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730 Sample Changer
and 759 Swing Head

Program version 5.730.0013

8.730.1103

98.2 sn

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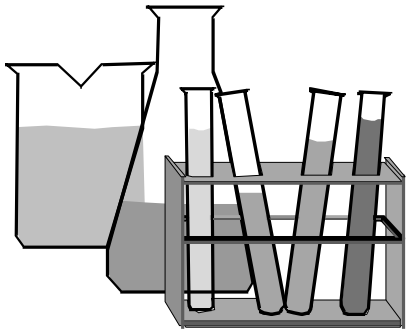


1 Overview

1.1 Application Range

The Metrohm 730 Sample Changer is an instrument for numerous applications. It was specially developed for the industrial or analytical laboratory and therefore covers a wide spectrum of applications. It provides indispensable support when processing a large sample series in the entire range of titrations, for various measurement jobs, or for dosing purposes.

Due to the well-developed communication interfaces (parallel remote control and serial RS 232) it can not only communicate with the large palette of Metrohm titration and dosing instruments; it can also control or be controlled by any instrument that has a suitable communication interface. These capabilities predestine it for all conceivable automatization jobs in a modern laboratory, even in conjunction with highly integrated laboratory data systems.

1.2 Scope on Applications

In spite of the extensive range of commands and configuration possibilities, the mode of operation is uncomplicated thanks to the ability for managing user-defined methods, making it suitable for routine use.
The user methods provided are industry-oriented and may be used “as is” for routine assignments. After a short training period the user can modify them for his own purposes and store them in the instrument. The 730 Sample Changer can therefore be used for challenging special applications as well as for routine jobs.

The sequences for the processing of each sample are freely definable within broad boundaries. The same is true for the start and end sequences that are executed once either before or at the end of a sample series. This is advantageous specially for titrations. The electrode can be conditioned prior to use or subjected to a special rinse procedure at any time.

With the help of the LEARN mode, which is provided for creating process methods, a method can be created easily.

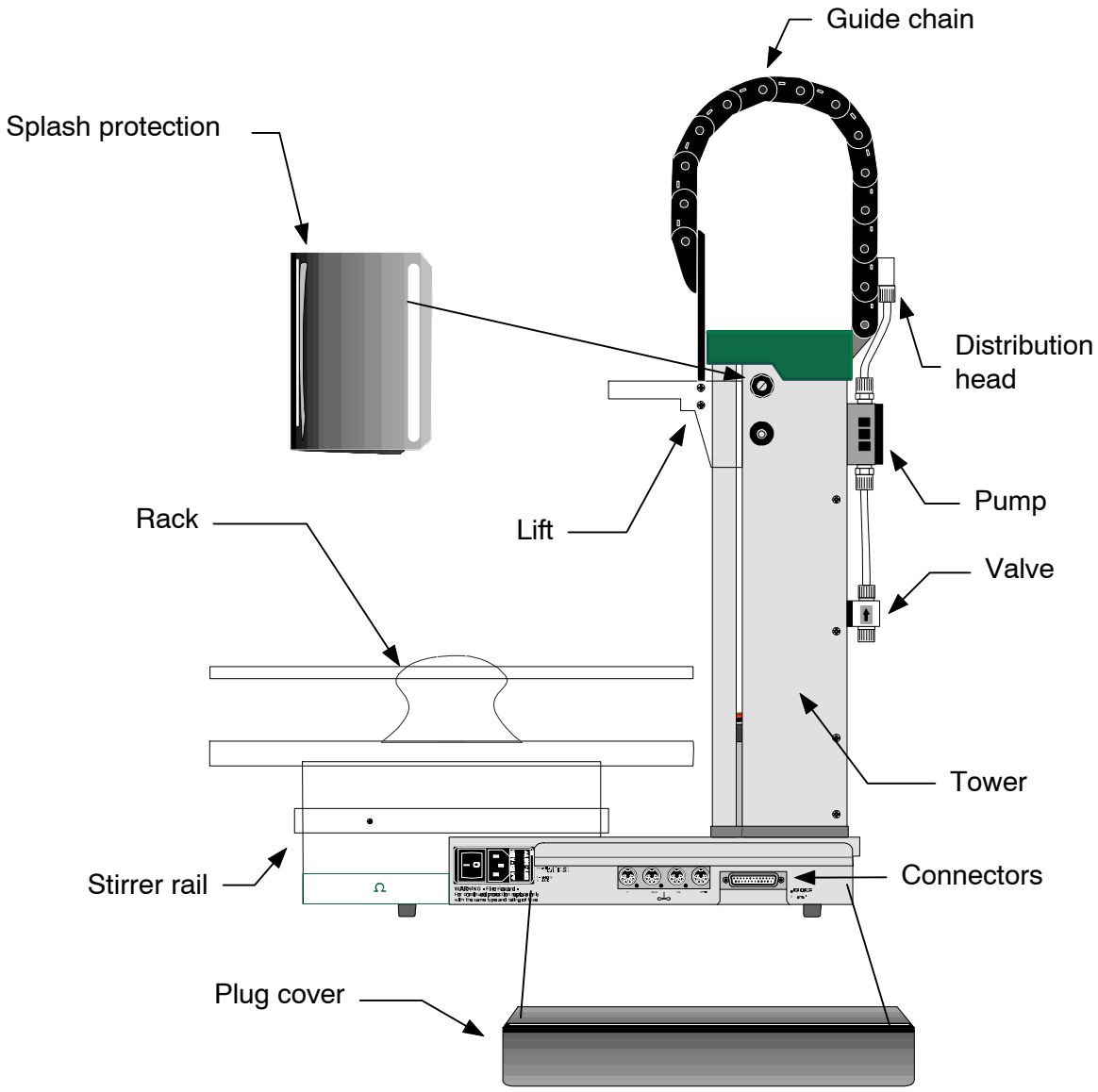
Standard interchangeable racks are provided for various beaker sizes. Freely-definable "special beaker" positions can be defined for every rack. They define a rack position for rinse or conditioning beakers that can then be selected in any sub-sequence.

Position tables which describe user-defined special racks may be downloaded via RS232 interface with the aid of a suitable PC software.

In order to increase the number of samples that can be treated, the 759 Swing Head can be installed. This drive is installed instead of the normal titration head and is obtainable in two versions: either with a titration head for the direct titration in the sample vessels or with a transfer head, with the help of which the samples can be transferred from test tubes into a central titration vessel.

1.3 Instrument Description

1.3.1 Side View

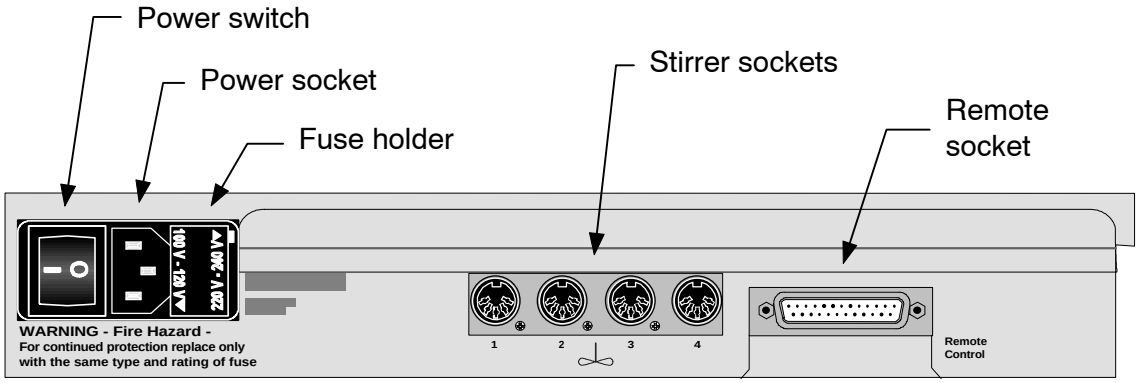


Safety note:

Never operate the 730 Sample Changer without splash protection and plug cover being mounted.

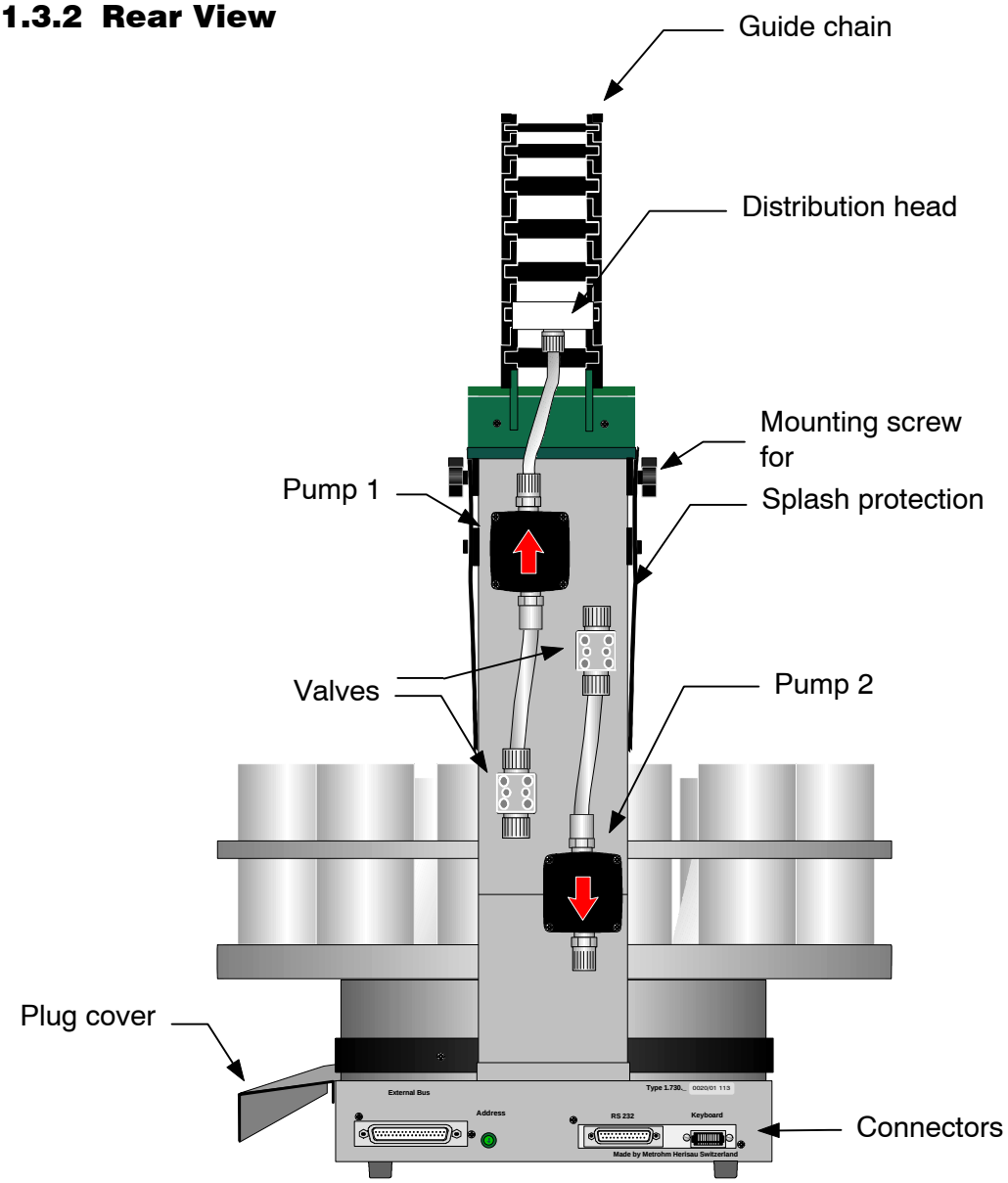
The plug cover prevents any contamination of the connectors, caused by spilled solvents or chemicals.

The Connectors (side view):

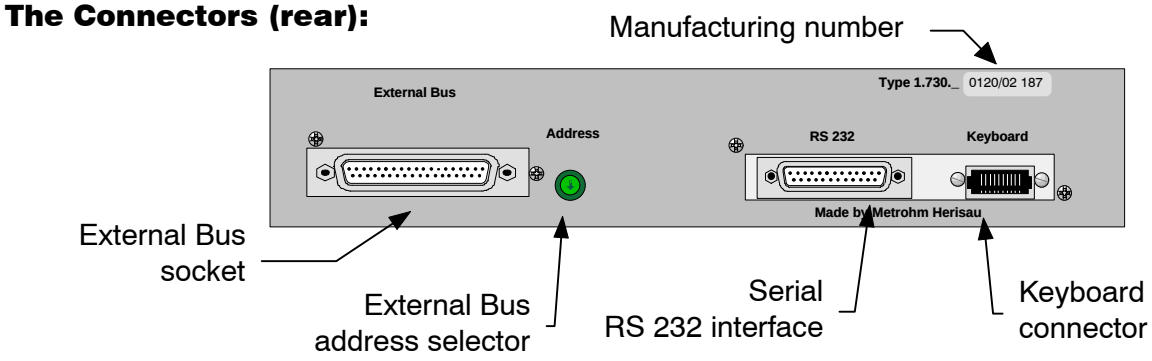


The remote socket serves the connection of Metrohm- or other measuring instruments that communicate via a serial cable.

1.3.2 Rear View



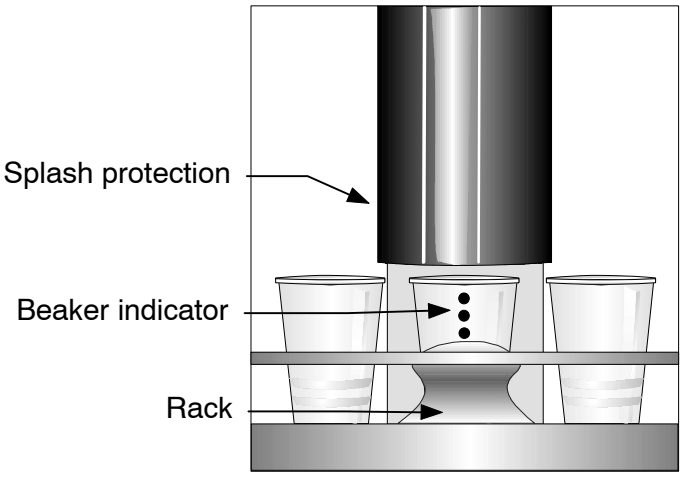
The Connectors (rear):



The External Bus address selector must be set to 0 (zero).

1.3.3 Sensors

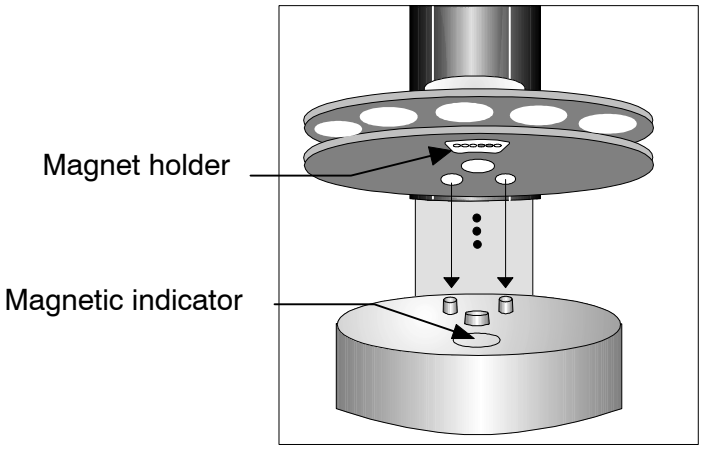
Beaker test



Front view

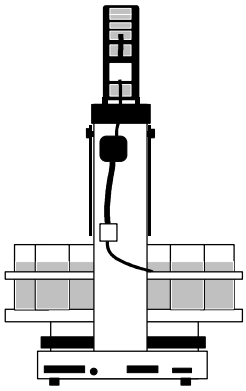
Each tower of the 730 Sample Changer is equipped with a beaker indicator to detect the presence of a beaker in front of the particular tower. This infrared sensor detects many different materials, if any object is placed in correct position. This beaker test is carried out after each MOVE operation.

Magnetic rack code indicator

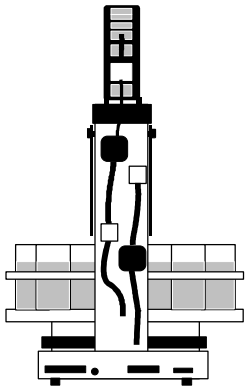


The magnetic sensor to detect the individual rack codes is mounted below the sample changer's turntable.
The magnetic binary code of the racks can only be read, if the rack is in initial position and therefore the magnet holder is in accurate position right above the rack code indicator.
For this reason the 730 Sample Changer should be initialized right after every rack change by pressing the <RESET> key or <ENDSEQ> followed by <ENTER>.

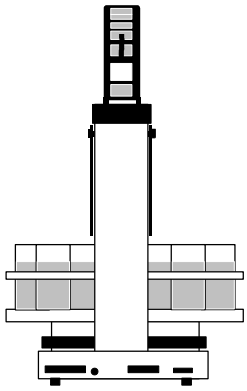
1.3.4 The Sample Changer Models



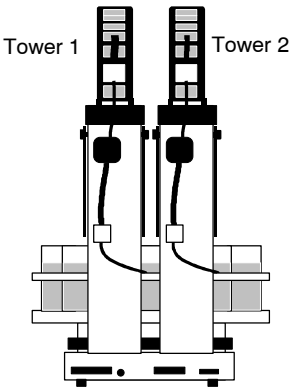
Model 2.730.0010
1 tower, 1 pump
2 stirrer connections



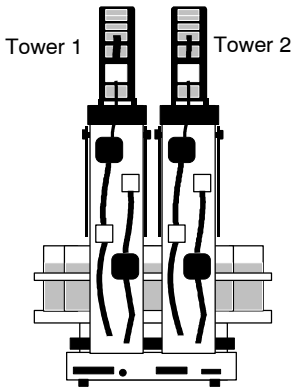
Model 2.730.0020
1 tower, 2 pumps
2 stirrer connections



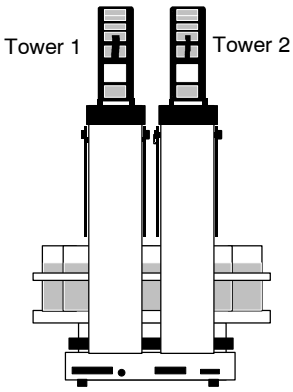
Model 2.730.0030
1 tower, no pumps
2 stirrer connections



Model 2.730.0110
2 towers, 2 pumps
4 stirrer connections



Model 2.730.0120
2 towers, 4 pumps
4 stirrer connections



Model 2.730.0130
2 towers, no pumps
4 stirrer connections

1.3.5 The Swing Head

In order to increase the number of samples, the 759 Swing Head with a titration head (2.759.0020) or a transfer head (2.759.0010) can be installed in place of a normal titration head. In this way the titration head can be moved very accurately to the individual vessels located in several rows on the sample rack. You will find a more detailed description in chapter 7 "Swing Head", page 42.

2 Installation

2.1 Setting up the Instrument

Packaging

The 730 Sample Changer is supplied with the accessories in separate special packages designed to ensure maximum protection. These contain shock-absorbing foam linings. As only these special packages guarantee damage-free transport of the instrument, it is essential you store them in a safe place.

Control

Immediately following delivery, check that the consignment is complete and undamaged (compare with delivery note and accessories list in the Instructions for Use, page 183). In case of damage see "Warranty", page 178.

Setting up

The 730 Sample Changer is a rugged instrument and may be used in rough environments such as laboratories and manufacturing plants. It must not be exposed to a corrosive atmosphere. If the sample changer is operated in a rough environment, regular maintenance is strongly recommended.

2.2 Power Supply

Follow these instructions to connect the 730 Sample Changer to the power supply. Ensure that the instrument is never operated with incorrect voltage ratings and/or with fuses of an incorrect rating, otherwise there is a fire hazard!

Setting the instrument supply voltage

Before switching on the Sample Changer for the first time, check that the line voltage set on the instrument (see next page) matches the local power supply voltage. If this is **not** the case, change the voltage setting as follows:

- **Disconnect line cable**
  Unplug the 730 Sample Changer.

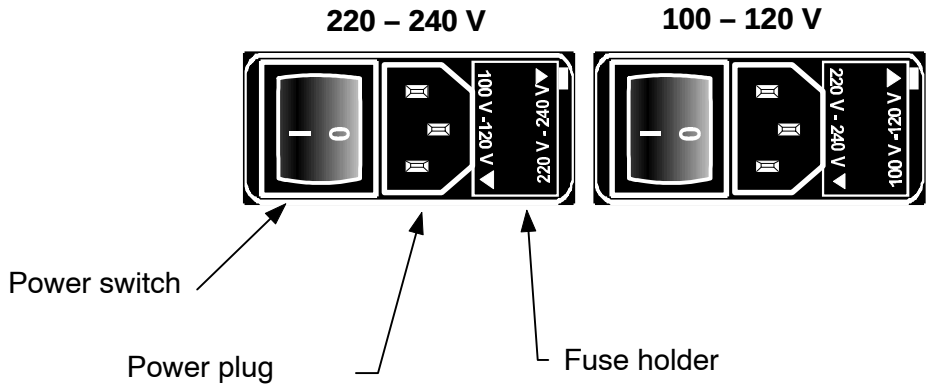
- **Remove fuse holder**
  Using a screw driver, loosen the fuse holder and pull it out.

- **Checking and replacing fuse**
  Carefully remove the built-in fuse and check its specifications. (The position of the fuse in the fuse holder is marked by the white arrow printed next to the supply voltage):

  100 ¼ 120 V 0.5 A (slow) ord. no. U.600.0014
  220 ¼ 240 V 0.25 A (slow) ord. no. U.600.0011

- **Replace fuse**
  Replace fuse if necessary and reinsert it in the fuse holder.

- **Insert the fuse holder**
  Insert the fuse holder according to the appropriate supply voltage. The white arrow besides the desired voltage has to point towards the white block mark printed on the fuse holder's panel (see below).



2.3 Safety Considerations

If failure or malfunctioning occurs during operation of the 730 Sample Changer, it is recommended to first search for the cause with the help of the diagnostic functions (see Instructions for Use, page 167). If this is of no help in rectifying the disorder or the cause of the malfunction cannot be identified, the Metrohm Service Department should be consulted.

If opening the instrument is unavoidable, the following safety precautions are to be strictly adhered to:

Before opening the instrument disconnect it from all electrical sources. Make sure that the power plug has been pulled out.

Only in exceptional cases should the instrument be opened while it is switched on. Because parts that conduct current are exposed in this case, this should only be undertaken by an expert who is acquainted with the associated dangers.

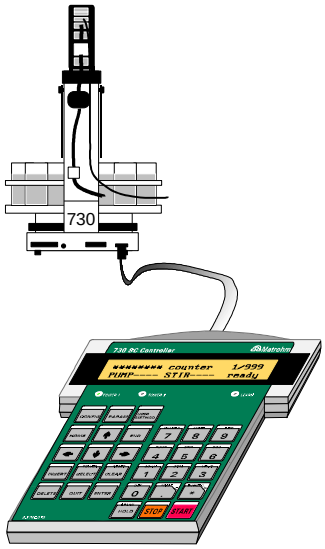
Electronic components are sensitive to static electricity and can be destroyed by discharge. Before touching any components inside the instrument, both the person and his tools should be grounded by grasping a grounded object (for example: a metallic part of the casing of the instrument or a radiator) in order to eliminate any static electricity.

When peripheral instruments are connected to the 730 Sample Changer, the sample changer and the instruments to be connected have to be switched off, otherwise all instruments could suffer damage.

If it becomes apparent that the instrument can no longer be operated safely, it must be put out of operation.

2.4 Arranging the Accessories

2.4.1 Connecting the Keyboard



The keyboard is to be connected to the keyboard socket on the rear side of the sample changer. To disconnect press the plug together slightly on both sides.

2.4.2 Setting up the Rinsing Equipment

To mount the PTFE tubings to the pump inlets or outlets enlarge it carefully using a pen or another appropriate tool. A piece of sand paper facilitates grasping of the tubing.

The arrangement of the tubing depends on the rinsing equipment.

Rotating nozzle

Using a changer model with one pump per tower only, the rotating nozzle (6.2740.000) is recommended for rinsing. The Teflon tubing is then directly connected to the rinsing pump (pump 1). The distribution head may be dismounted in this case.

Place the rotating nozzle vertically in the titration head with the aid of a SGJ14/12 mm sleeve.

Spray nozzles

When using a changer model with two pumps per tower, spray nozzles (6.2740.020) may be used in combination with an aspiration tip M8 (6.1543.170). Insert the spray nozzles into the sloped borings of the titration head. Use Teflon tubings to connect them to the distribution head. Each of the four outlets of the distribution head must be plugged. Plug unused outlets with an M6 thread stopper (6.1446.040) to avoid splashing of liquid during rinsing.

Fix the tubings in the guide chain. Chain links may be removed if necessary (see below).

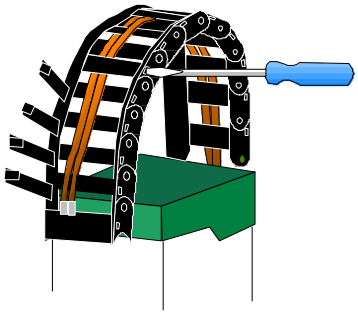
Insert the aspiration tip vertically into a boring (SGJ9) of the Macro Titration Head. The Micro Titration Head offers also a vertical boring for the placement of the aspiration tip. Connect the tip with the Teflon 4/6 tubing (6.1805.510) and a screw connector 4/6 mm (6.1820.030) to pump 2 (valve marked with '🡻'). During the rinsing procedure, first the sample is sucked off then the electrode is rinsed in the empty vessel.

The pump heads of the diaphragm pump, the fittings and the coupling rings are made of PVDF. PVDF is resistant to many chemicals. Acetone, acetanhydride or dimethylformamide (DMF) should **not** be used. The diaphragm, and the inner parts of the valves consist of PTFE and are resistant to most chemicals.

If your samples contain solids (e.g. silver chloride) or sticking substances, you should use the 772 Peristaltic Pump Unit in combination with the 731 Relay Box instead of the diaphragm pump integrated into the changer.

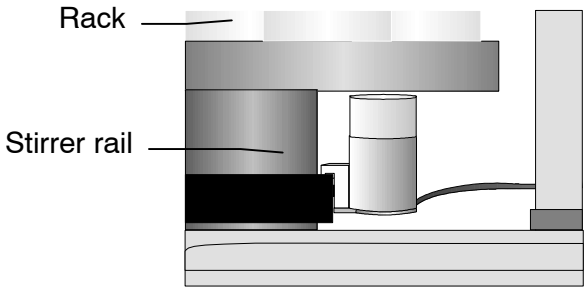
The PE canisters (6.1621.000) are suitable for aqueous solutions.

2.4.3 Tubing Fixation



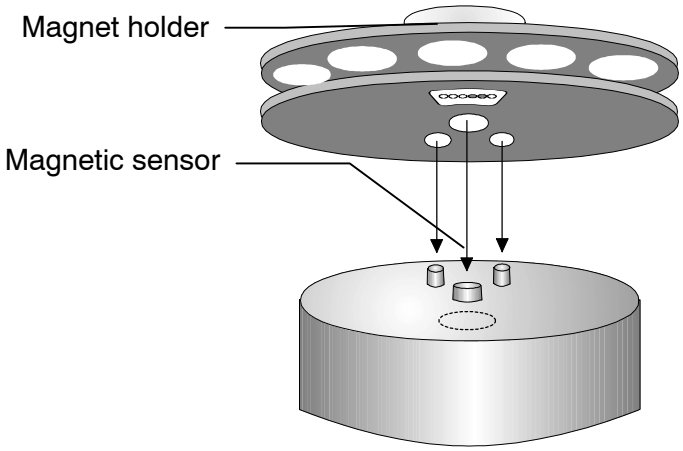
In order to fix the tubing in the guide chain any chain link may be opened with a screw driver or another appropriate tool.

2.4.4 Magnetic Stirrers



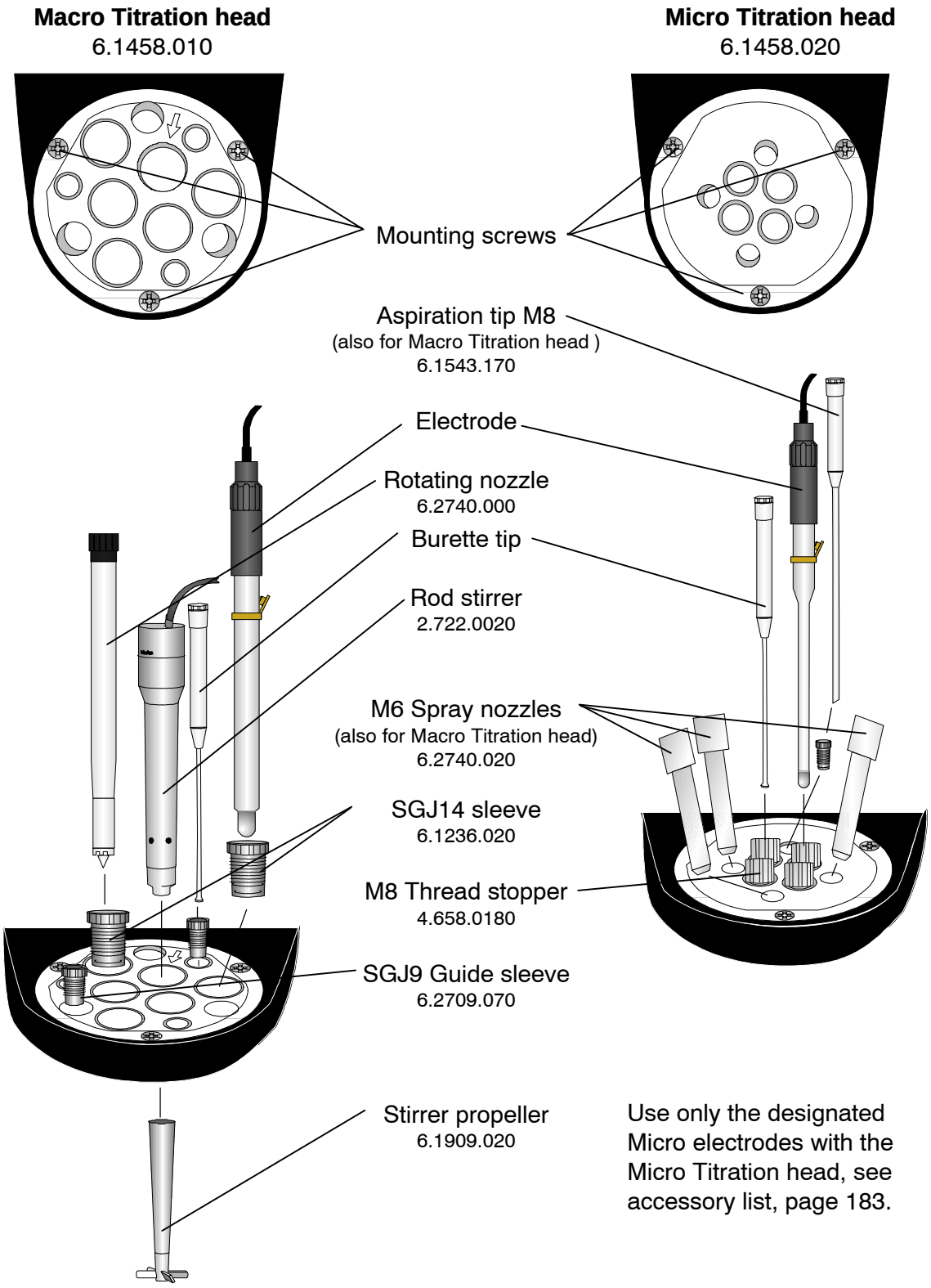
Magnetic stirrers 2.741.0010 may be placed in any position on the stirrer rail beneath the rack.

2.4.5 Sample Racks



After placing the rack on the turntable, the sample changer must be initialized by pressing the <RESET> key to enable the safe reading of the magnetic rack code.
This can only be done if rack position 1 is directed to tower 1.

2.4.6 Mounting and Setting up the Titration Heads

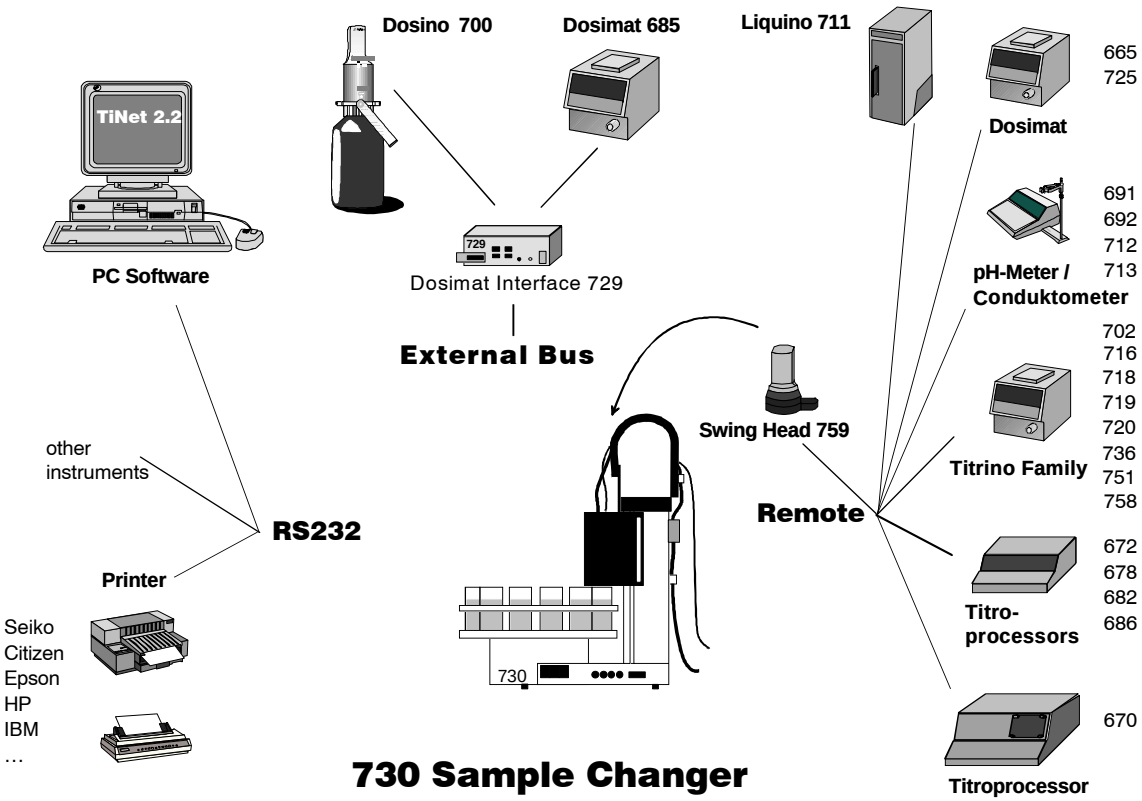


Use only the designated Micro electrodes with the Micro Titration head, see accessory list, page 183.

Note on Macro Titration head
The arrow sign marks the slightly sloped SGJ boring, which enables to center a rod stirrer or an electrode in a narrow titration vessel.

2.5 Integration

The 730 Automation System

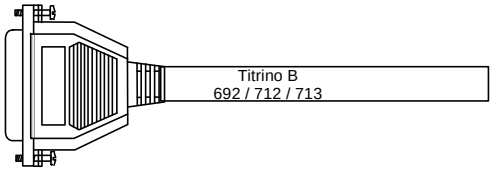


Cables

Connecting peripheral instruments to the 730 Sample Changer requires Metrohm cables. Otherwise a safe data transmission may not be guaranteed.

Remark:
Metrohm cables are labeled with the type of the instrument which they may be connected with and optionally with the particular socket. Mind the cable ends.

For example:

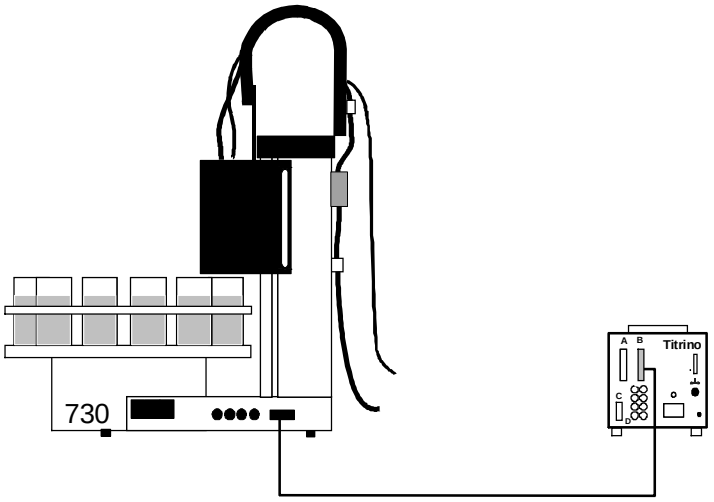


All instruments have to be switched off, before they are connected. Otherwise the instruments could suffer from damage.

2.5.1 Remote Connections

730 Sample Changer — Titrino

with standard cable



Cable 6.2141.020

Remote control commands:

```
CTL:Rm :  START device1
CTL:Rm : *************1
```

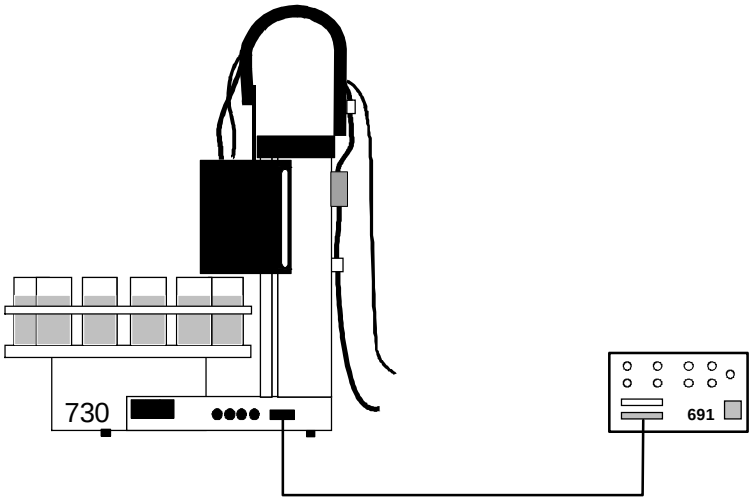
starts Titrino
"

Scan commands:

```
SCN:Rm :            end1
SCN:Rm :        ****1***
SCN:Rm :          ready1
SCN:Rm :        *******1
```

awaits end of titration
"
awaits readiness of Titrino
"

730 Sample Changer — 691 pH-Meter



Cable 6.2141.060

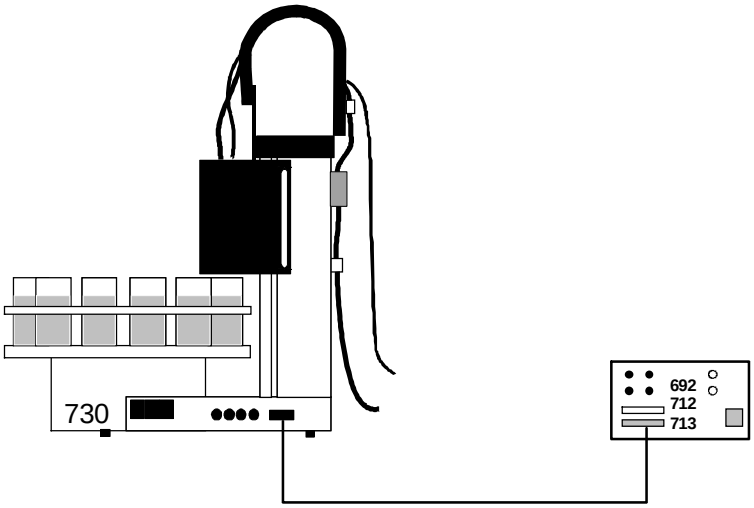
Remote control commands:

`CTL:Rm :  START device1`	starts measuring instrument
`CTL:Rm : *************1`	"
`CTL:Rm :  METER mode pH`	change mode to pH measurement
`CTL:Rm : *********0001*`	"
`CTL:Rm :   METER mode T`	change mode to temp. measurement
`CTL:Rm : *********0010*`	"
`CTL:Rm :   METER mode U`	change mode to mV measurement
`CTL:Rm : *********0011*`	"

Scan commands:

`SCN:Rm :           End1`	awaits end of measurement
`SCN:Rm :       ****1***`	"

730 Sample Changer — pH- / Ion- / Conductometer (692/712/713)



Cable 6.2141.020

Remote control commands:

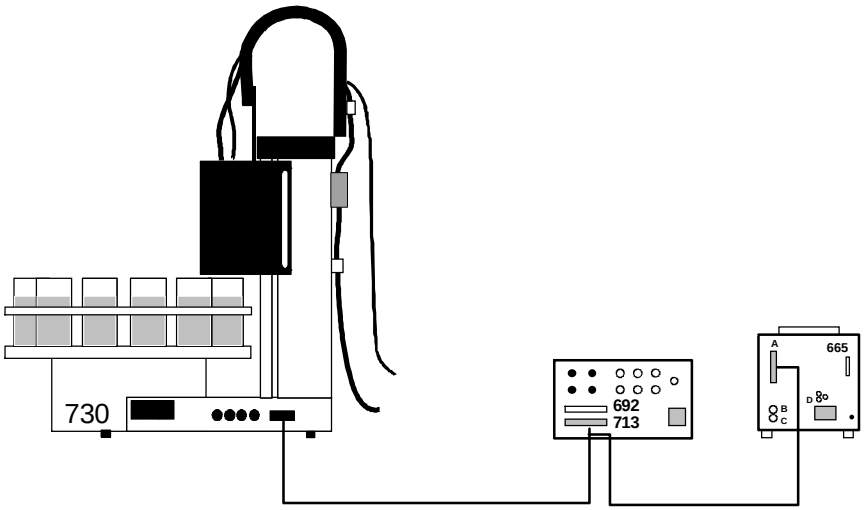
`CTL:Rm :  START device1`	starts measuring instrument
`CTL:Rm : *************1`	"
`CTL:Rm :  METER mode pH`	change mode to pH measurement
`CTL:Rm : *********0001*`	" (not appl. with 712)
`CTL:Rm :   METER mode T`	change mode temp. measurement
`CTL:Rm : *********0010*`	" (not appl. with 712)
`CTL:Rm :   METER mode U`	change mode to mV measurement
`CTL:Rm : *********0011*`	" (not appl. with 712)
`CTL:Rm :   METER mode I`	change mode to Ipol (mV meas.)
`CTL:Rm : *********0100*`	" (not appl. with 712)
`CTL:Rm :   METER mode C`	change mode to conc measurement
`CTL:Rm : *********1000*`	" (only appl. with 692)
`CTL:Rm :   METER cal pH`	change mode to pH calibration
`CTL:Rm : *********0101*`	" (not appl. with 712)
`CTL:Rm :    METER cal C`	change mode to conc calibration
`CTL:Rm : *********1001*`	" (only appl. with 692)
`CTL:Rm :    METER enter`	simulates <ENTER> key
`CTL:Rm : *********1111*`	" (not appl. with 712)

Scan commands:

`SCN:Rm :           end1`	awaits end of determination
`SCN:Rm :       ****1***`	"

730 Sample Changer — 713 / 692 pH/Ionmeter — 665 Dosimat

for automatic calibration including standard addition.



Cable 6.2141.070

The 692 pH/Ion Meter takes control of stirrer 1 connected to the 730 Sample Changer.

Remote control commands:

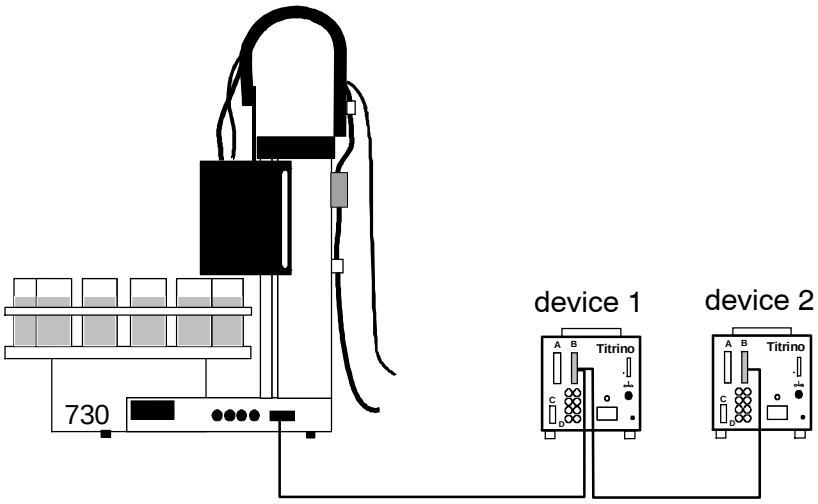
The same commands are applicable as above.

Scan commands:

The same commands are applicable as above, but also:

```
SCN:Rm :        endmeter   awaits end pulses from 692 Ion Meter
SCN:Rm :        ***11***                    "
```

730 Sample Changer — 2 x Titrino



Cable 6.2141.030

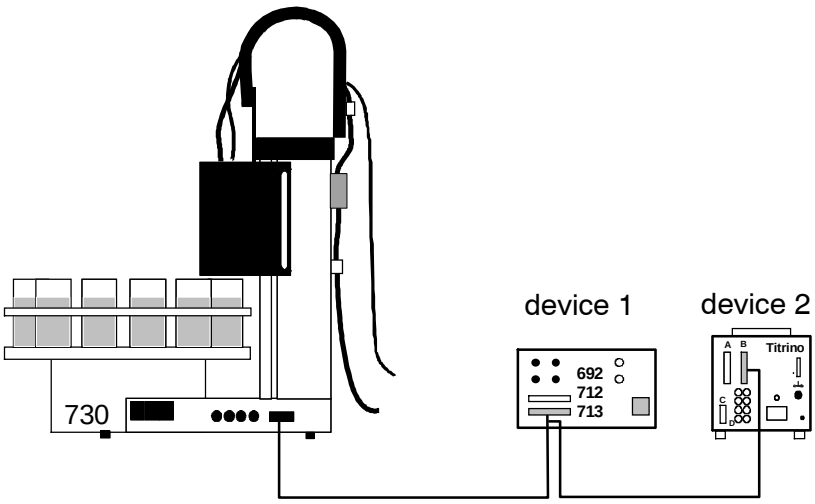
Remote control commands:

`CTL:Rm :  START device1`	starts Titrino 1
`CTL:Rm : **********1`	"
`CTL:Rm :  START device2`	starts Titrino 2
`CTL:Rm : ********1*****`	"
`CTL:Rm :  START device*`	starts both Titrinos at the same time
`CTL:Rm : ********1****1`	"

Scan commands:

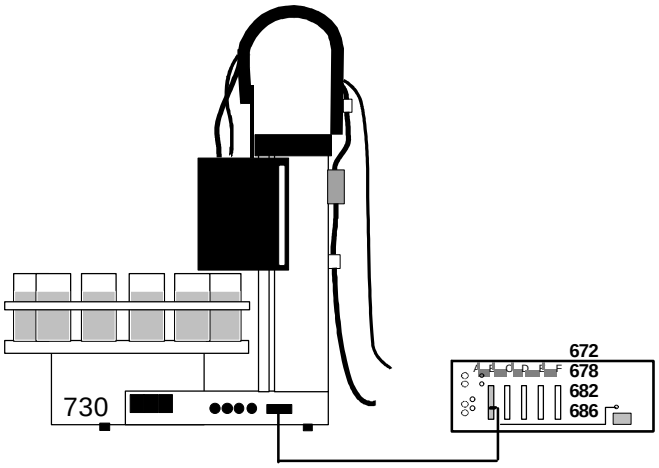
`SCN:Rm :  end1`	awaits end of titration of Titrino 1
`SCN:Rm :  ****1***`	"
`SCN:Rm :  end2`	awaits end of titration of Titrino 2
`SCN:Rm :  *1******`	"
`SCN:Rm :  ready1`	awaits readiness of Titrino 1
`SCN:Rm :  *******1`	"
`SCN:Rm :  ready2`	awaits readiness of Titrino 2
`SCN:Rm :  **1*****`	"
`SCN:Rm :  ready*`	awaits readiness of both Titrinos
`SCN:Rm :  **1****1`	"

Operating Titrinos and pH meters at the same time is also possible in the same manner.



Cable 6.2141.030

730 Sample Changer — 678 / 682 / 686 Titroprocessor



Cable 3.980.3640

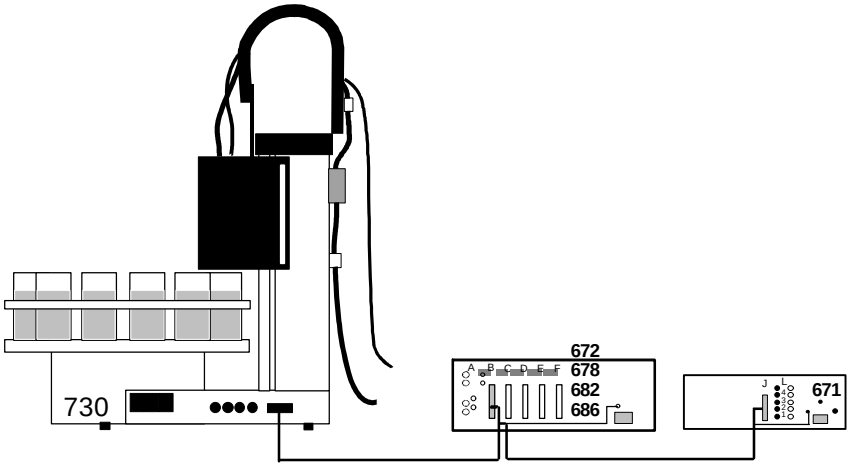
Remote control commands:

```
CTL:Rm :  START device1
CTL:Rm : *************1
```
starts Titroprocessor
"

Scan commands:

```
SCN:Rm :            End1
SCN:Rm :        ****1***
```
awaits end of titration
"

730 Sample Changer — 678 / 682 / 686 Titroprocessor — 671 Switch Box



Cable 3.980.3650

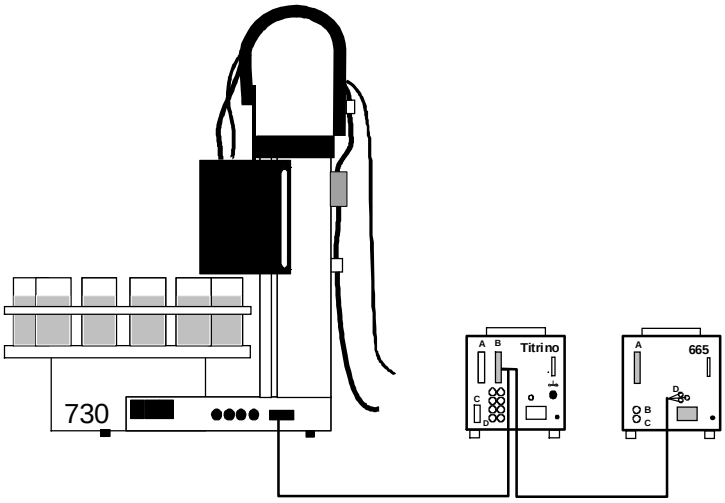
Remote control commands:

```
CTL:Rm :  START device1
CTL:Rm : *************1
```
starts Titroprocessor
"

Scan commands:

```
SCN:Rm :            end1
SCN:Rm :        ****1***
```
awaits end of titration
"

730 Sample Changer — Titrino / pH-Meter — 665/725 Dosimat



Cable 6.2141.040

Remote control commands:

```
CTL:Rm :  START device1
CTL:Rm : *************1
CTL:Rm :      START dos1
CTL:Rm : *******1******
```

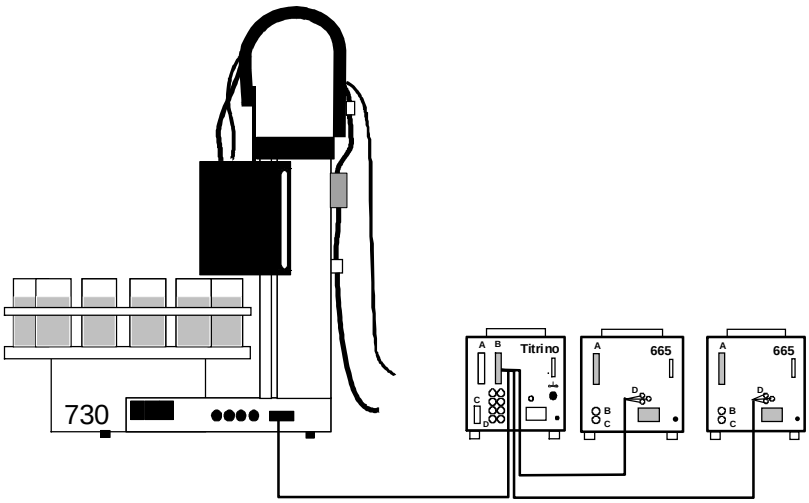
starts Titrino
"
starts Dosimat 1
"

Scan commands:

```
SCN:Rm :            end1
SCN:Rm :        ****1***
SCN:Rm :          ready1
SCN:Rm :        *******1
```

awaits end of titration
"
awaits readiness of Titrino
"

730 Sample Changer — Titrino/pH-Meter — 2x 665/725 Dosimat



Cable 6.2141.050

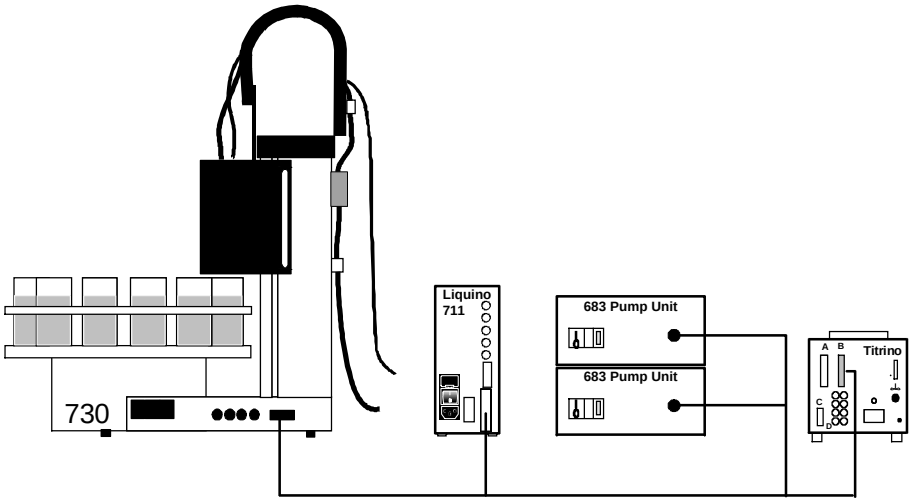
Remote control commands:

`CTL:Rm :  START device1`	starts Titrino
`CTL:Rm : ************1`	"
`CTL:Rm :     START dos1`	starts Dosimat 1
`CTL:Rm : *******1******`	"
`CTL:Rm :     START dos2`	starts Dosimat 2
`CTL:Rm : *****1********`	"
`CTL:Rm :     START dos*`	starts Dosimat 1 and 2
`CTL:Rm : *****1*1******`	"

Scan commands:

`SCN:Rm :           end1`	awaits end of titration
`SCN:Rm :       ****1***`	"
`SCN:Rm :         ready1`	awaits readiness of Titrino
`SCN:Rm :       *******1`	"

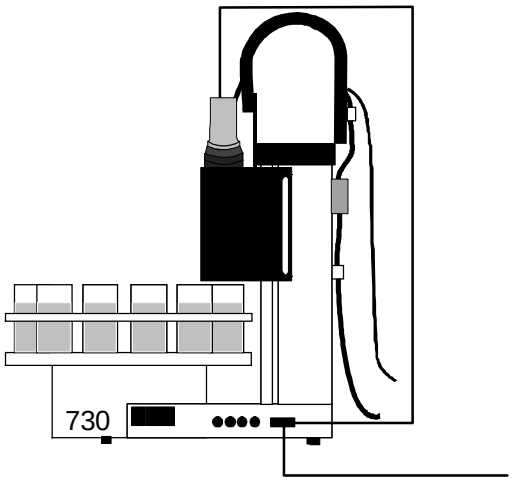
730 Sample Changer — 711 Liquino — 683 Pump — Titrino



Cable 6.2141.100

If you run the 730 Sample Changer together with the 711 Liquino, the Sample Changer should be controlled by the Liquino. For detailed informations see the Instructions for Use of the Liquino.

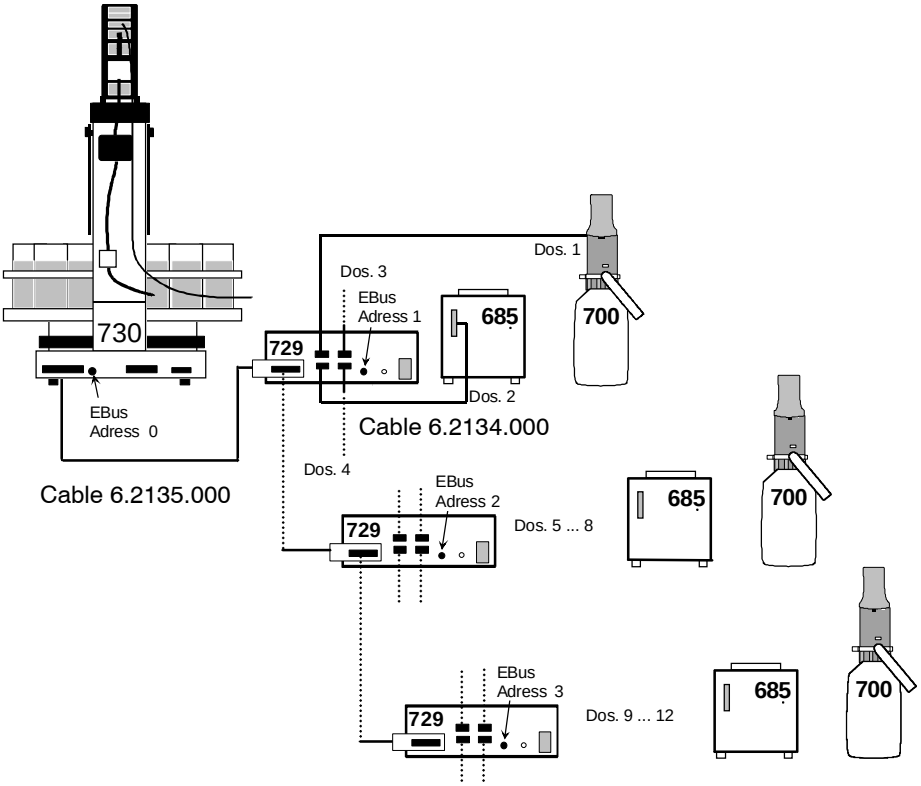
730 Sample Changer with 759 Swing Head



The 759 Swing Head is connected via the remote interface with a special cable. Using the remote cables for the 730 Sample Changer, additional instruments can be connected (see page 15ff), while four lines (Input 7 and Output 11–13, see page 119) are occupied by the swing head. These four lines are ignored when the swing head is switched on in the configuration, they are not continued in the plug.

2.5.2 External Bus Connections

Four dosing instruments may be connected to the "External Bus" interface using a 729 Dosimat Interface. Up to three Dosimat Interfaces may be connected in line (daisy chaining) and be assembled with dosing instruments. Each interface must be addressed correctly.
Thus it is possible to operate 12 dosing units using the DOS command of the 730 Sample Changer.

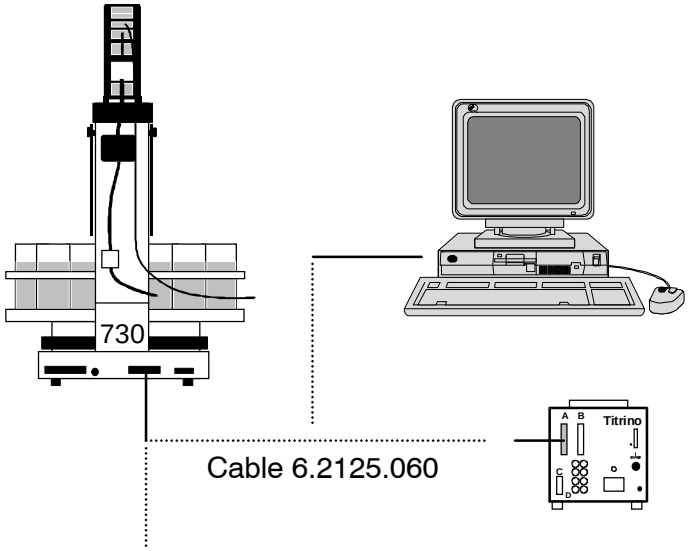


Addresses:

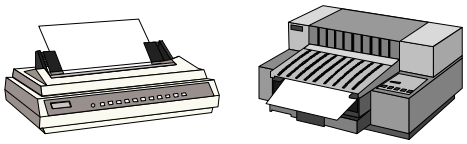
	"External Bus"-Address	Dosing Unit
Sample Changer	0	
1. Interface	1	Dos. 1 … Dos. 4
2. Interface	2	Dos. 5 … Dos. 8
3. Interface	3	Dos. 9 … Dos. 12

2.5.3 Serial Connections (RS232)

Many different instruments may be connected via the serial RS232 interface. In addition to all Metrohm instruments that support the Metrohm remote control language (see page 125ff) any printer with serial interface (or parallel interface and parallel/serial converter) or a personal computer (PC) may be connected. Any other measuring instrument may be controlled via RS232 interface, as long as it supports serial data transmission.



Printer cables, see page 25.



In order to guarantee safe data transmission, it is important to set the same RS232 interface parameters correctly for both instruments connected (see page 25).

Control commands (examples):

`CTL:RS`	`&M;$G`	starts a Metrohm instrument
`CTL:RS`	`&M;$S`	stops a Metrohm instrument
`PRINT:`	`config`	prints a configuration report to a printer or PC

Scanning input data (example):

`SCN:RS :`	`*R"`	waiting for readiness of a Metrohm instrument

2.5.4 Connecting a Printer

Printers with the following printer emulations may be connected:

`IBM`	IBM Proprinter and printers with IBM emulation
`Epson`	Epson printers and printers with Epson emulation
`Seiko`	Seiko printer DPU-411
`Citizen`	Citizen printer IDP560 RS
`HP`	HP printers and compatibles with HP PCL3 emulation

If you connect a printer not listed in the following table, be sure that it is able to emulate Epson or IBM Proprinter mode.
Use the 6.2125.050 cable for connecting a printer with built-in serial interface. Printers with parallel interface require the 2.145.0300 serial/parallel converter and 6.2125.020 cable.

Before connecting a printer to the RS232 interface, switch off the Sample Changer.

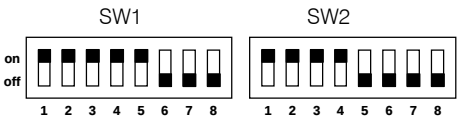
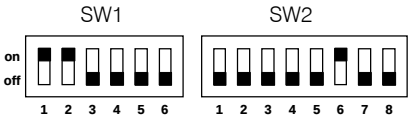
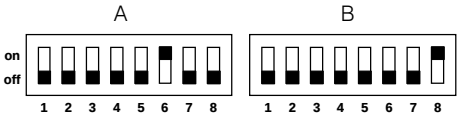
The parameters of the RS232 interface are accessible in the configuration menu under '>RS232 settings'.

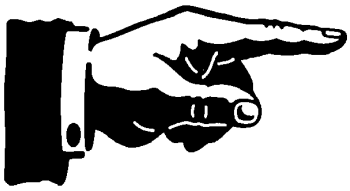
The following table lists the information necessary for connecting a printer:

Printer type	***Cable***	***RS232 Settings***	***Settings on Printer***

IBM Proprinter	6.2125.050	`baud rate: 9600`
		`data bit: 8`
		`stop bit: 1`
		`parity: none`
		`handshake: HWs`
		`character set: IBM`
			see printer manual

Seiko DPU-411	6.2125.020	`baud rate: 9600`
		`data bit: 8`
		`stop bit: 1`
		`parity: none`
		`handshake: HWs`
		`character set: Seiko`
			DIP switch settings:
			DIP01 DIP02
			 
			
			The 7-bit ASCII character is set automatically to the specific national character set according to the selected dialog language.

Printer type	*Cable*	*RS232 Settings*	*Settings on Printer*
Citizen IDP560-RS	6.2125.050	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: Citi-zen	DIP switch settings:  The 7-bit ASCII character is altered to the specific national character set by setting the jumpers J1 and J2 as follows: ***J1*** / ***J2*** / ***character set*** open / open / USA closed / closed / Great Britain closed. / open / France open / closed / Germany No spanish character set available (French may be best).
Epson with 6-pole round plug	6.2125.040	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: Epson	DIP switch settings: 
Epson with additional serial interface #8148	6.2125.050	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: Epson	DIP switch settings on the Interface: 
Epson LX-300	6.2125.050	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: Epson	see printer manual
HP Deskjet with built-in serial interface	6.2125.050 or cable 25-pole neg. / 9-pole pos. (e.g. HP C2933A)	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: HP	DIP switch settings : 
HP Laserjet with built-in serial interface	cable 25-pole neg. / 9-pole pos. (e.g. HP C2933A)	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: HP	see printer manual
HP Deskjet / Laserjet with parallel interface	6.2125.020 + serial/ parallel-converter 2.145.0300	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: HP	see printer manual



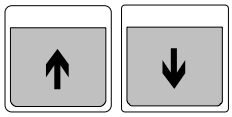
3 Introduction

3.1 Tutorial

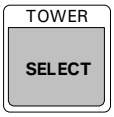
In order to become acquainted with the 730 Sample Changer and its mode of operation, it is helpful to work through the short Operating Tutorial. The basic operating steps that are required to prepare the first sample series and run it with a given method are described here.

Prerequisites / Preparations

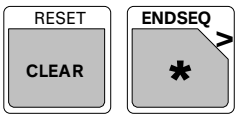
- This operating tutorial can be carried out with all changer variations (1-tower or 2-tower models). Only tower 1 will be used in this case. If a swing head is installed, see chapter 3.3 "Swing Head", page 42.
- It is assumed that the changer is fully installed.
- Connect a Metrohm titration instrument (a Titrino model is a good choice) to the remote socket (cable 6.2141.020). This tutorial can also be executed as a "dry run" i.e. without a titration instrument.
- Choose a simple titration method that you have saved in the titration instrument or create a new simple method.
- Mount the necessary tubing, an electrode and the rotating nozzle or spray nozzles on the titration head on tower 1. Don't forget to mount the splash protection and the plug cover.



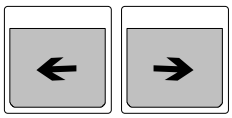
- The <↓> and <↑> keys can be used to move the lift up or down for this purpose.



- With the 2-tower model, the <TOWER/SELECT> key changes the active tower.

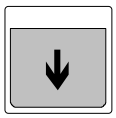


- Install the sample rack. Press the <RESET> or <ENDSEQ> (+<ENTER>) key. The changer is initialized in this way with each lift placed in the rest position and the rack is turned until the rack position 1 is positioned in front of tower 1. In this position the magnetic rack code can be read so that the internally stored rack data (position table, etc.) can be loaded.
  This should be done after every rack change.

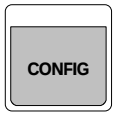


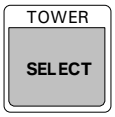
- Insert some sample beakers into the sample rack. One should be put in the highest possible rack position as rinse or conditioning beaker. The rest of the beakers are placed in ascending order, beginning with position 1. Using the keys <🡐> and <🡒> the rack can be turned for this purpose.

Basic Configuration



- Move the lift downwards carefully with the <🡓> key so that the electrode being used almost touches the bottom of the titration beaker or the titration head almost touches the edge of the beaker.





- The dialog language can be set in the configuration menu. Press <CONFIG>

```
Display:      configuration
              >auxiliaries
```

- and then <ENTER>.

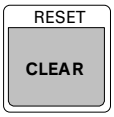
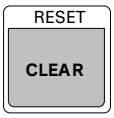
```
Display:      >auxiliaries
              dialog:         english
```

- This menu item has a colon, indicating that here the parameters can be selected from a list. Press <SELECT> several times in order to view the various selections and get used to this type of dialog.

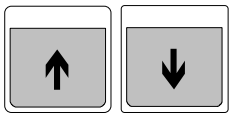
```
Display:      >auxiliaries
              dialog:          deutsch
              dialog:          francais
              …                …
```

- With <ENTER> you can accept the suggestion 'dialog: english'.

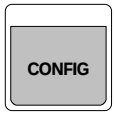
```
Display:      >auxiliaries
              display contrast:      3
```

4x <↓>	• By pressing <↓> 4 times you reach the menu selection 'max. lift way'.
	**Display: max. lift way 235 mm**
<ENTER>	• Here the lowest allowable lift position for automatic and manual operation can be set. This is a limit that can prevent damage to an electrode or a titration beaker in case of careless lift manipulation. Accept the present lift position by pressing <CLEAR> followed by <ENTER>.
<0>, <1> or <2> <ENTER>	**Display: pumps on tower 1 1**
	• Next you must indicate the number of pumps that are mounted on the towers (or on the single tower).
<SELECT> <ENTER>	**Display: swing head: OFF**
	• If you have installed a swing head instead of a titration head at tower 1, you need to select 'swing head: ON' using the <SELECT>-key to be able to use it.
<SELECT> <ENTER>	**Display: beaker sensor: ON**
	• With standard racks with one and two rows it is reasonable to switch on the beaker sensor. With this sensor, it is checked whether the sample vessels are in the right position in front of the tower. For racks with three rows the baker sensor should be switched off.
	• In order to put the sample changer back into the initial position, press <QUIT> twice or <STOP> once.
or	**Display: ******** Counter 1/12** **PUMP---- STIR---- ready**
	• In the normal state, the method name and the sample counter reading are displayed in the first line. The second line serves as status line which displays the pump status, the stirrer status and the changer status.
	• At the end of this basic configuration the sample changer must be turned off and on again or re-initialized by pressing <CLEAR> to make the latest settings effective. • All data entered up to this point however, are retained. The same is true for any methods that may have been saved.

Rack Configuration



- Using the keys <↓> and <↑> you can run the lift to the desired work position.



<↓>

<ENTER>

- Now open the configuration menu with <CONFIG> and move the cursor key <↓> until you reach the submenu '>rack definitions'. Press <ENTER> to open this submenu where you can define the rack configuration.

```
Display:      >rack definitions
              rack number          1
```

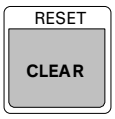
<ENTER>

- The rack number of the engaged rack will be displayed as soon as the sample rack has been correctly identified. By confirming with <ENTER> you access the rack data. (By entering another rack number you can also edit the data of a sample rack that is not engaged.)

<↓>

- You can skip the first entries with the cursor. Now you can enter the work position of the lift.

```
Display:      >rack definitions    1
              work position     0 mm
```



- Because you have already positioned the lift at the desired height, you can accept the current lift position directly by pressing <CLEAR>. Of course the work position can be entered manually or the value that has automatically been accepted can be modified later. Lift positions are given in millimeters (0–325 mm), measured from the uppermost limit (rest position) of the lift.

```
Display:      >rack definitions      1
              work position     150 mm
```

<ENTER>

- In any case don't forget to confirm the value with <ENTER>.

```
Display:      >rack definitions      1
              rinse position      0 mm
```

…

- The next menu item 'rinse position' defines the height at which the lift must be when the electrode is rinsed. As for the work position, the value here can also be entered manually or automatically accepted. For the latter, the configuration menu must be exited by pressing <QUIT> twice and the lift newly positioned.

<ENTER>

```
Display:      >rack definitions      1
              rinse position    130 mm
```

```
Display:      >rack definitions      1
              shift position      0 mm
```

…

- The menu item 'shift position' defines the height of the lift when the sample rack is rotated. For the entry proceed as for the work position. Make sure that the electrode, the titrating tip and the rod stirrer do not bump against the vessels when the rack rotates.

<ENTER>

```
Display:      >rack definitions      1
              shift position     20 mm
```

```
Display:      >rack definitions      1
              special position    0 mm
```

…

- The 'special position' defines a further height of the lift. It can be used for pipetting with the swing head. For the entry proceed as for the work position.

<ENTER>

```
Display:      >rack definitions      1
              special position  140 mm
```

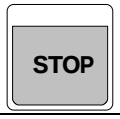
- The final entry in the rack configuration is the definition of the position of the special beakers.

<ENTER>

```
Display:      >rack definitions      1
              >>special positions
```

- In the submenu '>>special positions' under 'special beaker 1' enter the position at which you have placed the conditioning or rinsing beaker (see rack overview on page 104).

<ENTER>



- The configuration can now be exited with <STOP> or by pressing <QUIT> three times. The rack data entered are now available at all times and must not be re-defined every time.

The Method

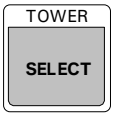
- Now open the user method menu.

```
Display:      methods
              >recall method
```

<ENTER>

- Press <ENTER> to load a predefined method.

```
Display:      method:          ********
```



- Choose "Titrino" with the <SELECT> key. This is the most universal of the predefined methods from which you can learn the basic sample changer commands.
- After you have confirmed loading the method with <ENTER>, the name of the method appears in the upper left corner of the display. You can now use the TRACE function to run the method in steps to understand how it works. See below.

<ENTER>

Tracing

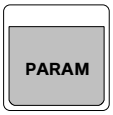
- Before you begin tracing, set the position of the first sample with the SAMPLE command. Press <SAMPLE>.

```
Display:      SAMPLE:     =          1
```

<2>

<ENTER>

- Press <2> and <ENTER>.



- Now press <PARAM> to open the parameter menu. All parameters and sequences that are stored with methods can be found here.

```
Display:      parameters
              number of samples:   rack
```

<3>

<ENTER>

- The first menu entry defines the number of sample beakers (without the special beakers) that are to be treated in a series. Here you can choose between 'rack' (= a sample rack that is partially or completely filled, only positions with a sample beaker are counted) and '∗' (= infinite number of samples) with <SELECT>. However for this learning sequence, enter '3' on the keyboard. It is also possible here, as with the other parameters, to enter data manually or use the "select" choice.

<ENTER>

```
Display:      parameters
              >start sequence
```

- In the submenu '<start sequence' the commands that are executed at the start of a sample series are found.

```
Display:      >start sequence
               1 CTL:Rm:          INIT
```

<QUIT>

- Only the CTL command is involved in the initialization of the remote interface in the 'Titrino' method. This command should be used in the start sequence of every method. Do not change anything here. Leave this submenu with <QUIT>.

<↓>

<ENTER>

- In the submenu '>sample sequence' you find the command sequences that are executed for every sample. It is recommended to test out this procedure line by line with the TRACE function.

```
Display:      >sample sequence
               1 MOVE  1    :   sample
```

- If you press the <START> key at this point, the MOVE command is executed. The sample beaker in the position predefined as sample position 2 is placed in front of tower 1.

```
Display:       2 LIFT: 1  :    work mm
```

<START>

- On the next line press <START> again to move the titration head on tower 1 into the work position you previously defined for this rack.

<START>

```
Display:       3 STIR: 1    :    on s
```

- Stirrer 1 is turned on in this line.

Display: 4 CTL:Rm: START device1

<START>

- In this line the Titrino that is connected via the remote interface is started.

Display: 5 SCN:Rm : end1

- In this line the SCAN command is used to check the end of the titration. The Titrino sends a signal (EOD) at the end of the titration. Afterwards the sample changer will complete the sample sequence.
- After you have started the command you can interrupt it with <STOP> in case you do not want to wait for the completion of the titration. Otherwise wait for device1 to send the EOD-Pulse. Tracing may be continued without pressing the <STOP> key.

<START>

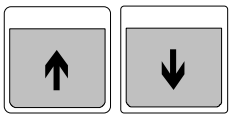
Display: 6 STIR: 1 : off s

- In this line stirrer 1 is turned off.

Display: 7 LIFT: 1 : rinse mm

- In this line the lift on tower 1 is put into the rinsing position.
- With this command you can become acquainted with the LEARN mode. It allows the user to manually set the parameters of a command on a trial basis.

- Press <LEARN> to access the LEARN mode. The blinking LEARN-LED indicates that the 730 Sample Changer is ready to execute the command.



<ENTER>

- Now move the lift into the desired position with the <🡻> and <🡹> keys. You will notice that the current lift position is always indicated "live". During execution of the command the LEARN-LED is lit continuously. Accept the lift position that has been set by pressing <ENTER> and thereby exit the LEARN mode. The LEARN LED goes off again.

Display: 8 PUMP 1.1 : 2 s

- In this line pump 1 on tower 1 is switched on to rinse the electrode and titrating tip for 2 seconds.
- Here, you can use the LEARN mode to optimize the rinsing time too.

- In this case, as with the other "teachable" commands (the LIFT command is an exception), pressing the LEARN key causes immediate execution of the corresponding command. The elapsed time is also displayed here "live". By pressing the <LEARN> key again the command can be interrupted.

- The blinking LED indicates that the sample changer is still in the LEARN mode. If you now switch the pump back on with the <LEARN> key, you will see that the "live" value (rinsing time) is now added to the existing value.

<ENTER>

- Now optimize the rinse time in this way. Accept the total time with <ENTER> and exit the LEARN mode in this way.

```
Display         9 WAIT              5 s
```

<ENTER>

- In this line a waiting time is defined that is used here as drip time.
- The LEARN mode can also be used with the WAIT command.

```
Display:        10 NOP
```

<QUIT>
<↓>
<ENTER>

- An empty line with a 'NOP' entry (no operation) always forms the end of a sequence.
- Exit the sample series with <QUIT> and go to the final sequence.

- After all sample beakers have been processed, the end sequence is executed.

```
Display:        >end sequence
                1 MOVE  1     :  spec.1
```

- In this line the special beaker 1 (as conditioning beaker) is put in front of tower 1. Press <START>.

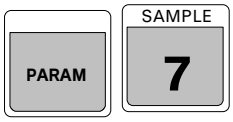
```
Display:        2 LIFT: 1  :  work  mm
```

<START>

- In this line lift 1 is put into the operating position with the electrode immersed in the conditioning solution.
- Press <START>.

```
Display:        3 NOP
```

- Now you have reached the end of the end sequence and have completed the entire run of a sample series.
- By pressing <QUIT> twice the sample changer returns to the normal state.



- Now prepare some sample beakers and fill the special beaker with a conditioning solution or water. Place all titrating vessels on the rack and prepare the Titrino for titration.
- Enter the number of samples to be processed (<PARAM>) and define the position of the first sample (SAMPLE =1).

- Now you can start your first sample series with <START>.

3.2 Configuration

Before using the 730 Sample Changer for the first time, it must be correctly configured. This includes not only the basic settings which vary slightly from one model to the other, but also the configuration of the sample racks used and the peripheral instruments that are connected. All of these settings can be accessed via the configuration menu, which can be opened with the <CONFIG> key. It is divided into 4 submenus according to topic. Navigating in the menu (selecting the individual settings) is accomplished simply using the cursor keys (<↓>, <↑>), <HOME>, <END> and the <ENTER> key. Submenus and main menus can be exited with the <QUIT> key. Many menu entries allow selection of the desired entry from a number of preset selections with the <SELECT> key. These menu items are marked with a colon (:). For more details, see page 78.

If you changed the configuration, you should RESET the sample changer using the <CLEAR> key or switch it off and on again to secure that all changes become effective.

3.2.1 Basic Settings

The following are some of the basic settings which can be set in the submenu '> auxiliaries':

- Dialog language
- Display contrast
- Acoustic signal for warnings on/off
- Device label (Instrument name or identification)
- Program version
- Maximum lift height or way
- Number of pumps on tower 1 and 2 (depending on the model)
- Swing head on/off
- Beaker sensor on/off

Dialog language

The dialog language can be chosen from the preset selections 'english, deutsch, français, español'.

Display contrast

The display contrast can be set on a scale from 0 (low contrast) to 7 (high contrast).

Beeper on/off

A warning signal sounds when error messages are displayed or if an entry is not confirmed with <ENTER> (and is therefore not accepted). This warning signal can be turned off.

Device label

To make every laboratory instrument unique (a requirement of GLP) the sample changer can be assigned an alphanumeric 8-place identification (consisting of letters and/or digits). The entry of the text is explained in detail on page 79.

Program version

The program version (instrument software) cannot be altered. The version is indicated for your information in the configuration menu.

Max. lift way

The maximum lift way is an important safety entry. If the entry is correct, you can be sure that the lift with the titration head cannot be run too low, which could lead to damage to electrodes or sample beakers. Here the lowest possible lift position (measured from the upper limit) can be entered in mm.
An easy method for determining this position is to first set the desired height manually (normal state) using the <↓> and <↑> keys. Afterwards the configuration menu can be opened and the current lift position taken over in the display by pressing the <CLEAR> key at the menu entry 'max. lift way'.

Important: The value entered only becomes valid after the instrument is switched off and on again.

Number of pumps tower 1 and 2

Here the number of pumps installed on every tower present must be indicated. This entry also becomes effective only after the changer is switched off and on again.

Swing head

When a 759 Swing Head is installed to increase the number of samples, the swing head is switched on here. Otherwise the default entry 'swing head: OFF' is retained. The swing head is switched on or off only after RESET or after the instrument is switched off and on again.

Beaker sensor

Each tower of the 730 Swing Head is equipped with an infrared sensor, which detects the presence of a beaker in front of the particular tower. If the beaker sensor is switched on, the test is performed after each MOVE-command. When triple-row sample racks in combination with the swing head are used, the beaker sensor has to be switched off. For the use of special racks, it has to be checked in each case whether the beaker sensor should be used. This entry also becomes effective only after the changer is switched off and on again.

3.2.2 Rack Definition

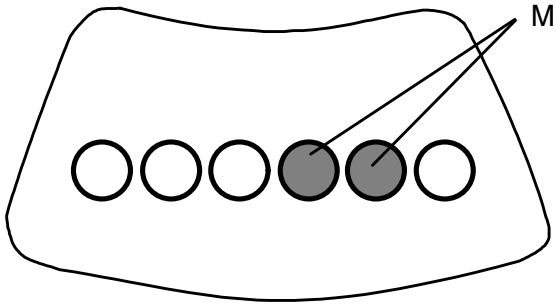
Every sample rack used must be configured to guarantee automatic rack recognition and assure that the rack positions are approached properly. The rack types available from Metrohm are already predefined and can easily be supplemented or altered.
If racks of the same type are to be configured differently, each rack must be assigned a different code and the rod magnets on the bottom of the sample rack must be arranged accordingly.
In this way a sample rack can be predefined for various applications and the use of the wrong rack can be avoided.

Rack number

Up to 16 different rack configurations can be stored in the sample changer.

Rack code

The rack code is used for automatic rack recognition. A code can be assigned only once. The standard racks that are supplied by Metrohm already have a predefined code (see Instructions for Use, page 104). The rack code is a 6-place binary pattern with the digits 0 and 1 and this has to correspond to the order of the rod magnets. The digit 1 stands for a magnet which is inserted and 0 signifies that no magnet is inserted. 63 different codes are possible (000001 to 111111).



bottom view

Rack type

The rack type or the rack name points to an internal position table in which the positions of the individual beakers in the rack is defined. Metrohm racks have the following scheme for the type definition:

MXX-Y (XX = Number of beakers, Y = special code, 0 for single-row, 1 for double-row and 2 for triple-row standard racks)

For example: M12-0 indicates a single-row normal Metrohm rack with 12 beaker positions.

Work position

Correctly setting the work position is very important. This is the lift height at which the corresponding sample rack will be processed. It should be chosen so that the electrodes, burette tips and stirrer are in the optimal position. The work position is indicated in mm (from upper limit). In the 2-tower version of the changer this is valid for both lifts.
An easy method for determining this position is to first set the desired height manually (normal state) using the <🡻> and <🡹> keys. Afterwards the configuration menu can be opened and the current lift position taken over in the display by pressing the <CLEAR> key at the menu entry 'operating position'.

Rinse position

The rinse position defines the height, at which the lift is during the rinsing of the electrode. As for the working position the rinse position can be entered manually or taken over automatically. In the 2-tower model the shift position is valid for both lifts.

Shift position

In principle, the sample rack can only be turned when the lift (or lifts) is/are higher or at the same height as the shift position.
The shift position should therefore be chosen so that safe turning of the sample rack is possible, i.e. make sure that when the rack is turning, there is no risk of breaking an electrode, etc. As for the working position the shift position can be entered manually or taken over automatically. In the 2-tower model the shift position is valid for both lifts.

Special position

The special position defines another lift height. E.g., for pipetting with the swing head, this additional lift position can be chosen in a way that the pipetting tip just dips into the sample solution. As for the working position the special position can be entered manually or taken over automatically. In the 2-tower model the shift position is valid for both lifts.

There are no commands combined with the lift positions. Thus, they can be used in principal for any lift position that should be stored.

Special beakers

For every sample rack up to 8 special beaker positions can be defined that are not considered to be sample beaker positions during the normal course of a method. Special beakers can be specifically accessed at any time. They can serve as rinsing or conditioning beakers or be defined in a start sequence as the beaker positions of the various buffer solutions for the calibration of an electrode. If the sample is transferred from the sample vessel to the titration vessel using the Swing head, the titration vessel is defined as special beaker too.
The special beakers 'spec.1' to 'spec.8' can also be assigned a beaker position from 1 up to the number of sample positions. Position 0 stands for "not defined". It is advantageous to put the special beakers at the rack positions carrying high numbers so that the sample series can begin at position 1.

3.2.3 Dosing Units

To automate the addition of auxiliary solutions, it is possible to connect up to 12 dosing instruments with the sample changer. For this purpose, the 685 Dosimat and the 700 Dosino are available. The maximum dosing and filling rate as well as the dimensions of the tubing can be defined for every dosing unit.

Dosing unit

Dosing unit, for which the parameters are entered (1–12, see page 23).

Max. Rate

This value stands for the maximum allowed dosing and filling rate of the dosing unit. The viscosity of the medium to be dosed should be considered and this value should be chosen so that the dosing is as fast as possible yet the filling of the burette can proceed without a problem and without air bubbles. The max. rate represents an absolute limit that cannot be exceeded even during manual dosing.

Tubing Length and Diameter

These values are only valid for the 700 Dosino. Because this instrument is capable of automatic preparation of the tubing system for dosing, i.e. rinsing the tubing and filling with dosing solution, the actual tubing lengths and inner diameters must be given. The rinsing volume required is then automatically calculated.

The settings mentioned above must be carried out for all 4 ports (inlets and outlets 1–4) of each 700 Dosino.

3.2.4 RS232 Interface

Either a printer (for protocolling the changer settings and methods) or a personal computer (for controlling the changer) can be connected to the RS232 Interface. Furthermore, other Metrohm instruments (via Metrohm remote control language) and possibly other foreign instruments can be accessed via this interface. The transfer parameters required, which must be adjusted according to the instrument which is being connected, are the following:

Baud Rate, Data Bit, Stop Bit, Parity and Handshake

For data communication with PC's, Metrohm and foreign instruments, the parameter 'send to: IBM' must be set. The remaining parameters should keep the standard value or be adapted to the settings of the peripheral instrument used.

For connecting a printer, see page 25.

With 'RS control: ON' the reception of data can be switched on and off. If the remote control is switched off, data cannot be received any more, but reports can still be printed.

3.2.5 Locking Keyboard Functions

Certain domains of the user dialog can be made inaccessible to the novice user by locking particular keys. For example, the inadvertent overwriting of a method or even the changing of parameters can be prevented in this way.

The menu **'keyboard options'** for the corresponding functions is opened by holding down the <CONFIG> key while turning on the changer. Alternatively, a reset can be executed by pressing <CLEAR> and then the <CONFIG> key within 0.4 seconds. This menu is also accessible when the entire keyboard has been locked.

The individual key domains that can be locked are the following:

Locking the entire keyboard

If, during routine use, only one particular method is to be used, it may be desirable to block manual manipulations on the changer. All the keys on the keyboard can be locked for this purpose. The <START>, <STOP> and <CLEAR/RESET> keys however, remain operable so that it is still possible to start and stop a method. This can also be beneficial when using the sample changer with a PC-software (for example, TiNet or Workcell). For this application the keyboard may be disconnected.

'lock keyboard: **ON'** locks all the keys on the keyboard (for exceptions, see above).

Locking the configuration

The basic configuration of the changer can be protected from overwriting. All settings of the configuration menu are no longer accessible at this point.

'lock config: **ON'** locks the <CONFIG> key.

Locking parameters

If user methods are generally used, it might be wise to protect the stored method parameters from alteration. The parameter menu can then be made inaccessible.

'lock parameters: **ON'** locks the <PARAM> key.

Locking the method storage function

It makes sense to prevent the inadvertent deletion of stored methods. Method deletion should only be made possible by consciously turning off the locking function.

'>user methods' + **<ENTER>** opens the submenu for locking method storage functions.

'lock method recall: **ON'** blocks the loading of methods.
'lock method store: **ON'** blocks the storage of methods.
'lock method delete: **ON'** blocks the deletion of methods.

Switching off the display

If the sample changer is to be operated exclusively by an external control software (see above) the display for manual operation can be switched off.

'lock display: **ON'** switches off the display.

3.3 Swing Head

To ensure that the individual vessels are approached with precision even when using multiple-row sample racks, a 759 swing head can be installed instead of the normal titration head. The swing head is fitted with either a titration head (2.759.0020) or a transfer head (2.759.0010) for pipetting the sample from the sample vessel into a bigger titrating vessel.

3.3.1 Prerequisites

If a swing head is to be used, program version 730.0013 or higher needs to be installed on the sample changer. The 759 swing head can be used in combination with the following racks:

	Sample rack	759 model	Number of towers
Titration	48 x 75 mL for direct titration Article No. 6.2041.350	Article No. 2.759.0020	1, 2
Pipetting	126 x 15 mL and 2 x 150 mL for pipetting Article No. 6.2041.400	Article No. 2.759.0010	2

If the two-row sample rack with 48 beakers is used on the 2-tower model for direct titration, sample beakers cannot be approached with tower 2. If the rack is used for transferring samples from 126 test tubes into two central measuring/rinsing vessels (special beakers), all the positions can be approached with tower 1, whereas tower 2 can only approach the two special beakers. The swing head cannot be used in combination with other standard rack types.

3.3.2 Installing the Swing Head

The best procedure for installing the swing head is described below. The swing head will normally be installed by our service personnel.

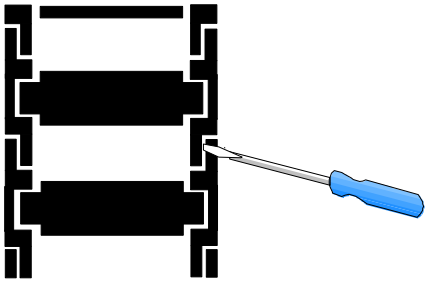
If a 2-tower sample changer is used, the swing head must always be connected to **tower 1** (see page 6)!

With 2-tower sample changers, tower 1 is first moved into a central lift position and tower 2 is moved into the rest position.

Turn off mains power switch.

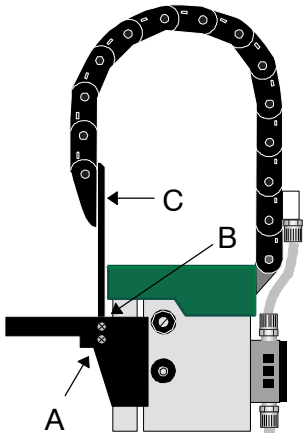
Install the new titration head (6.1462.020) or transfer head (6.1462.010) on the underside of the swing head.

Disengage the guide chain



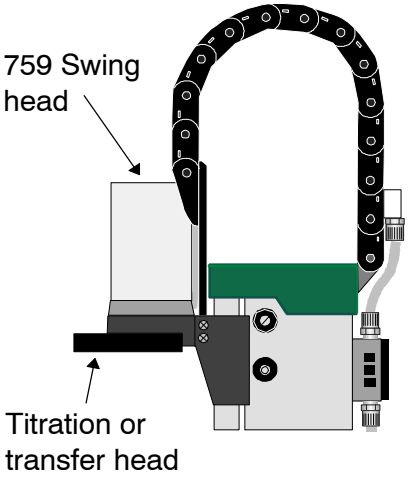
Use a screwdriver to open the guide chain in-between two links to facilitate the process of disassembling the titration head and installing the swing head.

Connect the swing head to Tower 1



Loosen screws A on both sides and remove the titration head together with the mounting plate and the lowest link. Use an angled screwdriver for recessed-head screws for 2-tower sample changers. Then loosen screws B and C and connect the new mounting plate for the swing head (6.2058.000) to the bottom link (screws C).

Before fixing the swing head to tower 1, rotate screws A a few times in the appropriate holes to cut a thread into the plastic.



The swing head can now be installed on the mounting plate (screws B). Ensure that the lead runs in the guide chain. After screwing the swing head and mounting plate into place on the tower, the bottom link is re-engaged

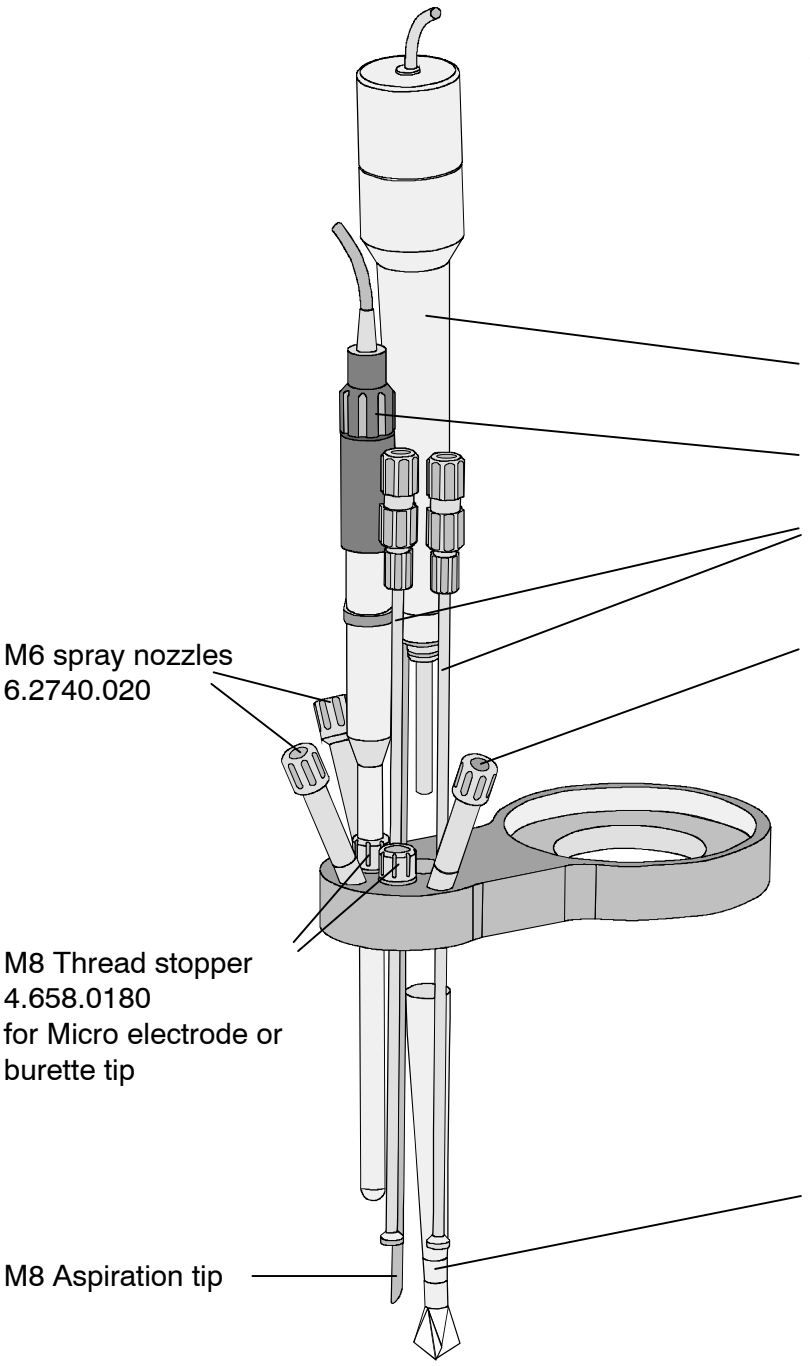
The splash protection supplied with the pipetting swing head (2.759.0010) is connected to tower 2. The splash shield supplied with the titration swing head (2.759.0020) is connected to tower 1 when used with the 2-tower model.

The 759 swing head can now be connected to the remote socket of the sample changer (see page 22) and the sample changer can be turned on again.

Configuration

In the configuration menu, select '>Auxiliaries' and then 'Swing head: ON'. Switch the beaker sensor off when using three-row racks.

3.3.3 Accessories for the Titration Head



Aligning the titration/transfer head

The swing head executes a shift movement as it approaches the sample vessels. It can adopt any of four fixed positions, depending on which row is targeted, or whether the lift is in the shift position. The titration or transfer head should be aligned in order to guarantee that the individual positions are approached with precision.

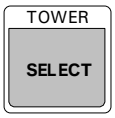
Place the sample rack that you wish to use on the sample changer and insert a few sample vessels. Approach one sample position. Slightly loosen the three screws securing the titration head to the underside of the swing head and align the titration head so that electrodes, stirrer, burette tip and tubes are centered in the sample vessel. Retighten the screws. Proceed in exactly the same way for the transfer head.

3.4 Manual Operation

By way of introduction, we list here only the basic functions for manual operation that are necessary to prepare the sample changer for the processing of a sample series. They can be executed with just a few keystrokes.

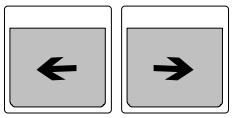
For further commands and details see chapter 4.4, "Changer Commands", page 94ff.

Selecting a tower (only with the 2-tower model)



Most of the functions for manual operation are specific and valid for only one tower at a time. With <SELECT/TOWER> you can switch between the towers. The tower that is currently active is indicated by the LEDs TOWER 1 and TOWER 2. The following commands or keys refer to the tower that is currently active: MOVE (←, →) , LIFT (↑, ↓, HOME, END), PUMP.

Turning the sample rack / Positioning the samples



Using the <←> and <→> keys the sample rack can be turned one position to the left (in the counterclockwise direction) or right (clockwise). The beaker positions are then directed to the active lift. Special attention should be given to sample racks whose angle of rotation for the beaker positions does not correspond to the arrangement of both towers (for example, 16 or 14-place racks, irregularly arranged rack positions).

With the MOVE command, a particular (sample) beaker can be placed under the active lift. With <SELECT> the numerical rack position as well as the predefined current sample (SAMPLE command) or the special beakers 1-8 can be chosen.

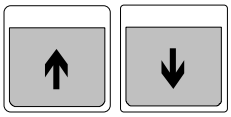
Example:

```
MOVE :      sample     <ENTER>
MOVE :      spec.1     <ENTER>
MOVE :           5     <ENTER>
```

Important:

For security reasons turning the sample rack is only possible when the lift (or both lifts) are in or above the shift position.

Moving the lift



The keys <↑> and <↓> allow upward and downward movement of the lift on the tower that is currently active. The lowest possible lift position is defined by the configuration parameter 'max. lift way'.

The <HOME> key runs the lift of the currently active tower to the rest position (0 mm), i.e. to the upper limit.
<END> runs the lift to the predefined work position.

With the LIFT command, the lift of the active tower can be run to a given position. In addition to selecting an exact position in mm (0 - 325 mm), the <SELECT> key can select a predefined position (work position, rinse position, shift position, special position, rest position = 0 mm).

Example:

```
LIFT :        work     <ENTER>
LIFT :       shift     <ENTER>
LIFT :     150 mm      <ENTER>
```

Setting the sample position

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

Pumps

The PUMP command controls the 1 or 2 pumps that are accessible on the active tower – for rinsing the titration head and for aspiration of sample or rinsing solution. Maximum 2 pumps can be operated simultaneously. The pump command switches the selected pump on or off, according to the current state. The current state of the pumps is shown directly in the display.

Example (Tower 1):

```
PUMP on/off    no. ?   <2>    Display: PUMP -+--  (+=on)
PUMP on/off    no. ?   <2>    Display: PUMP ----  (-=off)
```

Pump 2 on tower 1 is turned on and off.
Pressing <STOP>, all pumps (and stirrers) are switched off.

Stirrer

The STIR command controls the stirrers. It switches the selected stirrer on or off, according to the current state. The current state of the stirrers is shown directly in the display.

Example:

```
STIR  on/off   no. ?   <3>    Display : STIR +---
STIR  on/off   no. ?   <3>    Display : STIR ----
```

Stirrer No. 3 is turned on and off.
Pressing <STOP>, all stirrers (and pumps) are switched off.

Dosing units

The DOS command controls the connected dosing instruments. Positive and negative volumes can be dosed. Negative volumes are used to fill the pipetting tube during pipetting and are entered as <∗xx ml>. In addition to entering the volume that is to be aliquoted, <SELECT> also accesses additional functions of the current dosing instrument:

- filling the burette (fill),
- initializing the change of the dosing unit (release),
- preparing the tubing system (prepar.),
- emptying the tubing system and the burette (empty),
- ejecting the contents of the burette (eject),
- compensating the play between the piston and the spindle before sucking in and filling the cylinder respectively (adjust),
- compensating the play between the piston and the spindle before dosing (level).

The first parameter of the DOS command stands for the number of the dosing instrument (1–12) and the second parameter stands for the function or the volume to be dosed.

Example:

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

3.5 Methods and Sequences

3.5.1 Composition of a Method

A method consists of the following parts:

- Number of samples to be processed
- Process sequences (start, sample and final sequence)
- Definition of the various instrument settings (changer settings, stirrer speed, definition of the dosing units, manual stop options)

For details about the instrument settings see page 87ff.

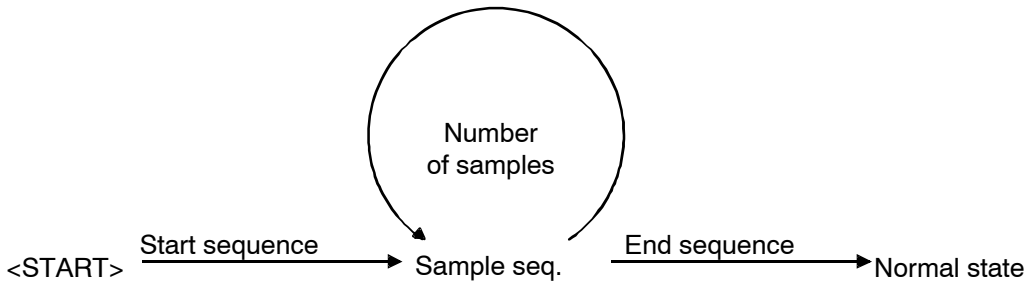
Sequences

A sequence is a succession of commands that are carried out in the order specified during automatic processing of a sample series. There are functions for controlling up to four stirrers, four pumps, (rinsing and aspiration), two lift stations (towers) and for moving the turntable (racks). External instruments such as titration instruments, pH Meters, Ion Meters, Dosimats, etc. can be controlled using the corresponding commands. Furthermore, the settings for the individual instrument components and dosing units (700 Dosino or 685 Dosimat) can be defined within a sequence.

Processing a sample series is accomplished in three phases. These are:

Start Sequence:	Sequence of commands that is executed once at the beginning of a series.
Sample Sequence:	Sequence of commands used for each sample.
Final Sequence:	Sequence of commands that is executed once at the end of a series.

Course of a method



The creation of sequences is done in the submenus '>start sequence', '>sample sequence' and '>final sequence', which are accessible via the main menu '>parameters' (press <PARAM>).

A sequence is organized in lines. When a command is entered, a new line with the corresponding command is added after the command that is displayed at the moment. The line number is visible in the display. 99 lines per sequence are possible.

Deletion of a line is done by pressing <DELETE>. The lines that follow are shifted upwards.
A new line can be added later. This is accomplished with <INSERT> whereby an empty line is inserted before the current line. The lines that follow are shifted downwards.

In a command sequence, the commands that are on the numerical keypad as alternate functions can be used. For the most part these are the same commands that are used for manual operation. However, in a sequence these can exhibit different or more extensive selection possibilities.

During the course of a method it is possible to change all entries in the menus "configuration" and "parameters". These changes have an immediate effect on the course of the method (with few exceptions, see page 83).

Care should be taken when editing process sequences. These can be edited "live" (including insertion or deletion of a command line). The TRACE and LEARN functions however, are not available in this case. Testing of the edited function is therefore not possible. Illogical command sequences could easily result, which would cause an error condition and force the interruption of a sample series.

3.5.2 LEARN Mode and TRACE Function

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. This is especially useful for the establishment of the pump time where the optimal length of the rinsing process can be interactively determined in this way.

Procedure for creating a method:

- Enter a command or select an existing command line
- Press the <LEARN / HOLD> key
  - Function is started, "LEARN" LED lights up
  - Press the <LEARN / HOLD> 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

The LEARN function can be used with the following commands:

Command	"Teachable" Parameter	Mode of function
LIFT	Lift position in mm	absolute
PUMP	Pump time in sec	additive
STIR	Stirring time in sec	additive
WAIT	Waiting time in sec	additive
DOS	Dosing volume in mL	additive
SCN Rm	Status of the 8 remote lines	"live" value
SCN RS	Character sequence received	"live" value

TRACE function

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.

3.5.3 Process Control

With **<START>** a method is started from the normal state. If there is no manual intervention or unexpected errors, the sample series is correctly processed and closed with the final sequence. The sample sequence is executed repeatedly according to the entry under 'number of samples', beginning with the sample beaker that is defined as 'SAMPLE'.

If the sample series is interrupted with **<STOP>**, the sample changer returns immediately to the normal state. Samples that have not been processed are ignored and the end sequence is not executed. If settings for such instances have been activated under **'manual stop options'**, the corresponding actions or commands

are also executed via the interfaces to stop instruments that are connected or to initiate other actions.

With **<HOLD>** the processing of a method can be interrupted. The command that is active at this point is immediately interrupted as a result. <START> continues the active sequence beginning with the command immediately following the one interrupted. Any peripheral instrument connected is **not** stopped with the <HOLD> key.

<CLEAR> interrupts a sample series at the end of a currently active sequence (soft break). The sample currently being processed will be completed.

<QUIT> interrupts the command currently being executed and starts the next command line in the sequence.

If errors occur during the sample series, the corresponding **error message** is displayed and must be acknowledged with **<QUIT>**. The changer then goes into the HOLD status (see above). After remedying the error, <START> resumes the sequence or <STOP> halts it entirely.

3.5.4 POWERUP Method

When the sample changer is switched on, the sample rack and the titration heads are brought into the rest position. Thus, electrodes are moved out of the conditioning vessel eventually. To bring them back into the conditioning vessel, the "POWERUP" method can be used. This method is started automatically, when the sample changer is switched on.

Create a method that contains the command sequence which should be worked off, when the sample changer is switched on. Store this method under the name "POWERUP" (see page 93).

3.6 User Methods

The following pages contain the listing of user methods included with the instrument with explanations of the important commands. A prerequisite for the use of these methods is a correct configuration. In particular, for each sample rack used, the work position, rinse position, shift position, special position, rack code and type as well as a special beaker must be defined.
The specific titration or measurement method must be set in each case on the appropriate instrument. The correct cable connections can be found on page 14ff. For these examples it is assumed that the measuring instruments are connected to the remote control socket.

It is recommended to work through every new method step-by-step with the TRACE function, making adjustments where necessary, before starting the method for the first time.

The methods 760_1 to 760_4 can be deleted, if additional memory is required (see page 93).

Method: **Titrino**

This is the most universal method for titrations with a Titrino and the 730 Sample Changer. It may serve as a model for additional methods.

```
730 Sample Changer 0120/02 187  730.0013   - report header with instrument identification and program
parameters                                    version
  method              Titrino               - method name
  number of samples:     rack               - number of samples to be processed (entire sample rack)
>start sequence
   1 CTL:Rm:             INIT               - initialize remote interface
>sample sequence
   1 MOVE  1     :     sample               - place first sample under lift 1
   2 LIFT: 1  :          work mm             - place titration head at work position
   3 STIR: 1     :         ON s             - switch on stirrer 1
   4 CTL:Rm:    START device1                - start e.g. Titrino
   5 SCN:Rm      :       End1               - wait for end of titration
   6 STIR: 1     :        OFF s             - switch off stirrer 1
   7 LIFT: 1  :         rinse mm            - place titration head at rinse position
   8 PUMP  1.1   :          2 s             - rinse electrode for 2 sec
   9 WAIT                   5 s             - let drip for 5 sec
>final sequence
   1 MOVE  1     :     spec.1               - place conditioning beaker under lift 1
   2 LIFT: 1  :          work mm             - immerse electrode
>changer settings
  rack number              0                ——— Settings for changer functions ———
  lift rate 1             25 mm/s
  lift rate 2             25 mm/s
  shift rate              20
  shift direction:      auto.
  beaker test mode:    single               - if a sample beaker is missing, the next one is automatically
  on beaker error:       MOVE                selected
>stirring rates
  stirrer 1                3                ——— Stirring speeds ———
  stirrer 2                3
  stirrer 3                3
  stirrer 4                3
>dosing unit def.                           ——— Settings for dosing instruments ——— (none)
>manual stop                                ——— Reaction to manual stop ———
  CTL Rmt:       STOP device1               - stop device 1
  CTL RS232:
          ------------
```

Method: **parallel**

This is a method for titrations with two Titrinos simultaneously on two towers (parallel titration). Prerequisite for this is a 2-tower sample changer, the 6.2141.030 remote control cable and a 12 or 24 place sample rack, since the rack positions must be accessible to both towers simultaneously. The rotating nozzle is employed for rinsing the electrode.

```
 'pa
730 Sample Changer 0120/02 187  730.0013
parameters
  method             parallel
  number of samples:        *                - infinite number of samples (until <STOP>), must be
>start sequence                                 modified (--> number of samples / 2).
   1 CTL:Rm:             INIT
>sample sequence
   1 MOVE  2     :     sample                 - place first sample in front of tower 2 (second sample in
   2 LIFT: *  :          work mm                front of tower 1)
   3 STIR: *     :         ON s               - both lifts to the work position
   4 CTL:Rm:    START device*                  - start both Titrinos
   5 SCN:Rm      :     Ready*                 - wait for end of both titrations, static "ready" signal from
   6 STIR: *     :        OFF s                 both Titrinos
   7 LIFT: *  :         rinse mm               - both lifts in rinsing position
   8 PUMP  1.1   :         ON s                - switch on rotating nozzle on tower 1
   9 PUMP  2.1   :          3 s                - switch on rotating nozzle on tower 2 for 3 seconds
  10 PUMP  1.1   :        OFF s                - stop rinsing process on tower 1
  11 WAIT                  5 s                - let drip for 5 sec
  12 SAMPLE:     +         2                  - raise sample beaker position by 2 positions
>final sequence
   1 MOVE  2     :     spec.2                 - direct conditioning beaker to tower 2
   2 LIFT: *  :          work mm               - both lifts in work position, immerse electrodes
>changer settings
  rack number              0
  lift rate 1             25 mm/s
  lift rate 2             25 mm/s
  shift rate              20
  shift direction:      auto.
  beaker test mode:      both                  - test for missing beakers on both towers
  on beaker error:    display                 - If sample beaker is missing, interrupt, display an error
>stirring rates                                  message
  stirrer 1                3
  stirrer 2                3
  stirrer 3                3
  stirrer 4                3
>dosing unit def.
>manual stop
  CTL Rmt:       STOP device*                  - stop both Titrinos if a manual stop occurs
  CTL RS232:
          ------------
```

Method: **pH cal**

This method serves to complete an automated series of pH measurements preceded by electrode calibration. It can be used with the Metrohm 713 and 692 pH Meters. Special beakers must be defined for this in the first rack positions during rack configuration (spec.1 = 1st buffer solution, spec.2 = 2nd buffer solution, spec.3 = rinsing beaker). This method shows the mode of operation when using spray nozzles combined with aspiration of the rinsing fluid.

```
'pa
730 Sample Changer 0120/02 187  730.0013
parameters
  method               pH cal
  number of samples:     rack
>start sequence
   1 CTL:Rm:             INIT
   2 MOVE  1     :     spec.3
   3 LIFT: 1  :          work mm
   4 PUMP  1.*   :           4 s
   5 MOVE  1     :     spec.1
   6 LIFT: 1  :          work mm
   7 STIR: 1     :          10 s
   8 CTL:Rm:     METER cal pH
   9 SCN:Rm      :        End1
  10 MOVE  1     :     spec.3
  11 LIFT: 1  :          work mm
  12 PUMP  1.*   :           4 s
  13 MOVE  1     :     spec.2
  14 LIFT: 1  :          work mm
  15 STIR: 1     :          10 s
  16 CTL:Rm:      METER enter
  17 SCN:Rm      :        End1
  18 MOVE  1     :     spec.3
  19 LIFT: 1  :          work mm
  20 PUMP  1.*   :           4 s
>sample sequence
   1 SHIFTRATE:     +       20
   2 MOVE  1     :     sample
   3 LIFT: 1  :          work mm
   4 STIR: 1     :          10 s
   5 CTL:Rm:    METER mode pH
   6 CTL:Rm:    START device1
   7 SCN:Rm      :        End1
   8 SHIFTRATE:     –       20
   9 MOVE  1     :     spec.3
  10 LIFT: 1  :          work mm
  11 PUMP  1.*   :           4 s
>final sequence
   1 MOVE  1     :     spec.3
   2 LIFT: 1  :          work mm
>changer settings
  rack number              0
  lift rate 1             25 mm/s
  lift rate 2             25 mm/s
  shift rate              20
  shift direction:      auto.
  beaker test mode:    single
  on beaker error:       MOVE
  …
```

- number of samples (entire rack, only positions where a beaker is placed are counted)
- rinsing beaker in front of tower 1
- rinse electrode
- first buffer solution in front of tower 1
- immerse electrode
- stir for 10 seconds
- start pH meter calibration
- wait for measurement of the first buffer (EOD pulse)
- rinsing beaker in front of tower 1
- rinse electrode
- second buffer solution in front of tower 1
- immerse electrode
- stir for 10 seconds
- start measurement in second buffer
- wait for end of measurement (EOD pulse)
- rinsing beaker in front of tower 1
- rinse electrode
- turning direction of the rack (ascending)
- sample beaker in front of tower 1
- immerse electrode
- stir for 10 seconds
- switch pH meter to pH measurement and start it
- the result is printed out
- wait for end of measurement (EOD pulse)
- turning direction of rack (descending)
- rinsing beaker in front of tower 1
- rinse electrode, suck off rinsing liquid
- turning direction of the rack at the beginning (calibration) automatic

Remark: The turning direction of the rack is altered during method processing to prevent the electrode, during rack rotation, from dripping into samples that have not yet been analyzed.

Method: **prepare**

This method shows the operating process when an auxiliary solution is to be added to several samples before the titration. A Titrino and a 665 or 725 Dosimat are required for this. Both are to be connected with the sample changer using the 6.2141.040 cable. The volume to be added must be set on the Dosimat.

```
730 Sample Changer 0120/02 187  730.0013
parameters
  method              prepare
  number of samples:        9                - 9 samples, effective number of samples – 2 (here using
>start sequence                                 the 12-place rack and 1 special beaker)
   1 CTL:Rm:             INIT
   2 MOVE  1     :     sample                 - first sample in front of tower 1
   3 LIFT: 1  :         rinse mm               - lift in rinse position
   4 CTL:Rm:       START dos1                 - start dosing
   5 WAIT                   4 s               - waiting time for Dos. must be adjusted (LEARN!)
   6 SAMPLE:     +          1                 - raise sample position by 1
   7 MOVE  1     :     sample                 - next sample in front of tower 1
   8 LIFT: 1  :         rinse mm
   9 CTL:Rm:       START dos1                 - dosing
  10 WAIT                   4 s               - waiting time
  11 SAMPLE:     –          1                 - lower sample position by 1
  12 MOVE  1     :     sample                 - first sample in front of tower 1
  13 LIFT: 1  :          work mm               - lift in work position
  14 STIR: *     :         ON s               - stirrer on
  15 WAIT                  40 s               - waiting time
  16 CTL:Rm:    START device1                 - start titration
  17 SCN:Rm      :     Ready1                 - wait for end of titration (static 'ready'-line)
  18 STIR: *     :        OFF s               - switch off stirrer
  19 LIFT: 1  :         rinse mm
  20 PUMP  1.1   :          3 s               - rinse electrode
  21 WAIT                   5 s
>sample sequence
   1 SAMPLE:     +          1                 - raise sample position by 1
   2 MOVE  1     :     sample                 - next sample in front of tower 1
   3 SAMPLE:     +          1                 - raise sample position by 1
   4 MOVE  1     :     sample                 - next sample in front of tower 1
   5 LIFT: 1  :         rinse mm               - lift in work position
   6 CTL:Rm:       START dos1                 - start dosing
   7 WAIT                   4 s               - waiting time for dosing
   8 SAMPLE:     –          1                 - lower sample position by 1
   9 MOVE  1     :     sample                 - next sample in front of tower 1
  10 LIFT: 1  :          work mm               …
  11 STIR: *     :         ON s
  12 CTL:Rm:    START device1                 - start titration
  13 SCN:Rm      :     Ready1                 - wait for end of titration
  14 STIR: *     :        OFF s               …
  15 LIFT: 1  :         rinse mm
  16 PUMP  1.1   :          3 s
  17 WAIT                   5 s
>final sequence                               ——— process last sample ———
   1 SAMPLE:     +          1                 …
   2 MOVE  1     :     sample
   3 LIFT: 1  :          work mm
   4 STIR: 1     :         ON s
   5 CTL:Rm:    START device1
   6 SCN:Rm      :     Ready1
   7 STIR: 1     :        OFF s
   8 LIFT: 1  :         rinse mm
   9 PUMP  1.1   :          3 s
  10 WAIT                   4 s
  11 MOVE  1     :     spec.1                 - place conditioning beaker
  12 LIFT: 1  :          work mm               - immerse electrode
>changer settings                             see method "Titrino"
   …
```

Remark: The first and last samples must be specially treated in the start and end sequences, respectively.

Method: **std add**

This method accomplishes the automatic measurement of a sample series with a 692 Metrohm pH/Ion Meter, including standard addition using a 665 or 725 Dosimat. A 6.2141.070 cable is required for this. The 692 Ion meter controls the Dosimat and stirrer 1.

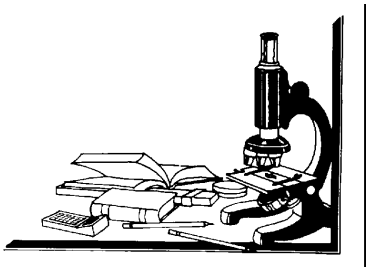
```
 'pa
730 Sample Changer 0120/02 187  730.0013
parameters
  method              std add
  number of samples:     rack
>start sequence
   1 CTL:Rm:             INIT
>sample sequence
   1 MOVE  1     :     sample
   2 LIFT: 1  :          work mm
   3 CTL:Rm:     METER mode C
   4 CTL:Rm:    START device1
   5 SCN:Rm      :   EndMeter
   6 LIFT: 1  :         rinse mm
   7 PUMP  1.1   :           2 s
   8 WAIT                    5 s
>final sequence
   1 MOVE  1     :     spec.1
   2 LIFT: 1  :          work mm
>changer settings
  rack number               0
  lift rate 1              25 mm/s
  lift rate 2              25 mm/s
  shift rate               20
  shift direction:      auto.
  beaker test mode:    single
  on beaker error:       MOVE
>stirring rates
  stirrer 1                 3
  stirrer 2                 3
  stirrer 3                 3
  stirrer 4                 3
>dosing unit def.
>manual stop
  CTL Rmt:       STOP device1
  CTL RS232:
          ------------
```

- set mode conc and start measurement
- print out the result (stirrer 1 is controlled by 692)
- wait for end of measurement (EOD pulse)
- rinse electrode

Method: **tower1+2**

This method allows titration of each sample using two different titration methods, one after the other, with the 2-tower model of the 730 Sample Changer (with 2x2 pumps) and 2 Titrinos. An auxiliary solution can also be added according to the titration method used. A 685 Dosimat or a 700 Dosino can be connected via the External Bus interface (and 729 Dosimat Interface) for this purpose. A 12 or 24-position rack is required for parallel titration. At tower 1 the electrode is rinsed after the titration. At tower 2 the sample solution will be aspirated after the titration.

```
 'pa
730 Sample Changer 0120/02 187  730.0013
parameters
  method             tower1+2
  number of samples:     rack
>start sequence                          ——— titrate first sample at tower 1 ———
   1 CTL:Rm:             INIT
   2 MOVE  1     :     sample
   3 LIFT: 1  :          work mm
   4 STIR: 1     :         ON s
   5 CTL:Rm:    START device1              - start first titration
   6 SCN:Rm      :     Ready1             - wait for end of titration (static 'ready'-Signal)
   7 STIR: 1     :        OFF s
   8 LIFT: 1  :         rinse mm
   9 PUMP  1.1   :          2 s           - rinse with rotating nozzle
  10 WAIT                   5 s
>sample sequence                         — parallel titr. of 2 samples at 2 towers simultaneously —
   1 MOVE  2     :     sample             - sample in front of tower 2 (next sample at tower 1)
   2 LIFT: *  :          work mm          - both lifts in work position
   3 STIR: *     :         ON s           - switch on all stirrers
   4 DOS:  1  :            15 ml          - add aux. solution (according to tubing arrangement on
   5 WAIT                   5 s            tower 1 or 2)
   6 CTL:Rm:    START device*               - both Titrinos start titration
   7 SCN:Rm      :     Ready*             - wait for end of titration at both Titrinos (static 'ready'-
   8 STIR: *     :        OFF s            signal)
   9 LIFT: 1  :         rinse mm
  10 PUMP  1.1   :          2 s           - rinse with rotating nozzle on tower 1
  11 PUMP  2.2   :         15 s           - suck off sample solution at tower 2
  12 PUMP  2.*   :          4 s           - rinsing and aspiration (with spray nozzles) at tower 2
>final sequence                          ——— treat last sample separately ———
   1 MOVE  2     :     sample
   2 LIFT: 2  :          work mm
   3 STIR: 2     :         ON s
   4 DOS:  1  :            15 ml
   5 WAIT                   5 s
   6 CTL:Rm:    START device2
   7 SCN:Rm      :     Ready2
   8 STIR: 2     :        OFF s
   9 PUMP  2.2   :         15 s
  10 PUMP  2.*   :          4 s
  11 MOVE  1     :     spec.1             - immerse electrodes in conditioning beakers spec.1 and
  12 LIFT: *  :          work mm           spec.2
>changer settings
  rack number               0
  lift rate 1              25 mm/s
  lift rate 2              25 mm/s
  shift rate               20
  shift direction:          +             - turning direction of the rack is always ascending
  beaker test mode:      both             - test for missing beakers at both towers
  on beaker error:    display             - if a sample beaker is missing, issue a message
>stirring rates
  stirrer 1                 3
  stirrer 2                 3
  stirrer 3                 3
  stirrer 4                 3
>dosing unit def.
>manual stop
 …
```

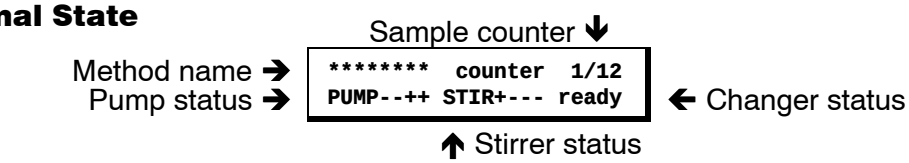


4 Detailed Description

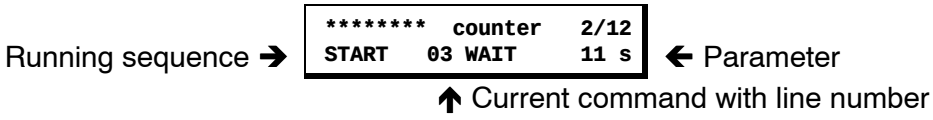
4.1 The Display

The display consists of two lines, each having 24 characters.
The first line serves as a title line in which the current method and the sample counter reading are displayed. In edit mode the menu title is shown.
The second line serves as a status line which displays specific activities depending on the operating state. In edit mode it serves as an entry line.

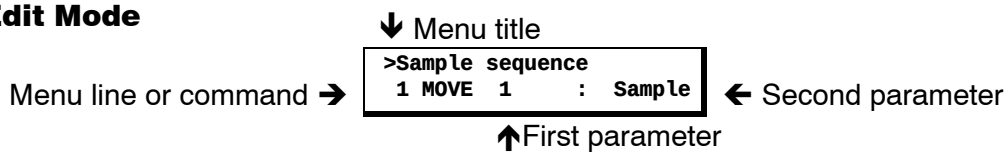
Normal State



Method Processing



Edit Mode



4.2 The Keyboard

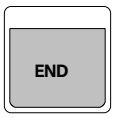
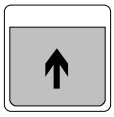
Most of the keys have two functions according to whether the sample changer is in the normal state or in edit mode.

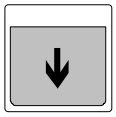
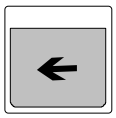
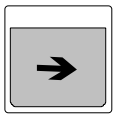
The uppermost row contains the keys which make the menus accessible (<CONFIG>, <PARAM>, <USER METHOD>). Here with the help of the keys on the left side of the keyboard, you can navigate and change parameters. For the latter, the numerical keypad on the right half of the keyboard is available. Except for the menu "User Method" the entries under these selection menus can be altered while a method is in process and for the most part, have an immediate effect on the procedure which is running.

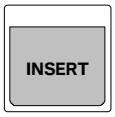
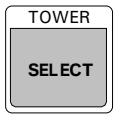
The lowermost row of keys (<HOLD>, <STOP>, <START>) is used for the direct control of method processing.

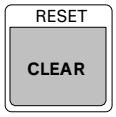
4.2.1 Individual Key Functions

Key	Normal State	Editing
	**Opens the configuration menu** • The <CONFIG> key opens the selection menu for the configuration of the sample changer. • The settings in the configuration menu remain constant until they are changed or the working memory (RAM) is re-initialized.	**Select configuration settings** • When the configuration menu is open, pressing the <CONFIG> key displays the next menu line. • After the last line is displayed, the first one follows. • <QUIT> exits the menu.
	**Open the parameter menu** • The <PARAM> key opens the selection menu for the changer and dosing settings. • All settings that are set in the parameter menu belong to a method and will be saved with the method. These parameters are method-specific.	**Select method parameters** • When the parameter menu is open, pressing the <PARAM> key displays the next menu line. • After the last line is displayed, the first one follows. • <QUIT> exits the menu.
	**Open the user method menu** • The <USER METHOD> key opens the selection menu for the loading, saving and deletion of user-defined methods.	**Select method functions** • When the user method menu is open, pressing the <USER METHOD> key displays the next menu line. • After the last line is displayed, the first one follows. • <QUIT> exits the menu.

Key	Normal State	Editing
	**Bring lift to zero-position** • The <HOME> key runs the lift of the active tower to the zero-position (0 mm), i.e. to the upper stop.	**Select the first line of a menu** • With the <HOME> key, the first line in a menu or a sequence can be accessed. • Any data that has been altered in a menu or command line is not carried over. See <ENTER> key.
	**Lift in work position** • The <END> key runs the lift of the active tower into the work position. • The work position is defined separately for every sample rack in the configuration menu under '>rack definitions' (in mm from the rest-position, i.e. as measured from the upper stop).	**Select the last line of a menu** • With the <END> key, the last line in a menu or a sequence can be accessed. • Any data that has been altered in a menu or command line is not carried over. See <ENTER> key.
	**Run lift upwards** • Run lift of the active tower of the sample changer upwards using the <↑> key. The lift movement is executed as long as the key remains pressed. • The speed of the lift movement can be adjusted separately for each tower in the Parameter Menu or with the <DEF> key.	**Select previous menu line** • In a Select Menu or a sequence the <↑> key accesses the previous line. • Any data which has been altered in a menu or command line is not carried over. See <ENTER> key.

Key	Normal State	Editing
	**Run lift downwards** • Run lift of the active tower of the sample changer downwards. The lift movement is executed as long as the key remains pressed. • The speed of the lift movement can be adjusted separately for each tower in the Parameter Menu or with the <DEF> key.	**Select next menu line** • In a Select Menu or a sequence the <🡻> key accesses the next line. • Any altered data in a menu or command line is not carried over. See <ENTER> key.
	**Turn rack left** • The <🡸> key turns the sample rack one position to the left, i.e. in the counterclockwise direction. The next highest beaker position is placed under the lift. • The turning speed of the rack can be defined in the Parameter Menu or with the <DEF> key. • The rotation of the rack can only be carried out when the lift (with the 2-tower variation, both lifts) is at or above the shift position.	**Move the cursor one column to the left** • With the <🡸> key the cursor is moved one column to the left in an edit line with two parameters. • Any altered data will not be carried over during this action. See <ENTER> key.
	**Turn rack right** • The <🡺> key turns the sample rack one position to the right, i.e. in the clockwise direction. The next lowest beaker position is placed under the lift.	**Move the cursor one column to the right** • With the <🡺> key the cursor is moved one column to the right in an editing line with two parameters.

Key	Normal State	Editing
	• The turning speed of the rack can be defined in the Parameter Menu or with the <DEF> key. · The rotation of the rack can only be carried out when the lift (with the 2-tower variation, both lifts) is at or above the turning position	· Any data which has been altered will not be carried over during this action. See <ENTER> key.
		**Add a command line to a sequence** • Adds a new command line **above the current line** in a sequence. The "NOP" command (no operation) automatically occupies this line and has no function. • The lines following this line are shifted one line downwards.
		**Delete a command line in a sequence** • Deletes the current line in a sequence • The lines which follow shift upwards by one line.
	**Select tower** (only effective with the 2-tower model) · With the <TOWER> key the active tower of the changer can be changed for manual operation. The tower that is accessible is indicated by an LED lit over the keypad of the keyboard.	**Select parameter** • With the <SELECT> key given data values can be selected for a particular parameter in manual operation.

Key	Normal State	Editing
	• The commands that control the titration heads and pumps are always executed at the currently active tower when operating in manual mode.	• With every repeated keystroke the next value that can be selected is displayed. The last value is followed again by the first. • The data is accepted with <ENTER>.
	**Initialization of the changer and the dosing units** • The <RESET> key serves to initialize the changer and the dosing units. • A method in the working memory remains unchanged. The sample rack and the lifts return to their initial positions in this case. A 'release' command will be executed when Dosinos are connected. **Interruption of a method after the current sequence** • During processing of a method, the sample series can be aborted with <CLEAR> so that the sample currently being processed is processed to completion. The end sequence is not executed in this case.	**Deleting parameters, setting the default values** • The <CLEAR> key sets the initial (default) value given for a parameter. **Delete last character** • In text edit mode the last character will be deleted with <CLEAR> (Backspace).

Key	Normal State	Editing
	**Aborting a command already in operation** • When a sequence is being processed the currently running command will be aborted and continued in the course of the next command line. This is useful when a programmed waiting time should be shortened or when a signal cannot be recorded with a SCAN command. **Quitting error message** • With the <QUIT> key error messages can be acknowledged. Before acknowledging error messages, the cause should be remedied. • The command during which the error message occurs will nevertheless be carried out (during manual operation). • If an error occurs during method processing the error message is acknowledged by pressing the <QUIT> key and the method is interrupted (HOLD status). Afterwards <START> can be used to continue with the following command line or <STOP> will halt processing.	**Abort entry, select next highest menu level** • With the <QUIT> key the active (sub)menu or a menu or command line is exited. The next highest menu level or the basic state is selected. • Any data from a menu or command line which has been changed will not be taken over in this case. This will be signaled by an acoustic signal. • <QUIT> acknowledges error messages.

Key	Normal State	Editing
		**Accept data, next line** • The <ENTER> key accepts the value entered and selects the next menu line. • A modification of data or parameters must **always** be confirmed by <ENTER>, otherwise the change will not be accepted. • If a change in a parameter is not confirmed by <ENTER> and another menu line is accessed, the previous value will be reinstated. This is indicated by an acoustic signal.
	**Set sample position** • The <SAMPLE> key serves to set the current sample position. • When starting a method, this position is assumed to have the first sample of a series. • If the current sample position is not manually set before the start of a sample series, rack position 1 is always started first.	**Numerical entry ('7')** or **Set sample position** • In a start sequence the SAMPLE command serves to define the first sample of a sample series. • If no SAMPLE definition is made in any sequence, the manually set rack position is assumed to be the first sample.

Key	Normal State	Editing
MOVE 8	**Position beaker** • Turn the sample rack to position the described beaker under the current lift. In addition to the predefined sample beakers, the eight rack-specific special beakers available can be placed. Absolute positions can also be chosen. • Turning direction and speed can be altered in the Parameter Menu or with the <DEF> key.	**Numerical entry ('8')** or **Position beaker** • Turning the sample rack to position the described beaker under the current lift. In addition to the predefined sample beakers, the 8 rack specific special beakers available can also be placed. Absolute positions can also be chosen. • Turning direction and speed can be altered in the parameter menu or with the <DEF> key.
LIFT 9	**Positioning the lift** • Raises or lowers the lift on the current tower to a predefined position. These positions (work position, rinse position, shift position, special position) can be defined in the Configuration Menu as rack-specific. • An absolute lift position in mm can also be given. • The current tower can be selected with <TOWER>.	**Numerical entry ('9')** or **Lift positioning** • Lift 1 and 2 on the corresponding towers (if two are present) can be run to the predefined positions (work position, rinse position, shift position, special position) in a sequence. • An absolute lift position in mm can also be entered (e.g. for rinsing an electrode).
PUMP 4	**Control pump** • The <PUMP> key is used to turn pumps 1 or 2 on or off. When the pump number is entered the state of the selected pump is reversed, i.e. if the pump is currently off, it will be switched on and vice versa.	**Numerical entry ('4')** or **Control pump** • The pumps can be specifically turned on and off in a sequence or set to operate for a fixed amount of time (in seconds).

Key	Normal State	Editing
	• This function refers to the pumps of the current tower at any given time. With <SELECT> you can switch between the towers (only with the 2-tower variant). • The state of all available pumps is shown in the second display line in the normal state, e.g. PUMP –+–+; + means "switched on" and – means "switched off").	• It is only possible to switch on at most 2 pumps simultaneously at any time.
	**Control stirrer** • The <STIR> key is used to turn stirrers 1 to 4 on or off. When the stirrer number is entered the state of the selected stirrer is reversed, i.e. if the stirrer is currently off, it will be switched on and vice versa. • The state of all available stirrers is shown in the second display line in the normal state. • The stirring speed can be set with the <DEF> key or in the parameter menu.	**Numerical entry ('5')** or **Control stirrer** • The stirrers can be specifically turned on and off in a sequence or set to operate for a fixed amount of time (in seconds). • The stirrer speed can be controlled within a program using the DEF command to change it (see below).

Key	Normal State	Editing
	**Dosing control** • The <DOS> key serves for the control of Dosimats and Dosinos. These are controlled via the "External Bus" connector. • The first parameter is for the selection of the dosing unit. The second parameter represents the function. • In addition to dosing volume and the fill command, the functions specific to the Dosino 'release', 'prepare', 'empty', 'eject', 'adjust' and 'level' can also be executed. • The dosing and filling speed can be set in the parameter menu or with the <DEF> key.	**Numerical entry ('6')** or **Dosing control** • In a sequence you can not only add a certain volume under process control, it is also possible to initiate the burette filling with Dosimats or initiate the designated functions with Dosinos as there are: filling, emptying, preparation, release, ejecting, adjusting or level of the exchange unit.
	**Display input signals** • Display of the incoming signal or data on the remote or RS interface. This function serves to control the data communication or states of connected instruments. • The first parameter represents the interface selection. The signals for data being received at that moment are displayed as the second parameter. • If the parallel remote interface (Rm) is selected, the signal states of the incoming remote lines are displayed in binary form (1=line active, 0=line inactive). Further details relating to this see page 119ff.	**Numerical entry ('1')** or **Scan input signals** • In a sequence the SCAN command causes method processing to stop until the predefined bit pattern (with the remote interface) or the given character string (with the RS232 interface) is received. • Predefined bit patterns are available for the remote interface and can be selected via simple shortnames (e.g. "ready1" or "end2").

Key	Normal State	Editing
	• If the serial RS232 interface (RS) is selected, the character string being received, is displayed line by line (14 characters). Details relating to this are on page 155ff.	• Character strings consisting of 14 ASCII characters may be defined with the RS232 interface. Use text edit mode.
	**Interface control** • Controlling of external instruments via the remote and RS232 interface. This function is used for data communication with or control of connected instruments. • The first parameter stands for the selection of the interface. The second parameter defines the state of the remote output lines or data to be transmitted via RS232 interface. **Parameters with remote interface selected** • Bit pattern with 14 digits (0, 1 or ∗) for the 14 output lines or predefined patterns accessible by the <SELECT> key (for ex. "START instr.1", "STOP instr.1" etc.). **Parameters for the RS232 interface** • Character string with up to 14 alphanumerical characters. Default value: "&M;$G", may be set with <CLEAR>. Most Metrohm instruments can be controlled with such remote control commands, see pages 155ff.	**Numerical entry ('2')** or **Interface control** • Setting the 14 signal lines of the remote interface or sending a character string via the RS232 interface to control instruments connected. • Predefined bit patterns are available for the remote interface and can be selected via simple shortnames (e.g. "START instr.1" or "STOP instr.2"). • Character strings consisting of 14 ASCII characters may be defined with the RS232 interface. Use text edit mode.

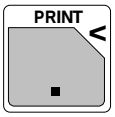
Key	Normal State	Editing
		**Numerical entry ('3')** or **Define waiting time** • Waiting for a certain time interval to elapse, e.g. to let drip the electrode.
	**Redefine various instrument settings** • This function serves to temporarily change various settings. Changes which are done in this way are not integrated in the method and are ignored during processing of a method. • By repeatedly pressing the <DEF> key the various settings can be selected. In order to change an entry the function must first be confirmed with <ENTER>. • The new settings take effect immediately after confirmation of the change by <ENTER>.	**Numerical entry ('0')** or **Redefine various instrument settings** • The DEF commands that are available during manual operation are also programmable in a sequence. • This makes it possible to change various instrument parameters under process control during execution of a running sequence.
	See next page.	See next page.

Key	Normal State and Editing
	• DEF commands are valid for manual operation as well as for the programmed processing of a method. • The individual DEF commands are listed below.
 **STIRRATE**	**Change stirring speed** • The stirring speed can be individually regulated for every stirrer (rod or magnet stirrer). • Syntax: STIRRATE [Stirrer-No.] [Stirring speed]
 **DOSRATE**	**Change dosing rate** • The dosing rate may be individually set for every dosing drive (Dosimat or Dosino). • Syntax: DOSRATE [Dosing unit] [Dosing rate]
 **FILLRATE**	**Change filling rate** • The filling rate may be set individually for every dosing drive (Dosimat or Dosino). • Syntax: FILLRATE [Dosing unit] [Filling speed]
 **LIFTRATE**	**Change lift speed** • The lift speed can be set for both towers (if two are present). • Syntax: LIFTRATE [Tower] [Lift speed]
 **SHIFTRATE**	**Change turning speed and direction** • In addition to giving the turning speed of the sample rack in angular degrees/sec., the turning direction can also be indicated with the first parameter. • Turning direction "+" causes the sample beakers to be processed in the counterclockwise direction, i.e. in ascending order. Turning direction "–" indicates in the clockwise direction, i.e. in descending order. The beaker positions are numbered on every sample rack and easily visible. • With turning direction "auto" the sample changer independently chooses the shortest possible path for placing a beaker under a particular lift. The turning direction is automatically chosen. • Syntax: SHIFTRATE [Turning direction] [Turning speed]

DRIVE.PORT

Change Dosino port assignments

- The ports for each of the 12 Dosinos which can be connected may be functionally redefined. Each port can therefore be used as dosing outlet or filling inlet, etc.
- The dosing drive must be given left of the dot of the first parameter and after the dot, the respective port must be indicated.
- For the second parameter you can choose between the functions: dosing (dos.), filling (fill), rinsing (rinse), prepare (prep) or empty (drain).
- Syntax: DRIVE.PORT [Dosing drive.Port] [Function]

Key	Normal State	Editing
	**Print report** • The <PRINT> key serves for the manual printout of reports. • The choice of printer type and the parameters of the RS232 interface must be done in the Configuration Menu under '>RS232 Settings'.	**Text entry** • In a menu or sequence line in which entry of text is required, (e.g. method name), text edit mode is activated with "**<**". • Existing text is deleted in this event and the text cursor is set on the left margin of the text field. • "<" serves also for shifting the chain of characters to chose from, i.e. the text cursor is shifted one place to the left for each instance. See page 79f.

Key	Normal State	Editing
	**Initialize Changer** • The sample changer is initialized with the <ENDSEQ> key followed by <ENTER>. Any peripheral instruments that might be connected (for ex. Dosimats, Dosinos) are not affected by this. • A method in the working memory remains unchanged. The rack and the lift (in the 2-tower model, both lifts) are run to the initial position.	**Text entry** • In a menu or sequence line in which entry of text is required, (for ex. method name), text edit mode is activated with "**>**". • Existing text remains in this event and the text cursor is set at the end of the existing character string. • "**>**" serves also for shifting the chain of characters to chose from, i.e. the text cursor is shifted one place to the right for each instance. See page 79f. **Set end mark** • For test purposes an <ENDSEQ> command can be placed at any line desired in a sequence. This has the effect that the sequence is only executed up to this end mark.
	**Start a Method** • The <START> key starts a method. Starting is only possible when the changer is in the normal state, i.e. when 'ready' is shown in the display. • When starting a sample series, the sample counter is set to 0. • When <START> is pressed after an interruption (<HOLD>), the sequence is continued with the next command line.	**Trace function** • During editing of a sequence, the command defined in the command line can be directly executed with the <START> key. • A sequence can therefore be tested from start to finish (or in parts) in single steps ("tracing").

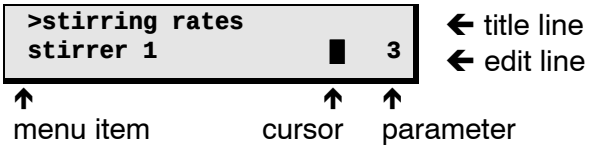
Key	Normal State	Editing
	**Stop process and peripheral instruments** • The <STOP> key terminates a method. • Any peripheral instruments that are connected (Titrinos, etc.) are not automatically stopped. In ">manual stop options", a submenu of the Parameter Menu, you can specify what signal or data is to be transmitted via the interface involved (remote or RS232) during manual activation of the <STOP> key. The connected instrument can be halted or if necessary, initialized (see page 92). • During a manual halt of a sample series with <STOP>, the end sequence of the method will not be executed. • In the normal state the <STOP> key also stops all pumps and stirrers. The manual stop options for connected peripheral instruments are also effective in the normal state.	**Stop editing** • <STOP> causes the editing to abort and the instrument to return to the normal state. (exception: Process sequences)

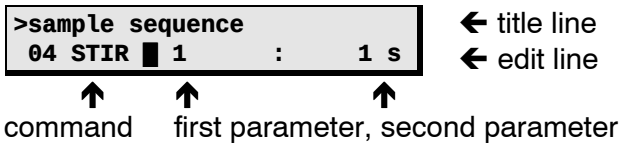
Key	Normal State	Editing
	**Interrupt Process** • The <HOLD> key interrupts the processing of a method. However connected peripheral instruments (Titrinos, etc.) are not halted. Only method processing is interrupted. • In the "HOLD" state a method can be completely halted with <STOP> or continued with the next command in line by pressing <START>. • After quitting an error message during method processing the changer automatically goes into the "HOLD" state.	**Switch on LEARN mode** • The <LEARN> key serves to start the Learn mode. This mode is provided for easier editing of process sequences. It allows direct acceptance of a parameter value that has been set by manual control. • LEARN mode is available for the following commands: LIFT, DOS, STIR, PUMP, SCN, WAIT • Further information about the LEARN mode can be found on page 50.

4.2.2 Data Entry

Edit line

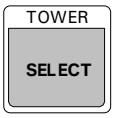
In a menu line or a sequence one or two parameters respectively can be entered. A blinking block cursor indicates where a parameter can be entered.





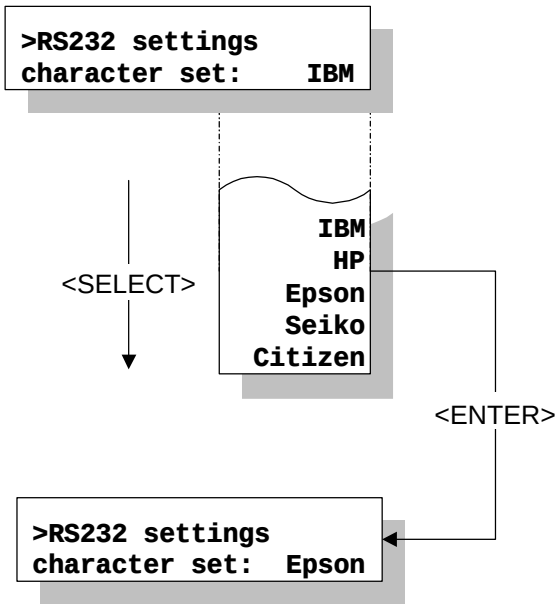
The cursor keys, <➔> and <🡐>, can be used to switch between the parameters. Pressing <ENTER> shifts the cursor automatically to the right, pressing <QUIT> correspondingly to the left.

<Select> Choices (Roll-up selection)



Data can usually be entered directly via the numerical keypad block on the keyboard. Pressing <SELECT> at entries which are specially identified by a colon displays a preset selection of data. This selection is cyclic, structured like a revolving drum.

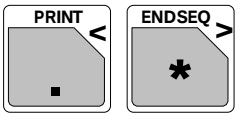
Example:



4.2.3 Text Entry

The text editor can be used when text entry is provided.

Numbers can be entered directly via the keyboard.



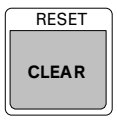
The keys "**<**" or "**>**" open the text editor. With "**<**" an existing character string is deleted and the text cursor is set to the left margin of the edit line. With "**>**" an existing character string remains and the text cursor is set on the last character of the existing text.
A character chain is displayed that is composed of all the characters in alphabetical order that can be entered. The blinking character is the currently selected one (text cursor).

Character selection

The keys "**<**" and "**>**" move the character chain composed of all possible characters (capital and small letters, numbers and special characters, in alphabetical order) in the desired direction underneath the text cursor. Pressing these keys once has the effect that the character chain is shifted one position left or right. The character chain can be shifted quickly by pressing the keys longer.

Confirmation of the character selection

The <ENTER> key causes the character that is currently positioned at the text cursor to be appended to the existing text. When the entire width of the edit line is filled, text edit mode is left and the text is accepted with <ENTER>.



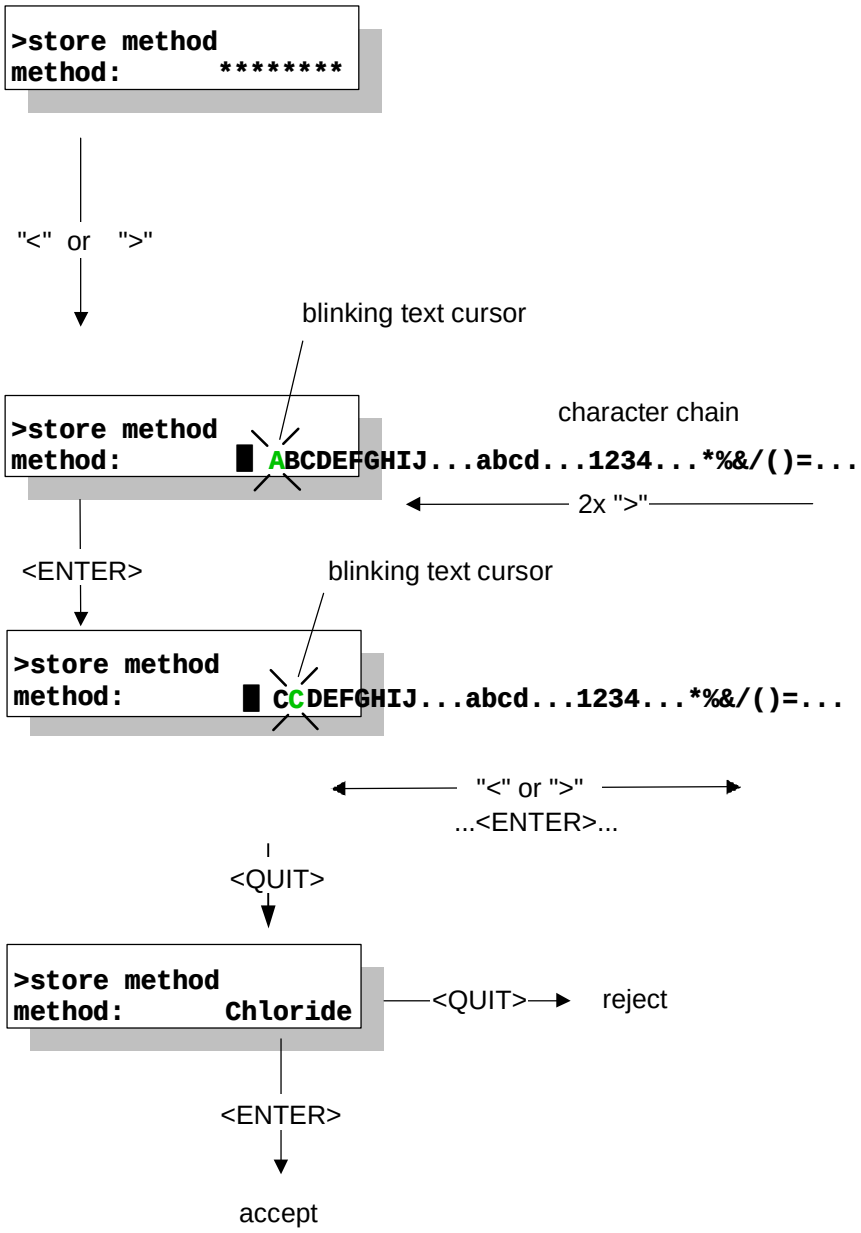
Delete character

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

Exit text entry

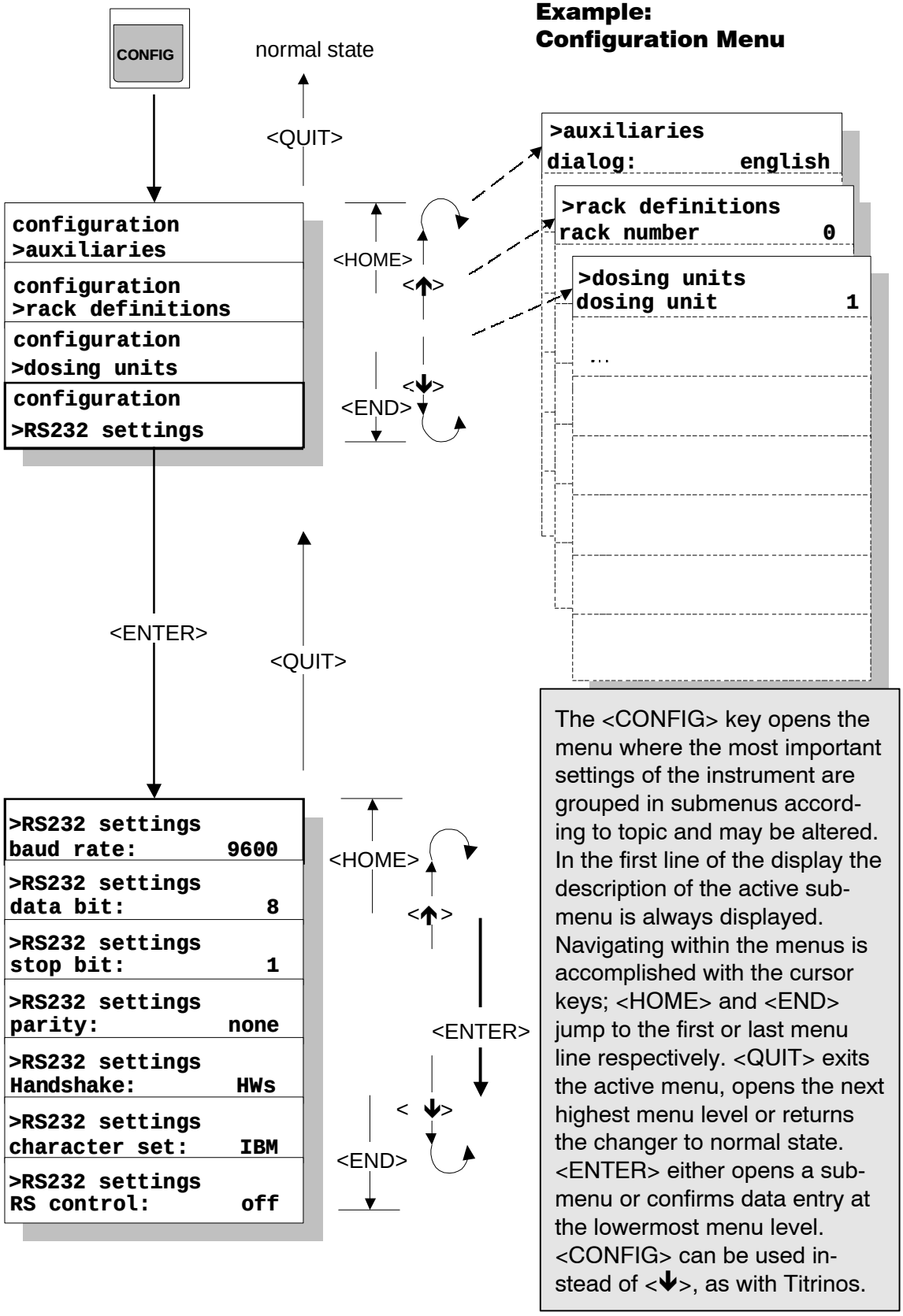
With <QUIT> the text edit mode is exited. The text line displayed can be accepted with <ENTER> or rejected by pressing <QUIT> a second time.

Scheme:

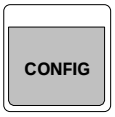


An entire text line can be entered in this way, for example, for the naming of a method. Text editing can be ended with <QUIT>. The text line will be displayed in its entirety and can be accepted with <ENTER> or rejected with <QUIT>.

4.3 Menu Organization



The <CONFIG> key opens the menu where the most important settings of the instrument are grouped in submenus according to topic and may be altered. In the first line of the display the description of the active submenu is always displayed. Navigating within the menus is accomplished with the cursor keys; <HOME> and <END> jump to the first or last menu line respectively. <QUIT> exits the active menu, opens the next highest menu level or returns the changer to normal state. <ENTER> either opens a submenu or confirms data entry at the lowermost menu level. <CONFIG> can be used instead of <↓>, as with Titrinos.



4.3.1 Configuration

Main Menu:

configuration **>auxiliaries**
configuration **rack definitions**
configuration **>dosing units**
configuration **>RS232 settings**

Open submenu with <ENTER>

Use <↑> or <↓> to move up or down one menu item
Use <HOME> or <END> to move to first or last menu item respectively
Return to normal state with <QUIT>

configuration **>auxiliaries**	Basic Settings Submenu Open the submenu with <ENTER>

use <QUIT> to access next highest level

>auxiliaries
dialog: english

english, deutsch, français, español

Choice of dialog language

>auxiliaries
display contrast 3

0…**3**…7

0 = no contrast
7 = large contrast

Setting display contrast

>auxiliaries
beeper: ON

ON,OFF

Turn acoustic warning signal on or off

>auxiliaries
device label ******

8 ASCII characters

Instrument label

>auxiliaries
program 730.0013

read only

Program version

The following three entries become effective after a RESET or switching the changer on again.

```
>auxiliaries
max. lift way          235 mm
```

0…**235**…325 mm

Max. stroke path for lift 1 and 2

use <QUIT> to access the next highest level

This setting for max. lift way is important for safe operation. If the value for this entry is correct, breaking the electrode glass can be avoided because this prevents the titration head from being driven lower than the position indicated.

The range of 235 mm to 325 mm is only significant for high tower models. For the normal tower model only values less than 236 mm may be set.

```
>auxiliaries
pumps on tower 1         1
```

0,**1**,2

Number of pumps on tower 1

```
>auxiliaries
pumps on tower 2         1
```

0,**1**,2

Number of pumps on tower 2

```
>auxiliaries
swing head             OFF
```

ON,**OFF**

Switch on/off swing head

```
>auxiliaries
beaker sensor           ON
```

ON,OFF

Switch on/off beaker sensor

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

```
>rack definitions
rack number              1
```

1…16

Number of the rack

The number of the rack in position is automatically displayed here, when its configuration is already stored and when a RESET has been performed. If the configuration of another rack must be changed, its rack number must be entered and confirmed with <ENTER>. The rack number will be shown in the first menu line for the subsequent entries. An overview of the available rack types is shown on page 104.

```
>rack definitions          1
code                  000001
```

6 bits

Identification code of the rack
See table on page 104.

The rack code must be unique and can only occur once in the instrument.

```
>rack definitions          1
type:                  M12-0
```

M12-0…

Type description of the rack
See table on page 104.

use <QUIT> to access the next highest level

<SELECT> enables the choice of Metrohm-specific and self-defined rack types.

```
>rack definitions          1
work position          0 mm
```

0…325 mm

Working position of the lift (in mm from the upper stop)

Pressing <CLEAR> directly accepts the current lift position of the active tower.

```
>rack definitions          1
rinse position         0 mm
```

0…325 mm

Rinsing position of the lift (in mm from the upper stop)

Pressing <CLEAR> directly accepts the current lift position of the active tower.

```
>rack definitions          1
shift position         0 mm
```

0…325 mm

Shifting position of the lifts (in mm from the upper stop)

Pressing <CLEAR> directly accepts the current lift position of the active tower.

```
>rack definitions          1
special position       0 mm
```

0…325 mm

Position of the lift (in mm from the upper stop)

Pressing <CLEAR> directly accepts the current lift position of the active tower.

```
>rack definitions          1
>>special positions
```

Special positions submenu
Open with <ENTER>

Position of special beaker 1

```
>>special positions
special beaker 1           0
```

0…number of positions

Position of special beaker 2

```
>>special positions
special beaker 2          0
```

0…number of positions

etc. up to special beaker 8

Up to 8 special beaker positions can be defined. More information about racks and special beakers is found in Chapter 4.5 "Sample Racks", page 104.

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

```
>dosing units
dosing unit               1
```

1…12

Select the dosing unit (700 Dosino or 685 Dosimat)

The number of the dosing (see page 23) unit must be confirmed with <ENTER>. This will then be displayed in the first menu line.

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

0.01…**160** ml/min

Max. dosing speed (dependent on burette size)

use <QUIT> to access the next highest level

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

0…**1000**…30000 mm

Length of the tubing on Dosino port 1

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

0.1…**2.0**…20 mm

Inner diameter of the tubing on Dosino port 1

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

0.01…1**60** ml/min

Max. dosing speed (dependent on burette size)

```
>dosing units             1
.........until Port 4
```

Enter the tubing parameters for all four ports of a Dosino

Only the dosing speed is relevant for the 685 Dosimat, the other parameters are ignored.

Configuration >RS232 settings	Submenu for the serial interface parameters Open the submenu with <ENTER>

use <QUIT> to access the next highest level

```
>RS232 settings
Baud Rate:          9600
```
Transmission speed in baud

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

```
>RS232 settings
data bit:             8
```
Number of data bits

7,**8**

```
>RS232 settings
stop bit:             1
```
Number of stop bits

1,2

```
>RS232 settings
parity:            none
```
Parity selection

even, odd, **none**

```
>RS232 settings
handshake:          HWs
```
Handshake selection

HWs,HWfull,
SWchar,SWline,
none

```
>RS232 settings
character set:      IBM
```
Character set for printer or PC

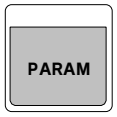
IBM,HP,Epson,
Seiko,Citizen

The settings for the printers recommended by Metrohm are listed on page 25f. For printers not listed, the setting "Epson" is recommended. In any case the printer handbook should be consulted. For data transfer with personal computers, "IBM" must be chosen.

```
>RS232 settings
RS control:          ON
```
Switch remote control on and off

ON, OFF

If the remote control is switched off, no data can be received, however reports can still be printed.



4.3.2 Parameters

All settings of the Parameter Menu constitute a method and may be saved as such.

Main Menu:

parameters **number of samples rack**

Number of samples to be processed

1…999, rack = one entire rotation of the rack
rack, * * = infinite number of samples

All sample positions of an engaged rack will be processed when the instrument is on the 'rack' setting (max. number of rack positions – number of special beakers defined), while only those positions are counted that contain a sample beaker. It is important that the changer can recognize the rack. This is only possible when the rack is at the ground position. It is recommended to initialize the changer with the <CLEAR> key or <ENDSEQ> and <ENTER> after every rack change.

parameters **>start sequence**
parameters **>sample sequence**
parameters **>final sequence**
parameters **>changer settings**
parameters **>stirring rates**
parameters **>dosing unit def.**
parameters **>manual stop**

Open the submenu with <ENTER>

Use <↑> or <↓> to move up or down one menu item
Use <HOME> or <END> to move to first or last menu item respectively
Return to the normal state with <QUIT>

Submenus:

In each of the submenus '>start sequence', '>sample sequence' and '>final sequence' up to 99 command lines can be entered as a processing sequence. The commands can be entered directly via the keyboard. The command keys which are situated on the right half of the keyboard are available.

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

The processing sequence entered here is **executed once at the start** of a sample series. This can be useful for rinsing or conditioning the electrode, for example.

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

This processing sequence is **executed during the processing of every sample** of a series**.**

parameters **>final sequence**	Editor for the end sequence of a sample series Open the submenu with <ENTER>

This processing sequence is **executed once at the end** of a sample series. This could be the positioning of a rinsing or conditioning beaker, for example.

In principle the same rules for entry are valid here as for manual operation, i.e. after selecting a command and entering the necessary data, the entry is accepted with <ENTER>. Afterwards the next command line is accessed where a new command can be entered.

The "**LEARN**" mode is available for the easy entry of parameters. With certain commands "live" values can be taken over by manual execution of a single command. More information can be found on page 50.

Furthermore the "**TRACE**" function can be used to execute every command line step by step. See page 50.

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 lines following are shifted one line upwards.

parameters >changer settings	Submenu for the changer settings Open the submenu with <ENTER>

```
>changer settings
rack number                0
```

The rack that is assigned to the method

0…16 0 = no particular rack

This setting can force the use of a certain rack with the method chosen. If this is not desired, the rack number 0 must be chosen.

```
>changer settings
lift rate 1          25 mm/s
```

Stroke speed of lift 1

3…**25** mm/s

```
>changer settings
lift rate 2          25 mm/s
```

Stroke speed of lift 2

3…**25** mm/s

```
>changer settings
shift rate                20
```

Turning speed of the rack in angular degrees/second

3…**20**

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

Turning direction of the rack

+,−,**auto.**

auto. = the sample changer chooses the shortest path for turning.

When the 759 Swing Head is installed, the shift direction is always "auto".

```
>changer settings
beaker test mode:     single
```

Test mode for beaker test

single,both

single = test on the active tower
both = always check on both towers

After executing a MOVE command a beaker test is always run to check the presence of a beaker in front of the chosen tower. With the 2-tower model of the sample changer, it can be specified whether the beaker test is to be executed on the tower selected or on both towers. The latter is recommended with parallel processes in which samples on both towers are processed simultaneously. A prerequisite for this is however, a sample rack whose beaker positions correspond to the arrangement of the towers (see accessories list).

>changer settings **on beaker error:** **MOVE**	Defining the reaction to a missing beaker

MOVE, display

MOVE = The last action will be executed once more. The next position according to the current SAMPLE command will be chosen.

display = Processing will be interrupted and a warning displayed.

If processing should not be halted when a sample beaker is missing, 'MOVE' can be chosen. In case of a missing beaker another MOVE command is executed with the next sample. The next sample is chosen according to the last SAMPLE command, i.e. if the previous command was 'SAMPLE +2', the sample in the rack position after the next beaker is chosen, etc.

If a special beaker is missing an error message is always displayed and processing is halted.

parameters **>stirring rates**	Submenu for Stirrer Settings Open the submenu with <ENTER>

>stirring rates **stirrer 1** **3**	Stirring speed stirrer 1 in intervals from 1 to 15

1…**3**…15

>stirring rates **stirrer 2** **3**	Stirring speed stirrer 2 in intervals from 1 to 15

1…**3**…15

>stirring rates **stirrer 3** **3**	Stirring speed stirrer 3 in intervals from 1 to 15

1…**3**…15

>stirring rates **stirrer 4** **3**	Stirring speed stirrer 4 in intervals from 1 to 15

1…**3**…15

Parameter >dosing unit def.	Submenu for dosing unit settings Open the submenu with <ENTER>

```
>dosing unit def.
dosing unit                1
```

1…12

Select dosing unit

After entering the address of the dosing unit (see page 23) and confirming with <ENTER> it will be displayed in the first menu line.

```
>dosing unit               1
dos.rate:        160 ml/min
```

0.01…160 ml/min,
max.

Set the dosing speed

```
>dosing unit               1
fill.rate:       160 ml/min
```

0.01…160 ml/min,
max.

Set the filling speed

The following entries are only valid for 700 Dosinos. For details about Dosinos and dosing units, see page 109ff.

```
>dosing unit               1
dosing                port  1
```

1…4

Define dosing outlet

```
>dosing unit               1
filling               port  2
```

1…**2**…4

Define filling inlet

```
>dosing unit               1
rinsing               port  2
```

1…**2**…4

Define rinsing inlet (when changing dosing units)

```
>dosing unit               1
preparation           port  1
```

1…4

Define outlet for the preparation cycle

```
>dosing unit               1
drain                 port  4
```

1…**4**

Define air inlet for emptying

parameters **>manual stop**	Submenu for defining reaction to manual stop Open the submenu with <ENTER>

The following entries define the commands or signals that are transmitted via the interfaces when the <STOP> key is pressed. This enables peripheral instruments connected to be stopped automatically.

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

Signal output via remote interface

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

When a swing head is connected, 4 lines (input 7 and output 11–13) are occupied and ignored.

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

Data to be transmitted via RS232 interface

14 ASCII characters

Clear value '&M;$S'

4.3.3 User Defined Methods

Main Menu:

methods **>recall method**
methods **>store method**
methods **>delete method**

Open the submenu with <ENTER>

<↑> or <↓> move up or down one menu item

Move to first or last menu item with the <HOME> or <END> keys respectively

<QUIT> returns to the normal state

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

>recall method **method: **********

8 ASCII characters

Select method name

With <SELECT> any method saved can be chosen. If an "empty" method is to be loaded, the method '********' can be selected. Like this, the actual work memory is deleted.

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

>store method **method: **********

8 ASCII characters

Define method name

'**<**' or '**>**' activates text edit mode where any method name desired can be entered (see page 79).
When a certain method should be worked off after switching on the sample changer, a command sequence can be stored under the name "POWERUP". This method is started automatically after switching on the main switch.

methods **>delete method**	Dialog for deletion of methods Open the dialog with <ENTER>

>delete method **method: **********

8 ASCII characters

Select method

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

Confirm with <ENTER>
Abort with <QUIT>

4.4 Changer Commands

4.4.1 Command Reference

The following commands are programmable within a sequence. Most of them are also available in manual operation but may vary partially in their operation or exhibit a limited parameter selection; see page 46ff.
The following listing is valid for the programming of process sequences.

SAMPLE


```
>start sequence
1 SAMPLE:     =        1
              =,+,–    1…999
```

Define first sample

The SAMPLE command can determine which rack position is to be the position of the first sample (SAMPLE = X). This is stored as a index variable. It may be modified for example, in a sample sequence (SAMPLE + X or SAMPLE – X), in order to control the course of a sample series during processing.

The SAMPLE command does not have to be used for simple applications. As a general rule the first sample of a series is assumed to be in rack position 1 unless specified otherwise. Therefore it is recommended not to place the special beakers in the first rack positions; place them in the highest positions instead.

Before starting a sample series, the position of the first sample can be defined with the <SAMPLE> key in manual operation, as long as this has not been defined in the method itself.

If a certain sample beaker order is needed for each application of a method, the position of the first sample can be defined in the start sequence with 'SAMPLE = X' and this setting can be saved with the corresponding method.

If the SAMPLE command is not executed during a sample sequence, the SAMPLE variable will be increased by 1 after every processing of the sample sequence.

MOVE


```
>sample sequence
 2 MOVE        1:  sample
```

Beaker positioning / Turn rack

1,2 **sample**,
spec.1…8
1…999

The MOVE command can place the current sample or a special beaker in front of tower 1 or 2 (if present) by rotating the rack. An absolute rack position can also be specified.

During method processing a MOVE command can run the lift or both lifts to the shift position.

The turning direction is automatically chosen by the changer according to the predefined changer setting. In the Parameter Menu under '>changer settings' the turning direction and speed can be defined specifically for each method. These can also be modified in a sequence with the corresponding 'DEF' command.

If there is no beaker in the rack position chosen, this is recognized by the beaker sensor.

The changer reaction to a missing beaker can be predefined in the Parameter Menu under '>changer settings'. The alternatives available are halting the processing and issuing an error message or selecting the next rack position. For more information about this see page 90. If a special beaker is missing, processing is always halted.

LIFT


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

Positioning the lift

1,2,* work,
rinse, shift,
special, **rest,**
0…325 mm

Raising or lowering one or both (*) titration heads to a defined position. Work, rinse, shift and special position are rack-specifically defined in the Configuration Menu under '>rack definitions'. See also page 38f. These parameters can also be changed in a sequence using the corresponding 'DEF' command.

The rest position is the zero position (0 mm) of the respective lift i.e. the upper stop.
Each lift can also be precisely positioned to the millimeter. The LEARN function is also available for this purpose. See also page 50.

PUMP


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

Pump control

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

Up to 4 pumps (2 pumps/tower) can be separately controlled with the PUMP command. The choice of pump is indicated in the first parameter.

The syntax: T.P (T=Tower number, P=Pump)

Only 2 pumps can be in operation simultaneously. Pump 1 of each tower does the rinsing of the titration head. Pump 2 (if present) can be used for removing of the sample solution by aspiration. Combined rinsing and aspiration is possible with 'PUMP 1.∗' or 'PUMP 2.∗' .

The pumps can be turned off and on as desired or operated for a specific amount of time. The LEARN function is useful for determining the interval of time for optimal rinsing or aspiration. See also page 50.

STIR


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

Stirrer control

```
       1…4,*          ON,OFF,
                    1…9999 s
```

Up to 4 stirrers can be individually controlled with the STIR command. The choice of stirrer is indicated in the first parameter. With 'STIR ∗' all stirrers can be operated simultaneously.

The stirrers can be specifically switched on or off or operated for a certain time interval.

In the Parameter Menu under '>stirring rates' the speed of each individual stirrer can be determined specific to a method. This can also be modified in a sequence using the corresponding 'DEF' command.

DOS


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

Dosing Control

```
      1…12,*           fill,
          release, prepar.,
              empty, eject,
              adjust, level
        0.001…1…999.999 ml
```

The DOS command is used to control Dosimats and Dosinos. Up to 12 Dosinos or Dosimats can be addressed via the External Bus control.

In addition to adding a certain volume, specific actions can be initiated.

filling	Filling the Dosimat or Dosino burette.
release	Prepare Dosimat or Dosino for changing the exchange unit. Burette is filled via the rinsing port. The stop cock is turned to the exchange position.
prepar.	Preparation cycle for Dosinos. All tubing is rinsed and filled completely.
empty	Empty burette and all tubings of the Dosino via dosing port.
eject	Empty burette of the Dosino via dosing port.
adjust	Compensating the play between the piston and the spindle before sucking in and filling the cylinder respectively.
level	Compensating the play between the piston and the spindle before dosing.

In the Parameter Menu under '>dosing unit def.' the port assignments for Dosinos can be defined as well as method-specific dosing and filling speeds. This can also be done within a sequence with the corresponding 'DEF' command.

More information about Dosino commands and port assignments is found on page 109ff.

The sample changer recognizes automatically whether a Dosimat or a Dosino is connected.

SCAN


```
>sample sequence
 7 SCN:Rm        :  ready1
```

Scanning the remote interface

RM	ready1	= device 1 ready
	ready2	= device 2 ready
	ready*	= device 1+2 ready
	end1	= EOD pulse of device 1
	end2	= EOD pulse of device 2
	endmeter	= End pulse of ion meter / pH meter
	8 bit (1,0 or *)	any 8-bit pattern

In a sequence the SCN:Rm command causes method processing to stop until the predefined bit pattern is received.
Predefined bit patterns are supported which can be selected by short names (for example: "ready1" or "end2").

"ready" signifies a static "ready" line of an external Metrohm instrument. "end" stands for pulse signals, for example EOD (=end of determination). When scanning for pulse signals parallel scanning of several lines cannot be applied.

Setting special bit patterns allows flexible control of connected instruments.

Here the following is valid: 0 = line inactive
1 = line active
∗ = arbitrary line state

Example: 00000001 = input 0 is active = instrument 1 "ready"

The bit pattern (= line state) can be taken over interactively with the LEARN function. See page 50.

Note:

If the PC software "WORKCELL" is used, the end of titration must always be scanned with "end1".

Details about the remote interface are found on page 119ff.

SCAN
1

```
>sample sequence
 8 SCN:RS
```

Scanning the RS232 interface

```
        RS
           Clear value: ∗R"   = scan for "ready" status message
        14 ASCII characters   arbitrary series of 14 characters
```

In a sequence the SCN:RS command causes method processing to stop until the predefined character string (up to 14 characters) is received via serial RS232 interface. The received data is compared character by character.

Be sure that the interface parameters agree with those of the instrument connected (see Configuration Menu '>RS232 settings', page 86).

Any letters, numbers and special characters from the character set of the sample changer can be chosen.
The asterisk (∗) may be used as a wildcard for an arbitrary character or character string. (If '∗' is to be interpreted as an ASCII character, '∗∗' has to be set.) A wildcard may be used in any position of a character string. If the first part of character string is correctly identified, the first appearance of the character following the asterisk (∗) is scanned. When it is found, the next part of the character string is compared.

This function is especially suited to instruments with Metrohm remote control language. Here the Auto-Info status messages can be scanned. The most useful of these are:

∗.T.R" Ready, 'ready' state attained, for ex., after titration
∗.T.F" Final, end of the determination is reached
∗.T.S" Stop, instrument manually halted
∗.T.G" Go, instrument was started
∗.E;∗ Error, error message

'∗' can be set as a wildcard for a particular character string. Example: ∗R" instead of !".T.R" (status message 'ready' after completing a titration).

These status messages, however, are only transmitted if the corresponding status message has been previously switched on, for example, in the the start sequence with the command CTL:RS &Se.A.T.R"ON", for example.

More detailed information about the syntax can be found in the Instructions for Use of the instrument from which the status messages should be transmitted.

CTL command, see below.

With the LEARN function transmitted data (=character strings) can be taken over interactively. See page 50.

CTL


```
>sample sequence
 9 CTL:Rm    START device1
```

Setting the remote lines

Rm START device1	= start instrument 1
START device2	= start instrument 2
START device∗	= start instruments 1 + 2
START dos1	= start Dosimat on instrument 1
START dos2	= start Dosimat on instrument 2
START dos∗	= start Dosimat on instruments 1 + 2
METER mode pH	= switch pH Meter to pH measurement
METER mode T	= switch pH Meter to temp measurement
METER mode U	= switch pH Meter to mV measurement
METER mode I	= switch pH Meter to Ipol mode
METER mode C	= Ion Meter to conc. measurement
METER cal pH	= switch pH Meter to pH calibration
METER cal C	= Ion Meter to conc. calibration
METER enter	= <ENTER> key on pH-meter simul.
INIT	= initialize remote interface
14 Bit (1,0 oder ∗)	arbitrary 14 bit pattern

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 (for example, "START device1" or "METER mode pH").

"START deviceX" starts the operating mode set for a connected Metrohm instrument. "START dosX" starts a Dosimat which is connected to a Metrohm titration instrument via the “activate” line (special Metrohm cable required). "METER XXX" causes the 691, 713 pH Meter and 692 Ion Meter to switch to a particular measuring mode.

Setting particular bit patterns allows flexible control of connected instruments.

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

Example: **********1 = Output line 0 active = start device1

Further details about the remote interface are found on page 119ff.

CTRL 2

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

Data communication via the serial RS232 interface

```
        RS
          Clear value: &M;$G = start instrument in current mode
       14 ASCII characters   arbitrary string of 14 characters
```

Data (=character string) can be sent to instruments connected via the serial RS interface.

Make sure that the transmission parameters of the RS232 interface correspond to those of the connected instrument (see Configuration Menu '>RS232 Settings', page 86).

Any letters, numbers and special characters can be chosen from the character set of the sample changer.

This function is suitable for instruments with Metrohm remote control language. These can be controlled with so-called triggers. The most important of these are:

&M;$G	Go, start instrument in current mode
&M;$S	Stop, stop instrument
&M;$H	Hold, interrupt method
&M;$C	Continue, resume method

The following remote control commands can switch on the Auto-Info status messages of a Metrohm instrument (for example, in a start sequence):

&Se.A.T.R"ON"	'Ready' status message
&Se.A.T.F"ON"	status message at the end of a determination
&Se.A.T.S"ON"	status message at manual halt
&Se.A.T.G"ON"	status message at the start of a method
&Se.A.T.E"ON"	status message during an error condition

To be consistent, the corresponding AutoInfo messages should also be switched off again in a final sequence (..."OFF").

Detailed information about the syntax of the Metrohm remote control language can be found in Chapter 4.9 "Operation via the RS232 interface" (page 125) or in the instruction manual of your titration instrument.

Please keep the syntax and conventions of the foreign instruments or computers the Sample Changer is communicating with.

WAIT


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

Waiting time

0...**1**...9999 s

The WAIT command sets a particular waiting interval during method processing.

ENDSEQ


```
>sample sequence
12 ENDSEQ
```

End of the sequence

End mark of a sequence. This ENDSEQ command can be inserted in any desired command line for test purposes. This has the effect that the sequence (start, sample, or final sequence) is processed only up to this line.

DEF

Redefining specific instrument settings

During method processing the most diverse settings can be made using the following DEF commands. The individual entries are accessed by repeatedly pressing the DEF key (roll-up selection).

```
>sample sequence
13 STIRRATE   1        3
```

1…4 1…**3**…15

Stirring speed

The stirring speeds for all 4 stirrers can be individually set. The first parameter stands for the number of the stirrer; the second parameter allows the setting of the stirrer speed in 15 steps.

```
>sample sequence
14 DOSRATE  1        160
```

1…12
0.01…**160** ml/min

Dosing speed

The dosing speed for all 12 dosing units can be individually set. The first parameter stands for the number of the dosing unit and the second parameter allows setting the dosing speed in mL/min.

```
>sample sequence
15 FILLRATE 1        160
```

1…12
0.01…**160** ml/min

Filling speed

The filling speed can be set for all 12 dosing units individually. The first parameter stands for the number of the dosing unit and the second parameter allows setting the filling speed in mL/min.

```
>sample sequence
16 LIFTRATE 1         25
```

1,2 3…**25** mm/s

Lift rate

The lift rate can be set for both towers individually. The first parameter stands for the number of the tower and the second parameter allows setting the lift rate in mm/s.

Turning direction and speed

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

auto.,+,– 3…**20** w/s

Turning direction and speed of the sample rack can be changed as desired. The first parameter determines the turning direction.

auto. : The changer automatically determines the shortest path.
+ : The sample rack turns in the counterclockwise direction (to a higher rack position)
– : The sample rack turns in the clockwise direction (to a lower rack position)

The second parameter determines the turning speed in angular degrees/sec.

Port assignment for the 700 Dosino

```
>sample sequence
18 DRIVE.PORT  1.1 : dos.
```

1.1…12.4 **dos.**, = Dosing
fill, = Filling
rinse, = Rinsing
prep., = Preparation
drain = Emptying

The port assignments of a 700 Dosino can be changed as needed. The first parameter stands for the dosing unit and inlet or outlet port of the Dosino. The dosing unit and the port must be separated by a period. The four ports (1–4) of every 700 Dosino can therefore each be designated a function.
The second parameter determines the function of the associated port.

dos. : Dosing occurs via the corresponding port.
fill : Filling always from the corresponding port.
rinse : Before changing the dosing unit the burette will be filled from this port.
prep. : Tubings will be emptied via this port during a preparation cycle. The rinsing volume will be aspirated from the filling port.
drain : During emptying air will be aspirated via this port. The liquid is ejected via the dosing port.

If the dosing device connected is a 685 Dosimat , the port assignments will be ignored.

4.5 Sample Racks

A sample rack is a sort of turntable for the positioning of beakers which are to be placed on the Sample Changer. Because for titration, various sizes of beakers are common or required, many kinds of racks can be used and are easily interchangeable. The rack offers space for various numbers of samples depending on the diameter of the beakers. Metrohm delivers the following predefined types of standard racks:

Type	Number of beakers	Type of beaker	Predef. Code	Predef. Rack no. +)	Order Number
M12-0	12 *)	250 mL Metrohm glass beaker	000001	1	6.2041.310
M12-0	12 *)	150 mL glass beaker or 200 mL disposable beaker (Euro)	100000	6	6.2041.360
M14-0	14	200 mL disposable beaker (Euro)	000011	4	6.2041.370
M14-0	14	8 oz disposable beaker PP (US)	000101	5	6.2041.380
M16-0	16	150 mL glass beaker	000010	2	6.2041.320
M16-0	16	120 mL disposable beaker (US)	100001		6.2041.390
M24-0	24 *)	75 mL Metrohm glass beaker	001000	3	6.2041.340
M48-1	48	75 mL Metrohm glass beaker	010000		6.2041.350
M128-2	126 2	15 mL test tubes 250 mL Metrohm glass beaker	001010		6.2041.400

*) Parallel titration at two towers possible.
+) For seven racks, the data are already assigned to a rack no.

If desired, other user-defined racks can be delivered and defined in the instrument via PC software. Irregular arrangements of beaker positions are also possible.

Every single rack can be identified by a unique magnetic code. Rod magnets which are attached to the bottom of the rack can be combined to form a 6-place binary code. The sample changer can then automatically recognize the mounted rack. This is possible when the rack is positioned with the first rack position under lift 1. When changing a rack, the sample Changer should first be re-set to the normal position by pressing the <RESET> key or <ENDSEQ> and <ENTER>. This way the save recognition of a rack and therefore the correct beaker positioning is made possible. An internal position table containing the unambiguous definition of the turning angles and beaker positions is assigned to each rack type.
When a sample series is started the changer first runs the rack automatically into the normal starting position so that it is always ensured that the beaker positions correspond with the internal position table of the current rack.

The standard racks provided by Metrohm are already equipped with a predefined magnetic code for every rack type. If several racks of the same type are used, the magnet rods can be arranged differently so that a unique identification of a sample rack is possible, if this is desired.

Format of a magnetic code (example):

000001 i.e. only one magnet is inserted, bit 0
000101 i.e. two magnets are inserted, bit 0 and 2

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

In order to assign a certain sample rack for different applications, certain properties or recognition data can be defined for up to 16 racks. This is useful when a certain beaker size or the size of the sample series or a certain course of processing is to be predefined in an application.

The following recognition data can be defined for each rack:

Rack number	*unique identification*
Code	*automatic rack recognition*
Type	*racktype / position table*
Work position	*working height of the titration head*
Rinse position	*rinsing height of the titration head*
Shift position	*turning height of the titration head*
Special position	*Additional height of the titration head*
Special beaker position	*reserved beaker positions (spec.1 to 8)*

The **Rack number** serves to identify a rack. It can be chosen from 1 to 16. In a method a particular rack number can be assigned to the process sequences (see page 89). This ensures that if the wrong sample rack is used, the automatic rack recognition will realize this and issue a warning to the user.

The **Code** is used for automatic rack recognition. Make sure that this 6-place binary code in the rack configuration agrees with the actual inserted magnet code on the rack. Rack codes can be changed at any time. They must however, only be assigned to one rack. The assignment of standard predefined codes of standard racks provided by Metrohm should be avoided.

The rack **Type** serves for the assignment to a position table internal to the instrument, in which the positions of the sample beakers in the rack are defined in tenths of a degree (0-3599) of the full turning angle. The rack type is coded as **Mxx-y**, whereby **M** stands for Metrohm-defined types. The placeholder **xx** stands for the number of sample beakers in a rack. The numerical code **y** is a special code for the number of rows on a rack (0 = single-row, 1 = double-row, 2 = triple-row). Position tables for user-defined rack types can be created with a suitable PC software and introduced into the instrument via the serial interface. The name of the rack type may be chosen at will this way.

The **Work position** determines the height of the titration head (lift), the position in which, for example, a titration can be carried out. In this way the ideal position for every sample rack can be chosen dependent on the height of the sample beaker. This work position can be accessed directly in manual operation with the <END> key. In a process sequence this can be programmed with 'LIFT:1 : work mm'.

The **Rinse position** determines the correct position of the titration head (Lift), in which the electrode can be rinsed. In this way the ideal position for every sample rack can be chosen dependent on the height of the sample beaker. This rinse position can be accessed with 'LIFT:1 : rinse mm'.

The **Shift position** determines the correct position of the titration head (Lift), in which the rack can be turned. If the lift is not at or above the shift position, the sample rack can not be turned in manual operation. This is a safety feature to prevent damage to electrodes due to turning maneuvers of the rack. However, a prerequisite is that this shift position is correctly set. In a process sequence the positioning of the lift to the shift position can be programmed with 'LIFT:1 : shift mm'.
The following racks are predefined (standard settings):

The **Special position** determines an additional user defined height of the titration head (Lift). E.g. for pipetting with the swing head it can be chosen in a way that the pipetting tip just dips into the sample solution. This special position can be accessed with 'LIFT:1 : special mm'.

Special beakers

Special beakers are reserved positions in a sample rack. 0 to 8 special beakers can be defined per rack. They can be placed under a lift during method processing for particular operations without interrupting or hindering the sample series run. Special beakers can be used in a sample sequence for rinsing the electrode or in a start sequence for calibrating an electrode (buffer solutions).

Special beakers are placed under lift 1 with 'MOVE 1 : spec.1'.

Reserved special beaker positions, that can be individually defined for each rack, are recognized as such in a sample series and are omitted during processing of the individual sample beakers.
If a special beaker is required in a method process but the sample changer finds no beaker present in the reserved position, an error message will always be displayed.

Sample method for the use of special beakers:

Electrode calibration in a start sequence

```
LIFT:  1 :     shift mm
MOVE   1 :    spec.1      Spec.1 = rinsing beaker
LIFT:  1 :     rinse mm
PUMP   1.1 :       3 s    rinse electrode
WAIT               2 s
LIFT:  1 :     shift mm
MOVE   1 :    spec.2      spec.2 = buffer 1
LIFT:  1 :      work mm
STIR:  1 :        on s
CTL:Rm: START device1      start measuring buffer 1
SCN:Rm:   endmeter 1       measurement finished? then ...
STIR:  1      :  off s
LIFT:  1 :     shift mm
MOVE   1 :    spec.1      spec.1 = rinsing beaker
LIFT:  1 :     rinse mm
PUMP   1.1 :       3 s    rinse electrode
WAIT               2 s
LIFT:  1 :     shift mm
MOVE   1 :    spec.3      spec.3 = buffer 2
LIFT:  1 :      work mm
STIR:  1 :        on s
CTL:Rm: START device1      start measuring buffer 2
SCN:Rm:     endmet 1       measurement finished? then...
STIR:  1      :  off s
...
```

4.6 Dosimats and Dosinos

685 Dosimats and 700 Dosinos can be connected as dosing units to the "external bus" socket. An E-bus cable and a 729 Dosimat Interface are required for this. Four dosing units can be operated on one interface. Three Dosimat Interfaces can be linked serially (cascaded, observe address, see page 23). This makes it possible to connect 12 dosing units simultaneously to a 730 Sample Changer and specifically address each of them with the 'DOS' command.

Each Dosimat or Dosino may be equipped with various exchange units. Before exchanging this units the stop-cock of the burette must be driven to the exchange position. Otherwise the stop-cock or the drive unit of the Dosimat or Dosino may be seriously damaged.

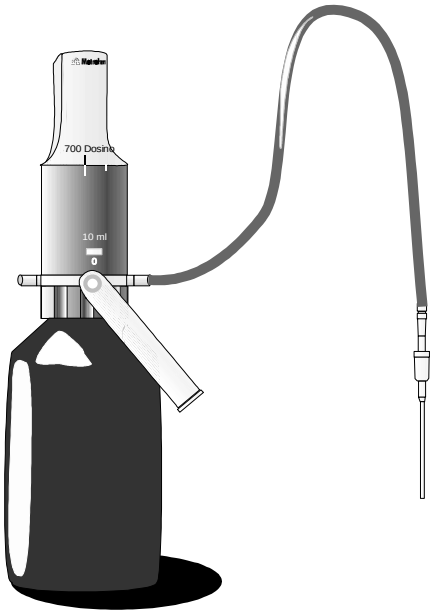
Always execute the 'DOS: XX : release' command before removing the exchange unit!

Dosimats and Dosinos can aliquot any volume of e.g. auxiliary solutions desired up to 999 mL (in LEARN mode up to 5 burette volumes). Filling the burette can be specifically initiated with both instrument types ('DOS: XX : fill'). The Dosino burette is always filled from the port 2 (rinse port) when the instrument is turned on.

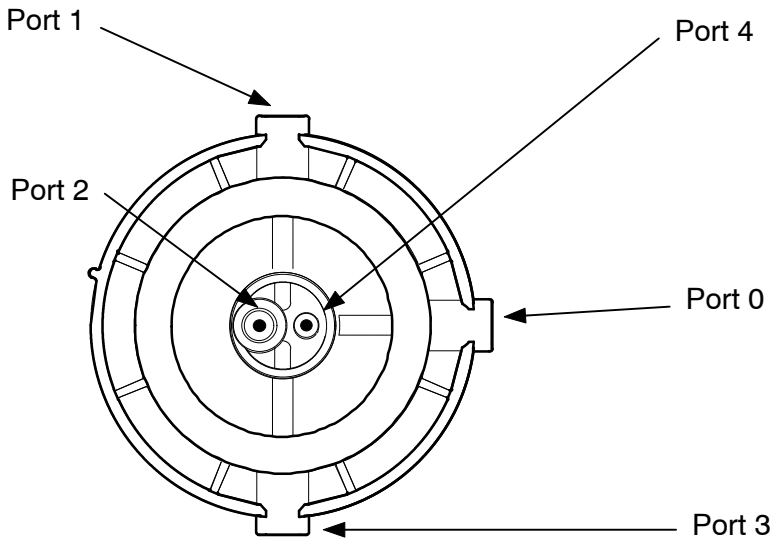
The changer automatically recognizes the type of the connected dosing instrument.

Further commands are available for the 700 Dosino so that the many and varied abilities of these dosing units can be fully taken advantage of.

700 Dosino



The Dosino has five ports (inlets and outlets) which can be assigned various functions.



View of a Dosino from underneath

Port 0 – serves as ventilation for the reserve bottle and is usually fitted with an absorber tube (filled with desiccant).

Port 1 – is situated on the side and under standard operating conditions is defined as the dosing outlet.

Port 2 – is situated on the bottom, generally defined as a filling inlet and is usually fitted with a stand pipe.

Port 3 – is situated on the side and not defined in standard operation.

Port 4 – is situated on the bottom and during standard operation is defined as an air inlet when emptying the tubing systems.

The maximum dosing and filling rates that can be entered in the configuration menu under '>dosing units' for every port of a dosing unit depend on the burette size:

Volume of the dosing unit	Max. dosing rate	Resolution
2 mL	7 mL/min	0.2 µL
5 mL	17 mL/min	0.5 µL
10 mL	33 mL/min	1.0 µL
20 mL	67 mL/min	2.0 µL
50 mL	160 mL/min	5.0 µL

The following commands can be executed with Dosinos. The associated inlets and outlets (ports) can be defined in the Parameter Menu under '>dosing unit def.' as standard arrangement for a particular method or with a DEF command in a process sequence or manual operation.

Dosing

DOS: XX : yyy.yy ml Dosing a certain volume.

The volume indicated is ejected at the dosing port. The burette is not refilled after every operation. The dosing port can be redefined as desired:

```
>dosing unit def.      XX
dosing               port Y
```

or

```
<DEF>  DRIVE.PORT  XX.Y  : dos.
```

Filling

DOS: XX : fill ml Filling the Dosino burette.

The burette is completely filled. It is aspirated via the filling port. This can be redefined as desired:

```
>dosing unit def.      XX
filling              port Y
```

or

```
<DEF>  DRIVE.PORT  XX.Y  : fill
```

Preparation

DOS: XX : prepar. ml Preparation = Filling the dosing and filling tubes.

The tubing system of the Dosinos should be freed of air bubbles daily by running a preparation cycle. During preparation, the burette as well as the filling and dosing tubing are completely filled. Several filling and dosing processes are executed for this. The volumes required for this are internally calculated from the configuration settings for tubing length and diameter (see page 85f). Under standard conditions the tubings are emptied via the dosing port. However this can be changed by the following commands.

```
>dosing unit def.      XX
preparation          port Y
```

or

```
<DEF> DRIVE.PORT  XX.Y : prep.
```

Emptying

DOS: XX : empty ml Empty the dosing and filling tubes.

The tubing system and the burette of the Dosino can be completely emptied. Under standard conditions, the entire tubing and burette volume is emptied via dosing port. Air will be aspirated via port 4 (from the reserve bottle). However this can be changed with the following commands:

```
>dosing unit def.      XX
drain                port Y
```

or

```
<DEF> DRIVE.PORT  XX.Y : drain
```

Release exchange unit

DOS: XX : release ml — Prepare Dosino for removing the exchange unit.

Before removing the exchange unit the burette must be filled and the Dosino stop-cock run to the exchange position. Under standard conditions the volume required for filling the burette is aspirated from the filling port. To fill the burette for example, with distilled water for storage, this can be changed with the following commands.

```
>dosing unit def.      XX
rinsing              Port Y
```

or

```
<DEF> DRIVE.PORT  XX.Y : rinse
```

Ejecting

DOS: XX : eject ml — Empty the Dosino burette.

The contents of the burette is ejected completely via the dosing port. This can be redefined as desired (see Dosing).

Adjust

DOS: XX : adjust ml — Conmpensate the play

The mechanical play between the dosing piston and the spindle is compensated. This command is important for exact pipetting when small volumes are aspired into the pipetting tube and ejected again. First, the content of the cylinder is ejected completely (eject), then before the solution is aspired, the piston is adjusted (adjust).

Level

DOS: XX : level ml — Compensate the play

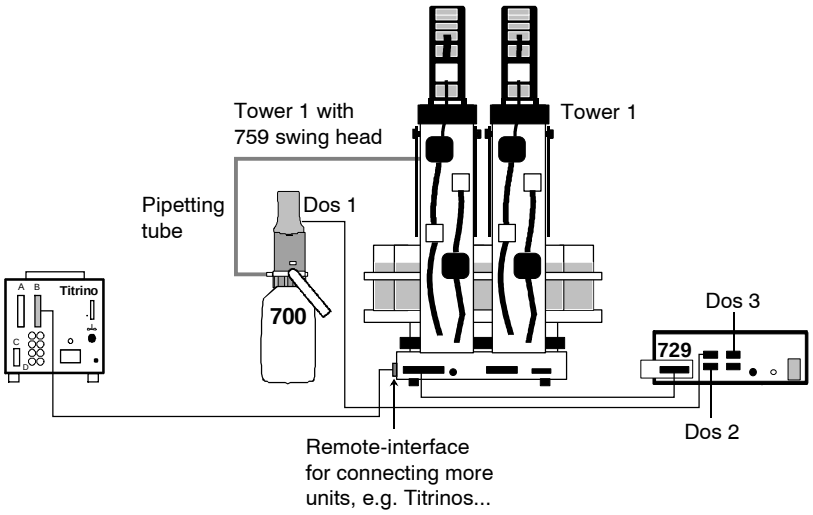
The mechanical play between the dosing piston and the spindle is compensated after the cock has been turned into the dosing position. The dosing port can be redefined as desired (see Dosing). This command is executed to increase the precision.

4.7 Pipetting with the Swing Head

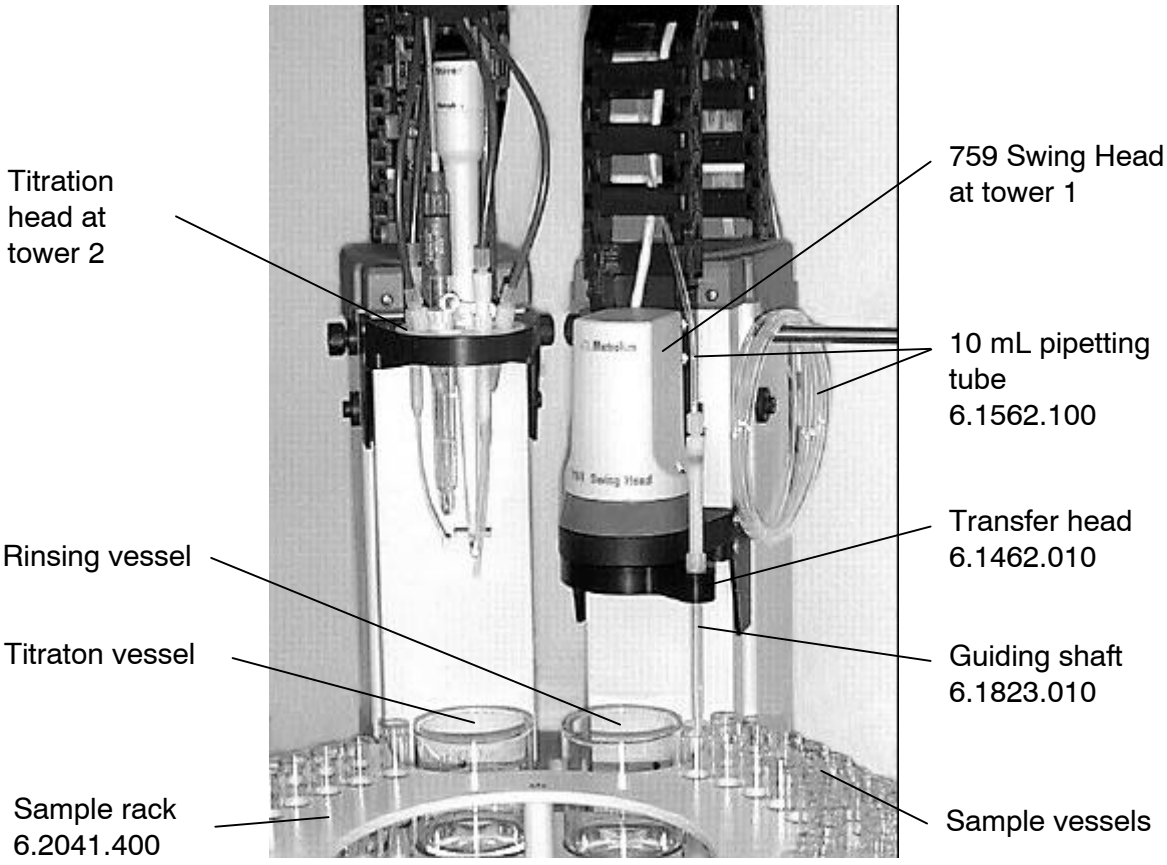
If you have connected the 759 swing head with transfer head to tower 1 of the sample changer instead of a conventional titration head, you can pipette, dilute and titrate with the sampler changer. This allows up to 126 samples to be processed in one series.

4.7.1 Setting up the System

To pipette with the 730 sample changer you will need the model with 2 towers and 4 pumps (2.730.0120). The swing head with transfer head is connected to tower 1 (see page 42), and a macro-titration head (6.1458.010) is connected to tower 2. A 700 Dosino for pipetting the sample solution from the sample vessels into the larger titration vessel is connected via the external bus interface and the 729 Dosimat interface. More Dosinos can be connected via the Dosimat Interface in order to add auxiliary solutions to the titration vessel.



The measuring units (Titrino, pH-meter, ...) are connected via the remote interface (see p. 14ff) or the RS232 interface (see page 24).



The swing head at tower 1 moves the pipette tip to each sample position. Using a Dosino, to which the pipetting tube is connected, a defined sample volume is aspirated out of the vessel and pipetted into a titration vessel. The titration head at tower 2 is equipped with electrodes, burette tips, a rod or magnetic stirrer and a rinsing device for aspirating the solution after titration and for rinsing the electrodes. The titration is effected at this workstation. The sample rack is also equipped with a rinsing vessel in which the pipetting tube is rinsed before aspirating the next sample.

4.7.2 Example Pipetting Method

We describe below a method for transferring volumes in the region of from approx. 1 to 9 mL. The method will need to be modified if you wish to pipette significantly smaller (µL) or larger volumes. Please consult our specialists for advice.

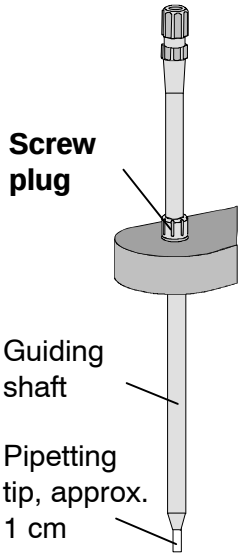
Note that the resolution of the 700 Dosino depends on the volume of the dispensing piston used (see page 111 and Instructions for Use of the 700 Dosino). Therefore, choose the volume of the dosing unit according to the volume to be pipetted.

Preparing the pipetting system

Before using for the first time, rinse the cylinder of the Dosino and the pipetting tube with n-hexane to remove any fatty residues. Then blow all parts dry with air or nitrogen.

Draw the pipetting tube with extended tip through the guide shaft and cut the tip down to approx. 1 cm with a sharp knife.

Wherever possible, use completely **degassed**, deionized water as the dosing liquid. Before using the pipetting system for the first time, or if the system has not been used for some time, execute the "prepare" command (<DOS> key) approx. three times to guarantee the absence of air bubbles in the dosing system.



Factors that influence the accuracy of the pipetting process

- Dosing or filling rates that are too high may cause air bubbles in the system, and may prevent the liquid being pipetted from being completely ejected. Reduce the rates to obtain more accurate results and to avoid carry-overs.
- When using a 10 mL pipetting tube (6.1562.100) with a 2 mm diameter, the volume of the air bubble between the two liquid systems should be approx. 50 µL, which is equivalent to a length of approx. 1.6 cm. If it is too large, the air is compressed or expanded, which alters the volume during aspiration and ejection.
- After ejecting the rinsing liquid, drops of liquid may remain on the tip of the pipette. They should be scraped off on a "scraper", as described on page 117 before aspirating more sample solution.
- All sample vessels should be filled to approximately the same level to allow an optimum lift height to be set for aspirating the solution.
- The dosing commands 'adjust' and 'level' serve to eliminate mechanical play between spindle and cylinder.
  adjust: Eliminate play away from the direction of the last piston movement.
  level: Eliminate play in the direction of the last piston movement after turning the cock to the fill position.

Configuration

Dosino 1: Pipetting Dosino
Dosino 2: For dosing auxiliary solution 1
Dosino 3: For dosing auxiliary solution 2

Sample rack 6.2041.400 for 126 x 15 mL and 2 x 250 mL vessels

Lift positions:	Working position:	Tower 2, lift height for titration
	Rinsing position:	Tower 1, lift height for rinsing pipette tip
	Shift position:	Tower 1 and Tower 2, lift position for shifting the sample rack
	Special position:	Tower 1, pipette tip submerged in sample to aspirate the solution
	Lift position 5:	Tower 1, pipette tip above the sample solution
	Lift position 6:	Tower 2, pipette tip submerged in titration solution to eject the sample solution
	Lift position 7:	Pipette tip on scraper

Special beaker positions:	Spec 1:	Titration vessel
	Spec 2:	Rinsing vessel
	Spec 3:	Scraper

To scrape away any drops of liquid remaining on the pipette tip after rinsing the pipetting tube, a "scraper" needs to be installed. This can be e.g. a test tube with a 1 mL pipette tip for air cushion pipettes fixed at its center. The position of the "scraper" is defined as special beaker 3.

```
730 Sample Changer              730.0013
Parameters
  method              PipMeth1
  number of samples:     rack
>start sequence
   1 CTL:Rm:             INIT
   2 MOVE  1     :    spec.2
   3 LIFT: 1  :        rinse mm
   4 DRIVE.PORT  1.4:   dos.
   5 DOS:  1  :        eject ml
   6 LIFT: 1  :        shift mm
>sample sequence
   1 MOVE  2     :    spec.1
   2 LIFT: 2  :          work mm
   3 DOS:  2  :           100 ml
   4 DOS:  3  :             2 ml
   5 STIR: 1     :          5 s
   6 LIFT: 2  :        shift mm
   7 MOVE  1     :    spec.2
   8 LIFT: 1  :        rinse mm
   9 DOSRATE     1        15
  10 FILLRATE    1        15
  11 DOS:  1  :         fill ml
  12 DRIVE.PORT  1.4:   dos.
  13 DOS:  1  :            5 ml
  14 DRIVE.PORT  1.1:   dos.
  15 DOS:  1  :        eject ml
  16 DOSRATE     1         5
  17 FILLRATE    1         5
```

The start sequence consists of commands which prepare the system for pipetting.

To remove air bubbles from the system, the content of the cylinder is ejected via port 4.

Titration vessel in front of tower 2

Auxiliary solution 1 added to the titration vessel
Auxiliary solution 2 added to the titration vessel

Rinsing station in front of tower 1
Lift 1 rises to rinsing height
Dosing and filling rates for Dosino 1

Filling of cylinder
Cock opened to port 4
Ejection of 5 mL of water via port 4
Cock opened to port 1
Content of cylinder ejected via pipetting tube
Dosing and filling rates for Dosino 1

```
  18 DRIVE.PORT  1.4:    dos.
  19 DOS:  1  :        -0.001 ml
  20 DOS:  1  :         level ml
  21 LIFT: 1  :         shift mm
  22 MOVE  1     :     spec.3
  23 LIFT: 1  :           144 mm
  24 LIFT: 1  :         shift mm
  25 MOVE  1     :     sample
  26 LIFT: 1  :           125 mm
  27 DRIVE.PORT  1.1:    dos.
  28 DOS:  1  :        -0.050 ml
  29 LIFT: 1  :       special mm
  30 DOS:  1  :          -2.0 ml
  31 WAIT                   3 s
  32 DRIVE.PORT  1.4:    dos.
  33 DOS:  1  :         0.001 ml
  34 DOS:  1  :         level ml
  35 LIFT: 1  :         shift mm
  36 MOVE  1     :     spec.1
  37 LIFT: 1  :           155 mm
  38 DOSRATE     1         10
  39 DRIVE.PORT  1.1:    dos.
  40 DOS:  1  :         2.035 ml
  41 WAIT                   3 s
  42 LIFT: 1  :         shift mm
  43 MOVE  2     :     spec.1
  44 LIFT: 2  :          work mm
  45 STIR: 1     :           ON s
  46 WAIT                   5 s
  47 CTL:Rm:    START device1
  48 SCN:Rm      :     Ready1
  49 PUMP  2.2   :          30 s
  50 PUMP  2.*   :          30 s
  51 PUMP  2.2   :          15 s
  52 STIR: 1     :         OFF s
  53 LIFT: 2  :          shift mm
>final sequence
>changer settings
  rack number               0
  lift rate 1              25 mm/s
  lift rate 2              25 mm/s
  shift rate               20
  shift direction:       auto
  beaker test mode:    single
  on beaker error:    display
>stirring rates
  stirrer 1                 3
  stirrer 2                 3
  stirrer 3                 3
  stirrer 4                 3
>dosing unit def.
>manual stop
  CTL Rmt:     STOP device1
  CTL RS232:
          ------------
```

Cock opened to port 4
Step to trigger opening of cock
Compensation of play between spindle and cylinder

Scraper in front of tower 1
Lift position 7

Sample vessel in front of tower 1
Lift position 5
Cock opened to port 1
Air bubble is aspirated.
Special lift height for aspirating sample
Sample is aspirated.

Cock opened to port 4
Step to trigger opening of cock
Compensation of play between spindle and cylinder

Titration vessel in front of tower 1
Lift position 6

Cock opened to port 1
Sample is ejected into titration vessel.

Titration vessel is moved in front of tower 2.

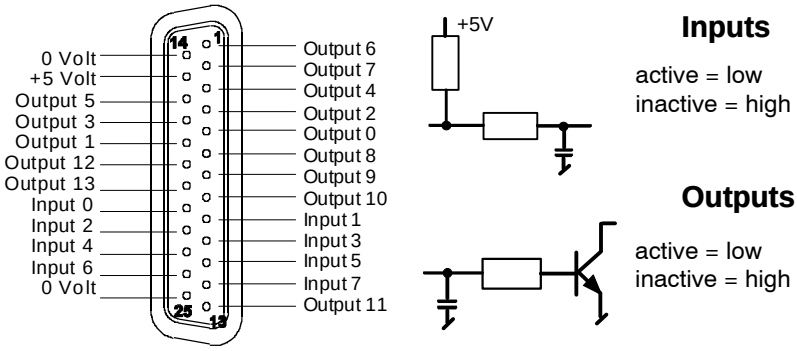
Titrino starts
Wait for end of titration (static 'ready' signal)
Pump 2 starts to aspirate the solution
Rinsing of electrodes
Aspiration of solution

Direction of rack shift is selected automatically.
No beaker test possible if 3-row racks are used.

4.8 Remote Interface

Peripheral instruments connected such as Titrinos, Titroprocessors, pH Meters etc. can be controlled via the remote interface (25-pin socket).
14 lines (Output 0–13) are available for the emission of signals. For receiving signals (e.g. the "ready" signal of a Titrino at the end of a titration) 8 lines are provided (Input 0–7).

Pin Assignment of the Remote socket:



The +5 V supply line may by charged with 20 mA maximally.

When the 759 Swing Head is connected to the remote interface, the output lines 11–13 and the input line 7 are occupied. These four lines are not continued in the plug and ignored, when further instruments are connected via the remote cable (see page 15ff).

The coupling with Metrohm instruments with the **standard cable 6.2141.020** is normally resolved in the following manner:

730	Metrohm instrument	730	Metrohm instrument
Output 0	Input 0	Input 0	Output 0
Output 1	Input 1	Input 1	Output 1
Output 2	Input 2	Input 2	Output 2
Output 3	Input 3	Input 3	Output 3
Output 4	Input 4	Input 4	Output 4
Output 5	Input 5	Input 5	Output 5
Output 6	Input 6	Input 6	Output 6
Output 7	Input 7	Input 7	Output 7
Output 8	free		
Output 9	"		
Output 10	"		
Output 11	"		
Output 12	"		
Output 13	"		

The Output lines 8…13 are unused by other Metrohm instruments as yet. They are assigned to pin 6…8, 13, 19…20.

Various remote cables are available to use the specific functions of the individual instruments of the various Metrohm model lines (see page 15ff). Metrohm also delivers special cables on request suited to the customer's needs, which allow complex couplings (including foreign instruments).

The 14 output lines of the remote socket can be separately set (statically) in manual operation as well as during method processing with the **"Control" command (CTL)**. A 14-place bit pattern must be defined for this. Every 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 the output line 1 to active (=set), that for example, would cause a STOP command with a connected Titrino.

0 = inactive
1 = active
* = no change

It is recommended to mask the output lines that are not relevant with a asterisk (*) to prevent alterations to these line states.

The 8 input lines of the remote socket are queried during method processing with the **SCAN command (SCN).** Method processing is interrupted until the predefined bit pattern compares to the effective state of the input lines (for example, the status of the ready line, for catching the end of a titration with a Titrino). An 8-place bit pattern must be set for this. Every bit is assigned to an input line. If there is correspondence, method processing will continue with the next command line. During manual operation the SCAN command serves as a status display 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"
expects an active input line 0 (1=set or active). This line is set for example, by a Titrino after a titration has ended and it is expecting a start signal again.

0 = inactive (high)
1 = active (low)
* = arbitrary

Input lines that are not being used or for which no defined state can be predicted, should also be masked here with an asterisk (*).

With a suitable multi-cable (with special wiring) several instruments can be controlled simultaneously via the remote lines. The bit patterns for the CTL and SCN commands can be combined for this, i.e. two Titrinos, for example, can be simultaneously started (CTL Rm *******1****1) and the end of both determinations can be queried (SCN Rm **1****1). Be aware, however, that some instruments (Titroprocessors, 691 pH Meters) only transmit short impulses (typically 20 ms) at the end of a determination and therefore a combined query of the end of determination with other instruments is only possible under certain conditions (dependent upon time).

To simplify the use of these remote control commands especially when connecting several instruments with Metrohm cables, the following command parameters are available for the CTL and SCN commands. For standard conditions (1 to 2 Titrinos, possibly with an auxiliary Dosimat, 1 Titroprocessor, 1 pH-meter or ion meter) predefined bit patterns are supported. These parameters are:

CTL Command

Parameter	Bit Pattern	Function
INIT	00000000000000	initializes the remote interface *)
START device1	************1	starts device1 (for ex., Titrino, Titroprocessor...)*)
START device2	********1*****	starts device2 (see above, only with multi-cable)
START device*	********1****1	starts devices1 and 2 " *)
START dos1	*******1******	starts Dosimat on device1 (Titrino via "activate")
START dos2	*****1********	starts Dosimat on device2 "
START dos*	*****1*1******	starts Dosimat on device1 and 2 "
METER mode pH	*********0001*	switches 692 Ion Meter or 691,713 pH Meter to pH measurement
METER mode T	*********0010*	switches 692 Ion Meter or 691, 713 pH Meter to temperature measurement
METER mode U	*********0011*	switches 692 Ion Meter or 691, 713 pH Meter to mV-measurement
METER mode I	*********0100*	switches 692 Ion Meter or 691, 713 pH Meter to Ipol (mV-measurement)
METER mode C	*********1000*	switches 692 Ion Meter to conc. measurement
METER cal pH	*********0101*	switches 692 Ion Meter or 691, 713 pH Meter to pH-calibration
METER cal C	*********1001*	switches 692 Ion Meter to conc. calibration
METER enter	*********1111*	simulates the <ENTER> key on 692 Ion Meter or 691, 713 pH Meter (obligatory with the 691 for pH calibration in order to start measurement of the second buffer)

With the START commands a short pulse (200 ms) is emitted.

*) with pH meters and Ion meters a result print-out is provoked

Manual stop options

Parameter	Bit Pattern	Function
STOP device1	************1*	stops device1 (for ex., Titrino, Titroprocessor...)
STOP device2	******1*******	stops device2 (see above, only with multi-cable)
STOP device*	******1*****1*	stops devices1 and 2 "

With the STOP commands a short pulse (200 ms) is emitted.

SCN Command

Parameter	Bit Pattern	Function
ready1	`*******1`	queries "ready" state of device1 (Titrinos)
ready2	`**1*****`	queries "ready" state of device2 "
ready*	`**1****1`	queries “ready" state of device1 and 2 "
end1	`****1***`	expects the end pulse of device1 (for ex. EOD)
end2	`*1******`	expects the end pulse of device2 “
endmeter	`***11***`	expects the end pulse from 692 Ion Meter or 713 pH Meter (during the waiting interval, the stirrer 1 is turned on)

With the 'ready∗' parameter the readiness of two concurrently operating instruments may be queried. The 'ready' line of both instruments must be automatically set (static) at the end of a determination. Two instruments that emit short pulses at the end of e.g. measurement, can not be controlled at the same time.

4.9 Operation via RS232 Interface

4.9.1 General Rules

The 730 Sample Changer has an extensive remote control facility that allows full control of the Sample Changer via the RS232 interface, i.e. the Sample Changer can receive data from an external controller or send data to an external controller. C_R and L_F are used as terminators for the data transfer. The Sample Changer sends 2xC_R and L_F as termination of a data block, to differentiate between a data line which has C_R and L_F as terminators. The controller terminates its commands with C_R and L_F. If more than one command per line is sent by the controller, ";" is used as a separator between the individual commands.

The data are grouped logically and easy to understand. Thus e.g., for the selection of the dialog language, the following must be sent

&**C**onfig.**A**ux.**L**anguage **"english"**

whereby it is sufficient to only transmit the boldface characters, thus:

&**C**.**A**.**L "english"**

The quantities of the commands above are:

Config	configuration data
Aux	auxiliaries, various data
Language	setting the dialog language

The data are hierarchically structured (tree form). The quantities that occur in this tree are called **objects** in the following. The dialog language is an object which can be called up with the

&**C**onfig.**A**ux.**L**anguage

command.

If one is in the desired location in the tree, the value of the object can be queried.

&**C**onfig.**A**ux.**L**anguage **$Q** Q for Query

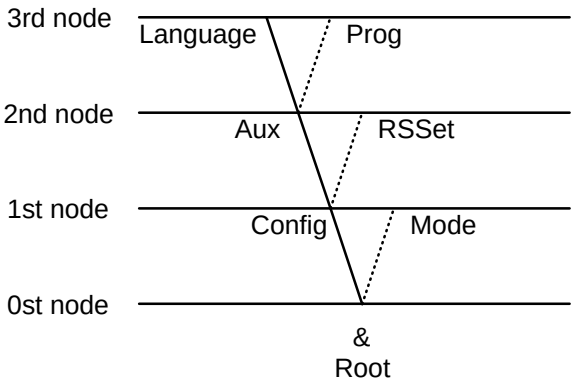
The query command $Q initiates the issuing of the value on the instrument and the value emission is triggered. Entries which start with $, trigger something. They are thus called **triggers**.

Values of objects can not only be queried, they can also be modified. Values are always entered in quotes, for example:

&**C**onfig.**A**ux.**L**anguage **"english"**

4.9.2 Calling up Objects

An excerpt from the object tree is represented below:



Rules	Example
The root of the tree is designated by &.	
The branches (levels) of a tree are marked with a dot (.) when calling up an object.	
When calling up an object, it is sufficient to give only as many letters as necessary to uniquely assign the object. If the call is not unequivocal, the first object in the series will be recognized.	Calling up the dialog language **&C**onfig**.A**ux**.L**anguage or **&C.A.L**
Upper- or lowercase letters may be used.	**&C.A.L** or **&c.a.l**
An object can be assigned a value. Values are signified at the beginning and end by quotes ("). They may contain up to 24 ASCII characters. Numerical values can contain up to 6 digits, a negative sign, and a decimal point. Numbers with more than 6 characters are not accepted; more than 4 decimal places are rounded off. For numbers <1, it is necessary to enter leading zeros.	Entering the dialog language: **&C.A.L"english"** correct entry of numbers: **"0.1"** incorrect entry of numbers "1,5" or "+3" or ".1"
The current object remains until a new object is called.	entry of another dialog language: **"deutsch"**
New objects can be addressed relative to the old object: **A preceding dot** leads **forwards** to the next level in the tree.	From the root to node 'Aux': **&C.A** Forward from node 'Aux' to 'Prog': **.P**
More than one preceding dot leads one level **backwards** in the tree. n node backwards require n+1 preceding dots.	Jump from node 'Prog' to node 'Aux' and select a new object 'Language' at this level: **..L**
If you must jump back to the root, enter a preceding &.	Change from node 'Language' via the root to node 'Mode': **&M**

4.9.3 Triggers

Triggers initiate an action on the 730 Sample Changer, for example, starting a process or sending data. Triggers are marked by the introductory symbol $.

The following triggers are possible:

$G	**G**o	Starts processes, e.g. starting the mode run or setting the RS232 interface parameters
$S	**S**top	Stops processes
$Q	**Q**uery	Queries all information from the current node in the tree forward up to and including the values
$Q.P	**P**ath	Queries the path from the root of the tree up to the current node
$Q.H	**H**ighest Index	Queries the number of son nodes of the current node
$Q.N"i"	**N**ame	Queries the name of the son node with index i, i = 1...n
$D	**D**etail-Info	Queries the detailed status information
$U	q**U**it	Aborts the data flow of the instrument, for example, after $Q

The triggers $G and $S are linked to particular objects, see the summary table page 130ff.

All other triggers can be used at any time and at all locations on the object tree.

Examples:

Querying the value of the baud rate: **&C**onfig**.R**SSet**.B**aud **$Q**
Querying all values of the node: RSSet: **&C**onfig**.R**SSet **$Q**
Querying the path of the node: RSSet: **&C**onfig**.R**SSet **$Q.P**
Start mode: **&M**ode **$G**
Querying the detailed status: **$D**

4.9.4 Status and Error Messages

In order to have an efficient control by an external control device, it must also be possible to query status conditions. They provide information about the status of the sample changer. The trigger $D initiates output of the status. Status messages consist of the global status, the detailed status and eventual error messages. The global status informs on the activity of the process, while the detailed status conditions show the exact activity within the process.

The following **global status conditions** are possible:

$G	**G**o	The sample changer is executing the last command.
$H	**H**old	The sample changer has been held ($H, <HOLD> key or by an error which effects the hold status).
$C	**C**ontinue	The sample changer has been restarted actively after hold.
$R	**R**eady	The sample changer has executed the last command and is ready.
$S	**S**top	A process has been aborted, e.g. by pressing the <STOP> key or because there was an error.

Detailed Status Conditions

Status conditions of the global $R:

`$R.Mode`	Basic state: ready to start automatic processing
`$R.Assembly`	An assembly step has been executed.

Status conditions of the global $G:

`$G.Mode.Start.`	Instrument at the beginning of processing
`$G.Mode.Start.01.WAIT`	Instrument processing the start sequence, displays line number and current command
`$G.Mode.Sample.01.WAIT`	Instrument processing the sample sequence, displays line number and current command
`$G.Mode.Final.01.WAIT`	Instrument processing the final sequence, displays line number and current command
`$G.Mode.`	Instrument processing a manual command
`$G.Assembly.`	Instrument processing an assembly-command

Status conditions of the global $H:

`$H.Mode`	The status conditions of the global $H are identical with the ones of the global $G.

4.9.5 Error Messages, Errors

Fatal Instrument Errors:

E1	Incorrect program check sum
E2	RAM read/write error
E3	RAM lost data
E4	Timer interrupt for multi-tasking missing
E5	RS232 module test error
E6	RS232 read/write error
E7	Display read/write error
E12	EBUS error
E18	Low battery
E19	RAM test error

Program-specific Messages:

E28	Wrong object call
E29	Wrong value or no value allowed
E30	Wrong trigger

RS Receive Errors:

E36	Parity error Exit: <QUIT> and set the same parity for both instruments.
E37	Stop bit error Exit: <QUIT>and set the same stop bit for both instruments.
E38	Overrun error. At least 1 character could not be read. Exit: <QUIT>.
E39	Internal receive buffer full (>82 characters). Exit: <QUIT>.

RS Send Errors:

E40	DSR=OFF. No proper handshake for more than 1s. Exit: <QUIT>. Is the receiver switched on and ready to receive?
E41	DCD=ON. No proper handshake for more than 1s. Exit: <QUIT>. Is the receiver switched on and ready to receive?
E42	CTS=OFF. No proper handshake for more than 1s. Exit: <QUIT>. Is the receiver switched on and ready to receive?
E43	Transmission has been interrupted for at least 3 s with XOFF. Exit: send XON or <QUIT>.
E44	The RS-interface parameters are no longer identical for both instruments. Re-set.
E45	The receive buffer of the Sample Changer contains an incomplete command (L_F missing). Transmission is therefore blocked. Exit: send L_F or <QUIT>.

E50…E59	I/O-Test error
E60…E82	RS232-Test error

Instrument-specific Errors:

E201	Sample changer function error
E202	Dosimat function error

4.10 Remote Control Commands

4.10.1 Overview

The internal object tree can be divided into the following branches:

&	**Root**
├ **M**ode	Method parameters
├ **C**onfig	Instrument configuration
├ **I**nfo	Current Data
├ **S**etup	Setting the operating mode
├ **U**serMeth	User-defined methods
├ **A**ssembly	Component data
└ **D**iagnosis	Diagnostics program

Detailed Description of the Main Branches:

&Mode

Object	Description	Input range	Reference
& Root			
├ **M**ode	**Method parameters**	**$G**, $S, $H, $C	4.10.2.1
: ├ **.M**ethod	Method name	8 ASCII characters	4.10.2.2
├ **.S**mplNo	Number of samples in a series	1...999, *, **rack**	4.10.2.3
├ **.St**artSeq	**Start sequence**		4.10.2.4
├ **.1**	Line number of the command		
├ **.C**md	Command	**NOP**, MOVE, LIFT, SAMPLE, STIR, DEF PUMP, DOS, SCAN, CTRL, WAIT, ENDSEQ	
└ **.***			
*			
:			
└ **.100**	Sequence end	**NOP**	
├ **.S**ampleSeq	**Sample sequence**	-	4.10.2.6
├ **.1**	Line number of the command		
├ **.C**md	Command	**NOP**, MOVE, LIFT, SAMPLE, STIR, DEF PUMP, DOS, SCAN, CTRL, WAIT. ENDSEQ	
└ **.** *			
*			
:			
└ **.100**	Sequence end	**NOP**	
:			

.Finalseq	**Final sequence**		4.10.2.8
.1	Line number of the command		
.Cmd	Command	**NOP**, MOVE, LIFT, SAMPLE, STIR, DEF PUMP, DOS, SCAN, CTRL, WAIT, ENDSEQ	
.*			
*			
.100	Sequence end	**NOP**	
.Changer	**Changer settings**	-	4.10.2.10
.RackNo	Rack number	**0**…16	
.L1Rate	Lift speed tower 1	3…**25** mm/s	
.L2 Rate	Lift speed tower 2	3…**25** mm/s	
.ShRate	Turning speed of the rack	3…**20**	
.ShDir	Turning direction of the rack	+,–,**auto.**	
.BeakTest	Beaker test mode	**single**, both	
.ModeSample	Reaction to error	**MOVE**, display	
.StirRates	**Stirring speeds**	-	4.10.2.11
.1	Stirrer 1	-	
.Rate	Stirring speed	1...**3**...15	
.4	Stirrer 4	-	
.Rate			
.DosimatSet	**Settings for dosing unit**	-	4.10.2.12
.DosUnitNo	Dosing unit number	**1**...12	
.1	Dosing unit 1		
.DosRate	Dosing speed	0.01...160 ml/min, **max.**	
.FillRate	Filling speed	0.01...160 ml/min, **max.**	
.DosTube	Dosing outlet	**1**...4	
.FillTube	Filling inlet	1...**2**...4	
.ExchTube	Rinse inlet	1...**2**...4	
.PrepTube	Preparation outlet	**1**...4	
.EmptyTube	Air inlet on emptying	1...**4**	
.12			
. EmptyTube	Air inlet on emptying	1...**4**	
.ManStop	Reaction to manual stop	-	4.10.2.13
.RemCtl	Command via remote	**STOP device1**, STOP device2, STOP device*, 14 x 1,0 or * (bin)	
.RS Ctl	Command via RS232	&M;$S, 14 ASCII characters	

&Config

Object	Description	Input range	Reference
& Root			
⋮			
├ **C**onfig	**Instrument configuration**	-	4.10.2.14
⋮ ├ **.A**ux	Miscellaneous		
│ ├ **.L**anguage	Dialog language	**english**, german français, español	
│ ├ **.C**ontrast	Display contrast	0...**3**...7	
│ ├ **.B**eeper	Beeper on/off	**on**, off	
│ ├ **.D**evName	Instrument identification	8 ASCII characters	
│ ├ **.P**rog	Program version	read only	
│ ├ **.M**axLift	Max. Lift height	0...**235**...320 mm	
│ ├ **.P**umps1	Number of pumps lift 1	0, **1**, 2	
│ ├ **.Pumps2**	Number of pumps lift 2	0, **1**, 2	
│ ├ **.S**wingH	Swing Head on/off	on, **off**	
│ └ **.Mo**nBeak	Beaker sensor on/off	**on**, off	
│			
├ **.R**ackDef	**Rack definitions**	-	4.10.2.15
│ ├ **.R**ackNo	Rack number	**1**...16	
│ *			
│ ├ **.C**ode	Rack code	**000001**...111111(b)	4.10.2.16
│ ├ **.T**ype	Rack type	**M12-0**, M14-0, M16-0, M18-0, M24-0, M48-0,.....	
│ ├ **.W**orkH	Work position	**0**…325 mm	
│ ├ **.Ri**nseH	Rinse position	**0**…325 mm	
│ ├ **.S**hiftH	Shift position	**0**…325 mm	
│ ├ **.Sp**ecialH	Special position	**0**…325 mm	
│ └ **.Spez**Beak	Special beaker positions	-	4.10.2.17
│ ├ **.1**	Special beaker 1	-	
│ ⋮ └ **.P**os	Beaker position	**0**…number of pos.	
│ └ **.8**	Special beaker 8	-	
│ └ **.P**os	Beaker position	**0**…number of pos.	
│			
├ **.P**osTab	**Position table**	-	4.10.2.18
│ ├ **.I**dx	Index of the table	**0**…31	
│ *			
│ ├ **.N**ame	Name of the position table	8 ASCII characters	4.10.2.19
│ ├ **.R**1Num	Highest Beaker pos. in row 1	2...(R2Num − 2)	
│ ├ **.R2**Num	Highest Beaker pos. in row 2	(R1Num + 2)...(R3Num − 2)	
│ ├ **.R3**Num	Highest Beaker pos. in row 3	(R2Num + 2)...200	
│ ├ **.R1O**ff	Offset in $^1/_{10}$-ang. degr. for R.1	**0**...3599	
│ ├ **.R2O**ff	Offset in $^1/_{10}$-ang. degr. for R.2	**0**...3599	
│ ├ **.Nu**m	Number of positions	**1**…200	
│ ├ **.1**	Position 1	-	4.10.2.20
│ │ └ **.V**alue	Position in $^1/_{10}$-angular degr.	**0**…3599	
│ ⋮			
│ └ **.12**, 14, 16, 24, 48, i.e. .PosTab.Num			
⋮ └ **.V**alue	Position in $^1/_{10}$-angular degr.	**0**…3599	

.WetPart	**Dosing unit definitions**	-	4.10.2.21
.WetPartNo	Dosing unit no.	**1**…12	
*			
.1	Port Number 1	-	
.MaxRate	Max. dosing rate	0.01…**160** ml/min	4.10.2.22
.Length	Tubing length	0...**1000**...30000 mm	
.Diameter	Tubing diameter	0.1...**2.0**...20 mm	
.2	Port Number 2	-	
.MaxRate	Max. dosing rate	0.01...**160** ml/min	4.10.2.22
.Length	Tubing length	0...**250**...30000 mm	
.Diameter	Tubing diameter	0.1...**2.0**...20 mm	
.3	Port Number 3	-	
.MaxRate	Max. dosing rate	0.01...**160** ml/min	4.10.2.22
.Length	Tubing length	0...**1000**...30000 mm	
.Diameter	Tubing diameter	0.1...**2.0**...20 mm	
.4	Port Number 4		
.MaxRate	Max. dosing rate	0.01...**160** ml/min	4.10.2.22
.Length	Tubing length	0...**1000**...30000 mm	
.Diameter	Tubing diameter	0.1...**2.0**...20 mm	
.RSset	**Settings RS232**	$G	4.10.2.23
.Baud	Baud rate	300, 600, 1200, 2400, 4800, **9600**	4.10.2.24
.DataBit	Number of data bits	7, **8**	
.StopBit	Number of stop bits	**1**, 2	
.Parity	Parity	even, odd, **none**	
.Handsh	Handshake	**HWs**, HWfull, SWchar, SWline, none	
.CharSet	Character set	**IBM**, HP, Epson, Seiko, Citizen	4.10.2.25

&Info

Object	Description	Input range	Reference
& Root			
Info	**Current data**	-	
.Report	**Report definition**	-	4.10.2.26
.Select	Report type	**config**, param, usermeth, all	
.ActualInfo	**Current data**	-	4.10.2.27
.Lift	Lift station	-	
.1	Lift 1	-	
.Exist	Availability	read only	
.MaxHeight	Max. stroke path	read only	
.ActHeight	Current lift position	read only	
.Beaker	Presence of beaker	read only	

.2	Lift 2	-	
.Exist	Availability	read only	
.MaxHeight	Max. stroke path	read only	
.ActHeight	Current lift position	read only	
.Beaker	Presence of beaker	read only	
.Rack	**Sample rack**	-	4.10.2.28
.Code	Rack ID code	read only	
.Type	Rack type	read only	
.WorkHeight	Work position	read only	
.RinseHeight	Rinse position	read only	
.ShiftHeight	Shift position	read only	
.SpecialHeight	Special position	read only	
.ActPos	Current beaker pos. tower 1	read only	
.Act2 Pos	Current beaker pos. tower 2	read only	
.Stirrer	**Stirrer**	-	4.10.2.29
.1	Stirrer 1	-	
.State	State	read only	
.4			
.State		read only	
.Pump	**Pump**	-	4.10.2.30
.1	Pump 1	-	
.State	State	read only	
.4			
.State			
.Buret	**Dosing units**	-	4.10.2.31
.1	Dosing unit 1	-	
.State	State	read only	
.Position	Piston position	read only	
.Cock	Cock position	read only	
.Type	Type of dosing drive	read only	
.Volume	Burette volume	read only	
.12	Dosing unit 12		
.State	State	read only	
.Position	Piston position	read only	
.Cock	Cock position	read only	
.Type	Dosing type	read only	
.Volume	Burette volume	read only	
.Inputs	**Input lines**	-	4.10.2.32
.Status	Status input lines	read only (d)	
.Outputs	**Output lines**	-	4.10.2.33
.Status	Status output lines	read only (d)	
.Display	**Display**	-	4.10.2.34
.L1	Text line 1	read only	
.L2	Text line 2	read only	
.Counter	**Display**	-	4.10.2.35
.Sample	Current sample position	read only	
.Maximum	Number of samples to be worked off	read only	

&Setup

Object	Description	Input range	Reference
& Root			
⋮			
├ **S**etup	**Settings for the operating mode**		
⋮ ├ **.I**dReport	Report identification	**on,** off	4.10.2.36
├ **.K**eycode	Send key code	on, **off**	4.10.2.37
├ **.T**ree	Sending format of path info		4.10.2.38
├ **.S**hort	Short format of path	on, **off**	
└ **.C**hangedOnly	Paths of modified nodes only	on, **off**	
├ **.Tra**ce	Message on changed values	on, **off**	4.10.2.39
├ **.L**ock	**Lock key functions**	-	
├ **.K**eyboard	Lock all keyboard keys	on, **off**	4.10.2.40
├ **.C**onfig	Lock <CONFIG> key	on, **off**	
├ **.P**arameter	Lock <PARAM> key	on, **off**	
├ **.U**serMeth	Lock all method functions	on, **off**	
├ **.R**ecall	Lock "loading"	on, **off**	
├ **.S**tore	Lock "saving"	on, **off**	
└ **.D**elete	Lock "deletion"	on, **off**	
└ **.D**isplay	Lock display function	on, **off**	
├ **.M**ode	**Setting the waiting Interval**		
└ **.S**tartWait	Waiting time after start	on, **off**	
├ **.A**utoInfo	**Automatic message for changes**		4.10.2.42
├ **.S**tatus	Switch AutoInfo on/off	on, **off**	
├ **.P**	When mains is switched on	on, **off**	
├ **.C**h	**Changer infos**	-	
├ **.G**	When method started	on, **off**	
├ **.GC**	When start is initiated	on, **off**	
├ **.R**	When changer is "ready"	**o**n, **off**	
├ **.S**	When changer is stopped	on, **off**	
├ **.H**	When changer is on "hold"	on, **off**	
├ **.C**	Continue after "hold"	on, **off**	
├ **.B**	Begin of method	on, **off**	
├ **.F**	End of process	on, **off**	
├ **.O**M	Begin start sequence "OMove"	on, **off**	
└ **.CM**	End final sequence "CMove"	on, **off**	
└ **.E**	When an error occurs	**on**, off	
├ **.P**owerOn	RESET (power on)	$G	4.10.2.43
├ **.In**itialize	Set default values	$G	4.10.2.44
└ **.S**elect	Selection of branch	**param**, config, assembly, setup, all	
├ **.R**amInit	Initialization of working mem.	$G	4.10.2.45
└ **.Ins**trNo	Instrument number	-	4.10.2.46
└ **.V**alue	Description (not available in manual operation)	8 ASCII characters	

&UserMeth

Object	Description	Input range	Reference
& Root			
⋮			
├ **U**serMeth	**User defined methods**		
⋮ ├ **.F**reeMemory	Memory available	read only	4.10.2.47
├ **.R**ecall	Load method	$G	4.10.2.48
└ **.N**ame	Method name	8 ASCII characters	
├ **.S**tore	Save method	$G	
└ **.N**ame	Method name	8 ASCII characters	
├ **.D**elete	Delete method	$G	
└ **.N**ame	Method name	8 ASCII characters	
├ **.DelA**ll	Delete all methods	$G	
└ **.L**ist	List of methods		4.10.2.49
*			
├ **.1**	Method 1		
* ├ **.N**ame	Method name	read only	
└ **.B**ytes	Method size in bytes	read only	

&Assembly

Object	Description	Input range	Reference
& Root			
⋮			
├ **A**ssembly	**Assembly control**		
⋮ ├ **.S**ample	**Beaker position**	$G	4.10.2.50
├ **.F**unc	Selection of function	**=**, +, –	
└ **.V**alue	Value of function	**1**...999	
├ **.M**ove	**Turning the rack**	$G, $S	4.10.2.51
├ **.T**arget	Lift selection	**1**, 2	
└ **.P**osition	Beaker or position	**sample**, spec1…8, 1…999	
├ **.L**ift	**Moving the lift**	$G, $S	4.10.2.52
├ **.S**tation	Lift address	1, 2, *	
└ **.W**ay	Position	work, rinse, shift, special, **rest**, 0...320 mm	
├ **.St**ir	**Switch stirrer on/off**	$G, $S	4.10.2.53
├ **.Ad**ress	Address of stirrer	**1**…4, *	
└ **.V**alue	Time or status	**1**…9999 s, on, off	
├ **.P**ump	**Pump control**	$G, $S	4.10.2.54
├ **.A**dress	Address of pump	**1.1,** 1.2, 1.*, 2.1, 2.2, 2.*	
└ **.V**alue	Time or status	**1**…999 s, on, off	
├ **.D**os	**Initiate dosing functions**	$G, $S	4.10.2.55
├ **.A**dress	Address of dosing unit	**1**…12	
└ **.V**alue	Volume or function	±0.001...**1**...999.999 ml, fill, release, prepar., empty, eject, adjust, level	
⋮			

.Scan	**Scanning the interfaces**	$G, $S	4.10.2.56
.Adress	Selection of interface	**Rm**, RS	
.Pattern	Input signal or data		
	for Rm (Remote):	8 x 1,0 or ∗ (bin) **ready1**, ready2, ready∗, end1, end2, endmeter	
	for RS (RS232):	14 ASCII characters !∗.R"	
.Ctrl	**Interface control**	**$**G	4.10.2.57
.Adress	Interface selection	**Rm**, RS	
.Pattern	Output signal or data signal		
	for Rm (Remote):	14 x 1,0 or ∗ (bin), START device1, START device2, START device∗, START dos1, START dos2, START dos∗, METER mode pH, METER mode T, METER mode U, METER mode I, METER mode C, METER cal pH, METER cal C, METER enter, **INIT**	
	for RS (RS232):	14 ASCII characters, &M;$G	
.Def	**Re- definitions**	$G	4.10.2.58
.Object	Item selection	**STIRRATE**, DOSRATE FILLRATE, LIFTRATE, SHIFTRATE, DRIVE.PORT	
.Adress	Component address	dependent upon item	
.Value	Value	dependent upon item	
.Wait	**Waiting time**	$G, $S	4.10.2.59
.Time	Waiting time	0...**1**...9999 s	
.End	Changer RESET	$G, $S	4.10.2.60

&Diagnosis

Levels	Description	Selection	Reference
& Root			
⋮			
└ **D**iagnosis	**Diagnosis**		
├ **.In**it	Initialization	$G, $S	4.10.2.61
│ └ **.S**elect	Select topic for initialization	param, config, setup, assembly, all	
├ **.R**amTest	Test working memory	$G	4.10.2.62
├ **.L**cdTest	Test display	$G, $S, $H	
├ **.C**ontrastTest	Test display contrast	$G, $S	
├ **.K**eyTest	Keyboard test	$G, $S	
├ **.Io**Test	Test input/output lines	$G, $S	
├ **.Rs**Test	Test RS232 interface	$G, $S	
├ **.E**busTest	Test Ebus interface	$G, $S	
├ **.B**eeperTest	Test beeper	$G, $S	
├ **.Rac**kcodeTest	Test rack code	$G, $S	
├ **.F**unctionTest	Metrohm internal test		
├ **.S**imulateKey	Key code simulation	**0**, 1...6, 8...31	4.10.2.63
├ **.Ins**trNo	Instrument number (Not accessible via RS232)		4.10.2.64
└ **.P**owerOn	Power-on simulation	$G	4.10.2.65

4.10.2 Description of the Remote Control Commands

&Mode ...

4.10.2.1 **M**ode $G, $S, $H, $C

Start ($G) or stop ($S) the current method. Interrupt with $H (hold), resume with $C (continue).

4.10.2.2 **M**ode**.M**ethod read only

Name of current method in the working memory. $Q sends 8 ASCII characters. ******** stands for a blank method.

4.10.2.3 **M**ode**.S**mplNo 1...999, *, **rack**

Number of samples. This entry determines the number of runs for the sample sequence.

* = infinite number of samples. Processing has to be stopped with &M;$S or <STOP>.

rack = (Number of rack positions – number of special beakers defined).

4.10.2.4 **M**ode**.St**artSeq**.1.C**md **NOP**, MOVE, LIFT, STIR, DEF, PUMP, DOS, SCAN, SAMPLE, CTRL, WAIT, ENDSEQ
etc. up to **.99**

Defines the command of the indexed command line in a start sequence. The introduction of a command appends the according sub-branch from &Assembly (see page 136) to the index node. A NOP-entry cuts the appended sub-branch from the index node. Each entry at the end of a sequence appends a new node &Mode.StartSeq.*.Cmd("NOP").

4.10.2.5 **M**ode**.St**artSeq**.1.*** .**M**ove…, .**L**ift…, .**St**ir…, .**P**ump…, .**D**os…, .**Sc**an…, .**C**trl…, .**De**f…, .**S**ample…, .**W**ait…, .**E**nd
etc. up to **.99**

Indexed start sequence; its commands will be executed line by line in processing. At the index node &Mode.StartSeq.1.Cmd (see 4.10.2.4) the according sub-branch from &Assembly… will be appended depending on the selected command (see 4.10.2.4).
Example:
&Mode.StartSeq.1.Cmd("MOVE")
⇒ &Mode.StartSeq.1.Move.Target("1")
⇒ &Mode.StartSeq.1.Move.Position("sample")

4.10.2.6 **M**ode**.S**ampleSeq**.1.C**md NOP, MOVE, LIFT, STIR,
etc. up to **.99** DEF, PUMP, DOS, SCAN,
SAMPLE, CTRL, WAIT, ENDSEQ

Defines the command of the indexed command line in a sample sequence. See start sequence (4.10.2.4).

4.10.2.7 **M**ode**.S**ampleSeq**.1.**∗ .**M**ove…, .**L**ift…, .**St**ir…, .**P**ump…,
etc. up to **.99** .**D**os…, .**Sc**an…, .**C**trl…, .**De**f…,
.**S**ample…, .**W**ait…, .**E**nd

Indexed sample sequence; its commands will be executed line by line in processing. See start sequence (4.10.2.5).

4.10.2.8 **M**ode**.F**inalSeq**.1.C**md NOP, MOVE, LIFT, STIR,
etc. up to **.99** DEF, PUMP, DOS, SCAN,
SAMPLE, CTRL, WAIT, ENDSEQ

Defines the command of the indexed command line in a final sequence. See start sequence (4.10.2.4).

4.10.2.9 **M**ode**.F**inalSeq**.1.**∗ .**M**ove…, .**L**ift…, .**St**ir…, .**P**ump…,
etc. up to **.99** .**D**os…, .**Sc**an…, .**C**trl…, .**De**f…,
.**S**ample…, .**W**ait…, .**E**nd

Indexed final sequence; its commands will be executed line by line in processing. See start sequence (4.10.2.5).

4.10.2.10

Mode**.Ch**anger**.R**ackNo	**0**…16
Mode**.Ch**anger**.L1**Rate	3...**25** mm/s
Mode**.C**hanger**.L2**Rate	3...**25** mm/s
Mode**.Ch**anger**.Sh**Rate	3...**20** w/s
Mode**.Ch**anger**.ShD**ir	+, –, **auto.**
Mode**.Ch**anger**.B**eakTest	**single**, both
Mode**.Ch**anger**.M**odeSample	**MOVE**, display

Changer settings.

RackNo:	Rack number, forces the use of the defined rack with the current method (0 = any rack).
L1Rate:	Lift speed for tower 1, in mm/sec
L2Rate:	Lift speed for tower 2, in mm/sec
ShRate:	Turning speed of the rack, in angular degrees/sec
ShDir:	Turning direction of the rack (ascending or descending rack positions; auto. means automatic choice of the shortest path)
BeakTest:	Mode for beaker test (single = test one single (selected) tower, both = test both towers). The beaker test is executed right after each MOVE command.
ModeSample:	Reaction on missing sample beaker. (MOVE = next sample beaker will be chosen regarding the recent SAMPLE command, display = display warning.)

4.10.2.11 **M**ode.**St**irRates.**1.R**ate 1...**3**...15
etc. until .**4**

Stirring speed in 15 steps.

4.10.2.12 **M**ode.**D**osimatSet.**D**osUnitNo **1**…12
Mode.**D**osimatSet.**1.DosR**ate 0.01…160 ml/min, **max.**
Mode.**D**osimatSet.**1.FillR**ate 0.01…160 ml/min, **max.**
Mode.**D**osimatSet.**1.DosT**ube **1**...4
Mode.**D**osimatSet.**1.FillT**ube 1...**2**...4
Mode.**D**osimatSet.**1.Ex**chTube 1...**2**...4
Mode.**D**osimatSet.**1.P**repTube **1**...4
Mode.**D**osimatSet.**1.Em**ptyTube 1...**4**
etc. until **.12**

Dosing unit settings.

DosUnitNo:	Number of current dosing unit
DosRate:	Dosing speed
FillRate:	Filling speed
DosTube:	Dosing outlet of 700 Dosino
FillTube:	Filling inlet of 700 Dosino
ExchTube:	Rinsing inlet on exchanging the exchange unit (see &Assembly.Dos.Value("release") 4.10.2.55)
PrepTube:	Dosing outlet on preparing cycle of 700 Dosino
EmptyTube:	Air inlet for emptying the 700 Dosino.

4.10.2.13 **M**ode.**M**an**S**top.**R**emCtl **STOP device1**, STOP device2, STOP device∗, 14 Bit (1,0, or ∗)
Mode.**M**anStop.**RS**Ctl 14 ASCII characters

Manual stop options. Signals or data that are transmitted via the interfaces after pressing the <STOP> key.

&Config ...

4.10.2.14

Config**.A**ux**.L**anguage	**english**, deutsch, français, español
Config**.A**ux**.C**ontrast	0…**3**…7
Config**.A**ux**.B**eeper	**ON**, OFF
Config**.A**ux**.D**evName	8 ASCII characters
Config**.A**ux**.P**rog	read only
Config**.A**ux**.M**axLift	0...**235**...325 mm
Config**.A**ux**.P**umps1	0, **1**, 2
Config**.A**ux**.Pumps2**	0, **1**, 2
Config**.A**ux**.S**wingH	on, **off**
Config**.A**ux**.Mo**nBeak	**on**, off

Basic configuration / miscellaneous

Language:	Selection of dialog language
Contrast:	Display contrast in steps from 0 to 15
Beeper:	Acoustic warning signal on/off
DevName:	Instrument name as identification for connections with other instruments (8 ASCII characters, no special characters)
Prog:	Program version ($Q sends "730.0013")
MaxLift:	Max. Lift height i.e. lowest possible lift position ∗
Pumps1:	Numbers of pumps on tower 1 ∗
Pumps2:	Numbers of pumps on tower 2 ∗
SwingH:	Swing Head on/off ∗
MonBeak:	Beaker Sensor on/off ∗

∗ Modifications effect after RESET or power on.

4.10.2.15

Config**.R**ackDef**.R**ackNo **1**...16

Rack number

4.10.2.16

Config**.R**ackDef**.C**ode	**000001**b...111111b
Config**.R**ackDef**.T**ype	8 characters
Config**.R**ackDef**.W**orkH	**0**...325 mm
Config**.R**ackDef**.R**inseH	**0**...325 mm
Config**.R**ackDef**.S**hiftH	**0**...325 mm
Config**.R**ackDef**.Sp**ecialH	**0**...325 mm

Rack definitions. Depending on the current rack number (see 4.10.2.15) the corresponding one of the 16 possible data sets is overlayed.

Code:	Identification code of the rack, has to be unique.
Type:	Rack type. Valid entries are the names of the position tables, see 4.10.2.19.
WorkH:	Working position of the lift in mm from the upper stop of the tower.
RinseH:	Rinsing position of the lift in mm from the upper stop of the tower.
ShiftH:	Shifting position of the lift in mm from the upper stop of the tower.
SpecialH:	Special position of the lift in mm from the upper stop of the tower.

4.10.2.17 **C**onfig**.Ra**ckDef**.Sp**ezBeak**.1.P**os **0**...number of rack positions
etc. until **.8**

Rack positions of special beakers 1 to 8 (position 0 = not defined).

4.10.2.18 **C**onfig**.P**osTab**.TabI**dx **0**...31

Index of position tables.

4.10.2.19

Config**.P**osTab**.N**ame	8 ASCII characters
Config**.P**osTab**.R**1Num	2...(R2Num – 2)
Config**.P**osTab**.R2**Num	(R1Num + 2)...(R3Num – 2)
Config**.P**osTab**.R3**Num	(R2Num + 2)...200
Config**.P**osTab**.R1O**ff	**0**...3599
Config**.P**osTab**.R2O**ff	**0**...3599
Config**.P**osTab**.Nu**m	**1**...200

Definitions of position tables. Depending on the table index (see 4.10.2.18) the corresponding one of the 16 possible data sets is overlayed.

Name:	Identification of the rack type. Will be available as a selector under &Config.RackDef.Type (see 4.10.2.16).
R1Num:	Highest Beaker position in row 1
R2Num:	Highest Beaker position in row 2
R3Num:	Highest Beaker position in row 3
R1Off	Offset in $^{1}/_{10}$-angular degrees for the beaker positions in row 1 (for the beaker test)
R2Off	Offset in $^{1}/_{10}$-angular degrees for the beaker positions in row 2 (for the beaker test)
Num:	Number of rack positions

4.10.2.20 **C**onfig**.P**osTab**.1.V**alue **0**...3599
up to **.200.V**alue

Angular offset for the particular rack position in tenth of angular degrees ($^{1}/_{10}$-degrees).

Definition of new rack types:

The definition of rack types is only possible via RS232 interface.

- Set table index (see 4.10.2.18)
- Enter name of rack type (&Config.PosTab.Name, see 4.10.2.19)
- Enter highest beaker position in row 1 to 3 (&Config.PosTab.R1–3Num, see 4.10.2.19)
- Enter the offset angle between beaker position 1 in row 1 and beaker position (R1num+1) in row 2, respectively and tower 1 (&Config.PosTab.R1–2Off, see 4.10.2.19)
- Define number of rack positions (&Config.Pos.Tab.Num, see 4.10.2.19)
- Enter the particular angular offset for each rack position (Irregular layouts of rack positions are possible)

4.10.2.21 **C**onfig**.W**etPart**.W**etPartNo **1**...12

Identification of dosing unit.

4.10.2.22 **C**onfig**.W**etPart**.1.M**axRate 0.01...**160** ml/min
Config**.W**etPart**.1.L**ength 0...**1000**...30000 mm
Config**.W**etPart**.1.D**iameter 0.1...**2**...20 mm
until **.4.D**iameter

(Default value .**2**.**L**ength : **250** mm)

Configuration of the dosing units. Depending on the selection of the dosing unit (see WetPartNo 4.10.2.21), the corresponding data set is overlayed. These settings are only relevant for Dosinos. For each port of the Dosino individual settings are possible.
MaxRate: Max. possible dosing and filling speed allowed
Length: Tubing length on selected port
Diameter: Inner tubing diameter on selected port

4.10.2.23 **C**onfig**.RS**set $G

$G effects all the RS settings. Modifications are only possible in inactive instrument state. After setting the interface parameters wait for 2 sec. to allow the components to equilibrate.

4.10.2.24 **C**onfig**.RS**set**.B**aud 300, 600, 1200, 2400, 4800, **9600**
Config**.RS**set**.D**ataBit 7, **8**
Config**.RS**set**.S**topBit **1**, 2
Config**.RS**set**.P**arity even, odd, **none**
Config**.RS**set**.H**andsh **HWs**, HWfull, SWchar, SWline, none

Settings for data transmission via RS interface, baud rate, data bit, stop bit, parity and type of handshake, see also page 155ff.

4.10.2.25 **C**onfig**.RS**set**.C**harSet **IBM**, HP, Epson, Seiko, Citizen

Setting the character set and print mode. For data communication with computers select 'IBM' (IBM code page 437).

&Info ...

4.10.2.26

Info.**R**eport $G
Info.**R**eport.**S**elect **config**, param, user meth, all

$G sends the selected report via RS interface.

config:	Configuration report (identifier 'co)
param:	Parameter or method report (identifier 'pa)
user meth:	Listing of method storage (identifier 'um)
all:	Full report

Reports, that are sent from the Sample Changer are marked with a space (ASCII 32) and the specific report identifier (see above).

4.10.2.27

Info.**A**ctualInfo.**L**ift.**1.E**xist read only
Info.**A**ctualInfo.**L**ift.**1.M**axHeight read only
Info.**A**ctualInfo.**L**ift.**1.A**ctHeight read only
Info.**A**ctualInfo.**L**ift.**1.B**eaker read only
Info.**A**ctualInfo.**L**ift.**2.E**xist read only
Info.**A**ctualInfo.**L**ift.**2.M**axHeight read only
Info.**A**ctualInfo.**L**ift.**2.A**ctHeight read only
Info.**A**ctualInfo.**L**ift.**2.B**eaker read only

Current data of lift 1 and 2.

Exist:	Tower exists (yes/no)
MaxHeight:	Preset max. height
ActHeight:	Current lift position
Beaker:	Beaker exists at tower X (yes/no)

4.10.2.28

Info.**A**ctualInfo.**R**ack.**C**ode read only
Info.**A**ctualInfo.**R**ack.**T**ype read only
Info.**A**ctualInfo.**R**ack.**W**orkHeight read only
Info.**A**ctualInfo.**R**ack.**R**inseHeight read only
Info.**A**ctualInfo.**R**ack.**S**hiftHeight read only
Info.**A**ctualInfo.**R**ack.**Sp**ecialHeight read only
Info.**A**ctualInfo.**R**ack.**A**ctPos read only
Info.**A**ctualInfo.**R**ack.**Act2**Pos read only

Current rack data.

Code:	Identification code of the mounted rack
Type:	Rack type
WorkHeight:	Working position
RinseHeight:	Rinsing position
ShiftHeight:	Shifting position
SpecialHeight:	Special position
ActPos:	Current rack position at tower 1
Act2Pos:	Current rack position at tower 2

4.10.2.29

Info.**A**ctualInfo.**S**tirrer.**1.S**tate read only
etc. up to **.4**

Current stirrer state (on/off).

4.10.2.30 **I**nfo.**A**ctualInfo.**P**ump.**1.S**tate
etc. up to **.4**

Current pump state (on/off).
Pump 1 and 2 on tower 1, Pump 3 and 4 on tower 2.

4.10.2.31 **I**nfo.**A**ctualInfo.**B**uret.**1.S**tate read only
Info.ActualInfo.**B**uret.**1.P**osition read only
Info.ActualInfo.**B**uret.**1.C**ock read only
Info.ActualInfo.**B**uret.**1.T**ype read only
Info.ActualInfo.**B**uret.**1.V**olume read only
etc. until **.12**

Current data of dosing drive.

State:	Status (ready/busy)
Position:	Piston position in mL
Cock:	Cock position
Type:	Type of dosing unit (685/700)
Volume:	Burette volume

4.10.2.32 **I**nfo.**A**ctualInfo.**I**nputs.**S**tatus read only

Status of the Input lines (Input0…7) of the Remote interface.
$Q sends the signal state as decimal number e.g.
10 ⇒ 00001010 binary ⇒ $2^1 + 2^3$ ⇒ Input1 and Input3 active
(active = low, inactive = high)
See also page 119ff.

4.10.2.33 **I**nfo.**A**ctualInfo.**O**utputs.**S**tatus read only

Status of the output lines (Output0…13) of Remote interface. See 4.10.2.32.

4.10.2.34 **I**nfo.**A**ctualInfo.**D**isplay.**L1** read only
Info.**A**ctualInfo.**D**isplay.**L2** read only

Text of the first and second line of the LCD display.

4.10.2.35 **I**nfo.**A**ctualInfo.**C**ounter.**S**ample read only
Info.**A**ctualInfo.**C**ounter.**M**aximum read only

Currently processed sample number and total number of samples.

&Setup ...

4.10.2.36 **S**etup**.I**dReport **on**, off

Switching on/off the transmission of report identifiers.

4.10.2.37 **S**etup**.K**eycode on, **off**

Switching on/off the automatic transmission of keys pressed. Example: when the <START> key is pressed, the Sample Changer sends: #3

Table of key codes:

Code	Key	Code	Key
1	<HOLD / LEARN>	16	<7 / SAMPLE>
2	<STOP>	17	<4 / PUMP>
3	<START>	18	<1 / SCAN>
4	<CONFIG>	19	<0 / DEF>
5	<PARAM>	20	<END>
6	<USER METHOD>	21	<→>
7		22	<CLEAR / RESET>
8	<9 / LIFT>	23	<ENTER>
9	<6 / DOS>	24	<↑>
10	<3 / WAIT>	25	<↓>
11	<* / ENDSEQ>	26	<SELECT / TOWER>
12	<8 / MOVE>	27	<QUIT>
13	<5 / STIR>	28	<HOME>
14	<2 / CTRL>	29	<←>
15	<. / PRINT>	30	<INSERT >
		31	<DELETE>

4.10.2.38 **S**etup**.T**ree**.S**hort on, **off**
Setup**.C**hangedOnly on, **off**

Definition of the type of answer to $Q.

.Short: With "on", each path is sent with only the amount of characters in order to be unequivocal (printed **bold** in this manual).

.ChangedOnly: Sends only the changed values, i.e. values that have been edited. All paths are sent absolute, i.e. from the root &.

4.10.2.39 **S**etup**.Tra**ce on, **off**

The Sample changer automatically reports when a value has been confirmed with <ENTER>. Message, e.g.
&Config.Aux.Language"english"
The beginning of the message is marked with a space (ASCII 32).

4.10.2.40

Setup.**L**ock.**K**eyboard	on, **off**
Setup.**L**ock.**C**onfig	on, **off**
Setup.**L**ock.**P**arameter	on, **off**
Setup.**L**ock.**U**serMeth.**R**ecall	on, **off**
Setup.**L**ock.**U**serMeth.**S**tore	on, **off**
Setup.**L**ock.**U**serMeth.**D**elete	on, **off**
Setup.**L**ock.**D**isplay	on, **off**

"on" means disable the corresponding function.

.Keyboard	Disables all keys of the keyboard, except the <START>, STOP> and <CLEAR> key.
.Config	Locks the configuration menu
.Parameter	Locks the parameter menu
.Usermeth.Recall	Locks the function "recall method"
.UserMeth.Store	Locks the function "store method"
.Usermeth.Delete	Locks the function "delete method"
.Display	Disables the LCD display. The Sample Changer will not support the display.

4.10.2.41 **S**etup.**M**ode.**S**tartWait on, **off**

Indefinite start delay. Only for remote control.

4.10.2.42

Setup.**A**utoInfo.**S**tatus	**on**, off
Setup.**A**utoInfo.**P**	on, **off**
Setup.**A**utoInfo.**C**h.**G**	on, **off**
Setup.**A**utoInfo.**C**h.**GC**	on, **off**
Setup.**A**utoInfo.**C**h.**R**	on, **off**
Setup.**A**utoInfo.**C**h.**S**	on, **off**
Setup.**A**utoInfo.**C**h.**H**	on, **off**
Setup.**A**utoInfo.**C**h.**C**	on, **off**
Setup.**A**utoInfo.**C**h.**B**	on, **off**
Setup.**A**utoInfo.**C**h.**F**	on, **off**
Setup.**A**utoInfo.**C**h.**O**M	on, **off**
Setup.**A**utoInfo.**C**h.**CM**	on, **off**
Setup.**A**utoInfo.**E**	on, **off**

"on" means, the Sample changer automatically sends a corresponding message when the specified event occurs.

.Status	Enables/disables the preset AutoInfo messages
.P	PowerOn: Simulation of PowerOn (see 4.10.2.43). Not from mains.

Messages from changer functions:

.Ch.G	Go: Method has been started
.Ch.GC	Go Command: Start command has been received
.Ch.R	Ready: Status 'Ready' reached
.Ch.S	Stop: Status 'Stop' reached
.Ch.H	Hold: Status 'Hold' reached
.Ch.C	Continue: Resuming after Hold
.Ch.B	Begin: Begin of sample sequence
.Ch.F	Final: End of sample sequence

.Ch.OM "Opening Moves": Begin of start sequence
.Ch.CM "Closing Moves": Begin of final sequence
.E Error: Message with error number (see page 128.)

Format of AutoInfo messages:
(space)!device name"AutoInfo node"

Example: !Changer1".G"

4.10.2.43 **S**etup**.P**owerOn $G

Simulation of "power on". The method last used is ready for operation.

4.10.2.44 **S**etup**.In**itialize $G
Setup**.In**itialize**.S**elect **param**, config, setup, assembly, all

Setting of default values for the following branches:
param: Method parameters (sets empty method '********')
config: Configuration, branch &Config
setup: Branch &Setup
assembly: Branch &Assembly
all: All values of the entire tree.

Initialization is triggered with &Setup.Initialize $G.

4.10.2.45 **S**etup**.R**amInit $G

Initialization of the entire working memory. All parameters will be set to default; error messages will be deleted (see page 175).

4.10.2.46 **S**etup**.Ins**trNo**.V**alue 8 ASCII characters

Device number. Essential for service purposes. The device number must not be altered.

&UserMeth ...

4.10.2.47 **U**serMeth**.F**reeMemory read only

$Q queries the size of free memory (in bytes), available for user methods.

4.10.2.48

UserMeth**.R**ecall	$G
UserMeth**.R**ecall**.N**ame	8 ASCII characters
UserMethod**.S**tore	$G
Usermethod**.S**tore**.N**ame	8 ASCII characters
UserMethod**.D**elete	$G
UserMethod**.D**elete**.N**ame	8 ASCII characters
UserMeth**.DelA**ll	$G

Management of the internal method memory: loading, storing and deletion of methods. The execution of a function is performed by sending $G to the corresponding node, after entering the method name. Do not use preceding or succeeding blanks in method names!
.DelAll;$G deletes all method in the user memory.

4.10.2.49

UserMeth**.L**ist**.1.N**ame	read only
UserMeth**.L**ist**.B**ytes	read only

For each method

List of all method in the user method memory including method name and file size in bytes.

&Assembly ...

4.10.2.50

Assembly.**S**ample $G
Assembly.**S**ample.**F**unc **=**, +, –
Assembly.**S**ample.**V**alue **1**...999

Defines the (first) sample beaker (rack position) to be processed.
Modification of the sample variable.
.Func Function
.Value Value (absolute or relative)
&Assembly.Sample;$G triggers this function.

4.10.2.51

Assembly.**M**ove $G, $S
Assembly.**M**ove.**T**arget 1, 2
Assembly.**M**ove.**P**osition **sample**, spec.1…8, 0...999

Positioning a beaker at the specified tower.
.Target Target or tower
.Position Rack position or identification of beaker

&Assembly.Move;$G triggers this function.

4.10.2.52

Assembly.**L**ift $G, $S
Assembly.**L**ift.**S**tation **1**, 2, ∗
Assembly.**L**ift.**W**ay **rest**, work, rinse, shift, special, 0...325 mm

Move lift.
.Station Selection of lift station (∗ = both lifts)
.Way absolute lift position

&Assembly.Lift;$G triggers this function.

4.10.2.53

Assembly.**St**ir $G, $S
Assembly.**St**ir.**A**dress **1**...4, ∗
Assembly.**St**ir.**V**alue **1**...9999 s, on, off

Stirrer control.
.Address Selection of stirrer (∗ = all stirrers)
.Value State or time interval in sec.

&Assembly.Stir;$G triggers this function.

4.10.2.54

Assembly.**P**ump $G, $S
Assembly.**P**ump.**A**dress **1.1**, 1.2, 1.∗, 2.1, 2.2, 2.∗
Assembly.**P**ump.**V**alue **1**...999 s, on, off

Pump control. Only two pumps may be operated concurrently.
.Address Selection of pumps in format 'tower.pump'
(∗ = both pumps of a tower)
.Value State or time interval in sec.

&Assembly.Pump;$G triggers this function.

4.10.2.55

Assembly**.D**os $G, $S
Assembly**.D**os**.A**dress **1**...12
Assembly**.D**os**.V**alue ±0.01…999.999 ml, fill, release, prepar., empty, eject, adjust, level

Control of dosing units.
.Address Selection of dosing unit
.Value Volume or function

&Assembly.Dos;$G triggers this function.

4.10.2.56

Assembly**.Sc**an $G, $S
Assembly**.Sc**an**.A**dress **Rm**, RS
Assembly**.Sc**an**.P**attern
With Rm (parallel/Remote): 8 x 1,0 or ∗ (bin)
ready1, ready2, ready∗, end1, end2, endmeter
With RS (serial/RS232): 14 ASCII characters

Scanning the interfaces.
.Address Selection of interface (Remote / RS232)
.Pattern Signal or character string
This function is not applicable for process control via RS232 interface. See &Info.ActualInfo.Inputs and …Outputs (4.10.2.32 and 4.10.2.33) instead.

4.10.2.57

Assembly**.C**trl $G
Assembly**.C**trl**.A**dress **Rm**, RS
Assembly**.C**trl**.P**attern
With Rm (parallel/Remote): 14 x 1,0 or ∗ (bin), START device1, START device2, START device∗, START dos1, START dos2, START dos∗, METER mode pH, METER mode T, METER mode U, METER mode I, METER mode C, METER cal pH, METER cal C, METER enter, **INIT**
With RS (serial/RS232): 14 ASCII characters

Signal or data transmission via interfaces.
.Address Interface selection (Remote/RS232)
.Pattern Signal or character string

With the Remote interface predefined bit patterns may be applied using the short names listed above (see page 99).

4.10.2.58

Assembly**.De**f $G
Assembly**.Def.O**bject **STIRRATE**, DOSRATE FILLRATE, LIFTRATE SHIFTRATE, DRIVE.PORT
Assembly**.Def.A**dress depending on object
Assembly**.Def.V**alue depending on object

Definition of various device settings. Depending on the selected item in …DEF.Object different parameters and ranges may be entered.

Def.Object	Def.Address	Def.Value
STIRRATE	**1**…4	1…**3**…15
DOSRATE	**1**…12	0.01…**160** mL/min
FILLRATE	**1**…12	0.01…**160** mL/min
LIFTRATE	**1**…2	3…**25** mm/s
SHIFTRATE	**auto.**, +, –	3…**20** ang. degrees/s
DRIVE.PORT	[**1**…12].[**1**…4]	**dos.,** fill, rinse, prep., drain

&Assembly.Def;$G triggers this function.

4.10.2.59

Assembly**.**Wait $G, $S
Assembly**.**Wait**.**Time 0...**1**...9999 s

Waiting time.
&Assembly.Wait;$G triggers this function.

4.10.2.60

Assembly**.**End $G

$G triggers a RESET (same as the <ENDSEQ> key).

&Diagnosis ...

4.10.2.61 **D**iagnose.**I**nit $G
Diagnose.**I**nit.**S**elect param, config, setup, assembly, all

RAM initialization. Sets all default values for the selected sub-branch. See also 4.10.2.44.
&Diagnose.Init;$G triggers the initialization.

4.10.2.62 **D**iagnose.**R**amTest $G
Diagnose.**L**cdTest $G, $S, $H
Diagnose.**C**ontrastTest $G, $S
Diagnose.**K**eyTest $G, $S
Diagnose.**Io**Test $G, $S
Diagnose.**Rs**Test $G, $S
Diagnose.**E**busTest $G, $S
Diagnose.**B**eeperTest $G, $S
Diagnose.**Rac**kcodeTest $G, $S
Diagnose.**F**unctionTest

Diagnostic functions. These functions can be triggered with $G. They may be stopped with $S.

.RamTest	Working memory test
.LcdTest	Display test
.ContrastTest	Display contrast test
.KeyTest	Displays key code and function of each key
.IoTest	Remote interface test
.RsTest	(This function is not applicable via RS232 interface)
.EbusTest	External Bus interface test
.BeeperTest	Test of the acoustic signal (only with Config.Beeper"on", see 4.10.2.14)
.RackcodeTest	Test of rack code recognition
.FunctionTest	Metrohm internal test

4.10.2.63 **D**iagnose.**S**imulateKey **0**, 1…6, 8…31

Key simulation (Key codes see 4.10.2.37)

4.10.2.64 **D**iagnose.**Ins**trNo

Instrument number. This entry is not accessible via RS232 interface.

4.10.2.65 **D**iagnose.**P**owerOn $G

Simulation of 'Power on'.

4.11 Properties of the RS232 Interface

4.11.1 Data Transfer Protocol

The Sample Changer is configured as DTE (Data Terminal Equipment).

The RS232 interface has the folllowing technical specifications:

- Data interface according to the RS232C standard, adjustable transfer parameters, see pages 86 and 143.
- Max. line length: 80 characters + C_R L_F
- Control characters: C_R (ASCII DEC 13)
  L_F (ASCII DEC 10)
  XON (ASCII DEC 17)
  XOFF (ASCII DEC 19)
- Cable length: max. approx. 15 m

Start	7 or 8 Data Bit	Parity Bit	1 or 2 Stop Bit

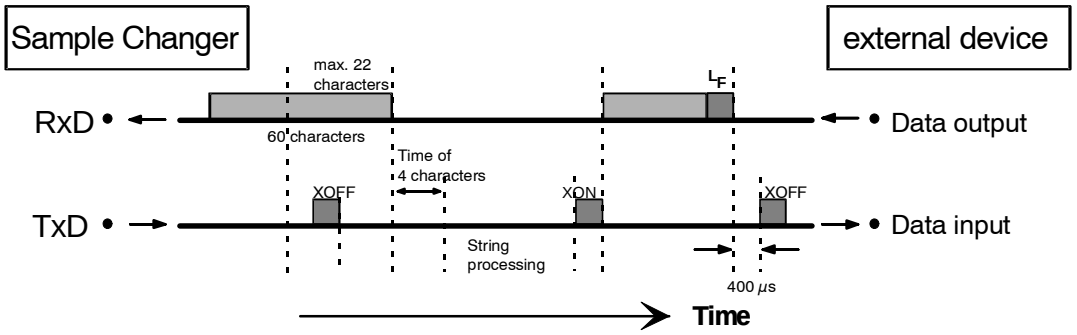
Only a shielded data cable (for example, METROHM D.104.0201) may be used to couple the 730 Sample Changer with foreign devices. The cable shield must be properly grounded on both instruments (pay attention to current loops; always ground in a star-head formation). Only plugs with sufficient shielding may be used (for example, METROHM K.210.0001 with K.210.9004).

4.11.2 Handshake

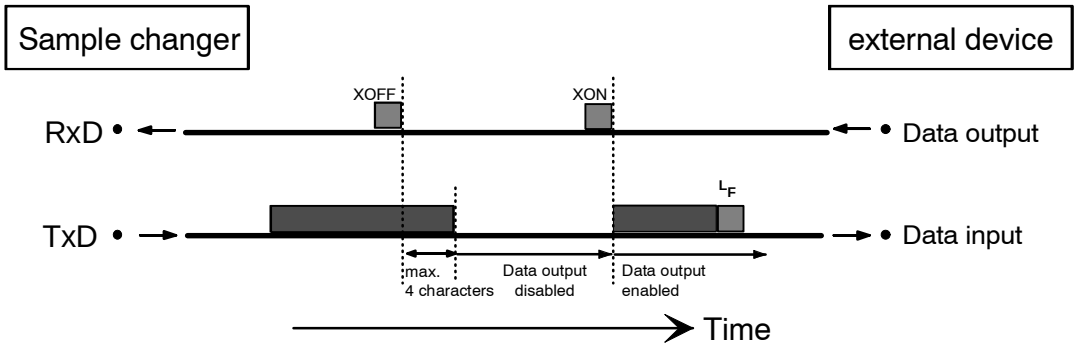
Software-Handshake, SWchar

Handshake inputs on the changer (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the changer.
As soon as an L_F is recognized the changer sends XOFF. After this it can still receive and store 6 characters.
The changer also sends XOFF when its input buffer contains 60 characters. After this it can receive 22 extra characters, (including L_F).
If the transfer is interrupted for the time of 4 characters after the changer has sent XOFF, the character string previously received will be processed even if no L_F has been sent.

Sample Changer as Receiver:



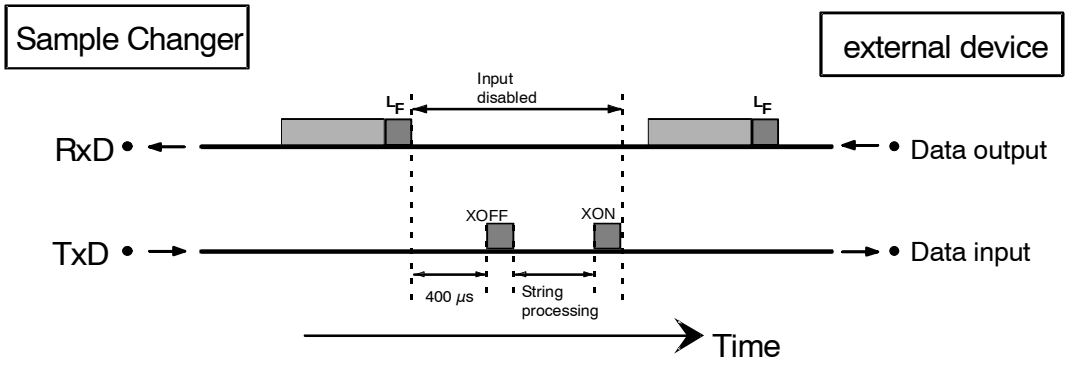
Sample Changer as Sender:



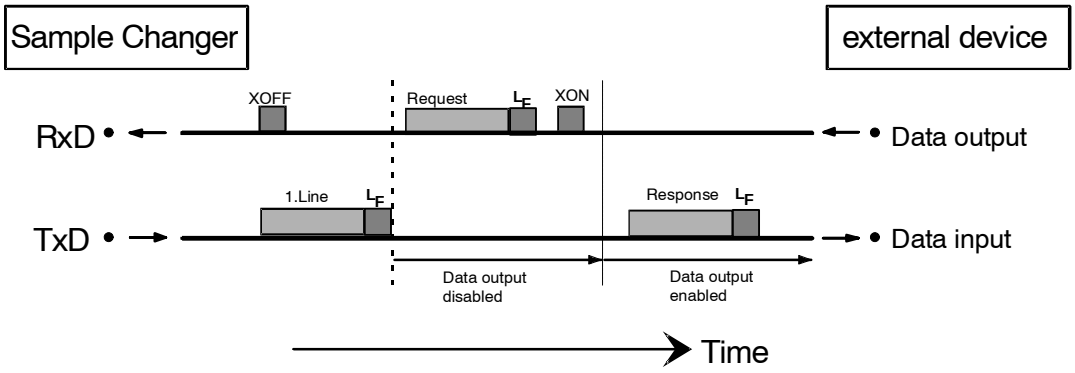
Software-Handshake, SWline

Handshake input ports on the changer (CTS, DSR, DCD) are not checked.
Handshake output ports (DTR, RTS) are set by the changer.
The changer has an input buffer which can accept up to 80 characters + C_R L_F . As soon as an L_F is recognized, the changer sends an XOFF. After this, it can receive and save a maximum of 6 characters. The character string previously sent is now processed by the changer. Afterwards the changer sends XON and is again ready for receiving.

Sample Changer as Receiver:



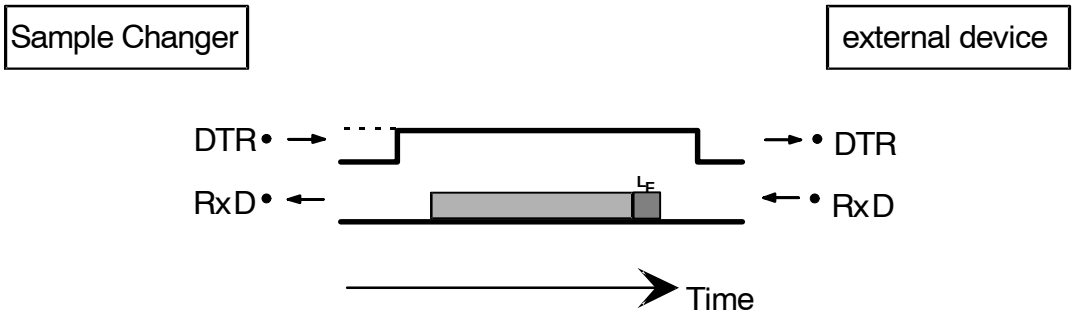
Sample Changer as Sender:



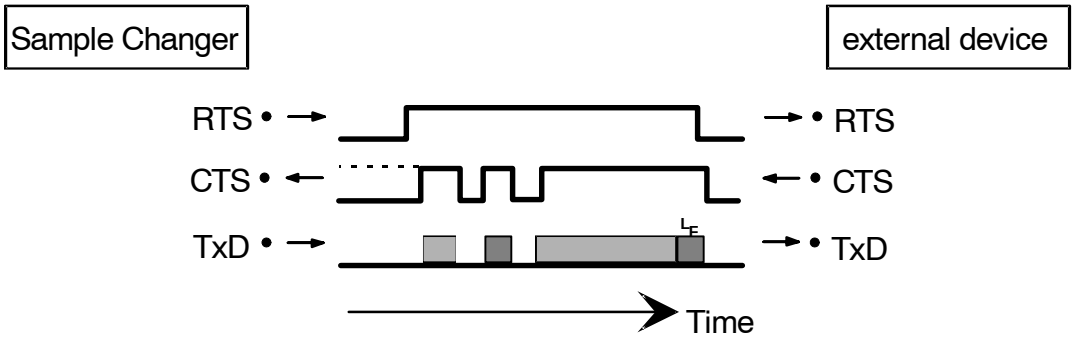
Changer transmission can be stopped by external instruments with XOFF. After XOFF is received the changer completes sending the line already started. If data output is disabled for more than 3 s by XOFF, E43 appears in the display.

Hardware-Handshake, HWs

Sample Changer as Receiver:



Sample Changer as Sender:

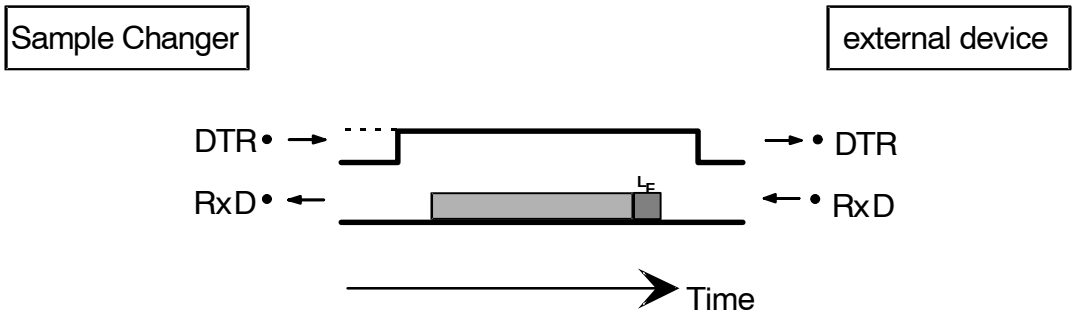


The data flow can be interrupted by deactivating the CTS line.

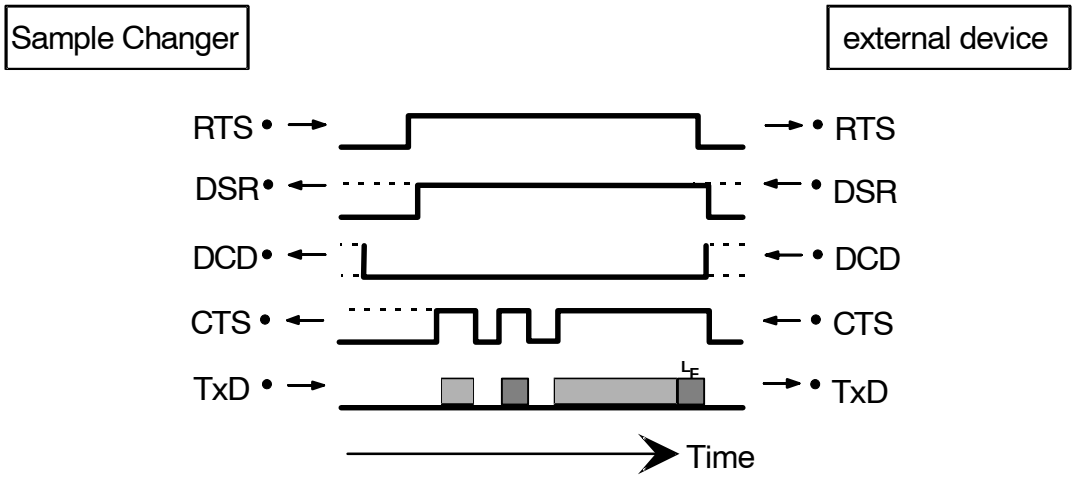
Hardware-Handshake, HWf

All handshake inputs are checked, handshake outputs set.

Sample Changer as Receiver:



Sample Changer as Sender:



The data flow can be interrupted by deactivating the CTS line.

4.11.3 Pin Assignment

RS232C Interface

Transmitted Data (TxD). If no data are transmitted, the line is held in the “ON” condition. Data will only be sent when CTS and DSR are in the ”ON” condition and DCD is in the “OFF” condition.	**Fehler! Keine gültige Verknüpfung.**
Received Data (RxD) Data will only be received when DCD is “ON”.	
Request to Send (RTS) ON condition: Sample Changer is ready to send data.	
Clear to Send (CTS) ON condition: Remote station is ready to receive data.	
Data Set Ready (DSR) ON condition: The transmission line is connected.	
Signal ground (GND)	
Data Carrier Detect (DCD) ON condition: The level of the received signal is within the tolerance range (remote station is ready to send data).	
Data Terminal Ready (DTR) ON condition: Instrument is ready to receive data.	

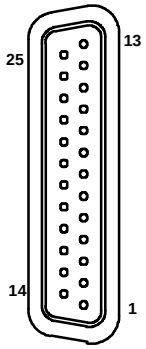
Protective earthing
Direct connection from cable plug to the protective ground of the instrument.

Polarity allocation of the signals
- Data lines (TxD, RxD)
  voltage negative (<–3 V): signal state "ON"
  voltage positive (>+3 V): signal state "ZERO"
- control or message lines (CTS, DSR, DCD, RTS, DTR)
  voltage negative (<–3 V): OFF state
  voltage positive (>+3 V): ON state

In the transitional range from +3 V to –3 V the signal state is undefined.

Driver 14C88 according to EIA RS232C specification
Receiver 14C89 " "

Contact arrangement at plug (female) for RS232C socket (male)



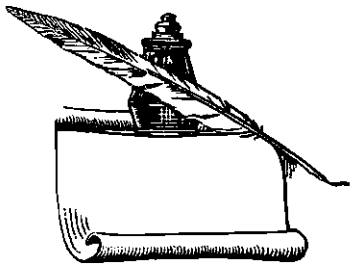
View of soldered side of plug

Order numbers:
K.210.9004 and K.210.0001

No liability whatsoever will be accepted for damage or injury caused by improper interconnection of instruments.

4.11.4 What to do if Data Transfer fails?

Problem	Helpful Questions for Troubleshooting
No characters can be received on a connected printer.	– Are the instruments switched on and the connection cables plugged in properly? – Is the printer set to "on-line"? – Are baud rate, data bit and parity set identically on both instruments? – Is the handshake set properly?
No data transfer occurs and an error message appears in the display.	– **E40–42**: Transmission error. Is the cable used correctly wired and plugged in? Is the printer switched on and set to "on-line"? – **E43**: Data output disabled for more than 3 s by XOFF. – **E36–39**: Receive error. Are the RS232 parameters set identically on both instruments?
The characters received are garbled.	– Are data bit and parity set identically for both instruments? – Is the baud rate set the same on both devices? – Is the correct printer selected? – The data transmission was interrupted (by the hardware) during printing. Re-establish connections again, turn printer off and on.



5 Appendix

5.1 Error Messages

When an error occurs the execution of the active command is interrupted and an error message is displayed (display blinks). This must be acknowledged with the <QUIT> key.
If an error occurs during processing of a sample series, the changer will then be switched into the 'HOLD' state. After the cause of the error has been rectified, the sample series can be continued with the next command in the active sequence by pressing the <START> key. If the error cannot be eliminated, the method running can also be halted with <STOP>.

The list of possible error messages and their causes:

*** battery low**	The battery for the permanent storage of user methods must be replaced.
*** changer low power**	The power supply cannot deliver enough power for the simultaneous operation of all components currently in use (stirrers, pumps, lifts).
*** changer not ready**	The changer cannot execute the command chosen because it is busy carrying out another action.
*** changer overload**	Load or resistance too large to carry out the chosen action.
*** Dos## command not exec**	An error has occurred with the indicated dosing unit.
*** Dos## ext. bus failure**	An unexpected error has occurred with an instrument (Dosimat, Dosino) that is connected on the external bus.
*** Dos## no exchange unit**	There is no exchange unit mounted on the dosing unit indicated.
*** dos.unit ## missing**	The dosing unit chosen is not connected.

*** dos.unit ## overload**	The dosing unit indicated cannot execute a dosing command. Check burette and piston.
*** dos.unit## not ready**	The dosing unit selected cannot execute the desired command because it is busy carrying out another action or the current instrument state does not allow it.
*** invalid position**	The sample position selected is defined as a special beaker or the special beaker chosen is not defined.
*** invalid rack code**	The rack code read by the changer could not be found in the internal position tables.
*** missing beaker**	After a MOVE command no beaker could be found at the selected position.
*** rack data missing**	No sample rack is in position or no rack data can be found for the sample rack that is in place.
*** raise lift first**	Turning of a rack could not be carried out because a lift was below the defined shift position.
*** RS232 error ##**	The transmission parameters of the RS232 interface do not agree with those of the receiving instrument.
*** user memory full**	The memory for the user-defined methods is full. Before saving a new method, methods that are not used or used only rarely must be deleted.
*** wrong rack**	The rack positioned is not the one that was assigned to the method under 'parameters'.
trap error XXX	Unexpected program error, turn instrument off and on again.
No display, LEDs tower 1 and tower 2 are lit up	LCD error (system error 7). Please contact Service.
Illegible display when switching on, LED tower 2 lit	Wrong 'external bus' address. Set address to 0 and execute RAM-initialization 'assembly' (see page 175).

5.2 Technical Specifications

5.2.1 730 Sample Changer

Dimensions Height: 0.72 m, Width: 0.28 m, Depth: 0.48 m

Weight 17.5 kg (without accessories, 2-tower model)
12.5 kg (without accessories, 1-tower model)

Material

Sample Changer case:	metal case, multiple enameling
Keyboard case:	Crastin (PBTB), aluminum-steamed on the inside
Keyboard film:	polyester, resistant to chemicals

LCD-display 2 lines of 24 characters each, height 5 mm

Lift path 235 mm

Lift

Load:	approx. 10 N
Stroke speed:	adjustable, 3 – 25 mm/s

Turntable Turning speed:
adjustable, 3 – 20 angular degrees/s

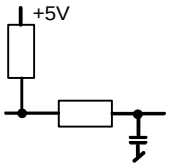
Stirrer Stirring speed: adjustable to 15 levels
- Magnet stirrer 180/s – 2600/s
- Rod stirrer 180/s – 3000/s

Pump with Valve Conveying capacity (manometric lift 2m):
0.33 L/min

RS232 Interface For connection to computer or printer
programmable for communication with external instruments

Remote Interface Programmable parallel interface for controlling external instruments

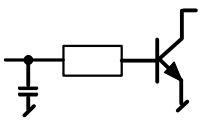
Input:  t_p >20 ms



active = low
inactive = high

Output:  t_p >200 ms

V_{CEO} = 40 V
I_C = 20 mA



active = low
inactive = high

+5 V: Maximum charge = 20 mA

Temperatures

Nominal functional range 5 – 40 °C
at 20 – 80 % humidity

Transport and storage –20 – +60 °C

60 °C	rel. humidity	<50%
50 °C	"	<85%
40 °C	"	<95%

Power connection

Voltage 100 – 120 V, 220 – 240 V
Frequency 50 – 60 Hz
Power input 40 VA
Fuses 0.5 AT (110 V), 0.25 AT (220 V)

All data are typical values with the exception of those specially marked.

Safety Specifications

Constructed and tested according to IEC 1010 / EN 61010 / UL 3101-1, Safety Class I
Degree of protection IP 22

The instruction manual contains information and warnings which the user should follow to guarantee the safe operation of the instrument.

Electromagnetic Compatibility (EMC)

Emitted Interference: The instrument complies with the basic specifications EN 50081-1/2 1992, EN 55011 (class B), EN 55022 (class B) and NAMUR.

Interference immunity: The basic specifications EN 50082-1 1997, IEC 801-2 to IEC 801-6 and EN 60555-2 are adhered to.

5.2.2 759 Swing Head

Dimensions	Height: 0.14 m, Width: 0.10 m, Depth: 0.09 m	
Weight	0.63 kg	
Material	Swing Head case:	Polybuteneterephthalate (PBTP) with metallic fiber
	Titration Head:	Polypropylene
Rotation	4 fix positions	
Temperatures	Nominal functional range 5 – 40 °C	
	Transport and storage –40 – +70 °C	
Distribution voltage	5 V DC, drawing of current 500 mA connection to the remote socket of the Metrohm Sample Changers, e.g. model 717, 730, 760, ...	

All data are typical values.

Safety Specifications

Constructed and tested according to IEC 1010 / EN 61010 / UL 3101-1, Safety Class III
Degree of protection IP 43

Electromagnetic Compatibility (EMC)

Emitted Interference: The instrument complies with the basic specifications EN 50081-1/2 1992, EN 55011 (class B), EN 55022 (class B) and NAMUR.

Interference immunity: The basic specifications EN 50082-1 1997 and IEC 801-2 to IEC 801-6 are adhered to.

5.3 Servicing and Maintenance

5.3.1 Servicing

The maintenance of the 730 Sample Changer should include a yearly service check carried out by a specialist from Metrohm. If caustic or corrosive chemicals are frequently used, shorter time intervals between service checks can be necessary.
The Metrohm Service Department can offer technical advice regarding servicing and maintenance of all Metrohm instruments at any time.

5.3.2 Maintenance / Attendance

Not only do highly sensitive measuring instruments require proper care, a sample changer also requires this. Serious contaminations can lead to functional disorders and a shortened life-span of the rugged mechanics and electronics of the sample changer.

Heavy soiling of the titration heads can influence the results of measurements. Regular cleaning of exposed parts can prevent this for the most part.

Chemical or solvent spills should be cleaned up immediately. The connectors (in particular the power supply) should be protected from contamination. The sample changer should never be operated without the covering foreseen for this purpose.

If corrosive media has entered the inside of the instrument, the power plug has to be disconnected immediately to avoid massive damage to the instruments electronic components. In case of such damage, the Metrohm service personnel should be notified.
The instrument should not be opened by untrained personnel.

5.4 Diagnosis

5.4.1 General Information

The 730 Sample Changer is a very precise and reliable control instrument. Thanks to its rugged construction, its functions are rarely influenced by mechanical or electrical affects.

Although an occasional fault in the instrument can not be excluded completely, it is certainly much more likely that malfunctions are caused by wrong operation or handling or by improper connections and operation with non-Metrohm instruments.

In any case it is advisable to localize the error with the quick and easy-to-use diagnostic functions. Metrohm Service only needs to be contacted if an actual error is apparent in the instrument. Additionally, the service technician can be much more precisely informed with the aid of the results of the specific built-in diagnostic functions.
In inquiries always quote the manufacturing (instrument rear side, see page 5) and program number (see configuration, page 82) and specify possible error displays.

Procedure

The following test list shows all components for which there are detailed instructions (diagnostic steps) to check their functionality. If there is a possible malfunction we recommend following the instructions of the corresponding diagnosis step or running all the diagnosis steps as a routine check of the instrument.
The sample changers reaction to the instructions should be compared with the description in the diagnosis step. If the instrument exhibits an unexpected reaction ("no" situation), the diagnosis step should be re-run to rule out operating error. Several false reactions however, indicate a high probability of a disorder.

Components	see Chapter
Operating Memory (RAM)	*Chap. 5.4.3*
Display	*Chap. 5.4.4*
Keyboard	*Chap. 5.4.5*
Remote	*Chap. 5.4.6*
RS232	*Chap. 5.4.7*
External Bus	*Chap. 5.4.8*
Beeper	*Chap. 5.4.9*
Rack code	*Chap. 5.4.10*

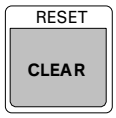
Required Instruments:

Only required, if the RS232 or remote interface is to be checked:
Test plug 3.496.8550 (on the 'Remote' plug)
Test plug 3.496.8480 (on the 'RS 232' plug)

5.4.2 Preparing the Instrument

- Disconnect power plug
- Remove cables to the RS232 and remote interfaces.
- Plug in power plug and immediately press <9> and keep it depressed until the start test pattern disappears.
- Alternatively, the <CLEAR> key can be pressed to cause a reset followed by pressing (within 0.4 sec) and holding down the <9> key to open the diagnosis menu.

Switch on and 

or 

and 

Main Menu Diagnosis:

diagnosis **>RAM initialization**
diagnosis **>RAM test**
diagnosis **>display test**
diagnosis **>display contrast test**
diagnosis **>key test**
diagnosis **>remote test**
diagnosis **>RS232 test**
diagnosis **>external bus test**
diagnosis **>beeper test**
diagnosis **>rack code test**
diagnosis **power on reset**

Open the submenu with <ENTER>

Use <↑> or <↓> to access one menu item up or down
Use <HOME> or <END> to access first or last menu item
<QUIT> returns to the normal state

The "function test" is a Metrohm internal test.

5.4.3 Working Memory (RAM)

This diagnosis step completes a non-destructive test over the entire range of the RAM contents (working memory).

- Prepare instrument for diagnosis (see chapter 5.4.2).
- If necessary, press <🡻> several times until

```
diagnosis
>RAM test
```

- <ENTER>

If no errors are found, this appears on the display:

```
>RAM test
 RAM test ok
```

- <ENTER>

```
diagnosis
>display test
```

5.4.4 Display

With this diagnosis step, the functionality of the LED's and the display is tested.

- Prepare instrument for diagnosis (see chapter 5.4.2).
- If necessary press <🡻> several times until

```
diagnosis
>display test
```

- <ENTER>

After pressing the <ENTER> key, the program automatically makes a test run to visually check the LED's and the display.

- *The LEDs for **TOWER 1**, **TOWER 2** and **LEARN** blink one after the other for a short time.*
- *The background lighting of the display is switched off for a short time and then turned on again.*
- *The start test pattern appears (every pixel active).*
- *Both lines of the display are turned off.*
- *Both lines of the display are occupied one after the other with the characters "#", "**H**" and finally "I".*
- *Both lines are filled from right to left with the endless running line "0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ."*

- The test run can be stopped and started again by pressing the <5> key.
- The test can be exited with the <QUIT> or <STOP> keys.

```
diagnosis
>display contrast test
```

- <ENTER>

After pressing the <ENTER> key the following display appears whereby the contrast of the display continuously varies between bright and dark.

```
>display contrast test
** 730 Sample Changer **
```

- The test can be exited with the <QUIT> or <STOP> key.

```
diagnosis
>key test
```

5.4.5 Keyboard

This diagnosis step allows all the keys on the keyboard to be tested for their functionality.

- Prepare instrument for diagnosis (see chapter 5.4.2).
- If necessary, press <↓> several times until

```
diagnosis
>key test
```

- <ENTER>

```
>key test
```

- Activate all the keys one after the other and check their reaction on the display.

The corresponding matrix code appears in the display and a description of the main function of the key pressed (for example, the following display should appear when the <CONFIG> key is pressed).

```
>key test
 code  4   CONFIG
```

- The test is exited by pressing the <STOP> key twice.

```
diagnosis
>remote test
```

The key code table:

Code	Key	Code	Key
1	<HOLD / LEARN>	16	<7 / SAMPLE>
2	<STOP>	17	<4 / PUMP>
3	<START	18	<1 / SCAN>
4	<CONFIG>	19	<0 / DEF>
5	<PARAM>	20	<END>
6	<USER METHOD>	21	<→>
7		22	<CLEAR / RESET>
8	<9 / LIFT>	23	<ENTER>
9	<6 / DOS>	24	<↑>
10	<3 / WAIT>	25	<↓>
11	<* / ENDSEQ>	26	<SELECT / TOWER>
12	<8 / MOVE>	27	<QUIT>
13	<5 / STIR>	28	<HOME>
14	<2 / CTRL>	29	<←>
15	<. / PRINT>	30	<INSERT >
		31	<DELETE>

5.4.6 Remote Interface

This diagnosis step tests the functionality of all the output (14) and input lines (8).

- Prepare instrument for diagnosis (see chapter 5.4.2).
- If necessary, press <↓> several times until

```
diagnosis
>remote test
```

- <ENTER>

```
>remote test
 remote test connector ?
```

- Plug test plug 3.496.8550 into the remote interface without turning the instrument off.
- <ENTER>

The test runs automatically. If no error occurs, the following appears:

```
>remote test
 remote test ok
```

- Remove test plug and press <ENTER>.

```
diagnosis
>RS232 test
```

5.4.7 RS232-Interface

This diagnosis step tests the functionality of the serial interface.

- Prepare instrument for diagnosis (see chapter. 5.4.2).
- If necessary, press <↓> several times until

```
diagnosis
>RS232 test
```

- <ENTER>

```
>RS232 test
 RS232 test connector ?
```

- Insert the test plug 3.496.8480 into the RS232 interface without turning off the instrument.
- <ENTER>

The test runs automatically. If no error occurs, the following appears:

```
>RS232 test
 RS232 test ok
```

- Remove test plug and press <ENTER>.

```
diagnosis
>external bus test
```

5.4.8 External Bus Interface

This diagnosis step tests the functionality of parts of the external bus interface.

- Prepare instrument for diagnosis (see chapter 5.4.2).
- If necessary, press <↓> several times until

```
diagnosis
>external bus test
```

- <ENTER>

The test searches for all instruments that are connected on the E-bus interface. The sample changer considers the following to be "instruments":

Tower 1 (minimum version)
Tower 2 (optional)
Dosimat Interface (optional, maximum 3 pieces)

If no error occurs, an identification for each instrument which is connected on the E-bus must appear on the display.

You can browse through this list of identifications found by pressing the <ENTER> key. The following table shows which identifications must appear with which configurations.

Configuration	Identification in the Display
Tower 1	**address 0x86 type 3**
Tower 2	**address 0x87 type 3**
Dos 1 - 4 (729 / Address 1)	**address 0x91 type 3** **address 0x92 type 3**
Dos 5 - 8 (729 / Address 2)	**address 0xA1 type 3** **address 0xA2 type 3**
Dos 9 - 12 (729 / Address 3)	**address 0xB1 type 3** **address 0xB2 type 3**

```
>external bus test
 address 0x86  type 3
```

- Press <ENTER> several times and compare display with the list above until

```
diagnosis
>beeper test
```

5.4.9 Beeper

- Prepare instrument for diagnosis (see *Chap. 5.4.2*).
- If necessary, press <🡻> several times until

```
diagnosis
>beeper test
```

- <ENTER>

The beeper is turned on and off in an endless loop.

```
>beeper test
```

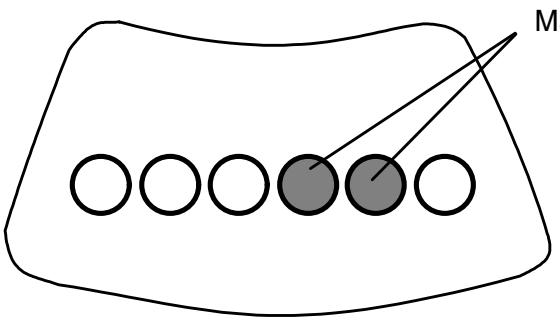
- The test can be exited by pressing the <QUIT> or <STOP> keys.

```
diagnosis
>rack code test
```

5.4.10 Rack Code Recognition

This diagnosis step checks the functionality of the sensors with regard to their ability to automatically recognize the attached rack.

- Note the code (magnets) on the underside of all the racks being used. The following diagram shows the magnet fixture on the underside of a rack.



In this example the code is:

000110

Magnet fixture as viewed from underneath

- Pick up the rack and lay it on its side.
- Prepare the instrument for diagnosis (see chapter 5.4.2).
- If necessary press <🡻> several times until

```
diagnosis
>power on reset
```

- <ENTER>

The sample changer runs through its start routine (initializing lift and rack positions). The initialization is important because it is vital for the following diagnosis step "rack code test" that the rack is in the basic position (beaker 1 at tower 1).

- Prepare instrument for diagnosis (see chapter 5.4.2).
- If necessary press <🡻> several times until

```
diagnosis
>rack code test
```

- <ENTER>

The test reads the code continuously and displays it immediately. For representation on the screen a 6-place bit pattern is provided (code ??????). The first position is for magnet no. 1, the second position for magnet no. 2, etc. If a magnet is recognized, a "1" is written into the corresponding position, otherwise a "0" is assigned.

- Position all racks which are used one after the other and compare the notes made before the test with the information on the display.

```
>rack code test
 code 000000
```

Example for:
no rack in position

```
>rack code test
 code 011000
```

Example for:
Rack with a code as in the example above

- The test can be stopped by pressing the <QUIT> or <STOP> keys.

```
diagnosis
>power on reset
```

The diagnosis can be exited from the main menu with <QUIT> or <STOP> .

5.5 Initialize data memory

This diagnostic step can be used to write default values to the instrument parameters using the keypad and thus switch the instrument to the original condition. This measure is important with the following two points:

The setting of certain instrument parameters such as the locking of keys is possible only via RS232, i.e. with the aid of a PC. If such instrument parameters are set and no PC is available to cancel the settings, full use can not be made of the instrument.

In rare cases, it is possible that major interference signals such as line spikes and lightning can have an adverse influence on the contents of the data memory. If the contents of the data memory are undefined, this may lead to a system crash.

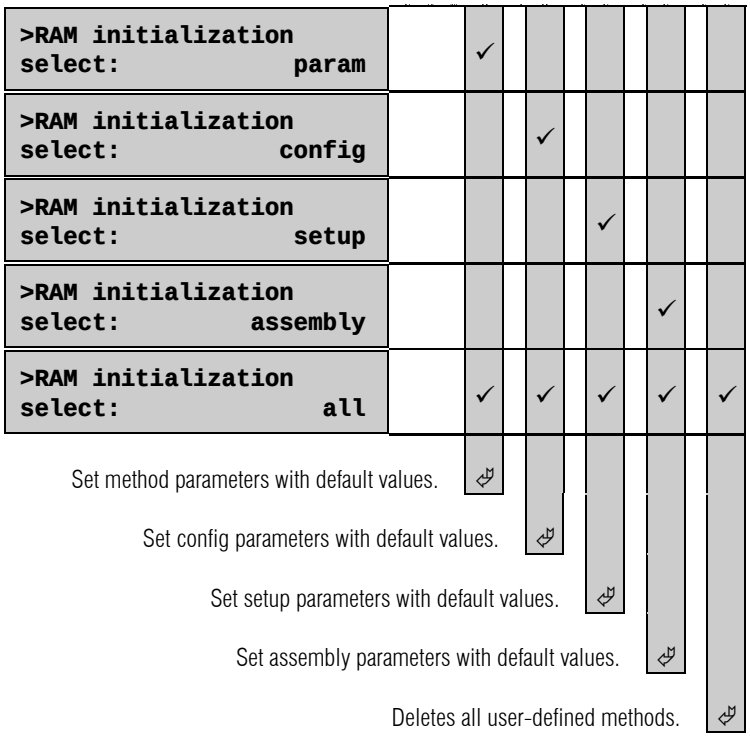
The 730 Sample Changer offers various possibilities to initialize the data memory. The entire data memory (**`all`**) or only parts of it (**`param, config, setup, assembly`**) can be written to with default values.

Although the instrument number will be retained, the initialization should be performed only if necessary as the stored user data (etc.) are deleted.

- Prepare instrument for diagnostic test (see chapter 5.4.2).
- If need be, press <9> key repeatedly until

```
diagnosis
>RAM initialization
```

- Press <ENTER> key to open the following diagnostic menu:



Pressing the <SELECT> key selects the submenus in turn. The individual initialization alternatives are accessed using the <ENTER> key, exit is with the <QUIT> key.

The table shows which parts of the data memory are affected by the corresponding initialization alternatives. When the instrument reacts with a system crash after being switched on (undefined display, no reactions to keystroke, etc.) we recommend to carry out the initialization with the submenu "**all**".

- If need be, press the <SELECT> key repeatedly until:

```
>RAM initialization
select:              all
```

- <ENTER>.

```
diagnosis
>RAM test
```

- <QUIT>.

The instrument quits the diagnostic menu and runs a power on reset.

5.6 Validation / GLP

GLP (**G**ood **L**aboratory **P**ractice) requirements include the periodic check of analytical instruments for reproducibility and accuracy using **Standard Operating Procedures (SOP**).

Although the instrument in question is not a measuring instrument, it is recommended to include the 730 Sample Changer in the validation of an analytical system as a part of it.
If the sample changer is mainly used for titration automation, the validation of the titration instrument should ideally be done with the help of the sample changer. In this way, any disturbing factors (for example, the entrainment of sample or titration solution) which could influence the measurement results can be included within the judgment of the entire titration system.

Checking of the electronic and mechanical components of measuring instruments can and should be undertaken by qualified personnel of the manufacturing company as part of regular servicing. All Metrohm instruments are provided with start-up test routines which check that the relevant assemblies are working perfectly when the instrument is switched on. If no error message is displayed, it can be assumed that the instrument is functioning faultlessly. Instruments from the Metrohm company are also supplied with built-in diagnostic programs which enable the user to check the functioning of certain components in the event of malfunctions or faulty behavior and to localize the fault. Diagnostic programs may also be integrated in a validation procedure.

Guidelines for the creation of standard operating procedures for checking a titration system can be found in the application Bulletin 252/1 ("Validation of Metrohm Titration Instruments according to GLP/ISO9001"). This can be requested free of charge from Metrohm.
Furthermore a 3.5" diskette *(Application Service Disk, order no. 8.000.8001)* is available which contains a work sheet (Format: MS-Excel, Version 4.0 and 5.0) for the statistical analysis of the validation.

5.7 Warranty and Conformity

5.7.1 Warranty

The warranty on our products is limited to defects that are traceable to material, construction or manufacturing error which occur within 12 months from the day of delivery. In this case, the defects will be rectified in our workshops free of charge. Transport costs are to be paid by the customer.

For day and night operation, the warranty is limited to 6 months.

Glass breakage in the case of electrodes or other parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period. For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With the regard to the guarantee of accuracy, the technical specifications in the instruction manual are authoritative.

Concerning defects in material, construction or design as well as the absence of guaranteed features, the orderer has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. lack of an official damage report releases Metrohm from any liability to pay compensation.

If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, burette cylinders and PTFE pistons. Before embedment in wood shavings or similar material, the parts must be packed in a dustproof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage which arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by Metrohm.

5.7.2 Certificate of Conformity and System Validation for the 730 Sample Changer

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	730 Sample Changer
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland
Principal technical information:	Voltages: 100…120, 220…240 V Frequency: 50…60 Hz

This Metrohm instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility

IEC 801-2/IEC 1000-4-2 (level 4), IEC 801-3 (level 2), IEC 801-4/IEC 1000-4-4 (level 3), IEC 801-5/IEC 1000-4-5 (level 2/3), IEC 801-6/IEC 1000-4-6 (level 2), EN 55011 / class B, EN 55022 / class B, EN 50081-1/2 1992, EN 50082-1 1997, EN 60555-2

Security specifications

IEC 1010, EN 61010, UL 3101-1

It has also been certified by the Swiss Electronical Association (SEV), which is member of the International Certification Body (CB / IEC).
The technical specifications are documented in the instruction manual.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance. The features of the system software are documented in the instruction manual.

Metrohm Ltd. is holder of the SQS certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, September 14th, 1995

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico
730 Sample Changer

CE

EU Declaration of Conformity

The Metrohm AG company, Herisau, Switzerland hereby certifies that the instrument:

730 Sample Changer

meets the requirements of EU Directives 89/336/EWG and 73/23/EWG.

Source of specifications:

EN 50081	Electromagnetic compatibility, basic specification Emitted Interference
EN 50082-1	Electromagnetic compatibility, basic specification Interference Immunity
EN 61010	Safety requirements for electrical laboratory measurement and control equipment

---

Description of the instrument:

Sample changer for the automation of batch processing of larger sample series, applying titration, dosing and measuring methods in laboratory and industry.

Herisau, September 14th, 1995

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

5.7.3 Certificate of Conformity and System Validation for the 759 Swing Head

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	759 Swing Head
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland
Principal technical information:	Distribution voltage: 5 V DC Drawing of Currency: 500 mA

This Metrohm instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility

IEC 801-2/IEC 1000-4-2 (level 4), IEC 801-3 (level 2), IEC 801-4/IEC 1000-4-4 (level 3), IEC 801-5/IEC 1000-4-5 (level 3), IEC 801-6/IEC 1000-4-6 (level 2), EN 55011 / class B, EN 55022 / class B, EN 50081-1/2 1992, EN 50082-1 1997

Security specifications

IEC 1010, EN 61010, UL 3101-1

The technical specifications are documented in the instruction manual.

Metrohm Ltd. is holder of the SQS certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, October 23rd, 1997

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico
759 Swing Head

CE

EU Declaration of Conformity

The Metrohm AG company, Herisau, Switzerland hereby certifies that the instrument:

759 Swing Head

meets the requirements of EU Directives 89/336/EWG and 73/23/EWG.

Source of specifications:

EN 50081	Electromagnetic compatibility, basic specification Emitted Interference
EN 50082-1	Electromagnetic compatibility, basic specification Interference Immunity
EN 61010	Safety requirements for electrical laboratory measurement and control equipment

---

Description of the instrument:

The Swing head is an accessory to the Metrohm sample changers 717, 730 and 760 for the automation of batch processing of larger sample series in chemical analytics.

Herisau, October 23rd, 1997

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

5.8 Accessories

Sample Changer with 1 Tower and 1 Pump		**2.730.0010**
includes the following accessories:		
	Pieces	
Keyboard		6.2142.010
SGJ14 sleeve	2	6.1236.020
SGJ14 plastic stopper	5	6.1446.000
SGJ9 stopper	3	6.1446.010
M6 thread stopper		6.1446.040
PE canister 10 liter		6.1621.000
FEP tubing connector M6 80		6.1805.110
PTFE tubing 4 meter 4/6		6.1812.000
Guiding shaft		6.1823.000
Connector for canister		6.1828.000
Fixing clip 10x		6.2053.000
Bushing	3	6.2709.070
Rotating nozzle		6.2740.000
Splash protection		6.2751.010
Plug cover		6.2752.010
Mains cable with cable socket, type CEE(22), V		
Cable plug to customer's specifications		
type SEV 12 (Switzerland...)		6.2122.020
type CEE(7), VII (Germany...)		6.2122.040
type NEMA/ASA (USA...)		6.2122.070
Instructions for Use for 730 Sample Changer		8.730.1103
Short Introduction and Tutorial		8.730.1123
Quick Reference		8.730.1113

Sample Changer with 1 Tower and 2 Pumps		**2.730.0020**
includes the following accessories:		
	Pieces	
Keyboard		6.2142.010
SGJ14 sleeve	2	6.1236.020
SGJ14 plastic stopper	5	6.1446.000
SGJ9 stopper	3	6.1446.010
M6 thread stopper		6.1446.040
SGJ14 stopper 6,4 mm		6.1446.160
M8 aspiration tip		6.1543.170
PE canister 10 liter	2	6.1621.000
FEP tubing connector M6 80		6.1805.110
FEP tubing connector M6 48		6.1805.420
PTFE tubing connector M8 60		6.1805.510
PTFE tubing 4 meter 4/6	2	6.1812.000
M8 screw connector 4/6 mm / M8		6.1820.030
Connector for canister	2	6.1828.000
Clip for burette tip		6.2042.020
Fixing clip 10x		6.2053.000

Bushing	3	6.2709.070
M6 spray nozzle	3	6.2740.020
Splash protection		6.2751.010
Plug cover		6.2752.010
Mains cable with cable socket, type CEE(22), V		
Cable plug to customer's specifications		
type SEV 12 (Switzerland...)		6.2122.020
type CEE(7), VII (Germany...)		6.2122.040
type NEMA/ASA (USA...)		6.2122.070
Instructions for Use for 730 Sample Changer		8.730.1103
Short Introduction and Tutorial		8.730.1123
Quick Reference		8.730.1113

Sample Changer with 1 Tower without Pumps 2.730.0030

includes the following accessories:

	Pieces	
Keyboard		6.2142.010
SGJ14 sleeve	2	6.1236.020
FEP tubing connector M6 80		6.1805.110
Bushing	3	6.2709.070
Splash protection		6.2751.010
Plug cover		6.2752.010
Mains cable with cable socket, type CEE(22), V		
Cable plug to customer's specifications		
type SEV 12 (Switzerland...)		6.2122.020
type CEE(7), VII (Germany...)		6.2122.040
type NEMA/ASA (USA...)		6.2122.070
Instructions for Use for 730 Sample Changer		8.730.1103
Short Introduction and Tutorial		8.730.1123
Quick Reference		8.730.1113

Sample Changer with 2 Towers and 2 Pumps 2.730.0110

includes following accessories

	Pieces	
Keyboard		6.2142.010
SGJ14 sleeve	4	6.1236.020
SGJ14 plastic stopper	10	6.1446.000
SGJ9 stopper	6	6.1446.010
M6 thread stopper	2	6.1446.040
PE canister 10 liter	2	6.1621.000
FEP tubing connector M6 80	2	6.1805.110
PTFE tubing 4 meter 4/6	2	6.1812.000
Guiding shaft	2	6.1823.000
Connector for canister	2	6.1828.000
Fixing clip 10x	2	6.2053.000
Bushing	6	6.2709.070
Rotating nozzle	2	6.2740.000
Splash protection		6.2751.020

Plug cover		6.2752.010
Mains cable with cable socket, type CEE(22), V		
Cable plug to customer's specifications		
type SEV 12 (Switzerland...)		6.2122.020
type CEE(7), VII (Germany...)		6.2122.040
type NEMA/ASA (USA...)		6.2122.070
Instructions for Use for 730 Sample Changer		8.730.1103
Short Introduction and Tutorial		8.730.1123
Quick Reference		8.730.1113

Sample Changer with 2 Towers and 4 Pumps 2.730.0120

includes the following accessories:

	Pieces	
Keyboard		6.2142.010
SGJ14 sleeve	4	6.1236.020
SGJ14 plastic stopper	10	6.1446.000
SGJ9 stopper	6	6.1446.010
M6 thread stopper	2	6.1446.040
SGJ14 stopper 6,4 mm	2	6.1446.160
M8 aspiration tip	2	6.1543.170
PE canister 10 liter	4	6.1621.000
FEP tubing connector M6 80	2	6.1805.110
FEP tubing connector M6 48	6	6.1805.420
PTFE tubing connector M8 60	2	6.1805.510
PTFE tubing 4 meter 4/6	4	6.1812.000
M8 screw connector 4/6 mm / M8	2	6.1820.030
Connector for canister	4	6.1828.000
Clip for burette tip	2	6.2042.020
Fixing clip 10x	2	6.2053.000
Bushing	6	6.2709.070
M6 Spray nozzle	6	6.2740.020
Splash protection		6.2751.020
Plug cover		6.2752.010
Mains cable with cable socket, type CEE(22), V		
Cable plug to customer's specifications		
type SEV 12 (Switzerland...)		6.2122.020
type CEE(7), VII (Germany...)		6.2122.040
type NEMA/ASA (USA...)		6.2122.070
Instructions for Use for 730 Sample Changer		8.730.1103
Short Introduction and Tutorial		8.730.1123
Quick Reference		8.730.1113

Sample Changer with 2 Towers without Pumps 2.730.0130

includes the following accessories:

	Pieces	
Keyboard		6.2142.010
SGJ14 sleeve	4	6.1236.020
FEP tubing connector M6 80	2	6.1805.110

Bushing	6	6.2709.070
Splash protection		6.2751.010
Plug cover		6.2752.010
Mains cable with cable socket, type CEE(22), V		
Cable plug to customer's specifications		
type SEV 12 (Switzerland...)		6.2122.020
type CEE(7), VII (Germany...)		6.2122.040
type NEMA/ASA (USA...)		6.2122.070
Instructions for Use for 730 Sample Changer		8.730.1103
Short Introduction and Tutorial		8.730.1123
Quick Reference		8.730.1113

Options

Accessories to separate order at additional charge:

722 Rod stirrer for the sample changer

Rod stirrer	2.722.0020
Stirrer propeller PP (104 mm)	6.1909.020

741 Magnetic stirrer

Magnetic stirrer	2.741.0010
Macro Titration head (6x NS14, 3x NS9)	6.1458.010
Micro Titration head (4x M10)	6.1458.020

759 Swing Head with Transfer Head **2.759.0010**

includes the following accessories:

Transfer head	6.1462.010
Pipetting tube 10 mL (length 3.8 m, inner diameter 2.0 mm)	6.1562.100
Guiding shaft for pipetting tube	6.1823.010
Holding plate for the swing head	6.2058.000
Splash protection for tower 2	6.2751.010

759 Swing Head with Titration Head **2.759.0020**

includes the following accessories:

	Pieces	
Titration head		6.1462.020
Stirrer propeller PP (104 mm) for 75 mL vessels		6.1909.030
Clip for burette tip	2	6.2042.030
Holding plate for the swing head		6.2058.000
Splash protection for swing head		6.2751.030

Connecting Cables

Cable 730 — Titrino/692/712/713	6.2141.020
Cable 730 — 2xTitrino/692/712/713	6.2141.030
Cable 730 — Titrino — 665/725	6.2141.040
Cable 730 — Titrino — 2x665/725	6.2141.050
Cable 730 — 691	6.2141.060
Cable 730 — 692 — 665	6.2141.070
Cable 730 — Liquino 711 — Pump 683 — Titrino	6.2141.100
Cable 730 — 678/682/686	3.980.3640
Cable 730 — 671— 678/682/686	3.980.3650

Sample racks and beakers

Rack 12x 250 mL M12-0 ***)**	**6.2041.310**
Metrohm glass beaker 250 mL	6.1432.320
Metrohm PP beaker 200 mL	6.1453.220
Metrohm PP beaker 250 mL	6.1453.250
Rack 12x 150 mL M12-0 ***)**	**6.2041.360**
for standard glass beaker 150 mL (narrow) or disposable beaker (Euro) PP 200 mL (1000 pcs.)	6.1459.310
Rack 14x 200 mL M14-0	**6.2041.370**
for disposable beaker (Euro) PP 200 mL	6.1459.310
Rack 14x 8 oz M14-0	**6.2041.380**
for disposable beaker (US) PP 8 oz	
Rack 16x 150 mL M16-0	**6.2041.320**
for standard glass beaker (narrow)	
Rack 16x 120 mL M16-0	**6.2041.390**
for disposable beaker (US) 120 mL	
Rack 24x 75 mL M24-0 ***)**	**6.2041.340**
(with Micro titration head only)	
Metrohm glass beaker 75 mL	6.1432.210

***)** Parallel processing at 2 towers possible

For operation with the 759 Swing Head:

Rack 48x 75 mL M48-1	**6.2041.350**
for direct titration	
Metrohm glass beaker 75 mL	6.1432.210
Rack 126 x 15 mL and 2 x 250 mL M128-2	**6.2041.400**
for pipetting	
for test tubes 15 mL and	
Metrohm glass beaker 250 mL	6.1432.320
Metrohm PP beaker 200 mL	6.1453.220
Metrohm PP beaker 250 mL	6.1453.250

Electrodes for Sample Changer

It is recommended to use Longlife-Electrodes (LL) or titrodes (without polished glass surface) with the SGJ sleeve SGJ14/12mm 6.1236.040 made of silicon caout-chouc for titrations with the Macro Titration head.

The following special micro electrodes can be used with the Micro Titration head and the 759 Swing Head for direct titration.

Comb. micro-pH-electrode (LL)	16 cm	6.0234.110
Micro reference electrode Ag/AgCl	16 cm	6.0736.110
Micro glass electrode	16 cm	6.0134.110
Micro-Ag titrode	16 cm	6.0433.110
Micro-Pt titrode	16 cm	6.0434.110
Micro-Au titrode	16 cm	6.0435.110
Pt 1000 temperature sensor	16 cm	6.1110.110

Dosing Instruments

685 Dosimat		**2.685.0010**
Exchange Unit with ceramic stopcock	1 mL	6.3013.113
	5 mL	6.3013.153
	10 mL	6.3013.213
	20 mL	6.3013.223
	50 mL	6.3013.253
Exchange Unit with PTFE stopcock	1 mL	6.3014.113
	5 mL	6.3014.153
	10 mL	6.3014.213
	20 mL	6.3014.223
	50 mL	6.3014.253
700 Dosino		**2.700.0010**
Dosing unit for Dosino	2 mL	6.3030.120
	5 mL	6.3030.150
	10 mL	6.3030.210
	20 mL	6.3030.220
	50 mL	6.3030.250
729 Dosimat Interface		**2.729.0010**

5.9 Index

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