HarmonicDrive®

LPA-20 Low Profile Rotary Actuators with Integrated Servo Drive

LPA with Integrated Servo Drive

The Integrated Series is a family of compact actuators that deliver high torque with exceptional accuracy and repeatability. These servo actuators feature high precision Harmonic Drive® gearing combined with a brushless servo motor, magnetic dual absolute encoders and an **Integrated Servo Drive with CANopen® or EtherCAT®** communication options. This revolutionary product eliminates the need for an external drive and greatly simplifies cabling yet delivers high-positional accuracy and torsional stiffness in a compact housing.

Features

- Actuator + Integrated Servo Drive with CANopen® or EtherCAT® Communication Options
- CANopen Option Features
  - Only a single cable with 4 conductors is needed for power and communication: CANH, CANL, VDC, 0VDC
  - Up to 127 devices can be connected with bus or line topology options
- EtherCAT Option Features
  - EtherCAT Conformance Tested Certification
  - Approximately 100x faster compared to CANopen (100Mps vs 1Mps)
  - Up to 200x more deterministic than CANopen (1 μs vs 100μs-200μs)
  - Up to 65,536 devices can be connected with line, star, tree or ring topology options
- 48VDC Nominal Supply Voltage
- Zero Backlash Harmonic Drive® Gearing
- Panel Mount sealed connectors with radial and axial options
- Dual Absolute Encoders
- Control Modes include: Torque, Velocity, and Position Control as well as CSP, CSV, and CST
- Harmonic Drive HDL Commissioning Software

Options:

- Flex-rated mating cables with sealed connectors
- 4 I/O and MTO
  - 2 NPN or PNP Opto-Isolated Digital Inputs
  - 2 Programmable Analog/Digital Inputs or Open Drain Outputs
  - Motor Torque Off (MTO) same as Safe Torque Off (STO) without third party certification

EtherCAT Conformance tested

The First EtherCAT Conformance Certified Integrated Actuator in the EtherCAT Product Guide!

LPA with Integrated Servo Drive Features

Cross Roller Bearing: High Moment Loading Capacity

Gearhead: Harmonic Drive® SHD-2SH

Connector(s): Panel Mount
Exit Options: PM1, PM4

Optional Connection: I/O & MTO

Integrated Servo Drive: CANopen® 48VDC (24-60VDC), EtherCAT®

Dual Absolute Encoders: Motor Input Encoder (15bit), Gear Output Encoder (14bit)

Motor: DC Brushless

Ordering Code

LPA	20	A	101	-	IDT 15b14b	-	PM1	S	-	SP
1	2	3	4		5		6	7		8

1.	Model	LPA Integrated Series
2.	Size	20
3.	Design Version	A
4.	Gear Ratio	51, 81, 101
5.	Encoder and Resolution	15b14b - Integrated Drive Motor Input Encoder (15bit), Gear Output Encoder (14bit)

6.	Options	PM1 – Axial Exit PM4 – Radial Exit
7.	Communication and I/O Connection Signal	Blank: CANopen® Option S: CANopen® with IO & MTO Option E: EtherCAT® Option ES: EtherCAT® with IO & MTO Option
8.	Special Specifications	Blank: Standard Product SP: Special Specification Code

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

Power/Connection

Description
CBL-D**ZZ**-L104-N

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

Description
CBL-E**ZZ**-L012-N

EtherCAT® Length in inches **(ZZZ)**: -020 is 20 inches

Connectors / PartNo.
Lemo® - Lemo® / 7318565-**ZZZ**
Lemo® - RJ45 / 7318549-**ZZZ**

Specifications LPA with Integrated Servo Drive

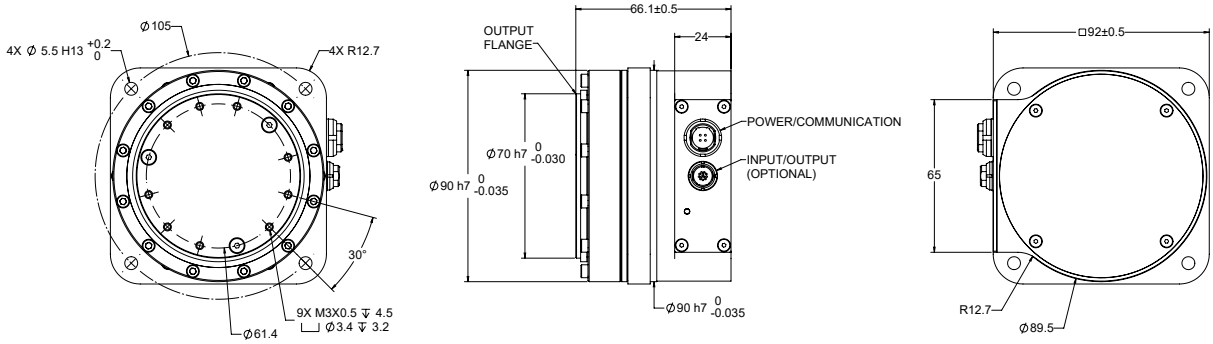
Item / Gear Ratio			LPA 20 IDT Actuator		
			51	81	101
Maximum torque		Nm	34	49	57
Maximum speed		rpm	88.2	55.6	44.6
Maximum current		A_{rms}	13.4	13.4	11.5
Continuous torque[1]		Nm	6.5	16	16.9
Continuous speed[1]		rpm	58.8	37.0	29.7
Continuous current[1]		A_{rms}	4.5	4.5	4
Torque constant		Nm/A_{rms}	3.0	4.8	6.0
Input power supply currrent		Adc	2.7	3.0	2.4
Moment of inertia		kgm^2	0.02	0.06	0.09
Allowable moment load		Nm	93		
Moment stiffness		Nm/rad	21×10^4		
Output bearing basic dynamic rated load		kN	7.3		
Encoder type		–	Dual Absolute		
Motor encoder resolution		–	2^{15} (32768)		
Gear encoder resolution		–	2^{14} (16384)		
Mass		kg	1.4		
Operating voltage		V	48 (24-60)		
Communication protocol		–	CANopen® (DS301/DS402), EtherCAT®		
Environmental	Ambient operating temp	°C	0-40 (-20 - 60 storage)		
	Ingress protection rating	–	IP54		
	Operating humidity	%RH	20-80 (no condensation)		
	Vibration resistance[2]	m/s^2	25		
	Shock resistance[2]	m/s^2	300		
	Max operating altitude	m	1000		
	No dust, no metal powder, no corrosive gas, no flammable gas, no oil mist, Indoor use only, no direct sunlight				
Motor insulation			Insulation resistance: 100MΩ (by DC500V insulation tester), Dielectric strength: AC1500v/1 min Insulation class: F		
Mounting direction			Can be installed in any direction		
Recommended heatsink size [mm][1]			300 X 300 X 15 mm		

1. Value after temperature rise and saturation when the recommended aluminum heatsink is installed.
2. All parts, except the rotary sliding parts (oil seal), are protected against solid bodies of dimensions to 1mm, and against water sprays. Panel mount connectors are IP68.

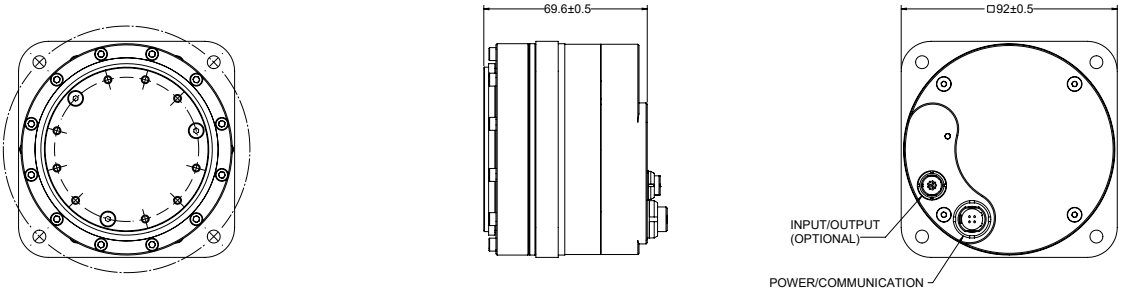
Outline Dimensions

CANopen®

Radial Connectors

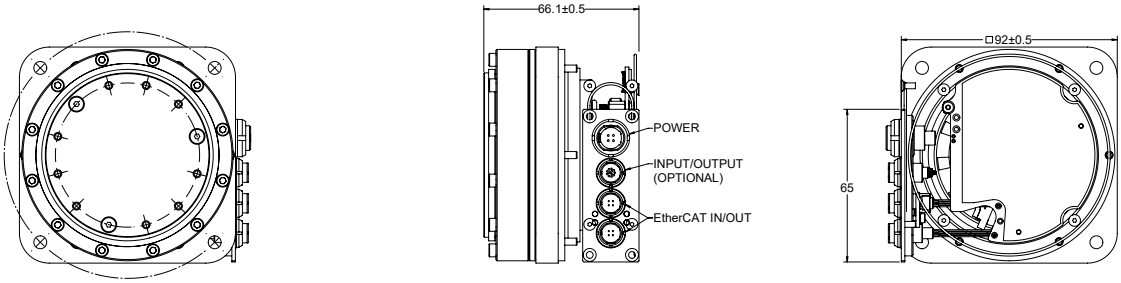


Axial Connectors

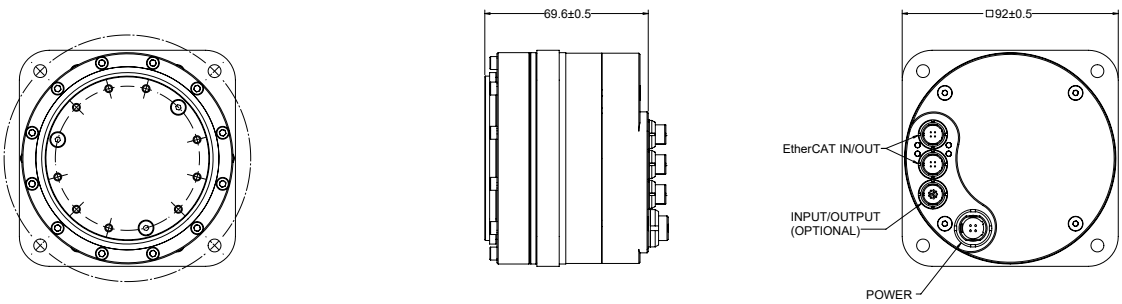


EtherCAT® Conformance tested

Radial Connectors



Axial Connectors

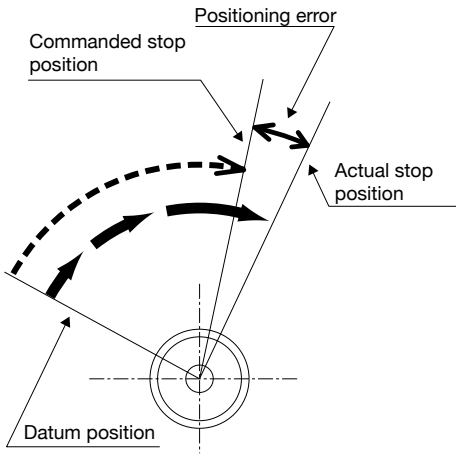


Units: mm
Common dimensions apply to all configurations

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 LPA series incorporates a Harmonic Drive® 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		LPA 20A		
		51	81	101
One-Way Positional Accuracy	arc sec	90	70	60

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	×10⁴ Nm/rad
LPA-20A	70	11	7.3	11.0	93	21x10⁴

Calculating the Maximum Load

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

$$M_{max}=Fr_{max}(Lr+R)+Fa_{max}\cdot La$$

Where, the variables of the formula are:
M*max*: Maximum torsional moment in N•m(kg•m)
Fr*max*: Maximum radial load in N(kgf); See Fig.1.
Fa*max*: 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.

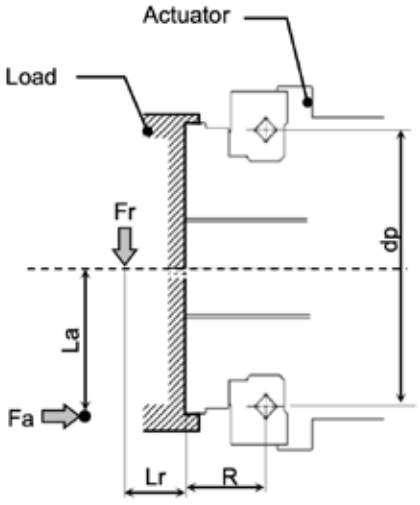


Fig. 1: External load action

Operating Range

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

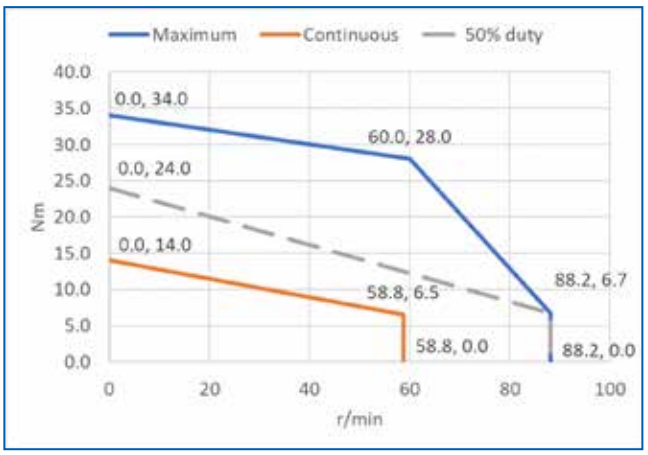
(1) **Continuous Motion Range**
The range allows continuous operation of the actuator.

(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).

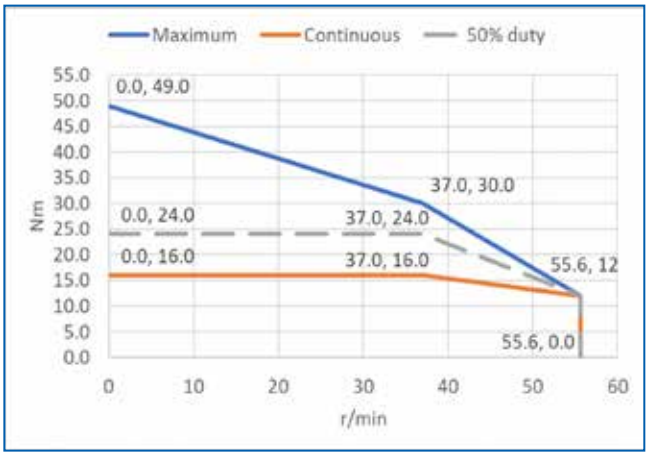
(3) **Motion Range During Acceleration and Deceleration**
This range indicates the torque/speed which the actuator can be operated momentarily. The range allows instantaneous operation like acceleration and deceleration.

Continuous and 50% duty operation require a heat sink: 300x300x15mm tested.
This characteristic is based on an ideal sinusoidal wave and 48V bus voltage.

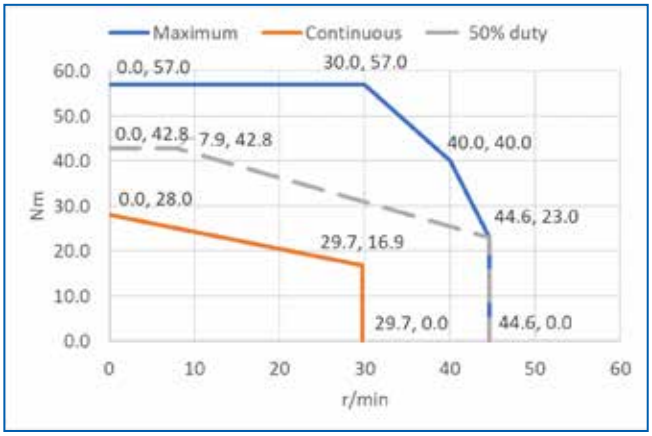
LPA-20A-51



LPA-20A-81



LPA-20A-101



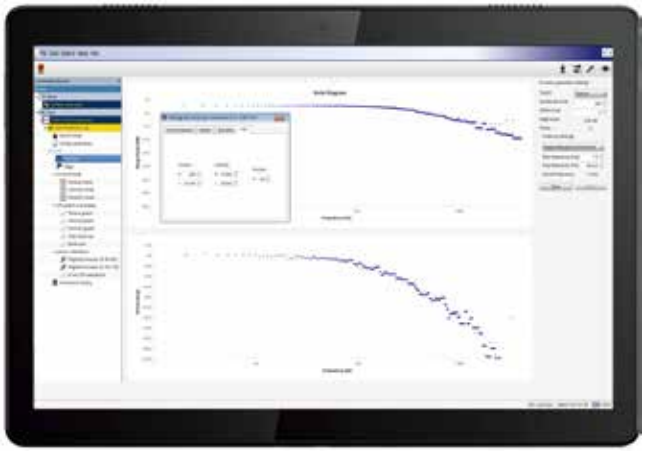
HDL-IDE 3.0 Software:

HDL-IDE 3.0 software provides the ability to setup or commission the LPA Integrated actuators without connecting to a CANopen or EtherCAT 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 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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