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789 Robotic Sample Processor XL
778 Sample Processor

Program version 5.789.0020+
and 5.778.0020+

Instructions for Use

8.789.1063 03.2007 / dm

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Although all the information given in these instructions has been checked with great care, errors cannot be entirely excluded. Should you notice any mistakes please inform the author at the address given above.

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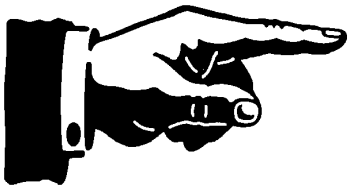


1 Introduction

This section offers you a first overview of the Metrohm Sample Processors. All the information applies to both the 789 Robotic Sample Processor XL and the 778 Sample Processor. You are informed about how you can use these versatile instruments and are introduced to the most important parts and controls.

1.1 Instrument description

1.1.1 Field of application of the Metrohm Sample Processors

The Metrohm Sample Processors are very versatile instruments intended exclusively for use in factories and laboratories, where they cover a wide range of applications. In this way they provide an indispensable service wherever large series of samples have to be processed, no matter whether in the titration, measurement or liquid handling sectors.

As a result of the extensive communication possibilities you can work via the parallel Remote and serial RS232 interface not just with the wide range of Metrohm titrators, measuring instruments and dosing devices, but you can also work with any other instruments that have a suitable communications interface; these can be controlled by or control the Sample Processor. These abilities mean that they are predestined for all imaginable automation tasks in a modern laboratory, even within highly integrated laboratory data systems.

Despite their comprehensive range of commands and the numerous possible configurations, the Metrohm Sample Processors offer an uncomplicated type of operation that is also suitable for routine work as a result of the possibility of managing user-defined methods.

The standard methods supplied with the instruments can be used for routine tasks without any further fuss. After a short familiarization period the user can alter them to meet any particular requirements and store them in the instrument. This means that, apart from routine work, Metrohm Sample Processors can also be used for demanding special applications.

The run sequences for processing the individual samples are freely definable within wide limits. The same applies to the start sequence and

final sequence, which have to be carried out once before the start of a sample series or once after it has been completed. This offers many advantages, particularly for titrations. The electrode can be conditioned before the first titration or subjected to a special rinsing process.

A learn mode is available for creating run sequences and, with its help, command parameters can be set in manual operation.

Exchangeable standard sample racks are available for many sizes of beakers and test tubes. Freely selectable "special beaker" positions can be defined for each rack. These are then used for including rinsing or conditioning beakers, which can be addressed in any part sequence, on the rack.

By extending the system with a 786 Swing Head the number of samples to be processed on a rack can be considerably increased. The robotic arm of the 786 Swing Head allows any point on a sample rack to be addressed. This means that the number (max. 999 rack positions) and arrangement of the samples is virtually unlimited. On request we can supply customer-specific special racks for individual requirements.

Freely definable position tables can be loaded via the RS232 interface and suitable PC software for the configuration of special racks.

1.1.2 Instrument versions

Variously equipped Metrohm Sample Processors models are available:

- All versions of the **789 Robotic Sample Processor XL** are suitable for sample racks of up to **48 cm** diameter.
- All versions of the **778 Sample Processor** are suitable for sample racks of up to **42 cm** diameter.

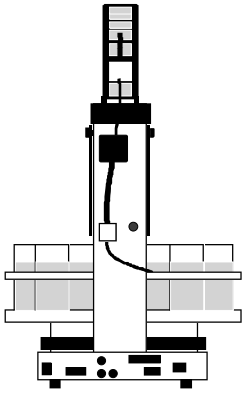
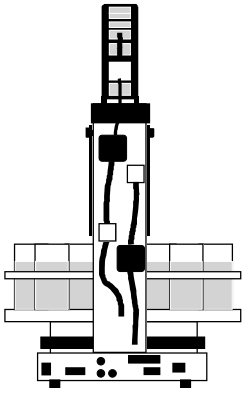
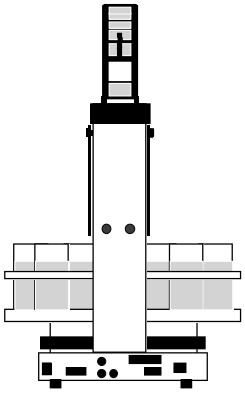
		
Model 2.789.0010 **Model 2.778.0010**	**Model 2.789.0020** **Model 2.778.0020**	**Model 2.789.0030** **Model 2.778.0030**
1 tower with 1 pump + 1 ext. pump connection + 1 stirrer connection + 1 Swing Head connection	1 tower with 2 pumps + 1 stirrer connection + 1 Swing Head connection	1 tower without pumps + 2 ext. pump connections + 1 stirrer connection + 1 Swing Head connection
Chassis with 3 MSB sockets for dosing devices and/or stirrers + Remote connection (25-pin) + RS232 connection (9-pin) + keyboard connection	Chassis with 3 MSB sockets for dosing devices and/or stirrers + Remote connection (25-pin) + RS232 connection (9-pin) + keyboard connection	Chassis with 3 MSB sockets for dosing devices and/or stirrers + Remote connection (25-pin) + RS232 connection (9-pin) + keyboard connection

Table 1 Model versions (1 tower)

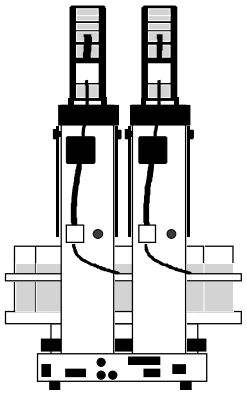
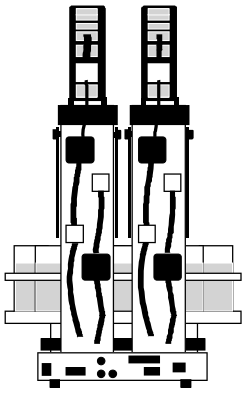
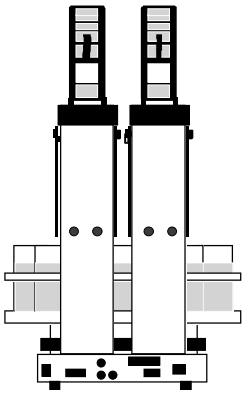
		
Model 2.789.0110 **Model 2.778.0110**	**Model 2.789.0120** **Model 2.778.0120**	**Model 2.789.0130** **Model 2.778.0130**
2 towers with 2 pumps + 2 ext. pump connections + 2 stirrer connections + 2 Swing Head connections	2 towers with 4 pumps + 2 stirrer connections + 2 Swing Head connections	2 towers without pumps + 4 ext. pump connections + 2 stirrer connections + 2 Swing Head connections
Chassis with 3 MSB sockets for dosing devices and/or stirrers + Remote connection (25-pin) + RS232 connection (9-pin) + keyboard connection	Chassis with 3 MSB sockets for dosing devices and/or stirrers + Remote connection (25-pin) + RS232 connection (9-pin) + keyboard connection	Chassis with 3 MSB sockets for dosing devices and/or stirrers + Remote connection (25-pin) + RS232 connection (9-pin) + keyboard connection

Table 2 Model versions (2 towers)

1.2 Sample Processors as part of a system

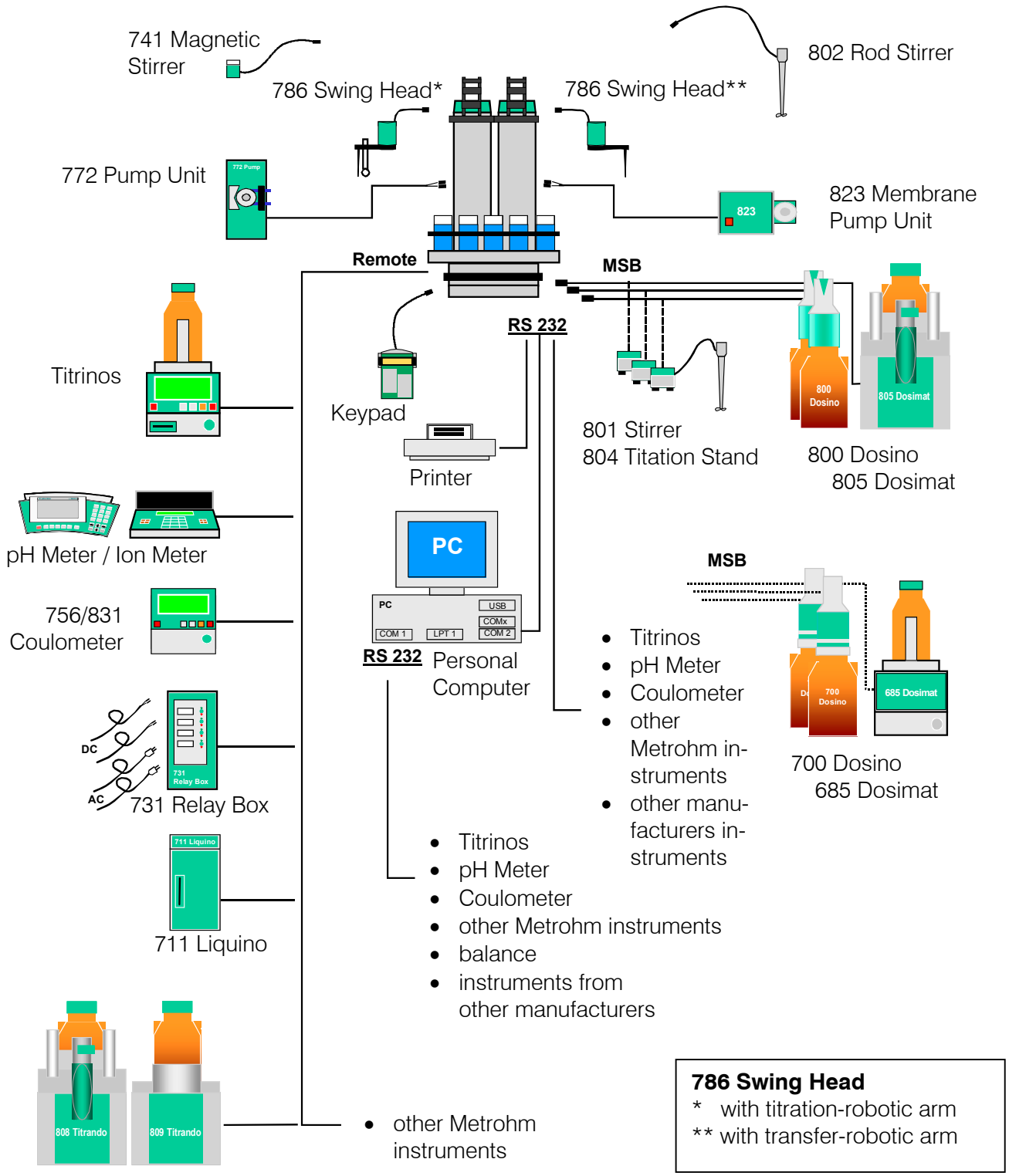


Fig. 1 System components

1.3 Information about these Instructions for Use

1.3.1 Please note

Please read through these Instructions for Use carefully before you start to use the Sample Processor. The instructions contain information and warnings that must be observed by the user in order to guarantee the safe use of the instrument.

1.3.2 Additional documents

- Quick Reference 8.789.1013 for the Metrohm Sample Processors
- Operating Tutorial 8.789.1023 for the Metrohm Sample Processors
- Technical Reference 8.789.1033 for the Metrohm Sample Processors

1.3.3 Notation and pictograms

The following notation and pictograms are used in these Instructions for Use:

Location	**Menu item, parameter or input value**
<OK>	**button, key**
	**Danger** This symbol indicates a possible risk of death or injury to the user if the instructions are not followed correctly.
	**Warning** This symbol indicates a possible risk of damage to the instruments or their components if the instructions are not followed correctly.
	**Attention** This symbol indicates important information. Read the information provided before you continue.
	**Remarks** This symbol indicates additional information and tips.

1.4 Parts and controls

1.4.1 Overall view

Safety information

Safety shield **2** must always be in position before the Metrohm Sample Processor is used.

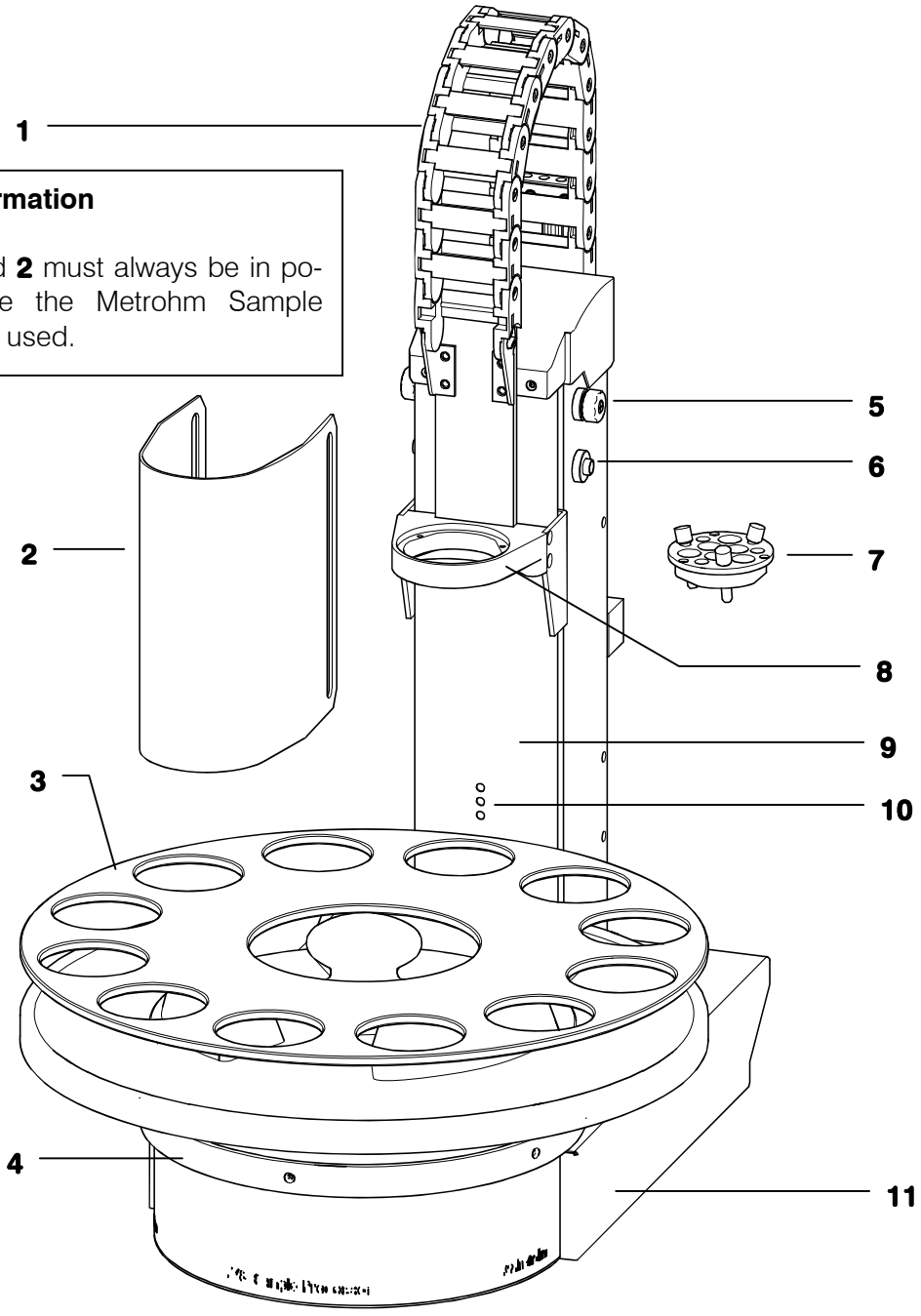


Fig. 2 Overall view

1	**Guide chain**
2	**Safety shield/Splash protection**
3	**Sample rack**
4	**Stirrer rail**
5	**Splash protection fixing**
6	**Splash protection guide**
7	**Titration head**
8	**Lift**
9	**Tower**
10	**Beaker sensor**
11	**Chassis**

1.4.2 Rear view

This illustration shows the rear view of the standard model 2.778.0010 with one tower, one membrane pump and one connection for an external pump.

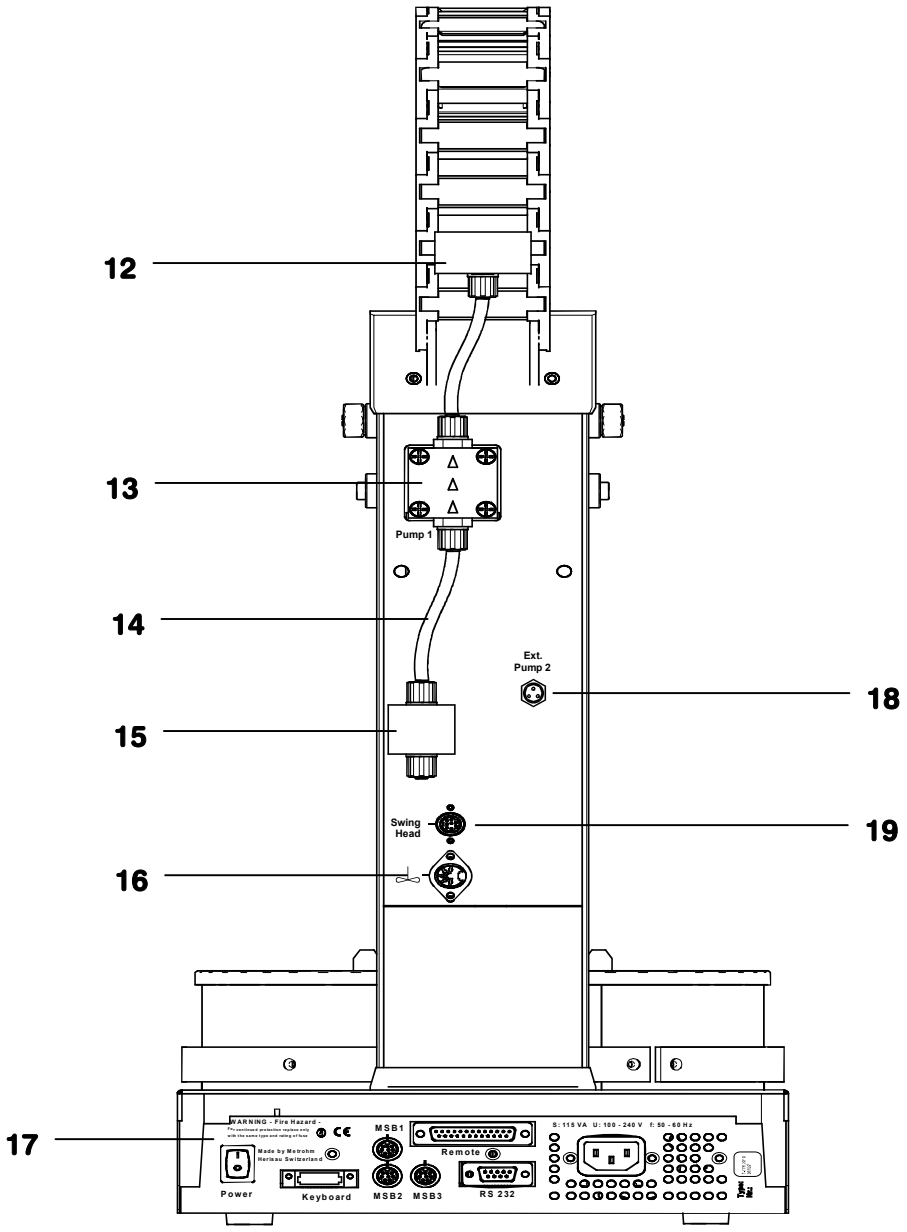


Fig. 3 Rear view

12	**Distributor block**
13	**Membrane pump**
14	**PTFE tubing**
15	**Solenoid valve**
a	**Warning: Biohazard** See Section *1.8.3 Personal protection*
16	**Stirrer connection (Tower 1)** For 802 Rod Stirrer or 741 Magnetic Stirrer
17	**Connection strip**
18	**Pump connection M8 (external)**
19	**Connection socket for the 786 Swing Head**
b	**Warning: Resistance to chemicals** See section *2.4.1 Connecting rinsing and aspiration equipment*

1.5 Connections

The electrical connections are the same for all models of the Metrohm 778/789 Sample Processor series.

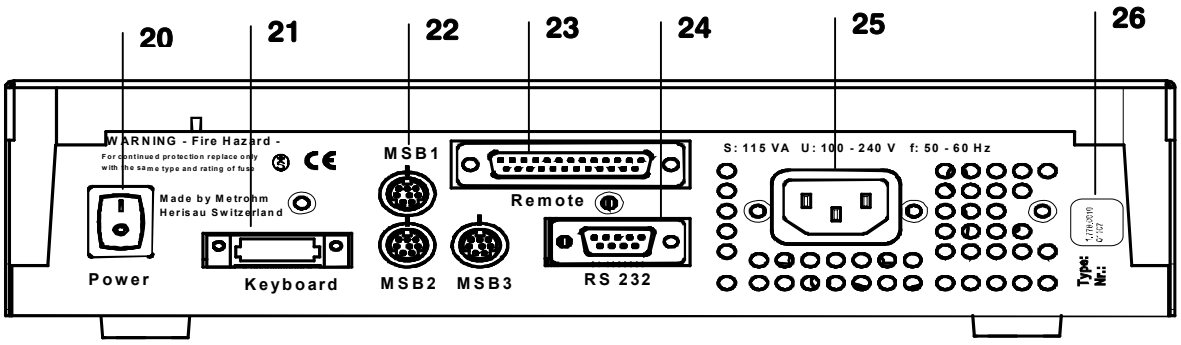


Fig. 4 Connection strip

20	**Mains switch**
21	**Keyboard connection**
22	**MSB connections MSB1 … MSB3** Metrohm Serial Bus Connection of dosing devices and stirrers
23	**Remote connection (25-pin)**
24	**Serial RS232 connection (9-pin)**
25	**Mains connection**
26	**Type plate**

1.5.1 Sensors of the Sample Processor

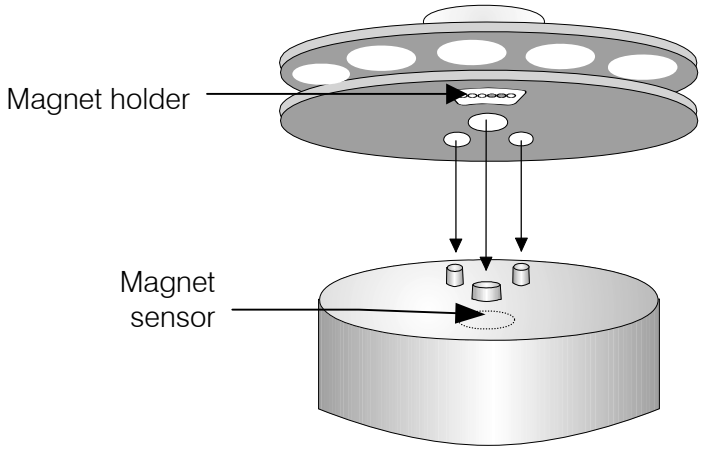


Fig. 5 Magnet sensor for rack code

Rack sensor

The magnet sensor for recognizing the individual rack code is located beneath the turntable of the Sample Processor. The magnet code of a rack can only be read in when the rack is in the initial position. The magnet holder must be positioned directly above the sensor.

For this reason the Sample Processor should be initialized each time that a rack is changed with the <RACK> key.

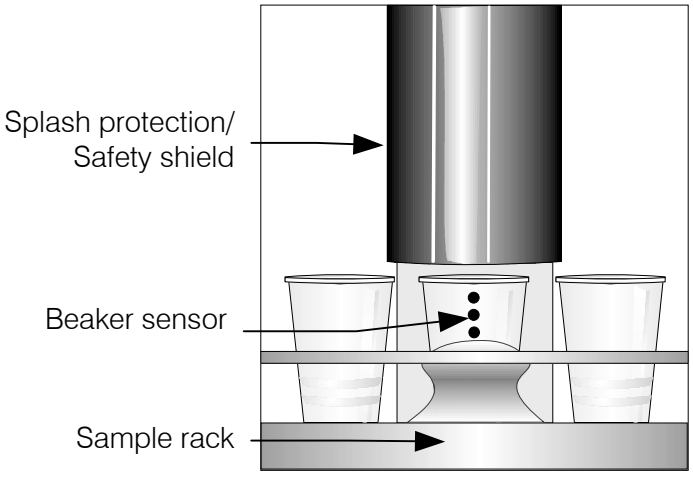


Fig. 6 Beaker sensor on the tower

Optical beaker sensor

Each tower of a Metrohm Sample Processor is equipped with a beaker sensor that detects the presence of a beaker in front of the tower. With this infrared sensor beakers made from different materials can be detected, provided that they are located in the correct position in front of the tower and the beaker sensor 'Tower' has been selected in the rack definition. This "Beaker test" is carried out after each MOVE command (i.e. each rotation of the rack). The beaker sensor on the tower can only be used with single-row sample racks.

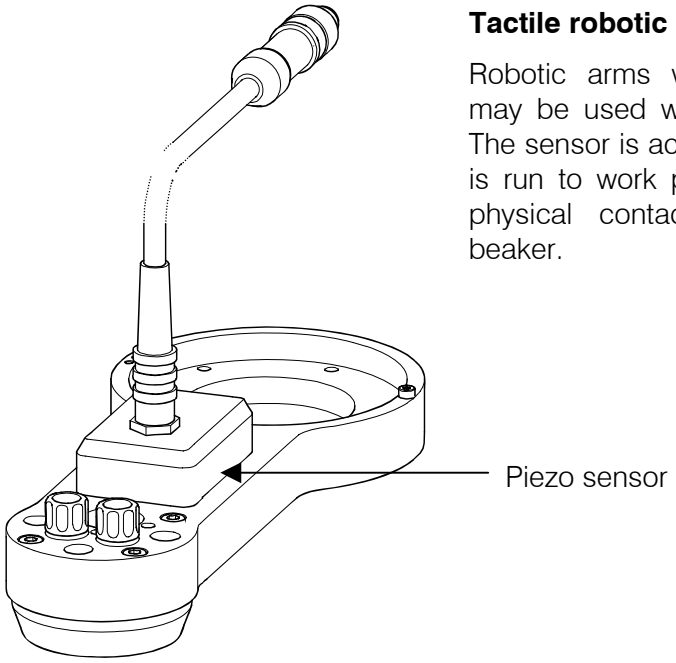


Fig. 7 Sensor on a robotic arm

Tactile robotic arm sensor

Robotic arms with piezo sensors may be used with multi-row racks. The sensor is activated, when the lift is run to work position and makes physical contact with a sample beaker.

1.6 Accessories

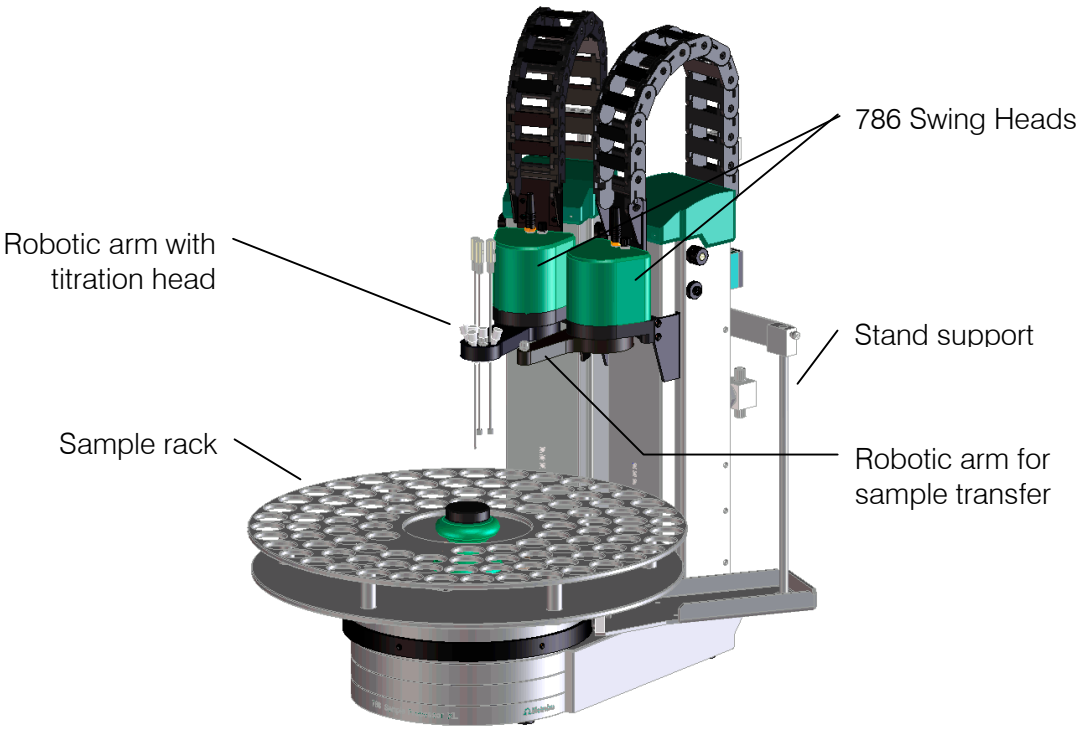


Fig. 8 Accessories

With suitable accessories a Sample Processor can be extended to form a comprehensive automated system. Depending on the tasks to be carried out, various standard components or even custom-made special parts can be used. Please consult the list of accessories on page 137ff.

Sample racks
Custom-made racks for various vessel sizes with any arrangement of rack positions can also be supplied in addition to the standard racks.

786 Swing Head with robotic arm
The use of multi-row sample racks or external titration cells requires the use of a 786 Swing Head. This motor drive, which is mounted on the lift of one of the Sample Processor towers, can move different types of robotic arm. Various types of standard robotic arms with accessories for titrating on the sample rack or for sample transfer to an external titration cell are available.

Stand support
If an external titration cell is to be used then we recommend the use of a stand support. The stand support can accommodate a magnetic stirrer (e.g. model 801) and, with a support rod, enables you to attach a titration cell or other accessories.

Swing head with tactile piezo sensor

When using a multi-row rack and a 786 Swing Head, a robotic arm with a touch-sensitive piezo sensor may be used. With that kind of sensor the presence of a sample beaker can be detected reliably.

Robotic arm for removing covers

Whenever covered sample containers are required (e. g. with volatile samples) the lids can be removed by a special robotic arm (so called Dis-Cover) with magnetic contact before the sample treatment. Special lids are available for this purpose.

Accessory set for sample transfer

For pipetting samples into external titration cells an accessory set (6.5619.000) is available, comprising all necessary parts.

1.7 The keypad

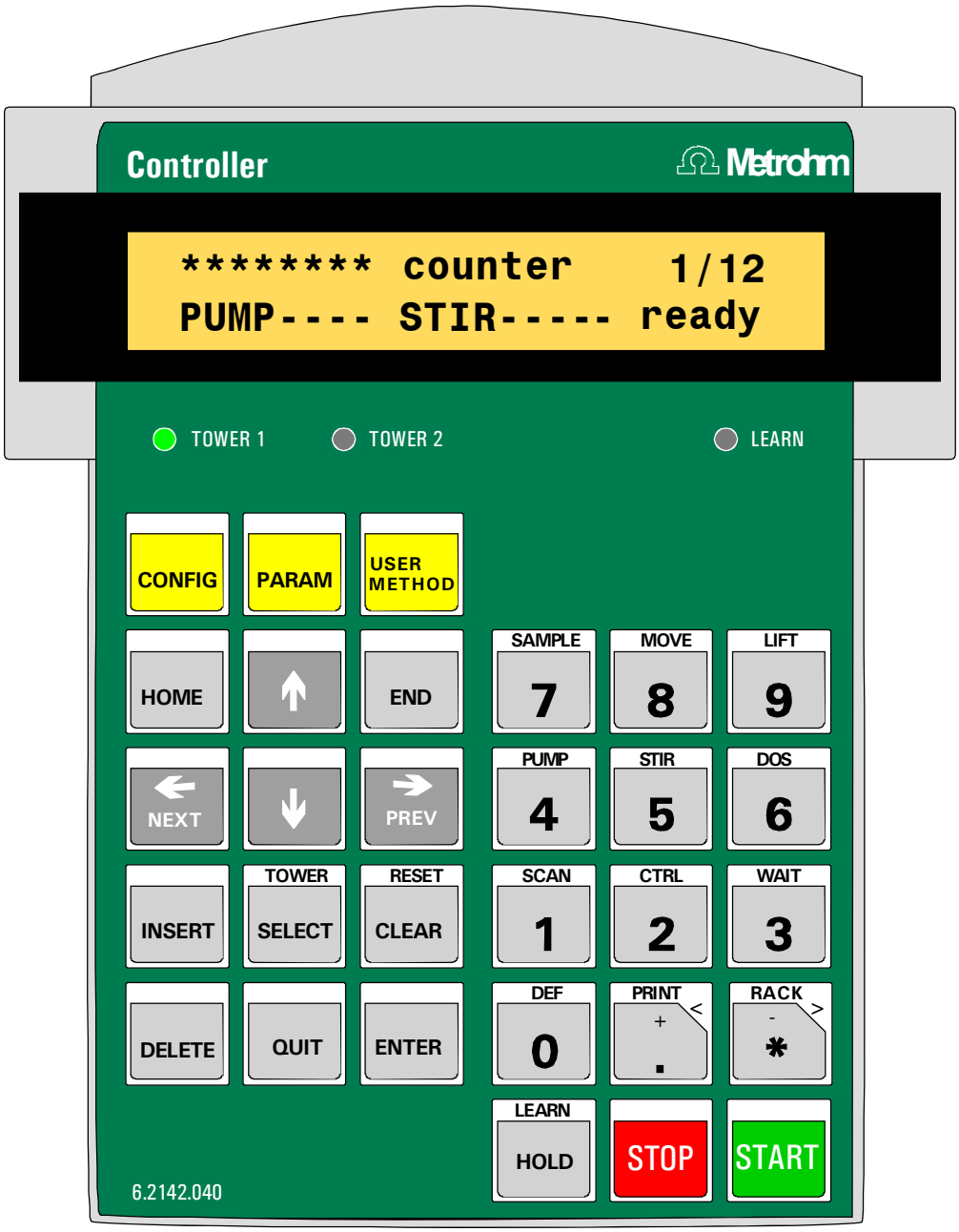


Fig. 9 Keypad

Below the 2-line display there are three LEDs. The two LEDs '**TOWER 1**' and '**TOWER 2**' indicate the tower that is currently active. The LED 'LEARN' lights up when the learn mode is activated.

Most keys have two functions, depending on whether the Sample Processor is in the normal operating mode or in the editing mode.

Selection menus can be accessed with the upper row of keys (**<CONFIG>**, **<PARAM>**, **<USER METHOD>**). The other keys on the left-

hand side of the keypad are used for navigation in the menus or for altering parameters. For entering parameters the numerical block on the right-hand side of the keypad is also available.

The lowest row of keys (**<HOLD>**, **<STOP>**, **<START>**) are used for the direct control of a method sequence.

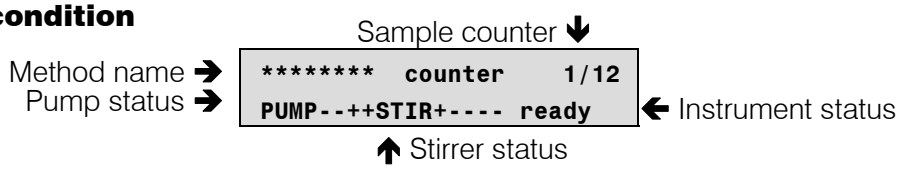
1.7.1 The display

The display consists of two lines each with 24 characters.

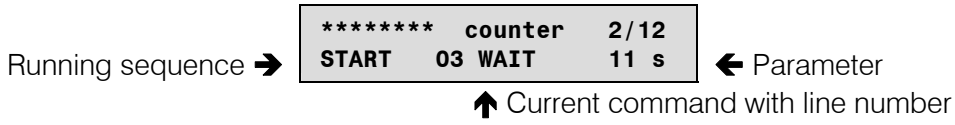
The first line is used as the title line, in which the current method and the sample counter count are shown. In the editing mode the menu title appears here.

The second line is used as the status line, which shows specific activities depending on the operating status. In the editing mode it is used as the input line.

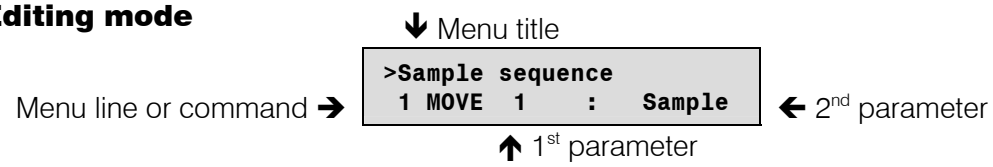
Normal condition



Method sequence



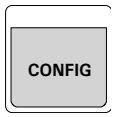
Editing mode



If the Sample Processor is included in a computer-controlled automation system and is completely controlled via the RS232 interface then it may be advisable to switch off the display. This can be done in the setup menu of the Sample Processor, see p. 114.

1.7.2 The keys

The menu keys

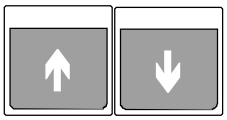


The **<Config>** key opens the selection menu for the configuration of the Sample Processor.

The **<PARAM>** key opens the selection menu for editing the run sequences and method parameters.

The **<User Method>** key opens the selection menu for opening, saving and deleting default or user-defined methods.

Lift operation and sample positioning keys

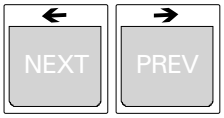


With the **<↑>** and **<↓>** keys the lift of the currently active tower can be moved up and down respectively. The lowest possible lift position is defined by the configuration parameter 'max. stroke path'.

- In the editing mode the arrow keys **<↑>** and **<↓>** are used for navigation in the particular menu or submenu.

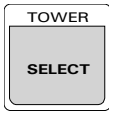
With the **<HOME>** key the lift of the currently active tower is returned to the rest position (0 mm), i.e. to the uppermost stop.
<END> moves the lift to the predefined working position (see p. 61).

- In the editing mode the **<HOME>** and **<END>** keys move to the first and last line of the menu or submenu respectively.



With the **<← NEXT>** and **<→ PREV>** keys the sample rack can be rotated forward or backward by one position. The beaker positions depend on the active lift. If necessary, the lift (or both lifts) are automatically raised to the shifting position. When the rack position has been reached a robotic arm which may be mounted will automatically be directed to the corresponding rack position.

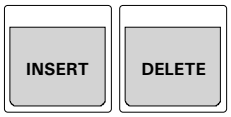
- In the editing mode the arrow keys **<←>** and **<→>** are used for navigation in a menu line.



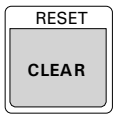
Most functions for manual operation apply specifically to a single tower. With the 2-tower models the **<SELECT/TOWER>** key can be used to switch between the towers. The currently active tower is indicated by the **TOWER 1** or **TOWER 2** LED. The following commands or keys refer to the active tower: **MOVE**, **<←>**, **<→>** , **LIFT**, **<↑>**, **<↓>**, **<HOME>**, **<END>** and **<PUMP>**.

- During data input the **<SELECT>** key is used to select a predefined entry from a selection list.

Editing and sequence control



When editing a method sequence the **<INSERT>** and **<DELETE>** keys are used to insert or delete a command line.



The **<CLEAR/RESET>** key is used to initialize the Sample Processor and dosing devices. This corresponds to the switching-on process.

➲ During data input the **<CLEAR/RESET>** key is used to delete an entry or to reset the default value. In text entry mode the last character is deleted.

During a method sequence the **<QUIT>** key can be used to terminate the command which is currently being carried out. The following command is executed.

➲ During data input the **<QUIT>** key is used to terminate an entry. During navigation in a menu the **<QUIT>** key is used to exit the active (sub)menu and select the next highest menu level.

During data input the **<ENTER>** key is used to accept the entry.

Command keys

The **<SAMPLE>** key is used to set the current sample position. This has to be done before a sample series is run.

At the start of a method this position is assumed to be the first sample in a series. If no sample position has been set then the Sample Processor will select rack position 1.

With **<MOVE>** a vessel or a particular rack position can be moved to the active tower or a robotic arm can be swung to an external position. The **<SELECT>** key is used to select the tower.
As well as the actual sample beaker a maximum of 16 possible special beakers can also be defined. A particular rack position can be moved to directly by entering the position number (with the numerical keys).
The direction and speed of rotation can be altered in the parameter menu or with the <DEF> key.

Important:
For safety reasons it is only possible to rotate the sample rack when the lift or both lifts are located in the shifting position or above it. During a rack rotation the lift (or both lifts) are automatically first raised to the predefined shift height.

Raises or lowers the lift of the active tower. The predefined lift positions (working position, rest position, rinsing position, shifting position, special position) can be selected with the **<SELECT>** key. They can be entered and saved separately for each rack in the configuration menu.
As well as the predefined lift positions it is also possible to enter absolute lift positions in mm via the numerical keys.
In the 2-tower models the tower can be selected with **<SELECT/TOWER>**.

The **<PUMP>** key is used for switching the pumps 1 or 2 of the active tower on and off. By entering the pump number (1 or 2) the condition of the corresponding pump will be switched, i.e. if the pump is switched off it will be switched on and vice versa. With Sample Processor models that have no pump or only one built-in membrane pump the selected pump connection will be switched on or off.

The status of all pumps is shown in the display (e.g. **PUMP–+–+**; **+** means switched on, **-** means switched off).

Example:

PUMP on/off No. ? <2> Display: **PUMP -+--**
PUMP on/off No. ? <2> Display: **PUMP ----**

In this case pump 2 is switched on and off.
Under **<PARAM>**, **>manual stop** you can define whether the pumps should be switched off with the **<STOP>** key or not.

The **<STIR>** key is used for controlling the stirrers. A stirrer can be switched on permanently or switched on for a given period and then switched off again. The **<SELECT>** key is used to select both the stirrer and the function. The current status of the stirrer is shown directly in the display.

Example:

STIR: T1 : ON s Display: **STIR +-** (+=on -=off)
STIR: MSB2 : 10 s Display: **STIR 10 s**

In this case in the first line the stirrer at tower 1 is switched on. The stirrer is selected with the **<SELECT>** key. As can be seen in the second line, the duration of the stirring process can also be entered.
The stirring rate can be set for each stirrer in the parameter menu or with the **<DEF>** key.
Under **<PARAM>**, **>manual stop** you can define which stirrers can be switched off with the **<STOP>** key.

The **<DOS>** key is used to control the connected dosing devices. Both positive and negative volumes can be dosed. Negative volumes are used for aspirating liquids, e.g. during pipetting.
As well as entering the volume to be dosed (with the numerical keys),

<SELECT> can also be used to select additional functions:

- Filling the dosing or exchange unit (fill)
- Initializing the escange of a Dosing unit (release)
- Preparing the tubing systems and cylinder (prep.)
- Emptying the tubing system and the dosing cylinder (empty)
- Ejecting the cylinder contents (Eject)
- Driving the piston to the max. volume
- Compensating for the play between piston and spindle (compen.)
- Valve switching (port)

The first parameter of the DOS command stands for the number of the dosing instrument (1…3, * = all) and the Dosino port (e. g. 1.1 stands for Dosino 1, port 1), the second parameter for the function or the volume to be dosed.

Example:
```
DOS: 2.1  <ENTER>  4.51 ml  <ENTER>
DOS: 2.*  <ENTER> <SELECT> ... fill  <ENTER>
```

The dosing and filling rates can be set in the parameter menu or with the **<DEF>** key.

Shows the incoming signals or data from the Remote or the serial RS232 interfaces.
This function is used for checking the data communication with connected devices.
The first parameter shows the selected interface. The second parameter shows the signals or data that are received directly.

If the parallel Remote interface (**Rm**) is selected then the signal states of the incoming Remote lines are shown in binary form (1=line active, 0=line inactive).

If the serial RS232 interface (**RS**) is selected then the data string received via this interface will be shown (14 characters per line).

Example (Remote interface):
```
SCN:Rm          :00000001
```

In this case the **Ready** line (Remote line input 0) of a connected Titrino is set.

Controls external devices via the Remote or RS232 interface.
The first parameter sets the interface (**<SELECT>**). The second parameter defines the status of the lines (Remote lines) or data (RS232 interface) to be outputted via the selected interface.

2nd parameter, for Remote interface
Binary pattern with 14 digits (0, 1 or *) for the 14 output lines or prede-

fined binary pattern (**<SELECT>** selection), e.g. **START device 1**, **INIT** etc.

2nd parameter, for RS232 interface
Data string with up to 14 alphanumeric characters (any).
The default value "&M;$G" (for starting Metrohm instruments) can be set with **<CLEAR>**.

The **<WAIT>** key has no function in the normal operating condition. It is used to insert the **WAIT** command in a run sequence.

The **<DEF>** key is used to edit various settings for manual operation. Repeated pressing of the **<DEF>** key is used to select the various settings. In order to change the entry you must first press **<ENTER>** and then enter the new value.
Alterations made in this way only apply to manual operation.

DEF settings

DOSRATE

Change dosing rate

- The dosing rate in mL/min can be set separately for each dosing device, see p. 70.
- Syntax: **DOSRATE** [dosing device] [dosing rate]

FILLRATE

Change filling rate

- The filling rate in mL/min can be set separately for each dosing device, see p. 70.
- Syntax: **FILLRATE** [dosing device] [filling rate]

COCKMOVE

Direction of stopcock rotation

- For each connected Dosino the direction of rotation of the stopcock switching can be defined separately, see p. 70.
- Syntax: **COCKMOVE** [Dosing device] [Direction of rotation]

LIFTRATE

Change lift rate

- The lift speed in mm/s can be set separately for each tower (for 2-tower models), see p. 68.
- Syntax: **LIFTRATE** [Tower] [Lift rate]

SHIFTRATE

Change rack rate and direction of rotation

- As well as the speed of rotation of the sample rack in degrees/second the direction of rotation can also be defined.
- Direction of rotation "**+**" means that the rack always rotates counterclockwise, i.e. in increasing rack position sequence, Direction of rotation "**–**" means clockwise, i.e. decreasing sequence.
- Direction of rotation **auto**: the Sample Processor itself selects the shortest possible path for a rack rotation, see p. 68.
- Syntax: **SHIFTRATE** [Direction of rotation] [Rotation rate]

SWINGRATE

Change swing rate

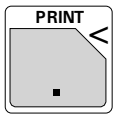
- The swing rate in degrees/s of a robotic arm can be set separately for each connected 786 Swing Head, see p. 68.
- Syntax: **SWINGRATE** [Tower] [Swing rate]

STIRRATE

Change stirring rate

- The stirring speed can be controlled separately for each stirrer (rod or magnetic stirrer), see p. 69.
- Syntax: **STIRRATE** [Stirrer] [Stirrer rate]

Auxiliary commands



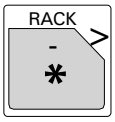
The **<PRINT>** key is used to print out a report. The following can be selected: parameter report (method), configuration report, list of stored methods, all reports.

The type of report can be selected with **<SELECT>**.

e. g.

```
Print:          config
```

The selection of the printer type and the settings of the RS232 interface must be made in the configuration menu under **>RS232 Settings**, see p. 37.



With the **<RACK>** key the sample rack can be initialized. The connected peripheral devices (e.g. Dosimats, Dosinos) are not affected by this.
The sample rack and lift (both lifts in 2-tower versions) are moved to the zero position and automatic rack recognition is carried out.

Sequence control

The **<START>** key starts a method. A start is only possible when the Sample Processor is in the normal operating condition, i.e. when the display shows **`ready`**.

If **<START>** is activated after an interruption (**<HOLD>**, see below), then the sequence continues with the next command.

The **<START>** can also be used to carry out a single command line in a run sequence (**TRACE** function), see p. 114.

The **<STOP>** key ends a method.

If a sample series is stopped manually with **<STOP>** then the final sequence of a method will not be carried out. When the **<STOP>** key is pressed the functions listed in the parameter menu under **`>manual stop`** will be carried out.

The **<HOLD>** key interrupts a method sequence.

Connected peripheral devices (Titrinos, etc.) will not be stopped automatically. Only the method sequence will be interrupted. In the **HOLD** condition a method can be completely terminated with **<STOP>** or continued with **<START>**.

After an error message in the method sequence the Sample Processor switches automatically to the **HOLD** condition after **<QUIT>**.

1.8 Safety information

Warning!
This instrument should only be used in accordance with the information given in these Instructions for Use.

1.8.1 General:

This instrument left our works in perfect condition from the point of view of its operational safety (see Technical data, safety specifications). To keep it in this condition and to continue to operate safely the following information must be carefully observed.

1.8.2 Electrical safety

Please observe the following guidelines:

- Only qualified Metrohm personnel should carry out service work on electronic components.
- Do not open the instrument housing as this could damage the instrument. The housing contains no components which could be serviced or exchanged by the user.

Electrical safety when handling the instrument is guaranteed within the scope of Standard IEC 61010-1.

- **Protection against electrostatic charges**

Warning!
Electronic components are sensitive to electrostatic charges and can be destroyed by a discharge. Before touching any electronic components of the Sample Processor one should ground himself and his tools by grasping a grounded object (e.g. the instrument housing or a radiator) in order to eliminate any electrostatic charges that may be present.

- **Mains connection**

*This instrument must only be operated at the specified **mains voltages** (see rear panel of instrument).*

- **Opening a Sample Processor**

*When the Sample Processor is connected to the mains supply the instrument must not be opened, nor should any of its components be dismantled as otherwise one could come into contact with current-carrying components. Before opening the instrument it must be separated from all current sources. **The mains cable has to be removed from the mains connection socket**!*

1.8.3 Personal protection

The different drives of the Sample Processor and the 786 Swing Head possess considerable force in order that they can freely move even under heavy loads. They are fitted with electronic overload limiters that are triggered if the mechanical resistance is too high.

*When the **instrument is running** do not intrude in the working range of the Sample Processor.*

*For the user there is a considerable **risk of injury from manual interference** with the automatic processes of the instrument.*

*Running methods and individual commands can be interrupted with the **<HOLD>** key and then continued with **<START>**.*

Emergency stop

*The **<STOP>** key always terminates all running processes immediately (exception: initialization during switch-on).*

Important!

*Before you use the instrument for the first time you must install the included **6.2751.0xx Safety Shield**, see p. 48.*

The Sample Processor must not be operated without the Safety Shield in position!

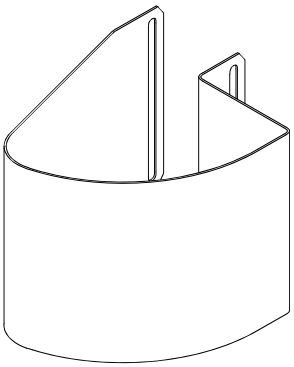


Fig. 10 Safety Shield
(example shown: 6.2751.0xx for transfer robotic arm)

Biohazard

The Sample Processor does not provide sufficient protection when processing potentially infectious samples or reagents.

In this case install the necessary safety devices.

2 Installation

This section described the installation of all the components of a Sample Processor and shows how it is connected to other instruments. Please read through the following sections carefully and follow the instructions in detail.

2.1 Installation flow chart

The following flow chart provides an overview of all the necessary installation work. Detailed information can be found in the given sections.

Setup	*Section 2.2*
⇩	
Connecting the mains cable	*Section 2.2.2*
⇩	
Connecting the keypad	*Section 2.2.3*
⇩	
* Mounting a 786 Swing Head	*Section 2.2.4*
⇩	
* Mounting a robotic arm	*Section 2.2.5*
⇩	
* Connecting the pumps	*Section 2.2.6*
⇩	
* Connecting a dosing device	*Section 2.2.7*
⇩	
Connecting the connection cables	*Section 2.3*
⇩	
Setting up the titration accessories	*Section 2.4.3*
⇩	
* Mounting the stand support	*Section 2.4.8*
⇩	
Mounting the safety shield	*Section 2.4.11*

* optional

2.2 Instrument setup

2.2.1 Setup

Packaging

A Metrohm Sample Processor and its specially packed accessories are supplied in very protective special packaging consisting of shock-absorbing plastic foam. Please store this packaging in a safe place; it is the only way in which the safe transport of the instrument can be guaranteed.

Checks

Please check that the delivery is complete and undamaged immediately on receipt (compare with delivery note and list of accessories given in Section 6.3, p. 137). If transport damage is evident please refer to the information given in Section 6.4.1 "Warranty", p. 162.

Location

The Sample Processor is a robust instrument and can therefore be used even in rough surroundings in laboratories and factories.

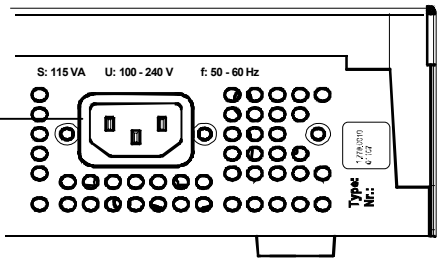
However, please ensure that it is not exposed to a corrosive atmosphere. The instrument should be serviced at regular intervals, particularly when operated under rough conditions.

2.2.2 Mains connection

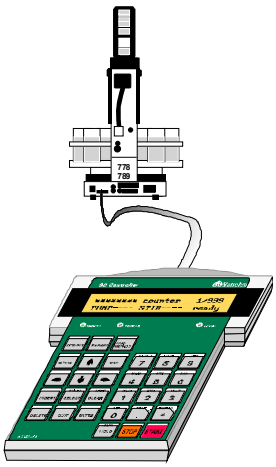
*This instrument must only be operated at the specified **mains voltages** (see rear panel of instrument).*

Protect the connection sockets against moisture.

Mains connection **25**



2.2.3 Connecting the keypad



The keypad is attached to the keyboard socket provided for it on the rear panel of the instrument. To remove the plug press both sides together.

2.2.4 Mounting a 786 Swing Head

The procedure for the installation of the 786 Swing Head is described below. This is normally carried out by the service technician.

For Sample Processors with 2 towers Tower 1 is moved to a central lift position and Tower 2 to the parking position.

Switch off the instrument at the mains switch.

- Loosen the titration head holder fitted as standard from the lift guide by removing the four side-mounted screws.
- Loosen the attachment plate from the titration head holder and remove the holder.
- Screw the Swing Head onto the attachment plate with the 2 delivered mounting screws.
- Mount the Swing Head on the lift guide.

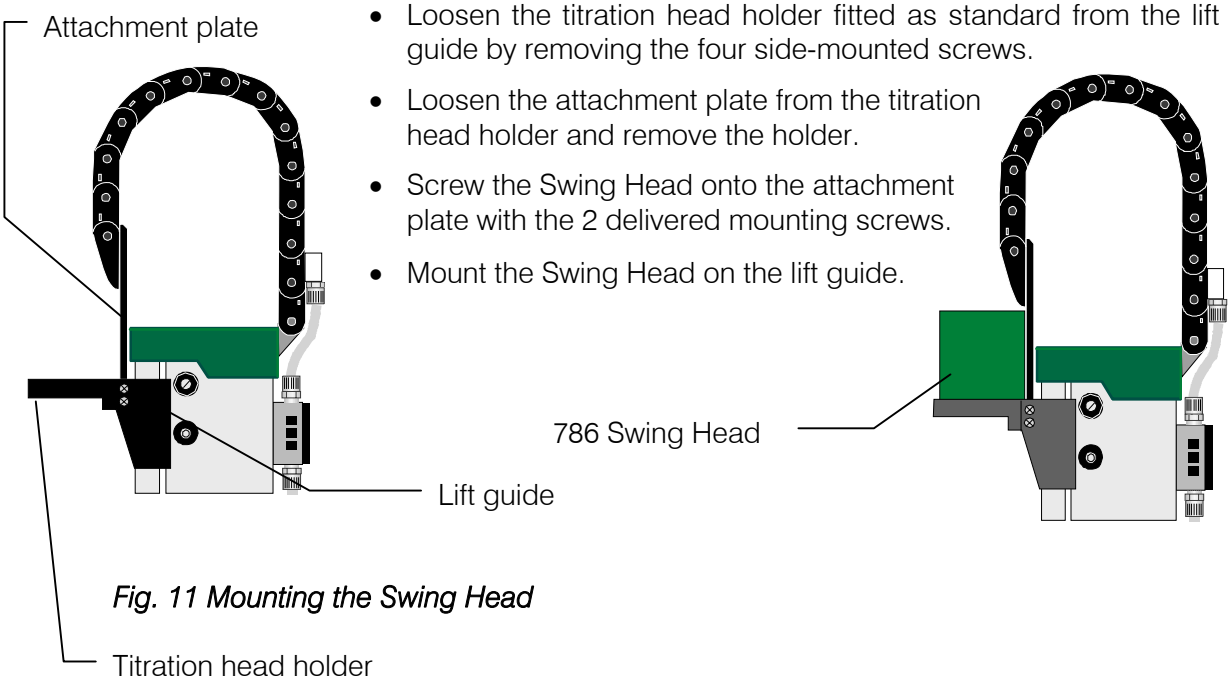
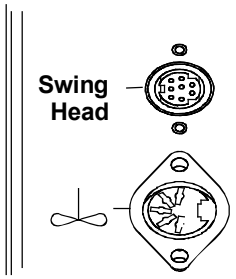


Fig. 11 Mounting the Swing Head



Connecting to the Swing Head connection socket

Lead the connection cable of the 786 Swing Head through the guide chain of the tower and connect the mini-DIN plug of the Swing Head connection cable to the **Swing Head** socket on the rear panel of the tower.

Configuring the Swing Head and robotic arm

As each type of robotic arm has its own dimensions, it is essential to adapt the Swing Head setup settings to suit the particular type of robotic arm.

The necessary alterations are made in the setup dialog, see Section 3.13. The individual settings affect:

- Swing offset (default: **0°**)
- Max. swing angle (default: **84°**)
- Swing radius (=length of robotic arm, default: **110 mm**)
- Swing direction (default Tower1: **–**, default Tower 2: **+**)

The setup dialog of the Sample Processor is opened by pressing the **<CONFIG>** key as the instrument is switched on. A short explanation is given in Section 3.13. Details about the individual settings and types of robotic arm can be found in the Instructions for Use of the 786 Swing Head.

2.2.5 Mounting the robotic arm

Certain robotic arms can, depending on the model, be mounted so that they swing to the right or the left. During the mounting process the location of the limiting screw of the robotic arm must be taken into account.

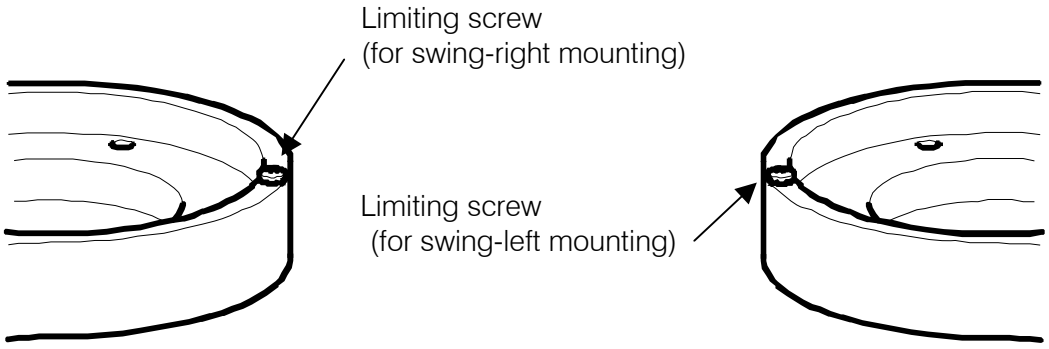


Fig. 12 Robotic arm with limiting screw

Swing-right mounting *means: The robotic arm can swing from the zero-axis (center of the rack) to the right, as seen from the front. The swing direction has to be set to* '**–**'.

Robotic arms that can be mounted in two different ways (e. g. 6.1462.050) can have the limiting screw positioned according to the required swing direction (see above).

Mounting procedure
The 786 Swing Head must already be in position and configured before the robotic arm can be mounted.

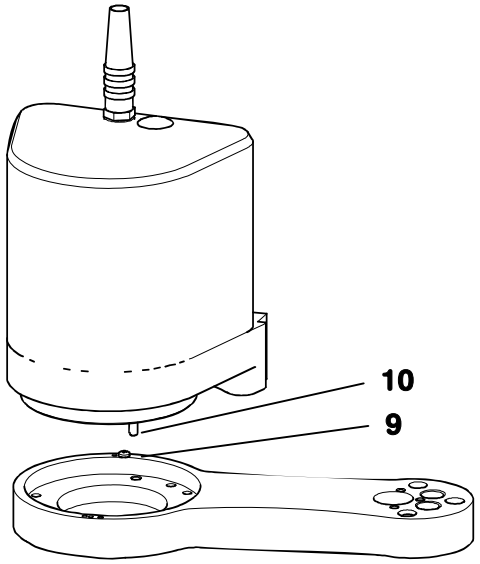


Fig. 13 Mounting the robotic arm

- Switch the instrument off and then on again. Wait until the Swing Head drive has finished the initialization movements.
- Carefully push the robotic arm over guide cam **10** from below (see drawing). Hold the robotic arm in such a way that limiting screw **9** points toward the tower of the Sample Processor while the robotic arm assumes the maximum swing angle.
- Use the three enclosed screws to attach the robotic arm from below.
- Switch the instrument off and on again.

Details about the individual robotic arm types can be found in the Instructions for Use of the 786 Swing Head.

2.2.6 Connecting pumps

On the Sample Processor models with one built-in membrane pump one external pump per tower can be connected and controlled. The models with no pumps even have two connections for external pumps.

Ext. Pump 2

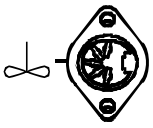
The pump connections (for 3-pin M8 connectors) on the rear panel of the Sample Processor tower supply a feed voltage of 16 V for a max. load of 600 mA.

Suitable pump models are:

- Metrohm 823 Membrane Pump Unit (membrane pump, suitable for aqueous media without particles)
- Metrohm 772 Pump Unit (peristaltic pump, suitable for organic solvents and aqueous solutions containing particles)

2.2.7 Connecting dosing devices and stirrers

Metrohm Sample Processors have various connections to which dosing devices and stirrers can be connected.



Stirrers

The **722/802 Rod Stirrers** and **741 Magnetic Stirrer** have a DIN connector and are connected to the rear panel of a tower (Tower stirrer T1 and T2).

As with other Metrohm instruments, e. g. Titrandos, the three **MSB connectors** (MSB = Metrohm Serial Bus) are very versatile. You can connect an **801 Stirrer** or an **804 Ti Stand** to them.

Dosing devices

Up to three **700/800 Dosino** or **685/805 Dosimat** type dosing drives can be operated by connecting them directly to the MSB sockets of a Sample Processor. One **800 Dosino** or **805 Dosimat** can also be connected to the **MSB output connector** of another instrument connected to the MSB socket, such as the 801 Stirrer, in a so-called '*daisy chain*'. Please note that only one instrument of a particular type may be present in such a daisy chain, e. g. a 801 Stirrer and a 805 Dosimat.

A **700 Dosino** or a **685 Dosimat** must be connected directly to the **MSB socket** of the Sample Processor.

Dosing device and stirrer connections MSB1…3

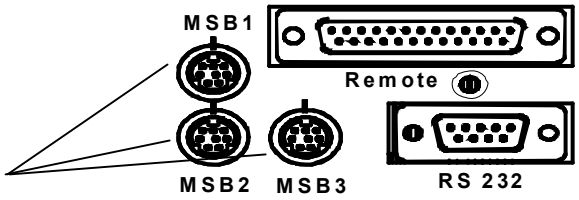


Fig. 14 MSB connections

The instrument will only recognize automatically a connected dosing device when it is switched on or after **RESET**.

2.3 Data transmission connections

Connection cables

Only Metrohm cables should be used to connect a Metrohm Sample Processor to other instruments. Only these will guarantee interference-free data transmission.

Note:

The Remote cables for Metrohm Sample Processors and Sample Processors have markings at each end of the cable to indicate the instrument that the particular connector is intended to be used with and the connection into which it is to be plugged.

Example:

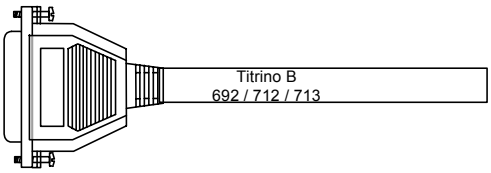


Fig. 15 Remote cable

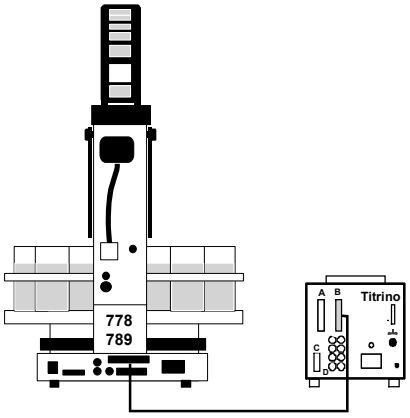
The Sample Processor must be switched off before peripheral devices are connected, as otherwise the instruments could be damaged.

2.3.1 Remote connections

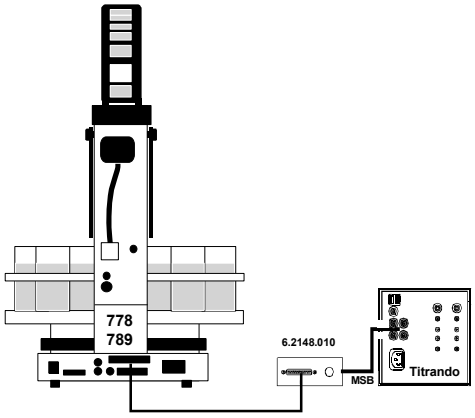
In order to connect Remote cables to Titrandos and the 780/781 pH/Ion Meter an 8.2148.010 Remote Box is required as an additional adapter; this is connected to one of the MSB sockets (MSB1…4), see above.

Sample Processor — Titrino / Titrando

with standard cable (and 6.2148.010 Remote Box)



Cable 6.2141.020



Cable 6.2141.020

Titrinos and Titrandos can be connected to a Sample Processor in the same way and can also be controlled.

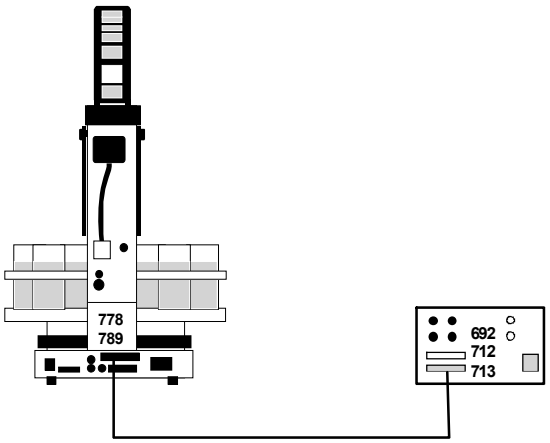
Control commands:

`CTL:Rm :  START Device1`	starts Titrino/Titrando
`CTL:Rm : *************1`	"

Final scan:

`SCN:Rm :  End1`	waits for end of titration (EOD-impulse)
`SCN:Rm :  ****1***`	"
`SCN:Rm :  Ready1`	waits until Titrino/Titrando is ready
`SCN:Rm :  *******1`	"

Sample Processor — pH / Ion Meter / Conductometer (692/712/713)



Cable 6.2141.020

Control commands:

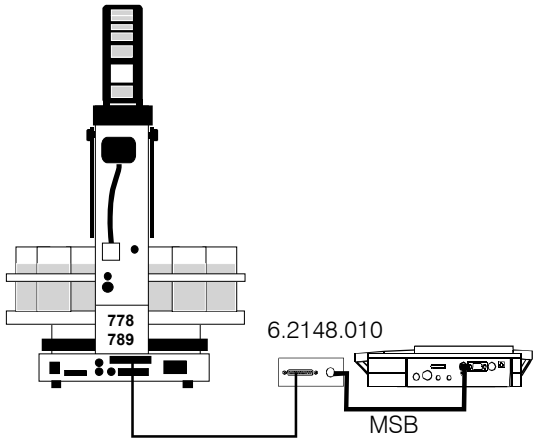
`CTL:Rm :  START device1`	starts instrument
`CTL:Rm : *************1`	"
`CTL:Rm :  METER Mode pH`	switches to pH measurement
`CTL:Rm : *********0001*`	" (not for 712)
`CTL:Rm :  METER Mode T`	switches to temp. measurement
`CTL:Rm : *********0010*`	" (not for 712)
`CTL:Rm :  METER Mode U`	switches to mV measurement
`CTL:Rm : *********0011*`	" (not for 712)
`CTL:Rm :  METER Mode I`	switches to Ipol (mV measurement)
`CTL:Rm : *********0100*`	" (not for 712)
`CTL:Rm :  METER Mode C`	switches to Conc measurement
`CTL:Rm : *********1000*`	" (for 692/781 only)
`CTL:Rm :  METER Cal pH`	switches to pH calibration
`CTL:Rm : *********0101*`	" (not for 712)
`CTL:Rm :  METER Cal C`	switches to Conc calibration
`CTL:Rm : *********1001`	" (for 692/781 only)

```
CTL:Rm :    METER enter    simulates <ENTER> key
CTL:Rm : *********1111*          "          (not for 712)
```

Final scan:

```
SCN:Rm :           End1    waits for end of measurement
SCN:Rm :       ****1***          "
```

Sample Processor — 780/781 pH / Ion Meter

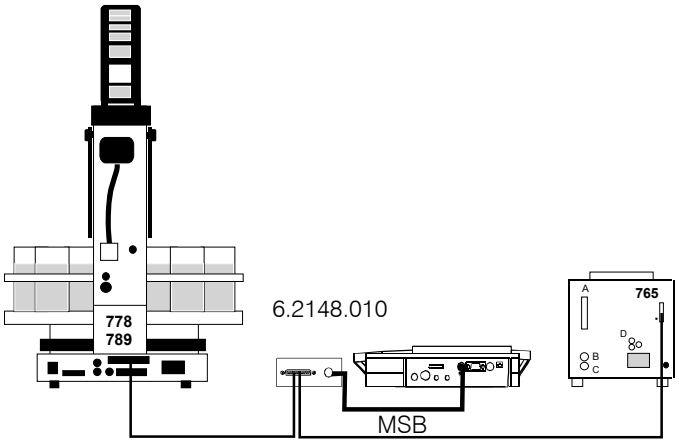


Cable 6.2141.020

Control commands: see above (692/712/713 pH/Ion meter/ Conductometer).

Sample Processor — 781 Ion Meter — 665 Dosimat

For ion measurements with calibration and standard addition.



Cable 6.2141.070

The 781 Ion Meter automatically controls Stirrer T1 of the Sample Processor.

Start commands:

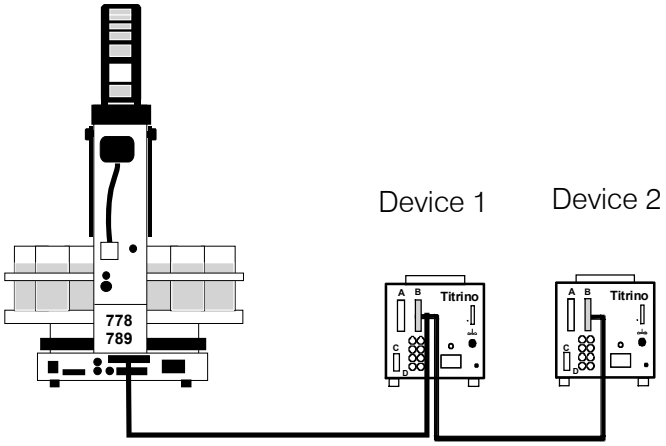
In principle these are the same commands as those given in the previous section.

Final scan:

In principle these are the same commands as those given in the previous section, with the addition of:

```
SCN:Rm :        EndMeter waits for end impulse from 781
SCN:Rm :        ***11***              "
```

Sample Processor— 2 x Titrino/Titrandos



Cable 6.2141.030

Control commands:

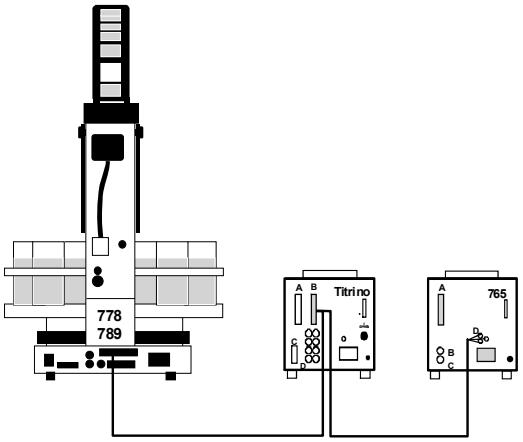
```
CTL:Rm :  START Device1    starts Titrino/Titrando 1
CTL:Rm : *************1          "
CTL:Rm :  START Device2    starts Titrino/Titrando 2
CTL:Rm : ********1*****          "
CTL:Rm :   START Device*   starts both Titrino/Titrandos
CTL:Rm : ********1****1          "
```

Final scan:

```
SCN:Rm :           End1    waits for end of titration Titrino/Titrando 1
SCN:Rm :       ****1***                "
SCN:Rm :           End2    waits for end of titration Titrino/Titrando 2
SCN:Rm :       *1******                "
SCN:Rm :         Ready1    waits until Titrino/Titrando 1 is ready
SCN:Rm :       *******1                "
SCN:Rm :         Ready2    waits until Titrino/Titrando 2 is ready
SCN:Rm :       **1*****                "
SCN:Rm :         Ready*    waits until both Titrino/Titrandos are ready
SCN:Rm :       **1****1                "
```

The combined operation of the Titrino/Titrando/pH meter can also be carried out without any problems by the same means.

Sample Processor — Titrino/Titrando/pH Meter — 665/725 Dosimat



Cable 6.2141.040

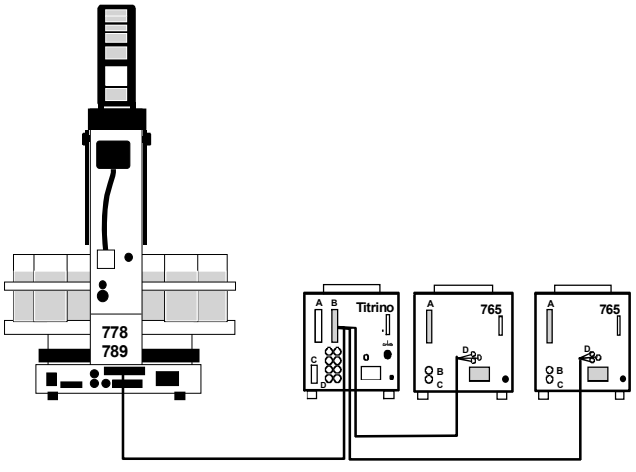
Control commands:

```
CTL:Rm :  START Device1     starts Titrino
CTL:Rm : *************1          "
CTL:Rm :      START Dos1    starts Dosimat 1
CTL:Rm : *******1******          "
```

Final scan:

```
SCN:Rm :           End1     waits for end of titration (impulse)
SCN:Rm :        ****1***          "
SCN:Rm :          Ready1    waits until Titrino is ready
SCN:Rm :        *******1          "
```

Sample Processor — Titrino/Titrando/pH Meter — 2x 665/725 Dosimat



Cable 6.2141.050

Control commands:

```
CTL:Rm :  START Device1     starts Titrino
CTL:Rm : *************1          "
CTL:Rm :      START Dos1    starts Dosimat 1
```

CTL:Rm : *******1******	"
CTL:Rm : START Dos2	starts Dosimat 2
CTL:Rm : *****1********	"
CTL:Rm : START Dos*	starts Dosimat 1 and 2
CTL:Rm : *****1*1******	"

Final scan:

SCN:Rm : End1	waits for end of titration (impulse)
SCN:Rm : ****1***	"
SCN:Rm : Ready1	waits until Titrino is ready
SCN:Rm : *******1	"

2.3.2 Serial connections (RS232)

Many different connection to the RS232 interface are possible. As well as all Metrohm instruments which understand the Metrohm Remote language (see '*Technical Reference 8.789.1033*'), a printer (requirement: serial interface or parallel/serial converter) or a personal computer can be connected. Instruments from other manufacturers that have a serial RS232 interface can also be connected.

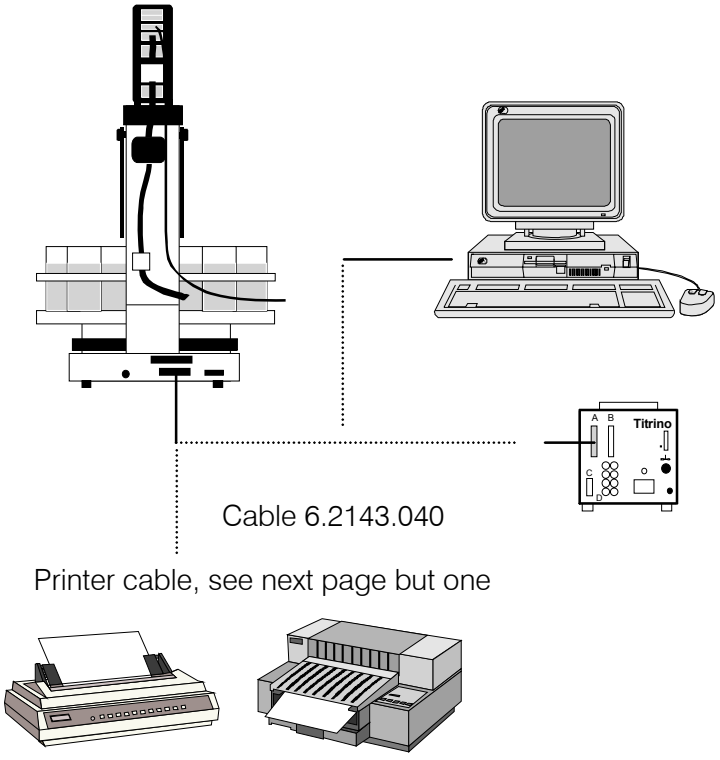


Fig. 16 RS232 connections

A precondition for correct data transmission is that the transmission parameters are set correctly, these must correspond to the interface settings of the connected instrument (see next page).

The following section provides information about the settings and cables required for the connection of a printer.

2.3.3 Connecting a printer

A printer with a serial or parallel interface can be connected to the RS232 interface for printing out reports (e. g. parameter report).

Printers with the following printer emulation can be connected:

IBM IBM Proprinter and printers with IBM emulation

Epson EPSON printers and printers with EPSON emulation

Seiko Seiko printer DPU-411

Citizen Citizen printer IDP560 RS

HP HP printers and printers with HP PCL3 emulation

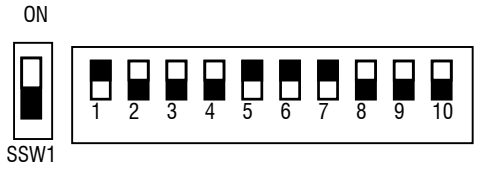
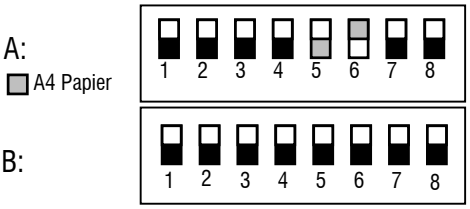
If you wish to connect a different printer then you must ensure that it can emulate one of the printer modes supported by the Sample Processor.

Printers with a parallel interface require a serial/parallel converter (e.g. 2.145.0300) and the 6.2125.020 Cable.

The Sample Processor must be switched off before a printer is connected to the RS232 interface!

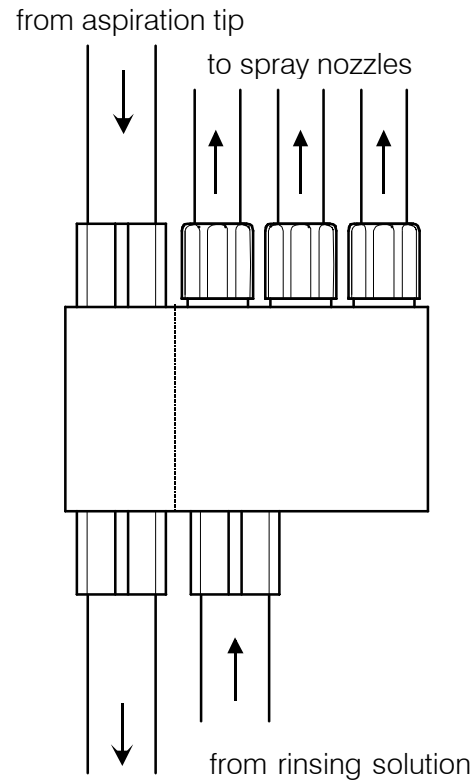
The interface parameters are entered in the configuration menu under "**>RS232 settings**".

The following table provided information about connecting some selected printers.

Printer	Cable	789/789 settings	Printer settings
Custom DP40-S4N	6.2134.110	Send to: Citizen Baud rate: 9600 Data bit: 8 Stop bit: 1 Parity: none Handshake: HWs	IDP-560 EMULATION FONT MAP = ENGLAND PRINT = REVERSE LITTLE CR CODE = VOID CR AFTER B. FULL = VOID CR ON B. EMPTY = VALID BUFFER 1K BYTE BAUD RATE = 9600 PROTOCOL = 8,N,1 FLOW CONTROL CTS-RTS
Seiko DPU-414	6.2134.110	Send to: Seiko Baud rate: 9600 Data bit: 8 Stop bit: 1 Parity: none Handshake: HWs	none
Citizen iDP562 RS	6.2134.050	Send to: Citizen Baud rate: 9600 Data bit: 8 Stop bit: 1 Parity: none Handshake: HWs	
Epson LX-300+	6.2134.050	As above, or Send to: Epson	see printer manual
HP Desk Jet with serial interface	6.2134.050	Send to: HP Baud rate: 9600 Data bit: 8 Stop bit: 1 Parity: none Handshake: HWs	
HP Desk Jet with parallel interface	2.145.0330 RS232/ Parallel Converter	Send to: HP Baud rate: 9600 Data bit: 8 Stop bit: 1 Parity: none Handshake: HWs	see printer manual

2.4 Connecting up accessories

2.4.1 Connecting rinsing and aspiration equipment



Both the existing built-in membrane pumps and external pumps can be used for rinsing the titration head and aspirating off samples that have been processed. The necessary tubing is supplied with the corresponding Metrohm instruments and is easily mounted on the Sample Processor.

Attach the tubing for the spray nozzles and the aspiration tip according to the diagram on the left and lead them through the guide chain.

Fig. 17 Distributor piece

Spray nozzles
Spray nozzles (6.2740.030) can be used for rinsing electrodes and dosing tips.

The spray nozzles are inserted in the oblique openings of the titration head. These are connected to the distributor block on the guide chain with tubing (6.1805.420). The three distributor block openings (M6) provided for them must all be occupied. Any unoccupied openings must be sealed with an M6 threaded stopper (6.1446.040) to prevent liquid escaping during the rinsing process.

The tubing is attached to the guide chain. It may be necessary to remove the stud of the first link in the chain.

Aspiration tip
In the macro titration head the M8 aspiration tip (6.1543.170) is placed in a vertical opening (SGJ9). In the micro titration head a vertical opening is also used. The tip is connected with a piece of PTFE tubing (6.1805.510) and a 6.1820.030 Screw connector to Pump 2 (marking on valve '↓').

Rinsing process
In an ideal rinsing process (with two pumps) the sample solution is first aspirated off. The electrode is then rinsed in an empty beaker and the rinsing solution is aspirated off at the same time. A short overrun of the aspiration pump ensures that the sample vessel (or titration cell) is emptied completely.

Sequence:

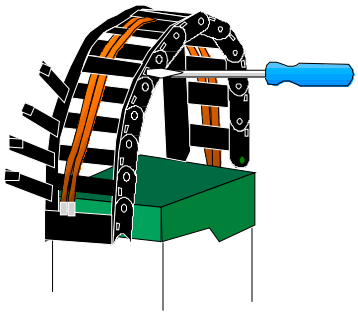
```
PUMP  1.2   :    10 s
PUMP  1.*   :     3 s
PUMP  1.2   :     3 s
```

Chemical resistance
The pump heads of the membrane pumps, the connection nipples and the union nuts are made of PVDF. PVDF is resistant to many chemicals.

The following should **not** be used: acetone, acetic anhydride or dimethylformamide (DMF). The membrane, the valve disks and valve components are made of PTFE and are resistant to almost all chemicals.
If your sample contains solids (e.g. silver chloride) or sticky substances then, instead of the membrane pump built into the Sample Processor, you should use the 772 Pump Unit.

The polyethylene canisters (6.1621.000) used as rinsing or waste canisters are (only) suitable for aqueous solutions.

2.4.2 Attaching the tubing



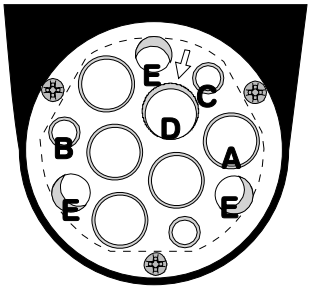
For attaching the tubing the individual chain links can be opened with a screwdriver or similar object.

Mind the markings on the chain links.

Fig. 18 Attaching the tubing

2.4.3 Installing the titration accessories

Macro titration head
6.1458.010



A	Electrode
B	Aspiration tip M8 6.1543.170
C	Buret tip
D	802 Stirrer 2.802.0020
E	Spray nozzle M6 6.2740.020
F	SGJ sleeve SGJ14 6.1236.020
G	Threaded stopper M8 4.658.0180
H	Guide sleeve SGJ9 6.2709.070
I	Stirrer shaft 6.1909.020/6.1909.040

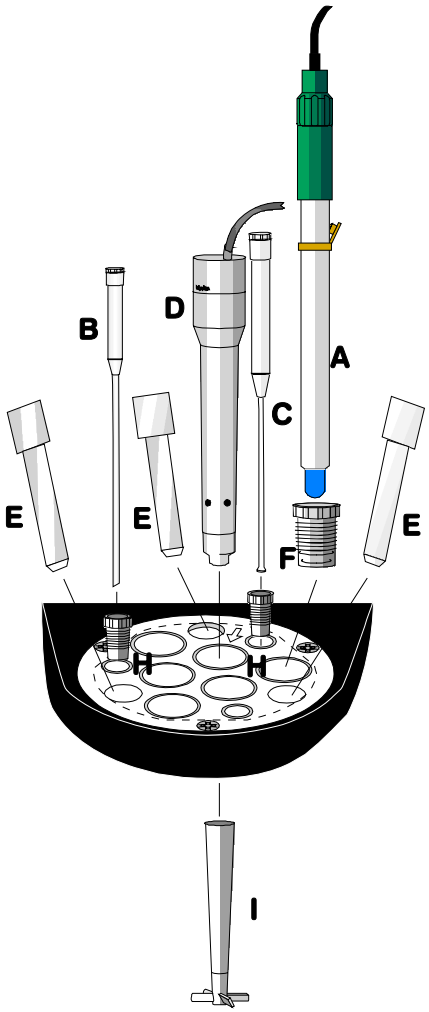
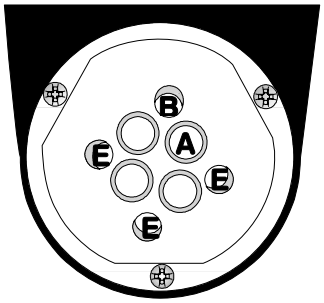


Fig. 19 Macro titration head

Micro titration head
6.1458.020



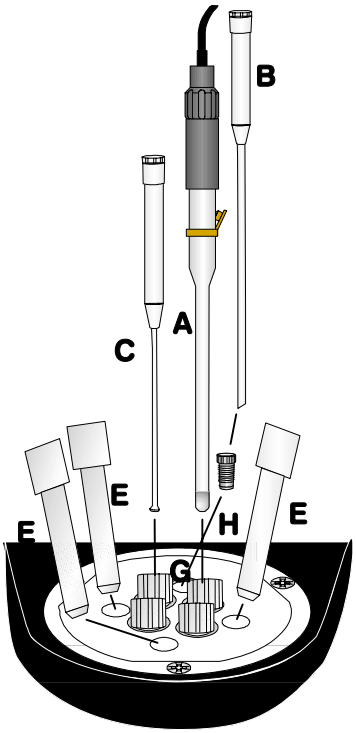


Fig. 20 Micro titration head

Only special micro-electrodes can be used in the micro titration head, see list of accessories, p. 161.

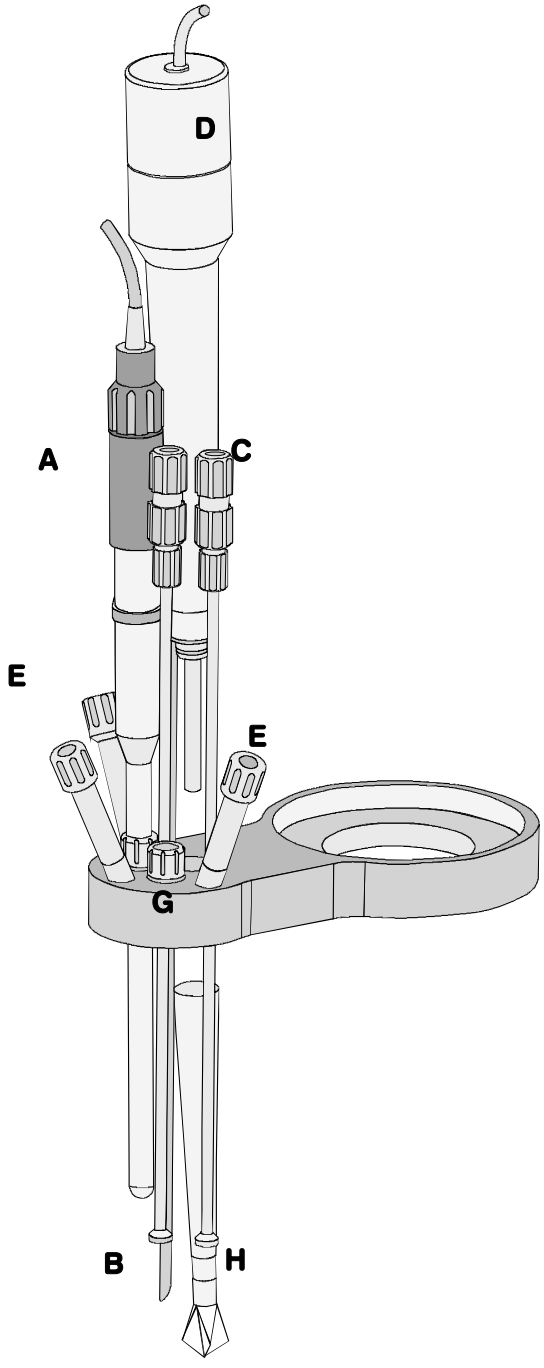
Use a 741 Magnetic Stirrer instead of a Rod Stirrer.

Information about the macro titration head

The SGJ14 opening indicated by an arrow has been bored slightly obliquely so that a rod stirrer or electrode can be centered in a narrow titration vessel.

Robotic arm with titration head
6.1462.050

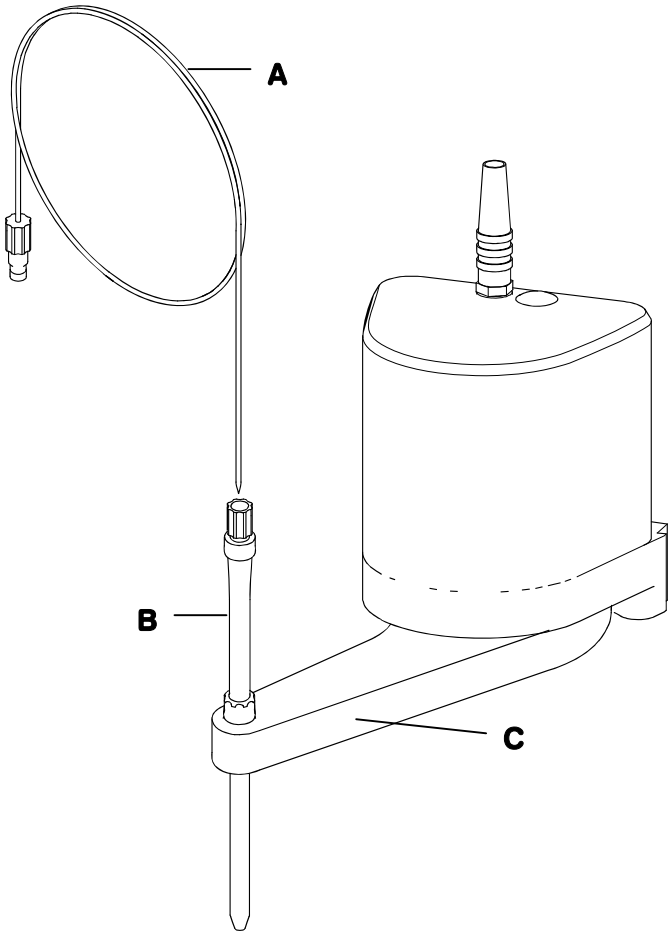
The titration head can be equipped with one 802 Rod Stirrer, up to two micro electrodes, three buret tips and three spray nozzles.



A	Micro electrode
B	Aspiration tip M8 6.1543.170
C	Buret tip (drawn back)
D	802 Rod Stirrer 2.802.0020
E	Spray nozzle M6 6.2740.030
F	Threaded stopper M8 4.658.0180 for micro electrode or buret tip
G	Guide sleeve SGJ9 6.2709.070
H	Stirrer shaft 6.1909.030

Fig. 21 Robotic arm with titration accessories

2.4.4 Assembling pipetting accessories



Either a left-swinging (6.1462.030) or right-swinging (6.1462.040) robotic arm can be used for sample transfer.

A	Pipetting tubing 10 mL 6.1562.100 (or 6.1562.020, etc.)
B	Guide shaft 6.1823.010
C	Robotic arm for sample transfer 6.1462.030 or 6.1462.040

Fig. 22 Transfer robotic arm with pipetting accessories

Before pipetting tubing **A** is used its tip should be drawn out as fine as possible (except for high-viscosity samples).

2.4.5 Installing a double-hollow needle

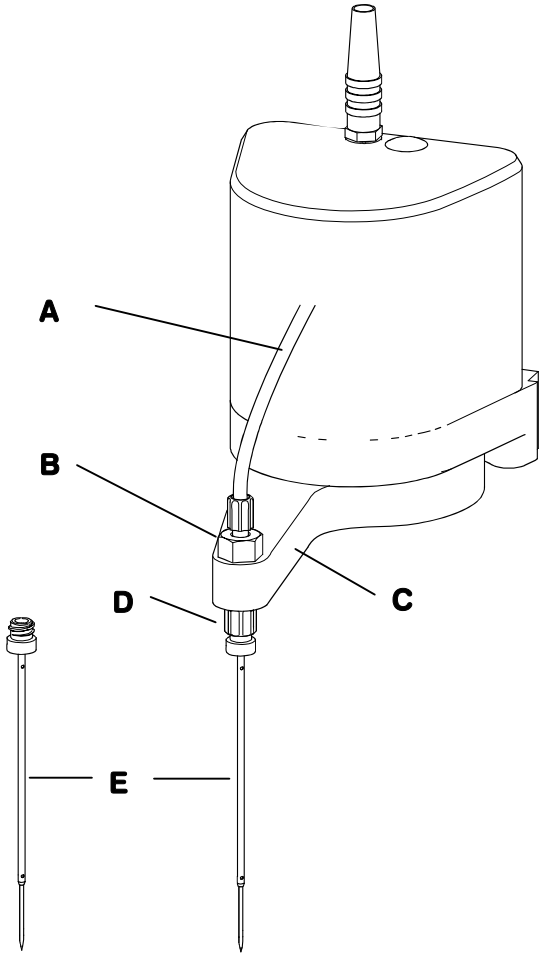


Fig. 23 Transfe r robotic arm with double-hollow needle

For sample transfer from closed containers by means of a double-hollow needle the 6.1462.090 right-swing robotic arm with luer lock adapter can be installed.

A	FEP tubing M6 (e.g. 6.1562.110 pipetting tubing 2 mL)
B	M6 adapter
C	Swing head with luer lock adapter (6.1462.090)
D	Luer lock adapter
E	Double-hollow needle with luer lock connector(6.2816.100)

The parts listed above are contained in 6.5619.000 sample transfer accessory set.

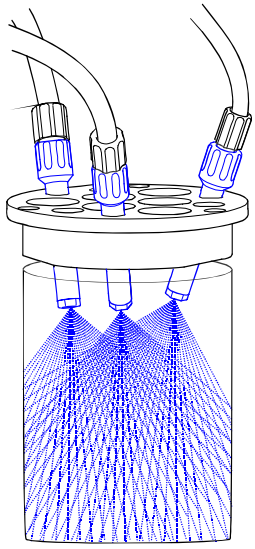
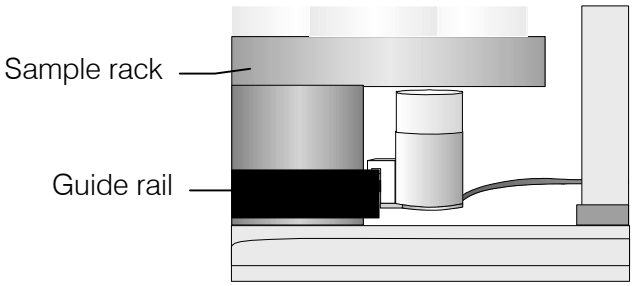


Fig. 24 Spray nozzles

2.4.6 Spray nozzles

The 6.2740.020 spray nozzles are installed as shown in the diagram. Their insertion height is adjustable so that an optimal rinsing effect can be achieved no matter how the head is equipped.

2.4.7 Magnetic stirrer



A 741 Magnetic Stirrer can be placed in any position on the stirrer guide below the sample rack and moved about as required.

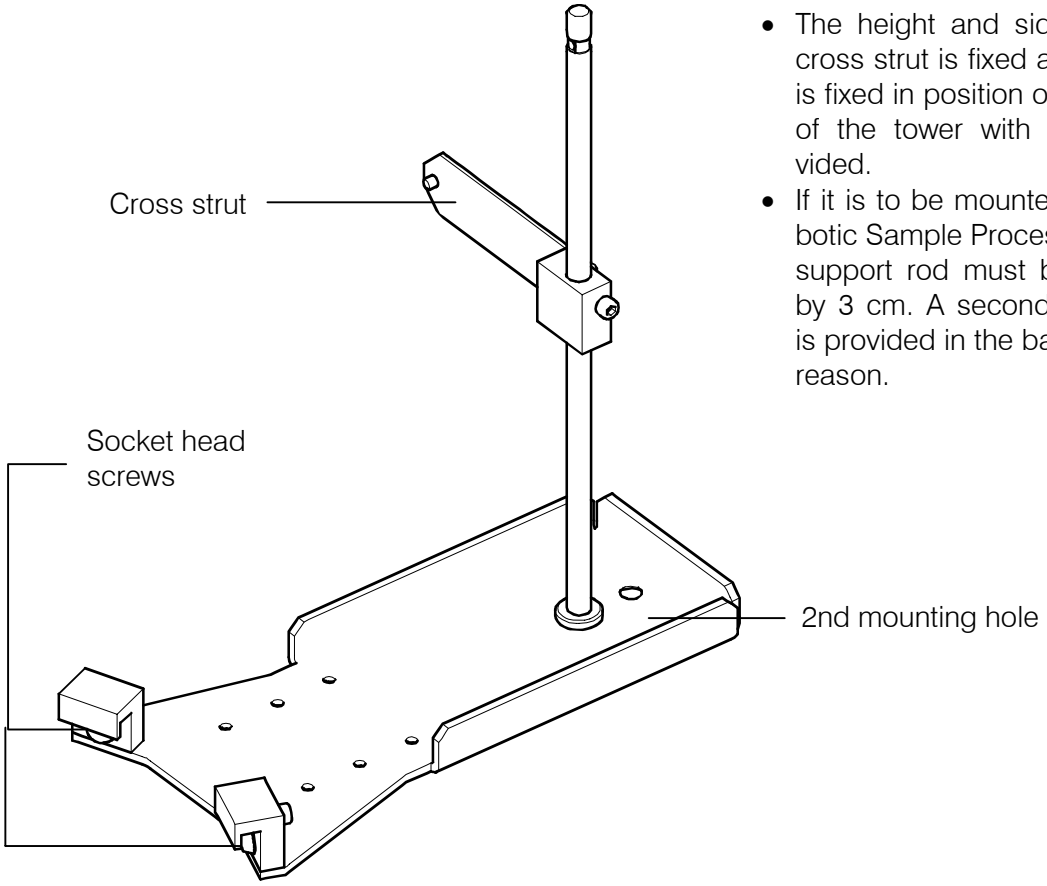
It is connected to the rear panel of the tower (connector).

Fig. 25 741 Magnetic stirrer

The 801 Magnetic Stirrer or 804 Titration Stand is connected to an MSB socket on the rear of the Sample Processor chassis.

2.4.8 Mounting the stand support

An external titration or measuring cell can be mounted on the Sample Processor by using the 6.2001.070 Stand Support. The stand support is attached to stirrer guide of the Sample Processor and fixed in position with the two socket head screws.



- The height and side at which the cross strut is fixed are adjustable. It is fixed in position on the rear panel of the tower with the screw provided.
- If it is to be mounted on a 789 Robotic Sample Processor XL then the support rod must be moved back by 3 cm. A second mounting hole is provided in the base plate for this reason.

Fig. 26 Stand support

2.4.9 Installing the collection trough

Two different sizes of collection trough are available as optional accessories for the Sample Processors. They are intended to prevent any escaping liquid from spreading over the bench or penetrating the instrument housing. The two models are:

- 6.2711.060 for 778 Sample Processor with 42 cm racks
- 6.2711.070 for 789 Robotic Sample Processor XL with 48 cm racks

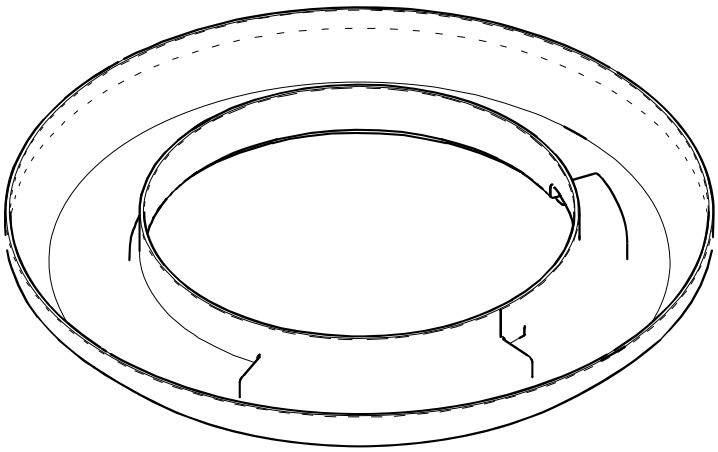


Fig. 27 Collection trough

Attach the supplied tubing to the collection trough outlet. Remove the sample rack and place the collection trough on the turntable so that it lies on the stirrer guide of the Sample Processor. The other end of the tubing should be located in a sink or waste container.

2.4.10 Sample racks

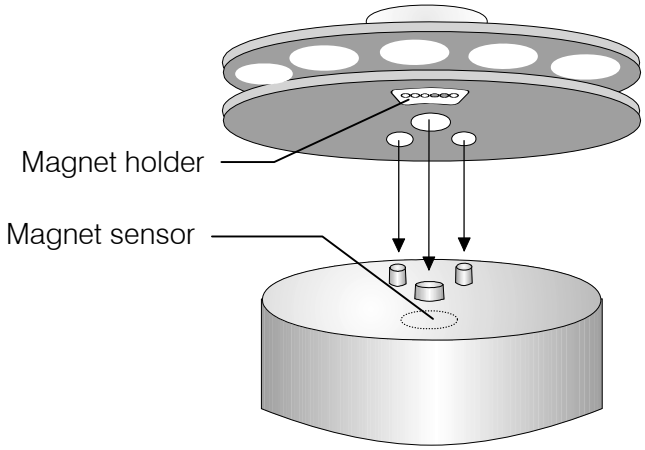
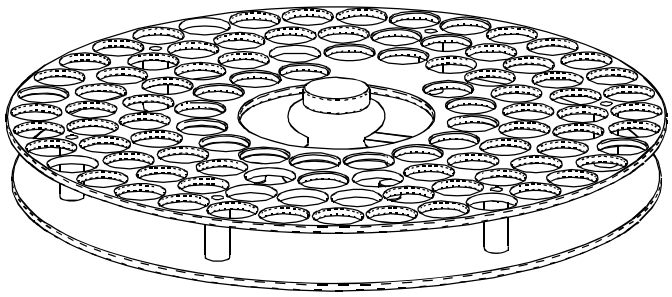


Fig. 28 Attaching a sample rack

Sample racks are attached so that the two guide pins are located in the openings provided for them in the base of the rack.

After a sample rack has been placed in position it should be initialized with **<RACK>** so that the magnet code of the rack can be read in. This is only possible when the rack is in the initial position.



Sample racks for the 789 Robotic Sample Processor XL (48 cm dia.) have a handle with fixing screws. This handle is used to fix the rack on the Sample Processor turntable by turning it clockwise.

Fig. 29 Sample rack for XL models

2.4.11 Mounting the safety shield

It is essential that the safety shield is mounted before the Sample Processor is used for the first time. Not only does it provide an effective protection against splashes, but it also considerably reduces the risk of injury.
Various versions of the safety shield are available.
The safety shield is mounted on the Sample Processor tower with the screws provided. The position of the safety shield can be modified to suit the height of the sample beakers.

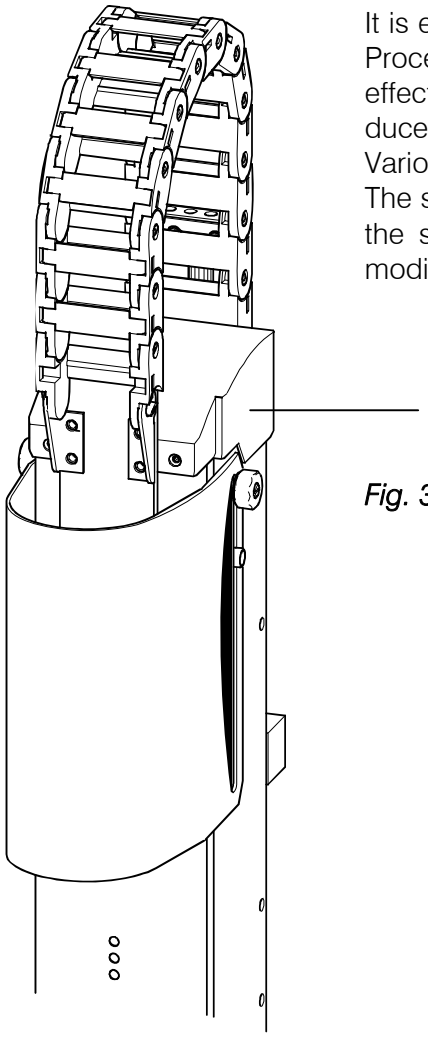


Fig. 30 Mounting the safety shield

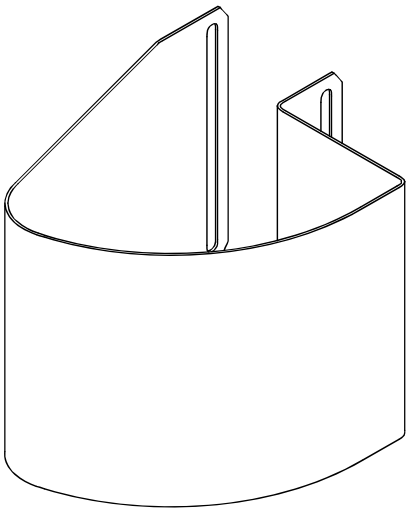


Fig. 31 Safety shield for Swing Heads

2.5 Start-up

Some instrument settings must be made on the Sample Processor before it is used for the first time. These are:

- Dialog language
- Counter setting of running time meter
- Tower configuration
- Robotic arm settings (optional)
- Rack definitions
- Dosing unit configurations
- RS232 interface parameters

All these settings are found in the configuration menu that you can open with the **<CONFIG>** key.

Under **>auxiliaries**:

- Set the dialog language to English, see p. 57.
- Enter a warning limit under **>>running time meter**, see p. 58. Recommendation: 1000 h

Under **>tower 1** and **>tower 2**:

- Limit the max. stroke path, i.e. set the lowest possible lift position, see p. 58. Recommendation: 160…200 mm (Can be set with the **LEARN** function)
- If a 786 Swing Head is installed then, under **>>swing head 1**, set the swing position for the robotic arm, select a swing angle for at least one external position and set its working height, see p. 58ff. All this can be set using the **LEARN** function.

Under **>rack definitions**:

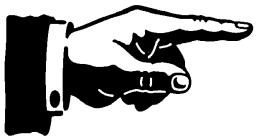
- Load the rack data of the attached sample rack and set the various lift positions (working position, shifting position, rinsing position, etc. for each lift) for processing the samples, see p. 61ff. This can all be done by using the **LEARN** function.
- Select a beaker sensor. For single row samples racks the optical sensor of the tower should be selected.
- Under **>>>special positions** you may want to define one or more special beaker positions. The rack position for the special beaker (e.g. rinsing beaker, conditioning beaker) must be entered and the working position must be set for each lift (with the **LEARN** function), see p. 61ff.
- The rack definitions must be saved and then the sample rack must be initialized with the **<RACK>** key.

Under **>Dosing units**:

- Select dosing drive 1…3
- For each port (1…4) of the corresponding Dosing unit set the max. dosing rate and enter the tubing dimensions, see p. 63ff. These settings are required for preparing the Dosing unit (with the **PREP** function of the DOS command). The dosing rate must be reduced for viscous liquids.

Under **>RS232 settings**:

If a PC control software (e. g. TiNet or Tiamo) is used then it may be necessary to match the transmission parameters of the serial interface to those of the software, see p. 65ff. However, the default settings are suitable for data transmission.



3 Operation

As well as the basic functions that can be carried out manually, this section also described the configuration of a Sample Processor. Detailed descriptions of the way that run sequences are created and how methods are managed are given.

3.1 Operating principles

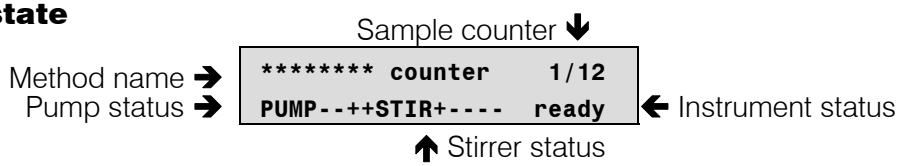
3.1.1 Display

The keypad (SC Controller) display consists of two lines each with 24 characters.

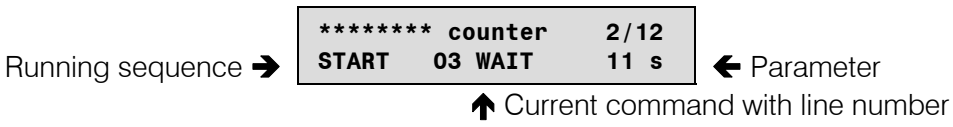
The first line is used as the title line and shows the current method together with the number of processed samples. In the editing mode the menu titles are shown here.

The second line is used as the status line and shows specific activities that depend on the operating condition. It is used as the input line in the editing mode.

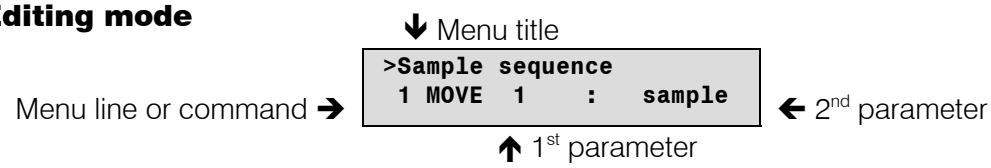
Normal state



Method sequence



Editing mode



3.1.2 Instrument dialog

The instrument dialog of the Sample Processor is arranged in menu levels in which the following rules apply:

Main menu

The **<CONFIG>**, **<PARAM>** and **<USER METHOD>** keys of the Sample Processor open a main menu whose thematically arranged submenus are accessed by repeatedly pressing this key or with <🡻>. The name of the main menu appears in the first line.

Submenu

Each submenu has its own title which is indicated by "**>**" and appears in the lower line of the display. From the title you can use **<ENTER>** to access the individual questions with which the most important instrument settings can be altered. The first line of the display always shows the name of the active submenu.

Navigation in the menus is by the cursor keys; with **<HOME>** you can access the first line of the menu and with **<END>** the last one.

<QUIT> exits the active menu and accesses either the next superior menu or the normal operating condition.

<ENTER> always opens a submenu or confirms the data input of the lowest menu level.

Input lines

For input lines without "**:**" the values can be entered by the numerical keys. The set value is accepted with **<ENTER>** and the next line appears.

For input lines with "**:**" predefined values can be selected with the **<SELECT>** key. **<ENTER>** accepts the set value and the next line appears.

Depending on the parameter, **<CLEAR>** is used to set the initial value. The **<CLEAR>** key is also used to reject incorrectly entered values.

<QUIT> exits the questions and returns to the submenu.

The following schematic diagram shows the instrument dialog arrangement.

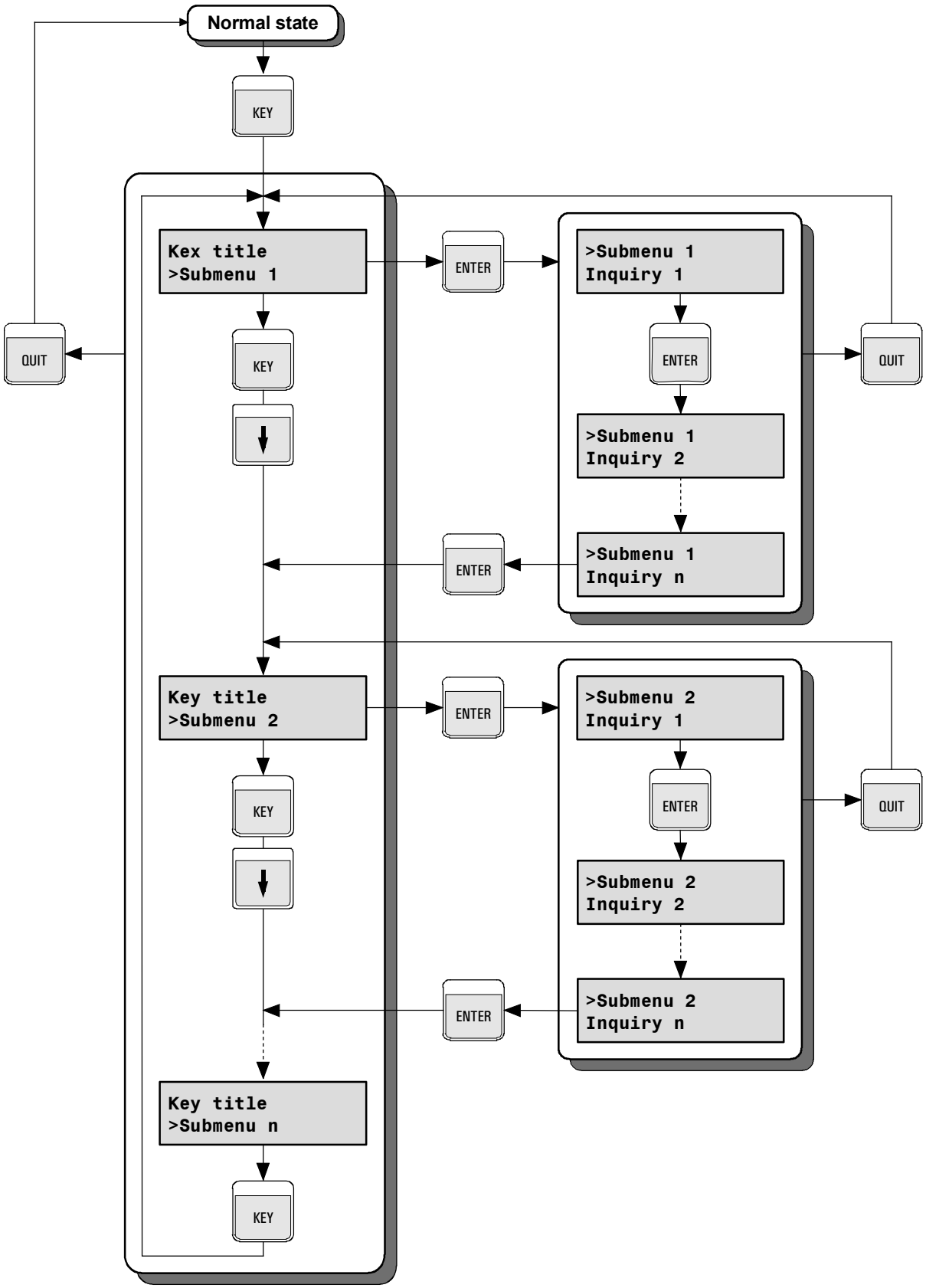
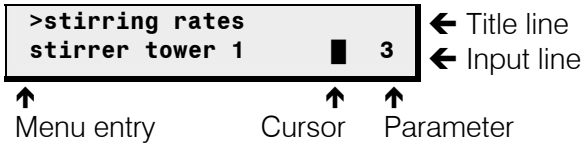


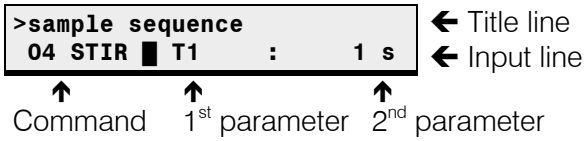
Fig. 32 Dialog arrangement

3.1.3 Data input

Input line

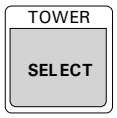
Either one or two parameters can be entered in a menu line or a sequence. A blinking block cursor indicates where a parameter can be entered.





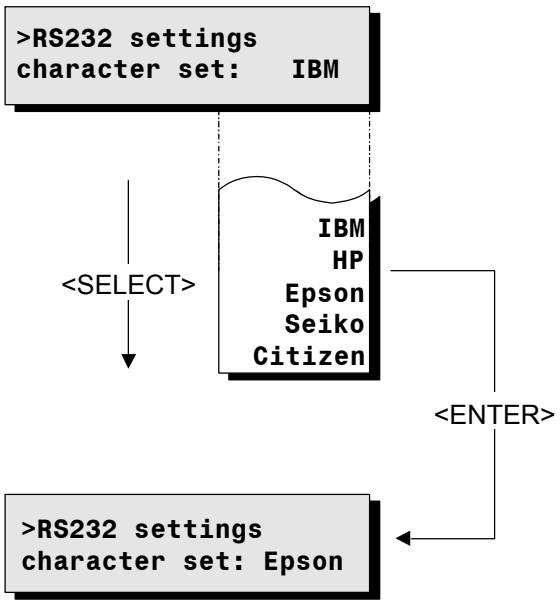
Switching between the parameters is carried out with the arrow keys **<➔>** and **<🡐>**. **<ENTER>** moves the cursor automatically to the right, **<QUIT>** moves it to the left.

<Select> (Selection drum)



Data can usually be entered directly by the numerical keys of the keypad. For entries marked by a colon the **<SELECT>** key can be used to display a selection of entries. This selection is cyclically arranged like a revolving drum.

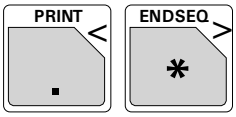
Example:



3.1.4 Text input

The text editor can be used wherever provision is made for the entry of a text.

Numbers can be entered directly via the keypad.



The "**<**" or "**>**" keys open the text editor. With "**<**" an existing character string is deleted and the text cursor moves to the left-hand end of the input field. With "**>**" an existing character string is retained, the text cursor moves to the last character of the existing text.
A character string is displayed that consists of all the characters that can be entered in alphabetic order. The currently selected character always blinks (text cursor).

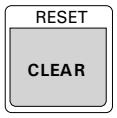
Character selection

The "**<**" and "**>**" keys move the character string made up of all the selectable characters (upper and lower case letters, numbers and special characters, arranged alphabetically) in the selected direction past the text cursor. Pressing either of these keys once moves the character string in the corresponding direction by one position. Rapid character string movement is achieved by keeping the key pressed down.

Confirming character selection

The **<ENTER>** key appends the character currently under the text cursor to the existing text line. When the complete width of the text input field has been filled the text input mode is exited and the text line is accepted with **<ENTER>**.

Delete character



The **<CLEAR>** key deletes the last character of an existing text line. The text cursor automatically moves one character to the left.

Ending text input

<QUIT> exits the text input mode. The displayed text line can then be accepted with **<ENTER>** or rejected by pressing **<QUIT>** a second time.

Arrangement:

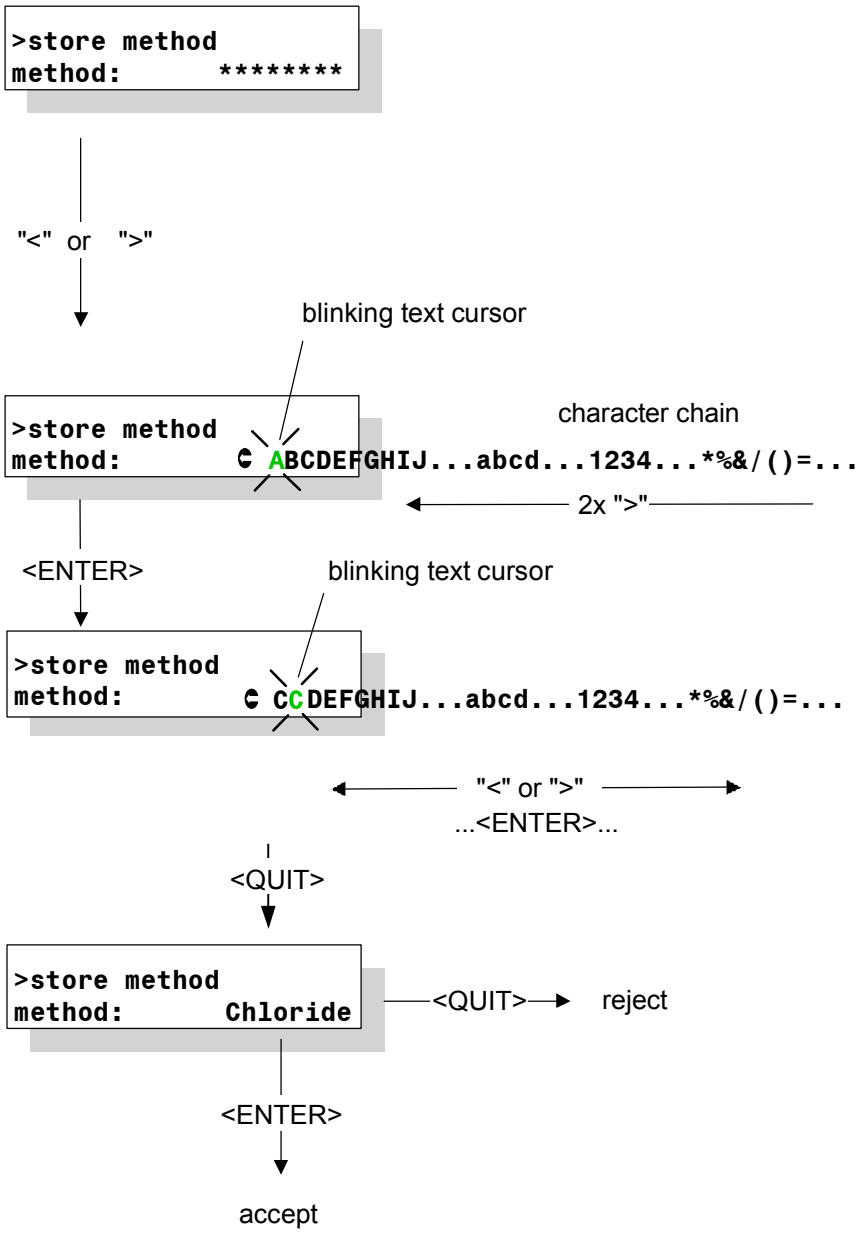
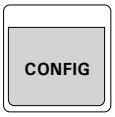


Fig. 33 Text input

Fig. 33 shows how a character string can be entered, e.g. for naming a method. Text input is concluded with **<QUIT>**. The whole of the entered character string is then shown and can be accepted with **<ENTER>** or rejected with **<QUIT>**.

3.2 Configuration



Main menu:

configuration **>auxiliaries**
configuration **>tower 1**
configuration **>tower 2**
configuration **>rack definitions**
configuration **>Dosing units**
configuration **>RS232 settings**

- Open submenu with **<ENTER>**
- Use **<↑>** or **<↓>** to move up and down by one menu item
- Use **<HOME>** or **<END>** to move to the first or last menu item
- Use **<QUIT>** to return to operating condition

3.2.1 Miscellaneous

configuration **>auxiliaries**	Submenu for basic settings Open the submenu with <ENTER>

Use <QUIT> for next higher level

>auxiliaries **dialog: english**	Select dialog language
english, deutsch, **français, español**	
>auxiliaries **display contrast 3**	Set display contrast
0…**3**…7	0 = low contrast 7 = high contrast
>auxiliaries **beeper: ON**	Beep for warnings on or off
ON,OFF	
>auxiliaries **external Start: off**	Switch on external start via Remote line (Input 7)
on, **off**	

Normally the Sample Processor takes over the complete run control for a sample series as the "Master". This may be unwanted, particularly if an automated system has been set up that includes instruments that are not from Metrohm. This is why the Sample Processor can also be started from any external instrument via the Remote interface.

With **external Start: ON** the run sequences of the Sample Processor will

be started as soon as **input line 7** is activated at the Remote interface (low level).
The run sequences of the Sample Processor will be stopped when **input line 6** is activated (low level). The technical details can be found in the **8.789.1033 Technical Reference** of the Sample Processors.

```
>auxiliaries
>>running time meter
```

Submenu for running time meter, open with <ENTER>

Shows the elapsed time

```
>>running time meter
elapsed time          0.0 h
```

0…9999 h

Warning limit for running time meter

```
>>running time meter
warning               OFF h
```

OFF, 0…9999 hours

The running time meter is used to support the regular maintenance of the Sample Processor. If a warning limit is entered then, when this period has elapsed, a message will appear indicating that maintenance is required.

```
>auxiliaries
device label
```

Name of the instrument for identification

8 ASCII characters

```
>auxiliaries
program          5.789.0011
```

Program version

read only

3.2.2 Tower settings

Sample Processor models with two towers can have each tower separately equipped and separately configured. For models with a single tower only the configuration menu for Tower 1 can be accessed.

configuration **>tower 1**	Submenu for basic settings for Tower 1 Open the submenu with <ENTER>

```
>tower 1
max. stroke path      235 mm
```
0…**235** mm

Max. lift range for Lift 1

This max. stroke path setting is **important for safety reasons**. Correct entry of this value can prevent electrode breakage, as the titration head cannot move any lower than the position entered here (0 mm = lower stop of lift).

```
>tower 1
min. beak. radius       * mm
```
*, 1…100 mm

Sets the minimum required beaker radius for processing at Tower 1

* = any value

This is also a safety setting. In order to prevent a fully equipped, wide titration head from trying to enter a narrow sample beaker a limit for the minimum necessary beaker radius can be entered here. During a method sequence the value entered here will be compared with the value given for the effective beaker radius in the rack table before the lift is lowered and, if necessary, an error message will be produced.
Entering ***** prevents a comparison from being made.

```
>tower 1
>>swing head 1
```

Submenu Swing Head 1
Open with <ENTER>

If a 786 Swing Head equipped with a robotic arm is mounted on the Sample Processor then it is essential that the correct settings for the mounted robotic arm are entered, as otherwise the instrument will not be able to position it exactly.

Each of the following settings can be interactively defined with the **LEARN function**. Press the **<LEARN>** key and then move the lift or robotic arm with the arrow keys **<🡻>** and **<🡹>** or **<🡸>** and **<🡺>**. The set values can be accepted with **<ENTER>** and corrected later.

Setting the rinsing height for external positions ***)**

```
>>swing head 1
rinse position          0 mm
```
0…235 mm

Setting the swing height for external positions ***)**

```
>>swing head 1
shift position          0 mm
```
0…235 mm

Swing angle for external position 1 *)

```
>>swing head 1
external pos.1       84.00°
```

Offset…**84.00**…max. angle+offset
0° = points to rack center

The swing angle for the external positions is entered as an absolute angle. The input limits are defined by the offset of the Swing Head drive (approx. 9°) and the set max. swing angle range.

Setting the working height for external position 1 *)

```
>>swing head 1
work position1         0 mm
```

0…235 mm

Swing angle for external position 2 *)

```
>>Robotic arm 1
external pos.2       84.00°
```

… up to external pos. 4

* can be set with LEARN function

configuration **>tower 2**	Submenu for basic settings for Tower 2 Open the submenu with <ENTER>

… see Tower 1

3.2.3 Rack definitions

configuration **>rack definitions**	Submenu for defining individual racks Open the submenu with <ENTER>

Use <QUIT> for next higher level

```
>rack definitions
>>recall rack
```

Loads rack definitions

In order to make a modification to the definition of a sample rack the rack data must first be loaded. The data of the Metrohm standard racks is stored under their ordering number.

```
>recall rack
name:            6.2041.310
```

10 ASCII characters

Name of the rack to be loaded

The **<SELECT>** key can be used to make a selection from the saved rack data. The rack data is loaded with **<ENTER>**. The first selection to appear is the rack name of the currently attached rack.

```
>recall rack
code                  000001
```

000001…111111

Magnet code of the rack
See table on p. 91.

The magnet code is used for the unambiguous identification of the rack. The magnet code is recognized during the initialization of the rack. This is why the **<RACK>** key should be pressed whenever a rack is changed.

```
>recall rack
work position T1        0 mm
```

0…235 mm

Working position for sample positions at Tower 1 *)
(in mm from upper stop point)

```
>recall rack
work position T2        0 mm
```

0…235 mm

Working position for sample positions at Tower 2 *)
(in mm from upper stop point)

```
>recall rack
rinse position T1       0 mm
```

0…235 mm

Rinsing position for sample positions at Tower 1 *)
(in mm from upper stop point)

```
>recall rack
rinse position T2       0 mm
```

0…235 mm

Rinsing position for sample positions at Tower 2 *)
(in mm from upper stop point)

```
>recall rack
shift position T1       0 mm
```

0…235 mm

Shifting position for sample positions at Tower 1 *)
(in mm from upper stop point)

```
>recall rack
shift position T2      0 mm
```
0…325 mm

Shifting position for sample positions at Tower 2 *)
(in mm from upper stop point)

```
>recall rack
special pos. T1        0 mm
```
0…325 mm

Special position for sample positions at Tower 1 *)
(in mm from upper stop point)

```
>recall rack
special pos. T2        0 mm
```
0…325 mm

Special position for sample positions at Tower 2 *)
(in mm from upper stop point)

```
>recall rack
beaker radius          * mm
```
***,** 1…100 mm

Effective beaker radius for the sample positions on the rack
* = any value

This setting is required for an automatic check of the beaker radius, see p. 58.

```
>recall rack
beaker sensor:       Tower
```
Tower, SwingH, OFF

Selection of the beaker sensor

The beaker sensor checks the presence of a sample beaker when executing a MOVE command.

```
>recall rack
rack offset          0.00°
```
-5.00…**0.00**…5.00°

Correction for the rotation angle of a sample rack *)

*) All the above lift positions and the rack offset can be set by using the **<LEARN>** function.

Special beaker positions

```
>>recall rack
>>>special positions
```

Submenu special beaker positions
Open with <ENTER>

Use <QUIT> for next higher level

Special beaker positions are predefined places on a sample rack that are not treated as sample positions. They can be occupied by rinsing beakers or conditioning beakers and selectively addressed during a run sequence. Up to 16 special beaker positions can be defined per rack. For each spezial beaker the work position of the lift (tower 1 and 2) and the beaker radius can be set, see above.

Selection of special beaker

```
>>>special positions
special beaker         1
```
1…16

Rack position of the special beaker

```
>>special positions        1
rack position              0
```

0…number Pos.
0 = not defined

etc. up to special beaker 16

```
>rack definitions
>>store rack
```

Save rack definitions

In order to store modifications to the definition of a sample rack the submenu **>>store rack** is selected.

```
>store rack
name:              6.2041.310
```

10 ASCII characters

Name of rack

With the **<SELECT>** key you can select one of the existing rack names. The rack data is stored with **<ENTER>**. Any rack name can be used. The input of any rack name can be made directly via the numerical keys or in the text input mode, see p. 55. Selection of the alphanumerical characters with the **<** and **>** keys or **<PRINT>** and **<RACK>**.

```
>rack definitions
>>delete rack
```

Delete rack definitions

The submenu **>>delete rack** must be selected if a rack definition is to be deleted.

```
>delete rack
name:              6.2041.310
```

Name of the rack

The **<SELECT>** key can be used to select one of the existing rack names. **<ENTER>** confirms the selection. **<QUIT>** stops the deletion process. Before the deletion a question appears.

```
>rack definitions
delete 6.2041.310 ?
```

<ENTER> confirms the deletion. **<QUIT>** stops the deletion process.

When the submenu '**>rack definitions**' is exited without saving modified data a request appears about saving the rack data.

```
>rack definitions
overwrite 6.2041.310 ?
```

Confirm the question (store the rack definitions) by pressing the **<ENTER>** key. Reject storage with **<QUIT>**.

3.2.4 Dosing units

Metrohm Exchange units (with 685 and 805 Dosimats as the dosing drive) and Dosing units for the Dosino 700 and 800 systems can be used with the Sample Processors. The following settings are used for preparing the Dosing units (**PREP** function). The tubing dimensions (length and diameter) are used for calculating the rinsing volumes.
If Exchange units are used then only the dosing rate is effective.

configuration **>Dosing units**	Submenu for the Dosing unit settings Open the submenu with <ENTER>

Use <QUIT> for next higher level

Selection of Dosing unit or dosing device connection

1…3

The Dosing unit selection must be confirmed with **<ENTER>**. It will then be shown in the first menu line.

Max. dosing and filling rate for Port 1 (depends on cylinder size)

0.01…**160** ml/min

Length of tubing at Dosino Port 1

0…**1000**…30000 mm

Diameter of tubing at Dosino Port 1

0.1…**2**…20 mm

Max. dosing and filling rate for Port 2 (depends on cylinder size)

0.01…**160** ml/min

Input of tubing parameters for all four ports of a Dosing unit.

3.2.5 RS232 settings

The correct settings of the interface parameters of the serial RS232 interface is essential for the perfect functioning of data transmission to and from the Sample Processor. This includes the control of the instrument by using a PC software such as **TiNet** or **Tiamo**, backing up of configurations or methods with the **VESUV** software from Metrohm or printing out a parameter report on a connected printer.

configuration **>RS232 settings**	Submenu for serial interface settings Open the submenu with <ENTER>

Use <QUIT> for next higher level

>RS232 settings
baud rate: 9600

300,600,1200,
2400,4800,**9600,** 19200

Transmission rate in baud

>RS232 settings
data bit: 8

7,**8**

Number of data bits

>RS232 settings
stop bit: 1

1,2

Number of stop bits

>RS232 settings
parity: none

even, odd,
none

Parity selection

>RS232 settings
handshake: HWs

HWs,SWchar,SWline,
none

Handshake selection

>RS232 settings
character set: IBM

IBM,HP,Epson,
Seiko,Citizen

Character set for printer and PC (printer emulation)

The settings for the printers recommended by Metrohm are listed on p. 37ff. If your printer is not shown there then we recommend the setting "Epson". It may be necessary to consult the printer manual. For data transmission using personal computers you should select "IBM".

>RS232 settings
RS control: ON

ON,OFF

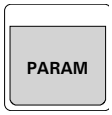
Switch data reception on/off

If Remote control is switched off then no data will be received, but reports can still be printed out.

3.3 Composition of a method

All the settings of the parameter menu form a method and can be stored as such.

3.3.1 Run sequences and method parameters



Main menu:

parameters **number of samples: rack**

Number of samples to be processed

1…999, rack = one sample rack rotation
rack,* * = infinite

In the **rack** setting all the sample positions of the current rack will be processed (max. no. of rack positions minus number of special beakers), with only the positions occupied by sample beakers being counted. It is important that the Sample Processor can recognize the rack. This is only possible when the rack is in initial position. We recommend that each time a rack is changed the Sample Processor is initialized with **<RACK>**.

parameters **>start sequence**
parameters **>sample sequence**
parameters **>final sequence**
parameters **>changer settings**
parameters **>stirring rate**
parameters **>Dosing unit def.**
parameters **>timeout settings**
parameters **>nanual stop**

Open submenu with **<ENTER>**

Use **<↑>** or **<↓>** to move up and down by one menu item
Use **<HOME>** or **<END>** to reach the first and last menu item
Use **<QUIT>** to return to normal operating condition

Submenus:
In each of the submenus **>start sequence**, **>sample sequence** and **>final sequence** up to 99 command lines can be entered as a run sequence. The commands can be entered directly via the keypad. The command keys on the right-hand side of the keypad are available.

parameters **>start sequence**	Commands for the start sequence of the sample series Open the submenu with <ENTER>

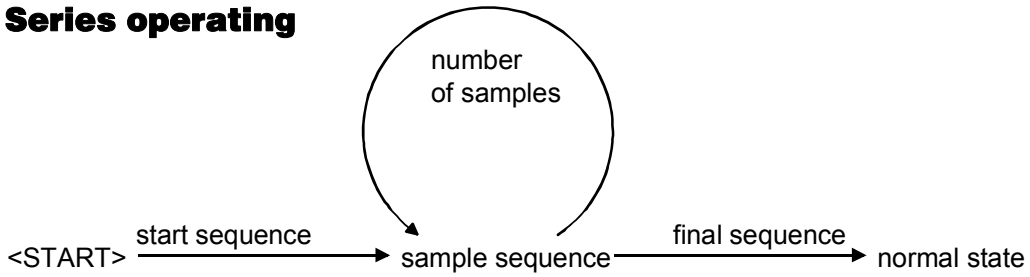
The start sequence is **carried out once** at the start of a sample series. For example, this can be used for rinsing or conditioning an electrode.

parameters **>sample sequence**	Commands for the processing of each sample Open the submenu with <ENTER>

The sample sequence is carried out when **each individual sample** in a sample series is processed.

parameters **>final sequence**	Commands for the final sequence of the sample series Open the submenu with <ENTER>

The final sequence is **carried out once** at the end of a sample series. For example, it can be used to move to a rinsing or conditioning beaker.



Creating methods

In principle the same input rules apply for creating run sequences as for manual operation, i. e. after selecting a command and entering the necessary parameters the entry is confirmed with **<ENTER>**. The next command line is then selected and a new command can be entered.

For more comfortable parameter input the **LEARN** function is available for certain commands. It can be used to accept direct values that are set when a single command is carried out manually. Please refer to p. 112 for details.

The **TRACE** function can be used to execute each entered command line individually in the editing mode. See p. 114.

Navigation in a sequence is the same as in other menus. In addition, the **<INSERT>** and **<DELETE>** keys are available.

<INSERT> inserts a new command line **above the current line** of a sequence. It is automatically occupied with the **NOP** command, which has no function. The following lines move downward by one position.

<DELETE> deletes the current line of a sequence. The following lines move upward by one position.

3.3.2 Sample Processor settings

parameters **>changer settings**	Submenu for setting the Sample Processor functions Open the submenu with <ENTER>

```
>changer settings
rack name:                *
```

The sample rack assigned to the method

***,**10 ASCII characters * = no particular rack

With this setting the user can be forced to use a particular rack for the selected method. If this is not required then **rack name: *** must be selected.

```
>changer settings
lift rate T1          25 mm/s
```

Vertical movement rate of Lift 1

5…**25** mm/s

```
>changer settings
lift rate T2          25 mm/s
```

Vertical movement rate of Lift 2
(only for 2-tower models)

5…**25** mm/s

```
>changer settings
shift rate            20°/s
```

Speed at which the rack rotates
in degrees per second

3…**20**

```
>changer settings
shift direction:      auto.
```

Direction of rotation of the sample rack

+,−,auto. auto. = the Sample Processor selects the shortest path for the rotation itself.

```
>changer settings
rotat. increment:     5.00°
```

Increment angle for the command
MOVE +/-rotate

0.00…**5.00**…270.00°

```
>changer settings
swing rate T1         55°/s
```

Swing rate of the robotic arm at Tower 1
in degrees/second

10…**55**

```
>changer settings
swing rate T2         55°/s
```

Swing rate of the robotic arm at Tower 2
in degrees/second
(only for 2-tower models)

10…**55**

```
>changer settings
swing increment      10.00°
```

Increment angle for the command
MOVE +/-swing

0.00…**10.00**…180

```
>changer settings
on beaker error:       MOVE
```

Definition of reaction if beaker is missing
(only applicable with beaker sensor on)

MOVE, Message

MOVE = the last action will be carried out again. The next position according to the current SAMPLE command will be selected.

Message = The run will be interrupted and a warning displayed.

When a rack position is accessed a check is made whether a sample beaker is present at the selected tower. If the run is not to be interrupted when a sample beaker is missing then **MOVE** can be selected. This means that, if a sample beaker is missing, the **MOVE** command moves on to the next sample position. The next sample is selected according to the last **SAMPLE** command, i.e. for a previous **SAMPLE +2** command the sample will be looked for at the next-but-one rack position, etc.
If a special beaker is missing an error message will always be shown and the run will be interrupted.

3.3.3 Stirrer settings

parameters **>stirring rates**	Submenu for the stirrer settings Open the submenu with <ENTER>

```
>stirring rates
stirrer tower 1          3
```
1…**3**…15

Stirring speed of the stirrer at Tower 1 (stirrer models 802, 741, 722)

```
>stirring rates
stirrer tower 2          3
```
1…**3**…15

Stirring speed of the stirrer at Tower 2 (stirrer models 802, 741, 722)

```
>stirring rates
stirrer MSB1             3
```
1…**3**…15

Stirring speed of MSB stirrer 1 (stirrer models 801, 804)

```
>stirring rates
stirrer MSB2             3
```
1…**3**…15

Stirring speed of MSB stirrer 2 (stirrer models 801, 804)

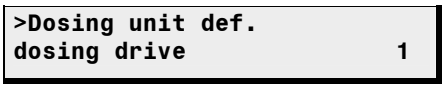
```
>stirring rates
stirrer MSB3             3
```
1…**3**…15

Stirring speed of MSB stirrer 3 (stirrer models 801, 804)

3.3.4 Dosing device settings

Both Dosinos (models 700 and 800, with Dosing units) and Dosimats (models 685 and 805, with exchange units) can be used as dosing drives on a Sample Processor. However, free assignment of the ports for the various functions is only possible with Dosinos.

parameters **>Dosing unit def.**	Submenu for setting the Dosing units Open the submenu with <ENTER>



Selection of the dosing device, or the connection

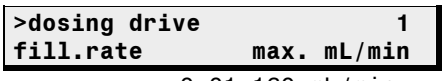
1…3

After entering the connection of the dosing device (see p. 8) and confirming its with **<ENTER>** the settings for the selected dosing device should then be made.

Set the dosing rate

0.01…160 mL/min,
max.

The maximum possible dosing rate depends on the size of the dosing cylinder (rule of thumb: cylinder volume x 3.3).



Set the filling rate

0.01…160 mL/min,
max.

The maximum possible filling rate depends on the size of the dosing cylinder (rule of thumb: cylinder volume x 3.3).
The following entries only apply to 700/800 Dosinos. Details about Dosinos and Dosing units can be found on p. 95ff.

Define standard dosing port 1

1…4

Define standard dosing port 2

1…4

Define standard filling port

1…**2**…4

Define standard rinsing inlet (if Dosing unit is exchanged)

1…**2**…4

Define standard outlet for the prepara-

preparation port 1	tion cycle
1…4	
>dosing drive 1 drain port 4	Define standard air inlet for emptying the Dosing unit
1…4	
>dosing drive 1 cock direction: auto	Direction of rotation of Dosino stopcock
auto	= cock direction according to shortest path
not over	= never turn beyond port given below
desc.	= cock rotation always in descending direction
asc.	= cock rotation always in ascending direction
>dosing drive 1 not over port 4	Protected port, that it not to be moved over during a stopcock rotation
1…4	(see above)

3.3.5 Behavior during timeout

Metrohm Sample Processors are designed to communicate with other instruments. In particular, this includes the coordination between the Sample Processor and devices connected to it. In the method sequence the **SCAN** command can be used to check whether an instrument is ready or to ask for an acknowledgement after a measurement has been made. However, it may happen sometimes that problems occur during a determination run and that the expected signal from the connected instrument is not received. This is known as a timeout.
This means that it is possible to define a maximum waiting time that will always be allowed to elapse if a timeout occurs. In addition, the behavior of the Sample Processor when this waiting period has elapsed (**SCAN** timeout) can also be defined.

parameters >timeout settings	Submenu for behavior if a **SCAN** timeout occurs Open the submenu with <ENTER>

>timeout settings SCAN timeout: OFF min	Waiting time if a SCAN timeout occurs
off,0…999 min	

When the waiting time has elapsed the function defined below will be carried out.

>timeout settings on SCAN timeout: error	Behavior if **SCAN** timeout occurs
error,continue	

If **error** is set then the run sequence will be interrupted and an error message will be shown. Otherwise the sequence will be continued.

3.3.6 Manual stop settings

The following settings can make a great contribution to the comfortable operation of the Sample Processor. A definition is made of what is to happen when the **<STOP>** key is pressed. This could be a normal manual cancellation of a running method, or an emergency stop of the complete system. Depending on the arrangement of the automated system and the type of application, it can be laid down in detail how the individual instrument components and connected instruments are to react when the **<STOP>** key is pressed.

parameters **>manual stop options**	Submenu for reaction after manual stop Open the submenu with <ENTER>

```
>manual stop
CTL Rmt:      **************
```

Stop device1,
Stop device2,
Stop device*
14 bit (1,0 or *)

Set signal lines at the Remote interface

Connected peripheral devices (e.g. a Metrohm Titrino) can be stopped automatically. The 14 signal lines of the Remote interface can be set as required, see also p. 31ff and p. 109ff.

```
>manual stop
CTL RS232:
```

14 ASCII characters

Command or character string, for output via the RS232 interface

default value '&M;$S' (= stops a Titrino)

Connected peripheral devices (e.g. a Metrohm Titrino) can be stopped automatically. Any character string can be transmitted. For details of the serial RS232 interface see "**Technical Reference**".

```
>manual stop
PUMP:                      OFF
```

OFF, ON, cont.

Switches the pumps, or pump connections

(cont. = retain condition)

This setting applies to all pumps and/or pump connections.

```
>manual stop
STIR T1:                  cont.
```

cont., ON, OFF

Switches the stirrer at Tower 1

(cont.= retain condition)

```
>manual stop
STIR T2:                  cont.
```

cont., ON, OFF

Switches the stirrer at Tower 2 (only for 2-tower models)

(cont.= retain condition)

```
>manual stop
STIR MSB1:                cont.
```

cont., ON, OFF

Switches the stirrer at MSB connection 1

(cont. = retain condition)

```
>manual stop
STIR MSB2:              cont.
```

cont., ON, OFF

Switches the stirrer at MSB connection 2

(cont. = retain condition)

```
>manual stop
STIR MSB3:              cont.
```

cont., ON, OFF

Switches the stirrer at MSB connection 3

(cont. = retain condition)

3.4 Commands

3.4.1 Sample Processor commands

The following commands can be programmed to form a sequence. Most of them are also available in manual operation.
The following list applies to the programming of run sequences.

SAMPLE


```
>start sequence
 1 SAMPLE: =              1
```

Set current sample position

=,+,– 1st parameter: function
1…999 2nd parameter: value

With the **SAMPLE** command you can define which sample (beaker position on the rack) is to be regarded as being the current sample position (SAMPLE = X). This is stored in a run variable and can, for example, be altered in a sample sequence (SAMPLE + X or SAMPLE – X) in order to selectively control a sample series.

Examples:

SAMPLE: =	**5**	Sets SAMPLE variable to 5, or first sample in the series to rack position 5
SAMPLE: +	**2**	Increases SAMPLE variable by 2
SAMPLE: -	**1**	Decreases SAMPLE variable by 1

If in a sample sequence the **SAMPLE** command is not programmed, then each run will automatically increases the **SAMPLE** variable by 1.

The **SAMPLE** command does not have to be used for simple applications. Unless anything to the contrary is required, the first sample in a series will automatically be assumed to be in rack position 1. This is why we recommend that special beakers are not placed on the first rack positions, but are set on the highest rack positions.

Under manual operation the **<SAMPLE>** key can be used before the start of a sample series to define the position of the first sample, provided that this has not already been defined in the method itself.

If a particular arrangement of sample beakers is always to be used for a certain application then the position of the first beaker can be defined in the start sequence with **SAMPLE = X** and this setting can be stored in the particular method.

The value of the **SAMPLE** variable remains at the end of a sample series. It is only reset to 1 when the instrument is switched on, when a **RESET** command (**<RESET>** key) is executed or after a **RACK** command (**<RACK>** key or in in a method run).

MOVE


```
>sample sequence
 2 MOVE  1     :  sample
         1,2
                 sample,
              ext.1…ext.4
                 spec.1…16
               prev., next
            +swing, -swing
           +rotate, -rotate
                    1…999
                  +/-1…999
```

Position beaker / Swing robotic arm

1st parameter: tower
2nd parameter: position

With the **MOVE** command rack positions are moved to, i.e. the turntable rotates until the sample rack is positioned so that the selected rack position is placed in front of Tower 1 or 2 (if present). If no 786 Swing Head is mounted then only the rack positions of a 1-row rack can be accessed.

With 786 Swing Head

If a 786 Swing Head is mounted then any rack positions can be moved to. The angle of rotation of the rack is then compared with the swing angle of the robotic arm and corrected accordingly.

In addition to a rack position, the robotic arm of a 786 Swing Head can also be swung to any external position. The selectable external positions **ext.1** to **ext.4** can be defined in the whole swing range from 0° up to the maximum swing angle of the robotic arm. For example, this means that it is possible to move to a titration cell located beside the sample rack.

Examples:

MOVE 1	**sample**	Moves sample beaker (defined by SAMPLE variable) in front of Tower 1
MOVE 1	**ext.1**	Moves robotic arm at Tower 1 to external position 1
MOVE 2	**spec.1**	Moves special beaker 1 in front of Tower 2
MOVE 2	**5**	Moves rack position 5 in front of Tower 2 (absolute positioning)
MOVE 1	**next**	Moves next highest rack position in front of Tower 1
MOVE 1	**+2**	Depending on the current sample position (SAMPLE variable), moves the next position but one in front of Tower 1 (relative positioning)

Parameters

sample – rack position corresponding to the current value of the **SAMPLE** variable, see also p. 74.

ext.1 to **4** – predefined angle positions of the robotic arm. These are defined in the configuration of a tower, see also p. 58.

spec.1 bis **16** – reserved special beaker positions on the sample rack. These are defined in the rack configuration, see also p. 61.

+swing, -swing – moves the robotic arm by a certain increment angle. The sign shows the swing direction. The value of the angle is predefined under **`Parameter >changer settings`**.

+rotate, -rotate – moves the rack by a certain increment angle. The sign shows the rotation direction. The value of the angle is predefined under **`Parameter >changer settings`**.

next, prev. – from the current rack position the next highest (next) or the next lowest (prev.) will be moved to. Special beaker positions will be skipped. If **MOVE next** is used at the highest rack position then the move will be made to position 1. If **MOVE prev.** is used at rack position 1 then the highest possible position will be moved to.

absolute positioning – the numbered rack position will always be moved to, even when this is a reserved special beaker position.

relative positioning – If a numerical rack position is given with a positive or negative sign then the selected rack position will always be relative to the value of the **SAMPLE** variable, i.e. to the current sample position.

Remarks

In a method sequence a **MOVE** command will move the lift (or both lifts) automatically to the shifting position.

After execution of the functions ***+/-swing*** *or* ***+/-rotate*** *the lift can be moved without restrictions. No defined rack position is required. Thus it is possible to cause damages if the lift is lowered without precautions. These functions must be used with great care.*

The direction of rotation is normally selected automatically by the Sample Processor. In the parameter menu under **>changer settings** the direction and speed of rotation can be defined specifically for particular methods. These can also be altered in a sequence with the corresponding **DEF** command.

If no beaker is present at the selected rack position then this will be recognized by the beaker sensor of the particular tower and the appropriate reaction will take place.

The reaction of the Sample Processors to a missing beaker can be defined in the parameter menu under **>changer settings**. You can choose between interrupting the run with an error message or selecting the next rack position (see p. 68). If a special beaker is missing the run will always be interrupted.

If a robotic arm with a tactile piezo sensor is installed and in use, a 'MOVE sample' command will automatically run the lift to work position. This is for the sensing of the sample beaker.

LIFT


```
>sample sequence
 3 LIFT: 1:       rest mm
```

Lift positioning

```
      1,2,*
                    work,
              rinse, shift,
             special, rest,
                   0…235 mm
```

1st parameter: tower
2nd parameter: position

Raises or lowers one or both (*) lifts to a defined position.

Examples:

LIFT: 1:	**work**	Moves lift at Tower 1 to working position
LIFT: 1:	**rinse**	Moves lift at Tower 1 to rinsing position
LIFT: 2:	**shift**	Moves lift at Tower 2 to shifting position
LIFT: 2:	**special**	Moves lift at Tower 2 to special position
LIFT: *:	**rest**	Moves both lifts to uppermost position (0 mm)
LIFT: 1:	**100 mm**	Moves lift at Tower 1 to position 100 mm

Working, rinsing, shifting and special positions are defined specifically for each rack in the configuration menu under **>rack definitions** (see p. 61). The rest position is the zero position (0 mm) of the particular lift, i.e. its upper stop.

The lift speed can be set in the parameter menu under **>sample changer settings** or altered in a sequence with the appropriate **DEF** command.

Each lift can be positioned with an accuracy of one millimeter. The **LEARN** function is available for this (see p. 112).

3.4.2 Switching components

Pumps and stirrers can be switched as required, either together or separately. They work independently and can be operated at the same time as other functions are being carried out.

PUMP


```
>sample sequence
 4 PUMP  1.1     :    1 s
```

Pump control

```
     1.1…2.2      1…999 s,
      1.*,2.*       ON,OFF
```

1st parameter: pump selection
2nd parameter: status or duration

With the **PUMP** command up to 4 pumps (2 pumps per tower) can be controlled separately. The first parameter selects the pump.

Syntax: T.P (T=Tower, P=Pump)

With Sample Processor models that have external pump connections instead of built-in pumps the **PUMP** command switches the appropriate pump connections (16 V).

The pump built into a tower as Pump 1 is always used for rinsing the titration head. Pump 2 (if present) can be used for aspirating off the

sample solution. Combined rinsing and aspiration is possible by **PUMP 1.*** or **PUMP 2.***.

The pumps can be switched on or off selectively, or operated for a particular time. The **LEARN** mode is very useful for determining the optimal rinsing or aspiration times (see p. 113).

STIR


```
>sample sequence
 5 STIR  T1    :      1 s
```

Stirrer control

```
T1, T2,T*,
MSB1…3, MSB*, *      ON,OFF
                  1…999 s
```

1st parameter: stirrer selection
2nd parameter: status, duration

With the **STIR** command up to 5 stirrers can be controlled separately. The first parameter selects the stirrer. With **STIR *** all the stirrers can be switched at the same time .

Selecting a stirrer

T1, **T2**, **T*** Stirrer connections as Tower 1 and 2 respectively (stirrer models 802 / 722 / 741), * = both connections on the towers.

MSB1...**3** Stirrer/Dosing device connectors in the chassis of the Sample Processor (stirrer models 801 / 803 / 804), **MSB*** = all stirrers connected to an MSB socket.

***** all stirrers

The stirrers can be switched on or off selectively, or operated for a particular time.

In the parameter menu under **>stirring rates** the speed of each individual stirrer can be defined for a particular method. This can also be altered in a sequence with the appropriate **DEF** command.

3.4.3 Dosing device control

Connected dosing devices can be controlled separately or all at the same time . Simultaneous addition of the same volumes or simultaneous filling of the connected dosing devices is also possible (Example: **DOS *.2 fill** = fill all dosing devices via port 2).

DOS


```
>sample sequence
 6 DOS  1.* :        1 ml
```

Dosing device control

```
      *.*, 1.*…3.4
  fill,release, prepar.
empty, eject, endVol,
      compen., port,
 ±0.001…1…±999.999 ml
```

1st parameter: dosing device and port selection
2nd parameter: selects function/enters volume

The **DOS** command is used for controlling Dosimats and Dosinos. Up to 3 Dosinos or Dosimats can be addressed individually or simultaneously via the **MSB** bus control.

The 1st parameter selects the dosing device and the corresponding dosing port, at which the required function is to be carried out. If '*****' is entered then the default port for the corresponding function will be used (e.g. dosing port = 1, filling port = 2, etc.)

Please note

*After dosing the Sample Processor **will not automatically fill** the dosing cylinder. If required, this can be programmed with the command* **`DOS: 1.* : fill`***, see below.*

It is possible to enter the volume to be added directly as the 2nd parameter or to carry out specific functions of a Dosino. Negative volumes can also be added, i.e. a certain volume can be aspirated and then ejected again (pipetting). The minus sign is entered with the **<*>** key.

The functions listed below are used for complex liquid handling tasks such as pipetting.

Dosing functions:

`fill` Fills the Dosimat and Dosino cylinder.

`release` Prepares the Dosimat or Dosino for changing the Exchange/Dosing unit. The dosing cylinder is filled via the rinse port. The stopcock is turned to the exchange position (Port 2).

`prepar.` Preparation cycle (**PREP**) for Dosinos. All tubing is rinsed and filled completely.

`empty` Tubing system and Dosino cylinder are emptied.

`eject` Complete Dosino cylinder contents are ejected.

`endVol` Ejects the cylinder content to the max. volume mark.

`compen.` Cancels the mechanical play between the dosing piston and spindle.

In the parameter menu under **`>Dosing unit def.`** the port assignments of the Dosinos as well as the dosing and filling rates can be defined for specific methods. This can also be carried out in a sequence with the appropriate **DEF** command.

More details about Dosino commands are given on p. 101ff.

The Sample Processor automatically recognizes whether a Dosimat or a Dosino is connected.

3.4.4 Communication commands

The coordination of external instruments or the explicit triggering of functions is possible via both the Remote interface and the serial RS232 interface. The interfaces can be scanned for particular signal patterns or incoming data strings. In return, individual signal lines can be set or any character strings (as control commands) can be transmitted to connected instruments.

SCAN


```
>sample sequence
 7 SCN:Rm      :  Ready1
```

Scans the Remote interface

Rm,RS	**Ready1** = Device 1 ready
	Ready2 = Device 2 ready
	Ready* = Devices 1+2 ready
	Cond ok = Conditioning finished
	End1 = EOD impulse device 1
	End2 = EOD impulse device 2
	EndMeter = End impulse 692 Ion Meter/713 pH Meter
	Continue = Continue impulse from instrument
	8 Bit (1,0 or *) any 8-bit binary pattern

In a sequence the **SCN:Rm** command will halt the run sequence until the predefined signal pattern has been received.

Predefined binary patterns are available; these can be selected via simple names (e.g. **Ready1** or **End2**).

Ready describes a statically set **Ready** line (Output 0) of a connected Metrohm instrument. **End** stands for a pulsed signal, e.g. **EOD** (=End of Determination, Output line 3). When pulsed signals are being scanned it is not possible to scan several lines in parallel.

Setting special binary patterns allows the flexible monitoring of connected instruments. The following applies:

- **0** = line inactive
- **1** = line active
- ***** = any line condition

Example: **00000001** = input line 0 is active = **Device 1: Ready1**

With the **LEARN** function the binary patterns (=line conditions) can be adopted interactively (see p. 113).

Details about the Remote interface can be found in the **Technical Reference**.


```
>Sample sequence
 8 SCN:RS
    Rm,RS
       default value: *R"
     14 ASCII characters
```

= scan "Ready" status message
any data string with 14 characters

Scanning the RS232 interface

In a sequence the **SCN:RS** command will halt the method sequence until the predefined data string (up to 14 characters) has been received via the serial RS232 interface. Incoming data is checked character by character.

Make sure that the transmission parameters of the RS232 interface are identical with those of the connected device (see configuration menu **>RS232 settings**, p. 65).

Any letters, numbers and special characters can be selected from the character set of the Sample Processor. '*' can be set as wild card for any character string. (If '*' is to be interpreted as an ASCII character then '**' must be used.) A wild card can be set within a character string. When the first part of the character string has been recognized correctly then a search will be made for the first appearance of the character standing after '*'. In this case the comparison will be made with the second part of the character string.

This function is primarily suitable for devices that understand the Metrohm Remote language, such as Titrinos. In this case the **AutoInfo** status messages can be scanned. The most useful of these are:

- *.T.R" Ready, 'Ready' state has been achieved, e.g. after titration
- *.T.F" Final, end of the determination has been achieved
- *.T.S" Stop, instrument has been stopped manually
- *.T.G" Go, instrument has been started
- *.E;* Error, error message

However, these status messages will only be transmitted when the corresponding status message has first been switched on, e.g. in the start sequence, e.g. for a Titrino with the command: CTL:RS &Se.A.T.R"ON".

More detailed information about the syntax can be found in the Instructions for Use of the instrument whose status messages are to be transmitted.

Details of the **CTL** command are given below.

With the **LEARN** function transmitted data (=character strings) can be adopted interactively (see p. 113).

CTL

CTRL
2

```
>sample sequence
 9 CTL:Rm   START Device1
```

Setting the Remote lines

Rm,RS **START Device1**	= Starts device 1
START Device2	= Starts device 2
START Device*	= Starts devices 1+2
SAMPLE ready	= Continue impulse to instrument
START Dos1	= Starts Dosimat at device 1
START Dos2	= Starts Dosimat at device 2
START Dos*	= Starts Dosimat at devices 1+2
METER Mode pH	= Switches pH meter to pH measurement
METER Mode T	= Switches pH meter to temp measurement
METER Mode U	= Switches pH meter to mV measurement
METER Mode I	= Switches pH meter to Ipol mode
METER Mode C	= Switches ion meter to Conc measurement
METER Cal pH	= Switches pH meter to pH calibration
METER Cal C	Switches ion meter to Conc calibration
METER enter	= <ENTER> key for pH meter simulation
INIT	= Initializes Remote interface
14 bit (1,0 or *)	any binary pattern with 14 bit

The **CTL:Rm** command is used for controlling external devices via the Remote interface. It sets defined line conditions or transmits impulses via the 14 Remote output lines.

Predefined binary patterns are available; these can be selected via simple names (e.g. **START device 1** or **METER Mode pH**).

START device x starts the set mode of a connected Metrohm device. **START Dos x** starts a Dosimat which is connected with a Metrohm titrator via the "activate" line (a special cable is required). **METER xxx** switches to a particular measuring mode with 691, 713, 780 pH Meters and 692, 781 Ion Meters.

Sample ready can be used as a continue impulse, e.g. for a connected Titrando.

Setting special binary patterns allows the flexible monitoring of connected instruments. The following applies

0 = line inactive
1 = line active
* = retain line condition

Example: ***************1** = Output line 0 active = start device 1

Details about the Remote interface can be found in the **Technical Reference**.

CTRL
2

```
>sample sequence
10 CTL:RS
```

Data transmission via serial interface

Rm,RS
default value: M;$G = starts Metrohm instrument in current mode
14 ASCII characters any character string with 14 characters

Data (=character strings) can be transmitted to connected devices via the serial RS232 interface.

Make sure that the transmission parameters of the RS232 interface are identical with those of the connected device (see configuration menu **>RS232 settings**, p. 65).

Any letters, numbers and special characters can be selected from the character set of the Sample Processor.

This function is primarily suitable for instruments that understand the Metrohm Remote language. These can be controlled with so-called triggers.

The most important of these are:

&M;$G	Go, starts instrument in current mode
&M;$S	Stop, stops device
&M;$H	Hold, interrupts determination
&M;$C	Continue, restarts determination

Switching on the **AutoInfo** status messages (e.g. in a start sequence) can be carried out with the following Remote commands:

&Se.A.T.R"ON"	Status message at "Ready" condition
&Se.A.T.F"ON"	Status message at end of a determination
&Se.A.T.S"ON"	Status message at manual Stop
&Se.A.T.G"ON"	Status message at start of a method
&Se.A.T.E"ON"	Status message at error condition

Logically the corresponding **AutoInfo** messages should be switched off again in a final sequence (**..."OFF"**).

Detailed information about the syntax of the Remote language can be found in the **Technical Reference** or in the Instructions for Use of your titrator.

For communication with instruments from other manufacturers or a computer please conform with their syntax and conventions.

3.4.5 Auxiliary commands

WAIT


```
>sample sequence
11 WAIT:   pause     1 s
```

Waiting time

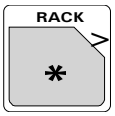
pause, runtime
0…**1**…9999 **s**

The **WAIT** command is used for setting a particular waiting time or for waiting until a particular time (run time) in a run sequence.

If **pause** is selected then the method run will be interrupted for the entered duration (in seconds).

If **runtime** is selected then the method run will be interrupted until the selected running time (seconds counter) has been reached. The running time (in seconds) always starts at the beginning of an individual sequence, i.e. start sequence, sample sequence or final sequence. If the running time of the sequence has already been reached or exceed when the **WAIT** command is executed then the method will be continued immediately.

RACK




```
>Sample sequence
12 RACK
```

Initialize rack

The rack turns to the starting position, i.e. the lift (or both lifts) move upward to the rest position and the rack is rotated to the initial position. The rack code is read off and the **SAMPLE** variable (position of the current sample) reset to 1. The **RACK** command should only be used in a final sequence.

DEF

Redefinition of specific device settings

With the following **DEF** commands a wide range of settings can be modified during a method run. The individual entries are selected by repeatedly pressing the **<DEF>** key (selection drum).

```
>sample sequence
 13 STIRRATE: T1      3
```

Stirring rate

T1,T2,T*,
MSB1, MSB2,
MSB3, MSB*,
*
1…**3**…15

The stirring speed can be set individually for all stirrers. The first parameter stands for the connector of the stirrer, the second parameter allows the stirring speed to be set in 15 steps.

```
>sample sequence
13 DOSRATE   1      160
```

1…3
0.01…**160** mL/min

Dosing rate

The dosing rate can be set individually for all three dosing devices. The first parameter stands for the address (MSB1…3) of the dosing device, the second parameter allows the setting of the dosing rate in mL/min.

```
>sample sequence
13 FILLRATE   1     160
```

1…3
0.01…**160** mL/min

Filling rate

The filling rate can be set individually for all three dosing devices. The first parameter stands for the address (MSB1…3)of the dosing device, the second parameter allows the setting of the filling rate in mL/min.

```
>sample sequence
 13 COCKMOVE   1 :  auto
```

1…3
auto,
not over, desc.,
asc.

Direction of rotation of the stopcock of a Dosing unit

The direction of rotation of the stopcock can be defined for each Dosino. Apart from the automatic selection (shortest path) a descending or ascending direction can also be selected. **Not over** means that rotation will never be carried out over the protected port (see Section 3.3.4).

```
>sample sequence
13 LIFTRATE 1    25 mm/s
```

1,2 5…**25** mm/s

Lift rate

The lift speed can be set individually for both towers. The first parameter stands for the selection of the tower, the second parameter allows the setting of the lift speed in mm/s.

```
>sample sequence
13 SHIFTRATE: auto.   20
```

auto.,**+**,**–** 3…**20** w/s

Direction and speed of rotation of the rack

Direction of rotation and speed of rotation of the sample rack can be altered as required. The first parameter determines the direction of rotation.

auto. : The Sample Processor automatically selects the shortest path.
+ : The rack rotates counterclockwise (to a higher rack position)
– : The rack rotates clockwise (to a lower rack position)

The second parameter determines the speed of rotation in degrees/s.

```
>sample sequence
 13 SWINGRATE 1        55
```

1,2 10…**55** °/s

Swing rate of a robotic arm

The swing rate of a robotic arm (786 Swing Head) can be set individually for both towers. The first parameter stands for the selection of the tower, the second parameter allows the swing rate to be set in degrees/s.

3.5 Managing methods

USER METHOD

3.5.1 User-defined methods

Main menu:

```
methods
>recall method
```

```
methods
>store method
```

```
methods
>delete method
```

Open submenu with **<ENTER>**

Use **<↑>** or **<↓>** up or down by one menu item

Use **<HOME>** or **<END>** to reach the first and last menu items

```
methods
>recall method
```

Dialog for loading methods
Open the dialog with **<ENTER>**

Use <QUIT> to return to normal operating condition.

```
>recall method
name:                ********
```

8 ASCII characters

Select method

All the stored methods can be selected with **<SELECT>**. If an "empty" method is to be loaded then the method ******** can be selected with **<CLEAR>**. This deletes the current working memory for methods.

```
methods
>store method
```

Dialog for saving methods
Open the dialog with **<ENTER>**

```
>store method
name:                ********
```

8 ASCII characters

Define method name

The text input mode is activated with '**<**' or '**>**' in order to be able to enter your chosen method name (see p. 55).

```
methods
>delete method
```

Dialog for deleting methods
Open the dialog with **<ENTER>**

```
>delete method
name:                ********
```

8 ASCII characters

Select method

```
>delete method
delete ******** ?
```

Confirm with **<ENTER>**
Cancel with **<QUIT>**

3.5.2 POWERUP method

When the Sample Processor is switched on the sample rack and the lifts move to their initial positions. This means that electrodes may also be removed from the conditioning beaker. In order to re-immerse them in the conditioning beaker you can use the **POWERUP** method. This method is automatically started when the Sample Processor is switched on and the initialization of the instrument is finished.

Create a method which contains a command sequence that is to be processed when the Sample Processor is switched on. Save this method under the name **POWERUP** (see p. 87).

3.6 Run control

With **<START>** you can start a method from the normal operating condition. If no manual intervention is made, or if no unexpected error occurs, the sample series will be processed correctly and terminated with the final sequence. The sample sequence will be repeated several times in accordance with the entry made under **<PARAM>, number of samples**, starting with the sample beaker defined as **SAMPLE**.

If **External START** (see configuration 3.2.1) is switched on then the activation of the *Remote line Input 7* will also start the method.

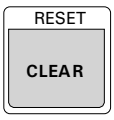
If the sample series is halted with **<STOP>** then the Sample Processor will return directly to the normal operating condition. Unprocessed samples will not be taken into account and the final sequence will not be carried out. If under **Manual stop** settings have been defined for this case, then the corresponding actions or commands will be carried out, e.g. connected devices will be stopped.

If **external START** (see configuration 3.2.1) is switched on then the activation of *Remote line Input 6* will also stop the method.

With **<HOLD>** the method run can be interrupted. The currently active command will be terminated immediately. With **<START>** the method can be continued with the following command in the active sequence. The connected peripheral devices will **not** be interrupted with the **<HOLD>** key.

<QUIT> breaks off the command which is currently being executed and starts the next command line in the sequence.

If a fault occurs during a sample series an appropriate **error message** will be shown; this must be confirmed with **<QUIT>**. The Sample Processor then returns to the **HOLD** status (see above). After the fault has been remedied the run can be continued with **<START>** or, if necessary, cancelled with **<STOP>**.



<CLEAR> interrupts a sample series after the currently active sequence **has been carried out** (*gentle stop*). The current sample will be processed to the end.

3.7 Sample racks

A sample rack is a turntable that accommodates sample vessels and is placed on the Sample Processor. In order to be able to process different shapes and sizes of sample vessels various types of sample rack can be used and easily exchanged. The number of samples that a rack can accommodate depends on the diameter of the sample beakers.

- Sample racks **42 cm diameter** can be used with all Sample Processor models. With the 789 Robotic Sample Processor XL models a 786 Swing Head with robotic arm is required.

- Sample racks **48 cm diameter** are only suitable for the 789 Robotic Sample Processor XL models with 786 Swing Head and robotic arm.

3.7.1 Metrohm standard sample racks

Racks 42 cm diameter

Article no. / Rack type	No. of samples	Type of sample vessel	Vessel diameter	Magnet code (predefined)
6.2041.310	12	250 mL Metrohm titration beaker	65 mm	000001
6.2041.320	16	150 mL beaker	55 mm	000010
6.2041.340	24	75 mL Metrohm titration beaker	35 mm	001000
6.2041.350	48 *)	75 mL Metrohm titration beaker	35 mm	010000
6.2041.360	12	150 mL beaker or 200 mL disposable beaker	55 mm	100000
6.2041.370	14	200 mL disposable beaker	55 mm	000011
6.2041.380	14	8 oz disposable beaker	59 mm	000101
6.2041.400	126+2 *)	11 mL test tube 250 mL Metrohm titration beaker	16 mm 65 mm	001010
6.2041.410	141+1 *)	11 mL test tube 500 mL beaker	16 mm 71 mm	001010
6.2041.430	127+2 *)	11 mL test tube 2x 300 mL beaker	16 mm 68 mm	010001
6.2041.440	148+3 *)	11 mL test tube 3x 300 mL beaker	16 mm 68 mm	010100
6.2041.460	21	100 mL CSB tubes	43 mm	101000
6.2041.710	160	6 mL vials	22 mm	000111

*) can only be used with 786 Swing Head

Racks 48 cm diameter (for 789 XL models only)

Article no. / Rack type	No. of samples	Type of sample vessel	Vessel diameter	Magnet code (predefined)
6.2041.800	100 *)	75 mL Metrohm titration beaker	35 mm	000100
6.2041.810	34 *)	150 mL beaker or 200 mL disposable beaker (Euro)	55 mm	001001
6.2041.820	28 *)	250 mL Metrohm titration beaker	65 mm	010010
6.2041.830	28 *)	200 mL PP sample beaker	55 mm	100010
6.2041.840	59 *)	120 mL PP sample beaker	42 mm	001100

*) can only be used with 786 Swing Head

On request we can supply further user-defined racks that can be defined in the instrument via PC software. The beaker positions can be arranged as required.

3.7.2 Magnet codes

Each individual sample rack can be identified unambiguously by a magnet code. Magnet pins attached to the base of the rack (see Fig. 5) can be arranged to form a 6-place binary code. The Sample Processor can then automatically recognize which rack has been placed on it if the rack is located at the starting position after initialization.

When a rack is changed it should first be brought to the starting position by pressing the **<RACK>** key. In this way the rack can be positively recognized, which makes correct beaker positioning possible. Each type of rack is assigned to an internal position table, in which the angle of rotation and distance to the center of the rack is defined for each rack position.

When a sample series is started the Sample Processor automatically moves the rack to the starting position so that its magnet code can be read off. This ensures that the beaker positions coincide with the internal position table of the current rack.

The standard racks supplied by Metrohm are already provided with a predefined magnet code for each type of rack. If several racks of the same type are in use then the magnet pins can be arranged differently to allow the unambiguous identification of each individual rack.

Magnet code format (examples):

000001 i.e. only one magnet inserted, Bit 0
000101 i.e. two magnets inserted, Bit 0 and 2

63 different combinations are possible. Code 000000 stands for "no defined code".

3.7.3 Rack data

In many applications the method and beaker sizes must be observed exactly. As sample racks are intended for particular beaker sizes, the rack definitions also contain, in addition to the rack positions themselves, data about the lift positions that are directly associated with the particular beaker size.

The following data can be defined for each rack:

Rack name	*Unambiguous identification, ordering number is standard*
Code	*Magnet code for automatic rack recognition*
Work position	*Working height for Lift 1 and 2**
Rinse position	*Rinsing height for Lift 1 and 2**
Shift position	*Shifting height for Lift 1 and 2**
Special position	*Additional height for Lift 1 and 2**
Beaker radius	*Radius of sample beaker*
Beaker sensor	*Beaker checking mode*
Special beaker positions	*16 reserved rack positions with individual working heights, beaker radius and beaker sensor test*
	** can be set for both towers separately*

The **rack name** is used for the unambiguous identification of a rack. The standard name stored for the rack is the ordering number. In a method, this can be assigned to a particular rack name (see Section 3.3.1). The automatic rack recognition ensures that if an incorrect rack is used this will be recognized and the user will be informed of this.

The **code** is used for automatic rack recognition. You must make sure that this 6-place binary code coincides with the actual magnet code set on the rack. Rack codes can be altered as required. However, they must always be assigned to a single rack only. Avoid the use of the predefined codes for the standard racks supplied by Metrohm, see also p. 90.

The **working position** is used for defining the lift position at which a sample is to be processed. This means that the ideal setting for a particular sample rack can be defined depending on the height of the sample beakers. In manual operation this working position can be moved to directly with the **<END>** key. In a run sequence this can be programmed with `LIFT :1 : work mm`.

The **rinsing position** is used for defining the lift position at which, for example, the electrode is to be rinsed. This means that the ideal setting for a particular sample rack can be defined depending on the height of the sample beakers. In a run sequence this can be programmed with **`LIFT: 1: rinse mm`**.

The **shifting position** is used for defining the lift position at which the rack can be rotated. If the lift is located below the shift position then it will be moved automatically to the shifting height before the rack is rotated. This safety feature prevents the electrode from being damaged by rotational movements of the rack to a large extent. However, a prerequirement is that this shifting height is set correctly. In a run sequence the movement of the lift to the shift position can be programmed with **`LIFT: 1 : shift mm`**.

The **special position** is a further user-defined lift position. For example, when pipetting with a robotic arm it can be selected so that the pipet tip is located directly above the sample solution so that a separating bubble (air gap) is formed. In a run sequence this can be programmed with **`LIFT: 1 : special mm`**.

The **beaker radius** can be used to prevent a titration head from trying to enter a beaker which is too narrow for it, which could damage the electrode or sample beaker. By entering the beaker radius a Sample Processor can decide whether a titration or transfer head on the lift will "fit" into the particular sample beaker, see also Section 3.2.

The **beaker sensor** recognizes whether a beaker is present. At the moment Metrohm Sample Processors support optical infrared sensors built into each tower of the Sample Processor. In the rack definition the beaker sensor can be switched on (**`Tower)`** or off (**`OFF)`**.
The setting for the beaker sensor can be made individually to suit the particular samples and the individual special beaker positions, see below.

Special beaker

Special beakers are reserved positions on a sample rack. Up to 16 special beaker positions can be defined per rack. They can be selectively moved to during a run sequence without interrupting the sample series run or interfering with it. Special beakers can be used for rinsing the electrode during a sample sequence or for calibrating an electrode in a start sequence (buffer solutions), etc.
Reserved special beaker positions are automatically recognized in a run sequence and are skipped over when the individual sample beakers themselves are being processed.

Special beakers are moved to with **`MOVE 1 : spec.1`**.

The following settings can be made separately for each special beaker position on a rack:

- **Rack position**
- **Working height at Tower 1**
- **Working height at Tower 2**
- **Beaker radius**
- **Beaker sensor**

If a special beaker is required in a run sequence, but the Sample Processor cannot find a beaker at the reserved position, then an error message will always appear.

3.8 Dosing and liquid handling

3.8.1 Dosimats and Dosinos

Three 685/805 Dosimats or 700/800 Dosinos can be used as dosing instruments connected directly to an **MSB** socket. They can be controlled with the **DOS** command.

Each Dosimat or Dosino can be equipped with various exchange units or Dosing units. Before these units are exchanged the buret stopcock must always be moved to the exchange position, as otherwise when the buret is removed there is the risk of serious damage to the buret itself or to the Dosimat or Dosino drive unit.

Before removing the Dosing unit or exchange unit always trigger the 'DOS: X.Y : release command!

With Dosimats and Dosinos any volumes of auxiliary solutions up to 999 mL can be added. With both types of instrument the filling function can be selectively triggered (**`DOS: X.Y : fill`**). When switched on the dosing or exchange unit will always be filled via Port 2 (filling port).

The Sample Processor automatically recognizes the type of dosing instrument connected to it.

Further commands are available for the 700/800 Dosinos, so that the wide range of possibilities which characterize these Dosing units can be used to the full extent.

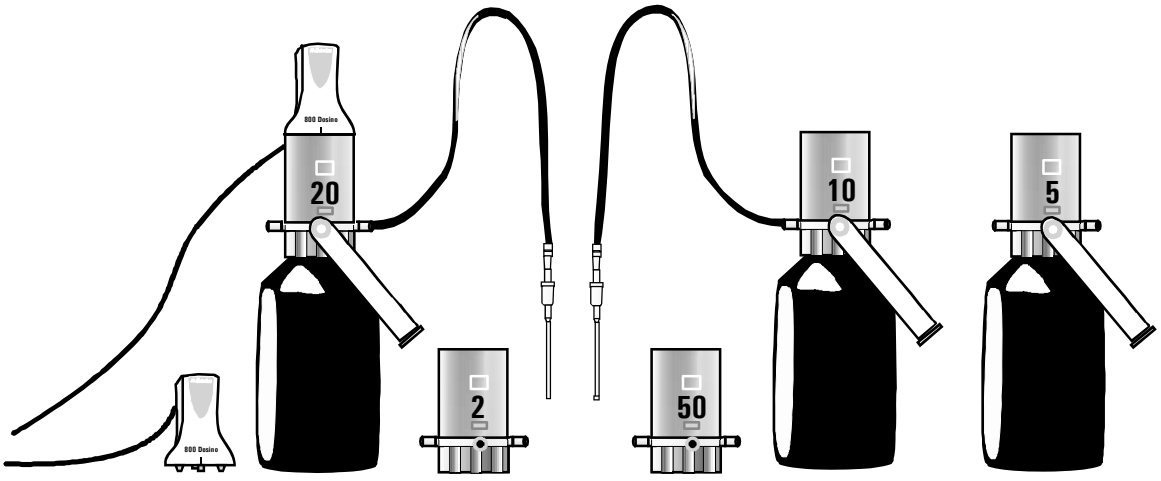


Fig. 34 800 Dosino with Dosing units

The Dosing unit has four ports (inlets/outlets) to which various functions can be assigned. There is an additional outlet (**VENT** or **0**) that is used for venting the bottle on which the Dosing unit is mounted.

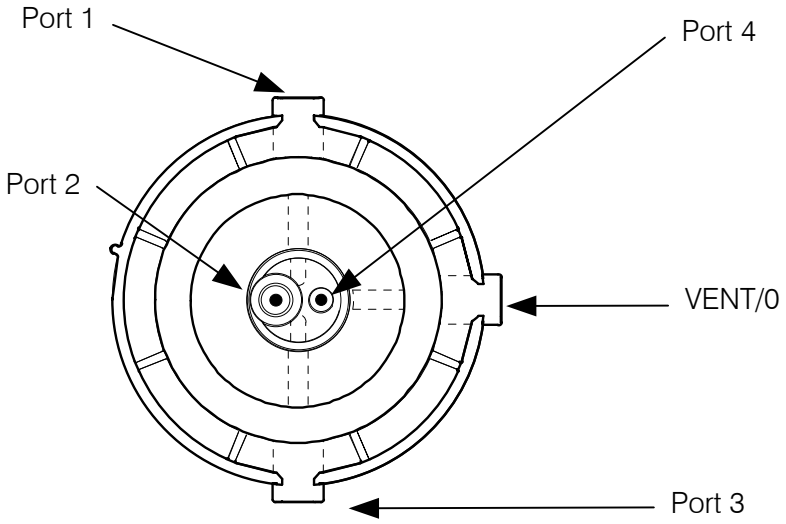


Fig. 35 Dosing unit from below

VENT/0 – is used for venting the storage bottle and is normally fitted with an absorber tube (filled with a drying agent).

Port 1 – is side-mounted and is defined as dosing outlet 1 as standard.

Port 2 – is located on the base and is defined as the filling inlet as standard; it is normally fitted with a standpipe.

Port 3 – is side-mounted and is defined as dosing outlet 2 as standard.

Port 4 – is located on the base and is defined as the air inlet opening for emptying the tubing system as standard.

The maximum dosing and filling rates, which can be entered for each port of the Dosing unit in the configuration menu under **>Dosing units**, depend on the cylinder size:

Cylinder volume	Max. dosing rate	Resolution
2 mL	6.6 mL/min	0.2 µL
5 mL	16.6 mL/min	0.5 µL
10 mL	33.3 mL/min	1.0 µL
20 mL	66.6 mL/min	2.0 µL
50 mL	160 mL/min	5.0 µL

The following commands can be executed with Dosinos. For each command the dosing drive and the Dosing unit port at which the command is to be executed can be entered. The addition of a particular

(positive) volume and filling the cylinder are also possible with 685 and 805 Dosimats.

If ***** is entered as **wild card for the drive** then the selected function will be carried out by all the connected dosing devices.

If ***** is entered as **wild card for the port** then the particular function will be carried out at the port defined as standard in the parameter menu under **>def. Dosing units**. This means that this setting is method-specific, but also applies to manual operation depending on the loaded method.

Dosing

DOS: X.Y : xxx.xx mL Adds a particular volume

The given volume will be ejected though the selected port. If a value with a negative sign is entered then the volume will be aspirated.

The Dosing unit will **not be refilled** after each addition. The standard dosing port (Port *) is that defined under

```
>dosing drive          X
dosing           port  Y
```

(default: Port 1).

Filling

DOS: X.Y : fill mL Fills the cylinder

The Dosing unit is filled completely. The liquid is aspirated via the given port. The standard filling port (Port *) is that defined under

```
>dosing drive          X
filling            port  Y
```

(default: Port 2).

Prepare

DOS: X.Y : prepar. mL Prepares = rinses and fills the connected tubing and the dosing cylinder

The tubing system of the Dosino should be freed from air bubbles at least once per day by carrying out a preparation cycle. This is a process that could take some time.

It is recommended to use this command in a start sequence.

During the preparation process the dosing cylinder as well as the connected tubing are completely filled. Several filling and dosing processes are carried out. The volumes required for this are calculated from the configuration settings of the Dosing unit, i.e. from the tubing lengths and diameters (see Section 3.2.4).

The contents of the dosing cylinder is ejected via the selected port. The standard PREP port (Port *) is that defined under

```
>dosing drive          X
preparation      port  Y
```

(default: Port 1).

Empty

DOS: X.Y : empty mL Completely empties the dosing cylinder and tubing

The tubing system and Dosing unit cylinder can be completely emptied. The liquid in the dosing cylinder is ejected via the dosing port. The air required to displace the liquid from the tubing is aspirated via the given port. The standard port (Port *) for aspirating the air is that defined under

```
>dosing drive          X
drain            port  Y
```

(default: Port 4).

The standard dosing port can be altered under

```
>dosing drive          X
dosing           port  Y
```

(default: Port 1).

Exchange Dosing unit

DOS: X.Y : release mL Prepares Dosino for exchanging the Dosing unit.

Before changing the Dosing unit the **release** command must be used to fill the dosing cylinder and move the stopcock to the exchange position. The cylinder is filled by aspirating the necessary volume via the given port. If * is entered as a wild card then the port given under

```
>dosing drive          X
rinsing          port  Y
```

will be used (default: Port 2).

Eject

DOS: X.Y : eject mL Ejects the complete dosing cylinder contents

The cylinder are completely ejected via the given port. The piston moves down to the stop. If * is entered as a wild card then the port given under

```
>dosing drive          X
dosing           port  Y
```

will be used (default: Port 1).

Endvolume

DOS: X.Y : endVol mL Ejects the cylinder volume to the max. volume mark

The content of the dosing cylinder is ejected via the given port. The piston is run the nominal volume. If * is entered as a wild card then the port given under

```
>dosing drive           X
dosing            port  Y
```

will be used (default: Port 1).

Compensate

DOS: X.Y : compen. mL Eliminates the mechanical play

The mechanical play between the dosing piston and drive spindle is eliminated after the stopcock has been rotated to the given port. If * is entered as a wild card then the port given under

```
>dosing drive          X
dosing           port  Y
```

will be used (default: Port 1).

3.8.2 Liquid handling functions

The Sample Processors can use the numerous capabilities of a Metrohm Dosino (700 or 800) to the full extent. The four ports of the Metrohm Dosing units for the Dosino can be used as outlet or inlet ports as defined by the user. This means that not only simple addition and filling tasks can be carried out, but complex liquid handling tasks such as pipetting or sample transfer can be carried out without any problems.

The dosing functions of the Metrohm Sample Processors are to be used in such a way that, in addition to the function, the port at which the function is to be carried out is also given. This means the Dosing unit inlet or outlet to which the stopcock first moves in order that the required function is carried out.

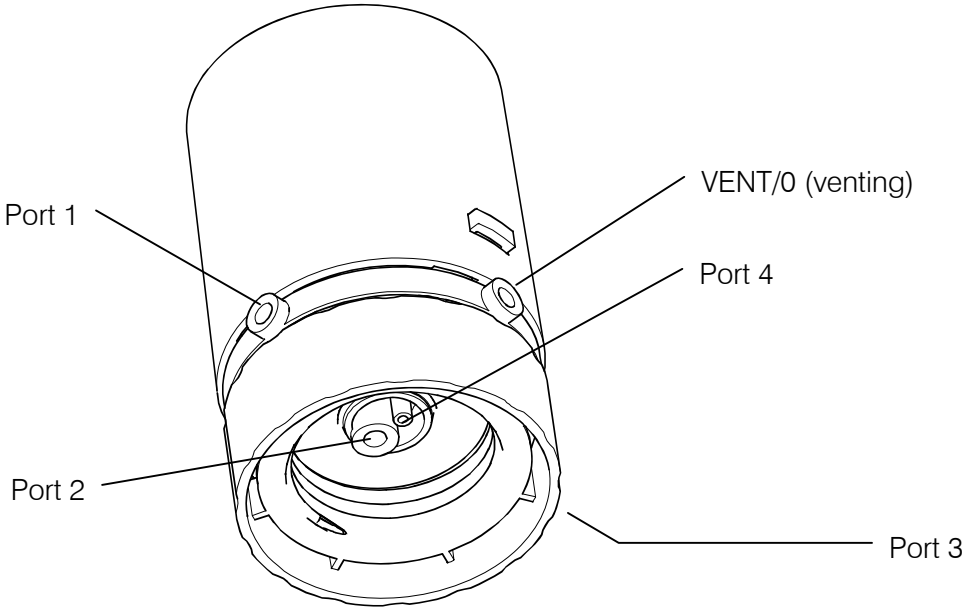


Fig. 36 Dosing unit - ports

3.8.3 The DOS command

The liquid handling command DOS has two parameters:

General:	**DOS:**	Address	Function
Example:	**DOS:**	**1.1**	**5 mL**
Parameter:		drive.port	Volume or function (negative volume permitted)

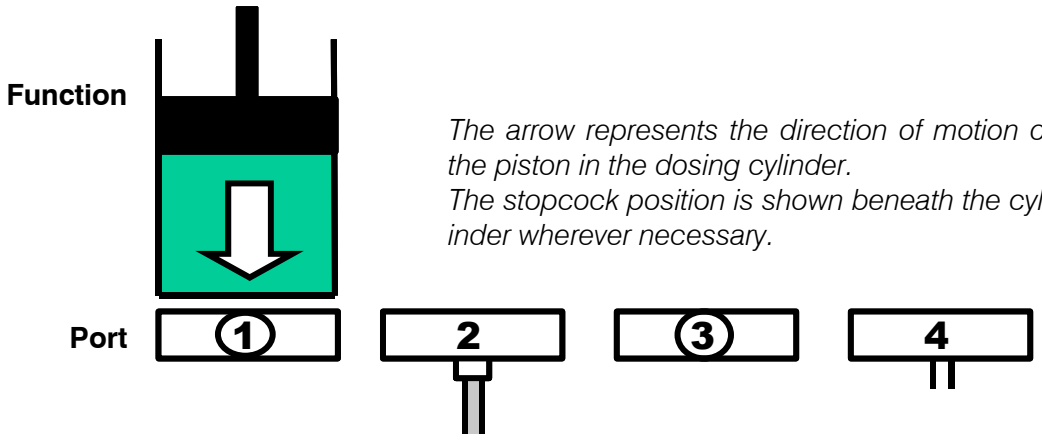
for drive: * = all dosing drives
for port: * = default port for particular function

Example:	**DOS:**	***.***	**fill mL**
means:	On all the connected dosing devices the cylinder is filled via the default port.		
Default ports:	The default ports are the ports assigned in the parameter menu under **>Dosing unit def.**, see also Section 3.3.4.		

3.8.4 Pictograms

For complex liquid handling tasks only Dosinos (700 or 800 models) can be used as dosing drive. In order to clarify the various functions and processes the following pictograms are used on the next few pages.

The following arrangement applies:



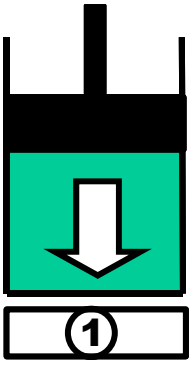
The arrow represents the direction of motion of the piston in the dosing cylinder.
The stopcock position is shown beneath the cylinder wherever necessary.

Port 1	Port 2	Port 3	Port 4
Default: Dosing port 1	*Default:* Filling port	*Default:* Dosing port 2	*Default:* Drain port

The pictograms above show the default settings..

3.8.5 Liquid handling functions in detail

Dosing



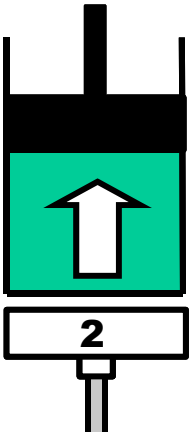
Example:

```
DOS:  1.1  :   1.000 mL
```

Default port = 1

'Normal' dosing can be carried out by entering a volume. Automatic cylinder filling is triggered neither before nor after the dosing process.
If the dosing piston reaches 'max. Volume' mark (10'000 impulses) during the dosing process then the cylinder will be refilled.

Dosing a negative volume



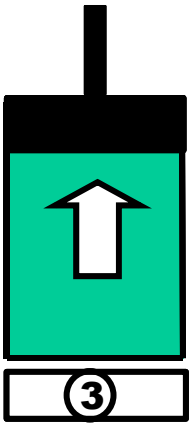
Example:

```
DOS:  1.2  :  -1.000 mL
```

Default port = 1

If a negative value is set for a volume then the dosing process will take part in the opposite direction, i.e. a liquid will be aspirated through the given port. Automatic cylinder filling is triggered neither before nor after the dosing process.
If the dosing piston reaches the zero mark during the dosing process then the cylinder will be refilled.
Do not select any volume that is larger than the nominal cylinder volume. Aspiration should take place with a single piston stroke.
This function can be used for pipetting.

Filling



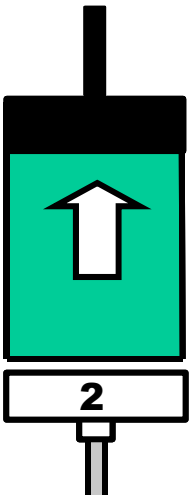
Example:

```
DOS:  1.3  :  fill mL
```

Default port = 2

Filling the cylinder can be carried out from a freely selectable port. After the filling process the stopcock remains at the selected port.

Exchanging Dosing unit

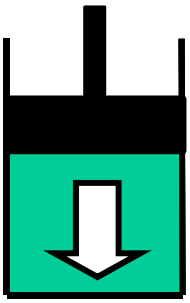


Example:

`DOS: 1.2 : release mL` Default port = 2

This command can be used before exchanging a Dosing unit to fill the cylinder via the given port. In this way, for example, air can be aspirated via Port 4.
After the cylinder has been filled the stopcock will move to Port 2. The dosing drive can then be removed from the Dosing unit.

Preparing the Dosing unit

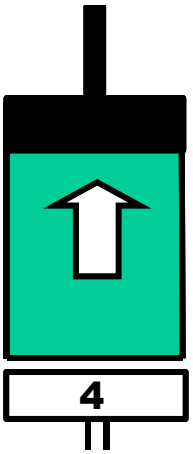


Example:

`DOS: 1.* : prepar. mL` Default port = 1

In order to prepare a Dosing unit for use a complex procedure is started: first the cylinder contents are ejected via the given port, then the volume of the filling tubing is drawn in and ejected again via the given port. All the connected pieces of tubing are then filled bubble-free (tubing length > 0 mm) and finally the cylinder is filled again.
The volumes of the connected pieces of tubing (calculated from length and diameter) are taken into account during the whole procedure.

Automatic emptying

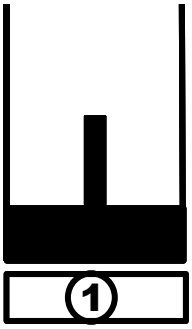


Example:

`DOS: 1.4 : empty mL` Default port = 1

Automatically emptying the Dosing unit takes place according to a complex procedure: first the cylinder contents are ejected via the given port, the ejection tubing is then briefly rinsed with reagent from the filling tubing and then all the pieces of tubing are emptied in sequence. Air is always aspirated via the drain port (default: Port 4) for emptying.
The volumes of the connected pieces of tubing (calculated from length and diameter) are taken into account during the whole procedure.

Ejecting

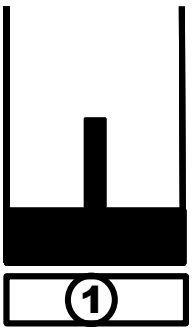


Example:

DOS: 1.1 : eject mL Default port = 1

The whole cylinder contents are ejected via the given port. The piston is lowered beyond the max. volume mark to the stop.
This command should be used for removing air bubbles.

Run piston to end volume

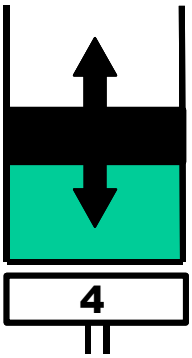


Example:

DOS: 1.1 : endVol mL Default port = 1

The cylinder content is ejected via the given port. The piston is run to the max. volume mark.
This command should be used for the pipetting functions.

Compensating the mechanical play

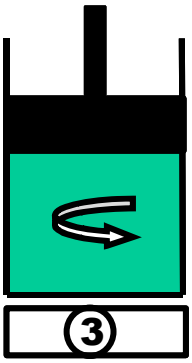


Example:

DOS: 1.4 : compen. mL Default port = 1

As the Dosing units are exchangeable, the coupling of the Dosino connecting rod (spindle) has a slight degree of mechanical tolerance which is noticeable when the direction of the piston movement changes. This tolerance can be compensated. This is done by first making a short piston movement in the same direction as the previous piston movement, followed by an equivalent piston movement in the opposite direction.

Stopcock rotation



Example:

DOS: 1.3 : port mL Default port = 1

The stopcock rotates to the given port. No piston movement takes place. The direction of rotation is determined by the parameter **stopcock direction** under **>Dosing unit def.** in the parameter menu.

3.8.6 Pipetting equipment

Together with an 700/800 Dosino as dosing drive (or "pipetting pump"), the Sample Processor is exceedingly suitable for pipetting liquids in a volume range from 0.1 to 10 mL.

Equipment required

- Sample Processor with 786 Swing Head
- Robotic arm with transfer head (e.g. 6.1462.030 or 6.1462.040)
- 800 Dosino with 2 mL, 5 mL, 10 or 20 mL Dosing unit
- Pipetting tubing 6.1562.020 (3 mL) or 6.1562.100 (10 mL) with drawn out tip
- Any sample rack
- Possibly Stand Support 6.2001.070 with titration cell

3.8.7 Pipetting procedure

Basic principles

Measuring out the liquid to be pipetted takes place in a pipetting tubing filled with a carrier liquid (preferably water). In order to prevent any carryover or mixing an air bubble (air gap) must be inserted between the sample and the carrier liquid. The tubing tip should be drawn out by hand to form a fine point.

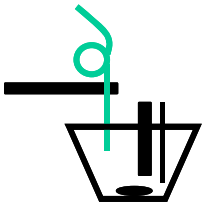
A Dosino drive is used to transfer the liquids into the pipetting tubing. The pipetting tubing is connected to Port 1 of the Dosing unit. The Dosing unit is mounted on a reagent bottle containing the carrier liquid. This can be refilled via filling port 2 of the Dosing unit. The carrier liquid can also be used for rinsing and diluting the sample.

Various pipetting procedures are possible. The following conditions must always be observed:

- The sample must always be measured out in the pipetting tubing; it must never enter the Dosing unit cylinder.
- The sample should always be aspirated after the dosing cylinder has been ejected.
- The difference in level between the surface of the sample liquid and that of the carrier liquid in the cylinder should be as small as possible.
- Aqueous sample solutions can be pipetted without having to rinse the tubing. Non-aqueous samples require the pipetting tubing to be rinsed with carrier liquid (same solvent as the sample), to avoid carryover.

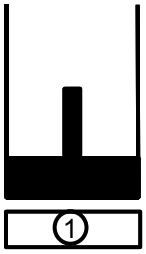
3.8.8 Preparing the Dosing unit

The Dosing unit must first be prepared, i.e. the filling tubing and pipetting tubing must be rinsed and completely filled. The cylinder contents must then be ejected.



Command sequence:

```
MOVE 1   :          ext.1
LIFT: 1  :        work mm
DOS: 1.1 :     prepar. mL
DOS: 1.1 :   EndVol mL
DOS: 1.1 : compen. mL
```



Important!
Eject the cylinder contents

This step should be carried out before every sample series involving pipetting. Before each pipetting process the Dosing unit cylinder contents must be completely ejected. This is the only way to achieve reproducible, accurate pipetting.

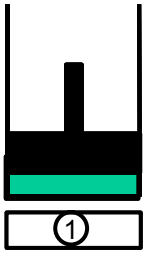
The titration cell can then be aspirated, rinsed and prepared with fresh solvent.

3.8.9 Pipetting

The pipetting procedure takes place in five steps:

- Ejection of cylinder contents (see above) and formation of separating bubble
- Move to sample
- Aspirate / Measure out sample
- Move to target
- Eject sample

Formation of separating bubble (air gap)

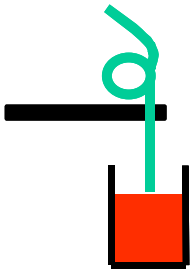


Command sequence:

```
LIFT: 1  :      shift mm
DOS: 1.1 :       -0.5 mL
```

In order to prevent the carrier liquid and sample solution from mixing a separating bubble, must be formed that occupies a length of at least 5 mm in the pipetting tubing. However, the separating bubble must also be measured out with sufficient accuracy. This is why a Dosing unit with max. 20 mL cylinder capacity should be used for pipetting.

Move to sample

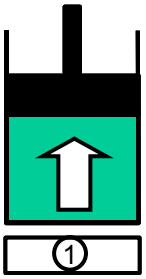


Command sequence:

```
MOVE: 1  :        sample
LIFT: 1  :       work mm
```

The (dissolved or liquid) samples can be contained in open beakers on the rack or in sealed vials. In the latter case instead of the pipetting tubing a suitable injection needle should be connected to Dosino Port 1 with a normal piece of tubing (2 mm dia.).

Aspirate sample



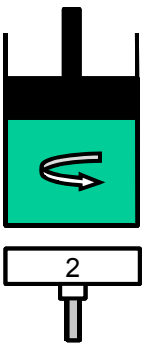
Command sequence:

```
DOS: 1.1 :       -5.0 mL
WAIT:  pause        3 s

LIFT: 1 :       shift mm
DOS: 1.1 :       -0.2 mL
```

Aspiration of the sample should be carried out at a reduced filling rate (<10 mL/min). The appropriate setting can be made under **<PARAM>** **`>Dosing unit def.`**
With non-aqueous samples an additional small air bubble may be drawn into the pipetting tip in order to prevent the sample solution from dripping.

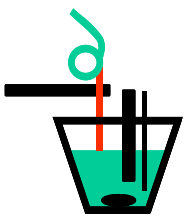
Move to target



Before the pipetting tubing containing the measured out sample is moved, the corresponding Dosino port must be closed.

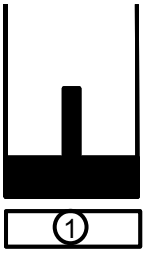
Command sequence:

```
DOS: 1.2 :       port mL
MOVE 1   :         ext.1
LIFT: 1  :       work mm
```



The titration cell should be filled with solvent before the sample is added so that the sample can be pipetted directly into the liquid (tip immersed).

Eject sample

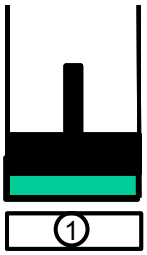


Command sequence:

```
DOS: 1.1 :     EndVol mL
```

The sample should be ejected at a reduced dosing rate (<10 mL/min). The appropriate settings can be made under **<PARAM>** `>Dosing unit def.`

Rinse



Command sequence:

```
DOS: 1.2 :       fill mL
DOS: 1.1 :     endVol mL
DOS: 1.1 :    compen. mL
```

or

```
DOS: 1.2 :      -x.xx mL
DOS: 1.1 :     endVol mL
DOS: 1.1 :    compen. mL
```

In order to keep sample solution carry-over as low as possible, rinsing with solvent can be carried out after the sample has been ejected. This is particularly recommended for non-aqueous samples.
In preparation for the next pipetting process the cylinder should be completely ejected.

3.9 The Remote interface

Connected peripheral devices such as Titrinos, Titrandos, pH meters, etc. can be controlled via the Remote interface (25-pin socket).

Fourteen lines are available for the output of signals (Output 0–13).
Eight lines (Input 0–7) are available for receiving signals (e.g. the "Ready" signal from a Titrino at the end of a titration).

Metrohm instruments should only be connected with the Metrohm Remote cables provided, see Section 2.3.1.

3.9.1 Output lines

The 14 output lines of the Remote socket can be set as required in both manual operation as well as in a run sequence with the **Control** command **(CTL)**. This is done by setting a 14-place binary pattern in which each bit is assigned to an output line.

Output	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(bits are always numbered from right to left)

Example: `CTL Rm ************1*`
sets output line 1 to active (= set), for example, with a connected Titrino this would be a Stop command. 0 resets the output line to inactive.

We recommend that non-relevant output lines are masked with an asterisk (*) in order that the condition of these lines are not altered.

3.9.2 Input lines

The 8 input lines of the Remote socket can be scanned during a method sequence with the **SCAN** command **(SCN)**. The method sequence will be halted until the given binary pattern coincides with the effective condition of the input lines (e.g. the status of the 'Ready' line for scanning the end of a titration from a Titrino). This is done by setting an 8-place binary pattern, in which each bit is assigned to an input line. When the patterns coincide the run sequence will continue with the next command line. In manual operation the **SCAN** command is used for displaying the status of all input lines.

Input	7	6	5	4	3	2	1	0
Bit	7	6	5	4	3	2	1	0

(bits are always numbered from right to left)

Example: `SCN Rm *******1`
is waiting for an active input on line 0 (1=set). For example, this line is set by a Titrino after a titration has been completed and the Titrino can again accept a start signal.

Input lines that are not of interest or for which no defined condition can be predicted should also be masked with an asterisk (*).

If **external START** *(see configuration 3.2.1) is switched on then Remote lines Input 7 and Input 6 will be reserved for external START and STOP.*

In order to simplify the use of Remote commands, particularly when several devices are linked together with Metrohm cables, predefined binary patterns are available as command parameters for the commands **CTL** and **SCN** for standard conditions (1 to 2 Titrinos, possibly with auxiliary Dosimats, pH meter or ion meter). These are:

3.9.3 SCN command

Parameter	Signal pattern	Function
Ready1	*******1	waits for "ready" condition of device 1 (Titrino, Titrando)
Ready2	**1*****	waits for "ready" condition of device 2
Ready*	**1****1	waits for "ready" condition of devices 1 and 2
Cond ok	******1*	waits for "cond ok" condition of device 1
End1	****1***	waits for the EOD impulse from device 1 (Titrino, Titrando)
End2	*1******	waits for the EOD impulse from device 2
EndMeter	***11***	waits for the EOD impulse from ion meter or pH-Meter (stirrer 1 will be switched on during the waiting period)
Continue	***1****	waits for an impulse to continue e. g. "Sample ready"

With the parameter **Ready*** it is possible to scan the condition of devices working in parallel. In this case the **Ready** line of both devices must be statically set at the end of a determination. Devices which only transmit a brief impulse at the end of e.g. a measurement cannot be controlled in parallel.

3.9.4 CTL command

Parameter	Signal pattern	Function
INIT	**00000000000000**	initializes the Remote interface
START device1	**********1	starts device [1] (e.g. Titrino, Titrando, ...) *)
START device2	********1*****	starts device 2 (see above, only with multiple cable)*)
START device*	********1****1	starts devices 1 and 2 " *)
SAMPLE ready	*********1****	sends a pulse for continuing a determination
START Dos1	*******1******	starts Dosimat at device 1 (Titrino via "activate")
START Dos2	*****1********	starts Dosimat at device 2 "
START Dos*	*****1*1******	starts Dosimat at devices 1 and 2 "
METER Mode pH	*********0001*	switches ion meter or pH meter to pH measurement and starts it
METER Mode T	*********0010*	switches ion meter or pH meter to temperature measurement and starts it
METER Mode U	*********0011*	switches ion meter or pH meter to mV measurement and starts it

METER Mode I	***********0100***	switches ion meter or pH meter to Ipol (mV measurement) and starts it
METER Mode C	***********1000***	switches ion meter to Conc measurement
METER Cal pH	***********0101***	switches ion meter or pH meter to pH calibration and starts it
METER Cal C	***********1001***	switches ion meter to Conc calibration
METER enter	***********1111***	simulates the **<ENTER>** key for ion meter or pH meter (essential for pH calibration with 691/780/481, in order to start the measurement of the second buffer)

For **START** commands the signal is transmitted as a short impulse of 200 ms.

*) With pH meters or ion meters a result report is triggered

3.9.5 Manual stop options

Parameter	Signal pattern	Function
STOP Device 1	**************1***	stops device 1 (e.g. Titrino, Titrando...)
STOP Device 2	********1*********	stops device 2 (see above, only with multiple cable)
STOP Device *	********1*****1***	stops devices 1 and 2 "

For STOP commands the signal is transmitted as a short impulse of 200 ms.

3.10 LEARN mode

The **LEARN** mode is used for three types of application:

- Interactive setting of lift and robotic arm positions
- Rack adjustment
- Interactive parametrizing sequence commands

3.10.1 Setting lift and robotic arm positions

The fine adjustment of defined positions, such as the working height of a lift, can be made by entering the height in mm. But it is recommended to use the LEARN function to run a lift or a robotic arm to a certain position by using the arrow keys of the keypad.

Example: procedure for setting the 'Work height at Tower 1'

- Use manual operation to move to a rack position (at Tower 1).
- Open configuration menu (with the **<CONFIG>** key).
- Open submenu **`>rack definitions`** and load the data of the rack which is currently on the turntable.
- Select **`work position T1`**.

LEARN mode
The quicker an arrow key is repeatedly pressed, the higher the speed of the lift or the longer the particular movement path.

- Press **<LEARN>** key.
- Use the **<↓>** and **<↑>** keys to move the lift to the required position.
- Accept the lift position with the **<ENTER>** key.
- If necessary modify the position (in mm) by entering numbers.

Example: procedure for setting 'External position 1 at Tower 1'

- Use manual operation to move to a sample beaker (at Tower 1) and move the lift to a suitable lift position.
- Open configuration menu (with the **<CONFIG>**) key.
- Select submenus **`>tower 1`** / **`swing head 1`** and **`external pos.1`**.

LEARN mode
The quicker an arrow key is repeatedly pressed, the higher the swing rate or the larger the particular swing angle.

- Press **<LEARN>** key.
- Use the **<←>** and **<→>** keys to move the robotic arm until it is in the required position.
- Accept the robotic arm position with **<ENTER>**.
- If necessary modify the position (in °) by entering numbers.

3.10.2 Rack adjustment

If necessary, each sample rack can be finely adjusted, i.e. the rack offset is determined in the direction of rotation. A requirement for this is that the working height has already been set for the particular rack and that the rack settings have been stored.

Procedure:

- Position sample rack on turntable and initialize with **<RACK>**.
- Open configuration menu (with **<CONFIG>**) and select submenu **>rack definitions**.
- Under **>>recall rack** call up the definitions for the current rack.
- Select **rack offset**.
- Press **<LEARN>** and confirm the question **adjust RACK ?** with **<ENTER>**.
- The rack rotates to rack position 1.
- Confirm the question **adjust tower 1 ?** with **<ENTER>**.
- The lift moves to the working position.
- Use the arrow keys to exactly align rack position 1 with the beaker sensor at Tower 1.
- Confirm the adjustment with **<ENTER>**.
- The rack offset (in °) is accepted in accordance with the adjustment carried out.

3.10.3 Parametrizing sequence commands

As when editing a method the parameters of a command can most easily be altered interactively, i. e. by altering them manually, particular commands are "adaptive". When editing a sequence the **LEARN** function allows certain commands to be carried out via manual operation. The resulting parameter (e.g. the lift position or the status of the input lines of the Remote interface) can then be adopted in the current command line. The **LEARN** function can be used repeatedly. Once times or volumes have been "learned" the values will always be added up. This is extremely useful for the determination of the pumping time, where the optimal duration of the rinsing process can be determined interactively in this way.

Procedure for editing methods:

- Enter command or select existing command line
- Press **<LEARN>** key
- The function starts, the "**LEARN**" LED lights up
- Press **<LEARN>** key
- The function is stopped, the "**LEARN**" LED blinks

- Accept the value with the **<ENTER>** key (or start the **LEARN** function again)
- The **LEARN** LED goes out; the next command line appears

The **LEARN** function is available for the following commands:

Command	Adaptive parameter	Type of function
LIFT	Lift position in mm	absolute
PUMP	Pumping time in s	additive
STIR	Stirring time in s	additive
WAIT	Waiting time in s	additive
DOS	Dosing volume in mL	additive
SCN Rm	Status of 8 Remote lines	"live" value
SCN RS	Received character string	"live" value

3.11 TRACE function

The comfortable **TRACE** function is available for testing the run of a command sequence.

The **TRACE** function is a valuable aid for testing either a complete method or parts of a method step by step for test purposes. Each command line in a sequence can be executed directly by pressing the **<START>** key. When the command has been executed the next command line is shown.

"Tracing" can be carried out directly after a command line has been entered or at any other time after the parameter menu has been opened and a sequence has been selected.

3.12 Disabling keypad functions

Certain user dialog areas can be made inaccessible to untrained users. Various dialog areas or keys can be disabled. For example, this can be used to prevent a method from being overwritten accidentally or parameters from being altered.

The **`>keyboard options`** menu for the corresponding settings is opened by keeping the **<CONFIG>** key pressed down when the Sample Processor is switched on. This menu can still be accessed even if the whole keypad has been disabled.

The individual key functions that can be disabled are:

3.12.1 Disable whole keypad

In routine work, if only a single particular method is used, it may be advisable to prevent manual manipulations on the Sample Processor. For this reason it is possible to disable (almost) all the keypad keys. The

<START>, **<STOP>** and **<CLEAR/RESET>** keys always remain accessible, so that it is always possible to start and stop methods.

lock keyboard: ON disables all the keypad keys (with the above exceptions).

3.12.2 Disable configuration

The configuration of the Sample Processor can be protected against being overwritten. All the settings in the configuration menu and it's submenus can then no longer be accessed.

lock <CONFIG>: ON disables the **<CONFIG>** key.

3.12.3 Disable parameter

If user-defined methods are normally used then it may be advisable to prevent the stored method parameters from being overwritten. The parameter menu and it's sub-menus can be made inaccessible.

lock <PARAM>: ON disables the **<PARAM>** key.

3.12.4 Disable method storage functions

It is extremely advisable to prevent stored methods from being accidentally deleted. It should only be possible to delete methods by deliberately switching off the disabling function.

>>user methods + <ENTER> opens the submenu for disabling the method storage functions.

lock method recall: ON prevents the loading of methods.

lock method store: ON prevents methods from being stored.

lock method delete: ON prevents methods from being deleted.

3.12.5 Disable display

If the Sample Processor is only to be operated by using external control software, the display for manual operation can be switched off.

lock display: ON switches off the display.

3.13 786 Swing Head settings

If a 786 Swing Head with robotic arm is to be mounted then its configuration data must be entered in the setup menu of the Sample Processor before. The most important data:

- Swing radius (=length of robotic arm)
- Swing arm offset
- Max. swing angle
- Swing direction

Setup menu of the Sample Processor

Procedure:

- Switch off instrument
- Keep **<CONFIG>** key pressed down and switch on the instrument again
- In the menu **`setup >changer setup`** select the submenu **`>>swing head 1`** or **`>>swing head 2`**.
- Make the following settings:

Axis distance

The axis distance is the horizontal distance between the axis of rotation of the rack and the swing axis of the robotic arm.

Default settings:

`axial distance 166.00 mm` (for model 778)
`axial distance 196.00 mm` (for model 789)

Swing offset

The swing offset is the physical angle offset of the specific robotic arm model, see the Instructions for Use for the 786 Swing Head.

Default values:

`swing offset` **`0.00°`** (for titration robotic arm)
`swing offset` **`8.00°`** (for transfer robotic arm)

Max. swing angle

The maximum swing angle is the useable swinging range (relative angle). The starting and finishing positions of this range (as absolute angle positions) are determined by the swing offset (see above) and the Swing Head drive. Because of its construction, each robotic arm model has a different

value for the max. swing range, see the Instructions for Use for the 786 Swing Head. This value can also be reduced if necessary.

Default values:

Max. swing angle 84.00° (for titration robotic arm)
Max. swing angle 117.00° (for transfer robotic arm)

Swing radius

The swing radius depends on the length of the robotic arm and, together with the axial distance (see above), is the most important parameter for accurately moving to a rack position. The distance from the robotic arm axis to the middle of the processing head at the front of the robotic arm is decisive. The various robotic arm models have different swing radii, see the Instructions for Use for the 786 Swing Head.

Default values:

swing radius 110 mm (for titration robotic arm)
swing radius 112 mm (for transfer robotic arm)

Rotation offset

The rotation offset does not normally need to be altered. It is only used if a Swing Head is to be mounted on the tower with a lateral displacement.

Default value:

rot. offset 0.00 mm (do not alter)

Swing direction

In principle the swing direction of the robotic arm can be selected as required. If two Swing Heads are mounted on a 2-tower model then you must take care that the two robotic arms do not come into conflict. For this reason the robotic arm at Tower 1 should always be mounted so that it swings to the right and that at Tower 2 to the left.

Right-swinging mounting means: swing direction **–**

Left-swinging mounting means: swing direction **+**

Default values:

Swing direction: **–** (at Tower 1, swing to the right)
Swing direction: **+** (at Tower 2, swing to the left)

Adjustment rate

When the **RACK** command is carried out after switch-on (rack initialization) the robotic arm is automatically adjusted to the zero position. If the highest possible degree of positioning accuracy of the robotic arm is required the rate of the adjustment process can be reduced. However, this also lengthens the duration of the automatic adjustment process, but increases the precision.

Default value:

```
Adjust rate.:     normal
```

After the settings for the robotic arm have been entered the **<QUIT>** key must be pressed three times. The settings become active the next time that the instrument is switched on.

4 Service, maintenance, errors

4.1 Service

Servicing the Sample Processor should be carried out within the framework of an annual service visit by technicians from Metrohm or one of its local agencies. If aggressive or corrosive chemicals are used then shorter service intervals are necessary.

The Metrohm service department is always pleased to provide competent advice about the servicing and maintenance of all Metrohm instruments.

4.1.1 Running time meter

The running time meter enables the service intervals to be based on the effective number of hours the instrument has been in use, See p. 57f.

4.2 Care and maintenance

Not just sensitive instruments, but even a Sample Processor requires a certain amount of care and attention. If the instrument becomes excessively dirty this could interfere with its functions and shorten the working life of its basically robust mechanism and electronics.

Excessive dirt on the working heads can influence the measuring results obtained. Regular cleaning of exposed parts can prevent this to a large extent.

Spilled chemicals and solvents should be cleaned up immediately. Above all, the connection strip (the mains plug in particular) must be protected against contamination.

Although this prevented to a large extent by constructive measures, if aggressive media should penetrate the interior of the instrument then the mains plug should be pulled out immediately in order to prevent massive damage to the electronics. If such damage should occur please contact the Metrohm service department.

The instrument must not be opened by untrained personnel.

4.3 Error messages

If a fault should occur then the execution of the active command will be stopped and an error message shown (display blinks). This must be confirmed with the **<QUIT>** key.

If the Sample Processor is processing a series of samples when the fault occurs then it will switch to the **HOLD** status. When the cause of the fault has been found and remedied the sample series can be re-started with the next command by pressing the **<START>** key. If it is not possible to remedy the fault then the method can be stopped with **<STOP>**.

List of possible error messages and their causes:

*** battery low**	The battery for the permanent storage of the user data must be replaced.
*** beaker too small**	The rack position which has been moved to has a smaller beaker radius than that defined as the min. beaker radius for the particular lift. There is a risk of damage. Check the sample rack, its configuration settings and those of the selected tower.
*** changer not ready**	The changer cannot execute the command chosen because it is busy carrying out another action.
*** changer overload**	Load too high, or resistance to the action to be carried out. After **<QUIT>** the Sample Processor will be initialized again.
*** dos.## not exec**	A fault has occurred at the given dosing device.
*** dos.## not ready**	The selected dosing device cannot carry out the particular command as it is carrying out a different action or the current instrument status does not allow it to be carried out.
*** dos.unit ## missing**	The selected dosing device has not been connected.
*** dos.unit ## overload**	The selected Dosing unit cannot carry out a dosing command. Check the buret and piston.
*** invalid position**	The selected sample position does not exist or is defined as a special beaker or the selected special beaker has not been defined. The selected lift position may lie outside the max. stroke path.

*** invalid rack code**	The rack code read in by the Sample Processor cannot be found in the internal table.
*** missing beaker**	After a **MOVE** command no beaker can be recognized at the selected position.
*** rack data missing**	No sample rack in position, or no rack data can be found for the sample rack currently on the turntable.
*** RS232 error**	The transmission parameters of the RS232 interface do not coincide with those of the receiving device.
*** SCAN timeout**	The connected device has not transmitted the expected signal within the defined timeout time. The sample determination may not have been carried out properly, or the connection has been interrupted. Check the connected device.
*** service recommended**	The warning limit of the running time meter has been reached. It is time for the Sample Processor to be serviced. Please contact your local Metrohm service department.
*** user memory full**	The memory for the user-defined methods is full. Before new methods can be stored methods that are not used, or only used infrequently, must be deleted.
*** wrong rack**	The rack placed on the turntable is not the rack assigned to the method under **parameters**.
trap error xxx	Unexpected program error; switch instrument off and then on again.
No display, LEDs Tower 1 and Tower 2 light up	LCD error (system error 7). Contact Service.

5 GLP validation – diagnosis

5.1 Validation / GLP

GLP (**G**ood **L**aboratory **P**ractice) requires, among other things, that the precision and correctness of analytical instruments is checked at regular intervals by using SOPs (**S**tandard **O**perating **P**rocedures.

As this instrument is not a measuring instrument as such, we recommend that the Sample Processor is included in an analytical system and is validated as part of the all-embracing validation of the whole analytical system.

If the Sample Processor is primarily used for titration purposes then it is advisable to carry out the validation of the titrator with the help of the Sample Processor. In this way any possible interference (e.g. carryover of titrant or sample solutions) that could influence the results is included within the framework of the evaluation of the complete titration system.

Checking the electronic and mechanical assemblies of Metrohm instruments can and should be undertaken within the framework of regular servicing by Metrohm technicians. All Metrohm instruments are equipped with start-up check routines which check that the relevant assemblies are functioning perfectly when the instrument is switched on. If no error message appears the instrument is functioning properly. Metrohm also supplies its instruments with built-in diagnosis programs which allow the service technicians to check the functioning of particular assemblies should faults or malfunctions occur and to localize them. Diagnosis programs can also be incorporated in a validation method.

Guidelines for drawing up standard operating procedures for checking a titration system can be found in Application Bulletin 252/1 ("Validation of Metrohm titrators in accordance with GLP/ISO9001"). This can be obtained free of charge from Metrohm.

5.2 Initializing the working memory

With this diagnostic step the default values for instrument parameters can be entered via the keypad and the instrument returned to its original condition. This measure is important with respect to the following:

In rare cases it could happen that massive interference signals such as current peaks, lightning, etc. could affect the contents of the data memory. If the data memory contents are undefined then this could lead to a system crash.

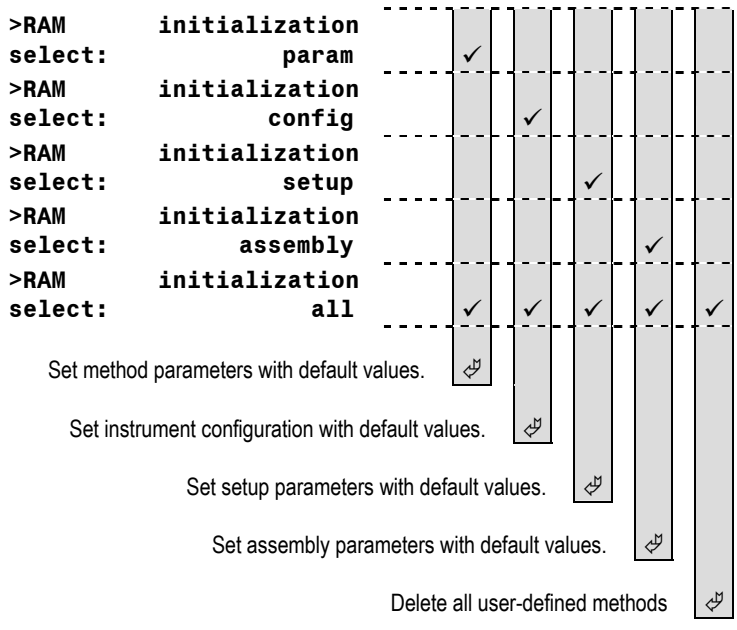
The Sample Processor has different ways of initializing the working memory. Either the complete data memory (**all**) or only parts of it (**param, config, setup, assembly**) can be overwritten with the default values.

Although the instrument number is retained, initialization should only be carried out when absolutely necessary, as this deletes the stored user data (etc.).

- Keep key **<9>** pressed down when the instrument is switched on.

```
diagnosis
>RAM initialization
```

- Press the **<ENTER>** key to open the following diagnosis menu:



The submenus are selected in sequence by pressing the **<Select>** key. The individual initialization versions are accessed by the **<ENTER>** key and exited with the **<QUIT>** key.

The table shows which parts of the working memory are affected by the corresponding initialization versions. If a system crash occurs (undefined display, no reaction to pressing keys, etc.) we recommend the initialization version "**all**".

- If necessary, press the **<SELECT>** key several times until this appears:

```
>RAM initialization
select:              all
```

- Press **<ENTER>**.

```
diagnosis
>RAM test
```

- Press **<ENTER>**.
- Press **<QUIT>**.

The instrument finishes the diagnosis process and carries out a start-up reset.

6 Annex

6.1 Technical data

6.1.1 Keypad

LC display	2 lines with 24 characters each character height 5 mm
LED display	3 LEDs
Keypad	Keypad with 30 keys

6.1.2 Interfaces

RS232 socket	For connecting a computers or printer, 9 pins
Remote socket	Universal parallel interface, programmable for communication with external devices, 22 signal lines (8x input, 14x output), TTL level

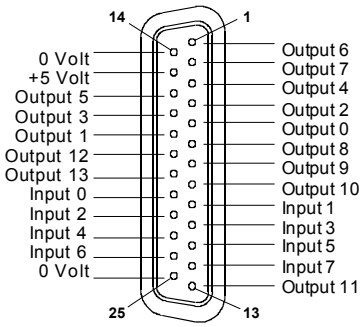
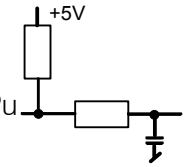


Fig. 37 Remote interface

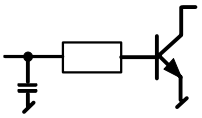
Input: t_p t_p >20 ms

approx. 50 kΩ Pu



active = low
inactive = high

Output: t_p t_p >200 ms
V_{CEO} = 40 V
I_C = 20 mA
open collector



active = low
inactive = high

+5 V: max. load = 20 mA

6.1.3 MSB connections

3 connection sockets	9-pin mini-DIN sockets - for 800/700 Dosino or 805 / 685 Dosimat - for 801 Stirrer or 804 Ti Stand

6.1.4 Pumps and pump connections

Various versions depending on the model:

Built-in pumps with valves

Capacity	> 450 mL/min head 2 m

Pump connections

Output	M8 socket: U = 16 ± 1 V I ≤ 0.8 A

for 823 Membrane Pump Unit or 772 Pump Unit

6.1.5 Swing Head connection

Connection socket	9-pin mini-DIN socket - for 786 Swing Head

6.1.6 Lift

Max. stroke path	235 mm
Max. load	approx. 30 N
Speed	adjustable, 5...25 mm/s

6.1.7 Turntable

Speed of rotation	adjustable, 3...20 degrees/s

6.1.8 Stirrer connection (DIN socket)

Stirring rate	adjustable in 15 steps 741 Magnetic Stirrer 180/min...2600/min 802/722 Rod Stirrer 180/min...3000/min

6.1.9 Mains connection

Voltage	100… 240 V (±10%)
Frequency	50...60 Hz
Power consumption	115 W
Fuses	2.0 ATH

6.1.10 Safety specifications

Construction and testing	According to EN/IEC 61010-1, UL 3101-1 protection class I
Safety instructions	The Instructions for Use contain safety information that must be observed by the user in order to ensure the safe operation of the instrument.

6.1.11 Electromagnetic compatibility (EMC)

Emission	Standards fulfilled : - EN/IEC 61326 - EN 55022 / CISPR 22 - EN/IEC 61000-3-2
Immunity	Standards fulfilled: - EN/IEC 61326 - EN/IEC 61000-4-2 - EN/IEC 61000-4-3 - EN/IEC 61000-4-4

- EN/IEC 61000-4-5
- EN/IEC 61000-4-6
- EN/IEC 61000-4-8
- EN/IEC 61000-4-11
- EN/IEC 61000-4-14
- NAMUR

6.1.12 Ambient temperature

Nominal working range	+5…+45 °C (at max. 80 % relative humidity)
Storage	-20 ...+60 °C relative humidity < +40 °C < 95% relative humidity < +50 °C < 85% relative humidity < +60 °C < 50%
Transport	-20 ...+60 °C relative humidity < +40 °C < 95% relative humidity < +50 °C < 85% relative humidity < +60 °C < 50%

6.1.13 Dimensions and materials

Height	730 mm
Width	280 mm
Depth	500 mm (2.778.XXXX model) 530 mm (2.789.XXXX model)
Weight (without accessories)	14.5 kg (2.7XX.0010 model) 15.4 kg (2.7XX.0020 model) 13.8 kg (2.7XX.0030 model) 18.9 kg (2.7XX.0110 model) 19.9 kg (2.7XX.0120 model) 16.8 kg (2.7XX.0130 model)
Materials	
- Sample Processor housing	Metal housing, surface-treated
- Keypad housing	Crastin (PBTB), inside Al-metallized
- Keypad film	Polyester, chemical-resistant

6.2 Standard methods

The following pages contain a list of the user methods supplied together with explanations of important commands. A requirement for the use of these methods is that the system is properly configured. In particular, the working position, rinsing position and shifting position of Lift 1 must be defined for the sample rack being used as well as a special beaker position on the rack.

The titration or measuring methods must always be set on the corresponding instrument itself. The correct cable connections are given on pages 31ff. In the methods described as examples it is assumed that the instruments are always connected to the Remote sockets.

We recommend that each new method is worked through step by step with the **TRACE** function before it is started for the first time and adapted to suit the particular requirements. This is done by using the **<PARAM>** key to open the loaded method and selecting **`>start sequence`**, **`>sample sequence`** or **`>final sequence`**. The displayed command line of a sequence can be executed directly with the **<START>** key. This means that it is possible to test the complete method sequence step by step.

If a standard method is not required then it can be deleted (see p. 87). Then more memory is available for storing methods.

6.2.1 Titrino

This is a universal method for carrying out automated titrations directly in the sample beaker. It is extremely suitable for use as a template for further methods.

Required instruments and cables:

- Metrohm titrator (Titrino or Titrando with 6.2148.010 Remote Box)
- Metrohm 802 Rod Stirrer or 741 Magnetic Stirrer
- 6.2141.020 Remote cable

The method can be used with or without a 786 Swing Head on the Sample Processor.

Special features:

After the titration the electrode is rinsed in the sample beaker (rinsing position). The rinsing position at Lift 1 must be set in the rack configuration so that the electrode is not immersed in the sample solution. An internal or external pump is required for rinsing.

```
789 Sample Proc. XL     11122 5.789.0011   - Report header with instrument ID and program version
parameters
  method              Titrino              - Method name
  number of samples:    rack               - No. of samples (here whole sample rack)
>start sequence
   1 CTL:Rm:            INIT               - Initialize Remote interface
>sample sequence
   1 MOVE  1     :    sample               - Move to sample
   2 LIFT: 1  :         work mm            - Run lift to working height
   3 STIR: T1    :        ON s             - Switch on stirrer at Tower 1
   4 CTL:Rm:    START device1               - Start titrator
   5 SCN:Rm      :       End1               - Wait for end of titration
   6 STIR: T1    :       OFF s              - Switch off stirrer at Tower 1
   7 LIFT: 1  :        rinse mm            - Run lift to rinsing height
   8 PUMP  1.1   :         5 s             - Rinse electrode for 5 seconds
   9 WAIT:   pause         3 s             - Allow electrode to drip
>final sequence
   1 MOVE  1     :    spec.1               - Move to conditioning beaker
   2 LIFT: 1  :         work mm            - Run lift to working height
>changer settings                          ----- Settings for Sample Processor functions -----
  rack name:              *
  lift rate T1           25 mm/s
  lift rate T2           25 mm/s
  shift rate             20°/s
  shift direction:      auto
  swing rate T1          55°/s
  swing rate T2          55°/s
  on beaker error:      MOVE
>stirring rates                            ------ Stirring rates ----------
  stirrer tower 1          3
  stirrer tower 2          3
  stirrer MSB1             3
  stirrer MSB2             3
  stirrer MSB3             3
>Dosing unit def.                          -------- Settings for dosing devices----------
>timeout settings                          -------- Settings for interface timeout ------
  SCAN timeout:         OFF min
  on SCAN timeout:     error
>manual stop                               -------- Reaction to manual stop ----------
  CTL Rmt:      STOP device*                - Stop titrator
  CTL RS232:
  PUMP:                cont.               - Do not alter pump status
```

```
  STIR T1:              cont.          - Do not alter stirrer  status
  STIR T2:              cont.                  "
  STIR MSB1:            cont.                  "
  STIR MSB2:            cont.                  "
  STIR MSB3:            cont.                  "
         ------------
```

6.2.2 PIP ext

Standard method for pipetting samples into an external titration cell. Very suitable for standard titrations.

Required instruments and cables:

- Metrohm titrator (Titrino or Titrando with 6.2148.010 Remote Box)
- 786 Swing Head with robotic arm for sample transfer (6.1462.030 or 6.1462.040)
- 803 Magnetic Stirrer or 804 Ti Stand with 802 Rod Stirrer connected to MSB1
- 800 Dosino with 807 Dosing unit (recommended: 10 mL cylinder, 6.3032.210) and 6.1562.100 Pipetting tubing
- 6.2141.020 Remote cable

Special features:

Samples are pipetted directly from the sample beaker into the external titration cell. The external Position 1 with the working height for moving to the titration cell must be set in the tower configuration. No special beaker is required.

```
789 Sample Proc. XL     11122 5.789.0011  - Report header with device ID and program version
parameters
  method               PIP ext            - Method name
  number of samples:     rack             - No. of samples (here whole sample rack)
>start sequence
   1 CTL:Rm:              INIT             - Initialize Remote interface
   2 MOVE  1     :       ext.1             - Move robotic arm to external titration cell
   3 LIFT: 1  :          rinse mm          - Run lift to rinsing height
   4 PUMP  1.2   :          30 s           - Rinse for 30 seconds
   5 DOS: 1.1 :         prepar. mL         - Prepare Dosing unit
   6 PUMP  1.*   :          30 s           - Rinse titration cell for 30 seconds and aspirate
   7 LIFT: 1  :          shift mm          - Run lift to shifting height
>sample sequence
   1 MOVE  1     :       ext.1             - Move robotic arm to external titration cell
   2 LIFT: 1  :           work mm          - Run lift to work height
   3 PUMP  1.2   :          ON s           - Rinse cell, pump on
   4 DOS: 1.1 :         endVol mL          - Eject all dosing cylinder contents
   5 DOS: 1.1 :         compen. mL         - Eliminate slack
   6 PUMP  1.2   :          OFF s          - Pump off
   7 LIFT: 1  :          shift mm          - Run lift to shifting height
   8 DOS: 1.1 :           -0.5 mL          - Aspirate air-gap bubble into pipetting tubing
   9 MOVE  1     :       sample            - Rotate rack to sample beaker
  10 LIFT: 1  :           work mm          - Run lift to working height
  11 DOS: 1.1 :           -5.0 mL          - Aspirate sample into pipetting tubing
  12 WAIT:   pause           3 s           - Wait for pressure equilibration in pipetting tubing
  13 LIFT: 1  :          shift mm          - Run lift to shifting height
  14 DOS: 1.1 :           -0.2 mL          - Aspirate air into pipetting tip
  15 DOS: 1.2 :           port mL          - Rotate Dosino stopcock, close Port 1
  16 MOVE  1     :       ext.1             - Move robotic arm to titration cell
  17 STIR: MSB1  :          ON s           - Switch on stirrer
  18 PUMP  1.1   :          10 s           - Add solvent with pump
  19 LIFT: 1  :          work mm           - Run lift to working height
```

```
  20 DOS: 1.1 :          5.4 mL
  21 WAIT:   pause         3 s
  22 DOS: 1.2 :         fill mL
  23 DOS: 1.1 :       endVol mL
  24 DOS: 1.1 :      compen. mL
  25 LIFT: 1  :        shift mm
  26 WAIT:   pause         5 s
  27 CTL:Rm:    START device1
  28 SCN:Rm     :     Ready1
  29 PUMP  1.*  :         30 s
  30 STIR: MSB1 :        OFF s
>final sequence
   1 MOVE  1    :      ext.1
   2 LIFT: 1  :         work mm
   3 DOS: 1.1 :        empty mL
   4 LIFT: 1  :        shift mm
   5 PUMP  1.1  :         15 s
>changer settings
...
>stirring rates
>Dosing unit def.
  dosing drive             1
  dos.rate              10.0 ml/min
  fill.rate             10.0 ml/min
  dosing          port     1
  dosing 2        port     3
  filling         port     2
  rinsing         port     2
  preparation     port     1
  drain           port     4
  cock direction:   not over
  not over port            4
>timeout settings
  SCAN timeout:          OFF min
  on SCAN timeout:     error
>manual stop
  CTL Rmt:       STOP device*
  CTL RS232:
  PUMP:                  OFF
  STIR T1:             cont.
  STIR T2:             cont.
  STIR MSB1:           cont.
  STIR MSB2:           cont.
  STIR MSB3:           cont.
         -----------
```

- Eject sample (+ air-gap bubble)
- Wait for drips
- Refill solvent in dosing cylinder
- Eject solvent into titration cell (rinse)
- Eliminate slack
- Run lift to shifting height
- Wait 5 seconds
- Start titrator
- Wait for end of titration
- Rinse and aspirate titration cell
- Switch off stirrer

- Move robotic arm to titration cell
- Run lift to working height
- Empty dosing cylinder and tubing
- Run lift to shifting height
- Rinse and aspirate titration cell

Changer settings

Stirring rates

Settings for dosing device

- Reduce dosing rate
- Reduce filling rate

- Do not rotate to open Port 4 (in bottle)
- see above

Actions after manual stop

- Stop titrator

- Switch off pump

6.2.3 KF_ext.

Standard method for coulometric or volumetric Karl Fischer determinations. The samples are pipetted from sealed vials into an external conditioned coulometer or KF titration cell.

Required instruments and cables:

- Metrohm Coulometer (756 or 831) or
- Metrohm KF Titrator (e.g. 795 Titrino or 835 Titrando) with 6.2148.010 Remote Box
- 786 Swing Head with robotic arm for sample transfer (6.1462.030 or 6.1462.040)
- 803 Magnetic Stirrer or 804 Ti Stand with 802 Rod Stirrer connected to MSB1
- 800 Dosino with 807 Dosing unit (recommended: 10 mL cylinder, 6.3032.210) and 6.1562.100 Pipetting tubing
- 6.2141.020 Remote cable
- Sample transfer accessory set (6.5619.000)

Special features:

Samples are pipetted directly from the sample beaker into the external titration cell. Freshly titrated conditioning solution from the KF cell is used as the transport medium for pipetting.

The external Position 1 with the working height for moving to the titration cell must be set in the tower configuration.

```
789 Sample Proc. XL     11122 5.789.0011   - Report header with device ID and program version
parameters
  method                KF ext             - Method name
  number of samples:      rack             - No. of samples (here whole sample rack)
>start sequence
   1 CTL:Rm:              INIT               - Initialize Remote interface
   2 STIR: MSB1  :          ON s             - Switch on stirrer
   3 CTL:Rm:    START device1                - Start conditioning
   4 MOVE  1     :       ext.1              - Move robotic arm to KF cell
   5 SCN:Rm      :     Cond ok              - Wait for conditioning
   6 WAIT:   pause           60 s           - Stabilization of "Cond." condition
   7 SCN:Rm      :     Cond ok              - Wait for conditioning
   8 LIFT: 1  :             work mm          - Insert needle into KF cell
   9 DOS: 1.4 :           eject mL           - Eject dosing cylinder into waste container
  10 DOS: 1.1 :            -5.0 mL          - Aspirate conditioning solution into dosing cylinder
  11 DOS: 1.2 :          endVol mL          - Eject dosing cylinder into waste container
  12 DOS: 1.1 :            -2.0 mL          - Aspirate conditioning solution into pipetting tubing
  13 DOS: 1.2 :          eject mL           - Eject dosing cylinder into waste container
  14 DOS: 1.2 :          endVol mL          - Piston to max. volume mark
  15 MOVE  1     :       spec.1             - Move robotic arm to conditioning beaker
  16 LIFT: 1  :            work mm          - Run lift to working height
  17 SCN:Rm      :     Cond ok              - Wait for conditioning
  18 WAIT:   pause          60 s           - Stabilization of "Cond." condition
  19 SCN:Rm      :     Cond ok              - Wait for conditioning
>sample sequence
   1 MOVE  1     :       ext.1              - Move robotic arm to KF cell
   2 DOSRATE   1             5
   3 FILLRATE  1             5
   4 DOS: 1.1 :           -0.1 mL          - Aspirate air-gap bubble
   5 LIFT: 1  :           work mm          - Pierce KF cell
   6 DOS: 1.1 :           -0.5 mL          - Aspirate conditioning solution
   7 LIFT: 1  :           shift mm         - Run lift to shifting height
   8 DOS: 1.1 :           -0.1 mL          - Aspirate air-gap bubble
```

```
   9 MOVE  1     :     sample          - Move to sample beaker
  10 LIFT: 1  :         work mm        - Pierce sample vial
  11 DOS: 1.1 :         -0.5 mL        - Aspirate sample volume
  12 WAIT:   pause        10 s         - Wait for pressure equilibration
  13 DOS: 1.2 :         port mL        - Close Port 1
  14 MOVE  1     :     ext.1           - Move to KF cell
  15 SCN:Rm      :    Cond ok          - Wait for  conditioning
  16 WAIT:   pause        60 s         - Stabilization of "Cond." condition
  17 SCN:Rm      :    Cond ok          - Wait for  conditioning
  18 CTL:Rm:    START device1           - Start titration
  19 LIFT: 1  :         work mm        - Pierce KF cell
  20 DOS: 1.1 :        endVol mL       - Eject sample volume
  21 DOS: 1.1 :        compen mL       - Eliminate slack
  22 MOVE  1     :     spec.1          - Move to parking position
  23 LIFT: 1  :         work mm        - Move lift to work height
  24 SCN:Rm      :    Cond ok          - Wait for end of titration
>final sequence
   1 CTL:Rm:   ***********1*           - Stop titrator
   2 WAIT:   pause         1 s         - Wait 1 second for stop impulse
   3 CTL:Rm:             INIT          - Initialize Remote interface
>changer settings                      Changer settings
  rack name:               *
  lift rate T1            25 mm/s
  lift rate T2            25 mm/s
  shift rate              20°/s
  shift direction:       auto
  swing rate T1           55°/s
  swing rate T2           55°/s
  on beaker error:       MOVE
>stirring rates                        Stirring rates
>Dosing unit def.                      Settings for dosing device
>timeout settings
  SCAN timeout:          OFF min
  on SCAN timeout:      error
>manual stop                           Actions after manual stop
  CTL Rmt:       STOP device*          - Stop titrator
  CTL RS232:
  PUMP:                 cont.
  STIR T1:              cont.
  STIR T2:              cont.
  STIR MSB1:              OFF
  STIR MSB2:            cont.
  STIR MSB3:            cont.
         -----------
```

6.2.4 pH_cal

This is a universal method for automated pH measurements directly in the sample beaker. The electrode calibration is included in the start sequence.

Required instruments and cables:

- Metrohm pH Meter (model 691 or 780/781) with 6.2148.010 Remote box
- Metrohm 802 Propeller Stirrer or 741 Magnetic Stirrer
- 6.2141.020 Remote cable

The method can be used with or without a 786 Swing Head on the Sample Processor. In the rack definition the special beaker positions 1 to 3 must be reserved.

Special features:
The two buffer solutions for the electrode calibration must be in special beaker positions 1 and 2.

After each measurement the electrode is rinsed in a rinsing beaker at special beaker position 3. Internal or external pump required for rinsing.

If a 780/781 pH Meter is used, two additional command lines must be inserted in the start sequence of the method. This is to cancel the display of the calibration results:

```
17 SCN:Rm      :       end1
18 WAIT:   pause          1 s
19 CTL:Rm:    START device1
20 MOVE  1     :     spec.3
```

```
789 Sample Proc. XL     11122 5.789.0011   - Report header with device ID and program version
parameters
  method               pH cal              - Method name
  number of samples:     rack              - No. of samples (here whole sample rack)
>start sequence
   1 CTL:Rm:             INIT              - Initialize Remote interface
   2 MOVE  1     :     spec.3              - Move to rinse beaker
   3 LIFT: 1  :          work mm           - Lower electrode
   4 PUMP  1.*   :             4 s         - Rinse electrode and aspirate beaker
   5 MOVE  1     :     spec.1              - Move to buffer 1
   6 LIFT: 1  :          work mm           - Immerse electrode
   7 STIR: T1    :            10 s         - Stir for 10 seconds
   8 CTL:Rm:     METER cal pH              - Start calibration with 1st buffer
   9 SCN:Rm      :       End1              - Wait for calibration
  10 MOVE  1     :     spec.3              - Move to rinse beaker
  11 LIFT: 1  :          work mm           - Lower electrode
  12 PUMP  1.*   :             4 s         - Rinse electrode and aspirate beaker
  13 MOVE  1     :     spec.2              - Move to  2nd buffer
  14 LIFT: 1  :          work mm           - Immerse electrode
  15 STIR: T1    :            10 s         - Stir for 10 seconds
  16 CTL:Rm:      METER enter               - Start calibration with 2nd buffer
  17 SCN:Rm      :       End1              - Wait for calibration
  18 MOVE  1     :     spec.3              - Move to rinse beaker
  19 LIFT: 1  :          work mm           - Lower electrode
  20 PUMP  1.*   :             4 s         - Rinse electrode and aspirate beaker
>sample sequence
   1 SHIFTRATE:+            20            - Rack rotation direction counterclockwise
```

```
   2 MOVE  1     :     sample          - Move to sample
   3 LIFT: 1  :          work mm      - Immerse electrode
   4 STIR: T1    :         10 s       - Stir for 10 seconds
   5 CTL:Rm:    METER mode pH          - Switch pH meter to measure
   6 CTL:Rm:    START device1          - Start measurement
   7 SCN:Rm      :       End1         - Wait for measurement
   8 SHIFTRATE:-           20         - Rack rotation direction clockwise
   9 MOVE  1     :     spec.3          - Move to rinse beaker
  10 LIFT: 1  :          work mm      - Lower electrode
  11 PUMP  1.*   :          4 s       - Rinse electrode and beaker
>final sequence
   1 MOVE  1     :     spec.3          - Move to rinse beaker
   2 LIFT: 1  :          work mm      - Lower electrode
>changer settings                     Changer settings
  rack name:               *
  lift rate T1            25 mm/s
  lift rate T2            25 mm/s
  shift rate              20°/s
  shift direction:       auto
  swing rate T1           55°/s
  swing rate T2           55°/s
  on beaker error:       MOVE
>stirring rates                       Stirring rates
>Dosing unit def.                     Settings for dosing device
>timeout settings
  SCAN timeout:           OFF min
  on SCAN timeout:       error        Actions after manual stop
>manual stop                          - Stop pH meter
  CTL Rmt:       STOP device*
  CTL RS232:                          - Pump off
  PUMP:                    OFF
  STIR T1:               cont.
  STIR T2:               cont.
  STIR MSB1:             cont.
  STIR MSB2:             cont.
  STIR MSB3:             cont.
         -----------
```

6.2.5 Std_add

This is a universal method for automated ion measurements directly in the sample beaker.

Required instruments and cables:

- Metrohm 692 Ion Meter oder 781 Ion Meter with 6.2148.010 Remote Box
- Metrohm 802 Propeller Stirrer or 741 Magnetic Stirrer
- 6.2141.020 Remote cable

The method can be used with or without a 786 Swing Head on the Sample Processor.

Special features:
After each measurement the electrode is rinsed in the sample beaker at the rinse position. Internal or external pump required for rinsing.

```
789 Sample Proc. XL     11122 5.789.0011  - Report header with device ID and program version
parameters
  method              std add             - Method name
  number of samples:     rack             - No. of samples (here whole sample rack)
>start sequence
   1 CTL:Rm:             INIT             - Initialize Remote interface
```

```
>sample sequence
   1 MOVE  1     :     sample
   2 LIFT: 1  :          work mm
   3 CTL:Rm:     METER mode C
   4 CTL:Rm:    START device1
   5 SCN:Rm      :   EndMeter
   6 LIFT: 1  :         rinse mm
   7 PUMP  1.1   :           5 s
   8 WAIT:   pause           3 s
>final sequence
   1 MOVE  1     :     spec.1
   2 LIFT: 1  :          work mm
>changer settings
  rack name:                 *
  lift rate T1              25 mm/s
  lift rate T2              25 mm/s
  shift rate                20°/s
  shift direction:         auto
  swing rate T1             55°/s
  swing rate T2             55°/s
  on beaker error:         MOVE
>stirring rates
>Dosing unit def.
>timeout settings
  SCAN timeout:            OFF min
  on SCAN timeout:        error
>manual stop
  CTL Rmt:        STOP device*
  CTL RS232:
  PUMP:                    OFF
  STIR T1:                cont.
  STIR T2:                cont.
  STIR MSB1:              cont.
  STIR MSB2:              cont.
  STIR MSB3:              cont.
          ------------
```

- Move to sample
- Run lift to work height
- Switch ion meter to concentration measurement
- Start measurement
- Wait for measurement
- Runlift to rinse height
- Rinse for 5 seconds with pump
- Allow to drip for 3 seconds

- Move to rinse beaker
- runlift to work height

Changer settings

Stirring rates

Settings for dosing device

Actions after manual stop

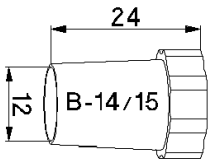
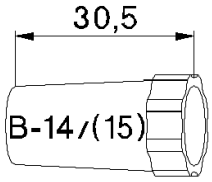
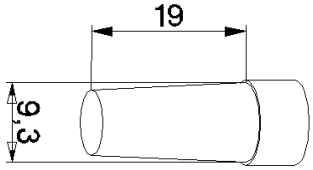
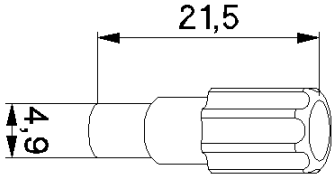
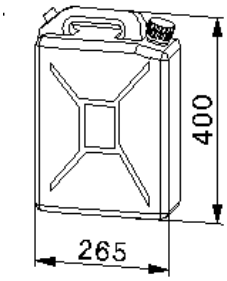
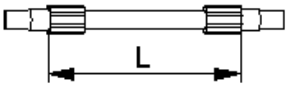
- Stop ion meter

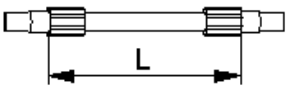
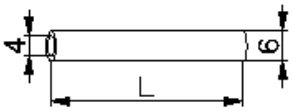
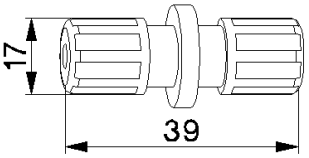
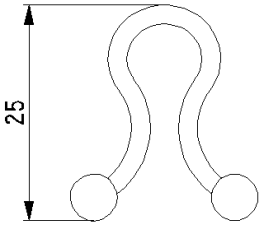
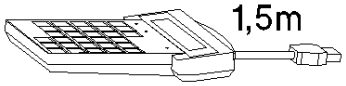
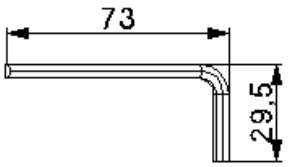
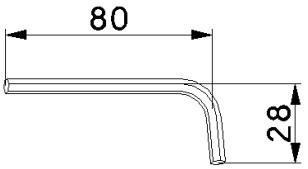
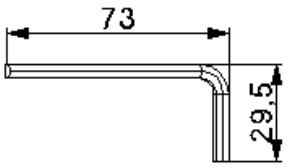
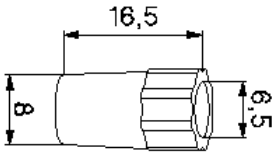
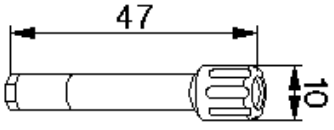
6.3 Standard equipment

On receipt of the instrument please check that the delivery is complete.

6.3.1 Metrohm Sample Processor:

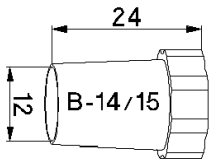
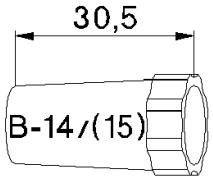
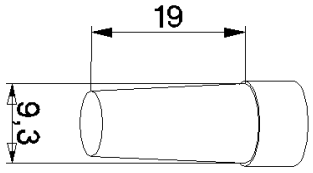
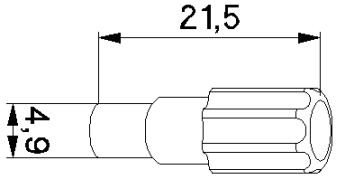
Order no. 2.789.0010 or 2.778.0010 (model versions with 1 tower and 1 pump)
The following accessories are included as standard:

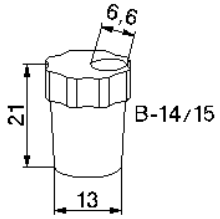
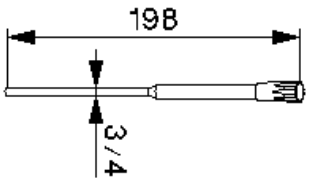
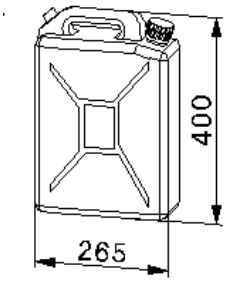
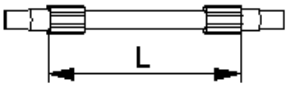
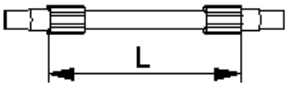
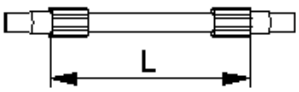
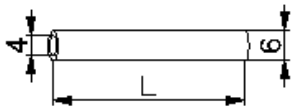
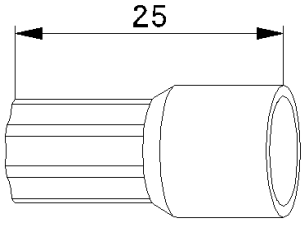
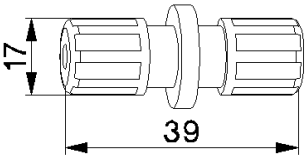
No.	*Order no.*	*Description*
1	1.789.0010 or 1.778.0010	**789 Robotic Sample Processor XL** **778 Sample Processor** 1 working station with rinsing equipment.
2	6.1236.020	Sleeve SGJ14/12 mm 
5	6.1446.000	Plastic stopper SGJ14 
3	6.1446.010	Stopper SGJ9 
1	6.1446.040	Threaded stopper M6 
1	6.1621.000	PE canister 10 L Use as rinsing solution or waste container 
1	6.1805.110	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 80 cm 

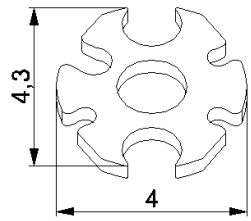
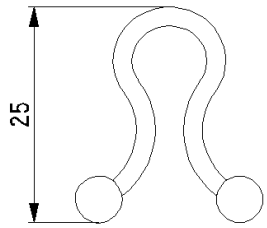
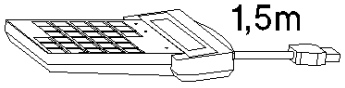
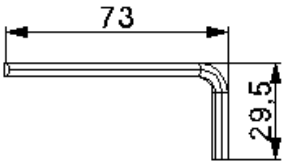
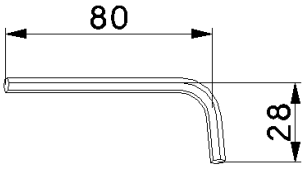
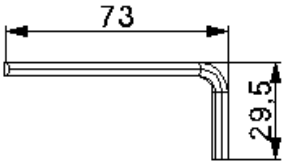
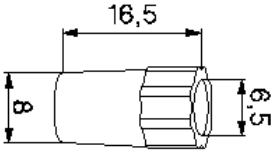
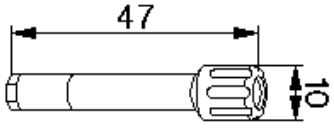
3	6.1805.420	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 48 cm	
1	6.1812.000	PTFE tubing L = 400 cm	
1	6.1828.000	Connecting nipple for canister 6.1621.000	
1	6.2053.000	Cable clips 10x for mounting cables	
1	6.2142.040	Keypad for 778/789 Sample Processor	
1	6.2621.030	Hexagon key 4 mm	
1	6.2621.070	Hexagon key 5 mm	
1	6.2621.140	Hexagon key 2.5 mm	
3	6.2709.070	Guide sleeve, ETFE, for 6.1543.xxx, SGJ 9	
3	6.2740.020	Spray nozzle ETFE With valve and M6 thread	
1	6.2751.080 or	Splash protection/Safety shield	(778 Model)

1	6.2751.100	Splash protection/Safety shield (789 Model)
1	6.2122.xxx	Mains cable with coupling type IEC 320/C13 Plug as per customer's requirements: - Type SEV 12 (Switzerland...) 6.2122.020 - Type CEE(7), VII (Germany...) 6.2122.040 - Type NEMA/ASA (USA...) 6.2122.070
1	8.789.1063	Metrohm Sample Processor Instructions for Use , English
1	8.789.1013	Quick reference Metrohm Sample Processor, English
1	8.789.1023	Metrohm Sample Processor Operating Tutorial, English
1	8.789.1033	Technical Reference: Metrohm Sample Processors, English

Order no. 2.789.0020 or 2.778.0020 (model versions with 1 tower and 2 pumps)
The following accessories are included as standard:

No.	*Order no.*	*Description*
1	1.789.0020 1.778.0020	**789 Robotic Sample Processor XL** or **778 Sample Processor** 1 working station with rinsing and aspiration equipment.
2	6.1236.020	Sleeve SGJ14/12 mm 
5	6.1446.000	Plastic stopper SGJ14 
3	6.1446.010	Stopper SGJ9 
1	6.1446.040	Threaded stopper M6 

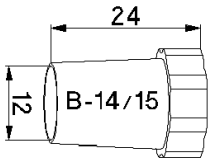
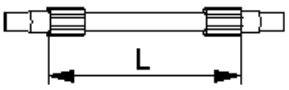
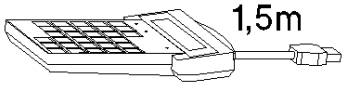
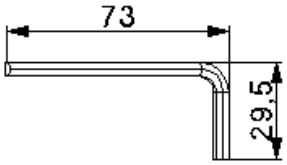
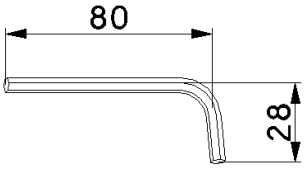
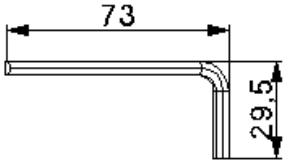
1	6.1446.160	Stopper SGJ 14/6.6 mm Made of PTFE For positioning inserts obliquely in the titration head	
1	6.1543.170	Aspiration tip, PTFE With M8 thread	
2	6.1621.000	PE canister 10 L Use as rinsing solution or waste container	
1	6.1805.110	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 80 cm	
3	6.1805.420	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 48 cm	
1	6.1805.510	PTFE tubing with anti-kink protection With 2 tubing nipples M8, L = 60 cm Inner diameter: 3 mm	
2	6.1812.000	PTFE tubing L = 400 cm	
1	6.1820.030	Screw connector with M8 thread For 6.1812.XXX and 6.1805.XXX Tubing	
2	6.1828.000	Connecting nipple for canister 6.1621.000	

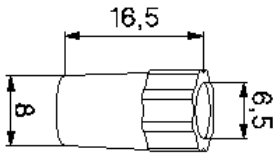
1	6.2042.020	Buret tip clip	
1	6.2053.000	Cable clips 10x for mounting cables	
1	6.2142.040	Keypad for 778/789 Sample Processor	
1	6.2621.030	Hexagon key 4 mm	
1	6.2621.070	Hexagon key 5 mm	
1	6.2621.140	Hexagon key 2.5 mm	
3	6.2709.070	Guide sleeve, ETFE, for 6.1543.xxx, SGJ 9	
3	6.2740.020	Spray nozzle, ETFE With valve and M6 thread	
1 or 1	6.2751.080 6.2751.100	Splash protection/Safety shield (778 Model) Splash protection/Safety shield (789 Model)	
1	6.2122.xxx	Mains cable with coupling type IEC 320/C13 Plug as per customer's requirements: - Type SEV 12 (Switzerland...) 6.2122.020	

		- Type CEE(7), VII (Germany...) 6.2122.040 - Type NEMA/ASA (USA...) 6.2122.070
1	8.789.1063	Metrohm Sample Processor Instructions for Use , English
1	8.789.1013	Quick reference Metrohm Sample Processor , English
1	8.789.1023	Metrohm Sample Processor Operating Tutorial, English
1	8.789.1033	Technical Reference: Metrohm Sample Processors, English

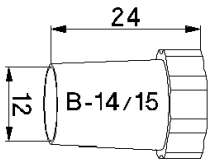
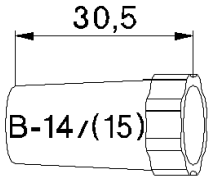
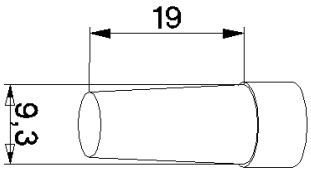
Order no. 2.789.0030 or 2.778.0030 (model versions with 1 tower, no pumps)

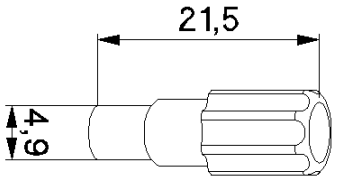
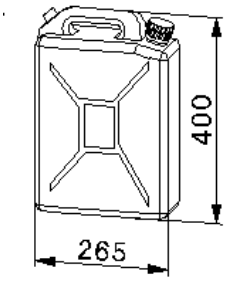
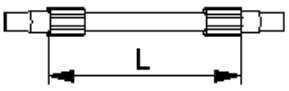
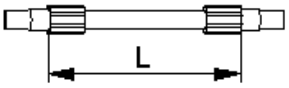
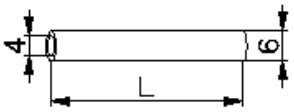
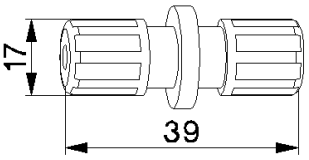
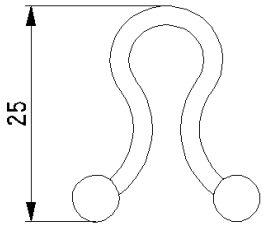
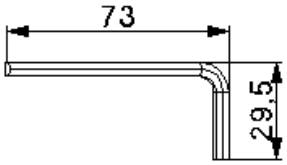
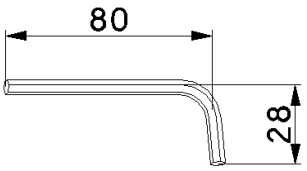
The following accessories are included as standard:

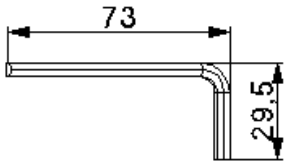
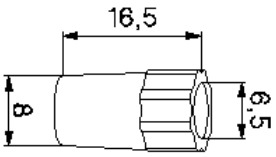
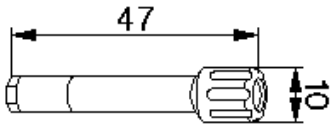
No.	*Order no.*	*Description*
1	1.789.0030 or 1.778.0030	**789 Robotic Sample Processor XL** **778 Sample Processor** 1 working station
2	6.1236.020	Sleeve SGJ14/12 mm 
1	6.1805.110	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 80 cm 
1	6.2142.040	Keypad for 778/789 Sample Processor 
1	6.2621.030	Hexagon key 4 mm 
1	6.2621.070	Hexagon key 5 mm 
1	6.2621.140	Hexagon key 2.5 mm 

3	6.2709.070	Guide sleeve, ETFE, for 6.1543.xxx, SGJ 9 
1 or 1	6.2751.080 6.2751.100	Splash protection/Safety shield (778 Model) Splash protection/Safety shield (789 Model)
1	6.2122.xxx	Mains cable with coupling type IEC 320/C13 Plug as per customer's requirements: - Type SEV 12 (Switzerland...) 6.2122.020 - Type CEE(7), VII (Germany...) 6.2122.040 - Type NEMA/ASA (USA...) 6.2122.070
1	8.789.1063	Metrohm Sample Processor Instructions for Use , English
1	8.789.1013	Quick reference Metrohm Sample Processor, English
1	8.789.1023	Metrohm Sample Processor Operating Tutorial, English
1	8.789.1033	Technical Reference: Metrohm Sample Processors, English

Order no. 2.789.0110 or 2.778.0110 (model versions with 2 towers and 2 pumps)
The following accessories are included as standard:

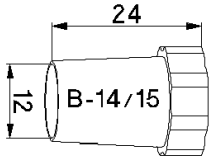
No.	*Order no.*	*Description*
1	1.789.0110 1.778.0110	**789 Robotic Sample Processor XL** or **778 Sample Processor** 2 working stations with rinsing equipment.
4	6.1236.020	Sleeve SGJ14/12 mm 
10	6.1446.000	Plastic stoppers SGJ14 
6	6.1446.010	Stopper SGJ9 

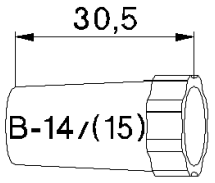
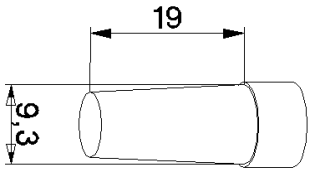
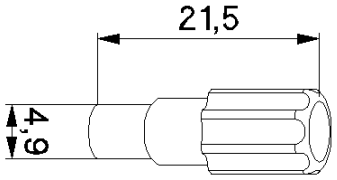
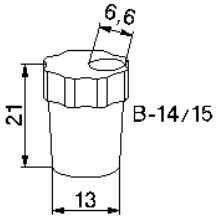
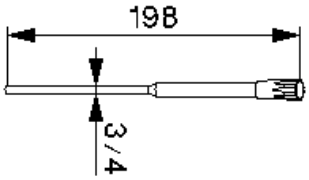
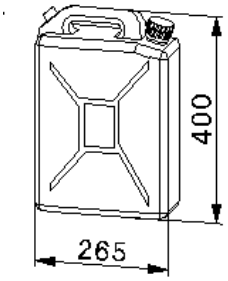
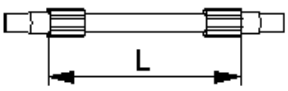
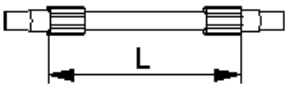
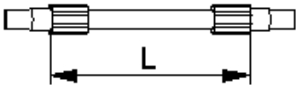
2	6.1446.040	Threaded stopper M6	
2	6.1621.000	PE canister 10 L Use as rinsing solution or waste container	
2	6.1805.110	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 80 cm	
6	6.1805.420	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 48 cm	
2	6.1812.000	PTFE tubing L = 400 cm	
2	6.1828.000	Connection nipple for canister 6.1621.000	
2	6.2053.000	Cable clips 10x for mounting cables	
1	6.2142.040	Keypad for 778/789 Sample Processor	
1	6.2621.030	Hexagon key 4 mm	
1	6.2621.070	Hexagon key 5 mm	

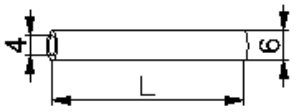
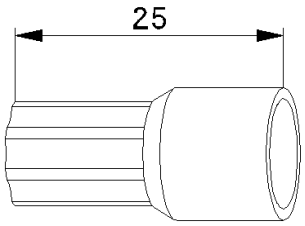
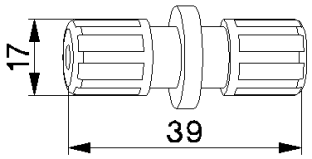
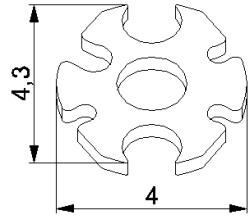
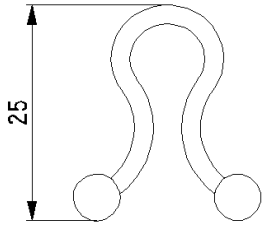
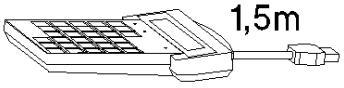
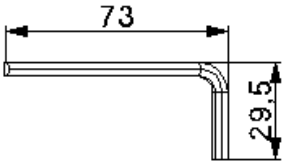
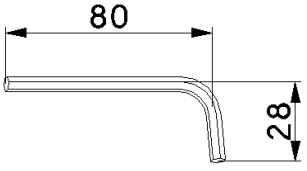
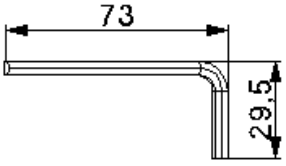
1	6.2621.140	Hexagon key 2.5 mm	
6	6.2709.070	Guide sleeve, ETFE, for 6.1543.xxx, SGJ 9	
6	6.2740.020	Spray nozzle, ETFE With valve and M6 thread	
1 or 2	6.2751.090 6.2751.100	Splash protection/Safety shield (778 Model) Splash protection/Safety shield (789 Model)	
1	6.2122.xxx	Mains cable with coupling type IEC 320/C13 Plug as per customer's requirements: - Type SEV 12 (Switzerland...) 6.2122.020 - Type CEE(7), VII (Germany...) 6.2122.040 - Type NEMA/ASA (USA...) 6.2122.070	
1	8.789.1063	Metrohm Sample Processor Instructions for Use , English	
1	8.789.1013	Quick reference Metrohm Sample Processor, English	
1	8.789.1023	Metrohm Sample Processor Operating Tutorial, English	
1	8.789.1033	Technical Reference: Metrohm Sample Processors, English	

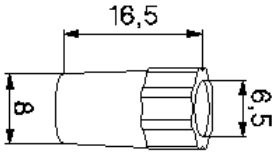
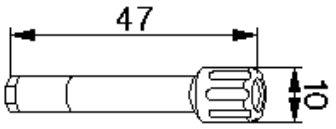
Order no. 2.789.0120 or 2.778.0120 (model versions with 2 towers and 4 pumps)

The following accessories are included as standard:

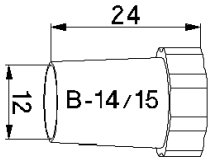
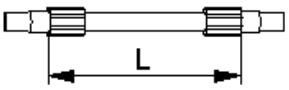
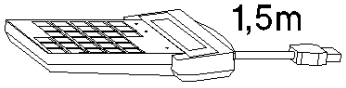
No.	*Order no.*	*Description*	
1	1.789.0120 1.778.0120	**789 Robotic Sample Processor XL** or **778 Sample Processor** 2 working stations with rinsing and aspiration equipment.	
4	6.1236.020	Sleeve SGJ14/12 mm	

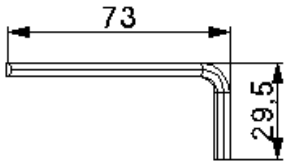
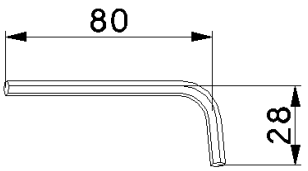
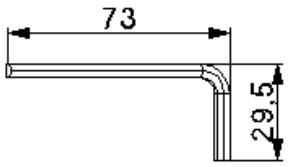
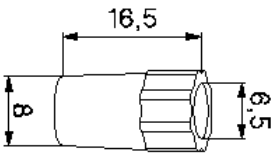
10	6.1446.000	Plastic stopper SGJ14	
6	6.1446.010	Stopper SGJ 9	
2	6.1446.040	Threaded stopper M6	
2	6.1446.160	Stopper SGJ 14/6.6 mm Made of PTFE For positioning inserts obliquely in the titration head	
2	6.1543.170	Aspiration tip, PTFE With M8 thread	
4	6.1621.000	PE canister 10 L For Sample Processor use as rinsing solution or waste container	
2	6.1805.110	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 80 cm	
6	6.1805.420	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 48 cm	
2	6.1805.510	PTFE tubing with anti-kink protection With 2 tubing nipples M8, L = 60 cm Inner diameter: 3 mm	

4	6.1812.000	PTFE tubing L = 400 cm	
2	6.1820.030	Screw connector with M8 thread For 6.1812.XXX and 6.1805.XXX Tubing	
4	6.1828.000	Connection nipple for canister 6.1621.000	
2	6.2042.020	Buret tip clip	
2	6.2053.000	Cable clips 10x for mounting cables	
1	6.2142.040	Keypad for 778/789 Sample Processor	
1	6.2621.030	Hexagon key 4 mm	
1	6.2621.070	Hexagon key 5 mm	
1	6.2621.140	Hexagon key 2.5 mm	

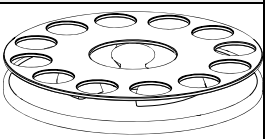
6	6.2709.070	Guide sleeve, ETFE, for 6.1543.xxx, SGJ 9 
6	6.2740.020	Spray nozzle, ETFE With valve and M6 thread 
1 or 2	6.2751.090 6.2751.100	Splash protection/Safety shield (778 Model) Splash protection/Safety shield (789 Model)
1	6.2122.xxx	Mains cable with coupling type IEC 320/C13 Plug as per customer's requirements: - Type SEV 12 (Switzerland...) 6.2122.020 - Type CEE(7), VII (Germany...) 6.2122.040 - Type NEMA/ASA (USA...) 6.2122.070
1	8.789.1063	Metrohm Sample Processor Instructions for Use , English
1	8.789.1013	Quick reference Metrohm Sample Processor, English
1	8.789.1023	Metrohm Sample Processor Operating Tutorial, English
1	8.789.1033	Technical Reference: Metrohm Sample Processors, English

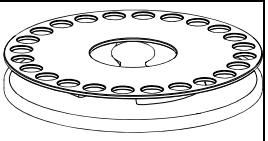
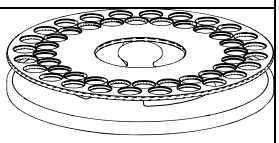
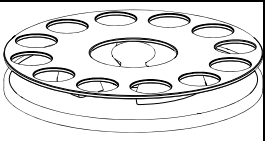
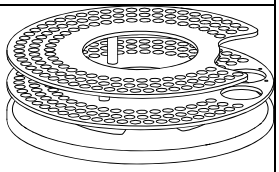
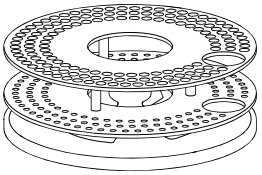
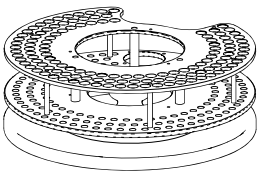
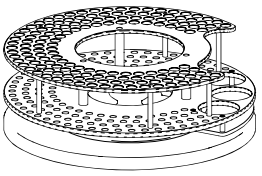
Order no. 2.789.0130 or 2.778.0130 (model versions with 2 towers, no pumps)
The following accessories are included as standard:

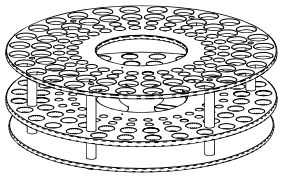
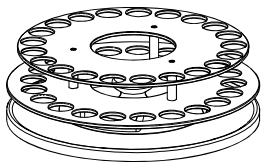
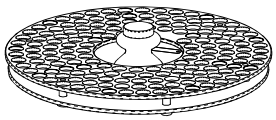
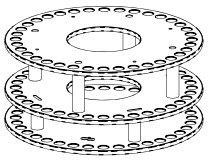
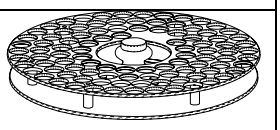
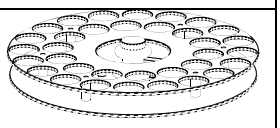
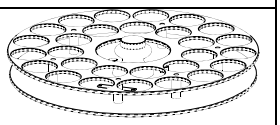
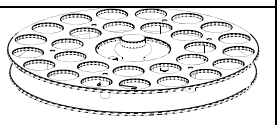
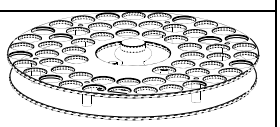
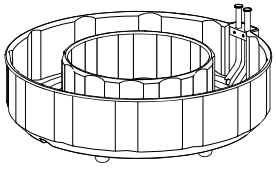
No.	*Order no.*	*Description*
1	1.789.0130 1.778.0130	**789 Robotic Sample Processor XL** or **778 Sample Processor** 2 working stations
4	6.1236.020	Sleeve SGJ14/12 mm 
2	6.1805.110	FEP tubing with light and anti-kink protection, with 2x M6 connections L = 80 cm 
1	6.2142.040	Keypad for 778/789 Sample Processor 

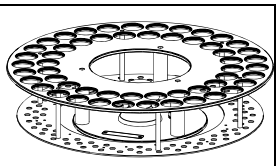
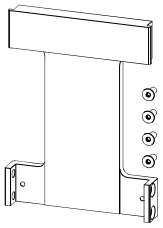
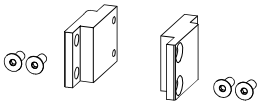
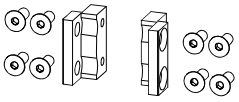
1	6.2621.030	Hexagon key 4 mm	
1	6.2621.070	Hexagon key 5 mm	
1	6.2621.140	Hexagon key 2.5 mm	
6	6.2709.070	Guide sleeve, ETFE, for 6.1543.xxx, NS 9	
1 2	6.2751.090 or 6.2751.100	Splash protection/Safety shield (778 Model) Splash protection/Safety shield (789 Model)	
1	6.2122.xxx	Mains cable with coupling type IEC 320/C13 Plug as per customer's requirements: - Type SEV 12 (Switzerland...) 6.2122.020 - Type CEE(7), VII (Germany...) 6.2122.040 - Type NEMA/ASA (USA...) 6.2122.070	
1	8.789.1063	Metrohm Sample Processor Instructions for Use , English	
1	8.789.1013	Quick reference Metrohm Sample Processor, English	
1	8.789.1023	Metrohm Sample Processor Operating Tutorial, English	
1	8.789.1033	Technical Reference: Metrohm Sample Processors, English	

6.3.2 Sample racks and sample beakers

Order no.	*Description*	
6.2041.310	**Sample rack 12 x 250 mL** (d=416 mm) for	
6.1432.320	Metrohm sample beakers, glass 250 mL	
6.1453.220	Metrohm sample beakers, PP 200 mL	
6.1453.250	Metrohm sample beakers, PP 250 mL	

6.2041.320	**Sample rack 16 x 150 mL** for Standard glass beakers (tall form)	
6.2041.340 6.1432.210 6.1458.020	**Sample rack 24 x 75 mL** (d=416 mm) for Metrohm sample beakers, glass 75 mL, Micro titration head required	
6.2041.350 6.1432.210	**Sample rack** *) **48 x 75 mL** (d=416 mm) for direct titration in Metrohm sample beakers, glass 75 mL	
6.2041.360 6.1459.310	**Sample rack 12 x 150 mL** (d=416 mm) for 150 mL standard glass beakers (tall form) 200 mL disposable beakers PP (1000 pcs.)	
6.2041.370 6.1459.310	**Sample rack 14 x 200 mL** (d=416 mm) for 200 mL disposable beakers (EU) PP	
6.2041.380	**Sample rack 14 x 8 oz** (d=416 mm) for Disposable beakers (US) PP 8 oz	
6.2041.390	**Sample rack 16 x 8 oz** (d=416 mm) for Disposable beakers (US) PP 8 oz	
6.2041.400 6.1432.320 6.1453.220 6.1453.250	**Sample rack** *) **126 x 15 mL and 2 x 250 mL** (d=416 mm) for test tubes 11 mL and Metrohm sample beakers, glass 250 mL or Metrohm sample beakers, PP 200 mL	
6.2041.410 6.2743.057	**Sample rack***) **141 x 11 mL und 1 x 500 mL** (d=416 mm) for 11 mL test tubes and 500 mL standard glass beakers	
6.2041.430 6.2743.057 6.1608.080	**Sample rack***) **127 x 11 mL und 2 x 300 mL** (d=416 mm) for 11 mL test tubes and 300 mL PE bottles	
6.2041.440 6.2743.057 6.1608.080	**Sample rack***) **148 x 11 mL und 3 x 300 mL** (d=416 mm) for 11 mL test tubes and 300 mL PE bottles	

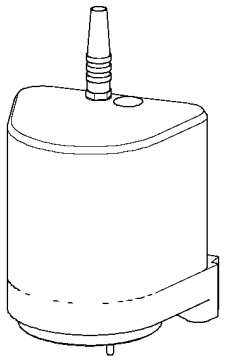
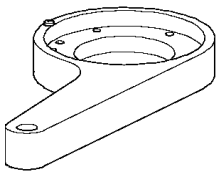
6.2041.450 6.2743.057 6.2747.010	**Sample rack*) 56 x 11 mL + 56 x 50 mL** (d=476 mm) for 11 mL test tubes and 50 mL PP sample beaker	
6.2041.460 6.2058.010	**Sample rack 21 x 100 mL** (d=416 mm) for 100 mL COD tubes Tower extension required	
6.2041.710 6.2419.000 6.1448.050	**Sample rack** *) **160 x 6 mL** (d=416 mm) for 6 mL vials (1000 pcs.) with septum seals (1000 pcs.)	
6.2041.750 6.2743.057	**Sample rack** *) **36 x 11 mL** (d=269 mm) for 11 mL test tubes	
6.2041.800 6.1432.210	**Sample rack** *) **100 x 75 mL** (d=476 mm) For use with 789 XL and 815 XL only, for Metrohm sample beakers, glass 75 mL	
6.2041.810	**Sample rack** *) **34 x 150 mL** (d=476 mm) For use with 789 XL and 815 XL only, for 150 mL standard glass beakers (tall form)	
6.2041.820 6.1432.320 6.1453.220 6.1453.250	**Sample rack** *) **28 x 250 mL** (d=476 mm) For use with 789 XL and 815 XL only, for Metrohm sample beakers, glass 250 mL Metrohm sample beakers, PP 200 mL Metrohm sample beakers, PP 250 mL	
6.2041.830 6.1459.310	**Sample rack** *) **28 x 200 mL** (d=476 mm) For use with 789 XL and 815 XL only, for Metrohm sample beakers, PP 200 mL	
6.2041.840 6.1459.300	**Sample rack** *) **59 x 120 mL** (d=476 mm) For use with 789 XL and 815 XL only, for Metrohm sample beakers, PP 120 mL	
6.2840.000	**Water bath with thermostat connector** *) for 789 Robotic Sample Processor XL or 815 Robotic USB Sample Processor XL	

6.2041.900 6.1432.210	**Rack insert for water bath 6.2840.000** *) **54 x 75 mL** for 75 mL Metrohm sample beakers, glass	
6.2058.010	**Tower extension** for COD applications	
6.2058.020	**Titration head extension (30 mm)**	
6.2058.030	**Titration head extension (9 mm) for water bath rack 6.2041.900** *)	

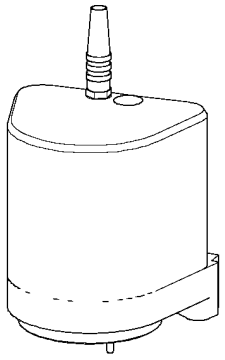
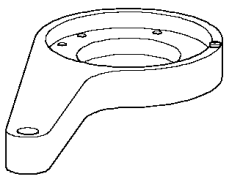
*) 786 Swing Head necessary

6.3.3 786 Swing Head

Order no. 2.786.0010 (model version 'transfer' with pipetting accessories)

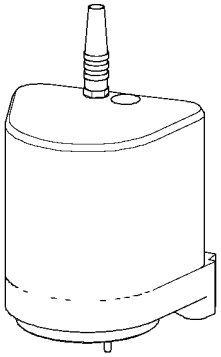
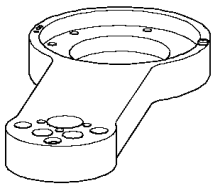
No.	*Order no.*	*Description*
1	**1.786.0010**	**786 Swing Head** High-precision drive for robotic arm 
1	6.1462.030	Robotic arm for sample transfer, for left-swinging assembly 
1	6.1562.100	Pipetting tubing 10 mL
1	6.1823.010	Guide shaft for pipetting tubing
1	6.2621.120	Hexagon key 1.5 mm
2	V.024.4012	Countersunk head screw M.I-6 KT.
1	8.786.1013	Instructions for Use for 786 Swing Head, english

Order no. 2.786.0020 (model version 'transfer' with pipetting accessories)

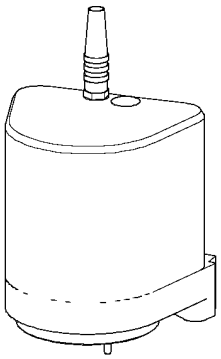
No.	*Order no.*	*Description*
1	**1.786.0010**	**786 Swing Head** High-precision drive for robotic arm 
1	6.1462.040	Robotic arm for sample transfer, for right-swinging assembly 
1	6.1562.100	Pipetting tubing 10 mL
1	6.1823.010	Guide shaft for pipetting tubing

1	6.2621.120	Hexagon key 1.5 mm
2	V.024.4012	Countersunk head screw M.I-6 KT.
1	8.786.1013	Instructions for Use for 786 Swing Head, english

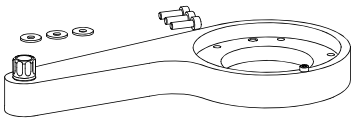
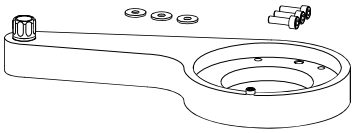
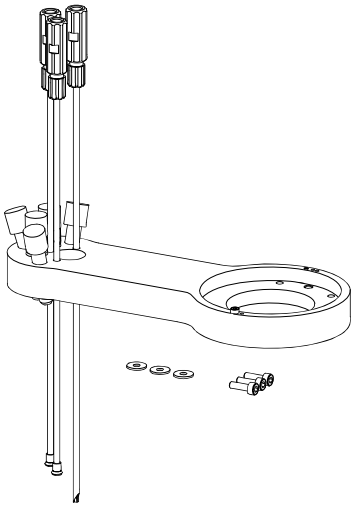
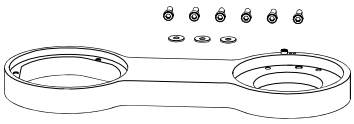
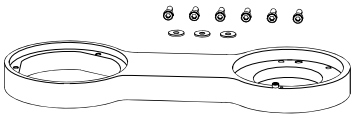
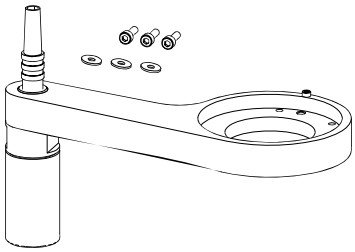
Order no. 2.786.0030 (model version with titration accessories)

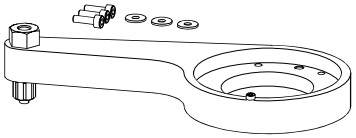
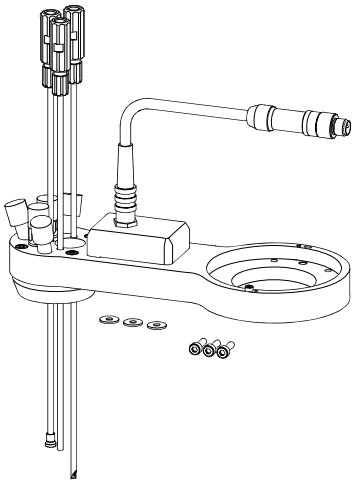
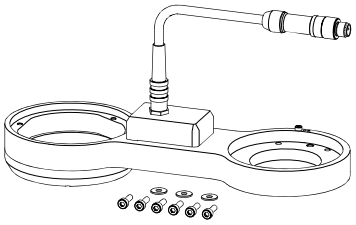
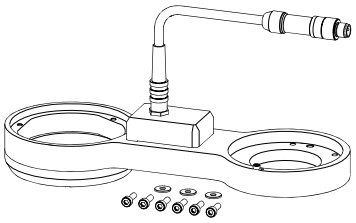
No.	*Order no.*	*Description*
1	**1.786.0010**	**786 Swing Head** High-precision drive for robotic arm 
1	6.1462.050	Robotic arm with micro titration head 
1	6.1909.030	Stirrer propeller PP (104 mm) KF
2	6.2042.030	Buret tip clip
1	6.2621.120	Hexagon key 1.5 mm
2	V.024.4012	Countersunk head screw M.I-6 KT.
1	8.786.1013	Instructions for Use for 786 Swing Head, english

Order no. 2.786.0040 (model version with no robotic arm)

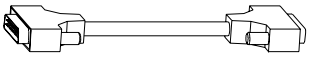
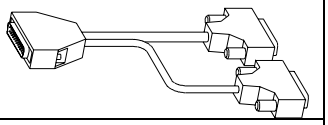
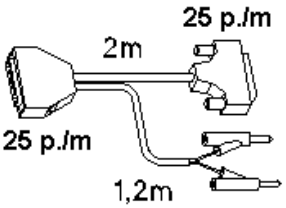
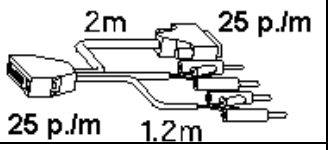
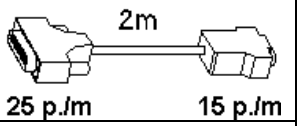
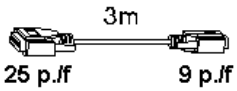
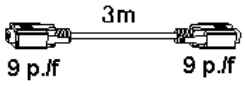
No.	*Order no.*	*Description*
1	**1.786.0010**	**786 Swing Head** High-precision drive for robotic arm 
1	6.2621.120	Hexagon key 1.5 mm
2	V.024.4012	Countersunk head screw M.I-6 KT.
1	8.786.1013	Instructions for Use for 786 Swing Head, english

Robotic arms for 786 Swing Head

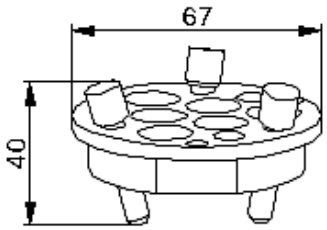
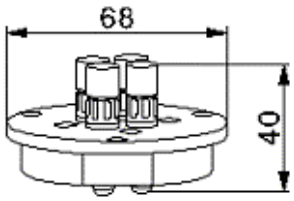
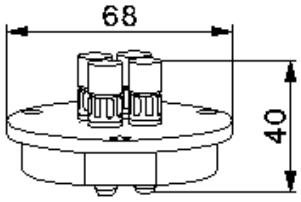
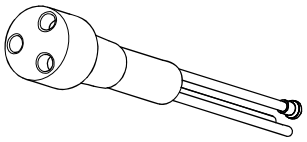
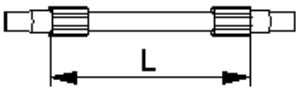
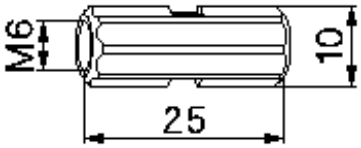
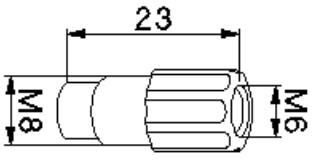
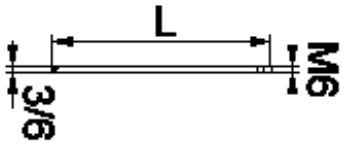
Order no.	*Description*	
6.1462.030 6.1562.100	**Robotic arm 'transfer'**, L=112 mm swing-left mounting, for 10 mL pipetting tubing	
6.1462.040 6.1562.100	**Robotic arm 'transfer'**, L=112 mm swing-right mounting, for 10 mL pipetting tubing	
6.1462.050	**Robotic arm 'titration'**, L=110 mm swing-left and swing-right mounting use with 75 mL sample beakers (6.1432.210) or greater	
6.1462.060 6.1458.010 6.1458.020 6.1458.030	**Robotic arm 'macro'**, L=127 mm swing-left mounting, use with Titration head " "	
6.1462.070 6.1458.010 6.1458.020 6.1458.030	**Robotic arm 'macro'**, L=127 mm swing-right mounting, use with Titration head " "	
6.1462.080 6.2037.050 6.2037.060	**Dis-Cover robotic arm,** L=112 mm, swing-left mounting, with magnetic contact, for decapping and covering of samples with lid for 75 mL sample beakers or lid for 250 mL sample beakers	

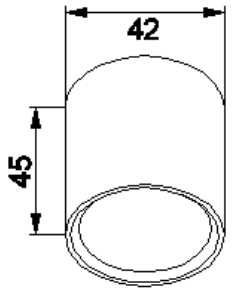
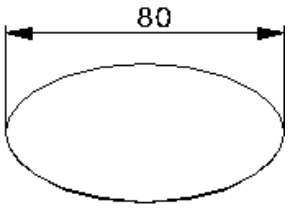
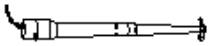
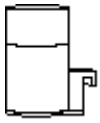
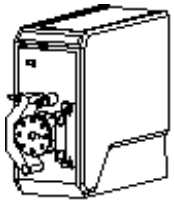
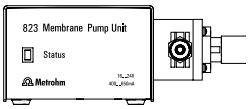
6.1462.090 6.2816.100 2.1562.110	**LQ robotic arm 'transfer'**, L=112 mm, swing-right mounting, with Luer lock adapter for Double-hollow needle with vent and 2 mL Pipetting tubing	
6.1462.150	**Robotic arm 'titration'**, with contact beaker sensor (piezo), L=110 mm swing-right/-left mounting, installation both ways possible use with 75 mL sample beakers (6.1432.210) or greater	
6.1462.160 6.1458.010 6.1458.020 6.1458.030	**Robotic arm 'macro'**, with contact beaker sensor (piezo), L=127 mm, swing-left mounting, use with Titration head " "	
6.1462.170 6.1458.010 6.1458.020 6.1458.030	**Robotic arm 'macro'**, with contact beaker sensor (piezo), L=127 mm, swing-right mounting, use with Titration head " "	

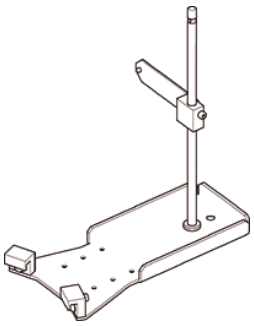
6.3.4 Connection cables

Order no.	*Description*
6.2141.020	**Remote cable**— Titrino/Titrando/ 692/712/713/780/781 
6.2141.030	**Remote cable**— 2xTitrino/Titrando/692/712/713/780/781 
6.2141.040	**Remote cable**— Titrino/Titrando — Dosimat 765/776 
6.2141.050	**Remote cable**— Titrino/Titrando — Dosimat 2x 765/776 
6.2141.060	**Remote cable**— pH-Meter 691 
6.2142.070	**Remote cable**— pH-Meter 692/712/713/780/781 — Dosimat 765/776
6.2125.110	**RS232 Connection cable** for the serial connection Metrohm instrument — PC, 25 pin/f to 9 pin/f 
6.2134.040	**RS232 Connection cable** for the serial connection Metrohm instrument — PC, 9 pin/f to 9 pin/f 

6.3.5 Optional accessories and additional devices

Order no.	*Description*
6.1458.010	Macro titration head, PTFE for Sample Processors With 6 openings SGJ 14 and 3 openings SGJ 9 Suitable for rinsing and aspiration equipment. 
6.1458.020	Micro titration head, PTFE for Sample Processors With 4xM10 thread connectors 
6.1458.030	Sample Processor titration head for Karl Fischer titrations, PTFE 
6.0340.000	Double Pt electrode for Sample Processor
6.1543.210	3-fold stopper NS 14, with anti-diffusion micro tip 
6.1805.060	FEP tubing with 2 tubing nipples M6, inner diameter 2 mm, with light and anti-kink protection L = 60 cm 
6.1808.000	Coupling bush, ETFE 3x M6 threads 
6.1808.090	Thread adapter, PVDF Thread M8 outer / M6 inner 
6.1821.000	Aspiration tube, PTFE L = 178 mm 

6.2037.040	Foil holder for sample beaker 6.1432.210, 24 pcs. for Al foil 6.2820.000, see below 
6.2820.000	Al foil 1000 disks 80 mm dia. Thickness 0.010 mm 
E.301.0022	O-Rings 5.28/1.78 mm
E.301.0080	O-Rings 28/5 mm
2.802.0020 6.1909.020 6.1909.040	**802 Rod Stirrer**  with PP propeller or PTFE propeller, optional
2.741.0010	**741 Magnetic Stirrer** 
2.772.0110 **2.772.0120** **2.772.0130**	**772 Pump Unit**  Peristaltic pump, with standard accessories 16…24 V, M8 connector **772 Pump Unit, with aspiration equipment** **772 Pump Unit, with rinsing equipment**
2.823.0010 **2.823.0020** **2.823.0030**	**823 Membrane Pump Unit**  Membrane pump, with standard accessories 16…24 V, M8 connector **823 Membrane Pump Unit, with aspiration equipment** **823 Membrane Pump Unit, with rinsing equipment**

6.2001.070	**Support stand for Sample Processor** Suitable for Sample Processor models 778/ 789/814/815 For mounting external titration cells and other accessories, including 801 Stirrer or 804 Ti Stand 
6.6056.xx1	**tiamo light** PC software for controlling a titration or dosing system. Up to two instruments can be connected.
6.6056.xx2	**tiamo full** PC software for controlling complex titration or dosing systems.
6.6056.xx3	**tiamo multi** Client/Server software for controlling complex titration or dosing systems.

6.3.6 Electrodes for automation

For titrations with the macro titration head we recommend the use of long-life electrodes (LL) or Titrodes (without glass joint) with 6.1236.040 Sleeve made of silicone rubber.

Order no.	*Description*	
6.0229.100	**Solvotrode**	12.5 cm
6.0232.100	**Ecotrode**	12.5 cm
6.0253.100	**Aquatrode**	12.5 cm
6.0258.000	**Unitrode**	12.5 cm
6.0431.100	**Ag-Titrode**	12.5 cm
6.0430.100	**Pt-Titrode**	12.5 cm

If the micro titration head or the 786 Swing Head is used for direct titration then the following special micro-electrodes can be used.

Order no.	*Description*	
6.0234.110	**Comb. Micro pH electrode (LL)**	16 cm
6.0736.110	**Micro reference electrode Ag/AgCl**	16 cm
6.0134.110	**Micro glass electrode**	16 cm
6.0433.110	**Micro Ag-Titrode**	16 cm
6.0434.110	**Micro Pt-Titrode**	16 cm
6.0435.110	**Micro Au-Titrode**	16 cm
6.1110.110	**Pt 1000 Temperature sensor**	16 cm

6.4 Warranty and conformity

6.4.1 Warranty (guarantee)

Metrohm guarantees that the deliveries and services it provides are free from material, design or manufacturing errors. The warranty period is 36 months from the day of delivery; for day and night operation it is 18 months. The warranty remains valid on condition that the service is provided by an authorized Metrohm service organization.

Glass breakage is excluded from the warranty for electrodes and other glassware. The warranty for the accuracy corresponds to the technical specifications given in the 'Instructions for Use' of the instrument. For components from third parties that make up a considerable part of our instrument, the manufacturer's warranty provisions apply. Warranty claims cannot be pursued if the Customer has not complied with the obligations to make payment on time.

During the warranty period Metrohm undertakes, at its own choice, to either repair at its own premises, free of charge, any instruments that can be shown to be faulty or to replace them. Transport costs are to the Customer's account.

Faults arising from circumstances that are not the responsibility of Metrohm, such as improper storage or improper use, etc. are expressly excluded from the warranty.

6.4.2 Declaration of Conformity (778 Sample Processor)

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity

778 Sample Processor

Metrohm
Ion analysis
CH-9101 Herisau, Switzerland
E-Mail info@metrohm.com
www.metrohm.com

Description Sample changer with advanced Liquid Handling abilities for the automation of batch processing of larger sample series, applying titration, dosing and measuring methods in analytical laboratories.

This instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility: Emission
EN/IEC 61326, EN 55022 / CISPR 22, EN/IEC 61000-3-2

Electromagnetic compatibility: Immunity
EN/IEC 61326, EN/IEC 61000-4-2, EN/IEC 61000-4-3, EN/IEC 61000-4-4, EN/IEC 61000-4-5, EN/IEC 61000-4-6, EN/IEC 61000-4-8, EN/IEC 61000-4-11, EN/IEC 61000-4-14, NAMUR

Safety specifications
EN/IEC 61010-1, UL 3101-1 protection class I

It has also been certified by ElectroSuisse, a member of the International Certification Body (CB/IEC).

CE *The instrument meets the requirements of the CE mark as contained in the EU directives 89/336/EEC and 73/23/EEC and fulfils the following specifications:*

EN 61326-1 Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use

Metrohm Ltd. is holder of the SQS-certificate ISO 9001:2000 Quality management system for development, production and sales of instruments and accessories for ion analysis.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance.

The technical specifications are documented in the instruction manual.

Herisau, March 31, 2003

Dr. J. Frank
Vice President
Head of R&D

Ch. Buchmann
Vice President
Head of Production
Responsible for Quality Assurance

6.4.3 Declaration of Conformity (789 Robotic Sample Processor XL)

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity

789 Robotic Sample Processor XL

Metrohm
Ion analysis
CH-9101 Herisau, Switzerland
E-Mail info@metrohm.com
www.metrohm.com

Description Sample changer with advanced Liquid Handling abilities for the automation of batch processing of larger sample series, applying titration, dosing and measuring methods in analytical laboratories.

This instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility: Emission
EN/IEC 61326, EN 55022 / CISPR 22, EN/IEC 61000-3-2

Electromagnetic compatibility: Immunity
EN/IEC 61326, EN/IEC 61000-4-2, EN/IEC 61000-4-3, EN/IEC 61000-4-4, EN/IEC 61000-4-5, EN/IEC 61000-4-6, EN/IEC 61000-4-8, EN/IEC 61000-4-11, EN/IEC 61000-4-14, NAMUR

Safety specifications
EN/IEC 61010-1, UL 3101-1 protection class I

It has also been certified by ElectroSuisse, a member of the International Certification Body (CB/IEC).

CE *The instrument meets the requirements of the CE mark as contained in the EU directives 89/336/EEC and 73/23/EEC and fulfils the following specifications:*

EN 61326-1 Electrical equipment for measurement, control and laboratory use – EMC requirements
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Metrohm Ltd. is holder of the SQS-certificate ISO 9001:2000 Quality management system for development, production and sales of instruments and accessories for ion analysis.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance.

The technical specifications are documented in the instruction manual.

Herisau, March 31, 2003

Dr. J. Frank
Vice President
Head of R&D

Ch. Buchmann
Vice President
Head of Production
Responsible for Quality Assurance

6.4.4 Quality Management Principles

Metrohm Ltd., CH-9101 Herisau, Switzerland

Metrohm
Ion analysis
CH-9101 Herisau/Switzerland
E-Mail info@metrohm.com
Internet www.metrohm.com

Metrohm Ltd. holds the ISO 9001 Certificate, registration number 10872-02, issued by SQS (Swiss Association for Quality and Management Systems). Internal and external audits are carried out periodically to assure that the standards defined by Metrohm's QM Manual are maintained.

The steps involved in the design, manufacture and servicing of instruments are fully documented and the resulting reports are archived for ten years. The development of software for PCs and instruments is also duly documented and the documents and source codes are archived. Both remain the possession of Metrohm. A non-disclosure agreement may be asked to be provided by those requiring access to them.

The implementation of the ISO 9001:2000 quality system is described in Metrohm's QM Manual, which comprises detailed instructions on the following fields of activity:

Instrument development

The organization of the instrument design, its planning and the intermediate controls are fully documented and traceable. Laboratory testing accompanies all phases of instrument development.

Software development

Software development occurs in terms of the software life cycle. Tests are performed to detect programming errors and to assess the program's functionality in a laboratory environment.

Components

All components used in the Metrohm instruments have to satisfy the quality standards that are defined and implemented for our products. Suppliers of components are audited by Metrohm as the need arises.

Manufacture

The measures put into practice in the production of our instruments guarantee a constant quality standard. Production planning and manufacturing procedures, maintenance of production means and testing of components, intermediate and finished products are prescribed.

Customer support and service

Customer support involves all phases of instrument acquisition and use by the customer, i.e. consulting to define the adequate equipment for the analytical problem at hand, delivery of the equipment, user manuals, training, after-sales service and processing of customer complaints. The Metrohm service organization is equipped to support customers in implementing standards such as GLP, GMP, ISO 900X, in performing Operational Qualification and Performance Verification of the system components or in carrying out the System Validation for the quantitative determination of a substance in a given matrix.

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