

FHA Mini Servo Actuator

24V Motor Winding



Harmonic Drive[®] actuator

P r e c i s i o n G e a r i n g & M o t i o n C o n t r o l



1. FHA-C Model

Specifications in this document apply to for the following FHA-C mini series actuators with incremental line driver encoder and hall sensors with US commutation. These actuators use a 24V DC motor supply voltage. Motor windings for higher voltages are also available..

The models are numbers for the actuators as follows:

- 1) FHA-8C-XXX-US200-E (INC), FHA-8C-XXX-12S17b-c (ABS)
- 2) FHA-11C-XXX-US200-E (INC), FHA-11C-XXX-12S17b-c (ABS)
- 3) FHA-14C-XXX-US200-E (INC), FHA-14C-XXX-12S17b-c (ABS)

2. Ordering Code

FHA	14-C	100-US	200-E	
				Model: AC servo actuator FHA-C mini series
				Frame size: 8, 11, 14
				Design revision
				Gear reduction ratio 30:1/30 50:1/50 100:1/100
				Encoder specifications US: Incremental encoder (with line driver encoder & US commutation) 12S: Absolute encoder (Nikon A format)
				Encoder resolution 200: 2000p/rev (Incremental) 17b: 131,072 count/rev (Absolute)
				Power supply voltage: 24V DC

3. Specifications

Refer to the standard FHA-C mini standard type except the following specifications.

3-1 Actuators

Table 1 Environmental Specifications of FHA-8C/11C/14C

Item	Environmental conditions
Service temperature	0~40°C
Storage temperature	-20~60°C
Service humidity	20~80% RH (no condensation)
Storage humidity	
Vibration	25m/s ² (frequency: 10~400Hz)
Impact resistance	300m/s ²

Table 2 Actuator Specifications

Item		Model ratio	FHA-8C			FHA-11C			FHA-14C		
			30	50	100	30	50	100	30	50	100
Max. torque		N·m	1.8	3.3	4.8	4.5	8.3	11	9	18	28
Max. speed		r/min	200	120	60	200	120	60	200	120	60
Torque constant Note 3		N·m/A	0.8	1.3	2.7	0.8	1.3	2.6	0.8	1.4	2.9
		kgf·m/A	0.08	0.13	0.28	0.08	0.13	0.27	0.08	0.14	0.3
Max. current		A	3	3.3	2.4	7.8	8.2	5.6	14.8	16.4	12.3
Continuous torque		N·m	0.75	1.5	2	1.8	2.9	4.2	3.5	4.7	6.8
Continuous speed		r/min	117	70	35	117	70	35	100	60	30
Continuous current		A	1.6	1.7	1.3	3.7	3.5	2.8	6.5	5.4	4.4
Power supply voltage		V (DC)	DC24			DC24			DC24		
BEMF		V/(r/min)	0.10	0.16	0.32	0.09	0.15	0.31	0.1	0.17	0.34
Phase resistance		Ω (20)	0.54			0.19			0.07		
Phase inductance		mH	0.22			0.11			0.06		
Moment of inertia	Incremental	kg·m ²	0.003	0.007	0.029	0.006	0.017	0.067	0.018	0.05	0.2
	Absolute	kg·m ²	0.026	0.073	0.029	0.0062	0.017	0.069	0.019	0.054	0.215
Allowable moment load		N·m	15			40			75		
		kgf·m	1.5			4.1			7.7		
Moment stiffness		N·m/rad	2x10 ⁴			4x10 ⁴			8x10 ⁴		
		kgf·m/rad	0.2x10 ⁴			0.4x10 ⁴			0.8x10 ⁴		
One-way positioning accuracy		arc sec	150	120	120	120	90	90	120	90	90
Encoder resolution Note 4	Incremental	p/rev	240,000	400,000	800,000	240,000	400,000	800,000	240,000	400,000	800,000
	Absolute		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
Mass	Incremental	kg	0.40			0.62			1.2		
	Absolute	kg	0.50			0.75			1.3		
Number of paired poles			5								
Insulation class			B								

Note 1: The table shows typical output values of actuators.

Note 2: All values are typical.

Note 3: Torque constant is specified considering the efficiency of the gear.

Note 4: Encoder resolutions are obtained by [motor encoder resolution]x4x[reduction ratio]



3-2 Encoder Specifications

Table 3-1 Incremental Encoder Specifications

Item		Unit	Specification
Type			Incremental, Rectangular wave, line driver
Output signal			A,A,B,B,Z,Z,U,U,V,V,W,W
Number of pulse	A,B	p/rev	2000
	U,V,W	p/rev	5
	Z	p/rev	1
Power supply voltage		V	+5VDC $\pm 5\%$
Current consumption Note1		mA	250 max
Output circuit form			Line driver (equivalent to SN75ALS192NS)

Note 1: When using R1 resistor shown in Fig.3 below

Table 3-2 Absolute Encoder Specifications

Item	Unit	Specification
Type		Absolute
Output signal		Serial communication (Nikon A-format equivalent) Communication 4M bps
Pulse	Count/ rev	Single (motor) turn: 131,072 (17 bit)
		Multi-turn: 65,536 (16 bit) Battery back-up
Power supply voltage	V	+5VDC ±5%
Current consumption	mA	180 max

Incremental Encoder Detailed Specifications

Signal Waveform

Fig. 1 A, B and Z signal and relationship with U-N motor EMF waveform with CW rotation facing the output flange end

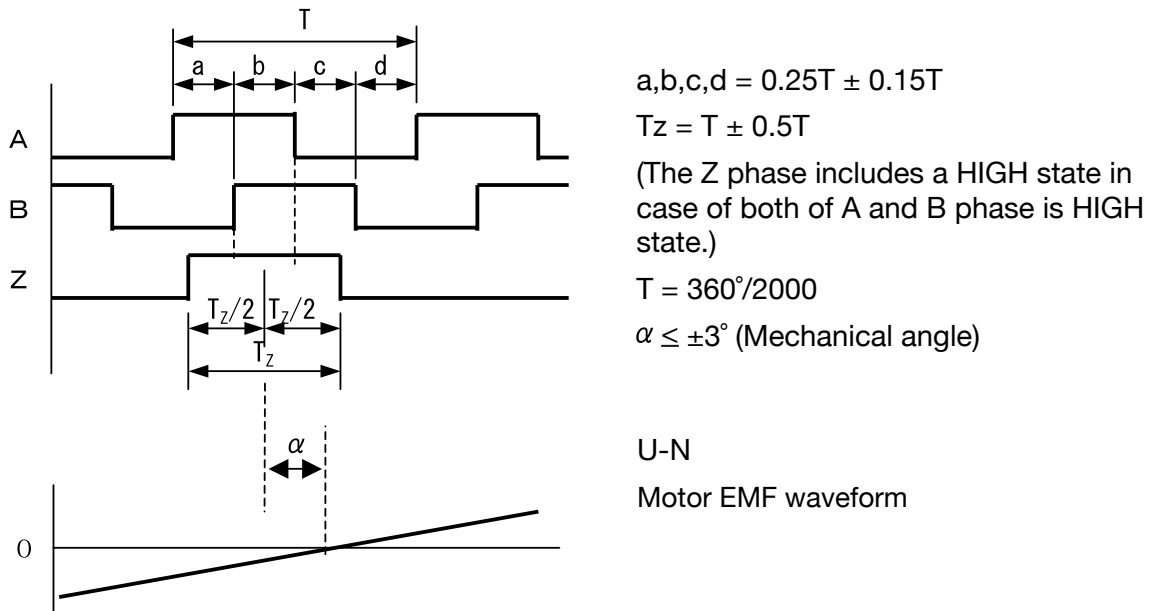
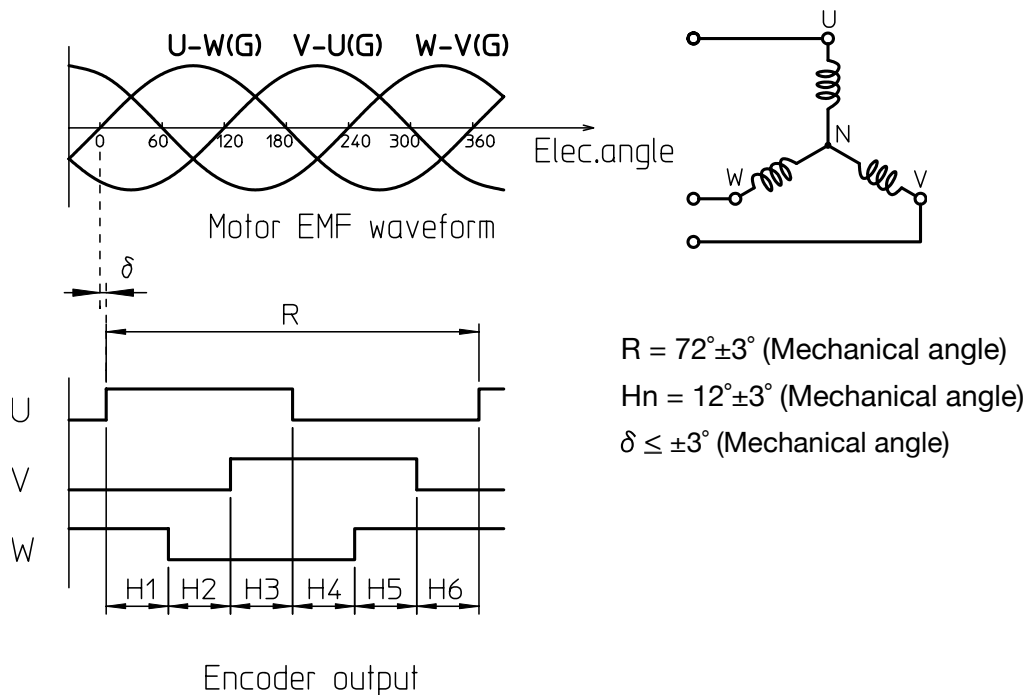


Fig. 2 U, V and W signal and relationship with motor's EMF with CW rotation facing the output flange end



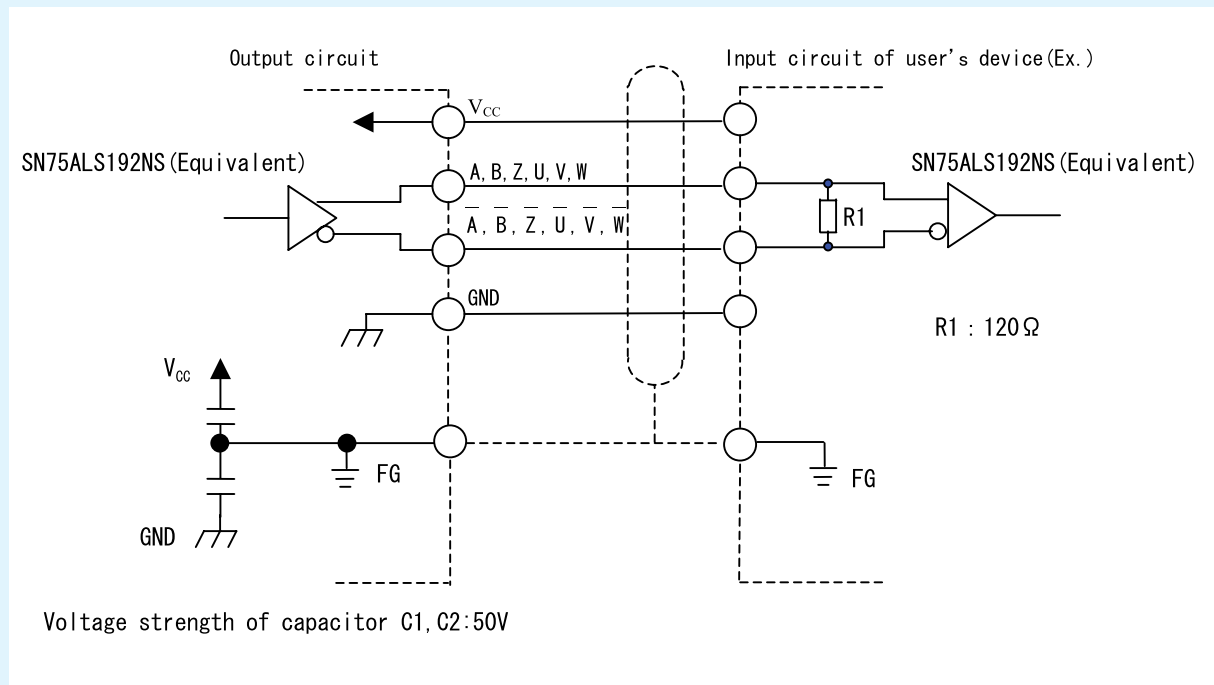
Incremental Encoder Leads

Table 4 Color code of encoder leads

Color	Signal	Color	Signal
Red	+5V (Vcc)	Black	OV (GND)
Green	A	Dark green	$\bar{A}$
Gray	B	White	$\bar{B}$
Yellow	Z	Clear	$\bar{Z}$
Brown	U	Purple	$\bar{U}$
Blue	V	Light blue	$\bar{V}$
Orange	W	Pink	$\bar{W}$

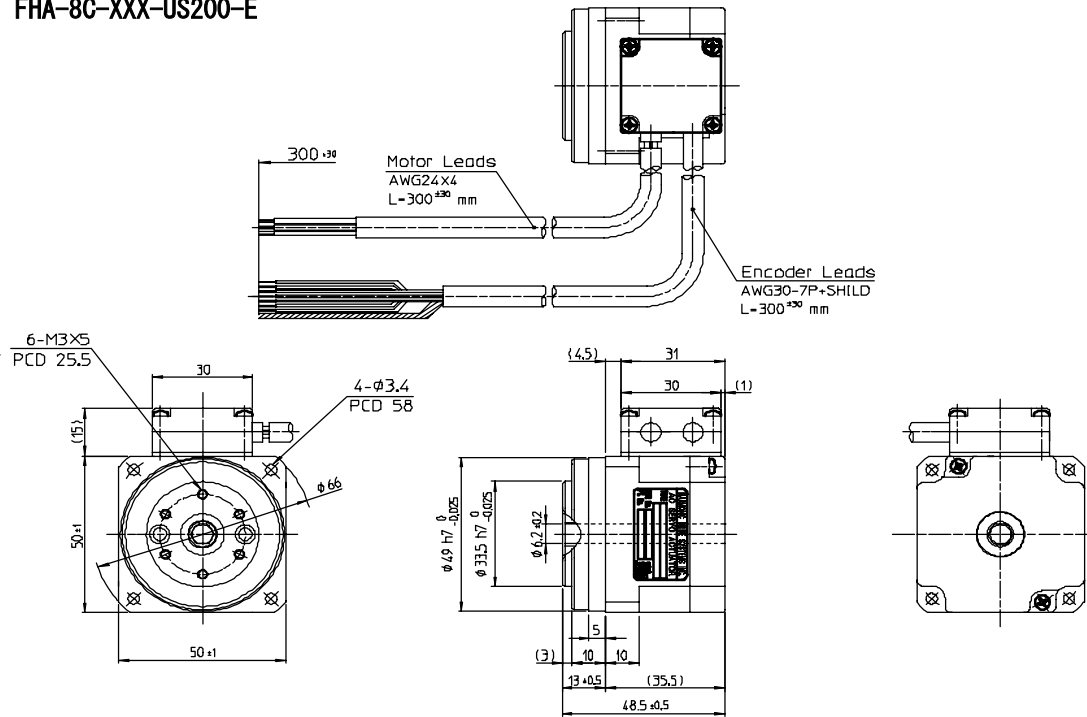
Output Circuit and Example for Receiving Signal

Fig. 3 Output circuit of encoder and connection example

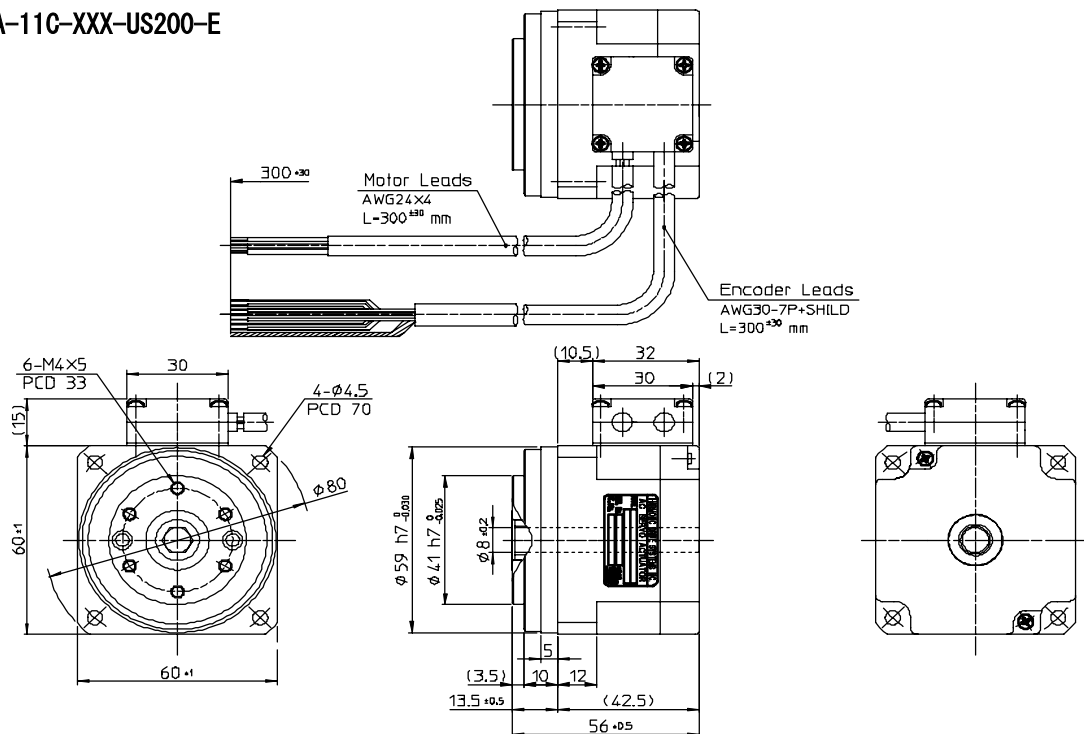


External Dimensions of FHA-C Mini Actuators with Incremental Encoder

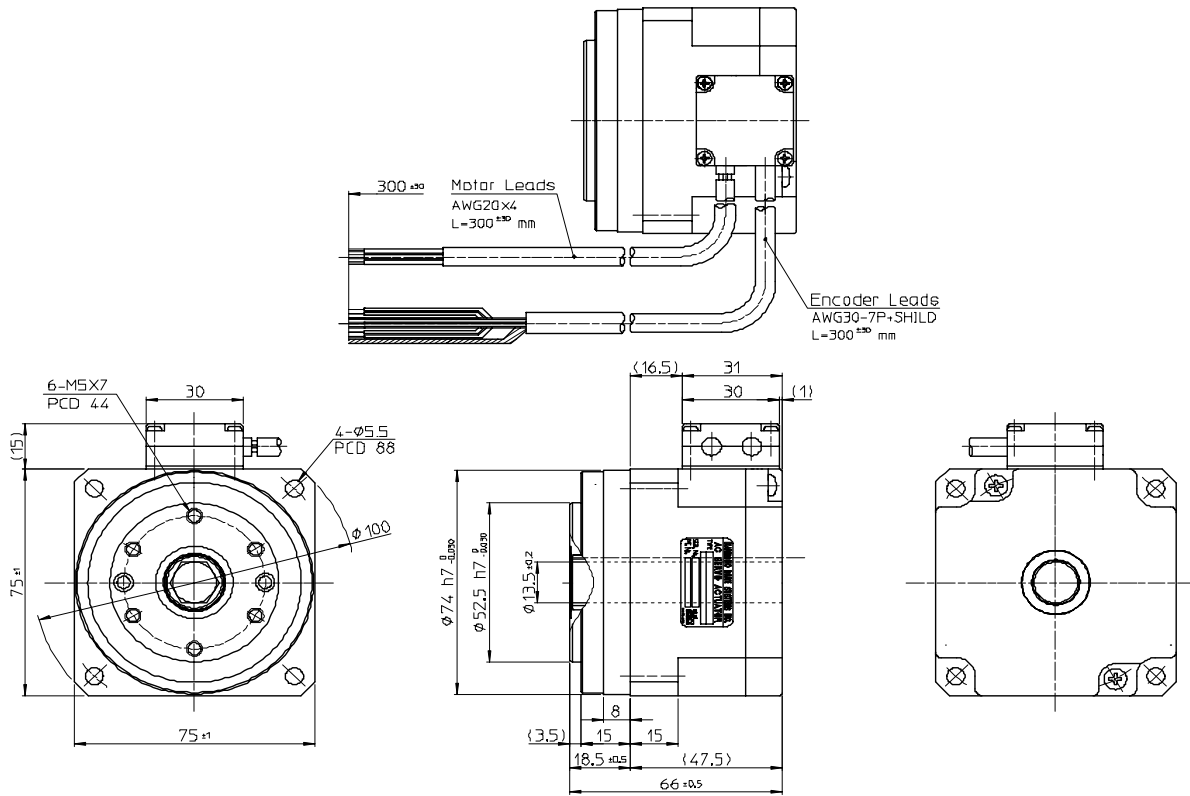
FHA-8C-XXX-US200-E



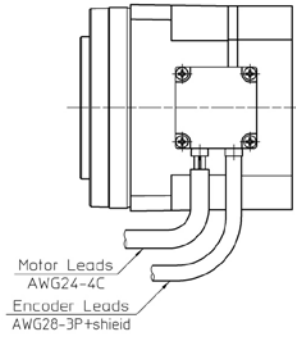
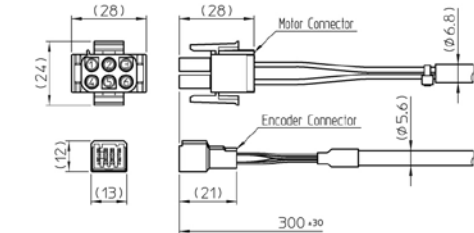
FHA-11C-XXX-US200-E



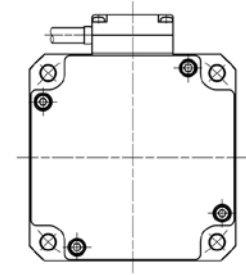
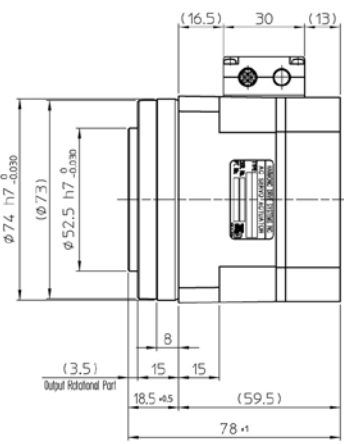
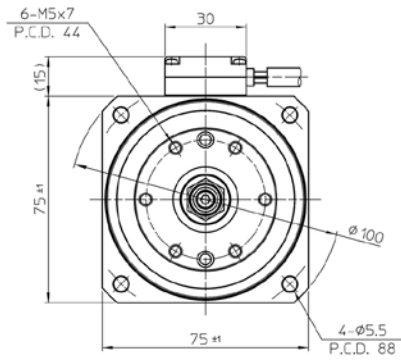
FHA-14C-XXX-US200-E



FHA-14C-xxx-12S17 b-c (ABS)



Unit: mm (third angle projection)



Contact an application engineer at Harmonic Drive LLC for more information on our matched servo drivers for use with FHA-C actuators.

Notes:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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