MP42E

M-126 Precision Microtranslation Stage

User Manual

Version: 3.1.0 Date: 10/23/2023

This document describes the following precision micropositioning stages:

- M-126.CG1, M-126.DG1:
  With DC gear motor, rotary encoder
- M-126.PD1, M-126.PD2:
  With ActiveDrive DC motor, rotary encoder
- M-126.2S1:
  With 2-phase stepper motor
- M-126.M0
  For manual operation

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Contents

1 About this Document

1.1 Objective and Target Group of this User Manual

This user manual contains the information necessary for using the M-126 as intended.

We assume that the user has basic knowledge of closed-loop systems, motion control concepts, and applicable safety measures.

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 to avoid the risk.

NOTICE

Dangerous situation
Failure to comply could cause damage to equipment.

➢ Precautionary measures to avoid the risk.

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
▪	List item

Symbol/ Label	Meaning
p. 5	Cross-reference to page 5
RS-232	Labeling of an operating element on the product (example: socket of the RS-232 interface)
	Warning sign on the product which refers to detailed information in this manual.

1.3 Figures

For better understandability, the colors, proportions, and degree of detail in illustrations can deviate from the actual circumstances. Photographic illustrations may also differ and must not be seen as guaranteed properties.

1.4 Other Applicable Documents

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

Product	Document
Positioners with Electric Motors	MP119EK Short Instructions
C-863.12 Mercury Controller	MS251 User Manual
C-884.xDC DC Motor Controller	MS243 User Manual
C-663.12 Mercury Step Stepper Motor Controller	MS241 User Manual

1.5 Downloading Manuals

INFORMATION

If a manual is missing or problems occur with downloading:

➢ Contact our customer service department (p. 29).

Downloading manuals

1. Open the website **www.pi.ws**.
2. Search the website for the product number (e.g., M-126).
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 ***ADD TO LIST*** button for the desired manual and then click ***REQUEST***.
6. Fill out the request form and click ***SEND REQUEST***.

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

2 Safety

2.1 Intended Use

The M-126 is a laboratory device as defined by DIN EN 61010. It is intended for indoor use and use in an environment that is free of dirt, oil and lubricants.

In accordance with its design, the M-126 is intended for single-axis positioning, adjusting and shifting of loads at different velocities. The M-126 is **not** intended for applications in areas where failure could lead to considerable risk to people or the environment.

The M-126 is intended for horizontal or vertical mounting. For the load limits with vertical mounting, see "General Notes on Installation" (p. 15).

It is only possible to use the M-126 as intended when completely mounted and connected.

The M-126 must be operated with a suitable controller (p. 10). The controller is not included in the scope of delivery of the M-126.

2.2 General Safety Instructions

The M-126 is built according to state-of-the-art technology and recognized safety standards. Improper use of the M-126 may result in personal injury and/or damage to the M-126.

- Use the M-126 for its intended purpose only, and only when it is in perfect condition.
- Read the user manual.
- Immediately eliminate any faults and malfunctions that are likely to affect safety.

The operator is responsible for installing and operating the M-126 correctly.

2.3 Organizational Measures

User manual

- Always keep this user manual together with the M-126. The latest versions of the user manuals are available for download on our website (p. 2).
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- If you give the M-126 to other users, include this user manual as well as all other relevant information provided by the manufacturer.
- Do the work only if the user manual is complete. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.

- Install and operate the M-126 only after you have read and understood this user manual.

Personnel qualification

The M-126 may only be installed, started, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

2.4 European Declarations of Conformity

For the M-126, declarations of conformity were issued according to the following European statutory requirements:

EMC Directive

RoHS Directive

The standards applied for certifying conformity are listed below.

EMC: EN 61326-1

Safety: EN 61010-1

RoHS: EN IEC 63000

3 Product Description

3.1 Model Overview

Product number	Description
M-126.CG1	Microtranslation stage, 25 mm travel range, compact DC gear motor
M-126.DG1	Microtranslation stage, 25 mm travel range, DC gear motor
M-126.PD1	Microtranslation stage, 25 mm travel range, ActiveDrive DC motor, including 24 V power adapter
M-126.PD2	Microtranslation stage, 20 mm travel range, ActiveDrive DC motor, ball screw, including 24 V power adapter
M-126.2S1	Microtranslation stage, 25 mm travel range, 2-phase stepper motor
M-126.M0	Microtranslation stage, 25 mm travel range, manual

3.2 Product View

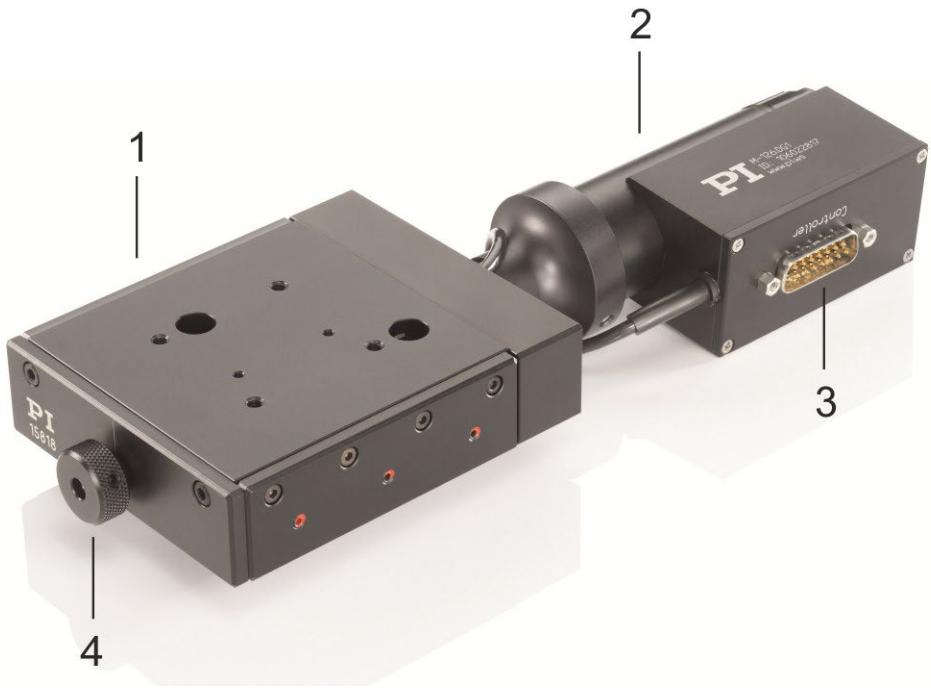


Figure 1: Elements of the M-126 with electric drive, example: M-126.DG1

1. Base body with platform
2. Motor
3. Connectors (controller, for M-126.PDx additionally: supply voltage)
4. Rotary knob of the drive screw for moving the platform by hand

3.3 Direction of Motion

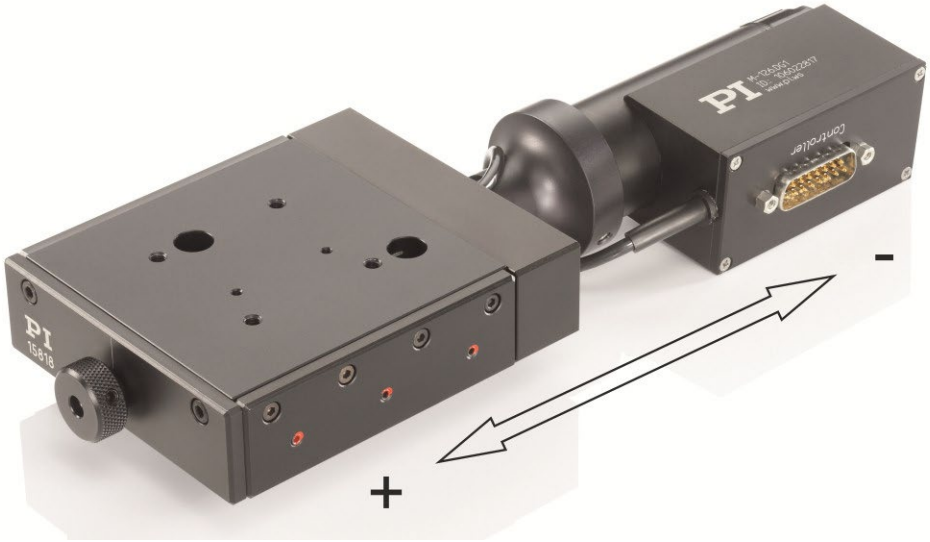


Figure 2: Direction of motion of the M-126

Arrow direction: Direction of motion on positive (+) and negative (-) command

3.4 Product Labeling

Figure 3: Position of the product labeling

1. Manufacturer's logo
2. Product name, serial number, Manufacturer's address (website)
3. Connection label

3.5 Scope of Delivery

The following items are supplied with the M-126 according to your order:

M-126.CG1, .DG1, .PDx models

Item number	Component
000011348	Screw set for mounting the positioner and the load ▪ 6 socket head screws, M4×18 ISO 4762 ▪ Hex key, AF 3
MP119EK	Short instructions for positioners with electric motors

Additionally for the M-126.PDx models:

Item number	Component
C-501.24050H	Wide input range power supply 24 V DC / 50 W

Item number	Component
3763	Power cord
K050B0002	Adapter from 5.5 mm x 2.1 mm barrel connector to mini XLR3 (f) for the power adapter connector

M-126.M0 model

Item number	Component
2490	Screw set for mounting the positioner and the load ▪ 4 socket head screws, M4×20 ISO 4762 ▪ Hex key, AF 3

3.6 Optional Accessories

The following articles are not in the scope of delivery of the M-126 and must be ordered separately, if required.

Order number	Description
M-126.80	Adapter plate for mounting M-126 stages onto honeycomb platforms (metric and inches)
M-125.90	Vertical mounting bracket for M-126

To order, contact our customer service department (p. 29).

3.7 Suitable Controllers

The version of the M-126 with electric drive must be connected to a suitable controller. The following controllers from PI are suitable for operating the M-126:

Models	Controller
M-126.XG1, M-126.PDx	C-863, C-884
M-126.2S1	C-663

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

Note that the cables required for connecting the M-126 to the controller and the required adapter must be ordered separately.

To order, contact our customer service department (p. 29).

3.8 Technical Features

3.8.1 Encoder

The M-126.XG1 and M-126.PDs models are equipped with an incremental rotary encoder.

A rotary encoder is implemented at a rotating point in the drivetrain, e.g., the motor shaft. The controller counts the encoder signals, (pulses), in order to determine the relative position.

3.8.2 Limit switches

The M-126.XG1 and M-126.PDx models are 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 positioner runs into the hard stop.

Refer to "Limit Switch Specifications" (p. 33) for further information.

3.8.3 Reference Switch

The M-126.XG1 and M-126.PDx models are equipped with a direction-sensing reference switch positioned at approx. the midpoint of the travel range. This sensor sends a TTL signal that indicates whether the positioner is on the positive or negative side of the reference switch.

The commands that use the reference signal are described in the user manual for the controller.

3.8.4 Integrated PWM Amplifier

The M-126.PDx models are equipped with a PWM amplifier ("ActiveDrive concept"). The PWM amplifier only receives the PWM 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 M-126 with care.
2. Compare the contents with the scope of delivery according to the contract and the delivery note.
3. Inspect the contents for signs of damage. If any parts are damaged or missing, contact our customer service department immediately (p. 29).
4. Keep all packaging materials in case the product needs to be returned.

5 Installing

5.1 General Notes on Installation

NOTICE

Unwanted changes in position when mounted vertically!
If the load exceeds the holding force of the M-126 when the drive is mounted vertically, unwanted changes in the position of the platform will occur. Unintentional changes in the position of the platform can damage the drive, the load or the surroundings.

- ➢ If the M-126 is mounted vertically, make sure that the installed load is lower than the holding force of the drive.

NOTICE

Protruding screw heads!
Protruding screw heads can damage the M-126.

- ➢ Make sure that the screw heads do not protrude from countersunk holes so that they do not interfere with the motion.

NOTICE

Cable break!
A cable break leads to failure of the M-126.

- ➢ Install the M-126 so that the cable is not bent too strongly or crushed.

NOTICE

Damage to the drive screw by foreign bodies!
Foreign bodies and dirt penetrating the open drive screw of the M-126 could damage the drive screw and interfere with platform's motion.

- ➢ Install the M-126 so that foreign bodies and dirt cannot penetrate. If necessary, install appropriate covers.
- ➢ Remove any foreign bodies and heavy contamination immediately.

In addition, the following applies for models with electric drive:

NOTICE

Damage if the wrong controller is connected!
Connecting a M-126 to an unsuitable controller can damage the M-126 or controller.

- Connect a M-126 with DC motor to a DC motor controller only.
- Connect a M-126 with stepper motor to a stepper motor controller only.
- If you are using controllers and software from other manufacturers, check their technical data to make sure that they are suitable before starting and operating the M-126.

The base body (with platform) and motor (with connectors) move **together** when the M-126 is operating. Make sure that the M-126 has enough room to move and the connecting cables are long enough. If necessary, turn the connectors of the M-126 to a position suitable for your application.

5.2 Turning the Connectors of the M-126

Requirements

- ✓ You have read and understood the General Notes on Installation (p. 15).

Tools and Accessories

- Hex key, AF 3 included in the scope of delivery (p. 9)

Turning the connectors of the M-126

1. Use the hex key to loosen the two socket head screws that fix the motor housing.

2. Turn the motor housing with the connections by hand to the desired orientation.
3. Tighten both socket head screws to fix the motor housing completely.
4. Check that the motor housing is sitting firmly on the M-126.

5.3 Mounting the M-126 onto a Surface

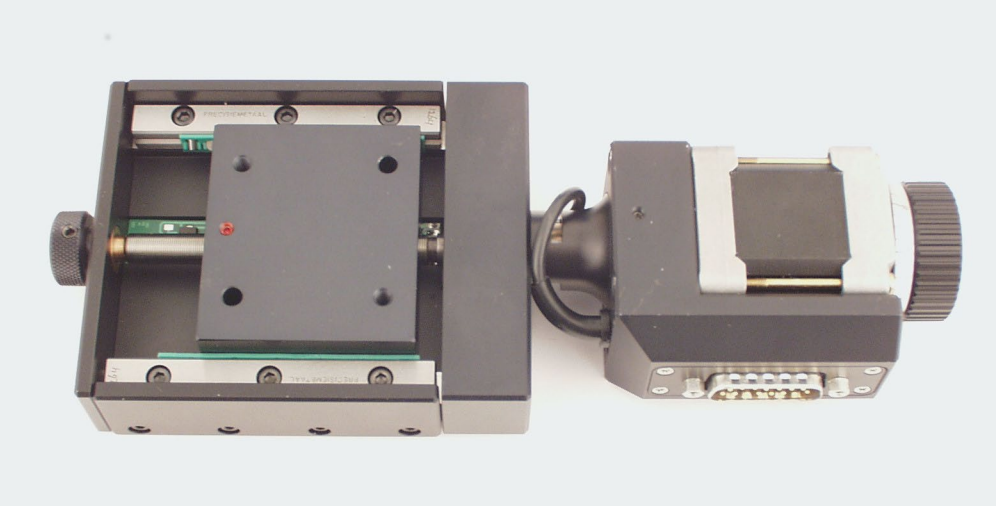


Figure 4: Mounting plate on the bottom of the M-126

There is a mounting plate with two threaded holes (mounting holes) on the bottom of the M-126. The M-126 is mounted on and underlying surface via this plate. Mounting is from above. Access to the mounting holes is via two through-holes in the M-126's platform.

Requirements

- ✓ You have read and understood the General Notes on Installation (p. 15).
- ✓ You have provided a suitable underlying surface (see "Dimensions" (p. 34) for the required position of the holes for the screws):
  - Two M4 threaded holes with sufficient depth are provided
    - Models with electric drive: Depth at least 18 mm
    - Model with manual drive: Depth at least 20 mm
  - For applications with large temperature fluctuations: The surface should have the same thermal expansion properties as the M-126 (e.g., underlying surface made of aluminum).

In addition, for models with electric drive:

- ✓ If necessary, the motor housing and connectors of the M-126 were brought into a suitable position (p. 16) for your application.
- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and Accessories

- 2 M4 socket head screws, included in the scope of delivery (p. 9)
- Hex key, AF 3, included in the scope of delivery

Mounting the M-126 onto an underlying surface

1. If necessary: Align the M-126's base body so that the through-holes in the platform (see fig.) are exactly above the mounting holes in the mounting plate.

   Possible measures:

   – Starting and operating the M-126 (p. 21) temporarily and commanding the motion platform to a suitable position
   – Moving the platform with the help of the drive screw's rotary knob

2. Align the M-126 on the underlying surface so that the mounting holes in the M-126 and underlying surface are in line.
3. Tighten the screws in the mounting holes from above completely.
4. Check that the M-126 is sitting firmly on the underlying surface.

5.4 Fixing the Load to the M-126

NOTICE

Impermissibly high load on the positioner!
An impermissible high load impairs the motion of the motion platform and can damage the positioner.

➢ For mounting type and mass of the load, pay attention to the maximum permissible forces that are allowed to act on the motion platform according to the specification (p. 31).

Requirements

✓ You have read and understood the general notes on installation (p. 15).

✓ You have mounted the M-126 onto an underlying surface (p. 17) properly.

- ✓ You have prepared the load so that it can be fixed to the mounting holes in the M-126's platform:
  - The gap between the center of gravity of the load and the center of the platform is as small as possible in all directions.
  - At least two points are provided for fixing the load on the platform (ideally: three fixing points).

In addition, for models with electric drive:

- ✓ The M-126 is **not** connected to the controller.
- ✓ M-126.PDx: The M-126 is **not** connected to the power adapter.

Tools and Accessories

- At least 2 socket head screws, included in the scope of delivery (p. 9)
- Hex key, AF 3, included in the scope of delivery

Fixing the load

1. Align the load so that the selected mounting holes in the platform can be used to fix it.
2. Use the screws to fix the load on the selected mounting holes in the platform.
3. Check that the load is sitting firmly on the platform of the M-126.

5.5 Connecting the M-126 to the Controller

Connecting a motor cable is only necessary for models with electric drive.

Requirements

- ✓ You have read and understood the general notes on installation (p. 15).
- ✓ You have installed the controller.
- ✓ The controller is switched off.

Tools and accessories

- Motor cable, suitable for the controller (p. 10)
- Suitable tools for tightening the screws to the connections

Connecting the M-126 to the controller

1. Connect the connector (f) of the motor cable to the D-sub 15 panel plug of the M-126.
2. Connect the other end of the motor cable to the controller's drive connector.
3. Use the integrated screws to secure the connections against accidental disconnection.

5.6 Connecting the Power Supply to the M-126

Connecting a power adapter is only necessary for the M-126.PDx models.

Requirements

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

Tools and accessories

- Supplied components:
  - 24 V wide-range-input power supply
  - Adapter for the power supply connection; barrel connector 5.5 mm x 2.1 mm to Mini XLR3 (f)
  - Power cord
- If one of the components supplied for connection to the power source has to be replaced: Use a sufficiently measured and certified replacement component. Details:
  - Power supply: Output 24 V DC, maximum output current 2 A
  - Power cord: Three wires, cable cross section at least 3 x 0.75 mm^2 (3 x AWG18), maximum length 2 m

Connecting the power supply to the M-126

➢ Connect the Mini XLR3 connector (f) of the adapter to the Mini XLR3 panel plug of the M-126.

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

➢ Connect the power cord to the power supply.

6 Startup

6.1 General Notes on Startup

The notes listed here and the startup procedure described below apply to models with electric drive.

NOTICE

Operating voltage excessively high or incorrectly connected!

Excessively high or incorrectly connected operating voltages could cause damage to the M-126.

- Do **not** exceed the operating voltage range (p. 32) specified for the M-126.
- Operate the M-126 only when the operating voltage is properly connected; see "Pin Assignment" (p. 41).

NOTICE

Unintentional motion!

The M-126 may move unintentionally when connecting it to the controller. Faulty software and incorrect operation of the software may also cause unintended movements.

- Do not place any objects in areas where they can be caught by moving parts.
- Before connecting the M-126, check whether a macro is defined as the startup macro in the controller and cancel the selection of the startup macro if necessary.

6.2 Starting and Operating the M-126

Requirements

- ✓ You have read and understood the General Notes on Startup (p. 21).
- ✓ You have installed (p. 15) the M-126 correctly.
- ✓ You have connected (p. 19) the M-126 with the controller properly.
- ✓ You have read and understood the user manual for the controller.
- ✓ The required PC software has been installed.
- ✓ You have read and understood the manual for the PC software.

Starting and operating the M-126

1. M-126.PDx models only: Connect the power adapter's cord to the power socket.
2. Start the controller (refer to the user manual for the controller).

   Configure the controller during startup using the PC software for the M-126 used (see the user manual for the controller, and the PC software):

   – If you use a PI controller: Select the correct entry from the positioner database that fits (p. 22) the model of the M-126 exactly.

   – If you use a controller from another manufacturer: Enter the parameters in the corresponding PC software that exactly fit the M-126 model.
3. Start a few motion cycles for testing purposes (see user manual of the controller).

M-126 Entries in the PI Positioner Database

For PI controllers, you can select the connected positioner from a positioner database in the corresponding PC software. The appropriate operating parameters are loaded into the controller. You can find a detailed description in the user manual for the controller.

If you are using a motor controller from a third-party supplier, it may be necessary to enter operating parameters to adapt it to the M-126.

Operating parameters for the M-126 with DC gear motor

Positioner	M-126.CG1	M-126.DG1	Unit
Drive screw pitch	0.5	0.5	mm
Gear ratio	16807:243	2401:81	

Motor	M-126.CG1	M-126.DG1	Unit
Nominal voltage	12	12	V DC
Nominal current, RMS	0.32	0.49	A
Resistance per phase	19.8	9.7	Ω
Inductance per phase	0.25	0.4	mH
Max. velocity	10000	8500	1/min

Encoder	M-126.CG1	M-126.DG1	Unit
Output signal	A/B	A/B	
Supply voltage	5 ±10 %	5 ±10 %	V
Current consumption	12	17	mA

Encoder	M-126.CG1	M-126.DG1	Unit
Output frequency	0.3	0.1	MHz
Resolution (quadruple evaluated)	2048	2000	Cts./rev.

Limit switches	M-126.CG1 / M-126.DG1	Unit
Supply voltage	5	V
Current consumption	80	mA
Logic	Open collector with pull-up to 5 V	
Position	Negative limit switch position on the connector side, reference edge in the middle of the travel range, positive limit switch position opposite the negative limit switch	

Operating parameters for the M-126 with ActiveDrive DC motor

Positioner	M-126.PD1 / M-126.PD2	Unit
Drive screw pitch	0.5	mm

Motor	M-126.PD1 / M-126.PD2	Unit
Nominal voltage	24	V DC

Encoder	M-126.PD1 / M-126.PD2	Unit
Output signal	A/B	
Supply voltage	5 ±10 %	V
Current consumption	57	mA
Output frequency	0.1	MHz
Resolution (quadruple evaluated)	4000	Cts./rev.

Limit switches	M-126.PD1 / M-126.PD2	Unit
Supply voltage	5	V
Current consumption	80	mA

Limit switches	M-126.PD1 / M-126.PD2	Unit
Logic	Open collector with pull-up to 5 V	
Position	Negative limit switch position on the connector side, reference edge in the middle of the travel range, positive limit switch position opposite the negative limit switch	

Operating parameters for the M-126 with 2-phase stepper motor

Positioner	M-126.2S1	Unit
Drive screw pitch	0.5	mm

Motor	M-126.2S1	Unit
Nominal voltage	24	V DC
Nominal current, RMS	0.85	A
Resistance per phase	6.6 ±15 %	Ω
Inductance per phase	20.8 ±20 %	mH
Full step angle	0.9	°
Number of full steps per revolution	400	
Holding torque	0.305	Nm

Limit switches	M-126.2S1	Unit
Supply voltage	5	V
Current consumption	80	mA
Logic	Open collector with pull-up to 5 V	
Position	Negative limit switch position on the connector side, reference edge in the middle of the travel range, positive limit switch position opposite the negative limit switch	

7 Maintenance

7.1 General Notes on Maintenance

NOTICE

Damage due to improper maintenance!
Improper maintenance could lead to misalignment and failure of the M-126.

➢ Loosen screws only according to the instructions in this manual or the instructions of our customer service department (p. 29).

7.2 Doing a Maintenance Run

Depending on the operating conditions and period of use of the M-126, perform a maintenance run at regular intervals.

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

Doing a maintenance run

➢ Perform one or several runs over the entire travel range to ensure that the existing lubricant is evenly distributed.

7.3 Cleaning and Relubricating the Drive Screw

At least every two years, perform the following maintenance work on the drive spindle of the M-126:

- Cleaning
- Relubrication

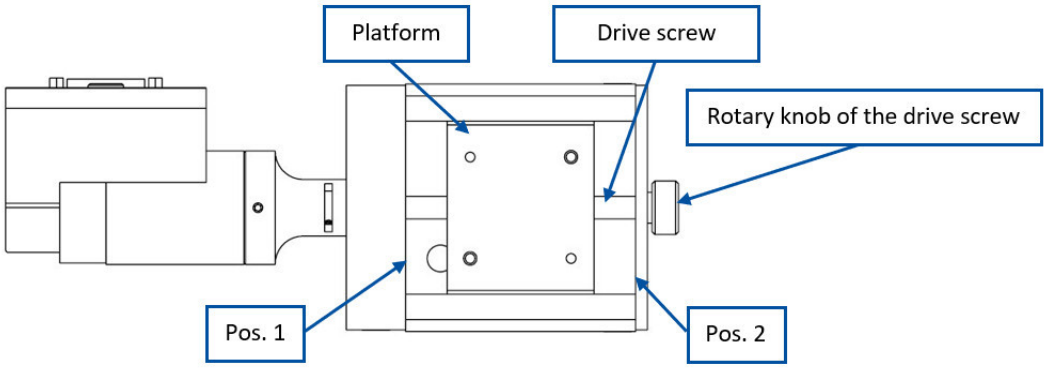
Requirements

✓ You have disconnected the M-126 from the controller.

Tools and accessories

- Lint-free cloth
- Clean brush
- Cleaning agent: brake cleaner, benzine, or acetone
- Lubricant: Klüber Isoflex LDS 18 Special A (PI article number: K492000024)

Cleaning and relubricating the drive screw



1. Clean the drive screw with the cloth that has been dampened with the cleaning agent:
   a) Use the rotary knob to move the drive screw to the positive end of the travel range (pos.2).
   b) Clean the drive screw to the left of the platform.
   c) Move the drive screw to the negative end of the travel range (pos.1).
   d) Clean the drive screw to the right of the platform.

   Perform steps a to d until there is no more lubricant on the drive screw.
2. Relubricate the drive screw with the brush:
   a) Use the rotary knob to move the drive screw to the positive end of the travel range (pos.2).
   b) Apply a small amount of lubricant to the drive screw to the left of the platform.
   c) Move the drive screw 6 to 8 times over the entire travel range (pos. 1 to pos. 2) to distribute the lubricant.

   If necessary: Perform steps a to c until there is sufficient lubrication.
3. Reconnect the M-126 to the controller.

7.4 Cleaning the M-126

Requirements

✓ You have disconnected the M-126 from the controller.

Cleaning the positioner

➢ When necessary, clean the surface of the M-126 with a cloth dampened lightly with a mild cleanser or disinfectant.

8 Troubleshooting

8.1 Possible Causes and Correction

Problem	Possible causes	Solution
Reduced positioning accuracy	When the M-126 is mounted vertically: Load exceeds the holding force of the drive	➢ Do **not** exceed the maximum permissible loads according to the specifications (p. 31).
	Increased wear due to small motion over a long period of time	➢ Do a maintenance run over the entire travel range.
Function impairment after system modification	▪ Controller was replaced. ▪ M-126 was replaced with another model.	Controller from PI: ➢ Load the parameters from the positioner database that correspond to the combination of controller and M-126 model. Controller from a third-party supplier: ➢ Check the operating parameters.
Mechanics do not move; no operating noise can be heard.	Controller and/or power adapter are connected incorrectly or defective.	➢ Check all connecting cables. ➢ Check the controller. ➢ If applicable: Check the positioner's power adapter.
	When a PI controller is used: Axis motion error.	Motion error = The difference between the current position and the commanded position exceeds the specified maximum value in closed-loop operation. Motion errors can be caused for example, by malfunctions of the drive or the position sensor of the positioner. 1. Read out the error code of the controller in the PC software. If there is a motion error, error code -1024 is output. 2. Check your system and make sure that all axes can be moved safely. 3. Switch the servo mode on in the PC Software for the affected axis. Refer to the user manual for the controller for details.

Problem	Possible causes	Solution
	Platform has triggered the limit switch.	If you use a controller from PI: 1. Switch the servo mode on in the PC software for the affected axis again. 2. Command an axis motion away from the limit switch in the PC software.
In the case of models with a stepper motor: The mechanics does not move any more but produces an operating noise.	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. ➢ Determine the maximum velocity for a positioner with stepper motor in the application.

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. 29)).

9 Customer Service Department

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

- If you have 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)
  - PC operating system (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 for download on our website (p. 2).

10 Technical Data

Subject to change. You can find the latest product specifications on the product web page at www.pi.ws (https://www.pi.ws).

10.1 Specifications

10.1.1 Data Table

	M-126.CG1	M-126.DG1	M-126.PD1	M-126.PD2	M-126.2S1	M-126.M0	Unit
Active axes	X	X	X	X	X	X	

Motion and positioning	M-126.CG1	M-126.DG1	M-126.PD1	M-126.PD2	M-126.2S1	M-126.M0	Unit
Travel range	25	25	25	20	25	25	mm
Integrated sensor	Rotary encoder	Rotary encoder	Rotary encoder	Rotary encoder	–	–	
Sensor resolution	2048	2000	4000	4000	–	–	Cts./rev.
Design resolution	0.0035	0.0085	0.125	0.25	1.25	–	µm
Minimum incremental motion	0.1	0.1	0.25	0.5	0.1	1	µm
Unidirectional repeatability	0.2	0.1	0.1	0.3	0.1	–	µm
Bidirectional repeatability	2	1	1	1	1	–	µm
Accuracy	2.5	2.5	2.5	2.5	2.5	–	µm
Pitch / yaw	±50	±50	±50	±50	±50	±50	µrad
Straightness / flatness	2	2	2	2	2	2	µm
Max. velocity	0.7	1.5	15*	50	6	–	mm/s
Reference switch repeatability	1	1	1	1	1	–	µm

Mechanical properties	M-126.CG1	M-126.DG1	M-126.PD1	M-126.PD2	M-126.2S1	M-126.M0	Unit
Drive screw	Leadscrew	Leadscrew	Leadscrew	Ball screw	Leadscrew	Leadscrew	
Drive screw pitch	0.5	0.5	0.5	1	0.5	0.5	mm
Gear ratio	16807:243	2401:81	–	–	–	–	
Motor resolution	–	–	–	–	400	–	Full steps/rev.
Max. load capacity	200	200	200	200	200	200	N
Max. push/pull force	40 / 40	50 / 50	50 / 50	50 / 50	40 / 40	50 / 50	N
Max. lateral force	100	100	100	100	100	100	N

Drive properties	M-126.CG1	M-126.DG1	M-126.PD1	M-126.PD2	M-126.2S1	M-126.M0	Unit
Motor type	DC gear motor	DC gear motor	DC motor, ActiveDrive	DC motor, ActiveDrive	2-phase stepper motor	–	
Operating Voltage	0 to ±12	0 to ±12	24 (PWM)	24 (PWM)	24	–	V
Max. nominal current per phase	–	–	–	–	0.85	–	A
Motor power	2	3	30	30	–	–	W
Reference and limit switches	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	–	

Miscellaneous	M-126.CG1	M-126.DG1	M-126.PD1	M-126.PD2	M-126.2S1	M-126.M0	Unit
Operating temperature range	-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65	°C
Material	Aluminum, steel	Aluminum, steel	Aluminum, steel	Aluminum, steel	Aluminum, steel	Aluminum, steel	
Mass	0.8	0.9	0.9	0.9	1	0.6	kg
Recommended controllers / drivers	C-863 (1 axis), C-884 (4/ 6 axes)	C-863 (1 axis), C-884 (4/ 6 axes)	C-863 (1 axis), C-884 (4/ 6 axes)	C-863 (1 axis), C-884 (4/ 6 axes)	C-663 (1 axis)	–	

* Max. recommended velocity

10.1.2 Maximum Ratings

The M-126 positioners are designed for the following operating data:

Device	Maximum operating voltage ⚠	Operating frequency ⚠	Maximum power consumption ⚠
M-126.CG1	12 V	0 Hz	2 W
M-126.DG1	12 V	0 Hz	3 W
M-126.PD1	24 V	0 Hz	30 W
M-126.PD2	24 V	0 Hz	30 W
M-126.2S1	24 V	0 Hz	10 W

10.1.3 Ambient Conditions and Classifications

Pay attention to the following ambient conditions and classifications for the M-126:

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	-20 °C to 80 °C
Transport temperature	-20 °C to 80 °C
Supply fluctuations	Max. ±10 % of the nominal voltage
Degree of pollution	2
Degree of protection according to IEC 60529	IP40

10.1.4 Limit Switch Specifications

Type	Magnetic (Hall effect) sensor
Supply voltage	+5 V/ground
Signal output	TTL level
Signal logic	The signal level changes when passing the limit switch. The signal logic depends on the model type: ▪ Models with DC motor: **active high**. That means: – Normal motor operation: low (0 V) – Limit switch reached: high (+5 V)

	▪ Models with stepper motor: **active low**. That means: – Normal motor operation: high (+5 V) – Limit switch reached: low (0 V)

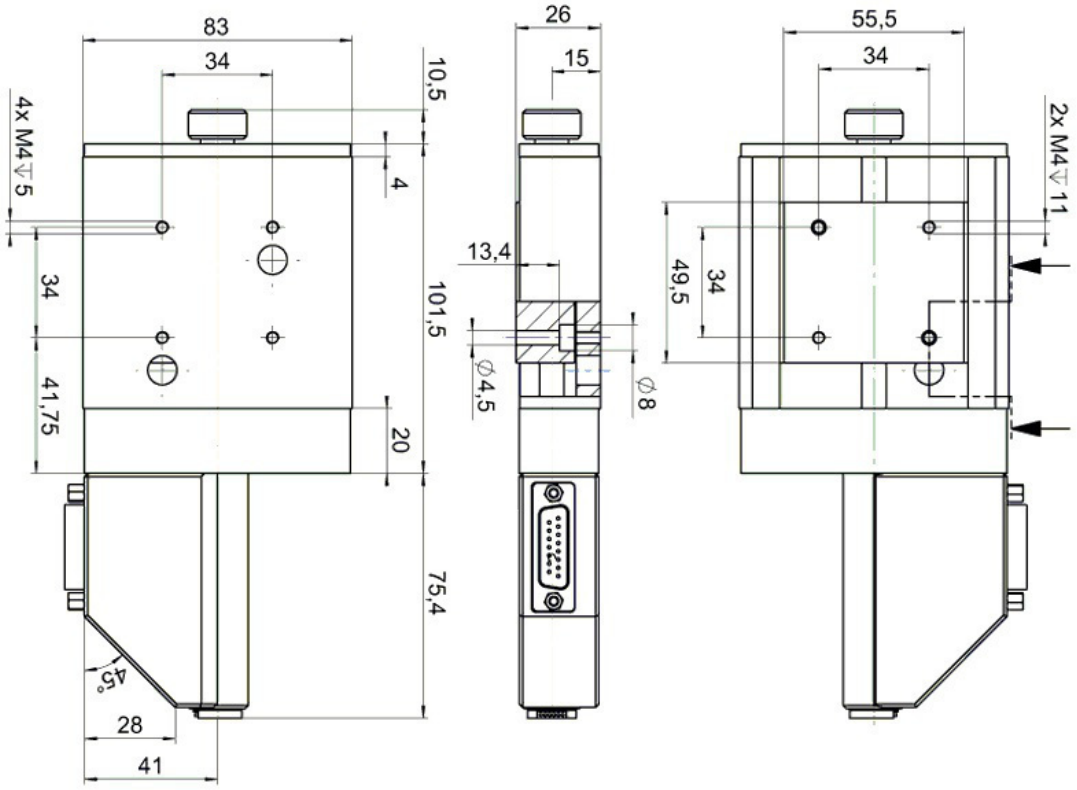
10.1.5 Reference Switch Specifications

Type	Magnetic (Hall effect) sensor
Supply voltage	+5 V/GND
Signal output	TTL level
Signal logic	Direction sensing by means of different signal levels on the left- and right-hand side of the reference switch: The signal level changes from 0 to +5 V when the reference switch is passed.

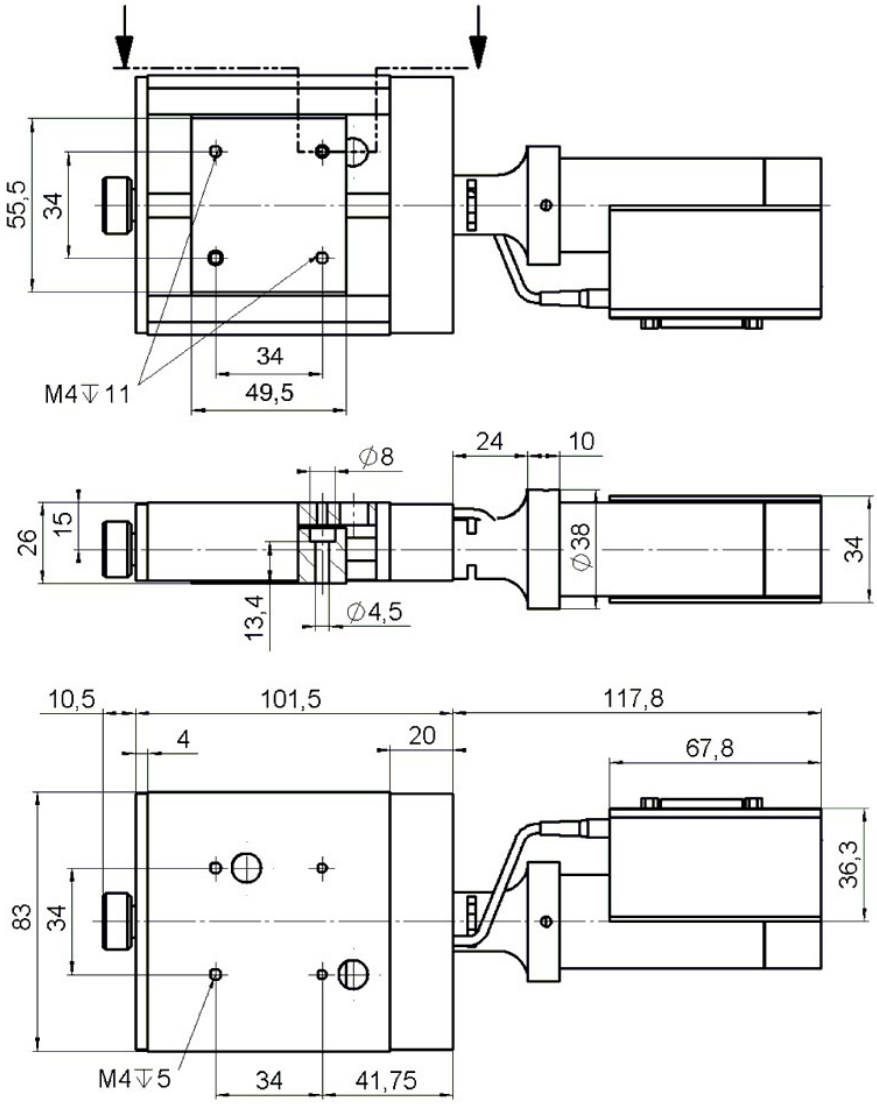
10.2 Dimensions

10.2.1 M-126

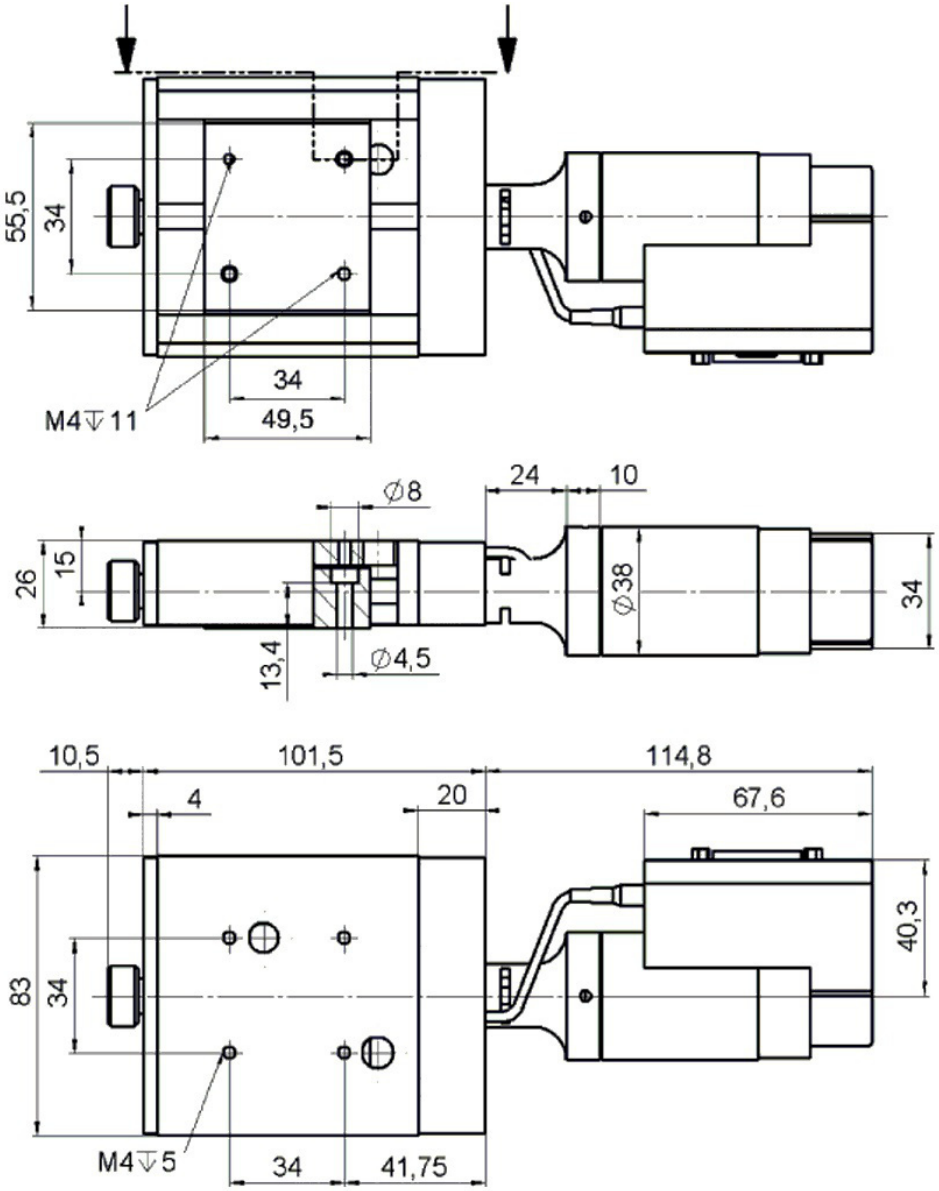
All dimensions in mm. Note that a comma is used in the drawings instead of a decimal point.



M-126.CG1


55,5
34
34
49,5
M4↧11
⌀8
24
10
26
15
13,4
⌀4,5
⌀38
34
10,5
101,5
117,8
4
20
67,8
83
34
36,3
M4↧5
34
41,75

M-126.DG1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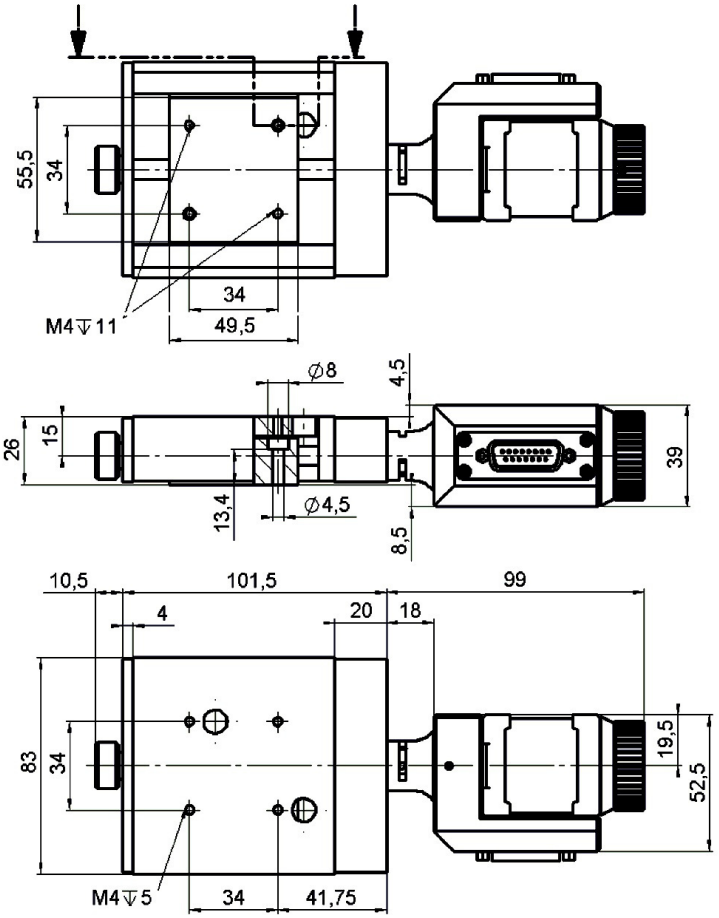
34
34
49,5
M4↧11
Ø8
24
10
26
15
Ø38
34
13,4
Ø4,5
10,5
101,5
114,8
4
20
67,6
83
34
40,3
M4↧5
34
41,75

M-126.PDx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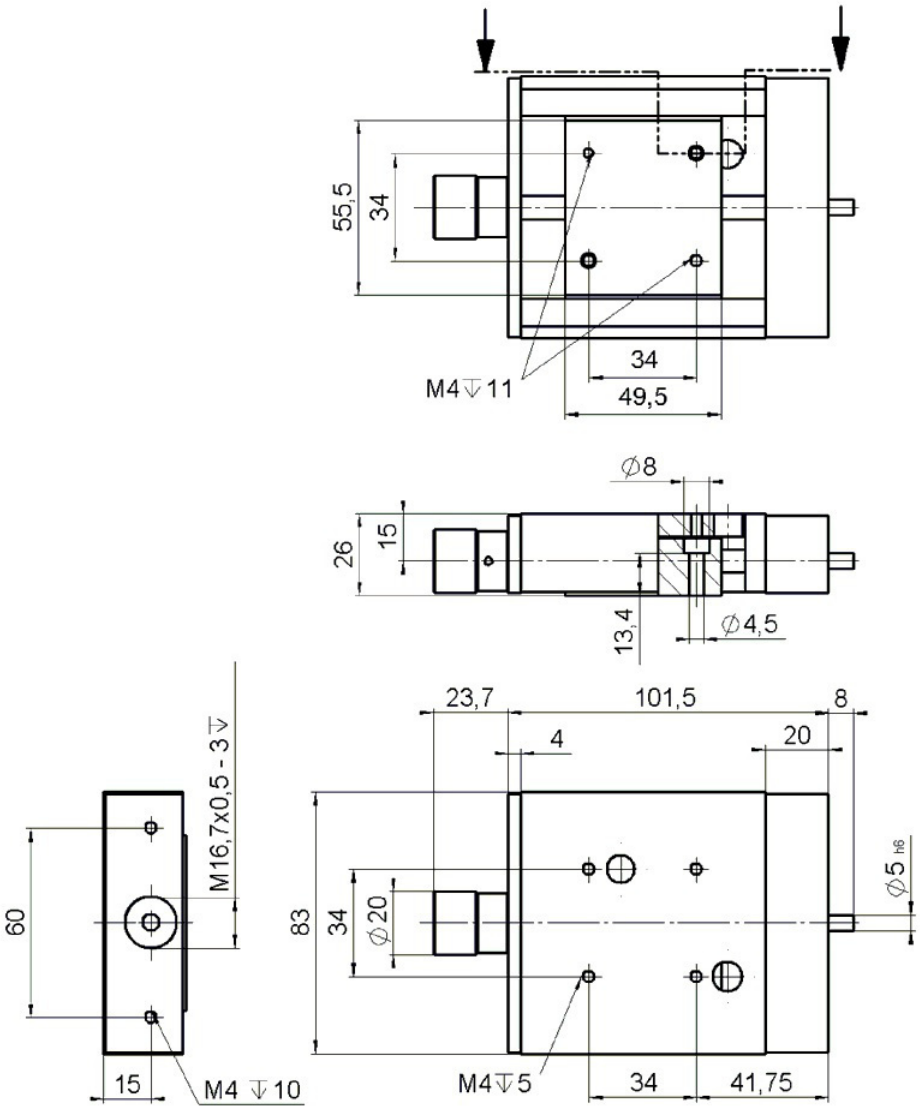
34
49,5
M4↧11
⌀8
4,5
26
15
39
13,4
⌀4,5
8,5
10,5
101,5
99
4
20
18
83
34
19,5
52,5
M4↧5
34
41,75

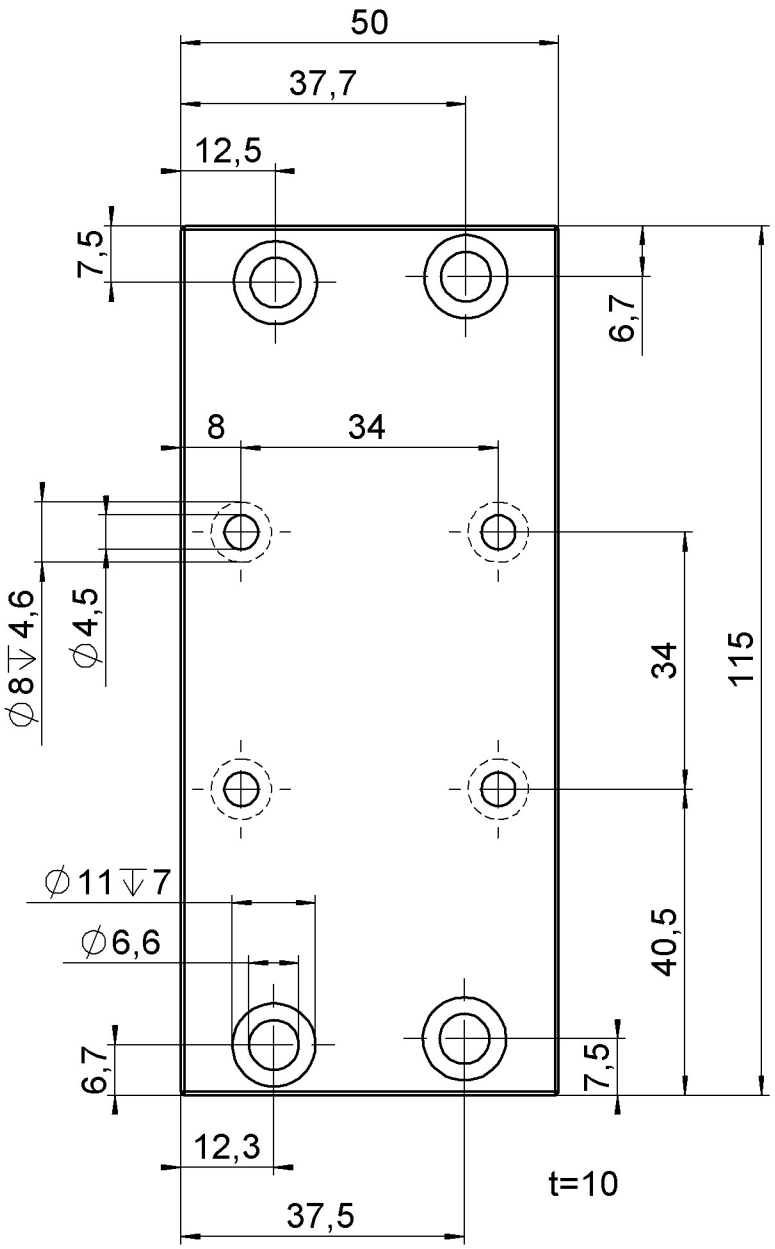
M-126.2S1


55,5
34
34
49,5
M4↧11
⌀8
26
15
13,4
⌀4,5
23,7
101,5
8
4
20
M16,7x0,5 - 3↧
60
83
34
⌀20
⌀5 h6
15
M4 ↧10
M4↧5
34
41,75

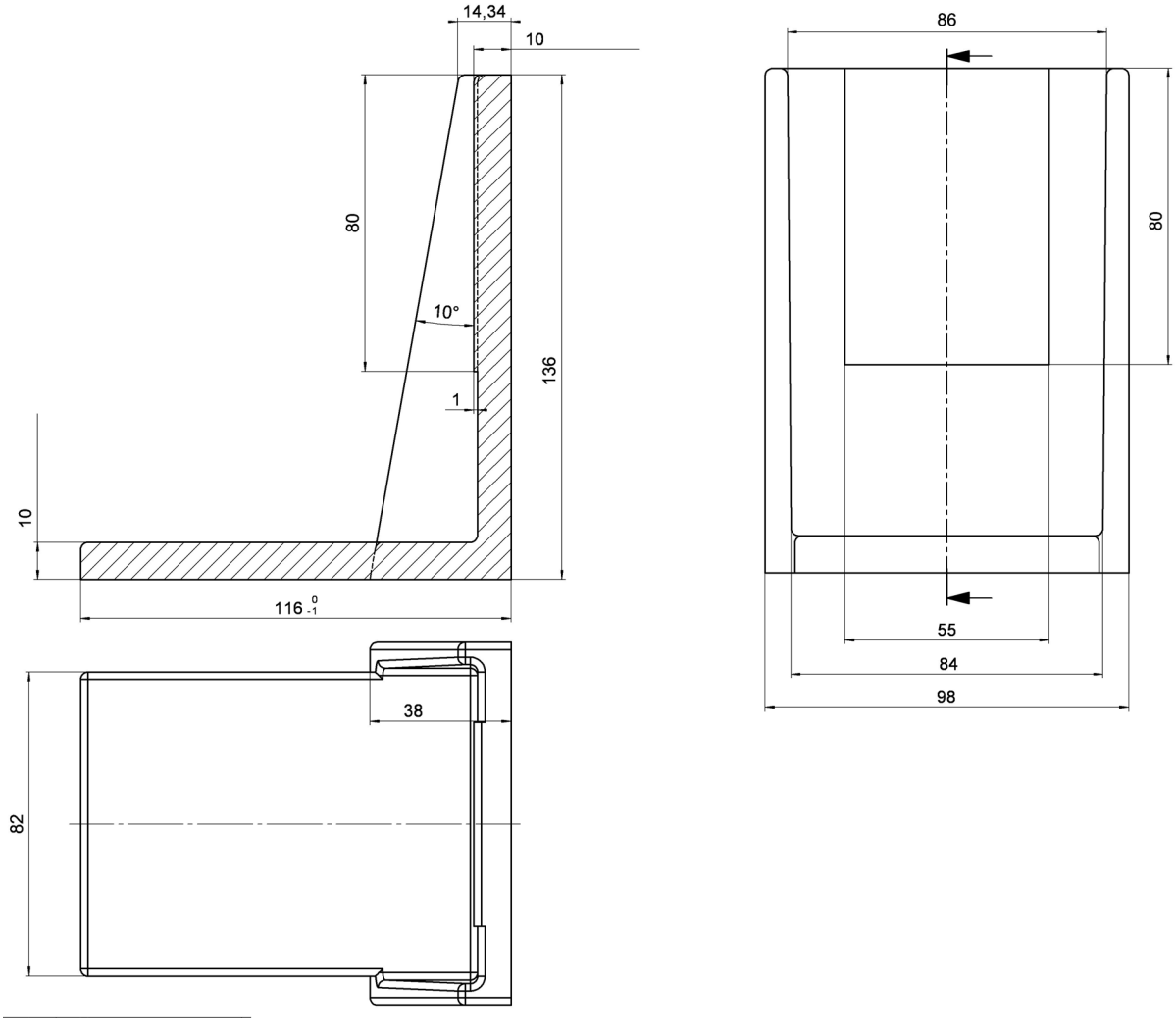
M-126.M0

10.2.2 Optional Accessories

All dimensions in mm. Note that a comma is used in the drawings instead of a decimal point.



M-126.80 adapter plate



M-125.90 adapter bracket

10.3 Pin Assignment

10.3.1 D-sub 15 (m) Controller Connection

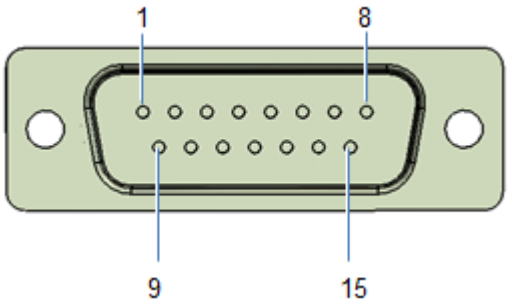


Figure 5: Sub-D 15 (m) controller connection, front view

Models with DC gear motor: M-126.XG1

Pin	Signal	Direction
1	Not connected	-
9	Motor (-)	Input
2	Motor (+)	Input
10	Ground	GND
3	Not connected	-
11	Not connected	-
4	+ 5 V (encoder)	Input
12	Negative limit switch, active high, TTL	Output
5	Positive limit switch, active high, TTL	Output
13	Reference switch, TTL	Output
6	Ground (logic voltage)	GND
14	Encoder A (+), TTL	Output
7	Encoder A (-), TTL	Output
15	Encoder B (+), TTL	Output
8	Encoder B (-), TTL	Output

Models with ActiveDrive DC motor: M-126.PDx

Pin	Signal	Direction
1	Not connected	-
9	Not connected	-
2	Not connected	-
10	Ground	GND
3	MAGN (PWM Magnitude)	Input
11	SIGN (PWM Sign), TTL	Input
4	+ 5 V	Input
12	Negative limit switch, active high, TTL	Output
5	Positive limit switch, active high, TTL	Output
13	Reference switch, TTL	Output
6	Ground (logic voltage)	GND
14	Encoder A (+), TTL	Output
7	Encoder A (-), TTL	Output
15	Encoder B (+), TTL	Output
8	Encoder B (-), TTL	Output

Models with 2-phase stepper motor: M-126.2S1

Pin	Signal	Direction
1	Motor phase 1A	Input
9	Motor phase 1B	Input
2	Motor phase 2A	Input
10	Motor phase 2B	Input
3	Not connected	-
11	Not connected	-
4	Not connected	-
12	Not connected	-
5	Not connected	-
13	Not connected	-
6	+5 V	Input
14	Positive limit switch, active low, TTL	Output

Pin	Signal	Direction
7	Ground	GND
15	Reference switch, TTL	Output
8	Negative limit switch, active low, TTL	Output

10.3.2 Mini XLR3 (m) Power Supply Connection

M-126.PDx models only

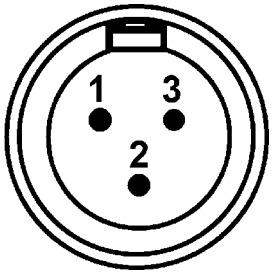


Figure 6: Mini XLR 3 (m) power supply connection, front view

Pin	Signal	Direction
1	GND	GND
2	24 V DC supply voltage	Input
3	Not connected	-

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.

To fulfill the responsibility as the product manufacturer, Physik Instrumente (PI) GmbH & Co. KG undertakes environmentally correct disposal of all old PI equipment made available on the market after 13 August 2005 without charge.

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

Physik Instrumente (PI) GmbH & Co. KG

Auf der Römerstraße 1

76228 Karlsruhe, Germany