711 Liquino

Manual

8.711.1023

Ω **Metrohm**

Ω Metrohm

711 Liquino

Manual

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Documentation in additional languages can be found on *http://products.metrohm.com* under **Literature/Technical documentation**.

Table of content

1 Overview

1.1 Application range

The Metrohm 711 Liquino is a very versatile laboratory instrument which can be used everywhere that liquid handling is to be simplified and automated. This is the case in both analytical laboratories and in synthesis laboratories. It is equally suitable for both the preparation of complicated formulations in filling plants and also for simple delivery and pumping tasks involving toxic or aggressive media.

Owing to the freely programmable process sequences and versatile communication interfaces (RS232 or remote connection) it can be integrated into complex automated systems to undertake demanding dosing and monitoring functions, which otherwise would only be capable of realization with a considerably greater expenditure.

1.2 Application possibilities

The 711 Liquino can be used for the whole range of applications which fall under the general heading of 'Liquid Handling'.

In analytical laboratories
- manual, highly accurate liquid dosing.
- complex, process-controlled dosing tasks with freely selectable specifications, e.g. a certain volume in a given period, constant dosing speed during a preselected time interval, a certain volume with constant dosing speed. In addition this can also be temperature-controlled, i.e. if a certain temperature limit is exceeded or undercut during the dosing process then the dosing process can be interrupted and a predefined action triggered, e.g. switching on a cooling bath.
- automated preparation of defined solutions (e.g. standard solutions) or mixtures of liquids (e.g. mobile phases for HPLC or IC). It is possible to connect a balance without any problems.
- highly accurate pipetting and diluting even small volumes of liquid.
- automated sampling and sample preparation for a range of analytical methods (e.g. titrations, pH measurements, etc.) with and without a sample changer.
- preparation of complex formulations in automated filling plant.

In synthesis laboratories
- manual, highly accurate liquid dosing.
- complex, process-controlled dosing tasks with freely selectable specifications, e.g. a certain volume in a given period, constant dosing speed during a preselected time interval, a certain volume with constant dosing speed. In addition this can also be temperature-controlled, i.e. if a certain temperature limit is exceeded or undercut during the dosing process then the dosing process can be interrupted and a predefined action triggered, e.g. switching on a cooling bath.

1.3 Instrument description

1.3.1 Front view

Slot for memory card

Always insert the card so that the upper edge of the card with the label faces right.

711 Liquino

Memory Card

Ω Metrohm

1.3.2 Rear view

Made by Metrohm
Herisau Switzerland

Name plate

Dos.1

Dos.2

Dos.3

Dos.4

Connections for
4 Dosinos

Pt 100

Connection for
Pt100 tempera-
ture sensor

Keyboard/Display

Keyboard connection

WARNING !

- Fire Hazard -
For continued protection replace
only with the same type and
rating of fuse

Fuse:
100/115V : 315mAT
230/240V : 160mAT

RS 232

Remote

Remote
interface

Serial RS 232
interface

Fuses, mains switch
and mains connec-
tion

2 Installation

2.1 Instrument setup

Packaging
The 711 Liquino is supplied in packaging which provides excellent protection. This includes a shock-absorbing plastic foam lining. Please store this packaging as it is the only way to guarantee damage-free transport of the instrument.

Checks
Please check immediately on receipt whether the shipment is complete and undamaged.

Location
The 711 Liquino is a robust instrument and can therefore be used even under rough conditions in laboratories and factories.
However, care must be taken that it is not exposed to a corrosive atmosphere. Regular care of the instrument is essential if it is used in rough surroundings.

2.1.1 Mains connection

Follow the instructions given below to connect the instrument to the mains supply. If the instrument is operated with the mains voltage incorrectly set and/or the wrong mains fuse there may be a fire risk!

Setting the mains supply
Before switching on the 711 Liquino for the first time check that the mains voltage set on the instrument (see illustration on following page) corresponds to the local mains voltage. If this is **not** the case then the correct mains voltage must be set as follows:

- **Pull out mains cable**
  Remove the mains cable from the mains connector of the 711 Liquino.

- **Remove fuse holder**
  Use a screwdriver to loosen the fuse holder beside the mains connector and remove completely.

- **Check and replace fuses**
  Remove the built-in fuses for the required mains voltage from the fuse holder and check their specifications:
  100…120 V 0.315 A (slow-blow)   Metrohm no. U.600.0011
  220…240 V 0.16 A (slow-blow)   Metrohm no. U.600.0008

- **Insert fuses**
  Exchange fuses if necessary and replace them in the fuse holder.

- **Set mains voltage**
  Remove the white fuse block from the fuse holder and reinsert it so that the correct mains voltage is visible through the window in the fuse holder.

- **Insert fuse holder**
  Insert fuse holder and press it until it clicks into place.
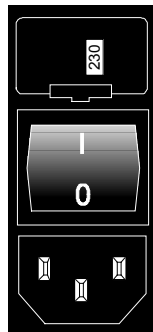
Fuse holder with
window

Mains switch

Mains connection
socket

2.2 Safety information

General
This instrument left our factory in perfect condition from a safety point of
view. The following information must be carefully observed in order to main-
tain this condition and to ensure hazard-free operation.

Mains connection
The mains cables supplied with the instrument are three-core and are fitted
with an earthing pin. If a different plug must be used then the yellow/green
lead must be connected to the protective earth.

WARNING!

*Any break in the earth conductor inside or outside the instrument can repre-
sent a source of danger to the operator. Making a break in the earth con-
ductor is forbidden.*

Before connecting the plug to the mains supply a check must be made that
the instrument is set to the local mains voltage and that the appropriate fus-
es are inserted.

WARNING!

*When changing a fuse and when setting a different mains voltage the mains
cable must be disconnected from the mains supply.*

When replacing fuses care must be taken that voltage, current and type
have been selected correctly (see Technical data, fuses, page 162).

WARNING!

Short-circuiting fuses or the temporary use of incorrect fuses is forbidden.

Repair and maintenance:
If faults or malfunctions occur during the operation of the 711 Liquino it is
recommended that the cable connections with the peripheral units are
checked first for proper functioning (see page 9ff). It may be possible to lo-

cate the source of the fault with the aid of the diagnosis functions. If the cause of the malfunction cannot be found please contact the Metrohm service department.

The instrument should only be opened when switched on under exceptional circumstances. As this exposes electrically live components it should only be carried out by an expert who is familiar with the risks involved.

The instrument must be separated from all electricity sources before it is opened. Make sure that the mains plug has been pulled out.

Condensers in the instrument may still be charged even when the instrument is no longer connected to the mains supply.

Changing the battery
The connecting wires of the old battery must be cut before desoldering so that any residual charge which may still be present cannot be short-circuited. The polarity of the new battery must be taken into account when it is fitted.
Lithium batteries cannot be recharged and should not be short-circuited or exposed to temperatures above 70 °C under any circumstances.
Old batteries must be disposed of in an environmentally acceptable way and must not be burnt.

Static electricity:
The circuit contains components which could be destroyed by electrostatic charges or whose functions could be affected by them. Work on an open instrument should only be carried out in ESD-protected surroundings.

Suitable measures:

1. A conductive mat on the work surface connected to the earth conductor via a resistor of approx. 1 MΩ.
2. Earthed soldering iron.
3. Persons working with components must have their wrists connected to the earth conductor via a resistor of approx. 1 MΩ.
4. Components and assembled PCBs should only be stored and transported in conductive packaging or foam.
5. New components should be stored in their original packaging until required.

If it becomes apparent that the instrument can no longer be operated safely then it should not be used at all.

2.3 Setup

2.3.1 Connecting the keyboard
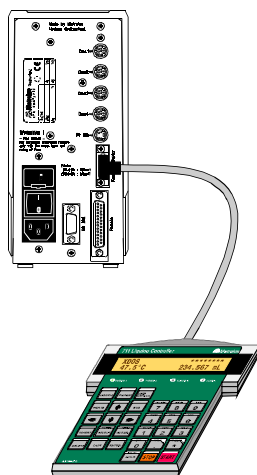
The keyboard is connected to the keyboard socket provided for it on the rear panel of the instrument.

2.3.2 Connecting the Dosinos

The Dosinos are connected to the sockets "DOS1" to "DOS4" on the rear panel of the 711 Liquino. Press each Dosino plug into the socket until it clicks into place!

Dos.1
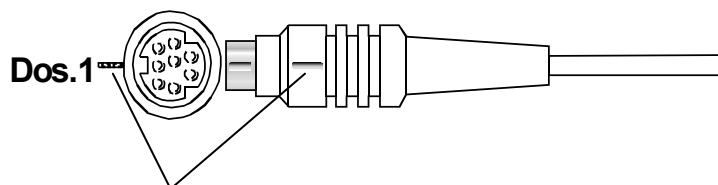
The notch on the plug must coincide with the marking on the panel.

A Dosino should only be connected when the instrument is *switched off*! The 711 Liquino only recognizes Dosinos which are already plugged in when it is switched on.

2.3.3 Connecting a Pt100 temperature sensor

The Pt100 temperature sensor 6.1111.030 with 4-wire technology can be used with the 711 Liquino. It is connected to the socket marked with "Pt100" on the rear panel of the instrument.

2.3.4 Installing the pipetting attachment

The pipetting attachment available as an option is suitable for automatic pipetting functions with a Dosino 700.

Connection to dosing port 1
of the Dosino 700

Connection cable to 711 Liquino (remote connection)

6.1562.050
Pipetting tubing

6.1562.040
Pipet handle

Black start
button

Green pilot lamp

Pipet tip
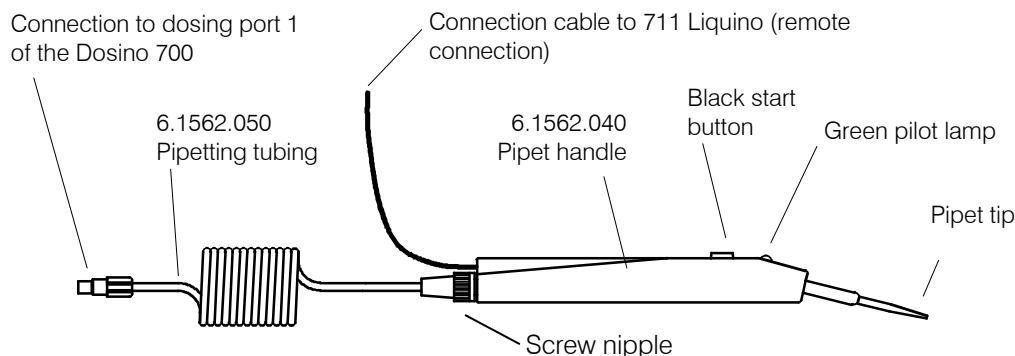
Screw nipple

To install the pipetting attachment proceed as follows:

- Loosen the screw nipple on the pipet handle and push it over the pipet tubing.

- Guide the pipet tubing into the handle and fix the tubing with the screw nipple.

- Mount the pipet tubing on dosing port 1 of the Dosino dosing unit.

- Insert in the 25-pin connection cable plug into the remote socket of the Liquino. The second connection cable plug is used to connect another peripheral unit to the Liquino.

- As soon as the pipet handle is connected the green pilot lamp lights up to indicate that it is ready for work.

- The angle between the tubing guide and the handle can be adjusted for strain-free work.

Important: the pipet tubing must always be clean and kink-free!

Pipetting accessories:

Pipet handle	6.1562.040
with spiral pipet tubing, 3 mL	6.1562.050
Pipet tubing, 10 mL	6.1562.100
Pipet tubing, 3 mL	6.1829.020
Pipet tubing, 0.7 mL	6.1562.010
Pipet tips for pipet tubing 0.7 mL, 10 pieces	6.1562.030
Pipet tip holder	6.2052.010

2.4 Memory card

The memory card (e.g. 6.2245.010) must be inserted in the slot on the front panel of the 711 Liquino so that the front of the memory card (with the type name) faces to the right. A little pressure is necessary to push the memory card completely into the slot. Never remove the memory card from the instrument when it is being accessed by the instrument.

2.5 Connections

Metrohm automated systems with the 711 Liquino

Seiko
Citizen
Epson
HP
IBM

Printer

Balance

Personal computer

other devices
e. g. thermostat

665
..
776
Dosimats

691
692
712
713
pH Meter /
Conductometer

702
...
751
Titrino family

RS 232

Pt100

Dos.1-4

Remote

726

726 Titroprocessor

711 Liquino

700 Dosinos

683 Pump

other
devices

731 Relay box

730

730 Sample changer

772 Pump unit

AC

DC

pumps
heating bath
etc.

pumps
heating bath
etc.

2.5.1 Remote connections

The remote control of instruments within a Metrohm automated system can (apart from data communication via RS232 interfaces) be carried out in a simple manner with the help of parallel-switched signal leads, the remote lines (or I/O lines). Signals can be set statically or transmitted as a signal pulse (usually approx. 200 ms duration); see SCAN and CONTROL commands, (page 91ff). The signal level is +5 volt (TTL-level) in each case.

The functions which can be used for remote control or monitoring tasks each occupy a particular remote lead. The remote socket of a Metrohm instrument has input leads (Input0…7, for the control of certain functions, e.g. START or STOP) and output leads (Output0…8, to display instrument conditions, e.g. 'ready' or 'End of Determination').

The remote connection is normally a 25-pin socket. Different connection cables are available for different types of instrument. The suitable remote cable is listed in the 'Instructions for use' of the corresponding instrument. Special connection cables can also be made according to the customers' particular requirements.

Remote lead occupancy for 711 Liquino:

Remote lead	Pin	Function
Input 0	21	START
Input 1	9	STOP
Input 2	22	HOLD / CONTINUE
Input 3	10	External ready
Input 4	23	Sample Changer ready
Input 5	11	not used
Input 6	24	PIP continue
Input 7	12	not used
Output 0	5	Ready
Output 1	18	Upper limit
Output 2	4	Lower limit
Output 3	17	EOD (End of Determination)
Output 4	3	Activate 1
Output 5	16	Activate 2
Output 6	1	External start
Output 7	2	Start Sample Changer

Output leads 8…13 cannot be used.
In the SEQ mode remote leads Input3…7 and Output4…7 can be freely used with the commands SCAN and CONTROL (see page 91ff).

Connection cables

Only Metrohm cables should be used to connect the 711 Liquino to other instruments as these are the only ones with which interference-free data transmission can be guaranteed.

Note:

Remote cables for the 711 Liquino always have a name on the end of the cable to indicate the instrument with which the particular plug is intended to be used and which connection it should be plugged in to.
Example:
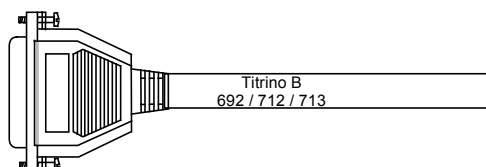
Liquino — Titrino
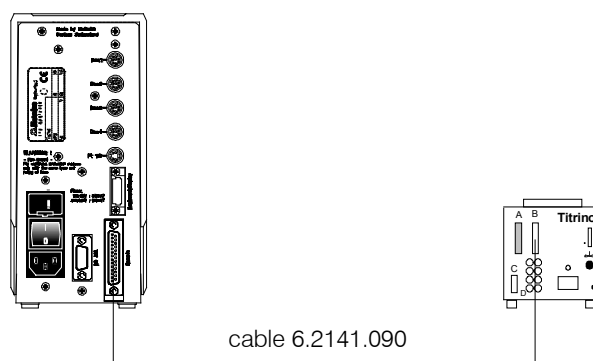
cable 6.2141.090

Cable 6.2141.090 is used in the SMPL mode. Details can be found on page 106ff.
Control commands can also be used in an SEQ method, for example:

>SEQ sequence	**step 4**	(CONTROL command)
pattern	***1**----**	starts Titrino (start pulse)
>SEQ sequence	**step 5**	(Pause command)
pause	**00:00:01**	wait 1 s
>SEQ sequence	**step 6**	(CONTROL command)
pattern	***0**----**	reset remote interface (end pulse)
>SEQ sequence	**step 7**	(SCAN command)
pattern	******1---**	wait for ready message from Titrino

711 Liquino — Titrino — 683 Pump — 730 Sample Changer
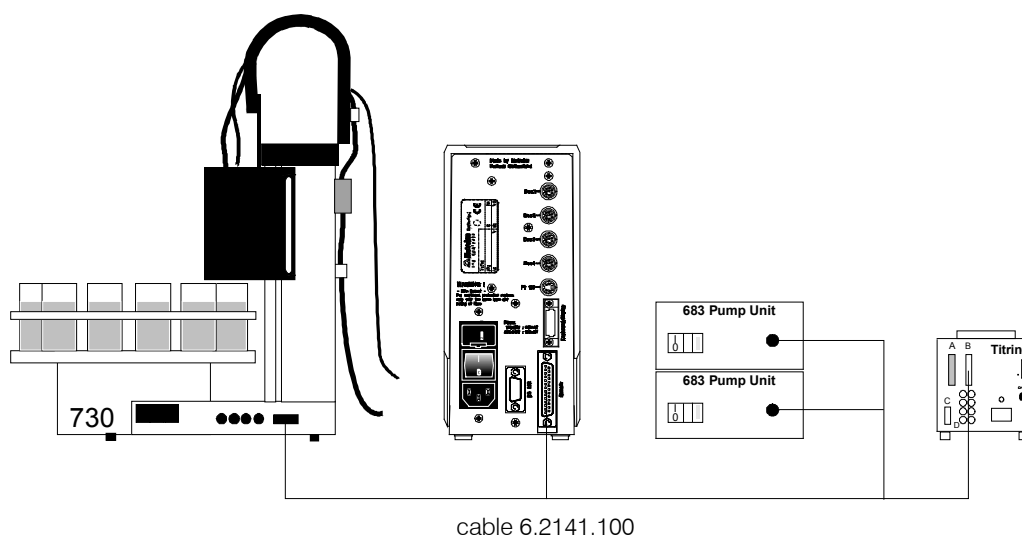
cable 6.2141.100

Cable 6.2141.100 is used for the SMPL mode if aspiration and rinsing the titration vessel are to be carried out as quickly as possible (with 2 x Pump 683). The sample changer connection can be left open if no sample changer is required.

The Titrino, the pumps and the sample changer can also be addressed with the control commands of a SEQ method, for example:

Start Titrino

>SEQ sequence	**step 4**	(CONTROL command)
pattern	***1**----**	starts Titrino (starts pulse)
>SEQ sequence	**step 5**	(Pause command)
pause	**00:00:01**	wait 1 s
>SEQ sequence	**step 6**	(CONTROL command)
pattern	***0**----**	starts Titrino (ends pulse)
>SEQ sequence	**step 7**	(SCAN command)
pattern	******1---**	wait for ready message from Titrino

Run pump 1 for 10 s

>SEQ sequence	**step 8**	(CONTROL command)
pattern	*****1----**	switches on 1st 683 pump
>SEQ sequence	**step 9**	(Pause command)
pause	**00:00:10**	wait 10 s
>SEQ sequence	**step 10**	(CONTROL command)
pattern	*****0----**	switches off 1st pump 683 again

Run pump 2 for 1 min 5 s

>SEQ sequence	**step 11**	(CONTROL command)
pattern	****1*----**	switches on 2nd pump 683
>SEQ sequence	**step 12**	(Pause command)
pause	**00:01:05**	wait 1 min 5 s
>SEQ sequence	**step 13**	(CONTROL command)
pattern	****0*----**	switches off 2nd pump 683 again

Command to *730 Sample Changer*	Switch sample changer to next sample[*)]		
SCN:Rm: ready1 ←	**>SEQ sequence** **pattern**	**step 14** **1***----**	(CONTROL command) switches sample changer 1 sample further (start pulse)
	>SEQ sequence **pause**	**step 15** **00:00:01**	(Pause command) wait 1 s
	>SEQ sequence **pattern**	**step 16** **0***----**	(CONTROL command) resets remote interface (end pulse)
CTL:Rm: START device1→	**>SEQ sequence** **pattern**	**step 17** *****1*---**	(SCAN command) wait for ready message from sample changer

711 Liquino – 730 Sample Changer – Titrino

730 Sample Changer with Titrino and 711 Liquino for automated pipetting of different samples on the sample changer into a special beaker on the sample rack.
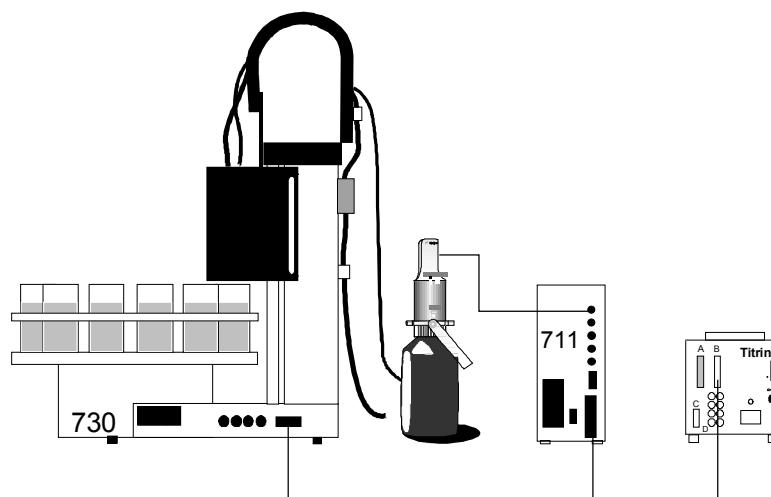
cable 6.9921.165

The 711 Liquino can be used in any automated system for pipetting tasks (PIP mode). In this case the 730 Sample Changer controls the working process. The 711 Liquino is used in the PIP mode. The determination of the samples is carried out by the Titrino which, like the Liquino, is started from the sample changer.
This arrangement of instruments requires a special remote cable (6.9921.165). Other special cables for similar instrument combinations are available on request.

[*)] For this function the sample changer must be appropriately programmed with Scan and Control commands!

Example of a sample changer method:

```
>start sequence
   1 CTL: Rm             INIT              ← Initialize remote interface

>sample sequence
   1 CTL: Rm     START device1
   2 SCN: Rm            ready1            ← Start Liquino (PIP mode)
   3 Lift: 1:           shift  mm         ← Wait for pipetting step
   4 CTL: Rm    *********1****             ← Lift out of sample vessel
   5 Wait               1 s               ← Switch pipetting further (corresponds to
   6 CTL: Rm    *********0****              <ENTER>)
   7 Move: 1:           sample                 — separating bubble is aspirated —
   8 Lift: 1:           work  mm          ← Reset remote interface
   9 CTL: Rm    *********1****             ← Position sample beaker
  10 Wait               1 s               ← Immerse pipet tubing in sample
  11 CTL: Rm    *********0****             ← Switch pipetting further (corresponds to
  12 SCN: Rm            ready1             <ENTER>)
  13 Move: 1:           spec. 1                — sample is aspirated —
  14 Lift: 1:           work  mm          ← Reset remote interface
  15 CTL: Rm    *********1****             ← Wait for next pipetting step
  16 Wait               1 s               ← Move to titrating beaker
  17 CTL: Rm    *********0****             ← Pipet tubing in titrating beaker
  18 SCN: Rm            end1              ← Switch pipetting further (corresponds to
  19 Stir: 1:           ON  s              <ENTER>)
  20 CTL: Rm    START device2                  — sample is ejected —
  21 SCN: Rm            end2              ← Reset remote interface
  22 Stir: 1:           OFF s             ← Wait for end of PIP mode
  23 Pump: 1.1:         12 s              ← Stirrer on
  24 Pump: 1.*:         10 s              ← Start Titrino
  25 Pump: 1.1:         12 s              ← Wait for end of determination
  28 NOP                                  ← Switch off stirrer

>final sequence                           ← Aspirate titration beaker
   1 Lift: 1:           shift  mm          ← Rinse titration beaker
   2                    NOP                ← Aspirate titration beaker
```
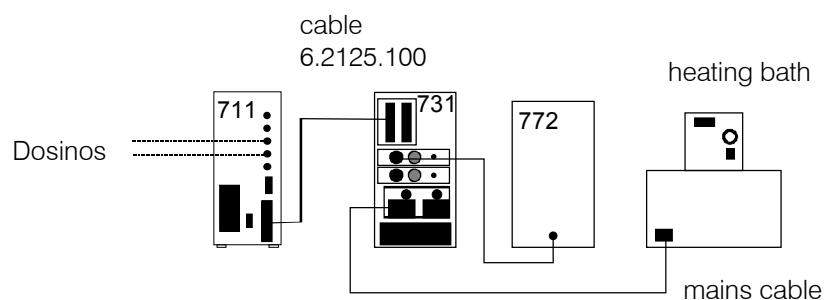
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711 Liquino – 731 Relay Box – 772 Pump Unit – Heating Bath

Liquino with 772 Pump Unit as delivery or aspiration pump and a heating bath.

With the aid of a Metrohm 731 Relay Box the output leads of the 711 Liquino can be monitored and, according to their line conditions, two low-voltage d.c. voltage outputs and two mains voltage outputs can be switched.

In this way the heating bath can be switched automatically via the temperature monitoring function. If the measured temperature falls below a certain value the bath is heated up.

A connected pump (e.g. the Metrohm 772 Pump Unit) can be selectively switched on or off during the method procedure.

<u>731 Relay Box settings:</u>

Connect 772 Pump Unit to DC1 (or DC2)
Output voltage: 18 or 24 volt
Remote address selection disk DC1:   7 (=Output 7)

Connect heating bath to AC1 (or AC2,
mains voltage)
Remote address selection disk AC1:   2 (=Output 2)

<u>711 Liquino settings</u>

Temperature monitoring

XDOS mode (contained in SEQ mode):

```
Parameters
>XDOS monitoring
temperature:            on
low limit               xx°C
upper limit             ...
action:                 ...
alarm pins:             under
```

Control commands for the pump

SEQ mode
Switch on pump:

```
command:            CONTROL
interface:          Remote
pattern             1***----  (Output 7)
(switch off with    0***----)
```

2.5.2 Serial connections

A wide range of possible connections can be made at the RS232 interface. As well as all Metrohm instruments which are equipped with the Metrohm remote control language, a printer (requirement: serial interface or parallel/serial converter) or a personal computer (PC) can also be connected. Any instrument from another manufacturer which is equipped with a serial RS232 interface can also be connected.

711

cable 6.2134.040 (9-pin/9-pin)
or   6.2134.050 (9-pin/25-pin)

printer cables: see page 17f
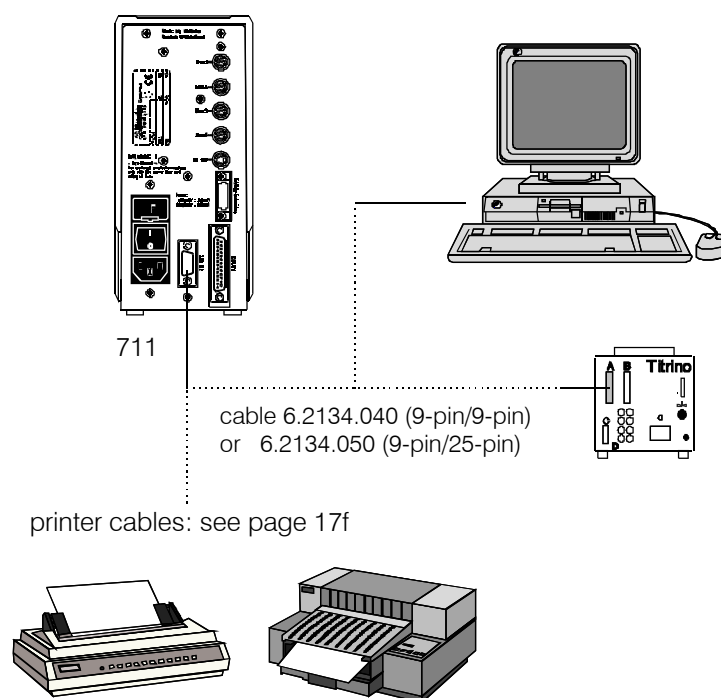
A requirement for correct data transmission is that the transmission parameters are correctly set; these must coincide with the interface settings of the connected instrument (see following page).

Control commands (examples):

| >SEQ sequence | step 4 | (Control command) |
| string | &M;$G | starts Metrohm instrument |

| >SEQ sequence | step 6 | (Control command) |
| string | &M;$S | stops Metrohm instrument |

Input data query (example):

| >SEQ sequence | step 5 | (Scan command) |
| string | *R" | wait for ready message from Metrohm instrument |

The following section provides information about the settings and cables necessary to connect a printer.

2.5.3 Connecting a printer

Printers with the following printer drivers can be connected:

`IBM`   IBM Proprinter and printers with IBM emulation
`Epson`   Epson printers and printers with Epson emulation
`Seiko`   Seiko printer DPU-411 or DPU-414
`Citizen`   Citizen printer IDP560 RS
`HP`   HP printers and printers with HP PCL3 emulation

If you wish to connect a different printer then ensure that this can emulate one of the printer modes supported by the 711 Liquino.
Most printers with a serial interface are connected with cable 6.2134.050.
Printers with a parallel interface require a serial/parallel converter (e.g. 2.145.0300) and cable 6.2125.020 + adapter cable 6.2125.010.
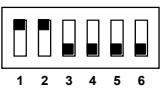
The Liquino must be switched off before a printer is connected to the RS232 interface!
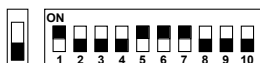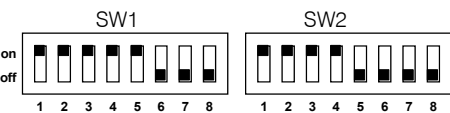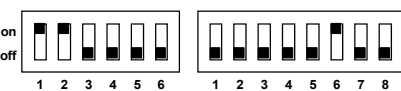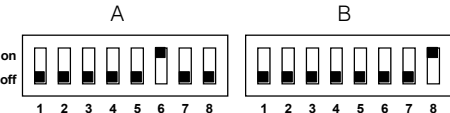
The interface parameters are entered in the configuration menu under '>RS232 settings'. The printer type must also be entered in the configuration menu under '>Peripheral units' and 'send to:'

If you use an A4 printer and the graphics do not cover the whole width of the page then you can proceed as follows:
When the instrument is switched on keep the <CONFIG> key pressed down. In this way you access the setup menu. Press the <⬇> key and <ENTER>. You can now alter the relative width and height of the graphics. In each case press <ENTER> after the entry.

The following table provides information about the connection of several selected printers.

Printer	*Cable*	*RS232 settings*	*Settings on printer*

IBM Proprinter	6.2125.050 + 6.2125.010	`baud rate:    9600`
		`data bit:        8`
		`stop bit:        1`
		`Parity:       none`
		`handshake:  Hardware`
		`send to:       IBM`
			see printer manual

Seiko DPU-411	6.2125.020 + 6.2125.010	`baud rate:    9600`
		`data bit:        8`
		`stop bit:        1`
		`parity:       none`
		`handshake:  Hardware`
		`send to:     Seiko`
			DIP switch settings:
			DIP01 DIP02
			
			on/off 1 2 3 4 5 6 7 8 1 2 3 4 5 6
			
			Depending on the set dialog language, the adjustable 7-bit ASCII character set of the printer will be set automatically to the national character set.

Printer	Cable	RS232 settings	Settings on printer

Seiko DPU-414	6.2125.130	```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: 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
			
			Depending on the set dialog language, the adjustable 7-bit ASCII character set of the printer will be set automatically to the national character set.

Citizen IDP562-RS	6.2125.050	```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: Citizen```
			DIP switch settings:
			
			The adjustable 7-bit ASCII character set of the printer can only be set to the national character set by switching DIP switches 4 and 5 in the printer:
			
			4 *5* *Character set*
			OFF OFF USA
			ON ON United Kingdom
			ON OFF France
			OFF ON Germany
			
			No special Spanish character set is available (it is best to select French).

Epson with 6-pin round plug	6.2125.040
	+
	6.2125.010
		```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: Epson```
			DIP switch settings:
			
			    SW1 SW2

Epson with additional serial interface #8148	6.2134.050	```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: Epson```
			DIP switch settings at <u>interface</u>:
			
			    SW1 SW2

Epson LX-300	6.2134.050	```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: Epson```
			see printer manual

HP Deskjet with serial interface	6.2134.050	```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: HP```
			DIP switch settings:
			
			    A B

HP Laserjet with serial interface	6.2134.050	```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: HP```
			see printer manual *

HP Deskjet/ Laserjet with parallel interface	6.2125.020
	+6.2125.010
	+ serial/
	parallel con-
	verter
	2.145.0300
		```baud rate: 9600```
		```data bit: 8```
		```stop bit: 1```
		```parity: none```
		```handshake: Hardware```
		```send to: HP```
			see printer manual *
			
			* The printer must be set to the PC-8 character set. PCL3 command: `esc(10U`

2.5.4 Connecting a balance

The following balances can be connected to the RS232 output of the 711 Liquino:

Balance	Cable
Sartorius MP8, MC1	6.2134.060
Mettler AB, AG (LC-RS25)	supplied with balance
Mettler AM, PM	from Mettler: ME 33995: green wire to Pin 2, brown wire to Pin 3, white wire to Pin 7, yellow wire to Pin 20 of the 25-pin plug + 6.2125.010 25-pin/9-pin adapter
Mettler interface 016	cable supplied with interface 016: red wire to Pin 3, white wire to Pin 7 of the 25-pin plug + 6.2125.010 25-pin/9-pin adapter
Mettler interface 011 or 012	6.2125.020 + 6.2125.010
Mettler AT	from Mettler: ME 33995: green wire to Pin 2, brown wire to Pin 3, white wire to Pin 7, yellow wire to Pin 20 of the 25-pin plug + 6.2125.010 25-pin/9-pin adapter

AND   models ER-60, 120, 180, 182
         models FR-200, 300
         models FX-200, 300, 320
with RS232 interface (OP-03)
	6.2125.020 + 6.2125.010

Precisa, balances with RS232C interface	6.2125.080 + 6.2125.010

The balance type must be preselected on the 711 Liquino with the <CONFIG> key under '>Peripheral units'.
The weight will be transmitted as a number with up to 6 places, together with sign and decimal point. Units and control characters sent by the balance will not be transmitted.

For the simultaneous connection of printer and balance the adapter cable 6.2125.010 + with junction plug 6.2125.030 are required.
If the balance only works with 7 bit and the printer only works with 8 bit then the balance parity must be set to "space" while the 711 Liquino and printer run with 8 bit, "no parity".
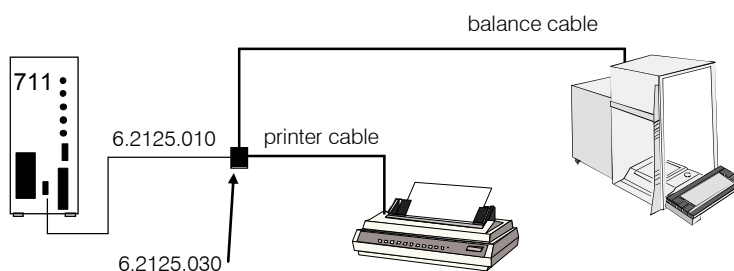
3 Introduction

3.1 The Liquino concept

The 711 Liquino is designed so that, together with one or more 700 Dosinos, it can automate a wide range of tasks in the laboratory. Everything which falls under the general heading of 'liquid handling', i.e. the transport of liquids in any form, belongs to its range of applications. Its functions can be divided up into three steps.

- Simple manual dosing and dispensing with up to four dosing devices.
- Automated procedures for frequently reoccurring and defined tasks. The preset modes in the instrument are used for this. When they are appropriately set they can be stored as methods in the Liquino itself or on a memory card and can be reloaded at any time.
- Complex process sequences, which can be made up from several individual methods or modes with additional auxiliary commands as required. In this way a large number of instruments can be controlled for use in demanding analytical or synthesis units.

The practical 700 Dosinos are used as dosing instruments; they can be conveniently operated with the functions and commands of the 711 Liquino. Special functions (PREP, EMPTY) are available for preparatory work (i.e. bubble-free filling and rinsing of the tubing) and emptying dosing units when a reagent needs to be changed. In order to carry out these procedures in as comfortable and reagent-saving manner as possible you can define different types of dosing unit. As the length and diameter of the tubing used can be defined the 711 Liquino is able to calculate and then use the optimal volumes for the above-mentioned functions.

With the help of the special GLP mode the 711 Liquino can be used to validate all your dosing units, i.e. to determine their accuracy. In this way GLP-conform work can be ensured and also documented.
The dosing procedures in the GLP mode have been optimized and realized for the 700 Dosino in such a way that meaningful characteristic values can be determined; these allow detailed information about the accuracy of the dosing cylinder to be obtained.
You can adapt the necessary limits for the assessment of the reliability of the dosing accuracy yourself to suit your requirements. The limits recommended by Metrohm are set as standard. We recommend that you use these limits.

3.2 Tutorial

This tutorial will introduce you step by step to the operation of the Metrohm 711 Liquino. It is arranged so that you can work through it from the beginning to the end and in this way become familiar with the most important functions of the instrument. You will be guided through each section step by step so that you will be able to carry out the simplest settings. You can also carry out further fine adjustments. The necessary information for this can be found in section 4.

3.2.1 Basic configuration

The most important basic settings are carried out as follows:
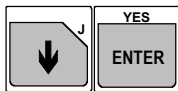
The dialog language, date and time can be set in the configuration menu.

- Press <CONFIG>

> Display: configuration
>   >peripheral units

- and then <↓> and <ENTER>.

> Display: >auxiliaries
>   dialog: english

- The colon in this menu entry indicates that parameters can be selected from a list here. Press the <SELECT> key several times in order to view the different selection possibilities and become familiar with this operating mode.

> Display: >auxiliaries
>   dialog: deutsch

- With <ENTER> the entry 'dialog: english' can be accepted.

> Display: >auxiliaries
>   date: 90-01-01

- The number keys are used to enter the current date in the format year-month-date. If a mistake is made then <CLEAR> can be used to delete the entry. (The date is "year 2000 safe"!)
- The entry is accepted with <ENTER>.

> Display: >auxiliaries
>   time: 01:00:00

- Enter the current time and confirm it with <ENTER>.

> Display: >auxiliaries
>   device label   ********

- Press <QUIT> 2x in order to exit the configuration menu.

3.2.2 Defining dosing units

In order for the complete tubing system of a Dosino to be fully filled with the reagent solution without any air bubbles the 711 Liquino must know the dimensions of the connected tubing. For this reason a dosing unit can be defined in the configuration menu and then selected for the method.[*)]

Except for the "Sampling dosing unit" in the SMPL mode the standard port occupancy for all modes is as follows:

Port 1:   dosing unit output
Port 2 (bottle):   refilling opening

- Press <CONFIG> and then 3x <↓>.

  Display: configuration
                  >dosing units

- Access the submenu 'dosing units' with <ENTER>.
  Display: > dosing units
                  dos.unit: D1

- One of the ten configurable dosing units can be selected with the <SELECT> key. Press <ENTER> to access the settings for the corresponding dosing unit. The index for the dosing unit is located in the top right-hand corner of the display.

  Display: >dosing units   1
                  ID   D1

- Enter an identification text for the dosing unit or leave the preset entry as it is. Text input is explained on page 63.
- Accept the entry with <ENTER>.

  Display: >dosing units   1
                  length tube1   400 mm

- Now enter the length of tubing at Dosino port 1 (for tandem dosing including the tubing length up to the T-piece) and accept the entry with <ENTER>.

  Display: >dosing units   1
                  diam tube1   2.0 mm

- The inner diameter of the tubing at Dosino port 1 can be entered here and confirmed with <ENTER>.

  Display: >dosing units   1
                  length tube2   250 mm

- Now enter the length of the tubing at Dosino port 2 (bottle) and accept the entry with <ENTER>.

  Display: >dosing units   1

[*)] In a single method 'standard' can also be selected for the dosing unit used. For the modes XDOS, CONT and GLP 'standard' means:

	Port1 (dosing port):	L = 40cm, D = 2mm
	Port2 (bottle):	L = 25cm, D = 2mm.
For PIP 'standard' means:	Port1 (pipetting tubing):	L = 150cm, D = 2mm
	Port2 (bottle):	L = 25cm, D = 2mm.
For SMPL 'standard' means:	Port1 (sample tubing):	L = 40cm, D = 2mm
	Port2 (measuring cell):	L = 16cm, D = 2mm
	Port3 (rinsing agent):	L = 50cm, D = 2mm.

                            diam tube2   2.0 mm

- The inner diameter of the tubing at Dosino port 2 can be entered here
  and confirmed with <ENTER>.

        Display: >dosing units   1
                         length tube3   0 mm

- As no tubing is connected to Dosino ports 3 and 4 the tubing lengths
  must be set to 0 mm. Check this for port 3, press <ENTER> and
  check the value for port 4 (the diameter is not requested if the length
  has been set to 0 mm). Press <ENTER> again.

        Display: >dosing units   2
                         ID   D2

NO
QUIT

- The dosing unit has now been defined. Press <QUIT> 2x to exit the
  configuration menu.

3.2.3 Dosing and dispensing

This is where you learn the simplest functions of the Liquino: manual dosing and dispensing.

Fit a reagent bottle with a dosing unit and a Dosino and connect the Dosino to the Liquino. Select, e.g. connection socket '**Dos. 1**' or '**Dos. 2**' for this. Now switch the 711 Liquino briefly off and then on again. In this way the instrument recognizes the connected Dosino.
Details about setting up dosing units can be found in section 6.1.2, page 143.

Now immerse the dosing tip, which must be connected to Dosino Port 1 by tubing, in a rinsing beaker.

MAN OFF D **MANUAL**	• Switch the Liquino to the manual operating mode. Press the <MANUAL> key. **Di spl ay:** **manual** **r eady** **0. 000 mL**
DOS NR P **SELECT**	• Now use the <DOS NR / SELECT> key to select the connected dosing device. On the 711 Liquino keyboard there are four LEDs. If you have connected the Dosino to socket '**Dos. 2**' then press the <DOS NR / SELECT> key once so that the LED '**DOS 1**' lights up.
PREP L **4**	• Prepare the dosing unit by pressing the <PREP> key. The PREP function is used to rinse the tubing and fill the dosing cylinder free from bubbles. **Di spl ay:** **wast e port :** **t i p(1) or f l ask(2) ?**
<1>	• Now select whether the rinsing volume of the reagent solution should be discharged via the dosing tip (connected to Dosino Port 1) or returned to the storage bottle (via filling Port 2 of the Dosino). Press <**1**>. **Di spl ay:** **manual** **PREP r unni ng. . .**
	• The tubing is now automatically rinsed with the required volume of reagent. Excess reagent solution is discharged into the rinsing beaker. Wait until the Liquino reports 'ready'.
	• Now exchange the rinsing beaker for the vessel into which you wish to carry out dosing.
DOSING G **7**	• Press the <DOSING> key. **Di spl ay:** **manual DOSI NG** **r eady** **0. 000 mL**
Z **START**	• If you now press the <START> key and hold it down then dosing will take place when the Dosino has switched the stopcock. You will notice that the dosing speed increases slowly. If you release the <START> key and then press it down again it will again start dosing at a slow speed which is gradually increased. This behavior can be very useful when you need to dose accurately, e.g. to fill a volumetric flask up to the mark.
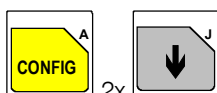
- If you do not want the dosing speed to increase or you require a quicker increase in the dosing speed then you can set this in the configuration.

- Press the <CONFIG> key and the <↓> key twice.

```
Display:        configuration
                >manual
```

- Here you will find the submenu with the settings which are effective for manual functions.

```
Display:        >manual              DOS1  ← dosing connection
                dos.unit:      default
```

- In the first line, above right, the address of the dosing connection to which the particular setting applies is shown. You can make different settings for each of the four dosing connections. The settings for the other dosing connections DOS2 to DOS4 are also found in this submenu. Now press the <ENTER> key three times.

<ENTER>

```
Display:        >manual              DOS1
                >>dosing
```

- If you want to alter the dosing behavior of dosing device 1 you will find this in the second submenu '>>Dosing' after pressing the <ENTER> key as given above. If your Dosino is connected to 'Dos. 2' then press the <ENTER> key six times.

<ENTER>

```
Display:        >>dosing             DOS1
                rate type:   increasing
```

- By pressing the <SELECT> key and confirming with <ENTER> you can switch to a constant dosing speed. You should, however, leave the setting with increasing speed alone and press <ENTER>.

<SELECT>

<ENTER>

```
Display:        >>dosing             DOS1
                slope                     4
```

- Enter the highest value '10' for the slope of the increase of the dosing speed. Confirm the entry with <ENTER>.

<ENTER>

- By pressing the <QUIT> key twice you will return to the display for dosing.

```
Display:        manual DOSING
                ready              3.349 mL
```

- Start dosing again by pressing the <START> key; you will see that the dosing speed increases more rapidly and that the highest dosing speed is reached very quickly.

- When the max. cylinder volume has been reached the dosing unit will be filled automatically. Filling the dosing cylinder can also be triggered manually by pressing the <FILL> key.

MAN OFF
D
MANUAL

- Operating the <MAN. OFF / MANUAL> key switches manual operation off again. The Liquino is again in the basic condition.

If you want to dose a particular volume several times then select the 'Dispense' function. Proceed in a similar manner to dosing.

MAN OFF
D
MANUAL

- Switch the Liquino to the manual operating mode by pressing the <MANUAL> key.

  Display: manual
                  ready   0.000 mL

DOS NR
P
SELECT

- Use the <DOS NR / SELECT> key to select the connected dosing device.

PREP
L
4

- Prepare the dosing unit again by pressing the <PREP> key. Accustom yourself to rinsing the dosing units with which you want to work by means of the 'PREP' function before you use them. This is an absolute necessity when you change the reagent. Other things which must be taken into account when a reagent is changed are mentioned below.

DISPENSE
H
8

- When you have prepared the dosing unit press the <DISPENSE> key.

  Display: manual DIS
                  volume?   1.0 mL

CLEAR
Q

- Enter the required volume. If you do not want to dose a particular volume or if you want to correct a faulty entry press the <CLEAR> key.

  Display: manual DIS
                  volume?   infinite mL

- You can enter a new value or confirm the value 'infinite'. In this case dosing or dispensing will be carried out automatically until you press the <STOP> key.

<ENTER>

- After you have entered a value and confirmed it with <ENTER> you can start to dispense with the <START> key. You also have the possibility of first altering the dosing speed. This is set to the maximum dosing speed as standard.

START
Z

  Display: manual DIS
                  rate?   max mL/min

The maximum dosing speed depends on the dosing unit used and the cylinder volume. For example, for a 10 mL cylinder it is 33.33 mL/min, for a 50 mL cylinder 166.66 mL/min. The same values apply to the filling speed of the dosing unit.

- For viscous reagent solutions you should select a lower dosing speed as otherwise a large counterpressure could build up in the tubing during rapid dispensing.

START
Z

- If you press the <START> key the required reagent volume will be dosed. This can be carried out several times. The 'DISPENSE' function is repetitive.

FILL
M
5

- Filling the dosing cylinder can be triggered with the <FILL> key.
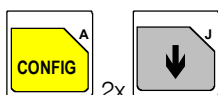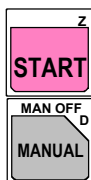
- If you want, you can configure your Liquino so that after each dispensing process the dosing cylinder is refilled automatically.

- Press the <CONFIG> key and the <↓> key twice.

      Display: configuration
              >manual

- Here you will find the submenu with the settings which are effective for manual functions.

      Display: >manual   DOS1 ← dosing connection
              dos. unit: default

- In the first line, above right, the address of the dosing connection to which the particular setting applies is shown. You can make different settings for each of the four dosing connections. The settings for the other dosing connections DOS2 to DOS4 are also found in this submenu. Now press the <ENTER> key twice.

      Display: >manual   DOS1
              auto fill: off

- The colon after the word 'fill' shows that a list of entries is available for this menu item. In this case there are only two possibilities: 'on' and 'off'.

- Press the <SELECT> key in order to switch on automatic filling of the dosing unit. Confirm the entry with <ENTER>.

- Exit the configuration menu by pressing <QUIT> twice.

- Now dispense again by pressing the <START> key and you will see that the dosing cylinder is automatically refilled after each dosing process.

- Pressing the <MAN. OFF / MANUAL> key switches manual operation off again. The Liquino is again in the basic condition.

<ENTER>

<ENTER>

2x

3.2.4 Changing the dosing unit

A dosing device consists of a dosing unit (the green part) with a dosing cylinder (2, 5, 10, 20 or 50 mL) and the dosing drive, the Dosino 700. If you are working with different reagents then you do not need a separate dosing drive for each reagent bottle. Fit the individual reagent bottles with a dosing unit (the actual buret) and simply mount the dosing drive connected to the Liquino or dosing unit on a different reagent bottle as it is required.

Warning!
Incorrect disassembly of the dosing drive can damage the dosing unit and/or the Dosino.

- Always press the **<EXCH> key first**. Only in this way will the stopcock of the dosing unit be moved to the safe, so-called 'exchange' position. You can then loosen the dosing drive without any risk by carefully turning it counterclockwise and lifting it off. Observe the lines marked on the front of the dosing unit when doing this.

If you do not use a dosing unit for a long time or want to change the reagent we recommend that the dosing unit or the dosing cylinder and the tubing are completely emptied. This can be carried out simply and conveniently by means of the 'EMPTY' function.
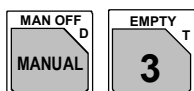
- Check whether the dosing tip is immersed in a waste beaker. Use the <MANUAL> key to switch to manual operation. Then press <EMPTY>.

      Display: empty to port:
                      tip(1) or flask(2)?

<1>, <2>

- You can now select whether the cylinder contents of the dosing unit are to be pumped back into the reagent bottle or discharged into a waste beaker via the dosing tip. Select <1> or <2>.

- The contents of the dosing cylinder are now discharged and the tubing emptied. Please remember that the contents of the dosing tubing at Port 1 will always be discharged via the dosing tip.

- To terminate the 'EMPTY' function the dosing cylinder is filled with air. After pressing the <EXCH> key the dosing unit can now be carefully removed.

3.2.5 Temperature measurement

The 711 Liquino is equipped with a Pt100 temperature measuring input. Apart from temperature-controlled dosing this means that simple manual temperature measurements can also be carried out.
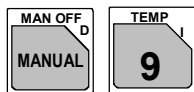
- Connect a Pt100 temperature sensor. The connection socket is on the rear panel of the 711 Liquino. Use the <MANUAL> key to switch to manual operation. Then press <TEMP>.

   Di spl ay: **manual**
                             21. 5° C

- The measured temperature in degrees Celsius is shown immediately. The measurement can be switched off by pressing the <MANUAL> key again.

3.2.6 PIP – precise pipetting/diluting

Example: Pipet 1mL and dilute with 9mL. Distilled water is used as the "hydraulic" liquid.

Preconditions / Preparation

The easiest and most accurate means of pipetting is with pipetting attachment 6.1562.040. The keyboard can be used to proceed from step to step.

Define a dosing unit which corresponds to the tubing of the Dosino used. This procedure is described on page 22. (This is not necessary if the pipetting attachment is used as this corresponds to the standard settings.)

Method editing
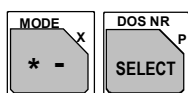
- The PIP mode must first be activated. This sets all method parameters to standard values. Press the <MODE> key and then <SELECT> until 'PIP' appears in the display:

  Display: mode select: PIP

- Press <ENTER>. The instrument is now in the PIP mode.

  Display: PIP   * * * * * * * *
               ready   0.000 mL

- The <PARAM> key is used to access the parameter menu, where all the possible settings for a PIP method can be found.

  Display: parameters
               >PIP parameters

- The submenu 'PIP parameters' contains the main settings for a PIP method. Press <ENTER> to open the submenu.

  Display: >PIP parameters
               pipetting vol.   1.000 mL

- Enter the required pipetting volume (1 mL) and press <ENTER> to accept the entry.

  Display: >PIP parameters
               diluting vol.   9.000 mL

- Enter the 9 mL used as diluting volume in the example and press <ENTER>

- In the submenu 'PIP parameters' no further entries are necessary. Press the <QUIT> key to exit the submenu.

  Display: parameters
               >PIP parameters

- The next submenu is accessed with <↓>.

  Display: parameters
               >PIP dosing unit

<ENTER>

- The submenu 'PIP dosing unit' is opened with <ENTER>.

  Display: >PIP dosing unit

```
                                          drive unit:           DOS1
```

<SELECT>
<ENTER>

- The Dosino which is to be used can be selected here with <SELECT> (DOSx refers to the connection number on the 711 Liquino). Accept with <ENTER>.

```
          Display:      >PIP dosing unit
                        dos.unit:          default
```

<SELECT>

- In this menu item the 711 Liquino is informed about the tubing of the Dosino. Press <SELECT> until the dosing unit defined in the above preparation step appears. (If the pipetting attachment is used this setting can be left as 'standard'). Confirm with <ENTER>.

<ENTER>

```
          Display:      parameters
                        >PIP rates
```

- As the 'PIP dosing unit' submenu contains no further menu items, an automatic return is made to the submenu selection. All necessary parameters have now been entered! The parameter menu is exited with <QUIT>.

<QUIT>

```
          Display:      PIP               ********
                        ready             0.000 mL
```

Tip!

If an inquiry is always to be made about the pipetting volume at the start of the method then enter the value under 'parameters/>PIP preselections/query pip. vol.'.

Various PIP methods can also be edited and then stored in the method memory. Each of these methods can then be reloaded by pressing a few keys. The method memory is described on page 128.

Carrying out the method

START

- When <START> is now pressed the display shows

```
          Display:      Not prepared yet!
                        Run PREP now?
```

ENTER (YES)

- Before the Dosino is used for the first time in the new configuration the Dosino cylinder and the complete tubing system must be filled bubble-free with reagent solution. Press <YES>.

```
          Display:      waste port:
                        tip(1) or flask(2)?
```

<1>, <2>

- Press <1> to empty the cylinder contents through the dosing tip, or <2> to return them to the bottle. Take care that the tip of the dosing tubing is located in a vessel. Wait until the 711 Liquino has ended the preparation (PREP). The instrument then returns to its normal state.

START z

<ENTER>

- From now on when <START> is pressed the method will be run immediately.[*)]

- The pipetting process consists of several steps. For each step instructions are shown on the display. If the pipetting attachment is used then the key built into the handle can be used to switch from one step to the next. The pipetting process can also be started with it. Whenever the LED on the handle lights up the 711 Liquino is ready for the next step. Without the pipetting attachment <ENTER> must be pressed in order to carry out the next step.

- In the first step a separatory bubble is formed, which is located between the "hydraulic" liquid (in this case water) and the sample. Just follow the instructions shown on the display.


[*)] The warning about the preparation of the tubing system appears each time the mode is changed and after the instrument has been switched off and on again. If it is certain that the Dosinos used have already been prepared then press <NO> (<QUIT> key) to acknowledge the warning. The method can now be run in the normal manner by pressing <START>.

3.2.7 SMPL – fully automatic sampling

The capabilities and possible uses of an SMPL method will be demonstrated by means of a complexometric titration of Ni^{2+} with the help of the 711 Liquino and Titrino 716.

Chemistry

The Ni^{2+} ion is buffered to pH 10, complexed with Cu-EDTA and then titrated with Na-EDTA. The detection mechanism with the Cu-ISE electrode is based on the following equilibrium equation:

$$Cu\text{-}EDTA \longleftrightarrow Cu^{2+} + EDTA^{2-}$$
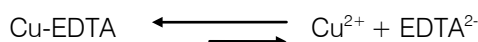
The presence of the Ni^{2+} ion displaces the equilibrium to the right:

$$Ni^{2+} + Cu\text{-}EDTA \longrightarrow Cu^{2+} + Ni\text{-}EDTA$$
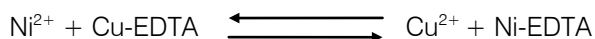
The concentration of the Cu^{2+} ion (to which the Cu-ISE electrode reacts) depends on the stability of the Ni-EDTA complex.

Procedure

The SMPL mode of the Liquino offers a fully automated sample transfer, perfect preparation of the titration cell between the individual titrations (for multiple determinations) and complete control of the Titrino. However, a corresponding method must first be created or selected in the Titrino.
The Dosino at connection 1 carries out the "sampling" processes, for which its four ports have fixed definitions.

1. Through port 1 the Liquino draws in the required amount of sample and transfers it to the titration vessel through the cylinder and port 2.
2. Solvent is drawn in through port 3 and transferred to the titration vessel for rinsing/diluting (the amount can be freely selected) – in this case H_2O is used.
3. The second Dosino adds the buffer (pH 10).
4. The third Dosino adds the complexing agent Cu-EDTA.
5. 30 s is allowed to elapse (this possibility exists after each reagent addition) in order to allow the complexing ion to be completely bound and to release the Cu^{2+} ions.
6. The Titrino is started via the remote lead and the sample is titrated with Na-EDTA.

At the end of the titration the "sampling" Dosino removes the contents of the titration vessel through port 2 and transfers them to a waste container via port 4.

A new titration can now be carried out. The number of determinations and the number of times the cell is to be rinsed out can be entered.

The Liquino offers the possibility of carrying out titrations comfortably and confidently. Even if the titration cell is only rinsed out once the variations only amount to 0.01 to 0.02%.

Multiple determinations at defined time intervals are also possible (e.g. periodic sampling of a sample flow).

Preconditions / Preparation
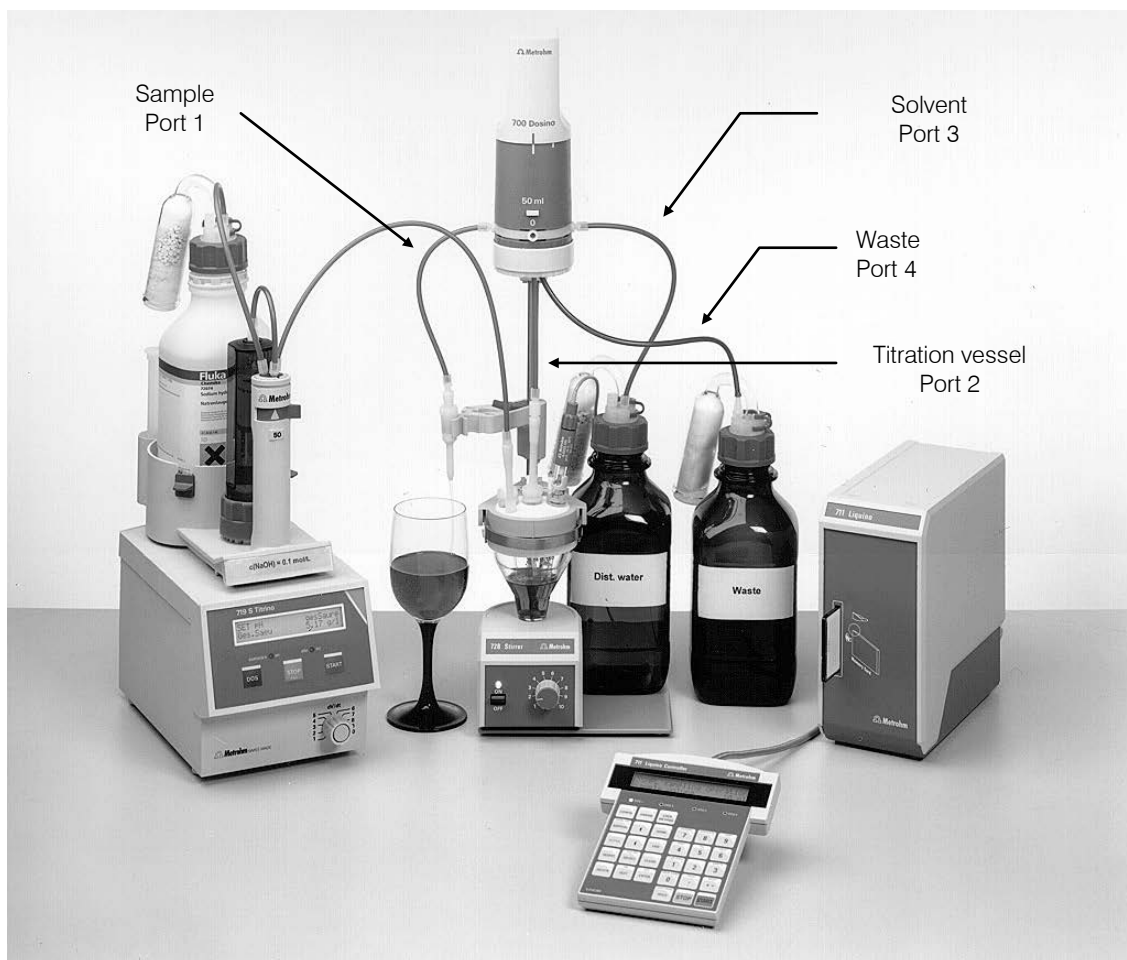
Tubing connections of the "sampling" Dosino

The determination of the NI^{2+} ion by potentiometric endpoint indication can be carried out with the help of the Cu-ISE electrode. For an elegant automation of the analysis the following items are required:

- the new 711 Liquino
- 3 Dosino 700s with dosing unit 710: 20 mL and 2x 10 mL glass cylinders. (20mL cylinder for "sampling" dosing unit).
- any Titrino available (e.g. 716)
- Liquino - Titrino connection cable 6.2141.090
- one Cu-ISE electrode 6.0605.02 with electrode cable 6.2104.020
- one reference electrode 6.0726.100 (KNO_3 sat.) with electrode cable 6.2106.020
- one magnetic stirrer 728
- sampling mode equipment 6.5614.010.

The dosing units which correspond to the tubing used for the Dosinos must be defined. This process is described on page 16.

Method editing
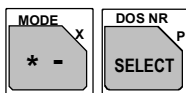
MODE x / **DOS NR** P / * - / **SELECT**	• The SMPL mode must first be activated. This sets all method parameters to standard values. Press the <MODE> key and then <SELECT> until 'SMPL' appears in the display:

> Display: mode select: SMPL

YES **ENTER**	• Press <ENTER>. The instrument is now in the SMPL mode.

> Display: SMPL   * * * * * * * *
>   ready   0.000 mL

B **PARAM**	• The <PARAM> key is used to access the parameter menu, where all the possible settings for an SMPL method can be found.

> Display: parameters
>   >SMPL parameters

<ENTER>   • The submenu 'SMPL parameters' contains the main settings for an SMPL method. Press <ENTER> to open the submenu.

> Display: >SMPL parameters
>   sample count   1

<ENTER>   • Enter the number of samplings (or titrations), which are to be carried out after each other automatically. Accept the value with <ENTER>.

> Display: >SMPL parameters
>   sampling mode: manual

<ENTER>   • If a multiple determination on the same sample is to be carried out then <SELECT> can be used to choose the entry 'auto'. However, if a different sample is to be transferred each time then 'manual' should be selected. In this case the process requires the sample tubing to be immersed in the new sample each time. Press <ENTER>.

> Display: >SMPL parameters
>   time interval   00:05:00

<ENTER>   • This parameter determines the time interval between successive samples. For a multiple determination this value should be set to 00:00:00. In this way the next sample will be transferred at the end of the titration. Press <ENTER> to accept the value.

> Display: parameters
>   >SMPL sampling operation

<ENTER>   • As the 'SMPL parameters' submenu contains no further menu items, an automatic return is made to the submenu selection. The submenu 'SMPL sampling operation' contains the parameters for sample transfer. Press <ENTER> to open it.

> Display: >SMPL sampling operation
>   sample volume   3 mL

• Enter the volume of the sample to be transferred to the measuring cell (in this case 3 mL). Press <ENTER> to accept the value.

<ENTER>   > Display: >SMPL sampling operation

```
dilution vol.       3 mL
```

<ENTER>

- The dilution volume is the amount of solvent to be added to the measuring cell after the sample has been transferred there (in the example 3 mL). Press <ENTER> to accept the value.

```
Display:      >SMPL sampling operation
              sample rinse vol.  3 mL
```

<ENTER>

- Before the actual sample transfer the Dosino cylinder is rinsed with the sample. This rinsing volume should be about the same as the transfer amount (in the example 3 mL). For a multiple determination, in which the same sample is always used, this volume can also be smaller. Press <ENTER> to accept the value.

```
Display:      >SMPL sampling operation
              sample rinse rep.     1
```

<ENTER>

- Enter how often the cylinder is to be rinsed with the sample. If samples are being transferred which do not greatly differ from one another 1 rinse is sufficient. Press <ENTER> to accept the value.

[NO QUIT key icon]

- As the remaining parameters in this submenu can be left at their preset values it can be exited with the <QUIT> key.

```
Display:      parameters
              >SMPL sampling operation
```

[down arrow J key icon]

- The next submenu is accessed with <↓>.

```
Display:      parameters
              >SMPL meas.cell rinsing
```

<ENTER>

- Press <ENTER> to open the submenu 'SMPL meas.cell rinsing.

```
Display:      >SMPL meas.cell rinsing
              external Pump:       off
```

<ENTER>

- The cell can also be rinsed with external pumps. However, the same Dosino is to be used here. Press <ENTER> to accept the default value 'off'.

```
Display:      >SMPL meas.cell rinsing
              rinsing repetitions   1
```

<ENTER>

- Enter the number of times that the measuring cell is to be rinsed. As this process takes a considerable time this value should be kept as low as possible. In this example 1 rinse is sufficient. Press <ENTER> to accept the value.

```
Display:      >SMPL meas.cell rinsing
              aspir. volume      40 mL
```

<ENTER>

- The suction volume corresponds to the sample volume + dilution volume (solvent) + titrant consumption. The value must be so large that the measuring cell is completely emptied after the titration. In this case the total volume amounts to 40 mL. Press <ENTER> to accept the value.

```
Display:      >SMPL meas.cell rinsing
              aspir. rate   max mL/min
```

<ENTER>

- This setting is left at 'max'. It only requires alteration for viscous liquids. Press <ENTER>.

```
Display:        >SMPL meas.cell rinsing
                rinsing volume    30.0 mL
```

<ENTER>

- The amount of solvent to be used to rinse the measuring cell is entered here. In this example 30 mL are sufficient. Press <ENTER> to accept the value.

```
Display:        >SMPL meas.cell rinsing
                rins. rate    max mL/min
```

- The measuring cell should be rinsed as rapidly as possible, so that the rate can be left at 'max'. Press <ENTER>.

<ENTER>

```
Display:        parameters
                >SMPL dosing units
```

<ENTER>

- As the 'SMPL meas. cell rinsing' submenu contains no further menu items, an automatic return is made to the submenu selection. The submenu 'SMPL dosing units' contains the parameters for the auxiliary dosing units and the tubing of the "sampling" dosing unit. The addition of the pH 10 buffer and the Cu-EDTA are defined here. The submenu is opened with <ENTER>.

```
Display:        >SMPL dosing units
                dos.unit 1:       default
```

- Here the tubing of the "sampling" dosing unit defined during the preparations is selected. *The "sampling" dosing unit must be connected to connection DOS1 of the Liquino.* Press <SELECT> until the correct entry appears and accept it with <ENTER>.

<SELECT>
<ENTER>

```
Display:        >SMPL dosing units
                >>aux.solut. BEFORE
```

<ENTER>

- The double arrow (>>) shows that <ENTER> can be used to open a further lower submenu. The auxiliary solution which is to be added directly **before** the sample transfer can be defined here. In this example only an auxiliary solution to be added **after** the sample transfer is needed. Press <⬇>.

```
Display:        >SMPL dosing units
                >>aux.solut. AFTER
```

- <ENTER> is used to open the next lower submenu '>>aux. solut. AFTER'. The auxiliary solution which is to be added directly **after** the sample transfer is defined here.

<ENTER>

```
Display:        >>aux.solut. AFTER    no1
                drive unit:           off
```

- Use <SELECT> to choose the Dosino which is to contain the pH 10 buffer (e.g. DOS2) and press <ENTER>.

```
Display:        >>aux.solut. AFTER    no1
                dos.unit:         default
```

<SELECT>
<ENTER>

- Here the tubing of the "sampling" dosing unit defined during the preparations is selected for the Dosino with pH 10 buffer. Press <SELECT> until the correct entry appears and accept it with <ENTER>.

```
Display:        >>aux.solut. AFTER    no1
                volume            1.000 mL
```

<SELECT>
<ENTER>

- Enter the volume which is to be added (in this example 1 mL). Accept

the value with <ENTER>.

```
Display:        >>aux.solut. AFTER    no1
                feed rate      max mL/min
```

<ENTER>

- The rate of addition for the pH 10 buffer can be entered here. The maximum rate (default) is already correct. Press <ENTER>.

```
Display:        >>aux.solut. AFTER    no1
                fill rate      max mL/min
```

<ENTER>

- This is the rate at which the Dosino cylinder will be refilled. The default value (max) can be accepted with <ENTER>.

```
Display:        >>aux.solut. AFTER    no1
                wait time        00:00:00
```

- After the auxiliary solution has been added a waiting period can be entered. However, this is not necessary after the addition of the pH 10 buffer. <ENTER> is used to accept the default value (00:00:00). In this way the definition of the first auxiliary solution addition is completed.

```
Display:        >>aux.solut. AFTER    no2
                drive unit:           off
```

- The second auxiliary solution can now be defined. The above steps are repeated, this time for the addition of Cu-EDTA. The volume to be added is 1.000 mL, the waiting time 00:00:20 (20 s).

2x <QUIT>

- The definition of the auxiliary solutions has now been completed. Press <QUIT> 2x to return to the upper level of the submenu.

```
Display:        parameters
                >SMPL dosing units
```

<⬇>

- <⬇> is used to open the next submenu.

```
Display:        parameters
                >SMPL control I/O
```

<ENTER>

- The submenu '>SMPL control I/O' defines the interaction of the Liquino with other instruments (e.g. Titrino). It is opened with <ENTER>.

```
Display:        >SMPL control I/O
                sample changer ctrl: off
```

- Press <ENTER> to accept the default values.

<ENTER>

```
Display:        >SMPL control I/O
                ext. device ctrl:     off
```

<SELECT>
<ENTER>

- Use <SELECT> to choose the entry 'on' and confirm it with <ENTER>.

```
Display:        >SMPL control I/O
                start ext. device:remote
```

- An external instrument can be addressed by both the Remote and the RS interface. In this example it is easier to control the Titrino via the remote interface. The default value is accepted with <ENTER>.

<ENTER>

```
Display:        >SMPL control I/O
                Answerback from    Remote
```

- The prompt from the Titrino after the titration should also be requested via the remote interface. Confirm the default value with <ENTER>.

<ENTER>

Display: parameters
                   >SMPL preselections

<QUIT>

• As the 'SMPL control I/O' submenu contains no further menu items, an automatic return is made to the submenu selection. The parameter menu is exited with <QUIT>. The instrument is now ready to carry out the SMPL method.

Tip!

Various SMPL methods can be edited and then stored in the method memory. Each of these methods can then be reloaded by pressing a few keys. The method memory is described on page 128.

Running the method

| START | • When <START> is now pressed the display shows |

Display: Not prepard yet!
                   Run PREP now?

| ENTER | • Before the Dosino is used for the first time in the new configuration the Dosino cylinder and the complete tubing system must be filled bubble-free with the particular reagent solution. Press <YES>. |

Display: waste port:
                   tip(1) or flask(2)?

• Press <1> to empty the contents of the cylinder through the dosing tip or <2> to return them to the bottle. Take care that the tip of the dosing tubing is located in a vessel. Wait until the 711 Liquino has ended the preparation (PREP) of all the Dosinos which are being used. The instrument then returns to its normal state.

| START | • From now on when <START> is pressed the method will be run immediately.[*) |

[*) The warning about the preparation of the tubing system appears each time the mode is changed and after the instrument has been switched off and on again. If it is certain that the Dosinos used have already been prepared then press <NO> (<QUIT> key) to acknowledge the warning. The method can now be run in the normal manner by pressing <START>.

3.2.8 CONT – the automatic volumetric flask

A typical daily task is the preparation of standard solutions. Preparing serial dilutions is often time-consuming and involves making calculations. The CONT/volume fraction mode of the 711 Liquino allows this monotonous routine work to be automated.

Example: the preparation of a standard for the determination of chloride in drinking water by ion chromatography. The sample to be determined has chloride content of about 10 ppm. The standard concentrations should be in the range 5 - 15 ppm.

Pipetting and adding the standard solution is no longer necessary as the dosing device (Dosino 700) can be screwed directly on to the bottle containing the standard solution.
All that needs to be done is to inform the instrument of the concentration of the standard solution and required target volume (volumetric flask mark). After the start the instrument will request the entry of the final content. The corresponding amount of standard solution is added automatically to the volumetric flask which then only needs to be filled up to the mark. At the next start the next concentration in the serial dilution is entered.

Preconditions / Preparation

Define a dosing unit which corresponds to the tubing of the Dosino used. This procedure is described on page 22.

Method editing
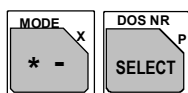
- The CONT mode must first be activated. This sets all method parameters to standard values. Press the <MODE> key and then <SELECT> until 'CONT' appears in the display:

  Display: mode select: CONT

- Press <ENTER>. The instrument is now in the CONT mode.

  Display: CONT   ********
                    ready   0.000 mL

- The <PARAM> key is used to access the parameter menu, where all the possible settings for a CONT method can be found.

  Display: parameters
                    >CONT parameters

- The submenu '>CONT parameters' contains the main settings for a CONT method. Press <ENTER> to open the submenu.

  Display: >CONT parameters
                    type: subst. conc.

- The colon indicates that the <SELECT> key can be used to select a value from a list. Press <SELECT> until 'volume fraction' appears.

  Display: >CONT parameters
                    type: volume fraction

- Accept the entry with <ENTER>.

    Display: >CONT parameters
                    meas. unit: mol / L

- Use the <SELECT> key to choose 'ppm' and confirm the entry with <ENTER>.

    Display: >CONT parameters
                    target volume   10.0 mL

- The target volume corresponds to the volumetric flask volume up to the mark. In this example enter '10' and confirm this value with <ENTER>.

    Display: >CONT parameters
                    content std.   1.000 ppm

- Enter the standard solution content (in this example 1000 ppm). Press <ENTER> to accept the entry.

    Display: parameters
                    >CONT dosing unit

- As the '>CONT parameters' submenu contains no further menu items, the next submenu automatically becomes available. Open it with <ENTER>.

    Display: >CONT dosing unit
                    drive unit: DOS1

- The Dosino to be used can be chosen with <SELECT> (DOSx refers to the connection number on the 711 Liquino). Press <ENTER> to accept the entry.

    Display: >CONT dosing unit
                    dos.unit: default

- In this menu item the 711 Liquino is informed about the tubing of the Dosino. Press <SELECT> until the dosing unit defined in the above preparation step appears. Confirm with <ENTER>.

    Display: parameters
                    >CONT rates

- All the necessary parameters have now been entered. The parameter menu is exited with the <QUIT> key.

Tip!	A CONT method can be edited and stored in the method memory for each standard solution. Each of these methods can then be reloaded by pressing a few keys. The method memory is described on page 128.

Running the method

START (z)

- When <START> is now pressed the display shows

    Display: Not prepared yet!
                    Run PREP now?

ENTER (YES)

- Before the Dosino is used for the first time in the new configuration the Dosino cylinder and the complete tubing system must be filled bubble-free with the reagent solution. Press <YES>.

    Display: waste port:
                    tip(1) or flask(2)?

- Press <1> to empty the contents of the cylinder through the dosing tip or <2> to return them to the bottle. Take care that the tip of the dosing tubing is located in a vessel. Wait until the 711 Liquino has ended the preparation (PREP) of all the Dosinos which are being used. The instrument then returns to its normal state.

START (z)

- From now on when <START> is pressed the method will be run immediately.[*]

- The instrument requires the target content to be entered. As soon as the entry is confirmed with <ENTER> the required volume is calculated and added.

---

[*] The warning about the preparation of the tubing system appears each time the mode is changed and after the instrument has been switched off and on again. If it is certain that the Dosinos used have already been prepared then press <NO> (<QUIT> key) to acknowledge the warning. The method can now be run in the normal manner by pressing <START>.

3.2.9 XDOS – the electronic dropping funnel

120mL of solution are to be added in 5 hours. This can be carried out easily and reliably with a tandem addition using 2 Dosinos. In this way interruption-free addition is guaranteed.

Preconditions / Preparation

The accessories for tandem addition (see "ordering information" in the "711 Liquino" leaflet) are required for the tubing. However, it is also possible to lead a separate tubing from each Dosino to the test apparatus.

A dosing unit which corresponds to the tubing used for the Dosino must be defined. This process is described on page 22.

Method editing
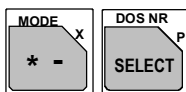
- The XDOS mode must first be activated. This sets all method parameters to standard values. Press the <MODE> key and then <SELECT> until 'XDOS' appears in the display:

      Display: mode select: XDOS

- Press <ENTER>. The instrument is now in the XDOS mode.

      Display: XDOS   * * * * * * * *
                      ready   0.000 mL

- The <PARAM> key is used to access the parameter menu, where all the possible settings for an XDOS method can be found.

      Display: parameters
                      >XDOS parameters

- The submenu 'XDOS parameters' contains the main settings for an XDOS method. Press <ENTER> to open the submenu.

      Display: >XDOS parameters
                      XDOS type: volume&rate

- The colon indicates that the <SELECT> key can be used to select a value from a list. Press <SELECT> until 'volume&time' appears. Accept the entry with <ENTER>.

      Display: >XDOS parameters
                      volume   1.000 mL

- Enter the volume which is to be added (1000 mL in this example) and press <ENTER>.

      Display: >XDOS parameters
                      dosing time   00:01:00

- Enter the length of time for the addition in 'hours:minutes:seconds' format (if a mistake is made press the <CLEAR> key and repeat the entry). Accept the value with <ENTER>.

      Display: >XDOS parameters
                      temp. measuring: off

- No further entries are necessary in the 'XDOS parameters' submenu. Exit with the <QUIT> key.

      Display: parameters

>XDOS parameters

- <↓> is used to open the next submenu.

        Display: parameters
                        >XDOS dosing units

- Press <ENTER> to access the submenu 'XDOS dosing units'.

        Display: >XDOS dosing units
                        setup: single

- Use the <SELECT> key to choose the entry 'tandem' and confirm it with <ENTER>.

        Display: >XDOS dosing unit   no. 1
                        drive unit: DOS1

- The first of the two Dosinos can now be entered with <SELECT> (DOSx refers to the connection number on the 711 Liquino). Accept with <ENTER>.

        Display: >XDOS dosing unit   no. 1
                        dos. unit: default

- In this menu item the 711 Liquino is informed about the tubing of the Dosino. Press <SELECT> until the dosing unit defined in the above preparation step appears. Confirm with <ENTER>.

- Skip the next menu item with <ENTER>.

        Display: >XDOS dosing unit   no. 2
                        dosing drive: DOS2

- Now repeat the entry for the second Dosino. Select the same dosing unit again.
  After the entry has been made for the second Dosino the submenu '>XDOS dosing unit' is terminated and the next submenu is displayed.

        Display: parameters
                        >XDOS monitoring

- No further entries are required for the task to be carried out. Exit the parameter menu with <QUIT>.

> **Tip!** Various XDOS methods can be edited and stored in the method memory.
> Each of these methods can then be reloaded by pressing a few keys. The
> method memory is described on page 128.

Running the method

START (Z)	• When <START> is now pressed the display shows
	Display: Not prepared yet! Run PREP now?
ENTER (YES)	• Before the Dosino is used for the first time in the new configuration the Dosino cylinder and the complete tubing system must be filled bubble-free with the reagent solution. Press <YES>.
	Display: Put tip in vessel! Run PREP?
	• Take care that the tip of the dosing tubing is located in a vessel and then press <YES>. Wait until the 711 Liquino has ended the preparation (PREP). The instrument then returns to its normal state.
START (Z)	• From now on when <START> is pressed the method will be run immediately.[*]

---

[*] The warning about the preparation of the tubing system appears each time the mode is changed and after the instrument has been switched off and on again. If it is certain that the Dosinos used have already been prepared then press <NO> (<QUIT> key) to acknowledge the warning. The method can now be run in the normal manner by pressing <START>.

3.2.10 XDOS – temperature-controlled addition

Example: during the preparation for a nitration 0.3 mol semi-concentrated hydrochloric acid is to be added to 0.1 mol freshly distilled aniline. During this process the temperature of the mixture should, if possible, not exceed 10°C.
The 711 Liquino will carry out the reagent addition and control the temperature.

Preconditions / Preparation

To carry out the above task the following items are required:

- the new 711 Liquino
- a Dosino 700 with a 50 mL dosing unit 710
- a printer with cable if the process is to be documented (see page 12)
- a four-neck flask with precision glass stirrer shaft
- a cooling device (if an appropriate cooling bath is used this can even be switched on and off by the Liquino via the remote interface).

A dosing unit which corresponds to the tubing used for the Dosino must be defined. This process is described on page 22.

Screw the Dosino 700 on to the bottle containing hydrochloric acid, place the 0.1 mol aniline in the four-neck flask and carry out the method described below under intensive stirring. The flask must be cooled continuously. If the temperature limit of 10 °C is exceeded the Liquino immediately stops the HCl addition. As soon as the temperature sinks below 10 °C again the Liquino continues with the addition [*] .

Method editing
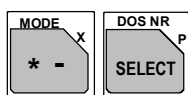
MODE X	DOS NR P
* -	SELECT

- The XDOS mode must first be activated. This sets all method parameters to standard values. Press the <MODE> key and then <SELECT> until 'XDOS' appears in the display:

  Display: mode select: XDOS

YES
ENTER

- Press <ENTER>. The instrument is now in the XDOS mode.

  Display: XDOS   * * * * * * * *
               ready   0.000 mL

---

[*] An upper and lower temperature limit can be defined as well as the action to be taken when these limits are exceeded. Possible actions are:
- none (limit violations are only mentioned in the report)
- stop
- switch instrument to HOLD condition (restart with <CONTINUE>)
- stop, wait until the temperature is again within the limits and then continue automatically.

PARAM (B)	• The <PARAM> key is used to access the parameter menu, where all the possible settings for an XDOS method can be found.
	Display: parameters >XDOS parameters
<ENTER>	• The submenu 'XDOS parameters' contains the main settings for an XDOS method. Press <ENTER> to open the submenu.
	Display: >XDOS parameters XDOS Type: volumen&rate
<ENTER>	• Press <ENTER> to accept the default value.
	Display: >XDOS parameters volume 1.000 mL
<ENTER>	• Enter the volume which is to be added (90 mL in this example) and press <ENTER>.
	Display: >XDOS parameters feed rate max mL/min
<ENTER>	• Enter the feed rate (in this example 50 mL/min). Accept the value with <ENTER>.
	Display: >XDOS parameters temp. measuring: off
<SELECT> <ENTER>	• The colon indicates that the <SELECT> key can be used to select a value from a list. Press <SELECT> until 'on' appears and confirm the entry with <ENTER>.
	Display: >XDOS parameters meas. interval 00:01:00
<ENTER>	• The time interval at which a measurement is to be added to the list of measuring points can be determined here. This is used for the graphics, the list of temperature measurements and the combined measurement list report. The interval at which the temperature is measured for controlling the temperature is not dependent on this value but is carried out every second. Press <ENTER> to confirm the entry.
QUIT (NO)	• No further entries are necessary in the 'XDOS parameters' submenu. Exit with the <QUIT> key.
	Display: parameters >XDOS parameters
↓ (J)	• <↓> is used to open the next submenu.
	Display: Parameter >XDOS dosing units
<ENTER>	• Press <ENTER> to access the submenu 'XDOS dosing units'.
	Display: >XDOS dosing units set up: single
<ENTER>	• As only 1 Dosino is needed the default value can be confirmed with <ENTER>.
	Display: >XDOS dosing units drive unit: DOS1
<SELECT> <ENTER>	• The Dosino to be used can be entered with <SELECT> (DOSx refers to the connection number on the 711 Liquino). Accept with <ENTER>.
	Display: >XDOS dosing units

dos. unit: standard

- In this menu item the 711 Liquino is informed about the tubing of the Dosino. Press <SELECT> until the dosing unit defined in the above preparation step appears. Confirm with <ENTER>.

<SELECT>

<ENTER>
- Skip the next menu item with <ENTER>.

<ENTER>

Display: parameters
                  >XDOS monitoring

- As the submenu '>XDOS dosing units' does not contain any further menu items, an automatic return is made to the submenu selection. Press <ENTER> to open the submenu '>XDOS monitoring'.

<ENTER>

Display: >XDOS monitoring
                  temperature: off

- Use the <SELECT> key to select the entry 'on'. This activates the temperature monitoring.

<SELECT>

Display: >XDOS monitoring
                  low limit   - 70 °C

- The lower temperature limit is of no interest in this application. Accept the default value with <ENTER>.

<ENTER>

Display: >XDOS monitoring
                  upper limit   200 °C

- Set the upper temperature limit to 10 °C. Confirm the entry with <ENTER>.

<ENTER>

Display: >XDOS monitoring
                  action: none

- The action to be taken if the temperature exceeds the set limits is determined here. Use <SELECT> to choose the entry 'wait'. This stops any addition when the temperature is outside the limits. When the temperature again lies within the limits the addition will be continued. Accept the setting with <ENTER>.

<SELECT>

<ENTER>
- No further entries are necessary in the 'XDOS monitoring' submenu. Exit with the <QUIT> key.

<QUIT>

Display: parameters
                  XDOS monitoring

- Press <↓> 2x to switch to the submenu 'XDOS reports'.[*)]

2x <↓>

Display: parameters
                  >XDOS reports

- Press <ENTER> to open the submenu.

<ENTER>

Display: >XDOS reports
                  temp. auto scale: on

[*)] If no printer or PC is connected the parameter menu can be exited with <QUIT> and the method rejoined at "Running the method".

<SELECT>

<ENTER>

- In this menu item <SELECT> can be used to choose whether a temperature curve should be scaled automatically or manually. Accept the default value 'on' with <ENTER>.

```
Display:        >XDOS reports        no. 1
                 report:              off
```

- The <SELECT> key can be used to select from the following reports:

  - 'off': no report

  - 'results': summary of the results

  - 'parameters': parameter settings

  - 'curve': graph of the measurements and additions

  - 'V-list': list of volume measuring points

  - 'T-list': list of temperature measuring points

  - 'comb. list': combined volume/temperature measuring point list

  - 'ff': page feed (may be useful between 2 reports)

<ENTER>
2x <QUIT>

Select the reports to be printed out and press the <ENTER> key after each selection. Up to 8 entries can be made.
Press <QUIT> 2x to exit the parameter menu.
All the necessary parameters have now been entered!

Tip!

Various XDOS methods can be edited and stored in the method memory. Each of these methods can then be reloaded by pressing a few keys. The method memory is described on page 128.

Running the method

START	• When <START> is now pressed the display shows Display: Not prepared yet! Run PREP now?
YES ENTER	• Before the Dosino is used for the first time in the new configuration the Dosino cylinder and the complete tubing system must be filled bubble-free with the reagent solution. Press <YES>. Display: Put tip in vessel! Run PREP? • Take care that the tip of the dosing tubing is located in a vessel and then press <YES>. Wait until the 711 Liquino has ended the preparation (PREP). The instrument then returns to its normal state
START	• From now on when <START> is pressed the method will be run immediately.[*]

---

[*] The warning about the preparation of the tubing system appears each time the mode is changed and after the instrument has been switched off and on again. If it is certain that the Dosinos used have already been prepared then press <NO> (<QUIT> key) to acknowledge the warning. The method can now be run in the normal manner by pressing <START>.

3.2.11 SEQ – complex procedures under control

Example: the preparation of phenolazonaphthol. A short version of the synthesis procedure might read as follows:

" 0.3 mol of a semi-concentrated hydrochloric acid is added to 0.1 mol freshly distilled aniline. The temperature should remain below approx. 10°C. After cooling the mixture to 0°C a 0.1 mol solution of $NaNO_2$ is added so that temperature does not exceed 5°C. When this addition is complete 8% β-naphthol solution (2 molar) is added. The temperature should not exceed approx. 10°C."

This procedure can be broken down into the following steps:

1. Temperature-controlled addition of semi-concentrated hydrochloric acid to aniline (temperature below approx. 10 °C).

2. Pause for 5 minutes for cooling down to 0 °C.

3. Temperature-controlled diazotization (temperature below 5 °C).

4. Pause for 1 minute.

5. Temperature-controlled azo coupling (temperature below approx. 10 °C) with β-naphthol.

The individual additions with temperature control can be carried out by an XDOS method. However, the SEQ mode is available to automate the complete procedure. It allows individual XDOS and also other methods to be combined with each another. Pauses between steps and the control of other instruments are also possible.

Preconditions / Preparation

The following instruments and accessories are required:

- the 711 Liquino
- 3 Dosino 700s, each with a 50 mL dosing unit 710
- a printer with cable if the process is to be documented (see page 12)
- a four-neck flask
- a cooling device (if an appropriate cooling bath is used this can even be switched on and off by the Liquino via the remote interface).

Dosing units which correspond to the tubings of the Dosinos used must be defined. This process is described on page 22.

Method editing

For the three temperature-controlled additions three different XDOS methods must be defined, each of these stored under "USER METHOD" and then selected at the appropriate step in the SEQ method. Storing a method which has been edited is described on page 64.

The way in which the first XDOS method (addition) is created can be found in the section "XDOS – temperature-controlled addition" on page 46.

For the other two XDOS methods (diazotization and azo coupling) the parameter lists are printed out below. Use these lists together with the practical experience already gained to enter the parameters. Lines marked with **(adapt)** must be adapted to the existing conditions.

XDOS method for diazotization

```
711 Liquino                         711.0011
date 1998-07-08  time   18:16
mode: XDOS          user method:  NaNO2add
parameters
>XDOS parameter
  XDOS type:        volume&rate
  volume               80.0 mL
  feed rate            30.0 mL/min
  temp. measuring        on
  rec. interval     00:01:00
  fill rate             max mL/min
  auto fill              on
>XDOS dosing units
  setup:             single
  dosing drive:        DOS2              ( adapt )
  dos.unit:            NaNO2             ( adapt )
  port use:          default
>XDOS monitoring
  temperature:           on
  low limit            -70 °C
  upper limit          4.0 °C
  action:             wait
  alarm pins:         none
  volume:              off
>XDOS preselections
  req.ident:           off
  >>XDOS prompts
    id1                Id1
    id2                Id2
    id3                Id3
  start delay       00:00:00
>XDOS reports
  temp. auto scale:      on
  report1:            result (with printer, if not: off)
  report2:            curve  (with printer, if not: off)
  report3:             off
  report4:             off
  report5:             off
  report6:             off
  report7:             off
  report8:             off
           ============
```

XDOS method for azo coupling

```
711 Liquino                        711.0011
date 1998-07-08  time  18:42
mode: XDOS        user method: AZZOcoup
parameters
>XDOS parameter
  XDOS type:       volume&rate
  volume              400.0 mL
  feed rate            30.0 mL/min
  temp. measuring        on
  rec. interval     00:01:00
  fill rate            max mL/min
  auto fill             on
>XDOS dosing units
  setup:            single
  dosing drive:     DOS3                    (adapt)
  dos.unit:         AZO1                    (adapt)
  port use:         default
>XDOS monitoring
  temperature:          on
  low limit           -70 °C
  upper limit        10.0 °C
  action:            wait
  alarm pins:        none
  volume:             off
>XDOS preselections
  req.ident:          off
  >>XDOS prompts
    id1               ld1
    id2               ld2
    id3               ld3
  start delay       00:00:00
>XDOS reports
  temp. auto scale:      on
  report 1:          result (with printer, if not: off)
  report 2:           curve (with printer, if not: off)
  report 3:           off
  report 4:           off
  report 5:           off
  report 6:           off
  report 7:           off
  report 8:           off
            ============
```

SEQ method editing

As the sub-methods have now been defined and stored, the SEQ method can now be assembled.
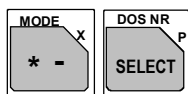
- The SEQ mode must first be activated. This sets all method parameters to standard values. Press the <MODE> key and then <SELECT> until 'SEQ' appears in the display:

    Display: mode select: SEQ

- Press <ENTER>. The instrument is now in the SEQ mode.

    Display: SEQ   * * * * * * * *
                     ready   0.000 mL

- The <PARAM> key is used to access the parameter menu, where all the possible settings for a SEQ method can be found.

    Display: parameters
                     >SEQ sequence

<ENTER>
- In the submenu 'SEQ sequence' previously defined and stored XDOS methods can be assembled to form a sequence and the corresponding pauses inserted. Press <ENTER> to open the submenu.

    Display: >SEQ sequence   step 1
                     command: NO OPERATION

- "*1. Temperature-controlled acidification of aniline with semi-concentrated hydrochloric acid (temperature below approx. 10 °C)*".

<SELECT>
<ENTER>
Use the <SELECT> key to choose the command 'METHOD' and confirm with <ENTER>.

    Display: >SEQ sequence   step 1
                     method:

<SELECT>
<ENTER>
Press the <SELECT> key until the name of the method which has been stored for the acidification appears. Press <ENTER> to accept the selection.

    Display: >SEQ sequence   step 2
                     command: NO OPERATION

- "*2. Pause for 5 minutes for cooling down to 0 °C.*"

<SELECT>
<ENTER>
The <SELECT> key can now be used to select the command 'PAUSE' and confirm it with <ENTER>.

    Display: >SEQ sequence   step 2
                     pause   00:00:00

Enter a pause of '00:05:00'. (If a mistake is made press the <CLEAR> key to delete the value and repeat the entry.)

    Display: >SEQ sequence   step 3
                     command: NO OPERATION

- "*3. Temperature-controlled diazotization (temperature below 5 °C).*"

<SELECT>
<ENTER>
Select the command 'METHOD' as in step 1 and then the XDOS method which has been stored for diazotization. Confirm each with <ENTER>.

    Display: >SEQ sequence   step 4

command: NO OPERATION

- "*4. Pause for 1 minute.*"

<SELECT>

<ENTER>

Proceed as in step 2: select the command 'Pause' and enter '00:01:00'. Press <ENTER> to accept the entry.

Display: >SEQ sequence   step 5
                command: NO OPERATION

- "*5. Temperature-controlled azo coupling (temperature below approx. 10 °C).*"

<SELECT>

<ENTER>

Select the command 'METHOD' and then the XDOS method which has been created and stored for the azo coupling. Confirm each step with <ENTER>.

Display: >SEQ sequence   step 6
                command: NO OPERATION

2x <QUIT>

- All the necessary entries have now been made. Press the <QUIT> key 2x to exit the parameter menu. The instrument is now in its normal state.

Tip!

When working on a sequence it is possible to switch rapidly between steps which have already been entered or to insert or delete a step with the aid of the following keys (provided that the program is in the command selection of a step, e.g. **command: PAUSE**):

<↓> and <↑> change to the next and previous command respectively.

<HOME> and <END> go to the first and last command respectively.

<INSERT> shifts the current and all subsequent steps downwards by one position and inserts a 'NO OPERATION' command.

<DELETE> deletes the current step and shifts all subsequent steps upwards by one position.

Running the method

START ²	• When <START> is now pressed the display shows
	Display: Not prepared yet! Run PREP now?
YES **ENTER**	• Before the Dosino is used for the first time in the new configuration the Dosino cylinder and the complete tubing system must be filled bubble-free with the particular reagent solution. Press <YES>.
	Display: waste port: tip(1) or flask(2)?
	• Press <1> to empty the contents of the cylinder through the dosing tip or <2> to return them to the bottle. Take care that the tips of the dosing tubing is located in a vessel. Wait until the 711 Liquino has ended the preparation (PREP) of all the Dosinos which are being used. The instrument then returns to its normal state.
START ²	• From now on when <START> is pressed the method will be run immediately.*)

---

*) The warning about the preparation of the tubing system appears each time the mode is changed and after the instrument has been switched off and on again. If it is certain that the Dosinos used have already been prepared then press <NO> (<QUIT> key) to acknowledge the warning. The method can now be run in the normal manner by pressing <START>.

3.2.12 GLP – automatic validation

For the automatic validation of a Dosino or the dosing unit a balance[*] must be connected to the 711 Liquino via the RS interface (see also page 19). In the GLP mode the Liquino automatically adds liquid to a tared vessel on the analytical balance, calculates the volume of the liquid added and compares this with the theoretical volume. The validation protocol is printed out on the connected printer in agreement with GLP practice.
The liquid used in this example is distilled water, which has advantages when used for this test.

Preconditions / Preparation

The connection of the printer and balance is described on pages 17 and 19.

A dosing unit which corresponds to the tubing of the Dosino used must be defined. This process is described on page 22.

The following instruments and accessories must be available:

- dosing tubing on Port 1 of the Dosino with buret tip 6.1543.060 (without diffusion-reducing valve)
- bottle filled with degassed water onto which the Dosino is screwed
- analytical balance, resolution 0.1 mg
- narrow-neck Erlenmeyer flask
- calibrated thermometer.

Make the following preparations:

- Measure the temperature of the water to be added. Set up the test apparatus so that it is not exposed to direct sunlight or draughts. The series of measurements must be carried out without any interruption.
- Mount the buret tip firmly on a support rod. It must not be moved during the test.
  If possible lead the buret tip into the balance chamber directly from above (cover the top of the balance chamber). Place the Erlenmeyer flask on the balance.
  It is important that during the addition the stream of liquid breaks off cleanly each time. This means that special precautions must be taken for some cylinder volumes:
 **2mL**: attach a yellow Eppendorf pipet tip to the buret tip. Insert a piece of absorbent cotton in the Erlenmeyer flask and fasten the buret tip so that it just does not touch the wad of cotton.
  5, 10, 20 mL: attach a yellow Eppendorf pipet tip to the buret tip.
  50 mL: attach a blue Eppendorf pipet tip to the buret tip.

---

[*] It is also possible to work without any direct connection between the balance and Liquino. The corresponding weight must then be entered via the keyboard.

Creating the GLP method
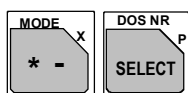
- The GLP mode must first be activated. This sets all method parameters to standard values. Press the <MODE> key and then <SELECT> until 'GLP' appears in the display:

  Display: mode select: GLP

- Press <ENTER>. The instrument is now in the GLP mode.

  Display: GLP   ********
                   ready   0.000 mL

- The <PARAM> key is used to access the parameter menu, where all the possible settings for a GLP method can be found.

  Display: parameters
                   >GLP parameters

<ENTER>
- The submenu 'GLP parameters' contains the main settings for a GLP method. Press <ENTER> to open the submenu.

  Display: >GLP parameters
                   drive unit: DOS1

<SELECT>
- The Dosino which is to be used can be chosen here with <SELECT> (DOSx refers to the connection number on the 711 Liquino). Press <ENTER> to accept the entry.

<ENTER>

  Display: >GLP parameters
                   dos.unit: default

<SELECT>
- In this menu item the 711 Liquino is informed about the tubing of the Dosino. Press <SELECT> until the dosing unit defined in the above preparation step appears.

  Display: >GLP parameters
                   temperature   20.00 °C

<ENTER>
- Enter the temperature of the water to be added here. This value should be as accurate as possible as it is used to calculate the density of the water. Press <ENTER> to accept the value.

  Display: parameters
                   >GLP options

- As the '>GLP parameters' submenu contains no further menu items, an automatic return is made to the submenu selection. Press <ENTER> to open the submenu 'GLP options'.

<ENTER>
  Display: >GLP options
                   liquid: water

<ENTER>
- Press <ENTER> to confirm that "water" is the liquid to be added.

  Display: >GLP options
                   weight from   balance

<ENTER>
- Use <ENTER> to confirm that the balance is connected to the RS interface and that the weight will be transmitted by the balance.[*]

---

[*] If the balance cannot be or is not to be connected to the RS interface then the <SELECT> key should be used to choose the entry 'keyboard'. During the procedure each weight must be read off from the balance and entered via the Liquino keyboard. (The next menu item 'Balance-Id' is skipped in this case!)

	Display: `>GLP options` `balance-Id`

- Enter an unambiguous identification for the balance used (e.g. serial number). The input of text is explained on 63.

<ENTER>	Display: `parameters` `>GLP reports`

- As the 'GLP options' submenu contains no further menu items, an automatic return is made to the submenu selection. Press <ENTER> to open the submenu 'GLP reports'. The reports which are to be printed out automatically at the end of the GLP test are defined here.

<ENTER>

	Display: `>GLP reports` `no. 1` `report:` `off`

- The <SELECT> key can be used to select from the following reports:

<SELECT>

  - 'off': no report

  - 'result': summary of the results

  - 'parameter': parameter settings

  - 'curve': graph of the measurement

  - 'detail': results in detail with list of measuring points

  - 'ff': page feed (may be useful between 2 reports)

<ENTER>

Select the reports to be printed out and press the <ENTER> key after each selection. Up to 5 entries can be made.

Press <QUIT> 2x to exit the parameter menu.

2x <QUIT>

All the necessary parameters have now been entered!

Tip!

Various GLP methods can be edited and stored in the method memory. Each of these memories can then be reloaded by pressing a few keys. The method memory is described on page 128.

Running the GLP method

START

- When <START> is now pressed the display shows

  Display: Not prepared yet!
                    Run PREP no?

YES ENTER

- Before a GLP test it is absolutely necessary that the Dosino cylinder and the complete tubing system must be filled bubble-free with reagent solution. Press <YES>.

  Display: waste port:
                    tip(1) or flask(2)?

<1> or <2>

- Press <1> to empty the contents of the cylinder through the dosing tip or <2> to return them to the bottle. Take care that the tips of the dosing tubing is located in a vessel. Wait until the 711 Liquino has ended the preparation (PREP) of all the Dosinos which are being used. The instrument then returns to its normal state.

START

- Press <START> again. The test procedure begins. Just follow the instructions show on the display!

4 Detailed description

4.1 The keyboard
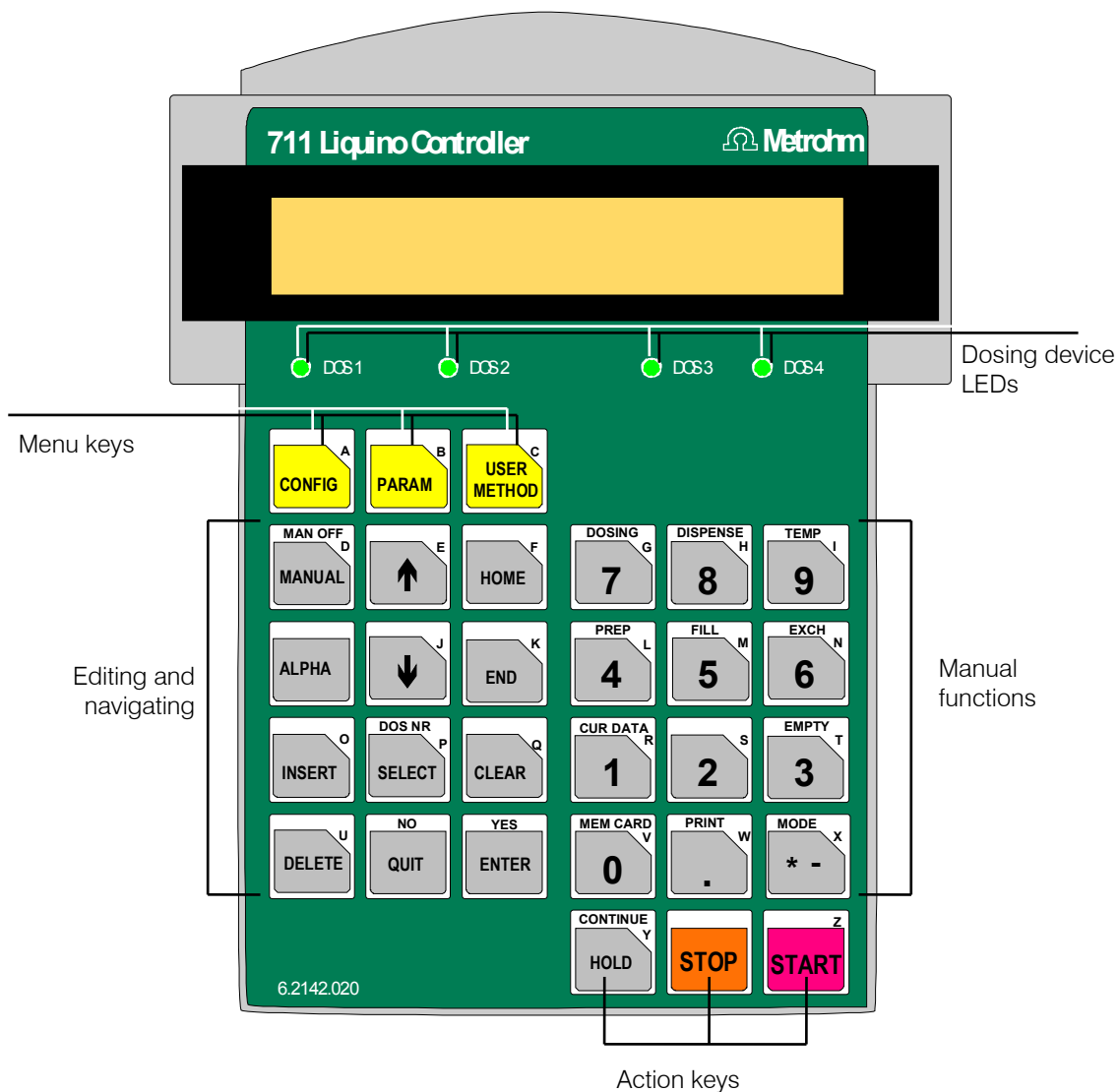
The dosing device LEDs indicate the active dosing device. In manual operation the dosing device can be selected with the <SELECT / DOS NR> key.

4.1.1 Menu keys

CONFIG A	Opens the configuration menu. For details see page 69.
PARAM B	Opens the parameter menu. For details see page 74ff.
USER METHOD C	Opens the method storage menu. For details see page 128. See also <MEM CARD> key.

4.1.2 Action keys

HOLD CONTINUE Y	Interrupts an automatic procedure or continues it again.
STOP	Stops an automatic procedure.
START Z	Starts a method or a manual function.

4.1.3 Editing and navigating keys
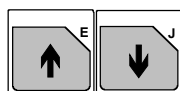
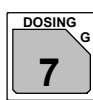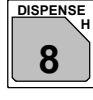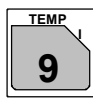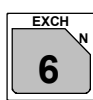|	
↑ E ↓ J	Cursor keys for rapid navigation in menus and submenus. Does not exit from submenu automatically.
HOME F **END** K	Selects the first or last entry in a menu or submenu.
ALPHA	Selects character set for text input by repeatedly pressing the <ALPHA> key. With the following possibilities: • number input (directly via the numeric block of the keyboard) • capital letters (directly via the keyboard), display: ALPHA • lower case letters (directly via the keyboard), display: alpha • special characters 1 and 2 (input via the numeric block)
INSERT O **DELETE** U	Inserts an empty command line or deletes a command line in the SEQ mode.
SELECT DOS NR P	Selects an entry from a selection list during editing. In manual mode: selects the active dosing device (DOS 1…4).
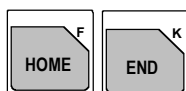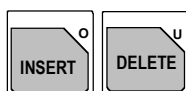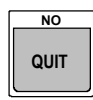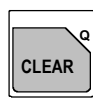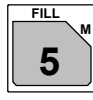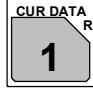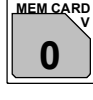
NO **QUIT**	Exits a submenu or confirms an error message.
CLEAR Q	Completely deletes an entry during editing or deletes the last character in the text input mode.
YES **ENTER**	Confirms an entry during editing. Opens a submenu during navigating.
MAN OFF D **MANUAL**	Switches on (or switches off) manual operation.

4.1.4 Manual functions and other keys

DOSING G **7**	Manual dosing. This function is only available in the manual mode, see <MANUAL> key.
DISPENSE H **8**	Manual dispensing of a particular volume. This function is only available in the manual mode, see <MANUAL> key.
TEMP I **9**	Manual temperature measurement with a Pt100 temperature sensor. This function is only available in the manual mode, see <MANUAL> key.
PREP L **4**	Manual preparation of a dosing unit.
FILL M **5**	Manual filling of a dosing unit.
EXCH N **6**	Moves 4-way stopcock of dosing unit to exchange position. Must be carried out each time before a dosing drive is disassembled.
CUR DATA R **1**	Input of sample-specific data (ID1…3). Only possible in automatic mode.
EMPTY T **3**	Completely empties a dosing unit.
MEM CARD V **0**	Accesses memory card. • Loads methods, stores them or deletes them • Changes directory, makes or deletes directory • Saves all methods or reloads • Formats card or changes battery

|	
PRINT w .	Prints out various reports.
MODE x * -	Selects an automatic run mode: • XDOS - controlled dosing • PIP - pipetting • CONT - preparation of solutions • SMPL - automated sampling • SEQ - sequential procedures • GLP - validation mode for dosing units Selection is made either with the <SELECT> key or by repeatedly pressing the <MODE> key.

4.2 Editing

The instrument dialog system of the Liquino 711 is chiefly organized as a menu system. For example, the <CONFIG> key forms the access to the configuration menu of the basic settings and the <PARAM> key provides access to the parameters of a run mode or a method. The menus are further split up into submenus.
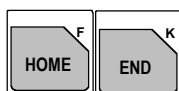
4.2.1 Navigating in menus

YES
ENTER
- Use the <ENTER> key to view and process the individual lines in a menu.

  Display: **configuration**
                        >peripheral units
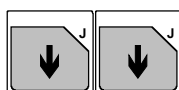
- Submenu titles are marked with a '**>**' character. Use the <ENTER> key to access a submenu.

J **J**
↓ ↓
- You can also navigate in menus with the cursor keys <↓> and <↑>. No data will be altered and no submenus opened.

F **K**
HOME **END**
- In order to reach the first or last menu item in a menu or submenu as quickly as possible use the <HOME> or <END> keys.

- The <QUIT> key is available to access the next higher level from a submenu or to reach the basic condition from a main menu.

4.2.2 Data input

YES
ENTER
- Numerical inputs can be entered easily with the number block of the keyboard. Confirm each input with the <ENTER> key.

Q
CLEAR
- An incorrect entry can be corrected with the <CLEAR> key. This always sets the so-called CLEAR value; a special value e.g. 'max' or 'infinite'.

  Display: **>XDOS parameter**
                       feed rate   max mL/min

NO
QUIT
- A data input can be aborted with <QUIT>. This restores the previous value.

DOS NR
P
SELECT
- Most menu items allow parameters to be selected from a selection list. By repeatedly pressing the <SELECT> key the individual entries in the list can be selected. These entries must also be confirmed with <ENTER>.

  Display: **>auxiliaries**
                       dialog: english

- Menu items which offer a selection list are indicated by a colon; see above.

ALPHA
- Some menu items require a text input. Switch the alphanumeric text editor on. Press the <ALPHA> keys. Details about text input are given below.

4.2.3 Text input

The text editor can be used wherever a text input is required. Numbers can be entered directly.

The <ALPHA> key can be used to switch between four sets of characters.

- Capital letters (ALPHA character set)
- Lower case letters (alpha character set)
- Special character set 1
- Special character set 2

The individual characters can then be entered directly via the keyboard. Observe the red printing on the keys.
Special characters are entered with the number block of the keyboard. The set of special characters is always shown in the first line of the display. Each special character occupies a numeric key:

1st special character set:

Di spl ay: 0?1 2! 3"4$5%6&7' 8=9esc

Number key occupancy:

Key	Sign	Key	Sign	Key	Sign
<0>	?	<3>	"	<7>	'
<1>	empty	<4>	$	<8>	=
	space	<5>	%	<9>	^
<2>	!	<6>	&	= esc-sign	

2nd special character set:

Di spl ay: 0@1(2) 3* 4+5, 6; 7_8/ 9#

Number key occupancy:

Key	Sign	Key	Sign	Key	Sign
<0>	@	<4>	+	<8>	/
<1>	(	<5>	,	<9>	#
<2>	)	<6>	;		
<3>	*	<7>	_		

Example:

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

First press the <CLEAR> key to delete the current contents.

ALPHA

Open the text editor with the <ALPHA> key.

```
ALPHA
method:        ■
```

The keyboard letters are now active. 'ALPHA' is in capital letters, i.e. all letters entered will appear as capital letters. Enter 'HC'.

```
alpha
method:        HC■
```

Press the <ALPHA> key again to allow lower case letters to be entered.
('alpha' is now in lower case letters). Type in 'l'.

```
alpha    1 2! 3" 4$5%6&7' 8=
method:        HCl ■
```

The next time <ALPHA> is pressed the 1st special character set will appear.
Press e.g. key <1> to insert an empty space.

```
alpha    1( 2) 3* 4+5, 6- 7. 8/
method:        HCl  ■
```

Press <ALPHA> a second time; the second special character set will appear.
Press e.g. key <1> to insert an open parenthesis.

```
>store method
method:        HCl  (■
```

Pressing the <ALPHA> key again exits the text editor.

If, for example, you want to add. '1m)' then you must press the following keys:
<1>, 2x <ALPHA>, <M>, 2x <ALPHA>, <2> and the <ENTER> key to accept the text entry.

```
>store method
method:        HCl  ( 1m)
```

CLEAR

In order to delete a character press the <ALPHA> key until the display 'ALPHA' or 'alpha' vanishes from the 1st line of the display and no special character set is shown either.
The <CLEAR> key now has its original function and deletes the last character entered (backspace function). Numbers can also be entered here.

The <QUIT> , <ENTER> and <STOP> keys always retain their standard functions.

4.3 Configuration

In order for the different modes and commands of the Liquino 711 to function properly it is essential that it is configured carefully. In particular, the definition of the different types of dosing unit and the serial RS 232 interface require special care.
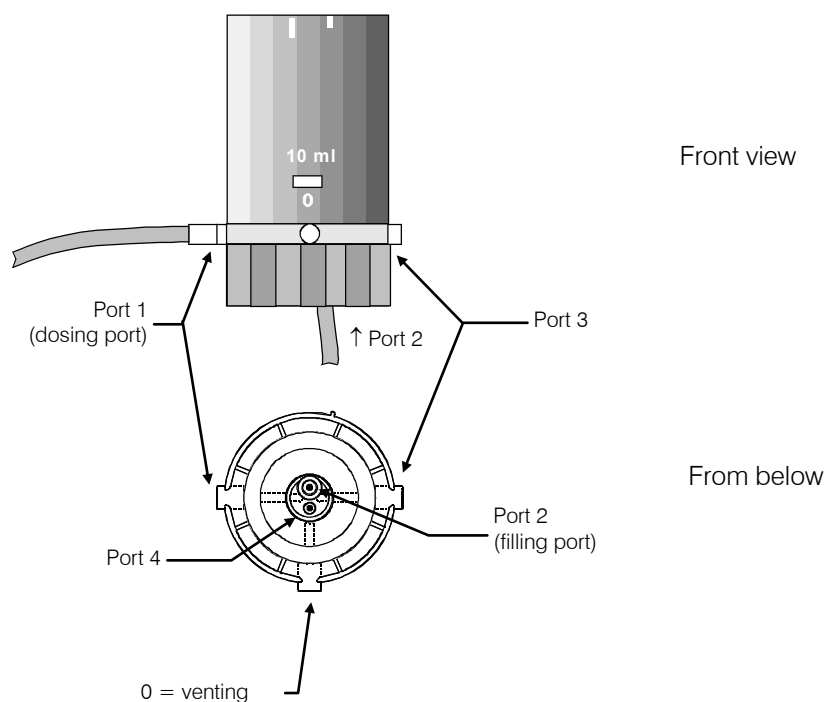
4.3.1 Defining the dosing units

Depending on your requirements you can fit your dosing units with tubing of different lengths and thicknesses. This results in different tubing volumes. These tubing volumes must be taken into account in the various automatic run modes and the manual operation commands <PREP> and <EMPTY> for the Liquino.
This is why you should define your own dosing unit type for any dosing unit which is not equipped with the standard tubing. This is not necessary if you only work with the standard tubing.

The standard tubing:

Port 1:   length 400 mm, diameter 2.0 mm
Port 2:   length 250 mm, diameter 2.0 mm
Port 3:   not fitted
Port 4:   not fitted

Front view

10 ml
0

Port 1
(dosing port)

↑ Port 2

Port 3

From below

Port 2
(filling port)

Port 4

0 = venting

4.3.2 The configuration menu

Please note: *menu entries with a colon offer a selection list. Press the <SELECT> key to make your se-lection.*

CONFIG [A]	>peripheral units >auxiliaries >manual >dosing units	>RS232 settings >report header >GLP error limits
Display Initial value	**Input range**	**Explanation**
>peripheral units	**Type of instrument connected (RS232 interface)**	
The specification of the externally connected instruments is extremely important for the correct functioning of the Liquino in an automated system. Instead of a printer a computer or other instrument (e.g. a Metrohm titrator) can be connected to the serial RS232 interface, in order to store Liquino reports or realize complex remote control functions. The is done by selecting the setting **'send to: IBM**. *If your type of printer is not listed select 'IBM' or 'Epson'; for laser printers select 'HP'. If your balance is not listed select 'Precisa'.*		
send to: IBM	IBM, Epson, Seiko, Citizen, HP	printer type
balance: Sartorius	Sartorius, Mettler, Mettler AT, AND, Precisa	balance manufacturer
>auxiliaries	**Basic Liquino settings**	
The configuration settings are retained even when the instrument is switched off.		
dialog: english	english, german	dialog language
date 1998-09-11	JJJJ-MM-TT	system date
time 08:10:15	SS:mm:ss	system time
device label XXXXXXXX	8 ASCII characters	instrument identification
program 711.0011	not editable	software version number
display contrast 3	0…7	LCD display contrast
beeper: on	on; off	beeper for warnings and error messages
PREP reminder: on	on; off	automatic request to prepare the dosing units.
>manual	**Settings for manual operation**	
These settings are only effective in manual operation, i.e. for dosing and dispensing. *In order for the PREP and EMPTY functions to work properly the type of dosing device must be given for each dosing device which is connected. When the type of dosing unit is specified the corresponding tubing dimensions as defined under 'Configura-tion>Dosing units' will be used for the internal calculation of the rinsing volume.* *By navigating with the <ENTER> key the settings for all 4 dosing device connections can be made one after the other.*		
dos.unit: default	selection list, see '**>dosing units**'	type of dosing unit connected.
fill rate max mL/min	0.001…166.666 mL/min; max	the maximum filling rate depends on the volume of the dosing cylinder.
auto fill: off	on; off	automatic filling after dosing.
>>dosing	**Submenu for dosing behavior**	
rate type: increasing	increasing; constant	increases dosing rate for precise manual dosing .
slope 4 *(only for increasing dosing rate)*	1…10	slope of increase in dosing rate.

>dosing units	**Configuration of dosing units**	
If dosing units with different lengths and diameters of tubing are used which do not correspond to the standard dimensions then special types of dosing units can be defined (max. 10). If such a dosing unit is used then its name must be entered under 'Configuration>Manual operation' or in the method with which it is to be used.		
dos.unit: D1	selection list, see 'ID below	selects dosing unit.
ID D1	12 ASCII characters as wished	name of type of dosing unit
length tube1 400 mm	0…9999 mm	length of tubing at Dosino Port 1 (dosing port)
diam tube1 2.0 mm	0.1…9.0 mm	diameter of tubing at Port 1
length tube2 250 mm	0…9999 mm	length of tubing at Dosino Port 2 (filling port, dipping tubing in the bottle)
diam tube2 2.0 mm	0.1…9.0 mm	diameter of tubing at Port 2
length tube3 0 mm	0…9999 mm	length of tubing at Dosino Port 3 (free port)
length tube4 0 mm	0…9999 mm	length of tubing at Dosino Port 4 (waste port in bottle)
>RS232 settings	**Serial RS232 interface settings**	
It is absolutely essential that the settings at the RS232 interface are in agreement with the corresponding data transmission parameters of the instrument connected.		
baud rate: 9600	300; 600; 1200; 2400; 4800; 9600; 19200; 38400; 57600	data transmission rate
data bits: 8	7; 8	number of data bits
stop bits: 1	1; 2	number of stop bits
parity: none	even; odd; none	type of parity check
handshake: Hardware	Hardware; SWChar; SWline; none	type of handshake
RS control: on	on; off	blocks data reception
>report header	**Definition of the user-defined report header**	
H1	21 ASCII characters as wished	contents of first header line
H2	21 ASCII characters as wished	contents of second header line
H3	21 ASCII characters as wished	contents of third header line
>GLP error limits	**Configuration of the error limits in the GLP test mode**	
>>err. limits 2mL-cyl.	**Submenu for 2 mL dosing units**	
error max.vol.+/- 6 µL	1…999 µL	maximum volume error
slope +/- 0.003	0.001…0.1	maximum variation in slope
intercept +/- 6 µL	1…99 µL	maximum y-axis intercept
>>err. limits 5mL-cyl.	**Submenu for 5 mL dosing units**	
error max.vol.+/- 15 µL	1…999 µL	maximum volume error
slope +/- 0.003	0.001…0.1	maximum variation in slope
intercept +/- 15 µL	1…99 µL	maximum y-axis intercept
>>err. limits 10mL-cyl.	**Submenu for 10 mL dosing units**	
error max.vol.+/- 30 µL	1…999 µL	maximum volume error
slope +/- 0.003	0.001…0.1	maximum variation in slope
intercept +/- 20 µL	1…99 µL	maximum y-axis intercept

`>>err. limits 20mL-cyl.`	**Submenu for 20 mL dosing units**		
`error max.vol.+/-   60 µL`	1…999 μL		maximum volume error
`slope +/-        0.003`	0.001…0.1		maximum variation in slope
`intercept +/-    30 µL`	1…99 μL	maximum y-axis intercept
`>>err. limits 50mL-cyl.`	**Submenu for 50 mL dosing units**		
`error max.vol.+/- 150 µL`	1…999 μL		maximum volume error
`slope +/-        0.003`	0.001…0.1		maximum variation in slope
`intercept +/-    50 µL`	1…99 μL		maximum y-axis intercept

4.3.3 Keyboard and graphics options

Further configuration possibilities are available:

- Locking the keyboard when the Liquino 711 is operated exclusively by remote control.

- Locking individual dialog ranges

- Settings for graphics printout

- Hiding individual instrument modes

These settings can be made in a special setup menu which is only accessible when the Liquino is switched on **with the <CONFIG> key pressed down**.

Switch the Liquino off, press down the <CONFIG> key and keep this pressed down while you switch the instrument on again.

Main menu:

`set up` `>keyboard options`	open submenu with <ENTER>
`set up` `>graphics printout`	use <↓> or <↑> to move up or down by 1 menu item
`set up` `>show hide modes`	use <HOME> or <END> to jump to first or last menu item

use <QUIT> to return to the basic condition

Submenus:

`set up` `>keyboard options`	**Locks keyboard or particular keys** Navigate with <ENTER>

`>keyboard options` `lock keyboard:      off`	Switches off keyboard

on = the Liquino cam only be operated via external software.
off

If the keyboard is locked the setup menu is still available to switch off the keyboard lock.

| >keyboard options
lock configuration: off | Locks <CONFIG> key |

 on = configuration menu is not available
 off

| >keyboard options
lock parameters off | Locks <PARAM> key |

 on = Parameters cannot be altered
 off

| >keyboard options
>>user methods | Submenu for locking the memory functions.
Press <ENTER>. |

The settings in this submenu only affect the internal method memory. The memory card can still be used. Memory cards can be protected against accidental erasure by activating the write protection switch on the card itself. Please read the information given on the sheet accompanying the memory card.

| >>user methods
lock method recall: off | Locks method loading |

 on = no methods can be loaded from the internal
 method memory
 off

| >>user methods
lock method store: off | Locks method storage |

 on = no methods can be stored in the internal meth-
 od memory
 off

| >>user methods
lock method delete: off | Locks method delete |

 on = no methods can be deleted in the internal
 method memory
 off

| >keyboard options
lock display: off | Switches off display
during operation via remote control |

 on = the display remains locked until the Liquino is switched
 off. However, it can be operated via the remote control,
 see 'Remote Control Reference'.
 off

| set up
>graphics printout | **Settings for printing out curves**
Navigate with <ENTER> |

| >graphics printout
relative width 0.50 | Width of the curve printout, referred to the
page format of the printer |

 0.3…1.00

| >graphics printout
relative height 0.50 | Height of the curve printout, referred to the
page formatof the printer |

 0.3…1.00

| set up
>show hide modes | **Visibility of the individual modes**
Navigate with <ENTER> |

```
>show/hide modes
hide XDOS :          no
```
Hides XDOS mode

yes = the XDOS mode cannot be selected
no

```
>show/hide modes
hide PIP :           no
```
Hides PIP mode

yes = the PIP mode cannot be selected
no

```
>show/hide modes
hide CONT :          no
```
Hides CONT mode

yes = the CONT mode cannot be selected
no

```
>show/hide modes
hide SMPL :          no
```
Hides SMPL mode

yes = the SMPL mode cannot be selected
no

```
>show/hide modes
hide SEQ :           no
```
Hides SEQ mode

yes = the SEQ mode cannot be selected
no

```
>show/hide modes
hide GLP :           no
```
Hides GLP mode

yes = the GLP mode cannot be selected
*no*

4.4 XDOS mode - controlled dosing

The XDOS mode (= Extended Dosing) of the 711 Liquino allows controlled dosing of liquids with variable parameters. In principle it is possible to select one of three different types of dosing. If continuos dosing is required a tandem dosing setup can be used, i.e. dosing is carried out with a combination of two Dosinos so that while one Dosino is being filled the other Dosino carries out the dosing and vice versa.

Depending on the type of task one of the types of dosing listed below can be used:

- **Volume&Rate** — you enter the volume to be dosed and the required dosing rate. Filling times lengthen the dosing process.
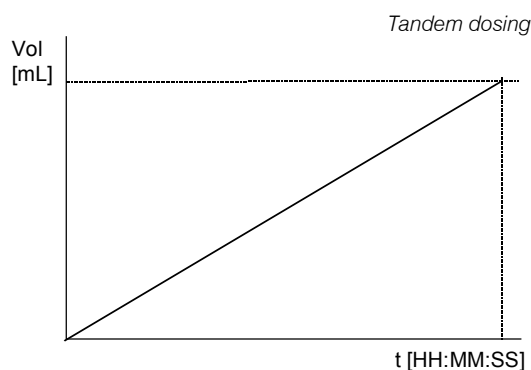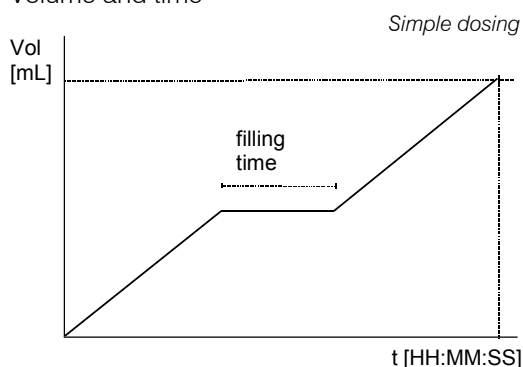
Task:
Volume and dosing rate
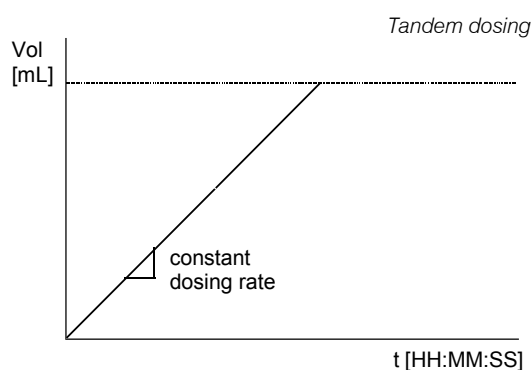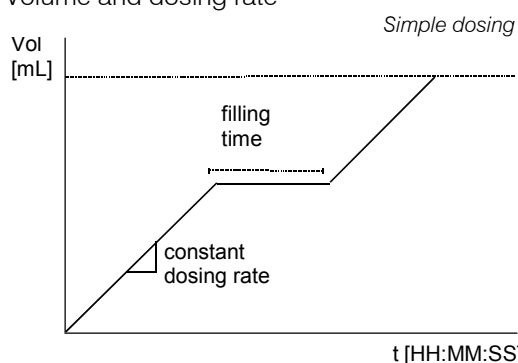
- **Volume&Time** — you enter the volume and the time in which this volume is to be dosed (particularly suitable for synthesis applications). The dosing rate is automatically optimized by the Liquino. The filling times of the dosing units are taken into account.

Task:
Volume and time

For tasks (volume and time) which cannot be fulfilled with the maximum dosing rate the 'max. rate' will be used.

The following equation can be used to estimate whether the max. dosing rate will be used:

Dosing rate = required delivery rate (in mL/min) ∗ 2.22

If the required dosing rate exceeds the max. dosing rate for the selected dosing unit (or cylinder volume) then a larger dosing unit must be selected.
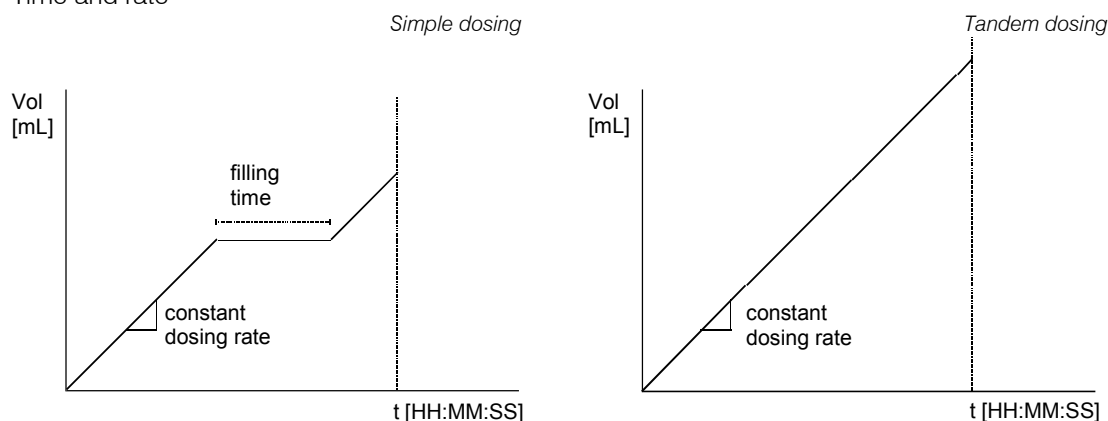
The limits of the individual dosing units:

Cylinder vol.	Max. dosing rate
2 mL	6.66 mL/min
5 mL	16.66 mL/min
10 mL	33.33 mL/min
20 mL	66.66 mL/min
50 mL	166.66 mL/min

- **Time&Rate** — you enter the time for which dosing is to be carried out at the preselected dosing rate. Filling times are taken into account.

Task:
Time and rate

Simple dosing   *Tandem dosing*

Delivery rate
To calculate the effective delivery rate of the Liquino the cylinder volume and the filling times of the dosing unit must be taken into account.
The max. delivery rates of the various dosing units:

Cylinder volume	Max. dosing rate	Max. delivery rate
2 mL	6.66 mL/min	approx. 170 mL/h
5 mL	16.66 mL/min	approx. 430 mL/h
10 mL	33.33 mL/min	approx. 890 mL/h
20 mL	66.66 mL/min	approx. 1.7 L/h
50 mL	166.66 mL/min	approx. 4.3 L/h

Tandem dosing
Tandem dosing with two dosing devices is used for continuos dosing. While one dosing device is filling its cylinder again after having dosed in a cylinder volume, the second dosing device takes over the dosing. The Dosinos work alternately.

However, in order to ensure interruption-free dosing the following points must be taken into account:

- In order to keep the filling times as short as possible use the highest filling rate permitted. Take the liquid viscosity and density into account.
- The dosing rate must not exceed 85% of the filling rate value. At the max. filling rate this corresponds to the following values:

Cylinder volume	Max. dosing rate	Max. delivery rate
2 mL	5.10 mL/min	approx. 300 mL/h
5 mL	12.75 mL/min	approx. 760 mL/h
10 mL	25.50 mL/min	approx. 1.5 L/h
20 mL	51.00 mL/min	approx. 3.0 L/h
50 mL	127.5 mL/min	approx. 7.6 L/h

For continuous dosing the dosing rate corresponds to the delivery rate.

Monitoring functions
Further options extend the dosing modes mentioned above so that you can adapt the dosing process to meet your own individual requirements:

- Temperature control: The built-in temperature measurement input (Pt100) allows the temperature in a reaction vessel to be monitored during the dosing process. The temperature monitoring function allows the dosing to be interrupted, delayed or terminated if set temperature limits are exceeded or undercut. In addition, external instruments can be switched via remote leads.

- Volume control: In order to prevent e.g. a vessel from overflowing it is possible to set an absolute stop volume which, when reached, immediately and unconditionally terminates the dosing. This is particularly useful for Time&Rate dosing, where the volume is not set in advance.

Documentation
For documentation of the dosing procedure a result report, a volume/temperature curve or measuring point list can be printed out or sent to a computer. To complete the documentation three lines of identification text can be entered (see example of report on page 81).

Port occupancy of the dosing units in the XDOS mode
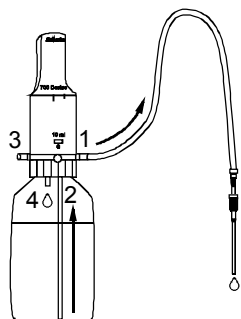
Standard occupancy

Port 1　　Dosing port
Port 2　　Filling port (with dipper tube)
Port 3　　empty
Port 4　　Waste (for PREP-function)

The port allocation can be altered under
<Parameter> >dosing unit port use 'special'.

4.4.1 XDOS mode parameters

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

Main menu:

parameters >XDOS parameter
parameters >XDOS dosing units
parameters >XDOS monitoring
parameters >XDOS preselections
parameters >XDOS reports

Open submenu with <ENTER>

Use <↓> or <↑> to move down or up from one menu point to the next

Use <HOME> or <END> to jump to first or last menu point

Return to basic condition with <QUIT>

Submenus:

parameters >XDOS parameter	**Dosing parameter** settings. Navigate with <ENTER>

>XDOS parameter XDOS type: vol- ume&rate	Selection of task parameters

volume&rate, = selection of volume and dosing rate
volume&time, = selection of volume and dosing time
time&rate = selection of dosing time and dosing rate

Depending on the selected XDOS type two of three dosing parameters will be shown. The third parameter will be automatically determined by the Liquino 711 or results from the dosing itself and will be printed out in the result report when dosing has been concluded.

>XDOS parameter volume 1.0 mL	Dosing volume

0.0…99999.9,
infinite = continuous dosing; can be ended with <STOP>
not for time&rate

>XDOS parameter feed rate max mL/min	Dosing rate

0.001…166.66,
max = highest possible dosing rate (depends on type of
not for volume&time   dosing unit.)

The dosing rate is the adjustable piston stroke speed when discharging the cylinder contents. For simple dosing it does not correspond to the effective delivery rate as the filling times of the dosing unit must be taken into account.

>XDOS parameter dosing time 00:01:00	Time selected for complete dosing process. Filing times must be taken into account.

HH:MM:SS in hours, minutes and seconds (corrections can be made
not for volume&rate with <CLEAR>.)

>XDOS parameter temp. measuring: off	Temperature measurement (compulsory for temperature-controlled dosing)

on, off

>XDOS parameter rec. interval 00:01:00	Recording interval for temperature measurement

HH:MM:SS in hours, minutes and seconds
(only for temp. measuring 'on')

**Maximal values for
dosing and filling rates**

Cylinder vol.   max. rate

2 mL	6.66 mL/min
5 mL	16.66 mL/min
10 mL	33.33 mL/min
20 mL	66.66 mL/min
50 mL	166.66 mL/min

These are pure piston stroke rates; filling times not taken into account.

```
>XDOS parameter
fill rate    max mL/min
```
max,
0.001…166.66

Filling rate of dosing unit

= highest possible filling rate (depends on type of dosing unit.)

The filling rate is the adjustable piston stroke speed for aspirating the cylinder contents. **Reduce the filling rate for liquids with a higher density or viscosity**, as otherwise too rapid filling may cause an underpressure in the cylinder.
The time for completely filling an empty dosing cylinder is approx. 20 seconds at max. filling rate (including stopcock switching); at slower filling rates it takes correspondingly longer.

```
>XDOS parameter
auto fill:        on
```
on, off

Automatic filling after dosing

```
parameters
>XDOS dosing units
```

Setting the dosing unit(s)
Navigate with <ENTER>

```
>XDOS dosing units
set up:        single
```
single,
tandem

Use of one or two dosing drives

= dosing with one dosing drive
= use of two dosing drives for interruption-free dosing

```
>XDOS dosing units
dosing drive:    DOS1
```
DOS1, DOS2, DOS3, DOS4

Dosing drive connection

```
>XDOS dosing units
dos. unit:     default
```
Selection list

Name of dosing unit used

see configuration '**>dosing units**'

For tandem dosing the settings for two dosing drives given alongside must be carried out. They are listed one after another in the menu.
It is a good idea to use the same settings for both dosing drives.

```
>XDOS dosing units
port use:      default
```
default,
custom

Port allocations of dosing unit

= standard port occupancy, see page 76
= user-defined port allocation , see below

```
>XDOS dosing units
dosing port        1
```
1…4
only for 'custom'

Dosino port through which dosing is carried out.

```
>XDOS dosing units
filling port       2
```
1…4
only for 'custom'

Dosino port from which the dosing cylinder is filled.

```
>XDOS dosing units
waste port         4
```
1…4
only for 'custom'

Dosino port for excess reagent with PREP.

parameters >XDOS monitoring	**Monitoring function settings** Navigate with <ENTER>

>XDOS monitoring temperature: off *on, off*	Temperature monitoring

>XDOS monitoring low limit -70 °C *-70…200.0*	Lower temperature limit

>XDOS monitoring upper limit 200 °C *-70…200.0*	Upper temperature limit

>XDOS monitoring action: none	Reaction if upper or lower temperature limit is infringed

none, = no reaction (alarm pins still active)
stop, = dosing is stopped
hold = dosing is interrupted and can be continued with <CONT>
wait = dosing is interrupted and automatically continued as soon as the measuring temperature is again within the limits.

The alarm pins can be used to switch an external instrument connected to the remote socket, e.g. a heating bath or a thermostat. *You are recommended to use Metrohm Relay Box 731.*	>XDOS monitoring alarm pins: none	Definition of the active alarm pins of the remote connection

none, = no activation
under, = Output2 lead (Lower Limit, pin 4) activated when temperature too low
over = Output1 lead (Upper Limit, pin 18) activated when temperature too high
all = Output1 and Output2 activated when corresponding temperature limits are infringed (see above)

>XDOS monitoring volume: off *on, off*	Volume monitoring function

>XDOS monitoring crit. volume 10000 mL *0.0…99999.9* **only for 'volume: on'**	Absolute volume limit for terminating dosing

parameters >XDOS preselections	**Definition of requests at start of dosing** Navigate with <ENTER>

>XDOS preselections req. ident: off	Automatic request of up to 3 identification texts

id1, = only ID1 is requested
id1&2, = ID1 and ID2 are requested
all, = ID1, ID2 and ID3 are requested
off = no request

Use identification texts (ID1…3) for identifying your sample or your test. The IDs will be printed out in the report of the dosing procedure so that the individual result reports or curves are identified unambiguously.

>XDOS preselections >>XDOS prompts	**Submenu for definition of the request texts**

>>XDOS prompts id1 I d1	Display text for requesting the first ID

14 ASCII characters

>>XDOS prompts id2 I d2	Display text for requesting the second ID

14 ASCII characters

>>XDOS prompts id3 I d3	Display text for requesting the third ID

14 ASCII characters

>XDOS preselections start delay 00:00:00	Delay time before dosing

HH:MM:SS

parameters >XDOS reports	**Report definitions for result output** Navigate with <ENTER>

>XDOS reports temp. auto scale: on	Automatic axis scaling for temperature curves

on, off

>XDOS Reports temp. scale low -70 °C	Lower limit value for temperature axis

-70…200
only for auto scale 'off'

>XDOS reports temp. scale high 200 °C	Upper limit value for temperature axis

-70…200
only for auto scale 'off'

>XDOS reports no. 1 report: off	Selection of one or more reports to be printed out when dosing is completed.

off = no report
result, = list of relevant results
parameter, = list of all method parameters
curve, = dosing curve, if necessary combined with temperature curve
V-list, = volume list, list of dosed volumes at events
T-list, = temperature list, list of measured temperatures
= combined volume and temperature list
comb. list, = FORM FEED; triggers page feed at printer
ff (important for laser and inkjet printers for ejecting pages)

>XDOS reports no. 2 report: off	… up to eight reports are possible

…

Examples of various reports are shown on the following pages.

4.4.2 Examples of reports - XDOS mode

Temperature-controlled dosing with volume and time selection

Parameter Report

```
711 Liquino          0220    711.0011        ← instrument number and program version
date 1998-09-30    time  11:51               ← date and time
*** Dev. Dept.                               ← 3-line report header
*** dm
*** Metrohm Ltd                              ← mode and method name
mode: XDOS       user method: TempDos1       ← ID1, identification with preselected display text
lot no.                    12-2
parameters
>XDOS parameter                              ← dosing parameters
  XDOS type:       volume&time
  volume                    10.0 mL
  dosing time        00:02:00
  temp. measuring:          on
  rec. interval      00:00:10
  fill rate             max mL/min
  auto fill:                on
>XDOS dosing units                           ← dosing unit settings
  setup:             single
  dosing drive:        DOS1
  dos.unit:              D3
  port use:          custom
  dosing port             1
  filling port            2
  waste port              1
>XDOS monitoring                             ← monitoring function settings
  temperature:             on
  low limit            20.0 °C
  upper limit          30.0 °C
  action:              wait
  alarm pins:          none
  volume:                 off
>XDOS preselections                          ← request settings
  req.ident:             id1
  >>XDOS prompts
   id1              lot no.
   id2                   id2
   id3                   id3
  start delay        00:00:00
>XDOS reports                                ← report definitions
  temp. auto scale:       on
  report1:            result
  report2:             curve
  report3:         comb. list
  report4:               off
  report5:               off
  report6:               off
  report7:               off
  report8:               off
          ------------                       ← identification of reproduced reports
```
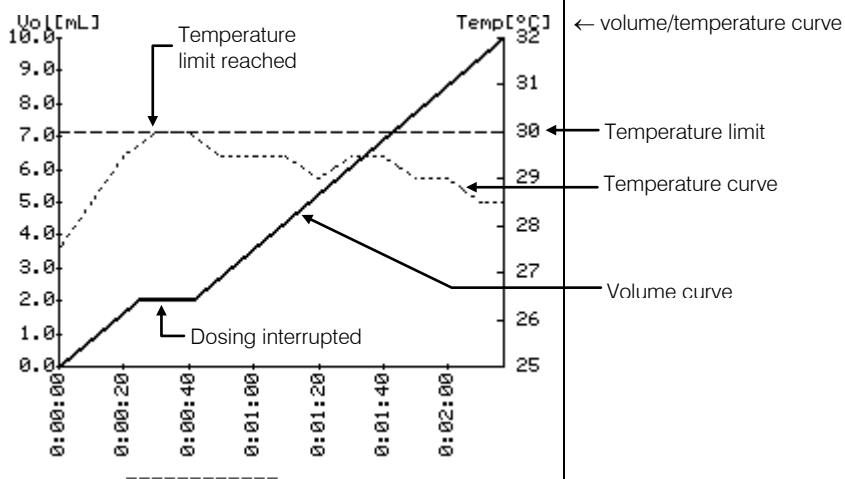
Result Report

```
711 Liquino          0220    711.0011        ← see above
date 1998-09-30    time  11:39
*** Dev. Dept.
*** dm
*** Metrohm Ltd
mode: XDOS       user method: TempDos1
lot no.                    12-2

total dosing time    = 000:02:17             ← effective time *
total volume         = 10.000 mL             ← dosed volume
dosing rate          = auto                  ← dosing rate
          ============                       ← identification of original report
```

* total time including waiting times during infringements of temperature limits or during filling

Curve Report

```
711 Liquino            0220      711.0011
date 1998-09-30    time  11:39
*** Dev. Dept.
*** dm
*** Metrohm Ltd
mode: XDOS          user method: TempDos1
lot no.                12-2
```


← volume/temperature curve

← Temperature limit

← Temperature curve

← Volume curve

Temperature limit reached

Dosing interrupted

Combined List

```
711 Liquino            0220      711.0011
date 1998-09-30    time  11:39
*** Dev. Dept.
*** dm
*** Metrohm Ltd
mode: XDOS          user method: TempDos1
lot no.                12-2

time     vol.(mL)  temp(°C)    event
-------------------------------------
000:00:00   0.000           *** START ***
000:00:00   0.000   27.5
000:00:10   0.828   28.5
000:00:20   1.656   29.5
000:00:25   2.075           T-limit,wait
000:00:30   2.075   30.0 upper T-limit
000:00:40   2.075   30.0 upper T-limit
000:00:42   2.075           continue
000:00:50   2.751   29.5
000:01:00   3.584   29.5
000:01:10   4.416   29.5
000:01:20   5.249   29.0
000:01:30   6.081   29.5
000:01:40   6.914   29.5
000:01:50   7.746   29.0
000:02:00   8.579   29.0
000:02:10   9.411   28.5
000:02:17  10.000           *** END ***
000:02:20           28.5
000:02:30           28.5
            ============
```

← tabular list of volumes, temperatures and
  events

← start of dosing

← temperature limit reached, dosing interrupted

← temperature back in limit, dosing continued

← end of dosing

← procedure ended after dosing unit has been filled.

4.5 SEQ mode - complex processes

The SEQ mode (sequence) of the Liquino allows complex process sequences with a total of up to 75 steps to be created. The individual steps can consist of methods (stored modes) or auxiliary commands. Sequences can be processed several times in automatic operation.

Applications in synthesis

For example, in synthesis applications in particular it may be useful to allow several XDOS modes to be carried out one after another and to extend these with time functions and communication commands.

An example:

Step 1:	wait for time (TIMER command)
Step 2:	add solvent (XDOS method)
Step 3:	switch on stirrer (CTRL remote command)
Step 4:	fill 1st educt into apparatus (XDOS method)
Step 5:	switch on heating bath (CTRL remote command)
Step 6:	add 2nd educt drop by drop (XDOS method, temperature-controlled)
Step 7:	wait for reaction (PAUSE command)
Step 8:	switch off heating bath (CTRL remote command)

Applications in analysis

In analysis process sequences are used wherever simple instruments are used to control individual automated systems. The SMPL mode is chiefly used in such applications to carry out sample preparation. In the process sequence various analytical instruments and peripheral units can be started, time-controlled if necessary.

An example:

Step 1:	Sampling (SMPL method)
Step 2:	pH/mV measurement (CTRL remote command)
Step 3:	Titration (SMPL method with start of titration)

Processing a sequence

A sequence is a series of part-steps which are carried out one after another. Each step defines a command. The command 'Method' as a special case causes a stored method to be loaded; this consists of a mode (e.g. XDOS, etc.) with its specially defined parameters. The other commands which are available carry out simple functions with one or two parameters. A sequence can be processed several times without interruption. The parameter 'auto start' determines the number of times it is carried out.

The process sequence is defined in the parameter menu and is part of the method.
The individual steps can be programmed in sequence. It is possible to insert steps in the sequence at a later date (<INSERT> key) or to delete whole steps from the sequence (<DELETE> key).
Example:

```
>SEQ sequence
   auto start              3          ← 3 repeats of the sequence
step 1
   command:             TIMER
   date             1998-12-01        ← start at a particular time
   time               10:00:00
step 2
   command:            METHOD
   method:              XDOS1         ← carry out method (XDOS1)
step 3
   command:            CONTROL
   interface:           Remote        ← start determination
   pattern             0001----
step 4
   command:             PAUSE
   pause               00:01:00       ← minimum waiting period
step 5
   command:            CONTROL
   interface:           Remote        ← reset remote leads
   pattern             0000----
step 6
   command:             SCAN
   interface:           Remote        ← wait for end of determination
   pattern             00001---
...
```

4.5.1 Commands

Sub-methods
Any number of methods can be used in a sequence, with the exception of GLP methods or methods which themselves represent a sequence. A precondition is that they are stored either in the internal memory (<USER METH> key) or on an inserted memory card (<MEM CARD> key). Avoid storing methods under the same name in the internal memory and on the memory card if the card is always inserted in the instrument. The Liquino will always load the version of the method which is stored in the internal memory.
If you work with memory cards you must take the following points into consideration. Various directories can be created on a card. When a sequence is being processed the Liquino will only access the directory which is currently opened. Before you use a sequence in which a method is stored on a memory card you must select the corresponding directory. This is done by pressing the <MEM CARD> key and then pressing the <↓> key three times. If '**>change directory**' is now shown, press <ENTER> and use the <SELECT> key to select the required directory. Confirm your selection with <ENTER>. See also page 128ff.

Auxiliary and communication commands
Time-oriented auxiliary commands and communication commands are available.

- **PAUSE** — this command interrupts sequence processing for a defined period.

- **TIMER** — sequence processing is interrupted until a defined time (date and time) has been reached.

- **CONTROL** — during the sequence processing it is possible to set a particular signal pattern at a remote connection or to send a character string via an RS232 connection to a connected instrument. The corresponding instrument interface can be selected.

  Remote connection:
  Four of the eight output lines (Output4…7) of the remote socket can be set. The lines Output0 to Output3 are reserved for functions of the various instrument modes.
  A bit pattern is selected which gives the conditions of the output lines (e.g. the status of the 'External start' line which is used to start a Metrohm instrument). Each bit corresponds to an output line.

  Output 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: **command:**   **CONTROL**
             interface: **Remote**
             pattern   **0100----** *(lines 0…3 are reserved)*

Line conditions:

0 = inactive (high)
1 = active (low)
* = as chosen

This example sets output line 6 active (1=set). This line starts a Titrino, provided that remote cable 6.2141.090 is used to make the connection. Output line 6 of the Liquino is connected to input line 0 of the Titrino and starts a determination when it is activated.

Output lines which are of no interest should be masked with an asterisk (*).

With a suitable multiple cable (with special wiring) it is possible to control several instruments simultaneously via the remote leads. The bit patterns for the CONTROL command can be combined, i.e. 2 Titrinos can be started simultaneously and the end of both determinations can be scanned with a SCAN command.

Details about the remote interface can be found under 'Remote Control Reference'.

RS232 connection:
Data (=character strings) can be sent to connected instruments via the serial RS interface.

Make sure that the transmission parameters of the RS232 interface agree with those of the connected instrument (see configuration menu >RS232 Settings, page 21).

Any combination of letters, numbers and special characters can be selected from the Liquino character set. To enter letters and special characters press the <ALPHA> key, see also page 66.

This function is particularly suitable for instruments with the Metrohm remote control language. Metrohm instruments 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;$H   Hold, interrupt determination
&M;$C   Continue, restart determination

Details about the Metrohm remote control language can be found in the 'Instructions for use' of the corresponding instrument.

- **SCAN** — this command has the effect of stopping the sequence. In order to continue the sequence a particular signal pattern at a remote connection or the receipt of a defined character string via an RS232 connection is necessary. The corresponding instrument interface can be selected.

  Remote connection:
  Eight input lines are available for communication with external instruments. Five of these (Input3…7) can be scanned with the SCAN command. Lines Input0 to Input2 are reserved for the functions START, STOP and HOLD/CONTINUE.
  The condition of the input lines (e.g. the status of the ready line to scan for the titration end at the Titrino) is compared with a preselected bit pattern. Each bit corresponds to an input line.

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)

Line conditions:

0 = inactive (high)
1 = active (low)
* = as chosen

Example: **command:**   **SCAN**
             interface: **Remote**
             pattern   **0***1---** *(lines 0…2 are reserved)*

The above command expects an active input line 3 (1=set). This line is set, e.g. by a Titrino, after a titration has been ended and the Titrino can again accept a start signal. A precondition is that the remote cable 6.2141.090 is used.

Input lines which are of no interest or for which no defined condition can be predicted should be masked with an asterisk (*).

With a suitable multiple cable (with special wiring) it is possible to scan several instruments simultaneously via the remote lines. The bit patterns for the SCAN command can be combined, i.e. 2 Titrinos can be monitored simultaneously and the end of both determinations can be scanned. Please note that several instruments (Titroprocessors, 691 pH meter) only send short impulses at the end of a determination (typically 200 ms) and therefore for these instruments a combined scan of the end of the determination together with other instruments is only possible under certain (time-related) conditions.
Details about the remote interface can be found under 'Remote Control Reference'.

RS232 connection:
When scanning the RS232 connection the input buffer of the interface is monitored. Incoming data are compared with the selected character string. The lines received must be concluded with the ASCII characters CR and LF. Incoming data are checked character by character.
Any combination of letters, numbers and special characters from the 711 Liquino character set can be selected. To enter letters and special characters press <ALPHA> key, see also page 66.
'*' can be used as place holder for any character strings. (If '*' is interpreted as an ASCII character then '**' must be used). A place holder can be set within a character string.
When the first part of the character string has been recognized correctly then the first appearance of the character which stands after the '*' is searched for. The comparison of the second part of the character string is carried out.

This function is particularly suitable for instruments with the Metrohm remote control language. The AutoInfo status messages can be scanned. The most useful of these are:

*.T.R"	Ready, 'Ready' condition is reached, e.g. after titration
*.T.F"	Final, end of determination is reached
*.T.S"	Stop, instrument stopped manually
*.T.G"	Go, instrument starts
.E;	Error, error message

These status messages are only transmitted if first the corresponding status message has been switched on, e.g. for a Titrino with the command:

```
command:        CONTROL
interface:           RS
string:      &Se.A.T.R"ON"
```

Details about the Metrohm remote control language can be found in the 'Instructions for use' of the corresponding instrument.

It is essential that the transmission parameters of the RS232 interfaces of both instruments are in agreement. Use RS cable 6.2125.010 for the connection.

- **ENDSEQ** — this command is used for marking the end within a sequence. It can be inserted into any command line for test purposes. This always has the effect that the sequence is only processed up to this line. However, it is not essential that a sequence has an end marking.

SEQ as method
A process sequence can, like the other instrument modes, be stored as a method. Sub-methods must be defined and stored before a sequence is put together.

Before carrying out a SEQ method make sure that all the sub-methods required are available, i.e. that they have not been deleted.

4.5.2 SEQ mode parameters

[PARAM B]

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

Main menu:

parameters
>SEQ sequence
parameters
>SEQ preselections
parameters
>SEQ reports

Open submenu with <ENTER>

Use <↓> or <↑> to move down or up from one menu point to the next

Use <HOME> or <END> to jump to first or last menu point

Return to basic condition with <QUIT>

Submenus:

parameters
>SEQ sequence

Process sequence
Navigate with <ENTER>

>SEQ sequence
auto start   1

Number of times sequence is to be repeated
(confirm with <ENTER>)

1…99999,
infinite   (can be set with the <CLEAR> key)

>SEQ sequence   step 1
command: NO OPERATION

Define step 1
(Select command with <SELECT>)

METHOD, PAUSE, TIMER,   Parameters of the individual commands can be
SCAN, CONTROL, ENDSEQ,   defined after confirmation with <ENTER>.
NO OPERATION

…

>SEQ sequence   step 75
command: NO OPERATION

Further steps, up to step 75

METHOD, PAUSE, TIMER,   Parameters of the individual commands can be
SCAN, CONTROL, ENDSEQ,   defined after confirmation with <ENTER>.
NO OPERATION.

Up to 75 commands can be programmed in the sequence. Each command forms a small submenu. After confirming the parameters of the individual commands a new step is automatically attached to the sequence.

In the sequence (step 1… x) quick navigation is possible by using the cursor keys <↓> and <↑>. The <HOME> and <END> keys allow a jump to the start or finish of the sequence.

With the <INSERT> key a new step can be inserted before the selected command.
<DELETE> deletes the selected command from the sequence. The following steps move up automatically.

parameters >SEQ preselections	**Definition of requests at start of sequence** Navigate with <ENTER>

>SEQ preselections req. ident: off	Automatic request for up to 3 identification texts

id1, = only ID1 is requested
id1&2, = ID1 and ID2 are requested
all, = ID1, ID2 and ID3 are requested
off = no request

>SEQ preselections >>SEQ prompts	**Submenu for definition of the request texts**

>>SEQ prompts id1 Id1	Display text for requesting the first ID

8 ASCII characters

>>SEQ prompts id2 Id2	Display text for requesting the second ID

8 ASCII characters

>>SEQ prompts id3 Id3	Display text for requesting the third ID

8 ASCII characters

Use the identification texts (ID1…3) for identifying your sample or your
test. The IDs will be printed out in the report of the dosing procedure so
that the individual reports are identified unambiguously.

parameters >SEQ reports	**Report definitions for result output** Navigate with <ENTER>

>SEQ reports no. 1 report: off	Selection of one or more reports to be printed out when the process is completed.

off = no report
parameter, = list of all SEQ parameters
ff = FORM FEED; triggers page feed at printer
     (important for laser and inkjet printers, for
     ejecting pages)

>SEQ reports no. 2 report: off	… up to two reports are possible

…

4.5.3 Commands in a sequence

METHOD

```
>SEQ sequence      step x
command:         METHOD
```
Carry out sub-method
Edit parameters with <ENTER>

```
>SEQ sequence      step x
method:
```
Name of method

Select,   <SELECT> can be used to select a method
8 ASCII characters stored in the internal memory or on a memory
card.

PAUSE

```
>SEQ sequence      step x
command:          PAUSE
```
Sequence interruption
Edit parameters with <ENTER>

```
>SEQ sequence      step x
pause          00:00:00
```
Definition of pause period

HH:MM:SS   <CLEAR> can be used to delete the entry.

TIMER

```
>SEQ sequence      step x
command:          TIMER
```
Time when sequence is to be continued

Edit parameters with <ENTER>

```
>SEQ sequence      step x
date         1998-01-01
```
Date

YYYY-MM-DD   <CLEAR> can be used to delete the entry.

```
>SEQ sequence      step x
time           12:00:00
```
Time

HH:MM:SS   <CLEAR> can be used to delete the entry.

SCAN

```
>SEQ sequence      step x
command:           SCAN
```
Scan interface
Edit parameters with <ENTER>

The sequence is stopped while the command is
carried out.

```
>SEQ sequence      step x
interface:       Remote
```
Selection of interface

Remote = monitor remote socket
RS = monitor RS232 interface

1 = line active (low level)	`>SEQ sequence      step x` `pattern        *****---`	Bit pattern of input lines of the remote socket
0 = line inactive (high level)		
* = condition will not be tested		

00000---…11111---
only for 'interface: Remote' <CLEAR> can be used to delete the entry.

`>SEQ sequence      step x`
`string`

Character string in input buffer of serial RS232 interface

15 ASCII characters
only for 'interface: RS' <CLEAR> can be used to delete the entry.

Input in text input mode. Press
<ALPHA> key.

CONTROL

`>SEQ sequence      step x`
`command:        CONTROL`

Operate interface
Edit parameters with <ENTER>

`>SEQ sequence      step x`
`interface:      Remote`

Select interface with
<SELECT>
Remote = output lines of remote socket
RS = send data via RS232 interface

1 = line active (low level)	`>SEQ sequence      step x` `pattern        ****----`	Bit pattern for setting output lines of remote socket
0 = line inactive (high level)		
* = condition will not be changed		

0000----…1111----
only for 'interface: Remote' <CLEAR> can be used to delete the entry.

`>SEQ sequence      step x`
`string`

Character string which is to be sent via the RS232 interface

15 ASCII characters
only for 'interface: RS' <CLEAR> can be used to delete the entry.

Input in text input mode. Press
<ALPHA> key.

ENDSEQ

`>SEQ sequence      step x`
`command:         ENDSEQ`

End mark of the sequence

This command can be used for marking the end
within a sequence. It is therefore very useful for
testing long sequences.
It is not necessary to set an ENDSEQ mark at the
end of a sequence.

4.5.4 Example of a report - SEQ mode

Sequences

Parameter-Report

```
711 Liquino           0220      711.0011      ← instrument number and program version
date 1998-10-20     time  14:36               ← date and time
*** Dev. Dept.                                ← 3-line report header
*** dm
*** Metrohm Ltd
mode: SEQ          user method: SEQ1          ← mode and method name
lot no.                    12-1               ← ID-texts and entries
project no.            4.567.98
parameters
>SEQ sequence
  auto start               1                  ← definition of process sequence
step 1                                        ← number of repeats
  command:              TIMER
  date             1998-12-01
  time             10:00:00                    ← start at a certain time
step 2
  command:             METHOD
  method:              XDOS1
step 3                                        ← sub-method with XDOS mode
  command:             CONTROL
  interface:           Remote
  pattern              0001----               ← start external instrument
step 4
  command:             PAUSE
  pause            00:01:00
step 5                                        ← delay period
  command:              SCAN
  interface:           Remote
  pattern              00001---
step 6
  command:       NO OPERATION                 ← wait for end of determination
>SEQ preselections
req.ident:            id1&2
  >>XDOS prompts
   id1               lot no.                  ← end of sequence
   id2              project no.
   id3                  Id3                   ← request settings

>SEQ reports
  report1:              off
  report2:              off
           -----------                        ← report definitions


                                              ← identification for reproduced reports
```

4.6 CONT mode - preparation of solutions

The CONT mode (content) allows the comfortable preparation of solutions or dilutions. With the 711 Liquino the required concentration of the solution can be set precisely. Various dosing procedures are available.

The port allocation of the Dosino in the CONT mode is defined as follows:
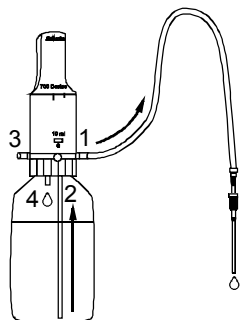
Port allocation

Port 1	Dosing port
Port 2	Filling port (with dipper tube)
Port 3	empty
Port 4	Waste (for PREP function)

The port allocation cannot be altered via the keyboard.

4.6.1 Preparation of solutions

If a 711 Liquino is used it is not necessary to weigh out the required amount of a substance with total accuracy. In the CONT mode the Liquino automatically calculates the required volume of solvent needed to obtain the necessary concentration with the sample weight used, e.g. for a standard solution.
A balance can be connected directly to the 711 Liquino via an RS232 cable so that the preparation of standard solutions can be automated to a large extent.
There is the possibility of documenting the dosing by printing out a result report. The simultaneous connection of a balance and a printer is possible (with branch plug 6.2125.030 and cable 6.2125.010).

Depending on the unit of mass of the target concentration the following dosing procedures can be used for the **preparation of solutions**:

Mass unit	Type of calculation
mol/L	molar fraction concentration
g/L	mass concentration
% (percent by weight)	mass fraction

The necessary information can be stored as a method. These are:
– target content (in mol/L, g/L or %)
– target volume in mL
– factor (e.g. relative content of original substance in g/g)
– molar mass (only for molar fraction concentration)
– density of solvent in g/mL (only for mass fraction)

It is assumed that the Dosino with dosing unit is mounted on a **solvent bottle**.

Dosing procedure

The necessary weight of the original substance is calculated when the <START> key of the Liquino is pressed and shown as a suggestion. The effective sample weight can then be accepted automatically by the balance or entered manually. The volume to be dosed is calculated from the effective sample weight and displayed. Dosing is carried out after confirmation with <ENTER>.

Note

If the effective weight of the original substance does not correspond to the amount calculated by the Liquino then the final volume will not correspond exactly to the target volume.

4.6.2 Standard solutions / Dilutions

The CONT mode of the 711 Liquino is extremely suitable for preparing standard solutions, particularly series of dilutions. When the concentration of the standard solution and the target volume have been defined then the Liquino automatically calculates the volume of the standard solution to be dosed in for the different target concentrations of a dilution series.

There is the possibility of documenting the preparation of a standard solution or a dilution series with the printout of a result report.

The dosing procedure **'Volume fraction'** is used for the preparation of dilutions and supports the following quantities or mass units:

mol/L, ppm, g/L, %

It is assumed that dosing is carried out into volumetric flasks and that the Dosino with dosing unit is mounted on the **standard solution** bottle.

The necessary information can be stored as a method. These are:

- mass unit of target concentration
- target volume in mL
- content of standard solution

Dosing procedure

After the <START> key is pressed the Liquino requests the target content of the standard solution. The volume to be dosed in is calculated from this target content and displayed. After confirmation of the volume to be dosed in with <ENTER> dosing is started. When dosing has been completed <START> can be pressed again and the target content of the next standard solution can be entered. In this way a dilution series can be prepared comfortably.

Note

The volumetric flasks with the standard solutions can of course also be filled up to the mark by the Liquino. This is done by using the manual functions 'DOSING' and 'DISPENSE'. The 'DOSING' function with increasing dosing rate (see page 24ff) is extremely suitable for drop-by-drop dosing which is required when filling a volumetric flask up to the mark.

4.6.3 CONT mode parameters

PARAM B

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

Main menu:

parameters >CONT parameter
parameters >CONT dosing units
parameters >CONT rates
parameters >CONT preselections
parameters >CONT reports

Open submenu with <ENTER>

Use <↓> or <↑> to move down or up from one menu point to the next

Use <HOME> or <END> to jump to first or last menu point

Return to basic condition with <QUIT>

Submenus:

parameters >CONT parameter	**Dosing parameter settings** Navigate with <ENTER>

>CONT parameter type: subst.conc	Select the dosing procedure

subst.conc. = solutions in mol/L
mass conc.. = solutions in g/L
mass fraction = solutions in %
volume fraction = dilutions in mol/L, ppm, g/L, %

>CONT parameter target content 1.0 Mol/L	Target concentration

0.001…9999.9
The unit depends on the 'type',
see above.

>CONT parameter target volume 10.0 mL	Target volume

0.01…9999
.

>CONT parameter factor 1.0	Correction factor

0.0000001…999999.0
not for 'volume fraction'.

>CONT parameter molar mass 1.0 g/Mol	Molar mass of the substance

0.0001…999999
only for 'subst.conc'.

>CONT parameter density 1.0 g/mL	Density of solvent

0.1…99.9999
only for 'mass fraction'.

>CONT parameter meas. unit Mol/L	Mass unit of target content

mol/L, ppm, g/L, %
only for 'volume fraction'.

| `>CONT parameter`
`content std.        1.0` | Content of standard solution |

0.01…9999.9
only for 'volume fraction'.

| `parameters`
`>CONT dosing units` | **Dosing unit settings**
Navigate with <ENTER> |

| `>CONT dosing units`
`dosing drive:    DOS1` | Dosing connection |

DOS1, DOS2, DOS3, DOS4

| `>CONT dosing units`
`dos.unit:      default` | Name of dosing unit used |

Selection list   see configuration '**>dosing units**'

| `parameters`
`>CONT rates` | **Setting the dosing rate and filling rate**
Navigate with <ENTER> |

Maximum values for dosing and filling rates

Cylinder vol.	Max. rate
2 mL	6.66 mL/min
5 mL	16.66 mL/min
10 mL	33.33 mL/min
20 mL	66.66 mL/min
50 mL	166.66 mL/min

These are pure piston stroke rates, filling times are not taken into account.

| `>CONT rates`
`feed rate    5.0 mL/min` | Dosing rate |

0.001…166.66,
max.   = highest possible dosing speed (depends on type of dosing unit.)

| `>CONT rates`
`fill rate    max mL/min` | Filling rate of dosing unit |

0.001…166.66,
max   = highest possible filling speed (depends on type of dosing unit.)

| `parameters`
`>CONT preselections` | **Definition of requests at start of dosing**
Navigate with <ENTER> |

| `>CONT preselections`
`req.ident:        off` | Automatic request for up to 3 identification texts |

id1,   = only ID1 is requested
id1&2,   = ID1 and ID2 are requested
all,   = ID1, ID2 and ID3 are requested
off   = no request

Use the identification texts (ID1…3) for identifying your sample or your test. The IDs will be printed out in the report of the dosing procedure so that the individual reports are identified unambiguously.

| `>CONT preselections`
`req.weight:        on` | Request for sample weight |

on, off
not for 'volume fraction'

| `>CONT preselections`
`req.target cont.:    on` | Request for target content |

>CONT preselections **>>CONT prompts**	**Submenu for definition of the request texts**

>>CONT prompts **id1** **Id1** *14 ASCII characters*	Display text for requesting the first ID

>>CONT prompts **id2** **Id2** *14 ASCII characters*	Display text for requesting the second ID

>>CONT prompts **id3** **Id3** *14 ASCII characters*	Display text for requesting the third ID

parameters **>CONT reports**	**Report definitions for result output** Navigate with <ENTER>

>CONT reports **no. 1** **report:** **off**	Selection of one or more reports to be printed out when the process is completed.

             off = no report
     result, = list of relevant results.
  parameter, = list of all method parameters
          ff = FORM FEED; triggers page feed at printer
                (important for laser and inkjet printers, for
                ejecting pages)

>CONT reports **no. 2** **report:** **off** *…*	… up to three reports are possible

Examples of various reports are shown on the following page.

4.6.4 Example of a report - CONT mode

Preparation of solutions and dilutions

Parameter Report (molar fraction concentration as example.)

```
711 Liquino           0220      711.0011
date 1998-10-02    time  09:26
*** Dev. Dept.
*** dm
*** Metrohm Ltd
mode: CONT         user method: Sol-Mol2
reagent                  NaNO2
parameters
>CONT Parameter
  type:             subst.conc
  target content         0.1 Mol/L
  target volume          20.0 mL
  factor                 1.0
  molar mass             69.0 g/Mol
>CONT dosing unit
  dosing drive:          DOS1
  dos.unit:          default
>CONT rates
  feed rate              max mL/min
  fill rate              max mL/min
>CONT preselections
  req.ident:             id1
  req. weight:            on
  >>CONT prompts
  id1               reagent
  id2                    Id2
  id3                    Id3
>CONT reports
  report1:           result
  report2:               off
  report3:               off
          ------------
```

← instrument number and program version
← date and time
← 3-line report header

← mode and method name
← ID1, identification with preselected display text

← dosing parameters

← dosing unit settings

← dosing and filling rate settings

← request settings

← report definitions

← identification of reproduced reports

Result Report (molar fraction concentration as example.)

```
711 Liquino           0220      711.0011
date 1998-10-02    time  09:26
*** Dev. Dept.
*** dm
*** Metrohm Ltd
mode: CONT         user method: Sol-Mol2
reagent                  NaNO2
subst.conc            0.100  Mol/L
factor                1.000000
molar mass            69.0000 g
weight                0.12640 g
volume dispensed      18.319 mL
          ============
```

← see above

← targets

← sample weight
← effectively dosed-in volume
← identification for original report

Result Report (volume fraction as example)

```
711 Liquino           0220      711.0011
date 1998-10-02    time  09:31
*** Dev. Dept.
*** dm
*** Metrohm Ltd
mode: CONT         user method:  Std-ppm
standard              chloride
volume fraction       25.000 ppm
target volume        100.000 ppm
volume dispensed       5.000 mL
          ============
```

← see above

← targets

← target content
← effectively dosed-in volume
← identification for original report

4.7 PIP mode - precise pipetting and diluting

The PIP mode of the 711 Liquino supports precise and comfortable pipetting with the aid of a Dosino 700. In contrast to conventional dosing, in this case the liquid to be pipetted is not aspirated into the dosing cylinder of the Dosino, but only into the attached pipet tubing. In this way the liquid can be aspirated rapidly and quickly and immediately discharged again. In order to do this it is necessary to fill the dosing cylinder and tubing with a 'hydraulic liquid'. A Dosino and dosing unit are mounted on a bottle containing the same solvent as the solution to be pipetted.

Note
- Volumes from 50 μL to 10 mL can be pipetted.
- 50 mL dosing units cannot be used.
- The pipetted sample can be diluted with solvent in the same working step.
- A separating bubble prevents mixing with the solvent.
- The sample to be pipetted must not be aspirated into the dosing cylinder.
- For samples in organic solvents the full accuracy is only guaranteed if pipetting is followed by rinsing.
- Sample and target vessels (liquid levels) should have the same approximate height to prevent hydrostatic effects from negatively influencing the pipetting accuracy.
- It is absolutely necessary that the dosing unit is correctly prepared with the PREP function before pipetting is carried out, i.e. tubing and dosing cylinder are completely filled.
- The pipetting tip should be held at an angle of about 45° to the vessel wall during pipetting - exactly the same position as is used with glass pipets.

Pipetting equipment
With the aid of the optional pipetting equipment it is possible to pipet a whole series completely controlled by the start button on the pipet handle. The installation of the pipetting attachment is described on page 8 of this 'Instructions for use'.

Connection to dosing port 1 of Dosino 700

Connection cable to Liquino 711 (remote connection)

6.1562.050 Pipetting tubing

6.1562.040 Pipet handle

Black start button

Green pilot lamp

Pipet tip

Screw nipple
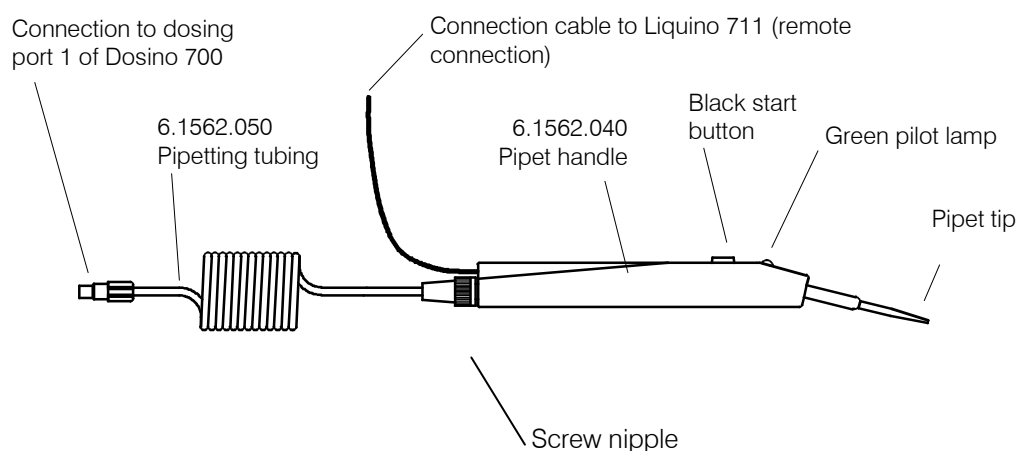
Dosing units

If you only want to pipet without any dilutions then select a 2 mL or 5 mL dosing unit. For dilutions a 10 mL or 20 mL dosing unit is recommended.

Parameters

The settings (pipetting volume, diluting volume, etc.) can be entered in the parameter menu (<PARAM> key) and stored as a method.

The **port allocation** of the Dosino in the PIP mode is defined as follows:
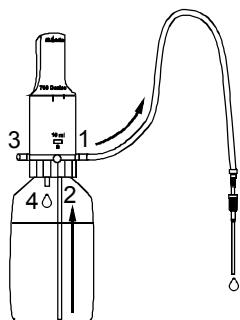
Port allocation

Port 1   Dosing port
Port 2   Filling port (with dipper tube)
Port 3   empty
Port 4   Waste (for PREP function)

The port occupancy cannot be altered via the keyboard.

Pipetting procedure (without pipet handle)

• Hold the pipet tip in a waste beaker and press the <PREP> key. The dosing cylinder and the tubing are rinsed and filled with solvent.

• Now press <START>. If you have switched on the pipetting volume request in the parameter menu under '<PIP select' you can now enter the required volume (up to 10 mL) and confirm with <ENTER>.

• The Dosino prepares for the aspiration process. The Liquino reports that it is ready to aspirate the separating bubble.

• Remove the pipet tip from the waste vessel so that air can be aspirated. Press the <ENTER> key.

• Air is now aspirated to form the separating bubble. The Liquino then reports that it is ready to aspirate the sample.

• Immerse the pipet tip in the sample solution and press <ENTER>.

• The sample is now aspirated. The sample solution and the separating bubble must now be completely contained in the pipet tubing. If sample solution is drawn into the dosing unit you must use a longer pipetting tubing.

• When the Liquino reports that it is ready to discharge the sample place the pipet tip in the target vessel and press <ENTER>.

• The sample is now discharged. If a diluting volume has been entered then the corresponding volume of solvent will also be automatically discharged. The pipetting process is then complete.

• If no diluting volume has been selected then you will be requested to carry out a rinsing procedure when the sample has been discharged. Hold the pipet tip in a waste beaker and press <ENTER>. The separating bubble will then be discharged completely. The Liquino is then ready for the next sample.

Pipetting with the pipetting equipment

In principle the procedure of pipetting with the aid of the pipet handle is the same as described above. The necessary key operations (<START> and <ENTER>) can be carried out with the start button on the handle. Ready messages from the Liquino are indicated by the green pilot lamp on the handle lighting up. Pressing the start button triggers a switching impulse via the remote cable so that the complete pipetting procedure can be controlled from the pipet handle.

- After preparing the dosing unit (with <PREP>) press the start button on the handle. The request for the pipetting volume should have been switched off previously (in the parameter menu under '<PIP selection').

- As soon as the pilot lamp lights up remove the pipet tip from the vessel in order to aspirate the separating bubble. Then press the start button on the handle.

- When the pilot lamp lights up again immerse the pipet tip in the sample and press the start button again. The sample volume is aspirated. The pilot lamp lights up again.

- The start button can now be used to discharge the sample (and any dilution volume) into the target vessel.

- If no dilution volume has been entered the pilot lamp lights up again. Discharge the separating bubble into a waste beaker by pressing the start button again.

- When the pipetting process is complete the pilot lamp no longer lights up. The next pipetting process can now be started by pressing the start button. When the pilot lamp lights up the separating bubble can be aspirated, and so on.

4.7.1 PIP mode parameters

PARAM B

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

Main menu:

parameters >PIP parameters
parameters >PIP dosing unit
parameters >PIP rates
parameters >PIP preselections
parameters >PIP reports

Open submenu with <ENTER>

Use <↓> or <↑> to move down or up from one menu point to the next

Use <HOME> or <END> to jump to first or last menu point

Return to basic condition with <QUIT>

Submenus:

parameters >PIP parameters	**Dosing parameters settings** Navigate with <ENTER>

>PIP parameters pipetting vol. 1.000 mL	Pipetting volume

0.05…10.000

>PIP parameters diluting vol. 0.0 mL	Solvent volume for dilution

0.000…99.999
.

>PIP parameters air gap 10 mm	Length of separating bubble

5…100
.

parameters >PIP dosing unit	**Dosing unit settings** Navigate with <ENTER>

>PIP dosing unit dosing drive: DOS1	Dosing connection

DOS1, DOS2, DOS3, DOS4

>PIP dosing unit dos. unit: default	Name of dosing unit used

Selection list   see configuration '**>dosing units**'

| parameters
>PIP rates | **Dosing and filling rate settings**
Navigate with <ENTER> |

Maximum values for dosing and filling rates

Cylinder vol.	Max. rate
2 mL	6.66 mL/min
5 mL	16.66 mL/min
10 mL	33.33 mL/min
20 mL	66.66 mL/min

These are pure piston stroke rates, without taking the filling times into account.

| >PIP rates
feed rate   max mL/min | Dosing rate
(should not exceed 20 mL/min.) |

0.001…166.66,
max = highest possible dosing rate (depends on type of dosing unit.)

| >PIP rates
fill rate   max mL/min | Filling rate of dosing unit
(should not exceed 20 mL/min.) |

0.001…166.66,
max = highest possible filling rate (depends on type of dosing unit.)

| parameters
>PIP preselections | **Definition of requests at start**
Navigate with <ENTER> |

| >PIP preselections
req. pip. vol.:   off | Automatic request for pipetting volume |

on, off

| parameters
>PIP reports | **Report definitions for result output**
Navigate with <ENTER> |

| >PIP reports   no. 1
report: off | Selection of one or more reports to be printed out when dosing process is completed. |

off = no report
result, = list of relevant results
parameter, = list of all method parameters
ff = FORM FEED; triggers page feed at printer (important for laser and inkjet printers, for ejecting pages)

| >PIP reports   no. 2
report: off | … up to three reports are possible |

…

An example of a report is shown on the following page.

4.7.2 Example of a report - PIP mode

Pipetting with dilution

Parameter Report

```
711 Liquino            0220     711.0011     ← instrument number and program version
date 1998-10-02     time  13:22              ← date and time
*** Dev. Dept.                               ← 3-line report header
*** dm
*** Metrohm Ltd
mode: PIP          user method: Pip05        ← mode and method name
parameters
>PIP parameters                              ← pipetting parameters
  pipetting vol.         0.5 mL
  diluting vol.          9.5 mL
  air gap               10 mm
>PIP dosing unit                             ← dosing unit settings
  dosing drive:         DOS1
  dos.unit:           default
>PIP rates                                   ← dosing and filling rate settings
  feed rate             max mL/min
  fill rate             max mL/min
>PIP preselections                           ← request settings
  req. pip. vol.:          on
>PIP reports                                 ← report definitions
  report1:            result
  report2:               off
  report3:               off
          ------------                       ← identification for reproduced report
```

Result Report

```
1998-10-02 13:24  cylinder 10mL
pip. vol. 0.500mL  dil. vol.  9.500mL
```

4.8 SMPL mode - fully automatic sampling

The SMPL mode (sampling) of the 711 Liquino is used for automated sampling and transfer of the sample to a measuring or titration cell.

Sample

Measuring cell

Solvent

Auxiliary dosing drive

Waste
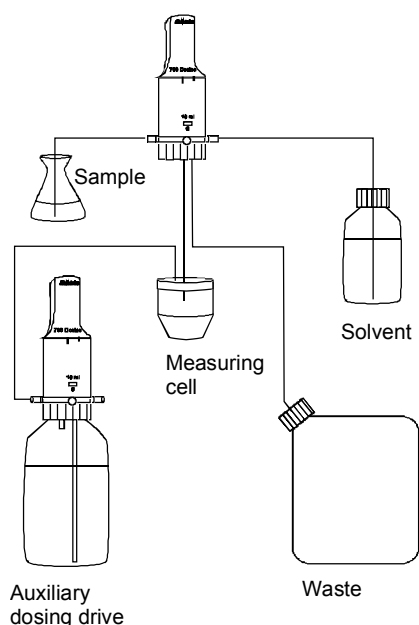
The Liquino with SMPL mode represents a sensible addition to all titrating instruments (e.g. the Metrohm Titrino family). It makes automatic functions available which are otherwise reserved for sample changers or computer-controlled analytical systems.
The 711 Liquino does not just carry out sampling, i.e. the aspiration of the sample, but also controls the addition of solvent and auxiliary solutions, rinsing the measuring cell (also with the help of external pumps) and the synchronization of the measuring or titration instrument.

In on-line analysis sampling can take place at defined time intervals and automated analyses can be carried out.

SMPL mode procedure
The various phases of automatic sampling can be divided as follows:

- Aspirate measuring cell: the measuring cell is first emptied and its contents transferred to the waste bottle. This process can be carried out with the help of an external pump or by the sampling Dosino.

- Rinse measuring cell: measuring cell, tubing and the dosing cylinder of the Dosino 700 are rinsed with solvent. Excess solvent is discharged to the waste bottle. The measuring cell can be aspirated with an external suction pump if required.

- Rinse dosing cylinder: the dosing cylinder of the Dosino 700 is rinsed with sample solution. Excess sample solution is discharged to the waste bottle.

- Add auxiliary solutions: auxiliary solutions can be added by further Dosinos.

- Transfer sample: the sample is aspirated into the dosing cylinder and dosed into the measuring cell.

- Rinse dosing cylinder: the dosing cylinder of the Dosino 700 is rinsed with solvent. Excess solvent is discharged to the waste bottle.

- Dilute sample: solvent is aspirated and dosed into the measuring cell.

- Add auxiliary solutions: auxiliary solutions can be added by further Dosinos.

- Start determination: a start signal is transferred to an externally connected instrument via the remote interface (or RS232). The actual determination is started.

- Wait for end of determination: the Liquino waits until a completion signal is received from the external instrument via the remote interface (or RS232) to indicate that the determination is finished. The next sample can then be processed similarly.

For series of samples or multiple determinations on the same sample the number of times that the sampling cycle is to be repeated can be preset. In this way several samples can be taken and determined automatically. A delay period of any length can be inserted between the individual cycles.
It is possible to further automate the sampling procedure by using a Metrohm 730 Sample Changer.

The sampling Dosino
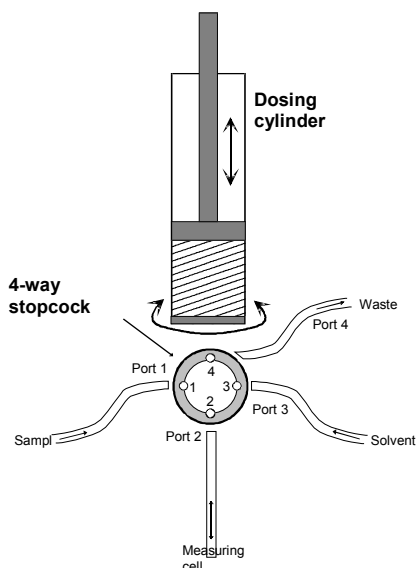
A Dosino 700 with a dosing unit (with 5, 10, 20 or 50 mL cylinder), which must be connected to the Dos1 socket of the Liquino, is used for transferring the sample to the measuring cell. In addition, it can also add solvent and can aspirate the measuring cell and rinse it if no external pumps are used.
In order to prevent carryover of sample solutions and to ensure as high a degree of accuracy and correctness of the determination results as possible, complex rinsing processes are incorporated in the SMPL mode.
In all dosing and aspiration processes carried out by a Dosino the corresponding tubing volumes are taken into account. It is therefore absolutely necessary that the definitions of the dosing units (tubing diameter and lengths, see page 68) are carried out properly and accurately and that in the parametrization of the SMPL mode the correct dosing unit is entered under 'Parameter >SMPL Dosing units'. See also pages 22 and 68.

Port allocation of the sampling Dosino:

Port:	Function:
1	Aspirate sample
2	Fill or aspirate measuring cell
3	Aspirate solvent
4	Discharge waste

PREP — preparation is important

All the Dosinos needed for the sampling mode must be prepared before the start. In the SMPL mode the port occupancy of the sampling Dosino is stipulated and does not correspond to the standard occupancy (see above diagram).

When <PREP> is pressed in the SMPL mode, any defined auxiliary dosing devices will be prepared first, i.e. the tubing and the dosing cylinder will be rinsed with solvent. Then the actual sampling Dosino will be prepared in a similar manner. In this case the PREP process also includes aspiration and rinsing of the measuring cell.

External pumps

The use of two external pumps for aspiration and rinsing the measuring cell simplifies the procedure and saves a considerable amount of time. Metrohm Diaphragm Pumps 683 can be easily connected and are optimally supported by the 711 Liquino.

Auxiliary dosing devices

Apart from the sampling Dosino (Dos1), three further Dosinos can be connected to the 711 Liquino and used to add auxiliary solutions (e.g. buffer solutions). This can occur during the sampling procedure directly before sample transfer or after diluting the sample in the measuring cell. After each addition of an auxiliary solution a fixed waiting period can be programmed. For time reactions this is absolutely necessary.

The port occupancy of the auxiliary dosing devices corresponds to the standard settings (dosing port 1, filling port 2, waste port 4). For preparing (PREP) the auxiliary dosing devices see above.

Titration and measuring instruments

Most Metrohm instruments can be used in combination with the 711 Liquino as titration or measuring instruments. The following are particularly suitable: titrators of the Titrino family and 726 Titroprocessor.

- Remote cable 6.2141.090 is needed to connect the Titrino; it is specially designed for communication between Liquino and Titrino so that no special settings are required on the instruments. If external Pumps 683 are used then multiple remote cable 6.2141.100 must be used; all the necessary peripheral units can be connected with it.
  The necessary remote lines are occupied as follows:

Liquino remote socket	Peripheral unit	Function
Input 3 (External Ready)	- Titrino (Output 3)	End of Determination EOD
Output 4 (Activate 1)	- 683 aspiration pump	Remote on/off
Output 5 (Activate 2)	- 683 rinsing pump	Remote on/off
Output 6 (External Start)	- Titrino (Input 0)	START

- If Titroprocessor 726 is connected a choice can be made between a remote connection (with standard remote cable 6.2141.020) and a serial RS232 connection (with serial cable 6.2125.110). With an RS232 connection the start command and the 'Ready' message can be freely selected. In this case the Titroprocessor 726 takes over the role of the main controller and starts the 711 Liquino.
  In the process sequence of the Titroprocessor 726 the communication commands must, however, be explicitly programmed.

Example: remote connection:

Titroprocessor 726	Liquino (under Parameter **>SMPL control I/O** **>>ext. device control**)
CTRL_RM Remote A pattern *******1	*The 711 Liquino is started.*
SCAN_RM Remote A pattern *1******	**start via:** remote
determination (e.g. **DET_PH***)*	
CTRL_RM Remote A pattern ****1***	**await acknowledge:** remote

With an RS232 connection any control sequences can be selected. See below.

Example: RS232 connection:

Titroprocessor 726	Liquino (under Parameter **>SMPL control I/O** **>>ext. device control**)
CTRL_RS1 &M;$G	*The 711 Liquino is started.*
SCAN_RS1 START *(example)*	**start via:** RS **start cmd** **START** *(example)*
determination (e.g. **DET_PH***)*	
CTRL_RS1 ready *(example)*	**await acknowledge:** RS **ack. string** ready *(example)*

Sample changer
If a Metrohm 730 Sample Changer is used the possibilities of the 711 Liquino can be extended even further. After the start of the SMPL mode a 730 Sample Changer can be started via a remote lead or a serial RS232 connection. This requires a special sample changer method which is optimized for communication with the 711 Liquino. Details for programming sample changer methods and instrument communication can be found in '730 Sample Changer, Instructions for use'.

Methods
All settings in the parameter menu can be stored as a method and reloaded when required.

4.8.1 Sampling process in detail

The SMPL mode procedure is laid down. It can be adapted to existing peripheral units.

Aspirate measuring cell

```
┌──────────────┐
│    empty     │
│   cylinder   │
└──────────────┘
        │
        │     ┌──────────────┐
        │     │    start     │         ╱│
        ├─────│ sample changer│  START >>
        │     └──────────────┘
        ▼
┌──────────────┐
│   aspirate   │
│  air bubble  │
└──────────────┘
        │
        ▼
┌──────────────┐
│   aspirate   │
│  meas. cell  │
└──────────────┘
        │
```
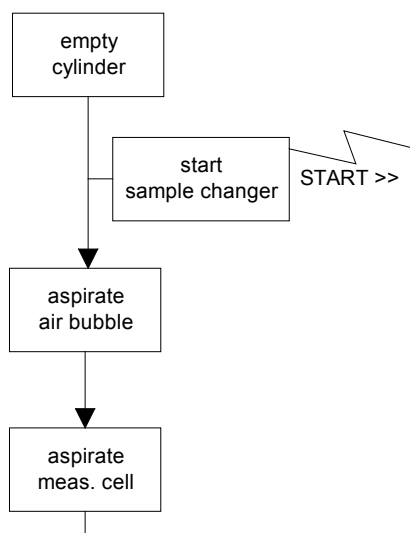
- The dosing cylinder is emptied. Its contents are discharged into the waste bottle (at port 4).

- If a sample changer is used (with 'Changer start on'), then this will receive a start signal (with a remote connection) or a start command (with an RS232 connection).

- A separating bubble is aspirated. If 'Manual sampling' is set (e.g. for individual, different determinations) then the tubing must be removed from the sample vessel and then re-immersed.

- The measuring cell is emptied. This can be carried out by the Dosino (with 'External pump off') and requires the input of the aspiration volume in mL. This can also be carried out with a pump (with 'External pump on'), e.g. a Metrohm 683 Pump. In the latter case the aspiration time must be entered (in HH:MM:SS).

Rinsing system

```
        ┌───────────────────┐
        ▼                   │
┌──────────────┐            │
│    rinse     │            │
│  meas. cell  │            │
└──────────────┘            │
        │                   │
        ▼                   │
┌──────────────┐            │
│   aspirate   │            │
│  meas. cell  │            │
└──────────────┘            │
        │                   │
        ▼                   │
      ╱────────╲            │
     ╱  repeat  ╲───────────┘
     ╲ rinsing  ╱
      ╲────────╱
        │
```
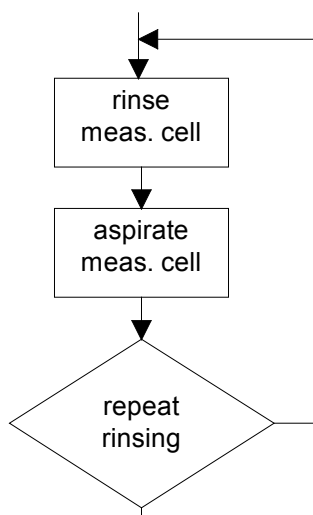
- The measuring cell is rinsed. Solvent is added. This can be carried out by the Dosino (with 'External pump off') and requires the input of the aspiration volume in mL. This can also be carried out with a pump (with 'External pump on'), e.g. a Metrohm 683 Pump . In the latter case the rinsing time must be entered (in HH:MM:SS).

- The measuring cell is again emptied, see above.

- The rinsing procedure can be repeated up to 10 times. (Recommendation: rinse twice.)

Rinse Dosino
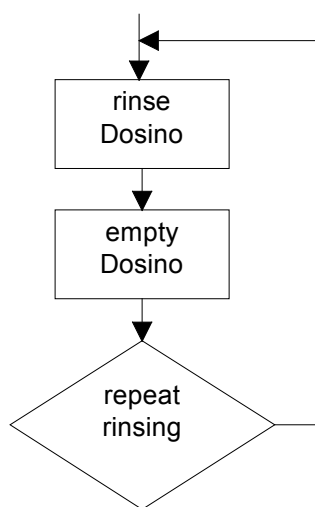
- The Dosino aspirates the sample solution. The aspirated amount is defined by the sample rinsing volume and the tubing volume at port 1.

- The dosing cylinder is emptied into the waste bottle via port 4.

- This initial rinsing can be repeated up to 10 times.

rinse Dosino → empty Dosino → repeat rinsing

Add auxiliary solution
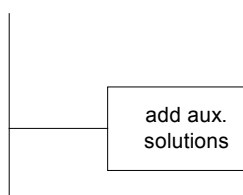
- With further Dosinos up to three different auxiliary solutions can be added, see '>SMPL Dosing units'. After the addition of each auxiliary solution a waiting period can be programmed (in HH:MM:SS). The addition of auxiliary solutions is optional. It is possible before or after sample transfer.

add aux. solutions

Transfer sample
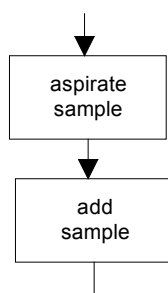
- The Dosino aspirates the sample via port 1.

- The defined sample volume is dosed into the measuring cell (via port 2).

aspirate sample → add sample

Dilute sample
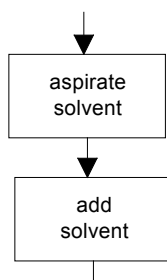
- The Dosino aspirates the solvent via port 3.

- The defined dilution volume is dosed into the measuring cell (port 2).

aspirate solvent → add solvent

Add auxiliary solution

```
        │
        │
   ┌────────────┐
   │    add     │
   │ aux. solution │
   └────────────┘
        │
        ▼
```
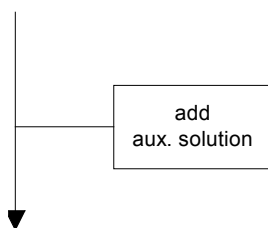
- With further Dosinos up to three different auxiliary solutions can again be added, see '>SMPL Dosing units'. After the addition of each auxiliary solution a waiting period can be programmed (in HH:MM:SS). The addition of auxiliary solutions is optional. It is possible before or after sample transfer.

Start/wait for determination

```
        │
        ▼
   ┌────────────┐
   │   start    │
   │ determination │        START >>
   └────────────┘
        │
        ▼
   ┌────────────┐
   │   await    │
   │   end of   │
   │ determination │
   └────────────┘         << Ready
```
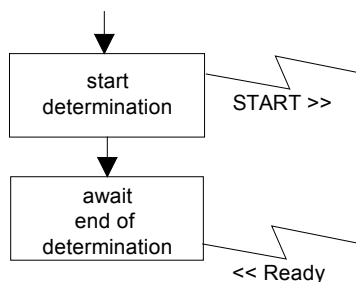
- The Liquino starts the measuring or titration instrument by a start signal via a remote lead or by any command via a serial RS232 connection. During the determination the Liquino remains in the ready condition.

- At the end of the determination the measuring or titration instrument sets a 'Ready' signal via a remote lead or sends a 'Ready' message via the RS232 interface. When this ready message is received the SMPL mode is terminated.

4.8.2 SMPL mode parameters

PARAM B

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

Main menu:

parameters >SMPL parameter
parameters >SMPL sampling operation
parameters >SMPL meas.cell rinsing
parameters >SMPL dosing units
parameters >SMPL control I/O
parameters >SMPL preselections
parameters >SMPL reports

Open submenu with <ENTER>

Use <↓> or <↑> to move down or up from one menu point to the next

Use <HOME> or <END> to jump to first or last menu point

Return to basic condition with <QUIT>

Submenus:

parameters >SMPL parameter	**Process parameter settings** Navigate with <ENTER>

>SMPL parameter sample count 1	Number of samples

1…99999,
infinite = continuous cycle, select with <CLEAR> key

>SMPL parameter sampling mode: manual	Type of sampling

manual, = sample changed by hand (with separating bubble)
auto = sampling with sample changer or series with the same sample (multiple determinations)

>SMPL parameter time interval 00:00:00	Waiting time between individual samples

HH:MM:SS

parameters >SMPL sampling operation	**Setting the sampling parameters** Navigate with <ENTER>

>SMPL sampling operation sample volume 10 mL	Sample volume

0.001…50.0

>SMPL sampling operation dilution vol. 10 mL	Solvent volume for dilution of sample

0.001…50.0

>SMPL sampling operation sample rinse vol. 10 mL	Sample volume for pre-rinsing the dosing cylinder

0.001…50.0   recommended: 20…50% of the sample volume

```
>SMPL sampling operation
sample rinse rep.        3
```
Number of times for pre-rinsing dosing cylinder

1…10 recommended: 1 pre-rinse

```
>SMPL sampling operation
aspir.rate    max mL/min
```
Aspiration rate for sample transfer

0.001…166.66,
max = highest possible aspiration rate (depends on type of dosing unit), select with <CLEAR> key

Maximum values for dosing and filling rates, etc.

Cylinder vol.	Max. rate
2 mL	6.66 mL/min
5 mL	16.66 mL/min
10 mL	33.33 mL/min
20 mL	66.66 mL/min
50 mL	166.66 mL/min

These are pure piston stroke rates. Filling times are not taken into account.

```
>SMPL sampling operation
dosing rate    max mL/min
```
Dosing rate for sample transfer

0.001…166.66,
max = highest possible dosing rate (depends on type of dosing unit), select with <CLEAR> key

```
>SMPL sampling operation
solv.fill      max mL/min
```
Filling rate for dilution of sample

0.001…166.66,
max = highest possible filling rate (depends on type of dosing unit), select with <CLEAR> key

```
>SMPL sampling operation
airgap length      10 mm
```
Length of separating bubble in aspiration tubing

1…100

```
parameters
>SMPL meas.cell rinsing
```
Settings for rinsing the measuring cell
Navigate with <ENTER>

```
>SMPL meas.cell rinsing
external pump:        off
```
External pumps for aspirating and rinsing the measuring cell

on, off

```
>SMPL meas.cell rinsing
rinsing repetitions    3
```
Number of aspiration and rinsing processes

1…10 recommended: twice

```
>SMPL meas.cell rinsing
rinse time      00:01:00
```
Rinsing time with external pump (solvent addition)

HH:MM:SS correction of input with <CLEAR>
only for 'external pump on'

```
>SMPL meas.cell rinsing
aspir. time     00:01:00
```
Length of aspiration with external pump

HH:MM:SS correction of input with <CLEAR>
only for 'external pump on'

```
>SMPL meas.cell rinsing
aspir. volume     10 mL
```
Aspiration volume of cell

0.1…500
with 'external pump off'

```
>SMPL meas.cell rinsing
aspir. rate   max mL/min
```
Aspiration rate for aspirating the cell

0.001…166.66,
max = highest possible aspiration rate (depends on type of
with 'external pump off' dosing unit), select with <CLEAR> key

| `>SMPL meas.cell rinsing`
`rinsing volume    50.0 mL` | Solvent volume for rinsing the cell |

0.1…250
with 'external pump off'

| `>SMPL meas.cell rinsing`
`rins. rate    max mL/min` | Dosing rate for rinsing the cell |

0.001…166.66,
max = highest possible dosing rate (depends on type of
with 'external pump off' dosing unit), select with <CLEAR> key

---

| `parameters`
`>SMPL dosing units` | **Settings for dosing units and auxiliary dosing devices**
Navigate with <ENTER> |

| `>SMPL dosing units`
`dos.unit 1:       default` | Name of dosing unit used |

selection list   see configuration '**>dosing units**'

| `>SMPL dosing units`
`>>aux.solut. BEFORE` | **Submenu for definition of dosing procedures before sample transfer** |

| `>>aux.solut. BEFORE  no1`
`dosing drive:       off` | Dosing connection for addition of first auxiliary solution |

DOS2, DOS3, DOS4, off

| `>>aux.solut. BEFORE  no1`
`dos.unit:        default` | Name of dosing unit used |

selection list   see configuration '**>dosing units**'

| `>>aux.solut. BEFORE  no1`
`volume         1.000 mL` | Volume of first auxiliary solution to be added |

0.0001…99999.9

| `>>aux.solut. BEFORE  no1`
`feed rate     max mL/min` | Dosing rate of auxiliary dosing device |

0.001…166.66,
max = highest possible dosing rate (depends on type of
dosing unit), select with <CLEAR> key

| `>>aux.solut. BEFORE  no1`
`fill rate     max mL/min` | Filling rate of auxiliary dosing device |

0.001…166.66,
max = highest possible filling rate (depends on type of
dosing unit), select with <CLEAR> key

| `>>aux.solut. BEFORE  no1`
`wait time      00:00:00` | Waiting time after addition of auxiliary solution |

HH:MM:SS

| `>>aux.solut. BEFORE  no2`
`dosing drive:       off` | Dosing connection for addition of second auxiliary solution |

DOS2, DOS3, DOS4, off   …

…up to 3 auxiliary dosing
devices

>SMPL dosing units **>>aux.solut. AFTER**	**Submenu for definition of dosing procedures after sample transfer**

>>aux.solut. AFTER no1 **dosing drive: off**	Dosing connection for addition of the first auxiliary solution

...up to 3 auxiliary dosing devices

See **>>aux.solut. BEFORE**

parameters **>SMPL control I/O**	**Settings for controlling external instruments** Navigate with <ENTER>

>SMPL control I/O **sample changer ctrl: off**	Use of a sample changer

on, off

with 'on' the following settings can be made:

>>sample changer control **start via: remote**	Type of connection to sample changer

Remote, = connection to parallel remote socket
RS = connection to serial RS232 interface

>>sample changer control **start cmd &M;$G**	Remote control command to start the sample changer via RS232

11 ASCII characters
only for 'start via RS'
see description of Metrohm remote control language in the
'Remote control reference'

>>sample changer control **await acknowledge: off**	Type of sample changer acknowledgment (ready message)

Remote, = acknowledgment via remote socket
RS, = acknowledgment via RS232 interface
off = no acknowledgment

>>sample changer control **ack. string ***	Sample changer acknowledgment as character string via RS232

11 ASCII characters
only for 'Start via RS'

* = any acknowledgment

see description of Metrohm remote control language in the
'Remote control reference'

>SMPL control I/O **start ext. device: off**	Start of external instrument (e.g. Titrino) to determine the sample

on,
off
with 'on' the following settings can be made:

>>ext. device control **start via: remote**	Type of connection to external instrument

remote, = connection to parallel remote socket
RS = connection to serial RS232 interface

>>ext. device control **start cmd &M;$G**	Remote control command to start the external instrument via RS232

11 ASCII characters
only for 'Start via RS'
see description of Metrohm remote control language in the
'Remote control reference'

>>ext. device control **await acknowledge: off**	Type of acknowledgment from external instrument (ready message)

Remote, = acknowledgment via remote socket
RS, = acknowledgment via RS232 interface
off = no acknowledgment

>>ext. device control **ack. string ∗**	Acknowledgment from external instrument as character string via RS232

11 ASCII characters
only for 'Start via RS'

∗ = any acknowledgment

see description of Metrohm remote control language in the
'Remote control reference'

parameters **>SMPL preselections**	**Definition of requests at start of sampling** Navigate with <ENTER>

>SMPL preselections **req. ident: off**	Automatic request for up to 3 identification texts

id1, = only ID1 is requested
id1&2, = ID1 and ID2 are requested
all, = ID1, ID2 and ID3 are requested
off = no request

>SMPL preselections **>>SMPL prompts**	**Submenu for definition of the request texts**

>>SMPL prompts **id1 Id1**	Display text for requesting the first ID

14 ASCII characters

>>SMPL prompts **id2 Id2**	Display text for requesting the second ID

14 ASCII characters

>>SMPL prompts **id3 Id3**	Display text for requesting the third ID

14 ASCII characters

Use identification texts (ID1…3) for identifying your sample or your test. The IDs will be printed out in the report of the dosing procedure so that the individual reports are identified unambiguously.

parameters **>SMPL reports**	**Report definitions for the result output** Navigate with <ENTER>

>SMPL reports no. 1 **report: off**	Selection of one or more reports to be printed out when sampling is completed.

off = no report
result, = list of relevant results.
parameter, = list of all method parameters
ff = FORM FEED; triggers paper feed at printer
(important for laser and inkjet printers for ejecting pages)

Up to three reports are possible.

4.8.3 Example of report - SMPL mode

Parameter Report

```
711 Liquino          0220     711.0011      ← instrument number and program version
date 1998-10-15     time  15:11            ← date and time
*** Dev. Dept.                             ← 3-line report header
*** dm
*** Metrohm Ltd
mode: SMPL         user method: NaOH10     ← mode and method name
sample            NaOH 10%                 ← ID1, identification with preselected display text
lot no.              25-1
parameters
>SMPL parameter
  sample count           5                 ← main parameters
  sampling mode:      auto
  time interval    00:00:00
>SMPL sampling operation
  sample volume        0.5 mL              ← settings for sample transfer
  dilution vol.       10.0 mL
  sample rinse vol.    1.0 mL
  sample rinse rep.      1
  aspir.rate        max mL/min
  dosing rate       max mL/min
  solv.fill         max mL/min
  airgap length      10 mm
>SMPL meas.cell rinsing
  external pump:        on
  rinsing repetitions    1                 ← rinsing parameters
  rinse time       00:00:10
  aspir. time      00:00:10
>SMPL dosing units
  dos.unit 1:      default
  >>aux.solut. BEFORE
  aux. solution 1                          ← settings for auxiliary solutions
    dosing drive:       off
  aux. solution 2
    dosing drive:       off
  aux. solution 3
    dosing drive:       off
  >>aux.solut. AFTER
  aux. solution 1
    dosing drive:       off
  aux. solution 2
    dosing drive:       off
  aux. solution 3
    dosing drive:       off
>SMPL control I/O
  sample changer ctrl:  off
  start ext. device:    on
  start via:        remote
  await acknowledge:  remote
>SMPL preselections
  req.ident:            off                ← settings for instrument communication
  >>SMPL prompts
   id1             sample
   id2             lot no.
   id3
>SMPL reports
  report1:          result                 ← request settings
  report2:             off
  report3:             off
           ------------
```

← report definitions

← identification for reproduced report

Result Report

```
711 Liquino            0220     711.0011        ← see above
date 1998-10-15      time  15:02
*** Dev. Dept.
*** dm
*** Metrohm Ltd
mode: SMPL          user method: NaOH10
sample               NaOH 10%
lot no.              25-1

sample no.  abs. time  rel. time
--------------------------------              ← start times for individual samplings
            14:52:08    start time
      1     14:54:17    000:02:09
      2     14:59:26    000:07:18
      3     15:04:35    000:12:27
      4     15:09:44    000:17:36
      5     15:15:53    000:23:45
            ============
```

← identification of original report

4.9 GLP mode - validation

With the 711 Liquino Dosinos or dosing units can be comfortably validated. Checking can be carried out with the GLP mode.

Validation of dosing units

With one cylinder filling of the dosing unit up to ten random volumes are dosed out and weighed accurately. Using the density of the liquid the volume of the liquid weighed out is calculated and compared with the theoretical dosed-out volumes.

For each individual dosing the absolute and the relative dosing errors are calculated. The mean value of the absolute dosing error in μL is used to assess the dosing accuracy.

The Liquino calculates the linear regression of actual volumes against theoretical volumes and determines the slope of the regression curve and the Y-axis intercept. For details see *Metrohm Application Bulletin 238, 'Dosimat Test according to GLP/ISO'*.

For the validation relevant limiting values for the absolute error, slope and the Y-axis intercept can be individually set. This is part of the configuration of the 711 Liquino. Details can be found on page 69ff of these 'Instructions for use'.
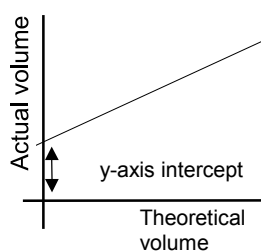
Requirements

You require the following items to carry out a validation:

- Dosing unit with dosing tubing at port 1, buret tip 6.1543.060 (without diffusion-reducing valve)

- Bottle with degassed water or other liquid of known density. The dosing unit is mounted on the bottle with the dosing drive (Dosino).

- Analytical balance with a resolution of at least 0.1 mg. If possible, connect the balance directly to the Liquino. The required connection cables are listed on page 19. However, it is also possible to enter the weight of the dosed amount of liquid directly via the Liquino keyboard.

- Printer with serial interface. The required connection cables are listed on page 17ff.
  If only a parallel Centronics interface is available on the printer then a serial/parallel converter SP 1000 (2.145.0300) can be used to make the connection.

- If printer and balance are to be connected at the same time then an adapter cable (6.2125.010) and a branch plug (6.2125.030) must be mounted on the RS232 interface.

- Narrow neck Erlenmeyer flasks

- Officially calibrated thermometer

Procedure

- Measure the temperature of the liquid to be dosed.

- Position the test setup so that it is protected from direct sunlight and drafts. The series of measurements must be carried out without any interruptions.

- Mount the buret tip on a support rod. It must not be moved during the series of measurements.
  If possible lead the buret tip into the weighing chamber directly from above

(cover top of weighing chamber). Place the Erlenmeyer flask on the weighing pan.

- It is important that the stream of liquid breaks off immediately each time on dosing. This is why it may be necessary to take special measures for some cylinder volumes:

yellow pipet tip
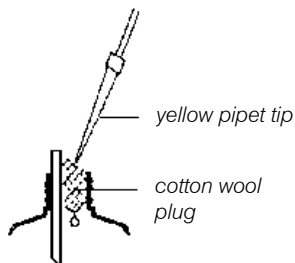
cotton wool plug

2mL: attach a yellow Eppendorf pipet tip to the buret tip. Place some cotton wool in the Erlenmeyer flask and fasten the buret tip so that it almost touches the cotton wool.
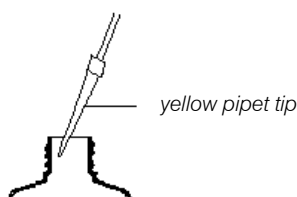
yellow pipet tip

5, 10, 20 mL: attach a yellow Eppendorf pipet tip to the buret tip. The stream of liquid should flow against the vessel wall.
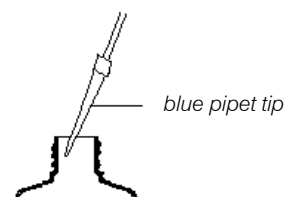
blue pipet tip

50 mL: attach a blue Eppendorf pipet tip to the buret tip. The stream of liquid should flow against the vessel wall.

- Dose a few milliliters of the liquid into the Erlenmeyer flask. Allow this to stand on the weighing pan for some time so that the air in the weighing chamber becomes saturated with the liquid vapor. This reduces evaporation of the liquid. In addition (for 2 mL cylinders) a small vessel filled with the liquid and a moistened filter paper may be placed in the weighing chamber.

- Edit the GLP mode parameters.
  In the configuration menu under '>GLP error limits' you can alter the permitted error limits for the validation results. Individual values can be selected for each type of dosing unit and cylinder size. The preset settings are recommended values, which you can accept or alter to meet your requirements.

GLP mode procedure

Tubing and dosing cylinder must be rinsed and filled bubble-free with the liquid before the actual dosing is carried out. Before starting the GLP mode it is absolutely essential that the PREP function is carried out.
After pressing the <START> key the operator name, a name for the dosing drive (Dosino 700) and an unambiguous identification text for the dosing unit to be validated can be entered. These entries will be printed out later in the validation report.
You will then be asked to tare the balance. After confirmation with the <ENTER> key the first dosing will be carried out automatically. The weight of the amount of liquid dosed in can now be accepted automatically from the balance or entered manually via the keyboard. The type of weight ac-

ceptance can be previously set in the parameter menu under '>GLP Options'.
Ten different and randomly chosen volumes will be dosed out. Enter the weight each time. At the end of the GLP mode the defined GLP report will be printed out.

In the result or detailed report the Y-axis intercept and the slope of the linear regression (theoretical volume against actual volume) and the volume error (referred to the complete cylinder volume) will be indicated.
The determined values are compared with the set limiting values by the Liquino and a corresponding commentary is produced; see example of report on page 125.

4.9.1 GLP mode parameters

PARAM B

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

Main menu:

parameters >GLP parameters	Open submenu with <ENTER>
parameters >GLP options	Use <↓> or <↑> to move down or up from one menu point to the next
parameters >GLP reports	Use <HOME> or <END> to jump to the first or last menu point

Return to normal state with <QUIT>

Submenus:

parameters >GLP parameters	**Dosing parameter settings** Navigate with <ENTER>

>GLP parameters dosing drive: DOS1	Dosing connection

DOS1, DOS2, DOS3, DOS4

>GLP parameters dos. unit: default	Name of dosing unit used

selection list   see configuration '**>dosing units**'

>GLP parameters temperature 20.00°C	Temperature of liquid

-70…200.0

parameters >GLP options	**Other settings** Navigate with <ENTER>

>GLP options liquid: water	Type of liquid

water, other

>GLP options liqu. name	Name of liquid

13 ASCII characters   Text input with <ALPHA> key
(only for 'liquid: other')

>GLP options liqu. dens. 1.0000 g/mL	Density of liquid at the measuring temperature

0.0100…20.0000
(only for 'liquid: other')

>GLP options feed rate max mL/min	Dosing rate

0.001…166.66,
max = highest possible dosing rate (depends on type
(only for 'liquid: other') of dosing unit.)

**Maximum values for
dosing and filling rates**

Cylinder vol.   Max. rate

 2 mL   6.66 mL/min
 5 mL   16.66 mL/min
10 mL   33.33 mL/min
20 mL   66.66 mL/min
50 mL   166.66 mL/min

These are pure piston
stroke rates, without taking
filling times into account.

```
>GLP options
fill rate      max mL/min
```

*0.001…166.66,
max
(only for 'liquid: other')*

Filling rate

= highest possible filling rate (depends on type
of dosing unit.)

Reduce the filling rate for liquids with
higher densities or viscosities as oth-
erwise too rapid filling may cause an
underpressure in the cylinder.

```
>GLP options
weight from      balance
```

balance, keyboard

Type of weight entry

```
>GLP options
balance-id
```

*8 ASCII characters
(only for 'weight from: balance')*

Name of balance

Text input with <ALPHA> key

```
parameters
>GLP reports
```

Report definitions for the result output
Navigate with <ENTER>

```
>GLP reports      no. 1
report:            off
```

off
result,
parameter,
curve,
detail,
ff

Selection of one or more reports which will be
printed out when the dosing procedure is
completed.

= no report
= list of relevant results.
= list of all parameters
= curve of absolute error
= detailed list of volumes and weights
= FORM FEED; triggers page feed at printer
 (important for laser and inkjet printers for
 ejecting pages)

```
>XDOS reports     no. 2
report:            off
```

… up to seven reports are possible

4.9.2 Example of report - GLP mode

Validation of dosing units

Parameter Report

```
711 Liquino           0220    711.0011        ← instrument number and program version
date 1998-10-03    time  11:32 - 11:35        ← date and time
*** Dev. Dept.                                ← 3-line report header
*** dm
*** Metrohm Ltd
mode: GLP          user method: GLP test      ← mode and method name
operator           D. Miller                  ← request texts
drive id           Dosino1
dos. unit id       Dos20_1
parameters                                     ← parameters
>GLP parameter
  dosing drive:        DOS2
  dos.unit:            default
  temperature          22.5 °C
>GLP options                                   ← options
  liquid:              water
  weight from:         balance
  balance id
>GLP reports                                   ← report definitions
  report1:             result
  report2:             parameter
  report3:             curve
  report4:             detail
  report5:             off
  report6:             off
  report7:             off

 >>err. limits 20mL-cyl.                       ← configured error limits
  error max.vol.+/-      60 µL
  slope +/-            0.003
  intercept +/-         30 µL
        ============                           ← identification for reproduced reports
```

Result Report

```
711 Liquino           0220    711.0011        ← instrument number and program version
date 1998-10-03    time  11:32 - 11:35        ← date and time
*** Dev. Dept.                                ← 3-line report header
*** dm
*** Metrohm Ltd
mode: GLP          user method: GLP test      ← mode and method name
operator           D. Miller                  ← request texts
drive id           Dosino1
dos. unit id       Dos20_1
dosing unit size   20 mL                       ← parameters
temperature        22.50 °C
liquid             water
>evaluation
  intercept (<30)      -11.2 uL      ok        ← results (with limits)
  slope (+/-0.003)     1.00076       ok
  error max. vol. (<60)-2 uL         ok
-> GLP test PASSED!                            ← result
        ============
```

Detail Report

```
711 Liquino            0220    711.0011      ← instrument number and program version
date 1998-10-03    time  11:32 - 11:35      ← date and time
*** Dev. Dept.                              ← 3-line report header
*** dm
*** Metrohm Ltd
mode: GLP          user method: GLP test    ← mode and method name
operator           D. Miller                ← request texts
drive id           Dosino1
dos.unit id        Dos20_1
dosing unit size   20 mL
temperature        22.50 °C                 ← temperature of liquid
liquid             water
liquid density     0.9977 g/mL              ← density of liquid at given temperature
air density        0.0012 g/mL              ← density of air at given temperature *
dens. std. weights 8.0000 g/mL              ← density of calibration weight *
calc. factor       1.0034033                ← correction factor for taking buoyancy of air into account
                                              when weighing in sample *

 nom.v.   mass   act.vol abs.err rel.err
  (mL)    (g)     (mL)    (uL)    (%)
----------------------------------------
  2.000   1.9900   1.9968   -3.2  -0.161     ← table of values
  3.532   3.5100   3.5219  -10.1  -0.285
  5.018   4.9900   5.0070  -11.0  -0.220
  8.764   8.7300   8.7597   -4.3  -0.049
  9.714   9.6700   9.7029  -11.1  -0.114
 11.258  11.2200  11.2582    0.2   0.002
 13.758  13.7100  13.7567   -1.3  -0.010
 16.290  16.2300  16.2852   -4.8  -0.029
 17.642  17.6000  17.6599   17.9   0.101
 20.000  19.9300  19.9978   -2.2  -0.011
----------------------------------------
>evaluation                                 ← results (with limits)
  intercept (<30)      -11.2 uL       ok
  slope (+/-0.003)      1.00076       ok
  error max.vol. (<60) -2 uL          ok
-> GLP test PASSED!                          ← result
         ============
```

* The correction factor for buoyancy of the air is automatically multiplied with the sample weight.
  The factor is calculated as follows:

Correction factor = $1 / \rho_F * (1 + \rho_L/\rho_F - \rho_F/\rho_S)$

where

ρ_F	density of liquid in g/mL
ρ_L	density of air in g/mL
ρ_S	density of balance calibration weight in g/mL

Curve
showing the absolute error

← limit value according to DIN

← limit value recommended by Metrohm,
　or self-defined limit

← effective values
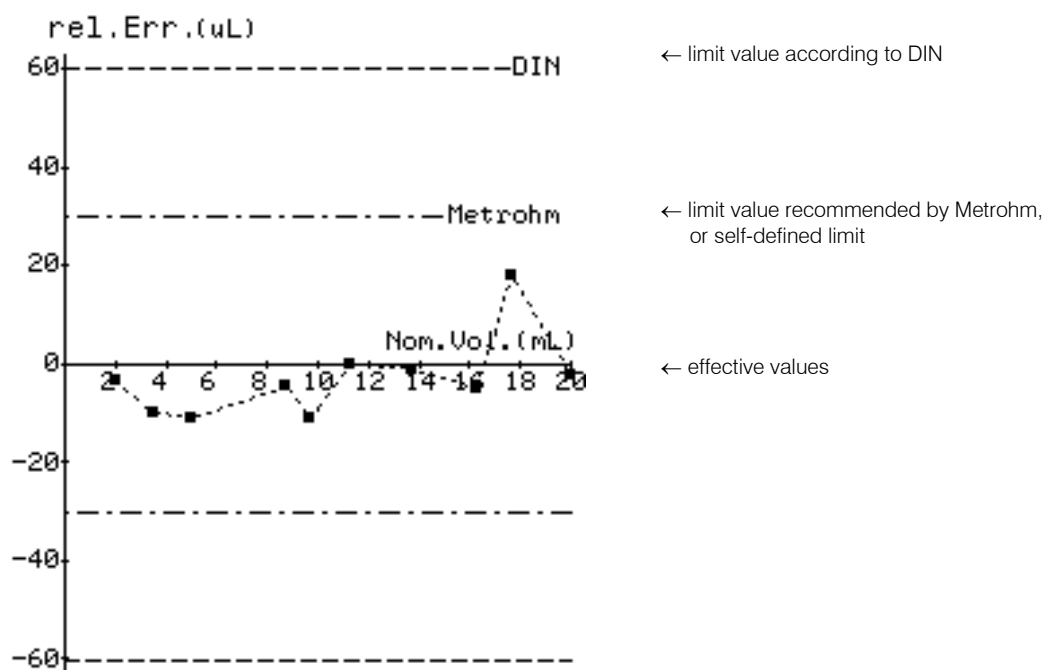
4.10 Storing and loading methods

The parameters of the different instrument modes (XDOS, PIP, CONT, SMPL, SEQ and GLP) can be optimized according to the requirements and stored as methods. Methods can either be stored in the internal memory or also on a memory card; this can be read in at any time. Storing methods on a memory card is highly recommended, as methods in the internal memory of the Liquino can be deleted relatively easily. Memory cards can be protected against overwriting or deletion.

4.10.1 Internal method memory

Methods which are stored in the internal memory remain in existence even when the instrument is switched off and can be reloaded at any time.
11 KByte of memory space is available. As methods are stored in a space-saving format (approx. 20…500 Byte) numerous methods can be stored in the Liquino itself.

The functions for loading, storing and deleting methods are accessed by pressing the <USER METHOD> key.

Main menu:

methods >recall method	Open submenu with <ENTER>
methods >store method	Use <↓> or <↑> to move down or up from one menu point to the next
methods >delete method	Use <HOME> or <END> to jump to first or last menu point
	Return to normal state with <QUIT>

Submenus:

methods >recall method	**Load method**

>recall method method: *******	Select method name with <SELECT> and <ENTER>

8 ASCII characters   Text input with <ALPHA>

methods >store method	**Store method**

>store method method: *******	Input of method name Confirm with <ENTER>

8 ASCII characters

methods >delete method	**Delete method**

>delete method method:	Delete a method Select with <SELECT>

8 ASCII characters Text input with <ALPHA>

A safety inquiry must be confirmed in order to delete a method, see below.

>delete method delete xxxxxxxx ?	Delete a method Confirm with <ENTER>

<QUIT> can be used to abort the deletion.

4.10.2 Memory card

Methods can be stored directly on a memory card. An SRAM card with a memory capacity of 128 KByte is supplied with the 711 Liquino. Please read the leaflet which accompanies each memory card supplied by Metrohm.

Memory cards must be formatted before use in the 711 Liquino. It is not possible to use cards which have been formatted in other Metrohm instruments in the 711 Liquino without reformatting, or vice versa.

In contrast to the internal method memory, various directories can be created on the memory card in which methods can be stored according to different criteria.

```
MEM CARD
   V
  0
```

The functions for loading, storing and deleting methods on a memory card are accessed by pressing the <MEM CARD> key.

Main menu:

method dir >recall method	Open submenu with <ENTER>
method dir >store method	Use <↓> or <↑> to move down or up from one menu point to the next
method dir >delete method	Use <HOME> or <END> to jump to first or last menu point
method dir >change directory	Return to normal state with <QUIT>
method dir >Neues Verzeichnis	
method dir >create directory	
method dir >backup	
method dir >reload	
method dir >format	
method dir >change battery	

Submenus:

| method dir
>recall method | **Load method from card**
The current directory on the memory card is opened. |

| >recall method
method: | Select the method name
with <SELECT> and <ENTER> |

8 ASCII characters   Text input with <ALPHA>

| method dir
>store method | **Store method**
The current directory on the memory card is opened. |

| >store method
method: ******** | Input of method name
Confirm with <ENTER> |

8 ASCII characters   Text input with <ALPHA>

<SELECT> can be used to select an existing method name and to overwrite the method.

| method dir
>delete method | **Delete method**
The current directory on the memory card is opened. |

| >delete method
method: | Delete a method
Select with <SELECT> |

8 ASCII characters   Text input with <ALPHA>

A safety inquiry must be confirmed in order to delete a method, see below.

| >delete method
delete xxxxxxxx ? | Delete a method
Confirm with <ENTER> |

<QUIT> can be used to abort the deletion.

| method dir
>change directory | **Change current directory** |

| >change directory
directory: method dir | Select a different directory
Select with <SELECT> |

10 ASCII characters   Text input with <ALPHA>

| method dir
>create directory | **Create new directory** |

| >create directory
directory: | Create new directory |

10 ASCII characters   Text input with <ALPHA>

`method dir` `>delete directory`	**Delete directory**

`>delete directory`
`directory:`
 	
10 ASCII characters
	Delete a directory
	Select with <SELECT>
	Text input with <ALPHA>
	
	The current directory cannot be deleted.

`>delete directory` `delete xxxxxxxx ?`	Confirm deletion of directory with <ENTER> <QUIT> can be used to abort the deletion.

`method dir` `>backup`	**Save complete internal method memory on the memory card**

`>backup`
`directory:`
 	
10 ASCII characters
	Enter the target directory
	Select with <SELECT>
	Text input with <ALPHA>
	
	All existing methods in the target directory will be deleted or overwritten. A backup in the standard directory of the memory card ('method dir') is not possible.

`method dir` `>reload`	**Load a complete directory of a memory card into the internal method memory**

`>reload`
`directory:`
 	
10 ASCII characters
	Input of source directory
	Select with <SELECT>
	Text input with <ALPHA>
	
	All methods in the internal method memory will be deleted or overwritten.

`method dir` `>format`	**Format a memory card**

`>format`
`card label`
 	
8 ASCII characters
	Input of card name
	
	Text input with <ALPHA>
	
	Select different meaningful and unambiguous names for different cards.

`>format`
`format :           no`
 	
yes, no
	Confirm formatting of card
	Select with <SELECT>
	<QUIT> can be used to abort the deletion.
	
	When formatting a memory card all the methods stored on it will be deleted permanently!
	When a new card is formatted the battery date must be entered, see below.

`method dir` `>change battery`	**Enter date of next battery change for the card**

`method dir` `date        2001-04-02`	Date of next battery change

YYYY-MM-DD   Note the shelf life of the card battery, see below.

Card battery
The card is a battery-buffered storage medium. The battery must be changed periodically so that no loss of data occurs. Please note the battery shelf life which is given on the leaflet accompanying the card.
When the card is inserted in the Liquino a warning is given when the instrument is switched on or when card functions are called up if either the battery potential is too low or if the date for changing the battery has elapsed.
The battery is located in a compartment at the front of the card. Please read the accompanying leaflet when changing the battery. Leave the card inserted in the Liquino when the battery is being changed so that the power supply is guaranteed.

Important: information about the shelf life of the battery refers to a storage temperature of 25 °C. At higher storage temperatures the shelf life is shorter.

Therefore **do not**
- carry the card on your body
- store it near a heating source
- expose it to direct sunlight.

Write protection
The write protection of the memory card prevents all functions which write on the card (store methods, delete methods, change directory, create directory, delete directory, backup, format card, alter battery change date). Reading functions are possible.
The write protection is switched on when the slide at the front edge of the card is in the right-hand position.

5 The 711 Liquino in synthesis laboratories

The modes which are most interesting for the use of 711 Liquino in synthesis laboratories are the XDOS and SEQ modes.
If necessary the other modes (PIP, CONT, SMPL, GLP) can be hidden in the operator dialog of the Liquino. This can be done in the setup menu. Proceed as follows:

- Switch the instrument off.
- Press the <CONFIG> key and keep it pressed down.
- Switch the Liquino on again.
- You can now see the first entry in the setup menu '**>keyboard options**'.
- Press the cursor key <↓> twice.
- You can now see the first entry in this submenu
  '**hide XDOS: no**'.
- Now press the cursor key <↓> and use the <SELECT> key to select 'yes' if you want to hide the corresponding mode which is displayed. Confirm your entry with <ENTER>.
- When the last entry in this submenu '**hide GLP**' has been confirmed with the <ENTER> key the Liquino switches automatically to the basic condition. In order to exit from this dialog you can also press the <QUIT> key twice.

5.1 The advantages of the 711 Liquino

Flexible dosing
Wherever the reaction control is carried out via the reaction time or the amount of reagent the Liquino is predestined for dosing in the reagents. The XDOS mode (Extended Dosing) allows a reagent to be dosed in under control. The exact observance of the reaction conditions with temperature control and freely selectable dosing speed is completely guaranteed. Different set parameters can be selected (see also page 74):

- ♦ Dosing a set volume within a given period ⇒ **XDOS-Type: Volume&Time**
  The dosing speed is determined automatically.
  Interruption-free dosing is possible with two Dosinos in 'tandem' operation, see page 74ff.

- ♦ Dosing a set volume at a defined dosing speed ⇒ **XDOS-Type: Volume&Rate**
  The dosing period can be protocolled in the result report.
  Interruption-free dosing is possible with two Dosinos in 'tandem' operation, see page 74ff.

- ♦ Dosing during a set period at a given dosing speed ⇒ **XDOS-Type: Time&Rate**
  The dosed-in volume can be protocolled in the result report.
  Interruption-free dosing is possible with two Dosinos in 'tandem' operation, see page 74ff.

- ♦ With **temperature control** (lower limit and/or upper limit) during dosing the reaction can be deliberately controlled by interrupting the dosing process. If one of the temperature limits is infringed a particular action can be programmed, e.g. interruption of the dosing

process until the temperature is again within the limits, interruption of the dosing process until it is continued manually (HOLD) or terminating the dosing process. A signal to an external instrument can also be sent by activating alarm pins at the remote interface. With the help of a relay box, e.g. Metrohm Relay Box 731, it is possible to switch various auxiliary instruments, e.g. cooling baths, heating baths, etc.

♦ Handling small and even very small amounts of reagent is possible without any problems. Different dosing units with cylinder volumes from 2 mL to 50 mL are available. Continuous and controlled reagent addition is guaranteed by all dosing units.

Safety aspects

By replacing dropping funnels by a single 711 Liquino, to which up to four dosing drives can be connected, it is possible to automate an experiment and in this way to work in a closed system. This means:

♦ No protective measures need to be taken against aggressive vapors. This also applies to the preparation of the reagents. Previous weighing out or measuring in the amounts of reagents required is no longer necessary. Thanks to a range of different bottle adapters/screw threads it is possible to take reagents directly from standard reagent bottles and original chemical storage containers.

♦ Direct contact with chemicals is no longer required. The 'PREP' and 'EMPTY' Liquino functions ensure that the dosing units are filled and emptied automatically.

♦ External influences such as atmospheric humidity can be ruled out in a closed system. This considerably increases the reproducibility of the experiments.

♦ While the dosing drives with the reagents can stand directly beside the experimental apparatus, the 711 Liquino and therefore the electronics can be positioned outside the fume cupboard. This allows the experimental setup to be operated with the fume cupboard window closed; it also increases the working life of the 711 Liquino in rough surroundings.

Programmable runs

Handling procedures can be programmed step-by-step as run sequences. An experiment can be completely automated. This means that potential dangers can be reduced and also increases the reproducibility.

♦ Individual dosing steps can be stored as separate methods and programmed in a run sequence as required.

♦ Time-related commands can be inserted in the run in addition to the dosing steps, see page 91. The inclusion of waiting periods (when waiting for reaction times to elapse), start delays or starting runs (also single part steps) according to time can be made without any problems. This allows the time required for a reaction to be carried out to be calculated exactly.

♦ Additional communication commands (see page 85ff) can control other instruments. Bidirectional communication with other instruments is possible via the serial RS232 interface or parallel remote leads (25-pin SubD connection, TTL-level).

If 'intelligent' thermostats with a suitable interface and the necessary functions are used it is possible to increase the degree of automation even further.

♦ Storage of the run sequences or dosing steps on the memory card allows the same experimental procedure to be carried out repeatedly and reproducibly, if necessary with slightly altered parameters, and without any further programming being required. Once a basic sequence has been programmed it can be easily altered and stored under a new name for use in further applications. Backup and restore of the complete method memory on a memory card is also possible.
Run sequences can be protocolled on a printer.

♦ Runs can be interrupted and restarted with the <HOLD/CONTINUE> key.

♦ Complete control and programming with the help of a PC is possible via the RS232 interface with suitable software.

♦ Protocolling the temperature/dosing sequence as a temperature or volume table or combined list is possible on a printer with a serial connection. Special events during the run sequence, e.g. dosing interruptions when a temperature limit is infringed, are also protocolled. A combined run curve (temperature/volume against time) can be shown for each dosing step.

5.2 Please note ...

If aggressive chemicals are used then care must be taken that the resistance of the materials coming into contact with them is adequate.

• The dosing units for the Dosino 700 are available with glass or plastic cylinders, see accessories on page 167ff. Wherever possible use dosing units with a glass cylinder. However, these are **not** suitable for:

 – strong alkalis
 – hydrofluoric acid HF

The plastic cylinders of the dosing units are made of **ETFE** (ethylenetetrafluoroethylene copolymer) and are **not** suitable for:

 – oleum
 – perchloroethylene
 – tetrachloroethane
 – tetrachloroethylene

ETFE cylinders have a **limited** resistance to:

diethylether, aminobenzene, aniline, bromine, bromomethane, dilute carboxylic acid, chloroethylene, chloroform, dichloromethane, diethylketone, diisobutylketone, dimethylformamide, crude oil products, vinyl acetate, ethylbenzene, fluorine, hydrazine hydrate, isovalerone, kerosine, methacrylate ester, methoxybutanone, methyl butyl ketone, methylene chloride, methyl isobutyl ketone, methyl methacrylate, methyloxirane, methylpentanone, oxolan, pentanone-3, perchloric acid, phenylamine, picric acid, propylene oxide, pyridine, tetrahydrofuran, tetramethylene oxide, tri-

chloromethane, trinitrophenol-2,3,6, vinyl acetate, vinyl chloride, vinyli-
dene chloride

Never dose **hot** (>60°C) chemicals or solutions with Dosinos!

- Metrohm offers tubing made of **FEP** (tetrafluoroethylene-
  hexafluoropropylene copolymer) and **PTFE** (polytetrafluoroethylene).
  These materials are largely resistant to organic solvents, strong acids
  and alkalis.

  FEP tubing is **not** suitable for:

  – perchloric acid
  – fluorine

  FEP tubing has a **limited** resistance to:

  – chlorosulfonic acid

  FEP tubing has a **limited** resistance at higher temperatures to:

  – crude oil products
  – perchloroethylene
  – tetrachloroethylene

  PTFE tubing has a **limited** resistance to:

  – halogenated hydrocarbons
  – perchloric acid
  – fluorine

  PTFE tubing has a **limited** resistance at higher temperatures to:

  – crude oil products
  – perchloroethylene
  – tetrachloroethylene

- Unoccupied dosing unit connections (Ports) can be sealed with
  drying tubes or stoppers.

- Divide your synthesis run into part steps and create separate XDOS
  methods for the individual dosing steps. Then you can link together the
  individual part steps (methods) to form a sequence (SEQ mode) and
  add further commands to it.

Two useful and simple methods for auxiliary tasks which are often repeated:

Pumping a chemical back from the dosing cylinder into the storage vessel (excerpt from the method):

```
mode: XDOS        user method: BACK1          ← One method for each connected Dosino
parameters
>XDOS parameter
  XDOS type:        volume&rate
  volume              10.0 mL
  feed rate          max mL/min               ← Total volume of the
  temp. measuring:     off                       dosing cylinder
  fill rate          max mL/min
  auto fill:           off
>XDOS dosing units                            ← No refilling
  set up:            single
  dosing drive:       DOS1
  dos.unit:         default
  port use.:        custom                    ← Dosing unit address
  dosing port           2
  filling port          4
  waste port            2                     ← Important! Special port allocations. In this case the rea-
                                                gent is dosed into the storage vessel.
                                                If required air will be aspirated from the storage vessel.
```
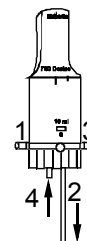
Rinsing the dosing unit with an inert solvent without disassembling the dosing unit. Connect the solvent to Port 3 with the tubing (excerpt from the method):

```
mode: XDOS        user method: RINSE1         ← One method for each connected Dosino
parameters
>XDOS parameter
  XDOS type:        volume&rate
  volume              20.0 mL                 ← Enter 2 to 3 times the cylinder volume
  feed rate          max mL/min
  temp. measuring:     off
  fill rate          max mL/min
  auto fill:           off
>XDOS dosing units                            ← No refilling
  set up:            single
  dosing drive:       DOS1
  dos.unit:          RINSE                    ← Dosing unit address
  port use:         custom                    ← Special dosing unit defined, s. below
  dosing port           1
  filling port          3
  waste port            1                     ← Important! Special Port allocations.
                                                Dosing via Port1, but aspirate solvent via Port 1.
```
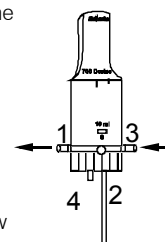
After the above rinsing method has been carried out, press <EXCHANGE> in order to prepare the dosing unit for disassembly. The dosing cylinder remains filled with solvent. If this is not required then you can empty all tubing automatically by pressing <EMPTY>. If the dip tube in the storage vessel under the Dosino is not emptied then a special dosing unit can be defined (e.g. RINSE, see above method) in which the tubing length 0 mm is given for Port 2. For configuration see following page.

```
configuration
…
>dosing units
1
   ID                   RINSE
   length tube1         400  mm
   diam  tube1          2.0  mm
   length tube2           0  mm
   diam  tube2            0  mm
   length tube3         400  mm
   diam  tube3          2.0  mm
   length tube4           0  mm
   diam  tube4            0  mm
```

6 Appendix

6.1 Dosing units and Dosinos

Four 700 Dosinos can be connected to the 711 Liquino as dosing devices. Dosinos are dosing drives which can be operated with various 710 dosing units. The dosing units form the 'buret' itself, which can be mounted directly on a reagent bottle or storage canister. For certain applications (e.g. for sampling) a dosing unit with Dosino can also be attached to a support rod (with support mounting 6.2047.010).

700 Dosino

Reagents

711 Liquino
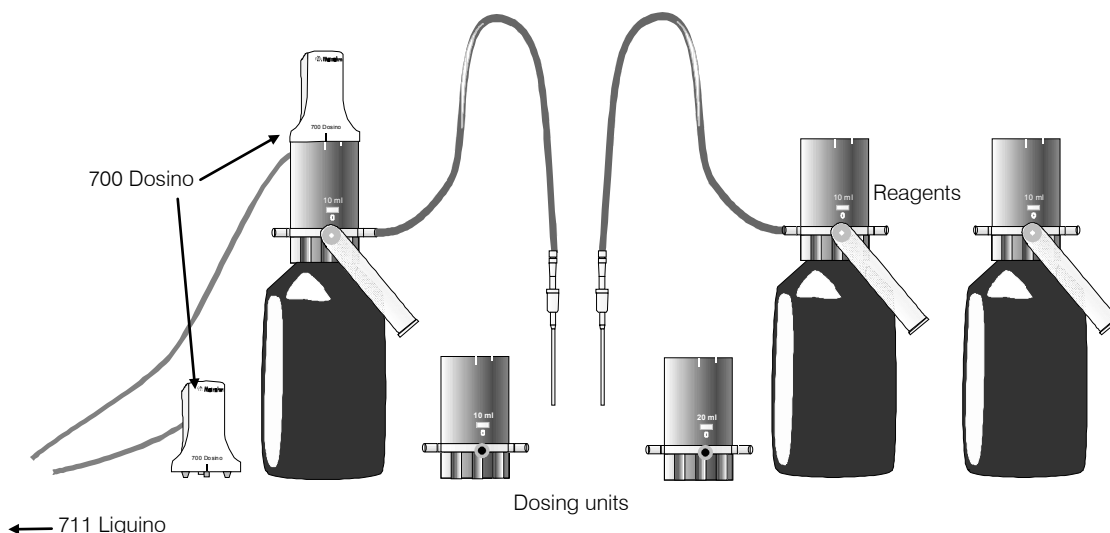
Dosing units

It is easy to change a dosing unit (and therefore also a reagent). The 700 Dosino remains attached to the Liquino.

Before changing the exchange unit the stopcock of the dosing unit must always be moved to the exchange position, as otherwise it could seriously damage itself or the dosing drive.

Before removing the dosing unit always carry out the "EXCHANGE" function; see page 63.

It is not possible to remove the Dosino if the 4-way stopcock of the dosing unit is not in the exchange position and the Liquino is switched off. Do not use force!
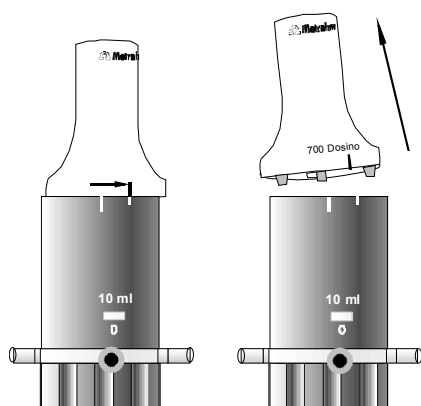
Remove dosing drive

The dosing drive mounted on the dosing unit is turned counterclockwise until it reaches the shorter of the two marking lines and then lifted off.
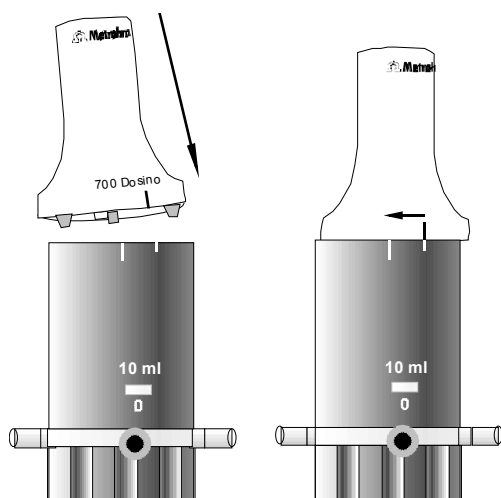
Mount dosing drive

The dosing drive can easily be attached to the next dosing unit (i.e. to the next reagent bottle). The green marking line on the Dosinos must coincide with the shorter white marking line on the, dosing unit. In this way the two ribs and the dosing spindle on the lower side of the dosing drive can be inserted in the dosing unit.

Then turn the dosing drive clockwise until the Dosino marking line coincides with the longer white marking line on the dosing unit.

Port assignment

A dosing unit has 5 ports (inlets/outlets) to which, depending on the Liquino mode, different functions can be allocated.
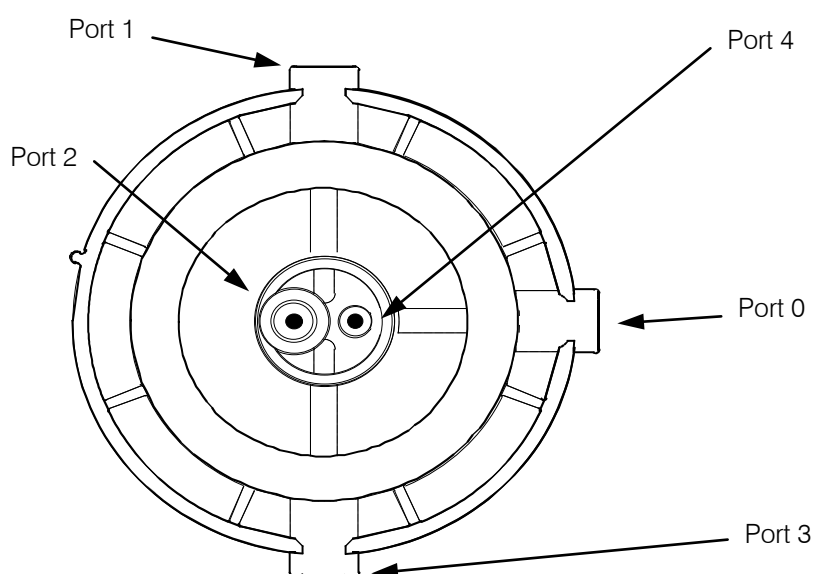
Dosing unit from below

Port 0   – is used for venting the storage vessel and is usually fitted with an absorber tube (filled with a drying agent).

Port 1   – is side-mounted and its standard definition is as the dosing outlet.

Port 2   – is located on the lower surface; its standard definition is as filling inlet and it is normally fitted with a dip tube.

Port 3   – is side-mounted and has no standard definition.

Port 4   – is located on the lower surface; its standard definition is as air inlet opening when the tubing system is being emptied.

6.1.1 Preparing and emptying the dosing units

When the reagent is changed or if the dosing unit has not been used for a long time the dosing cylinder and the dosing unit tubing must be rinsed. If allowed to stand for a long time gas bubbles may form in the dosing cylinder. This can be traced back to leaking or badly tightened tubing connections or to the release of dissolved gases from the liquid.

⚠️ **Always carry out PREP before starting!**
In order to achieve the highest possible precision during dosing it is an absolute necessity that the liquid filling the dosing cylinder and tubing system of the dosing unit is bubble-free.

In order that you do not have to carry this out manually by repeatedly filling and emptying the dosing unit the Metrohm dosing and titrating devices are equipped with the comfortable '**PREP**' function (<PREP> key). By carrying out an automated run in several steps the optimal amounts of regent solution (depending on cylinder and tubing dimensions) are aspirated; the tubing rinsed and filled bubble-free.

- If you want to work with a particular mode then select this mode (<MODE> key) and carry out the necessary settings. If you want to work with a stored method then load this method (<USER METHOD> key or <MEM CARD>). If you want to dispense or dose manually switch to manual operation with the <MANUAL> key. Depending on the selected mode the PREP function may be carried out differently. The occupancy of the Dosino ports can also be different. If a SEQ method in which several Dosinos are used is loaded then all the dosing units required are prepared one after the other.

- Hold the tip of the connected tubing in a waste beaker

- Press <PREP>.

- You can now select (except in XDOS mode) whether excess reagent solution should be emptied during the PREP run via the dosing tip (Port 1) or into the storage bottle (Port 4). This is done by pressing key <1> or <2>.

- When the dosing cylinder is empty the cylinder and all the connected tubing is rinsed and filled with reagent solution.

- If special port occupancies have been defined in the XDOS mode they will be used.

Emptying — but automatic
A comfortable function is also available for completely emptying the dosing unit when a reagent is changed: '**EMPTY**'.

In order to exchange the reagent to be dosed by the dosing unit with as little waste of reagent as possible, i.e. with a minimum exchange volume (typically $< 14\,\mu L$), the dosing cylinder and tubing can be emptied completely.
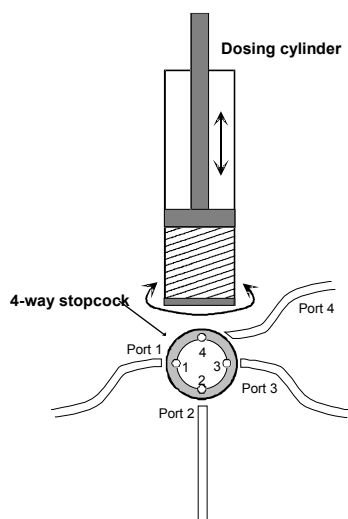
This is possible because with a Dosino and dosing unit dosing is carried out from top to bottom, i.e. the reagent is discharged downwards by the Dosino piston. Then air is drawn into the cylinder and again discharged through the tubing. This results in the whole tubing system being completely emptied.

- Hold the tip of the connected tubing in a waste beaker.

- Press <EMPTY>.

- You can now select (except in the XDOS mode) whether the excess reagent solution is to be emptied via the dosing tip (Port 1) or into the storage bottle (Port 4). This is done by pressing key <1> or <2>.

- When the dosing cylinder is empty air is drawn in via Port 4 the tubing is emptied. After this all the tubing and the dosing cylinder are filled with air.

- If special port occupancies have been defined in the XDOS mode they will be used.

In order to determine the optimal volumes for these two functions automatically the Liquino must be informed about the size of the cylinder and the volume contained in the connected tubing. The cylinder volume of the dosing unit is automatically recognized by the 711 Liquino. As different sizes of tubing can be used with the dosing unit the lengths and diameters of the tubing must be defined. In the configuration menu of the 711 Liquino (under 'Dosing units') different types of dosing unit with different tubing dimensions can be defined with their own identification (ID). The corresponding ID of the dosing unit can then be given for a method. In this way when the method has been loaded the optimal volumes for the PREP and EMPTY functions will always be used.
If the Dosino is operated manually the ID of the dosing unit can be given separately for each dosing connection. The definition can be made in the configuration menu under '>Manual operation'.

6.1.2 Defining dosing units

In the configuration menu (press <CONFIG>) under '<Dosing units' you can define up to ten types of dosing unit with different sets of tubing. Take care when allocating the IDs that you use unambiguous names. IDs D1…D10 are given as standard. These can be altered if necessary.

The tubing length and diameter are entered in mm. The total length including screw nipples must be entered for the tubing length (standard tubing length 400 mm). The diameter to be entered is the inner diameter (standard diameter 2 mm).

The tubing dimensions must be entered for all ports of the dosing unit.

Tubing 1 =   Tubing at dosing port 1
Tubing 2 =   Tubing at filling port 2 (lower surface, with thread)
Tubing 3 =   Tubing at second dosing port 3
Tubing 4 =   Tubing at waste port 4 (lower surface, without thread)

If you enter a length of 0 mm for a tubing then it will disregarded when the PREP or EMPTY function is carried out. This has already been defined as the standard setting for tubing 3 and 4.

For further information about the definition of dosing units please refer to page 22.

6.2 Error messages

`* 50mL cyl. not possible`	In the PIP mode 50 mL dosing units cannot be used. Press <QUIT> and <EXCHANGE>. Exchange the dosing unit.
`*** battery down`	The memory card battery is empty. Insert the card in the instrument and replace the battery according to the instructions given on the leaflet accompanying the memory card. Press <QUIT>. After changing the battery enter the date for the next battery change under '<MEM CARD>, '>change battery'.
	or
`*** battery down`	If no memory card is inserted and this message appears when the Liquino is switched on then the support battery in the 711 Liquino is empty. Please contact the Metrohm service department.
`*** change battery`	The date for the regular memory card battery change has been reached. Change the battery according to the instructions given on the leaflet accompanying the memory card. Leave the memory card inserted in the instrument. Press <QUIT>. After changing the battery enter the date for the next battery change under '<MEM CARD>, '>change battery'.
`*** card full`	No more free memory space is available on the memory card. Delete methods which are no longer needed or use a different card. Press <QUIT>.
`* card not accessible`	The memory card is being accessed simultaneously by the remote control and by manual operation. Press <QUIT> and try again.
`*** card read/write error`	The Liquino cannot read the memory card or cannot write on it. Check whether the memory card has been inserted correctly. The card may have been damaged by external influences. Press <QUIT>.
`*** card unformated`	Before a memory card is used for the first time it must be formatted in the Liquino. Press <QUIT> and format the card under '<MEM CARD>, >Format'.
`* card write-protected`	The memory card is write-protected. Remove the write protection (see leaflet accompanying memory card) or use a different card. Press <QUIT>.
`*** data lost`	The inserted memory card is damaged and can no longer be read. Press <QUIT> and use a different memory card.
`** dir. already exists`	A directory with the given name already exists. Select another name for the new directory. Press <QUIT>.
`DOSxx: fill first!`	The piston of Dosino xx is in an undefined position. Press <QUIT> and then <FILL>.
`DOSxx: invalid dos. port`	The multiple stopcock of Dosino xx is in an undefined position. Press <QUIT> and then <FILL> or <EXCHANGE>.
`DOSxx: not ready`	Dosino xx is not connected or no dosing unit is attached. The exchange unit may not be mounted correctly. Correct the fault and press <QUIT>.
`DOSxx: overload!`	Dosino xx is blocked. A tubing or the multiple stopcock may be blocked. Check the tubing and, if necessary, remove the dosing unit (not the Dosino!). Then press <QUIT>.

DOSxx: wrong dos. type	The connected dosing device is not a 700 Dosino. Switch off the Liquino, connect a Dosino and switch back on again.
*** invalid pip.vol.	The resolution (^{1}/10000 of the nominal volume) of the dosing cylinders does not allow the given volume to be pipetted accurately. Press <QUIT> and enter a different value.
*** invalid user method	The given method does not exist. Press <QUIT> and select a different method.
invalid tube dimensions	Check the given values for the tubing parameters (diameter and tubing length). Press <QUIT>.
*** manual Stop	A running method has been stopped manually. Press <QUIT>.
*** no memory card	There is no memory card in the Liquino or it has not been inserted correctly. The label (upper side) of the card must face right. Insert the card correctly and press <QUIT>.
*** no PT100	No temperature sensor is connected or it is faulty. Press <QUIT> and connect a Pt100 sensor or switch off the temperature measurement (under <PARAM>, >XDOS parameters).
*** not possible	It is not possible to write on the memory card as this is presumably based on flash technology which cannot be written on by the Liquino. Use an SRAM memory card. Press <QUIT>.
*** Pip.vol. too large	The entered pipetting volume is larger than 10 mL. Press <QUIT> and enter a smaller value.
*** system error #3	RAM error. Memory components are damaged. Inform the Metrohm service department.
*** same drive no.	Press <QUIT> and enter a different dosing device address.
*** T limit: stopped	A temperature limit has been reached. Dosing has been interrupted. Press <QUIT>.
*** use MANUAL	You must switch to manual operation in order to carry out the required function. Press <QUIT> and <MANUAL>.
*** user memory full	There is no space for further methods in the internal memory. Delete methods which are no longer required.
*** V limit: stopped	The volume limit has been reached. Dosing has been interrupted. Press <QUIT>.
*** wrong card	The read-in memory card has been formatted on a different Metrohm instrument. Change the card or format the memory card in the Liquino, under <MEM CARD>, >Format. Press <QUIT>.

Error messages relating to data transmission:

Note:

If neither a printer nor a computer is connected the report output must be switched off.

General form of error message:

*** RS error xx   Error during data transfer or printing. Check whether the connection cable has been attached correctly and that the RS232 parameters of the transmitting and receiving instruments are the same. See <CONFIG>, >RS232 settings

Reception errors:

*** RS error 36   Parity error
Exit: <QUIT> and set the same parameter on both instruments.

*** RS error 37   Framing error. The receiving instrument may not be ready to receive data. Exit: <QUIT> or switch Liquino off and on. Check settings of receiving instrument.

*** RS error 38   Overrun error. At least 1 character could not be read.
Exit: <QUIT>.

*** RS error 39   The internal processing buffer in the Liquino is overloaded (>128 characters). Exit: <QUIT>.

Transmission errors:

*** RS error 42   CTS=OFF. Handshake not satisfied for more than 1 s.
Exit: <QUIT>. Is the receiver switched on and ready to receive?

*** RS error 43   The Liquino transmission has been interrupted by XOFF for at least 6 s. Exit: <QUIT>.

*** RS error 45   The receive buffer of the Liquino contains an incomplete character string (L_F is missing). The Liquino transmission is therefore blocked. Exit: send L_F or <QUIT>.

Warnings

*** Dosing not continuous. Lower rate ***

You have defined a dosing rate which is too high for tandem dosing. Interruption-free dosing is not possible as a filling process (including stopcock switching) takes longer than dosing a cylinder volume. Press <HOLD> and reduce the dosing rate to 85% at the most of the maximum possible dosing rate for the dosing unit. Dosing can then be continued with <HOLD/CONTINUE>.

*** Rate to high. Adjust parameter! ***

The necessary dosing rate required to fulfill the task you have defined cannot be reached. Press <HOLD> and reduce the volume to be dosed in or extend the dosing period. Dosing can then be continued with <HOLD/CONTINUE>. If you do not correct the parameters dosing will be carried out at the highest possible dosing rate. However, the defined dosing time cannot be observed in this case.

*** Rate to low. Adjust parameter! ***

The necessary dosing rate required to fulfill the task you have defined cannot be reached. Press <HOLD> and increase the volume to be dosed in or reduce the dosing period. Dosing can then be continued with <HOLD/CONTINUE>. If you do not correct the parameters dosing will be carried out at the lowest possible dosing rate. However, the defined dosing time cannot be observed in this case.

*** Rate to low. Adjust parameter! ***

6.3 Service and maintenance

6.3.1 Service

The 711 Liquino should be serviced once per year by authorized specialists. If work is often carried out with corrosive chemicals it may be necessary to arrange for shorter service intervals.

The Metrohm service department will provide you with technical advice about the service and maintenance of all Metrohm instruments at any time.

6.3.2 Maintenance / Care

Not only highly sensitive measuring instruments but also the 711 Liquino requires adequate care. An excessively dirty instrument could be subject to functional interference and have a shorter working life. Whenever possible avoid using the 711 Liquino in a corrosive atmosphere.

Regular cleaning, above all of the Dosinos and the dosing units, can prevent possible functional interference.

Spilt chemicals and solvents should be cleaned up immediately. Great care should be taken to protect the electrical connections from contamination.

Although the penetration of corrosive liquids is to a large extent prevented by constructional measures, if aggressive media do penetrate the interior of the instrument the mains plug must be pulled out immediately to prevent extensive damage to the electronic system. In such cases please inform the Metrohm service personnel.

The instrument must not be opened by untrained personnel.

6.4 Validation / GLP

GLP (**G**ood **L**aboratory **P**ractice) requires, among other things, the regular checking of the reproducibility and accuracy of analytical instruments based on standard operating procedures, **SOP**.

We recommend that you read the Metrohm booklet "Quality management with Metrohm" if you require more detailed information about the principles and methods of Good Laboratory Practice.

- If the 711 Liquino is used as part of an analytical system (e.g. for sampling tasks) it is recommended that the instrument is included in the comprehensive validation of the complete system. If a complete system is validated as such then all the interfering influences of the individual components will be effective and also taken into account for the assessment of the complete analytical system.

- If the 711 Liquino is mainly used for dosing purposes it is recommended that the dosing units used are checked with the aid of the GLP mode of the 711 Liquino. You can set the demands placed on the dosing precision and accuracy by defining individual limiting values (y-axis intercept, slope, absolute volume error) according to your own requirements.

Checking the electronic and mechanical properties of Metrohm instruments can and should be carried out within the framework of a regular service by specialists from the manufacturing company. All Metrohm instruments are provided with start-up checking routines which check that the relevant components are functioning perfectly when the instrument is switched on. If no error message is displayed it can be assumed that the instrument is functioning properly. Metrohm also supplies its instruments with built-in diagnosis programs which, should a fault occur, permit the functioning of certain internal components to be checked and the fault to be localized. Diagnosis programs can also be integrated in a validation method.

Recommended literature
- Metrohm booklet "Quality management with Metrohm"
- Metrohm Application Bulletin 238/1 "Dosimat Test according to GLP/ISO"
- Metrohm Application Bulletin 252/1 "Validation of Metrohm Titrators according to GLP/ISO9001"

6.5 Diagnosis

6.5.1 General

The 711 Liquino is a very precise and reliable control instrument. Its functions can hardly be affected by external mechanical or electrical influences thanks to its robust construction.

Although it cannot be completely excluded that a defect could occur in the instrument, there is a greater possibility that malfunctions may be caused by incorrect operation or handling, or by incorrect connections, or by operation together with instruments from other manufacturers.

In each case it is advisable to localize the fault by diagnosis; this can be carried out rapidly and easily. The customer only needs to contact Metrohm service when a real fault is present in the instrument. In addition, the results of the specific diagnosis functions allow the customer to provide the service technician with far more accurate information.

If you have any questions always provide us with the following information: the manufacturing number on the name plate (see *page 3*), the program version (see Configuration, *page 69*) and any error message which might be displayed.

Procedure

The diagnosis menu given in *Sect. 6.5.2* shows all components for which detailed instructions (diagnosis steps) exist for checking their functions.

If a possible fault occurs we recommend that you carry out the instructions given in the relevant diagnosis step or carry out all the diagnosis steps as a routine check of the instrument.

The Liquino reactions given in the instructions should be compared with the descriptions in the diagnosis step. If the instrument does not show the expected reaction ("No" case) then the corresponding diagnosis step should be repeated in order to exclude an operating error. However, if wrong reactions occur repeatedly there is a strong possibility that a fault exists.

Required instruments:

Only necessary when RS232 or Remote are to be checked:

- Test plug 3.496.8510 (to socket '"Remote")
- Test plug 3.496.8560 (to socket "RS 232")

6.5.2 Overview

Access to the diagnosis main menu is described in section 6.5.3.

By pressing key <9> the submenus are selected in sequence. Access to the individual queries in a submenu is carried out with the <ENTER> key, exit is with the <QUIT> key.

Menu	Description	Section
diagnosis >RAM test	check working memory (RAM)	**Sect. 6.5.4**
diagnosis >display test	check display	**Sect. 6.5.5**
diagnosis >display contrast test	check display contrast	**Sect. 6.5.6**
diagnosis >key test	check keyboard	**Sect. 6.5.7**
diagnosis >remote test	check remote interface	**Sect. 6.5.8**
diagnosis >RS232 test	check RS232 interface	**Sect. 6.5.9**
diagnosis >external bus test	check external bus	**Sect. 6.5.10**
diagnosis >beeper test	check beeper	**Sect. 6.5.11**
diagnosis >memory card test	check memory card and memory card interface	**Sect. 6.5.12**
diagnosis >m card interface test	check memory card interface	**Sect. 6.5.13**
diagnosis >dosino test	check Dosino interface	**Sect. 6.5.14**
diagnosis >temperature calibration	check temperature calibration	**Sect. 6.5.15**
diagnosis >power on reset	check software reset	**Sect. 6.5.16**
1) diagnosis >instrument number	read and write instrument number	
2) diagnosis >RAM initialization	initialize data memory	**Sect. 6.6**

6.5.3 Preparing the instrument

- Switch off mains supply.
- Remove all external connection from 711 Liquino (except mains cable).
- Switch on and immediately press key <9> and keep pressed until

    ☞   diagnosis
             >RAM initialization

---
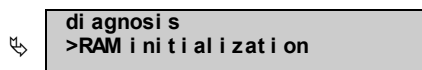
[1] This diagnosis step is reserved for the service technician and is therefore not described in this booklet.

[2] Take care: this diagnosis step can clear the complete data memory.

6.5.4 Check working memory (RAM)

This diagnosis step carries out a non-destructive test of the whole of the RAM contents (working memory).

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

  ↳
  | di agnosi s |
  | >RAM t est |

- <ENTER>

  ↳ *The test proceeds automatically. If no faults are found the display shows:*

  ↳
  | >RAM t est |
  | RAM TEST OK |

- The test is exited by pressing the <STOP> key.

  ↳
  | di agnosi s |
  | >di spl ay t est |

6.5.5 Check display

This diagnosis step allows the functioning of the LEDs and the display to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

  ↳
  | di agnosi s |
  | >di spl ay t est |

- <ENTER>

  ↳ *When the <ENTER> key is pressed the program automatically carries out a test run for an optical check of the LEDs and display.*

  a) *The LEDs **DOS 1**, **DOS 2**, **DOS 3** and **DOS 4** are switched off and on several times in sequence.*

  b) *The background lighting is switched off and on several times in sequence.*

  c) *Switch-on test pattern appears (each pixel is active).*

  d) *Both display lines are deleted.*

  e) *Both display lines are written in sequence with the characters "**#**", "**H**" and finally with "**▌**".*

  f) *Both lines are written from right to left with the endless text "**0123456789ABCDEFGHI JKLMNOPQRSTUVWXYZ**".*

- The test run can be interrupted by pressing any key (except <STOP>) and then restarted.

- The test is exited by pressing the <STOP> key twice.

  ↳
  | di agnosi s |
  | >di spl ay cont r ast t est |

6.5.6 Check display contrast
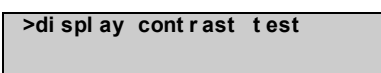
This diagnosis step allows the contrast setting variability function to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

  ↳
  ```
  diagnosis
  >display contrast test
  ```

- <ENTER>

  ↳ *After pressing the <ENTER> key the following display appears continuously with changing contrast settings for an optical check of the display.*

  ↳
  ```
  >display contrast test

  ```

- The test is exited by pressing the <STOP> key.

  ↳
  ```
  diagnosis
  >key test
  ```

6.5.7 Check keyboard

This diagnosis step allows the functioning of all the keyboard keys to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

  ↳
  ```
  diagnosis
  >key test
  ```

- <ENTER>

  ↳
  ```
  >key test

  ```

- Press all keys in sequence and observe the reaction on the display with the help of the following keyboard matrix.
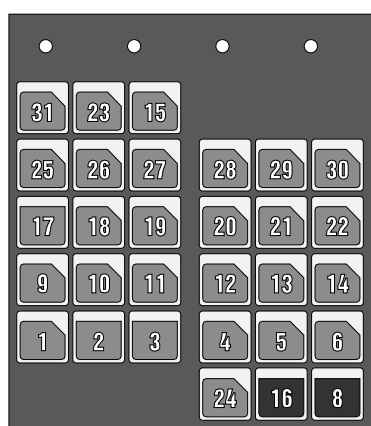
↳ *The corresponding matrix code for the pressed-down key appears in the display. The matrix code can be seen from the keyboard matrix alongside.*

↳ *For example, when the <CONFIG> key is pressed the following display must appear:*

```
>key test
KEY: 31    CONFIG
```

Fig. 1   Keyboard matrix

- The test is exited by pressing the <STOP> key twice.

  ↳
  ```
  diagnosis
  >remote test
  ```

6.5.8 Check remote interfaces

This diagnosis step allows the functioning of all outputs and inputs as well as the input filter of the remote interface to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

    ↰
    ```
    di agnosi s
    >remot e t est
    ```

- <ENTER>

    ↰
    ```
    >remot e t est
    >I O CONNECTOR ?
    ```

- Without switching the instrument off insert test plug 3.496.8510 into the "Remote" socket.

- <ENTER>

    ↰ *The test proceeds automatically. If no faults are found the display shows:*

    ↰
    ```
    >remot e t est
     I O TEST OK
    ```

- Remove test plug.

- The test is exited by pressing the <STOP> key.

    ↰
    ```
    di agnosi s
    >RS232 t est
    ```

6.5.9 Check RS232 interfaces

This diagnosis step allows the functioning of all outputs and inputs of the RS232 interface to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

    ↰
    ```
    di agnosi s
    >RS232 t est
    ```

- <ENTER>

    ↰
    ```
    >RS232 t est
     RS CONNECTOR ?
    ```

- Without switching the instrument off insert test plug 3.496.8560 into the "RS232" socket.

- <ENTER>

    ↰ *The test proceeds automatically. If no faults are found the display shows:*

    ↰
    ```
    >RS232 t est
     RS TEST OK
    ```

- Remove test plug.

- The test is exited by pressing the <STOP> key.
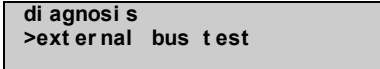
    ↰
    ```
    di agnosi s
    >ext er nal  bus t est
    ```

6.5.10 Check external bus
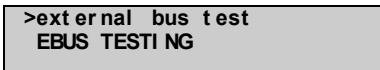
This diagnosis step allows the functioning of those parts of the hardware for controlling the Dosinos which are contained in the 711 Liquino to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until
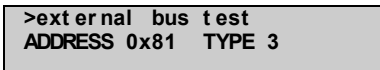
  ↳
di agnosi s
>ext er nal bus t est

- <ENTER>
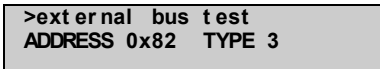
  - ↳ *When the <ENTER> key is pressed the Dosino interfaces located on the internal bus are searched for. During the test the following display appears:*

  ↳
>ext er nal bus t est
EBUS TESTI NG

  - ↳ *The test proceeds automatically. If no faults are found the display shows:*

  ↳
>ext er nal bus t est
ADDRESS 0x81   TYPE 3

- <ENTER>

  ↳
>ext er nal bus t est
ADDRESS 0x82   TYPE 3

- The test is exited by pressing the <STOP> key.

  ↳
di agnosi s
>beeper t est

6.5.11 Check beeper

This diagnosis step allows the functioning of the internal beeper to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until
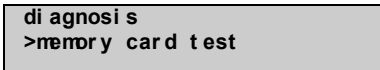
  ↳
di agnosi s
>beeper t est

- <ENTER>

  - ↳ *When the <ENTER> is pressed the internal beeper is continually switched on and off. The following display appears during the test:*

  ↳
>beeper t est

- The test is exited by pressing the <STOP> key.

  ↳
di agnosi s
>memor y car d t est

6.5.12 Check memory card

This diagnosis step allows both the functioning of the memory card interface as well as the memory card itself to be checked. The test duration depends on the size of the memory card to be tested. The test takes 2 minutes for a 128 Kbyte SRAM card.

> *Provided that the memory card remains inserted during the whole test proce-*
> *dure and that the mains switch is not operated the test is non-destructive, i.e.*
> *the memory card contents will not be altered by the test.*

> *If it is possible to assume that the memory card is functioning perfectly and*
> *that it does not explicitly need to be tested then the test described under*
> *section 5.4.13 can be carried out instead of this test. That test takes less than*
> *2 seconds and provides information about whether the memory card control*
> *contained in the 711 Liquino is functioning properly, but no information about*
> *the memory card itself.*

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).
- If necessary press key <9> several times until

  ↳ | **di agnosi s**
      >memor y car d t est |

- <ENTER>

  ↳ | **>memor y car d t est**
      I NSERT MEMORY CARD |

- Insert memory card.
- Press <ENTER>.

  ↳ *After pressing the <ENTER> key the address which is currently be-*
    ing tested appears in the display continuously in hex code.

  ↳ | **DON' T REMOVE MEMORY CARD**
      TEST RUNNI NG 0x????? | *If no memory card has been inserted then*
                                      MEMORY CARD NOT FOUND
                                      must appear in the display.

  ↳ *The test will be carried out until an address is found which no longer*
    responds. Subsequently the address of the last address to respond
    will appear in the display. Because the test does not know the size of
    the memory card the operator must check at this point whether the
    checked item is functioning properly or not by means of the BREAK
    ADDRESS.

  ↳ | **DON' T REMOVE MEMORY CARD**
      BREAK ADDRESS 0x20000 | *With an intact SRAM card with 128kB*
                                     BREAK ADDRESS 0x20000
                                     must appear in the display.

- Press <ENTER>.

  ↳ | **DON' T REMOVE MEMORY CARD**
      128K PASSED | *With an intact SRAM card with 128kB*
                         128 K PASSED
                         must appear in the display.

- The test is exited by pressing the <STOP> key.

  ↳ | **di agnosi s**
      >m car d i nt er f ace t est |

6.5.13 Check memory card interface

This diagnosis step allows the functioning of the internal memory card interface to be checked. The extent of the check depends on the size of the memory card; this is required for the check to be carried out. With a 128kB memory card the interface will only be checked to the extent of 128kB, even though the interface can address a much larger memory.

> *Provided that the memory card remains inserted during the whole test procedure and that the mains switch is not operated the test is non-destructive, i.e. the memory card contents will not be altered by the test.*

> *The memory card is not checked in this test. If it is thought that there is a fault on the memory card then the test described under section 5.4.12 should be carried out instead of this test. That test provides information about whether the memory card control contained in the 711 Liquino and the memory card itself are functioning properly.*
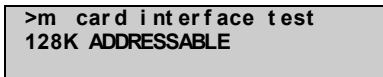
- Prepare instrument for diagnosis (see *Sect. 6.5.3*).
- If necessary press key <9> several times until

```
   di agnosi s
↳  >m card interface test
```

- <ENTER>

```
   >m card interface test
↳     INSERT MEMORY CARD
```

- Insert memory card.
- Press <ENTER>.

```
   >m card interface test
↳  128K ADDRESSABLE
```

With an SRAM card with 128kB
128K ADDRESSABLE
must appear in the display.

- The test is exited by pressing the <STOP> key.

```
   di agnosi s
↳  >dosi no test
```

6.5.14 Check Dosino interface

This diagnosis step allows the functioning of the 4 interfaces for controlling the Dosinos to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).
- If necessary press key <9> several times until

```
   di agnosi s
↳  >dosi no test
```

- Press <ENTER>.

  ↳ *After pressing the <ENTER> key the interface Dos.1 will be addressed and information about the connected Dosino shown on the display.*

>dosino test
Dos:1, INFO:0x??, CYL:??

  ↳

  If no dosing device is connected
  Dos:1, INFO:0x03, CYL: 0
  must appear in the display.

- Check the information in the second line against Table 1 or Table 2.

- Press <ENTER>.

  ↳ *After pressing the <ENTER> key the interface Dos.2 will be addressed and information about the connected Dosino shown on the display.*

- In the same way as for Dos.1 the interfaces Dos.2, Dos.3 and Dos.4 can now be checked in sequence.

Dosing device	Information
700 Dosino with	INFO: 0xBB, CYL: 0
700 Dosino with 2 mL	INFO: 0xB3, CYL: 2
700 Dosino with 5 mL	INFO: 0xAB, CYL: 5
700 Dosino with 10 mL	INFO: 0xA3, CYL: 10
700 Dosino with 20 mL	INFO: 0x9B, CYL: 20
700 Dosino with 50 mL	INFO: 0x93, CYL: 50

Code if a 700 Dosino is connected

- The test is exited by pressing the <STOP> key.

  ↳

diagnosis
>temperature calibration

6.5.15 Check temperature calibration

This diagnosis step allows the functioning of the interface for recording the temperature to be checked.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

  ↳

diagnosis
>temperature calibration

- <ENTER>

  ↳ *After pressing the <ENTER> key the temperature sensor will be addressed and shown on the display.*

  ↳

>temperature calibration
OVERRANGE,   CHECK SENSOR

- Insert temperature sensor into "Pt100" socket.

  ↳

>temperature calibration
TEMP. CELSIUS   ??.?

- Check whether the displayed value coincides with the actual temperature.

- The test is exited by pressing the <STOP> key.

  ↳

diagnosis
>power on reset

6.5.16 Check software reset

This diagnosis step allows a warm start (software-controlled instrument switch-off followed by switch-on) to be carried out.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

  ☞
  ```
  di agnosi s
  >power  on  r eset
  ```

- <ENTER>

  ☞ *After pressing the <ENTER> key the diagnosis menu is exited and a power-on reset is carried out.*

End of diagnosis

6.6 Initialize data memory

This diagnosis step allows standard values for the instrument parameters to be written via the keyboard and thus the instrument to be returned to its original condition. This measure is important for the following two reasons:

Setting certain instrument parameters is only possible via the RS232, i.e. with the aid of a PC. If such instrument parameters have been set and no PC is available to reset the parameters then it will not be possible to use the instrument to its full extent.

In seldom cases the contents of the data memory may be affected by large interfering signals such as mains spikes, lightning strikes, etc. If the contents of the data memory are undefined then this can lead to a system crash.

RAM initialization should only be carried out when necessary as this deletes the stored operator data.

The 711 Liquino offers various possibilities for initializing the data memory. The whole data memory (**all**) or only parts of it (**param, config, user meth, setup, assembly**) can be provided with standard values.

- Prepare instrument for diagnosis (see *Sect. 6.5.3*).

- If necessary press key <9> several times until

> **diagnosis**
> **>RAM initialization**

- Press <ENTER> key to open following diagnosis menu:

```
>RAM initialization
select:          all
```
```
>RAM initialization
select:          param
```
```
>RAM initialization
select:          config
```
```
>RAM initialization
select:          user meth
```
```
>RAM initialization
select:          setup
```
```
>RAM initialization
select:          assembly
```

set method parameters with standard values.

set instrument configuration with standard values

clear method memory.

set setup parameters with standard values.

set assembly parameters with standard values.
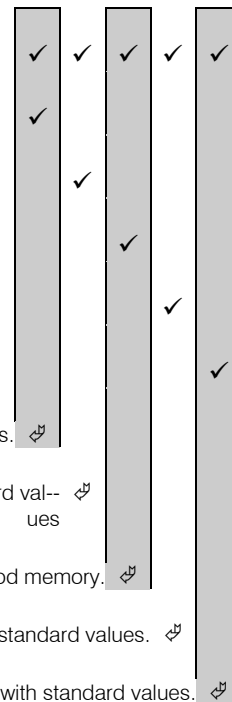
By pressing the <SELECT> key the submenus are selected in sequence. Access to the individual initialization versions is made with the <ENTER> key; the <QUIT> key is used to exit.

The table shows which parts of the data memory are affected by the different initialization versions. After a system crash we recommend the initialization version "all".

- If necessary press the <SELECT> key several times until:

> **>RAM initialization**
> **select: all**

- Press <ENTER>.

> **diagnosis**
> **>RAM test**

- Press <QUIT>.

  ✍ *The diagnosis menu is exited and a power-on reset is carried out.*

6.7 Technical specifications

Short description Compact, multi functional dosing and control instrument for analytical laboratory use and synthesis. Connection of 4 dosing drives and 1 temperature sensor possible.

Dimensions *Height:* 208 mm
Width: 96 mm
Depth: 208 mm

Weight 2.36 kg (without accessories and keyboard)

Housing Metal case, multiple stove-enamel
Upper part PUR (Polyurethane) nonflammable
Fire classification UL94HB(IEC707), lacquered

Keyboard case:	Crastine (PBTB), aluminized inside
Keyboard foil:	Polyester, chemical resistant

Power supply *Voltage selector*   100/115/230/240V
Settings with other supply voltages:
110 V --> 115 V
117 V --> 115 V
120 V --> 115 V
220 V --> 230 V

Tolerance	± 10%
Frequency	50 - 60 Hz
Power input	approx. 28 VA
Fuses	T315 mA for 100 and 115 V
	T120 mA for 230 and 240 V

Ambient temperature *Nominal*   5…40°C
operating range   (at 20…80 % atmospheric humidity)

Storage, transport   -20…60°C
at 60°C < 50 % atmospheric humidity
at 50°C < 85 % atmospheric humidity
at 40°C < 95 % atmospheric humidity

Working memory (RAM) Battery backed, 2 x 32 KB x 8

Real time clock
Supporting battery Battery backed
Lithium 3.6V, 0.85Ah, Order No. Q.005.0001
Not to be exchanged by customer!

Memory card *Type*   Memory Card, JEIDA 4.x / PCMCIA 2.x (68 Pins)

Memory *capacity:*   128 KByte to 2 Mbyte (SRAM)
Order No. 6.2245.010 (128 Kbyte)

External display LCD, 2 x 24 characters, character height 5 mm

Keyboard Tactile touch keyboard with action point, splashwater-proof

RS232-Interface	Socket D-subminiature 9-pin
	Connection for PC, printer or balance
	programmable for serial data communication with external devices.
Option	Cable RS232C - IBM PC AT,
	D-subminiature 9-pin --> D-subminiature 25-pin, Order No. 6.2125.010

Remote-Interface Socket D-subminiature 25-pin
Programmable parallel interface for control of external devices
8 x input 5V TTL or CMOS   active = low >100 ms
                             inactive = high
8 x output open collector < 40V < 20mA
                             active = low >200 ms
                             inactive = high

Input t_p t_p >20 ms

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

+5V

Dosing drives 4 connectors for dosing drives, socket MiniDIN 8-pin.
2 drives may be active concurrently.
Drive type Metrohm 700 Dosino
Options Adapter cable for 700 Dosino with D-subminiature plug,
Order No. 6.2134.020
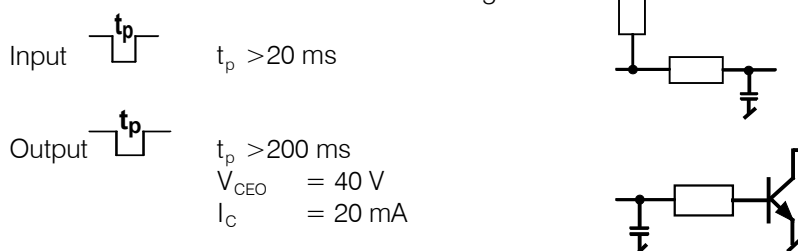
Temperature measuring *Sensor*   PT100, socket MiniDIN 4-pin.
                      Measuring mode   four-wire mode
                      Constant current 5 mA
                      Measuring range   -40 ... 240 °C

Measuring inaccuracy 1% of measured value ± 1°C ± sensor tolerance
Option sensor cable plug , Order No. K.106.0400

Safety specifications

Constructed and tested to IEC 1010 / EN 61010 / UL 3101-1,
Safety class I, EN 60 947-1 degree of protection IP2L1

The instruction manual contains information and warnings which the user
should follow to guarantee the safe operation of the instrument.

Electromagnetic Compatibility (EMC)

Emitted interference Standards met: EN 50081-1 01.92, EN 55011 (class B), EN 55022 (class B)
and NAMUR.

Immunity to interference Standards met: EN 50082-1 01.92, IEC801-2 to IEC801-6, EN 60555-2 and
NAMUR

6.8 Warranty and certificates

6.8.1 Warranty

The warranty regarding our products is limited to rectification free of charge in our workshops of defects that can be proved to be due to material, design or manufacturing faults which appear within 12 months from the day of delivery. Transport costs are chargeable to the purchaser.
For day and night operation, the warranty is valid for 6 months.
Glass breakage in the case of electrodes or other glass 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 regard to the guarantee of accuracy, the technical specifications in the Instructions for Use are authoritative.
Concerning defects in material, construction or design as well as the absence of guaranteed features, the purchaser 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, buret cylinders and PTFE pistons. The parts must be packed in a dustproof package (for instruments the use of a plastic bag is imperative) before embedding them in wood shavings or similar material. 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.

6.9 EC Declaration of conformity

The METROHM AG company, Herisau, Switzerland hereby certifies, that the instrument:

711 Liquino

meets the requirements of EC Directives 89/336/EWG and 73/23/EWG.

Source of the 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:

Compact control unit with memory card for liquid handling operations involving up to four Dosinos.

Herisau, December 12, 1997

Dr. J. Frank   Ch. Buchmann

Development Manager   Production and
Quality Assurance Manager

6.9.1 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:	711 Liquino
System software:	stored in ROMs
Name of manufacturer:	Metrohm AG, Herisau, Switzerland
Principal technical information:	Voltages: 100…120, 220…240 V Frequency: 50…60 Hz

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

Electromagnetic compatibility:

Emission
EN55011 (class B) EN55022 (class B) / EN50081

Immunity
EN50082-2 / IEC801-2, IEC1000-4-2 (class 4) / IEC801-3, IEC1000-4-3, ENV50140+ENV50204 (Klasse 3) / IEC801-4, IEC1000-4-4 (class 3) / IEC801-5, IEC1000-4-5, EN61000-4-5 (class 2/3) / IEC801-6, IEC1000-4-6, ENV50141 (class 3) / IEC1000-4-11

Safety specifications:
IEC1010, EN61010, UL3101-1

The technical specifications are documented in the instruction manual.

The instrument was validated with respect to functionality, analytical performance and accuracy of results. The instrument functions 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, December 12, 1997

Dr. J. Frank   Ch. Buchmann

Development Manager   Production and
                                                   Quality Assurance Manager

6.10 Accessories

711 Liquino	**2.711.0010**
includes the following accessories:	

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
Keyboard for 711 Liquino	6.2142.020
Memory card JEIDA4/128 KB	6.2245.010
Instructions for Use for 711 Liquino	8.711.1013

Options

Accessories to separate order at additional charge:	
Pt100 temperature sensor, 4-wire technology,	
length 40 cm, ∅ 8 mm, with 4-pin MiniDIN plug	6.1111.030
Stopper NS14/8 mm for Pt100 temperature sensor	6.1446.170
Support mounting for Dosinos	6.2047.010
Base plate with stand rod	6.2026.010
Double flask holder	6.2055.100
Wall holder for 711 keyboard	6.2051.010
T-connector for tandem dosing	6.1808.070
Draw-off tip with M8-thread	6.1543.170
Ball stopper	6.1446.030
PTFE-tubing with 3 M8 screw nipples	6.1805.510
2 FEP aspiration tubings,	
with M6 screw nipples, length 250 mm	6.1829.010
Tubing for buret tip	6.1805.120
Remote cable 711–Titrino	6.2141.090
Remote cable 711–Titrino–730–2*683	6.2141.100
RS232 cable , 9pin–9pin	6.2134.040
RS232 cable , 9pin-25pin	6.2134.050
Cable DB25 m/m (1:1), shielded, 2 m	6.2125.100

700 Dosino

Dosing drive with cable mounted (1m) and	
4-pole MiniDIN plug	2.700.0020

Dosing units 710 with glass cylinder, accessories included

Dosing unit 2 mL with buret tips, M6	6.3031.120
Dosing unit 5 mL with buret tips, M6	6.3031.150
Dosing unit 10 mL with buret tips, M6	6.3031.210
Dosing unit 20 mL with buret tips, M6	6.3031.220
Dosing unit 50 mL with buret tips, M6	6.3031.250

Dosing units 710 with ETFE cylinder, accessories included

Dosing unit 2 mL with buret tips, M6	6.3030.120
Dosing unit 5 mL with buret tips, M6	6.3030.150
Dosing unit 10 mL with buret tips, M6	6.3030.210
Dosing unit 20 mL with buret tips, M6	6.3030.220
Dosing unit 50 mL with buret tips	6.3030.250

Reagent bottles

Reagent bottle with GL 45 thread, 1000 mL, amber glass	6.1608.023
Reagent bottle with GL 45 thread, 1000 mL, glass	6.1608.030
Reagent bottle with GL 45 thread, 1000 mL, PE	6.1608.040
Reagent bottle with GL 45 thread, 100 mL, glass	6.1608.050

Thread adaptors for dosing units

Adaptor 32 mm/GL45 (Riedel-de Haën, Fluka)	6.1618.000
Adaptor 28 mm/GL45 (Fisher)	6.1618.010
Adaptor S40/GL45 (Merck)	6.1618.020
Adaptor 40 mm/GL45 (PE container 10 L, 6.1621.000)	6.1618.050
FEP tubing M6, length 50 cm, für PE container	6.1829.020

Equipment for sampling mode	**6.5614.000**
Micro titration vessel lid	6.1414.060
Titration vessel 10 mL	6.1415.210
Thread stopper M8	6.1446.080
Draw-off tip	6.1543.070
Draw-off tip 1,5/240 mm	6.1543.080
Siphon zu GL 45	6.1602.105
Reagent bottle GL45 2 L	6.1608.070
Drying tube NS14	6.1609.000
Thread adaptor S40 for dosing units	6.1618.020
PVC tubing 4/6 2M	6.1801.120
FEP tubing M6, length 80 cm	6.1805.110
FEP tubing M6, length 16 cm	6.1805.180
Olive connector/M8 exterial thread	6.1808.050
FEP tubing, $\varnothing$ 2 mm, length 250 mm	6.1819.020
PTFE tubing, $\varnothing$ 3 mm, length 88 mm	6.1819.050
PTFE stirring bar, length 12 mm	6.1903.010
Base plate with stand rod	6.2026.010
Clamping ring, $\varnothing$ 10 mm	6.2013.010
SGJ clip, POM, for SGJ 14/15	6.2023.020
Holding ring for titration vessel	6.2036.000
Support mounting for 700/710	6.2047.010
Stopper, $\varnothing$ 12 mm	6.2709.090
Stopper with nipple M10	6.2730.030
Stopper, 18mm/M6	6.2730.040
Screw nipple M16/12 mm	6.2730.060
O-rings 5,28/1,78 mm	E.301.0022

Supplement to 6.5614.000 for use with 683 pumps	**6.5614.010**
Transport tip M6	6.1543.100
FEP tubing, M6, 80 cm	6.1805.110
Thread adaptor M8 outside/M6 inside	6.1808.090
FEP tubing, $\varnothing$ 2 mm, length 250 mm	6.1819.020
PTFE tubing, $\varnothing$ 3 mm, length 250 mm	6.1819.030
Screw connector 4/6mm, M6	6.1820.020
Remote cable 711–Titrino–730–2x683	6.2141.100
Spray nozzle M6	6.2740.020

Pipetting equipment

Pipetting handle	6.1562.040
incl. spiral pipetting tube, 3 mL	6.1562.050
Pipetting tube, 10 mL	6.1562.100
Pipetting tube, 3 mL	6.1829.020
Pipetting tube, 0.7 mL	6.1562.010
Pipetting tips for pipetting tube 0.7 mL, 10 parts	6.1562.030
Pipetting tip holder	6.2052.010
FEP aspiration tubing M6, ∅ 2 mm, length 500 mm	6.1829.020

Connecting cables for printers, balances and PC

Connecting cable for printer Seiko DPU-411-11Bx (x=U (USA) or E (Europe))	6.2125.020
Connecting cable for printer Citizen iDP 560 RS or Epson FX, LX, LQ	6.2125.050
Connecting cable for printer Epson EX 800/LQ 850 (DIN plug)	6.2125.040
Stackable plug for simultaneous connection of a printer and a balance	6.2125.030
Cable for Sartorius balances MP8 and MC1 (RS 232C)	6.2125.070
Cable for Precisa balances	6.2125.080
Connecting cable for Mettler balances AE 011/012 and for AND balances	6.2125.020

*(use Mettler cable ME 33995 forMettler AM, AT, PM balances
and use the Mettle interface LC-RS25 for Mettler AB, AG balances)*

Accessories for synthesis applications

FEP tubing with 2xM6 thread, protected against light and buckling,

∅ 2 mm inside diameter, length 13 cm	6.1805.010
∅ 2 mm inside diameter, length 52 cm	.020
∅ 2 mm inside diameter, length 150 cm	.030
∅ 2 mm inside diameter, length 9 cm	.040
∅ 2 mm inside diameter, length 18 cm	.050
∅ 2 mm inside diameter, length 60 cm	.060
∅ 2 mm inside diameter, length 70.5 cm	.070
∅ 2 mm inside diameter, length 25 cm	.080
∅ 2 mm inside diameter, length 31 cm	.090
∅ 2 mm inside diameter, length 40 cm	.100
∅ 2 mm inside diameter, length 80 cm	.110
∅ 2 mm inside diameter, length 100 cm	.120
∅ 2 mm inside diameter, length 120 cm	.130

PTFE tubing with 2xM8 thread,

∅ 3 mm inside /4 mm outside diameter, length 50 cm	6.1805.200
∅ 3 mm inside /4 mm outside diameter, length 25 cm	.210

PTFE tubing with 2xM6 thread,

∅ 0.9 mm inside /1.6 mm outside diameter, length 15 cm	6.1805.300
∅ 0.9 mm inside /1.6 mm outside diameter, length 40 cm	.310

PTFE tubing with 2xM8 thread, protected against light and buckling,

∅ 3 mm inside diameter, length 60 cm	6.1805.510

PTFE capillary tubing with 2xM6 thread, protected against light and buckling
 ∅ 0.3 mm inside diameter, length 6.5 cm   6.1805.140
 ∅ 0.3 mm inside diameter, length 13 cm   6.1805.150
 ∅ 0.3 mm inside diameter, length 40 cm   6.1805.160
Coupling bush (to connect 2 tubings with M6 thread), ETFE 6.1808.000
Adaptor M6 outside/M8 inside thread, PCTFE   6.1808.040

PTFE buret tip with ball stopper and tubing, M6 thread
 ∅ 2mm, length 400 mm   6.1537.010
 ∅ 2mm, length 1000 mm   6.1537.020
PTFE buret tip with anti-diffusion tip (450 mm),   6.9915.046
Inlet/draw-off tip M8, ∅ 3/4 mm, length 151 mm, PTFE 6.1543.120
Inlet/draw-off tip M8, ∅ 3/4 mm, length 198 mm, PTFE 6.1543.170
 with: sleeve ∅ 7/15 mm, length 55 mm, for SGJ14/15, PVDF 6.2727.020
Inlet tube ∅ 3/6 mm, L 178 mm, M6 outside thread, PTFE 6.1821.000
Inlet tube ∅ 3/6 mm, L 278 mm, M6 outside thread, PTFE 6.1821.020
Stopper SGJ14/15 and M10 for inlet tube ∅ 3/6 mm, with 6.1446.060
 screw nipple M10 exterial/6 mm inside diameter   6.2730.030
 with O-ring   E.301.0022
SGJ Stopper SGJ14/15 with 4 borings, PVDF   6.2709.020
SGJ Stopper SGJ29/32 for round flasks (4x M6 thread), ETFE 6.9914.033
Aspiration tubing ∅ 1.5/2.5 mm, length 250 mm, M6, FEP 6.1829.010
Aspiration tubing 500 mm (M6 thread), FEP   6.1829.020
Guide sleeve NS14/15, ∅ 6.5 mm inside diameter   6.2705.000
Sleeve SGJ14/15, PTFE   3.2713.000
Sleeve SGJ29/32, PTFE   3.2713.010
Sleeve SGJ19/17, PTFE   3.2713.020
Sleeve SGJ14/15, POM   6.2023.020
Sleeve SGJ29/32, POM   6.2023.030
Clip for mounting cables/tubings   6.2053.000
Spiral band for holding together cables/tubings ∅ app. 4 mm 6.1815.000
Spiral band for holding together cables/tubings ∅ app. 7 mm 6.1815.010

See Metrohm accessories catalogue also.

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