

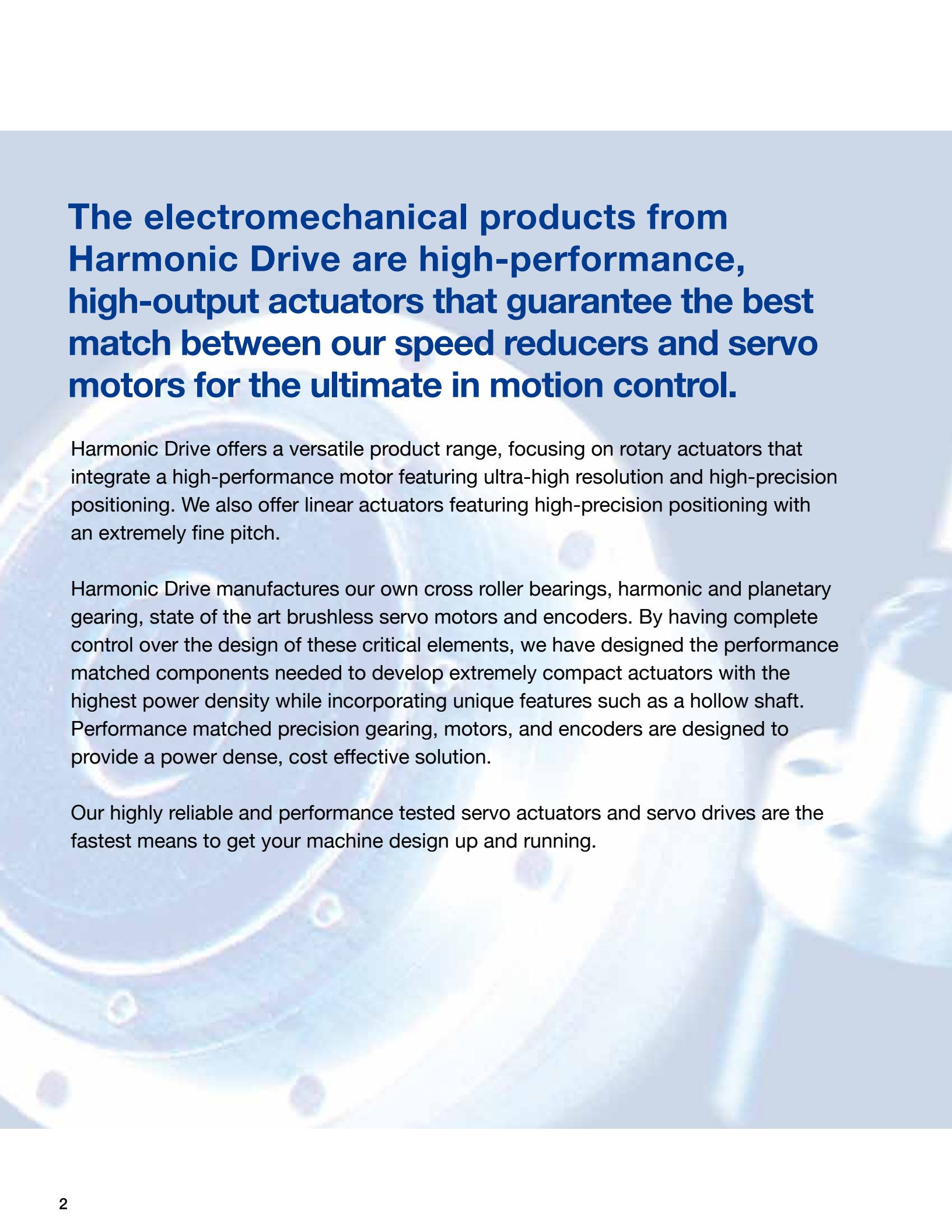
Harmonic Drive®

FINE MECHANICS & TOTAL *motion* CONTROL

MECHATRONICS

**General Catalog for
Electromechanical Products**



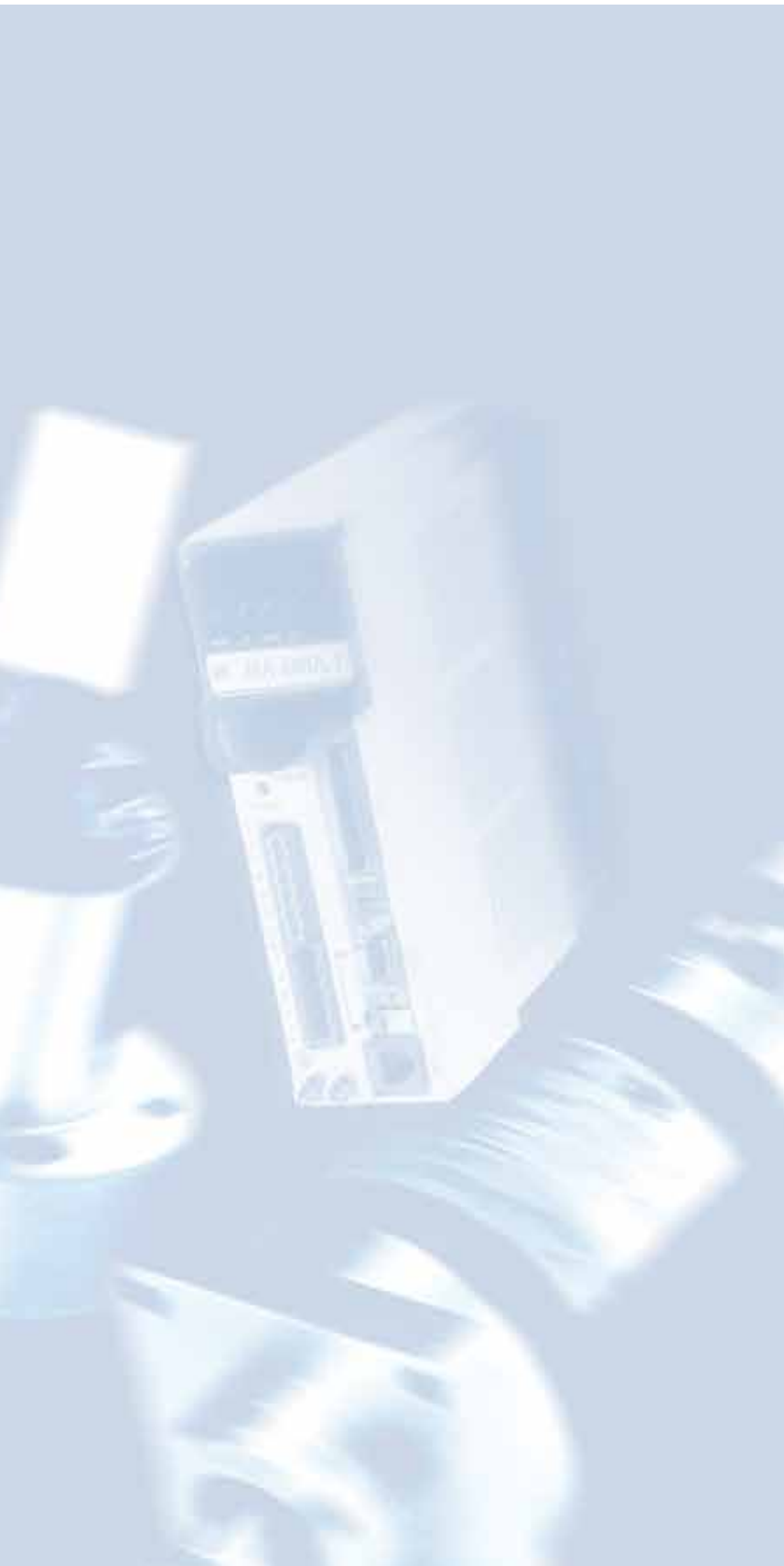


The electromechanical products from Harmonic Drive are high-performance, high-output actuators that guarantee the best match between our speed reducers and servo motors for the ultimate in motion control.

Harmonic Drive offers a versatile product range, focusing on rotary actuators that integrate a high-performance motor featuring ultra-high resolution and high-precision positioning. We also offer linear actuators featuring high-precision positioning with an extremely fine pitch.

Harmonic Drive manufactures our own cross roller bearings, harmonic and planetary gearing, state of the art brushless servo motors and encoders. By having complete control over the design of these critical elements, we have designed the performance matched components needed to develop extremely compact actuators with the highest power density while incorporating unique features such as a hollow shaft. Performance matched precision gearing, motors, and encoders are designed to provide a power dense, cost effective solution.

Our highly reliable and performance tested servo actuators and servo drives are the fastest means to get your machine design up and running.



CONTENTS

Overview

Product Lines	4
What is a Harmonic Gear	16
Structure of a Harmonic Gear	16
Operating Principles	17
Actuators Embedded with HarmonicDrive® Gears	18

Rotary Actuators

SHA Series	20
FHA-C Mini Series	41
FHA-C Mini Series w/Intetrated Drive	54
FHA-C Series	63
FHA-C-H Series	76
FLA Series	84
RKF Series	96
RSF Supermini Series	101
RSF-B Mini Series	107
RSF Series	113
RH Series	121
Tips for Selecting Rotary Actuator ..	128

Linear Actuators

LA Series	132
LAH-46 Series	135
LAH-80 Series	138
LBC Series	142

Direct Drive and Hollow Shaft Motors

KDU Series	148
HMA Series	153

Servo Drives for US

REL Series	160
RTL Series	164
DEP Series	168
DDP Series	172
DCJ Series	176

Servo Drives for Open Field Network

HA-800B Series	182
HA-800C Series	184
HA-680ML Series	186

Servo Drives

HA-800A Series	190
HA-680 Series	192
HA-770 Series	195
HS-360 Series	199

Warranty and Trademark	203
Company Profile.....	205

Rotary Actuator

Harmonic Drive® rotary actuators deliver both high-force and outstanding positional accuracy. Harmonic Drive manufactures our own cross-roller bearings, harmonic and planetary gearing, state-of-the-art brushless servo motors and encoders.

Rotary Actuators	Series	Features	Product	Power supply voltage	Size	Reduction ratio	Max. rotational speed (rpm)	Max. torque (Nm)
Rotary Actuators	RSF Supermini	• Ultra compact • High torque • Mitsubishi compatible		24 VDC	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		24 VDC	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		230 VAC	17	50	90	34
						100	45	54
						50	90	56
					20	100	45	82
						50	90	98
						100	45	157
					25	50	90	220
						100	45	330
						50	90	220
	RKF	• Compact size • High torque		230 VAC	20	50	90	56
						100	45	82
					25	50	90	98
						100	45	157
					32	50	90	220
						100	45	330
	RH ²	• Compact size • High torque		[20 VDC] [24 VDC] (100 VAC)	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
						50	100	14
	FHA-C Mini	• Hollow shaft (incremental encoder only) • Flat shape • Compact size • High torque • Multiple encoder options • (INC, ABS, Dual ABS)		120 VAC 230 VAC [24 VDC]	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 Mini with integrated servo drive	• Actuator + Integrated Servo Drive utilizing CANopen communication • Flat shape • Compact size • High torque		24 VDC	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
	FLA	• Ultra-Flat Shape • Lightweight		24 VDC 48 VDC	11	8	500	1.8
						50	100	6.7
						100	50	11
					14	8	500	3.7
						50	100	11.2
						100	50	18.2
					17	9	500	7.3
						50	100	23
						100	50	34
					20	9	400	12.1
						50	80	33

*1 Mass for FHA Mini with ABS encoder

*2 When an RH series actuator is used with an HS-360 series servo drive, a line driver type encoder is used.

Length	Outline Dimension	Mass (kg)	Compatible HDLLC drives	Compatible drives	Page in catalog
47	12	0.031	DEP-090-09, DDP-090-09, DCJ-055-09	HA-680-4B-24 HA-680ML-4B-24	99
58.1	20.5	Without brake 0.066 With brake 0.086			
124.3	33	0.3	DEP-090-09, DDP-090-09, DCJ-055-09	HA-680-4B-24 HA-680ML-4B-24	105
141.7	40	0.5	DEP-090-36, DDP-090-36	HA-680-6B-24	
168.5	50	0.8	DEP-090-36, DDP-090-36	HA-680ML-6B-24	
210	□70	2.1	RTL-230-18, REL-230-18	HA-800-3B-200	111
242	□85	2.9		HA-800-3B-200	
288.7	□110	4.7		HA-800-3B-200	
331	□130	8.7		HA-800-6B-200	
180	□100	2.9	RTL-230-18, REL-230-18	HA-800-3B-200	94
215.5	□120	5.0		HA-800-3B-200	
241	□155	9.5		HA-800-6B-200	
89	20	0.09	[DEP-090-09, DDP-090-09, DCJ-055-09]	(HS-360-1A-100)	119
129	33	0.3		(HS-360-1B-100)	
150.5	40	0.5		(HS-360-1C-100)	
176	50	0.77		(HS-360-1D-100)	
48.5-61.8	□50	0.40 0.50 ¹	RTL-230-18, REL-230-18, [DEP-090-09]	HA-800-1C-100 HA-800-1C-200 HA-800-1D-100 HA-800-1D-200 HA-680-4-24 HA-680ML-4-24	42
56-68.5	□60	0.62 0.75 ¹	RTL-230-18, REL-230-18, [DEP-090-18]		
66-68	□75	1.2 1.3 ¹	RTL-230-18, REL-230-18, [DEP-090-36]	HA-800-1C-100 / HA-800-1C-200 HA-800-1D-100 / HA-800-1D-200 HA-680-6-24 / HA-680ML-6-24	
51.5	□50	0.41	-	-	55
56.8	□60	0.63	-		
68	□75	1.2	-		
39.8 (40.3)	63.5	0.39 (.42)	-	-	84
43.3 (45.3)	76	.62 (.72)	-		
48.7 (51.8)	85.5	.87 (.94)	-		
47.8 (51.4)	95.5	1.06 (1.17)	-		

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.

Rotary Actuator

Harmonic Drive® rotary actuators deliver both high-force and outstanding positional accuracy. Harmonic Drive manufactures our own cross-roller bearings, harmonic and planetary gearing, state-of-the-art brushless servo motors and encoders.

	Series	Features	Product	Power supply voltage* ¹	Size	Reduction ratio	Max. rotational speed (rpm)* ¹	Max. torque (Nm)
Rotary Actuators	FHA-C FHA-C-PR FHA-C-H	- Hollow shaft - Flat shape - High torque - High resolution - Multiple encoder options		230 VAC [24 VDC] (120 VAC) ((480 VAC))	17	50	96	39
						80	60	51
						100	48	57
						120	40	60
						160	30	64
				230 VAC (120 VAC) ((480 VAC))	25	50	90	150
						80	56	213
						100	45	230
						120	37	247
						160	28	260
					32	50	80	281
						80	50	364
						100	40	398
						120	33	432
						160	25	453
				230 VAC ((480 VAC)) ⁴	40	50	70	500
						80	43	659
						100	35	690
						120	29	756
						160	22	820
	SHA-CG	- Superior precision rotary positioning - High accuracy - Hollow shaft - Flat shape - High torque - High resolution - Multiple configurations - Absolute encoder (17 bit single-turn, 16 bit multi-turn) - Incremental encoder option - Available with or without brake - Available with Low Voltage - Mitsubishi compatible - Yaskawa compatible - Panasonic compatible		230 VAC	20	50	120	73
						80	75	96
						100	60	107
						120	50	113
						160	37.5	120
				230 VAC (120 VAC)	25	50	112(96)	127
						80	70(60)	178
						100	56(48)	204
						120	46.7(40)	217
						160	35(30)	229
				230 VAC	32	50	96	281
						80	60	395
						100	48	433
						120	40	459
						160	30	484
				230 VAC	40	50	80	333
						80	50	548
						100	40	686
						120	33.3	802
						160	25	841
				48 VDC* ⁵	20	50	64	73
						80	40	96
						100	32	107
						120	27	113
						160	20	120
				48 VDC* ⁵	25	50	77	127
						80	48	178
						100	38	204
						120	32	217
						160	24	229
				48 VDC* ⁵	32	50	51	281
						80	32	395
						100	25	433
						120	21	459
						160	16	484

*1 Values in brackets [] = 24 VDC; values in parenthesis () = 120 VAC, values in double parenthesis (()) = 480 VAC

*2: FHA-C-PR mass

*3: FHA-C-H mass (without brake)

*4: Third party drives available for 480V, contact us for details

*5: Voltage range 20-90VDC

Length (mm)	Diameter (mm)	Mass (kg)	CANopen, EtherCAT Protocol ¹	CC Link, Mechatrolink, General IO Protocol ¹	Page in catalog
57~105.5	128	2.5, 2.8 ² 3.3 ³	RTL-230-18, REL-230-18 [DDP-090-36], [DEP-090-36]	HA-800-3C-100 HA-800-3C-200 HA-800-6C-100	63, 76
65.5~106.5	155	4.0, 4.7 ² 4.6 ³	(RTL-230-36, REL-230-36) RTL-230-18, REL-230-18		
			(RTL-230-18) RTL-230-18, REL-230-18		
89.5~129	175	6.5, 7.1 ² 6.8 ³	(RTL-230-36, REL-230-36) RTL-230-18, REL-230-18	HA-800-6C-100 HA-800-6C-200	
			(RTL-230-18)		
97~143.8	230	12, 13.6 ² 10.8 ³	RTL-230-36, REL-230-36 RTL-230-18, REL-230-18		
125.5	117	Without brake 2.6 With brake 2.7	REL-230-18	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200	20
144	144	Without brake 3.95 With brake 4.1	REL-230-18	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200 (HA-800A-6D/E-100) (HA-800B-6D/E-100) (HA-800C-6D/E-100)	
127.5	175	Without brake 7.7 With brake 8.0	REL-230-36	HA-800A-6D/E-200 HA-800B-6D/E-200 HA-800C-6D/E-200	
			REL-230-18		
170	225	Without brake 13.0 With brake 13.8	REL-230-40	HA-800A-6D/E-200 HA-800B-6D/E-200 HA-800C-6D/E-200 (HA-800A-24D/E-200) (HA-800B-24D/E-200) (HA-800C-24D/E-200)	
			REL-230-36		
125.5	117	Without brake 2.6 With brake 2.7	DEP-090-36	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200	
			DEP-090-18		
144	144	Without brake 3.95 With brake 4.1	DEP-090-36	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200 (HA-800A-6D/E-100) (HA-800B-6D/E-100) (HA-800C-6D/E-100)	
			DEP-090-18		
127.5	175	Without brake 7.7 With brake 8.0	DEP-090-36	HA-800A-6D/E-200 HA-800B-6D/E-200 HA-800C-6D/E-200	
			DEP-090-18		

Rotary Actuator

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	Series	Features	Product	Power supply voltage	Size	Reduction ratio	Max. rotational speed (rpm) ^{*2}	Max. torque (Nm)
Rotary Actuator	SHA-SG	• Hollow shaft • Flat shape • High torque • High resolution • Multiple configurations • Absolute encoder (17 bit single-turn, 16 bit multi-turn) • Incremental encoder option • Available with or without brake • Available with Low Voltage • Mitsubishi compatible • Yaskawa compatible • Panasonic compatible		230 VAC	20	51	117.6	73
						81	74.1	96
						101	59.4	107
						121	49.6	113
						161	37.3	120
				230 VAC (120 VAC)	25	11	509.1	26
						51	109.8(94.1)	127
						81	69.1(59.3)	178
						101	55.4(47.5)	204
						121	46.3(39.7)	217
						161	34.8(29.8)	229
				230 VAC	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
				230 VAC	40	51	78.4	340
						81	49.4	560
						101	39.6	686
						121	33.1	802
						161	24.8	841
				230 VAC	45	51	74.5	650
						81	46.9	918
						101	37.6	982
						121	31.4	1070
						161	23.6	1147
				230 VAC	58	81	37.0	1924
						101	29.7	2067
						121	24.8	2236
						161	18.6	2392
				230 VAC	65	81	34.6	2400
						101	27.7	2990
						121	23.1	3263
						161	17.4	3419
				48 VDC ^{*3}	20	51	63	73
						81	40	96
						101	32	107
						121	27	113
						161	20	120
				48 VDC ^{*3}	25	11	–	26
						51	75	127
						81	47	178
						101	38	204
						121	32	217
						161	24	229
				48 VDC ^{*3}	32	11	–	62
						51	50	281
						81	31	395
						101	25	433
						121	21	459
						161	16	484

* 1: The mass for SHA-HP with HPF hollow shaft planetary gear, 11:1 ratio.

* 2: Values in parenthesis () = 120 VAC,

* 3: Voltage range 20-90VDC

Length (mm)	Diameter (mm)	Mass (kg)	CANopen, EtherCAT Protocol	CC Link, Mechatrolink, General IO Protocol	Page in catalog
108.5	94	2	REL-230-18	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200	20
109	114	Without brake 2.95 5.0 ¹ With brake 3.1 5.1 ¹	REL-230-18	HA-800A-3D/E-200 HA-800B-3D/E-200 HA-800C-3D/E-200 (HA-800A-6D/E-100) ² (HA-800B-6D/E-100) ² (HA-800C-6D/E-100) ²	
125	146	Without brake 5.9 9.4 ¹ With brake 6.2 9.7 ¹	REL-230-36	HA-800A-6D/E-200 HA-800B-6D/E-200 HA-800C-6D/E-200	
			REL-230-18		
148	175	Without brake 9.9 With brake 10.7	REL-230-40	HA-800A-6D/E-200 HA-800B-6D/E-200 HA-800C-6D/E-200 (HA-800A-24D/E-200) (HA-800B-24D/E-200) (HA-800C-24D/E-200)	
			REL-230-36		
153.5	195	Without brake 12.4 With brake 13.2	REL-230-40	HA-800A-24D/E-200 HA-800B-24D/E-200 HA-800C-24D/E-200	
			REL-230-36		
213	247	Without brake 29.5 With brake 32	N/A	HA-800A-24D/E-200 HA-800B-24D/E-200 HA-800C-24D/E-200	
222	284	Without brake 37.5 With brake 40	N/A	HA-800A-24D/E-200 HA-800B-24D/E-200 HA-800C-24D/E-200	
108.5	94	2	DEP-090-36	N/A	
			DEP-090-18		
109	114	Without brake 2.95 5.0 ¹ With brake 3.1 5.1 ¹	—	N/A	
			DEP-090-36		
			DEP-090-18		
125	146	Without brake 5.9 9.4 ¹ With brake 6.2 9.7 ¹	—	N/A	
			DEP-090-36		
			DEP-090-18		

Linear

Harmonic Drive Linear Actuators deliver both high force and outstanding positional accuracy. These actuators provide linear forces from 49N to 12,000N with sub-micron position resolution.

	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
	LAH-80	• Medium driving force		□85	2	50	3,000
	LBC	• High driving force		Φ136	0.32	50	6,000
					0.16		12,000

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

* 2: If the drive motor is a stepper motor, the motor will be sold in combination with a driver.

Motors

Large Hollow Shaft design allows cables, shafts or lasers to pass through the axis of rotation.

	Series	Feature	Product	Size	Resolution (Pulses/Revolution)	Max. Rotational Speed (rpm)
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
Hollow Shaft Motors	HMA	• AC Servomotor • Large Hollow Shaft • Absolute Encoder (17 bit single-turn, 16 bit multi-turn) • Available in 5 frame sizes • Available with or without brake • Available with Low Voltage • Incremental encoder option		HMAC08A200		6000
				HMAC08B200		
				HMA09A200		5600
				HMA09B200		
				HMA09A100		4800
				HMA09B100		
				HMA12A200		4800
				HMA12B200		
				HMA15A200		4000
				HMA15B200		
				HMAA21AA200		3000
				HMAA21AB200		

Repeatability (μm /Stroke mm)	Mass (kg)	Drive Motor	Compatible Drives	Power Supply Vol.	Page in Catalog	Application
± 0.1 or less/mm	0.32	DC servo	HS-360-1A-100	120 VAC	130	- Semiconductor wafer positioning - Optical focusing systems - High precision stages
	0.55					
± 0.5 or less/1mm	0.81	DC servo	HS-360-1A-100	120 VAC	133	- Alignment of liquid crystal panel - Inspection equipment and measuring instruments - Image measuring instruments
	0.85					
± 1 or less/1mm	5	Stepper	RKD514-A	120 VAC	136	- Electronic equipment assembly systems - Media manufacturing systems - Precision die and mold spotting
± 5 or less/1mm	12.5	AC servo	HA-800A-3B	230 VAC	140	- Machine tools - Press-fitting, drawing and caulking work

Maximum Torque (Nm)	Repeatability arc sec	Mass (kg)	Compatible Drives	Power Supply Voltage	Page in Catalog	Application
7.0	±0.5	4.0	HA-770-2	120 VAC 230 VAC	100	Semiconductor and FPD manu- facturing 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				
1.8		1.1	REL-230-18	230 VAC	104	Semiconductor and FPD manu- facturing equipment and systems • Index tables • Micro feeding Measuring and inspection equipment and systems • Probe drives • Index tables • X-Y-Z tables
3		1.2	REL-230-18			
3		1.5	REL-230-36	120 VAC		
7		1.65		230 VAC		
13		2.8	REL-230-36			
45		3.2				
		4.4				
		5.2				
	14.8					
	17.1					

Servo Drives

	Series	Product	Power Supply Voltage	Control Mode	
CANopen and EtherCAT	REL Series EtherCAT Technology Group		120 VAC 230 VAC	• Indexer, Point-to-Point • Camming, Gearing • Position, Velocity, Torque (PVT)	
	RTL Series CANopen		120 VAC 230 VAC	• Indexer, Point-to-Point • Camming, Gearing • Position, Velocity, Torque (PVT)	
	DDP Series CANopen		90 VDC 180 VDC	• Indexer, Point-to-Point • Camming, Gearing • Position, Velocity, Torque (PVT)	
	DCJ Series CANopen		90 VDC 180 VDC	• Indexer, Point-to-Point • Camming, Gearing • Position, Velocity, Torque (PVT)	

Servo Drives

	Series	Product	Power Supply Voltage	Control Mode	
CC Link, MECHATROLINK, and General IO	HA-800B MECHATROLINK		120 VAC 230 VAC	Position control Speed control Torque control	
	HA-800C CC-Link		120 VAC 230 VAC	Position control Speed control Torque control	
	HA-680ML MECHATROLINK		24 VDC	Position control	

Servo Drives

	Series	Product	Power Supply Voltage	Control Mode	
General IO	HA-800A		120 VAC 230 VAC	Position control Speed control Torque control	
	HA-680		24 VDC	Position control Speed control Torque control	
	HA-690		24 VDC	Position control only	
	HA-770		120 VAC 230 VAC	Position control only	
	HS-360		120 VAC	Position control only	

Compatible Actuator/Motor	Page in Catalog
SHA series, FHA-C mini series, FHA-C series, RSF series, RKF series, HMA series	158
SHA series, FHA-C mini series, FHA-C series, RSF series, RKF series, HMA series	162
SHA series, FHA-C series (E option) RSF mini series, RSF supermini series	170
SHA series, FHA-C series (E option) RSF mini series, RSF supermini series	174

Compatible Actuator/Motor	Page in Catalog
SHA series FHA-C mini series FHA-C series RSF series RKF series	180
SHA series FHA-C mini series FHA-C series RSF series RKF series	182
FHA-C mini series RSF supermini series RSF-B mini series	184

Compatible Actuator/Motor/Direct Drive Motor	Page in Catalog
SHA series FHA-C mini series FHA-C series RSF series RKF series	150
FHA-C mini series RSF supermini series RSF-B mini series	190
FHA-C mini series	190
KDU series	103
RH series LA series LAH series (Line driver specification) RHS series	197

Compliance



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

* The above chart is a list of standard products.

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

* 1: Because these products are so small, there is no marking on them.

* 2: FHA-C-H only

	Product Name	Safety Standard		Marking	
Driver	HA-800A/B/C	UL standard	UL508C (File No.229163)		
		CSA standard	C22.2 No.14		
		EN standard	EN61800-5-1,EN61800-3		
	HA-655	UL standard	UL508C (File No.229163)		
		CSA standard	C22.2 No.14		
		EN standard	EN50178,EN61800-3		
	HA-680 ²	EN standard	EN50178,EN61800-3		
	HA-690	EN standard	EN61800-5-1,EN61800-3		
	REL with EtherCAT	UL Standard	UL508C		
		EN Standard	EN55011, EN61000-6-1, EN61010-1		
	RTL with CANopen	UL Standard	UL508C		
		EN Standard	EN55011, EN61000-6-1, EN61010-1		
	DCJ Series	UL Standard	UL508C		
		EN Standard	EN55011, EN61000-6-1, EN61010-1		
	DDP series	UL Standard	UL508C		
		EN Standard	EN55011, EN61000-6-1, EN61010-1		
	DEP Series	UL Standard	UL508C		
		EN Standard	EN55011, EN61000-6-1, EN61010-1		

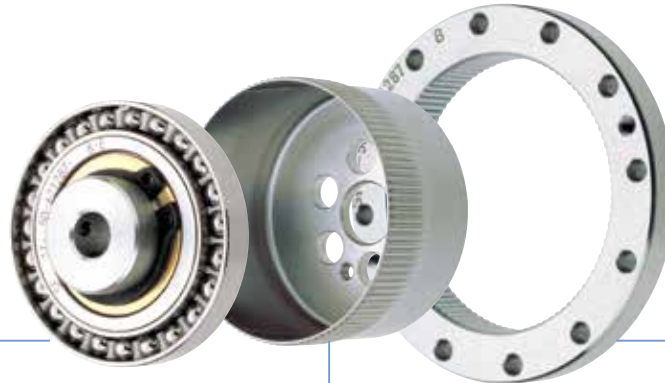
* The above chart is a list of standard products.

There are two types of TÜV mark.

* 1: Note that -ML/-CL for HA-680 series are not applicable.

HarmonicDrive® Gear

HarmonicDrive® gearing has a unique operating principle which utilizes the elastic mechanics of metals. This precision gear reducer consists of only 3 basic parts and provides high accuracy and repeatability.



Wave Generator

The Wave Generator is a thin raced ball bearing fitted onto an elliptical shaped hub. The inner race of the bearing is fixed to the cam and the outer race is elastically deformed into an ellipse via the balls. The Wave Generator is usually mounted onto the input shaft.

Flexspline

The Flexspline is a non-rigid, thin cylindrical cup with external teeth. The Flexspline fits over the Wave Generator and takes on its elliptical shape. The Flexspline is generally used as the output of the gear.

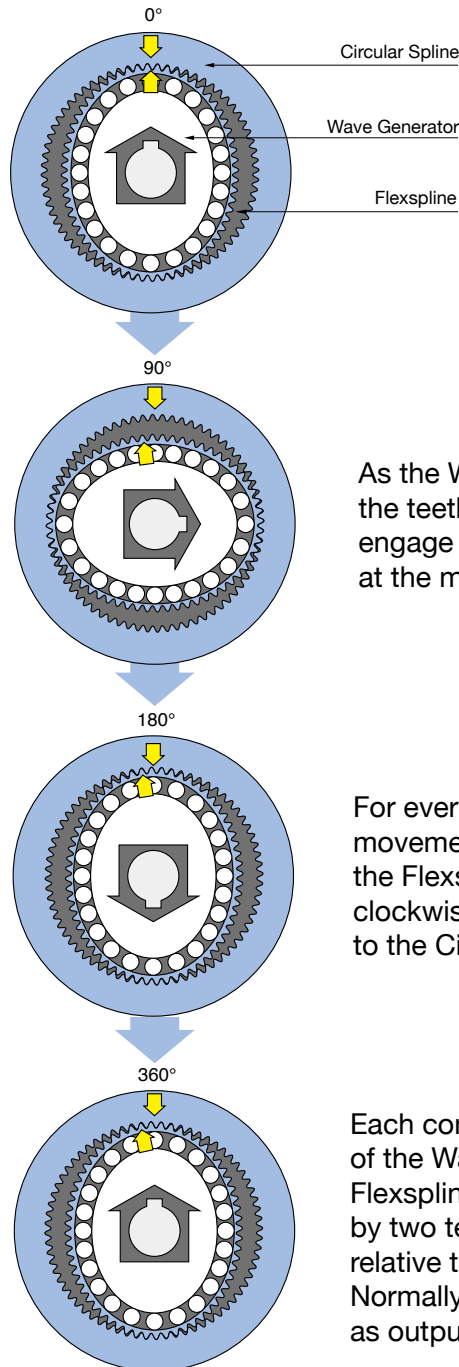
Circular Spline

The Circular Spline is a rigid ring with internal teeth, engaging the teeth of the Flexspline across the major axis of the Wave Generator. The Circular Spline has two more teeth than the Flexspline and is generally mounted to the housing.

The greatest benefit of HarmonicDrive® gearing is the weight and space savings compared to other gearheads because it consists of only three basic parts. Since many teeth are engaged simultaneously, it can transmit higher torque and provides high accuracy. A unique S tooth profile significantly improves torque capacity, life and torsional stiffness of the gear.

- **Zero-backlash**
- **High-reduction ratios, 30:1 to 160:1 in a single stage**
- **High-precision positioning (repeatability ± 4 to ± 10 arc-sec)**
- **High-torque capacity**

Operating Principles



The Flexspline is slightly smaller in diameter than the Circular Spline and usually has two fewer teeth than the Circular Spline. The elliptical shape of the Wave Generator causes the teeth of the Flexspline to engage the Circular Spline at two opposite regions across the major axis of the ellipse.

As the Wave Generator rotates the teeth of the Flexspline engage with the Circular Spline at the major axis.

For every 180 degree clockwise movement of the Wave Generator the Flexspline rotates counter-clockwise by one tooth in relation to the Circular Spline.

Each complete clockwise rotation of the Wave Generator results in the Flexspline moving counter-clockwise by two teeth from its original position relative to the Circular Spline. Normally, this motion is taken out as output.

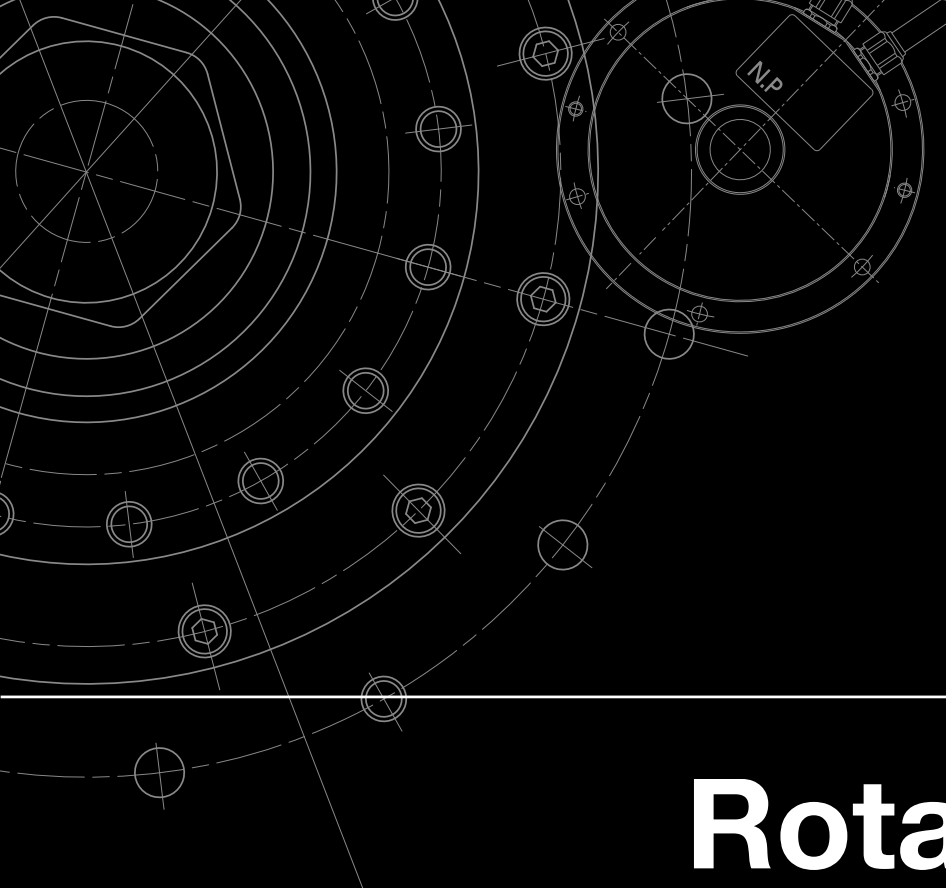
Actuator Embedded with HarmonicDrive® Gear

Performance matched precision gearing, motors, and encoders are designed to provide a power dense, cost effective solution. Harmonic Drive® actuators deliver both high force and outstanding positional accuracy. Harmonic Drive® rotary actuators are the easiest solution for your high precision motion control applications. Harmonic Drive manufactures our own cross roller bearings, harmonic and planetary gearing, state of the art brushless servo motors and encoders. By having complete control over the design of these critical elements, we have designed compact actuators with the highest power density while incorporating unique features such as a hollow shaft.

The availability of these complete servo actuators eliminates the need for machine designers to individually select a motor and gearhead as well as the effort needed to characterize its expected performance. Our highly reliable and performance tested servo actuators and servo drives are proven solutions, and are the most efficient means to get your design up and running.

Features

- **Zero-Backlash**
- **Compact**
- **High Torque**
- **High Moment Stiffness**



Rotary Actuator

AC Servo Actuators

SHA Series	20
FHA-C Mini Series	41
FHA-C Mini Series with Integrated Servo Drive	54
FHA-C Series	63
FHA-C-H Series	76
FLA Series	84
RKF Series	96
RSF Supermini Series	101
RSF-B Mini Series	107
RSF Series	113

DC Servo Actuators

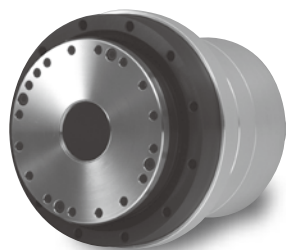
RH Series	121
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SHA Series

SHA Series AC Servo Actuators provide high torque and highly accurate rotary operation. These hollow shaft servo actuators utilize Harmonic Drive® precision gears combined with a brushless servomotor and magnetic absolute encoder space. The SHA series AC Servo Actuators all feature a large hollow shaft through the axis of rotation. This through hole allows wiring, air lines, laser beams or concentric shafts to be passed through. This feature can simplify the overall structure of machinery and equipment. Two types of actuators are available for the SHA series: SHA-SG featuring a compact shape, and SHA-CG with an improved output flange surface runout accuracy.

SHA-SG



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

SHA-CG



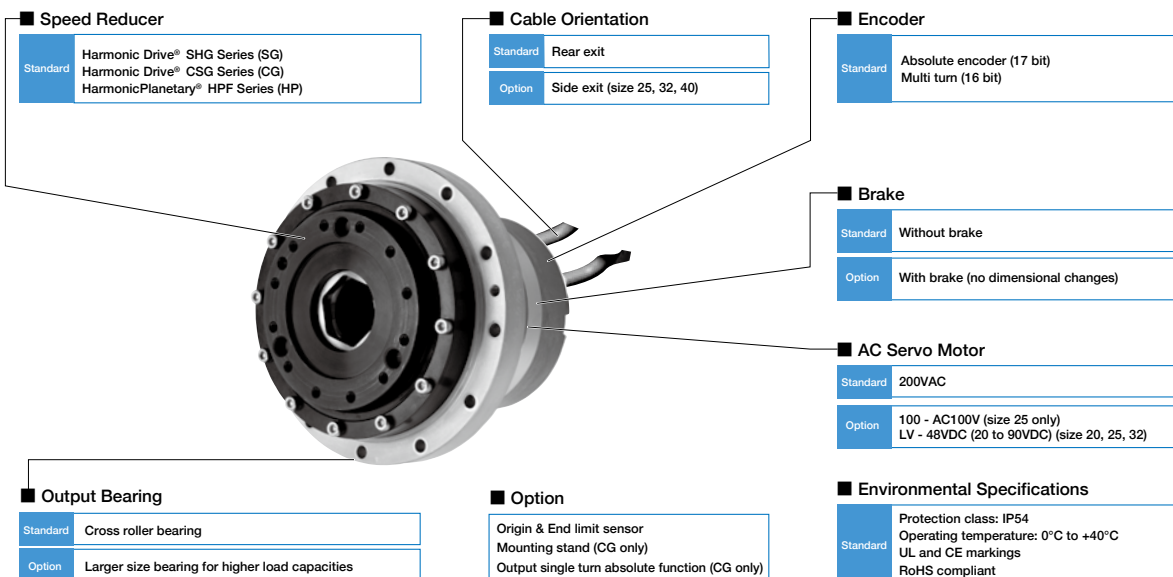
With SHA-CG actuators, the output shaft surface runout accuracy has been greatly improved by changing the model of the speed reducer.

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

Features

- The SHA series actuators have almost the same accuracy and resolution as direct drive motors, but are significantly smaller and lighter. (Torque/volume ratio is five times that of the direct drive motor *According to HDS research)
- Torque: 26 Nm to 3419 Nm.
- Hollow shaft (max. hollow diameter: $\phi 65$ mm), flat structure (max. outer diameter: $\phi 284$ mm, total length: 222 mm)
- Hollow shaft design enables cables, tubing or lasers to pass through the axis of rotation.
- Flat, compact design
- One-way positional accuracy: Excellent accuracy with a reduction ratio 50:1 = 40 arc-sec. (0.011 degrees) and a reduction ratio 80:1 or more = 30 arc-sec. (0.008 degrees) (SHA32/40CG)

Configuration



Ordering Code

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) Series: SHA AC Servo Actuator

(2) Size

SG	20, 25, 32, 40, 58, 65
CG	20, 25, 32, 40
HP	25, 32

(3) Design Version

(4) Reduction Ratio

SG		CG	
51	51:1	50	50:1
81	81:1	80	80:1
101	101:1	100	100:1
121	121:1	120	120:1
161	161:1	160	160:1
HP			
11	11:1		

(5) Speed Reducer

SG	SHG Series
CG	CSG Series
HP	HPF Series

(6) Motor Version

A	Sizes 58, 65
B	Sizes 25, 32, 40
C	Size 20
D	Size 45

(7) Motor Size

08	Size 20
09	Size 25
12	Size 32
15	Size 40
16	Size 45
21	Sizes 58, 65

(8) Brake

A	Without brake
B	With brake

(9) Power Supply Voltage

LV ¹	48 - 90 VDC
200	230 VAC
100 ²	120 VAC

¹ (size 20, 25 & 32)² (120 V is only compatible with size 25)

(10) Encoder Format

10	A-Format (2.5Mbps, 1 to 1 connection)
00	Incremental Encoder
14	Panasonic Format
15	Biss-C Format (Available in size 25)
16	Mitsubishi Format
17	Yaskawa Format

(11) Encoder, Resolution

S17b	17bit Absolute encoder; (Nikon-A format)
D250	Incremental encoder (size 25, 32, and 40)

(12) Encoder Offset Angle:

The phase difference of the Motor U phase and the Absolute encoder origin

A	0°
B	30 degree

(13) Connector Specifications

C	With pigtails and standard connector [*]
N	With pigtails (no connector)
D	With special connector ¹

^{*}This is for extension cable. ¹special specification

(14) Options

L	Origin & end limit sensor
Y	Side exiting cable
V	With stand (CG only)
S	Output shaft single revolution absolute model (CG only)

(15) Special Specifications

No description	Standard product
SP	Special specification code

Specifications (SG/HP)

Size /Ratio Item			SHA20A					SHA25A						SHA32A							
			51	81	101	121	161	11	51	81	101	121	161	11	51	81	101	121	161		
Max. torque ²	Nm ²		73	96	107	113	120	26	127	178	204	217	229	62	281	395	433	459	484		
	Nm [48VDC] ³		68	96	107	113	120	–	100	163	204	217	229	–	146	238	298	357	477		
Max. rotational speed	rpm		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		
	rpm [48VDC] ³		63	40	32	27	20	–	75	47	38	32	24	–	50	31	23	21	16		
Torque constant	Nm/A _{rms}		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		
	Nm/A _{rms} [48VDC] ³		6.3	10.1	12.7	15.2	20.2	–	5.3	8.5	10.6	12.7	16.9	–	7.9	12.8	16	19.1	25.4		
Max. current ²	A _{rms}		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		
	A _{rms} [48VDC] ³		14.9	13.2	12	10.8	9.1	–	25.5	25.5	25.5	23	19	–	25.5	25.5	25.5	25.5	25.5		
Moment of inertia (without brake)	GD ² /4	kgm 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		
Moment of inertia (with brake)	GD ² /4	kgm 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		
Allowable moment load	Nm		187					410		258				932		580					
Moment stiffness	Nm/rad		25.2×10 ⁴					37.9×10 ⁴		39.2×10 ⁴				86.1×10 ⁴		100×10 ⁴					
Encoder type			Absolute encoder with battery buffered multi-turn																		
Encoder resolution of motor shaft			2 ¹⁷ (131,072)																		
Motor multi revolution detection			2 ¹⁶ (65,536)																		
Encoder resolution of output shaft	counts/rev		6,684,672	10,616,832	13,238,272	15,859,712	21,102,592	1,441,792	6,684,672	10,616,832	13,238,272	15,859,712	21,102,592	1,441,792	6,684,672	10,616,832	13,238,272	15,859,712	21,102,592		
Power supply voltage	V		200 VAC or 48 VDC					200 VAC		100 VAC, 200 VAC or 48 VDC				200VAC		200 VAC or 48 VDC					
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											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 drive			HA-800□-3					HA-800□-3, HA-800□-6						HA-800□-6							
HDLLC compatible drives			REL-230-18					REL-230-18						REL-230-36							
HDLLC compatible drives [48VDC]			DEP-090-36		DEP-090-18			DEP-090-36			DEP-090-18			DEP-090-36			DEP-090-18				

* 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 are obtained when combined with DEP-090-36

* 4: The values in parentheses for the SHA25 actuators using 100V motor input voltage.

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

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

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
	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
	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
	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-
	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			
	179×10 ⁴					257×10 ⁴					531×10 ⁴				741×10 ⁴			
Absolute encoder with battery buffered multi-turn																		
2 ¹⁷ (131,072)																		
2 ¹⁶ (65,536)																		
	6,684,672	10,616,832	13,238,272	15,859,712	21,102,592	6,684,672	10,616,832	13,238,272	15,859,712	21,102,592	10,616,832	13,238,272	15,859,712	21,102,592	10,616,832	13,238,272	15,859,712	21,102,592
	200VAC																	
	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.)																		
Temperature: 0 to 40°C/Storage temperature: -20 to 60°C, Operating humidity/Storage humidity: 20 to 80%RH (no condensation), dust 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			
	REL-230-36			REL-230-40		REL-230-40, REL-230-36												
	N/A																	

Specifications (CG)

Size /Ratio			SHA20A					SHA25A					
			50	80	100	120	160	50	80	100	120	160	
Item			50	80	100	120	160	50	80	100	120	160	
Max. torque ²	Nm ²		73	96	107	113	120	127	178	204	217	229	
	Nm [48VDC] ³		67	96	107	115	120	98	161	201	217	229	
Max. rotational speed	rpm		120	75	60	50	37.5	112 (96)	70 (60)	56 (48)	46.7 (40)	35 (30)	
	rpm [48VDC] ³		64	40	32	27	20	77	48	38	32	24	
Torque constant	Nm/A _{rms}		16	26	33	39	53	19 (10.9)	31 (17.7)	38 (22)	46 (27)	61 (35)	
	Nm/A _{rms} [48VDC] ³		6.2	10	12.5	15	4.4	5.2	8.4	10.5	12.6	16.8	
Max. current ²	A _{rms}		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)	
	A _{rms} [48VDC] ³		14.9	13.3	12.1	10.9	9.1	25.5	25.5	25.5	23	19	
Moment of inertia (without brake)	GD ² /4	kgm ²	0.21	0.53	0.82	1.2	2.1	0.50	1.3	2	2.9	5.1	
	J	kgfcm ²	2.1	5.4	8	12	22	5.1	13	20	29	52	
Moment of inertia (with brake)	GD ² /4	kgm ²	0.23	0.6	0.94	1.3	2.4	0.60	1.5	2.4	3.4	6.1	
	J	kgfcm ²	2.4	6.1	9.6	14	24	6.1	16	24	35	62	
Allowable moment load	Nm		187					258					
Moment stiffness	Nm/rad		25.2×10 ⁴					39.2×10 ⁴					
Encoder type			Absolute encoder with battery buffered multi-turn										
Encoder resolution of motor shaft			2 ¹⁷ (131,072)										
Motor multi-turn detection			2 ¹⁶ (65,536)										
Encoder resolution of output shaft	counts/rev		6,553,600	10,485,760	13,107,200	15,728,640	20,971,520	6,553,600	10,485,760	13,107,200	15,728,640	20,971,520	
Power supply voltage	V		200 VAC or 48 VDC					100 VAC or 200 VAC or 48 VDC					
Mass (without brake)	kg		2.6					3.95 [4.1]					
Mass (with brake)	kg		2.7					4.1 [4.3]					
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 drive			HA-800□-3D/E-200					HA-800□-3D/E-200 (HA-800□-6D/E-100)					
HDLCC compatible drives			REL-230-18					REL-230-18					
HDLCC compatible drives [48 VDC]			DEP-090-36		DEP-090-18			DEP-090-36		DEP-090-18			

* 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 using 100V motor input voltage.

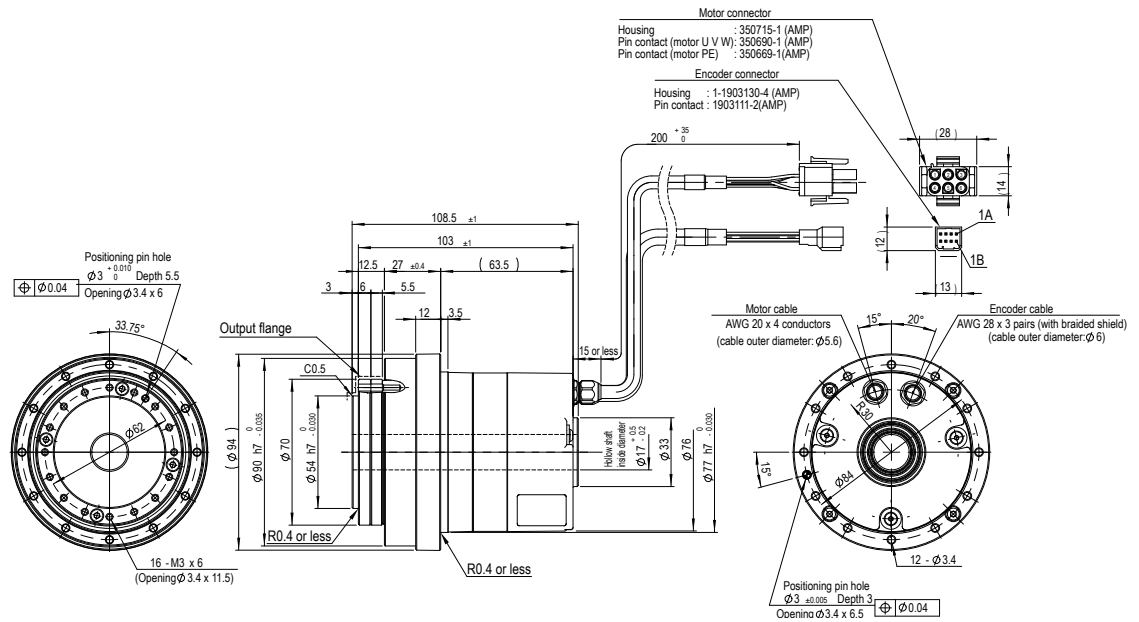
* 4: The values are obtained when combined with DEP-090-36 when the input power supply is 100 VAC.

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

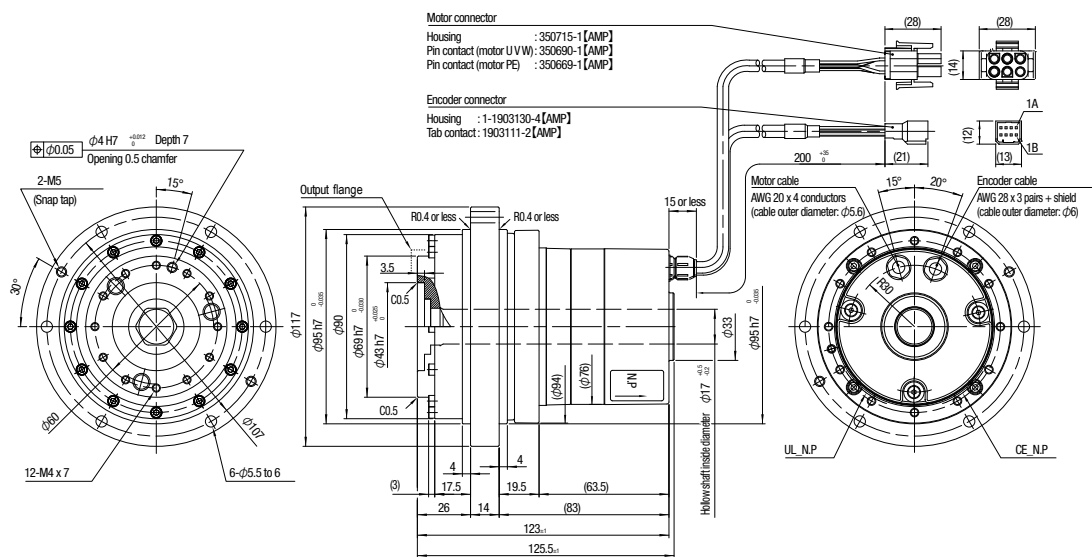
* 6: See the manual for details on rotation direction of actuators.

	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
	143	235	295	354	473	–	–	–	–	–
	96	60	48	40	30	80	50	40	33.3	25
	51	32	25	21	16	–	–	–	–	–
	20	33	41	49	66	25	40	50	60	80
	7.8	12.6	15.8	19	25.3	–	–	–	–	–
	17.7	15.4	13.7	12.2	10	18 (27.2)	18 (22)	18 (19.6)	17.6 (18)	14.3 (14.7)
	25.5	25.5	25.5	25.5	25.5	–	–	–	–	–
	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				
	100×10 ⁴					179×10 ⁴				
	Absolute encoder with battery buffered multi-turn									
	2 ¹⁷ (131,072)									
	2 ¹⁶ (65,536)									
	6,553,600	10,485,760	13,107,200	15,728,640	20,971,520	6,553,600	10,485,760	13,107,200	15,728,640	20,971,520
	200 VAC or 48 VDC					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				
	REL-230-36					REL-230-40				
	DEP-090-36		DEP-090-18			N/A				

Unit: mm

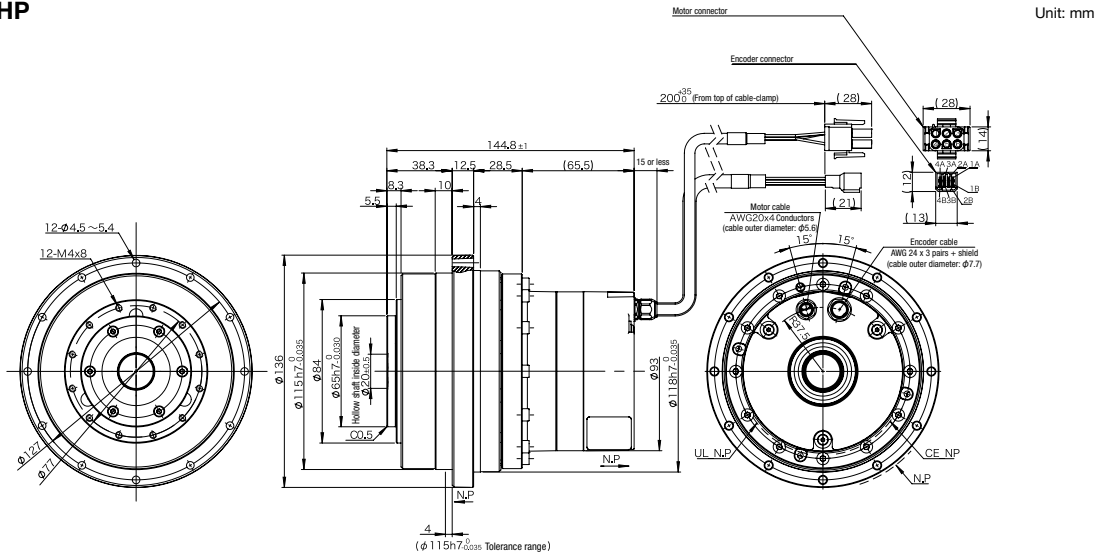


Unit: mm

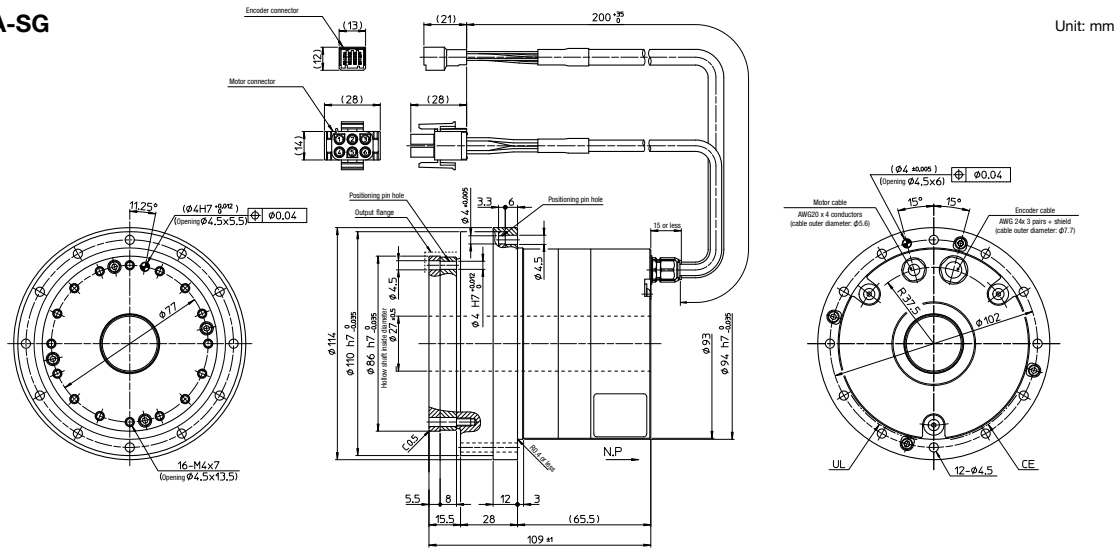


Note: The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

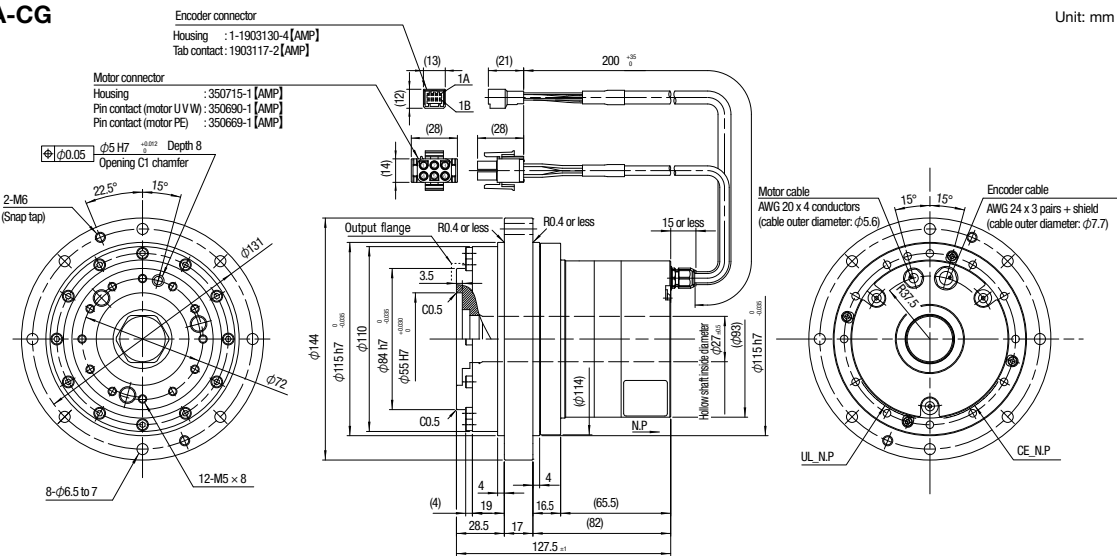
SHA25A-HP



SHA25A-SG



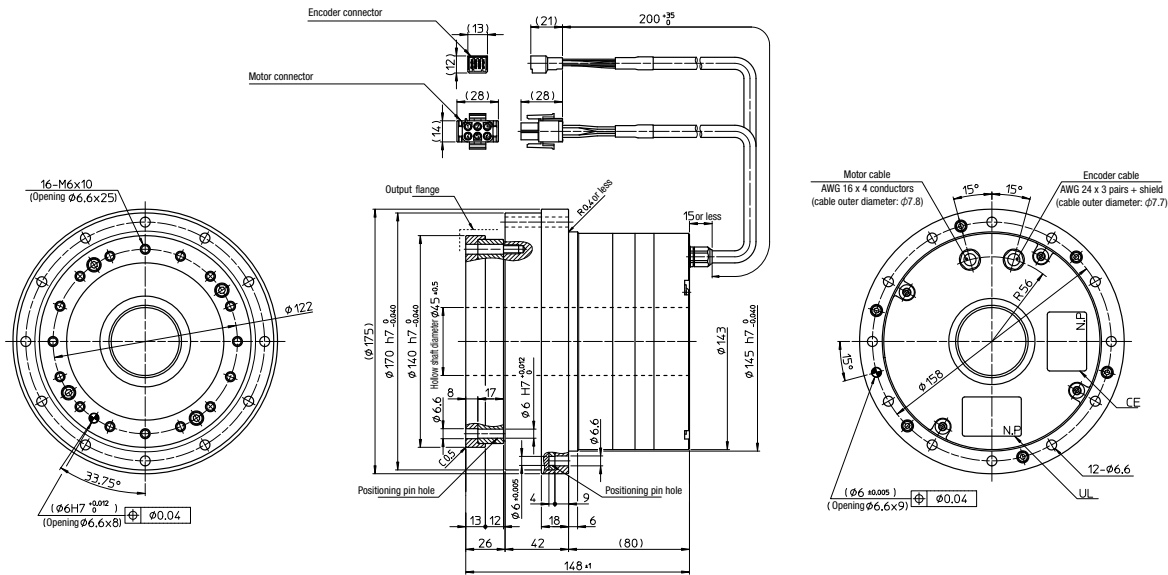
SHA25A-CG



Note: The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

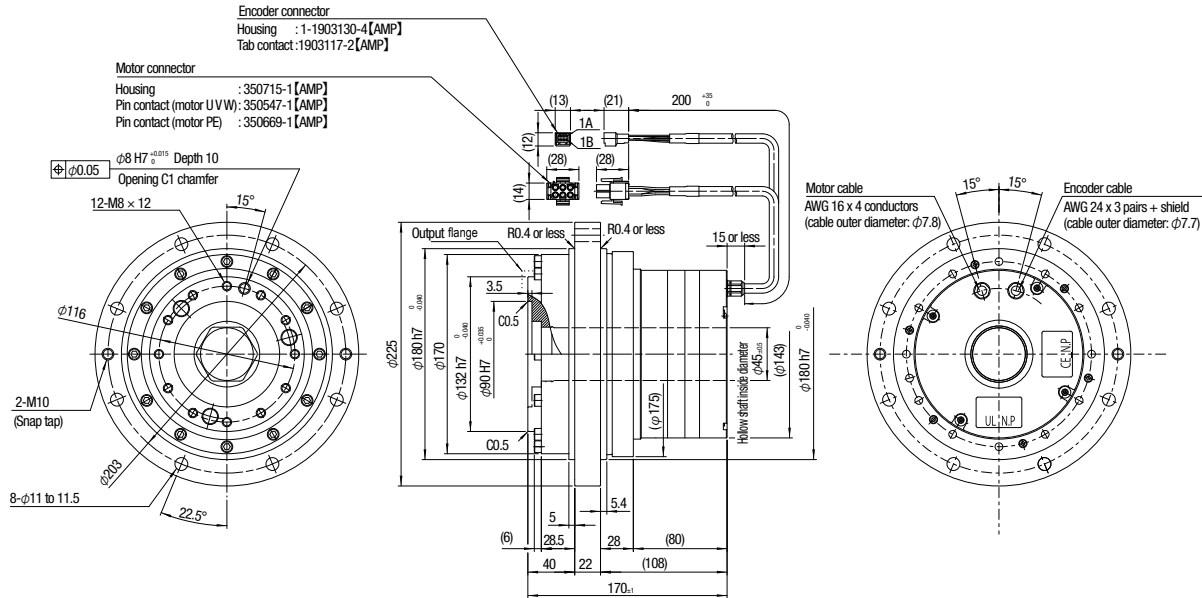
SHA40A-SG

Unit: mm



SHA40A-CG

Unit: mm

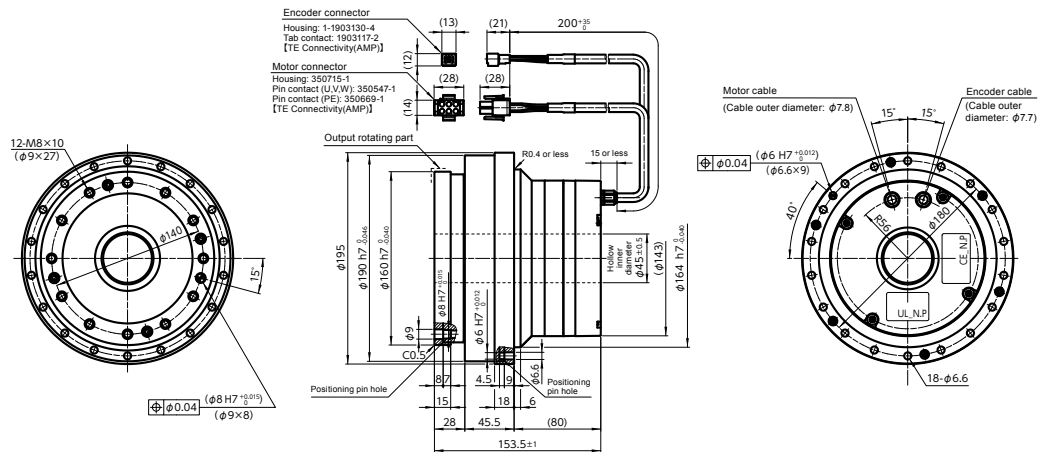


Note: The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

Outline Dimensions

SHA45A-SG

Unit: mm



One-Way Positional Accuracy

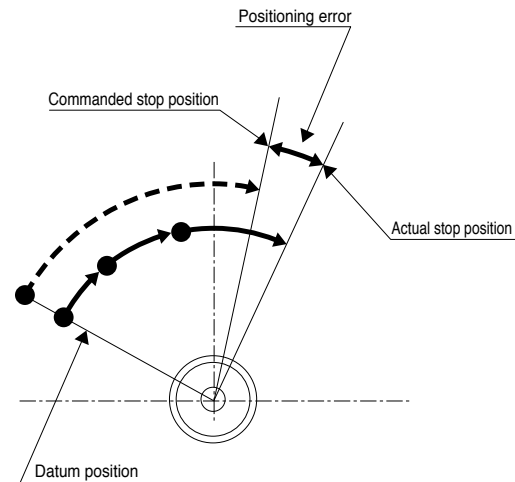
The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The SHA actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.

The one-way positional accuracy for each model is shown in the table below:

(Unit: arc-sec)

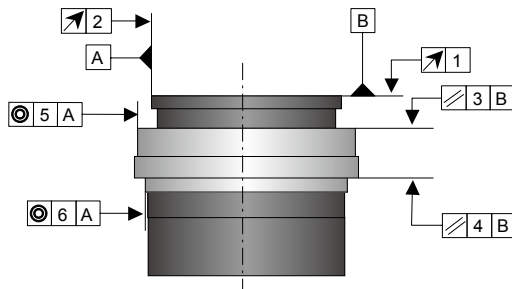
Speed Reducer		Size	SHA20A	SHA25A	SHA32A	SHA40A	SHA45A	SHA58A	SHA65A
Ratio									
HP	11:1	—	120	120	—	—	—	—	—
	51:1	60	50	50	50	50	—	—	—
SG	81:1 or more	50	40	40	40	40	40	40	40
	50:1	60	50	40	40	—	—	—	—
CG	80:1 or more	50	40	30	30	—	—	—	—



Mechanical Accuracy

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

SHA-SG/HP



(Unit: mm)

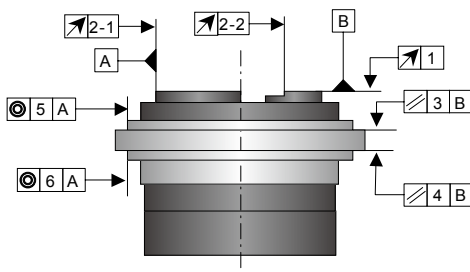
Item	SHA20A	SHA25A	SHA32A	SHA40A	SHA45A	SHA58A	SHA65A
1. Axial runout of output shaft	0.030	0.035	0.040	0.045	0.045	0.050	0.050
2. Radial runout of output shaft	0.030	0.035 (0.020)	0.040 (0.020)	0.045	0.045	0.050	0.050
3. Parallelism between the output shaft and mounting surface	0.030	0.035	0.040	0.045	0.045	0.050	0.050
4. Parallelism between the output shaft and mounting surface	0.055	0.050	0.055	0.060	0.060	0.070	0.070
5. Concentricity between the output shaft and mounting pilot	0.030	0.035	0.040	0.045	0.045	0.050	0.050
6. Concentricity between the output shaft and mounting pilot	0.045	0.060	0.065	0.070	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 for SHA-SG/HP with HP Hollow Shaft Planetary speed reducer.

SHA-CG



(Unit: mm)

Item	SHA20A	SHA25A	SHA32A	SHA40A
1. Axial runout of the output shaft	0.010	0.010	0.010	0.010
2-1. Radial runout of the output shaft (outside pilot)	0.010	0.010	0.010	0.010
2-2. Radial runout of the output shaft (inside pilot)	0.015	0.015	0.015	0.015
3. Parallelism between the output shaft and mounting surface	0.030	0.030	0.035	0.035
4. Parallelism between the output shaft and mounting surface	0.040	0.040	0.045	0.045
5. Concentricity between the output shaft and mounting pilot	0.050	0.050	0.055	0.060
6. Concentricity between the output shaft and mounting pilot	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).

Operating Range

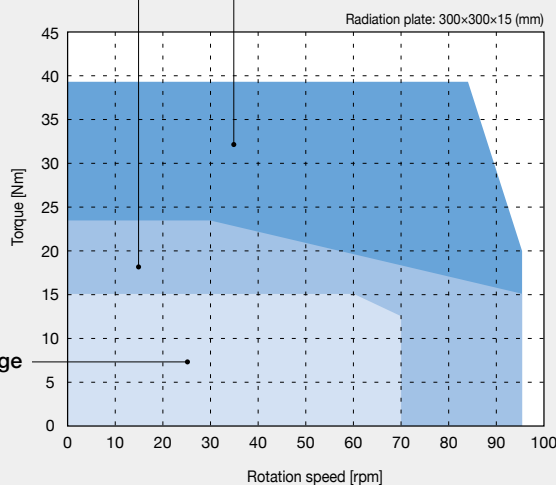
The diagram below shows how to read the operating ranges of the SHA series actuators (combined with HA-800 servo drive).

50% duty motion range

This range indicates the torque/speed where 50% duty cycle operation is permitted (the ratio of operating time and delay time is 50:50).

Continuous motion range

The range allows continuous operation of the actuator.



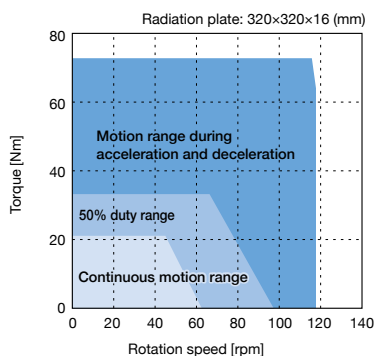
Motion range during acceleration and deceleration

This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.

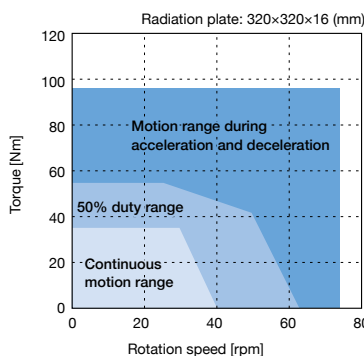
Note 1: The continuous and 50% duty motion ranges shown on each graph are measured when the actuator is mounted to an aluminum heatsink as specified.
Note 2: See the technical information for selection of a model No.

SHA20-SG (combined drive: HA-800□-3D -200)

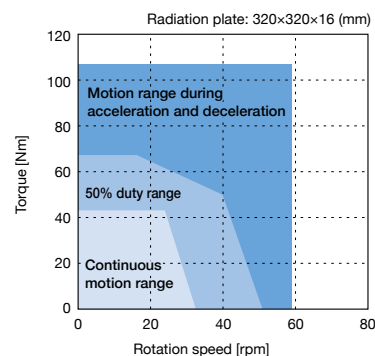
SHA20A51SG Input voltage: 200 V



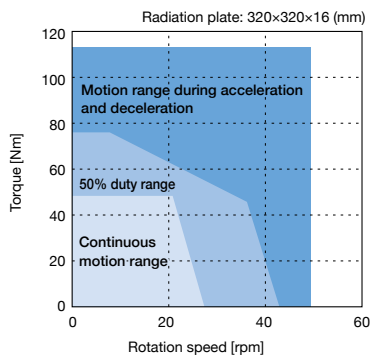
SHA20A81SG Input voltage: 200 V



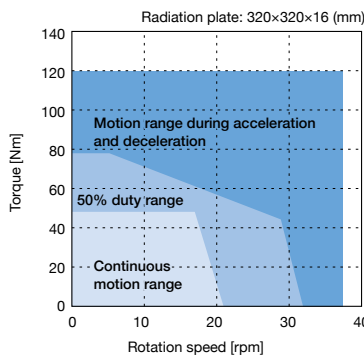
SHA20A101SG Input voltage: 200 V



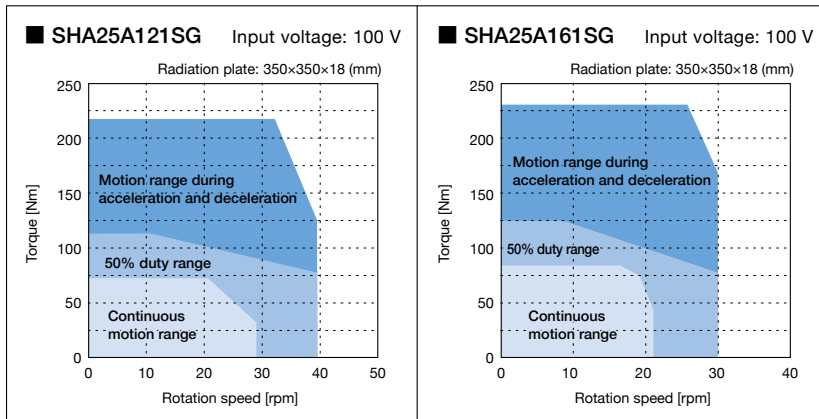
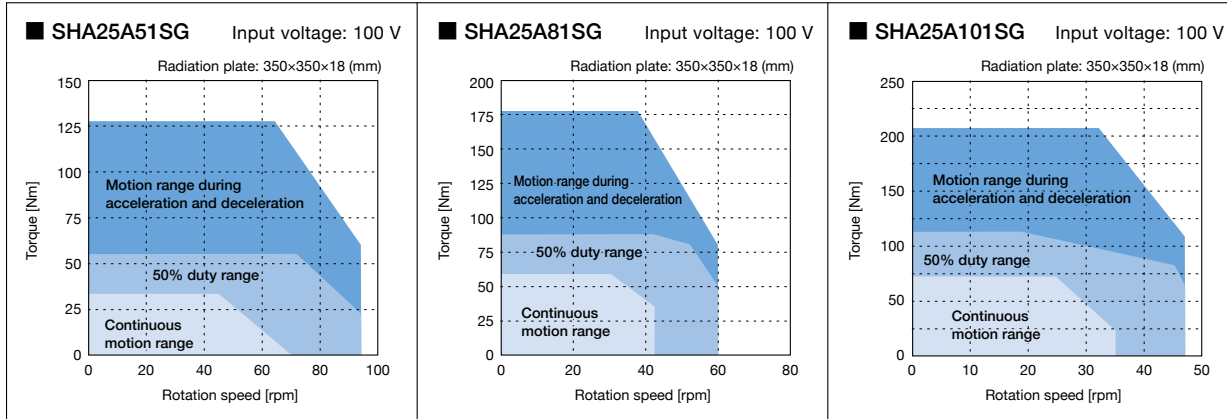
SHA20A121SG Input voltage: 200 V



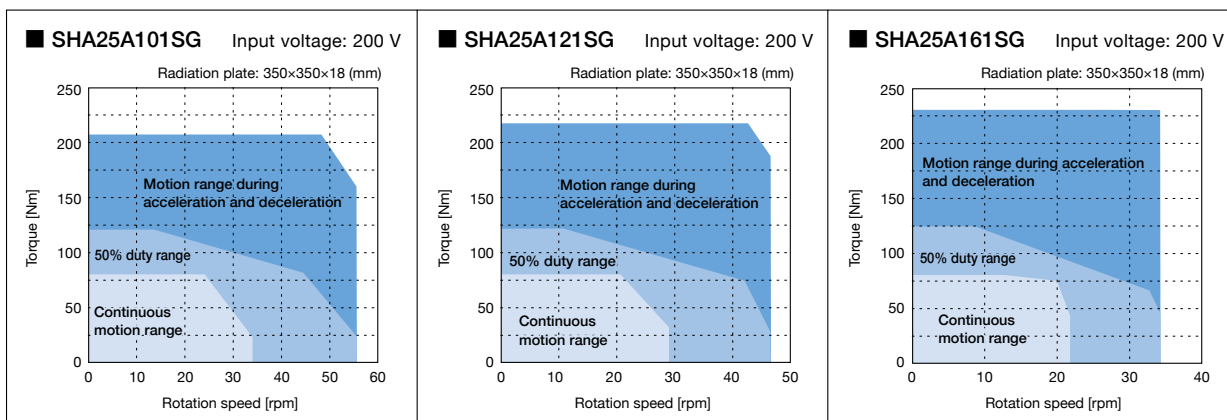
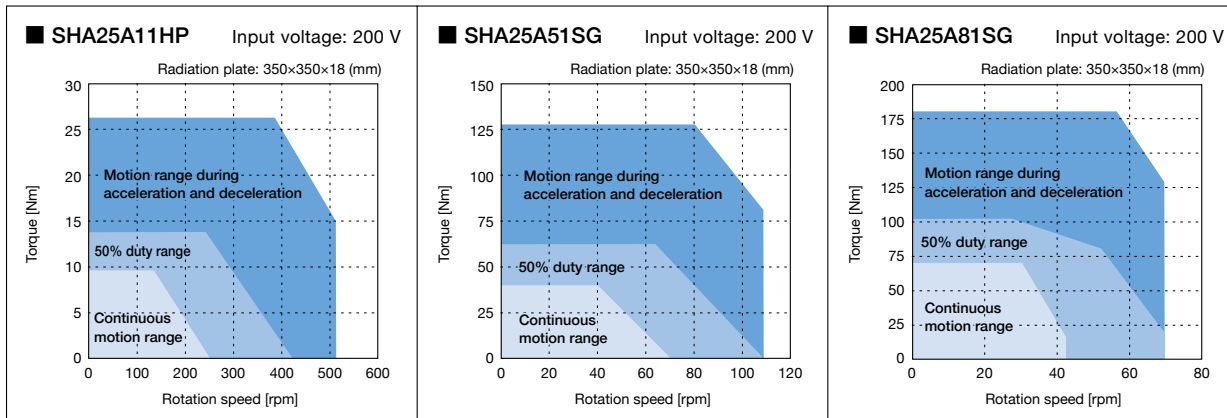
SHA20A161SG Input voltage: 200 V



SHA25-SG (100 VAC model) (combined drive: HA-800-6D -100)

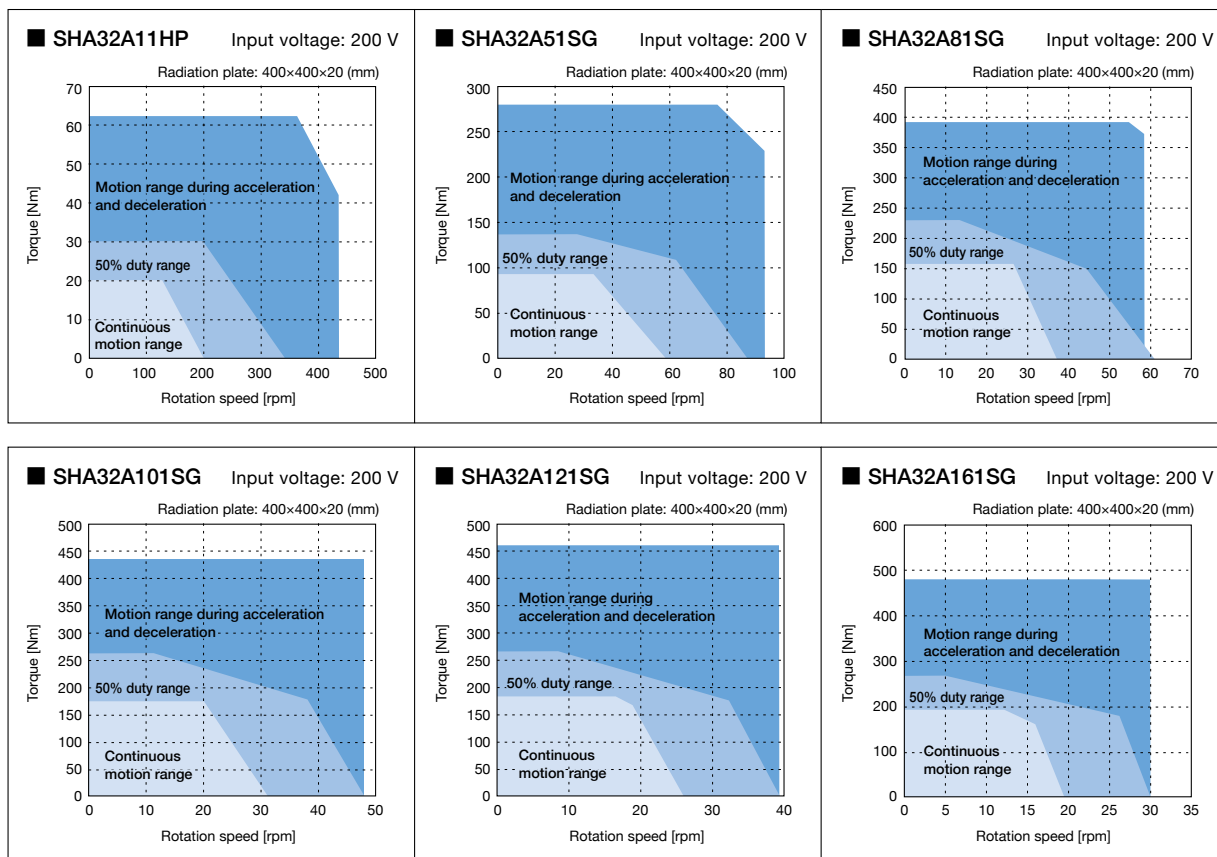


SHA25-SG/HP (200 VAC model) (combined drive: HA-800-3D -200)

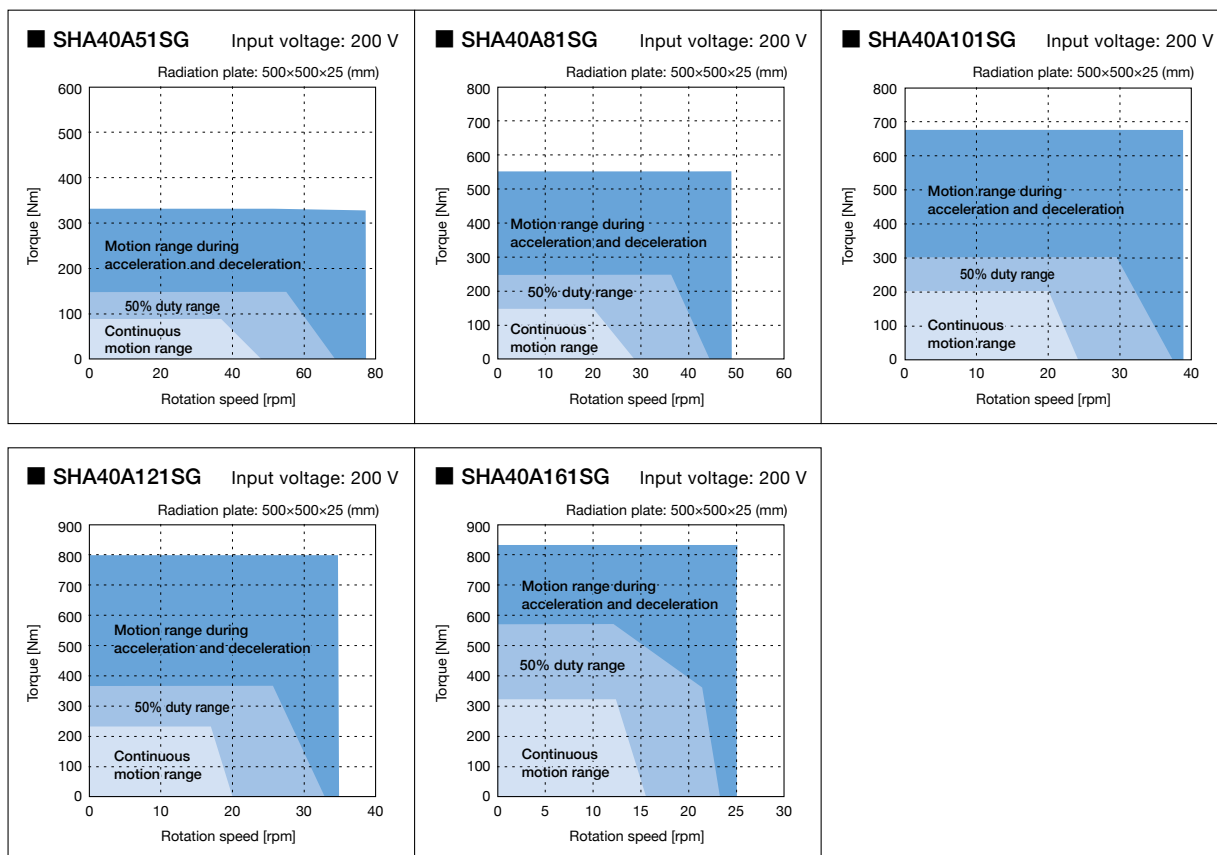


Operating Range

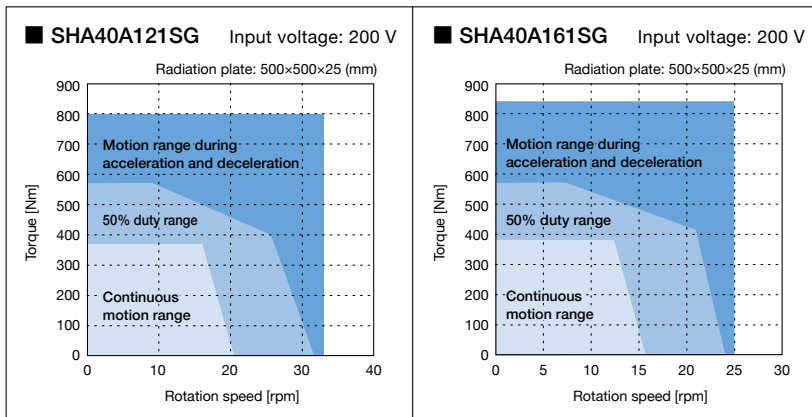
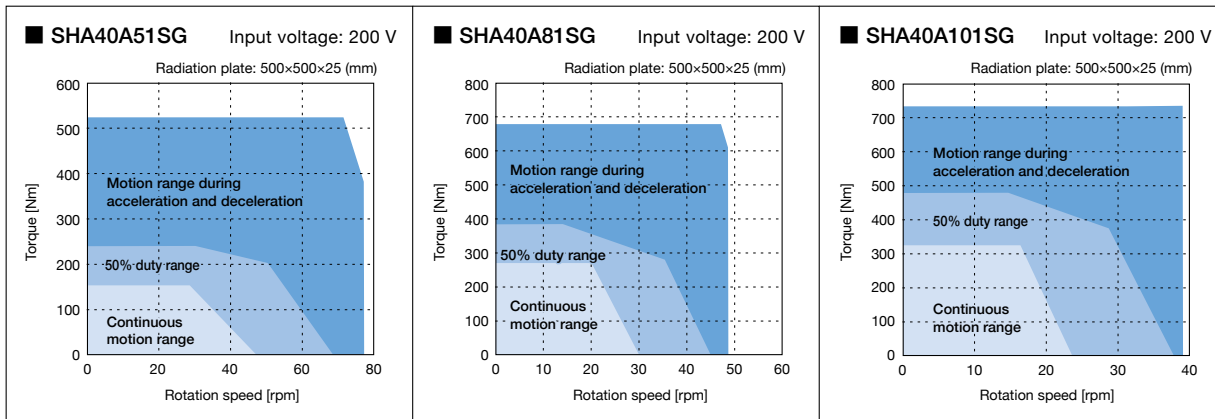
SHA32-SG/HP (combined drive: HA-800□-6D -200)



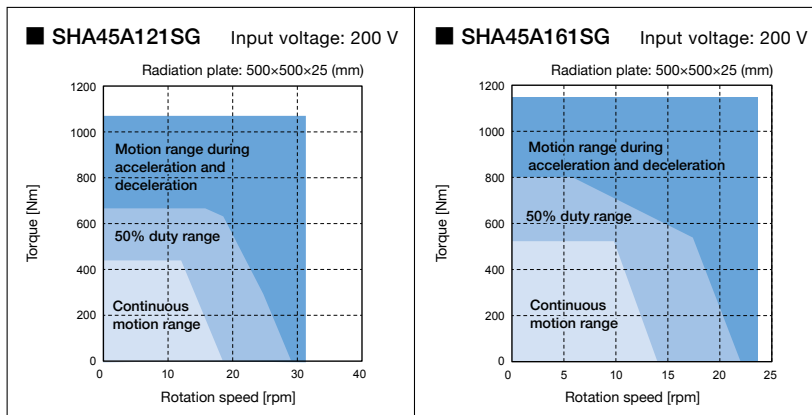
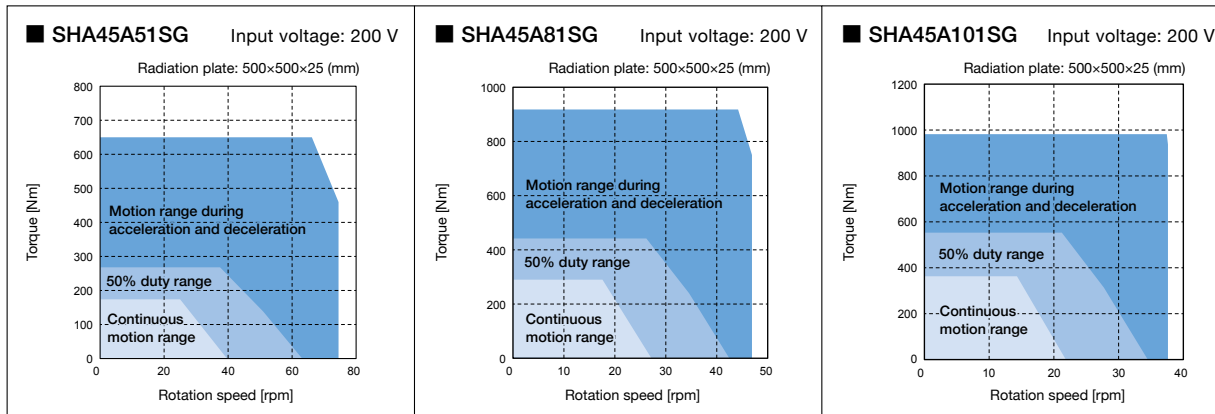
SHA40-SG (combined drive: HA-800□-6D -200)



SHA40-SG (combined drive: HA-800-24D -200)

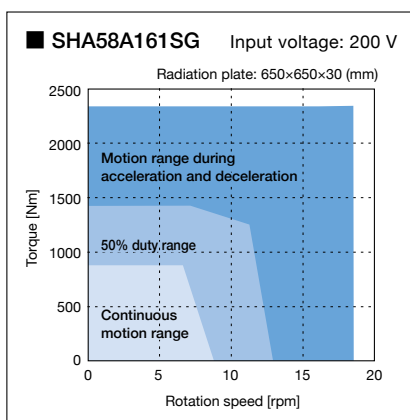
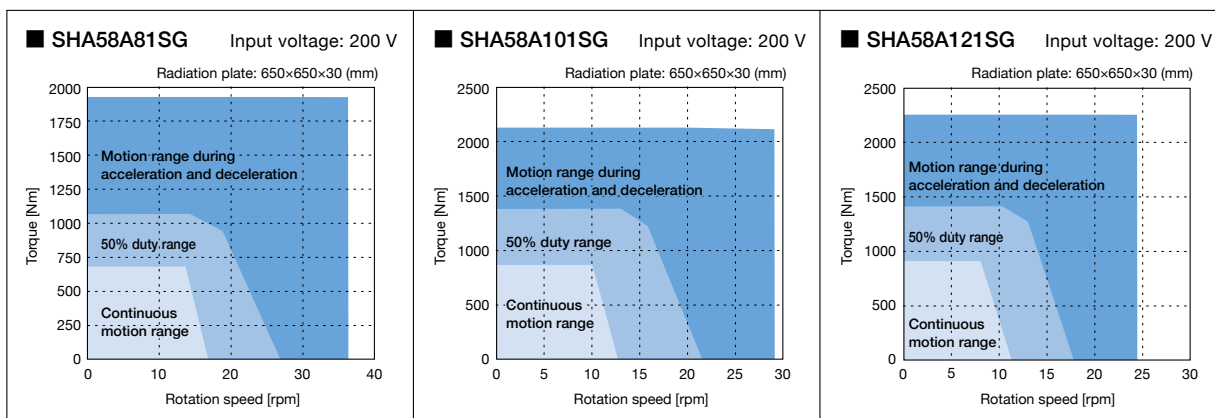


SHA45-SG (combined drive: HA-800-6D -200)

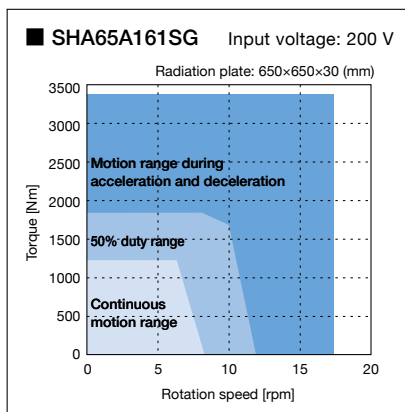
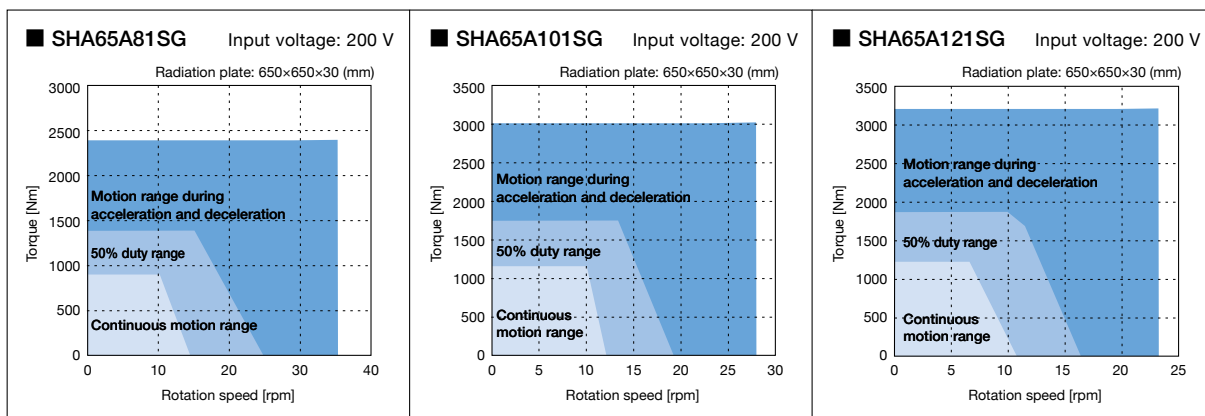


Operating Range

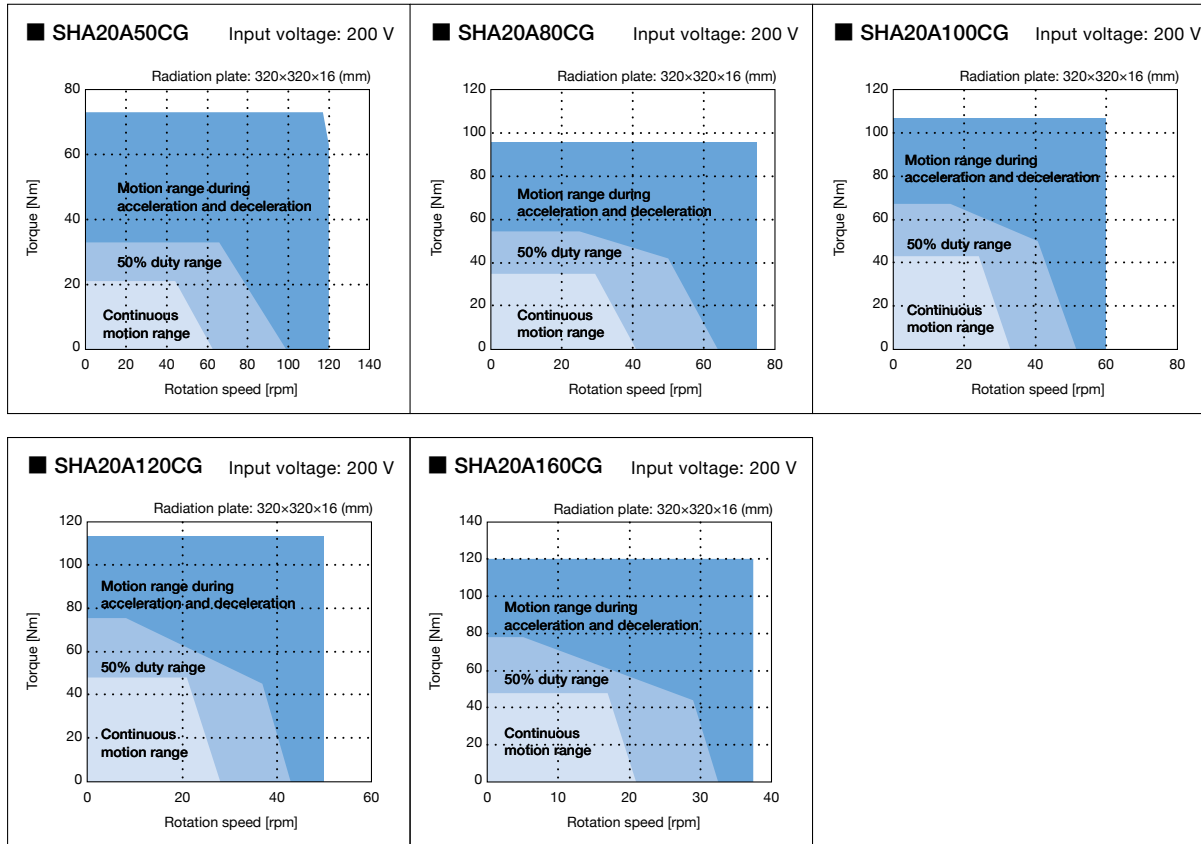
SHA58-SG (combined drive: HA-800-6D -200)



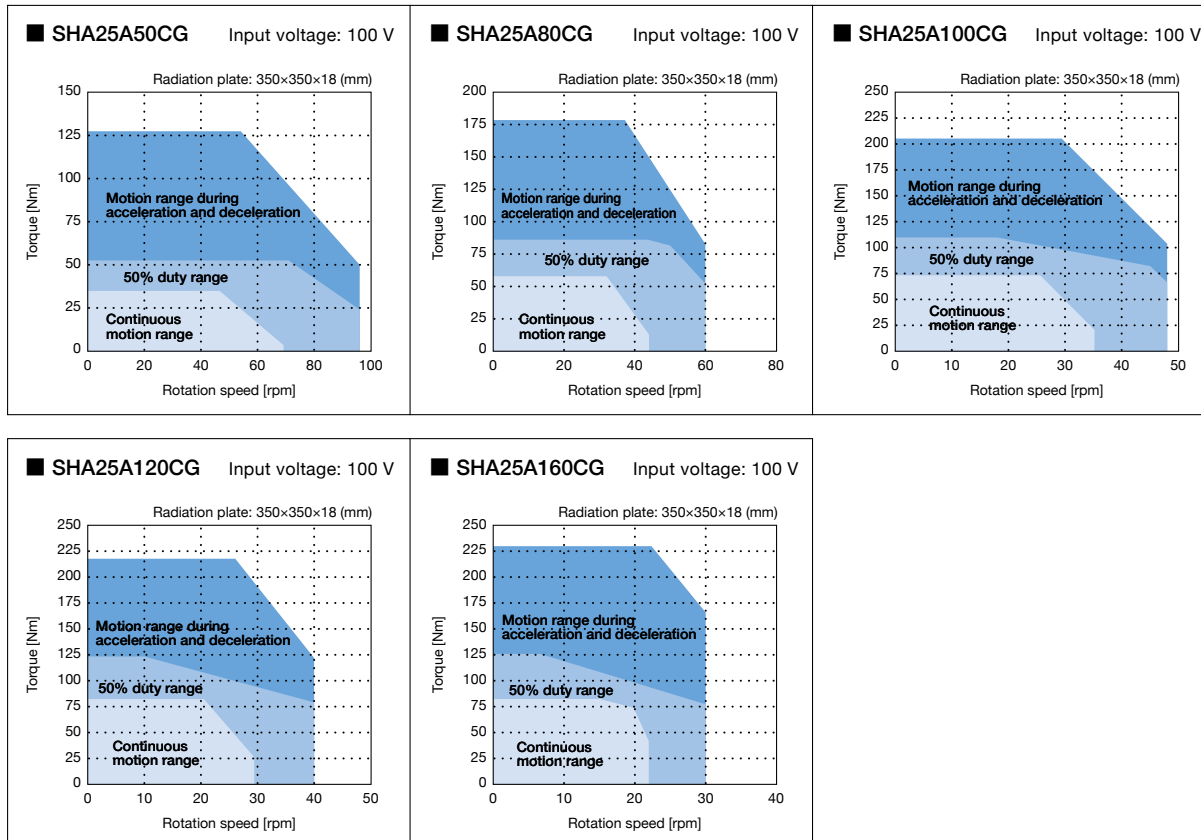
SHA65-SG (combined drive: HA-800-6D -200)



SHA20-CG (combined drive: HA-800-3D/E -200)

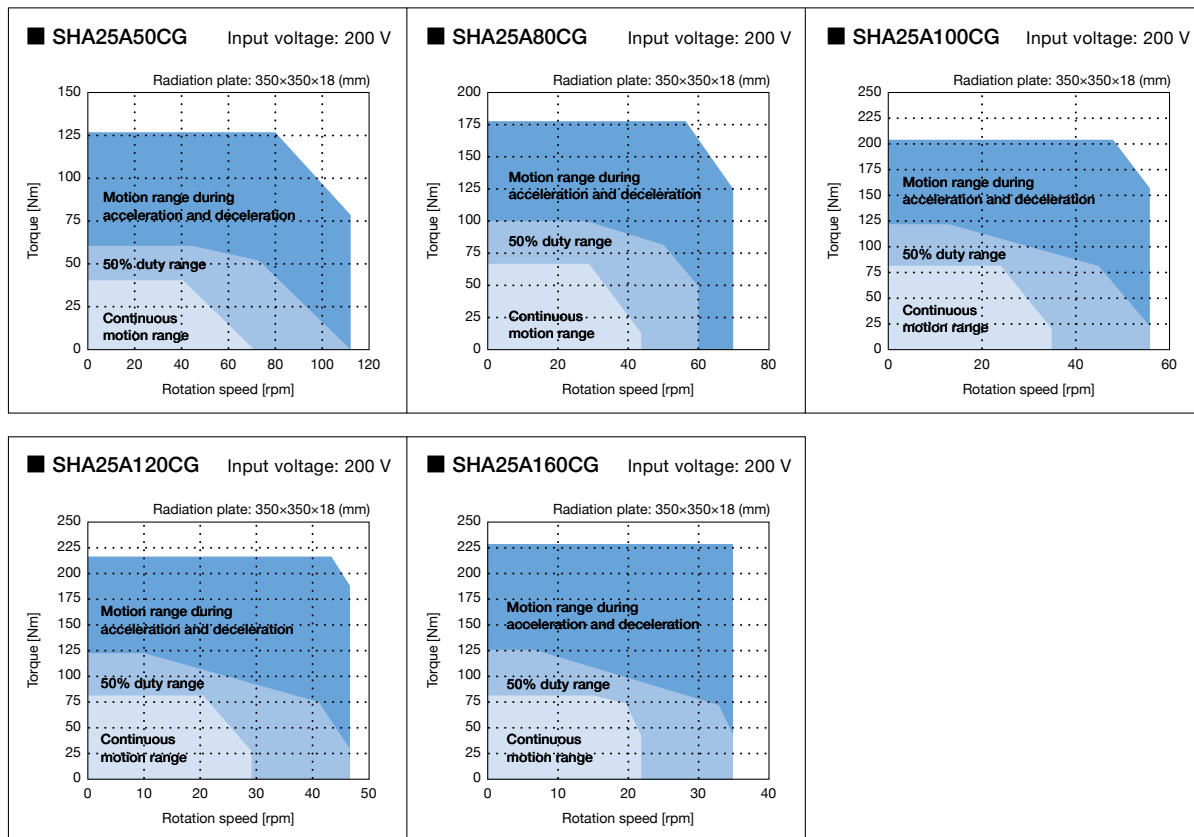


SHA25-CG (100 VAC model) (combined drive: HA-800-6D/ E -100)

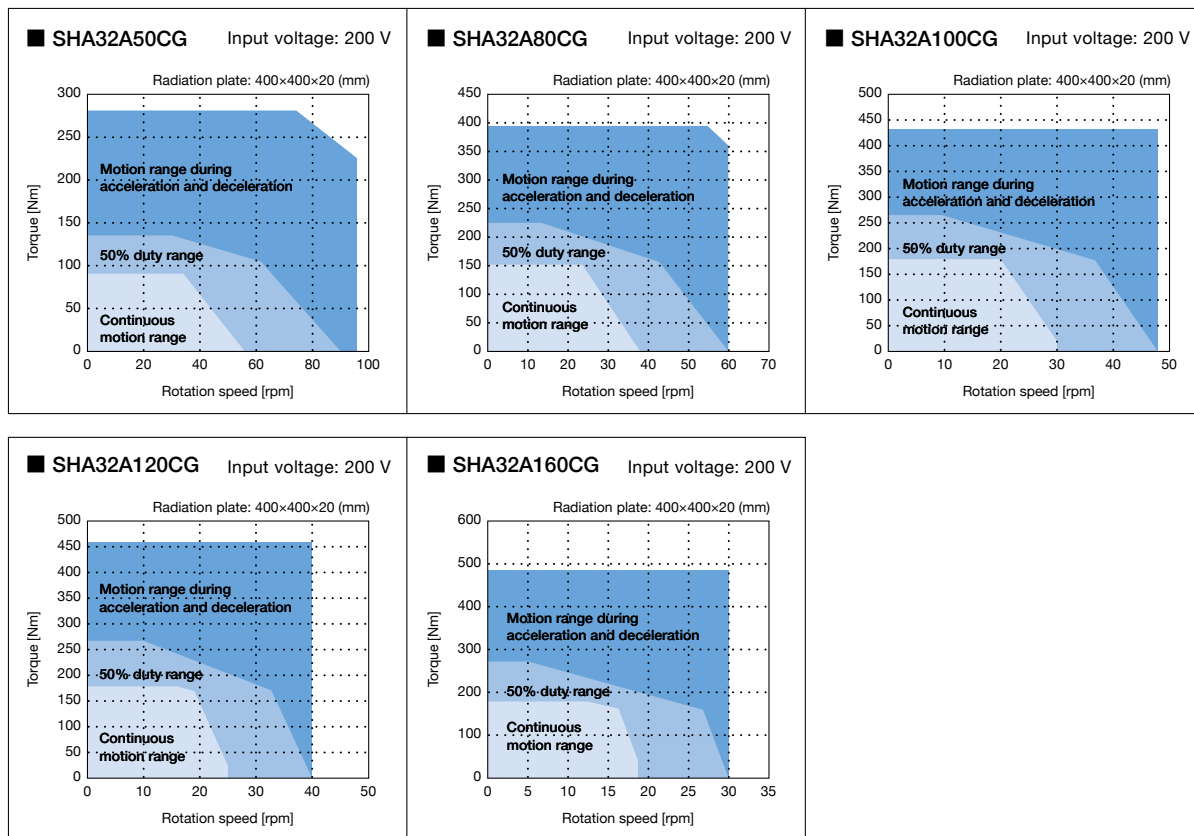


Operating Range

SHA25-CG (200 VAC model) (combined drive: HA-800-3D/ E -200)

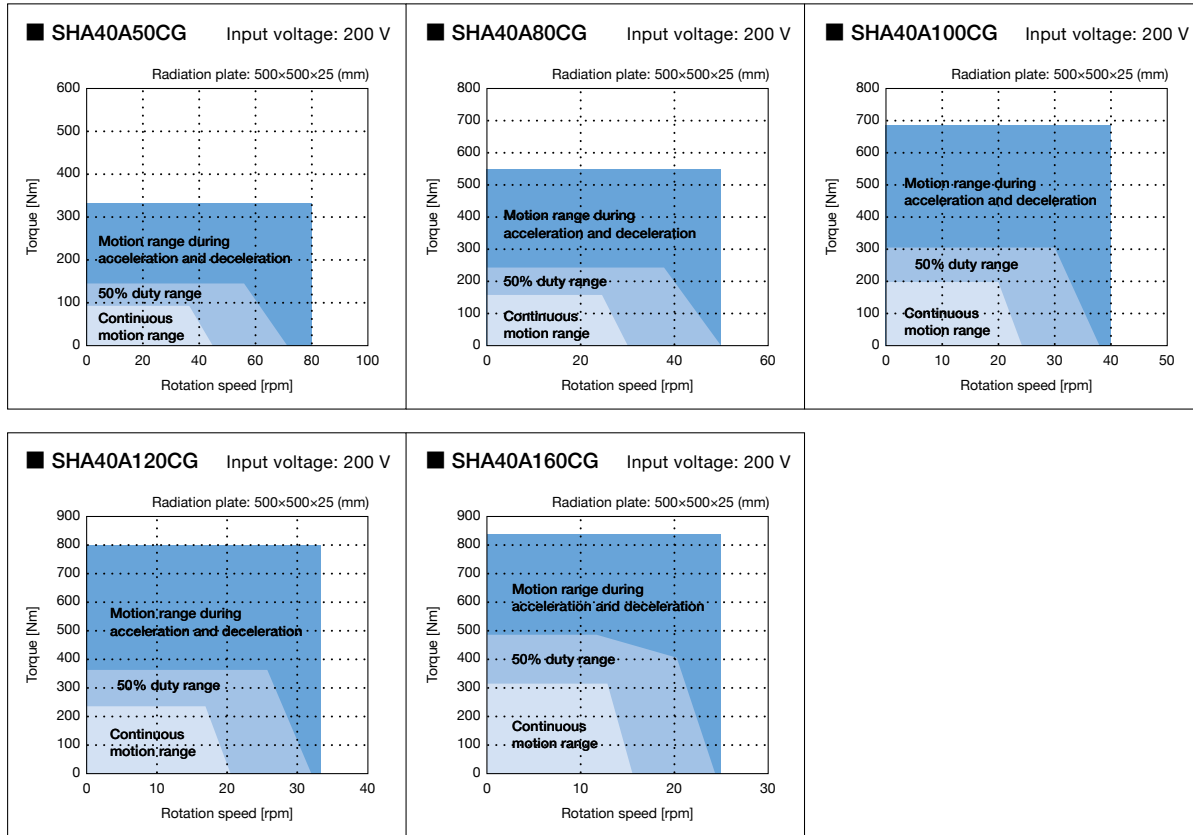


SHA32-CG (combined drive: HA-800-6D/ E -200)

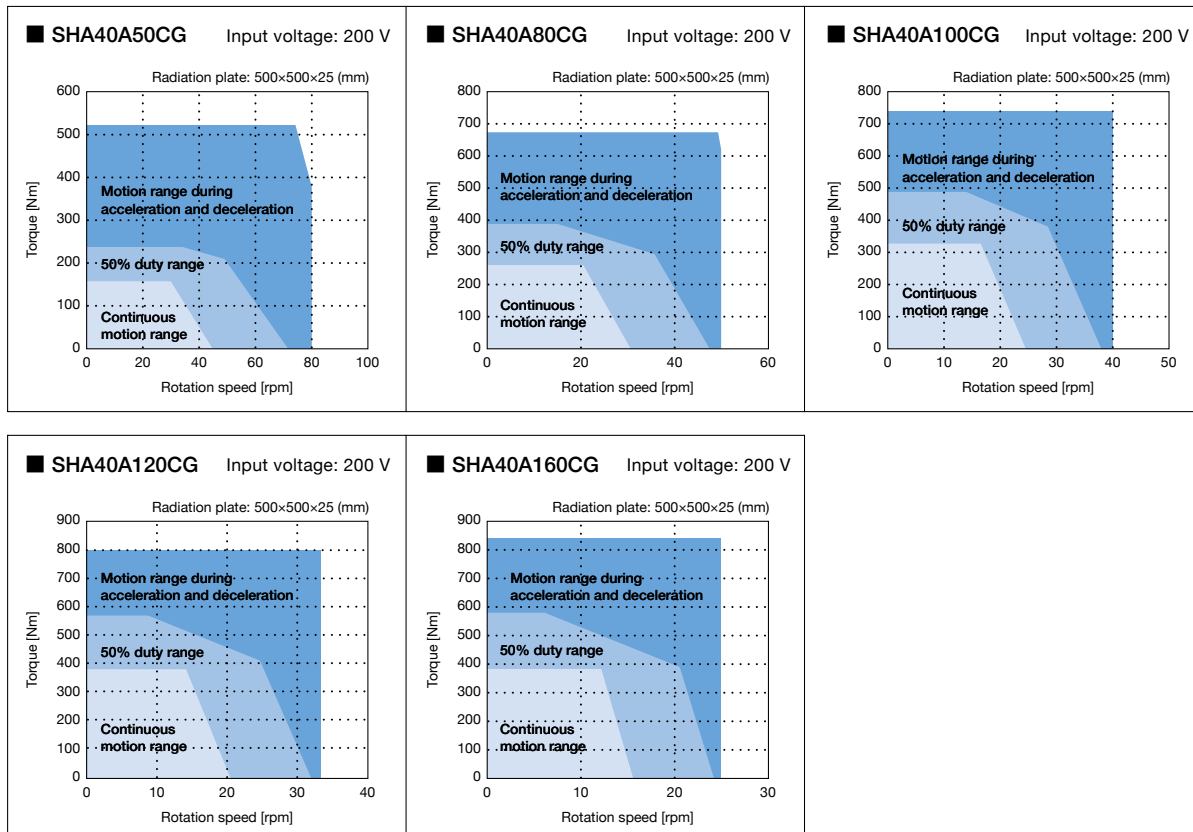


Operating Range

SHA40-CG (combined drive: HA-800□-6D/ E -200)



SHA40-CG (combined drive: HA-800□-24D/ E -200)

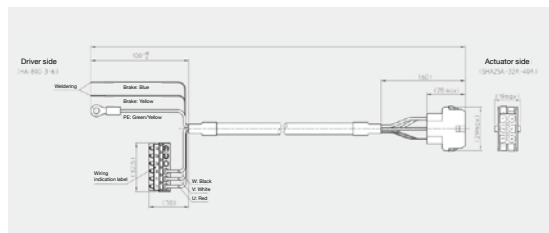


Options

Extension Cable (for motors)

Actuator sizes 20, 25, 32, 40 (Size 40 requires an extension cable when combined with the 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 extension cables; for motor (including brake wire) and for absolute encoder. The extension cable is required for connecting SHA series to HA-800 driver.

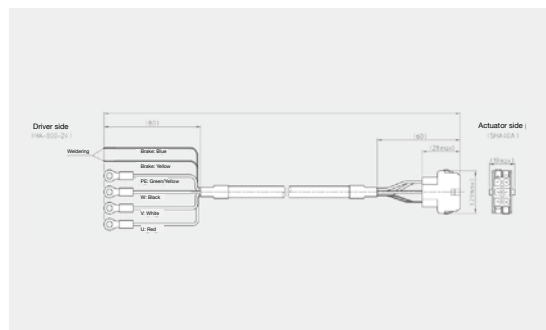
(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m))



Extension Cable (for motors)

Actuator size 40 (when combined with HA-800-24D/E)
Order Code Example: EWD-MB ** -A06-TMC

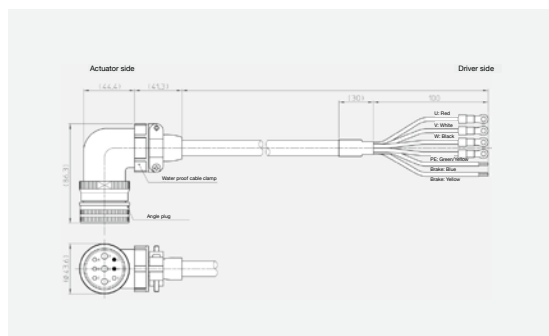
(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m))



Extension Cable (for motors)

Actuator sizes 58, 65 (SG)
Order Code Example: EWD-MB ** -D09-TMC

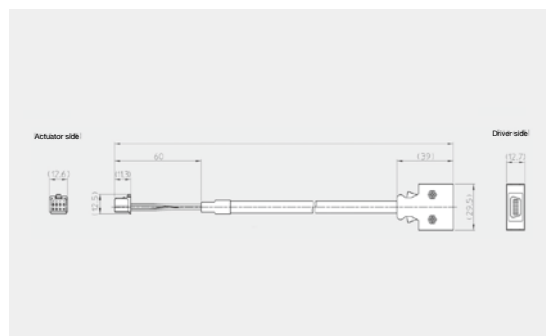
(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m))



Extension Cable (for absolute encoders)

Actuator sizes 20, 25, 32, 40
Order Code Example: EWD-S ** -A08-3M14

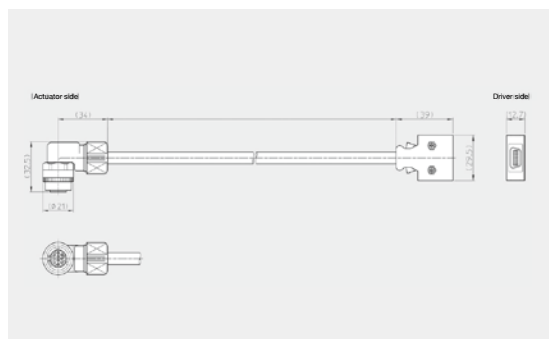
(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m))



Extension Cable (for absolute encoders)

Actuator sizes 58, 65 (SG)
Order Code Example: EWD-S ** -D10-3M14

(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m))



Stand (CG only, option code: V)

Optional mounting stand available. Contact us for details.



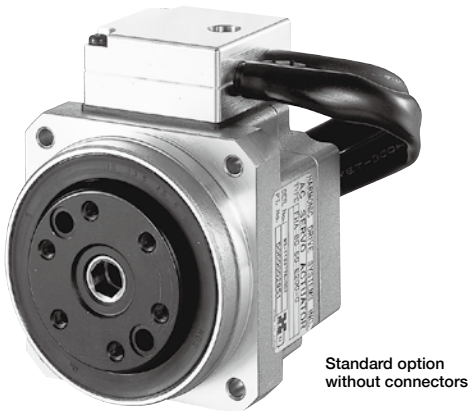
Note

- For detailed dimensions and specifications, please refer to the manual.
- The stand is used for SHA-CG only and the cable exits from the side of the actuator.

Output shaft single revolution absolute model (CG, 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 only.

FHA-C mini Series



Standard option
without connectors

The FHA-C Mini Series is a family of extremely compact Hollow Shaft Actuators that deliver high torque with exceptional accuracy and repeatability. The actuator combines a high-precision Harmonic Drive® gear component with a pancake brushless servo motor. An incremental or multi-turn absolute encoder is integrated to provide high-resolution velocity and position feedback. The large cross roller output bearing allows heavy loads to be mounted directly to the actuator without the need for additional support.

Features

■ Compact

FHA-C Mini actuator combines our thin, zero backlash speed reducer with an ultra-flat AC servo motor for an extremely compact solution. The high performance, compact package offers the design engineer flexibility when designing machines or equipment and keeps the equipment size down.

■ Hollow Shaft

Hollow shaft through the center of the output may be used to pass cables, wires or lasers through the axis of rotation. (note, hollow shaft is only available with incremental encoder)

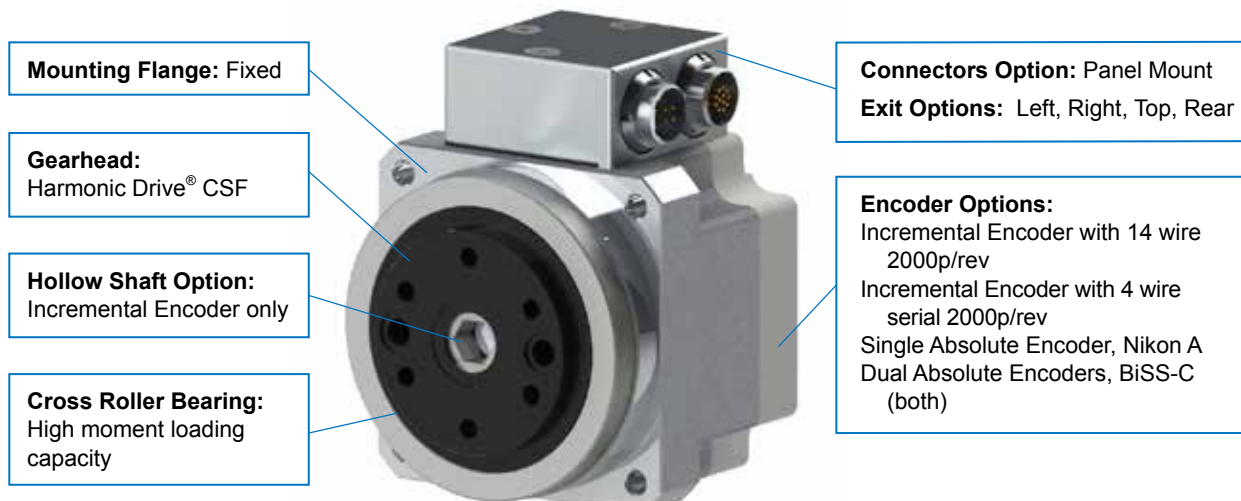
■ Harmonic Drive® CSF Reducer

Integrated CSF speed reducer with zero backlash features high input torque and high torsional stiffness in a very compact shape.

■ High-Positional Accuracy

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

Structure



Ordering Codes

FHA	-	8	C	-	50	US200	-	C	E	K	-	SP
(1)		(2)	(3)		(4)	(5)		(6)	(7)	(8)		(9)

1	Model		FHA-C Mini Series
2	Size		8, 11, 14
3	Design Version		C
4	Gear Ratio		30, 50, 100
5	Encoder Type and Resolution		US200 – Incremental Encoder with 14 wire 2000p/rev E200 – Incremental Encoder with 4 wire serial 2000p/rev
6	Connector (leads only)		Blank – Leads without connector C – Leads with connector for extension cable
7	Power Supply Voltage		Blank - 100V or 200VAC (Standard) E – 24VDC
8	Options	Leads	Blank – Side exit leads, right (of output side) K – Rear exit leads
		Cable	M1 – 1M Length Cable (motor & encoder) KM1 – Rear Exit 1M Length Cable (motor & encoder)
		Panel Mount	- PM1 – Panel Mount Connectors, rear exit - PM2 – Panel Mount Connectors, right exit - PM3 – Panel Mount Connectors, left exit - PM4 – Panel Mount Connectors, top exit NEW!
9	Special Specification		Blank – Standard Product SP ____ – Special Specification Code

FHA	-	8	C	-	50	12S17b	E	-	PM1	-	SP
(1)		(2)	(3)		(4)	(5)	(6)		(7)		(8)

1	Model		FHA-C Mini Series
2	Size		8, 11, 14
3	Design Version		C
4	Gear Ratio		30, 50, 100
5	Encoder Type and Resolution		12S17b - Single Absolute Encoder, Nikon A <i>Single Turn (17 bit) & Multi-Turn (16 bit)</i> SB14bSB14b - Dual Absolute Encoders, BiSS-C, bi-directional <i>Motor Input Encoder (14 bit) & Gear Output Encoder (14 bit)</i> NEW!
6	Power Supply Voltage		A - 100VAC G - 200VAC E – 24VDC
7	Options	Leads*	Blank – Leads without connector C – Leads with connector for extension cable
		Cable*	M1 – 1M Length Cable (motor & encoder)
		Panel Mount	PM1 – Panel Mount Connectors, rear exit PM2 – Panel Mount Connectors, right exit PM3 – Panel Mount Connectors, left exit PM4 – Panel Mount Connectors, top exit NEW!
8	Special Specification		Blank – Standard Product SP ____ – Special Specification Code

* only available with single absolute encoder.

Specifications

Size/Ratio Item			FHA-8C			FHA-11C			FHA-14C			
			30	50	100	30	50	100	30	50	100	
Maximum Torque ^{ⁱ²}		Nm		1.8	3.3	4.8	4.5	8.3	11	9.0	18	28
Max. Rotational Speed		rpm		200	120	60	200	120	60	200	120	60
Torque Constant	100V/200V	Nm/A _{rms}	3.9	6.7	14	3.8	6.6	13	4.2	7.2	15	
	24V	Nm/A _{rms}	0.8	1.3	2.7	0.8	1.3	2.6	0.8	1.4	2.9	
Maximum Current ^{ⁱ²}	100V/200V	A _{rms}	0.61	0.64	0.48	1.5	1.6	1.1	2.9	3.2	2.4	
	24V	A _{rms}	3.0	3.3	2.4	7.8	8.2	5.6	14.8	16.4	12.3	
Moment of Inertia ^{ⁱ³}	INC	GD ² /4	kgm ^²	0.0026	0.0074	0.029	0.0060	0.017	0.067	0.018	0.050	0.20
		J	kgfcm ^{s²}	0.027	0.075	0.30	0.061	0.17	0.68	0.18	0.51	2.0
	ABS	GD ² /4	kgm ^²	0.0026	0.0073	0.029	0.0062	0.017	0.069	0.019	0.054	0.215
		J	kgfcm ^{s²}	0.027	0.0747	0.298	0.063	0.176	0.705	0.197	0.547	2.189
	Dual ABS		kgm ^²	0.0036	0.0100	0.0399	0.007	0.019	0.077	0.019	0.052	0.206
Allowable Moment Load		Nm		15			40			75		
Moment Stiffness		Nm/rad		2×10 ⁴			4×10 ⁴			8×10 ⁴		
Encoder resolution of output shaft ^{ⁱ⁴}	INC	counts/revolution		240,000	400,000	800,000	240,000	400,000	800,000	240,000	400,000	800,000
	ABS			3,932,160	6,553,600	13,107,200	3,932,160	6,553,600	13,107,200	3,932,160	6,553,600	13,107,200
	Dual ABS Motor			491,520	819,200	1,638,400	491,520	819,200	1,638,400	491,520	819,200	1,638,400
	Dual ABS Output			16,384	16,384	16,384	16,384	16,384	16,384	16,384	16,384	16,384
Power Supply Voltage		V		24VDC or 100VAC or 200VAC								
Mass	INC	kg	0.40			0.62			1.2			
	ABS		0.50			0.75			1.3			
	Dual ABS	kg	0.40			0.62			1.2			
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									
Compatible Drives	Incremental (14 wire)	24VDC	DCJ-055-09, DDP-090-09, DEP-090-09				DCJ-055-18, DDP-090-18, DEP-090-18				DDP-090-36, DEP-090-36	
			HA-680-4-24						HA-680-6-24			
		100V/200VAC	RTL-230-18, REL-230-18									
			HA-800-1									
	Incremental (4 wire serial)	24VDC	DEP-090-09				DEP-090-18				DEP-090-36	
		100V/200VAC	REL-230-18									
	Single ABS	24VDC	DEP-090-09				DEP-090-18				DEP-090-36	
		100V/200VAC	REL-230-18									
Dual ABS	24VDC	BEL or BPL-06				BEL or BPL-14				BEL or BPL-30		

INC indicates incremental encoder, ABS indicates absolute encoder, and Dual ABS indicates dual absolute encoders.

* 1: The figures in the table are those at the output shaft.

* 2: Values in combination with HA-800, HA-680, or HA-690 servo drive.

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

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

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

Rotary Actuator

Linear Actuator

Direct Drive Motor

Servo Drives

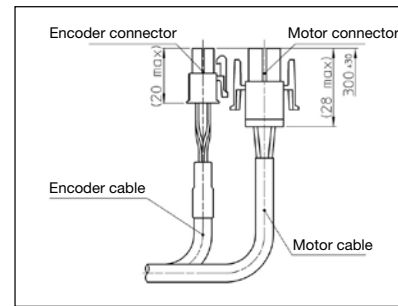
Servo Drives

Servo Drives

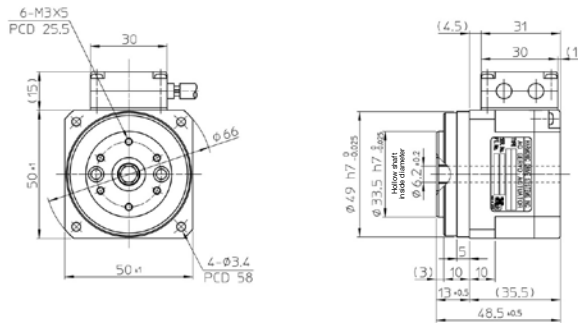
Outline Dimensions (Incremental Encoder)

Motor Encoder Cable
(Same for all models)

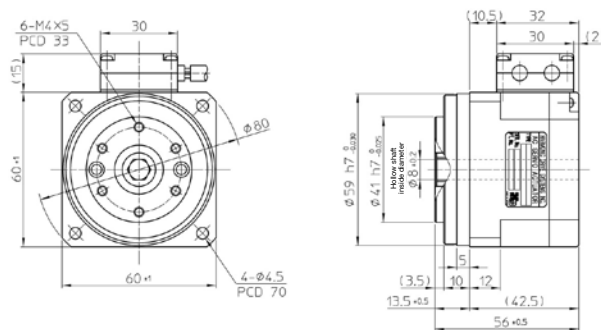
Unit: mm



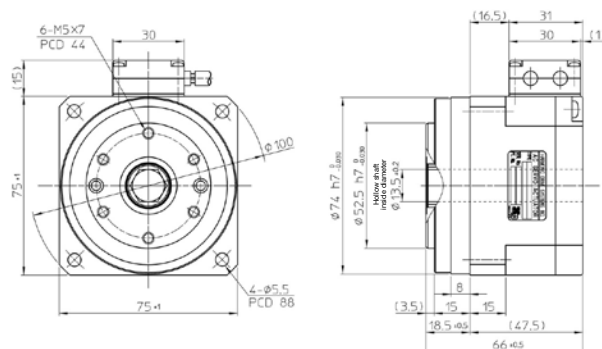
FHA-8C



FHA-11C



FHA-14C



*Note: The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

46

Outline Dimensions (Dual Absolute, Panel Mount Connectors)

Rotary Actuator

Linear Actuator

Direct Drive Motor

Servo Drives

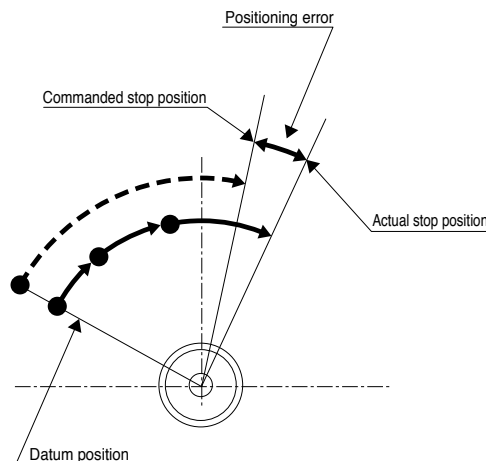
Servo Drives

Servo Drives

One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The FHA mini actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.



One-Way Positional Accuracy

Item \ Size		FHA-8C			FHA-11C			FHA-14C		
		30	50	100	30	50	100	30	50	100
One Way 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 provides an angle offset function to improve angular positioning accuracy of a horizontally installed actuator. The function offsets against a position error by a pre-analyzed positioning error of the Harmonic Drive® components to improve a one-way positioning accuracy by around 30% better than an accuracy without the angle offset function. For fluctuant load, test and examine whether the function is effective before applying it.

Mechanical Accuracy

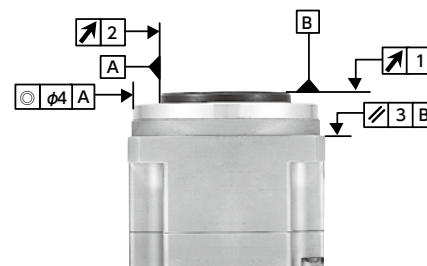
The mechanical accuracies of the output shaft and mounting flange of the actuators in the FHA-C mini series are as follows.

Mechanical Accuracy

Unit mm

Accuracy Item	FHA-8C	FHA-11C	FHA-14C
1 Axial runout of the output shaft	0.010		
2 Radial runout of the output shaft	0.010		
3 Parallelism between the output shaft and mounting surface	0.040		
4 Concentricity between the output shaft and mounting pilot	0.040		

* The aforementioned values are T.I.R (total indicator reading) values.
* See the technical information for the measuring method.



Operating Range

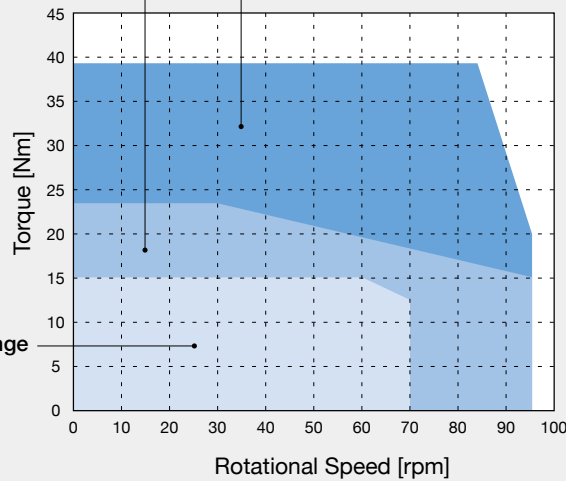
This graph plots operating ranges for the FHA-C mini series when combined with an HA-800 servo drive (input power voltage 100VAC or 200VAC) or an HA-680 servo drive (input power voltage 24VDC).

■ 50% duty motion range

This range indicates the torque/speed where 50% duty cycle operation is permitted (the ratio of operating time and delay time is 50:50).

■ Continuous motion range

The range allows continuous operation of the actuator.

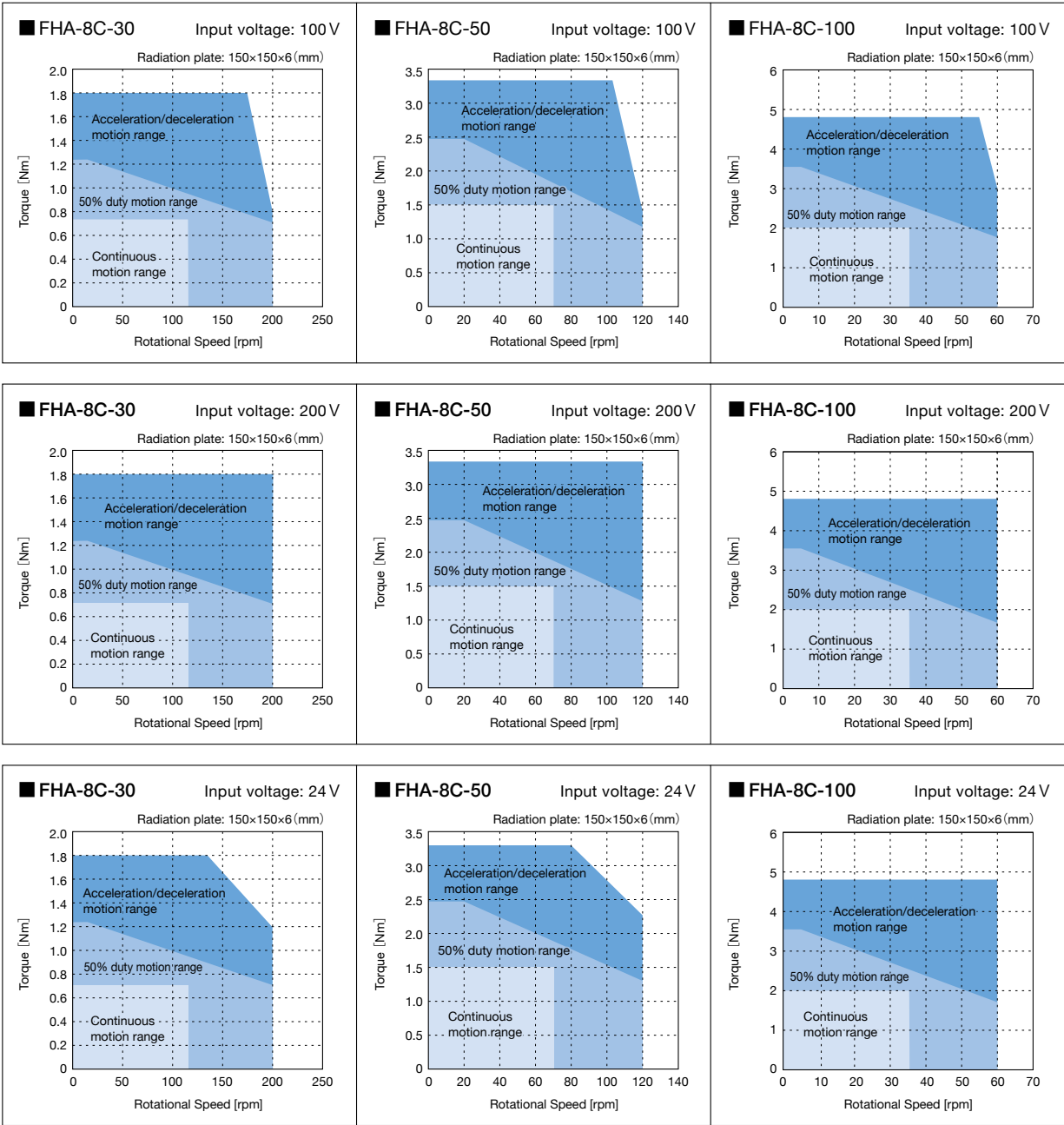


■ Motion range during acceleration and deceleration

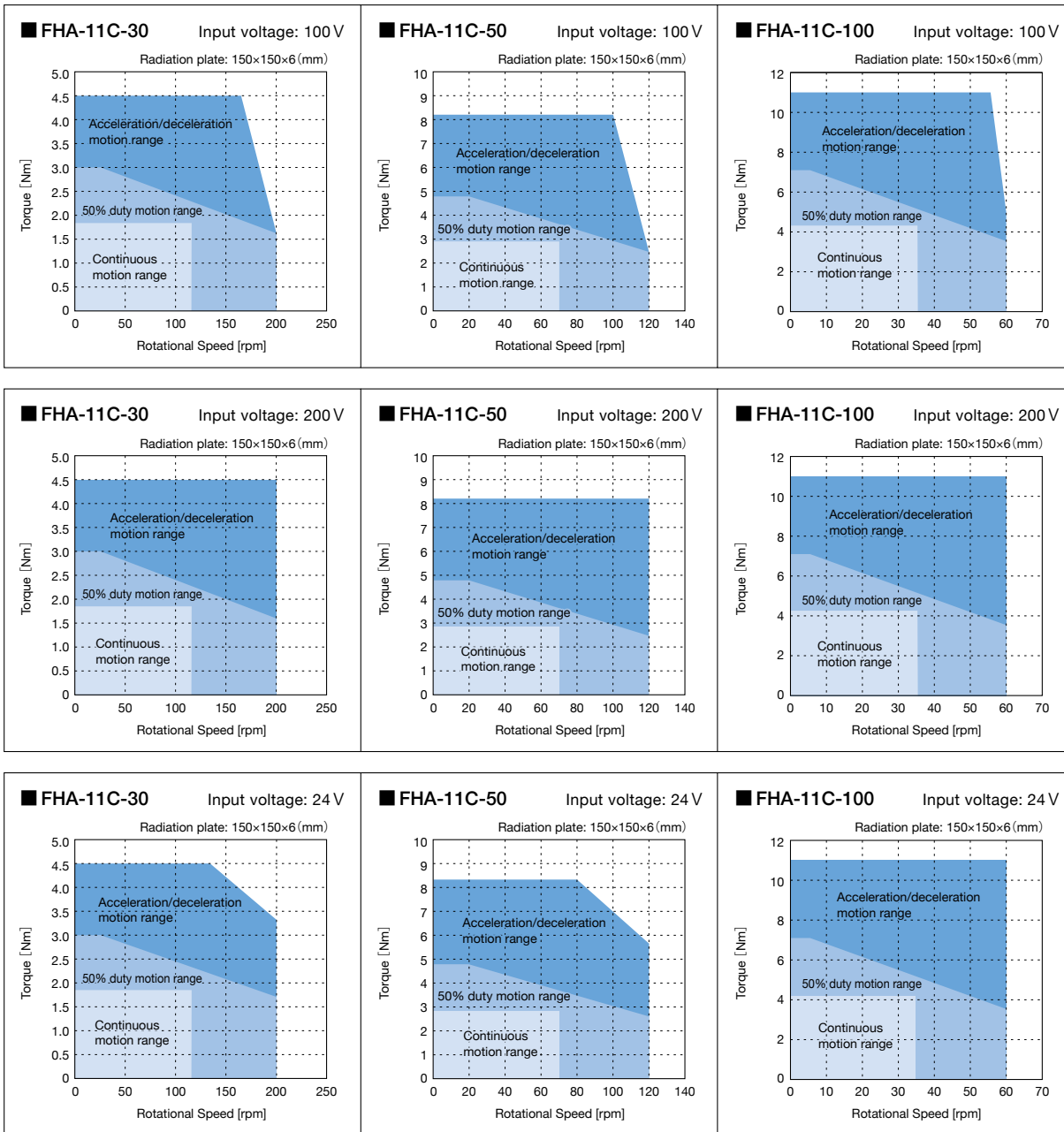
This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.

Note 1: The continuous and 50% duty motion ranges shown on each graph are measured when the actuator is mounted to an aluminum heatsink as specified.
 Note 2: See the technical information for selection of a model No.

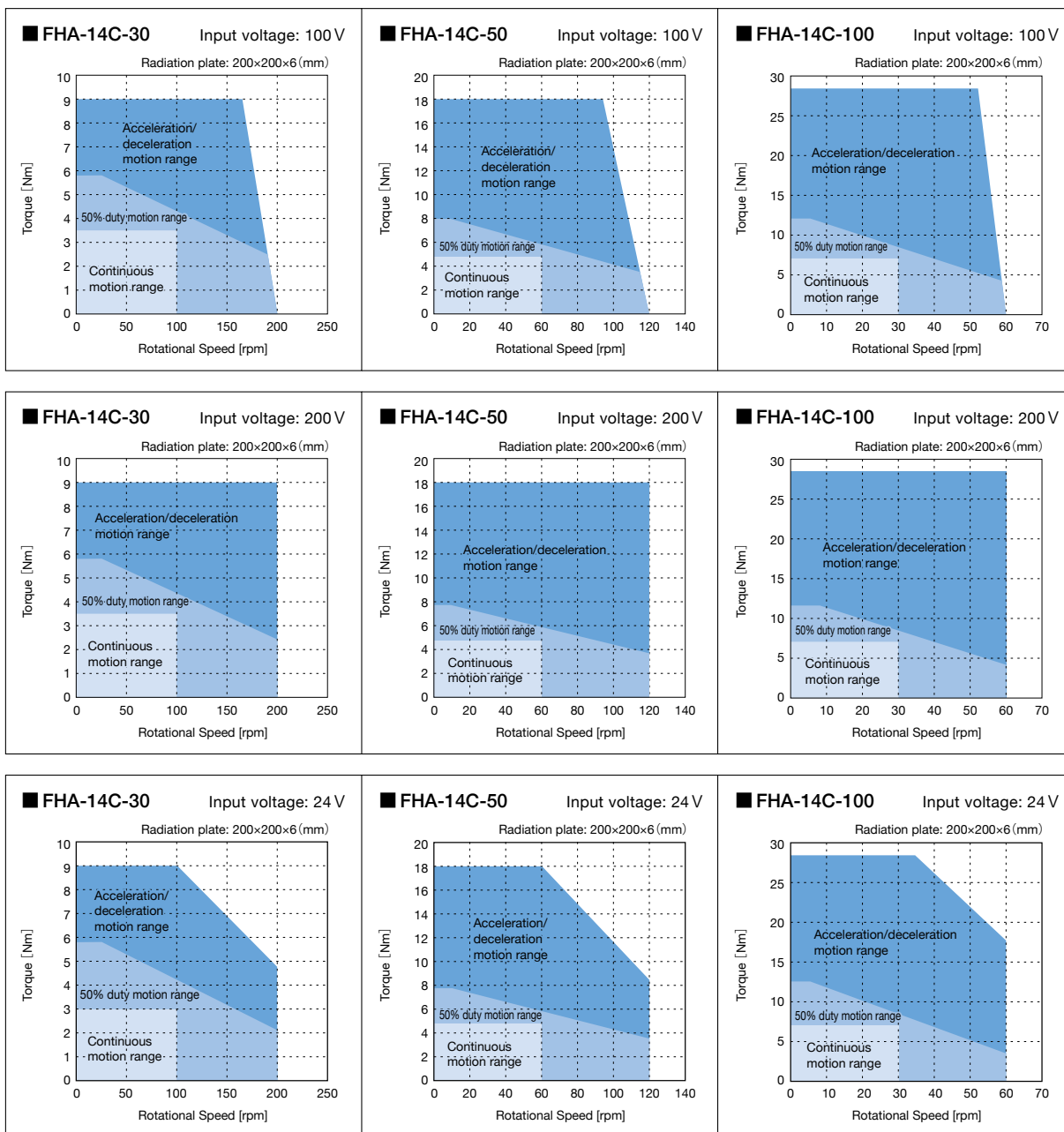
Operating Range



Operating Range



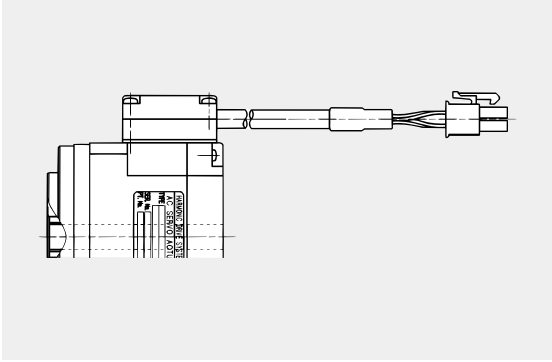
Operating Range



Options

Rear Exiting Cable

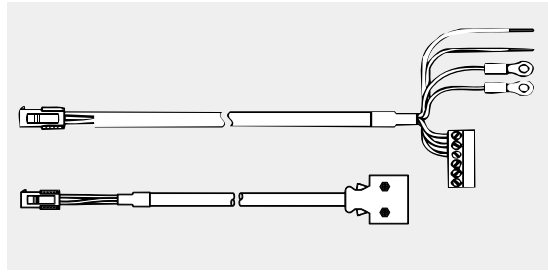
Order Code Example:
FHA-11C-50-E200-CK
Option for rear exiting cable.



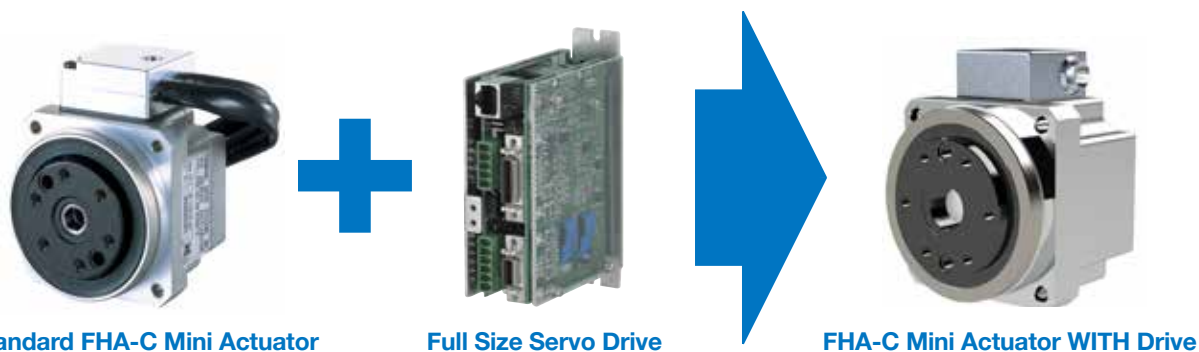
Extension Cable

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



FHA-C Mini Actuator with Integrated Servo Drive



This evolutionary product eliminates the need for an external drive and greatly improves wiring while retaining high-positional accuracy and torsional stiffness in a compact housing.

It communicates via CANopen, and only requires 4 wires: CANH, CANL, +24VDC, 0VDC. A single-turn 14bit (16384 cpr) gear output sensing encoder has been integrated along with a single-turn 15bit (32768 cpr) motor input sensing encoder providing a true absolute encoder that does not require a battery within 360° of rotation of the output.

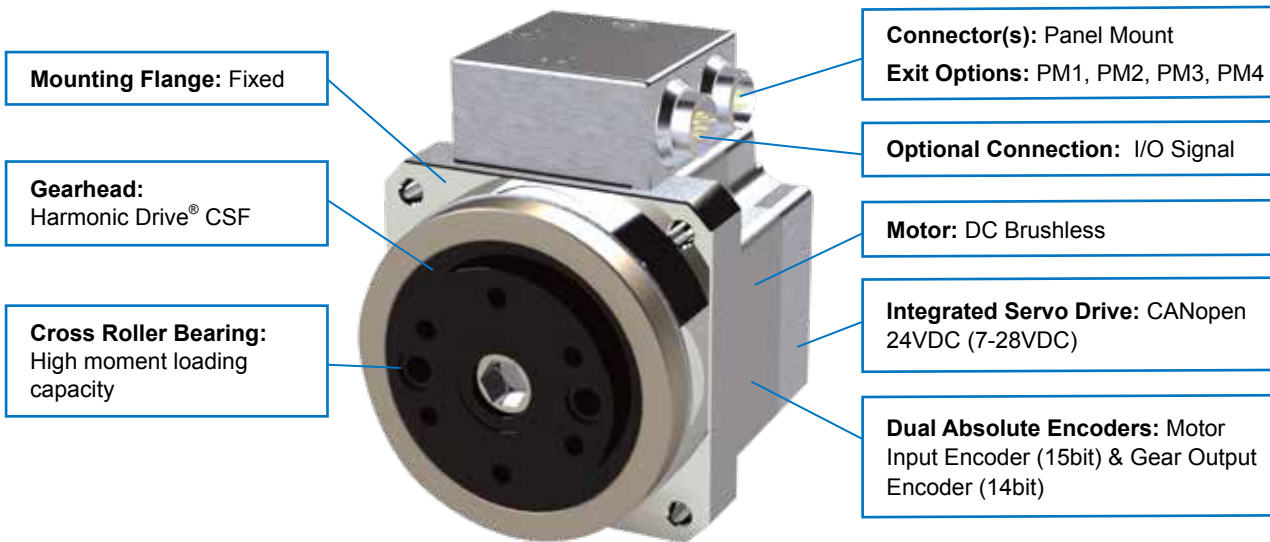
Features

- Actuator + **Integrated Servo Drive** utilizing CANopen communication
- 24VDC Nominal +7-28VDC Supply Voltage Range
- **Single Cable** with only 4 wires needed: CANH, CANL, +24VDC, 0VDC
- Zero Backlash
- **Dual Absolute** Encoders
- **Panel Mount** Connectors with 4 exit options
- Output Sensing Encoder 14bit (16384 cpr) resolution
- Input Sensing Encoder 15bit (32768 cpr) resolution
- **Control Modes** Including Torque, Velocity, and Position Control, CSP, CSV, CST
- Harmonic Drive HDL Software

Options:

- Flex-rated cables with sealed connectors
- 4 I/O
 - 2 NPN or 2 PNP Opto-Isolated Digital Inputs
 - 2 Programmable Analog/Digital Inputs or Open Drain Outputs

FHA-C Mini with Integrated Drive Servo Drive Features



Ordering Code (with Integrated Drive)

FHA - 8 C - 50 - IDT15b14b E - PM1 S - SP

(1) (2) (3) (4) (5) (6) (7) (8) (9)

1	Model		FHA-C Mini Series
2	Size		8, 11, 14
3	Design Version		C
4	Gear Ratio		30, 50, 100
5	Encoder Type and Resolution		IDT15b14b - Integrated Drive Motor Input Encoder (15bit) & Gear Output Encoder (14bit) NEW!
6	Power Supply		E – 24VDC
7	Options	Panel Mount	PM1 – Panel Mount Connector(s), rear exit PM2 – Panel Mount Connector(s), right exit PM3 – Panel Mount Connector(s), left exit PM4 – Panel Mount Connector(s), top exit NEW!
8	I/O Connection Signal		Blank – without I/O S – with I/O Signal Panel Mount Connector
9	Special Specification		Blank – Standard Product SP ____ – Special Specification Code

Specifications (FHA-C Mini with Integrated Servo Drive)

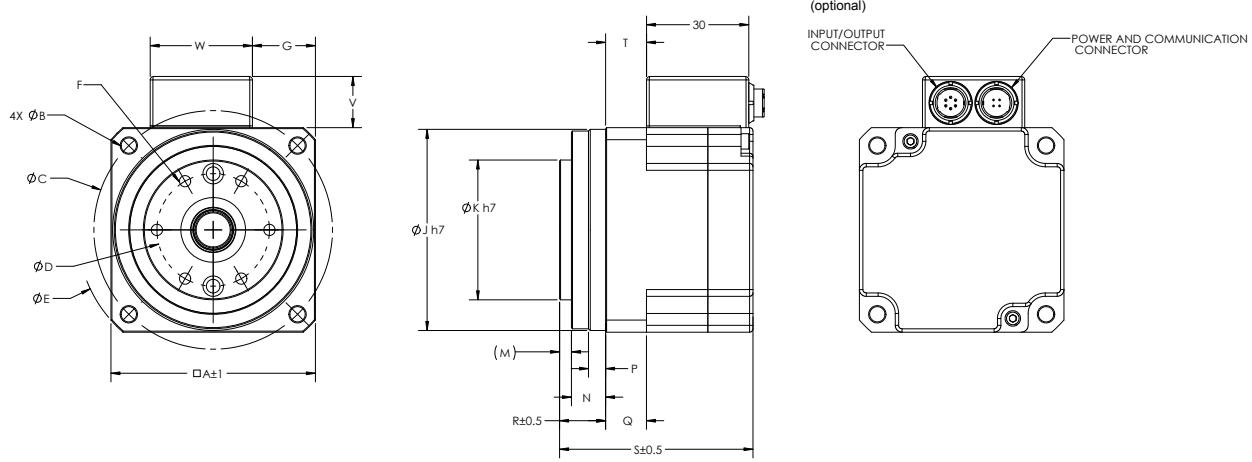
Size			FHA-8C			FHA-11C			FHA-14C		
			30	50	100	30	50	100	30	50	100
Item											
Maximum torque	Nm		1.8	3.3	4.8	4.5	8.3	11	9.0	18	28
Maximum speed	rpm		200	120	60	200	120	60	200	120	60
Torque constant	Nm/A _{rms}		0.8	1.3	2.7	0.8	1.3	2.6	0.8	1.4	2.9
Motor Maximum current	A _{rms}		3.0	3.3	2.4	7.8	8.2	5.6	14.8	16.4	12.3
Motor Allowable continuous current	A _{rms}		1.6	1.7	1.3	3.7	3.5	2.8	6	5.4	4.4
Input Power supply voltage	V		24VDC								
EMF constant	V/(rpm)		0.10	0.16	0.32	0.09	0.15	0.31	0.10	0.17	0.34
Phase resistance	Ω(20°C)		0.54			0.19			0.07		
Phase inductance	mH		0.22			0.11			0.06		
Number of poles			10								
Moment of inertia	GD ² /4	kgm ²	0.0036	0.0100	0.0399	0.007	0.019	0.077	0.019	0.052	0.206
Allowable moment load	Nm		15			40			75		
Moment Stiffness	Nm/rad		2 x 10 ⁴			4 x 10 ⁴			8 x 10 ⁴		
Output shaft resolution ²	Dual ABS Motor	counts/rev	983,040	1,638,400	3,276,800	983,040	1,638,400	3,276,800	983,040	1,638,400	3,276,800
	Dual ABS Output		16,384								
One-way positioning accuracy	arc sec		150	120	120	120	90	90	120	90	90
Mass	kg		0.41			0.63			1.2		
Enclosure ³			Totally enclosed self-cooled (IP44)								
Ambient environment specification			Use temperature: 0 to 40°C/Storage temperature: -20 to +60°C. Use humidity and storage humidity: 20 to 80%RH (non-condensing). Free from dust, dirt, metallic powder, corrosive gas, flammable gas, oil mist, and others. Avoid outdoor use or direct sunlight. Altitude: 1,000 m or less. Motor insulation: 100 MΩ (500 VDC) or higher. Dielectric strength: 1500 VAC/1 min. Insulation class: B								
Mounting direction			Can be installed in any direction								

1. The table shows typical output values

*2. Motor ABS encoder resolutions are obtained by [motor encoder resolution] x [reduction ratio].

*3. All parts, except the rotary sliding parts (oil seal), are protected against solid bodies of dimensions to 1mm, and against the water sprays. Panel mount connectors are IP68.

Outline Dimensions (FHA-C Mini with Integrated Servo Drive)



Rotary Actuator

Linear Actuator

Direct Drive Motor

Servo Drives

Servo Drives

Servo Drives

Operating Range

The following graphs show the operating range for an FHA-C Mini series actuator with an integrated drive.

(1) Continuous Motion Range

The range allows continuous operation of the actuator.

(2) 50% Duty Motion Range

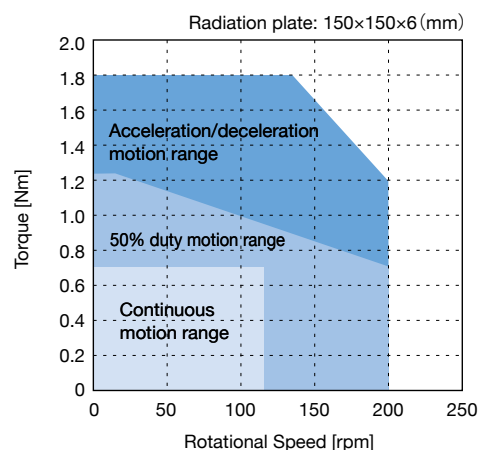
This range indicates the torque/speed where 50% duty cycle operation is permitted (the ratio of operating time and delay time is 50:50).

(3) Motion Range During Acceleration and Deceleration

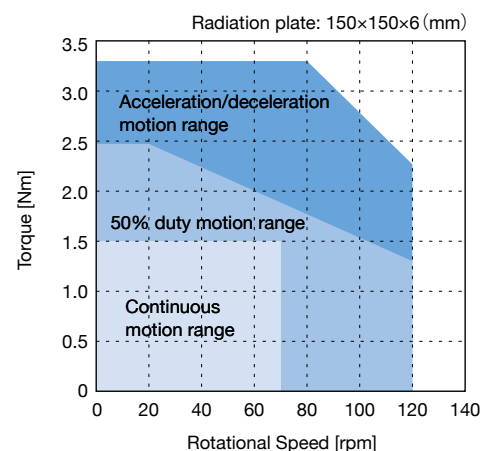
This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.

The continuous and 50% duty motion ranges shown on each graph are measured when the actuator is mounted to an aluminum heatsink as specified.

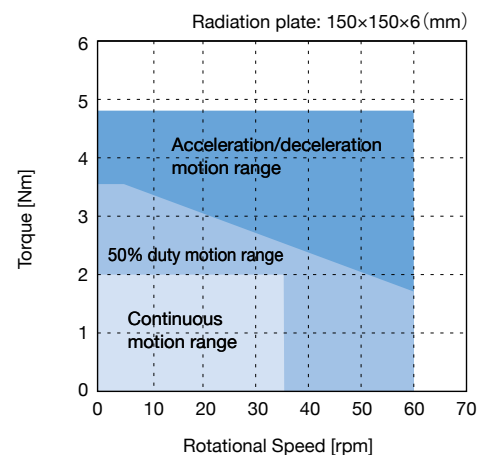
■ FHA-8C-30 Input voltage: 24 V



■ FHA-8C-50 Input voltage: 24 V

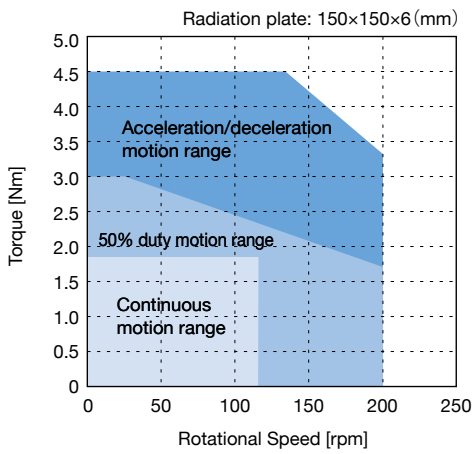


■ FHA-8C-100 Input voltage: 24 V

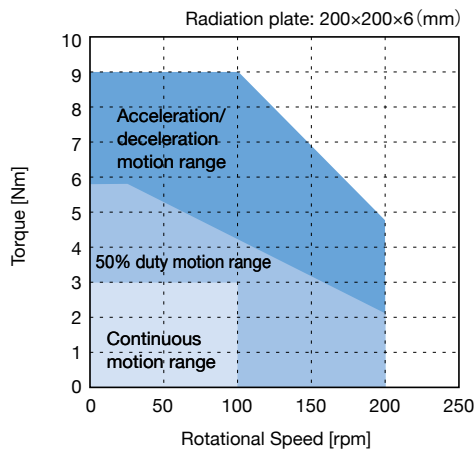


Operating Range

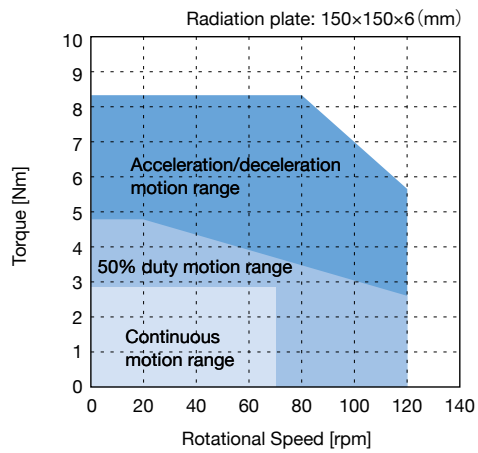
■ **FHA-11C-30** Input voltage: 24 V



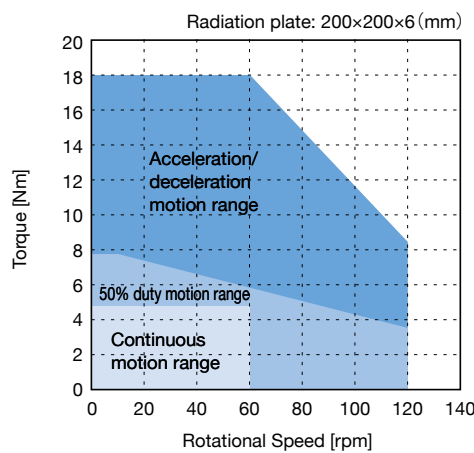
■ **FHA-14C-30** Input voltage: 24 V



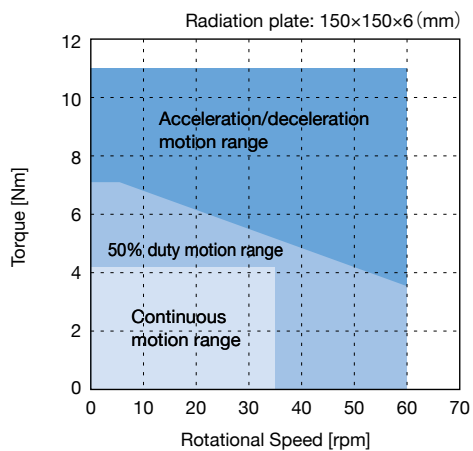
■ **FHA-11C-50** Input voltage: 24 V



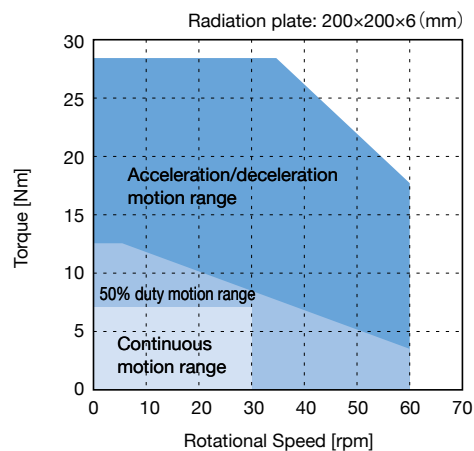
■ **FHA-14C-50** Input voltage: 24 V



■ **FHA-11C-100** Input voltage: 24 V



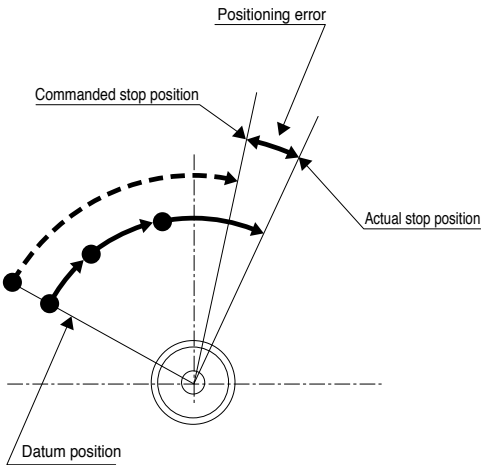
■ **FHA-14C-100** Input voltage: 24 V



One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The FHA mini actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.



One-Way Positional Accuracy

Item \ Size		FHA-8C			FHA-11C			FHA-14C		
		30	50	100	30	50	100	30	50	100
One Way 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 provides an angle offset function to improve angular positioning accuracy of a horizontally installed actuator. The function offsets against a position error by a pre-analyzed positioning error of the Harmonic Drive® components to improve a one-way positioning accuracy by around 30% better than an accuracy without the angle offset function. For fluctuant load, test and examine whether the function is effective before applying it.

Mechanical Accuracy

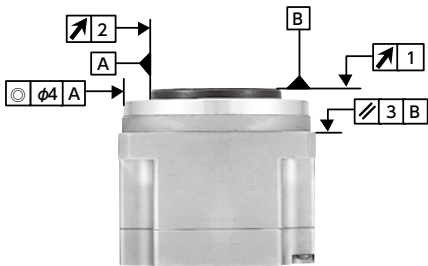
The mechanical accuracies of the output shaft and mounting flange of the actuators in the FHA-C mini series are as follows.

Mechanical Accuracy

Unit mm

Accuracy Item	FHA-8C	FHA-11C	FHA-14C
1 Axial runout of the output shaft	s0.010		
2 Radial runout of the output shaft	0.010		
3 Parallelism between the output shaft and mounting surface	0.040		
4 Concentricity between the output shaft and mounting pilot	0.040		

* The aforementioned values are T.I.R (total indicator reading) values.
* See the technical information for the measuring method.



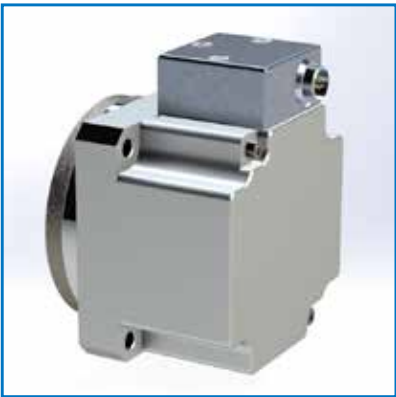
Panel Mount Connectors

FHA-C Mini actuators with an integrated servo drive include standard Lemo® connectors with four exit orientation options. Along with providing the equipment builder the flexibility to choose optimum cables for their specific application, panel mount connectors permit easy replacement of cables. In the event of cable damage, the cables can be replaced without disassembling or replacing the entire actuator.

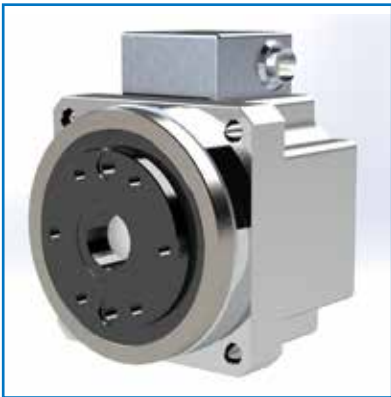
Exit Options

Key

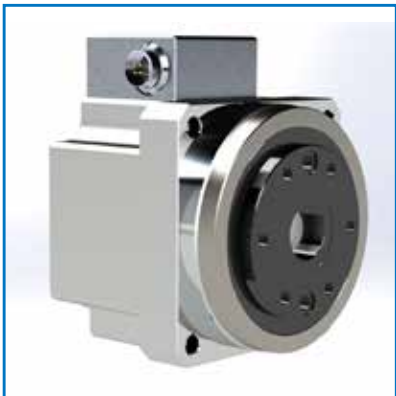
- **PM1** Panel mount connector(s), rear exit (opposite output)
- **PM2** Panel mount connector(s), right exit (of output side)
- **PM3** Panel mount connector(s), left exit (of output side)
- **PM4** Panel mount connector(s), top exit



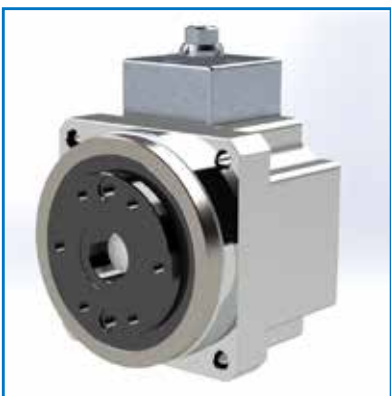
PM1 Rear Exit



PM2 Right Exit



PM3 Left Exit



PM4 Top Exit

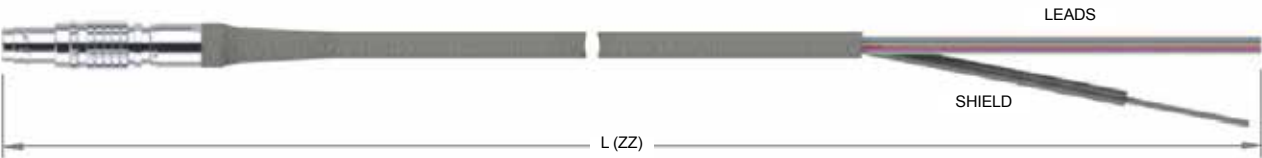
Optional Cables

Power/Connection

Actuator	Description
FHA-8, 11	CBL-DZZ-L004-N
FHA-14	CBL-DZZ-L104-N

Input/Output (for use with 'S' option only)

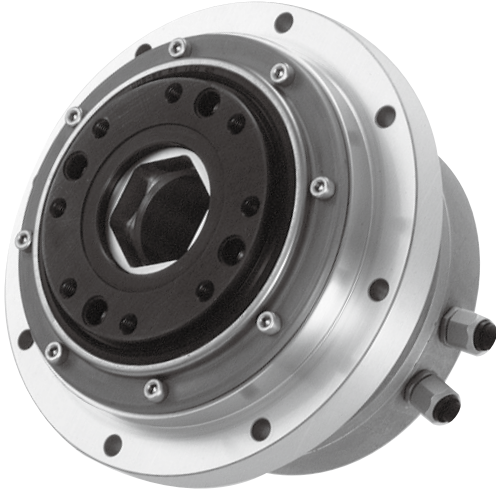
Actuator	Description
FHA-8, 11, 14	CBL-EZZ-L006-N



3 Lengths Available (**ZZ**): 3m (**03**), 5m (**05**), 10m (**10**)

MEMO

FHA-C Series

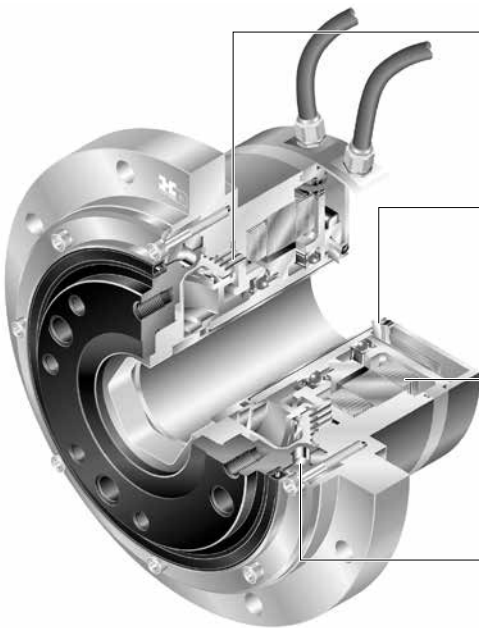


FHA series servo actuators utilize Harmonic Drive® precision gears combined with a performance matched brushless servo motor and incremental encoder. The FHA has a low profile form factor and features a hollow shaft through the center of the output. This hollow shaft feature may be used to pass cables, tubing or a laser beam through the axis of rotation. The FHA series is designed to operate with a wide range of third-party drivers, as well as Harmonic Drive LLC's DDP Series, DEP Series, and RTL Series.

- High torque
- Large center through hole
- Compact cylindrical design



Structure



- **HarmonicDrive® CSD Component Gear Set**
Precision positioning and high efficiency. Unmatched compactness and high-torque capacity.
- **High-Precision Hollow Shaft Rotary Encoder**
High resolution optical encoder
- **Flat AC Servo Motor with a Hollow Shaft**
A flat form factor is achieved by a performance-matched optimized motor design.
- **Cross Roller Output Bearing**
An integrated cross roller bearing for compactness, high precision, and high-load capability.

Ordering Code

FHA	-	17	C	-	50	-	US250	-	
(1)		(2)	(3)		(4)		(5)		(6)

1	Model	FHA-C Series
2	Size	17, 25, 32, 40
3	Design Version	C
4	Gear Ratio	50, 80, 100, 120, 160
5	Encoder Type and Resolution	E250 - Incremental encoder with 4 wire, 2500p/rev US250 - Incremental encoder with 14 wire, 2500p/rev
6	Options	See next page for details

Specifications

Model		FHA-17C-□□-US250					FHA-25C-□□-US250				
Item											
Reduction ratio		50:1	80:1	100:1	120:1	160:1	50:1	80:1	100:1	120:1	160:1
Maximum torque ^{*1}	Nm	39	51	57	60	64	150	213	230	247	260
Continuous torque ^{*1,2}	Nm	15	20	24	24	24	35	53	75	85	85
Maximum speed ^{*1}	rpm	96	60	48	40	30	90	56	45	37	28
Maximum current ^{*1}	A _{rms}	2.1	1.7	1.6	1.4	1.1	7.3	6.4	5.6	5.0	4.0
Continuous current ^{*1,2}	A _{rms}	0.93	0.82	0.74	0.63	0.51	2.1	2.1	2.1	2.0	1.6
Moment of inertia (GD ² /4) ³	kgm ²	0.17 (0.21)	0.43 (0.53)	0.67 (0.83)	0.97 (1.2)	1.7 (2.1)	0.81 (0.90)	2.1 (2.3)	3.2 (3.5)	4.7 (5.2)	8.3 (9.2)
Allowable radial load	kN	2.9					4.9				
Allowable axial load	kN	9.8					14.7				
Allowable moment load	Nm	188					370				
Moment stiffness	Nm/rad	220 x 10 ³					490 x 10 ³				
One-way positional accuracy	arc.sec	60	40	40	40	40	40	30	30	30	30
Encoder resolution of output shaft with quadrature ⁴	counts/revolution	500,000	800,000	1,000,000	1,200,000	1,600,000	500,000	800,000	1,000,000	1,200,000	1,600,000
Mass	kg	2.5 (2.8)					4.0 (4.7)				
Mounting direction		Can be installed in any direction									
Combined drive		HA-800-3C-200									
HDLCC Compatible drives	200VAC	RTL-230-18, REL-230-18, HA-800-3C-200					RTL-230-18, REL-230-18, HA-800-3C-200				
	100VAC	RTL-230-18, REL-230-18, HA-800-3C-100					Ratio 50 & 80:1 RTL-230-36, Ratio 50 & 80:1 REL-230-36, Ratio > 80:1 RTL-230-18, Ratio > 80:1 REL-230-18, HA-800-6C-100				
	24VDC	DDP-090-36, DEP-090-36					—				

The values in the table above show typical values for the output shaft.

*1: They are typical characteristics in the case of combinations with our drive (driven with the ideal sine wave). (Ambient temperature: 25°C)

*2: The values for saturated temperature were obtained when installed on an aluminum heatsink (17C: □300 x 15t, 25C: □350 x 18t, 32C: □400 x 20t, 40C: □500 x 25t [mm])

*3: The values of the moment of inertia and weight were obtained while the product is not equipped with a brake. The values in parenthesis are for -PR option.

*4: The output axis resolution is obtained by (Motor shaft encoder resolution multiplied by four) x (Reduction ratio).

Options

Symbol	Option Descriptions
A	100VAC power supply (Available for size 17, 25, and 32)
B	With Brake
L	Position Sensors
C	With connectors For motors (IP-20), For encoders (IP-40)
K	Rear Exiting Cable
F5	5 meter cables for each motor cable and encoder cable
E	24VDC power supply (Size 17 only)
PR	High Positional Accuracy

Note: Contact us when using two or more options.

Specifications

Model Item		FHA-32C-□□-US250					FHA-40C-□□-US250				
Reduction ratio		50:1	80:1	100:1	120:1	160:1	50:1	80:1	100:1	120:1	160:1
Maximum torque ^{*1}	Nm	281	364	398	432	453	500	659	690	756	820
Continuous torque ^{*1/2}	Nm	60	95	130	155	200	85	145	190	225	300
Maximum speed ^{*1}	rpm	80	50	40	33	25	70	43	35	29	22
Maximum current ^{*1}	A _{rms}	11.4	9.2	8.0	7.4	5.9	17.3	14.0	11.8	10.9	9.0
Continuous current ^{*1/2}	A _{rms}	3.1	3.1	3.1	3.1	3.0	4.0	4.0	4.0	3.9	3.8
Moment of inertia (GD ² /4) ³	kgm ²	1.8 (2.1)	4.5 (5.3)	7.1 (8.2)	10.2 (12)	18.1 (21)	4.9 (5.5)	12.5 (14)	19.5 (22)	28.1 (32)	50 (56)
Allowable radial load	kN	9.5					14.7				
Allowable axial load	kN	24.5					39.2				
Allowable moment load	Nm	530					690				
Moment stiffness	Nm/rad	790 x 10 ³					1400 x 10 ³				
One-way positional accuracy	arc.sec	40	30	30	30	30	40	30	30	30	30
Encoder resolution of output shaft with quadrature ⁴	counts/revolution	500,000	800,000	1,000,000	1,200,000	1,600,000	500,000	800,000	1,000,000	1,200,000	1,600,000
Mass	kg	6.5 (7.1)					12 (13.6)				
Mounting direction		Can be installed in any direction									
Combined drive		HA-800-6C-200									
HDLIC Compatible drives	200VAC	RTL-230-18, REL-230-18, HA-800-6C-200					Ratio <120:1 RTL-230-36, Ratio <120:1 REL-230-36, Ratio <100:1 RTL-230-18, Ratio <100:1 REL-230-18, HA-800-6C-100				
	100VAC	Ratio 50 & 80:1 RTL-230-36, Ratio 50 & 80:1 REL-230-36, Ratio > 80:1 RTL-230-18, Ratio > 80:1 REL-230-18, HA-800-6C-100					—				
	24VDC	—					—				

The values in the table above show typical values for the output shaft.

*1: They are typical characteristics in the case of combinations with our drive (driven with the ideal sine wave). (Ambient temperature: 25°C)

*2: The values for saturated temperature were obtained when installed on an aluminum heatsink (17C: □300 x 15t, 25C: □350 x 18t, 32C: □400 x 20t, 40C: □500 x 25t [mm])

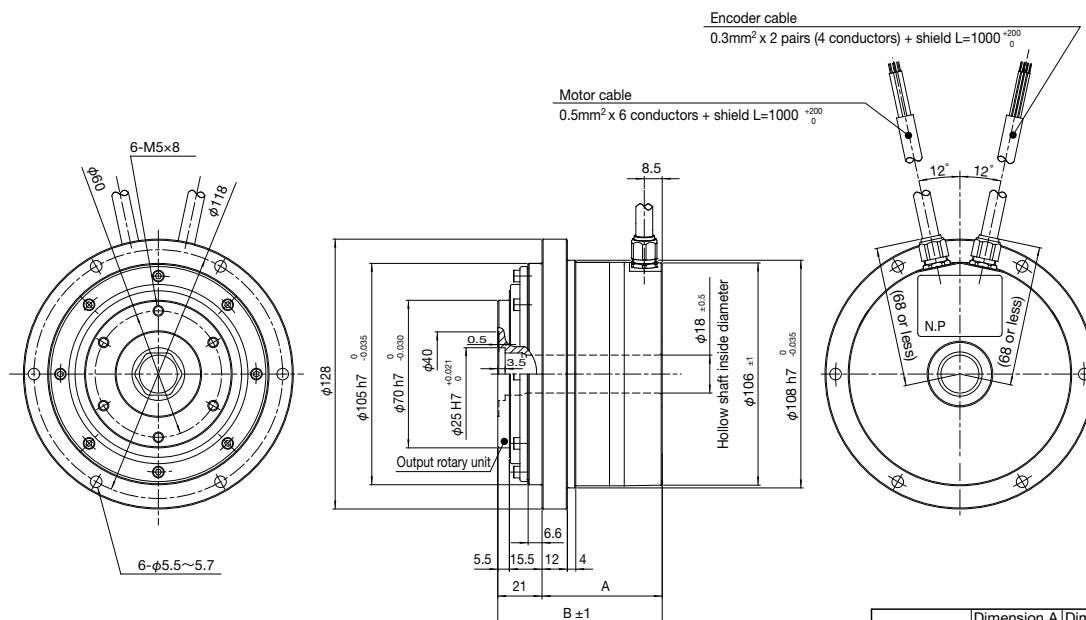
*3: The values of the moment of inertia and weight were obtained while the product is not equipped with a brake. The values in parenthesis are for -PR option.

*4: The output axis resolution is obtained by (Motor shaft encoder resolution multiplied by four) x (Reduction ratio).

Outline Dimensions

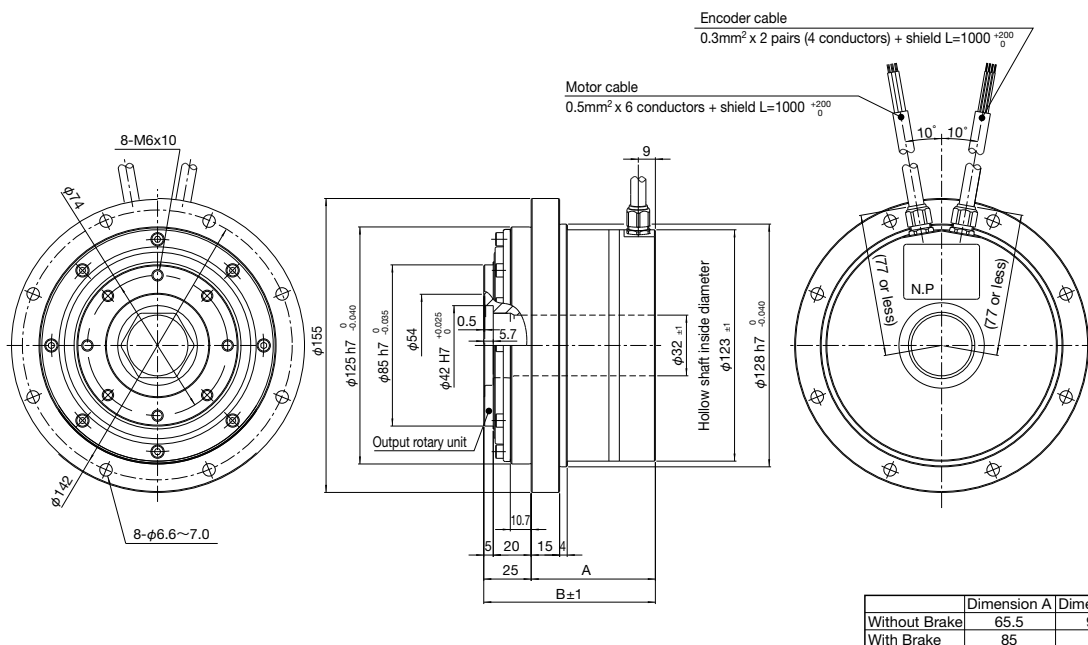
FHA-17C

Unit: mm



FHA-25C

Unit: mm



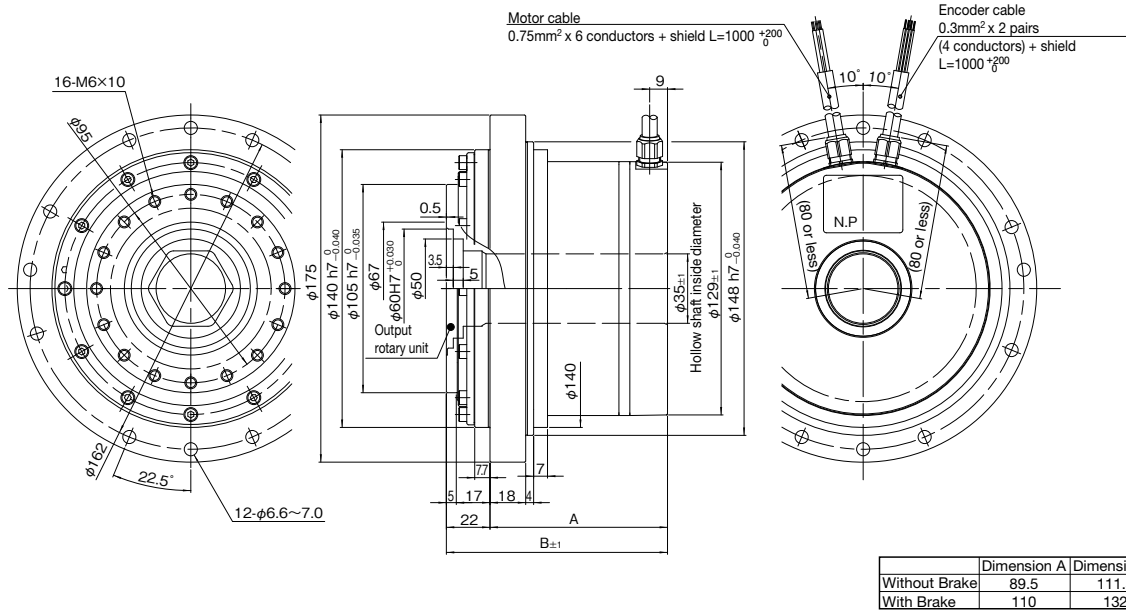
Note: The motor cable (6 conductors) contains yellow and blue wires for the brake.

* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

Outline Dimensions

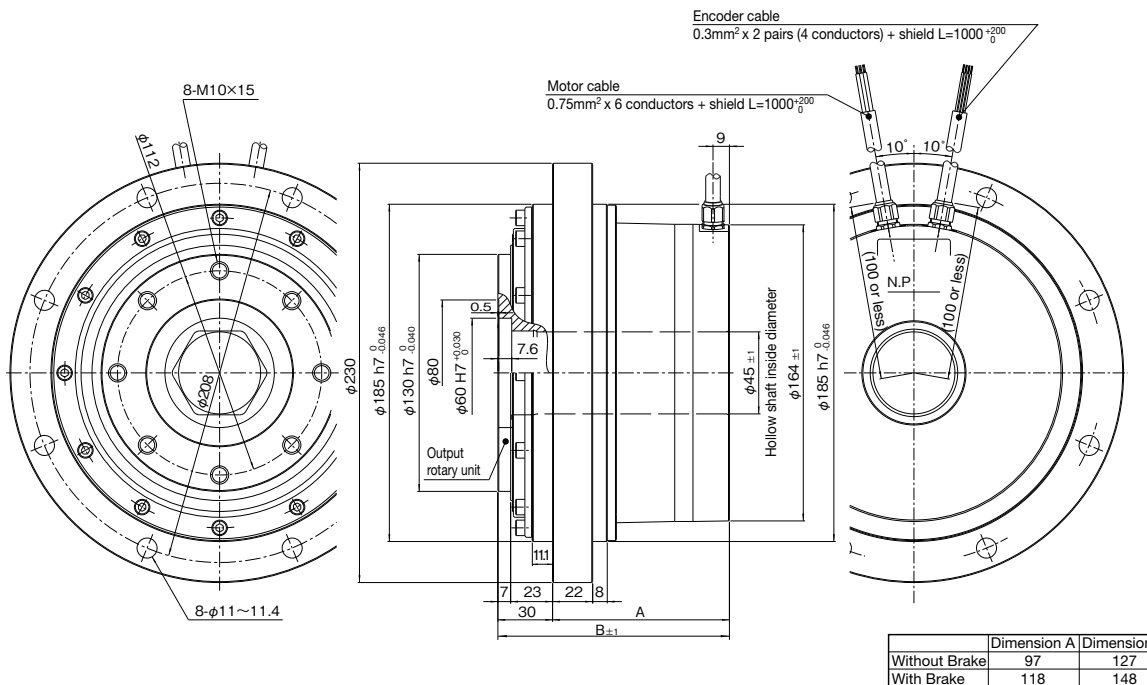
FHA-32C

Unit: mm



FHA-40C

Unit: mm



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

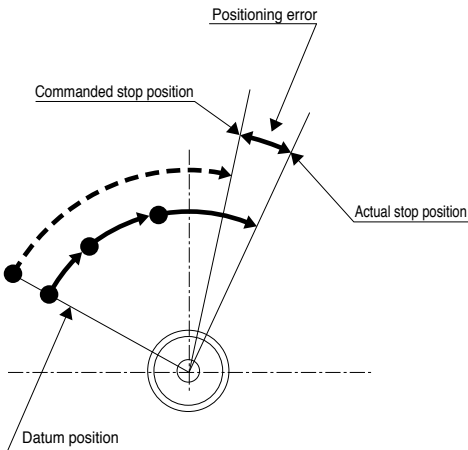
* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The FHA-C actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.

The one-way positional accuracy for each model is shown in the table below:



One -Way Positional Accuracy

Item \ Size		FHA-17C			FHA-25C			FHA-32C			FHA-40C		
		50	100	160	50	100	160	50	100	160	50	100	160
One Way Positional Accuracy	arc sec	60	40	40	40	30	30	40	30	30	40	30	30
	rad	2.91×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}

Mechanical Accuracy

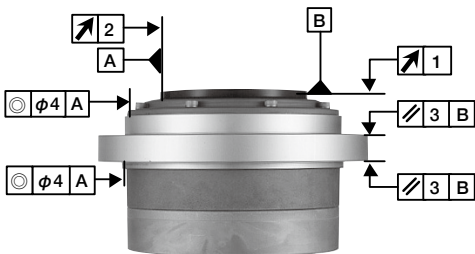
The mechanical accuracies of the output shaft and mounting flange of the actuators in the FHA-C series are as follows.

Mechanical Accuracy

Unit: mm

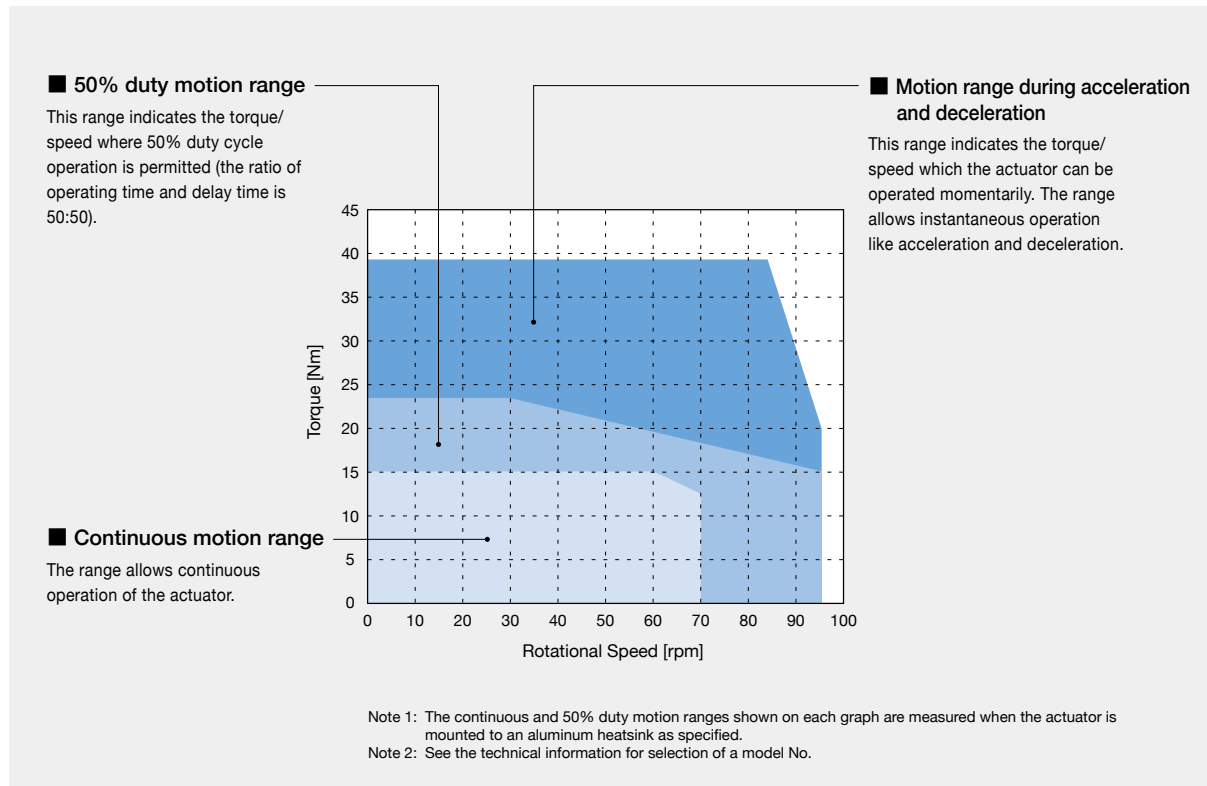
Accuracy Item	FHA-17C	FHA-25C	FHA-32C	FHA-40C
1 Axial runout of the output shaft	0.010	0.012	0.012	0.014
2 Radial runout of the output shaft	0.010	0.012	0.012	0.014
3 Parallelism between the output shaft and mounting surface	0.040	0.050	0.050	0.060
4 Concentricity between the output shaft and mounting pilot	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.



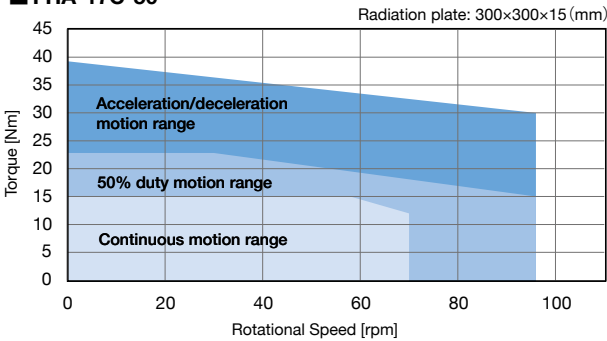
Operating Range

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

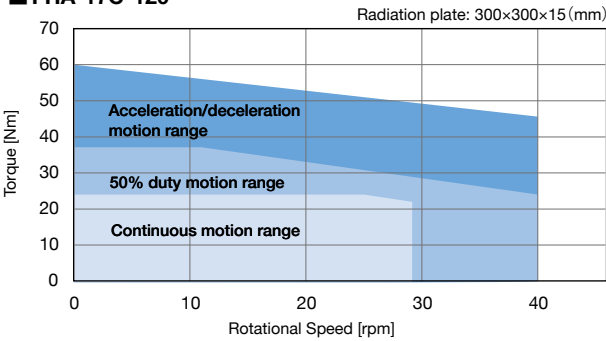


Operating Range

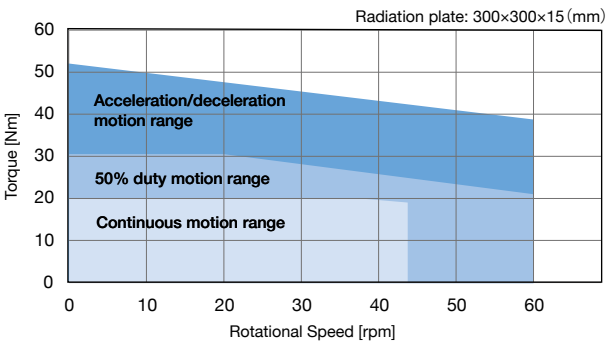
FHA-17C-50



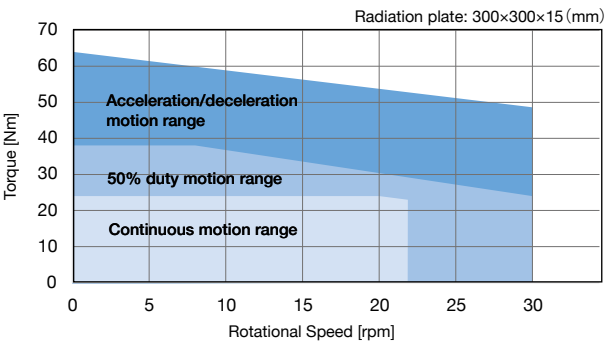
FHA-17C-120



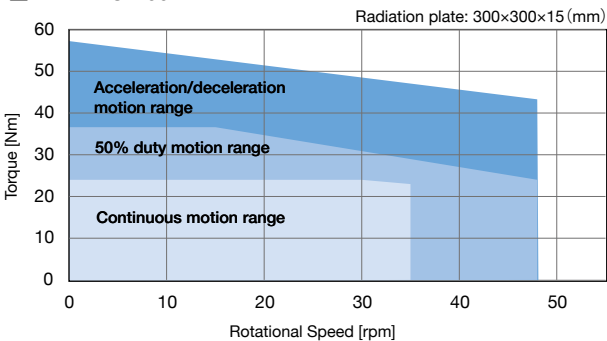
FHA-17C-80



FHA-17C-160

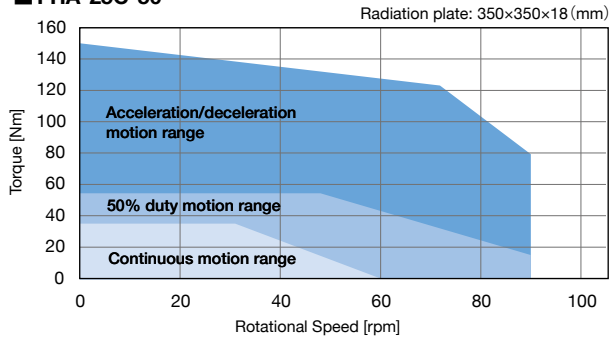


FHA-17C-100

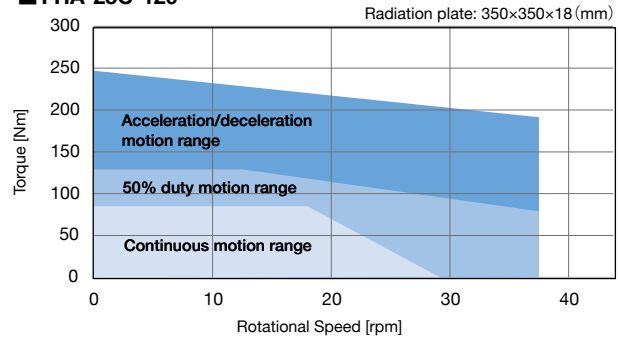


Operating Range

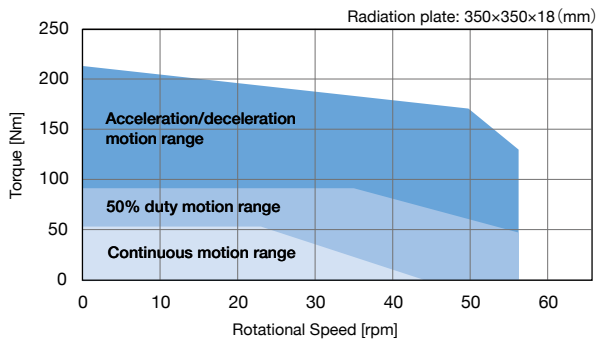
■ FHA-25C-50



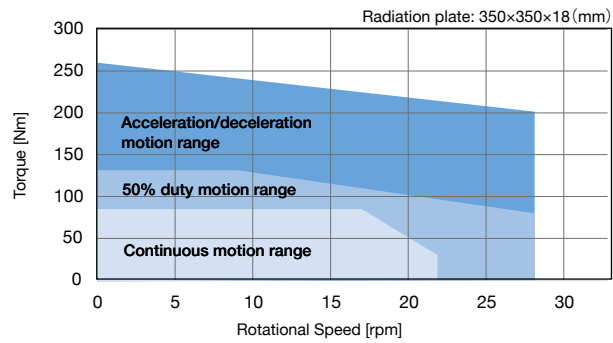
■ FHA-25C-120



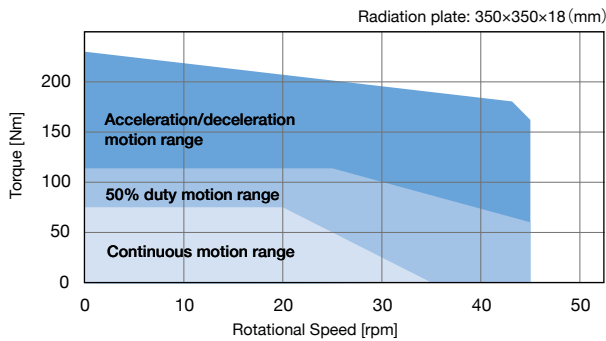
■ FHA-25C-80



■ FHA-25C-160

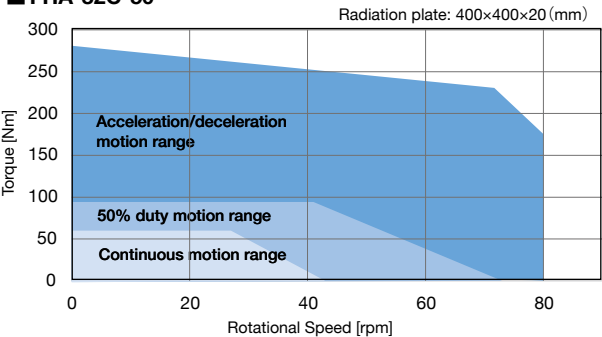


■ FHA-25C-100

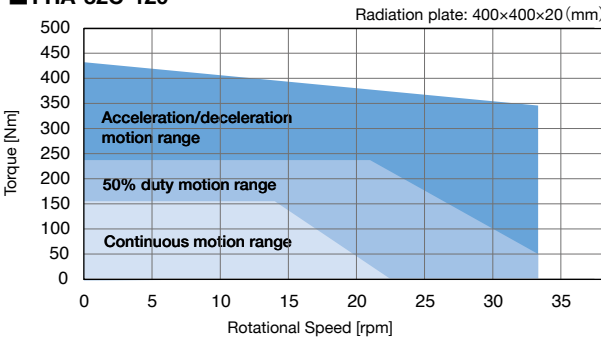


Operating Range

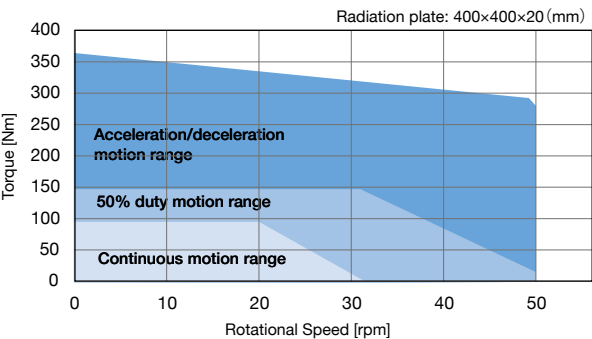
FHA-32C-50



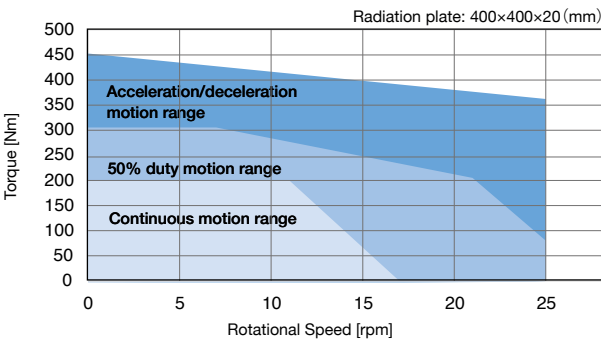
FHA-32C-120



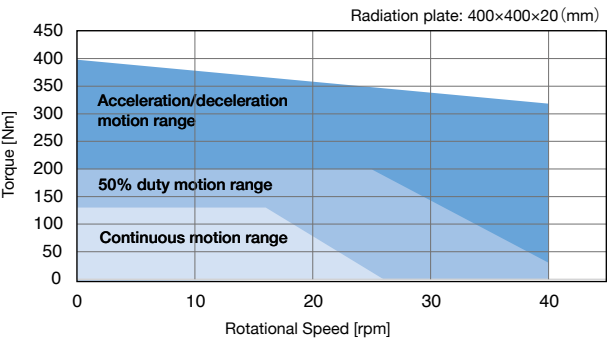
FHA-32C-80



FHA-32C-160

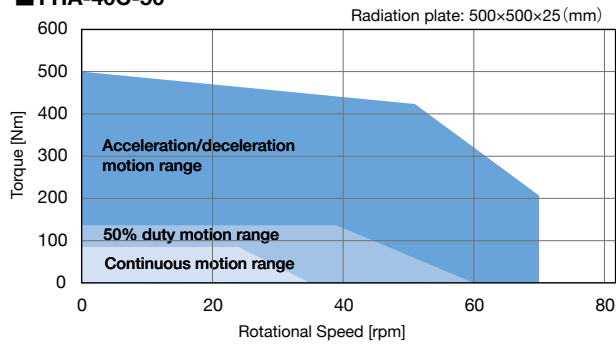


FHA-32C-100

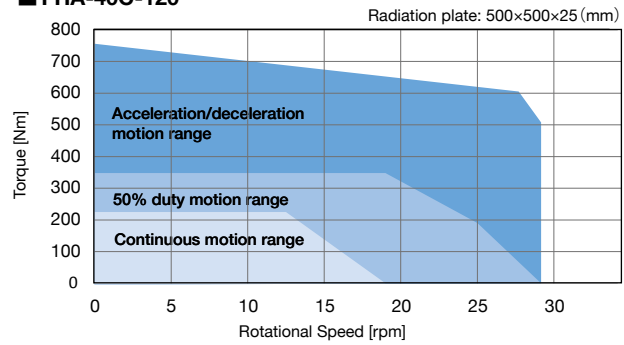


Operating Range

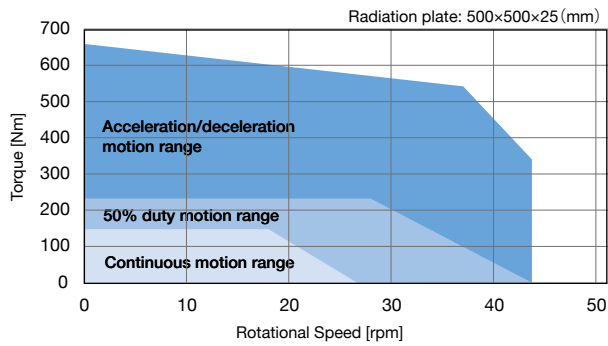
■ FHA-40C-50



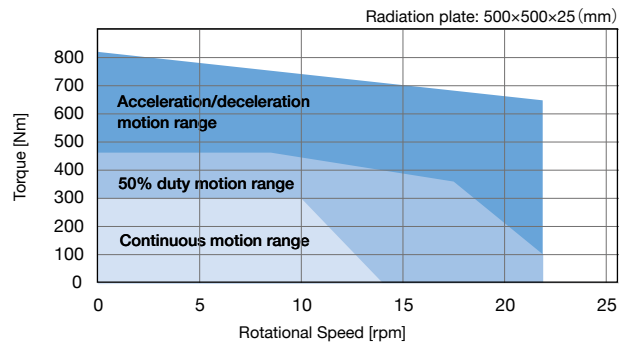
■ FHA-40C-120



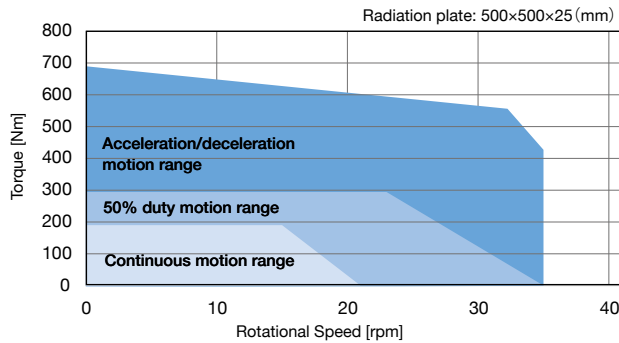
■ FHA-40C-80



■ FHA-40C-160



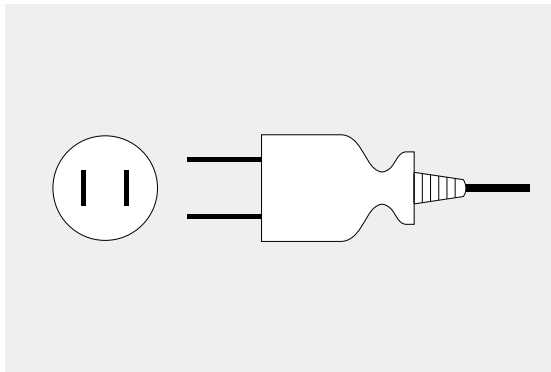
■ FHA-40C-100



Options

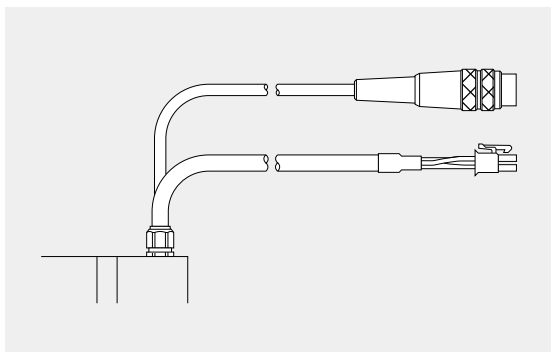
Power Supply AC100V

Order Code Example: FHA-25C-50-H-SE19b22-A
Actuator sizes FHA-17C, FHA-25C and FHA-32C can select AC100V as power supply.



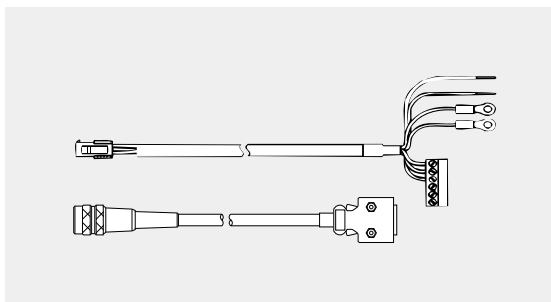
Connector

Order Code Example: FHA-25C-50-H-SE032SC-C
Connect a connector at the tip of the actuator cable. Use this connector with the extension cable to facilitate connection to HA-800 driver.



Extension 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.
(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m).



Motor Shaft Brake

Order Code Example: FHA-25C-50-H-SE19b22-B
-B Option provides the actuator with an integrated electro-magnetic fail safe brake. The brake holds the motor input shaft. The motor shaft is released when applying 24VDC to the brake.

Actuator Size Reduction Ratio		FHA-17C			FHA-25C			FHA-32C			FHA-40C		
		50	100	160	50	100	16	50	100	160	50	100	160
Holding Torque	Nm	24	49	78	49	98	157	75	150	240	108	216	345

* Cannot be used as a control brake.

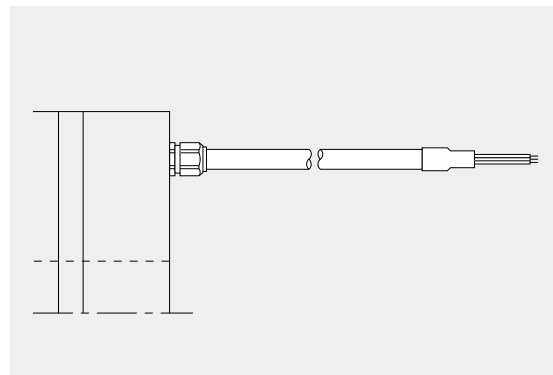
Motor Cable Color

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

The brake wires are contained in the motor cable.

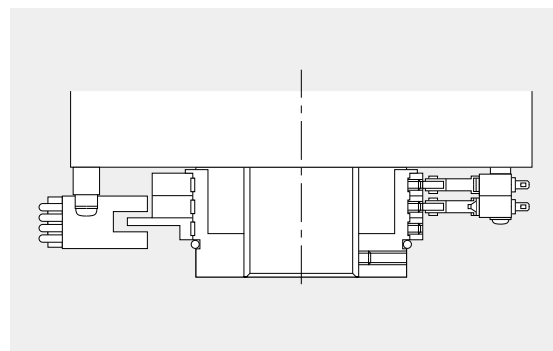
Rear Exit Cable

Order Code Example: FHA-25C-50-H-SE032SC-K
Optional rear exiting cable.



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.



FHA-C-H Series



FHA-C Series servo actuators are now available with IP65 protection. Four sizes are available: 17, 25, 32 and 40. The IP65 rated FHA-C actuator is ideal for harsh environments. With IP65 and 480V, the FHA actuator is well suited for machine tool, packaging, and wash-down applications. These rotary servo actuators utilize Harmonic Drive® precision gears combined with a performance matched brushless servo motor. Encoder options now include EnDat® & HIPERFACE®. The FHA has a low-profile form factor and features a hollow-output shaft. This hollow shaft feature may be used to pass cables, tubing or lasers through the axis of rotation.

- IP65 Rating
- 480VAC*
- EnDat® & HIPERFACE® Encoder Protocols
- DESINA style flex rated cables

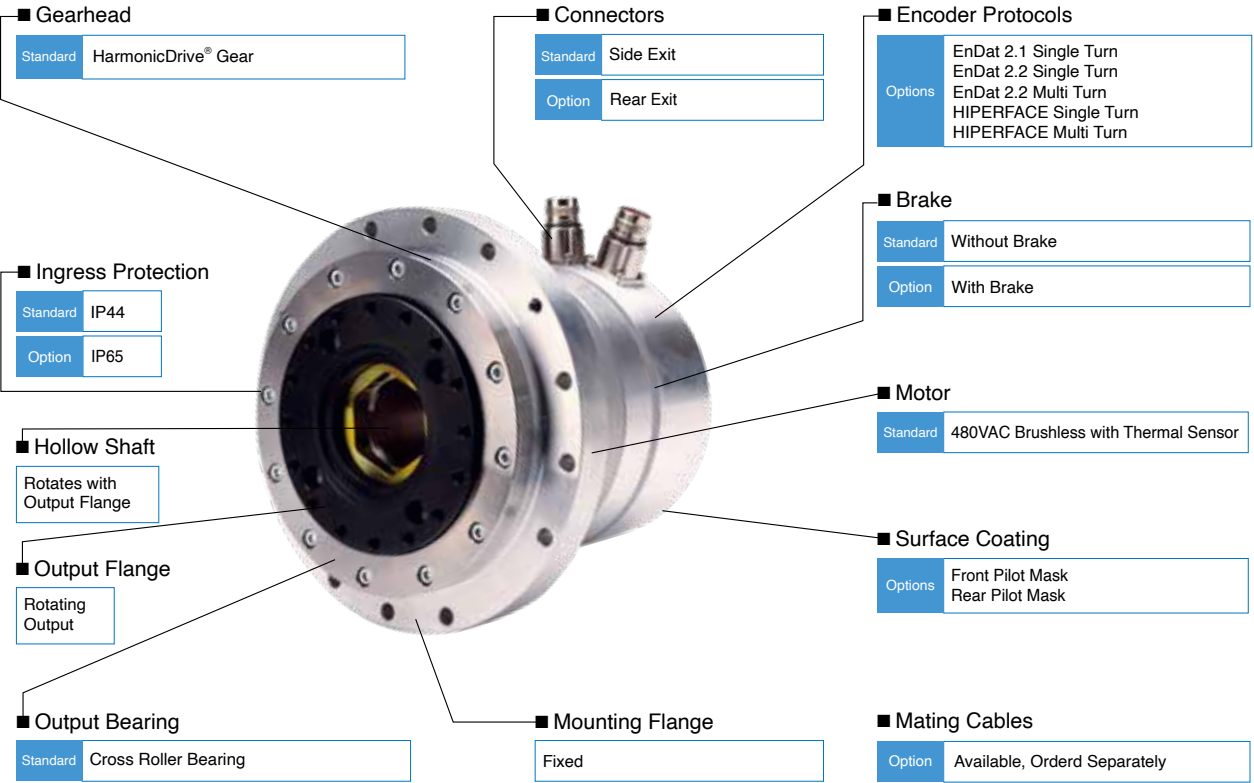
* Contact us for additional voltage options



Features

- Compact
- Hollow Shaft
- High-Output Torque
- High-Positional Accuracy
- High-Torsional Stiffness

Structure



Ordering Code

Series	Size	Design	Ratio	Winding Voltage	Brake	Motor Feedback	Option
FHA	17	C	50	H ^{*1}	B	SE032SC	KP
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

(2) Size	(3) Design	(4) Ratio	(5) Winding Voltage
17	C	50, 100, 160	H-(680VDC) ^{*1}
25			
32			
40			

(6) Brake Option	
Blank	Without Brake
B	With Brake

*1 Contact us for voltage options.

(7) Motor Feedback	Protocol	Type
SE032SC	EnDat2.1 with Sin-Cos	Single Turn Absolute
SE19b22	EnDat2.2 (Full Digital)	Single Turn Absolute
ME19b22	EnDat2.2 (Full Digital)	Battery Buffered Multi Turn Absolute
SH064SC	HIPERFACE	Single Turn Absolute
MH064SC	HIPERFACE	Multi Turn Absolute

(8) Options	
K	Connector Rear Exit (Standard: Side Exit)
P	IP65 (Standard: IP44)
R	Pilot Diameter - Rear (Standard: Pilot Diameter - Front)
T	Temperature Sensing Provided within EnDat 2.2 (Standard: Separate conductors within feedback cable)

Specifications

Item		Model		FHA-17C-H			FHA-25C-H			FHA-32C-H			FHA-40C-H		
				50	100	160	50	100	160	50	100	160	50	100	160
Maximum Torque	N·m	TM		39	57	64	151	233	261	281	398	453	500	686	823
Maximum Current	A _{rms}	IM		1.4	1.1	0.8	3.9	3	2.2	6.5	4.7	3.5	9.3	6.4	5.0
Continuous Torque	N·m	TC		15	23	23.2	40	72	90	60	153.5	240	90	234	400
Continuous Current	A _{rms}	IC		0.65	0.55	0.45	1.3	1.3	1.25	2	2	1.9	2.4	2.4	2.4
Maximum Speed	rpm	NM		96	48	30	90	45	28.1	80	40	25	70	35	21.9
Torque Constant	N·m/A _{rms}	KT		37	75	120	42	86	138	49	100	160	59	120	193
Motor EMF Constant (Line-Line)	V _{rms} / (krpm)	V _{EMF}		50			57			67			80		
	V _{rms} / (rad/s)			0.48			0.55			0.64			0.77		
Phase Resistance (20°C, Line-Line)	Ω	R		64			22.4			7.8			5.6		
Phase Inductance (Line-Line)	mH	L		42			20			9.8			11.2		
Number of Pole Pairs	p	P		6			6			6			6		
Allowable Axial Load	kN	LA		9.8			14.7			24.5			39.2		
Allowable Radial Load	kN	LR		2.9			4.9			9.5			14.7		
Allowable Moment Load	Nm	LM		188			370			530			690		
Moment Stiffness	N·m/rad			220 x 10 ³			490 x 10 ³			790 x 10 ³			1400 x 10 ³		
One-Way Positional Accuracy	arc-sec			60	40	40	40	30	30	40	30	30	40	30	30
Feedback Type ^{*1}				Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat)			Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat)			Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat)			Single-turn absolute (EnDat and HIPERFACE) Multi-turn absolute (EnDat)		
Mass	kg	M		3.3			4.6			6.8			10.8		
Mass (with brake)				3.7			5.4			7.7			12.8		
Motor Inertia (without brake) ^{*2}	EnDat	J _A	kg·m ² (x10 ⁻⁴)	1.37			3.95			7.63			19.3		
	HIPER-FACE			1.44			3.65			7.33			19.3		
Motor Inertia (with brake) ^{*2}	EnDat			1.66			4.84			9.00			21.9		
	HIPER-FACE			1.73			4.54			8.69			21.9		

The table shows typical values.

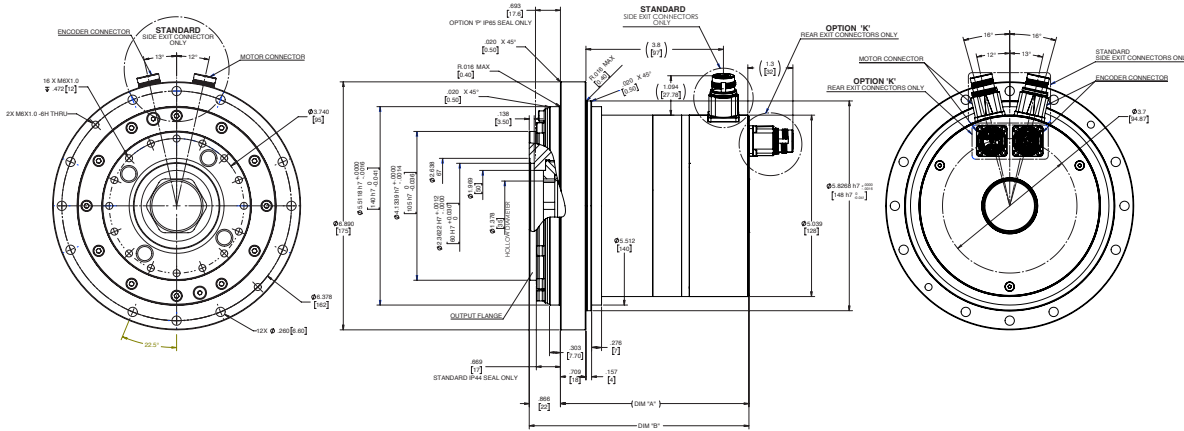
*1 Refer to the manual for details.

*2 Inertia shown in this table is at input side. To convert to output side, multiply the inertia by (ratio)²

Outline Dimensions

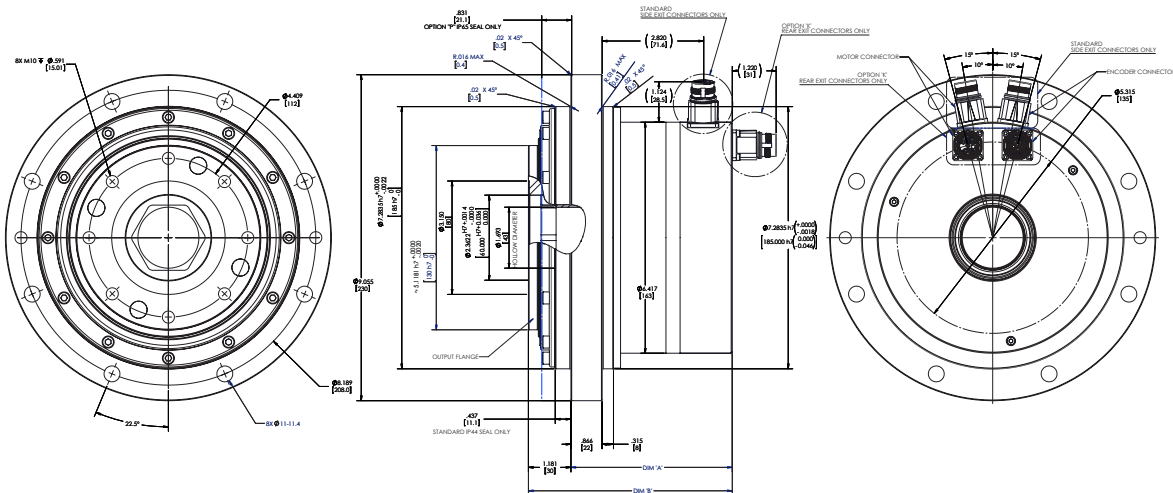
FHA-32C

Unit: mm



FHA-32C

Unit: mm



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

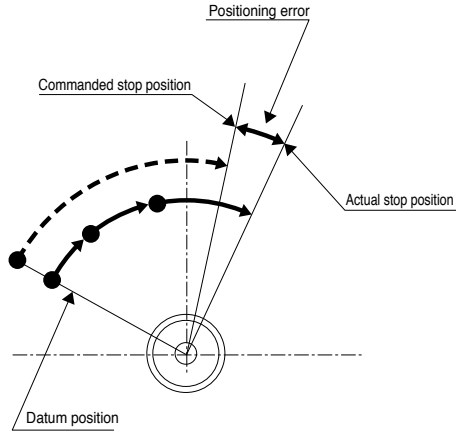
* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The FHA actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.

The one-way positional accuracy for each model is shown in the table below:



One-Way Positional Accuracy

Item \ Size		FHA-17C			FHA-25C			FHA-32C			FHA-40C		
		50	100	160	50	100	160	50	100	160	50	100	160
One Way Positional Accuracy	arc sec	60	40	40	40	30	30	40	30	30	40	30	30
	rad	2.91×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.94×10^{-4}	1.46×10^{-4}	1.46×10^{-4}	1.94×10^{-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

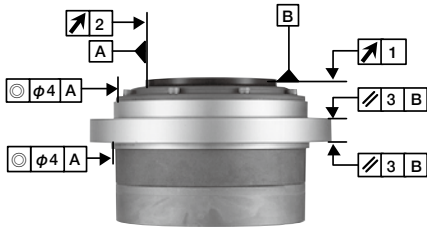
Unit: mm

Accuracy Item	FHA-17C	FHA-25C	FHA-32C	FHA-40C
1 Axial runout of the output shaft	0.010	0.012	0.012	0.014
2 Radial runout of the output shaft	0.010	0.012	0.012	0.014
3 Parallelism between the output shaft and mounting surface	0.040	0.050	0.050	0.060
4 Concentricity between the output shaft and mounting pilot	0.040	0.050	0.050	0.060

Note:

See the technical information for the measuring method.

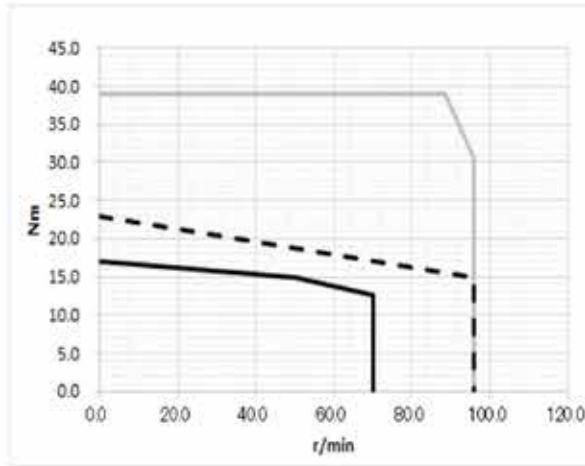
The aforementioned values are T.I.R (total indicator reading) values.



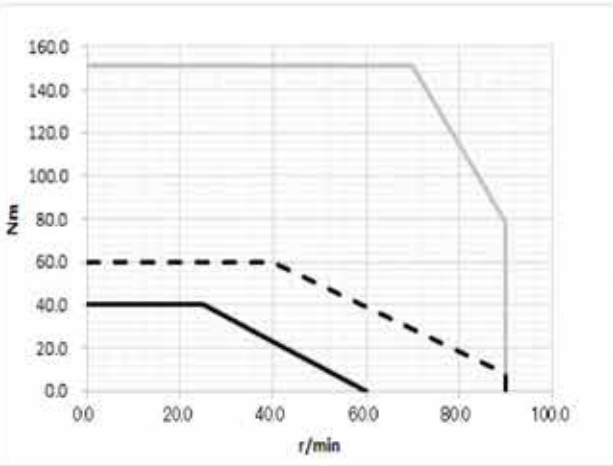
Operating Range

The following diagrams show the operating range of the FHA-H series (combined with HA-800 servo drive).

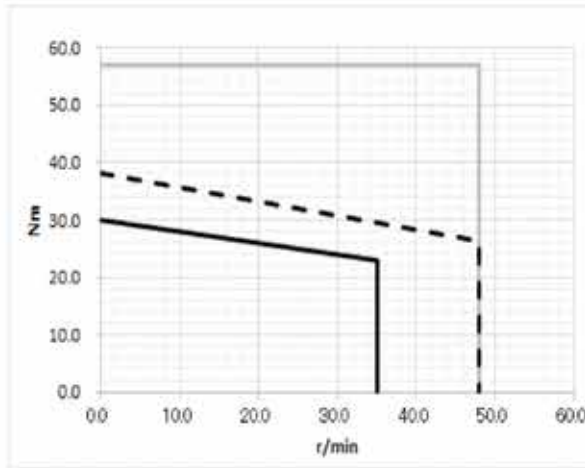
FHA-17C-50-H



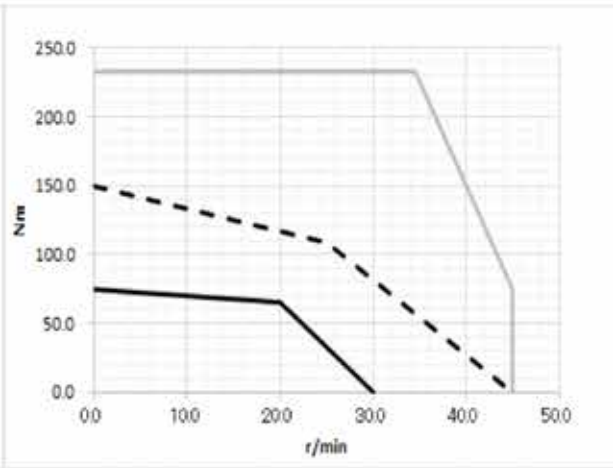
FHA-25C-50-H



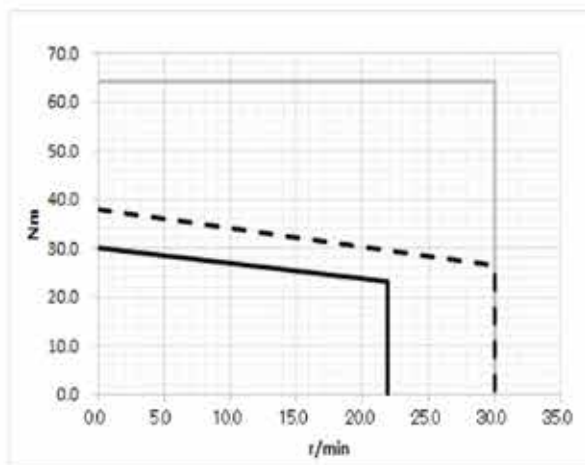
FHA-17C-100-H



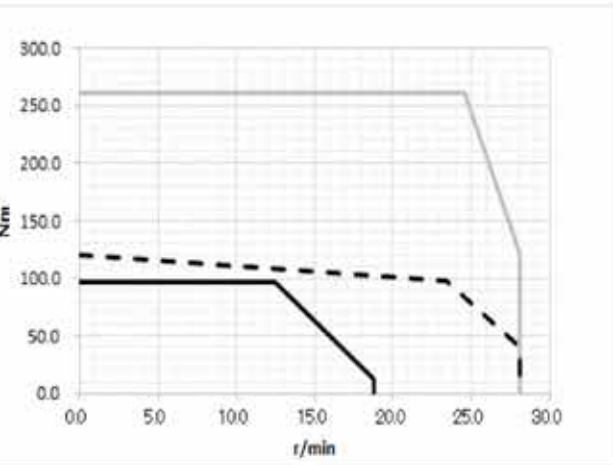
FHA-25C-100-H



FHA-17C-160-H

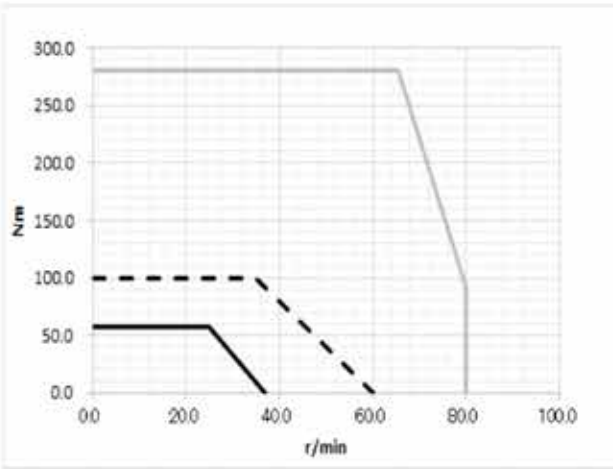


FHA-25C-160-H

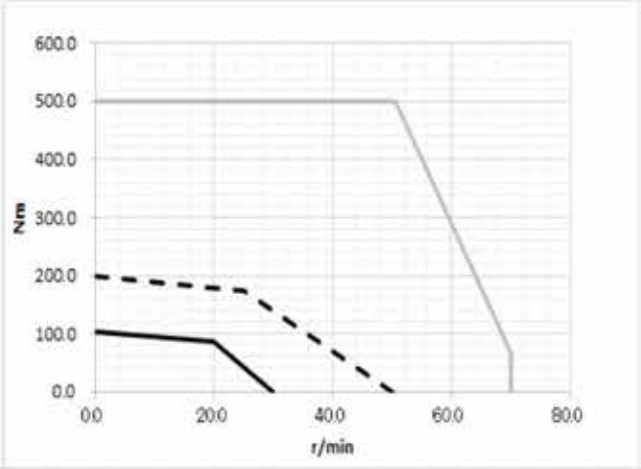


 Instantaneous maximum
 50% duty
 Continuous

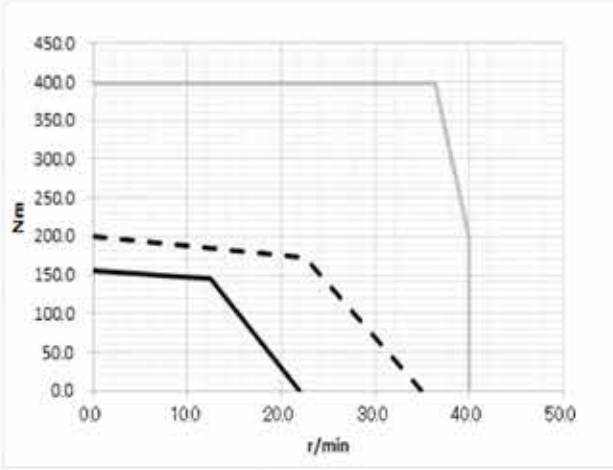
FHA-32C-50-H



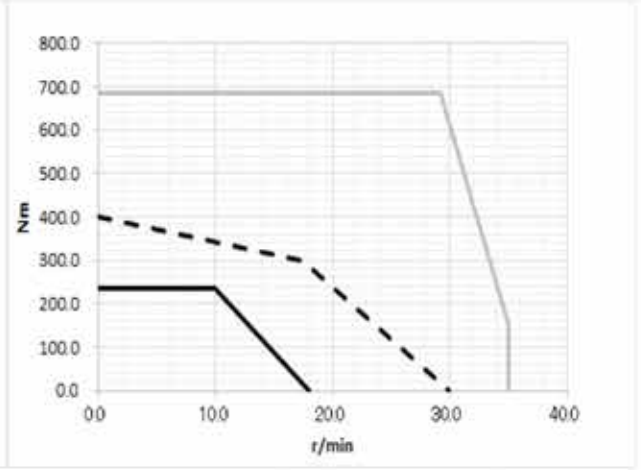
FHA-40C-50-H



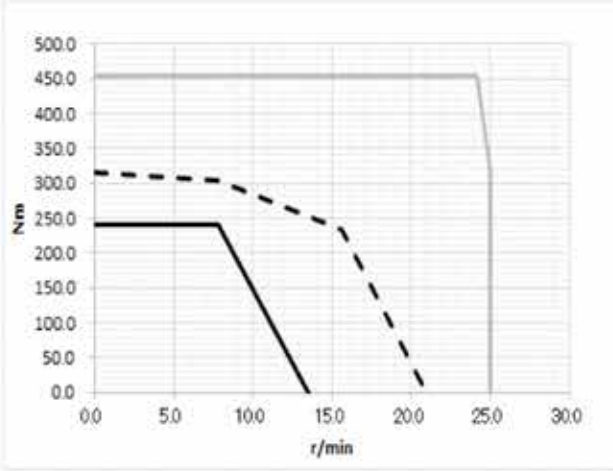
FHA-32C-100-H



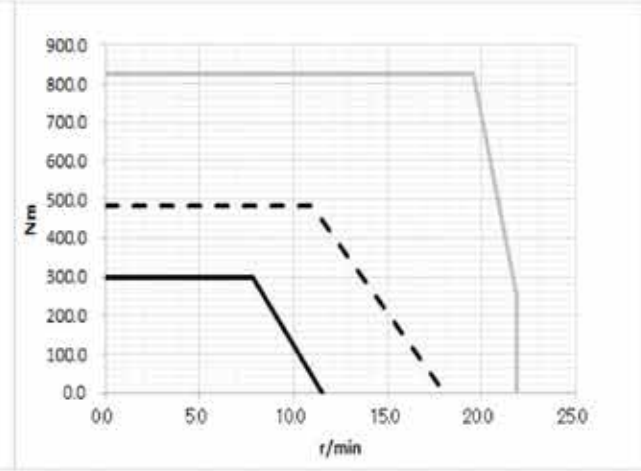
FHA-40C-100-H



FHA-32C-160-H



FHA-40C-160-H

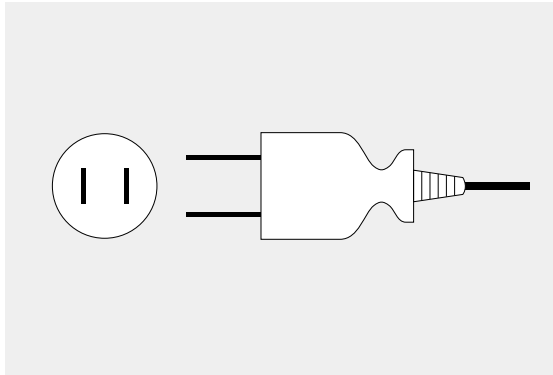


— Instantaneous maximum
- - - 50% duty
— Continuous

Options

Power Supply AC100V

Order Code Example: FHA-25C-50-H-SE19b22-A
Actuator sizes FHA-17C, FHA-25C and FHA-32C can select AC100V as power supply.



Motor Shaft Brake

Order Code Example: FHA-25C-50-H-SE19b22-B
-B Option provides the actuator with an integrated electro-magnetic fail safe brake. The brake holds the motor input shaft. The motor shaft is released when applying 24VDC to the brake.

Actuator Size Reduction Ratio		FHA-17C			FHA-25C			FHA-32C			FHA-40C		
		50	100	160	50	100	16	50	100	160	50	100	160
Holding Torque	Nm	24	49	78	49	98	157	75	150	240	108	216	345

* Cannot be used as a control brake.

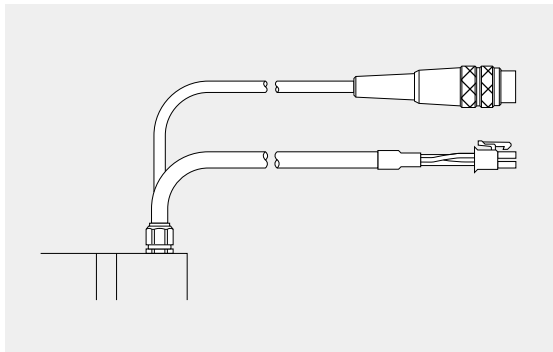
Motor Cable Color

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

The brake wires are contained in the motor cable.

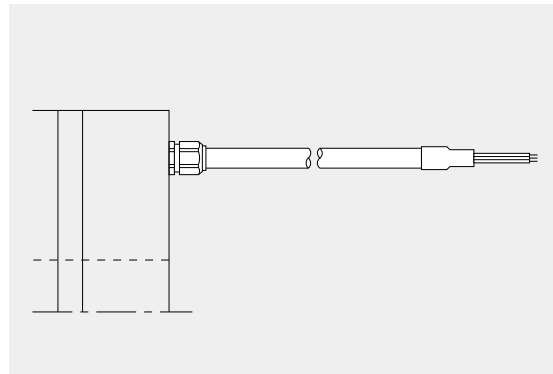
Connector

Order Code Example: FHA-25C-50-H-SE032SC-C
Connect a connector at the tip of the actuator cable. Use this connector with the extension cable to facilitate connection to HA-800 driver.



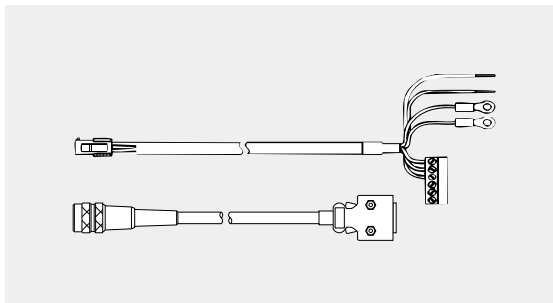
Rear Exit Cable

Order Code Example: FHA-25C-50-H-SE032SC-K
Optional rear exiting cable.



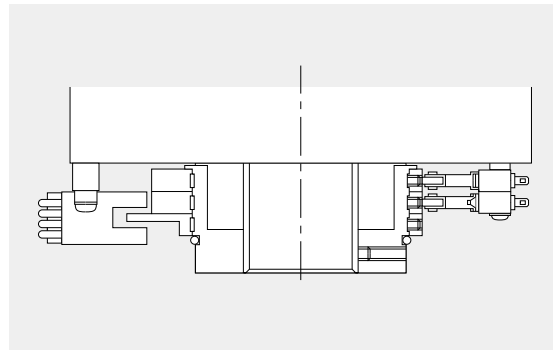
Extension Cable

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.
(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 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.



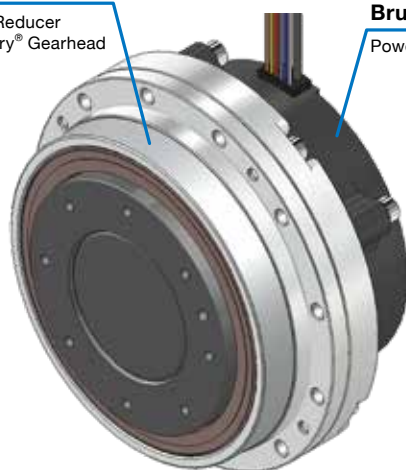
FLA Series

Speed Reducer

HarmonicDrive® Reducer
HarmonicPlanetary® Gearhead

Brushless DC Motor

Power Voltage: 24V
48V



The new ultra-flat, ultra-light brushless actuators combine our high-precision/high-performance reducers with a compact, high-output brushless DC motor. FLA actuators are available with our high-speed, high-efficiency Harmonic Planetary® gearhead or with our high-precision, high-torque Harmonic Drive® reducer. This new series targets a broad customer base and is ideal for a wide range of applications such as AGV wheel drives and powered exoskeletons. We offer both 24VDC and 48VDC versions to work with battery-powered applications.

Features

- **Ultra-Flat Shape**
- **Multiple Options Available:** Four sizes, multiple ratios and two voltages
- **Lightweight**
- **Designed to operate with a wide range of third party servo drives**

Ordering Code

FLA - 11 A - 09 HP - H - 24 - SP

(1) (2) (3) (4) (5) (6) (7) (8)

(1)	Series	Brushless DC Actuator FLA Series
(2)	Size	11, 14, 17, 20
(3)	Version Symbol	
(4)	Reduction Ratio	HarmonicDrive® Speed Reducer 50: 50:1 100: 100:1 (Size 11, 14 and 17 only) HarmonicPlanetary® Speed Reducer 08: 8:1 (Size 11 and 14 only) 09: 9:1 (Size 17 and 20 only)

(5)	Speed Reducer	FB: HarmonicDrive® Speed Reducer HP: HarmonicPlanetary® Speed Reducer
(6)	Sensor	H: Hall sensor
(7)	Input Power Voltage	24: 24VDC 48: 48VDC
(8)	Special Specification	No Symbol: Standard Product SP: Special Specification Code

FLA-HP - HarmonicPlanetary® Speed Reducer

24VDC

Item \ Size		FLA-11A-08HP	FLA-14A-08HP	FLA-17A-09HP	FLA-20A-09HP
Reduction Ratio		8:1	8:1	9:1	9:1
Power Supply Voltage	V	24VDC			
Maximum Torque ^{*1}	Nm	1.8	3.7	7.3	12.1
Allowable Continuous Torque ^{*1,2}	Nm	0.6	1.2	3	4.1
Maximum Speed ^{*1}	rpm	500	500	500	400
Allowable Continuous Speed ^{*1,2}	rpm	100	100	100	100
Maximum Current ^{*1}	A _{rms}	8.7	18.0	26.2	31.4
Allowable Continuous Current ^{*1,2}	A _{rms}	3.0	6.0	10.4	10.7
Moment of Inertia (GD ² /4)	kgm ²	0.00013	0.00039	0.001	0.0026
Allowable Moment Load	Nm	1.2	1.6	2.0	2.4
Moment Stiffness	Nm/rad	2.0 x 10 ³	3.3 x 10 ³	4.4 x 10 ³	5.1 x 10 ³
Motor Position Sensor		Hall sensor			
Encoder resolution per motor shaft revolution	counts/rev	30	30	30	48
Encoder resolution of output shaft	counts/rev	240	240	270	432
Weight	g	390	620	870	1,060
Installation Direction		Can be installed in any direction			
Enclosure		Fully enclosed self-cooling (IP40)			

48VDC

Item \ Size		FLA-11A-08HP	FLA-14A-08HP	FLA-17A-09HP	FLA-20A-09HP
Reduction Ratio		8:1	8:1	9:1	9:1
Power Supply Voltage	V	48VDC			
Maximum Torque ^{*1}	Nm	1.8	3.7	7.3	12.1
Allowable Continuous Torque ^{*1,2}	Nm	0.6	1.2	3	4.1
Maximum Speed ^{*1}	rpm	500	500	500	400
Allowable Continuous Speed ^{*1,2}	rpm	100	100	100	100
Maximum Current ^{*1}	A _{rms}	4.5	9.6	13.6	17.8
Allowable Continuous Current ^{*1,2}	A _{rms}	1.6	3.0	5.3	6.0
Moment of Inertia (GD ² /4)	kgm ²	0.00013	0.00039	0.001	0.0026
Allowable Moment Load	Nm	1.2	1.6	2.0	2.4
Moment Stiffness	Nm/rad	2.0 x 10 ³	3.3 x 10 ³	4.4 x 10 ³	5.1 x 10 ³
Motor Position Sensor		Hall sensor			
Encoder resolution per motor shaft revolution	counts/rev	30	30	30	48
Encoder resolution of output shaft	counts/rev	240	240	270	432
Weight	g	390	620	870	1,060
Installation Direction		Can be installed in any direction			
Enclosure		Fully enclosed self-cooling (IP40)			

The above values are typical values on the output shaft. Tested with Yaskawa drives.

*1: A typical value when used with F or S drive from Yaskawa:

F Series: FLA-11A or FLA-14A

S Series: FLA-17A or FLA-20A

*2: The value during saturation of temperature rise when mounted on an aluminum heat radiation board of a size described below.

(Heatsink dimensions: Size 11: 220 x 220 x 8mm, Size 14: 250 x 250 x 10mm, Size 17: 280 x 280 x 12mm, Size 20: 300 x 300 x 15mm)

FLA-FB - HarmonicDrive® Speed Reducer

24VDC

Size		FLA-11A-xxFB		FLA-14A-xxFB		FLA-17A-xxFB		FLA-20A-xxFB
Reduction Ratio		50:1	100:1	50:1	100:1	50:1	100:1	50:1
Power Supply Voltage	V	24VDC						
Maximum Torque [*]	Nm	6.7	11	11.2	18.2	23	34	33
Allowable Continuous Torque ^{*1,2}	Nm	1.7	2.4	2.6	3.8	7.9	11.4	13
Maximum Speed ^{*1}	rpm	100	50	100	50	100	50	80
Allowable Continuous Speed ^{*1,2}	rpm	60	30	60	30	60	30	50
Maximum Current ^{*1}	A _{rms}	6.0	5.0	9.7	8.7	18.4	14.3	19.2
Allowable Continuous Current ^{*1,2}	A _{rms}	1.9	1.7	3.0	2.5	6.8	5.3	8.7
Moment of Inertia (GD ² /4)	kgm ²	0.0073	0.029	0.019	0.077	0.048	0.19	0.12
Allowable Moment Load	Nm	1.2		1.6		2.0		2.4
Moment Stiffness	Nm/rad	2.0 x 10 ³		3.3 x 10 ³		4.4 x 10 ³		5.1 x 10 ³
Motor Position Sensor		Hall sensor						
Encoder resolution per motor shaft revolution	counts/rev	30		30		30		48
Encoder resolution of output shaft	counts/rev	1,500	3,000	1,500	3,000	1,500	3,000	2,400
Weight	g	420		720		940		1,170
Installation Direction		Can be installed in any direction						
Enclosure		Fully enclosed self-cooling (IP40)						

48VDC

Size Item		FLA-11A-xxFB		FLA-14A-xxFB		FLA-17A-xxFB		FLA-20A-xxFB
Reduction Ratio		50:1	100:1	50:1	100:1	50:1	100:1	50:1
Power Supply Voltage	V	48VDC						
Maximum Torque [*]	Nm	6.7	11	11.2	18.2	23	34	33
Allowable Continuous Torque ^{*1,2}	Nm	1.7	2.4	2.6	3.8	7.9	11.4	13
Maximum Speed ^{*1}	rpm	100	50	100	50	100	50	80
Allowable Continuous Speed ^{*1,2}	rpm	60	30	60	30	60	30	50
Maximum Current ^{*1}	A _{rms}	3.1	2.6	4.8	4.2	9.4	7.2	10.7
Allowable Continuous Current ^{*1,2}	A _{rms}	1.0	0.8	1.5	1.2	3.4	2.9	5.1
Moment of Inertia (GD ² /4)	kgm ²	0.0073	0.029	0.019	0.077	0.048	0.19	0.12
Allowable Moment Load	Nm	1.2		1.6		2.0		2.4
Moment Stiffness	Nm/rad	2.0 x 10 ³		3.3 x 10 ³		4.4 x 10 ³		5.1 x 10 ³
Motor Position Sensor		Hall sensor						
Encoder resolution per motor shaft revolution	counts/rev	30		30		30		48
Encoder resolution of output shaft	counts/rev	1,500	3,000	1,500	3,000	1,500	3,000	2,400
Weight	g	420		720		940		1,170
Installation Direction		Can be installed in any direction						
Enclosure		Fully enclosed self-cooling (IP40)						

The above values are typical values on the output shaft. Tested with Yaskawa drives.

*1: A typical value when used with F or S drive from Yaskawa:

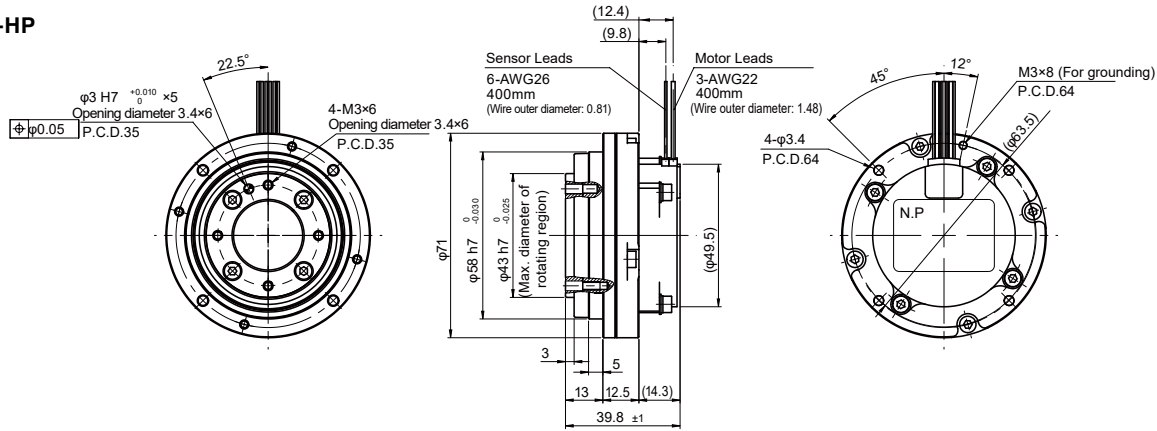
F Series: FLA-11A or FLA-14A

S Series: FLA-17A or FLA-20A

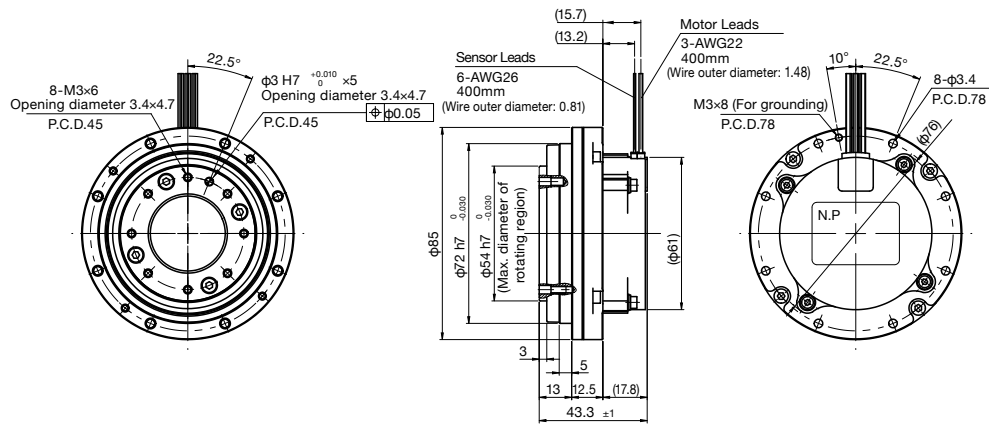
*2: The value during saturation of temperature rise when mounted on an aluminum heat radiation board of a size described below.
(Heatsink board dimensions: Size 11: 220 x 220 x 8mm, Size 14: 250 x 250 x 10mm, Size 17: 280 x 280 x 12mm, Size 20: 300 x 300 x 15mm)

Outline Dimensions

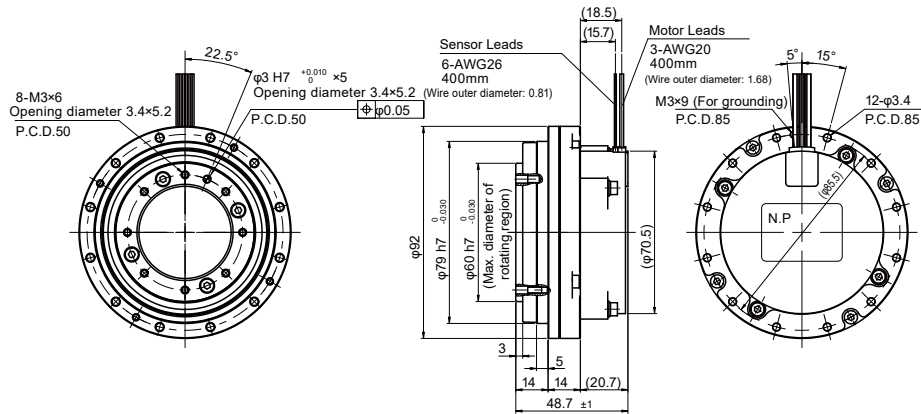
FLA-11A-HP



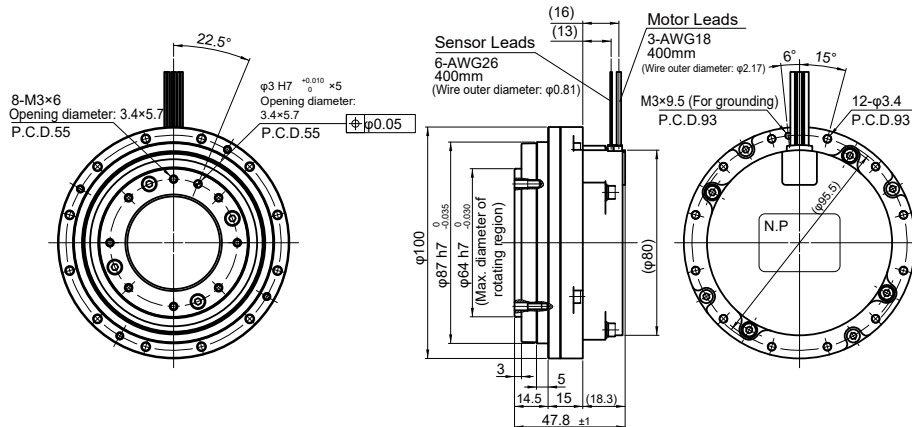
FLA-14A-HP



FLA-17A-HP

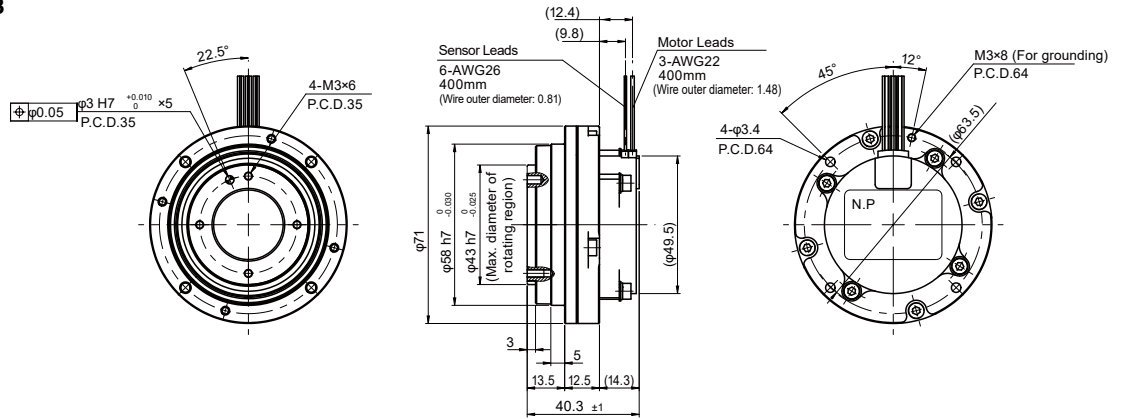


FLA-20A-HP

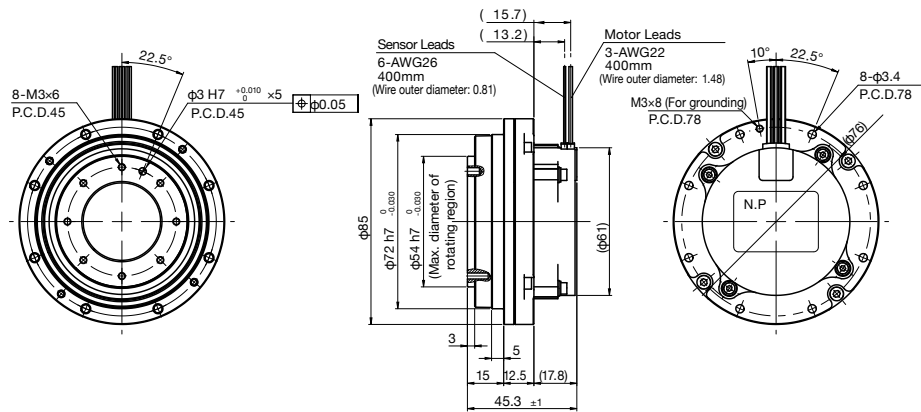


Outline Dimensions

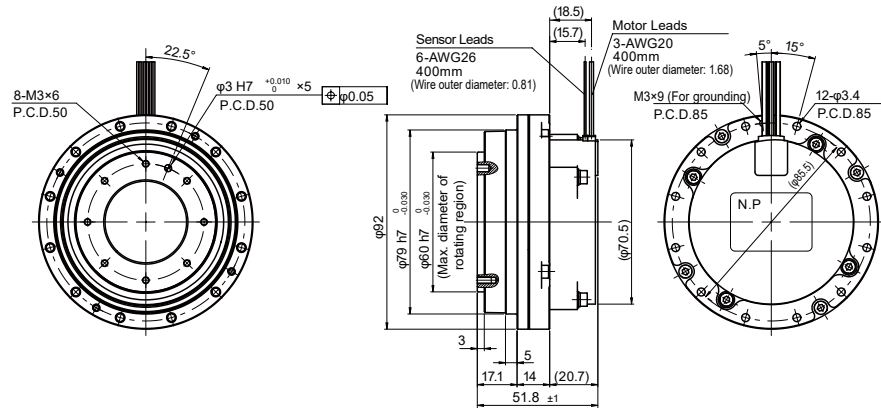
FLA-11A-FB



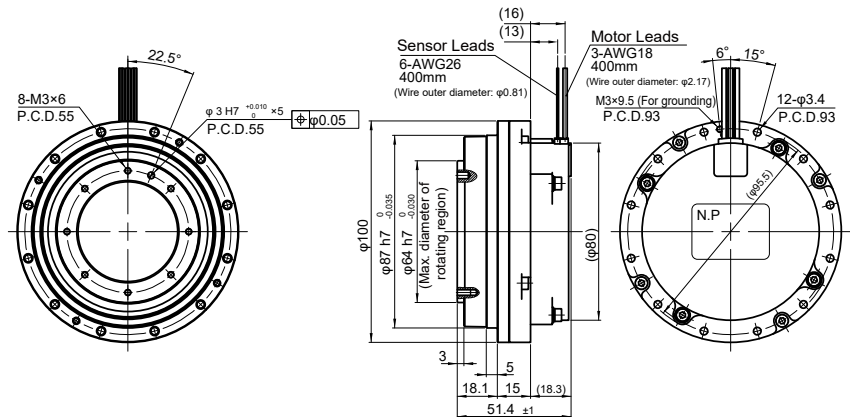
FLA-14A-FB



FLA-17A-FB



FLA-20A-FB



Operating Range

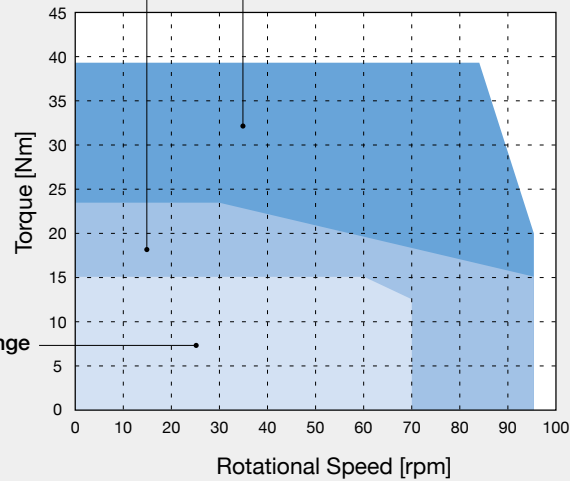
This graph plots operating ranges when an FLA is combined with a Yaskawa CCMDSP-D40P4YC1 (S Series) servo drive.

■ 50% duty motion range

This range indicates the torque/speed where 50% duty cycle operation is permitted (the ratio of operating time and delay time is 50:50).

■ Continuous motion range

The range allows continuous operation of the actuator.



■ Motion range during acceleration and deceleration

This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.

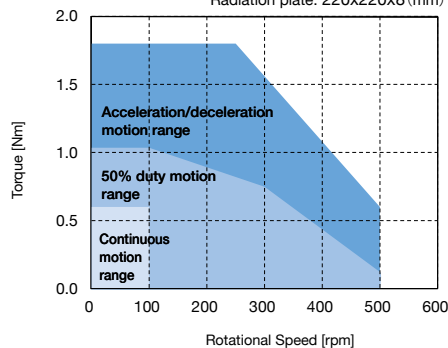
Note 1: The continuous and 50% duty motion ranges shown on each graph are measured when the actuator is mounted to an aluminum heatsink as specified.
 Note 2: See the technical information for selection of a model No.

Operating Range

HP (24VDC) Combined Drive: Yaskawa CCMDSP-D40P4YC1 (S Series)

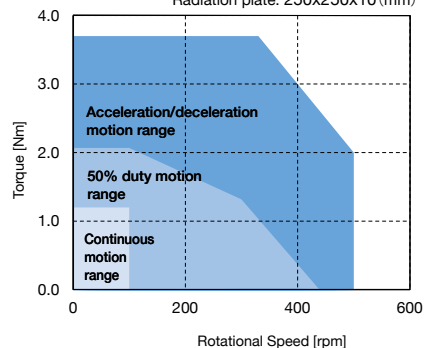
■ FLA-11A-08HP-H-24V

Radiation plate: 220x220x8 (mm)



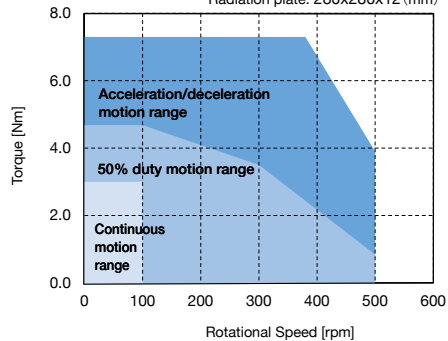
■ FLA-14A-08HP-H-24V

Radiation plate: 250x250x10 (mm)



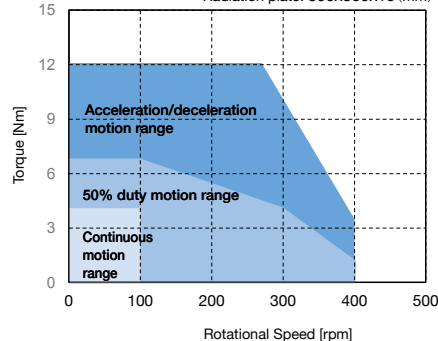
■ FLA-17A-09HP-H-24V

Radiation plate: 280x280x12 (mm)



■ FLA-20A-09HP-H-24V

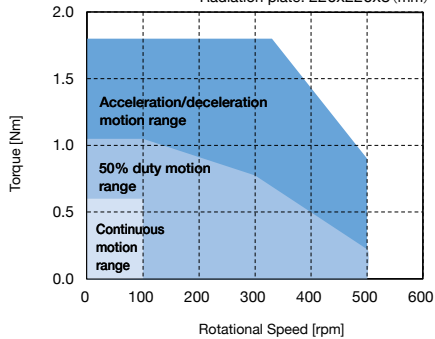
Radiation plate: 300x300x15 (mm)



HP (48VDC) Combined Drive: Yaskawa CCMDSP-D40P4YC1 (S Series)

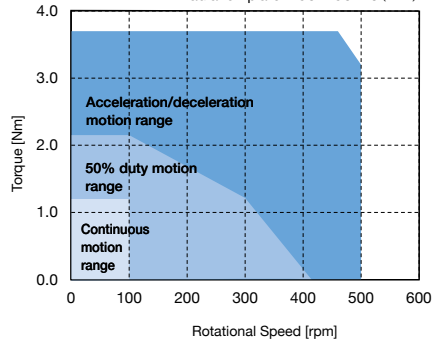
■ FLA-11A-08HP-H-48V

Radiation plate: 220x220x8 (mm)



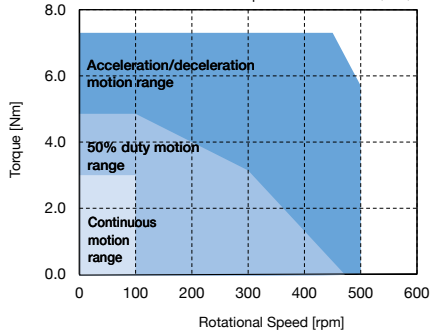
■ FLA-14A-08HP-H-48V

Radiation plate: 250x250x10 (mm)



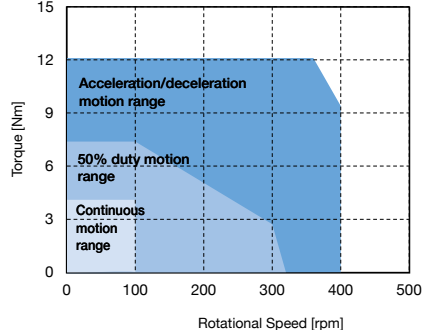
■ FLA-17A-09HP-H-48V

Radiation plate: 280x280x12 (mm)



■ FLA-20A-09HP-H-48V

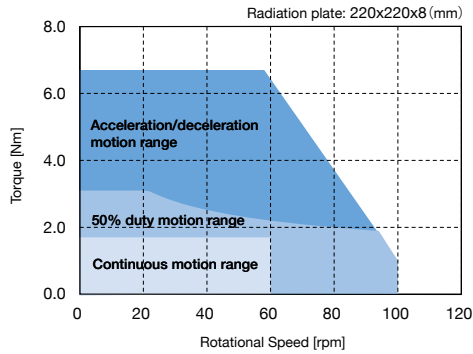
Radiation plate: 300x300x15 (mm)



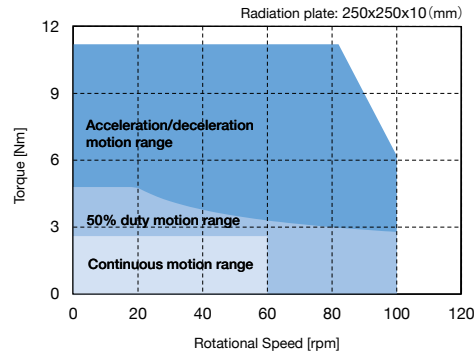
Operating Range

FB (Speed Ratio 50, 24VDC) Combined Drive: Yaskawa CCMDSP-D40P4YC1 (S Series)

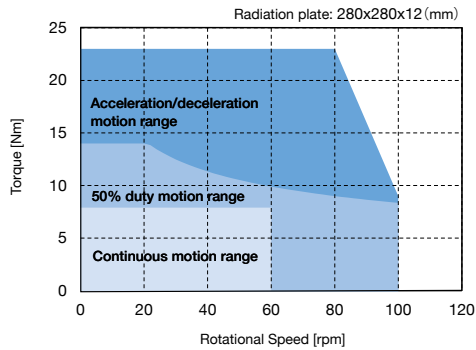
■ FLA-11A-50FB-H-24



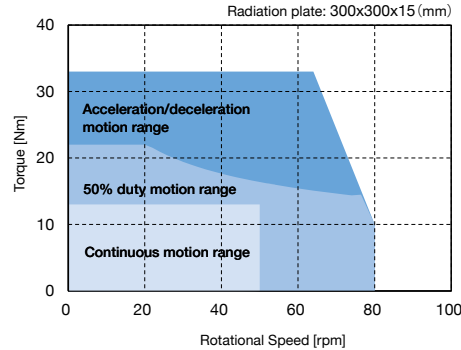
■ FLA-14A-50FB-H-24



■ FLA-17A-50FB-H-24

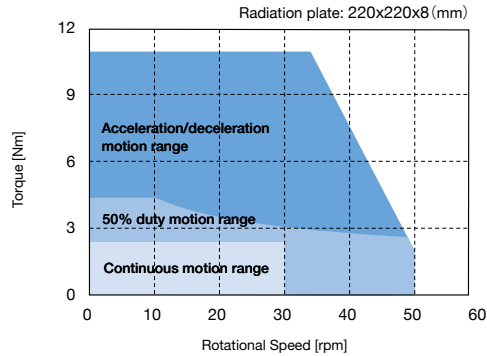


■ FLA-20A-50FB-H-24

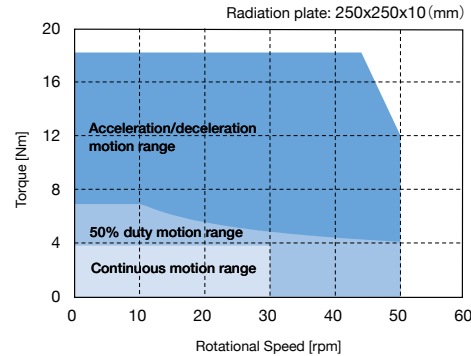


FB (Speed Ratio 100, 24VDC) Combined Drive: Yaskawa CCMDSP-D40P4YC1 (S Series)

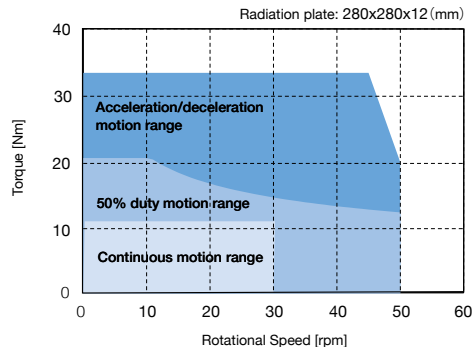
■ FLA-11A-100FB-H-24



■ FLA-14A-100FB-H-24



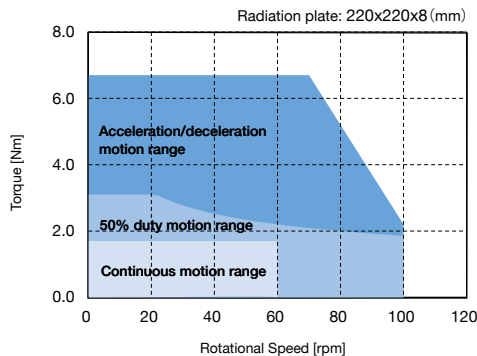
■ FLA-17A-100FB-H-24



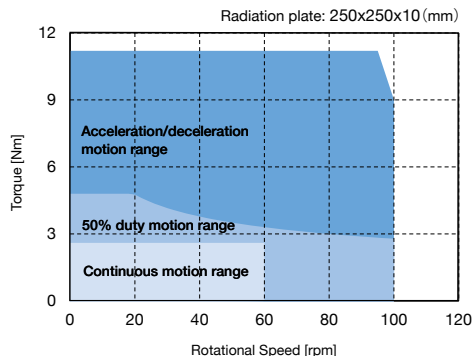
Operating Range

FB (Speed Ratio 50, 48VDC) Combined Drive: Yaskawa CCMDSP-D40P4YC1 (S Series)

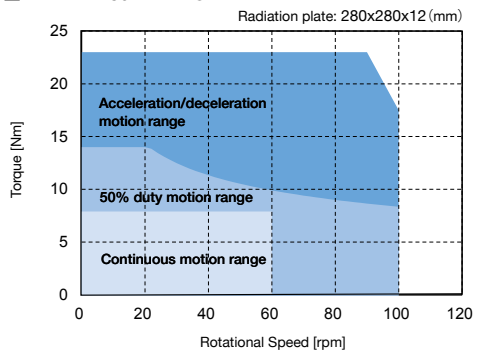
■ FLA-11A-50FB-H-48



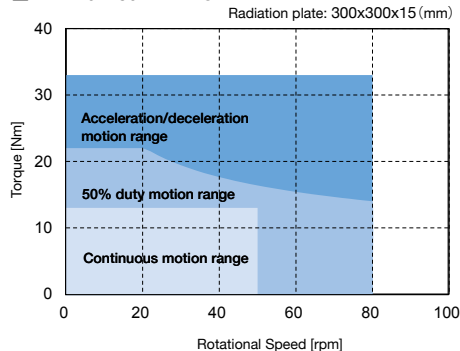
■ FLA-14A-50FB-H-48



■ FLA-17A-50FB-H-48

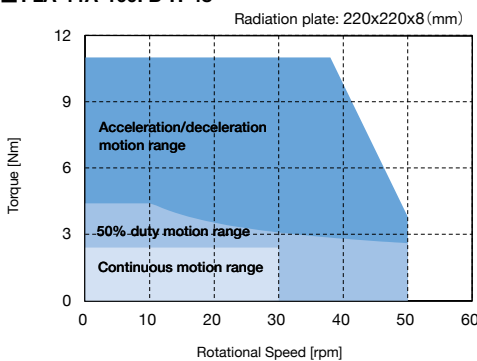


■ FLA-20A-50FB-H-48

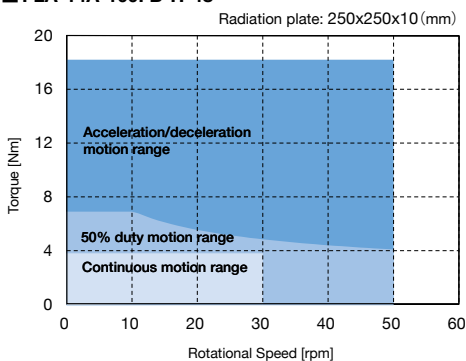


FB (Speed Ratio 100, 48VDC) Combined Drive: Yaskawa CCMDSP-D40P4YC1 (S Series)

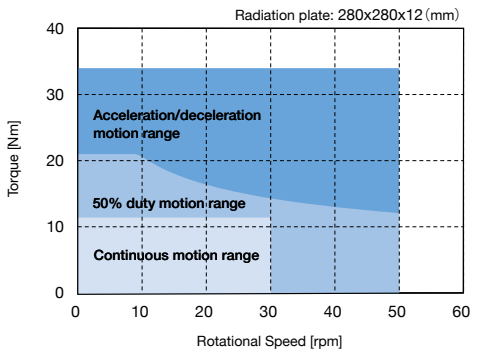
■ FLA-11A-100FB-H-48



■ FLA-14A-100FB-H-48



■ FLA-17A-100FB-H-48



MEMO

[illegible]

RKF Series



The RKF series is compact and includes high torque AC servo actuators with high-rotational accuracy, a flange output combining one of our Harmonic Drive® gears and an AC servo motor. The RKF Series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's RTL Series, and REL Series.

Features

■ High Resolution

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

■ High-Positional Accuracy

Our HarmonicDrive® gear unit 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.

Ordering Code

RKF - **20** **A** - **50** - **E** **200** - **SP**
 (1) (2) (3) (4) (5) (6) (7)

1	Model	RKF Series
2	Size	20, 25, 32
3	Design Version	A
4	Gear Ratio	50, 100
5	Encoder Type	E: Incremental Encoder
6	Encoder Resolution	200: 2000p/revolutions
7	Special specification	Blank: Standard Product SP: Special Specification Code

Specifications

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		

Size Item			RKF-20A		RKF-25A		RKF-32A	
			50	100	50	100	50	100
Rated Output ¹³		W	120	111	180	190	310	310
Power Supply Voltage ¹³		V	AC200					
Rated Torque ¹³		Nm	19	35	29	59	49	98
Rated Rotational Speed ¹³		rpm	60	30	60	30	60	30
Continuous Stall Torque ¹³		Nm	19	35	29	59	49	98
Maximum Momentary Torque ¹³		Nm	56	82	98	157	220	330
Max. Rotational Speed ¹³		rpm	90	45	90	45	90	45
Moment of Inertia ¹⁴	GD ² /4	kgm ²	0.098	0.39	0.19	0.77	0.67	2.7
	J	kgfcms ²	1.0	4.0	2.0	7.9	6.9	27
Allowable Radial Load		N	2000		2500		3900	
Allowable Axial Load		N	880		1100		1600	
Encoder resolution of output shaft with quadrature ¹⁵		counts/revolution	400,000	800,000	400,000	800,000	400,000	800,000
Mass		kg	2.9		5.0		9.5	
Combined Drive			HA-800-3B-200		HA-800-3B-200		HA-800-6B-200	
Compatible HDLLC Drives			RTL-230-18, REL-230-18					

* 1: The figures in the table are those at the output shaft.

* 2: The actuator specification is the value when mounted on the following heatsink:

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 the speed reducer 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.

One-Way Positional Accuracy

The one-way positional accuracy and repeatability are shown below. The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The RKF actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.

One-Way Positional Accuracy

Size		RKF-20A	RKF-25A	RKF-32A
Item	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	$\pm 1.46 \times 10^{-4}$	$\pm 1.21 \times 10^{-4}$	$\pm 0.97 \times 10^{-4}$

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

Mechanical Accuracy

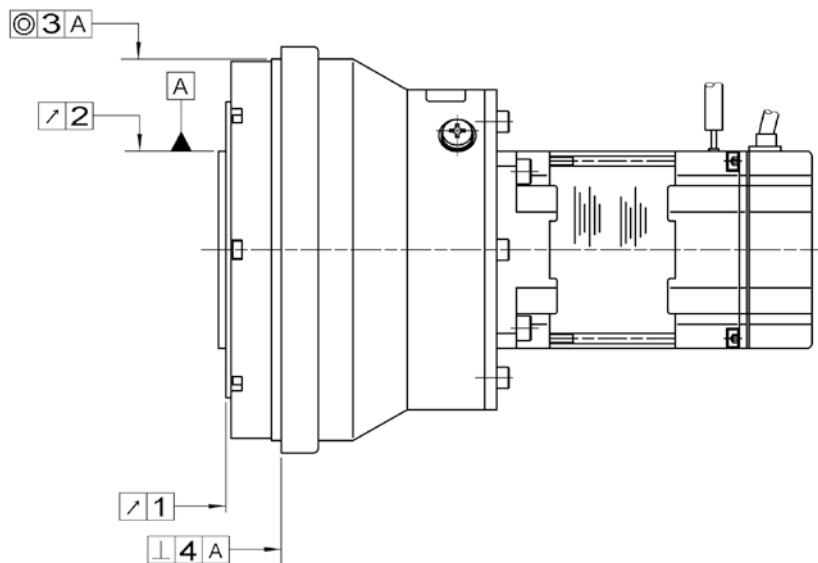
The mechanical accuracies of the output shaft and mounting of the RKF series are as follows.

Mechanical Accuracy

(Unit: mm)

Accuracy Item	RKF-20A	RKF-25A	RKF-32A
1 Axial runout of the output shaft	0.04	0.04	0.04
2 Radial runout of the output shaft	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.

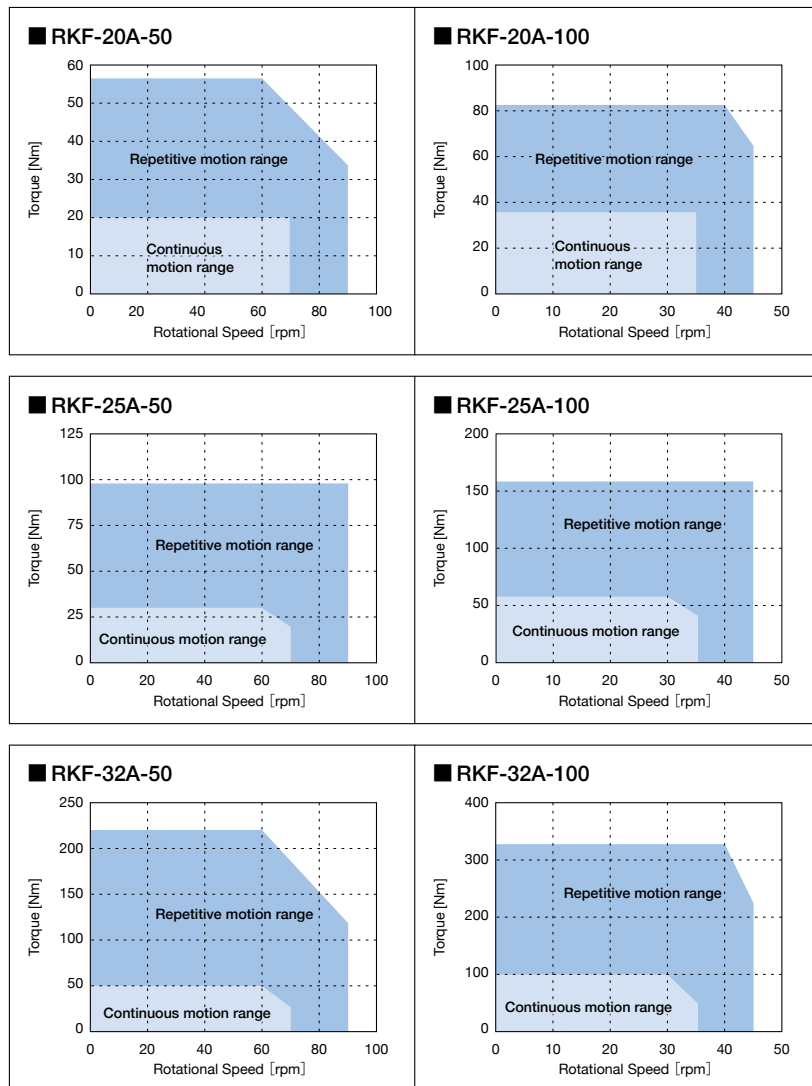


Operating Range

The following diagrams show the operating range of the RKF series combined with an HA-800 AC servo drive.

Continuous Motion Range: The range allows continuous operation of the actuator.

Repetitive Motion Range: This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.



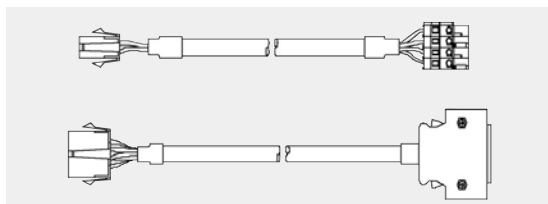
Note 1: The values in the graphs are those when the actuator is mounted to a heatsink as specified:
RKF-20: 250x250x12 (mm)
RKF-25, RKF-32: 300x300x15 (mm)

Options

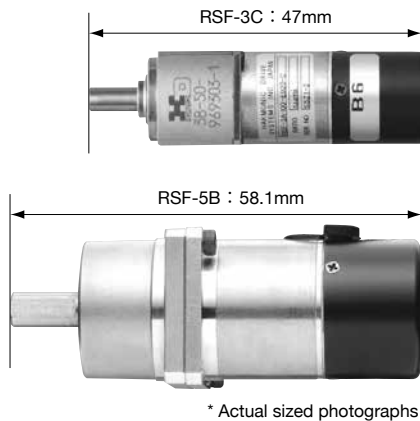
Extension Cable (For HA-520)

Order Code Example: EWA-M ** -A04-WG04 (For motor)
EWA-E ** -M15-3M36 (For incremental encoder)
The cable for connecting the actuator to the servo driver HA-520.

(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m).



RSF Supermini Series



These extremely small servo actuators integrate zero backlash Harmonic Drive® precision gears, a brushless servo motor and an incremental encoder. Small enough to fit in the fingers of a robotic hand, these actuators are instrumental driving tiny robotic joints. The RSF Supermini series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's DCJ Series, DDP Series, and HA680 drivers.



Features

■ Compact, Lightweight and High Torque

Our actuators are the union of Harmonic Drive® gearing with a super-flat AC servomotor. The ultra-compact size allows integration to smaller machines. RSF supermini series actuator outputs have a much higher torque per volume than direct drive motors.

■ Advanced Positioning Accuracy

Integrated Harmonic Drive® gear for zero backlash and advanced positioning accuracy.

■ Stable Controllability

High reduction ratio for 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 10,000rpm., thereby expanding the operational range of an actuator.

Ordering Code

RSF - **5B** **50** - **US** **50** - **C** - **SP**

(1) (2) (3) (4) (5) (6) (7)

1	Model	RSF Supermini Series
2	Size	3C, 5B
3	Gear Ratios	30, 50, 100
4	Encoder Type	US: Incremental Encoder
5	Encoder Resolution	020: 200p/revolutions 050: 500p/revolutions
6	Options	C: Standard Item (with connector) BC: With Brake (with connector) (only for Size 5B)
7	Special Specification	Blank: Standard Product SP: Special Specification Code

Specifications

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		

Size Item			RSF-3C			RSF-5B		
			30	50	100	30	50	100
Power Supply Voltage		V	24VDC±10%			24VDC±10%		
Allowable Continuous Current		A _{rms}	0.65	0.66	0.56	1.11	0.92	0.76
Allowable Continuous Torque (during operation at allowable continuous rotation speed)		Nm	0.03	0.07	0.11	0.18	0.29	0.44
Allowable Continuous Rotation Speed (output shaft)		rpm	150	90	45	150	90	45
Allowable Continuous Stall Torque		Nm	0.04	0.08	0.12	0.28	0.44	0.65
Instantaneous Maximum Current		A _{rms}	1.5	1.4	1.1	2.3	2.2	1.7
Maximum Torque		Nm	0.13	0.21	0.3	0.5	0.9	1.4
Maximum Speed		rpm	333	200	100	333	200	100
Torque Constant		Nm/A _{rms}	0.11	0.18	0.40	0.30	0.54	1.1
EMF Constant		V/(rpm)	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	kgm 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	kgfcm 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)
Allowable Radial Load (output shaft central value)		N	36			90		
Allowable Axial Load		N	130			270		
Encoder Pulses (motor shaft)		Pulse	200			500		
Encoder resolution of output shaft with quadrature ⁴		counts/ revolution	24,000	40,000	80,000	60,000	100,000	200,000
Motor Shaft Brake	Input Power Voltage	V	-			24VDC±10%		
	Retention Torque	Nm	-			0.18	0.29	0.44
Mass ⁵	Without Brake	g	31.0 (except clamp filter)			66.0 (except clamp filter)		
	With Brake	g	-			86.0 (except clamp filter)		
Combined Drive			HA-680-4B-24			HA-680-4B-24		
Compatible HDLLC Drives			DCJ-055-09, DDP-090-09					

*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 speed reducer. 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).

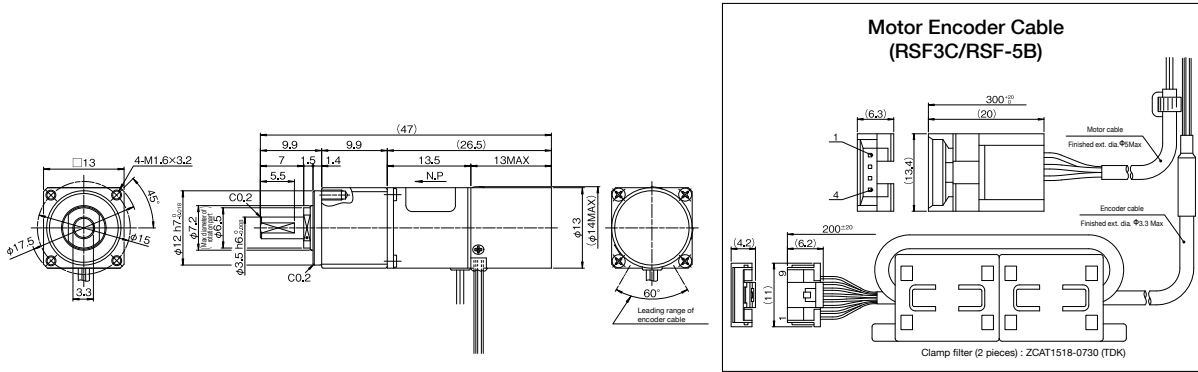
*5: The weight of clamp filter is 6g each.

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

Outline Dimensions

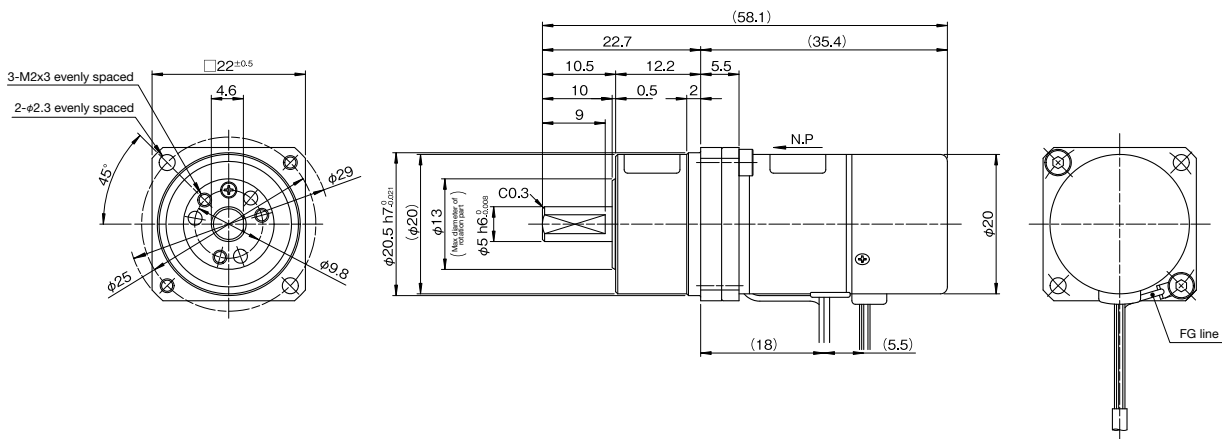
RSF-3C

Unit: mm



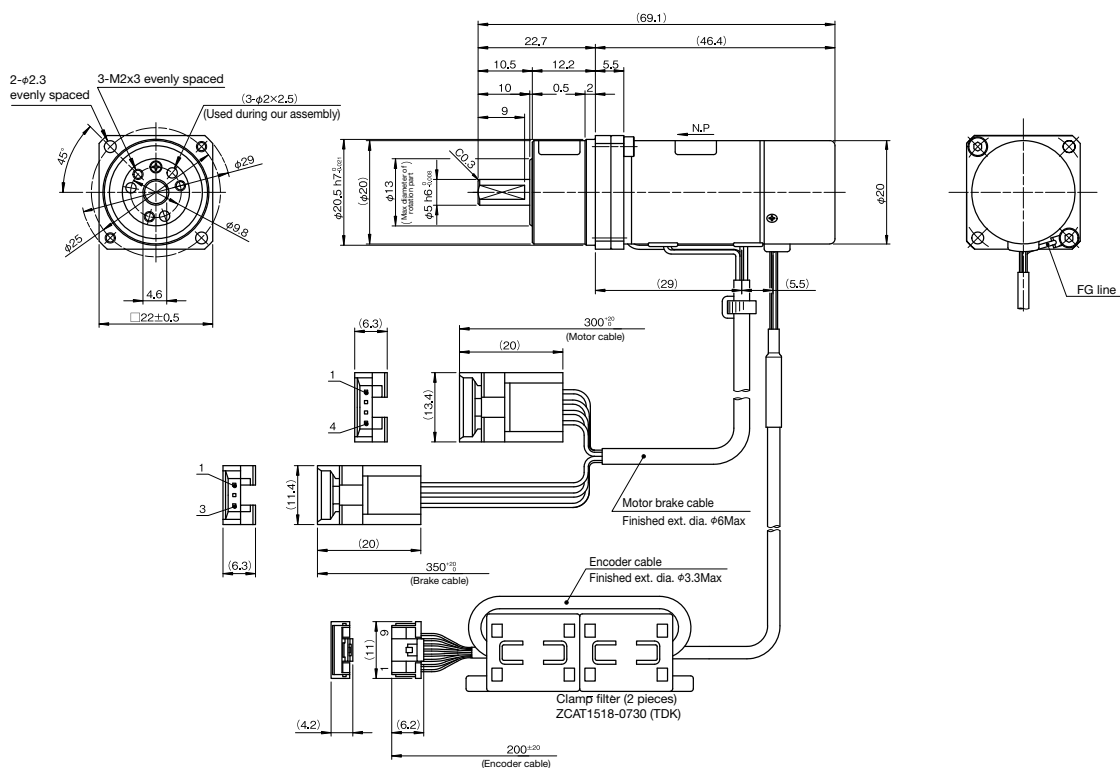
RSF-5B

Unit: mm



RSF-5B (with brake)

Unit: mm

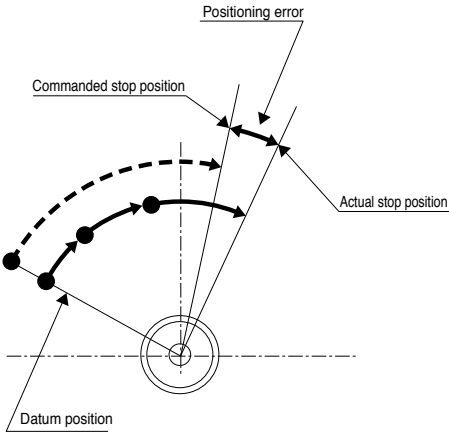


* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The RSF Supermini actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.



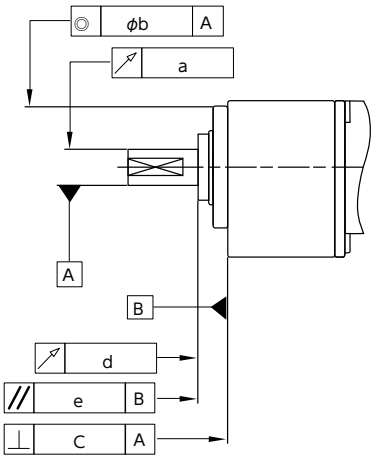
One-Way Positional Accuracy

Item	Size	RSF-3C			RSF-5B		
		30	50	100	30	50	100
One Way 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}

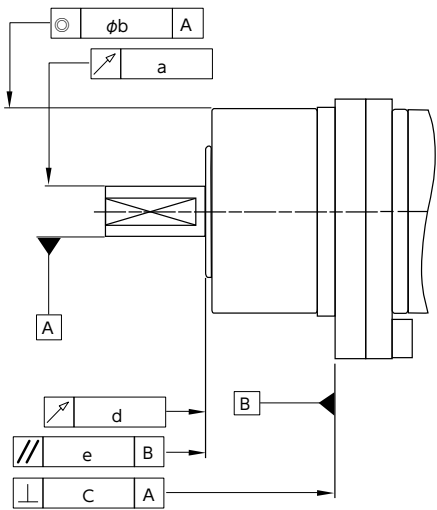
Mechanical Accuracy

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 gauge reading when the measurement unit is rotated once.

Operating Range

This graph plots operating ranges when an RSF-3C or RSF-5B is combined with an HA-680 servo drive.

50% duty motion range

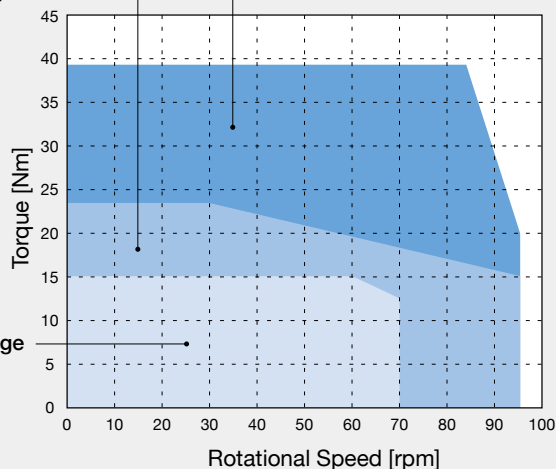
This range indicates the torque/speed where 50% duty cycle operation is permitted (the ratio of operating time and delay time is 50:50).

Continuous motion range

The range allows continuous operation of the actuator.

Motion range during acceleration and deceleration

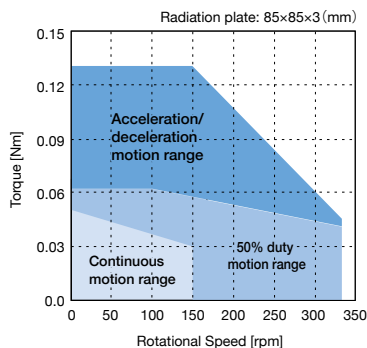
This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.



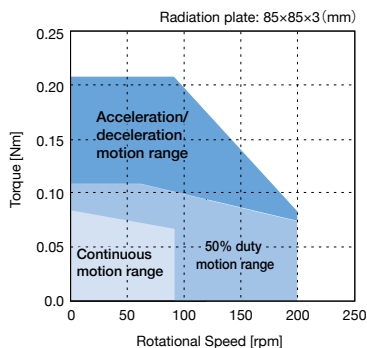
Note 1: The continuous and 50% duty motion ranges shown on each graph are measured when the actuator is mounted to an aluminum heatsink as specified.

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

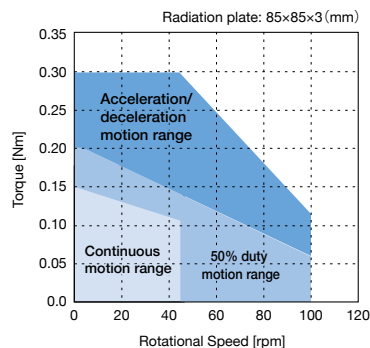
RSF-3C-30-E020-C



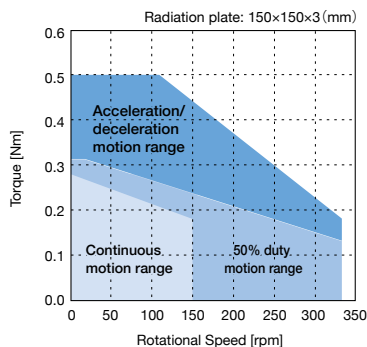
RSF-3C-50-E020-C



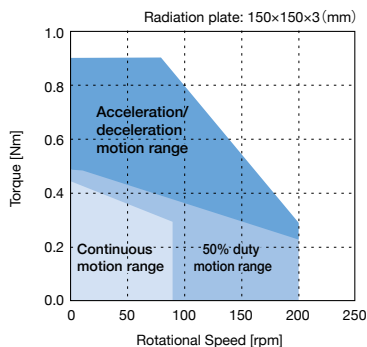
RSF-3C-100-E020-C



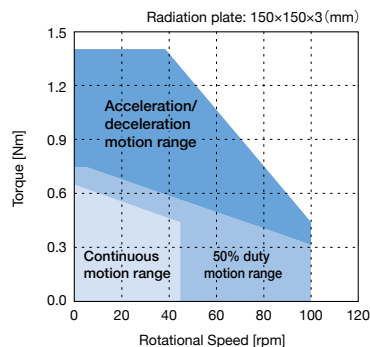
RSF-5B-30-E050-C, RSF-5B-30-E050-BC



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

Extension Cable (For HA-680)

Order Code Example:

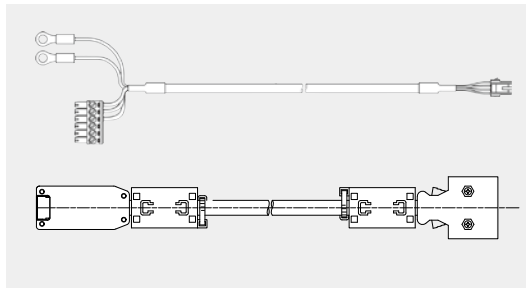
EWA-M ** -JST04-TN2 (For motor)

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.

(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m).

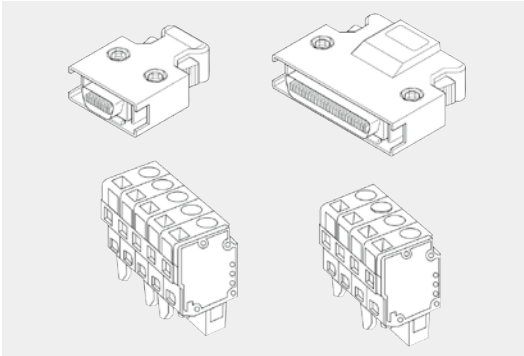


Connector

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

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

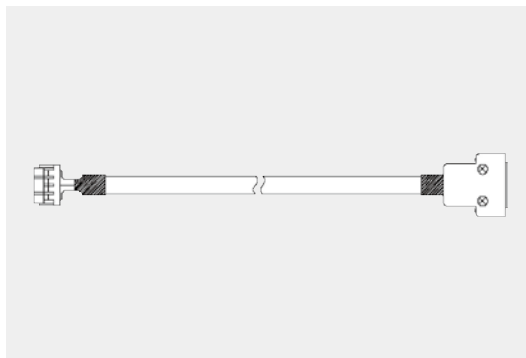
Connectors to connect the power supply, motor line, encoder line and I/O signals



EIA-232 (RS-232C) Communication Cable

Order Code Example: HDM-RS232C

The cable to connect the PC and servo driver.
Cable length (1.5m).

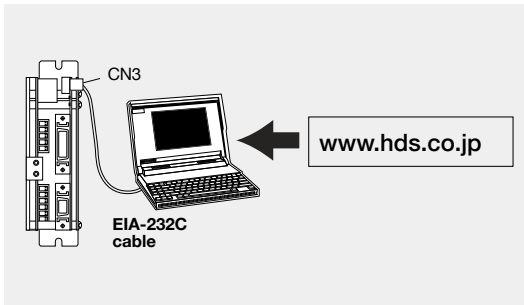


Servo Parameter Setting Software (Free delivery)

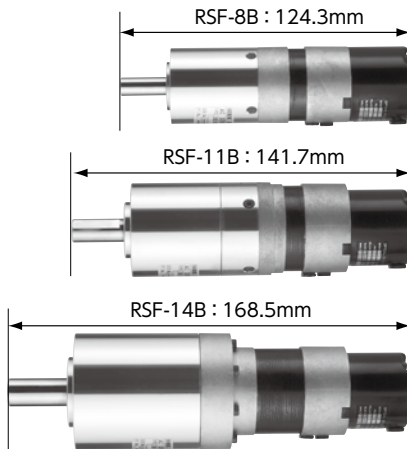
Reference model: PSF-520

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 (<http://www.hds.co.jp/>).

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



RSF-B Mini Series



RSF-B mini series are AC servo actuators that utilize zero backlash Harmonic Drive® precision gears for precise motion control. The RSF Mini Series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's DCJ Series, DDP Series, and HA680 drivers. Use RSF-B mini series for robot joint drive, semiconductor, LCD manufacturer, machine tools and other various types of FA devices.



Features

- Zero Backlash
- Exceptional Positional Accuracy
- Compact Design
- High Rotational Accuracy
- High Resolution
- Easy-to-Operate Dedicated Driver

Ordering Code

RSF	-	8	B	-	30	-	F	100	-	24	B	-	C	-	SP
(1)		(2)	(3)		(4)		(5)	(6)		(7)	(8)		(9)		(10)

1	Model	RSF-B Mini Series
2	Size	8, 11, 14
3	Design Version	B
4	Gear Ratio	30, 50, 100
5	Encoder Type	F: Incremental Encoder + Pole Sensor
6	Encoder Resolution	100:1000p/revolutions
7	Power Voltage Supply	24:24V
8	Encoder Output Form	A: 0° (Special) B: 30° (Standard)
9	Options	Blank: No Connector C: Connector Attached (Standard)
10	Special Specification	Blank: Standard Product SP: Special Specification Code

Specifications

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		Size	RSF-8B			RSF-11B			RSF-14B		
		30	50	100	30	50	100	30	50	100	
Power Supply Voltage		V	24VDC±10%								
Allowable Continuous Current		A _{rms}	2.0	2.0	1.5	5.0	4.9	4.9	4.9	4.7	4.7
Allowable Continuous Torque (during operation at allowable continuous rotation speed)		Nm	0.78	1.4	2.0	1.1	2.0	4.0	1.7	3.0	6.0
Allowable Continuous Rotation Speed (output shaft)		rpm	100	60	30	100	60	30	100	60	30
Allowable Continuous Stall Torque		Nm	0.95	1.7	3.5	1.7	3.0	5.7	2.5	4.5	9.0
Instantaneous Maximum Current		A _{rms}	3.8	3.9	2.9	14.4	15.8	9.4	14.4	17.2	12.3
Maximum Torque		Nm	1.8	3.3	4.8	4.5	8.3	11	9.0	18	28
Maximum Speed		rpm	200	120	60	200	120	60	200	120	60
Torque Constant		Nm/A _{rms}	0.62	1.1	2.1	0.40	0.66	1.5	0.76	1.3	2.6
EMF Constant		V/(rpm)	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	kgm 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
Allowable Radial Load (output shaft central value)		N	196			245			392		
Allowable Axial Load		N	98			196			392		
Encoder Pulses (motor shaft)		Pulse	1000								
Encoder resolution of output shaft with quadrature ⁴		counts/revolution	120,000	200,000	400,000	120,000	200,000	400,000	120,000	200,000	400,000
Mass		g	300			500			800		
Combined Drive			HA-680-4B-24			HA-680-6B-24					
Compatible HDLLC Drives			DCJ-055-09, DDP-090-09,			DDP-090-36					

*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 drive (HA-680).

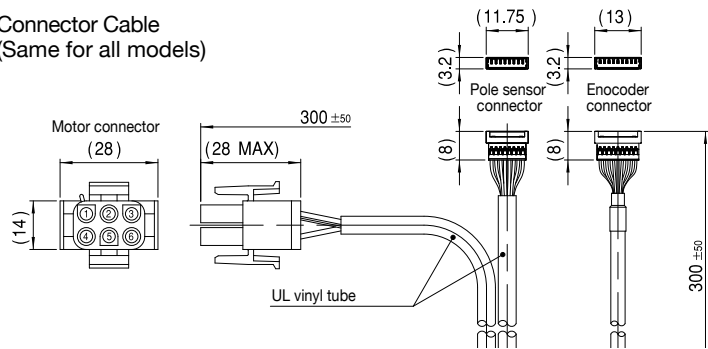
*3: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the speed reducer. The values in parentheses are for equipment with a brake.

*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.

Outline Dimensions

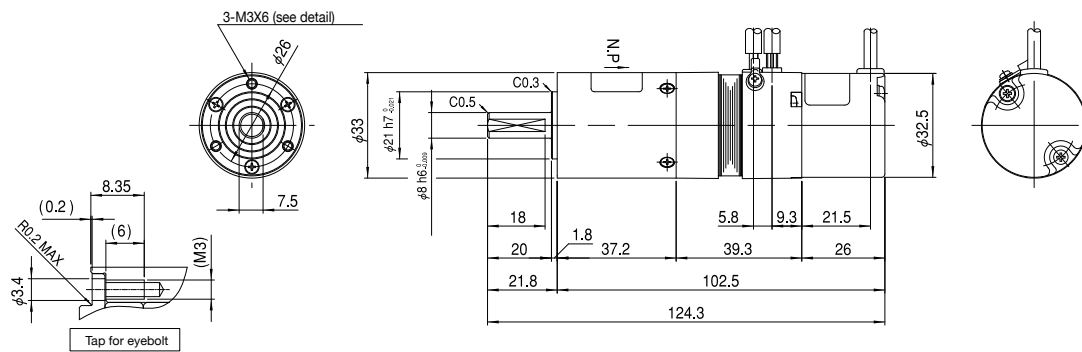
Connector Cable
(Same for all models)



Unit: mm

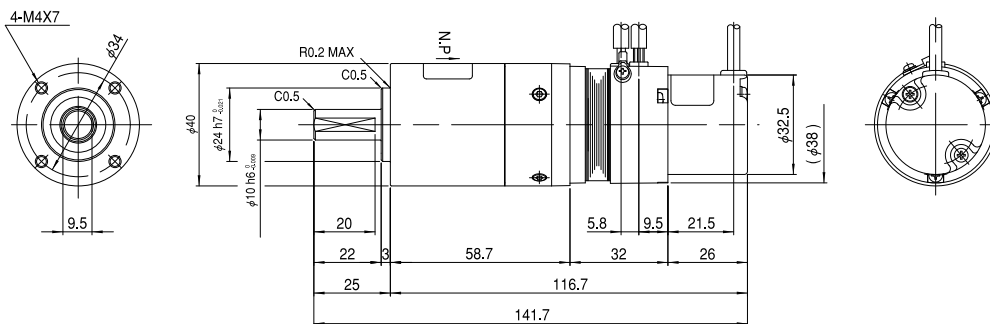
RSF-8B

Unit: mm



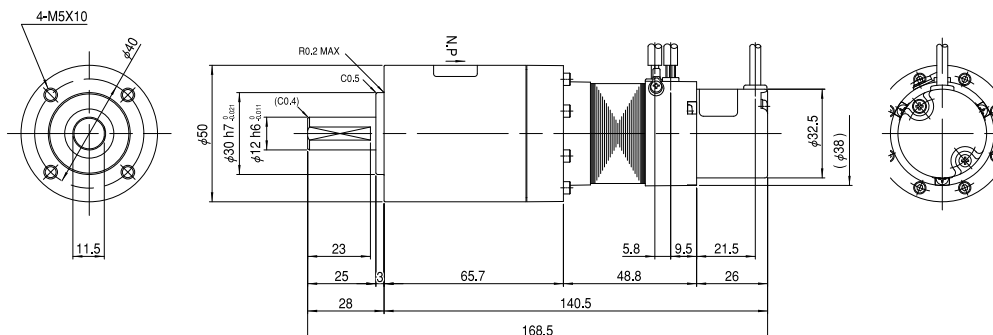
RSF-11B

Unit: mm



RSF-14B

Unit: mm



* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The RSF-B Mini actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.

The accuracy for each gear ratio is shown below.

One-Way Positional Accuracy

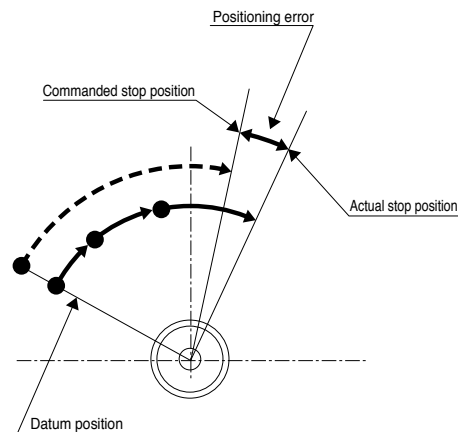
Item \ Size		RSF-8B			RSF-11B			RSF-14B		
		30	50	100	30	50	100	30	50	100
One Way Positional Accuracy	arc min	3	2.5		2.5	2		2.5	2	
	rad	8.73×10^{-4}	7.27×10^{-4}		7.27×10^{-4}	5.82×10^{-4}		7.27×10^{-4}	5.82×10^{-4}	

□ 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.



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

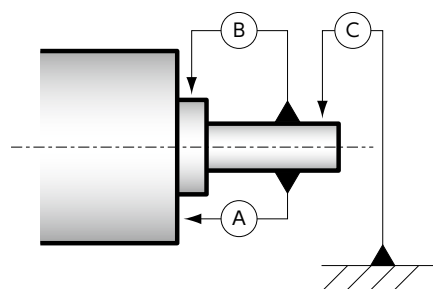
Accuracy Item	A	B	C
RSF-8B	0.04	0.04	0.03
RSF-11B	0.04	0.04	0.03
RSF-14B	0.04	0.04	0.03

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

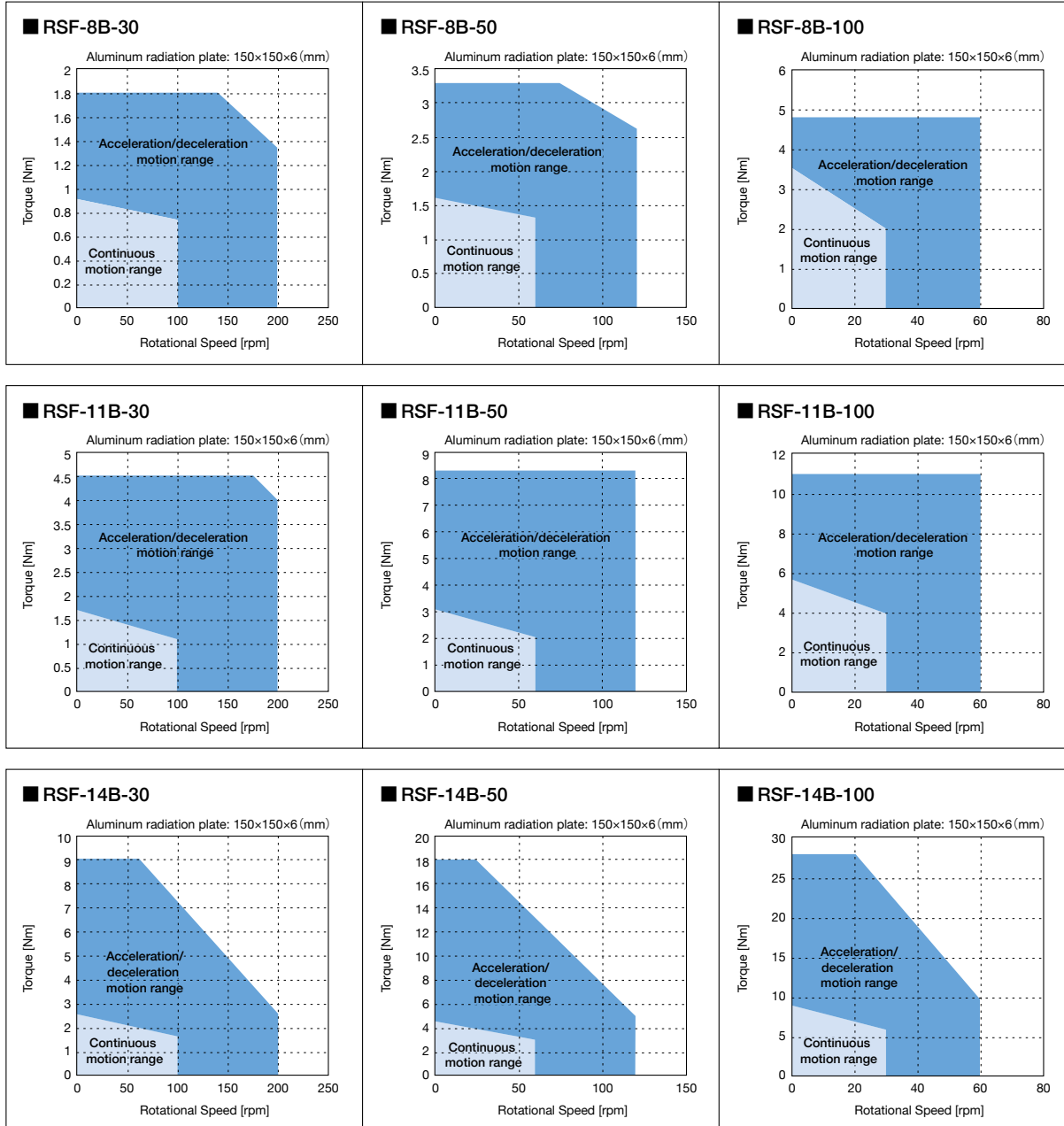
C: Deflection of the output shaft end



Operating Range

The following graphs show the operating ranges of the RSF-B mini series actuators combined with the dedicated AC servo drive HA-680 by the power voltage 24VDC input.

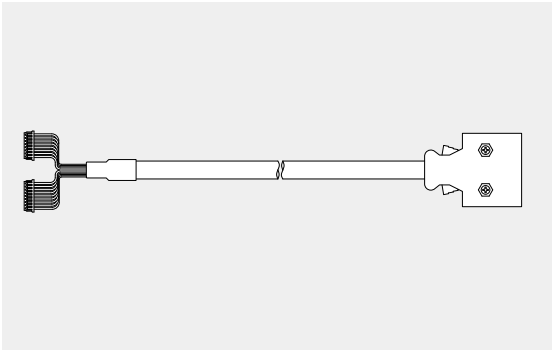
- **Continuous Motion Range:** The range allows continuous operation of the actuator.
- **Motion Range During Acceleration and Deceleration:** This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.



Options

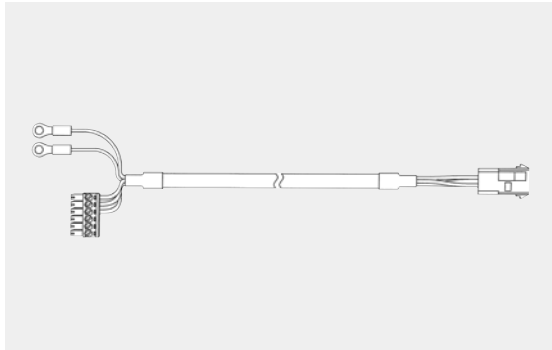
Encoder + Pole Sensor Cable

Order Code Example: EWB-F ** -M0809-3M14
The cable to connect the encoder + pole sensor and servo driver.
(** indicates the cable length (03:3m, 05:5m, 10:10m).
Note: This cable is mandatory for the connection between motor and servo driver.



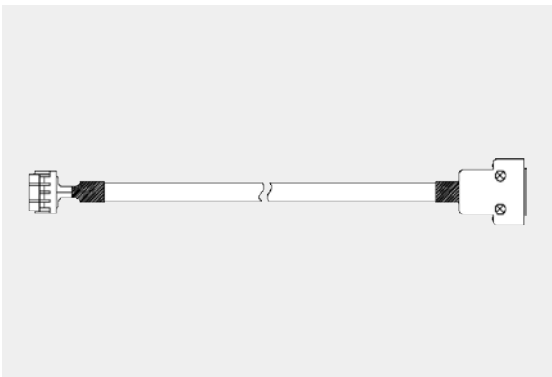
Extension Cable for Motor

Order Code Example: EWC-MB ** -A06-TN2
The cable to connect the motor and servo driver
(** indicates the cable length (03:3m, 05:5m, 10:10m).
Note: This cable is mandatory for the connection between motor and servo driver.

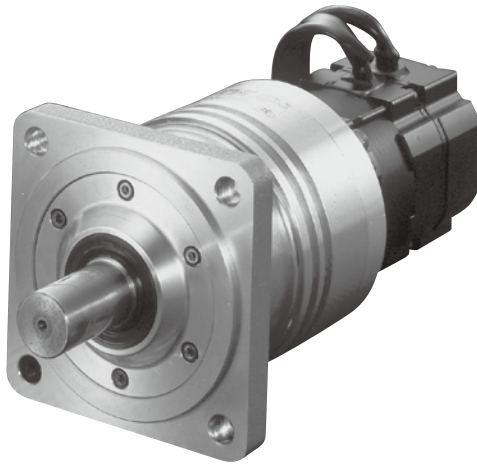


EIA-232 (RS-232C) Communication Cable

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



RSF Series



The RSF series servo actuator combines a high performance brushless servomotor with a high accuracy Harmonic Drive® gearhead. When combined with a performance matched servo drive, the RSF actuator delivers precise, reliable motion control for machines requiring both high torque and long life. The RSF Series is designed to operate with a wide range of third party drivers as well as Harmonic Drive LLC's RTL Series, and REL Series.

Features

■ High Resolution

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

■ High-Positioning Accuracy

Zero backlash, assuring high-positioning accuracy

■ Easy-to-Operate Dedicated Drive

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.

Ordering Code

RSF - **17** **A** - **50** - **E** **200** - **SP**
 (1) (2) (3) (4) (5) (6) (7)

1	Model	RSF Series
2	Size	17, 20, 25, 32
3	Design Version	A
4	Gear Ratio	50, 100
5	Encoder Type	E: Incremental Encoder
6	Encoder Resolution	200:2000p/revolutions
7	Special Specification	Blank: Standard Product SP: Special Specification Code

Specifications

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		

Size Item			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
Power Supply Voltage ³		V	200VAC							
Rated Torque ³		Nm	9.8	20	19	35	29	59	49	98
Rated Rotational Speed ³		rpm	60	30	60	30	60	30	60	30
Continuous Stall Torque ³		Nm	9.8	20	19	35	29	59	49	98
Maximum Momentary Torque ³		Nm	34	54	56	82	98	157	220	330
Max. Rotational Speed ³		rpm	90	45	90	45	90	45	90	45
Moment of Inertia ⁴	GD ² /4	kgm ²	0.047	0.19	0.098	0.39	0.19	0.77	0.67	2.7
Allowable Radial Load		N	780		1400		2900		4400	
Allowable Axial Load		N	780		1370		2900		4400	
Encoder resolution of output shaft with quadrature ⁵		counts/revolution	400,000	800,000	400,000	800,000	400,000	800,000	400,000	800,000
Mass		kg	2.1		2.9		4.7		8.7	
Combined Drive			HA-800-3B-200		HA-800-3B-200		HA-800-3B-200		HA-800-6B-200	
Compatible HDLLC Drives		200VAC	RTL-230-18, REL-230-18							

*1: The figures in the table are those at the output shaft.

*2: The actuator specification is the value when mounted on the following heatsink:

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 the speed reducer converted into the output shaft side.

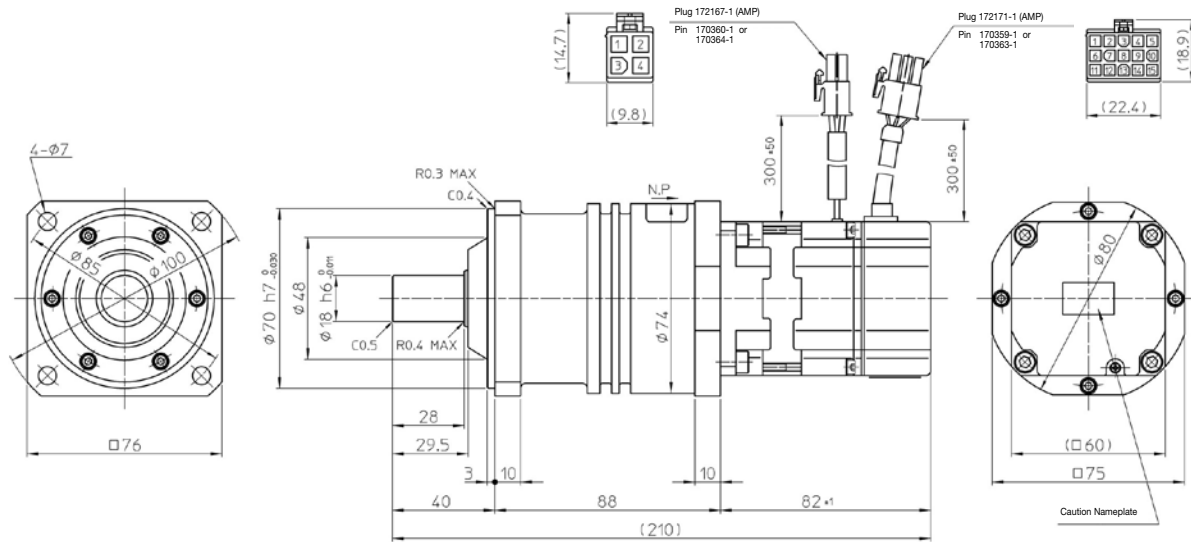
*5: Quadrature encoder resolution is calculated by (Motor shaft encoder resolution) x 4 x (Reduction ratio).

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

Outline Dimensions

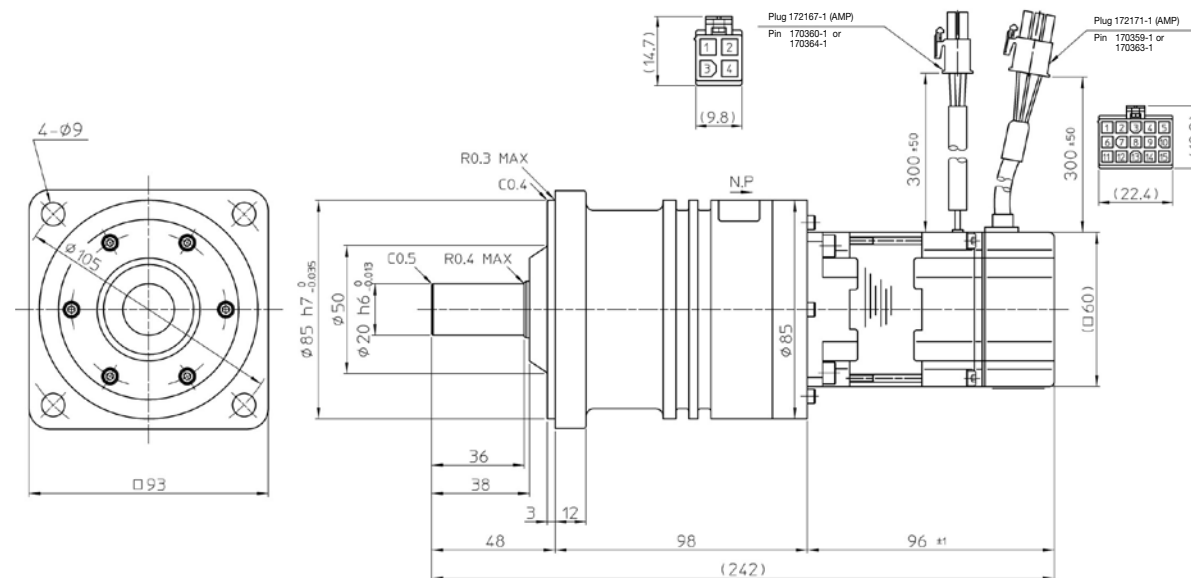
RSF-17A

Unit: mm



RSF-20A

Unit: mm

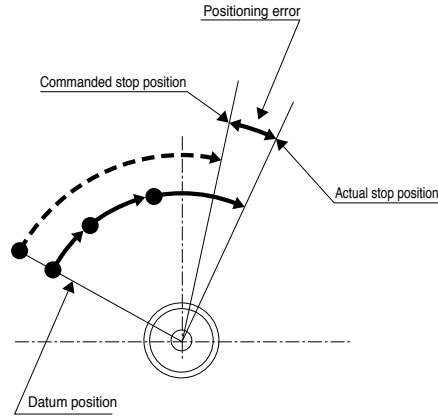


* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The RSF actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.



The accuracies of the individual models are shown below.

One-Way Positional Accuracy

Size		RSF-17A	RSF-20A	RSF-25A	RSF-32A
One-Way 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	$\pm 1.46 \times 10^{-4}$	$\pm 1.46 \times 10^{-4}$	$\pm 1.21 \times 10^{-4}$	$\pm 0.97 \times 10^{-4}$

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

Mechanical Accuracy

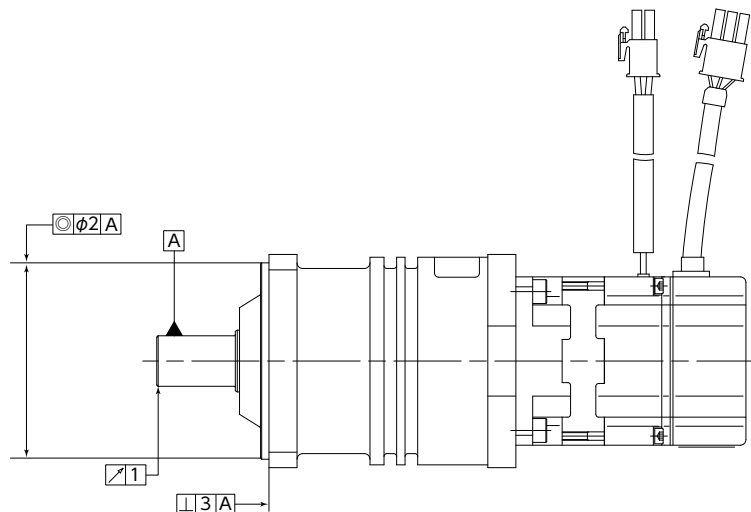
The mechanical accuracies of the output shaft and mounting flange of the RSF series are as follows.

Mechanical Accuracy

Unit: mm

Accuracy Item	RSF-17A	RSF-20A	RSF-25A	RSF-32A
1 Axial runout of the output shaft	0.04	0.04	0.04	0.04
2 Concentricity of output shaft and mounting surface	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.

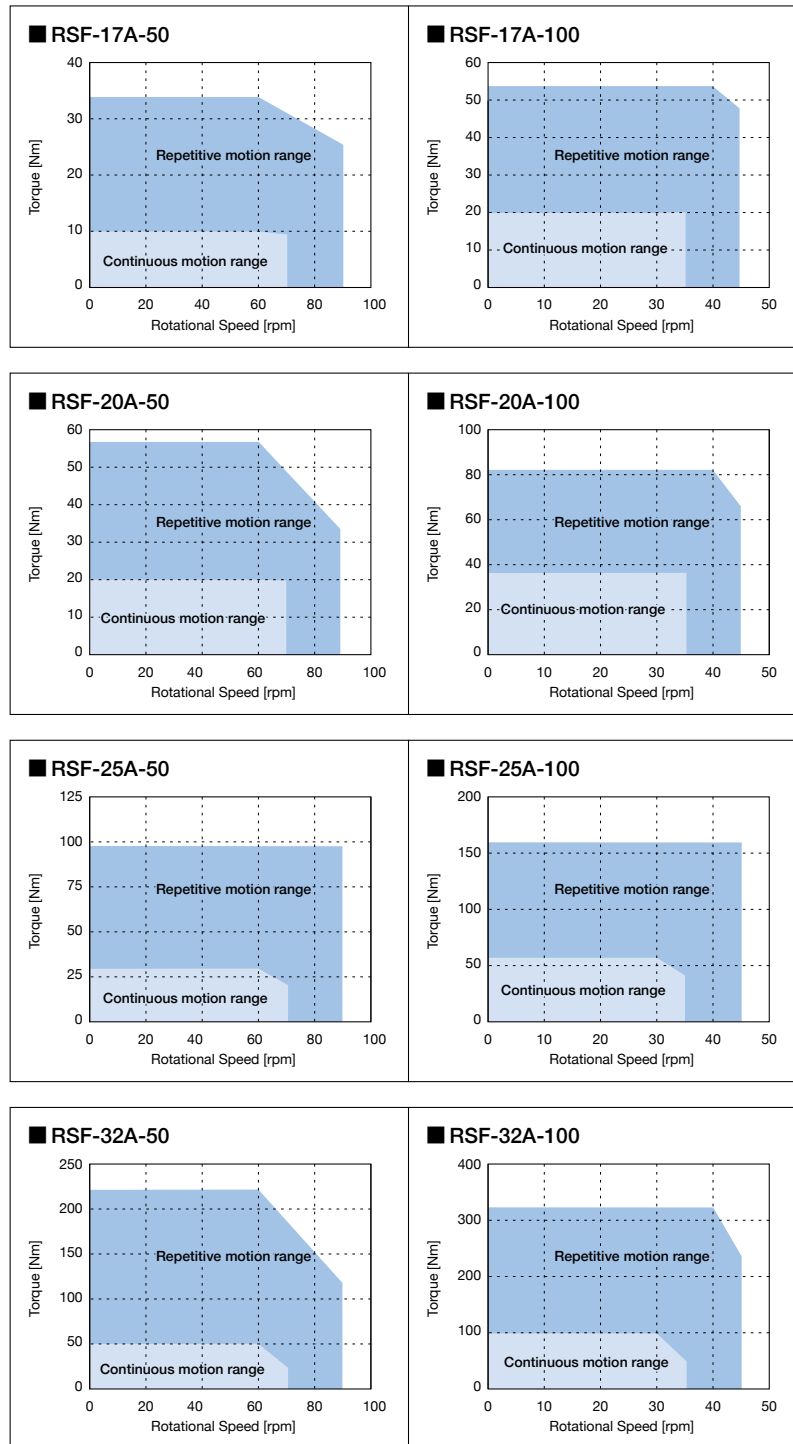


Operating Range

The following diagrams show the operating range of the RSF series combined with an HA-800 servo drive.

Continuous Motion Range: The range allows continuous operation of the actuator.

Repetitive Motion Range: This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.



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

RSF-17 : 250×250×12 (mm)

RSF-20 : 250×250×12 (mm)

RSF-25, RSF-32 : 300×300×15 (mm)

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

Options

Extension Cable (For HA-800)

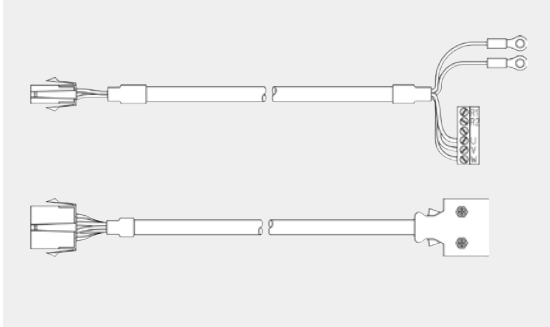
Order Code Example:

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.

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



Rotary Actuator

Linear Actuator

Direct Drive Motor

Servo Drives

Servo Drives

Servo Drives

MEMO

This image shows a full page of white paper with horizontal blue dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and run across the width of the page. There is no text or other markings on the page.

RH Series



RH Mini Series is a DC servo actuator that incorporates our Harmonic Drive® precision gears, a high performance brush DC servomotor and an incremental encoder. Used in highly demanding industrial servo systems, they provide precision motion control and high torque capacity in very compact packages.

Features

■ High Resolution

High-resolution of maximum 400,000 pulses/revolution (0.0009°/pulse).

■ High-Positioning Accuracy

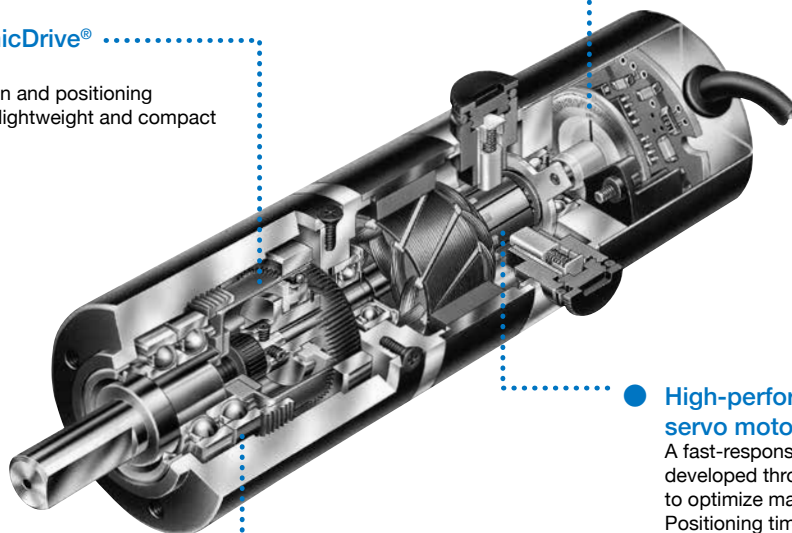
Zero backlash, assuring high-positioning accuracy

■ Compact Body and High-Output Torque

High output. 0.69Nm (maximum momentary torque) from our smallest model, RH-5A. Outside dimensions of $\phi 20\text{mm} \times 89\text{mm}$.

Structure

- **Compact HarmonicDrive® speed reducer**
Features high resolution and positioning accuracy. Unmatched lightweight and compact properties.



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

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

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

Ordering Code

RH	-	14	D	-	60	02	-	E	100	A	L	-	SP
(1)		(2)	(3)		(4)	(5)		(6)	(7)	(8)	(9)		(10)

1	Model	RH Series
2	Size	5, 8, 11 14
3	Design Version	A (Size 5 only) D (Size 8,11, and 14)
4	Output Shaft Rated Rotational Speed	Shows 60rpm
5	Rated Output (W)	RH-5, RH-8: x1(W), RH-11, RH-14: x10(W)
6	Options	E: Incremental Encoder T: Tachometer Generator
7	Encoder Resolution	100: 1000p/revolutions 036: 360p/revolutions
8	Encoder Power Supply	A: +5V-, D: +5 to 12V
9	Encoder Output Type	O: Open Collector Type L: Line Driver Type
10	Special Specification	Blank: Standard Product SP: Special Specification Code

Specifications (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.)

Size			RH-5A			RH-8D		RH-11D		RH-14D	
			8802	5502	4402	6006	3006	6001	3001	6002	3002
Item			8802	5502	4402	6006	3006	6001	3001	6002	3002
Reduction Ratio			50	80	100	50	100	50	100	50	100
Rated Output	W		1.5	1.7	1.4	8.6	6.2	13.6	12.3	20.3	18.5
Power Supply Voltage	V		12			24		24		24	
Maximum Momentary Torque	Nm		0.39	0.59	0.69	2.7	3.5	4.9	7.8	14	20
Max. Continuous Stall Torque	Nm		0.24	0.39	0.43	1.5	2.3	2.5	4.4	5.4	7.8
Rated Torque	Nm		0.16	0.29	0.29	1.4	2.0	2.2	3.9	3.2	5.9
Max. Rotational Speed	rpm		180	110	90	100	50	100	50	100	50
Rated Rotational Speed	rpm		88	55	44	60	30	60	30	60	30
Maximum Momentary Current	A _{rms}		0.83	0.78	0.77	1.6	1.1	2.4	2.1	5.4	4.1
Rated Current	A _{rms}		0.5	0.5	0.5	1.0	0.8	1.3	1.3	1.8	1.8
Torque Constant	Nm/A _{rms}		0.69	1.11	1.38	2.1	4.2	2.46	4.91	2.92	5.76
Moment of Inertia ^{*5}	GD ² /4	kgm 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	kgfcms ²	0.007	0.016	0.026	0.04	0.15	0.11	0.44	0.21	0.83
Allowable Radial Load	N		59			196		245		392	
Allowable Axial Load	N		29			98		196		392	
Mass	kg		0.09			0.3		0.5		0.77	
Combined Drive			HS-360-1A			HS-360-1B		HS-360-1C		HS-360-1D	
Compatible HDLLC Drives		20VDC	DCJ-055-09, DDP-090-09			-					
		24VDC	-			DCJ-055-09, DDP-090-09					

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

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

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

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

RH-5A : 150×150×3(mm)

RH-8D : 150×150×6(mm)

RH-11D : 150×150×6(mm)

RH-14D : 150×150×6(mm)

*5: The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the Harmonic Drive[®] gear.

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

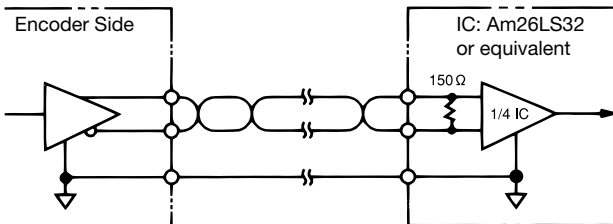
*7: The brush in DC servo motors requires replacement.

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

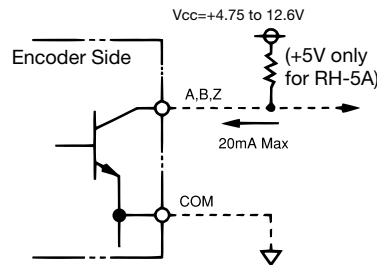
Encoder Specifications

Item	Size	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	

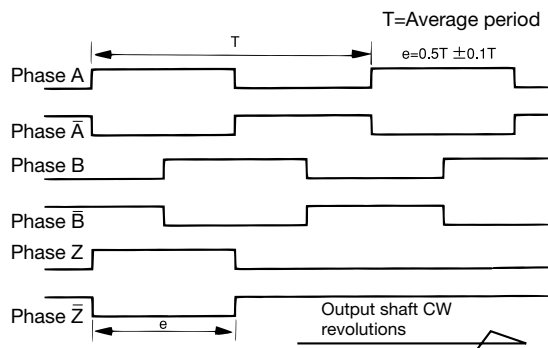
Line Driver Output Circuit



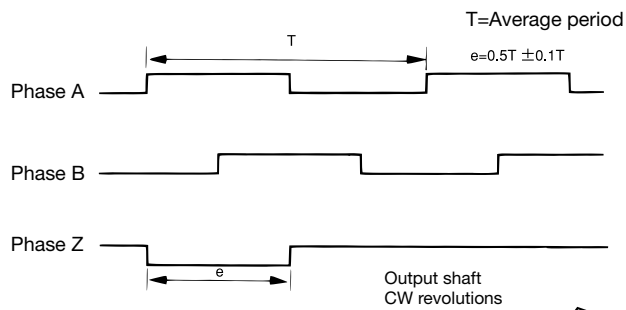
Open Collector Output Circuit



Line Driver Output Waveform



Open Collector Output Waveform



Color of Encoder Cables

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

Tachometer Generator Specifications

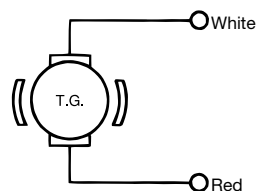
Specification

Item		
Voltage Generated ^{*1}	V/1000(rpm)	3±10%
Linearity ^{*1}	%max	±1
Ripple ^{*1}	%max	1(RHS)/3(P-P)
Armature Resistance	Ω	45±10%(20°C)
Armature Inductance	mH	7±20%
Moment of Inertia ^{*2}	gm ²	12×10 ⁻⁴

*1: Value of tachometer generator only at 200rpm or higher.

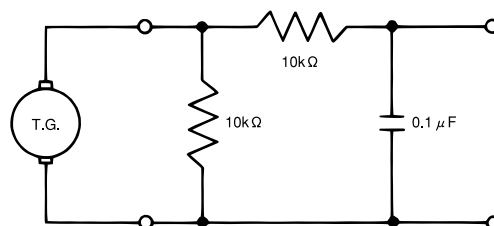
*2: Moment of inertia on motor shaft. When converted in terms of an actuator output shaft, the moment of inertia can be calculated by multiplying the reduction ratio R of the speed reducer by the square.

Polarity



(+) and (-) will be output to white and red cables respectively in CW revolutions when viewed from the actuator output shaft.

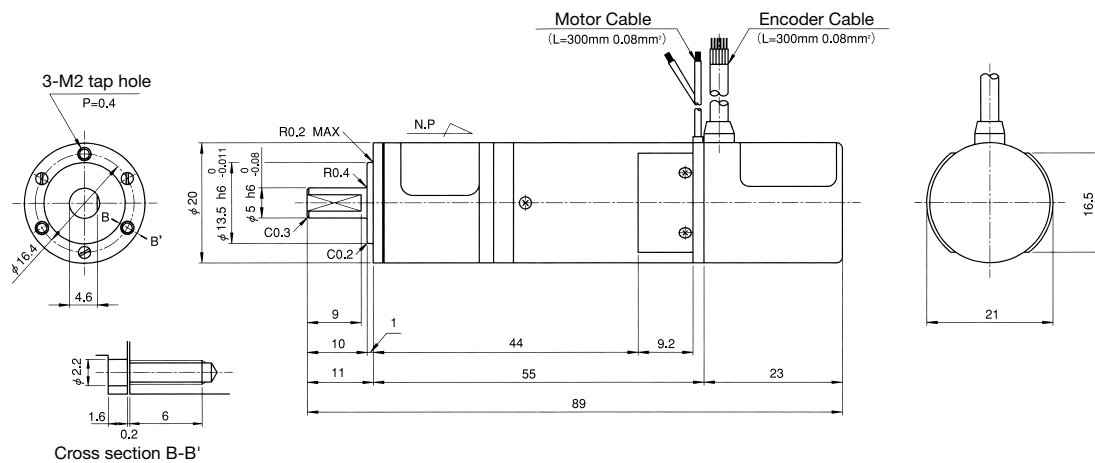
Measurement circuit of generated voltage, linearity and ripple



Outline Dimensions

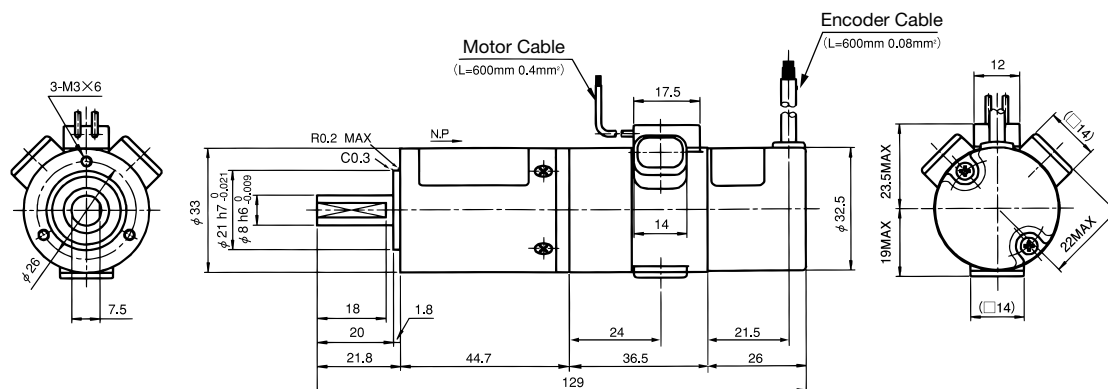
RH-5A (with incremental encoder)

Unit: mm



RH-8D (with incremental encoder)

Unit: mm

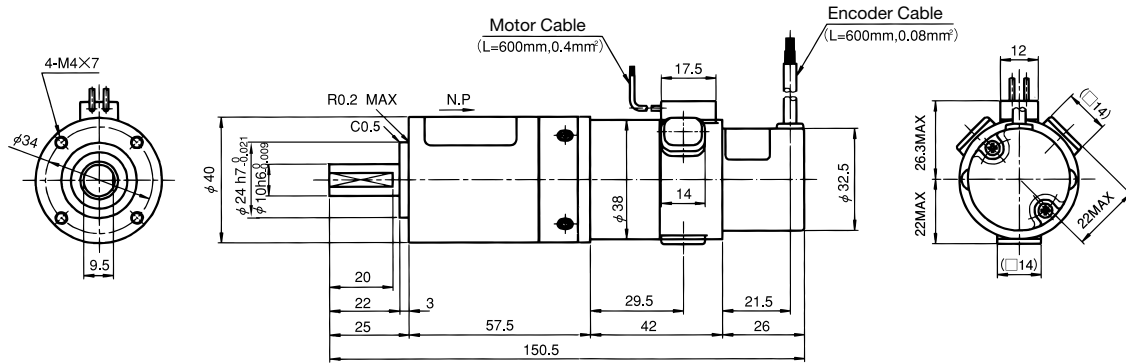


* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

Outline Dimensions

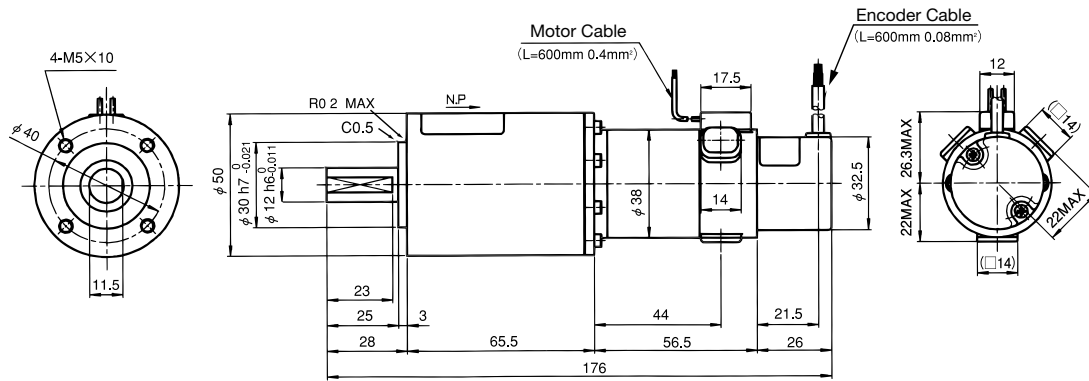
RH-11D (with incremental encoder)

Unit: mm



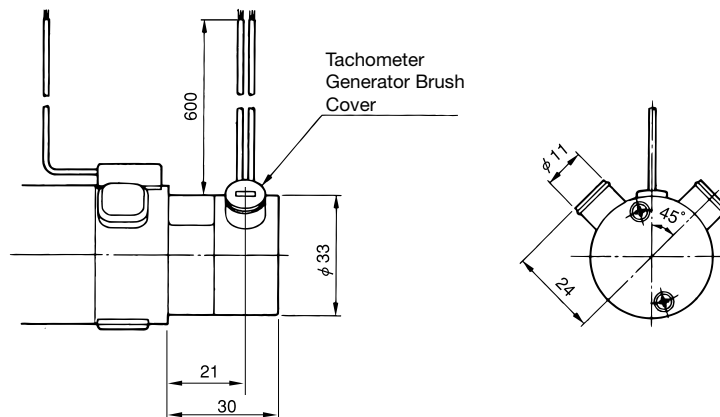
RH-14D (with incremental encoder)

Unit: mm



RH-8D, RH-11D, RH-14D (with tachometer generator)

Unit: mm



* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

One-Way Positional Accuracy

The one-way positioning accuracy is defined as the maximum positional difference between the commanded position and the actual stop position when a series of positioning moves are performed in the same rotation direction. (Refer to JIS B-6201-1987).

The RH Mini actuator incorporates a Harmonic Drive gear which inherently has high rotational position accuracy. Because of the gearing's high ratio, any rotational error at the input (i.e. motor shaft position error or motor feedback error) is reduced by a factor of the ratio (1/ratio) and typically becomes negligible at the output. Therefore most of the error is represented by the transmission error of the Harmonic Drive gear itself.

The accuracies of the individual models are shown below.

One-Way Positional Accuracy

Size		RH-5A	RH-8D	RH-11D	RH-14D
Item					
One-Way 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	$\pm 4.36 \times 10^{-4}$	$\pm 2.91 \times 10^{-4}$	$\pm 2.91 \times 10^{-4}$	$\pm 2.91 \times 10^{-4}$
Reverse Positional Accuracy	arc sec	150	60	60	60
	rad	7.27×10^{-4}	2.91×10^{-4}	2.91×10^{-4}	2.91×10^{-4}

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

Mechanical Accuracy

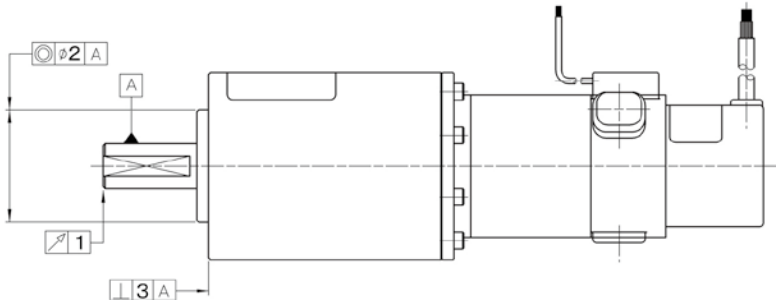
The mechanical accuracies of the output shaft and mounting flange of the RH series are as follows.

Mechanical Accuracy

Unit: mm

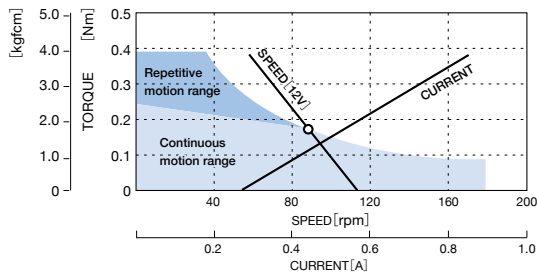
Accuracy Item	RH-5A	RH-8D	RH-11D	RH-14D
1 Axial runout of the output shaft	0.03	0.03	0.03	0.03
2 Concentricity of output shaft and mounting surface	0.04	0.04	0.04	0.04
3 Perpendicularity between the output shaft and mounting surface	0.04	0.04	0.04	0.04

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

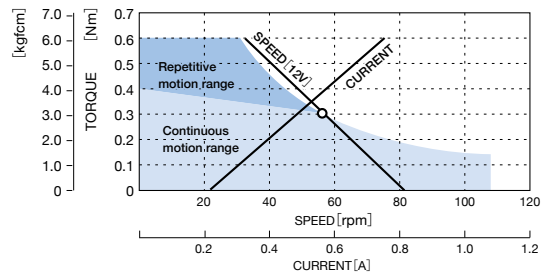


Operating Range

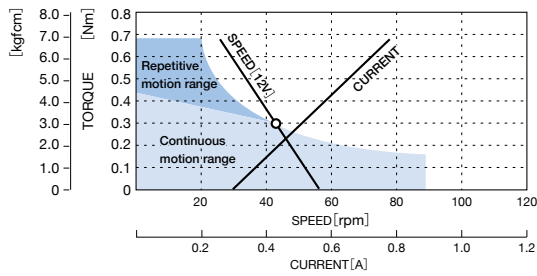
■ RH-5A-8802



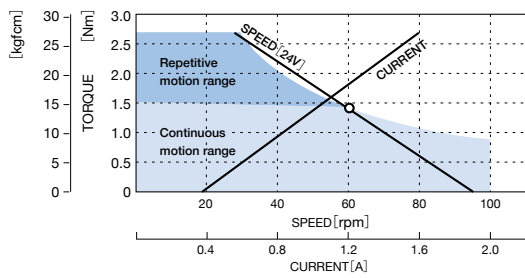
■ RH-5A-5502



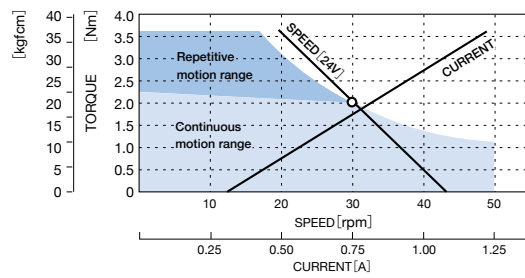
■ RH-5A-4402



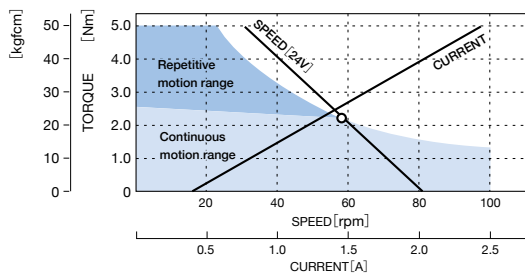
■ RH-8D-6006



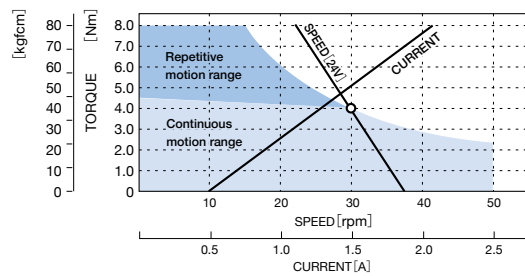
■ RH-8D-3006



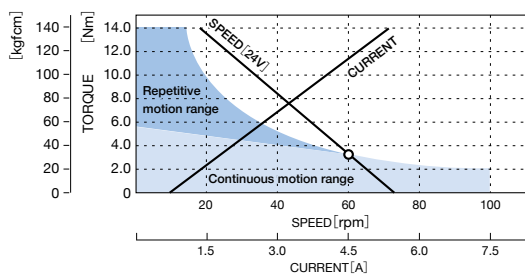
■ RH-11D-6001



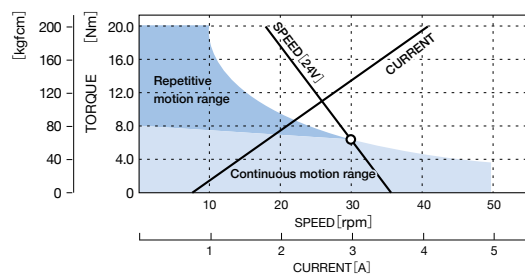
■ RH-11D-3001



■ RH-14D-6002



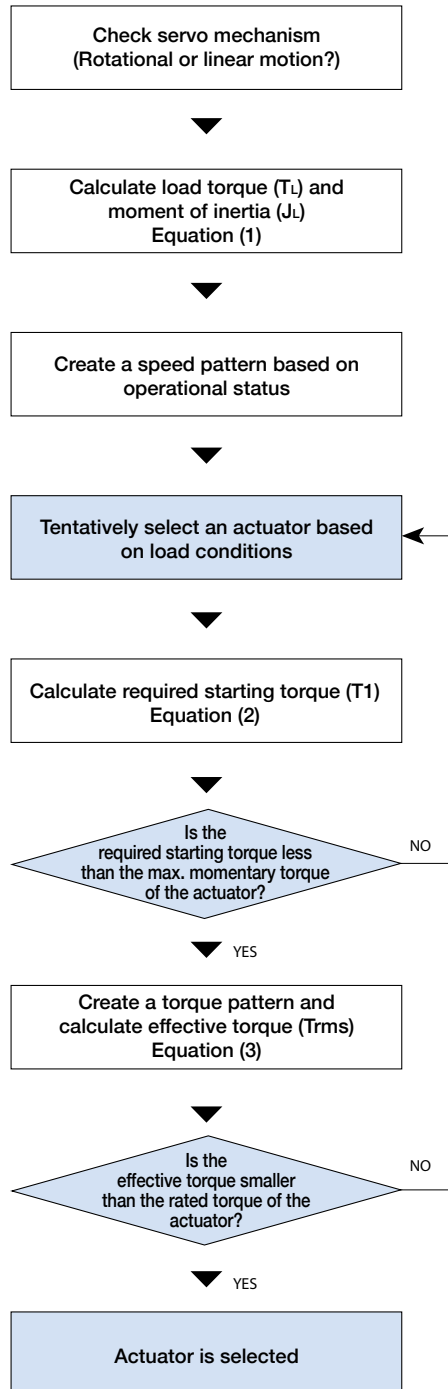
■ RH-14D-3002



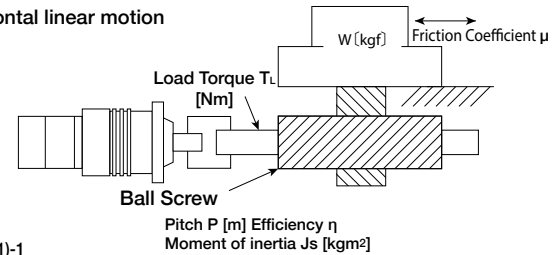
Tips for Selecting the Rotary Actuator

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

Flowchart for Actuator Selection



● For horizontal linear motion

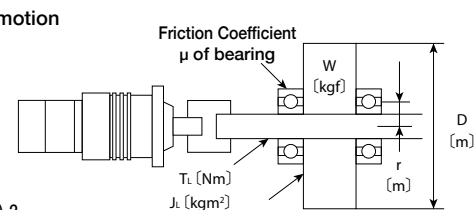


Equation (1)-1

$$J_L = J_s + w \left(\frac{P}{2\pi} \right)^2 (\text{kgm}^2)$$

$$T_L = \frac{\mu W \cdot P}{2\pi \cdot \eta} (\text{Nm})$$

● Rotation motion

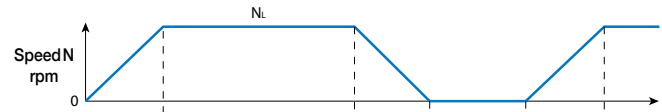


Equation (1)-2

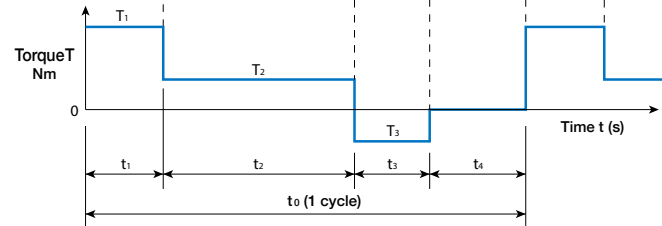
$$J_L = J_s + \frac{W}{8} D^2 (\text{kgm}^2)$$

$$T_L = \mu W \cdot r (\text{Nm})$$

● Speed pattern



● Torque pattern



Note: t_1 is assumed to be equal to t_3

● Tentative selection conditions

Load Condition	Check	Catalog Value	Unit
Load torque T_L	$\leq$	Rated torque T_R	Nm
Max. rotational speed of load N_L	$\leq$	Rated rotational speed N_R	rpm
Moment of inertia of load J_L	$\leq 3J_A^*$	Moment of inertia J_A	kgm ²

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

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

$$\text{Equation (3)} \quad T_2 = T_L$$

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

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

Actuator Selection Example

An example of the actuator selection is shown below.

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

$T_L = 2\text{Nm}$ $< T_R = 4.0\text{Nm}$
 $N_L = 25\text{rpm}$ $< T_R = 30\text{rpm}$
 $J_L = 0.02\text{kgm}^2$ $< J_A = 0.02\text{kgm}^2$

Calculate required starting torque (T_1)
Equation (1)

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

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

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

$$\begin{aligned}
 T_1 &= 3.0\text{Nm} \\
 T_2 &= T_L = 2\text{Nm} \\
 T_3 &= T_L - (T_1 - T_L) = 1\text{Nm} \\
 T_{rms} &= \sqrt{\frac{3^2 \times 0.1 + 2^2 \times 0.2 + 1^2 \times 0.1}{1}} \\
 &= 1.3\text{Nm}
 \end{aligned}$$

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

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

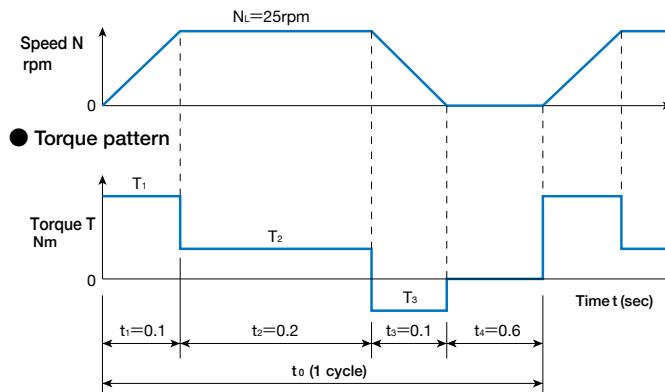
● Load Conditions

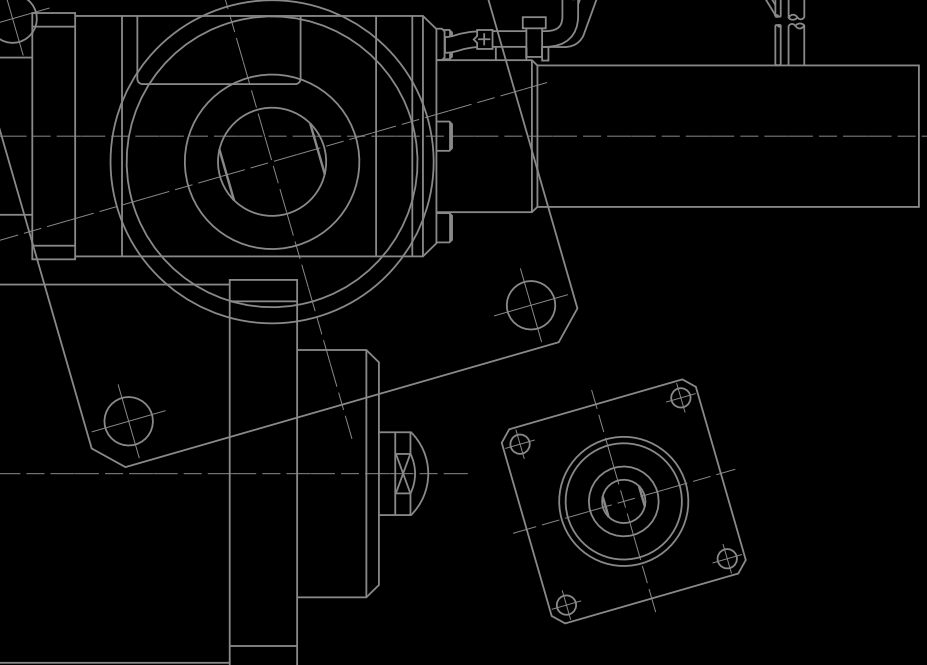
Preconditions: The servo mechanism involves horizontal linear motion and the actuator is of a shaft type (RSF series)

Load rotational speed N_L : 25rpm
 Load torque T_L : 2Nm
 Moment of load inertia J_L : 0.02kgm²
 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





Linear Actuator

Ultra Precision Positioning

LA Series 132

Medium Driving Force

LAH-46 Series 135

LAH-80 Series 138

High Driving Force

LBC Series 142



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 Stepper Motor**

Ordering Code

LA

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30

-

B

-

10

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F

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L

(1)

(2)

(3)

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(5)

(6)

1	Model	LA Series
2	Size	30
3	Design Version	B
4	Stroke (mm)	10
5	Flange Mounting Type	F
6	Options	None: DC Servo Motor Drive (Open Collector) L: DC Servo Motor Drive (Line Driver)

Rotary Actuator

Linear Actuator

Direct Drive Motor

Servo Drives

Servo Drives

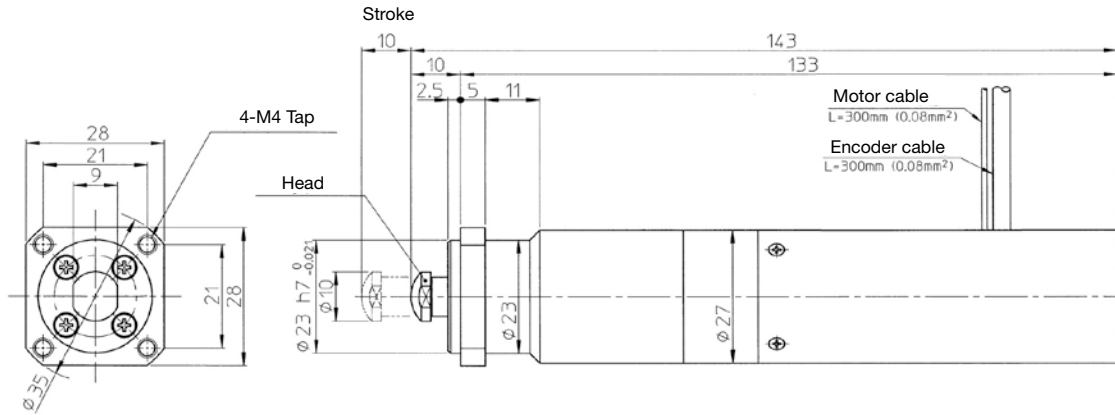
Servo Drives

131

Outline Dimensions

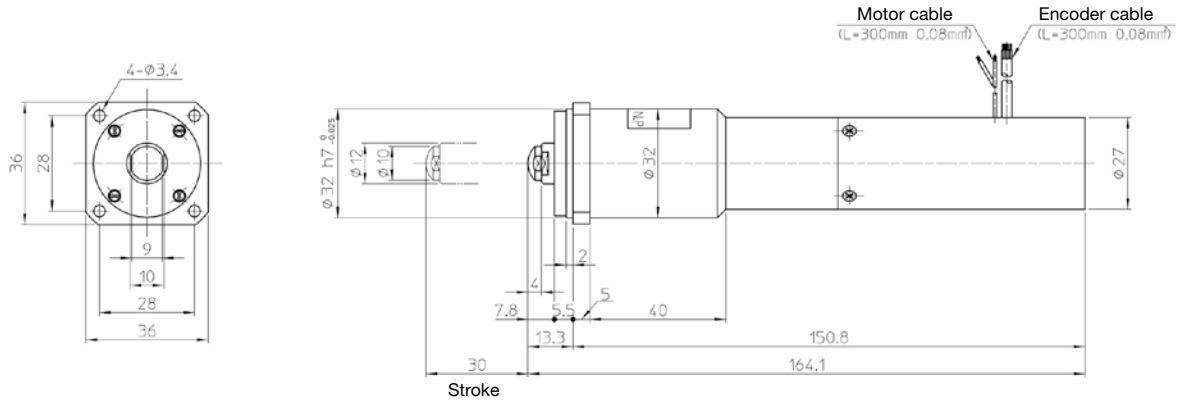
LA-30B-10-F

Unit: mm



LA-32-30-F

Unit: mm

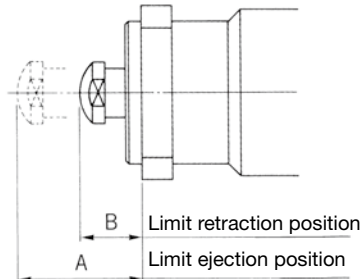


* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

Precautions

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

Unit: mm



Size	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 stepper 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 stepper motor**

Ordering Code

LAH - **46** - **10** - **02** - **F** - **L**
 (1) (2) (3) (4) (5) (6)

1	Model	LAH Series
2	Size	46
3	Stroke (mm)	10
4	Rated Driving Force (200N)	02
5	Flange Mounting Type	F
6	Options	None: DC Servo Motor Drive (Open Collector) L: DC Servo Motor Drive (Line driver)

Specifications

Size	LAH-46-1002-F		LAH-46-3002-F	
Item				
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, $\bar{A}$, B, $\bar{B}$, Z, $\bar{Z}$	
	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.

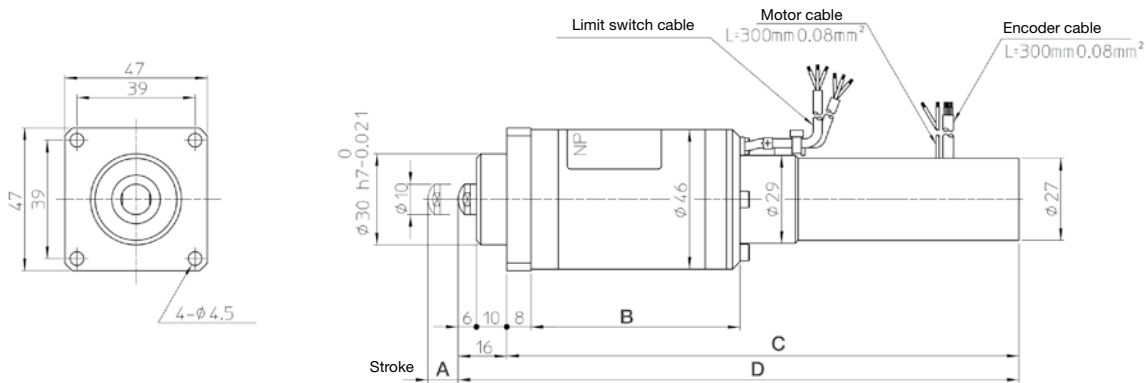
* 3: The actuators in the series conform to JIS B 6201 under a measurement temperature of 20±1°C and a load carrying capacity of 49N to maximum driving force.

* 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.

Outline Dimensions

Unit: mm

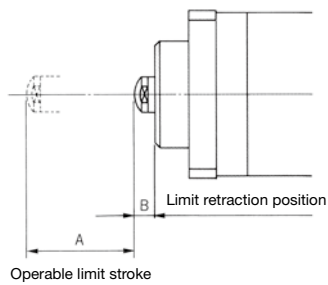


Size	Symbol	A	B	C	D	Mass
LAH-46-1002-F		10mm	69mm	169mm	185mm	0.81kg
LAH-46-3002-F		30mm	88mm	188mm	204mm	0.85kg

The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

Precautions

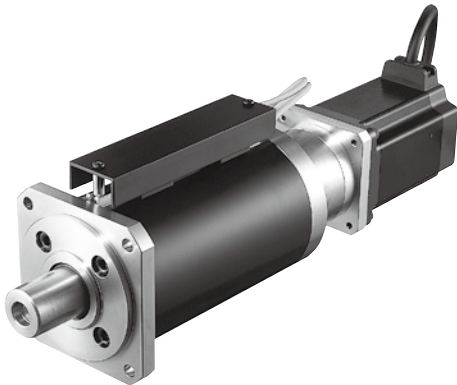
Limit rod ejection and retraction to within the operating limit stroke illustrated on the right.



Unit: mm

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

LAH-80 Series



The LAH-80 series includes linear actuators featuring a high maximum driving force of 3000N and resolution of 2μm.

Features

- **Medium Driving Force:** Maximum driving force: 3000N (306kgf)
Rated driving force: 2000N (204kgf)
- **Positioning in Micron Unit:** Moving quantity of 1 pulse: 2μm
- **High-Positional Accuracy and Repeatability:** One-way positioning: 4μm/2mm
Repeatability: ±1μm/1mm
- **End Limit Sensor (stroke limit detection switch) is mounted**
- **The Drive Motor can be changed**

Ordering Code

LAH

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80

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50

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20

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F

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PA

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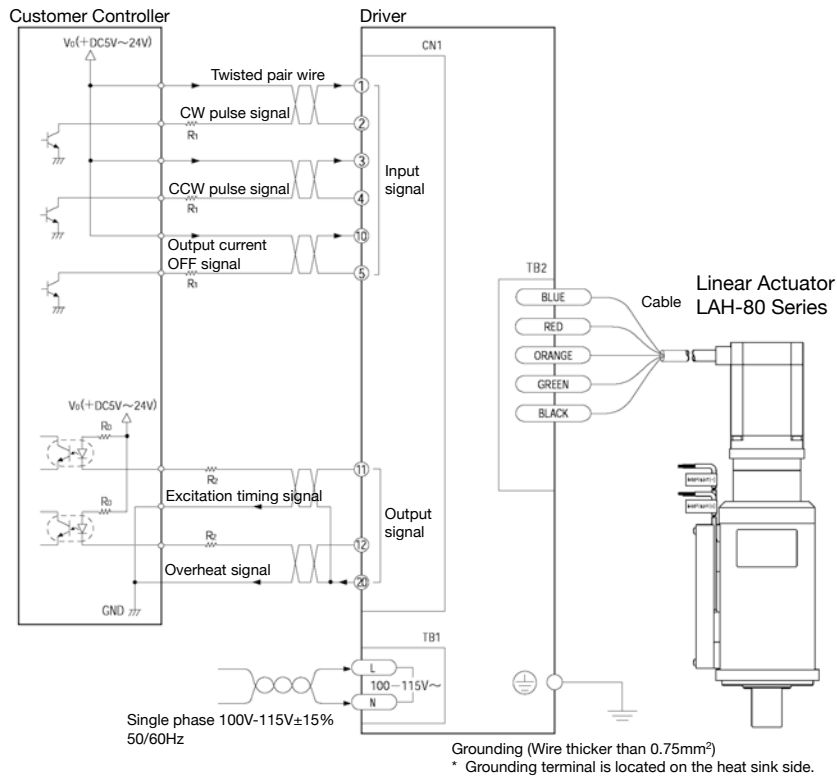
1	Model	LAH Series
2	Size	80
3	Stroke (mm)	50
4	Rated Driving Force (200N)	20
5	Flange Mounting Type	F
6	Motor Drive	PA: Stepper Motor Drive (No shaft on the non-load side) PB: Stepper Motor Drive (Shaft provided on the non-load side)

Specifications

Item		Size	LAH-80-5020-F-PA/PB
Actuator Unit	Resolution		2μm (half step)
	Stroke		50mm
			±25mm
	Maximum Feed Speed		10mm/s
	Rated Driving Force		2000N
			204kgf
	Maximum Driving Force		3000N
			306kgf
	Load Condition		Apply 10N or more to the shaft end to ensure accuracy
	Drive Motor		Stepper motor PK569A(B)W manufactured by Oriental Motor Corp. Step angle Full step: 0.72°/step Half step: 0.36°/step
	Protection Function		End limit sensor model D-F79 manufactured by SMC Co. contained
	Installation Direction		All directions (Must have adequate downward force when installed vertically.)
	Load Direction		Load to apply only in one direction, push direction or pull direction
	Operating Temperature		10°C to 25°C
	Lubrication		Grease
Driver Unit	Mass		5kg
	One-way Positional Accuracy *		10μm/50mm stroke 4μm/2mm stroke
	Repeatability *		±1μm/1mm stroke
	Reverse Positional Accuracy *		10μm/1mm stroke
	Model		RKD514L-A <Manufactured by Oriental Motor Corp.>
	Power Input		AC100 to 115V (single phase) 50/60Hz 5.5A
	Input signal	Input Type	Photo coupler input, input resistance 220 ohm, input current 10 to 20mA Photo coupler ON condition: +4 to +5V, Photo coupler OFF condition: 0 to +0.5V
		CW Pulse Signal (Pulse signal)	CW direction motion command pulse signal (For 1-pulse input type, motion command pulse signal) Pulse width 5μs or more, rise and fall time 2μs or less, activated by pulse fall (Negative logic pulse input)
		CCW Pulse Signal (Rotating direction signal)	CCW direction motion command pulse signal (For 1-pulse input type, rotational direction pulse signal) Photo coupler OFF: CCW, photo coupler ON: CW Pulse width 5μs or more for rise, and fall time 2μs or less, activated by pulse fall (Negative logic pulse input)
		Output Current Off Signal	When the photo coupler is ON, output current to the motor is turned off so that the motor shaft may be rotated using external force. When the photo coupler is OFF, operation current set by the "RUN" switch is supplied to the motor.
	Output signal	Output Type	Photo coupler open collector output (emitter common) external operation conditions DC24V or less, 10mA or less
		Excitation Timing Signal	Signal is output when excitation sequence is at Step "0." (Photo coupler ON) When in full step: One output per 10 pulses. When in half step: One output per 20 pulses
		Overheat Signal	Output when internal driver temperature exceeds around 80°C. (Open collector output) Motor turned OFF by auto current off function.
	Functions		Auto current down, auto current OFF, step angle selection, pulse input method selection
	Display (LED)		Power input, excitation timing signal output and overheat signal output
	Cooling Method Driver		Natural air-cooled
	Insulation Resistance		100M ohm or more at the following locations when measured by a DC500V megger at normal temperature and humidity: Power Input Terminal - Protective Ground Terminal, Motor Output Terminal - P.G.T., Input/Output Terminals - M.O.T., Signal Input/output Terminals - P.I.T.
	Insulation Strength		No anomalies detected when power is supplied to following locations for one minute at normal temperature and humidity: AC1.5kV 50Hz Power Input Terminal - Protective Ground Terminal, AC1.5kV 50Hz Motor Output Terminal - Protective Ground Terminal, AC3.0kV 50Hz Signal Input/output Terminals - P.I.T, AC3.0kV 50Hz Signal Input and Output terminal - M.O.T.
	Operating Environment (When in operation)	Ambient Temp.	0°C to +50°C
		Ambient Humidity	85% or less (Do not expose to condensation)
		Atmosphere	Do not expose to corrosive gas, dust or water or oil splashed directly.

* Conforms to JIS B 6201. Measurement temperature: 20°C ±1°C

Connection Diagram



Wiring Cautions:

1. Use twisted pair wire (more than 0.2mm²) as the signal cable when the length is less than 2m.
2. Use wire 0.5mm² or thicker as the motor line (if an extension is required) and as a power line. Use wire thicker than AWG18 (0.75mm²) as the grounding line.
3. Make one-point grounding when grounding the driver and controller.
4. Install signal cables more than 10cm away from power lines (power and motor lines). Neither install signal cables and power lines together in the same duct nor tie signal cables with power lines.

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**

Ordering Code

LBC

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25

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A

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5D

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12K

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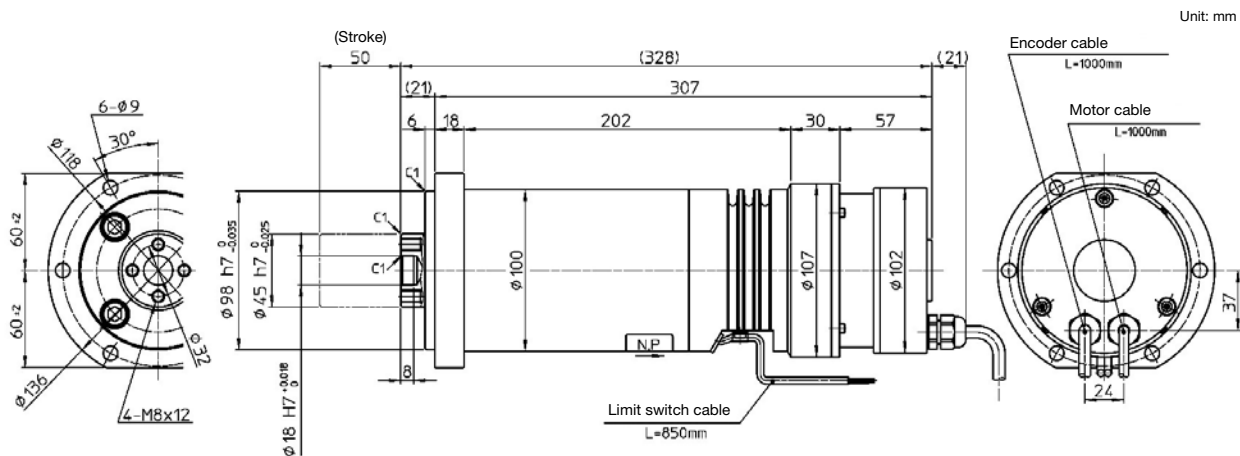
1	Model	LBC Series
2	Size	25
3	Design Version	A
4	Stroke (mm)	5D
5	Rated Driving Force	2000N
6	Origin Sensor (Option)	P: Ejection Limit C: Center R: Retraction Limit

Specifications

Item	Size	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).

Outline Dimensions



* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

Options

Extension Cable

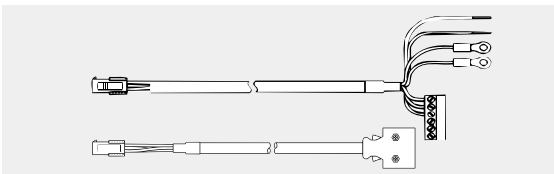
Order Code Example:

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

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

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

(** indicates the cable length (03 = 3m, 05 = 5m, 10 = 10m).

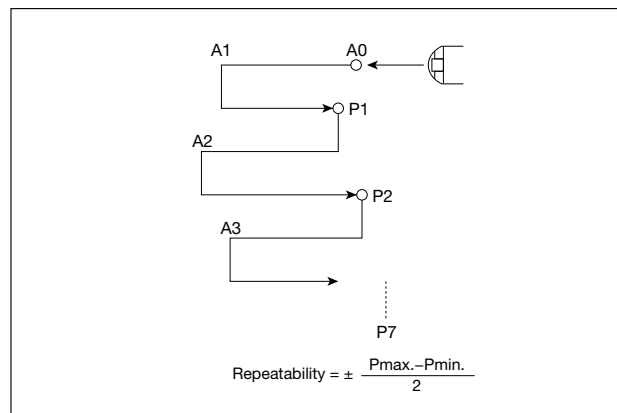


Tips for Evaluating Performance of the Linear Actuator

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)

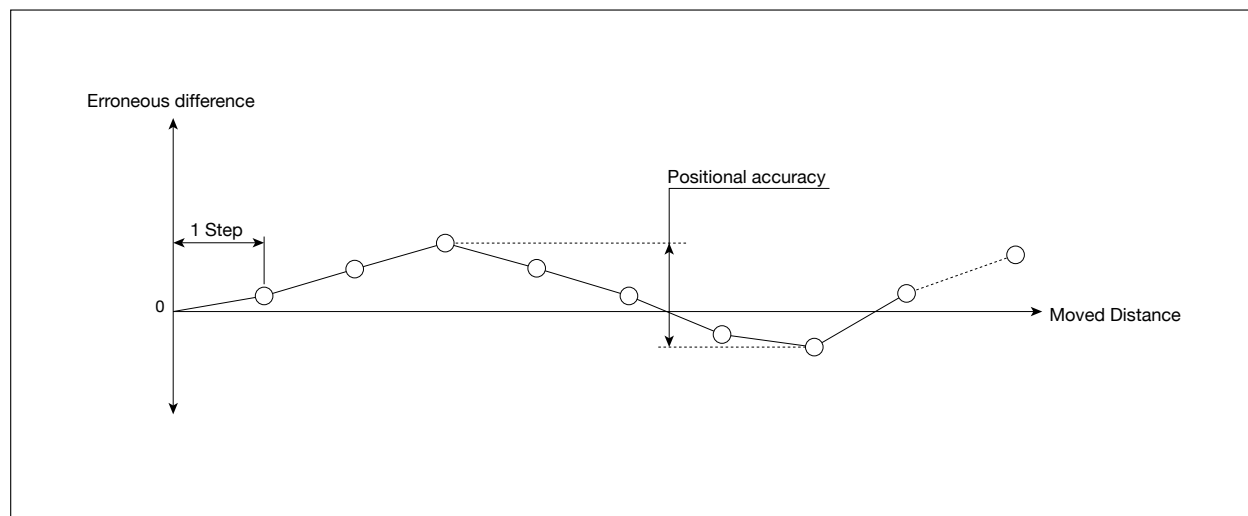
Represents a degree of coincidence between a position actually moved and a position commanded to move in a fine stroke.

- (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.

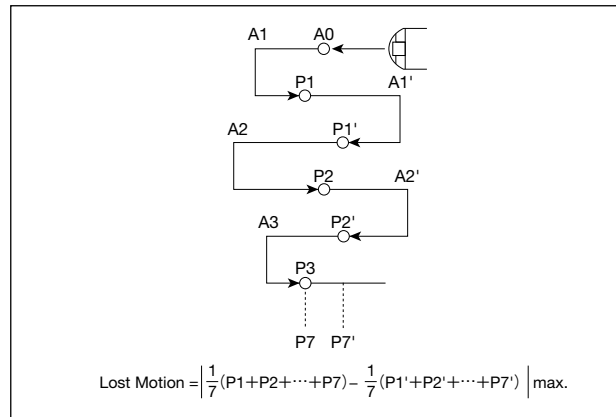
- (1) An output rod or a stage is moved to a position beyond the limit for the stroke on the retraction side, moved in an ejection (+) direction from there and is stopped near the stroke limit position. This position is set as a datum position.
- (2) Feed in succession from the datum position to the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



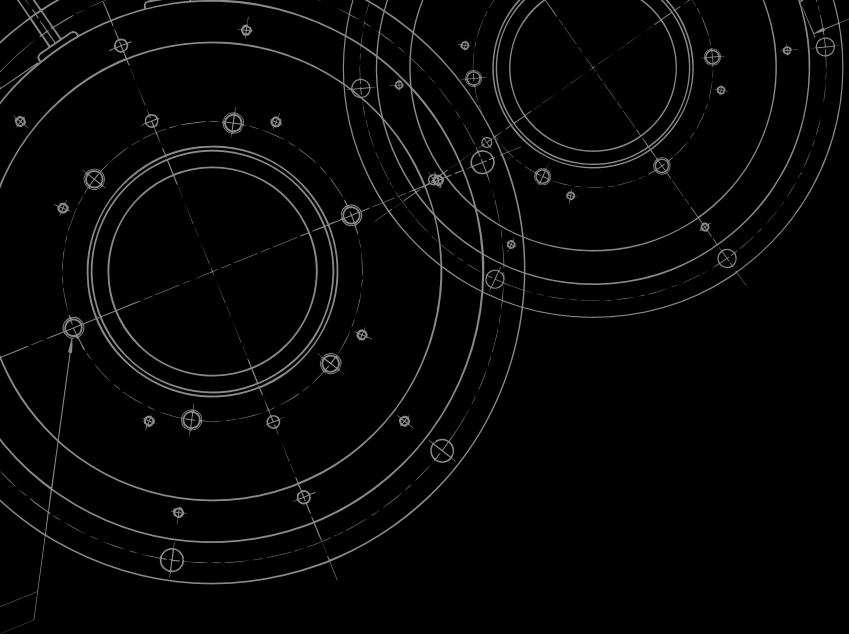
Lost Motion

Represents the difference between a stationary position during positioning while moving 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.



This image shows a full page of primary-ruled notebook paper. It features multiple sets of horizontal lines designed to guide handwriting. Each set consists of three lines: a solid top line, a dashed middle line, and a solid bottom line. These sets are repeated down the entire page, providing a template for writing practice. The paper is white, and the lines are light blue. There are no margins, text, or other markings on the page.



Direct Drive Motor

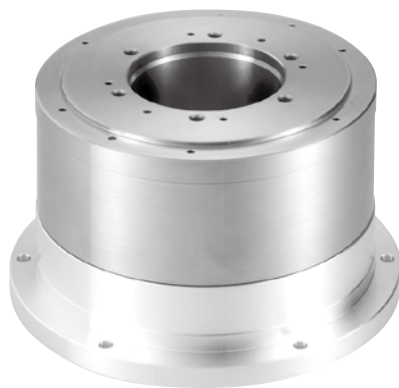
High Precision, High Resolution

KDU Series 148

HMA Series 153



KDU Series



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

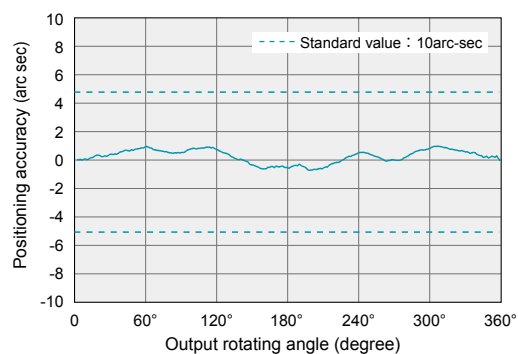
Features

■ High Precision

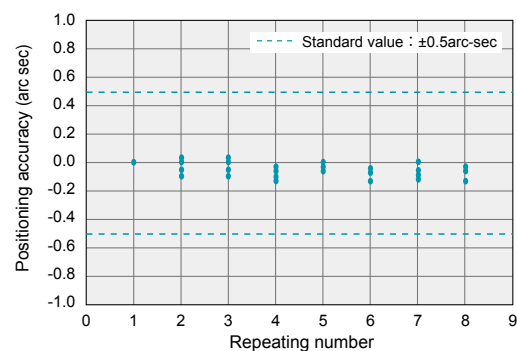
Absolute position accuracy: 10arc sec

Repetitive positioning accuracy: ± 0.5 arc sec

Absolute position accuracy ± 10 arc sec

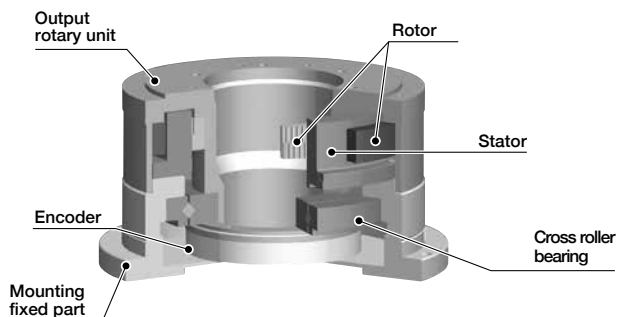
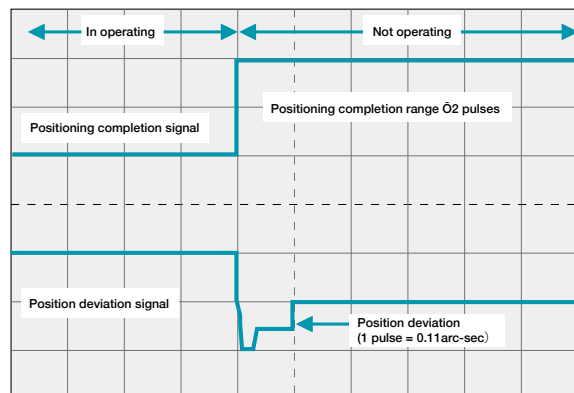


Repetitive positioning accuracy ± 0.5 arc sec



■ Stopping Stability

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



■ Large Hollow Opening Diameter

Motor outside diameter: $\phi 130$ mm

Hollow opening diameter: $\phi 50$ mm

■ Mechanical Accuracy

Runout on output side: 2 μ m

Ordering Codes

The direct drive motor KDU series is a set that functions in combination with an AC servo drive 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: | Direct driver motor KDU series
KDU-13SB: KDU-13SB-E10
KDU-13WB: KDU-13WB-E10 | (3) Power voltage: | 100: 100VAC
200: 200VAC |
| (2) System: | Combination with AC servo driver HA-770-2 | (4) Specification symbol: | No mark: Standard item
SP: Special specification item |

Single Motor

KDU - 13S B - E 10 - □

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

(Single Motor)

- | | |
|-------------------------------|--|
| (1) Model | Direct driver 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: 11,840,000p/rev |
| (6) Specification symbol | No symbol: Standard specification
SP: Special specification |

Single Driver

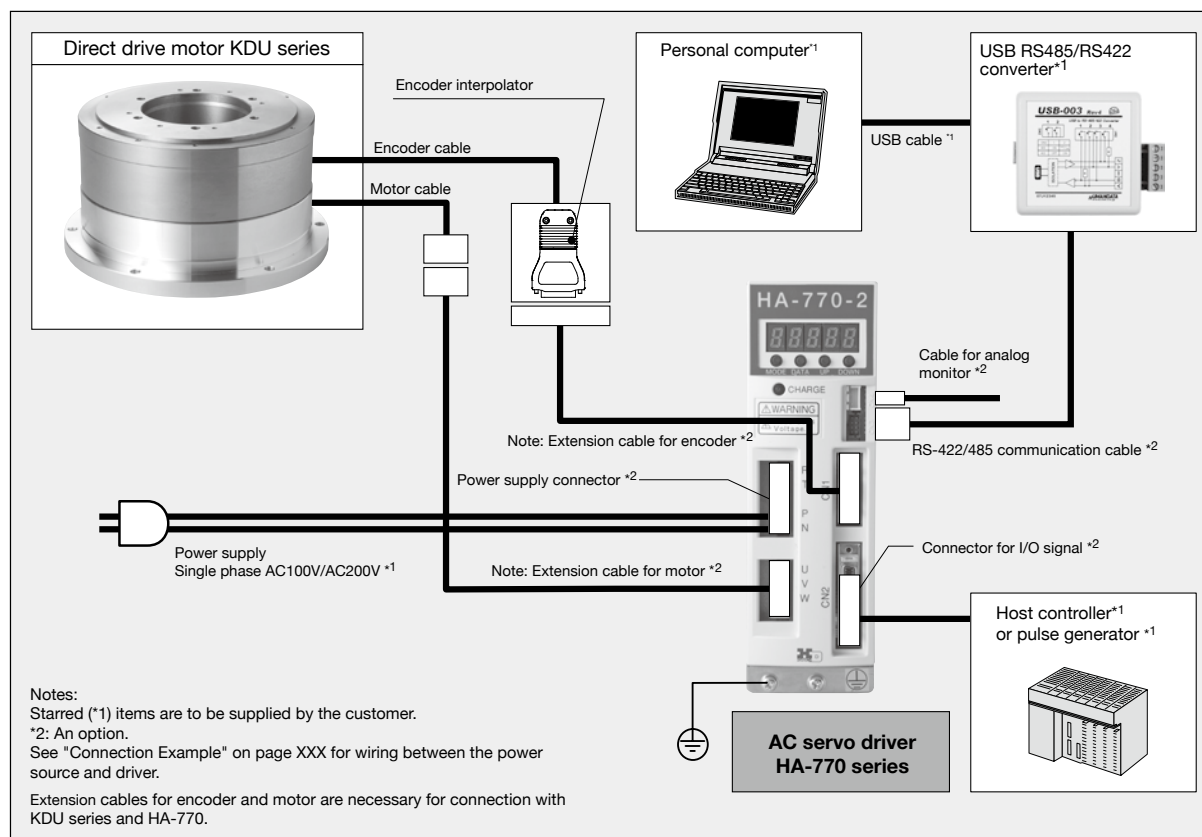
HA - 770 - 2 - □

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

(Single Motor)

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

Example of System Configuration



KDU Series Specifications

Item		Size	KDU	
			-13SB	-13WB
Maximum Torque ^{*2}	Nm		7.0	15.0
	kgfm		0.7	1.5
Maximum Rotational Speed	rpm		127	127
Torque Constant	Nm/A _{rms}		3.1	6.5
	kgfm/A _{rms}		0.32	0.66
Input Power Supply Voltage	V		AC100 / AC200	
EMF Constant	V / (rpm)		0.33	0.68
Line Resistance	Ω (20°C)		9.1	14.0
Line Inductance	mH		19	35
Moment of Inertia	GD ² /4	kgm ²	0.0047	0.0065
	J	kgfcm ²	0.048	0.066
Moment of Rigidity	Nm/rad		2.4×10 ⁵	
	kgfm/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 (°) 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 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 XXX.

*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

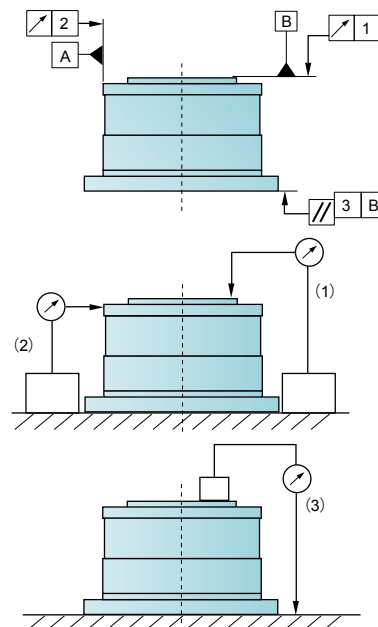
Unit: mm

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.

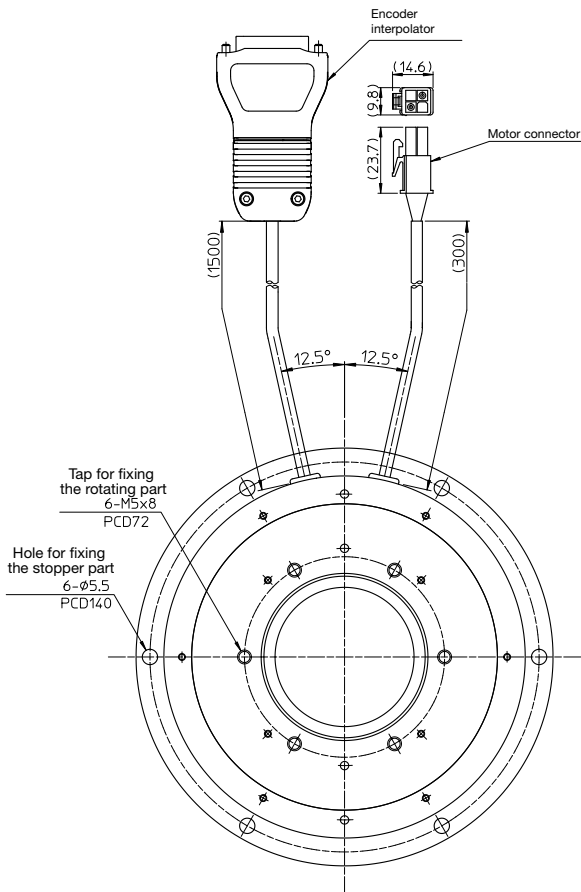
The measuring method is described below.

- 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.
- 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.
- 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.



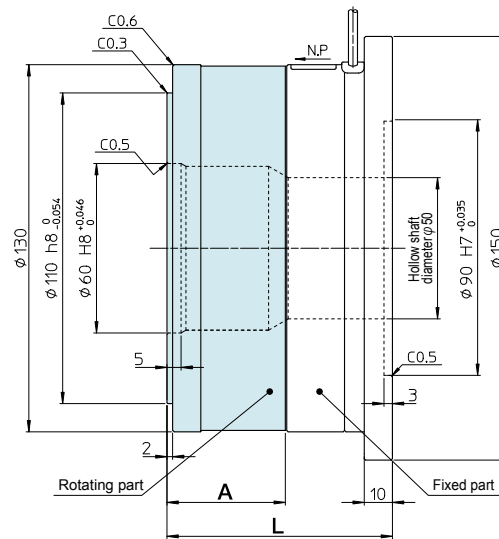
Outline Dimensions

KDU-13SB-E08-100□KDU-13WB-E08-100



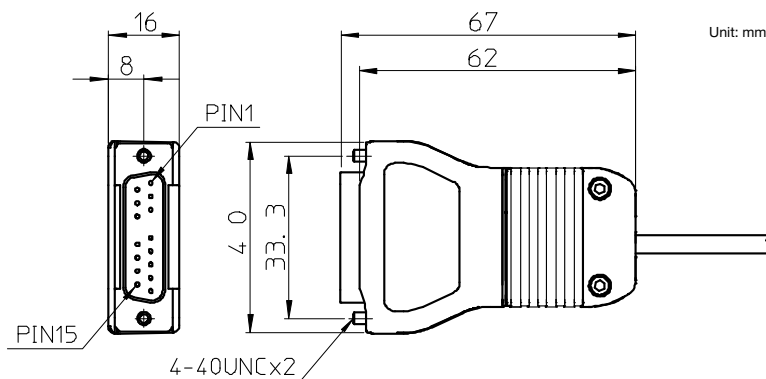
Unit: mm

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



Encoder Interpolator (mass: 130g)

Unit: mm

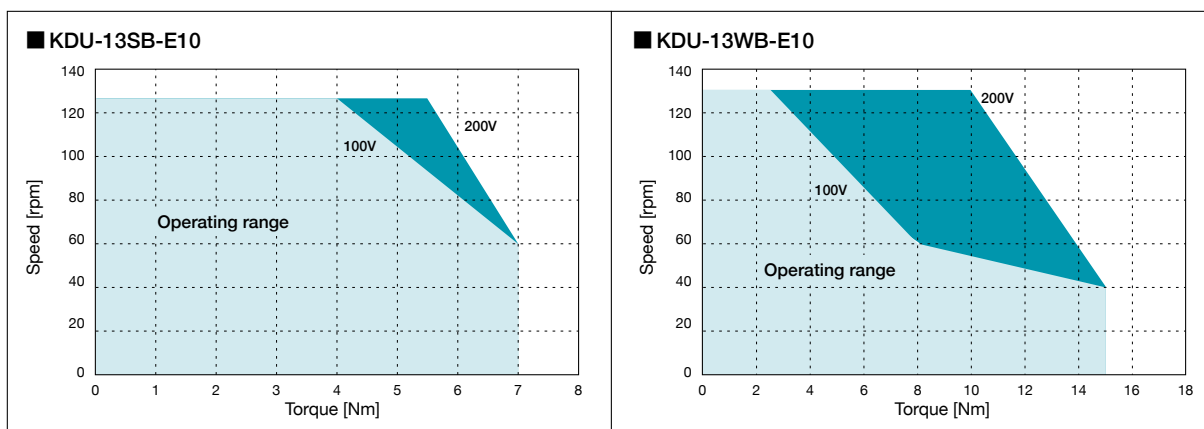


* The dimension tolerances that are not specified vary depending on the manufacturing method. Please check the confirmation drawing or contact us for dimension tolerances not shown on the drawing above.

Standard Combination Table of Extension Cables (option)

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

Operating Range



Precautions for Maintaining Accuracy

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

Checking the operating environment

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

Periodically rotate the output shaft 90° or more

Where the system operating environment requires fine motions, periodically rotate the output shaft more than 90° 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 for measurement of accuracies is that the output shaft is facing upward. Please contact Harmonic Drive, 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.

HMA Series

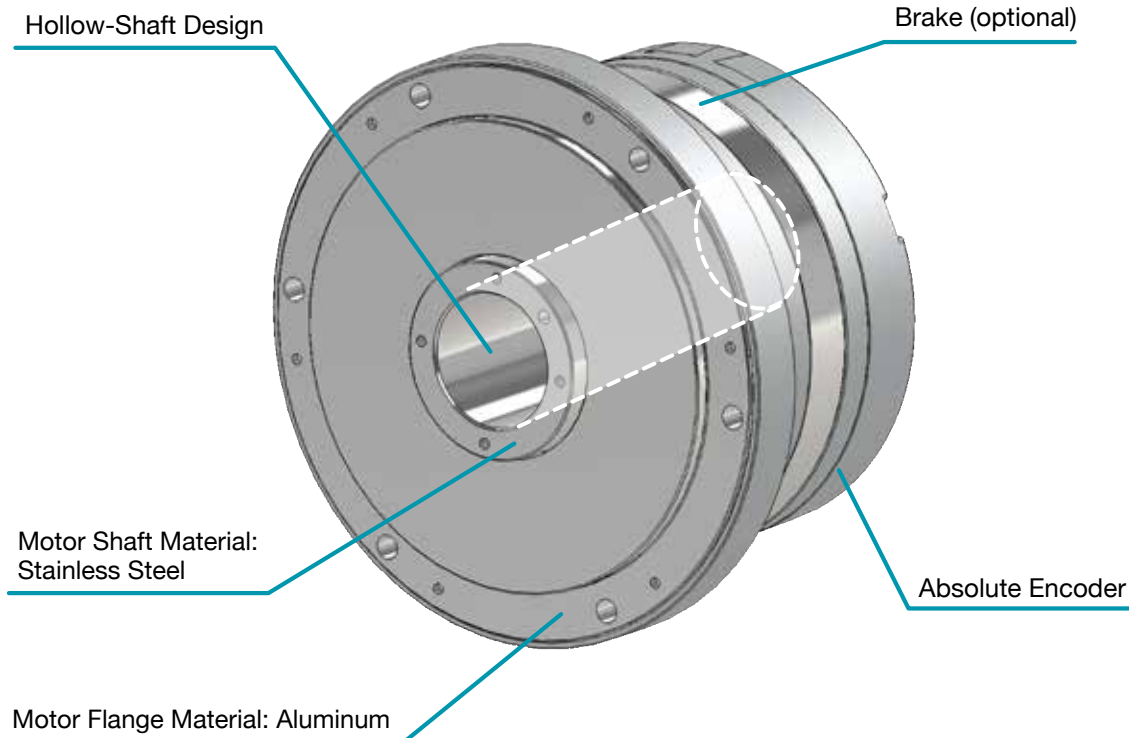


High-performance, hollow-shaft servo motors are available in five sizes. Flat design features a large through-hole to allow cables, shafts or lasers to pass through the axis of rotation.

Features

- Hollow-shaft design to pass cables, pipes or lasers through the axis of rotation
- Flat design
- Five models with rated output from 163 to 1320 W
- Optional brake available without change in dimensions
- Mitsubishi, Panasonic, Yaskawa compatible

Structure



Ordering Code

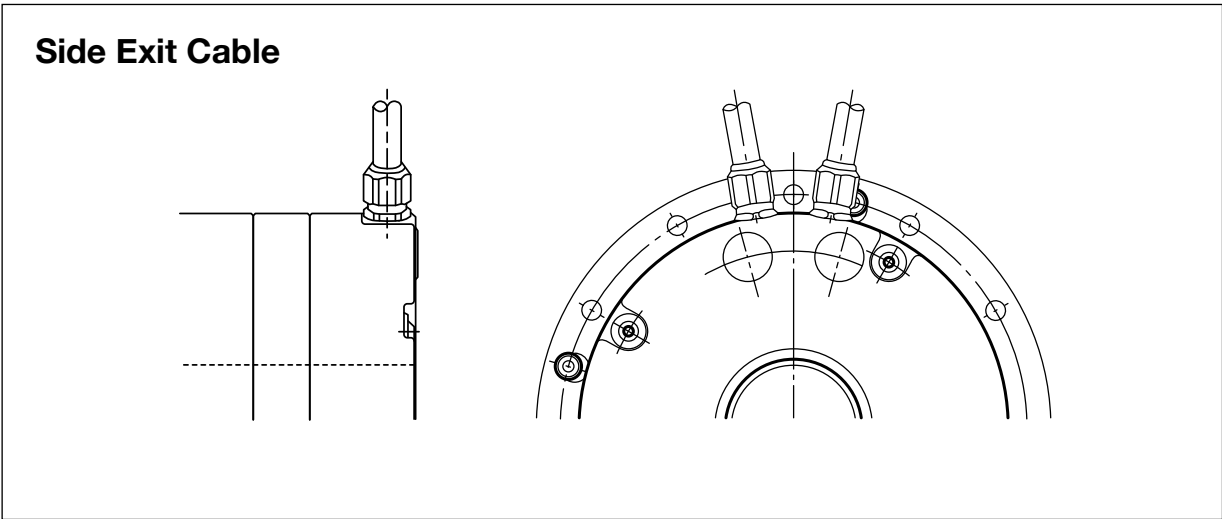
HMA	B	09	A	200	–	10	S17b	A	–	C	–	SP
(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)		(9)	(10)	(11)

(1)	Model Name	AC Servo Motor HMA Series	(6)	Encoder Format	10: A-format 2.5 Mbps, 1:1 connection 17: Yaskawa
(2)	Motor Version Symbol	A: Size 21A B: Size 09, 12, 15 C: Size 08	(7)	Encoder Resolution	S17b: 17-bit Absolute Encoder
(3)	Size	08, 09, 12, 15, 21A	(8)	Encoder Phase Angle	Phase difference between the motor U phase and the encoder origin A: 0 degrees
(4)	Brake	A: Without Brake B: With BJ99	(9)	Connector Specification	C : With Standard Connectors N : Without Connectors
(5)	Applied Servo Driver Input Voltage	100: 100 VAC (Only size 09 is compatible with 100 VAC) 200: 200 VAC	(10)	Option Symbols	Y : Side Exiting Cable
			(11)	Special Specifications	No Symbol: Standard Product SP: Special Specification Code

Options

Side Exit Cable (Option: Y)

Cables (motor and encoder cable) exit from the side of the motor.
Use this option when there is not enough space in the rear of housing when installing a motor.
For size 08, contact us. Size 21A is not compatible.



HMA Specifications

Item			Model	HMAC08	HMAB09		HMAB12	HMAB15	HMAA21A
Compatible drive				REL-230-18	REL-230-18	REL-230-36	REL-230-36	HA-800□-24D-E-200	HA-800□-24D-E-200
Input power supply voltage		V	200	200	100	200	200	200	
Rated output		W	163	251		406	754	1320	
Instantaneous maximum torque ^{*1}		N•m	1.8	3.0		6.6	13	33	
Rated torque ^{*1,*2}		N•m	0.52	0.80		1.55	3.60	12.6	
Maximum speed ^{*1}		rpm	6,000	5,600	4,800	4,800	4,000	3,000	
Rated speed		rpm	3,000	3,000		2,500	2,000	1,000	
Instantaneous maximum current ^{*1}		A _{rms}	6.5	8.9	15.4	18	29	55	
Rated current ^{*1,*2}		A _{rms}	2.1	2.5	4.3	4.2	7.8	20.0	
Torque constant ^{*1}		N•m/A _{rms}	0.35	0.41	0.24	0.44	0.54	0.72	
EMF constant ^{*3}		V/(rpm)	0.037	0.043	0.025	0.046	0.057	0.075	
Phase resistance (20°C)		Ω	1.43	1.2	0.4	0.33	0.19	0.028	
Phase inductance		mH	2.5	3.0	1.0	1.4	1.2	0.29	
Moment of Inertia () indicates with brake	GD ² /4	×10 ⁻⁴ kg•m ²	0.734 (0.828)	1.78 (2.16)		6.45 (6.83)	15.8 (19.8)	125 (141)	
	J	×10 ⁻⁴ kgf•cm•s ²	7.49 (8.45)	18.2 (22.1)		65.8 (69.7)	161 (202)	1280 (1444)	
Allowable radial load (static)		N	800	800		1200	2400	4500	
		kgf	81.6	81.6		122	245	459	
Allowable axial load (static)		N	1900	2400		3600	5000	14000	
		kgf	194	245		367	510	1429	
Rated radial load (At the rated speed)		N	175	185		233	530	1040	
		kgf	17.9	18.9		23.8	54.1	106.1	
Rated axial load (At the rated speed)		N	100	105		130	180	880	
		kgf	10.2	10.7		13.3	18.4	89.8	
Encoder type			Absolute encoder						
Encoder resolution capability	Single turn motor revolution	2 ¹⁷ (131,072)							
	Multi-turn revolution counter ^{*4}	2 ¹⁶ (65,536)							
Weight () indicates with brake		kg	1.4 (1.5)	2.0 (2.1)		3.4 (3.8)	5.5 (6.2)	17.5 (19.7)	
Ambient environment specification			Operating temperature: 0 to 40°C/Storage temperature: -20 to 60°C Operating/storage humidity: 20 to 80% RH (non-condensing) Vibration resistance: 25 m/s ² (frequency: 10 to 400 Hz) / impact resistance: 300 m/s ² Vibration resistance: 25 m/s ² (frequency: 10 to 400 Hz) / impact resistance: 300 m/s ² No dust, metal powder, corrosive gas, flammable gas, oil mist, or other similar material. Place indoors without being exposed to direct sunlight. Altitude: 1,000 m or less						
Motor insulation			Insulation resistance: 100 MΩ (500 VDC) or higher Dielectric strength: 1500 VAC/min Insulation class: A						
Mounting Direction			Can be installed in any direction						
Protection structure			Totally enclosed self-cooled type (IP54)						

The values in the table above show typical values.

*1: When tested with HA-800.

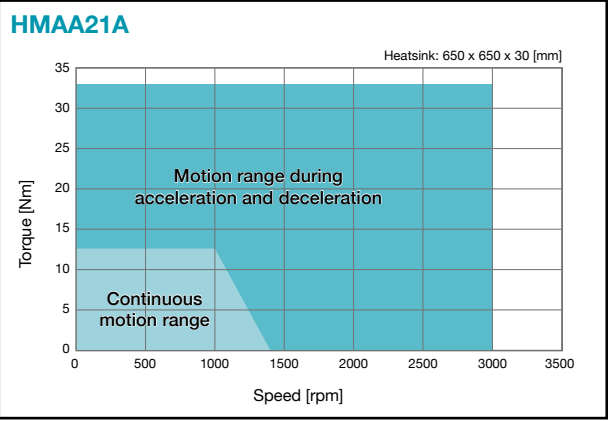
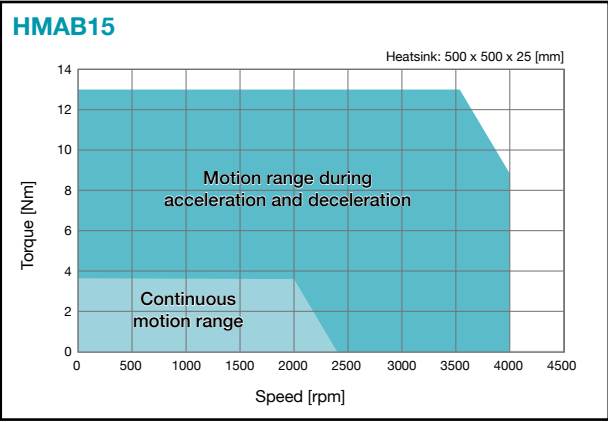
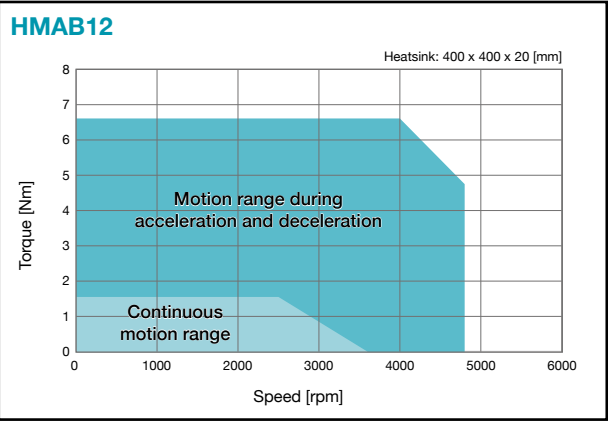
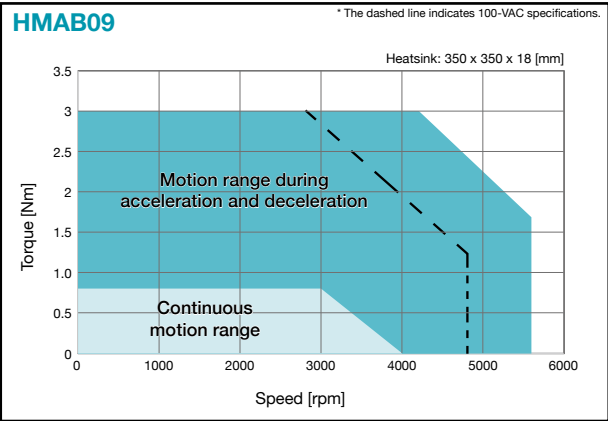
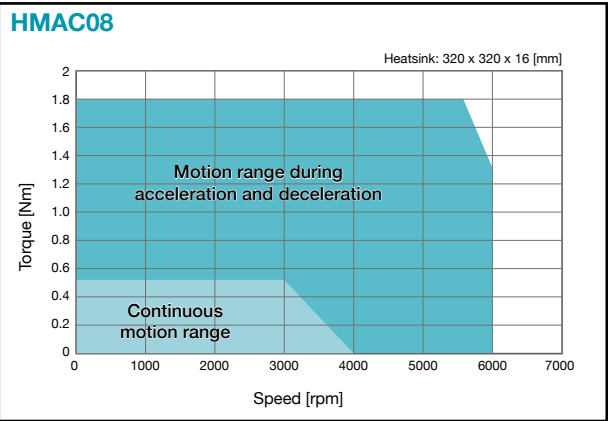
*2: This is the value for saturated temperature when installed on the next aluminum heatsink of the following size:

HMAC08: 320 x 320 x 16 [mm], HMAB09: 350 x 350 x 18 [mm], HMAB12: 400 x 400 x 20 [mm], HMAB15: 500 x 500 x 25 [mm], HMAA21A: 650 x 650 x 30 [mm]

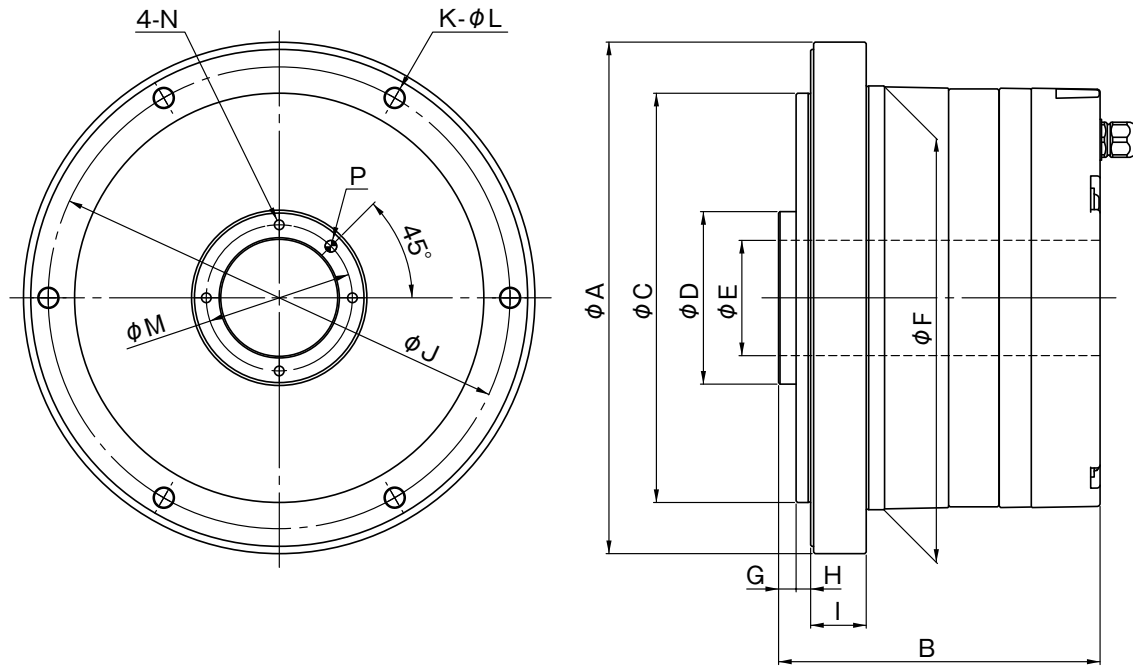
*3: This is the value of the phase EMF constant multiplied by 3.

*4: The range of the multi revolution counter is from -32,768 to 32,767.

Operating Range



Outline Dimensions



(Unit: mm)

Dimension	HMAC08	HMAC09	HMAC12	HMAC15	HMAA21A
φA	94	114	146	175	247
B	89	88.5	95.5	110	157
φC	75 h7	90 h7	114 h7	140 h7	200 h7
φD	28 h6	34 h6	43 h6	59 h6	88 h6
φE (hollow diameter)	16	22	30	40	60
φF	77 h7	94 h7	122 h7	145 h7	210 h7
G	5	5	5	6	8
H	5	5	5	5	8
I	13	13	15	19	39
φJ	84	102	132	158	226
K	6	6	6	6	8
φL	3.4	4.5	5.5	6.6	9.0
φM	22	28	36	50	74
N	M3X6	M3X6	M3X6	M4X8	M5X10
P	φ3 H7X5	φ3 H7X5	φ3 H7X5	φ4 H7X7	φ5 H7X8

Rotary Actuator

Linear Actuator

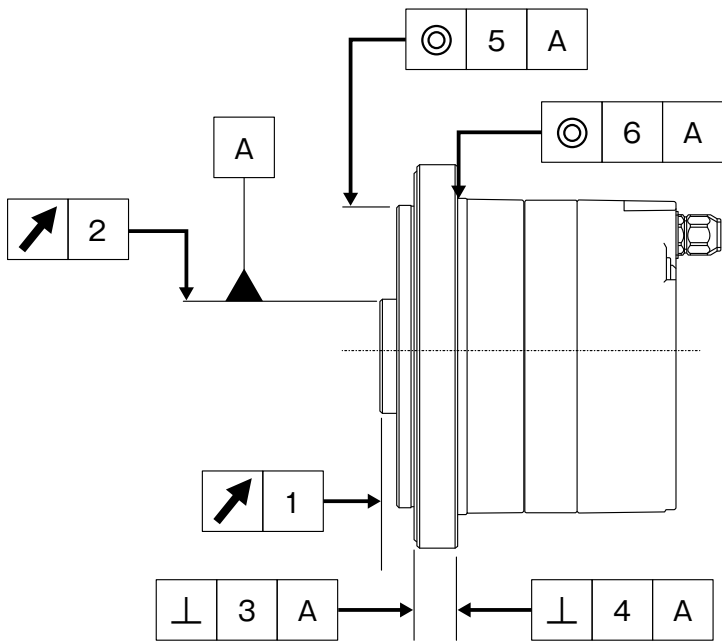
Direct Drive Motor

Servo Drives

Servo Drives

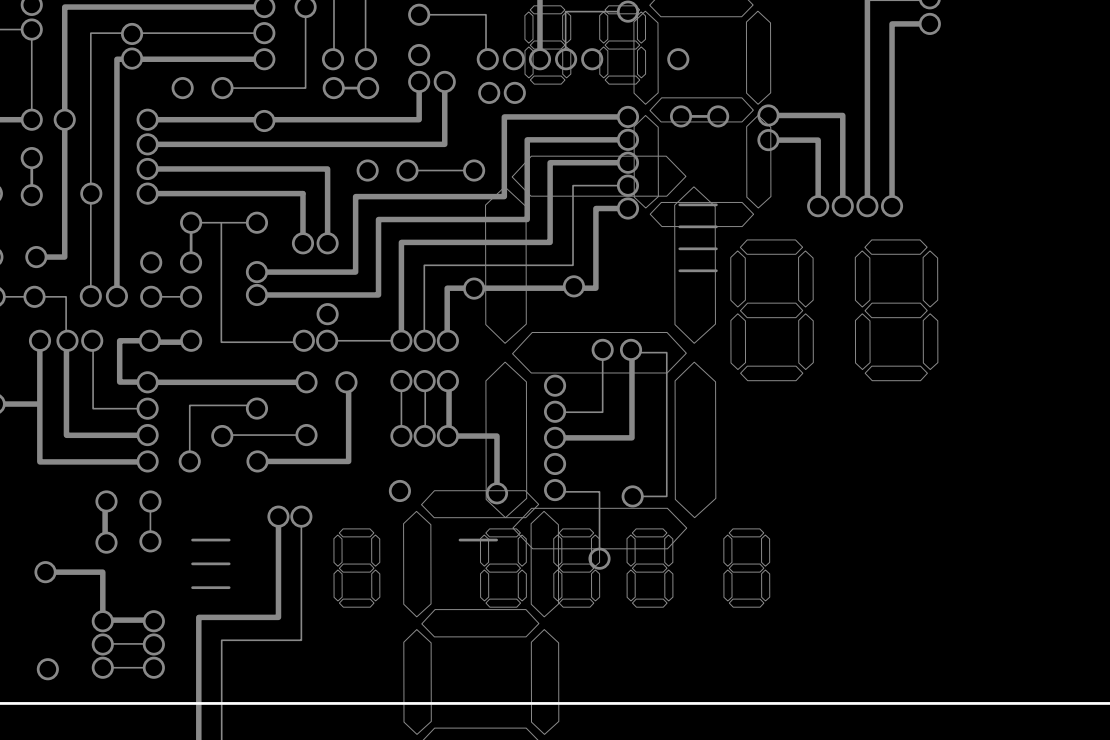
Servo Drives

Mechanical Accuracy



(Unit :mm)

Accuracy Item	HMAC08	HMAB09	HMAB12	HMAB15	HMAA21A
1. Output shaft surface runout	0.020	0.020	0.020	0.040	0.040
2. Output shaft radial runout	0.020	0.020	0.020	0.040	0.040
3. Mounting surface squareness to the output shaft	0.080	0.080	0.080	0.090	0.100
4. Mounting surface squareness to the output shaft	0.060	0.065	0.065	0.085	0.090
5. Concentricity between the output shaft and actuator mounting diameter	0.050	0.050	0.050	0.050	0.060
6. Concentricity between the output shaft and actuator mounting diameter	0.045	0.045	0.045	0.055	0.065

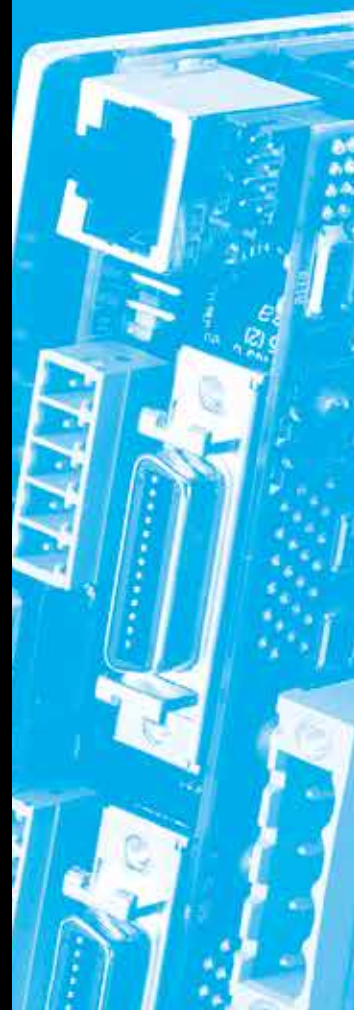


Servo Drives

For the U.S.

AC Servo Drives

REL Series	160
RTL Series	164
DDP Series	166
DCJ Series	170



REL Series



REL set new levels of performance, connectivity, and flexibility. Ethernet based EtherCAT operates in CANopen over EtherCAT mode (CoE). A wide range of absolute interfaces are built-in including EnDat, and BiSS.

High resolution A/D converters ensure optimal current loop performance. Both isolated and high-speed non-isolated I/O are provided. For safety critical applications, redundant power stage enable inputs can be employed.

EtherCAT

Features

■ Control Modes

- Indexer, Point-to-Point, PVT
- Camming, Gearing
- Position, Velocity, Torque

□ Command Interface

- CANopen over EtherCAT (CoE)
- ASCII and discrete I/O
- Stepper commands
- $\pm 10V$ position/velocity/torque (2 inputs)
- PWM velocity/torque command
- Master encoder (Gearing/Camming)

■ Communications

- EtherCAT
- RS-232

■ Accessories

- External regen resistors
- External edge filter

■ Feedback

- Digital quad A/B encoder
- EnDat, BiSS, SSI, Yaskawa & Panasonic encoders
- Aux. encoder / encoder out
- Analog sin/cos encoder
- Resolver option
- Digital Halls

■ Safety Disable

- Two active inputs enable power stage
- One output confirms power stage status

■ I/O Digital

- 15 inputs, 6 outputs

■ I/O Analog

- 2, 16 bit inputs
- 1, 12 bit output

■ Dimensions: in [mm]

- 7.9 x 5.5 x 2.3 [202 x 139 x 52]

Model	VAC	Ic*	Ip*
REL-230-18	100 - 240	6	18
REL-230-36	100 - 240	12	36
REL-230-40	100 - 240	20	40

Add -R for resolver feedback option.

Ic = Continuous Current (Apk)

Ip = Peak Current (Apk)

Specifications

Test conditions: Wye connected load: 2 mH line-line. Ambient temperature = 25 °C. Power input = 230 Vac, 60 Hz, 1 Ø

MODEL	REL-230-18	REL-230-36	REL-230-40	
OUTPUT CURRENT				
Peak Current	18 (12.7)	36 (25.5)	40 (28.3)	Adc (Arms, sinusoidal)
Peak time	1	1	1	s
Continuous current (Note 1)	6 (4.24)	12 (8.5)	20 (14.1)	Adc (Arms, sinusoidal)
INPUT POWER				
Mains voltage, phase, frequency		100~240		Vac, ±10%, 1 Ø or 3 Ø, 47~63 Hz
Mains current		20		Arms
+24 Vdc Control power		+20 to +32 VDC, 500 mA max		Required for operation
DIGITAL CONTROL				
Digital Control Loops		Current, velocity, position. 100% digital loop control		
Sampling rate (time)		Current loop: 16 kHz (62.5 µs), Velocity & position loops: 4 kHz (250 µs)		
Bus voltage compensation		Changes in bus or mains voltage do not affect bandwidth		
Minimum load inductance		200 µH line-line		
COMMAND INPUTS				
Distributed Control Mode				
CANopen over EtherCAT (CoE)		Position, Velocity, Torque, Homing, Profile, Interpolated Profile, and Cyclic Synchronous modes		
Stand-alone mode				
Analog torque, velocity, position reference		±10 Vdc, 16 bit resolution	Dedicated differential analog input	
Digital position reference		Pulse/Direction, CW/CCW	Stepper commands (2 MHz maximum rate)	
		Quad A/B Encoder	2 M line/sec, 8 Mcount/sec (after quadrature)	
Digital torque & velocity reference		PWM , Polarity	PWM = 0% - 100%, Polarity = 1/0	
		PWM 50%	PWM = 50% ±50%, no polarity signal required	
		PWM frequency range	1 kHz minimum, 100 kHz maximum	
		PWM minimum pulse width	220 ns	
Indexing		Up to 32 programs can be launched from inputs or ASCII commands.		
Camming		Up to 10 CAM tables can be stored in flash memory		
DIGITAL INPUTS				
Number	15			
[IN1,2]		Non-isolated Schmitt trigger, 1 µs RC filter, 24 VDC max, Vin-LO <= 1.25 VDC, Vin-HI >= 3.5 VDC, Hysteresis = 0.66 VDC minimum, 10 kΩ programmable per input to pull-up to +5 VDC or pull-down to ground		
[IN3~6]		Non-isolated line receiver, 100 ns RC filter, +12 VDC max, programmable as 4 single-ended, or 2 differential		
		Single-ended: [IN3,4] or [IN5,6]: Vin-LO <= 2.3 VDC, Vin-HI >= 2.7 VDC, Vhysteresis = 400 mVDC		
		Differential: [IN3/4] or [IN5/6]: Vin-LO <= -200 mVDC, Vin-HI >= 200 mVDC, Vhysteresis = ±200 mVDC		
[IN7~14]		Isolated: Opto-isolated, ±15~30 Vdc compatible, bi-polar, 2 groups of 4 with common for each group		
[ENCFLT]		Encoder fault; same electrical specs as [IN1,2,15] except 10 kΩ fixed pull-up to +5 VDC		
ANALOG INPUTS				
Number	3			
[AIN1~2]		Differential, ±10 Vdc, 5 kΩ input impedance, 16-bit resolution		
[AIN3]		Single-ended, motor temperature sensor, 4.99 kΩ pulled-up to +5 Vdc, 12-bit resolution		
DIGITAL OUTPUTS				
Number	6			
[OUT1~2]		Current-sinking MOSFET with 1 kΩ pullup to +5 Vdc through diode		
		1 Adc max, +40 Vdc max; external flyback diode required if driving inductive loads		
[OUT3]		High-speed CMOS buffer, ±32 mA		
[OUT4~5]		Opto-isolated Darlington with 36V Zener flyback diodes, 50 mA max		
[OUT6]		Motor brake control: opto-isolated, current-sinking with flyback diode to +24 VDC, 1 Adc max		
ANALOG OUTPUT				
Number	1			
Range		±5 Vdc single-ended, 12-bit resolution		
MULTI-MODE ENCODER PORT				
As Input		Secondary digital quadrature encoder (A, /A, B, /B, X, /X), 121 Ω terminating resistors		
		18 M-counts/sec, post-quadrature (4.5 M-lines/sec)		
As Output		Quadrature encoder emulation with programmable resolution to 4096 lines (65,536 counts) per rev from analog sin/cos encoders or resolvers. Buffered signals from digital quad A/B/X primary encoder		
		A, /A, B, /B, X, /X, from MAX3032 differential line driver		
RS-232 PORT				
Signals		RxD, TxD, Gnd in 6-position, 4-contact RJ-11 style modular connector		
Mode		Full-duplex, DTE serial communication port for drive setup and control, 9,600 to 115,200 Baud		
Protocol		Binary and ASCII formats		
ETHERCAT PORTS				
Format		Dual RJ-45 receptacles, 100BASE-TX		
Protocol		EtherCAT, CANopen over EtherCAT (CoE)		
STATUS INDICATORS				
Drive Status		Bicolor LED, drive status indicated by color, and blinking or non-blinking condition		
NET Status		Bicolor LED, status of EtherCAT bus indicated by color and blink codes to CAN Indicator Specification 303-3		
5V OUTPUT				
		Two independent 5 VDC @ 400 mA outputs: J8-20 and J10-6,17		

NOTES:

- *1. Heatsinking and/or forced-air cooling is required for continuous output power rating
- *2. Brake[OUT4] is programmable as motor brake, or as general purpose digital output

Specification

REGENERATION

Operation	Internal solid-state switch drives external regen resistor (see Ordering Guide for types)	
Cut-In Voltage	+HV > 390 VDC	Regen output is on, (optional external) regen resistor is dissipating energy
Drop-Out Voltage	+HV < 380 VDC	Regen output is off, (optional external) regen resistor not dissipating energy
Tolerance	±2 Vdc	For either Cut-In or Drop-Out voltage

PROTECTIONS

Mains power loss	Interruption or loss of AC power is detected	
HV Overvoltage	+HV > 400 VDC	Drive PWM outputs turn off until +HV is less than overvoltage
HV Undervoltage	+HV < 60 VDC	Drive PWM outputs turn off until +HV is greater than undervoltage
Drive over temperature	IGBT > 80 °C ±3 °C	Drive PWM outputs turn off until IGBT temperature is below threshold
Short circuits	Output to output, output to ground, internal PWM bridge faults, regen resistor fail-shorts	
I ² T Current limiting	Programmable: continuous current, peak current, peak time	
Motor over temperature	Drive shuts down when motor over-temperature switch changes to high-resistance state, or opens	
Feedback power loss	Fault occurs if feedback is removed or +5 V is <85% of normal	

MECHANICAL & ENVIRONMENTAL

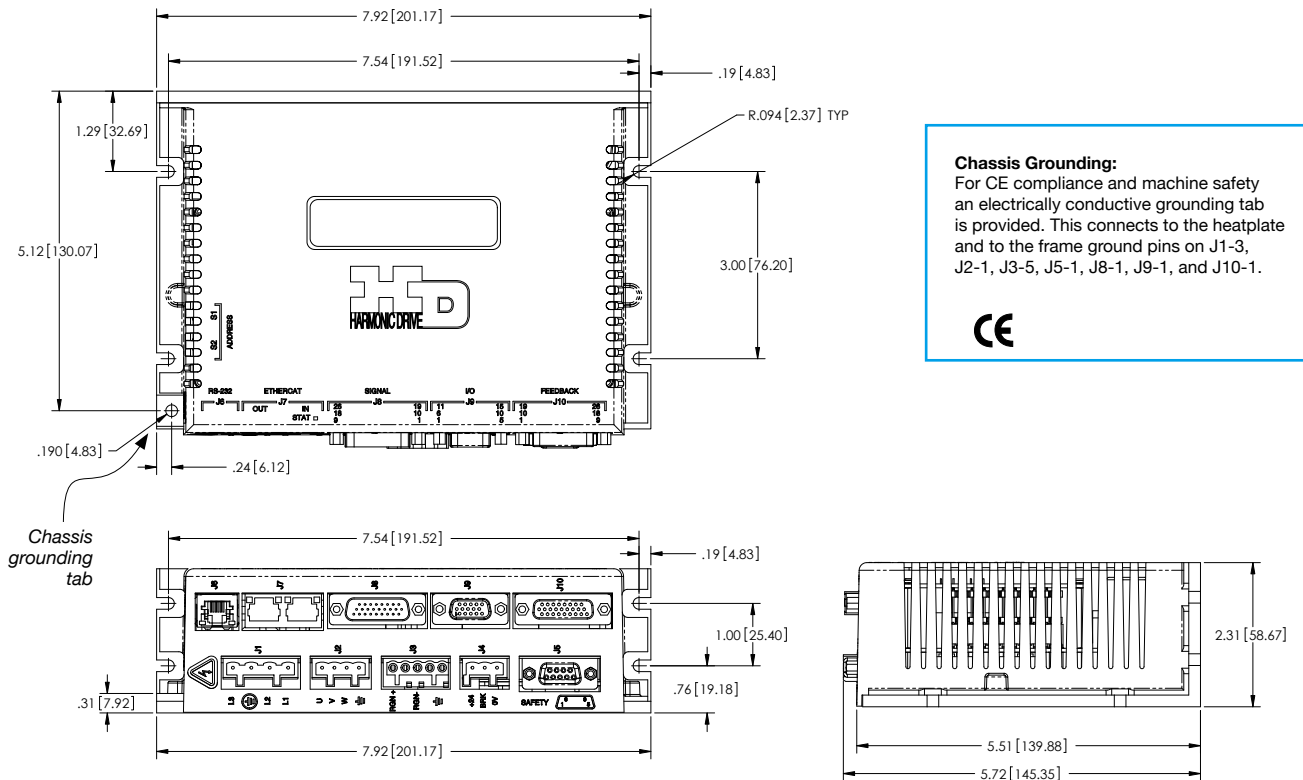
Size	7.55 in (191,8 mm) X 5.57 in (141,5 mm) X 2.57 in (65,3 mm)
Weight	3.0 lb (1.36 kg) for drive without heatsink 3.1 lb (1.40 kg) for XEL-HS heatsink, 1.86 lb (0.84 kg) for XEL-HL heatsink
Ambient temperature	0 to +45 °C operating, -40 to +85 °C storage
Humidity	0% to 95%, non-condensing
Contaminants	Pollution degree 2
Vibration	2 g peak, 10~500 Hz (sine), IEC60068-2-6
Shock	10 g, 10 ms, half-sine pulse, IEC60068-2-27
Environment	IEC68-2: 1990
Cooling	Heat sink and/or forced air cooling required for continuous power output

AGENCY STANDARDS CONFORMANCE

EN 55011 : 1998	CISPR 11 (1997) Edition 2/Amendment 2: Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment
EN 61000-6-1 : 2001	Electromagnetic Compatibility Generic Immunity Requirements <i>Following the provisions of EC Directive 89/336/EEC:</i>
EN 61010-1 2nd Ed.: 2004	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use <i>Following the provisions of EC Directive 2006/95/EC:</i>
UL 508C 3rd Ed.: 2002	UL Standard for Safety for Power Conversion Equipment

Dimensions

Inches [mm]



Feedback Specifications

DIGITAL QUAD A/B ENCODER

Type	Quadrature, differential line driver outputs
Signals	A, /A, B, /B, (X, /X, index signals optional)
Frequency	5 MHz line frequency, 20 MHz quadrature count frequency

ANALOG ENCODER

Type	Sin/cos/index, differential line driver outputs, 0.5 V _{peak-peak} (1.0 V _{peak-peak} differential) centered about 2.5 VDC typical. Common-mode voltage 0.25 to 3.75 Vdc
Signals	Sin(+), sin(-), cos(+), cos(-), index(+), index(-)
Frequency	230kHz maximum line (cycle) frequency
Interpolation	10 bits/cycle (1024 counts/cycle)

DIGITAL HALLS

Type	Digital, single-ended, 120° electrical phase difference
Signals	U, V, W
Inputs	10 kΩ pullups to +5 Vdc, 1 μs RC filter to Schmitt trigger inverters

MULTI-MODE ENCODER PORT

As Input	Secondary digital quadrature encoder (A, /A, B, /B, X, /X), 121 Ω terminating resistors 18 M-counts/sec, post-quadrature (4.5 M-lines/sec)
As Emulated Output	Quadrature encoder emulation with programmable resolution to 4096 lines (65,536 counts) per rev from analog sin/cos encoders or resolvers.
As Buffered Output	A, /A, B, /B, X, /X, from MAX3032 differential line driver Digital encoder feedback signals from primary digital encoder are buffered by MAX3032 line driver

RESOLVER (-R OPTION)

Type	Brushless, single-speed, 1:1 to 2:1 programmable transformation ratio
Resolution	14 bits (equivalent to a 4096 line quadrature encoder)
Reference frequency	7.5 kHz
Reference voltage	2.8 Vrms, auto-adjustable by the drive to maximize feedback
Reference maximum current	100 mA
Maximum RPM	10,000+

ENCODER POWER SUPPLIES

Number	2
Ratings	+5 VDC @ 400 mA from J10-6 and J8-20
Protection	Current-limited to 750 mA @ 1 Vdc if overloaded Encoder power developed from +24 Vdc so position information is not lost when AC mains power is removed

Rotary Actuator

Linear Actuator

Direct Drive Motor

Servo Drives

Servo Drives

Servo Drives

RTL Series



RTL Series Servo Driver combines CANopen networking with 100% digital control of brushless or brush motors in an off-line powered package that can operate from single or three-phase mains with continuous power output to 4 kW.

Standard models use quad A/B digital encoders for feedback. Two other versions are available for use with resolvers or sin/cos analog encoders.

Features

Control Modes

- Indexer, Point-to-Point, PVT
- Camming, Gearing, Position, Velocity, Torque

Command Interface

- Stepper commands
Single-ended or Differential selectable
- CANopen
- ASCII and discrete I/O
- $\pm 10V$ position/velocity/torque command
- PWM velocity/torque command
- Master encoder (Gearing/Camming)

Communications

- CANopen
- RS232

Feedback

- Digital quad A/B encoder
- Analog sin/cos encoder (-S versions)
- Resolver (-R versions)
- Secondary encoder / emulated encoder out
- Digital Halls

I/O Digital

- 12 inputs, 4 outputs

Dimensions: in [mm]

- 7.5 x 5.5 x 2.5 [191 x 140 x 64]

Model	VAC	Ic*	Ip*
RTL-230-18	100 - 240	6	18
RTL-230-36	100 - 240	12	36
RTL-230-40	100 - 240	20	40

Add -S to part numbers above for sin/cos feedback, or add -R for resolver feedback models.

*Ic = Continuous Current (Apk)

*Ip = Peak Current (Apk)

Specifications

Test conditions: Wye connected load: 2 mH line-line. Ambient temperature = 25 °C. Power input = 230 Vac, 60 Hz, 1 Ø

MODEL	RTL-230-18	RTL-230-36	RTL-230-40	Same specs for -S and -R models
OUTPUT CURRENT				
Peak Current	18 (12.7)	36 (25.5)	40 (28.3)	Adc (Arms, sinusoidal)
Peak time	1	1	1	s
Continuous current ⁻¹	6 (4.24)	12 (8.5)	20 (14.1)	Adc (Arms, sinusoidal)
INPUT POWER				
Mains voltage, phase, frequency		100~240		Vac, ±10%, 1 Ø or 3 Ø, 47~63 Hz
Mains current		20		Arms
+24 Vdc Control power		+20 to +32 VDC, 500 mA max		Required for operation
DIGITAL CONTROL				
Digital Control Loops		Current, velocity, position. 100% digital loop control		
Sampling rate (time)		Current loop: 15 kHz (67 µs), Velocity & position loops: 3 kHz (333 µs)		
Bus voltage compensation		Changes in bus or mains voltage do not affect bandwidth		
Minimum load inductance		200 µH line-line		
COMMAND INPUTS (NOTE: DIGITAL INPUT FUNCTIONS ARE PROGRAMMABLE)				
Distributed Control Modes				
CANopen		Position, Velocity, Torque, Homing, Profile, and Interpolated profile modes		
DeviceNet®		Compatible with Allen-Bradley PLC's		
ASCII		Multiple drives accessible from a single RS-232 port		
Stand-alone Mode				
Analog torque, velocity, position reference		±10 VDC, 12 bit resolution	Dedicated differential analog input	
Input impedance		74.8 kΩ	Between Ref(+), Ref(-)	
Digital position reference		Pulse/Direction, CW/CCW	Stepper commands (2 MHz maximum rate)	
		Quad A/B Encoder	2 M line/sec, 8 Mcount/sec (after quadrature)	
Digital torque & velocity reference		PWM , Polarity	PWM = 0% - 100%, Polarity = 1/0	
		PWM 50%	PWM = 50% ±50%, no polarity signal required	
		PWM frequency range	1 kHz minimum, 100 kHz maximum	
		PWM minimum pulse width	220 ns	
Indexing		Up to 32 programs can be launched from inputs or ASCII commands. Each program can consist of moves, I/O commands, time delays, and other programmable operations.		
Camming		Master quadrature encoder provides position as index to cam table. Digital inputs initiate cam functions.		
DIGITAL INPUTS				
Number	12			
Inputs [IN1~5,11,12]		74HC14 Schmitt trigger, 330 µs RC filter, Vin-LO < 1.35 VDC, Vin-HI >3.65 VDC, +24 VDC max [IN1] dedicated to drive enable function, other inputs are programmable		
Input [IN6]		74HC14 Schmitt trigger, 100 ns RC filter, Vin-LO < 1.35 VDC, Vin-HI >3.65 Vdc, +12 VDC max		
Inputs [IN7~10]		Single-ended: Comparator with 2.5 Vdc reference, 100 ns RC filter, Vin-LO <2.3 VDC, Vin-HI > 2.45 VDC Differential: RS-485 line receiver on input pairs [IN9-7], and [IN10-8], 100 ns RC filters, +12 VDC max		
All inputs		10 kΩ pull-up to +5 Vdc or pull-down to ground, selectable in groups, active level programmable		
DIGITAL OUTPUTS ^{*2}				
Number	4			
[OUT1], [OUT2], [OUT3]		Current-sinking MOSFET with 1 kΩ pullup to +5 VDC through diode		
Current rating		1 Adc max, +40 VDC max. Functions programmable External flyback diode required if driving inductive loads		
Brake [OUT4]		Opto-isolated, current-sinking with flyback diode to +24 VDC, 1 Adc max		
MULTI-MODE ENCODER PORT				
As Input		Secondary digital quadrature encoder (A, /A, B, /B, X, /X), 121 Ω terminating resistors 18 M-counts/sec, post-quadrature (4.5 M-lines/sec)		
As Output		Quadrature encoder emulation with programmable resolution to 4096 lines (65,536 counts) per rev from analog sin/cos encoders or resolvers. Buffered signals from digital quad A/B/X primary encoder A, /A, B, /B, X, /X, from 26LS31 differential line driver		
RS-232 PORT				
Signals		RxD, TxD, Gnd in 6-position, 4-contact RJ-11 style modular connector		
Mode		Full-duplex, DTE serial communication port for drive setup and control, 9,600 to 115,200 baud		
Protocol		Binary and ASCII formats		
CAN PORTS				
Signals		CANH, CANL, Gnd in 8-position RJ-45 style modular connector, wired as per CAN Cia DR-303-1, V1.1		
Format		CAN V2.0b physical layer for high-speed connections compliant		
Data		CANopen Device Profile DSP-402		
Address selection		16 position rotary switch on front panel with 3 additional address bits available as digital inputs or programmable to flash memory (7-bit addressing, 127 nodes per CAN network)		
STATUS INDICATORS				
Drive Status		Bicolor LED, drive status indicated by color, and blinking or non-blinking condition		
CAN Status		Bicolor LED, status of CAN bus indicated by color and blink codes to CAN Indicator Specification 303-3		
REGENERATION				
Operation		Internal solid-state switch drives external regen resistor (see Ordering Guide for types)		
Cut-In Voltage		+HV > 390 VDC	Regen output is on, (optional external) regen resistor is dissipating energy	
Drop-Out Voltage		+HV < 380 VDC	Regen output is off, (optional external) regen resistor not dissipating energy	
Tolerance		±2 Vdc	For either Cut-In or Drop-Out voltage	

NOTES:

*1. Heatsinking and/or forced-air cooling is required for continuous output power rating

*2. Brake[OUT4] is programmable as motor brake, or as general purpose digital output

Specifications

PROTECTIONS

HV Overvoltage	+HV > 400 VDC	Drive PWM outputs turn off until +HV is less than overvoltage
HV Undervoltage	+HV < 60 VDC	Drive PWM outputs turn off until +HV is greater than undervoltage
Drive over temperature	IGBT > 80 °C ±3 °C	Drive PWM outputs turn off until IGBT temperature is below threshold
Short circuits	Output to output, output to ground, internal PWM bridge faults	
I ² T Current limiting	Programmable: continuous current, peak current, peak time	
Motor over temperature	Drive shuts down when motor over-temperature switch changes to high-resistance state, or opens	
Feedback power loss	Fault occurs if feedback is removed or +5 V is <85% of normal	

MECHANICAL & ENVIRONMENTAL

Size	7.55 in (191,8 mm) X 5.57 in (141,5 mm) X 2.57 in (65,3 mm)
Weight	3.0 lb (1.36 kg) for drive without heatsink 1.9 lb (0.86 kg) for XTL-HS heatsink, 1.26 lb (0.57 kg) for XTL-HL heatsink
Ambient temperature	0 to +45 °C operating, -40 to +85 °C storage
Humidity	0% to 95%, non-condensing
Vibration	2 g peak, 10~500 Hz (sine), IEC60068-2-6
Shock	10 g, 10 ms, half-sine pulse, IEC60068-2-27
Contaminants	Pollution degree 2
Environment	IEC68-2: 1990
Cooling	Heat sink and/or forced air cooling required for continuous power output

AGENCY STANDARDS CONFORMANCE

EN 55011 : 1998	CISPR 11 (1997) Edition 2/Amendment 2: Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment
EN 61000-6-1 : 2001	Electromagnetic Compatibility Generic Immunity Requirements <i>Following the provisions of EC Directive 89/336/EEC:</i>
EN 61010-1 2nd Ed.: 2004	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use <i>Following the provisions of EC Directive 2006/95/EC:</i>
UL 508C 3rd Ed.: 2002	UL Standard for Safety for Power Conversion Equipment

Feedback Specifications

ENCODER

DIGITAL QUAD A/B ENCODER

Type	Quadrature, differential line driver outputs
Signals	A, /A, B, /B, X, /X, index signals optional
Frequency	5 MHz line frequency, 20 MHz quadrature count frequency

ANALOG ENCODER

Type	Sin/cos, differential line driver outputs, 0.5 V _{peak-peak} (1.0 V _{peak-peak} differential) centered about 2.5 VDC typical. Common-mode voltage 0.25 to 3.75 Vdc
Signals	Sin(+), sin(-), cos(+), cos(-)
Frequency	230 kHz maximum line (cycle) frequency
Interpolation	10 bits/cycle (1024 counts/cycle)

DIGITAL HALLS

Type	Digital, single-ended, 120° electrical phase difference
Signals	U, V, W
Frequency	Consult Harmonic Drive for speeds >10,000 RPM

ENCODER POWER SUPPLY

Power Supply	+5 Vdc @ 400 mA to power encoders & Halls
Protection	Current-limited to 750 mA @ 1 VDC if overloaded Encoder power developed from +24 VDC so position information is not lost when AC mains power is removed

MOTOR CONNECTIONS

Phase U, V, W	PWM outputs to 3-phase ungrounded Wye or delta connected brushless motors
Hall U, V, W	Hall signals
Digital Encoder	A, /A, B, /B, X, /X, on standard models
Analog Encoder	Sin(+), sin(-), cos(+), cos(-), X, /X, on -S versions (X & /X index signals are digital)
Hall & encoder power	+5 Vdc @ 400 mA maximum
Motemp [IN5]	Motor overtemperature sensor input, 4.99 kΩ to +5 VDC or ground
Signal ground	Return for encoder, Halls, and temperature sensor
Brake [OUT4]	Current-sinking motor brake driver
+24 Vdc	From drive +24 VDC power supply to power motor brake
Frame ground	For motor cable shield

Feedback Specifications

RESOLVER

Type	Brushless, single-speed, 1:1 to 2:1 programmable transformation ratio
Resolution	14 bits (equivalent to a 4096 line quadrature encoder)
Reference frequency	7.5 kHz
Reference voltage	2.8 Vrms, auto-adjustable by the drive to maximize feedback
Reference maximum current	100 mA
Maximum RPM	10,000+

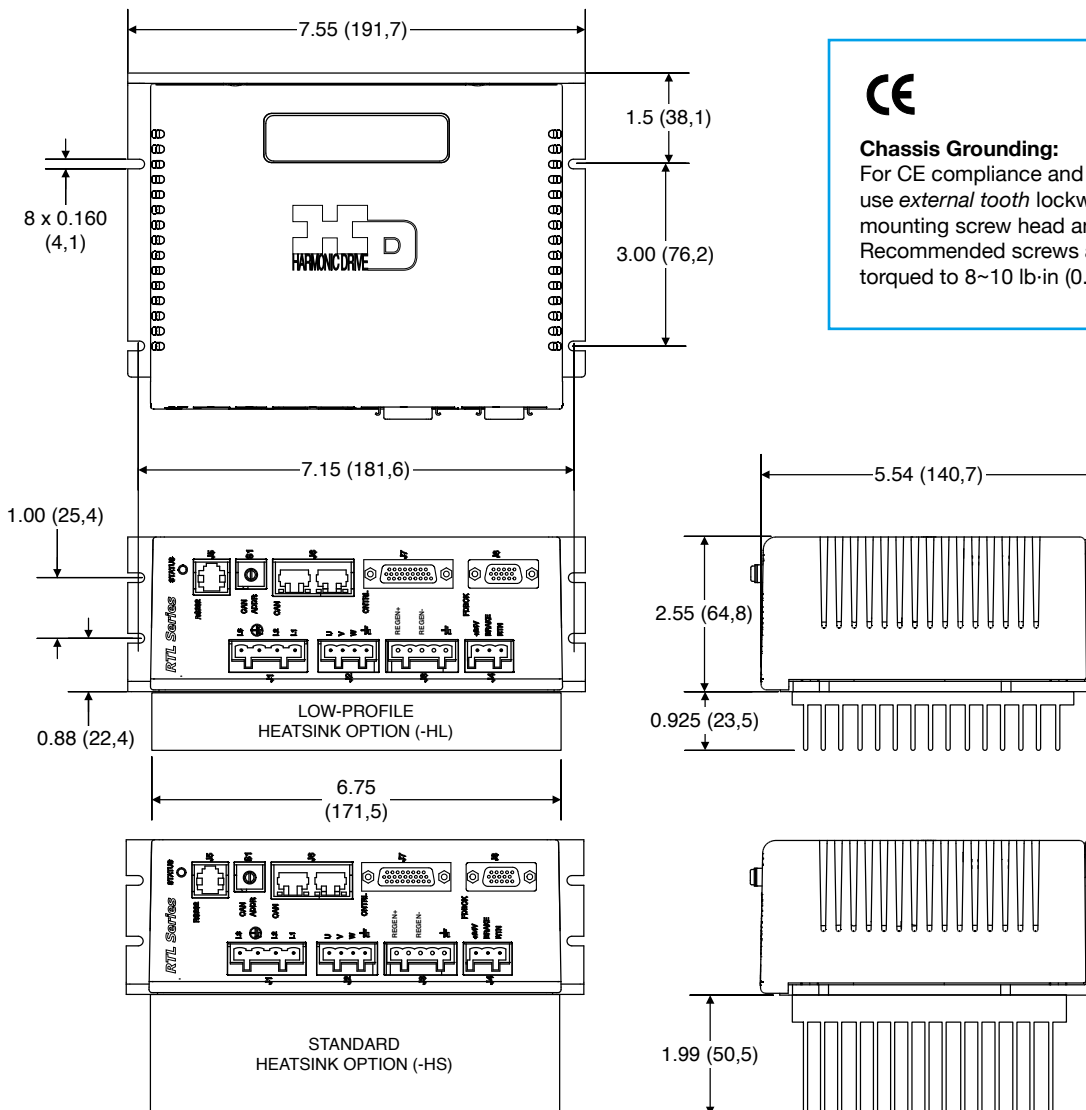
ENCODER EMULATION

Resolution	Programmable to 16,384 counts/rev (4096 line encoder equivalent)
Buffered encoder outputs	26C31 differential line driver

MOTOR CONNECTIONS

Phase U, V, W	PWM outputs to 3-phase ungrounded Wye or delta connected brushless motors
Resolver	R1, R2, S1, S2, S3, S4
Motemp [IN5]	Motor overtemperature sensor input. Active level programmable. 4.99 kΩ to +5 Vdc or ground Disables drive when motor over-temperature condition occurs Same input circuit as GP digital inputs
Signal ground	Return for temperature sensor
Brake [OUT4]	Current-sinking motor brake driver
+24 Vdc	From drive +24 Vdc power supply to power motor brake
Frame ground	For motor cable shield

Dimensions



Chassis Grounding:

For CE compliance and machine safety use *external tooth* lockwashers between mounting screw head and drive heatplate. Recommended screws are #6-32 (M3.5) torqued to 8~10 lb-in (0.79~1.02 N·m).

DDP Series

DDP Series is a high-performance, DC powered drive for position, velocity (using encoder, Halls, or BEMF), and torque control of brushless and brush motors. It can operate as a distributed drive using the CANopen or DeviceNet protocols, or as a stand-alone drive accepting analog or digital commands from an external motion controller. In stand-alone mode, current and velocity modes accept digital 50% PWM or PWM/polarity inputs as well as $\pm 10V$ analog. In position mode inputs can be incremental position commands from step-motor controllers, analog $\pm 10V$, or A/B quadrature commands from a master-encoder. Pulse to position ratio is programmable for electronic gearing.

Drive commissioning is fast and simple using HDM software operating under Windows® and communicating with DDP Series via CAN or an RS-232 link. CANopen is the default protocol, DeviceNet is supported by downloading firmware from the web-site. CAN address selection is by a 16-position rotary switch. If there are more than sixteen devices on the CAN bus, the additional address bits needed can come from programmable inputs, or can be set in flash memory.

DDP Series models operate as Motion Control Devices under the DSP-402 protocol of the CANopen DS-301 V4.01 (EN 50325-4) application layer.

DSP-402 modes supported include: Profile Position, Profile Velocity, Profile Torque, Interpolated Position Mode (PVT), and Homing. The two CAN ports are optically isolated from drive circuits.



Feedback options include digital quad A/B and absolute SSI encoders as standard. Sin/cos analog encoders are supported in models with an "S" appended to the part number. Resolver feedback is supported in models with "R" appended to the part number.

There are twelve digital inputs eleven of which have programmable functions. These include CAN address, motion-abort, limit & home switches, stepper/encoder pulse inputs, reset, digital torque or velocity reference, and motor over-temperature. Input [IN1] is dedicated for the drive Enable. There are three programmable logic outputs for reporting an drive fault, motor brake control, or other status indications.

Drive power is transformer-isolated DC from regulated or unregulated power supplies. An AuxHV input powers control circuits for "keep-alive" operation permitting the drive power stage to be completely powered down without losing position information, or communications with the control system.

Features

Control Modes

- Indexer, Point-to-Point, PVT
- Camming, Gearing, Position, Velocity, Torque

Command Interface

- Stepper commands
Single-ended or Differential selectable
- CANopen/DeviceNet
- ASCII and discrete I/O
- $\pm 10V$ position/velocity/torque command
- PWM velocity/torque command
- Master encoder (Gearing/Camming)

Communications

- CANopen/DeviceNet
- RS232

Feedback

- Digital Quad A/B encoders
- Analog sin/cos encoder (-S option)
- Brushless resolver (-R option)
- Aux encoder / emulated encoder output
- Digital Halls

I/O Digital

- 12 inputs, 3 outputs

Dimensions: in [mm]

- 168 x 99 x 31 [6.6 x 3.9 x 1.2]

Model	I _p *	I _c *	VDC
DDP-055-18	18	6	55
DDP-090-09	9	3	90
DDP-090-18	18	6	90
DDP-090-36	36	12	90
DDP-180-09	9	3	180
DDP-180-18	18	6	180

Add -S to part numbers above for sin/cos feedback

Add -R to part numbers above for resolver feedback

*I_c = Continuous Current (Apk)

*I_p = Peak Current (Apk)

Specifications

Test conditions: Load = Wye connected load: 2 mH + 2 Ω line-line. Ambient temperature = 25°C, +HV = HV_{max}

MODEL	DDP-055-18	DDP-090-09	DDP-090-18	DDP-090-36	DDP-180-09	DDP-180-18	
OUTPUT POWER							
Peak Current	18 (12.7)	9 (6.4)	18 (12.7)	36 (25.5)	9 (6.4)	18 (12.7)	Adc (Arms), ±5% Sec
Peak time	1	1	1	1	1	1	
Continuous current	6 (4.2)	3 (2.1)	6 (4.2)	12 (8.5)	3 (2.1)	6 (4.2)	Adc (Arms) per phase
Peak Output Power	0.92	0.79	1.55	2.95	1.59	3.15	kW
Continuous “ ”	0.32	0.27	0.53	1.06	0.53	1.06	kW
Output resistance	0.075	0.075	0.075	0.036	0.075	0.075	Rout (Ω)
Maximum Output Voltage	Vout = HV*0.97 - Rout*Iout						
INPUT POWER							
HV _{min} ~HV _{max}	+20 to +55	+20 to +90	+20 to +90	+20 to +90	+20 to +180	+20 to +180	VDC, trans former-isolated
Ipeak	20	10	20	40	10	20	Adc (1 sec) peak
Icont	5.47	2.74	5.47	10.64	2.74	5.47	Adc continuous
Aux HV	+20 to +HV VDC @ 500 mAdc maximum						
PWM OUTPUTS							
Type	3-phase MOSFET inverter, 15 kHz center-weighted PWM, space-vector modulation						
PWM ripple frequency	30 kHz						
DIGITAL CONTROL							
Digital Control Loops	Current, velocity, position. 100% digital loop control						
Sampling rate (time)	Current loop: 15 kHz (66.7 μs) Velocity, position loops: 3 kHz (333 μs)						
Commutation	Sinusoidal, field-oriented control for brushless motors						
Modulation	Center-weighted PWM with space-vector modulation						
Bandwidths	Current loop: 2.5 kHz typical, bandwidth will vary with tuning & load inductance						
HV Compensation	Changes in bus voltage do not affect bandwidth						
Minimum load inductance	200 μH line-line						
COMMAND INPUTS							
CANopen communications	Profile Position, Profile Velocity, & Profile Torque, Interpolated Position (PVT), Homing						
DeviceNet communications	UCMM (Unconnected Message Manager) protocol for explicit message objects <i>CANopen is the default communications mode, download firmware from web-site for DeviceNet</i>						
Digital position reference	Step/Direction, CW/CCW				Stepper commands (2 MHz maximum rate)		
Digital torque & velocity reference	Quad A/B Encoder				2 M lines/sec, 8 M count/sec (after quadrature)		
	PWM, Polarity				PWM = 0~100%, Polarity = 1/0		
	PWM = 50% +/-50%, no polarity signal required				1 kHz minimum, 100 kHz maximum		
	PWM frequency range				220 ns		
	PWM minimum pulse width						
Analog torque, velocity, position	±10 Vdc		Differential, 5 kΩ impedance				
DIGITAL INPUTS							
Number	12						
Inputs [IN1~5,11,12]	74HC14 Schmitt trigger, 330 μs RC filter, Vin-LO < 1.35 VDC, Vin-HI >3.65 VDC +30 Vdc max [IN1] dedicated to drive enable function, other inputs are programmable						
Input [IN6]	74HC14 Schmitt trigger, 100 ns RC filter, Vin-LO < 1.35 VDC, Vin-HI >3.65 VDC, +12 Vdc max						
Inputs [IN7~10]	Single-ended: Comparator with 2.5 VDC reference, 100 ns RC filter, Vin-LO <2.3 VDC, Vin-HI > 2.45 VDC Differential: RS-485 line receiver on input pairs [IN9-7], and [IN10-8], 100 ns RC filters, +12 VDC max						
All inputs	10 kΩ pull-up to +5 VDC or pull-down to ground, selectable in groups, active level programmable						
DIGITAL OUTPUTS							
Number	3						
[OUT1], [OUT2], [OUT3]	Current-sinking MOSFET with 1 kΩ pullup to +5 VDC through diode						
Current rating	1 Adc max, +30 VDCmax. Functions programmable External flyback diode required if driving inductive loads						
MULTI-MODE ENCODER PORT							
Operation	Programmable as input for secondary (dual) digital encoder or as buffered outputs in quad A/B/X format for digital motor feedback encoder, or emulated encoder outputs from analog sin/cos motor feedback encoder						
Signals	Quad A/B Encoder: A, /A, B, /B, X, /X						
Frequency	As input for digital encoder: 5M lines/sec, 20 M count/sec (after quadrature) As buffered outputs for digital motor encoder: 5 M lines/sec, 20 M count/sec (after quadrature) As emulated encoder outputs for sin/cos analog motor encoder: 4.5 M lines/sec, 18 M count/sec (after quadrature)						
Input/output	26C32 differential line receiver, or 26C31 differential line driver						
RS-232 PORT							
Signals	RxD, TxD, Gnd in 6-position, 4-contact RJ-11 style modular connector.						
Mode	Full-duplex, serial communication port for drive setup and control, 9,600 to 115,200 Baud						
Protocol	ASCII or Binary format						
Multi-drop	ASCII interface from single RS-232 port to control multiple drives (RTL, DDP) Drive with serial connection acts as master for bi-directional data flow to other drives using CAN connections in daisy-chain from drive to drive						
CAN PORT							
Signals	CANH, CANL, Gnd in dual 8-position RJ-45 style modular connectors, wired as per CAN Cia DR-303-1, V1.1 CAN interface circuit and +5 Vdc supply are optically isolated from drive circuits						
Format	CAN V2.0b physical layer for high-speed connections compliant						
Data	CANopen Device Profile DSP-402						
Address selection	16 position rotary switch on front panel with 3 additional address bits available as digital inputs or programmable to flash memory						

Specifications

DIGITAL QUAD A/B ENCODER

Type	Quadrature, differential line driver outputs
Signals	A, /A, B, /B, X, /X, index signals optional
Frequency	5 MHz line frequency, 20 MHz quadrature count frequency

ANALOG ENCODER (-S OPTION)

Type	Sin/cos, differential line driver outputs, 0.5 V _{peak-peak} (1.0 V _{peak-peak} differential) centered about 2.5 V _{dc} typical. Common-mode voltage 0.25 to 3.75 V _{dc}
Signals	Sin(+), sin(-), cos(+), cos(-)
Frequency	230 kHz maximum line (cycle) frequency
Interpolation	10 bits/cycle (1024 counts/cycle)

RESOLVER

Type	Brushless, single-speed, 1:1 to 2:1 programmable transformation ratio
Resolution	14 bits (equivalent to a 4096 line quadrature encoder)
Reference frequency	7.5 kHz
Reference voltage	2.8 V _{rms} , auto-adjustable by the drive to maximize feedback
Reference maximum current	100 mA
Maximum RPM	10,000+

ENCODER EMULATION

Resolution	Programmable to 16,384 counts/rev (4096 line encoder equivalent)
Buffered encoder outputs	26C31 differential line driver

DIGITAL HALLS

Type	Digital, single-ended, 120° electrical phase difference
Signals	U, V, W
Frequency	Consult Harmonic Drive for speeds >10,000 RPM

ENCODER POWER SUPPLY

Power Supply	+5 V _{dc} @ 400 mA to power encoders & Halls
Protection	Current-limited to 750 mA @ 1 V _{DC} if overloaded Encoder power developed from +24 V _{dc} so position information is not lost when AC mains power is removed

MOTOR CONNECTIONS

Phase U, V, W	PWM outputs to 3-phase ungrounded Wye or delta connected brushless motors, or DC brush motors
Hall U, V, W	Digital Hall signals, single-ended
Digital Encoder	Quadrature encoder signals, A, /A, B, /B, X, /X, differential (X or Index signal not required) 5 MHz maximum line frequency (20 M counts/sec) 26LS32 differential line receiver with 121 Ω terminating resistor between complementary inputs
Analog Encoder	Sin/cos, differential line driver outputs, 0.5 V _{peak-peak} (1.0 V _{peak-peak} differential) centered about 2.5 V _{DC} typical. Common-mode voltage 0.25 to 3.75 V _{DC}
Signals	Sin(+), sin(-), cos(+), cos(-)
Frequency	230 kHz maximum line (cycle) frequency
Interpolation	Programmable: 10 bits/cycle (1024 counts/cycle)
Resolver	R1, R2, S3, S1, S2, S4
Hall & encoder power	+5 V _{DC} ±2% @ 250 mAdc max, current limited to 750 mAdc @ +1 V _{DC} if output overloaded
Motemp [IN5]	Motor overtemperature sensor input. Active level programmable Programmable to disable drive when motor over-temperature condition occurs Same input circuit as GP digital inputs (Digital Inputs above)
Brake	[OUT1,2,3] programmable for motor brake function, external flyback diode required

STATUS INDICATORS

Amp Status	Bicolor LED, drive status indicated by color, and blinking or non-blinking condition
CAN Status	Bicolor LED, status of CAN bus indicated by color and blink codes to CAN Indicator Specification 303-3

PROTECTIONS

HV Overvoltage	+HV > HV _{max}	Drive outputs turn off until +HV < HV _{max} (See Input Power for HV _{max})
HV Undervoltage	+HV < +20 V _{DC}	Drive outputs turn off until +HV > +20 V _{DC}
Drive over temperature	Heat plate > 70°C.	Drive outputs turn off
Short circuits	Output to output, output to ground, internal PWM bridge faults	
I ^{FT} Current limiting	Programmable: continuous current, peak current, peak time	
Motor over temperature	Digital inputs programmable to detect motor temperature switch	

MECHANICAL & ENVIRONMENTAL

Size	6.58 in (167 mm) X 3.89 in (98.8 mm) X 1.17 in (29.7 mm)
Weight	0.94 lb (0.43 kg)
Ambient temperature	0 to +45°C operating, -40 to +85°C storage
Humidity	0 to 95%, non-condensing
Vibration	2 g peak, 10~500 Hz (sine), IEC60068-2-6
Shock	10 g, 10 ms, half-sine pulse, IEC60068-2-27
Contaminants	Pollution degree 2
Environment	IEC68-2: 1990
Cooling	Heat sink and/or forced air cooling required for continuous power output

Notes: 1. Digital input & output functions are programmable.

Specifications

AGENCY STANDARDS CONFORMANCE

EN 55011 : 1998

CISPR 11 (1997) Edition 2/Amendment 2:

Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment

EN 61000-6-1 : 2001

Electromagnetic Compatibility Generic Immunity Requirements

Following the provisions of EC Directive 89/336/EEC:

EN 61010-1 2nd Ed.: 2004

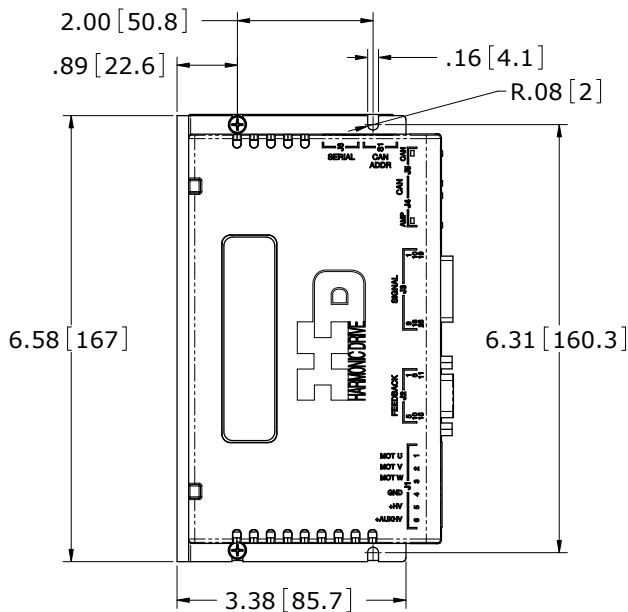
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use

Following the provisions of EC Directive 2006/95/EC

UL 508C 3rd Ed.:

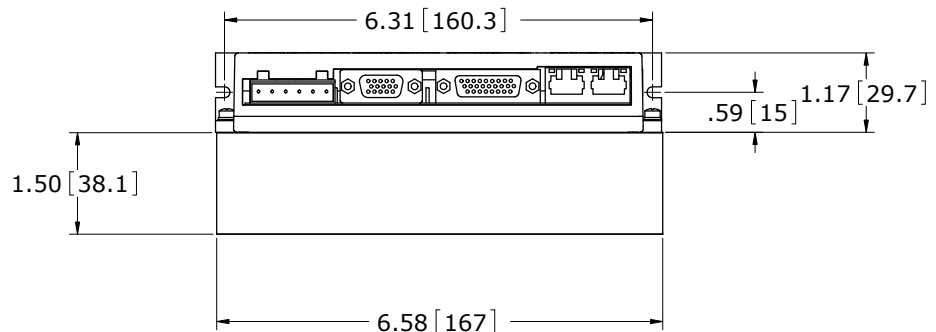
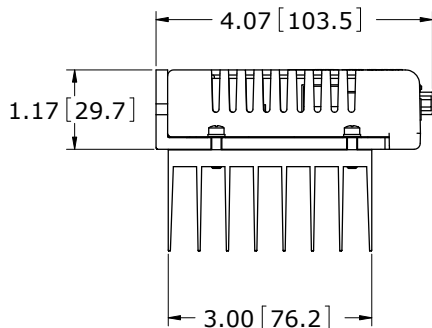
2002 UL Standard for Safety for Power Conversion Equipment

Dimensions



NOTES

1. Dimensions shown in inches [mm].
2. Heatsink is mounted with four screws. Two of these are not shown to show dimensions of slots in the heatplate.



Weights:

Drive: 0.94 lb (0.43 kg)

Heatsink: 1.0 lb (0.45 kg)

DCJ Series



DCJ Series is a compact, DC powered servo drive for position, velocity, and torque control of AC brushless and DC brush motors. It can operate on a distributed control network, as a stand-alone indexing drive, or with external motion controllers. Two versions are available to support digital quadrature, or analog sin/cos encoders.

Indexing mode enables simplified operation with PLC's which use outputs to select and launch indexes and inputs to read back drive status. Additionally, a PLC can send ASCII data that can change motion profiles so that one index can perform various motions as machine requirements change. DeviceNet capability enables multiple *DCJ Series* drives to be controlled from PLC's that use this communication protocol.

The CANopen distributed control architecture is also supported. As a CAN node operating under the CANopen protocol, it supports Profile Position, Profile Velocity, Profile Torque, Interpolated Position, and Homing. Up to 127 drives can operate on a single CAN bus and groups of drives can be linked via the CAN so that they execute motion profiles together.

Operation with external motion controllers is possible in torque (current), velocity, and position modes. Input command signals can be $\pm 10V$ (torque, velocity, position), PWM/Polarity (torque, velocity), or stepper format (CU/CD or Step/Direction).

Features

■ Feedback Versions

- Analog Sin/Cos
- Quad A/B digital

■ Control Modes

- Indexer, Point-to-Point, PVT
- Camming, Gearing, Position, Velocity, Torque

■ Command Interface

- CANopen/DeviceNet
- ASCII and discrete I/O
- Stepper commands
- $\pm 10V$ position/velocity/torque command
- PWM velocity/torque command
- Master encoder (Gearing/Camming)

■ Communications

- CANopen/DeviceNet
- RS-232

■ Feedback

- Digital Quad A/B encoder
- Secondary encoder / emulated encoder out
- Brushless resolver (-R versions)
- Analog sin/cos encoder (-S versions)
- Digital Halls

■ I/O Digital

- 9 inputs, 4 outputs

■ Dimensions: in [mm]

- 97 x 64 x 33 [3.8 x 2.5 x 1.3]

Model	VDC	Ic*	Ip*
DCJ-055-09	20-55	3	9
DCJ-055-18	20-55	6	18
DCJ-090-03	20-90	1	3
DCJ-090-09	20-90	3	9
DCJ-090-12	20-90	6	12

Add "-S" to part number for Sin/Cos version

Add "-R" to part number for resolver version

*Ic = Continuous Current (Apc)

*Ip = Peak Current (Apk)

Specifications

Test conditions: Load = Wye connected load: 2 mH + 2 Ω line-line. Ambient temperature = 25°C, +HV = HV_{max}

MODEL	DCJ-055-09	DCJ-055-18	DCJ-090-03	DCJ-090-09	DCJ-90-12	
OUTPUT POWER						
Peak Current	9 (6.36)	18 (12.73)	3 (2.12)	9 (6.36)	12 (8.5)	Adc (Arms, sinusoidal), ±5%
Peak time	1	1	1	1	1	Sec
Continuous current	3 (2.12)	6 (4.24)	1 (0.71)	3 (2.12)	6 (4.24)	Adc (Arms, sinusoidal), ±5%
Peak Output Power	490	970	270	800	1600	W
Continuous “ ”	163	323	89	267	533	W
Output resistance	0.075	0.075	0.075	0.036	0.075	Rout (Ω)
Maximum Output Voltage	Vout = HV*0.97 - Rout*Iout					
INPUT POWER						
HV _{min} to HV _{max}	20-55	20-55	20-90	20-90	20-90	+VDC, Transformer-isolated
I _{peak}	9	18	3	9	12	Adc (1 sec) peak
I _{cont}	3	6	1	3	6	Adc continuous
Aux HV	20-HVmax +VDC @ 500 mAdc maximum					
PWM OUTPUTS						
Type	3-phase MOSFET inverter, 15 kHz center-weighted PWM, space-vector modulation					
PWM ripple frequency	30 kHz					
DIGITAL CONTROL						
Digital Control Loops	Current, velocity, position. 100% digital loop control					
	Dual loop position control using secondary encoder input					
Sampling rate (time)	Current loop: 15 kHz (66.7 us) Velocity, position loops: 3 kHz (333 us)					
Commutation	Sinusoidal field-oriented control or trapezoidal from Halls for brushless motors					
Modulation	Center-weighted PWM with space-vector modulation					
Bandwidths	Current loop: 2.5 kHz typical, bandwidth will vary with tuning & load inductance					
HV Compensation	Changes in bus voltage do not affect bandwidth					
Minimum load inductance	200 μH line-line					
COMMAND INPUTS						
CANopen	Profile Position, Interpolated Position, Profile Velocity, Profile Torque, Homing					
Digital position	Step/Direction, CW/CCW					
	Stepper commands (2 MHz maximum rate)					
	Quad A/B Encoder					
	20 Mcount/sec (after quadrature), 5 Mline/sec					
Digital torque & velocity	PWM, Polarity					
	PWM = 0~100%, Polarity = 1/0					
	PWM					
	PWM = 50% ±50%, no polarity signal required					
	PWM frequency range					
	1 kHz minimum, 100 kHz maximum					
	PWM minimum pulse width					
	220 ns					
Analog torque/velocity/position	±10 VDC, 5 kΩ differential input impedance					
DIGITAL INPUTS						
Number, type	9, non-isolated. [IN1] dedicated to Drive Enable function, [IN2]~[IN9] are programmable					
All inputs	74HC14 Schmitt trigger operating from +5 VDC with RC filter on input					
	10 kΩ to +5 VDC or ground for all except [IN5] (see below)					
Logic levels	Vin-LO < 1.35 VDC, Vin-HI >3.65 VDC					
Pull-up, pull-down control	All inputs have group selectable connection of input pull-up/down resistor to +5 VDC, or ground					
Enable [IN1]	1 Dedicated input with 330 μs RC filter for drive enable, 0 to +24 VDC max					
GP [IN2,3,4]	3 General Purpose inputs with 330 μs RC filter, 0 to +24 VDC max					
MS [IN5]	1 Medium-Speed input for motor temperature switch, 33 μs RC filter, 4.99 kΩ pullup/pulldown, 0 to +24 VDC max					
HS [IN6,7,8,9]	4 High-Speed Inputs inputs with 100 ns RC filter, 0 to +5 VDC max					
DIGITAL OUTPUTS (NOTE 1)						
Number, type	4, non-isolated, programmable					
[OUT1~4],	Current-sinking MOSFET with 1 kΩ pullup to +5 VDC through diode					
Current rating	300 mAdc max, +30 VDC max. Functions programmable					
	External flyback diode required if driving inductive loads					
MULTI-MODE ENCODER PORT						
Operation	Operates as an input or output depending on drive Basic Setup					
Signals	Digital: A, /A, B, /B, X, /X					
As Input	26C32 differential line receivers (for operation as an encoder input port)					
As Output	26C31 differential line drivers (for operation as buffered encoder outputs)					
Frequency	20 MHz (post-quadrature)					
RS-232 PORT						
Signals	RxD, TxD, Gnd					
Mode	Full-duplex, serial communication port for drive setup and control, 9,600 to 115,200 baud					
Protocol	Binary or ASCII formats					
CAN PORTS						
Signals	CANH, CANL, Gnd					
Isolation	CAN interface circuit and +5 VDC supply for CAN is optically isolated from drive circuits					
Format	CAN V2.0b physical layer for high-speed connections compliant					
Data	CANopen Device Profile DSP-402					
Address selection	Programmable to flash memory or determined by digital inputs					

Specifications

DIGITAL QUAD A/B ENCODER

Type	Quadrature, differential line driver outputs
Signals	A, /A, B, /B, (X, /X, index signals optional)
Frequency	5 MHz line frequency, 20 MHz quadrature count frequency

ANALOG ENCODER (-S OPTION)

Type	Sin/cos, differential line driver outputs, 0.5 V _{peak-peak} (1.0 V _{peak-peak} differential) centered about 2.5 VDC typical. Common-mode voltage 0.25 to 3.75 VDC
Signals	Sin(+), sin(-), cos(+), cos(-)
Frequency	230 kHz maximum line (cycle) frequency
Interpolation	10 bits/cycle (1024 counts/cycle)

RESOLVER (-R OPTION)

Type	Brushless, single-speed, 1:1 to 2:1 programmable transformation ratio
Resolution	14 bits (equivalent to a 4096 line quadrature encoder)
Reference frequency	7.5 kHz
Reference voltage	2.8 Vrms, auto-adjustable by the drive to maximize feedback
Reference maximum current	100 mA
Maximum RPM	10,000+

ENCODER EMULATION

Resolution	Programmable to 16,384 counts/rev (4096 line encoder equivalent)
Buffered encoder outputs	26C31 differential line driver

DIGITAL HALLS

Type	Digital, single-ended, 120° electrical phase difference
Signals	U, V, W
Frequency	Consult factory for speeds >10,000 RPM

ENCODER POWER SUPPLY

Power Supply	+5 VDC @ 400 mA to power encoders & Halls
Protection	Current-limited to 750 mA @ 1 VDC if overloaded Encoder power developed from +24 VDC so position information is not lost when AC mains power is removed

MOTOR CONNECTIONS

Phase U, V, W	PWM outputs to 3-ph. ungrounded Wye or delta wound brushless motors, or DC brush motors
Hall U, V, W	Digital Hall signals, single-ended
Digital Encoder	Digital quadrature encoder signals, differential (X or Index signal not required) 5 MHz maximum line frequency (20 Mcounts/sec) 26C32 differential line receiver with 121 Ω terminating resistor between complementary inputs
Analog Encoder	Analog sin/cos signals, 1 V _{p-p} , differential
Hall & encoder power	+5 VDC ±2% @ 250 mAdc max
Motemp [IN 5]	Motor overtemperature sensor switch input Programmable to disable drive when motor over-temperature condition occurs
Brake	[OUT1~4] are programmable for motor brake function, external flyback diode required

STATUS INDICATORS

Drive Status	Bicolor LED, drive status indicated by color, and blinking or non-blinking condition
CAN Status	Bicolor LED, status of CAN bus indicated by color and blink codes to CAN Indicator Specification 303-3

PROTECTIONS

HV Overvoltage	HV > +56, +91 VDC	Drive outputs turn off until +HV < overvoltage (for 55, 90 VDC models)
HV Undervoltage	HV < +14 VDC	Drive outputs turn off until +HV ≥ +14 VDC
Drive over temperature	Heat plate > 70°C	Drive outputs turn off, latching fault
Short circuits		Output to output, output to ground, internal PWM bridge faults
I ² T Current limiting		Programmable: continuous current, peak current, peak time
Motor over temperature		Digital inputs programmable to detect motor temperature switch
Functions		Fault conditions are programmable as latching or non-latching types

MECHANICAL & ENVIRONMENTAL

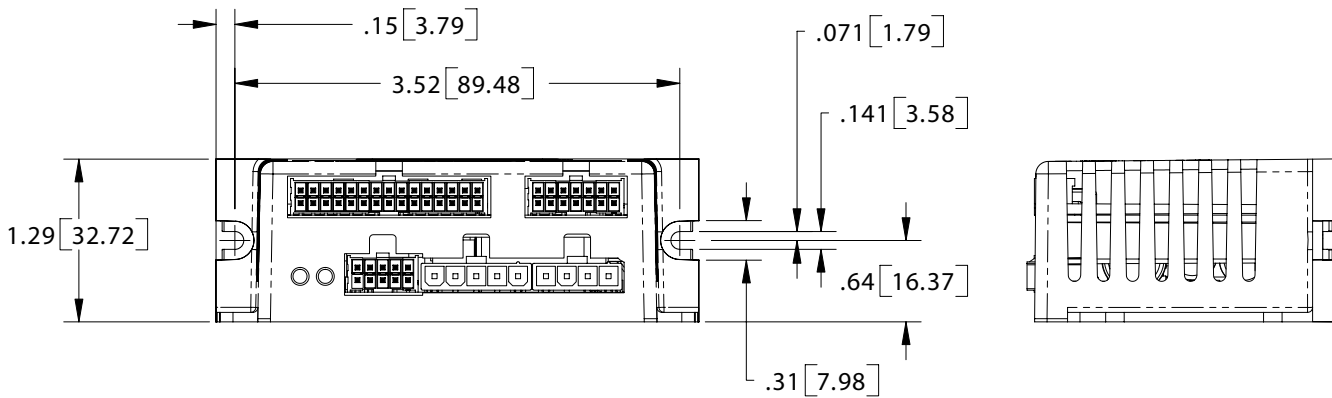
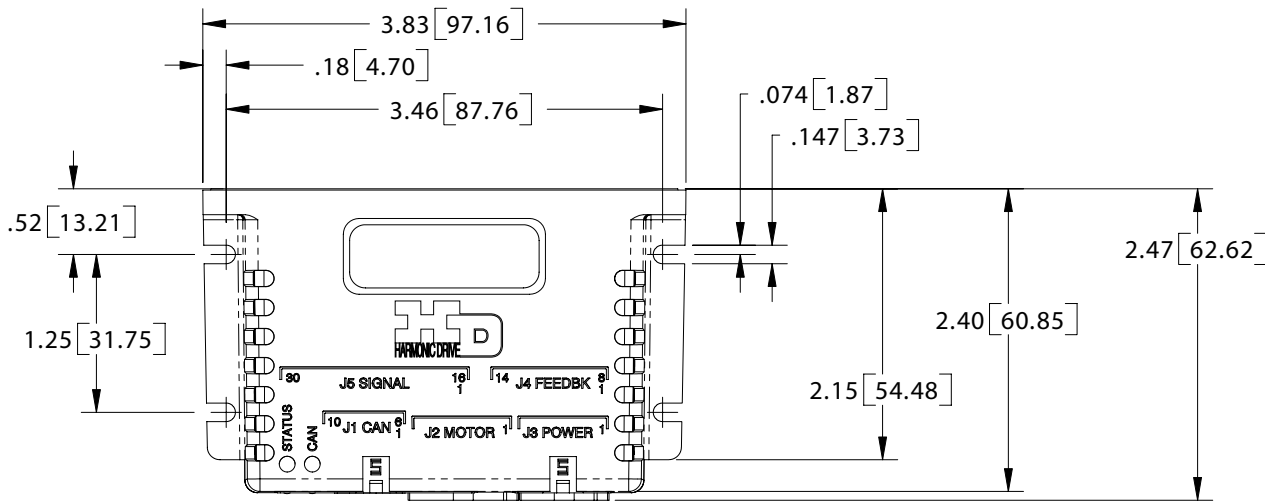
Size	3.83 x 2.47 x 1.29 in. (97.28 x 62.74 x 32.77 mm)
Weight	4.8 oz, 0.14 kg
Ambient temperature	0 to +45 °C operating, -40 to +85 °C storage
Humidity	0 to 95%, non-condensing
Contaminants	Pollution degree 2
Environment	IEC68-2: 1990
Cooling	Conduction through heatplate on drive chassis, or convection

AGENCY CONFORMANCE

EN 55011 : 1998	CISPR 11 (1997) Edition 2/Amendment 2: Limits and Methods of Measurement of Radio Disturbance Characteristics of Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment
EN 61000-6-1 : 2001	Electromagnetic Compatibility Generic Immunity Requirements Following the provisions of EC Directive 89/336/EEC:
EN 61010-1 2 nd Ed.: 2001	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use Following the provisions of EC Directive 2006/95/EC
UL 508C 3 rd Ed.:	2002 UL Standard for Safety for Power Conversion Equipment

Dimensions

Dimensions shown in inches [mm].



NOTES

1. Dimensions shown in inches[mm].
2. Weight: 4.8 oz (0.14 kg)
3. Recommended mounting hardware is pan-head SEMS screws with internal tooth lock washers, imperial size #4-40 or metric M3 thread.
4. For CE compliance heatplate must be grounded. When mounted with heatplate against the panel, the screws will ground the heatplate to the panel. If mounted with the plastic base against the panel, then a wire must be used to ground the heatplate. If this is terminated in a ring-lug, then this can be attached to the heatplate with a screw and nut of the size recommended above.

Rotary Actuator

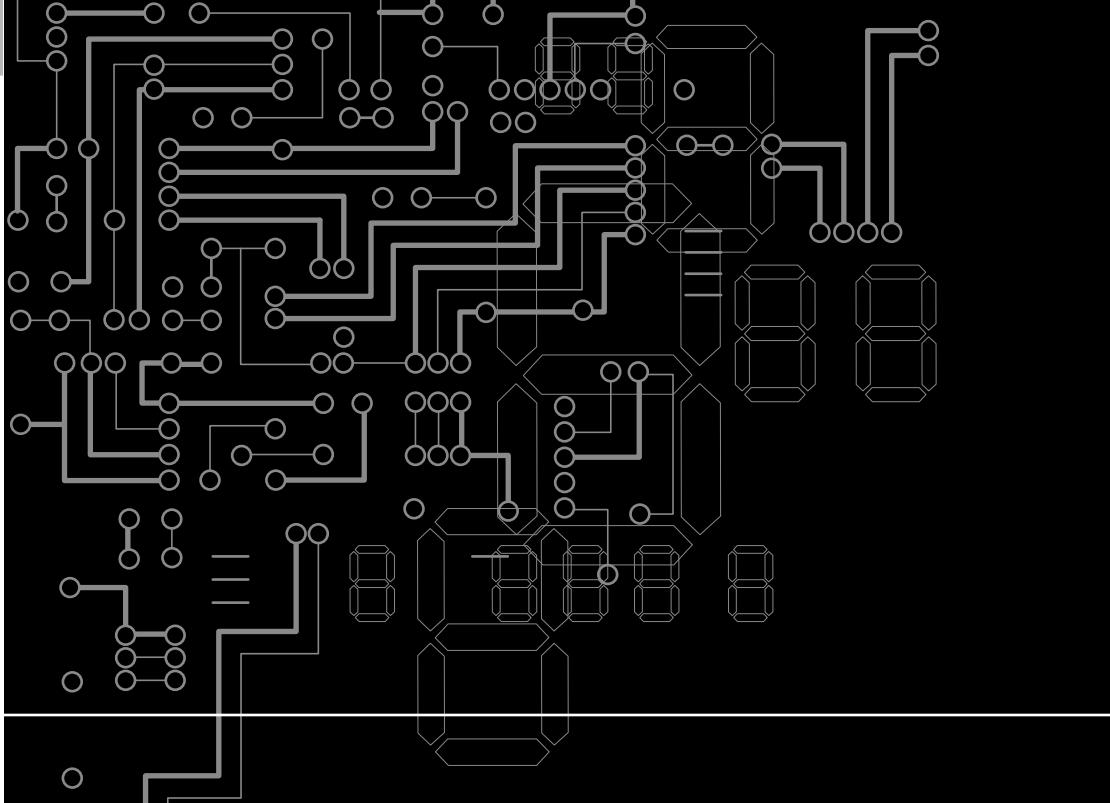
Linear Actuator

Direct Drive Motor

Servo Drives

Servo Drives

Servo Drives



Open field network support **Servo Drives**

AC Servo Drives

HA-800B Series	182
HA-800C Series	184
HA-680ML Series	186



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 from 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.

Ordering Code

HA - 800B - 3 A - 100 - □

1	Model	HA Series
2	Series Name	800B MECHATROLINK-II Support Type
3	Rated Output Current	1: 1.5A/3: 3A/6: 6A/24: 24A
4	Connected Encoder	A: 13bit Absolute Encoder B: 14-wire Incremental Encoder C: 4-wire Reduction Incremental Encoder D: 17bit Absolute Encoder
5	Inout Power Voltage	100: AC100V/200V: AC200V
6	Special Specification	No Symbol: Standard Product SP: Special Specification Code

Specifications

Driver model		HA-800B-1	HA-800B-3	HA-800B-6	HA-800B-24
Item					
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 (rpm), 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			
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 Specifications

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 (<http://www.mechatrolink.org>) for details.

*2: Use MP2000 series (Yaskawa 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.

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 from 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.

Ordering Code

HA - 800C - 3 A - 100 - □

1	Model	HA Series
2	Series Name	800B CC-Link Support Type
3	Rated Output Current	1: 1.5A/3: 3A/6: 6A/24: 24A
4	Connected Encoder	A: 13bit Absolute Encoder B: 14-wire Incremental Encoder C: 4-wire Reduction Incremental Encoder D: 17bit Absolute Encoder
5	Inout Power Voltage	100: AC100V/200V: AC200V
6	Special Specification	No Symbol: Standard Product SP: Special Specification Code

Specifications

Driver model		HA-800C-1	HA-800C-3	HA-800C-6	HA-800C-24
Item					
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 (rpm), 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, U/V/W 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			
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

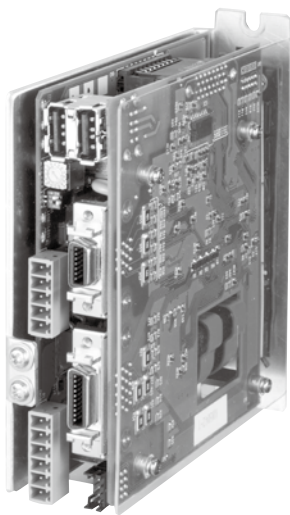
* 1: Set in accordance with the specification of a combined actuator.

Communication Specifications

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.

HA-680ML Series



* MECHATROLINK is a registered trademark of MECHATROLINK association.

Features

■ Small and compact design

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

■ Easy function setting with PC

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

■ Extensive operation status display

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

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

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

■ Electronic gear adapted to the machine system

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

■ Regeneration circuit included as standard equipment

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

Ordering Code

HA — 680 ML — 4 □ — 24 — S●●●

1	Model	HA Series
2	Series Name	680
3	Open Network Support	No Description: No Open Network ML: MECHATROLINK Support
4	Rated Output Current	4: 4A 6: 6A
5	Corresponding Symbol	No Description: For FHA-C mini AC24V type (FHA-8C, 11C, 14C) For RSF Supermini Series (RSF-3B, 5B) For RSF-B mini Series (RSF-8B, 11B, 14B)
6	Power Voltage	24: DC24V
7	Adjustment Model Control No.	

Specifications

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 Specifications

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 (http://www.mechatrolink.org/jp/index_jp.html) for the detail.

Servo Drives

AC Servo Drives

HA-800A Series	190
HA-680 Series	192
HA-770 Series	192

DC Servo Drives

HS-360 Series	199
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HA-800A Series



Features

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

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

Ordering Code

HA - 800A - 3 A - 100 - □

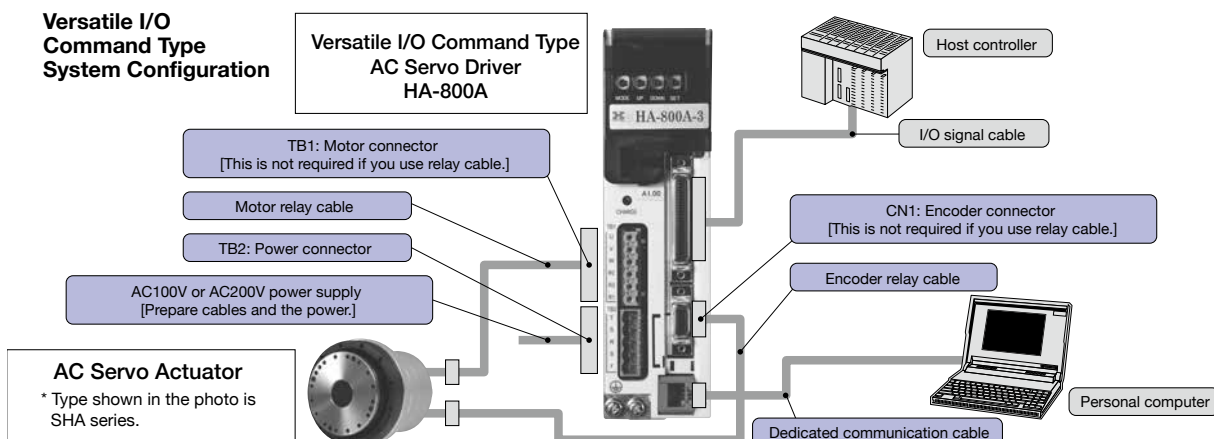
1	Model	HA Series
2	Series Name	800A: I/O Command Type
3	Rated Output Current	1: 1.5A/3: 3A/6: 6A/24: 24A
4	Connected Encoder	A: 13bit Absolute Encoder B: 14-wire Incremental Encoder C: 4-wire Reduction Incremental Encoder D: 17bit Absolute Encoder
5	Inout Power Voltage	100: AC100V/200V: AC200V
6	Special Specification	No Symbol: Standard Product SP: Special Specification Code

Specifications

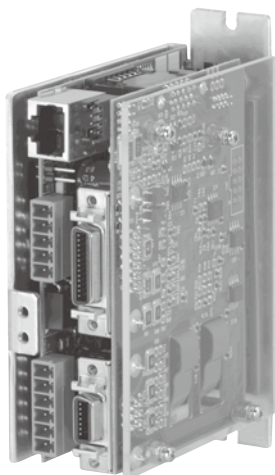
Driver model		HA-800A-1	HA-800A-3	HA-800A-6	HA-800A-24
Driver's Rated Current ^{*1}		1.5A	3.0A	6.0A	24.0A
Driver's Maximum Current ^{*1}		4.0A	9.5A	19.0A	55.0A
Power Supply Voltage	Main Circuit ^{*1}	AC100 to 115V (single phase) or AC200 to 230V (single phase/3 phases) +10 to -15%			AC200 to 230V (3 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: 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 (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 setting, for absolute encoder			
Operation Panel	Configuration	Display (7-segment LEDs) 5 digits (red), 4 push button switches			
	Status Display Function	Rotational speed (rpm), 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			
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



HA-680 Series



Features

■ 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.

Ordering Code

HA - 680 - 4 □ - 24

1	Model	HA Series
2	Series Name	680
3	Open Network Support	No Description: No Open Network ML: MECHATROLINK Support
4	Rated Output Current	4: 4A 6: 6A
5	Corresponding Symbol	No Description: For FHA-C mini AC24V type (FHA-8C, 11C, 14C) For RSF Supermini Series (RSF-3B, 5B) For RSF-B mini Series (RSF-8B, 11B, 14B)
6	Power Voltage	24: DC24V
7	Adjustment Model Control No.	

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

Specifications

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 $\pm 10V$ / Max. rotation speed			
Torque Control (Command Voltage)		DC0V to $\pm 10V$ / Max. torque			
Input/Output signal		DI: 5 points (insulation with photo coupler) DO: 5 points (insulation with photo coupler) Variable function assignment			
Encoder Monitor		Phase A-, B-, Z- line driver output Phase Z- open collector output (insulation with photo coupler)			
Display		LED 2 points (green:1 point red:1 point) For power on, servo-on, alarm operation state display			
Protection Function		Overload, Max. deviation, Encoder break detection, encoder reception error, UVW error, regenerative error, operating temperature error, system error, overcurrent, load short circuit, memory error, overspeed			
Regenerative Absorption Circuit		Incorporated (with an external capacitor/resistor installation terminal). The built-in resistance has a fuse.			
Communication Functions		By means of communication between PC and EIA-232C (RS-232C), changing of parameters, current wave monitor, and alarm monitor are available.			
Mass		230g			
Safety Standard		CE Marking			
Ambient Condition		Operating temperature: 0 to 50°C Storage temperature: -20 to 85°C Operating/Storage 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.

HA-770 Series



The HA-770 drive is the dedicated drive 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 drive 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.

Ordering Code

HA - 770 - 2 - □

1	Model	HA Series
2	Series Name	770 (for position control)
3	Rated Output Current	2: 8A
4	Special Specification	No Symbol: Standard Product SP: Special Specification Code

Rotary Actuator

Linear Actuator

Direct Drive Motor

Servo Drives

Servo Drives

Servo Drives

Combined Direct Drive Motor

Driver model	HA-770-2
Direct drive motor model	KDU-13SB-E10 KDU-13WB-E10

Specifications

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 0.1rpm
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
Safety Standard		Compliance with RoHs directive

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)

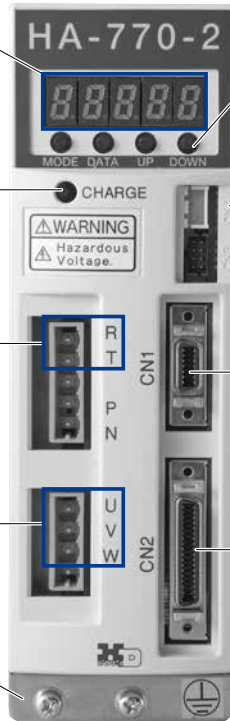
- The terminal for power supply

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.

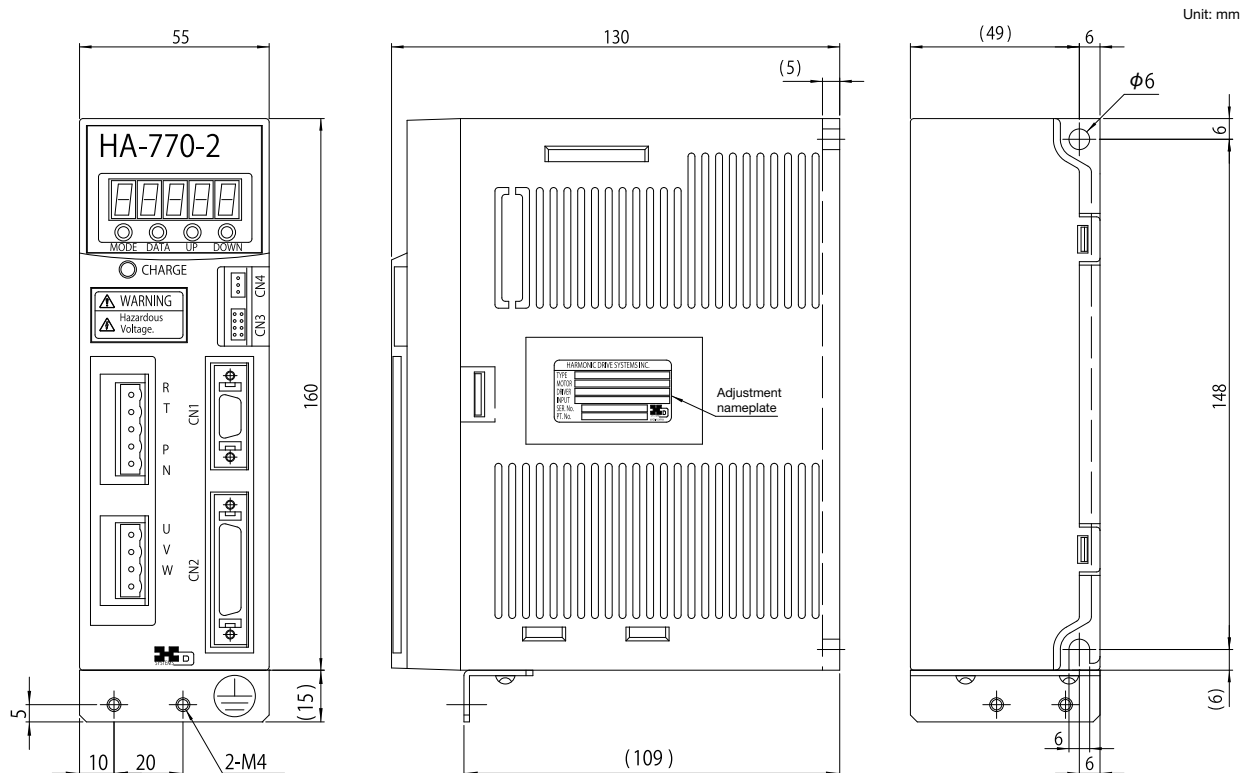
Encoder Connector (CN1)

- 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



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

Chart for Standard Combinations

System Model Name	Max. Torque	Motor Model Name	Servo Driver Model Name	Relay cable model name for incremental encoder	Total cable length (except connector)
				Relay cable model name for motor	
KDU-13SB-D3-□	7.0Nm	KDU-13SB-E10	HA-770-2	EWA-E015-OM15-3M14	Encoder cable : 3m Motor cable : 3.3m
				EWA-M03-A04-WG04-01	
				EWA-E035-OM15-3M14	Encoder cable : 5m Motor cable : 5.3m
				EWA-M05-A04-WG04-01	
KDU-13WB-D3-□	15.0Nm	KDU-13WB-E10		EWA-E015-OM15-3M14	Encoder cable : 3m Motor cable : 3.3m
				EWA-M03-A04-WG04-01	
				EWA-E035-OM15-3M14	Encoder cable : 5m Motor cable : 5.3m
				EWA-M05-A04-WG04-01	

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.

Ordering Code

HS - 360 - 1 A

1	Model	HS Series
2	Series Name	360
3	Rated Output Current	1: 1.0A or 1.4A 3: 3.2A
4	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

Specifications

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)

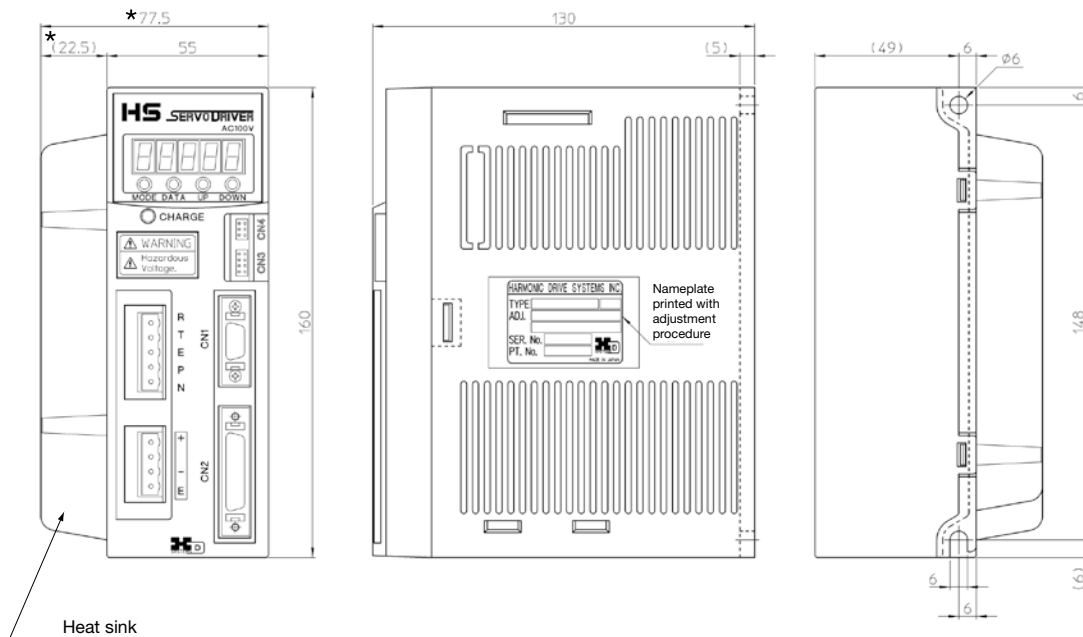
CN1: External Input/Output Connector

- 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.

Outline Dimensions



Note: Starred portions are for HA-360-3.

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

Warranty/ Trademark Company Overview

Warranty/Trademark	203
Company Overview	205

Warranty

Harmonic Drive undertakes warranty of its products contained in this catalog for the following warranty period and term.

● 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 terms

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.
- (3) Imperfection caused by the other than the products.
- (4) Disaster or others that does not belong to the responsibility of Harmonic Drive.

Our liability shall be limited exclusively to repairing or replacing the product only found by Harmonic Drive to be defective. Harmonic Drive 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 a registered trademark of Harmonic Drive LLC.

Specifications and dimensions in the catalog subject to change without notice.

All efforts have been made to assure that the information in this catalog is complete and accurate. However, Harmonic Drive LLC is not liable for any errors, omissions or inaccuracies in the reported data. Harmonic Drive LLC reserves the right to change the product specifications, for any reason, without prior 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/s² 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 Install the actuator at the specified accuracy. - Correctly align the centers of the actuator shaft and mating machine in accordance with the technical information. - Misalignment may cause damage of output shaft and/or cause vibration.
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.	

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

Caution	Do not exceed torque limits in rating table. - Do not exceed maximum torque. In most cases, this can be avoided by setting the correct parameters in the servo drive. - Do not collide with an obstacle such as mechanical stops. This may cause damage to the product and/or unexpected motion.	Warning Do not connect the actuator directly to a power supply or utility power. - The FHA-C actuator requires a proper servo driver for correct operation. - Do not connect the actuator to the utility power. It may cause injury, fire or damage to the actuator. The actuator may fracture and a fire may break out.
Warning	Do not inflict excessive mechanical impact or shock. - The FHA-C actuator consists of precise components. - Failure to observe this caution may cause reduced performance and result in damage to the actuator.	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	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	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 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.

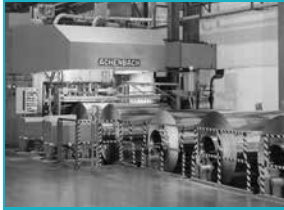
Warning	Do not change the wiring while the current is active. Always turn the power off when removing any wire or connecting or disconnecting a connector, otherwise an electric shock or runaway may result.	Warning Do not touch the terminals for 5 min after turning it off. - Residual electricity remains 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 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.	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	- Rust-proofing was applied before shipping. However, please note that rusting occurs earlier depending on the customers' storage environment. - Although black oxide finish is applied to some of our products, it does not guarantee the antirust effect.	Caution Please discard as industrial waste. Please discard as industrial waste when discarding.
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When Discarding Actuator and Servo Driver

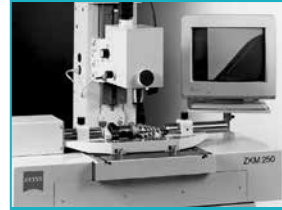
Major Applications of Our Products



Metal Working Machines



Processing Machines



Measurement, Analytical
and Test Systems



Medical Equipments



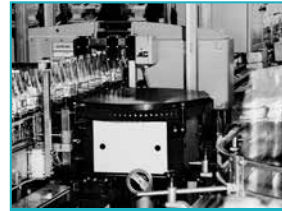
Telescopes

Source: National observatory of
Inter-University Research Institute Corporation



Energy

Courtesy of Halliburton/Sperry Drilling Services



Crating and
Packaging Machines

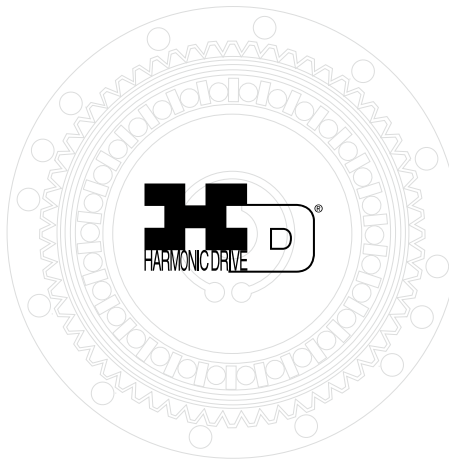


Communication
Equipments



Space Equipments

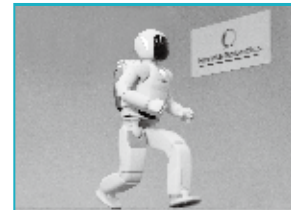
Rover image created by Dan Maas, copyrighted to Cornell
and provided courtesy NASA/ JPL-Caltech.



Glass and Ceramic
Manufacturing Systems



Robots



Humanoid Robots

Source: Honda Motor Co., Ltd.



Printing, Bookbinding
and Paper Machines



Semiconductor
Manufacturing Systems



Optical Machines



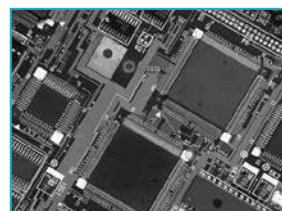
Wood, Light Metal and
Plastic Machine Tools



Paper-making Machines



Flat Panel Display
Manufacturing Systems



Printed Circuit Board
Manufacturing Machines



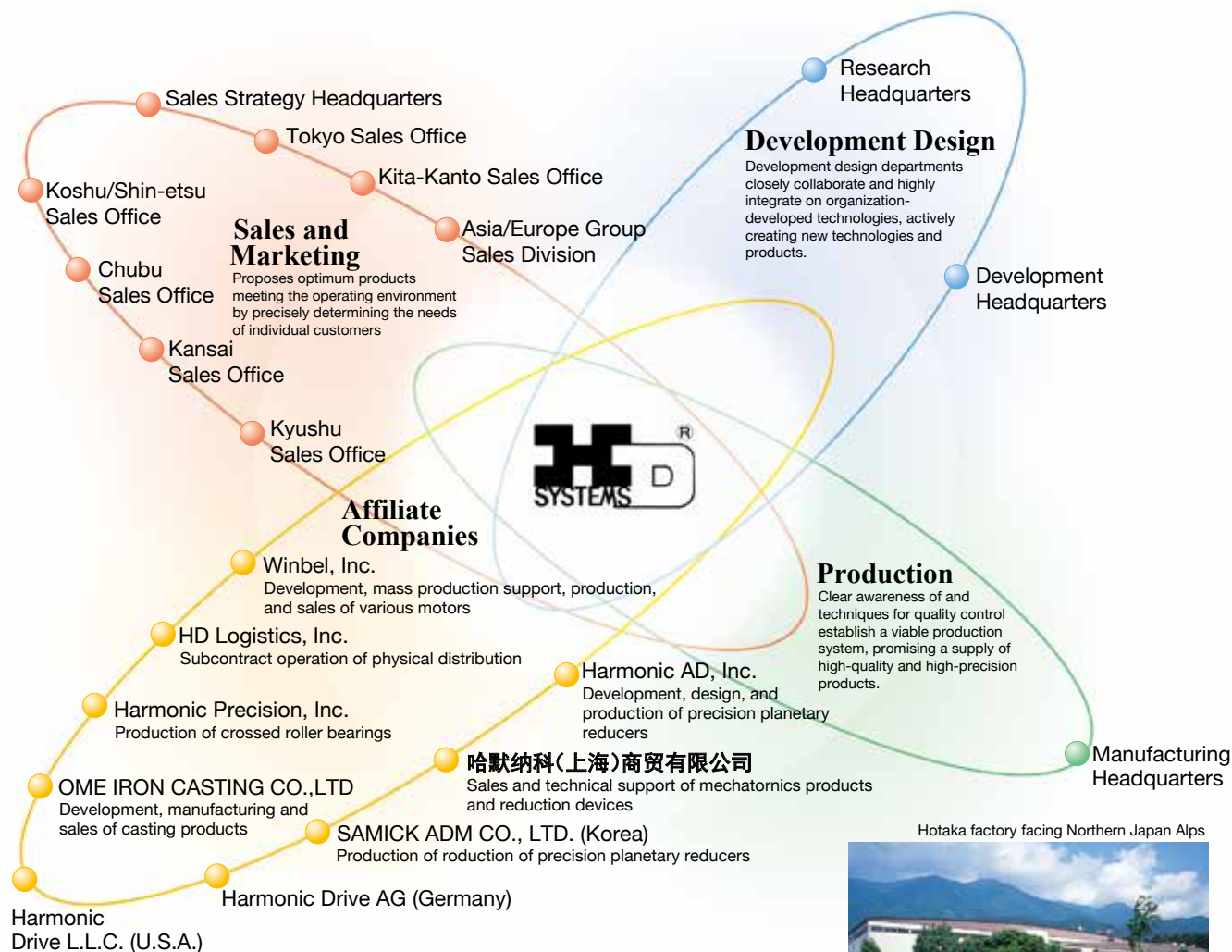
Aircraft Technology

As a Specialist in the Precision Control Field

Through close cooperation in areas of development, design, production and marketing, Harmonic Drive Systems creates unique products tailored to customer needs.



In 1995 and 1998, Harmonic Drive Systems respectively obtained approvals for ISO 9001 (International Quality Management Standard) and for ISO 14001 (International Environmental Management Systems) from TÜV Management Service GmbH, a German accreditation organization. The approvals signify global recognition of the quality assurance and environment management systems of Harmonic Drive Systems.



Other Products

HarmonicDrive® Gears

HarmonicDrive® gearing has a unique operating principle which utilizes the elastic mechanics of metals. This precision gear reducer consists of only 3 basic parts and provides high accuracy and repeatability.



Harmonic Planetary® Gearheads

Harmonic Planetary® gears use a precision engineered elastic ring gear which compensates for interference between meshing parts. This proprietary Harmonic Planetary® gear design provides smooth and quiet motion and maintains ultra-low backlash for the life of the reducer.



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“HarmonicDrive®” is a trademark of Harmonic Drive Systems Inc. The academic or general nomenclature of our products HarmonicDrive® is strain wave gearing.

All specifications and dimensions in this manual subject to change without notice. This manual is correct as of July 2026.

