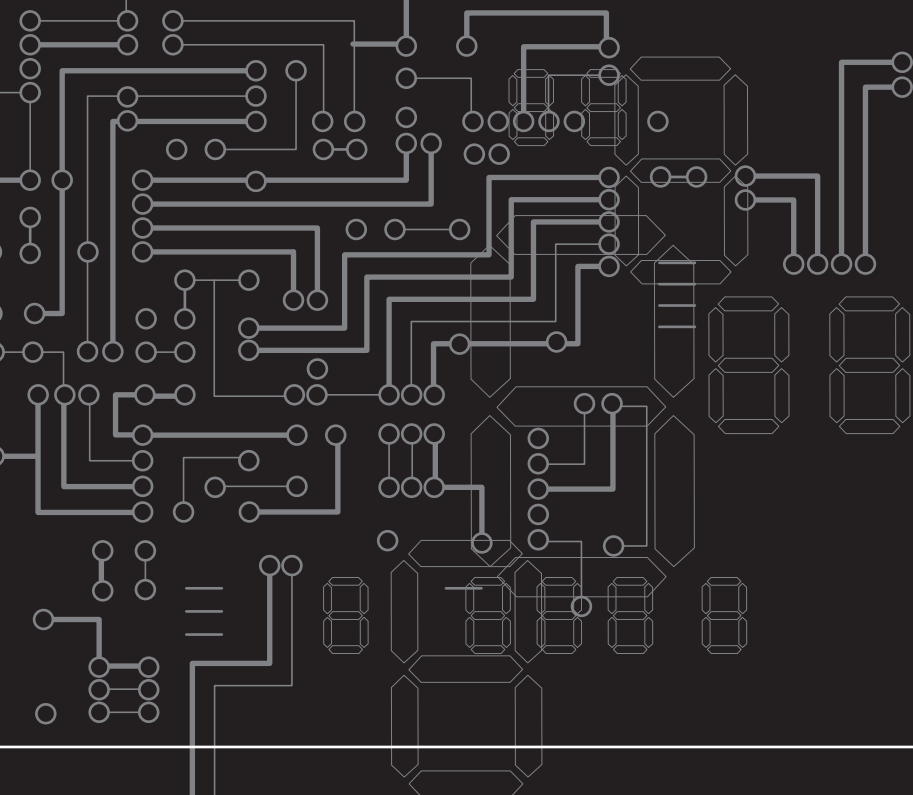
The angular transmission error\*1 of HarmonicDrive® embedded in actuators is extremely small, less than 2 minutes, and impacts of load fluctuations are determined by a HarmonicDrive® of high stiffness. The actuator achieves positioning with small errors even though load fluctuations are caused (high stiffness). The actuator achieves stable positioning that is resilient to load fluctuations.

\* 1: The angular transmission error is the difference between the rotational angle of an output shaft that is rotating theoretically and the rotational angle of an output shaft that actually rotates when a random rotational angle is applied to the input. The accuracy is high, closer to 0.

#### ● Stable control against fluctuations of moment of inertia of load (Short positioning time)

The positioning time can be shortened when an actuator is used compared with when a motor is used by driving a load with a large moment of inertia in a short time. When converted in terms of a motor shaft, the moment of inertia of an actuator output shaft can be calculated by dividing the reduction ratio by the square. This value is very small and stable control can be achieved even though a moment of inertia may be large or vary during operation, resulting in a shorter positioning time.

Harmonic Drive Systems ensures optimum pre-shipment adjustment meaning the machine operation will require only minimum adjustment when in the customer premises.



# Open field network support **Servo Drivers**

## **AC Servo Drivers**

|                       |     |
|-----------------------|-----|
| HA-800B Series .....  | 120 |
| HA-800C Series .....  | 129 |
| HA-680ML Series ..... | 138 |





# HA-800B Series



\* MECHATROLINK is a registered trademark of MECHATROLINK association.

## Features

### Compatible with the open field network

Compatible with MECHATROLINK-II

### Unique control theory reduces positional settling time to 1/2 (compared with HA-655 of Harmonic Drive Systems)

Unique control theory suppresses positional overshoot or undershoot, and reduces positional settling time to 1/2 of conventional item.

### Auto tuning function is available.

Auto tuning function is available, which can estimate the load to set optimal servo gain.

### Regenerative absorbing circuit and dynamic brake are embedded.

## Model and Symbols

HA - 800B - 3 A - 100 - □

Model: AC servo driver HA series

Series name: 800B MECHATROLINK-II support type

Rated output current: 1: 1.5A/3: 3A/6: 6A/24: 24A

Connected encoder:

|   |                                      |
|---|--------------------------------------|
| A | 13bit absolute encoder*              |
| B | 14-wire incremental encoder          |
| C | 4-wire reduction incremental encoder |
| D | 17bit absolute encoder*              |
| E | 17bit incremental encoder            |

Input power voltage 100: AC100V/200: AC200V

Special specification:

|           |               |
|-----------|---------------|
| No symbol | Standard item |
| SP        | Special item  |

\* A backup battery is not included. (Backup battery model: HAB-ER17/33-2)

## List of Combination Actuators

HA-800B series can be combined with the following rotary actuator (100V and 200V specifications).

| Actuator series name | Model No. | Power Supply Voltage (V) | Encoder Type                          | Combined Driver                  |
|----------------------|-----------|--------------------------|---------------------------------------|----------------------------------|
|                      |           |                          |                                       | MECHATROLINK-II Support          |
| SHA series           | 20        | 200                      | 17bit absolute (D)<br>incremental (E) | HA-800B-3D-200*/HA-800B-3E-200   |
|                      | 25        | 100                      |                                       | HA-800B-6D-100*/HA-800B-6E-100   |
|                      |           | 200                      |                                       | HA-800B-3D-200*/HA-800B-3E-200   |
|                      | 32        | 200                      |                                       | HA-800B-6D-200*/HA-800B-6E-200   |
|                      | 40        | 200                      |                                       | HA-800B-6D-200*/HA-800B-6E-200   |
|                      | 40        | 200                      |                                       | HA-800B-24D-200*/HA-800B-24E-200 |
|                      | 58        | 200                      |                                       | HA-800B-24D-200*/HA-800B-24E-200 |
|                      | 65        | 200                      |                                       | HA-800B-24D-200*/HA-800B-24E-200 |
| FHA-C mini series    | 8         | 200                      | 4-wire reduction<br>incremental       | HA-800B-1C-200                   |
|                      | 11        | 200                      |                                       | HA-800B-1C-200                   |
|                      | 14        | 200                      |                                       | HA-800B-1C-200                   |
|                      | 8         | 100                      |                                       | HA-800B-1C-100                   |
|                      | 11        | 100                      |                                       | HA-800B-1C-100                   |
|                      | 14        | 100                      |                                       | HA-800B-1C-100                   |
|                      | 8         | 200                      | 17bit absolute (D)<br>incremental (E) | HA-800B-1D-200*/HA-800B-1E-200   |
|                      | 11        | 200                      |                                       | HA-800B-1D-200*/HA-800B-1E-200   |
|                      | 14        | 200                      |                                       | HA-800B-1D-200*/HA-800B-1E-200   |
|                      | 8         | 100                      |                                       | HA-800B-1D-100*/HA-800B-1E-100   |
|                      | 11        | 100                      |                                       | HA-800B-1D-100*/HA-800B-1E-100   |
|                      | 14        | 100                      |                                       | HA-800B-1D-100*/HA-800B-1E-100   |
| FHA-C series         | 17        | 200                      | 4-wire reduction<br>incremental       | HA-800B-3C-200                   |
|                      | 25        | 200                      |                                       | HA-800B-3C-200                   |
|                      | 32        | 200                      |                                       | HA-800B-6C-200                   |
|                      | 40        | 200                      |                                       | HA-800B-6C-200                   |
|                      | 17        | 200                      | 13bit absolute                        | HA-800B-3A-200*                  |
|                      | 25        | 200                      |                                       | HA-800B-3A-200*                  |
|                      | 32        | 200                      |                                       | HA-800B-6A-200*                  |
|                      | 40        | 200                      |                                       | HA-800B-6A-200*                  |
|                      | 17        | 100                      | 4-wire reduction<br>incremental       | HA-800B-3C-100                   |
|                      | 25        | 100                      |                                       | HA-800B-6C-100                   |
|                      | 32        | 100                      |                                       | HA-800B-6C-100                   |
|                      | 17        | 100                      | 13bit absolute                        | HA-800B-3A-100*                  |
|                      | 25        | 100                      |                                       | HA-800B-6A-100*                  |
|                      | 32        | 100                      |                                       | HA-800B-6A-100*                  |
| RSF series           | 17        | 200                      | 14-wire<br>incremental                | HA-800B-3B-200                   |
| RSF/RKFseries        | 20        | 200                      |                                       | HA-800B-3B-200                   |
|                      | 25        | 200                      |                                       | HA-800B-3B-200                   |
|                      | 32        | 200                      |                                       | HA-800B-6B-200                   |

\* A backup battery is not included with the HA-800 driver. When using a driver with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## Specification

| Driver model                           |                               | HA-800B-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | HA-800B-3                                                                                        | HA-800B-6               | HA-800B-24                              |
|----------------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------|
| Item                                   |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |                         |                                         |
| Driver's Rated Current <sup>*1</sup>   |                               | 1.5A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3.0A                                                                                             | 6.0A                    | 24.0A                                   |
| Driver's Maximum Current <sup>*1</sup> |                               | 4.0A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 9.5A                                                                                             | 19.0A                   | 55.0A                                   |
| Power Supply Voltage                   | Main circuit <sup>*1</sup>    | AC100 to 115V (single phase) or AC200 to 230V (single phase/3 phases) +10 to -15%                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         | AC200 to 230V (3 phases)+10 to -15%     |
|                                        | Control circuit <sup>*1</sup> | AC100 to 115V (single phase) or AC200 to 230V (single phase) +10 to -15%                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                  |                         | AC200 to 230V (single phase)+10 to -15% |
| Power Supply Frequency                 |                               | 50/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                  |                         |                                         |
| Multi Revolution Limit (Motor Shaft)   |                               | -4096 to 4095 (FHA-C series), -32768 to 32767 (SHA series, FHA-C mini series)                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                  |                         |                                         |
| Ambient condition                      |                               | Working temperature: 0°C to 50°C    Storage temperature: -20°C to 65°C    Working humidity/storage humidity: 95%RH or less (No condensation)<br>Ambience: No dust, metal powder, corrosive gas and oil mist                                                                                                                                                                                                                                                                          |                                                                                                  |                         |                                         |
| Structure                              |                               | Self-cooled type                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                  | Forced air-cooling type |                                         |
| Mounting method                        |                               | Base mount (mounted on a wall)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                  |                         |                                         |
| Control mode                           |                               | Position control, speed control, torque control                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |                         |                                         |
| Monitor Terminal                       |                               | 3 channels, motor rpm, current command, versatile output (parameter selection)                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                  |                         |                                         |
| Communication Connector                |                               | RS-232C                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                  |                         |                                         |
| Operation Panel                        | Configuration                 | Display (7-segment LEDs) 5 digits (red), 4 push button switches                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |                         |                                         |
|                                        | Status Display Function       | Rotational speed (r/min), torque control (%), load rate (%), input signal monitor, output signal monitor, alarm history (8 times) and others                                                                                                                                                                                                                                                                                                                                         |                                                                                                  |                         |                                         |
|                                        | Parameter Adjustment Function | System parameter 3 or 4, adjustment parameter 1 or 2                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                  |                         |                                         |
| Protection function                    | Alarm                         | Emergency stop, overcurrent, overload, IPM error (overcurrent), regeneration resistance overheat, encoder break, encoder reception error, UVW error, system shutdown, multi revolution overflow, multi revolution data error, excessively large deviation, memory error, FPGA configuration error, FPGA setting error, MEMORY error, single revolution data error, multi revolution data error, BUSY error, overheating error, communication error, WDT error, synchronization error |                                                                                                  |                         |                                         |
|                                        | Warning                       | Low battery voltage, overload, cooling fan stop, low main circuit power voltage, forward limit inputting, reverse limit inputting                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         |                                         |
| Regenerative Processing                |                               | External Regenerative Resistance<br>With installation terminal                                                                                                                                                                                                                                                                                                                                                                                                                       | Regenerative Resistance Installed<br>With External Regenerative Resistance installation terminal |                         |                                         |
| Regenerative Resistance Absorbed Power |                               | —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3W Max                                                                                           | 8W Max                  | 90W Max                                 |
| Embedded Functions                     |                               | Status display, self diagnosis, electronic gear, jogging, etc, dynamic brake, multi revolution data backup battery (when installing an optional data backup battery)                                                                                                                                                                                                                                                                                                                 |                                                                                                  |                         |                                         |
| Inrush Current Prevention Function     |                               | Embedded (CPU control by main circuit voltage monitoring)                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                  |                         |                                         |
| Operation Mode                         |                               | Status display (normal operation) mode, test mode, adjustment mode, system parameter mode                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                  |                         |                                         |
| Mass                                   |                               | 1kg                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                  | 1.2kg                   | 5.8kg                                   |

\* 1: Set in accordance with the specification of a combined actuator.

## Communication Specification

| Item                                | Specification                                |
|-------------------------------------|----------------------------------------------|
| MECHATROLINK version                | MECHATROLINK-II                              |
| Transmission rate                   | 10Mbps                                       |
| Maximum transmission distance       | 50m                                          |
| Minimum inter-station distance      | 0.5m                                         |
| Transmission medium                 | Twisted pair cable with balanced type shield |
| Number of mobile units connected    | Maximum 30 mobile units                      |
| Topology                            | Bus                                          |
| Communication cycle                 | 1, 1.5, 2, 3, 4, 5ms                         |
| Communication method                | Master/slave full synchronous method         |
| Coding                              | Manchester encoding                          |
| Data length                         | 17 bytes/32 bytes selectable                 |
| Number of connections <sup>*1</sup> | Maximum 30                                   |

\*1: A repeater is required for communication over 17 units or 16 units with 30m or more total extended distance.

The maximum number of connectable units is restricted by the setting of the communication cycle and the retry count.

See the home page of MECHATROLINK association ([https://www.mechatrolink.org/jp/index\\_jp.html](https://www.mechatrolink.org/jp/index_jp.html)) for the detail.

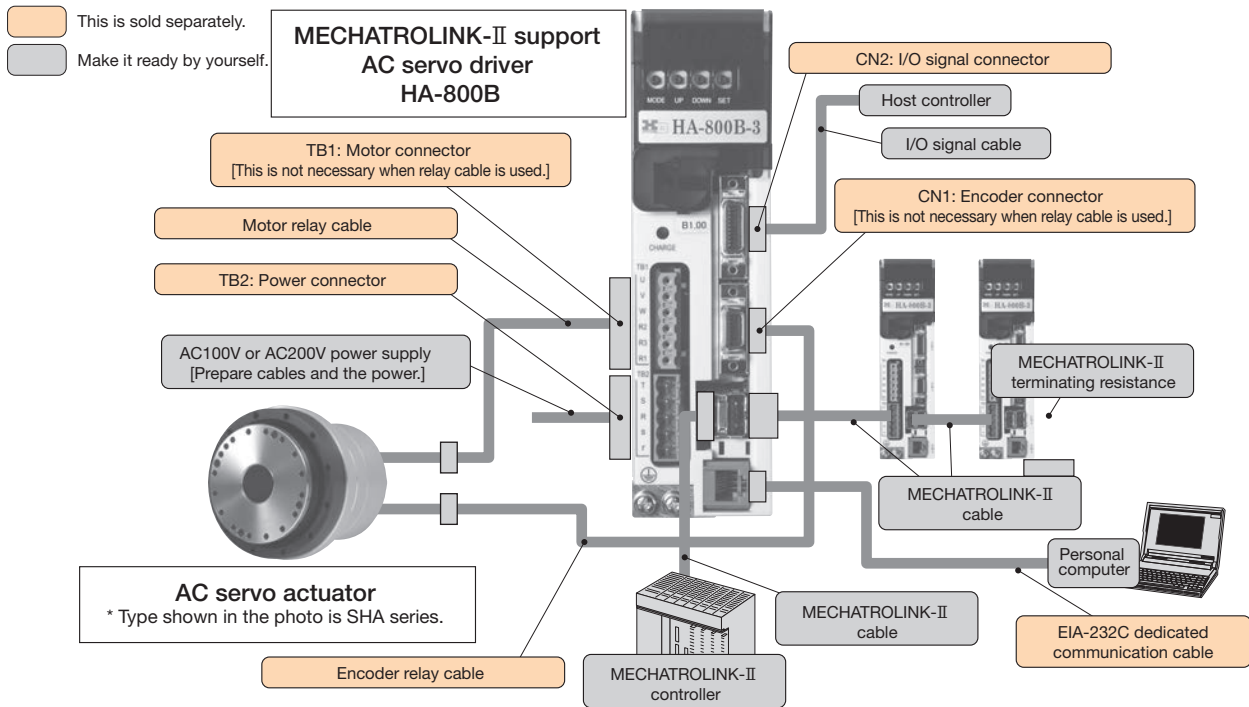
\*2: Use MP2000 series (Yasukawa Denki) or KV-ML16V (Keyence) for the Higher-level controller. (Some functions are limited)

See the home page on the limited functions for the latest detail.

\*3: Use cables specified. Never use commercial USB cables.

## System Configuration

### MECHATROLINK-II support system configuration



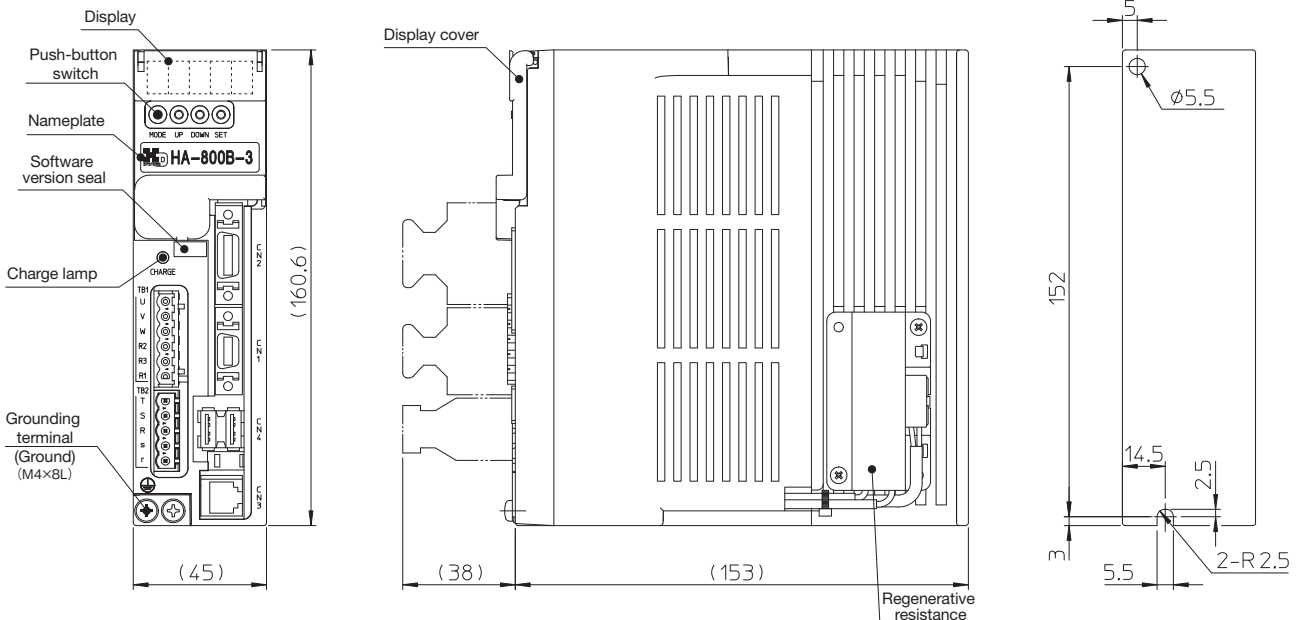
\* See the technical information for the details of configuration related to power supply.

\* When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## External Dimensions

### HA-800B-1, 3

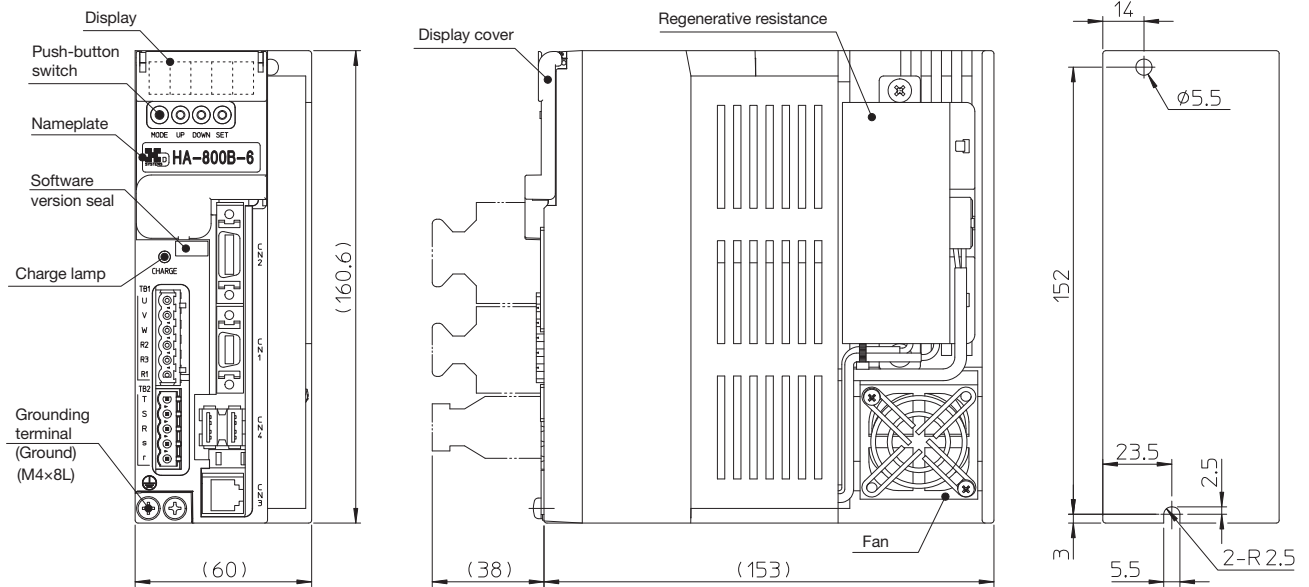
Unit: mm



## Dimensional Outline Drawing

### HA-800B-6

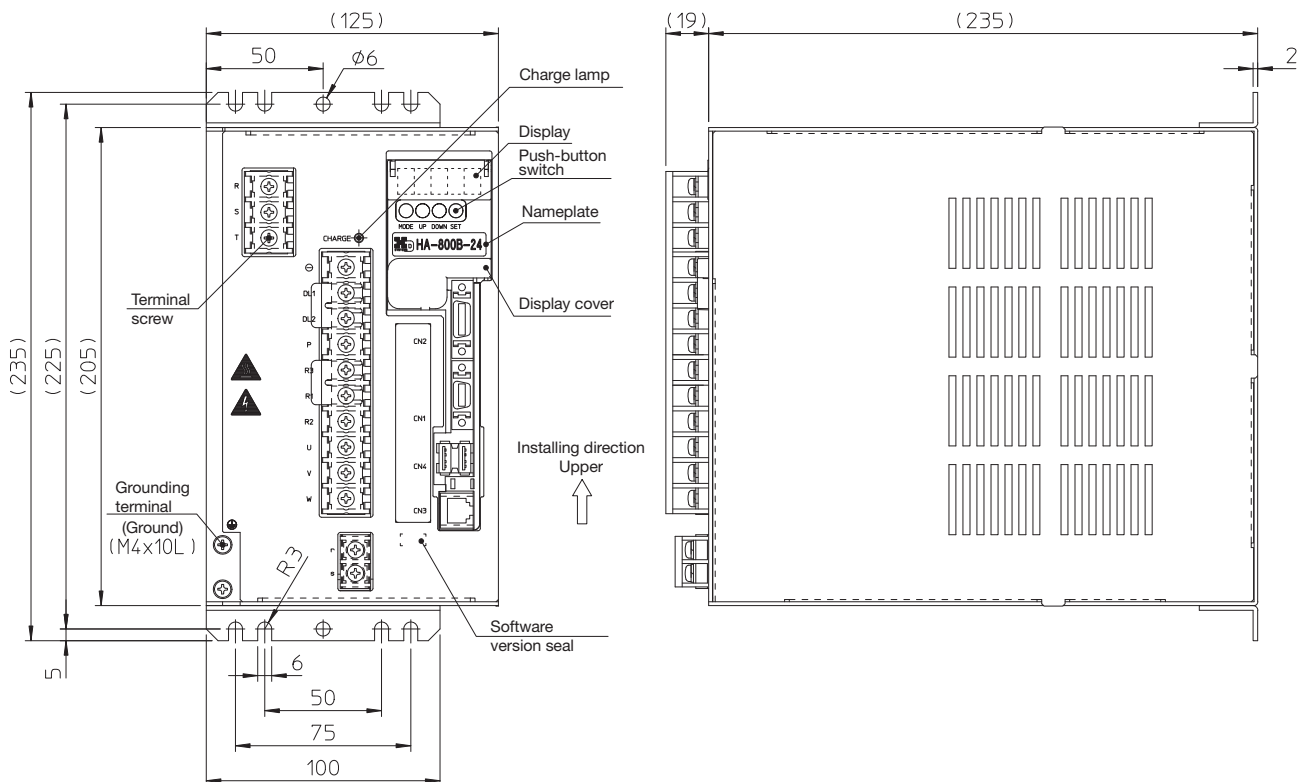
Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

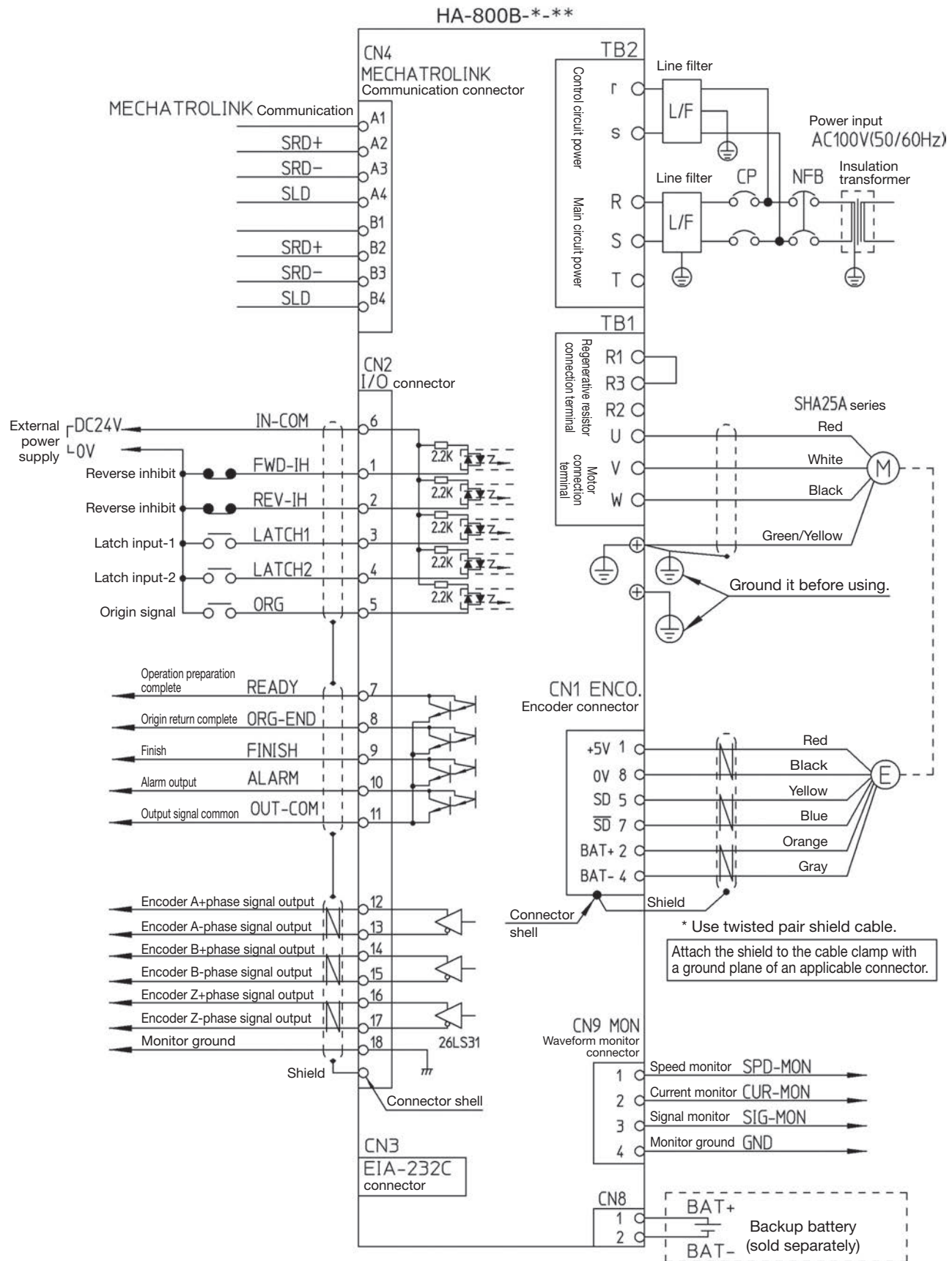
### HA-800B-24

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

## Example of Connection



A battery is not incorporated in the driver.  
Connect an optional HAB-ER17/33-2.

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## Option

## Relay Cable

The following table shows the actuator's combination with HA-800B driver and relay cable.

| Actuator Series Name | Model No. | Power Supply Voltage (V) | Combined Driver<br>MECHATROLINK-II support | Relay Cable (sold separately)                                                    |                                                                                    |
|----------------------|-----------|--------------------------|--------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| SHA series           | 20        | 200                      | HA-800B-3D-200/HA-800B-3E-200              | Motor cable<br>EWD-MB□□-A06-TN3                                                  | Encoder cable<br>EWD-S□□-A08-3M14                                                  |
|                      | 25        | 100                      | HA-800B-6D-100/HA-800B-6E-100              |                                                                                  |                                                                                    |
|                      |           | 200                      | HA-800B-3D-200/HA-800B-3E-200              |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800B-6D-200/HA-800B-6E-200              |                                                                                  |                                                                                    |
|                      | 40        | 200                      | HA-800B-6D-200/HA-800B-6E-200              | Motor cable<br>Model No. 40:EWD-MB□□-A06-TMC<br>Model No. 58,65:EWD-MB□□-D09-TMC | Encoder cable<br>Model No. 40:EWD-S□□-A08-3M14<br>Model No. 58,65:EWD-S□□-D10-3M14 |
|                      | 40        | 200                      | HA-800B-24D-200/HA-800B-24E-200            |                                                                                  |                                                                                    |
|                      | 58        | 200                      | HA-800B-24D-200/HA-800B-24E-200            |                                                                                  |                                                                                    |
| FHA-C mini series    | 65        | 200                      | HA-800B-24D-200/HA-800B-24E-200            | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (INC)<br>EWC-E□□-M06-3M14                                            |
|                      | 8         | 200                      | HA-800B-1C-200                             |                                                                                  |                                                                                    |
|                      | 11        | 200                      | HA-800B-1C-200                             |                                                                                  |                                                                                    |
|                      | 14        | 200                      | HA-800B-1C-200                             | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (INC)<br>EWC-E□□-M06-3M14                                            |
|                      | 8         | 100                      | HA-800B-1C-100                             |                                                                                  |                                                                                    |
|                      | 11        | 100                      | HA-800B-1C-100                             |                                                                                  |                                                                                    |
|                      | 14        | 100                      | HA-800B-1C-100                             | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (ABS)<br>EWD-S□□-A08-3M14                                            |
|                      | 8         | 200                      | HA-800B-1D-200/HA-800B-1E-200              |                                                                                  |                                                                                    |
|                      | 11        | 200                      | HA-800B-1D-200/HA-800B-1E-200              |                                                                                  |                                                                                    |
|                      | 14        | 200                      | HA-800B-1D-200/HA-800B-1E-200              | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (ABS)<br>EWD-S□□-A08-3M14                                            |
|                      | 8         | 100                      | HA-800B-1D-100/HA-800B-1E-100              |                                                                                  |                                                                                    |
|                      | 11        | 100                      | HA-800B-1D-100/HA-800B-1E-100              |                                                                                  |                                                                                    |
| FHA-C series         | 14        | 100                      | HA-800B-1D-100/HA-800B-1E-100              | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (INC)<br>EWC-E□□-B04-3M14                                            |
|                      | 17        | 200                      | HA-800B-3C-200                             |                                                                                  |                                                                                    |
|                      | 25        | 200                      | HA-800B-3C-200                             |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800B-6C-200                             |                                                                                  |                                                                                    |
|                      | 40        | 200                      | HA-800B-6C-200                             | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (ABS)<br>EWC-S□□-B08-3M14                                            |
|                      | 17        | 200                      | HA-800B-3A-200                             |                                                                                  |                                                                                    |
|                      | 25        | 200                      | HA-800B-3A-200                             |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800B-6A-200                             |                                                                                  |                                                                                    |
|                      | 40        | 200                      | HA-800B-6A-200                             | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (INC)<br>EWC-E□□-B04-3M14                                            |
|                      | 17        | 100                      | HA-800B-3C-100                             |                                                                                  |                                                                                    |
|                      | 25        | 100                      | HA-800B-6C-100                             |                                                                                  |                                                                                    |
|                      | 32        | 100                      | HA-800B-6C-100                             |                                                                                  |                                                                                    |
|                      | 17        | 100                      | HA-800B-3A-100                             | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (ABS)<br>EWC-S□□-B08-3M14                                            |
|                      | 25        | 100                      | HA-800B-6A-100                             |                                                                                  |                                                                                    |
|                      | 32        | 100                      | HA-800B-6A-100                             |                                                                                  |                                                                                    |
| RSF series           | 17        | 200                      | HA-800B-3B-200                             | Motor cable<br>EWA-M□□-A04-TN3                                                   | Encoder cable<br>EWA-E□□-A15-3M14                                                  |
|                      | 20        | 200                      | HA-800B-3B-200                             |                                                                                  |                                                                                    |
| RSF/RFK series       | 25        | 200                      | HA-800B-3B-200                             |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800B-6B-200                             |                                                                                  |                                                                                    |

\* (INC) indicates incremental encoder, while (ABS) indicates absolute encoder.

\* □□ in the relay cable model indicates cable length. Select from 3 types of length: 03=3m, 05=5m, and 10=10m.

## Dedicated Communication Cable

Use the dedicated communication cable to connect between HA-800 driver and personal computer.

| Model    | Length |
|----------|--------|
| EWA-RS03 | 1.6m   |

## Connector

## Connector

In HA-800B driver, connectors for CN1, CN2, motor cable, and power supply are followings.

### Connector type

#### ■ MECHATROLINK-II support 《HA-800B》

CNK-HA80B-S1: for CN1/for CN2/for motor cable connection/power supply connection: 4 types

CNK-HA80B-S2: for CN2/power supply connection: 2 types

|                         | Manufacturer         | Model                   |                                               |
|-------------------------|----------------------|-------------------------|-----------------------------------------------|
| For CN1                 | Sumitomo 3M Ltd.     | Connector: 10114-3000PE | Cover: 10314-52F0-008                         |
| For CN2                 | Sumitomo 3M Ltd.     | HA-800B, HA-800C        | Connector: 10120-3000PE Cover: 10320-52F0-008 |
| Motor cable connection  | PHOENIX CONTACT Inc. | FKIC2,5/6-ST-5.08       |                                               |
| Power supply connection | PHOENIX CONTACT Inc. | FKC2,5/5-ST-5.08        |                                               |

## Backup Battery

## Backup Battery

This battery is used to hold multi revolution data of an absolute encoder in case of power supply shutdown. Required when combining the driver to an actuator with an absolute encoder in order to use it with the absolute specifications.

### Model Symbol

When a new driver is purchased: HAB-ER17/33-2

When replacing the battery after extended use: HAB-ER17/33-2\_Maintenance

| Battery type    | Manufacturer              | Manufacturer's model    |
|-----------------|---------------------------|-------------------------|
| Lithium battery | Toshiba Battery Co., Ltd. | ER17330V (3.6V 1700mAh) |

### Holding Time

| Holding period           | Condition                                          |
|--------------------------|----------------------------------------------------|
| 1 year continuous motion | Total backup time when ambient temperature is 25°C |

Note: When purchasing the battery itself from the manufacturer, connector wire and removal ribbon are not attached. Use the battery after the similar process completed.

## Monitor Cable

This is a signal cable to measure signals such as speed or torque by using oscilloscope.

| Model          |
|----------------|
| EWA-MON01-JST4 |

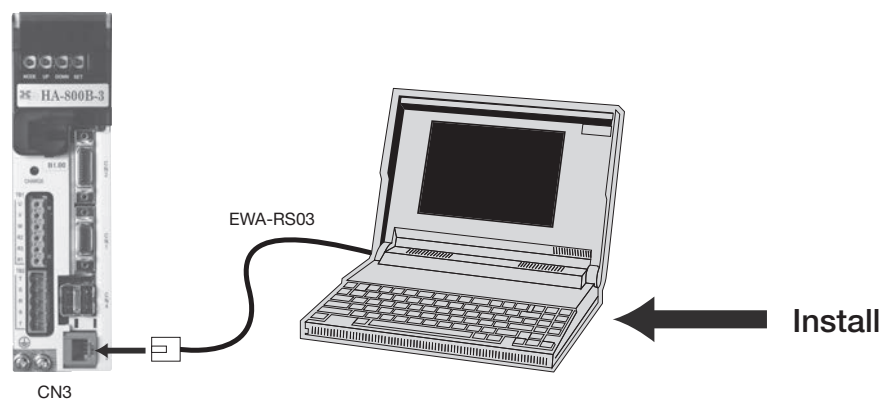


## Servo Parameter Setting Software PSF-800 (Free Delivery)

The software is used to set various servo parameters from your PC to HA-800 driver. Various servo parameters can be changed by using EIA-232C cable to connect to the PC to which "CN3" of HA-800 driver and "Servo parameter setting software PSF-800" are installed. For the details of the software, request the separated "PSF-800 Instruction Manual" and refer to it. You can download the software from our home page (<https://www.hds.co.jp/>).

| Model   | Support OS         | Parts to be prepared                     |
|---------|--------------------|------------------------------------------|
| PSF-800 | Windows XP/Vista/7 | Dedicated communication cable (EWA-RS03) |

Note: Windows is a registered trademark of Microsoft.



PSF-800  
Setting software

[www.hds.co.jp](http://www.hds.co.jp)

# HA-800C Series



\* CC-Link is a registered trademark of CC-Link association.

## Features

■ **Compatible with the open field network**

Compatible with CC-Link (Ver. 1.10).

■ **Unique control theory reduces positional settling time to 1/2 (compared with HA-655 of Harmonic Drive Systems)**

Unique control theory suppresses positional overshoot or undershoot, and reduces positional settling time to 1/2 of conventional item.

■ **Auto tuning function is available.**

Auto tuning function is available, which can estimate the load to set optimal servo gain.

■ **Regenerative absorbing circuit and dynamic brake are embedded.**

## Model and Symbols

HA - 800C - 3 A - 100 - □

Model: AC servo driver HA series

Series name: 800B CC-Link support type

Rated output current: 1: 1.5A/3: 3A/6: 6A/24: 24A

|                    |   |                                      |
|--------------------|---|--------------------------------------|
| Connected encoder: | A | 13bit absolute encoder*              |
|                    | B | 14-wire incremental encoder          |
|                    | C | 4-wire reduction incremental encoder |
|                    | D | 17bit absolute encoder*              |
|                    | E | 17bit incremental encoder            |

Input power voltage 100: AC100V/200: AC200V

|                        |           |               |
|------------------------|-----------|---------------|
| Special specification: | No symbol | Standard item |
|                        | SP        | Special item  |

\* A backup battery is not included. (Backup battery model: HAB-ER17/33-2)

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## List of Combination Actuators

HA-800C series can be combined with the following rotary actuator (100V and 200V specifications).

| Actuator Series Name | Model No. | Power Supply Voltage (V) | Encoder Type                          | Combined Driver                  |
|----------------------|-----------|--------------------------|---------------------------------------|----------------------------------|
|                      |           |                          |                                       | CC-Link Support                  |
| SHA series           | 20        | 200                      | 17bit absolute (D)<br>incremental (E) | HA-800C-3D-200*/HA-800C-3E-200   |
|                      | 25        | 100                      |                                       | HA-800C-6D-100*/HA-800C-6E-100   |
|                      |           | 200                      |                                       | HA-800C-3D-200*/HA-800C-3E-200   |
|                      | 32        | 200                      |                                       | HA-800C-6D-200*/HA-800C-6E-200   |
|                      | 40        | 200                      |                                       | HA-800C-6D-200*/HA-800C-6E-200   |
|                      | 40        | 200                      |                                       | HA-800C-24D-200*/HA-800C-24E-200 |
|                      | 58        | 200                      |                                       | HA-800C-24D-200*/HA-800C-24E-200 |
|                      | 65        | 200                      |                                       | HA-800C-24D-200*/HA-800C-24E-200 |
| FHA-C mini series    | 8         | 200                      | 4-wire reduction incremental          | HA-800C-1C-200                   |
|                      | 11        | 200                      |                                       | HA-800C-1C-200                   |
|                      | 14        | 200                      |                                       | HA-800C-1C-200                   |
|                      | 8         | 100                      |                                       | HA-800C-1C-100                   |
|                      | 11        | 100                      |                                       | HA-800C-1C-100                   |
|                      | 14        | 100                      |                                       | HA-800C-1C-100                   |
|                      | 8         | 200                      | 17bit absolute (D)<br>incremental (E) | HA-800C-1D-200*/HA-800C-1E-200   |
|                      | 11        | 200                      |                                       | HA-800C-1D-200*/HA-800C-1E-200   |
|                      | 14        | 200                      |                                       | HA-800C-1D-200*/HA-800C-1E-200   |
|                      | 8         | 100                      |                                       | HA-800C-1D-100*/HA-800C-1E-100   |
|                      | 11        | 100                      |                                       | HA-800C-1D-100*/HA-800C-1E-100   |
|                      | 14        | 100                      |                                       | HA-800C-1D-100*/HA-800C-1E-100   |
| FHA-C series         | 17        | 200                      | 4-wire reduction incremental          | HA-800C-3C-200                   |
|                      | 25        | 200                      |                                       | HA-800C-3C-200                   |
|                      | 32        | 200                      |                                       | HA-800C-6C-200                   |
|                      | 40        | 200                      |                                       | HA-800C-6C-200                   |
|                      | 17        | 200                      | 13bit absolute                        | HA-800C-3A-200*                  |
|                      | 25        | 200                      |                                       | HA-800C-3A-200*                  |
|                      | 32        | 200                      |                                       | HA-800C-6A-200*                  |
|                      | 40        | 200                      |                                       | HA-800C-6A-200*                  |
|                      | 17        | 100                      | 4-wire reduction incremental          | HA-800C-3C-100                   |
|                      | 25        | 100                      |                                       | HA-800C-6C-100                   |
|                      | 32        | 100                      |                                       | HA-800C-6C-100                   |
|                      | 17        | 100                      | 13bit absolute                        | HA-800C-3A-100*                  |
|                      | 25        | 100                      |                                       | HA-800C-6A-100*                  |
|                      | 32        | 100                      |                                       | HA-800C-6A-100*                  |
| RSF series           | 17        | 200                      | 14-wire reduction incremental         | HA-800C-3B-200                   |
| RSF/RKF series       | 20        | 200                      |                                       | HA-800C-3B-200                   |
|                      | 25        | 200                      |                                       | HA-800C-3B-200                   |
|                      | 32        | 200                      |                                       | HA-800C-6B-200                   |

\* A backup battery is not included with the HA-800 driver. When using a driver with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## Specification

| Driver model                           |                               | HA-800C-1                                                                                                                                                                                                                                                                                                                                                                                                                                          | HA-800C-3                                                                                        | HA-800C-6               | HA-800C-24                               |
|----------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------|
| Item                                   |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         |                                          |
| Driver's Rated Current <sup>*1</sup>   |                               | 1.5A                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3.0A                                                                                             | 6.0A                    | 24.0A                                    |
| Driver's Maximum Current <sup>*1</sup> |                               | 4.0A                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5A                                                                                             | 19.0A                   | 55.0A                                    |
| Power Supply Voltage                   | Main circuit <sup>*1</sup>    | AC100 to 115V (single phase) or AC200 to 230V (single phase/3 phases) +10 to -15%                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                  |                         | AC200 to 230V (3 phases) +10 to -15%     |
|                                        | Control circuit <sup>*1</sup> | AC100 to 115V (single phase) or AC200 to 230V (single phase) +10 to -15%                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                  |                         | AC200 to 230V (single phase) +10 to -15% |
| Power Supply Frequency                 |                               | 50/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                  |                         |                                          |
| Multi Revolution Limit (Motor Shaft)   |                               | -4096 to 4095 (FHA-C series), -32768 to 32767 (SHA series, FHA-C mini series)                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |                         |                                          |
| Ambient condition                      |                               | Working temperature: 0°C to 50°C    Storage temperature: -20°C to 65°C    Working humidity/storage humidity: 95%RH or less (No condensation) No dust, metal powder, corrosive gas and oil mist                                                                                                                                                                                                                                                     |                                                                                                  |                         |                                          |
| Structure                              |                               | Self-cooled type                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                  | Forced air-cooling type |                                          |
| Mounting method                        |                               | Base mount (mounted on a wall)                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                  |                         |                                          |
| Control mode                           |                               | Position control, speed control, torque control                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         |                                          |
| Monitor Terminal                       |                               | 3 channels, motor rpm, current command, versatile output (parameter selection)                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                  |                         |                                          |
| Communication Connector                |                               | RS-232C                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                  |                         |                                          |
| Operation Panel                        | Configuration                 | Display (7-segment LEDs) 5 digits (red), 4 push button switches                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         |                                          |
|                                        | Status Display Function       | Rotational speed (r/min), torque control (%), load rate(%), input signal monitor, output signal monitor, alarm history (8 times) and others                                                                                                                                                                                                                                                                                                        |                                                                                                  |                         |                                          |
|                                        | Parameter Adjustment Function | System parameter 3 or 4, adjustment parameter 1 or 2                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                  |                         |                                          |
| Protection function                    | Alarm                         | Emergency stop, overcurrent, overload, IPM error (overcurrent), regeneration resistance overheat, encoder break, encoder reception error, UVW error, system shutdown, multi revolution overflow, multi revolution data error, excessively large deviation, memory error, FPGA configuration error, FPGA setting error, MEMORY error, single revolution data error, multi revolution data error, BUSY error, overheating error, communication error |                                                                                                  |                         |                                          |
|                                        | Warning                       | Low battery voltage, overload, cooling fan stop, low main circuit power voltage, forward limit inputting, reverse limit inputting                                                                                                                                                                                                                                                                                                                  |                                                                                                  |                         |                                          |
| Regenerative Processing                |                               | External Regenerative Resistance<br>With installation terminal                                                                                                                                                                                                                                                                                                                                                                                     | Regenerative Resistance Installed<br>With External Regenerative Resistance installation terminal |                         |                                          |
| Regenerative Resistance Absorbed Power |                               | —                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3W Max                                                                                           | 8W Max                  | 90W Max                                  |
| Embedded Functions                     |                               | Status display, self diagnosis, electronic gear, jogging, etc, dynamic brake, multi revolution data backup battery (when installing an optional data backup battery)                                                                                                                                                                                                                                                                               |                                                                                                  |                         |                                          |
| Inrush Current Prevention Function     |                               | Embedded (CPU control by main circuit voltage monitoring)                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                  |                         |                                          |
| Operation Mode                         |                               | Status display (normal operation) mode, test mode, adjustment mode, system parameter mode                                                                                                                                                                                                                                                                                                                                                          |                                                                                                  |                         |                                          |
| Mass                                   |                               | 1kg                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                  | 1.2kg                   | 5.8kg                                    |

\* 1: Set in accordance with the specification of a combined actuator.

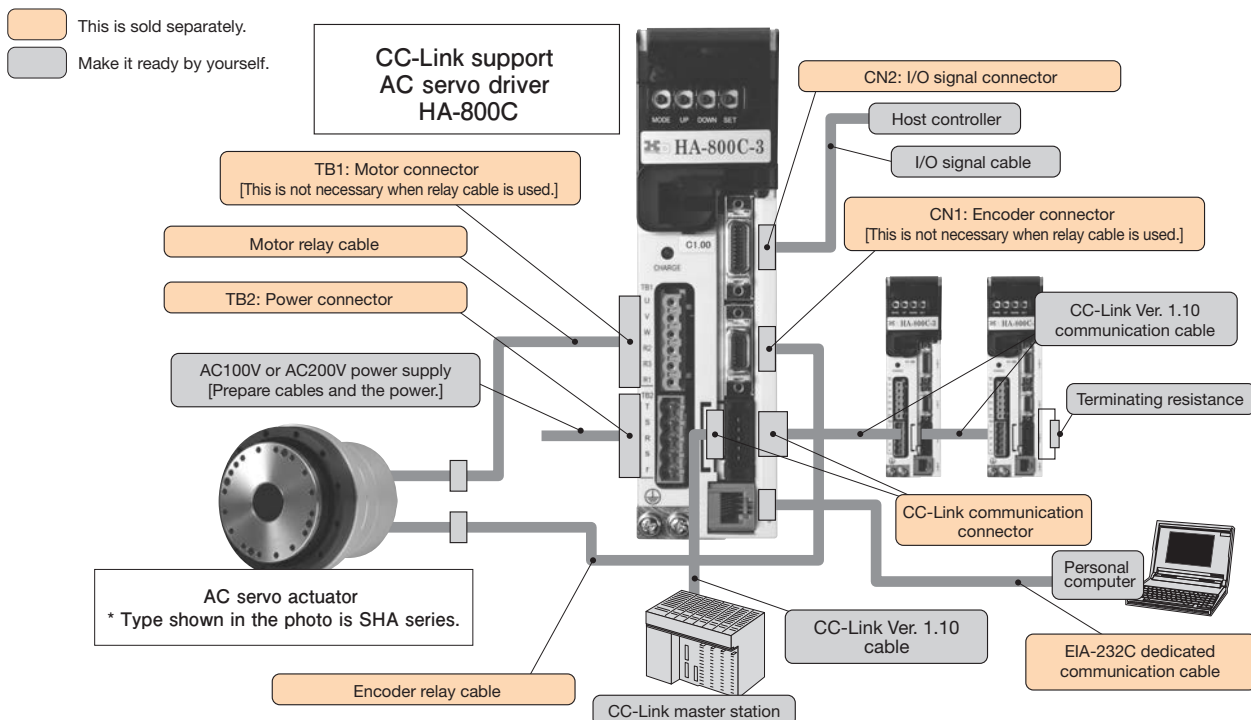
## Communication Specification

| Item                         |                               | Specification                                                               |         |         |       |        |
|------------------------------|-------------------------------|-----------------------------------------------------------------------------|---------|---------|-------|--------|
| Applicable CC-Link version   |                               | Ver 1.10                                                                    |         |         |       |        |
| Station type                 |                               | Remote device station                                                       |         |         |       |        |
| Transmission rate            |                               | 10M/5M/2.5M/625k/156kbps                                                    |         |         |       |        |
| Communication method         |                               | Broadcast polling method                                                    |         |         |       |        |
| Synchronous method           |                               | Frame synchronous method                                                    |         |         |       |        |
| Encoding method              |                               | NRZI                                                                        |         |         |       |        |
| Transmission channel type    |                               | Bus type (Compliant to EIA RS-485)                                          |         |         |       |        |
| Error control method         |                               | CRC ( $X^{16}+X^{12}+X^5+1$ )                                               |         |         |       |        |
| Connecting cable             |                               | CC-Link Ver1.10 support cable (triplex twisted pair cable with shield)      |         |         |       |        |
| Transmission format          |                               | Compliant to HDLC                                                           |         |         |       |        |
| Remote station number        |                               | 1 to 64                                                                     |         |         |       |        |
| Number of exclusive stations |                               | 1 station, 2 station                                                        |         |         |       |        |
| Cable length <sup>1</sup>    | Communication speed           | 156kbps                                                                     | 625kbps | 2.5Mbps | 5Mbps | 10Mbps |
|                              | Maximum cable extension       | 1200m                                                                       | 900m    | 400m    | 160m  | 100m   |
|                              | Cable length between stations | 0.2m or more                                                                |         |         |       |        |
| Number of connections        |                               | Maximum 42 units only for a remote station Can be shared with other devices |         |         |       |        |

\* If CC-Link Ver1.00 support cable is used together, the total cable extension and the cable length between stations should follow the specification of Ver1.00.

## System Configuration

### CC-Link support System configuration



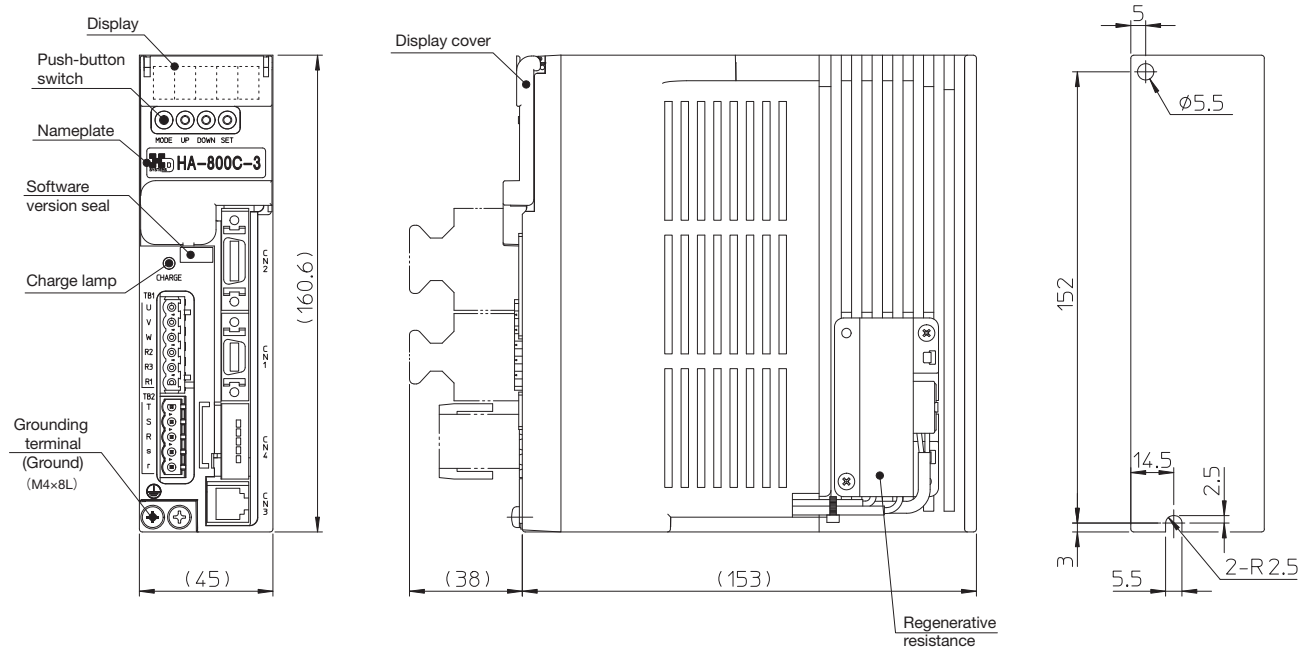
\* See the technical information for the details of configuration related to power supply.

\* When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## Dimensional Outline Drawing

### HA-800C-1, 3

Unit: mm

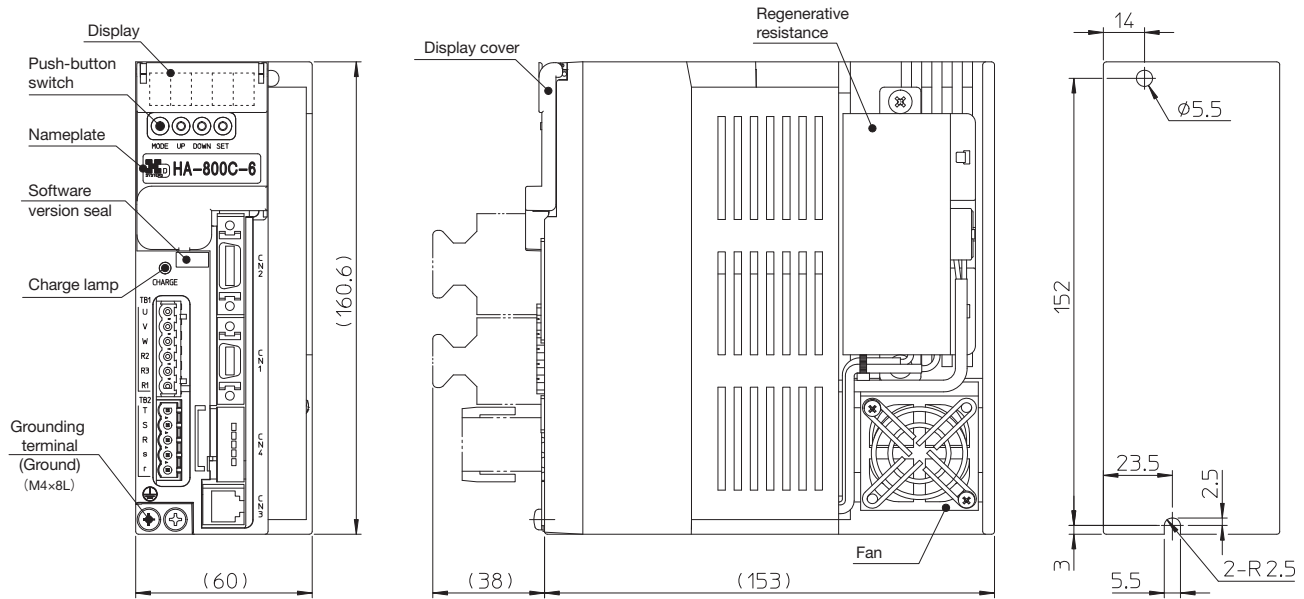


\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

## Dimensional Outline Drawing

### HA-800C-6

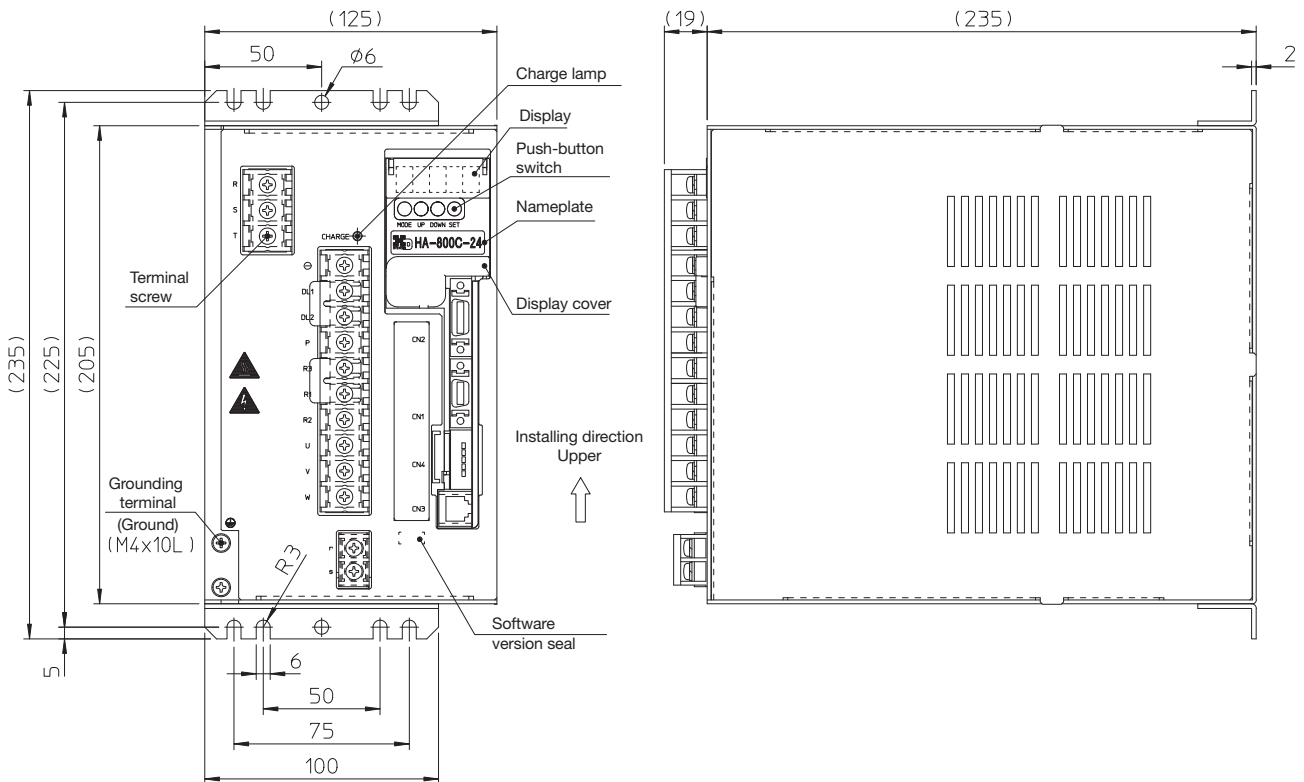
Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

### HA-800C-24

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

Rotary Actuator

DirectDrive motor

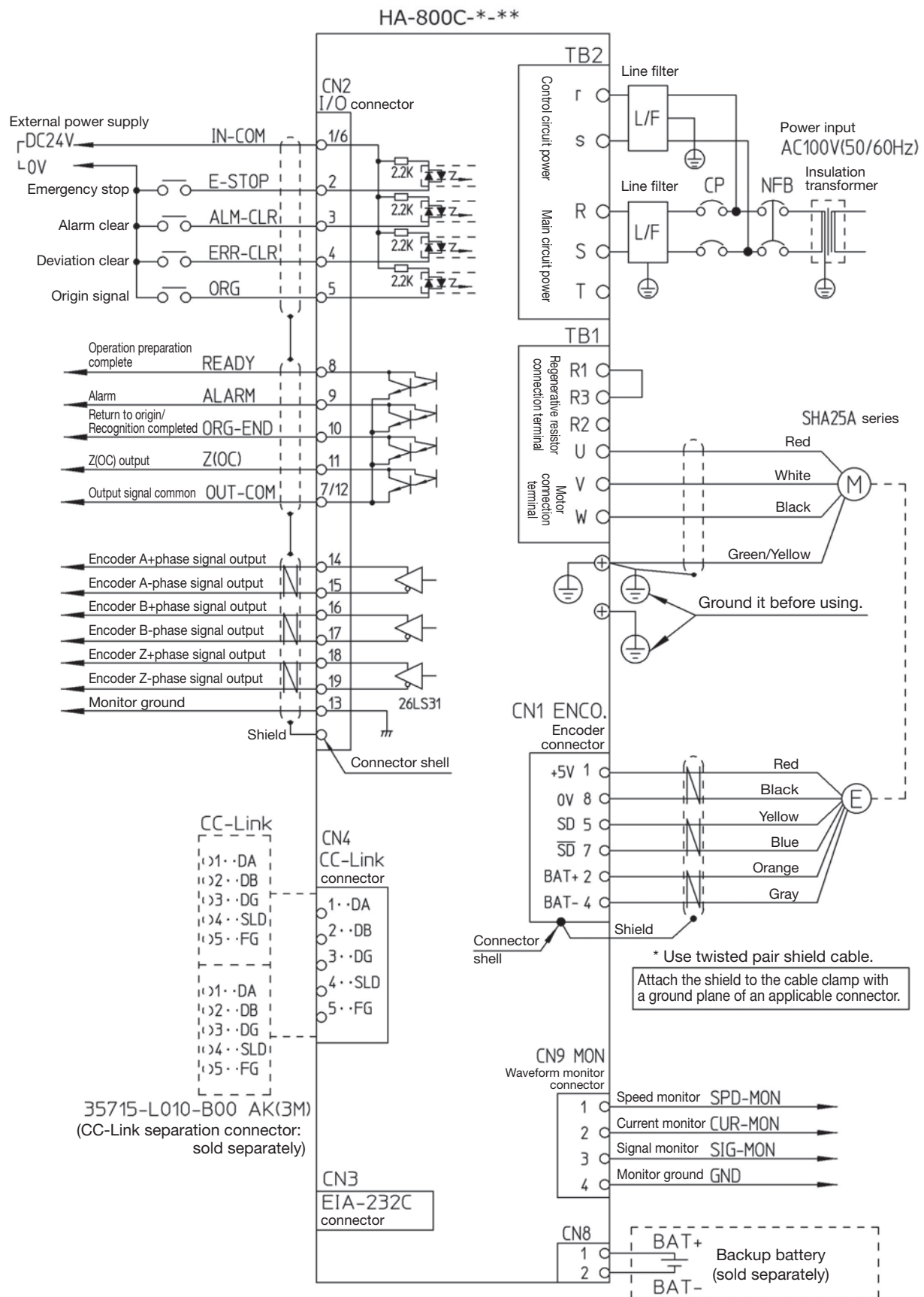
Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## Example of connection



A battery is not incorporated in the driver.  
Connect an optional HAB-ER17/33-2.

## Option

## Relay Cable

The following table shows the actuator's combination with HA-800C driver and relay cable.

| Actuator Series Name | Model No. | Power Supply Voltage (V) | Combined Driver                 | Relay Cable (sold separately)                                                      |                                                                                      |
|----------------------|-----------|--------------------------|---------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|                      |           |                          | CC-Link support                 |                                                                                    |                                                                                      |
| SHA series           | 20        | 200                      | HA-800C-3D-200/HA-800C-3E-200   | Motor cable<br>EWD-MB□□-A06-TN3                                                    | Encoder cable<br>EWD-S□□-A08-3M14                                                    |
|                      | 25        | 100                      | HA-800C-6D-100/HA-800C-6E-100   |                                                                                    |                                                                                      |
|                      |           | 200                      | HA-800C-3D-200/HA-800C-3E-200   |                                                                                    |                                                                                      |
|                      | 32        | 200                      | HA-800C-6D-200/HA-800C-6E-200   |                                                                                    |                                                                                      |
|                      | 40        | 200                      | HA-800C-6D-200/HA-800C-6E-200   | Motor cable<br>Model No. 40: EWD-MB□□-A06-TMC<br>Model No. 58,65: EWD-MB□□-D09-TMC | Encoder cable<br>Model No. 40: EWD-S□□-A08-3M14<br>Model No. 58,65: EWD-S□□-D10-3M14 |
|                      | 40        | 200                      | HA-800C-24D-200/HA-800C-24E-200 |                                                                                    |                                                                                      |
|                      | 58        | 200                      | HA-800C-24D-200/HA-800C-24E-200 |                                                                                    |                                                                                      |
| FHA-C mini series    | 65        | 200                      | HA-800C-24D-200/HA-800C-24E-200 | Motor cable<br>EWC-M□□-A06-TN3                                                     | Encoder cable (INC)<br>EWC-E□□-M06-3M14                                              |
|                      | 8         | 200                      | HA-800C-1C-200                  |                                                                                    |                                                                                      |
|                      | 11        | 200                      | HA-800C-1C-200                  |                                                                                    |                                                                                      |
|                      | 14        | 200                      | HA-800C-1C-200                  |                                                                                    |                                                                                      |
|                      | 8         | 100                      | HA-800C-1C-100                  |                                                                                    |                                                                                      |
|                      | 11        | 100                      | HA-800C-1C-100                  |                                                                                    |                                                                                      |
|                      | 14        | 100                      | HA-800C-1C-100                  |                                                                                    |                                                                                      |
|                      | 8         | 200                      | HA-800C-1D-200/HA-800C-1E-200   |                                                                                    | Encoder cable (ABS)<br>EWD-S□□-A08-3M14                                              |
|                      | 11        | 200                      | HA-800C-1D-200/HA-800C-1E-200   |                                                                                    |                                                                                      |
|                      | 14        | 200                      | HA-800C-1D-200/HA-800C-1E-200   |                                                                                    |                                                                                      |
|                      | 8         | 100                      | HA-800C-1D-100/HA-800C-1E-100   |                                                                                    | Encoder cable (ABS)<br>EWD-S□□-A08-3M14                                              |
|                      | 11        | 100                      | HA-800C-1D-100/HA-800C-1E-100   |                                                                                    |                                                                                      |
|                      | 14        | 100                      | HA-800C-1D-100/HA-800C-1E-100   |                                                                                    |                                                                                      |
| FHA-C series         | 17        | 200                      | HA-800C-3C-200                  | Motor cable<br>EWC-MB□□-M08-TN3                                                    | Encoder cable (INC)<br>EWC-E□□-B04-3M14                                              |
|                      | 25        | 200                      | HA-800C-3C-200                  |                                                                                    |                                                                                      |
|                      | 32        | 200                      | HA-800C-6C-200                  |                                                                                    |                                                                                      |
|                      | 40        | 200                      | HA-800C-6C-200                  |                                                                                    |                                                                                      |
|                      | 17        | 200                      | HA-800C-3A-200                  | Motor cable<br>EWC-MB□□-M08-TN3                                                    | Encoder cable (ABS)<br>EWC-S□□-B08-3M14                                              |
|                      | 25        | 200                      | HA-800C-3A-200                  |                                                                                    |                                                                                      |
|                      | 32        | 200                      | HA-800C-6A-200                  |                                                                                    |                                                                                      |
|                      | 40        | 200                      | HA-800C-6A-200                  |                                                                                    |                                                                                      |
|                      | 17        | 100                      | HA-800C-3C-100                  | Motor cable<br>EWC-MB□□-M08-TN3                                                    | Encoder cable (INC)<br>EWC-E□□-B04-3M14                                              |
|                      | 25        | 100                      | HA-800C-6C-100                  |                                                                                    |                                                                                      |
|                      | 32        | 100                      | HA-800C-6C-100                  |                                                                                    |                                                                                      |
|                      | 17        | 100                      | HA-800C-3A-100                  | Motor cable<br>EWC-MB□□-M08-TN3                                                    | Encoder cable (ABS)<br>EWC-S□□-B08-3M14                                              |
|                      | 25        | 100                      | HA-800C-6A-100                  |                                                                                    |                                                                                      |
|                      | 32        | 100                      | HA-800C-6A-100                  |                                                                                    |                                                                                      |
| RSF series           | 17        | 200                      | HA-800C-3B-200                  | Motor cable<br>EWA-M□□-A04-TN3                                                     | Encoder cable<br>EWA-E□□-A15-3M14                                                    |
| RSF/RKF series       | 20        | 200                      | HA-800C-3B-200                  |                                                                                    |                                                                                      |
|                      | 25        | 200                      | HA-800C-3B-200                  |                                                                                    |                                                                                      |
|                      | 32        | 200                      | HA-800C-6B-200                  |                                                                                    |                                                                                      |

\* (INC) indicates incremental encoder, while (ABS) indicates absolute encoder.

\* □□ in the relay cable model indicates cable length. Select from 3 types of length: 03=3m, 05=5m, and 10=10m.

## Dedicated Communication Cable

Use the dedicated communication cable to connect between HA-800 driver and personal computer.

| Model    | Length |
|----------|--------|
| EWA-RS03 | 1.6m   |



## Connector

## Connector

In HA-800C driver, connectors for CN1, CN2, motor cable, and power supply are followings.

## Connector type

## ■ CC-Link support 《HA-800C》

CNK-HA80C-S1: for CN1/for CN2/for motor cable connection/power supply connection/  
Two CC-Link connectors/CC-Link separation connector: 6 types

CNK-HA80C-S2: for CN2/power supply connection/Two CC-Link connectors/  
CC-Link separation connector: 4 types

|                              | Manufacturer         | Model                   |                                               |
|------------------------------|----------------------|-------------------------|-----------------------------------------------|
| For CN1                      | Sumitomo 3M Ltd.     | Connector: 10114-3000PE | Cover: 10314-52F0-008                         |
| For CN2                      | Sumitomo 3M Ltd.     | HA-800B, HA-800C        | Connector: 10120-3000PE Cover: 10320-52F0-008 |
| Motor cable connection       | PHOENIX CONTACT Inc. | FKIC2,5/6-ST-5.08       |                                               |
| Power supply connection      | PHOENIX CONTACT Inc. | FKC2,5/5-ST-5.08        |                                               |
| CC-Link connector            | Sumitomo 3M Ltd.     | 35505-6000-B0M GF       |                                               |
| CC-Link separation connector | Sumitomo 3M Ltd.     | 35715-L010-B00 AK       |                                               |

## Backup Battery

## Backup Battery

This battery is used to hold multi revolution data of an absolute encoder in case of power supply shutdown. Required when combining the driver to an actuator with an absolute encoder in order to use it with the absolute specifications.

## Model Symbol

When a new driver is purchased: HAB-ER17/33-2

When replacing the battery after extended use: HAB-ER17/33-2\_Maintenance

| Battery type    | Manufacturer              | Manufacturer's model   |
|-----------------|---------------------------|------------------------|
| Lithium battery | Toshiba Battery Co., Ltd. | ER17330V(3.6V 1700mAh) |

## Holding Time

| Holding period           | Condition                                          |
|--------------------------|----------------------------------------------------|
| 1 year continuous motion | Total backup time when ambient temperature is 25°C |

Note: When purchasing the battery itself from the manufacturer, connector wire and removal ribbon are not attached. Use the battery after the similar process completed.

## Monitor Cable

This is a signal cable to measure signals such as speed or torque by using oscilloscope.

| Model          |
|----------------|
| EWA-MON01-JST4 |

Servo Parameter Setting Software (Free Delivery)

Servo Parameter Setting Software PSF-800 (Free Delivery)

The software is used to set various servo parameters from your PC to HA-800 driver.  
Various servo parameters can be changed by using EIA-232C cable to connect to the PC to which “CN3” of HA-800 driver and “Servo parameter setting software PSF-800” are installed. For the details of the software, request the separated “PSF-800 Instruction Manual” and refer to it.  
You can download the software from our home page (<https://www.hds.co.jp/>).

| Model   | Support OS         | Parts to be prepared                     |
|---------|--------------------|------------------------------------------|
| PSF-800 | Windows XP/Vista/7 | Dedicated communication cable (EWA-RS03) |

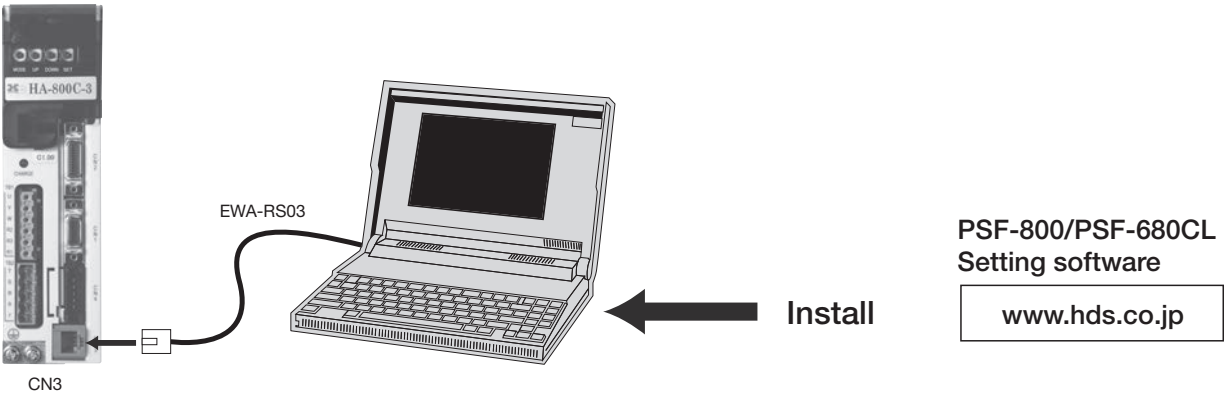
Note: Windows is a registered trademark of Microsoft.

Operational Table Data Creation Software PSF-680CL (Free Delivery)

The software is used to create operational table data with HA-800C (CC-Link support) driver and to operate the actuator.  
(Operational table data can be set from CC-Link)

| Model     | Support OS           | Parts to be prepared                     |
|-----------|----------------------|------------------------------------------|
| PSF-680CL | WindowsMe/NT/2000/XP | Dedicated communication cable (EWA-RS03) |

Note: Windows is a registered trademark of Microsoft.



Rotary Actuator

DirectDrive motor

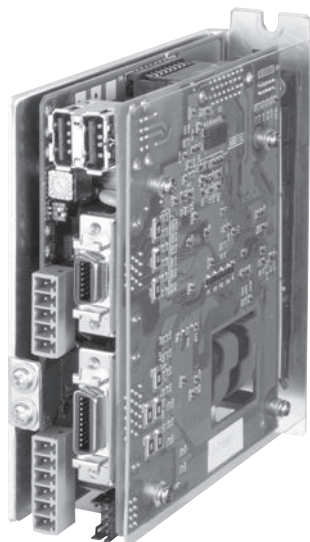
Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

# HA-680ML Series



\* MECHATROLINK is a registered trademark of MECHATROLINK association.

## Features

### ■ Small and compact design

The weight is 260g. It is super lightweight design and helps downsizing and space saving.

### ■ Easy function setting with PC

You can easily set and change parameters with the special communication software "PSF-520" via EIA232 communication on your PC.

### ■ Extensive operation status display

I/O signals, rotation speed, and deviation can be monitored using dedicated communication software "PSF-520". It is easy to diagnose defects as you can display "alarm history" up to 8 times backward.

### ■ The main circuit power and the control circuit power are separated

As the main circuit power is separate from the control circuit power, you can safely operate diagnosis in case of a trouble.

### ■ Electronic gear adapted to the machine system

The "electronic gear" function enables adjustment of the feed angle and pitch of the servo system to correspond to the reduction ratio and feed mechanism unit of the load machine.

### ■ Regeneration circuit included as standard equipment

As the regeneration circuit is included as standard equipment, you can use it without worrying about regeneration in an application with large inertia moment.

## Model and Symbols

HA - 680 ML - 4 □ - 24 - S●●●

Model: AC servo driver HA series

Series name: 680

Open network support:

|                |                      |
|----------------|----------------------|
| No description | No open network      |
| ML             | MECHATROLINK support |

Rated output current:

|   |    |
|---|----|
| 4 | 4A |
| 6 | 6A |

Corresponding symbol:

|                |                                              |
|----------------|----------------------------------------------|
| No description | For FHA-C mini AC24V type (FHA-8C, 11C, 14C) |
| B              | For RSF supermini series (RSF-3B, 5B)        |
|                | For RSF-B mini series (RSF-8B, 11B, 14B)     |

Power voltage: 24 DC24V

Adjustment model control No.

List of Adjustment Model Control No. and Combination Actuators

| Adjustment Model Control No. | Driver Model   | Actuator Model         |
|------------------------------|----------------|------------------------|
| S000                         | HA-680ML-4-24  | FHA-8C-30-E200-CE      |
| S001                         |                | FHA-8C-50-E200-CE      |
| S002                         |                | FHA-8C-100-E200-CE     |
| S003                         |                | FHA-11C-30-E200-CE     |
| S004                         |                | FHA-11C-50-E200-CE     |
| S005                         |                | FHA-11C-100-E200-CE    |
| S006                         | HA-680ML-6-24  | FHA-14C-30-E200-CE     |
| S007                         |                | FHA-14C-50-E200-CE     |
| S008                         |                | FHA-14C-100-E200-CE    |
| S018                         | HA-680ML-4B-24 | RSF-3B-30-E020-C       |
| S019                         |                | RSF-3B-50-E020-C       |
| S020                         |                | RSF-3B-100-E020-C      |
| S012                         |                | RSF-5B-30-E050-C       |
| S013                         |                | RSF-5B-50-E050-C       |
| S014                         |                | RSF-5B-100-E050-C      |
| S015                         |                | RSF-5B-30-E050-BC      |
| S016                         |                | RSF-5B-50-E050-BC      |
| S017                         |                | RSF-5B-100-E050-BC     |
| S021                         |                | RSF-8B-30-F100-24B-C   |
| S022                         |                | RSF-8B-50-F100-24B-C   |
| S023                         |                | RSF-8B-100-F100-24B-C  |
| S024                         |                | RSF-11B-30-F100-24B-C  |
| S025                         |                | RSF-11B-50-F100-24B-C  |
| S026                         |                | RSF-11B-100-F100-24B-C |
| S027                         | HA-680ML-6B-24 | RSF-14B-30-F100-24B-C  |
| S028                         |                | RSF-14B-50-F100-24B-C  |
| S029                         |                | RSF-14B-100-F100-24B-C |

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## Specification

| Driver model                   |                            | HA-680ML-4-24    HA-680ML-6-24                                                                                                                                                                                                                                                                                   |  | HA-680ML-4B-24    HA-680ML-6B-24           |  |
|--------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------|--|
| Item                           |                            |                                                                                                                                                                                                                                                                                                                  |  |                                            |  |
| Supply voltage                 | Control Circuit Power (CP) | DC24V (20 to 28V)                                                                                                                                                                                                                                                                                                |  |                                            |  |
|                                | Main Circuit Power (MP)    | DC24V (20 to 28V)                                                                                                                                                                                                                                                                                                |  |                                            |  |
| Control Method                 |                            | Sine wave PWM method: Switching frequency 12.5kHz                                                                                                                                                                                                                                                                |  | 14-wire specification    Line driver input |  |
| Encoder                        |                            | 4-wire specification    Serial transmission method    Line driver input                                                                                                                                                                                                                                          |  |                                            |  |
| I/O Signal                     |                            | DI:5 points (insulation by photo coupler)    DO: 4 points (insulation by photo coupler)    Variable function allocation                                                                                                                                                                                          |  |                                            |  |
| Encoder Monitor                |                            | A, B, Z phase line driver output                                                                                                                                                                                                                                                                                 |  |                                            |  |
| Control Mode                   |                            | Position control                                                                                                                                                                                                                                                                                                 |  |                                            |  |
| Display                        |                            | Driver status monitor: LED 2 points (green: 1 point Red: 1 point)    Power on, servo on, alarm<br>MECHATROLINK: LED 3 points (green: 2 points Red: 1 point)    communication error, sending/receiving data                                                                                                       |  |                                            |  |
| Protection Function            |                            | Overload, excessive deviation, encoder disconnection detected, encoder receiving trouble, UVW trouble, regeneration trouble, Operating temperature trouble, system trouble, overcurrent, load short circuit, memory trouble, overspeed                                                                           |  |                                            |  |
| Regenerative Absorbing Circuit |                            | Built-in (external capacitor with a terminal to attach resistance)    Fuse is attached to the built-in resistance.                                                                                                                                                                                               |  |                                            |  |
| Structure                      |                            | Semi-cover type (Aluminum base with a plastic cover)                                                                                                                                                                                                                                                             |  |                                            |  |
| Mounting Method                |                            | Base mount (mounted on a wall)                                                                                                                                                                                                                                                                                   |  |                                            |  |
| Mass                           |                            | 260g                                                                                                                                                                                                                                                                                                             |  |                                            |  |
| Ambient Condition              |                            | Working temperature: 0°C to 50°C    Storage temperature: -20°C to 85°C<br>Working humidity/storage humidity: 95%RH or less (No condensation)<br>Avoid vibration and shock<br>No dust, metal powder, corrosive gas, flammable gas and oil mist<br>No water and oil splashing<br>No indoor use and direct sunlight |  |                                            |  |

Note: Set parameters for an actuator combined with this driver. This driver may not be used for other actuators than preset ones.

## Communication Specification

| Item                             | Specification                                |
|----------------------------------|----------------------------------------------|
| Mechatrolink Version             | MECHATROLINK-II                              |
| Transmission Rate                | 10Mbps                                       |
| Maximum Transmission Distance    | 50m                                          |
| Minimum Inter-station Distance   | 0.5m                                         |
| Transmission Medium              | Twisted pair cable with balanced type shield |
| Number Of Mobile Units Connected | Maximum 30 mobile units                      |
| Topology                         | Bus                                          |
| Communication Cycle              | 1,2,3,4,5ms                                  |
| Communication Method             | Master/slave full synchronous method         |
| Coding                           | Manchester encoding                          |
| Data Length                      | 17 bytes/32 bytes selectable                 |
| Number Of Connections *          | Maximum 30                                   |

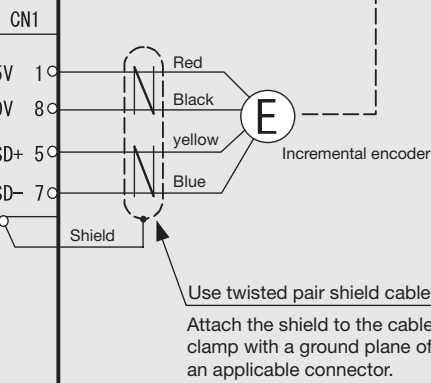
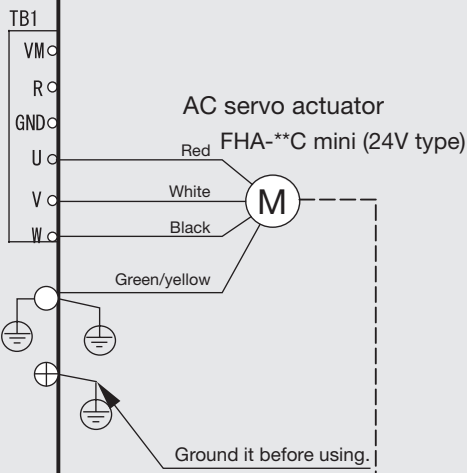
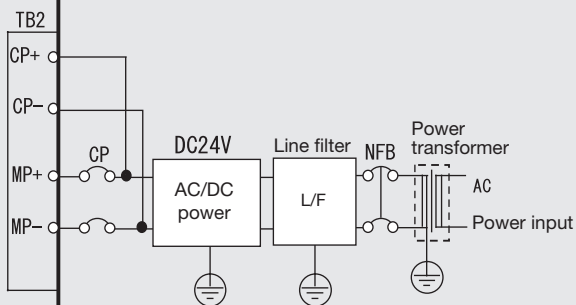
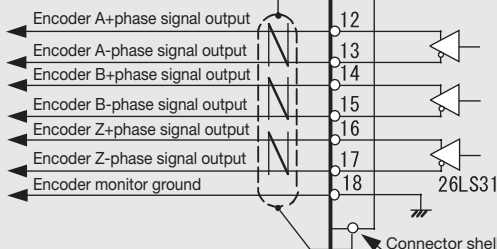
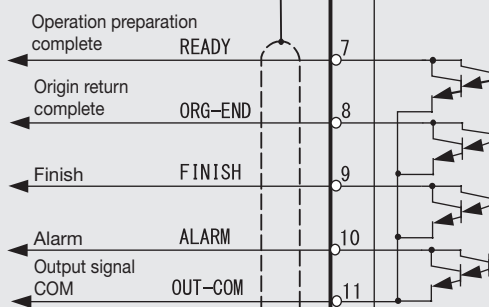
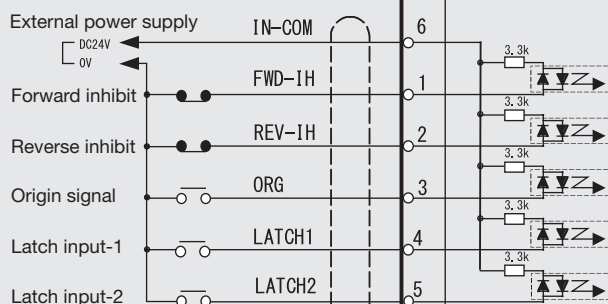
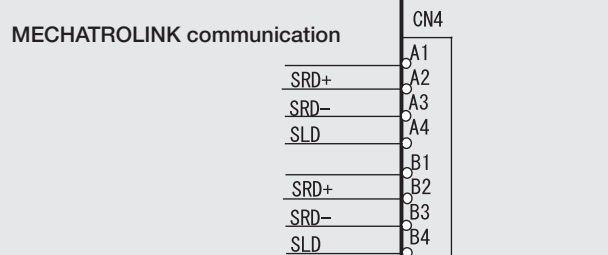
\* A repeater is required for communication over 17 units or 16 units with 30m or more total extended distance.  
The maximum number of connectable units is restricted by the setting of the communication cycle and the retry count.  
See the home page of MECHATROLINK association ([https://www.mechatrolink.org/jp/index\\_jp.html](https://www.mechatrolink.org/jp/index_jp.html)) for the detail.



## Example of Connection

HA-680ML-□-24

MECHATROLINK communication



Note: Connection varies depending on the actuator combined. Check the technical document for the detail before connecting the actuator.

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## Option

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

### Relay Cable

FHA-C mini series

Reference model: EWC-MB \* \*-A06-TN2 (for motor)  
EWC-E \* \*-M06-3M14 (for encoder)

RSF supermini series

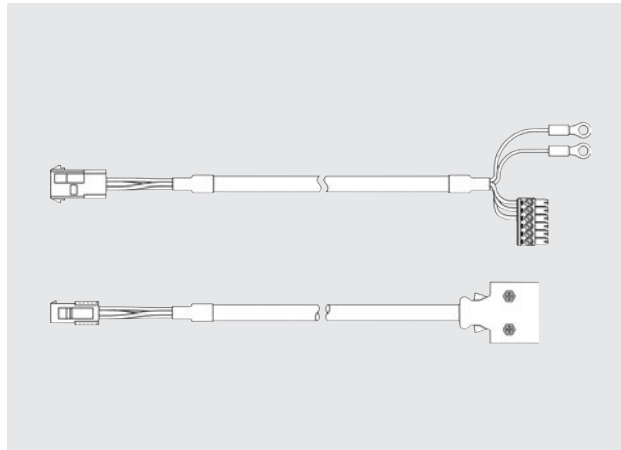
Reference model: EWA-M \* \*-JST04-TN2 (for motor)  
EWA-E \* \*-JST09-3M14 (for encoder)  
EWA-B \* \*-JST03-TMC (for brake)

RSF-B mini series

Reference model: EWC-MB \* \*-A06-TN2 (for motor)  
EWB-F \* \*-M0809-3M14 (for encoder + pole sensor)

\*\*\* in code indicates the cable length (03:3m, 05:5m, 10:10m).

Note: This cable is mandatory for the connection between motor and servo driver.

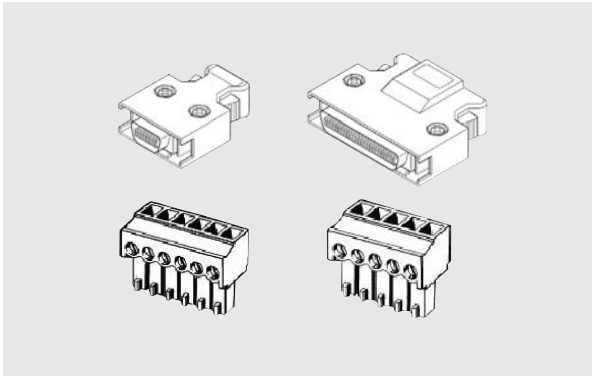


### Connector

For HA-680ML

Reference model: CNK-68ML-S1 (Four-part combination)  
CNK-68ML-S2 (Two-part combination)

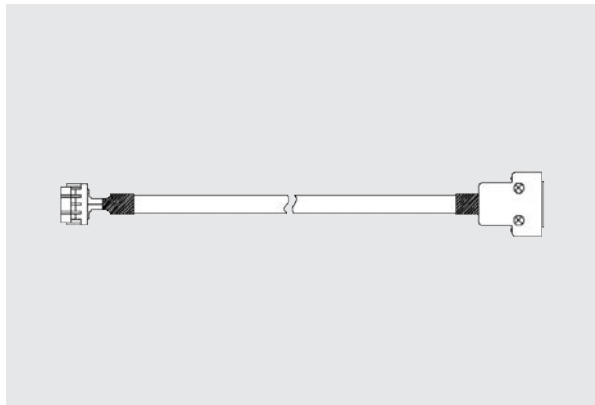
Connectors to connect the power supply, motor line, encoder line and I/O signals.



### EIA232C (RS232C) Communication Cable

Reference model: HDM-RS232C

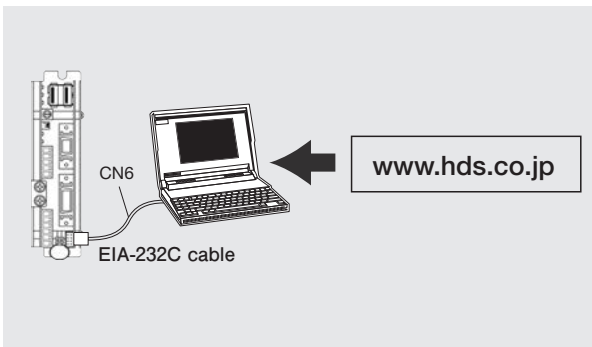
The cable is used to relay your PC and the servo driver. The standard cable length is 1.5m.



### Servo Parameter Setting Software (Free delivery)

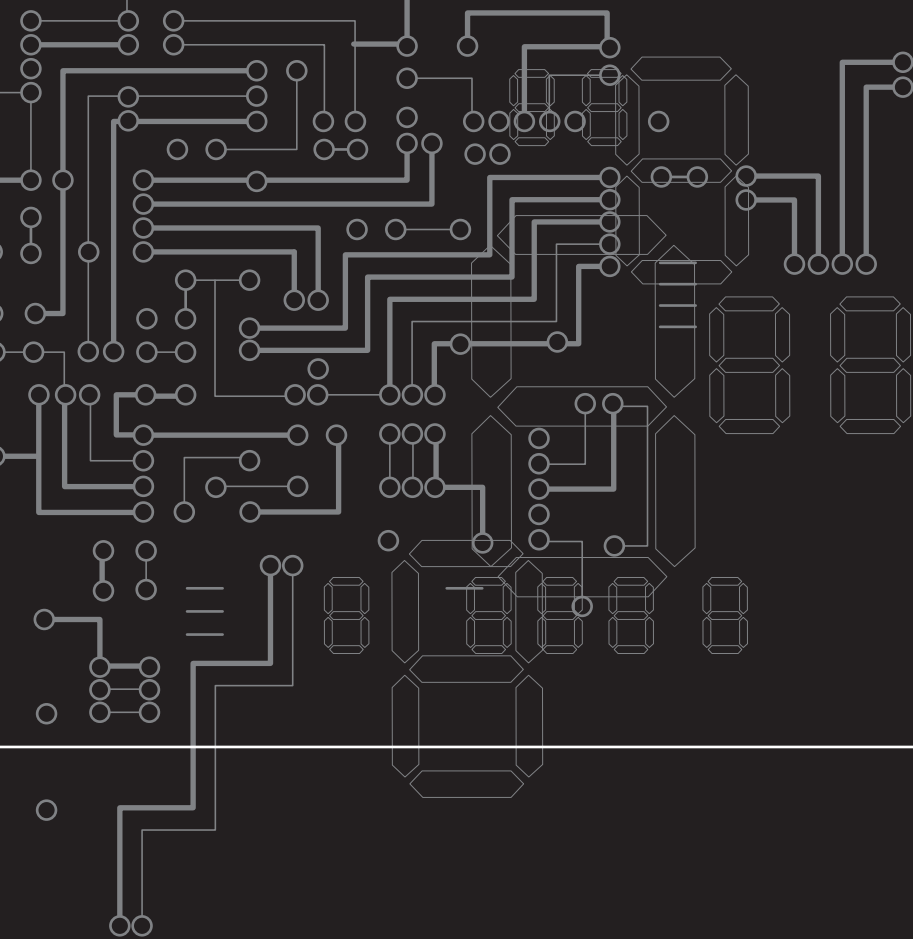
Reference model: PSF-520

The software is used to set various servo parameters from your PC to the servo driver. You can download the software from our home page (<https://www.hds.co.jp/>) EIA-232C cable is required to connect your PC to the servo driver.









# Servo Drivers

## AC Servo Drivers

|                      |     |
|----------------------|-----|
| HA-800A Series ..... | 146 |
| HA-680 Series .....  | 155 |
| HA-770 Series .....  | 160 |

## DC Servo Drivers

|                     |     |
|---------------------|-----|
| HS-360 Series ..... | 166 |
|---------------------|-----|



# HA-800A Series



## Features

### ■ Unique control theory reduces positional settling time to 1/2 (compared with HA-655 of Harmonic Drive Systems)

Unique control theory suppresses positional overshoot or undershoot, and reduces positional settling time to 1/2 of conventional item.

### ■ Auto tuning function is available.

Auto tuning function is available, which can estimate the load to set optimal servo gain.

### ■ Control mode can be switched by I/O input.

Control mode (position, speed, torque<sup>\*1</sup>) can be switched by I/O input in operation. This control mode switching function expands the usage.

### ■ Regenerative absorbing circuit and dynamic brake are embedded.

<sup>\*1</sup>: Control mode to control motor current

## Models and Symbols

HA - 800A - 3 A - 100 - □

Model: AC servo driver HA series

Series name: 800A I/O command type

Rated output current: 1: 1.5A/3: 3A/6: 6A/24: 24A

Connected encoder:

|   |                                      |
|---|--------------------------------------|
| A | 13bit absolute encoder*              |
| B | 14-wire incremental encoder          |
| C | 4-wire reduction incremental encoder |
| D | 17bit absolute encoder*              |
| E | 17bit incremental encoder            |

Input power voltage 100: AC100V/200: AC200V

Special specification:

|           |               |
|-----------|---------------|
| No symbol | Standard item |
| SP        | Special item  |

\* A backup battery is not included. (Backup battery model: HAB-ER17/33-2)

## List of Combination Actuators

HA-800A series can be combined with the following rotary actuator (100V and 200V specifications).

| Actuator series name | Model No. | Power Supply Voltage (V) | Encoder Type                           | Combined Driver                  |
|----------------------|-----------|--------------------------|----------------------------------------|----------------------------------|
|                      |           |                          |                                        | Versatile I/O command type       |
| SHA series           | 20        | 200                      | 17 bit absolute (D)<br>incremental (E) | HA-800A-3D-200*/HA-800A-3E-200   |
|                      | 25        | 100                      |                                        | HA-800A-6D-100*/HA-800A-6E-100   |
|                      |           | 200                      |                                        | HA-800A-3D-200*/HA-800A-3E-200   |
|                      | 32        | 200                      |                                        | HA-800A-6D-200*/HA-800A-6E-200   |
|                      | 40        | 200                      |                                        | HA-800A-6D-200*/HA-800A-6E-200   |
|                      | 40        | 200                      |                                        | HA-800A-24D-200*/HA-800A-24E-200 |
|                      | 58        | 200                      |                                        | HA-800A-24D-200*/HA-800A-24E-200 |
|                      | 65        | 200                      |                                        | HA-800A-24D-200*/HA-800A-24E-200 |
| FHA-C mini series    | 8         | 200                      | 4-wire reduction incremental           | HA-800A-1C-200                   |
|                      | 11        | 200                      |                                        | HA-800A-1C-200                   |
|                      | 14        | 200                      |                                        | HA-800A-1C-200                   |
|                      | 8         | 100                      |                                        | HA-800A-1C-100                   |
|                      | 11        | 100                      |                                        | HA-800A-1C-100                   |
|                      | 14        | 100                      |                                        | HA-800A-1C-100                   |
|                      | 8         | 200                      | 17 bit absolute (D)<br>incremental (E) | HA-800A-1D-200*/HA-800A-1E-200   |
|                      | 11        | 200                      |                                        | HA-800A-1D-200*/HA-800A-1E-200   |
|                      | 14        | 200                      |                                        | HA-800A-1D-200*/HA-800A-1E-200   |
|                      | 8         | 100                      |                                        | HA-800A-1D-100*/HA-800A-1E-100   |
|                      | 11        | 100                      |                                        | HA-800A-1D-100*/HA-800A-1E-100   |
|                      | 14        | 100                      |                                        | HA-800A-1D-100*/HA-800A-1E-100   |
| FHA-C series         | 17        | 200                      | 4-wire reduction incremental           | HA-800A-3C-200                   |
|                      | 25        | 200                      |                                        | HA-800A-3C-200                   |
|                      | 32        | 200                      |                                        | HA-800A-6C-200                   |
|                      | 40        | 200                      |                                        | HA-800A-6C-200                   |
|                      | 17        | 200                      | 13 bit absolute                        | HA-800A-3A-200                   |
|                      | 25        | 200                      |                                        | HA-800A-3A-200                   |
|                      | 32        | 200                      |                                        | HA-800A-6A-200                   |
|                      | 40        | 200                      |                                        | HA-800A-6A-200                   |
|                      | 17        | 100                      | 4-wire reduction incremental           | HA-800A-3C-100                   |
|                      | 25        | 100                      |                                        | HA-800A-6C-100                   |
|                      | 32        | 100                      |                                        | HA-800A-6C-100                   |
|                      | 17        | 100                      | 13 bit absolute                        | HA-800A-3A-100                   |
|                      | 25        | 100                      |                                        | HA-800A-6A-100                   |
|                      | 32        | 100                      |                                        | HA-800A-6A-100                   |
| RSF series           | 17        | 200                      | 14-wire reduction incremental          | HA-800A-3B-200                   |
| RSF/RKF series       | 20        | 200                      |                                        | HA-800A-3B-200                   |
|                      | 25        | 200                      |                                        | HA-800A-3B-200                   |
|                      | 32        | 200                      |                                        | HA-800A-6B-200                   |

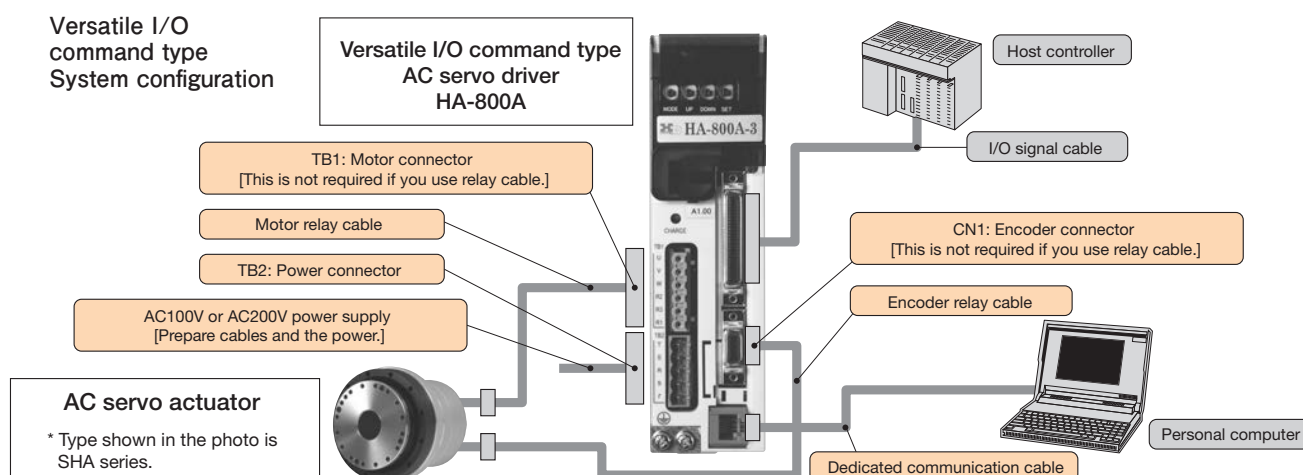
\* A backup battery is not included with the HA-800 driver. When using a driver with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## Specification

| Driver model                           |                               | HA-800A-1                                                                                                                                                                                                                                                                                                                                                                                                                                          | HA-800A-3                                                                                        | HA-800A-6               | HA-800A-24                               |
|----------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------|
| Item                                   |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         |                                          |
| Driver's Rated Current <sup>*1</sup>   |                               | 1.5A                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3.0A                                                                                             | 6.0A                    | 24.0A                                    |
| Driver's Maximum Current <sup>*1</sup> |                               | 4.0A                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9.5A                                                                                             | 19.0A                   | 55.0A                                    |
| Power Supply Voltage                   | Main Circuit <sup>*1</sup>    | AC100 to 115V (single phase) or AC200 to 230V (single phase/3 phases) +10 to −15%                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                  |                         | AC200 to 230V (3 phases) +10 to −15%     |
|                                        | Control Circuit <sup>*1</sup> | AC100 to 115V (single phase) or AC200 to 230V (single phase) +10 to −15%                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                  |                         | AC200 to 230V (single phase) +10 to −15% |
| Power Supply Frequency                 |                               | 50/60Hz                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                  |                         |                                          |
| Multi Revolution Limit (Motor Shaft)   |                               | −4096 to 4095 (FHA-C series), −32768 to 32767 (SHA series, FHA-C mini series)                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |                         |                                          |
| Ambient Condition                      |                               | Working temperature: 0°C to 50°C    Storage temperature: -20°C to 65°C    Working humidity/storage humidity: 95%RH or less (No condensation)<br>Ambience: No dust, metal powder, corrosive gas and oil mist                                                                                                                                                                                                                                        |                                                                                                  |                         |                                          |
| Structure                              |                               | Self-cooled type                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                  | Forced air-cooling type |                                          |
| Mounting Method                        |                               | Base mount (mounted on a wall)                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                  |                         |                                          |
| Control Mode                           |                               | Position control, speed control, torque control (can switch from I/O)                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                  |                         |                                          |
| Position Command Pulse                 |                               | Line driver type:    Maximum response frequency<br>1- and 2-pulse systems: 1MHz, 2-phase pulse system: 200kHz<br>Open collector type: Maximum response frequency 200kHz                                                                                                                                                                                                                                                                            |                                                                                                  |                         |                                          |
| Speed Command Voltage                  |                               | DC±10V/Max. rotation speed, input impedance approx. 68kΩ                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                  |                         |                                          |
| Torque Command Voltage                 |                               | DC±10V/Max torque, input impedance approx. 68kΩ                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         |                                          |
| Speed Control Range                    |                               | 1:1000                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                  |                         |                                          |
| Input Singal                           |                               | Emergency stop, servo-ON, reset, clear, forward inhibit, reverse inhibit, forward start, reverse start, forward selection, reverse selection,                                                                                                                                                                                                                                                                                                      |                                                                                                  |                         |                                          |
|                                        |                               | internal speed command 1, internal speed command 2, internal speed limit 1, internal speed limit 2,                                                                                                                                                                                                                                                                                                                                                |                                                                                                  |                         |                                          |
|                                        |                               | torque limit, electronic gear select, control mode, INHIBIT                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                  |                         |                                          |
| Output Singal                          |                               | Ready, servo-ON input available, alarm, position complete, speed reaching, torque reaching, speed in limiting, torque in limiting,                                                                                                                                                                                                                                                                                                                 |                                                                                                  |                         |                                          |
|                                        |                               | zero speed, control mode, DB state, low battery voltage, overload, cooling fan stop                                                                                                                                                                                                                                                                                                                                                                |                                                                                                  |                         |                                          |
|                                        |                               | Forward inhibit inputting, reverse inhibit, warning, Z-phase (OC)                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                  |                         |                                          |
| Monitor Terminal                       |                               | 3 channels, motor rpm, current command, versatile output (parameter selection)                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                  |                         |                                          |
| Communication Connector                |                               | RS-232C/RS-485: for output current monitor, for various parameter setng, for absolute encoder                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |                         |                                          |
| Operation Panel                        | Configuration                 | Display (7-segment LEDs) 5 digits (red), 4 push button switches                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                         |                                          |
|                                        | Status Display Function       | Rotational speed (r/min), torque control (%), load rate (%), input signal monitor, output signal monitor, alarm history (8 times) and others                                                                                                                                                                                                                                                                                                       |                                                                                                  |                         |                                          |
|                                        | Parameter Adjustment Function | System parameter 1, 2, 3 or 4, adjustment parameter 1 or 2                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                  |                         |                                          |
| Protection Function                    | Alarm                         | Emergency stop, overcurrent, overload, IPM error (overcurrent), regeneration resistance overheat, encoder break, encoder reception error, UVW error, system shutdown, multi revolution overflow, multi revolution data error, excessively large deviation, memory error, FPGA configuration error, FPGA setting error, MEMORY error, single revolution data error, multi revolution data error, BUSY error, overheating error, communication error |                                                                                                  |                         |                                          |
|                                        | Warning                       | Low battery voltage, overload, cooling fan stop, low main circuit power voltage, forward limit inputting, reverse limit inputting                                                                                                                                                                                                                                                                                                                  |                                                                                                  |                         |                                          |
| Regenerative Processing                |                               | External Regenerative Resistance<br>With installation terminal                                                                                                                                                                                                                                                                                                                                                                                     | Regenerative Resistance Installed<br>With External Regenerative Resistance installation terminal |                         |                                          |
| Regenerative Resistance Absorbed Power |                               | —                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3W Max                                                                                           | 8W Max                  | 90W Max                                  |
| Embedded Functions                     |                               | Status display, self diagnosis, electronic gear, jogging, etc, dynamic brake, multi revolution data backup battery (when installing an optional data backup battery)                                                                                                                                                                                                                                                                               |                                                                                                  |                         |                                          |
| Inrush Current Prevention Function     |                               | Embedded (CPU control by main circuit voltage monitoring)                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                  |                         |                                          |
| Operation Mode                         |                               | Status display (normal operation) mode, test mode, adjustment mode, system parameter mode                                                                                                                                                                                                                                                                                                                                                          |                                                                                                  |                         |                                          |
| Mass                                   |                               | 1kg                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                  | 1.2kg                   | 5.8kg                                    |

\* 1: Set in accordance with the specification of a combined actuator.

## System Configuration

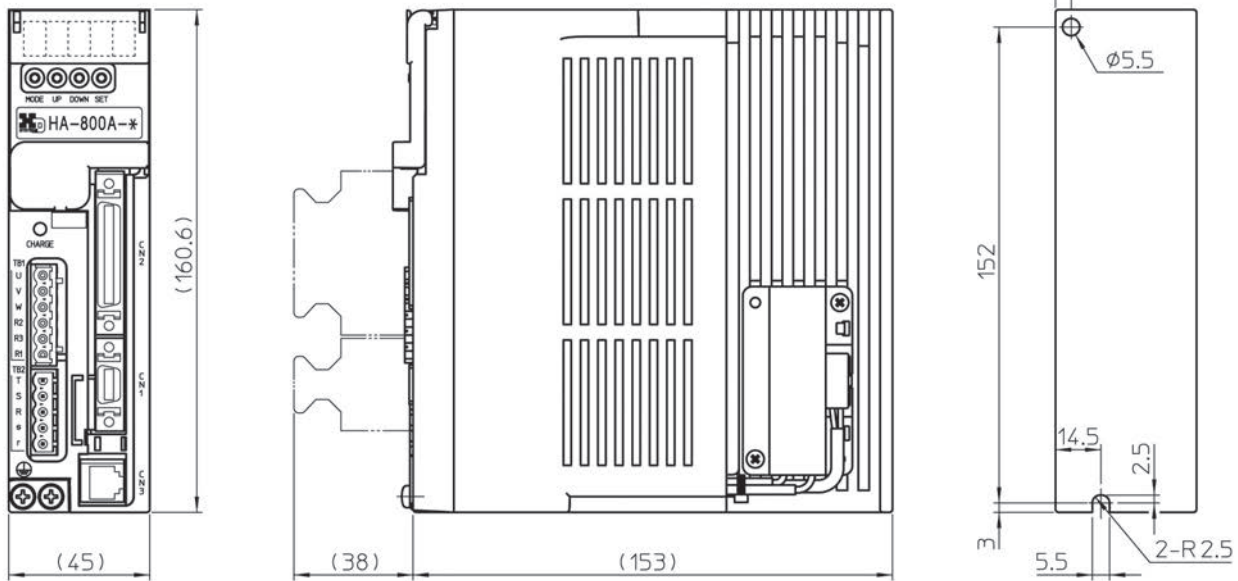


\* When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

## Dimensional Outline Drawing

### ■ HA-800A-1.3

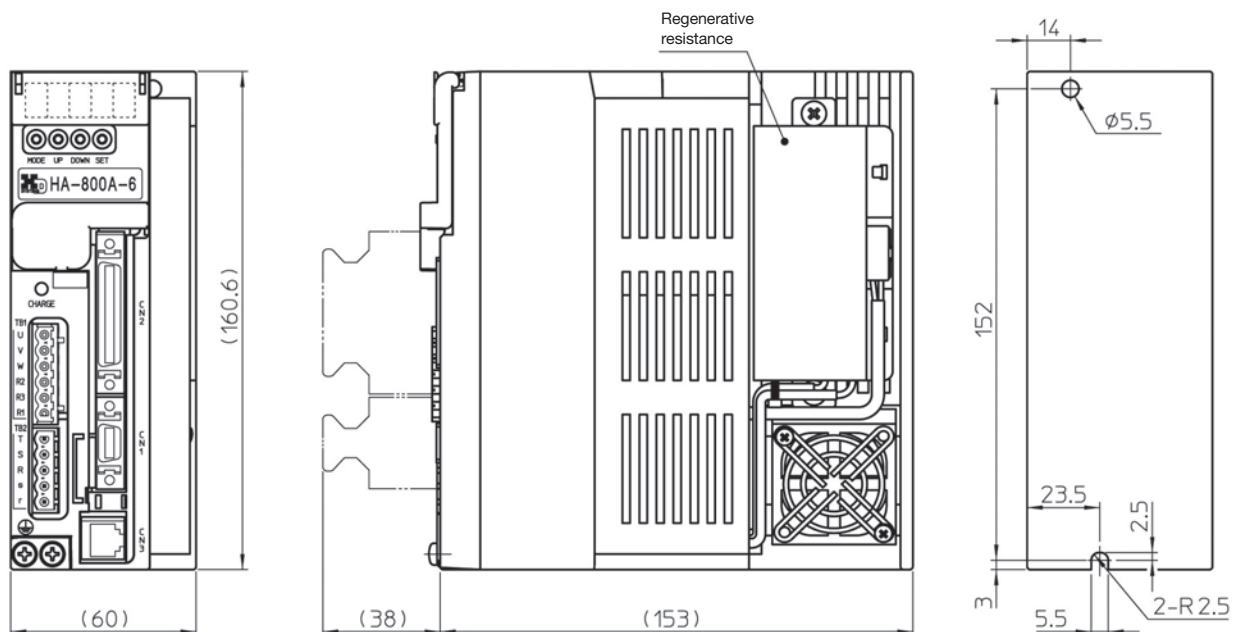
Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

### ■ HA-800A-6

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

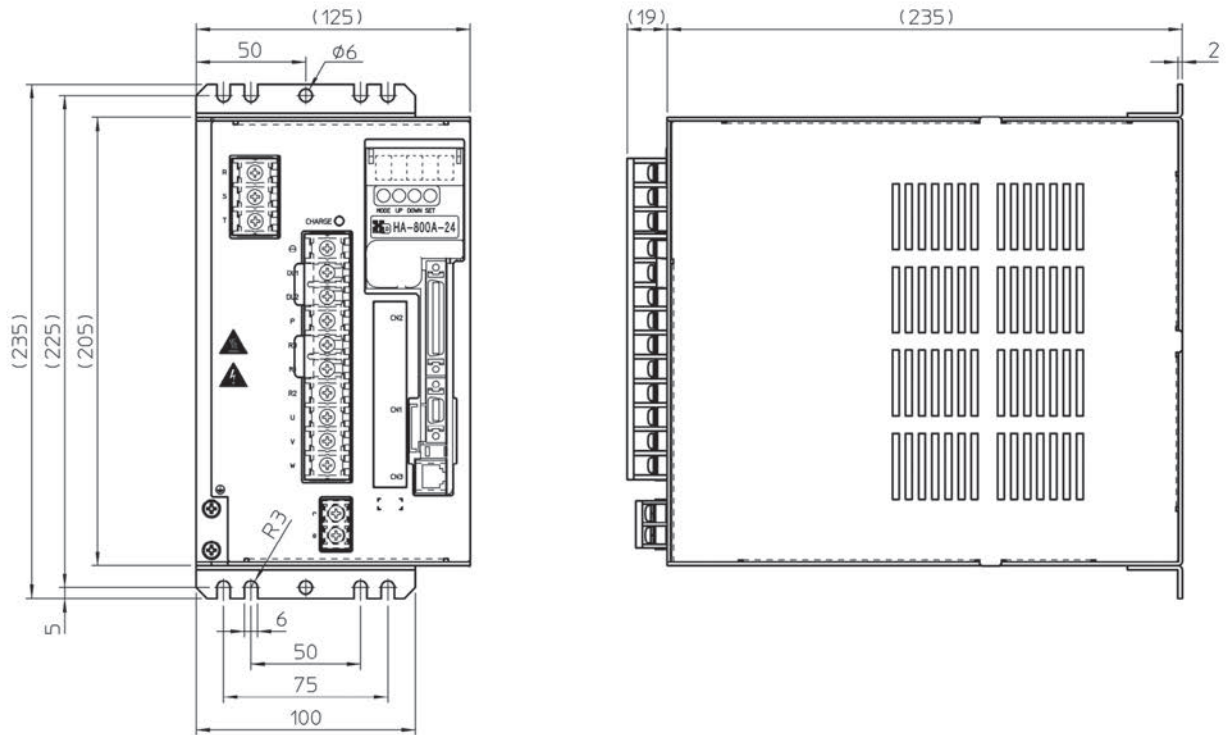
Servo Driver

Sensor System

## Dimensional Outline Drawing

### ■ HA-800A-24

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

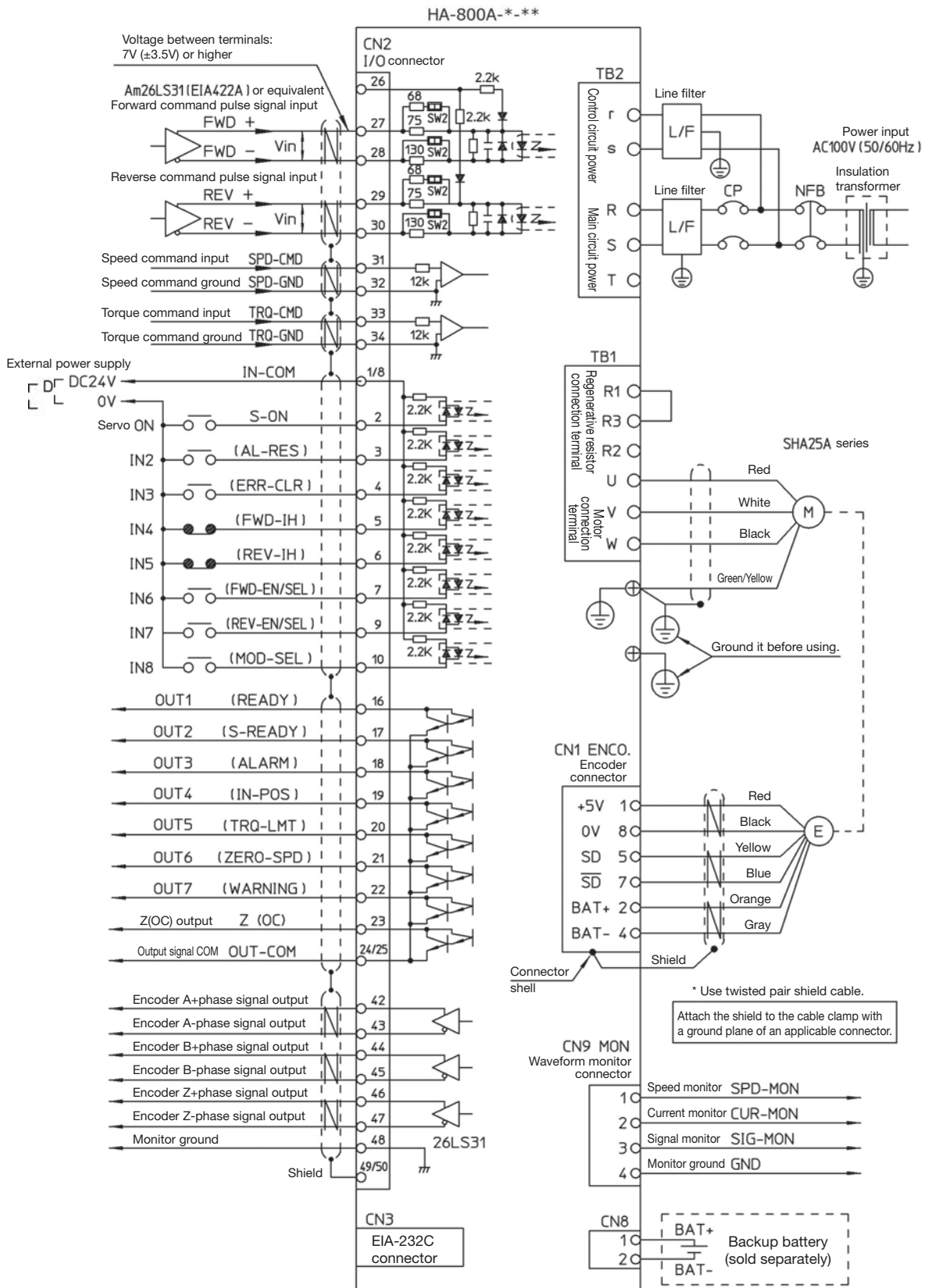
Servo Driver

Sensor System

## Example of Connection

### ◆17bit absolute encoder specification (SHA series)

This is a connection example when the position control is “line driver” in switching of the position control and speed control. The command mode is a “2-pulse system.”



A battery is not incorporated in the driver.  
Connect an optional HAB-ER17/33-2.



## Option

## Relay cable

The following table shows the actuator's combination with HA-800A driver and relay cable.

| Actuator Series Name | Model No. | Power Supply Voltage (V) | Combined Driver                 | Relay Cable (sold separately)                                                    |                                                                                    |
|----------------------|-----------|--------------------------|---------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|                      |           |                          | Versatile I/O command type      |                                                                                  |                                                                                    |
| SHA series           | 20        | 200                      | HA-800A-3D-200/HA-800A-3E-200   | Motor cable<br>EWD-MB□□-A06-TN3                                                  | Encoder cable<br>EWD-S□□-A08-3M14                                                  |
|                      | 25        | 100                      | HA-800A-6D-100/HA-800A-6E-100   |                                                                                  |                                                                                    |
|                      |           | 200                      | HA-800A-3D-200/HA-800A-3E-200   |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800A-6D-200/HA-800A-6E-200   |                                                                                  |                                                                                    |
|                      | 40        | 200                      | HA-800A-6D-200/HA-800A-6E-200   | Motor cable<br>Model No. 40:EWD-MB□□-A06-TMC<br>Model No. 58,65:EWD-MB□□-D09-TMC | Encoder cable<br>Model No. 40:EWD-S□□-A08-3M14<br>Model No. 58,65:EWD-S□□-D10-3M14 |
|                      | 40        | 200                      | HA-800A-24D-200/HA-800A-24E-200 |                                                                                  |                                                                                    |
|                      | 58        | 200                      | HA-800A-24D-200/HA-800A-24E-200 |                                                                                  |                                                                                    |
| FHA-C mini series    | 65        | 200                      | HA-800A-24D-200/HA-800A-24E-200 | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (INC)<br>EWC-E□□-M06-3M14                                            |
|                      | 8         | 200                      | HA-800A-1C-200                  |                                                                                  |                                                                                    |
|                      | 11        | 200                      | HA-800A-1C-200                  |                                                                                  |                                                                                    |
|                      | 14        | 200                      | HA-800A-1C-200                  |                                                                                  |                                                                                    |
|                      | 8         | 100                      | HA-800A-1C-100                  | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (INC)<br>EWC-E□□-M06-3M14                                            |
|                      | 11        | 100                      | HA-800A-1C-100                  |                                                                                  |                                                                                    |
|                      | 14        | 100                      | HA-800A-1C-100                  |                                                                                  |                                                                                    |
|                      | 8         | 200                      | HA-800A-1D-200/HA-800A-1E-200   | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (ABS)<br>EWD-S□□-A08-3M14                                            |
|                      | 11        | 200                      | HA-800A-1D-200/HA-800A-1E-200   |                                                                                  |                                                                                    |
|                      | 14        | 200                      | HA-800A-1D-200/HA-800A-1E-200   |                                                                                  |                                                                                    |
|                      | 8         | 100                      | HA-800A-1D-100/HA-800A-1E-100   | Motor cable<br>EWC-M□□-A06-TN3                                                   | Encoder cable (ABS)<br>EWD-S□□-A08-3M14                                            |
|                      | 11        | 100                      | HA-800A-1D-100/HA-800A-1E-100   |                                                                                  |                                                                                    |
|                      | 14        | 100                      | HA-800A-1D-100/HA-800A-1E-100   |                                                                                  |                                                                                    |
| FHA-C series         | 17        | 200                      | HA-800A-3C-200                  | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (INC)<br>EWC-E□□-B04-3M14                                            |
|                      | 25        | 200                      | HA-800A-3C-200                  |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800A-6C-200                  |                                                                                  |                                                                                    |
|                      | 40        | 200                      | HA-800A-6C-200                  |                                                                                  |                                                                                    |
|                      | 17        | 200                      | HA-800A-3A-200                  | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (ABS)<br>EWC-S□□-B08-3M14                                            |
|                      | 25        | 200                      | HA-800A-3A-200                  |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800A-6A-200                  |                                                                                  |                                                                                    |
|                      | 40        | 200                      | HA-800A-6A-200                  |                                                                                  |                                                                                    |
|                      | 17        | 100                      | HA-800A-3C-100                  | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (INC)<br>EWC-E□□-B04-3M14                                            |
|                      | 25        | 100                      | HA-800A-6C-100                  |                                                                                  |                                                                                    |
|                      | 32        | 100                      | HA-800A-6C-100                  |                                                                                  |                                                                                    |
|                      | 17        | 100                      | HA-800A-3A-100                  | Motor cable<br>EWC-MB□□-M08-TN3                                                  | Encoder cable (ABS)<br>EWC-S□□-B08-3M14                                            |
|                      | 25        | 100                      | HA-800A-6A-100                  |                                                                                  |                                                                                    |
|                      | 32        | 100                      | HA-800A-6A-100                  |                                                                                  |                                                                                    |
| RSF series           | 17        | 200                      | HA-800A-3B-200                  | Motor cable<br>EWA-M□□-A04-TN3                                                   | Encoder cable<br>EWA-E□□-A15-3M14                                                  |
| RSF/RKF series       | 20        | 200                      | HA-800A-3B-200                  |                                                                                  |                                                                                    |
|                      | 25        | 200                      | HA-800A-3B-200                  |                                                                                  |                                                                                    |
|                      | 32        | 200                      | HA-800A-6B-200                  |                                                                                  |                                                                                    |

\* (INC) indicates incremental encoder, while (ABS) indicates absolute encoder.

\* □□ in the relay cable model indicates cable length. Select from 3 types of length: 03=3m, 05=5m, and 10=10m.

## Dedicated Communication Cable

Use the dedicated communication cable to connect between HA-800 driver and personal computer.

| Model    | Length |
|----------|--------|
| EWA-RS03 | 1.6m   |

## Connector

## Connector

In HA-800A driver, connectors for CN1, CN2, motor cable, and power supply are followings.

### Connector type

#### ■ Versatile I/O command type 《HA-800A》

CNK-HA80A-S1: for CN1/for CN2/for motor cable connection/power supply connection/: 4 types

CNK-HA80A-S2: for CN2/power supply connection: 2 types

|                         | Manufacturer         | Model                   |                                               |
|-------------------------|----------------------|-------------------------|-----------------------------------------------|
| For CN1                 | Sumitomo 3M Ltd.     | Connector: 10114-3000PE | Cover: 10314-52F0-008                         |
| For CN2                 | Sumitomo 3M Ltd.     | HA-800A                 | Connector: 10150-3000PE Cover: 10350-52F0-008 |
| Motor cable connection  | PHOENIX CONTACT Inc. | FKIC2,5/6-ST-5.08       |                                               |
| Power supply connection | PHOENIX CONTACT Inc. | FKC2,5/5-ST-5.08        |                                               |

## Backup Battery

## Backup Battery

This battery is used to hold multi revolution data of an absolute encoder in case of power supply shutdown. Required when combining the driver to an actuator with an absolute encoder in order to use it with the absolute specifications.

### Model Symbol

When a new driver is purchased: HAB-ER17/33-2

When replacing the battery after extended use: HAB-ER17/33-2\_Maintenance

| Battery type    | Manufacturer              | Manufacturer's model    |
|-----------------|---------------------------|-------------------------|
| Lithium battery | Toshiba Battery Co., Ltd. | ER17330V (3.6V 1700mAh) |

### Holding time

| Holding period           | Condition                                          |
|--------------------------|----------------------------------------------------|
| 1 year continuous motion | Total backup time when ambient temperature is 25°C |

Note: When purchasing the battery itself from the manufacturer, connector wire and removal ribbon are not attached. Use the battery after the similar process completed.

## Monitor Cable

This is a signal cable to measure signals such as speed or torque by using oscilloscope.

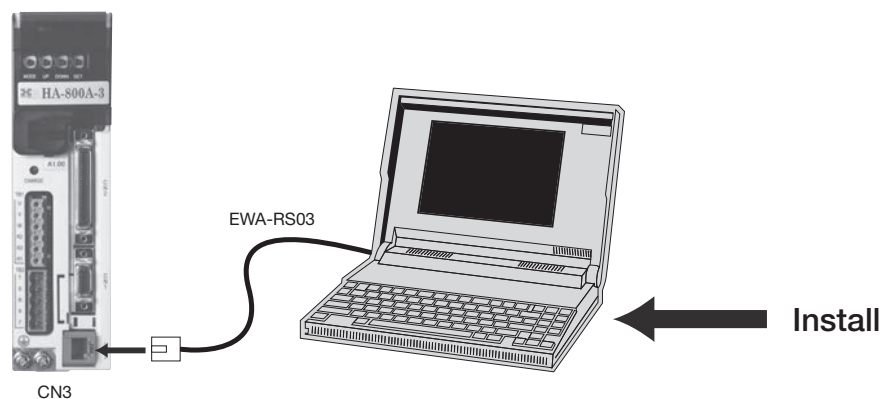
| Model          |
|----------------|
| EWA-MON01-JST4 |

### Servo Parameter Setting Software PSF-800 (Free Delivery)

The software is used to set various servo parameters from your PC to HA-800 driver. Various servo parameters can be changed by using EIA-232C cable to connect to the PC to which "CN3" of HA-800 driver and "Servo parameter setting software PSF-800" are installed. For the details of the software, request the separated "PSF-800 Instruction Manual" and refer to it. You can download the software from our home page (<https://www.hds.co.jp/>).

| Model   | Support OS         | Parts to be prepared                     |
|---------|--------------------|------------------------------------------|
| PSF-800 | Windows XP/Vista/7 | Dedicated communication cable (EWA-RS03) |

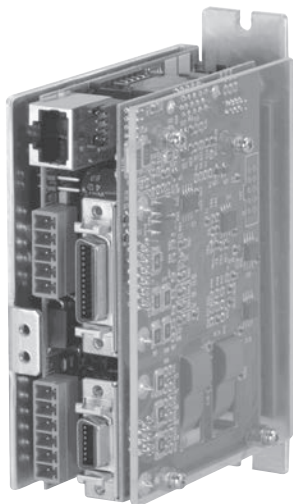
Note: Windows is a registered trademark of Microsoft.



PSF-800  
Setting software

[www.hds.co.jp](http://www.hds.co.jp)

# HA-680 Series



## Features

■ **Small and compact design**

It is about half the size of a postcard, just the size of a card case. Its ultra-light design with a weight of 230g is useful for small, space-saving devices.

■ **Substantial functions**

Position control, speed control, and torque control are provided as standard. It is compact and has substantial functions at the same time.

■ **Easy function setting**

You can easily set parameters with the special communication software “PSF-520”.

■ **Extensive operation status display**

I/O signals, rotation speed, and deviation can be monitored using dedicated communication software “PSF-520”. It is easy to diagnose defects as you can display “alarm history” up to 8 times backward.

■ **The main circuit power and the control circuit power are separated**

As the main circuit power is separate from the control circuit power, you can safely operate diagnosis in case of a trouble.

■ **Easy adjustment for trial run**

The gain can be adjusted with the special communication software “PSF-520”.

■ **Electronic gear adapted to the machine system**

The “electronic gear” function enables adjustment of the feed angle and pitch of the servo system to correspond to the reduction ratio and feed mechanism unit of the load machine.

■ **Three types of position command input**

Position command input of a 1- or 2-pulse system or a 2-phase pulse system can be specified.

## Models and Symbols

HA - 680 - 4 □ - 24

Type: AC servo driver HA series

Series: 680

Rated current:

|   |    |
|---|----|
| 4 | 4A |
| 6 | 6A |

Symbol for correspondence:

|      |                                             |
|------|---------------------------------------------|
| None | For FHA-C miniAC24V type (FHA-8C, 11C, 14C) |
| B    | For RSF supermini (RSF-3B, 5A)              |
|      | For RSF-B mini (RSF-8B, 11B, 14B)           |

Power supply:

|    |       |
|----|-------|
| 24 | DC24V |
|----|-------|

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## List of Combination Actuators

| Driver model   | HA-680-4-24                             | HA-680-6-24        | HA-680-4B-24                                                                      | HA-680-6B-24                                   |
|----------------|-----------------------------------------|--------------------|-----------------------------------------------------------------------------------|------------------------------------------------|
| Actuator model | FHA-8C-XX-E200-CE<br>FHA-11C-XX-E200-CE | FHA-14C-XX-E200-CE | RSF-3C-XX-E020-C<br>RSF-5B-XX-E050-C<br>RSF-5B-XX-E050-BC<br>RSF-8B-XX-F100-24B-C | RSF-11B-XX-F100-24B-C<br>RSF-14B-XX-F100-24B-C |

## Specification

| Item                               | Model           | HA-680-4-24                                                                                                                                                                                                                                                                                                                                                | HA-680-6-24    | HA-680-4B-24                                | HA-680-6B-24                     |
|------------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------|----------------------------------|
| Rated Output Current <sup>*2</sup> |                 | FHA-8C: 1.8A    FHA-11C: 3.9A                                                                                                                                                                                                                                                                                                                              | FHA-14C: 6.0A  | RSF-3C: 0.7A    RSF-5B: 1.2A    RSF-8B:2.0A | RSF-11B: 5.0A    RSF-14B: 4.9A   |
| Max. Output Current <sup>*3</sup>  |                 | FHA-8C: 3.4A    FHA-11C: 8.4A                                                                                                                                                                                                                                                                                                                              | FHA-14C: 16.5A | RSF-3C: 1.5A    RSF-5B: 2.3A    RSF-8B:3.9A | RSF-11B: 15.8A    RSF-14B: 17.2A |
| Power Supply Voltage               | Main Circuit    | DC24V (20 to 28V)                                                                                                                                                                                                                                                                                                                                          |                |                                             |                                  |
|                                    | Control Circuit | DC24V (20 to 28V)                                                                                                                                                                                                                                                                                                                                          |                |                                             |                                  |
| Control System                     |                 | Sine-wave PWM system, switching frequency 12.5kHz                                                                                                                                                                                                                                                                                                          |                |                                             |                                  |
| Connected Position Sensor          |                 | Incremental encoder (A-, B-, Z-phase output),                                                                                                                                                                                                                                                                                                              |                |                                             |                                  |
| Structure, Mounting Method         |                 | Semi-covered type (aluminum base with plastic cover)/base mount (wall mounting)                                                                                                                                                                                                                                                                            |                |                                             |                                  |
| Control Mode                       |                 | Position, speed, torque control                                                                                                                                                                                                                                                                                                                            |                |                                             |                                  |
| Position Control (Pulse Frequency) |                 | Pulse frequency, line driver command: 500kp/s (max), open collector command: 200kp/s (max), at max. actuator revolutions or less                                                                                                                                                                                                                           |                |                                             |                                  |
| Speed Control (Command Voltage)    |                 | DC0V to ±10V/ Max. rotation speed                                                                                                                                                                                                                                                                                                                          |                |                                             |                                  |
| Torque Control (Command Voltage)   |                 | DC0V to ±10V/ Max. torque                                                                                                                                                                                                                                                                                                                                  |                |                                             |                                  |
| Input/Output signal                |                 | DI: 5 points (insulation with photo coupler) DO: 5 points (insulation with photo coupler) Variable function assignment                                                                                                                                                                                                                                     |                |                                             |                                  |
| Encoder Monitor                    |                 | Phase A-, B-, Z- line driver output    Phase Z- open collector output (insulation with photo coupler)                                                                                                                                                                                                                                                      |                |                                             |                                  |
| Display                            |                 | LED 2 points (green:1 point red:1 point) For power on, servo-on, alarm operation state display                                                                                                                                                                                                                                                             |                |                                             |                                  |
| Protection Function                |                 | Overload, Max. deviation, Encoder break detection, encoder reception error, UVW error, regenerative error, operating temperature error, system error, overcurrent, load short circuit, memory error, overspeed                                                                                                                                             |                |                                             |                                  |
| Regenerative Absorption Circuit    |                 | Incorporated (with an external capacitor/resistor installation terminal). The built-in resistance has a fuse.                                                                                                                                                                                                                                              |                |                                             |                                  |
| Communication Functions            |                 | By means of communication between PC and EIA-232C (RS-232C), changing of parameters, current wave monitor, and alarm monitor are available.                                                                                                                                                                                                                |                |                                             |                                  |
| Mass                               |                 | 230g                                                                                                                                                                                                                                                                                                                                                       |                |                                             |                                  |
| Safety Standard                    |                 | CE Marking                                                                                                                                                                                                                                                                                                                                                 |                |                                             |                                  |
| Ambient Condition                  |                 | Operating temperature: 0 to 50°C    Storage temperature: -20 to 85°C<br>Operating/Storage humidity: 95% RH or less (Do not expose to condensation)<br>Avoid vibration or shock.<br>Ambience: Do not expose to metal powder, dust, oil mist, corrosive gas or flammable gas.<br>No contamination by water or oil<br>To be used indoors. No direct sunlight. |                |                                             |                                  |

\*1: Parameter setting of this driver is performed depending on the actuator combined with it. It cannot be used for any other actuator.

\*2: The value of the permissible continuous current is limited according to the combination of the actuator.

\*3: The value of the instantaneous maximum current is limited according to the combination of the actuator.

## Names and Functions of Components

### CN4: CAN connector

- Connector for CAN communication.  
Note: Currently not available. For details, contact one of our branch offices.

### TB2: Power supply connection terminals

- The terminals for power supply. These are divided into terminals for the control circuit power supply and terminals for the main circuit power supply.

### Ground connection terminal

- This terminal is for grounding. Connect the ground (earth) line here to prevent electric shock.

### TB1: Actuator/external regenerative resistance connection terminal

- The lead line of the actuator and an external regenerative resistance are connected here.

### CN5: Not available (side)

- This connector is for manufacture only. The customer should never use it.

### CN3: EIA-232C serial port connector

- The connector for connection with a PC. This is used for monitoring the output current and setting parameters. Connection with a PC requires dedicated communication cable "HDM-RS232C." Parameter setting requires dedicated communication software PSF-520.

### LED display unit

- Displays the operation state of the HA-680 driver with the green and red LEDs.

### CN2: Control I/O connector

- This connector is for receiving control signals from the host controller.

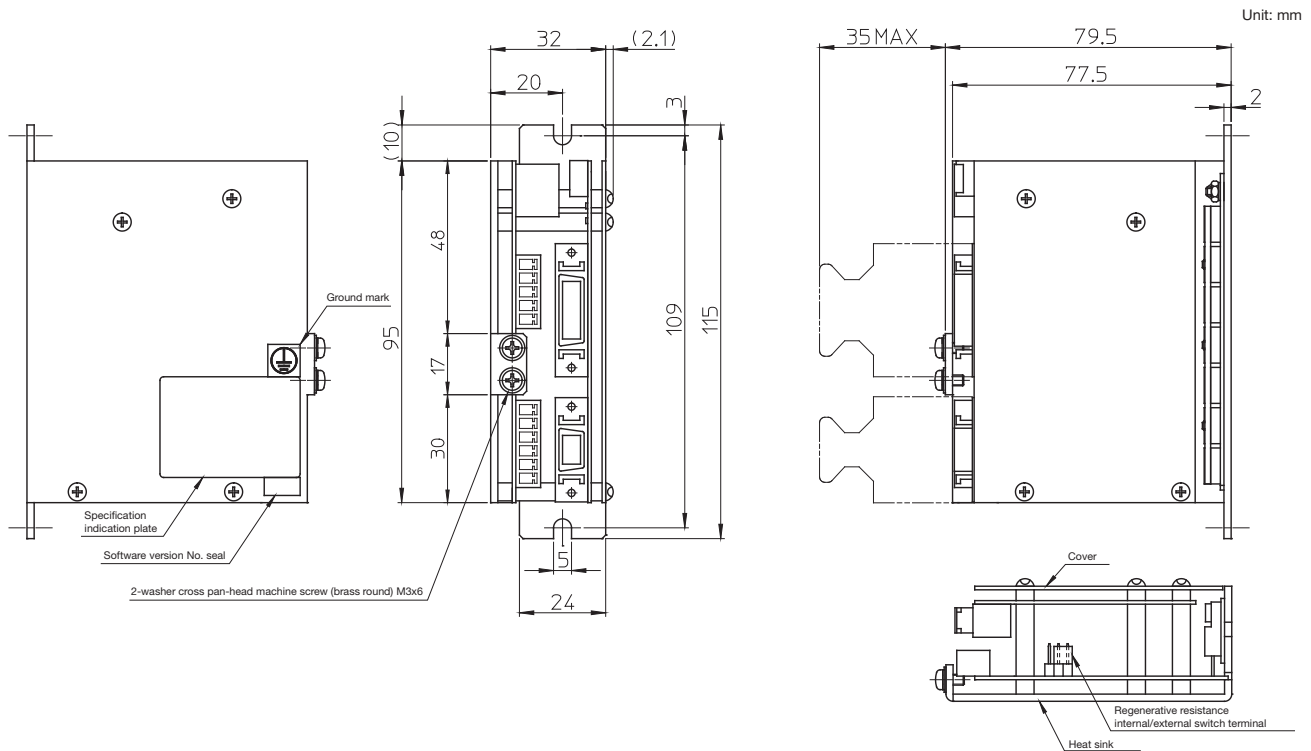
### CN1: Encoder connector

- The position detection encoder cable of the actuator is connected here.

### Regenerative resistance switch jumper (side)

- Switches between the internal regenerative resistance and the external regenerative resistance. Installing the jumper between the center pin and left pin selects the internal regenerative resistance, and installing the jumper between the center pin and right pin selects the external regenerative resistance.

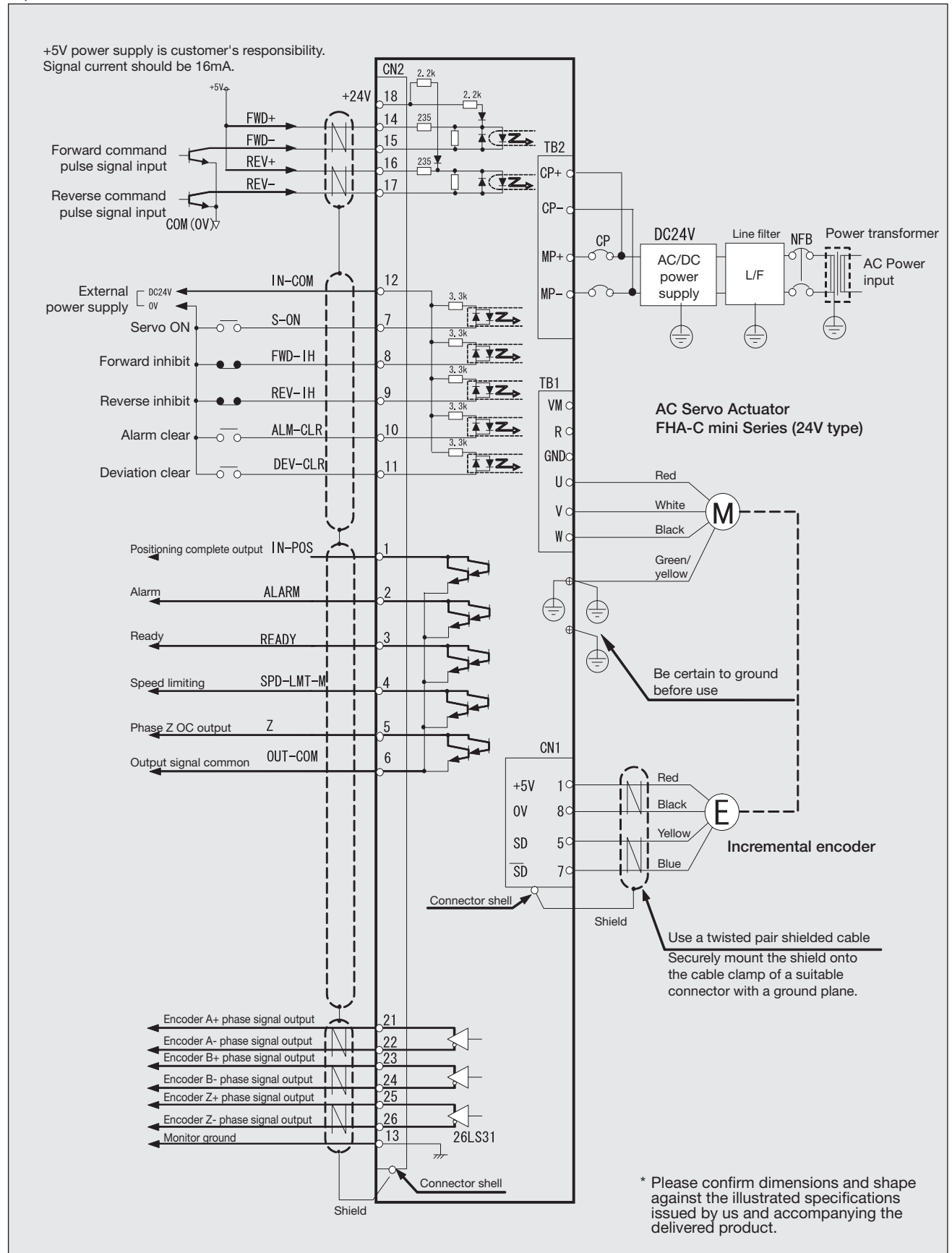
## External Dimensions



\*Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

## Connection Examples

This is a connection example when the actuator is an FHA-C mini series actuator and is for "position control" and "open collector." The command format is a "2-pulse system" and the allocation of input and output functions can be changed. (The following example has zero function allocation.) See "HA-680 Series Technical Data" for speed control, torque control and connection examples of RSF supermini series.



## Option

### Relay Cable

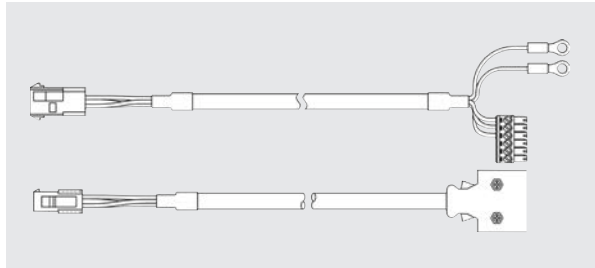
RSF supermini

Reference model: EWA-M \*\* -JST04-TN2 (For motor)  
EWA-E \*\* -JST09-3M14 (For incremental encoder)

FHA-C mini series

Reference model: EWC-MB \*\* -A06-TN2 (For motor)  
EWC-E \*\* -M06-3M14 (For incremental encoder)

The cable for connecting the actuator to the servo driver. Standard cable lengths are 3, 5 and 10m.



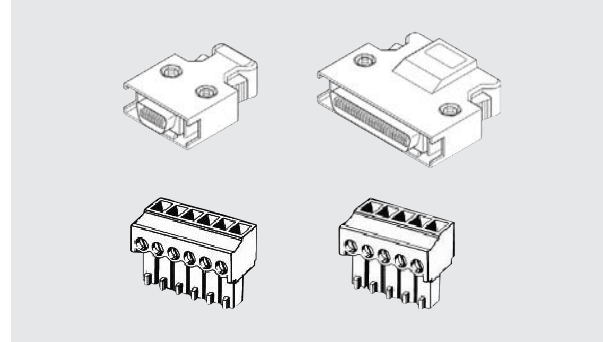
### Connector

Reference model:

CNK-HA68-S1 (Total 4 connectors to a set)

CNK-HA68-S2 (For power supply and input and output signal lines)

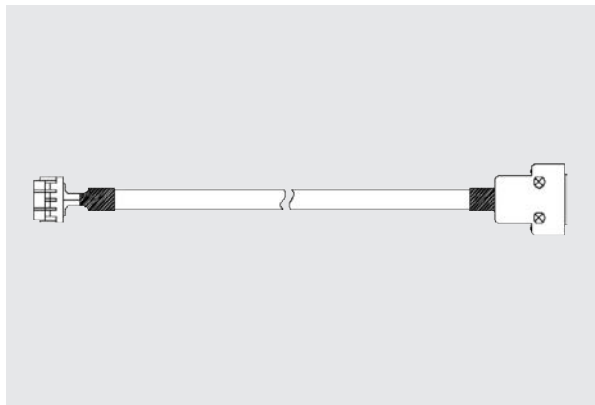
The connectors to connect the power supply, motor, encoder and input and output signal cables.



### EIA232C (RS232C) Communication Cable

Reference model: HDM-RS232C

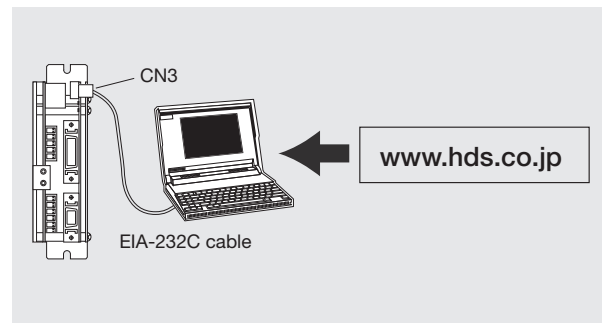
The cable to connect the personal computer and servo driver. Standard cable length is 1.5m.



### Software for Servo Parameter Setting (Free delivery)

Reference model: PSF-520

The software to set servo parameters in the servo driver from a personal computer. The software as updated can be downloaded from the homepage of Harmonic Drive Systems (<https://www.hds.co.jp/>). An EIA-232C cable is required for connection between your personal computer and the servo driver.



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System



# HA-770 Series



The HA-770 driver is the dedicated driver to drive the direct drive motor for ultrahigh resolution and ultra precision positioning. The HA-770 driver provides versatile features that can maximize the performance of KDU series.

## Features

■ **Shaft control function by command communication system, point table system, and pulse input system**

This driver features the precise positioning function by the servo control system such as command communication system, point table system, and pulse input system.

■ **Easy precise index of ultrahigh resolution**

Harmonic Drive System’s unique control theory provides high precision index of ultrahigh resolution encoder with 11.84 million pulses.

■ **High precision positioning by the control technology and the motor with high-precision structure**

The stopping stability pursuing stopping stability and the structure part pursuing high precision of motor provides the high precision positioning.

■ **Auto tuning function is available.**

Auto tuning function is available, which can estimate the load to set optimal servo gain.

## Models and Symbols

HA - 770 - 2 - □

Type: AC servo driver HA series

Series: 770 (for position control)

Rated current: 2: 1.8A

No symbol: Standard item  
SP: Special item

## Combined Direct Drive Motor

|                          |                              |
|--------------------------|------------------------------|
| Driver model             | HA-770-2                     |
| Direct drive motor model | KDU-13SB-E10<br>KDU-13WB-E10 |

## Specification

| Item                       |                         | Model | Specification                                                                                                                                                                                                                                                                                          |
|----------------------------|-------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Driver's Rated Current     |                         |       | 1.8Arms                                                                                                                                                                                                                                                                                                |
| Driver's Maximum Current   |                         |       | 5.4Arms                                                                                                                                                                                                                                                                                                |
| Power Supply Input Voltage |                         |       | Single phase AC100 to 115V+10% to -15% 50/60Hz Single phase AC200 to 230V+10% to -15% 50/60Hz                                                                                                                                                                                                          |
| Ambient Conditions         |                         |       | Operating temperature: 0 to 50°C Storage temperature: -20 to 85°C<br>Operating/Storage humidity: 90% RH or less (Do not expose to condensation)<br>Ambience: Do not expose to metal powder, dust, oil mist or corrosive gas                                                                            |
| Structure                  |                         |       | Self-cooled type                                                                                                                                                                                                                                                                                       |
| Installation Method        |                         |       | Base mount (wall installation)                                                                                                                                                                                                                                                                         |
| Positioning Command Method |                         |       | Pulse-train input command, command communication command, point table program command (32 points)                                                                                                                                                                                                      |
| Position Command Pulse     |                         |       | Line driver type: Maximum response frequency<br>1- and 2-pulse systems: 1MHz, 2-phase pulse system: 200kHz                                                                                                                                                                                             |
| Motion Command Selection   |                         |       | Motion by I/O port or by communication command (parameter selection)                                                                                                                                                                                                                                   |
| I/O Port                   | Number of Signal        |       | Input: 15 pin, output: 8 pin                                                                                                                                                                                                                                                                           |
|                            | Function Selection      |       | Pin allocation system by parameter                                                                                                                                                                                                                                                                     |
|                            | Input Singal            |       | Servo-ON, forward inhibit, reverse inhibit, alarm reset, deviation clear, origin start, origin detection, emergency stop, start, hold, operation stop, forward JOG, reverse JOG, teaching, point No. 0 to 4, input branch, pulse scaling selection, positioning command disabled                       |
|                            | Output Singal           |       | Servo ready, position complete, alarm, alarm code, program running, complete, torque limit, forward inhibiting, reverse inhibiting, origin completed, position correction enabled, origin position output, present point output, point completion output, origin point output, pulse scaling selecting |
| Command Communication      | Interface               |       | RS-422, RS-485                                                                                                                                                                                                                                                                                         |
|                            | Communication Rate      |       | 9,600bps, 19,200bps, 38,400bps                                                                                                                                                                                                                                                                         |
|                            | Operational Function    |       | Servo-ON, positioning command operation, speed command operation, JOG operation, point table operation, parameter change, point table edit, origin detection, status monitoring, auto tuning                                                                                                           |
| Operation Panel            | Configuration           |       | Display (7-segment LEDs) 5 digits (red), 4 push button switches                                                                                                                                                                                                                                        |
|                            | Status Display Function |       | Parameter confirmation, present position, positioning command, positioning deviation, present speed, command speed, torque command, relative command position, torque peak, point table status, Distance between ORG and Z pulses, effective load rate, present torque, servo status, I/O status       |
|                            | Operational Function    |       | Parameter change, JOG operation, point table edit                                                                                                                                                                                                                                                      |
| Monitor Terminal           |                         |       | 2 channels, rotational speed, command torque, positioning deviation, in position (parameter selection)<br>Output resolution: 8bit, output range: 0V to 4V                                                                                                                                              |
| Control Method             |                         |       | Sine wave PWM method: Switching frequency 25kHz                                                                                                                                                                                                                                                        |
| Speed Setting Unit         |                         |       | 1 or 0.1r/min                                                                                                                                                                                                                                                                                          |
| Embedded Functions         |                         |       | JOG operation, auto tuning, position correction function                                                                                                                                                                                                                                               |
| Origin Detection Method    |                         |       | Z signal, origin LS+Z signal (parameter selection)                                                                                                                                                                                                                                                     |
| Dynamic Brake              |                         |       | Embedded                                                                                                                                                                                                                                                                                               |
| Mass                       |                         |       | 0.8kg                                                                                                                                                                                                                                                                                                  |

## Note:

The memory of the HA-770 driver is stored with position correction data for the KDU series.

In "SER.No," on the nameplate of KDU series, same number as HA-770 driver is described. If combined with another drive motor, positional accuracy cannot be guaranteed.

## Names and Functions of Components

### LED display

- Displays information such as the operation state of driver, setting values of each functions, and alarms.

### CHARGE Display

- Illuminates in power-on state. When illuminating after turning the power off, the driver is in the high-pressure charging state. Do not touch the power connector.

### Terminal for power supply [R, T] (TB1)

- The terminal for power supply

### Terminal for motor cable connection: U,V,W (TB2)

- The cable of the motor is connected.

### Ground connection terminal

- The terminal for ground connection. To prevent an electric shock, make sure to connect this.

### Push-button Switch

- Using 4 types of switch, display switch, each function setting, and JOG operation are available.

### Waveform Monitor Connector

- Waveform monitor for speed or current and state signal monitor can be used.

### Communication Connector

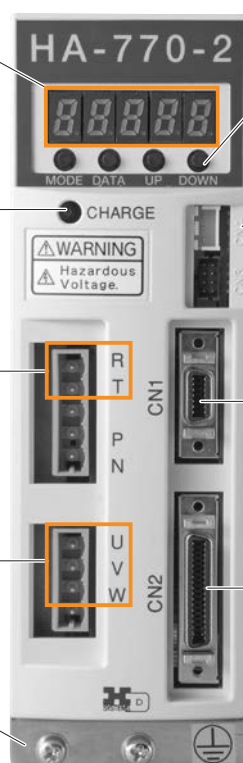
- The communication connector for RS485/RS422.

### Encoder connector (CN1)

- The connector for cable connection with the encoder of the motor.

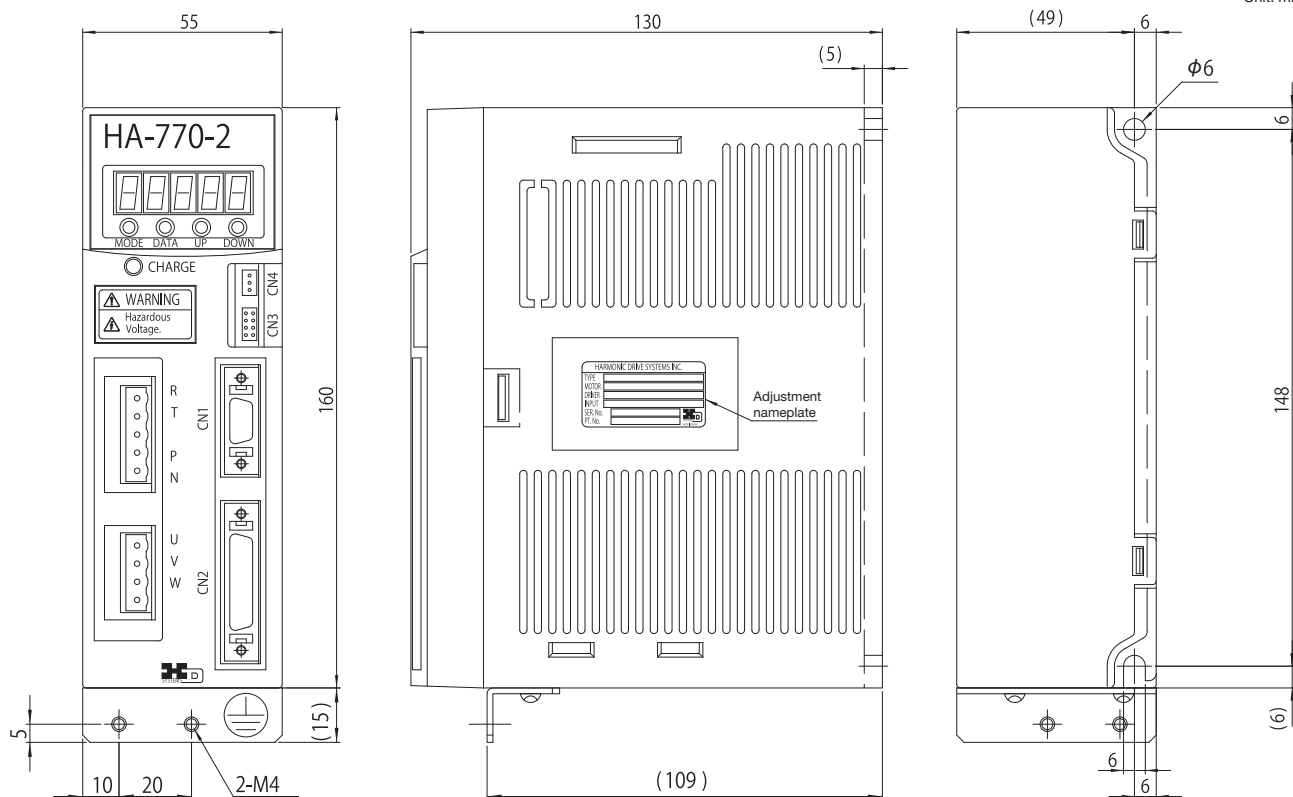
### I/O signal connector (CN2)

- The connector for receiving control signals or I/O signals.



## External Dimensions

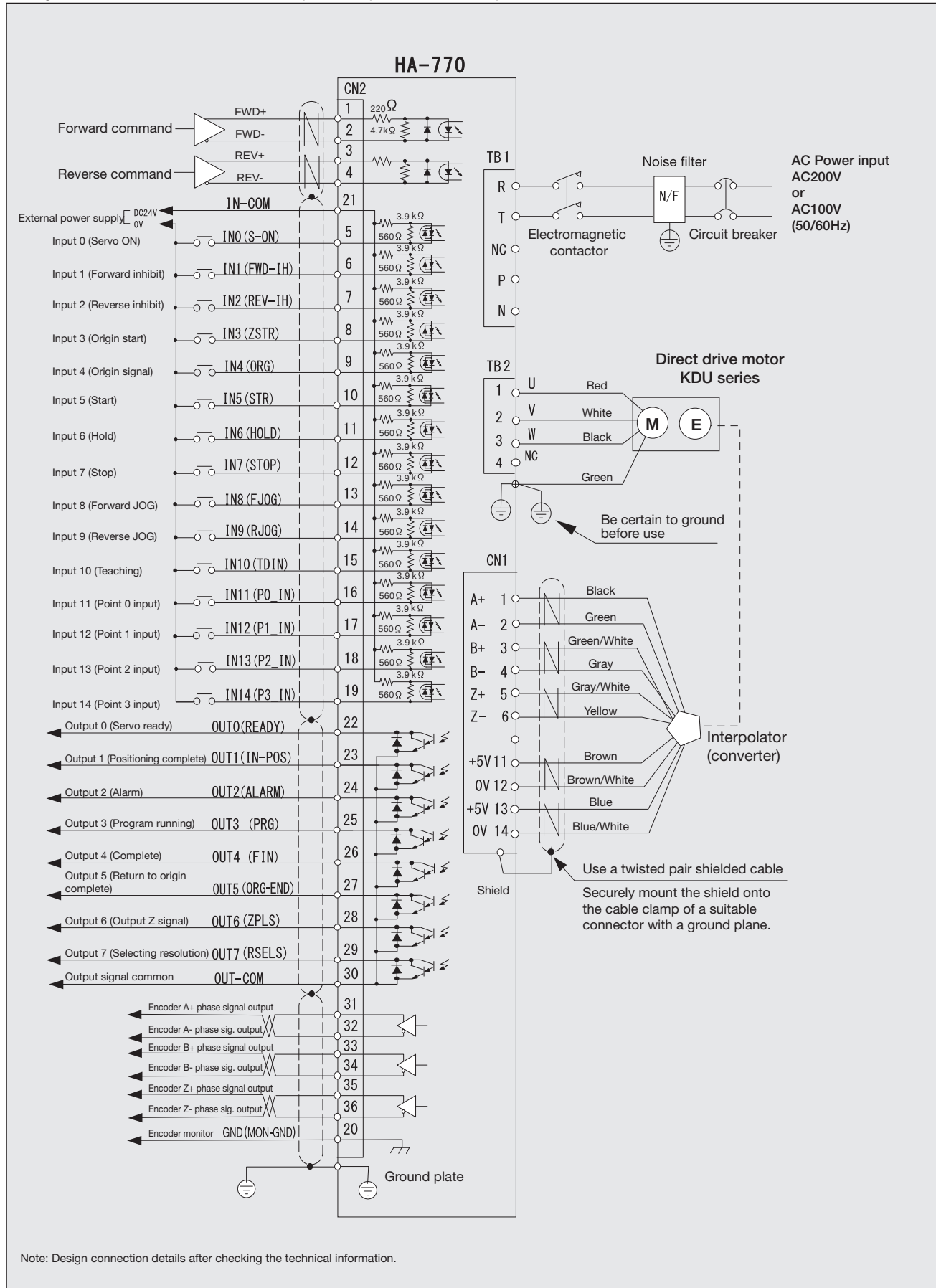
Unit: mm



\*Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

## Connection Examples

The figure below shows a connection example in the pulse command input.



Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

## Options

### Relay Cable for Encoder

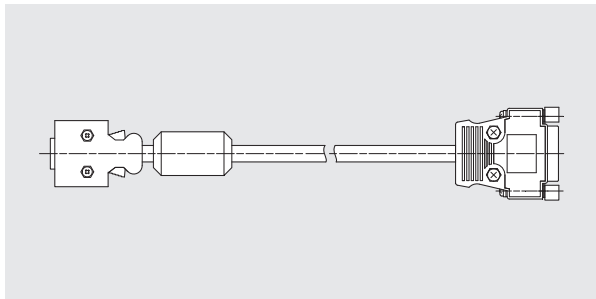
Order Code Example: EWA-E \*\* -OM15-3M14

The cable to connect interpolator of encoder and servo driver.

"\*\*" in code indicates the cable length (015: 1.5m, 035: 3.5m)

Length of motor side cable is about 1.5m. So, If combined with 015, total length is about 3m, and if combine with 035, total length is about 5m.

Note: This cable is mandatory for the connection between encoder and servo driver.



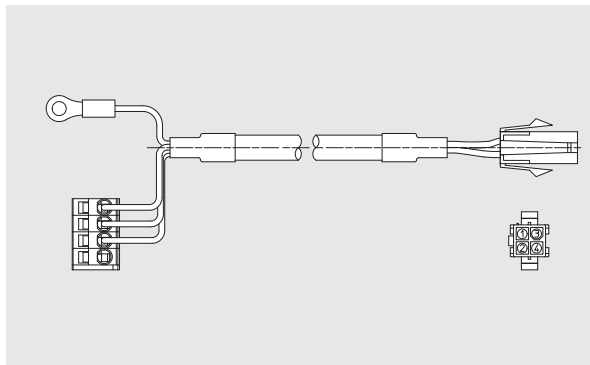
### Relay Cable for Motor

Order Code Example: EWA-M \*\* -A04-WG04-01

The cable to connect the motor and servo driver.

"\*\*" in code indicates the cable length (03: 3m, 05: 5m).

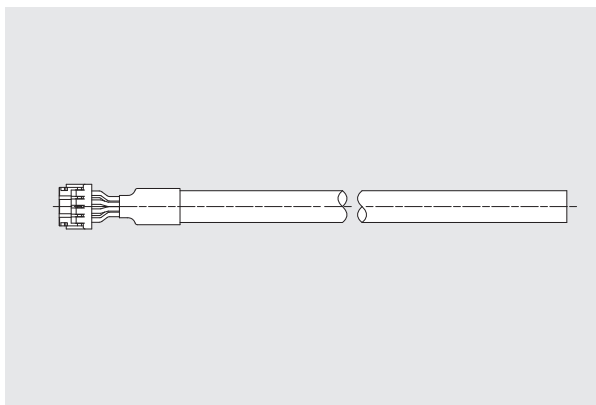
Note: This cable is mandatory for the connection between motor and servo driver.



### RS-422/485 Communication Cable

Order Code Example: HDM-RS422-HA770

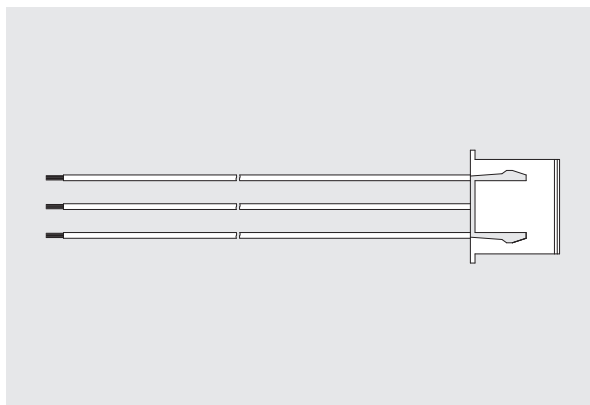
The cable to connect USB RS485/RS422 converter module and servo driver. Cable length is 1.5m.



### Cable for Analog Monitor

Order Code Example: EWA-MON01-770

The signal cable to measure signals such as speed or torque by using oscilloscope.



### Connector Set

Order Code Example: CNK-HA77-S1

The set of power supply connector and I/O signal connector.

|                                    |                                         |
|------------------------------------|-----------------------------------------|
| I/O signal connector               | Connector model: 10136-3000PE (3M)      |
|                                    | Cover model: 10336-52F0-008 (3M)        |
| Power supply connector             | Connector model: 231-305/026-000 (WAGO) |
| Wire connection/disconnection tool | Lever model: 231-131 (WAGO)             |

Chart for Standard Combinations

| System Model Name | Max. Torque | Motor Model Name | Servo Driver Model Name | Relay cable model name for incremental encoder | Total cable length (except connector)    |
|-------------------|-------------|------------------|-------------------------|------------------------------------------------|------------------------------------------|
|                   |             |                  |                         | Relay cable model name for motor               |                                          |
| KDU-13SB-D3-□     | 7.0N·m      | KDU-13SB-E10     | HA-770-2                | EWA-E015-OM15-3M14                             | Encoder cable : 3m<br>Motor cable : 3.3m |
|                   |             |                  |                         | EWA-M03-A04-WG04-01                            |                                          |
|                   |             |                  |                         | EWA-E035-OM15-3M14                             | Encoder cable : 5m<br>Motor cable : 5.3m |
|                   |             |                  |                         | EWA-M05-A04-WG04-01                            |                                          |
| KDU-13WB-D3-□     | 15.0N·m     | KDU-13WB-E10     |                         | EWA-E015-OM15-3M14                             | Encoder cable : 3m<br>Motor cable : 3.3m |
|                   |             |                  |                         | EWA-M03-A04-WG04-01                            |                                          |
|                   |             |                  |                         | EWA-E035-OM15-3M14                             | Encoder cable : 5m<br>Motor cable : 5.3m |
|                   |             |                  |                         | EWA-M05-A04-WG04-01                            |                                          |

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

# HS-360 Series



## Features

### ■ Easy function setting

Individual parameters for actuators to be connected are already set during pre-shipment inspection at the factory. Parameter setting by the customer is therefore not required.

The parameters to optimally suit the actuator to your host system and controllability can be set easily while observing a 7-segment LED display in the parameter mode.

### ■ Versatile displays of operation states

The operational status is always displayed in the “status display” and “numeric monitor” modes to monitor the status of the desired items. The “Status of commands,” “status of feedback” and “status of deviation counter” that are especially important for a servo system can also be monitored. “Alarm history” displays up to eight previously triggered alarm events and is useful in trouble diagnosis.

### ■ Easy adjustment for trial run

Jogging can be performed by keying the buttons on the panel in the “JOG run mode” for easy adjustment.

### ■ Electronic gear suiting machine systems

The “electronic gear” function enables adjustment of the feed angle and pitch of the servo system to the reduction ratio and feed mechanism unit of the load machine.

### ■ Three types of position command input

Position command input of a 1- or 2-pulse system or a 2-phase pulse system can be specified.

## Models and Symbols

HS - 360 - 1 A

Type: DC servo driver HS series

Series: 360

Rated current:

|   |              |
|---|--------------|
| 1 | 1.0A or 1.4A |
| 3 | 3.2A         |

Symbol for max. current:

|   |      |
|---|------|
| A | 1.0A |
| B | 2.6A |
| C | 3.7A |
| D | 4.2A |

## Combined Actuators

Five models are available in the HS-360 series in accordance with the driver rated output current and actuator maximum momentary current. The models of combined actuators are listed below.

(Serial connection of a DC reactor 15mH is required between the driver and actuator when using the HS-360-1A.

A DC reactor 15mH will be supplied as an accessory. See the technical information for dimensions and other specifications.)

### RH Series

| Driver model   | HS-360-1A                              | HS-360-1B                | HS-360-1C                                                | HS-360-1D                                                | HS-360-3                       |
|----------------|----------------------------------------|--------------------------|----------------------------------------------------------|----------------------------------------------------------|--------------------------------|
| Actuator model | RH-5A-8802<br>RH-5A-5502<br>RH-5A-4402 | RH-8D-6006<br>RH-8D-3006 | RH-11D-6001<br>RH-11D-3001<br>RHS-14-6003<br>RHS-14-3003 | RH-14D-6002<br>RH-14D-3002<br>RHS-17-6006<br>RHS-17-3006 | RHS-20<br>RHS-25 <sup>*2</sup> |

\* 1: The encoder resolution of a combined actuator will be the line driver specification of 1000 pulses/revolution.

The encoder resolution for RH-5A and the linear series will be the line driver specification of 360 or 500 pulses/revolution.

\* 2: RHS-25 cannot be combined with some models. Consult Harmonic Drive Systems beforehand when using RHS-25.

### Linear Series

| Driver model   | HS-360-1A     |              |                 |                 |
|----------------|---------------|--------------|-----------------|-----------------|
| Actuator model | LA-30B-10-F-L | LA-32-30-F-L | LAH-46-1002-F-L | LAH-46-3002-F-L |

## Specification

| Item                                    | Model | HS-360-1A                                                                                                                                                                                                                                                                                   | HS-360-1B | HS-360-1C | HS-360-1D | HS-360-3 |
|-----------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|----------|
| Rated Output Curr. (rms) <sup>*2</sup>  |       | 1.0A                                                                                                                                                                                                                                                                                        | 1.4A      |           |           | 3.2A     |
| Max. Output Current (rms) <sup>*3</sup> |       | 1.0A                                                                                                                                                                                                                                                                                        | 2.6A      | 3.7A      | 4.2A      | 10A      |
| Power Supply                            |       | AC100V (single phase) $\pm 10\%$ 50/60Hz                                                                                                                                                                                                                                                    |           |           |           |          |
| Control System                          |       | PWM control system (control element IPM), switching frequency 12.5kHz                                                                                                                                                                                                                       |           |           |           |          |
| Connected Position Sensor               |       | Incremental encoder (A-, B-, Z-phase output), line driver system                                                                                                                                                                                                                            |           |           |           |          |
| Structure, Mounting Method              |       | Totally enclosed self-cooled type, base mount (wall mounting)                                                                                                                                                                                                                               |           |           |           |          |
| Control Mode                            |       | Position control                                                                                                                                                                                                                                                                            |           |           |           |          |
| Maximum Input Pulse Frequency           |       | Line driver command: 400kp/s (max)<br>Open collector command: 200kp/s (max)                                                                                                                                                                                                                 |           |           |           |          |
| Position Signal Output                  |       | A-, B-, Z-phase voltage output (+5V), Z-phase photo coupler                                                                                                                                                                                                                                 |           |           |           |          |
| Monitor                                 |       | Operation status, alarm history, I/O, parameters and other items can be monitored. Using dedicated software, operation waveforms can also be monitored. (*5)                                                                                                                                |           |           |           |          |
| Pulse Input Mode                        |       | 1-, 2-pulse systems and 2-phase pulse system                                                                                                                                                                                                                                                |           |           |           |          |
| Control Input Signal                    |       | Enable, alarm reset, deviation counter reset, forward and reverse limits                                                                                                                                                                                                                    |           |           |           |          |
| Control Output Signal                   |       | Ready, alarm, in position                                                                                                                                                                                                                                                                   |           |           |           |          |
| Serial Interface                        |       | EIA232C <RS-232> (Connection by dedicated cable) (*5)                                                                                                                                                                                                                                       |           |           |           |          |
| Mass                                    |       | 0.8kg                                                                                                                                                                                                                                                                                       |           |           |           | 1.1kg    |
| Protection Functions                    |       | Memory error, overload, encoder trouble, regeneration trouble, overheat, system trouble, overcurrent, excessively large deviation, IPM trouble, overspeed                                                                                                                                   |           |           |           |          |
| Embedded Circuit                        |       | Dynamic brake circuit, regeneration unit connection terminal (*4)                                                                                                                                                                                                                           |           |           |           |          |
| Embedded Functions                      |       | Manual operation (jogging, alarm history clear and others)                                                                                                                                                                                                                                  |           |           |           |          |
| Environmental Conditions                |       | Operating temperature: 0°C to +50°C Storage temperature: -20°C to +85°C<br>Operating humidity: 90% RH or less (Do not expose to condensation) Storage humidity: 90% RH or less (Do not expose to condensation).<br>Ambience: Do not expose to metal powder, dust, oil mist or corrosive gas |           |           |           |          |

\* 1: The parameters of this product are set during pre-shipment inspection at the factory in accordance with the specification of the combined actuator (motor). If another actuator is to be used, please return the product to Harmonic Drive Systems for resetting of parameters.

\* 2: Rated output current represents the continuous output current of the driver. The value will be limited according to the combination of actuator.

\* 3: Maximum output current represents the maximum momentary current of the driver. The value will be limited according to the combination of actuator.

\* 4: This driver does not contain a regeneration circuit.

\* 5: Please direct your inquiries to Harmonic Drive Systems about dedicated software HS-360WAVE.

\*Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.



## Names and Functions of Components

### Key Buttons

- Key buttons for display mode selection, input and correction of set values when setting functions, for manual jogging of the actuator and for other functions

### Charge Voltage Monitor

- Monitors voltage status of the power supply terminal. High voltage is transmitted while the LED lamp is lit. Never touch the terminal.

### TB1: Power Supply Terminals R, T

- The AC100V power supply terminal for connecting supply power.

### TB1: Grounding Terminal E

- A terminal for grounding. Be certain to connect the grounding wire here to prevent an electric shock.

### TB1: Terminals for Connecting External Regenerative Resistance Unit P, N

- Terminals in case connection of external regeneration unit is required due to frequent actuator starts and stops.

### TB2: Terminals for Connecting Actuator +, -

- Terminals for connecting actuator cables. Correctly connect by matching the actuator cable color and the HS-360 driver symbol. Incorrect connection will damage the driver and actuator.

### TB2: Grounding Terminal E

- Connect this terminal to the periphery of the actuator.

### LED Display

- Displays operation status, set values of functions, alarms and other information concerning the HS-360 driver using a 5-digit 7-segment LED display.

### CN4: Not used

- This connector is not used. Never use this connector.

### CN3: RS-232C Serial Port Connector

- The connector for connecting to a personal computer, allowing parameter setting and modification, as well as status monitoring. (\* Dedicated software is required)

### CN1: External Input/Output Connector

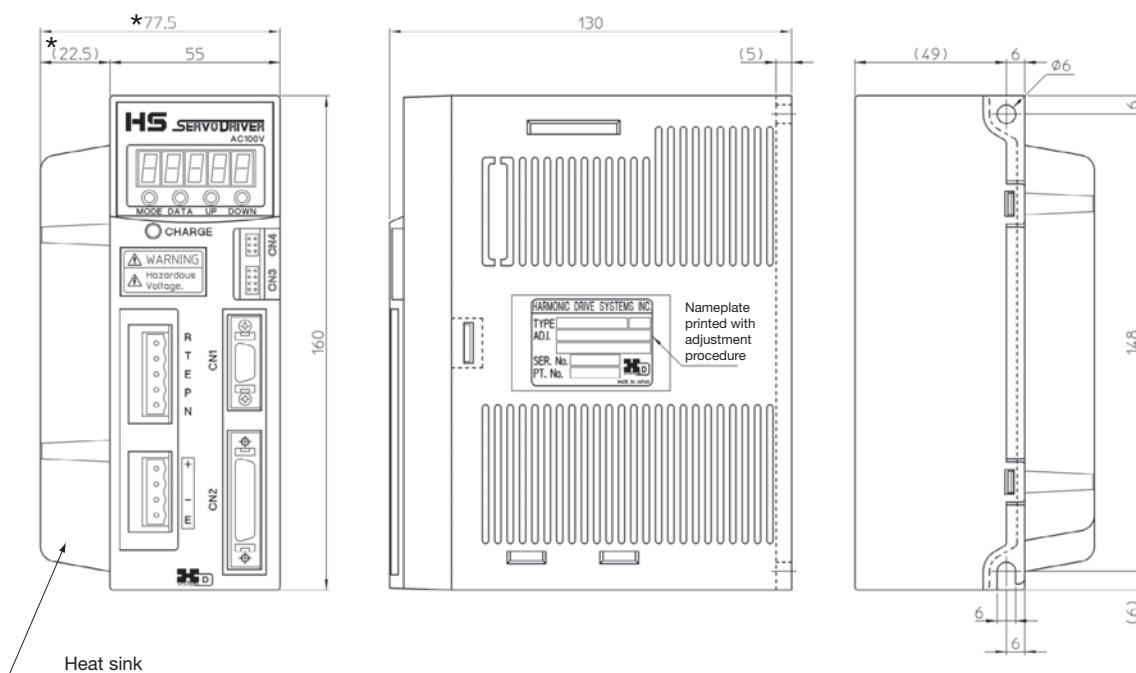
- The connector for control signal exchange with a host controller.

### CN2: Encoder Connector

- The connector to connect the encoder cable for actuator position detection and cables of the FWD and REV limit sensors.

## External Dimensions

Unit: mm



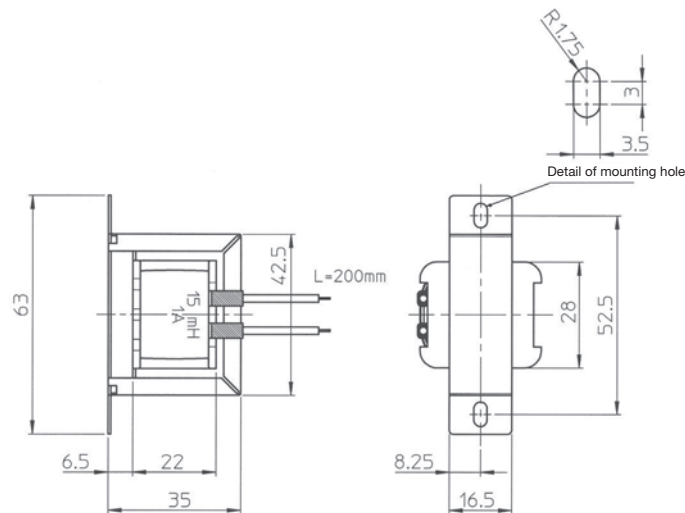
Note: Starred portions are for HA-360-3.

\*Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

## External Dimensions

### DC Reactor 15mH (Accessory)

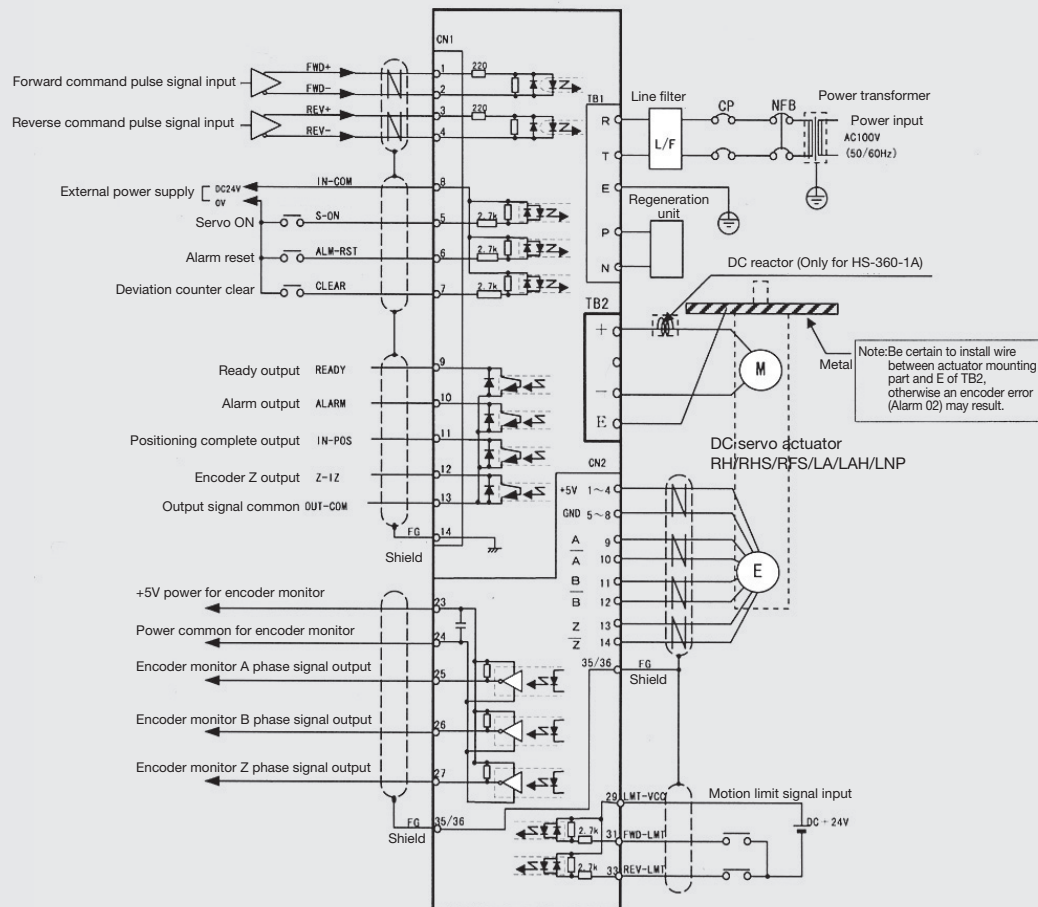
Unit: mm



\*Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

## Connection Examples

This is a connection example when the pulse output mode is "line driver." The command mode is a "2-pulse system."



Note: Design connection details after checking the technical information.

Rotary Actuator

DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System

MEMO

Rotary Actuator

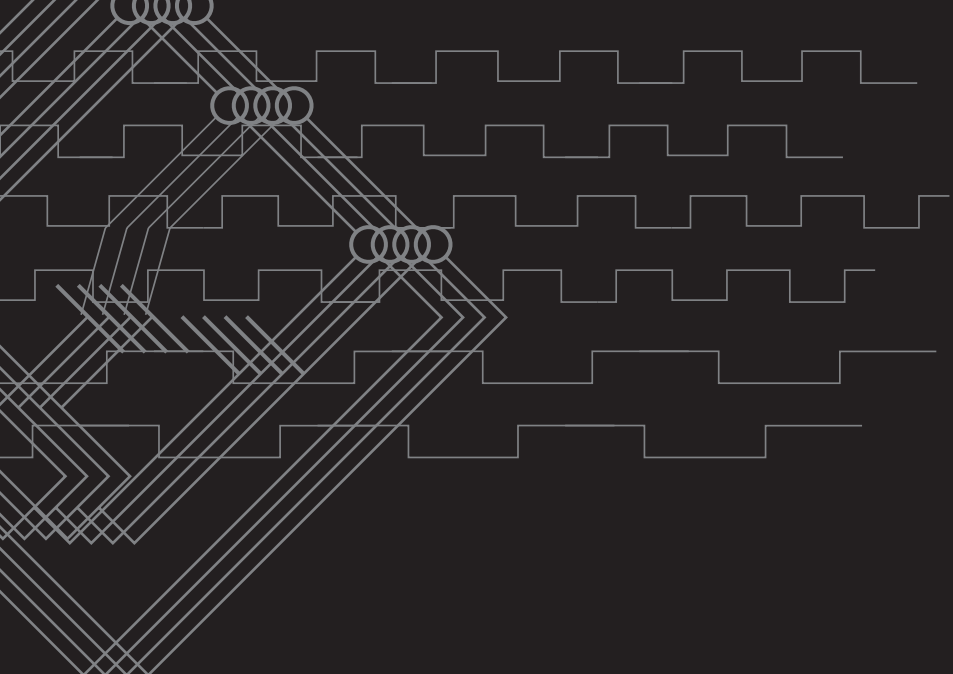
DirectDrive motor

Galvanometer Scanner System

Linear Actuator

Servo Driver

Sensor System



# *Harmonicsyn*<sup>®</sup> **Sensor Systems**

Micro Encoder Series ..... 172



# Micro Encoder Series

The micro encoder series includes super-compact and high-resolution incremental encoders capable of outputting three channels of square waves.



## Features

- **External dimensions**                       $\varnothing 7.5 \times 10.5\text{mm}$ ,  $\varnothing 13 \times 20\text{mm}$  (Body dimensions)
- **Detection system**                        Incremental
- **Output pulses per revolution**        100, 200, 300, 360, 500 (ME□-9), 1000 (ME□-9)
- **Output phase**                            A, B and Z

## Models and Symbols

ME S - 6 - 100P C

Type: Micro encoder ME series

Shaft shape: S Single shaft

Pulses: 100  
200  
300  
360

Output circuit: C Open collector output

ME □ - 9 - 100P □

Type: Micro encoder ME series

Shaft shape: S Single shaft  
H Hollow shaft

Pulses: 100  
200  
300  
360  
500  
1000

Output circuit: None Voltage output  
C Open collector output

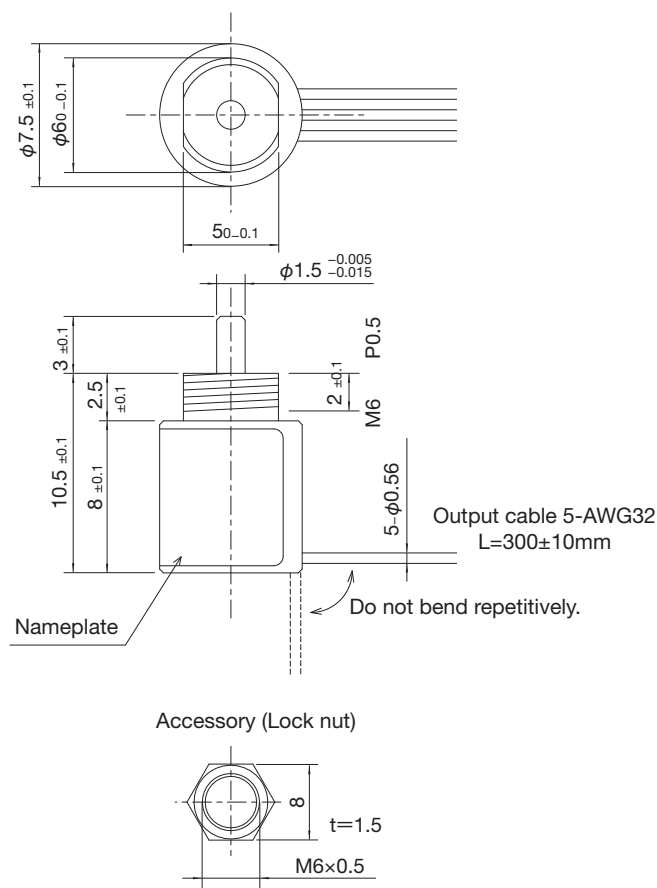
## Specification

| Item                                      |                                                 | Model | MES-6-□□PC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ME□-9-□□□                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|-------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power Supply                              |                                                 |       | DC5V ±10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DC5V ±10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Current Consumption                       |                                                 |       | 30mA or less (without load)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 40mA or less (without load)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Detection System                          |                                                 |       | Incremental                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Incremental                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Output                                    | Output Pulses (standard)<br>[Pulses/revolution] |       | 100 300<br>200 360                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 100 300 500<br>200 360 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                           | Output Phases                                   |       | A, B, Z                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | A, B, Z (Z = "H")                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                           | Output Mode                                     |       | Square wave open collector output                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Square wave open collector output or voltage output                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                           | Output Capacity                                 |       | Sink current: 4mA (output withstand voltage 7V)<br>Residual voltage: 0.4V or less                                                                                                                                                                                                                                                                                                                                                                                                                              | Sink current: 20mA<br>Residual voltage: 0.5V (at 10mA)                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                           | Max. Response Frequency<br>(Response Pulses)    |       | 100kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 100kHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                           | Output Phase Difference                         |       | A and B phase difference $90^\circ \pm 45^\circ$ (T/4 $\pm$ T/8)<br>Z phase T $\pm$ T/2 (see output waveform diagram)                                                                                                                                                                                                                                                                                                                                                                                          | A and B phase difference $90^\circ \pm 45^\circ$ (T/4 $\pm$ T/8)<br>Z phase T $\pm$ T/2 (see output waveform diagram)                                                                                                                                                                                                                                                                                                                                                                                          |
|                                           | Waveform Rise and Fall Time                     |       | 2 $\mu$ s or less (output cable 300mm or less)                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2 $\mu$ s or less (output cable 140mm or less)                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Starting Torque                           |                                                 |       | $0.3 \times 10^{-3}$ N·m (3gf·cm) or less                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $1 \times 10^{-3}$ N·m (10gf·cm) or less                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Permissible Shaft Load<br>(Electrical)    | Radial                                          |       | 1.9N (200gf)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1.9N (200gf) 0.98N (100gf)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                           | Thrust                                          |       | 0.98N (100gf)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.9N (200gf) 0.98N (100gf)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Permissible Max. Revolutions (Mechanical) |                                                 |       | 6000r/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6000r/min                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Operating Temperature and Humidity        |                                                 |       | 0°C to 60°C<br>RH35% to 90% No condensation                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0°C to 60°C<br>RH35% to 90% No condensation                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Storage Temperature                       |                                                 |       | -20°C to 80°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | -20°C to 80°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Resistance to Vibration                   |                                                 |       | Frequency 55Hz, double amplitude 1.5mm<br>Withstands 2 hours each in X, Y and Z directions                                                                                                                                                                                                                                                                                                                                                                                                                     | Frequency 55Hz, double amplitude 1.5mm<br>Withstands 2 hours each in X, Y and Z directions                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Resistance to Shock                       |                                                 |       | 500m/s <sup>2</sup> (about 50G)<br>Withstands 3 cycles each in X, Y and Z directions                                                                                                                                                                                                                                                                                                                                                                                                                           | 500m/s <sup>2</sup> (about 50G)<br>Withstands 3 cycles each in X, Y and Z directions                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Cable                                     |                                                 |       | Vinyl sheathed (AWG32)<br>cable length 300mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Vinyl sheathed (AWG30)<br>cable length 140mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Mass                                      |                                                 |       | 5g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 10g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Output Circuit                            |                                                 |       | <p><b>Open Collector Output</b></p> <p>Cable Color</p> <p>Power (Red)<br/>A, B, Z (White, Green, Yellow)<br/>4mA max<br/>0V (Black)</p> <p>Main circuit</p> <p>Power supply DC5V</p>                                                                                                                                                                                                                                                                                                                           | <p><b>Power Output Open Collector Output</b></p> <p>Cable Color</p> <p>Power (Red)<br/>A, B, Z (White, Green, Yellow)<br/>20mA max<br/>0V (Black)</p> <p>Main circuit</p> <p>Power supply DC5V</p>                                                                                                                                                                                                                                                                                                             |
| Output Waveform                           |                                                 |       | <p><b>CW Rotation</b><br/>(Clockwise viewed from mounting direction)</p> <p>Phase A<br/>Phase B<br/>Phase Z</p> <p><math>T/4 \pm T/8</math> (<math>90^\circ \pm 45^\circ</math>)</p> <p><math>T \pm T/2</math></p> <p><b>CCW Rotation</b><br/>(Counter clockwise viewed from mounting direction)</p> <p>Phase A<br/>Phase B<br/>Phase Z</p> <p><math>T/4 \pm T/8</math> (<math>90^\circ \pm 45^\circ</math>)</p> <p><math>T \pm T/2</math></p> <p>*Position of Phase Z to Phases A and B is not specified.</p> | <p><b>CW Rotation</b><br/>(Clockwise viewed from mounting direction)</p> <p>Phase A<br/>Phase B<br/>Phase Z</p> <p><math>T/4 \pm T/8</math> (<math>90^\circ \pm 45^\circ</math>)</p> <p><math>T \pm T/2</math></p> <p><b>CCW Rotation</b><br/>(Counter clockwise viewed from mounting direction)</p> <p>Phase A<br/>Phase B<br/>Phase Z</p> <p><math>T/4 \pm T/8</math> (<math>90^\circ \pm 45^\circ</math>)</p> <p><math>T \pm T/2</math></p> <p>*Position of Phase Z to Phases A and B is not specified.</p> |

## External Dimensions

### ■ MES-6

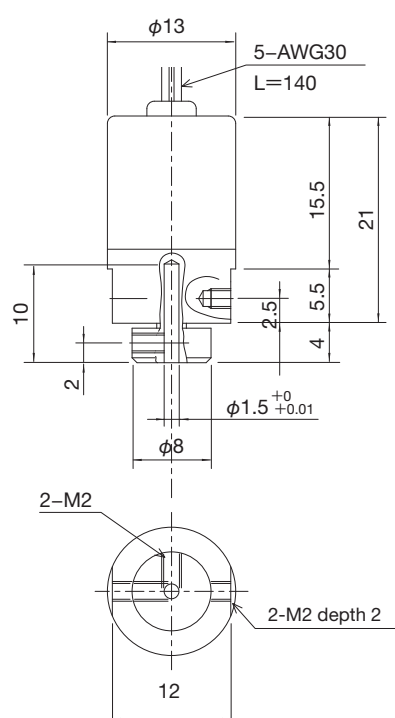
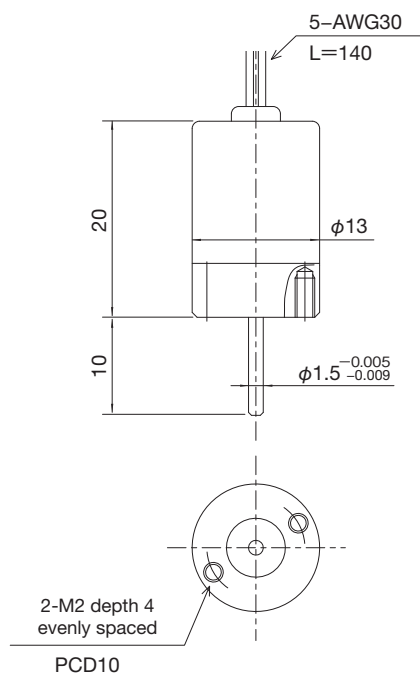
Unit: mm



### ■ MES-9

Unit: mm ■ MEH-9

Unit: mm



\* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

# Warranty/ Trademark Company overview

|                          |     |
|--------------------------|-----|
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| Company overview .....   | 179 |



## Warranty

**Harmonic Drive Systems undertakes warranty of its products contained in this catalog for the following warranty period and scope.**

● **Warranty Period**

Under the condition that the products are handled, used and maintained properly followed each item of the technical materials, the manuals, and this catalog, all the products are warranted against defects in workmanship and materials for the shorter period of either one year after delivery or 2,000 hours of operation time.

● **Warranty Scope**

All the products are warranted against defects in workmanship and materials for the warranted period. This limited warranty does not apply to any product that has been subject to:

- (1) User's misapplication, improper installation, inadequate maintenance, or misuse.
- (2) Disassembling, modification or repair by others than Harmonic Drive Systems, Inc.
- (3) Imperfection caused by the other than the products.
- (4) Disaster or others that does not belong to the responsibility of Harmonic Drive Systems, Inc.

Our liability shall be limited exclusively to repairing or replacing the product only found by Harmonic Drive Systems, Inc. to be defective. Harmonic Drive Systems, Inc. shall not be liable for consequential damages of other equipment caused by the defective products, and shall not be liable for the incidental and consequential expenses and the labor costs for detaching and installing to the driven equipment

## Trademark

**“HarmonicDrive” is registered trademark of Harmonic Drive Systems Inc. products.  
The academic or general nomenclature is “wave motion gearing”.**

Specifications and dimensions on the catalog may change without notice.



## For Safe Use of Servo Systems

**Warning** : Means that improper use or handling could result in a risk of death or serious injury.

**Caution** : Means that improper use or handling could result in personal injury or damage to property.

### Limited Applications

This product cannot be used for the following applications:

- \* Space equipment      \* Aircraft equipment      \* Nuclear power equipment      \* Equipment and apparatus used in domestic homes
- \* Vacuum equipment      \* Automotive equipment      \* Game equipment      \* Equipment that directly works on human bodies
- \* Equipment for transport of humans      \* Equipment for use in a special environment

Please consult Harmonic Drive Systems beforehand when intending to use one of its product for the aforementioned applications.

**Install a safety device that avoids an accident even if output of this product becomes uncontrollable due to breakdown when using it in equipment that affects human lives and that may trigger serious damage.**

### Actuator Safety Precautions

**Design Precaution:** Be certain to read the technical information when designing the equipment.

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                                                                                                                                                                                                                                              |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Caution</b> | <b>Use only in a specified environment.</b> <ul style="list-style-type: none"> <li>Actuators are designed and manufactured for indoor use. Please ensure the following environmental conditions are complied with: <ul style="list-style-type: none"> <li>Ambient temperature 0 to 40°C</li> <li>Vibration 24.5m/s<sup>2</sup> or less</li> <li>Ambient humidity 20 to 80% RH (Do not expose to condensation)</li> <li>No splashing of water or oil</li> <li>Do not expose to corrosive or explosive gas</li> </ul> </li> </ul> | <br><b>Caution</b> | <b>Install the actuator at the specified accuracy.</b> <ul style="list-style-type: none"> <li>Correctly align the centers of the actuator shaft and mating machine in accordance with the technical information.</li> <li>Any misalignment could cause vibration and fracture of the output shaft.</li> </ul>                |
| <br><b>Caution</b> | <b>Caution on Oil Leakage</b> <ul style="list-style-type: none"> <li>The output shaft contains an oil seal of high reliability. However, it is not guaranteed to be completely free of oil leakage. Customers are kindly requested to protect against grease or oil leakage depending on their application.</li> </ul>                                                                                                                                                                                                          | <br><b>Caution</b> | <ul style="list-style-type: none"> <li>When storing the product, store in a proper environment where the temperature and humidity are controlled. Anti-rust oil and anti-rust packaging are used for our products before shipment, but it does not guarantee that rust does not occur over a long period of time.</li> </ul> |

**Operational Precaution:** Be certain to read the instruction manual and technical information before operating the actuator.

|                    |                                                                                                                                                                                                                                                                                                             |                    |                                                                                                                                                                                                                                                                                        |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Caution</b> | <b>Do not exceed the permissible torque.</b> <ul style="list-style-type: none"> <li>Do not apply a torque larger than the maximum value.</li> <li>If an arm or other part is connected directly to the output shaft, this latter may become uncontrollable if the arm or other part is collided.</li> </ul> | <br><b>Warning</b> | <b>Do not plug directly into a socket.</b> <ul style="list-style-type: none"> <li>The actuator cannot be operated unless connected to a dedicated control unit.</li> <li>Never connect directly to the AC power supply. The actuator may fracture and a fire may break out.</li> </ul> |
| <br><b>Warning</b> | <b>Do not pat the actuator.</b> <ul style="list-style-type: none"> <li>An encoder is coupled to the actuator. Do not pat the actuator.</li> <li>A fractured encoder may cause the actuator to run out of control.</li> </ul>                                                                                | <br><b>Warning</b> | <b>Do not pull the cables.</b> <ul style="list-style-type: none"> <li>Pulling a cable may damage the connecting part and cause the actuator to run out of control.</li> </ul>                                                                                                          |

### Servo Driver Safety Precautions

**Design Precaution:** Be certain to read the technical information when designing the equipment.

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Caution</b> | <b>Use only in a specified environment.</b> <ul style="list-style-type: none"> <li>The driver generates heat. Exercise reasonable care concerning heat radiation and operate under the following conditions: <ul style="list-style-type: none"> <li>Install vertically and ensure sufficient space nearby</li> <li>0 to 50°C and 95% RH (Do not expose to condensation)</li> <li>Avoid vibration or shocks</li> <li>Do not expose to dust or corrosive or explosive gas</li> <li>Do not use the servo driver in environment where sudden temperature and atmospheric pressure changes.</li> </ul> </li> </ul> | <br><b>Caution</b> | <b>Take adequate precautionary measures to damp noise and ground</b> <ul style="list-style-type: none"> <li>Noise on signal wire may cause vibration and malfunction. Observe the following conditions: <ul style="list-style-type: none"> <li>Separate strong and weak wires.</li> <li>Minimize wiring distances and lengths.</li> <li>Ground the actuator and servo driver to one point and in class 3 in grounding.</li> <li>Do not use a power input filter in the motor circuit.</li> </ul> </li> </ul> |
| <br><b>Caution</b> | <b>Exercise reasonable care when rotating from load side</b> <ul style="list-style-type: none"> <li>The servo driver may break if the actuator is run while being rotated from the load side.</li> <li>Consult Harmonic Drive Systems when the servo driver is operated in this mode.</li> </ul>                                                                                                                                                                                                                                                                                                              | <br><b>Caution</b> | <b>Use an earth leakage breaker for the inverter.</b> <ul style="list-style-type: none"> <li>Use an earth leakage breaker for the inverter. A time-delay breaker cannot be used.</li> </ul>                                                                                                                                                                                                                                                                                                                  |

**Operational Precaution:** Be certain to read the instruction manual and technical information before operating the actuator.

|                    |                                                                                                                                                                                                                                                                |                    |                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Warning</b> | <b>Do not change the wiring while the current is active.</b> <ul style="list-style-type: none"> <li>Always turn the power off when removing any wire or connecting or disconnecting a connector, otherwise an electric shock or runaway may result.</li> </ul> | <br><b>Warning</b> | <b>Do not touch the terminals for 5 min after turning it off.</b> <ul style="list-style-type: none"> <li>Residual electricity remains after turning the power off. Make checks more than 5 minutes after turning the power off to prevent any electric shock</li> <li>When installing a servo driver, design the structure so that the electric parts inside cannot be touched easily.</li> </ul> |
| <br><b>Caution</b> | <b>Do not conduct a withstand voltage test.</b> <ul style="list-style-type: none"> <li>Do not conduct a megger or withstand voltage test, otherwise the control circuit of the servo driver may be damaged.</li> </ul>                                         | <br><b>Caution</b> | <b>Do not operate the servo driver by turning it on and off.</b> <ul style="list-style-type: none"> <li>Frequent turning on and off of the power causes the internal circuit devices to deteriorate.</li> <li>Start and stop the actuator by issuing a command signal.</li> </ul>                                                                                                                 |

**Operational Precaution:** Be certain to read the instruction manual and technical information before operating the actuator.

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                                                                                                                                                                                                          |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Caution</b> | <ul style="list-style-type: none"> <li>When a product has been stored for a long period of time, we recommend that you check its performance and check for rust. When storing a product for a long period of time, inspect the product for rust and other deterioration every 6 months and reapply anti-rust oil. Please contact us for information on reapplying anti-rust oil.</li> <li>Although black oxide finish is applied to some of our products, it does not guarantee the antirust effect.</li> </ul> | <br><b>Caution</b> | <b>When Discarding Actuator and Servo Driver</b> <p><b>Please discard as industrial waste.</b></p> <ul style="list-style-type: none"> <li>Please discard as industrial waste when discarding.</li> </ul> |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Major Applications of Our Products



Metal Working Machines



Processing Machines



Measurement, Analytical  
and Test Systems



Medical Equipments



Telescopes

Source: National observatory of  
Inter-University Research Institute Corporation



Energy

Courtesy of Halliburton/Sperry Drilling Services



Crating and  
Packaging Machines

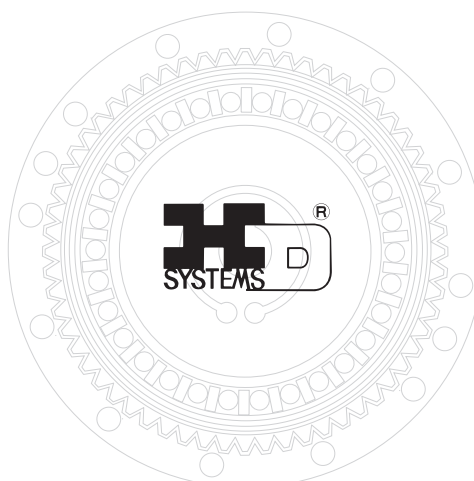


Communication  
Equipments



Space Equipments

Rover image created by Dan Maas, copyrighted to Cornell  
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Glass and Ceramic  
Manufacturing Systems



Robots



Humanoid Robots

Source: Honda Motor Co., Ltd.



Printing, Bookbinding  
and Paper Machines



Semiconductor  
Manufacturing Systems



Optical Machines



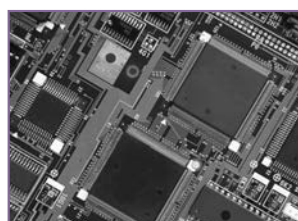
Wood, Light Metal and  
Plastic Machine Tools



Paper-making Machines



Flat Panel Display  
Manufacturing Systems



Printed Circuit Board  
Manufacturing Machines



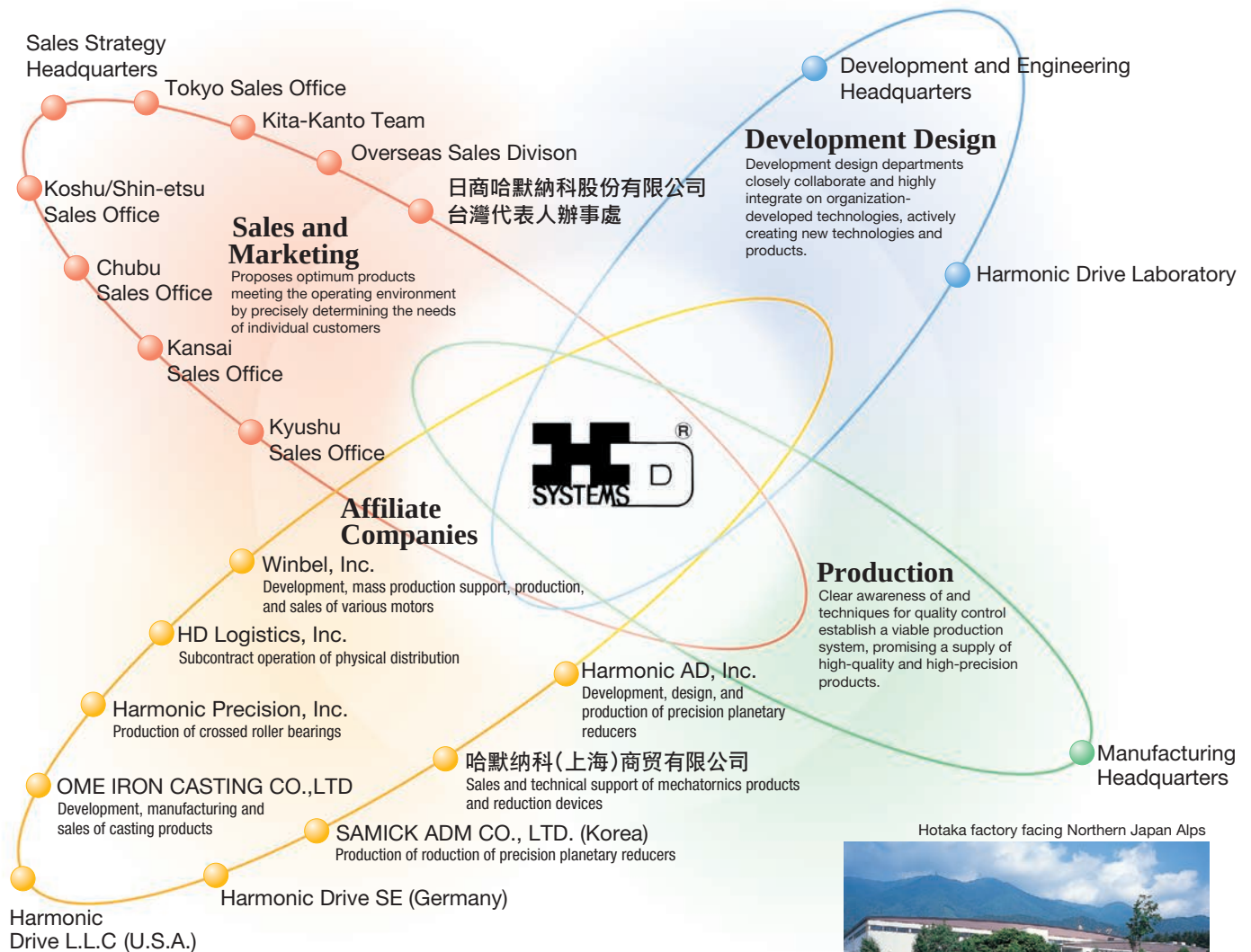
Aircraft Technology

# As a Specialist in Precision Control Field

Through close cooperation in areas of development, design, production and marketing, Harmonic Drive Systems creates unique products tailored to customer needs.



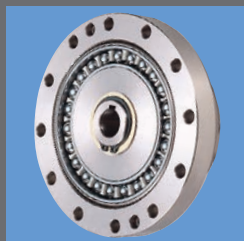
In 1995 and 1998, Harmonic Drive Systems respectively obtained approvals for ISO 9001 (International Quality Management Standard) and for ISO 14001 (International Environmental Management Systems) from TÜV Management Service GmbH, a German accreditation organization. The approvals signify global recognition of the quality assurance and environment management systems of Harmonic Drive Systems.



## OTHER PRODUCTS

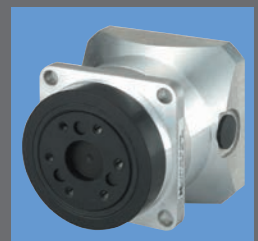
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• TEL: CS department 0263 (83) 6812

• Business hours: Monday ~ Friday 9:00~12:00 13:00~ 17:00 (Except Saturdays, Sundays, national holidays and our specified days off)

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|  |                                  |                                                                                                                                                                     |
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