HarmonicDrive®

FINE MECHANICS & TOTAL Motion CONTROL

MECHATRONICS

General Catalog for Mechanical Electronic Products

ISO14001
ISO9001

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

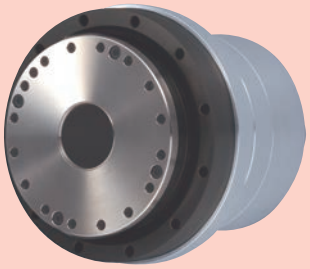
Harmonic Drive Systems offers a versatile product range, focusing on rotary actuators that integrate a high-performance motor featuring ultrahigh resolution and high precision positioning. Linear actuators featuring high-precision positioning with a super fine pitch are also a major feature of the Harmonic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

CONTENTS

Drive Systems are guarantee the best for precision control

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	● Hollow shaft ● Flat shape ● High torque ● High resolution ● Extensive variation ● Compact		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)*5	127
					81	69.1(59.3)*5	178
					101	55.4(47.5)*5	204
					121	46.3(39.7)*5	217
					161	34.8(29.8)*5	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)*4
					81	49.4	560(675)*4
					101	39.6	686(738)*4
					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	● Hollow shaft ● Flat shape ● High torque ● High resolution ● Extensive variation ● High accuracy Features		20	50	120	73
					80	75	96
					100	60	107
					120	50	113
					160	37.5	120
				25	50	112(96)*5	127
					80	70(60)*5	178
					100	56(48)*5	204
					120	46.7(40)*5	217
					160	35(30)*5	229
				32	50	96	281
					80	60	395
					100	48	433
					120	40	459
					160	30	484
				40	50	80	333(523)*4
					80	50	548(675)*4
					100	40	686(738)*4
					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.

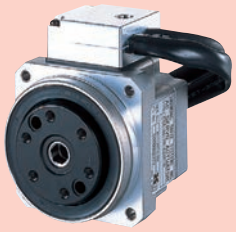
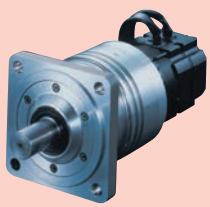
accuracy and rotational accuracy, and a servo motor with superior control characteristics.
accuracies by combining a dedicated servo driver that maximizes actuator performance.

Resolution*3 (Pulse/rev)	Mass (kg)	Drive motor	Combined driver	Input voltage	Page in catalog	Application
6,684,672	2	AC servo	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200	200 VAC	016	**Semi-conductor, flat panel display manufacturing system** ● Carrier robot ● Index table ● Inching feed **Robot** ● Indirect drive ● Hand drive ● Peripheral equipment **Metal-cutting machine** ● ATC drive ● Turret Indexing ● Index table ● Loader/unloader ● Axes drive ● Work table drive **Measurement and inspection equipment** ● Probe drive ● Index table ● X-Y-Z table **Medical equipment** ● Table drive ● Sensor positioning ● Manipulator ● Index table **Optical equipment** **Space and aviation related** **Electrical circuit manufacturing equipment** **Other FA peripheral equipment**
10,616,832						
13,238,272						
15,859,712						
21,102,592						
1,441,792	Without brake 2.95 (5.0)*1 With brake 3.1 (5.1)*1		HA-800A-3D/E-200 (HA-800A-6D/E-100)*2 HA-800B-3D/E-200 (HA-800B-6D/E-100)*2 HA-800C-3D/E-200 (HA-800C-6D/E-100)*2	200 VAC (100 VAC)		
6,684,672						
10,616,832						
13,238,272						
15,859,712						
21,102,592						
1,441,792	Without brake 5.9 (9.4)*1 With brake 6.2 (9.7)*1		HA-800A-6D/E-200 HA-800B-6D/E-200 HA-800C-6D/E-200	200 VAC		
6,684,672						
10,616,832						
13,238,272						
15,859,712						
21,102,592						
6,684,672	Without brake 9.9 With brake 10.7		HA-800A-6D/E-200 (HA-800A-24D/E-200) HA-800B-6D/E-200 (HA-800B-24D/E-200) HA-800C-6D/E-200 (HA-800C-24D/E-200)	200 VAC		
10,616,832						
13,238,272						
15,859,712						
21,102,592						
10,616,832	Without brake 29.5 With brake 32		HA-800A-24D/E-200 HA-800B-24D/E-200 HA-800C-24D/E-200	200 VAC		
13,238,272						
15,859,712						
21,102,592						
10,616,832	Without brake 37.5 With brake 40		HA-800A-24D/E-200 HA-800B-24D/E-200 HA-800C-24D/E-200	200 VAC		
13,238,272						
15,859,712						
21,102,592						
6,553,600	Without brake 2.6 With brake 2.7	AC servo	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200	200 VAC		
10,485,760						
13,107,200						
15,728,640						
20,971,520						
6,553,600	Without brake 3.95 With brake 4.1		HA-800A-3D/E-200 (HA-800A-6D/E-100)*2 HA-800B-3D/E-200 (HA-800B-6D/E-100)*2 HA-800C-3D/E-200 (HA-800C-6D/E-100)*2	200 VAC (100 VAC)		
10,485,760						
13,107,200						
15,728,640						
20,971,520						
6,553,600	Without brake 7.7 With brake 8.0		HA-800A-6D/E-200 HA-800B-6D/E-200 HA-800C-6D/E-200	200 VAC		
10,485,760						
13,107,200						
15,728,640						
20,971,520						
6,553,600	Without brake 13.0 With brake 13.8		HA-800A-6D/E-200 (HA-800A-24D/E-200) HA-800B-6D/E-200 (HA-800B-24D/E-200) HA-800C-6D/E-200 (HA-800C-24D/E-200)	200 VAC		
10,485,760						
13,107,200						
15,728,640						
20,971,520						

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

Rotary Actuator

Series	Features	Product	Model No.	Reduction ratio	Max. rotational speed (r/min)	Max. torque (N·m)
FHA-C mini	● Hollow shaft ● Flat shape ● Compact size ● High torque ● Absolute-compatible		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	● Hollow shaft ● Flat shape ● High torque ● High resolution		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	● Compact size ● High torque		20	50	90	56
				100	45	82
			25	50	90	98
				100	45	157
			32	50	90	220
				100	45	330
RSF supermini	● Ultra-compact size ● High torque		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	● Compact size ● High torque		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	● Compact size ● High torque		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*5	● Compact size ● High torque		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*1 *3 *4 (Pulse/rev)	Mass*1 (kg)	Drive motor	Combined driver	Input voltage*6	Page in catalog	Application
240,000 (3,932,160)	0.40 (0.50)	AC servo	HA-800*-1C-100 HA-800*-1C-200 HA-800*-1D-100 HA-800*-1D-200 HA-680-4-24 HA-680ML-4-24 RF2H21A0AHD by SANYO DENKI CO., LTD	100 VAC 200 VAC 24 VDC	037	**Semi-conductor, flat panel display manufacturing system** ● Carrier robot ● Index table ● Inching feed **Robot** ● Indirect drive ● Hand drive ● Peripheral equipment **Metal-cutting machine** ● ATC drive ● Turret Indexing ● Index table ● Loader/unloader ● Axes drive ● Work table drive **Measurement and inspection equipment** ● Probe drive ● Index table ● X-Y-Z table **Medical equipment** ● Table drive ● Sensor positioning ● Manipulator ● Index table **Optical equipment** **Space and aviation related** **Electrical circuit manufacturing equipment** **Other FA peripheral equipment**
400,000 (6,553,600)						
800,000 (13,107,200)						
240,000 (3,932,160)	0.62 (0.75)					
400,000 (6,553,600)						
800,000 (13,107,200)						
240,000 (3,932,160)	1.2 (1.3)		HA-800*-1C-100 / HA-800*-1C-200 HA-800*-1D-100 / HA-800*-1D-200 HA-680-6-24 / HA-680ML-6-24 RF2H21A0AHD by SANYO DENKI CO., LTD			
400,000 (6,553,600)						
800,000 (13,107,200)						
500,000	2.5	AC servo	HA-800*-3C-100 HA-800*-3C-200 HA-800*-6C-100	200 VAC (100 VAC)*2	049	
1,000,000						
1,600,000						
500,000	4.0					
1,000,000						
1,600,000						
500,000	6.5		HA-800*-6C-100 HA-800*-6C-200			
1,000,000						
1,600,000						
500,000	12			200 VAC		
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			
800,000						
400,000	9.5		HA-800*-6B-200			
800,000						
24,000	0.031	AC servo	HA-680-4B-24 HA-680ML-4B-24	24 VDC	065	
40,000						
80,000						
60,000	Without brake 0.066 With brake 0.086					
100,000						
200,000						
120,000	0.3	AC servo	HA-680-4B-24 HA-680ML-4B-24	24 VDC	071	
200,000						
400,000						
120,000	0.5		HA-680-6B-24 HA-680ML-6B-24			
200,000						
400,000						
120,000	0.8					
200,000						
400,000						
400,000	2.1	AC servo	HA-800*-3B-200	200 VAC	077	
800,000						
400,000	2.9		HA-800*-3B-200			
800,000						
400,000	4.7		HA-800*-3B-200			
800,000						
400,000	8.7		HA-800*-6B-200			
800,000						
100,000	0.09	DC servo	HS-360-1A-100	100 VAC	085	
160,000						
200,000						
200,000	0.3		HS-360-1B-100			
400,000						
200,000	0.5		HS-360-1C-100			
400,000						
200,000	0.77		HS-360-1D-100			
400,000						

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	● Super high resolution ● High accuracy ● Stopping stability ● High torque ● Large hollow dia. ● Mechanical precision		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	● High-speed response ● Temperature stability ● Resistant to external ambience ● Resistant to noise		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	● High resolution ● High positional accuracy		□28	0.0174	10	49
				□36	0.0174	30	49
	LAH-46	● High resolution ● High positional accuracy		□47	0.069	10	390
					0.069	30	390
	LBC	● High driving force		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 (N·m)	Repeatability arc sec	Mass (kg)	Combined Driver	Power Supply Voltage	Page in Catalog	Application
7.0	±0.5	4.0	HA-770-2	AC100V AC200V	096	Semiconductor and FPD manufacturing equipment and systems ● Index tables ● Micro feeding Measuring and inspection equipment and systems ● Probe drives ● Index tables ● 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 ($g \cdot cm^2$)	Mass (kg)	Power Supply Voltage	Combined Driver	Page in Catalog	Application
1.9	0.18	DC24V	PSM-130	102	● Laser markers ● Laser meters ● Laser machines ● Laser medical equipment ● 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 (μm/Stroke mm)	Mass (kg)	Drive Motor	Combined Driver	Power Supply Vol.	Page in Catalog	Application
±0.1 or less/mm	0.32	DC servo	HS-360-1A-100	AC100V	108	● Semiconductor wafer positioning ● Optical focusing systems ● High precision stages
	0.55					
±0.5 or less/1mm	0.81	DC servo	HS-360-1A-100	AC100V	111	● Alignment of liquid crystal panel ● Inspection equipment and measuring instruments ● Image measuring instruments
	0.85					
±5 or less/1mm	12.5	AC servo	HA-800A-3B	AC200V	114	● Machine tools ● Press-fitting, drawing and caulking work

Servo Driver Compatible with the Open Field Network

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

Servo Drivers

	Series	Product	Power Supply Voltage	Control Mode	Combined Encoder
AC servo Drivers	HA-800A		AC100V AC200V	Position control Speed control Torque control	Incremental encoder Absolute encoder
	HA-680		DC24V	Position control Speed control Torque control	Incremental encoder
	HA-770		AC100V 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
• Operation key of the driver panel • Special communication software on PC • MECHATROLINK	Available	SHA series FHA-C mini series FHA-C series RSF series RKF series	120
• Operation key of the driver panel • Special communication software on PC • CC-Link	Available	SHA series FHA-C mini series FHA-C series RSF series RKF series	129
• Special communication software on PC • MECHATROLINK	Available	FHA-C mini series RSF supermini series RSF-B mini series	138

Parameter Operation	Communication Function	Combined Actuator/Direct Drive Motor	Page in Catalog
• Operation key of the driver panel • Special communication software on PC	Available	SHA series FHA-C mini series FHA-C series RSF series RKF series	146
• Special communication software on PC	Available	FHA-C mini series RSF supermini series RSF-B mini series	155
• Operation key of the driver panel • Special communication software on PC	Available	KDU series	160
• Operation key of the driver panel • Special communication software on PC	Available	RH series LA series LAH series (Line driver specification) RHS series	166

Harmonicsyn®

Sensor Systems

The micro encoder series features ultra small incremental encoders with outside diameters of ϕ7.5 and ϕ13mm.

	Series	Feature	Product	Outside Diameter (mm)	Detection System	Resolution
Sensor Systems	Micro Encoder	● High resolution ● High reliability, long life		ø7.5	Incremental	100, 200 300, 360 (Pulses/revolution)
				ø13	Incremental	100, 200 300, 360 500, 1000 (Pulses/revolution)

Overseas Standard Compliance

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

* 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 (r/min)	Mass (g)	Application	Page in Catalog
Square wave Open collector output	6000	5	● Humanoid robots ● Semiconductor manufacturing systems ● Measurement, analysis and test systems ● Optical equipment ● Communication equipment	172
Square wave Open collector output	6000	10		

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

* 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®?

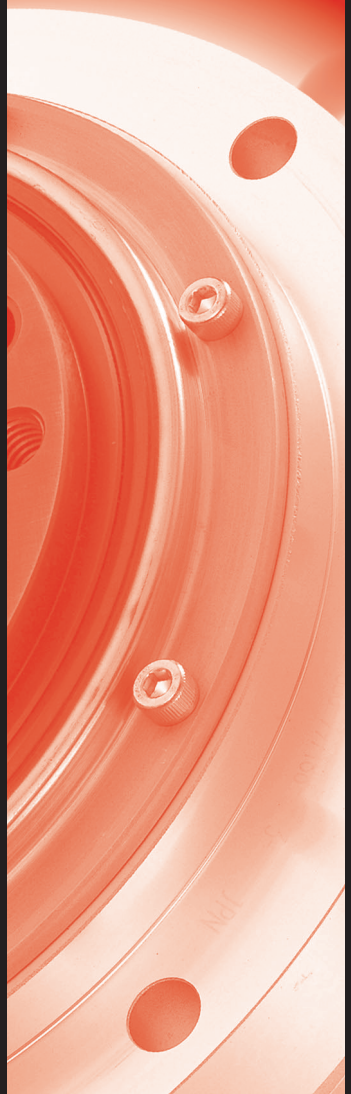
The HarmonicDrive® is operated based on a unique operating principle applying the elasticity dynamics of metals and is composed of only three basic parts, namely: a wave generator, and flex and circular splines respectively. The HarmonicDrive® features excellent properties, unmatched by competing speed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

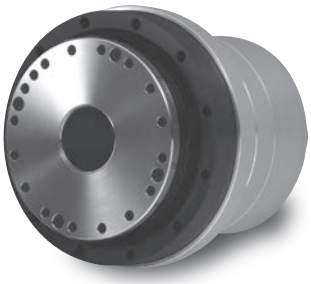
Rotary Actuator



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: ϕ65 mm), flat structure (max. outer diameter: ϕ284 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

Speed reducer model

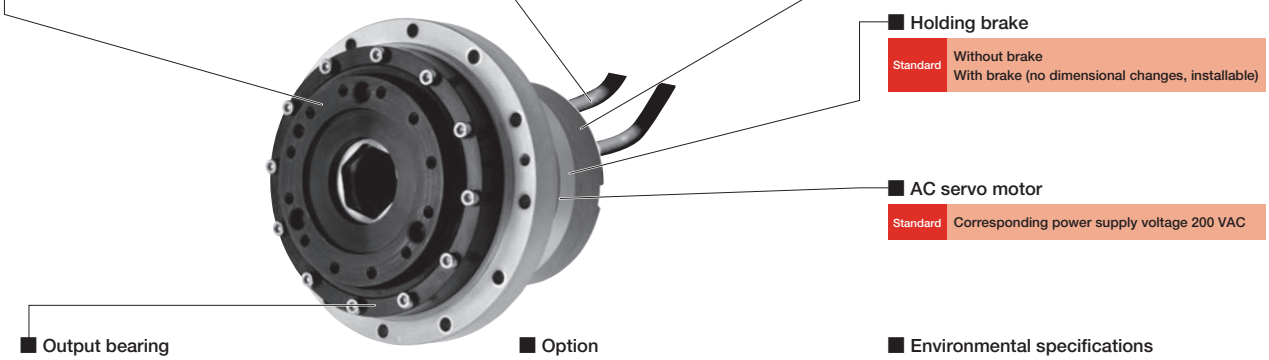
Standard	Harmonic Drive® SHG Series (SG Type) Harmonic Drive® CSG Series (CG Type) HarmonicPlanetary® HPF Series (HP type)

Cable lead-out

Standard	Rear
Option	Can be taken out from side (Please contact us for model numbers.)

Encoder

Standard	Absolute encoder (17 bit) Multi revolution backup (16 bit) A format compliant



Holding brake

Standard	Without brake With brake (no dimensional changes, installable)

AC servo motor

Standard	Corresponding power supply voltage 200 VAC

Output bearing

Standard	Cross roller bearing

Option

With near origin and end limit sensors
With stand (CG type only)

Environmental specifications

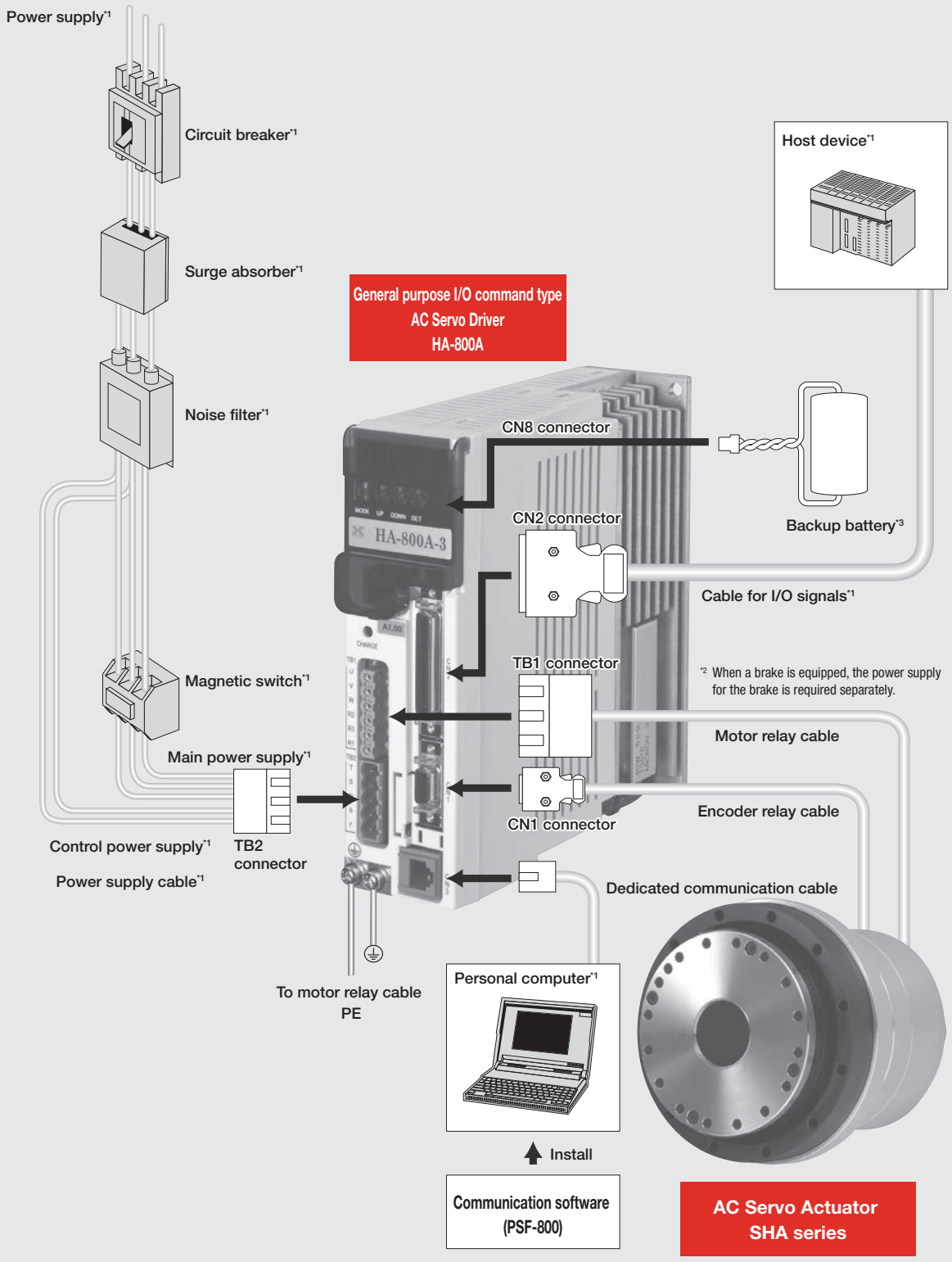
Standard	Protection class: IP54 Operating temperature: 0°C to +40°C UL and CE markings

* 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



*1: The customer should provide marked devices separately.
*2: See the manual for details on power supply related configurations.
*3: When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

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	
51	1/51
81	1/81
101	1/101
121	1/121
161	1/161

HP	
11	1/11*1

CG	
50	1/50
80	1/80
100	1/100
120	1/120
160	1/160

(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

*1: 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.
*2: When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

Specifications (SG/HP types)

Item \ Model			SHA20A					SHA25A						SHA32A					
			51	81	101	121	161	11	51	81	101	121	161	11	51	81	101	121	161
Max. torque*2	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*2	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)	$GD^2/4$	$kg·m^2$	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	$kgf·cms^2$	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)	$GD^2/4$	$kg·m^2$	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	$kgf·cms^2$	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		$25.2×10^4$					$37.9×10^4$	$39.2×10^4$					$86.1×10^4$	$100×10^4$				
	kgf·m/arc-min		7.5					11.3	11.6					25.7	29.6				
Encoder type			17-bit absolute encoder*6																
Encoder resolution per motor revolution			2^{17} (131072)																
Motor multi revolution detection			2^{16} (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 (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 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: 2.5 Mbps, 1-on-1 connection

(11) Encoder type, resolution

S17b	17-bit absolute encoder 131072 pulses/revolution*2

(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 (523)	560 (675)	686 (738)	802	841	650	918	982	1070	1147	1924	2067	2236	2392	2400	2990	3263	3419
	34.7 (53.4)	57.1 (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			
	179×10^4					257 × 10^4					531×10^4				741×10^4			
	53.2					76.3					158				220			
	17-bit absolute encoder*6																	
	2^{17} (131072)																	
	2^{16} (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 (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), 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 HA-800□-24					HA-800□-24D/E-200					HA-800□-24				HA-800□-24			

Specifications (CG type)

Item \ Model			SHA20A					SHA25A				
			50	80	100	120	160	50	80	100	120	160
Max. torque*2	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*2	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)	$GD^2/4$	$kg·m^2$	0.21	0.53	0.82	1.2	2.1	0.50	1.3	2	2.9	5.1
	J	$kgf·cms^2$	2.1	5.4	8	12	22	5.1	13	20	29	52
Inertia moment (with brake)	$GD^2/4$	$kg·m^2$	0.23	0.6	0.94	1.3	2.4	0.60	1.5	2.4	3.4	6.1
	J	$kgf·cms^2$	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		$25.2×10^4$					$39.2×10^4$				
	kgf·m/arc-min		7.5					11.6				
Encoder type			17-bit abosolute encoder*6									
Encoder resolution per motor revolution			2^{17} (131072)									
Motor multi revolution detection			2^{16} (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 (Protection class IP54: For details on protection classes, see the manual.)									
Environmental conditions			Operating temperature: 0 to 40℃/Storage temperature: -20 to 60℃, 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□-3D/E-200					HA-800□-3D/E-200 (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)

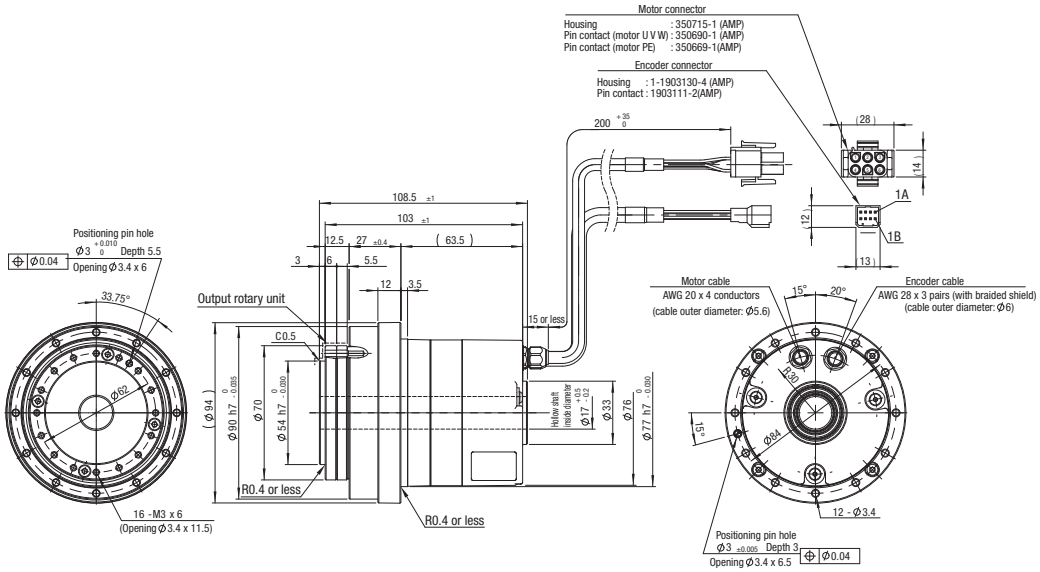
	SHA32A					SHA40A				
	50	80	100	120	160	50	80	100	120	160
	281	395	433	459	484	333 (523)	548 (675)	686 (738)	802	841
	28.7	40.3	44.2	46.8	49.4	34 (53.4)	55.9 (68.9)	70 (75.3)	81.8	85.8
	96	60	48	40	30	80	50	40	33.3	25
	20	33	41	49	66	25	40	50	60	80
	2.1	3.4	4.2	5	6.7	2.5	4.1	5.1	6.1	8.2
	17.7	15.4	13.7	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				
	100×10^4					179×10^4				
	29.6					53.2				
	17-bit abosolute encoder*6									
	2^{17} (131072)									
	2^{16} (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 (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), 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□-6D/E-200					HA-800□-6D/E-200 HA-800□-24D/E-200				

External dimensions

■SHA20A

(Speed Reducer Model: SG type)

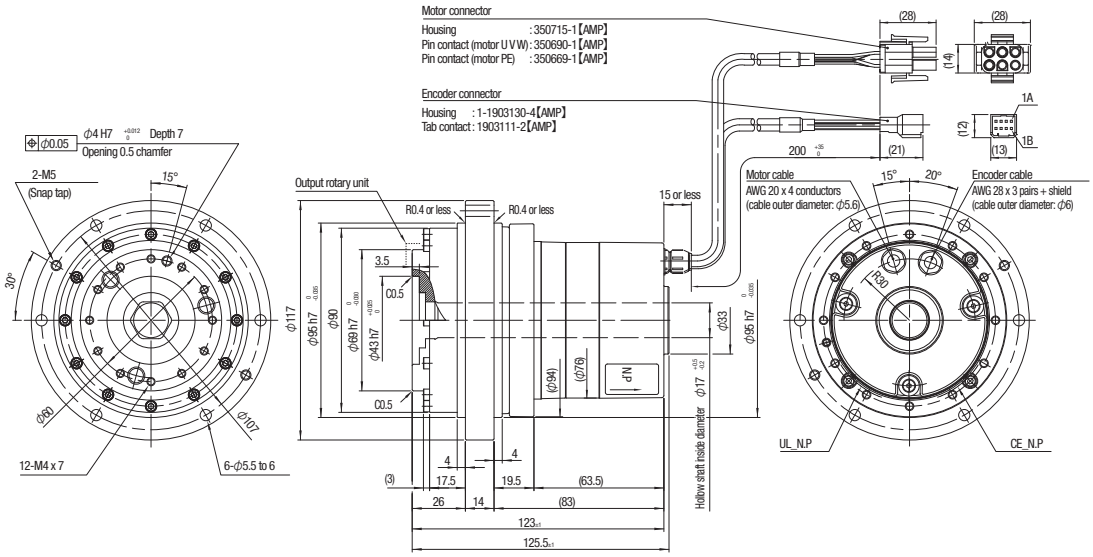
Unit: mm



■SHA20A

(Speed Reducer Model: CG type)

Unit: mm

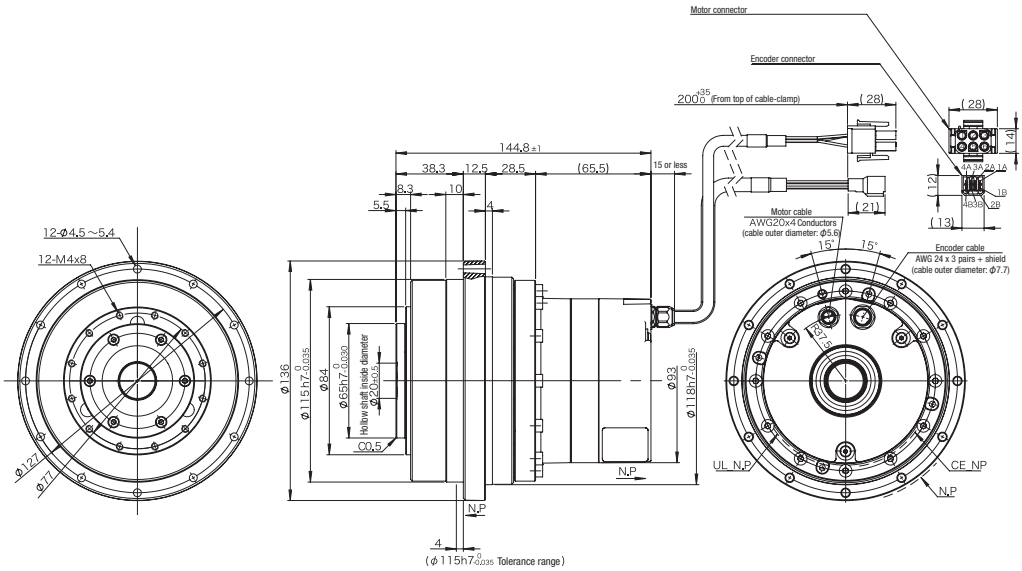


Note: For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.
Tolerances may vary due to product manufacturing method (foundry piece, machine-finished good).
Please contact us for the tolerance when it is not indicated in the dimensions.

■SHA25A

(Speed Reducer Model: HP type)

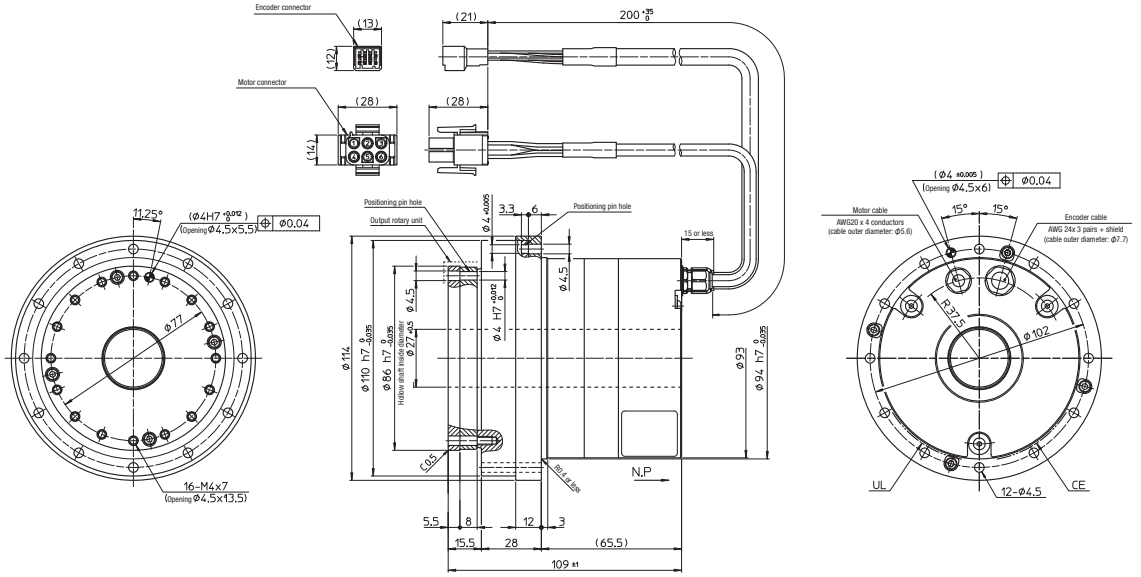
Unit: mm



■SHA25A

(Speed Reducer Model: SG type)

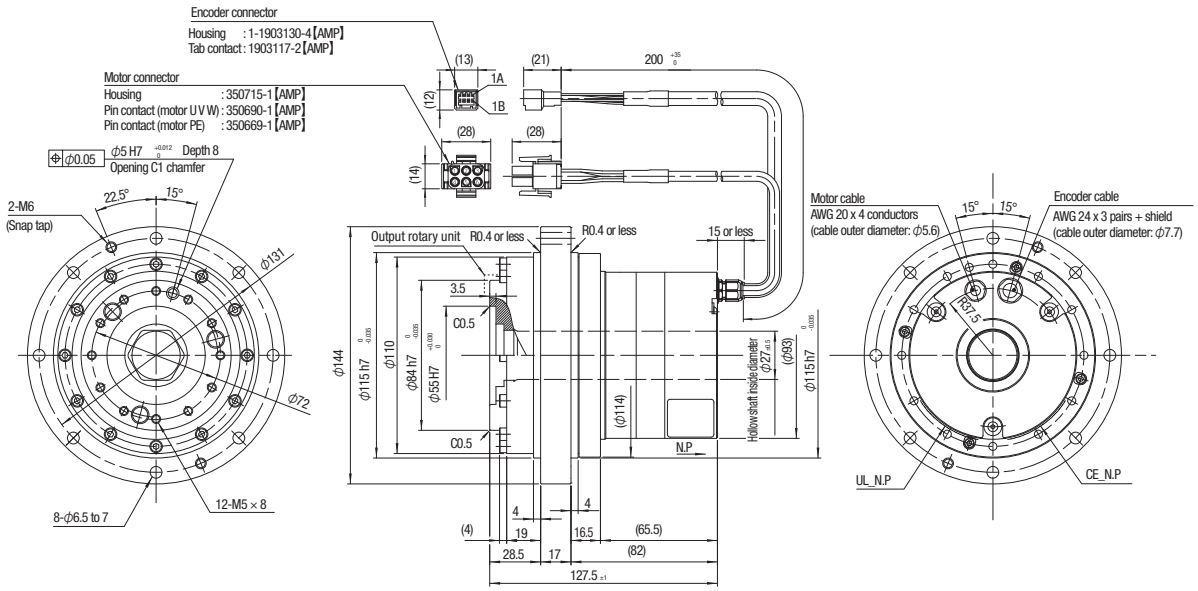
Unit: mm



■SHA25A

(Speed Reducer Model: CG type)

Unit: mm



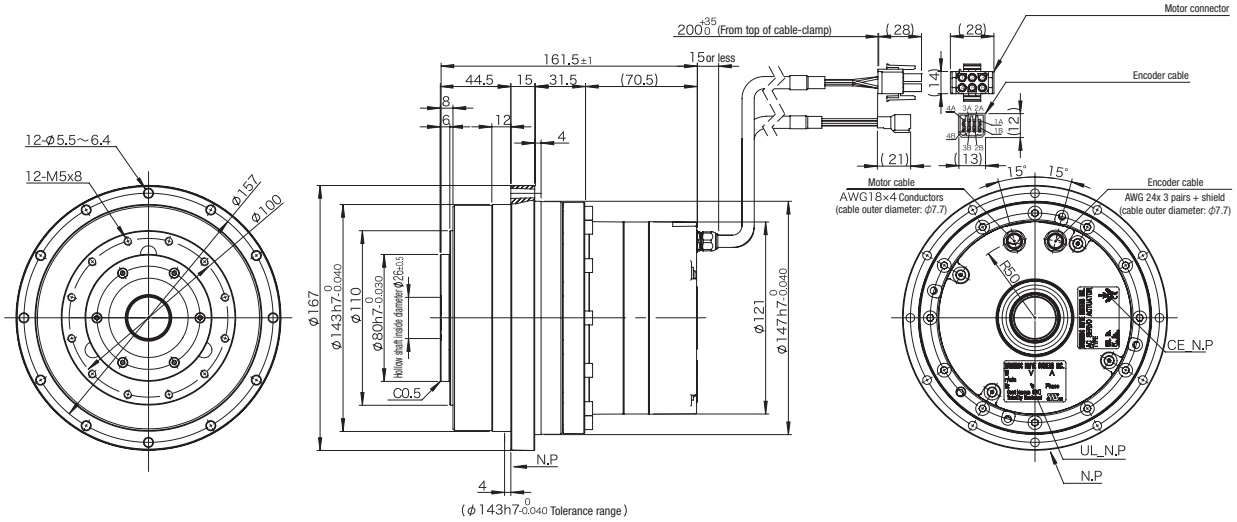
Note: For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.
Tolerances may vary due to product manufacturing method (foundry piece, machine-finished good).
Please contact us for the tolerance when it is not indicated in the dimensions.

External dimensions

■SHA32A

(Speed Reducer Model: HP type)

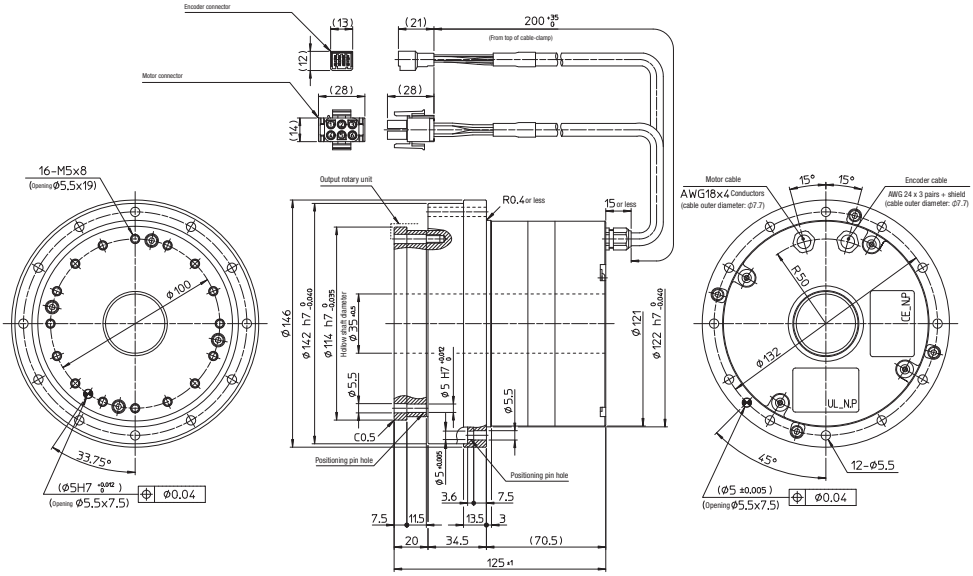
Unit: mm



■SHA32A

(Speed Reducer Model: SG type)

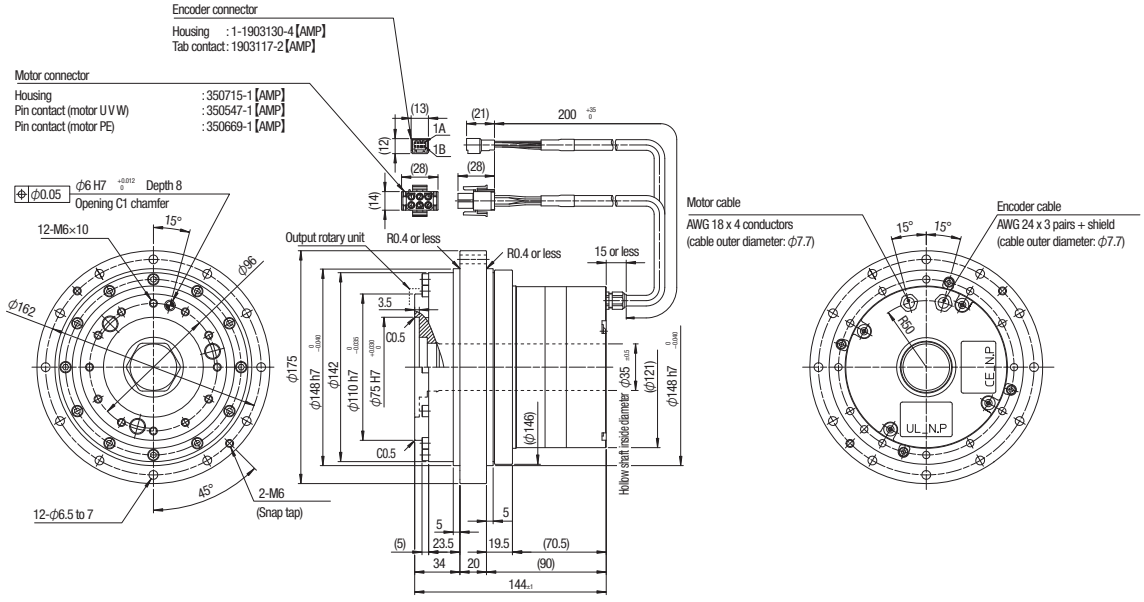
Unit: mm



■SHA32A

(Speed Reducer Model: CG type)

Unit: mm

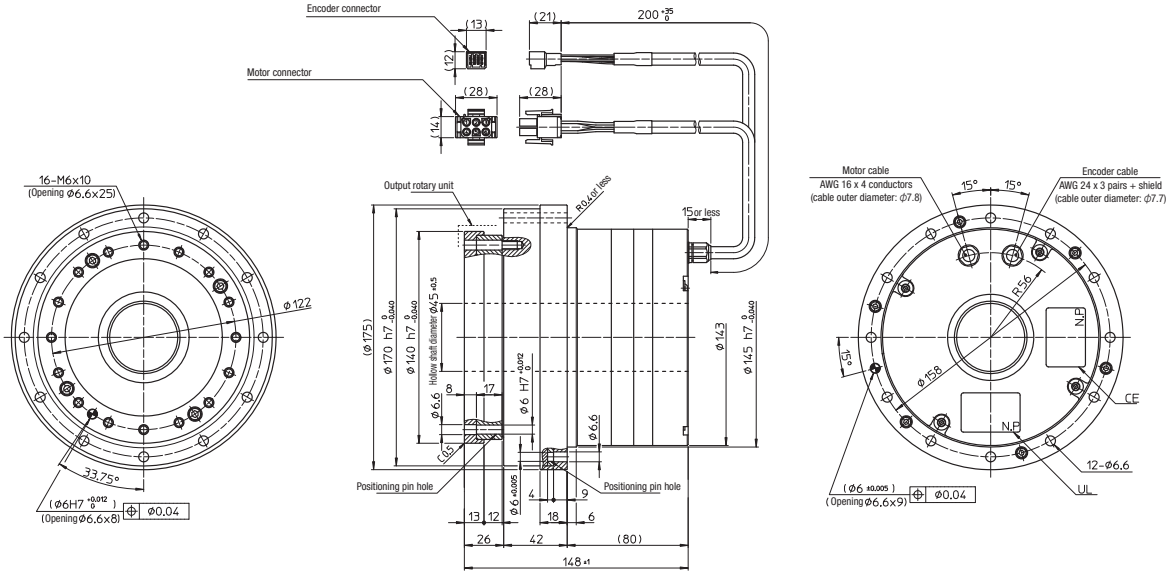


Note: For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.
Tolerances may vary due to product manufacturing method (foundry piece, machine-finished good).
Please contact us for the tolerance when it is not indicated in the dimensions.

■SHA40A

(Speed Reducer Model: SG type)

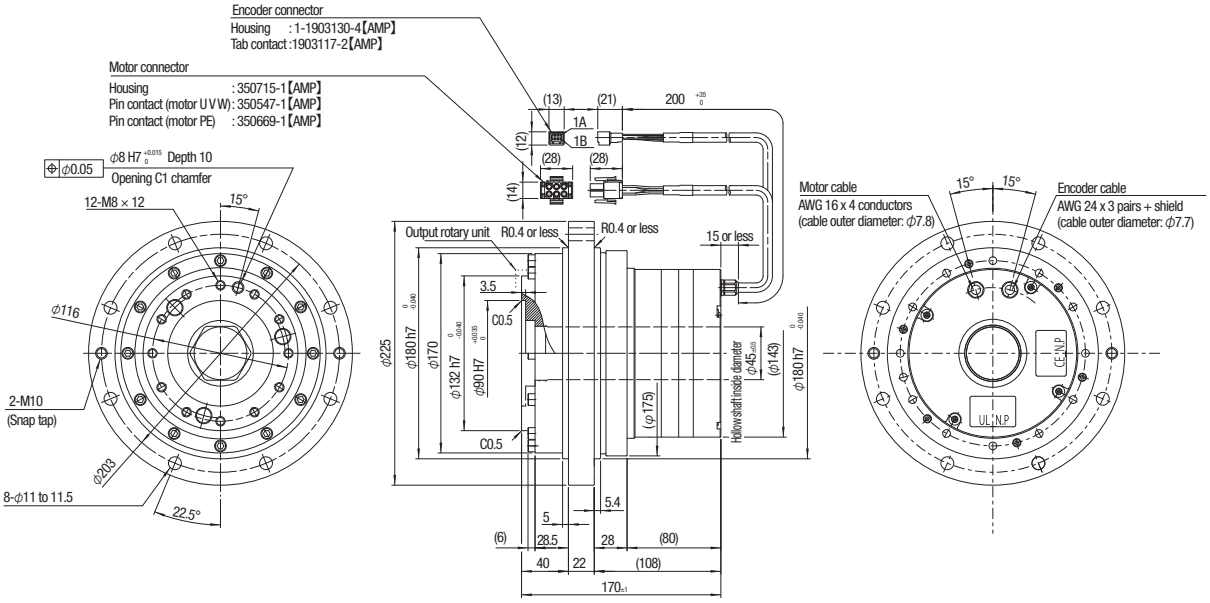
Unit: mm



■SHA40A

(Speed Reducer Model: CG type)

Unit: mm



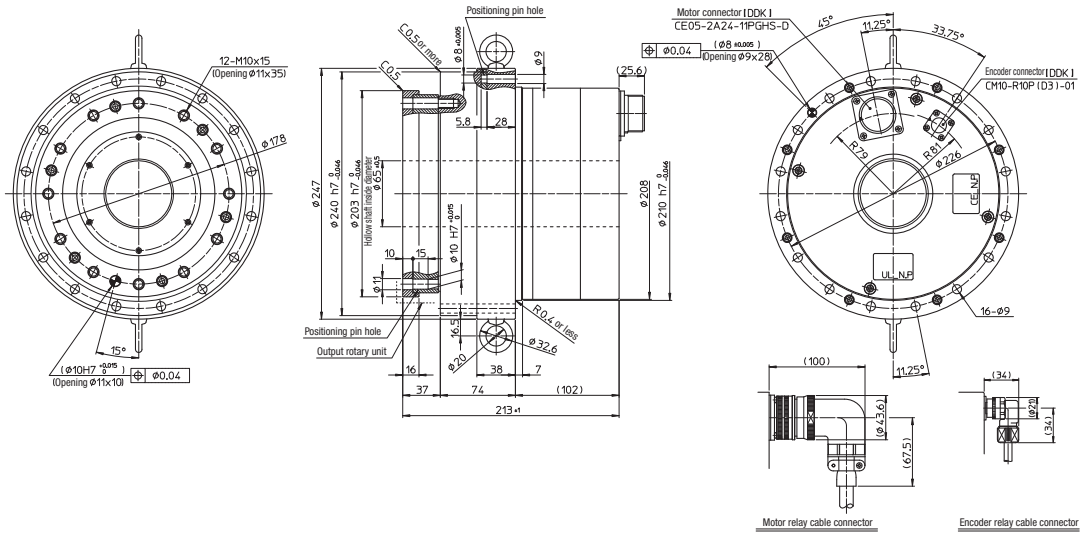
Note: For details on dimensions and shapes, check the illustrated specifications issued by Harmonic Drive Systems, Inc.
Tolerances may vary due to product manufacturing method (foundry piece, machine-finished good).
Please contact us for the tolerance when it is not indicated in the dimensions.

External dimensions

■SHA58A

(Speed Reducer Model: SG type)

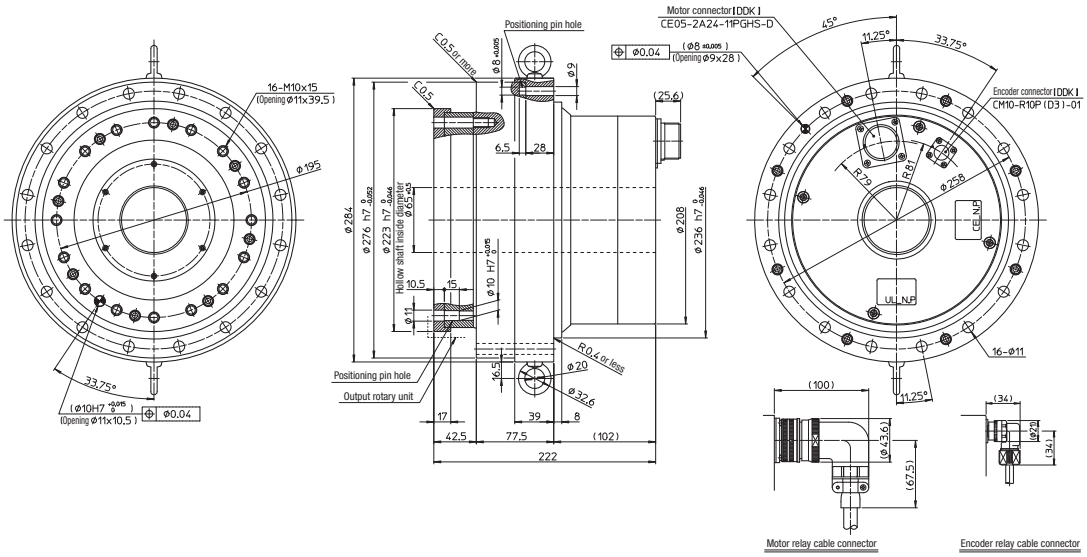
Unit: mm



■SHA65A

(Speed Reducer Model: SG type)

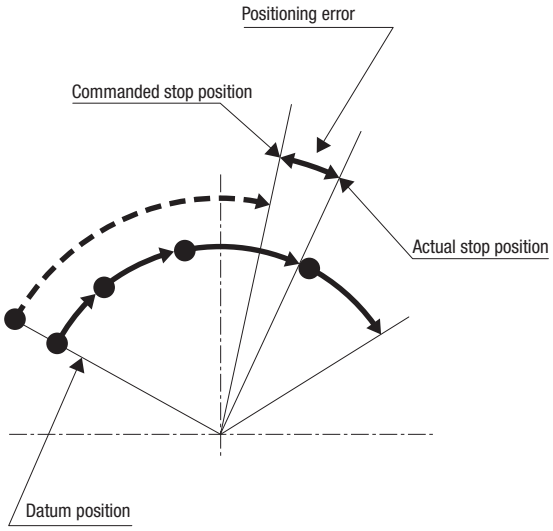
Unit: mm



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:

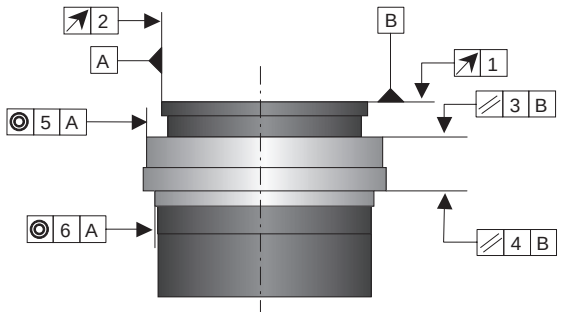


Speed reducer type / reduction ratio \ Model		SHA20A	SHA25A	SHA32A	SHA40A	SHA58A	SHA65A
HP type	1:11	—	120	120	—	—	—
SG type	1:51	60	50	50	50	—	—
	1:81 or more	50	40	40	40	40	40
CG type	1:50	60	50	40	40	—	—
	1:80 or more	50	40	30	30	—	—

Mechanical accuracy

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

■SHA-SG/HP type

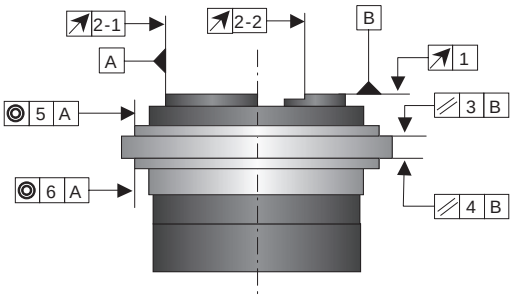


(Unit: mm)

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

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



(Unit: mm)

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

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

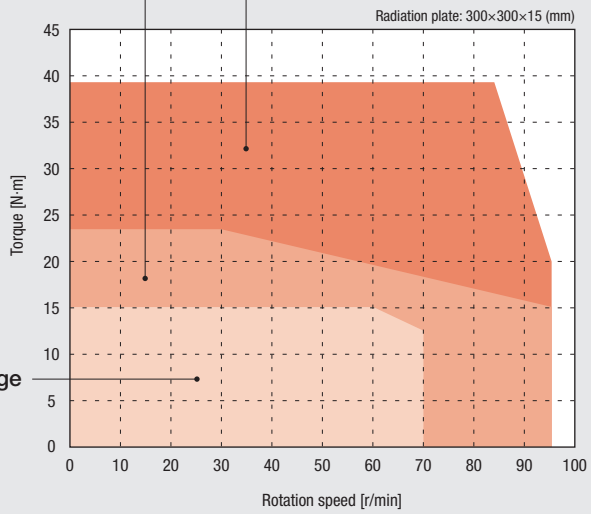
This range indicates the torque rotation speed at which the actuator can be operated at 50% duty operation (the ratio of operating time and delay time is 50:50).

■ 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.

■ Continuous motion range

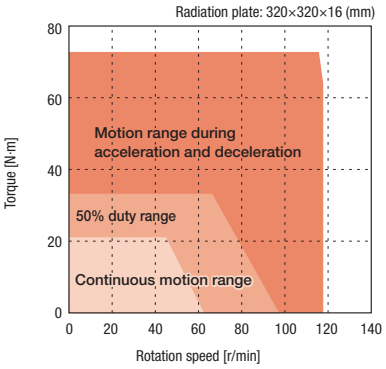
This range indicates the torque rotation speed at which the actuator can be operated continuously.



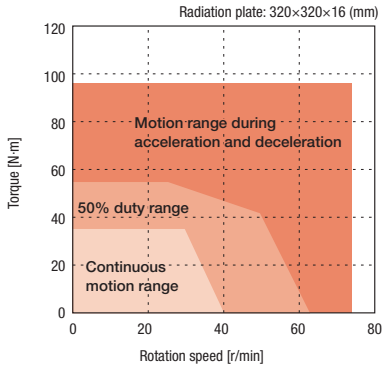
Note 1: Values in the continuous and 50% duty motion ranges are measured on the condition where the radiation plate specified in the graph is installed.
Note 2: See the manual for details on model number selection.

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

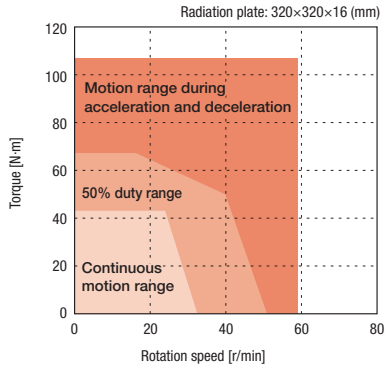
■ SHA20A51SG Input voltage: 200 V



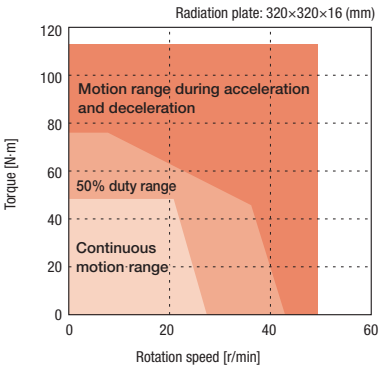
■ SHA20A81SG Input voltage: 200 V



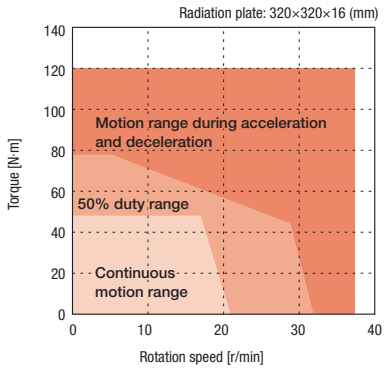
■ SHA20A101SG Input voltage: 200 V



■ SHA20A121SG Input voltage: 200 V

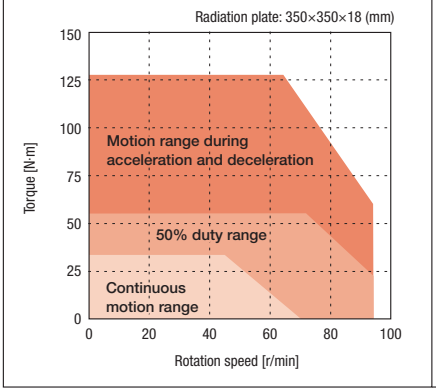


■ SHA20A161SG Input voltage: 200 V

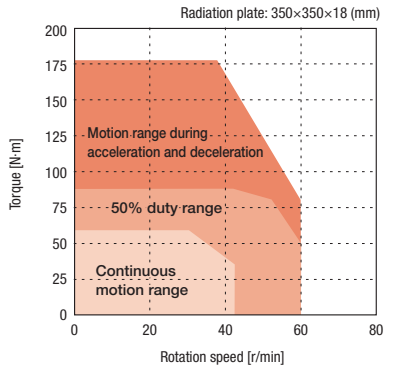


■SHA25-SG type (100 VAC model)《combined driver: HA-800□-6D -100》

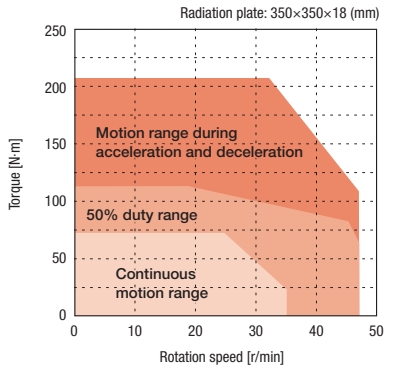
■ SHA25A51SG Input voltage: 100 V



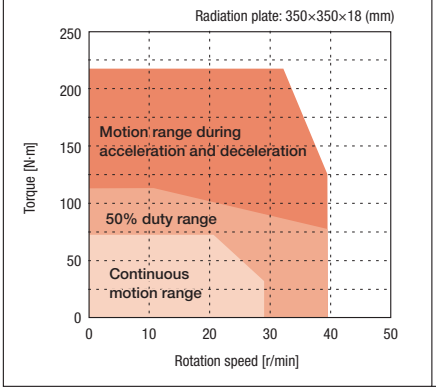
■ SHA25A81SG Input voltage: 100 V



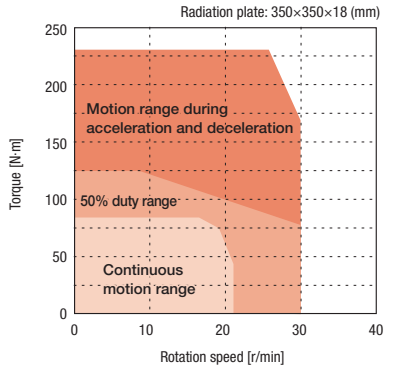
■ SHA25A101SG Input voltage: 100 V



■ SHA25A121SG Input voltage: 100 V

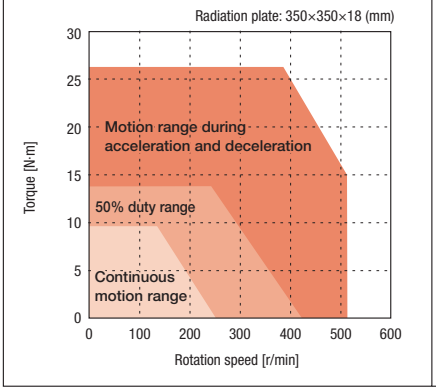


■ SHA25A161SG Input voltage: 100 V

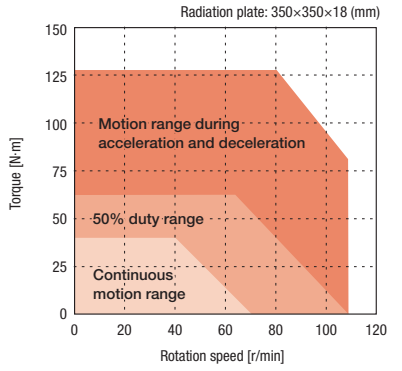


■SHA25-SG/HP type (200 VAC model)《combined driver: HA-800□-3D -200》

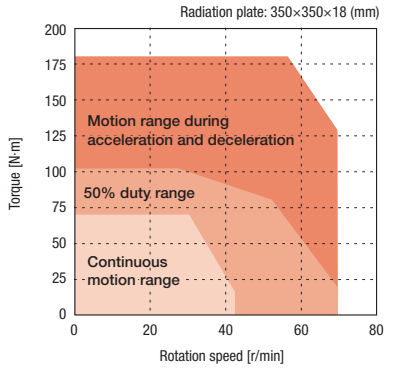
■ SHA25A11HP Input voltage: 200 V



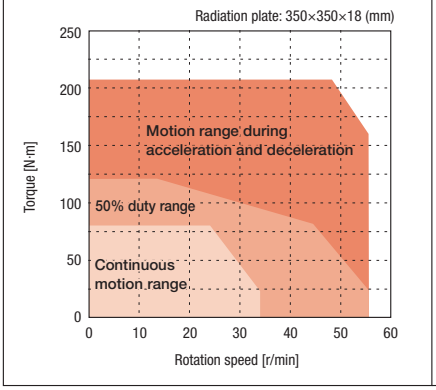
■ SHA25A51SG Input voltage: 200 V



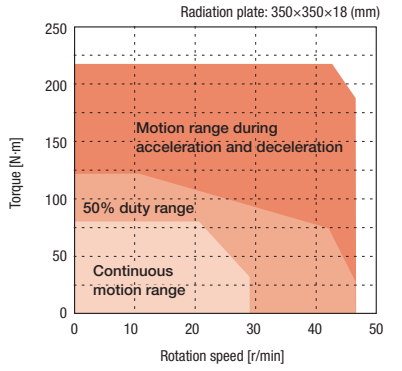
■ SHA25A81SG Input voltage: 200 V



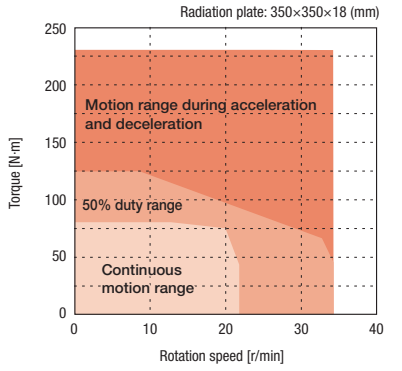
■ SHA25A101SG Input voltage: 200 V



■ SHA25A121SG Input voltage: 200 V



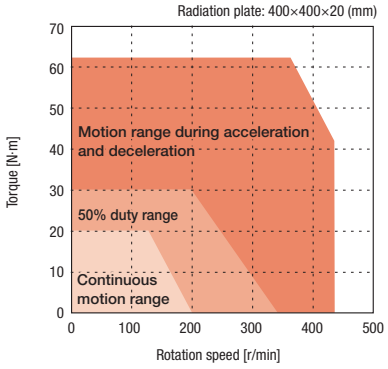
■ SHA25A161SG Input voltage: 200 V



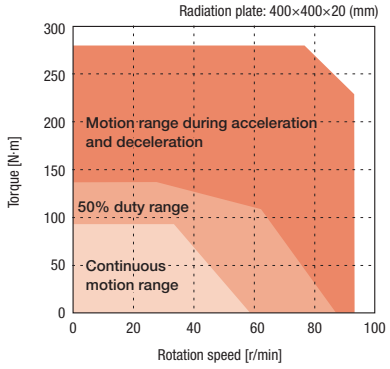
Operable range

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

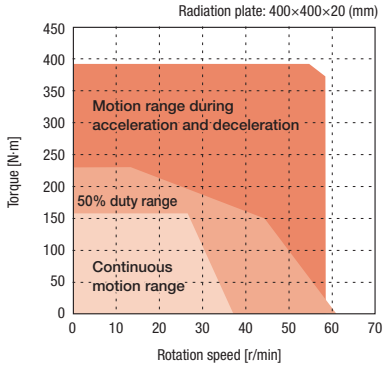
■ SHA32A11HP Input voltage: 200 V



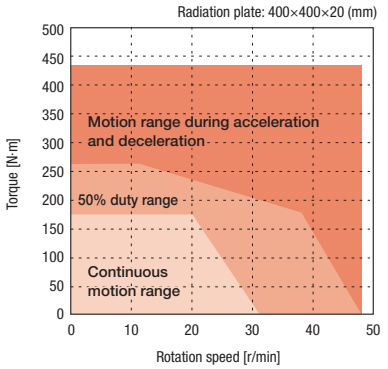
■ SHA32A51SG Input voltage: 200 V



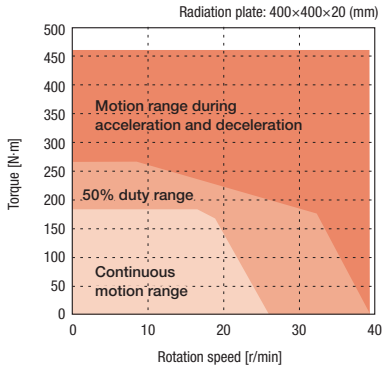
■ SHA32A81SG Input voltage: 200 V



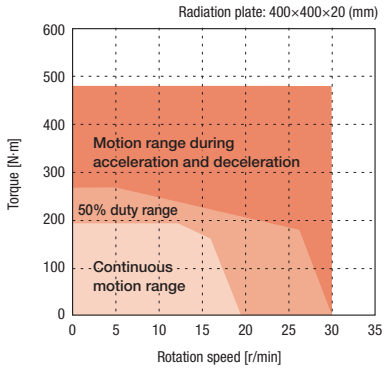
■ SHA32A101SG Input voltage: 200 V



■ SHA32A121SG Input voltage: 200 V

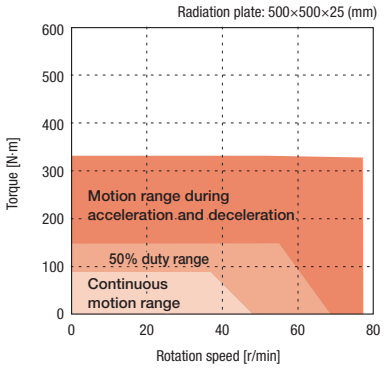


■ SHA32A161SG Input voltage: 200 V

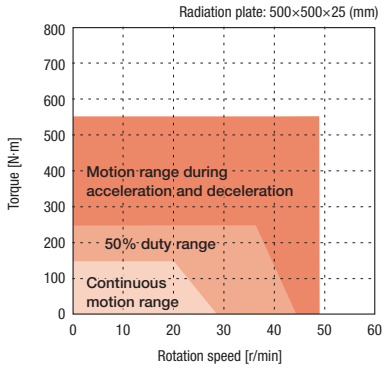


■SHA40-SG type《combined driver: HA-800□-6D -200》

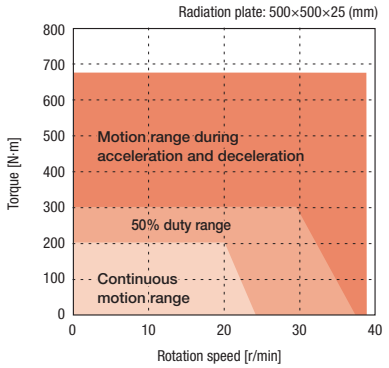
■ SHA40A51SG Input voltage: 200 V



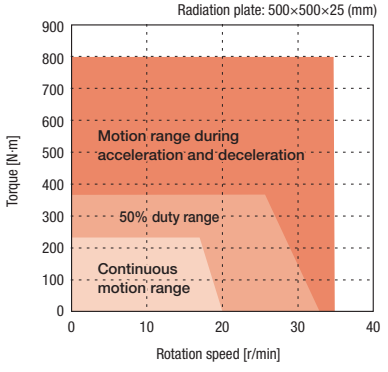
■ SHA40A81SG Input voltage: 200 V



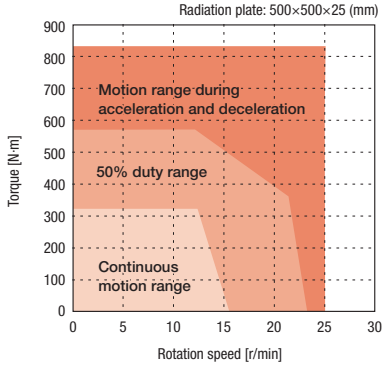
■ SHA40A101SG Input voltage: 200 V



■ SHA40A121SG Input voltage: 200 V

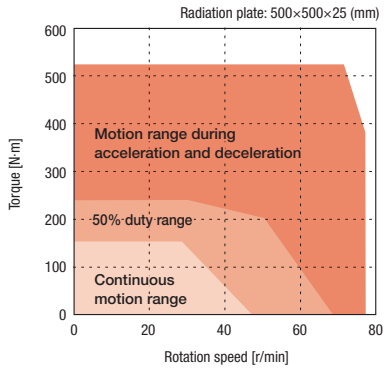


■ SHA40A161SG Input voltage: 200 V

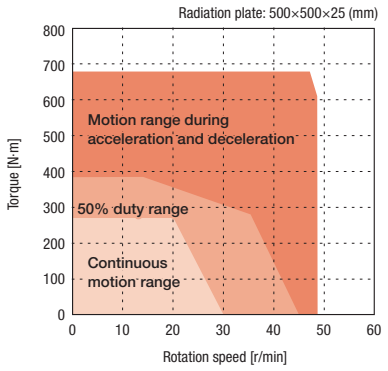


■SHA40-SG type《combined driver: HA-800□-24D -200》

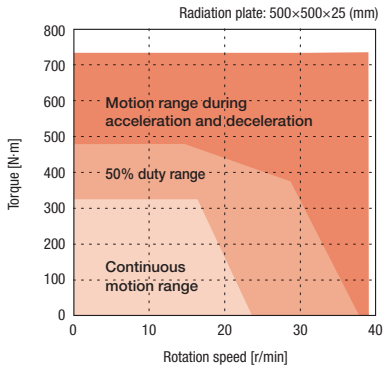
■ SHA40A51SG Input voltage: 200 V



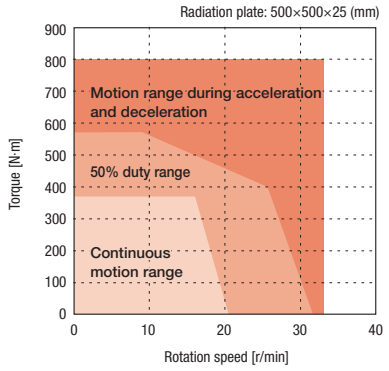
■ SHA40A81SG Input voltage: 200 V



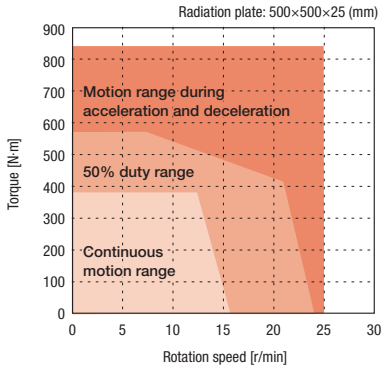
■ SHA40A101SG Input voltage: 200 V



■ SHA40A121SG Input voltage: 200 V

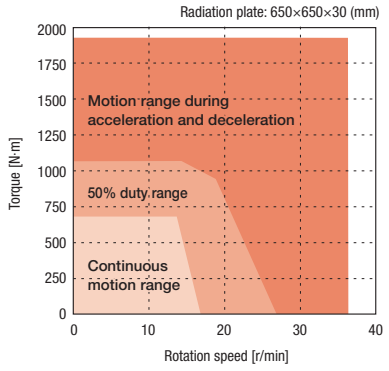


■ SHA40A161SG Input voltage: 200 V

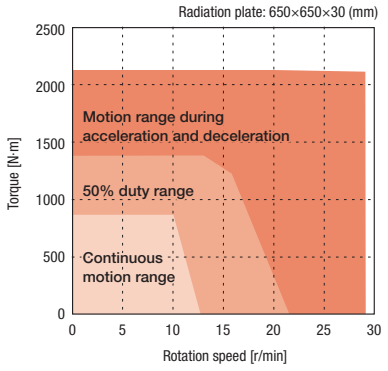


■SHA58-SG type《combined driver: HA-800□-24D -200》

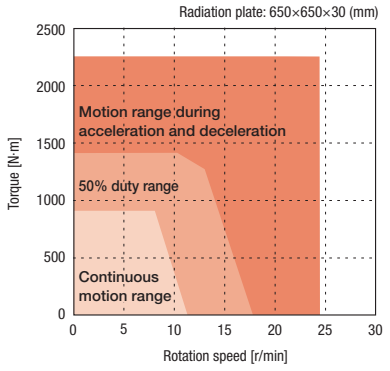
■ SHA58A81SG Input voltage: 200 V



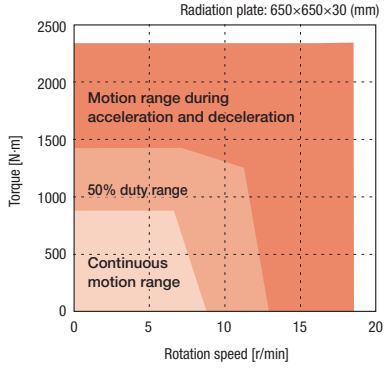
■ SHA58A101SG Input voltage: 200 V



■ SHA58A121SG Input voltage: 200 V



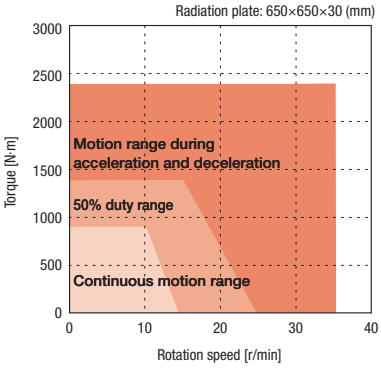
■ SHA58A161SG Input voltage: 200 V



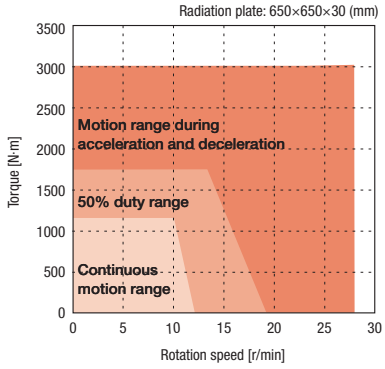
Operable range

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

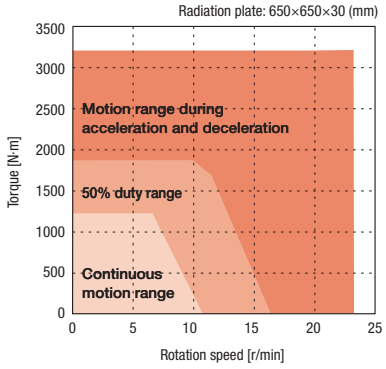
■ SHA65A81SG Input voltage: 200 V



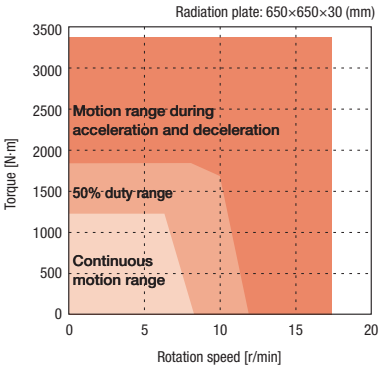
■ SHA65A101SG Input voltage: 200 V



■ SHA65A121SG Input voltage: 200 V

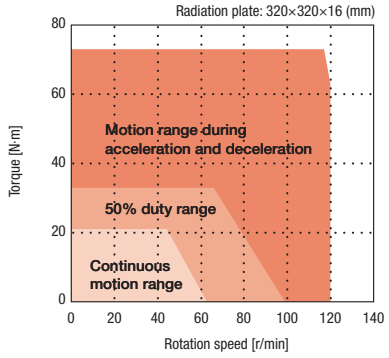


■ SHA65A161SG Input voltage: 200 V

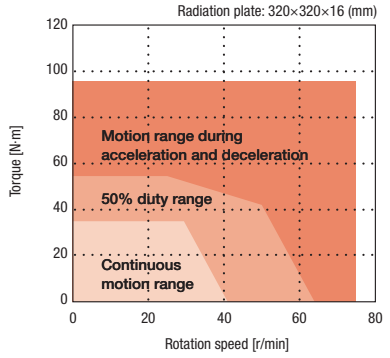


■SHA20-CG type《combined driver: HA-800□-3D/E -200》

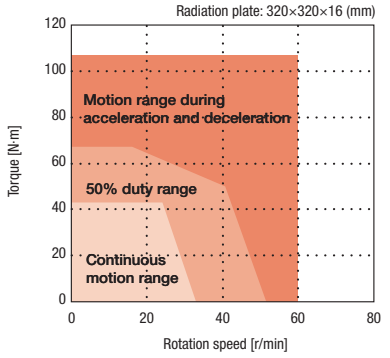
■ SHA20A50CG Input voltage: 200 V



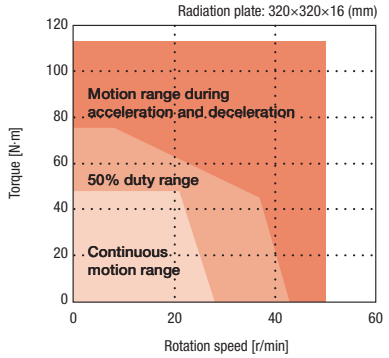
■ SHA20A80CG Input voltage: 200 V



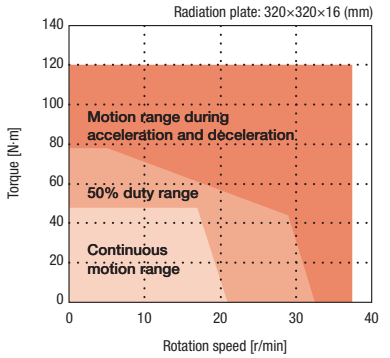
■ SHA20A100CG Input voltage: 200 V



■ SHA20A120CG Input voltage: 200 V

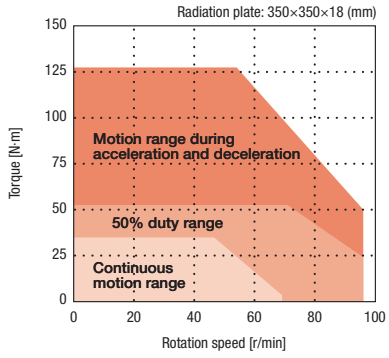


■ SHA20A160CG Input voltage: 200 V

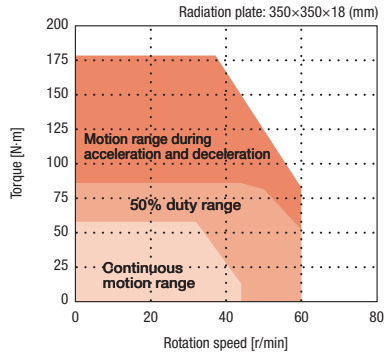


■SHA25-CG type (100 VAC model)《combined driver: HA-800□-6D/ E -100》

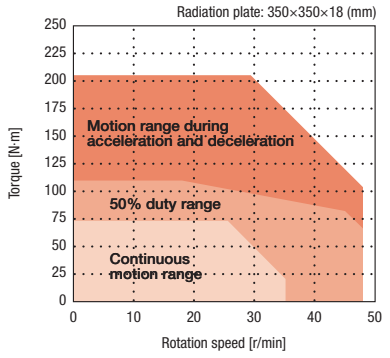
■ SHA25A50CG Input voltage: 100 V



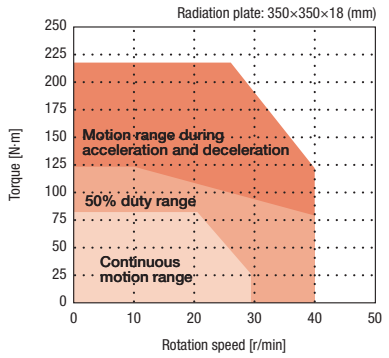
■ SHA25A80CG Input voltage: 100 V



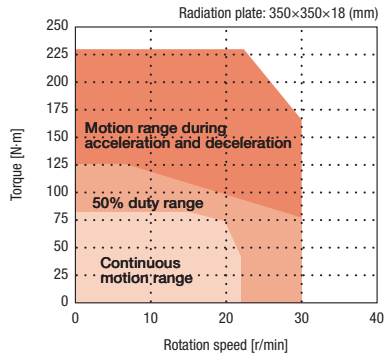
■ SHA25A100CG Input voltage: 100 V



■ SHA25A120CG Input voltage: 100 V



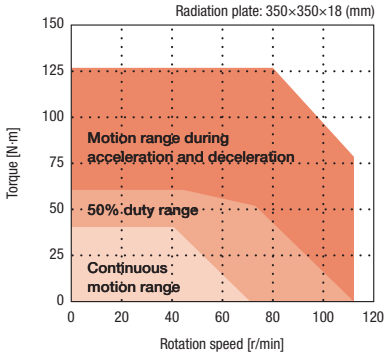
■ SHA25A160CG Input voltage: 100 V



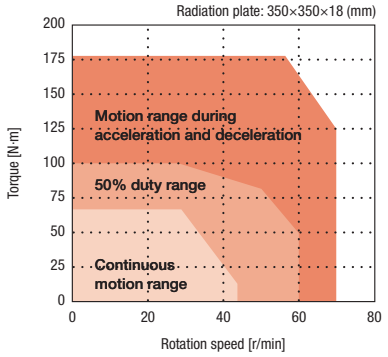
Operable range

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

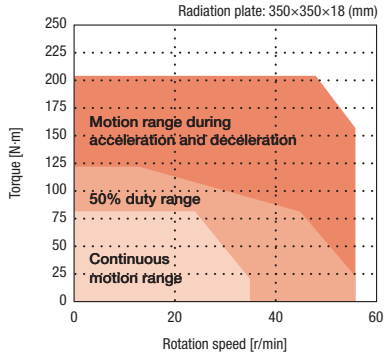
■ SHA25A50CG Input voltage: 200 V



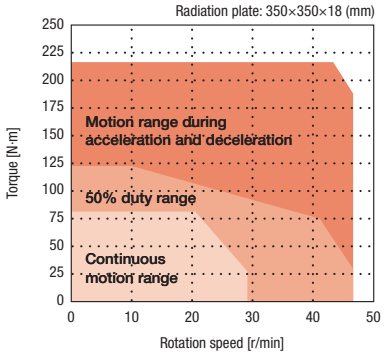
■ SHA25A80CG Input voltage: 200 V



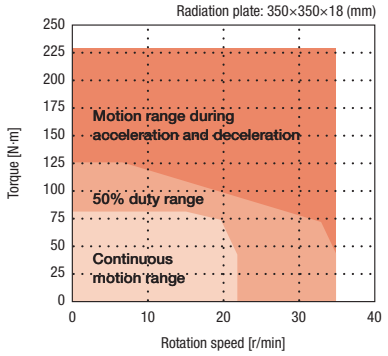
■ SHA25A100CG Input voltage: 200 V



■ SHA25A120CG Input voltage: 200 V

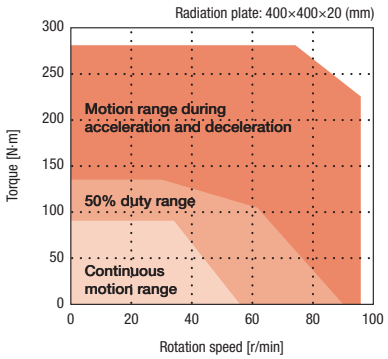


■ SHA25A160CG Input voltage: 200 V

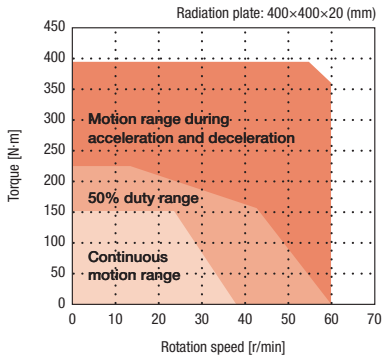


■SHA32-CG type《combined driver: HA-800□-6D/ E -200》

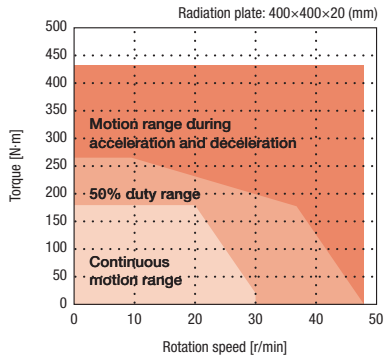
■ SHA32A50CG Input voltage: 200 V



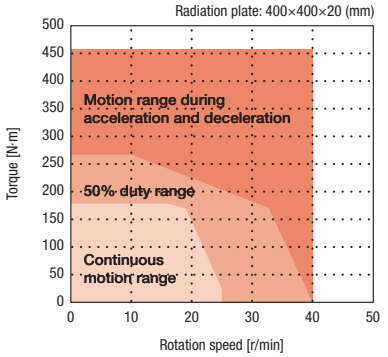
■ SHA32A80CG Input voltage: 200 V



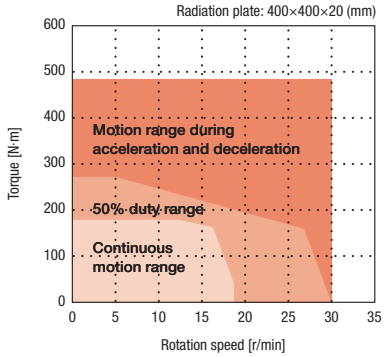
■ SHA32A100CG Input voltage: 200 V



■ SHA32A120CG Input voltage: 200 V



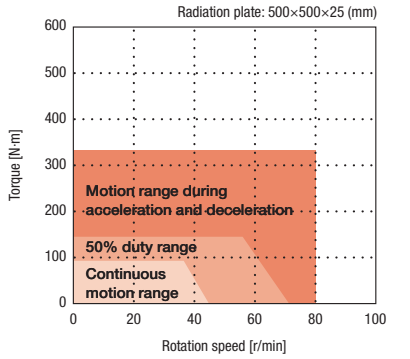
■ SHA32A160CG Input voltage: 200 V



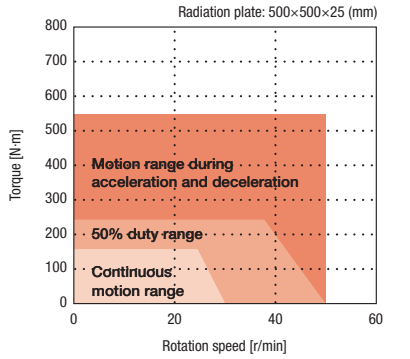
Operable range

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

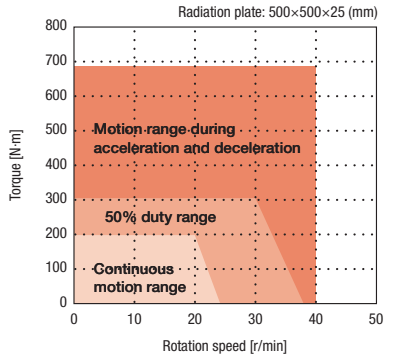
■ SHA40A50CG Input voltage: 200 V



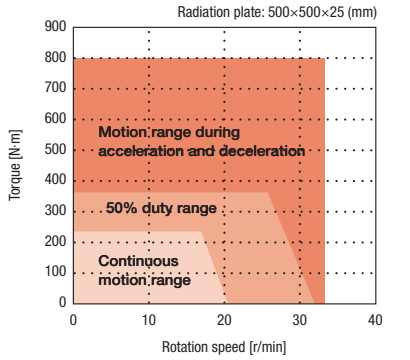
■ SHA40A80CG Input voltage: 200 V



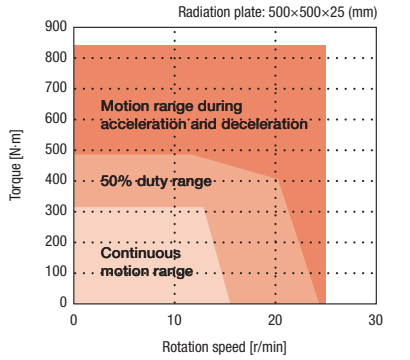
■ SHA40A100CG Input voltage: 200 V



■ SHA40A120CG Input voltage: 200 V

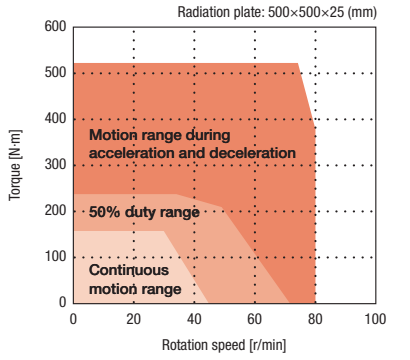


■ SHA40A160CG Input voltage: 200 V

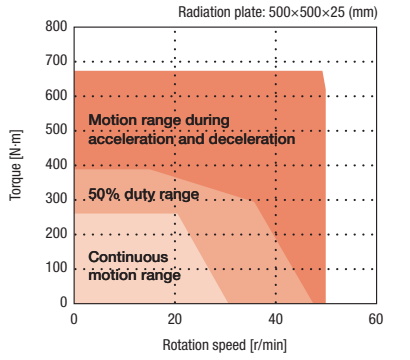


■SHA40-CG type《combined driver: HA-800□-24D/ E -200》

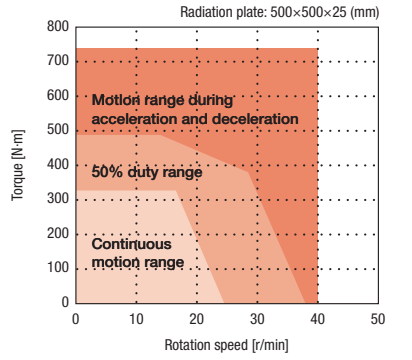
■ SHA40A50CG Input voltage: 200 V



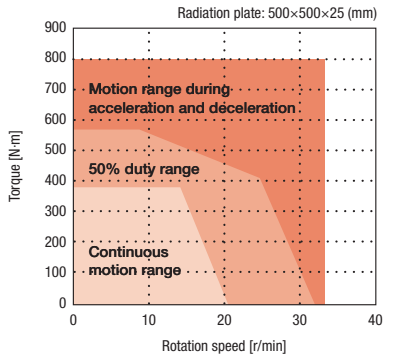
■ SHA40A80CG Input voltage: 200 V



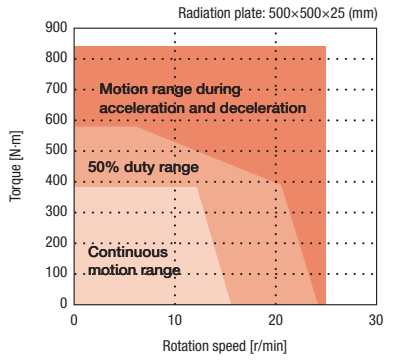
■ SHA40A100CG Input voltage: 200 V



■ SHA40A120CG Input voltage: 200 V



■ SHA40A160CG Input voltage: 200 V

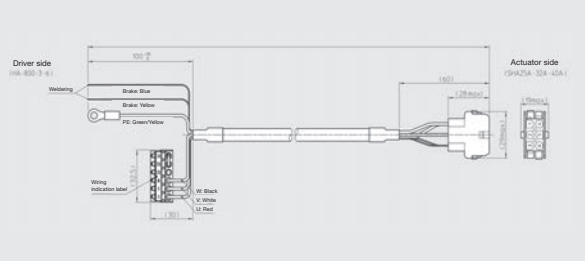


Options

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

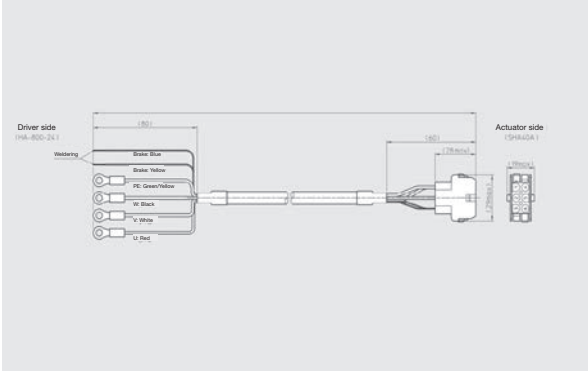
The cable for connecting SHA series to HA-800 driver.
There are two types of relay cable; for motor (including brake wire) and for absolute encoder. The relay cable is required for connecting SHA series to HA-800 driver.
Standard cable lengths are 3, 5 and 10m.



Relay Cable (for motors)

Actuator model No. 40 (when combined with HA-800-24D/E)
Order Code Example: EWD-MB * * -A06-TMC

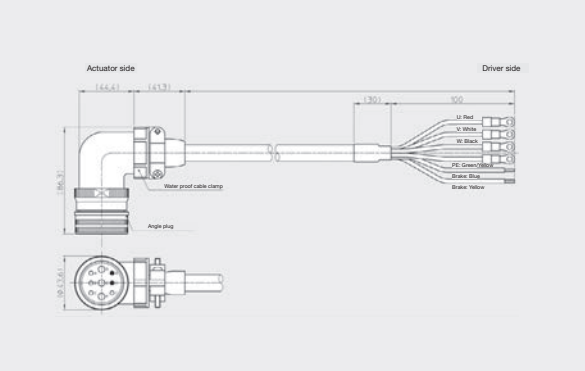
Standard cable lengths are 3, 5 and 10m.



Relay Cable (for motors)

Actuator model No. 58, 65 (SG type)
Order Code Example: EWD-MB * * -D09-TMC

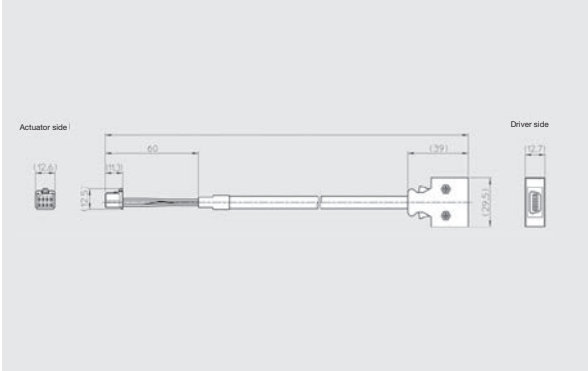
Standard cable lengths are 3, 5 and 10m.



Relay Cable (for absolute encoders)

Actuator model No. 20, 25, 32, 40
Order Code Example: EWD-S * * -A08-3M14

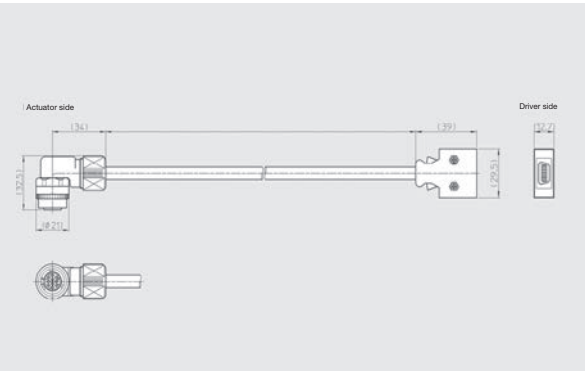
Standard cable lengths are 3, 5 and 10m.



Relay Cable (for absolute encoders)

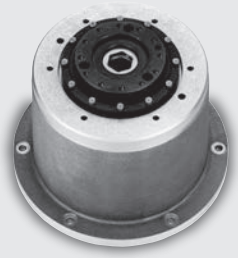
Actuator model No. 58, 65 (SG type)
Order Code Example: EWD-S * * -D10-3M14

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.

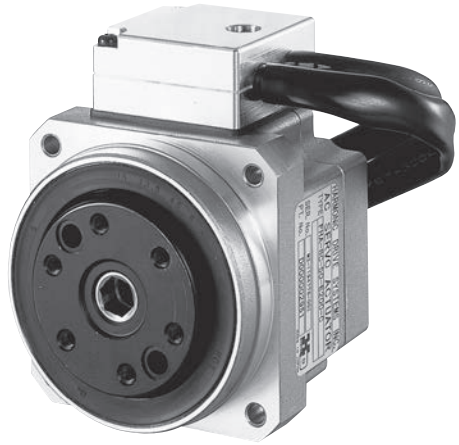


Note
1. For detailed dimensions and specifications of the actuator, refer to the manual or illustrated specifications.
2. The stand is used for SHA-CG type only and the cable is taken out from the side of the actuator.

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.

CE

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).

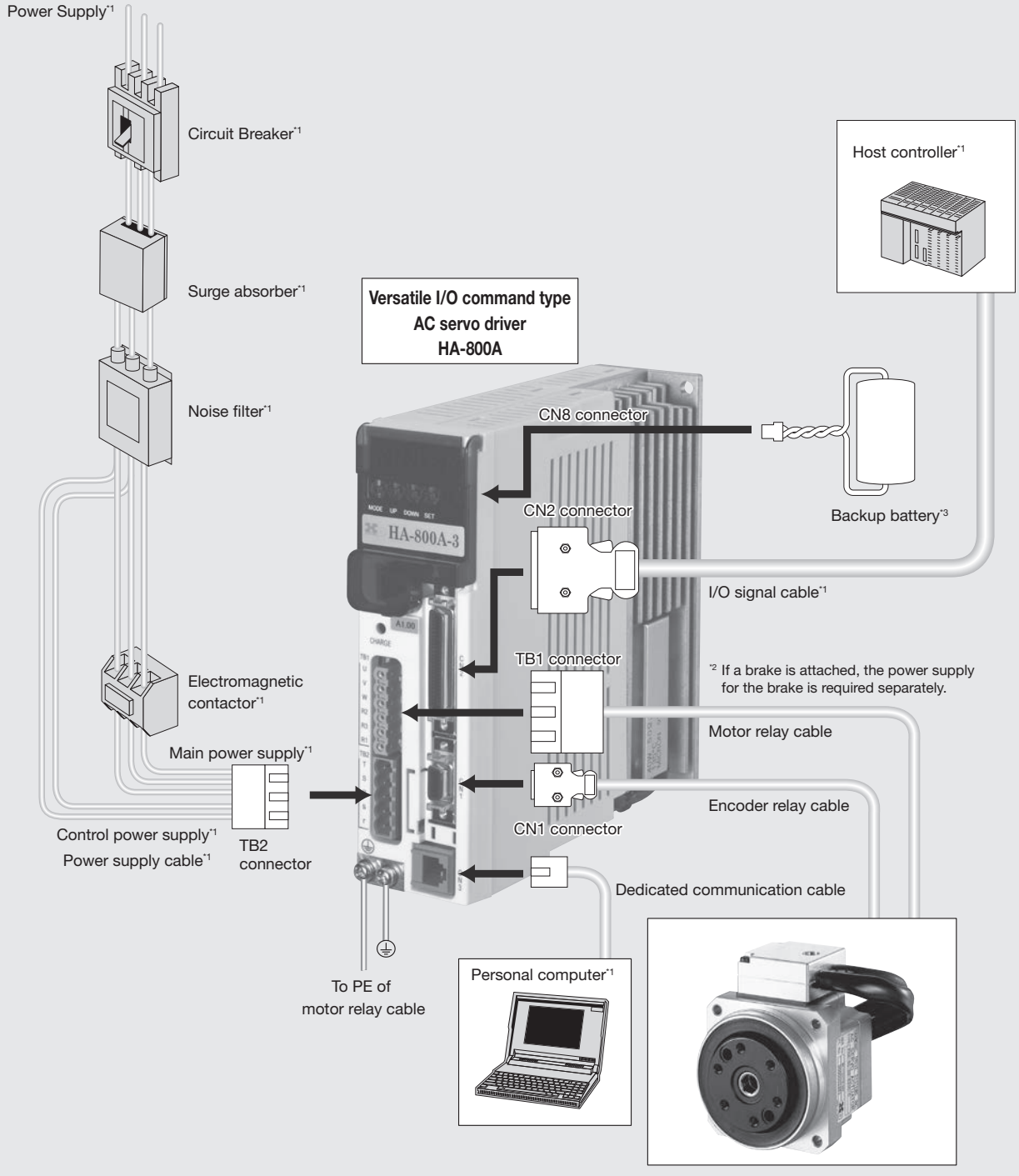
High-precision, high load sustaining bearing

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.

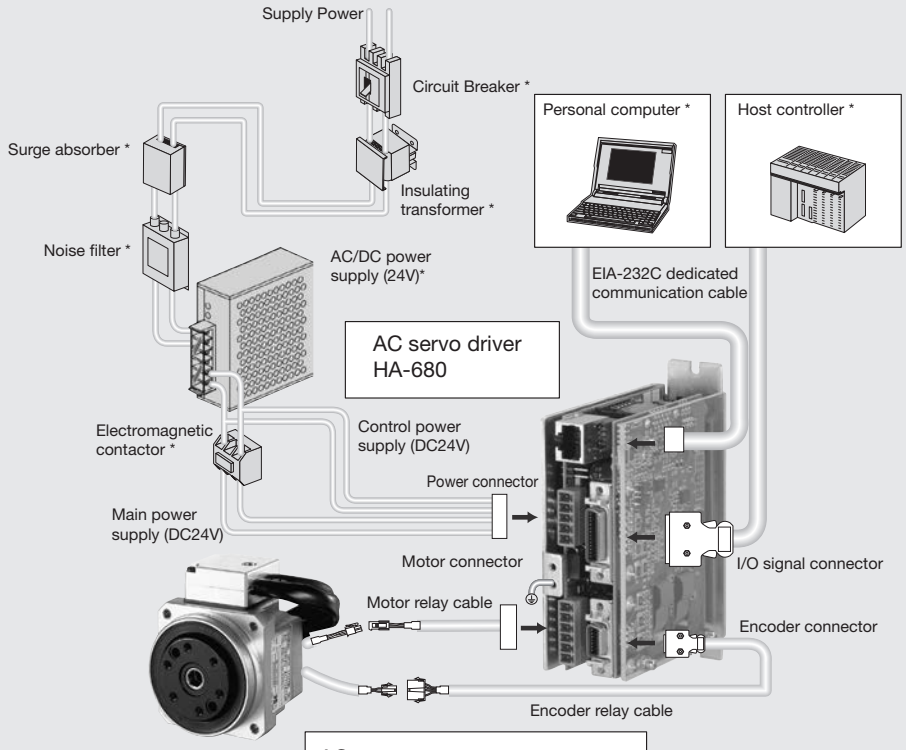
Versatile I/O command type System configuration



*1: The customer should provide marked devices separately.
*2: See the manual for details on power supply related configurations.
*3: When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

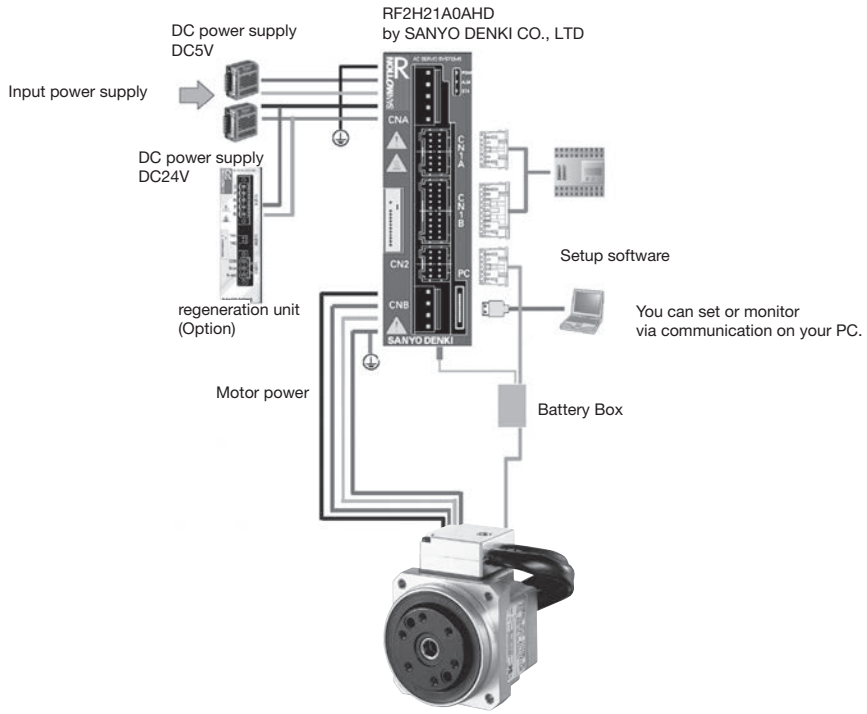
Example of System Configuration

An example of system configuration of FHA-C mini series 24V specification and the servo driver HA-680 series is illustrated.



Notes:
Starred (*) items are to be supplied by the customer.
Supply power of servo driver HA-680 must be DC24V.

An example of system configuration of FHA-C mini series 24V Spec. and RF2H21A0AHD manufactured by SANYO DENKI CO., LTD is illustrated.



Models and Symbols

FHA – 8 C – 30 – E200 A – C ☐ K

- Type: AC servo actuator FHA-C mini series
- Model Nos.: 8, 11 or 14
- Version symbol
- HarmonicDrive® reduction ratios: 30, 50 and 100
- Encoder type and resolution:

E200	Incremental encoder	2000p/rev
12S17b	Absolute encoder*	131,072p/rev (17bit)

- Absolute encoder specification
- Input power voltage
  A: AC100V specification* G: AC200V specification*
  E: DC24V specification (Inquire at Harmonic drive's sales office for combined driver) (Blank for incremental encoder specification)
- Connector supplied (Standard specification)
- Incremental encoder specification
- Input power supply
  None: AC100V, 200V specification
  E: DC24V specification (incremental encoder specification)
- Cable lead-out direction
  None: Lateral (Standard specification)
  K: Rear (Option specification/ only incremental encoder is supported)

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

Specification

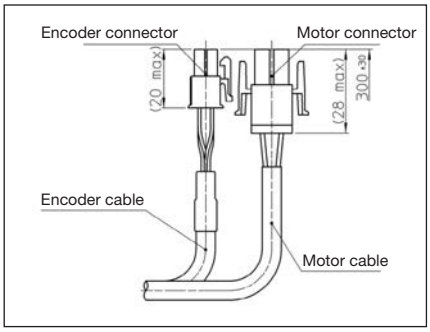
Item \ Model				FHA-8C			FHA-11C			FHA-14C		
				30	50	100	30	50	100	30	50	100
Maximum Torque *2 *5		N·m		1.8	3.3	4.8	4.5	8.3	11	9.0 (8.5)	18 (15.5)	28
		kgf·m		0.18	0.34	0.49	0.46	0.85	1.1	0.92 (0.87)	1.8 (1.6)	2.9
Max. Rotational Speed		r/min		200	120	60	200	120	60	200	120	60
Torque Constant		100V·200V	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 *2 *5		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 *3	INC	$GD^2/4$	$kg·m^2$	0.0026	0.0074	0.029	0.0060	0.017	0.067	0.018	0.050	0.20
		J	$kgf·cms^2$	0.027	0.075	0.30	0.061	0.17	0.68	0.18	0.51	2.0
	ABS	$GD^2/4$	$kg·m^2$	0.0026	0.0073	0.029	0.0062	0.017	0.069	0.019	0.054	0.215
		J	$kgf·cms^2$	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		$2×10^4$			$4×10^4$			$8×10^4$		
		kgf·m/arc-min		0.59			1.2			2.4		
Detector Resolution (At x4) *4	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		
	ABS			0.50			0.75			1.3		
Protection Structure				Totally enclosed self-cooled type								
Environmental Conditions				Operating temperature 0 to 40°C, storage temperature -20 to 60°C 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 *7		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 incoder)

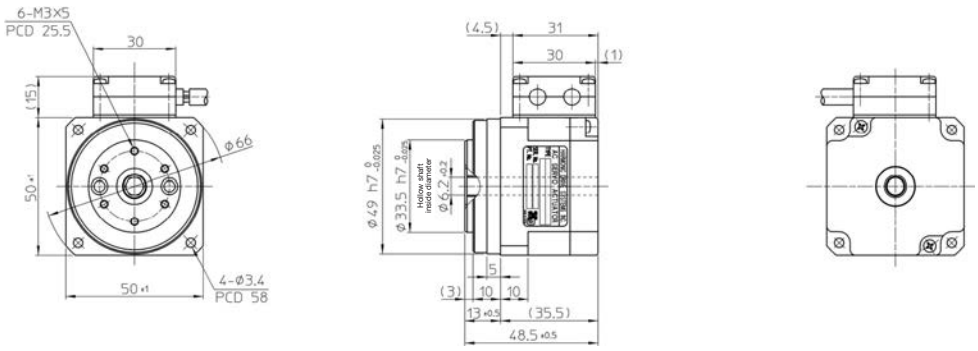
External Dimensions (Incremental encoder specification)

Unit: mm

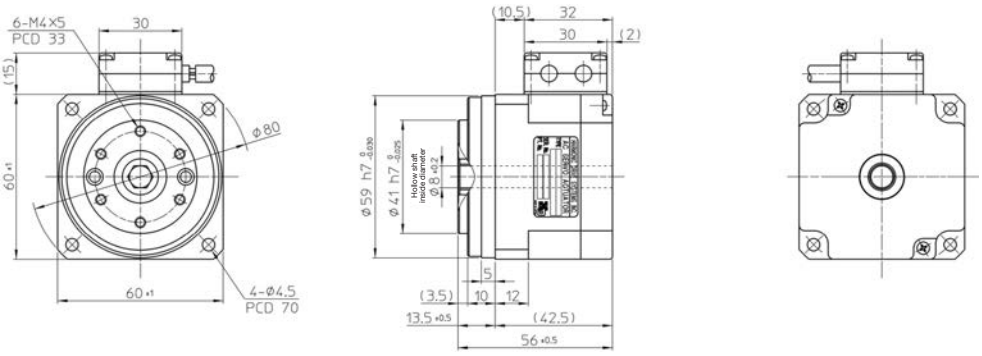
Motor Encoder Cable
(Same for all models)



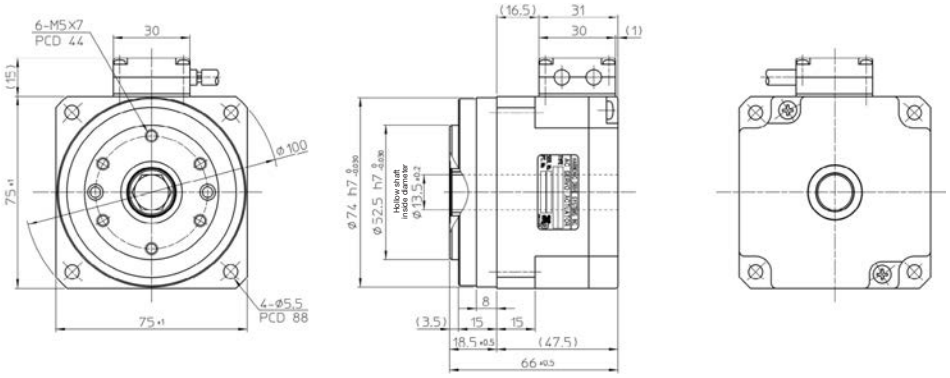
■FHA-8C



■FHA-11C



■FHA-14C

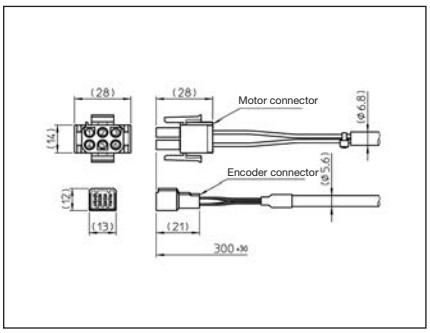


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.
* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).
Contact us for the differential range of the size that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

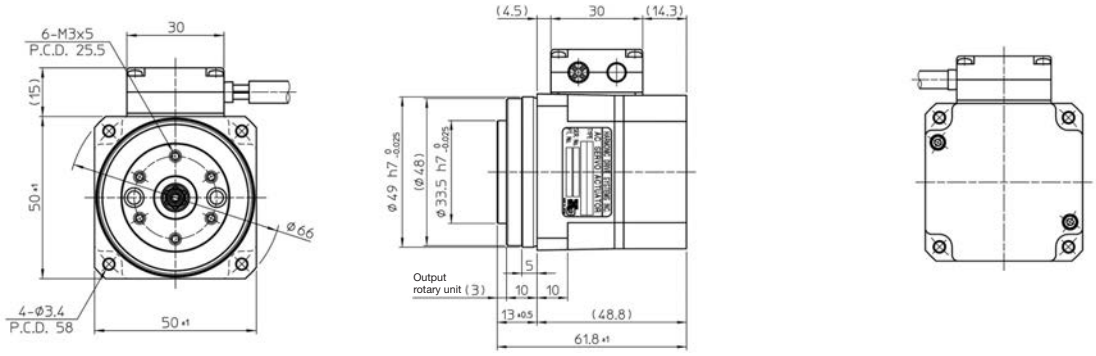
External Dimensions (Absolute encoder specification)

Unit: mm

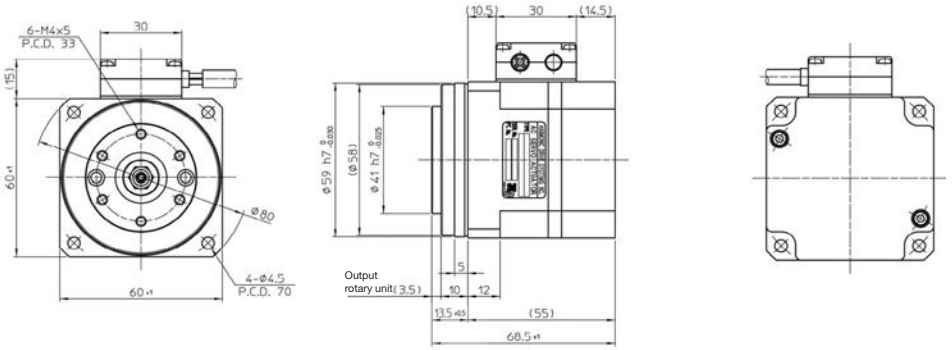
Motor Encoder Cable Part
(Same for all types)



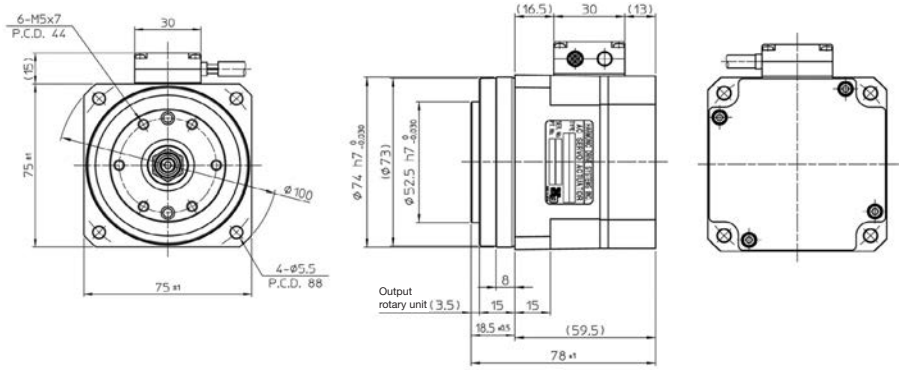
■FHA-8C



■FHA-11C



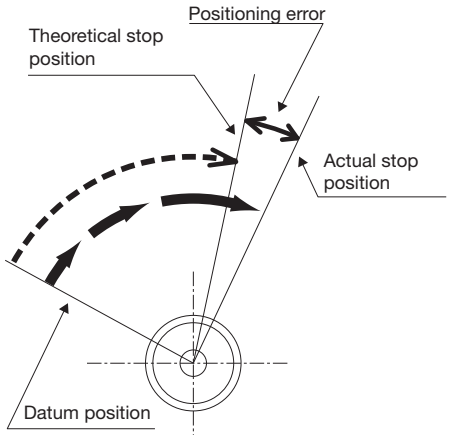
■FHA-14C



* 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

Item \ 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	7.27×10^{-4}	5.82×10^{-4}	5.82×10^{-4}	5.82×10^{-4}	4.37×10^{-4}	4.37×10^{-4}	5.82×10^{-4}	4.37×10^{-4}	4.37×10^{-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.)

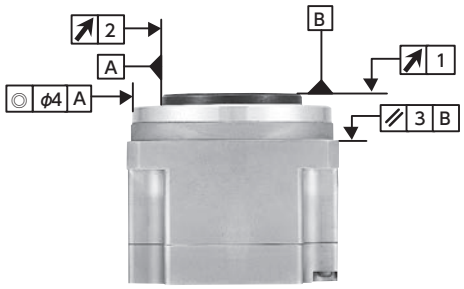
Mechanical Accuracy

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.

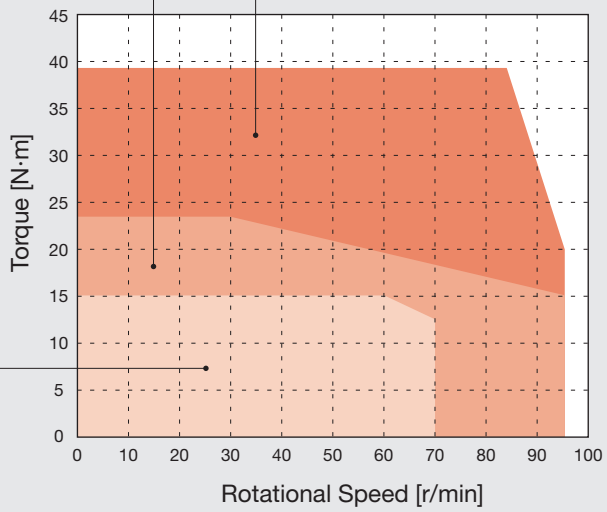
Operable Range

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.

■ **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.

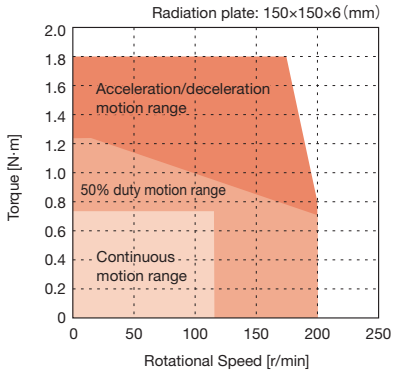
■ **Continuous motion range**
Range of continuously operable torque-rotational speed.



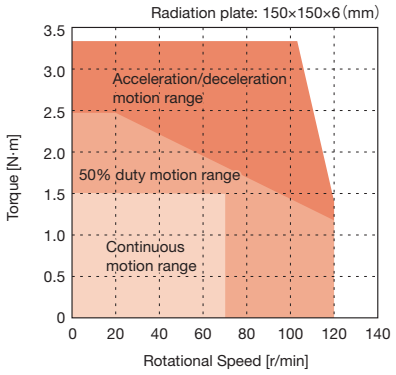
Note 1: Motion ranges for continuous motion and that at 50% duty are the values when the radiation plate mentioned in the graphs is mounted.
Note 2: See the technical information for selection of a model No.

Operable Range

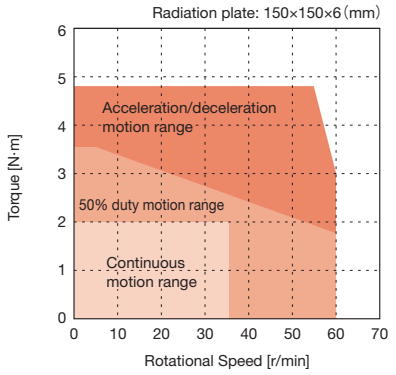
FHA-8C-30 Input voltage: 100V



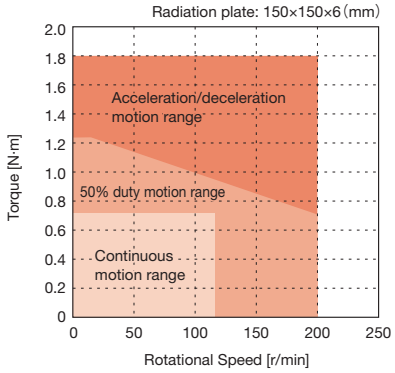
FHA-8C-50 Input voltage: 100V



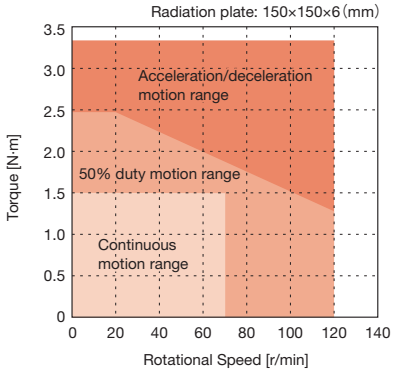
FHA-8C-100 Input voltage: 100V



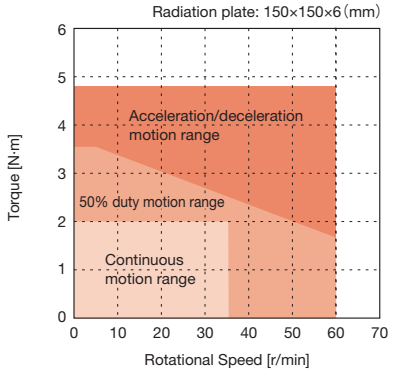
FHA-8C-30 Input voltage: 200V



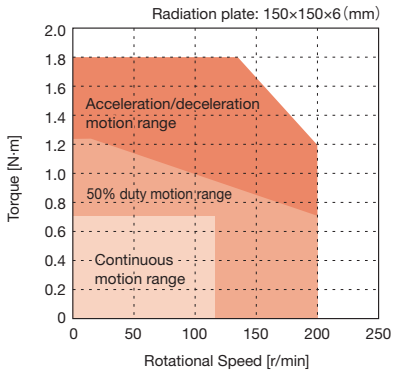
FHA-8C-50 Input voltage: 200V



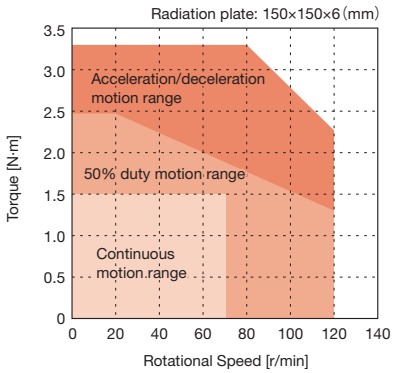
FHA-8C-100 Input voltage: 200V



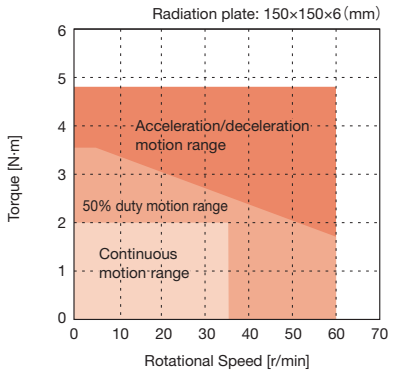
FHA-8C-30 Input voltage: 24V



FHA-8C-50 Input voltage: 24V

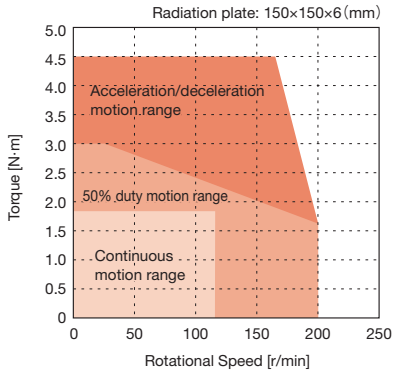


FHA-8C-100 Input voltage: 24V

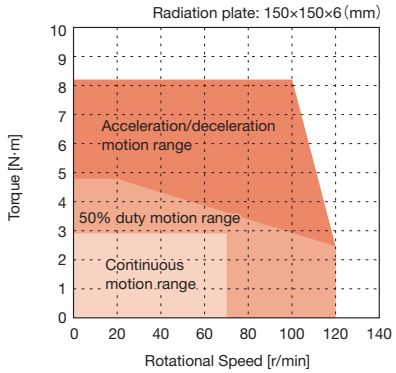


Operable Range

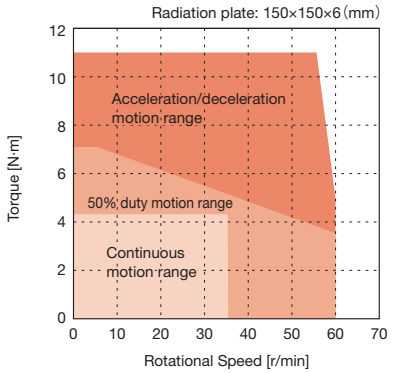
FHA-11C-30 Input voltage: 100V



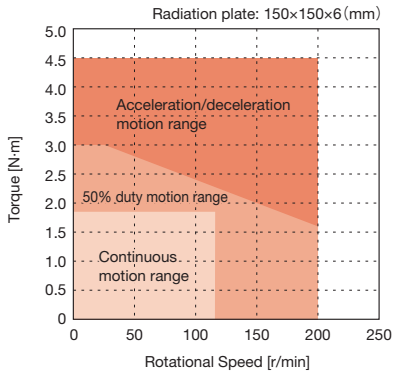
FHA-11C-50 Input voltage: 100V



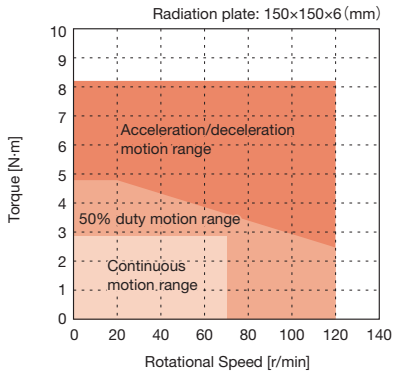
FHA-11C-100 Input voltage: 100V



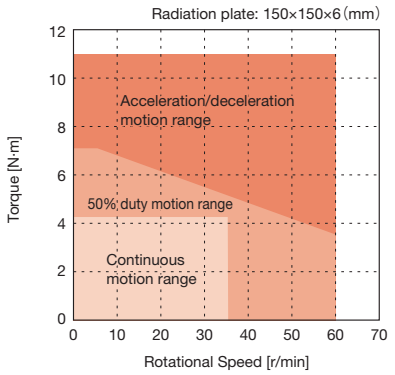
FHA-11C-30 Input voltage: 200V



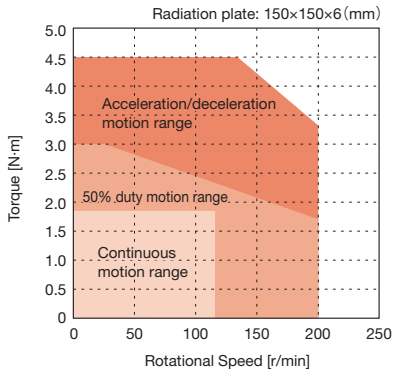
FHA-11C-50 Input voltage: 200V



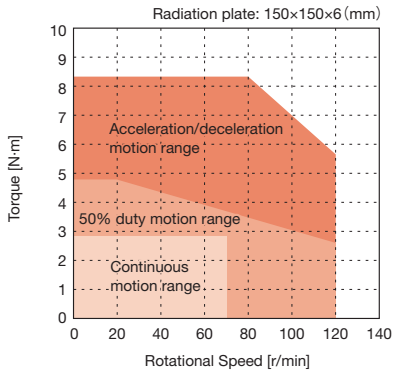
FHA-11C-100 Input voltage: 200V



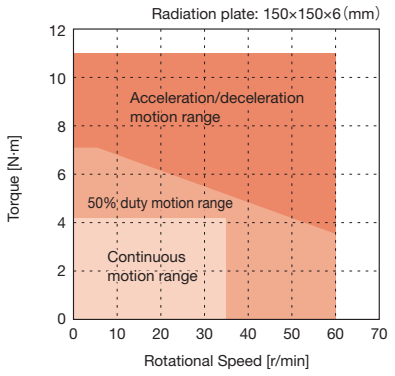
FHA-11C-30 Input voltage: 24V



FHA-11C-50 Input voltage: 24V

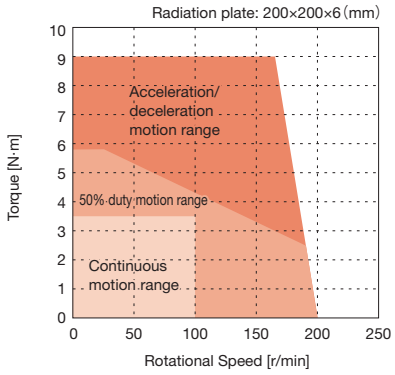


FHA-11C-100 Input voltage: 24V

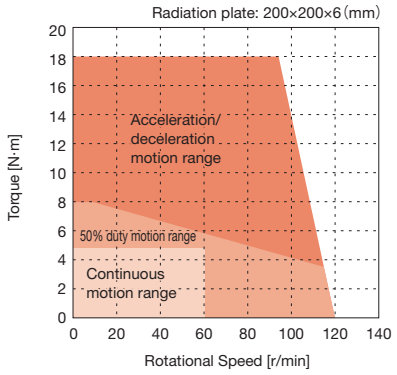


Operable Range

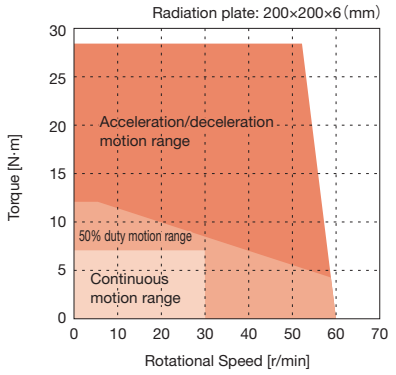
FHA-14C-30 Input voltage: 100V



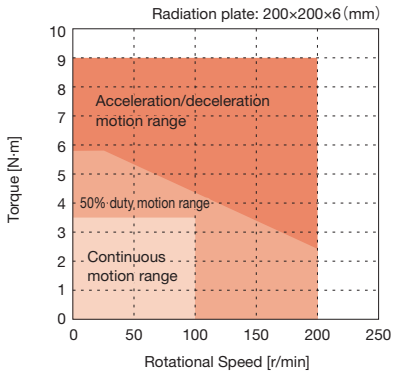
FHA-14C-50 Input voltage: 100V



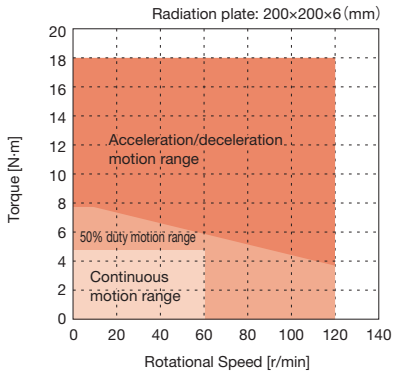
FHA-14C-100 Input voltage: 100V



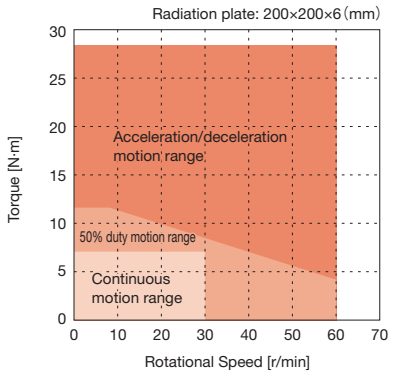
FHA-14C-30 Input voltage: 200V



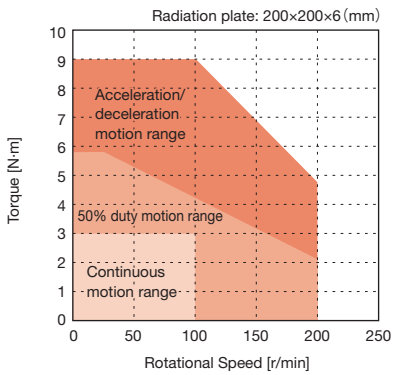
FHA-14C-50 Input voltage: 200V



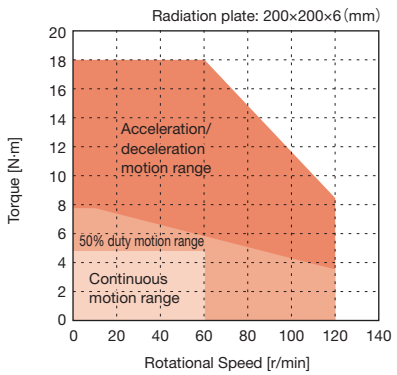
FHA-14C-100 Input voltage: 200V



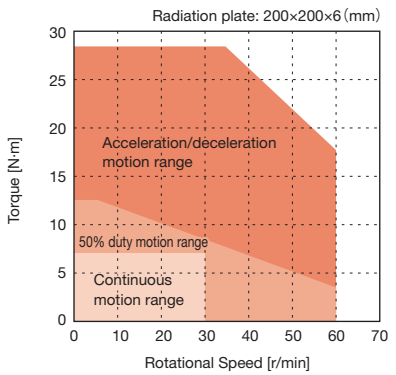
FHA-14C-30 Input voltage: 24V



FHA-14C-50 Input voltage: 24V



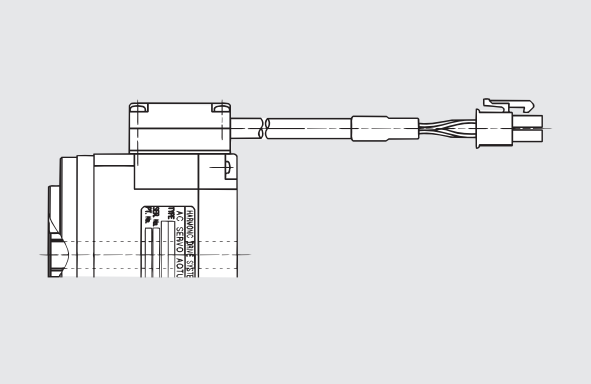
FHA-14C-100 Input voltage: 24V



Options

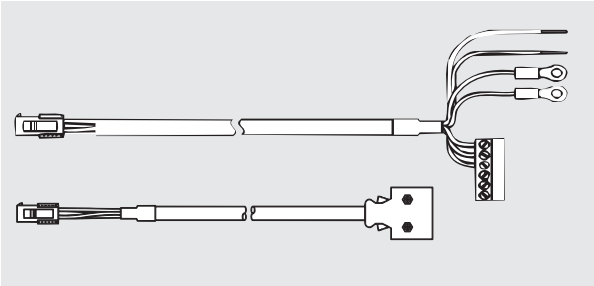
Rear Lead-out of Cable

Order Code Example:
FHA-11C-50-E200-CK
The cable lead-out direction of the actuator can be changed to the rear.

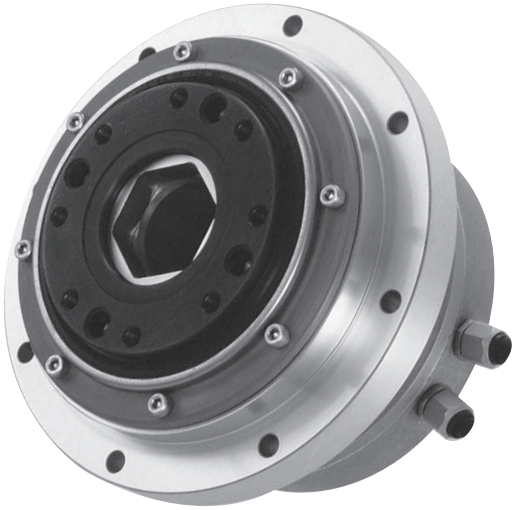


Relay Cable

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 HarmonicDive® 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.

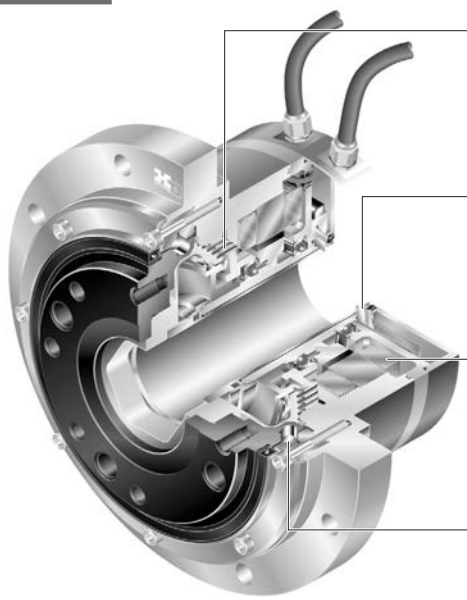
■High positional accuracy

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.

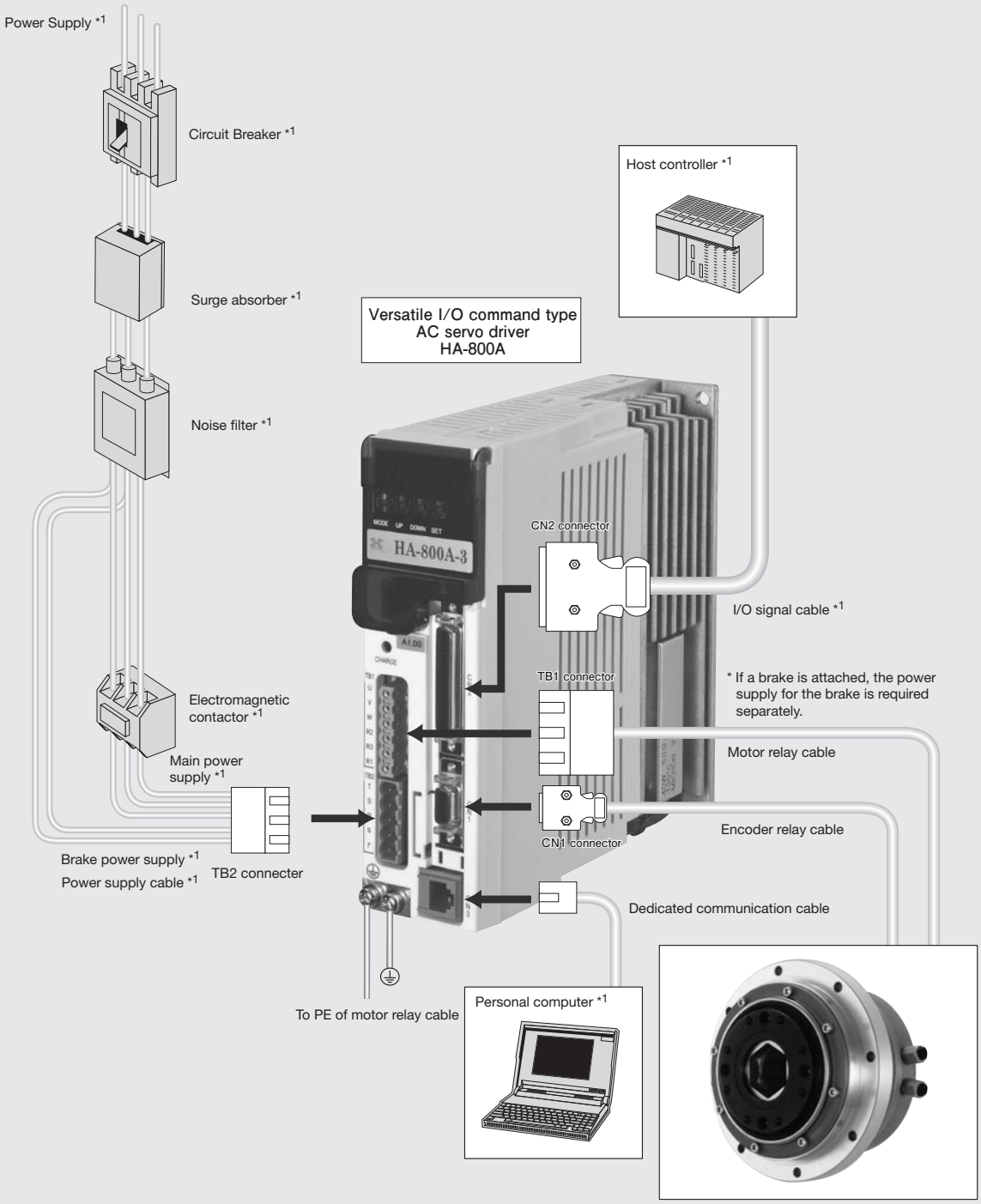
High-precision, high load sustaining bearing

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

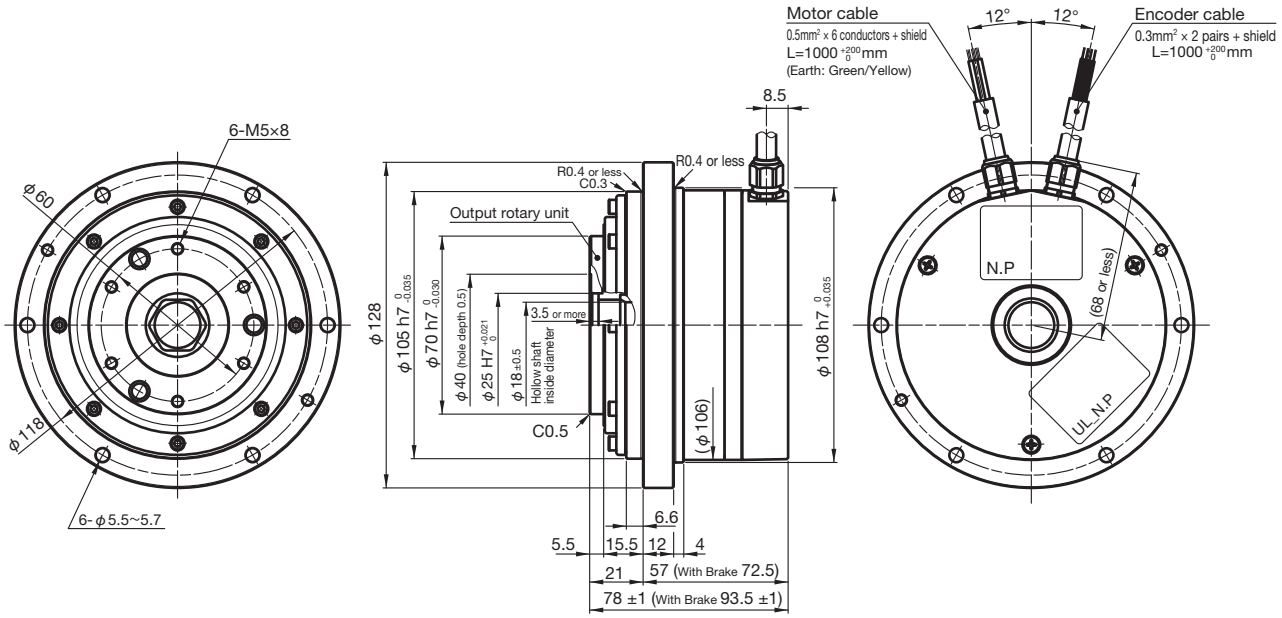
Item		Model	FHA-17C					FHA-25C					FHA-32C					FHA-40C				
			50	80	100	120	160	50	80	100	120	160	50	80	100	120	160	50	80	100	120	160
Maximum Torque *2		N·m	39	51	57	60	64	150	213	230	247	260	281	364	398	432	453	500	659	690	756	820
		kgf·m	4.0	5.2	5.8	6.1	6.5	15.3	21.7	23.5	25.2	26.5	28.7	37.1	40.6	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 *2		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 *3	$GD^2/4$	$kg·m^2$	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	$kgf·cms^2$	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	220×10^3					490×10^3					790×10^3					1400×10^3				
		kgf·m/arc-min	6.5					15					23					42				
Output shaft Resolution (At x4) *4		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 Never expose to dust, metal powder, corrosive gas, inflammable gas or oil mist. 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

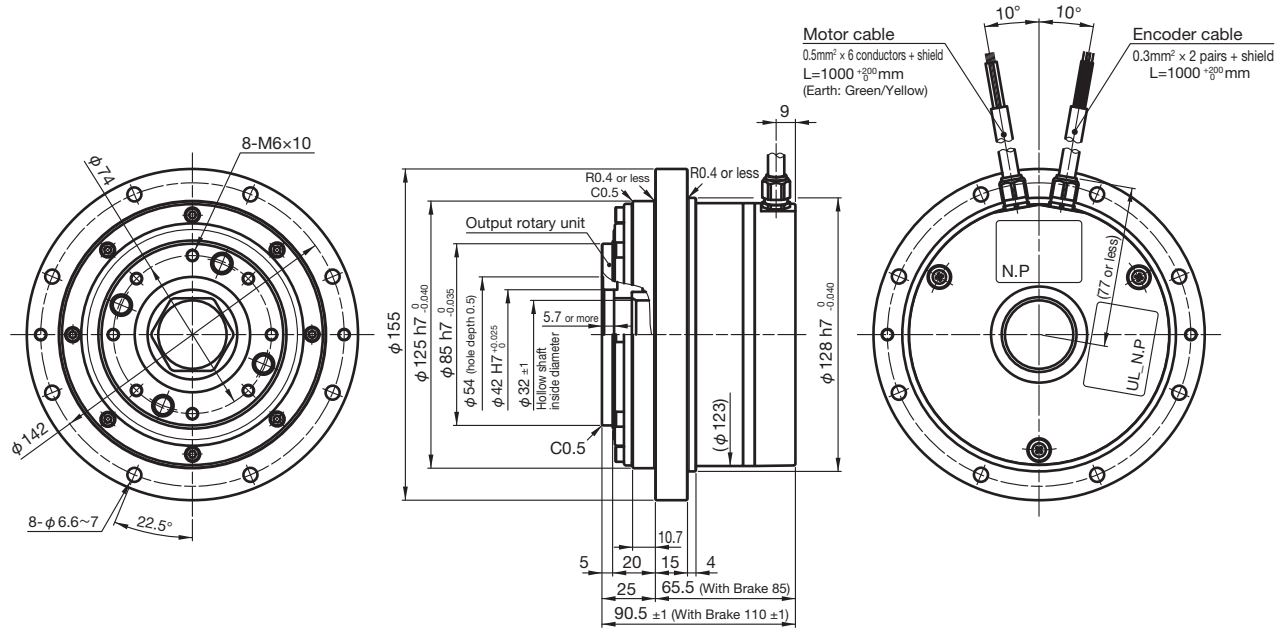
■FHA-17C

Unit: mm



■FHA-25C

Unit: mm



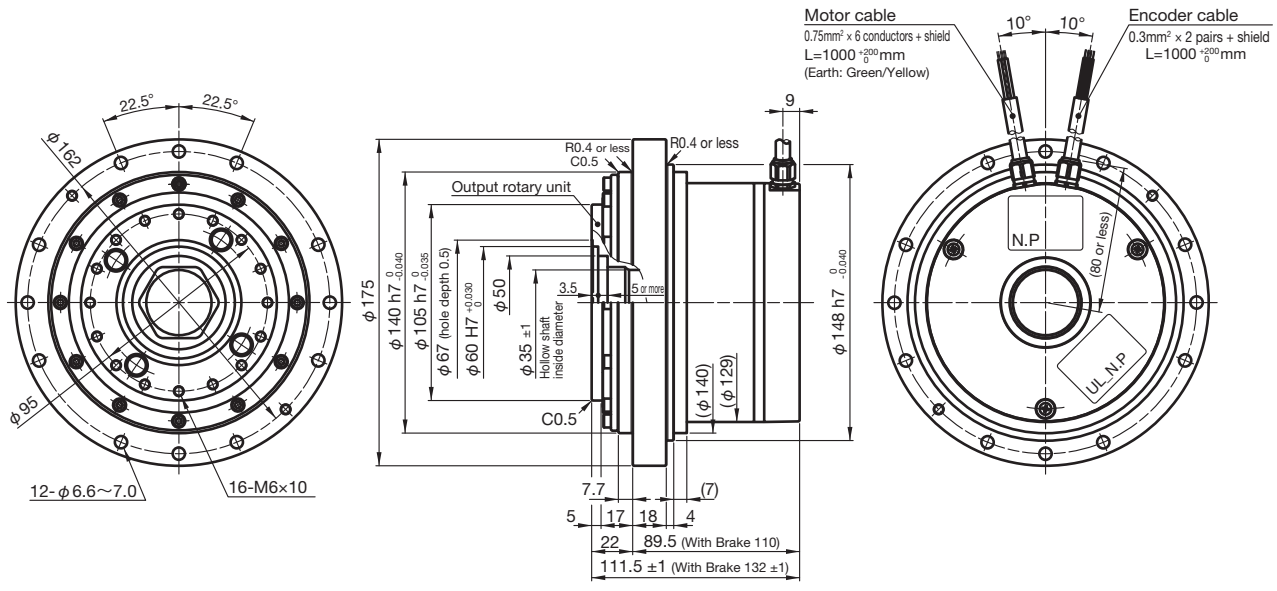
Note: The motor cable (6 conductors) contains yellow and blue wires for the brake.

* 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

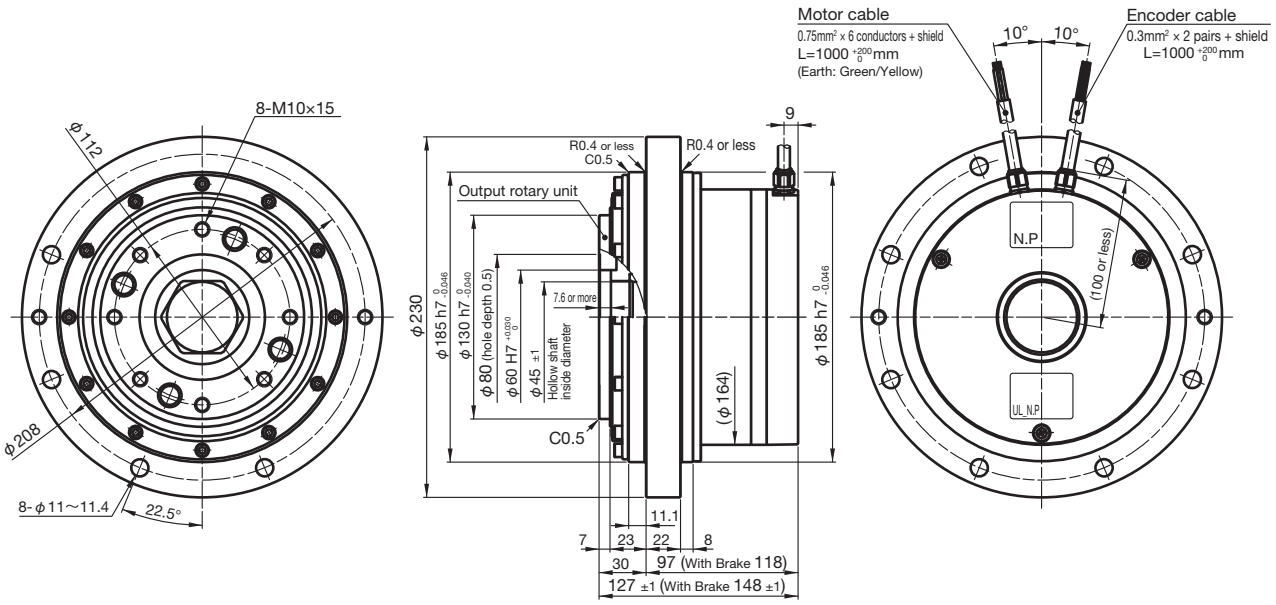
■FHA-32C

Unit: mm



■FHA-40C

Unit: mm

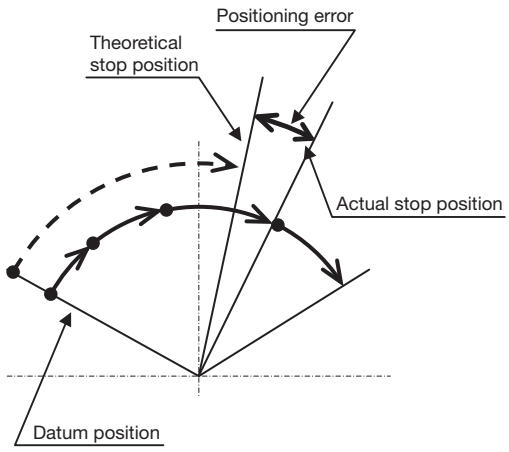


Note: The motor cable (6 conductors) contains yellow and blue wires for the brake.

* 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

Item \ 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	2.91×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.46×10^{-4}

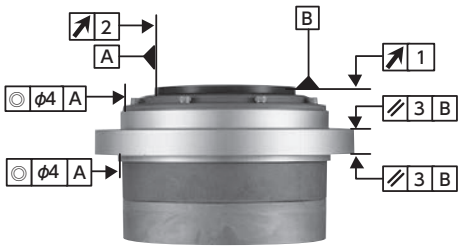
Mechanical Accuracy

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.

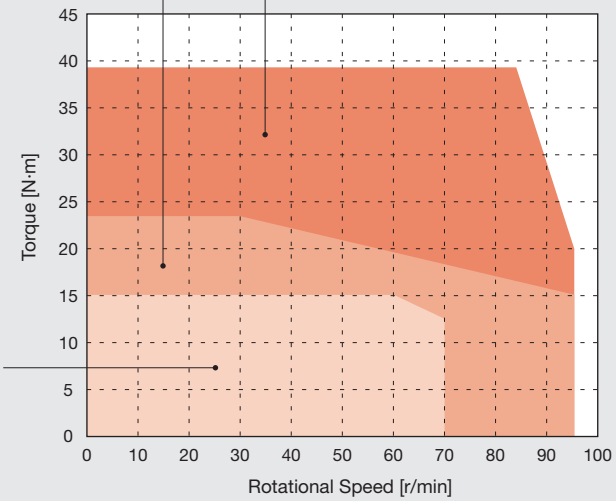
Operable Range

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)

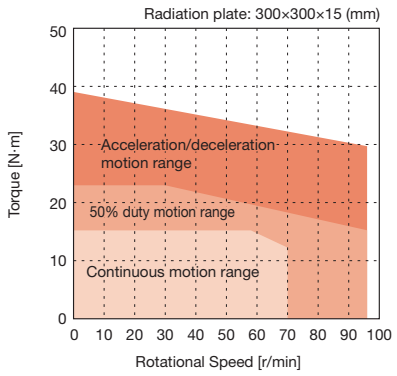
■ **Motion range during acceleration and deceleration**
Range of torque-rotational speed that is operable momentarily. Normally, this range is used during acceleration and deceleration.

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

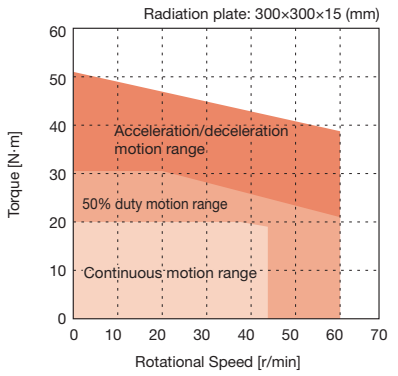


Note 1: Motion ranges for continuous motion and that at 50% duty are the values when the radiation plate mentioned in the graphs is mounted.
Note 2: See the technical information for selection of a model No.

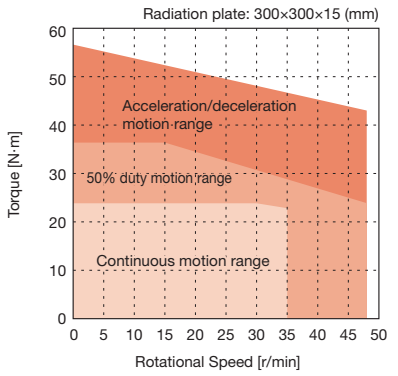
■ FHA-17C-50 Input voltage: 200V



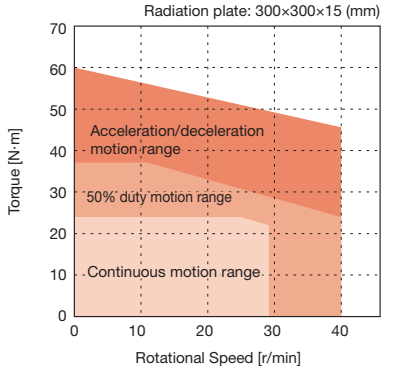
■ FHA-17C-80 Input voltage: 200V



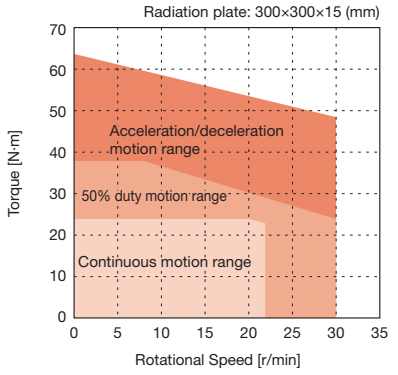
■ FHA-17C-100 Input voltage: 200V



■ FHA-17C-120 Input voltage: 200V

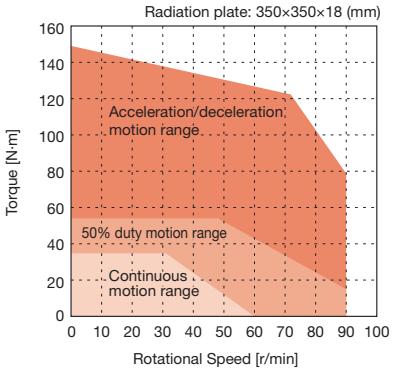


■ FHA-17C-160 Input voltage: 200V

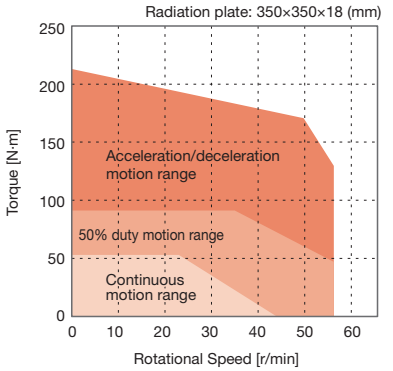


* Refer to the manual for information on the operable range for the 100 VAC input voltage model.

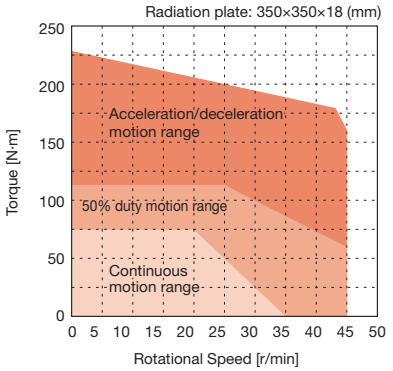
FHA-25C-50 Input voltage: 200V



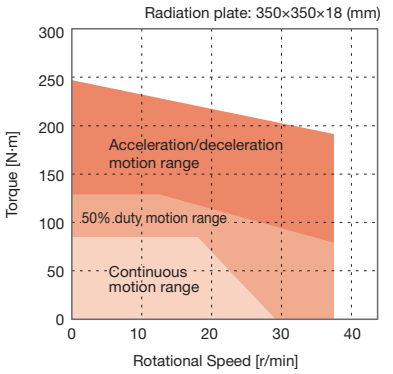
FHA-25C-80 Input voltage: 200V



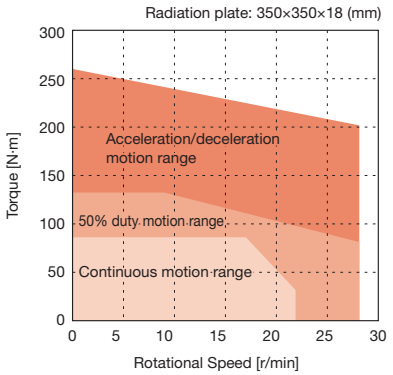
FHA-25C-100 Input voltage: 200V



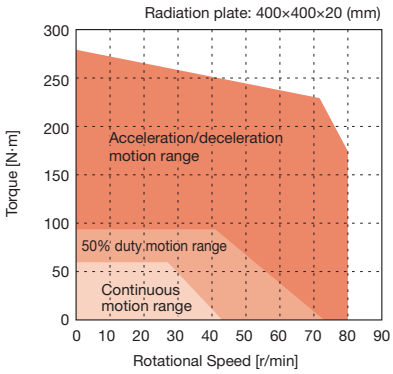
FHA-25C-120 Input voltage: 200V



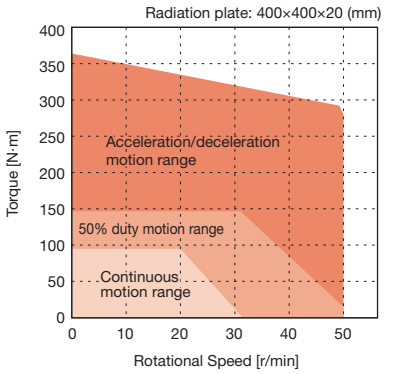
FHA-25C-160 Input voltage: 200V



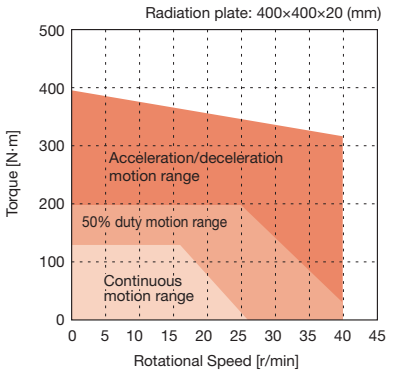
FHA-32C-50 Input voltage: 200V



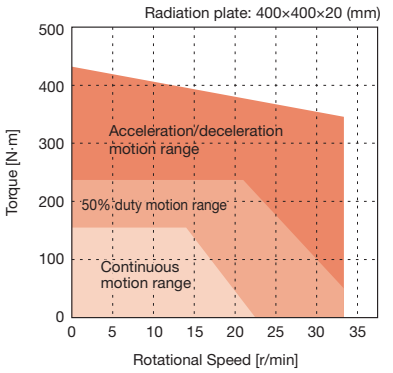
FHA-32C-80 Input voltage: 200V



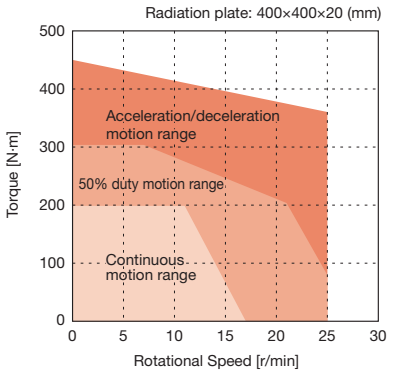
FHA-32C-100 Input voltage: 200V



FHA-32C-120 Input voltage: 200V

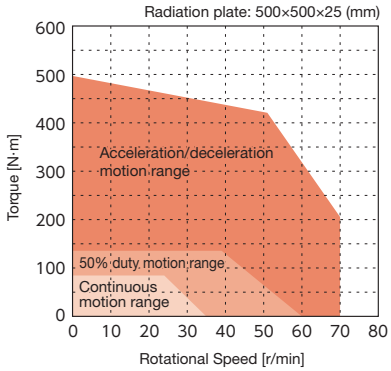


FHA-32C-160 Input voltage: 200V

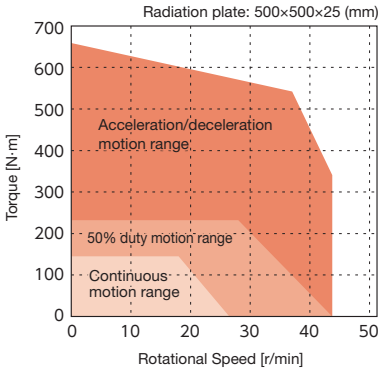


* Refer to the manual for information on the operable range for the 100 VAC input voltage model.

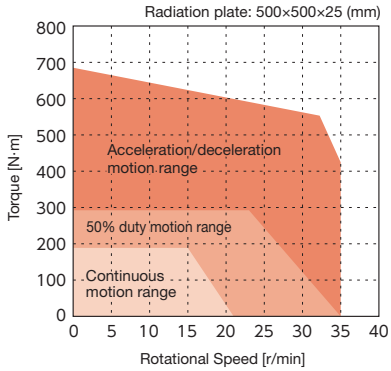
FHA-40C-50 Input voltage: 200V



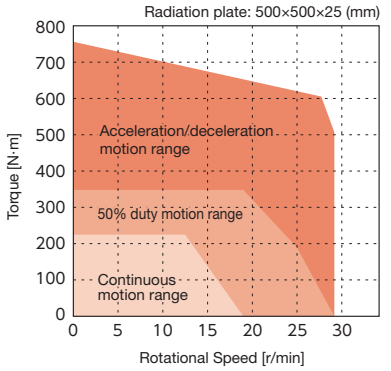
FHA-40C-80 Input voltage: 200V



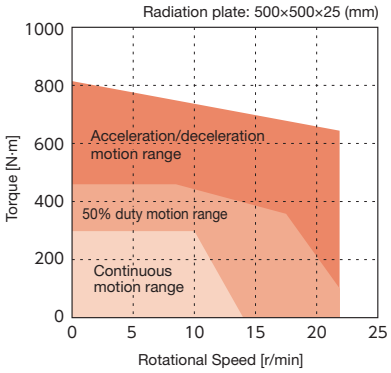
FHA-40C-100 Input voltage: 200V



FHA-40C-120 Input voltage: 200V



FHA-40C-160 Input voltage: 200V



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

Options

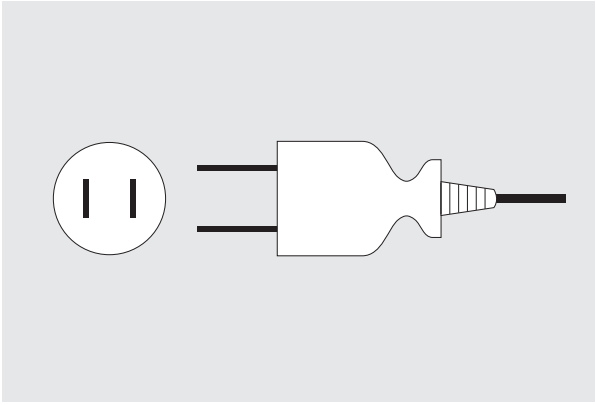
Options

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 / 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 / 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.

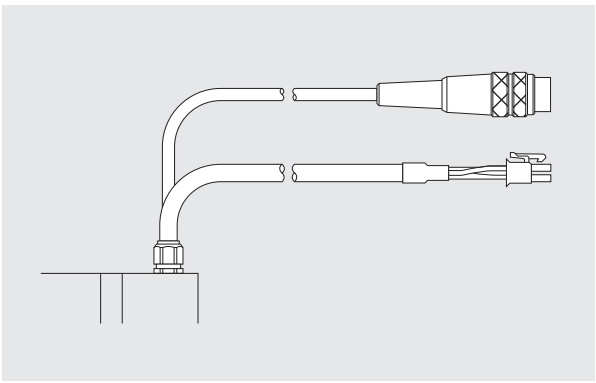
Moter Cable Color

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.

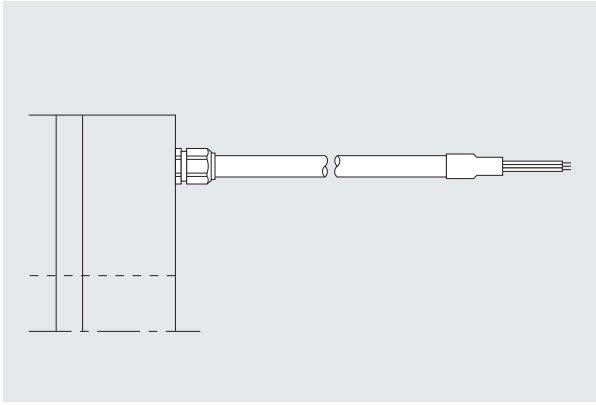
Connector

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

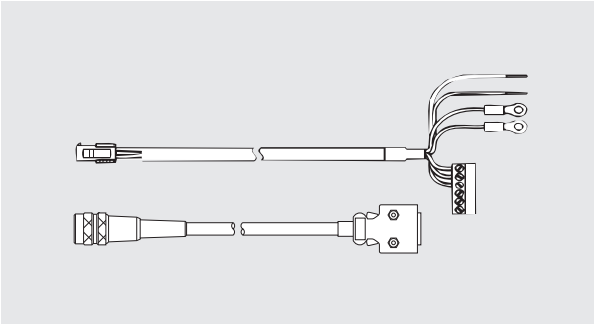
Order Code Example: FHA-25C-50-E250-K
Use this option if the outside diameter for actuator mounting is insufficient.



Options

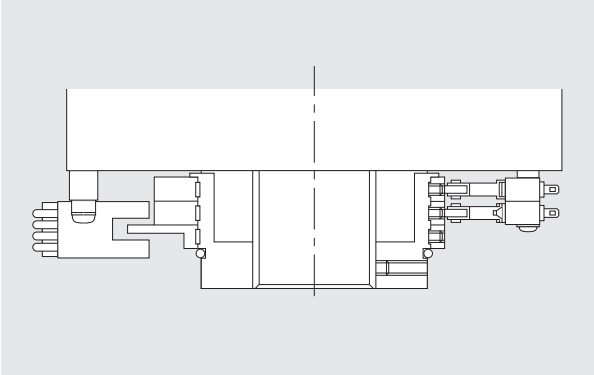
Relay Cable

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.



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®.

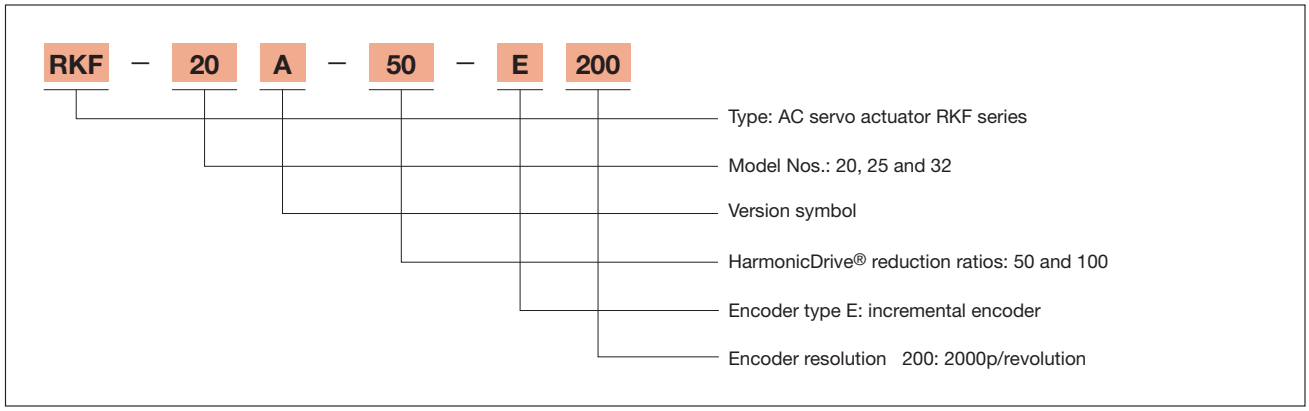
■High positional accuracy

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®)
Insulation class:	Class B	Ambient temperature:	0 to 40°C		
Dielectric strength:	AC1000V/min	Storage temperature:	-20°C to +60°C		

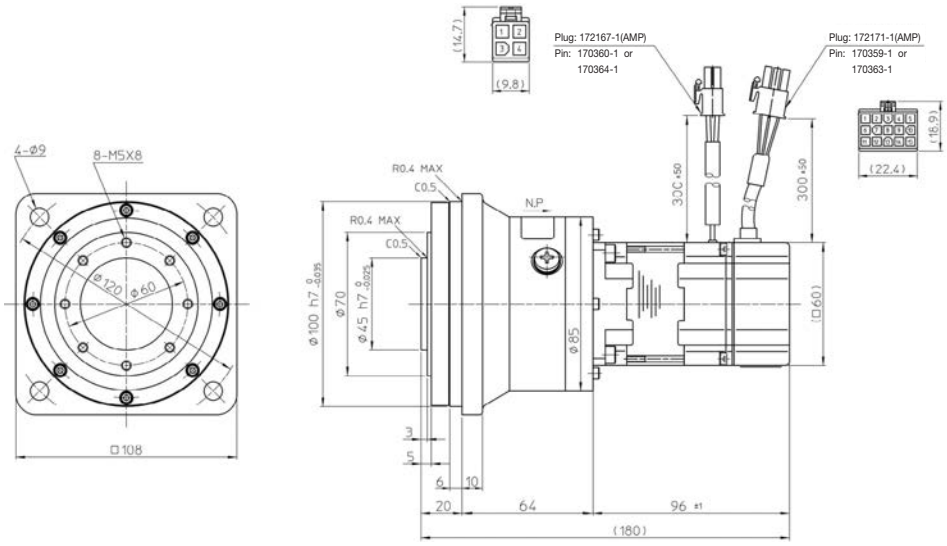
Item \ Model			RKF-20A		RKF-25A		RKF-32A	
			50	100	50	100	50	100
Rated Output *3		W	120	111	180	190	310	310
Input Power Supply *3		V	AC200					
Rated Torque *3		N·m	19	35	29	59	49	98
		kgf·cm	190	360	300	600	500	1000
Rated Rotational Speed *3		r/min	60	30	60	30	60	30
Continuous Stall Torque *3		N·m	19	35	29	59	49	98
		kgf·cm	190	360	300	600	500	1000
Maximum Momentary Torque *3		N·m	56	82	98	157	220	330
		kgf·cm	570	840	1000	1600	2200	3400
Max. Rotational Speed *3		r/min	90	45	90	45	90	45
Moment of Inertia *4	$GD^2/4$	$kg·m^2$	0.098	0.39	0.19	0.77	0.67	2.7
	J	$kgf·cms^2$	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) *5		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® 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® 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

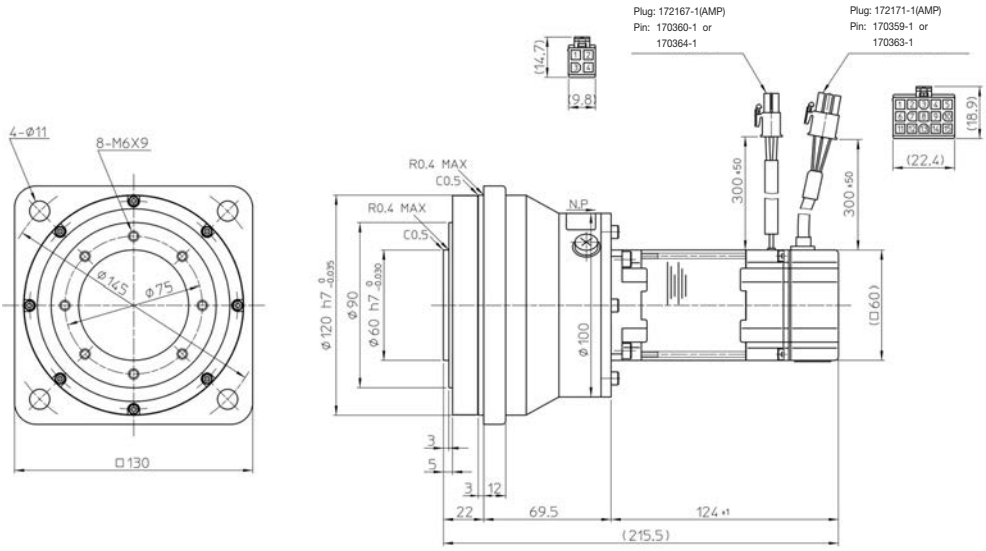
■RKF-20A

Unit: mm



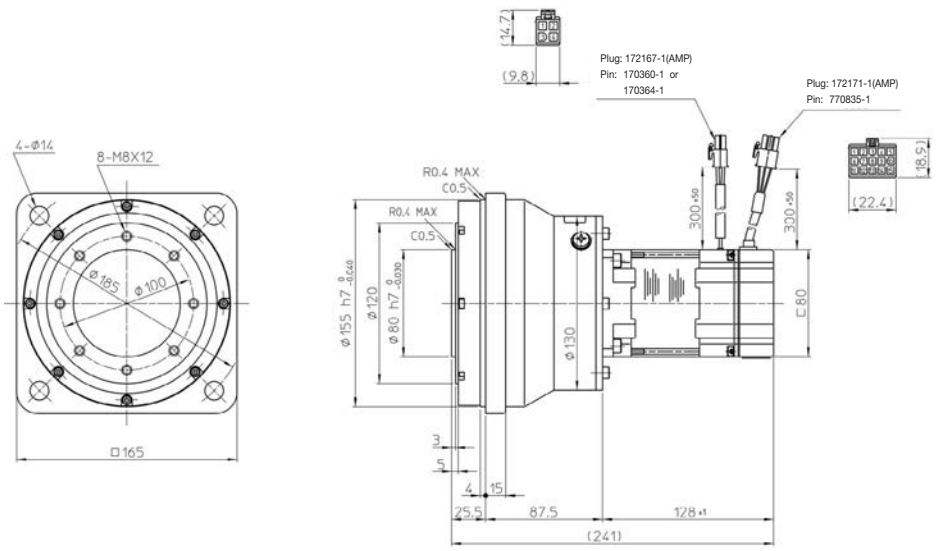
■RKF-25A

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.

Item \ Model		RKF-20A	RKF-25A	RKF-32A
Uni-directional Positional Accuracy	arc-sec	90	90	90
	rad	4.35×10^{-4}	4.35×10^{-4}	4.35×10^{-4}
Repeatability	arc-sec	±30	±25	±20
	rad	$\pm1.46\times10^{-4}$	$\pm1.21\times10^{-4}$	$\pm0.97\times10^{-4}$

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

Mechanical Accuracy

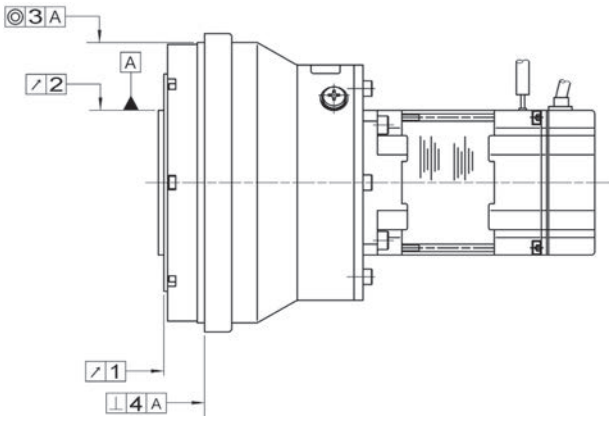
The mechanical accuracies of the output shaft and mounting flange of the RKF series are as follows.

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.

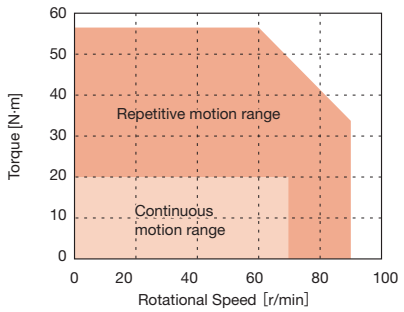


Operable Range

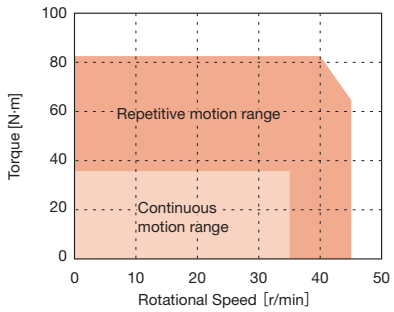
The following diagrams show the operable range of the RKF series combined with an AC servo driver (HA-800).

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.

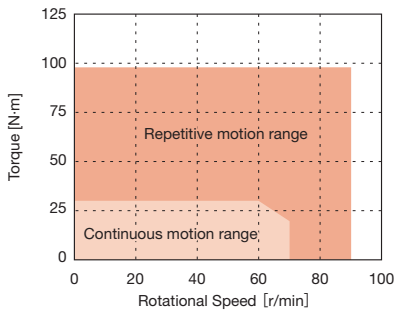
RKF-20A-50



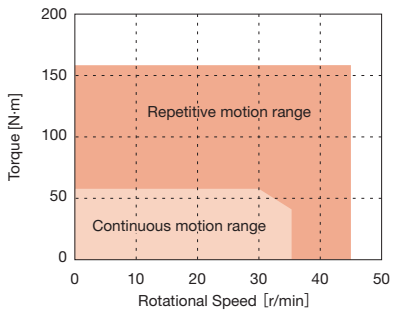
RKF-20A-100



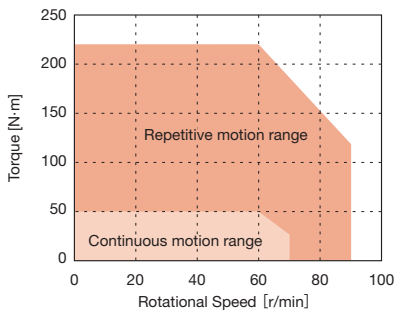
RKF-25A-50



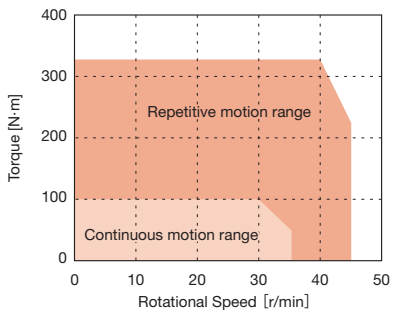
RKF-25A-100



RKF-32A-50



RKF-32A-100

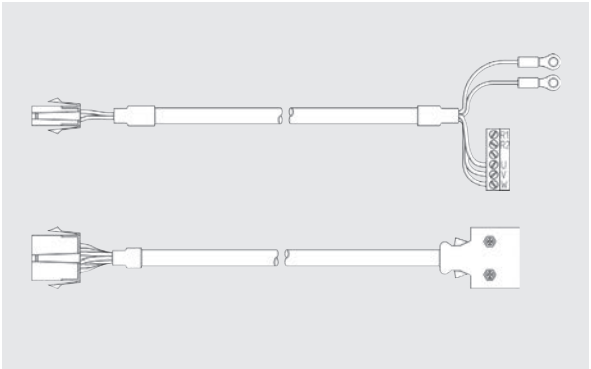


Note 1: The values in the graphs are those when one of the following aluminum radiation plates is mounted.
RKF-20: 250x250x12 (mm)
RKF-25, RKF-32: 300x300x15 (mm)

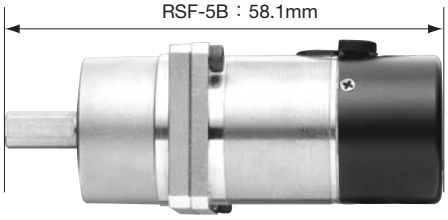
Options

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



* Exact sized photographs

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

RSF – 5 B – 50 – E 050 – C

- RSF: Type: AC servo actuator RSF series
- 5: Model Nos.: 3, 5
- B: Version symbol
- 50: HarmonicDrive® reduction ratios: 30, 50 and 100
- E: Encoder type E: incremental encoder
- 050: Encoder resolution 020: 200p/rev. 050: 500p/rev.
- C: C: Standard item (with connector)
  BC: With brake (with connector) (only for Model No. 5)
  SP: Special specification

Specification

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

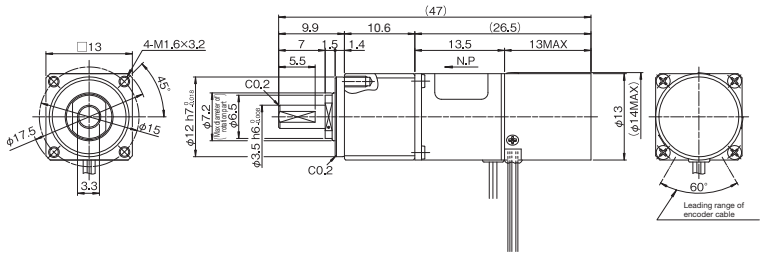
Item \ Actuator			RSF-3C			RSF-5B		
			30	50	100	30	50	100
Power Supply Voltage (driver)		V	DC24±10%			DC24±10%		
Permissible Continuous Current		A	0.65	0.66	0.56	1.11	0.92	0.76
Permissible Continuous Torque (during operation at allowable continuous rotation speed)		N·m	0.03	0.07	0.11	0.18	0.29	0.44
		kgf·cm	0.31	0.68	1.08	1.83	2.95	4.48
Permissible Continuous Rotation 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*3	$GD^2/4$	$kg·m^2$	0.11×10^{-4}	0.29×10^{-4}	1.17×10^{-4}	0.66×10^{-4} (0.11×10^{-3})	1.83×10^{-4} (0.31×10^{-3})	7.31×10^{-4} (1.23×10^{-3})
	J	$kgf·cms^2$	1.07×10^{-4}	2.98×10^{-4}	11.90×10^{-4}	0.67×10^{-3} (1.13×10^{-3})	1.87×10^{-3} (3.15×10^{-3})	7.45×10^{-3} (12.6×10^{-3})
Reduction Ratio			30	50	100	30	50	100
Permissible Radial Load (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: when multiplied by 4)*4		Pulses/ revolution	24000	40000	80000	60000	100000	200000
Motor Shaft Brake	Input Power Voltage	V	—			DC24±10%		
	Retention Torque	N·m	—			0.18	0.29	0.44
		kgf·cm	—			1.83	2.95	4.48
Mass*5	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		

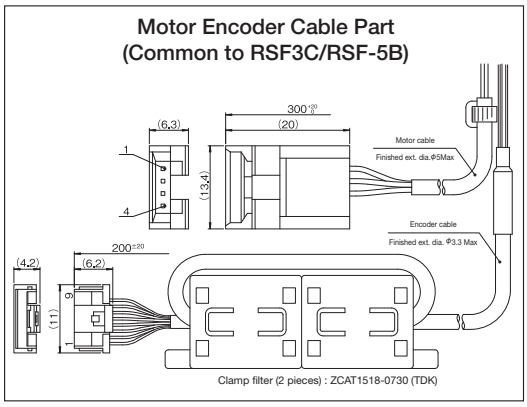
*1: The table shows typical output values of actuators.
*2: The values in the table above are obtained when it is combined with the combined driver (HA-680-4B-24).
*3: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the HarmonicDrive®. 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

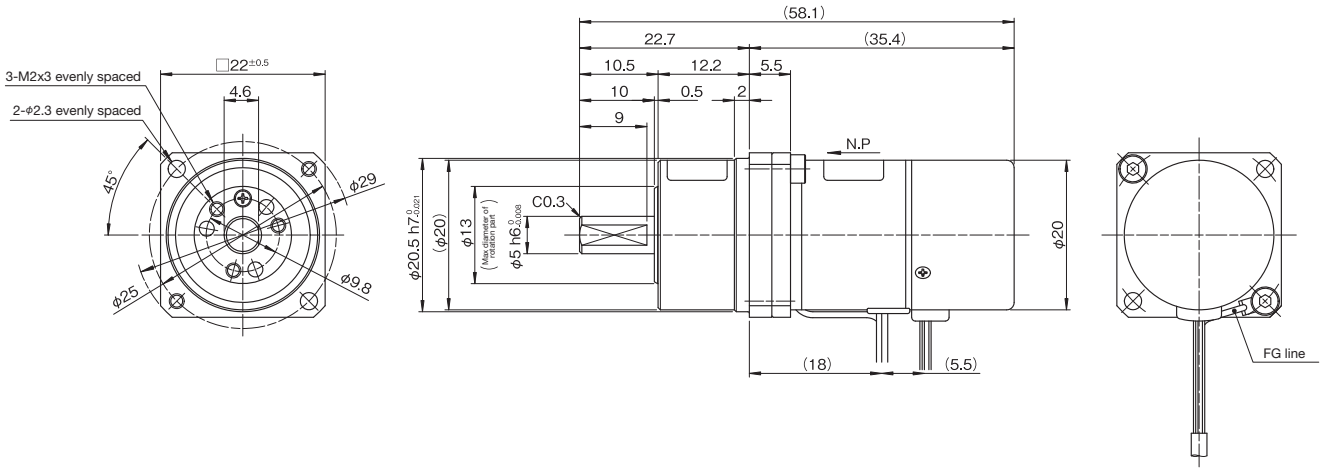
Unit: mm





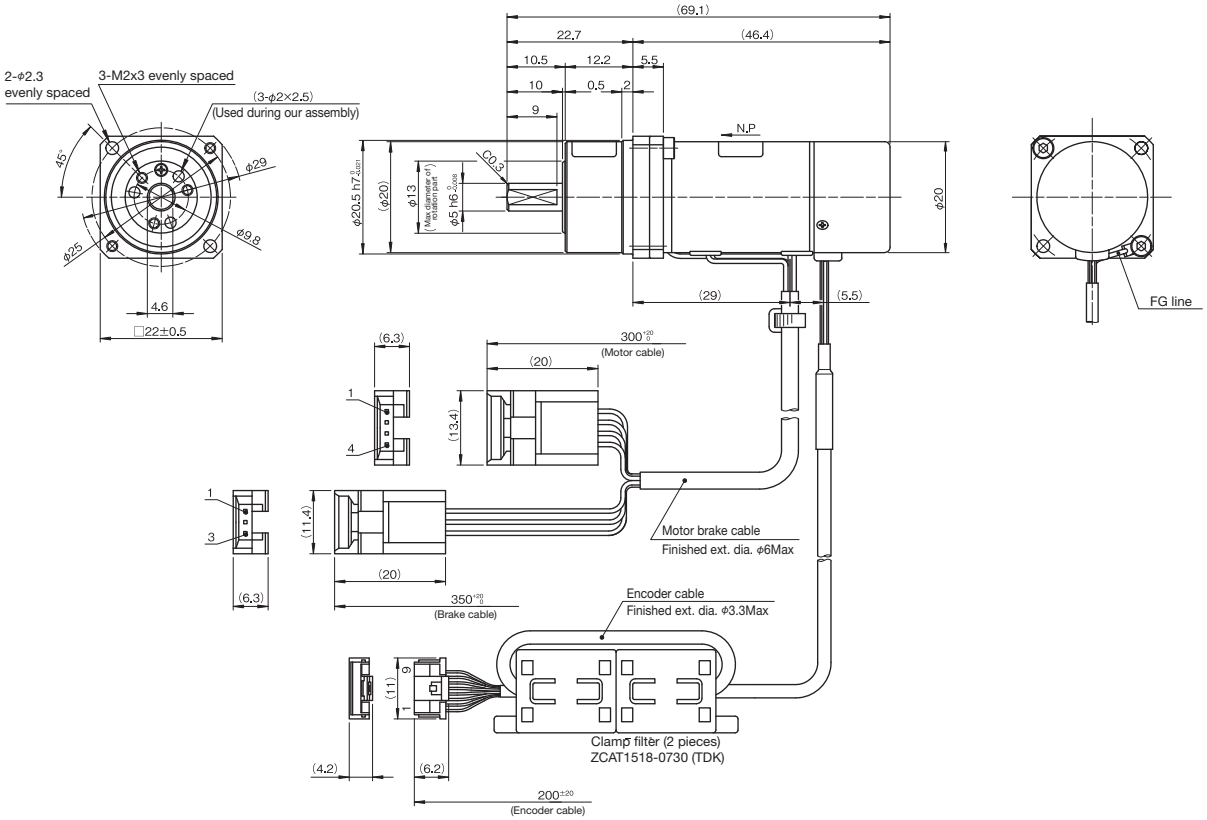
■RSF-5B

Unit: mm



■RSF-5B (With brake)

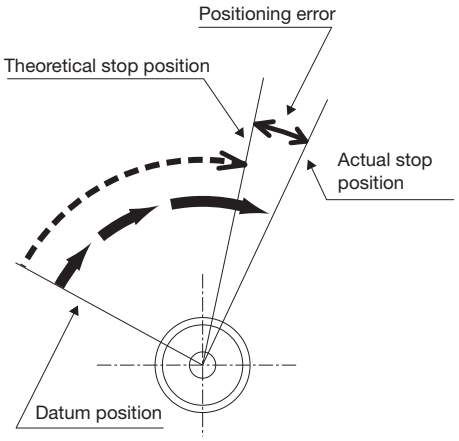
Unit: mm



* 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.



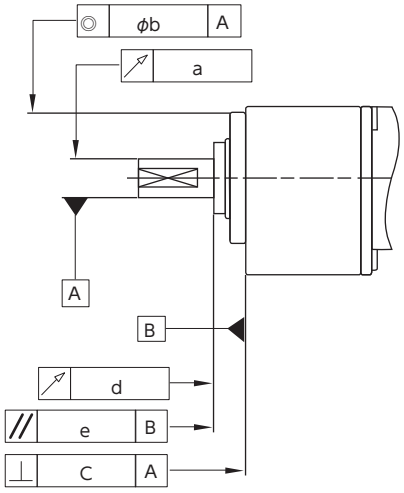
“Uni-directional Positional Accuracies” of Models

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

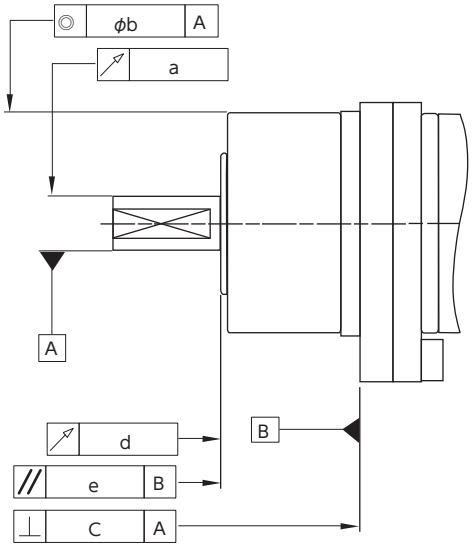
Mechanical Accuracy

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.

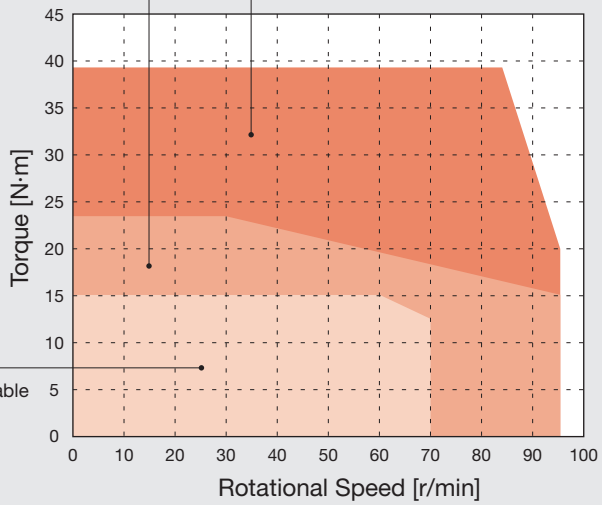
Operable Range

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)

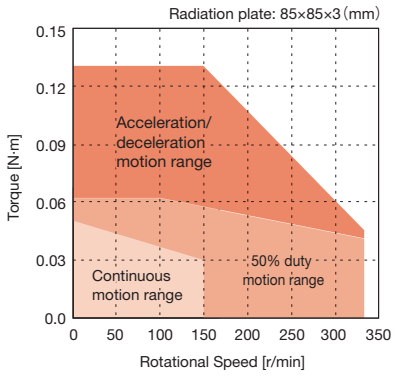
■ **Motion range during acceleration and deceleration**
Range of torque-rotational speed that is operable momentarily. Normally, this range is used during acceleration and deceleration.

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

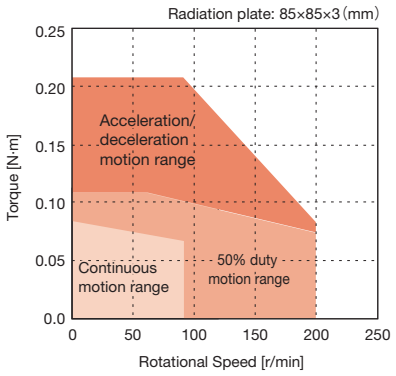


Note 1: Motion ranges for continuous motion and that at 50% duty are the values when the radiation plate mentioned in the graphs is mounted.
Note 2: See the technical information for selection of a model No.

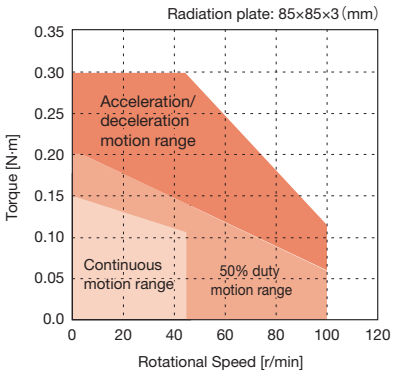
■ RSF-3C-30-E020-C



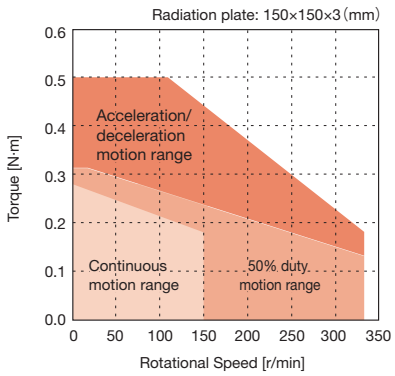
■ RSF-3C-50-E020-C



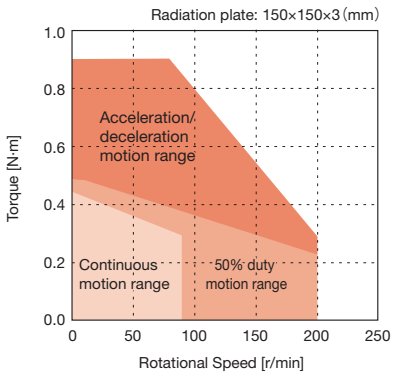
■ RSF-3C-100-E020-C



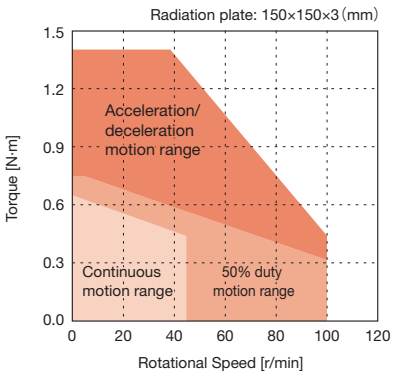
■ RSF-5B-30-E050-C、RSF-5B-30-E050-BC



■ RSF-5B-50-E050-C、RSF-5B-50-E050-BC



■ RSF-5B-100-E050-C、RSF-5B-100-E050-BC

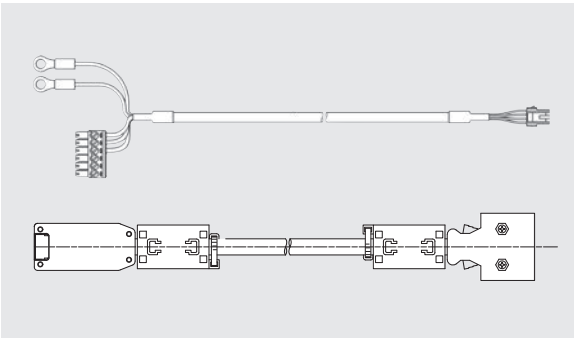


Note:
The values of the graph are obtained when the aluminum radiation plate shown at the upper right of the graph.
Even in the continuous range, if it is used continuously in one direction, please consult with us.

Options

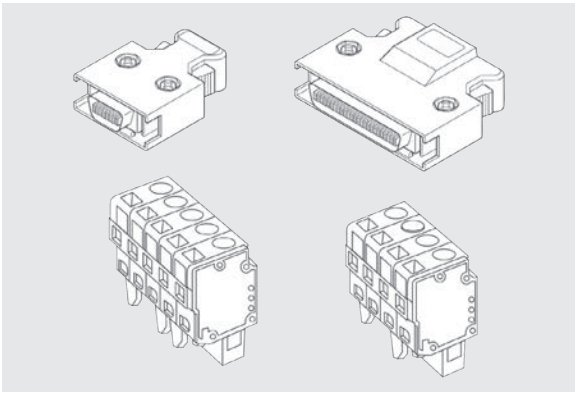
Relay Cable (For HA-680)

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.



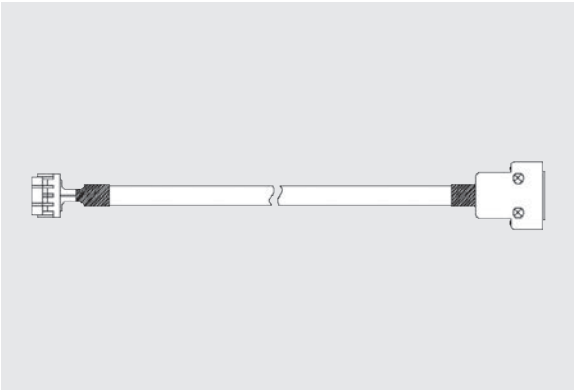
Connector

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



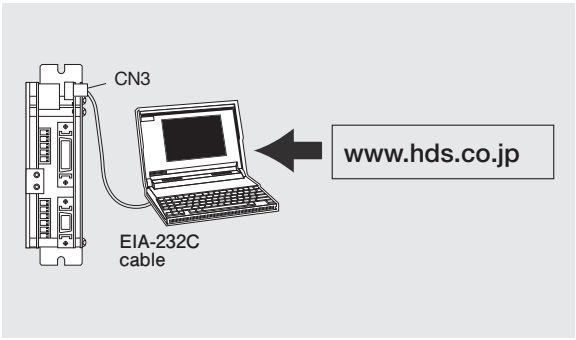
EIA-232 (RS-232C) Communication Cable

Order Code Example: HDM-RS232C
The cable to connect the PC and servo driver.
Cable length (1.5m).

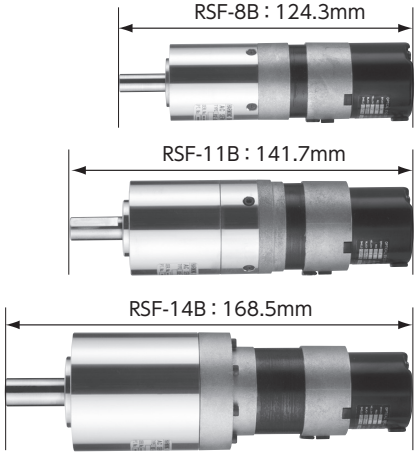


Servo Parameter Setting Software (Free delivery)

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 deriver.



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.

CE

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

RSF – 8 B – 30 – F 100 – 24 B – C – SP

- RSF: Type: AC servo actuator RSF-B mini series
- 8: Model
- B: Version symbol
- 30: HarmonicDrive® reduction ratios: 30: 1/30 50: 1/50 100: 1/1000
- F: Encoder type F: Incremental encoder + pole sensor
- 100: Encoder resolution 100: 1000p/rev
- 24: Motor power voltage specification 24: 24V
- B: Phase angle specification A: 0° (Special) B: 30° (Standard)
- C: Option No symbol: No connector C: Connector attached (standard item)
- SP: Special specification No symbol: Standard item SP: Special item

Specification

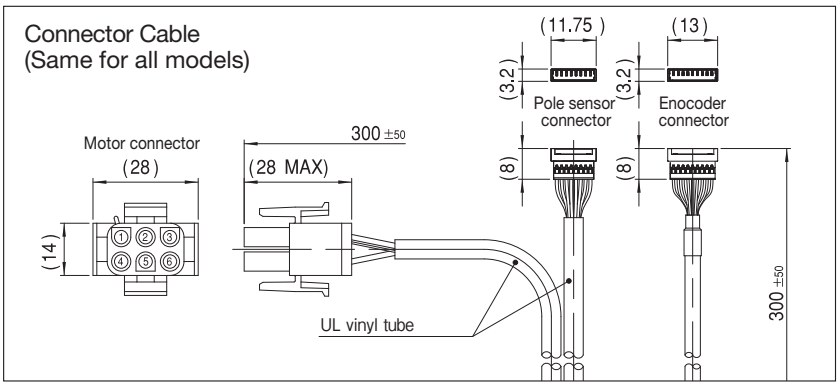
Time rating:	Continuous	Insulation resistance:	DC500V 100M ohm or higher	Ambient humidity:	20 to 80%RH (no condensation)
Excitation method:	Permanent magnet	Structure:	Totally enclosed, self-cooled	Lubricant:	Grease (Harmonic grease®)
Insulation class:	Class B	Ambient temperature:	0 to 40°C		
Dielectric 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 (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 (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*3	$GD^2/4$	$kg·m^2$	0.06×10^{-2}	0.16×10^{-2}	0.65×10^{-2}	0.18×10^{-2}	0.49×10^{-2}	2.0×10^{-2}	0.41×10^{-2}	1.1×10^{-2}	4.5×10^{-2}
	J	$kgf·cms^2$	0.60×10^{-2}	1.7×10^{-2}	6.6×10^{-2}	1.8×10^{-2}	5.0×10^{-2}	20×10^{-2}	4.1×10^{-2}	11×10^{-2}	46×10^{-2}
Reduction Ratio			1:30	1:50	1:100	1:30	1:50	1:100	1:30	1:50	1:100
Permissible Radial Load (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)*4		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®. 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.

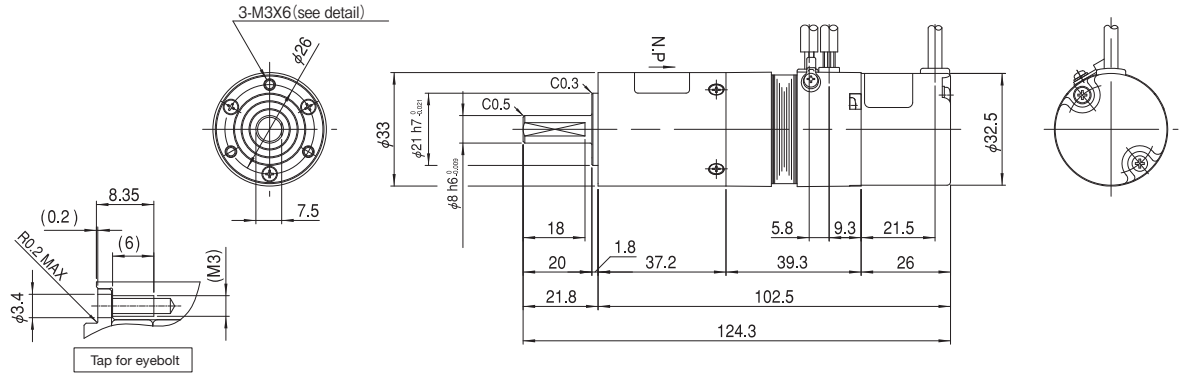
External Dimensions

Unit: mm



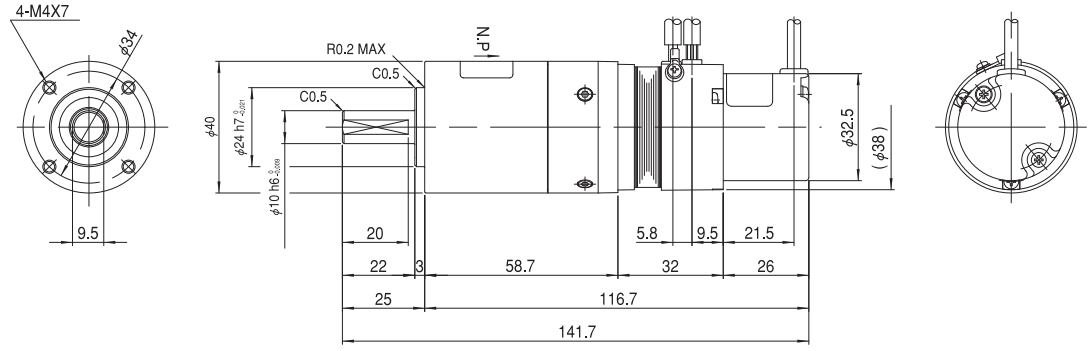
■RSF-8B

Unit: mm



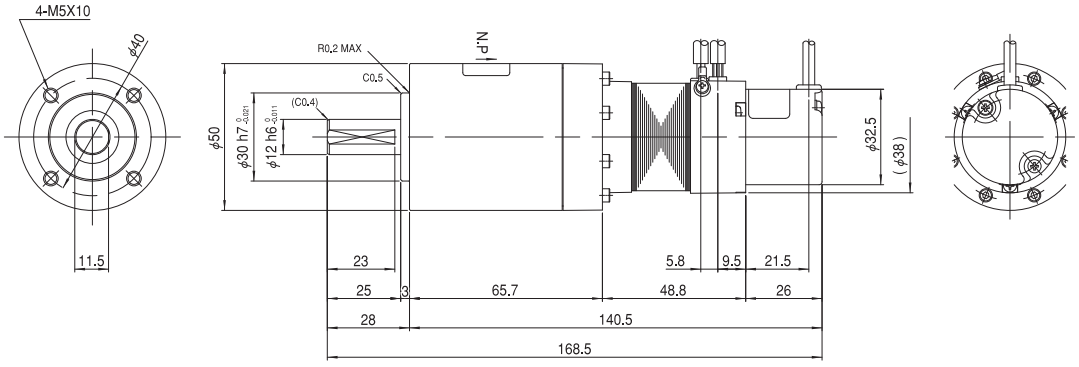
■RSF-11B

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

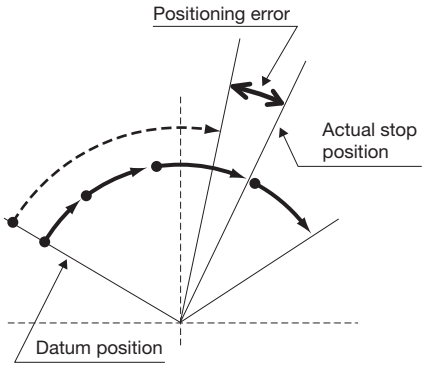
The following table shows the “one-way positioning accuracy”. The following table contains representing values. (JIS B-6201-1987)
The RSF-B mini series contains HarmonicDrive® and positioning errors of the motor shaft are therefore compressed. In reality, angular transmission errors of the speed reducer 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

Item \ 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	8.73×10^{-4}	7.27×10^{-4}		7.27×10^{-4}	5.82×10^{-4}		7.27×10^{-4}	5.82×10^{-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



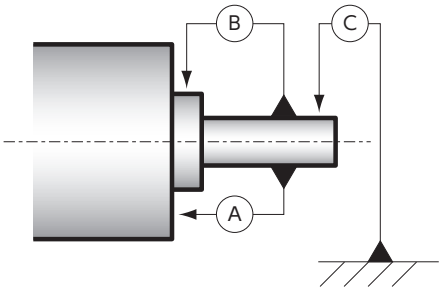
Mechanical Accuracy

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



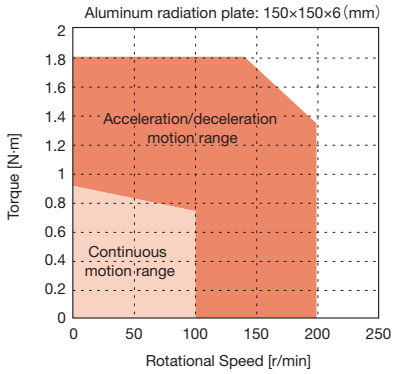
Note: The aforementioned values are T.I.R (total indicator reading) values.
A: Squareness of the output shaft and the mounting surface
B: Coaxial degree of the output shaft and the mounting connection
C: Deflection of the output shaft end

Operable Range

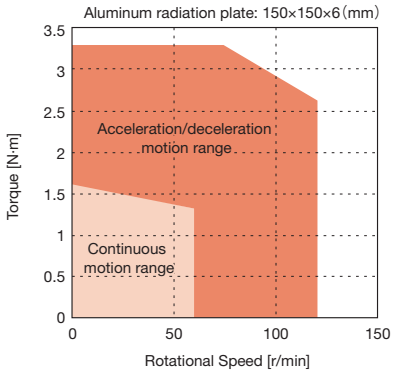
The following graphs show the usable ranges of the RSF-B mini series actuators combined with the dedicated AC servo driver HA-680 by the power voltage DC24V input.

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

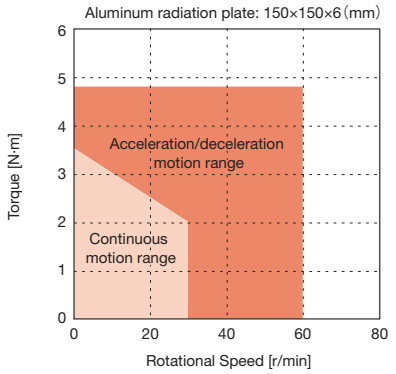
■ RSF-8B-30



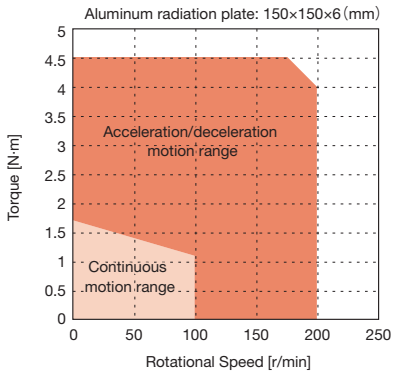
■ RSF-8B-50



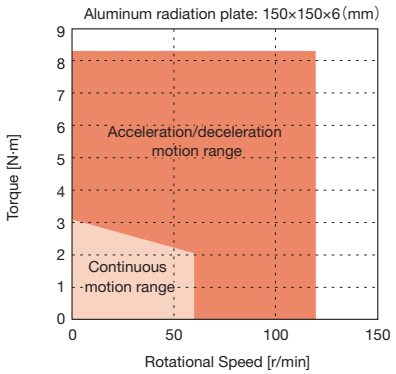
■ RSF-8B-100



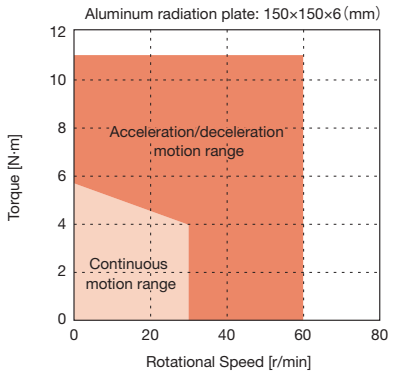
■ RSF-11B-30



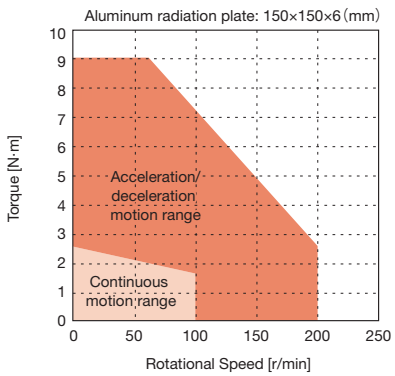
■ RSF-11B-50



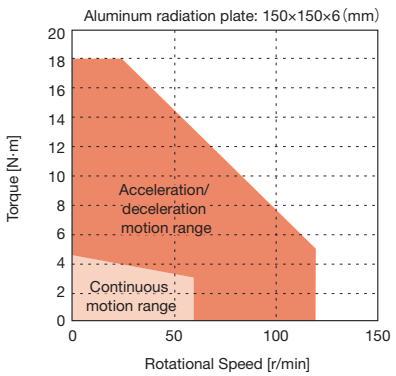
■ RSF-11B-100



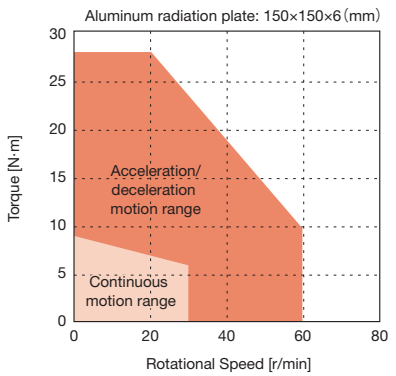
■ RSF-14B-30



■ RSF-14B-50



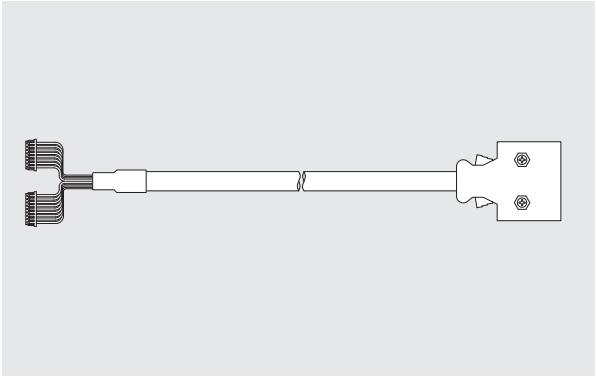
■ RSF-14B-100



Options

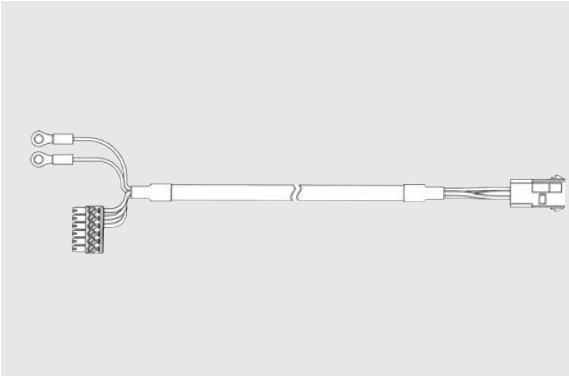
Encoder + Pole Sensor Cable

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.



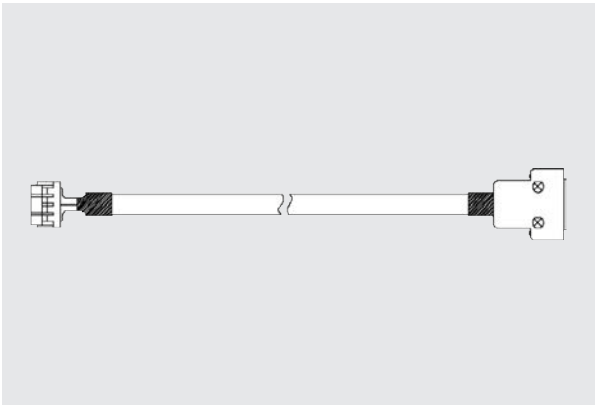
Relay Cable for Motor

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.

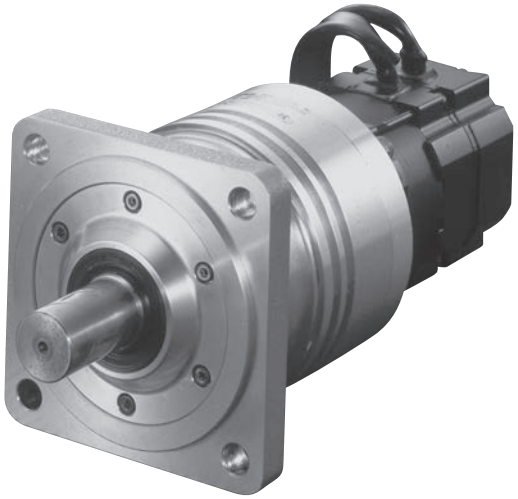


EIA-232 (RS-232C) Communication Cable

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

RSF – 17 A – 50 – E 200

- RSF: Type: AC servo actuator RSF series
- 17: Model Nos.: 17, 20, 25 and 32
- A: Version symbol
- 50: HarmonicDrive® reduction ratios: 50 and 100
- E: Encoder type E: incremental encoder
- 200: Encoder resolution 200: 2000p/revolution

Specification

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

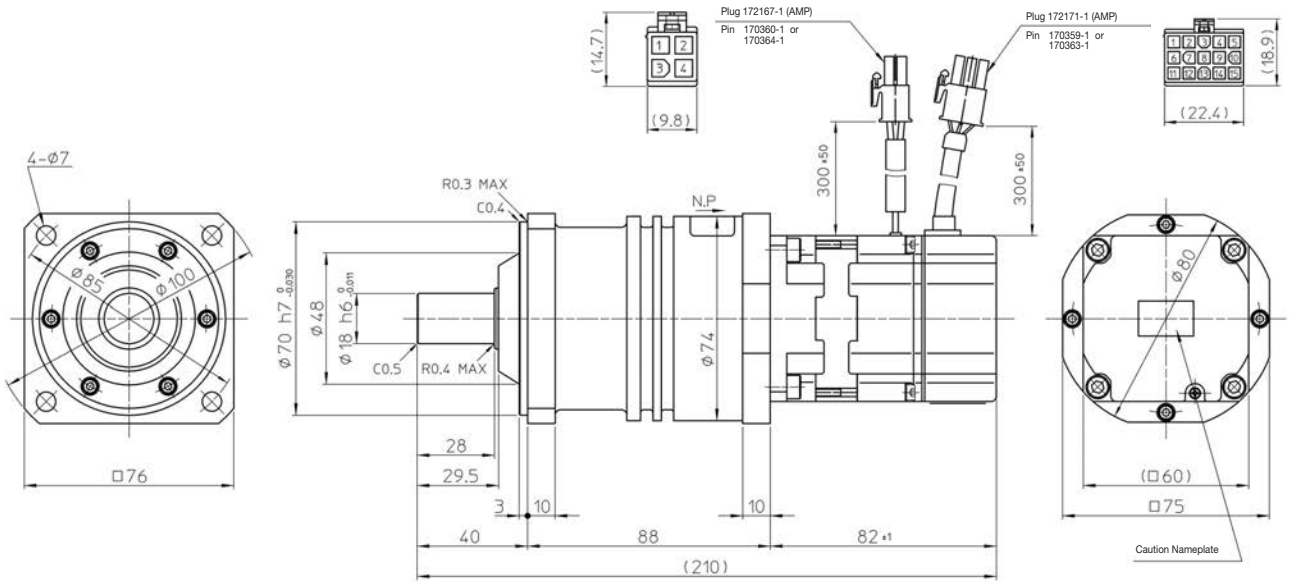
Item \ Model			RSF-17A		RSF-20A		RSF-25A		RSF-32A	
			50	100	50	100	50	100	50	100
Rated Output *3		W	62	62	120	111	180	190	310	310
Input Power Supply*3		V	AC200V							
Rated Torque*3		N·m	9.8	20	19	35	29	59	49	98
		kgf·cm	100	200	190	360	300	600	500	1000
Rated Rotational Speed*3		r/min	60	30	60	30	60	30	60	30
Continuous Stall Torque*3		N·m	9.8	20	19	35	29	59	49	98
		kgf·cm	100	200	190	360	300	600	500	1000
Maximum Momentary Torque*3		N·m	34	54	56	82	98	157	220	330
		kgf·cm	350	550	570	840	1000	1600	2200	3400
Max. Rotational Speed*3		r/min	90	45	90	45	90	45	90	45
Moment of Inertia*4	$GD^2/4$	$kg{\cdot}m^2$	0.047	0.19	0.098	0.39	0.19	0.77	0.67	2.7
	J	$kgf{\cdot}cms^2$	0.48	1.9	1.0	4.0	2.0	7.9	6.9	27
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) *5		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® 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® 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

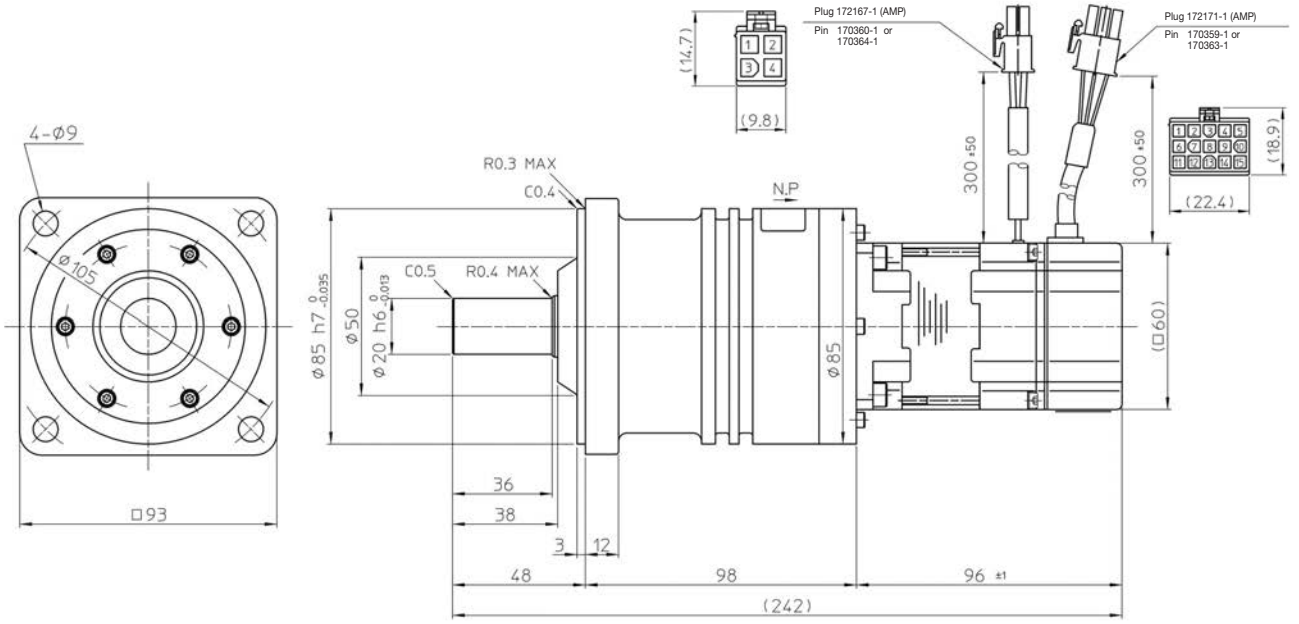
■RSF-17A

Unit: mm



■RSF-20A

Unit: mm

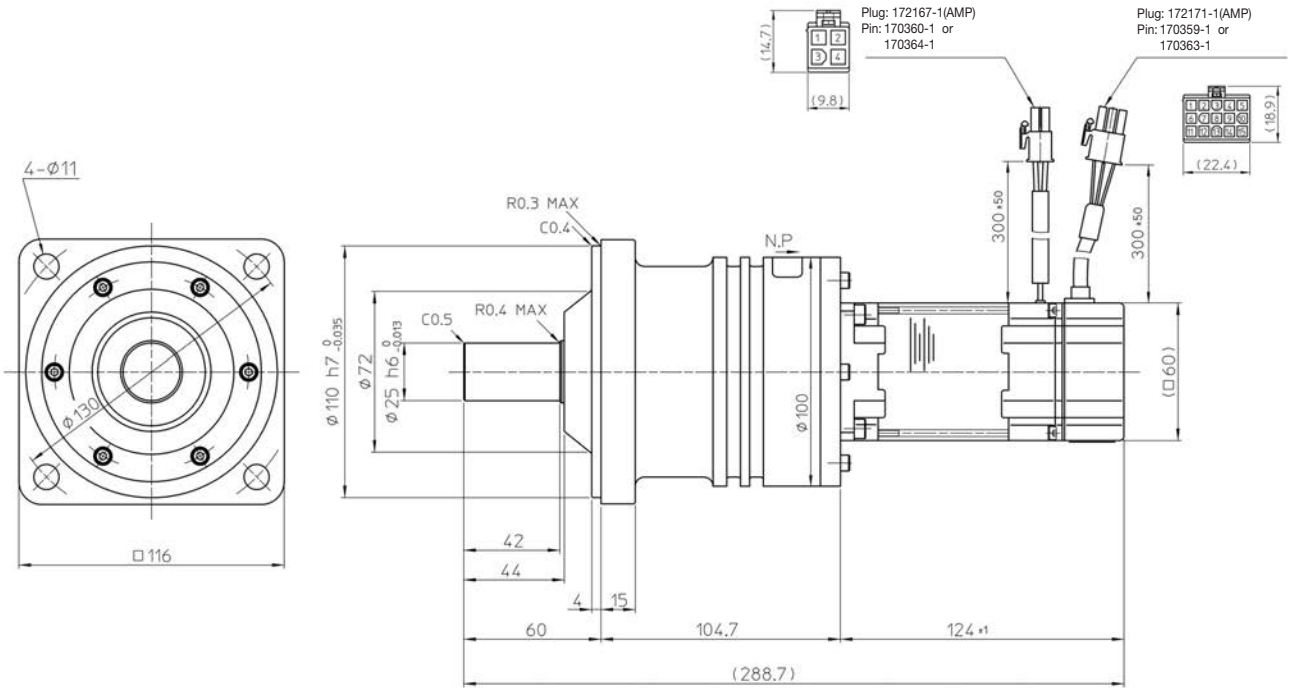


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.
* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles).
  Contact us for the differential range of the size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

External Dimensions

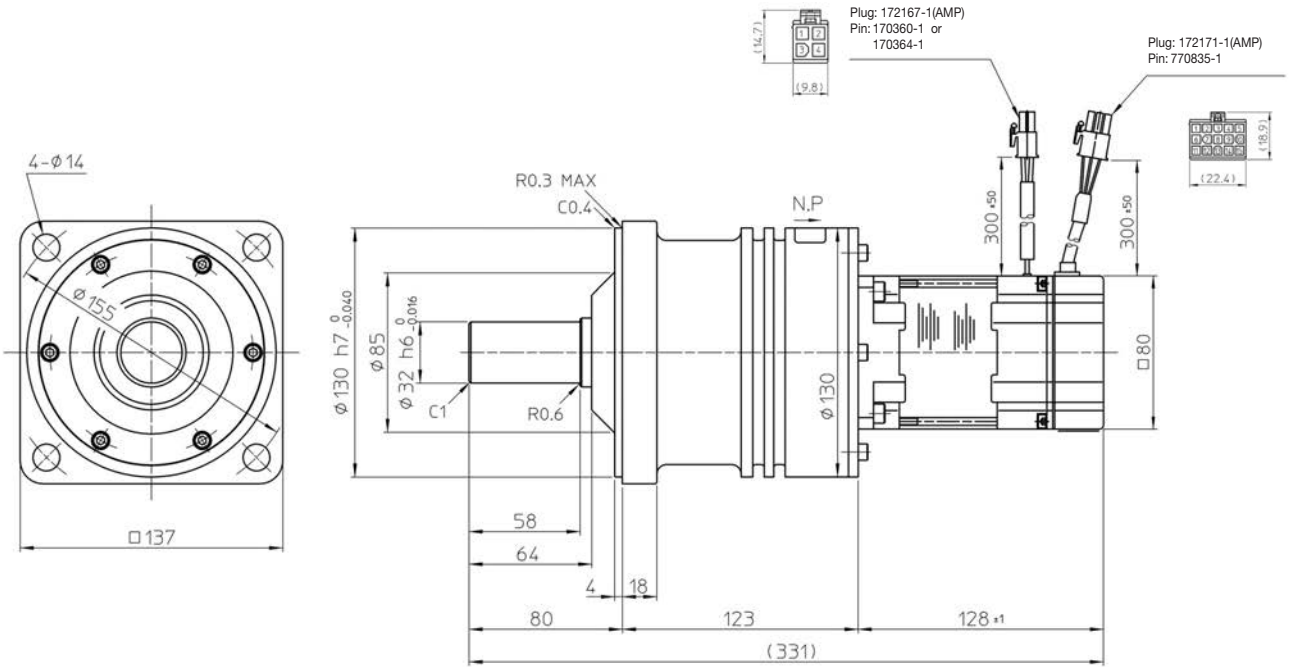
■RSF-25A

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.

Item \ Model		RSF-17A	RSF-20A	RSF-25A	RSF-32A
Uni-directional Positional Accuracy	arc-sec	120	90	90	90
	rad	5.82×10^{-4}	4.35×10^{-4}	4.35×10^{-4}	4.35×10^{-4}
Repeatability	arc-sec	±30	±30	±25	±20
	rad	$\pm1.46\times10^{-4}$	$\pm1.46\times10^{-4}$	$\pm1.21\times10^{-4}$	$\pm0.97\times10^{-4}$

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

Mechanical Accuracy

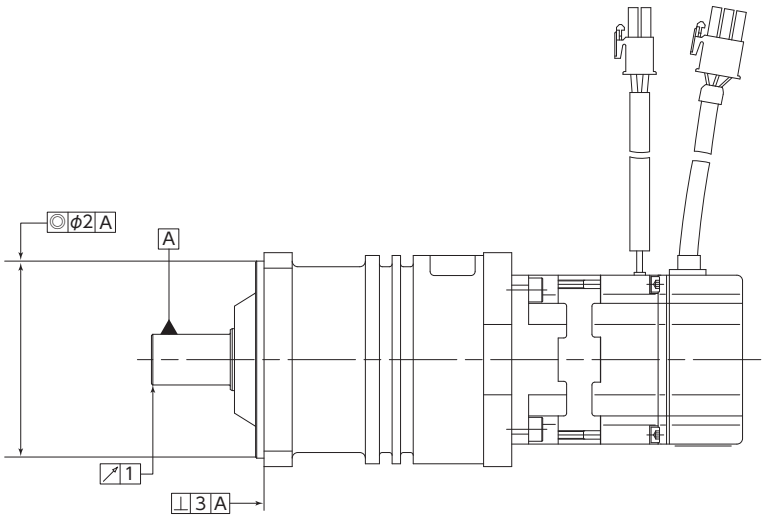
The mechanical accuracies of the output shaft and mounting flange of the RSF series are as follows.

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.

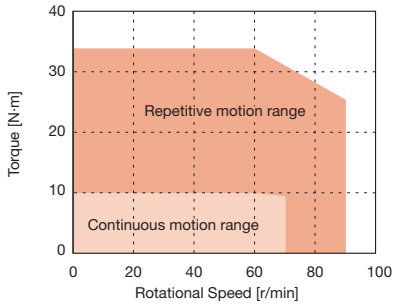


Operable Range

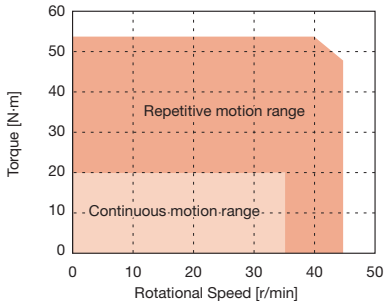
The following diagrams show the operable range of the RSF series combined with an AC servo driver (HA-800).

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.

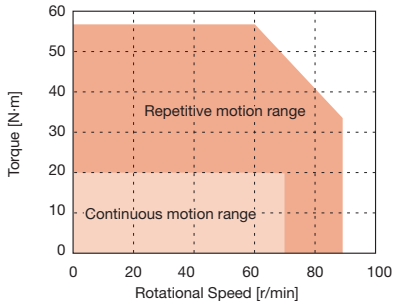
RSF-17A-50



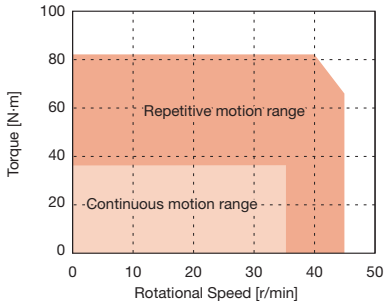
RSF-17A-100



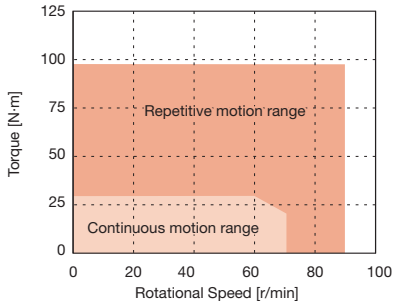
RSF-20A-50



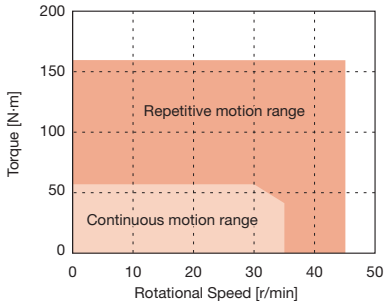
RSF-20A-100



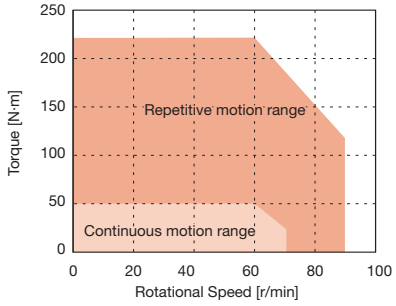
RSF-25A-50



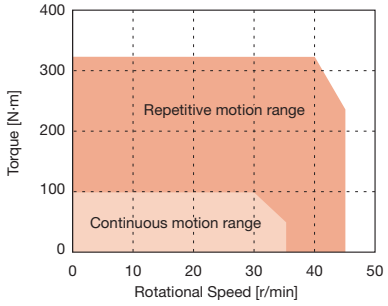
RSF-25A-100



RSF-32A-50



RSF-32A-100

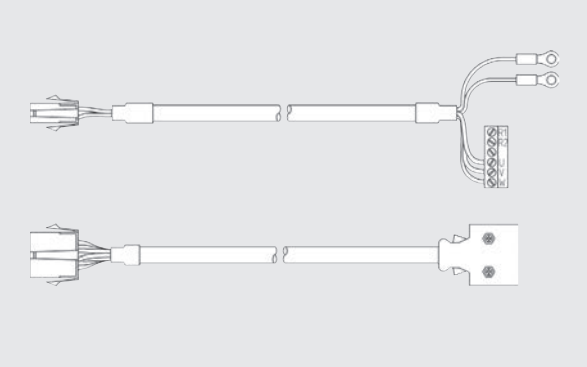


Note 1: The values in the graphs are those when mounted on the following aluminum radiation plate:
RSF-17 : 250×250×12 (mm)
RSF-20 : 250×250×12 (mm)
RSF-25, RSF-32 : 300×300×15 (mm)
Note 2: Please consult Harmonic Drive Systems if your mode of motions is uni-directional continuous motion also in the 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.



MEMO

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.

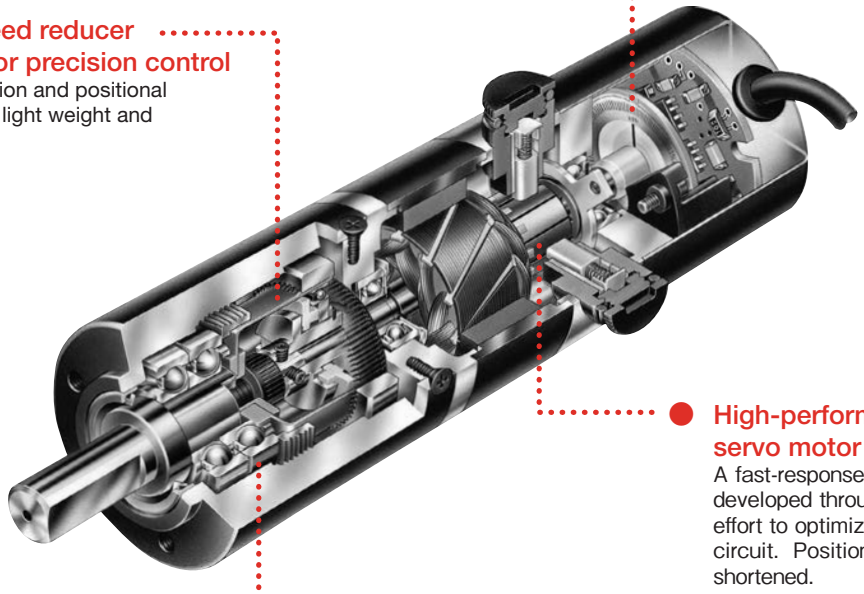
■Compact body and high-output torque

High output. 0.69N·m (maximum momentary torque achieved) by the smallest model RH-5A with outside dimensions of ϕ20mm in diameter x 89mm.

Structure

High-precision optical encoder
Rectangular output signal is dissolved up to x 4.

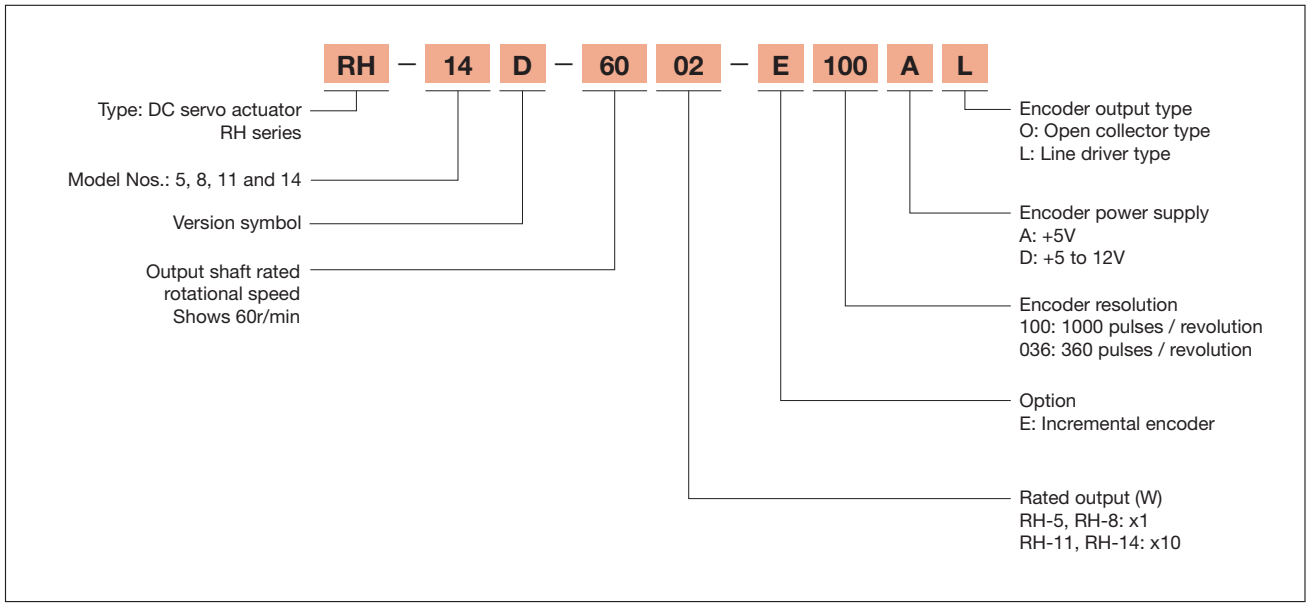
Compact and speed reducer HarmonicDrive® for precision control
Features a high resolution and positional accuracy. Unmatched light weight and compact properties.



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.)

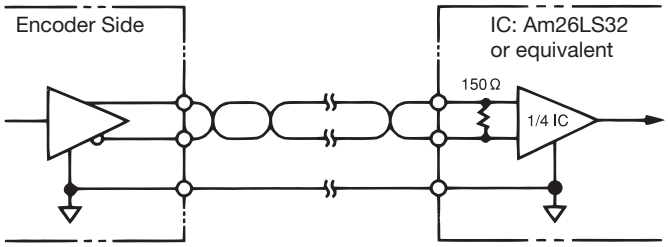
Item \ Model			RH-5A			RH-8D		RH-11D		RH-14D	
			8802	5502	4402	6006	3006	6001	3001	6002	3002
Rated Output		W	1.5	1.7	1.4	8.6	6.2	13.6	12.3	20.3	18.5
Rated Voltage		V	12			24		24		24	
Maximum Momentary Torque		N·m	0.39	0.59	0.69	2.7	3.5	4.9	7.8	14	20
		kgf·cm	4.0	6.0	7.0	27	36	50	80	140	200
Max. Continuous 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 *5	$GD^2/4$	$kg·m^2$	6.3×10^{-4}	16×10^{-4}	25×10^{-4}	37×10^{-4}	150×10^{-4}	110×10^{-4}	430×10^{-4}	210×10^{-4}	810×10^{-4}
	J	$kgf·cms^2$	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 inn 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, chose 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.

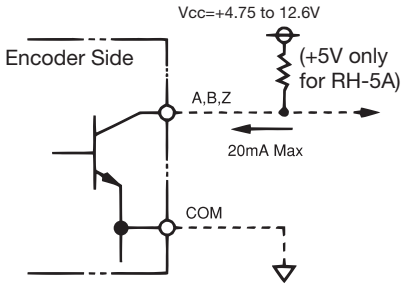
Encoder Specification

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	

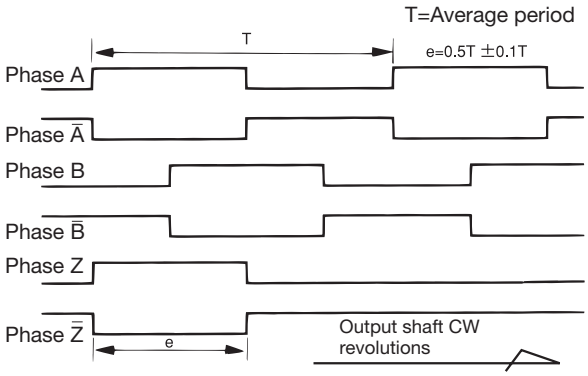
■Line Driver Output Circuit



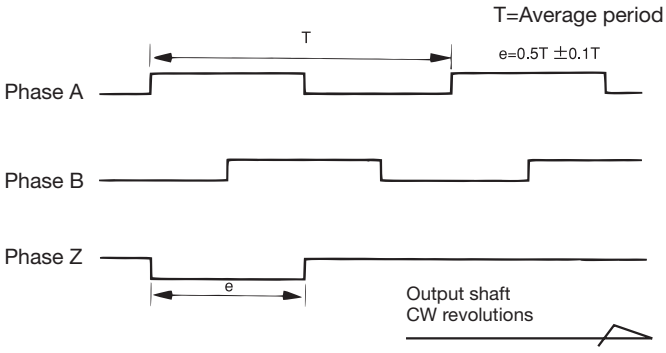
■Open Collector Output Circuit



■Line Driver Output Waveform



■Open Collector Output Waveform



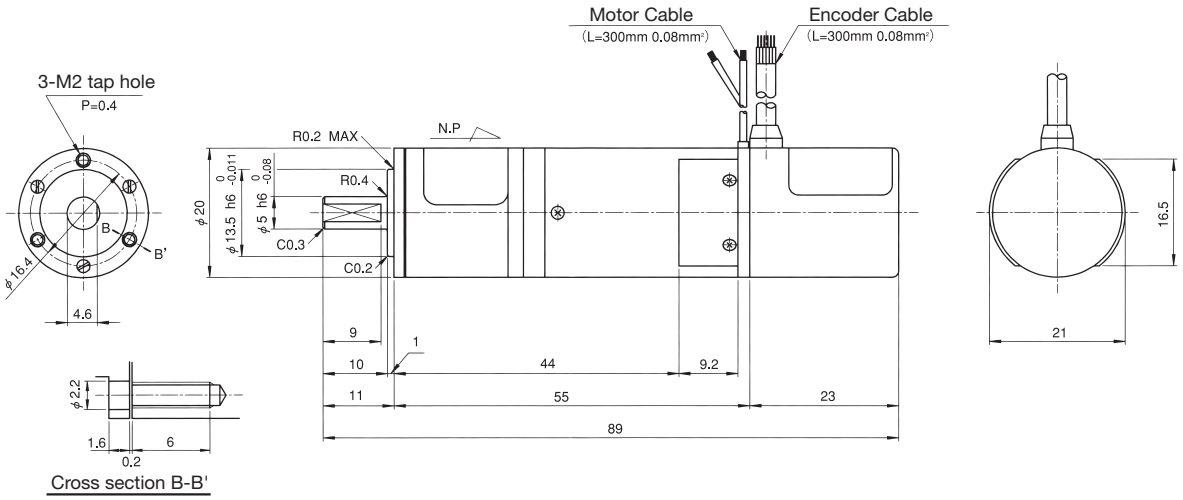
■Colors of Encoder Cables

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 Ā	–	Signal Ā	COM
Red	Signal B	Signal B	Signal B	Signal B
Green	Signal B̄	–	Signal B̄	COM
Yellow	Signal Z	Signal Z	Signal Z	Signal Z
Orange	Signal Z̄	–	Signal Z̄	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

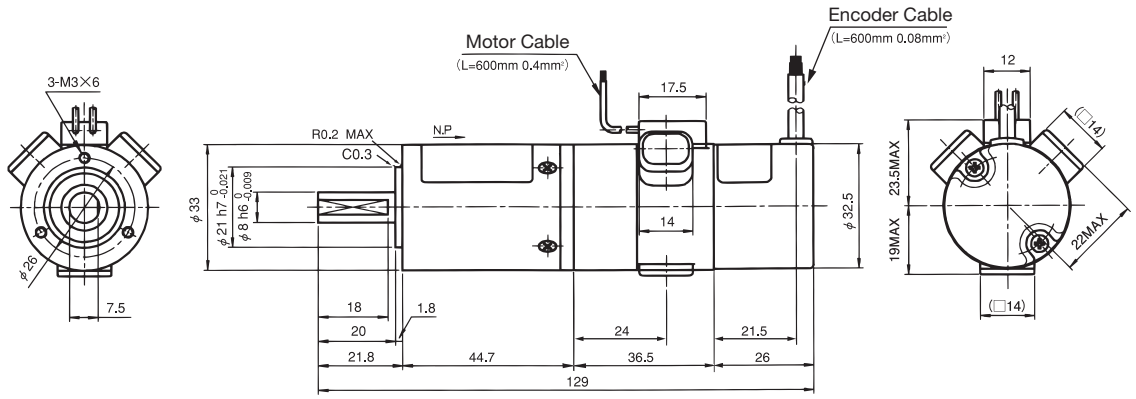
■RH-5A (With incremental encoder)

Unit: mm



■RH-8D (With incremental encoder)

Unit: mm

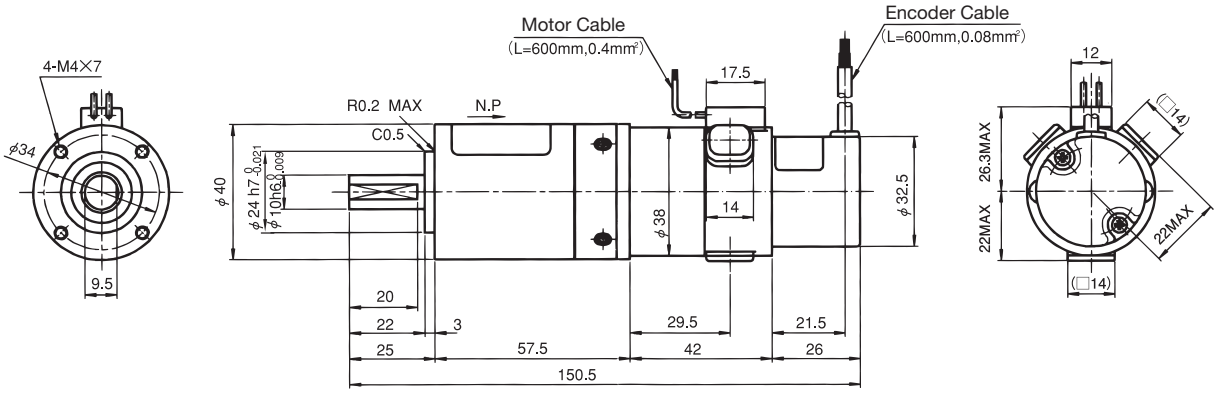


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.
* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles). Contact us for the differential range of the size that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

External Dimensions

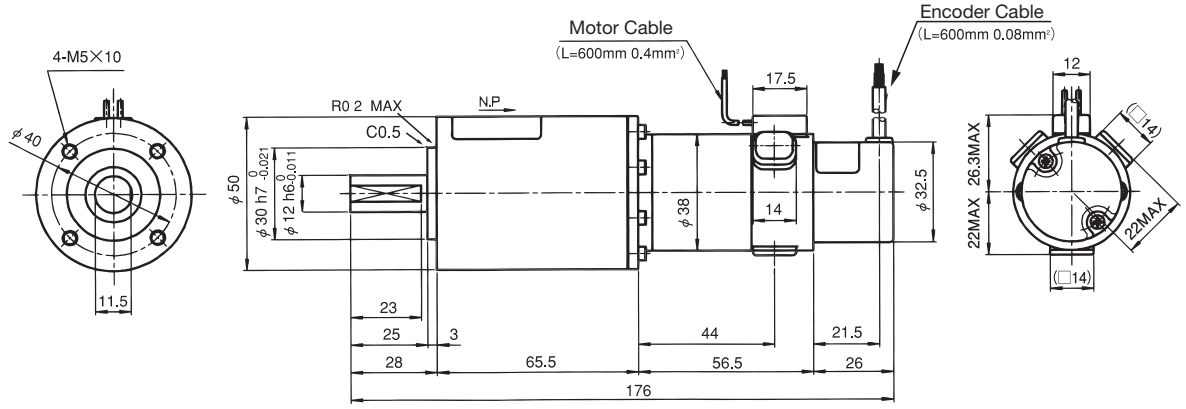
■RH-11D (With incremental encoder)

Unit: mm



■RH-14D (With incremental encoder)

Unit: mm



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.

Item \ Model		RH-5A	RH-8D	RH-11D	RH-14D
Uni-directional Positional Accuracy	arc-sec	290	150	120	120
	rad	1.31×10^{-3}	7.27×10^{-4}	5.82×10^{-4}	5.82×10^{-4}
Repeatability	arc-sec	±90	±60	±60	±60
	rad	$\pm4.36\times10^{-4}$	$\pm2.91\times10^{-4}$	$\pm2.91\times10^{-4}$	$\pm2.91\times10^{-4}$
Reverse Positional Accuracy	arc-sec	150	60	60	60
	rad	7.27×10^{-4}	2.91×10^{-4}	2.91×10^{-4}	2.91×10^{-4}

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

Mechanical Accuracy

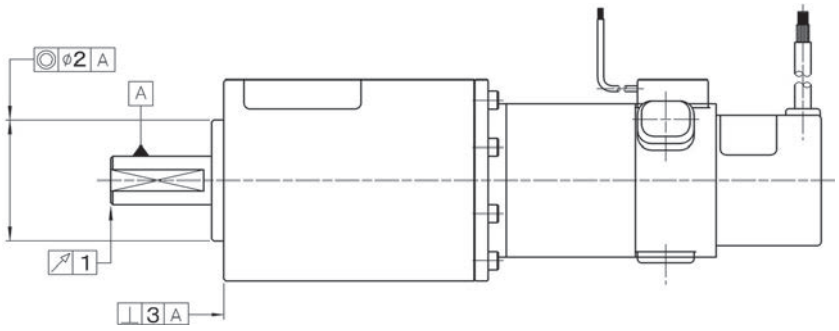
The mechanical accuracies of the output shaft and mounting flange of the RH series are as follows.

Mechanical Accuracy

Unit: mm

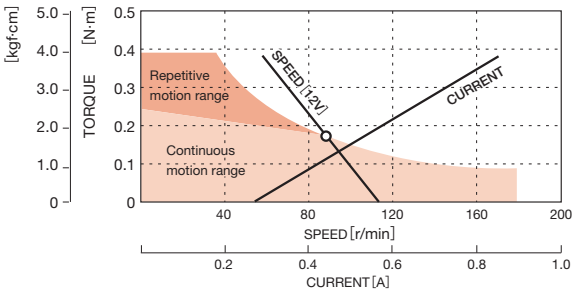
Accuracy Item	RH-5A	RH-8D	RH-11D	RH-14D
1 Output shaft surface runout	0.03	0.03	0.03	0.03
2 Concentricity of output shaft and fitting part	0.04	0.04	0.04	0.04
3 Perpendicularity between the output shaft and mounting surface	0.04	0.04	0.04	0.04

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

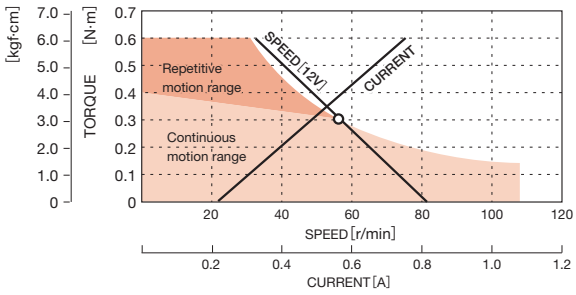


Operable Range

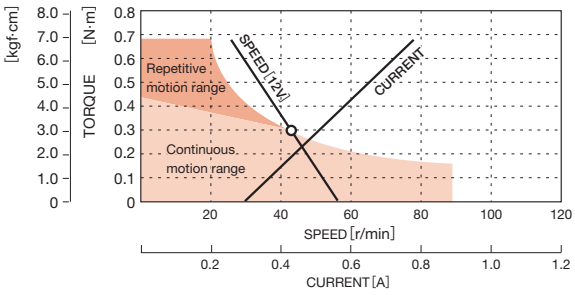
RH-5A-8802



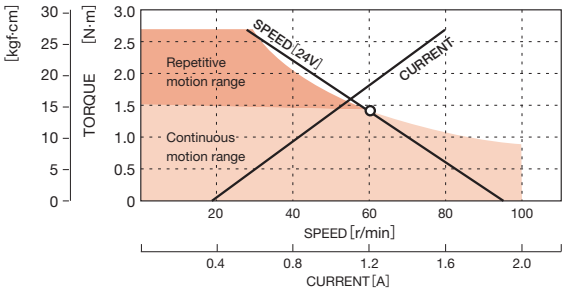
RH-5A-5502



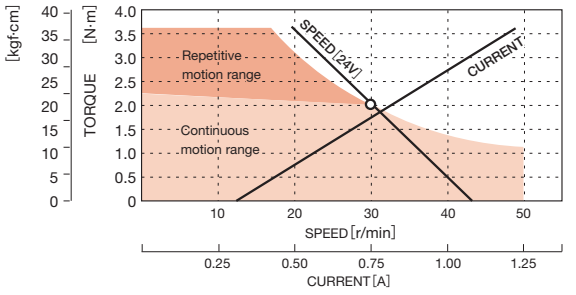
RH-5A-4402



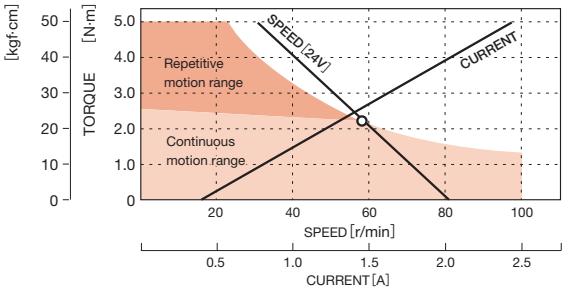
RH-8D-6006



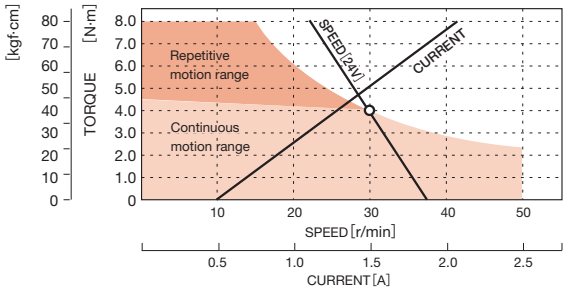
RH-8D-3006



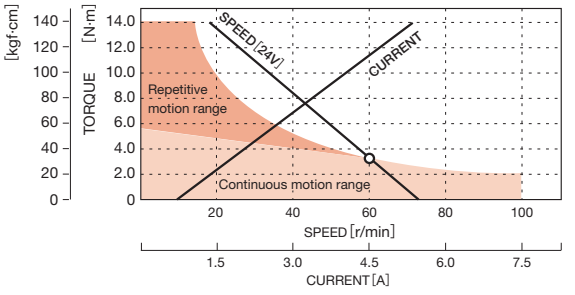
RH-11D-6001



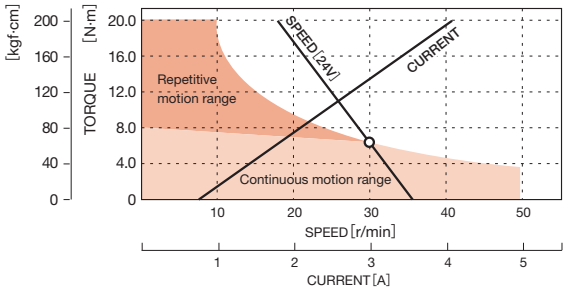
RH-11D-3001



RH-14D-6002



RH-14D-3002



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

Check servo mechanism (Rotational or linear motion?)

▼

Calculate load torque (T_L) and moment of inertia (J_L) Equation (1)

▼

Create a speed pattern based on operational status

▼

Tentatively select an actuator based on load conditions

▼

Calculate required starting torque (T1) Equation (2)

▼

Is the required starting torque less than the max. momentary torque of the actuator? — NO → (Tentatively select an actuator based on load conditions)

▼ YES

Create a torque pattern and calculate effective torque (Trms) Equation (3)

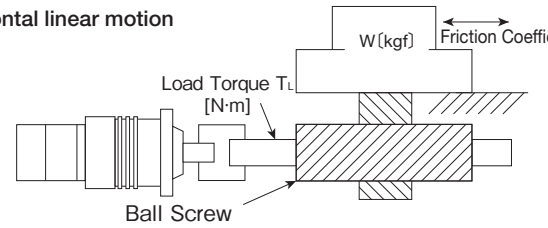
▼

Is the effective torque smaller than the rated torque of the actuator? — NO → (Tentatively select an actuator based on load conditions)

▼ YES

Actuator is selected

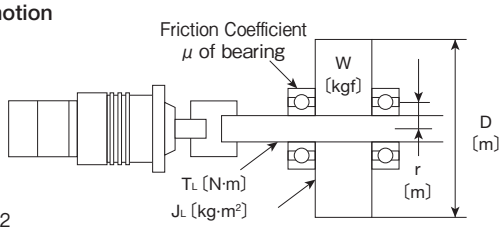
● For horizontal linear motion



Equation (1)-1

$$J_L = J_S + w\left(\frac{P}{2\pi}\right)^2 〔kg·m^2〕 \qquad T_L = \frac{\mu W \cdot P}{2\pi \cdot \eta} 〔N·m〕$$

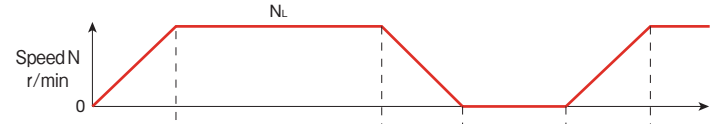
● Rotation motion



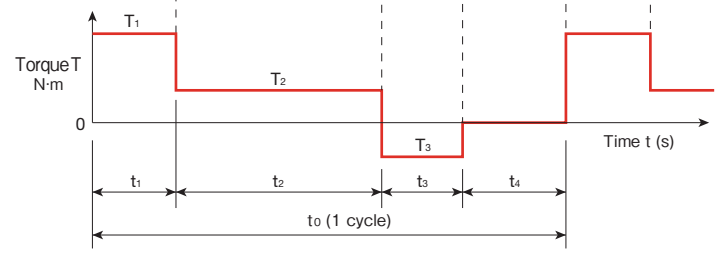
Equation (1)-2

$$J_L = J_S + \frac{w}{8} D^2 〔kg·m^2〕 \qquad T_L = \mu W \cdot r 〔N·m〕$$

● 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	≦	Rated torque TR	N·m
Max. rotational speed of load N_L	≦	Rated rotational speed NR	r/min
Moment of inertia of load J_L	≦$3J_A$*	Moment of inertia JA	kg·m²

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

Equation (2)

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

Equation (3)

$$T_2 = T_L$$

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

$$T_{rms} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3}{t0}}$$

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)

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

▼

Calculate required starting torque (T1)
Equation (1)

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

▼

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

▼

Calculate effective torque (T_{rms}) Equation (3)

$T_1 = 3.0N{\cdot}m$
$T_2 = T_L = 2N{\cdot}m$
$T_3 = T_L - (T_1 - T_L) = 1N{\cdot}m$

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

▼

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

▼

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

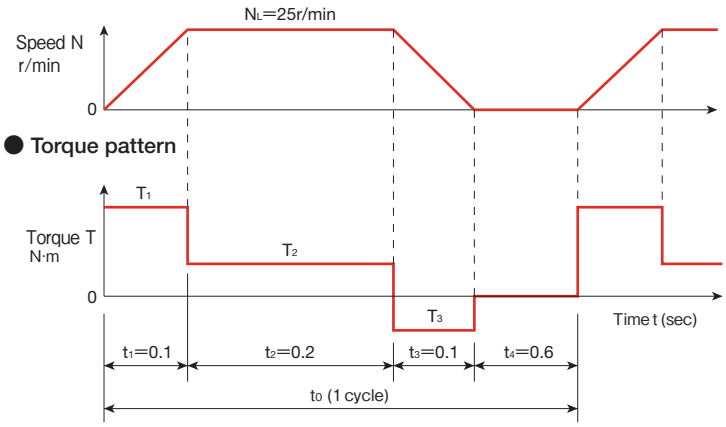
● Load Conditions

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·m²
Speed pattern	$t_1 = t_3$	:0.1sec
	t_2	:0.2sec
	t_4	:0.6sec

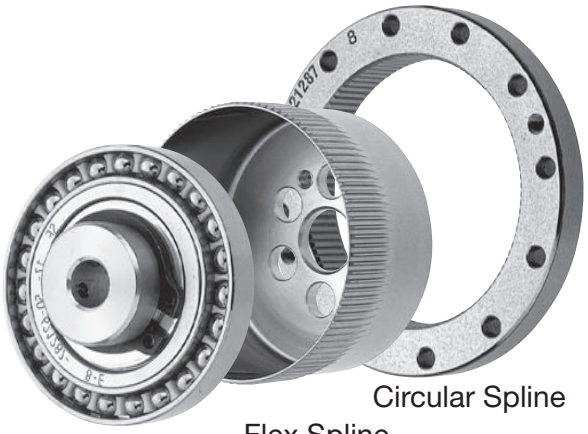
Note: Use characteristic values that are converted into those for the actuator output shaft.

● 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.

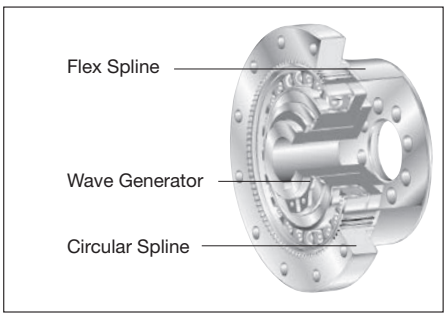
Flex Spline:

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.

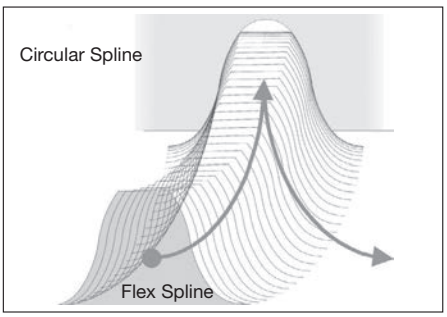
Circular Spline:

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

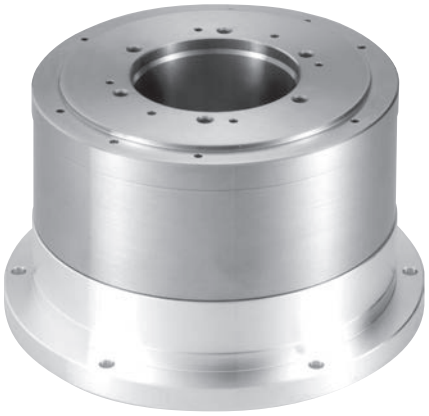


Continued on page 106

Direct Drive Motor

High precision, high resolution

KDU Series



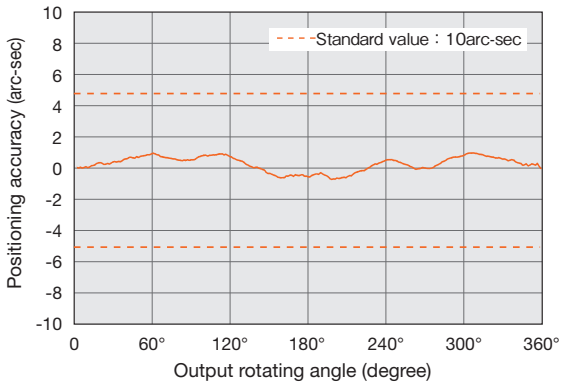
Persistence to extra-high resolution and high precision
Resolution: 11.84 million divisions/revolution (0.11arc-sec/pulse)
direct drive motor

Features

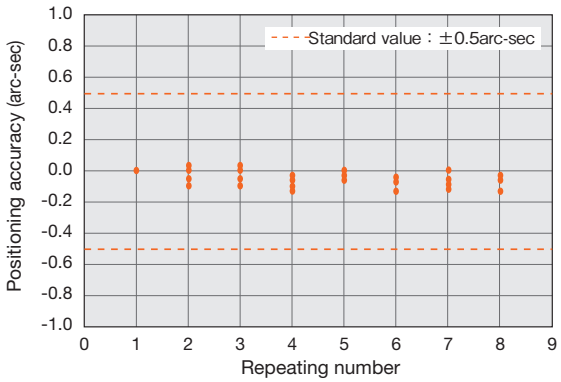
■High precision

Absolute position accuracy: 10arc-sec
Repetitive positioning accuracy: ±0.5arc-sec

Absolute position accuracy ±10arc-sec

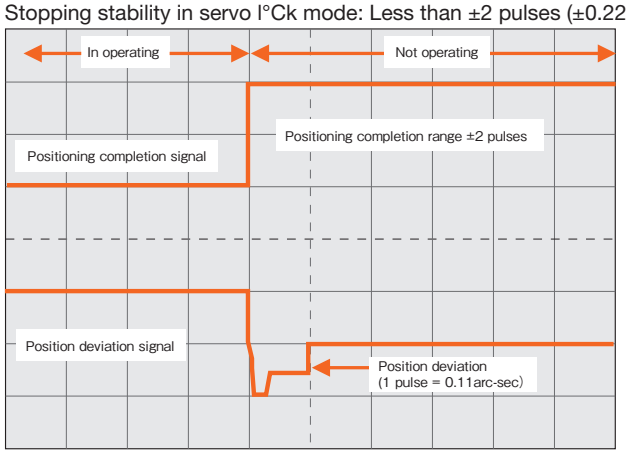


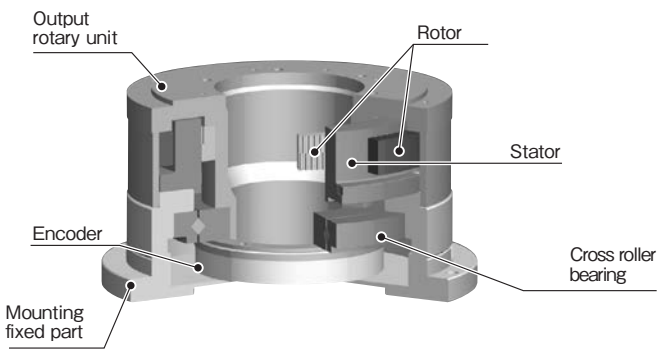
Repetitive positioning accuracy ±0.5arc-sec



■Stopping stability

Stopping stability in servo l°Ck mode: Less than ±2 pulses (±0.22 arc-sec)





■Large hollow opening diameter

Motor outside diameter: ϕ130mm
Hollow opening diameter: ϕ50mm

■Mechanical accuracy

Runout on output side: 2μm

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.

KDU-13SB – D3 – 100 – □
(1) (2) (3) (4)

(1) Motor type: Direct driver motor KDU series
KDU-13-SB: KDU-13SB-E10
KDU-13WB: KDU-13WB-E10

(2) System: Combination with AC servo driver HA-770-2

(3) Power voltage 100: AC100V
200: AC200V

(4) Specification symbol: No mark: Standard item
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: 11840000p/rev
(6) Specification symbol: No symbol: Standard specification
SP: Special specification

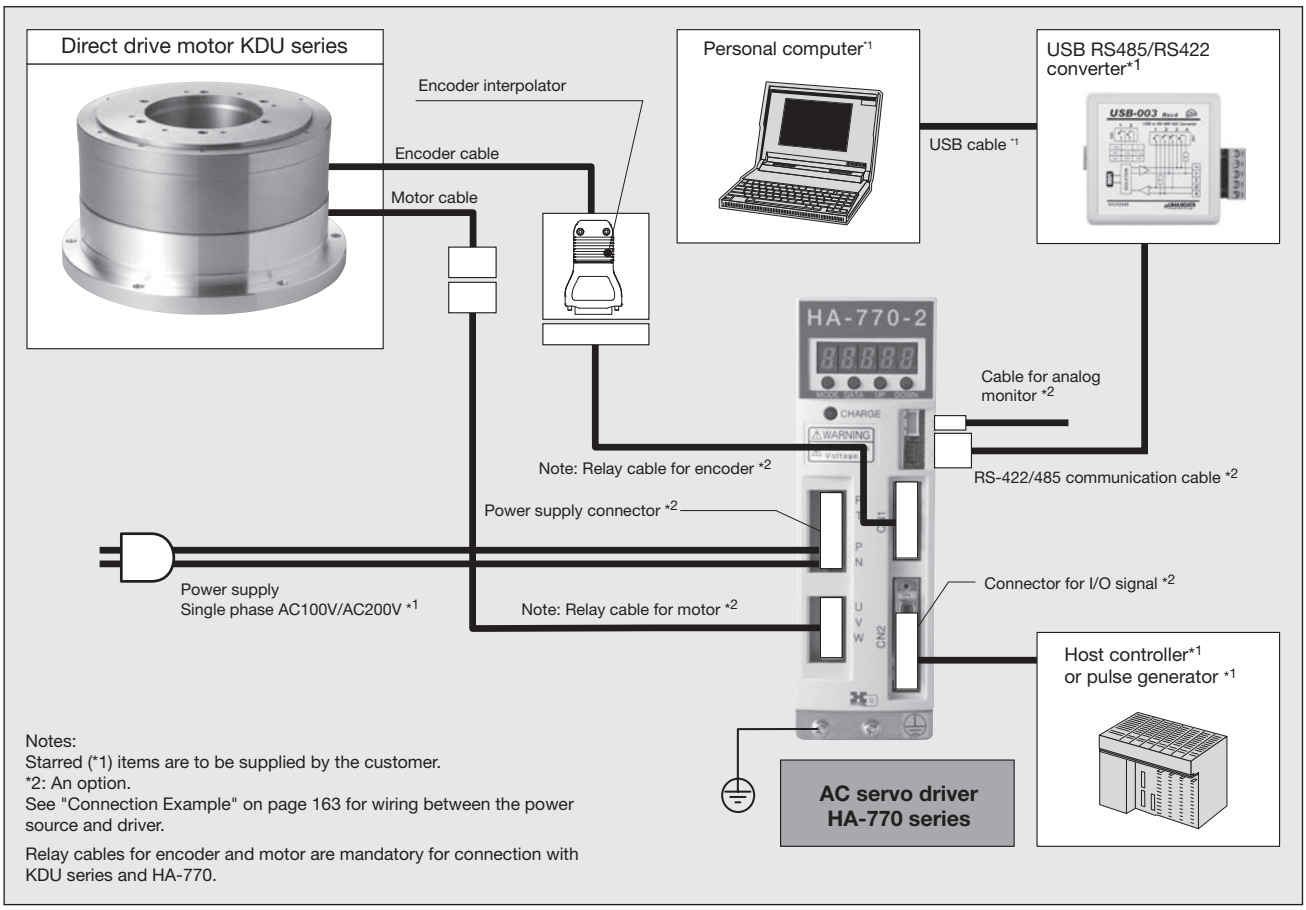
■Driver single type

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



Notes:
Starred (*1) items are to be supplied by the customer.
*2: An option.
See "Connection Example" on page 163 for wiring between the power source and driver.

Relay cables for encoder and motor are mandatory for connection with KDU series and HA-770.

KDU Series Specification

Item \ Model			KDU	
			-13SB	-13WB
Maximum Torque *2		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	$GD^2/4$	$kg·m^2$	0.0047	0.0065
	J	$kgf·cms^2$	0.048	0.066
Moment of Rigidity		N·m/rad	$2.4×10^5$	
		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 *3		arc-sec	±0.5	
Absolute Positioning Accuracy *3		arc-sec	10 (Angular position corrected) *4	
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 (*3) Operating humidity/storage humidity: 20 to 80% RH (no condensation) No powder or dust, metal powder, corrosive gases, flammable gases, or oil mist, etc. To be used indoors. No direct sunlight. Altitude: 1000m or lower	
Motor Insulation			Insulation resistance: 100m ohm or more (DC 500V) Dielectric strength: AC 1500V/1min 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

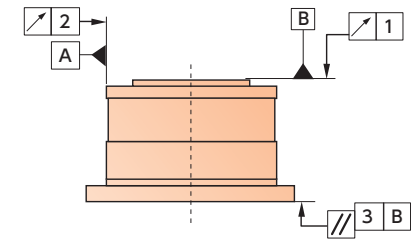
The mechanical accuracies of the output shaft and mounting flange of the KDU series are as follows.

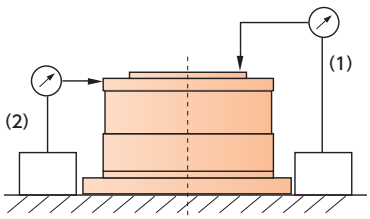
Mechanical Accuracy

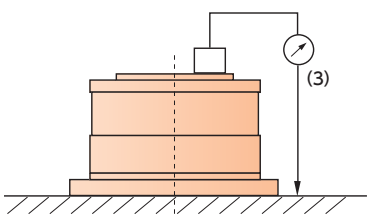
Unit: mm

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.

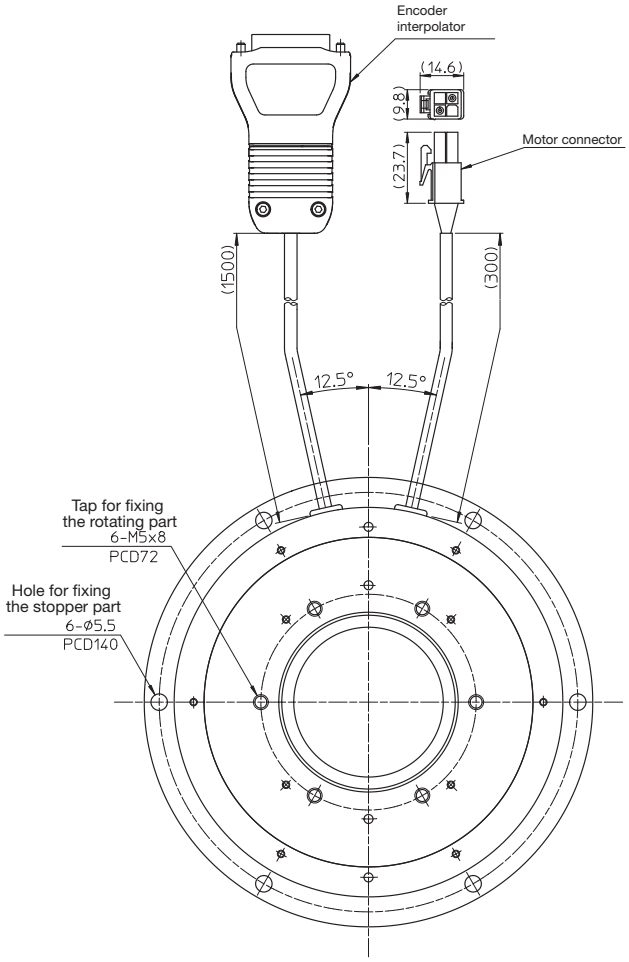
(1) Output shaft surface runout
The axial runout (maximum runout width) of the outermost part of the output shaft when the output rotating part is turned one turn is measured using a dial gauge mounted on the fixed part.

(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.

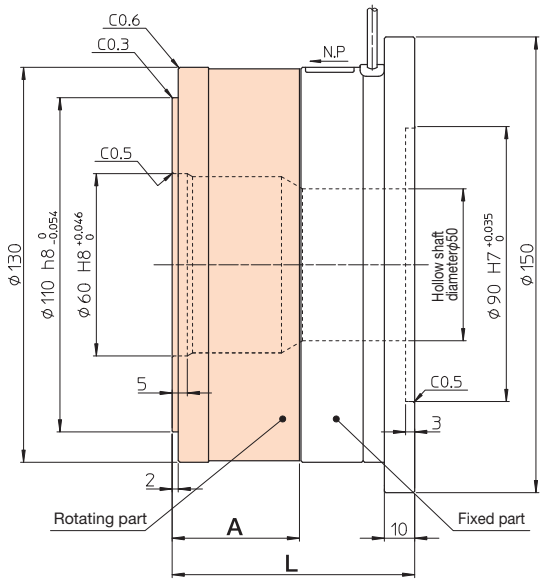
External Dimensions

■KDU-13SB-E08-100･KDU-13WB-E08-100

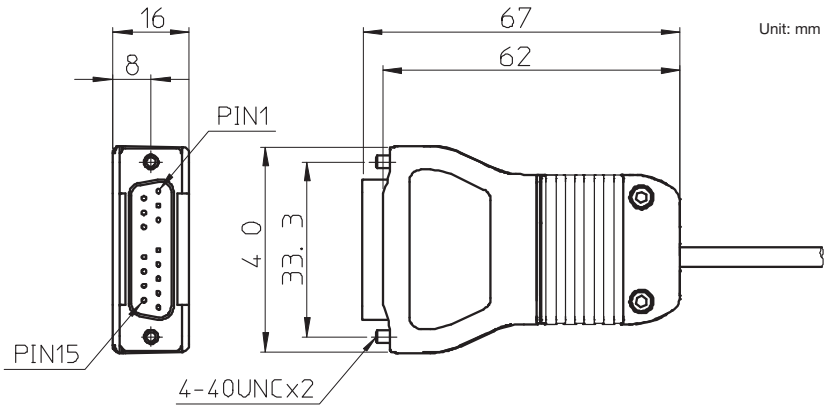


Unit: mm

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



■Encoder interpolator (mass: 130g)



Unit: mm

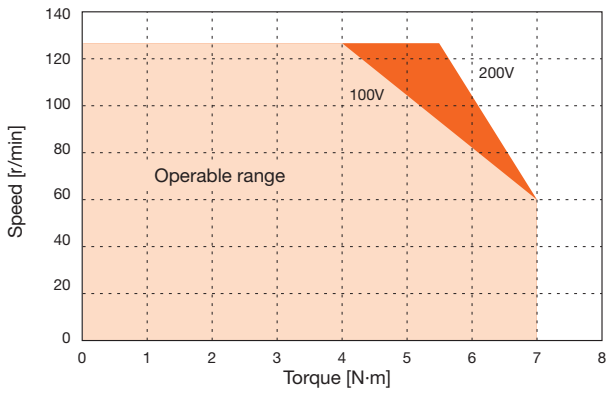
* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.
* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles). Contact us for the differential range of the size that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

Standard Combination Table of Relay Cables (option)

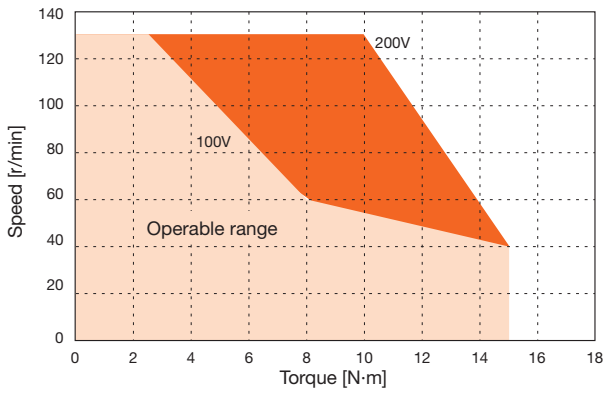
Relay cable model name for incremental encoder / Relay cable model name for motor	Total cable length (except connector)
EWA-E015-OM15-3M14 / EWA-M03-A04-WG04-01	Encoder cable: 3m Motor cable: 3.3m
EWA-E035-OM15-3M14 / EWA-M05-A04-WG04-01	Encoder cable: 5m Motor cable: 5.3m

Operable Range

■ KDU-13SB-E10



■ KDU-13WB-E10



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 ±0.3ºC 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 ±3ºC.

Periodically rotate the output shaft 90º or more.

Where the system operating environment requires fine motions, periodically rotate the output shaft more than 90º 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

LSA Series

The optical galvano 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

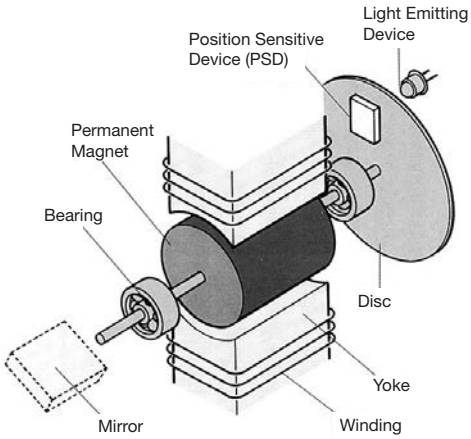
A unique movable magnet motor assures a high torque-inertia ratio, meaning even a relatively large mirror can be driven stably at a high speed.

■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

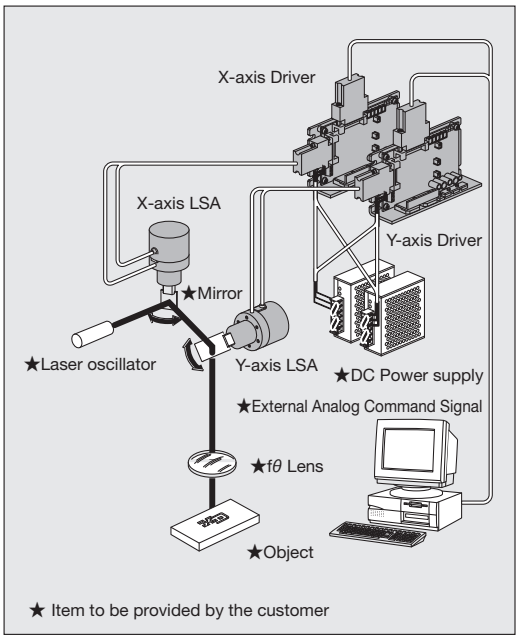
LSA-10A-30 – D – 130 – □□

- LSA-10A-30: Scanner model
- D: System designation
- 130: Combined driver model
- □□: Specification symbols
  None: Standard specification
  SP: Special specification

Note: LSA-50A-30 and PSM-110 are models without combination.

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^2	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) *1		μrad	5
1° Step Response *2		ms	0.5 (Load condition:1g·cm^2)
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

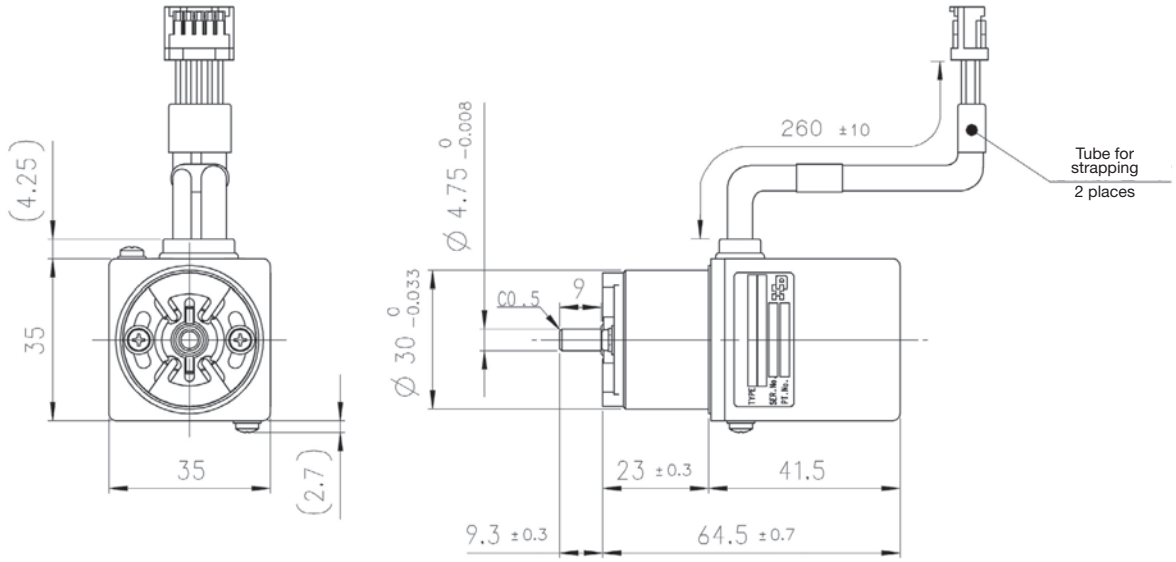
* 1: All angles are mechanical angles.

* 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.

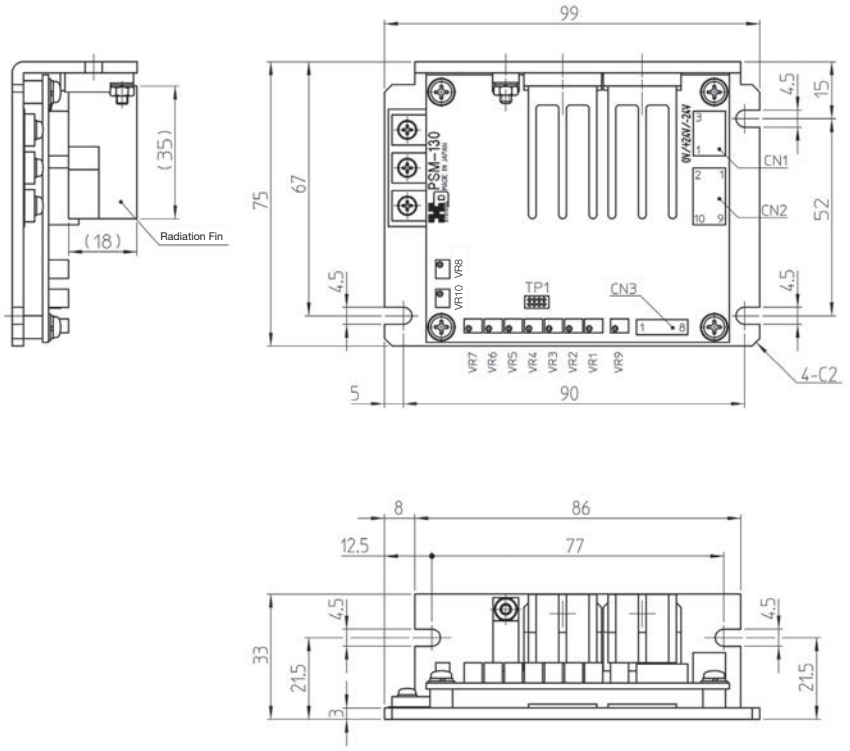
■Principal Specification

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.
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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 Please check intended application and describe your intended application in details.	Classification ☐ Laser machining ☐ Measurement ☐ Image processing ☐ Laser display ☐ 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.

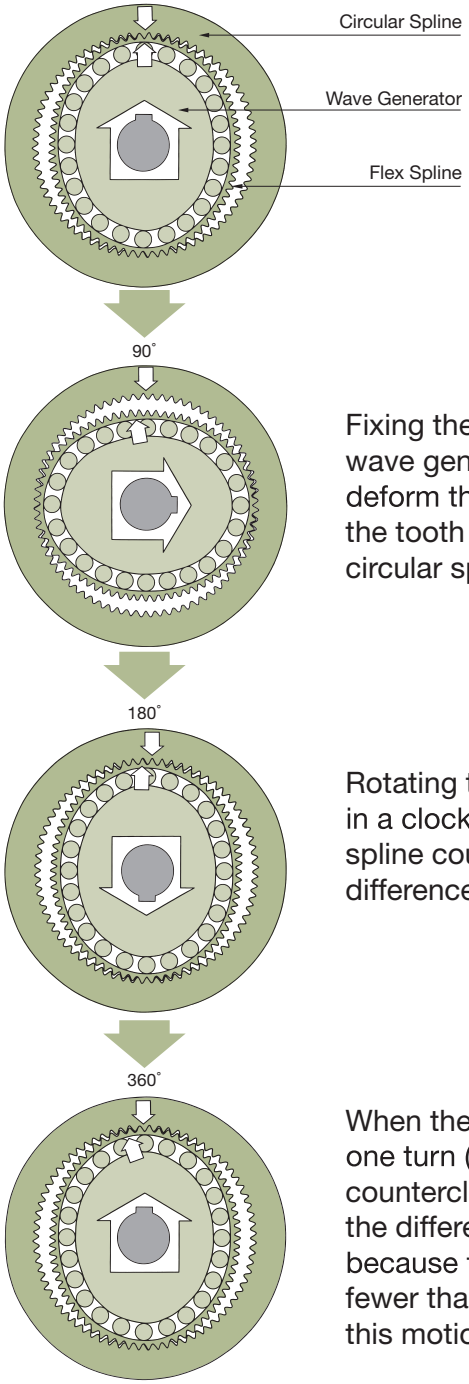
Drive Conditions

No.	Item	Specification	Remarks
①	Input command waveform (Fundamental waveform)	☐ Square wave ☐ Trapezoidal wave ☐ Saw-tooth wave ☐ Triangular wave ☐ 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^2]	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.

<<HDS Control No.: >>
<<HDS Sales Office: >>
<<HDS Salesperson: >>

Operating Principles of HarmonicDrive®



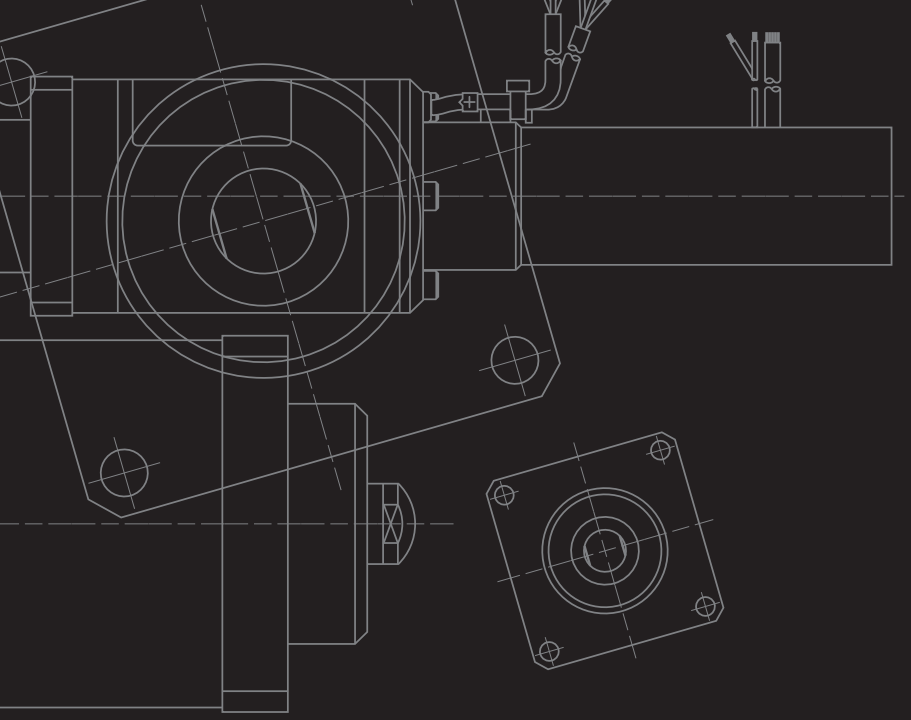
The flex spline is bent into an oval shape by the wave generator. Teeth on the long axis of the oval therefore mesh with the circular spline, while the teeth on the short axis of the oval perfectly detach from the circular spline.

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

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

LA – 30 B – 10 – F – L

- LA: LA series
- 30: Size
- B: Version symbol
- 10: Stroke (mm)
- F: Flange mounting type
- None: DC servo motor drive (Open collector type)
- L: DC servo motor drive (Line driver type)

Specification

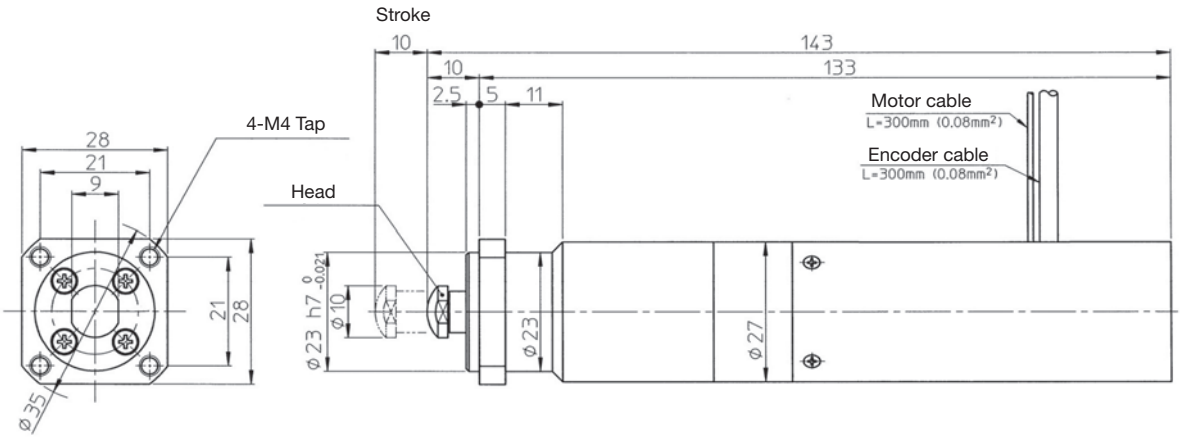
Item \ Model	LA-30B-10-F	LA-32-30-F
Resolution	0.0174μm	
Stroke *1	10mm	30mm
Rated Feed Speed	0.5mm/s	
Maximum Feed Speed	0.9mm/s	
Maximum Driving Force *2	49N	
	5kgf	
Repeatability *3	±0.1μm or less/1mm stroke	
Positional accuracy *3	2μm or less/stroke 40μm	
Full Stroke Positional accuracy *3	10μm or less	15μm or less
Lost motion *3	5μm or less/1mm stroke	
Load Condition	Apply 10N or more to the shaft end to ensure accuracy	
Drive Motor	DC servo motor MDC02-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 Line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ 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. (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

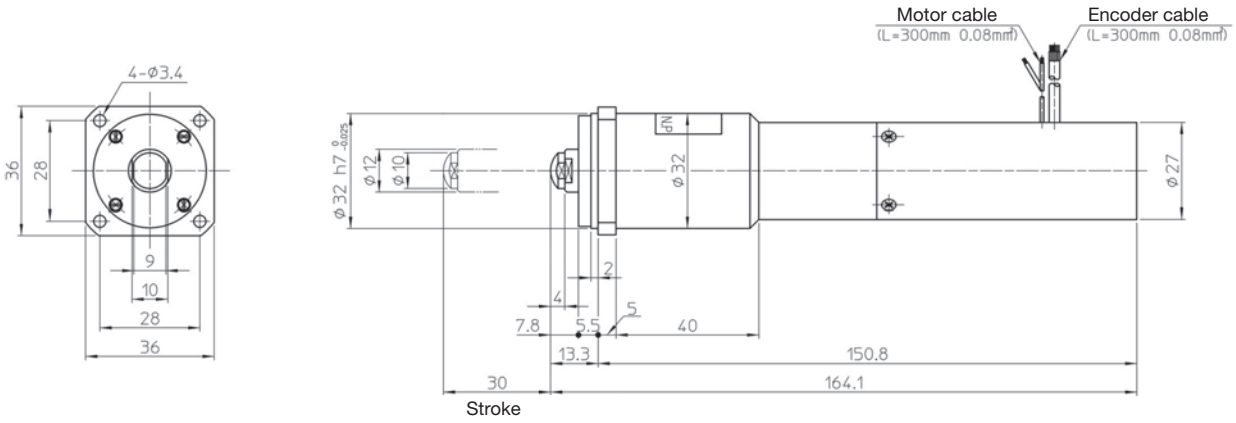
■LA-30B-10-F

Unit: mm



■LA-32-30-F

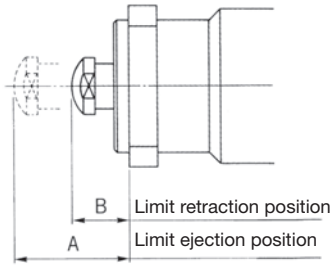
Unit: mm



* 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	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

LAH – 46 – 10 02 – F – L

- LAH: LAH series
- 46: Size
- 10 02: Stroke (mm)
- F: Rated driving force (200N)
- Flange mounting type
- None: DC servo motor drive (Open collector type)
- L: DC servo motor drive (Line driver type)

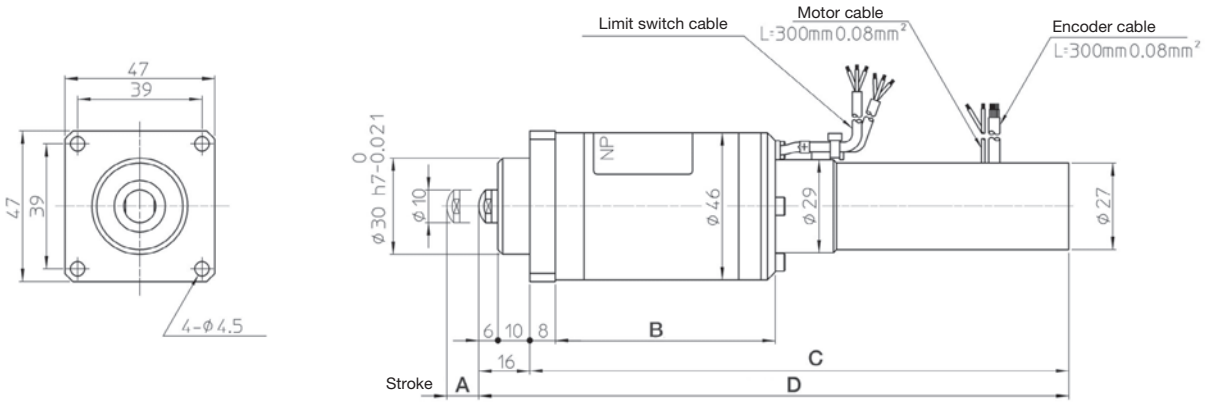
Specification

Item \ Model	LAH-46-1002-F	LAH-46-3002-F
Resolution	0.069μm	
Stroke *1	10mm	30mm
Rated Feed Speed	2mm/s	
Maximum Feed Speed	3.7mm/s	
Rated Driving Force *2	200N	
	20kgf	
Maximum Driving Force *2	390N	
	40kgf	
Repeatability *3	±0.5μm or less/1mm stroke	
Positional accuracy *3	4μm or less/0.2mm stroke	
Full Stroke Positional accuracy *3	7μm or less	10μm or less
Lost motion *3	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 Line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ 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. (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

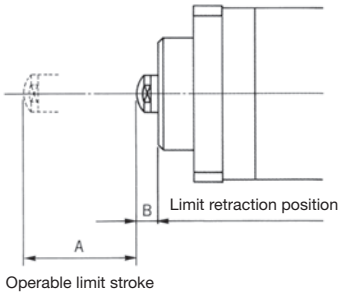


Model \ Symbol	A	B	C	D	Mass
LAH-46-1002-F	10mm	69mm	169mm	185mm	0.81kg
LAH-46-3002-F	30mm	88mm	188mm	204mm	0.85kg

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

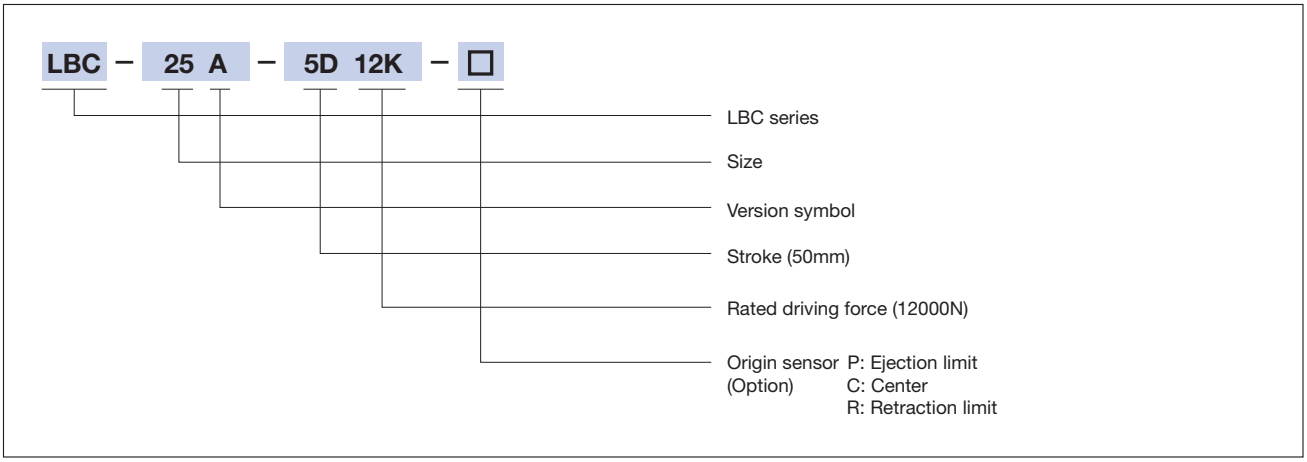
LBC Series

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



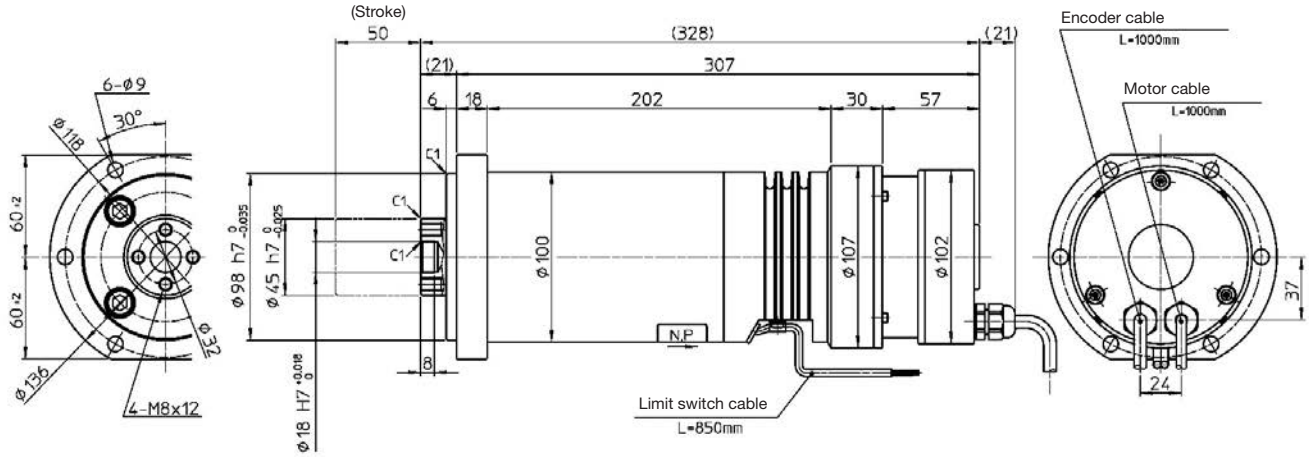
Specification

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

Unit: mm

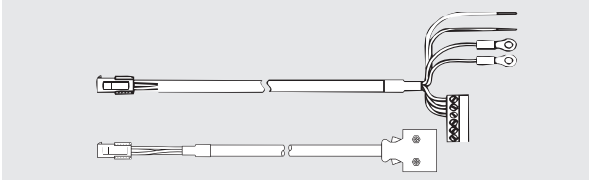


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.
* The differential range may differ depending on the method for manufacturing parts (molded articles, machining articles). Contact us for the differential range of the size that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

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.

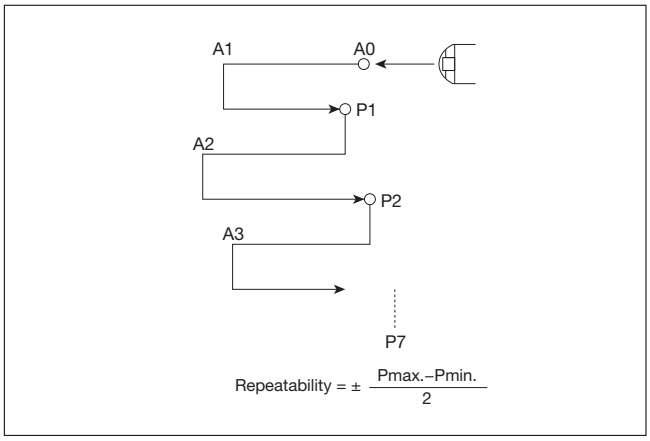


Tips for Evaluating Performance of the Linear Actuator

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)

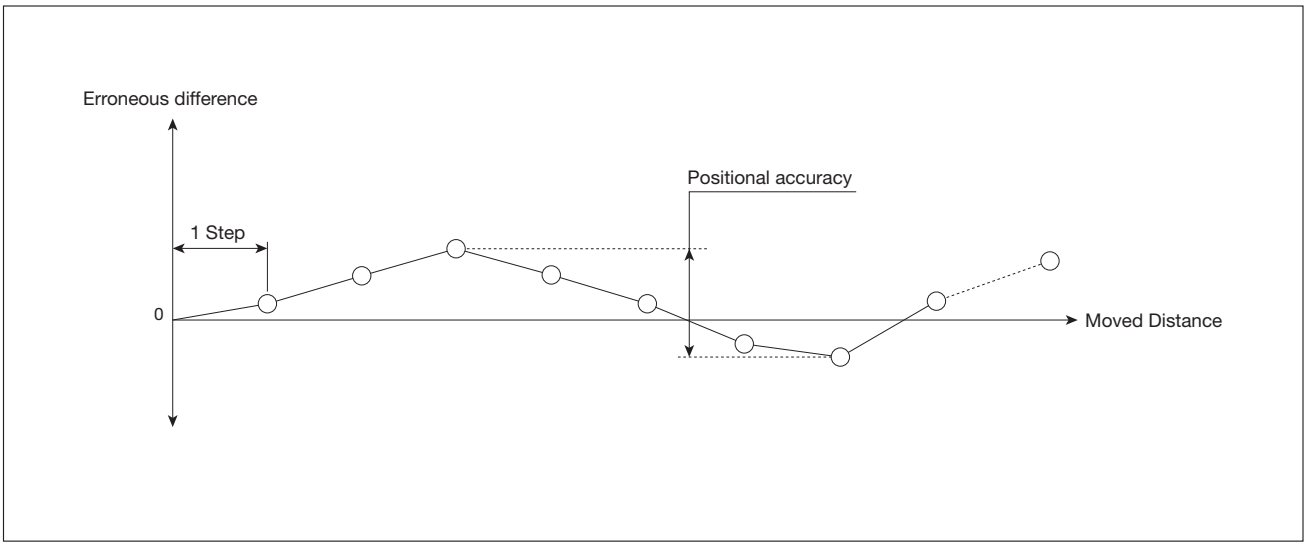
Represents a degree of coincidence between a position actually moved and a position commanded to move in a fine stroke.

(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.

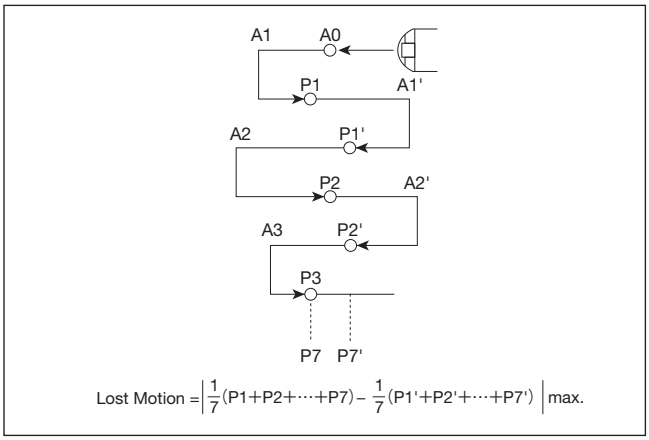
(1) An output rod or a stage is moved to a position beyond the limit for the stroke on the retraction side, moved in an ejection (+) direction from there and is stopped near the stroke limit position. This position is set as a datum position.
(2) Feed in succession from the datum position to the stroke 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)

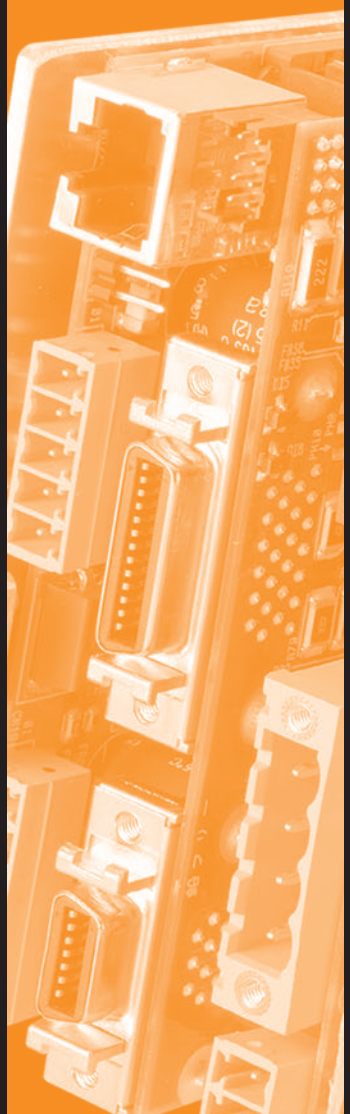
The servo stiffness of a motor influences the positional accuracy. Impacts are especially large if the load fluctuates.
The angular transmission error*1 of HarmonicDrive® embedded in actuators is extremely small, less than 2 minutes, and impacts of load fluctuations are determined by a HarmonicDrive® 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



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) 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 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) 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 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 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 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

Item \ Driver model		HA-800B-1	HA-800B-3	HA-800B-6	HA-800B-24
Driver's Rated Current*1		1.5A	3.0A	6.0A	24.0A
Driver's Maximum Current*1		4.0A	9.5A	19.0A	55.0A
Power Supply Voltage	Main circuit*1	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*1	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) 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 With installation terminal	Regenerative Resistance Installed 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.

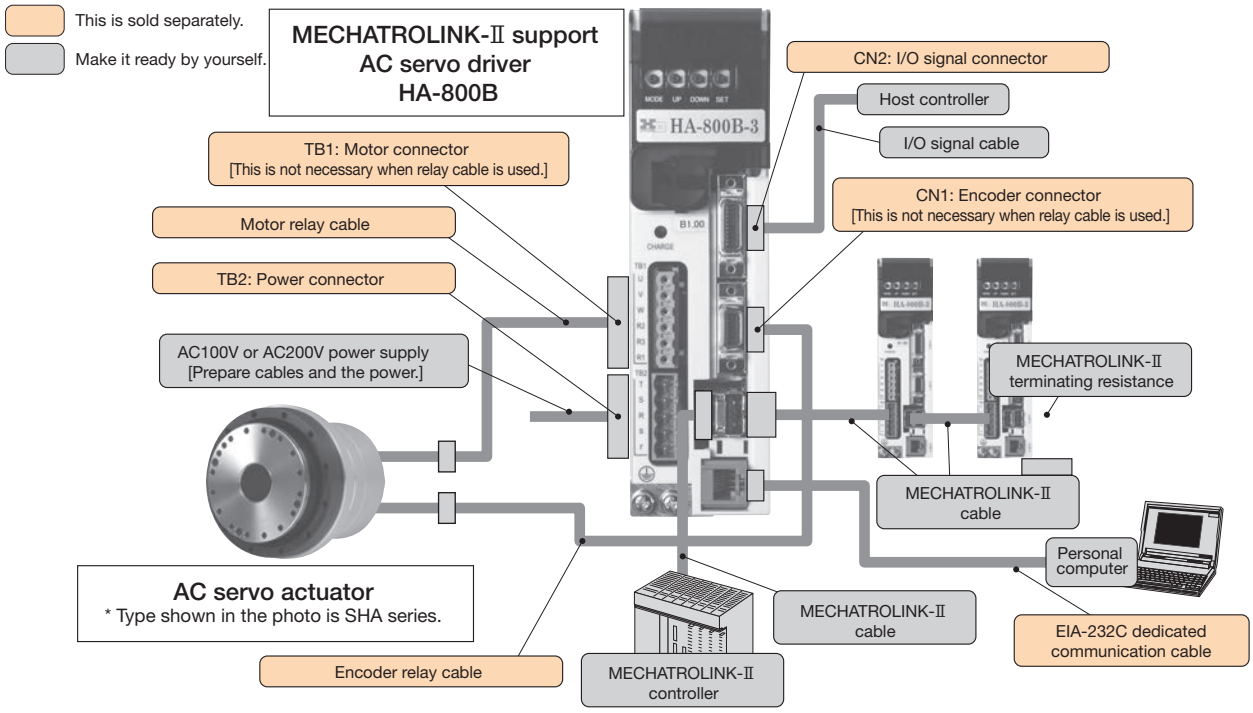
Communication Specification

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 *1	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) 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

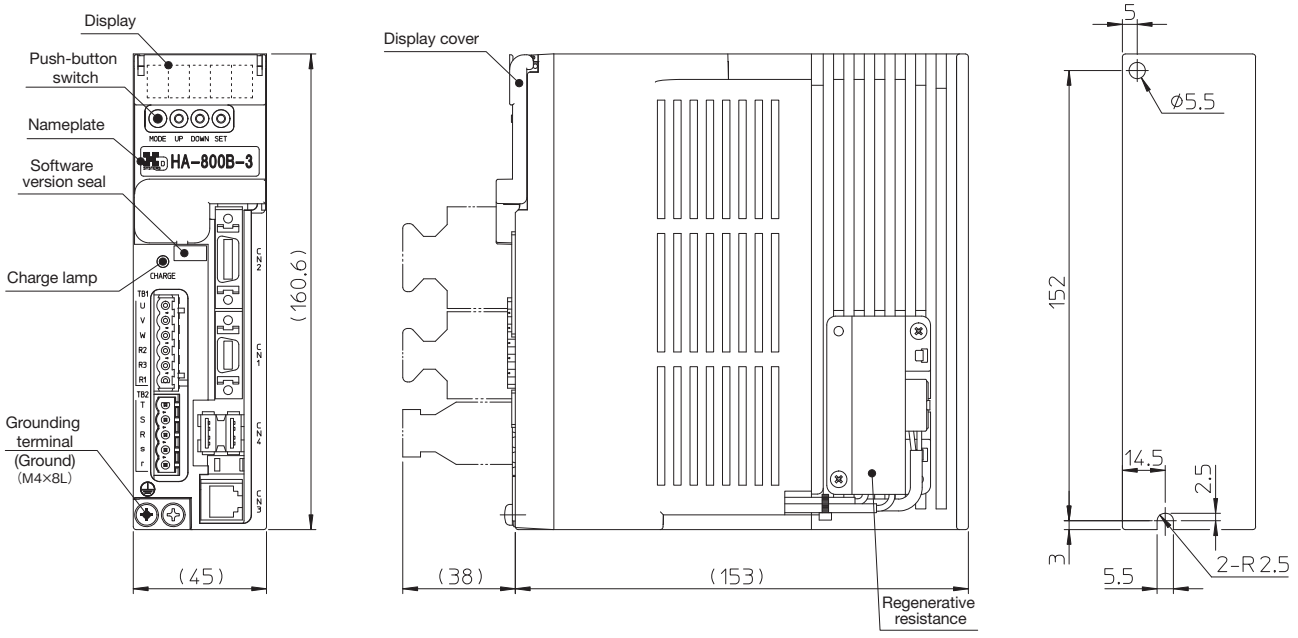


* See the technical information for the details of configuration related to power supply.
* When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

External Dimensions

■HA-800B-1, 3

Unit: mm

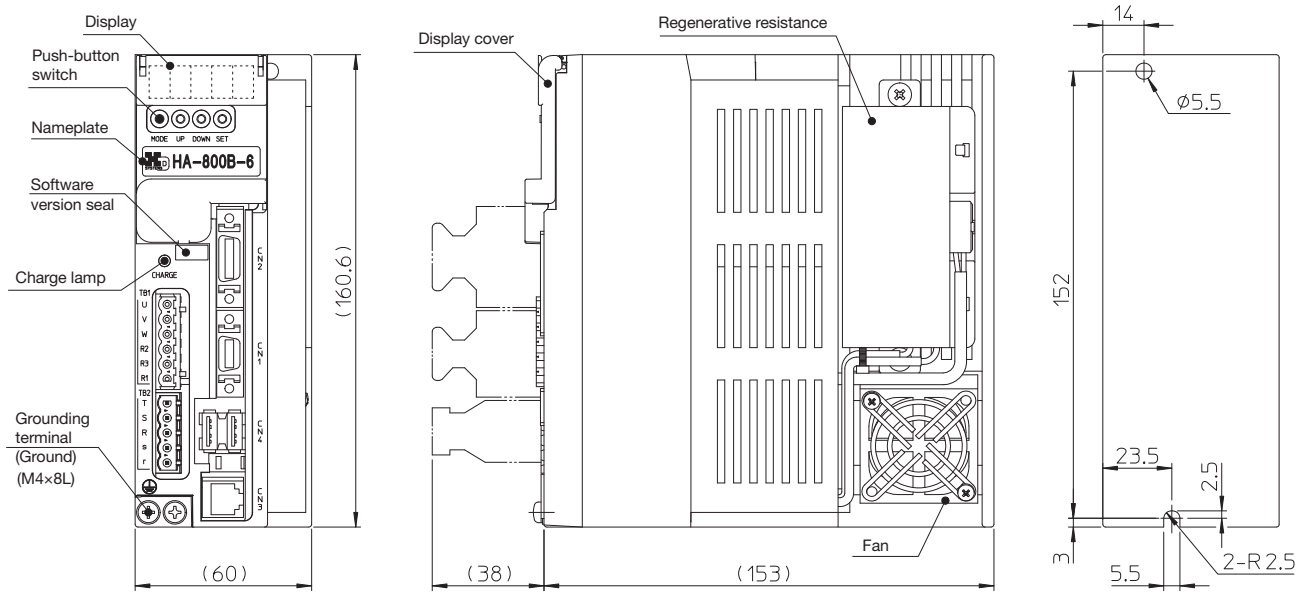


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

Dimensional Outline Drawing

■HA-800B-6

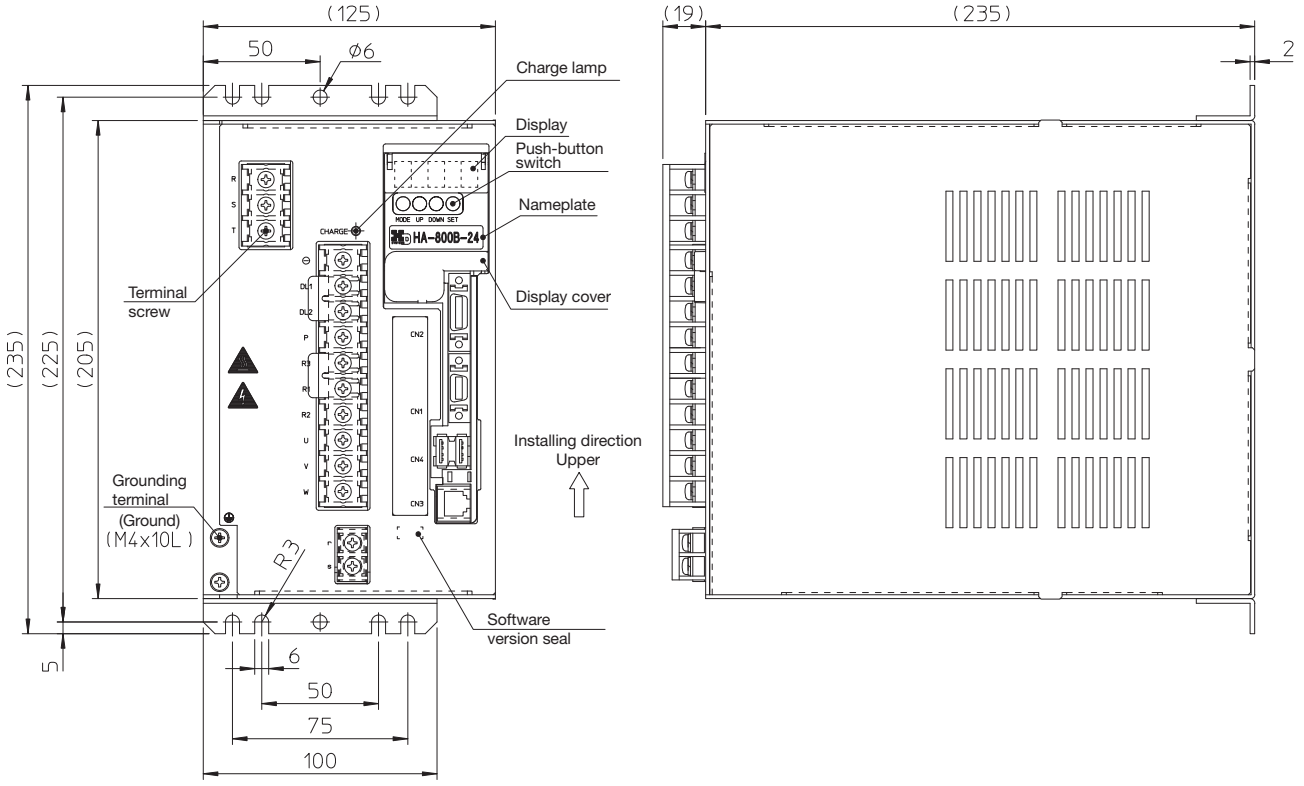
Unit: mm



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

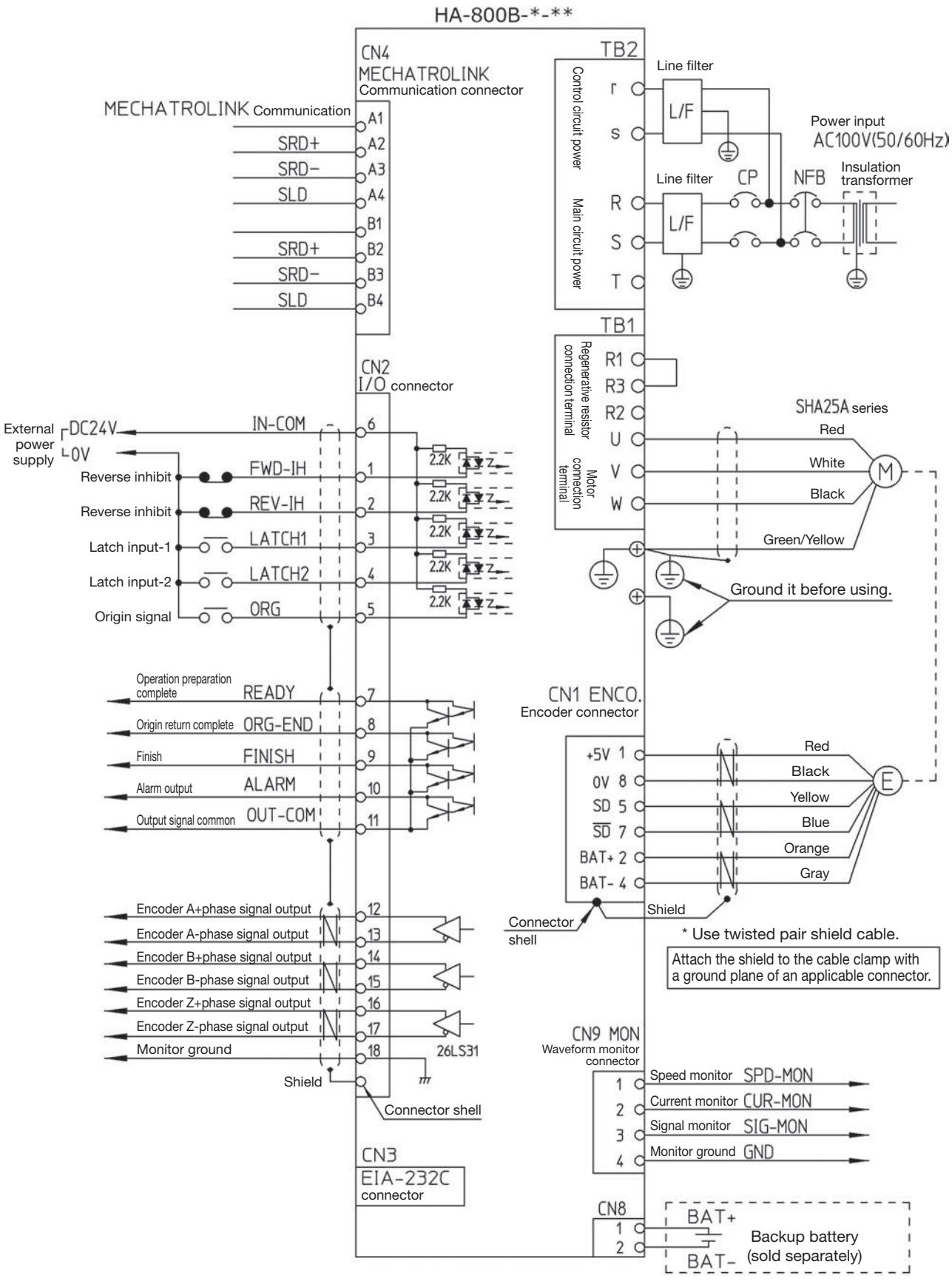
■HA-800B-24

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.

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 MECHATROLINK-Ⅱ support	Relay Cable (sold separately)	
SHA series	20	200	HA-800B-3D-200/HA-800B-3E-200	Motor cable EWD-MB□□-A06-TN3	Encoder cable 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		
	40	200	HA-800B-24D-200/HA-800B-24E-200	Motor cable Model No. 40:EWD-MB□□-A06-TMC Model No. 58,65:EWD-MB□□-D09-TMC	Encoder cable Model No. 40:EWD-S□□-A08-3M14 Model No. 58,65:EWD-S□□-D10-3M14
	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	HA-800B-1C-200	Motor cable EWC-M□□-A06-TN3	Encoder cable (INC) EWC-E□□-M06-3M14
	11	200	HA-800B-1C-200		
	14	200	HA-800B-1C-200		
	8	100	HA-800B-1C-100	Motor cable EWC-M□□-A06-TN3	Encoder cable (INC) EWC-E□□-M06-3M14
	11	100	HA-800B-1C-100		
	14	100	HA-800B-1C-100		
	8	200	HA-800B-1D-200/HA-800B-1E-200	Motor cable EWC-M□□-A06-TN3	Encoder cable (ABS) EWD-S□□-A08-3M14
	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	Motor cable EWC-M□□-A06-TN3	Encoder cable (ABS) EWD-S□□-A08-3M14
	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	HA-800B-3C-200	Motor cable EWC-MB□□-M08-TN3	Encoder cable (INC) EWC-E□□-B04-3M14
	25	200	HA-800B-3C-200		
	32	200	HA-800B-6C-200		
	40	200	HA-800B-6C-200		
	17	200	HA-800B-3A-200	Motor cable EWC-MB□□-M08-TN3	Encoder cable (ABS) EWC-S□□-B08-3M14
	25	200	HA-800B-3A-200		
	32	200	HA-800B-6A-200		
	40	200	HA-800B-6A-200		
	17	100	HA-800B-3C-100	Motor cable EWC-MB□□-M08-TN3	Encoder cable (INC) EWC-E□□-B04-3M14
	25	100	HA-800B-6C-100		
	32	100	HA-800B-6C-100		
	17	100	HA-800B-3A-100	Motor cable EWC-MB□□-M08-TN3	Encoder cable (ABS) 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 EWA-M□□-A04-TN3	Encoder cable 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

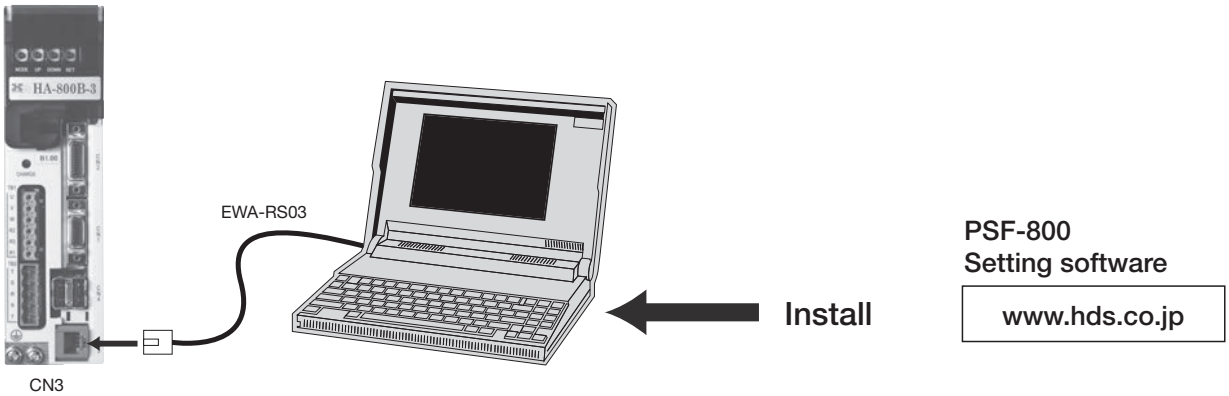
Servo Parameter Setting Software (Free Delivery)

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.



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)

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) 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) 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

Item \ Driver model		HA-800C-1	HA-800C-3	HA-800C-6	HA-800C-24
Driver's Rated Current*1		1.5A	3.0A	6.0A	24.0A
Driver's Maximum Current*1		4.0A	9.5A	19.0A	55.0A
Power Supply Voltage	Main circuit*1	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*1	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 With installation terminal	Regenerative Resistance Installed 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.

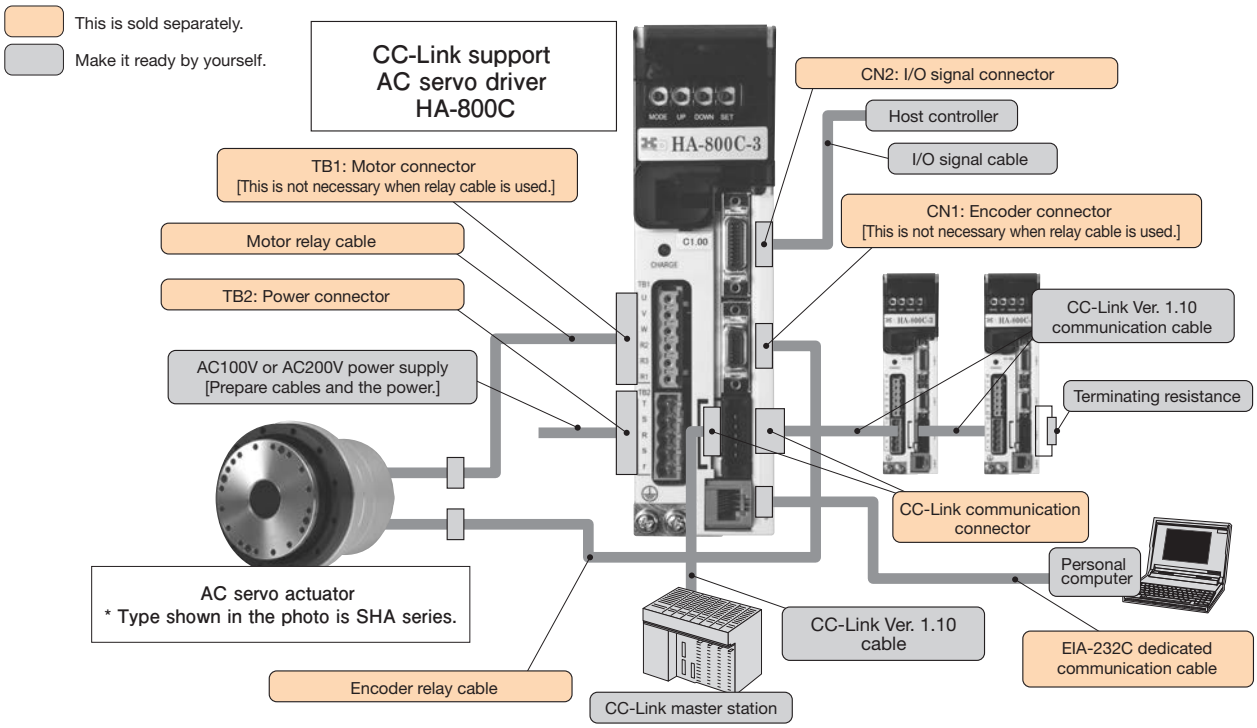
Communication Specification

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 *1	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

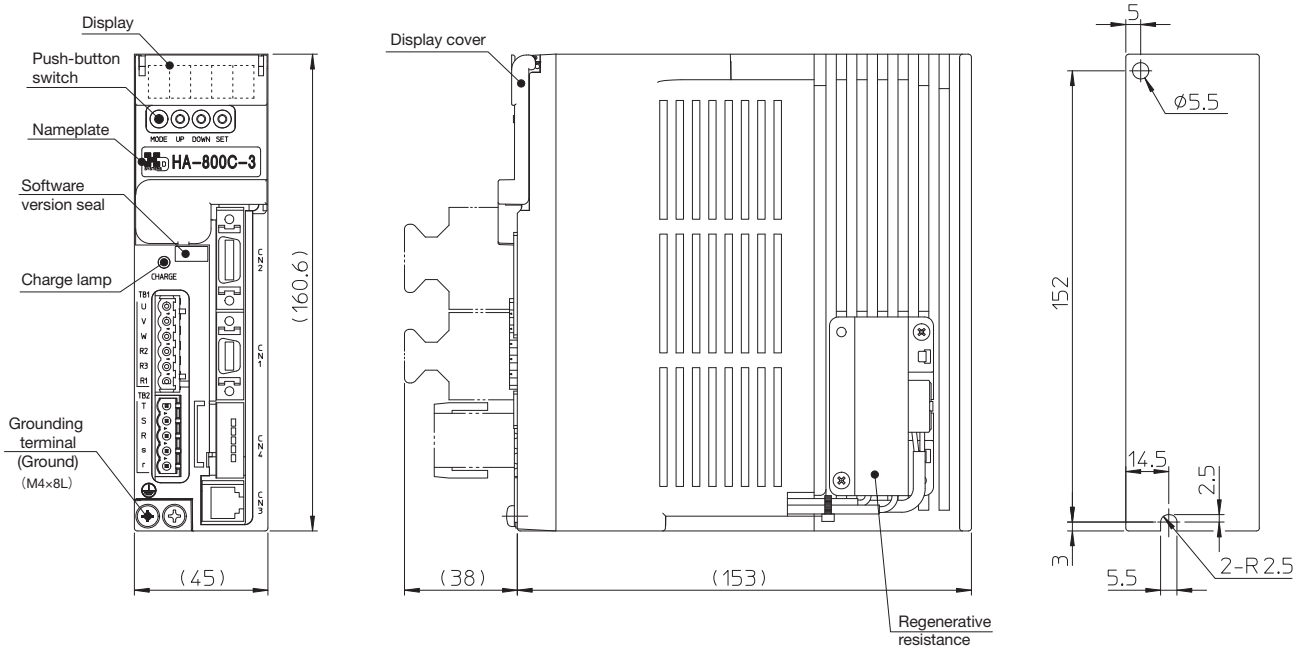


* See the technical information for the details of configuration related to power supply.
* When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

Dimensional Outline Drawing

■HA-800C-1, 3

Unit: mm

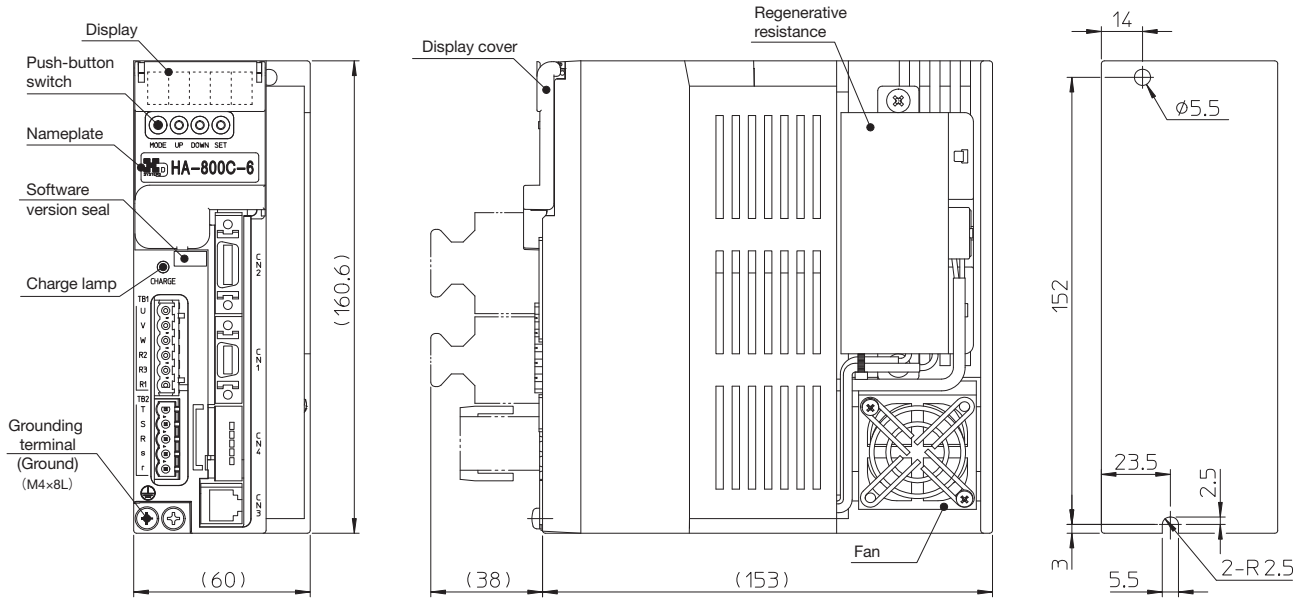


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

Dimensional Outline Drawing

■HA-800C-6

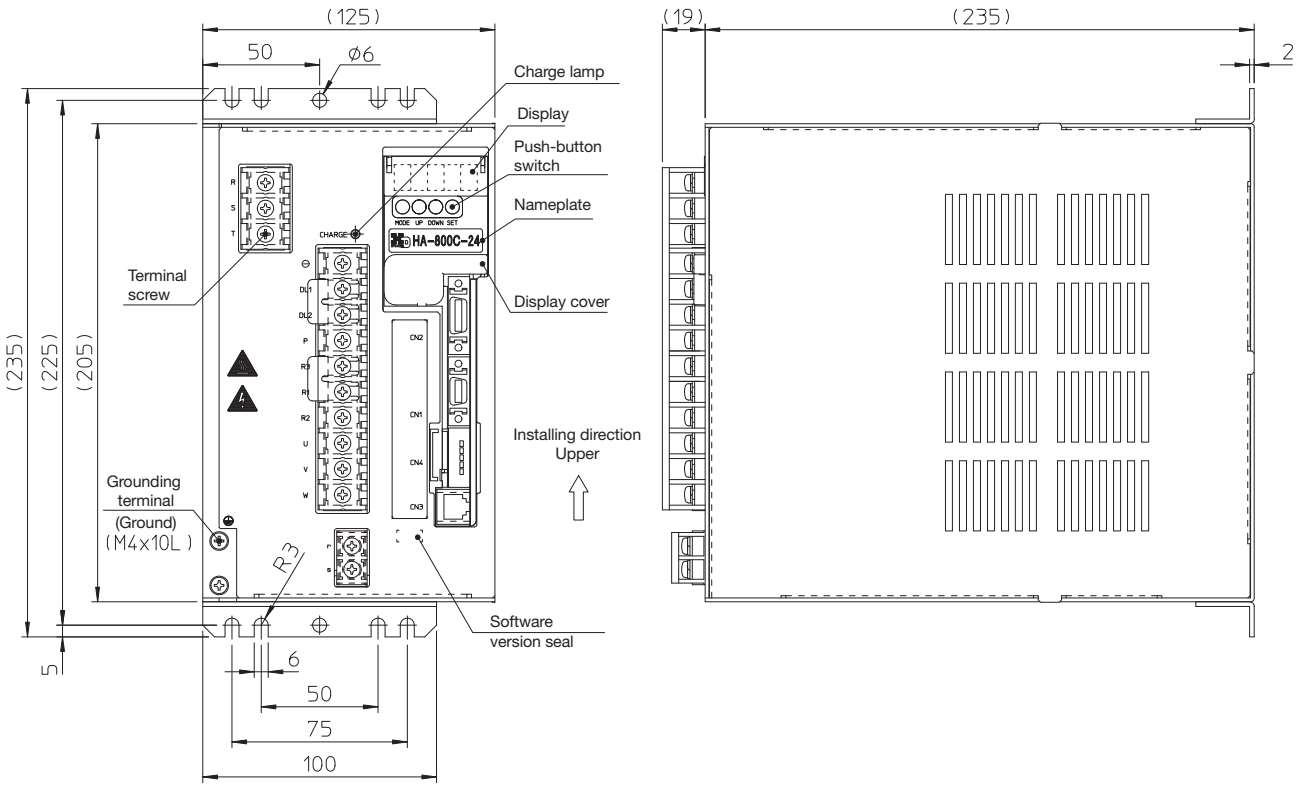
Unit: mm



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

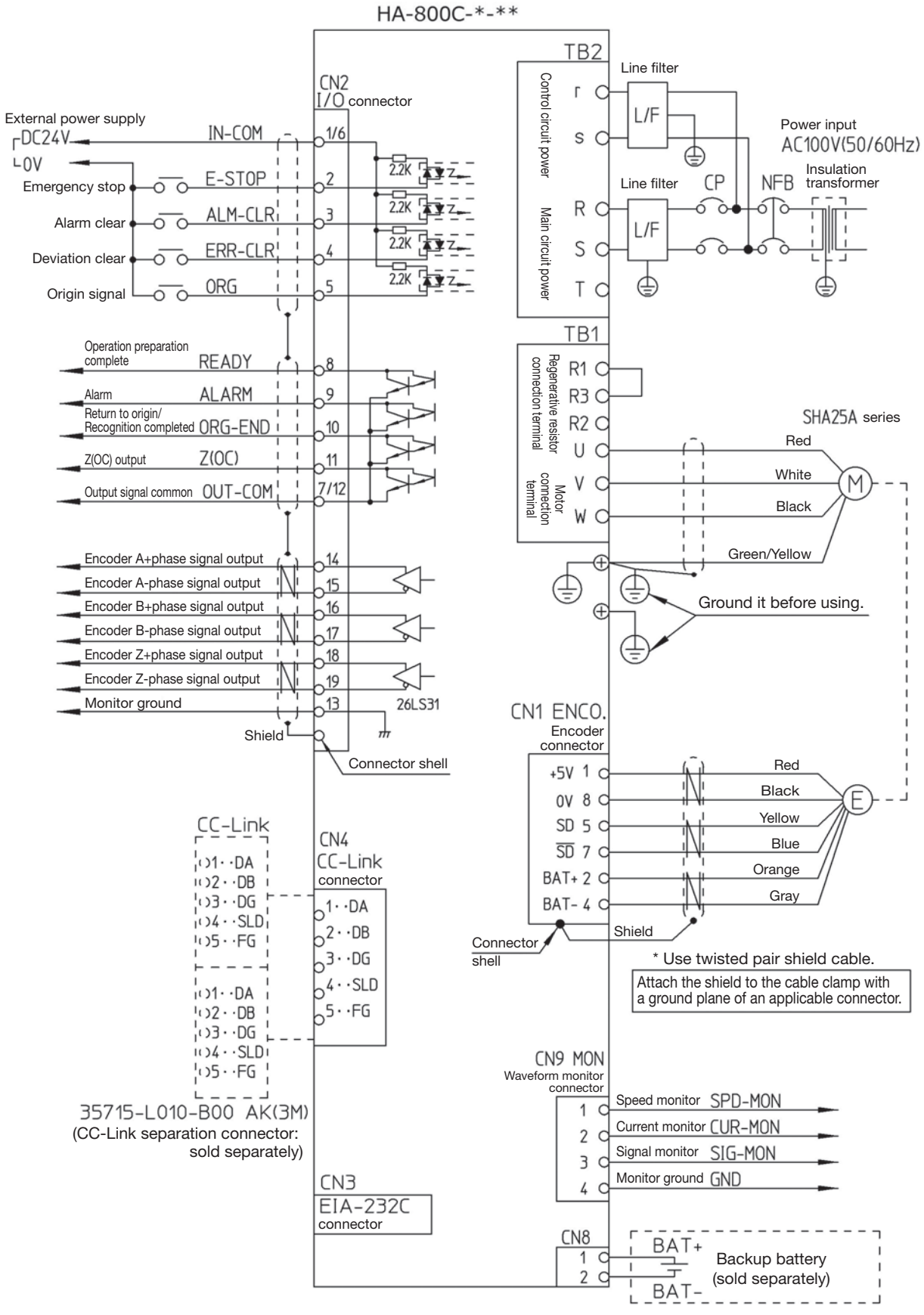
■HA-800C-24

Unit: mm



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

Example of connection



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 CC-Link support	Relay Cable (sold separately)	
SHA series	20	200	HA-800C-3D-200/HA-800C-3E-200	Motor cable EWD-MB□□-A06-TN3	Encoder cable 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		
	40	200	HA-800C-24D-200/HA-800C-24E-200	Motor cable Model No. 40: EWD-MB□□-A06-TMC Model No. 58,65: EWD-MB□□-D09-TMC	Encoder cable Model No. 40: EWD-S□□-A08-3M14 Model No. 58,65: EWD-S□□-D10-3M14
	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	HA-800C-1C-200	Motor cable EWC-M□□-A06-TN3	Encoder cable (INC) EWC-E□□-M06-3M14
	11	200	HA-800C-1C-200		
	14	200	HA-800C-1C-200		
	8	100	HA-800C-1C-100	Motor cable EWC-M□□-A06-TN3	Encoder cable (INC) EWC-E□□-M06-3M14
	11	100	HA-800C-1C-100		
	14	100	HA-800C-1C-100		
	8	200	HA-800C-1D-200/HA-800C-1E-200	Motor cable EWC-M□□-A06-TN3	Encoder cable (ABS) 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	Motor cable EWC-M□□-A06-TN3	Encoder cable (ABS) 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 EWC-MB□□-M08-TN3	Encoder cable (INC) 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 EWC-MB□□-M08-TN3	Encoder cable (ABS) 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 EWC-MB□□-M08-TN3	Encoder cable (INC) EWC-E□□-B04-3M14
	25	100	HA-800C-6C-100		
	32	100	HA-800C-6C-100		
	17	100	HA-800C-3A-100	Motor cable EWC-MB□□-M08-TN3	Encoder cable (ABS) 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 EWA-M□□-A04-TN3	Encoder cable 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 25ºC

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)

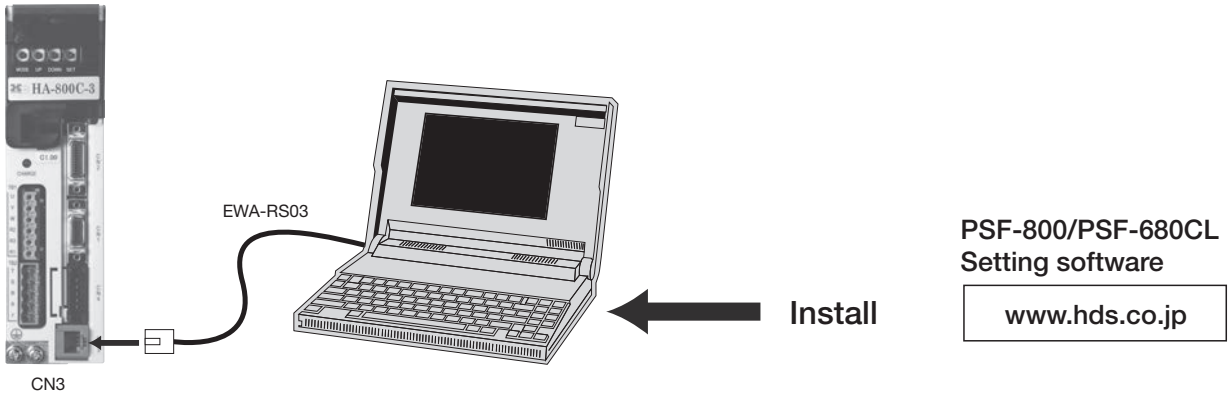
Note: Windows is a registered trademark of Microsoft.

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

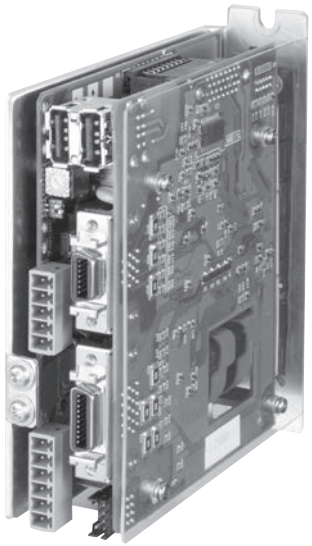
The software is used to create operational table data with HA-800C (CC-Link support) driver and to operate the actuator.
(Operational table data can be set from CC-Link)

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.



HA-680ML Series



MECHATROLINK

* 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	HA-680ML-6B-24	RSF-11B-30-F100-24B-C
S025		RSF-11B-50-F100-24B-C
S026		RSF-11B-100-F100-24B-C
S027		RSF-14B-30-F100-24B-C
S028		RSF-14B-50-F100-24B-C
S029		RSF-14B-100-F100-24B-C

Specification

Item \ Driver model		HA-680ML-4-24 HA-680ML-6-24	HA-680ML-4B-24 HA-680ML-6B-24
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 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 Working humidity/storage humidity: 95%RH or less (No condensation) Avoid vibration and shock No dust, metal powder, corrosive gas, flammable gas and oil mist No water and oil splashing No indoor use and direct sunlight	

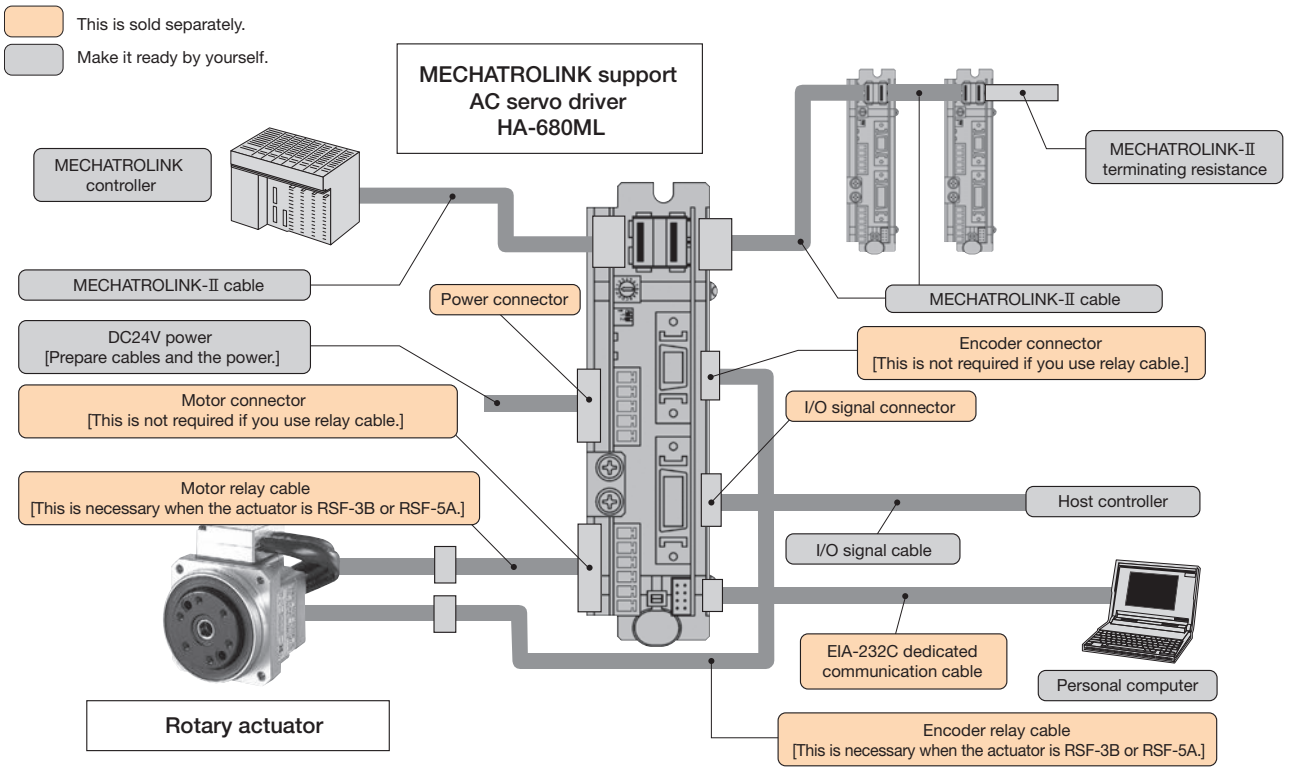
Note: Set parameters for an actuator combined with this driver. This driver may not be used for other actuators than preset ones.

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) for the detail.

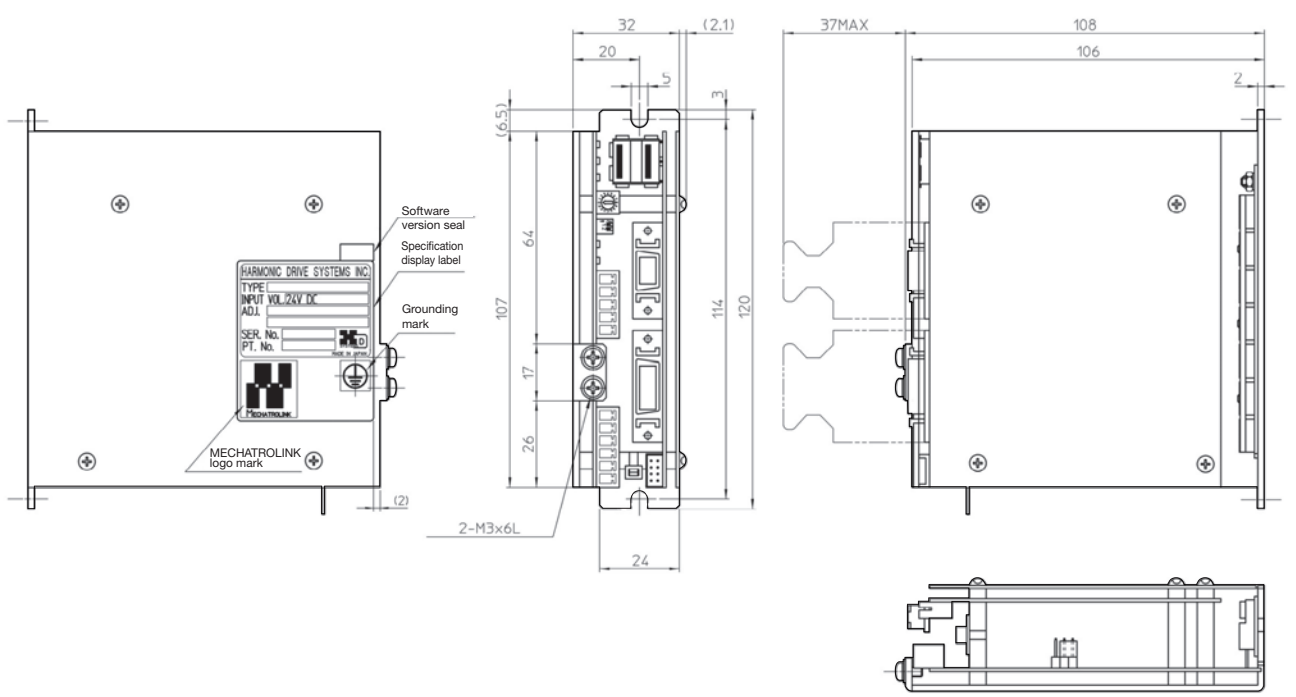
System Configuration



*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/) for the detail.
*2 Use MP2300 or MP2400 (Yasukawa Denki) for the MECHATROLINK cable.
*3 Use cables specified by the MECHATROLINK association for the MECHATROLINK cable. Never use commercial USB cables. See the home page of MECHATROLINK association (https://www.mechatrolink.org/) for the detail.

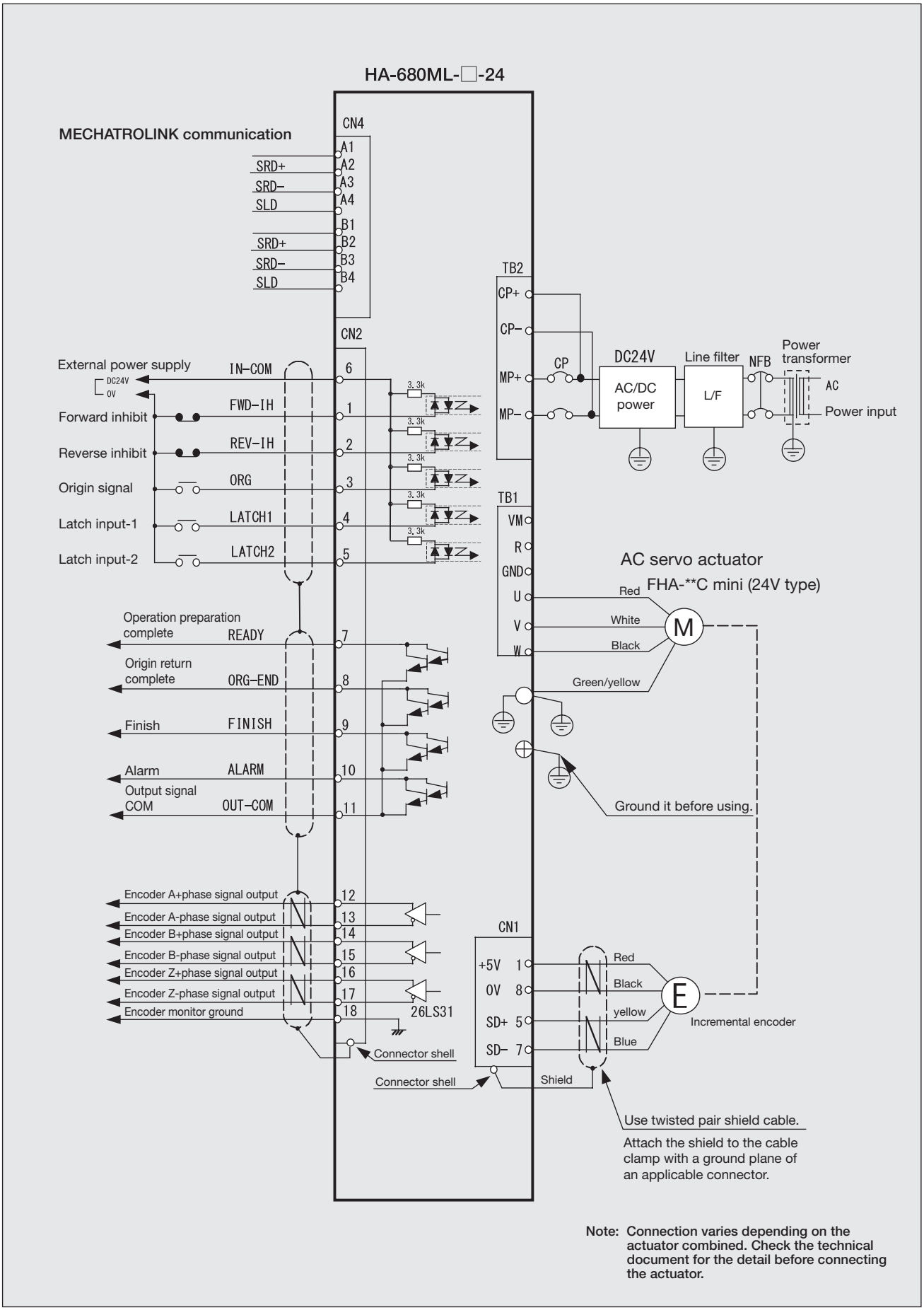
Dimensional Outline Drawing

Unit: mm



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

Example of Connection



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

Option

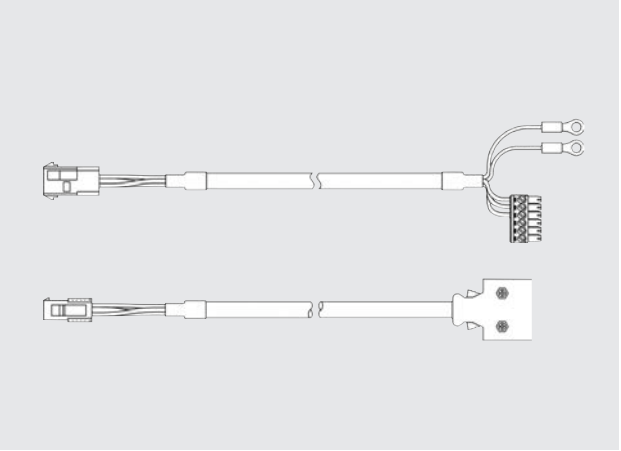
Relay Cable

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)

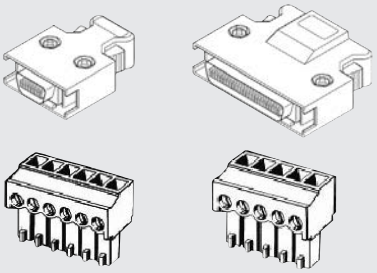
RSF-B mini series
Reference model: EWC-MB * * -A06-TN2 (for motor)
EWB-F * * -M0809-3M14 (for encoder + pole sensor)

"***" 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.



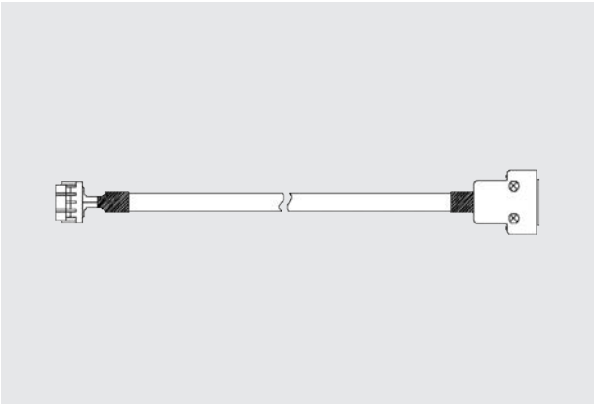
Connector

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.



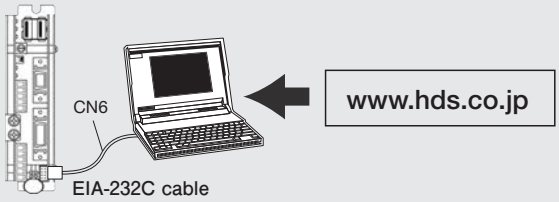
EIA232C (RS232C) Communication Cable

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 deriver.



MEMO

Servo Drivers

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*1) 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.

*1: 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) 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) 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)

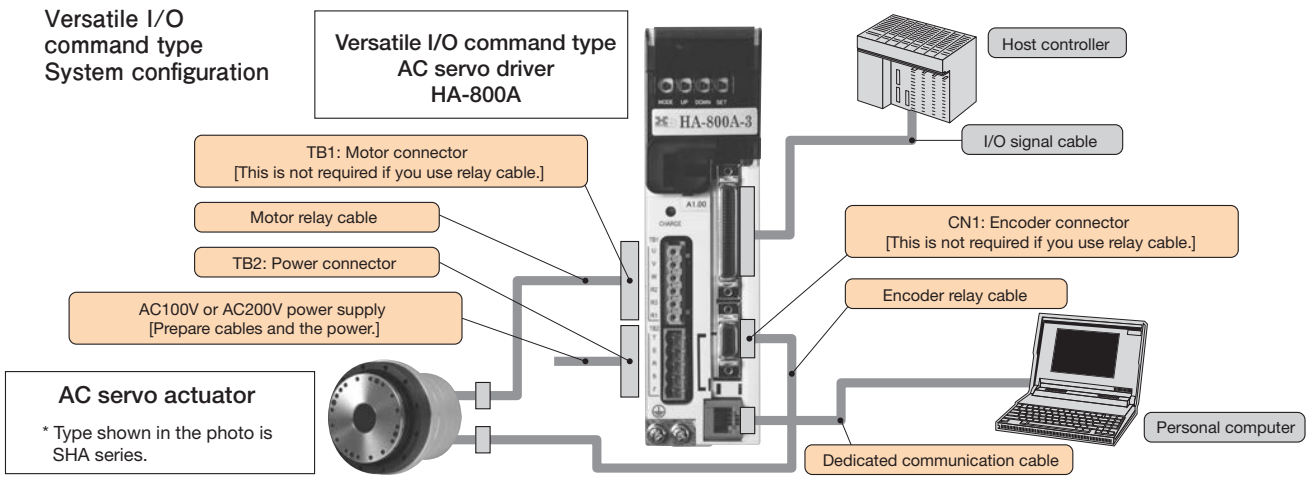
Specification

Item \ Driver model		HA-800A-1	HA-800A-3	HA-800A-6	HA-800A-24
Driver's Rated Current*1		1.5A	3.0A	6.0A	24.0A
Driver's Maximum Current*1		4.0A	9.5A	19.0A	55.0A
Power Supply Voltage	Main Circuit*1	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*1	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: 0ºC to 50ºC Storage temperature: -20ºC to 65ºC Working humidity/storage humidity: 95%RH or less (No condensation) 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 1- and 2-pulse systems: 1MHz, 2-phase pulse system: 200kHz 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 settng, 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 With installation terminal	Regenerative Resistance Installed 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

Versatile I/O command type System configuration

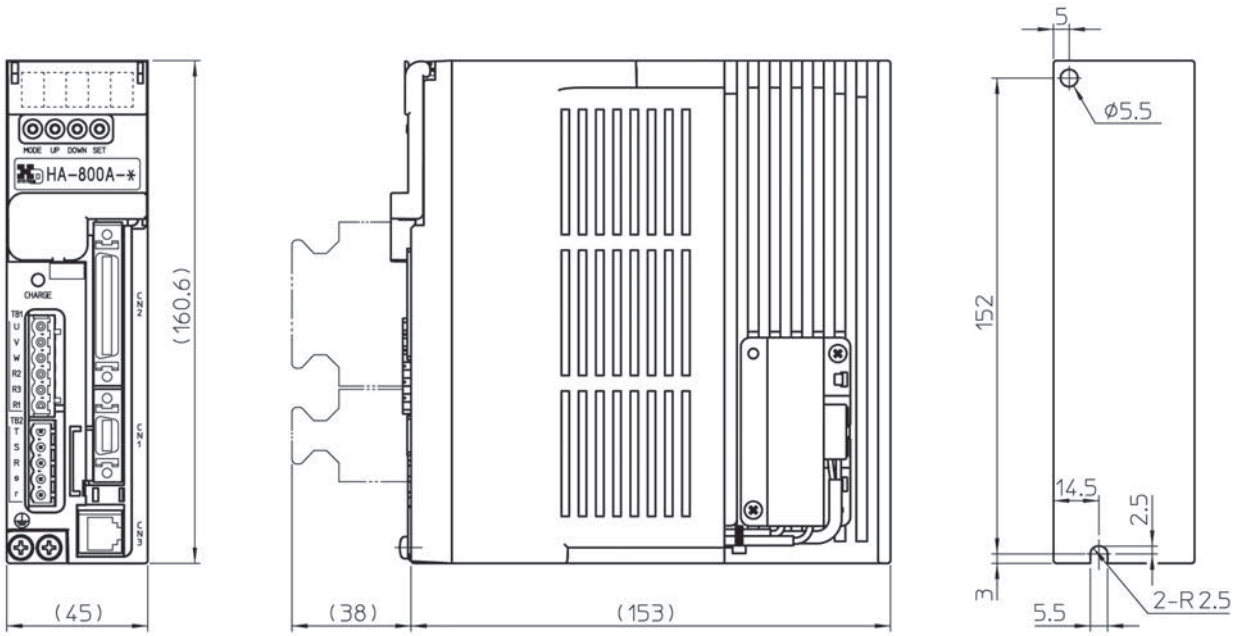


* When using an absolute encoder with the absolute specifications, purchase a separate backup battery. (Model: HAB-ER17/33-2)

Dimensional Outline Drawing

■HA-800A-1.3

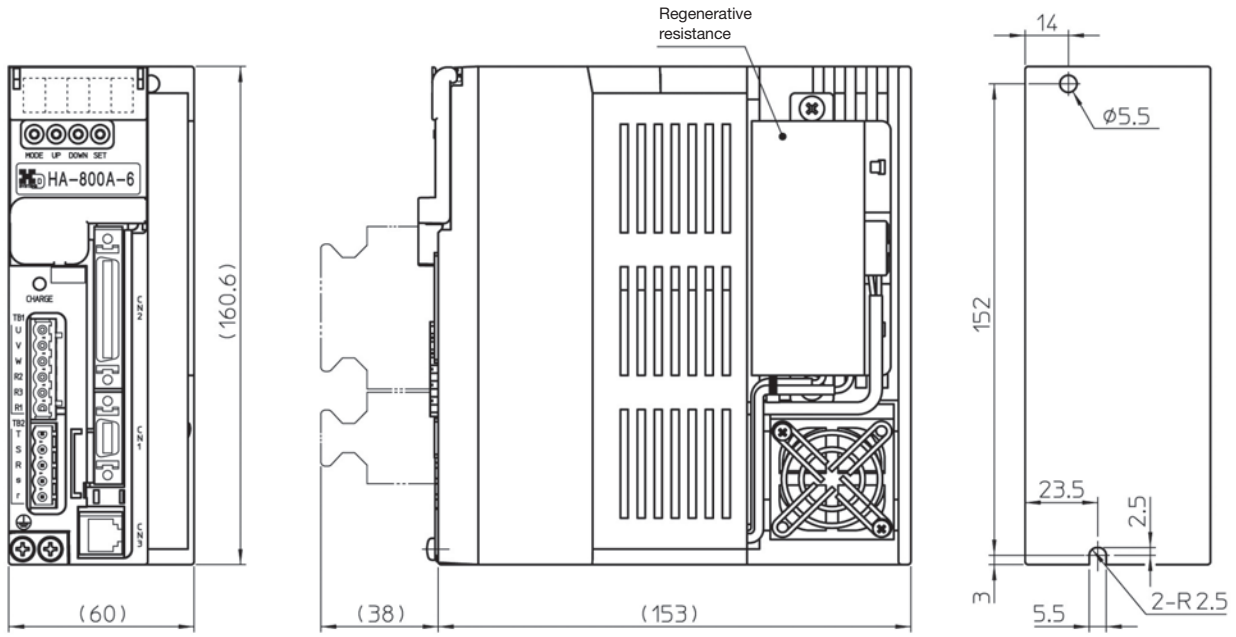
Unit: mm



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

■HA-800A-6

Unit: mm

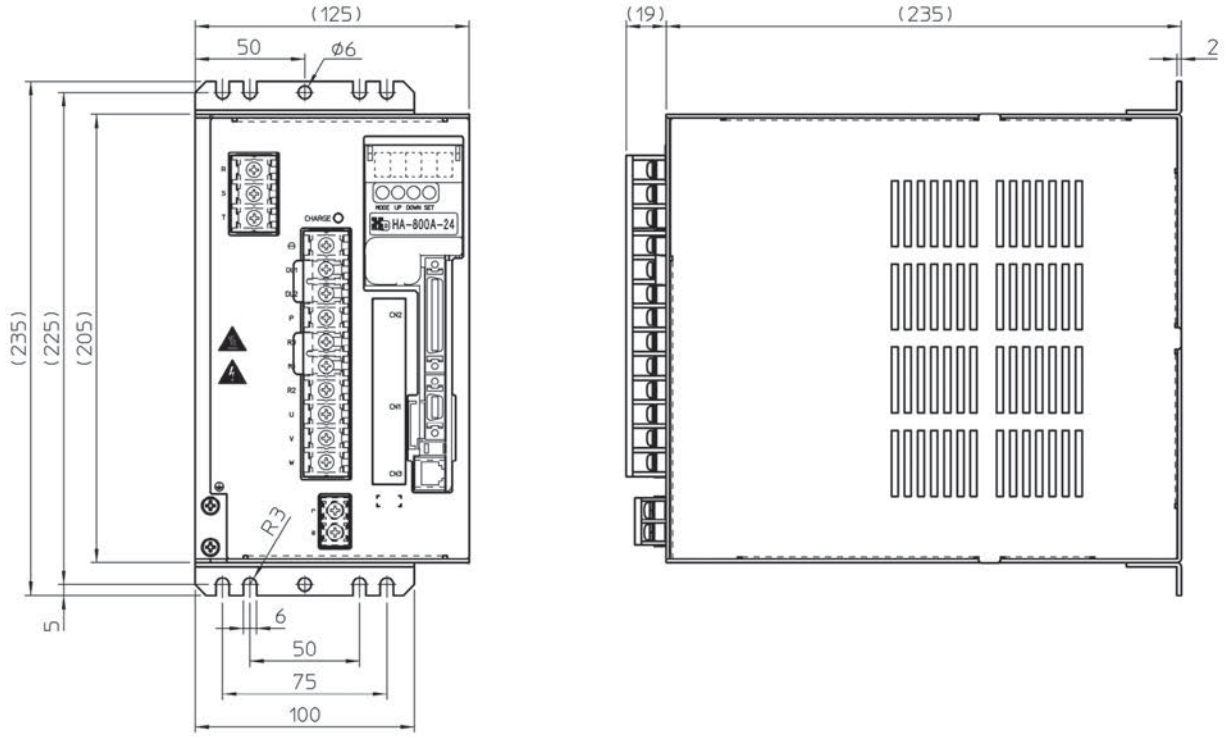


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

Dimensional Outline Drawing

■HA-800A-24

Unit: mm

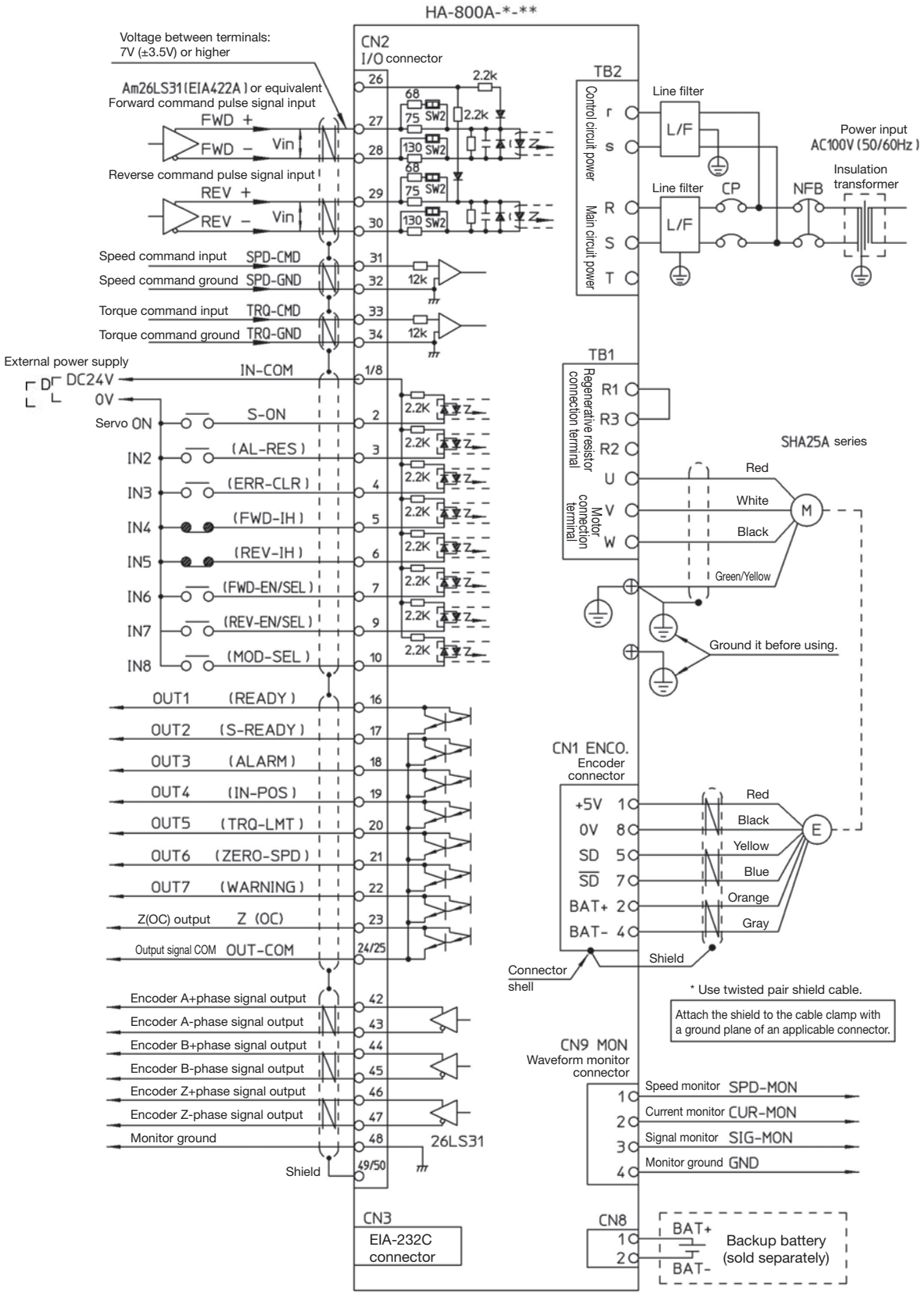


* Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

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 EWD-MB□□-A06-TN3	Encoder cable 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		
	40	200	HA-800A-24D-200/HA-800A-24E-200	Motor cable Model No. 40:EWD-MB□□-A06-TMC Model No. 58,65:EWD-MB□□-D09-TMC	Encoder cable Model No. 40:EWD-S□□-A08-3M14 Model No. 58,65:EWD-S□□-D10-3M14
	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	HA-800A-1C-200	Motor cable EWC-M□□-A06-TN3	Encoder cable (INC) EWC-E□□-M06-3M14
	11	200	HA-800A-1C-200		
	14	200	HA-800A-1C-200		
	8	100	HA-800A-1C-100	Motor cable EWC-M□□-A06-TN3	Encoder cable (INC) 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 EWC-M□□-A06-TN3	Encoder cable (ABS) 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 EWC-M□□-A06-TN3	Encoder cable (ABS) 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 EWC-MB□□-M08-TN3	Encoder cable (INC) 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 EWC-MB□□-M08-TN3	Encoder cable (ABS) 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 EWC-MB□□-M08-TN3	Encoder cable (INC) EWC-E□□-B04-3M14
	25	100	HA-800A-6C-100		
	32	100	HA-800A-6C-100		
	17	100	HA-800A-3A-100	Motor cable EWC-MB□□-M08-TN3	Encoder cable (ABS) 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 EWA-M□□-A04-TN3	Encoder cable 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℃

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

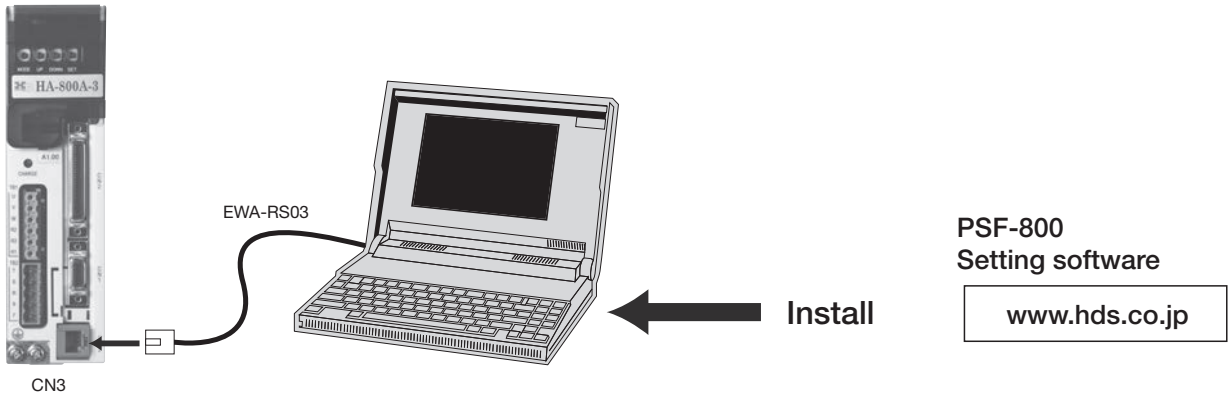
Servo Parameter Setting Software (Free Delivery)

Servo Parameter Setting Software PSF-800 (Free Delivery)

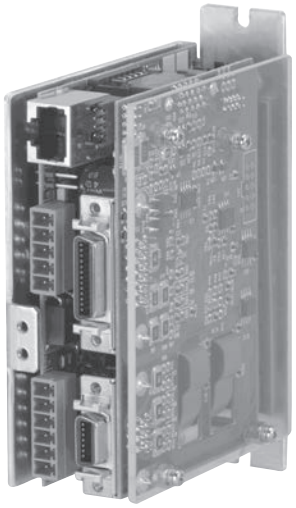
The software is used to set various servo parameters from your PC to HA-800 driver.
Various servo parameters can be changed by using EIA-232C cable to connect to the PC to which “CN3” of HA-800 driver and “Servo parameter setting software PSF-800” are installed. For the details of the software, request 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.



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

- HA: Type: AC servo driver HA series
- 680: Series: 680
- 4: 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）

- 24: Power supply:

24	DC24V

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 FHA-11C-XX-E200-CE	FHA-14C-XX-E200-CE	RSF-3C-XX-E020-C RSF-5B-XX-E050-C RSF-5B-XX-E050-BC RSF-8B-XX-F100-24B-C	RSF-11B-XX-F100-24B-C 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*2		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*3		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 phto coupler) DO: 5 points (insulation with phto coupler) Variable function assignment			
Encoder Monitor		Phase A-, B-, Z- line driver output Phase Z- open collector output (insulation with phto 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 Operating/Storate humidity: 95% RH or less (Do not expose to condensation) Avoid vibration or shock. Ambience: Do not expose to metal powder, dust, oil mist, corrosive gas or flammable gas. No contamination by water or oil 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

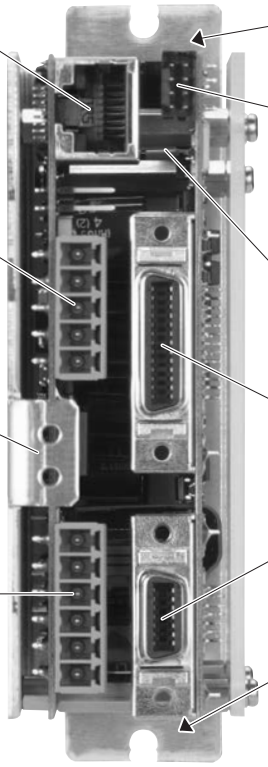
■ The terminals for power supply. These are divided into terminals for the control circuit power supply and terminals for the main circuit power supply.

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

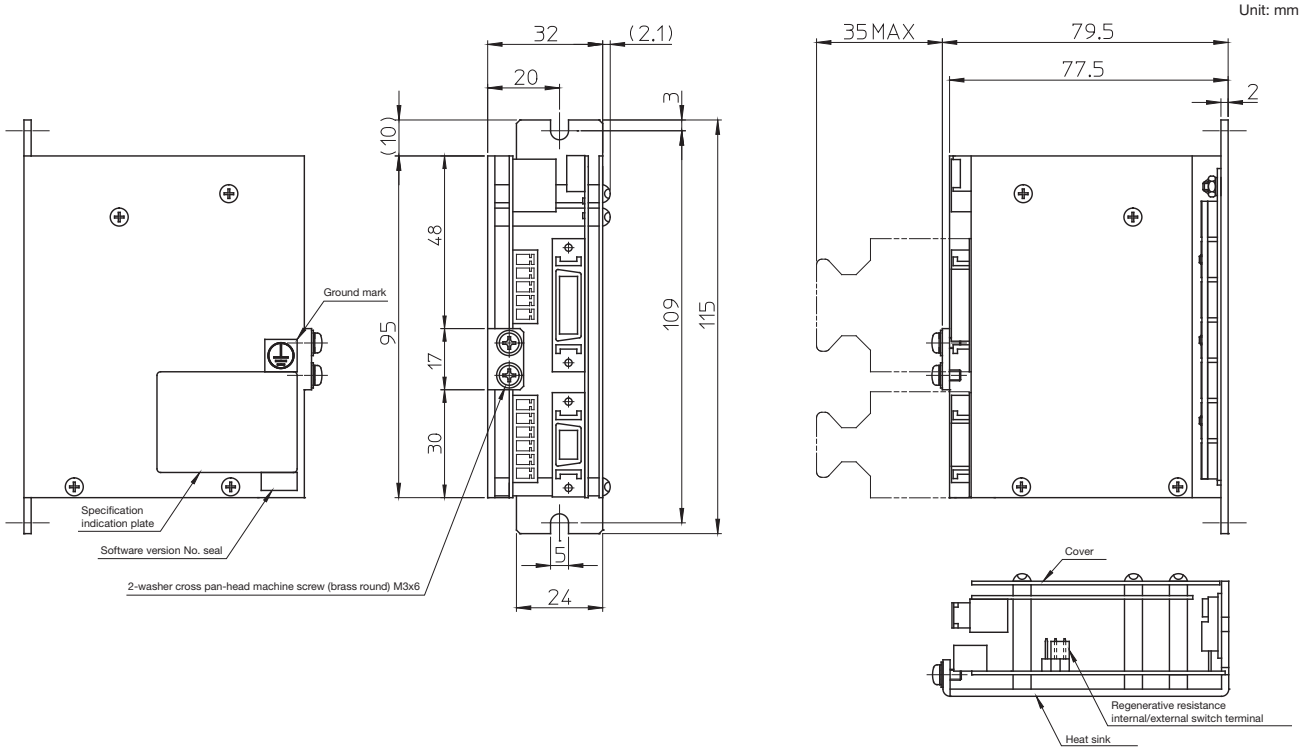
■ The position detection encoder cable of the actuator is connected here.

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

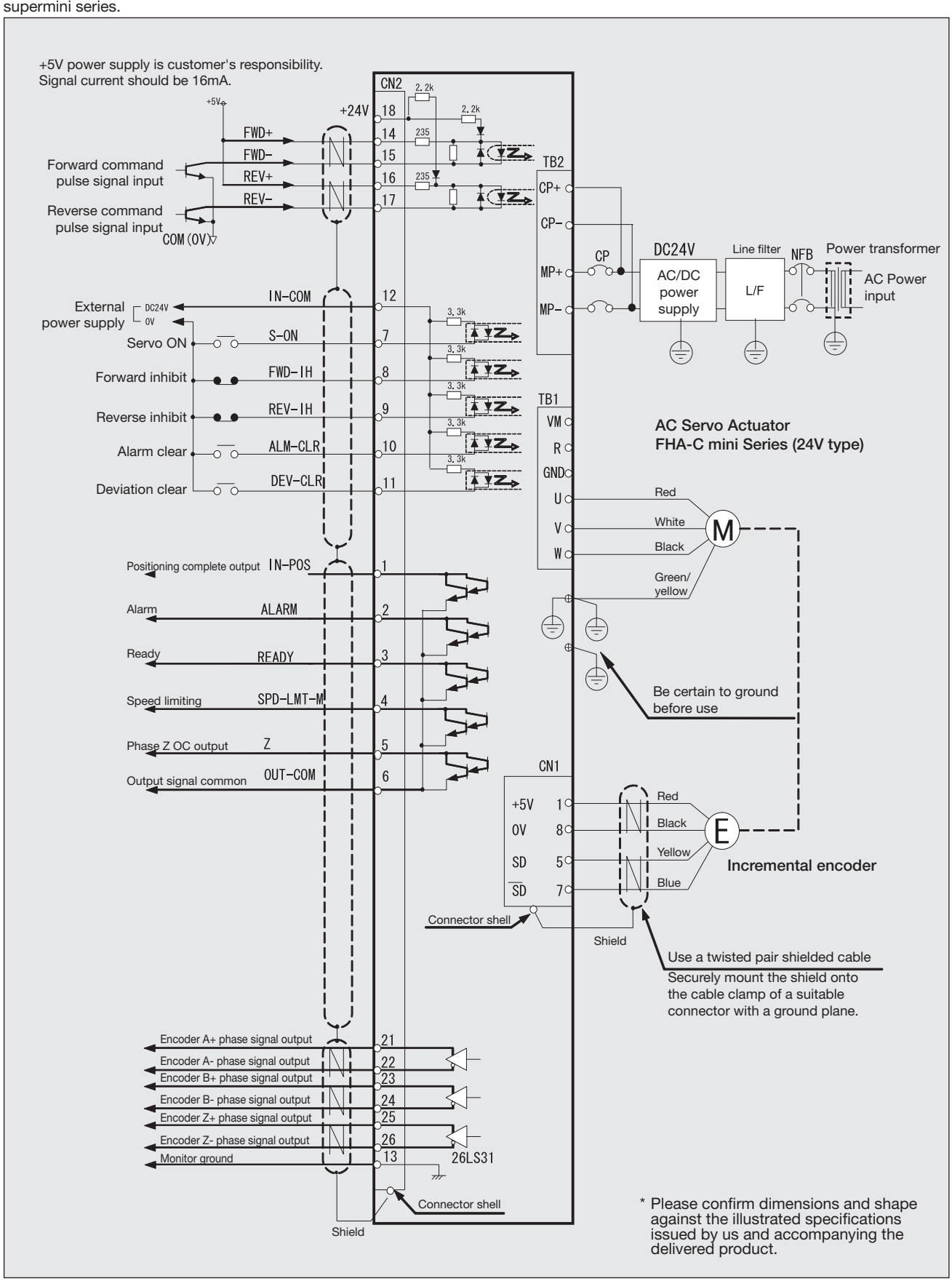
Unit: mm



*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 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.

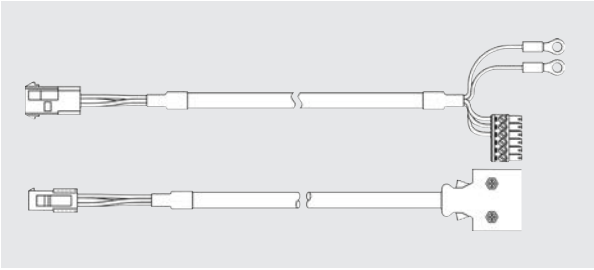


Option

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)

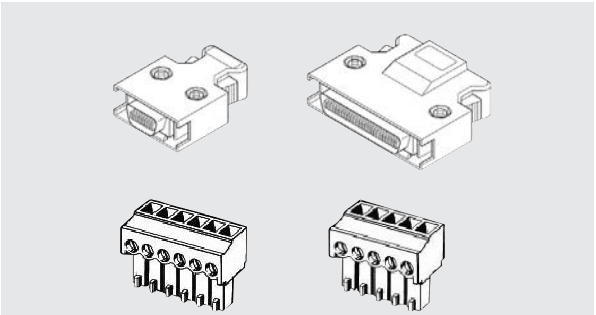
The cable for connecting the actuator to the servo driver. Standard cable lengths are 3, 5 and 10m.



Connector

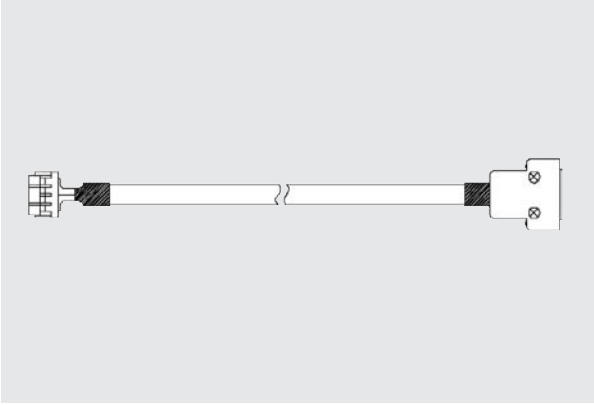
Reference model:
CNK-HA68-S1 (Total 4 connectors to a set)
CNK-HA68-S2 (For power supply and input and output signal lines)

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



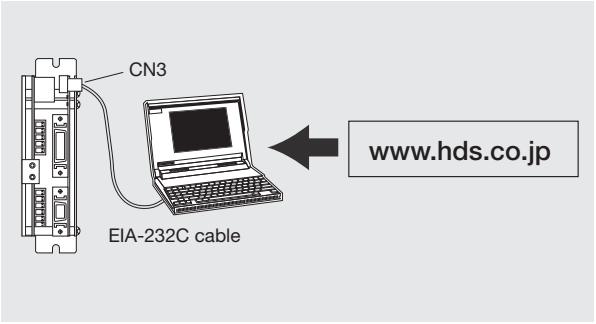
EIA232C (RS232C) Communication Cable

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.



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 – □

- HA: Type: AC servo driver HA series
- 770: Series: 770 (for position control)
- 2: 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 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 Operating/Storage humidity: 90% RH or less (Do not expose to condensation) 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 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) 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)

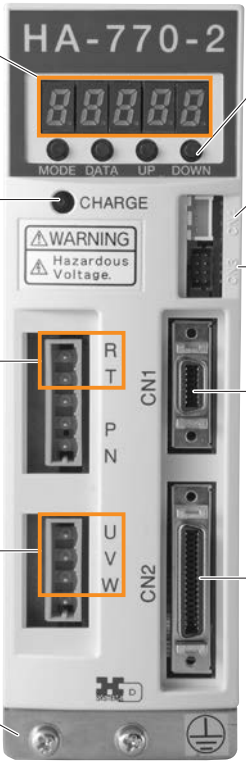
■ The terminal for power supply

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)

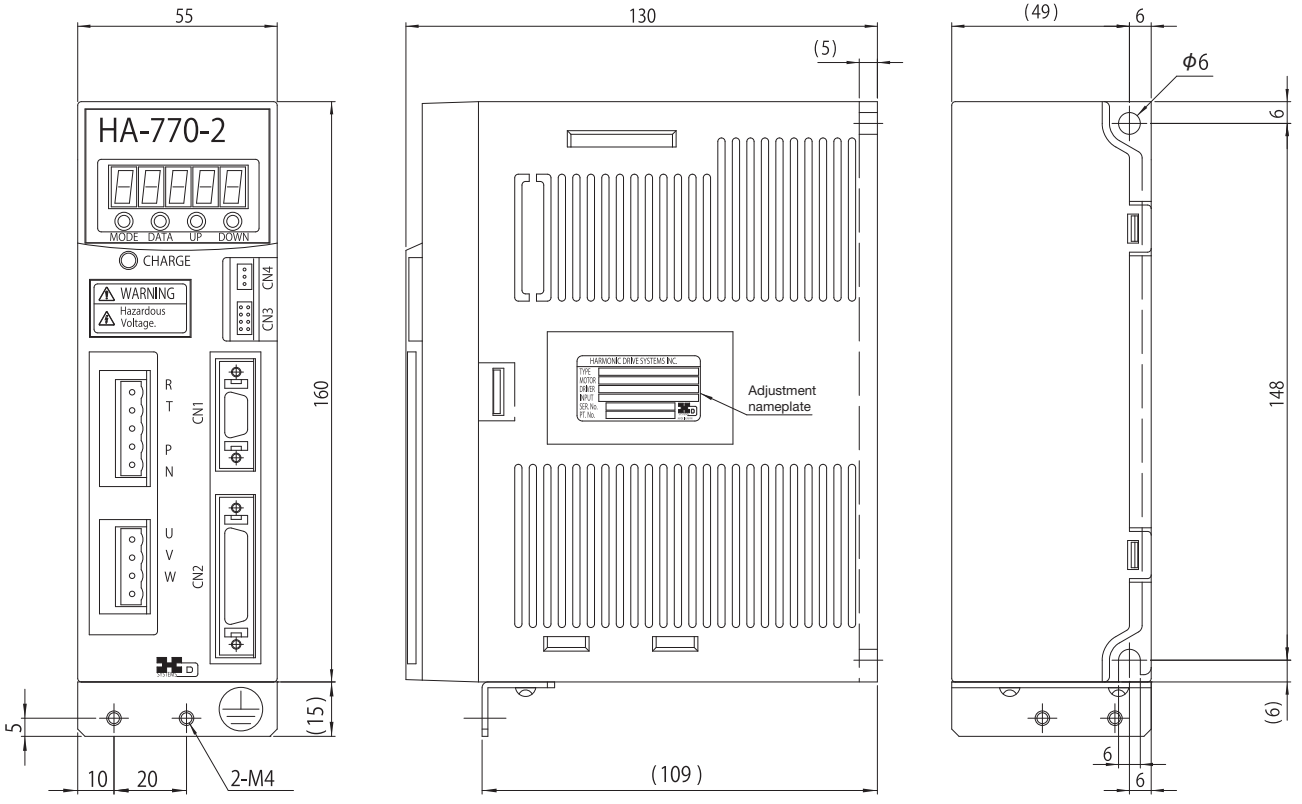
■ The connector for cable connection with the encoder of the motor.

I/O signal connector (CN2)

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

External Dimensions

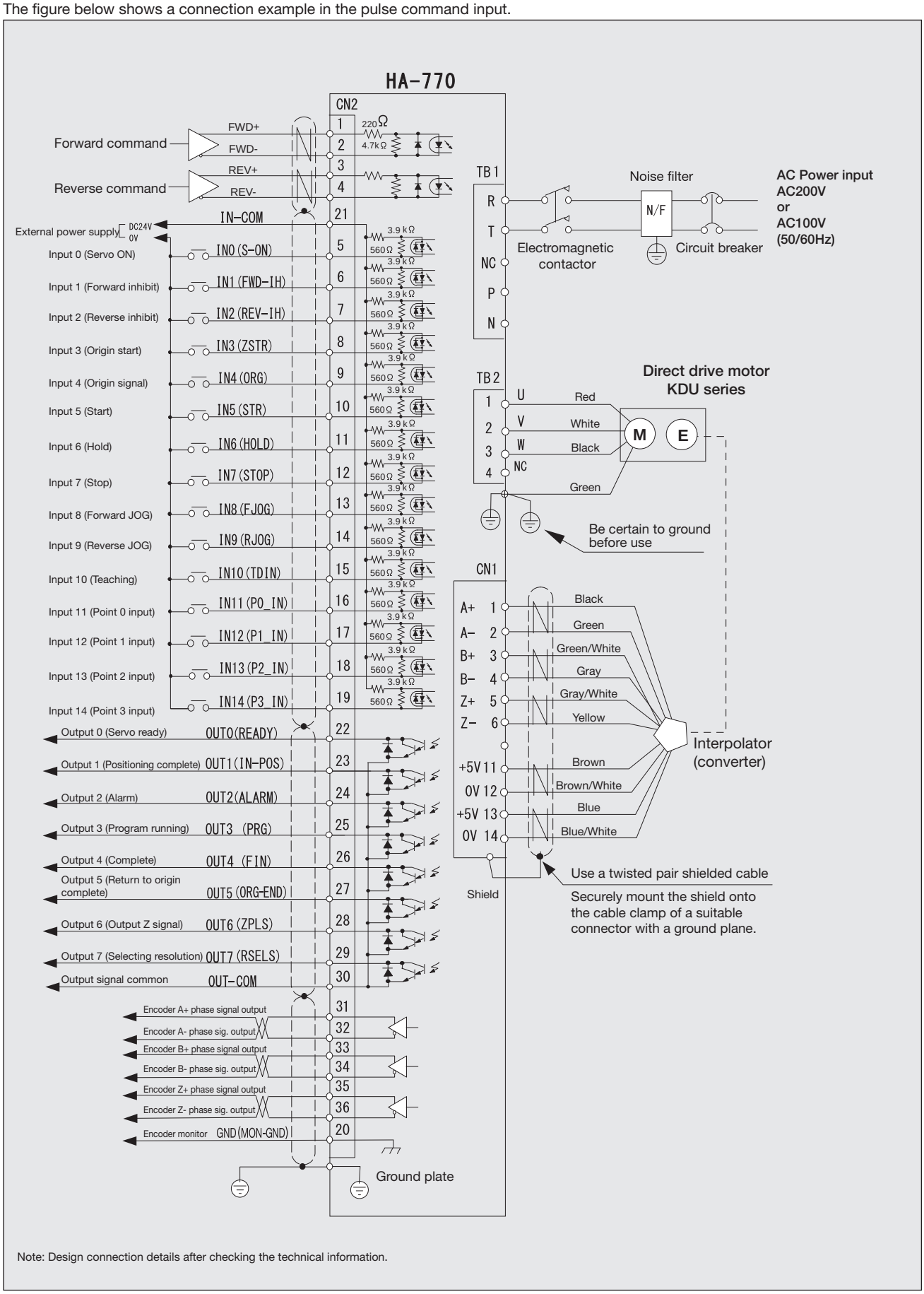
Unit: mm



*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.

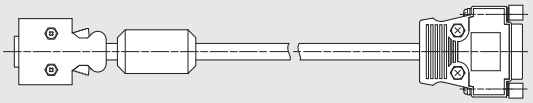


Note: Design connection details after checking the technical information.

Options

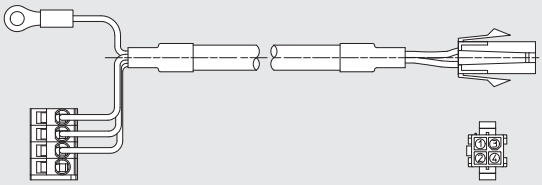
Relay Cable for Encoder

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.



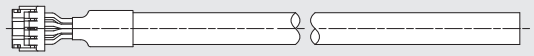
Relay Cable for Motor

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.



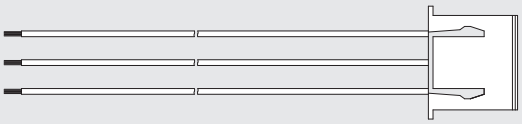
RS-422/485 Communication Cable

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

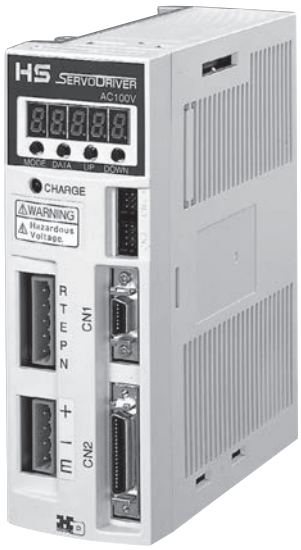
Order Code Example: CNK-HA77-S1
The set of power supply connector and I/O signal connector.

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 / Relay cable model name for motor	Total cable length (except connector)
KDU-13SB-D3-□	7.0N·m	KDU-13SB-E10	HA-770-2	EWA-E015-OM15-3M14 / EWA-M03-A04-WG04-01	Encoder cable : 3m Motor cable : 3.3m
				EWA-E035-OM15-3M14 / EWA-M05-A04-WG04-01	Encoder cable : 5m Motor cable : 5.3m
KDU-13WB-D3-□	15.0N·m	KDU-13WB-E10		EWA-E015-OM15-3M14 / EWA-M03-A04-WG04-01	Encoder cable : 3m Motor cable : 3.3m
				EWA-E035-OM15-3M14 / EWA-M05-A04-WG04-01	Encoder cable : 5m Motor cable : 5.3m

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 RH-5A-5502 RH-5A-4402	RH-8D-6006 RH-8D-3006	RH-11D-6001 RH-11D-3001 RHS-14-6003 RHS-14-3003	RH-14D-6002 RH-14D-3002 RHS-17-6006 RHS-17-3006	RHS-20 RHS-25 *2

* 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)*2	1.0A	1.4A			3.2A
Max. Output Current (rms)*3	1.0A	2.6A	3.7A	4.2A	10A
Power Supply	AC100V (single phase) ±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) 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 Operating humidity: 90% RH or less (Do not expose to condensation) Storage humidity: 90% RH or less (Do not expose to condensation). 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

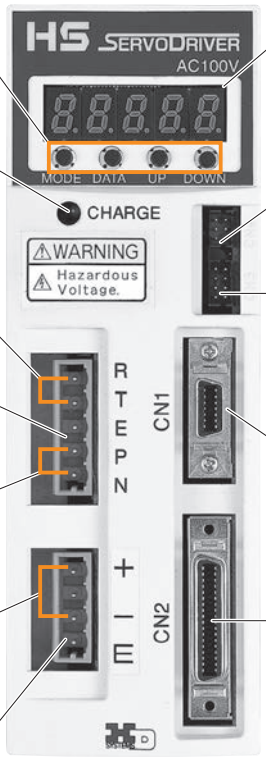
■ Terminals in case connection of external regeneration unit is required due to frequent actuator starts and stops.

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

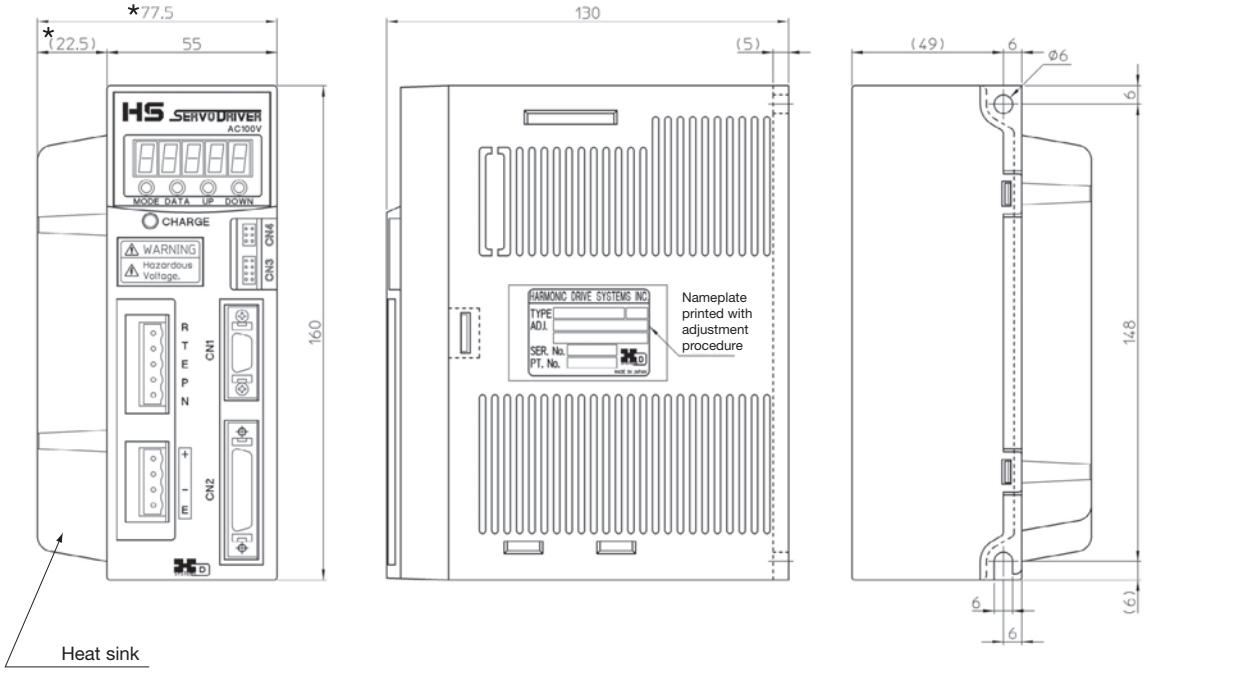
■ The connector for control signal exchange with a host controller.

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.

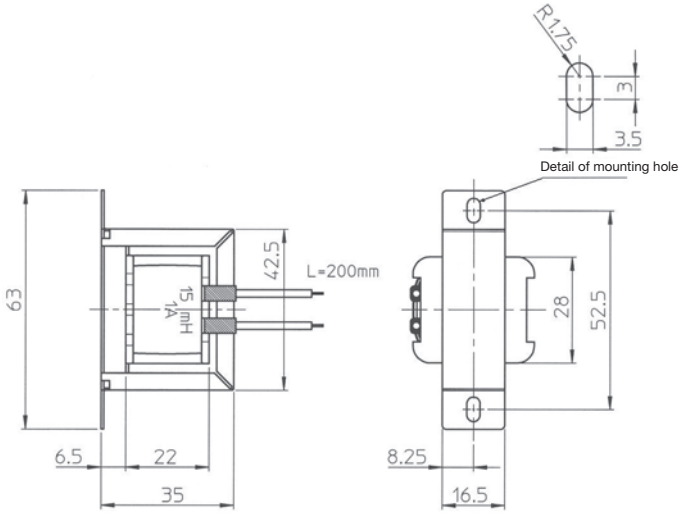
*Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

External Dimensions

■DC Reactor 15mH

(Accessory)

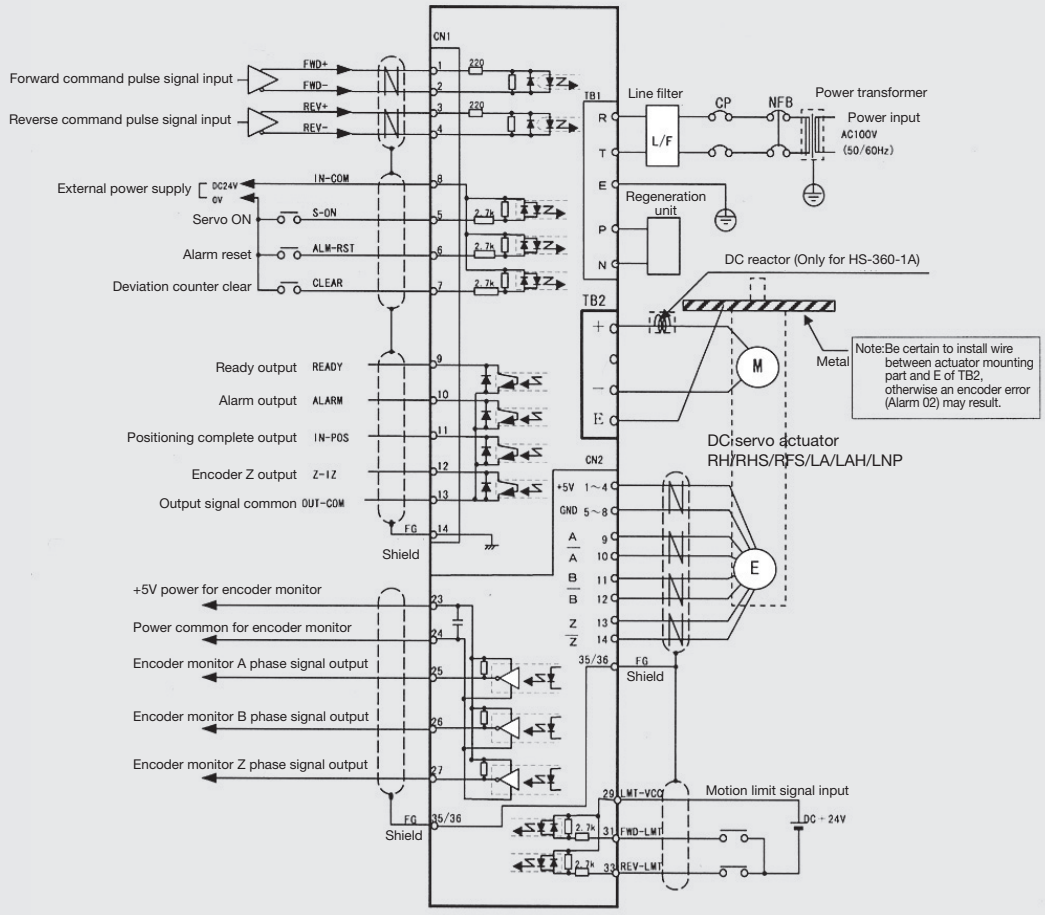
Unit: mm



*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.

MEMO

Harmonicsyn®

Sensor Systems

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 ø7.5 x 10.5mm, ø13 x 20mm (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 □

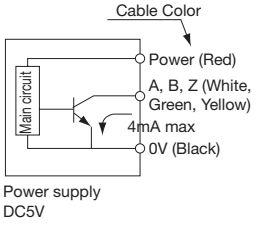
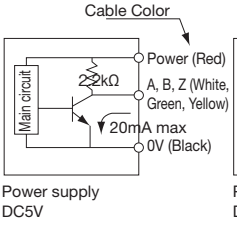
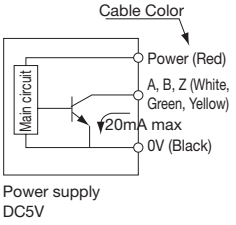
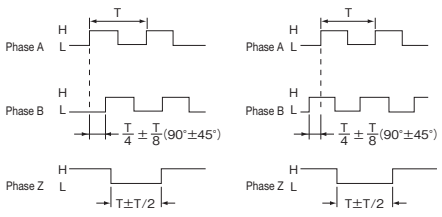
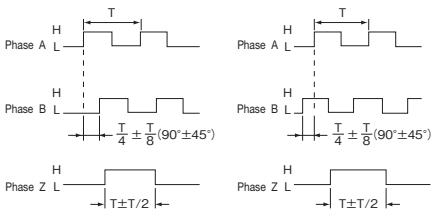
Type: Micro encoder ME series

Shaft shape: S Single shaft; H Hollow shaft

Pulses: 100, 200, 300, 360, 500, 1000

Output circuit: None Voltage output; C Open collector output

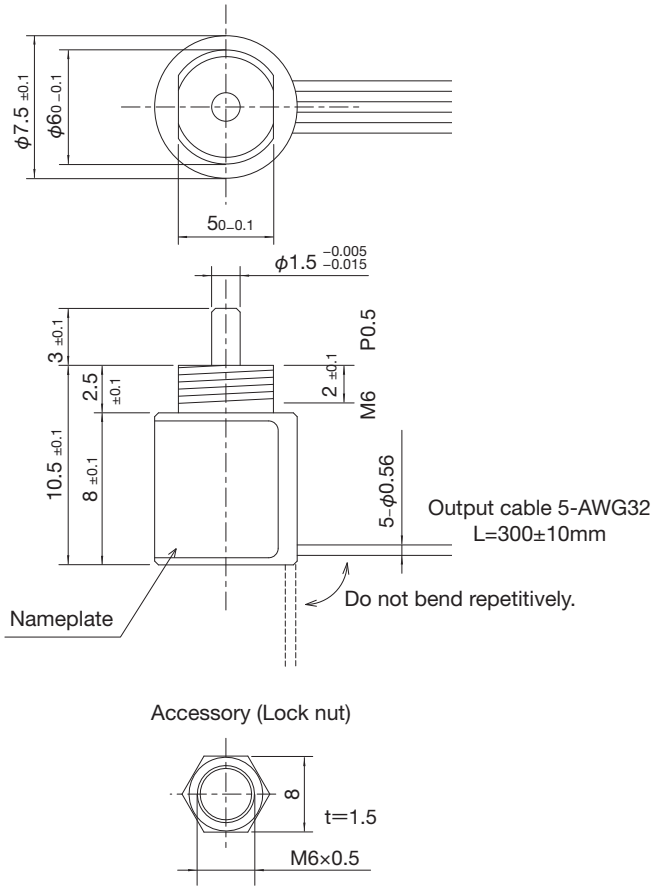
Specification

Item \ Model		MES-6-□PC	ME□-9-□P□	
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) [Pulses/revolution]	100 300 200 360	100 300 500 200 360	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) Residual voltage: 0.4V or less	Sink current: 20mA Residual voltage: 0.5V (at 10mA)	
	Max. Response Frequency (Response Pulses)	100kHz	100kHz	
	Output Phase Difference	A and B phase difference 90°±45° (T/4 ±T/8) Z phase T ±T/2 (see output waveform diagram)	A and B phase difference 90°±45° (T/4 ±T/8) Z phase T ±T/2 (see output waveform diagram)	
	Waveform Rise and Fall Time	2μs or less (output cable 300mm or less)	2μs or less (output cable 140mm or less)	
Starting Torque		$0.3x10^{-3}$N·m (3gf·cm) or less	$1x10^{-3}$N·m (10gf·cm) or less	
Permissible Shaft Load (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 RH35% to 90% No condensation	0°C to 60°C 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 Withstands 2 hours each in X, Y and Z directions	Frequency 55Hz, double amplitude 1.5mm Withstands 2 hours each in X, Y and Z directions	
Resistance to Shock		500m/s² (about 50G) Withstands 3 cycles each in X, Y and Z directions	500m/s² (about 50G) Withstands 3 cycles each in X, Y and Z directions	
Cable		Vinyl sheathed (AWG32) cable length 300mm	Vinyl sheathed (AWG30) cable length 140mm	
Mass		5g	10g	
Output Circuit		**Open Collector Output** 	**Power Output** 	**Open Collector Output** 
Output Waveform		**CW Rotation** (Clockwise viewed from mounting direction) **CCW Rotation** (Counter clockwise viewed from mounting direction)  *Position of Phase Z to Phases A and B is not specified.	**CW Rotation** (Clockwise viewed from mounting direction) **CCW Rotation** (Counter clockwise viewed from mounting direction)  *Position of Phase Z to Phases A and B is not specified.	

External Dimensions

■MES-6

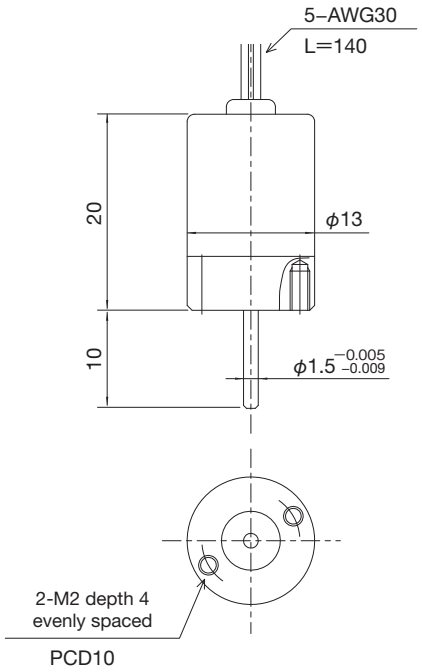
Unit: mm



Accessory (Lock nut)

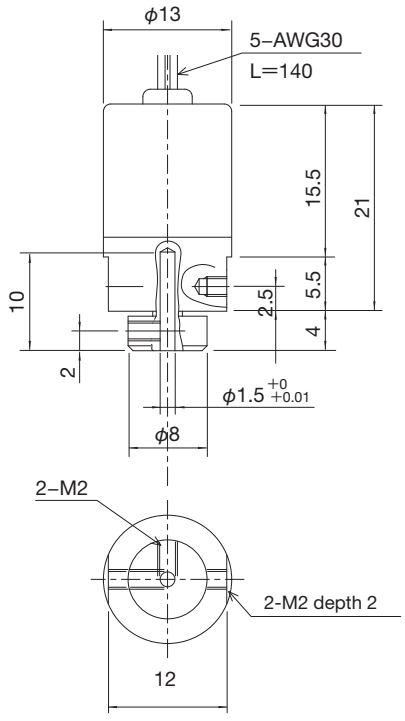
■MES-9

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

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.

Caution

Use only in a specified environment.

- Actuators are designed and manufactured for indoor use. Please ensure the following environmental conditions are complied with:
  - Ambient temperature 0 to 40°C • Vibration 24.5m/s^2 or less
  - Ambient humidity 20 to 80% RH (Do not expose to condensation) • No splashing of water or oil • Do not expose to corrosive or explosive gas

Caution

Caution on Oil Leakage

- 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.

Caution

Install the actuator at the specified accuracy.

- Correctly align the centers of the actuator shaft and mating machine in accordance with the technical information.
- Any misalignment could cause vibration and fracture of the output shaft.

Caution

- 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.

Operational Precaution: Be certain to read the instruction manual and technical information before operating the actuator.

Caution

Do not exceed the permissible torque.

- Do not apply a torque larger than the maximum value.
- 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.

Warning

Do not pat the actuator.

- An encoder is coupled to the actuator. Do not pat the actuator.
- A fractured encoder may cause the actuator to run out of control.

Warning

Do not plug directly into a socket.

- The actuator cannot be operated unless connected to a dedicated control unit.
- Never connect directly to the AC power supply. The actuator may fracture and a fire may break out.

Warning

Do not pull the cables.

- Pulling a cable may damage the connecting part and cause the actuator to run out of control.

Servo Driver Safety Precautions

Design Precaution: Be certain to read the technical information when designing the equipment.

Caution

Use only in a specified environment.

- The driver generates heat. Exercise reasonable care concerning heat radiation and operate under the following conditions.
  - Install vertically and ensure sufficient space nearby
  - 0 to 50°C and 95% RH (Do not expose to condensation)
  - Avoid vibration or shocks
  - Do not expose to dust or corrosive or explosive gas
  - Do not use the servo driver in environment where sudden temperature and atmospheric pressure changes.

Caution

Exercise reasonable care when rotating from load side

- The servo driver may break if the actuator is run while being rotated from the load side.
- Consult Harmonic Drive Systems when the servo driver is operated in this mode.

Caution

Take adequate precautionary measures to damp noise and ground

- Noise on signal wire may cause vibration and malfunction. Observe the following conditions:
  - Separate strong and weak wires.
  - Minimize wiring distances and lengths.
  - Ground the actuator and servo driver to one point and in class 3 in grounding.
  - Do not use a power input filter in the motor circuit.

Caution

Use an earth leakage breaker for the inverter.

- Use an earth leakage breaker for the inverter. A time-delay breaker cannot be used.

Operational Precaution: Be certain to read the instruction manual and technical information before operating the actuator.

Warning

Do not change the wiring while the current is active.

- Always turn the power off when removing any wire or connecting or disconnecting a connector, otherwise an electric shock or runway may result.

Caution

Do not conduct a withstand voltage test.

- Do not conduct a megger or withstand voltage test, otherwise the control circuit of the servo driver may be damaged.

Warning

Do not touch the terminals for 5 min after turning it off.

- Residual electricity remains after turning the power off. Make checks more than 5 minutes after turning the power off to prevent any electric shock
- When installing a servo driver, design the structure so that the electric parts inside cannot be touched easily.

Caution

Do not operate the servo driver by turning it on and off.

- Frequent turning on and off of the power causes the internal circuit devices to deteriorate.
- Start and stop the actuator by issuing a command signal.

Operational Precaution: Be certain to read the instruction manual and technical information before operating the actuator.

Caution

- 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.
- Although black oxide finish is applied to some of our products, it dose not guarantee the antirust effect.

When Discarding Actuator and Servo Driver

Caution

Please discard as industrial waste.

- Please discard as industrial waste when discarding.

Major Applications of Our Products

Metal Working Machines

Processing Machines

Measurement, Analytical and Test Systems

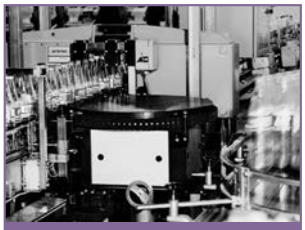
Medical Equipments

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 toCornell and provided courtesy NASA/ JPL-Caltech.

Glass and Ceramic Manufacturing Systems

Robots

Humanoid Robots

Source: Honda Motor Co., Ltd.

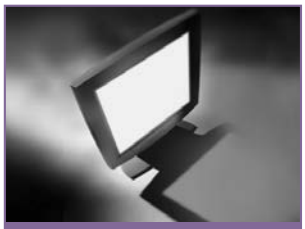
Printing, Bookbinding and Paper Machines

Semiconductor Manufacturing Systems

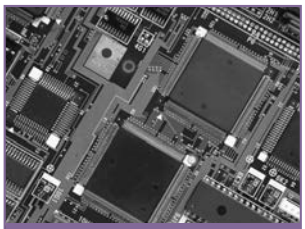
Optical Machines

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.

Sales Strategy Headquarters
Tokyo Sales Office
Kita-Kanto Team
Overseas Sales Divison
日商哈默納科股份有限公司 台灣代表人辦事處
Koshu/Shin-etsu Sales Office
Chubu Sales Office
Kansai Sales Office
Kyushu Sales Office

Sales and Marketing
Proposes optimum products meeting the operating environment by precisely determining the needs of individual customers

Development and Engineering Headquarters

Development Design
Development design departments closely collaborate and highly integrate on organization-developed technologies, actively creating new technologies and products.

Harmonic Drive Laboratory

Affiliate Companies

Winbel, Inc.
Development, mass production support, production, and sales of various motors

HD Logistics, Inc.
Subcontract operation of physical distribution

Harmonic Precision, Inc.
Production of crossed roller bearings

OME IRON CASTING CO.,LTD
Development, manufacturing and sales of casting products

Harmonic AD, Inc.
Development, design, and production of precision planetary reducers

哈默纳科(上海)商贸有限公司
Sales and technical support of mechatornics products and reduction devices

SAMICK ADM CO., LTD. (Korea)
Production of roduction of precision planetary reducers

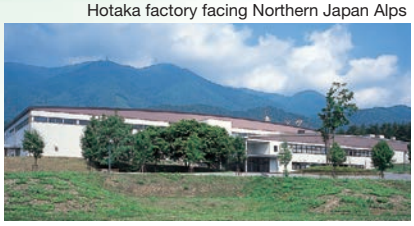
Harmonic Drive SE (Germany)

Harmonic Drive L.L.C (U.S.A.)

Production
Clear awareness of and techniques for quality control establish a viable production system, promising a supply of high-quality and high-precision products.

Manufacturing Headquarters

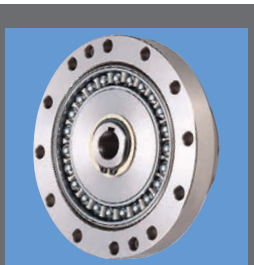
Hotaka factory facing Northern Japan Alps



OTHER PRODUCTS

HarmonicDrive®

Composed of only three basic components, the HarmonicDrive® speed reducer features more precision motion control through a unique mechanism.



Harmonic Planetary®

Harmonic Planetary® is a planetary gear speed reducer featuring high precision and stiffness, created by utilizing expertise in precision machining technology of HarmonicDrive® in the field of low speed reduction ratio. A high rotational accuracy is achieved by a unique backlash removal mechanism.

Harmonic Drive Systems Inc.

Information desk for urgent repair and inquiry [Information desk for urgent repair request and technical consultation]

• 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)

HarmonicDrive® ハーモニックドライブ®
HarmonicPlanetary® ハーモニックプラネタリ®
HarmonicGrease® ハーモニックグリース®
HarmonicGearhead® ハーモニックギヤヘッド®
HarmonicLinear® ハーモニックリニア®
BEAM SERVO® ビームサーボ®
Harmonicsyn® ハーモニックシン®

Registered Trademark in Japan

Certifications for ISO 14001 and ISO 9001 and obtained from TÜV Product Service GmbH

https://www.hds.co.jp/

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