MP156E

L-239 Linear Actuator

User manual

Version: 1.3.0 Date: 18.10.2022

This document describes the following high-load-linear actuators with 52 mm (2") travel range:

- **L-239.50SD**
  with stepper motor, without encoder
- **L-239.50AD**
  with DC motor with PWM control,
  with rotation encoder
- **L-239.033232**
  with DC motor,
  with rotation encoder
- **L-239.035232**
  with BLDC motor,
  with rotation encoder

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Contents

1 About this Document

1.1 Objective and Target Group of this User Manual

This user manual contains the required for the intended use of the L-239.

Basic knowledge of closed-loop systems, motion control concepts, and applicable safety measures is assumed.

1.2 Symbols and Typographic Conventions

The following symbols and typographic conventions are used in this user manual:

CAUTION

Dangerous situation

Failure to comply could lead to minor injury.

➢ Precautionary measures for avoiding.

NOTICE

Dangerous situation

Failure to comply could cause damage to equipment.

➢ Precautionary measures for avoiding.

INFORMATION

Information for easier handling, tricks, tips, etc.

Symbol/Label	Meaning
1. 2.	Action consisting of several steps whose sequential order must be observed
➢	Action consisting of one or several steps whose sequential order is irrelevant
▪	Lists
p. 5	Cross-reference to page 5
RS-232	Labeling of an operating element on the product

1.3 Other Applicable Documents

The devices and software tools from PI that are mentioned in this documentation are described in separate manuals.

Product	Document
L-239	MP159EK Short Instructions for L-2xx Linear Actuators
C-663.12 Stepper Motor Controller	MS241 User Manual
C-863.12 DC Motor Controller	MS249 User Manual
C-884 DC Motor Controller	MS213 User Manual
C-891 PIMag® Motor Controller	MS251 User Manual
C-885/C-891.11C885	C885T0002 User Manual C891T0005 User Manual
PIMikroMove	SM148 Software Manual

1.4 Downloading Manuals

INFORMATION

If a manual is missing or problems occur with downloading:

➢ Contact our customer service department (p. 25).

Downloading Manuals

1. Open the website **www.pi.ws**.
2. Search the website for the product number (e.g., P-882) or the product family (e.g., PICMA® bender).
3. Click the corresponding product to open the product detail page.
4. Click the ***Downloads*** tab.

   The manuals are shown under ***Documentation***. Software manuals are shown under ***General Software Documentation***.
5. Click the desired manual and fill out the inquiry form.

   The download link will then be sent to the email address entered.

2 Safety

2.1 Intended Use

The L-239 is a laboratory device as defined by DIN EN 61010-1. It is intended for indoor use and use in an environment which is free of dirt, oil, and lubricants.

In accordance with its design, the L-239 is intended for single-axis positioning, adjusting and shifting of loads at various velocities.

The intended use of the L-239 is only possible when installed and in conjunction with a suitable controller. The controller is not in the scope of delivery of the L-239.

2.2 General Safety Instructions

The L-239 is built according to state-of-the-art technology and recognized safety standards. Improper use of the L-220 may result in personal injury and/or damage to the L-239.

- Only use the L-239 for its intended purpose, and only use it if it is in perfect condition.
- Read the user manual.
- Eliminate any faults and malfunctions that are likely to affect safety immediately.

The operator is responsible for the correct installation and operation of the L-239.

2.2.1 Organizational Measures

User manual

- Always keep this user manual available when using the L-239.
  The latest versions of the user manuals are available on our website (p. 2) for download.
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- If you give the L-239 to other users, also include this user manual as well as all other relevant information provided by the manufacturer.
- Only use the device on the basis of the complete user manual. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.
- Only install and operate the L-239 after you have read and understood this user manual.

Personnel qualification

The L-239 may only be installed, started, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

3 Product Description

3.1 Model Overview

Classification of the Stages

All models are linear actuators with 52 mm travel range. They differ with respect to the drive type and encoder equipment.

Model	Drive type				Rotation encoder
	Stepper motor	DC motor	ActiveDrive DC motor	BLDC motor	
L-239.50AD			+		
L-239.50SD	+				+
L-239.033232		+			+
L-239.035232				+	+

3.2 Product View

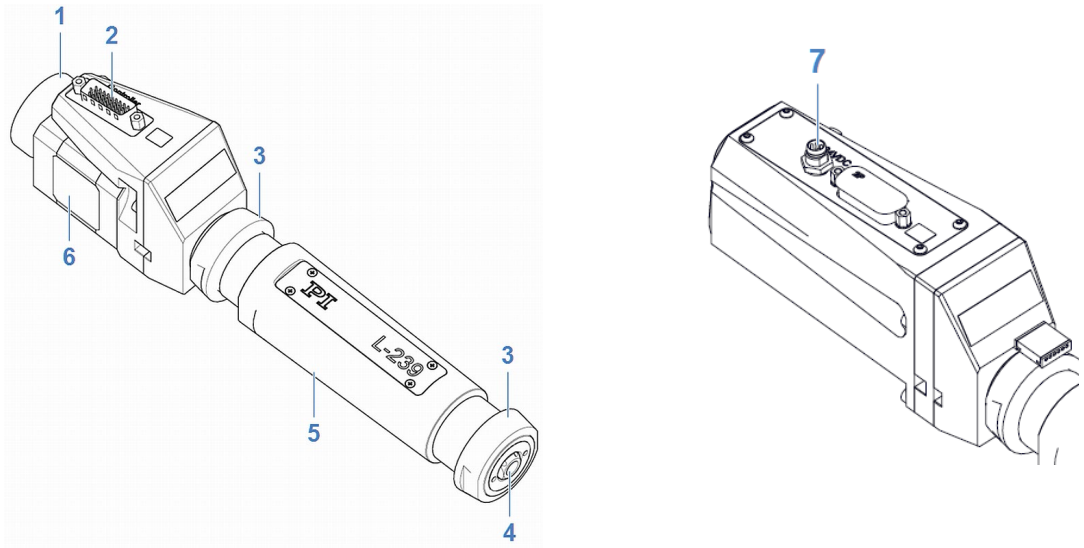

Figure 1: Parts (left: L-239.50SD, right L-239.50AD (detail))

1 Vibration absorber
2 Controller connector (L-239.50SD / L-239.033232 / L-239.035232: HD D-Sub 26, male; L-239.50AD: D-Sub 15, male)
3 Clamping screw
4 Pusher
5 Sleeve
6 Motor
7 Power adapter connector (L-239.50AD only)

3.3 Direction of Motion

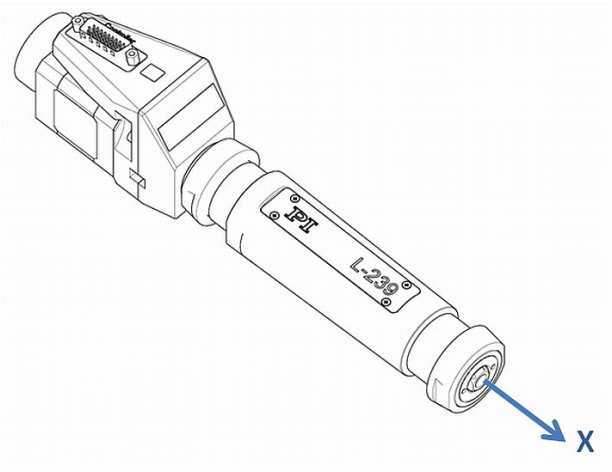

Figure 2: Direction of motion of the pusher

X (arrow direction:) Direction of motion on positive command

3.4 Product Labeling

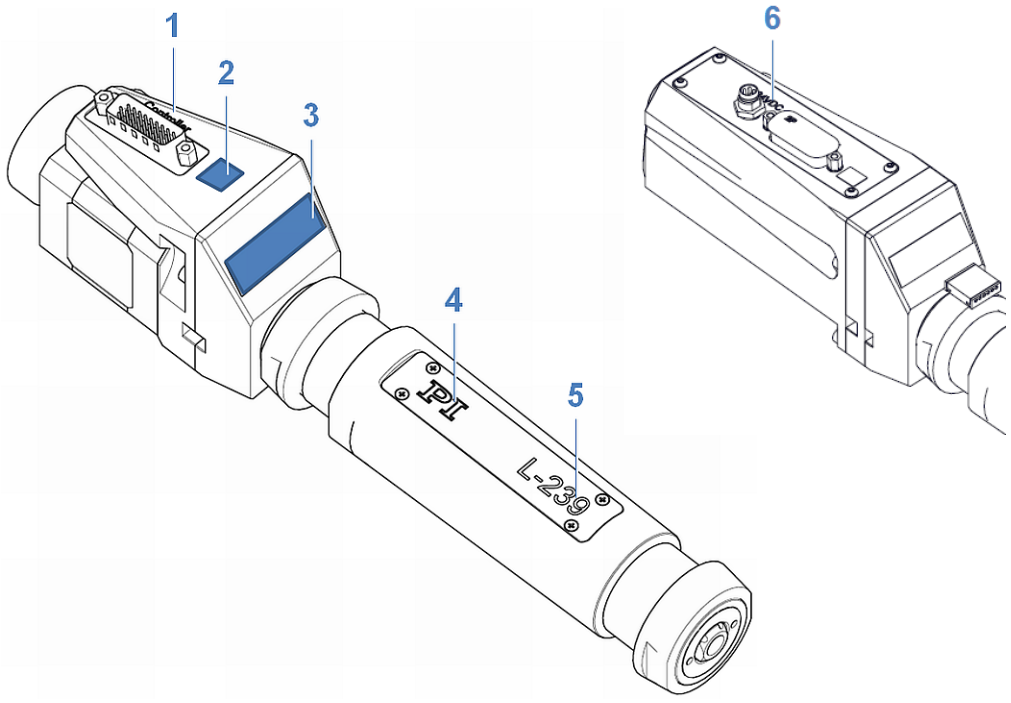

Figure 3: Product labeling (left: L-239.50SD, right L-239.50SD (detail))

Position	Labeling	Description
1	Controller	Controller connection
2		Warning sign "Electrostatic sensitive devices"
3, 4	PI	Manufacturer's logo
3	L-239.50SD	Product name (example); the characters after the period refer to the model
3	415002159	Serial number (example), individual for each L-239 Meaning of the places (counting from the left): 1 = internal information, 2 and 3 = year of manufacturer, 4 to 9 = consecutive numbers
3		Warning sign "Observe manual!"
3	Country of origin: Germany	Country of origin
3	CE	CE conformity mark
3	WWW.PI.WS	Manufacturer's address (website)
3		Old equipment disposal
5	L-239	Product series
6	24V DC	Power adapter connector

3.5 Scope of Delivery

Order number	Components
L-239	Linear actuator according to order
L239VE001	Open-end wrench AF 35
MP159EK	Short instructions for L-2xx linear actuators
7300900006-0180	L-239.50AD only: Power adapter with cable

3.6 Suitable Controllers

The L-239 must be connected to a suitable controller.

	C-663.12	C-863.12	C-891	C-884	C-885 with C-663. 12C885	C-885 with C-863. 20C885	C-885 with C-891. 11C885	Modular ACS controller
L-239.50AD		+				+		+
L-239.50SD	+				+			+
L-239.033232		+		+		+		+
L-239.035232			+				+	+

PC software is in the scope of delivery of the controllers from PI. The operation of the controllers is described in the corresponding user manuals.

The operating parameters must be adjusted depending on the version of the L-239 used. (Selection of the corresponding model in the PIMikroMove software).

Note that the cable required for connecting the L-239 to the controller must be ordered separately.

3.7 Technical Features

3.7.1 Encoder

The L-239.50AD, L-239.033232, and L-239.035232 models are equipped with an optical rotary encoder. A rotary encoder, also called an incremental rotary encoder, is implemented at a rotating point in the drivetrain, e.g., the motor shaft.

Refer to the table in the "Specifications" section for the encoder resolution (p. 27).

Model L-239.50SD does not have an encoder.

3.7.2 Limit Switches

The L-239 is equipped with noncontact, Hall-effect limit switches.

Each limit switch sends its signal to the controller on a dedicated line. The controller then stops the motion. If the controller does not stop the motion in time, the linear actuator runs into the hard stop.

See "Limit Switch Specifications" for more information (p. 29).

3.7.3 Reference Point Switch

The L-239 is equipped with one direction-sensing reference point switch that is located at about the midpoint of the travel range. This sensor transmits a TTL signal that indicates whether the linear actuator is on the positive or negative side of the reference point switch.

See the controller user manual and/or associated software manuals for the commands that make use of the reference point signal.

For more information, see "Reference Point Switch Specifications" (p. 30).

3.7.4 Integrated PWM Amplifier

The L-239.50AD model is equipped with a PWM amplifier ("ActiveDrive Concept"). The motor and PWM amplifier are installed in a common housing and therefore optimally integrated and shielded. The PWM amplifier only receives the control signals from the controller, whereas the supply voltage is provided via an external power adapter. The ActiveDrive concept allows high motor power and dynamics at low power loss.

4 Unpacking

1. Unpack the L-239 with care.
2. Compare the contents with the items listed in the contract and the packing list.
3. Inspect the contents for signs of damage. If there is any sign of damage or missing parts, contact PI immediately.
4. Keep all packaging materials in case the product needs to be returned.

5 Installation

5.1 General Notes on Installation

NOTICE

Damage / malfunction due to false handling when installing/removing the actuator

- Do **not** hold the actuator by the motor.
- Ensure that the motor is not warped in relation to the sleeve.
- Use the **wrench flat** in the actuator's sleeve for counteraction when tightening the clamping screws.

NOTICE

Cable break!

A cable break leads to failure of the linear actuator.

- Install the linear actuator so that the cable is not bent too strongly or crushed.

NOTICE

Increased friction!

Lateral forces that act on the pusher of the linear actuator increase the friction of the internal drive components. Increased friction impairs the motion of the pusher and increases wear on the drive components.

- Avoid lateral forces on the pusher of the L-239.

NOTICE

Heating up of the L-239 during operation!

The heat produced during operation of the L-239 can affect your application.

- Install the L-239 so that the application is not impaired by dissipating heat.

INFORMATION

Models with DC gear motors are equipped with integrated signal drivers for cable lengths ≤10 m between the linear actuator and the motor controller.

5.2 Providing a Suitable Mechanical Mounting and Installation Environment

A suitable mechanical mounting and installation environment are necessary for the proper use of the actuator.

- Make sure that the following conditions have been met:
  - Material and statics of the mounting are designed so that the static and dynamic forces that occur can be safely and continuously managed.
  - The dimensions of the mounting are adapted to the dimensions of the actuator (see above figures and dimensions).
  - The intended motion of the pusher and the load must not be inhibited by the dimensions of the installation environment.
- Take into account the following specifications as well when planning the application and installing the actuator:
  - Travel range (see data table (p. 27))
  - Space requirements for a kink-free and proper guiding of the connecting cable and additional motor cables
  - Length of the connection cable and the motor cable
- If the limit switches of the actuator cannot be reached with the planned minimum and maximum displacements: Make sure that the actuator and the load **only move within the planned range**. Suitable measures:
  - Corresponding programming of the controller
  - Emergency off switch
  - Automatic shutdown systems
- Avoid or label danger areas that result from the installation of the actuator and from use, in accordance with the legal regulations (e.g. risk of crushing in the case of heavy moving loads, fast actuator motion and/or high drive torques).

The complete dimensions of the actuator and relevant individual parts can be found in the figures in the “Dimensions” section (p. 31).

5.3 Installing the Linear Actuator in a Mechanical Mounting

We recommend installing the actuator into the mounting with a clamp connection. The following instructions refer to this case.

Requirements

- ✓ You have read and understood the general notes on installation (p. 13).
- ✓ You have provided your application with a suitable mounting for the mounting shaft of the actuator.

Tools and accessories

- Open-end wrench AF 35

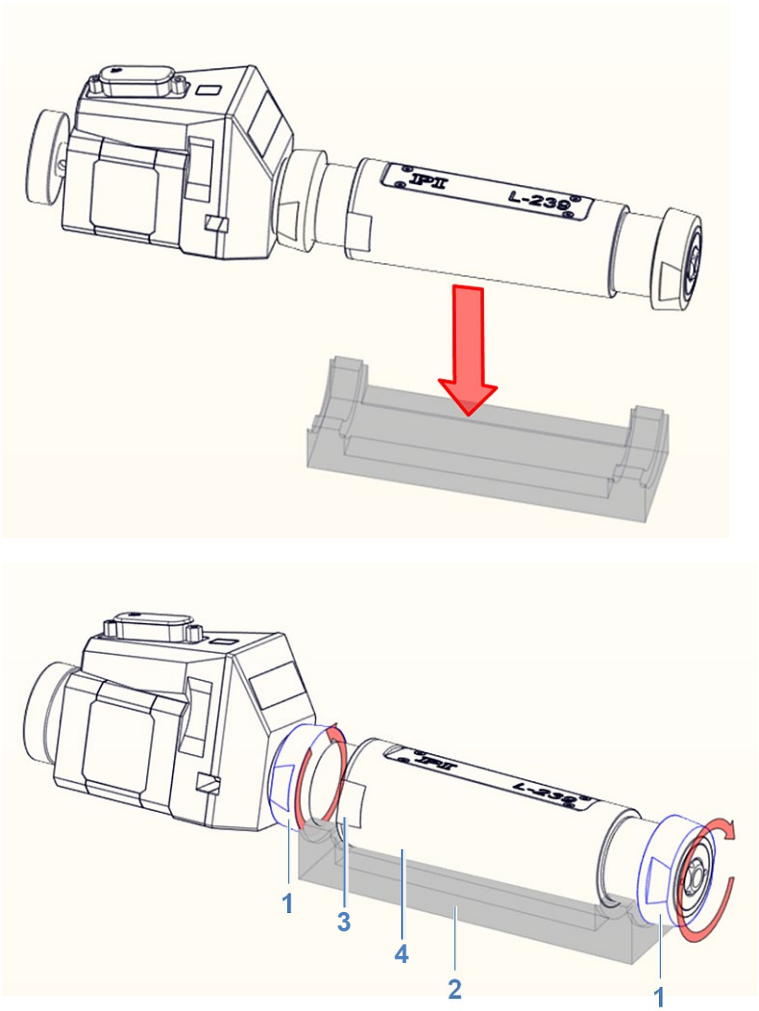

Figure 4: Installing the actuator into a mounting (example)

1 Clamping screw
2 Mechanical mounting
3 Wrench flat
4 Sleeve

Installing the actuator

1. Holding the actuator by the sleeve, insert it into the mounting (see figure).
2. Using an open-end wrench AF 36, hold the sleeve. Using an open-end wrench AF 35, tighten the clamping screws (see figure for turning direction). The torque may **not** exceed 12 Nm!
3. Check that the actuator is affixed firmly in the mounting.

6 Startup

6.1 General Notes on Startup

CAUTION

Unintentional motion of the linear actuator while connecting it to the controller!

- ➢ Do not place any objects in areas where they can be caught by moving parts.
- ➢ Keep a safe distance from the motion range of the linear actuator.

NOTICE

Damage if a wrong motor controller is connected!

Connecting a linear actuator to an unsuitable controller can cause damage to the linear actuator or controller.

- ➢ Connect a linear actuator with DC motor to a DC motor controller only.
- ➢ Connect a linear actuator with stepper motor to a stepper motor controller only.

NOTICE

Damage due to the pusher crashing into the hard stop!

When the limit switches are deactivated, the motion of the pusher is aborted by the hard stop and the L-239 can be damaged.

- ➢ Do **not** deactivate the limit switches in the software.
- ➢ Test limit switch operation at low velocities only.

NOTICE

Damage or considerable wear due to high accelerations!

High accelerations can cause damage to or considerable wear on the mechanics.

- ➢ Stop the motion immediately if a controller malfunction occurs.
- ➢ Ensure that the end of the travel range is approached at low velocity.
- ➢ Set the control signal so that the moving part does not stop abruptly or try to continue motion at the end of the travel range.
- ➢ Determine the maximum velocity for your application.

NOTICE

Damage from unsuitable controllers and PC software!

Unsuitable controllers and PC software can cause damage to the actuator.

- If you use controllers and software from other manufacturers, **before** starting and operating the actuator, check the technical data to make sure that they are suitable!

INFORMATION

The maximum velocity for a linear actuator with a stepper motor should be determined in the application. If the commanded velocity is too high, the stepper motor might stop without the controller detecting this state.

INFORMATION

Moving the pusher outwards corresponds to the positive direction of motion.

6.2 Connecting the Controller

NOTICE

Damage if an incorrect controller or motor cable is connected!

Connecting a stage to an unsuitable controller or using an unsuitable motor cable can cause damage to the stage or controller.

- ➢ Only connect the stage to a suitable controller (p. 8).
- ➢ To connect the stage to the controller, only use a motor cable that is suitable for the controller. Note that the cable must be ordered separately.

Requirements

- ✓ You have read and understood the general notes on installation (p. 13).
- ✓ You have installed the controller.
- ✓ You have read and understood the user manual for the controller.
- ✓ The controller is switched off.

Tools and accessories

- Motor cable according to controller ordered (cable to be ordered separately)
- Suitable tools for tightening the screws to the connections

Connecting the L-239 to a Controller

1. Remove the ESD protection from the motor connector of the L-239.
2. Connect the L-239 and the controller to each other.
3. Use the integrated screws to secure the connections against accidental disconnection.

6.3 Connecting the Power Adapter

Connecting a power adapter is only necessary for the L-239.50AD.

Requirements

✓ The power cord is **not** connected to the power socket.

Tools and accessories

- Supplied components:
  - 24 V wide input range power supply
  - Adapter for the power adapter connection; barrel connector, 5.5 mm x 2.1 mm to M8 4-pin (f)
  - Power cord
- If one of the components supplied for connecting to the power supply has to be replaced: Use a sufficiently measured and certified replacement component. Details:
  - Power adapter: Output 24 V DC, maximum output current 5 A
  - Power cord: Three wires, cable cross section at least 3 × 0.75 mm^2 (3 × AWG18), maximum length 2 m

Connecting the power adapter to the L-239

➢ Connect the M8 connector (f) of the adapter to the M8 panel plug of the L-239.

➢ Connect the barrel connector of the adapter to the barrel connector socket of the power adapter.

➢ Connect the power cord to the power adapter.

6.4 L-239 Entries in the Stage Database of PI

For PI controllers, you can select the connected linear actuator from a stage database in the corresponding PC software. The appropriate operating parameters are therefore loaded to the controller. You can find a detailed description in the user manual for the controller or in the manual for the PC software used.

7 Maintenance

NOTICE

Damage due to improper maintenance!

The L-239 can become misaligned as a result of improper maintenance.

- ➢ Do not loosen any sealed screws.

7.1 Performing a Maintenance Run

Depending on the operating conditions and the period of use of the L-239, the following maintenance measures are required:

Maintenance run

The maintenance run serves the purpose of distributing the existing lubricant.

- ➢ After 500 operating hours or at least after 1 year, perform a maintenance run over the entire travel range, in order for the existing lubricant to be distributed evenly.
- ➢ If you operate your stage continuously over only a short travel range (<20 % of the entire travel range), perform a run across the entire travel range approximately every 2000 motion cycles.

Relubricating

Under laboratory conditions, it is only necessary to relubricate the stage in exceptional cases. For continuous industrial use, the lubrication intervals must be defined individually.

- ➢ If you have any questions on relubricating, contact our customer service department (p. 25).

7.2 Cleaning the L-239

Requirements

- ✓ You have disconnected the linear actuator from the controller.

Cleaning the Linear Actuator

- ➢ If necessary, clean the surfaces of the linear actuator with a cloth that is dampened with a mild cleanser or disinfectant.

8 Troubleshooting

Problem	Possible causes	Solution
Reduced positioning accuracy	Mounting nut is fastened too tight	➢ Tighten the mounting nut to a maximum torque 12 Nm.
Impairment of the function after system modification	▪ Motor controller has been replaced ▪ L-239 was replaced by another model.	Motor controller from PI: ➢ Load the parameters from the stage database that correspond to the combination of motor controller and L-239 model. Motor controller from a third-party supplier: ➢ Check the operating parameters.
The mechanics do not move.	The cable is not connected correctly or is defective	➢ Check the connecting cable.
	Lateral forces are affecting the pusher	Lateral forces increase the friction on the internal drive components. ➢ Avoid lateral forces on the pusher of the L-239.
The mechanics do not move, but generate operating noise.	Values for the velocity, acceleration and/or load are too high	➢ Reduce the velocity. ➢ Reduce the acceleration. ➢ Reduce the load on the mechanics.
The mechanics did not stop in time and ran into the limit stop	▪ Velocity is too high (see chapter Limit Switches p. 8) ▪ Limit switch is defective ▪ Motor controller ignores the limit switch signal	1. Stop the motor. 2. Command the mechanics away from the hard stop. 3. Check the settings of the motor controller for the limit switch processing.
For L-239.50SD models: Actual position deviates from the displayed position.	The motor is overloaded by an external load torque or the mass to be driven in the case of strong acceleration or deceleration.	The motor skips steps. The information on the current position is lost without the controller detecting the state. ➢ Use a stepper motor in the application to determine the maximum velocity for a stage. ➢ Start a new reference move.

If the problem that occurred with your system is not listed in the table above or cannot be solved as described, contact our customer service department (p. 25).

9 Customer Service

For inquiries and orders, contact your PI sales engineer or send us an email (info@pi.de).

- If you have any questions concerning your system, provide the following information:
  - Product and serial numbers of all products in the system
  - Firmware version of the controller (if applicable)
  - Version of the driver or the software (if applicable)
  - Operating system on the PC (if applicable)
- If possible: Take photographs or make videos of your system that can be sent to our customer service department if requested.

The latest versions of the user manuals are available on our website (p. 2) for download.

10 Technical Data

10.1 Specifications

10.1.1 Data Table

Motion	L-239.50AD L-239.033232 L-239.035232	L-239.50SD	Unit	Tolerance
Active axis	X	X		
Travel range	52	52	mm	
Velocity	50	25	mm/s	Max.

Positioning	L-239.50AD L-239.033232 L-239.035232	L-239.50SD	Unit	Tolerance
Integrated sensor	Rotary encoder	–		
Sensor resolution	20000	–	Counts/ rev.	
Design resolution	0.05	5 (full step)	µm	Typ.
Minimum incremental motion	0.2	0.1	µm	Typ.
Unidirectional repeatability	0.2	0.1	µm	Typ.
Bidirectional repeatability	±1	±1	µm	Typ.
Reference and limit switches	L-239.50AD: Hall effect, N/C contact, 5V, TTL L-239.03x232: Hall effect, N/C contact, 5V, NPN	Hall effect, N/C contact, 5V, NPN		

Mechanical properties	L-239.50AD L-239.033232 L-239.035232	L-239.50SD	Unit	Tolerance
Guide type	Recirculating ball bearing guide	Recirculating ball bearing guide		
Drive screw type	Ball screw	Ball screw		
Drive screw pitch	1	1	mm	
Push / pull force	300	300	N	Max.
Holding force, power off	40	80		
Permissible lateral force	10	10	N	Max.

Drive properties	L-239.50AD	L-239.50SD	L-239.033232	L-239.035232	Unit	Tolerance
Motor type	ActiveDrive DC motor (PWM)	2-phase stepper motor (1)	DC motor	BLDC motor		
Operating voltage, nominal	24	24	24	24	V	Nom.
Operating voltage, max.	24	48	48	48		Max.
Step resolution	–	200	–	–	Full steps/ rev.	

Miscellaneous	L-239.50AD	L-239.50SD	L-239.033232	L-239.035232	Unit	Tolerance
Operating temperature range	5 to 40	5 to 40	5 to 40	5 to 40	°C	
Material	Aluminum, stainless steel	Aluminum, stainless steel	Aluminum, stainless steel	Aluminum, stainless steel		
Mass	1.72	1.65	1.75	1.75	kg	±5 %
Moved mass	0.155	0.155	0.155	0.155	kg	±5 %
Connector	D-sub 15 (m)	HD D-sub 26 (m)	HD D-sub 26 (m)	HD D-sub 26 (m)		
Recommended controllers/drivers	C-863 C-885 with C-863.20C885 C-884	C-663.12 C-885 with C-663.12C885 ACS modular controller	C-863 C-885 with C-863.20C885 C-884 ACS modular controller	C-891 C-885 with C-891.11C885 ACS modular controller		

10.1.2 Maximum Ratings

The linear actuator is designed for the following operating data:

Model	Maximum operating voltage ⚠	Operating frequency ⚠	Maximum power consumption ⚠
L-239.50SD	24 V	-	10 W
L-239.50AD	48 V*	-	40 W
L-239.033232	48 V*	-	40 W
L-239.035232	48 V*	-	30 W

*Not in continuous operation!

10.1.3 Ambient Conditions and Classifications

The following ambient conditions and classifications must be observed for the L-239:

Area of application	For indoor use only
Maximum altitude	2000 m
Relative humidity	Max. 80 % for temperatures up to 31 °C Linearly decreasing to 50 % at 40 °C
Storage temperature	-25 °C to 85 °C
Transport temperature	-25 °C to 85 °C
Supply fluctuations	Max. ±10 % of the nominal voltage
Degree of pollution	2
Degree of protection according to IEC 60529	IP00

10.1.4 Limit Switch Specifications

Type	Magnetic (Hall effect) sensor
Supply voltage	+5 V to +24 V
Signal output	Open collector, NPN
Signal logic	Active high: Limit switch reached: high (+5 V to + 24 V) Normal operation: low (0 V)

10.1.5 Reference Point Switch Specifications

Type	Magnetic (Hall effect) sensor
Supply voltage	+5 V to +24 V
Signal output	Open collector, NPN
Signal logic	Direction sensing via different signal levels on the left and right of the reference switch. The approximate position of the reference switch is the middle of the travel range.

10.2 Dimensions

All dimensions in mm. Note that the decimal places are separated by a comma in the drawings.

10.2.1 L-239.50SD

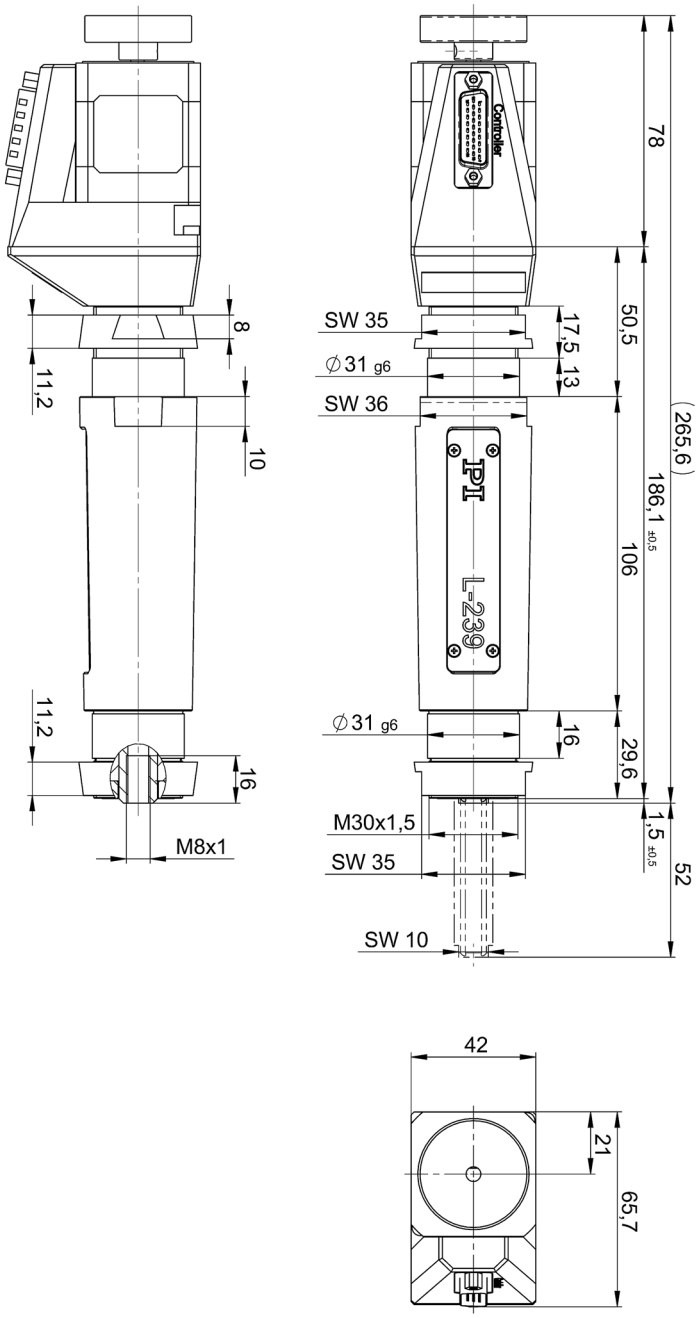

Figure 5: Dimensions

10.2.2 L-239.50AD/ L-239.033232 / L-239.035232

Electrical connections possible different, dimensions remain unchanged

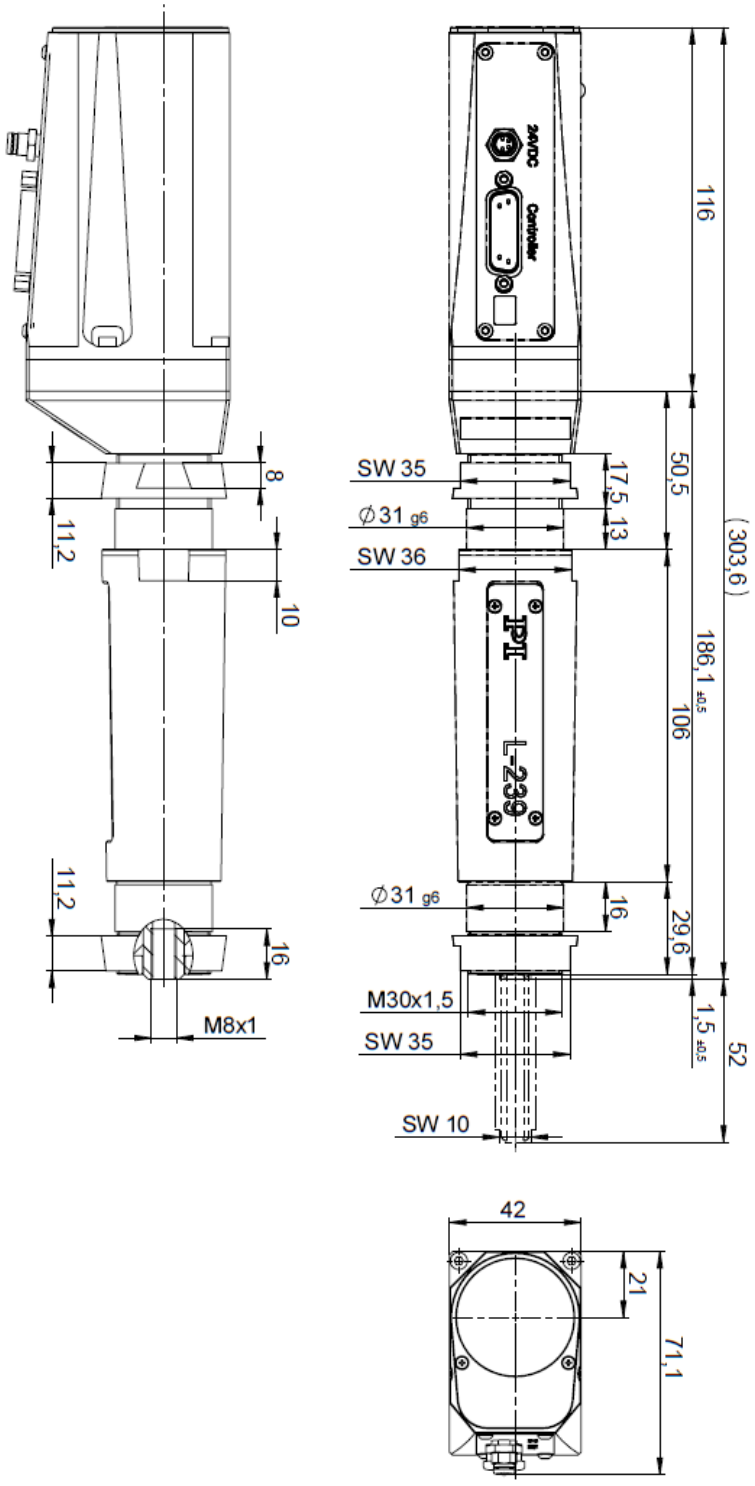

Figure 6: Dimensions

10.3 Pin Assignment

10.3.1 HD D-Sub 26 (Male)

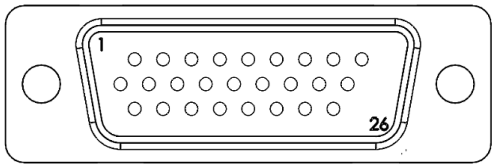

Figure 7: HD D-Sub 26 panel plug

L-239.50SD

Pin	Signal	Direction
1	Motor A+	Input
2	Motor A+	Input
3	Motor A-	Input
4	Motor A-	Input
5	Motor B+	Input
6	Motor B+	Input
7	Motor B-	Input
8	Motor B-	Input
9	-	-
10	REF	Output
11	Limit E1 (neg)	Output
12	Limit E2 (pos)	Output
13	-	-
14	-	-
15	-	-
16	-	-
17	ID	Output
18	Limit Power (5 V DC)	Input
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	GND (limit)	-
26	-	-

L-239.033232

Pin	Signal	Direction
1	Motor +	Input
2	Motor +	Input
3	Motor	Input
4	Motor	Input
5	-	-
6	-	-
7	-	-
8	-	-
9	-	-
10	REF	Output
11	Limit E1 (neg)	Output
12	Limit E2 (pos)	Output
13	-	-
14	-	-
15	-	-
16	-	-
17	ID	Output
18	Limit Power (+5 V)	Input
19	Encoder A+	Output
20	Encoder A-	Output
21	Encoder B+	Output
22	Encoder B-	Output
23	Encoder I+	Output
24	Encoder I-	Output
25	GND	-
26	Encoder Power (+5 V)	Input

L-239.035232

Pin	Signal	Direction
1	Phase 1	Input
2	Phase 1	Input
3	Phase 2	Input
4	Phase 2	Input
5	Phase 3	Input
6	Phase 3	Input
7	-	-
8	-	-
9	-	-
10	REF	Output
11	Limit E1 (neg)	Output
12	Limit E2 (pos)	Output
13	Hall 1	Output
14	Hall 2	Output
15	Hall 3	Output
16	-	-
17	ID	Output
18	REF Power (+5 V)	Input
19	Encoder A+	Output
20	Encoder A-	Output
21	Encoder B+	Output
22	Encoder B-	Output
23	Encoder I+	Output
24	Encoder I-	Output
25	GND	-
26	Encoder Power (+5 V)	Input

10.3.2 D-Sub 15 (Male)

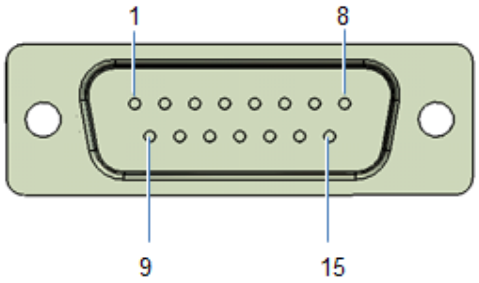

Figure 8: D-Sub 15 panel plug

Pin	Signal	Direction
1	-	-
2	Motor +	Input
3	MAGN	Input
4	Power 5 V	Input
5	Limit pos.	Output
6	ID	Output
7	Encoder A-	Output
8	Encoder B-	Output
9	Motor -	Input
10	GND	-
11	SIGN	Input
12	Limit neg.	Output
13	REF	Output
14	Encoder A+	Output
15	Encoder B+	Output

10.3.3 M8 4-pin (Male)

Connecting a power adapter is only necessary for the L-509.x0AD10 and L-509.x4AD00 models.

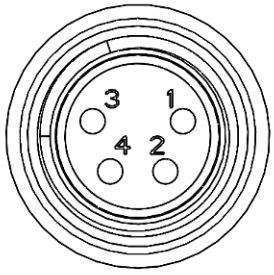

Figure 9: Power adapter connector M8, 4-pin

Pin	Signal	Direction
1	GND	GND
2	GND	GND
3	24 V DC supply voltage	Input
4	24 V DC supply voltage	Input

10.4 Tightening Torque for Screws, ISO 4762 - A2

The following tightening torques for screws according to ISO4762 (corresponds to DIN 912) - A2 may not be exceeded.

Value	Maximum tightening torque
M3	1.5 Nm
M4	2 Nm
M5	2.5 Nm
M6	3 Nm

11 Old Equipment Disposal

In accordance with EU law, electrical and electronic equipment may not be disposed of in EU member states via the municipal residual waste.

Dispose of your old equipment according to international, national, and local rules and regulations.

In order to fulfil the responsibility as the product manufacturer, PI miCos GmbH undertakes environmentally correct disposal of all old PI miCos equipment made available on the market after 13 August, 2005 without charge.

Any old PI miCos equipment can be sent free of charge to the following address:

PI miCos GmbH

Freiburger Strasse 30

79427 Eschbach, Germany

12 European Declarations of Conformity

For the L-239, declarations of conformity were issued according to the following European statutory requirements:

EMC Directive

RoHS Directive

The standards applied for certifying the conformity are listed below.

EMC: EN 61326-1

Safety: EN 61010-1

RoHS: IEC 63000