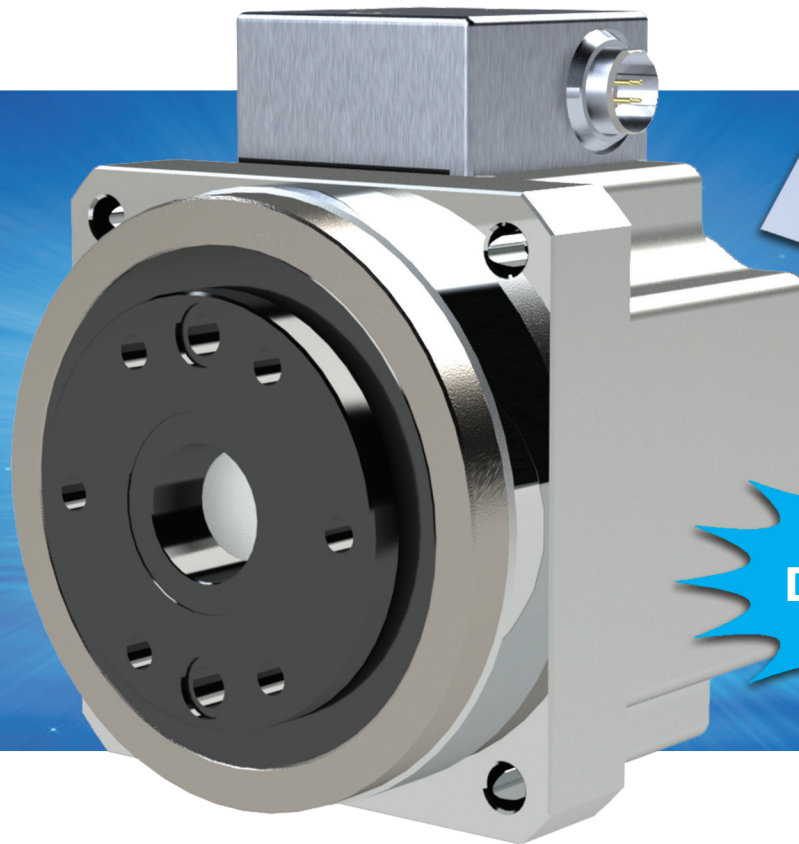


**NEW!**

# HarmonicDrive®

## FHA-C Mini Actuator with Integrated Servo Drive



**The Servo  
Drive is in the  
Actuator!**

Sold & Serviced By:

 **ELECTROMATE**

Toll Free Phone (877) SERV098  
[www.electromate.com](http://www.electromate.com)  
[sales@electromate.com](mailto:sales@electromate.com)

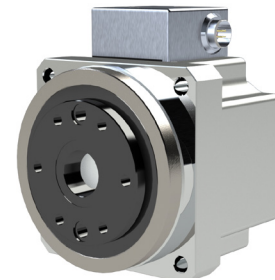
# FHA-C Mini Actuator with Integrated Servo Drive



Standard FHA-C Mini Actuator



Full Size Servo Drive



FHA-C Mini Actuator WITH Drive

The FHA-C Mini Series is a family of extremely compact actuators that deliver high torque with exceptional accuracy and repeatability. As part of the FHA-C Mini family, an integrated servo drive version utilizing CANopen<sup>®</sup> communication is now available. 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.

Since it communicates via CANopen, only 4 wires are needed: 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. Typical multi-turn encoders monitoring the motor input shaft require a battery to store the current position when power is lost to the system; however, the dual absolute encoders overcome this need. In other words, **No Battery Required**. When power is restored, the actuator knows its position.

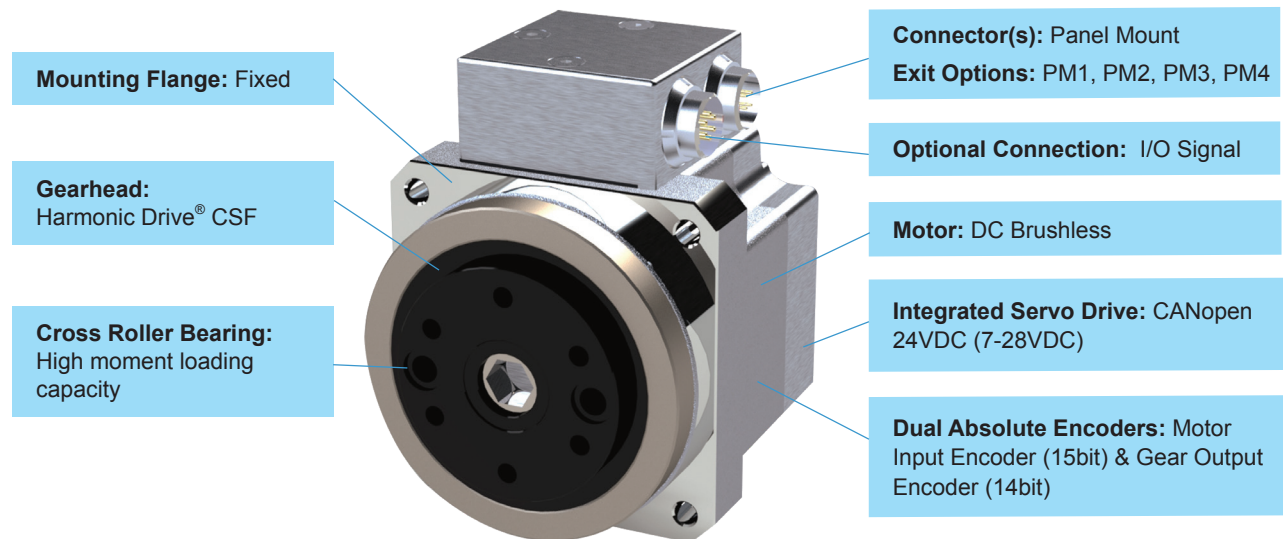
## ■ Features

- 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 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) <b>NEW!</b>	
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 <b>NEW!</b>
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	

Sold & Serviced By:



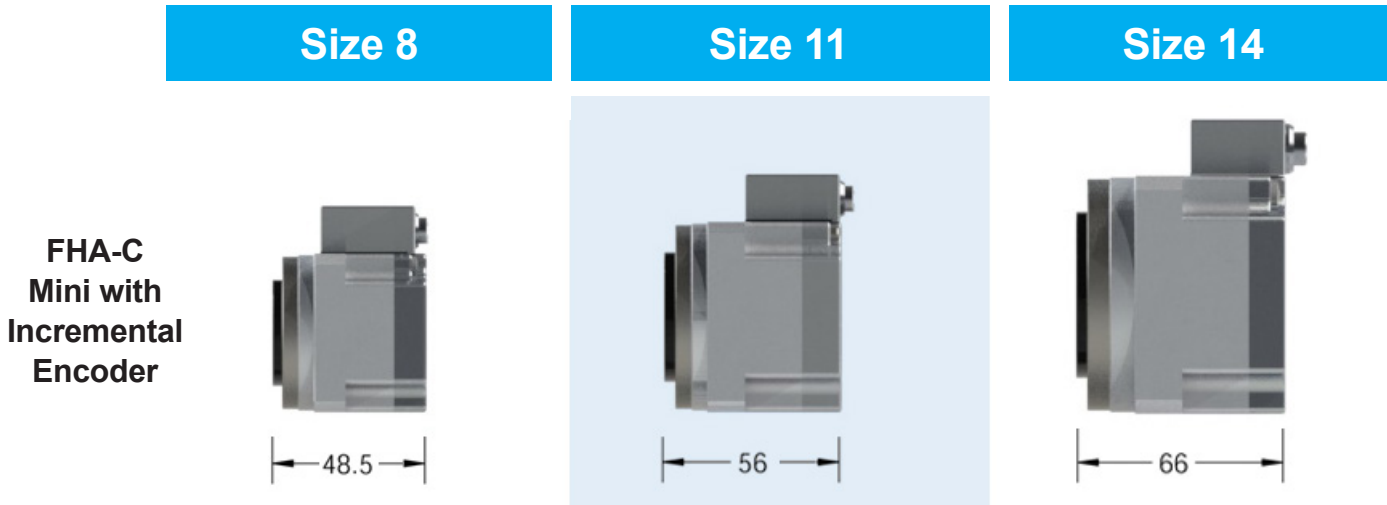
Toll Free Phone (877) SERV098

[www.electromate.com](http://www.electromate.com)

[sales@electromate.com](mailto:sales@electromate.com)

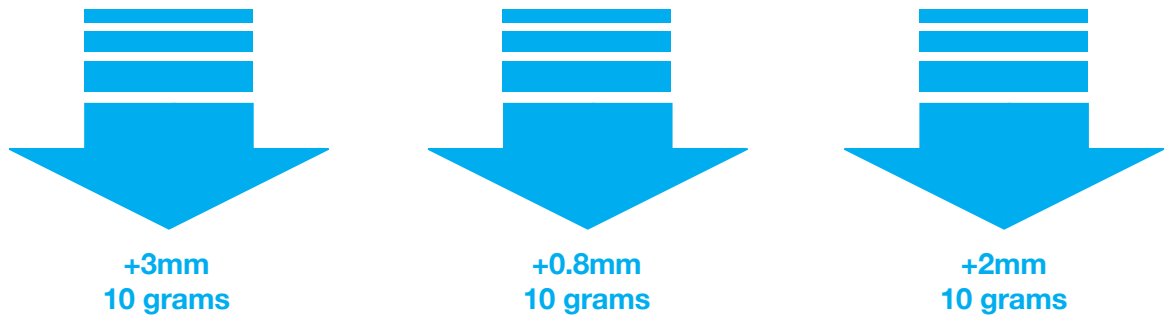
## ■ Ultra Compact

Our engineering team incorporated more features and capabilities without greatly impacting the size and mass of the actuator.



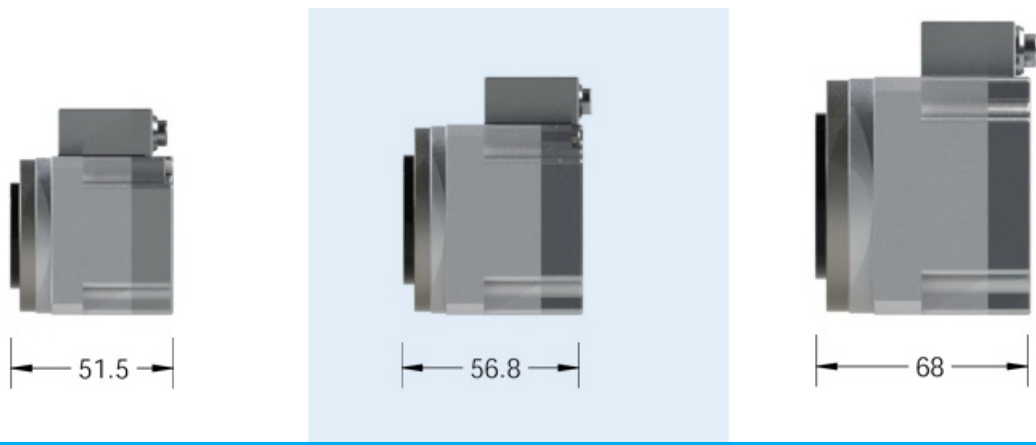
Decrease cable and cabinet requirements with a slight increase in length and weight. Simplify connections by reducing overall system needs, including:

- Cables • Volume • Mass •



**NEW!**

FHA-C Mini with Integrated Servo Drive



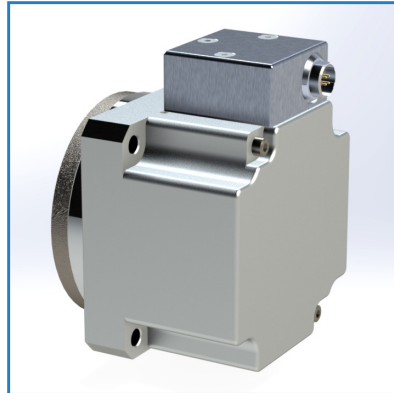
## ■ Panel Mount Connectors

FHA-C Mini actuators with an integrated servo drive include standard Lemo<sup>®</sup> 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.

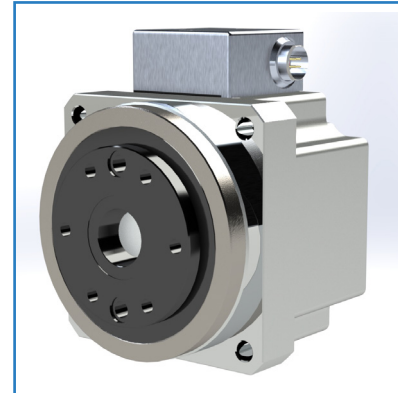
## Exit Options

### Key

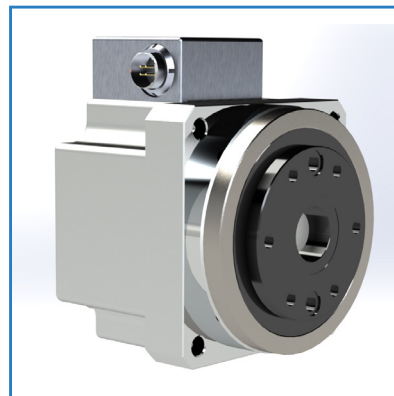
- **PM1** Panel mount connector(s), rear exit (opposite output)
- **PM2** Panel mount connector(s), right exit (of output side)
- **PM3** Panel mount connector(s), left exit (of output side)
- **PM4** Panel mount connector(s), top exit



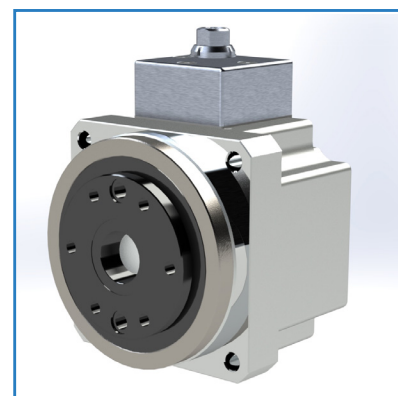
**PM1 Rear Exit**



**PM2 Right Exit**



**PM3 Left Exit**



**PM4 Top Exit**

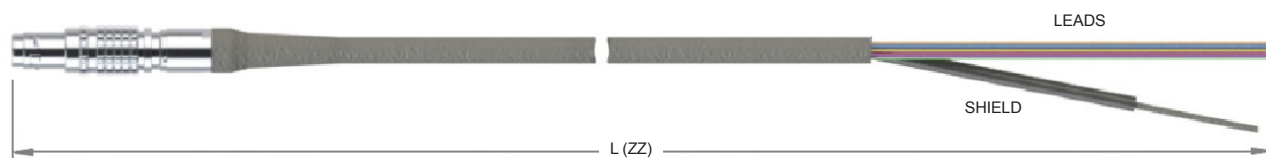
## ■ Optional Cables 3 Lengths Available (ZZ): 3m (03), 5m (05), 10m (10)

### 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



## Specifications FHA-C Mini with Integrated Servo Drive

Item		Size	FHA-8C			FHA-11C			FHA-14C		
			30	50	100	30	50	100	30	50	100
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 <sub>rms</sub>		0.8	1.3	2.7	0.8	1.3	2.6	0.8	1.4	2.9
Motor Maximum current	A <sub>rms</sub>		3.0	3.3	2.4	7.8	8.2	5.6	14.8	16.4	12.3
Motor Allowable continuous current	A <sub>rms</sub>		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 <sup>2</sup> /4	kgm <sup>2</sup>	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 <sup>4</sup>			4 × 10 <sup>4</sup>			8 × 10 <sup>4</sup>		
Output shaft resolution (Note) 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 (Note) 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

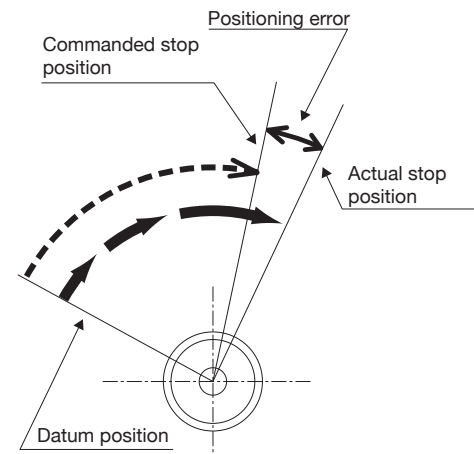
2. Motor ABS encoder resolutions are obtained by [motor encoder resolution] x [reduction ratio].

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.

## 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 Mini actuator incorporates a Harmonic Drive<sup>®</sup> 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.

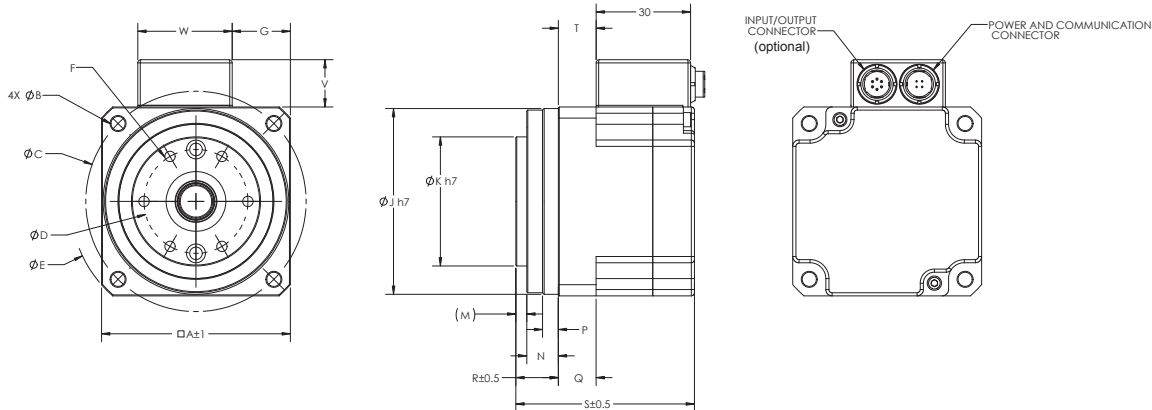


### One-Way Positioning Accuracy

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 <sup>-4</sup>	5.82×10 <sup>-4</sup>	5.82×10 <sup>-4</sup>	5.82×10 <sup>-4</sup>	4.37×10 <sup>-4</sup>	4.37×10 <sup>-4</sup>	5.82×10 <sup>-4</sup>	4.37×10 <sup>-4</sup>	4.37×10 <sup>-4</sup>



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



## Dimensions

Unit: mm

	FHA-8C	FHA-11C	FHA-14C
A	50	60	75
øB	3.4	4.5	5.5
øC	58	70	88
øD	25.5	33	44
øE	66	80	100
F	6-M3X5	6-M4X5	6-M5X7
G	10	18.5	24 (PM1), 25.8 (PM2, 3) 25.3 (PM4)
øJ	49	59	74
øK	33.5	41	52.5
M	3	3.5	3.5
N	10	10	15
P	5	5	8
Q	10	12	15
R	13	13.5	18.5
S	51.5	56.8	68
T	2.1	12	14.8 (PM1), 13 (PM2), 14 (PM3), 14.3 (PM4)
V	15	15	17.5 (PM1,2,3), 15 (PM4)
W	30	30	32.5 (PM1,2,3), 30 (PM4)

## Cross Roller Bearing Specifications

Table 1

Item Model	Circular pitch of roller (dp)	Offset (R)	Basic dynamic load rating (C)	Basic static load rating (Co)	Allowable axial load (Fa)	Allowable moment load (Mc)
	mm	mm	N	N	N	N·m
FHA-8C	35	12.9	5800	8000	200	15
FHA-11C	42.5	14	6500	9900	300	40
FHA-14C	54	14	7400	12800	500	75

## Calculating the Maximum Load

Calculate the maximum load (Mmax, Frmax, Famax) with the following formula and verify that they are less than their allowances.

$$M_{max} = Fr_{max}(L_r + R) + Fa_{max} \cdot L_a$$

Where, the variables of the formula are:

Mmax: Maximum torsional moment in N·m(kg·m)

Frmax: Maximum radial load in N(kgf); See Fig.1.

Famax: Maximum axial load in N(kgf); See Fig.1.

Lr, La: Loading point in mm; See Fig.1.

R: Offset; See Fig.1 and Table 1.

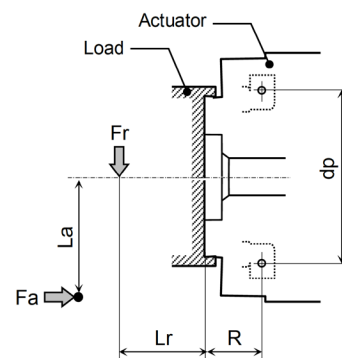


Fig.1 Loads

## ■ 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.

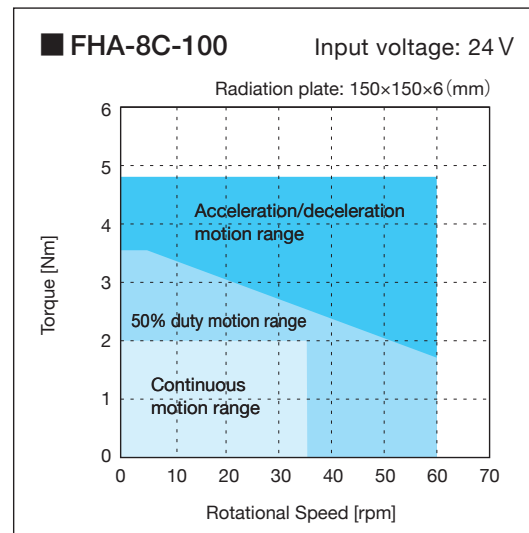
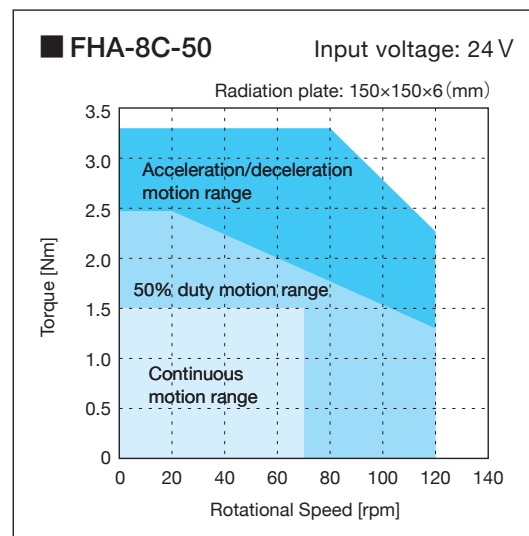
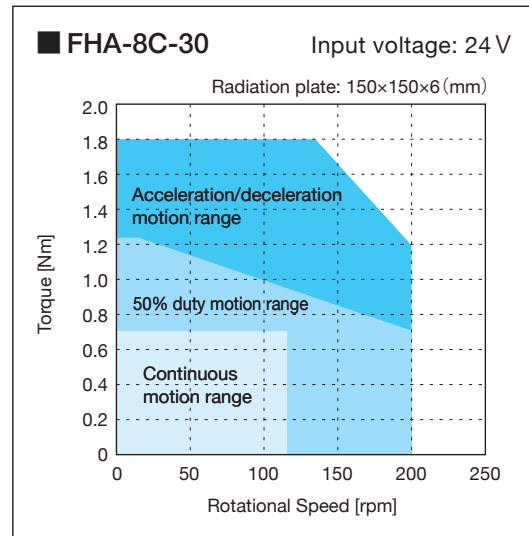
### (2) 50% Duty Motion Range

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

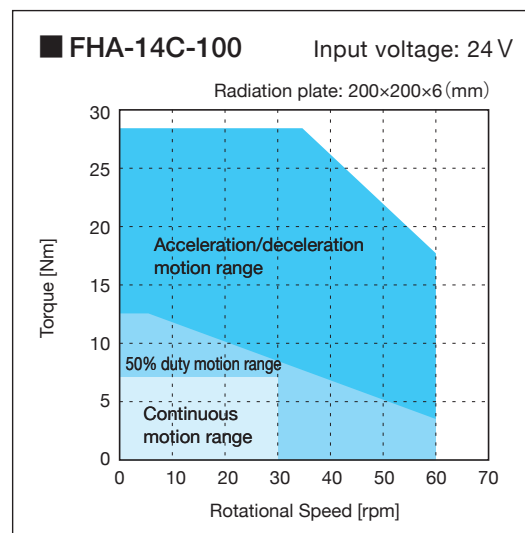
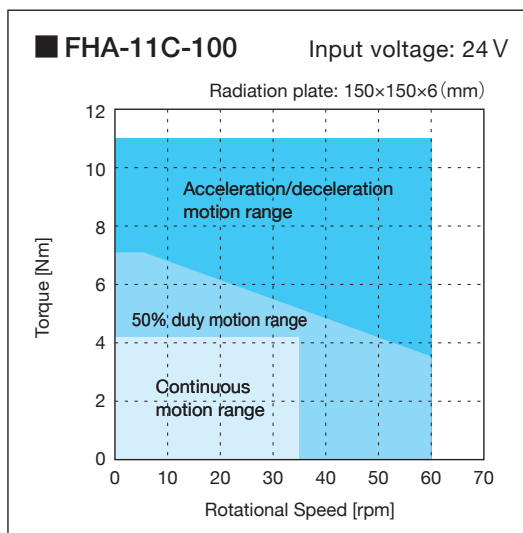
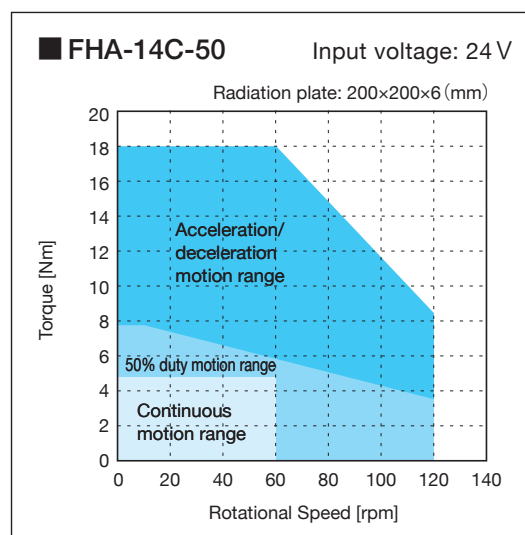
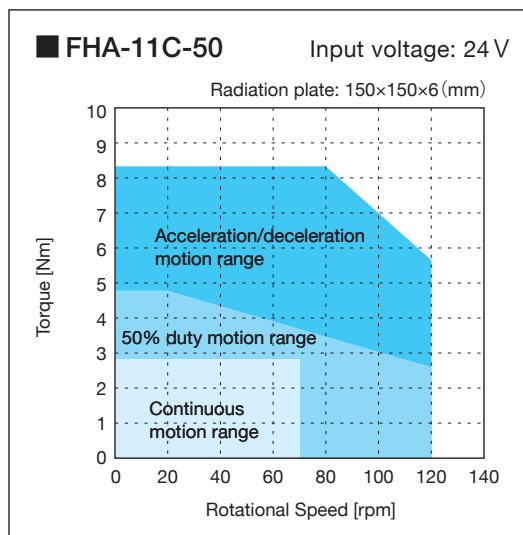
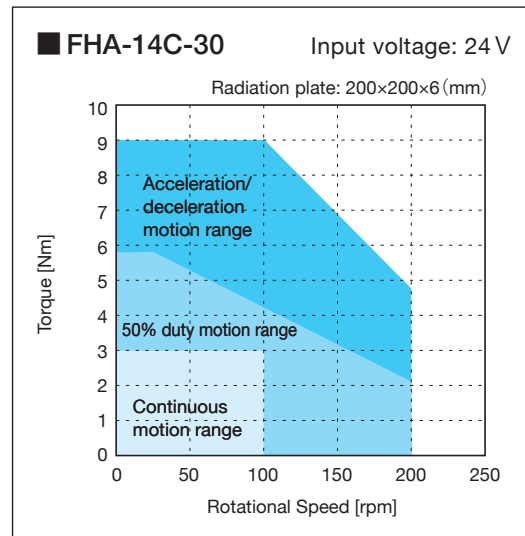
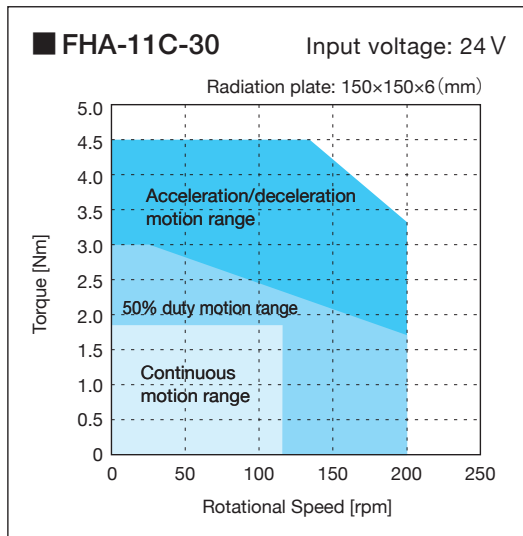
This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.

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





## Operating Range

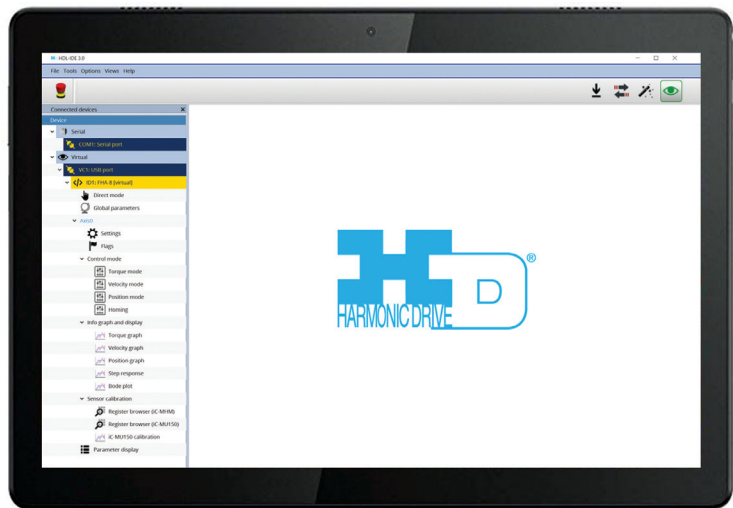


## ■ HDL-IDE 3.0 Software:

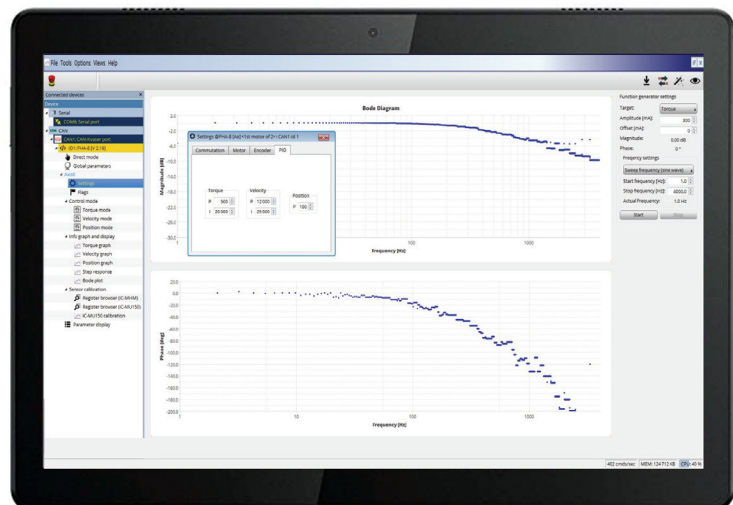
HDL-IDE 3.0 software provides the ability to setup or commission the FHA-C Mini Integrated actuator without connecting to a CANopen master controller. A single actuator can connect to a personal computer or laptop with a CAN communication converter and a power supply. All 256 parameters, including the tuning parameters and 256 general user variables can be set and stored to be recognized by the CANopen master controller operating the specific application. The following are some of the features included in HDL-IDE 3.0 software:

## Features

- Torque Mode and Graph
- Velocity Mode and Graph
- Position Mode and Graph
- Homing Mode
  - Limit Switch
  - Current Position
  - Hardstop Homing
- Step Response
- Bode Plot
- Parameter List
- Virtual Mode (shown)
- Common Features for all Actuators



## Bode Plot and Settings

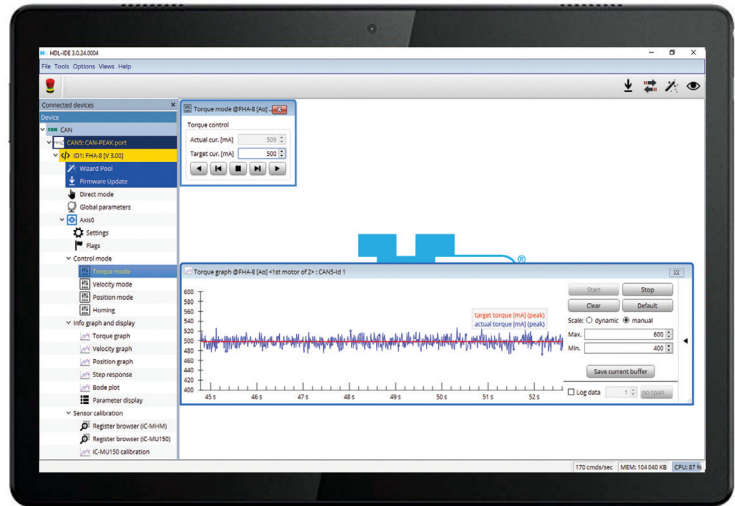


Sold & Serviced By:

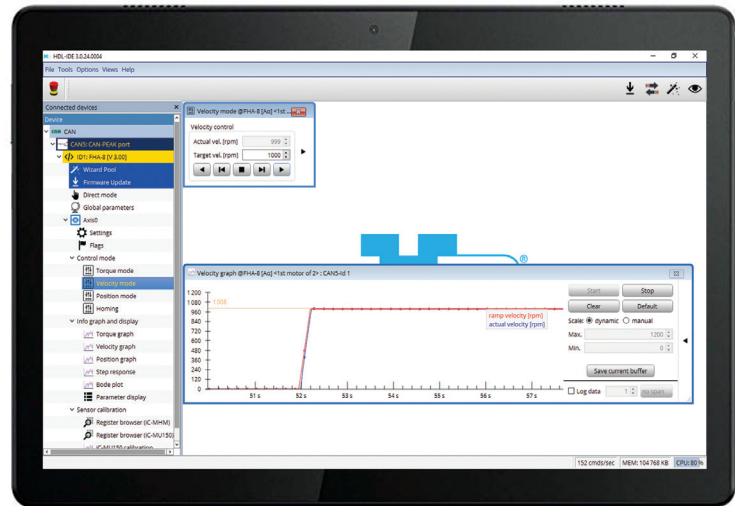


Toll Free Phone (877) SERV098  
[www.electromate.com](http://www.electromate.com)  
[sales@electromate.com](mailto:sales@electromate.com)

## Torque Mode



## Velocity Mode



## Position Mode



Sold & Serviced By:



Toll Free Phone (877) SERV098  
[www.electromate.com](http://www.electromate.com)  
[sales@electromate.com](mailto:sales@electromate.com)



All efforts have been made to ensure 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. © 2019 Harmonic Drive. All rights reserved.

Rev 20191107