

786 Swing Head



Manual

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1 Introduction

1.1 Instrument description

The 786 Swing Head is an auxiliary drive for the Sample Processors from Metrohm, e.g. the 815 USB Robotic Sample Processor XL. It extends the capabilities of these automation systems to include the possibility of moving precisely to any given position on a sample rack. The working area of the Sample Processors is now being expanded even further. Now, even positions outside of the sample rack can be moved to as a result. It is thus possible to transfer samples from the sample rack into separate working stations in just a few simple steps.

This is a high-precision motor drive, which is mounted on the tower of a Sample Processor. Robotic arms of different construction types are available for assembly on the 786 Swing Head. Equipped with the corresponding accessories, these can be used for applications requiring a high degree of flexibility or very complex working steps.

1.2 Model versions

786 Swing Head with transfer robotic arm left (2.786.0010)

Additional equipment for the Sample Processors for transferring/pipetting liquid samples out of smaller-sized sample vessels and into larger titration vessels on the rack or into an external titration cell which is mounted to the left of the workplace.

786 Swing Head with transfer robotic arm right (2.786.0020)

Additional equipment for the Sample Processors for transferring/pipetting liquid samples from smaller-sized sample vessels and into larger titration vessels on the rack or into an external titration cell which is mounted to the right of the workplace.

786 Swing Head with titration robotic arm (2.786.0030)

Additional equipment for the Sample Processor for the purpose of direct titration into sample vessels 75 mL in size and larger.

786 Swing Head without robotic arm (2.786.0040)

Additional equipment for the Sample Processor without titration or transfer robotic arm.

786 Swing Head with reinforcement right (2.786.0240)

Reinforced Swing Head for assembly on Sample Processors.

1.3 Intended use

The 786 Swing Head is designed for usage in an automation system in analytical laboratories. It is **not** suitable for usage in biochemical, biological or medical environments in its basic equipment version.

This instrument is suitable for transferring chemicals and flammable solvents. The usage of the 786 Swing Head therefore requires that the user has basic knowledge and experience in the handling of toxic and caustic substances. Knowledge with respect to the application of the fire prevention measures prescribed for laboratories or production plants is also mandatory.

1.4 About the documentation









CAUTION

Please read through this documentation carefully before putting the instrument into operation. The documentation contains information and warnings which have to be followed by the user in order to ensure safe operation of the instrument.

1.4.1 Symbols and conventions

The following symbols and styles are used in this documentation:

(5-12)	<p>Cross-reference to figure legend</p> <p>The first number refers to the figure number, the second to the instrument part in the figure.</p>
1	<p>Instruction step</p> <p>Carry out these steps in the sequence shown.</p>
	<p>Warning</p> <p>This symbol draws attention to a possible life hazard or risk of injury.</p>
	<p>Warning</p> <p>This symbol draws attention to a possible hazard due to electrical current.</p>
	<p>Warning</p> <p>This symbol draws attention to a possible hazard due to heat or hot instrument parts.</p>

	<p>Warning</p> <p>This symbol draws attention to a possible biological hazard.</p>
	<p>Caution</p> <p>This symbol draws attention to a possible damage of instruments or instrument parts.</p>
	<p>Note</p> <p>This symbol marks additional information and tips.</p>

1.5 Safety instructions

1.5.1 General notes on safety



WARNING

Operate this instrument only according to the information contained in this documentation.

This instrument left the factory in a flawless state in terms of technical safety. To maintain this state and ensure non-hazardous operation of the instrument, the following instructions must be observed carefully.

1.5.2 Electrical safety

The electrical safety when working with the instrument is ensured as part of the international standard IEC 61010.



WARNING

Only personnel qualified by Metrohm are authorized to carry out service work on electronic components.



WARNING

Never open the housing of the instrument. The instrument could be damaged by this. There is also a risk of serious injury if live components are touched.

There are no parts inside the housing which can be serviced or replaced by the user.

1.5.3 Tubing and capillary connections



CAUTION

Leaks in tubing and capillary connections are a safety risk. Tighten all connections well by hand. Avoid applying excessive force to tubing connections. Damaged tubing ends lead to leakage. Appropriate tools can be used to loosen connections.

Check the connections regularly for leakage. If the instrument is used mainly in unattended operation, then weekly inspections are mandatory.

1.5.4 Personnel safety



WARNING

Wear protective goggles and working clothes suitable for laboratory work while operating the 786 Swing Head. It is also advisable to wear gloves when caustic liquids are used or in situations where glass vessels could break.



WARNING

Always install the safety shield supplied with the equipment before using the instrument for the first time. Pre-installed safety shields are not allowed to be removed.

The 786 Swing Head may not be operated without a safety shield!



WARNING

Personnel are not permitted to reach into the working area of the instrument while operations are running!

A **considerable risk of injury** exists for the user.



WARNING

In the event of a possible blockage of a drive, the power plug must be pulled out of the socket immediately. Do not attempt to free jammed sample vessels or other parts while the device is switched on. Blockages can only be cleared when the instrument is in a voltage-free status; this action generally involves a **considerable risk of injury**.



WARNING

The 786 Swing Head is **not** suitable for utilization in biochemical, biological or medical environments in its basic equipment version.

Appropriate protective measures must be implemented in the event that potentially infectious samples or reagents are being processed.

1.5.5 Flammable solvents and chemicals

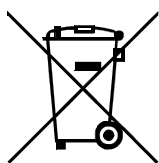


WARNING

All relevant safety measures are to be observed when working with flammable solvents and chemicals.

- Set up the instrument in a well-ventilated location.
- Keep all sources of flame far from the workplace.
- Clean up spilled liquids and solids immediately.
- Follow the safety instructions of the chemical manufacturer.

1.5.6 Recycling and disposal



This product is covered by European Directive 2012/19/EU, WEEE – Waste Electrical and Electronic Equipment.

The correct disposal of your old instrument will help to prevent negative effects on the environment and public health.

More details about the disposal of your old instrument can be obtained from your local authorities, from waste disposal companies or from your local dealer.

2 Overview of the instrument

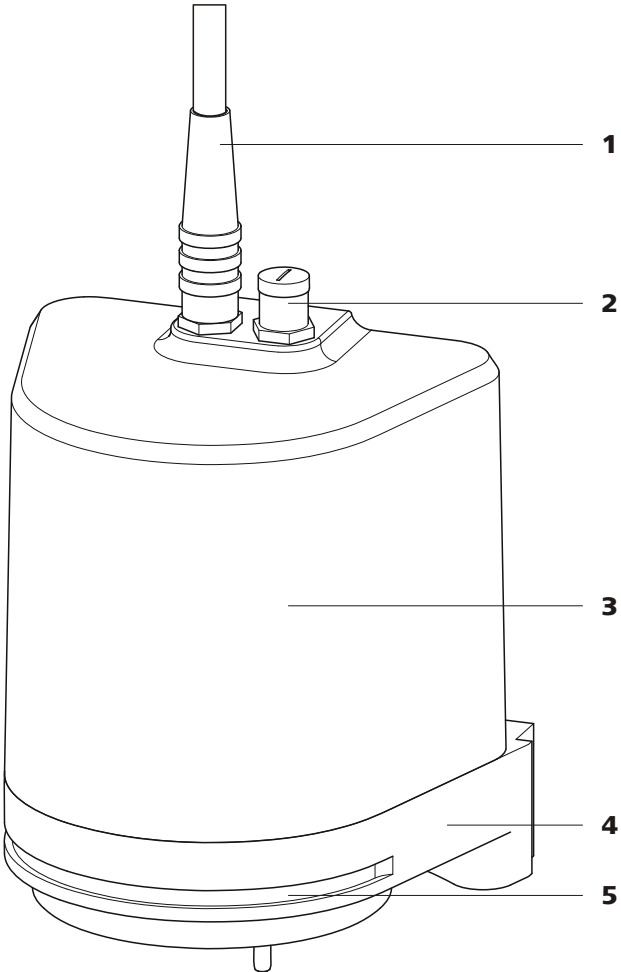


Figure 1 Front 786 Swing Head

1 Connection cable	2 Connector for beaker sensor
3 Housing	4 Fastening plate
5 Guide slot For the robotic arm reinforcement.	

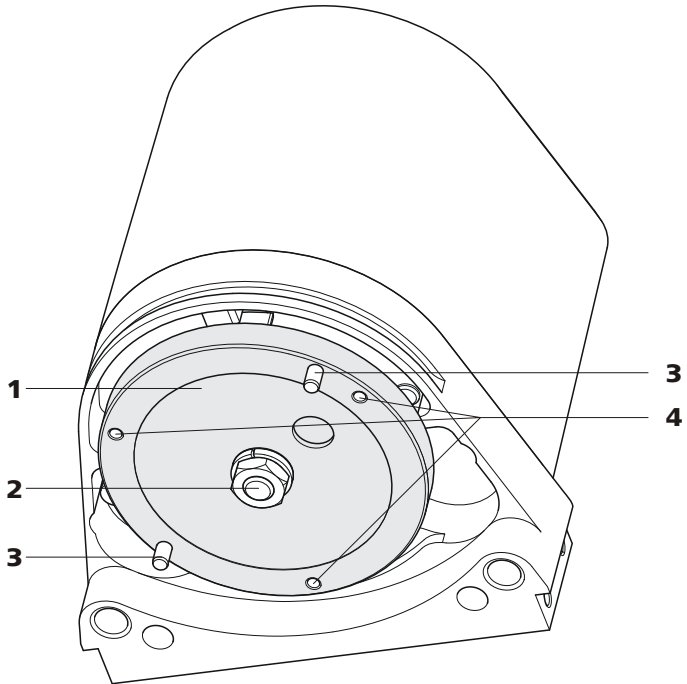


Figure 2 Underside 786 Swing Head

1 Drive disc	2 Swing axis
3 Drive pin	4 M2 bore holes For fastening a robotic arm.

3 Installation

3.1 Packaging

The instrument is supplied in protective packaging together with the separately packed accessories. Keep this packaging, as only this ensures safe transportation of the instrument.

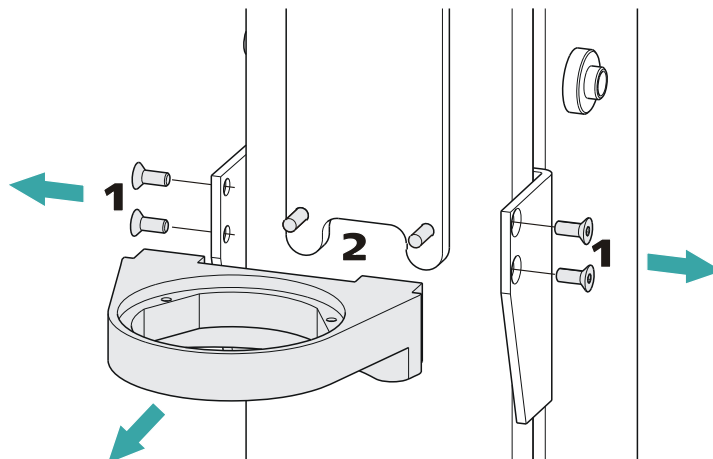
3.2 Checks

Immediately after receipt, check whether the shipment has arrived complete and without damage by comparing it with the delivery note.

3.3 Mounting the Swing Head to the Sample Processor

3.3.1 Mounting the Swing Head

Dismounting the titration head holder



- 1** Loosen the screws of the holder on both sides.
- 2** Unscrew and remove the holder from the holder plate of the guide chain.

Use the supplied hex key. Set the screws aside for later use.

Connecting the Swing Head

The connection socket (Mini DIN) for the Swing Head drive is located on the rear of the tower above the stirrer connector.

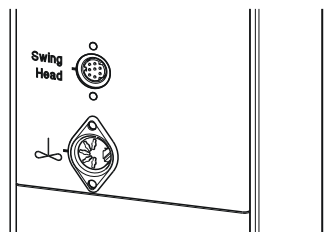


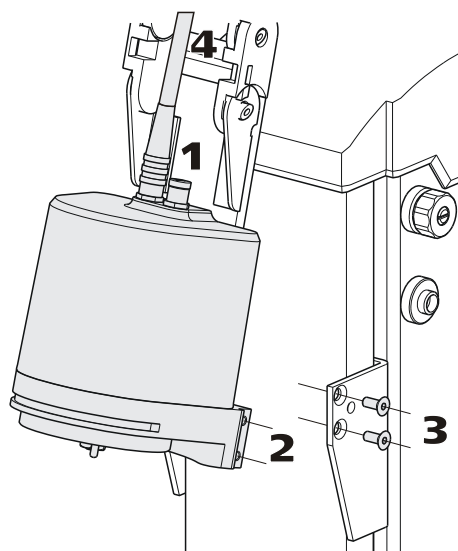
Figure 3 Connecting the Swing Head

Connect the Swing Head as follows:

1 Plugging in the cable

- Guide the connection cable of the Swing Head through the guide chain of the tower (see chapter 3.7, page 18).
- Plug the Mini DIN plug into the socket 'Swing Head'.

Mounting the Swing Head



- 1 Tighten the Swing Head to the holder plate of the guide chain with two V.024.4012 countersunk screws.

- 2 Clamp the Swing Head between the guide jaws.



- 3 Tighten the Swing Head to the guide jaws with the screws previously removed.
- 4 Place the connection cable into the guide chain (see chapter 3.7, page 18).

Mounting the Swing Head with tower extension

For certain applications, it may be necessary to mount the 786 Swing Head at a higher position. A **6.2058.010 tower extension** can be mounted on the lift for this purpose.

First, dismount the titration head holder (see chapter 3.3.1, page 8). Proceed afterwards as follows:

- 1 Fasten the tower extension to the lift guide of the Sample Processor in accordance with the following illustration and fix it in place with the screws provided.

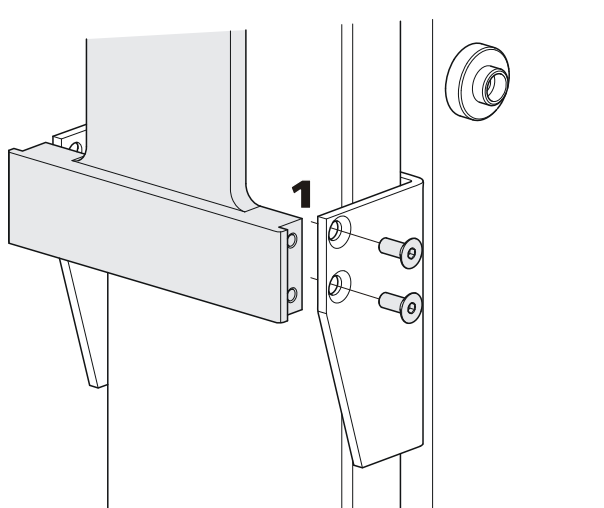


Figure 4 Mounting the tower extension

- 2 Tighten the Swing Head to the holder plate of the guide chain with two V.024.4012 countersunk screws.

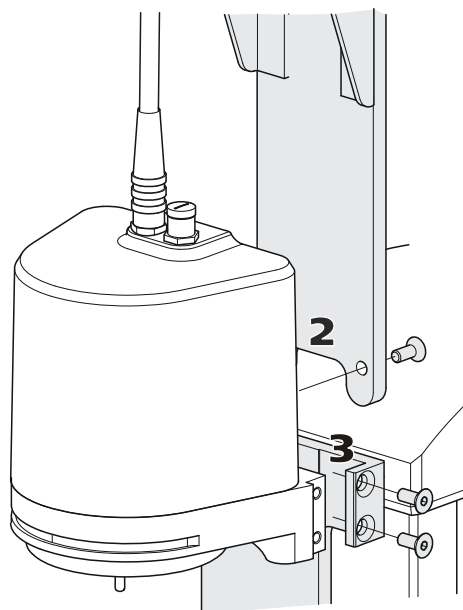


Figure 5 Mounting the Swing Head to the tower extension

- 3** Tighten the Swing Head to the upper end of the tower extension.

3.3.2 Mounting the robotic arm reinforcement

In cases in which it is necessary to take up or strip off a filter or a pipetting tip on the robotic arm, you must mount a **6.2058.090 robotic arm reinforcement**. The reinforcement provides the robotic arm with stable resistance when picking up or stripping the tools used and prevents it from bending.

The reinforcement has to be attached before mounting a robotic arm. Proceed as follows:

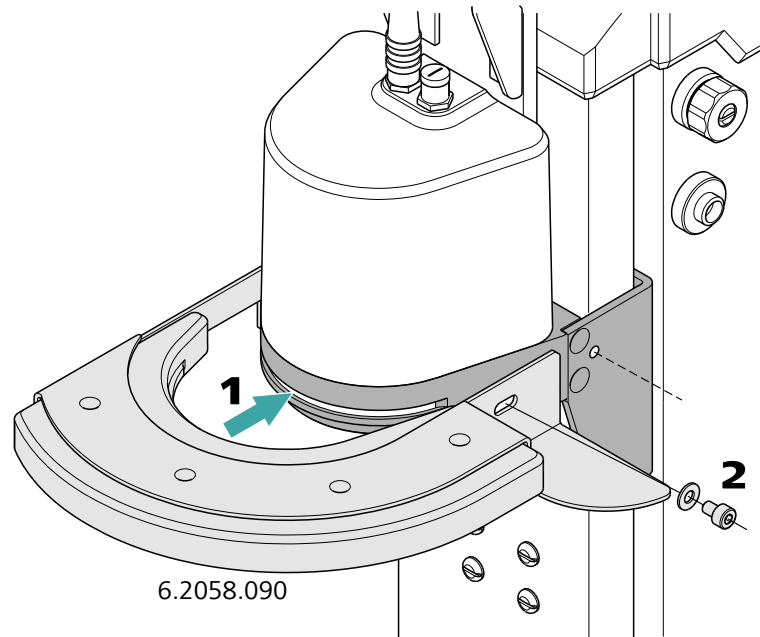


Figure 6 Mounting the 6.2058.090 robotic arm reinforcement

- 1 Slide the reinforcement from the front over the holder plate of the Swing Head.
- 2 Tighten the reinforcement to the lift guide with the screws provided.

3.4 Configuring the robotic arm

A variety of differently constructed robotic arms is available for enabling a wide range of applications. They differ from one another in their geometric sizes, e.g. swing radius or maximum permissible swing range. The configuration data must be entered in the Sample Processor or in the control software **prior to the assembly of the robotic arm**. The data required is engraved on the underside of the robotic arm. Examples of the most common robotic arms are shown in the illustration below.

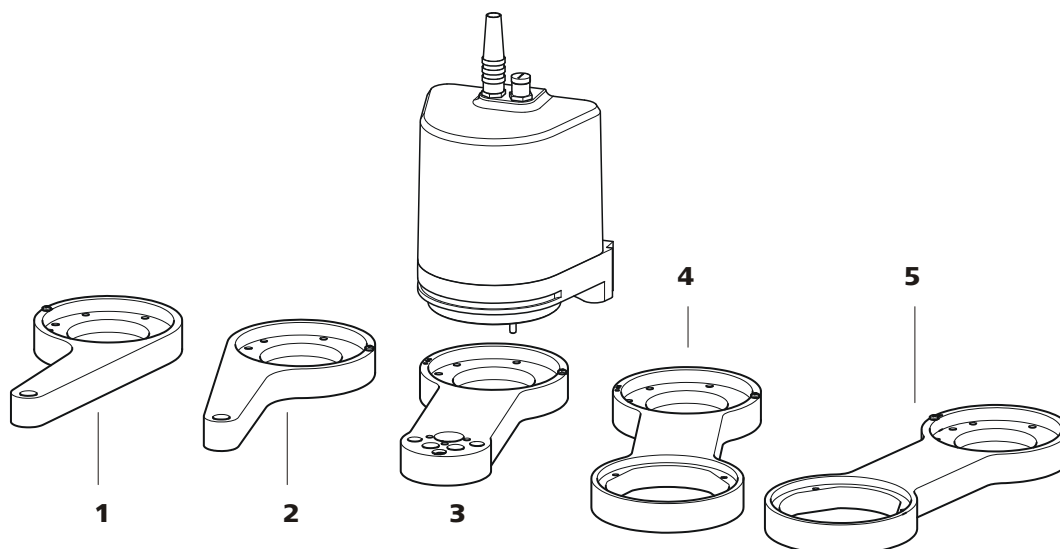


Figure 7 Robotic arms - standard model versions:

1 Transfer robotic arm (6.1462.030)

For sample transfer, left-swinging.

3 Titration robotic arm (6.1462.050)

With titration head, left-/right-swinging *).

5 Macro robotic arm (6.1462.070)

With holder for a 6.1458.XXX titration head insert, right-swinging.

2 Transfer robotic arm (6.1462.040)

For sample transfer, right-swinging.

4 Macro robotic arm (6.1462.060)

With holder for a 6.1458.XXX titration head insert, left-swinging.

*) can be mounted in two ways



NOTICE

A detailed list of the available robotic arms, along with the necessary configuration data, can be found in *Chapter Robotic arms and overflow buret, page 23ff.*

The following figure illustrates the most important configuration data that needs to be set in the control software to ensure correct usage of a robotic arm (left-swinging, here).

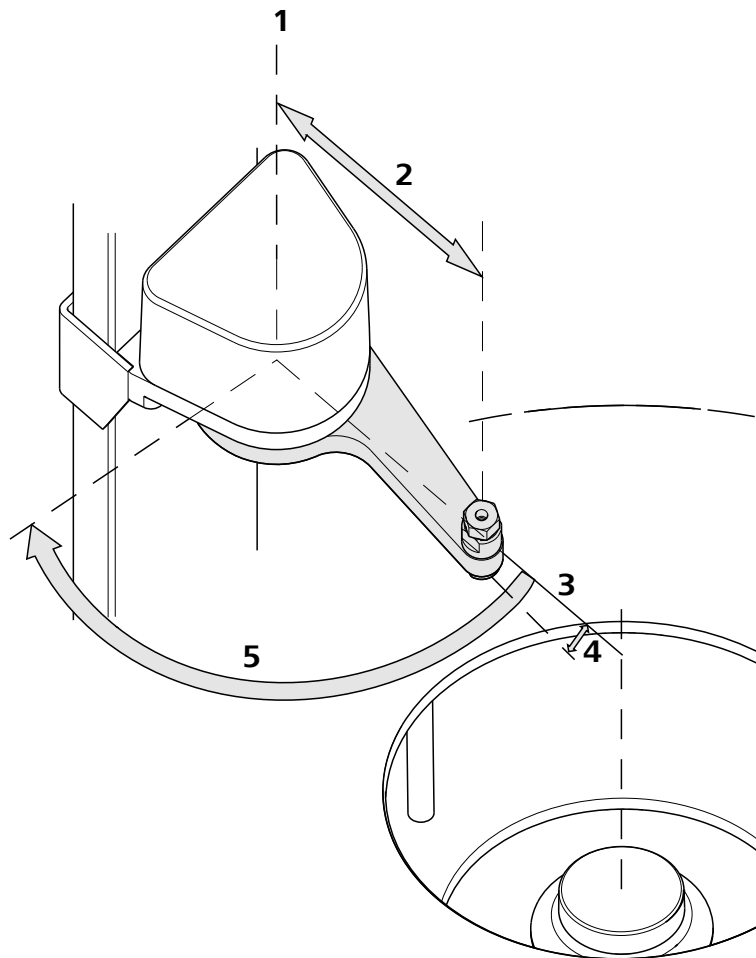


Figure 8 Configuration data of the robotic arms

1 Swing axis

This runs through the middle of the Swing Head drive.

2 Swing radius

This is determined by the length of the robotic arm. The radius runs from the axis of rotation to the midpoint of the tip of the robotic arm.

3 Source axis

It runs from the swing axis to the center of the sample rack and marks the initial position of the robotic arm.

4 Robotic arm offset

It determines the 0° position of the robotic arm.

5 Maximum swing range

This stands for the swing range that the robotic arm can reach. The range runs from the source axis to the maximum possible robotic arm position.

Swing direction

Left-swinging (**swing direction +**) or right-swinging (**swing direction -**) model versions are available as different types of robotic arms. Left-swing-

ing means swinging from the initial position (pointing towards the rack center) outwards to the left.

In the case of a Sample Processor with two towers, a right-swinging robotic arm must be mounted on Tower 1, a left-swinging robotic arm on Tower 2. If the positioning is incorrect, the two robotic arms could possibly come into contact with one another, resulting in damage to the drives.

3.5 Mounting the robotic arm

Depending on the model, robotic arms can be mounted as either right-swinging or left-swinging. The position of the limitation screw of the robotic arm must be taken into account during assembly. The limitation screw must face the tower of the Sample Processor when mounting the robotic arm. The following illustration shows on the left the position of the limitation screw on a right-swinging robotic arm (**Position 1**) and on the right on a left-swinging robotic arm (**Position 2**).

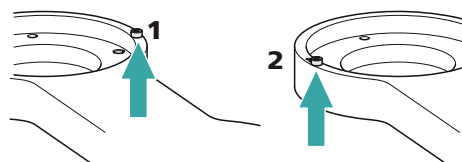


Figure 9 Limitation screw on the robotic arm

For robotic arms which can be mounted in two different ways (e.g. 6.1462.050), the limitation screw can be fitted in accordance with the required assembly direction (see above).



NOTICE

The configuration data of a robotic arm must be configured in the control software **before it is mounted** (see chapter 3.4, page 12).

Mounting the robotic arm

The mounting of a robotic arm on the Swing Head is described here, taking as an example a 6.1462.070 robotic arm for titration and a 6.1458.040 titration head insert. Initialize the Sample Processor before mounting.

After the initialization of the Sample Processor, the drive disk of the Swing Head is positioned as though the robotic arm were located in the outermost position.

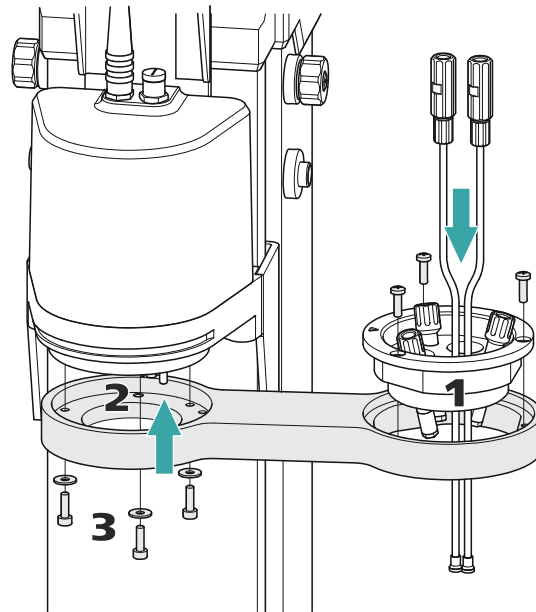


Figure 10 Mounting the robotic arm

Mount the robotic arm as follows:

- 1 Place the **6.1458.040 titration head insert** in the opening of the robotic arm. The marking on the edge must be closer to the Swing Head. Tighten the titration head insert with the provided screws.
- 2 Hold the robotic arm in such a way that the opening faces to the right. While doing so, rotate the robotic arm outwards as far as possible, i.e. towards the tower - see above. Slip the robotic arm from below over the guide bolts of the drive disk of the Swing Head.



NOTICE

Take care not to twist the drive disk and thereby put strain on the drive.

- 3 Tighten the robotic arm to the Swing Head with the screws and washers supplied.

3.6 Robotic arms with beaker sensor

For safety reasons, the presence of a beaker on the sample rack of a Sample Processor can be detected. Some robotic arm model versions are therefore equipped with a beaker sensor.

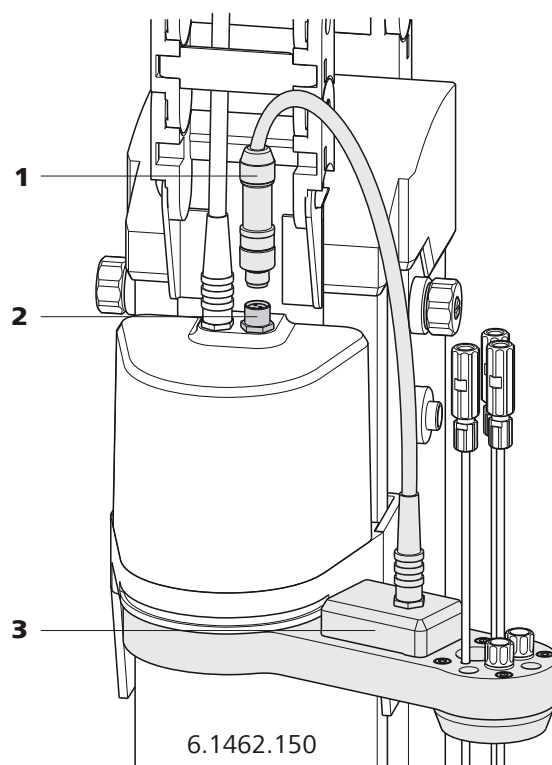


Figure 11 Connecting a beaker sensor (for example 6.1462.150)

1 Plug of the connection cable

2 Connection socket on the 786 Swing Head

3 Beaker sensor

Contact sensor in accordance with the Piezo principle

A robotic arm with beaker sensor is mounted as described on *page 15*. The connection of the sensor cable must take place while the instrument is switched off.

The beaker sensor is automatically recognized when switching on the instrument.

Functioning of the beaker sensor

If the beaker sensor of the robotic arm is activated, then the lift of the Sample Processor will move automatically into its work position after a MOVE command. The presence of the sample vessel is checked by the robotic arm setting down on top of it.



No separate LIFT command is required in such cases.



NOTICE

The work position of the lift must be configured in such a way that the robotic arm is in place on the sample vessel. The robotic arm must bend very slightly while doing so, so that the Piezo sensor will generate a signal.

3.7 Placing tubing and cables in the guide chain

Tubing and cables can be placed in the guide chain.

The guide chain contains a firmly installed clip on each chain link.



CAUTION

When mounting tubing and cables, make sure that there is no traction on the drives while moving the lift or swinging the robotic arm. Traction on the drive can overload and damage the drive.

If a robotic arm is used, we recommend placing the tubing and cables only above the third chain link in the guide chain to prevent traction on the drives.

Do **not** or only partially place rigid tubings, as for example aspiration tubings made of PTFE, into the guide chain.



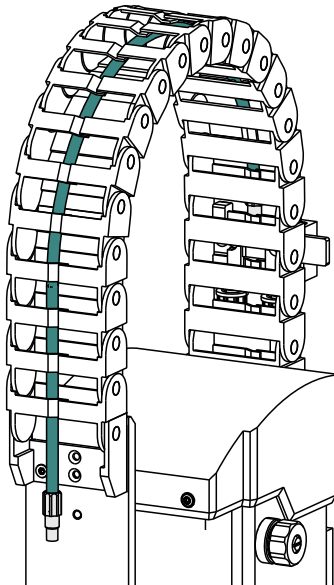
NOTICE

Make sure that tubing and cables do not kink.

Inserting and removing the tubing and cables requires no tools.

1 Placing tubing and cables

- Press one side of the clip downwards and place tubing or cables in the guide chain.



2 Removing tubing and cables

- Press one side of the clip downwards and remove tubing or cables from the guide chain.

4 Handling and maintenance

The 786 Swing Head requires appropriate care. Excess contamination of the instrument may result in functional disruptions and a reduction in the service life of the sturdy mechanics and electronics of the instrument.

Severe contamination can also have an influence on the measured results. Regular cleaning of exposed parts can prevent this to a large extent.

Spilled chemicals and solvents must be removed immediately.

5 Troubleshooting

5.1 Robotic arm

Problem	Cause	Remedy
The robotic arm moves all the way outward and buzzes.	<i>Sample Processor – The Swing Head is not correctly configured.</i>	<ol style="list-style-type: none"> 1. Immediately remove the power plug and close the control software. 2. Dismount the robotic arm. 3. Plug in the power plug again and restart the control software. 4. Enter the correct values for the swing radius, robotic arm offset etc. in the control software under "Configuration" (or under "Device manager" for Touch Control). 5. Initialize the instrument. 6. Remount the robotic arm.
	<i>Sample Processor – Robotic arm is wrongly mounted.</i>	<ol style="list-style-type: none"> 1. Immediately remove the power plug and close the control software. 2. Dismount the robotic arm. 3. Plug in the power plug again and restart the control software. 4. Check the configuration of the robotic arm and correct it if necessary (left-swinging ↔ right-swinging). 5. Initialize the instrument. 6. Mount the robotic arm correctly.
The Swing Head either misses the rack positions totally or is inaccurate	<i>Sample Processor – The Swing Head is not correctly configured.</i>	<ol style="list-style-type: none"> 1. Enter the correct values for the swing radius, robotic arm offset etc. in the control software under "Configuration" (or under "Device manager" for Touch Control). 2. Initialize the instrument.
	<i>Sample Processor – The axial distance is not correctly configured.</i>	<ol style="list-style-type: none"> 1. Enter the correct value for the axial distance in the control software under "Configuration" (or under "Device manager" for Touch Control). 2. Initialize the instrument.





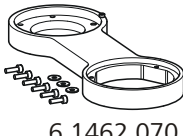
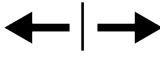


Problem	Cause	Remedy
	<i>Sample Processor – The wrong rack table is being used.</i>	Initialize the rack using the function Initialize rack in the "Manual control".
	<i>Swing Head – The Swing Head drive is defective.</i>	Contact Metrohm Service.

6 Appendix

6.1 Robotic arms and overflow buret

6.1.1 Robotic arms for titration

Table 1 Configuration data of the titration robotic arms

Type	6.1462.050	6.1462.060	6.1462.070
			
Swing direction			
	+/-	+	-
Robotic arm offset	0°	-8°	-8°
Maximum swing range	84°	73°	73°
Swing radius	110 mm	127 mm	127 mm

6.1462.050

Robotic arm with titration head, left or right-swinging

For titration in 75 mL sample vessels and larger.

The arm can be equipped with two microelectrodes, one rod stirrer and three spray nozzles. Two buret tips with antidiffusion valve and one aspiration tip with connectors for M6 tubing are already retracted into the arm.

Material: PP

6.1462.060

Robotic arm with holder for a titration head, left-swinging

The arm can be modified to create the desired titration robotic arm by means of the installation of a titration head 6.1458.xxx.

Material: PP





6.1462.070

Robotic arm with holder for a titration head, right-swinging

The arm can be modified to create the desired titration robotic arm by means of the installation of a titration head 6.1458.xxx.

Material: PP

Table 2 Configuration data for 6.1462.260

Type	6.1462.260
	
Swing direction	
	+
Robotic arm offset	-8°
Maximum swing range	105°
Swing radius	110 mm

6.1462.260

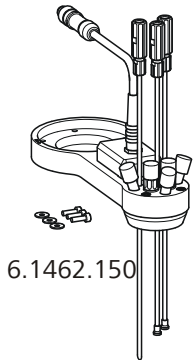
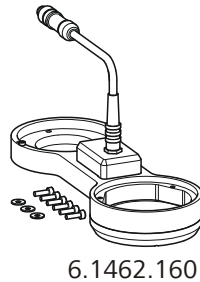
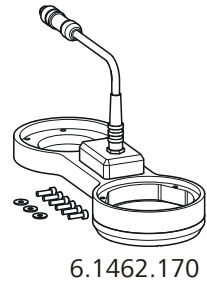
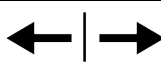


Robotic arm with holder for a titration head, left-swinging, external

The arm can be modified to create the desired titration robotic arm by means of the installation of a titration head 6.1458.xxx. The cutout permits movement to external positions near the rack, e.g. an external rinsing station.

Material: PVC

6.1.2 Robotic arms for titration with beaker sensor

Table 3 Configuration data of the titration robotic arms with beaker sensor

Type	6.1462.150	6.1462.160	6.1462.170
			
Swing direction			
	+/-	+	-
Robotic arm offset	0°	-8°	-8°
Maximum swing range	84°	73°	73°
Swing radius	110 mm	127 mm	127 mm

6.1462.150

Robotic arm with titration head and beaker sensor, left or right-swinging

For titration in 75 mL sample vessels and larger.

The arm can be equipped with two microelectrodes, one rod stirrer and three spray nozzles. Two buret tips with antidiffusion valve and one aspiration tip with connectors for M6 tubing are already retracted into the arm.

Material: PP

6.1462.160

Robotic arm with holder for a titration head and beaker sensor, left-swinging

The arm can be modified to create the desired titration robotic arm by means of the installation of a titration head 6.1458.xxx.

Material: PP

6.1462.170

Robotic arm with holder for a titration head and beaker sensor, right-swinging


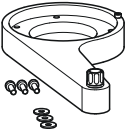

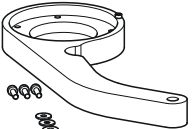






The arm can be modified to create the desired titration robotic arm by means of the installation of a titration head 6.1458.xxx.

Material: PP

6.1.3 Robotic arms for sample preparation

Table 4 Configuration data of the robotic arms for sample preparation

Type	6.1462.030	6.1462.040	6.1462.090	6.1462.240
				
	6.1462.030	6.1462.040	6.1462.090	6.1462.240
Swing direction				
	+	-	-	-
Robotic arm offset	8°	8°	8°	-8.6°
Maximum swing range	117°	117°	117°	122°
Swing radius	112 mm	112 mm	112 mm	149.8 mm

6.1462.030

Robotic arm with transfer head, left-swinging

Robotic arm for fully automated pipetting or dilution of liquid samples with Sample Processor systems.

Material: PP

6.1462.040

Robotic arm with transfer head, right-swinging

Robotic arm for fully automated pipetting or dilution of liquid samples with Sample Processor systems.

Material: PP

6.1462.090

Robotic arm with Luer lock adapter, right-swinging

For the connection of hollow needles with Luer lock connection. Suitable for the transfer of samples from sealed vials with septum cap.

Material: PP

6.1462.240

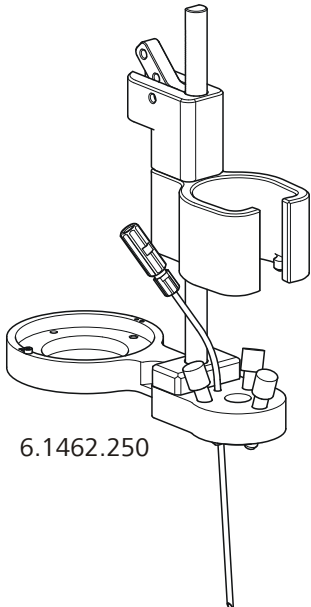
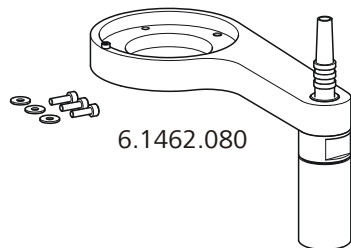
Robotic arm with transfer head, bent, right-swinging

The transfer head can, when equipped with 6.1808.220 adapter, be used as a holder for various tools with Luer connection on multirow racks.

Material: PP

6.1.4 Robotic arms for special applications

Table 5 Configuration data of the special robotic arms

Type	6.1462.250	6.1462.080
		
Swing direction	←	←
	+	+
Robotic arm offset	0°	8°
Maximum swing range	115.5°	117°
Swing radius	110 mm	112 mm

6.1462.250

Robotic arm as holder for Polytron PT 1300 D, left-swinging

The robotic arm makes it possible to use the Polytron PT 1300 D for sample preparation on multi-row sample racks. It contains one retracted buret tip for adding solvents and three spray nozzles for cleaning.

Material: PP

6.1462.080

Robotic arm Dis-Cover, left-swinging


Robotic arm for placing and removing sample vessel covers (75 mL and 250 mL, covers 6.2037.050 and 6.2037.060) on the sample rack of a Robotic Sample Processor.

Material: PP



6.1.5 Overflow buret

Table 6 Configuration data of the overflow buret

Type	6.9958.007
	
Swing direction	→
	-
Robotic arm offset	-8°
Maximum swing range	103°
Swing radius	115 mm

6.9958.007

Overflow buret

Overflow buret for rapid and automatic measuring of 100 mL of sample and for sample transfer into an external titration vessel.

7 Technical specifications

7.1 786 Swing Head

<i>Load</i>	Approx. 15 N
<i>Rate</i>	10...55 angular degree/s
<i>Beaker sensor socket</i>	For the robotic arm with sensor

7.2 Supply connection

<i>Connector plug</i>	9-pin Mini DIN plug For connecting to a Sample Processor (Swing Head socket)
-----------------------	---

7.3 Ambient temperature

<i>Nominal function range</i>	5...45 °C Humidity < 80 %
<i>Storage</i>	-20...60 °C
<i>Transport</i>	-40...60 °C

7.4 Reference conditions

<i>Ambient temperature</i>	25 °C (±3 °C)
<i>Relative humidity</i>	≤60 %



7.5 Dimensions

<i>Width</i>	0.10 m
<i>Height</i>	0.15 m
<i>Depth</i>	0.09 m
<i>Weight (without accessories)</i>	0.97 kg
<i>Material</i>	
<i>Housing</i>	Metal housing, surface-treated

8 Accessories

Up-to-date information on the scope of delivery and optional accessories for your product can be found on the Internet. You can download this information using the article number as follows:

Downloading the accessories list

- 1** Enter <https://www.metrohm.com/> into your Internet browser.
- 2** Enter the article number (e.g. **Variable Produktnummer**) into the search field.
The search result is displayed.
- 3** Click on the product.
Detailed information regarding the product is shown on various tabs.
- 4** On the **Included parts** tab, click on **Download the PDF**.
The PDF file with the accessories data is created.



NOTICE

Once you have received your new product, we recommend downloading the accessories list from the Internet, printing it out and keeping it together with the manual for reference purposes.



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