Metrohm

METROHM AG CH-9101 Herisau (Switzerland)

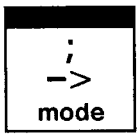
STAT-Titrino 718

Series 01 ...

Instructions for Use 8.718.1003

94.12 Ti/gg

Mode Selection



Press key <mode> until the desired mode is displayed, press <enter>, select desired measured quantity with <select>, and confirm with <enter>, see page 18.
Or:
Recall method from user memory with <user meth>. Select method with <select> or by entering its name, see page 70.

SET pH, U, Ipol, Upol	**S**et **E**ndpoint **T**itration.
STAT pH, U, Ipol, Upol	Keeping a measured value constant i.e. pH-**STAT**.
DOS	**Dos**ing function with volume, time, or rate control.
DOC pH, U, Ipol, Upol	**Dos**ing **C**ontrolled by a measured value gradient.
MEAS pH, U, Ipol, Upol, T	**MEAS**uring.
CAL	**CAL**ibration.
TIP	**T**itration-**P**rocedure. Linking of various commands and methods to a titration procedure.

Configuration

See page 15.
Go to next inquiry with <configuration> and <enter>.

Initial values are printed in **bold face**

Display	Meaning	Input range
>peripheral units		
send to:	Selection of printer.	Epson, Seiko, Citizen, HP, **IBM**
balance:	Selection of balance.	**Sartorius**, Mettler, Mettler AT, AND, Precisa
record:	Selection of record signal at the analog output. U(rel) is the controlling deviation in SET, STAT, and DOC.	**U**, dU/dt, V, dV/dt, U(rel), T
>auxiliaries		
dialog:	Selection of dialog language.	**english**, deutsch, français, español, portuguese, italiano, svenska
date		YYYY-MM-DD
time		HH:MM
run number	Current run number for result output.	**0**...9999
auto start	Automatic starts of titrations ("number of samples").	1...9999, **OFF**
start delay	Waiting time before start of titration.	**0**...999 999 s
device label	Device label to identify instrument for remote control.	up to 8 ASCII characters
program	Program version.	no input
>RS232 settings		
baud rate:	Baud rate.	300, 600, 1200, 2400, 4800, **9600**
data bit:	Data bit.	7, **8**
stop bit:	Stop bit.	**1**, 2
parity:	Parity.	even, odd, **none**
handshake:	Handshake.	**HWs**, HWf, SWline, SWchar, none
RS control:	Receiving of commands via RS; "OFF" means no reception.	**ON**, OFF
>common variables	Common variables.	
C30	Value of common variable C30.	**0**... ± 999 999
:		
C39		**0**... ± 999 999

(2 def | c 1 C-fmla

Calculation and Data Output Definition

Initial values are printed in **bold face**

Display	Meaning	Input range
>formula	Input of formula, see page 60.	
RS?	Enter result number.	1...9
RS1=EP1*C01/C00	Enter formula by means of 3rd functions of keyboard and <enter>. Calculation constant have 2 digits such as C01. C00 stands for sample size.	
RS1 text	Text for result output.	**RS1** or up to 8 ASCII char.
RS1 decimal places	Number of decimal places for result output.	0...**2**...5
RS1 unit:	Select result unit.	**%**, ppm, g/l, mg/ml, mg/pc,mol/l, mmol/l, g, mg, ml, s, ml/min, no unit or up to 6 ASCII characters
	Enter values of calculation variables with <C-fmla>.	
>silo calculations	Allocations for silo calculation, see page 77.	
C24=	Enter results which must be stored in the silo memory.	RSX, EPX, CXX
C25=		
match id:	Indication which id's must coincide for the statistical evaluation in the silo memory.	id1, id1 & 2, all, **OFF**
>common variables	Allocations of common variables C3X, see page 63.	
C3?=	Enter the number of the common variable and RSX, EPX, CXX, or MNX.	RSX, MNX, EPX, CXX
>report	Selection of report blocks for data output, see page 64.	
report:	Depends on selected mode. If you wish several reports, use ";" as separator.	full, short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, calc, param, calib, ff
>mean	Allocations for statistics, see page 62.	
MN?=	Enter mean number and result RSX, EPX, or CXX.	RSX, EPX, CXX
>temporary variables	Allocations of temporary variables for calculation under TIP, see page 69.	
C7?=		RSX, EPX, CXX

Meaning of the calculation variables CXX

Variable	Meaning
C00	Sample size.
C01...C19	Method specific calculation values, such as molecular mass, factors...
C21...C23	Sample specific calculation values, such as dilution factors.
C24, C25	Variables for storing determination results in the silo memory.
C26, C27	Means from silo calculations.
C30...C39	Common variables, e.g. for titer.
C40	Initial measured value of the sample.
C41	End volume.
C42	Determination time.
C43	Volume drift for SET with conditioning.
C44	Temperature.
C45	Dispensed start volume.
C46	Asymmetry pH (pH calibration).
C47	Electrode slope (pH calibration).
C51...C59	Fix V for STAT, i.e. evaluated volumes at preset times.
C61...C69	Fix times for STAT, i.e. evaluated times at preset fractions of the end volume.
C70...C79	Temporary variables for calculations in TIP.
C80	Mean rate for STAT: Overall rate, evaluated over all points of the measuring list.
C81...C89	Rates, evaluated in preset time windows for STAT.

Sample Data

See page 72.
Go to next inquiry with
<smpl data> and
<enter>.

Initial values are printed in **bold face**

Display	Meaning	Input range
	Inquiries with silo = OFF (LED "silo" is OFF):	
Id#1 or C21 **Id#2 or C22** **Id#3 or C23**	Sample identification. Can be used as sample specific calculation values.	up to 8 ASCII characters
smpl size	Sample size	–999 999...**1**...999 999
smpl unit:	Unit of sample size	**g**, mg, ml, ul, pc, no unit or up to 5 ASCII character

Sample data in the silo memory

Display	Meaning	Input range
>edit silo lines	Input for the silo memory:	
silo line	Number of the silo line: One silo line for each sample.	**1**...99
method:	Method, with which the sample is processed.	Method name
id#1 or C21 **id#2 or C22** **id#3 or C23**	Sample identification. Can be used as sample specific calculation values.	up to 8 ASCII characters
smpl size	Sample size	–999 999...**1**...999 999
smpl unit:	Unit of sample size	**g**, mg, ml, ul, pc, no unit or up to 5 ASCII character
>delete silo lines	Delete individual silo lines.	
delete line n	Line number of the line to be deleted.	1...99, **OFF**
>delete all silo lines	Delete the entire silo memory.	
delete all:	Double check: Do you want to delete?	yes, **no**
cycle lines:	With "ON", worked off silo lines will be copied to the highest line of the silo memory.	**OFF**, ON
save lines:	Determination results will be stored in the silo memory according to the allocations in the determination method.	**OFF**, ON

para-
meters

Parameters for SET

See page 20.
Go to next inquiry with
<parameters> and
<enter>.

Initial values are printed in **bold face**.

Display	Meaning	Input range
>SET1	Individual parameters for EP1.	
EP at pH	Preset EP1 at pH, U, or I, resp.	pH: 0.00... ±20.00, **OFF** (0... ±2000 mV, 0.0... ±200.0 uA)
dynamics	Distance from EP where constant dosing stops and controlling begins. OFF means no constant dosing.	pH: 0.01...20.00, **OFF** (1...2000 mV, 0.1...200.0 uA)
max.rate	Maximum dosing rate.	0.01...**10**...150 ml/min, max.
min.rate	Minimum dosing rate.	0.01...**25.0**...999.9 ul/min
stop crit:	Type of stop criteria.	**drift**, time
stop drift	Titration stops if stop drift is reached.	1...**20**...999 ul/min
t(delay)	Titration stops if there is no dosing during t(delay).	0...**10**...999 s, INF
stop time	If t(delay) is "INF" stop after a time.	0...999 999 s, **OFF**
>SET2	Individual parameters for EP2. Identical as SET1.	
>titration parameters	General titration parameters.	
titr.direction:	+: Titration to higher pH, voltage, or current. auto: Direction is set automatically.	+, –, **auto**
start V:	Type of start volume: absolute, relative or none.	abs., rel., **OFF**
start V	Volume for **absolute** start volume.	**0**...999.99 ml
factor	Factor for calculation of **relative** start volume: factor * smpl size.	**0**... ±999 999
dos.rate	Dosing rate for start volume.	0.01...150 ml/min, **max.**
pause	Waiting time, **after** start volume.	**0**...999 999 s
meas.input:	Measuring input for pH and U or polarization current for Ipol or -voltage for Upol in steps of 10 mV- and test for polarized electrodes.	**1**, 2, diff.
temperature	Titration temperature.	-170.0...**25.0**...500.0 °C
>stop conditions		
stop V:	Type of stop volume: absolute, relative or none.	**abs.**, rel., OFF
stop V	Volume for **absolute** stop volume.	0...**99.99**...9999.99 ml
factor	Factor for calculation of **relative** stop volume: factor * smpl size.	0... ±**999 999**
filling rate	Filling rate after the titration.	0.01...150 ml/min, **max.**
>statistics		
status:	Status of statistics calculation.	ON, **OFF**
mean n=	Number n of single values for statistics calculation.	**2**...20
res.tab:	Result table for statistics calculation.	**original**, delete n, delete all
delete n=	Delete data from sample number n.	**1**...20
>preselections		
conditioning:	Automatic conditioning of titration vessel	ON, **OFF**
display drift:	Display of drift during conditioning.	**ON**, OFF
req.ident:	Request of identifications after start of titration.	id1, id1 & 2, all, **OFF**
req.smpl size:	Request of sample size after start of titration.	value, unit, all, **OFF**
activate pulse:	Pulse output on remote line "activate" (L6).	first, all, cond., **OFF**

para-
meters

Parameters for STAT

See page 29.
Go to next inquiry with
<parameters> and
<enter>.

Initial values are printed in **bold face.**

Display	Meaning	Input range
>control parameters		
EP at pH	Endpoint, control point: This value is kept constant.	pH: 0.00... ±20.00, **OFF** (0... ±2000 mV, 0.0... ±200.0 uA)
dynamics	Distance from EP where constant dosing stops and controlling begins. OFF means no constant dosing.	pH: 0.01...**1**...20.00, OFF (1...**60**...2000 mV, 0.1...**6**...200.0 uA)
max.rate	Maximum dosing rate	0.01...**10**...150 ml/min, max.
min.rate	Minimum dosing rate	0.01...**25.0**...999.9 ul/min
>titration parameters	General titration parameters.	
start V:	Type of start volume: absolute, relative or none.	abs., rel., **OFF**
start V	Volume for **absolute** start volume.	**0**...999.99 ml
factor	Factor for calculation of **relative** start volume.	**0**... ±999 999
dos.rate	Dosing rate for start volume.	0.01...150 ml/min, **max.**
pause	Waiting time, **after** start volume.	**0**...999 999 s
start time	Start time for data acquisition.	**0**...999 999 s
start pH	Start measured value for data acquisition.	pH: 0.00... ±20.00, **OFF** (0... ±2000 mV, 0.0... ±200.0 uA)
start rate	Start rate for data acquisition.	0.01...150 ml/min, **OFF**
time interval	Time interval for data acquisition.	1...**2**...999 999 s
titr.direction:	+: Titration to higher pH, voltage, or current. auto: Direction is set automatically.	+, –, **auto**
meas.input:	Measuring input for pH and U or polarization values.	**1**, 2, diff.
temperature	Temperature.	-170.0...**25.0**...500.0 °C
>stop conditions		
stop time:	Type of stop time: absolute, relative or none.	abs., rel., **OFF**
stop time	Time for **absolute** stop time.	0...**999 999** s
factor	Factor for calculation of **relative** stop time.	0... ±**999 999**
stop V:	Type of stop volume: absolute, relative or none.	**abs.**, rel., OFF
stop V	Volume for **absolute** stop volume.	0...**99.99**...9999.99 ml
factor	Factor for calculation of **relative** stop volume.	0... ±**999 999**
stop rate	Stop when the dosing rate is smaller than...	0.01...150 ml/min, **OFF**
filling rate	Filling rate.	0.01...150 ml/min, **max.**
>statistics	See parameters under SET	
>evaluation		
low lim.	Evaluation of dosing rates within programmed time windows (→ C8X). Max. 9 windows.	0...999 999 s, **OFF**
up lim.		0...999 999 s, **OFF**
fix V1	Interpolation of volumes at fixed times (→ C5X). Up to 9 fix V's.	0...999 999 s, **OFF**
fix time 1	Interpolation of times at fixed volume rations of the end volume (→ C6X). Up to 9 fix times.	0.01...1, **OFF**
>monitoring		
meas.val:	Monitoring of measured values.	ON, **OFF**
low lim.pH	Limits for measured values.	pH: 0.00... ±20.00
up lim.pH		(0... ±2000 mV, 0.0... ±200.0 uA)
action:	Action, if a limit is exceeded. End: Abort. Wait: Dosing interrupted, until measured value is within limits again, then continue.	end, hold, wait, **none**
rate:	Monitoring of rate (same actions as above).	ON, **OFF**
temperature:	Monitoring of temperature (same actions as above).	ON, **OFF**
assign output:	Assignment of output L4 for monitoring.	meas, temp, rate, all, **none**
L4 output:	Set a signal when values are out of limit.	active, **pulse**
>preselections	See parameters under DOC.	

para-
meters

Parameters for DOS

See page 40.
Go to next inquiry with
<parameters> and
<enter>.

Initial values are printed in **bold face**.

Display	Meaning	Input range
>dosing parameters		
dispensing type:	Volume, time or rate. Inquiry of 2 values. 3rd value is calculated .	**volume**, time, rate
volume	1st criterion i.e. volume.	0...**10**...99 999.99 ml
disp.crit:	Selection of 2nd criterion.	time, **rate**
rate	2nd value, i.e. rate or	0.001...150 ml/min, **max.**
disp.time	dispensing time.	1...**100**...999 999 s
pause	Waiting time before start.	**0**...999 999 s
time interval	Time interval for data acquisition.	1...**10**...999 999 s
temperature	Temperature.	-170.0...**25.0**...500.0 °C
>stop conditions		
stop V:	Type of stop volume: absolute, relative or none.	abs., rel., **OFF**
stop V	Volume for **absolute** stop volume.	0...**99.99**..99 999.99 ml
factor	Factor for calculation of **relative** stop volume:	0... ± **999 999**
filling rate	Filling rate.	0.01...150 ml/min, **max.**
>statistics		
status:	Status of statistics calculation.	ON, **OFF**
mean n=	Number n of single values for statistics calculation.	**2**...20
res.tab:	Result table for statistics calculation.	**original**, delete n, delete all
delete n=	Delete data from sample number n.	**1**...20
>monitoring		
meas.mode:	Measured quantity for monitoring.	pH, U, Ipol, Upol, **OFF**
meas.input:	Meas. input for pH and U resp. polarization values and test for polarized electrodes.	**1**, 2, diff
low lim.pH	Limits for measured values.	pH: 0.00... ± 20.00
up lim.pH		(0... ± 2000 mV, 0.0... ± 200.0 uA)
action:	Action, if a limit is exceeded. End: Abort. Wait: Dosing interrupted, until measured value is within limits again, then continue.	end, hold, wait, **none**
temperature:	Monitoring of temperature.	ON, **OFF**
low lim.	Limits for temperature.	**-170.0**...500.0 °C
up lim.		-170.0...**500.0** °C
action:	Action, if a limit is exceeded .	end, hold, wait, **none**
assign output:	Assignment of output L4 for monitoring.	meas, temp, all, **none**
L4 output:	Set a signal when values are out of limit.	active, **pulse**
>preselections		
req.ident:	Request of identifications after start.	id1, id1 & 2, all, **OFF**
req.smpl size:	Request of sample size after start.	value, unit, all, **OFF**
activate pulse:	Pulse output on remote line "activate" (L6).	ON, **OFF**

para-
meters

Parameters for DOC

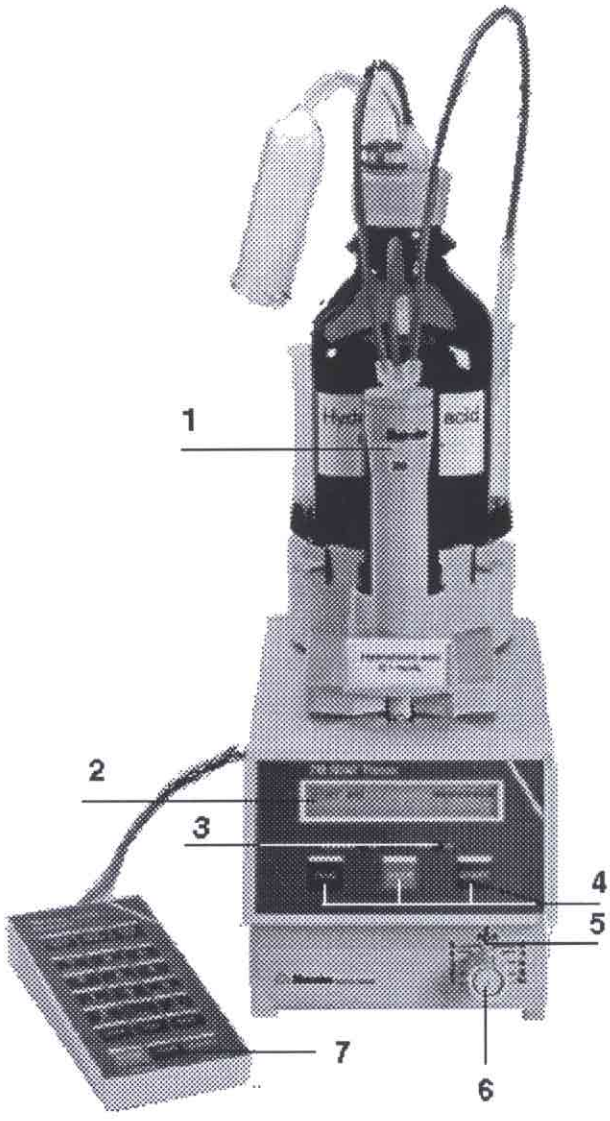
See page 47.
Go to next inquiry with
<parameters> and
<enter>.

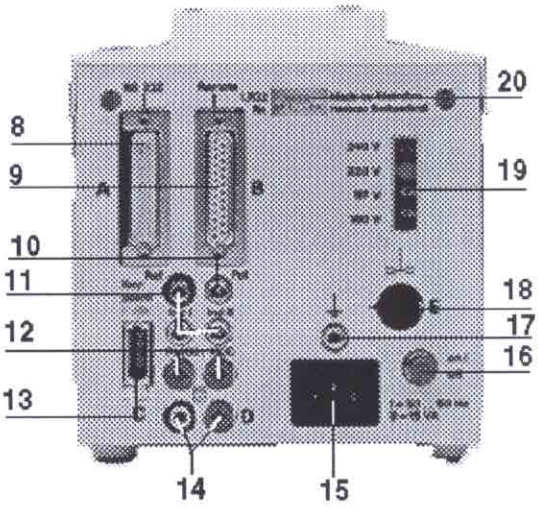
Initial values are printed in **bold face**.

Display	Meaning	Input range
>dosing parameters		
begin at	Begin of measured value sweep.	pH: 0.00... ± 20.00, **init** (0... ± 2000 mV, 0.0... ± 200.0 uA)
end at	End of measured value sweep.	pH: 0.00... ± 20.00, **OFF** (0... ± 2000 mV, 0.0... ± 200.0 uA)
sweep time	Time required for sweep.	0...**300**...999 999 s
dynamics	Distance from EP where constant dosing starts. OFF means no constant dosing.	pH: 0.01...**0.25**...20.00, OFF (1...**15**...2000 mV, 0.1...**6**...200 uA)
max.rate	Maximum dosing rate.	0.01...150 ml/min, **max.**
min.rate	Minimum dosing rate.	0.01...**5**...999.9 ul ml/min
direction:	Direction of sweep. +: Titration to higher pH, voltage, or current. Auto: Direction is set automatically.	+, –, **auto**
start V:	Type of start volume: absolute, relative or none.	abs., rel., **OFF**
start V	Volume for **absolute** start volume.	**0**...999.99 ml
factor	Factor for calculation of **relative** start volume:	**0**... ± 999 999
dos.rate	Dosing rate for start volume.	0.01...150 ml/min, **max.**
pause	Waiting time, **after** start volume.	**0**...999 999 s
time interval	Time interval for data acquisition	1...**10**...999 999 s
meas.input:	Meas. input for pH and U resp. polarization values.	**1**, 2, diff.
temperature	Temperature.	-170.0...**25.0**...500.0 °C
>stop conditions		
stop V:	Type of stop volume: absolute, relative or none.	**abs.**, rel., OFF
stop V	Volume for **absolute** stop volume.	0...**99.99**...9999.99 ml
factor	Factor for calculation of **relative** stop volume.	0... ± **999 999**
filling rate	Filling rate.	0.01...150 ml/min, **max.**
>statistics		
status:	Status of statistics calculation.	ON, **OFF**
mean n=	Number n of single values for statistics calculation.	**2**...20
res.tab:	Result table for statistics calculation.	**original**, delete n, delete all
delete n=	Delete data from sample number n.	**1**...20
>monitoring		
meas.val:	Monitoring of measured value.	ON, **OFF**
low lim.pH	Limits for measured value.	pH: 0.00... ± 20.00
up lim.pH		(0... ± 2000 mV, 0.0... ± 200.0 uA)
action:	Action, if a limit is exceeded. End: Abort. Wait: Dosing interrupted, until measured value is within limits again, then continue.	end, hold, wait, **none**
temperature:	Monitoring of temperature.	ON, **OFF**
low lim.	Limits for temperature.	**-170.0**...500.0 °C
up lim.		-170.0...**500.0** °C
action:	Action, if a limit is exceeded .	end, hold, wait, **none**
assign output:	Assignment of output L4 for monitoring.	meas, temp, all, **none**
L4 output:	Set a signal when values are out of limit.	active, **pulse**
>preselections		
req.ident:	Request of identifications after start.	Id1, Id1 & 2, all, **OFF**
req.smpl size:	Request of sample size after start.	value, unit, all, **OFF**
display rate:	Display of rate.	ON, **OFF**
activate pulse:	Pulse output on remote line "activate" (L6).	ON, **OFF**

Instructions for Use of 718 STAT Titrino

Table of contents


1
2
3
4
5
6
7


8
9
10
11
12
13
14
15
16
17
18
19
20

1. Overview

Front view of instrument:

(1) **Exchange Unit**

(2) **Display**

(3) **Indicator lamps**
"statistics on": Lamp is on when the "statistics" function (calculation of mean value and standard deviation) is switched on.
"silo on": Lamp is on when silo memory (for sample data) is switched on.

(4) **Control keys of Titrino**
DOS: Dispensing is performed as long as <DOS> is pressed. Used to prepare the Exchange Unit. The dispensing rate can be set with potentiometer ⑥ .
STOP/FILL: – Stops procedures, e.g. titration, conditioning.
– Fill command after <DOS> to prepare the Exchange Unit.
Identical with the <STOP> key of the separate keypad.
START: Starts procedures, e.g. titration, conditioning.
Identical with the <START> key of the separate keypad.

(5) **Setting of the display contrast**

(6) **Control of the dispensing rate in dispensing with <DOS> and in subsequent filling**

(7) **Separate keypad**

Rear view of instrument:

(8) **RS232 Interface**
for the connection of a printer and balance or a computer

(9) **Remote lines** (input/output)
for the connection of a sample changer, robot, etc.

(10) **Connection for polarized electrodes**
for measured quantities Ipol and Upol

(11) **Connection for potentiometric electrodes**
for measured quantities pH and U (voltage). 2 measuring inputs which can be used either separately or as a single differential potentiometric input for non-aqueous titrations, see also page 152.
Important: If work is performed in the same measuring vessel with both measuring inputs, the same reference electrode must be used.

(12) **Connection for temperature sensor**
Pt100 or Pt1000

(13) **Connection for the separate keypad**

(14) **Analog output**
for the connection of a recorder

(15) **Mains connection**
With mains supplies where the mains voltage is subject to severe HF disturbances, the Titrino should be operated via an additional mains filter, e.g. Metrohm 615 model.

(16) **Mains switch**

(17) **Earthing socket**
The Titrino must be earthed properly and effectively, if need be via the earthing socket.

(18) **Connection for 728 Magnetic Stirrer, 722 Rod Stirrer, 727 or 703 Ti Stand**
Supply voltage: +9 VDC ($I \leq 200$ mA)

(19) **Display of the set mains voltage**
Before switching on for the first time, check that the set mains voltage matches the voltage of your power supply. If this is not the case, disconnect mains cable and change voltage.

(20) **Rating plate**
with fabrication, series and instrument number

2. Manual operation

2.1 Getting started; a short operating course with examples

Your instruments are already set up. If not, see pages 145 ff.

We can thus make a start and first take a look at the fundamentals for the entry of data. As an example we set the dialog language just for fun to Spanish. How do you like a Spanish dialog?

2.1.1 Entering data, setting the dialog language

<configuration>

Press <STOP> if the Titrino is busy. It is now in the inactive standby state of the instrument. Then press the <configuration> key. The display shows:

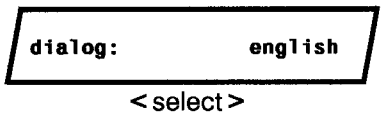
This is the title of the group "peripheral units". This group contains various inquiries about peripheral units.

<configuration>

Press the <configuration> key once more. You see the title of a new group of inquiries:

This is the title of the "auxiliaries" group. This group contains the inquiry for the dialog language. Note the ">" sign. All titles are prefixed by this sign.

<enter>

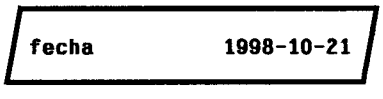


Pressing the <enter> key takes you to the inquiries of the group "auxiliaries". The display shows

This is the first inquiry of the "auxiliaries" group: the selection of the dialog language. You select the various dialog languages with the <select> key. Note the ":" sign. It appears if the values can be selected with key <select>. Press <select> repeatedly until "español" appears in the display. Accept the new "value" with <enter> and the next inquiry appears.

<select>

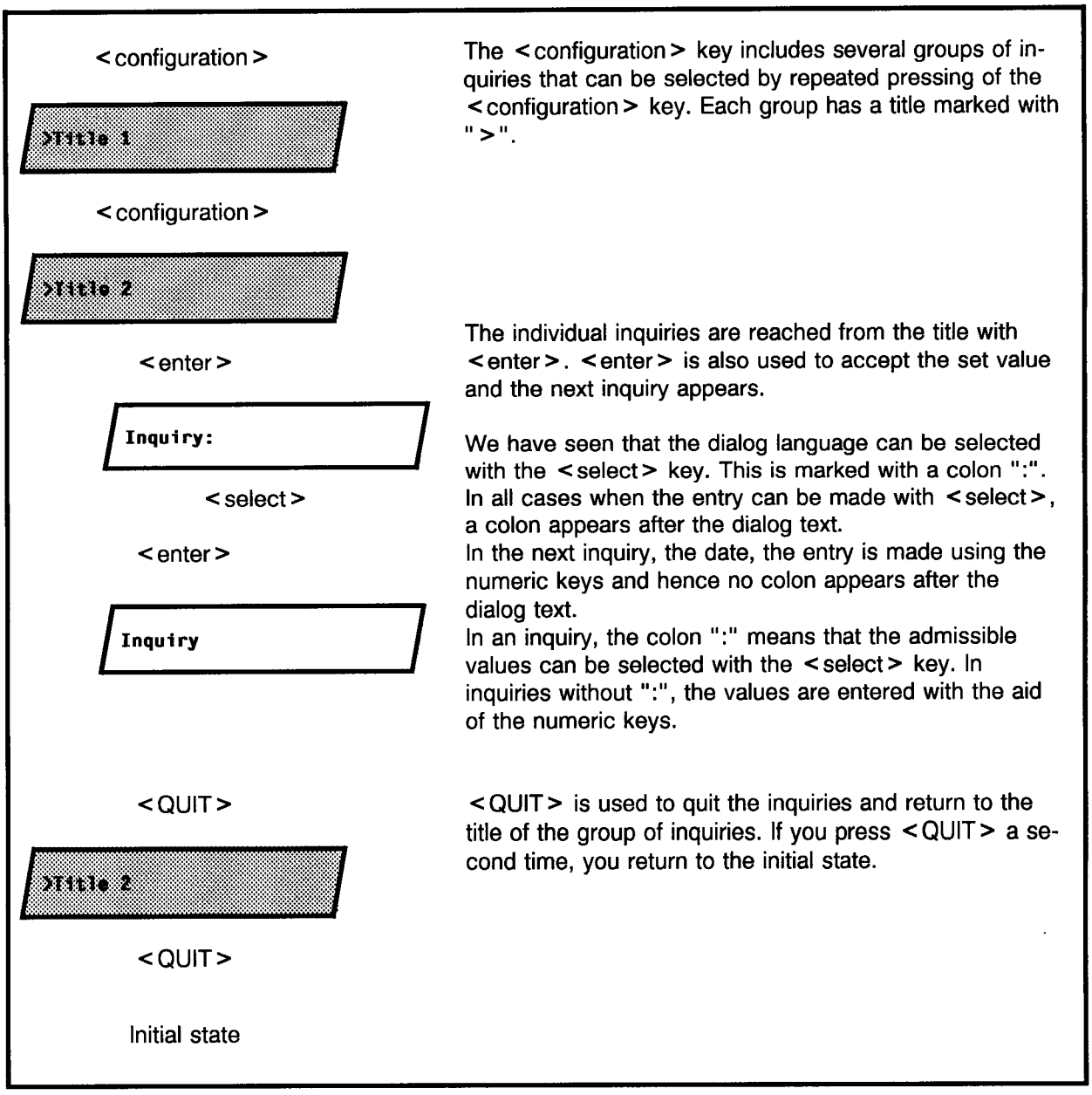
<enter>



The date in Spanish. Other inquiries of the <auxiliaries> group are not of interest at the moment. Exit the inquiries with <QUIT>. You are again shown the title of the group "ajustes varios" (auxiliaries in Spanish). Press <QUIT> once again to exit the inquiries of the <configuration> key and return to the standby state.
All the dialog texts will now be displayed in Spanish. Do you understand anything? You may want to change the dialog language back to English because this is still easier, isn't it? Proceed as before and select "english".

2 x <QUIT>

Summary



All data entries follow this principle.

Now perform your first determination.

2.1.2 Development of a method

Let's discuss the acid capacity of drinking water as an example. For this, the SET (**S**et **E**nd-point **T**itration) is used to titrate to pH = 4.3.

Selecting the mode

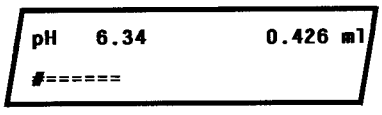
<mode>	Press <mode> repeatedly until "SET" appears in the display.
mode SET	
<enter>	Confirm "SET" with <enter>.
SET: U	Now select the measured quantity: Press <select> until "pH" appears in the display.
<select>	
SET: pH	Confirm the measured quantity "pH" with <enter>.
<enter>	
SET pH ********	

Now set the end point.

Entry of the end point and the control parameters

<parameters>	Press <parameters>. The display shows
>SET1	Control parameters for EP1.
<enter>	
EP at pH 4.30	End point at pH = 4.3
<enter>	
dynamics 3	Dynamics means the control range in which control is exercised slowly and carefully. With buffered systems such as drinking water, this value can be set low, e.g. to 3.
<enter>	
max.rate 10.0 ml/min	Maximum possible titration rate outside the control range.
<enter>	
min.rate 25.0 ul/min	Minimum titration rate inside the control range.
2 x <QUIT>	Quit the inquiry with <QUIT>.

Connect a combined pH glass electrode to measuring input 1 ("Ind I"). (For setting up the titration vessel see page 152).
Mount an Exchange Unit with HCl, c = 0.1 mol/L as titrant. Add 100 mL drinking water as sample and start the titration with <START>. During the titration the first line of the display shows the measured value and dispensed volume. The "c" in pHc shows that the electrode assembly has been calibrated. The second line shows a "control bar", which indicates the control deviation of the current measured value from the set end point.



If the titration runs too slow or too fast, you can change the control parameters during the titration. If you wish to titrate faster, you can make the following changes:
- dynamics: lower (Warning: titration can overshoot)
- max. rate: greater
- min.rate: greater

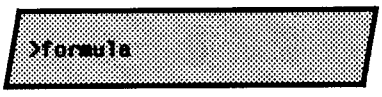
You will find further details of the control parameters on page 26.

After the titration, endpoint volume and pH value at the endpoint are displayed. You may do calculations with the endpoint volume:

Entry of a formula

<def>

Press <def>. The display shows

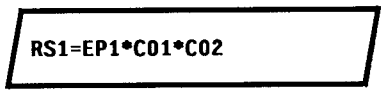


<enter>

Press <enter> to move on to the formula entry. The display now shows "RS?".

<1>

Press "1", i.e. the first formula.

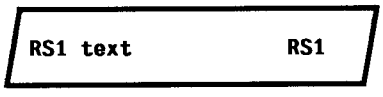


You can now enter a formula. Note here the top inscription on the keys of the keypad and the numbers. The following symbols can be used:
- EP: EP's with 1-digit number, e.g. EP1.
- RS: Previously calculated results, e.g. RS1 in the second formula.
- C: Calculation constant with 2-digit number, e.g. C01. C00 is reserved for the sample size.
- Mathematical operations and parentheses.

Calculate the of m value of drinking water:
RS1 = EP1*C01*C02

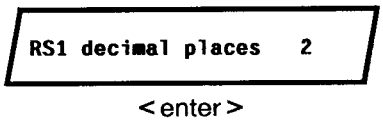
<enter>

Confirm the formula with <enter>.



You may enter a text for the result output, see page 14.

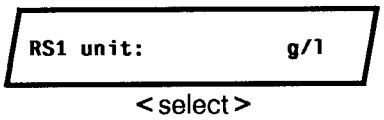
<enter>



Enter the desired number of decimal places for the result

and

<enter>



select the desired unit with <select> (e.g. "no unit").

<select>

<enter>

2 x <QUIT>

Quit the formula entry by pressing <QUIT> twice.

Now enter the calculation constants C01 and C02:

Entry of the calculation constants

<C-fmla>	Press <C-fmla>. The constants which have been used in the formula are requested: C01: Concentration of your titrant,* 10 mol/L. Enter 1.
C01	
1 <enter>	
C02	C02: Factor for 100 mL sample = 4
4 <enter>	

The result is now calculated and can be displayed in place of the equivalence point. If your method already includes a formula at the end of the titration, the calculated result is displayed directly after the titration. As we have entered the formula later, we now have to select the result display:

Display of the result

<select>	Press <select> repeatedly until ">display results" appears in the display.
>display results	
<enter>	Press <enter> to move on to the result display.
RS1 5.43	

If you have a printer connected, you probably wish to have a result report printed out automatically at the end of a titration. If you are operating the printer for the first time, see page 146.

Selection of the automatic report

4 x <def>	Press <def> repeatedly until the display shows
>report	Press <enter> to move to the definition of reports.
<enter>	With <select> you select the individual report blocks. If you wish to print out a full result report, enter "full". If you want to print several report blocks, use ";" as separator between the blocks.
report:	
<select>	Confirm the entry with <enter> and quit the inquiries with <QUIT>.
report:full	
<enter>	
<QUIT>	

Press <print> <reports> <enter>. Your printout will look like the following:

```
 'fr
718 STAT Titrino       OP1/101    718.0010
date 1998-10-21      time 09:07:54       1
pH(init)        7.44      SET pH  ********
EP1            1.358 ml                4.26
RS1             5.43
          ____________
```

- Identification of the report type (fr = full report)
- Instrument and program identification

- Initial pH and method with identification
- Volume and pH value of EP1
- Calculated result, evtl. with result text

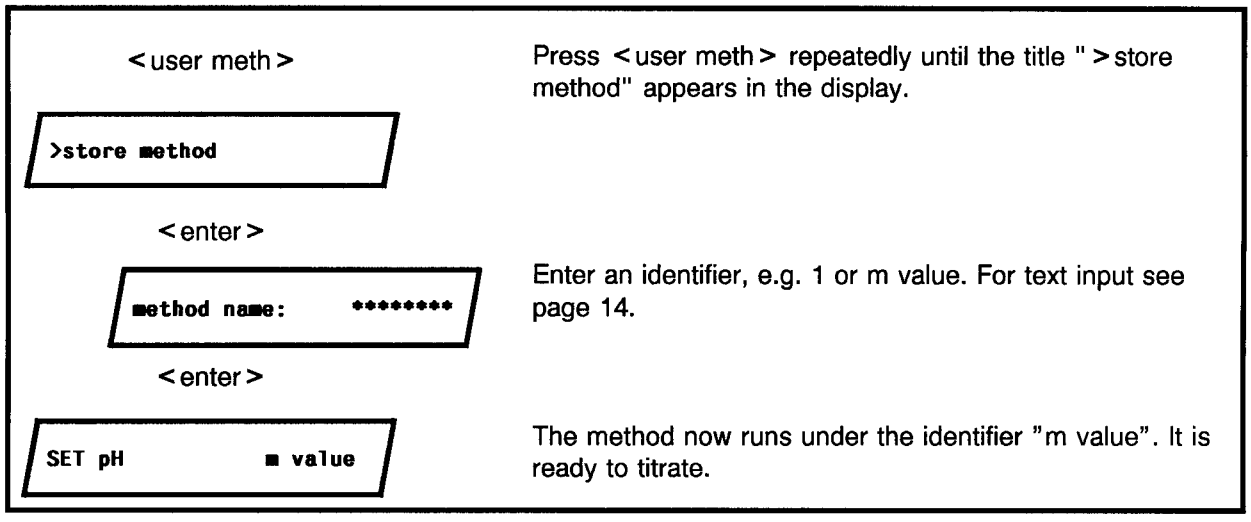
The development of your method is now complete. Before we store it in the method memory, you should check it again. Prepare a fresh sample and restart the titration with <START>.

If everything appears to be in order, you can now store the method in the method memory.

2.1.3 Method memory, storage and loading of methods

Now store the method you have just developed in the method memory.

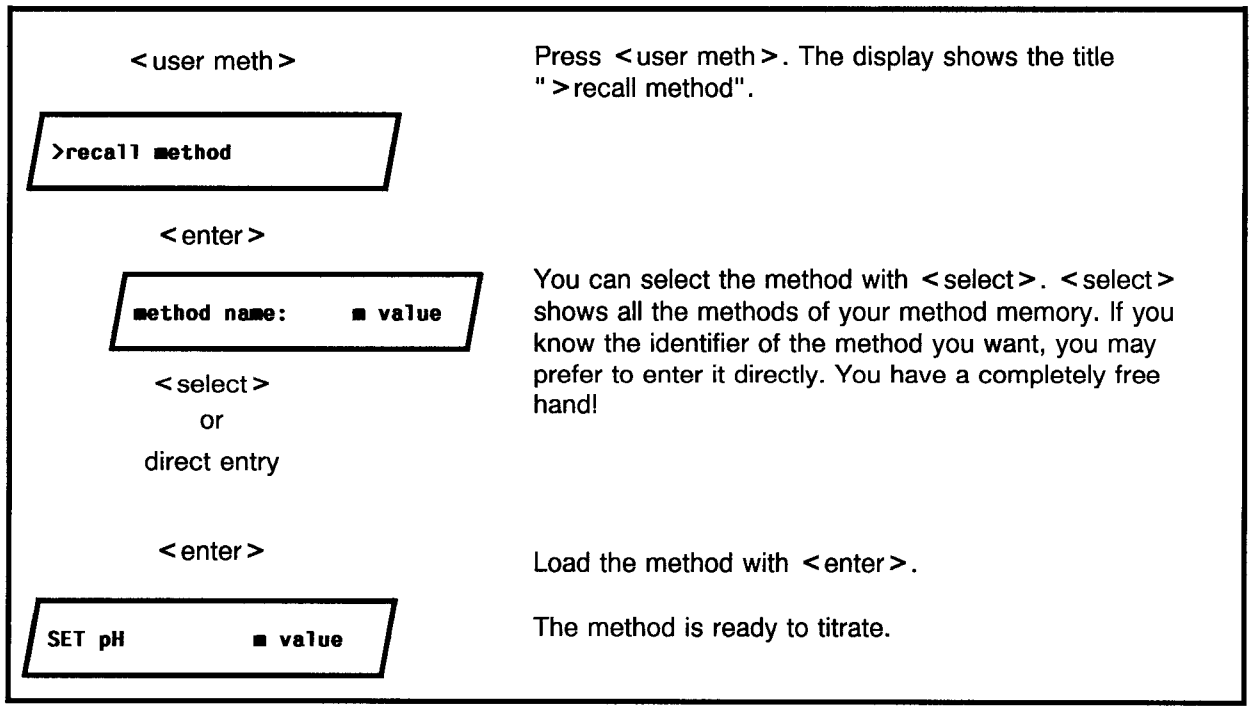
Storage of a method



If you have a printer connected, you can print out the contents of your method memory. Key sequence
<print> <user meth> <enter>

Stored methods can be loaded at any time.

Loading a method from the method memory



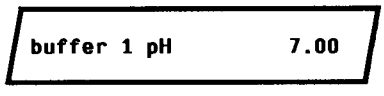
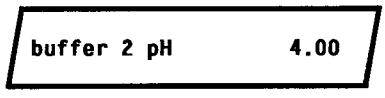
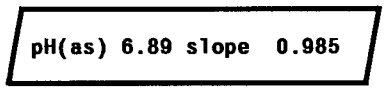
2.1.4 pH calibration

pH calibrations are a requirement for all applications which need preset measured values such as endpoint titrations (SET), STAT, and monitoring of measured value limits.

Selection of the CAL mode, calibration

<mode>	Press <mode> repeatedly until "CAL" appears in the display and confirm the mode with <enter>.
	
<enter>	
	The instrument is ready for a 2-point calibration. The second display line shows the current calibration data for measuring input 1.

Calibration procedure

<START>	Immerse your electrode in the first buffer and start the calibration procedure.
	Inquiry of the calibration temperature. Enter the current temperature. If you have a temperature sensor connected, this inquiry is skipped.
<enter>	
	pH value of the first buffer. Enter the pH value of the buffer at your calibration temperature.
<enter>	The voltage of the first buffer is measured. When the measured value has met the set drift criterion, the measurement is stopped and the pH value of the second buffer requested.
	
<enter>	Now enter the pH value of the second buffer. If you require a 1-point calibration, you can also terminate the calibration with <STOP>.
or	
<STOP>	
	At the end of the calibration, the calibration data obtained are displayed: asymmetry pH and slope.

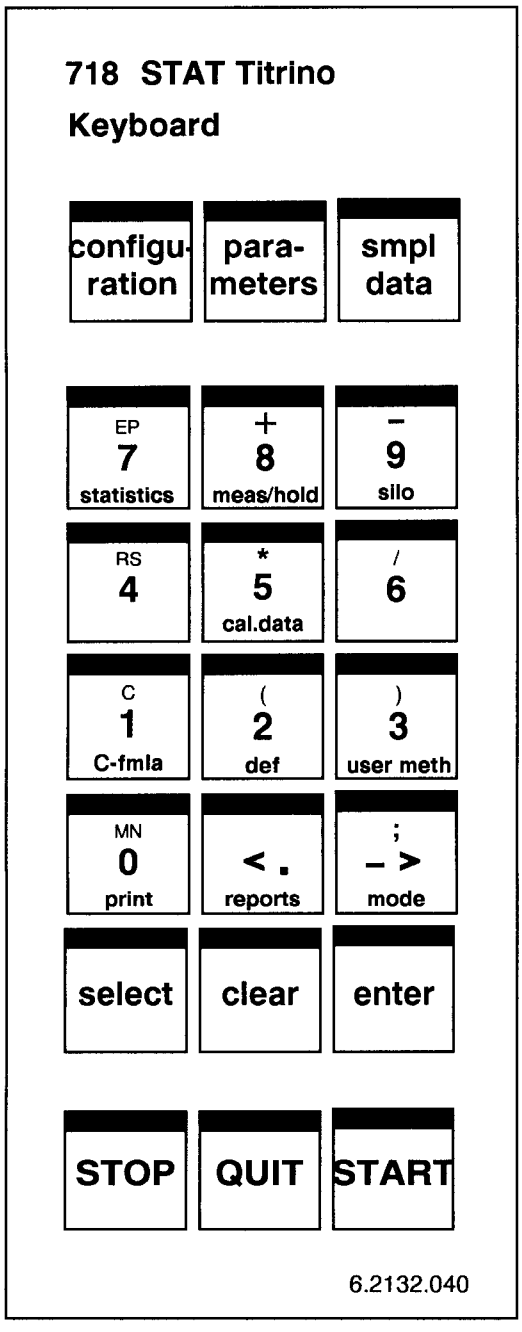
The calibration data can be viewed at any time under the <cal.data> key. Our calibration data are stored under " >input 1".

The calibration report can be printed out at any time with the key sequence
<print> <cal.data> <enter>

pH values are now designated as "pHc". "c" means "calibrated".

2.2 Detailed description

2.2.1 Keypad



<configuration>: Configuration

<parameters>: Parameters

<smpl data>: Sample data

<statistics>: On/off switching of statistics calculations of consecutive determinations (see page 62)

<meas/hold>: On/off switching of
- measurements between titrations
- the hold function during titrations

<silo>: On/off switching of the silo memory for sample data (see page 73 ff)

<cal.data>: Calibration data (see page 71)

<C-fmla>: Calculation constants (see page 61)

<def>: Formulas, information for result output, sequence for TIP (see page 60 ff)

<user meth>: Method memory (see page 70)

<print>: Printing of reports (see page 66)

<reports>: Result output: <print> + <reports> + <enter>

<mode>: Mode selection (see page 18)

<select>:
- selection of special input values, designated with ":" in the dialog
- switching of the result display

<clear>:
- clears entries
- sets special values, e.g. "OFF"

<enter>:
- accepts values and advances rolling inquiries
- branches to the individual inquiries of the inquiry groups ">"
- closing of command sequences

<STOP>: Stops methods

<QUIT>: Exit from
- rolling inquiries; leads to the next higher level
- waiting times
- printing

<START>: Starts methods

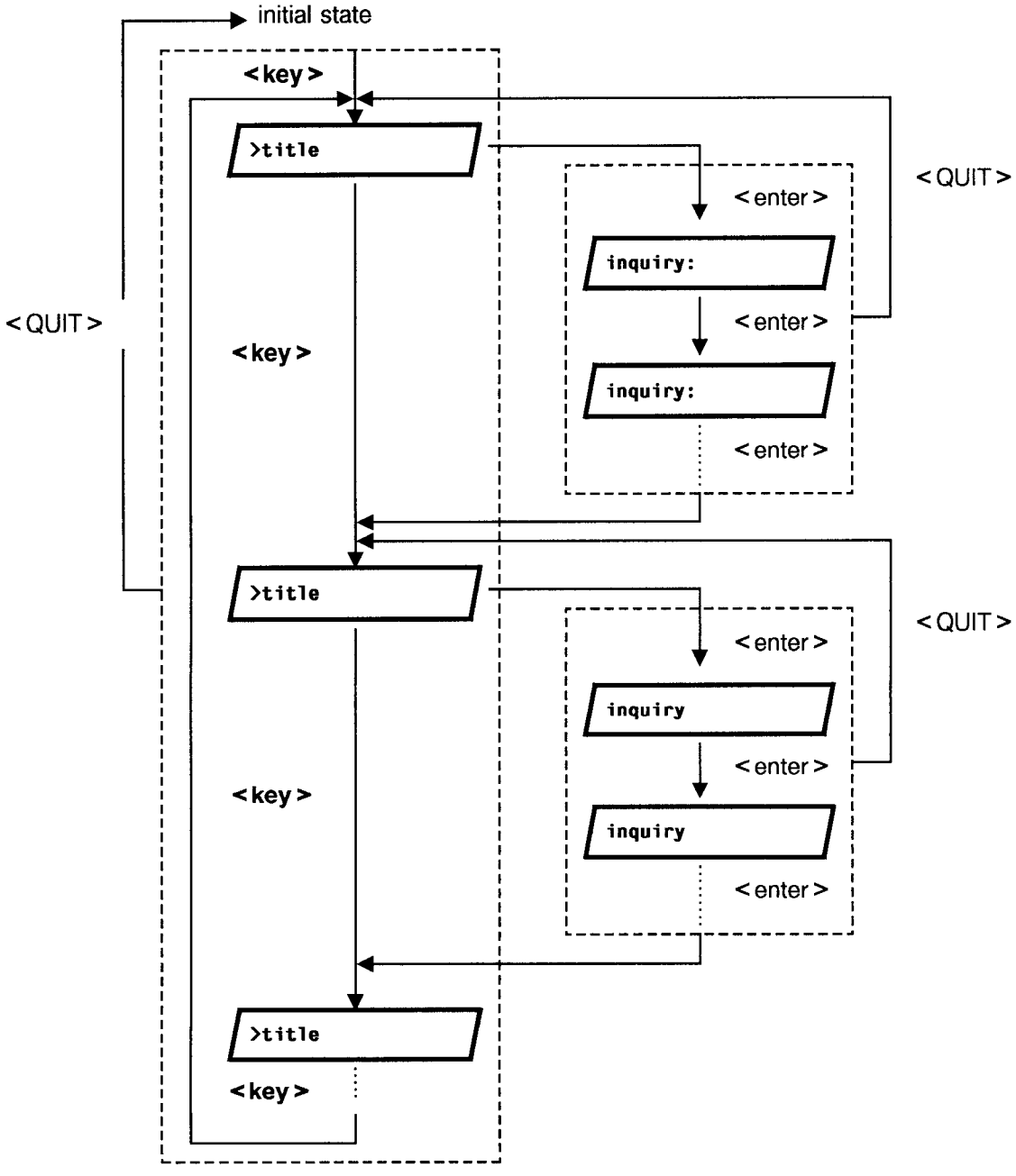
The third functions (topmost inscriptions) on the keys of the keypad are used for formula entry.

2.2.2 Keys with rolling inquiries

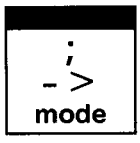
Inquiry keys are organised as rolling inquiries, i.e.

- The inquiries are collected into groups. Repeated pressing of these keys fetches the title of these groups into the display. All titles are marked with the symbol " >" before the dialog text. <enter> is used to branch to the individual inquiries.
- Displayed values of these inquiries are accepted with <enter> and the next inquiry appears.
- Entries can be performed either with the numeric keys or by selecting from preallocated values with the <select> key. All entries in which the <select> key can be used are marked with a colon ":" after the dialog text.
- <QUIT> can be used to exit the inquiries. The next higher level appears, i.e. return to the title of the inquiry group or the initial state.

The organisation of the rolling inquiries is shown schematically below:



2.2.3 Input of texts, > and < keys



The > and < keys serve to select characters and write texts.

Writing of texts

1. Press the < key as first key for input of a new text.
2. The blinking postion can be selected. Move the characters with keys > and < until the desired character appears.
3. Confirm the character with <enter>.
4. Select the character for the next position and confirm it with <enter>... etc.
5. If your text is ok and shorter than the whole writing space in the display (16, 8, 6 or 5 characters), press <QUIT> to leave the text input mode, then <enter> to store the text.
   If your text fills up the possible writing space, press just <enter> to store the text.
6. If you made a spelling mistake, you can erase one position backwards pressing <clear>. If you press <clear> repeatedly, one position after the other is cleared.

Correction of stored texts

You can add characters to stored texts or correct them as follows:

1. Press the > key as first key for correction of an old text. The stored text appears, the last position is blinking and can be re-selected.
2. If you wish to correct another position, press <clear> until this position is blinking and can be corrected.

2.2.4 Configuration, <configuration> key

configu-ration	The <configuration> key serves to enter data specific to the instrument. The key is organised as a rolling inquiry. The set values apply to all modes. The values shown in the displays "/_____/" are the default values.

>peripheral units	**Settings for peripheral devices**
send to: IBM	*Selection of the printer type/character set (Epson, Seiko, Citizen, HP, IBM)* "Epson", for Epson mode "Seiko", e.g. for DPU-411 "Citizen", e.g. for iDP 560 RS "HP" e.g. for Desk Jet. Place curves always at the beginning of a page because you can't have them over 2 pages. "IBM" for all printers with IBM character set Table 437 and IBM graphics, as well as for the data transmission to a computer or a data system.
balance : Sartorius	*Selection of the balance type (Sartorius, Mettler, Mettler AT, AND, Precisa)* Sartorius: Models MP8, MC1 Mettler: Models AM, PM and balances with 011, 012, and 016 interfaces Mettler AT: Model AT AND: Models ER-60, 120, 180, 182, FR-200, 300 and FX-200, 300, 320 Precisa: Models with RS232C interface
record: U	*Selection of the curve for the output at the analog output (U, dU/dt, V, dV/dt, U(rel), T)* U: Voltage dU/dt: Measured value drift V: Volume dV/dt: Volume drift U(rel): Control deviation with SET, STAT, and DOC T: Temperature if its monitoring is on with STAT, DOS, and DOC or with MEAS T.

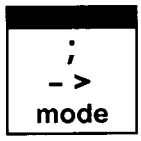
>auxiliarieses	**Various settings**
dialog: english	*Selection of the dialog language (english, deutsch, francais, español, portuguese, italiano, svenska)*
date 1998-10-21	*Current date (YYYY-MM-DD)* Format: Year-month-day, entry with leading zeros.
time 08:13	*Current time (HH-MM)* Format: Hours-minutes, entry with leading zeros.
run number 1	*Current sample number (0...9999)* The sample number is set to 0 when the instrument is switched on and incrementd on every determination.
auto start OFF	*Automatic, internal instrument start (1...9999, OFF)* Number of automatic starts ("number of samples"). Used for instrument interconnections in which the external instrument does not initiate a start. Not advisable in connections with the 664 Control Unit and Sample Changer.
start delay 0 s	*Start delay (0...999 999 s)* Delay time after the start before the method starts. The delay time can be aborted with <QUIT>.
device label	*Device label for the individual identification of devices in the instrument network (up to 8 characters)*
program 718.0010	*Display of program version*

RS232 settings>	**Settings for the RS232 interface** see also page 124 - Characteristics of the RS232 interface
baud rate: 9600	*Baud rate (300, 600, 1200, 2400, 4800, 9600)*
data bit: 8	*Data bit (7, 8)*
stop bit: 1	*Stop bit (1, 2)*
parity: none	*Parity (even, odd, none)*
handshake: HWs	*Handshake (HWs, HWf, SWline, SWchar, none)* see pages 124ff
RS control: ON	*Control via RS232 interface (OFF, ON)* "OFF" means that the receipt of commands via the RS232 interface is blocked. Data output is possible.
>Common Variable	**Values of the common variables**
C30 etc.	*Common variable C30...C39 (0... ±999 999)* The values of all common variables are displayed.

Settings for the curve plot

Length and width of the curve plot as well as its appearance can be varied, see page 123.

2.2.5 Selection of the mode, <mode> key



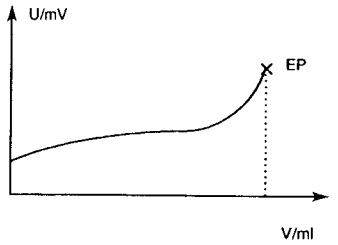
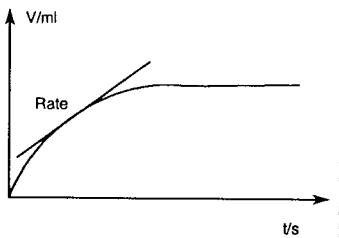
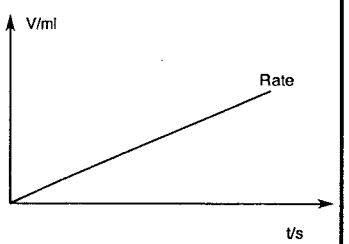
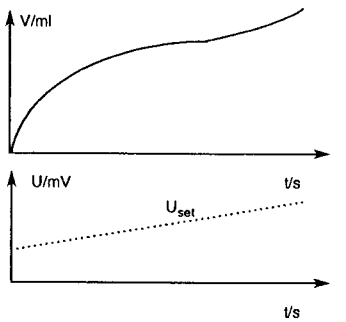
The <mode> key is pressed repeatedly until the desired mode is displayed. It is accepted with <enter>.

The measured quantity pH, U, Ipol, Upol, (T) is selected with <select> and also confirmed with <enter>.

The following modes can be selected:

- SET: **S**et **E**ndpoint **T**itration.
- STAT: Keeping a measured value constant, i.e. pH-**STAT**.
- DOS: **Dos**ing function with volume, time, or rate control.
- DOC: **Dos**ing **C**ontrolled by a measured value gradient.
- CAL: pH **Cal**ibration.
- MEAS: **Meas**uring.
- TIP: **T**itration **P**rocedure. Linking of various commands and methods to a titration procedure.

These standard modes are equipped with a set of standard parameters. They only need few settings in order to be ready to work.
TIP is an empty "shell". The TIP sequence has to be defined first with key <def>, see page 67.

	SET Endpoint titration	STAT Holding a measured value	DOS Dosing function	DOC Controlled dosing
Overview	 Titration to preset end point. Up to 2 EP#s can be entered.	 The reagent addition is controlled such that a preset measured value is adhered to as accurately as possible.	 Linear dosing function where two quantities of the equation "Rate = V/t" are specified; the third is calculated by the Titrino.	 The dosing function is controlled such that a nominal measured value is adhered to as accurately as possible. The nominal measured value follows a linear ramp.
Evaluation	Volume that has been dispensed up to the endpoint (EPX in ml).	– Rates in the set time windows and the mean rate over the entire measuring point list (C8X in ml/min) are determined by linear regression. – Volume associated with a preset time (fix V, C5X in ml). – Time associated with a preset fraction of the total volume (fix time, C6X in s).	– The total volume can be calculated (C41). – The time needed for dosing can be calculated (C42).	– The total volume can be calculated (C41). – The time needed for dosing can be calculated (C42).
Monitoring	–	Monitoring of limit values for rate, measured value and temperature. On limit value violation, the reagent addition can be stopped or interrupted. Output can be set on limit value violation.	Monitoring of limit values for measured value and temperature. On limit value violation, the reagent addition can be stopped or interrupted. Output can be set on limit value violation.	Monitoring of limit values for measured value and temperature. On limit value violation, the reagent addition can be stopped or interrupted. Output can be set on limit value violation.
Applications	– For rapid, quantitative determinations in analytical chemistry. Requirement: EP of the titration reaction is known and does not change during a determination series. – As a "pretitration" for the precise setting of a specified measured value.	– For rapid, quantitative determinations in analytical chemistry. – For kinetic investigations (first-order kinetics). – For the controlled dosing to a preset end point in the synthesis laboratory.	– For general dosing tasks in the laboratory.	– Sweeping a measured value gradient for reaction formulations in the syntheses laboratory.
Further information	see page 25ff.	see page 36ff.	see page 44ff.	see page 52ff.

2.2.6 Parameters, <parameters> key

para- meters	The <parameters> key is used for the entry of values that determine the modes. The key is organised as a rolling inquiry. Values marked with "cond." are accessible during the conditioning in the SET mode, and "**titr." means that these values can be changed during the titration. They then influence the ongoing determination. The values shown in the display "/_____/" are the default values.

2.2.6.1 Parameters for SET

>SET1	**Control parameters for the first end point, EP1**
EP at pH OFF ** titr.	*First end point, EP1 (input range depends on the measured quantity:* *pH: 0... ± 20.00, OFF* *U, Ipol: 0... ± 2000 mV, OFF* *Upol: 0... ± 200.0 uA, OFF)* <clear> sets "OFF". If EP1 is "OFF", no further inquiries under SET1 appear.
dynamics OFF ** titr.	*Dynamics (control range, input range depends on the measured quantity:* *pH: 0.01...20.00, OFF* *U, Ipol: 1...2000 mV, OFF* *Upol: 0.1...200.0 uA, OFF)* <clear> sets "OFF". "OFF" means largest control range, i.e. low titration. Outside the control range, dispensing is performed continuously, see also page 26.

max.rate 10 ml/min ** titr.	*Maximum titration rate (0.01...150 mL/min, max.)* <clear> sets "max.". This parameter determines primarily the addition rate outside the control range, see also page 26. The maximum rate depends on the Exchange Unit: Exchange Unit — max. 5 mL — 15 mL/min 10 mL — 30 mL/min 20 mL — 60 mL/min 50 mL — 150 mL/min
min.rate 25.0 ul/min ** titr.	*Minimum possible titration rate (0.01...999.9 uL/min)* This parameter determines the addition rate right at the start and the end of the titration, see also page 26. This parameter influences the titration speed and therefore its accuracy very strongly: A smaller min.rate results in a slower titration.
stop crit: drift ** titr.	*Type of stop criterion (drift, time)*
stop drift 20 ul/min ** titr.	*Switch off titration when end point and stop drift are reached (1...999 uL/min)*
t(delay) 10 s ** titr.	*Switch-off delay time (0...999 s, INF)* <clear> sets "INF" Switch off when the end point is reached and the set time after the last dispensing has elapsed. If "INF" is set, an inquiry regarding the stop time appears.
stop time OFF s ** titr.	*Stop time (0...999 999 s, OFF)* <clear> sets "OFF". Stop after expiry of the set time after the start of the titration. "OFF" means no stop, i.e. titration for an "infinitely" long time.
>SET2	**Control parameters for the second end point, EP2** They are identical to those under SET1.

>titration parameters

Titration parameters
Apply globally for the entire titration.

titr.direction: auto

Titration direction (+ , –, auto)
auto: The direction is defined automatically by the Titrino (sign [U_{init} – EP]).
+ : In the direction of higher pH, higher voltage (more "positive"), larger currents.
– : In the direction of lower pH, lower voltage, smaller currents.
The titration direction is fixed if two EP's are set. In this case, an input for titration direction has no meaning.

start V: OFF

Type of start volume (OFF, abs., rel.)
"OFF": start volume switched off
"abs.": absolute start volume in mL
"rel.": start volume relative to sample size.

start V 0.00 ml

If "abs." is set:
Absolute start volume (0...999.99 mL)

factor 0

If "rel." is set:
Factor for the calculation of the relative start volume (0... ± 999 999).
Calculated as:
start V in mL = factor * sample size

dos.rate max. ml/min

**titr.

Dispensing rate for the start volume (0.01...150 mL/min, max.)
<clear> sets "max.".
The maximum rate depends on the Exchange Unit:

Exchange Unit	max.
5 mL	15 mL/min
10 mL	30 mL/min
20 mL	60 mL/min
50 mL	150 mL/min

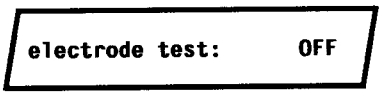
pause 0 s

** titr.

Pause (0...999 999 s)
Waiting time, e.g. for equilibration of the electrode after the start or reaction time after the dispensing of a start volume. The equilibration time can be aborted with <QUIT>.

or

or



Measuring input (1, 2, diff.)
Inquiry only with measured quantities pH and U.
Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 152.

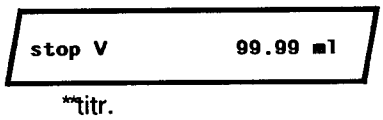
With polarized electrodes, instead of the measuring input the
polarisation current (-127...127 uA)
or the
polarisation potential (-1270...1270 mV, in steps of 10 mV)
is inquired.
Electrode test (OFF, ON)
Test for polarized electrodes. Performed on changeover from the inactive standby state to a measurement. "OFF" means that the test is not performed.

Titration temperature (-170.0...500.0°C).
This parameter is used for temperature compensation in pH titrations.
The temperature is measured at the the start of the titration if a T sensor is connected.

Conditions for titration termination
If this is not "normal", i.e. after attainment of the end point.

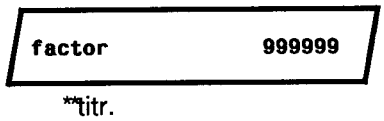
**titr.

Type of stop volume as a safety volume (abs., rel., OFF)
"abs.": absolute stop volume in mL.
"rel.": stop volume relative to sample size.
"OFF": stop volume switched off. Stop volume is not monitored.



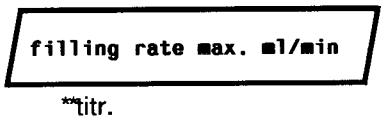
**titr.

If "abs." is set:
Absolute stop volume (0...9999.99 mL)



**titr.

If "rel." is set:
Factor for the calculation of the relative stop volume (0... ±999 999)
Calculated as:
Stop V in mL = factor * sample size



**titr.

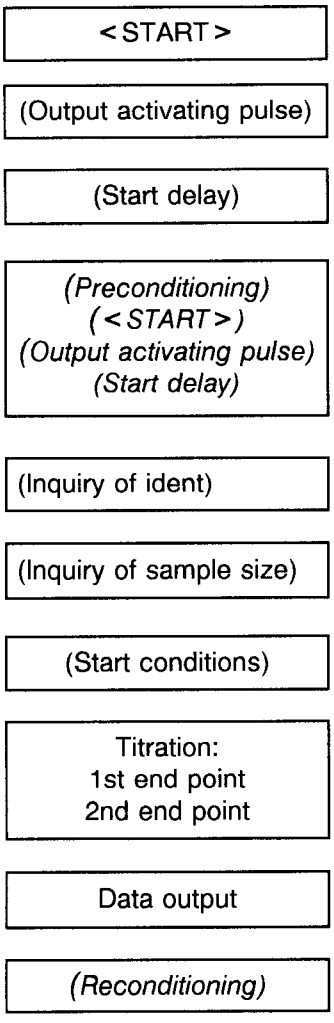
Filling rate (0.01...150 mL/min, max.)
<clear> sets "max.".
The maximum rate depends on the Exchange Unit:

Exchange Unit	max.
5 mL	15 mL/min
10 mL	30 mL/min
20 mL	60 mL/min
50 mL	150 mL/min

>statistics	**Statistics calculations** Mean value, absolute and relative standard deviation, see also page 62.
status: OFF *cond.	*ON/OFF switching of statistics calculations (OFF, ON).* If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.
mean n= 2 *cond.	*Mean value calculation from n single results (2...20)*
res.tab: original *cond.	*Result table for the statistics (original, delete n, delete all)* "original": The original table is used. Deleted individual results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete n= 1 *cond.	*Index n of the result to be deleted (1...20)* The deleted result is removed from the statistics calculation.
>preselections	**Preselections for the titration sequence**
conditioning : ON	*Conditioning (ON, OFF)* If conditioning is "on", between the titrations the titration solution is constantly maintained at the (1st) end point. When conditioning is performed, the volume drift can be displayed during the conditioning:
display drift: ON *cond.	*Drift display (ON, OFF).* Volume drift.
req. ident: OFF	*Inquiry of sample identifications after the start of the titration (id1, id1 & id2, all, OFF)* After the start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req. smpl size: OFF	*Inquiry of sample size after the start of the titration (value, unit, all, OFF)*
activate pulse: OFF	*Output pulse on the line "activate", L6 of the remote socket (first, all, cond., OFF)* see pages 161, 162.

Titration sequence of SET

The titration sequence can be configured to match the application. The following parameters determine the sequence (see schematic diagram below):
- Start delay (setting with <configuration>, >auxiliaries)
- Conditioning (ON, OFF)
- Inquiry of the sample identifications and the sample size after the start of titration
- Start conditions: start volume and pause



After the start, the start delay time is waited out.

If *conditioning* is switched on, after the first start the titration vessel is brought to the (1st) end point. If the conditioning is at an end, the display shows, e.g. /SET pH conditioning/ or when the drift display is switched on, /drift ok 5 ul/min/. The instrument is ready for titration. If the drift display is switched on, the volume drift is displayed continuously during conditioning. After the titration, conditioning is again performed to the (1st) end point.

After the start of the titration, the activate pulse is outputted (possibilities to activate pulse, see page 162) and the start delay time is waited out.

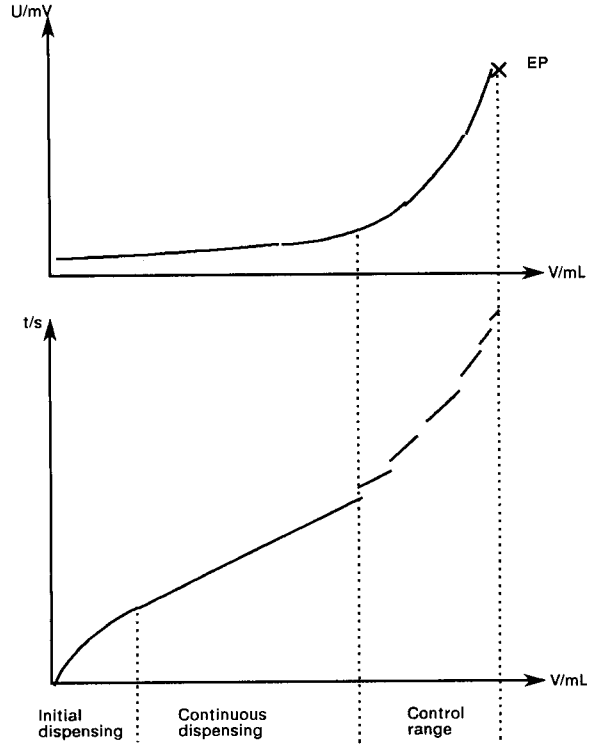
Then the temperature is measued (if a T sensor is connected), "req.ident" and "req.smpl size" are requested and the start conditions are executed: The start volume is dispensed and the pause is waited out. During dispensing of the start volume, no control is exerted. Then the titration is performed to the first then to the second end point.

At the end, the data are outputted. If you have a printer connected, see page 64.

Control parameters

The control parameters can be set separately for each end point. Optimize your control parameters for routine analyses for samples with a rather low content.

During the titration, reagent dispensing occurs in 3 phases:



1) Initial dispensing:
During this phase, the dispensing rate increases constantly. It starts at the set "min.rate" and continues up to the allowed "max.rate".

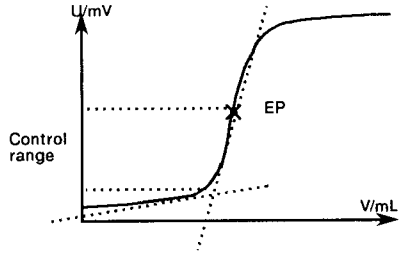
2) Continuous dispensing:
Dispensing is performed at the maximum rate "max.rate" until the control range (dynamics) is reached.

3) Dynamics (control range)
In this range, dispensing is performed in single steps. The last dispensing steps are controlled by the "min.rate" parameter.

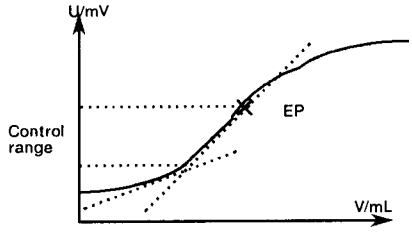
Trial settings for the size of the control range

Set a large control range for steep curves. Relatively flat curves, on the other hand, need a smaller control range. You can get an initial, good approximation for the start of the control range from the intersection point of the tangents:

"steep" curves



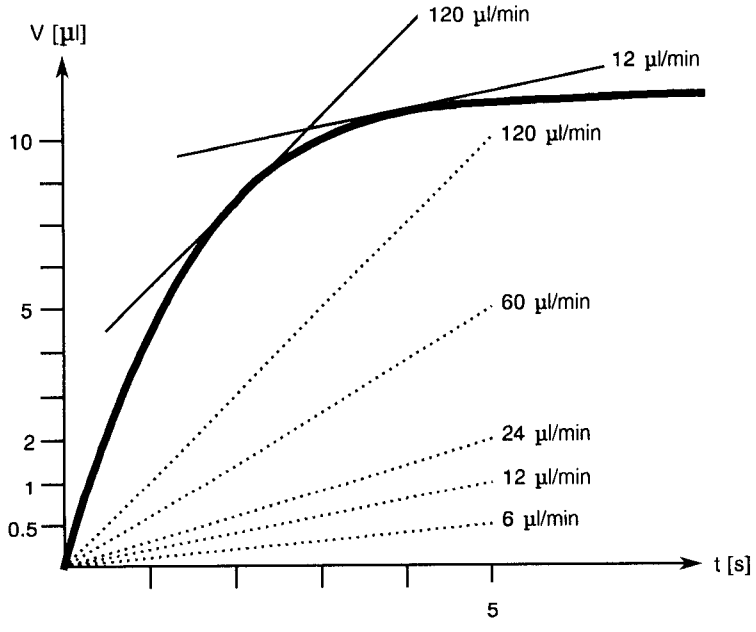
"flat" curves



Relation between the stop criteria "time" and "drift"

The stop criterion "time", t(delay), means that the end point must be exceeded for a certain period of time. In other words, after the last dispensed increment, time t is allowed to elapse before the titration is stopped. The size of this last increment depends on the volume of the Exchange Unit used. With a 20 mL Exchange Unit, the smallest possible increment is 2µL. With a t(delay) = 5 s, the last 2 µL reagent must thus suffice for 5 s or longer. This results in a drift of ≤ 2 µL/5 s = 24 µL/min (the drift can be less than 24 µL/min as it is not known whether the last increment would also suffice for 10 s). If you have been working up to this point with a 20 mL Exchange Unit and a t(delay) = 5 s, you can set a value of ≤ 24 µL/min as stop drift. The following Table shows several values for the maximum stop drift.

t(delay) / min. increment (Exchange Unit)	5 s	10 s	20 s
0.5 µl (5 mL)	6 µl/min	3 µl/min	1.5 µl/min
1 µl (10 mL)	12 µl/min	6 µl/min	3 µl/min
2 µl (20 mL)	24 µl/min	12 µl/min	6 µl/min
5 µl (50 mL)	60 µl/min	30 µl/min	15 µl/min



Same t(delay) with a range of extremely small volume increments means different switch-off points. When the stop criterion "drift" is used, on the other hand, the switch-off point remains the same.

If you have entered the end point and the control range (dynamics), the default values for the other control parameters should suffice for the first titration. If you encounter difficulties in optimizing your titration, the following Table will be of use:

How to proceed if ...

Problem	Possible causes and corrective measures
Dispensing at the end too long and with too small increments. "Never ends!"	– Increase "min.rate". Perform an experiment with a much higher min.rate. – Change switch-off criterion. Attempt, e.g. to increase the stop drift or use a shorter t(delay) as stop criterion. – Possibly pass an inert gas through the titration vessel.
"Overshoots". Titration is not controlled, i.e. at the end single pulses are not dispensed.	– Lower "max.rate". – Set larger control range. – Set "min.rate" much lower. – Optimize arrangement of electrode and burette tip and improve stirring, see page 151. This is particularly important with very fast titration reactions and with steep curves.
Titration time is too long.	– Set higher "min.rate". – Set higher "max.rate". – Lower "dynamics".
Scatter in titration results is too great.	– Set "min.rate" lower.

2.2.6.2 Parameters for STAT

>control parameters	Control parameter
EP at pH OFF ** titr.	*Control point (input range depends on the measured quantity:* *pH: 0... ± 20.00, OFF* *U, Ipol: 0... ± 2000 mV, OFF* *Upol: 0... ± 200.0 uA, OFF)* <clear> sets "OFF".
dynamics 1 ** titr.	*Control range (input range depends on the measured quantity:* *pH: 0.01...20.00, OFF* *U, Ipol: 1...2000 mV, OFF* *Upol: 0.1...200.0 uA, OFF)* <clear> sets "OFF". "OFF" means largest control range, i.e. low reagent addition. Outside the control range, dispensing is performed continuously, see also page 37.
max.rate 10 ml/min ** titr.	*Maximum titration rate (0.01...150 mL/min, max.)* <clear> sets "max.". This parameter determines primarily the addition rate outside the control range, see also page 37. The maximum rate depends on the Exchange Unit: Exchange Unit — max. 5 mL — 15 mL/min 10 mL — 30 mL/min 20 mL — 60 mL/min 50 mL — 150 mL/min
min.rate 25.0 ul/min ** titr.	*Minimum titration rate (0.01...999.9 uL/min)* This parameter determines the addition rate in the range of the control point. Rule of thumb for "min.rate" in uL/min = (expected rate of the reaction in uL/min)/10.

>titration parameters	**Titration parameters**
start V: OFF	*Type of start volume (OFF, abs., rel.)* "OFF": start volume switched off "abs.": absolute start volume in mL "rel.": start volume relative to sample size.
start V 0.00 ml	If "abs." is set: *Absolute start volume (0...999.99 mL)*
factor 0	If "rel." is set: *Factor for the calculation of the relative start volume (0... ± 999 999).* Calculated as: start V in mL = factor * sample size
dos.rate max. ml/min **titr.	*Dispensing rate for the start volume (0.01...150 mL/min, max.)* <clear> sets "max.". The maximum rate depends on the Exchange Unit: Exchange Unit — max. 5 mL — 15 mL/min 10 mL — 30 mL/min 20 mL — 60 mL/min 50 mL — 150 mL/min
pause 0 s ** titr.	*Pause (0...999 999 s)* Waiting time, e.g. for equilibration of the electrode after the start or reaction time after the dispensing of a start volume. The equilibration time can be aborted with <QUIT>.
start time 0 s	*Start time (0...999 999 s)* Measured values will be acquired only after the start time has elapsed.
start pH OFF	*Start measured value (input range depends on the measured quantity:* *pH: 0... ± 20.00, OFF* *U, Ipol: 0... ± 2000 mV, OFF* *Upol: 0... ± 200.0 uA, OFF)* <clear> sets "OFF". Measured values will be acquired only after the start measured value has been reached.

start rate OFF	*Start rate (0.01...150 mL/min, OFF)* <clear> sets "OFF". Measured values will be acquired only if the current rate is below the start rate. This criterion effective 10 s after the start.
time interval 2 s	*Time interval (1...999 999 s)* Time interval for the entry of the values in the measuring point list. The measuring point list can contain max. 500 points.
titr.direction: auto	*Titration direction (+, –, auto)* auto: The direction is defined automatically by the Titrino (sign [U_{init} – EP]). +: In the direction of higher pH, higher voltage (more "positive"), larger currents. – : In the direction of lower pH, lower voltage, smaller currents.
meas.input: 1 or I(pol) 1 uA or U(pol) 400 mV electrode test: OFF	*Measuring input (1, 2, diff.)* Inquiry only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 152. With polarized electrodes, instead of the measuring input the *polarisation current (-127...127 uA)* or the *polarisation potential (-1270...1270 mV, in steps of 10 mV)* is inquired. *Electrode test (OFF, ON)* Test for polarized electrodes. Performed on changeover from the inactive standby state to a measurement. "OFF" means that the test is not performed.
temperature 25.0 °C	*Temperature (-170.0...500.0 °C)* If a T sensor is attached, the temperature is measured continuously and the pH values corrected accordingly. The value last measured is entered as the "temperature" parameter.

>stop conditions

Stop conditions
The condition which is met first will be effective.

stop time: OFF
**titr.

Type of stop time (abs.,rel., OFF)
"abs": absolute stop time in s
"rel.": stop time relative to sample size.
"OFF": stop time switched off. Stop time is not monitored.

stop time 999999 s
**titr.

If "abs." is set:
Absolute stop time (0...999 999 s)

factor 999999
**titr.

If "rel." is set:
Factor for the calculation of the relative stop time (0... ± 999 999)
Calculated as:
Stop time in s = factor * sample size

stop V: abs.
**titr.

Type of stop volume as a safety volume (abs., rel., OFF)
"abs.": absolute stop volume in mL.
"rel.": stop volume relative to sample size.
"OFF": stop volume switched off. Stop volume is not monitored.

stop V 99.99 ml
**titr.

If "abs." is set:
Absolute stop volume (0...9999.99 mL)

factor 999999
**titr.

If "rel." is set:
Factor for the calculation of the relative stop volume (0... ± 999 999)
Calculated as:
Stop V in mL = factor * sample size

stop rate OFF ml/min
**titr.

Stop rate (0.01...150 mL/min, OFF)
<clear> sets "OFF".
Stop if the current rate is below the stop rate.
This criterion becomes effective 10 s after start.

filling rate max. ml/min
**titr.

Filling rate (0.01...150 mL/min, max.)
<clear> sets "max.".
The maximum rate depends on the Exchange Unit:

Exchange Unit	max.
5 mL	15 mL/min
10 mL	30 mL/min
20 mL	60 mL/min
50 mL	150 mL/min

>statistics	**Statistics calculations** Mean value, absolute and relative standard deviation, see also page 62.
status: OFF	*ON/OFF switching of statistics calculations (OFF, ON).* If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.
mean n= 2	*Mean value calculation from n single results (2...20)*
res.tab: original	*Result table for the statistics (original, delete n, delete all)* "original": The original table is used. Deleted individual results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete n= 1	*Index n of the result to be deleted (1...20)* The deleted result is removed from the statistics calculation.
>evaluation	**Evaluation** see also page 39.
low lim. OFF s up lim. OFF s	*Time window for the evaluation of rates (0...999 999 s, OFF)* Up to 9 time windows in which a rate should be calculated. The rates are available for calculations as C8X. For the calculation of a rate, the measuring point list in the time window must contain at least 4 points. If no point falls on the window limits, the next outer one is used.
fix V1 OFF s	*Interpolation of the volume at a preset time (0...999 999 s, OFF)* Up to 9 fix V. The associated volumes are available for calculations as C5X.
fix time 1 OFF V(tot)	*Interpolation of the time at a preset volume (0.01 ... 1.00, OFF)* The volume is entered as a fraction of the final volume, e.g. 0.25 = 25% of the final volume. Up to 9 fix times. The associated times are available for calculations as C6X.

Monitoring of limit values
Limit value violations are marked in the measuring point list.

Measured value monitoring (ON, OFF)
With "on" follow the requests:

**titr.

**titr.

Limit values for the measured value (input range depends on the measured quantity):
pH: 0... ± 20.00
U, Ipol: 0... ± 2000 mV
Upol: 0... ± 200.0 uA)

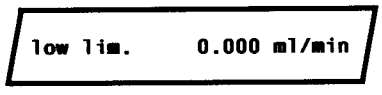
**titr.

**titr.

Action if the limits are violated (end, hold, wait, none)
end: Abort.
hold: Hold reagent addition until restarted manually.
wait: Hold reagent addition until limits are again complied with, then automatically continue.

Monitoring of the reagent addition rate (ON, OFF)
With "on" follow the requests:

**titr.



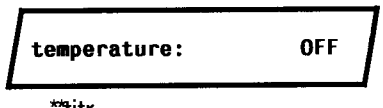
Limit values (0.000...150 mL/min)

**titr.

Action if the limits are violated (end, hold, wait, none)
end: Abort.
hold: Hold reagent addition until restarted manually.
wait: Hold reagent addition until limits are again complied with, then automatically continue. If the lower limit has been violated, "wait" is senseless as the rate will only become less during the wait time!

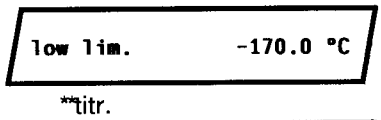
**titr.

**titr.



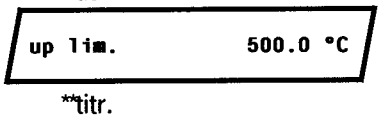
Monitoring of the temperature (ON, OFF)
With "on", the following requests:

**titr.



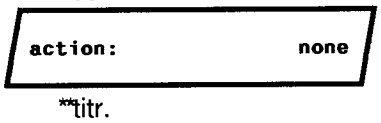
Limit values (-170.0...500.0° C)

**titr.



Action if the limits are violated (end, hold, wait, none)
end: Abort.
hold: Hold reagent addition until restarted manually.
wait: Hold reagent addition until limits are again complied with, then automatically continue.

**titr.

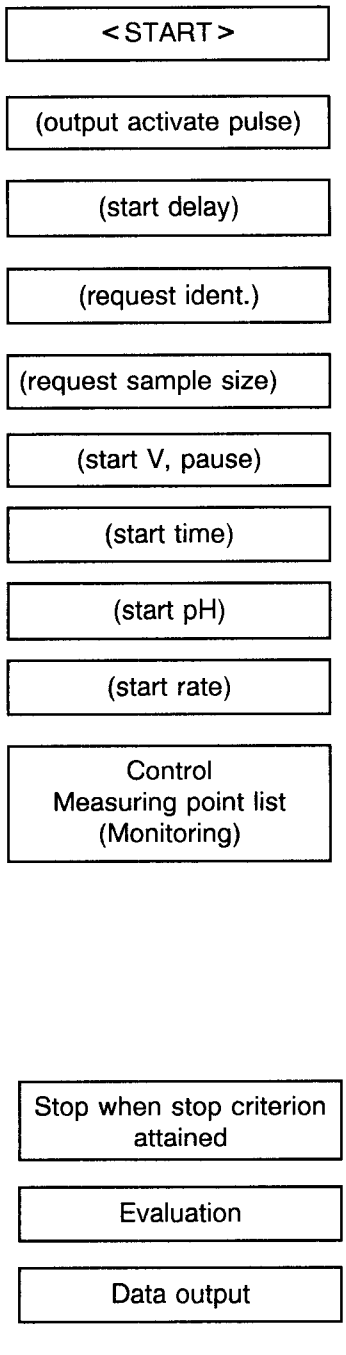


**titr.

assign output: none **titr.	*Assignment of the output to a monitoring value (meas, temp, rate, all, none)* A signal can be outputted at L4 output (pin 3) of the remote socket if a limit value has been violated.
L4 output: pulse **titr.	*Type of signal at L4 output (active, pulse) of the remote socket:* active: Output line is set to 0 V. pulse: Pulse > 100 ms. Important: An output which is already active will be set to inactive by a pulse!
>preselections	**Preselections for the sequence**
req.ident: OFF	*Inquiry of sample identifications after the start of the titration (id1, id 1 &id2, all, OFF)* After the start, sample identifications can be inquired automatically: Only id1, id1 &id2, all three id's or no inquiries.
req.smpl size: OFF	*Inquiry of sample size after the start of the titration (value, unit, all, OFF)*
display rate: OFF	*Display current rate during the sequence (ON, OFF)* The rate is displayed instead of the temperature.
activate pulse: OFF	*Output pulse on the line "activate" of the remote socket (first, all, cond., OFF)* see page 161.

Sequence with STAT

The start of the sequence depends on the application and can be configured with the following parameters (see schematic representation below):
- Start delay (setting under <configuration>, >auxiliaries).
- Request of the sample identifications and the sample size following titration start



After the start, the activate pulse is outputted and the start delay time allowed to elapse.

After the request of "ident" and "smple size", the start conditions are processed.

During dispensing of the start volume, no control is effected. The pause time is then allowed to elapse. During dispensing of the start volume and the pause time, the limit values are not checked.

The other start conditions are now processed in the same order as their input. Control is effected, but no measured points are entered into the measuring point list.
The limit values are checked when the monitoring is switched on.

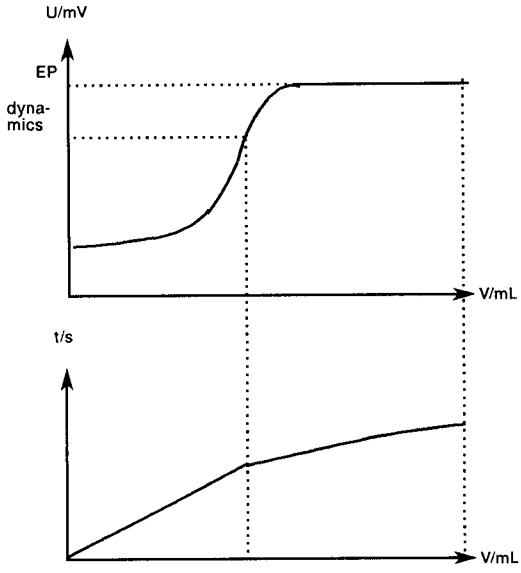
Once the start conditions have been met, measured points (time, volume) are entered in the measuring point list. If the monitoring of the measured value and/or the temperature is active, these values are also entered in the measuring point list. Violations of the limit values are marked in the measuring point list.
The temperature is measured continuously, i.e. a T measurement is carried out every 2 s; the slope of pH electrodes is corrected. If no T sensor is connected, only measured values are recorded (without interruption by the temperature measurement) and the temperature set manually applies.

Stop is effected after the first stop criterion has been reached (time, volume, rate).

The measuring point list forms the basis for the evaluation and graphics.

Finally, the data are outputted. If a printer is connected, see page 64.

Control parameters



Dispensing outside the control range (dynamics):
Here, the principal determining factor for the addition rate is the "max.rate".
Optimise "max.rate" and "dynamics" together so that overshooting of the titration is kept to a minimum on run-up.
Select dynamics (control range) such that the measured value is within the control range when held. With slow reactions, set dynamics rather large, e.g. ΔpH = 3 or ΔU = 180 mV .
In many cases, the control point is reached with a SET pretitration so that dynamics is not a critical parameter.

Dispensing within the control range:
Here, the principal determining factor for the addition rate is "min.rate".
Rule of thumb for "min.rate": "min.rate" in uL/min = (Expected rate of the reaction in uL/min)/10.

How to proceed if ...

Problem	Possible causes and corrective action
Adherence to the control point is not good. The measured value is too high, then too low. "The controller oscillates".	– Set "max.rate" and possibly also "min.rate" lower. – Set "dynamics" larger. – Is the stirring efficiency adequate? – Arrange electrode and burette tip properly, see page 151. – Are the tubing lengths kinked? – Possibly use Exchange Unit with a small cylinder volume (smaller volume increment per pulse).
Time to attainment of the control point is too long.	– Set "dynamics" smaller. – Set "min.rate" higher. – Set "max.rate" higher.

Measuring point list and monitoring

General information on measuring point list:

- Measured points are entered in the measuring point list at the preset time interval.
- If one (or more) entries appear in the time during refilling, one measured point is entered immediately after the refilling. The time reference otherwise remains unchanged, however.
- If the stop time occurs within the refilling time period, after filling one measured point is entered and only then is the determination stopped.
- The measuring point list always includes the values time and volume. If monitoring of measured values and/or temperature is active, the corresponding values are also entered.
- The "mess." column shows a message if a limit value was violated in the last time interval, see example below. "*" is used to mark when the dispensing was interrupted, e.g. owing to refilling, action "wait" or "hold" on limit value violation or manual <hold>.
- The volume of the last measured point entry can differ from the final volume as time may have elapsed between the last entry and the actual stop.
  The final volume is available as variable C41 and can be used to calculate results.

Example of a measuring point list. Monitoring of measured value and temperature active.

```
 'mp
718 STAT Titrino   OP1/101      718.0010
date 1998-09-27  time  08:54          14
pH(init)      7.42     STAT pH  ********
smpl size   1.0021 g
t/s           V/ml       pH   T/°C mess.
0           0.0000    7.434   35.5 limit   <-- More than 1 limit value was violated.
30          0.9140    3.039   35.7 limit
60          1.0010    3.056   36.0 temp.   <-- Temperature limit value was violated.
90          1.0780    3.022   36.2
120         1.1470    2.972   36.4 meas    <-- pH limit value was violated.
150         1.2250    3.018   36.5 *       <-- The dispensing was interrupted.
:
:
```

Evaluation

Rates C8X

The rates are calculated by linear regression.
C80 is the mean rate over all points of the measuring point list.
C8X (9≤X>0) are the rates in the specified time windows. At least 4 points are necessary for an evaluation. If the limit of the time window does not coincide with a current measured point, the next outer is taken as the limit, see example below.
In monitoring, neither "wait" nor "hold" should be used as an action as otherwise the resulting volume/time curve is no longer linear. The linear regression of such a curve then results in high standard deviations.

Fix volume C5X

The associated volume at a specified time is interpolated from the measuring point list.

Fix time C6X

The associated time at a specified volume is interpolated from the measuring point list. The volume is entered as a fraction of the total dispensed volume. If the volume remains constant over several measured points, the last associated time value is taken.
The fix time for 1.0 V(tot) is evaluated after the final volume.

Example:

```
 'mp
718 STAT Titrino   OP1/101     718.0010
date 1998-09-27  time  08:54         14
pH(init)      7.42    STAT pH  ********
smpl size   1.0021 g
t/s            V/ml       pH   T/°C mess.
0            0.0000    7.434   35.5
30           0.9140    3.039   35.7      <--
60           1.0010    3.056   36.0
90           1.0780    3.022   36.2
120          1.1470    2.972   36.4      <--
150          1.2250    3.018   36.5
:
:
1560         6.3290    2.994   37.0
1590         6.3290    2.998   37.0
1620         6.3290    2.998   37.0
1650         6.3290    2.998   37.0      <--
1680         6.3465    2.975   37.0
:
```

Specified time window for the rate calculation: 40...100 s.
Measured points used for the regression: 30...120 s

Fix time: 0.8 V(tot) → 1650 s

2.2.6.3 Parameters for DOS

>dosing parameters	**Dosing parameters**
dispensing type: volume	*Type of dosing (volume, time, rate)* Main parameters. Two parameters of the equation "rate = volume/time" are specified, the third is calculated. The request which appears depends on the type of dosing selected:
volume 10.00 ml	*Volume (0...99 999.99 mL)*
disp.time 100 s	*Dispensing time (1...999 999 s)* Dispensing time only. Wait times, e.g. for refilling are not included.
rate max. ml/min	*Rate (0.001...150 mL/min, max.)*
disp.crit: rate	*Dispensing criterion (volume, time, rate)* Selection of the second dispensing parameter. The request which appears depends on the dispensing criterion selected.
pause 0 s ** titr.	*Pause (0...999 999 s)* Wait time, e.g. for stabilisation of the electrode after the start. The wait time can be aborted with <QUIT>.
time interval 10 s	*Time interval (1...999 999 s)* Time interval for the entry of the values in the measuring point list. The measuring point list can contain max. 500 points.
temperature 25.0 °C	*Temperature (-170.0...500.0 °C)* If a T sensor is connected, the temperature is measured continuously and the pH values corrected accordingly. The value last measured is entered as the "temperature" parameter. Without a T sensor, the temperature entered manually applies.

>stop conditions

Stop conditions
If a stop is not made after the dispensing time or after the dispensed volume.

stop V: OFF

**titr.

Type of stop volume as safety volume (abs., rel., OFF)
"abs": absolute stop volume in mL
"rel.": stop volume relative to sample
"OFF": stop volume switched off, not monitored.
If "abs." is set:
Absolute stop volume (0...99 999.99 mL)
If "rel." is set:
Factor for the calculation of the relative stop volume (0... ± 999 999)
Calculated using:
Stop V in mL = factor * sample size

stop V 99.99 ml

**titr.

factor 999999

**titr.

filling rate max. ml/min

**titr.

Filling rate (0.01...150 mL/min, max.)
<clear> sets "max".
The maximum rate depends on the Exchange Unit:

Exchange Unit	max.
5 mL	15 mL/min
10 mL	30 mL/min
20 mL	60 mL/min
50 mL	150 mL/min

>statistics

Statistics calculations
Mean value, absolute and relative standard deviation, see also page 62.

status: OFF

Switch statistics calculations on/off (OFF, ON)
If the statistics calculation is switched off, the following requests regarding the statistics do not appear.

mean n= 2

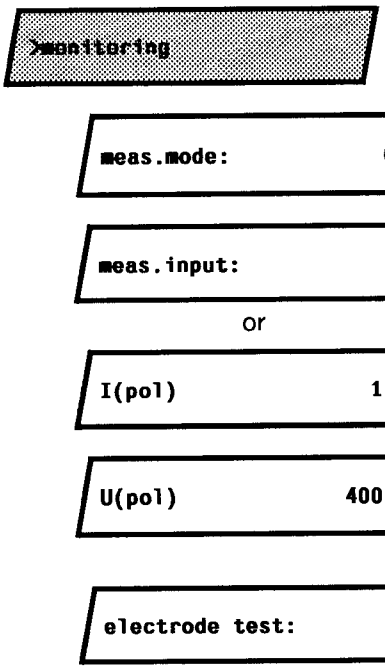
Mean value calculation from n individual results (2...20)

res.tab: original

Result table for the statistics (original, delete n, delete all)
"original": The original table is used. Deleted individual results are reincorporated in the evaluation.
"delete n": Deletes individual results with the index n.
"delete all": The entire table is deleted.

delete n= 1

Index n of the result to be deleted (1...20)
The deleted result is removed from the statistics calculation.



Monitoring of limit values
Limit value violations are marked in the measuring point list.

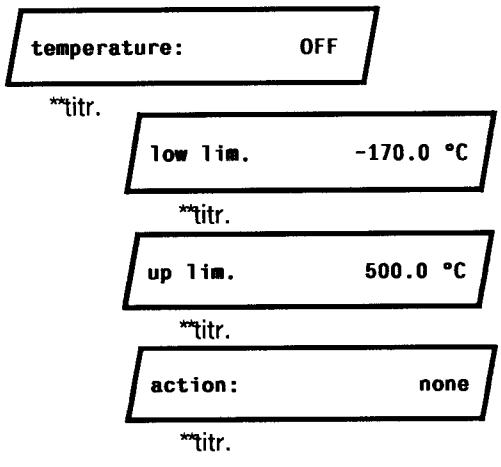
Measurement mode (pH, U, Ipol, Upol, OFF)
Measurement mode for monitoring.

Measurement input (1, 2, diff.)
Request only with measurement modes pH and U. Measurement input 1 or 2 or differential amplifier; connection of electrodes, see page 152.

With polarised electrodes, the request of the measurement input is replaced by one regarding the
polarisation current (-127...127 uA),
or the
polarisation voltage (-1270...1270 mV, in steps of 10 mV)
Electrode test (OFF, ON)
Test for polarised electrodes. Performed on the switchover from inactive basic status to a measurement. "OFF" means the test is not performed.

Limit values for the measured value (input range depends on the measured quantity:
pH: 0... ± 20.00
U, Ipol: 0... ± 2000 mV
Upol: 0... ± 200.0 uA)

Action if limits violated (end, hold, wait, none)
end: Abort
hold: Hold reagent addition until restarted manually.
wait: Hold reagent addition until limits are again complied with, then automatically continue.



Monitoring of the temperature (ON, OFF)
With "on", the following requests:

Limit values (-170.0...500.0° C)

Action if the limits are violated (end, hold, wait, none)
end: Abort.
hold: Hold reagent addition until restarted manually.
wait: Hold reagent addition until limits are again complied with, then automatically continue.

assign output: none **titr.	*Assignment of the output to a monitoring value (meas, temp, all, none)* A signal can be outputted at L4 output (pin 3) of the remote socket if a limit value has been violated.
L4 output: pulse **titr.	*Type of signal at L4 output (active, pulse) of the remote socket:* active: Output line is set to 0 V. pulse: Pulse > 100 ms. Important: An output which is already active will be set to inactive by a pulse!
>preselections	**Preselections for the sequence**
req.ident: OFF	*Inquiry of sample identifications after the start of the titration (id1, id1 & id2, all, OFF)* After the start, sample identifications can be inquired automatically; Only id1, id1 & id2, all three id0s or no inquiries.
req.smpl size: OFF	*Inquiry of sample size after the start of the titration (value, unit, all, OFF)* .
activate pulse: OFF	*Output pulse on the line "Activate" (L6, Pin1) of the remote socket (ON, OFF)* see page 161.

Sequence with DOS

The start of the sequence depends on the application and can be configured with the following parameters (see schematic representation below):
- Start delay (setting under <configuration>, >auxiliaries)
- Request of the sample identifications and the sample size following the start

<START>	
(output activate pulse)	After the start, the activate pulse is outputted and the start delay time allowerde to elapse.
(start delay)	
(request ident.)	After the request of "ident" and "smpl size", dispensing is started.
(request sample size)	
(pause)	The pause time is allowerde to elapse. Limit values are not yet checked.
Dosing Measuring point list (Monitoring)	During the dispensing, measured points (time, volume) are entered into the measuring point list. If monitoring of measured values and/or the temperature is active, these values are also entered in the measuring point list. Violations of the limit values are marked in the measuring point list. If a T sensor is connected, the temperature is measured continuously (a T measurement every 2 s) and the slope of pH electrodes is corrected. If no T sensor is connected, the temperature set manually applies. Stop is effected when the dispensed volume (or stop volume) or the dispensing time) has been reached.
Data output	Finally, the data are outputted. If a printer is connected, see page 64. The measuring point list forms the basis for the graphics.

If dispensing is performed based on time and rate, the dispensed volume is zeroed at 99 999.99 mL and dispensing is continued.

Filling times

Refilling times are not incorporated by theTitrino in the calculation of the rate. The filling times can be calculated using the following formula:

$$\text{Filling time in s} = \frac{\text{Max. filling rate}}{\text{Current filling rate}} * 20\ \text{s} + 3\ \text{s}$$

The max. filling rate depends on the Exchange unit installed, see page 41. The filling times (incl. stopcock rotation) can be estimated with the aid of the following Table and taken into account in your dispensing routine:

Exchange Unit	Filling rate "max."	Filling rate "100 mL/min"	Filling rate "50 mL/min"	Filling rate "10 mL/min"
5 mL	23 s	–	–	33 s
10 mL	23 s	–	–	63 s
20 mL	23 s	–	27 s	123 s
50 mL	23 s	33 s	63 s	303 s

Example:
Dispensing of 1 l reagent is required over a period of 1 hour with a 50 mL Exchange unit.
Calculate the rate to be set.

Dispensing time = 60 min.
Dispensed volume = 1000 mL
Filling time = 23 s (filling rate = max.)
Volume of the Exchange Unit = V(B) = 50 mL

Number of refills = Dispensed volume/V(B) = 1000/50 = 20

If this division does not result in a remainder, the last filling is no longer a "refilling" and must be deducted. In our example, 19 refills are required. During this time, dispensing is not performed, i.e. the actual dispensing time is 3600 s – 19 * 23 s = 3163 s = 52.717 min.

The dispensing rate is thus given by 1000 mL/52.717 min = 18.972 mL/min

Summary in a formula:

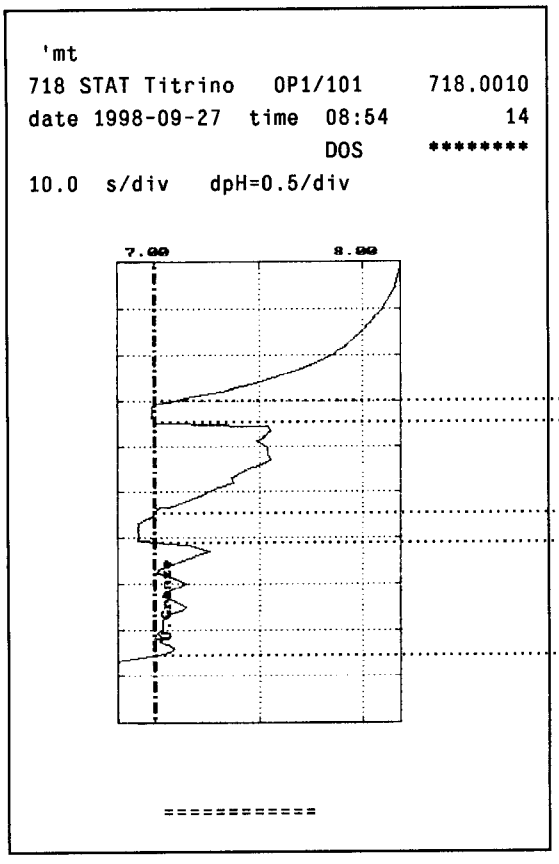
$$\text{Rate} = \frac{\text{Dispensed volume}}{\text{Dispensing time} - \text{refilling} * \text{filling time} * 1/60} = \frac{1000}{60 - 19 * 23 * 1/60} = 18.972 \text{ mL/min}$$

Measuring point list and monitoring

- Measured points are entered in the measuring point list at the preset time interval.
  The inputted times represent the clock time. This must be distinguished from the dispensing time: The dispensing time does not include any wait times which can arise in refilling, hold or wait as a result of limit value violations.
- If one (or more) entries occur in the time during refilling, one measured point is entered immediately after the refilling. The time reference otherwise remains unchanged, however.
- The measuring point list always includes the values "time" and "volume". If monitoring of measured values and/or temperature is active, the corresponding values are also entered.
- The "mess." column shows a message if a limit value was violated in the last time interval, see page 38. "*" is also used in this column to mark when the dispensing was interrupted: refilling, action "wait" or "hold" on limit value violation or manual <hold>.
- The volume of the last measured point entry can differ from the final volume as time may have elapsed between the last entry and the actual stop.

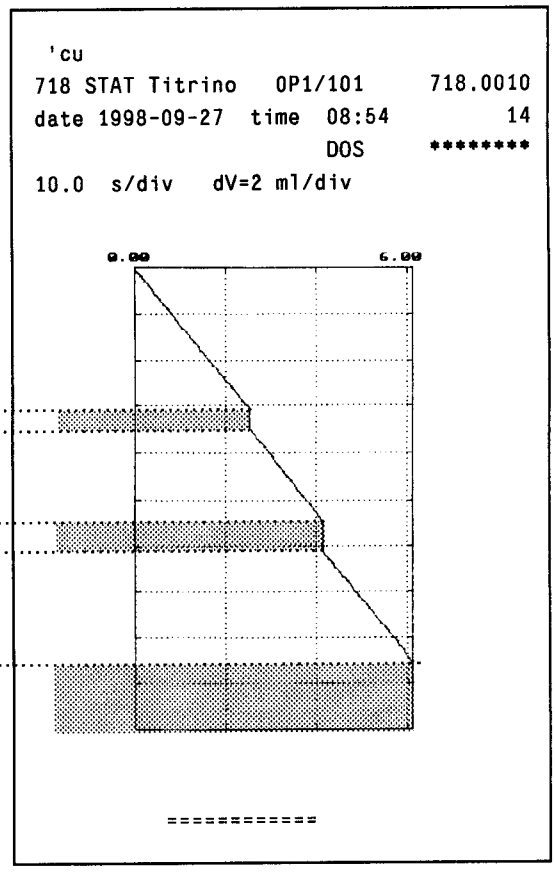
The values from the measuring point list can be shown graphically. Example: Profile of the pH value during a dispensing with the "wait" action.

Curve pH vs Time ("meas crv")



Action: wait

Curve Volume vs Time ("curve")



2.2.6.4 Parameters for DOC

>dosing parameters	**Dosing parameters**
begin at init	*Start of the measured value for the beginning of dosing (input range depends on the measured quantity:* *pH: 0... ± 20.00, init* *U, Ipol: 0... ± 2000 mV, init* *Upol: 0... ± 200.0 uA, init)* <clear> sets "init" = initial measured value.
end at OFF	*Final measured value (input range depends on the measured quantity:* *pH: 0... ± 20.00, OFF* *U, Ipol: 0... ± 2000 mV, OFF* *Upol: 0... ± 200.0 uA, OFF)* <clear> sets "OFF"
sweep time 300 s	*Sweep time for measured value (0...999 999 s)* The change in the set measured value from the initial to the final value within the sweep time is linear.
dynamics 0.25 ** titr.	*Dynamics (input range depends on the measured quantity:* *pH: 0...20.00, OFF* *U, Ipol: 0... ± 2000 mV, OFF* *Upol: 0... ± 200.0 uA, OFF)* <clear> sets "OFF". "OFF" means largest control range (dynamics), i.e. slow reagent addition. Outside the control range, dispensing is performed continuously, see also page 53.
max.rate max. ml/min ** titr.	*Maximum addition rate (0.01...150 mL/min, max)* <clear> sets "max.". This parameter primarily determines the addition rate outside the control range, see also page 53. The maximum rate depends on the Exchange Unit: Exchange Unit — max. 5 mL — 15 mL/min 10 mL — 30 mL/min 20 mL — 60 mL/min 50 mL — 150 mL/min
min.rate 5.0 ul/min ** titr.	*Minimum possible addition rate (0.01...999.9 uL/min)* This parameter determines the addition rate within the control range.

Direction of the measured value ramp (+ , –, auto)

auto: The direction is automatically defined by the Titrino [U_{init} -U_{end}]).

+ : In the direction of higher pH, higher voltage (more "positive"), higher current.s

– : In the direction of lower pH, lower voltage, lower currents.

The direction is used only when "init" has been selected as start value.

Type of start volume (OFF, abs., rel.)

"OFF": start volume switched off

"abs": absolute start volume in mL

"rel.": start volume relative to sample

If "abs." is set:

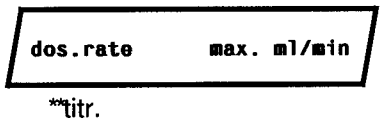
Absolute start volume (0...999.99 mL)

If "rel." is set:

Factor for the calculation of the relative start volume (0... ± 999 999)

Calculated using:

Start V in mL = factor * sample size



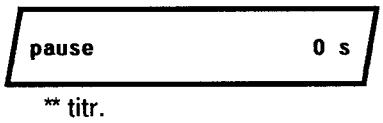
**titr.

Rate for the start volume (0.01...150 mL/min, max.)

<clear> sets "max.".

The maximum rate depends on the Exchange Unit:

Exchange Unit	max.
5 mL	15 mL/min
10 mL	30 mL/min
20 mL	60 mL/min
50 mL	150 mL/min



** titr.

Pause (0...999 999 s)

Wait time, e.g. for stabilisation of the electrode after the start or reaction time after the dispensing of a start volume. The wait time can be aborted with <QUIT>.

Time interval (1...999 999 s)

Time interval for the entry of the measured values in the measuring point list. The measuring point list can contain max. 500 points.

meas.input: 1 or I(pol) 1 uA or U(pol) 400 mV electrode test: OFF	*Measuring input (1, 2, diff.)* Request only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 152. With polarised electrodes, the request of the measuring input is replaced by one regarding the *polarisation current (-127...127 uA),* or the *polarisation voltage (-1270...1270 mV, in steps of 10 mV)* *Electrode test (OFF, ON)* Test for polarised electrodes. Performed on the switchover from the inactive basic status to a measurement. "OFF" means the test is not performed.
temperature 25.0 °C	*Temperature (-170.0...500.0 °C)* If a T sensor is connected, the temperature is measured continuously and the pH values corrected accordingly. The value last measured is entered as the "temperature" parameter.
>stop conditions	**Conditions for stop**
stop V: abs. **titr.	*Type of stop volume as safety volume (abs., rel., OFF)* "abs": absolute stop volume in mL "rel.": stop volume relative to sample size. "OFF": stop volume switched off, not monitored.
stop V 99.99 ml **titr.	If "abs." is set: *Absolute stop volume (0...9999.99 mL)*
factor 999999 **titr.	If "rel." is set: *Factor for the calculation of the relative stop volume (0... ±999 999)* Calculated using: Stop V in mL = factor * sample size
filling rate max. ml/min **titr.	*Filling rate (0.01...150 mL/min, max.)* <clear> sets "max.". The maximum rate depends on the Exchange Unit: Exchange Unit — max. 5 mL — 15 mL/min 10 mL — 30 mL/min 20 mL — 60 mL/min 50 mL — 150 mL/min

>statistics

Statistics calculations
Mean value, absolute and relative standard deviation, see also page 62.

status: OFF

Switch statistics calculations on/off (OFF, ON)
If the statistics calculation is switched off, the following requests regarding the statistics do not appear.

mean n= 2

Mean value calculation from n individual results (2...20)

res.tab: original

Result table for the statistics (original, delete n, delete all)
"original": The original table is used. Deleted results are reincorporated in the evaluation.
"delete n": Deletes individual results with the index n.
"delete all": The entire table is deleted.

delete n= 1

Index n of the result to be deleted (1...20)
The deleted result is removed from the statistics calculation.

>monitoring

Monitoring of limit values
Limit value violations are marked in the measuring point list.

meas.val: OFF

Measured value monitoring (ON, OFF)

**titr.

low lim.pH -20.00

**titr.

up lim.pH 20.00

Limit values for the measured value (input range depends on measured quantity:
pH: 0... ± 20.00
U, Ipol: 0... ± 2000 mV
Upol: 0... ± 200.0 uA)

**titr.

action: none

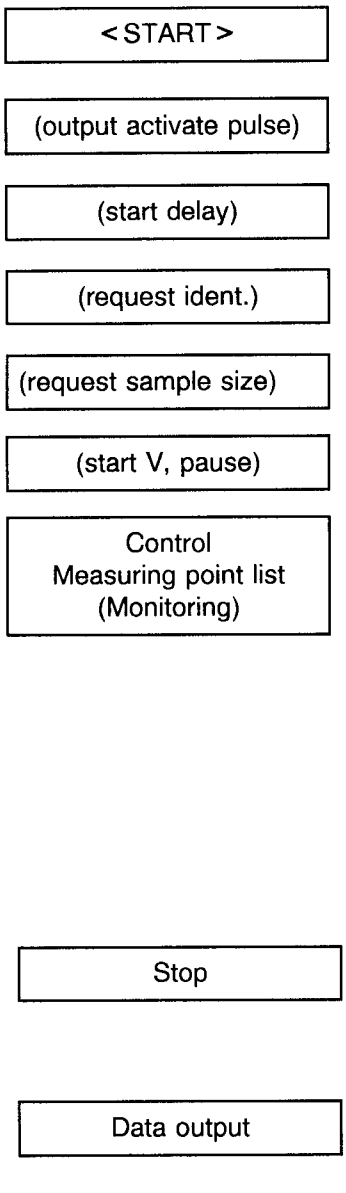
Action if limits violated (end, hold, wait, none)
end: Abort
hold: Hold reagent addition until restarted manually.
wait: Hold reagent addition until limits are again complied with, then automatically continue.

**titr.

temperature: OFF **titr. low lim. -170.0 °C **titr. up lim. 500.0 °C **titr. action: none **titr.	*Monitoring of the temperature (ON, OFF)* *Limit values (-170.0...500.0 °C)* *Action if the limits are violated (end, hold, wait, note)* end: Abort hold: Hold reagent addition until restarted manually. wait: Hold reagent addition until limits are again complied with, then automatically continue.
assign output: none **titr. L4 output: pulse **titr.	*Assignment of the output to a monitoring value (meas, temp, all, none)* A signal can be outputted at L4 output (pin 3) of the remote socket if a limit value has been violated. *Type of signal at L4 output (active, pulse) of the remote socket:* active: Output line is set to 0 V. pulse: Pulse >100 ms. Important: An output which is already active will be set to inactive by a pulse!
>preselections	**Preselections for the sequence**
req.ident: OFF	*Request of sample identifications after the start (id1, id1 & 2, all, OFF)* After the start sample identifications can be requested automatically: Only id1, id 1 & 2, all three ids or no requests.
req.smpl size: OFF	*Request of sample size after the start (value, unit, all, OFF)* With "all" first the value, the the unit is requested.
display rate : OFF	*Display current rate during the sequence (ON, OFF)* The rate is displayed instead of the temperature.
activate pulse: OFF	*Output pulse at output "Activate" (L6, pin 1) of the remote socket (ON, OFF)* see page 161.

Sequence with DOC

The start of the sequence depends on the application and can be configured with the following parameters (see schematic representation below):
- Start delay (setting under <configuration>, >auxiliaries)
- Request of the sample identifications and the sample size following titration start



After the start, the activate pulse is outputted and the start delay time allowed to elapse.

After the request of "ident" and "smpl size", the start conditions are processed.

During the dispensing of the start volume, no control is exerted. The pause time is then allowed to elapse. The limit values are not checked during the dispensing of the start volume and during the pause time.

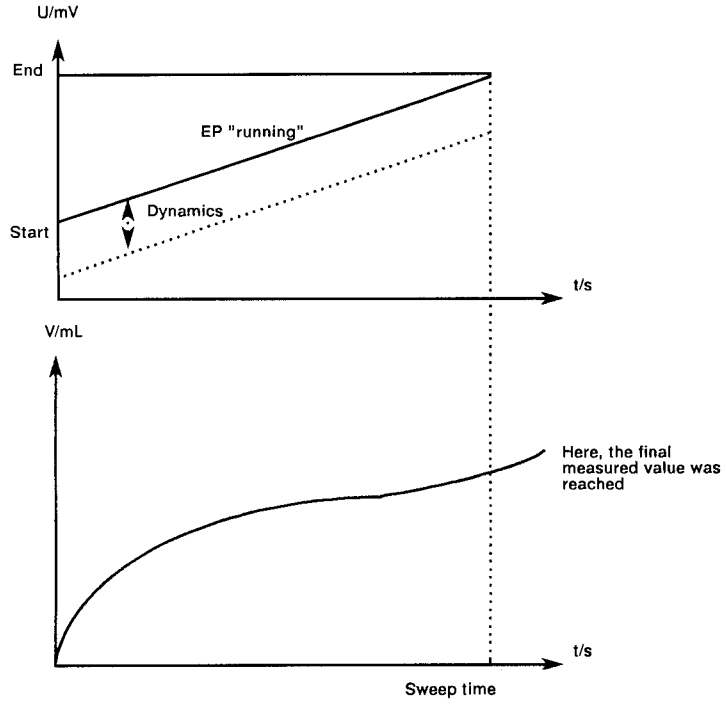
The control starts. Measured points (time, volume) are entered in the measuring point list. Limit values are checked if monitoring is active and the measured values and/or the temperature entered in the measuring point list. Violations of the limit values are marked in the measurement point list.
The temperature is measured continuously, i.e. a T measurement is carried out every 2 s. If no T sensor is connected, only measured values are recorded (without interruption by the temperature measurement) and the temperature set manually holds.

Stop is effected when the measured value ramp has been swept, i.e. when the sweep time is reached. If the measured value monitoring is active, the current measured value must also have attained the end of the ramp.

Finally, the data are outputted. If a printer is connected, see page 64.
The measuring point list forms the basis for the graphics.

Measured value ramp

In DOC the set value of a measured quantity is changed linearly from a start value to a final value during a preset sweep time (measured value gradient). The reagent addition is so controlled that the current measured value follows the nominal value. DOC is stopped when the sweep time is at an end and (if the measured value monitoring is active) when the current measured value corresponds to the end of the ramp.
The control deviation nominal-actual value can be kept very small by a suitable choice of parameters and reagent concentration.



- If the current measured value lies outside the control range, the reagent addition rate is determined primarily by the parameter "max.rate".
- If the current measured value lies within the control range, the reagent addition rate is determined primarily by the parameter "min.rate".

If a T sensor is connected, the temperature is measured continuously and pH values compensated accordingly.

Measuring point list and monitoring

- Measured points are entered in the measuring point list at the preset time interval.
  The inputted times represent the clock time. This must be distinguished from the dispensing time: The dispensing time does not include any wait times which can arise in refilling, hold or wait as a result of limit value violations.
- If one (or more) entries occur in the time during refilling, one measured point is entered immediately after the refilling. The time reference otherwise remains unchanged, however.
- The measuring point list always includes the values "time" and "volume". If monitoring of measured values and/or temperature is active, the corresponding values are also entered.
- The "mess." column shows a message if a limit value was violated in the last time interval, see example of a measured point list on page 38. "*" is also used in this column to mark when the dispensing was interrupted: refilling, action "wait" or "hold" on limit value violation or manual <hold>.
- The volume of the last measured point entry can differ from the final volume as time may have elapsed between the last entry and the actual stop.

2.2.6.5 Parameters for MEAS

>measuring parameters	Measurements parameters
signal drift OFF mV/min	*Drift for the measured value acquisition (input range depends on the measured quantity:* *pH, U, Ipol: 0.5...999 mV/min, OFF* *Upol: 0.05...99.9 uA/min, OFF* *T: 0.5...999 °C/min, OFF)* <clear> sets "OFF". "OFF" means that the measured value is acquired after a fixed equilibration time.
equilibr.time OFF s	*Equilibration time (0...9999 s, OFF)* <clear> sets "OFF". If no new equilibration time has been entered, the Titrino calculates an equilibration time appropriate to the drift with the formula $\text{equilibr.time (in s)} = \frac{150}{\sqrt{\text{drift} + 1}} + 5$ The measured value is acquired when the first criterion (drift or time) is met. With drift and time "OFF", you will have an "infinite" measurement.
meas.input: 1 or I(pol) 1 uA or U(pol) 400 mV	*Measuring input (1, 2, diff.)* Inquiry only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 152. With polarized electrodes, instead of the measuring input the *polarisation current (-127...127 µA)* or the *polarisation potential (-1270...1270 mV, in steps of 10 mV)* is inquired.
electrode test: OFF	*Electrode test (OFF, ON)* Test for polarized electrodes. Performed on changeover from the inactive standby mode to a measurement. "OFF" means that the test is not performed.
temperature 25.0 °C	*Measurement temperature (-170.0...500.0C).* The temperaturte is measured at the the start if a T sensor is connected. This parameter is used for temperature compensation in pH measurements.

>statistics	**Statistics calculations** Mean value, absolute and relative standard deviation, see also page 62.
status: OFF	*ON/OFF switching of statistics calculations (OFF, ON).* If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.
mean n= 2	*Mean value calculation from n single results (2...20)*
res.tab: original	*Result table for the statistics (original, delete n, delete all).* "original": The original table is used. Single deleted results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete n= 1	*Index n of the result to be deleted (1...20).* The deleted result is removed from the statistics calculation.
>preselections	**Preselections for the sequence**
req.ident: OFF	*Inquiry of sample identifications after the start (id1, id1 & id2, all, OFF)* After the start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size: OFF	*Inquiry of sample size after the start (value, unit, all, OFF)*
activate pulse: OFF	*Output pulse on the line "Activate" (L6, Pin1) of the remote socket (ON,OFF)* see page 161.

2.2.6.6 Parameters for CAL

>calibration parameters	Calibration parameters
meas.input: 1	*Measuring input (1, 2, diff.)* Measuring input 1 or 2 or differential amplifier; Connection of electrodes, see page 152.
cal.temp. 25.0 °C	*Calibration temperature (-20.0 ... 120.0 °C)* The calibration temperature can also be inputted during the calibration sequence.
buffer 1 pH 7.00 buffer 2 pH 4.00 buffer 3 pH OFF	*pH value of first buffer (0... ± 20.00)* The pH value of the buffers can also be inputted during the calibration sequence. *pH value of second and the following buffers (0... ± 20.00, OFF)* <clear> sets "OFF". Buffers are requested until "OFF" is set. This gives an n-point calibration. Up to 9 buffers.
signal drift 2 mV/min	*Drift for measured value acquisition (0.5...999 mV/min, OFF)* <clear> sets "OFF". "OFF" means that the measured value is acquired after an equilibration time.
equilibr.time 110 s	*Equilibration time (0...9999 s, OFF)* <clear> sets "OFF". If a new equilibration time has not been entered, the Titrino calculates an equilibration time appropriate to the drift, see page 54. The measured value is acquired as soon as the first criterion (drift or time) has been met. If drift and time are both set to "OFF", the measured value acquisition is immediate.
electr.id	*Electrode identification (up to 8 characters).*
sample changer cal: OFF	*Calibration with sample changer (ON, OFF)* In calibrations with a sample changer, there are no hold points in the calibration sequence for inputs. Calibration temperature and pH values of the buffers (which are temperature dependent) must therefore be entered in advance.
activate pulse: OFF	*Output pulse on the line "activate" (L6, Pin 1) of the remote socket (all, first, OFF)* See pages 161, 162.

>statistics	**statistics** see page 62

Calibration sequence

Immerse electrode in first buffer solution.

<START>	Start calibration.
(Output activate pulse)	Before the calibration, possibly an activate pulse is outputted and a start delay is waited out.
(Start delay)	(Setting in <configuration>, >auxiliaries)
Measure cal. temp. or input cal. temp.	Then the calibration temperature is measured or if no temperature sensor is connected, it must be entered. Confirm value with <enter> or advance with <START>.
Buffer 1 pH	Entry of the pH value of the 1st buffer. Accept value with <enter> or advance with <START>.
Measure buffer 1	The first buffer is measured.
Buffer 2 pH	Entry of the pH value of the 2nd buffer. Accept value with <enter> or advance with <START>. or quit the calibration with <STOP> → 1-point calibration.
(Measure buffer 2)	The second buffer is measured.
etc.	As many buffers appear as have been specified under the <parameters> key (up to 9). The calibration can be terminated at any time with <STOP>.
Data output	The calibration data appear in the display. If you have a printer connected, see page 64.

The calibration data are available for calculation:
C46: pHas
C47: Electrode slope

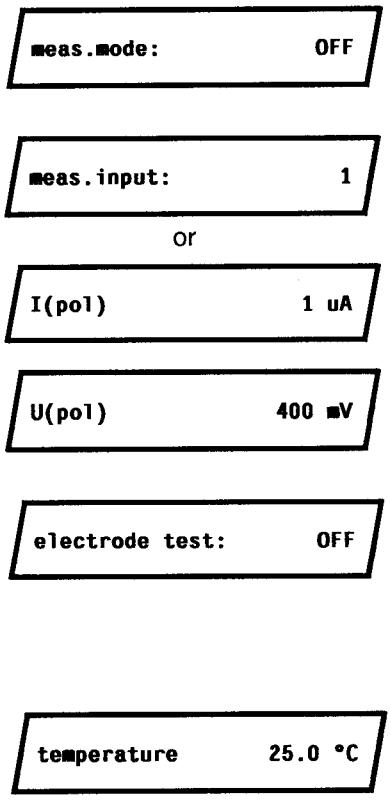
In calibrations with the sample changer, there are no hold points for entries in the calibration sequence. The values entered under the <parameters> key apply.

Calibration data can be viewed at any time with the <cal.data> key (see page 71) and the calibration report printed out using the key sequence <print> <cal.data> <enter>.

2.2.6.7 Parameters for TIP

In TIP, several commands and methods can be linked to make a titration precedure. The TIP sequence can be defined in key <def>, see page 67.

>sequence	**Parameters for the sequence** see page 67.
>statistics	**Statistics calculations** Mean value, absolute and relative standard deviation, see also page 62.
status: OFF	*ON/OFF switching of statistics calculations (OFF, ON).* If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.
mean n= 2	*Mean value calculation from n single results (2...20)*
res.tab: original	*Result table for the statistics (original, delete n, delete all)* "original": The original table is used. Deleted results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete n= 1	*Index n of the result to be deleted (1...20)* The deleted result is removed from the statistics calculation.
>preselections	**Preselections for the sequence**
req.ident: OFF	*Inquiry of sample identifications after the start (id1, id1 & id2, all, OFF)* After the start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size: OFF	*Inquiry of sample size after the start (value, unit, all, OFF)*



Measured quantity (pH, U, Ipol, Upol, T, OFF)
Measured quantity for measurements with key <meas/hold>.

Measuring input (1, 2, diff.)
Inquiry only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 152.

With polarized electrodes, instead of the measuring input the
polarisation current (-127...127 uA)
or the
polarisation potential (-1270...1270 mV, in steps of 10 mV)
is inquired.

Electrode test (OFF, ON)
Test for polarized electrodes. Performed on changeover from the inactive standby state to a measurement. "OFF" means that the test is not performed.

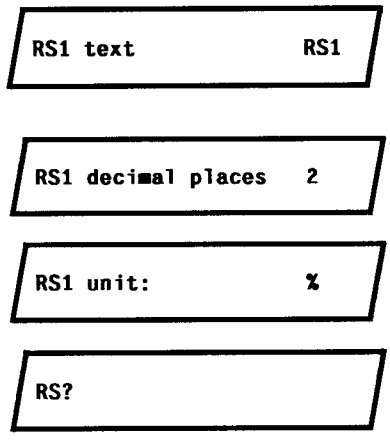
Temperature (-170.0...500.0 °C)
Temperature for pH compensation. Its value has to be entered manually even if a T sensor is connected.

2.2.7 Result calculations

Formula entry, <def> key

With the <def> key, you can enter formulas for the result calculation. The formulas are specific to a method and are stored in the method memory.

>formula	**Formula entry**
RS?	Result number ? (1...9) You can calculate up to 9 results per method. Enter a number 1...9.
RS1=	*Formula entry* Example: RS1 = EP1*C01/C00 When you enter a formula, note the third function on the keys of the keypad. Here you will find operands, mathematical operations and parentheses. Operands require a number as an identification. You can use the following operands:
RS1=EP1*C01/C00	EPX: EP's. X = 1...2 (SET) RSX: Results which have already been calculdated with previous formulas. X = 1...9. CXX: Calculation constants. XX = 00...89. The constants have the follow. meaning: C00 Sample size C01 : C19 Method-specific operands, see page 61. Are stored in the method memory. C21 : C23 Sample-specific operands, see page 72ff. C26, 27: Mean values from silo calculations. C30 : C39 Common variables which have been determined by other methods, see page 63. C40 Initial measured value of the smpl. C41 End volume C42 Determination time. C43 Volume drift at start of the titration (only in the case of SET with conditioning) C44 Temperature C45 Start volume C46 Asymmetry pH, pH_{as} C47 Electrode slope C5X Fix-V's , X = 1...9 (STAT) C6X Fix times, X = 1...9 (STAT) C7X Temporary variables for calculations in TIP, X = 0...9 C80 Mean rate (STAT) C8X Rates in time windows, X = 1...9 (STAT)



Rules:
- Calculation operations are performed in the algebraic hierarchy: * and / before + and -.
- Store formula with <enter>.
- Overwrite formula with <clear> and new formula.
- Delete formula with <clear> + <enter>.

If a formula is stored with <enter>, werden Resultattext, Anzahl Nachkommastellen und Resultateinheit abgefragt:???

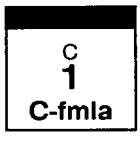
Text for result display and report (up to 8 characters)
Text input see page 14.

Number of decimal places for the result (0...5)

Unit for the result (%, ppm, g/l, mg/ml, mol/l, mmol/l, g, mg, ml, mg/pc, s, ml/min, no unit or up to 6 characters).

The next formula can now be entered, e.g. for RS2.

Entry of the method-specific operands, <C-fmla> key



With the <c-fmla> key, you can enter the values for operands C01...C19. Only those constants are inquired which you have used in the formulas.

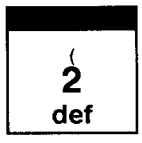
The entries are specific to a method and are stored in the method memory.

The calculation report can be printed out with the key sequence
<print> <select> (press key repeatedly until "calc" appears in the display) <enter>.

2.2.8 Statistics calculations

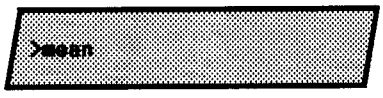
Mean values, absolute and relative standard deviations are calculated.

Allocations for the statistics calculations, <def> key

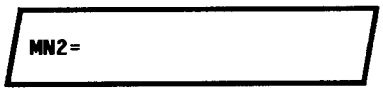


The <def> key is used to allocate results for statistics calculations.

The entries are specific to the method and are stored in the method memory.



Allocations for statistics calculations



Mean value number ? (1...9)
You can perform statistics calculations using up to 9 results (RSX), endpoints (EPX) or variables (CXX). For MN1, the default value RS1 is entered.
Enter a number 1...9.

Allocation of a size (RSX, EPX, CXX)
Delete allocation with <clear> + <enter>

How do you obtain statistics calculations?

1) Enter the allocations for the statistics calculations, see above.
2) Switch on the statistics calculations: Either with the <statistics> key or set the status under the <parameters> key, "> statistics" to "on". The "statistics" LED is on. On storage of the method in the method memory, the status of the statistics calculations is retained.
3) If need be, change the number of the individual values n under "mean n".
4) Perform at least 2 titrations. The statistics calculations are constantly updated and outputted. The values are printed out in the short and full result report or you can view them in the display: Press <select> until the display shows "display mean". You can view the mean values with <enter>. Proceed in the same manner for the absolute standard deviations.

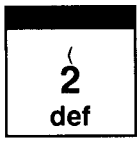
Rules:
- Recalculated results are incorporated in the statistics calculation.
- If a result of a particular titration can not be calculated, no results for this determination are incorporated in the statistics calculation. However, the sample counter is still operative, i.e. the statistics calculations start afresh when the number of required individual determinations has been performed.
- If the statistics are switched off ("statistics" LED no longer on), results are no longer entered in the statistics table. But the table remains unchanged. When the statistics are switched on again, you can immediately continue working from where you last left off.
- If you delete results (see page 24), all results of the determination with index n are removed from the statistics evaluation.
- On method change, the old statistics table is cleared and the statistics instructions of the new method followed.
- Old results in the statistics table no longer needed can be deleted with "delete all" (under <parameters> key, "> statistics", "res.tab:").
- The individual results of the statistics table can be printed out with <print> <statistics> <enter>.

2.2.9 Common variables

A common variable can be useful for, e.g. the following applications:
- Determination of a titer with a method A. This titer is stored permanently as C3X. The operand C3X can then be used in various other methods like any other operand.
- Determination of a blank value with a method A. Use of this blank value in various other methods.
- Determination of a result with method A. Reconciliation of this result in various other methods.

You may view the values of the common variables with key <configuration>.

Allocations for common variables, <def> key

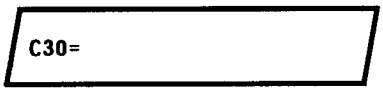


With the <def> key, results (RSX), endpoints (EPX), variables (CXX) or mean values (MNX) are allocated for common variables.

The entries are specific to the method and are stored in the method memory.

Allocation for common variables

Common variable C3? (0...9)
Common variables are stored as C3X (X = 0...9).

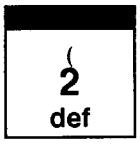


Enter a number.

Allocation of a size (RSX, EPX, CXX, MNX)
The values of the common variables remain in force for all methods until they are overwritten or deleted. They can be viewed under the <configuration> key, see page 17.
Delete allocation with <clear> + <enter>.

2.2.10 Data output

Definition of the report sequence for the output at the end of a determination



With the <def> key, the report sequence at the end of the determination is defined.

The entries are specific to the method and are stored in the method memory.

>report

Definition of the report sequence on completion of a determination

report:

Report sequence (input range depends on the mode:

STAT, DOC:
full short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, param, calc, calib, ff

DOS: *full, short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, param, calc, ff*

SET, MEAS, CAL:
full, short, scalc full, scalc srt, param, calc, calib, ff

TIP: *full, short, scalc full, scalc srt, param, calc, ff*

report:full;curve

Select a block. If you require more than one report block, set a ";" as a delimiter between the blocks.
The individual blocks have the following meaning:

full	Full result report with raw results, calculations and statistics.
short	Short result report with calculations and statistics.
mplist	Measuring point list.
curve	Curve volume against time.
meas crv	Curve measured value vs. time (monitoring of meas active).
temp crv	Curve temperature vs. time (monitoring of temp active).
scalc full	Full report of silo calculations.
scalc srt	Short report of silo calculations.
param	Parameter report.
calc	Report with formulas and operands.
calib	Calibration data.
ff	Form feed on printer.

Original reports which are outputted automatically at the end of the titration can be printed out with re-calculated values at any time. Key sequence:

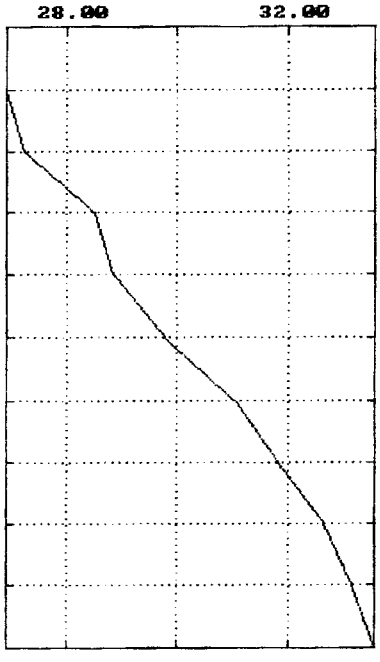
<print> <reports> <enter>.

Original reports have double dashes = = = = at the end, whereas recalculations are marked by single dashes - - - - .

Report outputs can be stopped with <QUIT>.

Example of a report:

```
 'tt
718 STAT Titrino   OP1/101      718.0010
date  1998-09-27   time  08:54        14
start time      0 s     STAT pH  ********
2.0 s/div       dT 2.0 °C/div
```




```
============
```

Example of a temperature curve in STAT (report temp crv).
In order to obtain such a curve, the temperature monitoring has to be active. If the limit values lie in the range of the measurement, the limit will be marked in the curve as well, see page 46.

The curve "measured values vs. time" may be printed as well (report meas crv).

Additional possibilities for report outputs

In addition to the reports which are printed out at the end of the titration, various other reports can be outputted. There are 2 possibilities to select the reports:

1) <print> <select> <enter> <select> is pressed repeatedly until the desired report appears in the display.
2) <print> <key X> <enter> key X is the key under which the appropriate data are entered.

List of the "key X":

Report	<key X>
Configuration report	configuration
Parameter report	parameters
Current sample data	smpl data
Statistics report with the individual results	statistics
All sample data from the silo memory	silo
Calibration data	cal.data
Operands C01...C19	C-fmla
Contents of the <def> key	def
Contents of the method memory with details of the memory requirements of the individual methods and the remaining bytes	user methods
Complete report sequence of the last determination, as defined under the <def> key in the method	reports

Result display without printer

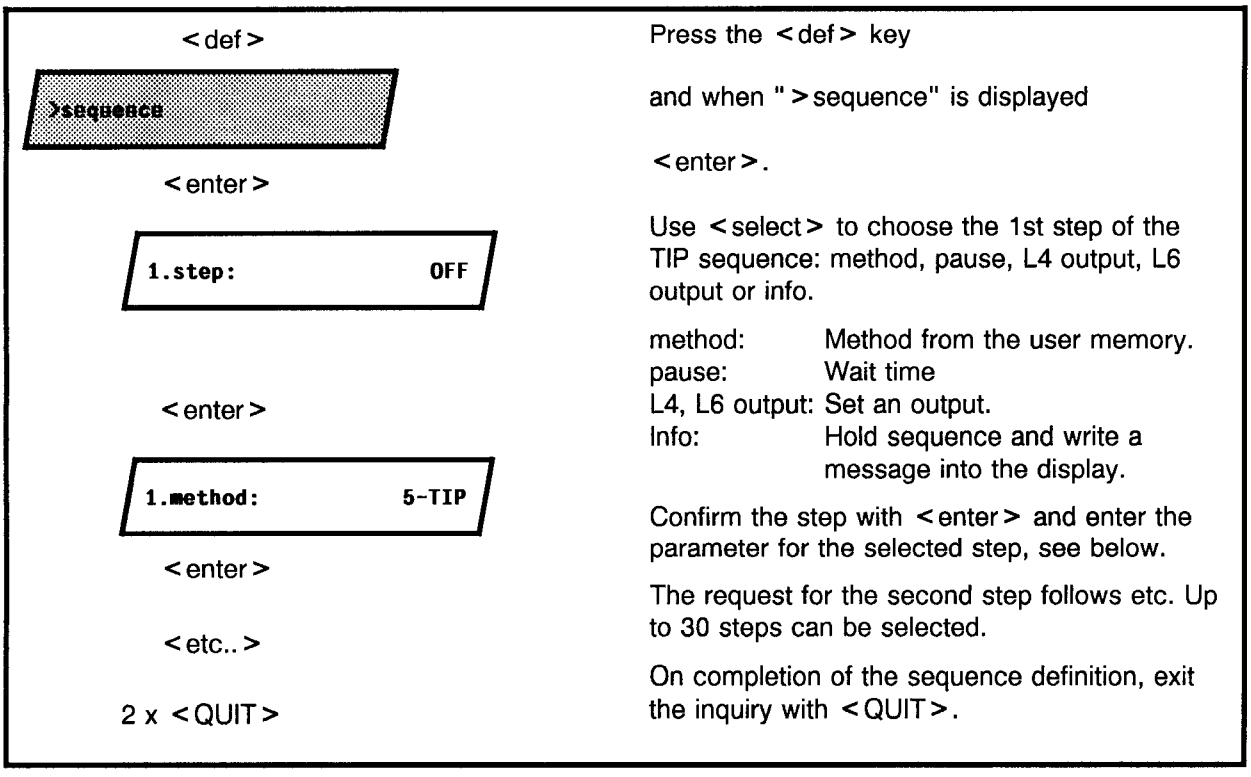
Results can also be viewed in the display. With the <select> key, the appropriate section (EP's, results, etc.) can be selected and <enter> can be used to view the individual EP's, results, etc.

<select>: display	<enter>: display	Remarks
>display results	RS1...RS9	calculated results
>display EP's	EP1, EP2	with SET
>display rates	C81...C89	Rates in time windows (STAT)
>display fix V	C51...C59	Interpolated volumes (STAT)
>display fix time	C61...C69	Interpolated times (STAT)
>display mean	m(RS1)...m(RS9), n	mean values and number of individual values
>display std.deviation	s(RS1)...s(RS9)	absolute standard deviation
>display messages		various (error) messages
>display meas.val	C40	with MEAS
>display calibration	slope and pHas	with CAL
>display temp. variables	C70...C79	with TIP
>display other values	volume, dosing time, rate	with DOS

2.2.11 TIP, Titration Procedure

TIP (**T**itration **P**rocedure) is used to link several commands in a sequence. TIP is selected with the <mode> and <enter> keys. TIP is an "empty shell" in which the sequence of the determination must be defined.

Definition of the determination sequence



The following commands can be used:

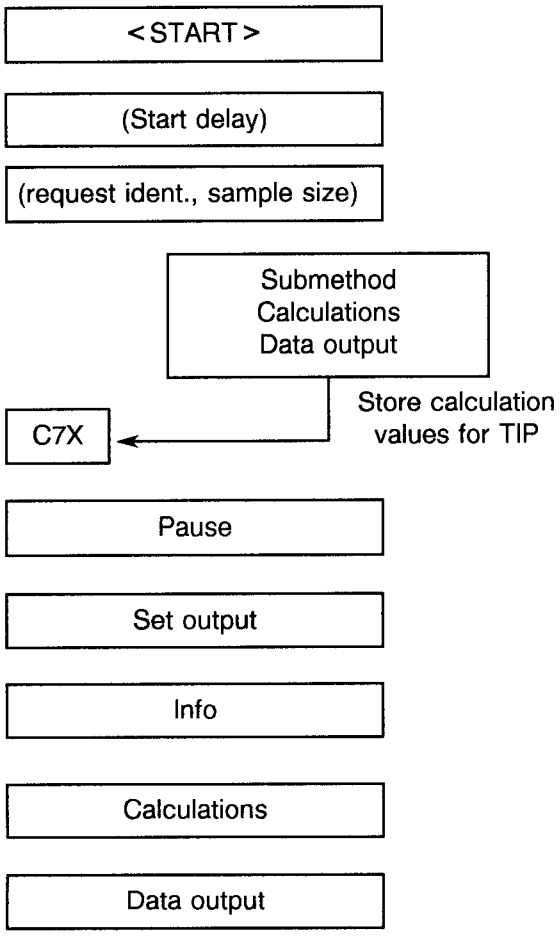
Command	Meaning	Input range
Method	Method from the user memory. This method runs as a submethod.	Name
Pause	Pause time. The pause time can be stopped with <QUIT>. <clear> sets "inf" (= infinitely long pause time).	0...999 999 s, inf.
L4 output	Set L4 output (pin 3) of the remote socket. active = 0 V, inactive = 5 V, pulse > 100 ms, off = output is not used. Important: A pulse (e.g. from a monitoring output in a submethod) can set an active output to inactive! At the end of the TIP method, the outputs are set to "inactive".	active, inactive, pulse, off
L6 output	Set output L6 (pin 1) of the remote socket. Cable 718 STAT Titrino (L6) - 6.2139.000 Dosimat. Important: A pulse (e.g. an activate pulse in a submethod) can set an active output to inactive! At the end of the TIP method, the outputs are set to "inactive".	active, inactive, pulse, off
Info	Message in the display . The TIP sequence is held and the message displayed. Continue the sequence with <START>, <QUIT> or <enter>.	up to 16 characters

The parameters of the sequence can be viewed and changed at any time under the <parameters> key .

Sequence of TIP

As there is no preset sequence of TIP, in what follows the procedure is illustrated by a sequence that contains all available commands.
The start of the sequence depends on the application and can be configured with the following parameters (see schematic representation below):

- Start delay (setting under <configuration>, > auxiliaries)
- Request of the sample identifications and the sample size following titration start. The data apply to all calculations in the submethods and in TIP.



Following the start, the start delay time is allowed to elapse.

After the request of "ident" and "sample size", the individual sequence steps are processed.

Submethods are processed according to their parameters. They run to completion, incl. calculations and data output (e.g. curves). The determination data of the submethod are overwritten in the next sequence step of TIP. Those values which are needed for higher-level calculations must therefore be assigned to temporary variables C7X in the submethod.

Pause time allowed to elapse.

Outputs of the remote socket can be set.

A message can be written in the display. The sequence is held until it is continued manually (with <START>, <QUIT> or <enter>).

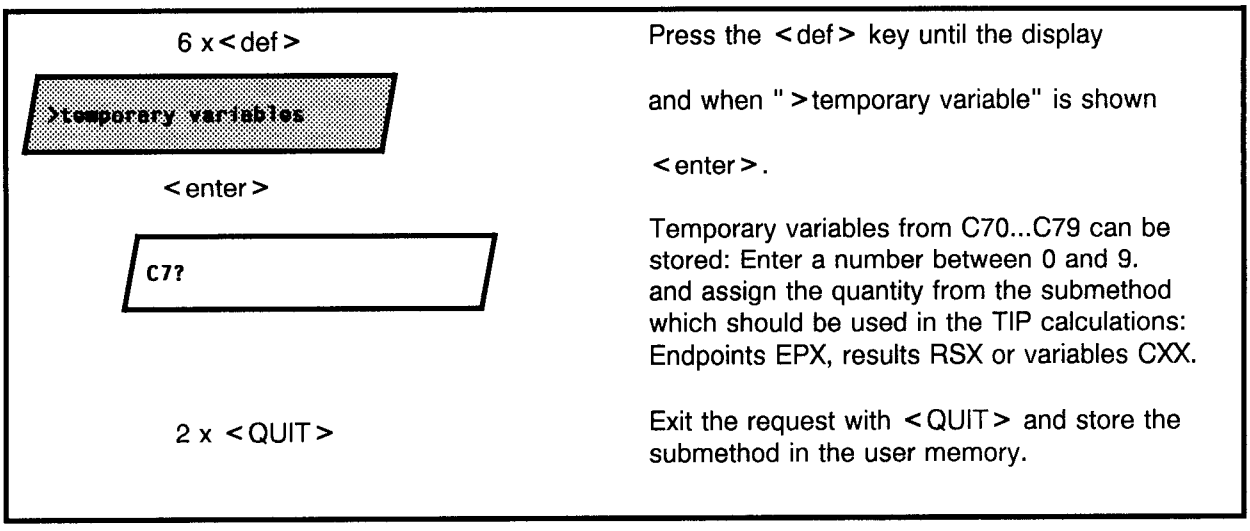
Higher level calculations in TIP.

Data output in TIP (TIP contains no more determination data, i.e. curves must be outputted within the submethods).

Preparation of submethods for use in TIP

All titration data, i.e. curves and lists of measured points must be outputted in the submethod as they are overwritten on return to TIP.
Individual values from the submethod, e.g. endpoints or calculated results must be stored as temporary variables C7X. This allows them to be used in TIP for further calculations.
Reevaluations of data of a submethod are not possible in TIP. The submethods should thus be thoroughly wet tested before they are used in TIP.

Assignment of temporary variables in the submethod:



Press the <def> key until the display

and when " >temporary variable" is shown

<enter>.

Temporary variables from C70...C79 can be stored: Enter a number between 0 and 9.
and assign the quantity from the submethod which should be used in the TIP calculations: Endpoints EPX, results RSX or variables CXX.

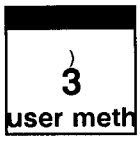
Exit the request with <QUIT> and store the submethod in the user memory.

Calculations in TIP

In TIP general calculations can be performed with variables C7X from different submethods. For formula entry, see page 60.

Note:
It is advisable to perform the calculations within TIP if at all possible as only these can be recalculated "dry" after the determination, e.g. with a different sample size.

2.2.12 Method memory, <user meth> key



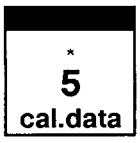
The <user meth> key is used to manage the method memory.
Method identifications can be entered directly or selected with the <select> key from the memory contents.

>recall method	**Recall method**
method name:	*Load method from the method memory into the working memory (entry of a method identification contained in the memory).* You may select a method with <select>. If a method identification is entered which is not found in the method memory, the inputted value flashes.
>store method	**Store method**
method name:	*Store method from the working memory in the method memory (entry of up to 8 characters).* Text input see page 17. If a method is already stored under the inputted identification, you are asked if you wish to overwrite the old method. With <enter> it is overwritten, with <QUIT> you return to the entry of the method identification.
>delete method	**Delete method**
method name:	*Delete method from the method memory (entry of a method identification contained in the memory).* For safety's sake, you are again asked if you really wish to delete the method. With <enter> it is deleted, with <QUIT> you return to the working memory. If a method identification is entered which is not found in the method memory, the inputted value flashes.

You can print out the contents of the method memory with the key sequence
<print> <user meth> <enter>.

Document your methods (e.g. parameter report, def. report and C-fmla report)! With a PC and the 6.6021.000 menu program, you should carry out a complete method backup from time to time.

2.2.13 Calibration data, <cal.data> key



With the <cal.data> key, the current pH calibration data of all measuring inputs can be viewed. Calibration data are entered here automatically on completion of a calibration.

>input 1	**pH calibration data of measuring input 1**
pH(as) 7.00	*Asymmetry pH (0... ± 20.00)* Entered automatically after a calibration with measuring input 1.
slope 1.000	*Slope (0... ± 9.999)* Entered automatically after a calibration with measuring input 1.
temp. 25.0 °C	*Calibration temperature (-170...500 °C)* Entered automatically after a calibration with measuring input 1.
cal.date	*Date of the last calibration (no entry possible)* If the calibration data "pH(as)" and/or "slope" are changed by a manual entry, the date entry is deleted.
electr.id	*Electrode identification of the electrode that has been calibrated (no entry possible)* If an electrode identification has been entered in the CAL mode, this entry is entered here automatically after the calibration.
>input 2	**pH calibration data of measuring input 2** Identical to that with measuring input 1.
>input diff.	**pH calibration data of the differential measuring input** Identical to that with measuring input 1.

The calibration report with the data for the current measuring input can be printed out at any time with the key sequence

<print> <cal.data> <enter>.

2.2.14 Current sample data, <smpl data> key

The <smpl data> key can be used to enter the current sample data. The contents of this key change when the silo memory is switched on, see page 74.

Instead of entering the current sample data with the <smpl data> key, you can request these automatically after the start of the determinations. For this, configure the determination sequence under the <parameters> key, "> preselections", see pages 24, 35, 43, 51 and 55.

Current sample data can be entered live. For work with the silo memory see page 73.

id#1 or C21 id#2 or C22 id#3 or C23	*Sample identification 1...3 or sample-specific operand C21...C23 (up to 8 characters).* Sample identifications or sample-specific operands can be entered using the keypad or via a balance with a special input device (see page 147).
smpl size 1 g	*Sample size (6-digit number: ± X.XXXXX)* Entry using keypad or via a balance (see page 147).
smpl unit: g	*Unit of the sample (g, mg, ml, ul, pc, no unit or up to 5 characters)* Selection with <select>.

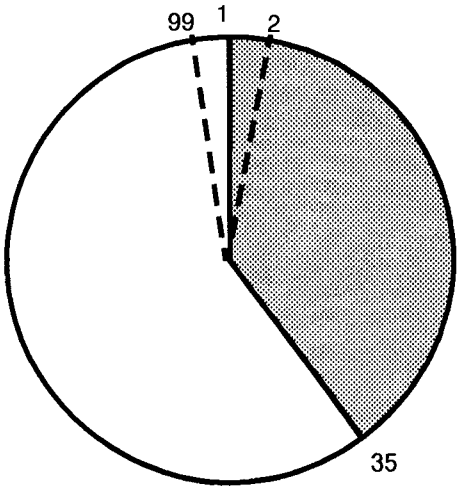
2.2.15 Silo memory for sample data

In the silo memory or pushup storage, sample data (method, identifications and smpl size) can be stored. This is useful, e.g. when you work with sample changers and other automatic sample addition systems or if you wish an overview of your determination results, see page 76.

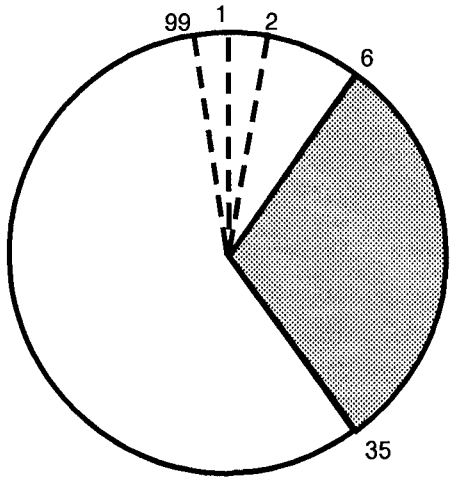
The <silo> key is used to switch the silo memory on and off. The status LED "silo" is on when the silo memory is switched on. The silo memory works by the FIFO principle (First In, First Out).

If the silo memory is switched on, sample data are routed to the last free line of the silo memory. If no new value is inputted, the value from the last line is automatically copied. In this manner, data can be simply taken over when they remain unchanged.
When the instrument is started, the sample data are fetched from the next silo line.

Organisation of the silo memory



Silo memory contains 35 lines.
Next free line is 36.



6 of the 35 lines have been processed. Free lines from 36 to 99 and from 1 to 6.

1 silo line needs between 18 and 120 bytes memory capacity.

If the silo memory is filled from the balance, you must ensure that there is sufficient space in the silo memory for the required number of silo lines! The number of free bytes is given in the user memory report.

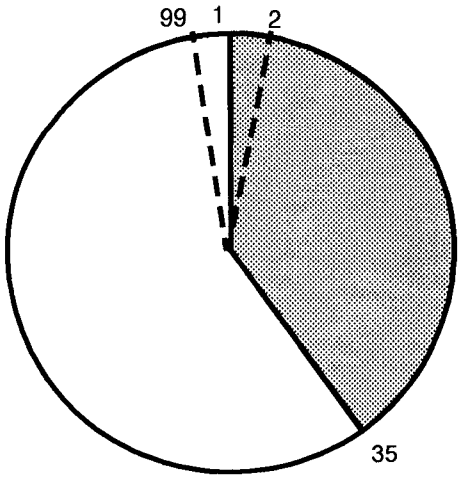
<smpl data> key with the silo memory switched on

>edit silo lines	**Entry of sample data in the silo memory** can be entered live.
silo line 1	*Silo line (1...99)* The next free line is displayed automatically. Lines already occupied can be corrected.
method:	*Method with which the sample is processed (method identification from the method memory)* If no method identification has been entered, the sample is processed with the method in the working memory. The method can be selected with <select> or entered directly.
id#1 or C21 id#2 or C22 id#3 or C23	*Sample identifications or sample-specific operands (up to 8 characters)*
smpl size 1 g	*Sample size (6-digit number: ±X.XXXXX)* When the sample data have been entered from a balance, the transfer of the sample size is taken as the end of the silo line.
smpl unit: g	*Unit of the sample (g, mg, ml, ul, pc, no unit or up to 5 characters)*
>delete silo lines	**Delete individual silo lines**
delete line n OFF	*Delete individual silo lines (1...99, OFF)* <clear> sets "OFF". Deleted lines remain in the silo memory. Access is blocked during the processing. To show that a line has been deleted, the inquiry "method*" appears. The symbol * indicates that the line has been deleted. Deleted lines can be reactivated when the appropriate line is reedited.

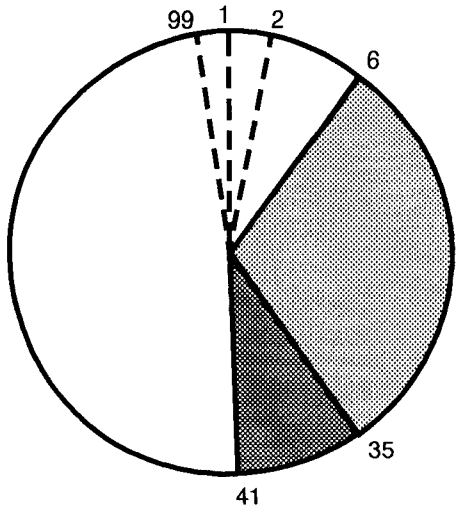
>delete all silo lines	**Deleting the entire silo memory**
delete all: no	*Delete all silo lines (yes, no)* When all silo lines are deleted, the silo is completely empty: The line numbering starts again with 1.
cycle lines: OFF	*Data cycling (ON, OFF)* Data cycling "on" is useful if you constantly have to process the same sample data. In such a case, the processed silo line is not deleted, but copied to the next free line, see below. When you work in this mode, you should not enter any new silo lines during the determinations.
save lines: OFF	*Store results in the silo memory (ON, OFF)* Results can be stored as C24 or C25 if the method has an assignment, see page 76. "save lines" can only be set to "OFF" if the silo is completely empty.

If the silo memory is filled from the balance, a new silo line is established when transfering the weight. For mixed operation, manual entry and entry from a balance, the values from the balance are sent into the line in which editing just takes place. They must be confirmed with <enter> at the 718 STAT Titrino.

Silo memory with data cycling "on"



Silo memory contains 35 lines.
Next free line is 36.



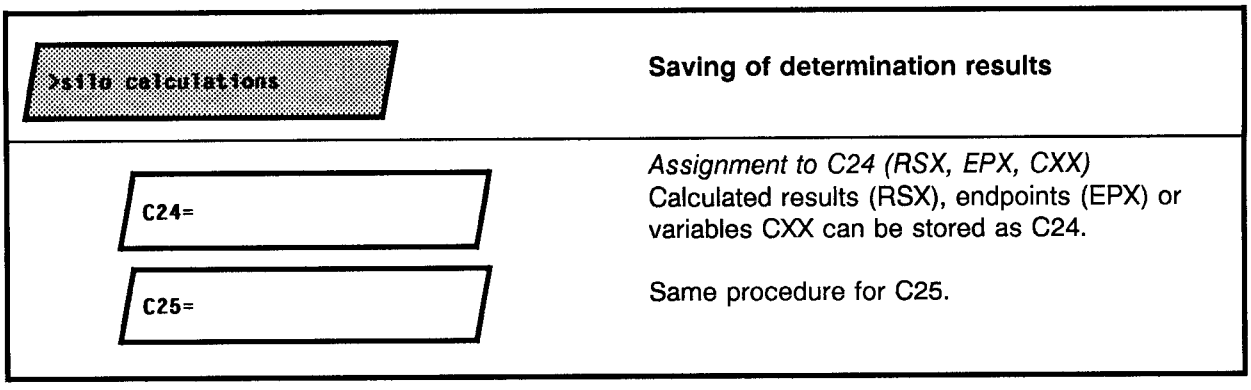
- 6 of 35 lines have been processed.
- the processed lines have been copied to the end of the silo memory: your silo is filled up to line 41.

2.2.16 Saving determination results and silo calculations

Saving determination results

If the sample-specific data of the silo memory should be kept after the determination and supplemented by results, the following entries are necessary:

1. In the method under the <def> key
   Assignment of the determination results to C24 and/or C25:



2. In the silo memory, <smpl data> key (when the silo memory is switched in):
   "save lines: on"

Important:
Ensure that there is still sufficient space for saving the results C24 and C25. (In the report <print><user meth><enter> the number of free bytes is shown.) Result name, value and unit are stored. The memory requirements can be estimated as follows:
Result with text (8 characters) and unit (5 characters): 32 bytes
Measured value C40, value without unit: 22 bytes

After several samples have been processed, the silo memory report can have the following appearance (printout with <print><silo>):

```
 'si
718 STAT Titrino   OP1/101     718.0010
date  1998-09-27   time  08:54       14
>silo
  cycle lines:             OFF
  save lines:               ON
 sl  method  id 1/C21 id 2/C22 id 3/C23   C00        C24          C25
+ 1    11-2      A/12 94-09-12           0.233g    0.142ml/min  98.53%
+ 2    11-2      A/13 94-09-12           0.286g    0.138ml/min  95.75%
+ 3    11-2      A/14 94-09-12           0.197g    0.145ml/min 100.61%
  4    11-2      A/15 94-09-12           0.288g       NV           NV
  5    11-2      A/16 94-09-12           0.263g       NV           NV
```

Silo lines have been processed, results saved

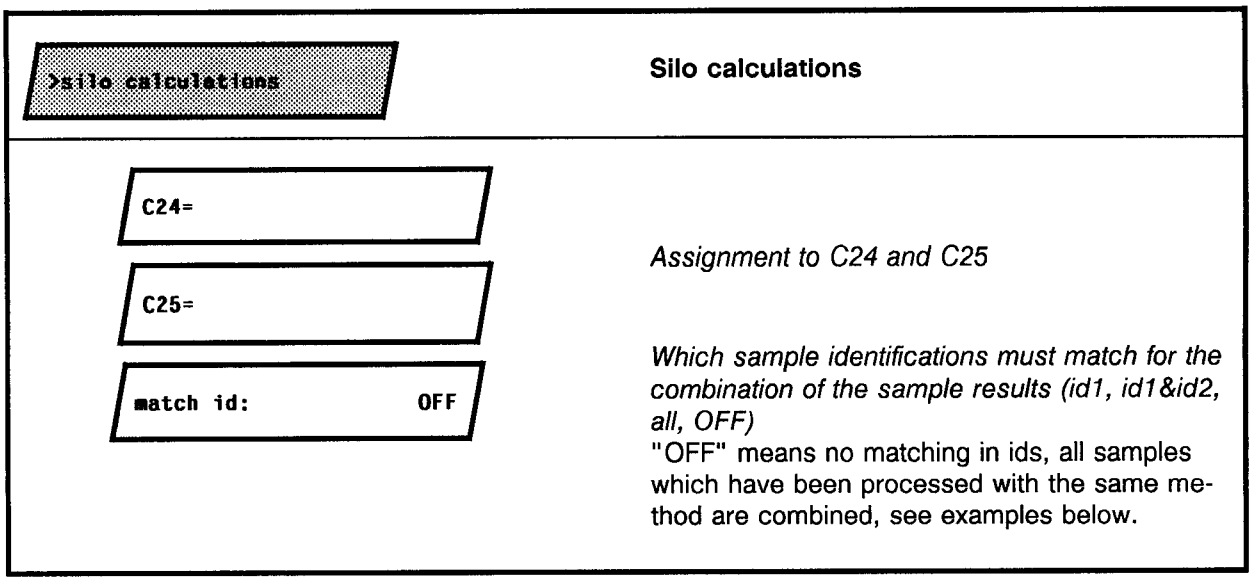
Silo lines not yet processed

The silo lines can be marked as follows (at very left of report):
+ Silo line has been processed.
* A silo line not yet processed has been deleted.
– A processed silo line has been deleted and hence removed from the silo calculations.
/ The last processed silo line. Recalculated results are inputted in this line.
No marking: The silo line is awaiting processing.

Silo calculations

Mean value and standard deviation of the results available in the silo memory can subsequently be calculated over the entire series.

The following details can be entered in the method under the <def> key:



Starting from the following silo report:

```
 'si
718 STAT Titrino   OP1/101     718.0010
date  1998-09-27   time  08:54
>silo
  cycle lines:         OFF
  save lines:           ON
 sl  method  id 1/C21 id 2/C22 id 3/C23   C00        C24          C25
+ 1    11-2      A/12 94-09-12          0.233g    0.142ml/min  98.53%
+ 2    0-15      A/13 94-09-12          0.286g   0.9976          NV
+ 3    0-15      A/13 94-09-12          0.197g   0.9947          NV
+ 4    11-2      A/12 94-09-12          0.288g    0.138ml/min  95.75%
+ 5    11-2      A/15 94-09-12          0.263g    0.145ml/min 100.61%
```

← Assignment for C24 only.
←
←

with "match id: off" the following silo calculation report (scalc full) is obtained:

```
:
 method  id 1/C21 id 2/C22 id 3/C23          mean          +/-s  n
   11-2         *        *        *    rate  0.142ml/min   0.0035  3
                                     content  98.30%         2.438  3
   0-15         *        *        *   titer 0.9962        0.00205  2
```

All samples which have been processed with the same method are combined.

With "match id: id1" the following silo calculation report (scalc full) is obtained:

```
:
 method   id 1/C21 id 2/C22 id 3/C23          mean          +/-s  n
   11-2       A/12        *        *    rate  0.140ml/min   0.0028  2
                                     content  97.14%         1.966  2
   0-15       A/13        *        *   titer 0.9962        0.00205  2
   11-2       A/15        *        *    rate   0.145ml/min    0.000  1
                                     content 100.61%         0.000  1
```

Samples which have been processed with the same method and have the same id1 are combined.

The short silo calculation report contains only calculations for the least, current sample.

```
:
 method    id 1/C21 id 2/C22 id 3/C23          mean           +/-s  n
   11-2       A/15        *        *     rate  0.145ml/min    0.000  1
                                       content 100.61%         0.000  1
```

The mean values of the silo calculations are available for further result calculations as C26 and C27 and can be used in the Titrino in formulas.
Mean value of C24 → C26
Mean value of C25 → C27

Important:

- If work is performed with silo calculations, the method name must be entered in the silo memory. Results will be overwritten in the silo on recalculation.
  If you do not wish such an entry, e.g. because you work off an urgent sample between a series, disconnect the silo and work with a method which has a different name from the one you use in the silo.
- Calculations and assigments are carried out in the following order:
  . Calculation of the results RSX
  . Assignment of temporary variables C7X for TIP
  . Calculation of means MNX
  . Assignment of silo results C24 and C25
  . Silo calculations
  . Assignment of means C26 and C27 from silo calculations
  . Assignment of common variables C3X

3. Operation via RS232 interface

3.1 General rules

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

The commands are grouped logically and are simple to understand. Thus, e.g. for the selection of the SET mode the command

&Mode.**S**elect **"SET"**

must be sent, but only the boldface characters need be inputted, thus

&M.S"SET" .

All quantities of the Titrino are collected in groups. For example, the entries for the configuration are in the group

&Config

The "Config" group contains subgroups, e.g. for the setting of the RS interface parameters (RS Settings)

&Config.**R**SSet

This subgroup in turn contains the individual inquiries for the settings, e.g. the inquiry regarding the baud rate

&Config.**R**SSet.**B**aud

or regarding the setting of the parity

&Config.**R**SSet.**P**arity

The commands have a hierarchial structure (tree structure). The quantities that appear in this tree are called **objects** in what follows. The baud rate is an object that is called up with the command

&Config.**R**SSet.**B**aud

If one is at the desired location in the tree, the value of the appropriate object can be queried, e.g. in the case of the inquiry regarding the baud rate:

&Config.**R**SSet.**B**aud **$Q** Q for Query

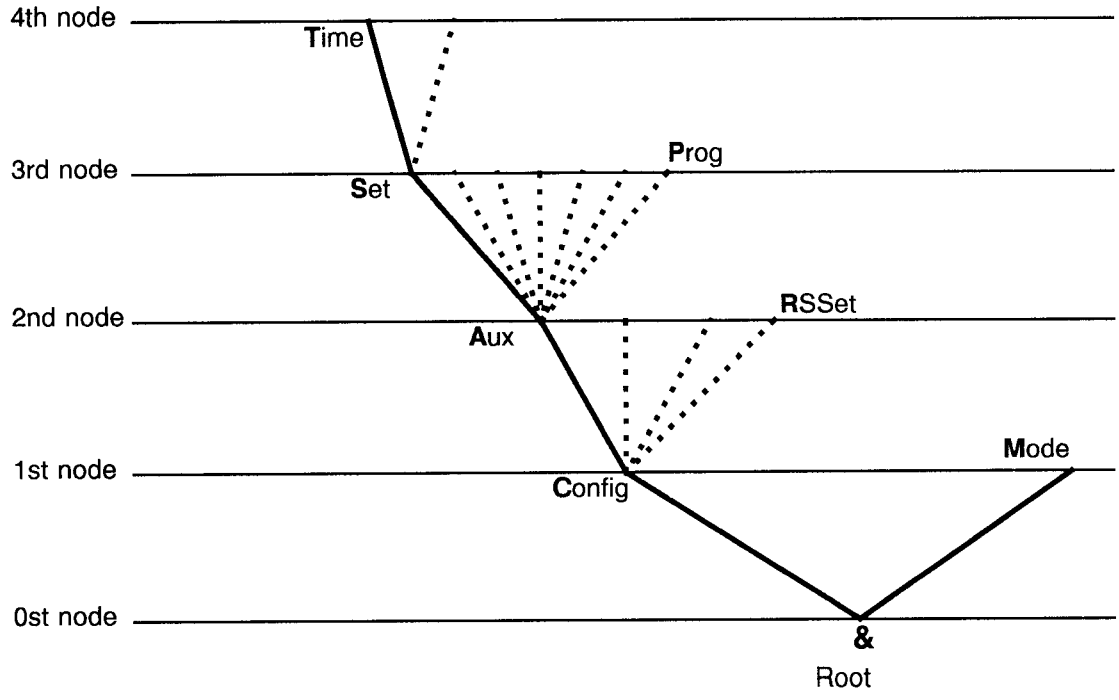
$Q triggers the output of the value from the Titrino. Entries that are introduced with the character dollar ($) trigger something. They are thus called **triggers** in what follows.

Values of objects can not only be requested, however, they can also be modified. Values are always entered in quotation marks ("), e.g.

&Config.**R**SSet.**B**aud **"9600"**

3.1.1 Call up of objects

All objects of the Titrino are grouped hierarchically. They have a tree structure. A section of this tree is shown below:



Rules:

- The root of the tree is designated with &.
- For the call up of an object the nodes (levels) of the tree are marked with a point (.).
- The call up of the objects requires as many letters as necessary to ensure unequivocal assignment of the object. If the call is not unequivocal, the first object in the series is recognised.
- Upper- or lowercase letters can be used
- An object can be assigned a value. Each value is marked at the beginning and end with quotation marks ("). A value can contain up to 24 characters. Numeric values can include up to 6 digits, a negative sign and a decimal point. Numbers with more than 6 digits will not be accepted; more than 4 decimal places are rounded off (5 decimal places for smpl size). With numbers <1, it is necessary to enter leading zeros.
- If a new object is not called up, the old object remains current.

Examples:

Call up of the time:
&Config.Aux.Set.Time
or **&C.A.S.T**

&C.A.S.T or **&c.a.s.t**

Entry of "08:10" for the time
&C.A.S.T "08:10"

Correct entries of numbers:
"-31.2273"
"0.1"
incorrect entries:
"1,5" or " +3" or ".1"

Entry of a different time:
"08:15"

– New objects can also be addressed relative to old objects: **A preceding point** moves one node **forwards** in the tree.	From the root to the node 'Aux': **&C.A** Forwards from the node 'Aux' to 'Set': **.S**
More than one preceding point moves one node **backwards** in the tree. n nodes backwards require n + 1 preceding points.	Jump from 'Set' onto the node 'Aux' and selection of a new object at this node 'Prog': **..P** Jump from the object 'Prog' over the node 'Aux' to the node 'Config' and to the new node 'RSSet': **...R**
– If a jump is to be made back to the root, a preceding & is entered.	Change from the node 'RSSet' via the root into the node 'Mode': **&M**

3.1.2 Triggers

Triggers initiate an action at the Titrino, e.g. starting of a mode or sending of data. Triggers are marked with the introducer: **$**

The following triggers are possible:

$G	Go:	Starts operations, e.g. start of the titration or setting of the RS232 interface parameters
$S	Stop:	Stops operations, e.g. titration
$H	Hold:	Holds operations, e.g. titration
$C	Continue:	Continue after "Hold"
$Q	Query:	Used for inquiry of all information from the current node in the tree upwards up to and including the values
$Q.P	Path:	Used for inquiry of the path from the root of the tree up to the current node
$Q.H	Highest index:	Used for inquiry of the number of son nodes of the current node
$Q.N"i"	Name:	Used for inquiry of the name of the son node with index i, i = 1...n
$D	Detailed Info:	Used for inquiry of the detailed status
$U	qUit:	Used to abort the data flow of the Titrino, e.g. after $Q

The triggers $G, $S and $H, $C are linked to objects, see overview table, pages 87ff.

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

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

3.1.3 Status and error messages

In order to have an efficient control by an external control device, it must also be possible to query status conditions; they provide information on the status of the Titrino. The trigger $D initiates output of the status. Status messages consist of the global status, the detailed status and eventual error messages, e.g. $S.Mode.SET;E26. The global status informs on the activity of the process, while the detailed status conditions show the exact activity within the process.

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

$G	Go:	The Titrino is executing the last command.
$H	Hold:	The Titrino has been holded ($H, key <meas/hold> or by an error which effects the hold status)
$C	Continue:	The Titrino has been restarted actively after hold
$R	Ready:	The Titrino has executed the last command and is ready
$S	Stop:	A process has been aborted in an "unnatural manner". e.g. stopped or aborted because there was an error.

Detailed status conditions

Status conditions of the global $G:

$G .Mode.SET	.Inac:	Instrument at the beginning or the end of a titration.
	.Req .Id1:	Instrument in the SET mode, requesting Id1 after start.
	.Id2:	Instrument in the SET mode, requesting Id2 after start.
	.Id3:	Instrument in the SET mode, requesting Id3 after start.
	.Smpl:	Instrument in the SET mode, requesting sample size after start.
	.Unit:	Instrument in the SET mode, requesting unit of sample size after start.
	.Start:	Instrument in the SET mode, processing the start conditions.
	.SET1:	Instrument in the SET mode, titrating to the first end point.
	.SET2:	Instrument in the SET mode, titrating to the second end point.
	.Cond.Ok:	Instrument in the SET, conditioning, end point reached (after the first startup from the standby mode).
	.Cond.Prog:	Instrument in the SET mode, conditioning, end point not reached (Conditioning progressing).
$G .Mode.STAT	.Inac:	Instrument at the beginning or the end of a determination.
	.Req .Id1:	Instrument in the STAT mode, requesting Id1 after start.
	.Id2:	Instrument in the STAT mode, requesting Id2 after start.
	.Id3:	Instrument in the STAT mode, requesting Id3 after start.
	.Smpl:	Instrument in the STAT mode, requesting sample size after start.
	.Unit:	Instrument in the STAT mode, requesting unit of sample size after start.
	.Start:	Instrument in the STAT mode, processing the start conditions.
	.Titr:	Instrument in the STAT mode, controlling.
	.Wait:	Instrument in the STAT mode, waiting because a monitored limit has been violated.
$G .Mode.DOS	.Inac:	Instrument at the beginning or the end of a determination.
	.Req .Id1:	Instrument in the DOS mode, requesting Id1 after start.
	.Id2:	Instrument in the DOS mode, requesting Id2 after start.
	.Id3:	Instrument in the DOS mode, requesting Id3 after start.
	.Smpl:	Instrument in the DOS mode, requesting sample size after start.
	.Unit:	Instrument in the DOS mode, requesting unit of sample size after start.
	.Start:	Instrument in the DOS mode, processing the start conditions.
	.Titr:	Instrument in the DOS mode, dosing.
	.Wait:	Instrument in the DOS mode, waiting because a monitored limit has been violated.

$G .Mode.DOC	.Inac:	Instrument at the beginning or the end of a determination.
	.Req .Id1:	Instrument in the DOC mode, requesting Id1 after start.
	.Id2:	Instrument in the DOC mode, requesting Id2 after start.
	.Id3:	Instrument in the DOC mode, requesting Id3 after start.
	.Smpl:	Instrument in the DOC mode, requesting sample size after start.
	.Unit:	Instrument in the DOC mode, requesting unit of sample size after start.
	.Start:	Instrument in the DOC mode, processing the start conditions.
	.Titr:	Instrument in the DOC mode, controlling.
	.Wait:	Instrument in the DOC mode, waiting because a monitored limit has been violated.
$G .Mode.MEAS	.Inac:	Instrument at the beginning or the end of a titration.
	.Req .Id1:	Instrument in the MEAS mode, requesting Id1 after start.
	.Id2:	Instrument in the MEAS mode, requesting Id2 after start.
	.Id3:	Instrument in the MEAS mode, requesting Id3 after start.
	.Smpl:	Instrument in the MEAS mode, requesting sample size after start.
	.Unit:	Instrument in the MEAS mode, requesting unit of sample size after start.
	.Meas:	Instrument in the MEAS mode, measuring.
$G .Mode.CAL	.Inac:	Instrument at the beginning or the end of a calibration
	.Req.Temp:	Instrument in the CAL mode, requesting calibration temperature.
	.Meas.Temp:	Instrument in the CAL mode, measuring calibration temperature.
	.Req.Buf1:	Instrument in the CAL mode, requesting pH of buffer 1.
	.Meas.Buf1:	Instrument in the CAL mode, measures buffer1.
	.Req.Buf2:	Instrument in the CAL mode, requesting pH of buffer 2.
	.Meas.Buf2:	Instrument in the CAL mode, measures buffer 2.
	etc.	
$G .Assembly.Bur	.Fill:	Burette in filling process
	.ModeDis:	Burette in Dis mode

In TIP, its global status as well as the step number (X) is available.

$G .TIP.X	.Inac:	Instrument at the beginning or the end of a TIP.
	.Req .Id1:	Instrument in the TIP mode, requesting Id1 after start.
	.Id2:	Instrument in the TIP mode, requesting Id2 after start.
	.Id3:	Instrument in the TIP mode, requesting Id3 after start.
	.Smpl:	Instrument in the TIP mode, requesting sample size after start.
	.Unit:	Instrument in the TIP mode, requesting unit of sample size after start.
	.Pause:	Instrument in the TIP mode, in pause.
	.Info:	Instrument in the TIP mode, in info.
	.Mode...:	Instrument in the TIP mode, working off a submethod. The detailed status messages of the submethod appear, see above.

Status conditions of the global $H:
The status message of the action which has been held appears.
If the process is held because a monitored limit has been violated, its status message is $H.Mode.XXX.Titr.

Status conditions of the global $C:
The status conditions of the global $C are identical with the ones of the global status $G. They appear when the process has been restarted actively from the status "Hold" ($C, key <meas/hold> or automatically after elimination of an error).

Status conditions of the global $R:

$R .Mode.XXXX.QuickMeas:		Quick manual measurement from the initial status in mode XXXX.
$R .Mode.SET	.Inac:	Instrument in the SET mode, inactive.
	.Cond.Ok:	Instrument in the SET mode, conditioning, endpoint reached.
	.Cond.Prog:	Instrument in the SET mode, conditioning, endpoint not reached.
$R .Mode.STAT	.Inac:	Instrument in the STAT mode, inactive.
$R .Mode.DOS	.Inac:	Instrument in the DOS mode, inactive.
$R .Mode.DOC	.Inac:	Instrument in the DOC mode, inactive.
$R .Mode.MEAS	.Inac:	Instrument in the MEAS mode, inactive.
$R .Mode.CAL	.Inac:	Instrument in the CAL mode, inactive.
$R .Assembly.Bur	.ModeDis:	Burette in the Dis mode, inactive.
$R .TIP.Inac:		Instrument in TIP, inactive.

Status conditions of the global $S:

$S .Mode.XXXX.QuickMeas: Quick manual measurement from the initial status in mode XXXX.

The instrument gives the status from which it has been stopped. The detailed status information is therefore identical as for the global status $G.
Violation of monitored limits with action "end" give the status message $S.Mode.XXX.Inac;EYYY.

Error messages:

Error messages are added to the status messages and separated from them by the sign ";".

E20 Check exchange unit
Exit: Mount Exchange Unit (properly).

E21 Check electrode, short circuit
Exit: Rectify fault or &m $S.

E22 Check electrode, break
Exit: Rectify fault or &m $S.

E23 Division by zero.
Exit: The error message disappears on next startup or on recalculation.

E26 Manual stop.
Exit: The error message disappears on next startup.

E27 Stop V reached in SET, DOS or DOC.
Exit: The error message disappears on next startup.

E28 Wrong object call up
Exit: Send correct path for object. Start path at root.

E29 Wrong value or no value allowed.
Exit: Send correct value or call up new object.

E30 Wrong trigger, this trigger is not allowed or carrying-out of action not possible.
Exit: Send correct trigger (exception: $D) or call up new object.

E31 Command is not possible in active status. Repeat command in inactive status.
Exit: Send new command.

E32 Command is not possible during titration. Repeat command during the conditioning phase or in inactive status.
Exit: Send new command.

E33 Value has been corrected automatically.
Exit: Send new command.

E34 Instrument at the end of the titration and sample data is edited; the instrument at rest or editing during filling.
Exit: &m $S.

RS receive errors:

E36 Parity
E37 Stop Bit
} Exit: <QUIT> and ensure settings of appropriate parameters at both devices are the same.

E38 Overrun error. At least 1 character could not be read.
Exit: <QUIT>

E39 The internal receive buffer of the Titrino is full (>82 characters).
Exit: <QUIT>

RS send errors:

E40 DSR = OFF
E41 DCD = ON
E42 CTS = OFF
} No proper handshake for more than 1 s.
Exit: <QUIT>
Is the receiver switched on and ready to receive?

E43 The transmission of the Titrino has been interrupted with XOFF for at least 3 s.
Exit: Send XON or <QUIT>

E44 The RS interface parameters are no longer the same for both devices. Reset.

E45 The receive buffer of the Titrino contains an incomplete command (L_F missing). Sending from the Titrino is therefore blocked.
Exit: Send L_F or <QUIT>.

E120 Overrange of the primary measured value (pH, U, Ipol, Upol or T with MEAS T).
The secondary measured value (temperature) may be instable as well.
Exit: Correct error or &m $S.

E121: Measuring point list overflow (more than 500 measuring points).
Exit: The error message disappears on next startup.

E122: EP overflow.
Exit: The error message disappears on next startup or on recalculation.

E123: Missing EP for calculation.
Exit: The error message disappears on next startup or on recalculation.

E128: No new mean.
Exit: The error message disappears on next startup or on recalculation.

E129: No new common variable, old value remains.
Exit: The error message disappears on next startup or on recalculation.

E130: Wrong sample. For SET or DOC with preset titration direction the first measured value lies behind the endpoint.
Exit: The error message disappears on next startup.

E131: No EP set for SET, STAT.
Exit: The error message disappears on next startup.

E132: Silo empty and it has been started with open silo or empty silo has been opened.
Exit: Send a silo entry.

E133: Silo full.
Exit: Send new command.

E134: No method. A method, which is required from the silo memory or in TIP, does not exist in the method memory.
Exit: The error message disappears on next startup.

E135: Check temp.sensor in MEAS T or with activated temperature monitoring.
Exit: Correct error or &m $S.

E136: Same buffer in CAL. Measured value of the second buffer differs less than 6 mV from the measured value of the first buffer.
Exit: Correct error or &m $S.

E137: XXX Bytes are missing so that the method, the silo line could not be stored or not enough RAM for TIP.
Exit: Send new command.

E149: Rate missing for calculation.
Exit: The error message disappears on next start or on recalculation.

E150: Number of rates does not agree with the set windows or the mean rate C80 could not be calculated.
Exit: The error message disappears on next start or on recalculation.

E151: Fix volume missing for calculation.
Exit: The error message disappears on next startup or on recalculation.

E152: Measured value outside the limits.
Exit: The error message disappears when again within the limits or &m $S.

E153: Rate outside the limits.
Exit: The error message disappears when again within the limits or &m $S.

E154: Temperature outside the limits.
Exit: The error message disappears when again within the limits or &m $S.

E155: No new silo result (C24 or C25).
Exit: The error message disappears on next start or on recalculation.

E157: No sequence defined in TIP
Exit. The error message disappears on next start.

E158: A second TIP has been called up in TIP
Exit: The error message disappears on next start.

E159: No measured quantity defined in TIP or DOS for manual measurements.
Exit: The error message disappears on next start or &Mode.QuickMeas $S.

E160: No new temporary variable.
Exit: The error message disappears on next start.

E161: Measurement range of the secondary measured value (temperature) exceeded. The primary measured value (pH, U, Ipol, Upol) can also be unstable.
Exit: Rectify error or &m $S.

E162: No ramp end set in DOC.
Exit: The error message disappears on next start or &m $S.

E166: Save lines is "OFF" although method includes assignment to C24 or C25.
Exit: The error message disappears on next start.
Warning: The silo line has already been copied to the working memory. When the sample is processed, the silo memory must be switched out. Switch in silo memory before the next start and switch on "save lines".

E167: Rate too high in DOS. No dispensing possible with the Exchange Unit currently mounted.
Exit: The error message disappears on next start or &m $S.

E170: Fix time missing for calculation.
Exit: The error message disappears on next start or on recalculation.

E171: Rate too low in DOS. No dispensing possible with the Exchange Unit currently mounted.
Exit: The error message disappears on next start or &m $S.

3.2 Remote control commands

3.2.1 Overview

Object	Function	Input range	see...
&	**Root**		
.Mode	**Mode**	$G, $S, $H, $C	3.2.2.1
.QuickMeas	Rapid measurement in basic mode	$G, $S	3.2.2.2
.Select	Selection of the mode	SET, STAT, DOS, DOC MEAS,CAL, TIP	3.2.2.3
.DETQuantity	Measured quantity for DET	no meaning	
.METQuantity	Measured quantity for MET	no meaning	
.SETQuantity	Measured quantity for SET	pH, U, Ipol, Upol	3.2.2.3
.MEASQuantity	Measured quantity for MEAS	pH, U, Ipol, Upol, T	3.2.2.3
.STATQuantity	Measured quantity for STAT	pH, U, Ipol, Upol	3.2.2.3
.DOCQuantity	Measured quantity for DOC	pH, U, Ipol, Upol	3.2.2.3
.Name	Name of the current method	read only/read + write	3.2.2.4
.Parameter*	Parameters of current method, depend on the mode, see pages 88 to 95		
.Def	**Definitions for the data output**		
.Formulas	**Calculation formulae**		
.1	For result 1		
.Formula	Calculation formula	special	3.2.2.5
.TextRS	Text for result specification	up to 8 ASCII char	3.2.2.5
.Decimal	Decimal places	0...5	3.2.2.5
.Unit	Unit for the result	up to 8 ASCII char	3.2.2.5
	up to 9 results		
.SiloCalc	**Silo calculations**		
.Assign	Assignments for result storage		
.C24	As C24	RSX, EPX, CXX	3.2.2.6
.C25	As C25	RSX, EPX, CXX	3.2.2.6
.MatchId	Matching of Ids	id1, id1&2, all, OFF	3.2.2.6
.ComVar	**Assignment of common variables**		
.C30	Common variable C30	RSX, MNX, EPX, CXX	3.2.2.7
	up to C39		
.Report	**Data output at the end of titration**		
.Assign	Assignment	depends on mode	3.2.2.8
.Mean	**Assignments for statistics calculations**		
.1	Mean value 1, MN1		
.Assign	Assignment for MN1	RSX, EPX, CXX	3.2.2.9
	up to 9 assignments		
.TempVar	**Assignment of temporary variables**		
.C70	Common variable C70	RSX, EPX, CXX	3.2.2.10
	up to C79		
.CFmla	**Calculation constants**		
.1	Calculation constant C01		
.Value	Value for C01	0... ±999 999	3.2.2.11
	up to C19		

Object	Function	Input range	see...
*Parameter	**Branch "Parameters for SET"**		
.SET1	**Control parameters for EP1**		
.EP	End point 1	depends on meas quant.	3.2.2.12
.UnitEp	Unit of the end point EP1	read only	3.2.2.12
.Dyn	Dynamics	depends on meas quant.	3.2.2.13
.UnitDyn	Unit for dynamics	read only	3.2.2.13
.MaxRate	Maximum dosing rate	0.01...150, max.	3.2.2.13
.MinRate	Minimum dosing rate	0.01...999.9	3.2.2.13
.Stop	Titration stop		
.Type	Type of stop criterion	drift, time	3.2.2.14
.Drift	Stop drift	1...999	3.2.2.14
.Time	Switch-off delay time	0...999, inf	3.2.2.14
.StopT	Stop time	0...999 999, OFF	3.2.2.14
.SET2	**Control parameters for EP2**, identical to SET1		
.TitrPara	**Titration parameters**		
.Direction	Titration direction	+, –, auto	3.2.2.15
.StartV	Start volume		
.Type	Type of start volume	abs., rel., OFF	3.2.2.16
.V	Volume for the absolute start volume	0...999.99	3.2.2.16
.Factor	Factor for the relative start volume	0... ±999 999	3.2.2.16
.Rate	Dosing rate	0.01...150, max.	3.2.2.16
.Pause	Wait time	0...999 999	3.2.2.16
.MeasInput	Measurement input	1, 2, diff.	3.2.2.17
.Ipol	Polarisation current	0... ±127	3.2.2.17
.Upol	Polarisation voltage	0... ±1270	3.2.2.17
.PolElectrTest	Test for polarized electrodes	ON, OFF	3.2.2.17
.Temp	Titration temperature	–170.0...500.0	3.2.2.18
.StopCond	**Stop conditions**		
.VStop	Stop volume		
.Type	Type of stop volume	abs., rel., OFF	3.2.2.19
.V	Volume for the absolute stop volume	0...9999.99	3.2.2.19
.Factor	Factor for the relative stop volume	0... ±999 999	3.2.2.19
.FillRate	Filling rate after the titration	0.01...150.0, max.	3.2.2.20
.Statistics	**Statistics calculations**		
.Status	Status of the statistics	ON, OFF	3.2.2.21
.MeanN	Number of individual determinations	2...20	3.2.2.21
.ResTab	Result table		
.Select		original, delete n, delete all	3.2.2.21
.DelN	Deletion of individual results	1...20	3.2.2.21
.Presel	**Preselections**		
.Cond	Conditioning	ON, OFF	3.2.2.22
.DriftDisp	Display of the drift during conditioning	ON, OFF	3.2.2.22
.IReq	Request of Id's after start	id1, id2, all, OFF	3.2.2.23
.SReq	Request of sample size after start	value, unit, all, OFF	3.2.2.23
.ActPulse	Output of a pulse	first, all, cond., OFF	3.2.2.24

Object	Function	Input range	see...
***Parameter**	**Branch"Parametes for STAT"**		
.CtrlPara	**Control parameters**		
.EP	Control point	depends on meas.quant.	3.2.2.25
.UnitEp	Unit of control point	read only	3.2.2.25
.Dyn	Dynamics	depends on meas.quant.	3.2.2.26
.UnitDyn	Unit of dynamics	read only	3.2.2.26
.MaxRate	Maximum dosing rate	0.01...150, max.	3.2.2.26
.MinRate	Minimum dosing rate	0.01...999.9	3.2.2.26
.**T**itrPara	**Titration parameters**		
.StartV	Start volume		
.Type	Type of start volume	abs., rel., OFF	3.2.2.16
.V	Volume for absolute start volume	0...999.99	3.2.2.16
.Factor	Factor for relative start volume	0... ± 999 999	3.2.2.16
.Rate	Dosing rate	0.01...150, max.	3.2.2.16
.Pause	Wait time	0...999 999	3.2.2.16
.TStart	Start time	0...999 999	3.2.2.27
.StartMeas	Start measured value	depends on meas.quant.	3.2.2.27
.RateStart	Start rate	0.01...150, OFF	3.2.2.27
.**TD**elta	Time interval for measured point entry	1...999 999	3.2.2.28
.Direction	Titration direction	+, –, auto	3.2.2.15
.MeasInput	Measuring input	1, 2, diff.	3.2.2.17
.Ipol	Polarisation current	0... ± 127	3.2.2.17
.Upol	Polarisation voltage	0... ± 1270	3.2.2.17
.Pol ElectrTest	Test for polarised electrodes	ON, OFF	3.2.2.17
.Temp	Temperature	–170.0...500.0	3.2.2.18
.**S**topCond	**Stop conditions**		
.TStop	Stop by time		
.Type	Type of stop time	abs., rel., OFF	3.2.2.29
.Time	Time for absolute stop time	0...999 999	3.2.2.29
.Factor	Factor for relative stop time	0... ± 999 999	3.2.2.29
.VStop	Stop volume		
.Type	Type of stop volume	abs., rel., OFF	3.2.2.19
.V	Volume for absolute stop volume	0...9999.99	3.2.2.19
.Factor	Factor for relative stop volume	0... ± 999 999	3.2.2.19
.RateStop	Stopp rate	0.01...150, OFF	3.2.2.30
.FillRate	Filling rate after titration	0.01...150.0, max.	3.2.2.20
.**St**atistics	**Statistics calculations**		
.Status	Status of the statistics	ON, OFF	3.2.2.21
.MeanN	Number of individual determinations	2...20	3.2.2.21
.ResTab	Result table		
.Select		original, delete n, delete all	3.2.2.21
.DelN	Deletion of individual results	1...20	3.2.2.21
.**E**valuation	**Evaluation**		
.TimeWin	Time window for rate evaluation		
.1	Window 1		
.LowLim	Lower limit value	0...999 999, OFF	3.2.2.31
.UpLim	Upper limit value	0...999 999, OFF	3.2.2.31
	up to 9 windows		
.FixVol	Fix volumes		
.1	1st fix volume		
.Value	Value	0...999 999, OFF	3.2.2.32
	up to 9 fix volumes		
.FixTime	Fix times		
.1	1st fix time		
.Value	Value	0.01...1, OFF	3.2.2.33
	up to 9 fix times		

Object	Function	Input range	see...
*Parameter	**Branch "Parameters for STAT", continued**		
.Monitoring	**Monitoring**		
.MeasVal	Measured value monitoring		
.Status	Status	ON, OFF	3.2.2.34
.LowLim	Lower limit	depends on meas.quant.	3.2.2.34
.UpLim	Upper limit	depends on meas.quant.	3.2.2.34
.Action	Action on limit violation	end, hold, wait, none	3.2.2.34
.Rate	Monitoring of rate		
.Status	Status	ON, OFF	3.2.2.35
.LowLim	Lower limit	0.000...150	3.2.2.35
.UpLim	Upper limit	0.000...150	3.2.2.35
.Action	Action on limit violation	end, hold, wait, none	3.2.2.35
.Temp	Temperature monitoring		
.Status	Status	ON, OFF	3.2.2.36
.LowLim	Lower limit	-170.0...500.0	3.2.2.36
.UpLim	Upper limit	-170.0...500.0	3.2.2.36
.Action	Action on limit violation	end, hold, wait, none	3.2.2.36
.AssignOutput	Assign L4 output, pin 3	meas, temp, rate, all none	3.2.2.37
.Output	Type of signal	active, pulse	3.2.2.37
.Presel	**Preselections**		
.IReq	Request of Ids after start	id1, id1&2, all, OFF	3.2.2.23
.SReq	Request of sample size after start	value, unit, all, OFF	3.2.2.23
.RateDisp	Live display of rate	ON, OFF	3.2.2.38
.ActPulse	Output of a pulse	ON, OFF	3.2.2.24

Object	Function	Input range	see...
***Parameter**	**Branch "Parameters for DOS"**		
.DosPara	**Dosing parameters**		
.Type	Type of dosing	volume, time, rate	3.2.2.39
.Volume	If dosing by volume		
.Volume	Volume	0.000...99999.99	3.2.2.39
.DisType	2nd dispensing criterion	time, rate	3.2.2.39
.Rate	Rate	0.001...150, max.	3.2.2.39
.Time	Dosing time	1...999 999	3.2.2.39
.Time	If dosing by time		
.Time	Dosing time	1...999 999	3.2.2.39
.DisType	2nd dispensing criterion	volume, rate	3.2.2.39
.Rate	Rate	0.001...150, max.	3.2.2.39
.Volume	Dispensed volume	0.000...99999.99	3.2.2.39
.Rate	If dosing by rate		
.Rate	Rate	0.001...150, max.	3.2.2.39
.StopType	Stop criterion	time, volume	3.2.2.39
.Time	Dosing time	1...999 999	3.2.2.39
.Volume	Dispensed volume	0.000...99999.99	3.2.2.39
.Pause	Wait time	0...999 999	3.2.2.40
.TDelta	Time interval for measured point entry	1...999 999	3.2.2.41
.Temp	Titration temperature	–170.0...500.0	3.2.2.42
.StopCond	**Stop conditions**		
.VStop	Stop volume		
.Type	Type of stop volume	abs., rel., OFF	3.2.2.19
.V	Volume for absolute stop volume	0...99 999.99	3.2.2.19
.Factor	Factor for relative stop volume	0... ± 999 999	3.2.2.19
.FillRate	Filling rate after the titration	0.01...150.0, max.	3.2.2.20
.Statistics	**Statistics calculations**		
.Status	Status of the statistics	ON, OFF	3.2.2.21
.MeanN	Number of individual determinations	2...20	3.2.2.21
.ResTab	Result table		
.Select		original, delete n, delete all	3.2.2.21
.DelN	Deletion of individual results	1...20	3.2.2.21
.Monitoring	**Monitoring**		
.MeasVal	Measured value monitoring		
.MeasMode	Measured quantity	pH, U, Ipol, Upol, OFF	3.2.2.43
.MeasInput	Measuring input	1, 2, diff.	3.2.2.43
.PCurrent	Polarisation current	0... ± 127	3.2.2.43
.PVoltage	Polarisation voltage	0... ± 1270	3.2.2.43
.PolElectrTest	Test for polarised electrodes	ON, OFF	3.2.2.43
.pH	Limits for pH value monitoring		
.LowLim	Lower limit	0... ± 20.00	3.2.2.43
.UpLim	Upper limit	0... ± 20.00	3.2.2.43
.U	Limits for voltage monitoring		
.LowLim	Lower limit	0... ± 2000	3.2.2.43
.UpLim	Upper limit	0... ± 2000	3.2.2.43
.Ipol	Limits for voltage monitoring		
.LowLim	Lower limit	0... ± 2000	3.2.2.43
.UpLim	Upper limit	0... ± 2000	3.2.2.43
.Upol	Limits for current monitoring		
.LowLim	Lower limit	0... ± 200.0	3.2.2.43
.UpLim	Upper limit	0... ± 200.0	3.2.2.43
.Action	Action on limit violation	end, hold, wait, none	3.2.2.43

Object	Function	Input range	see...
*Parameter	**Branch "Parameters for DOS, Monitoring", continued**		
.Monitoring	**Monitoring**		
.Temp	Temperature monitoring		
.Status	Status	ON, OFF	3.2.2.36
.LowLim	Lower limit	-170.0...500.0	3.2.2.36
.UpLim	Upper limit	-170.0...500.0	3.2.2.36
.Action	Action on limit violation	end, hold, wait, none	3.2.2.36
.AssignOutput	Assign L4 output, pin 3	meas, temp, all, none	3.2.2.37
.Output	Type of signal	active, pulse	3.2.2.37
.Presel	**Preselections**		
.IReq	Request of Ids after start	id1, id1&2, all, OFF	3.2.2.23
.SReq	Request of sample size after start	value, unit, all, OFF	3.2.2.23
.ActPulse	Output of a pulse	ON, OFF	3.2.2.24

Object	Function	Input range	see...
***Parameter**	**Branch"Parameters for DOC"**		
.DosPara	**Dosing parameters**		
.BeginMeas	Ramp start	depends on meas.quant.	3.2.2.44
.EndMeas	Ramp end	depends on meas.quant.	3.2.2.44
.UnitMeas	Unit of measured quantity	read only	3.2.2.44
.SweepTime	Sweep time	0...999 999	3.2.2.45
.Dyn	Dynamics	depends on meas.quant.	3.2.2.46
.UnitDyn	Unit for dynamics	read only	3.2.2.46
.MaxRate	Maximum dosing rate	0.01...150, max.	3.2.2.46
.MinRate	Minimum dosing rate	0.01...999.9	3.2.2.46
.Direction	Titration direction	+, –, auto	3.2.2.47
.StartV	Start volume		
.Type	Type of start volume	abs., rel., OFF	3.2.2.48
.V	Volume for absolute start volume	0...999.99	3.2.2.48
.Factor	Factor for relative start volume	0... ± 999 999	3.2.2.48
.Rate	Dosing rate	0.01...150, max.	3.2.2.48
.Pause	Wait time	0...999 999	3.2.2.48
.TDelta	Time interval for measured point entry	1...999 999	3.2.2.41
.MeasInput	Measuring input	1, 2, diff.	3.2.2.49
.Ipol	Polarisation current	0... ± 127	3.2.2.49
.Upol	Polarisation voltage	0... ± 1270	3.2.2.49
.PolElectrTest	Test for polarised electrodes	ON, OFF	3.2.2.49
.Temp	Titration temperature	–170.0...500.0	3.2.2.42
.StopCond	**Stop conditions**		
.VStop	Stop volume		
.Type	Type of stop volume	abs., rel., OFF	3.2.2.19
.V	Volume for absolute stop volume	0...9999.99	3.2.2.19
.Factor	Factor for relative stop volume	0... ± 999 999	3.2.2.19
.FillRate	Filling rate after the titration	0.01...150.0, max.	3.2.2.20
.Statistics	**Statistics calculations**		
.Status	Status of the statistics	ON, OFF	3.2.2.21
.MeanN	Number of individual determination	2...20	3.2.2.21
.ResTab	Result table		
.Select		original, delete n, delete all	3.2.2.21
.DelN	Deletion of individual results	1...20	3.2.2.21
.Monitoring	**Monitoring**		
.MeasVal	Measured value monitoring		
.Status	Status	ON, OFF	3.2.2.34
.LowLim	Lower limit	depends on meas.quant.	3.2.2.34
.UpLim	Upper limit	depends on meas.quant.	3.2.2.34
.Action	Action on limit violation	end, hold, wait, none	3.2.2.34
.Temp	Temperature monitoring		
.Status	Status	ON, OFF	3.2.2.36
.LowLim	Lower limit	-170.0...500.0	3.2.2.36
.UpLim	Upper limit	-170.0...500.0	3.2.2.36
.Action	Action on limit violation	end, hold, wait, none	3.2.2.36
.AssignOutput	Assign L4 output, pin 3	meas, temp, all, none	3.2.2.37
.Output	Type of signal	active, pulse	3.2.2.37
.Presel	**Preselections**		
.IReq	Request of Ids after start	id1, id1&2, all, OFF	3.2.2.23
.SReq	Request of sample size after start	value, unit, all, OFF	3.2.2.23
.RateDisp	Live display of the rate	ON, OFF	3.2.2.38
.ActPulse	Output of a pulse	ON, OFF	3.2.2.24

Object	Function	Input range	see...
*Parameter	**Branch "Parameters for MEAS"**		
.Measuring	**Measurement parameters**		
.SignalDrift	Drift for measured value acquisition	depends on meas quant.	3.2.2.50
.UnitSigDrift	Unit of measured value drift	read only	3.2.2.50
.EquTime	Equilibr. time for meas. value acquisition	0...9999, OFF	3.2.2.50
.MeasInput	Measuring input	1, 2, diff.	3.2.2.50
.Ipol	Polarisation current	0... ± 127	3.2.2.51
.Upol	Polarisation potential	0... ± 1270	3.2.2.51
.PolElectrTest	Test for polarized electrodes	ON, OFF	3.2.2.51
.Temp	Measurement temperature	–170.0...500.0	3.2.2.52
.Statistics	**Statistics calculations**		
.Status	Status of the statistics	ON, OFF	3.2.2.21
.MeanN	Number of individual determinations	2...20	3.2.2.21
.ResTab	Result table		
.Select		original, delete n, delete all	3.2.2.21
.DelN	Deletion of individual results	1...20	3.2.2.21
.Presel	**Preselections**		
.IReq	Request of Id's after start	id1, id2, all, OFF	3.2.2.23
.SReq	Request of sample size after start	value, unit, all, OFF	3.2.2.23
.ActPulse	Output of a pulse	ON, OFF	3.2.2.24

Object	Function	Input range	see...
*Parameter	**Tree part "Parameters for CAL"**		
.Calibration	**Calibration parameters**		
.MeasInput	Measuring input	1, 2, diff.	3.2.2.53
.CalTemp	Calibration temperature	–20.0...120.0	3.2.2.54
.Buffer	pH value of the buffers		
.1	Buffer 1		
.Value	pH value of buffer 1	0... ± 20.00	3.2.2.55
.2	Buffer 2		
.Value	pH value of buffer 2	0... ± 20.00, OFF	3.2.2.55
	up to 9 buffers		
.SignalDrift	Drift for measured value acquisition	0.5...999, OFF	3.2.2.56
.EquTime	Equilibr. time for meas. value acquisition	0...9999, OFF	3.2.2.56
.ElectrodeId	Electrode identification	up to 8 ASCII char	3.2.2.57
.SmplChanger	Calibration at sample changer	ON, OFF	3.2.2.58
.ActPulse	Output of a pulse	first, all, OFF	3.2.2.59
.Statistics	**Statistics calculations**		
.Status	Status of the statistics	ON, OFF	3.2.2.21
.MeanN	Number of individual determinations	2...20	3.2.2.21
.ResTab	Result table		
.Select		original, delete n, delete all	3.2.2.21
.DelN	Deletion of individual results	1...20	3.2.2.21

Object	Function	Input range	see...
*Parameter	**Branch "Parameters for TIP"**		
.Sequence	**Sequence**		
.1	1st step		
.Select	Selection of the step	method, pause, L4 output L6 output, info, OFF	3.2.2.60
.Method	Method from user memory	special	3.2.2.61
.Pause	Wait time	0...999 999, INF	3.2.2.61
.L4Output	L4 output	active,inactive,pulse,OFF	3.2.2.61
.L6Output	L6 output	active,inactive,pulse,OFF	3.2.2.61
.Info	Message in display	up to 16 ASCII characters	3.2.2.61
	up to 30 steps		
.Statistics	**Statistics calculations**		
.Status	Status of the statistics	ON, OFF	3.2.2.21
.MeanN	Number of individual determinations	2...20	3.2.2.21
.ResTab	Result table		
.Select		original, delete n, delete all	3.2.2.21
.DelN	Deletion of individual results	1...20	3.2.2.21
.Presel	**Preselections**		
.IReq	Request of Ids after start	id1, id1&2, all, OFF	3.2.2.23
.SReq	Request of sample size after start	value, unit, all, OFF	3.2.2.23
.MeasMode	Meas. mode for manual measurements	pH, U, Ipol, Upol, T, OFF	3.2.2.62
.MeasInput	Measuring input	1, 2, diff.	3.2.2.62
.Ipol	Polarisation current	0... ± 127	3.2.2.62
.UPol	Polarisation voltage	0... ± 1270	3.2.2.62
.PolElectrTest	Test for polarised electrodes	ON, OFF	3.2.2.62
.Temp	Temperature	-170.0...500.0	3.2.2.62
&	**Root**		
UserMeth	**Management of the method memory**		
.FreeMem	Memory still available	read only	3.2.2.63
.Recall	Recall method	$G	3.2.2.64
.Name	Method identification	up to 8 ASCII characters	3.2.2.64
.Store	Store method	$G	3.2.2.64
.Name	Method identification	up to 8 ASCII characters	3.2.2.64
.Delete	Delete method	$G	3.2.2.64
.Name	Method identification	up to 8 ASCII characters	3.2.2.64
.DelAll	Delete all methods	$G	3.2.2.64
.List	List of all methods in the method memory		
.1	Method 1		
.Name	Name of the method	read only	3.2.2.65
.Mode	Mode	read only	3.2.2.65
.Quantity	Measured quantity	read only	3.2.2.65
.Bytes	Bytes used from the method memory	read only	3.2.2.65
.Checksum	Checksum of the method	read only	3.2.2.65
	for all the methods		

Object	Function	Input range	see...
&	**Root**		
Config	**Configuration**		
.PeriphUnit	**Selection of external devices**		
.CharSet	Selection of the character set	Epson,Seiko,Citizen, IBM, HP	3.2.2.66
.Balance	Selection of the balance	Sartorius,Mettler,Mettler AT, AND,Precisa	3.2.2.67
.Plot	Sel. of the curve at the analog output	U,dU/dt,V,dV/dt,U(rel),T	3.2.2.67
.Aux	**Setting of various auxiliary functions**		
.Language	Selection of the dialog language	english,deutsch, francais,espanol, etc.	3.2.2.68
.Set	Setting of date and time	$G	3.2.2.69
.Date	Date	XXXX-XX-XX	3.2.2.69
.Time	Time	XX:XX	3.2.2.69
.RunNo	Current sample number	0...9999	3.2.2.70
.AutoStart	Internal automatic start	1...9999, OFF	3.2.2.71
.StartDelay	Start delay	0...999 999	3.2.2.72
.DevName	Device name	up to 8 ASCII characters	3.2.2.73
.Prog	Program version	read only	3.2.2.74
.RSSet	**Settings for RS232**	$G	3.2.2.75
.Baud	Baud Rate	special (300...9600)	3.2.2.76
.DataBit	Data Bit	7,8	3.2.2.76
.StopBit	Stop Bit	1,2	3.2.2.76
.Parity	Parity	even,odd,none	3.2.2.76
.Handsh	Handshake	HWs,HWf,SWchar, SWline,none	3.2.2.76
.ComVar	**Values of the common variables**		
.C30	Value of C30 up to C39	0... ±999 999	3.2.2.77
SmplData	**Sample data**		
.Status	Status of the silo memory	ON, OFF	3.2.2.78
.OFFSilo	Current sample data (Silo = OFF)		
.Id1	Sample identification 1	up to 8 ASCII characters	3.2.2.79
.Id2	Sample identification 2	up to 8 ASCII characters	3.2.2.79
.Id3	Sample identification 3	up to 8 ASCII characters	3.2.2.79
.ValSmpl	Sample size	±X.XXXXX	3.2.2.79
.UnitSmpl	Unit of the sample size	up to 5 ASCII characters	3.2.2.79
.ONSilo	Sample data in the silo memory (Silo = ON)		
.Counter	Counters for the silo memory		
.MaxLines	Maximum possible number of lines	read only	3.2.2.80
.FirstLine	First occupied line	read only	3.2.2.80
.LastLine	Last occupied line	read only	3.2.2.80
.EditLine	Edit silo lines		
.1	1st silo line		
.Method	Method used to process sample	up to 8 ASCII characters	3.2.2.81
.Id1	Sample identification 1	up to 8 ASCII characters	3.2.2.81
.Id2	Sample identification 2	up to 8 ASCII characters	3.2.2.81
.Id3	Sample identification 3	up to 8 ASCII characters	3.2.2.81
.ValSmpl	Sample size	±X.XXXXX	3.2.2.81
.UnitSmpl	Unit of sample	up to 5 ASCII characters	3.2.2.81
.C24	Variable C24	read only	3.2.2.81
.C25	Variable C25	read only	3.2.2.81
.Mark	Mark of silo line	read only	3.2.2.81
	up to max. 99 lines		
.DelLine	Delete silo line	$G	3.2.2.82
.LineNum	Line number	1...99, OFF	3.2.2.82
.DelAll	Delete entire silo memory	$G	3.2.2.83
.CycleLines	Data cycling	ON, OFF	3.2.2.84
.SaveLines	Store the results	ON, OFF	3.2.2.85

Object	Function	Input range	see...
&	**Root**		
Info	**Information**		
.Report	**Send formatted report**	$G	3.2.2.86
.Select	Selection of the reports	configuration, parameters, smpl data, statistics, silo, calib, C-fmla, def, user method, calc, full, short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, calc, all, ff	3.2.2.86
.CalibrationData	**pH calibration data**	$G	3.2.2.87
.Inp1	For measuring input 1		
.pHas	Asymmetry pH	0... ±20.00	3.2.2.87
.Slope	Slope of the electrode	0... ±9.999	3.2.2.87
.Temp	Calibration temperature	-170...500	3.2.2.87
.Date	Date of the calibration	read only	3.2.2.87
.ElectrodeId	Id of the calibrated electrode	read only	3.2.2.87
.Inp2	For measuring input 2, identical to 1		
.Diff	For differential input, identical to 1		
.Checksums	**Checksums**	$G	3.2.2.88
.MPList	Checksum of the measuring point list	read only	3.2.2.88
.ActualMethod	Checksum of the current method	read only	3.2.2.88
.DetermData	**Determination data**	$G	3.2.2.89
.Write	Read/Write for "read only/read + write"	ON, OFF	3.2.2.89
.ExV	Volume of excahnge unit	read only/read + write	3.2.2.89
.MPList	Measuring point list		
.1	Measuring point 1		
.Attribute	Attribute	read only/read + write	3.2.2.89
.X	X coordinate, time	read only/read + write	3.2.2.89
.Y	Y coordinate, volume	read only/read + write	3.2.2.89
.Z1	Z1 coordinate, measured value	read only/read + write	3.2.2.89
.Z2	Z2 coordinate, temperature	read only/read + write	3.2.2.89
	for every measuring point		
.TitrResults	**Results of the determination**		
.RS	Calculated results		
.1	Result 1		
.Value	Numeric value of result 1	read only	3.2.2.90
	up to 9 results		
.EP	Endpoints		
.1	Endpoint 1		
.V	Volume coordinate	read only	3.2.2.90
.Meas	Measured value coordinate	read only	3.2.2.90
.Mark	Mark if more than 1EP per window	no meaning	3.2.2.90
	up to 2 endpoints		
.Var	Variables C4X		
.C40	Initial measured value	read only/read + write	3.2.2.90
.C41	Titration end volume	read only/read + write	3.2.2.90
.C42	Titration time	read only/read + write	3.2.2.90
.C43	Volume drift	read only/read + write	3.2.2.90
.C44	Titration temperature	read only/read + write	3.2.2.90
.C45	Start volume	read only/read + write	3.2.2.90
.C46	Asymmetry pH	read only	3.2.2.90
.C47	Slope of the electrode	read only	3.2.2.90
.DTime	Dosing time	read only/read + write	3.2.2.90
.FixEP	Fix volume		
.51	Fix volume		
.Value	Time	read only	3.2.2.91
.TitrResults			
.pK	Values of the fix times		
.61	up to C69		
.Value	Value	read only	3.2.2.91

Object	Function	Input range	see...
&	**Root**		
	Information, TitrResults, Continued		
.TempVar	Temporary variables		
.C70	up to C79	read only/read + write	3.2.2.91
.TimeWin	Rates of time windows		
.81	up to C89		
.Mean	Rate	read only	3.2.2.92
.Dev	Standard deviation of rate	read only	3.2.2.92
.MeanRateC80	Mean rate C80		
.Mean	Rate	read only	3.2.2.92
.Dev	Standard deviation of rate	read only	3.2.2.92
.StatisticsVal	**Statistics values**		
.ActN	Number of single results in statistics table	read only	3.2.2.93
.1	Data of MN1		
.Mean	Mean	read only	3.2.2.93
.Std	Absolute standard deviation	read only	3.2.2.93
.RelStd	Relative standard deviation	read only	3.2.2.93
	up to 9 means		
.SiloCalc	**Values from silo calculations**		
.C24	From C24		
.Name	Name	read only	3.2.2.94
.Value	Value	read only	3.2.2.94
.Unit	Unit	read only	3.2.2.94
.C25	as for C24		
.C26	From C26		
.ActN	Number of single results	read only	3.2.2.94
.Mean	Mean	read only	3.2.2.94
.Std	Absolute standard deviation	read only	3.2.2.94
.RelStd	Relative standard deviation	read only	3.2.2.94
.C27	as for C26		
.ActualInfo	**Current information**		
.Inputs	I/O inputs		
.Status	Status of the lines	read only	3.2.2.95
.Change	Change in the status of the lines	read only	3.2.2.95
.Clear	Clears the change byte	$G	3.2.2.95
.Outputs	I/O outputs		
	same as inputs		
.Assembly	Regarding assembly		
.CyclNo	Cycle number	read only	3.2.2.96
.Counter	Counter in assembly		
.V	Volume counter	read only	3.2.2.97
.Clear	Clears above counter	$G	3.2.2.97
.Meas	Measured value	read only	3.2.2.98
.Titrator	Regarding the titrator		
.CyclNo	Cycle number	read only	3.2.2.99
.V	Volume	read only	3.2.2.99
.Meas	Measured value	read only	3.2.2.99
.dVdt	Volume drift dV/dt	read only	3.2.2.99
.dMeasdt	Measured value drift	read only	3.2.2.99
.dMeasdV	1st derivative of the titration curve	read only	3.2.2.99
.ERC	ERC of DET	no meaning	3.2.2.99
.T	Temperature as secondary value	read only	3.2.2.99
.MeasPt	Entry in the measuring point list		
.Index	Index of the input	read only	3.2.2.100
.X	X coordinate, time	read only	3.2.2.100
.Y	Y coordinate, volume	read only	3.2.2.100
.Z1	Z1 coordinate, measuring value	read only	3.2.2.100
.Z2	Z2 coordinate, temperature	read only	3.2.2.100
.EP	Entry onf an EP		
.Index	Index of the input	read only	3.2.2.100
.X	X coordinate, volume	read only	3.2.2.100
.Y	Y coordinate, measuring value	read only	3.2.2.100

Object	Function	Input range	see...
&	**Root**		
	Information, ActualInfo, continued		
.ActualInfo			
.Display	Display		
.L1	1st line	24 ASCII characters	3.2.2.101
.L2	2nd line	24 ASCII characters	3.2.2.101
.Assembly	**Assembly**		
.CycleTime	Cycle time	read only	3.2.2.102
.ExV	Volume of the exchange unit	read only	3.2.2.102
Assembly	**Basic elements of the assembly**		
.Bur	**Burette**		
.Rates	Rates		
.Forward	In direction "expel"		
.Select	Type of rate control	digital, analog	3.2.2.103
.Digital	Digital rate	0...150,max.	3.2.2.103
.Reverse	In direction "aspirate"		
.Select	Type of rate control	digital, analog	3.2.2.103
.Digital	Digital rate	0...150,max.	3.2.2.103
.Fill	Filling	$G, $H, $C	3.2.2.104
.ModeDis	Dispensing mode	$G, $S, $H, $C	3.2.2.105
.Select	Type of dispensing control	volume, time	3.2.2.105
.V	Volume to be dispensed	0.0001...9999	3.2.2.105
.Time	Time of dispensing	0.25...86400	3.2.2.105
.VStop	Limit volume	0.0001...9999,OFF	3.2.2.105
.AutoFill	Filling after every increment	ON, OFF	3.2.2.105
.Meas	**Measurement**		
.Status	On/off switching of measurement	ON, OFF	3.2.2.106
.MeasInput	Selection of the measuring input	1, 2, Diff., Ipol, Upol, Temp	3.2.2.106
.Ipol	Polarisation current	0... ± 127	3.2.2.106
.Upol	Polarisation potential	0... ± 1270	3.2.2.106
.Outputs	**I/O outputs**		
.AutoEOD	Output of pulse End Of Determination	ON, OFF	3.2.2.107
.SetLines	Set I/O lines	$G	3.2.2.107
.L1	Signal on line 1	active, inactive, pulse, OFF	3.2.2.107
	up tp L3		
.ResetLines	Reset I/O outputs	$G	3.2.2.107
Setup	**Setting the operation mode**		
.Keycode	Send key code of pressed key	ON,OFF	3.2.2.108
.Tree	Definitions as to the response to $Q		
.Short	Only necessary characters	ON,OFF	3.2.2.109
.ChangedOnly	Only changed values	ON,OFF	3.2.2.109
.Trace	Message when values change	ON,OFF	3.2.2.110
.Lock	**Disable key functions**		
.Keyboard	Disable all keys of the Titrino	ON,OFF	3.2.2.111
.Config	Disable the <configuration> key	ON,OFF	3.2.2.111
.Parameter	Disable the <parameters> key	ON,OFF	3.2.2.111
.SmplData	Disable the <smpl data> key	ON,OFF	3.2.2.111
.UserMeth			
.Recall	Disable "recall" in key <user meth>	ON,OFF	3.2.2.111
.Store	Disable "store" in key <user meth>	ON,OFF	3.2.2.111
.Delete	Disable "delete" in key <user meth>	ON,OFF	3.2.2.111
.Display	Disable display service of the Titrino	ON,OFF	3.2.2.111

Object	Function	Input range	see...
&	**Root**		
	Setting the operation mode, continued		
.Mode	**Mode sequence**		
.StartWait	Holding point after start	ON, OFF	3.2.2.112
.FinWait	Holding point at the end	ON, OFF	3.2.2.112
.SendMeas	**Automatic transmission of meas. data**		
.SendStatus	On/off switching of transmission	ON,OFF	3.2.2.113
.Interval	Time interval for transmission	0.08...16200, MPList	3.2.2.113
.Select	Selection	Assembly, Titrator	3.2.2.114
.Assembly	Values from &Assembly		
.CyclNo	Cycle number	ON,OFF	3.2.2.115
.V	Volume	ON,OFF	3.2.2.115
.Meas	Associated measured value	ON,OFF	3.2.2.115
.Titrator	Values from titrator		
.CyclNo	Cycle number	ON,OFF	3.2.2.116
.V	Associated volume	ON,OFF	3.2.2.116
.Meas	Associated measured value	ON,OFF	3.2.2.116
.dVdt	Associated volume drift	ON,OFF	3.2.2.116
.dMeasdt	Associated measured value drift	ON,OFF	3.2.2.116
.dMeasdV	Associated 1st derivative titr. curve	ON,OFF	3.2.2.116
.ERC	Associated ERC in DET	no meaning	3.2.2.116
.T	Temperature as secondary value	ON,OFF	3.2.2.116
.AutoInfo	**Automatic message on status changes**		
.Status	Global switch for set AutoInfos	ON,OFF	3.2.2.117
.P	When power is switched on	ON,OFF	3.2.2.117
.T	From titrator		
.R	When instrument in "ready" status	ON,OFF	3.2.2.117
.G	When instrument is started.	ON,OFF	3.2.2.117
.GC	A go command has been received	ON,OFF	3.2.2.117
.S	When instrument in "stop" status	ON,OFF	3.2.2.117
.B	Begin of titration	ON,OFF	3.2.2.117
.F	End of titration.	ON,OFF	3.2.2.117
.E	On error message	ON,OFF	3.2.2.117
.H	When instrument in "hold" status	ON,OFF	3.2.2.117
.C	Continue after hold	ON,OFF	3.2.2.117
.O	Conditioning OK.	ON,OFF	3.2.2.117
.N	Conditioning Not OK.	ON,OFF	3.2.2.117
.Re	When in request after titration start	ON,OFF	3.2.2.117
.Si	Entry in measuring point list	ON,OFF	3.2.2.117
.M	When silo memory empty	ON,OFF	3.2.2.117
.EP	Entry in EP list	ON,OFF	3.2.2.117
.RC	Recalculation	ON,OFF	3.2.2.117
.I	On change of an I/O input	ON,OFF	3.2.2.117
.O	On change of an I/O output	ON,OFF	3.2.2.117
.Graphics	Change of the curve output		
.Grid	Grid over the curve	ON,OFF	3.2.2.118
.Frame	Frame surrounding curve	ON,OFF	3.2.2.118
.Scale	Type of curve scaling of meas.value axis	Full, Auto	3.2.2.118
.Recorder			
.Right	Length of the measured value axis	0.2...1.00	3.2.2.118
.Feed	Length of the volume axis	0.01...1.00	3.2.2.118
.PowerOn	Simulation "power on"	$G	3.2.2.119
.Initialise	Set values to default settings	$G	3.2.2.120
.Select	Selection	ActMeth,Silo,Calib, Setup, Config, Assembly, All	3.2.2.120
.RamInit	Initialisation, see page 143	$G	3.2.2.121
.InstrNo	Set instrument identification	$G	3.2.2.122
.Value	Enter instrument identification	8 ASCII characters	3.2.2.122

3.2.2 Description of the remote control commands

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

Start and stop ($G, $S) or hold of the current method (3.2.2.3) with $H and continue with $C.
$G also serves to continue after inquiries of identifications and sample size after the start (see 3.2.2.23) as well as after inquiries of calibration temperature and pH values of buffers (see 3.2.2.54 and 3.2.2.55).

3.2.2.2 **M**ode.**Q**uickMeas $G, $S

Start and stop of a measurement in the basic mode with the parameters (measured quantity, measuring input) of the current method. Corresponds to the <meas/hold> key. In TIP and DOS, the measured quantity is selected with &Mode.Parameter, see 3.2.2.62 and 3.2.2.43.
With an ongoing measurement, the current mode can be started. This stops the measurement automatically.

3.2.2.3 **M**ode.**S**elect SET, **STAT**, DOS, DOC, MEAS, CAL, TIP
Mode.**SET**Quantity **pH**, U, Ipol, Upol
Mode.**MEA**SQuantity **pH**, U, Ipol, Upol, T
Mode.**ST**ATQuantity **pH**, U, Ipol, Upol
Mode.**DO**CQuantity **pH**, U, Ipol, Upol

Selection of the standard mode. Mode and the measured quantity belong to the complete selection.
If a method is selected from the method memory, the nodes &Mode.Select and &Mode.XXXQuantity are overwritten with mode and measured quantity of the corresponding user method.

3.2.2.4 **M**ode.**N**ame read only

Name of the current method in the working memory. $Q sends 8 ASCII characters. Standard methods carry the name ********.

3.2.2.5 **M**ode.**Def.F**ormulas.**1.F**ormula EPX, CXX, RSX, +, –, *, /, (,)
Mode.**Def.F**ormulas.**1.T**extRS up to 8 ASCII characters
Mode.**Def.F**ormulas.**1.D**ecimal 0...**2**...5
Mode.**Def.F**ormulas.**1.U**nit up to 6 ASCII characters
Mode.**Def.F**ormulas.**2.F**ormula
etc. up to **.9**

Entry of formulas. Rules for formula entry, see page 60.
Example: "(EP2–EP1)*C01/C00"
In addition to the formula, a text for result output, the number of decimal places and a unit for the result output can be selected. "No unit" is selected with the blank string.
In place of "RSX", a result name may be entered (.TextRS). This name is outputted in the report full, short, scalc full and scalc srt. It is used for the result and the corresponding mean value.

3.2.2.6 **M**ode.**Def.S**iloCalc.**A**ssign.**C**24 RSX, EPX, CXX
Mode.**Def.S**iloCalc.**A**ssign.**C25** RSX, EPX, CXX
Mode.**Def.S**iloCalc.**M**atchId id1, id1&2, all, **OFF**

.Assign.C2X: Assignment to store results in the silo as C2X.
.MatchId: Indication which sample identification(s) have to match so that the results can be combined.

3.2.2.7 **M**ode.**Def.C**omVar.**C**30 RSX, MNX, EPX, CXX
Mode.**Def.C**omVar.**C31**
etc, up to **.C39**

Assignment of common variables.
The values of the common variables are to be found in &Config.ComVar. They can be viewed and entered there, see 3.2.2.77.

3.2.2.8 **M**ode.**Def.R**eport.**A**ssign

SET, MEAS, CAL:	full, short, scalc full, scalc srt, calc, param, calib, ff
STAT, DOC:	full, short,mplist, curve, meas crv, temp crv, scalc full, scalc srt, calc, param, calib, ff
DOS:	full, short,mplist, curve, meas crv, temp crv, scalc full, scalc srt, calc, param, ff
TIP:	full, short, scalc full, scalc srt, calc, param, ff

Definition of the report sequence, which is outputted automatically at the end of the determination. Entries of more than one block have to be separated with ";".

3.2.2.9 **M**ode.**Def.M**ean.**1.A**ssign **RS1**,RSX, EPX, CXX
Mode.**Def.M**ean.**2.A**ssign
etc, up to **.9**

Assignment of the statistics calculations. Valid assignments are a requirement for statistics calculations. In addition, the statistics calculation must be switched on, see 3.2.2.21. Rules for statistics calculations see page 62.

3.2.2.10 **M**ode.**Def.T**empVar.**C70** RSX, EPX, CXX
usw. bis **.C79**

Assignment of temporary variables in a submethod for calcualtions in TIP.

3.2.2.11 **M**ode.**C**Fmla
Mode.**C**Fmla.**1.V**alue **0**... ± 999 999
Mode.**C**Fmla.**2.V**alue
etc, up to.**19**

Calculation constants specific to a method. Stored in the method memory of the 718 STAT Titrino.
Operands specific to the sample (3.2.2.79 and 3.2.2.90) and values of common variables (3.2.2.77) on the other hand are not stored with the methods.

3.2.2.12 **M**ode.**P**arameter.**S**ET1.**E**P pH: 0... ± 20.00, **OFF**
U, Ipol: 0... ± 2000, **OFF**
Upol: 0... ± 200.0, **OFF**

Mode.**P**arameter.**S**ET1.**U**nitEp read only

Parameter for SET: Setting of the 1st end point as a pH value, in mV (with U and Ipol) or µA (with Upol). The corresponding unit can be read with .UnitEP.
If the value is on "OFF", there are no further nodes of SET1 appearing.

3.2.2.13	**M**ode.**P**arameter.**S**ET1.**D**yn	pH: 0.01...20.00, **OFF** U, Ipol: 1...2000, **OFF** Upol: 0.1...200.0, **OFF**
	Mode.Parameter.SET1.**UnitD**yn	read only
	Mode.Parameter.SET1.**M**axRate	0.01...**10**...150, max.
	Mode.Parameter.SET1.**Mi**nRate	0.01...**25.0**...999.9

Parameters for SET: Control parameters, see page 26.

.Dyn: Dynamics, control range in pH, mV (with U and Ipol) or µA (with Upol). The corresponding unit can be read with .UnitDyn.

.MaxRate: Maximum allowed titration rate in mL/min. Max. means maximum possible rate with the Exchange Unit in current use.

.MinRate: Minimum titration rate in µL/min.

3.2.2.14	Mode.Parameter.SET1.**S**top.**T**ype	**drift**, time
	Mode.Parameter.SET1.**S**top.**D**rift	1...**20**...999
	Mode.Parameter.SET1.**S**top.**Ti**me	0...**10**...999, inf
	Mode.Parameter.SET1.**S**top.**S**topT	0...999 999, **OFF**

Parameter für SET: Type and size of the stop criterion of the titration.

.Type: Type of stop criterion – after stop drift or switch-off delay time.

.Drift: Stop drift in µl/min. Applies when "drift" has been selected.

.Time: Switch-off delay time in s. Applies when "time" has been selected. "inf" means infinite.

.StopT: Stop time in s. Applies when "time" has been selected and the value of .Time is set to "inf.".

3.2.2.15	Mode.**P**arameter.**T**itrPara.**D**irection	**+**, **–**, **auto**

Parameter for SET, STAT: Titration direction.

"auto" means the titration direction is determined automatically by the instrument. If 2 EP's have been set in a SET titration, the titration direction is given by the two EP's. The entry of the titration direction is then invalid.

3.2.2.16	Mode.**P**arameter.**T**itrPara.**S**tartV.**T**ype	abs., rel., **OFF**
	Mode.**P**arameter.**T**itrPara.**S**tartV.**V**	**0**...999.99
	Mode.**P**arameter.**T**itrPara.**S**tartV.**F**actor	**0**... ± 999 999
	Mode.**P**arameter.**T**itrPara.**S**tartV.**R**ate	0.01...150, **max.**
	Mode.**P**arameter.**T**itrPara.**P**ause	**0**...999 999

Parameter for SET and STAT: Start volume and pause in s. The pause is worked off after the dosing of the start volume.

If an absolute start volume (abs.) has been selected, the volume in mL is valid.

A relative start volume (rel.) is dispensed as a function of the sample size:

Start volume in mL = smpl size* factor

The factor is valid.

The dispensing rate in mL/min applies to both cases. Max. means maximum possible dispensing rate with the Exchange Unit in current use.

3.2.2.17	Mode.**P**arameter.**T**itrPara.**Me**asInput	**1**, 2, diff.
	Mode.**P**arameter.**T**itrPara.**I**pol	-127...**1**... + 127
	Mode.**P**arameter.**T**itrPara.**U**pol	-1270...**400**... + 1270
	Mode.**P**arameter.**T**itrPara.**Pol**ElectrTest	ON, **OFF**

Parameter for SET and STAT:

Selection of the measuring input; valid with measured quantities pH and U. "diff." means differential amplifier, see page 152.

With Ipol, the inquiries for the polarisation current in µA (Ipol) and .PolElectrTest are valid.

With Upol, the inquiry for the polarisation voltage in mV (Upol) is valid. Entry in steps of 10 mV.

Besides .PolElectrTest is valid.

If the test for polarized electrodes is switched on, it is performed on changeover from the inactive state to an active state (titration or conditioning).

3.2.2.18 **M**ode.**P**arameter.**T**itrPara.**T**emp –170.0...**25.0**...500.0

Parameter for SET and STAT: Titration temperature in °C.
In SET, the temperature is measured after the start if a T sensor is connected. In STAT, the temperature is measured continuously.
The temperature is used for the temperature correction in pH measurements.

3.2.2.19 **M**ode.**P**arameter.**S**topCond.**V**Stop.**T**ype **abs.**, rel., OFF
Mode.**P**arameter.**S**topCond.**V**Stop.**V** 0...**99.99**...9999.99
Mode.**P**arameter.**S**topCond.**V**Stop.**F**actor 0... ± **999 999**

Parameter for SET, STAT, DOS, and DOC: Stop volume. (For DOS, the default value for .Type is "OFF" and the input range for .V is 0...99 999.99.)
If an absolute stop volume (abs.) has been selected, the volume in mL is valid.
A relative stop volume (rel.) is dispensed as a function of the sample size:

Stop volume in mL = smpl size* factor

The factor is valid.
OFF means that the criterion is not monitored.

3.2.2.20 **M**ode.**P**arameter.**S**topCond.**F**illRate 0.01...150, **max.**

Parameter for SET, STAT, DOS, and DOC: Filling rate after the titration in mL/min. Max. means maximum possible filling rate with the Exchange Unit in current use.

3.2.2.21 **M**ode.**P**arameter.**Sta**tictics.**S**tatus ON, **OFF**
Mode.**P**arameter.**Sta**tictics.**M**eanN **2**...20
Mode.**P**arameter.**Sta**tictics.**R**esTab.**S**elected **original**, delete n, delete all
Mode.**P**arameter.**Sta**tictics.**R**esTab.**D**elN **1**...20

Entries for the statistics calculations.

.Status: On/off switching. Requirement for statistics calculations is a valid assignment, see 3.2.2.9.
.MeanN: Number of individual results for statistics calculations.
.ResTab.Select: Selection of the table for the statistics calculations.
- original: Original table. The original table is (again) set up, i.e. any individual results which have been deleted are reincorporated in the statistics calculations.
- delete n: Single result lines are removed from the statistics calculation. All results of the corresponding line in the statistics table are deleted. Specification of the line number in .ResTab.DelN.
- delete all: Clear entire statistics table. The results can not be reactivated.

.ResTab.DelN: Specification of the line number to be deleted.

3.2.2.22 **M**ode.**P**arameter.**P**resel.**C**ond ON, **OFF**
Mode.**P**arameter.**P**resel.**D**riftDisp **ON**, OFF

Parameter für SET:
.Cond: On/off switching of conditioning.
.DriftDisp: On/off switching of drift display during conditioning.

3.2.2.23 **M**ode.**P**arameter.**P**resel.**I**Req id1, id1&2, all, **OFF**
Mode.**P**arameter.**P**resel.**S**Req value, unit, all, **OFF**

Parameter for SET, STAT, DOS, DOC, MEAS, and TIP: Automatic inquiry after the start of the determination. From such an inquiry, the determination continues if the requested entry/entries is/are made, e.g. &SmplData.OFFSilo.Id1 (see 3.2.2.79) or with &M $G, siehe 3.2.2.1.

3.2.2.24 **M**ode.**P**arameter.**P**resel.**A**ctPulse — SET: first, all, cond.,**OFF**; STAT, DOS, DOC, MEAS: ON, **OFF**

Parameters for STAT: Setting the control point as a pH value, in mV (with U and Ipol) or uA (with Upol). The corresponding unit can be read with .UnitEP.

3.2.2.25 **M**ode.**P**arameter.**C**trlPara.**E**P — pH: 0... ±20.00, **OFF**; U, Ipol: 0... ±2000, **OFF**; Upol: 0... ±200.0, **OFF**

Mode.**P**arameter.**C**trlPara.**U**nitEp — read only

Parameters for STAT: Setting the control point as a pH value, in mV (with U and Ipol) or uA (with Upol). The corresponding unit can be read with .UnitEP.

3.2.2.26 **M**ode.**P**arameter.**C**trlPara.**D**yn — pH: 0.01...20.00, **OFF**; U, Ipol: 1...2000, **OFF**; Upol: 0.1...200.0, **OFF**

Mode.**P**arameter.**C**trlPara.**UnitD**yn — read only

Mode.**P**arameter.**C**trlPara.**M**axRate — 0.01...**10**...150, max.

Mode.**P**arameter.**C**trlPara.**Mi**nRate — 0.001...**25.0**...999.9

Parameters for STAT: Control parameters, see page 37.
.Dyn: Dynamics (control range) in pH, mV (with U and Ipol) or uA (with Up ol). The corresponding unit can be read with .UnitDyn.
.MaxRate: Maximum allowed titration rate in ml/min. Max. means maximum possible rate with mounted Exchange Unit.
.MinRate: Minimum titration rate in ul/min.

3.2.2.27 **M**ode.**P**arameter.**T**itrPara.**T**Start — **0**...999 999

Mode.**P**arameter.**T**itrPara.**StartM**eas — pH: 0.00... ±20.00, **OFF**; U, Ipol: 0... ±2000, **OFF**; Upol:0.0... ±200.0, **OFF**

Mode.**P**arameter.**T**itrPara.**R**ateStart — 0.01...150, **OFF**

Parameters for STAT: Start of the measured point acquisition after the start condition has been met.
.TStart: Start time in s.
.StartMeas: Start measured value.
.RateStart: Start rate in mL/min. The current rate must be less than the start rate .This criterion does not become effective until 10 s after the start.

3.2.2.28 **M**ode.**P**arameter.**T**itrPara.**TD**elta — 1...**2**...999 999

Parameter for STAT: Time interval for the entry of a measurement point in the list of measured points.

3.2.2.29 **M**ode.**P**arameter.**S**topCond.**T**Stop.**T**ype — abs., rel., **OFF**

Mode.**P**arameter.**S**topCond.**T**Stop.**T**ime — 0...**999 999**

Mode.**P**arameter.**S**topCond.**T**Stop.**F**actor — 0... ±**999 999**

Parameters for STAT: Stop time.
If an absolute stop time (abs.) has been selected, the time is in s (Time).
A relative stop time (rel.) is calculated as a function of the sample size:

Stop time in s = sample size*factor

The factor selected (Factor) applies.
OFF means that the criterion is not monitored.

3.2.2.30 **M**ode.**P**arameter.**St**opCond.**R**ateStop 0.01...150, **OFF**

Parameter for STAT: Stop rate in ml/min. The current rate must be less than the start rate. This criterion does not become effective until 10 s after the start.

3.2.2.31 **M**ode.**P**arameter.**E**valuation.**T**imeWin.**1**.**L**owLim 0...999 999, **OFF**
Mode.**P**arameter.**E**valuation.**T**imeWin.**1**.**U**pLim 0...999 999, **OFF**

Parameters for STAT: Evaluation of rates in time windows. Entry of the times in s. The evaluated rates are available as variables C8X (X = 1...9).

3.2.2.32 **M**ode.**P**arameter.**E**valuation.**F**ixVol.**1**.**V**alue 0...999 999, **OFF**

Parameter for STAT: Interpolation of the volume at preset times. Entry of the times in s. The interpolated volumes are available as variables C5X.

3.2.2.33 **M**ode.**P**arameter.**E**valuation.**FixT**ime.**1**.**V**alue 0.01...1.00, **OFF**

Parameter for STAT: Interpolation of the time at preset fraction of the final volume. Entry as part of V(tot). The interpolated volumes are available as variable C6X.

3.2.2.34 **M**ode.**P**arameter.**M**onitoring.**M**easVal.**S**tatus ON, **OFF**
Mode.**P**arameter.**M**onitoring.**M**easVal.**L**owLim pH: 0... ± 20.00
Mode.**P**arameter.**M**onitoring.**M**easVal.**U**pLim U, Ipol: 0... ± 2000
Upol: 0... ± 200.0
Mode.**P**arameter.**M**onitoring.**M**easVal.**A**ction end, hold, wait, **none**

Parameters for STAT, DOC: Monitoring of limit values. Measured values (pH, U or I) are entered in the list of measured points only if the monitoring is active.
On limit value violation, an action can be selected:
end: Abort of the determination.
hold: Interrupt dosing until the sequence is continued by manual switching (& m $C).
wait: Interrupt dosing until the limit value is no longer violated, then continue automatically.

3.2.2.35 **M**ode.**P**arameter.**M**onitoring.**R**ate.**S**tatus ON, **OFF**
Mode.**P**arameter.**M**onitoring.**R**ate.**L**owLim **0.000**...150
Mode.**P**arameter.**M**onitoring.**R**ate.**U**pLim 0.000...**150**
Mode.**P**arameter.**M**onitoring.**R**ate.**A**ction end, hold, wait, **none**

Parameters for STAT: Monitoring of limit values of the rate. Entry in ml/min.
On limit value violation, an action can be selected:
end: Abort of the determination.
hold: Interrupt dosing until the sequence is continued by manual switching (& m $C).
wait: Interrupt dosing until the limit value is no longer violated, the n continue automatically. On violation of the lower limit, the sequence can no longer be continued as the rate would become even less than that when dosing was interrupted.

3.2.2.36 **M**ode.**P**arameter.**M**onitoring.**T**emp.**S**tatus ON, **OFF**
Mode.**P**arameter.**M**onitoring.**T**emp.**L**owLim **-170.0**...500.0
Mode.**P**arameter.**M**onitoring.**T**emp.**U**pLim -170.0...**500.0**
Mode.**P**arameter.**M**onitoring.**T**emp.**A**ction end, hold, wait, **none**

Parameters for STAT, DOS, DOC: Monitoring of the limit values of the temperature in °C. Temperature values are entered in the list of measured points only if the monitoring is active.
On limit value violation, an action can be selected:
end: Abort of the determination.
hold: Interrupt dosing until the sequence is continued by manual switching (& m $C).
wait: Interrupt dosing until the limit value is no longer violated, then continue automatically.

3.2.2.37 **M**ode.**P**arameter.**M**onitoring.**A**ssignOutput — meas, temp, rate, all, **none**
Mode.**P**arameter.**M**onitoring.**O**utput — active, **pulse**

Parameters for STAT, DOS, DOC: Output of a signal on L4 output (pin 3) of the remote socket on limit value violation.
The output can be assigned a definite or all monitoring value(s) and the type of signal to be outputted determined.

3.2.2.38 **M**ode.**P**arameter.**P**resel.**R**ateDisp — ON, **OFF**

Parameter for STAT, DOC: Display of the current rate during the determination.

3.2.2.39	**M**ode.**P**arameter.**D**osPara.**T**ype	**volume**, time, rate
	Mode.**P**arameter.**D**osPara.**V**olume.**V**olume	0.000...**10**...99999.99
	Mode.**P**arameter.**D**osPara.**V**olume.**D**isType	time, **rate**
	Mode.**P**arameter.**D**osPara.**V**olume.**R**ate	0.001...150, **max.**
	Mode.**P**arameter.**D**osPara.**V**olume.**T**ime	1...**100**...999 999
	Mode.**P**arameter.**D**osPara.**T**ime.**T**ime	1...**100**...999 999
	Mode.**P**arameter.**D**osPara.**T**ime.**D**isType	**volume**, rate
	Mode.**P**arameter.**D**osPara.**T**ime.**R**ate	0.001...150, **max.**
	Mode.**P**arameter.**D**osPara.**T**ime.**V**olume	0.000...**10**...99999.99
	Mode.**P**arameter.**D**osPara.**R**ate.**R**ate	0.001...150, **max.**
	Mode.**P**arameter.**D**osPara.**R**ate.**S**topType	**volume**, time
	Mode.**P**arameter.**D**osPara.**R**ate.**T**ime	1...**100**...999 999
	Mode.**P**arameter.**D**osPara.**R**ate.**V**olume	0.000...**10**...99999.99

Parameters for DOS: In the equation Rate = Volume/Time, two parameters are preset, the third is calculated. Depending on the entry of the type, the following information is required: .Volume, .Time or .Rate.
Entries: .Volume in ml, .Time in s, .Rate in ml/min.

3.2.2.40 **M**ode.**P**arameter.**D**osPara.**P**ause — **0**...999 999

Parameter for DOS: Pause time in s.

3.2.2.41 **M**ode.**P**arameter.**D**osPara.**TD**elta — 1...**10**...999 999

Parameter for DOS, DOC: Time interval for the entry of a measured point in the list of measured points.

3.2.2.42 **M**ode.**P**arameter.**D**osPara.**T**emp — –170.0...**25.0**...500.0

Parameter for DOS, DOC: Temperature in °C. The temperature is measured continuously and updated if a T sensor is attached.
The temperature is used for temperature compensation in pH measurements.

3.2.2.43	**M**ode.**P**arameter.**M**onitoring.**M**easVal.**M**easMode	pH, U, Ipol, Upol, **OFF**
	Mode.**P**arameter.**M**onitoring.**M**easVal.**M**eas**I**nput	**1**, 2, diff.
	Mode.**P**arameter.**M**onitoring.**M**easVal.**P**Current	-127...**1**... + 127
	Mode.**P**arameter.**M**onitoring.**M**easVal.**P**Voltage	-1270...**400**... + 1270
	Mode.**P**arameter.**M**onitoring.**M**easVal.**P**olElectrTest	ON, **OFF**
	Mode.**P**arameter.**M**onitoring.**M**easVal.**pH.L**owLim	**0**... ± 20.00
	Mode.**P**arameter.**M**onitoring.**M**easVal.**pH.U**pLim	0... ± **20.00**
	Mode.**P**arameter.**M**onitoring.**M**easVal.**U.L**owLim	**0**... ± 2000
	Mode.**P**arameter.**M**onitoring.**M**easVal.**U.U**pLim	0... ± **2000**
	Mode.**P**arameter.**M**onitoring.**M**easVal.**I**pol.**L**owLim	**0**... ± 2000
	Mode.**P**arameter.**M**onitoring.**M**easVal.**I**pol.**U**pLim	0... ± **2000**
	Mode.**P**arameter.**M**onitoring.**M**easVal.**U**pol.**L**owLim	**0**... ± 200.0
	Mode.**P**arameter.**M**onitoring.**M**easVal.**U**pol.**U**pLim	0... ± **200.0**
	Mode.**P**arameter.**M**onitoring.**M**easVal.**A**ction	end, hold, wait, **none**

Parameters for DOS: Selection of the measured quantity for measured value monitoring. Measured values (pH, U and I) are entered in the list of measured points only when the monitoring is active.
Selection of the measurement input (MeasInput) applies with measured quantities pH and U. diff. means differential amplifier, see page 152.
With Ipol, the requests for the polarisation current in uA (Ipol) and .PolElectrTest apply.
With Upol, the request for the polarisation voltage in mV (Upol) applies. Entry in steps of 10 mV.
.PolElectrTest also applies. If the test for polarised electrodes is switched on (ON), it is performed on the change from the inactive basic mode to an active mode.
On limit value violation, an action can be selected:
stop: Abort of the determination.
hold: Interrupt dosing until the sequence is continued by manual switching (& m $C).
wait: Interrupt dosing until the limit value is no longer violated, then continue automatically.

3.2.2.44 **M**ode.**P**arameter.**D**osPara.**B**eginMeas — pH: 0... ±20.00, **init**; U, Ipol: 0... ±2000, **init**; Upol: 0... ±200.0, **init**

Mode.**P**arameter.**D**osPara.**E**ndMeas — as with .Begin, but OFF instead of init

Mode.**P**arameter.**D**osPara.**U**nitMeas — read only

Parameters for DOS: Setting of ramp start and ramp end. init means ramp start with default measured value.

3.2.2.45 **M**ode.**P**arameter.**D**osPara.**S**weepTime — 0...**300**...999 999

Sweep time for the ramp in s.

3.2.2.46 **M**ode.**P**arameter.**D**osPara.**D**yn — pH: 0.01...**0.25**...20.00, OFF; U: 1...**15**...2000, OFF; Ipol: 1...**6**...2000, OFF; Upol: 0.1...**10**...200.0, OFF

Mode.**P**arameter.**D**osPara.**UnitD**yn — read only

Mode.**P**arameter.**D**osPara.**M**axRate — 0.01...150, **max.**

Mode.**P**arameter.**D**osPara.**M**inRate — 0.01...**5.0**...999.9

Parameters for DOC: Control parameters, see page 53.
.Dyn: Dynamics in pH, mV (with U and Ipol) or uA (with Upol). The corresponding unit can be read with .UnitDyn.
.MaxRate: Maximum allowed titration rate in ml/min. Max. means maximum possible ratewith the mounted Exchange Unit.
.MinRate: Minimum titration rate in ul/min.

3.2.2.47 **M**ode.**P**arameter.**D**osPara.**D**irection — +, –, **auto**

Parameter for DOC: Titration direction.
auto means the titration direction is determined automatically by the instrument. The direction is used only when the ramp start is the same as init.

3.2.2.48	**M**ode.**P**arameter.**D**osPara.**S**tartV.**T**ype	abs., rel., **OFF**
	Mode.**P**arameter.**D**osPara.**S**tartV.**V**	**0**...999.99
	Mode.**P**arameter.**D**osPara.**S**tartV.**F**actor	**0**... ± 999 999
	Mode.**P**arameter.**D**osPara.**S**tartV.**R**ate	0.01...150, **max.**
	Mode.**P**arameter.**D**osPara.**P**ause	**0**...9999

Parameters for DOC: Start volume and pause time in s. Runs after dispensing of the start volume.
If an absolute start volume (abs.) has been selected, the volume is in ml (Volume).
A relative start volume (rel.) is dispensed as a function of the sample size:

Start volume in ml = sample size * factor (the factor selected (Factor)

The dosing rate in ml/min holds for both cases. Max. means the maximum possible dosing rate with the Exchange Unit currently mounted.

3.2.2.49	**M**ode.**P**arameter.**D**osPara.**Me**asInput	**1**, 2, diff.
	Mode.**P**arameter.**D**osPara.**I**pol	-127...**1**... + 127
	Mode.**P**arameter.**D**osPara.**U**pol	-1270...**400**... + 1270
	Mode.**P**arameter.**D**osPara.**Po**lElectrTest	ON, **OFF**

Parameters for DOC:
Selection of the measurement input (MeasInput) applies to the measured quantities pH and U. diff. means differential amplifier, see page 152.
With Ipol, the requests for the polarisation current in uA (Ipol) and .PolElectrTest apply.
With Upol, the request for the polarisation voltage in mV (Upol) applies. Entry in steps of 10 mV.
.PolElectrTest also applies.
If the test for polarised electrodes is switched on (ON), it will be performed on the change from the inactive basic mode to an active mode.

3.2.2.50	**M**ode.**P**arameter.**M**easuring.**S**ignalDrift	pH, U, Ipol, T: 0.5...999, **OFF** Upol: 0.05...99.9, **OFF**
	Mode.**P**arameter.**M**easuring.**U**nitSigDrift	read only
	Mode.**P**arameter.**M**easuring.**E**quTime	0...9999, **OFF**

Parameters for MEAS: Criteria for the measured value acquisition. Measured value drift in mV/min (with pH, U, Ipol, T), µA/min (with Upol), resp. °C/min (with T). Equilibration time in s. OFF means that the corresponding criterion is switched off. If both criteria are OFF, the measurement continues indefinitely.
If the equilibration time has never been edited, it is automatically calculated by the instrument to match the drift, see page 54. After it has been edited once, it remains in force with the set value.

3.2.2.51	**M**ode.**P**arameter.**M**easuring.**M**easInput	**1**, 2, diff.
	Mode.**P**arameter.**M**easuring.**I**pol	-127...**1**... + 127
	Mode.**P**arameter.**M**easuring.**U**pol	-1270...**400**... + 1270
	Mode.**P**arameter.**M**easuring.**Po**lElectrTest	ON, **OFF**

Parameter for MEAS:
Selection of the measuring input; valid with measured quantities pH and U. "diff." means differential amplifier, see page 152.
With Ipol, the inquiries for the polarisation current in µA (Ipol) and .PolElectrTest are valid.
With Upol the inquiry for the polarisation voltage in mV (Upol) is valid. Entry in steps on 10 mV.
Besides .PolElectrTest is valid.
If the test for polarized electrodes is switched on, it is performed on changeover from the inactive state to the measurement.

3.2.2.52 **M**ode.**P**arameter.**M**easuring.**T**emp –170.0...**25.0**...500.0

Parameter for MEAS: Measurement temperature in °C. If a Pt100 or Pt1000 is connected, the temperature is measured.
The temperature is used for the temperature correction in pH measurements.

3.2.2.53 **M**ode.**P**arameter.**C**alibration.**M**easInput **1**, 2, diff.

Parameter for CAL: Selection of the measuring input. "diff." means differential amplifier, see page 152.

3.2.2.54 **M**ode.**P**arameter.**C**alibration.**C**alTemp –20.0...**25.0**...120.0

Parameter for CAL: Calibration temperature in °C. If a Pt 100 or Pt1000 is connected, the temperature is measured.

3.2.2.55 **M**ode.**P**arameter.**C**alibration.**B**uffer.**1.V**alue -20.00...**7.00**... + 20.00
Mode.**P**arameter.**C**alibration.**B**uffer.**2.V**alue -20.00...**4.00**... + 20.00, OFF
usw. bis 9 Puffer

Parameter for CAL: pH of buffers. The first buffer which is set to "OFF" determines the number of buffers in the calibration.

3.2.2.56 **M**ode.**P**arameter.**C**alibration.**S**ignalDrift 0.5...**2**...999, OFF
Mode.**P**arameter.**C**alibration.**E**quTime 0...**110**...9999, OFF

Parameter for CAL: Criteria for measured value acquisition. Measured value drift in mV/min, equilibration time in s. OFF means that the corresponding criterion is switched off. If both criterions are on OFF, the measured value is acquired immediately.
If the equilibration time has never been edited, it is automatically calculated by the instrument to match the drift, see page 54. After it has been edited once, it remains in force with the set value.

3.2.2.57 **M**ode.**P**arameter.**C**alibration.**E**lectrodeId up to 8 ASCII char

Parameter for CAL: Electrode identification. It is classified under calibration data, see 3.2.2.87.

3.2.2.58 **M**ode.**P**arameter.**C**alibration.**S**mplChanger ON, **OFF**

Parameter for CAL: Calibration at sample changer.
With "ON", there are no hold points in the calibration sequence for entries, the first buffer is measured directly.

3.2.2.59 **M**ode.**P**arameter.**C**alibration.**A**ctPulse first, all, **OFF**

Parameter for CAL: Output of a pulse on the I/O line "activate", see pages 161 and 162.

3.2.2.60 **M**ode.**P**arameter.**S**equence.**X.S**elect method, pause, L4 output, L6 output, info, **OFF**

Parameter for TIP: Selection of an element for step X (X = 1...30). For the parameters of the elements see 3.2.2.61.

3.2.2.61	**M**ode.**P**arameter.**S**equence.**X.M**ethod	Method name from the user memory
	Mode.**P**arameter.**S**equence.**X.P**ause	**0**...999 999, INF
	Mode.**P**arameter.**S**equence.**X.L**4Output	active, inactive, pulse, **OFF**
	Mode.**P**arameter.**S**equence.**X.L6**Output	active, inactive, pulse, **OFF**
	Mode.**P**arameter.**S**equence.**X.I**nfo	up to 16 ASCII characters

Parameters for TIP: Parameters of the elements of TIP.

.Method: Method name of a method available in the user memory. Up to 8 ASCII characters.

.Pause: Pause time in s. INF means infinite. Continue the sequence with &m $G.

.L4 Output: Warning: A pulse triggered by the limit value monitoring at L4 (pin 3) in a submethod sets an output set to active in TIP to inactive.

.L6 Output: Warning: An activate pulse at L6 output (pin 1) in a submethod sets an output set to active in TIP to inactive.

.Info: Entry of a message which is written into the display. The sequence remains in the display with the corresponding message. Continue with &m $G.

3.2.2.62	**M**ode.**P**arameter.**P**resel.**M**easMode	pH, U, Ipol, Upol, **OFF**
	Mode.**P**arameter.**P**resel.**Meas**Input	**1**, 2, diff.
	Mode.**P**arameter.**P**resel.**I**pol	-127...**1**... + 127
	Mode.**P**arameter.**P**resel.**U**pol	-1270...**400**... + 1270
	Mode.**P**arameter.**P**resel.**Pol**ElectrTest	ON, **OFF**
	Mode.**P**arameter.**P**resel.**T**emp	-170....**25.0**...500.0

Parameters for TIP: Selection of the measured quantity for manual measurements in the inactive state, see 3.2.2.2. Selection of the measuring input (MeasInput) applies to measured quantities pH and U. "diff." means differential amplifier, see page 152. With Ipol the requests for the polarisation current in uA (Ipol) and .PolElectrTest apply. With Upol the request for the polarisation voltage in mV (Upol) applies. Entry in steps of 10 mV. .PolElectrTest also applies. If the test for polarised electrodes is switched on (ON), it will be performed on the change from the inactive state to an active state. The temperature applies to pH measurements.

3.2.2.63	**U**serMeth.**F**reeMem	read only

Memory space, available for user methods or silo lines. $Q sends the number of free bytes, e.g. "4928".

3.2.2.64	**U**serMeth.**R**ecall	$G
	UserMeth.**R**ecall.**N**ame	up to 8 ASCII characters
	UserMeth.**S**tore	$G
	UserMeth.**S**tore.**N**ame	up to 8 ASCII characters
	UserMeth.**D**elete	$G
	UserMeth.**D**elete.**N**ame	up to 8 ASCII characters
	UserMeth.**DelA**ll	$G

Management of the method memory from the 718 STAT Titrino: Loading, storage and deletion of methods. An action is performed if "$G" is sent to the corresponding node just after entering the name.
Do not use preceding or succeeding blanks in method names!
.DelAll: Deletes all methods in the user memory.

3.2.2.65 **U**serMeth.**L**ist.**1**.**N**ame read only
UserMeth.**L**ist.**1**.**M**ode read only
UserMeth.**L**ist.**1**.**Q**uantity read only
UserMeth.**L**ist.**1**.**B**ytes read only
UserMeth.**L**ist.**1**.**C**hecksum read only
für jede Methode

List of the methods in the user method memory with the following characteristics:
.Name: Name of the method
.Mode: Mode
.Quantity: Measured quantity
.Bytes: Number of bytes of the user memory used by the method
.Checksum: Checksum of the method, see 3.2.2.88.

3.2.2.66 **C**onfig.**P**eriphUnit.**C**harSet Epson, Seiko, Citizen, HP, **IBM**

Selection of the character set and the graphics control characters.
IBM means the IBM character set following character set table 437 and IBM graphics control characters.
Select 'IBM' for work with the computer.

3.2.2.67 **C**onfig.**P**eriphUnit.**B**alance **Sartorius**, Mettler, Mettler AT, AND, Precisa
Config.**P**eriphUnit.**P**lot **U**, dU/dt, V, dV/dt, U(rel), T

Selection of the balance type and the signal for the output at the analog output.

3.2.2.68 **C**onfig.**A**ux.**L**anguage **english**, deutsch, francais, espanol, porztuguese, italiano, svenska

Selection of the dialog language.

3.2.2.69 **C**onfig.**A**ux.**S**et $G
Config.**A**ux.**S**et.**D**ate YYYY-MM-DD
Config.**A**ux.**S**et.**T**ime HH:MM

Date and time.
Input format of the date: Year-month-day, enter leading zeros.
Input format for the time: Hours:minutes, two-digit, enter leading zeros.
Date and time have to be set with &Config.Aux.Set $G just after entry of the value.

3.2.2.70 **C**onfig.**A**ux.**R**unNo **0**...9999

Current sample number.
Set to 0 on power on and initialisation. After 9999, counting starts again at 0.

3.2.2.71 **C**onfig.**A**ux.**A**utoStart 1...9999, **OFF**

Number of automatic, internal starts.

3.2.2.72 **C**onfig.**A**ux.**S**tartDelay **0**...999 999

Start delay time in s. During this time, the data of the preceding determination are retained.

3.2.2.73 **C**onfig.**A**ux.**De**vName — up to 8 ASCII characters

Name of the instrument for connections with several units. It is advisable to use only the letters A...Z (ASCII Nos 65...90), a...z (ASCII Nos 97...122) and the numbers 0...9 (ASCII Nos 48...57) when the function Setup.AutoInfo (3.2.2.117) is used at the same time.

3.2.2.74 **C**onfig.**A**ux.**P**rog — read only

Output of the program version.
The STAT Titrino sends "718.0010" on requests with $Q.

3.2.2.75 **C**onfig.**R**SSet — $G

$G sets all RS settings. The changes are performed only if the instrument is inactive. After the setting of the interface parameters, wait at least 2 s to allow the components to equilibrate.

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

Settings of the values for the data transmission via the RS interface: baud rate, data bit, stop bit, parity and type of handshake, see also page 124 ff.
The setting of the values must be initiated with $G immediately after entry of the values, see 3.2.2.75.

3.2.2.77 **C**onfig.**C**omVar.**C30** — **0**... ±999 999
usw. bis **.C39**

Values of the common variables C30 to C39. The common variables can either be entered or written directly from the experimental results of the methods, see 3.2.2.7.

3.2.2.78 **S**mplData.**S**tatus — ON, **OFF**

On/off switching of silo memory. When the silo memory is switched on, the sample data are fetched from the lowest valid silo line.

3.2.2.79	**S**mplData.**O**FFSilo.**Id1**	up to 8 ASCII characters
	SmplData.**O**FFSilo.**Id2**	up to 8 ASCII characters
	SmplData.**O**FFSilo.**Id3**	up to 8 ASCII characters
	SmplData.**O**FFSilo.**V**alSmpl	6-digit number with sign and decimal point
	SmplData.**O**FFSilo.**U**nitSmpl	up to 5 ASCII characters

Current sample data.
The identifications Id1...Id3 can be used in formulas as sample-specific calculation constants C21...C23.
If "no unit" is desired for the unit of the sample size, the blank string must be entered.

3.2.2.80	**S**mplData.**ON**Silo.**C**ounter.**M**axLines	read only
	SmplData.**ON**Silo.**C**ounter.**F**irstLine	read only
	SmplData.**ON**Silo.**C**ounter.**L**astLine	read only

Information on silo memory.
.MaxLines: Maximum possible number of silo lines.
.FirstLine: Lowest valid silo line.
.LastLine: Last occupied silo line.

3.2.2.81 **S**mplData.**ON**Silo.**E**ditLine.**1.M**ethod — up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.I**d1 — up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.Id2** — up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.Id3** — up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.V**alSmpl — 6-digit number with sign and decimal point
SmplData.**ON**Silo.**E**ditLine.**1.U**nitSmpl — up to 5 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.C**24 — read only
SmplData.**ON**Silo.**E**ditLine.**1.C25** — read only
SmplData.**ON**Silo.**E**ditLine.**1.Ma**rk — read only
etc, up to **.99**

Contents of a silo line.
.Method: Method used to process the sample, from the method memory.
.Id: The identifications Id1...Id3 can also be used as sample-specific calculation constants C21...C23 in formulas.
.UnitSmpl: If "no unit" is desired for the sample size, the blank string must be entered.
.C24, .C25: Results which have been assigned to C24 and C25.
.Mark: Mark of the silo line: "*" = deleted line, " + " = line which is worked off, "–" = line which is worked off
and not valid for silo calculations (deleted).
Silo lines which have been worked off are "read only".

3.2.2.82 **S**mplData.**ON**Silo.**D**elLine — $G
SmplData.**ON**Silo.**D**elLine.**L**ineNum — 1...99, **OFF**

Deletion of a silo line. The line # is deleted with &SmplData.ONSilo.DelLine $G. If a formerly deleted line is edited again, it becomes valid (function "undelete").

3.2.2.83 **S**mplData.**ON**Silo.**DelA**ll — $G

Deletes the entire silo memory. Must be triggered with $G.

3.2.2.84 **S**mplData.**ON**Silo.**Cy**cleLines — ON, **OFF**

Silo data cycling.
With "ON", executed lines are copied to the next free silo lines, see page 75. Exercise caution if you edit the silo memory during the determinations!

3.2.2.85 **S**mplData.**ON**Silo.**S**aveLines — ON, **OFF**

Silo lines are not deleted when they are worked off. Assigned results are stored as C24 and C25. "Save lines" can only be set to "ON" if the silo is completely empty. Delete the silo, see 3.2.2.83.

3.2.2.86 **I**nfo.**R**eport — $G
Info.**R**eport.**S**elect — configuration, parameters, smpl data, statistics, silo, calib, C-fmla, def, user method, **full**, short, mplist, curve, meas crv, temp crv, scalc full, scalc srt, calc, all, ff

$G sends the selected report:
configuration: Configuration report. Is not accessible during a running determination.
parameters: Parameter report of the current method. During a running determination only "live"-parameters are accessible.
smpl data: Current sample data.
statistics: Statistics table with the individual results.
silo: Contents of the silo memory.
calib: Calibration data of the measuring input in the current method.
C-fmla: Contents of the <C-fmla> key.
def: Contents of the <def> key.
user method: Contents of the method memory.

full: Full result report of the last completed determination.
short: Short result report of the last completed determination.
mplist: Measuring point list of the running determination (with STAT, DOS, DOC).
curve: Titration curve of the last determination (with STAT, DOS, DOC).
meas crv: Curve measured value vs. time (with STAT, DOS, DOC and activated meas monitoring).
temp crv: Curve temperature vs. time (with STAT, DOS, DOC and activated temperature monitoring).
scalc full: Full report of the silo calculations.
scalc srt: Short report of the silo calculations.
calc: Calculation report of the current method.
all: All reports.
ff: Form feed on printer.
Reports which are sent from the 718 are marked with space (ASCII32) and ' at the beginning. Then an individual identifier for each report follows. Reports which are triggered by RS232 ($G) have the same introducer but without preceeding space, i.e. they start with '.

3.2.2.87

Info.**C**alibrationData	$G
Info.**C**alibrationData.**I**np1.**p**Has	-20.00...**7.00**... + 20.00
Info.**C**alibrationData.**I**np1.**S**lope	-9.999...**1.000**... + 9.999
Info.**C**alibrationData.**I**np1.**T**emp	-170.0...**25.0**... + 500.0
Info.**C**alibrationData.**I**np1.**D**ate	read only
Info.**C**alibrationData.**I**np1.**E**lectrodeId	read only
identical for .Inp2 and .Diff	

pH calibration data for measuring input 1. After the calibration, the data are entered automatically together with the date of the calibration and the electrode identification, see 3.2.2.57.
Calibration data can be entered. They are accepted with &Info.CalibrationData $G. If calibration data are entered, the calibration date is deleted.

3.2.2.88

Info.**Ch**ecksums	$G
Info.**Ch**ecksums.**M**PList	read only
Info.**Ch**ecksums.**A**ctualMethod	read only

The checksums can be used to identify the content of a file unequivocally, e.g. files with identical content have identical results of the checksums. An empty file has checksum "0". The calculation of the checksums is triggered with $G.
.MPList: Result of the checksum of the current measuring point list.
.ActualMethod: Result of the checksum of the current method in the working memory. Identical methods with different method names have the same results of the checksum.

3.2.2.89

Info.**D**etermData	$G
Info.**D**etermData.**W**rite	ON, **OFF**
Info.**D**etermData.**E**xV	read only/read + write
Info.**D**etermData.**M**PList.**1.A**ttribute	read only/read + write
Info.**D**etermData.**M**PList.**1.X**	read only/read + write
Info.**D**etermData.**M**PList.**1.Y**	read only/read + write
Info.**D**etermData.**M**PList.**1.Z**1	read only/read + write
Info.**D**etermData.**M**PList.**1.Z2**	read only/read + write
for every measuring point	

Determination data in hexadecimal format. A measuring point list is available in mode STAT, DOS, DOC. Recalculation of the measuring data is triggered with $G.
.Write: With "ON", the following nodes can be overwritten: &Info.DetermData.MP.List, &Info.TitrResults.Var.C4X (X = 0...5), &Info.TitrResults.TempVar.C7X (X = 0...9), and &Mode.Name.
.MPList.1.Attribute: Attribute
.MPList.X: X coordinate, time
.MPList.Y: Y coordinate, volume
.MPList.Z1: Z1 coordinate, measuring value
.MPList.Z2: Z2 coordinate, temperature

3.2.2.90 Info.**T**itrResults.**RS**.**1**.**V**alue read only
etc, up to **.9**
Info.**T**itrResults.**EP**.**1**.**V** read only
Info.**T**itrResults.**EP**.**1**.**M**eas read only
etc, up to **.2**
Info.**T**itrResults.**V**ar.**C**40 read only/read + write
etc, up to **.C47**
Info.**T**itrResults.**V**ar.DTime read only/read + write

.RS: Values of the calculated results.

.EP: Endpoints with SET:
- Volume coordinate in mL, e.g. "1.2340"
- Measured value coordinate in pH "5.12", mV (with U and Ipol) "-241" or µA (with Upol) "43.7".

.Var: Various variables. You may overwrite the variables C40...C45, see 3.2.2.65.
C40: Initial measured value in pH "5.12", mV (with U and Ipol) "–241", µA (with Upol) "43.7" or °C (withT) "25.0".
C41: End volume with SET, STAT, DOS, DOC in ml, "12.5360".
C42: Time from start of titration to end in s, "62".
C43: Volume drift on start of a SET titration from the conditioning in µL/min, "3.5".
C44: Temperature in °C. Used for the temperature compensation in pH measurements.
C45: Start volume with SET, STAT, DOC in ml, "2.800".
C46: Asymmetry pH of CAL, "6.89".
C47: Relative electrode slope of CAL, "0.9950".
DTime: Dosing time in s in DOS .

3.2.2.91 Info.**T**itrResults.**FixEP**.**51**.**V**alue read only
etc. up to **.59**
Info.**T**itrResults.**pK**.**61**.**V**alue read only
etc. up to **.69**
Info.**T**itrResults.**T**empVar.**C70** read only/read + write
etc. up to **.C79**

.FixEP: Interpolated volumes in mL at fixed times in STAT. C5X corresponds to the fix volumes X, X = 1...9.
.pK: Interpolates times in s at fixed volume rations of the end volume in STAT. C6X corresponds to the fix time X, X = 1...9.
.TempVar: Temporary variables in TIP corresponding to the assignments in the submethods.

3.2.2.92 Info.**T**itrResults.**T**imeWin.**81**.**M**ean read only
Info.**T**itrResults.**T**imeWin.**81**.**D**ev read only
etc. up to **.89**
Info.**T**itrResults.**M**eanRateC80.**M**ean read only
Info.**T**itrResults.**M**eanRateC80.**D**ev read only

For STAT: Mean rates and standard deviations in mL/min which have been calculated with linear regression. C80 is the rate calculated over all points of the measuring point list, C8X are the rates in the time windows X, X = 1...9.

3.2.2.93 Info.**S**tatisticsVal.**A**ctN read only
Info.**S**tatistics.**1**.**M**ean read only
Info.**S**tatistics.**1**.**S**td read only
Info.**S**tatistics.**1**.**R**elStd read only
etc. up to **.9**

The current values of the statistics calculation.

	$Q sends, e.g.
ActN: Current value of the individual results	"3"
Data for MN1:	
Mean: Mean value (decimal places as in result)	"3.421"
Std: Standard deviation (1 decimal place more than in result)	"0.0231"
RelStd: Relative standard deviation (in %, 2 decimal places)	"0.14"

3.2.2.94 Info.SiloCalc.**C24.N**ame read only
Info.SiloCalc.**C24.V**alue read only
Info.SiloCalc.**C24.U**nit read only
for **.C25** as for .C24
Info.SiloCalc.**C26.A**ctN read only
Info.SiloCalc.**C26.M**ean read only
Info.SiloCalc.**C26.S**td read only
Info.SiloCalc.**C26.R**elStd read only
for **.C27** as for .C26

The current values from the silo calculations. C26 is the mean value out of the C24 variables; C27 comes from C25.

	$Q sends
C24.Name: Name of the assigned value	"RS1"
C24.Value: Value	"2.222"
C24.Unit: Unit of the assigned value	"%"
C26.ActN: Number of single results	"3"
C26.Mean: Mean (decimal places as for the result itself)	"3.421"
C26.Std: Standard deviation (decimal places as for the result + 1)	"0.0231"
C26.RelStd: Relative standard deviation (in %, 2 decimal places)	"0.14"???

3.2.2.95 Info.**A**ctualInfo.**I**nputs.**S**tatus read only
Info.**A**ctualInfo.**I**nputs.**C**hange read only
Info.**A**ctualInfo.**I**nputs.**C**lear $G
Info.**A**ctualInfo.**O**utputs.**S**tatus read only
Info.**A**ctualInfo.**O**utputs.**C**hange read only
Info.**A**ctualInfo.**O**utputs.**C**lear $G

Status sends the current status of the I/O lines, Change sends the information regarding whether a change in status of a line has taken place since the last clearing, Clear clears the change byte. For the output, the byte is converted from binary to decimal, e.g.

	0	0	0	0	1	0	1	0
Line No.	7	6	5	4	3	2	1	0

Output: $2^1 + 2^3$ = "10"
1 means ON or change; 0 means OFF or no change.
The lines are assigned as follows (see also pages 161ff):

Inputs:		**Outputs**:	
0	Start (pin 21)	0	Ready (pin 5)
1	Stop (pin 9)	1	Cond. ok (pin 18)
2	Enter (pin 22)	2	Titration (pin 4)
3	Clear (pin 10)	3	EOD (pin 17)
4	Smpl Ready (pin 23)	4	Monitoring, line L4 (pin 3)
5	pin 11	5	Error (pin 16)
6	pin 24	6	Activate, line L6 (pin 1)
7	pin 12	7	Pulse for recorder (pin 2)

3.2.2.96 Info.**A**ctualInfo.**A**ssembly.**C**yclNo read only

$Q sends the current cycle number of the voltage measurement cycle, e.g. "127". From the cycle number and the cycle time (see 3.2.2.102), a time frame can be set up.
The cycle number is set to 0 on switching on the instrument, on every start and for QuickMEAS. It is incremented as long as the instrument remains switched on.

3.2.2.97 Info.**A**ctualInfo.**A**ssembly.**Co**unter.**V** read only
Info.**A**ctualInfo.**A**ssembly.**Co**unter.**C**lear $G

$Q sends the volume. With the function $Info.Assembly.Counter.Clear $G, the volume counter is set to zero.

3.2.2.98 **Info.ActualInfo.Assembly.PistonPos** read only
Info.ActualInfo.Assembly.Meas read only

Piston position and measured value in mV from assembly.
Piston position:
0 = initial position (filled)
10 000 = end position (empty)

3.2.2.99 **Info.ActualInfo.Titrator.CyclNo** read only
Info.ActualInfo.Titrator.V read only
Info.ActualInfo.Titrator.Meas read only
Info.ActualInfo.Titrator.dVdt read only
Info.ActualInfo.Titrator.dMeasdt read only
Info.ActualInfo.Titrator.dMeasdV read only
Info.ActualInfo.Titrator.T read only

$Q sends the current values in the following formats:

	SET	STAT	DOS	DOC	MEAS	CAL
Cycle number	127	127	127	127	127	127
Volume (ml)	1.2345	1.2345	1.2345	1.2345	–	–
Meas.value:pH	345.6 (mV)	345.6 (mV)	345.6 (mV)	345.6 (mV)	3.456	3.456
U, Ipol (mV)	-345.6	-345.6	-345.6	-345.6	-345.6	–
Upol (uA)	-12.5	-12.5	-12.5	-12.5	-12.5	–
T (°C)	–	–	–	–	25.0	–
Volume drift (ul/s)	2.5224	2.5224	–	2.5224	–	–
Meas. value drift:						
pH, U, Ipol (mV/s)	0.7462	0.7462	–	0.7462	0.7462	0.7462
Upol (uA/s)	0.7462	0.7462	–	0.7462	0.7462	–
T (°C/s)	–	–	–	–	0.7462	–
1st derivative (mV/ul)	10.6326	10.6326	–	10.6326	–	–
Temperature (°C)	–	25.9	25.9	25.9	25.9	–

NV: Not Valid. If the signal drift is OFF in modes MEAS and CAL, the signal drift is NV.
OV will be sent for "overrange".
A time frame can be set up from the cycle number and the cycle time (see 3.2.2.102). The cycle number is set to 0 at the start of a method and it is incremented until the end of the method.

3.2.2.100 **Info.ActualInfo.MeasPt.Index** read only
Info.ActualInfo.MeasPt.X read only
Info.ActualInfo.MeasPt.Y read only
Info.ActualInfo.MeasPt.Z1 read only
Info.ActualInfo.MeasPt.Z2 read only
Info.ActualInfo.EP.Index read only
Info.ActualInfo.EP.X read only
Info.ActualInfo.EP.Y read only

$Q sends the last entry into the measuring point list (.MeasPt) with STAT, DOS, DOC or the last entry into the list of EP's with SET.

.MeasPt.X"165"	Time of the MPList in s
.MeasPt.Y"3.654"	Volume of the MPList in mL
.MeasPt.Z1"6.34"	Measured value of the MPList, format depends on the measured quantity
.MeasPt.Z2"25.8"	Temperature of the MPList in °C
.EP.X"1.234"	Volume coordinate of the EP
.EP.Y"5.34"	Measured value coordinate of the EP

3.2.2.101 **I**nfo.**A**ctualInfo.**D**isplay.**L**1 up to 24 ASCII characters
Info.**A**ctualInfo.**D**isplay.**L2** up to 24 ASCII characters

1st or 2nd line of the display. The display can be written to from the computer.

The display is not operated by the 718 if 'Setup.Lock.Display' is set to ON, see 3.2.2.111.
$Q sends the contents of the corresponding display line.

3.2.2.102 **I**nfo.**A**ssembly.**C**ycleTime read only
Info.**A**ssembly.**E**xV read only

Inquiries regarding basic variables of the assembly: Cycle time in s, volume of the Exchange Unit in mL.

3.2.2.103 **A**ssembly.**B**ur.**R**ates.**F**orward.**S**elected digital, **analog**
Assembly.**B**ur.**R**ates.**F**orward.**D**igital 0...150, **max.**
Assembly.**B**ur.**R**ates.**R**everse.**S**elected digital, **analog**
Assembly.**B**ur.**R**ates.**R**everse.**D**igital 0...150, **max.**

Expel and aspirating rate.
Digital or analog control. With digital control, the inputted value applies (in mL/min). "max." means maximum possible rate with the Exchange Unit in current use.
Analog means rate control with the analog potentiometer on 718 STAT Titrino.

3.2.2.104 **A**ssembly.**B**ur.**F**ill $G, $H, $C

$G starts the 'FILL' mode of the burette function.

3.2.2.105 **A**ssembly.**B**ur.**M**odeDis $G, $S, $H, $C
Assembly.**B**ur.**M**odeDis.**S**elected **volume**, time
Assembly.**B**ur.**M**odeDis.**V** 0.0001...**0.1**...9999
Assembly.**B**ur.**M**odeDis.**T**ime 0.25...**1**...86400
Assembly.**B**ur.**M**odeDis.**VS**top 0.0001...9999, **OFF**
Assembly.**B**ur.**M**odeDis.**A**utoFill ON, **OFF**

Dispensing mode with parameters. The dispensing mode can only be started and stopped via the RS Control. During a running dosification, no method can be started at the 718.
.Selected: Dispensing of volume increments or during a preset time.
.Volume, .Time: Size of the volume increments or entry of time.
.VStop: Limit volume for the dispensing.
.AutoFill: ON means automatic filling after every dispensing.

3.2.2.106 **A**ssembly.**M**eas.**S**tatus ON, **OFF**
Assembly.**M**eas.**M**easInput **1**, 2, Diff., Ipol, Upol, Temp
Assembly.**M**eas.**I**pol -127...**1**... + 127
Assembly.**M**eas.**U**pol -1270...**400**... + 1270

Measurement in assembly. The measuring function can only be started via RS Control. When the measuring function is switched on, no method can be started at the 718.
.Input: Selection of the potentiometric measuring input 1, 2, diff., polarized electrodes or temperature.
.Ipol: Polarisation current in µA.
.Upol: Polarisation potential in mV, entry in steps of 10 mV.

3.2.2.107 **A**ssembly.**O**utputs.**A**utoEOD **ON**, OFF
Assembly.**O**utputs.**S**etLines $G
Assembly.**O**utputs.**S**etLines.**L**1 active, inactive, pulse, **OFF**
up to .L3
Assembly.**O**utputs.**R**esetLines $G

Setting the I/O output lines.

.AutoEOD: The automatic output of the EOD (End of Determination) at the end of the determination can be switched off. Thus, for example, in conjunction with a sample changer several determinations can be performed in the same beaker. Before AutoEOD is switched on, line 2 must be set to "OFF".

.SetLines: With $G, lines 1, 2 and 3 are set.

.SetLines.LX: Set the line LX. "active" means setting of a static signal, "inactive" means resetting of the signal, "pulse" means output of a pulse of app. 150 ms, "OFF" means the line is not operated, see also page 161.
L2 is the EOD line. Warning: If you have "AutoEOD" to "ON", an active line 2 is set to "inactive" by the EOD pulse.
L3 is the line of the activate pulse. Warning: An active line 3 is set to "inactive" by the activate pulse.

.ResetLines: Lines 1, 2 and 3 are set to the inactive status (=high).

3.2.2.108 **Se**tup.**K**eycode — ON, **OFF**

ON means the key code of a key pressed on the STAT Titrino is outputted. The key code comprises 2 ASCII characters; table of the keys with their code, see page 136. A keystroke of key 11 is sent as follows:

#11

The beginning of the message is marked by a space (ASCII 32).

3.2.2.109 **Se**tup.**T**ree.**S**hort — ON, **OFF**
Setup.**T**ree.**C**hangedOnly — ON, **OFF**

Definition of the type of answer to $Q.

.Short: With "ON", each path is sent with only the necessary amount of characters in order to be unequivocal (printed in bold in this manual).
A combination of .Short and .ChangedOnly is not possible.

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

3.2.2.110 **Se**tup.**Tra**ce — ON, **OFF**

The STAT Titrino automatically reports when a value has been confirmed with <enter> at the 718 STAT Titrino. Message, e.g.:

&SmplData.OFFSilo.Id1"Trace"

The beginning of the message is marked by a space (ASCII 32).

3.2.2.111 **Se**tup.**L**ock.**K**eyboard — ON, **OFF**
Setup.**L**ock.**C**onfig — ON, **OFF**
Setup.**L**ock.**P**arameter — ON, **OFF**
Setup.**L**ock.**S**mplData — ON, **OFF**
Setup.**L**ock.**U**serMeth.**R**ecall — ON, **OFF**
Setup.**L**ock.**U**serMeth.**S**tore — ON, **OFF**
Setup.**L**ock.**U**serMeth.**D**elete — ON, **OFF**
Setup.**L**ock.**D**isplay — ON, **OFF**

ON means disable the corresponding function:

.Keyboard: Disable all keys of the 718 STAT Titrinos

.Config: Disable the <configuration> key

.Parameter: Disable the <parameter> key

.SmplData: Disable the <smpl data> key

.UserMeth.Recall: Disable "recall" in <user meth> key

.UserMeth.Store: Disable "store" in <user meth> key

.UserMeth.Delete: Disable "delete" in <user meth> key

.Display: Disable the display, i.e. it will not be written to by the device program of the STAT Titrino and can be operated from the computer.

3.2.2.112 **Se**tup.**M**ode.**S**tartWait ON, **OFF**
Setup.**M**ode.**F**inWait ON, **OFF**

Holding points in the method sequence. If they are "ON", the sequence stops until "OFFD" is sent. Switching the instrument on sets both nodes to OFF:

.StartWait: Holding point right after starting a method or submethod in TIP (holding point after AutoInfo !".T.GC").

.FinWait: Holding point at the end a method or submethod in TIP (holding point after AutoInfo !".T.F").

3.2.2.113 **Se**tup.**S**endMeas.**S**endStatus ON, **OFF**
Setup.**S**endMeas.**I**nterval 0.08...**4**...16200, MPList

.SendStatus: ON means the automatic transmission of measured values (see 3.2.2.115 and 3.2.2.116) in the inputted interval is active.

.Interval: Time interval (in s) for the automatic transmission of associated measured values defined under points 3.2.2.115 and 3.2.2.116. The inputted value is rounded off to a multiple of 0.08. The smallest possible time interval depends on the number of measured values which have to be sent, on the baud rate, on the load on the interface and on the type of device connection.
With "MPList" the measured values are sent at the time of their entry into the measured point list (in modes STAT, DOS, DOC; in the modes SET, MEAS, CAL nothing is being sent).

The automatic transmission is switched on/off with 'SendStatus'.

3.2.2.114 **Se**tup.**S**endMeas.**Sel**ect Assembly, **Titrator**

Selection of the unit of which the measured values should be sent (3.2.2.115 or 3.2.2.116).

3.2.2.115 **Se**tup.**S**endMeas.**A**ssembly.**C**yclNo ON, **OFF**
Setup.**S**endMeas.**A**ssembly.**V** ON, **OFF**
Setup.**S**endMeas.**A**ssembly.**M**eas ON, **OFF**

Selection of the values from Assembly for the output in the set time interval (see 3.2.2.113):

.CyclNo: Cycle number of the potential measurement. Together with the cycle time (3.2.2.101), a time frame can be set up.
The cycle number is set to 0 on switching on the instrument and it is always incremented as long as the instrument remains switched on.

.V: Volume

.Meas: Measured value associated to the cycle number.

The unit "assembly" must be preset (see 3.2.2.114).

3.2.2.116 **Se**tup.**S**endMeas.**T**itrator.**C**yclNo ON, **OFF**
Setup.**S**endMeas.**T**itrator.**V** ON, **OFF**
Setup.**S**endMeas.**T**itrator.**M**eas ON, **OFF**
Setup.**S**endMeas.**T**itrator.**d**Vdt ON, **OFF**
Setup.**S**endMeas.**T**itrator.**dM**easdt ON, **OFF**
Setup.**S**endMeas.**T**itrator.**dMeasdV** ON, **OFF**
Setup.**S**endMeas.**T**itrator.**T** ON, **OFF**

Selection of the values from the titrator which are sent in the set time interval (see 3.2.2.113, formats see 3.2.2.99):

.CyclNo: Cycle number. Together with the cycle time (3.2.2.101), a time frame can be set up.The other data belong to the corresponding cycle number. The cycle number is set to 0 at the start of a method and it is incremented until the end of the method.

.V: Volume.

.Meas: Measuring value with STAT, DOS, DOC with activated measured value monitoring

.dVdt: associated volume drift.

.dMeasdt: associated measured value drift.

.dMeasdV: associated 1st derivative of the titration curve.

.T: In STAT, DOS, DOC, with activated temperature monitoring

The unit "titrator" must be preset (see 3.2.2.114).

3.2.2.117	**Se**tup.**A**utoInfo.**S**tatus	**ON**, OFF
	Setup.**A**utoInfo.**P**	ON, **OFF**
	Setup.**A**utoInfo.**T.R**	ON, **OFF**
	Setup.**A**utoInfo.**T.G**	ON, **OFF**
	Setup.**A**utoInfo.**T.GC**	ON, **OFF**
	Setup.**A**utoInfo.**T.S**	ON, **OFF**
	Setup.**A**utoInfo.**T.B**	ON, **OFF**
	Setup.**A**utoInfo.**T.F**	ON, **OFF**
	Setup.**A**utoInfo.**T.E**	ON, **OFF**
	Setup.**A**utoInfo.**T.H**	ON, **OFF**
	Setup.**A**utoInfo.**T.C**	ON, **OFF**
	Setup.**A**utoInfo.**T.O**	ON, **OFF**
	Setup.**A**utoInfo.**T.N**	ON, **OFF**
	Setup.**A**utoInfo.**T.Re**	ON, **OFF**
	Setup.**A**utoInfo.**T.Si**	ON, **OFF**
	Setup.**A**utoInfo.**T.M**	ON, **OFF**
	Setup.**A**utoInfo.**T.EP**	ON, **OFF**
	Setup.**A**utoInfo.**T.RC**	ON, **OFF**
	Setup.**A**utoInfo.**I**	ON, **OFF**
	Setup.**A**utoInfo.**O**	ON, **OFF**

ON means that the STAT Titrino reports automatically the moment the corresponding change occurs.

.Status: Global switch for all set AutoInfo.
.P PowerOn: Simulation of power on (3.2.2.119). Not from mains.

Messages from node .T, Titrator:

.T.R Ready: Status 'Ready' has been reached.
.T.G Go: Instrument has been started.
.T.GC GoCommand: Instrument (or submethod in TIP) has received a go command.
.T.S Stop: Status 'Stop' has been reached.
.T.B Begin of sequence (or submethod).
.T.F Final: End of determination (or submethod), the final steps will be carried out.
.T.E Error. Message together with error number, see page 84ff.
.T.H Hold: Status 'Hold' has been reached.
.T.C Continue: Continue after hold.
.T.O Conditioning OK in SET with conditioning.
.T.N Conditioning Not OK in SET with conditioning.
.T.Re Request: In the inquiry of an identification or the sample size after start of titration.
.T.Si SiloEmpty: Silo empty, i.e. the last line has been removed from the silo memory.
.T.M MeasList: Entry in the measuring point list (with STAT, DOS, DOC).
.T.EP EPList: Entry into EP list (with SET)
.T.RC Recalculation of results.

Messages for changements in the I/O lines. If the changements are made simultaneously, there is 1 message. Pulses receive 2 messages: one message each for line active and inactive.

.I Input: Change of an input line.
.O Output: Change of an output line (except 7, pin 2, for recorder pulses).

If a change occurs that requires a message, the STAT Titrino sends space (ASCII 32) and ! as an introducer. This is followed by the name of the device (see 3.2.2.73). Special ASCII characters in the device name are ignored. If no device name has been entered, only ! is sent. Finally the 718 STAT Titrino sends the information which node has triggered the message.
Example: !John".T.Si": The message was triggered from instrument "John", node .T.Si

3.2.2.118 **Se**tup.**G**raphics.**G**rid — **ON**, OFF
Setup.**G**raphics.**F**rame — **ON**, OFF
Setup.**G**raphics.**S**cale — **Full**, Auto
Setup.**G**raphics.**R**ecorder.**R**ight — 0.2...**0.5**...1.00
Setup.**G**raphics.**R**ecorder.**F**eed — 0.01...**0.05**...1.00

Change in the appearance and the format of the curve for the output:

.Grid: On/off switching of grid over curve.

.Frame: On/off switching of frame surrounding the curve. If grid and frame are switched off, the curve is printed faster as the print head does not have to move to the end of the paper.

.Scale: Type of scaling of the measured value axis:
Full means that the scale runs from the smallest up to the greatest measured point.
With auto, the smallest measured value is taken and the next smaller tick defines the beginning of the scale; the next greater tick to the greatest measured value is the end of the scale.

.Right: Relative specification of the width of the output medium (e.g. paper width) for the length of the measured value axis. 1 means the measured value axis is plotted over the entire width of the paper (largest possible width). In extreme cases, the writing of the right tick may lie outside.

.Feed: Length of the volume axis referred to the burette cylinder volume, V(B) per cm (0.1 means, e.g. 1 mL/cm with a 10 mL Exchange Unit). Depending on the printer, the measure in cm may not always be correct.

The settings can be made without a PC:
Press <configuration> key on switching on the instrument.

3.2.2.119 **Se**tup.**P**owerOn — $G

Simulation of 'power on'. The device has the same status as after power on: The cylinder is filled, error messages deleted and the current sample number set to 0. The method last used is ready for operation.

3.2.2.120 **Se**tup.**I**nitialise — $G
Setup.**I**nitialise.**S**elect — **ActMeth**, Silo, Calib, Config, Assembly, Setup, All

Setting of default values for the following areas:

ActMeth: Current method. Parameters, calculations, and assignments for the data output, operands C01...C19.

Silo: The silo memory is deleted. Same function as delete entire silo.

Calib: pH calibration data for all measuring inputs.

Config: All values under &Config.

Assembly: All values under &Assembly.

Setup: All values under &Setup.

All: Values of the entire tree (except silo and method memory).

The action must be triggered with &Setup.Initalise $G.

3.2.2.121 **Se**tup.**R**amInit — $G

Initialises instrument as in the diagnosis, see page 143. All parameters are set to their default value and error messages are cleared. The user and silo memories will be deleted. The user memory contains the default user methods from Metrohm.

3.2.2.122 **Se**tup.**Ins**trNo — $G
Setup.**Ins**trNo.**V**alue — **serial number**, 8 ASCII characters

Instrument identification for report output.
Set the value with &Setup.InstrNo $G .

3.3. Characteristics of the RS232 interface

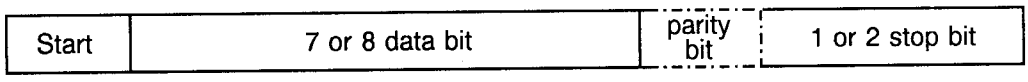
3.3.1 Data transfer protocol

The Titrino is configured as DTE (Data Terminal Equipment).

The RS232 interface has the following technical specifications:

Data interface in accordance with the RS 232C standard. RS parameters can be selected, see page 17.

Max. line length:	80 characters + C_R L_F
Control characters:	C_R (ASCII DEC 13)
	L_F (ASCII DEC 10)
	XON (ASCII DEC 17)
	XOFF (ASCII DEC 19)
Cable length:	max. ca. 15 m



For interconnections of the Titrino with non-Metrohm units, only a shielded data cable (e.g. METROHM D.104.0201) may be used. The cable shielding must be faultlessly earthed at both units (pay attention to current loops; always use star-head earthing). Only connectors with adequate shielding may be used (e.g. METROHM K.210.0001 with K.210.9004).

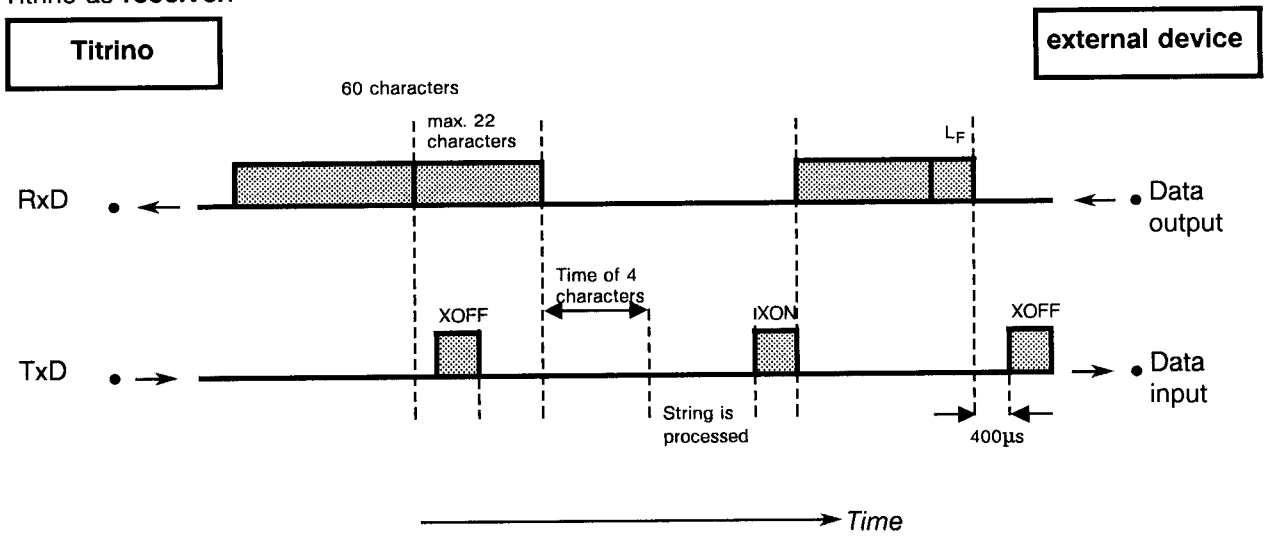
3.3.2 Handshake

3.3.2.1 Software handshake , SWChar

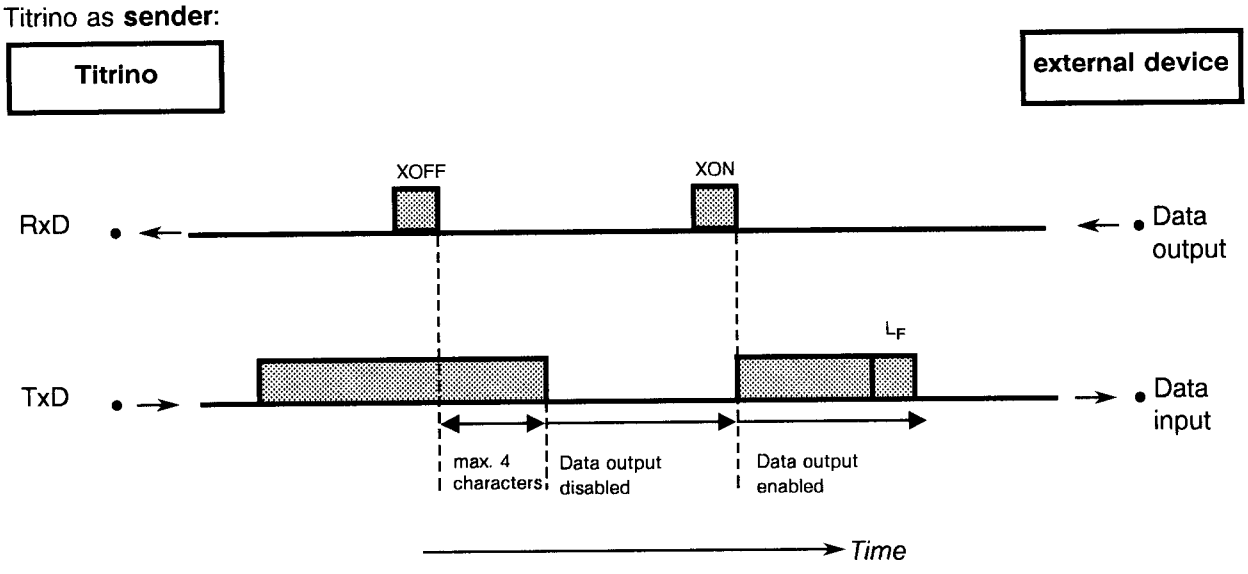
Handshake inputs at the Titrino (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the Titrino.

As soon as a L_F is recognised, the Titrino sends XOFF. It can then receive 6 extra characters and store them.
However, the Titrino also sends XOFF if its input buffer contains 60 characters. After this, it can receive maximum 22 extra characters (incl. L_F).
If the transmission is interrupted for the time of 4 characters after the Titrino has sent XOFF, the string received earlier is processed even if no L_F has been sent.

Titrino as **receiver**:



Titrino as **sender**:

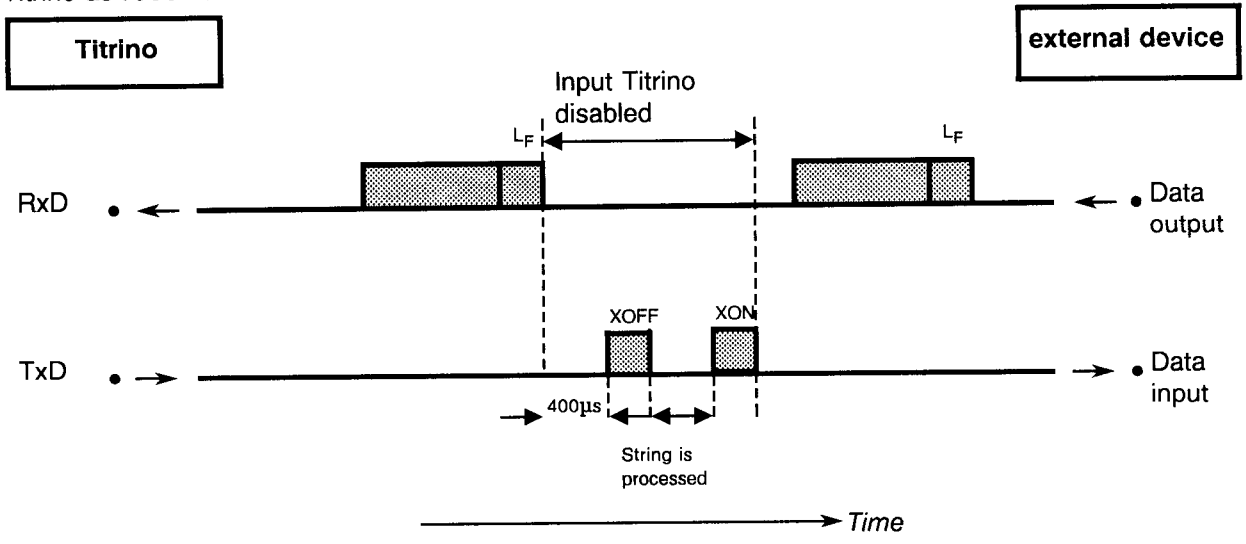


3.3.2.2 Software-Handshake , SWline

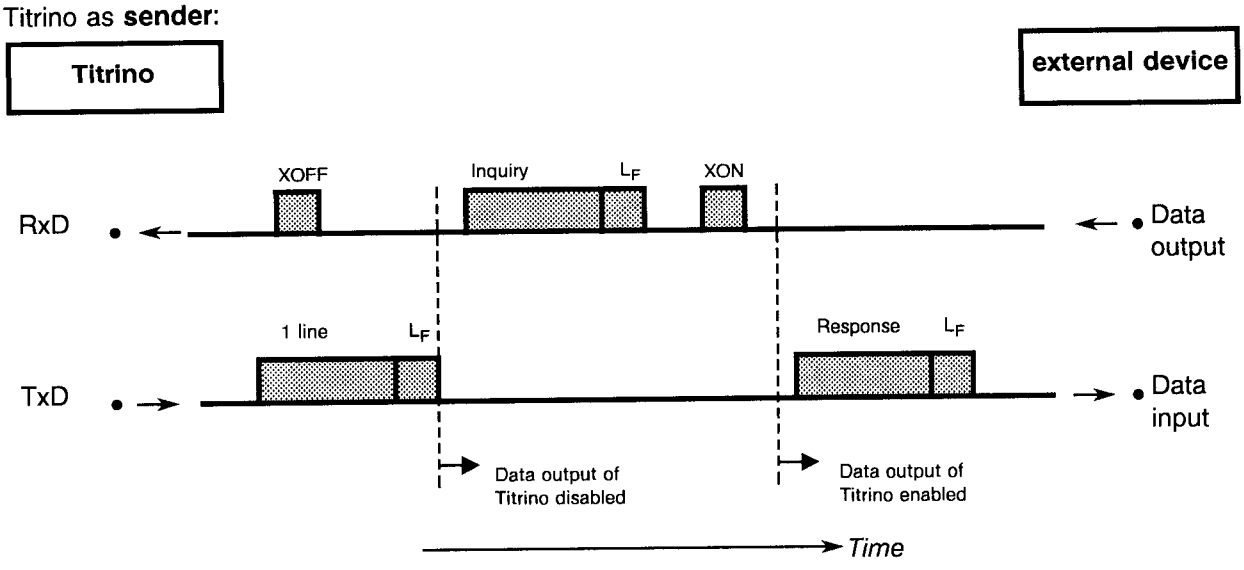
Handshake inputs at the Titrino (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the Titrino.

The Titrino is equipped with an input buffer that can accommodate a string of up to 80 characters + C_RL_F. As soon as an L_F is recognised, the Titrino sends XOFF. After this, it can receive maximum 6 extra characters and store them. The string sent previously is now processed by the Titrino. Afterwards, the Titrino sends XON and is again ready to receive.

Titrino as **receiver**:



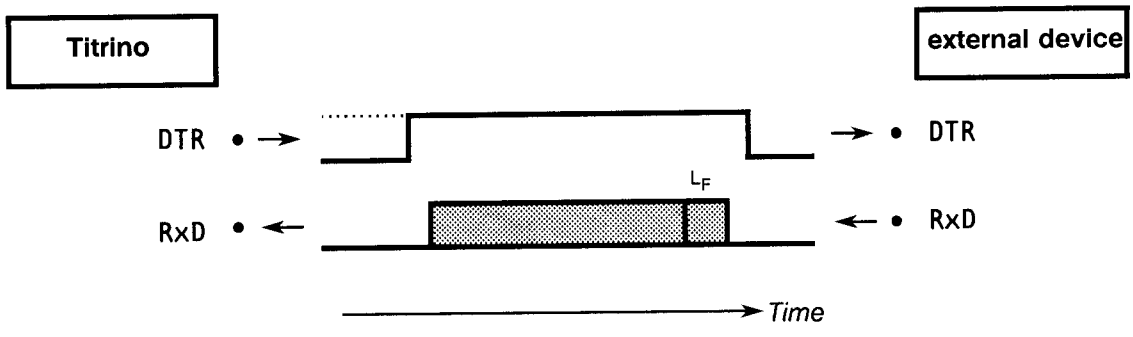
Titrino as **sender**:



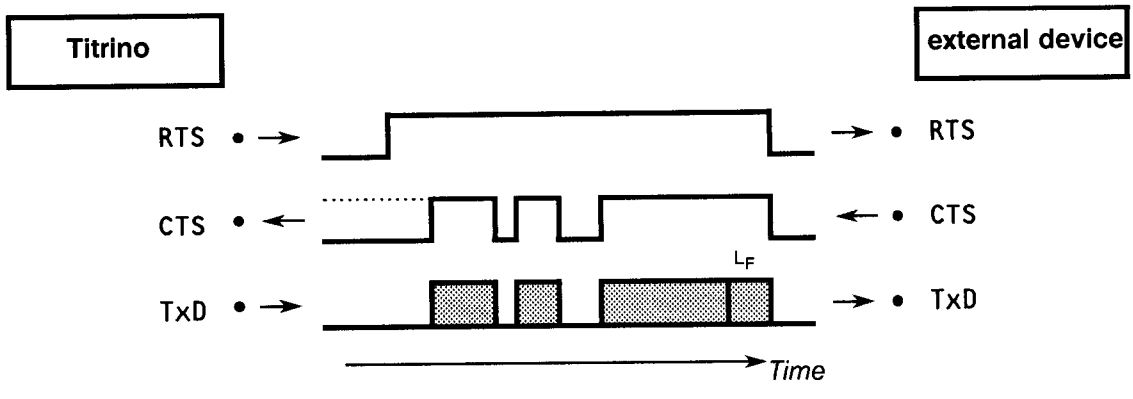
The transmission of the Titrino can be stopped by the external device with XOFF. After receipt of XOFF, the Titrino completes transmission of the line already started. If the data output is disabled for more than 3 s by XOFF, E43 appears in the display.

3.3.2.3 Hardware handshake, HWs

Titrino as **receiver**:



Titrino as **sender**:

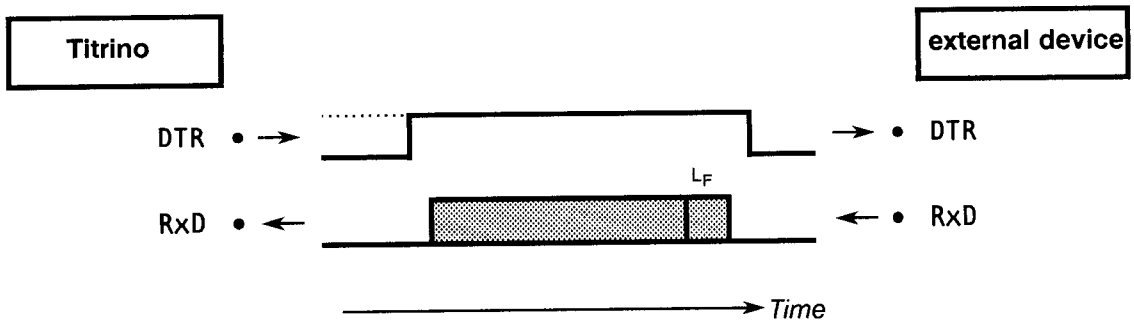


The data flow can be interrupted by deactivation of the CTS line.

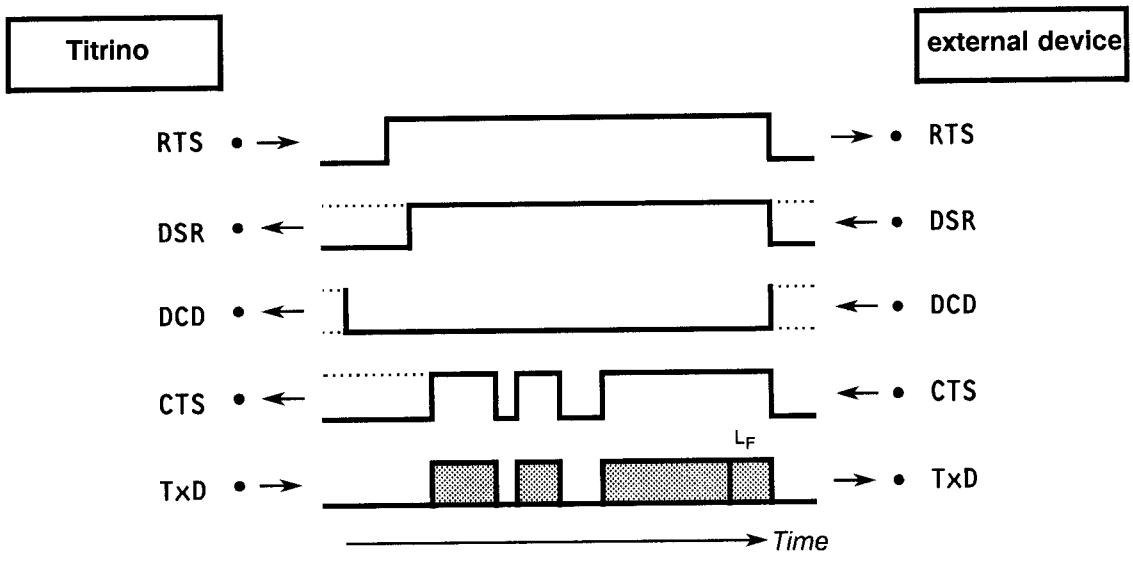
Hardware handshake, HWf

All handshake inputs are checked at the Titrino, handshake outputs are set.

Titrino as **receiver**:

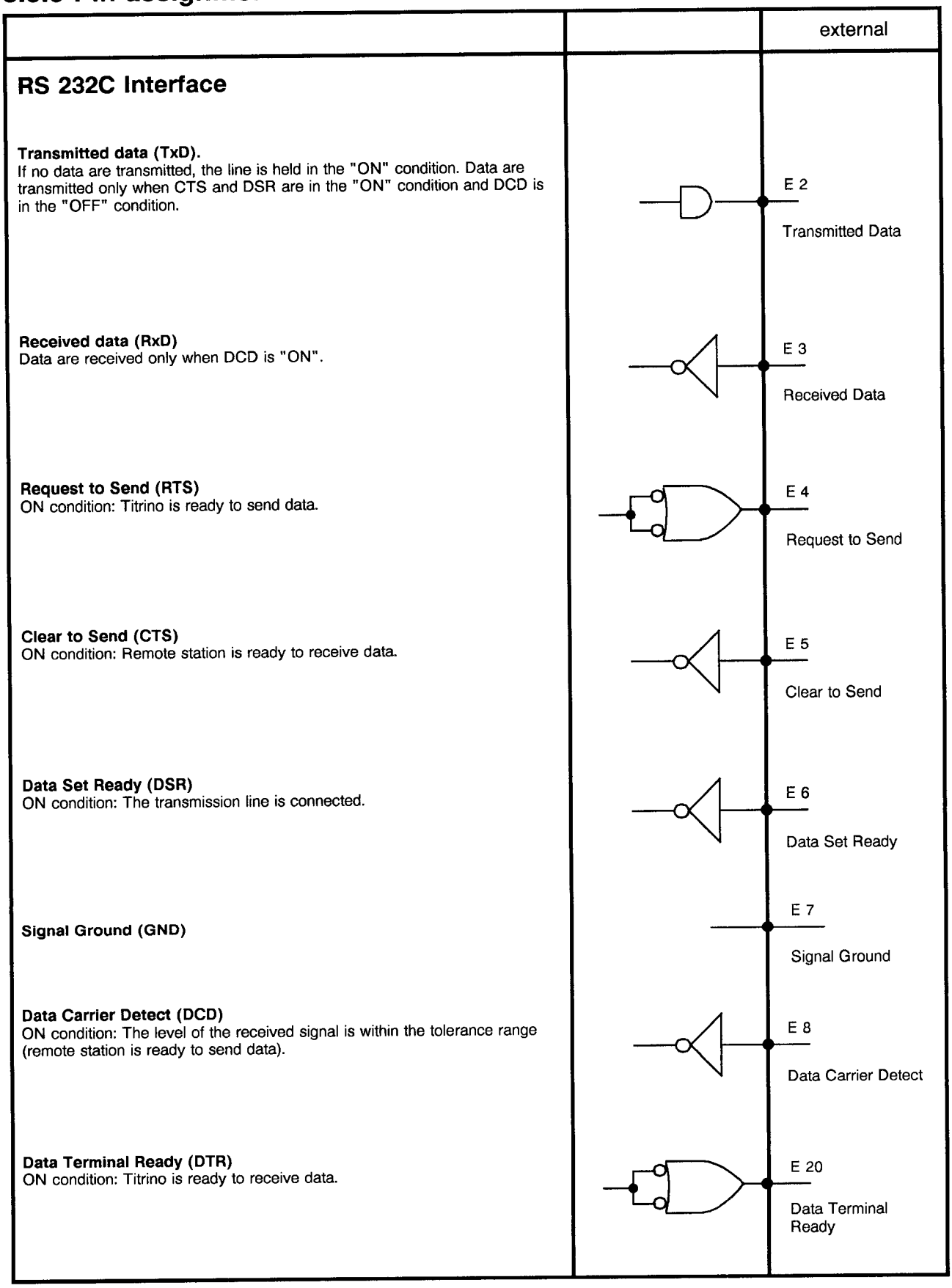


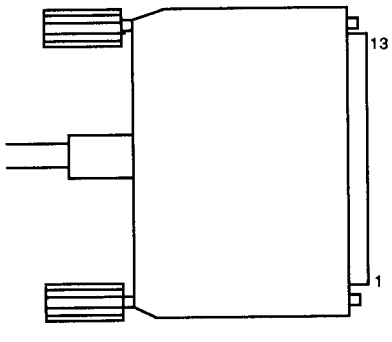
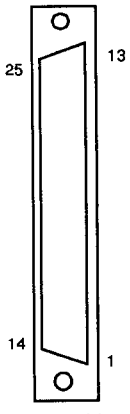
Titrino as **sender**:



The data flow can be interrupted by deactivation of the CTS line.

3.3.3 Pin assignment



		external
RS 232C (continued) **Protective earth** Direct connection from cable connector to protective earth of instrument. **Polarity allocation of the signals** - Data lines (TxD, RxD) Voltage negative (<–3 V): signal status "ONE" Voltage positive (> +3 V): signal status "ZERO" – Control or message lines (CTS, DSR, DCD, RTS, DTR) Voltage negative (<–3 V): OFF status Voltage positive (> +3 V): ON status In the transition region from +3 V to - 3 V the signal status is undefined. Driver 14C88 Receiver 14C89 } in compliance with EIA RS 232C specification **Contact arrangement at connector (female) for RS 232 C socket (male)**  Ordering numbers: K.210.9004 und K.210.0001  View from solder side of connector		

No liability whatsoever will be accepted for damage or injury caused by improper interconnection of instruments.

3.4 What can you do if the data transfer does not work?

Problem	Questions for remedial action
No characters can be received on a connected printer	– Are the instruments and the connection cables plugged in properly? – Is the printer set to "on-line"? – Are baud rate, data bit and parity settings the same for both devices? – Is the handshake set properly? If everything appears to be in order, try to print out a report with the key sequence <print><smpl data><enter>. If this report is printed out correctly, check whether under the key <def>, >report a report is preselected.
No data transmission occurs and the display of the Titrino shows an error message	– **E40-42**: Transmission error. Is the cable used properly wired and connected? Is the printer switched on and set to "on-line"? – **E43**: Data output of the Titrino disabled for longer than 3 s by XOFF. – **E36-39**: Receive error. Are the settings of the RS232 data transmission parameters the same for both devices?
The received characters are garbled	– Are the data bit and the parity settings the same for both devices? – Is the baud rate setting the same for both devices? – Has the correct printer been selected? – Data transfer has been interrupted on the hardware side during the printout of a curve. Re-establish connections and switch printer off/on.
Wrong line spacing	The printer does not emulate completely the preset mode. Usually these problemes arise with the IBM mode. Set the printer to a different mode (e.g. Epson).
Printout of titration curve is not ok. Other reports are printed ok	Handshake is necessary for the printout of a titration curve. – Is your cable correctly wired? (The DTR of the printer has to be connected to the CTS of the 718 STAT Titrino.) – Set "HWs" for the handshake at the 718 STAT Titrino. Configure the printer such that its DTR is set (normally with DIP switches).

4. Error messages, Troubleshooting

"Ticking" of the Exchange Unit	Cause: Stopcock switch mechanism bouncing. Press the stopcock switch lever manually into the end position. Do not rotate the stopcock when the Titrino is switched on!
Data transfer inoperative	See measures on page 130.

4.1 Error and special messages

XXX bytes missing	XXX bytes missing. For the storage of a method or a silo line XXX bytes are missing or there is insufficient RAM for a TIP sequence. Exit: <QUIT>. Delete methods no longer needed or use fewer silo lines.
check electrode	With polarized electrodes. There is a break or short circuit. Possible causes and rectification of the fault: – the electrode is not plugged in → plug it in – the electrode is not immersed in the solution → immerse it – the electrode is defective → use new electrode. – the electrode cable is defective → use new cable. The electrode test can be switched off under the <parameters> key, , see pages 23, 31, 42, 49 or 54. Exit: Rectify fault or <STOP>.
check exchange unit	The Exchange Unit is not mounted (properly). Exit: Mount Exchange Unit (properly) so that the coupling engages.
check T-sensor	No temperature sensor is attached (with MEAS T or if the temperature monitoring is active). Exit: Connect Pt100 or Pt1000 or <STOP>.
data set reevaluation	Message if Titrino is reevaluating downloaded measuring point lists.
division by zero	The result could not be calculated as a divisor in the formula was equal to zero. Exit: Enter appropriate value.
limit	Message in the measuring point list: More than one limit value of the activated monitoring functions has been violated.
manual stop	The determination has been terminated manually.
meas out of limit	The determination has been stopped as a limit value of the measured value monitoring has been violated.
meas.lim	Message in the measuring point list: A limit value of the measured value monitoring has been violated.
meas.pt list overflow	Maximum 500 measured points can be stored. Exit: Use start criteria or select larger time interval.
missing EP	An EP needed for calculation in a formula is missing.
missing fix time	A fix time C6X needed for calculation in a formula is missing.
missing fix V	A fix V C5X needed for calculation in a formula is missing.
missing rate	A rate C8X needed for calculation in a formula is missing.
no end set	With DOC the end of the ramp has not been set. Exit: <STOP> and set end.
no EP set	In SET or STAT, no EP has been set. Exit: <STOP> and set EP.
no meas.quantity	In DOS or TIP a manual measurement (<meas/hold>) has been performed without defining a measured quantity. Exit: <meas/hold> and define measured quantity.
no method	The method required by the sample data from the silo memory or in a TIP sequence is not available in the method memory. Exit: <clear>.

no new com.var. The common variable could not be assigned as the result or the mean value could not be calculated. The old value remains in force.

no new mean No new mean value has been calculated as at least one quantity stipulated for mean value calculations could not be calculated.

no new silo result No new silo result C24 or C25 could be stored as the assigned quantity could not be calculated.

no new temp.var. No new temporary variable C7X could be stored as the assigned quantity could not be calculated.

no sequence No sequence is defined in TIP.
Exit: <clear> and define sequence.

no titration data With STAT, DOS and DOC no curve can be printed as no data are available.
With the curves measured value vs time or temperature vs time, the limit value must be switched on for the recording of measured points.

not valid A value is not available.

outside With STAT the set fix volume or fix time is outside the measurement range.

overrange The measurement range of ±2 V has been exceeded. Overrange replaces the corresponding measured value (pH, U, I or temperature). If a measured value is in overrange (primary or secondary measured value), the other (secondary or primary measured value) can also be unstable.

rate lim Message in the measuring point list. A limit value of the rate monitoring has been violated.

rate out of limit The determination has been stopped as a limit value of the rate monitoring has been violated.

rate too high With DOS the calculated rate is too high. It can not be achieved with the mounted Exchange Unit.
Exit: <clear> and use Exchange Unit with larger burette volume or change dispensing conditions.

rate too low With DOS the calculated rate is too low. It can not be achieved with the mounted Exchange Unit.
Exit: <clear> and use Exchange Unit with smaller burette volume or change dispensing conditions.

rates not corresponding With STAT the number of rates that could be calculated is not equal to the number of time windows set or the mean rate C80 could not be calculated. The calculation of a rate requires at least 4 points.

same buffer In the calibration sequence the voltage difference between the first and second buffer is < 6 mV.
Exit: <quit> and change buffer or <STOP> (abort calibration).

save lines OFF The function "save lines" is not active although the method contains assignments to C24 or C25.
Exit: <clear> and switch on "save lines" under <smpl data> key.
Warning: The sample data of the silo line have already been copied to the working storage, the results of this line are thus not stored. If the sample is processed, the following procedure is necessary:
– Switch out silo.
– Process sample. When the sample has been processed, then
– switch in silo again.

second TIP call In TIP no further TIP can be called up as a submethod.
Exit: <clear> and define new sequence.

silo empty The silo memory is switched in and empty and a titration has been started.
Corrective action: Complete at least 1 silo line before starting the first titration.
Exit: <clear>.

silo full The silo memory is full up.
Corrective action: If you have filled less than 99 silo lines, you can create more space by deleting old methods no longer needed. 1 silo line needs 18...120 bytes.
Exit: <clear>.

stop rate reached	STAT has been stopped as the stop rate has been reached.
stop time reached	SET or STAT has been stopped as the stop time has been reached.
stop V reached	The determination has been stopped as the stop volume has been reached.
system error 3	The instrument adjustment data have been overwritten. Exit: <clear>. Default adjustment data are set. The error message appears each time the instrument is switched on until it has been readjusted (Metrohm service).
temp out of limit	The determination has been stopped as a limit value of the temperature monitoring has been violated.
temp.lim	Message in the measuring point list: A limit value of the temperature monitoring has been violated.
TIP terminated	TIP has been terminated.
wrong sample	With SET or DOC with preset titration direction the first measured value is outside the end point.

Error messages in connection with the data transfer

If neither a computer nor a printer is attached, the report output at the end of the titration must be switched off:

	Receive errors:
E36 **E37**	Parity Stop bit } Exit: <QUIT> and set corresponding quantity the same on both instruments
E38	Overrun error. At least 1 character could not be read. Exit: <QUIT>
E39	Overflow of the receive buffer of the STAT Titrino (> 82 characters). Exit: <QUIT>
	Send errors:
E40 **E41** **E42**	DSR = OFF DCD = ON CTS = OFF } Handshake unsatisfactory for more than 1 s. Exit: <QUIT> Is the receiver switched on and ready to receive?
E43	The transmission of the STAT Titrino has been interrupted with XOFF for at least 3 s. Exit: <QUIT>.
E44	The RS interface parameters are no longer the same for both instruments.
E45	The receive buffer of the STAT Titrino contains an incomplete string (missing L_F). Transmission of the STAT Titrino is thus blocked. Exit: Send L_F or <QUIT>.

4.2 Diagnosis (for 5.718.001X Program)

The STAT Titrino is a very precise and reliable instrument. Thanks to its rugged construction it is virtually impossible for external mechanical or electrical influences to have an adverse effect on its functions.

Although the occasional fault in the instrument can not be excluded completely, it is certainly much more likely that malfunctions are caused by wrong operation or handling or through improper connections and operation with non-Metrohm instruments.

It is thus advisable in each case to isolate the fault with the rapid and easy to perform diagnostic tests. The customer thus need not call METROHM service until there is a true fault in the instrument. In addition, with the aid of the numbering in the diagnostic program he can provide the service engineer with much more accurate information.

In inquiries always quote the manufacturing (page 3) and program number (see configuration, page 19) and specify possible error displays.

Procedure

- The diagnostic steps must be performed in sequence and compared with the reactions of the 718 STAT Titrino (indented). In the "yes" case, continue with the next instruction.

- If the instrument does not show the expected reaction ("no" case), the appropriate diagnostic step must be repeated to exclude an operating error. With repeated wrong reactions, however, there is a strong possibility that a malfunction exists.

- The diagnostic steps marked with a triangle (≫) allow re-entry into the test routine for repetition if the following display appears:

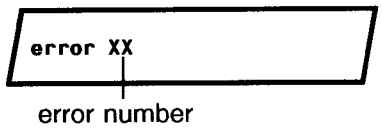
  

  If the instrument is in a subprogram of the diagnostic routine: Press the <clear> key.

  If need be, switch the power off then on again after a few seconds. At the same time press key "9" until the above display appears.

- If the <clear> key is pressed during the display of 'diagnose press key 0...9', the instrument jumps back into the user program.

- Error display: An error is shown in the display as follows:

- If a fault causes the burette drive to stick at the top or bottom end of the cylinder, see point 13, page 97.

Equipment required:
- voltage calibrator, e.g. Metrohm pH Simulator 642[1]
- Highly insulated interconnection cable 6.2108.060
- Resistor switch-box, class 0.1% (or resistor 14.3 k 0.1%)
- 3.496.5070 Cable[2]
- Exchange Units, if possible with different cylinder volumes (or 3.496.0070 Dummy Exchange Unit)
- Stop watch or watch with second hand
- 6.2132.040 Keypad
- Digital or analog voltmeter (if need be, connect a calibrated recorder)
  (2 connecting cables with 4 mm banana plugs)

Necessary only if external functions should also be checked:
- 3.496.8510 Test Plug (at 'Remote' connector)
- 3.496.8480 Test Plug (at 'RS 232' connector)

≫ 1. **Prepare instruments for diagnostic test**

Power off

Disconnect all external connections (cables at rear) except mains cable and keypad.

Remove Exchange Unit

Power on and immediately press and hold the <9> key until the powerup test pattern disappears.

```
diagnose press key 0...9
```

≫ 2. **Perform display test**

Press <2>

```
display test
```

Press <enter>.

After the <enter> key has been pressed, characters for a visual check of the display are generated on both lines.

Test sequence:

- Display is cleared and overwritten from the left with a dot pattern.
- Display is cleared and both lines are written into with the letters A, B, C...Z.
- The complete character set (see Fig. 4-1) is shown as a moving display. At the same time with the moving display, the LED lamps 'statistics' and 'silo' are switched on and off.

The test sequence can be held at any time with the <5> key and then continued.

Block 2 is quit with the <clear> key.

1 If no suitable voltage calibrator is available: Use any stable voltage source and connect a precise DVM in parallel.

2 If no suitable cable is available: Remove indicator electrode from cell. Connect switch-box or resistor combination with laboratory cable and test clips carefully to the platinum wires of the indicator electrode.
(Warning: Do not bend platinum wire!)

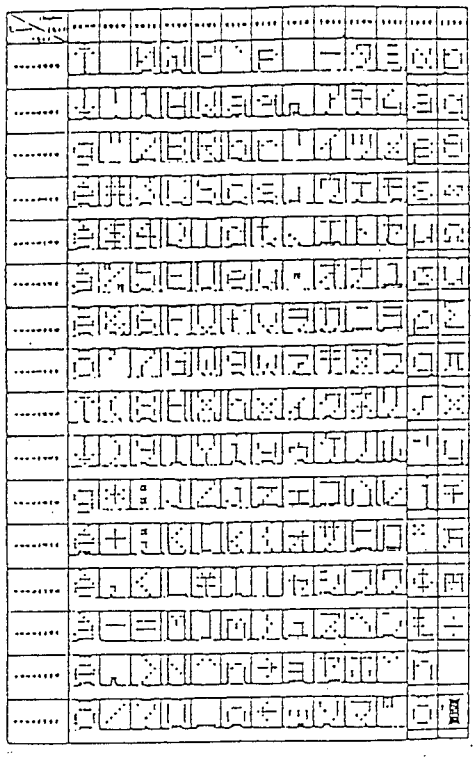


Fig. 4-1: Character set

≫ 3. Keypad test

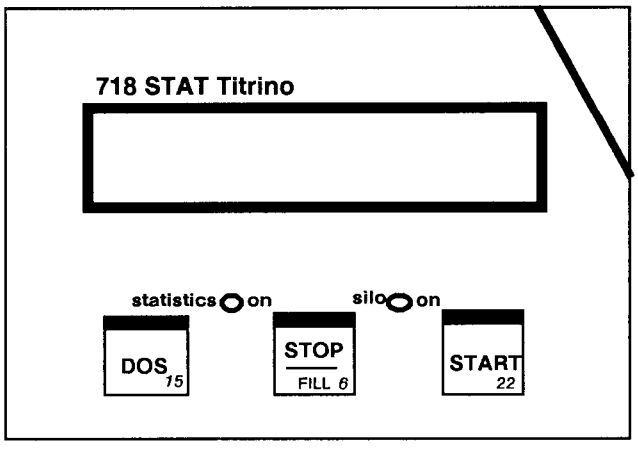
Press <1>

```
keys test
```

Press <enter>

```
keys test
matrix code
```

If any key is now pressed (on the 6.2132.040 Keypad or on the front panel of the 718), the appropriate matrix code appears in the display (0...31).



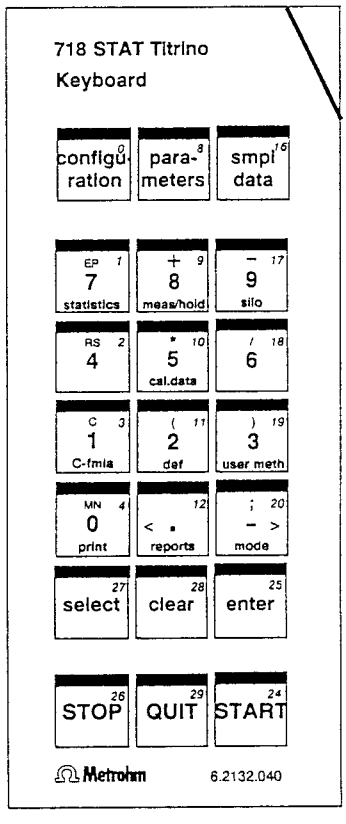


Fig. 4-2 Matrix code table

Block 1 is quit by pressing the <clear> key twice.

≫ 4. Cylinder code, date, time

Press <0>

```
date/time
cylinder code
```

Press <enter>

```
date XX-XX-XX[1] XX:XX:27[2]
check exchange unit
```

Check date and time. If deviations are found, enter new date and/or time, see page 18 and 19.

Insert Exchange Unit (or dummy)

```
date XX-XX-XX[1] XX:XX:XX[2]
code:            XX ml[3]
```

For the sake of completeness, different Exchange Units can be inserted to verify their ml code.

If desired, the Exchange Unit can be removed again.

Press <clear>

```
diagnose press key 0...9
```

≫ 5. Check analog output

A voltage can be set at the analog output (sockets at D) using the keypad. But this should not exceed ±2000 mV. This voltage can also be used for the calibration of a connected recorder.

Connect a voltage measuring instrument (voltmeter, DVM, recorder) to the analogue output(***14***)

Press key <3>

```
analog output-1 test
```

<enter>

```
analog output-1 test
V-out =      XX[4] mV
```

Enter a voltage value in the range (±)2000 mV using the keypad. After the <enter> key has been pressed, this value appears as a voltage at the analog output.

Read off value on the connected voltmeter and compare with the mV value on the display. (Tolerance ±2 mV)

Exit: <QUIT>

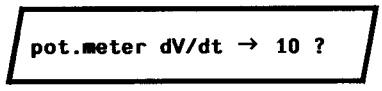
Disconnect voltmeter.

1 acurrent date
2 current time
3 Check that mL code of Exchange unit used is displayed
4 This value is incidental, but can be accepted with <enter>.

≫ 6. Motortimertest

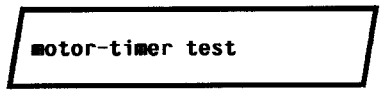
<6>

<enter>



Turn knob 'dV/dt' to the right stop

<enter>



Test sequence

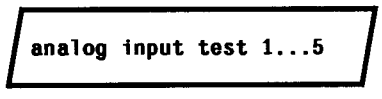
- In a first step, the frequency of the RC oscillator (analog rate) is tested over a period of 1 second.
- In a second step, the frequency of the quartz oscillator (digital rate) is tested over a period of 1 second.

After ca. 3 s, the text 'o.k' appears in the display.

<clear>

≫ 7. Analog input test

Press <7>



7.1 Examination of highly insulated measuring inputs

Connect 'Ind I' measuring input (***11***) to a voltage calibrator (e.g. Metrohm 642 pH simulator) by means of a highly insulated cable (e.g. 6.2108.060). Set calibrator to 0 V.

<1>

Tolerance: ±0.5 mV

Set the calibrator voltage, on setting 'low ohmic' (with 642 = ~0.002 MΩ), to different values (e.g. +1500 mV) and compare with the displayed value.

Tolerance (with ±1500÷2000 mV) ±1 mV
(Be aware of the calibrator's tolerance.)

Set simulator to high ohmic condition (with 642 = 1000 MΩ).

The displayed reading may vary slightly only (with 1500 mV ≤1 mV)

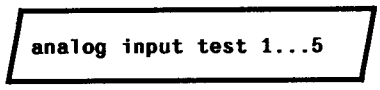
<clear>

Disconnect simulator from 'Ind I' input and connect to 'Ind II' input (***11***):

<2>

Carry out the same measurements as with Input I and compare the displayed value.

<clear>

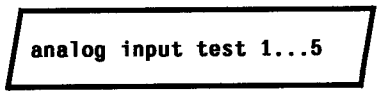


Short-circuit input 'Ind I' (e.g. with cable 3.496.5070)

<3>

The differencial voltage between inputs 'Ind I' and 'Ind II' is displayed.
Example: 0 – (+)1500 mV = –1500 mV

<clear>



7.2 To check Pt 100 / 1000 connection

Connect a Pt 100 or Pt 1000 sensor, a resistor switch-box or a single resistor of 100 Ω or 1 kΩ, respectively, to sockets 'Pt 100/1000' (***12***) by means of short cables.

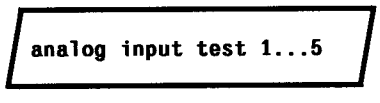
<4>

(* oder Pt 1000)

Tolerance: ±0.5 °C
(Note also tolerance of resistor switch-box.)

The sensor allows automatic displaying of the room temperature. (The resistances correspond to 0 °C.)

<clear>



Remove resistor switch-box.

7.3 Polarizer test

Press <5>

```
Polarizer test
```

<enter>

```
dummy resistor 14.3 kΩ ?
```

Connect resistor switch-box (or suitable resistor 14.3 k /0.1%) using 3.496.5070 Cable[3] to 'Pol' socket(***10***). Switch-box to14.3 k.

<enter>

```
polarizer test
```
—An asterisk flashes during the test

The test runs automatically. If no error is found, after about 15 s 'polarizer test o.k' appears. If not, an error message appears. (If the switch-box is not connected, Error 100 appears.)

In case of an error: depress <clear> several times until all error numbers are indicated.

<clear>

```
analog input test 1...5
```

<clear>

```
diagnose press key 0...9
```

Remove cable and resistor switch-box.

≫ 8. External inputs and outputs

This test is meaningful only if the 718 STAT Titrino is used interconnected with other instruments via the 'Remote' connection. In addition, a 3.496.8510 Test Plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number.
For the sake of completeness, the procedure is described here.
(If a diagnostic test of the external inputs and outputs is not required, continue with point 9.)

Plug 3.496.8510

PIN	PIN	PIN	PIN
1	24	5	21
2	12	9	18
3	23	10	17
3	22	11	16

Fig. 4-3 Connections in the 3.496.8510 Test Plug

Press key <4>

```
extern input/output test
```

[3] If cable not available see page 135.

<enter>

```
I/O-test-connector?
```

Insert the 3.496.8510 Test Plug in port B 'Remote' (**9**) (do not switch off instrument, pay attention to alignment of the plug!).

<enter>

The test runs automatically. If no error is found, 'extern input/output o.k.' appears. Otherwise, an error message is displayed. If no test plug is connected, 'error 50 01 HEX' appears.

Remove test plug

<clear>

```
diagnose press key 0...9
```

≫ 9. RS 232 Test

This test is meaningful only if the STAT Titrino 718 is used interconnected with other instruments via the 'RS 232' connection. In addition, a 3.496.8480 Test Plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number.

For the sake of completeness, the procedure is described here.

(If a diagnostic test of the RS232 interface is not required, continue with point 10.)

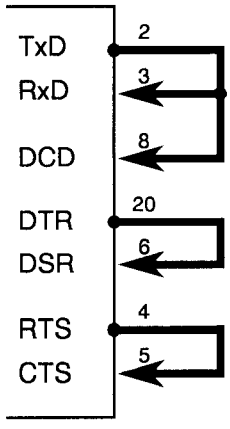


Fig. 4-4 Connections in the 3.496.8480 Plug

Press key <5>

```
RS232  test
```

<enter>

```
RS232 test-connector?
```

Insert 3.496.8480 Plug in 'RS 232' port (do not switch off instrument, pay attention to alignment of the plug!).

<enter>

The test runs automatically. If no error is found, 'RS 232 test o.k.' appears after ca. 3 s. Otherwise, an error message is shown. If no test plug is connected, 'error 68' appears.

Remove test plug

<clear>

```
diagnose press key 0...9
```

⩾ 10. Spindle drive and stopcock changeover

<clear>

Titrino fills (only if an exchange unit is inserted).

```
XXX X          ********
```

X = according to the selected method

Remove Exchange Unit (if still inserted).

Check spindle zero position, see Fig. 4-5

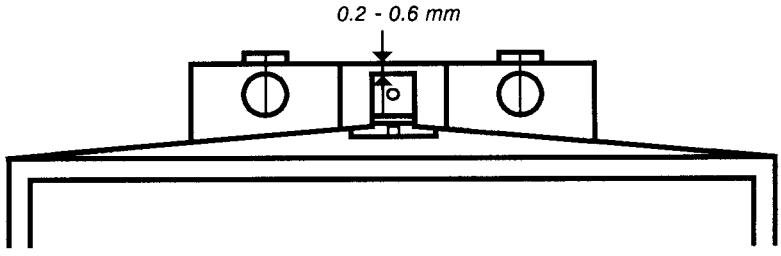


Fig. 4-5

The spindle must be 0.2 - 0.6 mm below the edge of the sliding plate.

The bar of the stopcock coupling must be exactly parallel to the lateral edges of the Titrino

Reinsert Exchange Unit.

Titrino fills

The display of before reappears.

(Knob 'dV/dt' to right stop)

Press the <DOS> key (on instrument) until the piston rod reaches the top and at the same time measure the time from start to end.

```
XXX X          ********
cylinder empty!
```

mind selected language!

Spindle remains at maximum position.
The transit time of the spindle is 20 s.

Measure spindle height (can be performed only if the 3.496.0070 Dummy Exchange Unit is inserted or the locking switch (in right hole) is carefully operated with a screwdriver after removal of the Exchange Unit).

From the start point, the spindle travels 80 mm.

Instead of the spindle height, the expelled volume can be measured (corresponds to max. vol. of Exchange Unit used).

Press <FILL> and simultaneously measure the time until the Titrino is again in the 'ready' position.

Times for filling: per stop cock cycle 1 s
for filling 20 s (tolerance 10%)

The following generally holds:
Spindle and stopcock must move at a constant speed (noise!).
In the filling setting, the stopcock coupling must position the lever of the Exchange Unit correctly at the left stop (with virtually no play and without sticking).

Set potentiometer 'dV/dt' to left stop.

Press <DOS> at same time and use a stopwatch to measure the time for 1/10 of the cylinder volume to be expelled. The time should be ca. 76 ... 126 s.

set potentiometer 'dV/dt' to right stop.

<FILL>

End of test.

11. **Setting up original arrangement**

Reconnect all peripherals disconnected at the start of the diagnostic routine and perform a short function test with these.

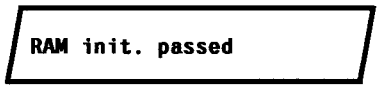
⩾ 12. **Initialise and test RAM**

On the odd occasion large disturbing signals (e.g. mains spikes, lightning, etc.) can have an adverse effect on the processor functions and hence lead to a system crash. After such a crash the RAM area must be initialised. Although the basic instrument data remain stored, the RAM initialisation should be performed only when necessary since the stored user data (configuration, parameters, calculation variables, etc.) are cleared as a result.

Perform point 1 of the diagnostic routine.

Press <8>

<enter>



RAM is tested and initialised.

The lost data of the user memory must now be reentered.

Perform point 11.

If 'system error 3' appears in the display, <clear> can be used to exit to the instrument program. The initialisation values are loaded automatically. The instrument thus remains capable of measurement. However, possibly a small loss in accuracy must be anticipated. A new optimum adjustment can be performed by Metrohm service. The error message 'system error 3' always appears after the instrument is switched on until this adjustment has been performed.

⩾ 13. Releasing a locked spindle with inserted Exchange Unit

- The burette drive may very occasionally jam at the top or bottom end of the cylinder. If jamming occurs at the top or when the drive is out of function, the Exchange Unit can no longer removed. In this case, it is necessary to proceed as follows:

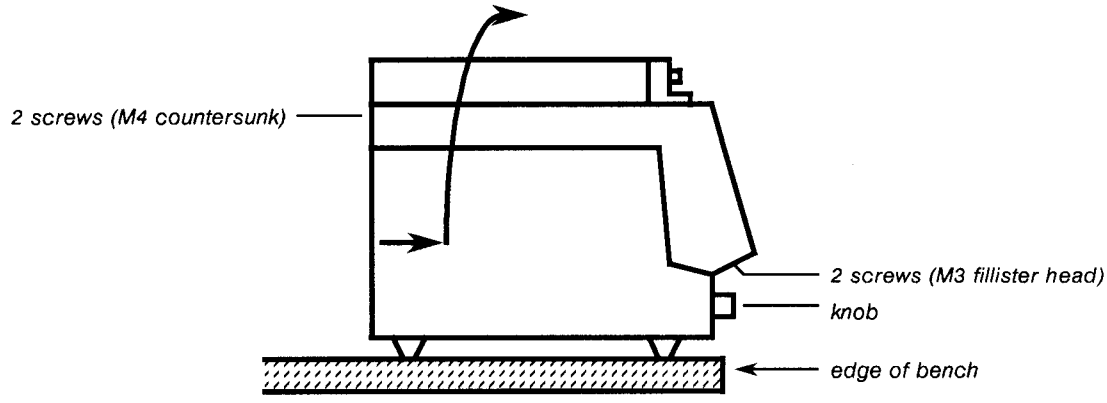


Fig. 4-6

- Disconnect instrument from power supply!
- Remove control knob
- Place instrument over edge of bench to allow the M3 screws to be removed (Fig. 4-6)
- Remove M4 screws
- Lift off top part of instrument together with Exchange Unit in the manner shown by the arrow

! **The electronic circuits are now accessible!!**
On no account touch these!

- Remove spindle from mechanical stop by turning the large gear wheel. (In case that the motor is inoperative, position spindle by hand to zero position.)

Overview of the key assignment in the diagnostic tests

via key <9> with power on→ `diagnose press key 0...9`

For repeat observations and special applications, it may be an advantage to enter a particular check directly. In what follows, the numeric assignment is thus given.

5. Preparations

Ensure that the set operating voltage corresponds to the mains voltage before switching on the instrument.
The mains cables supplied with the instrument are three-core and equipped with a plug with an earthing pin. If a different plug has to be fitted, the yellow/green lead must be connected to the protective earth. If no socket with earthing is available, the instrument must be connected to a perfect earthing conductor via its earthing socket. Each break in the earthing inside or outside the instrument can make it a hazard.
When the instrument is opened or if parts of it are removed, certain components may be live if the instrument is connected to the mains. The mains cable must therefore always be unplugged when certain adjustments are made or parts replaced.

5.1 Setting up and connecting the instruments

5.1.1 Titrino with Magnetic Stirrer

The instruments are set up and connected as shown in Fig. 5-1.

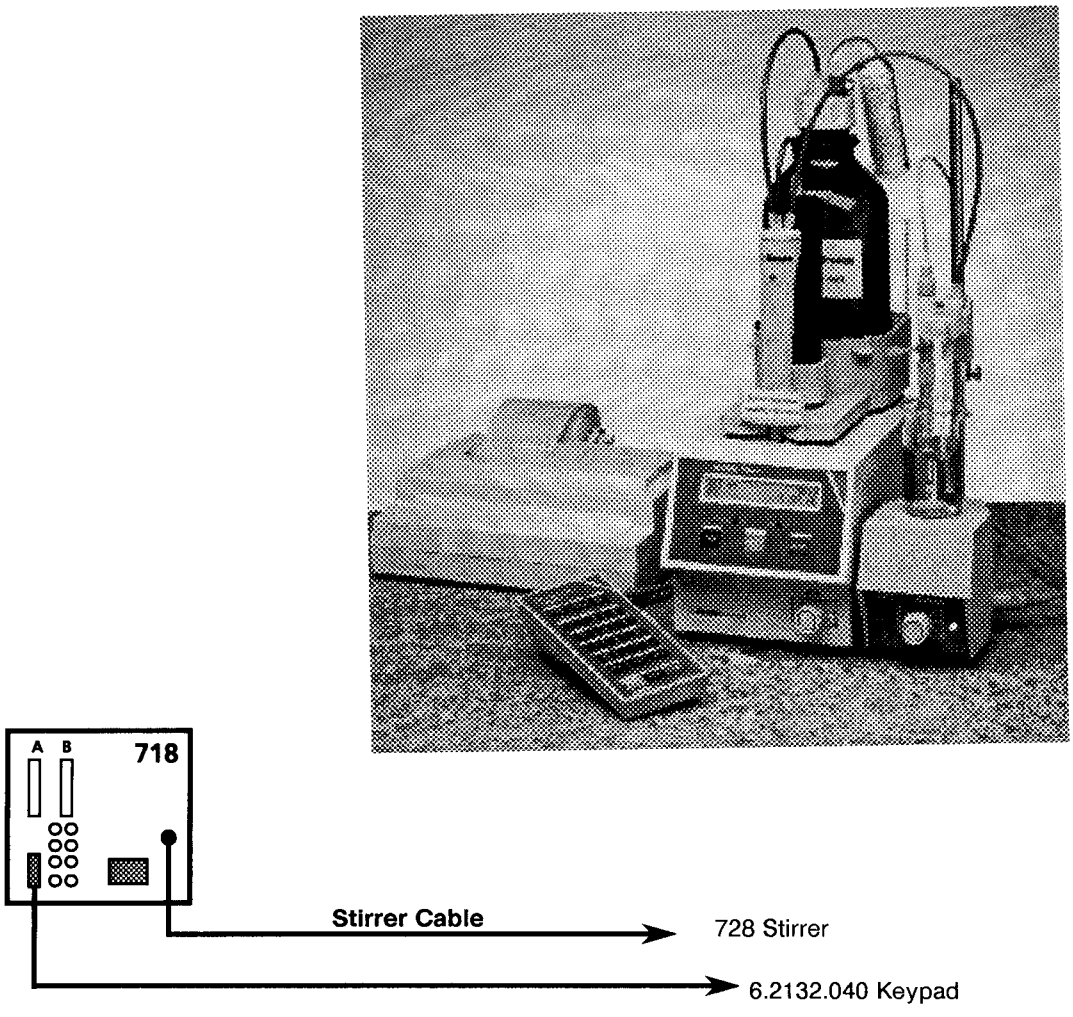


Fig. 5-1: Setting up the STAT Titrino and connection of the stirrer

The 722 Rod Stirrer, the 727, or the 703 Ti Stand with 6.2108.100 cable can also be connected instead of the 728 Magnetic Stirrer.

5.1.2 Connection of a printer

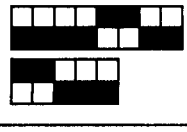
A variety of printers can be connected to the RS232 interface of the 718 STAT Titrino. If you connect a printer other than one of those mentioned below, ensure that the Epson mode is emulated or that it uses the international character set following the IBM Standard Table 437 and IBM-compatible graphics control characters.

If a **balance** is connected at the same time as a printer, the 6.2125.030 Adapter must be used. The printer must be plugged into the "data out" receptacle of the adapter. It can be operated only with the simple hardware handshake (HWs) or without handshake.

The connection of a selection of printers is facilitated by the following Table:

Printer type	Cable	Settings at STAT Titrino	Settings at printer
Citizen iDP560 RS	6.2125.050	baud rate: 9600 data bit: 7 stop bit: 1 parity: even handshake: HWs send to: Citizen	**DIP switches:** 1 on 2 off } 9600 baud 3 off 4 off 5 on 7 bit 6 – 7 off } even 8 on parity Set printer to on-line with <sel> **Jumpers:** 1 open } USA 2 open char.set 3 open 4 open 5 **closed**
Seiko DPU-411	6.2125.020	baud rate: 9600 data bit: 7 stop bit: 1 parity: even handshake: HWs send to: Seiko	**DIP switches:** **DIP01** 1 off serial 2 off no auto LF 3 on 40 characters 4 on character style 5 off zero represent. 6 off } USA 7 on -character set 8 on Set printer to on-line **DIP02** 1 off 7 bit 2 off } even 3 off parity 4 off } 9600 baud 5 off 6 off

The following printers can also be connected:

Printer	Cable	Settings at 718 Titrino	Settings at printer
Epson Printer with 6-pin circular connector [1]	6.2125.040	send to: Epson data bit: 8 parity: none handshake: HWs	8 bit no parity
Epson Printer with #8148 interface	6.2125.050	send to: Epson data bit: 7 parity: even handshake: HWs	7 bit even parity
HP: Think Jet	6.2125.050	send to: Epson baud rate: 9600 data bit: 7 parity: even handshake: HWs	Switches: 

Printer	Cable	Settings at 718 Titrino	Dip switches at printer
HP: Desk Jet[1)]	6.2125.050	Send to: HP baud rate: 9600 data bit: 8 parity: none handshake: HWs	A:  For A4 paper B: 
Kodak Diconix 180 si	6.2125.050	send to: Epson baud rate: 9600 data bit: 7 parity: even handshake: HWs	Epson emulation 7 bit even parity

1): When connecting a balance at the same time, which only is capable to work with 7 bit, set "parity space" on the balance, while Printer and Titrino work on 8 bit, no parity.

5.1.3 Connection of a balance

The following balances can be connected to the RS232 output of the STAT Titrino:

Balance		Cable
Sartorius	MP-8, MC1	6.2125.070
Mettler	AM, PM	From Mettler: ME 33995: Green lead to pin 2, brown to pin 3, white to pin 7, yellow to pin 20 of the 25-pin connector.
	Interface 016:	Cable in scope of delivery of interface 016: Red lead to pin 3, white lead to pin 7 of the 25-pin connector
	Interface 011 or 012:	6.2125.020
Mettler AT		From Mettler: ME 33995: Green lead to pin 2, brown to pin 3, white to pin 7, yellow to pin 20 of the 25-pin connector.
AND	Models ER-60, 120, 180, 182 Models FR-200, 300 Models FX-200, 300, 320 with RS232 interface (OP-03)	6.2125.020 6.2125.020 6.2125.020
Precisa	Balances with RS232C interface	6.2125.080

The balance type must be preselected at the STAT Titrino with the <configuration> key.
Balance and printer can be connected at the same time with the aid of the 6.2125.030 Adapter. The balance must then be plugged into the "data in" receptacle of the adapter.

The weight is transferred as a number with up to 6 digits, sign and decimal point. Units and control characters sent by the balance are not transmitted.
With the aid of a special input unit supplied by the balance manufacturer, in addition to the weight identifications and methods can be inputted from the balance. For this, the address of the identifications and method, resp. must be preselected on the input unit.

Balance	Method	Id#1	Id#2	Id#3
Sartorius	METH or 27	ID.1 or 26	ID.2 or 24	C-20 or 23
Mettler (AT)	D (Mthd)	C (ID#1)	B (ID#2)	A (c20)

5.1.4 Connection of a sample changer

The sample changer is connected as follows:

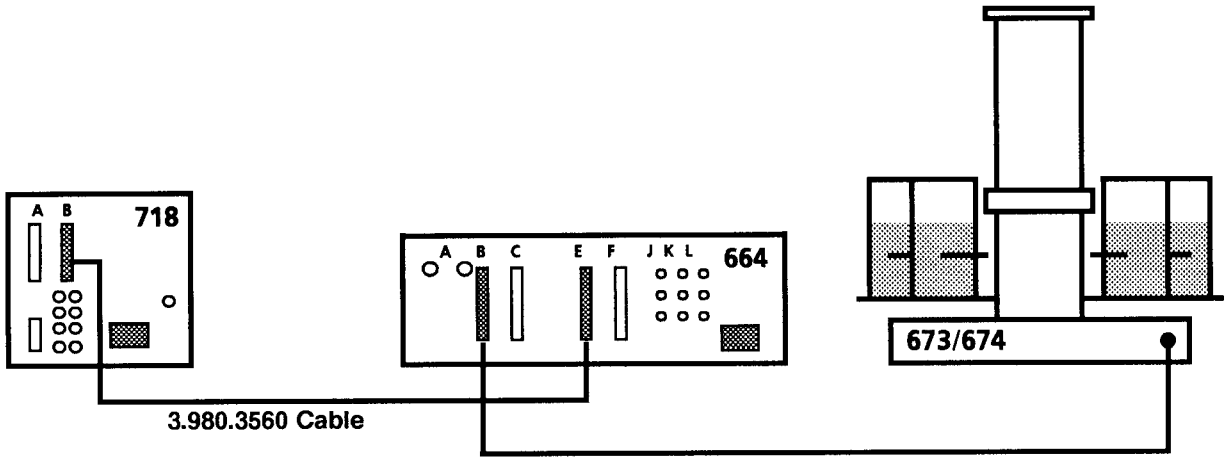


Fig. 5-2: Connection of a sample changer

- The "remote" socket allows not only connection of a sample changer but also additional control functions. Pin assignment of the "remote" socket and control possibilities, see page 161.
- If a calibration has to be performed with the sample changer, the calibration parameter "sample changer:" must be set to "ON".
- In connections with the sample changer, "auto start" should be set to "OFF" in the <configuration> key. The start command is given by the 664 Control Unit when the sample beaker is at the processing station.

5.1.5 Connection of a recorder

The recorder is connected to the analog output of the STAT Titrino:

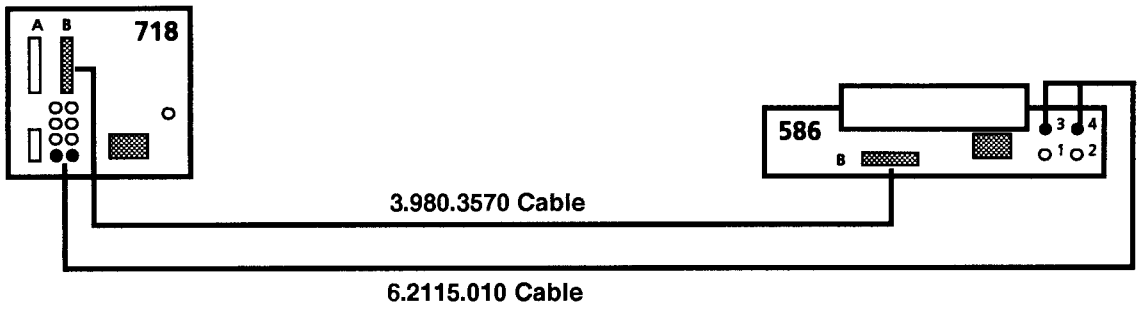


Fig. 5-3: Connection of a recorder

If the connection is set up with the 3.980.3570 cable, the chart feed axis of the recorder becomes the volume axis, i.e. the signal at the analog output is plotted against volume. The chart length per $V_{burette}$ corresponds to the set chart speed on the recorder in mm. For 400 mm/min and 200 mm/min the maximum dosing rate v_{max} has to be reduced to $\frac{1}{4}$ v_{max}, or $\frac{1}{2}$ v_{max}, respectively.

If the connection is not set up with the 3.980.3570 cable, the chart feed axis of the recorder becomes the time axis and the signal at the analog output is plotted against time. For such curves, another laboratory recorder can be connected instead of the 586 Labograph.

The signal at the analog output can be preselected on the STAT Titrino (<configuration key>, " >peripheral units", "record:"). The following are available:

Preselection at STAT-Titrino	Meaning	Resolution, Signal at analog output
U	Voltage	pH = 0.00: −700 mV pH = 7.00: 0 mV pH = 14.00: +700 mV U = +1 mV: +1 mV U = −1 mV: −1 mV I = +1 uA: +10 mV I = −1 uA: −10 mV T = 0 °C: 0 mV T = +1 °C: +10 mV T = −1 °C: −10 mV
dU/dt	Measured value drift	1 mV/min: 1 mV 1 °C/min: 1 mV 1 uA/min: 10 mV
V	Volume	1 Zylindervolumen: 2000 mV
dV/dt	Volume drift	100 µl/min: 1000 mV
U(rel)	Control deviation	ΔpH = 1: 100 mV ΔU = 1 mV: 1 mV ΔI = 1 uA: 10 mV
T	Temperature	ΔT ±1 °C: 10 mV T = 0 °C : 0 mV

5.1.6 Connection of a computer

The computer is connected as follows:

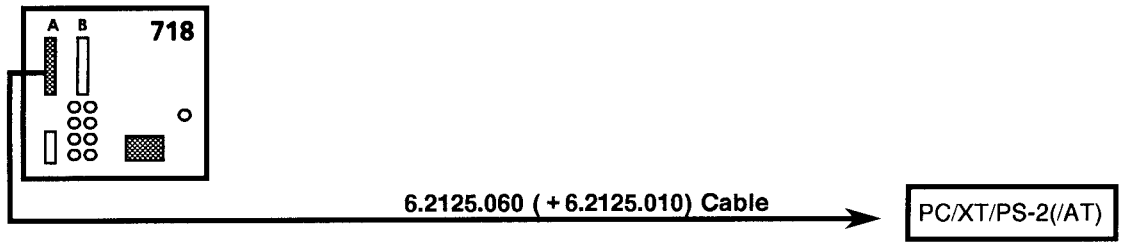


Fig. 5-4: Connection of a computer

For the connection of IBM® AT computers, the 6.2125.010 Adapter is also needed.

Preselections on STAT Titrino:

RS232 settings:	depend on the control program of the computer
Send to:	IBM

Program package for the data transfer STAT Titrino ↔ computer,
3½" diskettes, in PASCAL and BASIC 6.6021.000

5.2 Installation of the titration vessel, connection of electrodes

5.2.1 Setting up the titration vessel

The titration vessel is set up as shown in Fig. 5-5. During a titration, it is important to ensure that the solution in contact with the electrode is thoroughly mixed. This is achieved by

- efficient stirring. But it should not be too fast, otherwise the stirrer vortex will suck in air bubbles and CO_2 or O_2 can disturb the titration.
- positioning the burette tip as centrally as possible, above the stirring bar.

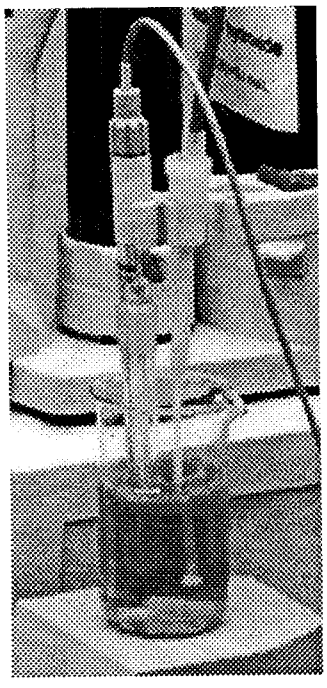
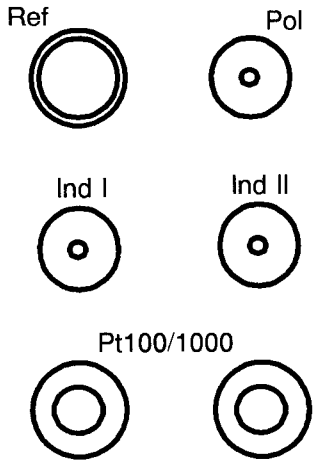


Fig. 5-5: Setting up the titration vessel

5.2.2 Connection of the sensors



Ref: Separate reference electrode. Input is free when a combined electrode is used.

Pol: Connection for polarized electrodes. If measured quantity Ipol or Upol is selected, this measuring input is automatically active.

Ind I: Indicator electrode I. (pH, redox, ISE electrodes). Combined or separate electrode. If "meas. input: 1" is selected under the <parameters> key, this measuring input is active.

Ind II: Indicator electrode II: "meas. input: 2" must be selected.

Important:
The two measuring inputs Ind I and Ind II have a common reference. They can be used as a differential amplifier, see below. However, only 1 reference electrode can be used in the same analysis solution.

Pt100/1000: Pt100 or Pt1000 temperature sensor. This measuring input is active in the "MEAS T" mode.

Fig. 5-6: Connection of electrodes

Differential potentiometry

In potentiometric measurements in media of low conductivity, e.g. in organic solvents, high-impedance electrode assemblies such as pH electrodes record noise voltages which arise from stray electrostatic and electromagnetic fields. Particularly high field strengths occur through friction at insulators such as plastic floors, synthetic clothing, etc; conditions which can appear in every normal laboratory environment.

Problems of this type can be solved by measurement using a differential amplifier. Here, the indicator and reference electrode are each connected to a high-impedance measuring input. It is important to ensure that both electrodes have identical shielding and are thus symmetrical with regard to the recording of noise signals. An auxiliary electrode provides the electrical connection between the reference point of the amplifier circuit and the measurement solution.

Recommended electrodes:

Measuring input	Manual determinations	Determinations at sample changer
Ind I	6.0133.100 pH glass electrode	6.0130.100 pH glass electrode
Ind II	6.0729.100 double-shielded Ag/AgCl reference elecrode	6.0729.110 double-shielded Ag/AgCl reference electrode
Ref	6.0301.100 auxiliary elecrode	6.0302.110 auxiliary electrode

Practical tips
- Glass electrodes should be preconditioned in the solvent used for ca. 1 hour.
- If the potential jump after the first dispensing step is too large, a small start volume may help.
- As an "auxiliary electrode", the 6.1808.030 burette tip with earthing may be used in some cases. Use burette tips without anti-diffusion valve!

5.3. Preparing the Exchange Unit

The Exchange Units are available in brown or clear glass with light protection. The models with light protection or in brown glass should be used for light-sensitive reagents (silver nitrate, Karl Fischer, etc.).

Accuracy data:

Burette volume V_{bur} (in ml)	Abs. error rel. to nominal value ± ΔV (in ml)	Reproductibility error Accuracy ± ΔV (in ml)	Resolution of the display ΔV (in ml)
1.000	0.003	0.001	0.001
5.000	0.015	0.005	0.001
10.000	0.02	0.005	0.001
20.000	0.03	0.01	0.002
50.000	0.05	0.04	0.005

Note:
In gravimetric checks of the dispensed volume, the air buoyancy (ca. 0.1%) must be taken into account in the weighing. Consideration should also be given to evaporation.

5.3.1 Setting up the 6.3011.XXX/6.3012.XXX Exchange Units

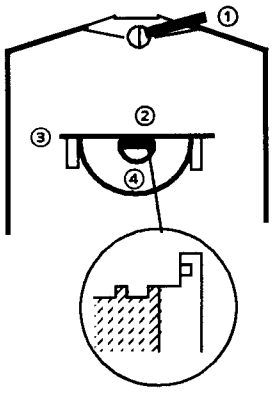


Fig. 5-7: Bottom of Exchange Unit

Before mounting the Exchange Unit, check that stopcock switch ① is on the right and coupling ② is parallel to ridge ③ and even with rings ④. The coupling can be adjusted with the 6.2739.010 key.

- Remove packing plate below the reagent bottle.
- Mount retaining clips for reagent bottle, see Fig. 6-1, page 180.

If you do not wish to use the reagent bottle supplied, convert your Exchange Unit as follows:
Snap in the reagent bottle retaining clips so that the reagent bottle sits snugly in the Exchange Unit. For different original reagent bottles, you need a special bottle siphon and possibly a threaded adapter. The following bottle siphons are available:

for bottles with GL45 thread, e.g. Riedel-de Haën (1 L), Baker (bottle siphon included in the standard equipment)	6.1602.100
for bottles with S40 thread, e.g. Merck	6.1602.110
for bottles with 32 mm thread, e.g. Fluka, Riedel-de Haën (500 mL)	6.1602.100 + 6.1618.000
for bottles with 28 mm thread, e.g. Fisher	6.1602.100 + 6.1618.010

- Screw the appropriate bottle siphon onto the reagent bottle.
- If necessary, replace the 6.1602.100 bottle siphon with the combination you need.

The holder on the right serves to hold the burette tip; in the holder on the left you can store, for instance the electrode associated with the reagent.

5.3.2 Assembly of the 6.3006.XXX/6.3007.XXX Exchange Units

See also Fig. 6-2, page 181.

- The instrument without Exchange Unit is set to zero.
- Mount Exchange Unit (without glass cylinder) from the front on the sliding plate and push right back.
- Allow piston spindle to run out by ca. 2 cm.
- Carefully grease PTFE piston (see section 5.3.5), assemble coupling and carefully slide glass cylinder over it from above ensuring exact axial alignment. (If the PTFE piston slips out of the coupling, the 6.1546.010 piston rod can be used to shift the piston in the glass cylinder.)
- Center cylinder in the slot of the exchange support.
- Clamp cylinder with 6.2035.00 flange and 6.1549.00 clamping ring moderately tightly. (For 50 mL units, use 6.1551.000 plastic flange.)
- Fit remaining components of Exchange Unit.
  . Tubing connections:

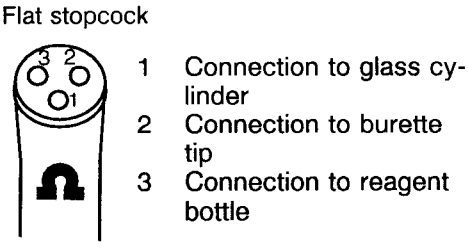


Fig. 5-8: Stopcock tubing connections

  . Tighten screw nipple by hand. Nipples should be tightened with the 6.2739.000 key only at inaccessible locations and not too tightly (tightening force ca. 100 p ≈ 1 N with 5 cm key). The tubing must not be pinched.
- Let piston move to zero position.

5.3.3 First-time filling

- Fill the reagent bottle with the titrant.
- Insert a cotton wool plug in the adsorption tube and add a suitable protective agent. Cover with another cotton wool plug and close with cover.
- Press <DOS> key until the piston is in the very top position.
- Press <STOP/FILL> .

Repeat filling process in both directions until the glass cylinder together with the connections up to the burette tip is filled. To allow air to escape better, hold burette tip up. Experience has shown that small air bubbles do not cause any disturbance as they remain connected to the wall even when the piston moves quickly.

5.3.4 Changing the Exchange Unit

When the Exchange Unit is mounted or removed, the burette must be in the zero position (filled + drive play taken up), otherwise the exchange support will be mechanically arrested by the piston spindle.

All Exchange Units are adjusted such that the spindle is even with the sliding plate when in the zero position thereby ensuring universal interchangeability.

If an Exchange Unit can not be mounted, the coupling of the PTFE piston must be adjusted with the aid of the 6.2739.010 Key in the case of the 6.3011.XXX/6.3012.XXX models or with the 6.1546.010 Piston Rod with the other models.

Caution: If no liquid is aspirated into the glass cylinder of the Exchange Unit upon filling – despite a filled reagent bottle and correct tubing connections – the cylinder can be under vacuum. In this case, it may be dangerous to remove the Exchange Unit (the cylinder may break). Aerate the cylinder by opening the tubing connection at the head of the cylinder.

5.3.5 Maintenance

It is best to store the burette tip in the same solvent as the reagent to prevent crystallisation of reagent: Fill glass holder with solvent, pass burette tip through the bulb stopper and place in the glass holder. In the case of KF reagent, use methanol as storage solution. Warning: Before dispensing check that the burette tip is not blocked!

Emptying and cleaning:
- Discharge as much titrant as possible.
- Burette in the zero position, disconnect connections to bottle and burette tip.
- With 6.3011.XXX and 6.3012.XXX Exchange Units, remove light protection.
- Undo attachment of the glass cylinder and let spindle run out until the piston can be disengaged.
- Completely empty cylinder with the aid of the 6.2739.010 Key or 6.1546.010 piston rod and carefully pull out piston.
- Rinse and clean individual parts properly. (Especially ensure that no reagent remains in the threaded hole of the PTFE tubing connections.)

PTFE piston

The PTFE piston must be handled with care to avoid damaging the lip seals. Residual grease should be wiped off with a soft, lint-free cloth. Carefully apply fresh grease with your finger to the lip seals and in the spaces. Wipe off leading edge to ensure that the reagent does not come into contact with the grease. When inserting the piston in the glass cylinder, ensure that it is introduced straight and not at an angle.

SISCO 3000 (Swedish Iron & Steel Corp.) grease - this is not silicon grease (!), the name refers to the manufacturer - has well proved its worth since our tests have shown that it is not only inert to all titrants in normal use, but also has a favourable viscosity.

A worn piston must be replaced immediately to prevent titrant leaking out and corroding the drive spindle.

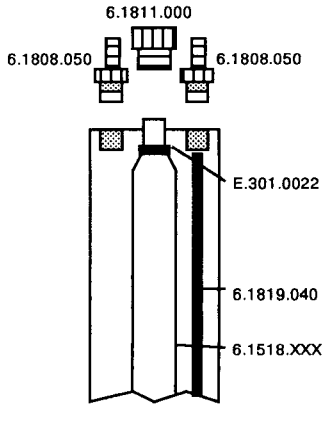
Stopcock

The stopcock needs no maintenance. If a defect is suspected, it is best to return it to the manufacturer for checking unopened (improper handling can render the stopcock completely useless). It is thus advisable to keep a 6.1542.0X0 stopcock as a spare at all times.

Removing the stopcock:
- Switch lever to "↑" ≙ dispensing.
- Unscrew nipples of the tubing connections.
- Pull out 6.1542.0X0 stopcock upwards (pull hard!).

Refitting:
- Switch lever to "↑" ≙ dispensing.
- For PTFE stopcock: Align marking on shaft and housing of stopcock.
- Insert stopcock from above in the holder and press down until the quick-release coupling engages.
- Screw in screw nipples.

5.3.6 Mounting the thermostat jacket of the 6.3011.XXX/6.3012.XXX Exchange Units



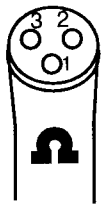
1. Undo tubing connection of 6.1518.XXX glass cylinder.
2. Remove light protection.
3. Unscrew 6.1811.000 screw fitting at glass fitting.
4. Roll O-ring upwards out of groove on glass fitting. Do not use any hard objects to remove the O-ring, otherwise the edge of the glass fitting can splinter! If all else fails, cut O-ring. Ordering number for new O-ring: E.301.0022.
5. Lightly grease inside of 6.1536.010 thermostat jacket at the bottom and mount.
6. Lightly grease O-ring and attach to glass fitting.
7. Attach upper part of 6.1811.000 screw fitting to glass fitting.
8. Make connection to stopcock.
9. Insert 6.1819.040 PTFE tubing in thermostat jacket and attach thermostat tubing using 6.1808.050 coupling.

Fig 5-9: Thermostat jacket

5.3.7 6.3006.113 Micromodel - 1 mL

Assembly:
See also Fig. 6-3, page 182.
- Dosimat without Exchange Unit is in the zero position.
- Mount Exchange Unit (without glass cylinder) from the front on the sliding plate and push right back.
- Allow piston spindle of Dosimat to run out by ca. 2 cm
- Mount 6.3022.113 Exchange Set and screw tightly.
- Join coupling of the piston spindle to that of the exchange set and move piston spindle of the Dosimat into the zero position.
- Fasten fitting with 6.2035.000 metal flange and V.911.0040 knurled nuts using 6.2035.000 metal flange.
- Turn glass piston until curve is aligned towards the handle.
- Attach remaining components of the Exchange Unit.
  . Tubing connections:

Flat stopcock



1 Connection to glass cylinder
2 Connection to burette tip
3 Connection to reagent bottle

Fig. 5-10: Stopcock tubing connections

  . Tighten tubing connections firmly by hand. Use 6.2739.000 key at all inaccessible positions and tighten using a moderate amount of force (tubing must not be pinched).
  Warning: Solids block the capillary tubing! Never pull on the tubing!
- Move piston to zero position.

Filling:

- Fill the reagent bottle with titrant.
- Insert a cotton wool plug in the adsorption tube and add a suitable protective agent. Cover with cotton wool and close with cover.
- Press <DOS> key until the piston is in the very top position.
- Press <STOP/FILL> .

Repeat filling process in both directions until the glass cylinder together with the connections up to the burette tip is filled. Drive any air bubbles to the top by lightly tapping the glass cylinder. If the air bubbles do not move, the Exchange Unit must be disassembled and the glass piston carefully degreased and dried.

Cleaning:
- Undo tubing connection to reagent bottle, repeat "dispensing" and "filling" until the piston is as empty as possible.
- Undo tubing connection to glass piston.
- Remove Exchange Unit from Dosimat.
- Unscrew knurled nuts and remove piston and fitting.
- Unscrew exchange set from fitting and disassemble Exchange Unit into its parts.
- Clean all parts thoroughly and dry (ensure that no reagent remains in the threaded holes of the tubing connections).
- If need be, replace 6.2712.000 Seal (round part pointing upwards).

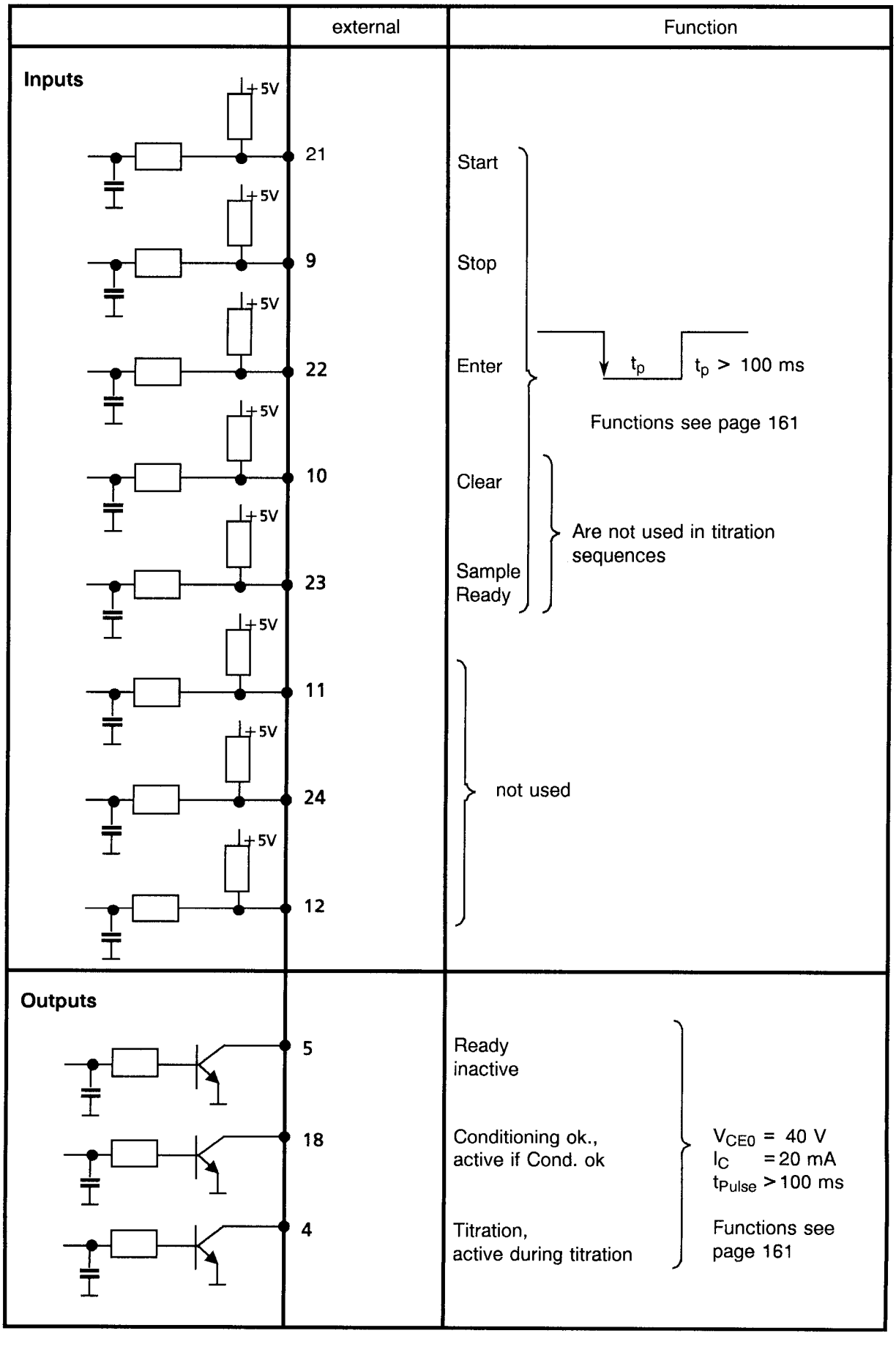
6. Appendix

6.1 Technical specifications

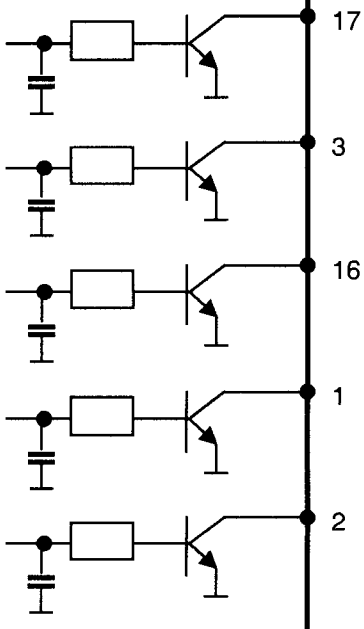
Modi	SET: **S**et **E**nd point **T**itration STAT: Keeping a measured value constant DOS: **Dos**ing DOC: Controlled dosing with measured value gradient MEAS: **MEAS**urement CAL: pH **cal**ibration TIP: Links commands to **ti**tration **p**rocedure
Measuring input	2 high-impedance measuring inputs for pH, redox and ISE electrodes 1 reference input for a separate reference electrode May also be used as a differential amplifier. 1 measuring input for polarized electrodes 1 measuring input for temperature sensor Pt100 or Pt1000
Measuring range	
pH value (pX)	0... ± 20.00
Voltage	0... ± 2000 mV
Current	0... ± 200.0 µA
Temperature	−150.0... + 450.0 °C
Error of measurement of instrument (without sensors)	
at 25 °C and with a warmed-up Titrino	
pH value	± 0.02
Voltage	± 2 mV
Temperature	≤ 0.2 °C in the range of 0... + 100 °C
as a function of the ambient temperature	
pH value, voltage	typical 40 µV/K
Temperature	0.04 °C/K
Measuring amplifier	
Input resistence	$> 10^{13}\Omega$
Offset current	$< 3 \cdot 10^{-13}$ A
Deviation of offset voltage as a function of the ambient temperature	15 µV/K
Polarizer	Ipol: 0... ± 127 µA Upol: 0... ± 1270 mV, in 10 mV steps
Dosification	
Volume of a burette cylinder	1, 5, 10, 20 or 50 ml
Resolution	10 000 steps per burette cylinder
Materials	
Housing	polybutyleneterephthalate (PBTP)
Keypad covers	polycarbonate (PC)
Display	LCD, 2 lines of 24 characters each
Height of characters	5 mm
RS232 interface	for printer and balance connection or computer connection: completely remote controllable from external

Conventional input/output lines	for connection of sample changer or robot
Input lines	Start, Stop, Enter, Clear, Sample Ready
Output lines	Ready, Conditioning ok, Titration, EOD (end of determination), Error, Activate, Monitoring
Analog output	
Output signal	–2000 ... 2000 mV
Signal at analog output	depending on preselection: U (measuring value) dU/dt (measured value drift) V (volume) dV/dt (volume drift) U(rel) (control deviation) T (Temperature)
Resolution	1 mV (12 bit), see also page 149
Ambient temperature	
Nominal operational range	5 ... 40 °C
Storage, transport	– 20 ... 60 °C
Safety specifications	Designed and tested in accordance to IEC publication 1010, safety class I. This manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in safe condition.
Mains connection	
Voltage	100, 117, 220, 240 V ± 10% (switchable)
Frequency	50 ... 60 Hz
Power consumption	15 VA
Fuse	Thermal fuse
Dimensions with Exchange Unit	
Width	150 mm
Height	450 mm
Depth	275 mm
Weight, incl. keypad	app. 3.4 kg

6.2 Pin assignment of the "Remote" socket



Outputs



End of determination EOD

Monitoring, L4 in TIP

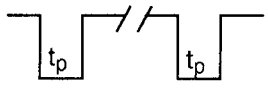
Error: active with errors

Activate, as set in method (see also page 162). L6 in TIP

V_{CE0} = 40 V
I_C = 20 mA
t_{Pulse} > 100 ms

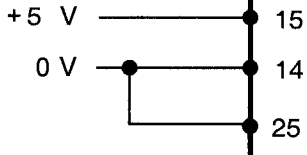
Functions see page 161

Pulses for recorder



t_p = 150 µs

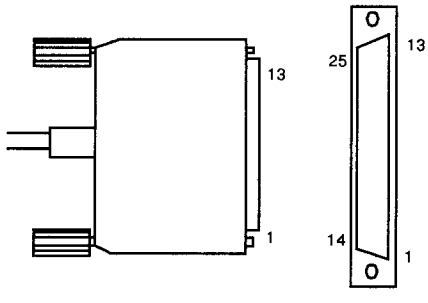
Voltage



I ≤ 75 mA

0 V: active
5 V: inactive

Contact arrangement at socket (male) for connector "Remote" (female)

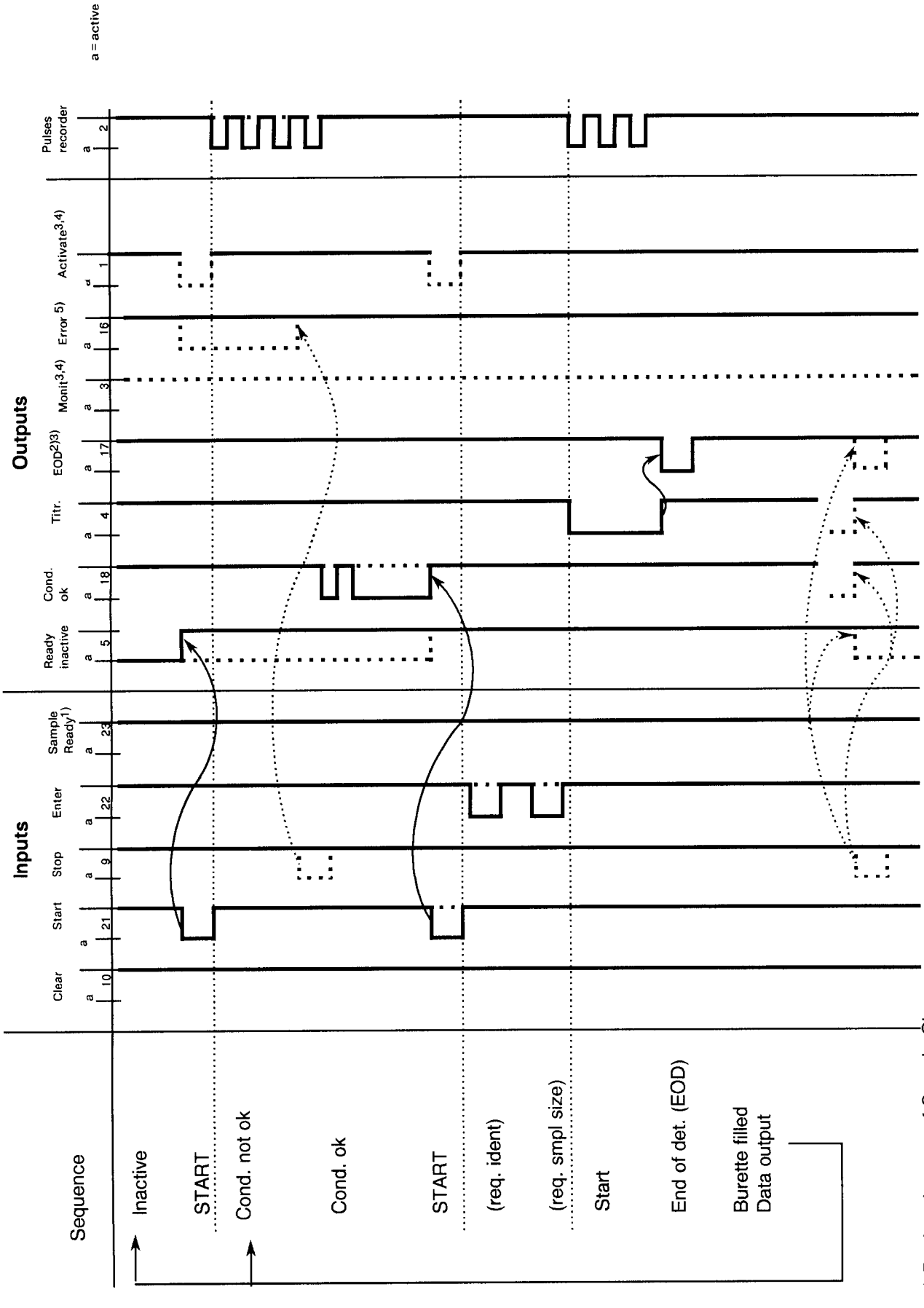


View from solder side of connector

Ordering numbers:
K.210.9004 (shell) and K.210.0002

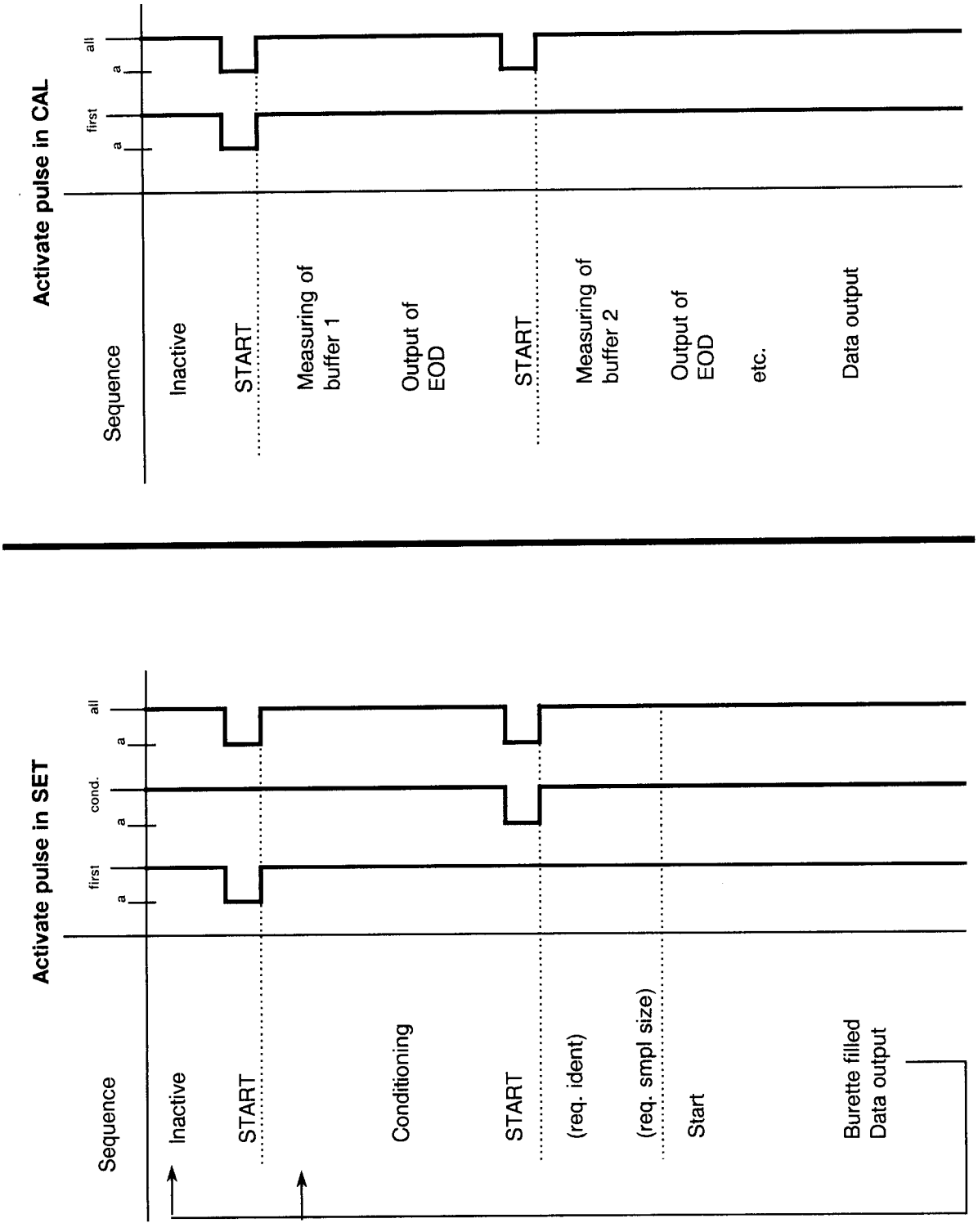
No liability whatsoever will be accepted for damage caused by improper interconnection of instruments.

6.2.1 Lines of the "Remote" socket during the titration



1) Beaker detector of Sample Changer.
2) In CAL, EOD is sent after every buffer. Automatic output of EOD can be switched off via RS232, see page 119.
3) Line can be set via RS232, see page 119.
4) Line can be set in TIP.
5) The error line is reset when the error is rectified.

Possible configurations of the activate pulse in SET and CAL



6.3 User methods

The methods are stored ready for use in the user memory. They can be loaded, modified and overwritten.

The following user methods are available:

```
 'um
718 STAT Titrino     OP1/105   718.0010
date   1998-10-05    time  08:42
user method                      bytes
SET  pH        Tit.NaOH           178
SET  pH        Tit.HCl            176
SET  pH       TrypsPre             94
STAT pH       TrypsDet            234
TIP            Trypsin            228
SET  pH         LipPre             98
STAT pH       LipDeter            270
TIP              LipStd            262
TIP             LipSmpl            170
TIP            LipSmpSC            184
SET  pH       AntacPre            100
STAT pH       AntacDet            252
TIP             Antacid            180
       remaining bytes            7388
          ------------
```

- Titer determination of NaOH
- Titer determination of HCl
- Trypsin: Pretitration
- Trypsin: Determination
- Trypsin: Method, with pretitration and determination
- Lipase: Pretitration
- Lipase: Determination
- Lipase: Method for the standard
- Lipase: Method for samples
- Lipase: Method for samples with silo calculation
- Antacida: Pretitration
- Antacida: Determination
- Antacida: Method, with pretitration and determination

6.3.1 "Tit.NaOH"

```
 'pa
718 STAT Titrino      ON2/284   718.0010
date 1998-10-11    time   10:20        0
SET  pH            Tit.NaOH
parameters
>SET1
  EP at pH              8.65
  dynamics                 3
  max.rate                 5 ml/min
  min.rate               0.5 ul/min
  stop.crit:           drift
  stop drift              20 ul/min
>SET2
  EP at pH              OFF
>titration parameters
  titr.direction:       auto
  start V:              rel.
  factor                  35
  dos.rate  .           max. ml/min
  pause                    5 s
  meas.input:              1
  temperature           25.0 °C
>stop conditions
  stop V:               abs.
  stop V               99.99 ml
  filling rate          max. ml/min
>statistics
  status:                 ON
  mean               n=     5
  res.tab:           original
>preselections
  conditioning:          OFF
  req.ident:             OFF
  req.smpl size:       value
  activate pulse:        OFF
         ------------

 'de
718 STAT Titrino      ON2/284   718.0010
date 1998-10-11     time  10:21
SET  pH            Tit.NaOH
def
>formula
  Titer=C00*C01/C02/EP1
  RS1 text              Titer
  RS1 decimal places        4
  RS1 unit:
>silo calculations
  match id:              OFF
>common variables
  C37=MN1
>report
>mean
  MN1=RS1
>temporary variables
         ------------

 'cf
718 STAT Titrino      ON2/284   718.0010
date 1998-10-11     time  10:21        0
SET  pH            Tit.NaOH
C-fmla
C01=               10000
C02=              204.23
         ------------
```

Titer of c(NaOH) = 0.1 mol/l with potassium hydrogenphthalate

The titer is determined as a number without dimensions. 5 single determinations can be carried out. Their mean value is stored as common variable C37 such that it can be used directly in subsequent methods.

Electrode: 6.0232.100 combined pH glass electrode at measuring input 1.

Reagent: c(NaOH) = 0.1 mol/l (free of carbonate)

Sample: Weigh out potassium hydrogenphthalate (PHP) according to the burette volume. Enter the sample size in g.

Dry PHP for 2 h at 105 °C, dissolve it in 40 mL dist. water without carbonate.

Literature: Metrohm Application Bulletin No. 206

Parameters

Key <def>

– Result calculated as number without dimensions

C37: Common variable for titer

Formula constants

– Theoretical consumption for 1 mol PHP
– Molecular mass of PHP

6.3.2 "Tit.HCl"

```
 'pa
718 STAT Titrino      ON2/105   718.0010
date 1998-10-11     time  10:20        0
SET  pH             Tit.HCl
parameters
>SET1
  EP at pH              5.10
  dynamics                 3
  max.rate                 5 ml/min
  min.rate               0.5 ul/min
  stop.crit:           drift
  stop drift              20 ul/min
>SET2
  EP at pH               OFF
>titration parameters
  titr.direction:       auto
  start V:              rel.
  factor                  70
  dos.rate              max. ml/min
  pause                    5 s
  meas.input:              1
  temperature           25.0 oC
>stop conditions
  stop V:               abs.
  stop V               99.99 ml
  filling rate          max. ml/min
>statistics
  status:                 ON
  mean               n=     5
  res.tab:           original
>preselections
  conditioning:          OFF
  req.ident:             OFF
  req. smpl size:      value
  activate pulse:        OFF
          ------------

 'de
718 STAT Titrino      ON2/105   718.0010
date 1998-10-11     time  10:20
SET  pH             Tit.HCl
def
>formula
  Titer=C00*C01/C02/EP1
  RS1 text              Titer
  RS1 decimal places        4
  RS1 unit:
>silo calculations
  match id:              OFF
>common variables
  C36=MN1
>report
>mean
  MN1=RS1
>temporary variables
          ------------

 'cf
718 STAT Titrino      ON2/105   718.0010
date 1998-10-11     time  10:20        0
SET  pH             Tit.HCl
C-fmla
C01=               10000
C02=              121.14
          ------------
```

Titer of c(HCl) = 0.1 mol/l with TRIS

The titer is determined as a number without dimensions. 5 single determinations can be carried out. Their mean value is stored as common variable C36 such that it can be used directly in subsequent methods.

Electrode: 6.0232.100 combined pH glass electrode at measuring input 1.

Reagent: c(HCl) = 0.1 mol/l

Sample: Weigh out tris(hydrodxymethyl)aminomethane, TRIS, according to the burette volume. Enter the sample size in g.

Dry TRIS for 2 h at 105 °C, dissolve it in 40 mL dist. water .

Literature: Metrohm Application Bulletin No. 206

Parameters

Key <def>

– Result calculated as number without dimensions

C36: Common variable for titer

Formula constants

– Theoretical consumption for 1 mol TRIS
– Molecular mass of TRIS

6.3.3 "Trypsin"

Trypsin is an enzyme which is determined using a TIP method: The pH is adjusted to 8.00 with a pretitration (TrypsPre), then the sample is added und the pH kept at 8 during 8 minutes (TrypsDet). The determination is carried out in a thermostated titration vessel (e.g. 6.9914.023 with 6.2036.000 holding ring) at 25.0 °C.

Electrode:	6.0234.100 combined micro pH glass electrode with 6.1236.040 SGJ sleeve, at measuring input 1. 6.1110.100 T sensor.
Reagent:	NaOH, c = 0.1 mol/l
Sample size:	Enter C00 in mg per 50 ul solution.
Literature:	B. Stellmach, Bestimmungsmethoden Enzyme, Steinkopff Verlag Darmstadt, 1988, p. 263

Pretitration, submethod "TrypsPre":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
SET  pH            TrypsPre
parameters
>SET1
  EP at pH               8.00
  dynamics                  1
  max.rate                  1 ml/min
  min.rate                  1 ul/min
  stop crit:            drift
  stop drift               20 ul/min
>SET2
  EP at pH                OFF
>titration parameters
  titr.direction:           +
  start V:                OFF
  pause                     0 s
  meas.input:               1
  temperature            25.0 °C
>stop conditions
  stop V:                 abs.
  stop V                 99.99 ml
  filling rate            max. ml/min
>statistics
  status:                 OFF
>preselections
  conditioning:           OFF
  req.ident:              OFF
  req. smpl size:         OFF
  activate pulse:         OFF
         ------------
```

Parameters

Determination, submethod "TrypsDet":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
STAT pH            TrypsDet
parameters
>control parameters
  EP at pH               8.00
  dynamics                  1
  max.rate                  1 ml/min
  min.rate                  1 ul/min
>titration parameters
  start V:                OFF
  pause                     0 s
  start time                0 s
  start pH                OFF
  start rate              OFF ml/min
  time interval             5 s
  titr.direction:           +
  meas.input:               1
  temperature            25.0 °C
>stop conditions
  stop time:              abs.
  stop time               480 s
  stop V:                 abs.
  stop V                99.99 ml
  stop rate               OFF ml/min
  filling rate            max. ml/min
>statistics
  status:                 OFF
>evaluation
  low lim. 1              OFF s
  fix V1                  OFF s
  fix time 1              OFF V(tot)
>monitoring
  meas.val:               ON
  low lim.   pH          7.9
  up lim   pH            8.1
  action:                none
  rate:                   OFF
  temperature:             ON
  low lim.               24.9 °C
  up lim.                25.1 °C
  action:                none
  assign output:         none
>preselections
  req.ident:              OFF
  req.smpl size:          OFF
  display rate:           OFF
  activate pulse:         OFF
         ------------


'de
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29
STAT pH            TrypsDet
def
>formula
  RS1=C41;4;ml
>silo calculations
  match id:               OFF
>common variables
>report
  report:curve;
>mean
  MN1=RS1
>temporary variables
  C70=RS1
  C71=C80
         ------------
```

Parameters

For entries in the measuring point list.

Stop after 8 minutes.

The pH value should be kept in the range ±0.1.

The temperature should be kept in the range ±0.1 °C.

Key <def>

Curve output, necessarily in the submethod.

Temporary variables for calculations in TIP:
final volume
mean rate

Method "Trypsin":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:30        0
TIP                 Trypsin
parameters
>sequence
  1.method:          TrypsPre
  2.info     Add smpl & start
  3.method:          TrypsDet
>statistics
  status:                OFF
>preselections
  req.ident:             OFF
  req.smpl size:         OFF
  meas.mode:               T
  temperatue           25.0 °C
         ------------


 'de
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:30
TIP                 Trypsin
def
>sequence
  1.method:          TrypsPre
  2.info     Add smpl & start
  3.method:          TrypsDet
>formula
  FIP=C70*C01/C02/C00
  RS1 text               FIP
  RS1 decimal places       1
  RS1 unit:            U/mg
  FIP(reg)=C71*C01/C00
  RS2 text          FIP(reg)
  RS2 decimal places       1
  RS2 unit:            U/mg
>silo calculations
  match id.:             OFF
>common variables
>report
  report:full;
>mean
  MN1=RS1
>temporary variables
         ------------


 'cf
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:30
TIP                 Trypsin
C-fmla
  C01                    100
  C02                      8
         ------------
```

Parameters

TIP sequence:
Pretitration "TrypsPre".
Stop sequence and display message.
Determination "TrypsDet".

T may be measured with <meas/hold> .

Key <def>

Calculation using the final volume, according the FIP.
Result in FIP units/mg.

Calculation using the mean rate. Result in FIP units/mg. *)

If a formula is not used, you may delete it.

Formula constants

(factor for ml → ul) * (concentration of reagent)
Determination time = 8 minutes

*) The calculation using the mean rate is fundamentally different from the FIP method (final volume / time). The mean rate is calcualted by a linear regression over all measuring points of the list. If you wish to use only the linear part of the curve for the regression, use a start time of app. 30 s in the method "Tryps-Det".

6.3.4 "Lipase"

Pancreas lipase is determined using a TIP method: The pH is adjusted to 9.20 with a pretitration (LipPre), then the sample is added und the pH kept at 9 during 5 minutes (LipDeter). The determination is carried out in a thermostated titration vessel (e.g. 6.1418.220) at 37.0 °C.

Electrode:	6.0233.100 combined pH glass electrode, at measuring input 1. 6.1110.100 T sensor.
Reagent:	NaOH, c = 0.1 mol/l
Sample size:	Enter C00 in mg per 500 ul solution.
Literature:	B. Stellmach, Bestimmungsmethoden Enzyme, Steinkopff Verlag Darmstadt, 1988, p. 169

Pretitration, submethod "LipPre":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:26        5
SET  pH              LipPre
parameters
>SET1
  EP at pH              9.20
  dynamics                 1
  max.rate                 5 ml/min
  min.rate                 5 ul/min
  stop.crit:           drift
  stop drift              20 ul/min
>SET2
  EP at pH                OFF
>titration parameters
  titr.direction:           +
  start V:                OFF
  pause                     0 s
  meas.input:               1
  temperature            25.0 °C
>stop conditions
  stop V:                 abs.
  stop V                99.99 ml
  filling rate           max. ml/min
>statistics
  status:                 OFF
>preselections
  conditioning:           OFF
  req.ident:              OFF
  req.smpl size:          OFF
  activate pulse:         OFF
         ------------
```

Parameters

Determination, submethod "LipDeter":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
STAT pH              LipDeter
parameters
>control parameters
  EP at pH               9.00
  dynamics                  1
  max.rate                  5 ml/min
  min.rate                 10 ul/min
>titration parameters
  start V:                OFF
  pause                     0 s
  start time               60 s
  start pH                OFF
  start rate              OFF ml/min
  time interval             1 s
  titr.direction:           +
  meas.input:               1
  temperature            25.0 °C
>stop conditions
  stop time:              abs.
  stop time               300 s
  stop V:                 abs.
  stop V                99.99 ml
  stop rate               OFF ml/min
  filling rate            max. ml/min
>statistics
  status:                 OFF
>evaluation
  low lim. 1               60 s
  up lim. 1               119 s
  low lim. 2              120 s
  up lim. 2               179 s
  low lim. 3              180 s
  up lim. 3               239 s
  low lim. 4              240 s
  up lim. 4               299 s
  low lim. 5              OFF s
  fix V1                  OFF s
  fix time 1              OFF V(tot)
>monitoring
  meas.val:               OFF
  rate:                    ON
  low lim.              0.08 ml/min
  up lim.               0.16 ml/min
  action:               none
  temperature:             ON
  low lim.              36.9 °C
  up lim.               37.1 °C
  action:               none
  assign output:        none
>preselections
  req.ident:              OFF
  req.smpl size:          OFF
  display rate:           OFF
  activate pulse:         OFF
         ------------



def
:
>report
  report:full;curve;
>mean
  MN1=RS1
>temporary variables
  C70=C80
         ------------
```

Parameters

Start of measuring point list after 1 minute.

For entries into the measuring point list.

Stop after 5 minutes.

Time windows for rate evaluations:

The rate should be in the range 0.08...0.16 mL/min.

The temperature should be in the range ±0.1 °C.

Key <def>

Curve output, necessarily in the submethod.

Temporary variables for calculations in TIP:
mean rate.

Method for the determination of standards "LipStd":

Delete assignments which you don't need according to the method you use for your samples:
If you work with method "LipSmpl", delete C31 = C26.
If you work with method "LipSmpSC", delete C30 = MN1.

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                  LipStd
parameters
>sequence
  1. method:           LipPre
  2.info     Add smpl & start
  3.method:          LipDeter
>statistics
  status:                 ON
  mean               n=     3
  res.tab:           original
>preselections
  req.ident:             OFF
  req.smpl size:         OFF
  meas.mode:               T
  temperature          25.0 °C
         ------------


 'de
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                  LipStd
def
>sequence
  1.method:            LipPre
  2.info     Add smpl & start
  3.method:          LipDeter
>formula
  Factor=C00*C01/C70
  RS1 text             Factor
  RS1 decimal places        2
  RS1 unit:
  FIP=C70*C02/C00
  RS2 text                FIP
  RS2 decimal places        1
  RS2 unit:             U/mg
>silo calculations
  C24=RS1
  C25=RS2
  match id:              OFF
>common variables
  C30=MN1
  C31=C26
>report
  report:full;
>mean
  MN1=RS1
>temporary variables
         ------------


 'cf
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                  LipStd
C-fmla
  C01=               36.2
  C02=                100
         ------------
```

Parameters

TIP sequence:
Pretitration "LipPre".
Stop sequence and display message.
Determination "LipDeter".

Mean from 3 single values.

T may be measured with <meas/hold> .

Key <def>

Calculation factor.

Activity of the reference standard in FIP units/mg.
According to FIP, the relative activity = RS2/C01 should be between 0.7 and 1.3 (check for standard).

Calculation factor as C24 for silo calculations.
Assignment for the silo overview.

Mean of calculation factor as C30.
Mean of the silo calculation as C31.

Formula constants

Declared activity of FIP standard.
1000 * concentration of the reagent.

Method for the determination of samples "LipSmpl":

If you work with the method "LipSmpl" (and not with "LipSmpSC"), you should delete the assignments for the silo caluclations in the method "LipStd":
- In key <def>, >silo calculations: C24 = RS1 and C25 = RS2
- In key <def>, >common variables: C31 = C26

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                 LipSmpl
parameters
>sequence
  1.method:             LipPre
  2.info     Add smpl & start
  3.method:           LipDeter
>statistics
  status:                   ON
  mean                n=     3
  res.tab:            original
>preselections
  req.ident:               OFF
  req.smpl size:           OFF
  meas.mode:                 T
  temperature            25.0 °C
         ------------


 'de
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                 LipSmpl
def
>sequence
  1.method:             LipPre
  2.info     Add smpl & start
  3.method:           LipDeter
>formula
  FIP=C70*C30/C00
  RS1 text                 FIP
  RS1 decimal places         1
  RS1 unit:              U/mg
>silo calculations
  match id:                OFF
>common variables
>report
  report:full;
>mean
  MN1=RS1
>temporary variables
         ------------
```

Parameters

TIP sequence:
Pretitration "LipPre".
Stop sequence and display message.
Determination "LipDeter".

Mean from 3 single values.

T may be measured with <meas/hold> .

Key <def>

Activity of the sample in FIP units/mg.
(C30 = calculation factor from method "LipStd").

Method for the determination of samples using silo calculations "LipSmpSC":

If you work with the method "LipSmpSC" (and not with "LipSmpl"), you should delete the assignment of the mean value (because you use silo statistics):
– In key <def>, >common variables, delete C30 = MN1.

If you work with the silo memory, it is recommendable to use the silo calculations for the sample determinations such that all standards, which have been determined, can be used for the calcualtion of the sample activity.
At the beginning of a series, you should determine 3 standards.
Switch silo ON and set "save lines" in key <smpl data> to ON.
Example of a silo report:

```
:
  save lines:            ON
 sl   method id 1/C21 id 2/C22 id 3/C23     C00       C24       C25
  1   LipStd                            0.300 mg        NV        NV
  2   LipStd                            0.300 mg        NV        NV
  3   LipStd                            0.300 mg        NV        NV
  4 LipSmpSC        1                   0.423 mg        NV        NV
  5 LipSmpSC        1                   0.423 mg        NV        NV
  6 LipSmpSC        2                   0.465 mg        NV        NV
  7 LipSmpSC        2                   0.465 mg        NV        NV
  8   LipStd                            0.300 mg        NV        NV
  9 LipSmpSC        3                   0.447 mg        NV        NV
          ------------
```

NV = not valid. There are no data yet.

3 determinations of the standard

Next standard

Method LipSmpSC:

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                LipSmpSC
parameters
>sequence
  1.method:             LipPre
  2.info     Add smpl & start
  3.method:           LipDeter
>statistics
  status:                   ON
  mean                n=     3
  res.tab:            original
>preselections
  req.ident:               OFF
  req.smpl size:           OFF
  meas.mode:                 T
  temperature             25.0 °C
          ------------


 'de
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                LipSmpSC
def
>sequence
  1.method:             LipPre
  2.info     Add smpl & start
  3.method:           LipDeter
>formula
  FIP=C70*C31/C00
  RS1 text                 FIP
  RS1 decimal places         1
  RS1 unit:              U/mg
>silo calculations
  C25=RS1
  match id:                OFF
>common variables
>report
  report:full;
>mean
  MN1=RS1
>temporary variables
          ------------
```

Parameters

TIP sequence:
Pretitration "LipPre".
Stop sequence and display message.
Determination "LipDeter".

Mean from 3 single values.

T may be measured with <meas/hold> .

Key <def>

Activity of the sample in FIP units/mg.
(C31 = calculation factor from silo calc of method "LipStd").

For the overview of the results.
You may wish to select a match id.

6.3.5 "Antacid"

Method to determine the efficiency of tablets against an excess of acid in the stomach.
Use a TIP method for the determination: The pH is adjusted to 3 with a pretitration (AntacPre), then the sample is added und the pH kept at 3 during 30 minutes (AntacDet). The determination is carried out in a thermostated titration vessel (e.g. 6.1418.220) at 37.0 °C.

You may have to adjust the control parameters of the submethod "AntacDet" according to your sample. The given parameters are optimized for products which release their base slowly (rate app. 100 ul/min).

Electrode: 6.0233.100 combined pH glass electrode, at measuring input 1. 6.1110.100 T sensor.

Reagent: HCl, c = 1 mol/l

Sample size: 200...400 mg sample. Enter C00 in g.

Literature: N.J. Kerkhoff et al., Journal of Phramceutical Sciences, 66, 1528-1535 (1977)

Pretitration, submethod "AntacPre":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:26        5
SET  pH            AntacPre
parameters
>SET1
  EP at pH              3.00
  dynamics                 3
  max.rate                 1 ml/min
  min.rate                 1 ul/min
  stop.crit:           drift
  stop drift              20 ul/min
>SET2
  EP at pH               OFF
>titration parameters
  titr.direction:          -
  start V:               OFF
  pause                    0 s
  meas.input:              1
  temperature           37.0 °C
>stop conditions
  stop V:                abs.
  stop V                99.99 ml
  filling rate           max. ml/min
>statistics
  status:                OFF
>preselections
  conditioning:          OFF
  req.ident:             OFF
  req.smpl size:         OFF
  activate pulse:        OFF
         ------------
```

Parameters

Determination, submethod "AntacDet":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
STAT pH            AntacDet
parameters
>control parameters
  EP at pH               3.00
  dynamics                1.2
  max.rate                 15 ml/min
  min.rate                 10 ul/min
>titration parameters
  start V:                OFF
  pause                     0 s
  start time                0 s
  start pH                OFF
  start rate              OFF ml/min
  time interval            30 s
  titr.direction:           -
  meas.input:               1
  temperature            37.0 °C
>stop conditions
  stop time:               abs.
  stop time              1800 s
  stop V:                 abs.
  stop V                99.99 ml
  stop rate               OFF ml/min
  filling rate            max. ml/min
>statistics
  status:                 OFF
>evaluation
  low lim.1               OFF s
  fix-V1                  450 s
  fix-V2                  900 s
  fix-V3                 1620 s
  fix-V4                 1800 s
  fix-V5                  OFF s
  fix time 1            0.25 V(tot)
  fix time 2             0.5 V(tot)
  fix time 3             0.9 V(tot)
  fix time 4               1 V(tot)
  fix time 5              OFF V(tot)
>monitoring
  meas.val:                ON
  low lim.  pH          -20.00
  up lim.  pH            20.00
  action:                none
  rate:                   OFF
  temperature:             ON
  low lim.                 36 °C
  up lim.                  38 °C
  action:                none
  assign output:         none
>preselections
  req.ident:              OFF
  req.smpl size:          OFF
  display rate:           OFF
  activate pulse:         OFF
          ------------


:
def
:
>report
  report:full;curve;
:
>temporary variables
  C70=C41
          ------------
```

Parameters

For entries into the measuring point list.

Stop after 30 minutes.

Interpolation of volumes at preset times.

Interpolation of times at preset volumes. The volumes are given in rations of the final volume.

Monitoring of measured values activated in order to get entries of measured values in the measuring point list.

Key <def>

Curve output, necessarily in the submethod.

Temporary variables for calculations in TIP:
final volume

Method "Antacid":

```
 'pa
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                 Antacid
parameters
>sequence
  1.method:          AntacPre
  2.info     Add smpl & start
  3.method:          AntacDet
>statistics
  status:                OFF
>preselections
  req.ident:             OFF
  req.smpl size:         OFF
  meas.mode:               T
  temperature          25.0 °C
         ------------


 'de
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                 Antacid
def
>sequence
  1.method:          AntacPre
  2.info     Add smpl & start
  3.method:          AntacDet
>formula
  acid cap=C70*C01/C00
  RS1 text           acid cap
  RS1 decimal places        3
  RS1 unit:            mmol/g
>silo calculations
  match id:              OFF
>common variables
>report
  report:full;
>mean
  MN1=RS1
>temporary variables
         ------------


 'cf
718 STAT Titrino      OP1/123   718.0010
date 1998-09-13     time  09:29        5
TIP                Antacid
C-fmla
  C01=                 1
         ------------
```

Parameters

TIP sequence:
Pretitration "AntacPre".
Stop sequence and display message.
Determination "AntacDet".

T may be measured with <meas/hold> .

Key <def>

Acid capacity.

Formula constants

Concentration of reagent in mol/l.

6.4 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, burette cylinders and PTFE pistons. Before embedment in wood shavings or similar material, the parts must be packed in a dustproof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage which arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by METROHM.

6.5 Scope of delivery and ordering designations

6.6.1 718 STAT Titrino

718 STAT Titrino	**2.718.0010**
including the following accessories:	
1 Keypad to 718 STAT Titrino	6.2132.040
1 Key for exchange units	6.2739.010
1 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
1 Instructions for Use for 718 STAT Titrino	8.718.1003

Options

Accessories to separate order and on payment of extra charge:

728 Magnetic Stirrer	
Magnetic Stirrer 728	2.728.0040
727 Ti Stand	
For rinsing and addition of fresh solvent	2.727.0010
Rod stirrer	2.722.0010
or	
727 Ti Stand with built-in magnetic stirrer and rinsing and addition of fresh solvent	2.727.0100
703 Ti Stand	2.703.0010
Magnetic stirrer, stand, siphoning device for waste solvent, addition of fresh solvent.	
Titration equipment	
Titration vessel, volumes	
1... 50 mL	6.1415.110
5... 70 mL	6.1415.150
10... 90 mL	6.1415.210
20... 90 mL	6.1415.220
50... 150 mL	6.1415.250
70... 200 mL	6.1415.310
Thermostatable titration vessel, volumes	
1... 50 mL	6.1418.110
5... 70 mL	6.1418.150
10... 90 ml, order 6.2036.000 holding ring separately	6.9914.023
20... 90 mL	6.1418.220
50... 150 mL	6.1418.250
Titration vessel upper half for electrodes and burette tips (5 openings)	6.1414.010
Magnetic stirring bars, length	
12 mm	6.1903.010
16 mm	6.1903.020
25 mm	6.1903.030
Electrode holder	6.2021.020
Equipment for KF titrations	6.5609.000

Electrodes	
comb. pH glass electrode with SGJ, without cable	6.0233.100
comb. pH glass electrode, without cable	6.0232.100
comb. pH micro glass electrode, without cable	6.0234.100
comb. pH glass electrode with built-in T sensor, with SGJ	6.0238.000
T adaptor for the connection of one electrode to 2 Titrinos	6.2103.100
T sensor (Pt1000) with SGJ, without cable	6.1110.100
Electrode cable, 1m	6.2104.020
Cable for T sensor	6.2104.080
SGJ sleeve for electrodes without SGJ	6.1236.040
Printers	
Citizen printer iDP560 RS	2.140.0014
Cable 718 STAT Titrino – Citizen printer iDP560 RS	6.2125.050
Seiko printer DPU-411, 220 V	2.141.0014
Seiko printer DPU-411, 120 V	2.141.0015
Cable 718 STAT Titrino – Seiko Printer DPU 411	6.2125.020
Cable 718 STAT Titrino – EPSON printer with 6 pin plug	6.2125.040
Cable 718 STAT Titrino – EPSON printer with RS interface #8148	6.2125.050
Cable 718 STAT Titrino – HP Think Jet, HP Desk Jet	6.2125.050
Cable 718 STAT Titrino – Kodak Diconix 180 si	6.2125.050
Adapter for simultaneous connection of printer and balance	6.2125.030
Balance connection	
Sartorius balance MP8, connecting cable	6.2125.070
Mettler AT, PM balances and balances with interface 016	Cable from Mettler
Mettler balances with interface 011 or 012	6.2125.020
AND balances (with RS232 interface OP-03), connecting cable	6.2125.020
Precisa balances, connecting cable	6.2125.080
Adapter for simultaneous connection of printer	6.2125.030
PC connection, control via RS232 C interface	
Cable 718 STAT Titrino – IBM® PC/XT/PS-2 or compatible	6.2125.060
Cable 718 STAT Titrino – IBM® AT	6.2125.060 + 6.2125.010
RS232 C extension cable	6.2125.020
Program package for the data transfer 718 STAT Titrino – IBM® PC or compatible,3½" diskettes, PASCAL and BASIC	6.6021.000
Analog recorder	
Labograph 586, 50 Hz	2.586.0012
Labograph 586, 60 Hz	2.586.0013
Cable 718 STAT Titrino – Labograph 586	3.980.3570 + 6.2115.010
Sample Changer	
With 10 sample beakers, 1 work station	2.673.0020
With 10 sample beakers, 2 work stations	2.673.0010
With 32 sample beakers, 1 work station	2.674.0010
With 32 sample beakers, 2 work stations	2.674.0020
Control Unit for all Sample Changers	2.664.0010
Cable 718 STAT Titrino – 664 Control Unit	3.980.3560
Cable 718 STAT Titrino – 664 Control Unit and 665 or 725 Dosimat	3.980.3610
Dosimat	
Cable 718 STAT-Titrino (activate pulse, line L6) – 665 or 725 Dosimat	6.2139.000

6.5.2 Exchange Units

Burette cylinder volume 5 mL	
Light protection, burette tip with microvalve	6.3012.153
Amber glass, burette tip with microvalve	6.3007.153
Amber glass, burette tip without microvalve	6.3006.153
Burette cylinder volume 10 mL	
Light protection, burette tip with microvalve	6.3012.213
Amber glass, burette tip with microvalve	6.3007.213
Amber glass, burette tip without microvalve	6.3006.213
Burette cylinder volume 20 mL	
Light protection, burette tip with microvalve	6.3012.223
Amber glass, burette tip with microvalve	6.3007.223
Amber glass, burette tip without microvalve	6.3006.223
Burette cylinder volume 50 mL	
Light protection, burette tip without microvalve	6.3011.253
Amber glass, burette tip without microvalve	6.3006.253

Accessories, see Fig. 6-1 and 6-2.

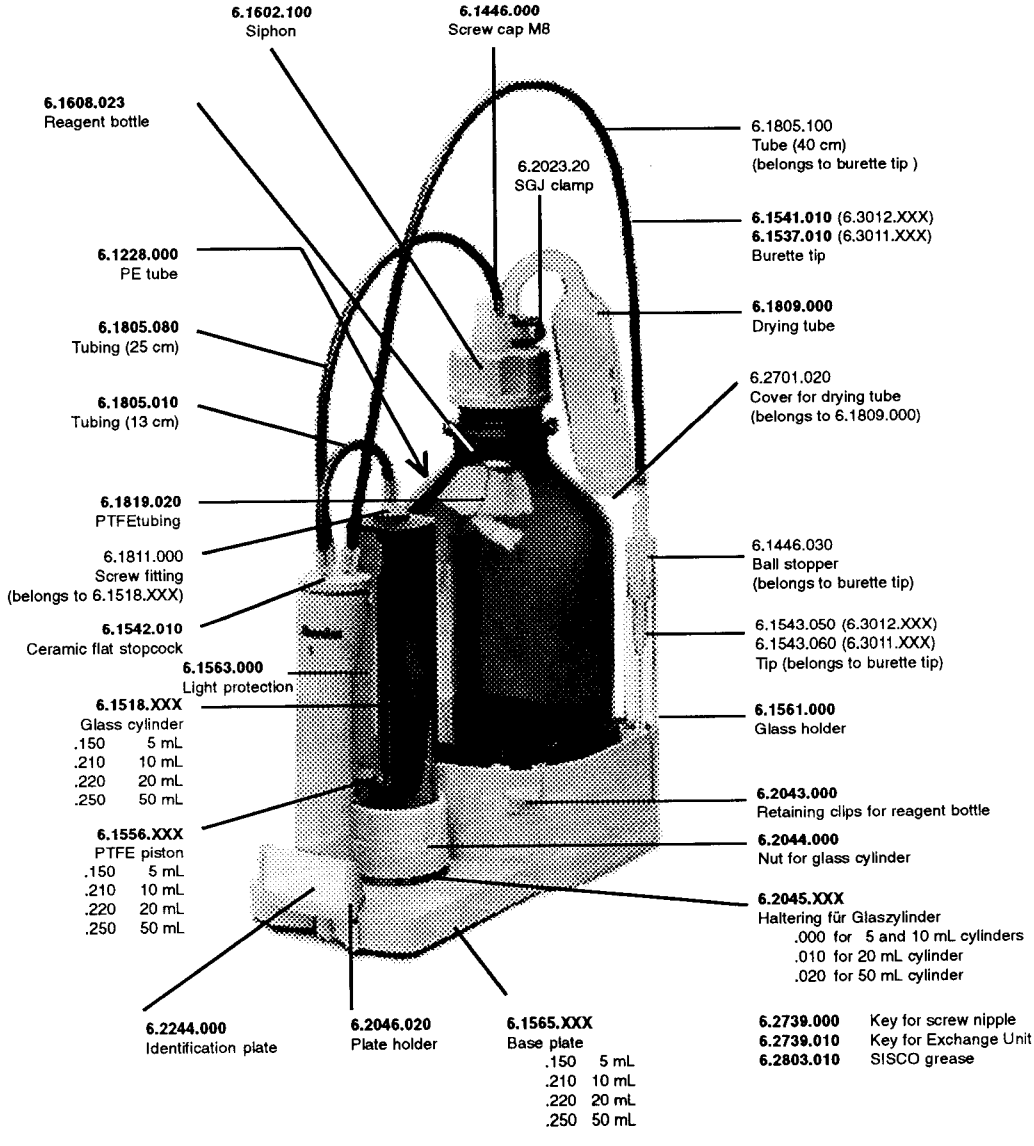


Fig. 6-1: Standard accessories and ordering designations for the 6.3011.253 and 6.3012.XXX Exchange Units

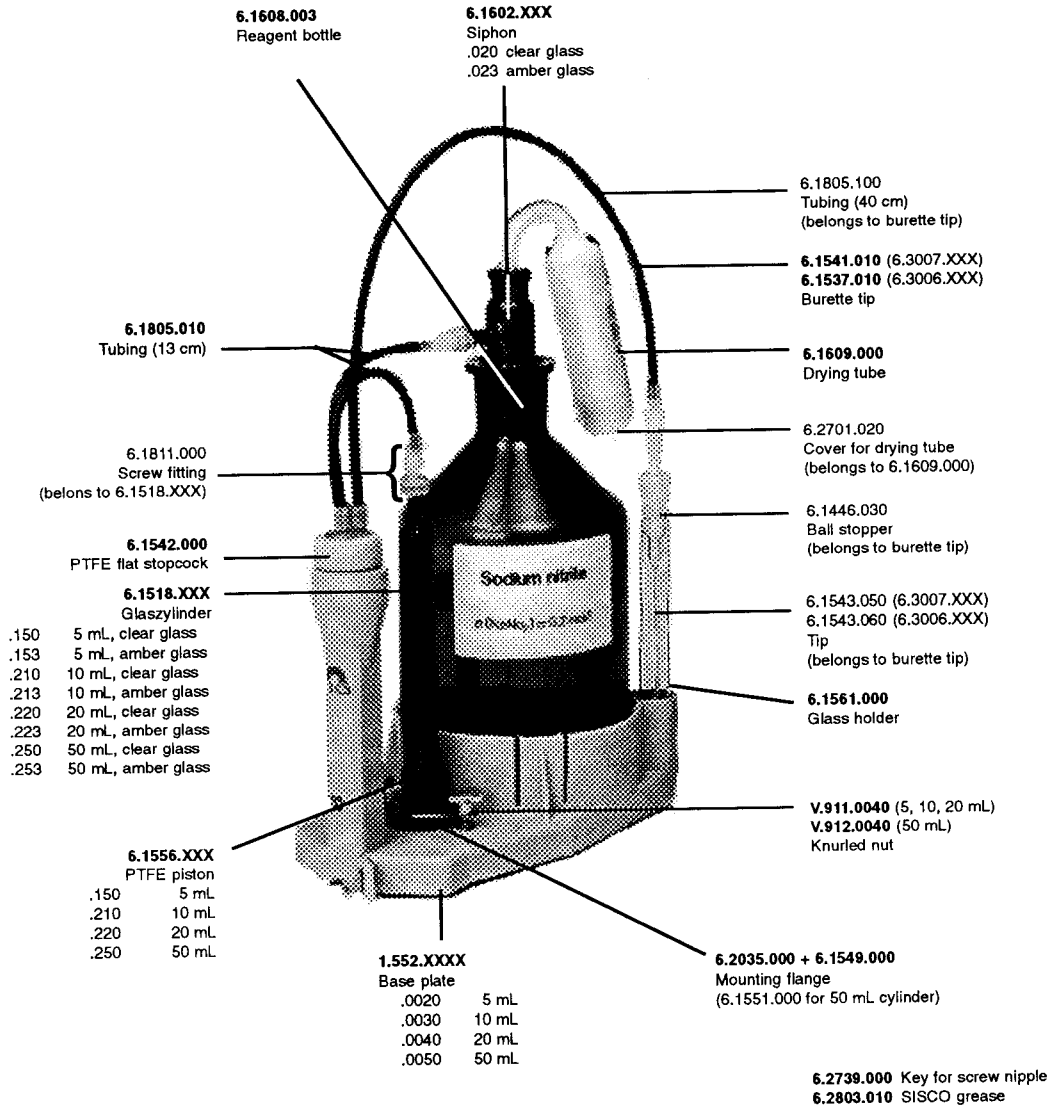


Fig. 6-2: Standard accessories and ordering designations for the 6.3006.XXX and 6.3007.XXX Exchange Units

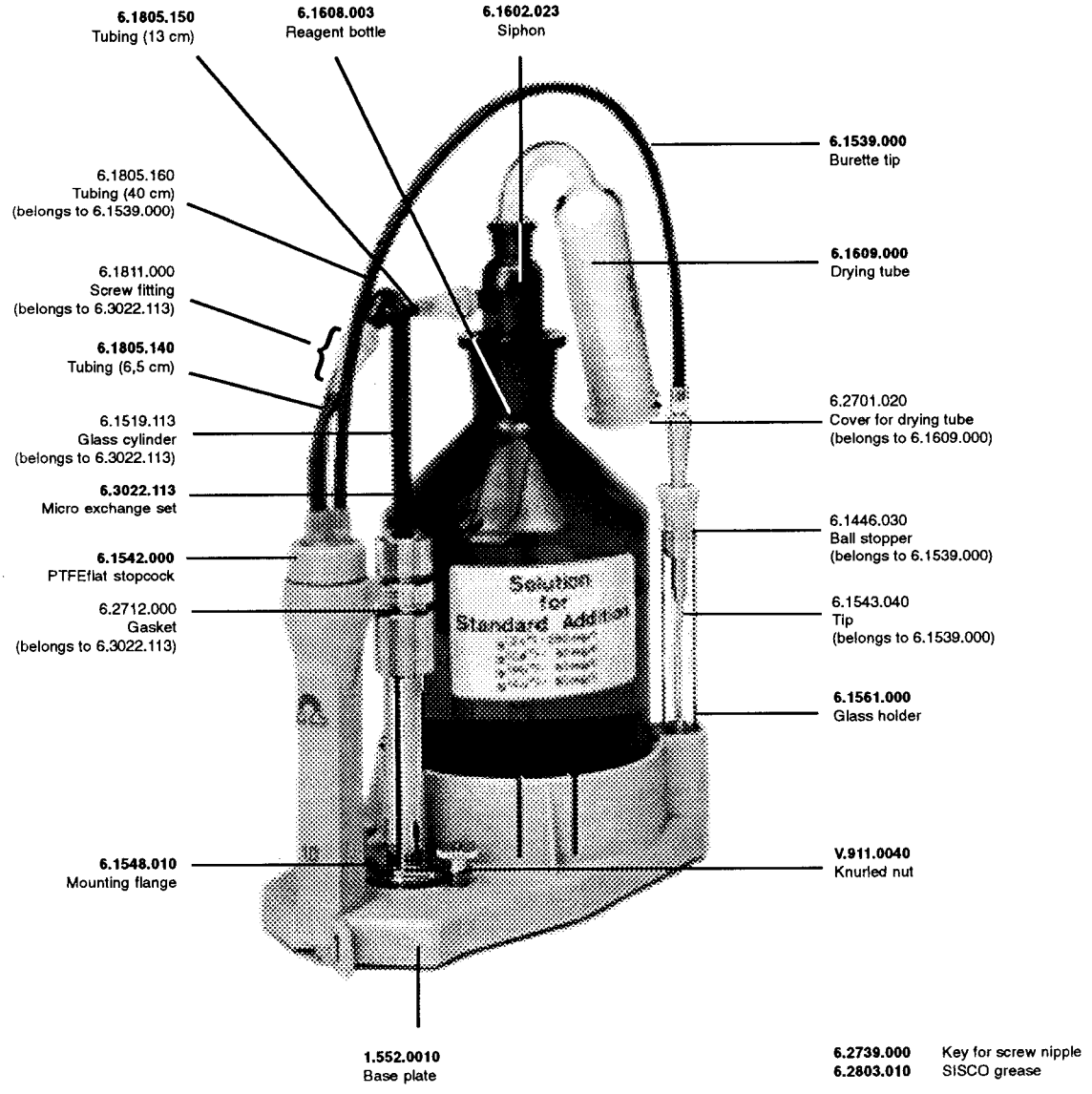


Fig. 6-3: Standard accessories and ordering designations for the 6.3006.113 1 mL Exchange Unit

Options for Exchange Units

Accessories to separate order and on payment of extra charge:

Bottles and accessories:

Siphon with GL 45 thread (bottles from Riedel de Haën, ...)	6.1602.120
Siphon with S40 thread (bottles from Merck ...)	6.1602.130
Amber glass bottle with GL 45 thread	6.1608.023
Bottle made of PE with thread GL45	6.1608.040
Bottle made of PP with ground-glass joint SGJ 29	6.1608.004
Siphon for bottles with SGJ 29	6.1602.023
Thread adapter 32 mm/GL 45	6.1618.000
Thread adapter 28 mm/GL 45	6.1618.010

Tubing and accessories:
The standard screw fitting of the Exchange Units has M6 thread size. On change to M8 thread, the 6.1808.040 Thread Adapter is needed.

Extension tubing with screw nipples, M6 thread	
Length 80 cm	6.1805.110
Length 150 cm	6.1805.030
additional lengths, see Accessories catalogue	
Extension tubing with screw nipples, M8 thread	
Length 50 cm	6.1805.200
Length 25 cm	6.1805.210
Connecting sleeve for tubing extensions (tubing with M6 thread)	6.1808.000
T-connection for tubing with M6 thread	6.1808.060
T-connection for tubing with M8 thread	6.1808.070
Coupling with M6 thread and stub for tubing with internal diameter app. 3 mm	6.1808.020
Coupling with M8 thread and stub for tubing with internal diameter app. 3 mm	6.1808.050
Screw cap, seals tubing with M6 thread together with 6.1808.000 Connecting Sleeve	6.1446.040
Screw fitting for glass cylinder and tubing with M6 thread	6.1811.000
Screw fitting for glass cylinder and tubing with M8 thread	6.1811.010

Tubing connections with larger internal diameter and M8 thread at Exchange Unit:

For the connection bottle-stopcock:	
Stopper, M6 thread	6.1446.040
PTFE tubing	6.1819.030
Tubing with screw nipples, 25 cm, M8 thread	6.1805.210
Thread adapter with M6 outer thread, M8 inner thread	6.1808.040
For the connection stopcock-tip:	
Thread adapter with M6 outer thread, M8 inner thread	6.1808.040
Tubing with screw nipples, 50 cm, M8 thread	6.1805.200
Tip, M8 thread	6.1543.120

Burette tips:

Earthing for burette tip	6.1808.030
Tip without anti-diffusion valve	6.1543.060
Tip with anti-diffusion valve	6.1543.050

Miscellaneous:

Thermostat jacket for 6.3011.XXX and 6.3012.XXX Exchange Units with M8 thread	6.1563.010
PTFE tubing for thermostat jacket, 105 mm	6.1819.040
Coupling for thermostat jacket tubing	6.1808.050
Coupling for 6.1542.010 Ceramic Flat Stopcock in 6.3006.XXX and 6.3007.XXX Exchange Units	6.1564.000
SISCO 300 grease, 1 oz. (28.35 g)	6.2803.000

Index

Texts which appear in the display are **printed in bold face**. Pages concerning the operation via RS232 interface (green leaves) are *printed in italic*.

N

O

P

Q

R

S

T

U

V

W

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico

718 STAT Titrino

CE

Metrohm

Metrohm Ltd.
CH-9101 Herisau
Switzerland
Phone +41 71 53 85 85
Fax +41 71 53 89 01

EC Declaration of Conformity

The METROHM AG company, Herisau, Switzerland hereby certifies, that the instrument:

718 STAT Titrino

meets the requirements of EC Directives 89/336/EWG and 73/23/EWG.

Source of the specifications:

EN 50081-1	Electromagnetic compatibility, basic specification Emitted Interference
EN 50082-1	Electromagnetic compatibility, basic specification Interference Immunity
EN 61010	Safety requirements for electrical laboratory measurement and control equipment

Description of the instrument:

Universal titrator for 'STAT' titrations in analytical and synthesis laboratories, supports potentiometric end-point titrations, stat/dosing functions with temperature monitoring and the combination of user methods as titration procedures.

Herisau, December 5, 1995

Dr. J. Frank
Development Manager

Ch. Buchmann
Production and
Quality Assurance Manager

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico
718 STAT Titrino

CE

Metrohm

Metrohm AG
CH-9101 Herisau
Schweiz
Telefon +41 71 53 85 85
Fax +41 71 53 89 01

EU-Konformitätserklärung

Die Firma Metrohm AG, Herisau, Schweiz bescheinigt hiermit, dass das Gerät:

718 STAT Titrino

den Anforderungen der EG-Richtlinien 89/336/EWG und 72/23/EWG entspricht.

Erfüllte Spezifikationen:

EN 50081-1	Elektromagnetische Verträglichkeit, Fachgrundnorm Störaussendung
EN 50082-1	Elektromagnetische Verträglichkeit, Fachgrundnorm Störfestigkeit
EN 61010	Sicherheitsanforderungen für elektrische Labor-Mess- und Regelausrüstungen

Beschreibung des Geräts:

Universeller Titrator für "STAT"-Anwendungen in Analytik- und Syntheselabors, speziell geeignet für enzymatische Bestimmungen. Ermöglicht Endpunkttitrationen, Stat-/Dosierfunktionen mit Temperaturüberwachung und die Verknüpfung von Anwendermethoden durch Titrationsprozeduren.

Herisau, 25. Oktober 1995

Dr. J. Frank
Leiter Entwicklung

Ch. Buchmann
Leiter Produktion und Beauftragter Qualitätssicherung