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774 Oven Sample Processor

Instructions for use

Program version 5.774.0010

8.774.1043

2005.07 dm

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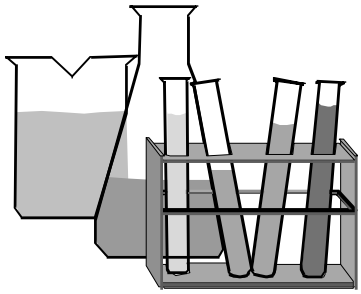


1 Overview

1.1 Application range

The Metrohm 774 Oven Sample Processor is a very versatile instrument. It has been specially designed for laboratory use and can be used for a wide range of applications. It provides an essential service when large numbers of samples have to be processed in which the samples require to be heated and/or whenever it is necessary to remove moisture or organic solvents from solids or liquids by the application of heat.

The construction of the 774 Oven Sample Processor has been principally based on the determination of moisture by the oven method. The sample heated in the oven block releases its moisture as water vapor which is transferred to a measuring cell in a stream of gas. The moisture determination in the cell can be carried out either coulometrically or volumetrically according to Karl Fischer.
This method is becoming increasingly popular wherever moisture determinations have to be carried out in matrices which interfere with the moisture determination process or which release their moisture only with great difficulty.

Its comprehensive range of communications possibilities means that it cannot just work together with the wide range of Metrohm titrators, meters and dosing instruments via its parallel remote interface and its serial RS232 interface, but that it can also control or be controlled by any instrument which is equipped with a suitable communications interface. These abilities mean that it is predestined for automation tasks in a modern laboratory, even within highly integrated laboratory data systems.

1.2 Application possibilities

Despite its comprehensive range of commands and numerous configuration possibilities the 774 Oven Sample Processor, with its capability of managing operator-defined methods, offers an uncomplicated operation system which is suitable for routine use.
The standard methods for routine tasks which we supply together with the instrument can be used without any further ado. After a short familiarization period the operators can alter them to suit their own requirements and store them in the instrument. In this way the 774 Oven Sample Processor can

also be used for demanding special applications as well as for routine tasks.

The operating sequences for processing individual samples can be freely defined within wide limits. The same applies to the start and final sequences, which always need to be carried out once before the start and once at the end of a sample series.

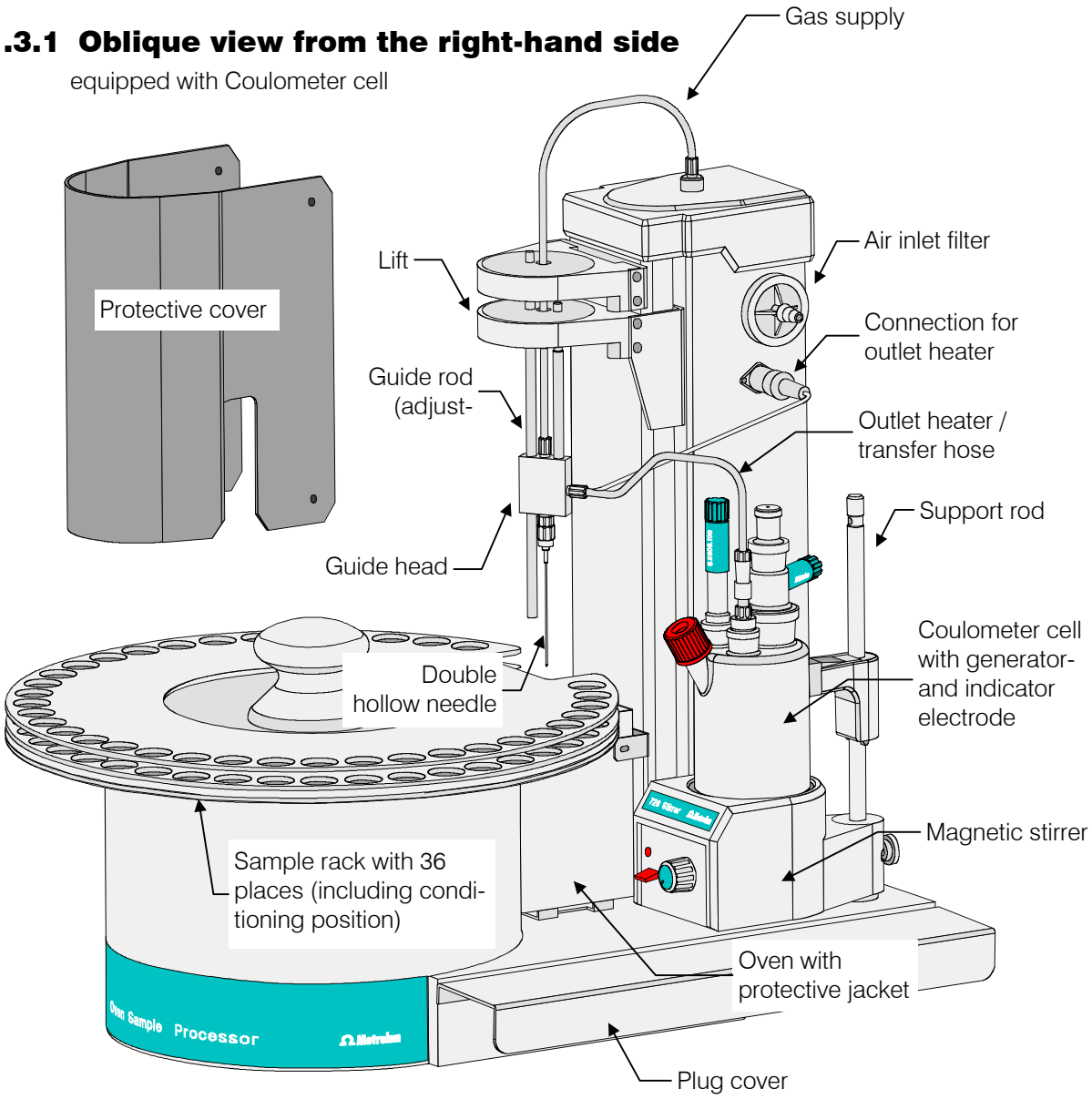
A learning mode is provided for the creation of operating sequences; with its help command parameters can be set manually.

The standard sample rack offers place for 36 sample vials (22 mm x 38 mm). Freely definable "special beaker" positions can also be defined. These are used for positioning conditioning beakers, which can be selected in each part-sequence, on the rack.

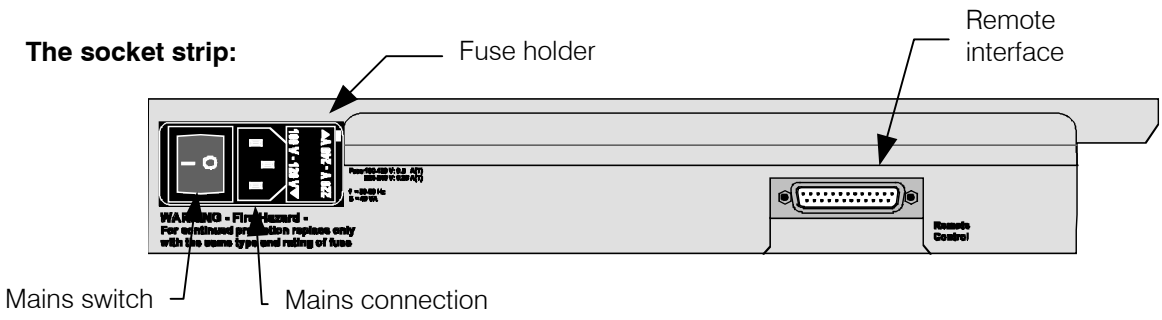
1.3 Instrument description

1.3.1 Oblique view from the right-hand side

equipped with Coulometer cell

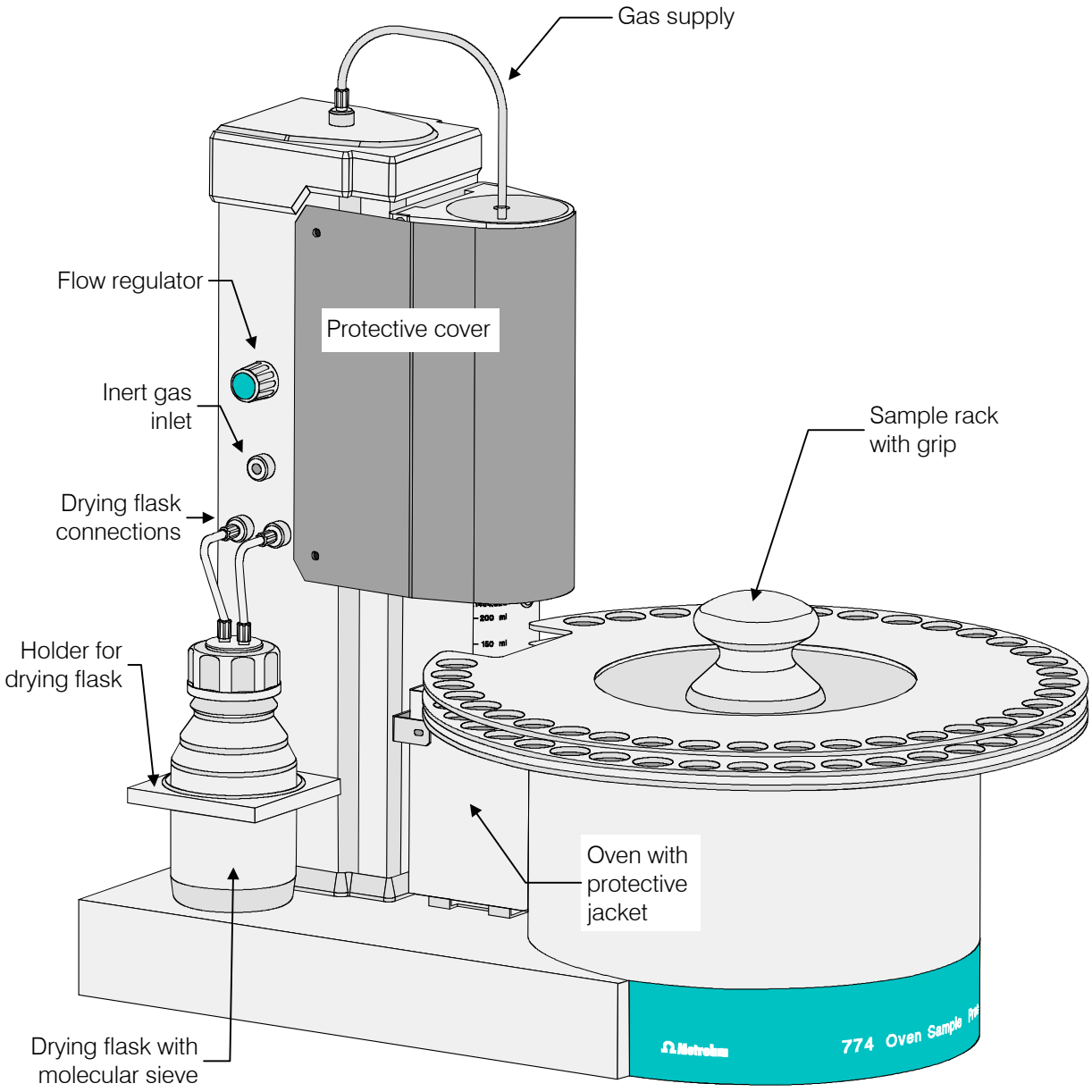


The socket strip:



1.3.2 Oblique view from left-hand side

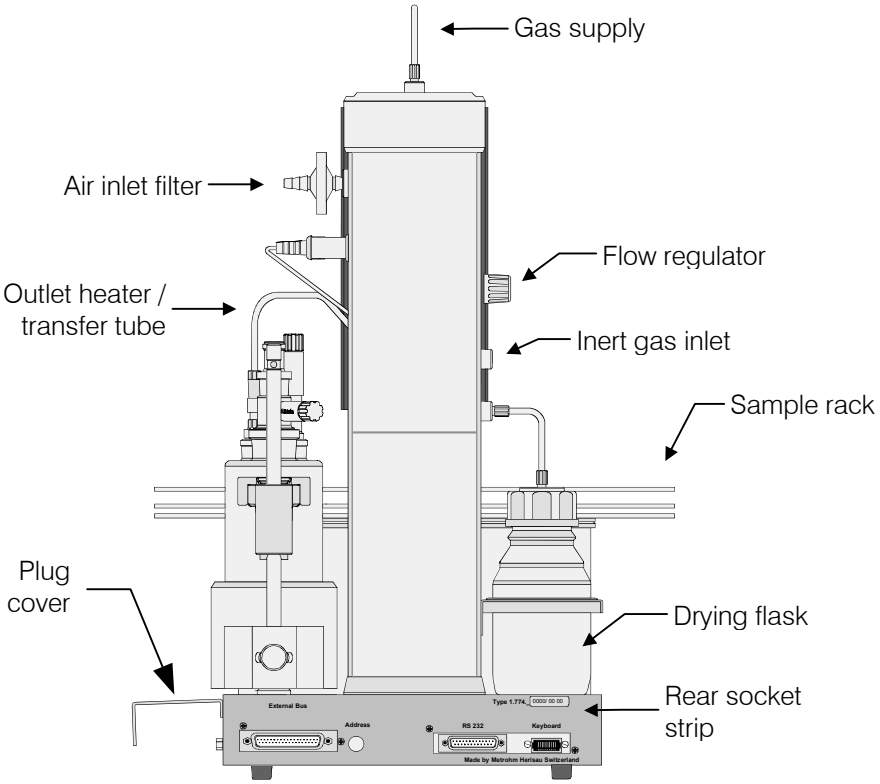
with protective cover in position



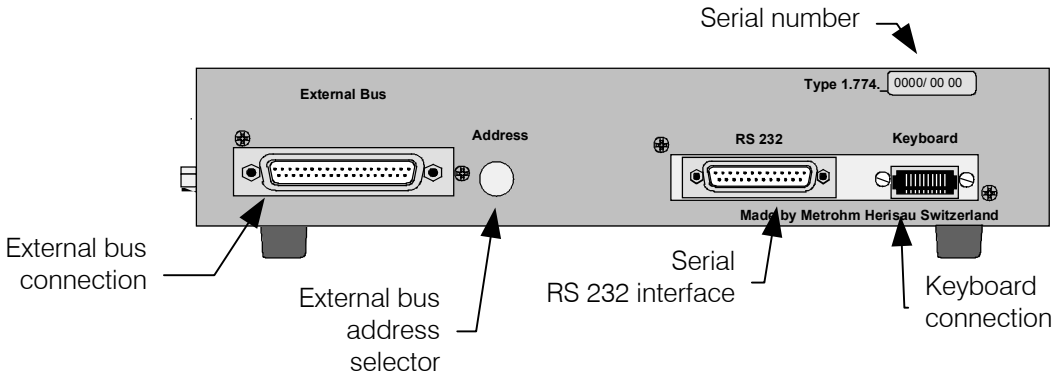
Safety information:
The protective cover and the plug cover have to be in position for safety reasons.

The plug cover prevent spilt solvents or chemicals from adversely affecting the connections and interfaces.

1.3.3 Rear view

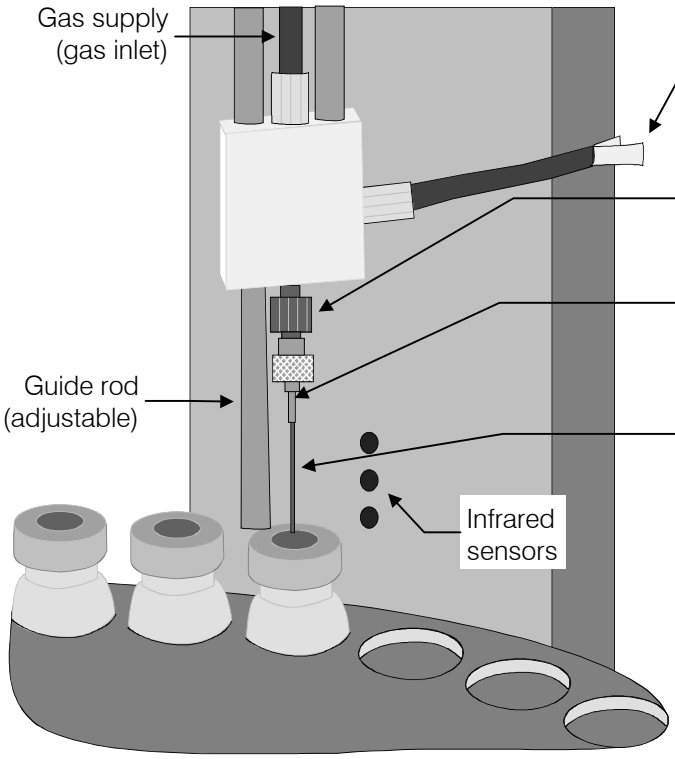


1.3.4 The socket strip (rear panel):



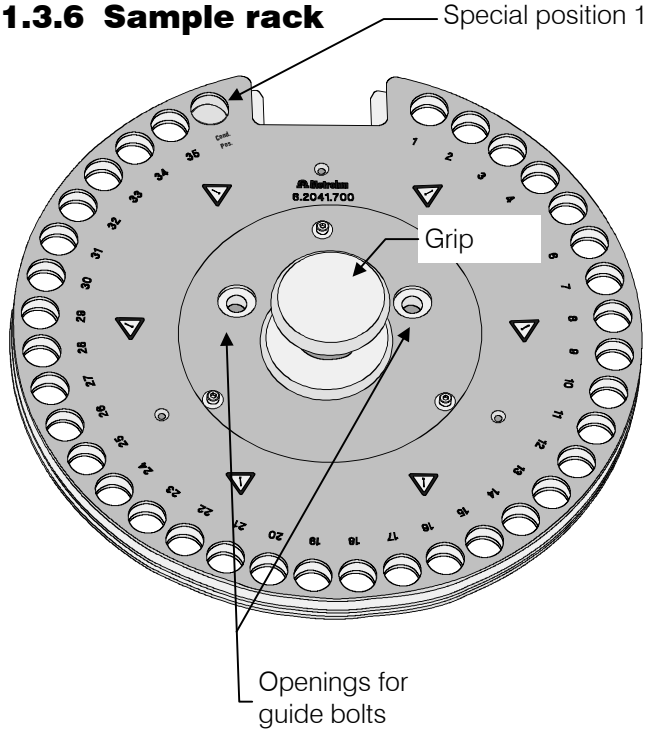
The 'External Bus' address must be set to 0 (zero).

1.3.5 Guide head



The tower of the 774 Oven Sample Processor is equipped with infrared beaker sensors which detect the presence of a vial in front of the tower. This "beaker test" is carried out after every MOVE command.

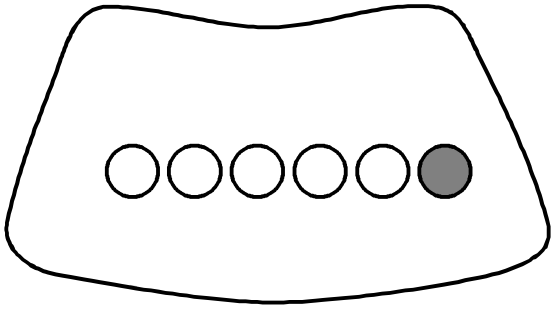
1.3.6 Sample rack



The removable sample rack offers space for 35 sample vials and a conditioning vessel. A snap-in mechanism ensures that the rack base is blocked when the rack is removed so that no sample vials can fall out. When the rack is replaced this block is removed so that the upper part of the rack with the sample vials can be rotated.
The rack can only be exchanged in the base position (recess in front of the tower). The sample rack is moved to the base position by pressing the <RACK> key.
When replacing the rack take care that it is positioned correctly. The guide bolts of the turntable must be located in the openings provided for them in the sample rack. The recess of the rack must surround the oven block.

Warning!
If sample vials on the racks have just been processed they could have a temperature above 200°C!

When the sample rack is positioned the rod magnets on the base of the rack are read in automatically. The arrangement of the magnets defines the rack code, which is allocated to an internal position table with whose help the 774 Oven Sample Processor recognizes the arrangement of the vial positions on the rack.



The above arrangement corresponds to the magnet code 000001.

1.3.7 Sample vials

The sample rack (order no. 6.2041.700) is intended for use with sample vials (order. no. 6.2419.000) with 21 mm outer diameter. Only these vials guarantee optimal heat transfer between the oven block and the sample. Use only septum seals with a PTFE insert (order. no. 6.1448.050), as these are exposed to high temperatures. The sample vials must be tightly sealed by using the septum closure crimpers.
Closures which are not sufficiently tight can cause significant errors in the results. Closures which are not mounted properly may cause damage to the injection needle.

2 Installation

2.1 Setting up the instrument

Packaging
The 774 Oven Sample Processor 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 155). In case of damage see "Warranty", page 154.

Setting up
The 774 Oven Sample Processor 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

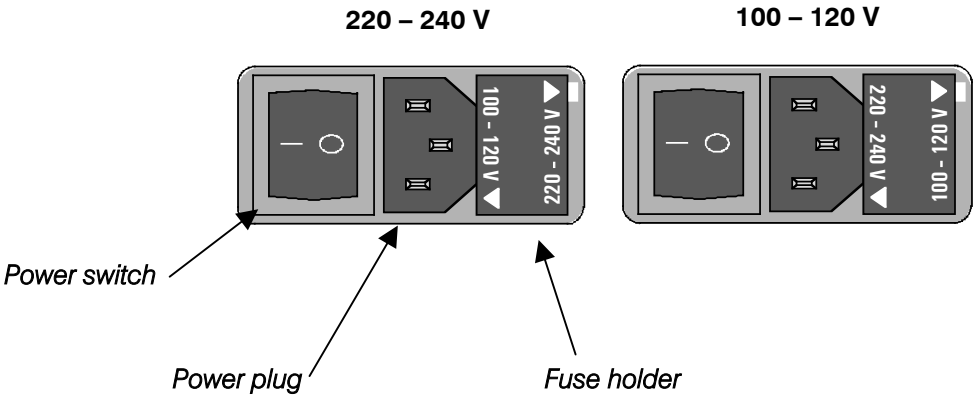
Follow these instructions to connect the 774 Oven Sample Processor to the power supply. Ensure that the instrument is never operated with incorrect voltage ratings and/or with fuses of an incorrect rating, otherwise there is a fire hazard!

Setting the instrument supply voltage

Before switching on the 774 Oven Sample Processor 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 774 Oven Sample Processor.
  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):
  2.0 A (slow) ord. no. U.600.0019
- **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

- Do not operate the 774 Oven Sample Processor without protective covers.

The **plug cover** protects the connectors from spillage. Organic solvents are always a potential serious fire hazard.

The **protective cover** of the guide head prevents the access to the stroke path of the injection needle. Never get your hand beneath the protective cover while operating the instrument.

- If you work with inflammable samples the 774 Oven Sample Processor has to be operated under a safety hood. In addition to that you have to use nitrogen or another inert gas instead of the integrated air pump. See chapters 2.2.4 and 4.2.

- Always wear safety goggles while working with the 774 Oven Sample Processor.

The oven can reach 250 °C and more. The heating block is covered by a protective jacket. **Keep your hands off the heated oven or the sample in work. Do not reach under the protective cover.**

Caution! Just after processing sample vials may be hot, too. Even parts of the sample rack can reach elevated temperature up to 60 °C.

- Allow the sample vials to cool off before removing vials from the rack or detaching the sample rack .

The 774 Oven Sample Processor may be used for sample processing with extraction methods at higher temperatures. These kinds of method require special safety precautions.

Before working with **inflammable organic solvents** read the relevant safety sheets or consult common accessible safety literature.

- **Do not heat organic solvents to their flash point!**

- Use nitrogen or another inert gas.

If failure or malfunctioning occurs during operation of the 774 Oven Sample Processor, it is recommended to first search for the cause with the help of the diagnostic functions (see Instructions for Use, page 143). 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.

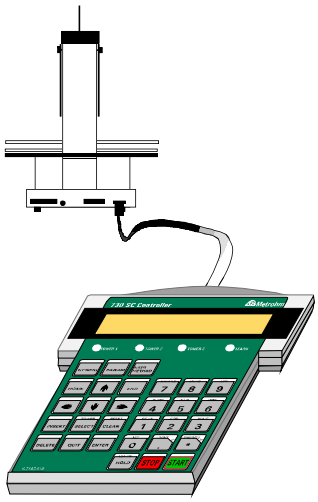
Electronic components are sensitive to static electricity and can be destroyed by discharge. Before touching any components inside the instrument, both the person and his tools should be grounded by grasping a grounded object (for example: a metallic part of the casing of the instrument or a radiator)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

When peripheral instruments are connected to the 774 Oven Sample Processor, 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 not be used at all.

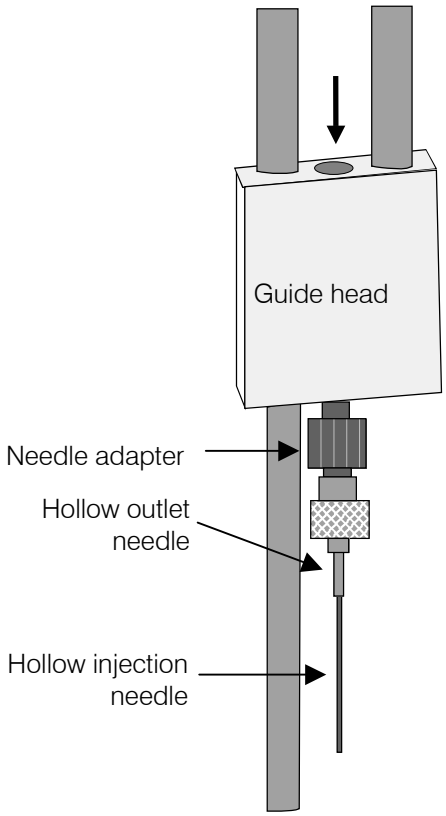
2.4 Arranging the accessories

2.4.1 Connecting the keyboard



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

2.4.2 Equipping the guide head



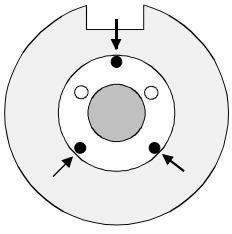
- Screw the needle adapter (6.1808.150) onto the bottom of the guide head.
- Attach the outlet hollow needle (6.2816.060) to the Luer connection of the needle adapter.
- Carefully introduce the hollow injection needle (6.2816.050) into the guide head from above (see arrow). Pull the needle downwards to the full extent.
- Now lead the gas inlet (6.1805.470) through the lift head from above and screw it onto the guide head (see arrow). Connect the other end of the tubing to the gas outlet opening on the top of the tower. Take care that the connections are tight.

If necessary, the injection needle may be lifted by attaching the PTFE spacer ring (that is supplied with) to the needle.

If you wish to avoid the penetration of the sample by the needle, you may lift the injection needle by the use of two different M6/M8 adapters (order no. 6.1808.040 and 6.1808.090). The injection needle must only puncture the vial's seal by a few milimeters.

2.4.3 Adjusting the sample rack

- Check the positioning of the sample rack. After switching on the 774 Oven Sample Processor place the rack on the instrument and let it move to the first sample position by pressing the <🡐> key. The circular opening of sample position 1 of the rack must coincide with the opening of the oven block beneath it.

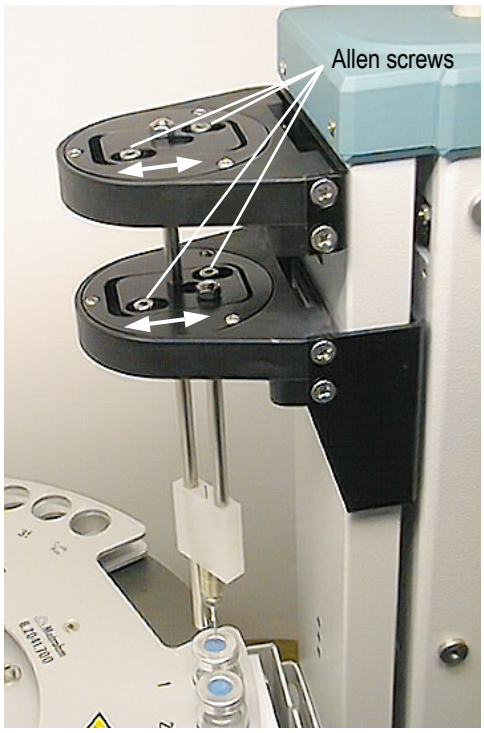


- If this is not the case then loosen the three Allen screws (see diagram) on the sample rack. Carefully adjust the upper part of the rack and then re-tighten the Allen screws.
- Now place a sample vial with a septum cap closure in sample position 2 and press the <🡐> key again. By carefully pressing the <🡓> key to lower the lift it is now possible to check whether the penetration needle correctly penetrates the center of the sample vial septum and that the vial is pressed down into the oven opening without tilting.

Warning!
Do not lower the needle too far. It must not contact the base of the vial and become bent.

- Press the <RACK> key in order to return the sample rack and lift to the starting position.
- Readjust the sample rack, if necessary.

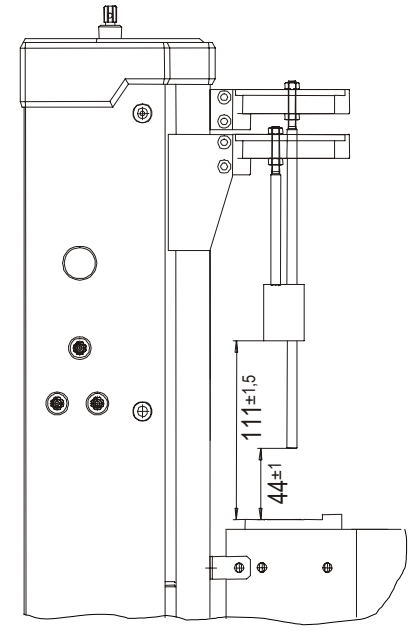
2.4.4 Adjusting the needle position



Positioning the needle

In addition to the adjustment of the sample rack, the position of the needle (radial positioning) may be adjusted.
After the adjustment of the sample rack proceed as follows:

1. Place a sealed beaker under the needle.
2. Lower the needle on to the seal.
3. Loosen the Allen screws of the sliding devices.
4. Position the needle in the centre of the seal.
5. Fasten the sliding devices.
6. Press <RACK>. The instrument moves to initial position.
7. Remove rack.



Distances of the guide head and rod (in mm)

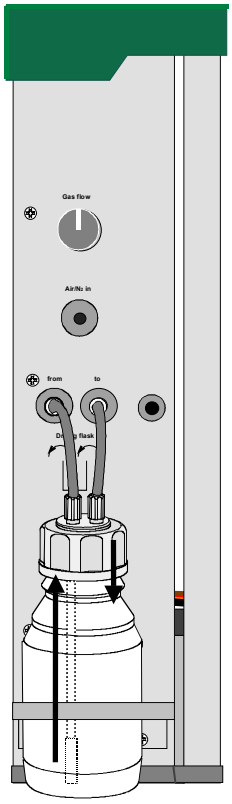
8. Check the distances according to the drawing on the right and adjust if necessary.

2.4.5 Installation of the tubing system and the drying flask

A stream of gas with a constant flow rate is required to transfer the moisture which is released when the sample is heated to a measuring vessel. You can either use the built-in pump to supply air or use an inert gas such as nitrogen for this purpose.

Inert gas connection
Connect the inert gas to the 'Air/N_2 in' connection on the left-hand side of the instrument. Make sure that the pressure in the supply line is less than 1 bar. The inert gas should be dried by passing it through the drying flask. The flow rate is measured and monitored by the 774 Oven Sample Processor. A solenoid valve is used to switch the gas flow on and off.

Air supply from the built-in pump
A stream of air can be used for the determination of chemically and thermally stable samples. The pump built into the tower of the 774 Oven Sample Processor provides a sufficiently large and stable flow rate.

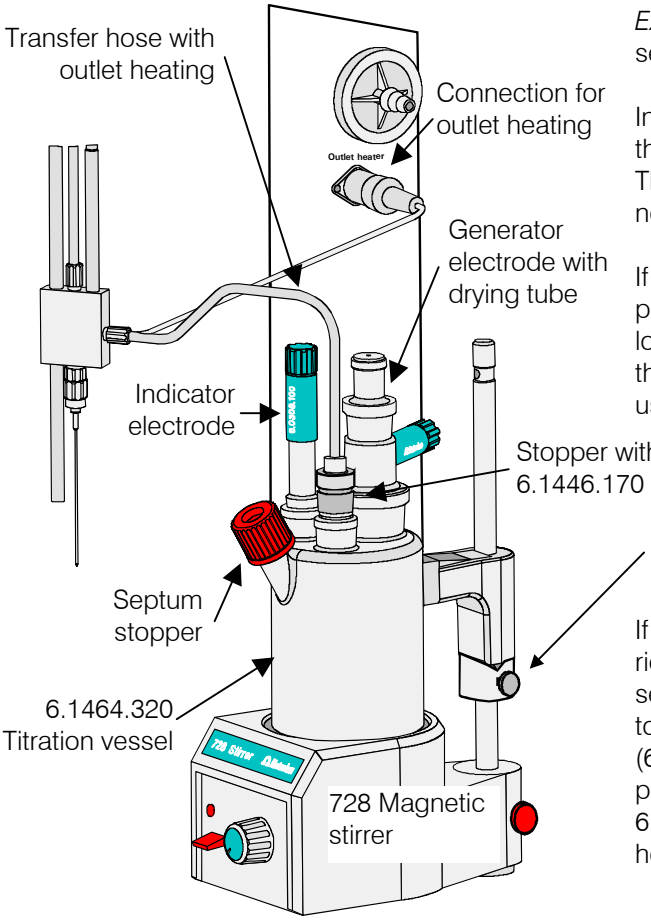


It is essential that the flow of gas is dried and filtered. If the pump is used the air is drawn in through the right-hand side of the instrument. A dust filter (6.2724.010) should be mounted on the 'Inlet filter' connection. The gas is dried by mounting a drying flask on the left-hand side of the instrument, as shown in the drawing alongside.

The drying flask is filled with molecular sieve and the outlet tube (6.1821.050) with its filter is fitted to the drying flask insert (6.1602.140). Screw the completely assembled insert onto the drying flask and attach the two tubing connections (6.1805.520, 7 cm long) to the drying flask cap. Place the flask in the drying flask holder and then attach the free ends of the tubing connections to the corresponding connections on the tower of the 774 Oven Sample Processor. The tubing connected to the inlet tube in the drying flask is connected to the left-hand connection marked 'from Drying flask'. The carrier gas will stream into the head space of the flask and penetrate the molecular sieve. Then it can stream up inside the outlet tube and enter the tower's gas tubings via the 'from Drying flask' connector'.

The filling of the drying flask must be replaced from time to time. The interval may vary depending on the length of use, moisture content of the gas and atmospheric humidity. Read the information given on the label of the molecular sieve container for more details.

2.4.6 Installation of the measuring cell



Example: 6.1464.320 Coulometer titration vessel

Install the necessary accessories as shown in the diagram alongside.
The fastening screws can be used to permanently fix the whole assembly in position.

If you wish to automate the reagent changing process (aspiration and dosing) then the Coulometer titration vessel with two side-mounted threaded openings (6.1465.320) should be used.

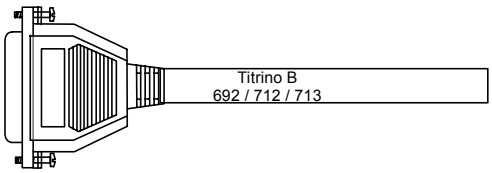
If volumetric KF determinations are to be carried out a suitable titration vessel should be selected (see Metrohm accessories catalog) together with the KF titration vessel upper part (6.1414.030). Instead of the 6.1446.170 stopper use the nipple and O-ring of the 6.2730.030 stopper to introduce the transfer hose into the titration vessel.

2.5 Integration

Cables

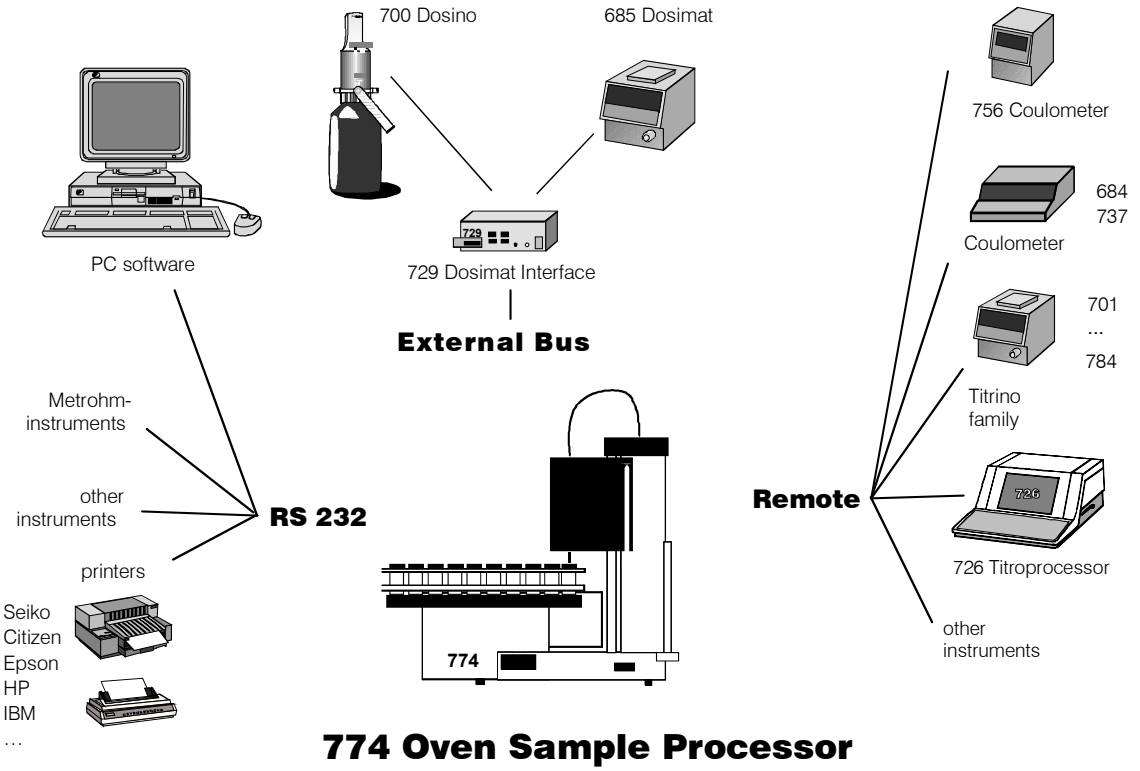
Connecting peripheral instruments to the 774 Oven Sample Processor requires Metrohm cables. Otherwise safe data transmission may not be guaranteed.

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



All instruments have to be switched off before they are connected. Otherwise the instruments could be damaged.

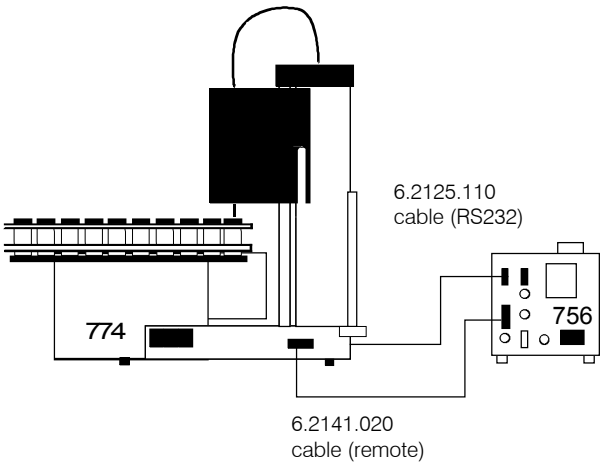
The 774 Automation System



2.5.1 Remote connections

774 Oven Sample Processor — 756 Coulometer

for coulometric determinations



Control of the 756 Coulometer is carried out via the control lines of the remote connection.
While a sequence is being processed the 774 Oven Sample Processor can, via the serial RS232 interface, cause the 756 Coulometer to load a particular method. When drawing up a report the 756 Coulometer automatically obtains the temperature of the 774 Oven Sample Processor via the RS232 connection.

Control commands of the 774:

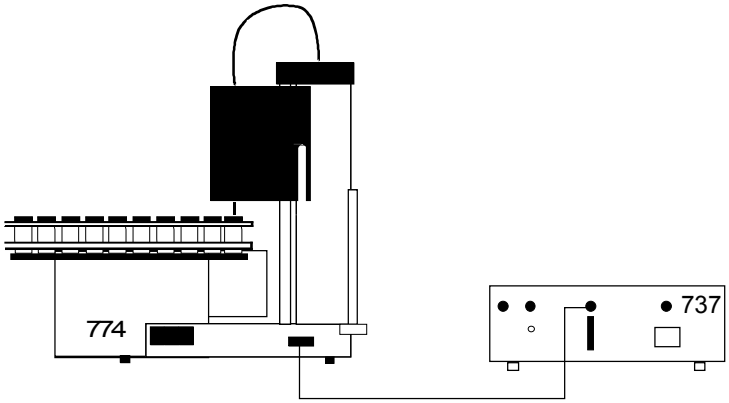
```
CTL:Rm :   START Gerät1     starts Coulometer
CTL:Rm : ************1                 "
CTL:RS             &U.R.N   loads a method in the Coulometer
CTL:RS   "774BLANK"..$G     here e.g. "774BLANK"
```

Scanning the remote lines of the 774:

```
SCN:Rm      :    **0**010   waits for 'cond. ready'
SCN:Rm      :    *****000   waits for end of determination
```

774 Oven Sample Processor — 737 Coulometer

for coulometric determinations



6.2141.000 cable (remote)

The 737 Coulometer is completely controlled via the remote lines.

Control commands:

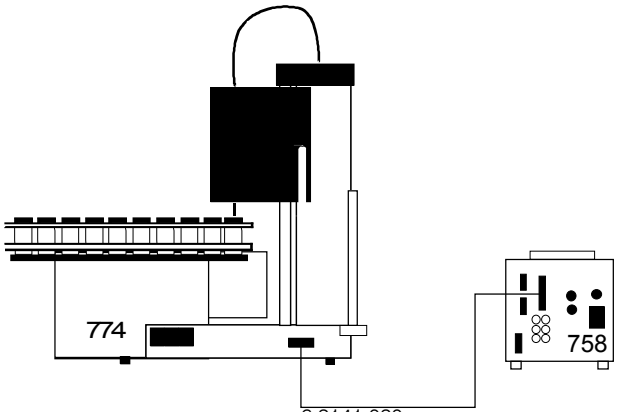
```
CTL:Rm:  *********1****    starts Coulometer with
CTL:Rm:  *********0****    a start impulse
```

Scanning via remote lines:

```
SCN:Rm      :    10000100   waits for 'cond. ready'
```

774 Oven Sample Processor — 7xx Titrino

for volumetric KF titrations



6.2141.020
cable (remote)

Control commands:

`CTL:Rm :  START Gerät1`	starts Titrino
`CTL:Rm : ***********1**`	advance impulse / ENTER

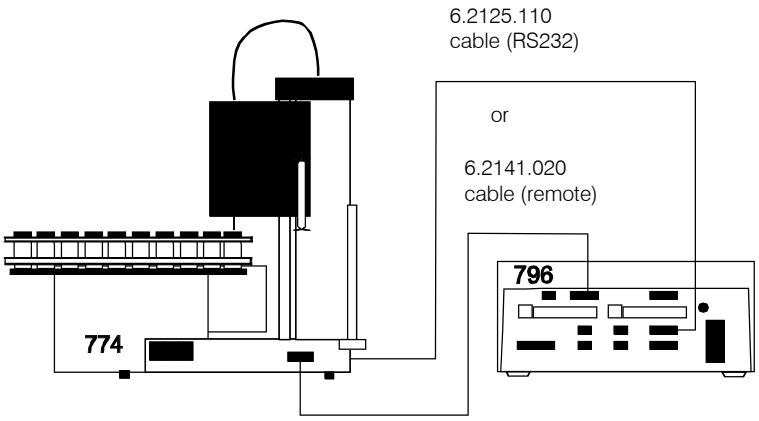
Scanning via remote lines:

`SCN:Rm :  ****1000`	waits for end of titration (EOD-impulse)
`SCN:Rm :  *****010`	waits for 'cond. ok'

In principle it is possible to use an additional RS232 connection to automatically load a particular method in the Titrino while a sequence is being processed. Please refer to the example of the remote connection given for the 756 Coulometer on the previous page.

774 Oven Sample Processor — 796 Titroprocessor

for volumetric KF titrations



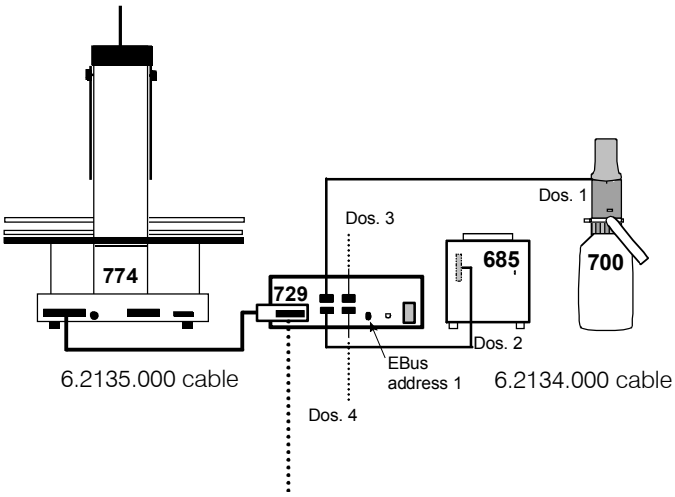
If connected to a 774 Oven Sample Processor the 796 Titroprocessor takes over the functions of the control instrument itself (Master). The communication between the 774 Oven Sample Processor and the 796 Titroprocessor can be solved in any manner.

If a remote connection is used (6.2141.020 cable) the input and output lines 0…7 can be used as required. However, it is then not possible to start a 774 Oven Sample Processor method. See page 79ff for the communication commands.

A serial RS232 connection between the 796 Titroprocessor and the 774 Oven Sample Processor has the advantage that the Titroprocessor as control unit can access all internal functions except starting or loading a method in the 774 Oven Sample Processor. Please refer to the description of the Metrohm remote language and the 774 remote control tree on page 98ff.

2.5.2 External bus connections

If a KF Titrino or a Coulometer which does not support automatic solvent changing is connected to the 774 Oven Sample Processor then this can be carried out with the help of a 700 Dosino. 685 Dosimats can also be used for the addition of solvents. 700 Dosinos or 685 Dosimats are connected to the 774 Oven Sample Processor via the so-called 'External Bus'.
A 729 Dosimat interface can be used to connect up to 4 dosing devices to the 'External Bus' interface. Up to 3 Dosimat interfaces can be switched in line (cascaded) and equipped with further dosing instruments. The instrument address must always be set correctly at the interfaces. In this way it is possible to operate up to 12 dosing instruments directly with the 774 Oven Sample Processor with the aid of the DOS command.

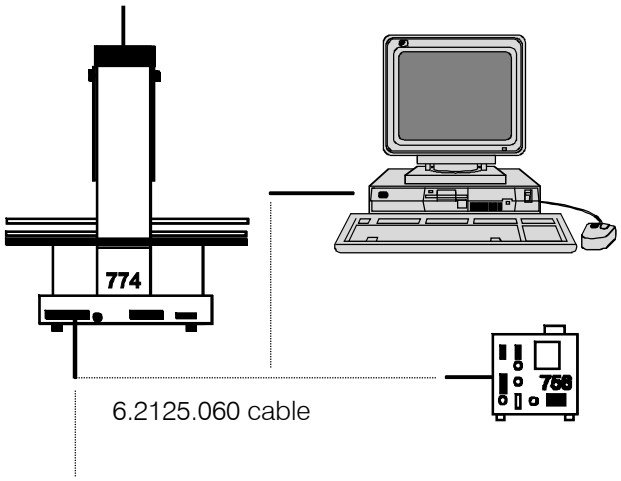


Addresses:

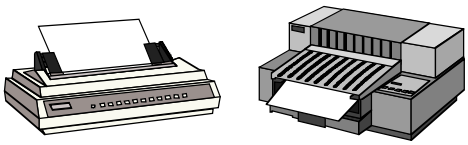
	'External Bus'-address	Dosing instrument
774 Oven Sample Processor	0	
1st interface	1	Dos. 1 … Dos. 4
2nd interface	2	Dos. 5 … Dos. 8
3rd interface	3	Dos. 9 … Dos. 12

2.5.3 Serial connection (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 101ff) 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. 20f



In order to guarantee safe data transmission, it is important to set the same RS232 interface parameters correctly for both instruments connected (see page 21f).

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

Information about the settings and cables required for connecting a printer is given in the following section.

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-411/414
Citizen Citizen printer IDP560 RS
HP HP printers and compatibles with HP PCL3 emulation

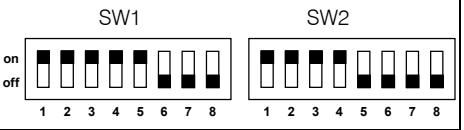
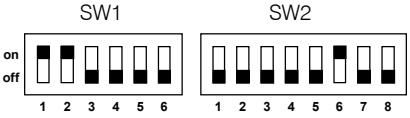
If you connect a printer not listed in the following table, be sure that it is able to emulate Epson or IBM Proprinter mode.
Use the 6.2125.050 cable for connecting a printer with built-in serial interface. Printers with parallel interface require the 2.145.0300 serial/parallel converter and 6.2125.020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

Before connecting a printer to the RS232 interface, switch off the 774 Oven 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 on / off 1 2 3 4 5 6 7 8 — 1 2 3 4 5 6 The 7-bit ASCII character is set automatically to the specific national character set according to the selected dialog language.
Seiko DPU-414	6.2125.130	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs character set: Seiko	Recommended DIP switch settings **Dip SW-1** / **Dip SW-2** / **Dip SW-3** **1** OFF ON ON **2** ON OFF ON **3** ON ON ON **4** OFF ON ON **5** ON ON OFF **6** OFF ON ON **7** ON OFF ON **8** ON OFF ON 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:Citizen	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* ** character set PC-8 is required.* *PCL3 command:* **esc(10U**

3 Introduction

3.1 Configuration

The 774 Oven Sample Processor must be configured correctly before it is used for the first time. This includes both the basic settings with the oven settings and the configuration of the sample rack and the peripheral devices which are connected. All these settings are accessible via the configuration menu which can be opened with the **<CONFIG>** key. It is arranged in various submenus according to subject. Navigating (selecting the individual settings) in the menu is carried out with the cursor keys (**<↓>**, **<↑>**) and is also possible with the **<HOME>**, **<END>** and **<ENTER>** keys. Submenus and main menus are exited with the **<QUIT>** key. In many menu entries the **<SELECT>** key can be used to select the required entry from a list of entries. These menu items are marked with a colon (:). Further details are given on page 58.

When the configuration has been altered a **RESET** should be carried out with **<CLEAR>** or the oven sample changer should be switched off and on in order to ensure that the alterations become effective.

3.1.1 Basic settings

The basic settings which can be set in the submenu '**>auxiliaries**' include:

- dialog language
- display contrast
- beeper on/off for warnings
- Instrument identifier (instrument name or identification)
- program version
- maximum lift height and way
- beaker sensor on/off.

dialog

The dialog language can be selected from 'deutsch, english, français, español'.

display contrast

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

beeper on/off

With error messages or when a value has been entered and not confirmed with **<ENTER>** (and as a result is not accepted) then an acoustic signal is produced. This signal can be switched off.

device label

In order to be able to identify each particular laboratory instrument unambiguously (required by GLP) the sample changer can be given an 8-character identifier made up of letters and/or numbers. Text input is described on page 59.

program version

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

max. lift way

The maximum lift way is an important safety entry. If a correct entry is made this ensures that the lift with the working head cannot be moved down too far; this could cause damage to the needle or the sample vessel. The lowest lift position to be reached can be entered in mm (measured from the upper stop position).
A convenient way of determining this position is to set the required height manually (normal state) with the **<↓>** and **<↑>** keys. The configuration menu is then opened and the current lift position in the display can be accepted in the menu entry 'max. lift way' with the **<CLEAR>** key.

Important: the entered value only becomes effective after a RESET or when the instrument is switched off and then on again.

beaker sensor

The tower of the 774 Oven Sample Processor is equipped with an infrared-beaker sensor which detects the presence of a sample vial in front of the tower. If the beaker sensor is switched on then this test will be carried out after each MOVE command.
This entry also only becomes effective after a RESET or when the instrument is switched off and then on again.

3.1.2 Oven settings

The basic settings for the oven affect the various temperatures.

initial temperature

Entry of an initial temperature means that the oven is heated up to the set temperature immediately after the 774 Oven Sample Processor is switched on. The initial temperature can also be used as a parameter for the HEATER command. (HEATER:init°C)

max. temperature

The maximum temperature is used as a safety setting. The entered value cannot be exceeded. If the oven reaches the maximum temperature during heating up then an error message is produced and the oven heating is switched off. This emergency stop prevents the sample from being overheated.

temp. correction

The temperature correction allows the temperature control to be adjusted. This can compensate for any temperature difference which may occur between the oven temperature and the sample temperature. The temperature correction has a direct effect on the temperature control. The temperature which is displayed is always the corrected oven temperature.

3.1.3 Rack definitions

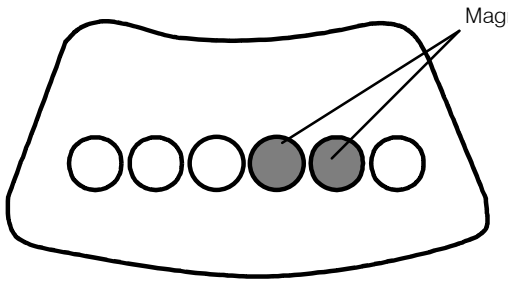
The 774 Oven Sample Processor is supplied with the standard rack for 35 samples. The rack positions for this rack (Rack 1) are already preconfigured. Sample position 36 is reserved for a conditioning beaker.
If different configurations are to be defined for the same type of rack then the individual racks must be allocated different codes and the stud magnets on the base of each sample rack arranged accordingly.
This means that a particular sample rack can be designated for use with a particular application and that the use of the wrong rack can be avoided by the automatic rack code recognition feature.

rack number

Up to 32 different rack configurations can be stored in the sample changer.

rack code

The rack code is used for automatic rack recognition. A particular code can only be issued once. The standard racks supplied by Metrohm are already predefined with a code (see page 90). The rack code consists of a 6-place binary pattern made up of the numbers 0 or 1 which must coincide with the arrangement of the stud magnets. Number '1' stands for an inserted magnet, '0' means that no magnet has been inserted. 63 different codes are possible (000001 to 111111).



base of rack

In this example the code is:

000110

rack type

The rack type indicates an internal table of positions, in which the angles of rotation of the beaker positions are defined. Metrohm racks use the following type name pattern:

MXX-Y (XX = number of sample beakers, Y = special code: 0 for 1-row, 1 for 2-row and 2 for 3-row standard racks)

e.g. M36-0 is a 1-row Metrohm standard rack with 36 sample positions.

work position

The correct setting of the working position is very important. This is the lift height which is to be used with the corresponding sample rack. It should be selected so that the working head is standing in the optimal position. The working position is given in mm (from the upper stop position).
A convenient way of determining this position is to set the required height manually (normal state) with the **<↓>** and **<↑>** keys. This is done by placing a sealed sample vessel on the oven and moving the lift carefully downwards until the needle penetrates the septum and the lower rim of the septum closure coincides with the upper rim of the oven opening.
The keyboard can then be used to open the configuration menu and the current lift position in the display can be accepted in the menu entry 'work position' with the **<CLEAR>** key.

shift position

The sample rack can only be rotated when the lift is at or above the shift position height.
The shift position should therefore be selected so that safe rotation of the sample rack is always possible, i.e. it must be impossible to damage either the needle or the rack when the rack is rotated. Please note that the conditioning vessel is slightly higher than the other sample vessels.
The value can also be entered manually or accepted automatically, as described for the work position - see above.

rinse position

The rinsing position defines a further height setting, which is used for conditioning, i.e. penetration into the conditioning vessel. See the exemplary methods given in the 774 Tutorial.
The value can also be entered manually or accepted automatically, as described for the work position - see above.

special position

The special position can be used to define a further lift height.

No commands are linked with the defined lift positions. In principle they can therefore be used with any lift heights which are to be stored.

special beakers (in sub-menu special positions)

Up to 8 special beaker positions can be defined for each sample rack; in a normal method procedure these are not regarded as sample beakers. Special beakers can be deliberately selected at any time. For example, they can be used as conditioning beakers. See the exemplary methods in the 774 Tutorial.
The special beakers 'Spec.1' to 'Spec.8' can each be allocated a beaker position from 1 up to [number of sample positions]. Position 0 stands for "not defined". Special beakers are preferably set at higher rack positions in order to be able to start the series of samples at position 1. In the standard rack for the 774 Oven Sample Processor position 36 is already defined as a special position for the conditioning vessel and should not be altered.

3.1.4 Dosing units

In order to be able to additionally automate the dosing-in of auxiliary solutions or aspiration from the measuring cell it is possible to connect up to 12 dosing instruments to the 774 Oven Sample Processor via 729 Dosimat interfaces. The 685 Dosimats and 700 Dosinos can be used for this.
The maximum dosing and filling rates as well as the tubing dimensions of the inlet tubing can be defined for each dosing instrument.

dosing unit

Dosing unit for which the parameters are to be entered
(1–12, see page 65f).

max. rate

This value represents the maximum permissible dosing and filling speed (mL/min) of the dosing unit. Depending on the viscosity of the medium to be dosed in, this value should be selected so that as rapid a dosing as possible is selected; however, the buret must still be filled without any problems and free from any air bubbles. The max. rate is an absolute limit; it cannot be exceeded even during manual dosing.

tubing lengths and diameters

These values are only relevant for the 700 Dosino. As this has the ability to prepare the complete tubing system automatically for dosing, i.e. to rinse the tubings and fill them with dosing solution, the particular tubing lengths and (inner) diameters must be entered. The necessary rinsing volumes are then calculated automatically.

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

3.1.5 RS232 interface

Either a printer (for protocolling the instrument settings and methods) or a PC for controlling the Oven Sample Processor can be connected to the RS232 interface.
It is also possible to communicate with other Metrohm instruments (e.g. Coulometer via Metrohm remote control language) and possibly instruments from other manufacturers via the interface.
The necessary transmission parameters which must be matched to those of the instrument to be connected are:

baud rate, data bit, stop bit, parity and handshake.

For data communication with PCs, Metrohm instruments and instruments from other manufacturers the parameter 'Send to: IBM' must be set. The other parameters should remain set to the standard values or the settings should be adapted to those of the corresponding peripheral unit.

Connection of a printer: see page 21.

Data reception can be switched on and off with 'control via RS: on'. If the remote control is switched off then data can no longer be received, but reports can still be printed out.

3.1.6 Lock keyboard functions

Particular areas of the operator dialog can be made inaccessible to untrained operators by locking individual dialog areas or keys. In this way the accidental overwriting of a method or even the alteration of parameters can be prevented.

The menu **'>keyboard options'** for the corresponding functions is opened by holding down the **<CONFIG>** key when the Oven Sample Processor is switched on. Alternatively this can be done by triggering a reset with **<CLEAR>** and then pressing the **<CONFIG>** key within 0.4 seconds. This menu can even be accessed when the complete keyboard has previously been locked.

The individual keyboard areas which can be locked are:

whole keyboard

In routine operation where only a single method is used it may be necessary to prevent manual manipulation. For this reason it is possible to lock (almost) all keyboard keys. The **<START>**, **<STOP>** and **<CLEAR/ RESET>** keys are always accessible so that starting and interrupting methods is always possible. If the Oven Sample Processor is operated with PC software this may also be necessary. In this case it is possible to do without the keyboard and to remove it completely.

'lock keyboard: on' locks all keyboard keys (exceptions: see above).

lock configuration

The basic configuration can be protected against overwriting. All settings of the configuration menu are no longer accessible.

'lock configuration: on' locks the **<CONFIG>** key.

lock parameters

If operator-defined methods are normally used then it may be necessary to ensure that the stored method parameters cannot be altered. The parameter menu can therefore be made inaccessible.

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

lock method memory functions

Preventing the accidental deletion of stored methods makes sense. The deletion of methods should only be possible after deliberately switching off the locking function.

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

'lock method recall: on' locks method loading.
'lock method store: on' locks method saving.
'lock method delete: on' locks method deletion.

lock display

If the Oven Sample Processor is to be operated solely by external control software (see above) then the display for manual operation can be switched off.

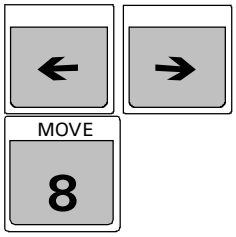
'lock display: on' locks the display.

3.2 Manual operation

As an introduction only those basic manual control functions which are necessary for preparing the sample changer for processing a series of samples are described here.
Only a few keys are required.

For further commands and details please refer to page 61ff and page 74ff.

Shift sample rack / position samples



The **<←>** and **<→>** keys can be used to rotate the sample rack one position to the left (counterclockwise) or right (clockwise).

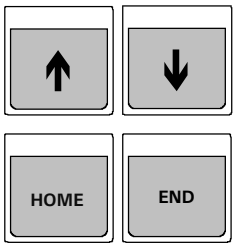
The MOVE function can be used to position a particular sample vessel on the oven. Apart from the numerical rack position, **<SELECT>** can also be used to enter the position defined as the current sample (SAMPLE command) or the special beaker 1 to 8.

Example:

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

Important:
For safety reasons it is only possible to rotate the rack when the lift is at or above the shift position height.

Move lift



The **<↑>** and **<↓>** keys move the lift upwards and downwards respectively. The lowest possible lift position is defined under the configuration parameter 'max. lift way'.

The **<HOME>** key is used to return the lift to the resting position (0 mm), i.e. to the upper stop position.
<END> moves the lift to the predefined working position (see pages 65 and 77).

The LIFT function can be used to move the lift to a particular position. As well as the exact position in mm (0 –100 mm), a previously defined position can be selected with **<SELECT>** (rest pos = 0 mm, working, rinsing, shift pos, special).

Example:

```
LIFT :        work      <ENTER>
LIFT :   shift pos      <ENTER>
LIFT :       50 mm      <ENTER>
```

Set sample position

The SAMPLE function is used to set the current sample position. It defines the first sample beaker for the following series of samples.

Pump / Valve

The FLOW function is used for switching the pump or inert gas solenoid valve on and off. **<SELECT>** is used to select the parameters for this command from the two possibilities. The first parameter of the command defines whether the pump (i.e. air as gas flow) or the solenoid valve for other gases is to be switched on. The current gas flow rate is shown directly in the display .

Example:

```
FLOW:  pump       :   ON
FLOW:  valve      :  OFF
```

<STOP> is used to switch off the pump (or valve) again, provided that nothing else has been defined under 'Manual stop options', see page 74.

Oven control

The HEATER function is used for controlling the oven temperature. The first parameter of the command defines the oven temperature, the second parameter sets the heating-up time, i.e. the time in which the defined temperature is to be reached. If the defined temperature is lower than the current oven temperature then the oven unit will be automatically cooled. The current oven temperature is always shown in the display.

Example:

```
HEATER:init°C        min  (=heat up to initial temperature)
HEATER: 130°C     15 min  (=heat to 130°C within 15 minutes)
```

Dosing units

The DOS function is used to control the connected dosing instruments. Both positive and negative volumes can be dosed.
Apart from entering the volume to be dosed, **<SELECT>** can be used to select additional functions of the particular dosing instrument:

- Filling the cylinder (fill),
- Change dosing unit initialization (change),
- Prepare the tubing system (prepare),
- Empty the tubing system and the cylinder (empty),
- Eject the cylinder contents (eject),
- Adjust, i.e. remove the play between dosing piston and spindle before aspiration or filling the cylinder (adjust),
- Compensate for the play between dosing piston and spindle before dosing (level).

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

Example:

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

Interface monitoring

The SCAN function is used for monitoring the serial RS232 and the remote interfaces. In this way it is possible to check the communication of the 774 Oven Sample Processor with other instruments. The interface can be selected with the **<SELECT>** key and must then be confirmed with **<ENTER>**.
If the Remote interface is selected then the logical condition of input lines 0…8 is displayed as a bit pattern (1=active, 0=inactive). If the RS232 interface is selected then the received character strings are shown.

Example:

```
SCN:Rm          :00000001  (= e.g. Coulometer is 'ready')
SCN:RS                $d  (= status query of Coulometer)
```

Operate interfaces

The CTRL function is used to operate the serial RS232 and remote interfaces. In this way it is possible to check the communication of the 774 Oven Sample Processor with other instruments. It is therefore possible to transmit a remote command as a character string to a connected instrument via the RS232 interface or to individually activate or deactivate remote lines Output 0…13.
The interface can be selected with the **<SELECT>** key and must then be confirmed with **<ENTER>**.
If the RS232 interface is selected then any character string can be entered; this will be transmitted after confirmation with the <ENTER> key.
If the remote interface is selected then a 14-place bit pattern can be defined which then defines the required logical conditions of remote lines 0…14. (1=active, 0=inactive, * =do not alter current condition). The **<SELECT>** key can be used to select predefined bit patterns to cover the most frequently required tasks (see also page 98ff). Setting the lines (static signals) is carried out after pressing the **<ENTER>** key.

Example:

```
SCN:RS                $d  (=status query of Coulometer)
CTL:Rm   :************01  (=start Coulometer or Titrino)
CTL:Rm   : START device1  (=start Coulometer or Titrino)
```

3.3 Methods and Sequences

3.3.1 Designing a method

A method is made up of the following components:

- number of samples to be processed
- run sequences (start, sample and final sequences)
- Definition of the various instrument settings (report definitions, sample changer settings, time-out settings, gas flow settings, dosing unit definitions, manual stop options)

For details about instrument settings please refer to page 67ff.

Sequences

A sequence is a series of commands which are carried out in the defined order when a series of samples is being processed. Functions for controlling the oven temperature, gas flow, lift and for moving the turntable are available. External instruments (titrators, Coulometers, Dosimats, etc.) can be controlled by efficient commands. In a sequence the further settings for the individual instrument components and dosing units (700 Dosino or 685 Dosimat) can also be defined or altered.

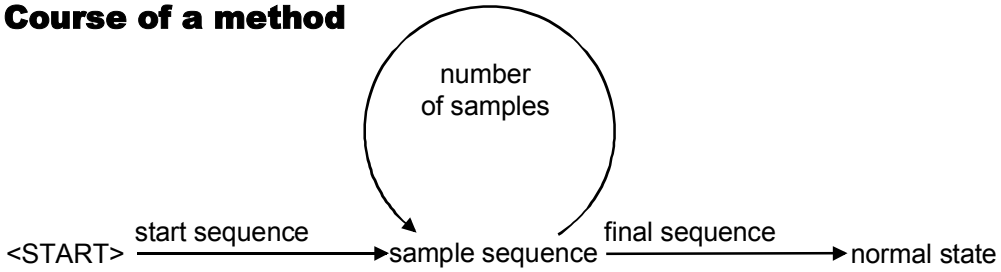
Processing a sample series is carried out in three phases. These are:

Start sequence: Command sequence which is carried out once at the start of the series.

Sample sequence: Command sequence which is carried out for each sample.

Final sequence: Command sequence which is carried out once at the end of the series.

Course of a method



Sequences are created in the submenus '**>start sequence'**, '**>sample sequence**' and '**>final sequence'**; these can be accessed via the parameter menu (press **<PARAM>**).

A sequence is arranged in lines. If a command is entered a new line containing this command will be appended to the line which is currently shown. The line number can be seen in the display. 99 lines are possible per sequence.

A line is deleted by pressing **<DELETE>**. The following lines move up one position.
A new line can be inserted at a later date by using **<INSERT>**. This inserts an empty line before the line which is currently shown. The following lines move down one position.

The commands which are available as a second function on the numeric block of the keyboard can also be used in a command sequence. These are almost the same commands which are used for manual operation. However, in a sequence these may possess other or further selection possibilities.

During the course of a method it is possible to alter all entries in the '**configuration**' and '**parameters**' menus. With a few exceptions (see page 23ff) these alterations directly affect the course of the method.

Care should be taken in making alterations to the method sequences. These can be edited "live" (including inserting or deleting a command line); however, the TRACE and LEARN functions are not available. It is therefore not possible to test out the edited function. This means that it is easy to produce illogical or critical command sequences which create an error situation and compel a sample series to be aborted.

3.3.2 LEARN mode and TRACE function

As when editing a method it is easiest to determine the parameters of a command interactively, i.e. by manual operation, certain commands are "adaptive". When editing a sequence the LEARN mode makes it possible to carry out particular sample changer commands by manual operation. In this way the resulting parameter (e.g. the lift position or the status of the input lines of the remote interface) can be included in the actual command line. The LEARN function can be used repeatedly. If times or volumes are "learned" then this means that the values will always be added together.

Procedure for creating methods:

- Enter a command or select an existing command line
- Press the **<LEARN / HOLD>** key
  - the function starts, the "LEARN"-LED lights up
  - press the **<LEARN / HOLD>** key
  - function is stopped, the "LEARN"-LED blinks
  - use the **<ENTER>** key to accept the value (or start the LEARN function again)
- The "LEARN"-LED goes out, edit the next command line

The LEARN function is available for the following commands:

Command	Adaptive parameter	Type of function
LIFT	Lift position in mm	absolute
WAIT	pause time in seconds	additive
DOS	Dosing volume in mL	additive
SCN Rm	Status of the 8 remote lines	"live" value
SCN RS	Received character string	"live" value

TRACE function

The "TRACE" function is a valuable aid for processing a complete sequence or method, or excerpts, step-by-step for test purposes. Each command line in a sequence can be carried out directly by pressing the **<START>** key. When the action is finished the following command line is displayed. "Tracing" can be used directly after the entry of a command line or at any time after the parameter menu has been opened and a sequence has been selected.

3.3.3 Process control

<START> is used to start a method from the normal state. If not interrupted manually and if no unexpected errors occur the sample series will be processed properly and terminated with the final sequence. The sample sequence is carried out several times according to the entry in 'No. of samples', starting with the sample beaker which has been defined as '**SAMPLE**'.

If the sample series is interrupted with **<STOP>** the Oven Sample Processor immediately returns to the normal state. Unprocessed samples are not taken into account; the final sequence is not carried out. If settings for this occurrence have been entered under '**>manual stop'** then the corresponding actions or commands will be carried out via the interface in order to stop the connected instruments as well or to carry out other actions.

The sample series can also be interrupted with **<HOLD>**. The command which is currently active is immediately terminated. <START> can be used to continue the method with the following command in the sequence which is active. Connected peripheral units are **not** stopped with the **<HOLD>** key. In the 'HOLD' condition the current oven temperature is maintained.

<CLEAR> interrupts a sample series when the currently active sequence has ended (soft termination). The sample which is currently being processed will be processed to the end.

<QUIT> terminates the command currently being carried out and starts the next command line of the sequence.

If errors occur during a sample series then a corresponding **error message** will appear; this must be confirmed with **<QUIT>**. The sample changer then goes to the HOLD status (see above). When the error has been remedied **<START>** can be used to continue or, if necessary, **<STOP>** can be used to terminate the sample series completely.
If the gas flow limits are exceeded or undercut this does not interrupt the method sequence. The gas flow can be corrected manually with the gas flow regulator.

3.3.4 POWER-UP methods

When the 774 Oven Sample Processor is switched on the sample rack and the guide head move to their rest positions. In order to condition the complete carrier gas tubing system when the instrument is switched on a "POWER-UP" method can be used. This method is automatically started when the instrument is switched on.

Create a method containing a command sequence which is to be carried out when the 774 Oven Sample Processor is switched on and save this method under the name "POWERUP" (see page 75).

In the 774 Oven Sample Processor tutorial you will find a list of the exemplary methods stored in the instrument as standard together with comments about them.

4 Oven control and gas flow

In addition to the essential sample changer features, such as rotating the sample rack and raising and lowering the lift, the 774 Oven Sample Processor also has a controllable sample heating block and a gas supply device. This means that it is extremely suitable for applications in which moisture or solvent vapors are to be driven out of a sample at an increased temperature and transferred to a measuring cell in a stream of carrier gas. The 774 Oven Sample Processor together with the Metrohm Coulometer or a Metrohm KF Titrator and the suitable KF measuring cell form the ideal analytical system for the determination of water in samples which cannot be titrated directly or only with great difficulty according to the conventional Karl Fischer method.

4.1 Oven control

The oven heating block of the 774 Oven Sample Processor consists of a solid aluminium block with a chromium steel jacket surrounding the sample chamber. The sample chamber is intended for 22 mm x 38 mm sample vials and allows samples of up to approx. 8 g to be heated up to 250 °C in a very short time. The heating rate is up to 15 °C/min, depending on the temperature range. The built-in fan quickly cools the oven down and supports the accurate temperature control of the oven block.
The temperature control of the oven is functionally separate from the other (sample changer) functions of the 774 Oven Sample Processor, i.e. the set oven temperature remains constant (background control), even when other functions or commands are carried out.

The required oven temperature can be set in three different ways:

- Initial temperature – an **initial temperature** can be set in the configuration menu of the 774 Oven Sample Processor. As soon as the instrument is switched on the temperature control is activated and the oven heats up to the required (initial) temperature. The value of the initial temperature remains stored in the instrument and can be used by the manual HEATER function or the programmable HEATER command.

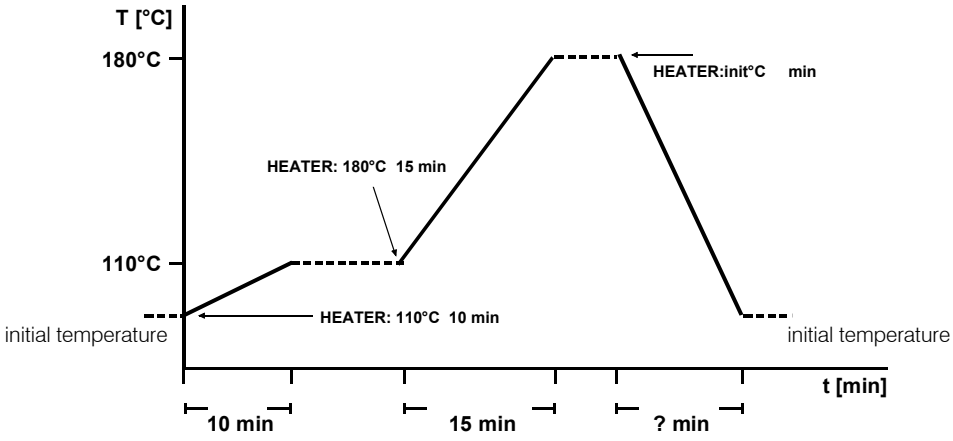
  <CONFIG> key
  Configuration
  >oven settings
  initial temperature 110°C

- Manual HEATER function – the oven temperature can be set manually to any required value. When the **<HEATER>** key has been pressed the required temperature and the duration of the heating-up phase can be entered. If no heating-up time is entered then the full heating power will be used to reach the required temperature as quickly as possible; this temperature is then maintained.

  <HEATER> key
  HEATER: 110°C **10 min** or
  HEATER:init°C **min**

- Programmable HEATER command – the **HEATER command** can be used as a part step in the processing sequence of a method. This means that it is possible to alter the program-controlled oven temperature whenever this is necessary. If the HEATER command is used the heating-up period can be freely selected so that it is possible to carefully warm up a sensitive sample. Temperature profiles or ramps within a sequence can be followed by repeated use of the HEATER command. This allows the realization of complex applications, e.g. the determination of surface moisture and the water of crystallization content of solid samples in the same run.

```
parameters                    Method:
>sample sequence
 1 HEATER: 110°C  10 min   – controlled heat-up (moisture)
...
10 HEATER: 180°C  15 min   – controlled heat-up (water of crystallization)
...
15 HEATER:init°C     min   – rapid cooling to initial temperature
```

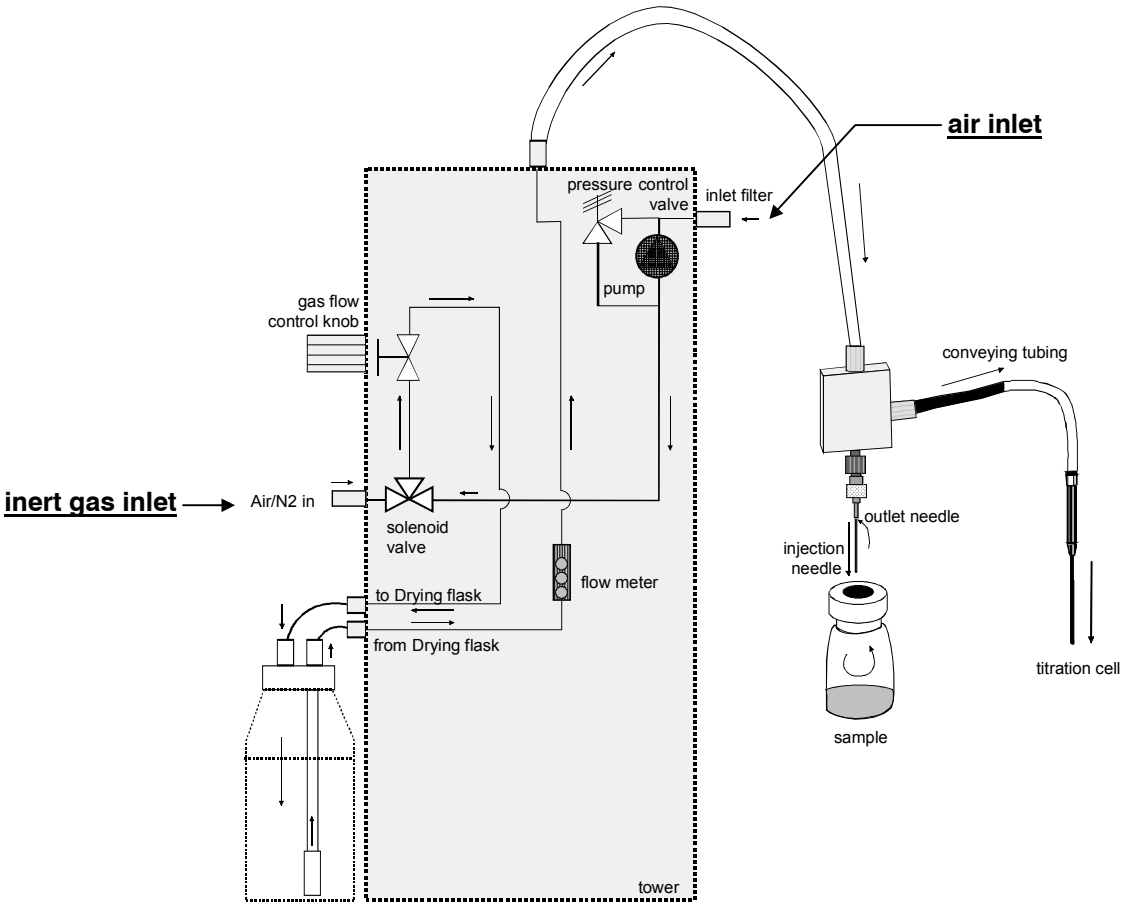


4.2 Gas flow

In order to drive out moisture quantitatively from a sample it is necessary to remove the vapors formed on heating with a stream of gas. This stream of gas is also used to lead the vapors into a reaction solution contained in a measuring cell.

With thermally stable, unproblematic sample substances, such as oils, air can be used as the carrier gas; this can be supplied by the pump built into the tower of the 774 Oven Sample Processor. However, it is necessary to dry the air with a desiccant such as molecular sieve before it can be used. In the Oven Sample Processor tower the flow of air is led through a pressure regulator and a flowmeter. An excess pressure valve ensures a constant overpressure of approx. 60…80 mbar in the tubing system.
With thermally unstable samples or samples which are sensitive to air it is recommended that nitrogen or helium is used as an inert carrier gas. As these gases are available in gas cylinders or pressure lines they can be connected directly to the tower of the Oven Sample Processor via the solenoid valve. A pressure reduction valve must be used to ensure that the gas pressure is less than 1 bar. The required value can also be set here with gas flow regulator.

Gas flow diagram:



left-hand instrument side

The gas flow can be set manually with the help of the gas flow regulator and the flowmeter. The flow rate of the carrier gas is shown on the display in mL/min or L/h so that it is easy to set the required gas flow with the rotary knob of the gas flow regulator. A gas flow of 20 to 100 mL/min is required; this depends on the determination method and moisture in the sample.

Display:

```
******** counter   1/36
110°C  55 mL/min  ready
```

or:
(press <DISPLAY>)

```
gas flow      55 mL/min
heater temp.     120°C
```

The gas flow is monitored automatically. A lower and an upper limit can be defined for the gas flow; if these are undercut or exceeded an error message is displayed. It is recommended that the safety limits (min. flow and max. flow) are not set too closely for gas flow monitoring. A range of approx. 30 mL/min should be set.

During needle penetration and removal the gas flow should be switched off as large variations in gas pressure occur during these processes. This avoids unnecessary error messages.

4.3 KF Moisture determination

The 774 Oven Sample Processor is predestined for Karl Fischer moisture determinations. The oven method is used for those samples in which the direct determination of the water content is either impossible or very difficult. This applies for substances which either directly react with the Karl Fischer reagents or only release their moisture very slowly into the reaction solution because of their insolubility, e.g. plastic granulates or oils.

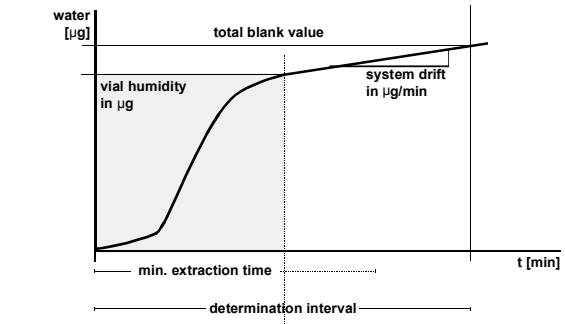
The principle of the oven method with the 774 Oven Sample Processor:

Preparation:

- The samples are weighed into sample vials and tightly sealed with a PTFE-coated septum. The sample weights are entered on the Coulometer or KF Titrator.
- The sample vials are placed on the rack and the sample oven is heated up.
- A sealed but empty sample vial is used as the conditioning vial and is placed in the rack position intended for it.

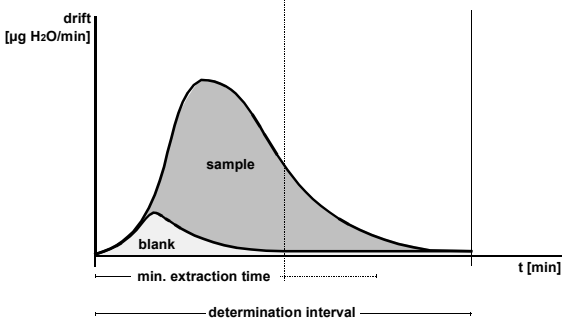
Conditioning and blank determination

- The conditioning vial is moved to the oven and the lift is lowered to the rinsing position. The needle penetrates the conditioning vial septum.
- The gas flow is now switched on in order to purge the complete tubing system and to provide reproducible and constant conditions.
- The measuring cell is now conditioned with a Coulometer or KF Titrator until the reaction medium is sufficiently dry.
- The gas flow is switched off and a blank sample is moved into the oven, the gas flow is switched on again and a blank value determination is carried in order to determine the influence of the surroundings during the heating-up period. The moisture released during a constant heating-up period (similar to the sample heating-up period) or the moisture in the empty sample vessel and the basic drift per unit of time can be determined separately.
- When the determination of the blank value has been completed the reaction medium is reconditioned.



The blank value is made up of the moisture which adheres to the sample vial * and a system drift which is latently present and whose cause can be found in a minimal residual moisture in the carrier gas and possibly leaks in the tubing system.

*The use of pre-dried sample vials has no significant advantages. On the contrary, this causes the reproducibility of the results to be adversely affected.



The accompanying diagram shows the theoretical course of a sample determination with the 774 Oven Sample Processor. It is clear that, in order to determine the amount of water correctly (dark gray area), the blank value must be subtracted from the total amount of moisture determined.

Sample determination

- When the reaction medium has been conditioned fully the gas flow is interrupted, the sample moved to the oven and introduced into the oven block with the help of the penetration needle.
- The gas flow is switched on again and the sample determination started at the Coulometer or KF Titrator. Definition of an extraction time ensures that a minimum determination time and therefore heating period will be observed.
- The driven-off moisture is now transported to the reaction vessel by the stream of gas. The transfer tube heating ensures that no moisture can condense in the tubing.
- When the determination is finished the moisture content of the sample is calculated taking the previously determined blank value into consideration.
- The gas flow is switched off again and the conditioning vessel again move to the oven.
- When the needle has penetrated the conditioning vessel septum the gas flow is switched on again and the reaction medium is conditioned.
- When conditioning has been carried out the next sample can be determined, see above.

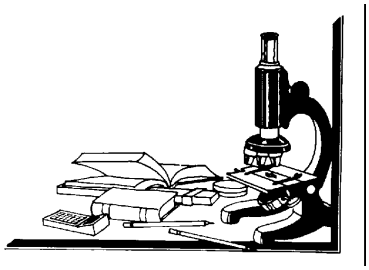
Care must be taken that the septa are still airtight after penetration by the hollow needle and that no moisture can escape. The septum of the conditioning vessel is particularly at risk as it is penetrated many times during the sample series.

Evaluation

The water determination as such can be carried out with a Coulometer or Karl Fischer titrator.

If a Coulometer is used care must be taken that gas flow and oven temperature are selected so that the sample moisture is not driven off too quickly. Otherwise a moisture excess may not be absorbed by the solvent in the Coulometer cell, but condense in the upper part of the cell or even be blown out of the cell. Moisture depots lead significant increase of the measured value drift. Reduced reproducibility of results may occur.

Please note: The measured value of the Coulometer must not exceed 100 mV.

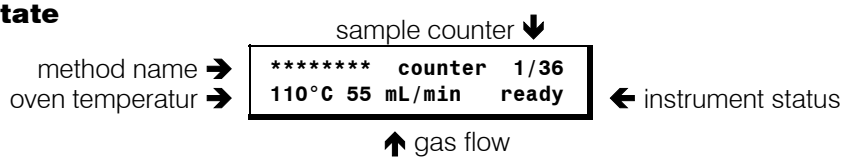


5 Detailed description

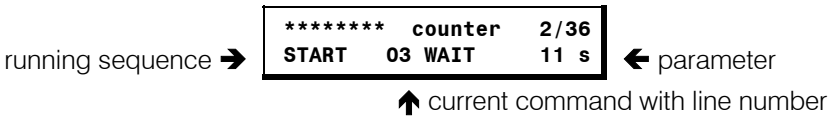
5.1 The display

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.

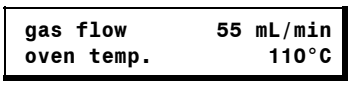
Normal state



Method processing

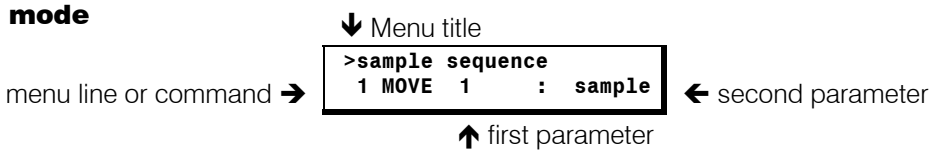


Mesured values

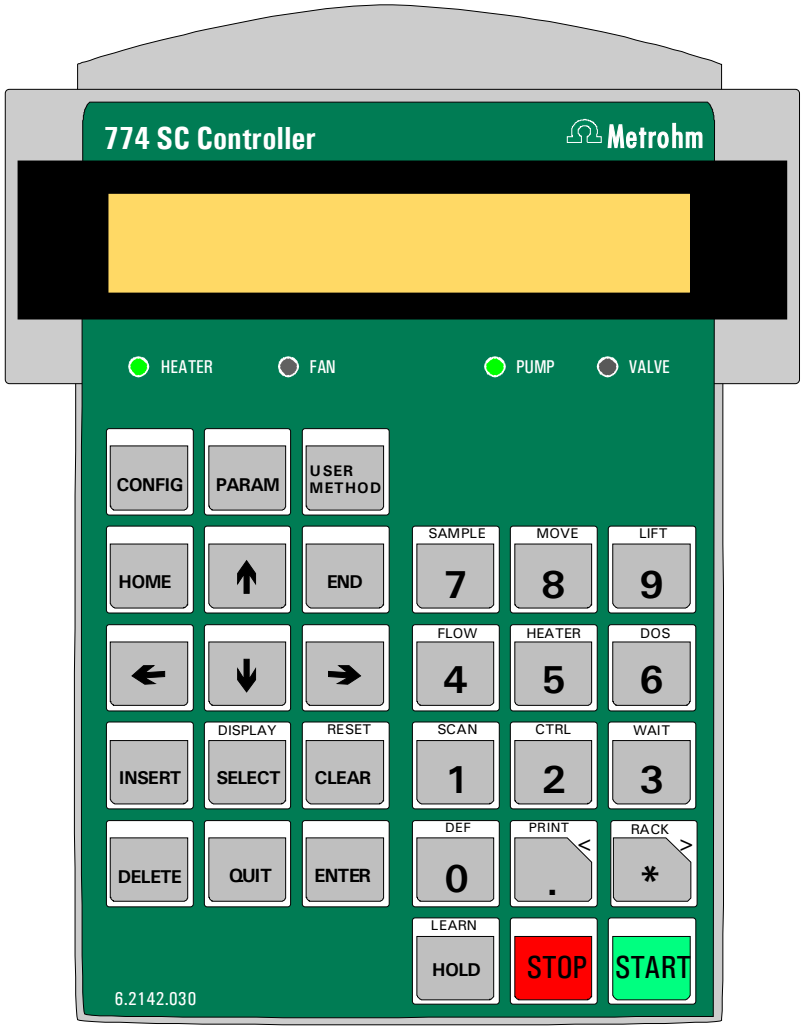


Using key <SELECT/DISPLAY>, you can switch back to measured value display at any time

Edit mode



5.2 The keyboard

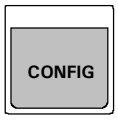
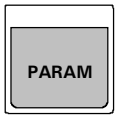


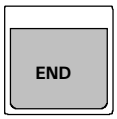
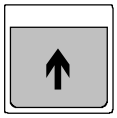
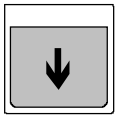
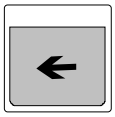
Most of the keys have two functions according to whether the sample changer is in the normal state or in edit mode.

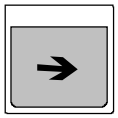
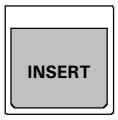
The uppermost row contains the (**<CONFIG>**, **<PARAM>**, **<USER METHOD>**) keys which make the menus accessible. Here with the help of the keys on the left side of the keyboard, you can navigate and change parameters. For the latter, the numerical keypad on the right half of the keyboard is available. 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.

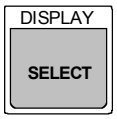
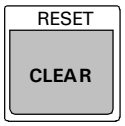
The lowermost row of keys (**<HOLD>**, **<STOP>**, **<START>**) are used for the direct control of method processing.

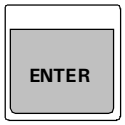
5.2.1 Individual key functions

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 reinitialized.	**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. • The settings in the Parameter Menu also apply to Manual mode.	**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.
	**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.

Key	Normal state	Editing
	**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**".	**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 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.	**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.
	**Run lift downwards** • Run lift 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 counter-clockwise 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 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.

Key	Normal state	Editing
	**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. • 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 is at or above the turning position	**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. • 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 **before 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.

Key	Normal state	Editing
	**Selection of the display mode** • The display can be switched over to display of the measured values (oven temperature and gas flow) with key **<DISPLAY / SELECT>**. Pressing this key again switches back to the previous display mode. This can be done in the basic state and whilst the method is running.	**Select parameter** • With the **<Select>** key given data values can be selected for a particular parameter in manual operation. • 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
	**Abort current command** • Whilst a method is running, you can abort a command currently running with the **<QUIT>** key and continue with the next command. This is practical if a programmed waiting time is to be shortened or, in the case of a SCAN command, the expected signal cannot be recorded. **Quit error messages** • **<QUIT>** acknowledges error messages. During method processing the sample changer goes into the 'HOLD' state after this. After this, you can continue with the next command line with **<START>** or stop the sequence with **<STOP>** • The command at which the error message occurred is always continued (in Manual mode).	**Abort Entry** • The **<QUIT>** key interrupts the entry of a parameter. The original entry is reset. • The next highest menu level or the normal state is selected. • Any changed data of a menu or command line is not adopted in this case. This is signalled by a beep. See **<ENTER>** key. • **<QUIT>** acknowledges error messages.
		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.

Key	Normal state	Editing
	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.
	**Position vial** • Turn the sample rack to position the described vial under the lift. In addition to the predefined sample vials, the eight rack-specific special positions 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 vial** • Turning the sample rack to position the described vial under the current lift. In addition to the predefined sample vials, the 8 rack specific special positions 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.
	**Positioning the lift** • Raises or lowers the lift to a predefined position. These positions (shift position, work position, …) can be defined in the Configuration Menu as rack-specific. • An absolute lift position in mm can also be given.	**Numerical Entry ('9')** or **Lift positioning** • The lift can be run to the predefined positions (work position, shift position, …) in a sequence. • An absolute lift position in mm can also be entered.

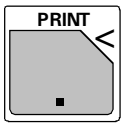
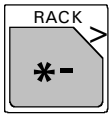
Key	Normal state	Editing
	**Activating/deactivating gas flow** • Key **<FLOW>** is used to activate resp. deactivate the air pump or the solenoid valve (Air/N_2 in). • The first parameter serves to select pump or valve. The second parameter defines status 'On/Off'. The function must be confirmed with **<ENTER>**.	**Numeric entry ('4')** or **activate/deactivate gas flow** • The FLOW command serves to activate resp. deactivate the air pump or the solenoid valve (Air/N_2 in). • The first parameter serves to select pump or valve. The second parameter defines status 'On/Off'.
	**Oven control** • Key **<HEATER>** serves to set the current oven temperature. • The first parameter defines the oven temperature. With the second parameter, it is possible to achieve a slow, time-controlled heating-up process to the set target temperature. You can set a time interval within which the target temperature should be reached. The function must be confirmed with **<ENTER>**.	**Numeric entry ('5')** or **oven control** • The first parameter defines the oven temperature (target temperature). • Using the second parameter, it is possible to program temperature ramps or (by combining several HEATER commands) entire temperature profiles. The heat-up interval defines the period within which the set target temperature should be reached.
	**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 -'prepare', 'release, 'empty' and 'release'- 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 or release of the exchange unit.

Key	Normal state	Editing
SCAN 1	**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 are on page 78ff. • If the serial RS 232 interface (RS) is selected, the character string being received, is displayed line by line (14 characters). Details relating to this are on page 96ff.	**Numerical entry** 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 RS 232 interface) is received. • Predefined bit patterns are available for the remote interface and can be selected via simple short-names (for ex. “ready1” or “end1”). • Character strings consisting of 14 ASCII characters may be defined with the RS 232 interface. Use text edit mode.
CTRL 2	**Interface control** • Controlling of external instruments via the remote and RS 232 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 RS 232 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 device1", "STOP instr.1" etc.).	**Numerical entry** or **Interface control** • Setting the 14 signal lines of the remote interface or sending a character string via the RS 232 interface to control instruments connected. • Predefined bit patterns are available for the remote interface and can be selected via simple short-names (for ex. “START instr.1” or "STOP device2"). • Character strings consisting of 14 ASCII characters may be defined with the RS 232 interface. Use text edit mode.

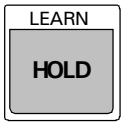
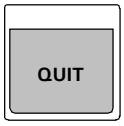
Key	Normal state	Editing
	Parameters for the RS 232 interface • Character string with up to 14 alphanumerical characters. Default value: "&M;$G", may be set with **<CLEAR>**. Most Metrohm instruments can be controlled with such remote control commands, see pages 101ff.	
		**Numerical entry ('3')** or **Define waiting time** • Waiting for a certain time interval to elapse.
	**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** 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.

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.
 **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 oder Dosino). • Syntax: FILLRATE [Dosing unit] [Filling speed]
 **LIFTRATE**	**Change lift speed** • The lift speed can be set at will. • Syntax: LIFTRATE [Tower] [Lift speed]

Key	Normal state and Editing
 **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 vial 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), Empty (Empty) or Prepare (Prep). • 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 unter "**>RS232 Settings**".	**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 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 60.
	**Initialise sample rack** • The changer can be initialised with key **<RACK>**. The connected peripherals (e.g. Dosimats or Dosinos) are not affected by this. • Once a method has been loaded, it is retained. Sample rack and lift are moved to initial position and automatic rack detection is performed. The rack can be removed in the basic 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, ie. the text cursor is shifted one place to the right for each instance. See page 60f.

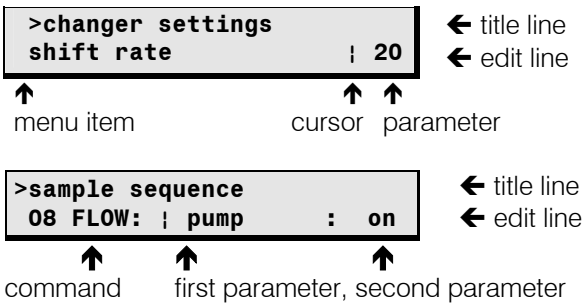
Key	Normal state	Editing
	**Start a Method** • The **<START>** key starts a method. Starting is only possible when the 774 Oven Sample Processor is in the normal state, i.e. when 'ready' is shown in the display. • When starting a sample series, the sample counter is set to 0. • When **<START>** is pressed 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").
	**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 74). In addition, you can define whether the oven heater and the pump (resp. the solenoid valve) are to be switched off or not. • During a manual halt of a sample series with **<STOP>**, the end sequence of the method will not be executed. • The manual stop options 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, SCN, WAIT • See page 34 also.
	**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 state). Afterwards **<START>** can be used to continue with the following command line or **<STOP>** will halt processing. **Interrupt processing of current command line** • During the processing of a method **<QUIT>** stops a running command and continues with the next command. This is useful when a programmed waiting time is to be shortened or when the expected signal cannot be received during a SCAN command.	**Interrupt, 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.

5.2.2 Data entry

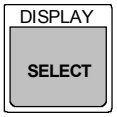
Edit line

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.



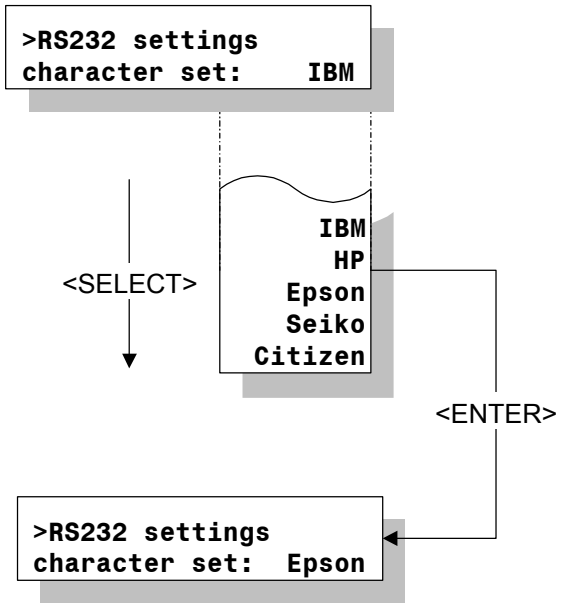
The cursor keys, **<➔>** and **<🡐>**, can be used to switch between the parameters. Pressing **<ENTER>** shifts the cursor automatically to the right, pressing **<QUIT>** correspondingly to the left.

<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.

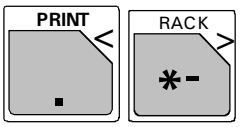
Example:



5.2.3 Text Entry

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

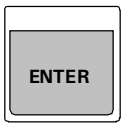
Numbers can be entered directly via the keyboard.



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).

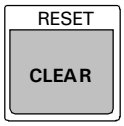
Character selection

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.



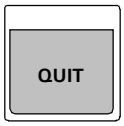
Confirmation of the character selection

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

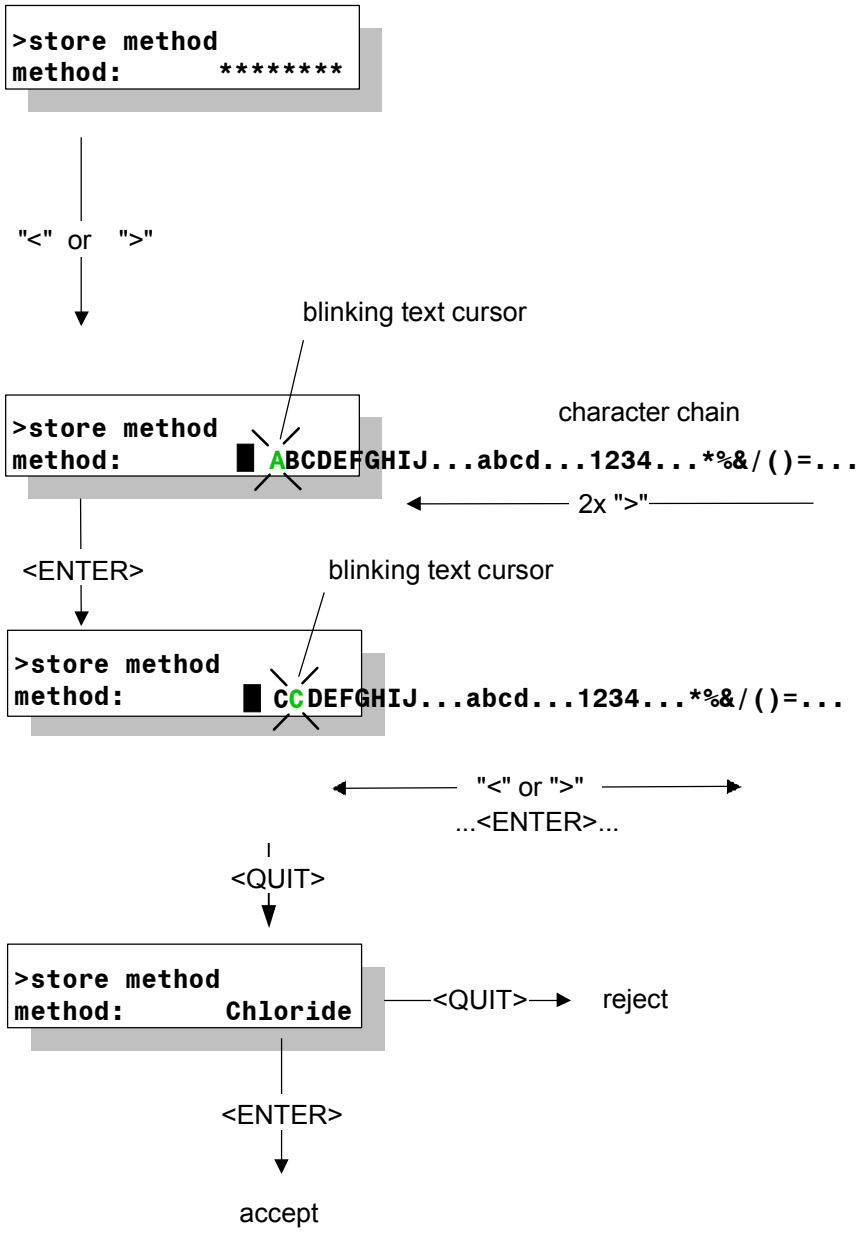
The **<CLEAR>** key deletes the last character of the existing text line. The text cursor automatically shifts one character to the left.



Exit text entry

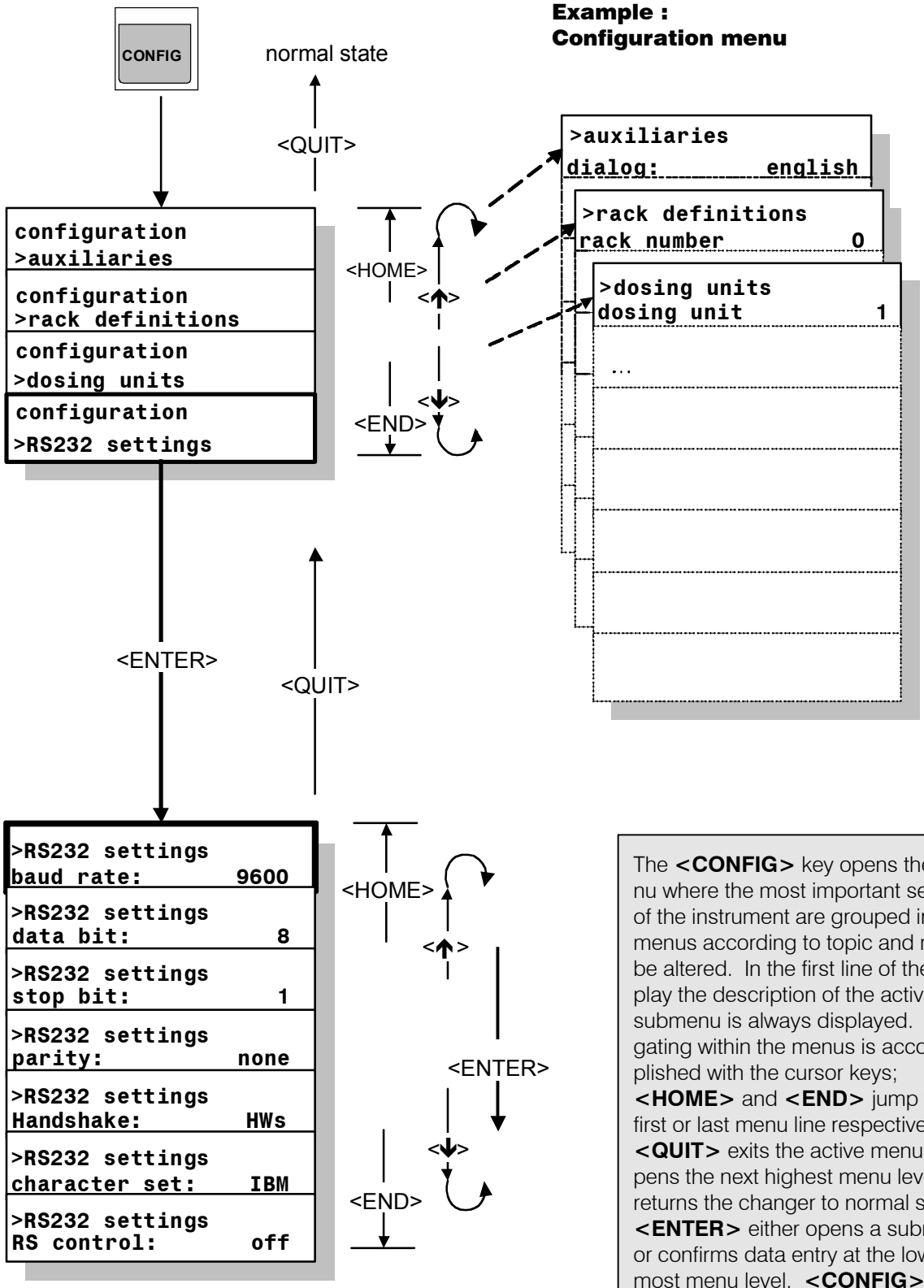
With **<Quit>** text edit mode is exited. The text line displayed can be accepted with **<ENTER>** or rejected by pressing **<QUIT>** a second time.

Scheme:

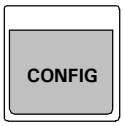


An entire text line can be entered in this way, for example, for the naming of a method. Text editing can be ended with **<QUIT>**. The text line will be displayed in its entirety and can be accepted with **<ENTER>** or rejected with **<QUIT>**.

5.3 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 **<↓>**.



5.3.1 Configuration

Main Menu:

configuration **>auxiliaries**
configuration **>oven settings**
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 higher level

>auxiliaries
dialog: english

english, deutsch, français, español

Choice of dialog language

>auxiliaries
display contrast 3

0…3…7

Setting display contrast

0 = no contrast
7 = large contrast

>auxiliaries
beeper: ON

ON,OFF

Turn acoustic warning signal on or off

>auxiliaries
device label ******

8 ASCII characters

Instrument label

>auxiliaries
program 5.774.0010

read only

Program version

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

>auxiliaries
max. lift way 90 mm

0…**90**…100 mm

Max. stroke path for lift

This setting of the max. lift path is **important** as regards safety. Correctly entering this value can prevent the puncture needle breaking off since the lift cannot be moved lower than as far as the specified position.

```
>auxiliaries
beaker sensor:          ON
```

ON,OFF

Activate or deactivate beaker sensor

configuration **>oven settings**	Submenu of oven settings Open submenu with <ENTER>

```
>oven settings
initial temp.:       OFF °C
```

OFF, 50…250 °C

Setting the initial temperature of the oven after switching on

OFF = Do not switch on oven heater

Use <QUIT> to access next higher level

```
>oven settings
max.temperature      275 °C
```

50…275 °C

Maximum possible temperature (overheating safeguard)

```
>oven settings
temp.correction        0 °C
```

-10…**0**…10 °C

Correction value for heater control

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. 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.

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

6 Bits

Identification code of the rack

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

```
>rack definitions        1
type :               M36-0
```

M36-0…

Type description of the rack
See p. 88ff.

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

>rack definitions 1 **work position 0 mm**	Working position of the lift (in mm from the upper stop)
0…100 mm	*The working position is used for sample determinations*

Pressing <CLEAR> directly accepts the current lift position.

>rack definitions 1 **rinse position 0 mm**	Rinsing position of the lift (in mm from the upper stop)
0…100 mm	*The rinsing position is used for the conditioning vessel*

Pressing <CLEAR> directly accepts the current lift position.

>rack definitions 1 **shift position 0 mm**	Shifting position of the lift (in mm from the upper stop)
0…20 mm	

Use <QUIT> to access next higher level

Pressing <CLEAR> directly accepts the current lift position.

>rack definitions 1 **spezial position 0 mm**	Special position of the lift (in mm from the upper stop)
0…100 mm	

Pressing <CLEAR> directly accepts the current lift position.

>rack definitions 1 **>>special positions**	Special positions submenu Open with <ENTER>

Position of special beaker 1

>>special positions **special beaker 1 36**	
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 on page 87ff.

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

>dosing units **dosing unit 1**	Select the dosing unit (700 Dosino or 685 Dosimat)
1…12	

The address of the dosing unit (see p. 19) 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 (depends on burette size)

use <QUIT> to access the next highest level

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

0, 1**000**, 30000 mm

Length of the tubing on Dosino port 1

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

0.1…**2.0**…20 mm

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 (dependends on burette size)

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

Enter the tubing diameter 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>

```
>RS232 settings
Baud Rate:              9600
```

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

Transmission speed in baud

```
>RS232 settings
data bit:                  8
```

7,**8**

Number of data bits

```
>RS232 settings
stop bit:                  1
```

1,2

Number of stop bits

```
>RS232 settings
parity:                 none
```

even, odd, **none**

Parity selection

use <QUIT> to access the next highest level

```
>RS232 settings
handshake:               HWs
```

HWs,HWfull,
SWchar,SWline,
none

Handshake selection

```
>RS232 settings
character set:           IBM
```

IBM,HP,Epson,
Seiko,Citizen

Character set for printer or PC

The settings for the printers recommended by Metrohm are listed on page 20f. For printers not listed, the setting “Epson” is recommended.

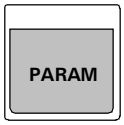
In any case the printer handbook should be consulted. For data transfer with personal computers, “IBM” must be chosen.

```
>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.



5.3.2 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,***	rack *	= one entire rotation of the 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). 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 <RACK> key.

parameters **>start sequence**	Open the submenu with <ENTER>
parameters **>sample sequence**	Use <↑> or <↓> to move up or down one menu item
parameters **>final sequence**	Use <HOME> or <END> to move to first or last menu item respectively
parameters **>report**	Return to the normal state with <QUIT>
parameters **>changer settings**	
parameters **>timeout settings**	
parameters **>gas flow**	
parameters **>dosing unit def.**	
parameters **>manual stop**	

Submenus:

Up to 99 lines can be entered as a sequence in submenus '>Start Sequence', '>Sample Sequence' and '>Final Sequence'. The commands can be entered directly on the keyboard. The command keys arranged at the right-hand half of the keyboard are available.

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

The sequence entered here is **run once** when a sample series is started. This may be used to process blind samples for instance.

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

This sequence is run when processing **each individual sample** of a series.

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

This sequence is **run once** at the end of a sample series. This may be re-setting of the sample rack for instance.

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 33.

Furthermore the **TRACE** function can be used to execute every command line step by step. See page 34.

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 >report	Submenu for report type definition Open the submenu with <ENTER>

```
>report
report:                none
```

Setting of the report type

none	= No report output
fulll	= Output of the oven temperatures
short	= Short result report
config	= Listing of the device configuration
param	= Method listing
usermeth	= List of all stored methods
all	= Printout of all above reports

When selecting a result report (full or short), a separate report is printed out for each sequence (start, sample and final sequence).

```
>report
rec. interval          10 s
```

1…**10**…60 s

Time interval for recording the oven temperatures

Maximum 400 temperature values (measurement points) can be recorded per sequence. This results in a maximum recording time of approx. 6…7 hours in the case of one measuring report per minute. The recording starts at the start of a sequence in each case.

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

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

0…16

The rack that is assigned to the method

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          12 mm/s
```

3…**12** mm/s

Stroke speed of lift 1

```
>changer settings
lift rate 2          12 mm/s
```

3…**12** mm/s

Stroke speed of lift 2

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

3…**20**

Turning speed of the rack in angular degrees/second

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

+, -, **auto.**

Turning direction of the rack

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

>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 currrent 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 **>timeout settings**	Submenu for actions in the case of timeout statuses Open the submenu with <ENTER>

>timeout settings **HEATER timeout: 20 min**	Waiting time if a set target temperature is not reached (see below)

OFF, = Do not trigger timeout

0…**20**…100 min (<SELECT> key)

>timeout settings **on HEATER timeout: STOP**	Response to a HEATER timeout

STOP = The sequence is aborted

cont. = The next command is executed

A HEATER timeout is triggered if the target temperature cannot be reached within the defined heating interval when executing a HEATER command. This may be the case if the heating interval has been selected too short and the maximum heating rate of 15 °C/min is adequate.

The timeout time starts after expiry of the heating interval. After the timeout time has also expired, the sequence of the method is aborted or the system continues with the next command of the sequence, depending on the setting above.

>timeout settings **SCAN timeout: 20 min**	Waiting time if an interface signal is not received (see below)

OFF, = Do not trigger timeout

0…**20**…100 min (<SELECT> key)

>timeout settings **on SCAN timeout: error**	Response to a SCAN timeout

error, = Trigger error message

cont. = The next command is executed

A SCAN timeout is triggered if the interface signal is not received immediately when executing a SCAN command. This is normally the case if a connected device is performing a determination and the 774 Oven Sample Processor is to wait for the end of the determination. The SCAN command intercepts the

'EoD' (End of Determination) pulse at the remote link. The SCAN timeout defines the maximum permitted duration of a determination in this case.

The timeout time starts directly on activation of the SCAN command. After the timeout time has expired, an error message is displayed and the sequence of the method is aborted (HOLD status) or the system continues with the next command of the sequence, depending on the setting above.

Parameter >gas flow	Submenu for gas flow settings Open the submenu with <ENTER>

```
>gas flow
unit gas flow:        mL/min
```

mL/min, L/h

Selection of the unit for display of the gas flow rate

```
>gas flow
min. flow          0.0 mL/min
```

0,0…999 mL/min

Lower warning limit of flow rate

```
>gas flow
max. flow          900 mL/min
```

0,0…**900**…999 mL/min

Upper warning limit of the flow rate

```
>gas flow
gas type                  air
```

air,N2, other

Selection of the carrier gas

```
>gas flow
gas flow factor             1
```

0,001…**1**…9,9

Correction factor for gas flow measurement in the case of 'other' gases

Carrier gas:	**Factor:**
Argon	1.456
Methane	0.717
CO_2	0.738
Natural gas	0.681
Helium	1.456
N_2O	0.666
Oxygen	0.992
Propane	0.357

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

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

Select dosing unit

1…12

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

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

Set the dosing speed

0.01…**160** ml/min, max.

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

Set the filling speed

0.01…**160** ml/min, max.

The following entries are only valid for 700 Dosinos. For details about Dosinos and dosing units, see page 92ff.

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

Define dosing outlet

1…4

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

Define filling inlet

1…**2**…4

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

Define rinsing inlet (when changing dosing units)

1…**2**…4

```
>dosing unit               1
preparation           port  2
```

Define inlet for the preparation cycle

1…**2**…4

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

Define air inlet for emptying

1…**4**

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

The following entries define the commands to be executed when the <STOP> key is pressed. This allows connected peripherals to be stopped automatically or the functions of the 774 Oven Sample Processor to be reset.

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

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

Signal output via remote interface

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

14 ASCII characters

Data to be transmitted via RS 232 interface

Clear value '&M;$S'

```
>manual stop
FLOW:                cont.
```

cont., OFF

Leave gas flow unchanged or deactivate it

```
>manual stop
HEATER:            INIT °C
```

INIT, OFF,
50…250 °C

Set oven heater to specific temperature or switch it off

5.3.3 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.

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.

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>

5.4 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 31ff.
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
           1        sample,
                  spec.1…8
                    1…999
```

Beaker positioning / Turn rack

The first parameter of this command defines the destination of the rack's MOVE command. Since the 774 Oven Sample Processor is euipped only with Lift 1, it is not practical to enter any other value at this point.

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

During method processing a MOVE command can run the lift 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 vial in the rack position chosen, this is recognized by the beaker sensor.

The changer reaction to a missing vial 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 70. If a special beaker is missing, processing is always halted.

LIFT


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

1 work, rinse, shift, special, **rest**, 0…100 mm

Positioning the lift

The first parameter of this command defines the lift on which the command is to be executed. Since the 774 Oven Sample Processor is equipped only with Lift 1, it is not practical to enter any other value at this point.

Raising or lowering of the lift to a defined position. Work and shift position are rack-specifically defined in the Configuration Menu under "**>rack definitions**". See also page 64. 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 lift i.e. the upper stop. The lift can also be precisely positioned to the millimeter. The LEARN function is also available for this purpose. See also page 34.

FLOW


```
>sample sequence
 4 FLOW:  pump    :   ON
        pump,          ON,
        valve          OFF
```

Gas flow control

The FLOW command can be used to activate resp. deactivate the pump (air) or the solenoid valve (inert gas input). The first parameter is used to select pump or valve.

The flow rate of the carrier gas stream can be controlled in both cases with the flow controller on the left-hand side of the tower of the 774 Oven Sample Processor. The flow rate is measured and monitored electronically. If the limits set in the methods are overshot or undershot, an error message is displayed.

You should avoid switching on pump and valve since, otherwise, constant gas flow cannot be guaranteed.

HEATER


```
>sample sequence
 5 HEATER:INIT°C     min
      INIT, OFF      blank
         50…250      1…999
```

Oven control

press <CLEAR> for 'blank'

The HEATER command defines the oven control. The first parameter sets the target temperature and the second parameter determines the time interval in which the target temperature is to be reached.

A specific value in the above-specified range can be selected for the target temperature. If you always work with the same temperature, it is advisable to set an initial temperature to which the system is heated as early as starting in the configuration of the 774 Oven Sample Processor. In the method, you can then select the initial temperature with parameter 'init'. The oven heater is switched off if 'off' is the first parameter.

Using the time interval as the second parameter, you can modify the heating rate in order to program temperature ramps or entire temperature profiles (with several HEATER commands). A blank entry for the heating interval results in heating at the maximum possible heating rate (up to approx. 15°C/min in the temperature range <150°C). Entering a defined heating interval results in slower but controlled heating so that the oven reaches the target temperature precisely in the specified time. Should it not be possible to reach the target temperature in the specified time interval (note maximum heating rate, see above), a HEATER timeout is triggered. In the Parameter menu, you can define, under '**>Timeout Settings**' (see Page 71) how the system is to react if a timeout occurs. It is advisable to select a timeout time (additional time tolerance) of a few minutes.

The HEATER command causes a delay in the method run until the oven has reached the set target temperature or, if applicable until the timeout has expired. The next command in the sequence is then executed.

DOS


```
>sample sequence
06 DOS   1  :        1 ml
     1…12,*           fill,
                   release,
                   prepar.,
                     empty,
          0.001…1…999.999 ml
```

Dosing Control

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.

fill	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.
prep	Preparation cycle for Dosinos. All tubing is rinsed and filled completely.
empty	Empty burette of the Dosino via dosing port.

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 info about Dosino commands and port assignments is found on page 91ff.

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

SCAN


```
>sample sequence
 7 SCN:Rm       :  Ready1
     Rm,RS          Ready1  = device 1 ready
                      End1  = EOD pulse of device 1
                   Cond ok  = device conditioned
                  Cond 737  = Coulometer 737 conditioned
                  no error  = no error status

            8 Bit (1,0 or *)  any 8-bit pattern
```

Scanning the remote interface

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 "End1").

"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 34.
Details about the remote interface are found on page 97.

SCAN
1

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

= scan for "Ready" status message
arbitrary series of 14 characters

Scanning the RS232 interface

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 RS 232 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 66).

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.
CTL command, see below.

With the LEARN function transmitted data (=character strings) can be taken over interactively. See page 34.

CTL

CTRL
2

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

Setting the remote lines

```
        Rm   START device1   = start instrument 1
               START Dos1    = start Dosimat on instrument 1
             STOP device1    = stop instrument 1
                START 737    = start Coulometer 737
                     ENTER   = simulate <ENTER> key
                      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 "ENTER").

"START device1" 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). "ENTER" simulates pressing of the **<ENTER>**key of a Coumeter or Titrino. "INIT" resets all output lines of the Remote socket to 0 (zero).

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 96ff.

CTRL
2

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

Data communication via the serial RS 232 interface

```
        RS
          Clear value: &M;$   = 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 RS 232 interface are in corespond to those of the connected instrument (see Configuration Menu '**>RS232 settings**', page 66).

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

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 AutoInfo 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 “Operation via the RS 232 interface" (page 99) or in the instruction manual of your instrument.

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

WAIT

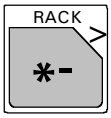

```
>sample sequence
11 WAIT                1 s
```

Waiting time

0…1…9999 s

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

RACK




```
>final sequence
 1 RACK
```

Reset sample rack

The RACK command serves to reset the sample rack. The lift is moved to initial position and the rack is turned to the basic position so that it can be removed.

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
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
12 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  12 mm/s
```

1 3…**12** mm/s

Lift rate

The first parameter of this command defines the lift on which the command is to be executed. Since the 774 Oven Sample Processor is equipped only with Lift 1, it is not practical to enter any other value at this point.

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

auto.,**+**,**–** 3…**20** w/s

Turning direction and speed

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.

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

Port assignment for the 700 Dosino

```
          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 :	Tubing will be filled from this port during a preparation cycle. The rinsing volume will be ejected via the dosing port.
empty :	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.

5.5 Printing reports

You can have reports printed out directly by the 774 Oven Sample Processor for documentation purposes. However, this does necessitate connecting a printer with serial port to the RS232 socket. This means that no direct RS232 connection to a Metrohm Coulometer 756 is possible. Please refer to Page 20f for details of how to connect and configure a printer.

The available reports 774 Oven Sample Processor are as follows:

- **Full result report**
  — Comprehensive listing of oven temperatures, gas flow rates and error list
- **Short result report**
  — Short listing of the oven temperatures and gas flow rates
- **Configuration report**
  — Listing of all configuration entries
- **Parameter report**
  — Listing of all parameters of a method
- **User method report**
  — Listing of the names of all stored methods

Examples of the reports:

Short result report

```
 'sr                                          ← Report identification ('sr = short report)
774 Oven Sample Proc. 0130/03 5.774.0010      ← Report title with device number and program version
  run number                 1                ← Sample number
  method               756Pump                ← Method name
  oven temp.             120.0 °C             ← Mean oven temperature
  lowest temp.           120.1 °C             ← Minimum oven temperature
  highest temp.          124.8 °C             ← Maximum oven temperature
  mean gas flow           59.0 mL/min         ← Mean gas flow rate
         ============
```

The values listed each refer to the part-sequence currently being processed or processed last (start sequence, sample sequence or final sequence) of the method.

Full result report

```
 'fr                                          ← Report identification ('fr = full report)
774 Oven Sample Proc. 0130/03 5.774.0010      ← Report title with device number and program version
  run number                 1                ← Sample number
  method               756Pump                ← Method name
  oven temp.             120.0 °C             ← Mean oven temperature
  lowest temp.           119.7 °C             ← Minimum oven temperature
  highest temp.          122.7 °C             ← Maximum oven temperature
  mean gas flow           59.0 mL/min         ← Mean gas flow rate
  lowest flow             56.7 mL/min         ← Minimum gas flow rate
  highest flow            61.7 mL/min         ← Maximum gas flow rate
  smpl heating time        226 s              ← Dwell time of sample in oven
>error list
     11 s   * gas flow too low                ← List of errors which have occurred
>table      time   temperature
```

```
  0 s      120.9 °C
 10 s      121.9 °C
 20 s      122.7 °C
 30 s      121.9 °C
 40 s      120.7 °C
 50 s      120.5 °C
 ...        ...
350 s      121.1 °C
360 s      121.1 °C
370 s      120.7 °C
============
```

← Oven temperatures, intervals in accordance with 'recording interval'

The values listed each refer to the part-sequence currently being processed or processed last (start sequence, sample sequence or final sequence) of the method

Configuration report

```
 'co                                    ← Report identification ('co = configuration report)
774 Oven Sample Proc. 0130/03 5.774.0010 ← Report title with device number and program version
configuration
>auxiliaries
  dialog:             english
  display contrast          3
  beeper:                  ON
  device label         M774-1          ← Freely selectable ID designation for the device
  program          5.774.0010          ← Release number of the device software (cannot be
  max. lift way             90 mm      changed)
  beaker sensor:            ON
>oven settings
  initial temp.:          OFF °C
  max.temperature         275 °C
  temp.correction           0 °C
>rack definitions
  number  code    type
  1       000001  M36-0
  work position             88 mm      ← Default settings of the standard rack
  rinse position            48 mm
  shift position             0 mm
  special position           0 mm
  position special beaker 1...8
  36  0   0   0   0   0   0   0
>dosing units                            ← Reserved special positions (conditioning vessel at 36)
  default values
     tube  max.rate    length   diameter ← Standard definitions for a connected Dosino
     1      160 mL/min  1000 mm 2.0 mm
     2      160 mL/min   250 mm 2.0 mm
     3      160 mL/min  1000 mm 2.0 mm
     4      160 mL/min    30 mm 2.0 mm
  changed values
  no tube  max.rate    length   diameter
>RS232 settings
  baud rate:              9600
  data bit:                  8
  stop bit:                  1
  parity:                 none
  handshake:               HWs
  character set:           IBM
  RS control:               ON
          ------------
```

Parameter report / method

```
 'pa                                    ← Report identification ('pa = parameter report)
774 Oven Sample Proc. 0130/03 5.774.0010 ← Report title with device number and program version
parameters
  method              756Pump           ← Method name
  number of samples:     rack           ← Scope of sample series
>start sequence                         ← Command sequence run once prior to sample series
   1 CTL:Rm:              INIT
   2 MOVE  1     :     spec.1
   3 CTL:Rm:    START device1
   4 HEATER:INIT°C            min
   5 LIFT: 1  :         rinse mm
   6 FLOW:   pump   :      ON
   7 WAIT                 300 s
   8 SCN:Rm      :    Cond ok
>sample sequence                        ← Command sequence for each individual sample
   1 MOVE  1     :     spec.1
   2 LIFT: 1  :         rinse mm
   3 FLOW:   pump   :      ON
   4 WAIT                  30 s
   5 SCN:Rm      :    Cond ok
   6 WAIT                  60 s
   7 SCN:Rm      :    Cond ok
   8 FLOW:   pump   :     OFF
   9 SCN:Rm      :   no error
  10 CTL:Rm:    START device1
  11 MOVE  1     :     sample
  12 LIFT: 1  :          work mm
  13 FLOW:   pump   :      ON
  14 SCN:Rm      :       End1
  15 FLOW:   pump   :     OFF
  16 WAIT                   5 s
>final sequence                         ← Command sequence run after the sample series
   1 RACK                               ← Rack reset
>report                                 ← Type of report
  report:                none
  rec. interval            10 s
>changer settings                       ← Changer settings
  rack number               0
  lift rate 1              12 mm/s
  lift rate 2              12 mm/s
  shift rate               20
  shift direction:      auto.
  on beaker error:       MOVE
>timeout settings                       ← Definition of behaviour in the case of exceptional states
  HEATER timeout:          20 min
  on HEATER timeout:     STOP
  SCAN timeout:            20 min
  on SCAN timeout:      error
>gas flow                               ← Parameters for the carrier gas stream
  unit gas flow:       mL/min
  min. flow                50 mL/min
  max. flow               100 mL/min
  gas type:                air
>dosing unit def.
>manual stop                            ← Behaviour in the event of manual method abort
  CTL Rmt:     **************
  CTL RS232:
  FLOW:                   OFF
  HEATER:                INIT °C
          ------------
```

See the Tutorial for further method listings.

Method memory report

```
 'um                                          ← Report identification ('um = user methods)
774 Oven Sample Proc. 0130/03 5.774.0010      ← Report title with device number and program version
user memory
>methods                                      ← List of stored methods
  Titrino                            1304
  756Pump                            1216
  756Valve                           1216
  756Coulo                           2680
  737Coulo                           1144
  KF+Exch                            1696
         remaining bytes            17720     ← Memory space still available
          ------------
```

5.5.1 Automatic reports

You can choose the type of report in the Parameter menu. Only one report can be defined at any one time. This report is printed at the end of each sequence (also in the start and final sequence).

The report can also be transferred to a personal computer or to an LIMS (Laboratory data Information Management System) instead of output to printer. For this purpose, the computer can be connected in place of a printer to the RS232 interface. In this case, you must select setting 'IBM' under **<CONFIG>**, **>RS232 Settings**, 'Send To:'.

5.5.2 Manual reports

Manual reports can also be output at the press of a key. In order to do this, press key **<PRINT>** and choose the required report with **<SELECT>**. The 'full' and 'short' reports each contain the data of the last sequence run.

5.6 Sample racks

A sample rack is a turntable for accommodating sample vials. The standard sample rack supplied with the 774 Oven Sample Processor can be detached to insert samples and can then be fitted back on again. It is designed for 35 sample vials whose dimensions must correspond to the specifications so that these vials (22 mm Head Space Vials, order No. 6.2419.000) fit precisely in the oven's opening. The arrangement of the sample positions on the rack is defined in a rack table. This rack table is assigned to rack type M36-0 (= Metrohm standard rack with 36 positions).

Type	Number of vials	Type of sample vessel	Magnetic code predefined	Rack No. pre-defined	Article No.
M36-0	35 (+1)	22 mm Head Space Vials	000001	1	6.2419.000

Other rack types are scheduled for future further developments.

Each individual sample rack can be identified uniquely by a magnetic code. Magnetic pins attached to the underside of the rack can be combined to form a binary, six-digit code. The sample changer can thus detect automatically what rack is fitted when the first rack position is beneath the lift. You must press key **<RACK>** when changing a rack in order to move the rack to the initial position. This activates unique recognition of the rack and, thus, the correct position table.

When a sample series is started, the changer automatically moves the rack first to initial position so that it is always ensured that the beaker positions correspond to the internal position table of the relevant 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.

The format of a magnetic code (example):

000001 i.e. only one magnet is inserted, outer right or 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 lift head*
Rinse position	*rinsing height of the lift head*
Shift position	*turning height of the lift head*
Special position	*freely available lift position*
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 70). 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 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 reserved for special racks (unused as yet). 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 lift head, the position in which a sample vial is heated. In this way the ideal position for every sample rack can be chosen dependent on the size of the vials. 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”.

The **Rinse position** serves to define the position of the lift head at which a Rinse function (for the conditioning vessel) is to be performed. Thus, dependent on the sample vessel, it is possible to select the ideal setting for each sample rack. This can be programmed in a sequence with 'LIFT :1: rinse mm'.

The **Shift position** determines the correct position of the lift 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 accessories 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 **Special position** is a further, user-defined positioned of the lift head. It can be programmed in a sequence with 'LIFT :1 : Special mm'.

Special beakers

Special beakers are reserved positions of a sample rack. 0 to 8 special beakers (1 special beaker as conditioning vial as the default setting) per rack can be defined. They can be positioned in front of the tower in a method sequence for specific operations without interrupting or obstructing the sequence of the sample series. Special beakers may be used to schedule special functions for a conditioning vessel.

Special beakers are placed under the lift 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 changer finds no vial present in the reserved position, an error message will always be displayed.

5.7 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 19). 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.

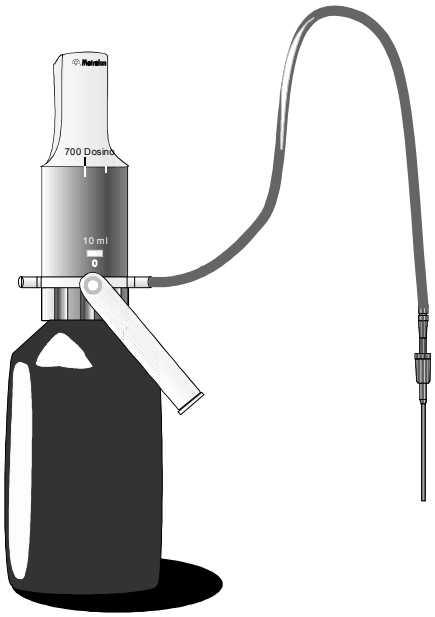
Always execute the 'DOS: XX : release' command before removing the burette!

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.

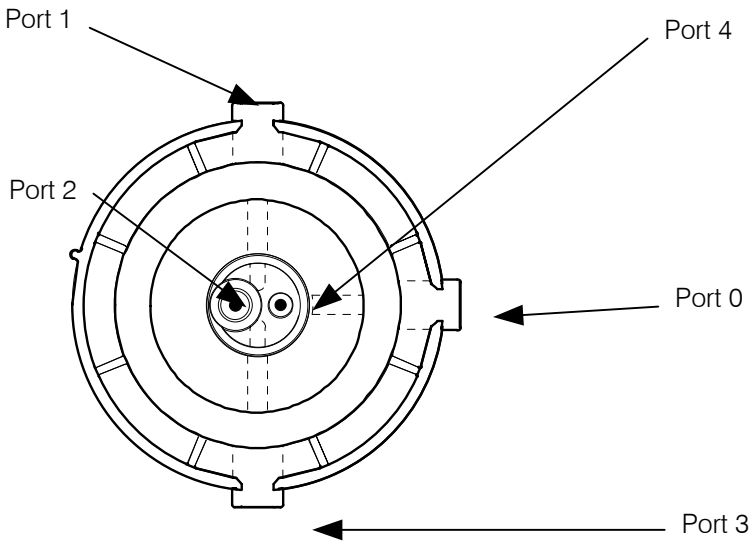
The changer automatically recognizes the type of the connected dosing instrument.

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 66f). 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 Compensate 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

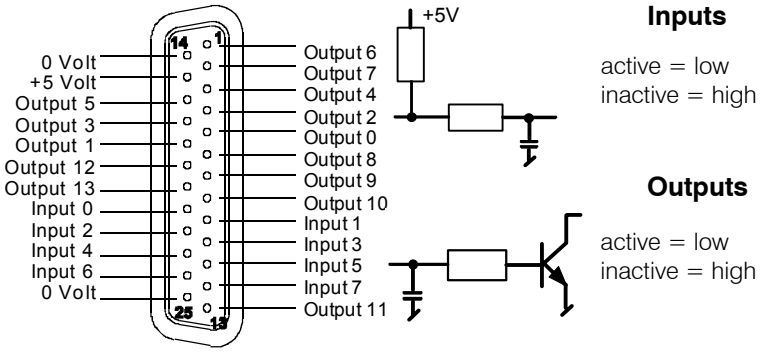
DOS: XX : level mL Compensate the play

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.

5.8 Remote Interface

Peripheral instruments connected such as Titrinos, Titroprocessors, Coulometers 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.

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

774		Metrohm instrument
Output 0	———	Input 0
Output 1	———	Input 1
Output 2	———	Input 2
Output 3	———	Input 3
Output 4	———	Input 4
Output 5	———	Input 5
Output 6	———	Input 6
Output 7	———	Input 7
Output 8	———	Pin 6
Output 9	———	Pin 7
Output 10	———	Pin 8
Output 11	———	Pin 13
Output 12	———	Pin 19
Output 13	———	Pin 20

774		Metrohm instrument
Input 0	———	Output 0
Input 1	———	Output 1
Input 2	———	Output 2
Input 3	———	Output 3
Input 4	———	Output 4
Input 5	———	Output 5
Input 6	———	Output 6
Input 7	———	Output 7

The Output lines 8…13
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 16ff).
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 determination with a Coulometer). 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 (*).

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. See next page.

CTL-command

Parameter	Bit Pattern	Function
INIT	**00000000000000**	initializes the remote interface
START device1	***************1**	starts device1 (for ex., Titrino, Coulometer...)
START dos1	*********1********	starts Dosimat on device1 (Titrino via "activate", 6.2141.040 cable required)
STOP device1	**************1***	stops device1 (for ex., Titrino, Coulometer...)
START 737	**********1******	starts Coulometer 737 (6.2141.000 cable required)
ENTER	**********1111***	simulates the <ENTER> key of Titrinos or a 756 Coulometer

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

Manual stop options

Parameter	Bit Pattern	Function
STOP device1	**************1***	stops device1 (for ex., Titrino, Coulometer...)

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

SCN Command

Parameter	Bit Pattern	Function
Ready1	*********1**	queries "ready" state of device1 (Titrinos. …)
End1	******1*****	expects the end pulse of device1 (EOD)
Cond ok	********1***	queries "Cond" state of device1 (Titrinos. …)
Cond 737	**1****1****	queries "Cond" state of the 737 Coulometer
no error	****1*******	queries "no error" state of device1 (Titrinos. …)

5.9 Operation via RS232 Interface

5.9.1 General rules

The 774 Oven Sample Processor 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

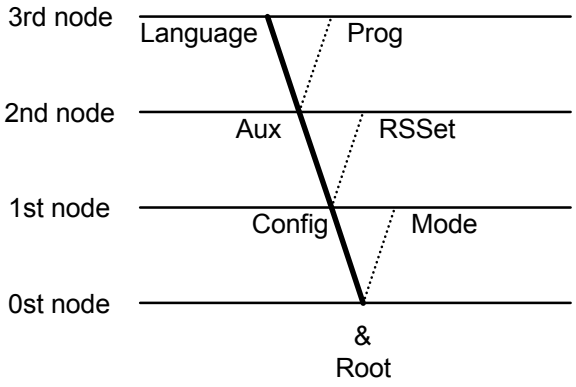
The query command $Q initiates the issuing of the value on the instrument and the value emission is triggered. Entries which start with $, trigger something. They are thus called **triggers**.

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"**

5.9.2 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**

5.9.3 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 106ff.

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**

5.9.4 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 instrument. 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 instrument is executing the last command.
$H	**H**old	The instrument has been held ($H, **<HOLD>** key or by an error which effects the hold status).
$C	**C**ontinue	The instrument has been restarted actively after hold.
$R	**R**eady	The instrument 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.

5.9.5 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:

E26	Manual stop
E28	Wrong object call
E29	Wrong value or no value allowed
E30	Wrong trigger
E31	Comman currently not allowed

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 instrument 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
	Device-specific errors:
E121	Measuring point list full
E137	Method memory full
E154	Temperature not reached / HEATER timeout
E163	Gas flow too low
E165	Max. temperature reached
E168	Temperature sensor defect
E169	Flowmeter defect
E201	Changer function error (div.)
E202	Dosimat function error
E206	Gas flow too high
E207	Error list full
E208	SCAN timeout

5.10 The remote control tree

5.10.1 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**iagnose	Diagnostics program

Detailed Description of the Main Branches:

5.10.2 &Mode

Object	Description	Input range	Reference
& Root			
├ **M**ode	**Method parameters**	$G, $S, $H, $C	5.11.1.1
: ├ **.M**ethod	Method name	8 ASCII characters	5.11.1.2
├ **.S**mplNo	Number of samples in a series	1...999, ∗, **Rack**	5.11.1.3
├ **.St**artSeq	**Start sequence**	-	5.11.1.4
├ **.1**	Line number of the command	-	
├ **.C**md	Command	**nop**, MOVE, LIFT, SAMPLE, HEATER, DEF FLOW, DOS, SCAN, CTRL, WAIT, RACK	5.11.1.5
└ **.***			
*			
:			
└ **.100**	Sequence end	**NOP**	
├ **.S**ampleSeq	**Sample sequence**	-	5.11.1.6
├ **.1**	Line number of the command	-	
├ **.C**md	Command	**nop**, MOVE, LIFT, SAMPLE, HEATER, DEF FLOW, DOS, SCAN, CTRL, WAIT, RACK	5.11.1.7
└ **. ***			
*			
:			
└ **.100**	Sequence end	**NOP**	
:			

.Finalseq	**Final sequence**	-	5.11.1.8
.1	Line number of the command	-	
.Cmd	Command	**nop**, MOVE, LIFT, SAMPLE, HEATER, DEF FLOW, DOS, SCAN, CTRL, WAIT, RACK	5.11.1.9
.*			
*			
.100	Sequence end	**NOP**	
.Report	**Report definitions**	-	5.11.1.10
.Assign	Type of report	**none,** short, full, param, config, Usermeth	
.TDelta	measuring interval of temp. (s)	1…**10**…60	
.Changer	**Changer settings**	-	5.11.1.10
.RackNo	Rack number	**0**...16	
.L1Rate	Lift speed tower 1	3...**12** mm/s	
.L2 Rate	Lift speed tower 2	3...**12** mm/s	
.ShRate	Turning speed of the rack	3...**20** w/s	
.ShDir	Turning direction of the rack	+,–,**auto.**	
.ModeSample	Reaction to error	**MOVE**, display	
.TimeoutSet	**Timeout settings**	-	5.11.1.12
.HTime	HEATER timeout	**off**, 0…999	-
.HAction	Reaction to timeout	cont., **STOP**	-
.STime	SCAN timeout	**off**, 0…999	-
.SAction	Reaction to timeout	cont., **ERROR**	-
.Gas	**Gas flow settings**	-	5.11.1.12
.UnitFlow	Unit of gas flow display	**mL/min**, L/h	-
.MinFlow	Minimal gas flow	**0**…999	-
.MaxFlow	Maximum gas flow	0…**900**…999	-
.Select	Type of carrier gas	**Air**, others, N2	-
.Otherfac	Factor for 'other' gases	0.001…**1**…9.999	-
.DosimatSet	**Settings for dosing unit**	-	5.11.1.14
.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	-	
.RemCtl	Command via remote	**STOP device1**, 14 x 1, 0 or * (bin)	5.11.1.15
.RS Ctl	Command via RS232	**&M;$S**, 14 ASCII characters	
.FLOW	Gas flow control	**cont.**, off	
.HEATER	Heater control	**INIT**, off, 50…250	

5.10.3 &Config

Object	Description	Input range	Reference
& Root			
⋮			
├ **C**onfig	**Instrument configuration**	-	
⋮ ├ **.A**ux	**Miscellaneous**	-	5.11.2.1
│ ├ **.L**anguage	Dialog language	**english**, deutsch 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...**90**...100 mm	
│ └ **.Mo**nBeak	Beaker sensor on/off	**on**, off	
│			
│ ├ **.O**venSet	**Ofen settings**	-	5.11.2.2
│ ├ **.I**nitTemp	Initial temperature	**Off**, 50…250	
│ ├ **.M**axTemp	max. temperature	50...**275**	
│ └ **.T**empCorr	Temperature correction	-10…**0**…10	
│			
│ ├ **.R**ackDef	**Rack definitions**	-	5.11.2.2
│ ├ **.R**ackNo	Rack number	**1**...16	
│ *			5.11.2.4
│ ├ **.C**ode	Rack code	**000001**(b)...111111(b)	
│ ├ **.T**ype	Rack type	**M36-0**, M12-0, M14-0, …	
│ ├ **.W**orkH	Work position	**0**...100 mm	
│ ├ **.Ri**nseH	Rinse position	**0**...100 mm	
│ ├ **.S**hiftH	Shift position	**0**...20 mm	
│ ├ **.Sp**ecialH	Special position	**0**...100 mm	
│ └ .**Spez**Beak	**Special beaker positions**		5.11.2.5
│ ⋮ ├ **.1**	Special beaker 1	-	
│ ⋮ │ └ **.P**os	Beaker position	**0**...number of rack pos.	
│ ⋮			
│ └ **.8**	Special beaker 8		
│ └ **.P**os	Beaker position	**0**...number of rack pos.	
│			
│ ├ **.P**osTab	**Position table**	-	5.11.2.6
│ ├ **.I**dx	Index of the table	**0**...31	
│ *			5.11.2.7
│ ├ **.N**ame	Name of the position table	8 ASCII characters	
│ ├ **.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	-	
│ ⋮ └ **.V**alue	Position in 1/10-ang. 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**	-	5.11.2.9
.WetPartNo	Dosing unit no.	**1**...12	
*			
.1	Port number 1	-	5.11.2.10
.MaxRate	Max. dosing rate	0.01...**160** ml/min	
.Length	Tubing length	0...**1000**...30000 mm	
.Diameter	Tubing diameter	0...**2**...20 mm	
.2	Port number 2	-	5.11.2.10
.MaxRate	Max. dosing rate	0.01…**160** ml/min	
.Length	Tubing length	0...**250**...30000 mm	
.Diameter	Tubing diameter	0.1…**2**…20 mm	
.3	Port number 3	-	5.11.2.10
.MaxRate	Max. dosing rate	0.01...**160** ml/min	
.Length	Tubing length	0...**1000**...30000 mm	
.Diameter	Tubing diameter	0.1...**2**...20 mm	
.4	Port number 4		5.11.2.10
.MaxRate	Max. dosing rate	0.01...**160** ml/min	
.Length	Tubing length	0...**1000**...30000 mm	
.Diameter	Tubing diameter	0.1...**2**...20 mm	
.Rsset	**RS232 Settings**	$G	5.11.2.11
.Baud	Baud rate	300, 600, 1200, 2400, 4800, **9600**	5.11.2.12
.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	5.11.2.13

5.10.4 &Info

Object	Description	Input range	Reference
& Root			
Info	**Current data**	-	
.Report	**Report definition**	$G	5.11.3.1
.Select	Report type	**short**, full, config, param, usermeth, all	
.DetermData	**Determination data**	-	5.11.3.2
.Mplist	Meas. point list of temperature	-	
.1	Meas. point 1	-	
.Y	Temperature in °C	read only	
.400	Meas. point 400		

.Errorlist	List of error messages	-	5.11.3.3
.1	Error message 1	-	
.Time	Time of occurence in s	read only	
.ErrNo	Error number	read only, see error messages	
.10			
.Results	**Resultats**	-	5.11.3.4
.TempSet	Temperatur set	read only	
.LowTemp	Lowest temperature	read only	
.HighTemp	Highest temperature	read only	
.Gasflow	Mean of gas flow	read only	
.Lowflow	Lowest gas flow	read only	
.Highflow	Highest gas flow	read only	
.SmplHeatTime	Heating interval of sample in min	read only	
.ActualInfo	**Current data**	-	5.11.3.5
.Meas	Meas. value temperature	-	
.CyclNo	Cycle number	read only	
.OvenTemp	Oven temperature	read only	
.Gasflow	Gas flow rate	read only	
.Lift	**Lift station**	-	5.11.3.6
.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**	-	5.11.3.7
.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	
.Act2Pos	Current beaker pos. tower 2	read only	
.Valve	**Valve**	-	5.11.3.8
.State	State	read only	
.Pump	**Pump**	-	5.11.3.9
.State	State	read only	
.OutHeater	**Outlet heater**	-	5.11.3.10
.State	State	read only	
.Fan	**Fan**	-	5.11.3.11
.State	State	read only	

.Heating	**Heater**	-	5.11.3.12
└ **.S**tate	State	read only	
.Buret	**Dosing units**	-	5.11.3.13
├ **.1**	Dosing unit 1	-	
│ ├ **.S**tate	State	read only	
│ ├ **.P**osition	Piston position	read only	
│ ├ **.C**ock	Cock position	read only	
│ ├ **.T**ype	Type of dosing drive	read only	
│ └ **.V**olume	Burette volume	read only	
└ **.12**	Dosing unit 12		
├ **.S**tate	State	read only	
├ **.P**osition	Piston position	read only	
├ **.C**ock	Cock position	read only	
├ **.T**ype	Type of dosing drive	read only	
└ **.V**olume	Burette volume	read only	
.Inputs	**Input lines**	-	5.11.3.14
└ **.S**tatus	Status input lines	read only (d)	
.Outputs	**Output lines**	-	5.11.3.15
└ **.S**tatus	Status output lines	read only (d)	
.Display	**LCD display**	-	5.11.3.16
├ **.L1**	Text line 1	read only	
└ **.L2**	Text line 2	read only	
.Counter	**Sample counter**	-	5.11.3.17
├ **.S**ample	Current sample position	read only	
└ **.M**aximum	Number of samples to process	read only	

5.10.5 &Setup

Object	Description	Input range	Reference
& Root			
⋮			
├ **S**etup	**Settings for the operating mode**	-	
⋮ ├ **.I**dReport	Report identification	**on,** off	5.11.4.1
├ **.K**eycode	Send key code	on, **off**	5.11.4.2
├ **.T**ree	Sending format of path info		5.11.4.3
│ ├ **.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**	5.11.4.4
├ **.L**ock	**Lock key functions**	-	5.11.4.5
│ ├ **.K**eyboard	Lock all keyboard keys	on, **off**	
│ ├ **.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 time**		
│ └ **.S**tartWait	Waiting time after start	on, **off**	5.11.4.6
├ **.S**endMeas	**Automatic message for meas. values**		
│ ├ **.S**endstatus	Switch on/off	on, **off**	5.11.4.9
│ ├ **.I**nterval	Sending interval	1…**4**…999	
│ └ **.M**eas	**Measuring point**	-	5.11.4.8
│ ├ **.C**yclNo	Send cycle number	on, **off**	
│ ├ **.O**venTemp	Send temperatur	on, **off**	
│ └ **.G**asFlow	Send gas flow rate	on, **off**	
├ **.A**utoInfo	**Automatic message for changes**		
│ ├ **.S**tatus	Switch AutoInfo on/off	**on**, off	5.11.4.9
│ ├ **.P**	When mains is switched on	on, **off**	
│ ├ **.C**h	**Changer messages**	-	
│ │ ├ **.G**	When method started	on, **off**	
│ │ ├ **.GC**	When start is initiated	on, **off**	
│ │ ├ **.R**	When changer is "ready"	on, **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**	
⋮ ⋮			

.Heater	**Heater messages**	-	
.T	Changes of target temperature	on, **off**	
.S	When heater is switched off	on, **off**	
.E	When an error occurs	on, **off**	
.PowerOn	RESET (power on)	$G	5.11.4.10
.Initialize	Set default values	$G	5.11.4.11
.Select	Selection of branch	**param**, config, assembly, setup, all	
.RamInit	Initialization of working mem.	$G	5.11.4.12
.InstrNo	Instrument number	-	5.11.4.13
.Value	Description (not available in manual operation)	8 ASCII characters	

5.10.6 &UserMeth

Object	Description	Input range	Reference
& Root			
UserMeth	**User defined methods**		
.FreeMemory	Memory available	read only	5.11.5.1
.Recall	Load method	$G	5.11.5.2
.Name	Method name	8 ASCII characters	
.Store	Save method	$G	
.Name	Method name	8 ASCII characters	
.Delete	Delete method	$G	
.Name	Method name	8 ASCII characters	
.DelAll	Delete all methods	$G	
.List	List of methods	-	5.11.5.3
*			
.1	Method 1		
* **.N**ame	Method name	read only	
.Bytes	Method size in bytes	read only	

5.10.7 &Assembly

Object	Description	Input range	Reference
& Root			
Assembly	**Assembly control**		
.Sample	**Beaker position**	$G	5.11.6.1
.Func	Selection of function	**=**, +, –	
.Value	Value of function	0...**1**...999	
.Move	**Turning the rack**	$G, $S	5.11.6.2
.Target	Lift selection	**1**, 2	
.Position	Beaker or position	**sample**, spec.1...8, 1...999	

.Lift	**Moving the lift**	$G, $S	5.11.6.3
├ **.S**tation	Lift address	**1**, 2, *	
└ **.W**ay	Position	work, rinse, shift, special, **rest**, 0...325 mm	
.Heater	**Temperature control**	$G	5.11.6.4
├ **.T**emp	Target temperature	**INIT**, off, 50…250	
└ **.Ti**me	Heating interval	**blank**, 1...999 min	
.Flow	**Gas flow control**	$G	5.11.6.5
├ **.A**ddress	Pump or valve	**Pump**, Valve	
└ **.S**tate	Status	**on**, off	
.Dos	**Initiate dosing functions**	$G, $S	5.11.6.6
├ **.A**ddress	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	5.11.6.7
├ **.A**ddress	Selection of interface	**Rm**, RS	
└ **.P**attern	Input signal or data		
	for Rm (Remote):	8 x 1, 0 or * (bin) **ready1**, end1, Cond ok, Cond 737, no error	
	for RS (RS232):	14 ASCII characters	
.Ctrl	**Interface control**	$G	5.11.6.8
├ **.A**ddress	Interface selection	**Rm**, RS	
└ **.P**attern	Output signal or data		
	for Rm (Remote):	14 x 1, 0 or * (bin), START device1, START dos1 STOP device1, START 737 ENTER, **INIT**	
	for RS (RS232):	14 ASCII characters, &M;$G	
.Def	**Re-definitions**	$G	5.11.6.9
├ **.O**bject	Item selection	**DOSRATE,** FILLRATE, LIFTRATE, SHIFTRATE, DRIVE.PORT	
├ **.A**dress	Component address	dependent upon item	
└ **.V**alue	Value	dependent upon item	
.Wait	**Waiting time**	$G, $S, $H, $C	5.11.6.10
└ **.T**ime	Waiting time	0...**1**...9999 s	
.End	Changer RACK / RESET	$G	5.11.6.11

5.10.8 &Diagnose

Objects	Description	Selection	Reference
& Root			
Diagnose	**Diagnosis**		
.Init	Initialization	$G	5.11.7.1
.Select	Select topic for initialization	param, config, setup, assembly, all	
.RamTest	Test working memory	$G	5.11.7.2
.LcdTest	Test display	$G, $S, $H	
.ContrastTest	Test display contrast	$G, $S	
.KeyTest	Keyboard test	$G, $S	
.IoTest	Test input/output lines	$G, $S	
.Rs Test	Test RS232 interface	$G, $S	
.EbusTest	Test Ebus interface	$G, $S	
.BeeperTest	Test beeper	$G, $S	
.RackcodeTest	Test rack code	$G, $S	
.FunctionTest	Metrohm internal test		
.SimulateKey	Key code simulation	**0**, 1...6, 8...31	5.11.7.3
.InstrNo	Instrument number (Not accessible via RS232)		5.11.7.4
.OvenTest	Test heater	$G, $S	5.11.7.5
.Adjust	Temperature meas. adjustment	$G, $S	
.MeasTest	Test temperature measurement	$G, $S	
.PowerOn	Power-on simulation	$G	5.11.7.6

5.11 Description of the remote control commands

5.11.1 &Mode ...

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

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

5.11.1.2 **M**ode**.M**ethod read only

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

5.11.1.3 **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).

5.11.1.4 **M**ode**.St**artSeq**.1.C**md **NOP**, MOVE, LIFT, SAMPLE,
etc. up to **.100** HEATER, DEF, FLOW,
DOS, SCAN, CTRL, WAIT, RACK

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 128ff) 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").

5.11.1.5 **M**ode**.St**artSeq**.1.***** .**M**ove…, .**L**ift…, .**S**ample…,
etc. up to **.100** .**H**eater…,.**D**ef…, .**F**low…, **D**os…,
Scan…, .**C**trl…, .**W**ait…, .**R**ack, .**N**op

Indexed start sequence; its commands will be executed line by line in processing. At the index node &Mode.StartSeq.1.Cmd (see 5.11.1.4) the according sub-branch from &Assembly… will be appended depending on the selected command.
Example:
&Mode.StartSeq.1.Cmd("MOVE")
⇒ &Mode.StartSeq.1.Move.Target("1")
⇒ &Mode.StartSeq.1.Move.Position("sample")

5.11.1.6 **M**ode**.S**ampleSeq**.1.C**md **NOP**, MOVE, LIFT, SAMPLE,
etc. up to **.100** HEATER, DEF, FLOW,
DOS, SCAN, CTRL, WAIT, RACK

Defines the command of the indexed command line in a sample sequence. See start sequence (5.11.1.5).

5.11.1.7 **M**ode.**S**ampleSeq.**1.***
etc. up to **.100**
.**M**ove…, .**L**ift…, .**S**ample…, .**H**eater…,.**D**ef…, .**F**low…, **D**os…, **Sc**an…, .**C**trl…, .**W**ait…, .**R**ack, .**N**op

Indexed sample sequence; its commands will be executed line by line in processing. See start sequence (5.11.1.5).

5.11.1.8 **M**ode.**F**inalSeq.**1.C**md
etc. up to **.100**
NOP, MOVE, LIFT, STIR, DEF, PUMP, DOS, SCAN, SAMPLE, CTRL, WAIT, ENDSEQ

Defines the command of the indexed command line in a final sequence. See start sequence (5.11.1.4).

5.11.1.9 **M**ode.**F**inalSeq.**1.***
etc. up to **.100**
.**M**ove…, .**L**ift…, .**S**ample…, .**H**eater…,.**D**ef…, .**F**low…, **D**os…, **Sc**an…, .**C**trl…, .**W**ait…, .**R**ack, .**N**op

Indexed final sequence; its commands will be executed line by line in processing. See start sequence (5.11.1.5).

5.11.1.10 **M**ode.**R**eport.**A**ssign
none, short, full, param, config, Usermeth

Mode.**R**eport.**T**Delta
1…**10**…60

Report definition.
Only one report is possible. In the case of a 'full' result report, a measuring point list with the oven temperatures as a function of time is output by contrast with the 'short' result report. The time interval (in seconds) between the measuring points defines the node .TDelta. 400 measuring points are possible, see 5.11.3.2.

5.11.1.11
Mode.**Ch**anger.**R**ackNo — **0**…16
Mode.**Ch**anger.**L1**Rate — 3...**12** mm/s
Mode.**C**hanger.**L2**Rate — 3...**12** mm/s
Mode.**Ch**anger.**Sh**Rate — 3...**20** w/s
Mode.**Ch**anger.**ShD**ir — +, –, **auto.**
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)
ModeSample:	Reaction on missing sample beaker. (MOVE = next sample beaker will be chosen regarding the recent SAMPLE command, display = display warning.)

5.11.1.12
Mode.**T**imeoutSet.**H**Time — **off**, 0...999
Mode.**T**imeoutSet.**HA**ction — cont, **STOP**
Mode.**T**imeoutSet.**S**Time — **off**, 0...999
Mode.**T**imeoutSet.**SA**ction — cont, **ERROR**

Timeout settings. Timeout times are defined in seconds.
The HEATER timeout occurs if the set oven temperature (in the case of the HEATER command) is not reached after the specified heating (in minutes).

HTime is the additionally granted waiting time for still reaching the target temperature. HAction is executed after HTime elapses.
The SCAN timeout is triggered on execution of a SCAN command. STime determines the reliable response time of the connected device (generally the determination time). SAction is executed after expiry of STime.

cont:	Continue without action
STOP:	Stop method
ERROR:	Trigger error message

5.11.1.13

Mode.**G**as.**U**nitFlow	**mL**/**min**, L/h
Mode.**G**as.**M**inFlow	**0**…999
Mode.**G**as.**Ma**xFlow	0…**900**…999
Mode.**G**as.**S**elect	**Air**, others, N2
Mode.**G**as.**O**therfac	0.001…**1**…9.999

.UnitFlow determines the unit of the gas flow rate. The two nodes .Minflow and .Maxflow define the limits which, if undershot or overshot, trigger error messages (RS error E163 resp. E206).
Node .Otherfac takes effect only if 'others' is selected at the .Select node.

5.11.1.14

Mode.**D**osimatSet.**D**osUnitNo	**1**…12
Mode.**D**osimatSet.**1.DosR**ate	0.01…160 ml/min, **max.**
Mode.**D**osimatSet.**1.F**illRate	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") 5.11.6.6)
PrepTube:	Dosing outlet on preparing cycle of 700 Dosino
EmptyTube:	Air inlet for emptying the 700 Dosino.

5.11.1.15

Mode.**M**an**S**top.**R**emCtl	**STOP device1**, 14 Bit (1,0, or ∗)
Mode.**M**anStop.**RS**Ctl	**&M;$S,** 14 ASCII characters
Mode.**M**anStop.**F**low	**cont.**, off
Mode.**M**anStop.**H**EATER	**INIT**, off, 50…250

Functions executed when the <STOP> key is pressed.

.RemCtl	Bit pattern defines the line statuses of the Remote socket
.RSCtl	Character string is transferred via the RS232 cable
.Flow	The pump and the solenoid valve remain in the current state or are both deactivated
.HEATER	Oven control is either set to the initial temperature or switched off. Any temperature may also be selected

5.11.2 &Config ...

5.11.2.1

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...**90**...100 mm
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 *
MonBeak:	Beaker sensor on/off *

* Modifications effect after RESET or power on.

5.11.2.2

Config.**O**venSet.**I**nitTemp	**Off**, 50…250
Config.**O**venSet.**M**axTemp	50…**275**
Config.**O**venSet.**T**empCorr	-10…**0**…10

The initial temperature of the oven control is set on power-up of the unit. When the maximum temperature is reached, this aborts the running method and the RS error message E165.
The temperature correction varies the preset temperature for the oven control, i.e. it also influences the control algorithm.

5.11.2.3

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

Rack number

5.11.2.4

Config.**R**ackDef.**C**ode	**000001**b...111111b
Config.**R**ackDef.**T**ype	8 ASCII characters
Config.**R**ackDef.**W**orkH	**0**...100 mm
Config.**R**ackDef.**Ri**nseH	**0**...100 mm
Config.**R**ackDef.**S**hiftH	**0**...20 mm
Config.**R**ackDef.**Sp**ecialH	**0**...100 mm

Rack definitions. Depending on the current rack number (see 5.11.2.3) 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.
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.

5.11.2.5 **C**onfig.**Ra**ckDef.**Spez**Beak.**1.P**os **0**...number of rack positions
etc. until **.8**

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

5.11.2.6 **C**onfig.**P**osTab.**Tabl**dx **0**...31

Index of position tables..

5.11.2.7

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 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 5.11.2.4).
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

5.11.2.8 **C**onfig.**P**osTab.**1.V**alue **0**...3599
bis **.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 5.11.2.6).
- Enter name of rack type (&Config.PosTab.Name, see 5.11.2.7).
- Enter highest beaker position in row 1 to 3 (&Config.PosTab.R1–3Num, see 5.11.2.7).
- 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 5.11.2.7).
- Define number of rack positions (&Config.Pos.Tab.Num, see 5.11.2.7).
- Enter the particular angular offset for each rack position (Irregular layouts of rack positions are possible)

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

Identification of dosing unit.

5.11.2.10

Config.**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 5.11.2.9) 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

5.11.2.11 **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.

5.11.2.12

Config**.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 131ff.

5.11.2.13 **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).

5.11.3 &Info ...

5.11.3.1 **I**nfo.**R**eport $G
Info.**R**eport.**S**elect **full**, short, config, param, usermeth, all

$G sends the selected report via RS interface.

full:	Full result report (identifier 'fr)
short:	Short result report (identifier 'sr)
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 changer are marked with a space (ASCII 32) and the specific report identifier (see above).

5.11.3.2 **I**nfo.**D**etermData.**M**plist.**1**.**Y** read only
up to .**400**.**Y**

Indexed list of the measuring points of the oven temperature. The time interval between the individual measuring points is defined by node &Mode.Report.TDelta.

5.11.3.3 **I**nfo.**D**etermData.**E**rrorlist.**1**.**T**ime read only
Info.**D**etermData.**E**rrorlist.**1**.**E**rrNo read only
up to .**10**.**T**ime bzw. .**10**.**E**rrNo

Up to 10 error messages per sequence are stored in the error list. Besides the instant of occurrence (from the start of the sequence, in seconds), the error number (see RS error list Page 104) is also stored.

5.11.3.4 **I**nfo.**Res**ults.**T**empSet read only
Info.**Res**ults.**L**owTemp read only
Info.**Res**ults.**H**ighTemp read only
Info.**Res**ults.**G**asflow read only
Info.**Res**ults.**L**owflow read only
Info.**Res**ults.**Highf**low read only
Info.**Res**ults.**S**mplHeatTime read only

The results each refer to the current sequence.

5.11.3.5 **I**nfo.**A**ctualInfo.**M**eas.**C**yclNo read only
Info.**A**ctualInfo.**M**eas.**O**venTemp read only
Info.**A**ctualInfo.**M**eas.**G**asflow read only

$Q sends the current, measured values.

5.11.3.6 **I**nfo.**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)

5.11.3.7

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

5.11.3.8

Info.**A**ctualInfo.**V**alve.**S**tate read only
Current valve state (on/off).

5.11.3.9

Info.**A**ctualInfo.**P**ump.**S**tate read only
Current pump state (on/off).

5.11.3.10

Info.**A**ctualInfo.**O**utHeater.**S**tate read only

Current status of the outlet heater of the transfer hose (on/off). The outlet heater is 'on' when the oven control is activated, i.e. as soon as a HEATER command is triggered either manually or in a sequence. The outlet heater is also activated on switch-on if an initial temperature is set. It is switched off automatically with a "HEATER off' command.

5.11.3.11

Info.**A**ctualInfo.**F**an.**S**tate read only

Current fan state (on/off).

5.11.3.12

Info.**A**ctualInfo.**H**eating.**S**tate read only

Current value of the manipulated variable (control deviation) of the oven heater (0…50).

5.11.3.13

Info.**A**ctualInfo.**B**uret.**1.S**tate read only
Info.**A**ctualInfo.**B**uret.**1.P**osition read only
Info.**A**ctualInfo.**B**uret.**1.C**ock read only
Info.**A**ctualInfo.**B**uret.**1.T**ype read only
Info.**A**ctualInfo.**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

5.11.3.14 **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 121ff.

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

Status of the output lines (Output0…13) of Remote interface. See 5.11.3.14.

5.11.3.16 **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.

5.11.3.17 **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.

5.11.4 &Setup ...

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

Switching on/off the transmission of report identifiers.

5.11.4.2 **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>

5.11.4.3 **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 &.

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

The instrument 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).

5.11.4.5 **S**etup.**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 instrument will not support the display.

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

Indefinite start delay. Only for remote control.

5.11.4.7 **S**etup.**M**ode.**S**endMeas.**S**endstatus on, **off**
Setup.**M**ode.**S**endMeas.**I**ntervall 1…**4**…999

Automatic sending of the current measured values defined below at a selectable interval (in seconds).

5.11.4.8 **S**etup.**M**ode.**S**endMeas.**M**eas.**C**yclNo on, **off**
Setup.**M**ode.**S**endMeas.**M**eas.**O**venTemp on, **off**
Setup.**M**ode.**S**endMeas.**M**eas.**G**asFlow on, **off**

Definition of the measured values to be sent automatically, see above.

5.11.4.9 **S**etup.**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.**H**eater.**T** on, **off**
Setup.**A**utoInfo.**H**eater.**S** on, **off**
Setup.**A**utoInfo.**E** on, **off**

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

.Status	Enables/disables the preset AutoInfo messages
.P	PowerOn: Simulation of PowerOn (see 5.11.4.10). 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
.Heater.T	Target: Change of target temperatur

.Heater.S Stop: Switching off of the heater
.E Error: Message with error number (see page 104)

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

Example: !Oven1".G"

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

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

5.11.4.11 **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.

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

Initialization of the entire working memory. All parameters will be set to default; error messages will be deleted.

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

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

5.11.5 &UserMeth ...

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

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

5.11.5.2 **U**serMeth**.R**ecall $G
UserMeth**.R**ecall**.N**ame 8 ASCII characters
UserMeth**.S**tore $G
UserMeth**.S**tore**.N**ame 8 ASCII characters
UserMeth**.D**elete $G
UserMeth**.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.

5.11.5.3 **U**serMeth**.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.

5.11.6 &Assembly ...

5.11.6.1

Assembly**.S**ample $G
Assembly**.S**ample**.F**unc **=**, +, –
Assembly**.S**ample**.V**alue 0...**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.

5.11.6.2

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 a specific vial

&Assembly.Move;$G triggers this function.

5.11.6.3

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.

5.11.6.4

Assembly**.H**eater $G
Assembly**.H**eater.**T**emp **Init**, off, 50…250
Assembly**.H**eater**.Ti**me **blank**, 1...999

Temperature control.
.Temp Target temperature in °C
.Time Heating interval in minutes

&Assembly.Heater;$G triggers this function.

5.11.6.5

Assembly**.F**low $G
Assembly**.F**low**.A**ddress **Pump**, Valve
Assembly**.F**low**.S**tate **on**, off

Pump or valve control.
.Address Selection of pump or valve
.Value State

&Assembly.Flow;$G triggers this function.

5.11.6.6

Assembly**.D**os $G, $S
Assembly**.D**os**.A**ddress **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.

5.11.6.7

Assembly.**Sc**an $G, $S
Assembly.**Sc**an.**A**ddress **Rm**, RS
Assembly.**Sc**an.**P**attern
with Rm (parallel/Remote): 8 x 1, 0 or ∗ (bin)
ready1, end1, Cond ok.
Cond 737, no error
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 (5.11.3.14 and 5.11.3.15) instead.

5.11.6.8

Assembly.**C**trl $G
Assembly.**C**trl.**A**ddress **Rm**, RS
Assembly.**C**trl.**P**attern
with Rm (parallel/Remote): 14 x 1, 0 or ∗ (bin),
START device1, START dos1,
STOP device1, 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 99ff).

5.11.6.9

Assembly.**De**f $G
Assembly.**De**f.**O**bject **DOSRATE**
FILLRATE, LIFTRATE
SHIFTRATE, DRIVE.PORT
Assembly.**De**f.**A**ddress depending on .object
Assembly.**De**f.**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
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.

5.11.6.10

Assembly.**W**ait $G, $S, $H, $C
Assembly.**W**ait.**T**ime 0...**1**...9999 s

Waiting time.
&Assembly.Wait;$G triggers this function.

5.11.6.11

Assembly.**E**nd $G

$G triggers a RESET (same as the <RACK> key).

5.11.7 &Diagnosis ...

5.11.7.1 **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 5.11.4.11.
&Diagnose.Init;$G triggers the initialization..

5.11.7.2

Diagnose.**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

5.11.7.3 **D**iagnose.**S**imulateKey **0**, 1…6, 8…31

Key simulation (Key codes see 5.11.4.2).

5.11.7.4 **D**iagnose.**Ins**trNo

Instrument number. This entry is not accessible via RS232 interface.

5.11.7.5

Diagnose.**O**venTest	$G, $S
Diagnose.**A**djust	$G, $S
Diagnose.**M**easTest	$G, $S

.OvenTest	Heater test.
.Adjust	Adjustment of temperature and gas flow measurement.
.MeasTest	Test of temperature measurement.

5.11.7.6 **D**iagnose.**P**owerOn $G

Simulation of 'Power on'.

5.12 Properties of the RS232 Interface

5.12.1 Data Transfer Protocol

The 774 Oven Sample Processor 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 87 and 145.
- 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

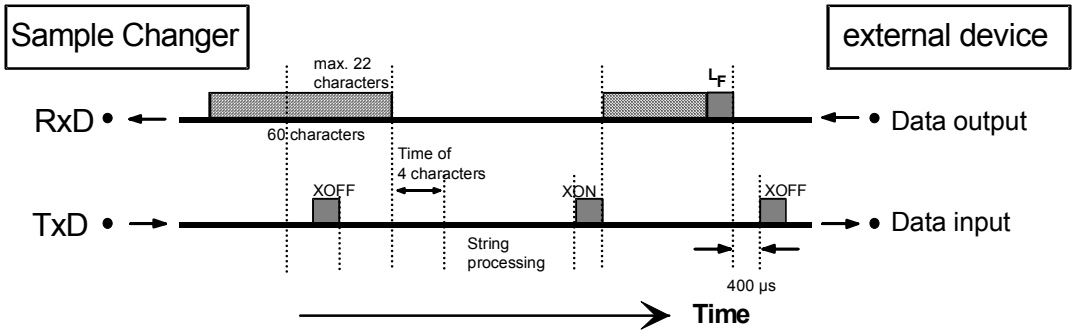
Only a shielded data cable (for example, METROHM D.104.0201) may be used to couple the changer with foreign devices. The cable shield must be properly grounded on both instruments (pay attention to current loops; always ground in a star-head formation). Only plugs with sufficient shielding may be used (for example, METROHM K.210.0001 with K.210.9004).

5.12.2 Handshake

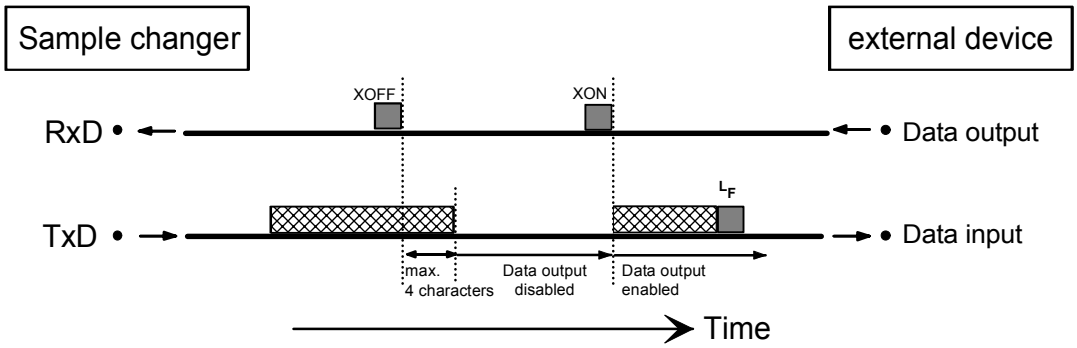
Software-Handshake, SWchar

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.

774 Oven Sample Processor as Receiver:



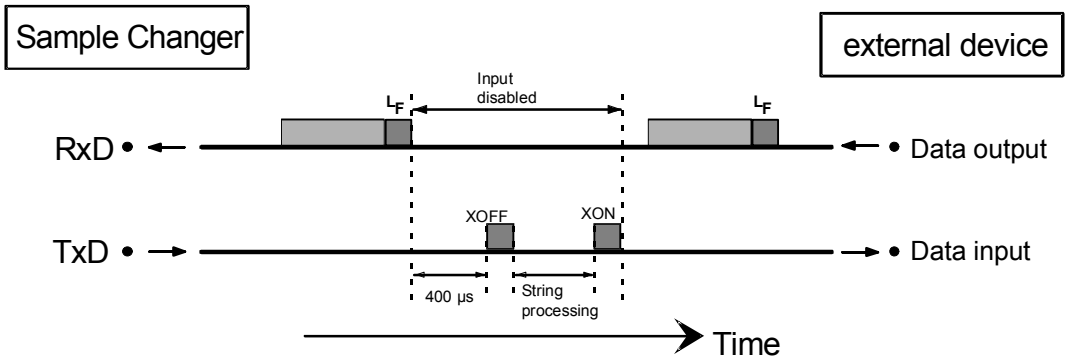
774 Oven Sample Processor as Sender:



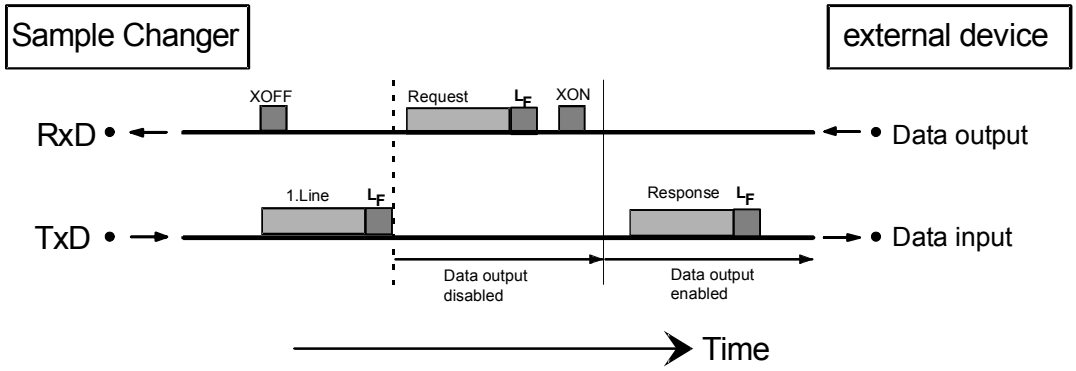
Software-Handshake, SWline

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.

774 Oven Sample Processor as Receiver:



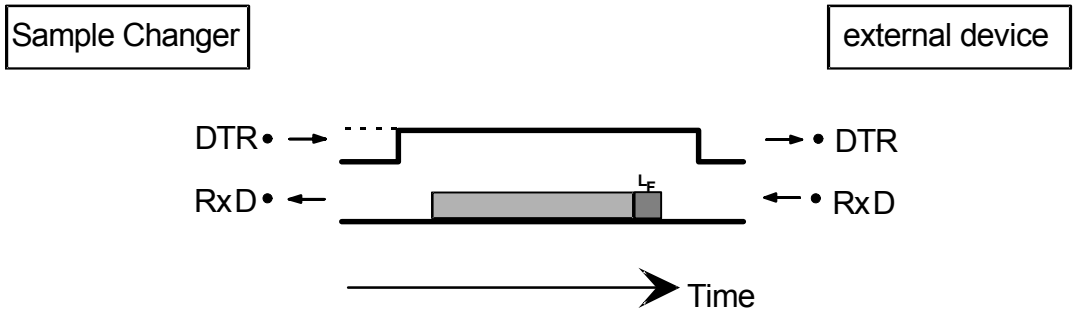
774 Oven Sample Processor as Sender:



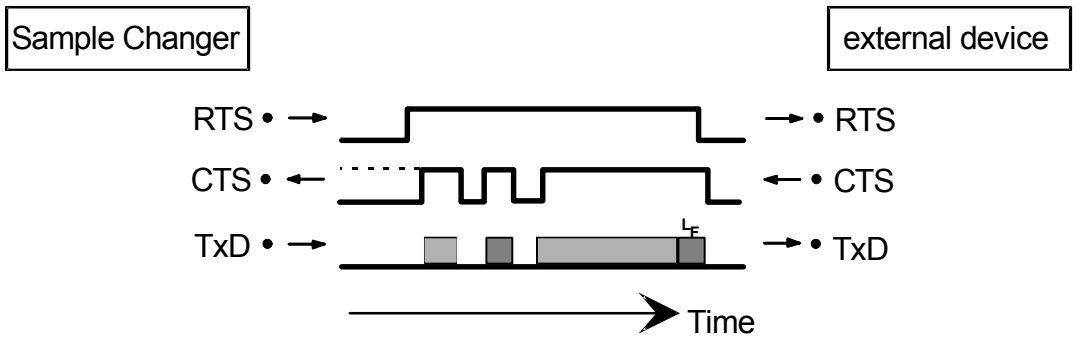
Changer transmission can be stopped by external instruments with XOFF. After XOFF is received the changer completes sending the line already started. If data output is disabled for more than 3 s by XOFF, E43 appears in the display.

Hardware-Handshake, HWs

774 Oven Sample Processor as Receiver:



774 Oven Sample Processor as Sender:

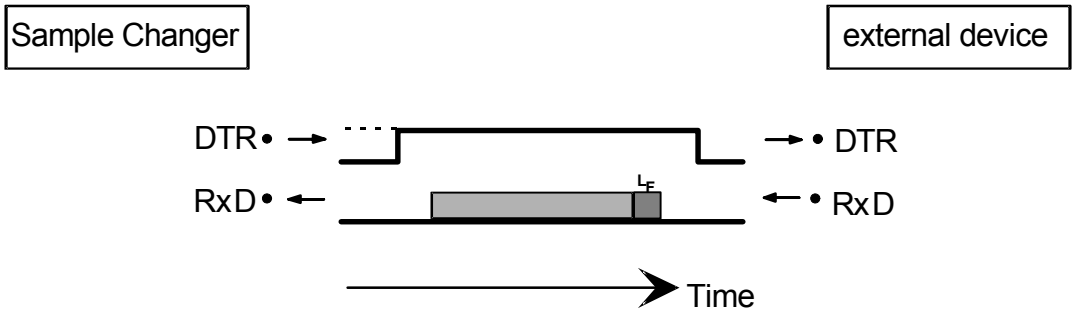


The data flow can be interrupted by deactivating the CTS line.

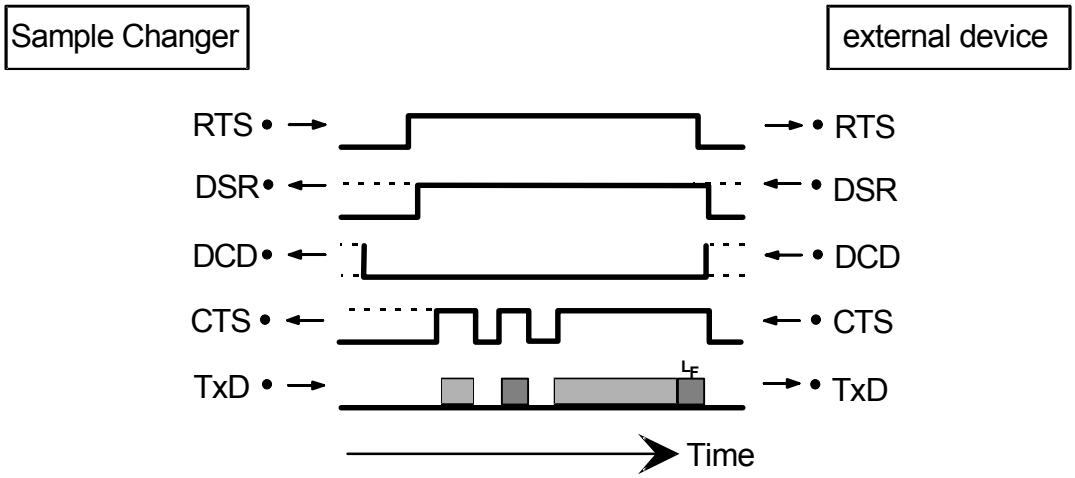
Hardware-Handshake, HWf

All handshake inputs are checked, handshake outputs set.

774 Oven Sample Processor as Receiver:



774 Oven Sample Processor as Sender:



The data flow can be interrupted by deactivating the CTS line.

5.12.3 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.

Received Data (RxD)
Data will only be received when DCD is “ON”.

Request to Send (RTS)
ON condition: the changer is ready to send data.

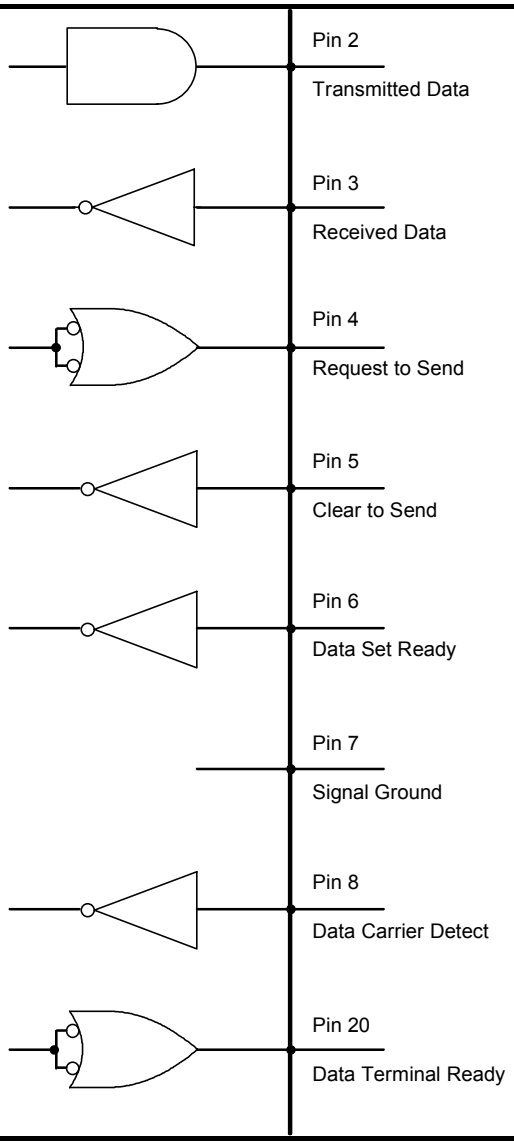
Clear to Send (CTS)
ON condition: Remote station is ready to receive data.

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.



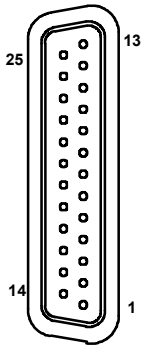
Protective earthing
Direct connection from cable plug to the protective ground of the instrument.

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)



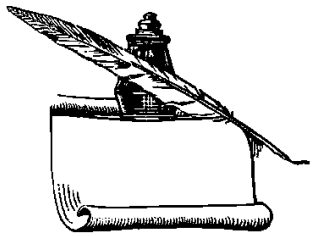
View of soldered side of plug

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.

5.12.4 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.



6 Appendix

6.1 Error messages

If an error occurs, execution of the active command is aborted and an error message is displayed (display blinks). This must be confirmed with the **<QUIT>** key.
If the changer was processing a sample series when the error occurred, it then switches to 'HOLD' state. After the cause of the fault or error has been remedied, the sample series can be continued by pressing key **<START>** with the next command in the current sequence. If the fault or error cannot be remedied, the current method can also be aborted with **<STOP>**.

List of the possible error messages and their causes:

*** battery low**	The battery for non-volatile storage of the user data must be replaced.
*** changer low power**	The power supply unit is unable to supply adequate power for all components currently switched on.
*** changer not ready**	The changer is unable to execute the selected command since it is busy executing another action or since the selected position cannot be approached.
*** changer overload**	Load too high or excessive mechanical resistance for performing the selected action.
*** Dos## ext. bus failure**	An unforeseen error or fault has occurred on a device (Dosimat or Dosino) connected to the external bus.
*** Dos## command not exec**	An error has occurred on the specified dosing unit.
*** Dos## no exchange unit**	The related change unit is missing for the specified dosing unit.
*** Dos.## not ready**	The selected dosing unit is unable to execute the selected command since it is busy executing another action or since the current device status does not allow this.
*** Dos.unit ## missing**	The selected doser is not connected.
*** Dos.unit ## overload**	The specified dosing unit is unable to execute a dosing command. Check the burette and plunger.
*** error list full**	More than 10 error messages have occurred. Check the unit. Switch the unit off and back again if necessary. Restart the sample series.

*** gas flow too high**	The gas flow rate is higher than the set max. limit. Regulate the gas flow.
*** gas flow too low**	The gas flow rate is lower than the set min. limit. Regulate the gas flow.
*** gas flow sensor defect**	The flowmeter is defective. Call your Metrohm servicing technician.
*** invalid position**	The selected sample position does not exist or is defined as a special beaker or the selected special beaker is not defined.
*** invalid rack code**	The rack code read in by the changer has not been found in the internal table.
*** manual stop**	The previous determination has been stopped manually.
*** max. temp. reached**	The current oven temperature is higher than the set safety limit in the configuration.
*** meas.pt list overflow**	The measuring point list of the oven temperature values already contains 400 data items and is unable to accommodate further measured values. Choose a longer measuring interval for the next determination (under **<PARAM>**, **>report**).
*** missing beaker**	No vessel was found at the selected position after a MOVE command.
*** rack data missing**	No sample rack fitted or no rack data can be found for the fitted sample rack.
*** raise lift first**	Unable to execute a rotary movement of the rack since the lift is located beneath the defined rotary position.
*** RS232 error xx**	A data transfer error has occurred. It may be the case that the transfer parameters of the RS232 interface do not correspond to those of the receiving device.
*** SCAN timeout**	The connected device has not sent the expected signal within the defined timeout time. It may be the case that the sample determination was not performed regularly or there may be a discontinuity. Check the connected device.
*** system error #3**	The adjustment data for temperature measurement or for the flowmeter is missing. Call out your Metrohm servicing technician for readjustment.
*** system error #12**	Incorrect 'External Bus' address. Switch off, set the address to 0 (rotary switch on the rear side of the unit) and switch the unit back on.
*** Temp. not reachedyet**	The oven heater has been unable to reach the set oven temperature in the preset time. Choose a longer heating interval.
*** temp. sensor defect**	The temperature sensor is defective or not connected. Call your Metrohm servicing technician.
*** user memory full**	The memory for the user-defined methods is full. Methods not used or methods used only rarely must be deleted before saving new methods.
*** wrong rack**	The fitted rack does not correspond to that assigned to the method under 'Parameters'.

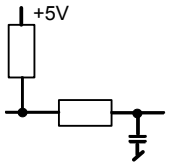
trap error xxx	Unforeseen program error. Switch the unit off and back on again.
No display, LEDs light	LCD error (system error 7). Inform your servicing technician.

6.2 Technical data

Dimensions	Height: 0.51 m, width: 0.38 m, depth: 0.55 m	
Weight	15.9 kg (not including accessories)	
Material	Sample changer housing:	Metal housing, multiple stove-enamelled
	Keypad housing:	Crastin (PBTB), aluminium vapour-deposited on inside
	Keypad seal:	Polyester, resistant to chemicals
LCD display	2 lines of 24 characters each, height 5 mm	
Lift path	Approx. 100 mm	
Lift	Load:	approx. 30 N
	Lift speed:	adjustable, 3...12 mm/s
Turntable	Rotary speed: Adjustable, 3...20 angular degrees/second	
Oven	Temperature range:	50…250 °C
	Correction range:	-10…+10 °C
	Heat output:	82 W
	Heating rate (50…150 °C):	15 °C/min
	Materials Oven block: Aluminium Cover: PTFE Inner sleeve: Chromium steel	
Pump	Pump delivery: 0…300 mL/min resp. 0…18 L/h	
Inert gas	max input pressure 1 bar	
RS232 interface	For computer or printer connection programmable for communication with external devices	
Remote interface	Programmable parallel port for control of external devices	

Input: 

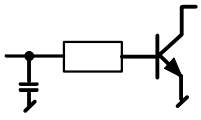
t_p >20 ms



active = low
inactive = high

Output: 

t_p >200 ms
V_{CEO} = 40 V
I_C = 20 mA



active = low
inactive = high

+5 V: maximum load = 20 mA

Temperatures

Nominal function range 5...40 °C
at 20…80 % relative humidity

Transportation and storage –20...+60 °C

60 °C	relative humidity	<50%
50 °C	"	<85%
40 °C	"	<95%

Mains connection

Voltage 100...120 V, 220...240 V
Frequency 50...60 Hz
Power consumption 120 VA

Fuses

Mains filter:	2.0 A slow-blow (5 mm ∅, 20 mm in length or 6.3 ∅, 32 mm in length)
on board 3.774.0110:	0.25 A slow-blow (5 mm ∅, 20 mm in length)

All data typical values unless specified otherwise.

Safety specification

Design and testing in accordance with IEC 1010 / EN 61010 / UL 3101-1, safety class I
Enclosure IP 22

The Instructions for Use contain information and warnings which must be followed by the user in order to guarantee safe operation of the unit.

Electromagnetic compatibility (EMC)

Emitted interference: This unit complies with the Basic Specifications EN 50081-1/2 1992, EN 55011 (Class B), EN 55022 (Class B) and NAMUR.

Interference immunity: Standards EN 50082-1/2 1997/1995, IEC 801-2 to IEC 801-6, 61000-3-2/1995, 61000-3-3/1995 and 61000-4-11 are complied with.

Emitted interference and interference immunity: Laboratory Apparatus Standard IEC61326-1/1997

6.3 Maintenance and servicing

6.3.1 Maintenance / service

Maintenance of the 774 Oven Sample Processor should be performed within the framework of an annual service carried out by technical personnel of Messrs. Metrohm. If you frequently work with caustic and corrosive chemicals, shorter maintenance intervals will be necessary.
The Metrohm Servicing Department offers technical advice on maintenance and servicing of all Metrohm equipment at any time.
Within the framework of the annual service, the oven block mounting should be adjusted since precise alignment thereof is absolutely essential for safely lowering a sample vial into the oven chamber.

6.3.2 Servicing / care

Not only highly sensitive measuring instruments but also other laboratory apparatus items require appropriate care. Excessive soiling of the unit may, under certain circumstances, lead to malfunctions and a shorter service life of the mechanical and electronic systems of your unit which are robust in themselves.

Heavy soiling may lead to influencing of measurement results. Regular cleaning of exposed parts can largely prevent this.

Spilt chemicals and solvents should be removed immediately. Above all, the connector strips (in particular the mains connector) should be protected against contamination. The 774 Oven Sample Processor should never be operated without the scheduled covers fitted.

The oven chamber must be kept free of chemicals and dirt. Clean the oven block regularly.

Even though penetration of aggressive media to the unit's interior should be largely prevented by design measures, you should immediately disconnect the mains plug if this occurs in order to prevent massive damage to the equipment's circuitry. Inform Metrohm servicing personnel of such damage. The unit may never be opened by untrained personnel.

It is advisable to check adjustment of the sample rack from time to time; see Page 12.

6.4 Diagnosis

6.4.1 General

The 774 Oven Sample Processor is a very precise and reliable unit. Thanks to its rugged construction, its functions can hardly be impaired by external mechanical or electrical influences.
Even though the possibility of a fault occurring in the unit can never be entirely precluded, there is a greater possibility of malfunctions occurring as the result of operating errors or incorrect connections and operation with third-party equipment.
At all events, it is advisable to localise the fault or error using the diagnosis utility which can be run quickly and simply. This means that you do not need to call your Metrohm servicing technician unless an actual fault or error has occurred in the unit. In addition, the results of the specific diagnostic functions provide better information for the servicing technician.
Should you have any queries, please always state the serial number (rear side of the unit, see Page 5) and program version (see configuration, Page 63) and, possibly, the text on the error or fault display.

Procedure

The following test list lists all components for which detailed instructions (diagnosis steps) exist in order to check their operability.
If an error occurs, we recommend that you follow the instructions of the corresponding diagnosis step or run through all diagnosis steps as a routine check of the unit.
The unit's responses to the instructions must be compared with the descriptions in the diagnosis step. If the unit does not show the expected response ("No"), repeat the corresponding diagnosis step in order to exclude the possibility of operating errors. Repeated incorrect responses do, however, indicate a fault with a high probability.

Components	See Chapter
Main memory (RAM)	*Chap. 6.4.3*
Display	*Chap. 6.4.4*
Keypad	*Chap. 6.4.5*
Remote	*Chap. 6.4.6*
RS 232	*Chap. 6.4.7*
External bus	*Chap. 6.4.8*
Beeper	*Chap. 6.4.9*
Rack code	*Chap. 6.4.10*

Required equipment:

Required only if RS232 or Remote are to be checked:
Test connector 3.496.8550 (connected to socket ‘Remote’)
Test connector 3.496.8480 (connected to socket ‘RS 232’)

6.4.2 Preparing the instrument

- Disconnect the cables to the RS232 and Remote interfaces.
- Switch the power on and immediately press key <9> and keep it pressed until the power-up test pattern disappears.

Switch on and 

drücken.

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 **>function test ***
diagnosis **>instrument number ***
diagnosis **>oven test ***
diagnosis **>instrument adjustment ***
diagnosis **>measure test ***
diagnosis **power on reset**

Open the sub-menu with <ENTER>

Move one menu item down or up with <↑> or <↓>

Move to the first resp. last menu item with <HOME> or <END>
Return to basic state with <QUIT>

* These tests are reserved for servicing personnel.

6.4.3 Main memory (RAM)

This diagnosis step completes a non-destructive test of the entire area of the RAM contents (main memory).

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press <🡻> several times until

```
diagnosis
>RAM test
```

- <ENTER>

If no errors are found, you will see the following on the display :

```
>RAM test
 RAM test ok
```

- <ENTER>

6.4.4 Display

This diagnosis step allows you to check the LEDs and the display for operability.

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press <🡻>several times until

```
diagnosis
>display test
```

- <ENTER>

After you press key <ENTER>, the program runs automatically through a test run for optical checking of the LEDs and the display.

⇒ *All LEDs blink consecutively for a brief period.*

⇒ *The background lighting of the display is switched off for a short period and back on again.*

⇒ *The power-up test pattern (each pixel active) is displayed.*

⇒ *Both lines of the display are cleared.*

⇒ *Both lines of the display consecutively display characters " **#** ", "**H**" and, lastly, "**I**".*

⇒ *Both lines display the continuous moving text "0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ" from right to left.*

- The test run can be halted and started again by pressing key <5>.
- The test is quit with key <QUIT> or <STOP>.

```
diagnosis
>display contrast test
```

- <ENTER>

After you press the <ENTER> key, the following display is shown, whereby the contrast of the display is varied constantly between bright and dark.

```
>display contrast test
 774 Oven Sample Proc.
```

- The test can be quit with key <QUIT> or <STOP>.

6.4.5 Keypad

This diagnosis step allows you to check all keys of the keypad for operability.

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press <🡻> several times until

```
diagnosis
>key test
```

- <ENTER>

```
>key test

```

- Press all keys consecutively and check the response on the display.

The corresponding matrix code and designation of the main function for the key pressed are shown on the display (e.g. the following display must be shown when you press key <CONFIG>).

```
>key test
 code  4   CONFIG
```

- You can quit the test by pressing key <STOP> twice.

Key table:

Code	Key	Code	Key
1	<HOLD / LEARN>	16	<7 / SAMPLE>
2	<STOP>	17	<4 / FLOW>
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	<* / RACK>	26	<SELECT / DISPLAY>
12	<8 / MOVE>	27	<QUIT>
13	<5 / HEATER>	28	<HOME>
14	<2 / CTRL>	29	<🡸>
15	<. / PRINT>	30	<INSERT >
		31	<DELETE>

6.4.6 Remote interface

This diagnosis step allows you to check all outputs (14) and inputs (8) for operability.

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press <🡻> several times until

```
diagnosis
>remote test
```

- <ENTER>

```
>remote test
 remote test connector ?
```

- Connect the test connector 3.496.8550 to the Remote socket without switching the unit off.
- <ENTER>

The test runs automatically. If no error occurs, the following is displayed:

```
>remote test
 remote test ok
```

- Disconnect the test connector and press <ENTER>.

6.4.7 RS232 interface

This diagnosis step allows you to check all outputs and inputs for operability.

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press <↓> several times until

```
diagnosis
>RS232 test
```

- <ENTER>

```
>RS232 test
 RS232 test connector ?
```

- Connect the test connector 3.496.8480 to socket RS232 without switching the unit off.
- <ENTER>

The test runs automatically. If no error occurs, the following is displayed.

```
>RS232 test
 RS232 test ok
```

- Disconnect the test connector and press <ENTER>.

6.4.8 External bus interface

This diagnosis step allows you to check all parts of the external bus interface for operability.

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).

- If necessary, press <↓> several times until

```
diagnosis
>external bus test
```

- <ENTER>

The test searches for all devices connected to the E-Bus interface. The term "devices" means:

Tower 1
Dosimat interface (optional, max. 3 ea.)

If no error occurs, an identification must be shown on the display for each device connected to the E-Bus. You can scroll through the list of identifications found with key <ENTER>. The following table shows what identifications must be displayed for what configurations.

Configuration	Identification on the display
Tower 1	**address 0x86 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 the display with the above list until

```
>diagnosis
>beeper test
```

6.4.9 Beeper

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press <↓> several times until

```
diagnosis
>beeper test
```

- <ENTER>

The beeper is switched on and back off again as an endless loop.

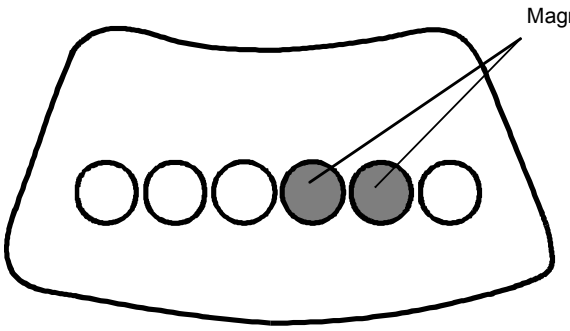
```
>beeper test
```

- You can quit the test by pressing <QUIT> or <STOP>.

6.4.10 Rack code recognition

This diagnosis step allows you to check the sensors for automatic recognition of the fitted rack for operability.

- Note down the coding (magnets) on the underside of the racks for all racks used for the test. The magnet fixture on the underside of the rack is shown in the diagram below.



In this example, the code is:

000110

Magnet fixture viewed from below

- Raise the rack and place it to one side.
- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press<🡻> several times until

```
diagnosis
>power on reset
```

- <ENTER>

The unit runs through the power-up routine (initialisation of lift and rack positions). Initialisation is important since it is essential that the turntable (rack holder) be in basic position (beaker 1 at tower 1) for the following "rack code test" diagnosis step.

- Prepare the unit for diagnosis (see *Chap. 6.4.2*).
- If necessary, press <🡻> several times until

```
diagnosis
>rack code test
```

- <ENTER>

The test reads in the coding constantly and displays it. A six-digit bit pattern (code ??????) is scheduled for this for the display. The first digit for magnet No. 1, the second digit for magnet No. 2 etc. If a magnet is detected, the corresponding digit is assigned "1". Otherwise, it is assigned "0".

- Consecutively fit all racks to be used and compare the related note which you made beforehand with the information on the display.

```
>rack code test
 code 000000
```

Example of:
No rack fitted

```
>rack code test
 code 000001
```

Example of:
Rack with coding in accordance with above example.

- You can quit the test by pressing key <QUIT> or <STOP>.

```
diagnosis
>power on reset
```

You can quit diagnosis from the main menu with <QUIT> or <STOP>.

6.5 Initialise data memory

This diagnosis step allows you to assign default values to device parameters using the keypad and thus set the unit to its original state. This is important owing to the following two aspects:

Certain device parameters can be set only via RS232, i.e. using a PC. If such device parameters are set and if no PC is available to cancel the settings, the unit cannot be fully set to the previous state.

In rare cases, high-magnitude unwanted signals such as mains spikes and lightning strike etc. may impair the contents of the data memory. If the data memory has undefined contents, this may lead to a system crash.

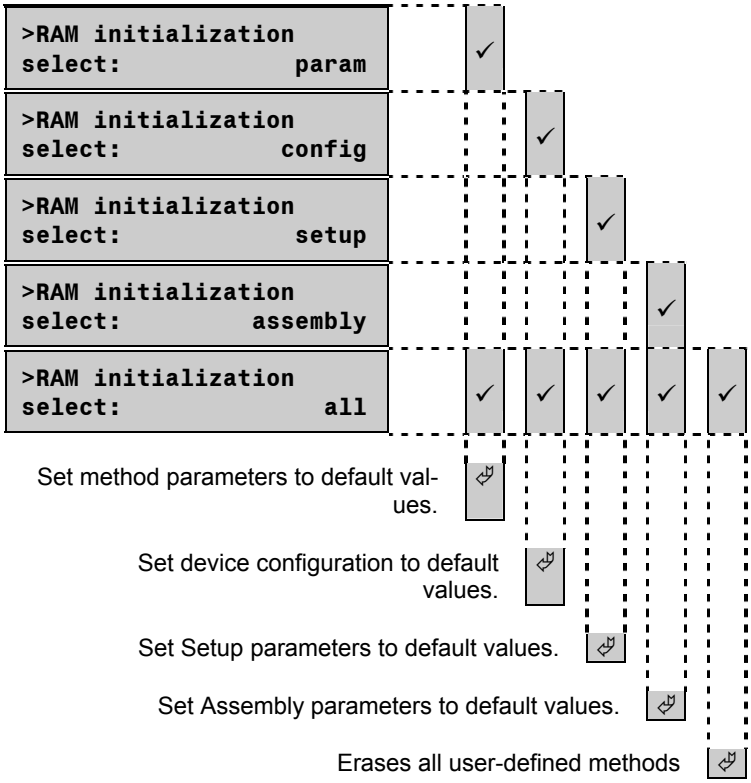
The 774 Oven Sample Processor offers various options for initialising the data memory. Either the entire memory (**all**) or only parts of it (**param, config, setup, assembly**) may be assigned default values.

Even though the device number is retained in this case, you should initialise only when necessary since the stored user data (etc.) will be deleted in this case.

- Prepare the unit for diagnosis (see Chap. 5.4.2).
- If necessary, press key <9> several times until

```
diagnosis
>RAM initialization
```

- Press key <ENTER> to open the following Diagnosis menu:



The sub-menus can be selected one after the other by pressing key <Select>. You can access the individual initialisation variants with key <ENTER>, and you can quit with key <QUIT>.

The table shows what parts of the data memory are affected by the corresponding initialisation variants. In the case of a system crash (undefined display), no responses to keystrokes etc.), it is advisable to use initialisation variant "**all**".

- If necessary, press key <Select> several times until:

```
>RAM initialization
select:              all
```

- Press <ENTER>.

```
diagnosis
>RAM test
```

- Press <QUIT>.

The Diagnosis menu is closed and the device runs through a power-up reset.

6.6 Validation / GLP

GLP (**G**ood **L**aboratory **P**ractice) demands, amongst other things, a periodic inspection of analytical measuring instruments for reproducibility and correctness on the basis of **S**tandard **O**perating **P**rocedure (**SOPs**).

Since this unit is not a measuring instrument as such, the user is advised to include the 774 Oven Sample Processor as a part of an analysis system in comprehensive validation of this system.

Inspection of the electrical and mechanical function groups of Metrohm equipment can and should be performed within the framework of regular servicing by technical staff of the manufacturer's company. All Metrohm units feature start-up check routines which, when the unit is switched on, check proper operation of the relevant modules. If no error message is displayed in this case, it can be assumed that the device is functioning correctly. Messrs. Metrohm also supply their equipment with integrated diagnostic routines allowing the user to check the function of specific modules and localise the error or fault in the event of any faults or incorrect responses occurring. Diagnostic routines may also be integrated in a validation procedure.

Please refer to the Metrohm Application Bulletins 255/1 ("Validation of Metrohm KF Titrators and KF Ovens according to GLP/ISO 9001") and 273/1 ("Validation of Metrohm KF Coulometers according to GLP/ISO 9001") for directives on elaborating Standard Operating Procedures for checking a titration system. These Bulletins are available free of charge from Metrohm.

Notes on the use of standard substances
If the 774 Oven Sample Processor is used primarily at high temperatures (>150 °C), use a certified water-standard substance on the basis of potassium citrate-1-hydrate (5.55 % water).

Recommended settings:

Oven temperature:	220 °C
Gas flow:	Approx. 40 mL/min
Sample size:	20 to 40 mg

Important! Since this solids standard features a high water content for the determination with a Coulometer, it must be ensured that the moisture is not transferred too quickly to the titration cell during the determination. If necessary, further-reduce the gas flow. The measured value of the Coulometer should never exceed 100 mV.

You can use a water standard on an anisole or xylene basis (1.00 mg resp. 0.10 mg water/mL) for validation of a 774 Oven Sample Processor at lower temperatures (<150 °C). The oven temperature must be lower than the boiling point of the solvent used.

Recommended settings:

Oven temperature:	120 °C
Gas flow:	Approx. 60 mL/min
Sample size:	Approx. 1 g

6.7 Warranty and Conformity

6.7.1 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 embedding 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.

6.7.2 EU Declaration of Conformity

The Metrohm Ltd. company, Herisau, Switzerland hereby certifies, that the instrument:

774 Oven Sample Processor

meets the requirements of EU Directives 89/336/EEC and 73/23/EEC.

Source of specifications:

EN 50081	Electromagnetic compatibility, basic specification Emitted Interference
EN 50082	Electromagnetic compatibility, basic specification Interference Immunity
EN 61010	Safety requirements for electrical laboratory measurement and control equipment

Description of the instrument:

Sample changer with integrated heating block for the automation of batch processing of larger sample series in analytical laboratories.

Herisau, Sept. 3, 1998

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

6.7.3 Certificate of Conformity and System Validation

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:	774 Oven Sample Processor	
System software:	stored in ROM	
Name of manufacturer:	Metrohm Ltd, Herisau, Switzerland	
Principal technical information:	Voltages: Frequency:	100…120, 220…240 V 50…60 Hz

This Metrohm instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility

IEC801-2 / level 3, IEC801-3 / level 3, IEC801-4 / level 4,
IEC 801-5 / level 2/3, IEC801-6 level 3, EN55011 / Class B, EN55022 / Class B, EN50081-1/2 1992, EN50082-1/2 1997/1995, EN61000-3-2/1995, EN61000-3-3/1995, EN61000-4-11, IEC61326-1/1997

Security specifications

IEC1010, EN61010, UL3101-1

It has also been certified by the Swiss Electronics 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, Sept. 3, 1998

Dr. J. Frank
Development Manager

Ch. Buchmann
Production and
Quality Assurance Manager

6.8 Accessories

774 Oven Sample Processor		**2.774.0010**
includes the following accessories:		
Keyboard		6.2142.030
Injection needle		6.2816.050
Outlet needle		6.2816.060
M6 adapter M6 outer/Luer-Lock		6.1808.150
Protective cover		6.2751.060
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
Stopper SGJ14 /8 mm		6.1446.170
FEP tubing M6 44 mm		6.1805.470
FEP tubing M6 7 mm	2 ea.	6.1805.520
Insert for drying flask		6.1602.145
Glass bottle		6.1608.090
Molecular sieve 250 g		6.2811.000
Inlet/Outlet tube with filter		6.1821.050
Heatable transfer hose		6.1830.010
Sample rack M36-0		6.2041.700
Septum tweezers		6.2621.110
Dust filter 32 mm		6.2724.010
Wrench for nipple M6		6.2739.000
Sample vials 6 mL	1000 ea.	6.2419.000
Aluminum crimp seals/septa		
with PTFE insert	1000 ea.	6.1448.050
Instructions for use for 774 Oven Sample Processor		8.774.1043
Quick reference for 774 Oven Sample Processor		8.774.1011
Tutorial for 774 Oven Sample Processor		8.774.1021

Options

Accessories to separate order and on payment of extra charge

Cables

Remote cable 774 — Titrino/756 Coulometer	6.2141.020
Remote cable 774 — 737 Coulometer	6.2141.000
RS232 cable 774 — 756 Coulometer	6.2125.110

Sample vials

Vials 6 mL (Head Space Vials)	1000 ea.	6.2419.000
Septum caps, with aluminium cover and PTFE insert	1000 ea.	6.1448.050

Dosing instruments

729 Dosimat Interface	**2.729.0010**
685 Dosimat	**2.685.0010**
Mains cable	6.2134.000
700 Dosino	**2.700.0010**

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