

HarmonicDrive®

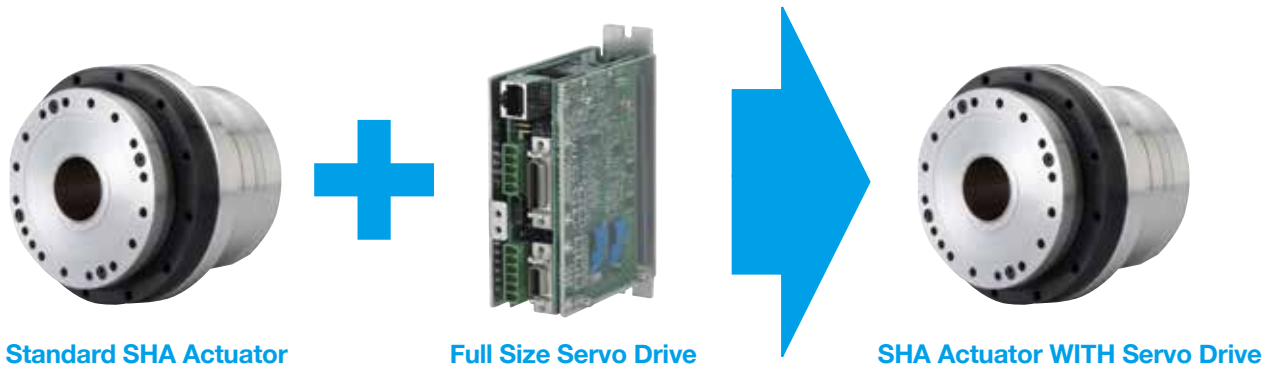
SHA Rotary Actuator with Integrated Servo Drive

NEW



**The Servo
Drive is Inside!**

SHA Actuator with Integrated Servo Drive



The **SHA-IDT Series** is a family of compact actuators that deliver high torque with exceptional accuracy and repeatability. These hollow shaft servo actuators feature Harmonic Drive® precision strain wave gears combined with a brushless servomotor, a brake, two magnetic absolute encoders and an **integrated Servo Drive with CANopen® Communication**. This revolutionary product eliminates the need for an external servo drive and greatly simplifies cabling yet delivers high-positional accuracy and torsional stiffness in a compact housing.

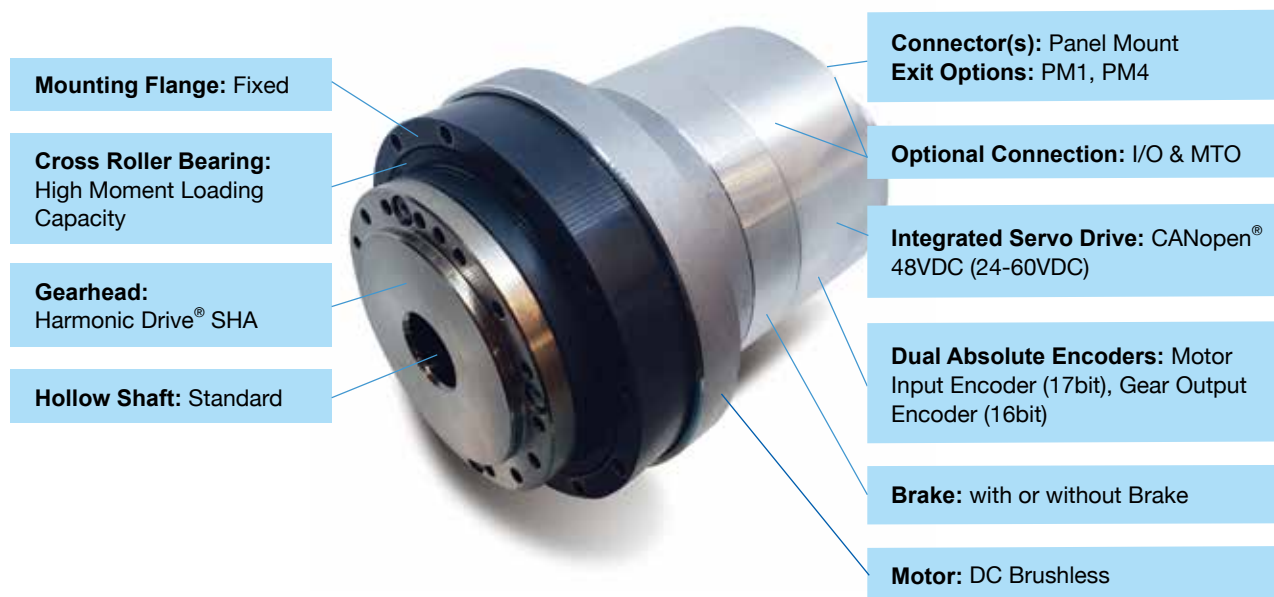
■ Features

- Actuator + Integrated Servo Drive with CANopen® Communication
- 48VDC Supply Voltage
- Single Cable with only 4 conductors is needed: CANH, CANL, +48VDC, 0VDC
- Zero Backlash Harmonic Drive® Gearing
- Panel Mount Connectors with radial and axial options
- Dual Absolute Encoders
 - Output Sensing Encoder: 16 bit resolution (65,536 cpr)
 - Input Sensing Encoder: 17 bit resolution (131,072 cpr)
- Control Modes include: 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
- Motor Torque Off (MTO): When either or both of the 2 MTO inputs are low, PWM outputs to the motor are inactive and current to the motor will not be possible. Control power remains active.

SHA with Integrated Servo Drive Features



Ordering Code (with Integrated Drive)

SHA 25 A 101 SG - B 09 B LV - IDT17b16b - PM1 S - SP

1 2 3 4 5 6 7 8 9 10 11 12 13

1.	Model	SHA Integrated Series
2.	Size	20, 25, 32
3.	Design Version	A
4.	Gear Ratio	51, 81, 101, 121, 161
5.	Gearhead	Harmonic Drive® SG Series
6.	Motor Version	B
7.	Motor Size	09: SHA 25 12: SHA 32

8.	Brake	A: Without brake B: With brake
9.	Voltage Rating	LV: 48VDC (24-60VDC)
10.	Encoder and Resolution	IDT17b16b - Integrated Drive Motor Input Encoder (17bit) Gear Output Encoder (16bit)
11.	Options	PM1 – Axial Exit PM4 – Radial Exit
12.	I/O Connection Signal	Blank: without I/O and MTO side S: with I/O Panel Mount Connection
13.	Special Specifications	Blank: Standard product SP: Special-specification code

■ 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 weight from the standard. Simplify connections while maintaining the same overall length, with the exception of connector mounting features, reducing overall system needs, including: cables, volume and mass.

Size 25

Only 4.6 mm feature added for connectors
plus 0.2 kg



Only 25.8 mm maximum radial protrusion
plus 0.2 kg



Same overall length as standard versions

Size 32

Only 6 mm feature added for connectors
plus 0.1 kg



Only 22.7 mm maximum radial protrusion
plus 0.2 kg



Same overall length as standard versions

■ Panel Mount Connectors

SHA actuators with an integrated servo drive include standard Lemo[®] connectors with two 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)
- **PM4** Panel mount connector(s), top exit (of output side)



PM1 Rear Exit



PM4 Top Exit

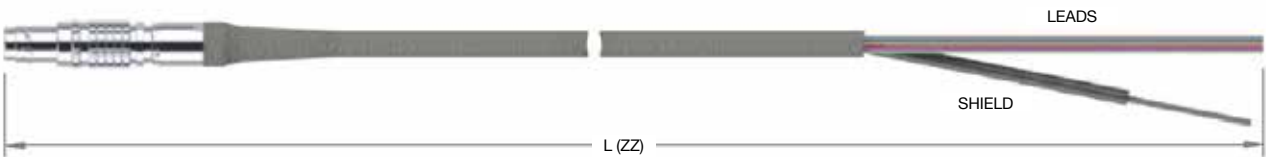
■ Optional Cables 3 Lengths Available (ZZ): 3m (03), 5m (05), 10m (10)

Power/Connection

Actuator	Description
SHA-20A	CBL-DZZ-L104-N
SHA-25A	CBL-DZZ-L204-N
SHA-32A	CBL-DZZ-L204-N

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

Actuator	Description
SHA-20, 25, 32	CBL-EZZ-L012-N



Specifications SHA with Integrated Servo Drive

Size		SHA 20A Coming Soon!					SHA 25A					SHA 32A				
		51	81	101	121	161	51	81	101	121	161	51	81	101	121	161
Item																
Maximum torque	Nm	68	96	107	113	120	100	163	204	217	229	146	238	298	357	477
Maximum speed	rpm	63	40	32	27	20	75	47	38	32	24	50	31	25	21	16
Maximum current	A _{rms}	14.9	13.2	12	10.8	9.1	25.5	25.5	25.5	23.2	19	25.5	25.5	25.5	25.5	25.5
Continuous torque ¹	Nm	16	26.6	33.4	40.2	48	28	46	57	69	81	37	61	77	93	126
Continuous speed ¹	rpm	49	32.4	26	21.9	17.1	51	35	28.2	23	15	47.2	30	24	20	15
Continuous current	A _{rms}	4.7	4.7	4.7	4.7	4.4	8.5	8.5	8.5	8.5	7.8	8.5	8.5	8.5	8.5	8.5
Torque constant	Nm/A	6.3	10.1	12.7	15.2	20.2	5.3	8.5	10.6	12.7	16.9	7.9	12.8	15	19.1	25.4
Moment of inertia with brake	kgm²	0.2	0.6	0.9	1.3	2.3	0.6	1.6	2.5	3.6	5.4	2.2	5.6	8.7	12.5	22.2
Moment of inertia without brake	kgm²	0.2	0.5	0.8	1.2	2.0	0.5	1.4	201	3.0	6.4	1.9	4.8	7.5	10.8	19.1
Allowable moment load		187					258					580				
Moment Stiffness		25.2 x 10 ⁴					39.2 x 10 ⁴					100 x 10 ⁴				
Output bearing basic dynamic rated load	kN	14.6					21.8					38.2				
Encoder type	–	Dual magnetic absolute					Dual magnetic absolute					Dual magnetic absolute				
Motor encoder resolution	–	2 ¹⁷ (131072)					2 ¹⁷ (131072)					2 ¹⁷ (131072)				
Gear encoder resolution	–	2 ¹⁶ (65536)					2 ¹⁶ (65536)					2 ¹⁶ (65536)				
Mass	kg	TBD					3.3					PM1: 6.3, PM4: 6.4				
Operating voltage	V	48 (24-60)					48 (24-60)					48 (24-60)				
Communication protocol	–	CAN, CANopen® (DS301/DS402)					CAN, CANopen® (DS301/DS402)					CAN, CANopen® (DS301/DS402)				
Environmental ⁴	Ambient operating temp	°C	0-40 (-20-60 storage)				0-40 (-20-60 storage)				0-40 (-20-60 storage)					
	Operating humidity	%RH	20-80 (no condensation)				20-80 (no condensation)				20-80 (no condensation)					
	Vibration resistance ³	m/s²	25				25				25					
	Shock resistance ³	m/s²	300				300				300					
	Max operating altitude	m	1000 above sea level				1000 above sea level				1000 above sea level					
		No dust, no metal powder, no corrosive gas, no flammable gas, no oil mist, Indoor use only, Refer to standard SHA manual for more information														
Motor insulation		Insulation resistance: 100MC or more (by DC500V insulation tester), Dielectric strength: AC1500v/1 min Insulation class: A														
Mounting direction		Can be installed in any direction														

1. Value after temperature rise and saturation when the 320x320x16 [mm] aluminum heatsink is installed.

2. Value of phase induced voltage constant multiplied by 3.

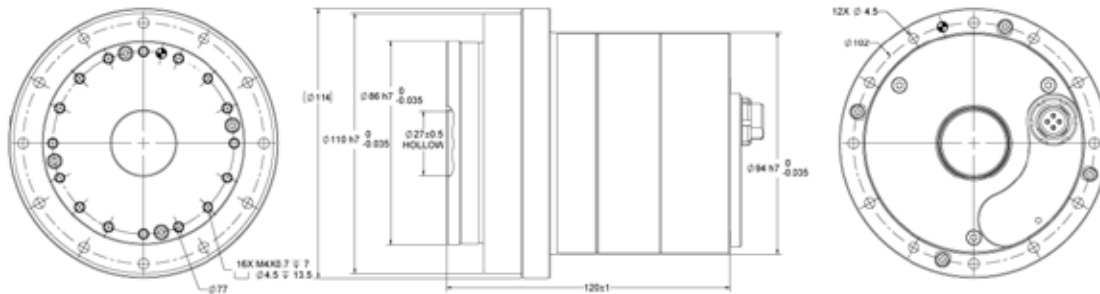
3. For testing conditions, refer to [1-12 Shock resistance] (P1-41) and [1-13 Resistance to vibration] (P1-42) of SHA manual. Motor operation is not guaranteed in applications where vibrations and impacts are continuously applied for a long period of time.

4. For details, refer to [3-3 Location and installation] (P3-6) of SHA manual.

Outline Dimensions (SHA with Integrated Servo Drive)

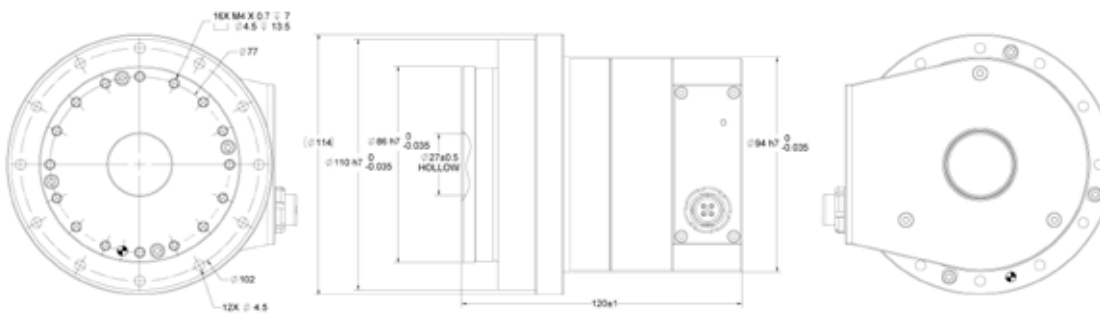
SHA-25A-XXXSG-B09BLV-IDT17b16b-PM1

(Units: mm)



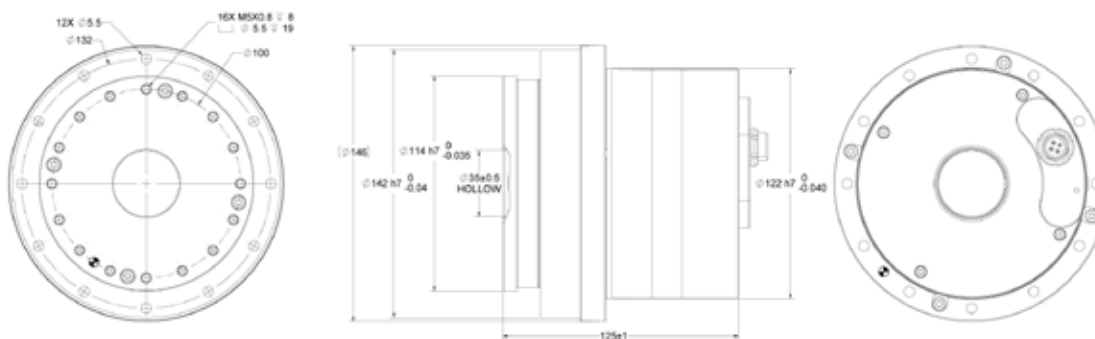
SHA-25A-XXXSG-B09BLV-IDT17b16b-PM4

(Units: mm)



SHA-32A-XXXSG-B12BLV-IDT17b16b-PM1

(Units: mm)



SHA-32A-XXXSG-B12BLV-IDT17b16b-PM4

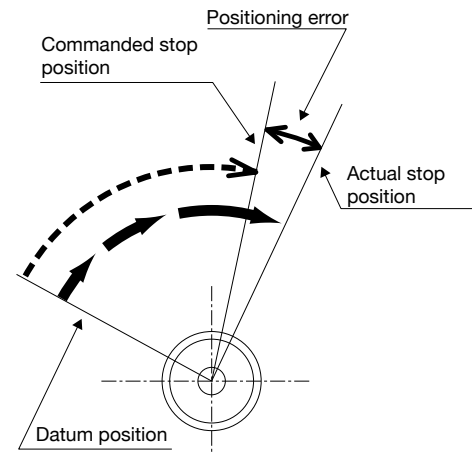
(Units: mm)



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 series incorporates a HarmonicDrive® speed reducer or an HPF hollow shaft planetary 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 gear itself.



One-Way Positioning Accuracy

Item	Size	SHA 20A Coming Soon!					SHA 25A					SHA 32A				
		51	81	101	121	161	51	81	101	121	161	51	81	101	121	161
One-Way Positional Accuracy	arc sec	60	50	50	50	50	50	40	40	40	40	50	40	40	40	40

Cross Roller Bearing Specifications

Size	Item	Circular pitch of the roller (dp)	Offset amount (R)	Basic dynamic rated load (C)	Basic static rated load (Co)	Permissible moment load (Mc)	Moment stiffness (Km)
		mm	mm	kN	kN	Nm	×10 ⁴ Nm/rad
SHA-20A		70	23.5	14.6	22	187	25.2
SHA-25A		85	27.6	21.8	35.8	258	39.2
SHA-32A		111	34.9	38.2	65.4	580	100

Calculating the Maximum Load

Calculate the maximum load (M_{max} , F_{rmax} , F_{amax}) with the following formula and verify that they are less than their allowances.

$$M_{max} = F_{rmax}(L_r + R) + F_{amax} \cdot L_a$$

Where, the variables of the formula are:

M_{max} : Maximum torsional moment in N·m(kg·m)

F_{rmax} : Maximum radial load in N(kgf); See Fig.1.

F_{amax} : Maximum axial load in N(kgf); See Fig.1.

L_r , L_a : Loading point in mm; See Fig.1.

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

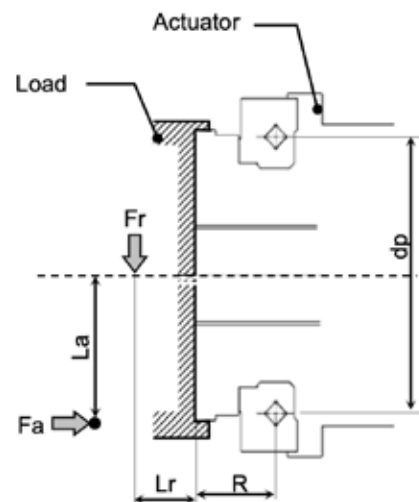


Fig. 1: External load action

Operating Range

The following graphs show the operating range for an SHA series actuator with an integrated drive.

(1) Continuous Motion Range

The range allows continuous operation of the actuator.

(2) 50% Duty Motion Range

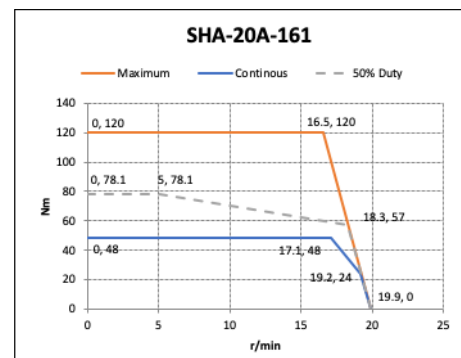
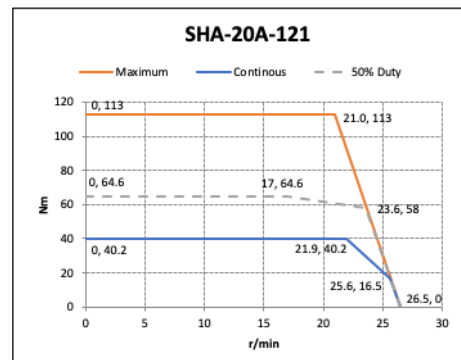
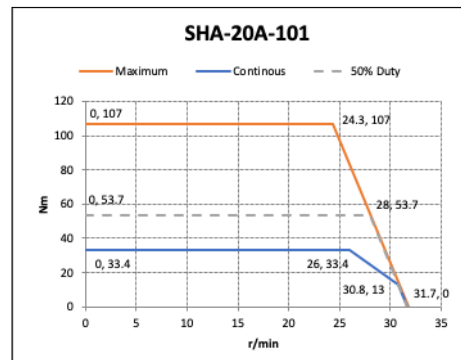
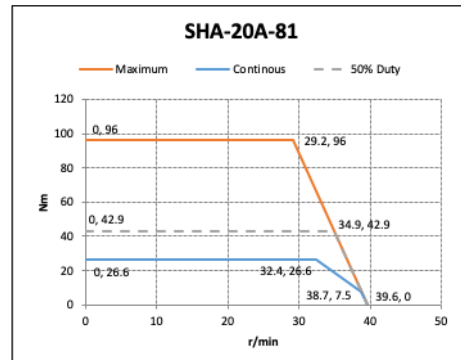
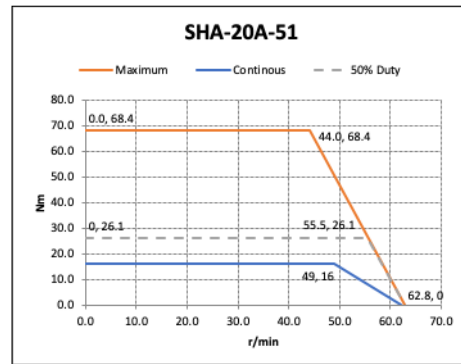
This range indicates the torque/speed where 50% duty cycle operation is permitted (the ratio of operating time and delay time is 50:50).

(3) Motion Range During Acceleration and Deceleration

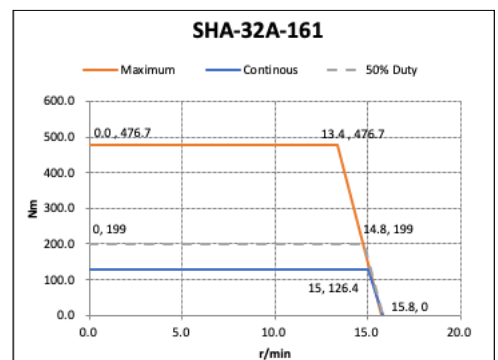
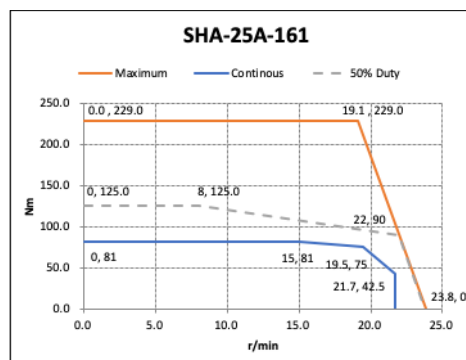
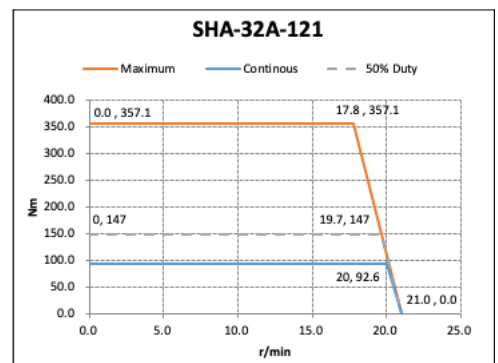
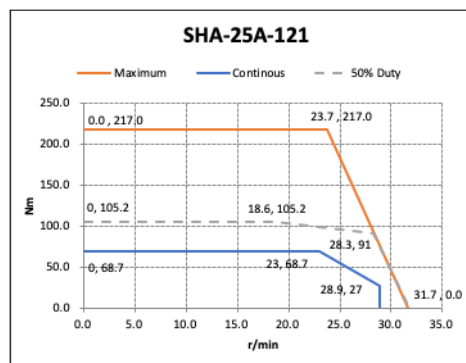
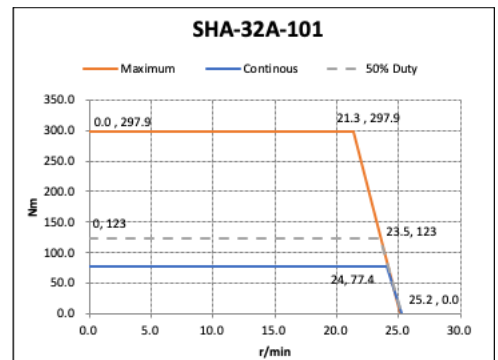
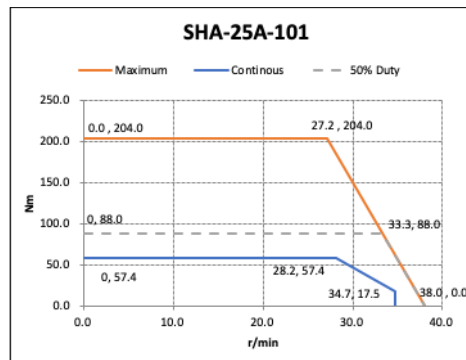
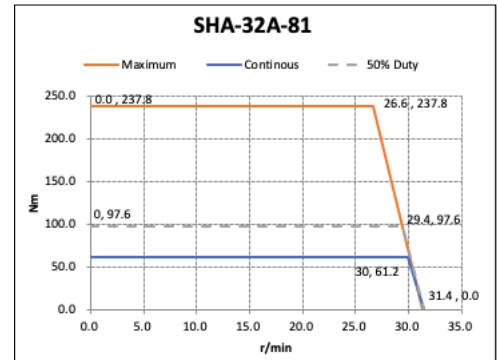
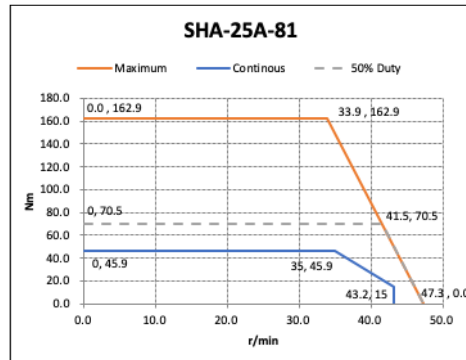
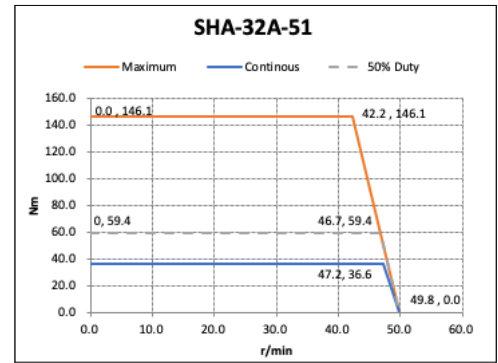
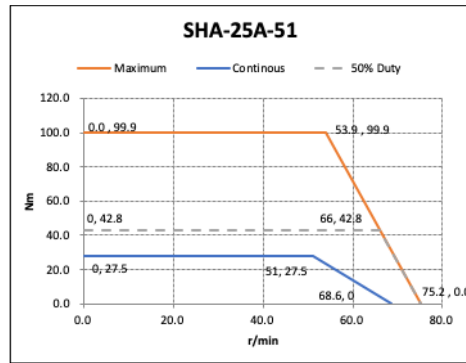
This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.

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

Coming Soon!



Operating Range

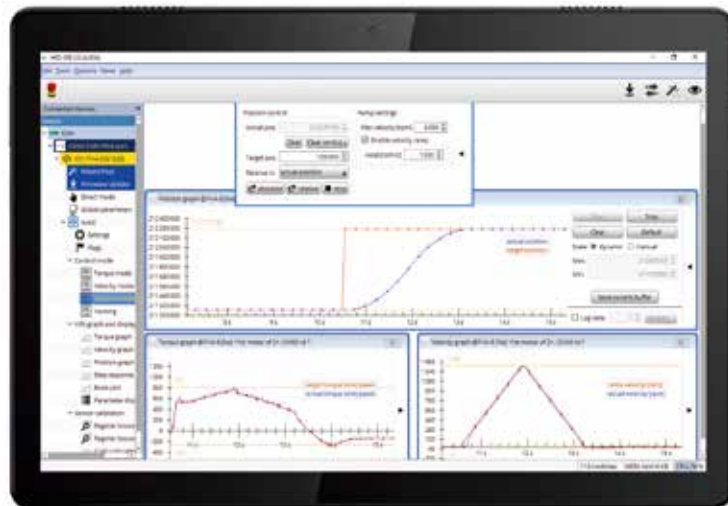


■ HDL-IDE 3.0 Software:

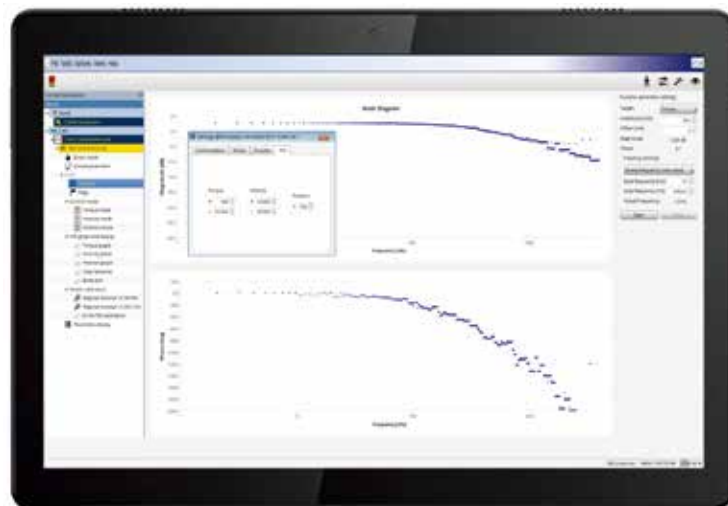
HDL-IDE 3.0 software provides the ability to setup or commission the SHA Integrated actuators without connecting to a CANopen master controller. A single actuator can connect to a personal computer or laptop with a CAN communication converter and a power supply. All 256 parameters, including the tuning 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
- Common Features for all Actuators



Position Mode and Graph



Bode Plot and Settings

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