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ENGINEERING SPECIFICATION

Specifications of the flat and hollow shaft servo-actuator
with incremental encoder

SHA25, 32, 40

APPD	CHKD	BY
Jul-22-'15 T.ICHIKAWA	Jul-22-'15 N.NAKAMURA	Jul-22-'15 T.Hirabayashi

		CLASS	SPEC No.
			B2T1115
REV	DESCRIPTION	SHEET No. 1 OF 13	



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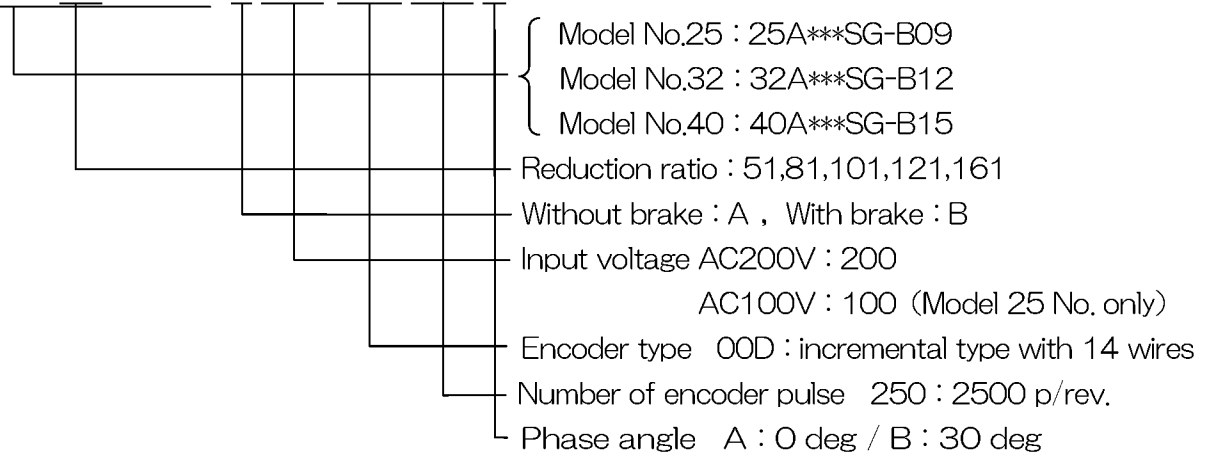
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1. Application

This specification applies to the following flat and hollow shaft servo actuator with incremental encoder.

SHA25A***SG-B09 B 200-00D 250 A



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2. Actuator

2-1 Main Specifications

The main specifications are shown in table 1 to table 4.

Table 1 Specifications of SHA25 (Input voltage 200V)

Item	Model	SHA25A***SG-B09*200				
		51	81	101	121	161
Max. torque ^{Note 2}	Nm	127	178	204	217	229
Allowable continuous torque ^{Note2,3}	Nm	41	67	81	81	81
Max. rotational speed ^{Note 2}	r/min	94.1	59.3	47.5	39.7	29.8
Torque constant ^{Note 2}	Nm/A	19	31	39	46	62
Max. current ^{Note 2}	Arms	8.6	7.5	7.0	6.3	5.2
Allowable continuous current ^{Note2,3}	Arms	3.0	3.0	2.9	2.6	2.1
EMF constant ^{Note 4}	V/(r/min)	2.2	3.5	4.3	5.2	6.9
Moment of Inertia(without brake)	kg·m ²	0.59	1.49	2.3	3.3	5.9
Moment of Inertia(with brake)	kg·m ²	0.70	1.76	2.7	3.9	7.0
Reduction ratio	—	1:51	1:81	1:101	1:121	1:161
Permissible moment load	Nm	258				
Moment stiffness	Nm/rad	39.2×10 ⁴				
Uni-directional positional accuracy	arc-sec	50	40	40	40	40
Number of pulses of encoder	pulse/rev	2500				
Output resolution	count/rev	510000	810000	1010000	1210000	1610000
Mass(without brake)	kg	3.2				
Mass(with brake)	kg	3.8				

Note1) The table shows typical output values of actuator.

Note2) Typical characteristics when combined driven by ideal sinewave.

Note3) Value after temperature rise and saturation when the 350x350x18 [mm] aluminum radiation plate is installed.

Note4) Value of phase induced voltage constant multiplied by 3.

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Table 2 Specifications of SHA25 (Input voltage 100V)

Item	Model	SHA25A***SG-B09*100				
		51	81	101	121	161
Max. torque ^{Note 2}	Nm	127	178	204	217	229
Allowable continuous torque ^{Note2,3}	Nm	35	58	73	81	81
Max. rotational speed ^{Note 2}	r/min	94.1	59.3	47.5	39.7	29.8
Torque constant ^{Note 2}	Nm/A	11.1	17.9	22	27	36
Max. current ^{Note 2}	Arms	14.9	13.0	12.1	10.9	9.0
Allowable continuous current ^{Note2,3}	Arms	4.7	4.7	4.7	4.5	3.7
EMF constant ^{Note 4}	V/(r/min)	1.3	2.0	2.5	3.0	4.0
Moment of Inertia(without brake)	kg·m ²	0.59	1.49	2.3	3.3	5.9
Moment of Inertia(with brake)	kg·m ²	0.70	1.76	2.7	3.9	7.0
Reduction ratio	—	1:51	1:81	1:101	1:121	1:161
Permissible moment load	Nm	258				
Moment stiffness	Nm/rad	39.2×10 ⁴				
Uni-directional positional accuracy	arc-sec	50	40	40	40	40
Number of pulses of encoder	pulse/rev	2500				
Output resolution	count/rev	510000	810000	1010000	1210000	1610000
Mass(without brake)	kg	3.2				
Mass(with brake)	kg	3.8				

Note1) The table shows typical output values of actuator.

Note2) Typical characteristics when combined driven by ideal sinewave.

Note3) Value after temperature rise and saturation when the 350x350x18 [mm] aluminum radiation plate is installed.

Note4) Value of phase induced voltage constant multiplied by 3.

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Table 3 Specifications of SHA32

Item	Model	SHA32A***SG-B12*200				
		51	81	101	121	161
Max. torque ^{Note 2}	Nm	281	395	433	459	484
Allowable continuous torque ^{Note2,3}	Nm	92	153	178	178	178
Max. rotational speed ^{Note 2}	r/min	94.1	59.3	47.5	39.7	29.8
Torque constant ^{Note 2}	Nm/A	21	33	42	50	66
Max. current ^{Note 2}	Arms	17.3	15.2	13.5	12.2	9.9
Allowable continuous current ^{Note2,3}	Arms	6.0	6.0	5.7	5.0	4.1
EMF constant ^{Note 4}	V/(r/min)	2.3	3.7	4.7	5.6	7.4
Moment of Inertia(without brake)	kg·m ²	1.9	4.9	7.6	11	19
Moment of Inertia(with brake)	kg·m ²	2.2	5.7	8.8	13	22
Reduction ratio	—	1:51	1:81	1:101	1:121	1:161
Permissible moment load	Nm	580				
Moment stiffness	Nm/rad	100×10 ⁴				
Uni-directional positional accuracy	arc-sec	50	40	40	40	40
Number of pulses of encoder	pulse/rev	2500				
Output resolution	count/rev	510000	810000	1010000	1210000	1610000
Mass(without brake)	kg	5.9				
Mass(with brake)	kg	6.2				

Note1) The table shows typical output values of actuator.

Note2) Typical characteristics when combined driven by ideal sinewave.

Note3) Value after temperature rise and saturation when the 400x400x20 [mm] aluminum radiation plate is installed.

Note4) Value of phase induced voltage constant multiplied by 3.

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Table 4 Specifications of SHA40

Item	Model	SHA40A***SG-B15*200				
		51	81	101	121	161
Max. torque ^{Note 2}	Nm	523	675	738	802	841
Allowable continuous torque ^{Note2,3}	Nm	160	263	330	382	382
Max. rotational speed ^{Note 2}	r/min	78.4	49.4	39.6	33.1	24.8
Torque constant ^{Note 2}	Nm/A	25	41	51	61	81
Max. current ^{Note 2}	Arms	26.7	21.8	19.4	17.9	14.6
Allowable continuous current ^{Note2,3}	Arms	9.0	9.0	9.0	8.8	7.2
EMF constant ^{Note 4}	V/(r/min)	2.9	4.6	5.7	6.8	9.1
Moment of Inertia(without brake)	kg·m ²	4.6	12	18	26	46
Moment of Inertia(with brake)	kg·m ²	5.8	15	23	32	58
Reduction ratio	—	1:51	1:81	1:101	1:121	1:161
Permissible moment load	Nm	849				
Moment stiffness	Nm/rad	179×10 ⁴				
Uni-directional positional accuracy	arc-sec	50	40	40	40	40
Number of pulses of encoder	pulse/rev	2500				
Output resolution	count/rev	510000	810000	1010000	1210000	1610000
Mass(without brake)	kg	9.9				
Mass(with brake)	kg	10.7				

Note1) The table shows typical output values of actuator.

Note2) Typical characteristics when combined driven by ideal sinewave.

Note3) Value after temperature rise and saturation when the 500x500x25 [mm] aluminum radiation plate is installed.

Note4) Value of phase induced voltage constant multiplied by 3.

2-2 Outline

External dimensions may be different from standard absolute encoder type depends on size as shown in table 5.

For more details please refer confirmation drawing of each actuator.

Table 5 Outline of Actuator

	Without brake	With brake
SHA25	Fig.1	Fig.2
SHA32	Same as standard model	Same as standard model
SHA40	Fig.3	Same as standard model

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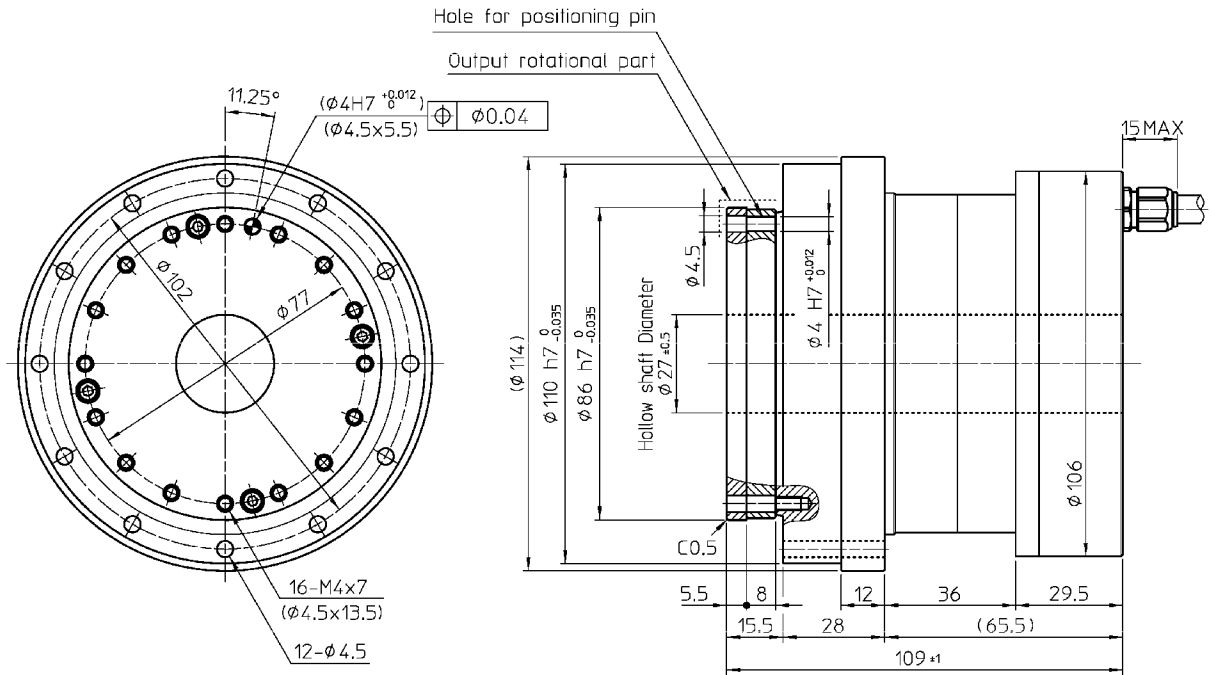


Fig.1 SHA25 without brake

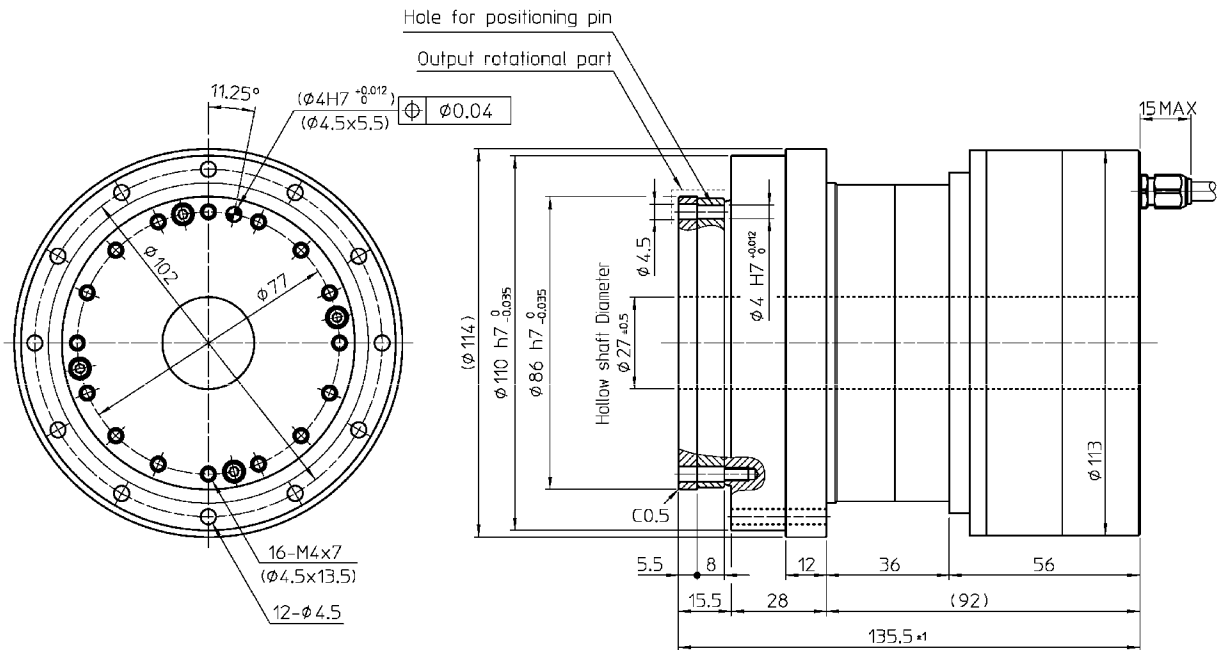


Fig.2 SHA25 with brake

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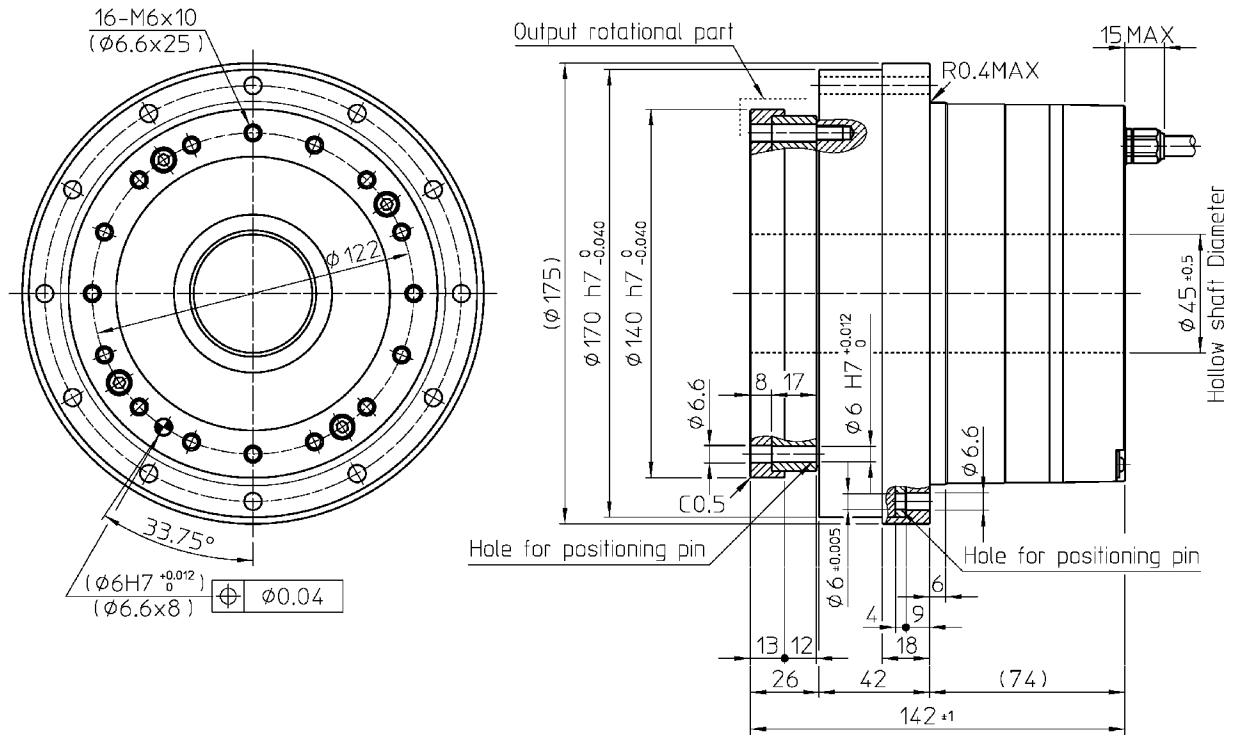


Fig.3 SHA40 without brake

2-3 Operable Range

Please refer SHA technical manual since operable range is same as standard model (Absolute encoder type) except SHA25 with AC 200V winding model.

Please refer Fig.4 for each reduction ratio of SHA25A with AC 200V winding model.

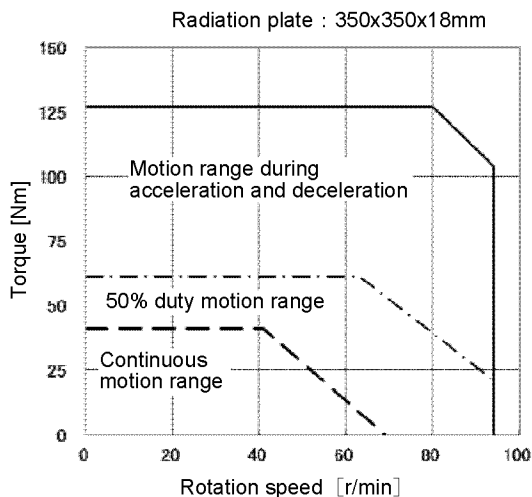


Fig.4-1 SHA25A51SG-B09*200

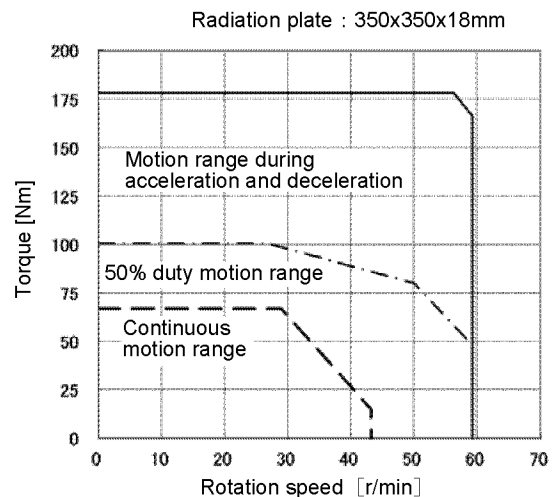


Fig.4-2 SHA25A81SG-B09*200

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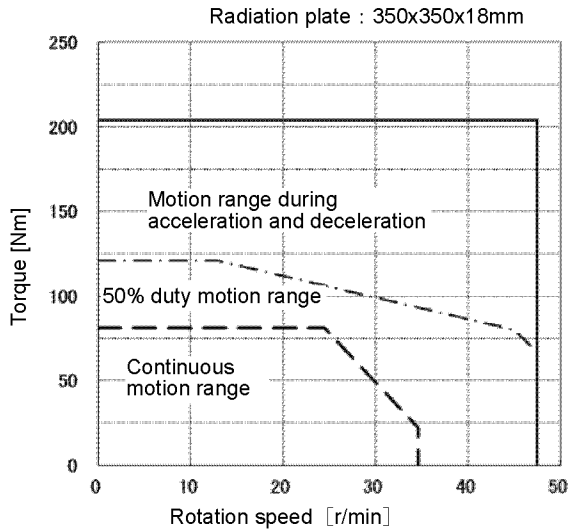


Fig.4-3 SHA25A101SG-B09*200

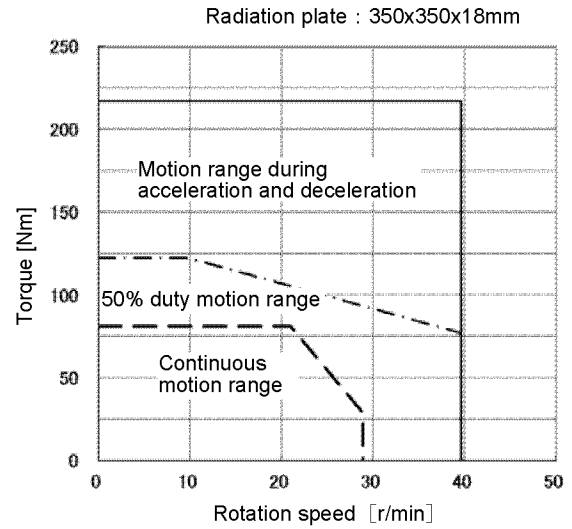


Fig.4-4 SHA25A121SG-B09*200

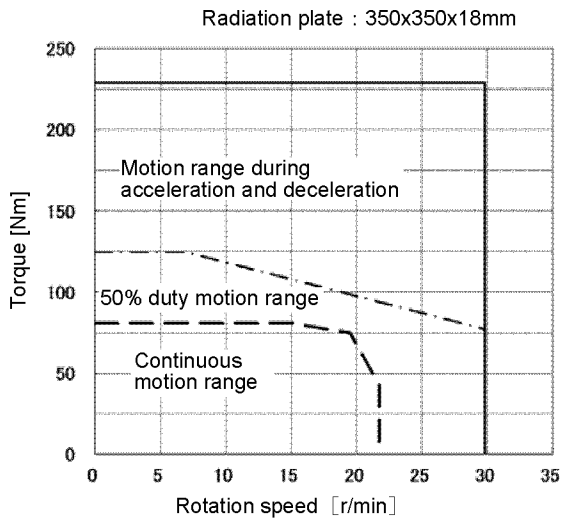


Fig.4-5 SHA25A161SG-B09*200

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3. Motor

Specifications of the motor as a part of the actuator shown in Table 6.

Table 6 Motor specifications

Item	Model	MAB09*200	MAB09*100	MAB12*200	MAB15*200
		Applied actuator model	—	SHA25	SHA25
Motor type	—	AC servo motor with permanent magnet field			
Number of poles	—	10			
Rated torque ^{Note 1,2}	Nm	1.0	0.88	2.2	4.5
Rated rotational speed ^{Note 1,2}	r/min	3000	3000	2500	2000
Rated output ^{Note 1,2}	W	314	276	576	942
Torque constant ^{Note 1,2}	Nm/Arms	0.41	0.24	0.44	0.54
Rated current ^{Note 1,2}	Arms	3	4.7	6	10
Max. torque ^{Note 1}	Nm	3	3	7	13
Max. rotational speed ^{Note 1}	r/min	4800	4800	4800	4000
Max. current ^{Note 1}	Arms	8.9	15.4	19	29
EMF constant ^{Note 3}	V/(r/min)	0.043	0.025	0.046	0.057
Phase resistance (at 20°C)	Ω	1.2	0.4	0.33	0.19
Phase inductance	mH	3	1.0	1.4	1.2
Phase sequence		U→V→W (with CW rotation facing the encoder end)			
Insulation resistance	—	100MΩ or more (by DC500V insulation tester)			
Dielectric strength	V/1min	AC 1500	AC 1200	AC 1500	AC 1500
Insulation class	—	A			
Supply voltage into driver	V	AC200	AC100	AC200	AC200

Note1) Typical characteristics when combined driven by ideal sinewave.

Note2) Values at temperature saturation when mounted on the following aluminum radiation plate.

MAB09 : 350×350×18 [mm]

MAB12 : 400×400×20 [mm]

MAB15 : 500×500×25 [mm]

Note3) Value of phase induced voltage constant multiplied by 3.

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4. Encoder

4-1 Main Specifications

Specifications of the encoder as a part of the actuator shown in Table 7.

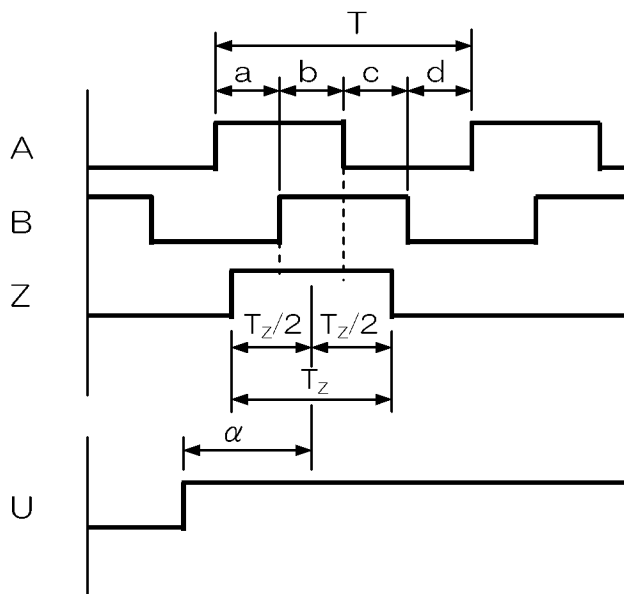
Table 7 Encoder specifications

Item		Specification	
Type	—	Incremental, Rectangular wave, 14-wires	
Output signal	—	A, B, Z, U, V, W	
Number of pulse	A,B	pulse/rev	2500
	U,V,W	pulse/rev	5
	Z	pulse/rev	1
Power supply voltage	V	+5DC±5%	
Current consumption ¹⁾	mA	350 max.	
Output circuit form	—	Line driver (equivalent to AM26LS31C)	
Maximum response frequency	kHz	200	

Note 1) When connecting to the terminating resistor.

4-2 Signal waveform

Fig. 5 shows A, B and Z signal specifications.



$$a, b, c, d = 1/4T \pm 1/10T$$

$$(a+b), (b+c) = 1/2T \pm 1/8T$$

$$T_z = 1/2T \sim 3/2T$$

(The Z phase includes a HIGH state in case of both of A and B phase is HIGH state.)

$$T = 360^\circ / 2500$$

$$\alpha \leq \pm 10^\circ / 5 \text{ (Mechanical angle)}$$

Fig. 5 A,B,Z signal and relationship with U signal
(CW rotation facing the encoder end)

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Fig. 6 shows U, V and W signal specifications and relationship with motor's EMF with CW rotation facing the encoder end. In case of phase angle A, encoder U-signal corresponds to motor U phase voltage. On the other hand, in case of phase angle B, encoder U-signal corresponds to motor terminal U-W voltage.

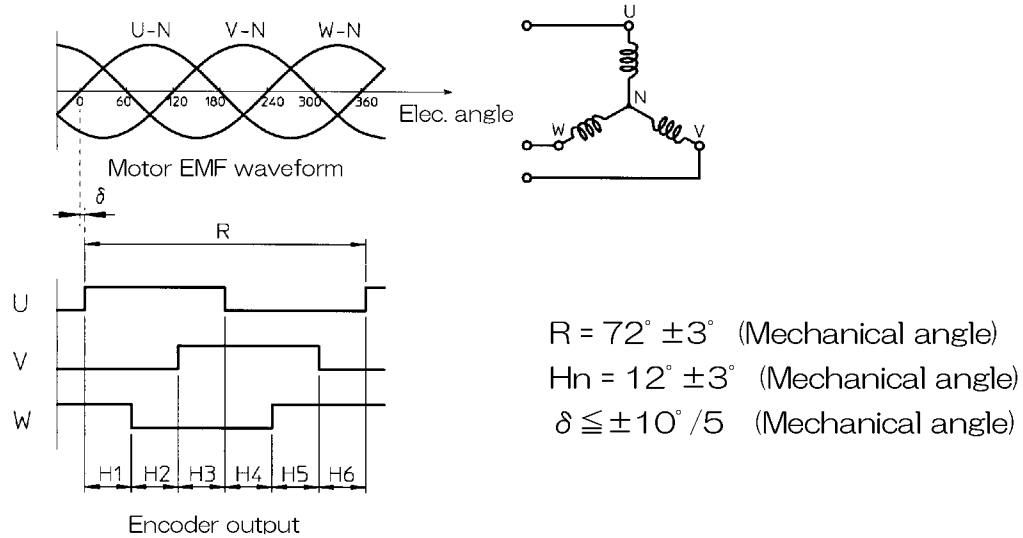


Fig. 6-1 In case of phase angle : A

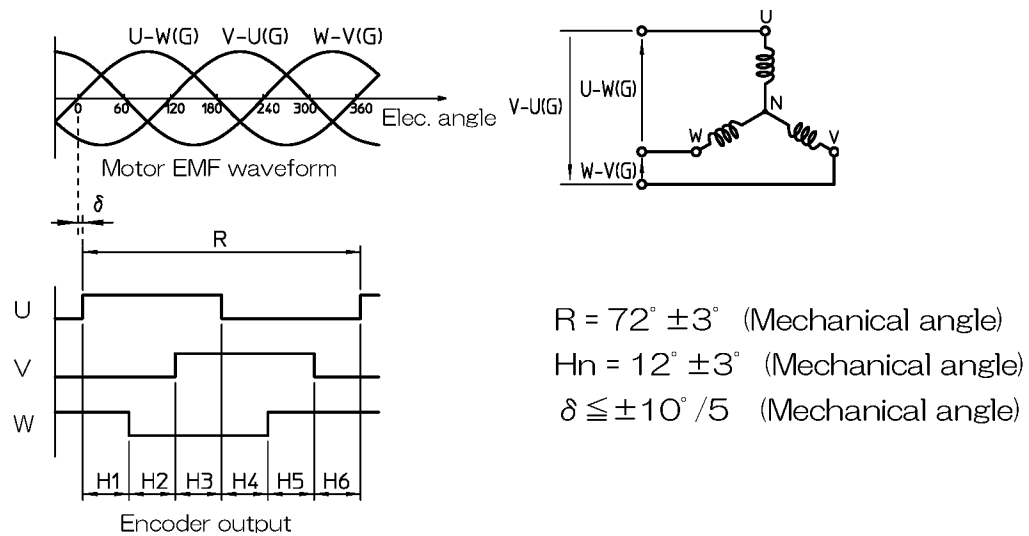


Fig. 6-2 In case of phase angle : B

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4-3 Encoder leads

Color code of encoder leads shown in Table 8.

Table 8 Color code of encoder leads

Color	Signal	Color	Signal
Red	V_{CC}	Black	GND
Green	A	Green/White	\bar{A}
Gray	B	Gray/White	\bar{B}
Yellow	Z	Yellow/White	\bar{Z}
Brown	U	Brown/White	\bar{U}
Blue	V	Blue/White	\bar{V}
Orange	W	Orange/White	\bar{W}

4-4 Output circuit and example for receiving signal.

Fig.7 shows output circuit of encoder and example for input circuit to user's device. Please be sure to perform the shield treatment.

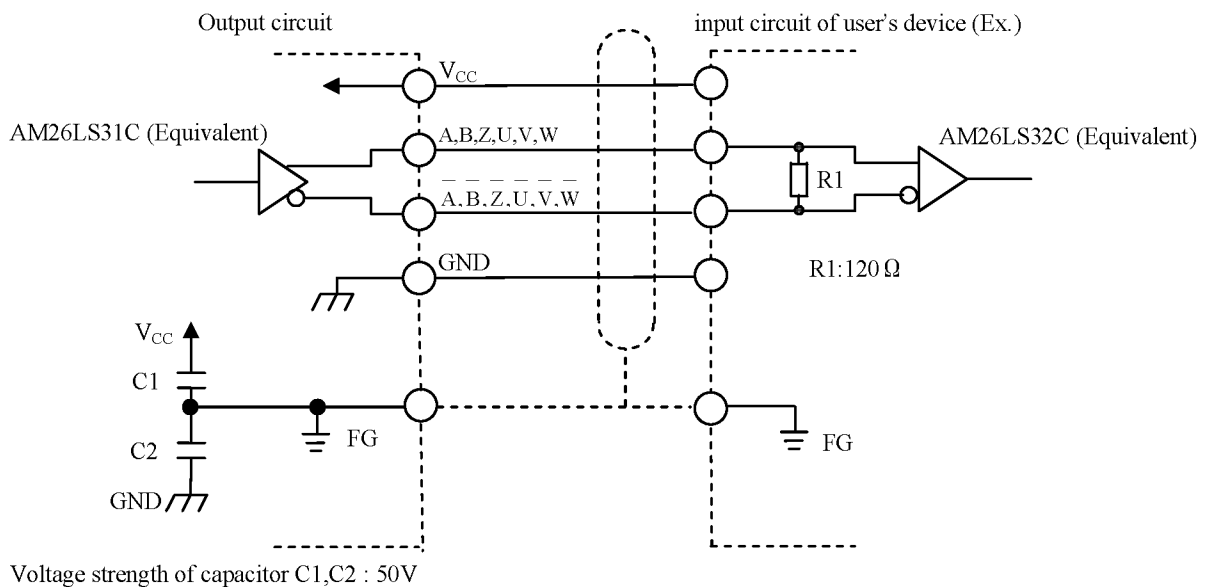


Fig. 7 Example for electrical connection

5. Others

Please refer SHA technical manual for further information.

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