MP41E

M-11x Micro-translation stage

User Manual

Version: 4.0.0 Date: 15.03.2011

This document describes the following products:

- **M-11x.1DG**
  Translation Stage, DC Motor Gearhead
- **M-11x.2DG**
  Translation Stage, DC Motor Gearhead, Recirculating Ballscrew
- **M-11x.12S**
  Translation Stage, Stepper Motor
- **M-11x.22S**
  Translation Stage, Stepper Motor, Recirculating Ballscrew

x stands for travel range:
0 = 5 mm
1 = 15 mm
2 = 25 mm

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Contents

1 About this Document

In this Chapter

1.1 Goal and Target Audience of this Manual

This manual contains information on the intended use of the M-11x.

It assumes that the reader has a fundamental understanding of basic servo systems as well as motion control concepts and applicable safety procedures.

For updated releases of this user manual, or if you have any questions, contact our customer service department (see p. 33).

1.2 Symbols and Typographic Conventions

The symbols and typographic conventions used in this manual have the following meanings:

CAUTION

Hazardous situation

Light injuries may result from non-observance.

➢ Action to be taken to avoid the hazard.

NOTICE

Hazardous situation

If not avoided, the hazardous situation will result in damage to the equipment.

➢ Action to be taken to avoid the hazard.

INFORMATION

Information to facilitate operation and handling, tips and tricks, and so on.

Symbol	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
see p. 5	Cross-reference to page 5.

1.3 Other Applicable Documents

The devices and software tools which are mentioned in this documentation are described in their own manuals.

For the latest versions of the user manuals contact our customer service department (see p. 33).

Device	Document
C-843 DC-Servo-Motor Controller	MS77E User Manual
C-863 Mercury Servo Controller	MS173E User Manual
C-663 Mercury Step Controller	MS138E User Manual

2 Safety

In this Chapter

2.1 Intended Use

The M-11x is a laboratory device as defined by DIN EN 61010. It is intended to be used in interior spaces and in an environment which is free of dirt, oil and lubricants.

Based on its design and realization, the M-11x is intended for single-axis positioning, adjusting and shifting of loads at various velocities.

The intented use of the M-11x is only possible with a suitable motor controller (see p. 44). The motor controller is not included in the scope of delivery of the M-11x.

2.2 General Safety Instructions

The M-11x is built according to state-of-the-art technology and recognized safety standards. Improper use can result in personal injury and/or damage to the M-11x.

- Only use the M-11x for its intended purpose, and only use it if it is in a good working order.
- Read the user manual.
- Immediately eliminate any faults and malfunctions that are likely to affect safety.

The operator is responsible for the correct installation and operation of the M-11x.

2.2.1 Organizational Measures

User Manual

- Always keep this user manual next to the M-11x when using the M-11x. If the user manual is lost or damaged, contact our customer service department (see p. 33).
- Add all information given by the manufacturer to the user manual, for example supplements or Technical Notes.
- Only use the device on the basis of the complete user manual. If your user manual is incomplete and is therefore missing important information, serious or fatal injury as well as property damage can result.
- Only install and operate the M-11x after having read and understood this user manual.

Personnel Qualification

Only authorized and qualified personnel must install, operate, maintain and clean the M-11x.

2.2.2 Safety Measures During Installation

The M-11x can be damaged by screws that are too long and parts that are wrongly mounted.

- When mounting the M-11x on a surface, make sure that the mounting screws do not interfere with the motion of the stage. The screw heads must not protrude from the counter-sunk holes.
- Note the depth of the mounting holes in the moving platform.
- Only use screws of the correct length for the respective mounting holes.
- Only mount the M-11x and the loads on the M-11x using the mounting fixtures (holes) intended for this purpose.

2.2.3 Safety Measures During Start-Up

A motorized stage can generate powerful forces depending on the gear ratio.

Faulty motor controllers can cause unintentional motor motions and run the stage to the hard stop.

When connecting the stage to the motor controller for the first time, the stage can perform an unintentional motion.

- Do not place any objects in areas where they can get caught by moving parts.
- Do not place any objects in the gap between the platform and the base body.
- Keep your fingers at a safe distance from the motion range of the stage.

The collision of a moving part with the end of the travel range, as well as high acceleration, may cause damage to, or considerable wear on the mechanics.

- In the event of a malfunction of the motor controller, stop the motion immediately.
- Ensure that the platform approaches the end of the travel range at low velocity.
- Set your control signal in such a way that the moving part does not stop abruptly or tries to continue moving at the end of the travel range.
- Determine the maximum velocity for your application.
- Ensure that the automatic limit switch halt is supported by, or activated at the motor controller.

2.2.4 Safety Measures During Operation

Unsuitable settings made to the servo-control parameters may impair the performance of the M-11x. The consequences of this may be expressed as follows:

- Vibrations
- The position is not precisely approached
- Settling time is too long

- If the performance of the M-11x is not satisfactory, please check the settings for the servo-control parameters of your controller.

2.2.5 Safety Measures During Maintenance

The M-11x is precisely aligned.

- Do not loosen any sealed screw.

3 Product Description

In this Chapter

3.1 Features and Applications

M-11x micro-translation stages are extremely compact motorized stages with travel ranges of up 5, 15 or 25 mm. They are equipped with precision linear bearings with a guidance accuracy of <0.5 µm.

M-11x.1DG and M-11x.12S

With M-11x.1x models, the stage is driven by a small DC gear motor (DG) or stepper motor (2S) via a backlash-compensated screw / nut system and a gearhead.

The DC gear motor is equipped with a rotary encoder that can achieve a design resolution of up to 0.007 µm per impulse. The low-adhesion and low-friction combination with a high-resolution encoder allows for the most minute increments of 50 nm at speeds of up to 1.5 mm/s.

The M-11x.1x models with stepper motor have been designed for open-loop control and do not have an encoder. In combination with a high-resolution C-663 stepper-motor controller, the design resolution is 14 nm per step.

M-11x.2DG and M-11x.22S

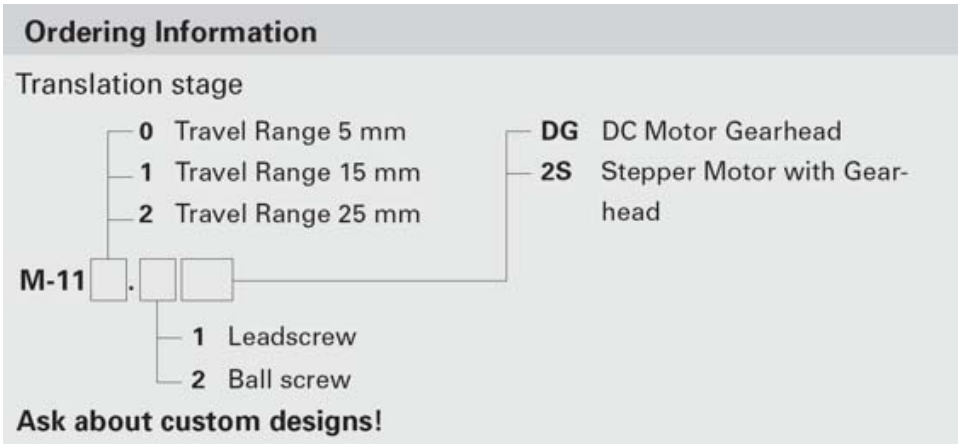
For M-11x.2x models, instead of the lead screw, a ball screw generates the precision motion with reduced friction. The design has been optimized for high duty cycles and is well suited for industrial purposes.

To protect the application, non-contact Hall-effect limit switches and direction-sensing reference point switches are used.

The stages can be assembled as compact XY and XYZ systems for multi-axis motion.

3.2 Model Overview

There are 12 standard versions of M-11x available. They differ in terms of drive type and travel range.



Model	Name
M-110.1DG	Translation Stage, 5 mm, DC Motor Gearhead
M-111.1DG	Translation Stage, 15 mm, DC Motor Gearhead
M-112.1DG	Translation Stage, 25 mm, DC Motor Gearhead
M-110.2DG	Translation Stage, 5 mm, DC Motor Gearhead, Ballscrew
M-111.2DG	Translation Stage, 15 mm, DC Motor Gearhead, Ballscrew
M-112.2DG	Translation Stage, 25 mm, DC Motor Gearhead, Ballscrew
M-110.12S	Translation Stage, 5 mm, Stepper Motor
M-111.12S	Translation Stage, 15 mm, Stepper Motor
M-112.12S	Translation Stage, 25 mm, Stepper Motor
M-110.22S	Translation Stage, 5 mm, Stepper Motor, Ballscrew
M-111.22S	Translation Stage, 15 mm, Stepper Motor, Ballscrew
M-112.22S	Translation Stage, 25 mm, Stepper Motor, Ballscrew

3.3 Product View

Figure 1: Product view (example: M-111.1DG)

1 Base body
2 Moving platform
3 Cable for the connection to the motor controller
4 Motor

3.4 Scope of Delivery

Order Number	Item(s)
M-11x	Stage according to order (see p. 8)
C-815.38	Motor cable, 3 m, 15-pin D-sub connector
000018146	Screw set: ▪ 4 hex-head cap screws M3x6 DIN 7984 ▪ 1 Allen wrench 2.0 for hex-head cap screws ▪ 1 Allen wrench 1.5 for manual shifting of moving platform during remedial actions.
MP41	User manual (this document) in printed form

3.5 Accessories

Order Number	Description
M-110.01	Adapter plate for the installation of the stage to honeycomb tables (metric or imperial)
M-110.02 M-110.03 M-110.04	Adapter brackets for the vertical installation of M-11x to other M-11x-stages to create XZ or XYZ systems : ▪ for M-110 stage as Z stage ▪ for M-111 stage as Z stage ▪ for M-112 stage as Z stage
C-842.AP1	Adapter box PWM-analog to operate M-11x stages with PWM signals

To order, please contact our customer service department (see p. 33).

3.6 Technical Features

3.6.1 Limit Switches

The M-11x is equipped with non-contact, Hall-effect limit switches.

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

For further details, refer to the "Specifications" section (see p. 35).

3.6.2 Reference Point Switch

The M-11x is equipped with a direction-sensing reference point switch, which is located close to the positive limit switch. This sensor provides a TTL signal indicating whether the stage is on the positive or negative side of the reference point switch.

The rising or falling edge of this signal can be used to indicate a known reference position. The difference in the reference points when approached from the positive or the negative side is about 0.2 mm to 0.4 mm.

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

For further details, refer to the "Specifications" section (see p. 35).

4 Unpacking

1. Unpack the M-11x with care.
2. Compare the contents against the items covered by the contract and against the packing list.
3. Inspect the contents for signs of damage. If parts are missing or you notice signs of damage, contact PI immediately.
4. Keep all packaging materials. You can use it to re-package the M-11x in the event the product needs to be returned.

5 Installation

In this Chapter

5.1 General Notes on Installation

INFORMATION

Stages with DC gear motors are equipped with integrated signal drivers for cable lengths of ≤ 10 m between stage and motor controller.

5.2 Mounting the Stage on a Surface

NOTICE

Protruding screw heads!

Protruding screw heads can damage the M-11x.

- ➢ Ensure that the screws are completely fastened and that the screw heads do not protrude from the counter-sunk holes so that they do not interfere with the stage motion.

NOTICE

Warping of the base body!

Incorrect mounting can warp the base body. Warping of the base body will increase wear and reduce accuracy.

- ➢ Mount the M-11x on a flat surface (recommended evenness: <10 µm).

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INFORMATION

The displacement of the moving platform of the stage during mounting has to be controlled with a suitable motor controller.

➢ Connect the stage to a suitable controller prior to mounting.

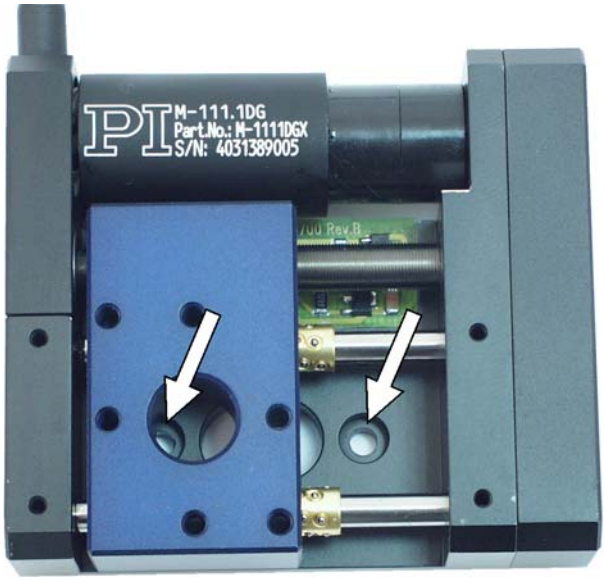


Figure 2: Positions of the mounting holes (left mounting hole is partially covered by the moving platform)

Prerequisites

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

Tools and Accessories

- 2 included screws and Allen wrench (see p. 9)
- Appropriate motor controller (see p. 44)

Mounting the M-11x

1. Connect the stage to an appropriate motor controller (see p. 23).
2. Displace the moving platform so that the countersinks for mounting are accessible in the base body (refer to the user manual of the motor controller and the arrows in the figure).
3. Mount the stage with two of the included screws.
4. Ensure that the screw heads do not protrude from the countersunk mounting holes.

5.3 Affixing the Load

NOTICE

Screws that are too long!

The M-11x can be damaged by screws that are too long.

- ➢ Note the depth of the mounting holes in the moving platform (see p. 38).
- ➢ Only use screws of the correct length for the respective mounting holes.

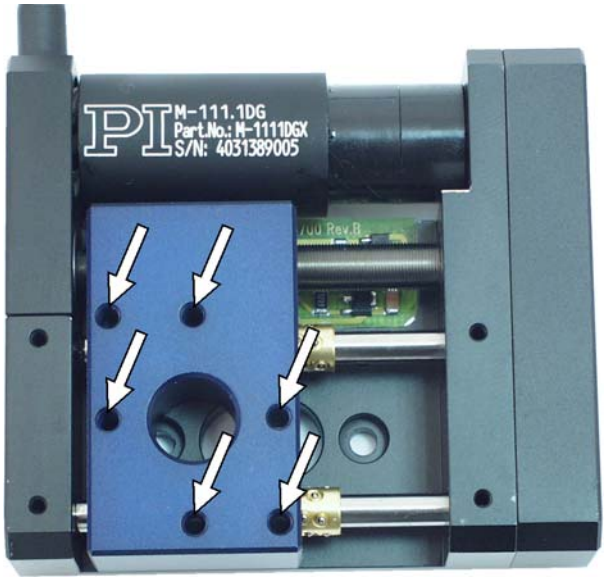


Figure 3: Threaded holes in the moving platform

Prerequisites

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

Tools and Accessories

- Size M3 screws in appropriate length (see p. 38)
- Suitable wrench

Affixing the Load

1. Choose the mounting position so that the six M3 threaded holes in the moving platform (see arrows in the figure) can be used for affixing the load.
2. Affix the load to the moving platform using the screws.

5.4 Mounting Stacked Systems

5.4.1 Stacking an XY System

The stages can be combined at will to a stacked XY system.

NOTICE

Screws that are too long!

The M-11x can be damaged by screws that are too long.

- ➢ Note the depth of the mounting holes in the moving platform (see p. 38).
- ➢ Only use screws of the correct length for the respective mounting holes.

INFORMATION

The displacement of the moving platform of the stage during mounting has to be controlled with a suitable motor controller.

- ➢ Connect the stage to a suitable controller prior to mounting.

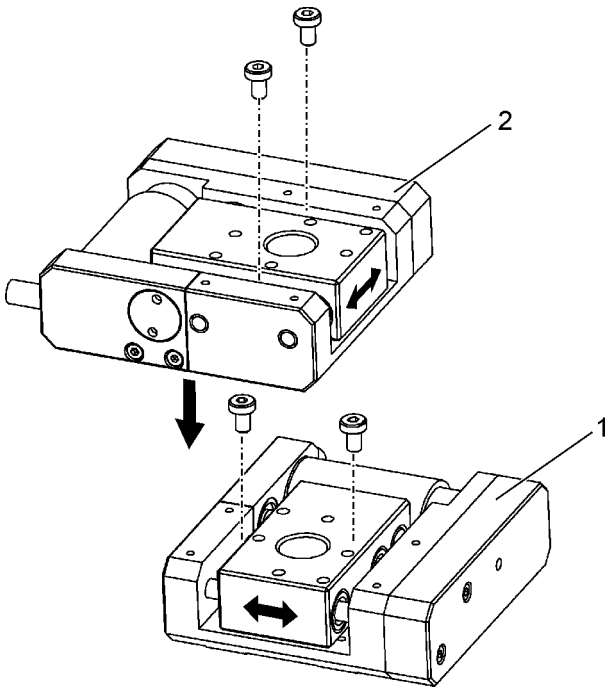


Figure 4: Stacked XY systems

1 X system
2 Y system

Prerequisites

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

Tools and Accessories

- 2 included screws and Allen wrench (see p. 9)

Stacking an XY System

1. Mount the X system (see p. 15).
2. Connect the Y system to an appropriate motor controller. (see p. 23)
3. Displace the moving platform (Y system) so that the countersinks for mounting are accessible in the base body (refer to the user manual of the motor controller).
4. Rotate the Y system by 90° and position it on the X system. It is possible to rotate again by 180° for a different orientation of its cable exit.

5. Mount the Y system using the included screws in the relevant threaded holes (see arrows in the figure) of the X system (see p. 17).

5.4.2 Stacking a Z System

To construct a Z system, the M-11x models can be combined as follows:

- XYZ system: Mounting a stage to an XY system (see p. 18)
- XZ system: Mounting a stage to an X system

NOTICE

Screws that are too long!

The M-11x can be damaged by screws that are too long.

➢ Note the depth of the mounting holes in the moving platform (see p. 38).

➢ Only use screws of the correct length for the respective mounting holes.

INFORMATION

The displacement of the moving platform of the stage during mounting has to be controlled with a suitable motor controller.

➢ Connect the stage to a suitable controller prior to mounting.

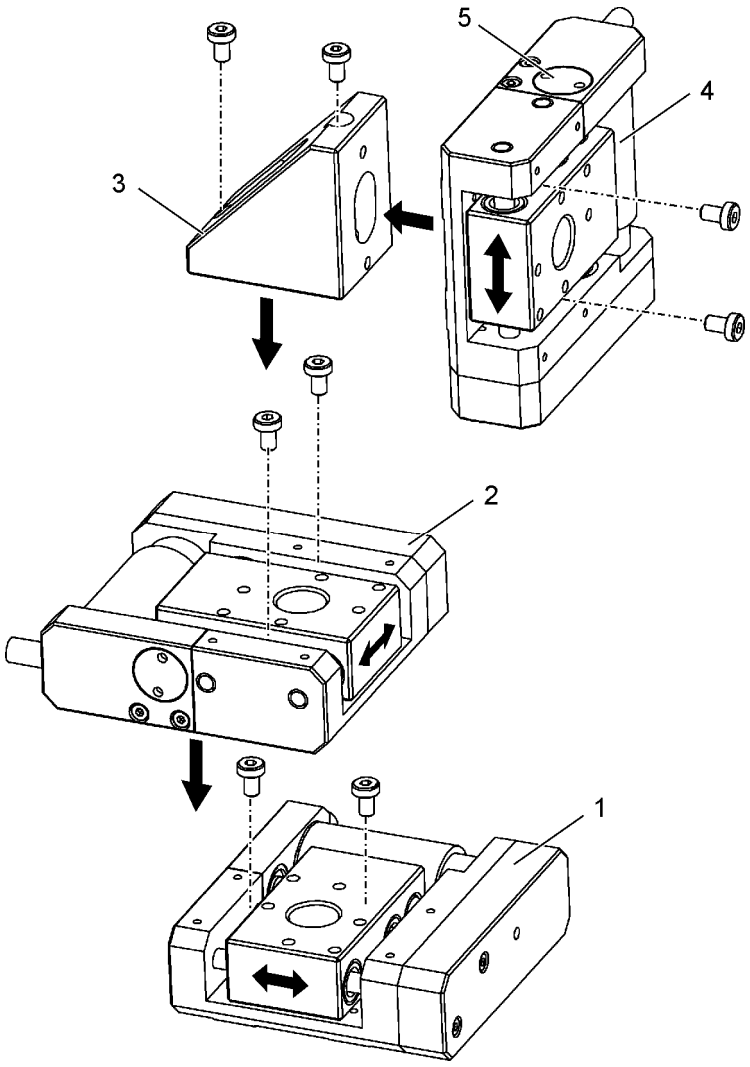


Figure 5: XYZ System

1	*X system*	*4*	*Z system*
2	*Y system*	*5*	*Counter nut*
3	*Adapter bracket*		

Prerequisites

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

Tools and Accessories

- Appropriate adapter bracket and matching screws (see p. 10).

Stacking a Z System

1. Mount the X system (see p. 15).
2. When mounting an XYZ system:
   Mount the Y system on the X system (see p. 18).
3. Affix the adapter bracket in the threaded holes of the X system or the Y systems (see p. 17).
4. Connect the Z system to an appropriate motor controller. (see p. 23)
5. Displace the moving platform (Z system) so that the countersinks for mounting are accessible in the base body (refer to the user manual of the motor controller).
6. Orient the Z system so that the counter nut (5) is at the top (see figure).
7. Mount the Z system with two of the included screws to the adapter bracket.
8. Ensure that the screw heads do not protrude from the countersunk mounting holes.

6 Start-Up

In this Chapter

6.1 General Notes on Start-Up

CAUTION

Unintentional motion of stage while connecting it to the motor controller!

- Do not place any objects in areas where they can get caught by moving parts.
- Do not place any objects in the gap between the platform and the base body.
- Keep your fingers at a safe distance from the motion range of the stage.

NOTICE

Collision of the moving platform with the hard stop!

When the limit switches are deactivated, the motion of the moving platform is aborted by the hard stop and the M-11x can be damaged.

- Do **not** deactivate the limit switches in the software.
- Test limit switch operation at low velocities only.
- Avoid collisions of the moving platform with the hard stop.

NOTICE

Damage or major wear to the mechanical system as a result of high acceleration!

- In the event of a malfunction of the motor controller, stop the motion immediately.
- Ensure that the platform approaches the end of the travel range at low velocity.
- Set your control signal in such a way that the moving part does not stop abruptly or tries to continue moving at the end of the travel range.
- Determine the maximum velocity for your application.

6.2 Starting up the M-11x

Prerequisites

✓ You have read and understood the General Notes on Start-Up (see p. 23).

Accessories

- Appropriate motor controller (see p. 44)
- Host computer
- Host software

Starting up the M-11x

1. Connect the motor controller to a host computer and install the host software (see the user manual of the motor controller and the respective software manual).
2. Connect the stage to the motor controller.
3. Start up the motor controller (see user manual of the motor controller).
4. Configure the motor controller in the host software for the connected stage (see p. 25). You can find a detailed description in the respective software manual.
5. Initiate a few motion cycles for testing.

7 Operation

In this Chapter

7.1 General Notes on Operation

INFORMATION

Unsuitable settings made to the servo-control parameters may impair the performance of the M-11x. The consequences of this may be expressed as follows:

- Vibrations
- The position is not precisely approached
- Settling time is too long

➢ If the performance of the M-11x is not satisfactory, please check the settings for the servo-control parameters of your controller.

7.2 Operating Parameters

7.2.1 M-11x Entries in the Stage Database

The stage has to be connected to an appropriate motor controller (see p. 44). For some motor controllers you have to select the connected stage from a stage database in the respective host software.

The following table shows the stages and their names in the stage database.

Stage*	Reference point switch**	Signal to stage	Name in the stage database*	Deviating parameters
M-11x.1DG	not available	Analog	**M-11x.1DG**	–
		PWM via C-842.AP1 adapter box PWM analog	**M-11x.1DG-PWM**	like M-11x.1DG except PWM parameter
	available	Analog	**M-11x.1DG-NEW**	like M-11x.1D except reference point switch parameter
		PWM via C-842.AP1 adapter box PWM analog	**M-11x.1DG-NEW-Pd**	like M-11x.1DG-NEW except PWM parameter
M-11x.2DG	not available	Analog	**M-11x.2DG**	–
		PWM via C-842.AP1 adapter box PWM analog	**M-11x.2DG-PWM**	like M-11x.2DG except PWM parameter
	available	Analog	**M-11x.2DG-NEW**	like M-11x.2DG except reference point switch parameter
		PWM via C-842.AP1 adapter box PWM analog	**M-11x.2DG-NEW-Pd**	like M-11x.2DG-NEW except PWM parameter
M-11x.12S	available	Analog	**M-11x.12S**	–
M-11x.22S	available	Analog	**M-11x.22S**	–

* x = 0, 1 or 2, according to product labeling (see p. 8)

** Models with 3 or 4-digit serial numbers do not have a reference point switch

7.2.2 Operating Parameters of the Models with DC Gear Motor

Parameter	M-11x.1DG	M-11x.2DG
Recommended start values:		
P-term	140	140
I-term	180	180
D-term	120	120
I-limit	2000	2000
Max. acceleration (impulses/s^2)	1456355	1165084
Max. velocity (mm/s)	M-110.1DG: 1 M-111.1DG: 1.5 M-112.1DG: 1.5	M-110.2DG: 1.5 M-111.2DG: 1.75 M-112.2DG: 1.75
Max. velocity (impulse/s)	M-110.1DG: 145635 M-111.1DG: 218453 M-112.1DG: 218453	M-110.2DG: 174762 M-111.2DG: 203889 M-112.2DG: 203889
Hardware properties:		
Impulses/mm	145635.555555	116508.444444
Limit switch polarity	"active high"	"active high"

7.2.3 Operating Parameters of the Models with Stepper Motor

Parameter	M-11x.12S	M-11x.22S
Recommended start values:		
Quiescent current (mA)	50	50
Run current (mA)	250	250
Current delay time (ms)*	500	500
Max. motor current (mA)	250	250
Max. acceleration (step/s^2)	17066	13653
Max. velocity (steps/s)	1706	1365
Max. velocity (mm/s)	1	1
Hardware properties:		
Steps/mm	1706.666666	1365.333333
Limit switch polarity	"active low"	"active low"
Motor serial type	AM 1524, A-0.25-12.5	AM 1524, A-0.25-12.5
Full-step resolution (steps/revolution)	24	24
Phase resistance (ohm)	12.5	12.5
Phase current, bipolar (mA)	250	250
Gear type	15 A, Planetary design	15 A, Planetary design

* When the motor has stopped, we advise to change to a reduced quiescent current after a "current delay time".

8 Maintenance

NOTICE

Damage due to improper maintenance!

The M-11x can become misaligned as a result of improper maintenance.

- ➢ Do not loosen any sealed screws.

Depending on the operational conditions and the period of use of the stage, the following maintenance measures are required:

Spread lubricant

- ➢ To evenly distribute the existing lubricant, perform a maintenance run across the entire travel range after 5000 hours of operation, or after 2 years at the latest.
- ➢ If you operate your stage continuously on a small travel range (<20 % of the entire travel range), perform a maintenance run every 2000 motion cycles across the entire travel range.

Lubrication

Under laboratory conditions, the stage needs extra lubrication in exceptional cases only. For continuous industrial use the lubrication intervals must be defined individually.

- ➢ Do not lubricate the M-11x without consulting our customer service department (see p. 33).
- ➢ To lubricate, follow the instructions given in the maintenance manual which you can obtain from our customer service department.

9 Troubleshooting

In this Chapter

9.1 Possible Causes and Remedies

Problem	Possible Causes	Solution
Increased wear Reduced accuracy	Warped base body	➢ Mount the M-11x on a flat surface (recommended evenness: <10 µm).
Functional impairment after system modification	▪ Motor controller has been replaced ▪ M-11x has been replaced with another model	➢ Load the parameters from the stage database that correspond to the combination of motor controller and M-11x model. (see p. 25)
The stage no longer moves	The moving platform has become stuck at the end of the travel range	➢ Move the moving platform manually away from the end of the travel range. (see p. 32)

If the problem that occurred with your system is not listed in the table above or it cannot be solved as described, contact our customer service department (see p. 33).

9.2 Displacing the Moving Platform Manually

The moving platform of the stage can be manually displaced for remedial measures.

Figure 6: Manual displacement of moving platform

Tools

- Allen wrench 1.5 mm (see p. 9)

Displacing the Moving Platform Manually

➢ Turn the screw accessible from the side of the stage carefully **and only as far as necessary** using the Allen wrench (see figure).

The rotary motion is directly transferred to the lead screw or the ball screw.

10 Customer Service

For inquiries and orders, contact your PI sales engineer or send us an e-mail (mailto:info@pi.ws).

If you have questions concerning your system, have the following information ready:

- Product codes and serial numbers of all products in the system
- Firmware version of the controller (if present)
- Software version of driver or host software (if present)
- Operating system on host PC (if present)

The latest versions of the relevant user manuals for your system are available for download on our website (http://www.pi.ws).

11 Technical Data

In this Chapter

11.1 Specifications

	M-110.1DG / M-111.1DG / M-112.1DG	M-110.12S / M-111.12S / M-112.12S	M-110.2DG / M-111.2DG / M-112.2DG	M-110.22S / M-111.22S / M-112.22S	Units
Motion and positioning					
Travel range	5 / 15 / 25	5 / 15 / 25	5 / 15 / 25	5 / 15 / 25	mm
Integrated sensor	Rotary encoder	—	Rotary encoder	—	
Sensor resolution	2048		2048		Cts./rev.
Design resolution	0.0069	0.038*	0.0086	0.046*	µm
Min. incremental motion	0.05	0.05	0.2	0.2	µm
Backlash	2	2	4	4	µm
Unidirectional repeatability	0.1	0.1	0.5	0.5	µm
Pitch / Yaw	±50 / ±150 / ±150	±50 / ±150 / ±150	±50 / ±150 / ±150	±50 / ±150 / ±150	µrad
Max. velocity	1 / 1.5 / 1.5	1 / 1 / 1	1.5 / 2 / 2	1 / 1 / 1	mm/s
Mechanical properties					
Drive screw	Leadscrew	Leadscrew	Recirculating ballscrew	Recirculating ballscrew	
Thread pitch	0.4	0.4	0.5	0.5	mm

	M-110.1DG / M-111.1DG / M-112.1DG	M-110.12S / M-111.12S / M-112.12S	M-110.2DG / M-111.2DG / M-112.2DG	M-110.22S / M-111.22S / M-112.22S	Units
Gear ratio	28.44444:1	28.44444:1	28.44444:1	28.44444:1	
Motor resolution*	—	384*	—	384*	
Max. load	30 / 30 / 20	30 / 30 / 20	30 / 30 / 20	30 / 30 / 20	N
Max. push / pull force	10	10	10	10	N
Max. holding force	10	10	10	10	N
Max. lateral force	15 / 10 / 10	15 / 10 / 10	15 / 10 / 10	15 / 10 / 10	N
Drive properties					
Motor type	DC-motor, gearhead	2-phase stepper motor	DC-motor, gearhead	2-phase stepper motor	
Operating voltage	0 to ±12	24	0 to ±12	24	V
Electrical power	0.52 / 1.75 / 1.75	1.5	0.52 / 1.75 / 1.75	1.5	W
Current consumption	160 / 320 / 320**		160 / 320 / 320**		mA
Limit and reference switches	Hall-effect	Hall-effect	Hall-effect	Hall-effect	
Miscellaneous					
Operating temperature range	-20 to +65	-20 to +65	-20 to +65	-20 to +65	°C
Material	Al (black anodized)	Al (black anodized)	Al (black anodized)	Al (black anodized)	
Mass	0.3 / 0.4 / 0.5	0.3 / 0.4 / 0.5	0.3 / 0.4 / 0.5	0.3 / 0.4 / 0.5	kg
Recommended controller/driver	C-863 single-axis C-843 PCI board, for up to 4 axes	C-663 single-axis	C-863 single-axis C-843 PCI board, for up to 4 axes	C-663 single-axis	

*Max. 0.25 A/phase; 24 full steps/rev., motor resolution with C-663 stepper motor controller

**thermally limited

Limit Switch Specifications

Type	Magnetic (Hall-effect) sensor
Supply voltage	+5 V/GND, supply via the motor connector
Signal output	TTL level
Signal logic	The signal level changes when passing the limit switch. The signal logic depends on the stage type. Models with DC gear motor: "active high" ▪ Normal motor operation: low (0 V) ▪ Overtravel: high (+5 V) Models with stepper motor: "active low" ▪ Normal motor operation: high (+5 V) ▪ Overtravel: low (0 V)

Reference Point Switch Specifications

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

11.2 Dimensions

11.2.1 M-110 Micro-Translation Stage

Decimal places are separated by commas in the drawings.

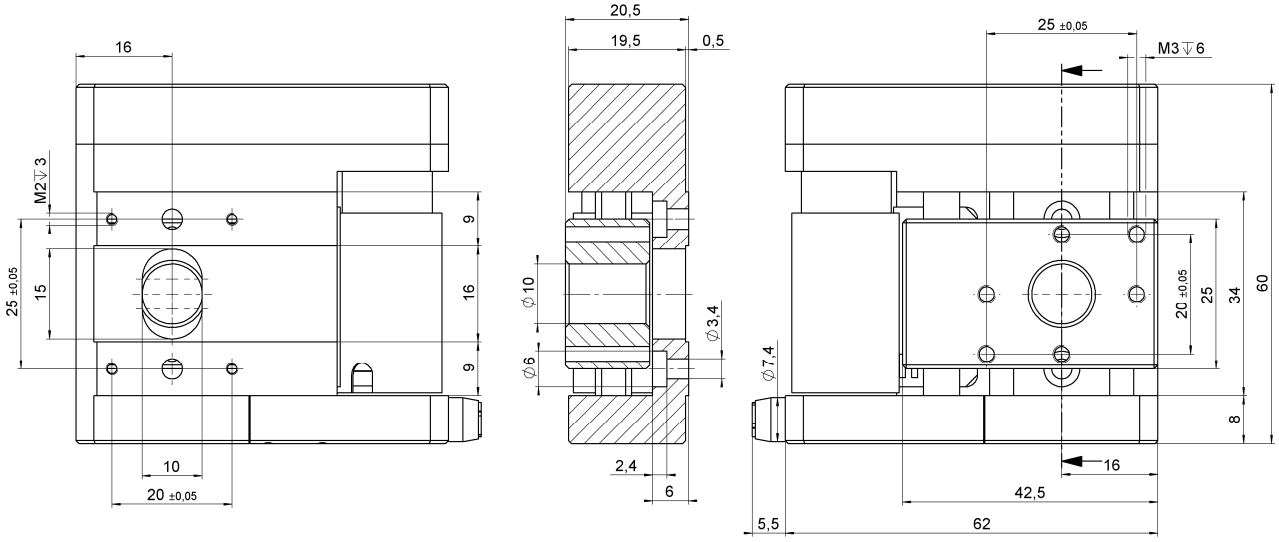


Figure 7: M-110.xxx micro-translation stage, dimensions in mm

11.2.2 M-111 Micro-Translation Stage

Decimal places are separated by commas in the drawings.

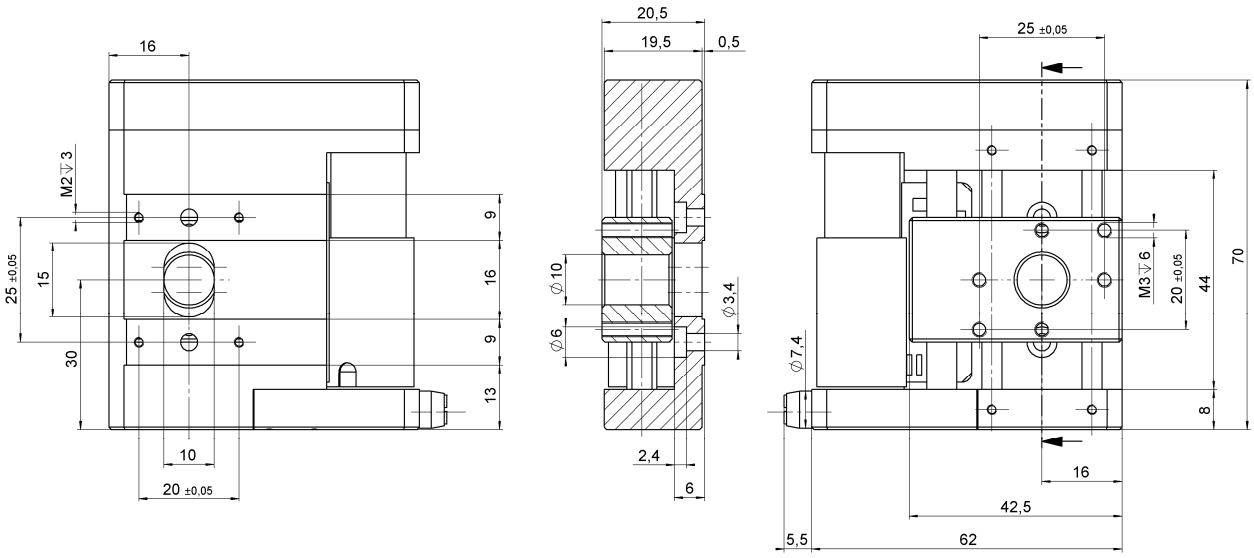


Figure 8: M-111.xxx micro-translation stage, dimensions in mm

11.2.3 M-112 Micro-Translation Stage

Decimal places are separated by commas in the drawings.

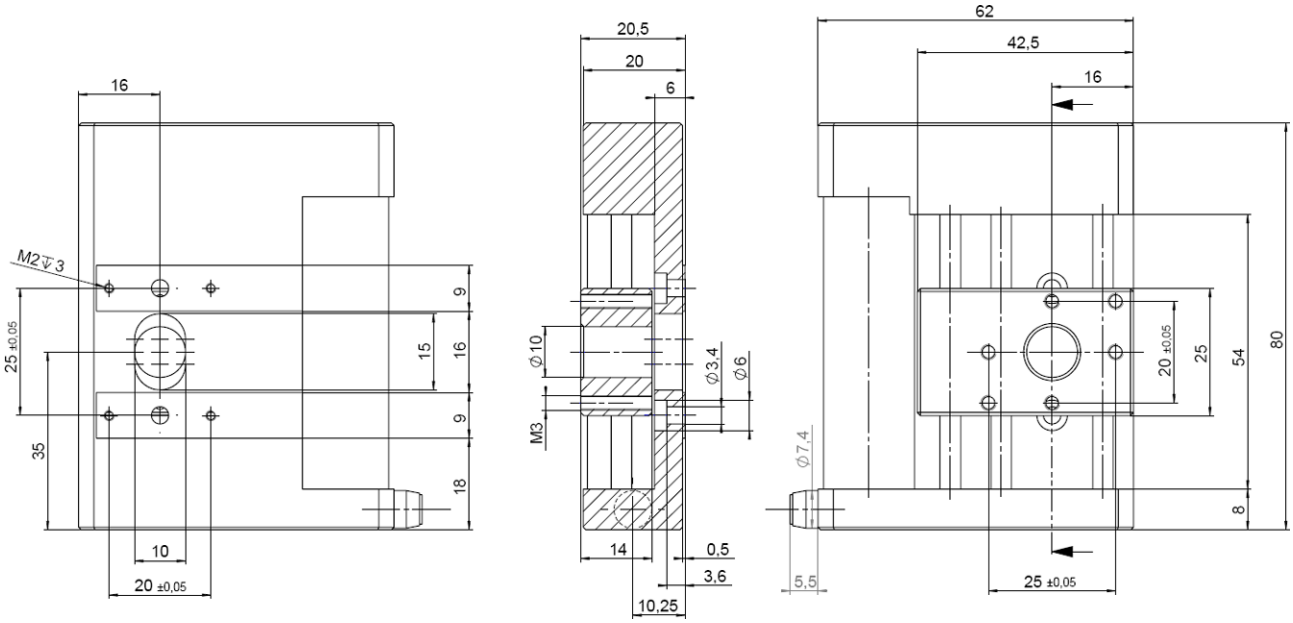


Figure 9: M-112.xxx micro-translation stage, dimensions in mm

11.2.4 M-11x Adapter Bracket

Decimal places are separated by commas in the drawings.

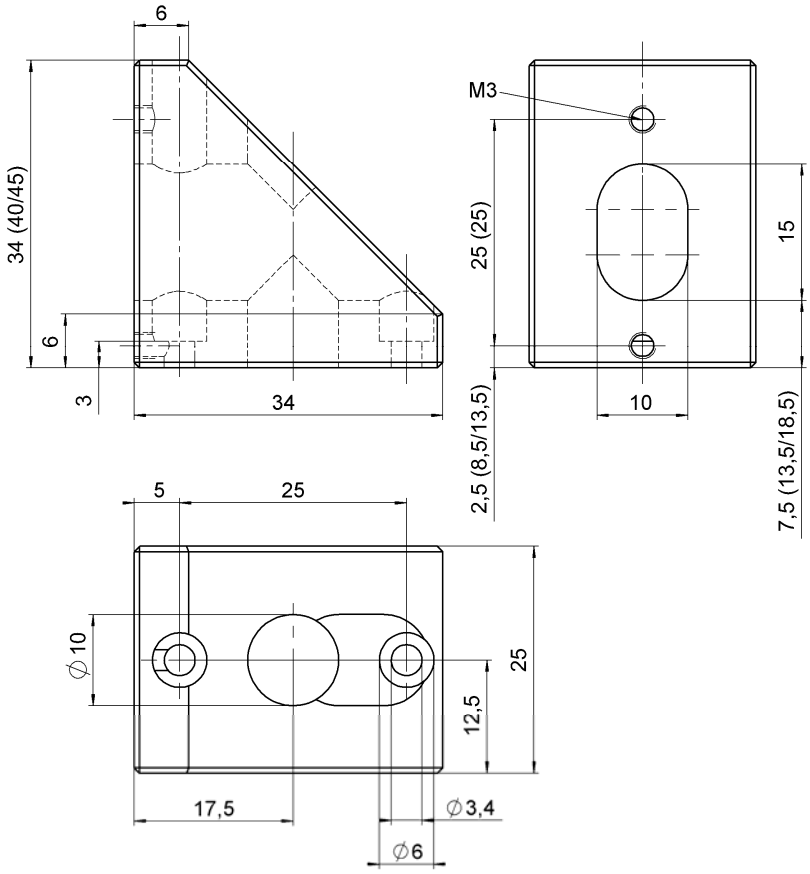


Figure 10: M-11x Adapter bracket, dimensions: M-110.02 (M-110.03/M-110.04) in mm

11.3 Pin Assignments

11.3.1 Model DC Gear Motor (DG)

Connector: D-sub 15-pin (m)

Pin no.	Function
1	internal
9	Motor (–) Input
2	Motor (+) Input
10	internal
3	internal
11	internal
4	+5 V Input
12	Limit switch (negative side)
5	Limit switch (positive side)
13	Reference point signal output
6	GND (limit switch and logic)
14	Encoder A (A(+) with RS-422 data transfer)
7	A(–) with RS-422 data transfer
15	Encoder B (B(+) with RS-422 data transfer)
8	B(–) with RS-422 data transfer

11.3.2 Stepper Motor with Gear (2S)

Connector: D-sub 15-pin (m)

Pin no.	Function
1	Phase 1a
9	Phase 1b
2	Phase 2a
10	Phase 2b
3	not connected
11	not connected
4	not connected
12	not connected
5	not connected
13	not connected
6	Input: +5 V supply from controller
14	Output: Limit switch signal positive
7	GND
15	Output: reference point switch signal
8	Output: Limit switch signal negative

11.4 Suitable Controllers

The stage must be connected to a suitable motor controller. The following motor controllers from PI can be used:

Drive Type	Controller	Axes per Controller	Host PC-Interface	Multiple Controllers on the Same Host PC
DC gear motor	C-843	2 or 4	internal (PCI bus)	yes, separate boards
	C-863	1	USB, RS-232, daisy chain	yes, same interface
Stepper motor	C-663	1	USB, RS-232, daisy chain	yes, same interface

The operation of the motor controllers is described in the corresponding user manuals.

The operating parameters must be adjusted depending on the stage used (see p. 25).

12 Old Equipment Disposal

Since 13 August 2005, in accordance with the EU directive 2002/96/EC (WEEE), electrical and electronic equipment can no longer be disposed of in the member states of the EU with other wastes.

When disposing of your old equipment, observe the international, national and local rules and regulations.

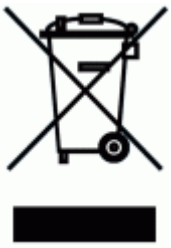
To meet the manufacturer's product responsibility with regard to this product, Physik Instrumente (PI) GmbH & Co. KG ensures environmentally correct disposal of old PI equipment that was first put into circulation after 13 August 2005, free of charge.

If you have old PI equipment, you can send it postage-free to the following address:

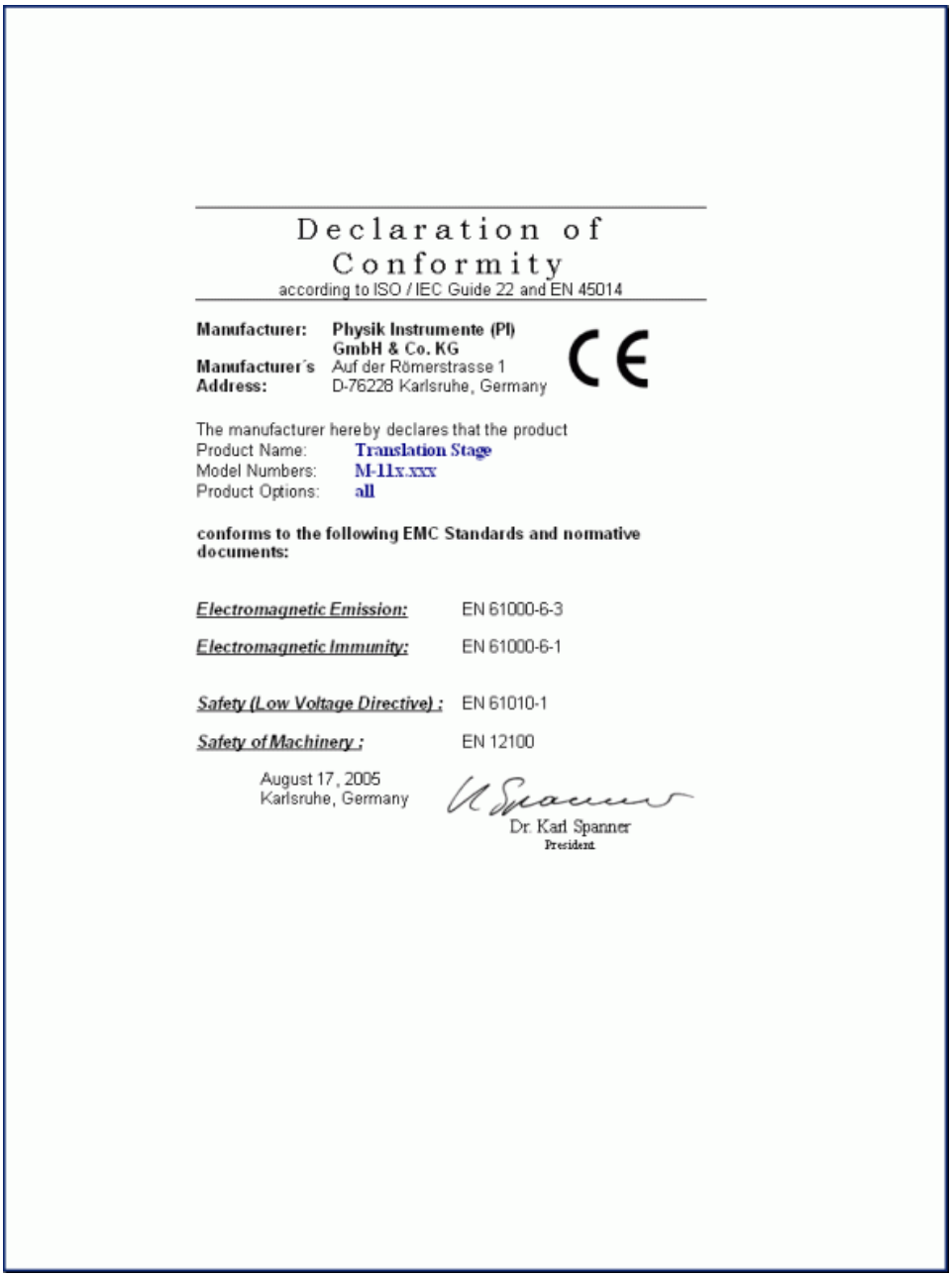
Physik Instrumente (PI) GmbH & Co. KG

Auf der Römerstr. 1

D-76228 Karlsruhe, Germany



13 EC Declaration of Conformity



Declaration of Conformity

according to ISO / IEC Guide 22 and EN 45014

Manufacturer: **Physik Instrumente (PI) GmbH & Co. KG**
Manufacturer's Address: Auf der Römerstrasse 1, D-76228 Karlsruhe, Germany

CE

The manufacturer hereby declares that the product
Product Name: **Translation Stage**
Model Numbers: **M-11x.xxx**
Product Options: **all**

conforms to the following EMC Standards and normative documents:

Electromagnetic Emission:	EN 61000-6-3
Electromagnetic Immunity:	EN 61000-6-1
Safety (Low Voltage Directive) :	EN 61010-1
Safety of Machinery :	EN 12100

August 17, 2005
Karlsruhe, Germany

Dr. Karl Spanner
President