

# FHA-mini Servo Actuator

24 Volt Motor Winding  
Line Driver Encoder



*Total Motion Control*

Harmonic Drive™ actuator  
Precision Gearing & Motion Control



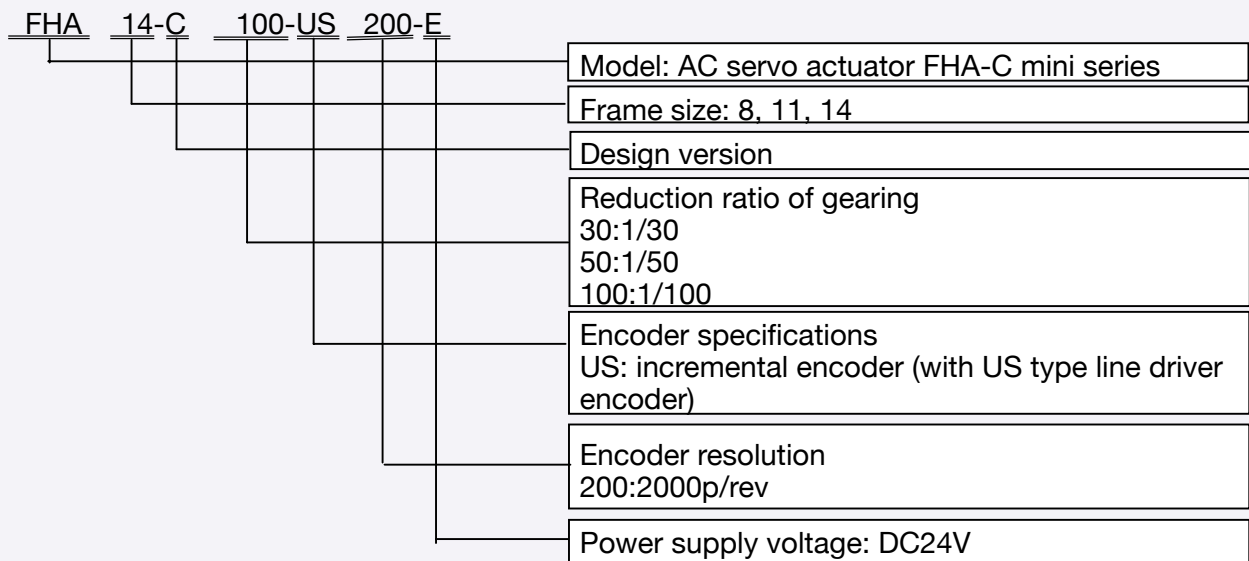
### 1. Application Model

Specifications in this document should be applied for the following FHA-C mini series with US type line driver encoder and supply voltage DC24V.

The object models are as follows:

- 1) FHA-8C-XXX-US200-E
- 2) FHA-11C-XXX-US200-E
- 3) FHA-14C-XXX-US200-E

### 2. Ordering information



### 3. Specifications (B2N1666 / Jun-2-05)

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

#### 3-1 Actuators

**Table 1 General 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 <sup>2</sup> (frequency: 10~400Hz)
Impact resistance	300m/s <sup>2</sup>



**Table 2 Ability specifications of FHA-8C/11C/14C**

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	DC24			DC24			DC24			
EMF constant	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	kg•m <sup>2</sup>	0.003	0.007	0.029	0.006	0.017	0.067	0.018	0.05	0.2	
	kgf•cm•s <sup>2</sup>	0.027	0.075	0.3	0.061	0.17	0.68	0.18	0.51	2	
Allowable torsional moment	N•m	15			40			75			
	kgf•m	1.5			4.1			7.7			
Moment stiffness	N•m/rad	2x10 <sup>4</sup>			4x10 <sup>4</sup>			8x10 <sup>4</sup>			
	kgf•m/rad	0.2x10 <sup>4</sup>			0.4x10 <sup>4</sup>			0.8x10 <sup>4</sup>			
One-way positioning accuracy	Arc sec	150	120	120	120	90	90	120	90	90	
Quad encoder-resolution Note 4	p/rev	240000	400000	800000	240000	400000	800000	240000	400000	800000	
Mass	kg	0.40			0.62			1.2			
Number of paired poles		5									
Insulation class		B									
Insulation resistance		100MΩ or more (by DC500V insulation tester)									
Withstanding voltage		AC500V/1minute									

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

Note 2: All values are typical.

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

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



### 3-2 Specifications of encoder

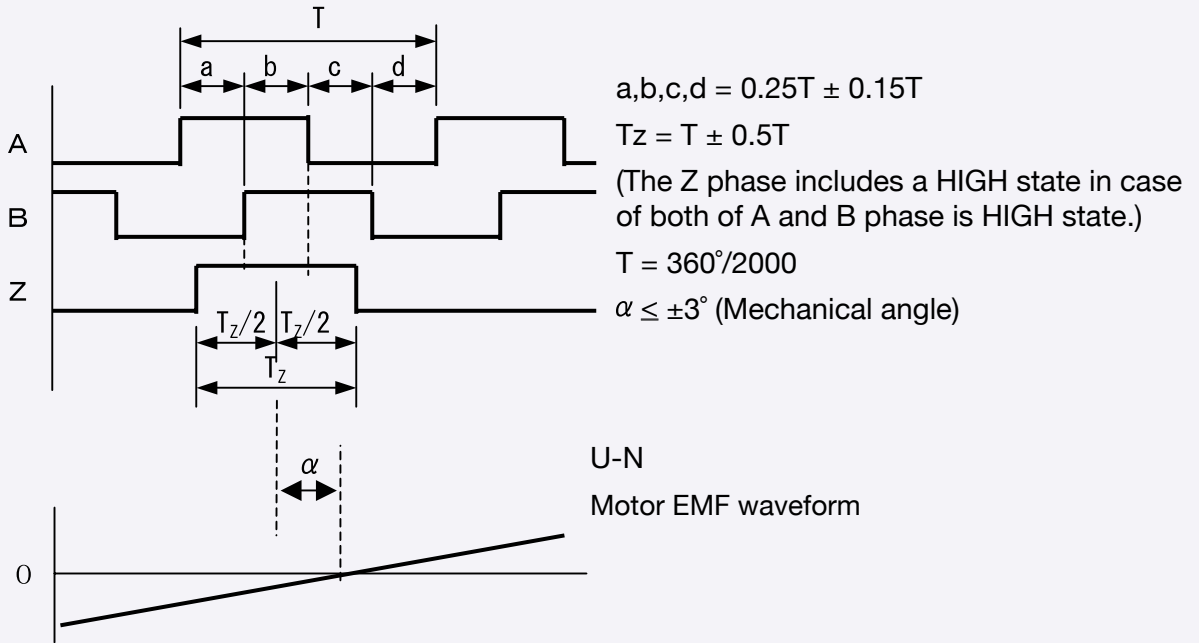
**Table 3 Main specifications of encoder**

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	DC +5 ±5%	
Current consumptionNote1	mA	250 max	
Output circuit form		Line driver (equivalent to SN75ALS192NS)	

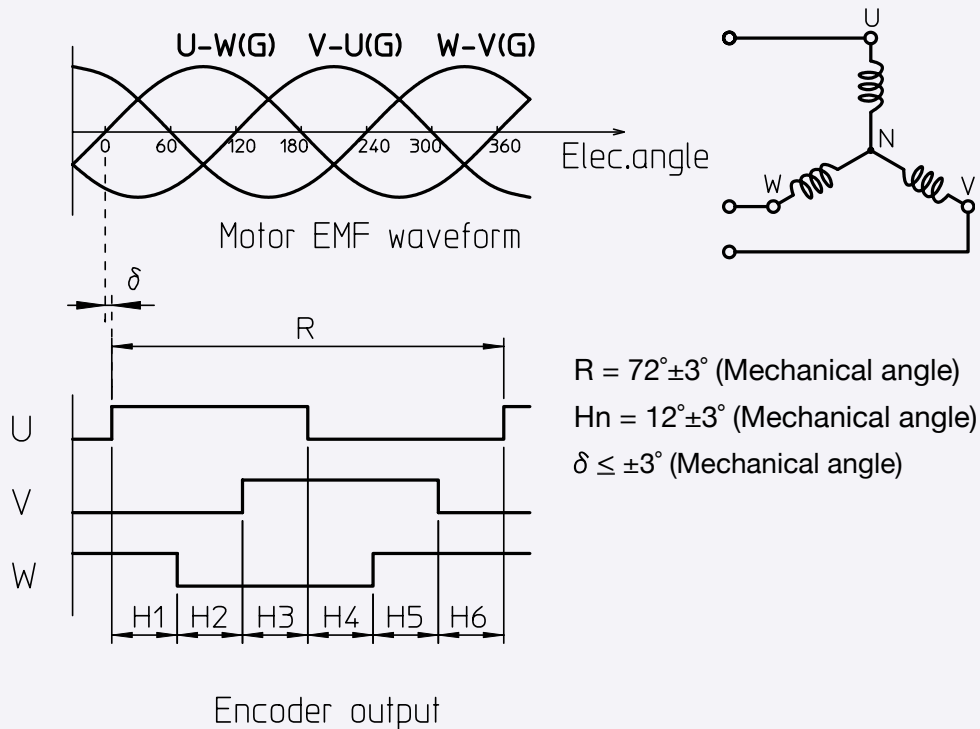
Note 1: When R1 resistor shown in Fig.3 below

**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**



### Encoder leads

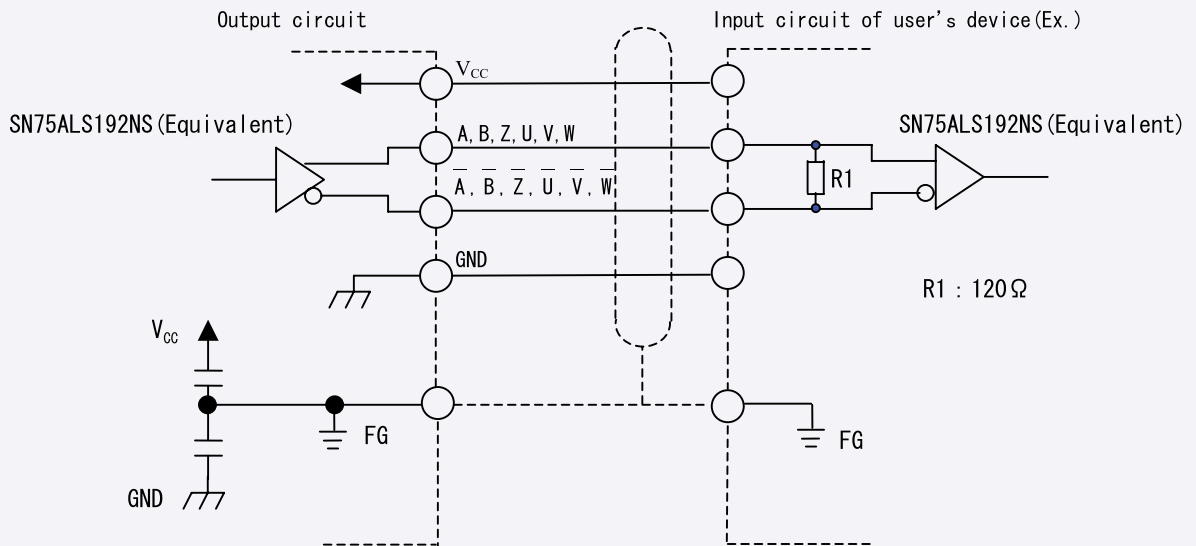
Color code of encoder leads shown in Table 4.

**Table 4 Color code of encoder leads**

Color	Signal	Color	Signal
Red	+5V (V <sub>CC</sub> )	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

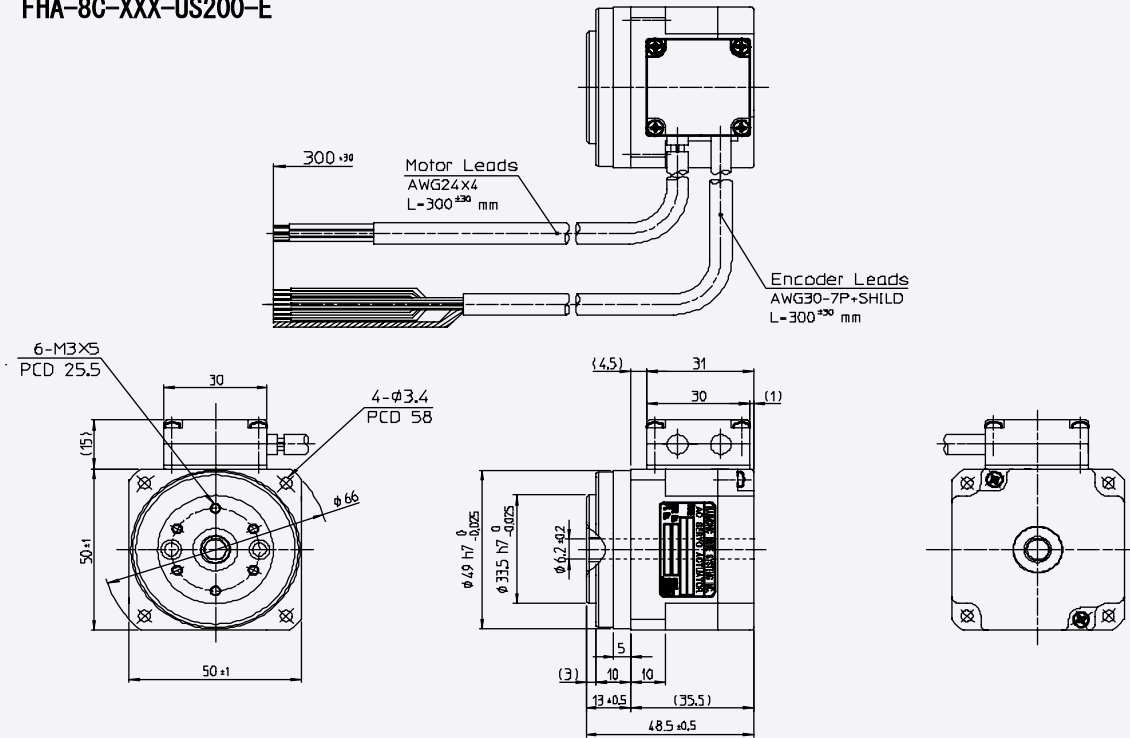
**Fig.3 Output circuit of encoder and example for input to user's device**



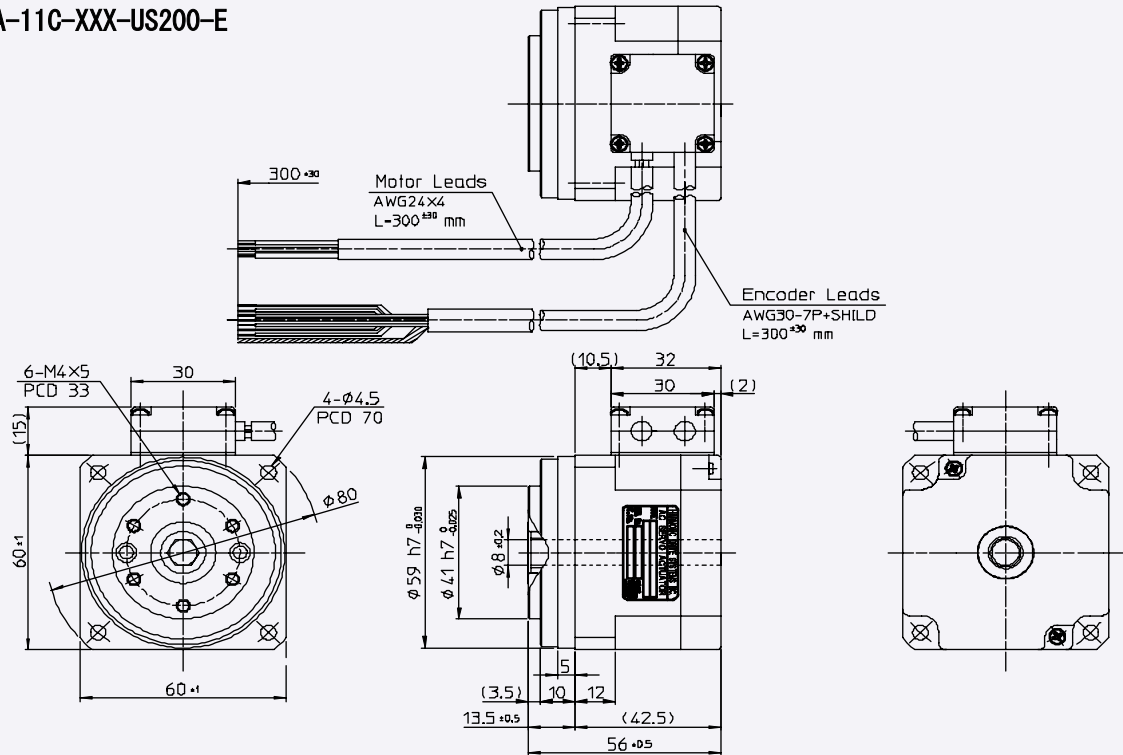
Voltage strength of capacitor C1, C2: 50V



**4 External dimensions of FHA-C mini actuators with US type**  
**FHA-8C-XXX-US200-E**

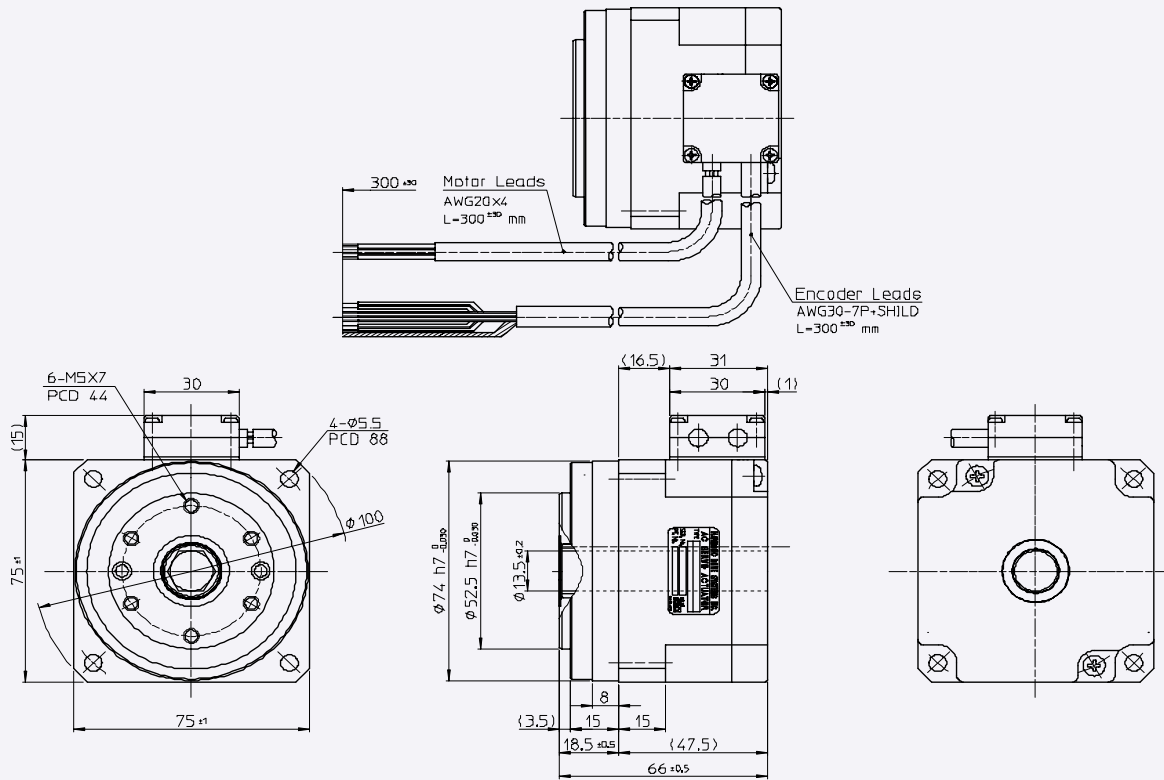


**FHA-11C-XXX-US200-E**





FHA-14C-XXX-US200-E





## Harmonic Drive LLC

### **Boston**

247 Lynnfield Street  
Peabody, MA 01960

### **New York**

89 Cabot Court  
Hauppauge, NY 11788

800-921-3332

F: 978-532-9406

[www.HarmonicDrive.net](http://www.HarmonicDrive.net)

### **Worldwide Locations:**

Harmonic Drive Systems, Inc.  
Minamiohi 6-25-3, Shinagawa-ku  
Tokyo 140, Japan

Harmonic Drive AG  
Hoenbergstr, 14  
Limburg/Lahn, D-65555 Germany