LDD 1840 User Manual

Revision B - July 30, 2021

LiveDrive® Direct Drive

LiveDrive®
LDD 1800 Series

Motion Redefined

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Genesis Robotics &
Motion Technologies

genesisrobotics.com

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A	June 8, 2021	Production Release
B	July 30, 2021	Information Update

Contents

About This Manual

This manual describes the components, operating conditions, and acceptable use of the LiveDrive LDD 1840 actuator. It contains information for robot and machinery designers responsible for selecting, operating, and maintaining the LDD 1840 actuator.

Important

This manual is limited to the actuator alone and does not include the robot or system in which it is used.

In this section	Find information about
Service and support	Customer service support hours and contact information
Safety Instructions	Safe operating instructions and potential hazards for installing, operating or maintaining a LiveDrive actuator
Product overview	LiveDrive LDD 1840 design and technical description
Product Specifications	Size, performance, electrical, and mechanical technical specifications
Interfaces	How to connect to the actuators, signal pinouts, and field cables
Handling, transport and storage	Delivery and inspection of goods, and handling, transport and storage recommendations
Installation and commissioning	Safety precautions for installation, mechanical mounting, electrical connections, and initial startup steps
Operation and maintenance	Basic operation, deactivation, maintenance, dismantling and disposal recommendations
Maintenance and troubleshooting	Inspection recommendations and troubleshooting guidelines
Appendices	List of standards that apply to the design and operation of the actuator

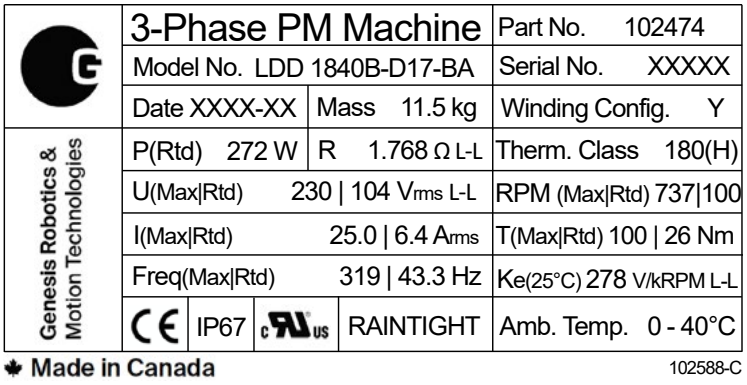
Service and Support

Customer service and technical support for LiveDrive actuators and accessories are available from Genesis Robotics technical support staff during normal weekday business hours:

- Hours: Monday to Friday, 8:00 AM to 4:00 PM PST
- International Phone: +1 604 800 1907
- Toll Free:
  North America: +1 866 682 3085
  Germany: +00 800 7777 4400
  Switzerland: +00 800 7777 4400
  Japan: +001 010 800 7777 4400
- Email: service@genesis-robotics.com

Before contacting support, make sure you have recorded a detailed description of the issue, including when it occurred, and the model and serial numbers from the actuator name plate.

For Example:



1.0 Introduction

LiveDrive technology from Genesis Robotics and Motion Technologies (Genesis Robotics) enables a family of high torque, direct drive actuators.

LiveDrive direct drive actuators have a much smaller form factor than other actuators of the same capacity. With a reduced footprint, robots and machinery can save valuable factory space. The simple construction of machines using LiveDrive actuators means higher system reliability and cleanliness for the end-user since lubricated gearboxes are eliminated with direct drive actuation.

Key features include:

- Small footprint: reduced actuator size, enabling more efficient robot designs and factory floorspace utilization
- High torque density: higher speeds and precision on packaging or assembly lines
- Direct drive: increased system reliability and joint dynamics due to the elimination of the gearbox

1.1 About the LiveDrive LDD 1840 Actuator

The LiveDrive LDD 1840 (LDD 1840) is an actuator that helps manufacturers design more productive, simpler and more reliable robots and machines. The LDD 1840 is particularly valuable in demanding and highly dynamic applications where the backlash-free instant response of robots or machinery is important.

Typical applications of the LDD 1840 are:

- Delta robots
- Precision indexing
- Machine automation

LiveDrive LDD 1840 actuators can also be customized to meet unique application needs.

2.0 Safety Instructions

This section contains the safety messages used throughout the manual to highlight hazardous conditions, as well as an explanation of hazards and safety precautions.

Only qualified personnel may install, operate, or maintain a LiveDrive actuator. A qualified person has the knowledge and training to perform tasks such as installing, commissioning, tuning, and operating electrical motors.

Important

This document summarizes the hazards and necessary safety precautions. If the content in this document is unclear to the operator, or if the user wishes to deviate from the recommended practices presented herein, please contact Genesis Robotics prior to installing or operating the actuator.

Non-compliance with the safety instructions, legal and technical regulations may lead to injuries and damage to property and environment.

2.1 Safety symbols

Electric Shock

Electric shock may result in serious injury or death. The LiveDrive actuator operates at high voltages and may become energized under certain circumstances.

Warning

Death or severe bodily injury can occur.

Sparking or Arcing Hazard

Sparking or arcing may be present in the event of LiveDrive actuator failure.

No Pacemakers

The LiveDrive actuator is a high current electrical device and may present EMI levels dangerous to those with pacemakers or other sensitive medically necessary equipment.

High Temperature

The LiveDrive actuator operates at high internal temperatures. The actuator, in addition to the mounting equipment, cables, and control panel may become hot during operation.

Fire

The LiveDrive actuator may create a fire hazard in the event of an equipment failure.

Crushing, Impacting, Pinching

The LiveDrive actuator is designed to rotate at high speeds. Depending on equipment setup, significant risk of crushing, impact, or pinching may result.

Entanglement

The LiveDrive actuator is designed to rotate at high speeds. Depending on equipment setup, risk of entanglement may result.

2.2 Shock Hazard

- Actuator operates at hazardous voltages. Electric shock may result in serious injury or death.
- Do not touch the actuator, shaft or connected conductive components (the load on the shaft) while the actuator is enabled.
- Do not conduct work on live (energized) equipment. Prior to connecting or disconnecting cables, ensure that the system power is off and locked out.
- Do not disassemble the actuator. Only qualified and experienced personnel may work on the actuator and must use insulated tools (as per IEC 60900).
- Avoid contact with power connector pins, since back-driving the actuator can create hazardous voltages (Back EMF) on the power wires.
- Do not operate the actuator with any exposed leads. Terminate or insulate and protect any unused leads on the drive end of the cables.
- The actuator drive (provided by customer) must include fault detection that will disconnect power to the actuator in the event of a short circuit (for example, line-to-line and line-to-ground), or other fault (for example, over-speed, over-voltage and over-current).
- The actuator drive (provided by customer) must include a main disconnect and circuit breaker on the main power for overload protection.

2.3 Sparking/Arcing Hazard

Actuator or component overheating may result in sparking/arcing and actuator failure.

- Verify that system grounding is in place. For information on actuator grounding through the power cable, see section 5.2 and 5.3.
- Ensure the internal actuator temperature sensor is connected to a thermal shutdown circuit. For information on the resistance temperature detectors (RTDs), see section 4.7.
- Do not allow the actuator to remain in a stall condition. A stall condition is defined as when the actuator is generating torque but prevented from rotating.

Removing connectors while power is enabled may result in sparking/arcing or unexpected motion. Excessive bending of cables may result in internal cable damage.

- Disable all power to the actuator before disconnecting any cables or terminals.
- Ensure there is enough space around the actuator to safely bend the cables.

2.4 Electromagnetic and Magnetic Interference

Electromagnetic interference may affect performance of personal medical equipment and implants.

- Personnel with personal electric medical equipment or a ferromagnetic prosthesis must not operate the actuator.

2.5 Handling and Installation Safety

LiveDrive actuators weigh between 10 and 12 kg. Carrying or lifting the actuator without adequate protection (such as safety footwear), assistance, or safe lifting practices, may result in equipment damage and personal harm.

- Wear adequate personal protection equipment and follow safe lifting practices.

2.6 Operating Safety Precautions

The actuator can impart significant mechanical energy: (a) Unexpected movements of the actuator (and attached components) may occur due to control instability, wiring damage or internal actuator damage; (b) during a sudden power-shutdown event, the actuator may continue to move; and, (c) components attached to the actuator housing and shaft may loosen over time (this could occur if inappropriate bolted joints are not correctly torqued or if there is excessive vibration) and may be ejected as projectiles.

- Establish appropriate boundary around actuator during troubleshooting and operation. Appropriate shielding and/or working boundaries are especially important when working with eccentric loads.
- Ensure E-Stop (emergency button) is wired correctly and nearby the operator.
- Perform regular verifications of critical mechanical connections.
- Monitor for unusual vibration and noise. Cease operation and resolve issue(s) if unusual vibration or noise are detected.

2.7 High Temperatures

The actuator, frame, and components attached to the shaft, connectors and cables may become hot during operation.

- Be aware of hot surfaces on the actuator. Internal temperatures of 105^{0}C are possible during operation.
- Always ensure parts have had sufficient time to cool prior to touching the actuator.
- Ensure the internal actuator temperature sensor is connected to a thermal shutdown circuit. Please refer to the actuator datasheet for maximum operating temperature.

2.8 Equipment Damage

Inspect the actuator for damages prior to installation, commissioning and operation. Contact Genesis Robotics for additional guidance if the actuator is damaged.

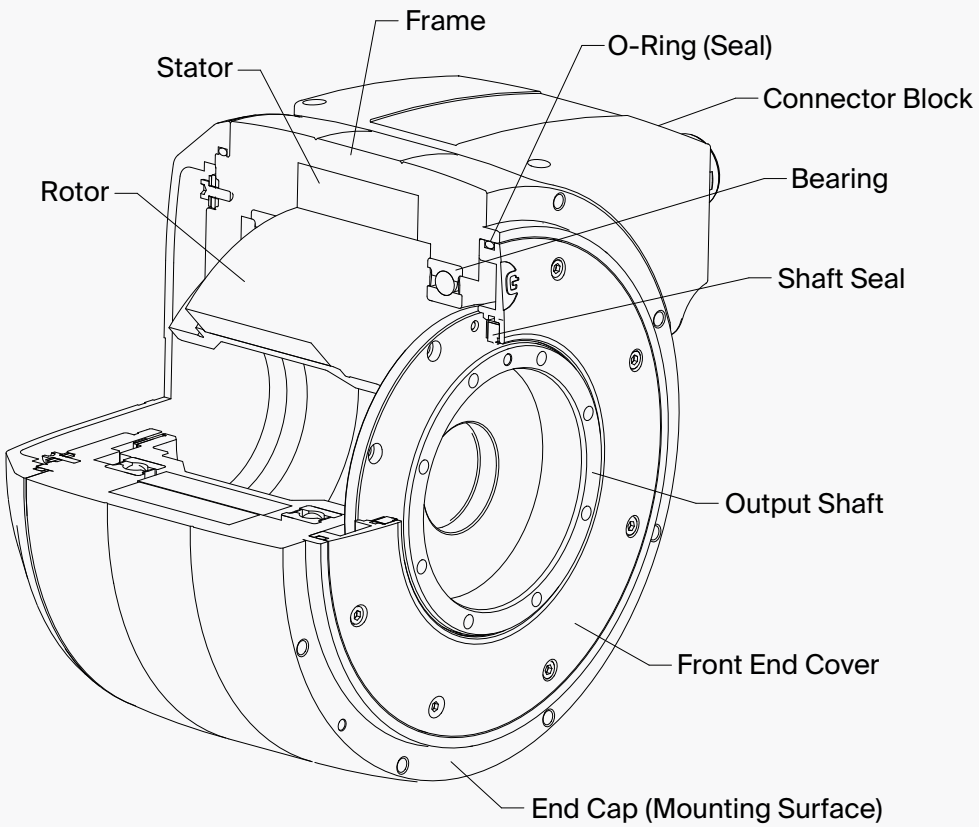
3.0 Product Overview

3.1 General

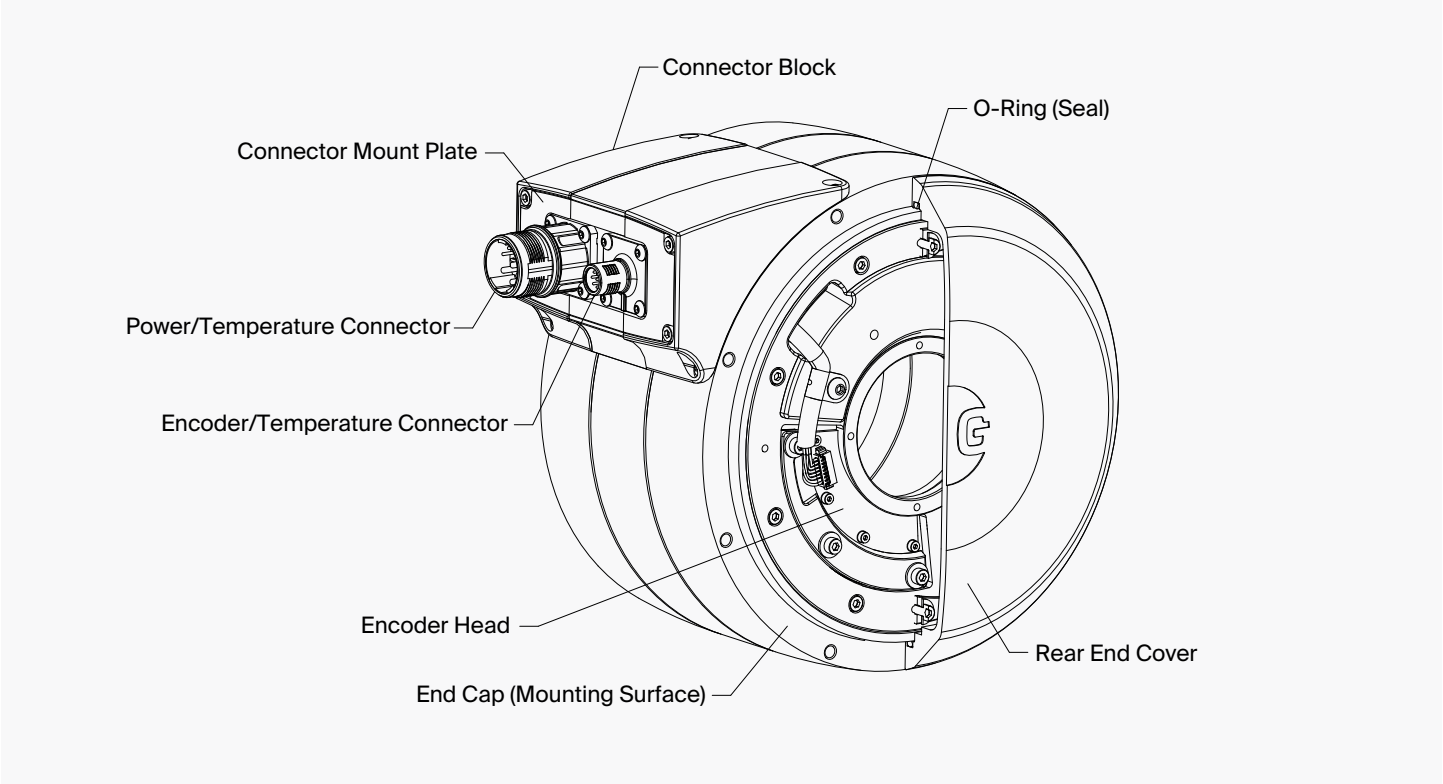
LiveDrive is a high torque density, direct-drive actuator for robotics and automation machinery. As a direct drive actuator, loads can be directly coupled to the output of the actuator without additional transmission components (ie. belts or gears). Additionally, LiveDrive actuators are designed for applications where dynamic operation and positioning is required. In technical terms, a LiveDrive actuator is a brushless, permanent-magnet, 3-phase synchronous motor. Compared with other servo motor technology, LiveDrive technology delivers much higher torque at comparatively lower speed and therefore is best suited to these types of applications.

Please refer to the LDD nomenclature and specifications for the features included in the LDD 1840 Actuator.

3.1.1 Front Section View



3.1.2 Rear Section View



3.2 Nomenclature

LiveDrive LDD actuators, can be described using the following nomenclature. For custom models, additional codes may be used.

LDD 1840B-D17-NA

Product Series
18: 180 Frame size

Stack Length
40: 26N·m Rated torque
Other: By application request

Voltage
B: 200-230VAC Standard
X: Custom feature

Feedback
E1: Endat2.2, single turn, absolute
H1: Hiperface®, single turn, absolute
D1: Hiperface DSL®, single turn, absolute
B1: BiSS-C®, single turn, absolute
XX: Custom feature

Sealing
7: IP67
X: Custom feature

Brake
B: Holding brake
N: No brake
X: Custom feature

Configuration
A: Standard product
X: Custom feature

3.3 Nameplate

All LiveDrive actuators have a name plate attached to the actuator housing. The name plate is used for:

- Identification of the actuator.
- Ordering spare parts.
- Service information.

E.g. Nameplate for LDD 1840B-D17-BA

	3-Phase PM Machine			Part No. 102474
	Model No. LDD 1840B-D17-BA			Serial No. XXXXX
	Date XXXX-XX	Mass 11.5 kg		Winding Config. Y
Genesis Robotics & Motion Technologies	P(Rtd) 272 W	R 1.768 Ω L-L		Therm. Class 180(H)
	U(Max|Rtd) 230 | 104 V_{rms} L-L			RPM (Max|Rtd) 737|100
	I(Max|Rtd) 25.0 | 6.4 A_{rms}			T(Max|Rtd) 100 | 26 Nm
	Freq(Max|Rtd) 319 | 43.3 Hz			Ke(25°C) 278 V/kRPM L-L
	CE IP67 cULus RAINTIGHT			Amb. Temp. 0 - 40°C

Made in Canada

102588-C

3.4 Selection and Sizing

Follow the procedure below to size a LiveDrive LDD actuator to your application. For application and sizing assistance, please contact Genesis Robotics & Motion Technologies.

3.4.1 Basic Sizing From Motion Profile

Follow these steps to size an LDD actuator for your application:

1. Determine the desired motion profile for the application. Compute torque (Nm) vs. time (s) and speed (rpm) vs. time (s).
2. Calculate the RMS (root mean square) torque and speed for the motion profile.
3. Calculate the maximum torque and maximum speed for the motion profile.

CHECK

- RMS torque (Nm), RMS speed (rpm) within continuous operating range (see torque vs. speed curve) of the LDD actuator, assuming a 100% duty cycle.
- Maximum torque (Nm), maximum speed (rpm) within the peak operating range of the LDD actuator.
- The actuator drive (provided by customer) must include a main disconnect and circuit breaker on the main power for overload protection.

4. Determine the thermal constraints of the system: ambient temperature, temperature limitations on the actuator, cooling condition.

CHECK

- Ambient temperatures >40^{0}C require de-rating of the continuous operating range. Ambient temperatures <40^{0}C may allow increased performance. Contact Genesis Robotics & Motion Technologies for more information.
- Continuous operating range based on passive cooling with a radiation plate to represent a typical machine installation. Field performance may vary depending on cooling condition. Contact Genesis Robotics & Motion Technologies for more information.

3.4.2 Drive Selection and Sizing

LiveDrive LDD actuators are controlled by standard 3-phase servo drives. It is important to check compatibility with the servo drive to realize optimal system performance. Follow the general steps below. For further assistance please contact Genesis Robotics & Motion Technologies.

1. Select a drive based on the rated voltage, rated current, and peak current of the LDD actuator. The drive must be able to supply the rated and peak current in order to achieve the rated performance.
2. Determine the appropriate encoder protocol (Endat 2.2, Hiperface®, Hiperface DSL®, BiSS-C®) that is compatible with the selected servo drive.
3. Determine the accuracy and precision required by the application and select the appropriate encoder.

CHECK

- Some industrial servo drives are compatible only with encoders including a proprietary digital license. Please contact Genesis Robotics & Motion Technologies for more information on controller compatibility with various brands.
- Depending on the application, LiveDrive LDD actuators operate best with a PWM switching frequency of 8kHz or higher. Some industrial drives may require de-rating of the current capacity at higher PWM frequencies.

Genesis Robotics & Motion Technologies has conducted testing with major servo drive brands in order to ensure compatibility.

4.0 Product Specifications and Ratings

4.1 Specifications

LDD Models		1840B-E17-BA	1840B-D17-BA	1840B-H17-BA	1840B-B17-BA	1840B-E17-NA	1840B-D17-NA	1840B-H17-NA	1840B-B17-NA
Size									
Outer Diameter	mm	177.5	177.5	177.5	177.5	177.5	177.5	177.5	177.5
Length	mm	124	124	124	124	124	124	124	124
Mass	kg	11.5	11.5	11.5	11.6	11.0	11.0	11.0	10.9
Rotor Inertia	kg·m²	0.0099	0.0099	0.0099	0.0099	0.0098	0.0098	0.0098	0.0098
Performance									
Nominal Voltage	VAC	200-230	200-230	200-230	200-230	200-230	200-230	200-230	200-230
Rated Power	W	272	272	272	272	272	272	272	272
Rated Torque	N·m	26	26	26	26	26	26	26	26
Peak Torque	N·m	100	100	100	100	100	100	100	100
Rated Current	A	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Peak Current	A	25	25	25	25	25	25	25	25
Rated Speed	rpm	100	100	100	100	100	100	100	100
Maximum Speed	rpm	710	710	710	710	710	710	710	710
Rated Angular Acceleration	rad/s²	2600	2600	2600	2600	2600	2600	2600	2600
Maximum Winding Temp.	°C	105	105	105	105	105	105	105	105
Electrical Parameters									
Phase Resistance[1]	mΩ	1760	1760	1760	1760	1760	1760	1760	1760
Torque Constant[2]	N·m/A	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Back EMF Constant[2]	V/krpm	283	283	283	283	283	283	283	283
Mechanical Parameters									
Allowable Thrust Load[3] [4]	N	720	720	720	720	720	720	720	720
Allowable Radial Load[3]	N	1350	1350	1350	1350	1350	1350	1350	1350
Allowable Moment Load[3]	N·m	120	120	120	120	120	120	120	120
Torsional Rigidity	N·m/arcmin	102700	102700	102700	102700	102700	102700	102700	102700
Operating Noise	dBA	<65	<65	<65	<65	<65	<65	<65	<65
Protection Class	-	IP67	IP67	IP67	IP67	IP67	IP67	IP67	IP67

1. Line to line at motor levels

2. Normalized to 25°C ambient temperature

3. Single allowable load in continuous operation. For simultaneous axial, radial, and moment load, please consult with Genesis applications engineering.

4. In compression only, for tension tools contact Genesis applications engineering.

LDD Models		1840B-E17-BA	1840B-D17-BA	1840B-H17-BA	1840B-B17-BA	1840B-E17-NA	1840B-D17-NA	1840B-H17-NA	1840B-B17-NA

Operation

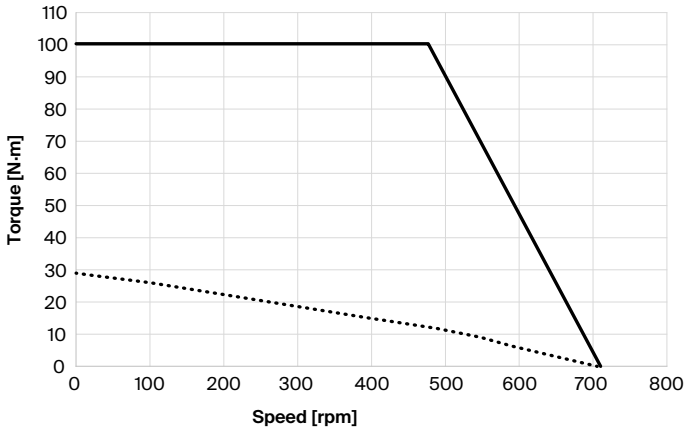
Operating Ambient Temp.	°C	0 to 40 (no freezing)	0 to 40 (no freezing)	0 to 40 (no freezing)	0 to 40 (no freezing)	0 to 40 (no freezing)	0 to 40 (no freezing)	0 to 40 (no freezing)	0 to 40 (no freezing)
Operating Humidity	%RH	20% to 80% (no condensation)	20% to 80% (no condensation)	20% to 80% (no condensation)	20% to 80% (no condensation)	20% to 80% (no condensation)	20% to 80% (no condensation)	20% to 80% (no condensation)	20% to 80% (no condensation)
Heat Sink	mm	305x305x12.7 (aluminium)	305x305x12.7 (aluminium)	305x305x12.7 (aluminium)	305x305x12.7 (aluminium)	305x305x12.7 (aluminium)	305x305x12.7 (aluminium)	305x305x12.7 (aluminium)	305x305x12.7 (aluminium)
Servo Drive Requirements[5]		Compatible with industry servo drives: minimum PWM frequency 8 kHz.	Compatible with industry servo drives: minimum PWM frequency 8 kHz.	Compatible with industry servo drives: minimum PWM frequency 8 kHz.	Compatible with industry servo drives: minimum PWM frequency 8 kHz.	Compatible with industry servo drives: minimum PWM frequency 8 kHz.	Compatible with industry servo drives: minimum PWM frequency 8 kHz.	Compatible with industry servo drives: minimum PWM frequency 8 kHz.	Compatible with industry servo drives: minimum PWM frequency 8 kHz.

Features

Encoder Type	Endat 2.2 Single turn	Hiperface DSL® Single turn	Hiperface® Single turn	BiSS-C® Single turn	Endat 2.2 Single turn	Hiperface DSL® Single turn	Hiperface® Single turn	BiSS-C® Single turn
Encoder Resolution	19 bit	20 bit	128 sine/cosine periods per revolution	20 bit	19 bit	20 bit	128 sine/cosine periods per revolution	20 bit
Integrated Holding Brake	9 N·m	9 N·m	9 N·m	9 N·m	No brake	No brake	No brake	No brake
Temperature Sensors	(2) PT1000 RTD	(1) PT1000 RTD	(1) PT1000 RTD	(2) PT1000 RTD	(3) PT1000 RTD	(1) PT1000 RTD	(2) PT1000 RTD	(3) PT1000 RTD
Connector Interface	M23 power M12 encoder	M23 one cable technology	M23 power M12 encoder	M23 power M12 encoder	M23 power M12 encoder	M23 one cable technology	M23 power M12 encoder	M23 power M12 encoder

5. Performance depends on tuning parameters and may vary slightly between servo drive models. For additional details, contact applications engineering.

4.2 Torque vs Speed



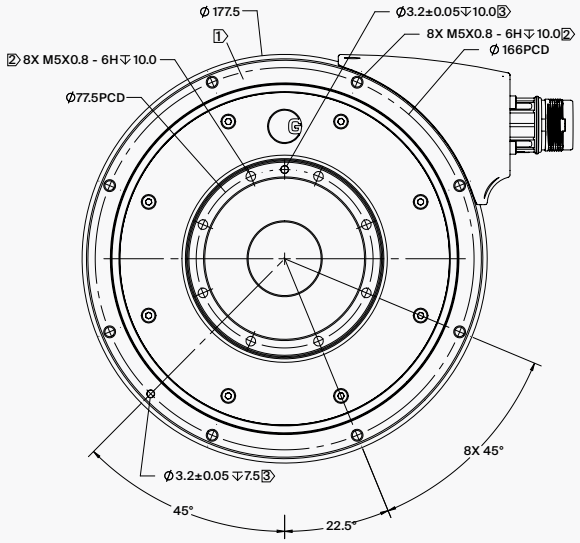
— Peak Performance[1,2]

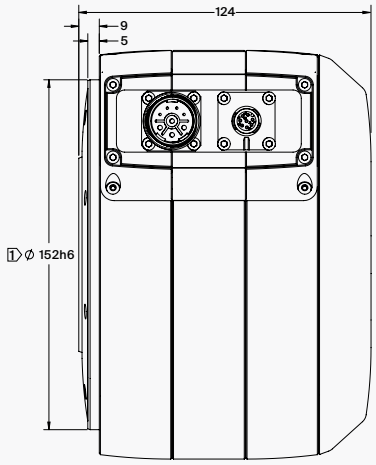
···· Continuous Performance[3]

1. Maximum bus voltage: 325 VDC
2. Coil temperature 25° C
3. Actuator mounted to aluminium radiation plate (305mmx305mmx12.7mm, anodized black)

4.3 Dimensions

For mounting information, see section 7.2.

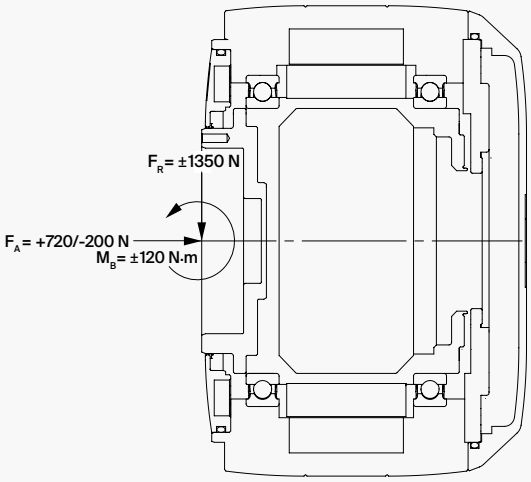




1. Mounting (thermal and structural) interface.
   - Recommended ⏥ 0.03 & ⌀⌀ for mating surface
   - Apply thermal paste between mounting surface to assist
2. Recommended use of class 12.9 fasteners with loctite for mounting
   - Torque M5 bolts to 7.6N·m
3. Location feature for 3mm dowel pin to aid mounting of motor and aligning bolt holes (use is optimal)
4. Dimensions apply to all LDD 1840B models. Hiperface DSL® model includes single M23 connector only

4.4 Shaft Load

The following diagram shows the maximum permissible continuous loads which can be applied to the LDD 1840. These loads can be applied individually in any direction. For simultaneous axial, radial or moment loads please consult with Genesis applications engineering team.



- Maximum permissible radial force (F_R): ± 1350 N
- Maximum permissible axial force (F_A): + 720/- 200 N
- Maximum permissible bending moment (M_B): ± 120 Nm

4.5 Positioning Encoder

The following tables outline the encoder part numbers.

LDD 1840B-E17-NA & LDD 1840B-E17-BA

Manufacturer	Heidenhain®
Manufacturer Part Number	1164809-52
Resolution	524 288 (19 bit)
Interface/Protocol	Endat 2.2

LDD 1840B-D17-NA & LDD 1840B-D17-BA

Manufacturer	SICK®
Manufacturer Part Number	EDS35-2KF0A020A
Resolution	1 048 576 (20 bits)
Interface/Protocol	Hiperface DSL®

LDD 1840B-H17-NA & LDD 1840B-H17-BA

Manufacturer	SICK®
Manufacturer Part Number	SKS36-HFA0-S05
Sine/Cosine Periods per Revolution	128
Interface/Protocol	Hiperface®

LDD 1840B-B17-NA & LDD 1840B-B17-BA

Manufacturer	Renishaw®	
Manufacturer Part Number	MB080DCC20BDNT00 (Readhead)	MRA080BC055DSE00 (Ring)
Resolution	1 048 576 (20 bits)	
Interface/Protocol	BiSS-C®	

4.6 Holding Brake

The following table outlines the brake specification included in the LDD 1840B actuator.

Holding Torque	9 Nm (20°C) 8 Nm (100°C)
Supply Voltage	24VDC

4.7 Temperature Monitoring

See the table below of the summary of the temperature monitoring locations in each model.

Model Number	RTD Signal	Connector Output	Pin
LDD 1840B-E17-BA	TH1	M23 Power Connector	C & D
	TH2	M12 Encoder Connector	3 & 4 - EnDat 2.2 datastream
LDD 1840B-D17-BA	TH1	M12 Encoder Connector	C & D - Hiperface DSL® datastream
LDD 1840B-H17-BA	TH1	M23 Power Connector	C & D
LDD 1840B-B17-BA	TH1	M23 Power Connector	C & D
	TH2	M12 Encoder Connector	1 & 2
LDD 1840B-E17-NA	TH1	M23 Power Connector	A & B
	TH2	M23 Power Connector	C & D
	TH3	M12 Encoder Connector	3 & 4 - EnDat 2.2 datastream
LDD 1840B-D17-NA	TH1	M23 Power Connector	A & B
	TH2	M12 Encoder Connector	C & D - Hiperface DSL® datastream
LDD 1840B-H17-NA	TH1	M23 Power Connector	A & B
	TH2	M23 Power Connector	C & D
LDD 1840B-B17-NA	TH1	M23 Power Connector	A & B
	TH2	M23 Power Connector	C & D
	TH3	M12 Encoder Connector	1 & 2

Important

One temperature sensor must be monitored and connected to a thermal shut down at all times during operation.

4.7.1 Temperature Sensors

The following table outlines sensor information.

Manufacturer	Honeywell®
Manufacturer Part Number	HEL-705-U-1-12-00
Type	RTD
Operating Temperature	-70 to 260°C
Resistance	1000 Ω

4.8 Housing Material

The LDD 1840B consists of parts with a number of exterior finishes. All finishes are compatible with standard cleaning (washdown) products and chemicals. For more information on specific compatibility in the end-user environment, contact Genesis Robotics

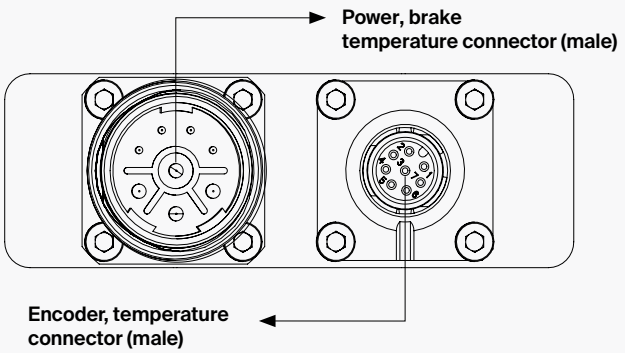
Item	Finish
1	Anodized Aluminium (Black)
2	Nitrided Steel

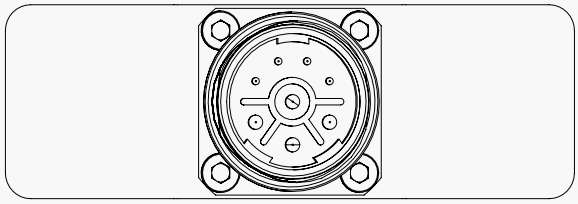
5.0 Interfaces

5.1 Connector Block

The LDD 1840B features a connector block with two straight head connector receptacles or interfaces:

- M23 power/brake connector
- M12 encoder connector

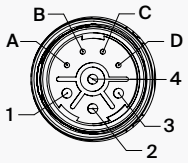




LDD models with one cable technology

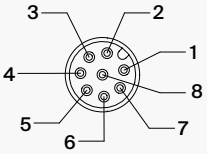
LDD 1840B-D17-NA
LDD 1840B-D17-BA

5.2 Pinouts



LDD Series

Pin	1840B-E17-BA	1840B-D17-BA	1840B-H17-BA	1840B-B17-BA	1840B-E17-NA	1840B-D17-NA	1840B-H17-NA	1840B-B17-NA
1	L1	L1	L1	L1	L1	L1	L1	L1
2	PE	PE	PE	PE	PE	PE	PE	PE
3	L2	L2	L2	L2	L2	L2	L2	L2
4	L3	L3	L3	L3	L3	L3	L3	L3
A	BR+	BR+	BR+	BR+	TH-1	TH-1	TH-1	TH-1
B	BR-	BR-	BR-	BR-	TH+1	TH+1	TH+1	TH+1
C	TH-1	DSL+	TH-1	TH-1	TH-2	DSL+	TH-2	TH-2
D	TH+1	DSL-	TH+1	TH+1	TH+2	DSL-	TH+2	TH+2



LDD Series

Pin	1840B-E17-BA	1840B-D17-BA	1840B-H17-BA	1840B-B17-BA	1840B-E17-NA	1840B-D17-NA	1840B-H17-NA	1840B-B17-NA
1	SENSOR 0V	-	DATA-	TH-2	SENSOR 0V	-	DATA-	TH-3
2	SENSOR Up	-	DATA+	TH+2	SENSOR Up	-	DATA+	TH+3
3	DATA+	-	REFCOS	DATA+	DATA+	-	REFCOS	DATA+
4	DATA-	-	COS+	DATA-	DATA-	-	COS+	DATA-
5	0V	-	GND	0V	0V	-	GND	0V
6	CLK-	-	REFSIN	CLK-	CLK-	-	REFSIN	CLK-
7	CLK+	-	SIN+	CLK+	CLK+	-	SIN+	CLK+
8	Up	-	U_s	V_{DD}	U_P	-	U_s	V_{DD}

5.3 Field Cables

The LDD 1840B should be operated with the following field cables supplied by Genesis Robotics and Motion Technologies:

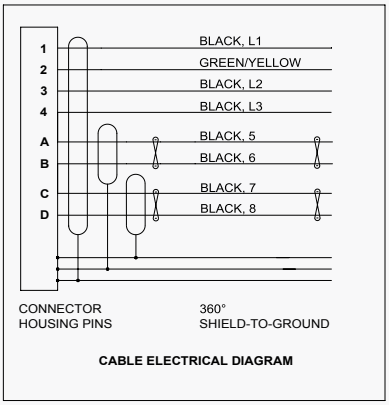
- M23 Power cable
- M12 Encoder cable

The actuator end of each cable comes with the appropriate connectors to mate with connector block. The drive end of each cable is flying leads and are terminated upon installation with the appropriate connector to mate with the drive.

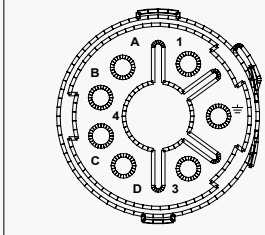
5.3.1 Power Cable

STRAIGHT CONNECTOR

Colour	Orange
Cable Jacket Type	PVC
Minimum Bend Radius	67.5mm
Current rating	21 A
Cable Length	3, 5, & 10m



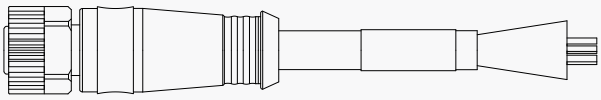
CABLE ELECTRICAL DIAGRAM



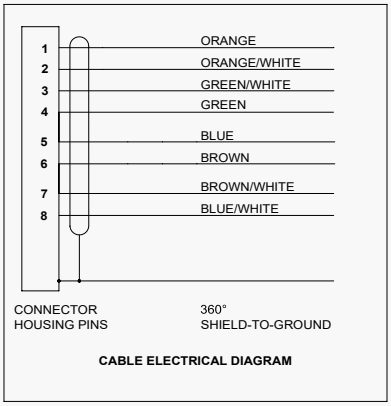
SECTION A
CONNECTOR PIN ASSIGNMENT
SCALE: NTS

5.3.2 Encoder Cable

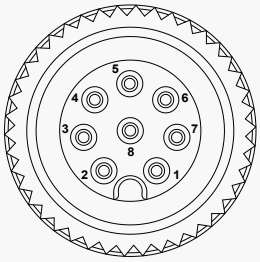
STRAIGHT CONNECTOR



Colour	Teal
Cable Jacket Type	PVC
Minimum Bend Radius	58.5mm
Current rating	2 A
Cable Length	3, 5, & 10m



CABLE ELECTRICAL DIAGRAM



SECTION A
CONNECTOR PIN ASSIGNMENT
SCALE: NTS

6.0 Handling, Transport and Storage

This section details the approved handling, transport, and storage requirements for the LDD 1840B.

6.1 State on Delivery

The LDD 1840 Actuator is delivered from the factory fully tested and packaged. For a list of electrical and mechanical tests performed at the factory before shipping, contact Genesis Robotics and Motion Technologies.

When you receive the shipment, inspect the packaging for damage, and compare the order form with the physical goods received. If the packaging is damaged or the actuator itself appears damaged, follow these guidelines

- Retain the original packaging if possible
- Record the device model and serial number listed on the name plate
- Notify the carrier and contact Genesis Robotics customer service immediately
- Phone: +1 866 682 3085

6.2 Handling and Transport

To avoid equipment damage, injuries, and invalidation of the warranty due to improper handling, transport the actuator securely and in its original packaging designed to protect against vibration and shock. The actuator may be damaged in the event of a drop or excessive vibration when not secured in its packaging.

Caution

Wear adequate personal protection equipment and follow safe lifting practices

6.3 Storage

Store the LDD 1840 Actuator in its original packaging in a dry location that is free of vibration, dust, and corrosive materials.

Storage Temperature (ºC)	0 to 40 (no freezing)
Storage Humidity (RH%)	20% to 80% (no condensation)

Caution

Incorrect storage of the actuator can result in damage to the equipment and invalidation of the warranty.

7.0 Installation and commissioning

This section describes the approved installation and commissioning procedures for the LDD 1840 Actuator.

7.1 Safety Precautions for Installation

In addition to the general “Safety Instructions” described on page 8, observe the following specific safety precautions for installing and configuring the LDD 1840B.

Damaged Equipment – Caution

- Inspect the actuator for damages prior to installation, commissioning and operation.
- Do not operate damaged equipment.
- Contact Genesis Robotics for further guidance if the equipment is damaged.

Heavy Loads – Caution

Carrying or lifting the actuator without adequate protection (such as safety footwear), assistance, or safe lifting practices, may result in equipment damage and personal harm.

- Wear adequate personal protection equipment.
- Get assistance during handling and installation of the actuator.

Grounding – Danger. Electric shock and severe bodily injury

- The grounding conductor for the actuator must be permanently connected in accordance with the actuator wiring diagram (see “Cables” on page 22) before applying power to the actuator. Mount the ground wires to PE terminal.
- Never operate the actuator if the grounding conductor is not permanently connected to a suitable grounding point.

7.2 Mechanical Mounting and Actuator Assembly

To mount the LDD 1840 Actuator to the robot assembly, use the mounting holes provided on the frame and output shaft.

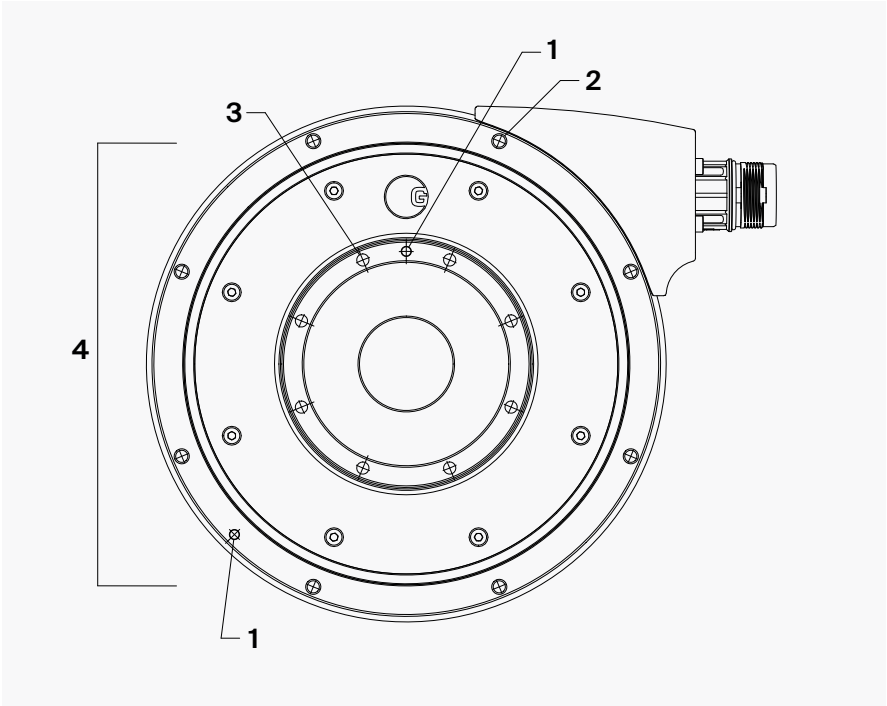
- Use recommended screws: 16 M5 x 0.8 (class 12.9 fasteners) with thread locker
- Apply torque: 7.6 Nm
- Optional: use the 3 mm dowel pin for aligning the mounting holes
- Use thermal paste between the mounting surface and actuator

Important

All torque transmission is transferred through the two mounting interfaces via friction produced by proper bolt torque. If the mounting bolts are not torqued correctly, the mounting interface can slip causing bolt failure and damage to the surfaces.

Important

Ensure the mounting surfaces are clean and undamaged. A high quality contact surface between the actuator and the end user mounting surface is critical for good thermal performance.



1	3 mm dowel pin for aligning frame and shaft mounting holes
2	8 frame mounting holes for M5 x 0.8 (class 12.9 fasteners)
3	8 shaft mounting holes for M5 x 0.8 (class 12.9 fasteners)
4	Mounting surface

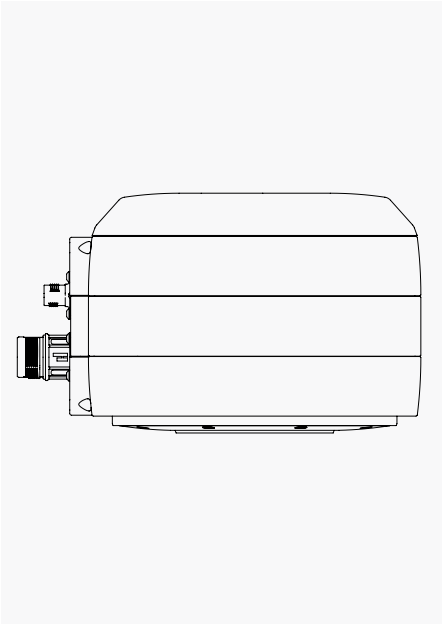
Please refer to the LDD 1840 Actuator interface drawing for more details.

7.3 Design and Installation Positions

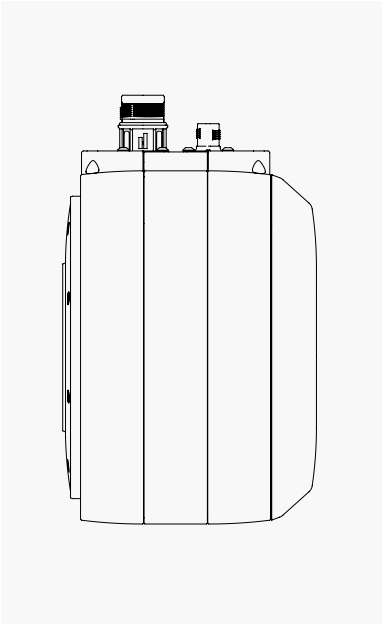
The LDD 1840 Actuator can be mounted in any orientation, or in increments of the three positions shown below.

If you are using the vertical mounting orientation with the drive side up, ensure no fluids or debris rests on the shaft output. Over a prolonged period of time, fluids or debris may penetrate the shaft seal and cause damage to the actuator.

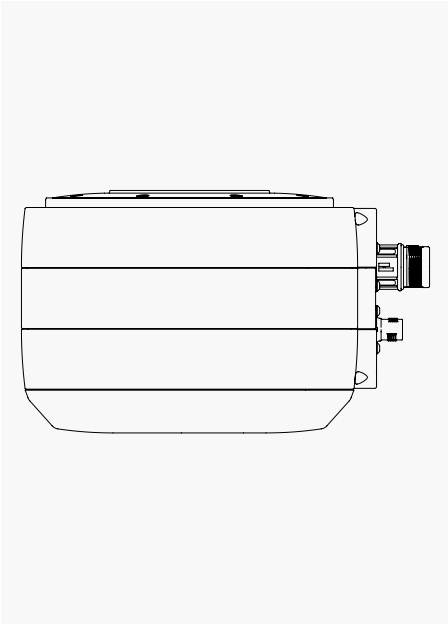
Vertical Mounting Drive Side Down



Horizontal Mounting



Vertical Mounting Drive Side Up



7.4 Electrical connections

Connect and terminate the power and encoder cables using appropriate connectors, torque, and grounding. See “Cables” on page 22 for the individual cable specifications and bend radius.

Caution

All electrical connections must be made by a qualified personnel

- Ensure the ground lead in the power cable is connected to a suitable grounding point
- Verify the power and grounding connections before applying power

7.5 Drive Setup and Configuration

The LDD 1840B operates with various industrial servo drives. Follow the specifications in Section 4 & 5. Note that not all drives have the same options and equivalent settings may be called something different. Refer to your drive documentation for the appropriate names of these options.

Ensure that the following limits are setup in the drive prior to operation of the motor (refer to datasheet for values):

- Peak current limit
- Peak voltage limit
- Maximum operating speed (a.k.a. no-load speed)
- Maximum winding temperature

8.0 Operation

This section describes general operation and maintenance procedures for the LDD 1840 Actuator. For recommendations and support for your specific actuator application, contact Genesis Robotics.

8.1 Operation

During operation, ensure the ratings and specifications of the actuator are not exceeded. Once a machine is setup, typical operation will not require any additional steps. Follow the guidelines and recommendations in your drive system documentation and ensure that the control system is performing adequately.

8.2 Power Off Brake

Some LDD actuators are equipped with a power off brake. This brake will engage whenever power is removed from the BR+ and BR- control pins of the actuator. The brake is intended for holding during a power off condition and emergency stop events only. The brake is not intended for regular use during active motion.

8.3 Deactivation

If you need to deactivate the LDD 1840B for any reason, observe all appropriate safety notices concerning working with hot surfaces, moving parts, and high voltages. Refer to the safety section 2 of this manual for more details. To deactivate the actuator:

1. Bring the machine to a controlled stop.
2. De-energize the actuator by switching off the power at the drives and the main input breaker to the drives.
3. When power is off, the holding brake is activated.
4. Wait a sufficient amount of time for the electrical components to fully discharge. Consult the documentation for the actuator drive system you are using for these recommendations and safe practices.
5. Disconnect all electrical connections (the power and encoder cables).
6. Unscrew the actuator from the mounting surface.

8.4 Disposal

Genesis Robotics products do not contain any dangerous substances which could be released with proper use. The products also do not contain any chemically banned substances, and are free of mercury, asbestos, and chlorinated hydrocarbons.

For recycling, Genesis Robotics products contain a high proportion of metal, which can be disassembled into individual components and recycled at appropriate facilities. The packaging materials can also be recycled where facilities exist.

9.0 Maintenance and Troubleshooting

9.1 Troubleshooting

Follow the troubleshooting guide below; please contact service@genesis-robotics.com if any issues persist.

Performance Issue	Possible Cause	Troubleshooting Steps
Unusual noise/vibration	Poor motor tuning	Tune motor to optimize for noise and performance.
	Loose mounting bolt	Confirm mounting bolts are torqued according to spec. Refer to 7.2 Mechanical mounting and actuator assembly for bolt requirements.
	High drag torque	1. Check for seal debris on the shaft extension. 2. Do not power motor, supply power to the brake, and rotate the motor by hand. Check for high or intermittent drag torque.
Poor control	Poor motor tuning	Tune motor to optimize for noise and performance.
	High drag torque	1. Check for seal debris on the shaft extension. 2. Do not power motor, supply power to the brake, and rotate the motor by hand. Check for high or intermittent drag torque.
	Short circuit in stator	1. Measure line-to-line resistance and compare to datasheet value. 2. Continuity test between phase and ground pin
	Encoder failure	Manually rotate motor 360° and compare to encoder output.
	Loose connector	Confirm that the connectors are properly secured.
	Supply voltage fluctuations	Check input voltage to the drive. Refer to datasheet for DC bus voltage value.
Overheating	Poor motor control	1. Confirm current draw is appropriate for desired output torque. Refer to datasheet for torque constant value. 2. Measure line-to-line resistance and compare to datasheet value.
	High drag torque	1. Check for seal debris on the shaft extension. 2. Do not power motor, supply power to the brake, and rotate the motor by hand. Check for high or intermittent drag torque.
	Short circuit in stator	1. Measure line-to-line resistance and compare to datasheet value. 2. Continuity test between phase and ground pin.
	Loose connector	1. Confirm that the connectors are properly secured.
	Faulty temperature sensor	1. Check RTD temperature output. 2. Redo setup of RTD in the drive system.

Performance Issue	Possible Cause	Troubleshooting Steps
Holding brake slipping	Temporary degradation of brake	Burnishing Procedure: 1. Remove linkage from motor to allow for continuous rotation. 2. Spin motor at 300 rpm. 3. While motor is spinning, engage brake for 1s, disengage for 0.5s . 4. Re-engage the brake and spin @300rpm for 60 revolutions (12 seconds). 5. Only burnish the brake a maximum of twice per hour to avoid damaging the brake.

10.0 Appendixes

10.1 List of Standards

UL 1004-1	Standard for Rotating Electrical Machines - General Requirements
UL 1004-6	Standard for Servos and Stepper Motors
UL 840	Insulation and Creepage
UL 1446	Standard for Systems of Insulating Materials
IEC-60034-1	Rotating Electrical Machines
IEC 60027-4	Letter symbols to be used in electrical technology –Part 4: Symbols for quantities to be used for rotating electrical machines
IEC 60034-5	Rotating electrical machines - Part 5: Degrees of protection provided by integral design of rotating electrical machines (IP-Code) – Classification
IEC 60085	Electrical insulation – Thermal evaluation and designation

10.2 Declarations of Conformity

CE

Certificate of conformity certifying the structure of and the compliance with the valid EN standards and EC-guidelines are available for all Genesis Robotics and Motion Technologies motors. If required, the declarations of conformity can be requested from the responsible sales office.

The CE mark is applied to the motor type label of the Genesis Robotics and Motion Technologies motor.

cURus

Genesis Robotics and Motion Technologies motors are certified by the UL authority (Underwriters Laboratories Inc.®) under UL file #E515181. Certified motors are marked with the following symbol on the motor type label. Current information on UL approvals can be found at **https://iq.ulprospector.com/en/.**

RoHS2

Genesis Robotics and Motion Technologies declares that our products conform to the directive 2011/65/EU RoHS II, including amendment 2015/863, on Restriction of the use of certain hazardous substances in electrical and electronics equipment.

10.3 Genesis Robotics EC Conformity Statement

Genesis Robotics and Motion Technologies actuators are not allowed to be put into service until the machinery into which they are to be incorporated has been declared in conformity with the requirements of the Machinery Directive 2006/42/EC and the Electromagnetic Compatibility Directive 2014/30/EU.