838 Advanced Sample Processor

Instructions for Use

8.838.1013

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838 Advanced Sample Processor

Program version 5.838.0012

Instructions for Use

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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

Like all Metrohm Sample Processors, the 838 Advanced Sample Processor can be operated as stand-alone device or be controlled entirely by a PC software (e. g. «IC Net»). In the latter case the particular functions of the instrument are invoked directly by the PC software. The keypad of the 838 Advanced Sample Processor therefore is not necessary.

In a stand-alone system with a keypad connected, the 838 Advanced Sample Processor can execute methods containing command sequences automatically. These sequences may be programmed freely in a wide range. The Sample Processor can even be operated manually to prepare a sample series.

«IC Net 2.3» (Service release 3 or later) sets a parameter in the 838 Advanced Sample Processor, which forces the Sample Processor to reset all of it's device settings and delete all stored methods on start-up (RAM init). This behavior is intended and necessary for controlling the Sample processor with «IC Net».

If a 838 Advanced Sample Processor is to be used as a stand-alone system with keypad control and instrument methods, which previously was controlled by «IC Net 2.3», the setting mentioned above has to be switched off beforehand. In «IC Net» uncheck the check box "Autoinit" which is accessible after right-clicking the Sample Processor icon in the working system.

The 838 Advanced Sample Processor is delivered with four standard methods for voltammetric analysis. These can be used in the connection with the Metrohm 797 VA Computrace.

Operating and programming of the 838 Advanced Sample Processor is described in this Instructions for Use.

1.1 Information about these Instructions for Use

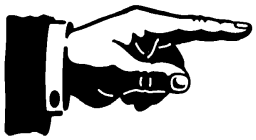
1.1.1 Note

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

1.1.2 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.



2 Operation

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

2.1 Operating principles

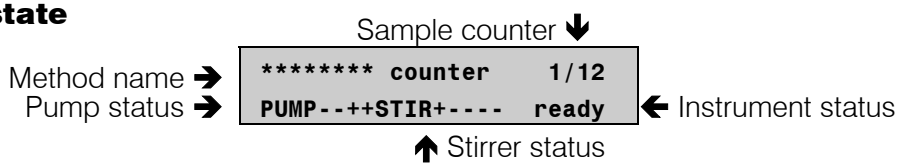
2.1.1 Display

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

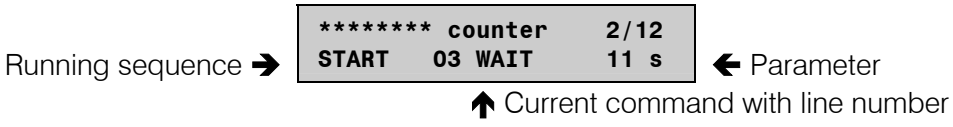
The first line is used as the title line and shows the current method together with the number of processed samples. In the editing mode the menu titles are shown here.

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.

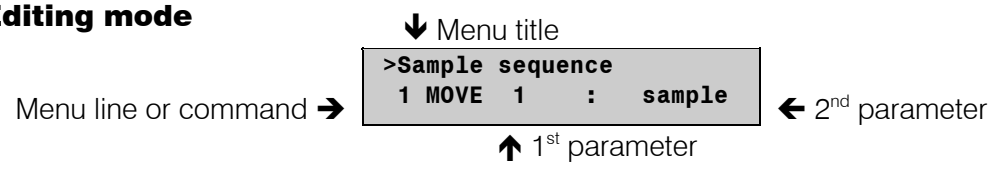
Normal state



Method sequence



Editing mode



2.1.2 Keypad

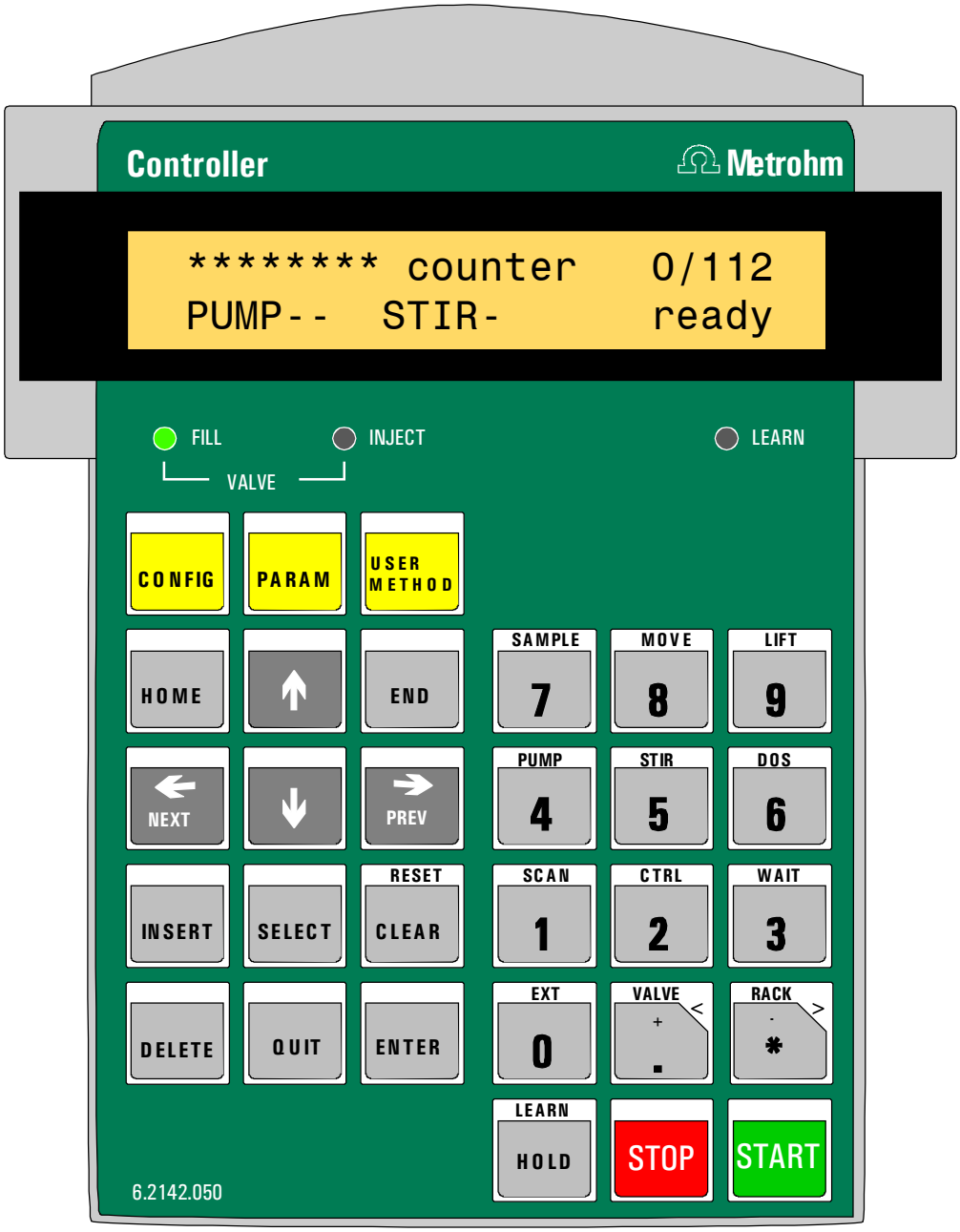


Fig. 1 Key pad

Below the 2-line display there are three LEDs. The two LEDs '**FILL**' and '**INJECT**' indicate the current position of the injection valve. 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 al-

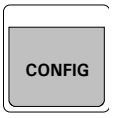
tering parameters. For entering parameters the numerical block on the right-hand side of the keypad is also available.

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

If the Sample Processor is integrated in a PC-controlled automation system and is entirely controlled via the RS232 interface, it is possible to operate the instrument without the keypad.

2.1.3 The keys

The menu keys

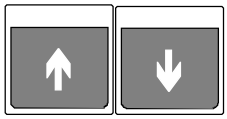


The **<CONFIG>** key opens the selection menu for the configuration of the Sample Processor.

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

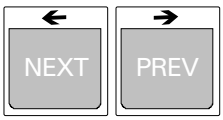


With the **<↑>** and **<↓>** keys the lift can be moved up and down respectively. The lowest possible lift position is defined by the configuration parameter '**max. stroke path**'.

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

With the **<HOME>** key the lift 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. 20).

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

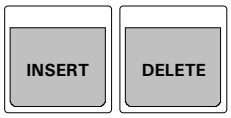


With the **<← NEXT>** and **<→ PREV>** keys the sample rack can be rotated forward or backward by one position. If necessary, the lift is automatically raised to the shifting position. When the rack position has been reached the robotic arm will automatically be aligned to the corresponding rack position.

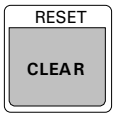
➲ During data input the **<SELECT>** key is used to select a predefined entry from a selection list.

The **<SELECT>** key allows to select from a given list of entries when editing a parameter.

Editing and sequence control



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

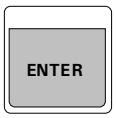


The **<CLEAR/RESET>** key is used to initialize the Sample Processor and dosing devices. This corresponds to the switching-on process.

➲ 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. 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.

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.

When a method is started a second time, without switching off and on again, the last accessed sample position is memorized and be applied in the next method run.

Raises or lowers the lift. 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.

The **<PUMP>** key is used for switching the peristaltic pump. The pump rate can be selected in 15 steps. Selecting a sign (+ or –) with the pump rate allows to set the direction of the rotation of the pump drive.

Under **<PARAM>**, `>manual stop` you can define whether the peristaltic pump 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.
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 exchange 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.

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).

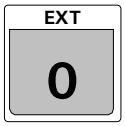
If the serial RS232 interface (**RS**) is selected then the data string received via this interface will be shown (14 characters per line).

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 predefined binary pattern (**<SELECT>** selection), e.g. **PUMP R/S 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.

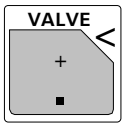


The **<EXT>** key is used to switch on and off the pump connectors on the rear side of the tower. On entry of the address of the connector (1 or 2) the current state of the connected pump is switched, i. e. a currently active pump is switched on.
The display indicates the current state of the pump conncectors (i. e. **PUMP–+**; **+** means active, **–** means inactive).

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 pump connectors should be switched off with the **<STOP>** key or not.

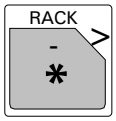


The **<VALVE>** key is used to switch the position of the injection valve at the tower of the Advanced Sample Processor.

Example:

VALVE: inject

<ENTER> switches the injection valve to the displayed position.
This function is only working in the Sample Processor models 2.838.0x20 with built-in injection valve.



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. The **SAMPLE** variable (= rack position of the current sample) is reset to 1.

Sequence control

The **<START>** key starts a method. A start is only possible when the Advanced 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. Fehler! Textmarke nicht definiert..

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 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 Advanced Sample Processor switches automatically to the **HOLD** condition after **<QUIT>**.

2.1.4 Instrument dialog

The instrument dialog of the Advanced Sample Processors 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.

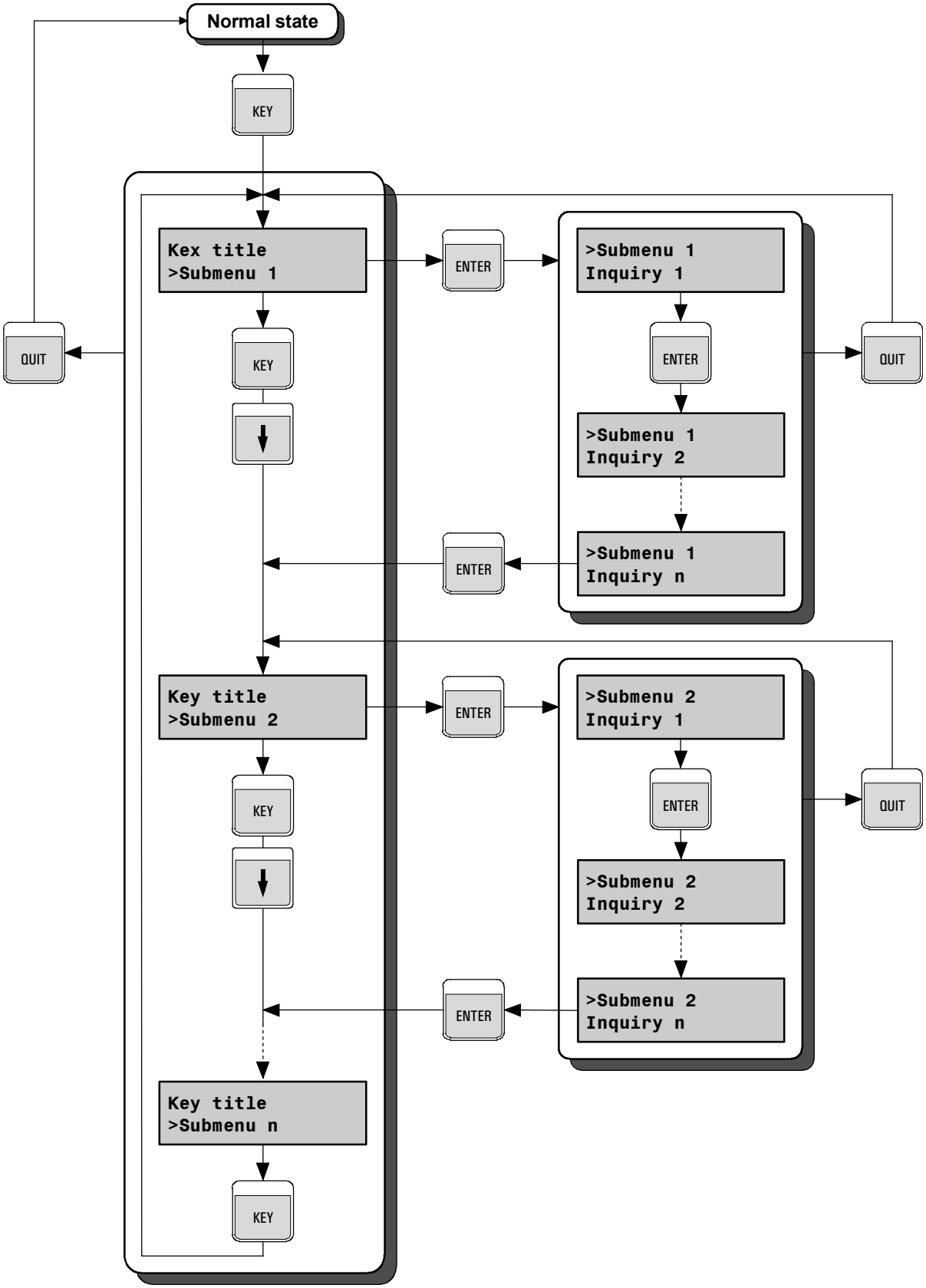
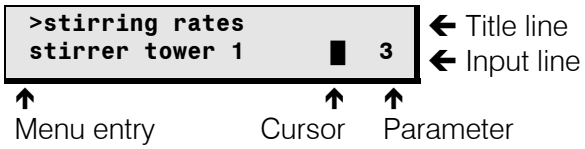


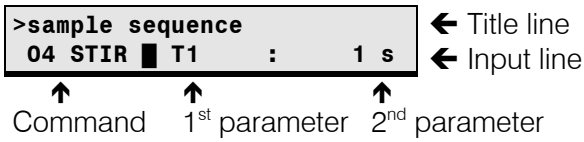
Fig. 2 Dialog arrangement

2.1.5 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> list

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:

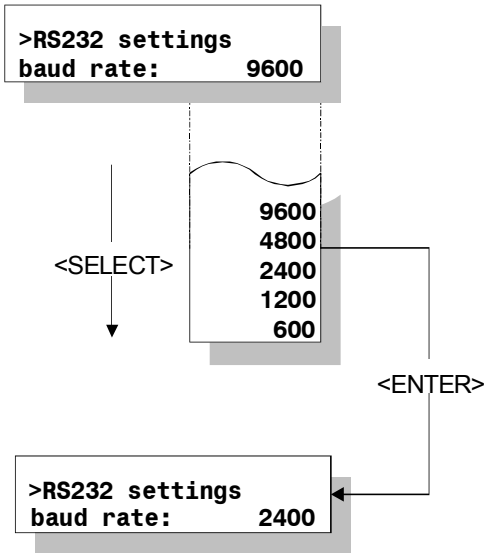
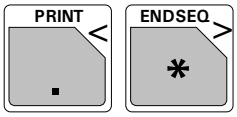


Fig. 3 Selection list

2.1.6 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).

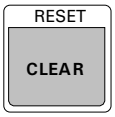
Character selection

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:

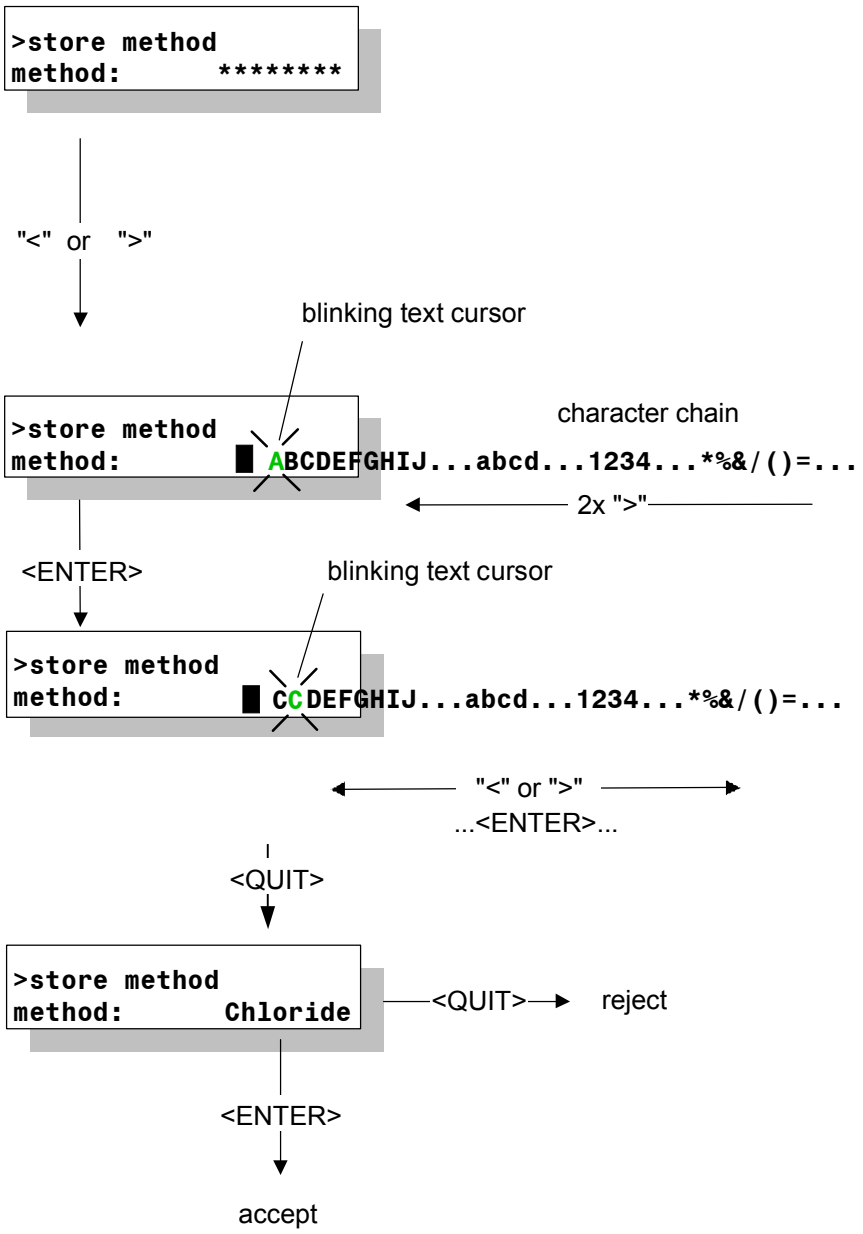
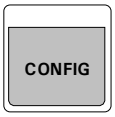


Fig. 4 Text input

The figure above 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>**.

2.2 Configuration



Main menu:

configuration **>auxiliaries**
configuration **>tower 1**
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

2.2.1 Miscellaneous

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

Use <QUIT> for next higher level

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

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          5.838.0012
```

Program version

read only

2.2.2 Tower settings

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

```
>tower 1
max. stroke path      125 mm
```

0…**125**…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, that i. e. an injection needle or tubing will be bent. The working head cannot move any lower than the position entered here (0 mm = upper stop of lift). Make these settings before you edit the rack definitions.

```
>tower 1
min. beak. radius       * mm
```

*, 1…100 mm

Sets the minimum required beaker radius for processing a sample

* = 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
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.

For further explanations of the LEARN mode, see section *2.3.8*.

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      117.00°
```

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 ***)**

```
>>swing head 1
external pos.2      117.00°
```

… up to external pos. 4

* can be set with LEARN function

2.2.3 Rackdefinitionen

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

Use <QUIT> for next higher level

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

Load 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:            6.2041.450
```

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. 65.

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.

For security reasons the max. stroke path should be set before modifications of the lift positions are made, see *section 2.2.1*.

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

0…235 mm

Working position for sample positions *)

(in mm from upper stop point)

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

0…235 mm

Rinsing position for sample positions *)

(in mm from upper stop point)

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

0…235 mm

Shifting position for sample positions *)

(in mm from upper stop point)

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

0…235 mm

Special position for sample positions *)

(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 the check of the beaker radius, see p. 17.

```
>recall rack
beaker sensor:          off
```

Tower, SwingH, **off**

Selection of the beaker sensor

Not implemented.

```
>recall rack
rack offset           0.00°
```

-5.00…**0.00**…5.00°

Correction for the rotation angle of the 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 special beaker the work position of the lift 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. 14. 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>**.

2.2.4 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 and filling rate is effective (**max. rate)**.

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

Use <QUIT> for next higher level

```
>Dosing units
Dosing unit                 1
```

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.

```
>Dosing units               1
max. rate 1       160 ml/min
```

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

0.01…**160** ml/min

```
>Dosing units               1
tube length 1        1000 mm
```

Length of tubing at Dosino Port 1

0…**1000**…30000 mm

```
>Dosing units               1
tube diameter 1         2 mm
```

Diameter of tubing at Dosino Port 1

0.1…**2**…20 mm

```
>Dosing units               1
max. rate 2       160 ml/min
```

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

0.01…**160** ml/min

```
>Dosing units               1
.......... to port 4
```

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

2.2.5 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 «IC Net».

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)

For data transmission using personal computers you should select **IBM**.

>RS232 settings
RS control: ON

ON,OFF

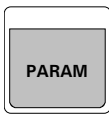
Switch data reception on/off

If Remote control is switched off then no data will be received.

2.3 Composition of a method

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

2.3.1 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.

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.

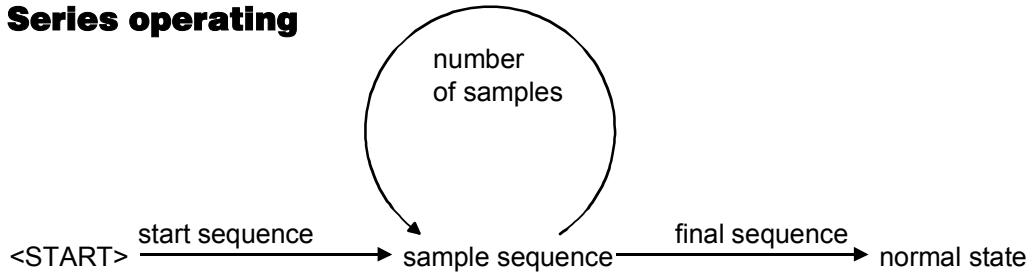


Fig. 5 Sample series

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. Fehler! Textmarke nicht definiert. for details.

The **TRACE** function can be used to execute each entered command line individually in the editing mode. See p. 33.

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.

2.3.2 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 the lift

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 in degrees/second

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

Not implemented.

2.3.3 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 the tower (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)

2.3.4 Dosing drive 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 an Advanced 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>

```
>Dosing unit def.
dosing drive              1
```
1…3

Selection of the dosing device, or the connection

After entering the connection of the dosing device (see Installation instructions 8.1303) and confirming with **<ENTER>** the settings for the selected dosing device should then be made.

```
>dosing drive             1
dos.rate        max. mL/min
```
0.01…160 mL/min, **max.**

Set the dosing rate

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

```
>dosing drive             1
fill.rate       max. mL/min
```
0.01…160 ml/min, **max.**

Set the filling rate

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. 54ff.

```
>dosing drive             1
dosing               port 1
```
1…4

Define standard dosing port 1

```
>dosing drive             1
dosing 2             port 3
```
1…4

Define standard dosing port 2

```
>dosing drive             1
filling              port 2
```
1…**2**…4

Define standard filling port

```
>dosing drive             1
rinsing              port 2
```
1…**2**…4

Define standard rinsing inlet (if Dosing unit is exchanged)

```
>dosing drive             1
preparation          port 1
```
1…4

Define standard outlet for the preparation cycle

```
>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)

2.3.5 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.

2.3.6 Manual stop options

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:      **************
          14 bit (1,0 or *)
```

Set signal lines of the Remote interface

Connected peripheral devices can be stopped automatically. The 14 signal lines of the Remote interface can be set as required, see also *p. 68ff*.

```
>manual stop
CTL RS232:
          14 ASCII characters
```

Command or character string, for output via the RS232 interface
default value '&M;$S' (= stops a Metrohm device)

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

```
>manual stop
PERISTALT:              cont.
              cont., off, on
```

Switches the peristaltic pump
(cont. = retain condition)

```
>manual stop
PUMP:                   cont.
              cont., off, on
```

Switches the pump connectors
(cont. = retain condition)

This setting applies to both pump connectors.

```
>manual stop
STIR T1:                cont.
              cont., off, on
```

Switches the stirrer at the tower
(cont. = retain condition)

```
>manual stop
STIR MSB1:              cont.
              cont., off, on
```

Switches the stirrer at MSB connection 1
(cont. = retain condition)

```
>manual stop
STIR MSB2:              cont.
              cont., off, on
```

Switches the stirrer at MSB connection 2
(cont. = retain condition)

```
>manual stop
STIR MSB3:              cont.
              cont., off, on
```

Switches the stirrer at MSB connection 3
(cont. = retain condition)

2.3.7 Programming of sequences

The creation of sequences is done in the submenus `'>start sequence'`, `'>sample sequence'` and `'>final sequence'`, which are accessible via the parameter menu.

Each sequence is organized in lines. In each line, the commands that are on the numerical keypad as alternate functions can be used to enter commands. After selecting a command and entering the necessary data, the entry is accepted with <ENTER>. The line number is visible in the display. 99 lines per sequence are possible.

Navigation in a sequence is accomplished as in the other menus. In addition the **<INSERT>** and **<DELETE>** keys can be used.

<INSERT> adds a new command line **above the current line** in a sequence. It is automatically occupied by the "NOP" command that has no function. The following lines are shifted one line downwards.

<DELETE> deletes the current line in a sequence. The following lines are shifted one line upwards.

The "**LEARN**" mode is available for the easy entry of parameters.

Furthermore the "**TRACE**" function can be used to execute every command line step by step.

2.3.8 LEARN mode

When editing a method, the parameters of a command are most easily determined experimentally, i.e. by manual execution, and it is for this reason that certain commands are "teachable". The LEARN function makes the manual execution of particular changer commands possible during the editing of a sequence. The resulting parameters (for example, the lift position or the status of the input lines) can be taken over in the current command line. The LEARN function can be used repetitively. When times or volumes are "learned", the repetitive values are added up.

Procedure for creating a method

- Enter a command or select an existing command line.
- Press the <LEARN> key.
  - Function is started, "LEARN" LED lights up.
  - Press the <LEARN> key.
  - Function is stopped, "LEARN" LED blinks.
  - With the <ENTER> key, accept the value (or re-start the LEARN function).

"LEARN" LED goes out, edit next command line.

Die LEARN-Funktion steht für folgende Befehle zur Verfügung:

Command	*Teachable parameter*	*Mode of function*
LIFT	Lift position in mm	absolute
PERISTALT	Pump time in sec	additive
PUMP	Pump time in sec	additive
WAIT	Waiting time in sec	additive
SCN Rm	Status of the 8 remote lines	"live" value
SCN RS	Character sequence received	"live" value

2.3.9 TRACE-Funktion

The "TRACE" function is a valuable aid for operating through an entire sequence or method (or parts thereof) for test purposes. Every command line in a sequence can be executed directly by pressing the <START> key. Upon completion of the action the next command line is displayed.

Tracing can be executed immediately after entry of a sequence line or at any time after opening the parameter menu and selecting a sequence.

2.4 Commands

2.4.1 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.

Beispiele:

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 (Tower 2 not possible)
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.

Beispiele:

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

Parameters

sample – rack position corresponding to the current value of the **SAMPLE** variable, see also p. Fehler! Textmarke nicht definiert..

ext.1 to **4** – predefined angle positions of the robotic arm. These are defined in the configuration of a tower, see also p. 17.

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.

spec.1 bis **16** – reserved special beaker positions on the sample rack. These are defined in the rack configuration, see also p. 20.

+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**.

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.

LIFT


```
>sample sequence
 3 LIFT: 1:       rest mm
      1,2,*
                    work,
              rinse, shift,
            special, rest,
                  0…235 mm
```

Lift positioning

1st parameter: tower (Tower 2 not possible)
2nd parameter: position

Raises or lowers the lift to a defined position.

Beispiele:

LIFT: 1:	**work**	Moves the lift to working position
LIFT: 1:	**rinse**	Moves the lift to rinsing position
LIFT: 1:	**shift**	Moves the lift to shifting position
LIFT: 1:	**special**	Moves the lift to special position
LIFT: 1:	**rest**	Moves the lift to uppermost position (0 mm)
LIFT: 1:	**100 mm**	Moves the lift 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. 20). 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. 70).

2.4.2 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.

PERISTALT


```
>sample sequence
 4 PERISTALT:  on s   3
```

Pump control

on,off,1...999 1st parameter: status or duration in s
-15…-1, 1…**3**…15 2nd parameter: pump rate and direction

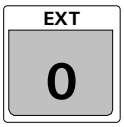
With the **PERISTALT** command the peristaltic pump can be controlled.

The first parameter switches the peristaltic pump on or off. Alternatively a particular pump duration (in seconds) can be set.

The second parameter sets the pump rate in 15 steps. The signed value (+ or –) also defines the pump direction. If a negative signed pump rate is set, the roller head of the pump drive revolves counter-clockwise, otherwise it revolves in clockwise direction.

The **LEARN** mode is very useful for determining the optimal pump time (see p. 71).

PUMP




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

Switching the pump connectors

1.1,1.2 **1**…999 s, 1st parameter: select pump connector
1.*,2.* on,off 2nd parameter: status or duration

With the **PUMP** command one or both pump connectors (16 V, DC) on the rear side of the tower can be controlled separately. The first parameter selects the connector.

Syntax Of the 1st parameter: tower.pump
1.* affects both pump connectors (tower 2 not possible)

The connectors can be switched on or off individually or be activated for a particular duration.

The **LEARN** mode is very useful for determining the optimal pump time (see p. 71).

STIR


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

Stirrer control

```
T1, T2,T*,                          1st parameter: stirrer selection
MSB1…3, MSB*, *     ON,OFF          2nd parameter: status, duration
                   1…999 s
```

With the **STIR** command up to 4 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. T2 not possible.

`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.

2.4.3 Dosing drive 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          1st parameter: dosing device and port selection
    fill,release, prepar,   2nd parameter: selects function/enters volume
  empty, eject, endVol,
       compen., port,
  ±0.001…1…±999.999 ml
```

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.

More details about Dosino commands are given on p. 60ff.

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

2.4.4 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
End1	= EOD impulse device 1
End2	= EOD impulse device 2
Wait1	= Wait for Input2 to be set (e.g. by 797 VA Computrace)
Wait2	= Wait for Input4 to be set
Wait*	= Wait for Input2 and Input4 to be set
Pump1 ?	= Wait until pump 1 is running
Pump2 ?	= Wait until pump 2 is running
Pump* ?	= Wait until pump 1 and 2 are running
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).

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. 71).


```
>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. 23).

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.

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

With the **LEARN** function transmitted data (=character strings) can be adopted interactively (see p. 71).

CTL


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

Setting the Remote lines

Rm,RS

INIT	initializes all Remote lines
INIT 732/819	initializes the Remote lines of 732/819
PROG R/S 1	starts/stops the time program of 732/819-1
PROG R/S 2	starts/stops the time program of 732/819-2
PUMP R/S 1	starts/stops IC Pumpe 818/1
FILL A 1	switches valve A of 733/820/1 to "Fill"
INJECT A 1	switches valve A of 733/820/1 to "Inject"
FILL B/STEP 1	switches valve B of 733/820/1 to "Fill"
INJECT B 1	switches valve B of 733/820/1 to "Inject"
ZERO 1	activates autozero of 732/819
PUMP 833 on	start pump 833
PUMP 833 off	stops pump 833
STEP MSM 833	advances suppressor module 833
14 Bit (1,0 or *)	= any binary pattern with 14 bit
************1	start/advance device1 (e. g. 797 VA Computrace)

The **CTL:Rm** command is used for controlling external devices via the Remote interface. It sets defined line conditions or transmits impulses (200 ms) via the 14 Remote output lines.

Predefined binary patterns are available; these can be selected via simple names (e.g. **PUMP 833 on** or **FILL A 1**).

PROG R/S 1 starts e. g. the time program of a connected IC detector.

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 1 active = start pump 833

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.23).

Any letters, numbers and special characters can be selected from the character set of the Advanced 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 Instructions for Use of your Metrohm instrument.

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

2.4.5 Auxiliary commands

WAIT


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

Waiting time

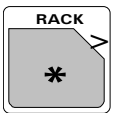
pause, runtime
0…**1**…9999 **s**

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.

2.5 Managing methods

2.5.1 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. 14).

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>**

2.5.2 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. 46).

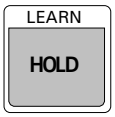
2.6 Run control

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 2.2.1) 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.

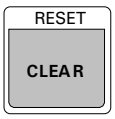
If **external START** (see configuration 2.2.1) is switched on then the activation of *Remote line Input 6* will also stop the method.



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.

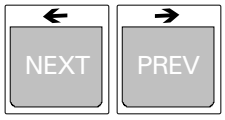
If a fault occurs during a sample series an appropriate **error message** will be shown; this must be confirmed with **<QUIT>**. The Sample Processor then returns to the **HOLD** status (see above). After the fault has been remedied the run can be continued with **<START>** or, if necessary, cancelled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

2.7 Manual operation

2.7.1 Turning the sample rack / Positioning the samples



With the **<🡐 NEXT>** and **<🡒 PREV>** keys the sample rack can be rotated forward or backward by one position. **<🡐/NEXT>** moves the next sample position (SAMPLE+1) to the tower. **<🡒/PREV>** moves the previous sample position (SAMPLE-1) to the tower.

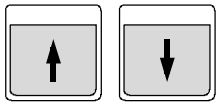

```
Handbetrieb
MOVE  1        :   Probe
                     sample,
                ext.1…ext.4
                  spec.1…16
                prev., next
              +swing, -swing
            +rotate, -rotate
                       1…999
                   +/-1…999
```

Position vessel / Turn rack

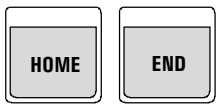
With the **MOVE** command rack positions are moved to, i.e. the turntable rotates until the sample rack is positioned so that the selected rack position is placed under the needle. With <SELECT> the numerical rack position as well as the predefined current sample (SAMPLE command) or the special beakers 1-16 can be chosen. Furthermore, with the robotic arm external position (not on the rack) can be accessed. More details about the MOVE command you can find in section *2.4.1*.

For security reasons turning the sample rack is only possible when the lift is in or above the shift position. The lift is automatically raised, if its current position is lower than the predefined shift position.

2.7.2 Moving the lift



The keys <🡑> and <🡓> allow upward and downward movement of the lift. The lowest possible lift position is defined by the configuration parameter '**max. stroke path**'.



The <HOME> key runs the lift to the rest position (0 mm), i.e. to the upper limit.

<END> runs the lift to the predefined work position (see *section 2.2.3*).

LIFT 9

```
manual operation
LIFT: 1     :    rest mm
       work,rinse,shift,
           special,rest,
               0...235 mm
```

Position the lift

With the LIFT command, the lift can be run to a given position. In addition to selecting an exact position in mm (0 – 125 mm) the <SELECT> key can select a predefined position (work position, rinse position, shift position, special position, rest position = 0 mm). The lowest possible lift position can be set in the configuration menu, see *section 2.2.2.*

2.7.3 Setting the sample position

SAMPLE 7

```
manual operation
SAMPLE:     =          1
                    1...999
```

Define current sample position

The <SAMPLE> command serves to set the current sample position. It defines the first sample tube for the subsequent sample series.

2.7.4 Pump control

PUMP 4

```
manual operation
PERISTALT:  on s       3
           on,off
            -15...-1,1...15
```

Switch peristaltic pump on/off

The PUMP command is used to switch on/off the peristaltic pump at the 838 Advanced Sample Processor. The PERISTALT command switches on or off the peristaltic pump, according to the current state. Pump rate and rotation direction of the pump drive can be set in 15 steps. A negative value of the pump rate defines a counter-clockwise rotation. A positive value of the pump rate defines a clockwise rotation.

2.7.5 Switching the stirrers

STIR 5

```
manual operation
STIR: T1       :     1 s
      T1, T2, T*,
      MSB1, MSB2,
      MSB 3; MSB*,*

              on, off,
               1...9999 s
```

Stirrer control

With the STIR command all of the connected stirrers can be controlled. The first parameter selects the stirrer. In addition to switching on and off, the stirring time can be chosen (in seconds).

2.7.6 Dosing device control


```
manual operation
DOS: 1.*   :   :    1 mL
     1.1…3.4,
     1.*…3.*, *.*

        fill,release, prep
    empty, eject, endVol,
           compen., port,
```

Dosing functions

The **DOS** command is used for controlling Dosimats and Dosinos. The 1st parameter selects the dosing device and the corresponding dosing port, at which the required function is to be carried out. In addition to the dosing volume, several dosing functions can be chosen. For details, see *section 2.4.3.*

2.7.7 Display interface signals


```
manual operation
SCN:Rm          :00000000
  Rm,RS               0,1
```

Display remote interface signals

The SCN:Rm command causes the signal states of the incoming remote lines to be displayed in binary format (1 = line active, 0 = line inactive).

```
manual operation
SCN:RS
   Rm,RS          ASCII
              characters
```

Display RS232 interface signals

The SCN:RS command causes the character string received at the RS232 interface to be displayed line by line (14 characters).

2.7.8 Interface control

Setting the remote lines

```
manual operation
CTL:Rm   :          INIT
```

`Rm,RS INIT`	initializes all Remote lines
`INIT 732/819`	initializes the Remote lines of 732/819
`PROG R/S 1`	starts/stops the time program of 732/819-1
`PROG R/S 2`	starts/stops the time program of 732/819-2
`PUMP R/S 1`	starts/stops IC Pumpe 818/1
`FILL A 1`	switches valve A of 733/820/1 to "Fill"
`INJECT A 1`	switches valve A of 733/820/1 to "Inject"
`FILL B/STEP 1`	switches valve B of 733/820/1 to "Fill"
`INJECT B 1`	switches valve B of 733/820/1 to "Inject"
`ZERO 1`	activates autozero of 732/819
`PUMP 833 on`	start pump 833
`PUMP 833 off`	stops pump 833
`STEP MSM 833`	advances suppressor module 833
`14 Bit (1,0 or *)`	= any binary pattern with 14 bit
`************1`	start/advance device1 (e. g. 797 VA Computrace)

The `CTL:Rm` command controls external instruments via the remote interface. It causes the setting of defined line states or the sending of pulses via the 14 remote output lines. Predefined bit patterns are supported which can be selected by short names (e.g. `'INIT 732/819'` or `'ZERO 1'`).

Here the following is valid: `0` = line inactive
`1` = line active
`*` = do not change line state

Example: `************1` = Output line 0 active
= advances 797 VA Computrace

For details about the remote interface, see *section 3.2*.

Data communication via RS232 interface

```
manual operation
CTL:RS
    Rm,RS

     Clear value: &D.S"9"
      14 ASCII characters
```

= start/stop time program at 732
arbitrary string of 14 characters

Using the `CTL:RS` command data (= character string) can be sent to instruments connected via the serial RS232 interface.

For details about the remote interface, see *section 2.4.4* and *section 3.2.4*.

2.7.9 External pump control


```
manual operation
PUMP on/off        no. ?
                    1, 2
```

Switching the pump connectors

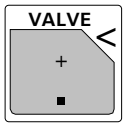
The pump connectors at the rear side of the tower can be switched with the **<EXT>** key. Just enter the number of the connector to switch its state (on/off).

The state of the pump connector is displayed in the normal state of the instrument:

```
******** counter   1/112
PUMP-+  STIR-----  ready
```

The + sign stands for an activated pump connector 2.

2.7.10 Switching the injection valve

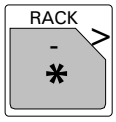



```
manual operation
VALVE:             inject
                inject, fill
```

Switching the injection valve

The injection valve on the tower of the 838 Advanced Sample Processors has two positions. With the <VALVE> and the <ENTER> key the position is switched directly.

2.7.11 Rack initialization




```
******** counter   1/112
RACK              busy
```

Initialize the sample rack

The <RACK> key immediately rotates the rack to initial position. The magnetic rack code is read off and the corresponding rack table is loaded. This should be done after every rack change.

2.8 Dosing and liquid handling

2.8.1 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.

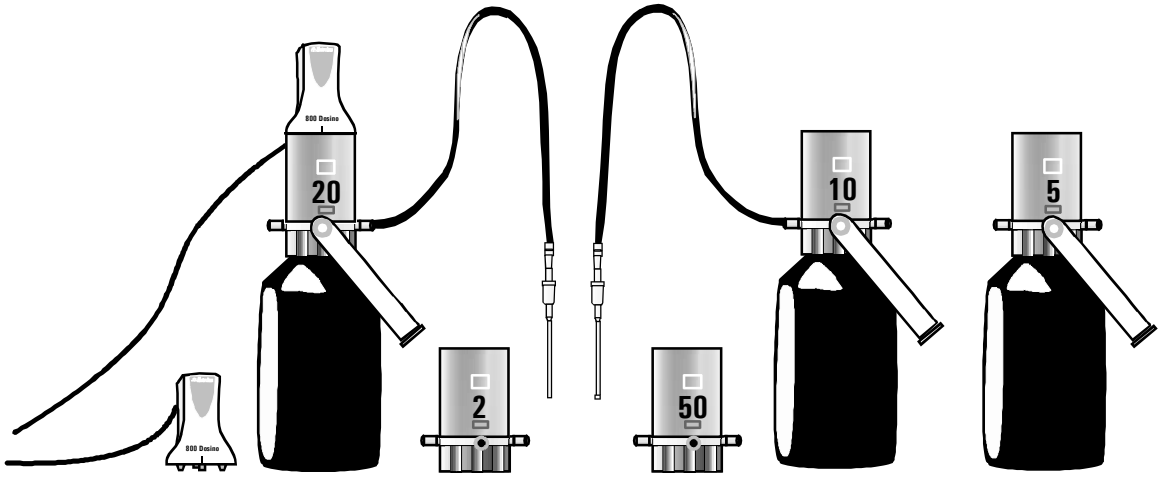


Fig. 6 Dosino 800 with Dosing units

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.

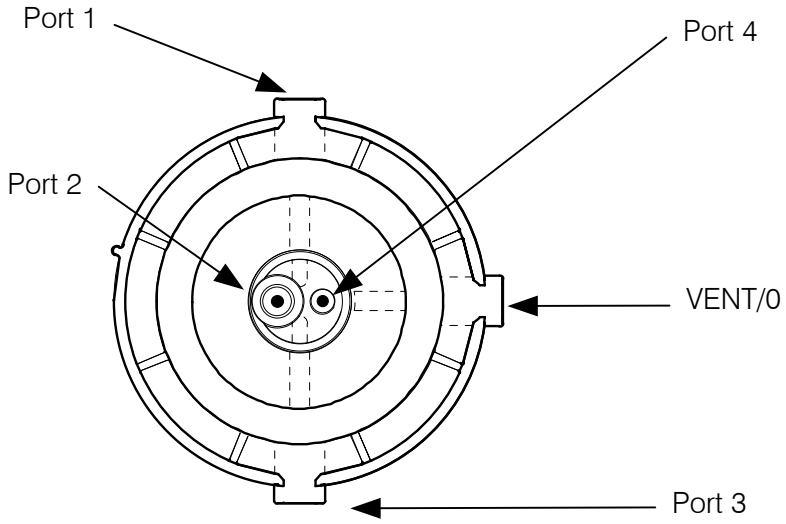


Fig. 7 Dosing unit from below

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

Dosing command

The following functions 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 2.2.4).

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).

2.8.2 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.

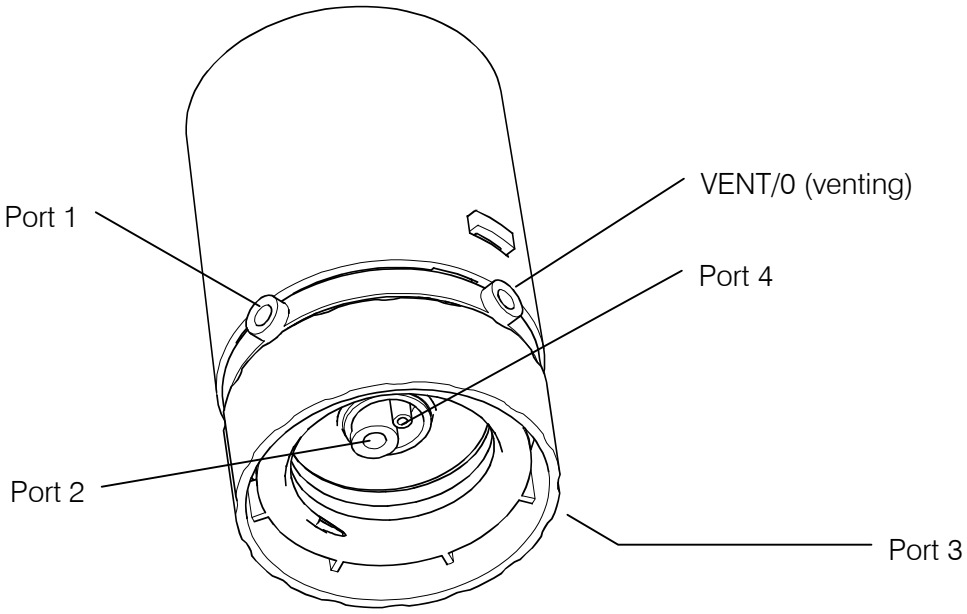


Fig. 8 Dosing unit - ports

2.8.3 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)

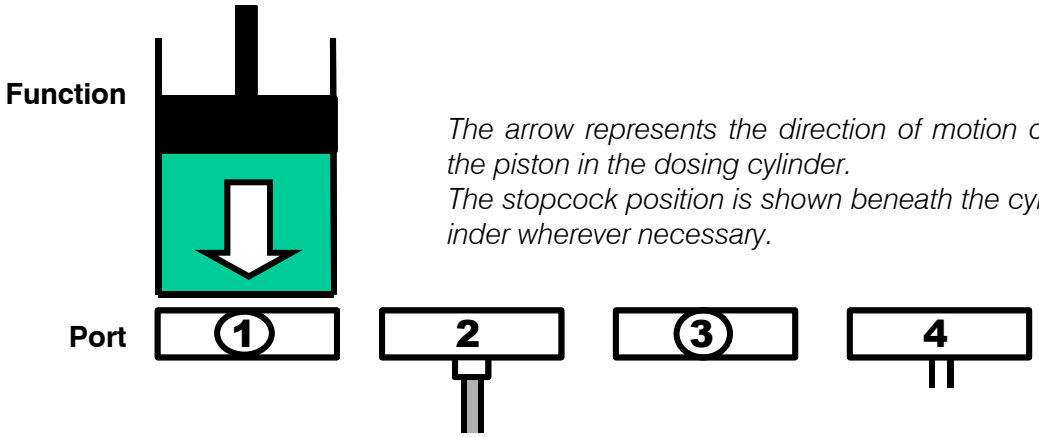
for drive: * = all dosing drives
for port: * = default port for particular function

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 2.2.4.

2.8.4 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:



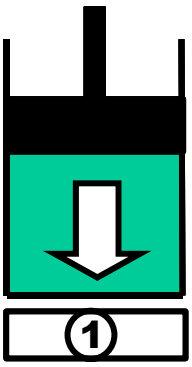
The arrow represents the direction of motion of the piston in the dosing cylinder.
The stopcock position is shown beneath the cylinder wherever necessary.

Default:	*Default:*	*Default:*	*Default:*
Dosing port 1	Filling port	Dosing port 2	Drain port

The pictograms above show the default settings..

2.8.5 Liquid handling functions in detail

Dosing

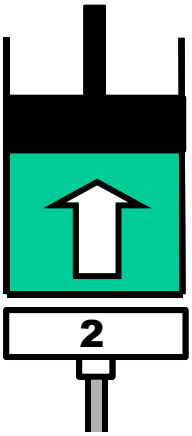


Example:

```
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

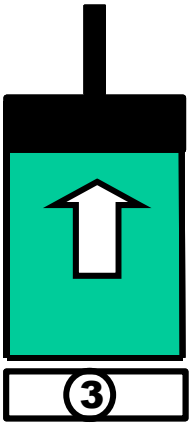


Example:

```
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

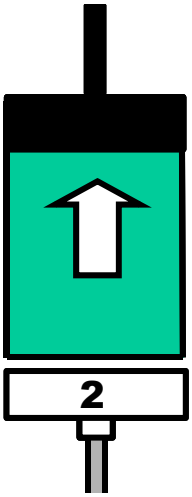


Example:

```
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

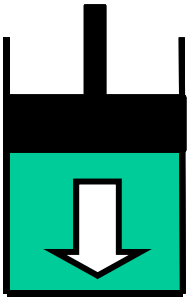


Example:

```
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

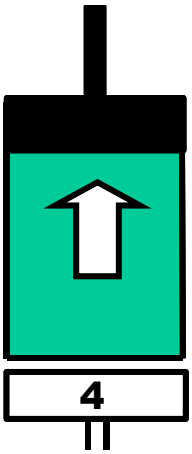


Example:

```
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

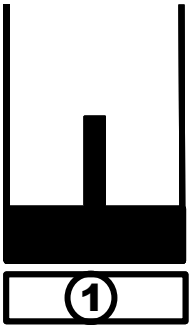


Example:

```
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

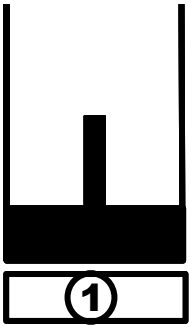


Example:

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

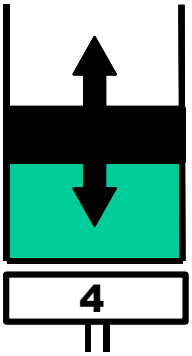


Example:

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

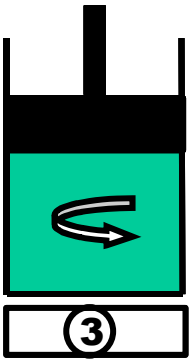


Example:

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 **stop-cock direction** under **>Dosing unit def.** in the parameter menu.

3 Appendix

3.1 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.

- With the 838 Advanced Sample Processor all of the Metrohm-sample racks with **42 cm diameter** can be used. These are also usable with the Sample Processor models 778 and 814.

3.1.1 Metrohm standard sample racks

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 sample tube 250 mL Metrohm titration beaker	16 mm 65 mm	001010
6.2041.410 *	141+1 *)	11 mL sample tube 500 mL beaker	16 mm 71 mm	001010
6.2041.430 *	127+2 *)	11 mL sample tube 2x 300 mL beaker	16 mm 68 mm	010001
6.2041.440 *	148+3 *)	11 mL sample tube 3x 300 mL beaker	16 mm 68 mm	010100
6.2041.450**	56 + 56	50 mL PP sample beakers 11 mL sample tube	30 mm 16 mm	100100
6.2041.750 *	36	11 mL sample tube	16 mm	011000

* recommended for IC applications

** recommended for VA applications

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.

3.1.2 Magnet codes

Each individual sample rack can be identified unambiguously by a magnet code. Magnet pins attached to the base of the rack 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".

3.1.3 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*

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 2.3.1). 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. 64.

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 2.2.

A **beaker sensor** is not available for the 838 Advanced Sample Processor at this time.

Special beakers

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.

3.2 The Remote interface

Connected peripheral devices 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 of a Metrohm device).

Metrohm instruments should only be connected with the Metrohm Remote cables provided.

3.2.1 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.

3.2.2 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 determination end of a Metrohm device). 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).

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 2.2.1) 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. These are:

3.2.3 SCN command

Parameter	*Signal pattern*	*Function*
Ready1	*******1	waits for "ready" condition of 732/1
End1	****1***	waits for the EOD impulse from 732/1
End2	*1******	waits for the EOD impulse from 732/2
Wait1	*****1**	waits for active Remote line 2 set by 732/1 or 797
Wait2	***1****	waits for active Remote line 4 set by 732/2
Wait*	***1*1**	waits for active Remote line 2 and 4 set by 732/1 and 732/2
Pump1 ?	******1*	waits for active IC pump 709/1
Pump2 ?	**1*****	waits for active IC pump 709/2
Pump* ?	**1***1*	waits for active IC pumps 709/1 and 709/2 laufen

3.2.4 CTL-Befehl

Parameter	*Signal pattern*	*Function*	*Signal*
INIT	00000000000000	initializes the Remote interface	static
INIT 732/819	***0000*000**0	initializes the Remote lines of 732 or 819	static
PROG R/S 1	***000*******1	starts/stops the time program of 819/1	pulse (200 ms)
PROG R/S 2	******0*100***	starts/Stopps the time program of 819/2	pulse (200 ms)
PUMP R/S 1	***001*******0	starts/stops IC pump 818/1	pulse (200 ms)
FILL A 1	***010*******0	switches valve A of 820/1 to "Fill"	pulse (200 ms)
INJECT A 1	***100*******0	switches valve A of 820/1 to "Inject"	pulse (200 ms)
FILL B/STEP 1	***001*******1	switches valve B of 820/1 to "Fill"	pulse (200 ms)
INJECT B 1	***110*******0	switches valve B of 820/1 to "Inject"	pulse (200 ms)
ZERO 1	***011*******0	activates autozero of 819/1	pulse (200 ms)
PUMP 833 ein	************1*	starts the pump of a 833	static
PUMP 833 aus	************0*	Stopps the pump of a 833	static
STEP MSM 833	***********1**	advances a step of the suppressor module 833	pulse (200 ms)
	************1	starts or advancesdevice 1 (e. g. 797 VA Computrace)	static

3.3 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

3.3.1 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.

3.3.2 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.

3.3.3 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

3.4 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:

3.4.1 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).

3.4.2 Disable configuration

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

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

3.4.3 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.

3.4.4 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.

3.4.5 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.

3.5 786 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`**.
- 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
```

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      8.00°
```

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 117.00°
```

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 **112 mm**

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 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.

3.6 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 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.
*** 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.

3.7 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 points:

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.

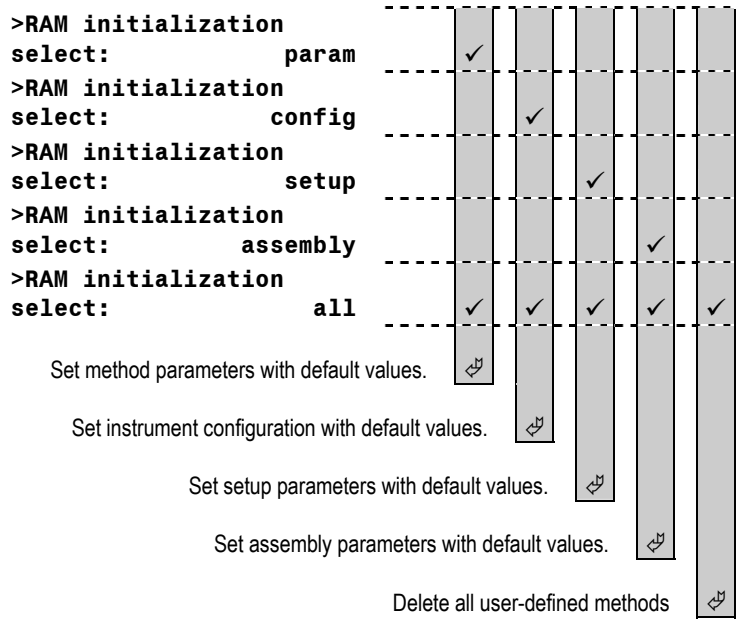
The Sample Processor has different ways of initializing the working memory. Either the complete data memory (**all**) or only parts of it **(param, config, setup, assembly**) can be overwritten with the default values.

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 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.

3.8 Standard methods

The following pages contain a list of the user methods supplied together with explanations of important commands. They are used, if the 838 Advanced Sample Processor is not being controlled directly by a PC software.

These standard methods are therefore mostly used in combinations of the 838 Advanced Sample Processor with the Metrohm VA instruments, e. g. the VA Computrace 797. Synchronizing the instruments is achieved by activating signals via Remote lines.

An overview of the standard methods for voltammetric analysis stored in the 838 is given below.

Method name	*Function*
LAT	*Linear Approximation Technique* Standard addition for brightener (electroplating bath analysis)
MLAT	*Modified Linear Approximation Technique* Standard addition for brightener (electroplating bath analysis)
DT	*Dilution Titration* Suppressor analysis ("Dilution Titration Technique", electroplating bath analysis)
VA	*Voltammetric Trace Analysis*

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

3.8.1 Method "LAT"

LAT = Linear Approximation Technique

Application

Brightener analysis (electroplating bath analysis)

System setup

See 8.838.1303 Installation Instructions, *Section 3.6* or 8.797.1013 Hardware Manual of the 797 VA Computrace, *Section 2.11.5.*

Run sequences for the 838 Advanced Sample Processor

```
838 Advanced S.Proc.    00030 5.838.0010   - report header with instrument ID and program version
parameters
  method                  LAT              - method name
  number of samples:     rack              - number of samples (e. g. entire rack)
>start sequence
   1 CTL:Rm:              INIT              - initialize all Remote lines
   2 MOVE  1     :      sample              - approach first sample
   3 CTL:Rm:   **************1             - remote start of the 797 VA Computrace
   4 CTL:Rm:   **************0
>sample sequence
   1 SCN:Rm      :   *****1**               - wait for advance signal of the 797 VA Computrace
   2 MOVE  1     :     sample               - approach sample
   3 LIFT: 1  :          work mm            - run lift and needle to work position
   4 PERISTALT: 300 s      10               - transfer sample with peristaltic pump
   5 CTL:Rm:   **************1             - set Remote line: sample transfer ready
   6 CTL:Rm:   **************0
   7 MOVE  1     :        +28               - approach rinsing vessel
   8 LIFT: 1  :          work mm            - run needle to work position
   9 PERISTALT:   5 s      10               - aspirate rinsing solution
  10 SCN:Rm      :   *****1**               - wait for advance signal of the 797 VA Computrace
  11 PERISTALT: 300 s      10               - rinse needle and transfer tubing
  12 CTL:Rm:   **************1             - set Remote line: needle cleaning ready
  13 CTL:Rm:   **************0
>final sequence
>changer settings                           ----- miscellaneous settings -----
>dosing unit def.
>timeout settings
>manual stop
```

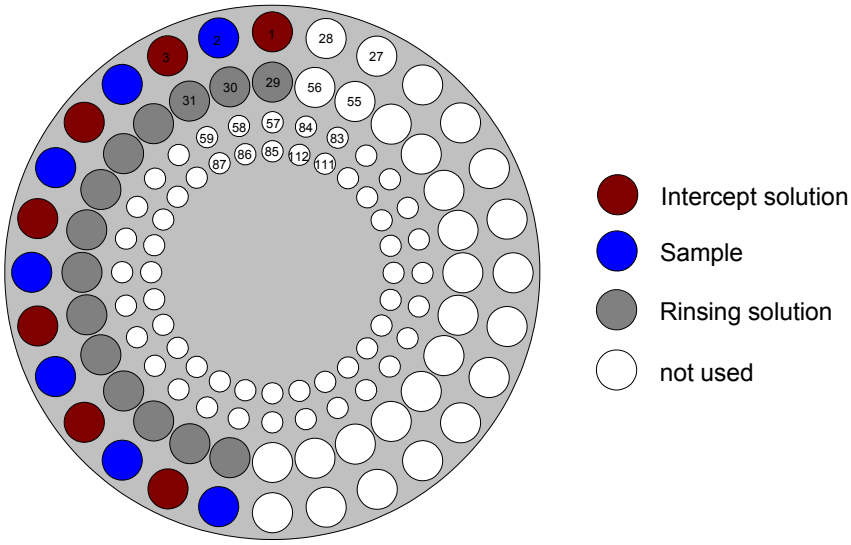
6.2041.450 sample rack

50 mL sample vessels can be placed on the two outer rings (11 mL sample vessels on the two inner rings).

Arrangement: Place on the outer of the two rings alternately "Intercept solution" and sample solution, on the inner of the two rings the rinsing solution.

Example for an arrangement with 7 samples:

⇒ With 50 mL sample vessels: first sample on position 1, first rinsing solution on position 29:



***Note**: Although the first sample is placed on position 2, posi-tion 1 remains the starting position in the start sequence of the method at the 838 (recording the "Intercept value").*

*Before each start, define the position of the first sample vessel. Press the **<SAMPLE>** key of the 838 keypad and enter the rack position.*

Find more information in the 8.797.8011 Software Manual of the 797 VA Computrace, see *section 8.6.*

3.8.2 Methode "MLAT"

MLAT = Modified Linear Approximation Technique

Application

Brightener analysis

System setup

See 8.838.1303 Installation Instructions, *Section 3.6* or 8.797.1013 Hardware Manual of the 797 VA Computrace, *Section 2.11.4.*

Run sequences for the 838 Advanced Sample Processor

```
838 Advanced S.Proc.    00030 5.838.0010   - report header with instrument ID and program version
parameters
  method                 MLAT              - method name
  number of samples:     rack              - number of samples (e. g. entire rack)
>start sequence
   1 CTL:Rm:              INIT              - initialize all Remote lines
   2 MOVE  1      :     sample              - approach first sample
   3 CTL:Rm:   *************1              - remote start of the 797 VA Computrace
   4 CTL:Rm:   *************0
>sample sequence
   1 SCN:Rm       :   *****1**              - wait for advance signal of the 797 VA Computrace
   2 DOS: 1.* :            30 mL           - add VMS
   3 DOS: 2.* :             1 mL           - add suppressor solution
   4 CTL:Rm:   *************1              - set Remote line: Intercept solution ready
   5 CTL:Rm:   *************0
   6 DOS: *.* :          fill mL           - fill dosing units
   7 SCN:Rm       :   *****1**              - wait for advance signal of the 797 VA Computrace
   8 MOVE  1      :     sample              - approach sample
   9 LIFT: 1  :           work mm           - run lift and needle to work position
  10 PERISTALT: 300 s      10              - transfer sample with peristaltic pump
  11 CTL:Rm:   *************1              - set Remote line: sample transfer ready
  12 CTL:Rm:   *************0
  13 MOVE  1      :        +28              - approach rinsing vessel
  14 LIFT: 1  :          work mm           - run needle to work position
  15 PERISTALT:   5 s      10              - aspirate rinsing solution
  16 SCN:Rm       :   *****1**              - wait for advance signal of the 797 VA Computrace
  17 PERISTALT: 300 s      10              - rinse needle and transfer tubing
  18 CTL:Rm:   *************1              - set Remote line: needle cleaning ready
  19 CTL:Rm:   *************0
>final sequence                            ----- miscellaneous settings -----
>changer settings
>dosing unit def.
>timeout settings
>manual stop
```

Note: *The command lines 1 to 6 are only necessary, if dosing drives are connected to the Sample Processor for adding auxiliary solutions. In the 797 VA Computrace software the parameter "Dose auxiliary solution via sample processor" in the configuration dialog "Settings / General settings / Automation" must be activated.*

If adding of auxiliary solutions is operated by the 797 VA Computrace, line 1 to 6 have to be deleted.

Using the method above, it is assumed that dosing drive 1 adds the VMS solution and dosing drive 2 adds suppressor solution. The intercept solution is there mixed in situ by the 838 Advanced Sample Processor in the measuring cell.

The volumes added in method line 2 and 3 of the sample sequence are to be adapted to the specific application. It is recommended to save the modified methods separately under specific method names.

Only similar samples which require the same amount of auxiliary solutions can be processed in one sample series.

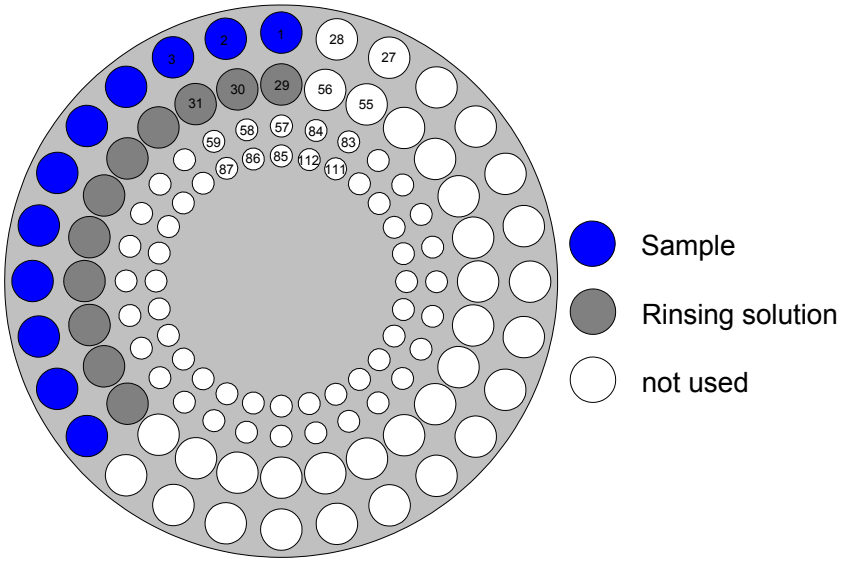
6.2041.450 sample rack

50 mL sample vessels can be placed on the two outer rings (11 mL sample vessels on the two inner rings).

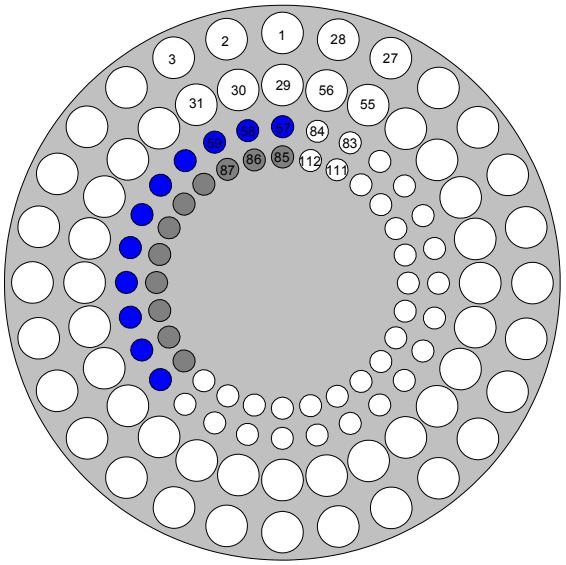
Arrangement: Place the samples solutions on the outer and the rinsing solutions on the inner of the two rings.

Example for an arrangement with 11 samples:

⇒ With 50 mL sample vessels: first sample on position 1, first rinsing solution on position 29:



⇒ With 11 mL sample vessels: first sample on position 57, first rinsing solution on position 85.



*Before each start, define the position of the first sample vessel. Press the **<SAMPLE>** key of the 838 keypad and enter the rack position.*

Find more information in the 8.797.8011 Software Manual of the 797 VA Computrace, see *section 8.6.*

3.8.3 Method "DT"

DT = Dilution Titration

Application

Suppressor determination

System setup

See 8.838.1303 Installation Instructions, *Section 3.6* or 8.797.1013 Hardware Manual of the 797 VA Computrace, *Section 2.11.3.*

Run sequences for the 838 Advanced Sample Processor

```
838 Advanced S.Proc.    00030 5.838.0010   - report header with instrument ID and program version
parameters
  method                   DT              - method name
  number of samples:       20              - number of samples (e. g. 20)
>start sequence
   1 CTL:Rm:             INIT               - initialize all Remote lines
   2 MOVE  1     :     sample               - approach first sample
   3 CTL:Rm:   **********1                  - remote start of the 797 VA Computrace
   4 CTL:Rm:   **********0
>sample sequence
   1 SCN:Rm      :   *****1**               - wait for advance signal of the 797 VA Computrace
   2 MOVE  1     :     sample               - approach sample
   3 LIFT: 1  :          work mm            - run lift and needle to work position
   4 CTL:Rm:   **********1                  - set Remote line: Sample ready
   5 CTL:Rm:   **********0
   6 SCN:Rm      :   *****1**               - wait for advance signal of the 797 VA Computrace
   7 DOS: 1.* :            50 mL            - add auxiliary solution (e. g. VMS) with Dosino
   8 CTL:Rm:   **********1                  - set Remote line: auxiliary solution ready
   9 CTL:Rm:   **********0
  10 DOS: 1.* :          fill mL            - fill dosing unit
>final sequence
   1 SCN:Rm      :   *****1**               - wait for advance signal of the 797 VA Computrace
   2 MOVE  1     :       next               - approach next rack position
   3 LIFT: 1  :          work mm            - run needle to work position
   4 CTL:Rm:   **********1                  - set Remote line: cleaning solution ready
   5 CTL:Rm:   **********0
>changer settings                           ----- miscellaneous settings -----
>stirring rates
>dosing unit def.
>timeout settings
>manual stop
```

***Note**: The command lines 6 to 10 are only necessary, if a dosing drive is connected to the Sample Processor for adding auxiliary solution. In the 797 VA Computrace software the parameter "Dose auxiliary solution via sample processor" in the configuration dialog "Settings / General settings / Automation" must be activated.*

If adding of auxiliary solution is operated by the 797 VA Computrace, line 6 to 10 have to be deleted.

Using the method above, it is assumed that dosing drive 1 adds the VMS solution. The volume added in method line 7 of the sample sequence has to be adapted to the specific application. It is recom-

mended to save the modified methods separately under specific method names.

Only similar samples which require the same amount of auxiliary solutions can be processed in one sample series.

Samples

The method parameter 'Number of samples' has to correspond exactly to the real number of samples. Place a vessel with rinsing solution at the end of the series on the rack.

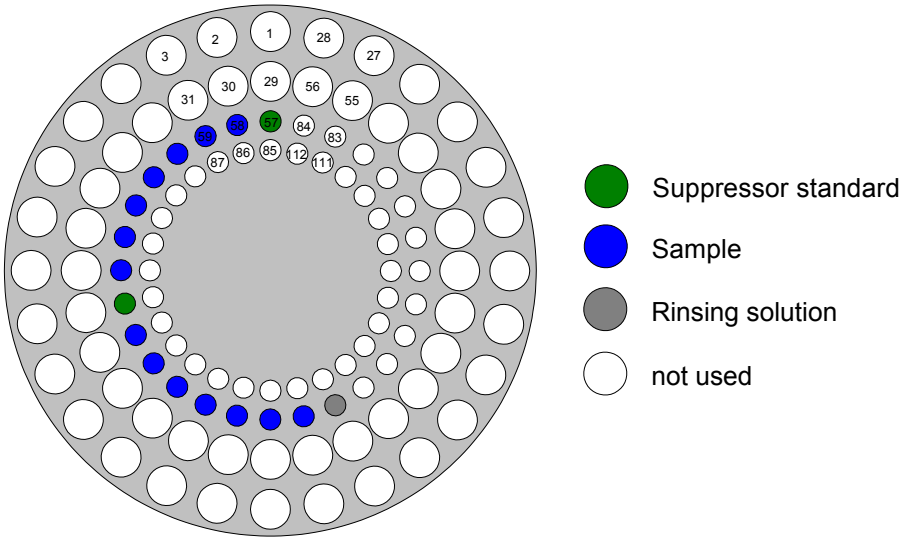
6.2041.450 sample rack

Samples and auxiliary solutions are placed on the rack. It is recommended to use the two inner rings with 11 ml sample vessels. How frequently the calibration curve needs to be recorded (with **Calibration** technique "DT Record calibration curve") depends on the chemistry of the bath.

***Note**: Place a vessel with water at the end of the series on the rack.*

Arrangement: At the first position a Suppressor standard solution to record the calibration curve. Then samples, and, when a recalibration is necessary, another Suppressor standard solution. At the end of the series place a vessel with water.

Example for a sample rack with 14 samples, 2 Suppressor standard solutions and one rinsing solution:



*Before each start, define the position of the first sample vessel. Press the **<SAMPLE>** key of the 838 keypad and enter the rack position.*

Find more information in the 8.797.8011 Software Manual of the 797 VA Computrace, see *section 8.6.*

3.8.4 Method "VA"

VA = Voltammetric trace analysis

Application

Voltammetric trace analysis

System setup

See 8.838.1303 Installation Instructions, *Section 3.6* or 8.797.1013 Hardware Manual of the 797 VA Computrace, *Section 2.11.*

Run sequences for the 838 Advanced Sample Processor

```
838 Advanced S.Proc.    00030 5.838.0010   - report header with instrument ID and program version
parameters
  method                    VA             - method name
  number of samples:      rack             - number of samples (e. g. entire rack)
>start sequence
   1 CTL:Rm:               INIT            - initialize all Remote lines
   2 MOVE  1      :      sample            - approach first sample
   3 CTL:Rm:    **************1            - remote start of the 797 VA Computrace
   4 CTL:Rm:    **************0
>sample sequence
   1 SCN:Rm       :    *****1**            - wait for advance signal of the 797 VA Computrace
   2 MOVE  1      :      sample            - approach sample
   3 LIFT: 1  :            work mm         - run lift and needle to work position
   4 PERISTALT: 300 s       10             - transfer sample with peristaltic pump
   5 CTL:Rm:    **************1            - set Remote line: sample transfer ready
   6 CTL:Rm:    **************0
   7 MOVE  1      :         +28            - approach rinsing vessel
   8 LIFT: 1  :            work mm         - run needle to work position
   9 PERISTALT:   5 s       10             - aspirate rinsing solution
  10 SCN:Rm       :    *****1**            - wait for advance signal of the 797 VA Computrace
  11 PERISTALT: 300 s       10             - rinse needle and transfer tubing
  12 CTL:Rm:    **************1            - set Remote line: needle cleaning ready
  13 CTL:Rm:    **************0
>final sequence
>changer settings                          ----- miscellaneous settings -----
>stirring rates
>dosing unit def.
>timeout settings
>manual stop
```

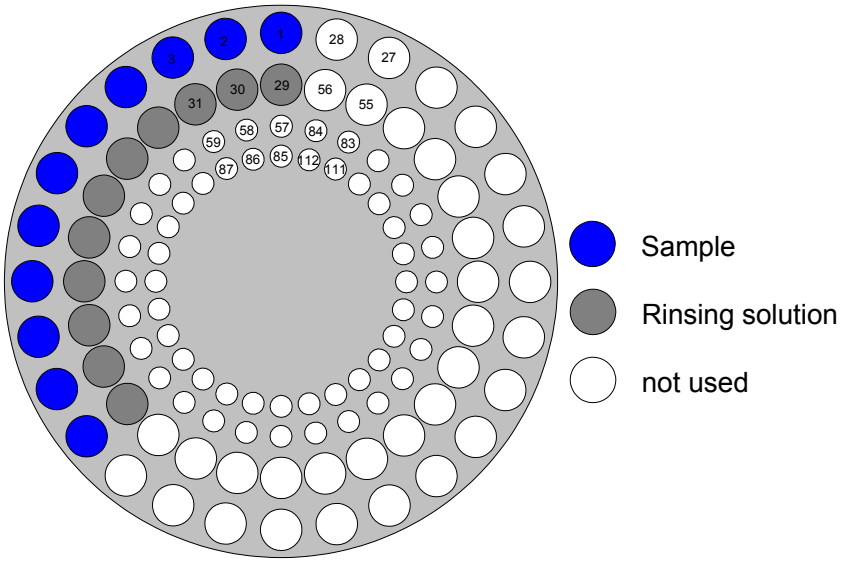
6.2041.450 sample rack

50 mL sample vessels can be placed on the two outer rings (11 mL sample vessels on the two inner rings).

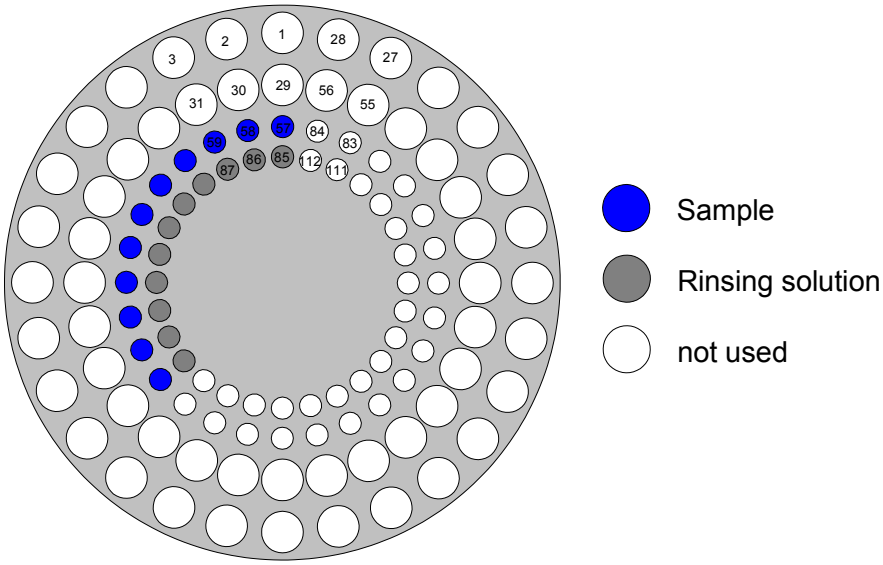
Arrangement: Place the samples solutions on the outer and the rinsing solutions on the inner of the two rings.

Example for an arrangement with 11 samples:

⇒ With 50 mL sample vessels: first sample on position 1, first rinsing solution on position 29:



⇒ With 11 mL sample vessels: first sample on position 57, first rinsing solution on position 85.



Before each start, define the position of the first sample vessel. Press the ***<SAMPLE>*** *key of the 838 keypad and enter the rack position.*

Find more information in the 8.797.8011 Software Manual of the 797 VA Computrace, see *section 8.5.*

4 Index