PI

MP128E
Q-622 Miniature Rotation Stage
User Manual

Version: 1.1.0   Date: 28.11.2017

This document describes the following products:

- **Q-622.930**
  Q-Motion® rotation stage, piezoelectric inertia drive, >360° rotation range, incremental encoder, 0.55 µrad resolution, 5 mNm torque, 22 mm diameter, vacuum compatible to 10^{-6} hPa

- **Q-622.900**
  Q-Motion® rotation stage, piezoelectric inertia drive, >360° rotation range, without position sensor for open-loop operation, 5 mNm torque, 22 mm diameter, vacuum compatible to 10^{-6} hPa

- **Q-622.90U**
  Q-Motion® rotation stage, piezoelectric inertia drive, >360° rotation range, without position sensor for open-loop operation, 5 mNm torque, 22 mm diameter, vacuum compatible to 10^{-9} hPa

MOTION | POSITIONING

PI

Contents

PI

1 About this Document

In this Chapter

1.1 Objective and Target Audience of this User Manual

This manual contains information necessary for the intended use of the Q-622.

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

The latest versions of the user manuals are available for download (p. 3) on our website.

1.2 Symbols and Typographic Conventions

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

CAUTION
Dangerous situation If not avoided, the dangerous situation will result in minor injuries or damage to the equipment. ➢ Actions to take to avoid the situation.

NOTICE
Dangerous situation If not avoided, the dangerous situation will result in damage to the equipment. ➢ Actions to take to avoid the situation.

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
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 affixed to the product that refers to detailed information in this manual.

1.3   Definition of Terms

Term	Explanation
Load capacity	Maximum load capacity in the vertical direction when the rotation stage is mounted horizontally. The contact point of the load is in the center of the motion platform.

1.4   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.

1.5   Other Applicable Documents

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

Description	Document
E-870.1G, E-870.2G, E-870.4G piezo motor / PiezoMike drive electronics, benchtop device, 1 to 4 channels	E870T0002 technical note
E-872.401 Q-Motion® controller, 4 channels, USB interface	PZ279E user manual
E-873.1A1, E-873.1AR, E-873.1AT Q-Motion® controller, 1 channel, USB interface	E873T0001 technical note
E-873.3QTU Q-Motion® controller for piezoelectric inertia drives, 3 axes, benchtop device (industry), TCP/IP, USB, I/O, joystick	E873T0001 technical note
E-873.10C885 Q-Motion® controller module for PIMotionMaster, 1 axis, for systems with piezoelectric inertia drive	E873T0002 technical note
PIMikroMove	SM148E software manual

1.6   Downloading Manuals

INFORMATION

If a manual is missing or problems occur with downloading:
➢ Contact our customer service department (p. 41).

INFORMATION

For products that are supplied with software (CD in the scope of delivery), access to the manuals is protected by a password. Protected manuals are only displayed on the website after entering the password.

The password is included on the CD of the product.

For products with CD: Identify the password

1. Insert the product CD into the PC drive.

2. Switch to the Manuals directory on the CD.

3. In the Manuals directory, open the Release News (file including *releasenews* in the file name).

4. Find the user name and the password in the section "User login for software download" in the Release News.

Downloading manuals

1. Open the website **www.pi.ws**.
2. If access to the manuals is protected by a password:
   a) Click *Login*.
   b) Log in with the user name and password.
3. Click *Search*.
4. Enter the product number up to the period (e.g., P-882) or the product family (e.g., PICMA® Bender) into the search field.
5. Click *Start search* or press the Enter key.
6. Open the corresponding product detail page in the list of search results:
   a) If necessary: Scroll down the list.
   b) If necessary: Click *Load more results* at the end of the list.
   c) Click the corresponding product in the list.
7. Scroll down to the *Downloads* section on the product detail page.

   The manuals are displayed under *Documentation*.
8. Click the desired manual and save it to the hard disk of your PC or to a data storage medium.

2 Safety

In this Chapter

2.1 Intended Use

The Q-622 is a laboratory device as defined by DIN EN 61010-1. 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 Q-622 is intended for positioning, adjustment and rotation of loads in a rotational axis at different velocities in interval operation. The Q-622 uses a PIShift piezo motor as a drive. When at rest, the drive is self-locking, requires no current, generates no heat, and maintains its position.

The Q-622 can be mounted in any orientation. The specifications of the Q-622 apply to horizontal mounting (p. 43).

The Q-622 is **not** intended for applications in areas in which a failure would present severe risks to human beings or the environment. The Q-622 is not intended for continuous operation. For further information on the operating conditions of the Q-622, see "Technical Data" (p. 43).

The Q-622 is also available with a linear encoder for direct position detection or as a vacuum-compatible model for an atmospheric pressure to 10^{-9} hPa.

The intended use of the Q-622 is only possible when completely mounted and connected. The Q-622 must be operated with suitable electronics (p. 12). The electronics are not included in the scope of delivery of the Q-622.

2.2 General Safety Instructions

The Q-622 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 Q-622.

> ➢ Only use the Q-622 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 Q-622.

PI

2.3 Organizational Measures

User manual

➢ Always keep this user manual available with the Q-622.
The latest versions of the user manuals are available for download (p. 3) on our website.

➢ Add all information from the manufacturer to the user manual, for example supplements or technical notes.

➢ If you give the Q-622 to other users, also include this user manual as well as 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 Q-622 after you have read and understood this user manual.

Personnel qualification

The Q-622 may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

2.4 Measures for Handling Vacuum-Compatible Products

When handling the vacuum version of the rotation stage, attention must be paid to appropriate cleanliness. At PI, all parts are cleaned before assembly. During assembly and measurement, powder-free gloves are worn. In addition, the Q-622.xxU models are wipe cleaned afterwards and then shrink-wrapped twice in vacuum-compatible film.

➢ Only touch the rotation stage with powder-free gloves.

➢ If necessary, wipe the rotation stage clean after unpacking.

3   Product Description

In this Chapter

3.1   Model Overview

Model	Description
Q-622.930	Q-Motion® rotation stage, piezoelectric inertia drive, >360° rotation range, incremental encoder, 0.55 µrad resolution, 5 mNm torque, 22 mm diameter, vacuum compatible to 10^{-6} hPa
Q-622.900	Q-Motion® rotation stage, piezoelectric inertia drive, >360° rotation range, without position sensor for open-loop operation, 5 mNm torque, 22 mm diameter, vacuum compatible to 10^{-6} hPa
Q-622.90U	Q-Motion® rotation stage, piezoelectric inertia drive, >360° rotation range, without position sensor for open-loop operation, 5 mNm torque, 22 mm diameter, vacuum compatible to 10^{-9} hPa

3.2   Product View

Figure 1:   Model with sensor: Rotation stage Q-622.930

1   ESD protection: ESD protective cap with Q-622.930; nonconductive foil with Q-622.90U
2   Type plate p. 10
3   Connection for drive and sensor: D-Sub 15 (m)
4   Warning sign "Electrostatic sensitive devices"
5   Cable exit for connection of drive and sensor
6   Motion platform
7   Base body
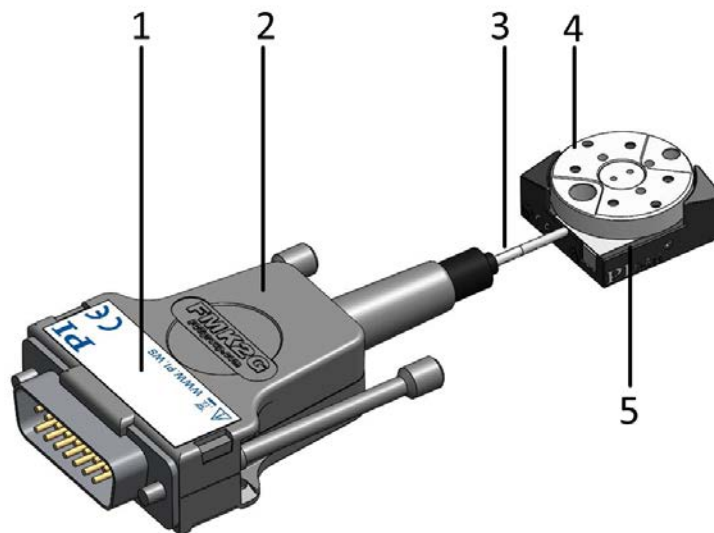
Figure 2:   Example of a model with sensor: Rotation stage Q-622.900

1   Type plate p. 10
2   Connection for drive; with Q-622.900: D-Sub 15 (m), with Q-622.90U models: D-Sub 15 (f)
3   Cable exit for drive connection
4   Motion platform
5   Base body
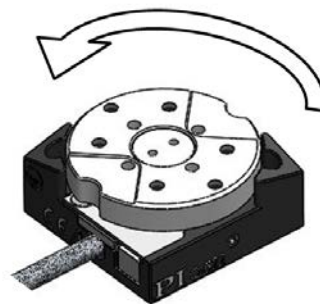
Figure 3:   Direction of motion of the platform of the Q-622

The arrow in the figure above shows the direction of motion on positive commanding.

3.3 Product Labeling
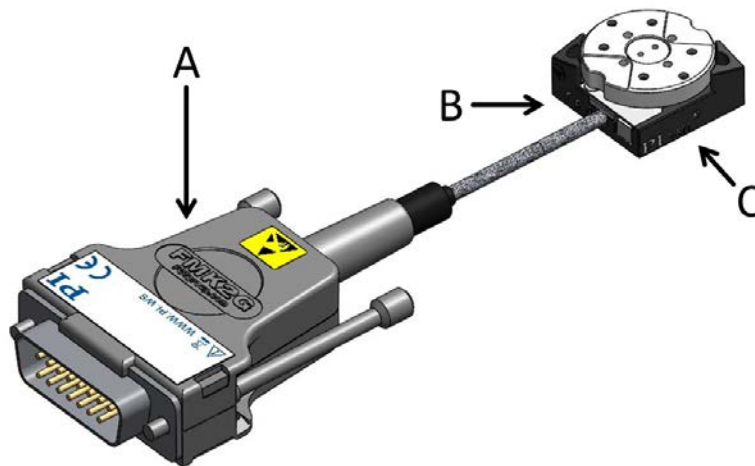
Figure 4:   Q-622: Position of the product labeling (example view)

Position	Labeling	Description
A	113064246	Serial number (example), individual for each Q-622 Meaning of the places (counting from left): 1 = internal information, 2 and 3 = year of manufacture, 4 to 9 = consecutive numbers
A	Q-622.900	Product name (example), the characters following the period refer to the model
A, B	⚠	Warning sign "Observe manual!"
A	🗑	Old equipment disposal
A, B	CE	CE conformity mark
A	WWW.PIMICOS.COM	Manufacturer's address (website)
A, C	PI	Manufacturer's logo
A	⚠	Warning sign "Electrostatic sensitive devices"
B	⏚	Symbol for the protective earth conductor, marks the position of the holes via which the Q-622 is to be connected to the protective earth conductor

3.4 Scope of Delivery

Item ID	Components
Q-622	Rotation stage according to the order (p. 7)
MP139EK	Short instructions for Q-5xx / Q-6xx PIShift stages
Only for models **with** sensor:	
Q622B0002	Screw set for mounting the Q-622, consisting of: ▪ 2 dowel pins, A2 1.5 m6 × 3 ISO 2338 ▪ 2 socket head screws, A2 M1.6x6 ISO 4762
Only for models **without** sensor:	
RPS22.5005	Screw set for mounting the Q-622, consisting of: ▪ 2 dowel pins, A2 1.5 m6 × 3 ISO 2338 ▪ 3 socket head screws, A2 M2x5 ISO 4762
7202500042-0015	Adapter cable for connection to the E-870 driver electronics, Sub-D 15 (f) to Mini-DIN 4 (m), 0.3 m
7202500060-0015	Adapter cable for connecting to the E-872 drive electronics, D-Sub 15 (f) to LEMO 3-pin. (m), 0.15 m
Only for models suitable for operation to 10^{-9} hPa:	
5604500041	Adapter for operation outside of a vacuum chamber, Sub-D 15 (m/m)

3.5 Accessories

Order number	Description
E-873.UHV1	Air-side extension cable from vacuum feedthrough or Q-622.xx0 to the adapter cable to the electronics, Sub-D 15 (f) to Sub-D 15 (m), 1 m
E-873.UHV2	Air-side extension cable from vacuum feedthrough or Q-622.xx0 to the adapter cable to the electronics, Sub-D 15 (f) to Sub-D 15 (m), 2 m
E-873.UHV3	Air-side extension cable from vacuum feedthrough or Q-622.xx0 to the adapter cable to the electronics, Sub-D 15 (f) to Sub-D 15 (m), 3 m
Q-101.AP1	Adapter plate for mounting a Q-622 onto an optical stage, for use in a vacuum to 10^{-6} hPa. Material: Aluminum alloy, anodized; mass: 8 g

For Q-622.xx0 models only (suitable for use in a vacuum to 10^{-6} hPa):

Order number	Description
C-815.VF	Vacuum feedthrough (drive and sensor signals), Sub-D 15 (m/f), including C815T0003 technical note

For Q-622.xxU models only (suitable for use in a vacuum to 10^{-9} hPa)

Order number	Description
C-815.VFU1	Vacuum feedthrough (drive and sensor signals), Sub-D 15 (m/m), DN40CF
C-815.VFU3	Vacuum feedthrough (drive and sensor signals), 3 × Sub-D 15 (m/m), DN63CF
C-815.VFU6	Vacuum feedthrough (drive and sensor signals), 6 × Sub-D 15 (m/m), DN100CF
C-815.VFU15	Vacuum feedthrough (drive and sensor signals), 15 × Sub-D 15 (m/m), DN160CF

3.6 Suitable Electronics

Electronics		Suitable for	
Order number	Description	Rotation stage without sensor Q-622.x0x	Rotation stage with sensor Q-622.x3x
E-870.1G	PIShift piezo motor / PiezoMike drive electronics, 1 channel, benchtop device	☑	
E-870.21	PIShift piezomotor / PiezoMike drive electronics, 2 channels, OEM board with connector strip	☑	
E-870.2G	PIShift piezomotor / PiezoMike drive electronics, 2 channels, benchtop device	☑	
E-870.41	PIShift piezomotor / PiezoMike drive electronics, 4 channels, OEM board with connector strip	☑	

Electronics		Suitable for	
Order number	Description	Rotation stage without sensor Q-622.x0x	Rotation stage with sensor Q-622.x3x
E-870.4G	PIShift piezomotor / PiezoMike drive electronics, 4 channels, benchtop device	☑	
E-872.401	Q-Motion® piezomotor / PiezoMike driver electronics, 4 channels, demultiplexing, benchtop device, TCP/IP, USB, USB for joystick, digital I/O	☑	
E-873.1A1	Q-Motion® controller, 1 channel, TCP/IP, USB and RS-232 interface, benchtop device		☑
E-873.1AR	Q-Motion® controller, 1 channel, USB interface, benchtop device (industry)		☑
E-873.1AT	Q-Motion® controller, 1 channel, TCP/IP-, USB and RS-232 Interface, benchtop device (Industry)		☑
E-873.3QTU	Q-Motion® controller for piezoelectric inertia drives, 3 axes, benchtop device (industry), TCP/IP, USB, I/O, joystick		☑
E-873.10C885	Q-Motion® controller module for PIMotionMaster, 1 axis, for systems with piezoelectric inertia drive		☑

> ➢ To order, contact our customer service department (p. 41).

3.7 Technical Features

3.7.1 Linear Encoder (Sensor)

Some of the Q-622 models are equipped with an optical linear encoder. For the encoder resolution, refer to the table in the "Specifications" section (p. 43).

Optical linear encoders measure the actual position directly (direct metrology). Therefore, errors occurring in the drivetrain such as nonlinearity, backlash or elastic deformation, cannot influence the measurement of the position.

3.7.2 Reference Point Switch

The Q-622 models equipped with a sensor have an optical reference point switch.

The commands that use the reference signal are described in the user manual of the controller and/or in the corresponding software manuals.

3.7.3   ID Chip

Q-622 models with sensor contain an ID chip in the connector.

The following data is stored as parameters on the ID chip:

- Information on the stage: Type, serial number, date of manufacture, version of the hardware
- Settings for the sensor: Interpolation rate, corrections of hysteresis as well as of phase and offset, gain values

When switched on or rebooted, controllers from PI read the data from the ID chip.

For more information on the ID chip recognition, see the manual of the controller used.

4   Unpacking

NOTICE

Electrostatic hazard

Touching the pins in the Sub-D 15 connection of models equipped with sensor can damage electrostatic (also: ESD-) sensitive components of the Q-622. For this reason, these models are supplied with ESD protection.

➢ Remove the ESD protection from the connection only when you connect the Q-622 to the controller.

INFORMATION

When handling the vacuum version of the rotation stage, attention must be paid to appropriate cleanliness. At PI, all parts are cleaned before assembly. During assembly and measurement, powder-free gloves are worn. In addition, the Q-622.xxU models are wipe cleaned afterwards and then shrink-wrapped twice in vacuum-compatible film.

➢ Only touch the rotation stage with powder-free gloves.

➢ If necessary, wipe the rotation stage clean after unpacking.

1. Unpack the Q-622 with care.

2. If present, do **not** remove the ESD protection from the connection of the Q-622.

3. Compare the contents with the items listed in the contract and the packing list.

4. Inspect the contents for signs of damage. If there is any sign of damage or missing parts, contact PI immediately.

5. Keep all packaging materials and the ESD protection in case the product needs to be returned.

5 Installation

In this Chapter

5.1 General Notes on Installation

NOTICE

Heating up of the Q-622 during operation!

The heat produced during operation of the Q-622 can affect your application.

> ➢ Install the Q-622 so that the application is not impaired by the dissipated heat.
> ➢ Ensure sufficient ventilation at the place of installation.
> ➢ Make sure that the complete bottom side of the Q-622 is in contact with the surface on which the Q-622 is mounted.

NOTICE

Unintentional changes in position with vertical mounting!

If the load exceeds the maximum torque of the drive when the rotation stage is mounted vertically, unintentional changes in the position of the moving platform occur. Unintentional changes in position of the moving platform can damage the drive, the load or the environment.

> ➢ When a rotation stage is mounted vertically, make sure that the installed load is lower than the maximum torque of the drive (p. 43).

NOTICE

Lubricants, dirt, condensation!

Dirt, oil, lubricants and condensation will render the motor/drive inoperable.

> ➢ Keep the Q-622 free from lubricants.
> ➢ Keep the Q-622 free from dirt and condensation.

NOTICE

Damage from unsuitable cables!

Unsuitable cables can damage the electronics.

➢ Only use cables provided by PI for connecting the Q-622 to the electronics.

INFORMATION

The positive direction of motion is a counterclockwise rotation.

INFORMATION

The Q-622 can be mounted on an optical stage with the Q-101.AP1 adapter plate. The adapter plate is available (p. 11)as an accessory.

5.2 Mounting the Q-622 on a Surface and Connecting It to a Protective Earth Conductor

---

NOTICE

Protruding screw heads!

Protruding screw heads can damage the Q-622.

➢ Ensure that the screw heads do not protrude from countersunk holes so that they do not interfere with the stage motion.

NOTICE

Warping of the Q-622 due to mounting on uneven surfaces!

Mounting the Q-622 on an uneven surface can warp the Q-622. Warping reduces the accuracy.

➢ Mount the Q-622 onto an even surface. The recommended flatness of the surface is ≤2 µm.

➢ For applications with large temperature changes:
Only mount the Q-622 on surfaces that have the same or similar thermal expansion properties as the Q-622.

INFORMATION

The contact of the Q-622 with the protective earth conductor is made as follows:

➢ Three countersunk holes in the base body of the Q-622

➢ Suitable conductive screws (p. 11)

➢ Protective earth conductor connected to the surface on which the Q-622 is mounted

➢ The screws are secured against unintentional loosening, e.g., with locking paint or threadlocker

---

Figure 5: Bottom of the Q-622.930: Two of the four available locating holes can be used for aligning on a surface

Figure 6: Top of the Q-622-930: After turning the platform to position the recesses accordingly, insert one of the two M1.6 screws into the respective hole in the rotation stage and tighten them to the surface
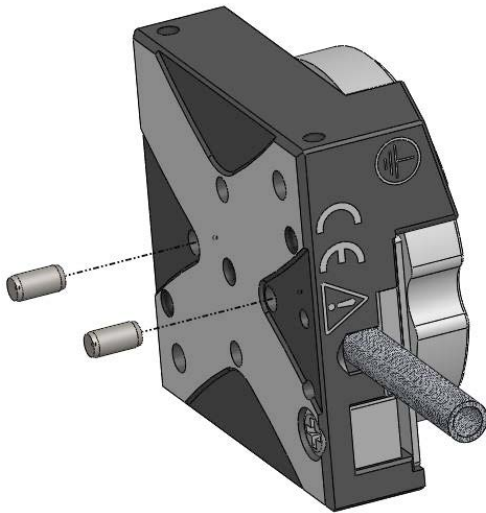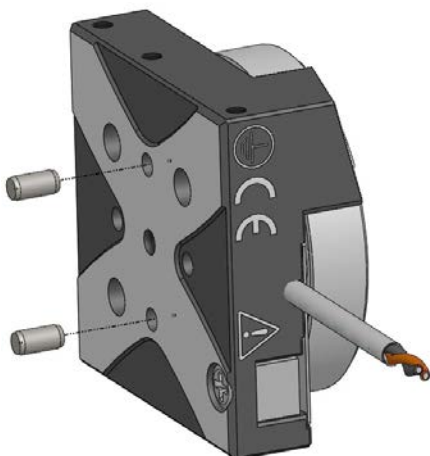

Figure 7: Bottom of the Q-622.900: Two of the four available locating holes can be used for aligning on a surface
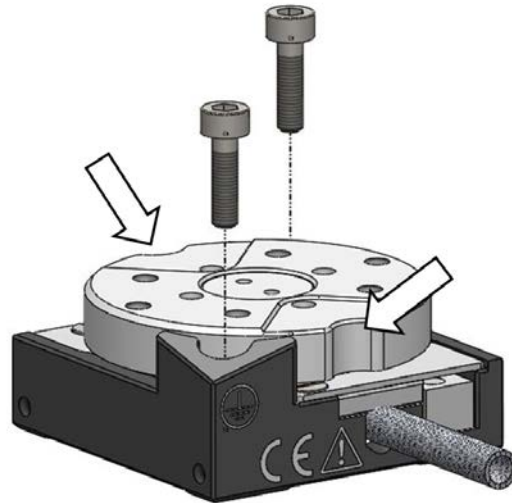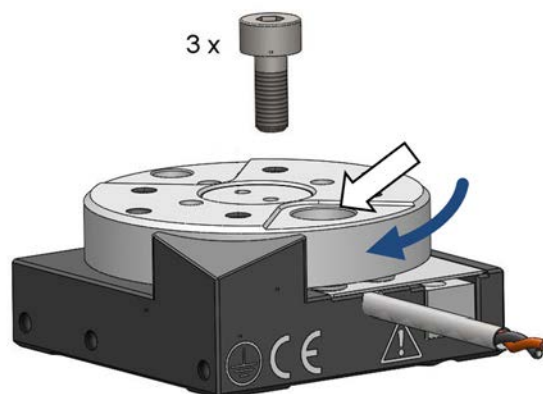

Figure 8: Top of the Q-622.900: After turning the platform accordingly (blue arrow), insert one of the three M2 screws through each respective hole (white arrow) in the rotation stage and screw them to the surface

Requirements

- ✓ You have read and understood the general notes on installation (p. 17).
- ✓ The Q-622 is **not** connected to the electronics.
- ✓ You have provided a suitable surface (for the required position and depth of the holes for accommodating the screws and locating pins, see "Dimensions" (p. 47)):
  - − The surface must be connected to a protective earth conductor.
  - − The following holes are in the bottom:
    - ▫ Two locating hole with ∅1.5 mm H7
    - ▫ For Q-622.930:   Two M1.6 mounting holes
    - ▫ For Q-622.900 and Q-622.90U: Three M2 mounting holes
  - − The holes for accommodating the screws have to be sufficiently conductive to ensure the proper functioning of the protective earth conductor.
  - − For applications with large temperature changes: The surface should have the same thermal expansion properties as the Q-622 (e.g., surface made of aluminum).
  - − The flatness of the surface is ≤2 µm.
- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and accessories

Q-622.930:

- ▪ Q622B0002 screw set in the scope of delivery of the Q-622 (p. 11):
  - − 2 dowel pins, 1.5 m6 × 3 ISO 8734; for use as locating pins
  - − 2 socket head screws, M1.6x5 ISO 4762

Q-622.900 or Q-622.90U:

- ▪ RPS22.5005 screw set from the scope of delivery of the Q-622 (p. 11):
  - − 2 dowel pins, 1.5 m6 × 3 ISO 8734; for use as locating pins
  - − 3 M2x5 socket head screws ISO 4762
- ▪ Suitable screwdriver

Mounting the Q-622 onto a surface and connecting it to a protective earth conductor

1. Insert the two locating pins into the locating holes on the bottom side of the Q-622 (see figure above) or in the surface.
2. Place the Q-622 on the surface so that the locating pins are inserted into the corresponding locating holes on the other side.
3. Mount the Q-622 onto the surface. Use the following screws for this purpose:
   - − Q-622.930: Two M1.6x5 screws
   - − Q-622.900 and Q-622.90U: Three M2x5 screws
   - a) Turn the motion platform of the Q-622 by hand until one of the countersunk screws in the base body is accessible.

b) Insert the screw into the countersunk hole.

c) Tighten the screw and pay attention to the following maximum torques:

▫ Q-622.930: 35 Ncm

▫ Q-622.900 and Q-622.90U: 17 Ncm

d) Make sure that the screw head does not protrude from the countersunk hole.

e) Repeat steps a) to d) for the other countersunk holes in the base body of the Q-622.

4. Make sure that the contact resistance at all connection points relevant for mounting the protective earth conductor is <0.1 Ω at 25 A.

5. Check that the Q-622 is affixed firmly to the surface.

5.3 Setting Up a Multi-Axis System

In a stacked X-θZ system, the Q-622 can be mounted as a θZ axis on a Q-522 (X axis).

INFORMATION

The Q-622.900 and Q-922.90U models can be mounted on all of the Q-522 models. The Q-622.930 model can be mounted on the Q-522.0xx and Q-522.2xx models but not on the Q-522.1xx.

➢ If you want to mount a Q-622.930 onto a Q-522.1xx, contact our customer service department (p. 41).

Figure 9:   Mounting the Q-622.930 onto the Q-522.200

Requirements

- ✓ You have read and understood the general notes on installation (p. 17).

- ✓ The stages are disconnected from the electronics.

- ✓ You have properly mounted the Q-522 stage onto a surface and connected it to a protective earth conductor (see user manual of the Q-522).

- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and accessories

Q-622.930:

- ▪ Q622B0002 screw set in the scope of delivery of the Q-622 (p. 11):

  - – 2 dowel pins, 1.5 m6 × 3 ISO 8734; for use as locating pins

  - – 2 socket head screws, M1.6x5 ISO 4762

Q-622.900 or Q-622.90U:

- ▪ RPS22.5005 screw set from the scope of delivery of the Q-622 (p. 11):

  - – 2 dowel pins, 1.5 m6 × 3 ISO 8734; for use as locating pins

  - – 3 M2x5 socket head screws ISO 4762

- ▪ Suitable screwdriver

Setting up a multi-axis system

1. Insert the two locating pins into the selected locating holes on the bottom of the Q-622 or in the motion platform of the Q-522 (see figure above).

2. Place the Q-622 on the Q-522 so that the locating pins are inserted into the corresponding locating holes on the other side.

3. Also mount the Q-622 on the Q-522. Use the following screws for this purpose:

   - – Q-622.930: Two M1.6x5 screws

   - – Q-622.900 and Q-622.90U: Three M2x5 screws

   a) Turn the motion platform of the Q-622 by hand until one of the three countersunk screws in the base body is accessible.

   b) Insert the screw into the countersunk hole.

   c) Tighten the screw and pay attention to the following maximum torques:

      - ▫ Q-622.930: 35 Ncm

      - ▫ Q-622.900 and Q-622.90U: 17 Ncm

   d) Make sure that the screw head does not protrude from the countersunk hole.

   e) Repeat steps a) to d) for the other countersunk holes in the base body of the Q-622.

4. Check that the Q-622 is affixed firmly to the Q-522.

5.4 Affixing the Load to the Q-622

	NOTICE
ⓘ	**Impermissibly high forces and torques!** Impermissibly high forces and torques that are applied to the motion platform can damage the Q-622. ➢ For affixing type and mass of the load, observe the maximum permissible forces according to the specifications (p. 43). ➢ Avoid tilting torques at the motion platform.

	NOTICE
ⓘ	**Screws that are too long!** The Q-622 can be damaged by screws that are too long. ➢ Note the depth of the mounting holes in the motion platform (p. 47). ➢ Only use screws of the correct length for the respective mounting holes.
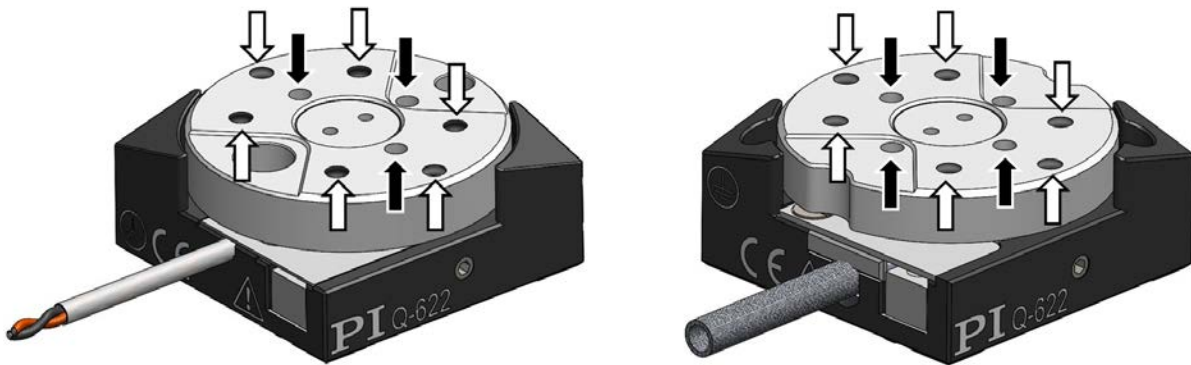
Figure 10: Left: Q-622.900 (platform hole pattern of the Q-622.90U is identical), right: Q-622.930; the black arrows indicate the locating holes for aligning the load; the white arrows indicate the threaded holes for mounting the load
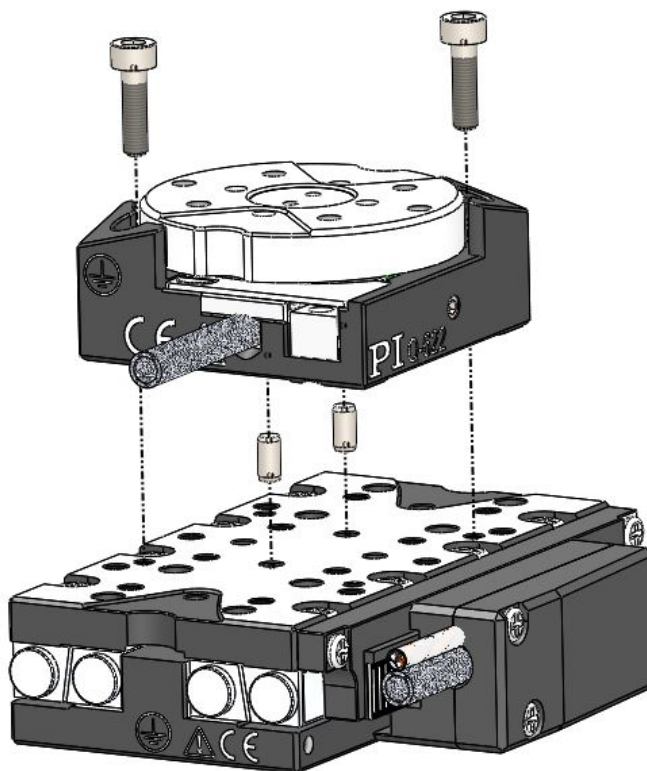
Requirements

- ✓ You have read and understood the general notes on installation (p. 17).
- ✓ You have properly mounted the Q-622 onto a surface (p. 18) or on a Q-522 stage (p. 21).
- ✓ The Q-622 is **not** connected to the electronics.
- ✓ You have prepared the load so that it can be affixed to the motion platform (for the required position and depth of the holes for accommodating the screws and locating pins, see "Dimensions" (p. 47)):

    – The distance between the center of gravity of the load and the center of the motion platform is as small as possible in all directions.

    – At least four points are provided for affixing the load on the motion platform.

    – If you use locating pins for aligning the load: You made two or three locating holes of Ø 1.5 mm H7 for accommodating locating pins.

Tools and accessories

- 4 to 6 M2 screws of suitable length (p. 47)
- Suitable tool for tightening the screws
- Optional: 2 to 4 locating pins of suitable length, for locating holes with ∅ 1.5 mm H7

Affixing the load to the Q-622

1. Align the load on the Q-622 so that the mounting holes in the load and the holes in the motion platform overlap.

   If you use locating pins to align the load:

   a) Insert the locating pins into the locating holes in the motion platform or in the load.

   b) Place the load on the motion platform so that the locating pins are inserted into the corresponding locating holes on the other side.

2. Affix the load using the screws.

   – Maximum torque: 35 Ncm.

3. Check that the load is affixed firmly to the motion platform of the Q-622.

5.5 Connecting the Q-622 to the Electronics

The electronics to be used for operating the Q-622 depends on the presence of a sensor (see also "Suitable Electronics" (p. 12)):

- Models with sensor (Q-622.x3x): E-873 controller
- Models without sensor (Q-622.x0x): E-870 or E-872 driver electronics

---

INFORMATION

The Q-622 and the electronics can be delivered as a preconfigured system.

➢ If a connection assignment is given on the labels of the Q-622 and/or electronics, pay attention to this assignment when connecting the Q-622.

5.5.1   Overview: Connecting for Atmospheric Operation

Figure 11:   Options for connecting the Q-622 to suitable electronics for atmospheric operation

1	Controller
2	Drive electronics
3	Adapter cable
4	Extension cable
5	Adapter for operation outside of a vacuum chamber
6	Mechanics

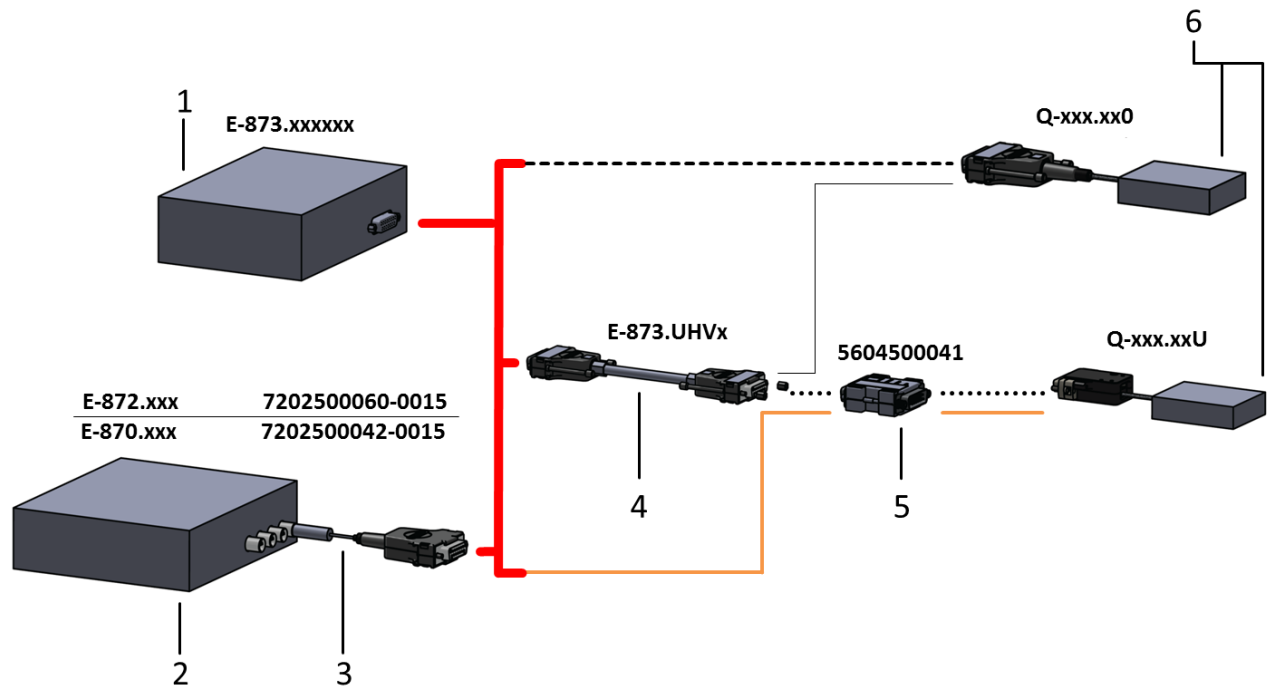## 5.5.2 Overview: Connecting for Operation in Vacuum
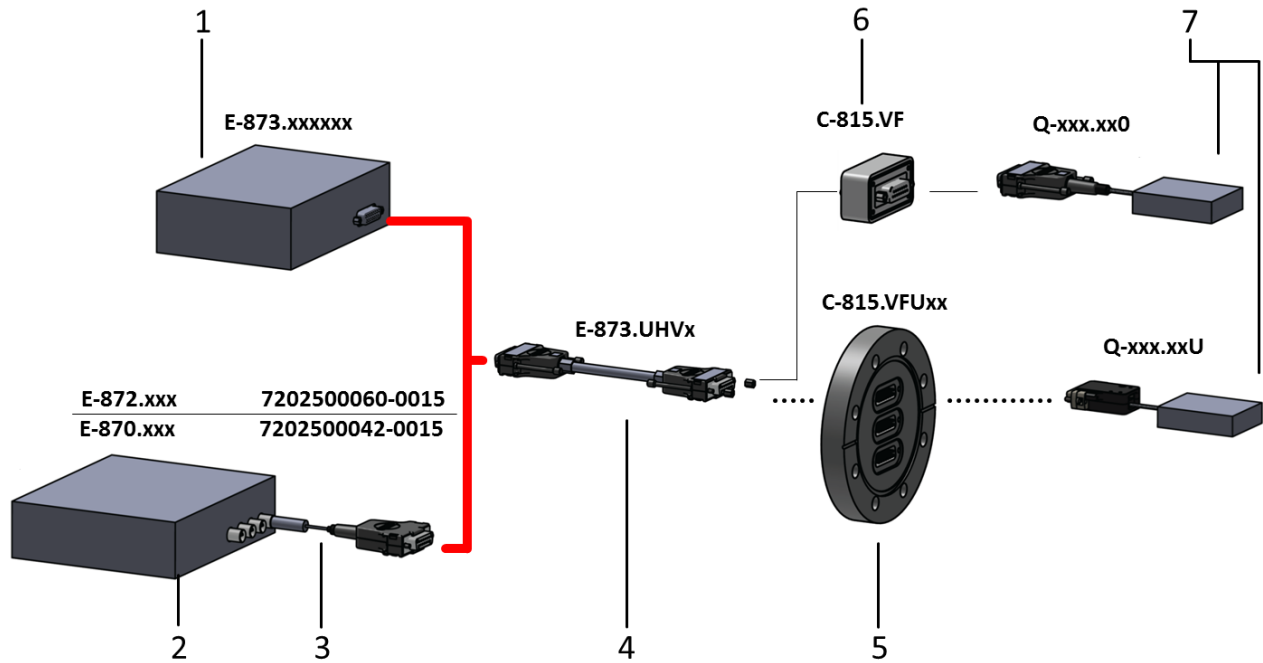
Figure 12:   Options for connecting the Q-622 to suitable electronics for operation in a vacuum

1   Controller
2   Drive electronics
3   Adapter cable
4   Extension cable
5   Vacuum feedthrough for pressure to 10^{-9} hPa
6   Vacuum feedthrough for pressure to 10^{-6} hPa
7   Mechanics
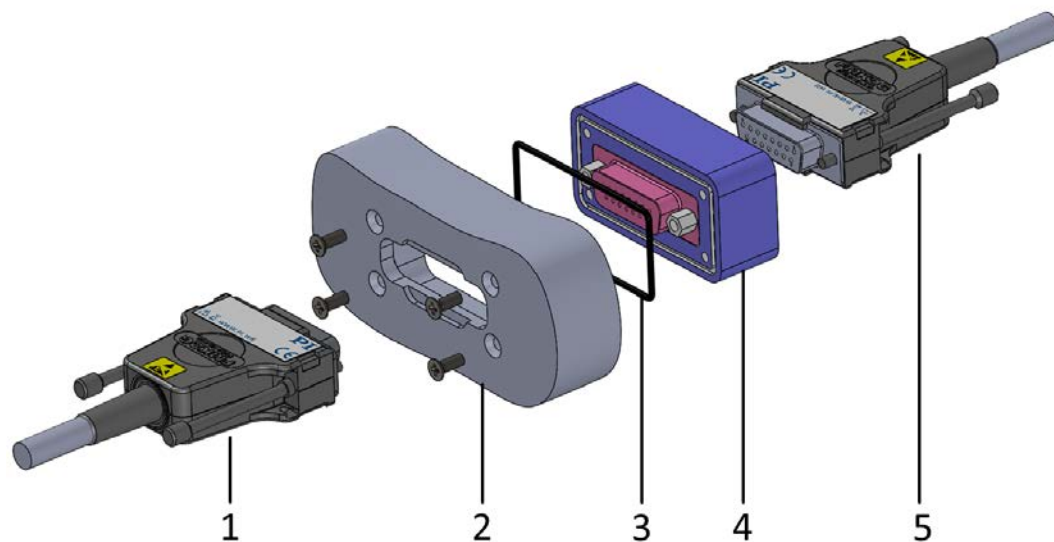
Figure 13:   Example for installing the C-815.VF vacuum feedthrough. Links: Vacuum side, right: Air side

1   Q-622.90U connection on the vacuum side
2   Example of a vacuum feedthrough, part of a vacuum chamber
3   Sealing ring
4   C-815.VF vacuum feedthrough
5   Connection of the air side adapter cable for connecting to the electronics.

Tools and accessories

- Four M3 stainless steel countersunk screws of suitable length (ISO 7046)

Installing the vacuum feedthrough

➢ For C-815.VF vacuum feedthrough: Install the vacuum feedthrough so that the Sub-D 15 (f) socket is in the vacuum chamber.

➢ Pay attention to the maximum torque of 0.9 Nm.

Requirements

✓ You have read and understood the general notes on installation (p. 17).

✓ You have installed the drive electronics or the controller.

✓ You have read and understood the user manual of the electronics.

✓ The electronics are **not** connected to the supply voltage.

Tools and accessories

- If the driver electronics have a Mini-DIN 4 socket (models: E-870.x1, E-870.xG): 7202500042-0015 adapter cable, in the scope of delivery (p. 11)

- When the E-872 drive electronics are used: 7202500060-0015 adapter cable, in the scope of delivery (p. 11)

- If a Q-622.x0U is to be operated at atmospheric pressure: 5604500041 adapter, in the scope of delivery (p. 11)

- If the Q-622 is to be operated in a vacuum:
  - E-873.UHVx extension cable, available as optional accessory (p. 11)
  - Suitable vacuum feedthrough, available as an optional accessory (p. 11):
    For Q-622.x00: C-815.VF (suitable for use in a vacuum to 10^{-6} hPa)
    For Q-622.x0U: C-815.VFUx (suitable for use in a vacuum to 10^{-9} hPa)
  - Suitable tools for installing the vacuum feedthrough

Connecting the Q-622 to the electronics

1. Prepare the Q-622 for connection:

   When using a Q-622 with sensor:
   - Remove the ESD protection from the connection of the Q-622.

   When a Q-622 is to be operated in a vacuum:
   - Installing the vacuum feedthrough:
   a) Obtain the dimensions from the corresponding dimensional drawing (p. 50).
   b) Make sure that the vacuum feedthrough is oriented correctly:
      C-815.VF: Vacuum side = Sub-D 15 (f) socket
      C-815.VFUx: See dimensional drawing (p. 50)
   c) Make a suitable opening in the vacuum chamber.
   d) Install the vacuum feedthrough.

2. Connect the electronics to the Q-622 and if necessary, any further components as shown in the connection diagram above.

3. Take suitable measures to prevent the adapter cable from being accidentally disconnected.

6 Startup and Operation

In this Chapter

6.1 General Notes on Startup and Operation

CAUTION

Risk of electric shock if the protective earth conductor is not connected!

If a protective earth conductor is not or not properly connected, dangerous touch voltages can occur on the Q-622 in the case of malfunction or failure of the system. If touch voltages exist, touching the Q-622 can result in minor injuries from electric shock.

➢ Connect the Q-622 to a protective earth conductor (p. 18) before start-up.
➢ Do **not** remove the protective earth conductor during operation.
➢ If the protective earth conductor has to be removed temporarily (e.g., in the case of modifications), reconnect the Q-622 to the protective earth conductor before starting it up again.

CAUTION

Burning from hot surface!

The surface of the Q-622 and its vicinity can heat up during operation. Touching the Q-622 and surrounding parts can result in minor injuries from burning.

➢ Cool the Q-622 so that the temperature of its surface and surrounding parts does **not** exceed 65 °C.
➢ If sufficient cooling is not possible: Make sure that the hot Q-622 and its surrounding parts **cannot** be touched.
➢ If sufficient cooling and protection against contact are not possible: Mark the danger zone in accordance with the legal regulations.

NOTICE

Overheating during continuous operation!

The highest velocity is achieved at maximum operating frequency; however, the Q-622 can overheat during continuous operation as a result.

➢ Pay attention to the recommended operating time according to the operating frequency in step mode (p. 46).
➢ Ensure sufficient ventilation at the place of installation.

NOTICE

Operating voltage too high or incorrectly connected!

Operating voltages that are too high or incorrectly connected can cause damage to the Q-622.

➢ Only operate the Q-622 with controllers/drivers and original accessories from PI.
➢ Do **not** exceed the operating voltage range (p. 45) for which the Q-622 is specified.
➢ Only operate the Q-622 when the operating voltage is properly connected; see "Pin Assignment" (p. 57).

NOTICE

Operating frequency too high!

An operating frequency that is too high can cause damage to the Q-622.

➢ Only operate the Q-622 with controllers/drivers and original accessories from PI.
➢ Do **not** exceed the operating frequency range (p. 45) for which the Q-622 is specified.

NOTICE

Reduced lifetime of the piezo actuator due to permanently high voltage!

The permanent application of a high static voltage to piezo actuators leads to a considerable reduction in the lifetime of the piezo ceramic.

➢ If the Q-622 is not used for a longer period of time, e.g., several days, switch the electronics off.

NOTICE

Destruction of the piezo actuator due to electric flashovers!

Using the Q-622 in environments that increase the electrical conductivity can lead to the destruction of the piezo actuator by electric flashovers. Electric flashovers can be caused by moisture, high humidity, liquids, and conductive materials (e.g., metal dust). In addition, electric flashovers can also occur in certain air pressure ranges due to the increased conductivity of the air.

➢ Avoid operating the Q-622 in environments that can increase the electric conductivity.
➢ Only operate the Q-622 within the permissible ambient conditions and classifications (p. 45).

NOTICE

Damage due to collisions!

Collisions can damage the rotation stage, the load to be moved, and the surroundings.

➢ Make sure that no collisions are possible between the rotation stage, the load to be moved, and the surroundings in the motion range of the rotation stage.
➢ Do not place any objects in areas where they can be caught by moving parts.
➢ Stop the motion immediately if an electronics malfunction occurs.

PI

NOTICE

Considerable wear due to high operating frequency!

A high operating frequency in step mode can cause considerable wear on the mechanical system.

➢ Reduce the value of the *PIShift Steps per Second* parameter (ID 0x1F000600) and the *PIShift Frequency* parameter (ID 0x1F000400) on the drive electronics; see user manual of the electronics.

➢ Reduce the operating time with a high operating frequency (p. 46).

➢ Stop the motion immediately if an electronics malfunction occurs.

NOTICE

Increased wear due to small working range!

➢ If you only move the Q-622 over a small working range (<20°), perform at least one full rotation of the moving platform at regular intervals.

INFORMATION

The drive electronics is adapted via parameters to the Q-622. Changing parameter values can cause undesirable results.

➢ Only operate the Q-622 when the parameters of the drive electronics have been correctly set, see "Operating Parameters of the Q-622".

INFORMATION

The PIShift drive generates noise in step mode. The noise generation depends on the current step frequency.

6.2 Starting Up the Rotation Stage

The electronics to be used for operating the Q-622 depends on the presence of a sensor (see also "Suitable Electronics" (p. 12)):

- Models with sensor (Q-622.x3x): E-873 controller
- Models without sensor (Q-622.x0x): E-870 or E-872 drive electronics

---

INFORMATION

If the parameters of the electronics are not adapted to the Q-622 and the application (load, orientation of the Q-622), the Q-622 will either not move or not move satisfactorily.

➢ Only operate the Q-622 when the parameters of the electronics have been correctly set.

➢ Pay particular attention to the parameter settings for operating voltage and operating frequency.

PI

INFORMATION

The PIShift drive generates noise in step mode. The noise generation depends on the current step frequency.

6.2.1 Starting up the Controller and Q-622 Models with Sensor

---

INFORMATION

If you use the software included in the scope of delivery of the E-873 controller, the operating parameters can be loaded from the *PIMicosStages3.dat* database. The entries in the stage database are updated regularly.

➢ Install the PI Update Finder from the product CD of the controller onto your PC, which updates the *PIMicosStages3.dat* database on your PC.

For further information, see the user manual of the E-873 controller.

INFORMATION

For optimum drive performance in step mode, the **Maximum Motor Output** (ID 0x9) parameter in the *PIMicosStages3.dat* database takes a value of 20 kHz.

For further information, see "Operating >Time" (p. 46) and the documentation of the controller.

Requirements

- ✓ You have read and understood the general notes on start-up and operation (p. 29).
- ✓ You have properly installed the stage (p. 17).
- ✓ You have read and understood the user manual of the controller.
- ✓ You have read and understood the manual of the PC software.
- ✓ The controller and the required PC software have been installed. All connections on the controller have been set up (see user manual of the controller).

Starting up the Q-622 with controller

1. Start up the rotation stage (see user manual of the controller).
   The startup comprises the following steps:

   – Selecting the stage type

   – Defining the reference point of the axis

   – Commanding of first motion for testing

2. If necessary: Adapt the **Maximum Motor Output** (ID 0x9) parameter to your application (also refer to "General Notes on Start-Up and Operation" (p. 29) and "Operating Time" (p. 46)).

   In the user manual of the controller, the startup is described using the PIMikroMove program.

6.2.2   Starting Up the Q-622.x0x with E-870 Drive Electronics

---

INFORMATION

If the parameters of the drive electronics are not adapted to the Q-622 and the application (load, orientation of the Q-622), the Q-622 will either not move or not move satisfactorily.

➢ Only operate the Q-622 when the parameters of the drive electronics have been correctly set, see "Operating Parameters of the Q-622".

➢ Pay particular attention to the parameter settings for operating voltage and operating frequency.

INFORMATION

The values of the *PIShift Steps per Second* parameter (ID 0x1F000600) and the *PIShift Frequency* parameter (ID 0x1F000400) should be identical for optimum drive performance. Further information can be found in the user manual of the electronics.

Requirements

✓ You have read and understood the general notes on start-up and operation (p. 29).

✓ The Q-622 has been installed properly (p. 17).

✓ The E-870 drive electronics has been properly installed, and all connections on the E-870 have been set up (see E870T0001 technical note or E870T0002 technical note).

Starting up the Q-622 with E-870 drive electronics

1. Make sure that the parameters of the E-870 drive electronics have been correctly set, see "Operating Parameters of the Q-622".

2. Provide the control signal required for operating the system. Details can be found in the E870T0001 or E870T0002 technical note.

3. If necessary: Adapt the *PIShift Steps per Second* parameter (ID 0x1F000600) and the *PIShift Frequency* parameter (ID 0x1F000400) to your application (see also "Operating Time" (p. 46)).

The following table lists the settings for the parameters of the E-870 drive electronics. Further information on the parameter settings is found in the "Operating Time" section (p. 46).

Parameter	Parameter in E-870 Drive Electronics	Value	Unit
Operating voltage, upper limit	*PIShift Upper Supply Voltage* ID 0x1F000000	48	V
Operating voltage, lower limit	*PIShift Lower Supply Voltage* ID 0x1F000100	0	V
Charging current during forward motion	*PIShift Forward Current* ID 0x1F000200	0.2	A

Parameter	Parameter in E-870 Drive Electronics	Value	Unit
Charging current during backward motion	**PIShift Backward Current** ID 0x1F000300	-0.2	A
Operating frequency in step mode	**PIShift Frequency** ID 0x1F000400	20000	Hz
Duty cycle of the current source during the output of one period of the modified sawtooth signal in step mode	**PIShift Charge Cycle** ID 0x1F000500	1	-
Number of steps that the rotation stage moves per second with the set operating frequency.	**PIShift Steps per Second** ID 0x1F000600	20000	

6.2.3 Starting Up the Q-622.x0x with E-872 Drive Electronics

INFORMATION

If you use the software included in the scope of delivery of the E-872 drive electronics, the operating parameters can be loaded from the *PIMicosStages3.dat* database. The entries in the stage database are updated regularly.

➢ Install the PI Update Finder from the product CD of the controller onto your PC, which updates the *PIMicosStages3.dat* database on your PC.

For further information, see the user manual of the E-873 controller.

INFORMATION

For optimum drive performance in step mode, the **Maximum Motor Output** (ID 0x9) parameter in the *PIMicosStages3.dat* database takes a value of 20 kHz.

For further information, see "Operating Time" (p. 46).

Requirements

✓ You have read and understood the general notes on start-up and operation (p. 29).

✓ You have properly installed the stage (p. 17).

✓ You have read and understood the user manual of the controller.

✓ You have read and understood the manual of the PC software.

✓ The controller and the required PC software have been installed. All connections on the controller have been set up (see user manual of the controller).

Starting up the Q-622.x0x with the E-872 driver electronics

1. Start up the rotation stage (see user manual of the controller).
   The startup comprises the following steps:

   – Selecting the stage type

   – Commanding of first motion for testing

2. If necessary: Adapt the ***Maximum Motor Output*** (ID 0x9) parameter to your application (also refer to "General Notes on Start-Up and Operation" (p. 29) and "Operating Time" (p. 46)).

7 Maintenance

In this Chapter

7.1 General Notes on Maintenance

NOTICE

Damage due to improper maintenance!

Improper maintenance can lead to misalignment and failure of the Q-622.

> ➢ Only loosen screws according to the instructions in this manual.

7.2 Performing a Maintenance Run

The maintenance run must comprise at least one full rotation of the moving platform of the Q-622.

> ➢ Perform the maintenance run after every 10 million steps.

7.3 Cleaning the Q-622

Requirements

> ✓ You have disconnected the rotation stage from the electronics.

Cleaning the rotation stage

Only when the rotation stage is **not** used in vacuum:

> ➢ When necessary, clean the surfaces of the rotation stage with a cloth that is lightly dampened with a mild cleanser or disinfectant.

Only when the rotation stage is used in vacuum:

> ➢ Only touch the rotation stage with powder-free gloves.

> ➢ If necessary, wipe the rotation stage clean.

8   Troubleshooting

Problem	Possible causes	Solution
Functional impairment after system modification	▪ Drive electronics or controller has been replaced ▪ The rotation stage has been replaced	E-870 driver electronics from PI: ➢ Set the parameters in the E-870 Control PC program so that they correspond to the combination of driver electronics and Q-622 model (for details, see "Operating Parameters of the Q-622" and E870T0001 or E870T0002 technical note). E-872 drive electronics or E-873 controller from PI: ➢ Load the parameter set from the stage database that corresponds to the Q-622 model. ➢ If necessary: Set the parameters on the controller in the PIMikroMove PC program so that they correspond to the application (load, orientation) of the Q-622 model (see user manual of the controller).
No or limited motion	The cable is not connected correctly or is defective	➢ Check the connecting cable(s)
	Excessive load	➢ Reduce the load. Observe the information in the "Technical Data" section (p. 43). ➢ When a rotation stage is mounted vertically, make sure that the installed load is lower than the maximum torque of the drive.
	Parameters of the electronics incorrectly set	➢ See the "Functional impairment after system modification" problem in this table.
	Operating voltage too low	➢ Provide an operating voltage of 48 V.
	Unfavorable operating frequency for step mode	➢ Adapt the operating frequency for the step mode (for details, see "Starting up the Rotation Stage" (p. 31) and manual of the electronics used).

Problem	Possible causes	Solution
	Warped base body	➢ Mount the Q-622 on an even surface. The recommended flatness of the surface is 2 μm.
	Unfavorable load mounting	➢ Observe the maximum torque when affixing the load (p. 23). ➢ The distance between the center of gravity of the load and the center of the moving platform is as small as possible in all directions.
	Unsuitable ambient conditions	➢ Only operate the Q-622 in a clean environment and within the permissible ambient conditions (p. 45).
	Wear of the drive	➢ Replace the Q-622 and make sure that the operating parameters of the electronics are adapted to the rotation stage.
	Drive is blocked	➢ Carefully release the blockage by manually turning the motion platform back and forth. ➢ Contact our customer service department (p. 41).

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. 41).

9 Customer Service

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

> ➢ If you have questions concerning your system, have the following information ready:
>> − Product and serial numbers of all products in the system
>> − Firmware version of the controller (if available)
>> − Version of the driver or the software (if available)
>> − Operating system on the PC (if available)
> ➢ 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 (p. 3) on our website.

PI

10 Technical Data

In this Chapter

10.1 Specifications

10.1.1 Data Table

	Q-622.930	Q-622.900	Q-622.90U	Unit	Tolerance
Motion and positioning	Miniature rotation stage with position sensor for closed-loop operation	Miniature rotation stage without position sensor	Miniature rotation stage, without position sensor for ultrahigh vacuum up to 10^{-9} hPa		
Active axis	θ_z	θ_z	θ_z		
Rotation range	>360	>360	>360	°	
Integrated sensor	Incremental encoder	–	–		
Sensor resolution	0.55	–	–	µrad	
Minimum incremental motion	2.2	100*	100*	µrad	typ.
Unidirectional repeatability	3	–	–		
Maximum velocity, open-loop	70	70	70	°/s	
Mechanical properties					
Load capacity	1	1	1	N	
Holding torque, power off	6	6	6	mNm	min.

PI

	Q-622.930	Q-622.900	Q-622.90U	Unit	Tolerance
Torque	5	5	5	mNm	typ.
Length	22	22	22	mm	
Width	22	22	22	mm	
Height	10	10	10	mm	
Turntable diameter	22	22	22	mm	
Drive properties					
Motor type	Piezoelectric inertia drive	Piezoelectric inertia drive	Piezoelectric inertia drive		
Miscellaneous					
Operating temperature range	0 to 40	0 to 40	0 to 40	°C	
Material	Aluminum	Aluminum	Aluminum		
Mass without cable	15	12	12	g	
Cable length	1	1	1	m	
Connector	Sub-D	Sub-D	Sub-D		
Recommended controller	E-873	E-870, E-872	E-870, E-872		

Ask about custom designs!

* Open-loop

The Q-622 stage series replaces the RPS-22 series.

The specifications were determined on a surface with an evenness of 2 μm.

10.1.2   Maximum Ratings

The Q-622 rotation stage is designed for the following operating data:

Maximum Operating Voltage	Maximum Operating Frequency	Maximum Power Consumption
⚠	⚠	⚠
48 V	20 kHz	10 W

10.1.3   Ambient Conditions and Classifications

The following ambient conditions and classifications for the Q-622 must be observed:

Area of application	For indoor use only
Maximum altitude	2000 m
Air pressure	Q-622.xx0: 1100 hPa to 10^{-6} hPa Q-622.xxU: 1100 hPa to 10^{-9} hPa
Relative humidity	Highest relative humidity 80 % for temperatures up to 31 °C Decreasing linearly to 50 % relative humidity at 40 °C
Operating temperature	0 °C to 40 °C
Storage temperature	-20 °C to 70 °C
Transport temperature	-20 °C to 70 °C
Maximum bakeout temperature for Q-622.xxU:	120 °C, for 12 hours, only in **switched-off** state
Maximum bakeout temperature for Q-622.xx0:	80 °C, for 2 hours, only in **switched-off** state
Overvoltage category	II
Protection class	I
Degree of pollution	1
Degree of protection according to IEC 60529	IP20

PI

10.2 Operating Time

The duration of motion and the operating frequency in step mode affect the lifetime of the rotation stage. In order to prevent overheating and increased wear, the motion duration at the given velocity or given operating frequency may not exceed the values given in the following table.

Velocity in mm/s	Operating frequency in Hz[1]	Maximum duration of motion in s	Idle time in s
10	20000	10	10
5	10000	20	10
2.5	5000	60	10
0.5	≤ 1000	120	10

[1] For the relevant parameters, see "Starting up the Rotation Stage" (p. 31) and the user manual of the electronics used.

10.3 Dimensions

10.3.1 Q-622.930

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

Figure 14:   Q-622.930

PI
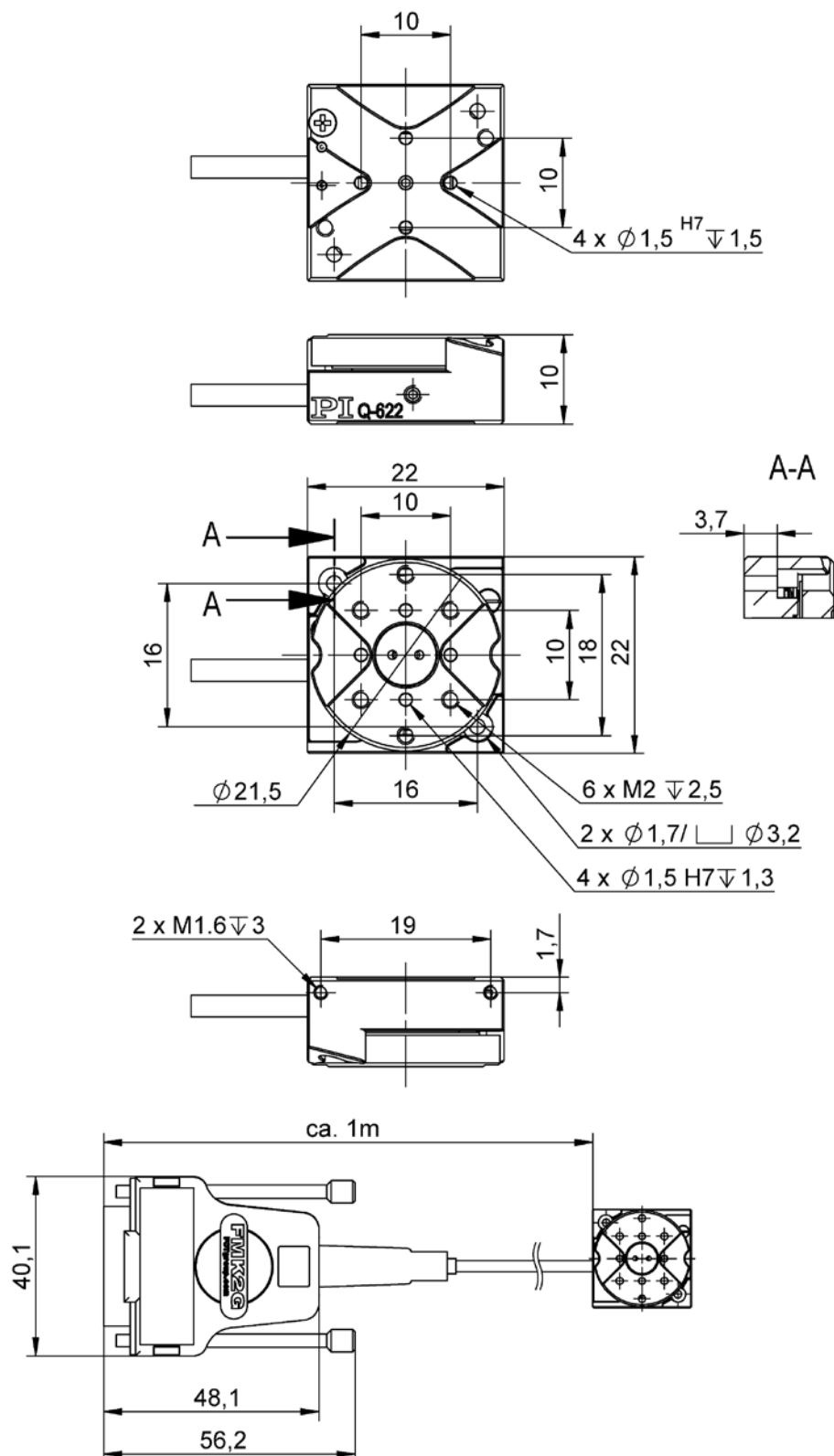
10.3.2 Q-622.900

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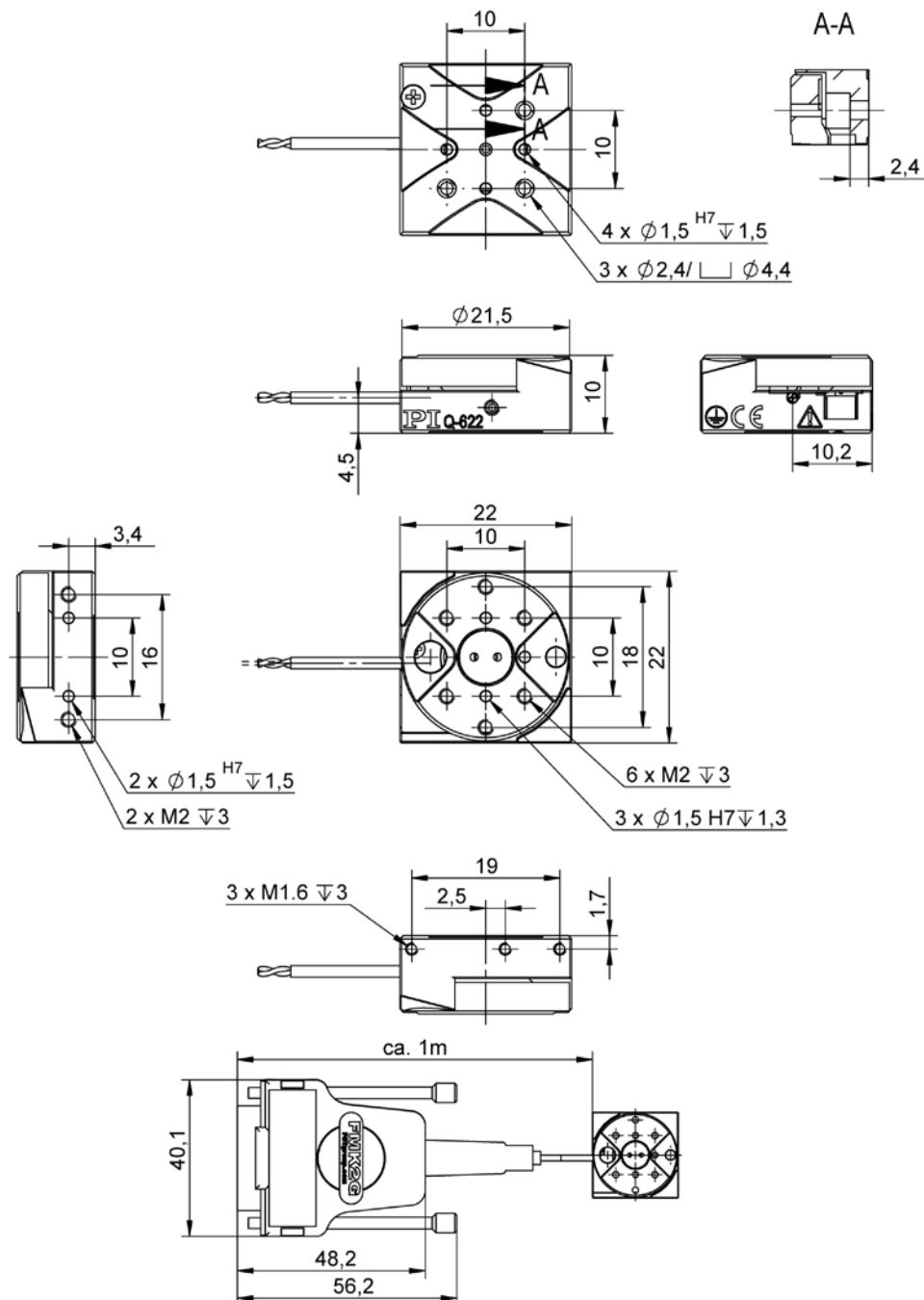

Figure 15:   Q-622.900

10.3.3   Q-622.90U

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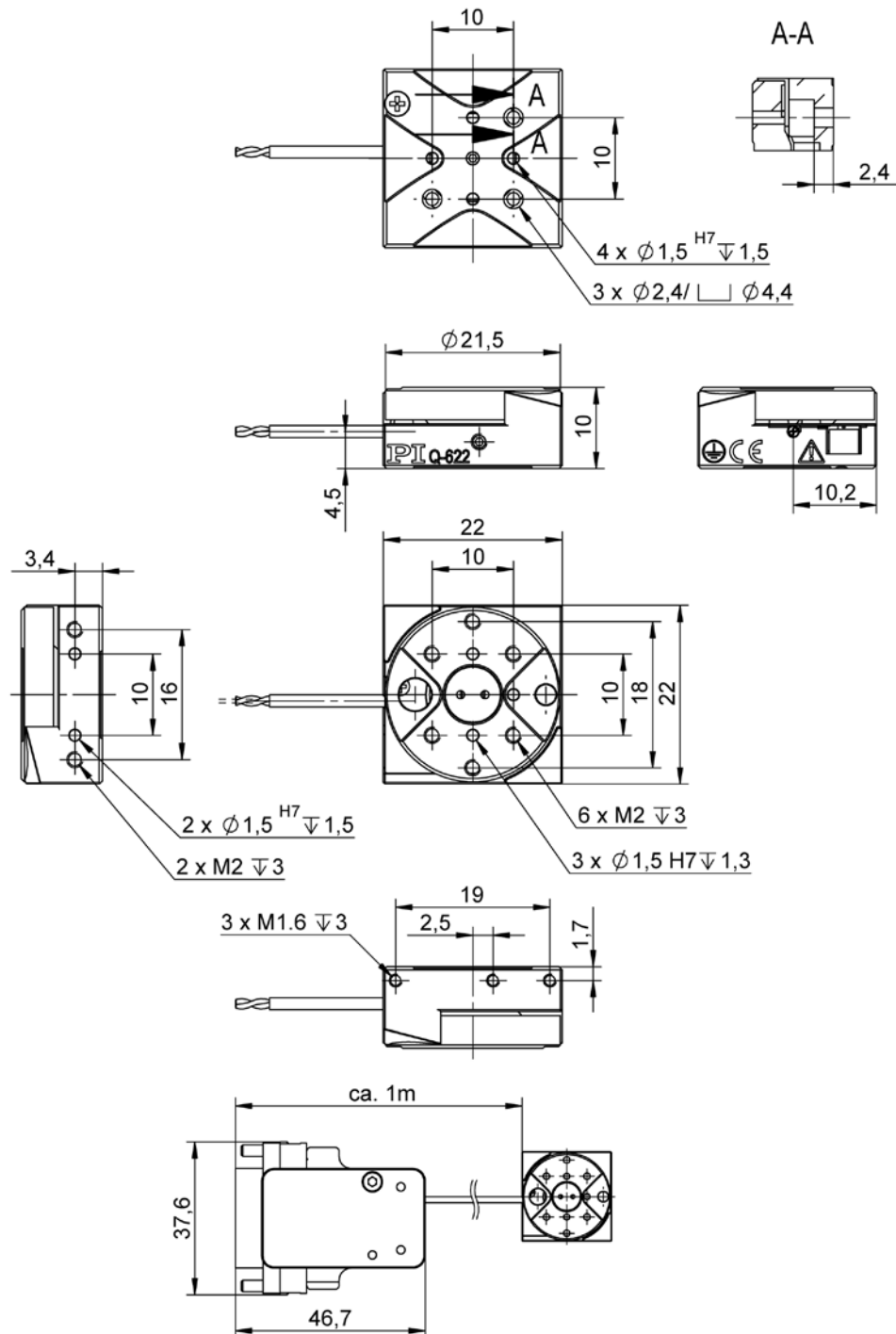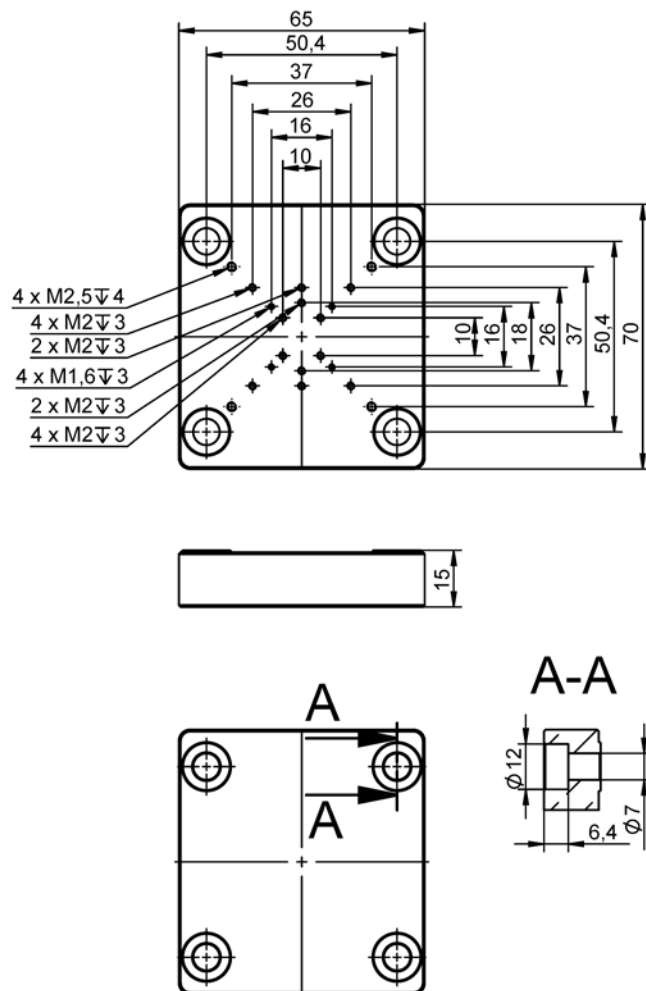

Figure 16:   Q-622.90U

PI

10.3.4 Q-101.AP1 Adapter Plate

Dimensions in mm.

Figure 17:   Q-101.AP1 adapter plate

10.3.5 Vacuum Feedthroughs

Available vacuum feedthroughs:

- C-815.VF (p. 51)
- C-815.VFU1 (p. 53)
- C-815.VFU3 (p. 54)
- C-815.VFU6 (p. 55)
- C-815.VFU15 (p. 56)

For the C-815.VF vacuum feedthrough, the recommended dimensions for a vacuum chamber opening can be found on p. 52.

C-815.VF vacuum feedthrough for 10⁻⁶ hPa

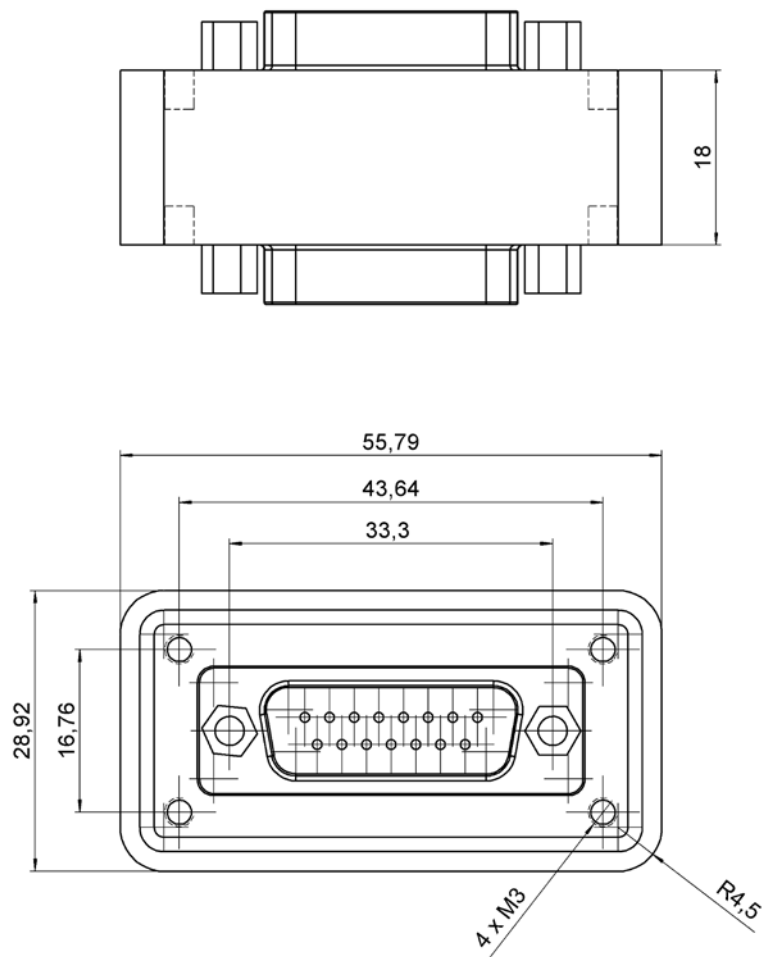Dimensions in mm. Note that the decimal places are separated by a comma in the drawings.

Figure 18:   C-815.VF vacuum feedthrough Sub-D 15 (m/f)

Recommended vacuum chamber opening for the C-815.VF vacuum feedthrough for 10^{-6} hPa

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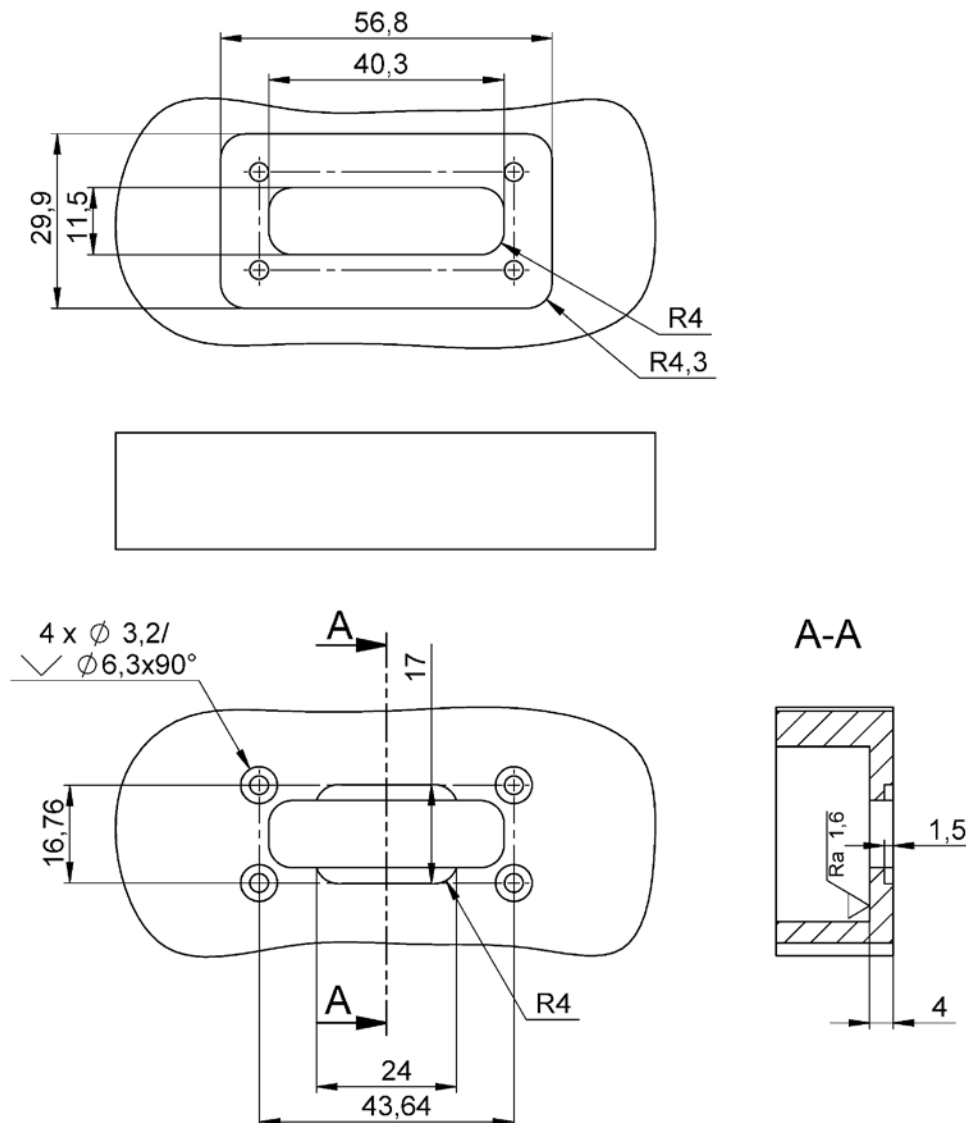

Figure 19: Top: View of the opening on the air side; middle: Section of the vacuum chamber as specified by the customer; bottom: View from the vacuum side

C-815.VFU1 vacuum feedthrough for 10^{-9} hPa

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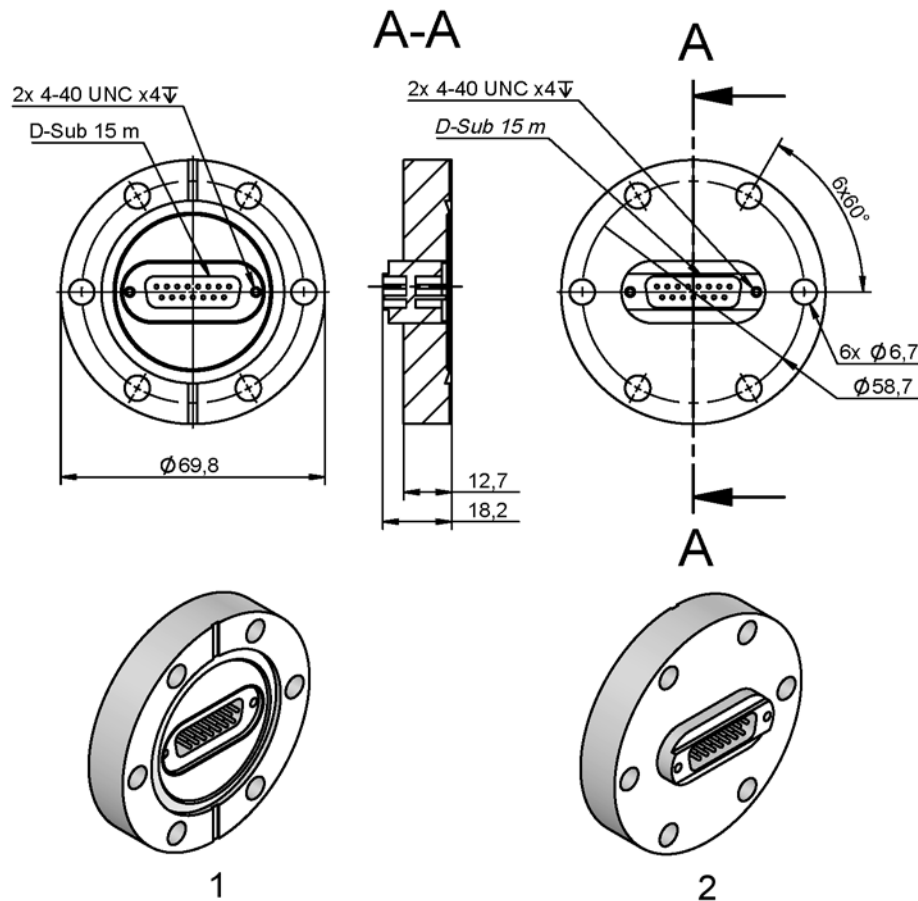

Figure 20:   C-815.VFU1 vacuum feedthrough, Sub-D 15 (m/m)

1   Vacuum side
2   Air side

C-815.VFU3 vacuum feedthrough for 10^{-9} hPa

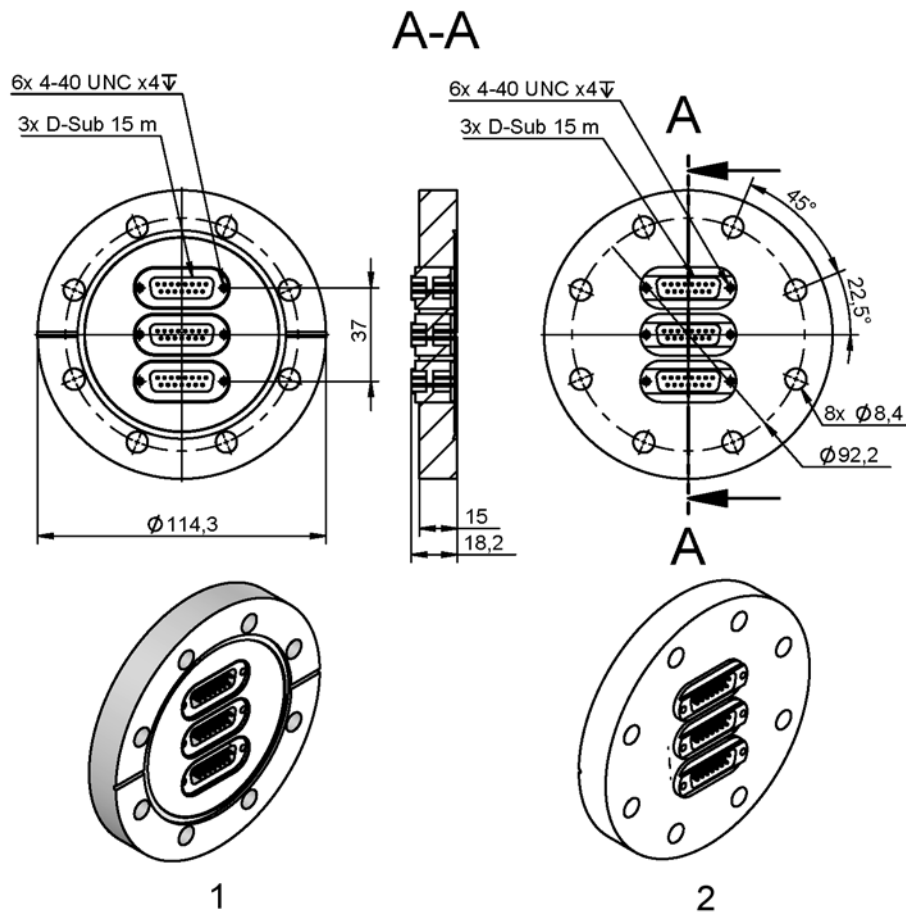Dimensions in mm. Note that the decimal places are separated by a comma in the drawings.

Figure 21:   C-815.VFU3 vacuum feedthrough, Sub-D 15 (m/m)

1	Vacuum side
2	Air side

C-815.VFU6 vacuum feedthrough for 10⁻⁹ hPa

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

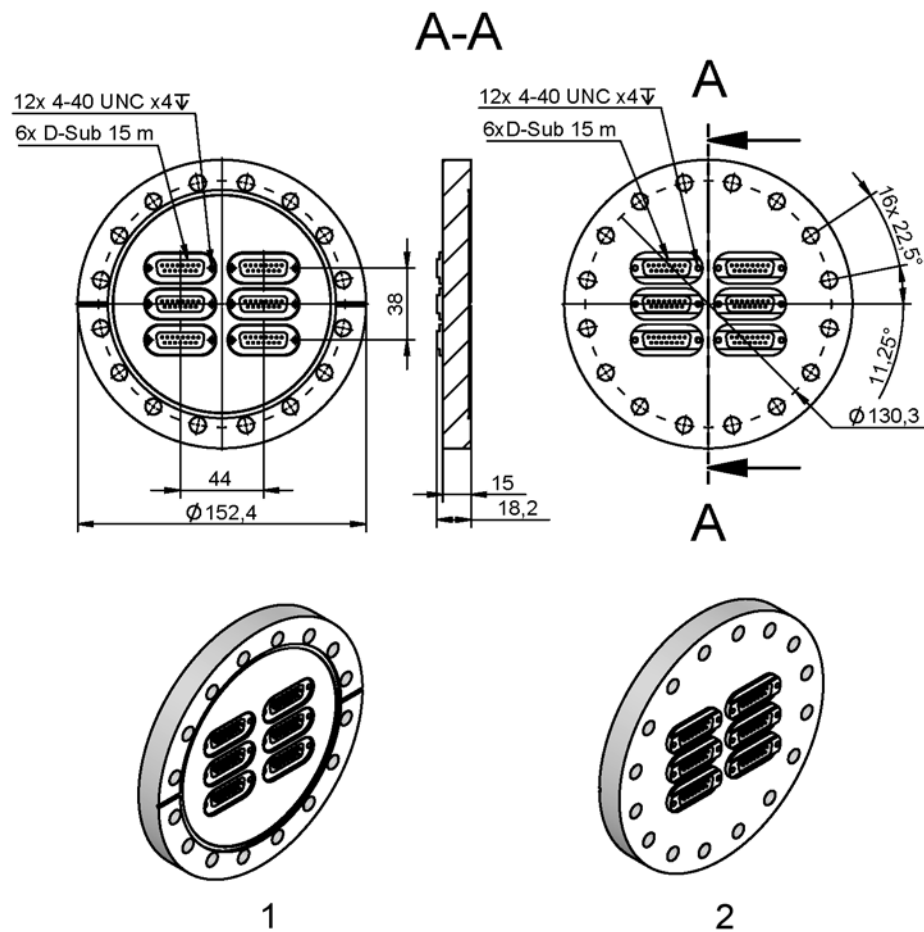Figure 22:   C-815.VFU6 vacuum feedthrough, Sub-D 15 (m/m)

1   Vacuum side
2   Air side

C-815.VFU15 vacuum feedthrough for 10^{-9} hPa

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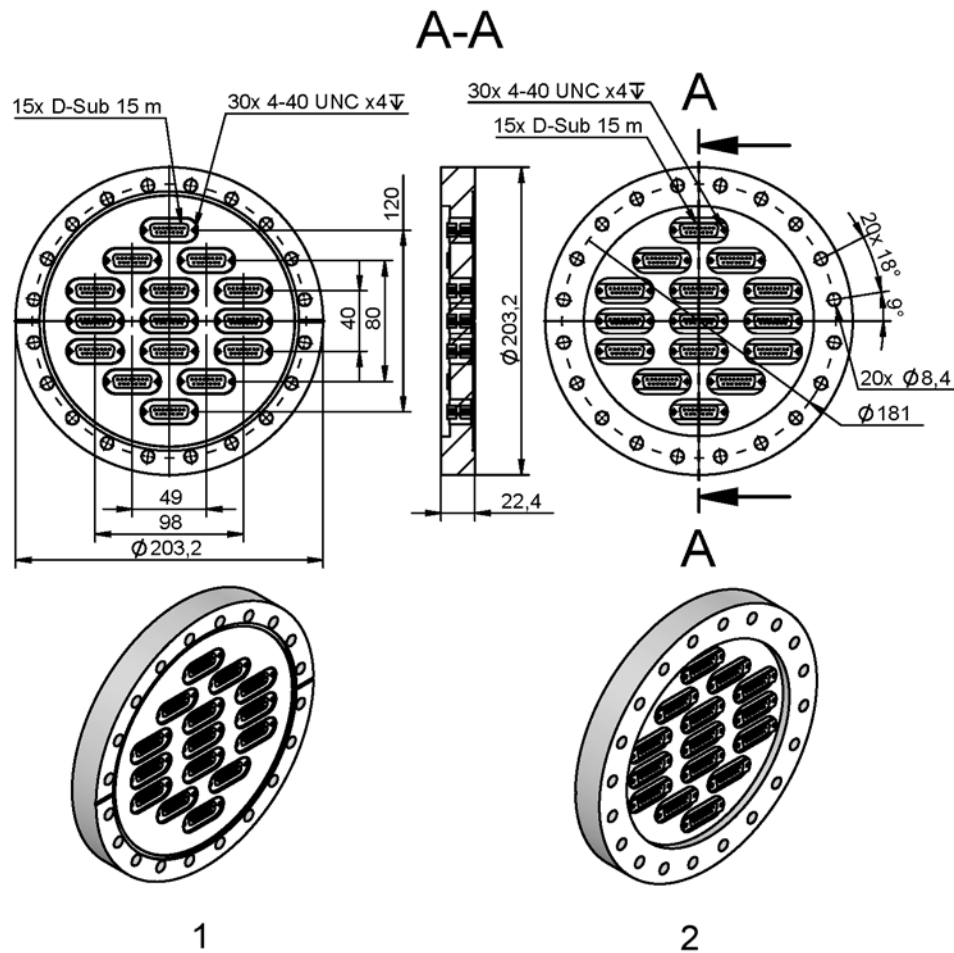

Figure 23:   C-815.VFU15 vacuum feedthrough, Sub-D 15 (m/m)

1   Vacuum side
2   Air side

10.4 Pin Assignment

10.4.1 Q-622.xx0

Connector: Sub-D 15 (m)

The Sub-D 15 (m) connector transmits the signals of the drive and, for the models with sensor, in addition the signals of the sensor and of the ID chip.
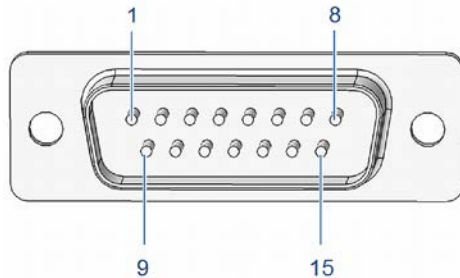

Figure 24: Sub-D 15 (m) connector

Pin	Signal[1]	Function	Direction
1	REF - [2]	Reference signal differential (-)	Output
2	Motor (-)	Motor signal differential (-)	Input
3	Motor (+)	Motor signal differential (+)	Input
4	V_{DD} [2]	Supply voltage (+5 V)	Input
5	-	-	-
6	ID chip data [2]	ID chip data	Output
7	SIN - [2]	Encoder A (-)	Output
8	COS - [2]	Encoder B (-)	Output
9	Motor (-)	Motor signal differential (-)	Input
10	GND	GND	GND
11	Motor (+)	Motor signal differential (+)	Input
12	-	-	-
13	REF +	Reference signal differential (+)	Output
14	SIN + [2]	Encoder A (+)	Output
15	COS + [2]	Encoder B (+)	Output

[1] The "-" sign indicates that the corresponding pin has not been assigned.

[2] Only for models with sensor. Not assigned for models without sensor.

The cable shield is connected to the connector shell.

10.4.2   Q-622.xxU

Connector: Sub-D 15 (f)

The Sub-D 15 (f) connector transmits the signals of the drive and, for the models with sensor, in addition the signals of the sensor and of the ID chip.
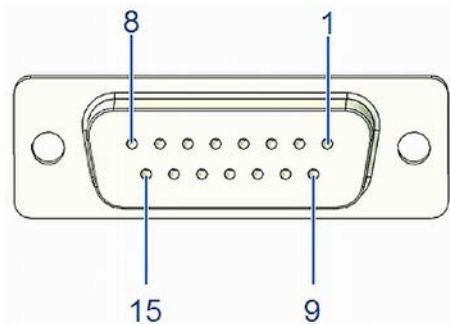

Figure 25:   Sub-D 15 (f) connector

Pin	Signal[1]	Function	Direction
1	COS - [2]	Encoder B (-)	Output
2	SIN - [2]	Encoder A (-)	Output
3	ID chip data [2]	ID chip data [2]	Output
4	-	-	-
5	V_{DD} [2]	Supply voltage (+5 V)	Input
6	Motor (+)	Motor signal differential (+)	Input
7	Motor (-)	Motor signal differential (-)	Input
8	REF - [2]	Reference signal differential (-)	Output
9	COS + [2]	Encoder B (+)	Output
10	SIN + [2]	Encoder A (+)	Output
11	REF + [2]	Reference signal differential (+)	Output
12	-	-	-
13	Motor (+)	Motor signal differential (+)	Input
14	GND	GND	GND
15	Motor (-)	Motor signal differential (-)	Input

[1] The "-" sign indicates that the corresponding pin has not been assigned.

[2] Only for models with sensor. Not assigned for models without sensor.

The cable shield is connected to the connector shell.
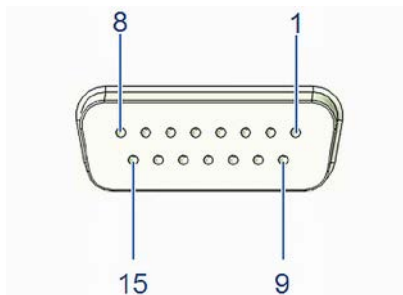
10.4.3   C-815.VF Vacuum Feedthrough

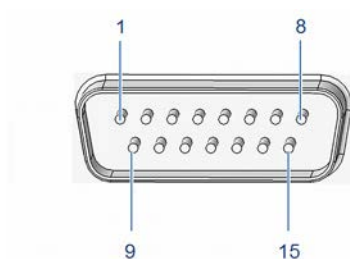**Sub-D 15 (m/f)**

Figure 26:   Vacuum side: Sub-D 15 (f) socket

Figure 27:   Air side: Sub-D 15 (m) panel plug

Vacuum side (f)			Air side (m)
Pin	Signal	Function	Pin
1	REF -	Reference signal differential (-)	1
2	Motor (-)	Motor signal differential (-)	2
3	Motor (+)	Motor signal differential (+)	3
4	V_{DD}	Supply voltage (+5 V)	4
5	-	-	5
6	ID chip data	ID chip data	6
7	SIN -	Encoder A (-)	7
8	COS -	Encoder B (-)	8
9	Motor (-)	Motor signal differential (-)	9
10	GND	GND	10
11	Motor (+)	Motor signal differential (+)	11
12	-	-	12
13	REF +	Reference signal differential (+)	13
14	SIN +	Encoder A (+)	14
15	COS +	Encoder B (+)	15

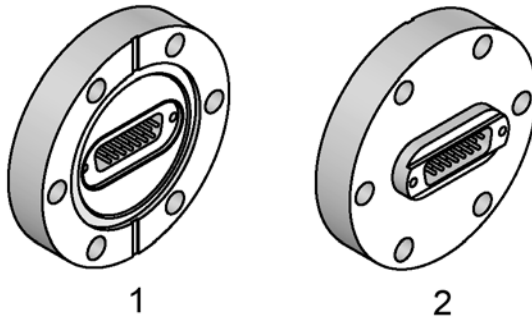### 10.4.4   C-815.VFUx Vacuum Feedthrough

Sub-D 15 (m/m)

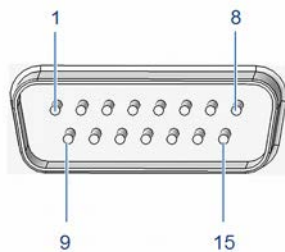Figure 28:   C-815.VFUx vacuum feedthrough

1   Vacuum side
2   Air side

Figure 29:   Sub-D 15 (m) panel plug

Vacuum side			Air side
Pin	Signal	Function	Pin
1	COS -	Encoder B (-)	8
2	SIN -	Encoder A (-)	7
3	ID chip data	ID chip data	6
4	-	-	5
5	V_{DD}	Supply voltage (+5 V)	4
6	Motor (+)	Motor signal differential (+)	3
7	Motor (-)	Motor signal differential (-)	2
8	REF -	Reference signal differential (-)	1
9	COS +	Encoder B (+)	15
10	SIN +	Encoder A (+)	14
11	REF +	Reference signal differential (+)	13
12	-	-	12

Vacuum side			Air side
Pin	Signal	Function	Pin
13	Motor (+)	Motor signal differential (+)	11
14	GND	GND	10
15	Motor (-)	Motor signal differential (-)	9

10.4.5   5604500041 Adapter

Sub-D 15 (m/m)

The adapter is only required if a Q-622.xxU model is to be operated at atmospheric pressure (i.e., without a vacuum feedthrough).
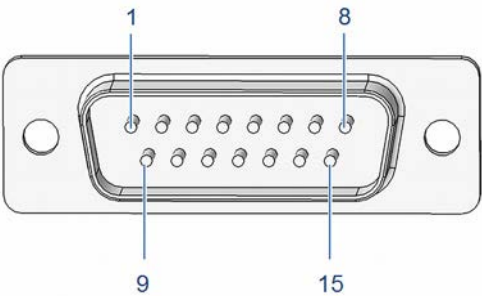

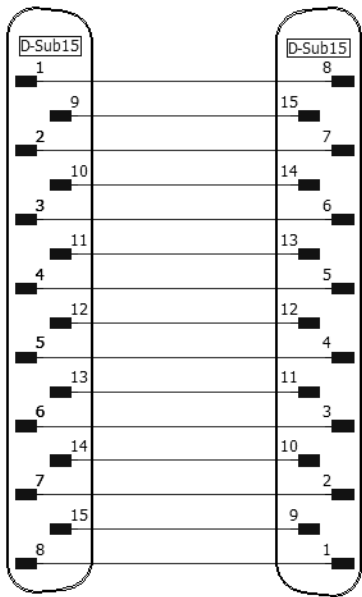Figure 30:   Sub-D 15 (m) connector

Figure 31:   Pin assignment of the 5604500041 adapter

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

PI

12 EU Declaration of Conformity

For the Q-622, an EU Declaration of Conformity has been issued in accordance with the following European directives:

Low Voltage Directive

EMC Directive

RoHS Directive

The applied standards certifying the conformity are listed below.

Safety (Low Voltage Directive): EN 61010-1

EMC: EN 61326-1

RoHS: EN 50581