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799 GPT Titrino

Program version 5.799.0010

Instructions for Use

8.799.1003 12.2001 / pkl

Table of contents

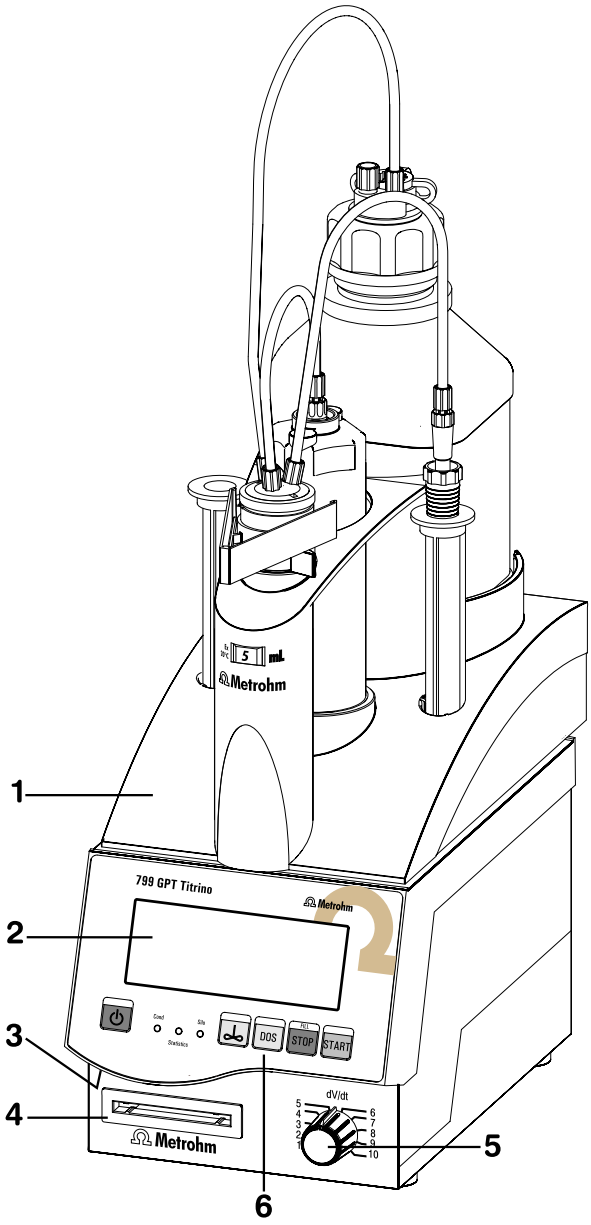
1 Introduction

1.1 Instrument description

The 799 GPT Titrino is an all-purpose titrator with LCD graphical display. Titration curves can be observed in real-time. The 799 GPT Titrino controls up to three dosing units for complex titrations.
Titration modes of the 799 GPT Titrino are constant or – depending on the titration curve – variable dosing of the titration reagent, Endpoint- and Karl-Fischer-Titration. In addition the 799 GPT Titrino is able to serve as a sensor controlled dosing unit, with the controlled variable fixed, respectively swept on a linear ramp during the dosing.
The operator is almost free to define his titrations. All operating modes of the Titrino can be combined to perform extensive analytical sequences. The 799 GPT Titrino provides the opportunity to store, transfer and upload applications and results via memory card.
Data exchange with a PC is possible with the Metrodata VESUV Software and with Metrodata TiNet Software complete remote control, data acquisition and evaluation via PC is enabled.

1.2 Controls and parts

Front view of instrument:



1 Exchange Unit

2 Display

3 Setting of display contrast

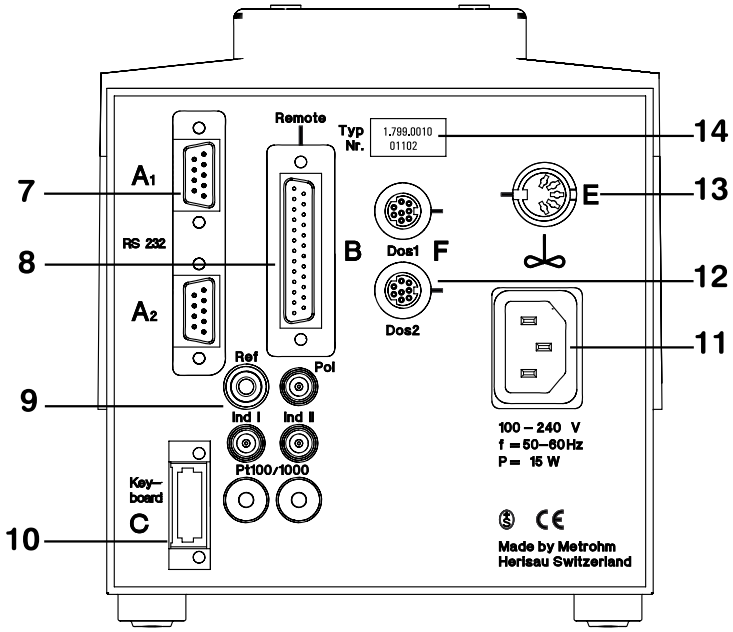
4 Opening for the memory card

5 Controls the dosing rate during manual dosing with <DOS> and subsequent filling

6 Control keys and indicator lamps on the Titrino

Key <⏻>	Power switch
Key <⏻>	Switching stirrer ON/OFF
Key <DOS>	Dosing key. Dispensing is performed as long as <DOS> is being pressed. Used e.g. to prepare the Exchange Unit. The dispensing rate can be set with potentiometer (**5**).
Key <STOP/FILL>	- Stops procedures, e.g. titrations, conditioning. - Filling after manual dosing with <DOS>.
Key <START>	Starts procedures, e.g. titrations, conditioning. Identical with key <START> of the separate keypad.
Indicator lamps:	
"COND."	Lamp flashes when conditioning is performed and the titration vessel is still wet. It is on if conditioning is ok.
"STATISTICS"	Lamp is on when the "statistics" function (calculation of mean and standard deviation) is on.
"SILO"	Lamp is on when silo memory (for sample data) is on.

Rear view of instrument:



7 RS232 interfaces
2 separate interfaces for the connection of printer, balance, and computer

8 Remote lines
(input/output)
for the connection of the Remote Box, Sample Changers, robots etc.

9 Connection of electrodes and temperature sensor

- 2 high-impedance measuring inputs for pH and U measurements. They can either be used separately or for differential potentiometry, see page 216.
  Important: If you work with both measuring inputs in the same vessel, the same reference electrode must be used.
- 1 measuring input for polarized electrodes, e.g. KF electrode
- 1 measuring input for PT100 or Pt1000 temperature sensor

10 Connection for separate keypad

11 Connection for power cable
With power supplies where the voltage is subject to severe HF disturbances, the Titrino should be operated via an additional power filter, e.g. Metrohm 615 model.

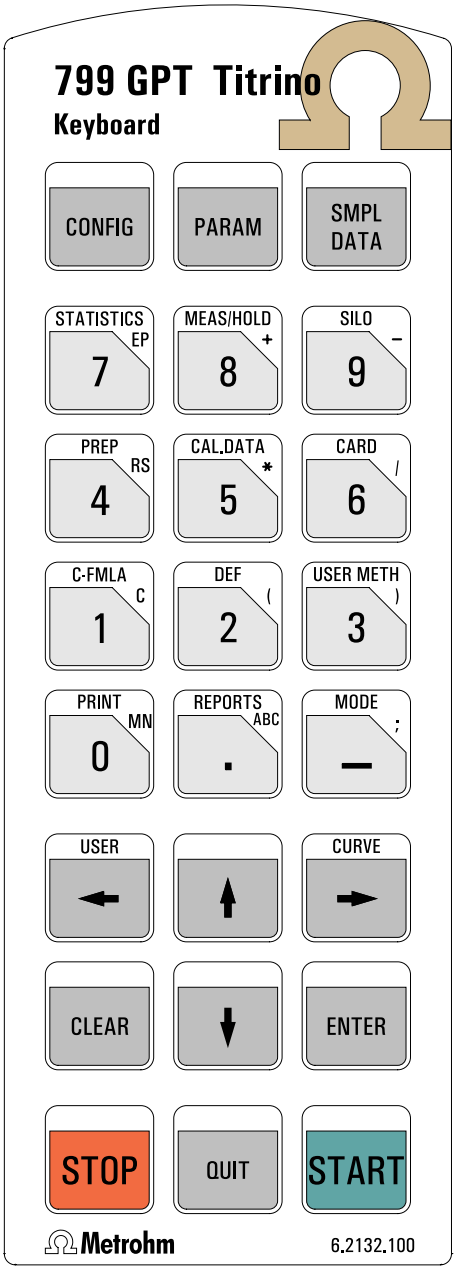
12 Connection for external dosing units D1 and D2
685 Dosimats or 700 Dosinos

13 Connection for stirrer
728 Magnetic Stirrer, 802 Rod Stirrer, 703 or 727 Ti Stand
Supply voltage: 10 VDC (I ≤ 200 mA)

14 Rating plate
with fabrication, series and instrument number

2 Manual operation

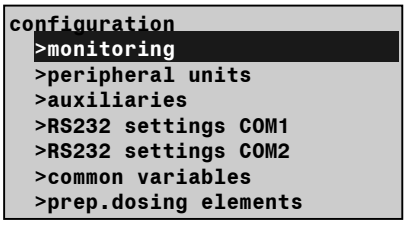
2.1 Keypad



CONFIG	Configuration.
PARAM	Parameters.
SMPL DATA	Sample data.
STATISTICS	ON/OFF switching of statistics calculations of consecutive determination, see page 77.
MEAS/HOLD	ON/OFF switching of measurements between titrations and hold during titrations.
SILO	ON/OFF switching of silo memory for sample data, see page 96.
PREP	Preselection of dosing units, see page 103.
CAL.DATA	Calibration data, see page 94.
CARD	Management of memory card, see page 91.
C-FMLA	Calculation values, see page 76.
DEF	Formulas, data output, sequence for TIP, see page 74ff.
USER METH	Management of internal method memory, see page 89.
PRINT	Printing of reports, see page 80.
REPORTS	Result output.
MODE	Mode selection, see page 14.
USER	User name, see page 84.
CURVE	Switching result/curve display.
←,→	Selection of special values (dialog marked with ":")
↑,↓	Cursor key for navigation.
CLEAR	Clears values, set special values.
ENTER	Stores values.
STOP	Stops methods.
QUIT	Quits inquiries, waiting times, printing.
START	Starts methods.

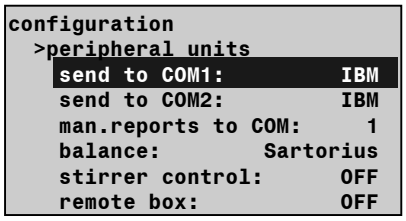
The third functions (inscriptions in the triangle) on the keys of the keypad are used for formula entry, see page 74.

2.2 Principle of data input



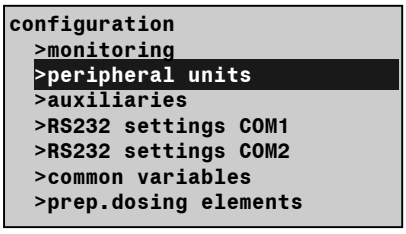
- If you press a key you will find a group of inquiries in the display.
  Example key <CONFIG>:
  In the first line you see where you are: You pressed key <CONFIG> and you are now in the inquiries "configuration".

- The cursor is inverted. In our example the cursor is on the inquiry ">monitoring". You can move the cursor up and down with keys <↑> and <↓>.



- If a dialog text is marked with ">", it contains a group of inquiries itself. You go to this group pressing <ENTER>.
  Example inquiries of "peripheral units":
  The first two lines indicate again where you are.
  Then you find the inquiries.
  If a dialog text of an inquiry is marked with ":", you can select a value with keys <←> and <→> (forward/backward).

- A value is stored with <ENTER> and the cursor moves to the next inquiry.

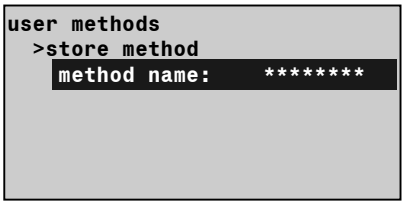


- With key <QUIT> you move one level up, in our example you go back to ">peripheral units".
  If you press <QUIT> once more you quit the inquiries in "configuration" altogether.

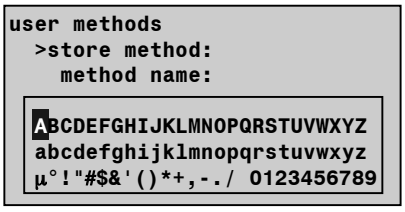
- If you can scroll, ↓ or ↑ appear in the right lower or upper corner of the display.

2.3 Text input

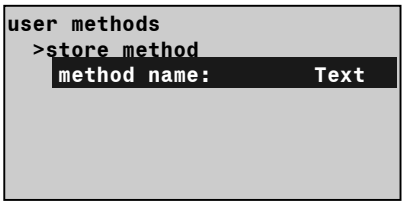
Example storing a method:



<CLEAR>



<QUIT>



<ENTER>

- Press key <USER METH>.
  Place the cursor to ">store method" and press <ENTER>.
  The name of the method which is currently in the working memory is displayed.
- Delete this name with <CLEAR>.
- Open the "text writing mode" with key <ABC>.
  You can now select the desired character by means of the cursor keys, then confirm this character. Select the next character...
  When you confirmed the last character, i.e. your name is complete, you quit the text writing mode with <QUIT>.
  Confirm now the name with <ENTER>.
- During text input you can correct typing errors with <CLEAR>:
  <CLEAR> deletes the characters one by one.
- If you wish to modify an existing name (e.g. if you have names like Text 1, Text 2, Text 3), do not delete the existing name before you start the text input mode. Proceed then as follows:
  1. Press <USER METH>, place the cursor to ">store method" and press <ENTER>.
  2. Open the text writing mode directly: Press key <ABC>.
  3. <CLEAR> now deletes the characters one by one or you can add additional characters.
  4. If your text is complete, leave the text writing mode with <QUIT> and confirm the text with <ENTER>.

2.4 Configuration, key <CONFIG>


```
configuration
  >monitoring
  >peripheral units
  >auxiliaries
  >RS232 settings COM1
  >RS232 settings COM2
  >common variables
  >prep.dosing element
```

Key <CONFIG> serves to enter device specific data. The set values apply to all modes.

monitoring:
Monitoring of instrument validation, pH calibration, service interval and printout of diagnostic report.

peripheral units:
Selection of printer, balance, stirrer control and COM for manual report output.

auxiliaries:
e.g. setting of dialog language, date time, type of result display.

RS232 settings COM1 and 2:
RS parameters for the COM's.

common variables:
Values of common variables.

prep.dosing element:
Parameters for the preparation of the dosing units.

The display texts of the Titrino are shown to the left. The values are the default values.

```
>monitoring
```

Monitoring functions

```
   validation:          OFF
```

Monitoring the validation interval (ON, OFF)
Monitoring is carried out at the end of the titrations and when the Titrino is switched on. If the monitoring responds the message "validate instrument" appears. The message vanishes with <CLEAR>. At the same time the counter is reset to zero.

If "on" has been set:

```
     time interval      365 d
```

Time interval for validation (1...9999 d)
see also page 225.

```
     time counter         0 d
```

Time counter (0...9999 d)
Counts the number of days since the last time the counter was reset.

```
   calibration:         OFF
```

Monitoring the pH calibration interval (ON, OFF)
Monitoring is carried out at the end of the titrations and when the Titrino is switched on if the measuring input has a current calibration date. If the monitoring responds the message "calibrate electrode" appears. The counter will be reset to zero on the next pH calibration of this input.

	If "on" has been set:
meas.input: 1	*Measuring input (1, 2, diff.)*
time interval 7 d	*Time interval for validation (1...9999 d)*
time counter 0 d	*Time counter (0...9999 d)* Counts the number of days since the last time the counter was reset.
service: OFF	*Monitoring the service interval (ON, OFF)* Monitoring is carried out after the Titrino has been switched on. If the monitoring responds the message "Service is due" appears. The message vanishes with <CLEAR>.
next service YYYY-MM-DD	If "on" has been set: *Date of next service (YYYY-MM-DD)*
system test report: OFF	*System test report printout (ON, OFF)* With "on" the report of the system test is printed out after the Titrino has been switched on, see also page 226.
>peripheral units	**Settings for peripheral units**
send to COM1: IBM	*Selection of printer (Epson, Seiko, Citizen, HP, IBM) at the Titrino COM1*
send to COM2: IBM	"Epson", for Epson "Seiko", e.g. for DPU-414 "Citizen", e.g. for iDP 562 RS, Custom DP40-S4N "HP" e.g. for Desk Jet types. Place curves always at the beginning of a page as you cannot 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.
man.reports to COM: 1	*COM of Titrino for the output of manually triggered reports (1, 2, 1&2)* Manually triggered reports e.g. with <PRINT> .... . Exception <PRINT><REPORTS>: These reports are outputted on the COM as defined in the method.
balance: Sartorius	*Selection of balance (Sartorius, Mettler, Mettler AT, AND, Precisa)* Sartorius: Models MP8, MC1 Mettler: Models AM, PM, AX, MX, UMX 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

stirrer control: OFF	*Automatic switching ON/OFF of the stirrer in the titration sequence (ON, OFF)* If stirrer control is ON, the stirrer will be switched on at the beginning and switched OFF at the end of a determination. For SET and KFT with conditioning the stirrer will be switched off in the inactive state. In the modes MEAS, CAL, DOS, and TIP the stirrer is not switched automatically. For stirrer control the red switch on the stirrer unit must be ON.
remote box: OFF	*Connection of a remote box (on ,OFF)* To the remote socket for PC keyboard and barcode reader, see page 212. If "on" has been set:
keyboard: US	*Type of PC keyboard (US, German, French, Spanish, Swiss.)* The PC keyboard is used as an input aid, see page 214.
barcode: input	*Target for barcode reader (input, method, id1, id2, id3, smpl size)* The barcode reader is used as an input aid, see page 213. Input: The barcode string goes to the entry field in which the cursor is currently located. Method: The barcode string goes to the entry field "Methods" in the silo memory. Id1: The barcode string goes to the entry field "Id1". (Similar for Id2 and Id3.) Smpl size: The barcode string goes to the entry field "smpl size".
>auxiliaries	**General settings**
dialog: english	*Selection of dialog language (english, deutsch, francais, español, italiano, portugese, svenska)*
date 2001-09-14	*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 0	*Current run number for result output (0...9999)* The sample number is set to 0 when the instrument is switched on and incremented on every determination.
auto start OFF	*Automatic starts of titrations. (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 Sample Changers.

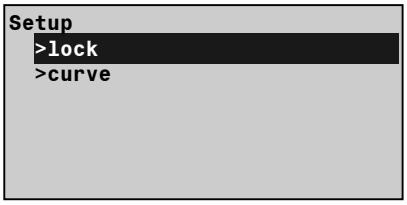
start delay 0 s	*Start delay (0...999 999 s)* Delay time after start of methods. Abort start delay time with <QUIT>.
result display: bold	*Type of result display at the end of the determination (bold, standard)* bold: The calculated results are displayed in bold characters. standard: Displays the whole information, e.g. results, endpoints, messages etc.
dev.label.	*Individual identification of devices (up to 8 ASCII characters)* Will be printed in the result report, see page 81.
program 799.0010	*Display of program version*
>RS232 settings COM1	**Settings of RS232 interface** see also page 180. Identical for COM2.
baud rate: 9600	*Baud rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)*
data bit: 8	*Data bit (7, 8)*
stop bit: 1	*Stop bit (1, 2)*
parity: none	*Parity (even, odd, none)*
handshake: HWs	*Handshake (HWs, SWline, SWchar, none)* see page 180.
>common variables	**Values of the common variables**
C30 0.0 **etc.**	*Common variables C30...C39 (0.. ± 999 999)* The values of all common variables are displayed. For creating of common variables see page 79.
>prep.dosing elements	**Preparation of titration burets, "prep" and "empty"** see also page 103
power ON prep: OFF	*Warning after power ON (ON, OFF)* If this function is on, a warning appears after switching on the Titrino, that a preparation should be executed.
report: OFF	*Report of prep (ON, OFF)* With ON, a report will be printed automatically after prep. The report is outputted on the COM which is given for manual reports.

dos.element: internal D0	*Selection of the dosing element (internal D0, external D1, external D2)* internal D0: buret of the Titrino external D1/2: buret D1, D2, resp.
warn.interv.DX OFF min	*Warning interval for prep (5...9999 min, OFF)*
dos.drive: Dosimat	*Selection of the type of dosing element (Dosimat, Dosino)* The internal buret D0 reacts like a "Dosimat".
volume DX 3.5 ml	***Parameters for the internal buret and for Dosimats:*** *Volume, that will be dosed with the preparation (0...99 999.99 mL)*
cycles DX 2	*Number of cycles (1...9)*
dos.rate max. ml/min	*Dosing rate (0.01...150 mL/min, max.)*
fill rate max. ml/min	*Filling rate (0.01...150 mL/min, max.)*
outlet: tip	***Parameters for Dosinos:*** *Location where the liquid will be expelled (tip, flask)* With "flask" the reagent will be re-expelled into the bottle. In this case, it is possible that the titer will be changed! The next 4 entries serve to calculate the volumes which will be expelled in prep:
len.dos.tub.DX 40.0 cm	*Length of the dosing tube (1...999.9 cm)*
diam.dos.tub.DX 2.0 mm	*Diameter of the dosing tube (0.1...9.9 mm)*
len.asp.tub.DX 25.0 cm	*Length of the aspirating tube (1...999.9 cm)*
diam.asp.tub.Dx 2.0 mm	*Diameter of the aspirating tube (0.1...9.9 mm)*
dos.rate max. ml/min	*Dosing rate (0.01...150 mL/min, max.)*
fill rate max. ml/min	*Filling rate (0.01...150 mL/min, max.)*

Settings with key <CONFIG> and power ON

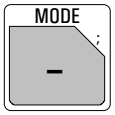
Proceed as follows:

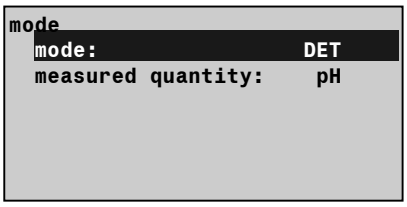
1. Switch the Titrino OFF.
2. Press <CONFIG> and keep it pressed during switching the Titrino ON.
   The display shows the following:

	**lock:** Locking keys <CONFIG>, <PARAM> and <SMPL DATA>, and the functions "recall method", "store method" and "delete method" of the internal method memory in the Titrino. **curve**: Changes the appearance of the curve printout.
>lock <configuration>: OFF <parameters>: OFF <smpl data>: OFF recall method: OFF store method: OFF delete method: OFF	**lock** "ON" means that the corresponding function is not accessible anymore. The corresponding key is locked. The corresponding function in the internal method memory of the Titrino is locked.

>curve		**curve** The settings are valid for COM1 and COM2. If you change the printer type, the following settings are initialized according to the printer.
grid:	**ON**	*Grid drawing (ON, OFF)*
frame:	**ON**	*Frame drawing (ON, OFF)*
scaling:	**Full**	*Type of scaling (Full, Auto)* Full: The scaling goes from the greatest to the smallest value. auto: The scaling from tick to tick, e.g. the smallest/greatest values lie in between the first/last tick.
width	**0.75**	*Width (0.2...1.00)* 1 is greatest width. If you set 1 you may loose the label at the right margin.
length	**0.1**	*Length (0.01...1.00)* *Volume axis* Curve length per cylinder volume 0.01 100 cm 0.1 10 cm 0.5 2 cm 1 1 cm *Time axis*: Curve length 0.01 100 cm 0.1 10 cm 0.5 2 cm 1 1 cm

2.5 Selection of the mode, key <MODE>





Press key <MODE> until the desired mode is displayed and confirm with <ENTER>.
Select the measured quantity pH, U, Ipol, Upol, (T) with <←> or <→> and confirm it also with <enter>.

The following modes can be selected:
- DET: **D**ynamic **E**quivalence-point **T**itration
- MET: **M**onotonic **E**quivalence-point **T**itration
- SET: **S**et **E**ndpoint **T**itration.
- KFT: **K**arl **F**ischer **T**itration, the determination of water content.
- STAT: Keeping a measured value constant, i.e. pH-STAT.
- DOS: **Dos**ing function with volume, time, or rate control.
- DOC: **Do**sing **C**ontrolled by a measured value gradient.
- CAL: pH **Cal**ibration.
- MEAS: **Meas**uring.
- TIP: **Ti**tration **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 with <DEF>, see page 85.

You will find a survey of the modes in the short Instructions for use.

2.6 Parameters, key <PARAM>

The key <PARAM> is used for the entry of values that determine the modes. Values marked with "cond." are accessible during the conditioning in the SET and KFT mode. "**titr." means that these values can be changed during the titration. They influence the ongoing determination. Other values can only be changed in the inactive state.
The display texts of the Titrino are shown to the left. The values are the default values.

2.6.1 Parameters for DET and MET

```
parameters
  >titration parameters
  >stop conditions
  >statistics
  >evaluation
  >preselections
```

titration parameters
determine the course of the titration and measured value acquisition.
stop conditions:
Parameters for the automatic termination of the titration.
statistics:
Calculation of mean values and standard deviation, see page 77.
evaluation:
Parameters for the evaluation of EP's, fix EP's, and pK/HNP.
preselections:
ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.

```
 >titration parameters

    meas.pt.density        4
DET
```

General titration parameters

Measuring point density (0...9)
0 means highest density, 9 lowest. Selection of the meas.pt.density, see page 21.

```
    min.incr.        10.0 µl
DET
```

Minimum increment (0...999.9 µL)
The increment is dispensed at the beginning of the titration and in the region of the equivalence point.

```
    V step           0.10 ml
MET
```

Size of volume increment (0...9.999 mL)
Dosing step. Small volume increments are needed to determine blank values or to assure accuracy with highly unsymmetrical curves. Selection of size of the increment, see page 21.

dos.rate max. ml/min
****titr.***

Dosing rate for volume increments (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

signal drift 50 mV/min
****titr.***

Drift criterion for measured value acquisition. (input range depends on the measured quantity:
pH, U, Ipol: 0.5...999 mV/min, OFF
Upol: 0.05...99.9 µA/min, OFF)
<CLEAR> sets "OFF".
This type of measured value acquisition is often called an equilibrium titration.
"OFF" means that the measured value is acquired after an equilibration time. This may be useful for slow titration reactions or when the response of the electrode assembly is slow.

equilibr.time 26 s
****titr.***

Waiting time for measured value acquisition. (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, see page 20. The measured value is acquired as soon as the first criterion (drift or time) has been met.

start V: OFF

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

start V 0.0 ml

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

factor 0

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

dos.rate max. ml/min
****titr.***

Dosing rate for start volume (0.01...150 mL/min, max.)
<CLEAR> sets "max.".
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.**	*Waiting time (0...999 999 s)* Waiting time, e.g. for equilibration of the electrode after the start or reaction time after dosing of start volume. The pause can be aborted with <QUIT>.
dos.element: internal D0	*Selection of the dosing element (internal D0, external D1, external D2)* internal D0: internal buret of the Titrino external D1/2: buret D1, D2, resp.
meas.input: 1	*Measuring input for pH and U (1, 2, diff.)* Request for measuring input for pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 215.
	With polarized electrodes, instead of the measuring input the
I(pol) 1 µA	*polarization current (-127...127 µA)*
	or the
U(pol) 400 mV	*polarization voltage (-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 state to a measurement. "OFF" means that the test is not performed.
temperature 25.0 °C	*Titration temperature (-170.0...500.0 °C)* The temperature is continuously measured if a T sensor is connected. This parameter is used for temperature compensation in pH titrations.
>stop conditions	**Stop conditions for the titration** If several stop conditions have been set, the criterion which is met first applies.
stop V: abs. ***titr.**	*Type of stop volume (abs., rel., OFF)* "abs.": absolute stop volume in mL. "rel.": relative stop volume to sample size. "OFF": stop volume switched off. Stop volume is not monitored.
	If "abs." is set:
stop V 99.99 ml ***titr.**	*Absolute stop volume (0...9999.99 mL)*
	If "rel." is set:
factor 999999 ***titr.**	*Factor for relative stop volume (0...±999 999)* Calculated as: Stop V (in mL) = factor ∗ sample size

stop pH OFF ***titr.**	*Stop at measured value (input range dependent on measured variable:* *pH: 0... ± 20.00, OFF* *U, Ipol: 0... ± 2000 mV, OFF* *Upol: 0... ± 200.0 µA, OFF)* <CLEAR> sets "OFF". "OFF" means that the criterion is not monitored.
stop EP 9 ***titr.**	*Stop after a number of EP's have been found (1...9, OFF)* <CLEAR> sets "OFF". "OFF" means that the criterion is not monitored.
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
>evaluation	**EP evaluation/recognition** See page 21 ff.
EPC 5	*Equivalence point criterion (input range depends on mode.* *For DET:* *0...200* *For MET:* *pH: 0.10...9.99* *U, Ipol: 1...999 mV* *Upol: 0.1...99.9 µA)* Threshold for the size of the jump, see page 23.
EP recognition: all	*Recognition of EP's which fulfill the EP criterion. (all, greatest, last, window, OFF)* Selection of equivalence point recognition: "all": All equivalence points are recognized. "greatest": Only the greatest (steepest) equivalence point is recognized. "last": Only the last equivalence point is recognized. "window": Only EP's in specified windows are recognized. "OFF": Evaluation switched off. If "window" is selected, lower and upper limits of windows are inquired.
low lim.1 pH -20.00	*Lower limit of window 1*
up lim.1 pH 20.00	and *upper limit of window 1* *(Input ranges for both inquiries depend on the measured quantity):* *pH: 0...±20.00, OFF* *U, Ipol: 0...±2000 mV, OFF* *Upol: 0...±200.0 µA, OFF)*

		<CLEAR> sets "OFF". Only equivalence points are recognized which lie within the set lower and upper limits. The equivalence point numbering is defined with the windows, see page 23. Window inquiries continue until the lower limit is set to "OFF". Up to 9 possible windows. Always set both limits to ≠ OFF for a valid window.
fix EP1 at pH	**OFF**	*Interpolation of volumes at fixed times (input range depends on the measured quantity:* *pH: 0...±20.00, OFF* *U, Ipol: 0...±2000 mV, OFF* *Upol: 0...±200.0 µA, OFF)* <CLEAR> sets "OFF". If a fix end point has been set, the volume value for the input measured value is interpolated from the curve, see also page 24. The volume values are available as C5X. Fix EP's are inquired until "OFF" is set. Up to 9 fix EP's.
pK/HNP:	**OFF**	*Evaluation of pK or HNP (ON, OFF)* pK evaluation in case of pH titrations and half neutralization potential for U, see page 24.
>preselections		**Preselections for the sequence**
req.ident:	**OFF**	*Request of identifications after start of titration. (id1, id1&2, all, OFF)* After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size:	**OFF**	*Request of sample size after start of titration (value, unit, all, OFF)* "all" requests the value, then the unit.
limit smpl size:	**OFF**	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim.	**0.0**	*Lower limit for sample size (0.0...999 999)*
up lim.	**999999**	*Upper limit for sample size (0.0...999 999)*
activate pulse:	**OFF**	*Pulse output on I/O line "activate" (L6, pin 1) of the remote socket (ON, OFF)* see page 224.

Titration sequence of DET and MET

<START>	
(Activate pulse) (Stirrer ON)	After the start, the activate pulse is outputted and the stirrer switched on.
(Start delay)	The start delay time is waited off.
(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested.
(Start conditions)	The start volume is dispensed (no meas.value acquisition) and the pause is waited off.
Titration: Dispense increments Acquire meas.values	During the titration the volume increments are dispensed and after each increment a measured value is acquired. Meas.values are either acquired drift controlled ("equilibrium titration") or a after a fixed waiting time. If you have not intentionally changed the equilibration time, it is calculated according to the formula: $\text{equilibr.time (in s)} = \frac{150}{\sqrt{\text{Drift} + 0.01}} + 5$ The criterion (drift or equilibration time) which is first met applies. This avoids "infinite" titrations. If the parameter "signal drift" is set "OFF", the measured values are acquired after a fixed equilibration time.
Stop conditions	The titration is terminated according to the first criterion which is met.
(Stirrer OFF)	The stirrer is switched off.
Calculations	Evaluations and calculations are carried out.
Data output	Data are outputted.

Reagent feeding and EP evaluation of DET

The reagent feeding of DET is similar to the controlling, a human being would apply in manually controlled titrations: Great volume increments are dosed far away from the EP, small increments in the region of the equivalence point.
The size of the volume increments dosed by the Titrino is determined by the following parameters:

meas.pt.density	The measuring point density is entered as a relative value from 0...9. Input of a low number means small volume increments, i.e. a large measuring point density on the curve. A curve results which reproduces all fine details. "Fine details", however, also include signal noise, which can easily lead to unwanted equivalence points. A high number, i.e. low measuring density, on the other hand, allows a more rapid titration. The standard value of 4 is suitable for most cases. If you work with small cylinder volumes (1 or 2 mL), a small measuring point density may be advisable. In these cases you should also lower the drift for meas.value acquisition and set a higher EPC.
min.incr.	Defines the minimum possible increment. This minimum increment is dosed at the beginning of the titration and in the region of the equivalence point (for steep curves). Use low minimum increments only, if small volumes of titrant consumption are expected, e.g. in micro titrations; otherwise unwanted equivalence points may arise. The standard value of 10.0 µL is suitable for most cases.
EPC	The EP's are evaluated according to a special METROHM procedure which is so sensitive that even weak equivalence points are determined correctly. Equivalence Point Criteria. The *preset* EPC is compared to the *found* ERC (Equivalence point Recognition Criteria) for each evaluated equivalence point. The size of the ERC is displayed in the titration curve, see page 83. The ERC is the first derivative of the titration curve overlaid with a mathematical function so that small maxima become higher and great maxima smaller. EP's whose ERC is below the preset EPC will not be recognized. For most cases the standard value of 5 is suitable. The evaluation can be repeated at any time after the titration in a "dry run" with changed evaluation criteria. The old titration data are not deleted until a new titration is started.

Reagent feeding and EP evaluation of MET

In monotonic titrations, the volume increment is constant over the whole titration curve.

V step	Volume increment. A prerequisite for good accuracy is the correct size of the volume increments. A good value is given by V step = 1/20 V_{EP} (V_{EP} = volume of the EP). In any case, the increment size should always be between 1/10 V_{EP} and 1/100 V_{EP}; with steep jumps preferably in the region of 1/100 and with flat jumps preferably in the region of 1/10. The accuracy of the evaluation can not be increased by dispensing small increments as the changes in the measured value can then be of the same order of magnitude as the noise. This can produce "ghost EP's"!
	The EP's are localized with an algorithm which is based on Fortuin and has been adapted by METROHM for numeric procedures. (METROHM Bulletin 2, No. 10, 1971). Here, the greatest change in the measured value is sought (Δ_n). The exact equivalence point is determined with an interpolation factor, which depends on the delta values before and after Δ_n: $V_{EP} = V_0 + \rho \Delta V$ V_{EP}: EP volume V_0: Total dispensed volume before Δ_n ΔV: Volume increment ρ : Interpolation factor (Fortuin)
EPC	Equivalence Point Criteria. The *preset* EPC is compared to the *found* ERC (Equivalence point Recognition Criteria) for each evaluated equivalence point. The size of the ERC is displayed in the titration curve, see page 83. ERC is the sum of the measured value changes before and after the break: $\lvert\Delta_{n-2}\rvert + \lvert\Delta_{n-1}\rvert + \lvert\Delta_n\rvert + \lvert\Delta_{n+1}\rvert + \lvert\Delta_{n+2}\rvert$ (In certain cases there are only 3 or 1 summand). EP's whose ERC is below the preset EPC will not be recognized. For most titrations the standard value is suitable. The evaluation can be repeated at any time after the titration in a "dry run" with changed evaluation criteria. The old titration data are not deleted until a new titration is started.

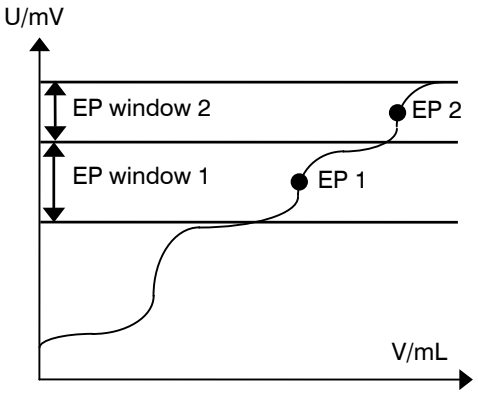
EP recognition criteria for DET and MET

The parameter "EP recognition" offers you a range of possibilities to ensure selection of the EP you are interested in: If the desired jump is very large, you can select the "greatest" jump (with DET the steepest jump will be evaluated). Thus you always obtain just one EP per titration (EP1).
If you wish to determine the sum of different components (e.g. acid or base numbers), the "last" jump can be the correct one.
And finally you can set a "window" for each expected EP.

EP windows
EP windows are used

- to suppress disturbing influences and EP's which are not needed.
- to increase the liability for the calculation of the results. The EP windows make an unequivocal assignment of the EP's possible: per window one EP is recognized; the numbering of EP's is defined by the windows so that even if EP's are missing, the calculations are still performed with the correctly assigned EP volumes.

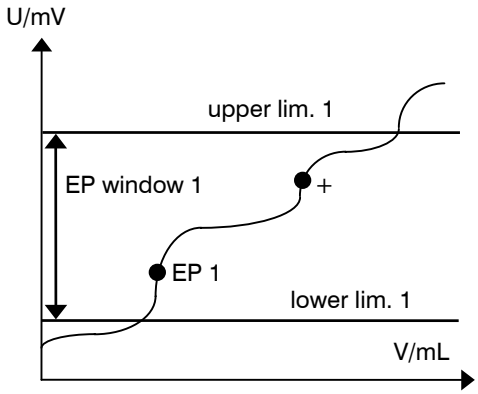
An EP window defines the range in which an EP is expected. EP's outside these ranges are not recognized. Windows are defined on the measured value axis.



2 EP's are recognized. Their numbering is defined by the windows:
Window 1 ⇒ EP1
Window 2 ⇒ EP2

If more than 1 EP is expected, a window must be set for each EP.

Windows must not overlap. They may only touch each another.



Rule: If there are more than 1 EP in a window, the first jump is recognized as EP1, the second is not recognized. EP1 is marked as EP1 + to indicate that more than one EP has been found in the window

Fix EP's

Fix EP's allow determination of the associated volume value for every inputted measured value on the titration curve. This function is useful for performing standard methods such as TAN/TBN determinations. For the evaluation of fix EP's, the pH calibration is advisable. The volume values of the fix EP's are available for the calculation as C5X:

Fix EP1 ⇒ C51
:
Fix EP9 ⇒ C59 Maximum 9 fix EP's are possible.

pK and HNP evaluation

The following relation (Henderson-Hasselbach), derived from the law of mass action, exists between the activities of a conjugate acid-base pair in aqueous solutions:

$$pH = pK + \log (a_B/a_A)$$

When the activities $a_B = a_A$, then pH = pK is valid. This value corresponds to the pH at the half neutralization point and can be taken from the titration curve. For pK determinations, a careful pH calibration is necessary.

The pK value determined is an approximate value owing to the fact that the ionic strength of the solution has not been taken into account. For more exact values, titrations must be performed with decreasing ionic strength and the results extrapolated to zero ionic strength.

The evaluation of pK's in aqueous solutions is limited to

pK>3.5 due to the leveling effect of strong acids in aqueous solutions

pK<10.5 because for weaker acids no inflection points can be found aqueous solutions.

pK evaluation for polybasic acids and for acid mixtures is also possible.

In non-aqueous solutions, the half neutralization potential (HNP) is often used instead of pK. The HNP is evaluated accordingly.

A start volume must be smaller than half of the equivalence point volume of the first EP.

The pK/HNP values are available for calculation as C6X.

Minimum/maximum evaluation

Volumes at minimum or maximum voltage values are extrapolated. These volumes are accessible as variables C49 and C48 resp. and can be used in formulas.

2.6.2 Parameters for SET

```
parameters
  >SET1
  >SET2
  >titration parameters
  >stop conditions
  >statistics
  >preselections
```

SET1, SET2:
Control parameters for EP1 and EP2.
titration parameters
are valid for the global titration sequence.
stop conditions:
Parameters for the termination of the titration.
statistics:
Calculation of mean values and standard deviation, see page 77.
preselections:
ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.

>SET1

Control parameters for EP1 or EP2, resp.

EP at pH **OFF**
***titr.*

Preset EP1 (input range depends on the measured quantity:
pH: 0...±20.00, OFF
U, Ipol: 0...±2000 mV, OFF
Upol: 0...±200.0 µA, OFF)
<CLEAR> sets "OFF".
If EP1 is "OFF", no further inquiries under SET1 appear.

dynamics **OFF**
***titr.*

Distance from EP where constant dosing should stop and controlling begins. (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 µA, OFF)
<CLEAR> sets "OFF".
"OFF" means largest control range, i.e. low titration.
Outside the control range, dispensing is performed continuously, see also page 31.

max.rate **10.0 ml/min**
***titr.*

Maximum dosing rate (0.01...150 mL/min, max.)
<CLEAR> sets "max.".
This parameter determines primarily the addition rate outside the control range, see also page 31.
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 µl/min ***titr.**	*Minimum dosing rate (0.01...999.9 µL/min)* This parameter determines the addition rate right at the start and the end of the titration, see also page 31. 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 criteria (drift, time)*
stop drift 20 µl/min ***titr.**	*Titration stops if EP is and stop drift is reached. (1...999 µL/min)*
t(delay) 10 s ***titr.**	*Titration stops if there is no dosing during t(delay). (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. If t(delay) is "INF"
stop time OFF s ***titr.**	*Stop after a time (0...999 999 s, OFF)* <CLEAR> sets "OFF". Stop after the set time after the start of the titration. "OFF" means no stop, i.e. titration for an "infinitely" long time.
>titration parameters	**General titration parameters**
titr.direction: auto	*Direction is set automatically (+, -, auto)* auto: The direction is set automatically by the Titrino (sign [U_{first} - EP]). +: Direction of higher pH, higher voltage (more "positive"), larger currents. - : 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.
pause 1 0 s ***titr.**	*Pause 1 (0...999 999 s)* Waiting time before start volume, e.g. for equilibration of the electrode after the start. The waiting time can be aborted with <QUIT>.
start V: OFF ***cond.**	*Type of start volume (OFF, abs., rel.)* "OFF": start volume switched off "abs.": absolute start volume in mL "rel.": relative start volume to sample size.
start V 0.0 ml ***cond.**	If "abs." is set: *Absolute start volume (0...999.99 mL)*
factor 0 ***cond.**	If "rel." is set: *Factor for relative start volume (0...±999 999).* Calculated as: start V (in mL) = factor∗sample size

dos.rate max. ml/min ***titr.**	*Dosing rate for 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 2 0 s ***titr.**	*Pause 2 (0...999 999 s)* Waiting time after start volume, e.g. reaction time after dosing of a start volume. The waiting time can be aborted with <QUIT>.
extr.time 0 s ***titr.**	*Extraction time (0...999 999 s)* During this time the titration is already running. It will be not stopped (also if the EP is already reached) before the extraction time is terminated. The extraction time can be aborted with <QUIT>.
dos.element: internal D0	*Selection of dosing element (internal D0, external D1, external D2)* internal D0: internal buret of the Titrino external D1/2: buret D1, D2, resp.
meas.input: 1	*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 215.
	With polarized electrodes, instead of the measuring input the
I(pol) 1 µA	*polarization current (-127...127 µA)* or the
U(pol) 400 mV	*polarization 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 state to a measurement. "OFF" means that the test is not performed.
temperature 25.0 °C ***cond.**	*Titration temperature (-170.0...500.0°C).* Temperature is measured at the start of the titration if a T sensor is connected. The value is used for temperature compensation in pH titrations.
time interval 2 s ***cond.**	*Time interval (1...999 999 s)* Time interval for acquisition of a measured value into the measuring point list.

>stop conditions	**Stop conditions for titration** If this is not "normal", i.e. after reaching the EP.
stop V: abs. ***titr.**	*Type of stop volume (abs., rel., OFF)* "abs.": absolute stop volume in mL. "rel.": relative stop volume 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 relative stop volume (0...±999 999)* Calculated as: Stop V (in mL) = factor∗sample size
filling rate max. ml/min	*Filling rate after the titration (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
>preselections	**Preselections for the sequence**
conditioning: OFF	*Automatic conditioning of titration vessel. (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.**	*Display of drift during conditioning (ON, OFF).* Volume drift.
drift corr: OFF ***cond.**	*Type of drift correction (auto, man. OFF)* auto: The value of the drift will be stored automatically at the start of the titration.
drift value 0.0 µl/min ***cond.**	*Value for manual drift correction (0...99.9 µL/min)*
req.ident: OFF ***cond.**	*Request of identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be requested automatically: Only id1, id1 & id2, all three id's or no inquiries.

req.smpl size: ***cond.***	**OFF**	*Request of sample size after start of titration (value, unit, all, OFF)* "all" the value and the unit will be requested.
limit smpl size: ***cond.***	**OFF**	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim. ***cond.***	**0.0**	*Lower limit for sample size (0.0...999 999)*
up lim. ***cond.***	**999999**	*Upper limit for sample size (0.0...999 999)*
activate pulse: ***cond.***	**OFF**	*Pulse output on I/O line 6 (L6, pin 1) of the remote socket (first, all, cond., OFF)* see page 224.

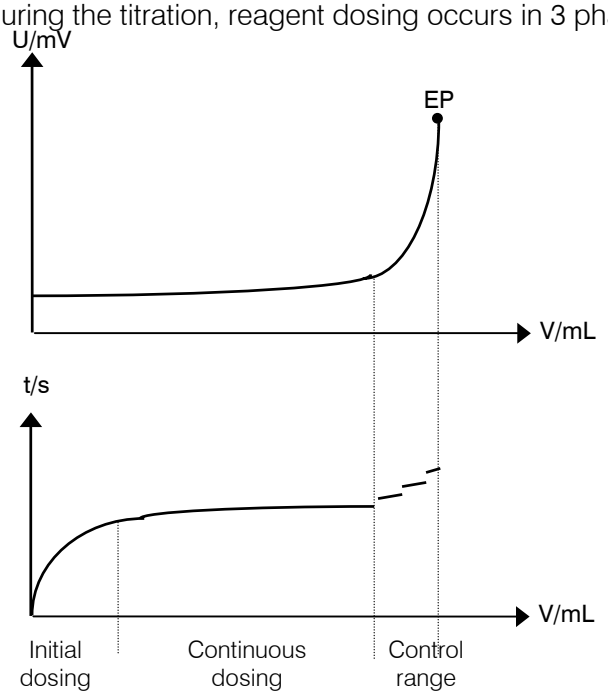
Titration sequence of SET

<START>	
(Activate pulse) (Stirrer ON)	After the start, the activate pulse is outputted and the stirrer switched on.
(Start delay)	The start delay time is waited off.
(Preconditioning) (<START>) (Activate pulse) (Start delay)	If conditioning is on, the sample solution is titrated until the (first) EP is reached. The display shows then **drift OK 2.3 µl/min** or **SET pH conditioning** The vessel is now conditioned. The titration can be started with <START>.
(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested.
	The temperature is measured if a T sensor is connected.
(Start conditions)	Pause 1 is waited off, the start volume is dispensed and pause 2 waited off.
(Extraction time) Titration with test of stop criterion	The titration to EP1 then to EP2 is executed. If the extraction time is not yet over when EP1 has been reached, the titration will only be terminated after the extraction time is over.
(Stirrer OFF)	The stirrer is switched off when there is no conditioning.
Calculations	Calculations are carried out.
Data output	Data are outputted.
(Reconditioning)	Conditioning is carried out.

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 dosing occurs in 3 phases:



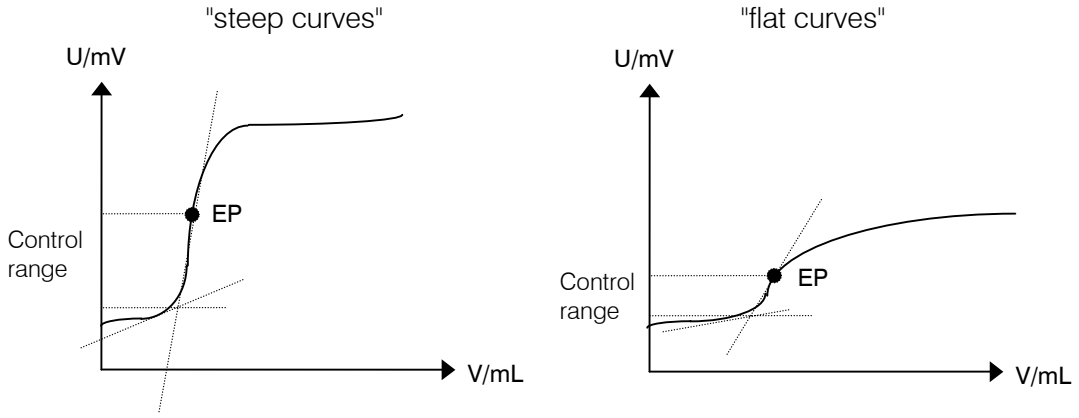
1. Initial dosing:
   Here the dosing rate increases constantly. The rate starts with "min.rate" and goes up to "max.rate".

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

3. Control range (dynamics):
   In this range, dosing is performed in single steps. The last dosing steps are controlled by the parameter "min.rate".

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:



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 dosed 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 2 µL. 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.incr. (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. In case the stop criterion "drift" is used, the stopping point remains the same.

If you have entered the endpoint 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
Dosing 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 dosed.	• Lower "max.rate". • Set larger control range. • Set "min.rate" much lower. • Optimize arrangement of electrode and buret tip and improve stirring, see page 217. 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.

2.6.3 Parameters for KFT

```
parameters
  >control parameters
  >titration parameters
  >stop conditions
  >statistics
  >preselections
```

control parameters:
for the EP.
titration parameters
control the general course of the titration.
stop conditions:
Parameters for the termination of the titration.
statistics:
Calculation of mean values and standard deviation, see page 77.
preselections:
ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.

>control parameters

Control parameters

EP at U **250 mV**
***titr.*

Endpoint (input range depending on the measured quantity:
U, Ipol: 0.. ±2000 mV
I, Upol: 0...±200.0 µA)

---

dynamics **100 mV**
***titr.*

Control (input range depends on the measured quantity:
U, Ipol: 1...2000 mV
I, Upol: 0.1...200.0 µA)
Outside of the control range: constant dosing, see page 40.

---

max.rate **max. ml/min**
***titr.*

Maximum dosing rate (0.01...150 mL/min, max.)
<CLEAR> sets "max.".
This parameter determines primarily the addition rate outside the control range, see page 40.
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.volume incr. **min. µl**
***titr.*

Minimum volume increment (0.1...9.9 µL)
This parameter determines the addition rate at the start and the end of the titration, see also page 40.
This parameter influences the titration speed and therefore its accuracy very strongly: A smaller "min.volume incr." results in a slower titration.

stop crit: drift ***titr.*	*Type of stop criteria (drift, time)*
stop drift 20 µl/min ***titr.*	*Titration stops if EP and stop drift are reached (1...999 µL/min)*
t(delay) 10 s ***titr.*	*Titration stops if there is no dosing during t(delay) (0...999 s, INF)* <CLEAR> sets "INF" Switch off when EP is reached and the set time after the last dosing has elapsed. If "INF" = an inquiry for the stop time appears.
stop time OFF s ***titr.*	*Stop after a time (0...999 999 s, OFF)* <CLEAR> sets "OFF". Stop after the set time after start of titration. "OFF" means no stop, i.e. titration for an "infinitely" long time.

>titration parameters	**Titration parameters**
titr.direction: -	*Direction is set automatically (+, -, auto)* auto: The direction is set automatically by the Titrino. +: Direction of higher voltage (more "positive"), larger currents. - : Direction of lower voltage, smaller currents.
pause 1 0 s ***titr.*	*Waiting time before start volume (0..999 999 s)* Waiting time, e.g. for equilibration of the electrode after start. The waiting time can be aborted with <QUIT>.
start V: OFF *cond.*	*Type of start volume (OFF, abs., rel.)* "OFF": start volume switched off "abs.": absolute start volume in mL "rel.": relative start volume to sample size.
start V 0.0 ml *cond.*	If "abs." is set: *Absolute start volume (0...999.99 mL)*
factor 0 *cond.*	If "rel." is set: *Factor for relative start volume (0...±999 999).* Calculated as: start V (in mL) = factor∗sample size
dos.rate max. ml/min ***titr.*	*Dosing rate for 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 2 0 s ***titr.**	*Waiting time after start volume (0...999 999 s)* Second waiting time, e.g. reaction time after dosing of a start volume. The waiting time can be aborted with <QUIT>.
extr.time 0 s ***titr.**	*Extraction time (0...999 999 s)* During the extraction time no dosing occurs but the titration does not stop. The extraction time can be aborted with <QUIT>.
dos.element: internal D0	*Selection of dosing element (internal D0, external D1/ D2)* internal D0: internal buret of the Titrino external D1/2: Buret D1, D2, resp.
I(pol) 1 µA **U(pol) 400 mV**	*Polarization current (-127...127 µA)* or the *polarization 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 state to a measurement. "OFF" means that the test is not performed.
temperature 25.0 °C ***cond.**	*Titration temperature (-170.0...500.0°C).* The temperature is measured at the start of the titration if a T sensor is connected.
time interval 2 s ***cond.**	*Time interval (1...999 999 s)* Time interval for acquisition of a measured value into the measuring point list.

>stop conditions	**Stop conditions for titration** If this is not "normal", i.e. after reaching the EP
stop V: abs. ***titr.**	*Type of stop volume (abs., rel., OFF)* "abs.": absolute stop volume in mL. "rel.": relative stop volume to sample size. "OFF": stop volume switched off. Stop volume is not monitored. The stop volume applies for one single titration. The conditioning 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 relative stop volume (0...±999 999)* Calculated as: Stop V (in mL) = factor∗sample size
filling rate max. ml/min	*Filling rate after titration (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
>preselections	**Preselections for the sequence**
conditioning: ON	*Automatic conditioning of titration vessel (ON, OFF)* If conditioning is "on", the solution is constantly kept at the endpoint. When conditioning is performed, the volume drift can be displayed during the conditioning:
display drift: ON ***cond.**	*Display of drift during conditioning (ON, OFF).* Volume drift.
drift corr: OFF ***cond.**	*Type of drift correction (auto, man., OFF)* Type of drift correction: (EP - drift∗time) auto: drift value at start is valid man.: see below OFF : no correction
drift value 0.0 µl/min ***cond.**	*Value for manual drift correction (0.0...99.9 µL/min)*
req.ident: OFF ***cond.**	*Request of identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be requested automatically: Only id1, id1 & id2, all three id's or no inquiries.

req.smpl size: **OFF** ***cond.***	*Request of sample size after start of titration (value, unit, all, OFF)* "all" the value and the unit will be requested.
limit smpl size: **OFF** ***cond.***	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim. **0.0** ***cond.***	*Lower limit for sample size (0.0...999 999)*
up lim. **999999** ***cond.***	*Upper limit for sample size (0.0...999 999)*
Oven: **no** ***cond.***	*Connected oven (COM1, COM2, no)* COM of the Titrino to which the oven is connected. If an oven is connected via RS232 an inquiry will be made for the oven results and these will be inserted into the result report of the Titrino. The report output on the oven must be switched OFF. Set "no" if no oven has been connected or if you have not connected the oven to Titrino the via RS232 interface.
activate pulse: **OFF** ***cond.***	*Pulse output on I/O line L6 (L6, pin 1) of the remote socket (first, all, cond., OFF)* e.g. start of a Dosimat, see page 224.

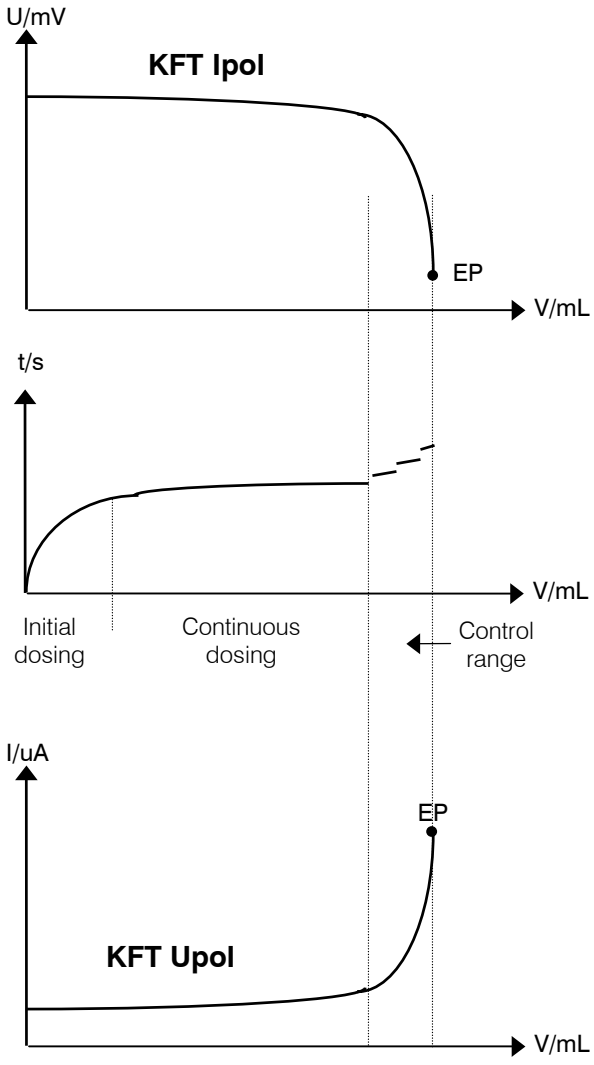
Titration sequence of KFT

<START>	
(Activate pulse) (Stirrer ON)	After the start, the activate pulse is outputted and the stirrer switched on.
(Start delay)	The start delay time is waited off.
(Preconditioning) (<START>) (Activate pulse) (Start delay)	If conditioning is on, the sample solution is titrated until the EP is reached. The display shows then **drift OK 2.3 µl/min** or **KFT conditioning** The vessel is now conditioned. The titration can be started with <START>.
(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested.
	The temperature is measured if a T sensor is connected.
(Start conditions)	Pause 1 is waited off, the start volume is dispensed and pause 2 waited off.
(Extraction time) Titration with test of stop criterion	The titration is executed. If the extraction time is not yet over when the endpoint has been reached, the titration will only be terminated after the extraction time is over.
(Stirrer OFF)	The stirrer is switched off when there is no conditioning.
Calculations	Calculations are carried out.
Data output	Data are outputted.
(Reconditioning)	Conditioning is carried out.

Control parameters for KFT

The control parameters can be set according to your samples. The default parameters are already set to get satisfactory results. Optimize the control parameters for specific samples only.

During the titration, reagent dosing is carried out in 3 phases:



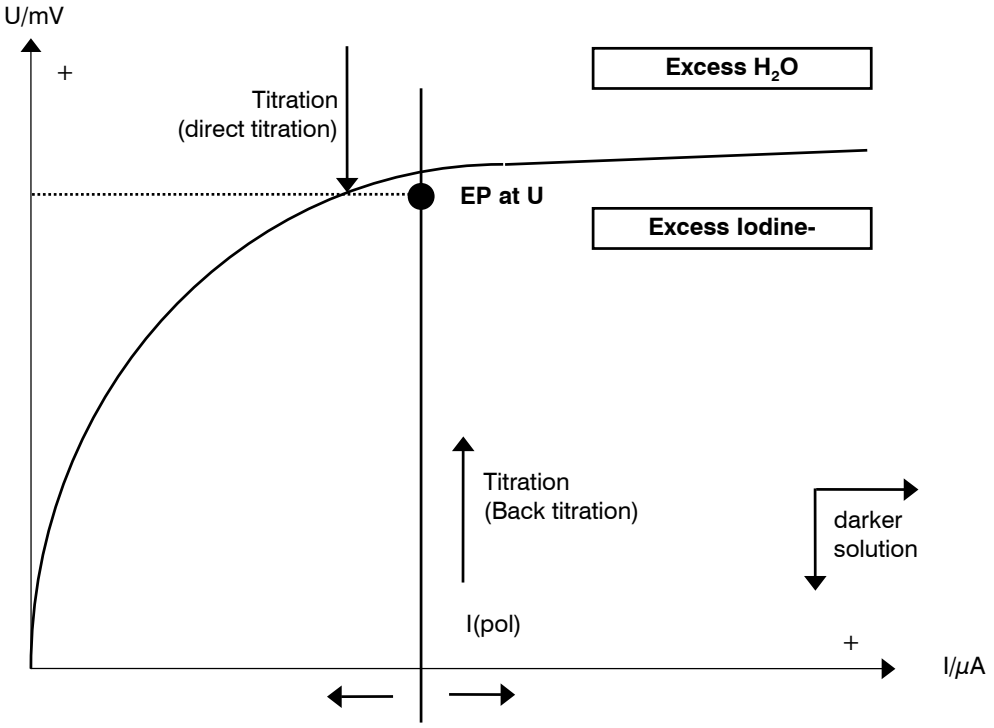
1. Initial dosing:
   Here the dosing rate increases constantly up to "max.rate".

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

3. Control range (dynamics):
   In this range, dosing is performed in single steps. The last dosing steps are controlled by the parameter "min.volume incr.".

Remarks:
- Titer determination should have the same modes and the same parameters as the sample titrations.
- In most cases the preset default parameters provide precise and reproducible results.
- Ipol gives relatively steep curves. They are flatter with Upol.

Mechanisms of the KFT parameters in Ipol mode



- The position and curve characteristics of the line between the ranges of excess water or excess iodine depends on the type of sample and the ingredients of the working media.

- The endpoint has to be set close to the range margin, but always within the iodine excess range. If the endpoint is set too close to the limit, an overdose of KF reagent may be dispensed. The steeper the curve at the preset polarization current I(pol), the more delicate it is to titrate to a steady and reproducible endpoint. For the titration of troublesome samples, the particular conditions must be optimized by trial and error. Always mind the color of the working medium at the end point as your guideline.
  Remark: In most cases the preset default parameters provide precise and reproducible results.

- If you select negative values for a parameter, you should choose negative values for all other parameters too in order to have compatible parameter sets.

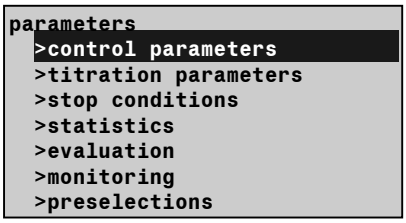
- In KFT Upol mode, all parameters work in a similar manner as in KFT Ipol mode.

The determination of the free water is easily done, as far as the specifications of the reagent manufacturer regarding the "water capacity" of the reagents are considered. Problems may occur with specific sample matrices. The relevant literature contains many precise analysis instructions. In the following table we attempt to show you solutions related more to the instrument's side:

What to do if ...

Problem	Possible causes and remedial action
Dosing at end too long and increments too small. "Is never finished!"	• Increase "min.volume incr.". • Change stop criterion. Try to increase stop drift or use a short stopping time as stop criterion, e.g. • With problematical samples change solvents with ketones or aldehydes in 2-methoxyethanol or with amines mixture in methanol/glacial acetic, e.g., see literature.
The increments at the end of the titration are too large. "Overshoots".	• Lower "max.rate". The following experiment gives you a reference point for the optimum max.rate: Drift display during conditioning and add sample without starting the titration. Select a value below the maximum drift as "max.rate". • Optimize setup of electrode and buret tip and improve stirring.
Solution becomes too brown at the end of the titration.	• The methanol fraction in the solvent is too low. Change the solvent. • Electrode could be coated; wipe off with acetone.
Solution becomes darker with every titration.	• Renew solvent. • Electrode could be coated; wipe off with acetone.
The drift increases with every titration.	• Does your sample evolve water extremely sluggishly? Work with the KF oven. • Are acids esterified in your sample? Change solution more frequently. Increase buffer capacity of the solvent. • Does your sample contain ketones or aldehydes? Use special reagents suitable for ketones and aldehydes.
The endpoint is reached "too rapidly".	• Reduce "max.rate".
The titration times become longer and longer.	• With 2-component reagents the buffer capacity of the solvent can be exhausted. Change solution. • If the drift increases at the same time, see above.

2.6.4 Parameters for STAT



control parameters:
for reaching the control point.
titration parameters
control the global course of the titration.
stop conditions:
Parameters for automatic termination of the titration.
statistics:
Calculation of mean values and standard deviation, see page 77.
evaluation:
Evaluation of rates, fix volumes and fix times.
monitoring
of limit values for the measured value, temperature and rate.
preselections:
ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.

>control parameters

Control parameters

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 µA, OFF)
<CLEAR> sets "OFF".

---

dynamics **1**
***titr.**

Controlling 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 µA, OFF)
<CLEAR> sets "OFF".
"OFF" means largest control range, i.e. always controlled reagent addition.
Outside: constant dosing, see also page 51.

---

max.rate **10.0 ml/min**
***titr.**

Maximum dosing rate (0.01...150 mL/min, max.)
<CLEAR> sets "max.".
This parameter determines primarily the addition rate outside the control range, see page 51.
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 µl/min ***titr.**	*Minimum dosing rate (0.01...9999 µL/min)* This parameter determines the addition rate in the range of the control point. Rule of thumb for "min.rate" in µL/min = (expected rate of the reaction in µL/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.": relative start volume to sample size.
start V 0.0 ml	If "abs." is set: *Absolute start volume (0...999.99 mL)*
factor 0	If "rel." is set: *Factor for relative start volume (0...±999 999).* Calculated as: start V (in mL) = factor∗sample size
dos.rate max. ml/min ***titr.**	*Dosing rate for 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.**	*Waiting time after start volume (0...999 999 s)* Waiting time, e.g. for equilibration of the electrode after start or reaction time after dosing of a start volume. The waiting time can be aborted with <QUIT>.
start time 0 s	*Start time for data acquisition (0...999 999 s)* Measured values will be acquired only after the start time has elapsed.
start pH OFF	*Start measured value for data acquisition (input range depends on the measured quantity:* *pH: 0...±20.00, OFF* *U, Ipol: 0...±2000 mV, OFF* *Upol: 0...±200.0 µA, OFF)* <CLEAR> sets "OFF". Measured values will be acquired only after start of measured value has been reached.

start rate OFF ml/min	*Start rate for data acquisition (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 for data acquisition (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	*Direction is set automatically (+, -, auto)* auto: The direction is set automatically by the Titrino (sign [U_{init} - EP]). +: Direction of higher pH, higher voltage (more "positive"), larger currents. - : Direction of lower pH, lower voltage, smaller currents.
dos.element: internal D0	*Selection of dosing element (internal D0, external D1, external D2)* internal D0: internal buret of the Titrino external D1/2: buret D1, D2, resp.
meas.input: 1	*Measuring input for pH and U. (1, 2, diff.)* Request only with measured quantities pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 216.
	With polarized electrodes, instead of the measuring input the
I(pol) 1 µA	*polarization current (-127...127 µA)*
	or the
U(pol) 400 mV	*polarization 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 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 last measured value 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., delta, delay, OFF)* "abs": absolute stop time in s "rel.": relative stop time to sample size. "delta" Time after having reached the EP the first time. "delay" Time after last dosing increment. "OFF": stop time switched off. Stop time is not monitored. See page 52.
stop time 999999 s **t(delta) 999999 s** **t(delay) 999999 s** ****titr.***	If "abs.", "delta" or "delay" are set: *Request of time (0...999 999 s)*
factor 999999 ****titr.***	If "rel." is set: *Factor for relative stop time (0...±999 999)* Calculated as: Stop time (in s) = factor∗sample size
stop V: abs. ****titr.***	*Type of stop volume (abs., rel., OFF)* "abs.": absolute stop volume in mL. "rel.": relative stop volume 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 relative stop volume (0...±999 999)* Calculated as: Stop V (in mL) = factor∗sample size
stop rate OFF ml/min ****titr.***	*Stop when dosing rate is smaller than the preset 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

>evaluation	**Evaluation** see also page 54.
low lim.1 OFF s **up lim.1 OFF s**	*Evaluation of dosing rates within time windows (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 fixed 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 times at volume ratios at the end V (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	**Monitoring of limit values** Out of limits are marked in the measuring point list. Measured values and temperatures are only stored in the measuring point list if their monitoring is active.
meas.val: OFF ***titr._**	*Monitoring of measured values (ON, OFF)* With "on" follow the requests:
low lim. pH -20.00 **up lim. pH 20.00** ***titr**	*Limits for measured values (input range depends on the measured quantity):* *pH: 0...±20.00* *U, Ipol: 0...±2000 mV* *Upol: 0...±200.0 µA)*
action: none ***titr.**	*Action if a limit is exceeded (end, hold, wait, none)* end: Abort. hold: Hold reagent addition until manually restarted. wait: Hold reagent addition until limits are again complied with, then continue automatically.

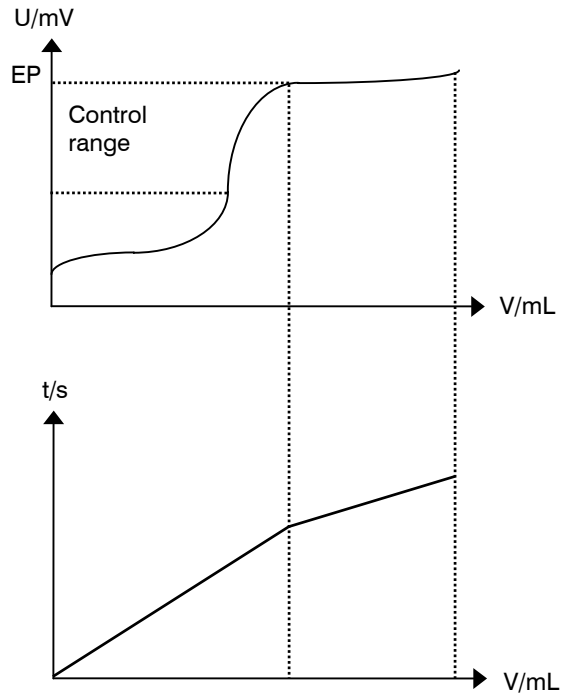
rate: OFF ***titr._**	*Monitoring of rate (ON, OFF)* With "on" follow the requests:
low lim. 0.000 ml/min **up lim. 150 ml/min**	*Limit values (0.000...150 mL/min)*
action: none ***titr.**	*Action if a limit is exceeded (end, hold, wait, none)* end: Abort. hold: Hold reagent addition until manually restarted. wait: Hold reagent addition until limits are again complied with, then automatically continue. If the lower limit has been exceeded, "wait" is senseless as the rate will only become smaller during the waiting time-
temperature: OFF ***titr._**	*Monitoring of temperature (ON, OFF)* With "on", the following requests:
low lim. -170.0 °C **up lim. 500.0 °C**	*Limit values (-170.0...500.0°C)*
action: none ***titr.**	*Action if a limit is exceeded (end, hold, wait, none)* end: Abort. hold: Hold reagent addition until manually restarted. wait: Hold reagent addition until limits are again complied with, then continue automatically.
assign output L10: none	*Assignment of output L10 for monitoring (meas, temp, rate, all, none)* A signal can be output at L10 (pin 8) of the remote socket if a limit has been violated.
violated limit: any	*Assignment of a violated limit (any, upper, lower)* The signal will be set if the assigned limit is violated.
output L10: pulse	*Type of signal to be set when limits are violated. (active, pulse)* active: Output line is set to 0 V. pulse: Pulse > 100 ms. Important: An active line will be set inactive with an impulse! Same possibilities for lines L11, L12, L13. Pin assignment on socket "Remote": L10 Pin 8 L11 Pin 13 L12 Pin 19 L13 Pin 20

>preselections		**Preselections for the sequence**
req.ident:	**OFF**	*Request of sample identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size:	**OFF**	*Request of sample size after start of titration (value, unit, all, OFF)*
limit smpl size:	**OFF**	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim.	**0.0**	*Lower limit for sample size (0.0...999 999)*
up lim.	**999999**	*Upper limit for sample size (0.0...999 999)*
display rate:	**OFF**	*Display rate (ON, OFF)* Display current rate during the titration.
activate pulse:	**OFF**	*Pulse output on line "activate" (L6, pin 1) of the remote socket (ON, OFF)* see page 224.

Sequence for STAT

<START>	
(Activate pulse) (Stirrer ON)	After the start, the activate pulse is output and the stirrer switched on.
(Start delay)	The start delay time is waited off.
(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested.
(Start conditions)	The start volume is dispensed (without controlling or measured value acquisition and there is no monitoring during this time) and the pause is waited off. Then the other start conditions are worked off in the order given below: Start time Start measured value Start rate During this time the controlling is active as well as the monitoring. However, there is no acquisition of measured values.
Controlling Acquisition of meas. (Monitoring)	Once the start conditions have been met, measured values (time, volume) are acquired and stored in the measuring point list. If monitoring of measured values and/or temperature is active, these values will also be stored in the measuring point list. If limits are violated it will be marked in the measuring point list. If a T sensor is connected, the temperature is measured continuously (in intervals of 2 s). In pH titrations, the pH will be corrected as a function of temperature. Without T sensor the values are measured without interrupt by T measurements. The manually set temperature is then valid.
Stop conditions	The titration is terminated according to the first stop criterion which has been met.
(Stirrer OFF)	Stirrer is switched off.
Calculations	Evaluations and calculations are carried out. The measuring point list is the base for evaluations (and curves).
Data output	Data are output.

Control parameters



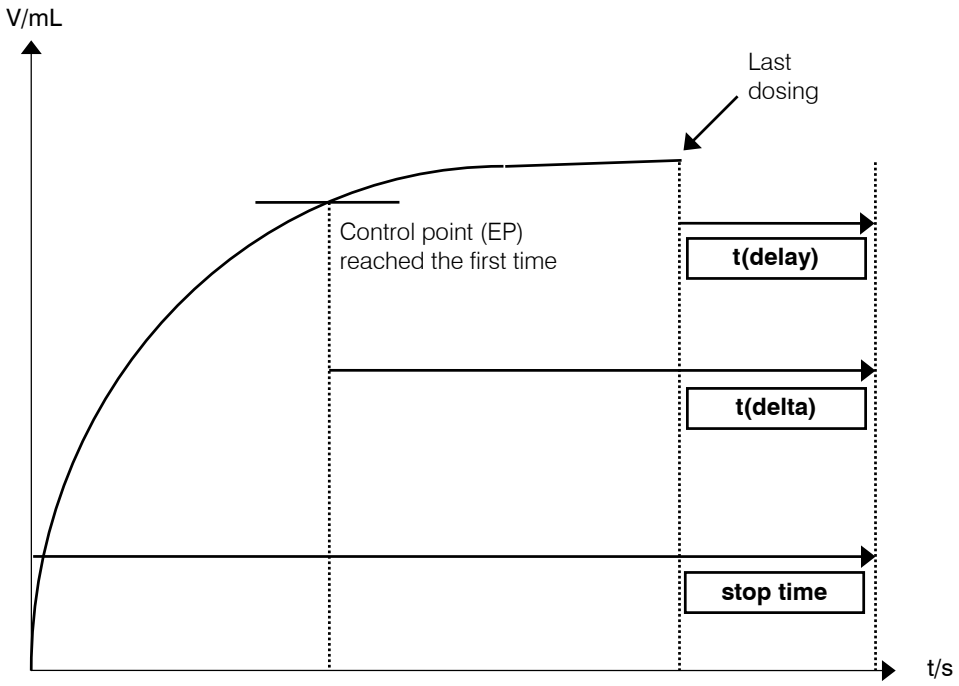
Dosing outside the control range:
The dosing rate is given mainly by the parameter "max.rate".
Optimize the parameters "max.rate" and "dynamics" together to avoid overtitration the first time the control point is reached.
Set "dynamics" such that the measured value lies inside the control range during the phase where the value is kept. Set "dynamics" to e.g. pH=3, U=180 mV for slow reactions.
You can also make a SET pretitration to reach the control point. In this case, "dynamics" of the STAT titration is not very crucial.

Dosing inside the control range:
Here the dosing rate is given mainly by the parameter "min.rate".
Rule of thumb for "min.rate" in µL/min = (expected rate of the reaction in µL/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 buret tip properly, see page 218. • Are the tubing lengths kinked? • Possibly use Exchange Unit with a small cylinder volume (smaller volume increment per pulse).
Time for reaching the control point is too long.	• Set "dynamics" smaller. • Set "min.rate" higher. • Set "max.rate" higher.

Stop times



Stop time: The stop time runs over the whole controlling time of the determination: It starts after dosing of the start volume and after the pause:
The stop time can be absolute (in s) or relative to the sample size (time (in s) = factor∗smpl size).

t(delta): t(delta) starts after controlling point (EP) has been reached the first time.

t(delay): t(delay) can be used as "after reaction time". It starts after the last dosing step, i.e. with every dosing, t(delay) will be restarted from zero.

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 during the refilling time, 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 the determination is stopped.
- The measuring point list always includes the values of time and volume. If monitoring of measured values and/or temperature is active, the corresponding values are entered too.
- The "mess." column shows a message if a limit value was exceeded in the last time interval, see example below. "* " is used to mark if dosing 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
799 GPT Titrino      01102     799.0010
date  2001-09-14   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
30          0.9140   3.039   35.7 limit
60          1.0010   3.056   36.0 temp.
90          1.0780   3.022   36.2
120         1.1470   2.972   36.4 meas
150         1.2250   3.018   36.5 *
:
:
```

← More than 1 monitored quantity violated.

← Temperature limit violated.

← pH limit violated.

← Dosing interruption.

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.

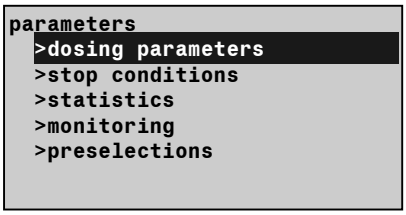
Fix time C6X

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
799 GPT Titrino      01102     799.0010
date  2001-09-14   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 <-- Specified time window for rate evaluation: 40...100 s.
60          1.0010   3.056   36.0
90          1.0780   3.022   36.2
120         1.1470   2.972   36.4 <-- Used for the regression: 30...120 s
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 <-- Fix time: 0.8 V(tot) ⇒ 1650 s
1680        6.3465   2.975   37.0
:
```

2.6.5 Parameters for DOS



dosing parameters
control the dosing
stop conditions:
Parameters for termination.
statistics:
Calculation of mean values and standard deviation, see page 77.
monitoring
of limit values for the measured value and temperature.
preselections:
ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.

>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 requests which appear depend 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. Waiting 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)
Waiting time, e.g. for stabilization of the electrode after start. The waiting 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.

dos.element: internal D0

Selection of dosing element (internal D0, external D1, external D2)
internal D0: internal buret of the Titrino
external D1/2: buret D1, D2, resp

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 are corrected accordingly. The last measured value 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 (abs., rel., OFF)* "abs": absolute stop volume in mL "rel.": relative stop volume to sample "OFF": stop volume switched off, not monitored. If "abs." is set:
stop V 99.99 ml ****titr.**	*Absolute stop volume (0...99 999.99 mL)*
factor 999999 ****titr.**	If "rel." is set: *Factor for relative stop volume (0...± 999 999)* Calculated as: 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
>monitoring	**Monitoring of measured values** Limit value violations are marked in the measuring point list. Measured values and temperatures are only stored in the measuring point list if their monitoring is active.
meas.mode: OFF ****titr._**	*Measured values (pH, U, Ipol, Upol, OFF)* If ≠ "OFF" follow the requests:
meas.input: 1	*Measuring input (1, 2, diff.)* Request only with measuring modes pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 216.

	With polarized electrodes, the request of the measuring input is replaced by one regarding the
I(pol) 1 µA	*polarization current (-127...127 µA)*,
	or the
U(pol) 400 mV	*polarization voltage (-1270...1270 mV, in steps of 10 mV)*
electrode test: OFF	*Electrode test (OFF, ON)* Test for polarized electrodes. Performed on the switchover from inactive basic status to a measurement. "OFF" means the test is not performed.
low lim. pH -20.00 **up lim. pH 20.00** ****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 µA)*
action: none ****titr.**	*Action if a limit is exceeded (end, hold, wait, none)* end: Abort hold: Hold reagent addition until manually restarted. wait: Hold reagent addition until limits are again complied with, then continue automatically.
temperature: OFF ****titr._**	*Monitoring of temperature (ON, OFF)* With "on", the following requests:
low lim. -170.0 °C **up lim. 500.0 °C**	*Limits (-170.0...500.0 °C)*
action: none ****titr.**	*Action if a limit is exceeded (end, hold, wait, none)* end: Abort hold: Hold reagent addition until manually restarted. wait: Hold reagent addition until limits are again complied with, then continue automatically.
assign output L10: none	*Assignment of output I/O lines (meas, temp, all, none)* L10 output sets a signal when values are out of limit (pin 8). With an assignment, the following requests:
violated limit: any	*Assignment of a violated limit (any, upper, lower)* The signal will be set if the assigned limit is violated.
output L10: pulse	*Type of signal to be set when limits are violated. (active, pulse)* active: Output line is set to 0 V. pulse: Pulse > 100 ms. Important: An active line will be set inactive with an impulse!

		Same possibilities for lines L11, L12, L13. Pin assignment on socket "Remote": L10 Pin 8 L11 Pin 13 L12 Pin 19 L13 Pin 20
>preselections		**Preselections for the sequence**
req.ident:	**OFF**	*Request of sample identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size:	**OFF**	*Request of sample size after start of titration (value, unit, all, OFF)*
limit smpl size:	**OFF**	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim.	**0.0**	*Lower limit for sample size (0.0...999 999)*
up lim.	**999999**	*Upper limit for sample size (0.0...999 999)*
activate pulse:	**OFF**	*Pulse output on line "activate" (L6, pin 1) of the remote socket (ON, OFF)* see page 224.

Sequence with DOS

<START>	
(Activate pulse)	After the start, the activate pulse is output.
(Start delay)	The start delay time is waited off.
(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested.
(Pause)	The pause is waited off. During this time the limits are not yet monitored.
Dosing Acquisition of meas. (Monitoring)	During the dosing, measured values (time, volume) are acquired and stored in the measuring point list. If monitoring of measured values and/or temperature is active, these values will also be stored in the measuring point list. If limits are violated it will be marked in the measuring point list. If a T sensor is connected, the temperature is measured continuously (in intervals of 2 s). The pH will be corrected as a function of temperature. Without T sensor the values are measured without interrupt by T measurements. The manually set temperature is then valid. In dosings which use "time" or "rate" as dispensing type, the volume goes up to 99 999.99 mL. After that it will be set to zero and the dosing continues. The dosing is terminated when the dosing volume or the dosing time is reached.
Calculations	Calculations are carried out.
Data output	Data are output. The measuring point list is the base for curves.

Filling times

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

$$\text{filling rate (in s)} = \frac{\text{max.fill.rate}}{\text{curr.fill.rate}} * 20\text{s} + 3\text{s}$$

The max. filling rate depends on the Exchange unit installed, see page 56. The filling times (incl. stopcock rotation) can be estimated with the aid of the following table and taken into account in your dosing 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 (disp.time)= 60 min.
Dispensed volume (disp.vol.)= 1000 mL
Filling time (fill.time)= 23 s (filling rate = max.)
Volume of the Exchange Unit = V(B) = 50 mL

Number of refills (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:

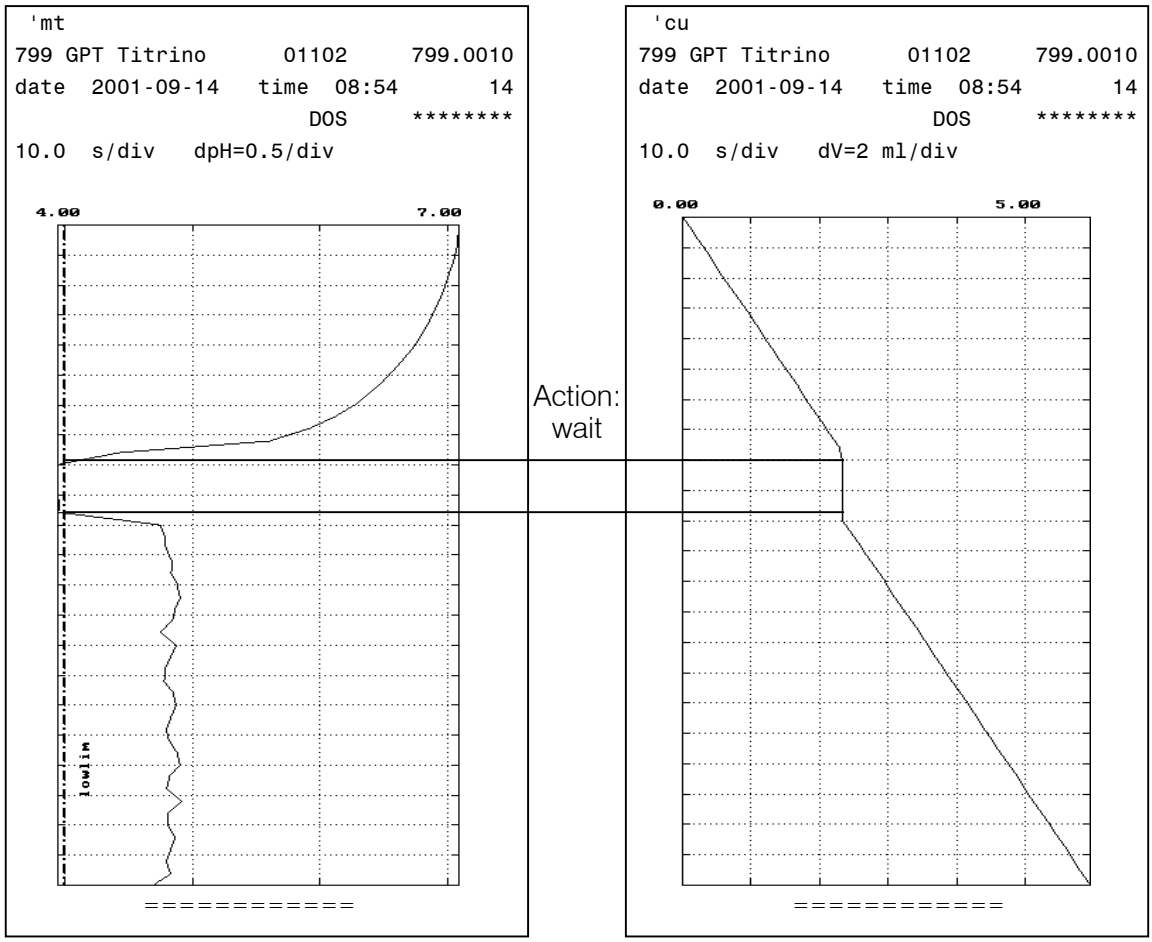
$$\text{Dispensing rate} = \frac{\text{disp.vol.}}{\text{disp.time} - \text{refills} * \text{fill.time} * 1/60} = \frac{1000}{60 - 19 * 23 * 1/60} = 18.972$$

Measuring point list and monitoring

- Measured points are entered in the measuring point list at the preset time interval. The input times represent the clock time. This must be distinguished from the dispensing time: The dispensing time does not include any waiting 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 53. "*" 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 end volume (C41) can be used for calculations.

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") Curve volume vs. time ("curve")



2.6.6 Parameters for DOC

parameters >dosing parameters >stop conditions >statistics >monitoring >preselections	**dosing parameters** control the dosing **stop conditions:** Parameters for termination. **statistics**: Calculation of mean values and standard deviation, see page 77. **monitoring** of limit values for the measured value and temperature. **preselections**: ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.
>dosing parameters	**Dosing parameters**
begin at pH 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 µA, init)* <CLEAR> sets "init" = initial measured value.
end at pH 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 µA, 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.*	*Control range (input range depends on the measured quantity:* *pH: 0...20.00, OFF* *U, Ipol: 0...±2000 mV, OFF* *Upol: 0...±200.0 µA, 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 68.

max.rate **max. ml/min**
***titr.**

Maximum rate (0.01...150 mL/min, max.)
<CLEAR> sets "max.".
This parameter primarily determines the addition rate outside the control range, see also page 68.
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 µl/min**
***titr.**

Minimum rate (0.01...9999 µL/min)
This parameter determines the rate within the control range.

direction: **auto**

Direction is set automatically (+, -, auto)
auto: The direction is set automatically by the Titrino [U_{init} -U_{end}]).
+: Direction of higher pH, higher voltage (more "positive"), higher current.
- : Direction of lower pH, lower voltage, lower currents.
The direction is used only when "init" has been selected as start value.

start V: **OFF**

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

If "abs." is set:
start V **0.0 ml**
Absolute start volume (0...999.99 mL)

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

dos.rate **max. ml/min**
***titr.**

Dosing rate for 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**

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

time interval **10 s**

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.

dos.element: internal D0	*Selection of dosing element (internal D0, external D1, external D2)* internal D0: internal buret of the Titrino external D1/2: buret D1, D2, resp.
meas.input: 1	*Measuring input (1, 2, diff.)* Measuring input for pH and U. Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 215.
I(pol) 1 µA **U(pol) 400 mV**	With polarized electrodes, the request of the measuring input is replaced by one regarding the *polarization current (-127...127 µA)*, or the *polarization voltage (-1270...1270 mV, in steps of 10 mV)*
electrode test: OFF	*Electrode test (OFF, ON)* Test for polarized 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 are corrected accordingly. The last measured value is entered as the "temperature" parameter.
>stop conditions	**Stop conditions**
stop V: abs. ****titr.***	*Type of stop volume (abs., rel., OFF)* "abs": absolute stop volume in mL "rel.": relative stop volume 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 relative stop volume (0...±999 999)* Calculated as: 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

>monitoring	**Monitoring of measured values** Limit value violations are marked in the measuring point list. Measured values and temperatures are only stored in the measuring point list if their monitoring is active.
meas.val: OFF ***titr._	*Monitoring of measured values (ON, OFF)* With "ON", the following requests:
low lim. pH -20.00 **up lim. pH 20.00** ***titr**	*Limits for measured values (input range depends on measured quantity:* *pH: 0...±20.00* *U, Ipol: 0...±2000 mV* *Upol: 0...±200.0 µA)*
action: none ***titr.**	*Action if a limit is exceeded (end, hold, wait, none)* end: Abort hold: Hold reagent addition until manually restarted. wait: Hold reagent addition until limits are again complied with, then continue automatically.
temperature: OFF ***titr._	*Monitoring of temperature (ON, OFF)* With "ON", the following requests:
low lim. -170.0 °C **up lim. 500.0 °C**	*Limits for measured values (-170.0...500.0 °C)*
action: none ***titr.**	*Action if a limit is exceeded (end, hold, wait, none)* end: Abort hold: Hold reagent addition until manually restarted. wait: Hold reagent addition until limits are again complied with, then continue automatically.
assign output L10: none	*Assignment of output I/O lines (meas, temp, all, none)* L10 output sets a signal when values are out of limit (pin 8). With an assignment, the following requests:
violated limit: any	*Assignment of a violated limit (any, upper, lower)* The signal will be set if the assigned limit is violated.
output L10: pulse	*Type of signal to be set when limits are violated. (active, pulse)* active: Output line is set to 0 V. pulse: Pulse > 100 ms. Important: An active line will be set inactive with an impulse! Same possibilities for lines L11, L12, L13. Pin assignment on socket "Remote": L10 Pin 8 L11 Pin 13 L12 Pin 19 L13 Pin 20

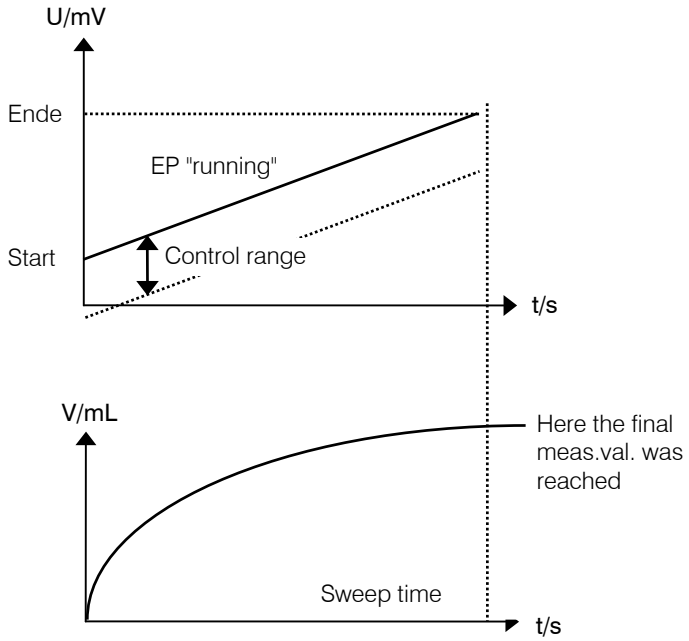
>preselections		**Preselections for the sequence**
req.ident:	**OFF**	*Request of sample identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size:	**OFF**	*Request of sample size after start of titration (value, unit, all, OFF)*
limit smpl size:	**OFF**	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim.	**0.0**	*Lower limit for sample size (0.0...999 999)*
up lim.	**999999**	*Upper limit for sample size (0.0...999 999)*
display rate:	**OFF**	*Display rate (ON, OFF)* Display current rate during the titration.
activate pulse:	**OFF**	*Pulse output on line "activate" (L6, pin 1) of the remote socket (ON, OFF)* see page 224.

Sequence with DOC

<START>	
(Activate pulse) (Stirrer ON)	After the start, the activate pulse is output and the stirrer switched on.
(Start delay)	The start delay time is waited off.
(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested.
(Start conditions)	The start volume is dispensed (without controlling or measured value acquisition and there is no monitoring during this time) and the pause is waited off.
Controlling Acquisition of meas. (Monitoring)	Once the start conditions have been met, measured values (time, volume) are acquired and stored in the measuring point list. If monitoring of measured values and/or temperature is active, these values will also be stored in the measuring point list. If limits are violated it will be marked in the measuring point list. If a T sensor is connected, the temperature is measured continuously (in intervals of 2 s). In pH titrations, the pH will be corrected as a function of temperature. Without T sensor the values are measured without interrupt by T measurements. The manually set temperature is then valid.
Termination	The determination is terminated when the end of the measured value ramp is reached, i.e. after the sweep time. If measured value monitoring is active, the current measured value also must have reached the end of the ramp.
(Stirrer OFF)	The stirrer is switched off.
Calculations	Calculations are carried out.
Data output	Data are output. The measuring point list is the base for curves.

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 controlled so 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 values is still outside of the control range, the dosing rate is mainly given by the parameter "max.rate".

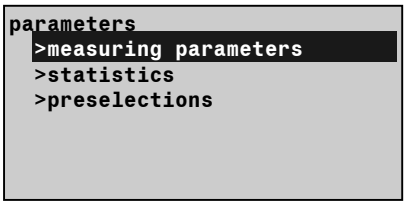
If the current measured values is inside the control range, the dosing rate is mainly given by the parameter "min.rate".

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 53. "*" 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.
- If the last measured value is important, set the sweep time 1 s higher than the last expected measured value, i.e. sweep time = (time interval∗number meas.values)+1.

2.6.7 Parameters for MEAS



measuring parameters
determine the measurement.
statistics:
Calculation of mean values and standard deviation, see page 77.
preselections:
ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.

>measuring parameters

Measuring parameters

signal drift OFF mV/min

Drift criterion for measured value acquisition (input range depends on the measured quantity:
pH, U, Ipol: 0.5...999 mV/min, OFF
Upol: 0.05...99.9 µA/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

Waiting time for measured value acquisition (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

$$\text{equilibr.time (in s)} = \frac{150}{\sqrt{\text{Drift} + 0.01}} + 5$$

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

Measuring input for pH and U. (1, 2, diff.)
Inquiry only with measured quantities pH and U.
Measuring input 1 or 2 or differential amplifier; connection of electrodes, see page 215.

With polarized electrodes, instead of the measuring input the

I(pol) 1 µA

polarization current (-127...127 µA)
or the

U(pol) 400 mV

polarization potential (-1270...1270 mV, in steps of 10 mV)
is inquired.

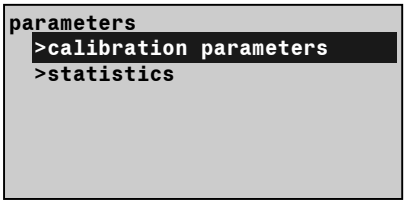
electrode test: OFF

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	*Temperature (-170.0...500.0 °C)* Temperature is measured at the start if a T sensor is connected. This parameter is used for temperature compensation in pH measurements.
time interval 2 s	*Time interval (1...999 999 s)* Time interval for acquisition of measured values.
>preselections	**Preselections for the sequence**
req.ident: OFF	*Request of sample identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size: OFF	*Request of sample size after start of titration (value, unit, all, OFF)*
limit smpl size: OFF	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim. 0.0	*Lower limit for sample size (0.0...999 999)*
up lim. 999999	*Upper limit for sample size (0.0...999 999)*
activate pulse: OFF	*Pulse output on line "activate" (L6, pin 1) of the remote socket (ON, OFF)* see page 224.

2.6.8 Parameters for CAL

The calibration interval may be monitored, see page 7.

	**calibration parameters** determine the calibration procedure. **statistics**: Calculation of mean values and standard deviation, see page 77.
>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 215.
cal.temp. 25.0 °C	*Calibration temperature (-20.0 ... 120.0 °C)* If a T sensor is connected, the temperature will be measured. The calibration temperature can also be input during the calibration sequence.
buffer #1 pH 7.00	*pH value of first buffer (0...±20.00)* The pH value of the buffers can be put in during the calibration sequence.
buffer #2 pH 4.00	*pH value of second and the following buffers (0...±20.00, OFF)* <CLEAR> sets "OFF".
buffer #3 pH OFF	Buffers are requested until "OFF" is set. This gives an n-point calibration. Up to 9 buffers. A regression line will be calculated in calibrations with more than 2 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 69. 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

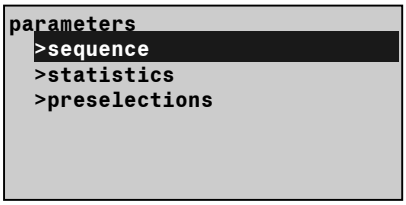
	hold points in the calibration sequence for inputs. Calibration temperature and pH values of the buffers (which are temperature dependent) must therefore be entered in advance. The inputs in key <PARAM> are valid.
activate pulse: OFF	*Pulse output on the line "activate" (L6, pin 1) of the remote socket (all, first, OFF)* See page 224.

Calibration sequence

<START>	
(Activate pulse)	After the start, the activate pulse is output.
(Start delay)	The start delay time is waited off.
Measuring cal.temp. or entry	Then, the calibration temperature is measured. It no T sensor is connected, you enter the temperature manually. Store the value with <ENTER> or continue with <START> (T is not stored).
Buffer 1 pH	Enter the nominal value of the first buffer. Store the value with <ENTER> or continue with <START> (the value is not stored).
Measuring buffer 1	The first buffer is measured.
Buffer 1 pH	Enter the nominal value of the second buffer. Store the value with <ENTER> or continue with <START> (the value is not stored). Leave the calibration with <STOP> ⇒ 1 point calibration.
Measuring buffer 2	The second buffer is measured.
etc.	As many buffers appear as have been specified in the <PARAM> key (up to 9). You may leave the calibration any time with <STOP>.
Data output	Data are output. The calibration data are available for calculation: C46: pHas C47: Electrode slope Calibration data can be viewed at any time with the <CAL.DATA> key and the calibration report printed out using the key sequence <PRINT><CAL.DATA><ENTER>.

2.6.9 Parameters for TIP

In TIP, several commands and methods can be linked to make a titration procedure. The TIP sequence can be defined with <DEF>, see page 85.



sequence
Parameters for the TIP sequence see page 86.
statistics:
Calculation of mean values and standard deviation, see page 77.
preselections:
ON/OFF of various auxiliary functions such as automatic requests after the start and activate pulse.

>preselections		**Preselections for the sequence**
req.ident.:	OFF	*Request of sample identifications after start (id1, id1&2, all, OFF)* After start, sample identifications can be inquired automatically: Only id1, id1 & id2, all three id's or no inquiries.
req.smpl size:	OFF	*Request of sample size after the start (value, unit, all, OFF)*
limit smpl size:	OFF	*Limiting value check for sample size (ON, OFF)* With "on" the error message "sample size out." appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If "on" has been set:
low lim.	0.0	*Lower limit for sample size (0.0...999 999)*
up lim.	999999	*Upper limit for sample size (0.0...999 999)*
meas.mode:	OFF	*Measured quantity (pH, U, Ipol, Upol, T, OFF)* Quantity for measurements with key <MEAS/HOLD>.
meas.input:	1	*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 215.
I(pol)	1 µA	With polarized electrodes, inquiry of *polarization current (-127...127 µA)* or
U(pol)	400 mV	*polarization potential (-1270...1270 mV, steps of 10 mV)*
electrode test:	OFF	*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)* Temperature for pH compensation. Its value has to be entered manually even if a T sensor is connected.

2.7 Result calculations

Formula entry, key <DEF>


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
  >temporary variables
```

Key <DEF> contains various inquiries for result calculations and data output. The data of this key are method specific and they are stored in the method memory together with the method.

formula:
Formulas for result calculations.

The display texts of the Titrino are shown to the left. The values are the default values.

```
>formula
```

Input of formulas

```
  RS?
```

Enter formula number (1...9)
You can calculate up to 9 results per method.
Enter a number 1...9.

```
  RS1=
```

Input of formula
Example:
RS1=EP1∗C01/C00
Enter formula by means of 3rd functions of keyboard. Here you will find operands, mathematical operations and parentheses. Operands require a number as an identification. You can use the following operands:
EPX: EP's. X = 1...9
RSX: Results which have already been calculated with previous formulas. X = 1...9.
CXX: Calculation constants. XX = 00...89.

```
  RS1=EP1*C01/C00
```

Rules:
- Calculation operations are performed in the algebraic hierarchy: ∗ and / before + and -.
- Store formula with <ENTER>.
- Calculation quantities and operands can be deleted with <CLEAR> one by one.
- To delete a complete formula press <CLEAR> repeatedly until only RSX remains in the display. Confirm with <ENTER>.

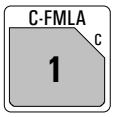
If a formula is stored with <ENTER>, result text, number of decimals and result unit will be requested:

RS1 text	**RS1**	*Text for result output (up to 8 characters)* Text input see page 6.
RS1 decimal places	**2**	*Number of decimal places for result (0...5)*
RS2 unit:	**%**	*Selection of result unit (%, ppm, g/L, mg/mL, mol/L, mmol/L, g, mg, mL, mg/pc, s, mL/min, no unit or up to 6 characters).*
RS1 limit control:	**OFF**	*Limit control for the result (on, off)* The limits are checked each time a result is calculated.
		If "on" has been set:
RS1 low lim.	**0.0**	*Lower limit (0.0...999 999)*
RS1 up lim.	**0.0**	*Upper limit (0.0...999 999)*
RS1 L13 output:	**OFF**	*Sets line L13 of the remote socket (OFF, active, pulse)* if the result lies outside the limits.
		Enter next formula, e.g. for RS2.

Meaning of the calculation variables CXX:

C00	Sample size, see page 95.
C01...C19	Method specific operands, see page 76. They are stored with the method in the method memory.
C21...C23	Sample specific operands, see page 95ff.
C26, 27	Mean values from silo calculations.
C30...C39	Common variables.
C40	Initial measured value of the sample, last measured value in MEAS.
C41	End volume.
C42	Determination time.
C43	Volume drift for KFT and SET with conditioning.
C44	Temperature.
C45	Dispensed start volume.
C46	Asymmetry-pH (calibration).
C47	Electrode slope (calibration).
C48	Volume value at maximum voltage in the curve (for STAT, DOS, DOC measured value monitoring has to be active; no evaluation in CAL and TIP).
C49	Volume value at minimum voltage in the curve (for STAT, DOS, DOC measured value monitoring has to be active; no evaluation in CAL and TIP).
C51...C59	Fix EP for DET and MET or Fix V for STAT.
C61...C69	pK/HNP values for DET and MET or Fix V for STAT.
C70...C79	Temporary variables for calculations in TIP.
C80	Mean rate for STAT.
C81...C89	Rates, evaluated in preset time windows for STAT.

Input method specific operands C01...C19, key <C-FMLA>

	With <C-FMLA> the operands C01...C19 can be put in. For the calculation, the operands are used, which were introduced in the formula. The inputs method specific and are store in method memory.

The calculation report can be printed with the key sequence
<PRINT><←/→> (press keys repeatedly until "calc" appears in the display) <ENTER>

2.8 Statistics calculation

Mean values, absolute and relative standard deviations are calculated.


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
  >temporary variables
```

The <DEF> key is used to allocate results for statistics calculation.
The entries are specific to the method and are stored in the method memory.

mean:
Assigns values for statistics calculations.

The display texts of the Titrino are shown to the left.
The values are the default values.

```
>mean

   MN1=RS1
   MN2=
   :
   MN9=
```

Allocations for statistics calculations

Number n of single values for statistics calculation. (1...9)
You can perform statistics calculation using up to 9 results (RSX), endpoints (EPX) or variables (CXX). For MN1, the default value RS1 is entered.
Delete allocation with <CLEAR> + <ENTER>

Each mode has an inquiry group ">statistics" in key <PARAM>

```
>statistics

   status:              OFF

     mean               n=  2

     res.tab:           original

     delete             n=  1
```

Statistics calculation

Status of statistics calculation (OFF, ON)
If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.

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

Result table (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 data from sample number n (1...20)
The deleted result is removed from the statistics calculation.

How do you obtain statistics calculations?

1) Enter the allocations for the statistics calculation, see page 77.
2) Switch on the statistics calculations: Either with <STATISTICS> or set the status under <PARAM>, "> statistics" to "ON". The "STATISTICS" LED is on. Storing a method in the method memory, the status of the statistics calculation is retained.
3) Change the number of the individual values n under "mean n", if necessary.
4) Perform at least 2 titrations. The statistics calculation are constantly updated and printed. The values are printed in the short and full result report.
5) The statistics report can be printed with <PRINT><STATISTICS><ENTER>.

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 calculation 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.
- If you delete results, 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 can be deleted with "delete all" (<PARAM>, ">statistics", "res.tab:").

2.9 Common variables

Common variables are used for:

- Determination of a titer with a method. This titer is stored permanently as C3X. The operand C3X can be used in various other methods like any other operand.
- Determination of a blank values with a method . Using this blank value in various other methods.
- Determination of a result with method. Reconciliation of this result in various other methods.

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


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
  >temporary variables
```

With <DEF>, results (RSX), endpoints (EPX), variables (CXX) or mean values (MNX) can be allocated as common variables.
The entries are specific to the method and are stored in the method memory.

common variables:
Assigns values as common variables.

The display texts of the Titrino are shown to the left.
The values are the default values.

```
>common variables

   C30=
   C31
   :
   C39=
```

Allocation for common variables

Common variable C30...C39 (RSX, EPX, CXX, MNX)
Results (RSX), endpoints (EPX), variables (CXX), and means (MNX) can be assigned.
The values of the common variables remain in force for all methods until they are overwritten or deleted. They can be viewed under the <CONFIG> key.
Delete allocation with <CLEAR>+<ENTER>.

2.10 Data output

2.10.1 Reports for the output at the end of a determination


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
  >temporary variables
```

With <DEF>, 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 report blocks to be printed automatically at the end of the determination.

The display texts of the Titrino are shown to the left.
The values are the default values.

>report

report COM1:

Report sequence for COM1 (input range depends on the mode:
DET: full, short, mplist, curve, derive, comb, scalc full, scalc srt, param, calc, calib, ff
MET, SET, MEAS: full, short, mplist, curve, scalc full, scalc srt, param, calc, calib, ff
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
CAL: full, short, scalc full, scalc srt, param, calc, calib, ff
KFT: full, short, mplist, curve, scalc full, scalc srt, param, calc, ff
TIP: full, short, scalc full, scalc srt, param, calc, ff

report COM1:full;curve

Select a block. If you require more than one report block, set a ";" as a delimiter between the blocks.

Identical for COM2.

Meaning of the report blocks:

full	Full result report with raw results, calculations and statistics.
short	Short result report with calculations and statistics.
mplist	Measuring point list.
curve	Titration curve (with DET and MET) or volume vs. time (with SET, KFT, STAT, DOS, and DOC) or measured value vs. time (with MEAS)
derive	1st derivative of the titration curve (with DET)
comb	Combined titration curve and 1st derivative (with DET)
meas crv	Measured value vs. time (with STAT, DOS and DOC; monitoring of meas active).
temp crv	Temperature vs. time (with STAT, DOS and DOC; monitoring of temperature 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 put out automatically at the end of the titration can be printed with recalculated 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 reports:

Full result report

```
 'fr
799 GPT Titrino      01102     799.0010
date  2001-09-14   time  08:54       14
card label: Appl.799
pH(init)       2.88    DET pH  ********
smpl size     0.372 g
EP1           2.083 ml             7.64
RS1            3.80 g/L
device label   Titr 1        sign:
         ============
```

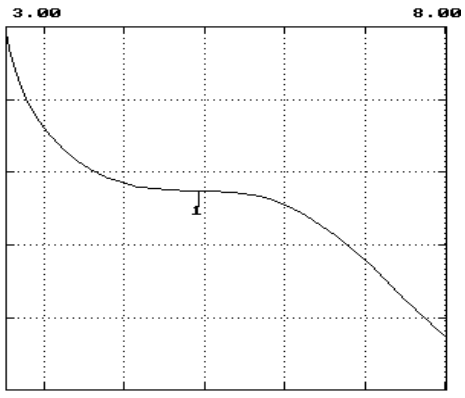
Card label if a card was inserted, see page 92.

Device label (if there is a designation) and manual signature

Titration curve

Scaling of volume and pH axis

```
 'cu
799 GPT Titrino      01102     799.0010
date  2001-09-14   time  08:54       14
start V    0.000 ml    DET pH  ********
1.0 ml/div      dpH=1.0/div
```




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

Additional possibilities for report outputs

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

1) <PRINT><←/→><ENTER> Cursor is pressed repeatedly until the desired report appears in the display.

2) <PRINT><keyX><ENTER> key X is the key under which the appropriate data are entered.

List of the "keys X":

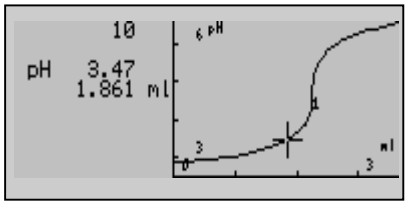
Report	<Key X>
Configuration report	CONFIG
Parameter report	PARAM
Current sample data	SMPL DATA
Statistics report with the individual results	STATISTICS
All sample data from the silo memory	SILO
Preparation of titration burets	PREP
Calibration data	CAL.DATA
Content of the current card directory	CARD
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 METH
Complete report sequence of the last determination, as defined under the <DEF> key in the method	REPORTS

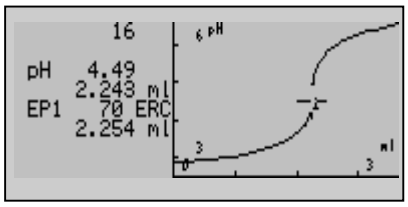
Result display without printer

If you work without printer, we recommend to work with the standard character set for result display (settings in key <CONFIG>, ">auxiliaries", see page 10). You will get the complete information on your determinations: Calculated results, endpoints, messages etc.

2.10.2 Display of the titration curve

After the titration, the curve can be viewed.
Switch between "curve" and "result display" with key <CURVE>.



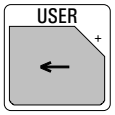


You can trace the curve with keys <↑> and <↓>. In the text field to the left of the curve the index of the current measured value is displayed in the first line. In the subsequent lines, the corresponding measured values are shown.

If you place the cursor in DET and MET curves onto the EP, the data of this EP are also shown.

- The EP number and its ERC (Endpoint Recognition Criterion).
- The EP volume.

2.11 User name, key <USER>




```
user
  name:                Boss
  >delete
```

The key <USER> manages the user names.
User names can be entered directly or selected with the keys <←> and <→>.

Name:
Selection or input of user name.
Delete:
Delete user name.

The display texts of the Titrino are shown below at the left.

```
   name:
```

User name (up to 10 ASCII characters)
User names can be entered directly or selected with the keys <←> and <→>.
The operator name is printed out in the report.
The operator name remains in the instrument until it is deleted (or until the RAM is initialized).
If no operator name is to be printed out the operator "blank" can be selected.

```
>delete
   name:
```

Delete user name
Enter the name directly or select it with the keys <←> and <→>. <ENTER> will delete the name from the list of user names.

2.12 TIP, Titration procedure

TIP (**Ti**tration **P**rocedure) is used to link several commands in a sequence.
TIP is selected with <MODE> and <ENTER>. TIP is an "empty shell" in which the sequence of the determination must be defined.

Definition of the sequence


```
def
  >sequence
  >formula
  >silo calculations
  >common variables
  >report
  >mean
```

With key <DEF> the TIP can be defined.

sequence:
of TIP.

The display texts of the Titrino are shown to the left.
The values are the default values.

```
>sequence

  1.step:              OFF
```

<ENTER>

```
  1.method:          5-TIP
```

<ENTER>

etc.

2 x <QUIT>

Sequence

Select a step with keys <←> and <→>:

method:	Method from the user memory or from the card.
pause:	Waiting time
L4, L6 output:	Set an output.
info:	Hold sequence and write a message into the display.
prep	Preparation of titrating burets.
stirrer	ON/OFF

Confirm the step with <ENTER> and enter the parameter for the selected step, see below.
The request for the second step follows etc. Up to 30 steps can be selected.
On completion of the sequence definition, exit the inquiry with <QUIT>.

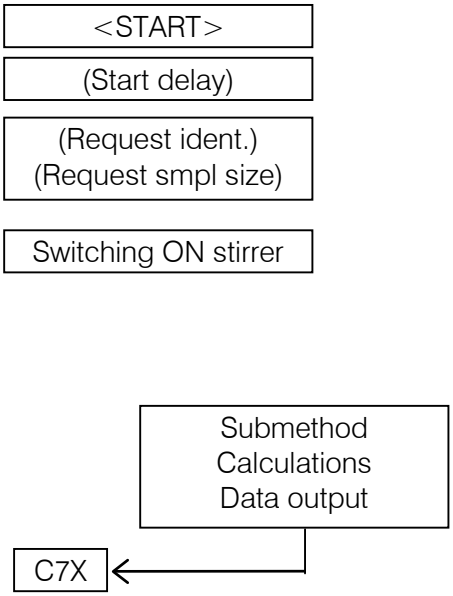
Information for the commands (steps):

Command	Meaning	Input range
method	Method from the user memory or from the card. This method runs as a submethod.	Name
pause	Waiting time. The waiting time can be aborted with <QUIT>. <CLEAR> sets "inf" (= infinitely long pause time).	0...999 999 s, inf.
L4, L6 output	Set L4 output (pin 3) resp. L6 output (pin 1) of the remote socket. active = 0 V, inactive = 5 V, pulse > 100 ms, off = output is not used. Cable Titrino (L6) - Dosimat: 6.2139.000. Important: A pulse (e.g. a pulse from monitoring or 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
prep	Preparation of titrating burets.	internal D0, external D1, external D2
stirrer	Switching stirrer ON/OFF. In TIP the stirrer is not switched automatically in the submethods. At the end of TIP the stirrer is switched off (if stirrer control is ON).	ON, OFF

The parameters of the sequence can be viewed and changed at any time under the <PARAM> 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 delay time is waited off.

The sample identifications and the sample size are requested.

Stirrer is switched on. The stirrer is not operated automatically in submethods of TIP. At the end of TIP, however, the stirrer is switched off (with stirrer control ON).

Submethods are processed according to their parameters. They run to completion, including calculations and data output (e.g. curves). The determination data of submethods 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.

The pause is waited off.

Outputs on the socket "Remote" 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>).

The titration burets can be prepared.

TIP higher-level calculations are carried out.

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

Preparation of submethods for use in TIP

All titration data, i.e. curves and lists of measured points must be put out 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:


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
  >temporary variables
```

With key <DEF> temporary variables can be assigned.
The entries are specific to the method and are stored in the method memory.

temporary variables
for higher-level calculations.

The display texts of the Titrino are shown to the left.
The values are the default values.

```
>temporary variables

   C70=
   C71=
   :
   C79=
```

Temporary variables

Assignment of result, endpoints or variables (RSX, EPX, CXX)
Values of the submethod to be used in TIP calculations.

Calculations in TIP

In TIP calculations variables C7X from different submethods can be used, formula entry see page 74.

Note:
We recommend to execute the calculations in TIP, as they can only be recalculated in TIP itself, e.g. with a different sample size.

2.13 Method memory, keys <USER METH> and <CARD>

2.13.1 Key <USER METH>


```
user methods
  >recall method
  >store method
  >delete method
```

Management of the internal method memory with key <USER METH>.
Select method name with keys <←> and <→>.

recall method:
Loads a method from the internal method memory into the working memory.
store method:
Stores the method which is in the working memory in the internal method memory.
delete method:
Deletes a method from the internal method memory.

The display texts of the Titrino are shown to the left. The values are the default values.

```
>recall method

   method name:
```

Recall method

Recall method from the internal method memory to the working memory (input of method name, which is included in the memory).
If a method identification is entered which is not found in the method memory, the selected value blinks.

```
>store method

   method name:
```

Store method

Store method from the working memory to the internal method memory (up to 8 ASCII characters).
If a method with an identical name is already stored, you are requested if you wish to overwrite the old method. With <ENTER> it is overwritten, with <QUIT> you return to the entry.

```
>delete method

   method name:
```

Delete method

Delete method from the internal method memory (input of method name, which is included in the memory).
For safety, 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 name is entered which is not found in the method memory, the selected value blinks.

The contents of the method memory can be printed 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 6.6008.XXX Vesuv program, you should carry out a complete method backup from time to time.
Making the backup on the card, pay attention of the exchange date of the battery!

2.13.2 Key <CARD>


```
user meth.
  >recall method
  >store method
  >delete method
  >change directory
  >create directory
  >delete directory
  >backup                    ↓
```

Management of the method memory on the card with key <CARD >.
Select names with keys <←> and <→>.

On the first line you find the name of the current directory (here user meth.).
recall method:
Loads a method from the current directory of the card into the working memory.
store method:
Stores the method, which is in the working memory, in the current directory of the card.
delete method:
Deletes a method from the current directory of the card.
change directory:
Changes the current directory of the card.
create directory:
Creates a new directory on the card.
delete directory:
Deletes a directory on the card.
backup:
Backup of the internal method memory on the card.
reload:
Reloads a backup from the card into the internal method memory.
format:
Formats the card.
change battery:
Date for changing the battery.

The display texts of the Titrino are shown to the left. The values are the default values.

```
>recall method
>store method
>delete method
```

Recall, store, delete method

Identical with the corresponding function of the internal method memory. The functions operate on the current directory of the card.

```
>change directory
>create directory
>delete directory

   dir.name:
```

Change, create, delete directory

If a directory is deleted, it is deleted together with all its methods.
(directory name with up to 10 characters)

>backup	**Backup of the internal method memory on the card**
dir.name:	*(directory name with up to 10 characters)* Existing methods in this directory will be deleted, and all methods from the internal method memory are stored in the directory.
>reload	**Reload methods from the card to the internal method memory**
dir.name:	*(directory name with up to 10 characters)* Primary all methods from the internal method memory are deleted. Afterwards all methods from the directory of the card are copied into the internal method memory.
>format	**Format the card**
card label	*Card label (with up to 8 characters)* The card label will be printed in the card report and in the full result report (if the card is inserted, see page 81).
format: no	*Confirmation of formatting the card (yes, no)* Upon formatting the card, all data on the card are deleted. After formatting a new card, the date for battery change must be entered.
>change battery	**Battery change date**
date	*Date for changing the battery (YYYY-MM-DD)* see page 93.

Possibilities of the card

Methods can be stored on the card.

- Simple exchange of methods between different users, laboratories, factories. Every user can use his card with his own methods. The user specific card label will be printed in the full result report, if the card remains inserted.
- Methods can be stored in different directories, e.g. in directories depending on the sample type or the user.
- The card can be used as an extended memory.
- You will find many application methods on the application card 6.6047.000.

Internal method memory and methods on the card

If methods are called from TIP or from the silo memory, the Titrino will search these methods primary in the internal method memory, and afterwards in the current directory of the card.
Important: We do not recommend not to store identical methods in the current directory of the card as well as in the internal method memory at the same time. Otherwise, you have to update both methods!

Card battery

The card is supplied by a battery. This battery must be changed periodically. Note the lifetime of the battery which is indicated in the manual of the card.
If the card is inserted in the Titrino you will receive a warning if the battery is low on switching on the Titrino or if the battery change date is expired.
The battery is in a case of the card. Read the note enclosed with the card before changing the battery. Leave the card in the Titrino when you change the battery to ensure sufficient power supply.
Important: The battery lifetime refers to a storing temperature of 25 °C. With higher temperatures, the lifetime is shorter.
Therefore do **not**

- carry the card on the body
- store the card near radiators
- have the card in the sun.

Write protection

The write protection prevents all functions, which write on the card (store methods, delete methods, change directory - the current directory is written on the card, create directory, delete directory, backup, format the card, change date of the card battery). Reading functions are possible.
Write protection is on, if the lash in front of the card is on the right.

Reports

- Methods of the current directory, key sequence <PRINT><CARD><ENTER>.
- Methods of the whole card: key sequence <PRINT><←/→><ENTER>; press the cursor keys repeatedly until "card" appears in the display.

Ordering designations

Memory card with 128 Kbytes memory space 6.2245.010
Application card with application file 6.6047.000

2.14 Calibration data, key <CAL.DATA>


```
cal.data
  >input 1
  >input 2
  >input diff.
```

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

input 1:
Calibration data for measuring input 1.
Identical for input 2 and diff.

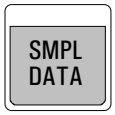
The display texts of the Titrino are shown to the left. The values are the default values.

>input 1	**pH calibration data for 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 (-20.0...120.0 °C)* Will be printed automatically after calibration with measuring input 1.
cal.date	*Date of 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. This date is the reference date for calibration monitoring, see page 7.
electr.id	*Electrode identification of calibrated electrodes (no entry possible)* If an electrode identification has been entered in the CAL mode, it is automatically entered after the calibration.

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

<PRINT><CAL.DATA><ENTER>.

2.15 Current sample data, key <SMPL DATA>




```
smpl data
  id#1 or C21
  id#2 or C22
  id#3 or C23
  smpl size          1.0 g
  smpl unit:             g
```

The key <SMPL DATA> can be used to enter the current sample data. The contents of this key change when the silo memory is switched on, see page 97.
Instead of entering the current sample data with <SMPL DATA>, you can request these data automatically after start of determinations.
Configuration: <PARAM>, ">preselections".
Current sample data can be entered live. For working with the silo memory see page 96.

id#1...3 or C21...C23, sample identifications:
The sample identifications can also be used as sample specific calculation variables C21...C23.

smpl size:
Sample size.
The sample size can be monitored, see e.g. page 19. The limits are then displayed in this window.

smpl unit:
Unit of the sample size.

The display texts of the Titrino are shown to the left. The values are the default values.

```
smpl data

    id#1 or C21
    id#2 or C22
    id#3 or C23

    smpl size          1.0 g

    smpl unit:             g
```

Sample data

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, via a balance with a special input device or via barcode reader.

Sample size (6-digit number: ±X.XXXXX)
Entry using keypad, via balance or via barcode reader.

Unit of sample size (g, mg, mL, µL, pc, no unit or up to 5 characters)
Select unit with <←/→>.

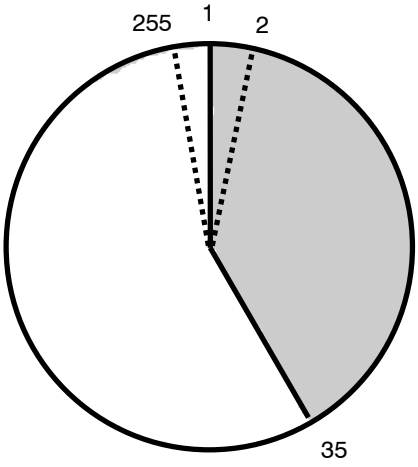
2.16 Silo memory for sample data

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 100.

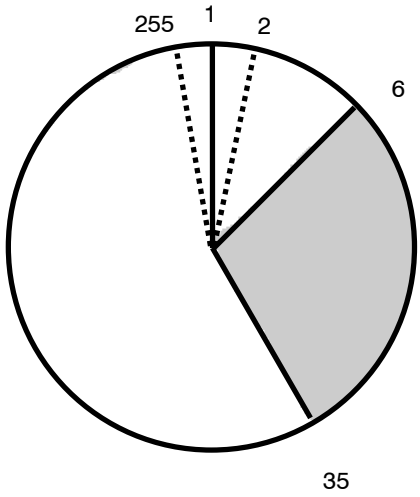
	Press the key <SILO> for working with the silo memory. The status LED "silo" is on when the silo memory is switched on. The silo memory works by the FIFO principle (First In, First Out).

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 put in, 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.

Organization 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 255 and from 1 to 6.

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

Filling the silo memory with a connected balance

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.

When the sample data are entered from a balance, the transfer of the sample size is taken as the end of the silo line. You should not send data from the balance and edit the silo memory at the same time.
For mixed operation, manual input of identifications and sample sizes from a balance, the values from the balance are sent into the line in which editing just takes place. Confirmed the data with <ENTER> at the Titrino.

Key <SMPL DATA> with the silo memory switched on


```
smpl data
  >edit silo lines
  >delete silo lines
  >delete all silo lines
  cycle lines:          OFF
  save lines:           OFF
```

Sample data can be entered into the silo memory with key <SMPL DATA>.

edit silo lines:
Entering sample data into the silo memory.
delete silo lines:
Deletes single silo lines.
delete all silo lines:
Deletes the whole silo memory.

The display texts of the Titrino are shown to the left. The values are the default values.

```
>edit silo lines

   silo line              1

   method:

   id#1 or C21
   id#2 or C22
   id#3 or C23

   smpl size          1.0 g

   smpl unit:             g
```

Input for silo memory

Silo line (1...255)
The next free line is displayed automatically. Lines already occupied can be corrected.

Method with which the sample is processed (method name from the method memory)
If no method name has been entered, the sample is processed with the method in the working memory. Selection of the method with <←/→>.

Sample identification 1..3 or sample specific calculation variables C21...C23 (up to 8 characters)

Sample size (6-digit number: ±X.XXXXX)
The method specific limits are tested on result calculation.

Unit of sample size (g, mg, mL, µL, pc, no unit or up to 5 characters)
Select unit with <←/→>.

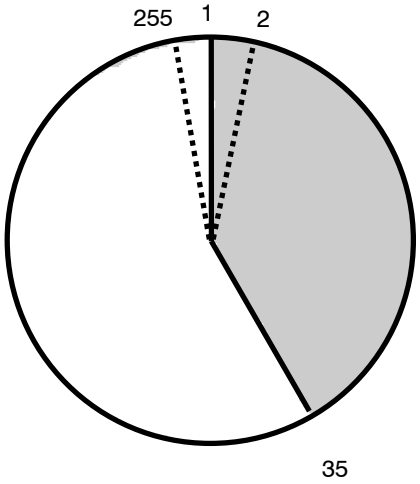
```
>delete silo lines

   delete line n        OFF
```

Delete individual silo lines

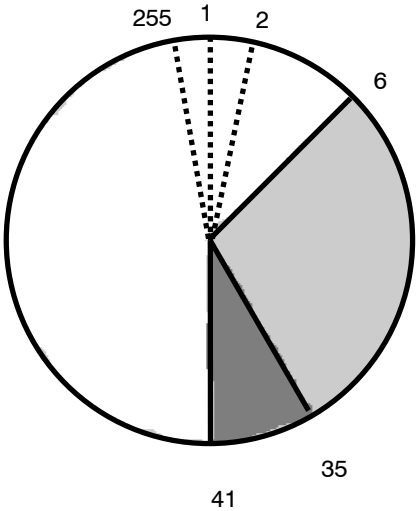
Line number of the line to be deleted(1...255, OFF)
<CLEAR> sets "OFF".
Deleted lines remain in the silo memory. Access is blocked during the processing. To show that a line has been deleted, they are marked with "*". The symbol * indicates that the line has been deleted.
Deleted lines can be reactivated if the appropriate line is re-edited.

>delete all silo lines **delete all: no**	**Delete all silo lines** *Confirmation (yes, no)* When all silo lines are deleted, the silo is completely empty: The line numbering starts again with 1.
cycle lines: OFF	*With "ON", worked off silo lines will be copied to the highest line of the silo memory (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. If 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)* Determination results will be stored as C24 or C25 in the silo memory according to the allocations in the methods, see page 100. "save lines" can only be set to "OFF" if the silo is completely empty.

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.

2.17 Storing determination results and silo calculations

2.17.1 Storing 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 <DEF>
   Assignment of the determination results to C24 and/or C25:
2. In the silo memory, <SMPL DATA> (when the silo memory is switched in):
   "save lines: on"

Assignment of determination results


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
  >temporary variables
```

The determination results are assigned in key <DEF>.

The display texts of the Titrino are shown to the left. The values are the default values.

```
>silo calculations

   C24=
   C25=
```

Silo calculations

Assignment to C24 (RSX, EPX, CXX)
Calculated results (RSX), endpoints (EPX) or variables CXX can be stored as C24.
Same procedure for C25.

Important:
Ensure that there is still sufficient space for storing 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><ENTER>):

```
 'si
799 GPT Titrino      01102     799.0010
date  2001-09-14   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
```

← processed silo lines with saved results

The silo lines can be marked as follows (at very left of report):

\+ Silo line has been processed. It cannot be edited anymore.

* 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. Recalculation will be considered e.g., if the sample data of this line are changed.
No marking: The silo line is awaiting processing.

For silo lines ≥100, the first digit will be overwritten by the marking.

2.17.2 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 <DEF>:

>silo calculations	**Silo calculations**
C24= **C25=**	*Assignment to C24 and C25* Calculated results (RSX), endpoints (EPX) and variables (CXX) can be stored as C24. Identical for C25.
match id: **OFF**	*Which sample identifications must match in order to combine of the results (id1, id1&2, all, OFF)* "OFF" means no matching ids, all samples which have been processed with the same method are combined, see examples below.

Starting from the following silo report:

```
 'si
799 GPT Titrino      01102     799.0010
date  2001-09-14   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    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
```

Sample processed with the same method and having the same id1 are combined

The short silo calculation report contains only calculations for the 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 recalculation, as long as the silo line is marked with "/". If you do not wish such an input, e.g. because you work off an urgent sample between a series, disconnect the silo.

- Calculations and assignments are carried out in the following order:
  1. Calculation of the results RSX
  2. Assignment of temporary variables C7X for TIP
  3. Calculation of means MNX
  4. Assignment of silo results C24 and C25
  5. Silo calculations
  6. Assignment of means C26 and C27 from silo calculations
  7. Assignment of common variables C3X

2.18 Manual dosing and preparation of titration burets

2.18.1 Manual dosing

<PREP> serves as preselection for the buret: internal D0, external D1, external D2.
With <DOS>, the preselected buret will dose as long as <DOS> is pressed. The dosing rate can be set with the analog potentiometer at the Titrino. If no buret has been preselected, the buret which is active in the method, will dose.

2.18.2 Preparation of the titration burets, key <PREP>

The titrating burets should be prepared, if
- they have not been used for a long time
- a new bottle of reagent is used
- you are using the exchange unit for the first time.

With <START>, the preparation (or emptying, resp.) of the selected buret will begin. The parameters for the preparation are under <CONFIG>, see page 10.

To change the buret, press <PREP> repeatedly.
Attention: Liquid will be expelled at the buret tip!

`internal D0 prep` **Internal buret D0, Titrino buret**

`external D1: prep` **External buret D1**
The Titrino recognizes the buret type automatically (Dosimat or Dosino).
For Dosinos:
- After the preparation the dosing unit is without air bubbles and filled up to the top of tube.
- Press <←/→> for "empty" . This function empties the Dosino completely, e.g. for cleaning the dosing unit.

External buret D2
as for buret D1

Prep sequence for Dosinos:
The following volumes are dosed:
Volume of the aspiration tube, volume of the cylinder, volume of the dosing tube.
The cylinder volume can be expelled either through the top or back to the bottle. The parameters are entered under <CONFIG>, see page 11.

3 Operation via RS232 Interface

3.1 General rules

The Titrino has an extensive remote control facility that allows full control of the Titrino via the RS 232 interface, i.e. the Titrino can receive data from an external controller or send data to an external controller. C_R and L_F are used as terminators for the data transfer. The 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 terminators. The controller terminates its commands with C_R and L_F. If more than one command per line is sent by the controller, ";" is used as a separator between the individual commands.

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

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

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

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

The quantities of the commands above are:

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

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

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

command.

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

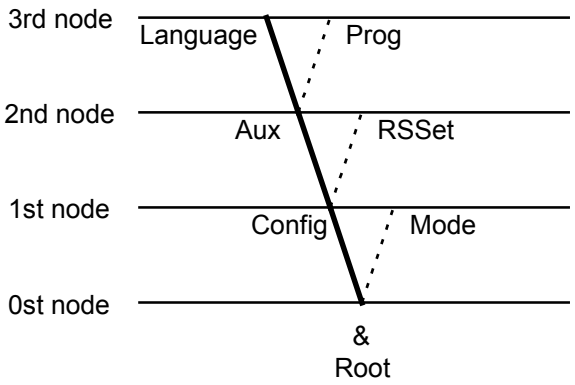
&**C**onfig.**A**ux.**L**anguage **$Q** Q means Query

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

Values of objects can not only be queried, they can also be modified. Values are always entered in quotes, for example:
&**C**onfig.**A**ux.**L**anguage **"english"**

3.1.1 Call up of objects

An excerpt from the object tree is represented below:



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

3.1.2 Triggers

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

The following triggers are possible:

$G	**G**o	Starts processes, for ex. starting the mode run or setting the RS 232 interface parameters
$S	**S**top	Stops processes
$H	**H**old	Holds processes
$C	**C**ontinue	Continues processes after Hold
$Q	**Q**uery	Queries all information from the current node in the tree forward up to and including the values
$Q.P	**P**ath	Queries the path from the root of the tree up to the current node
$Q.H	**H**ighest Index	Queries the number of son nodes of the current node
$Q.N"i"	**N**ame	Queries the name of the son node with index i, i = 1 - n
$D	**D**etail-Info	Queries the detailed status information
$U	q**U**it	Aborts the data flow of the instrument, for example, after $Q

The triggers $G and $S are linked to particular objects, see the summary table page 116ff.

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

Examples:

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

3.1.3 Status 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.
$H	Hold:	The Titrino has been held ($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.DET	**.Inac**:	Instrument at the beginning or at the end of a titration.
	.Req .Id1:	Instrument in the DET mode, requesting Id1 after titration start.
	.Id2:	Instrument in the DET mode, requesting Id2 after titration start.
	.Id3:	Instrument in the DET mode, requesting Id3 after titration start.
	.Smpl:	Instrument in the DET mode, requesting sample size after titration start.
	.Unit:	Instrument in the DET mode, requesting unit of sample size after titration start.
	.Start:	Instrument in the DET mode, processing the start conditions.
	.Titr:	Instrument in the DET mode, titrating.
$G .Mode.MET...		As DET.
$G .Mode.SET	**.Inac**:	Instrument at the beginning or at 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 endpoint.
	.SET2:	Instrument in the SET mode, titrating to the second endpoint.
	.Cond.Ok:	Instrument in the SET, conditioning, endpoint reached (after the first startup from the standby mode).
	.Cond.Prog:	Instrument in the SET mode, conditioning, endpoint not reached (Conditioning progressing).
$G .Mode.KFT...		As SET.
$G .Mode.STAT	**.Inac**:	Instrument at the beginning or at 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...		As STAT.

$G .Mode.DOC...		As STAT.
$G .Mode.MEAS	**.Inac**:	Instrument at the beginning or at 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 at 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 buffer 1.
	.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**:	Buret in filling process
	.ModeDis:	Buret in DIS mode
$G .Prep.X.Active:		Preparing buret X, X=0, 1, 2.
.Empty.X.Active:		Emptying buret X, X=1, 2.

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

$G .TIP.X	**.Inac**:	Instrument at the beginning or at 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.DET .Inac:	Instrument in the DET mode, inactive.
$R .Mode.MET .Inac:	Instrument in the MET mode, inactive.
$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.KFT...	As SET.
$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:	Buret 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 to for the global status $G.
Violation of monitored limits with action "end" give the status message $S.Mode.XXX.Inac;EYYY.

3.1.4 Error messages

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

E8 Card read/write error.
Exit: Send new command.

E9 Wrong card, a card has been removed/inserted during the inquiry.
Exit: Send new command.

E10 The card has lost data.
Exit: Send new command.

E18 Card battery low (it is between 2.37...2.64 V).
Exit: Send new command.

E20 Check exchange unit.
Exit: Mount Exchange Unit (properly) or &m $S.

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.

E24 Check drive unit.
Exit: Connect drive unit (correctly) or &m $S.

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

E27 Stop V reached in SET, STAT, 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
Exit: <QUIT> and ensure settings of appropriate parameters at both devices are the same.

E37 Framing error
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 working-off buffer of the Titrino is full (>82 characters).
Exit: <QUIT>

RS send errors:

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 6 s.
Exit: Send XON or <QUIT>

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.

E124 Number of EP does not correspond with the set windows.
Exit: The error message disappears on next startup or on recalculation.

E125 Missing fix EP for calculation, has not been defined.
Exit: The error message disappears on next startup or on recalculation.

E126 Fix-EP outside of measuring point list.
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, KFT 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.
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 running 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.

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.

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 a submethod of TIP includes an assignment to C24 or C25.
Exit: The error message disappears on next start. Attention: The data of this sample will not be stored.

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.

E172 In TIP or DOS a QuickMeas was started, without defining a measuring quantity.
Exit: The error message disappears on next start or &Mode.QuickMeas $S.

E173 The warning interval of the internal buret D0 called.
Exit: Execute prep &a.b.p $G or start next method.

E174 The warning interval of the external buret D1 called.
Exit: Execute prep &a.b.p $G or start next method.

E175 The warning interval of the external buret D2 called.
Exit: Execute prep &a.b.p $G or start next method.

E176 The function &Assembly.Buret.Prep or &Assembly.Buret.Empty was interrupted manually.
Exit. The error message disappears on next start.

E177 Accessing to the memory card, the card was not (properly) inserted.
Exit. The error message disappears on next start.

E178 The date of changing the battery of the card is expired.
Exit. The error message disappears on next start.

E180 Memory card write-protected.
Exit: Send new command.

E181 Memory card not formatted.
Exit: Send new command.

E182 Memory card not accessible.
Exit: Send new command.

E183 A directory with the same name exists already on the memory card.
Exit: Send new command.

E184 Measured value below lower limit.
Exit: The error message disappears when again within the limits or &m $S.

E185 Measured value above upper limit.
Exit: The error message disappears when again within the limits or &m $S.

E186 Temperature below lower limit.
Exit: The error message disappears when again within the limits or &m $S.

E187 Temperature above upper limit.
Exit: The error message disappears when again within the limits or &m $S.

E188 Rate below lower limit.
Exit: The error message disappears when again within the limits or &m $S.

E189 Rate above upper limit.
Exit: The error message disappears when again within the limits or &m $S.

E196 Result is out of limits.
Exit: The error message disappears on next start or on recalculation.

E197 Sample size is out of limits.
Exit: The error message disappears on next start or on introduction of new sample size.

E198 Validation interval is expired.
Exit: The error message disappears on next start or clear counter with &Config.Monitoring.Validation.ClearCount $G.

E199 Service date is reached.
Exit: The error message disappears on next start or change date in &Config.Monitoring.Service.Date.

E203	No Oven parameters: Oven not (correctly) connected. Exit: The error message disappears on next start. If you don't wish oven parameters in your report, select &Mode.Parameter.Presel.Oven "no" in your method(s).
E205	Calibration interval is expired. Exit: The error message disappears on next calibration or if you delete the calibration.
E212	Transmission error from Remote Box. Unknown characters. Exit: Rectify error and switch Titrino off and on again.
E213	Time-out error from PC keyboard (Remote Box) Exit: Rectify error and switch Titrino off and on again.
E214	Check Remote Box. Remote Box not (properly) connected but activated in &Config.Periph.RemoteBox. Exit: Rectify error and switch Titrino off and on again.
E270	Overload in dosing element: piston is blocked. Exit: <STOP>, <QUIT>. Rectify fault at the wet part. Mount it again onto the dos driver and press <CLEAR>. The dosing element will be initialized.
E282	Overload in dosing element: cock is blocked. Exit: <STOP>, <QUIT>. Rectify fault at the wet part. Mount it again onto the dos driver and press <CLEAR>. The dosing element will be initialized.

3.2 Remote control commands

3.2.1 Overview

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

&	**Root**
├ **M**ode	Method parameters
├ **U**serMeth	Administration of the internal user-memory for methods
├ **Me**moryCard	Administration of the memory card
├ **C**onfig	Instrument configuration
├ **S**mplData	Sample specific data
├ **H**otkey	Keys with direct access
├ **I**nfo	Current Data
├ **A**ssembly	Component data
├ **Se**tup	Setting the operating mode
└ **D**iagnosis	Diagnostics program

&Mode

Object	Description	Input range	Reference
& Root			
├ **M**ode	**Mode**	$G, $S, $H, $C	3.2.2.1.
: ├ **.Q**uickMeas	Rapid meas. in basic mode	$G, $S	3.2.2.2.
├ **.S**elect	Mode selection	**DET**,MET,SET,KFT,STAT,DOS, DOC,MEAS,CAL,TIP	3.2.2.3.
├ .**D**ETQuantity	Measured quantity for DET	**pH**, U, Ipol, Upol	ditto
├ .**M**ETQuantity	Measured quantity for MET	**pH**, U, Ipol, Upol	ditto
├ .**SET**Quantity	Measured quantity for SET	**pH**, U, Ipol, Upol	ditto
├ .**MEA**SQuantity	Measured quantity for MEAS	**pH**, U, Ipol, Upol, T	ditto
├ .**K**FTQuantity	Measured quantity for KFT	**Ipol**, Upol	ditto
├ .**ST**ATQuantity	Measured quantity for STAT	**pH**, U, Ipol, Upol	ditto
├ .**DO**CQuantity	Measured quantity for DOC	**pH**, U, Ipol, Upol	ditto
├ .**N**ame	Name of current method	read only/read+write	3.2.2.4.
├ **.P**arameter*	Parameter of current mode, see below		
├ **.Def**	**Definitions for data output**		
├ **.F**ormulas	**Calculation formulas**		
├ **.1**	for result 1		
├ **.F**ormula	Calculation formula	special	3.2.2.5.
├ **.T**extRS	Text for result output	up to 8 ASCII char	ditto
├ **.D**ecimal	Number of decimal places	0...**2**...5	ditto
├ **.U**nit	Unit for result output	up to 6 ASCII char	ditto
├ **.L**imits	Limits for result	ON, **OFF**	ditto
├ **.Lo**Lim	Lower limit	**0**...±999 999	ditto
├ **.Up**Lim	Upper limit	**0**...±999 999	ditto
├ **.O**utput	Output on L13	active, pulse, **OFF**	ditto
:	up to 9 results		
├ **.S**iloCalc	**Silo calculations**		
├ **.A**ssign	Assignment		
├ **.C**24	Store as variable C24	RSX,EPX,CXX	3.2.2.6.
├ **.C25**	Store as variable C25	RSX,EPX,CXX	
├ **.M**atchId	Matching of Id's	id1, id1&2, all, **OFF**	
├ **.C**omVar	**Assignment of common variables**		
├ **.C**30	for C30	RSX,EPX,CXX,MNX	3.2.2.7.
├ up to C39			
├ **.R**eport	**Reports at the end of determination**		
├ **.A**ssign1	Output to COM1	special	3.2.2.8.
├ **.Assign2**	Output to COM 2	as COM1	
├ **.M**ean	**Assignment for mean calculation**		
├ **.1**	MN1		
├ **.A**ssign	Input of variable	RSX, EPX, CXX	3.2.2.9.
:			
├ **.T**empVar	**Assignment of temporary variables**		
├ **.C**70	for C70	RSX,EPX,CXX	3.2.2.10.
├ up to C79			
├ **.C**Fmla	**Calculation constants**		
├ **.1**	Calculation constant C01		
├ **.V**alue	Input of value	**0**...±999 999	3.2.2.11.
├ up to C19			

***Parameter**	**Tree part "Parameters for DET"**		
.TitrPara	**Titration parameters**		
.**M**ptDensity	Measuring point density	0...**4**...9	3.2.2.12.
.**Mi**nIncr	Minimum increment	0...**10.0**...999.9	ditto
.**D**osRate	Dispensing rate for increments	0.01...150.0, **max.**	3.2.2.13.
.**S**ignalDrift	Drift for meas. value acquisition	depends on meas.quant.	3.2.2.14.
.**U**nitSigDrift	Unit of measured value drift	read only	ditto
.**E**quTime	Equilibrium time	0...**26**...9999, OFF	ditto
.**St**artV	Start volume		
.**T**ype	Type of start volume	abs., rel., **OFF**	3.2.2.15.
.**V**	Volume for absolute start volume	**0**...999.99	ditto
.**F**actor	Factor for relative start volume	**0**...±999 999	ditto
.**R**ate	Dispensing rate for start volume	0.01...150.0, **max.**	ditto
.**P**ause	Waiting time	**0**...999 999	3.2.2.16.
.**DosU**nit	Selection of the dosing unit	**internal D0**, external D1, external D2	3.2.2.17.
.**Me**asInput	Measuring input	**1**, 2, diff.	3.2.2.18.
.**I**pol	Polarization current	0...**1**...±127	ditto
.**U**pol	Polarization voltage	0...**400**...±1270	ditto
.**Po**lElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
.**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.19.
.StopCond	**Stop conditions**		
.**V**Stop	Stop volume		
.**T**ype	Type of stop volume	**abs**., rel., OFF	3.2.2.20.
.**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
.**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
.**M**easStop	Stop measured value pH, U, I	depends on meas.quant.	3.2.2.21.
.**U**nitMStop	Unit of stop measured value	read only	ditto
.**E**PStop	Stop after a number of EP's	1...**9**, OFF	3.2.2.22.
.**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.23.
.Statistics	**Statistics**		
.**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
.**M**eanN	No. of individual determinations	**2**...20	ditto
.**R**esTab	Result table		
.**S**elect		**original**,delete n,delete all	ditto
.**D**elN	Deletion of individual results	**1**...20	ditto
.**E**valuation	**Evaluation**		
.**E**PC	EP criterion	0...**5**...200	3.2.2.25.
.**R**ecognition	EP recognition		
.**S**elect	Type of EP recognition	**all**,greatest,last,window,OFF	ditto
.**W**indow	Window		
.**1**	up to 9 windows		
.**L**owLim	Lower limit window 1	depends on meas.quant.	ditto
.**U**pLim	Upper limit window 1	depends on meas.quant.	ditto
.**F**ixEP	Fix endpoints		
.**1**	up to 9 fix EP's		
.**V**alue	Measured value for fix EP1	depends on meas.quant.	ditto
.**p**K	pK or HNP evaluation	ON, **OFF**	ditto
.Presel	**Preselections**		
.**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
.**S**req	Request of smpl size after start	value, unit, all, **OFF**	ditto
.**L**imSmplSize	Limits for sample size		3.2.2.27.
.**S**tatus	Status of limit control	ON, **OFF**	ditto
.**L**oLim	Lower limit	**0.0**...999 999	ditto
.**U**pLim	Upper limit	0.0...**999 999**	ditto
.**A**ctPulse	Output of a pulse	ON, **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for MET"**		
├ .**T**itrPara	**Titration parameters**		
│ ├ .**V**Step	Volume increment	0...**0.10**...999.9	3.2.2.12.
│ ├ .**D**osRate	Dispensing rate for increments	0.01...150.0, **max.**	3.2.2.13.
│ ├ .**S**ignalDrift	Drift for meas. value acquisition	depends on meas.quant.	3.2.2.14.
│ ├ .**U**nitSigDrift	Unit of measured value drift	read only	ditto
│ ├ .**E**quTime	Equilibrium time	0...**26**...9999, OFF	ditto
│ ├ .**St**artV	Start volume		
│ │ ├ .**T**ype	Type of start volume	abs., rel., **OFF**	3.2.2.15.
│ │ ├ .**V**	Volume for absolute start volume	**0**...999.99	ditto
│ │ ├ .**F**actor	Factor for relative start volume	**0**...±999 999	ditto
│ │ ├ .**R**ate	Dispensing rate for start volume	0.01...150.0, **max.**	ditto
│ ├ .**P**ause	Waiting time	**0**...999 999	3.2.2.1.
│ ├ .**DosU**nit	Selection of the dosing unit	**internal D0**, external D1, external D2	3.2.2.17.
│ ├ .**Me**asInput	Measuring input	**1**, 2, diff.	3.2.2.18.
│ ├ .**I**pol	Polarization current	0...**1**...±127	ditto
│ ├ .**U**pol	Polarization voltage	0...**400**...±1270	ditto
│ ├ .**Po**lElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ ├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.19.
├ .**S**topCond	**Stop conditions**		
│ ├ .**V**Stop	Stop volume		
│ │ ├ .**T**ype	Type of stop volume	**abs**., rel., OFF	3.2.2.20.
│ │ ├ .**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
│ │ ├ .**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
│ ├ .**M**easStop	Stop measured value pH, U, I	depends on meas.quant.	3.2.2.21.
│ ├ .**U**nitMStop	Unit of stop measured value	read only	ditto
│ ├ .**E**PStop	Stop after a number of EP's	1...**9**, OFF	3.2.2.22.
│ ├ .**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.23.
├ .**Sta**tistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
│ ├ .**M**eanN	No. of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto
├ .**E**valuation	**Evaluation**		
│ ├ .**E**PC	EP criterion	depends on meas.quant.	3.2.2.25.
│ ├ .**R**ecognition	EP recognition		
│ │ ├ .**S**elect	Type of EP recognition	**all**,greatest,last,window,OFF	ditto
│ │ ├ .**W**indow	Window		
│ │ │ ├ .**1**	up to 9 windows		
│ │ │ │ ├.**L**owLim	Lower limit window 1	depends on meas.quant.	ditto
│ │ │ │ ├.**U**pLim	Upper limit window 1	depends on meas.quant.	ditto
│ ├ .**F**ixEP	Fix endpoints		
│ │ ├ .**1**	up to 9 fix EP's		
│ │ │ ├.**V**alue	Measured value for fix EP1	depends on meas.quant.	ditto
│ ├ .**p**K	pK or HNP evaluation	ON, **OFF**	ditto
├ .**P**resel	**Preselections**		
│ ├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
│ ├ .**S**Req	Request of sample size after start	value, unit, all, **OFF**	ditto
│ ├ .**L**imSmplSize	Limits for sample size		3.2.2.27
│ │ ├ .**S**tatus	Status of limit control	ON, **OFF**	ditto
│ │ ├ .**L**oLim	Lower limit	**0.0**...999 999	ditto
│ │ ├ .**U**pLim	Upper limit	0.0...**999 999**	ditto
│ ├ .**A**ctPulse	Output of a pulse	ON, **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for SET"**		
├ **.S**ET1	**Control parameters for EP1**		
│ ├ .**E**P Endpoint 1	depends on meas.quant.	3.2.2.29.	
│ ├ .**U**nitEp	Unit of endpoint	read only	ditto
│ ├ .**D**yn	Dynamics	depends on meas.quant.	3.2.2.30.
│ ├ .**UnitD**yn	Unit of dynamics	read only	ditto
│ ├ .**M**axRate	Maximum dosing rate	0.01...**10**...150, max.	ditto
│ ├ .**Mi**nRate	Minimum dosing rate	0.01...**25.0**...9999	ditto
│ ├ .**S**top	Titration stop		
│ │ ├ .**T**ype	Type of stop criterion	**drift**, time	3.2.2.31.
│ │ ├ .**D**rift	Stop drift	1...**20**...999	ditto
│ │ ├ .**Ti**me	Switch-off delay time	0...**10**...999, inf	ditto
│ │ ├ .**S**topT	Stop time	0...999 999, **OFF**	ditto
├ **.SET2**	**Control parameters for EP2, as for EP1**		
├ **.T**itrPara	**Titration parameters**		
│ ├ .**D**irection	Titration direction	+, -, **auto**	3.2.2.32.
│ ├ .**X**Pause	Waiting time before start volume	**0**...999 999	3.2.2.33.
│ ├ .**S**tart V	Start volume		
│ │ ├ .**T**ype	Type of start volume	abs., rel., **OFF**	3.2.2.15.
│ │ ├ .**V**	Volume for absolute start volume	**0**...999.99	ditto
│ │ ├ .**F**actor	Factor for relative start volume	**0**...±999 999	ditto
│ │ ├ .**R**ate	Dispensing rate for start volume	0.01...150.0, **max.**	ditto
│ ├ .**P**ause	Waiting time after start volume	**0**...999 999	3.2.2.16.
│ ├ .**E**xtrT	Extraction time	**0**...999 999	3.2.2.34.
│ ├ .**Do**sUnit	Selection of the dosing unit	**internal D0**, external D1, external D2	3.2.2.17.
│ ├ .**M**easInput	Measuring input	**1**, 2, diff.	3.2.2.18.
│ ├ .**I**pol	Polarization current	0...**1**...±127	ditto
│ ├ .**U**pol	Polarization voltage	0...**400**...±1270	ditto
│ ├ .**Po**lElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ ├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.19.
│ ├ .**TD**elta	Time interv. for meas.acquisition	1...**2**...999 999	3.2.2.35.
├ **.St**opCond	**Stop conditions**		
│ ├ .**V**Stop	Stop volume		
│ │ ├ .**T**ype	Type of stop volume	**abs**., rel., OFF	3.2.2.20.
│ │ ├ .**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
│ │ ├ .**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
│ ├ .**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.23.
├ **.Sta**tistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
│ ├ .**M**eanN	No. of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto
├ **.P**resel	**Preselections**		
│ ├ .**C**ond	Conditioning	ON, **OFF**	3.2.2.36.
│ ├ .**D**riftDisp	Display of drift during cond.	**ON**, OFF	ditto
│ ├ .**DC**or	Drift correction		
│ │ ├ .**T**ype	Type of drift acquisition	auto, man., **OFF**	ditto
│ │ ├ .**V**alue	Drift value for manual drift corr.	**0.0**...99.9	ditto
│ ├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
│ ├ .**S**Req	Request of smpl size after start	value, unit, all, **OFF**	ditto
│ ├ .**L**imSmplSize	Limits for sample size		3.2.2.27
│ │ ├ .**S**tatus	Status of limit control	ON, **OFF**	ditto
│ │ ├ .**L**oLim	Lower limit	**0.0**...999 999	ditto
│ │ ├ .**U**pLim	Upper limit	0.0...**999 999**	ditto
│ ├ .**A**ctPulse	Output of a pulse	first, all, cond., **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for KFT"**		
├ .**C**trlPara	**Control parameters**		
│ ├ .**E**P Endpoint	depends on meas.quant.	3.2.2.37.	
│ ├ .**U**nitEp	Unit of endpoint	read only	ditto
│ ├ .**D**yn	Dynamics	depends on meas.quant.	3.2.2.38.
│ ├ .**UnitD**yn	Unit of dynamics	read only	ditto
│ ├ .**M**axRate	Maximum dosing rate	0.01...150, **max.**	ditto
│ ├ .**Mi**nIncr	Minimum increment	0.1...9.9, **min.**	ditto
│ ├ .**S**top	Titration stop		
│ │ ├ .**T**ype	Type of stop criterion	**drift**, time	3.2.2.30.
│ │ ├ .**D**rift	Stop drift	1...**20**...999	ditto
│ │ ├ .**Ti**me	Switch-off delay time	0...**10**...999, inf	ditto
│ │ ├ .**S**topT	Stop time	0...999 999, **OFF**	ditto
├ .**T**itrPara	**Titration parameters**		
│ ├ .**D**irection	Titration direction	+, **-**, auto	3.2.2.31.
│ ├ .**X**Pause	Waiting time before start volume	**0**...999 999	3.2.2.32.
│ ├ .**S**tartV	Start volume		
│ │ ├ .**T**ype	Type of start volume	abs., rel., **OFF**	3.2.2.15.
│ │ ├ .**V**	Volume for absolute start volume	**0**...999.99	ditto
│ │ ├ .**F**actor	Factor for relative start volume	**0**...±999 999	ditto
│ │ ├ .**R**ate	Dispensing rate for start volume	0.01...150.0, **max.**	ditto
│ ├ .**P**ause	Waiting time after start volume	**0**...999 999	3.2.2.16.
│ ├ .**E**xtrT	Extraction time	**0**...999 999	3.2.2.33.
│ ├ .**Do**sUnit	Selection of the dosing unit	**internal D0**, external D1, external D2	3.2.2.17.
│ ├ .**M**easInput	without meaning		
│ ├ .**I**pol	Polarization current	0...**50**...±127	3.2.2.18.
│ ├ .**U**pol	Polarization voltage	0...**400**...±1270	ditto
│ ├ .**Po**lElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ ├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.19.
│ ├ .**TD**elta	Time interv. for meas.acquisition	1...**2**...999 999	3.2.2.34.
├ .**S**topCond	**Stop conditions**		
│ ├ .**V**Stop	Stop volume		
│ │ ├ .**T**ype	Type of stop volume	**abs**., rel., OFF	3.2.2.20.
│ │ ├ .**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
│ │ ├ .**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
│ ├ .**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.23.
├ .**Sta**tistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
│ ├ .**M**eanN	No. of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto
├ .**P**resel	**Preselections**		
│ ├ .**C**ond	Conditioning	**ON**, OFF	3.2.2.35.
│ ├ .**D**riftDisp	Display of drift during cond.	**ON**, OFF	ditto
│ ├ .**DC**or	Drift correction		
│ │ ├ .**T**ype	Type of drift acquisition	auto, man., **OFF**	ditto
│ │ ├ .**V**alue	Drift value for manual drift corr.	**0.0**...99.9	ditto
│ ├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
│ ├ .**S**Req	Request of smpl size after start	value, unit, all, **OFF**	ditto
│ ├ .**L**imSmplSize	Limits for sample size		3.2.2.27
│ │ ├ .**S**tatus	Status of limit control	ON, **OFF**	ditto
│ │ ├ .**L**oLim	Lower limit	**0.0**...999 999	ditto
│ │ ├ .**U**pLim	Upper limit	0.0...**999 999**	ditto
│ ├ .**O**ven	KF Oven connected	COM1, COM2, **no**	3.2.2.39.
│ ├ .**A**ctPulse	Output of a pulse	first, all, cond., **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for STAT"**		
├ .**C**trlPara	**Control parameters**		
│ ├ .**E**P Measuring point		depends on meas.quant.	3.2.2.36.
│ ├ .**U**nitEp	Unit of endpoint	read only	ditto
│ ├ .**D**yn	Dynamics	depends on meas.quant.	3.2.2.37.
│ ├ .**UnitD**yn	Unit of dynamics	read only	ditto
│ ├ .**M**axRate	Maximum dosing rate	0.01...**10**...150, max.	ditto
│ ├ .**Mi**nRate	Minimum dosing rate	0.01...**25.0**...9999	3.2.2.40.
├ .**T**itrPara	**Titration parameters**		
│ ├ .**S**tartV	Start volume		
│ │ ├ .**T**ype	Type of start volume	abs., rel., **OFF**	3.2.2.15.
│ │ ├ .**V**	Volume for absolute start volume	**0**...999.99	ditto
│ │ ├ .**F**actor	Factor for relative start volume	**0**...±999 999	ditto
│ │ ├ .**R**ate	Dispensing rate for start volume	0.01...150.0, **max.**	ditto
│ ├ .**P**ause	Waiting time after start volume	**0**...999 999	3.2.2.16.
│ ├ .**T**start	Start time	**0**...999 999	3.2.2.41.
│ ├ .**StartM**eas	Start measuring value	depends on meas.quant.	ditto
│ ├ .**R**ateStart	Start rate	0.01...150, **OFF**	ditto
│ ├ .**TD**elta	Time interv.for meas.acquisition	1...**2**...999 999	3.2.2.34.
│ ├ .**D**irection	Titration direction	+, -, **auto**	3.2.2.31.
│ ├ .**Do**sUnit	Selection of the dosing unit	**internal D0**, external D1, external D2	3.2.2.17.
│ ├ .**M**easInput	Measuring input	**1**, 2, diff.	3.2.2.18.
│ ├ .**I**pol	Polarization current	0...**1**...±127	ditto
│ ├ .**U**pol	Polarization voltage	0...**400**...±1270	ditto
│ ├ .**Pol**ElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ ├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.19.
├ .**S**topCond	**Stop conditions**		
│ ├ .**T**Stop	Stop time		
│ │ ├ .**T**ype	Type of stop time	abs.,rel.,delta,delay,**OFF**	3.2.2.42.
│ │ ├ .**Ti**me	Time for absolute stop time	0...**999 999**	ditto
│ │ ├ .**F**actor	Factor for relative stop time	0...±**999 999**	ditto
│ │ ├ .**D**elta	Time after EP is once reached	0...**999 999**	ditto
│ │ ├ .**Dela**y	Time after last dosing step	0...**999 999**	ditto
│ ├ .**V**Stop	Stop volume		
│ │ ├ .**T**ype	Type of stop volume	**abs**., rel., OFF	3.2.2.20.
│ │ ├ .**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
│ │ ├ .**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
│ ├ .**R**ateStop	Stop rate	0.01...150.0, **OFF**	3.2.2.43.
│ ├ .**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.23.
├ .**Sta**tistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
│ ├ .**M**eanN	No. of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto

*Parameter	Tree part "Parameters for STAT", continuation		
.Evaluation	**Evaluation**		
.TimeWin	Time windows for rate evaluation		
.1	up to 9 windows		
.LowLim	Lower limit window 1	0...999 999, **OFF**	3.2.2.44.
.UpLim	Upper limit window 1	0...999 999, **OFF**	ditto
.FixVol	Fix volumes		
.1	up to 9 fix volumes		
.Value	Value for fix volume 1	0...999 999, **OFF**	3.2.2.45.
.FixTime	Fix times		
.1	up to 9 fix times		
.Value	Value for fix time 1	0.01...1, **OFF**	3.2.2.46.
.Monitoring	**Monitoring**		
.MeasVal	Monitoring of measured values		
.Status	Status	ON, **OFF**	3.2.2.47.
.LowLim	Lower limit	depends on meas.quant.	ditto
.UpLim	Upper limit	depends on meas.quant.	ditto
.Action	Action if out of limits	end, hold, wait, **none**	ditto
.Rate	Monitoring of rates		
.Status	Status	ON, **OFF**	3.2.2.48.
.LowLim	Lower limit	**0.000**...150	ditto
.UpLim	Upper limit	0.000...**150**	ditto
.Action	Action if out of limits	end, hold, wait, **none**	ditto
.Temp	Monitoring of temperatures		
.Status	Status	ON, **OFF**	3.2.2.49.
.LowLim	Lower limit	**-170.0**...500.0	ditto
.UpLim	Upper limit	-170.0...**500.0**	ditto
.Action	Action if out of limits	end, hold, wait, **none**	ditto
.L10Output	Assignment of output L10		
.AssignOutput	To type of limit violation	meas,temp,rate,all,**none**	3.2.2.50.
.Limit	Assign output to violated limit	upper, lower, **any**	ditto
.Output	Signal to be set on output L10	active, **pulse**	ditto
.L11Output	as for output L10		
.L12Output	as for output L10		
.L13Output	as for output L10		
.Presel	**Preselections**		
.IReq	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
.SReq	Request of sample size after start	value, unit, all, **OFF**	ditto
.LimSmplSize	Limits for sample size		3.2.2.27
.Status	Status of limit control	ON, **OFF**	ditto
.LoLim	Lower limit	**0.0**...999 999	ditto
.UpLim	Upper limit	0.0...**999 999**	ditto
.RateDisp	Display of drift during cond.	ON, **OFF**	3.2.2.51.
.ActPulse	Output of a pulse	ON, **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for DOS"**		
├ **.D**osPara	**Dosing parameters**		
│ ├ .**T**ype	Type of dosing	**volume**, time, rate	3.2.2.52.
│ ├ .**V**olume	Volume dosing		
│ │ ├ .**V**olume	Volume	0...**10**...99 999.99	ditto
│ │ ├ .**D**isType	Second dosing criterion	time, **rate**	ditto
│ │ ├ .**R**ate	Rate	0.001...150, **max.**	ditto
│ │ ├ .**T**ime	Dosing time	1...**100**...999 999	ditto
│ ├ .**Ti**me	Time dosing		
│ │ ├ .**T**ime	Dosing time	1...**100**...999 999	ditto
│ │ ├ .**D**isType	Second dosing criterion	**volume**, rate	ditto
│ │ ├ .**R**ate	Rate	0.001...150, **max.**	ditto
│ │ ├ .**V**olume	Volume	0...**10**...99 999.99	ditto
│ ├ .**R**ate	Rate dosing		
│ │ ├ .**R**ate	Rate	0.001...150, **max.**	ditto
│ │ ├ .**S**topType	Second dosing criterion	**volume**, time	ditto
│ │ ├ .**T**ime	Dosing time	1...**100**...999 999	ditto
│ │ ├ .**V**olume	Volume	0...**10**...99 999.99	ditto
│ ├ .**P**ause	Waiting time after start volume	**0**...999 999	3.2.2.53.
│ ├ .**TD**elta	Time interv.for meas.acquisition	1...**10**...999 999	3.2.2.54.
│ ├ .**D**osUnit	Selection of the dosing unit	**internal D0**, external D1, external D2	3.2.2.17.
│ ├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.55.
├ **.S**topCond	**Stop conditions**		
│ ├ .**V**Stop	Stop volume		
│ │ ├ .**T**ype	Type of stop volume	abs., rel., **OFF**	3.2.2.20.
│ │ ├ .**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
│ │ ├ .**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
│ ├ .**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.23.
├ **.Sta**tistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
│ ├ .**M**eanN	No.of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto
├ **.M**onitoring	**Monitoring**		
│ ├ .**M**easVal	Monitoring of measured values		
│ │ ├.**M**easMode	Measured value	pH, U, Ipol, Upol, **OFF**	3.2.2.56.
│ │ ├.**MeasI**nput	Measuring input	**1**, 2, diff.	ditto
│ │ ├.**P**Current	Polarization current	0...**1**...±127	ditto
│ │ ├.**PV**oltage	Polarization voltage	0...**400**...±1270	ditto
│ │ ├.**Po**lElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ │ ├.**pH**	Limits for monitoring of pH values		
│ │ │ ├.**L**owLim	Lower limit	**-20.00**...20.00	ditto
│ │ │ ├.**U**pLim	Upper limit	-20.00...**20.00**	ditto
│ │ ├.**U**	Limits for monitoring of U values		
│ │ │ ├.**L**owLim	Lower limit	**-2000**...2000	ditto
│ │ │ ├.**U**pLim	Upper limit	-2000...**2000**	ditto
│ │ ├.**I**pol	Limits for monitoring of Ipol values		
│ │ :	as for U		
│ │ ├.**U**	Limits for monitoring of Upol values		
│ │ :	as above		
│ │ ├.**A**ction	Action if out of limits	end, hold, wait, **none**	ditto

***Parameter**	**Tree part "Parameters for DOS, monitoring", continuation**		
├ .**M**onitoring	**Monitoring**		
│ ├ .**T**emp	Monitoring of temperatures		
│ │ ├.**S**tatus	Status	ON, **OFF**	3.2.2.47.
│ │ ├.**L**owLim	Lower limit	**-170.0**...500.0	ditto
│ │ ├.**U**pLim	Upper limit	-170.0...**500.0**	ditto
│ │ ├.**A**ction	Action if out of limits	end, hold, wait, **none**	ditto
│ ├ .**L10**Output	Assignment of output L10		
│ │ ├ .**A**ssignOutput	To type of limit violation	meas,temp,all,**none**	3.2.2.48.
│ │ ├ .**L**imit	Assign output to violated limit	upper, lower, **any**	ditto
│ │ ├ .**O**utput	Signal to be set on output L10	active, **pulse**	ditto
│ ├ .**L11**Output	as for output L10		
│ ├ .**L12**Output	as for output L10		
│ ├ .**L13**Output	as for output L10		
│			
├ .**P**resel	**Preselections**		
│ ├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
│ ├ .**S**Req	Request of smpl size after start	value, unit, all, **OFF**	ditto
│ ├ .**L**imSmplSize	Limits for sample size		3.2.2.27
│ │ ├ .**S**tatus	Status of limit control	ON, **OFF**	ditto
│ │ ├ .**L**oLim	Lower limit	**0.0**...999 999	ditto
│ │ ├ .**U**pLim	Upper limit	0.0...**999 999**	ditto
│ ├ .**A**ctPulse	Output of a pulse	ON, **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for DOC"**		
├ .**D**osPara	**Dosing parameters**		
│ ├ .**B**eginMeas	Begin of measuring	depends on meas.quant.	3.2.2.57.
│ ├ .**E**ndMeas	End of measuring	depends on meas.quant.	ditto
│ ├ .**U**nitMeas	Unit of measured quantity	read only	ditto
│ ├ .**S**weepTime	Sweep time	0...**300**...999 999	3.2.2.58.
│ ├ .**D**yn	Dynamics	depends on meas.quant.	3.2.2.59.
│ ├ .**UnitD**yn	Unit of dynamics	read only	ditto
│ ├ .**M**axRate	Maximum dosing rate	0.01... 150, **max**.	ditto
│ ├ .**Mi**nRate	Minimum dosing rate	0.01...**5.0**...9999	ditto
│ ├ .**Di**rection	Direction	+, -, **auto**	3.2.2.60.
│ ├ .**St**artV	Start volume		
│ │ ├ .**T**ype	Type of start volume	abs., rel., **OFF**	3.2.2.61.
│ │ ├ .**V**	Volume for absolute start volume	**0**...999.99	ditto
│ │ ├ .**F**actor	Factor for relative start volume	**0**...±999 999	ditto
│ │ ├ .**R**ate	Dispensing rate for start volume	0.01...150.0, **max.**	ditto
│ ├ .**P**ause	Waiting time after start volume	**0**...999 999	ditto
│ ├ .**T**Delta	Time interv. for meas.acquisition	1...**10**...999 999	3.2.2.52.
│ ├ .**Do**sUnit	Selection of the dosing unit	**internal D0**, external D1, external D2	3.2.2.17.
│ ├ .**Me**asInput	Measuring input	**1**, 2, diff.	3.2.2.62.
│ ├ .**I**pol	Polarization current	0...**1**...±127	ditto
│ ├ .**U**pol	Polarization voltage	0...**400**...±1270	ditto
│ ├ .**Pol**ElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ ├ .**Te**mp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.53.
├ .**S**topCond	**Stop conditions**		
│ ├ .**V**Stop	Stop volume		
│ │ ├ .**T**ype	Type of stop volume	**abs**., rel., OFF	3.2.2.20.
│ │ ├ .**V**	Volume for absolute stop volume	0...**99.99**...9999.99	ditto
│ │ ├ .**F**actor	Factor for relative stop volume	0...±**999 999**	ditto
│ ├ .**F**illRate	Filling rate	0.01...150.0, **max.**	3.2.2.23.
├ .**Sta**tistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
│ ├ .**M**eanN	No. of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto
├ .**M**onitoring	**Monitoring**		
│ ├ .**M**easVal	Monitoring of measured values		
│ │ ├.**S**tatus	Status	ON, **OFF**	3.2.2.45.
│ │ ├.**L**owLim	Lower limit	depends on meas.quant.	ditto
│ │ ├.**U**pLim	Upper limit	depends on meas.quant.	ditto
│ │ ├.**A**ction	Action if out of limits	end, hold, wait, **none**	ditto
│ ├ .**T**emp	Monitoring of temperatures		
│ │ ├.**S**tatus	Status	ON, **OFF**	3.2.2.47.
│ │ ├.**L**owLim	Lower limit	**-170.0**...500.0	ditto
│ │ ├.**U**pLim	Upper limit	-170.0...**500.0**	ditto
│ │ ├.**A**ction	Action if out of limits	end, hold, wait, **none**	ditto

*Parameter	Tree part "Parameters for DOC, monitoring", continuation		
├ .**M**onitoring	**Monitoring**		
│ ├ .**L**10Output	Assignment of output L10		
│ │ ├ .**A**ssignOutput	To type of limit violation	meas,temp,all,**none**	3.2.2.48.
│ │ ├ .**L**imit	Assign output to violated limit	upper, lower, **any**	ditto
│ │ ├ .**O**utput	Signal to be set on output L10	active, **pulse**	ditto
│ ├ .**L11**Output	as for output L10		
│ ├ .**L12**Output	as for output L10		
│ ├ .**L13**Output	as for output L10		
│			
├ .**P**resel	**Preselections**		
│ ├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
│ ├ .**S**Req	Request of sample size after start	value, unit, all, **OFF**	ditto
│ ├ .**L**imSmplSize	Limits for sample size		3.2.2.27
│ │ ├ .**S**tatus	Status of limit control	ON, **OFF**	ditto
│ │ ├ .**L**oLim	Lower limit	**0.0**...999 999	ditto
│ │ ├ .**U**pLim	Upper limit	0.0...**999 999**	ditto
│ ├ .**R**ateDisp	Display of drift during cond.	ON, **OFF**	3.2.2.49.
│ ├ .**A**ctPulse	Output of a pulse	ON, **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for MEAS"**		
.Measuring	**Measuring parameters**		
.**S**ignalDrift	Drift for meas.value acquisition	depends on meas.quant.	3.2.2.63.
.**U**nitSigDrift	Unit of measured value drift	read only	ditto
.**E**quTime	Equilibrium time	0...9999, **OFF**	ditto
.**Me**asInput	Measuring input	**1**, 2, diff.	3.2.2.64.
.**I**pol	Polarization current	0...**1**...±127	ditto
.**U**pol	Polarization voltage	0...**400**...±1270	ditto
.**P**olElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
.**T**emp	Titration temperature	-170.0...**25.0**...500.0	3.2.2.65.
.**TD**elta	Time interv.for meas.acquisition	1...**2**...999 999	3.2.2.66.
.Statistics	**Statistics**		
.**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
.**M**eanN	No. of individual determinations	**2**...20	ditto
.**R**esTab	Result table		
.**S**elect		**original**,delete n,delete all	ditto
.**D**elN	Deletion of individual results	**1**...20	ditto
.Presel	**Preselections**		
.**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
.**S**Req	Request of sample size after start	value, unit, all, **OFF**	ditto
.**L**imSmplSize	Limits for sample size		3.2.2.27
.**S**tatus	Status of limit control	ON, **OFF**	ditto
.**L**oLim	Lower limit	**0.0**...999 999	ditto
.**U**pLim	Upper limit	0.0...**999 999**	ditto
.**A**ctPulse	Output of a pulse	ON, **OFF**	3.2.2.28.

***Parameter**	**Tree part "Parameters for CAL"**		
.Calibration	**Calibration parameters**		
.**M**easInput	Measuring input	**1**, 2, diff.	3.2.2.67.
.**C**alTemp	Calibration temperature	-20.0...**25.0**...120.0	3.2.2.68.
.**B**uffer			
.**1**			
.**V**alue	pH value of buffer 1	0...**7.00**...±20.00	3.2.2.69.
.**2**			
.**V**alue	pH value of buffer 2	0...**4.00**...±20.00, OFF	ditto
:	up to 9 buffers		
.**S**ignalDrift	Drift for meas.value acquisition	depends on meas.quant.	3.2.2.70.
.**E**quTime	Equilibrium time	0...**26**...9999, OFF	ditto
.**El**ectrodeId	Electrode identification	8 ASCII char.	3.2.2.71.
.**Sm**plChanger	Calibration on a Titrino	ON, **OFF**	3.2.2.72.
.**A**ctPulse	Output of a pulse	first, all, **OFF**	3.2.2.73.
.Statistics	**Statistics**		
.**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
.**M**eanN	No.of individual determinations	**2**...20	ditto
.**R**esTab	Result table		
.**S**elect		**original**,delete n,delete all	ditto
.**D**elN	Deletion of individual results	**1**...20	ditto

***Parameter**	**Tree part "Parameters for TIP"**		
├ .**S**equence	**Sequence**		
│ ├ .**1**	Step 1		
│ │ ├ .**S**elect	Step selection	method,pause,L4 output,L6 output, info,prep,stirrer,**OFF**	3.2.2.74.
│ │ ├ .**M**ethod	Method from mem.or card	special	3.2.2.75.
│ │ ├ .**P**ause	Waiting time	**0**...999 999, INF	ditto
│ │ ├ .**L**4Output	Line L4	active,inactive,pulse,**OFF**	ditto
│ │ ├ .**L6**Output	Line L6	active,inactive,pulse,**OFF**	ditto
│ │ ├ .**I**nfo	Display information	up to 16 ASCII char.	ditto
│ │ ├ .**Pr**ep	Preparation of titrating buret	**internal D0**, external D1, external D2	ditto
│ │ ├ .**St**irrer	Stirrer	**ON**, OFF	ditto
│ ├ :	up to 30 steps		
├ .**St**atistics	**Statistics**		
│ ├ .**S**tatus	Status of statistics calculation	ON, **OFF**	3.2.2.24.
│ ├ .**M**eanN	No. of individual determinations	**2**...20	ditto
│ ├ .**R**esTab	Result table		
│ │ ├ .**S**elect		**original**,delete n,delete all	ditto
│ │ ├ .**D**elN	Deletion of individual results	**1**...20	ditto
├ .**P**resel	**Preselections**		
│ ├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	3.2.2.26.
│ ├ .**S**Req	Request of sample size after start	value, unit, all, **OFF**	ditto
│ ├ .**L**imSmplSize	Limits for sample size		3.2.2.27
│ │ ├ .**S**tatus	Status of limit control	ON, **OFF**	ditto
│ │ ├ .**L**oLim	Lower limit	**0.0**...999 999	ditto
│ │ ├ .**U**pLim	Upper limit	0.0...**999 999**	ditto
│ ├ .**M**easMode	Measuring mode for man.meas.	pH,U,Ipol,Upol,T,**OFF**	3.2.2.76.
│ ├ .**Me**asInput	Measuring input	**1**, 2, diff.	ditto
│ ├ .**I**pol	Polarization current	0...**1**...±127	ditto
│ ├ .**U**pol	Polarization voltage	0...**400**...±1270	ditto
│ ├ .**P**olElectrTest	Test for polarized electrodes	ON, **OFF**	ditto
│ ├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	ditto

&UserMeth

Object	Description	Input range	Reference
& Root			
:			
├ **U**serMeth	**Method memory**		
: ├ **.F**reeMemory	Memory available	read only	3.2.2.77.
├ **.R**ecall	Load method	$G	3.2.2.78.
│ ├ **.N**ame	Method name	8 ASCII characters	ditto
├ **.S**tore	Save method	$G	ditto
│ ├ **.N**ame	Method name	8 ASCII characters	ditto
├ **.D**elete	Delete method	$G	ditto
│ ├ **.N**ame	Method name	8 ASCII characters	ditto
├ **.DelA**ll	Delete all methods	$G	ditto
├ **.L**ist	List of methods		
│ ├ **.1**	Method 1		
│ │ ├ **.N**ame	Method name	read only	3.2.2.79.
│ │ ├ **.M**ode	Mode	read only	ditto
│ │ ├ **.Q**uantity	Measured quantity	read only	ditto
│ │ ├ **.D**osUnit	Dosing element	read only	ditto
│ │ ├ **.B**ytes	Method size in bytes	read only	ditto
│ │ ├ **.C**hecksum	Checksum of method	read only	ditto
│ ├ **.2**	for each method		

&MemoryCard

Object	Description	Input range	Reference
& Root			
⋮			
⋮ ├ **Me**moryCard	**Administration of the memory card**		
⋮ │ ├ **.R**ecall	Load method	$G	3.2.2.80.
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.S**tore	Save method	$G	ditto
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.D**elete	Delete method	$G	ditto
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.C**hangeDir	Change directory	$G	3.2.2.81.
⋮ │ │ ├ **.N**ame	Directory name	10 ASCII characters	ditto
⋮ │ │ ├ **.C**hecksum	Checksum of directory	$G	ditto
⋮ │ │ │ ├ **.V**alue	Value of checksum	read only	ditto
⋮ │ ├ **.C**reateDir	Create new directory	$G	3.2.2.82.
⋮ │ │ ├ **.N**ame	Directory name	10 ASCII characters	ditto
⋮ │ ├ **.DelD**ir	Delete directory	$G	3.2.2.83.
⋮ │ │ ├ **.N**ame	Directory name	10 ASCII characters	ditto
⋮ │ ├ **.B**ackup	Backup of internal memory	$G	3.2.2.84.
⋮ │ │ ├ **.N**ame	Directory name	10 ASCII characters	ditto
⋮ │ ├ **.Rel**oad	Reload backup from the card	$G	3.2.2.85.
⋮ │ │ ├ **.N**ame	Directory name	10 ASCII characters	ditto
⋮ │ ├ **.F**ormat	Format the card	$G	3.2.2.86.
⋮ │ │ ├ **.C**ardLabel	Directory name		
⋮ │ │ │ ├ **.N**ame	Value of checksum	8 ASCII characters	ditto
⋮ │ ├ **.Fr**eeMemory	Memory available	read only	3.2.2.87.
⋮ │ ├ **.Bat**teryChange	Date for battery change	$G	3.2.2.88.
⋮ │ │ ├ **.D**ate	Date	YYYY-MM-DD	ditto
⋮ │ ├ **.L**ist	Lists		
⋮ │ │ ├ **.C**ard	Directories on the card	read only	
⋮ │ │ │ ├ **.1**	Method 1		
⋮ │ │ │ │ ├ **.N**ame	Directory name	read only	3.2.2.89.
⋮ │ │ │ │ ├ **.B**ytes	Directory size in bytes	read only	ditto
⋮ │ │ │ ├ **.2**	for each directory		
⋮ │ │ ├ **.A**ctDir	Methods in the current directory		
⋮ │ │ │ ├ **.1**	Method 1		
⋮ │ │ │ │ ├ **.N**ame	Method name	read only	3.2.2.90.
⋮ │ │ │ │ ├ **.M**ode	Mode	read only	ditto
⋮ │ │ │ │ ├ **.Q**uantity	Measured quantity	read only	ditto
⋮ │ │ │ │ ├ **.D**osUnit	Dosing element	read only	ditto
⋮ │ │ │ │ ├ **.B**ytes	Method size in bytes	read only	ditto
⋮ │ │ │ │ ├ **.C**hecksum	Checksum of method	read only	ditto
⋮ │ │ │ ├ **.2**	for each method		

&Config

Object	Description	Input range	Reference
& Root			
├ **C**onfig	**Instrument configuration**		
│ ├ **.M**onitoring	**Monitoring functions**		
│ │ ├ **.V**alidation	Validation monitoring		3.2.2.91.
│ │ │ ├ **.S**tatus	Status of validation monitoring	ON, **OFF**	ditto
│ │ │ ├ **.I**nterval	Time interval for validation	1...**365**...9999	ditto
│ │ │ ├ **.C**ounter	Time counter	**0**...9999	ditto
│ │ │ ├ **.C**learCount	Clears the counter above	$G	ditto
│ │ ├ **.C**alibration	pH calibration monitoring		3.2.2.92.
│ │ │ ├ **.S**tatus	Status of calibration monitoring	ON, **OFF**	ditto
│ │ │ ├ **.M**easInput	Measuring input	**1**, 2, diff	ditto
│ │ │ ├ **.I**nterval	Time interval for validation	1...**7**...9999	ditto
│ │ │ ├ **.C**ounter	Time counter	**0**...9999	ditto
│ │ ├ **.S**ervice	Monitoring of Metrohm service	$G	3.2.2.93.
│ │ │ ├ **.S**tatus	Status of service monitoring	ON, **OFF**	ditto
│ │ │ ├ **.D**ate	Date of next service	XXXX-XX-XX	ditto
│ │ ├ **.D**iagRep	Printing of system test report	ON, **OFF**	3.2.2.94.
│ ├ **.P**eriphUnit	**Selection of peripheral units**		
│ │ ├ **.C**harSet1	External printer	Epson,Seiko,Citizen **IBM**,HP	3.2.2.95.
│ │ ├ **.CharSet2**	as for CharSet1		
│ │ ├ **.R**epToComport	Output of manual reports	**1,** 2, 1&2	3.2.2.96.
│ │ ├ **.B**alance	Selection of balance	**Sartorius**,Mettler,Mettler AT AND,Precisa	3.2.2.97.
│ │ ├ **.S**tirrer	Stirrer control	ON, **OFF**	3.2.2.98.
│ │ ├ **.Rem**oteBox	Connected remote box		3.2.2.99.
│ │ │ ├ **.S**tatus	Status	ON, **OFF**	ditto
│ │ │ ├ **.K**eyboard	Type of keyboard	**US**, deutsch, francais, español, schweiz.	ditto
│ │ │ ├ **.B**arcode	Input of barcode reader	**input**, method, id1, id2, id3, smpl size	ditto
│ ├ **.A**ux	**Miscellaneous**		
│ │ ├ **.L**anguage	Dialog language	**english**, deutsch, francais, espanol, italiano, portugese, svenska	3.2.2.100.
│ │ ├ **.S**et	Setting of date and time	$G	3.2.2.101.
│ │ │ ├ **.D**ate	Date	XXXX-XX-XX	
│ │ │ ├ **.T**ime	Time	XX:XX	
│ │ ├ **.R**unNo	Run number	**0**...9999	3.2.2.102.
│ │ ├ **.A**utoStart	Automatic start	1...9999, **OFF**	3.2.2.103.
│ │ ├ **.St**artDelay	Start delay time	**0**...999 999	3.2.2.104.
│ │ ├ **.Re**sDisplay	Result display	standard,**bold**	3.2.2.105.
│ │ ├ **.D**evName	Device label	8 ASCII char.	3.2.2.106.
│ │ ├ **.P**rog	Program version	read only	3.2.2.107.

.RSSet1	**Settings RS232, 1**	$G	3.2.2.108.
.Baud	Baud rate	300,600,1200,2400,4800, **9600,**19200,38400,57600, 115200	ditto
.DataBit	Number of data bits	7, **8**	ditto
.StopBit	Number of stop bits	**1**, 2	ditto
.Parity	Parity	even, odd, **none**	ditto
.Handsh	Handshake	**HWs**, SWchar, SWline, none	ditto
.RSSet2	as for RS1		
.ComVar	**Values of common variables**		
.C30	C30	**0**... ±999 999	3.2.2.109.
up to C39	**0**... ±999 999		
.DosPrep	**Parameters for the preparation of burets**		
.PowerOnPrep	Warning after power on	ON, **OFF**	3.2.2.110.
.Report	Preparation report	ON, **OFF**	3.2.2.111.
.Select	Selection of dosing unit	**internal D0**, external D1, external D2	3.2.2.112.
.D0	Internal Titrino buret		
.**W**arnInterval	Warning interval for preparation	5...9999, **OFF**	3.2.2.113.
.**V**	Volume	0...**3.5**...99999.99	3.2.2.114.
.**R**epeat	Number of cycles	1...**2**...9	3.2.2.115.
.**D**osRate	Dosing rate	0.01...150, **max.**	3.2.2.116.
.**F**illRate	Filling rate	0.01...150, **max.**	ditto
.D1	Buret D1		
.**W**arnInterval	Warning interval for preparation	5...9999, **OFF**	3.2.2.104.
.**S**elect	Type of dosing unit	**Dosimat**, Dosino	3.2.2.117.
.**D**osimat	Parameters for Dosimats		
.**V**	Volume	0...**3.5**...99999.99	3.2.2.107.
.**R**epeat	Number of cycles	1...**2**...9	3.2.2.108.
.**D**osRate	Dosing rate	0.01...150, **max.**	3.2.2.109.
.**F**illRate	Filling rate	0.01...150, **max.**	ditto
.**Dosin**o	Parameters for Dosinos		
.**O**utlet	Expelling outlet	**tip**, flask	3.2.2.118.
.**D**osTubing	Size of dosing tubes		
.**L**ength	Length	1...**40.0**...999.9	3.2.2.119.
.**D**iam	Diameter	0.1...**2.0**...9.9	ditto
.**A**spirTubing	Size of aspirating tubes		
.**L**ength	Length	1...**25.0**...999.9	ditto
.**D**iam	Diameter	0.1...**2.0**...9.9	ditto
.**DosR**ate	Dosing rate	0.01...150, **max.**	3.2.2.120.
.**F**illRate	Filling rate	0.01...150, **max.**	ditto
.D2	Buret D2 as for D1		

&SmplData

Object	Description	Input range	Reference
& Root			
├ **S**mplData	**Sample data**		
├ **.S**tatus	Status of silo memory	ON, **OFF**	3.2.2.121.
├ **.O**FFSilo	Current sample data		
├ **.I**d1	Sample identification 1	up to 8 ASCII char	3.2.2.122.
├ **.Id2**	Sample identification 2	up to 8 ASCII char	ditto
├ **.Id3**	Sample identification 3	up to 8 ASCII char	ditto
├ **.V**alSmpl	Sample size	±X.XXXXX	ditto
├ **.U**nitSmpl	Unit of sample size	up to 5 ASCII char	ditto
├ **.ON**SiloCurrent sample data			
├ **.C**ounter	Counter of silo memory		
├ **.M**axLines	Maximum lines	read only	3.2.2.123.
├ **.F**irstLine	First line	read only	ditto
├ **.L**astLine	Last line	read only	ditto
├ **.E**ditLine	Editing silo lines		
├ **.1**	1st silo line		
├ **.M**ethod	Method name	up to 8 ASCII char	3.2.2.124.
├ **.I**d1	Sample identification 1	up to 8 ASCII char	ditto
├ **.Id2**	Sample identification 2	up to 8 ASCII char	ditto
├ **.Id3**	Sample identification 3	up to 8 ASCII char	ditto
├ **.V**alSmpl	Sample size	±X.XXXXX	ditto
├ **.U**nitSmpl	Unit of sample size	up to 5 ASCII char	ditto
├ **.C**24	Value of variable C24	read only	ditto
├ **.C25**	Value of variable C25	read only	ditto
├ **.Ma**rk	Mark of silo line	read only	ditto
├ up to 255 lines			
├ **.D**elLine	Delete silo line	$G	3.2.2.125.
├ **.L**ineNum	Line number	1...255, **OFF**	ditto
├ **.DelA**ll	Delete silo line	$G	3.2.2.126.
├ **.Cy**cleLines	Cycle lines	ON, **OFF**	3.2.2.127.
├ **.S**aveLines	Save results	ON, **OFF**	3.2.2.128.

&HotKey

Object	Description	Input range	Reference
& Root			
├ **H**otKey	**Keys with direct access**		
├ **.U**ser	User name		3.2.2.129.
├ **.N**ame	Input of user name	up to 10 ASCII char	ditto
├ **.D**elete	Delete user	$G	ditto
├ **.N**ame	Input of user name	up to 10 ASCII char	ditto
├ **.DelA**ll	Delete all users	$G	ditto
├ **.L**ist	List of users		
├ **.1**	User 1		
├ **.N**ame	Name of user	read only	ditto
├ up to 99			

&Info

Object	Description	Input range	Reference
& Root			
├ **I**nfo	**Current data**		
│ ├ **.R**eport	**Transmission of formatted reports**	$G	3.2.2.130.
│ │ ├ **.S**elect	Report type	configuration, parameters, smpl data, statistics, silo, calib C-fmla, def, user method, **full**, short, mplist, curve, derive, comb, meas crv, temp crv, adj para, scalc full, scalc srt, prep, calc, act dir, mem card, all, ff	ditto
│ ├ **.C**alibrationData	**pH calibration data**	$G	3.2.2.131.
│ │ ├ **.I**np1	For measuring input 1		
│ │ │ ├ **.p**Has	Asymmetry pH	0...**7.00**...±20.00	ditto
│ │ │ ├ **.S**lope	Slope of electrode	0...**1.000**...±9.999	ditto
│ │ │ ├ **.T**emp	Calibration temperature	-170.0...**25.0**...500.0	ditto
│ │ │ ├ **.D**ate	Date of calibration	read only	ditto
│ │ │ ├ **.E**lectrodeId	Id of the calibrated electrode	read only	ditto
│ │ ├ **.Inp2**	For measuring input 2, as for input 1		
│ │ ├ **.D**iff	For differential input, as for input 1		
│ ├ **.P**repData	**Preparation data**		
│ │ ├ **.D**0	For the internal Titrino buret		
│ │ │ ├ **.D**ate	Preparation date	read only	3.2.2.132.
│ │ │ ├ **.T**ime	Preparation time	read only	ditto
│ │ ├ **.D1**	For buret D1		
│ │ │ ├ **.T**ype	Buret type	read only	ditto
│ │ │ ├ **.D**ate	Preparation date	read only	ditto
│ │ │ ├ **.Ti**me	Preparation time	read only	ditto
│ │ ├ **.D2**	For buret D2, as for D1		
│ ├ **.C**hecksums	**Checksums**	$G	3.2.2.133.
│ │ ├ **.M**PList	Checksum of meas.point list	read only	ditto
│ │ ├ **.A**ctualMethod	Checksum of current method	read only	ditto
│ ├ **.D**etermData	**Determination data**	$G	3.2.2.134.
│ │ ├ **.W**rite	Read/write for several nods	ON, **OFF**	
│ │ ├ **.E**xV	Volume of Exchange/Dosing unit	read only/read+write	ditto
│ │ ├ **.M**PList	Measuring point list		
│ │ │ ├ **.1**	Measuring point 1		
│ │ │ │ ├ **.A**ttribute	Attribute	read only/read+write	ditto
│ │ │ │ ├ **.X**	X coordinate	read only/read+write	ditto
│ │ │ │ ├ **.Y**	Y coordinate	read only/read+write	ditto
│ │ │ │ ├ **.Z**1	Z1 coordinate	read only/read+write	ditto
│ │ │ │ ├ **.Z2**	Z2 coordinate	read only/read+write	ditto
│ │ │	for each measuring point		
│ ├ **.T**itrResults	**Titration results**		
│ │ ├ **.R**S	Calculated results		
│ │ │ ├ **.1**	1st result		
│ │ │ │ ├ **.V**alue	Value	read only	3.2.2.135.
│ │ │ ├ up to 9 results			

	"Info", continuation		
.EP	Endpoint		
.1	1st result		
.V	Value	read only	ditto
.Meas	Measured value	read only	
.Mark	Mark if more than 1 EP per window	read only	
up to 9 EP's			
.Var	Variables C4X		
.C40	Start measured value	read only/read+write	ditto
.C41	Titration end volume	read only/read+write	
.C42	Titration time	read only/read+write	
.C43	Volume drift in SET/KFT	read only/read+write	
.C44	Titration temperature	read only/read+write	
.C45	Start volume	read only/read+write	
.C46	Asymmetry pH	read only	
.C47	Slope of electrode	read only	
.C48	Volume at maximum voltage	read only/read+write	
.C49	Volume at minimum voltage	read only/read+write	
.DTime	Time for drift corr.or dosing time	read only/read+write	
.FixEP	Fix EP or fix volume		
.51	C51		
.Value	Value	read only	3.2.2.136.
	up to 59		
.pK	pK/HNP or fix times		
.61	C61		
.Value	Value	read only	ditto
	up to 69		
.TempVar	Temporary variables C7X		
.C70	up to C79	read only/read+write	ditto
.TimeWin	Rates in time windows		
.81	C81		
.Mean	Rate	read only	3.2.2.137.
.Dev	Standard deviation of the rate	read only	ditto
	up to 89		
.MeanRateC80	Mean rate C80		
.Mean	Rate	read only	ditto
.Dev	Standard deviation of the rate	read only	ditto
.StatisticsVal	**Statistics values**		
.ActN	Number of results in chart	read only	3.2.2.138.
.1	1st mean		
.Mean	Mean	read only	ditto
.Std	Absolute standard deviation	read only	ditto
.RelStd	Relative standard deviation	read only	ditto
up to 9 mean values			
.SiloCalc	**Values of silo calculations**		
.C24	Values of variable C24		
.Name	Name	read only	3.2.2.139.
.Value	Value	read only	ditto
.Unit	Unit	read only	ditto
.C25	as for C24		
.C26	Values of variable C26		
.ActN	Number of single values	read only	ditto
.Mean	Mean value	read only	ditto
.Std	Absolute standard deviation	read only	ditto
.RelStd	Relative standard deviation	read only	ditto
.C27	as for C26		

	"Info", continuation		
.ActualInfo	**Current data**		
.Inputs	I/O Inputs		
.Status	Line status	read only	3.2.2.140.
.Change	Change of line status	read only	ditto
.Clear	Clear change	$G	ditto
.Outputs	as for I/O Inputs		
.Assembly	From Assembly		
.CyclNo	Cycle number	read only	3.2.2.141.
.Counter	Assembly counter	read only	3.2.2.142.
.V	Volume counter	read only	ditto
.Clear	Clears counter	$G	ditto
.Meas	Measured value	read only	3.2.2.143.
.Titrator	From Titrator		
.CyclNo	Cycle number	read only	3.2.2.144.
.V	Volume	read only	ditto
.Meas	Measured indicator voltage	read only	ditto
.dVdt	Volume drift dV/dt	read only	ditto
.dMeasdt	Measured value drift	read only	ditto
.dMeasdV	1st deviation of titration curve	read only	ditto
.ERC	ERC from DET	read only	ditto
.T	Temp.as secondary meas.	read only	ditto
.MeasPt	Entry in measuring point list		
.Index	Index of entry	read only	3.2.2.145.
.X	X coordinate	read only	ditto
.Y	Y coordinate	read only	ditto
.Z1	Z1 coordinate	read only	ditto
.Z2	Z2 coordinate	read only	ditto
.EP	EP entry		
.Index	Index of entry	read only	ditto
.X	X coordinate	read only	ditto
.Y	Y coordinate	read only	ditto
.Oven	**Oven data**		
.HeatTime	Heating time	read only	3.2.2.146.
.SampleTemp	Sample temperature	read only	ditto
.LowTemp	Lowest temperature	read only	ditto
.HighTemp	Highest temperature	read only	ditto
.GasFlow	Gas flow	read only	ditto
.UnitFlow	Unit of gas flow	read only	ditto
.Display	**Display**		
.L1	Text line 1	up to 32 ASCII char	3.2.2.147.
up to line 8			
.DelAll	Delete display	$G	ditto
.Comport	Comport		
.Number	COM where PC is connected	read only	3.2.2.148.
.Assembly	**Assembly**		
CycleTime	Cycle time	read only	3.2.2.149.
ExV	Volume of Exchange/Dosing unit	read only	ditto

&Assembly

Object	Description	Input range	Reference
& Root			
⋮			
├ **A**ssembly	**Assembly control**		
├ **. B**ur	**Buret**		
├ **.S**elect	Selection of buret	**internal D0**, external D1 external D2	3.2.2.150.
├ **.E**mpty	Empties the buret	$G,$S,$H,$C	3.2.2.151.
├ **.P**rep	Prepares the buret	$G,$S,$H,$C	3.2.2.152.
├ **.R**ates	Rates		
├ **.F**orward	Forward rate		
├ **.S**elect	Type of rate control	digital, **analog**	3.2.2.153.
├ **.D**igital	Digital rate	0...150, **max**.	ditto
├ **.R**everse	as for forward rate		
├ **.S**elect	Type of rate control	digital, **analog**	ditto
├ **.D**igital	Digital rate	0...150, **max**.	ditto
├ **.F**ill	Fill	$G,$H,$C	3.2.2.154.
├ **.M**odeDis	Dispensing	$G,$S,$H,$C	3.2.2.155.
├ **.S**elect	Type of dispensing control	**volume**, time	ditto
├ **.V**	Volume to be dispensed	0.0001...**0.1**...9999	ditto
├ **.T**ime	Time to dispense	0.25...**1**...86 400	ditto
├ **.VS**top	Limit volume	0.0001...9999, **OFF**	ditto
├ **.A**utoFill	Filling after each increment	ON, **OFF**	ditto
├ **.M**eas	**Measuring**		
├ **.S**tatus	Measuring ON/OFF	ON, **OFF**	3.2.2.156.
├ **.M**easInput	Selection of measuring input	**1**, 2, diff., Ipol, Upol, Temp	ditto
├ **.I**pol	Polarization current	0...**1**...±127	ditto
├ **.U**pol	Polarization voltage	0...**400**...±1270	ditto
├ **.O**utputs	**I/O outputs**		
├ **.A**utoEOD	Automatic output of EOD	**ON**, OFF	3.2.2.157.
├ **.S**etLines	Set I/O lines	$G	ditto
├ **.L**0	Signal on L0	active,inactive,pulse,**OFF**	ditto
├ up to L13			
├ **.R**esetLines	Reset I/O lines	$G	ditto
├ **.S**tirrer	**Stirrer**	ON, **OFF**	3.2.2.158.

&Setup

Object	Description	Input range	Reference
& Root			
├ **S**etup	**Settings for the operating mode**		
├ **.C**omport	Output of automatic info	**1**,2,1&2	3.2.2.159.
├ **.K**eycode	Send key code	ON, **OFF**	3.2.2.160.
├ **.T**ree	Sending format of path info		
├ **.S**hort	Short format of path	ON, **OFF**	3.2.2.161.
├ **.C**hangedOnly	Paths of modified nodes only	ON, **OFF**	ditto
├ **.Tra**ce	Message on changed values	ON, **OFF**	3.2.2.162.
├ **.L**ock	**Lock key functions**		
├ **.K**eyboard	Lock all keyboard keys	ON, **OFF**	3.2.2.163.
├ **.C**onfig	Lock <CONFIG> key	ON, **OFF**	ditto
├ **.P**arameter	Lock <PARAM> key	ON, **OFF**	ditto
├ **.S**mplData	Lock <SMPL DATA> key	ON, **OFF**	ditto
├ **.U**serMeth	Lock functions		
├ **.R**ecall	Lock “loading”	ON, **OFF**	ditto
├ **.S**tore	Lock “saving”	ON, **OFF**	ditto
├ **.D**elete	Lock “deletion”	ON, **OFF**	ditto
└ **.D**isplay	Lock display function	ON, **OFF**	ditto
├ **.M**ode	**Setting waiting intervals**		
├ **.S**tartWait	Waiting time after start	ON, **OFF**	3.2.2.164.
├ **.F**inWait	Waiting time after run	ON, **OFF**	ditto
├ **.S**endMeas	**Automatic sending of measured values**		
├ **.S**endStatus	Connect/disconnect sending	ON, **OFF**	3.2.2.165.
├ **.I**nterval	Time interval	0.08...**4**...16200, MPList	ditto
├ **.Sel**ect	Selection	Assembly, **Titrator**	3.2.2.166.
├ **.A**ssembly	From assembly		
├ **.C**yclNo	Cycle number	ON, **OFF**	3.2.2.167.
├ **.V**	Volume	ON, **OFF**	ditto
├ **.M**eas	Measured indicator voltage	ON, **OFF**	ditto
├ **.T**itrator	From Titrator		
├ **.C**yclNo	Cycle number	ON, **OFF**	3.2.2.168.
├ **.V**	Volume	ON, **OFF**	ditto
├ **.M**eas	Measured indicator voltage	ON, **OFF**	ditto
├ **.d**Vdt	Volume drift dV/dt	ON, **OFF**	ditto
├ **.dM**easdt	Measured value drift	ON, **OFF**	ditto
├ **.dMeasdV**	1st deviation of titration curve	ON, **OFF**	ditto
├ **.E**RC	ERC from DET	ON, **OFF**	ditto
├ **.T**	Temp.as secondary meas.	ON, **OFF**	ditto

	"Setup", continuation		
.AutoInfo	**Automatic message for changes**		3.2.2.169.
.Status	Switch AutoInfo on/off	ON, **OFF**	ditto
.P	When mains is switched on	ON, **OFF**	ditto
.T	**Titrator infos**		
.R	When “ready”	ON, **OFF**	ditto
.G	When method started	ON, **OFF**	ditto
.GC	When start is initiated	ON, **OFF**	ditto
.S	When stopped	ON, **OFF**	ditto
.B	Begin of method	ON, **OFF**	ditto
.F	End of process	ON, **OFF**	ditto
.E	Error	ON, **OFF**	ditto
.H	When “hold"	ON, **OFF**	ditto
.C	Continue after "hold"	ON, **OFF**	ditto
.O	Conditioning OK	ON, **OFF**	ditto
.N	Conditioning not OK	ON, **OFF**	ditto
.Re	Request after start	ON, **OFF**	ditto
.Si	Silo empty	ON, **OFF**	ditto
.M	Entry in measuring point list	ON, **OFF**	ditto
.EP	Entry in EP list	ON, **OFF**	ditto
.RC	Recalculation of results done	ON, **OFF**	ditto
.C	**Comport infos**		
.B1	When COM1 sends a report	ON, **OFF**	ditto
.R1	When COM1 is ready again	ON, **OFF**	ditto
.B2	When COM2 sends a report	ON, **OFF**	ditto
.R2	When COM2 is ready again	ON, **OFF**	ditto
.I	Changing an I/O input	ON, **OFF**	ditto
.O	Changing an I/O output	ON, **OFF**	ditto
.Graphics	Changing the curve output		
.Grid	Grid on curve	**ON**, OFF	3.2.2.170.
.Frame	Frame on curve	**ON**, OFF	ditto
.Scale	Type of depending axis	**Full**, Auto	ditto
.Recorder	Length of axes		
.Right	Length of meas value axis	0.2...**0.5**...1.00	ditto
.Feed	Length of paper drive axis	0.01...**0.05**...1.00	ditto
.PowerOn	RESET (power on)	$G	3.2.2.171.
.Initialise	Set default values	$G	3.2.2.172.
.Select	Selection of branch	**ActMeth**,Config,Silo,Calib Assembly,Setup,All	ditto
.RamInit	Initialization of working mem.	$G	3.2.2.173.
.InstrNo	Device Identification	$G	3.2.2.174.
.Value	Input of device identification	8 ASCII characters	ditto

&Diagnose

Object	Description	Input range	Reference
& Root			
┆			
├ **D**iagnose	**Diagnose**		
├ **.R**eport	Output of adjustment parameters	$G	3.2.2.175.

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 3.2.2.26) as well as after inquiries of calibration temperature and pH values of buffers (see 3.2.2.68 and 3.2.2.69).

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 3.2.2.76 and 3.2.2.56.
With an ongoing measurement, the current mode can be started. This stops the measurement automatically.

3.2.2.3. **M**ode.**S**elect **DET**, MET, SET, KFT, STAT, DOS, DOC, MEAS, CAL, TIP

Mode.**D**ETQuantity	**pH**, U, Ipol, Upol
Mode.**M**ETQuantity	**pH**, U, Ipol, Upol
Mode.**SET**Quantity	**pH**, U, Ipol, Upol
Mode.**MEA**SQuantity	**pH**, U, Ipol, Upol, T
Mode.**K**FTQuantity	**Ipol**, Upol
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 ********. The node can be set read + write, see 3.2.2.134.

3.2.2.5.

Mode.**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.**D**ef.**F**ormulas.**1.L**imits	ON, **OFF**
Mode.**D**ef.**F**ormulas.**1.Lo**Lim	**0**...±999 999
Mode.**D**ef.**F**ormulas.**1.Up**Lim	**0**...±999 999
Mode.**D**ef.**F**ormulas.**1.O**utput	active, pulse, **OFF**
Mode.**D**ef.**F**ormulas.**2.F**ormula	
etc. up to **.9**	

Entry of formulas. Rules for formula entry, see page 74.
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.
The limit control for results can also be activated. If a result is out of limit, a message appears in the result report, E196 is sent, and output line L13 can be set.

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 3.2.2.109.

3.2.2.8. **M**ode**.Def.R**eport**.A**ssign1
Mode**.Def.R**eport**.Assign2**

DET: full, short, mplist, curve, derive comb, scalc full, scalc srt, calc, param, calib, ff
MET, SET, MEAS: full, short, mplist, curve, scalc full, scalc srt, calc, param, calib, ff
KFT: full, short, mplist, curve, scalc full, scalc srt, calc, param, ff
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 ";".
.Assign1: Output to COM1 of the Titrino. Identical for COM2.

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 3.2.2.24. Rules for statistics calculations see page 77.

3.2.2.10. **M**ode.**Def.T**empVar.**C70** RSX, EPX, CXX
etc. up to **.C79**
Assignment of temporary variables in a submethod for calculations 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 Titrino. Operands specific to the sample (3.2.2.117 and 3.2.2.135) and values of common variables (3.2.2.109) on the other hand are not stored with the methods.

3.2.2.12. **M**ode.**P**arameter.**T**itrPara.**M**ptDensity 0...**4**...9
Mode.**P**arameter.**T**itrPara.**Mi**nIncr 0...**10.0**...999.9
Mode.**P**arameter.**T**itrPara.**V**Step 0...**0.10**...9.999
.MptDensity: Parameter for DET: Measuring point density.
.MinIncr: Parameter for DET: Minimum increment in uL. If the minimum increment is set to 0, measured values are stored vs. time.
.VStep: Parameter for MET: Volume increment in mL. With "0", there is no dispensing and measured values vs. time are entered in the measuring point list.

3.2.2.13. **M**ode.**P**arameter.**T**itrPara.**D**osRate 0.01...150, **max.**
Parameters for DET and MET: Dispensing rate for the volume increments in mL/min. Max. means maximum possible dispensing rate with the Exchange Unit in current use.

3.2.2.14. **M**ode.**P**arameter.**T**itrPara.**S**ignalDrift pH,U,Ipol:0.5...**50**...999, OFF
Upol: 0.05...**50**...99.9, OFF
Mode.**P**arameter.**T**itrPara.**U**nitSigDrift read only
Mode.**P**arameter.**T**itrPara.**E**quTime 0...**26**...9999, OFF
Parameters for DET and MET: Criteria for the measured value acquisition. Measured value drift in mV/min (with pH, U, Ipol) or uA/min (with Upol), equilibration time in s. OFF means that the corresponding criterion is switched off. If both criteria are OFF, the measured values are acquired immediately after dispensing.
If the equilibration time has never been edited, it is automatically calculated by the instrument to match the drift, see page 20. After it has been edited once, it remains in force with the set value.

3.2.2.15. **M**ode.**P**arameter.**T**itrPara.**St**artV.**T**ype abs., rel., **OFF**
Mode.**P**arameter.**T**itrPara.**St**artV.**V** **0**...999.99
Mode.**P**arameter.**T**itrPara.**St**artV.**F**actor **0**...±999 999
Mode.**P**arameter.**T**itrPara.**St**artV.**R**ate 0.01...150, **max.**
Parameters for DET, MET, SET, KFT, STAT: 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.

3.2.2.16. **M**ode.**P**arameter.**T**itrPara.**P**ause **0**...999 999
Parameters for DET, MET, SET, KFT, STAT: Pause time in s. Is waited off after the dispensing of the start volume.

3.2.2.17. **M**ode.**P**arameter.**T**itrPara.**DosU**nit **internal D0**, external D1/D2
Mode.**P**arameter.**D**osPara.**DosU**nit **internal D0**, external D1/D2
.TitrPara.DosUnit: Parameter for DET, MET, SET, KFT, STAT. Selection of dosing unit.
.DosPara.DosUnit: Parameter for DOS, DOC. Selection of dosing unit.

3.2.2.18. **M**ode.**P**arameter.**T**itrPara.**Me**asInput **1**, 2, diff.
Mode.**P**arameter.**T**itrPara.**I**pol -127...**1**...+127
Mode.**P**arameter.**T**itrPara.**Up**ol -1270...**400**...+1270
Mode.**P**arameter.**T**itrPara.**Po**lElectrTest ON, **OFF**
Parameters for DET, MET, SET, KFT STAT:
Selection of the measuring input; valid with measured quantities pH and U. "diff." means differential amplifier, see page 216.
With Ipol, the inquiries for the polarization current in uA (Ipol) and .PolElectrTest are valid.
With Upol, the inquiry for the polarization 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 change-over from the inactive state to an active state (titration or conditioning).

3.2.2.19. **M**ode.**P**arameter.**T**itrPara.**T**emp -170.0...**25.0**...500.0
Parameters for DET, MET, SET, KFT, STAT: Titration temperature in °C. If a Pt100 or Pt1000 is connected, the temperature is measured continuously and the parameter .Temp is updated.
The temperature is used for the temperature correction in pH measurements.

3.2.2.20. **M**ode.**P**arameter.**St**opCond.**V**Stop.**T**ype **abs.**, rel., OFF
Mode.**P**arameter.**St**opCond.**V**Stop.**V** 0...**99.99**...9999.99
Mode.**P**arameter.**St**opCond.**V**Stop.**F**actor 0...±**999 999**
Parameters for DET, MET, SET, KFT, STAT, DOS, DOC: Stop volume. (With DOS the default value for .Type is "OFF" and the input range for V is 0...99999.99.)
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.

3.2.2.21. **M**ode.**P**arameter.**S**topCond.**M**easStop pH: 0...±20.00, **OFF**
U: 0... ±2000, **OFF**
I: 0...200.0, **OFF**

Mode.**P**arameter.**S**topCond.**U**nitMStop read only

Parameters for DET and MET: Stop when a measured value is reached. Entry as pH value, in mV (with U and Ipol) and in uA (with Upol). The appropriate unit can be viewed with .UnitMStop.
OFF means that the criterion is not monitored.

3.2.2.22. **M**ode.**P**arameter.**S**topCond.**E**PStop 1...**9**, OFF

Parameters for DET and MET: Stop when a certain number of EP's has been found.
OFF means that the criterion is not monitored.

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

Parameters for DET, MET, SET, KFT, STAT, DOS, DOC: Filling rate in the titration in mL/min. Max. means maximum possible filling rate with the Exchange Unit in current use.

3.2.2.24. **M**ode.**P**arameter.**Sta**tistics.**S**tatus ON, **OFF**

Mode.**P**arameter.**Sta**tistics.**M**eanN **2**...20

Mode.**P**arameter.**Sta**tistics.**R**esTab.**S**elected **original**, delete n, delete all

Mode.**P**arameter.**Sta**tistics.**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.

3.2.2.25. **M**ode.**P**arameter.**E**valuation.**E**PC DET: 0...**5**...200
MET pH: 0.1...**0.50**...9.99
U, Ipol: 1...**30**...999
Upol: 0.1...**2**...99.9

Mode.**P**arameter.**E**valuation.**R**ecognition.**S**elected **all**, greatest, last, window, OFF

Mode.**P**arameter.**E**valuation.**R**ecognition.**W**indow.**1.L**owLim
pH: 0...±20.00, **OFF**
U, Ipol: 0...±2000, **OFF**
Upol: 0...±200.0, **OFF**
Mode.**P**arameter.**E**valuation.**R**ecognition.**W**indow.**1.U**pLim
Input range as LowLim
etc. up to 9 windows
Mode.**P**arameter.**E**valuation.**F**ixEP.**1.V**alue pH: 0...±20.00, **OFF**
U; Ipol: 0...±2000, **OFF**
etc. up to 9 fix EP's Upol: 0...±200.0, **OFF**
Mode.**P**arameter.**E**valuation.**p**K ON, **OFF**

Parameters for DET and MET: Evaluation of the EP's, see page 21.
.EPC: EP criterion in pH, in mV (with U and Ipol) or in uA (with Upol).
.Recognition.Selected: EP recognition.
all: All endpoints found are recognized.
great: Only the largest EP is recognized.
last: Only the last EP is recognized.
window: Only EP's that lie within set windows are recognized.
OFF: The EP evaluation is switched off.
.Recognition.Window.1.LowLim: Lower limit for window in pH, mV (with U and Ipol) or uA (with Upol).
.Recognition.Window.1.UpLim: Upper limit for window in pH, mV (with U and Ipol) or uA (with Upol).
Windows are opened until the lower limit is set to OFF. For every expected EP, an individual window must be set, see page 23.
.FixEP.1.Val: Fix-EP's in pH, mV (for U, Ipol) resp. uA (for Upol). Fix EP's are evaluated until the setting OFF is found.
.pK: pK or HNP evaluation. Possible only in pH and U titrations.

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

Parameters for DET, MET, SET, KFT, STAT, DOS, DOC, MEAS: 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 3.2.2.122) or with &M $G, see 3.2.2.1.
$H is not possible in requests.

3.2.2.27. **M**ode.**P**arameter.**P**resel.**L**imSmplSize.**S**tatus ON, **OFF**
Mode.**P**arameter.**P**resel.**L**imSmplSize.**L**oLim **0.0**...999 999
Mode.**P**arameter.**P**resel.**L**imSmplSize.**U**pLim 0.0...**999 999**

Limit control for the sample size.

3.2.2.28. **M**ode.**P**arameter.**P**resel.**A**ctPuls ON, **OFF**
for SET, KFT: first, all, cond., **OFF**

Output of a pulse on the I/O line "Activate", see page 224.

3.2.2.29. **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
Parameters for SET: Setting the 1st endpoint as pH value, in mV (with U and Ipol) resp. uA (with Upol). The corresponding unit can be read with .UnitEP.
If the value is on "OFF", no further nodes will appear from SET1.

3.2.2.30. **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.**P**arameter.**S**ET1.**UnitD**yn read only
Mode.**P**arameter.**S**ET1.**M**axRate 0.01...**10**...150, max.
Mode.**P**arameter.**S**ET1.**Mi**nRate 0.01...**25.0**...999.9
Parameters for SET: Control parameters, see page 31.
.Dyn: Dynamics, control range 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 rate with the Exchange Unit in current use.
.MinRate: Minimum titration rate in ul/min.

3.2.2.31. **M**ode.**P**arameter.**S**ET1.**S**top.**T**ype **drift**, time
Mode.**P**arameter.**S**ET1.**S**top.**D**rift 1...**20**...999
Mode.**P**arameter.**S**ET1.**S**top.**Ti**me 0...**10**...999, inf
Mode.**P**arameter.**S**ET1.**S**top.**S**topT 0...99 999, **OFF**
Parameters for 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 ul/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.".

3.2.2.32. **M**ode.**P**arameter.**T**itrPara.**D**irection +, -, **auto**
Parameters for SET, KFT, 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.

3.2.2.33. **M**ode.**P**arameter.**T**itrPara.**X**Pause **0**...999 999
Parameter for SET, KFT: Pause time in s. Runs before dosing the start volume.

3.2.2.34. **M**ode.**P**arameter.**T**itrPara.**E**xtrT **0**...999 999
Parameter for SET, KFT: Extraction time in s.

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

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

3.2.2.36. **M**ode.**P**arameter.**P**resel.**C**ond ON, **OFF**
Mode.**P**arameter.**P**resel.**D**riftDisp **ON**, OFF
Mode.**P**arameter.**P**resel.**DC**or.**T**ype auto, man., **OFF**
Mode.**P**arameter.**P**resel.**DC**or.**V**alue **0.0**...99.9

Parameters for SET, KFT:
.Cond: Conditioning ON/OFF
.DriftDisp: Drift display during conditioning ON/OFF.
.DCor.Type: Type of drift take-over for the drift correction. auto: Take-over of the drift value at start.
.DCor.Value: Drift value for the manual drift correction.

3.2.2.37. **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 KFT, STAT: Setting of the EP, resp. Control point as a pH value, in mV (with U and Ipol) or uA (with Upol). The corresponding unit can be read with .UnitEP.
With KFT the standard value for Ipol is 250 mV, for Upol 25 uA.

3.2.2.38. **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**nIncr 0.1...9.9, **min.**

Parameters for KFT, STAT: Control parameters.
.Dyn: Dynamics (control range) in pH, mV (with U and Ipol) or uA (with Upol). The corresponding unit can be read with .UnitDyn. Standard with KFT Ipol 100, with KFT Upol 10.
.MaxRate: Maximum allowed titration rate in ml/min. Max. means maximum possible rate with mounted Exchange Unit.
.MinIncr: Parameter for KFT. Minimum volume increment in ul.

3.2.2.39. **M**ode.**P**arameter.**P**resel.**O**ven COM1, COM2, **no**

Parameter for KFT.
If an Oven is connected, its results will be incorporated into the result report of the Titrino.
If there is no Oven connected via RS232, this parameter has to be on "no".

3.2.2.40. **M**ode.**P**arameter.**C**trlPara.**Mi**nRate 0.01...**25.0**...9999

Parameter for STAT: Control parameters.
.MinRate: Minimum titration rate in ul/min.

3.2.2.41. **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.

3.2.2.42. **M**ode.**P**arameter.**St**opCond.**T**Stop.**T**ype abs.,rel.,delta,delay**,OFF**
Mode.**P**arameter.**St**opCond.**T**Stop.**T**ime 0...**999 999**
Mode.**P**arameter.**St**opCond.**T**Stop.**F**actor 0...±**999 99**
Mode.**P**arameter.**St**opCond.**T**Stop.**D**elta 0...**999 999**
Mode.**P**arameter.**St**opCond.**T**Stop.**Dela**y 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.
delta: Time in s after control point is reached for the first time.
delay: Time in s after last dosing step.
OFF means that the criterion is not monitored.

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

Parameters 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.

3.2.2.44. **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).

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

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

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

Parameters 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.

3.2.2.47. **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.

3.2.2.48. **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, then 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.

3.2.2.49. **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.

3.2.2.50. **M**ode.**P**arameter.**M**onitoring.**L**10Output.**A**ssignOutput
meas, temp, rate, all, **none**
Mode.**P**arameter.**M**onitoring.**L**10Output.**L**imit upper,lower,**any**
Mode.**P**arameter.**M**onitoring.**L**10Output.**O**utput active, **pulse**

Parameters for STAT, DOS, DOC: Output of a signal on L10 output (pin 8) of the remote socket on limit value violation.

The output can be assigned a definite or all monitoring value(s) as well as the violated limit and the type of signal to be outputted determined.

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

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

3.2.2.52. **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.**Ti**me.**T**ime 1...**100**...999 999
Mode.**P**arameter.**D**osPara.**Ti**me.**D**isType **volume**, rate
Mode.**P**arameter.**D**osPara.**Ti**me.**R**ate 0.001...150, **max.**
Mode.**P**arameter.**D**osPara.**Ti**me.**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.

3.2.2.53. **M**ode.**P**arameter.**D**osPara.**P**ause **0**...999 999

Parameters for DOS: Pause time in s.

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

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

3.2.2.55. **M**ode.**P**arameter.**D**osPara.**Te**mp -170.0...**25.0**...500.0

Parameters 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.

3.2.2.56. **M**ode.**P**arameter.**M**onitoring.**M**easVal.**M**easModepH,U,Ipol,Upol,**OFF**
Mode.**P**arameter.**M**onitoring.**M**easVal.**MeasI**nput **1**, 2, diff.
Mode.**P**arameter.**M**onitoring.**M**easVal.**P**Current 0...**1**...±127
Mode.**P**arameter.**M**onitoring.**M**easVal.**PV**oltage 0...**400**...±1270
Mode.**P**arameter.**M**onitoring.**M**easVal.**Po**lElectrTest 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.**Up**ol.**L**owLim **0**...±200.0
Mode.**P**arameter.**M**onitoring.**M**easVal.**Up**ol.**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 216.
With Ipol, the requests for the polarization current in uA (Ipol) and .PolElectrTest apply.
With Upol, the request for the polarization voltage in mV (Upol) applies. Entry in steps of 10 mV. .PolElectrTest also applies. If the test for polarized 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.

3.2.2.57. **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.

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

Sweep time for the ramp in s.

3.2.2.59. **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.**Mi**nRate 0.01...**5.0**...9999

Parameters for DOC: Control parameters, see page 68.
.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 rate with the mounted Exchange Unit.
.MinRate: Minimum titration rate in ul/min.

3.2.2.60. **M**ode.**P**arameter.**D**osPara.**Di**rection +, -, **auto**

Parameters 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.

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

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.

3.2.2.62. **M**ode.**P**arameter.**D**osPara.**Me**asInput **1**, 2, diff.
Mode.**P**arameter.**D**osPara.**I**pol 0...**1**...±127
Mode.**P**arameter.**D**osPara.**Up**ol 0...**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 216.
With Ipol, the requests for the polarization current in uA (Ipol) and .PolElectrTest apply.
With Upol, the request for the polarization voltage in mV (Upol) applies. Entry in steps of 10 mV. .PolElectrTest also applies.
If the test for polarized electrodes is switched on (ON), it will be performed on the change from the inactive basic mode to an active mode.

3.2.2.63. **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), uA/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 69. After it has been edited once, it remains in force with the set value.

3.2.2.64. **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.**Up**ol ±1270...**400**...+1270
Mode.**P**arameter.**M**easuring.**P**olElectrTest ON, **OFF**

Parameters for MEAS:

Selection of the measuring input; valid with measured quantities pH and U. "diff." means differential amplifier, see page 216.
With Ipol, the inquiries for the polarization current in uA (Ipol) and .PolElectrTest are valid.
With Upol the inquiry for the polarization 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 change-over from the inactive state to the measurement.

3.2.2.65. **M**ode.**P**arameter.**M**easuring.**T**emp -170.0...**25.0**...500.0
Parameters 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.

3.2.2.66. **M**ode.**P**arameter.**M**easuring.**TD**elta 1...**2**...999 999
Parameters for MEAS: Time interval in s for the acquisition of a measured value into the measuring point list.

3.2.2.67. **M**ode.**P**arameter.**C**alibration.**M**easInput **1**, 2, diff.
Parameters for CAL: Selection of the measuring input. "diff." means differential amplifier, see page 215.

3.2.2.68. **M**ode.**P**arameter.**C**alibration.**C**alTemp -20.0...**25.0**...120.0
Parameters for CAL: Calibration temperature in °C. If a Pt 100 or Pt1000 is connected, the temperature is measured.

3.2.2.69. **M**ode.**P**arameter.**C**alibration.**B**uffer.**1.V**alue 0...**7.00**...±20.00
Mode.**P**arameter.**C**alibration.**B**uffer.**2.V**alue 0...**4.00**...±20.00, OFF
etc. up to 9 buffers
Parameters for CAL: pH of buffers. The first buffer which is set to "OFF" determines the number of buffers in the calibration.

3.2.2.70. **M**ode.**P**arameter.**C**alibration.**S**ignalDrift 0.5...**2**...999, OFF
Mode.**P**arameter.**C**alibration.**E**quTime 0...**110**...9999, OFF
Parameters 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 20. After it has been edited once, it remains in force with the set value.

3.2.2.71. **M**ode.**P**arameter.**C**alibration.**El**ectrodeId up to 8 ASCII char
Parameters for CAL: Electrode identification. It is classified under calibration data, see 3.2.2.131.

3.2.2.72. **M**ode.**P**arameter.**C**alibration.**Sm**plChanger ON, **OFF**
Parameters for CAL: Calibration at Titrino.
With "ON", there are no hold points in the calibration sequence for entries, the first buffer is measured directly.

3.2.2.73. **M**ode.**P**arameter.**C**alibration.**A**ctPulse first, all, **OFF**
Parameters for CAL: Output of a pulse on the I/O line "Activate", see page 224.

3.2.2.74. **M**ode.**P**arameter.**S**equence.**X.S**elect method, pause, L4 output, L6 output, info, prep, stirrer, **OFF**
Parameters for TIP: Selection of an element for step X (X = 1...30). For the parameters of the elements see 3.2.2.75.

3.2.2.75.

Mode.**P**arameter.**S**equence.**X.M**ethod	Method name
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	as for L4
Mode.**P**arameter.**S**equence.**X.I**nfo	up to 16 ASCII characters
Mode.**P**arameter.**S**equence.**X.Pr**ep	**internal D0**, external D1, external D2
Mode.**P**arameter.**S**equence.**X.S**tirrer	**ON**, OFF

Parameters for TIP: Parameters of the elements of TIP.
.Method: Method name of a method available in the user memory or on the card. 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.
.Prep: Preparation of titrating buret.
.Stirrer: Switching stirrer on/off.

3.2.2.76.

Mode.**P**arameter.**P**resel.**M**easMode	pH, U, Ipol, Upol, **OFF**
Mode.**P**arameter.**P**resel.**MeasI**nput	**1**, 2, diff.
Mode.**P**arameter.**P**resel.**Ip**ol	0...**1**...±127
Mode.**P**arameter.**P**resel.**U**pol	0...**400**...±1270
Mode.**P**arameter.**P**resel.**Po**lElectrTest	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 215. With Ipol the requests for the polarization current

in uA (Ipol) and .PolElectrTest apply. With Upol the request for the polarization voltage in mV (Upol) applies. Entry in steps of 10 mV. .PolElectrTest also applies. If the test for polarized 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.

3.2.2.77. **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".

3.2.2.78. **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 internal method memory: Load, store and delete methods. An action is performed if "$G" is sent to the corresponding node just after entering the name.
Do not use blank characters before and after method name!
.DelAll: Deletes all methods in the user memory.

3.2.2.79. **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.D**osUnit read only
UserMeth.**L**ist.**1.B**ytes read only
UserMeth.**L**ist.**1.C**hecksum read only
for each method

List of the methods in the user method memory with the following characteristics:
.Name: Name of the method
.Mode: Mode
.Quantity: Measured quantity
.DosUnit: Buret of the method
.Bytes: Number of bytes of the user memory used by the method
.Checksum: Checksum of the method, see 3.2.2.133.

3.2.2.80. **Me**moryCard.**R**ecall $G
MemoryCard.**R**ecall.**N**ame up to 8 ASCII characters
MemoryCard.**S**tore $G
MemoryCard.**S**tore.**N**ame up to 8 ASCII characters
MemoryCard.**D**elete $G
MemoryCard.**D**elete.**N**ame up to 8 ASCII characters

Administration of the method memory of the current directory of the memory card: load, store and delete methods. The action is carried out, if "$G" is transmitted to the corresponding node.
Do not use blank characters before and after method name!

3.2.2.81. **Me**moryCard.**C**hangeDir $G
MemoryCard.**C**hangeDir.**N**ame up to 10 ASCII characters
MemoryCard.**C**hangeDir.**C**hecksum $G
MemoryCard.**C**hangeDir.**C**hecksum.**V**alue read only

Changing the current directory. The action is carried out if "$G" is transmitted to the corresponding node.
Do not use blank characters before and after name!
The checksum characterizes the content of the directory.

3.2.2.82. **Me**moryCard.**Cr**eateDir $G
MemoryCard.**Cr**eateDir.**N**ame up to 10 ASCII characters

Delete directory. The action is carried out if "$G" is transmitted to the corresponding node.
Do not use blank characters before and after name!

3.2.2.83. **Me**moryCard.**DelD**ir $G
MemoryCard.**DelD**ir.**N**ame up to 10 ASCII characters

Delete directory. The action is carried out if "$G" is transmitted to the corresponding node.
Do not use blank characters before and after name!

3.2.2.84. **Me**moryCard.**B**ackup $G
MemoryCard.**B**ackup.**N**ame up to 10 ASCII characters

Backup of the internal memory onto the card. The action is carried out if "$G" is transmitted to the corresponding node.
Do not use blank characters before and after name!

3.2.2.85. **Me**moryCard.**Rel**oad $G
MemoryCard.**Rel**oad.**N**ame up to 10 ASCII characters

Reload a backup from the memory card into the internal memory. The action is carried out if "$G" is transmitted to the corresponding node.
Do not use blank characters before and after name!

3.2.2.86. **Me**moryCard.**F**ormat $G
MemoryCard.**C**ardLabel.**N**ame up to 8 ASCII characters

Format the memory card. The action is carried out if "$G" is transmitted to the corresponding node.
Do not use blank characters before and after name!

3.2.2.87. **Me**moryCard.**Fr**eeMem read only

Free memory on the card. $Q sends number of free bytes, e.g. "4928".

3.2.2.88. **Me**moryCard.**Bat**teryChange $G
MemoryCard.**Bat**teryChange.**D**ate YYYY-MM-DD

Date for changing battery. The date will be set with "$G".

3.2.2.89. **Me**moryCard.**L**ist.**C**ard.**1.N**ame read only
MemoryCard.**L**ist.**C**ard.**1.B**ytes read only
for each directory
List of all directories on the memory card with the following information:
.Name: Name of the directory
.Bytes: Number of bytes used by the directory

3.2.2.90. **Me**moryCard.**L**ist.**A**ctDir.1.**N**ame read only
MemoryCard.**L**ist.**A**ctDir.1.**M**ode read only
MemoryCard.**L**ist.**A**ctDir.1.**Q**uantity read only
MemoryCard.**L**ist.**A**ctDir.1.**D**osUnit read only
MemoryCard.**L**ist.**A**ctDir.1.**B**ytes read only
MemoryCard.**L**ist.**A**ctDir.1.**C**hecksum read only
for each method
List of all methods of the current card directory with the following information:
.Name: Name of the method
.Mode: Mode
.Quantity: Measured quantity
.DosUnit: Buret of the method
.Bytes: Number of bytes used by the method
.Checksum: Checksum of the method, see 3.2.2.133.

3.2.2.91. **C**onfig.**M**onitoring.**V**alidation.**S**tatus ON, **OFF**
Config.**M**onitoring.**V**alidation.**I**nterval 1...**365**...9999
Config.**M**onitoring.**V**alidation.**C**ounter **0**...9999
Config.**M**onitoring.**V**alidation.**Cl**earCount $G
Monitoring of validation.
.Interval: Time interval in days for validation.
.Counter: Time counter in days since last validation.
.ClearCount: Clears the above counter.

3.2.2.92. **C**onfig.**M**onitoring.**C**alibration.**S**tatus ON, **OFF**
Config.**M**onitoring.**C**alibration.**M**easInput **1**, 2, diff
Config.**M**onitoring.**C**alibration.**I**nterval 1...**7**...9999
Config.**M**onitoring.**C**alibration.**C**ounter **0**...9999
Monitoring of pH calibration.
.MeasInput:Measuring input.
.Interval: Time interval in days for calibration from the last calibration date.
.Counter: Time counter in days since last calibration. The counter is reset to zero if a new calibration is carried out or if the calibration for the corresponding measuring input is entered manually.

3.2.2.93. **C**onfig.**M**onitoring.**S**ervice.**S**tatus ON, **OFF**
Config.**M**onitoring.**S**ervice.**D**ate XXXX-XX-XX
Monitoring of service interval.

3.2.2.94. **C**onfig.**M**onitoring.**D**iagRep ON, **OFF**
Printing of system test report after each switching on of the Titrino.

3.2.2.95. **C**onfig.**P**eriphUnit.**C**harSet1 Epson, Seiko, Citizen, HP, **IBM**
Config.**P**eriphUnit.**CharSet2**

Selection of the character set and the graphics control characters for COM1 resp. COM2 of the Titrino.
IBM means the IBM character set following character set table 437 and IBM graphics control characters. Select 'IBM' for work with the computer.

3.2.2.96. **C**onfig.**P**eriphUnit.**R**epToComport **1**, 2, 1&2

Selection of COM of the Titrino where manually triggered reports should be outputted.

3.2.2.97. **C**onfig.**P**eriphUnit.**B**alance **Sartorius**,Mettler,Mettler AT, AND,Precisa

Selection of the balance type.

3.2.2.98. **C**onfig.**P**eriphUnit.**S**tirrer ON, **OFF**

Automatic stirrer control. With "ON" the stirrer will be switched on after starting a method. At the end of the method it is switched off again. Valid for DET, MET, SET, KFT, STAT, DOC.

3.2.2.99. **C**onfig.**P**eriphUnit.**Rem**oteBox.**S**tatus ON, **OFF**
Config.**P**eriphUnit.**Rem**oteBox.**K**eyboard **US**, deutsch, francais, español, schweiz.
Config.**P**eriphUnit.**Rem**oteBox.**B**arcode **input**, method, id1, id2, id3, smpl size

Connections via Remote Box.
.Status: Select if a Remote Box is connected.
.Keyboard: Type of keyboard which is connected to the Remote Box.
.Barcode: Select target in Titrino where you wish to have the string from the barcode reader. "input" means that the string comes into the field where the cursor is currently placed.

3.2.2.100. **C**onfig.**A**ux.**L**anguage **english**, deutsch, francais, espanol, italiano, portugese, svenska

Selection of the dialog language.

3.2.2.101. **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, two-digit, 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.

3.2.2.102. **C**onfig.**A**ux.**R**unNo **0**...9999
Current sample number.
Set to 0 on power on and initialization. After 9999, counting starts again at 0.

3.2.2.103. **C**onfig.**A**ux.**A**utoStart 1...9999, **OFF**
Number of automatic, internal starts.

3.2.2.104. **C**onfig.**A**ux.**St**artDelay **0**...999 999
Start delay time in s. During this time, the data of the preceding determination are retained.

3.2.2.105. **C**onfig.**A**ux.**Re**sDisplay **bold**, standard
Character set for the result display at the end of the determination.

3.2.2.106. **C**onfig.**A**ux.**D**evName 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 No. 65...90), a...z (ASCII No. 97...122) and the numbers 0...9 (ASCII No. 48...57) when the function Setup.AutoInfo (3.2.2.169) is used at the same time.
If a name has been entered, it will be printed out in the result report (full, short).

3.2.2.107. **C**onfig.**A**ux.**P**rog read only
Output of the program version.
The Titrino sends "799.0010" on requests with $Q.

3.2.2.108. **C**onfig.**R**SSet1 $G
Config.**R**SSet1.**B**aud 300, 600, 1200, 2400, 4800, **9600,** 19200, 38400, 57600, 115200
Config.**R**SSet1.**D**ataBit 7, **8**
Config.**R**SSet1.**S**topBit **1**, 2
Config.**R**SSet1.**P**arity even, odd, **none**
Config.**R**SSet1.**H**andsh **HWs**, SWchar, SWline, none
$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.
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 180 ff.
Baud rates >9600 need a PC which is equipped accordingly (e.g. with 16550 component).
The setting of the values must be initiated with $G immediately after entry of the values.

3.2.2.109. **C**onfig.**C**omVar.**C30**
with up to **.C39**, etc. 0... ±999 999
Values of the common variables from C30 up to C39. Insert the common variables directly or describe the determination results directly from the method, see 3.2.2.7

3.2.2.110. **C**onfig.**D**osPrep.**P**owerOnPrep ON, **OFF**
Warning after power on, that the preparation of the buret has to be executed.

3.2.2.111. **C**onfig.**D**osPrep.**R**eport ON, **OFF**
Report output after preparation of burets.

3.2.2.112. **C**onfig.**D**osPrep.**S**elect **internal D0**, external D1, external D2
Selection of buret.

3.2.2.113. **C**onfig.**D**osPrep.**DX.W**arnInterval 5...9999, **OFF**
Time interval in min for automatic warning that a preparation has to be executed.

3.2.2.114. **C**onfig.**D**osPrep.**DX**(**.D**osimat).**V** 0...**3.5**...99999.99
Volume in ml, which will be expelled at the preparation. Start of sequence see 3.2.2.152.

3.2.2.115. **C**onfig.**D**osPrep.**DX**(**.D**osimat).**R**epeat 1...**2**...9
Number of cycles for expelling the volume at the preparation. Start of sequence see 3.2.2.152.

3.2.2.116. **C**onfig.**D**osPrep.**DX**(**.D**osimat).**D**osRate 0.01...150, **max.**
Config.**D**osPrep.**DX**(**.D**osimat).**F**illRate 0.01...150, **max.**
Dosing and filling rate in ml/in for the preparation. Start of sequence see 3.2.2.152.

3.2.2.117. **C**onfig.**D**osPrep.**DX.S**elect **Dosimat**, Dosino
Selection of buret type. Start of sequence see 3.2.2.152.

3.2.2.118. **C**onfig.**D**osPrep.**DX.Dosin**o.**O**utlet **tip**, flask
Place where the liquid of the preparation is expelled. Start of sequence see 3.2.2.152.
tip: To the tip.
flask: Back to the flask.

3.2.2.119. **C**onfig.**D**osPrep.**DX.Dosin**o.**D**osTubing.**L**ength 1...**40**...999.9
Config.**D**osPrep.**DX.Dosin**o.**D**osTubing.**D**iameter 0.1...**2**...9.9
Config.**D**osPrep.**DX.Dosin**o.**A**spirTubing.**L**ength 1...**25**...999.9
Config.**D**osPrep.**DX.Dosin**o.**A**spirTubing.**D**iameter 0.1...**2**...9.9

.DosTubing: Dosing tube. Length in cm, diameter in mm.
.AspirTubing: Aspiration tube. Length in cm, diameter in mm.
Start of sequence see 3.2.2.152.

3.2.2.120. **C**onfig.**D**osPrep.**DX.Dosin**o.**D**osRate 0.01...150, **max.**
Config.**D**osPrep.**DX.Dosin**o.**F**illRate 0.01...150, **max.**

Dosing and filling rate in ml/min for preparation. Start of sequence see 3.2.2.152.

3.2.2.121. **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.

3.2.2.122. **S**mplData**.O**FFSilo**.I**d1 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-digits, 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.

3.2.2.123. **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.

3.2.2.124. **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-digits, sign and dec.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 **.255**

Contents of a silo line.

.Method: Method used to process the sample, from the method memory or from the card.
.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), "/" last worked-off line, where recalculation can still be done. Silo lines which have been worked off are "read only".

3.2.2.125. **S**mplData**.ON**Silo**.D**elLine $G
SmplData**.ON**Silo**.D**elLine**.L**ineNum 1...255, **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").

3.2.2.126. **S**mplData**.ON**Silo**.DelA**ll $G
Deletes the entire silo memory. Must be triggered with $G.

3.2.2.127. **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 96.
Exercise caution if you edit the silo memory during the determinations!

3.2.2.128. **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 3.2.2.126.

3.2.2.129. **H**otKey**.U**ser**.N**ame up to 10 ASCII characters
HotKey**.U**ser**.D**elete $G
HotKey**.U**ser**.D**elete**.N**ame up to 10 ASCII characters
HotKey**.U**ser**.DelA**ll $G
HotKey**.U**ser**.L**ist**.1.N**ame read only
Management of user names.
.Name: Input of user names.
.Delete.Name: Deletes selected user name with &HotKey.User.Delete $G.
.List: List of all user names.

3.2.2.130. **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, deriv, comb, meas crv, temp crv, adj para, scalc full, scalc srt, prep, calc, act dir, mem card, all, ff

$G sends the selected report to the COM which is set in &Config.PeriphUnit.RepToComport:
configuration: Configuration report. Is not accessible during a running determination.
parameters: Parameter report of the current method. During a running determination only "live"-parameters are accessible.
smpl data: Current sample data.
statistics: Statistics table with the individual results.
silo: Contents of the silo memory.
calib: Calibration data of the measuring input in the current method.
C-fmla: Contents of the <C-fmla> key.
def: Contents of the <def> key.
user method: Contents of the method memory.
full: Full result report of the last completed determination.
short: Short result report of the last completed determination.
mplist: Measuring point list of the running determination.
curve: Titration curve of the last determination.
derive: 1st derive of titration curve of the last determination (with DET).
comb: 1st derive combined with the titration curve of the last determination (with DET).
meas crv: Curve measured value vs. time (with STAT, DOS, DOC and activated meas monitoring).
temp crv: Curve temperature vs. time (with STAT, DOS, DOC and activated temperature monitoring).
adj para: Adjustment parameters.
scalc full: Full report of the silo calculations.
scalc srt: Short report of the silo calculations.
prep: Preparation report.
calc: Calculation report of the current method.
act dir: Methods of the current directory of the memory card.
mem card: All methods of the memory card.
all: All reports.
ff: Form feed on printer.
Reports which are sent from the Titrino are marked with space (ASCII 32) and ' at the beginning. Then an individual identifier for each report follows. Reports which are triggered by RS232 ($G) have the same introducer but without preceding space, i.e. they start with '.

3.2.2.131. **I**nfo.**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 3.2.2.71.
Calibration data can be entered. They are accepted with &Info.CalibrationData $G. If calibration data are entered, the calibration date is deleted.

3.2.2.132. **I**nfo.**P**repData.**D**0.**D**ate read only
Info.**P**repData.**D**0.**T**ime read only
Info.**P**repData.**D1**.**T**ype read only
Info.**P**repData.**D1**.**D**ate read only
Info.**P**repData.**D1**.**T**ime read only
identical to .D2

Data from the last correctly executed preparation.

3.2.2.133. **I**nfo.**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.

3.2.2.134. **I**nfo.**D**etermData $G
Info.**D**etermData.**W**rite ON, **OFF**
Info.**D**etermData.**M**PList.**1.A**ttribute read only/read+write
Info.**D**etermData.**E**xV 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 DET, MET, STAT, DOS, DOC, SET, KFT, and MEAS.
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.

.ExV: Volume of the exchange unit, with which the determination was executed

.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

3.2.2.135. **I**nfo.**T**itrResults.**R**S.**1.V**alue read only
etc., up to **.9**
Info.**T**itrResults.**E**P.**1.V** read only
Info.**T**itrResults.**E**P.**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 DET, MET, SET, KFT:
Volume coordinate in mL, e.g. "1.2340"
Measured value coordinate in pH "5.12", mV (with U and Ipol) "-241" or uA (with Upol) "43.7".

.Var: Various variables. You may overwrite the variables C40...C45, see 3.2.2.134.
C40: Initial measured value in pH "5.12", mV (with U and Ipol) "41", uA (with Upol) "43.7" or °C (with T) "25.0". In MEAS final measured value.
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/KFT titration from the conditioning in ul/min, "3.5".
C44: (Last measured) 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".
C48: Voltage at maximum voltage (not valid in CAL and TIP)
C49: Voltage at minimum voltage (not valid in CAL and TIP)
DTime: Dosing time in s in DOS/DOC or time for the drift correction in SET/KFT with conditioning, resp.

3.2.2.136. **I**nfo.**T**itrResults.**F**ixEP.**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: Fix EP with DET, MET resp. Fix V with STAT. C5X corresponds to the fix volumes X, X = 1...9.

.pK: With DET, MET resp. time with given part of the end volume in s in STAT. C6X corresponds to X = 1...9.

.TempVar: Temporary variables in TIP corresponding to the assignments in the submethods.

3.2.2.137. **I**nfo.**T**itrResults.**Ti**meWin.**81.M**ean read only
Info.**T**itrResults.**Ti**meWin.**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.

3.2.2.138. **I**nfo.**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"

3.2.2.139. **I**nfo.**S**iloCalc.**C**24.**N**ame read only
Info.**S**iloCalc.**C**24.**V**alue read only
Info.**S**iloCalc.**C**24.**U**nit read only
for **.C25** as for .C24
Info.**S**iloCalc.**C26.A**ctN read only
Info.**S**iloCalc.**C26.M**ean read only
Info.**S**iloCalc.**C26.S**td read only
Info.**S**iloCalc.**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"

3.2.2.140. **I**nfo.**A**ctualInfo.**I**nputs.**S**tatus read only
Info.**A**ctualInfo.**I**nputs.**C**hange read only
Info.**A**ctualInfo.**I**nputs.**Cl**ear $G
Info.**A**ctualInfo.**O**utputs.**S**tatus read only
Info.**A**ctualInfo.**O**utputs.**C**hange read only
Info.**A**ctualInfo.**O**utputs.**Cl**ear $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 information. For the output, there is a conversion from binary to decimal, e.g.

	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Line No.	13	12	11	10	9	8	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 222ff):

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)
		8	not used	(pin 6)
		9	not used	(pin 7)
		10	Monitoring	(pin 8)
		11	Monitoring	(pin 13)
		12	Monitoring	(pin 19)
		13	Monitoring	(pin 20)

3.2.2.141. **I**nfo.**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 3.2.2.149), 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.

3.2.2.142. **I**nfo.**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.

3.2.2.143. **I**nfo.**A**ctualInfo.**A**ssembly.**M**eas read only

$Q sends the current measured value from the assembly.

3.2.2.144. **I**nfo.**A**ctualInfo.**T**itrator.**C**yclNo read only
Info.**A**ctualInfo.**T**itrator.**V** read only
Info.**A**ctualInfo.**T**itrator.**M**eas read only
Info.**A**ctualInfo.**T**itrator.**d**Vdt read only
Info.**A**ctualInfo.**T**itrator.**dM**easdt read only
Info.**A**ctualInfo.**T**itrator.**dMeasdV** read only
Info.**A**ctualInfo.**T**itrator.**E**RC read only
Info.**A**ctualInfo.**T**itrator.**T** read only

$Q sends the current values in the following formats:

	DET	MET	SET	KFT	STAT, DOC	DOS	MEAS	CAL
CyclNo	127	127	127	127	127	127	127	127
V(ml)	1.2345	1.2345	1.2345	1.2345	1.2345	1.2345	-	-
Meas:								
pH	3.345	3.345	3.6(mV)	-	3.6(mV)	3.6(mV)	3.345	3.345
U, Ipol (mV)	-345.6	-345.6	-345.6	-345.6	-345.6	-345.6	-345.6	-
Upol (uA)	-12.5	-12.5	-12.5	-12.5	-12.5	-12.5	-12.5	-
T (°C)	-	-	-	-	-		25.0	-
dVdt (ul/s)	-	-	2.5142	2.5142	2.5142	-	-	-
dMeasdt								
pH,U,Ipol mV/s	0.7957	0.7957	0.7957	0.7957	0.7957	-	0.7957	0.7957
Upol (uA/s)	0.7957	0.7957	0.7957	0.7957	0.7957	-	0.7957	-
T (°C/s)	-	-	-	-	-	-	0.7957	-
dMeasdV (mV/ul)	-	-	10.6326	10.6326	10.6326	-	-	-

ERC	34	-	-	-	-	-	-	-
T (°C)	25.9	25.9	-	-	25.9	25.9	25.9	-

NV: Not Valid. If in 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 3.2.2.149). The cycle number is set to 0 at the start of a method and it is incremented until the end of the method.

3.2.2.145. **I**nfo.**A**ctualInfo.**M**easPt.**I**ndex read only
Info.**A**ctualInfo.**M**easPt.**X** read only
Info.**A**ctualInfo.**M**easPt.**Y** read only
Info.**A**ctualInfo.**M**easPt.**Z**1 read only
Info.**A**ctualInfo.**M**easPt.**Z2** read only
Info.**A**ctualInfo.**E**P.**I**ndex read only
Info.**A**ctualInfo.**E**P.**X** read only
Info.**A**ctualInfo.**E**P.**Y** read only

$Q sends the last entry into the measuring point list (.MeasPt) or the last entry into the list of EP's with DET, MET, SET, KFT.
.MeasPt.X"165" Volume (DET, MET), time (STAT, DOS, DOC, SET, KFT, MEAS), resp. of the MPList in s
.MeasPt.Y"3.654" Measured value (DET, MET), volume (STAT, DOS, DOC, SET, KFT), resp. of the MPList in mL
.MeasPt.Z1"6.34" Measured value (STAT, DOS, DOC, SET, KFT, MEAS) 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

3.2.2.146. **I**nfo.**A**ctualInfo.**Ov**en.**H**eatTime read only
Info.**A**ctualInfo.**Ov**en.**S**ampleTemp read only
Info.**A**ctualInfo.**Ov**en.**L**owTemp read only
Info.**A**ctualInfo.**Ov**en.**H**ighTemp read only
Info.**A**ctualInfo.**Ov**en.**G**asFlow read only
Info.**A**ctualInfo.**Ov**en.**U**nitFlow read only

$Q sends the current values from a connected KF Oven. If no Oven is connected, the values are empty.
.HeatTime: Heating time of sample in s.
.SampleTemp: Nominal sample temperature in °C.
.LowTemp: Lowest temperature during the sample heating time in °C.
.HighTemp: Highest temperature during the sample heating time in °C.
.GasFlow: Average gas flow during sample heating time.
.UnitFlow: Unit of gas flow.

3.2.2.147. **I**nfo.**A**ctualInfo.**D**isplay.**L**1 up to 32 ASCII characters
Info.**A**ctualInfo.**D**isplay.**L8** up to 32 ASCII characters
Info.**A**ctualInfo.**D**isplay.**D**elAll $G

Lines of the display. The display can be written to from the computer. Proceed as follows:
1. Lock the display, see 3.2.2.163.
2. Delete the whole display (.DelAll).

3. For writing onto the display, the standard character set will be used.
4. Unlock the display, see 3.2.2.163
5. Delete the whole display (.DelAll).
6. Send a value to nod &Config.Aux.ResDisplay (see 3.2.2.105) to refresh the display.

$Q sends the contents of the corresponding display line.

3.2.2.148. **I**nfo.**A**ctualInfo.**C**omport.**N**umber read only

$Q sends the comport number of the Titrino where the PC is connected.

3.2.2.149. **I**nfo.**As**sembly.**C**ycleTime read only
Info.**As**sembly.**E**xV read only

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

3.2.2.150. **I**nfo.**As**sembly.**B**ur.**S**elect **internal D0**, external D1, external D2

Selection of buret for assembly functions.

3.2.2.151. **I**nfo.**As**sembly.**B**ur.**E**mpty $G, $S, $H, $C

Starts the function "empty". Only possible with the buret type "Dosino". The parameters are under the function &Config.DosPrep, see 3.2.2.118 up to 3.2.2.120.

3.2.2.152. **I**nfo.**As**sembly.**B**ur.**P**rep $G, $S, $H, $C

Starts the function "preparation". The parameters are under the function &Config.DosPrep, see 3.2.2.110 up to 3.2.2.120.

3.2.2.153. **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 Titrino.

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

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

3.2.2.155. **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 Titrino.
.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.

3.2.2.156. **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 Titrino.
.Input: Selection of the potentiometric measuring input 1, 2, diff., polarized electrodes or temperature.
.Ipol: Polarization current in uA.
.Upol: Polarization potential in mV, entry in steps of 10 mV.

3.2.2.157. **A**ssembly.**O**utputs.**A**utoEOD **ON**, OFF
Assembly.**O**utputs.**S**etLines $G
Assembly.**O**utputs.**S**etLines.**L**0 active, inactive, pulse, **OFF**
up to .L13
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 Titrino several determinations can be performed in the same beaker. Before AutoEOD is switched on, line 3 must be set to "OFF".
.SetLines: With $G, all lines 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 224.

Warnings:
- If you have "AutoEOD" to "ON", an active line 3 is set to "inactive" by the EOD pulse.
- L6 is the line of the activate pulse. An active line 6 is set to "inactive" by the activate pulse.
- L5 is the error line. It is continuously controlled by the Titrino program and can therefore not be set freely.

Line assignments in Titrino program:
L0 Ready, inactive state
L1 Conditioning OK
L2 Titration in progress
L3 EOD (End Of Determination)
L4 Can be set in TIP
L5 Error

L6	Activate pulse + can be set in TIP
L7	Buret volume pulses
L8, 9	---
L10-13	Monitoring in modes STAT, DOS, DOC

.ResetLines: Lines are set to the inactive status (= high).

3.2.2.158. Assembly.**S**tirrer ON, **OFF**
Switching stirrer ON/OFF.

3.2.2.159. Setup.**C**omport **1**, 2, 1&2
Selects the Titrino COM for the output of automatic info:
&Setup.Keycode
&Setup.Trace
&Setup.SendMeas
&Setup.AutoInfo

3.2.2.160. Setup.**K**eycode ON, **OFF**
ON means the key code of a key pressed on the Titrino is outputted. The key code comprises 2 ASCII characters; table of the keys with their code, see page 195. A keystroke of key 11 is sent as follows:
#11
The beginning of the message is marked by a space (ASCII 32).

3.2.2.161. Setup.**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 have been edited. All paths are sent absolute, i.e. from the root.

3.2.2.162. Setup.**Tra**ce ON, **OFF**
The Titrino automatically reports when a value has been confirmed with <enter> at the Titrino. Message, e.g.:
&SmplData.OFFSilo.Id1"Trace"
The beginning of the message is marked by a space (ASCII 32).

3.2.2.163. Setup.**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 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 Titrino and can be operated from the computer.

3.2.2.164. **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 "OFF" 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").

3.2.2.165. **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 3.2.2.167 and 3.2.2.168) in the inputted interval is active.
.Interval: Time interval (in s) for the automatic transmission of associated measured values defined under points 3.2.2.167 and 3.2.2.168. 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.

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

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

Selection of the unit of which the measured values should be sent (3.2.2.167 or 3.2.2.168).

3.2.2.167. **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 3.2.2.165):
.CyclNo: Cycle number of the potential measurement. Together with the cycle time (3.2.2.149), 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 3.2.2.166).

3.2.2.168.

Setup.**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.**E**RC	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 3.2.2.165, formats see 3.2.2.144):
.CyclNo: Cycle number. Together with the cycle time (3.2.2.149), 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.
.ERC: ERC in DET.
.T: In STAT, DOS, DOC, with activated temperature monitoring.
The unit "titrator" must be preset (see 3.2.2.166).

3.2.2.169.

Setup.**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.**C.B**1	ON, **OFF**
Setup.**A**utoInfo.**C.R**1	ON, **OFF**
Setup.**A**utoInfo.**C.B2**	ON, **OFF**
Setup.**A**utoInfo.**C.R2**	ON, **OFF**
Setup.**A**utoInfo.**I**	ON, **OFF**

Setup.**A**utoInfo.**O** ON, **OFF**

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

.Status: Global switch for all set AutoInfo.

.P PowerOn: Simulation of power on (3.2.2.171). 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 111ff.

.T.H Hold: Status 'Hold' has been reached.

.T.C Continue: Continue after hold.

.T.O Conditioning OK: EP reached (in SET, KFT with conditioning).

.T.N Conditioning Not OK: EP not reached (in SET, KFT 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 DET, MET, STAT, DOS, DOC, SET, KFT, MEAS).

.T.EP EPList: Entry into EP list (with DET, MET, SET, KFT)

.T.RC Results have been recalculated.

Messages from node .C, Comport:

.C.B1 COM1: A report is outputted on COM1. During this time, COM2 will be blocked. COM2 is generally blocked, if COM1 is busy.

.C.R1 COM1 is ready again. (Comes also when you <QUIT> an error.)

.C.B2, .R2 Identical for COM2.

Messages for changings in the I/O lines. If the changings 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 Titrino sends space (ASCII 32) and ! as an introducer. This is followed by the name of the device (see 3.2.2.106). Special ASCII characters in the device name are ignored. If no device name has been entered, only ! is sent. Finally the Titrino sends the information which node has triggered the message.

Example: !John".T.Si": The message was triggered from instrument "John", node .T.Si

3.2.2.170. **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. The settings are valid for both Titrino COM ports.

.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 buret 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.

3.2.2.171. Setup.**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.

3.2.2.172. Setup.**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.

3.2.2.173. Setup.**R**amInit $G

Initializes instrument, see page 205. 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.

3.2.2.174. Setup.**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 .

3.2.2.175. Diagnose.**R**eport $G

Output of the report containing the adjustment parameters. The Titrino has to be in its inactive basic state.

3.3 Properties of the RS 232 Interface

Data Transfer Protocol

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

The RS 232 interface has the following technical specifications:

- Data interface according to the RS 232C standard, adjustable transfer parameters, see page 10.
- Max. line length: 512 characters
- Control characters: C_R (ASCII DEC 13)
  L_F (ASCII DEC 10)
  XON (ASCII DEC 17)
  XOFF (ASCII DEC 19)
- Cable length: max. approx. 15 m

Start	7 or 8 Data Bit	Parity Bit	1 or 2 Stop Bit

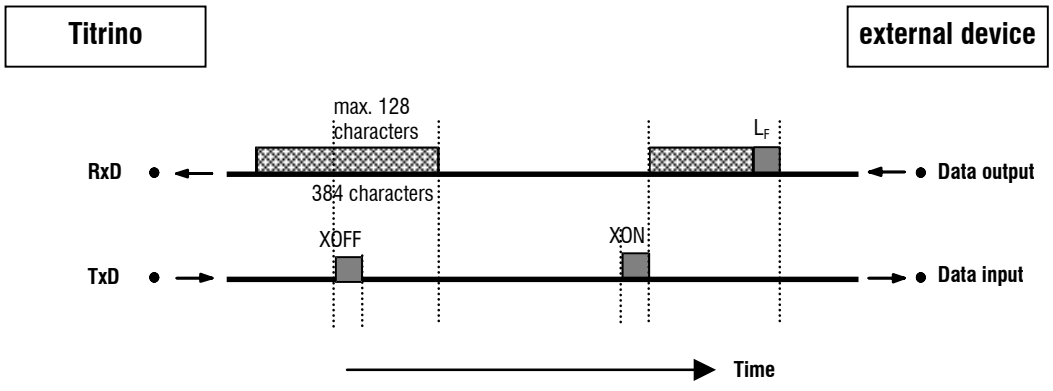
Only a shielded data cable (for example, METROHM D.104.0201) may be used to couple the Titrino with foreign devices. The cable shield must be properly grounded on both instruments (pay attention to current loops; always ground in a star-head formation). Only plugs with sufficient shielding may be used (for example, METROHM K.210.0381 with K.210.9045).

3.3.1 Handshake

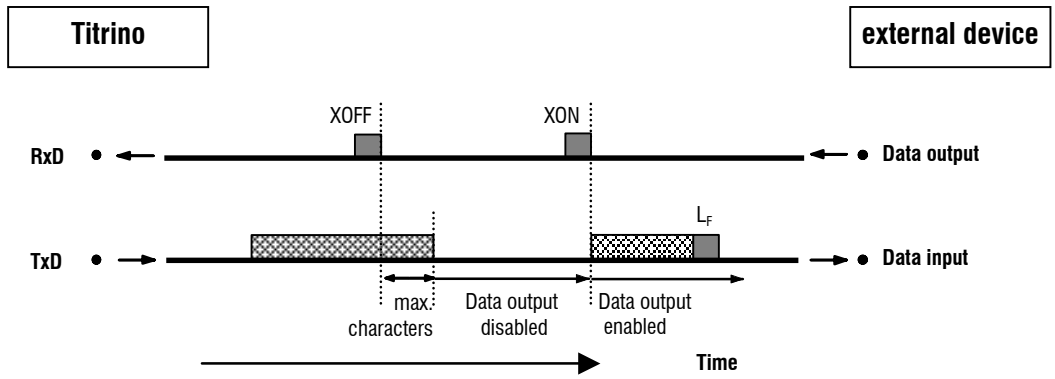
Software-Handshake, SWchar

Handshake inputs on the Titrino (CTS) are not checked.
Handshake outputs (DTR, RTS) are set by the Titrino.
The Titrino sends XOFF when its input buffer contains 384 characters. After this it can receive 128 extra characters (including L_F).

Titrino as Receiver :



Titrino as Sender :

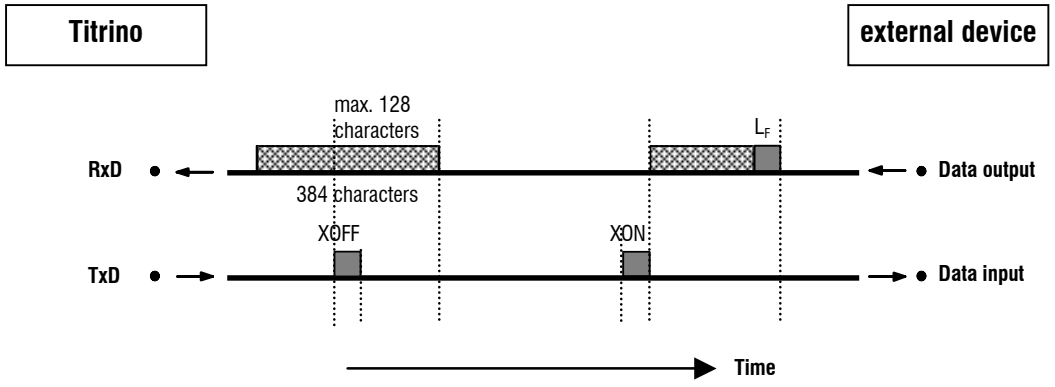


max. characters: 2 characters at 300...9600 baud
16 characters at ≥ 19200 baud

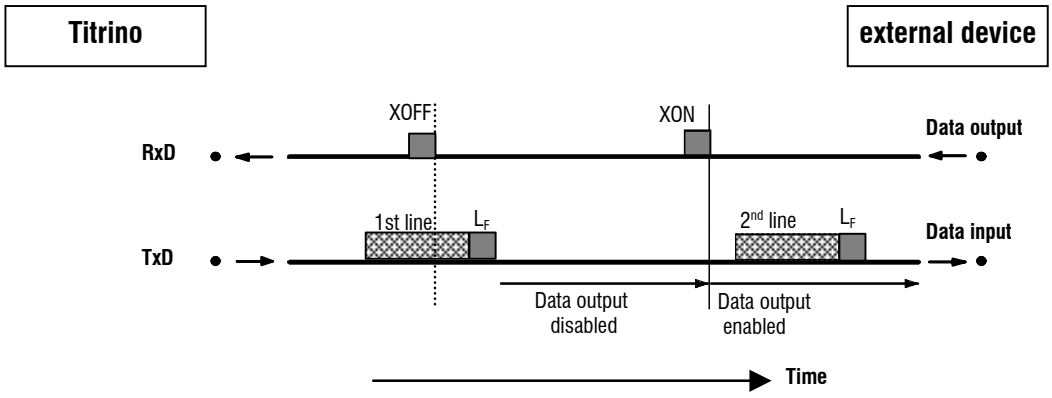
Software-Handshake, SWline

Handshake input ports on the Titrino (CTS) are not checked.
Handshake output ports (DTR, RTS) are set by the Titrino.
The Titrino has an input buffer which can accept up to 512 characters.

Titrino as Receiver :



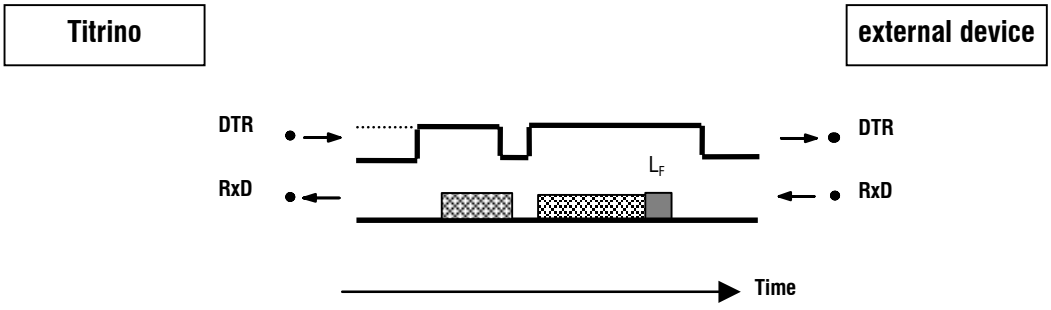
Titrino as Sender:



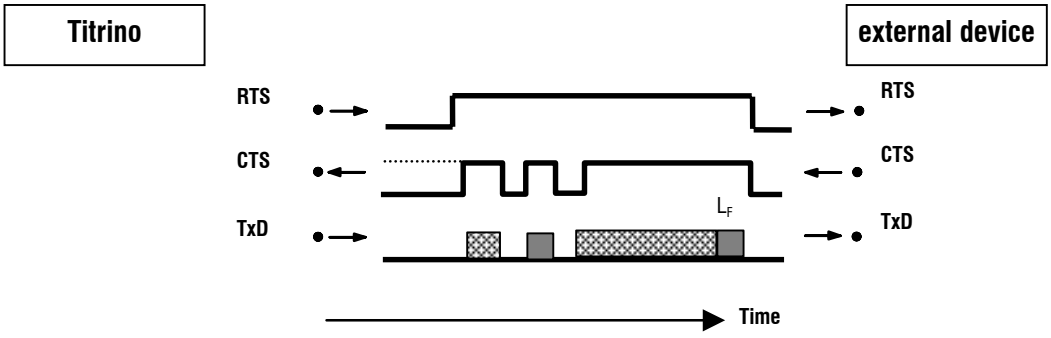
Titrino transmission can be stopped by external instruments with XOFF. After XOFF is received the Titrino completes sending the line already started. If data output is disabled for more than 6 s by XOFF, E43 appears in the display.

Hardware-Handshake, HWs

Titrino as Receiver :



Titrino as Sender:



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

3.3.2 Pin Assignment

RS232C Interface

Transmitted Data (TxD).
If no data are transmitted, the line is held in the “ON” condition. Data will only be sent when CTS is in the ”ON” condition.

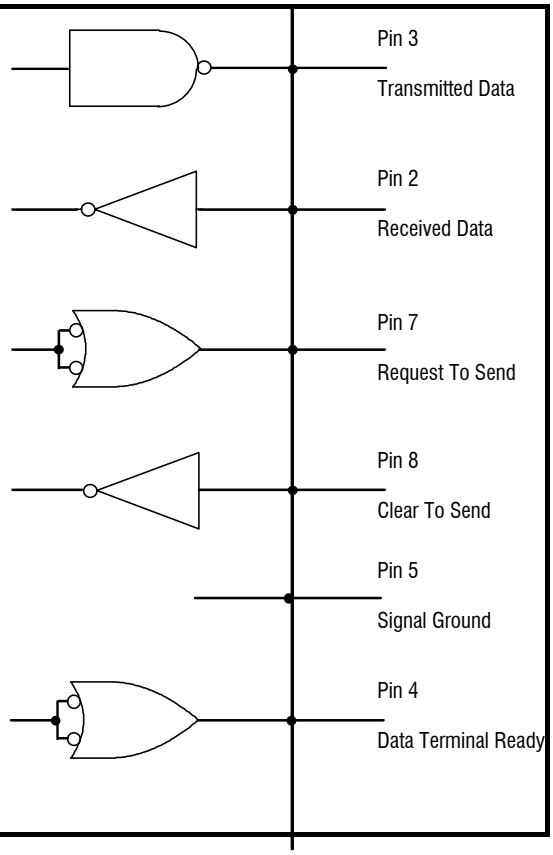
Received Data (RxD)

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

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

Signal ground (GND)

Data Terminal Ready (DTR)
ON condition: Instrument is ready to receive data.



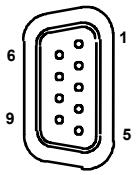
Protective earthing
Direct connection from cable plug to the protective ground of the instrument.

Polarity allocation of the signals
- Data lines (TxD, RxD)
  voltage negative (<-3 V): signal state ”ON”
  voltage positive (>+3 V): signal state ”ZERO”
- control or message lines (CTS, RTS, DTR)
  voltage negative (<-3 V): OFF state
  voltage positive (>+3 V): ON state

In the transitional range from +3 V to -3 V the signal state is undefined.

Driver 14C88 according to EIA RS 232C specification
Receiver 14C89 " "

Contact arrangement at plug (female) for RS 232C socket (male)



View of soldered side of plug

Ordering numbers:
K.210.0381 and K.210.9045

No liability whatsoever will be accepted for damage or injury caused by improper interconnection of instruments.

3.3.3 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 switched on and cables plugged in correctly? - Is the printer set to ”on-line”? - Are baud rate, data bit and parity the same on both instruments? - Is the handshake set properly? If everything seems to be ok, try to print a report with the key sequence <PRINT><SMPL DATA><ENTER>. If this report is printed out correctly, check if reports are defined in key <DEF>.
No data transmission and the display of the Titrino shows an error message.	- **error 42**: Transmission error. Is the printer set to "on-line"? Is the connection cable properly wired? - **error 43**: Data output of the Titrino disabled for longer than 6 s by XOFF. - **error 36-39**: Receive error. Are the RS settings the same on both devices?
The received characters are garbled.	- Are the RS settings the same on 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 problems 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 curves. - Is your cable correctly wired? (The DTR of the printer has to be connected to the CTS of the Titrino.) - Set "HWs" for the handshake of the Titrino. Configure the printer such that its DTR is set (possibly with DIP switches).

4 Error messages, Troubleshooting

Data transfer inoperative See measures on page 185.

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.
Remedy: <QUIT>. Delete methods no longer needed or use fewer silo lines.

calibrate electrode
The calibration interval is expired.
Exit: Carry out a calibration with mode CAL or delete calibration by entering data for pHas or slope in key <CAL.DATA>.

card battery low
The battery tension is between 2.37...2.64 V.
Remedy: <CLEAR> and change battery as soon as possible.

card busy
The memory card is busy.

card not accessible
The card is not accessible because it is used by the RS interface or a card report is prepared.

card read/write error
Working with the card a read/write error appeared.
Remedy: <CLEAR> or insert a different card.

card unformatted
Remedy: <CLEAR> and format the card.

card write-protected
Writing functions are not possible, if the card is write-protected.
Remedy: <QUIT> and remove write protection, i.e. push write protection to the left.

change card battery
The date for changing the battery is expired. Leave the card in Titrino during battery change to ensure constant power supply.
Remedy: <CLEAR>, change the card battery and enter a new battery change date.

check drive unit!
The buret is not connected (correctly) or defect.
Remedy: Rectify fault or <STOP>.

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 <PARAM> key.
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 or <STOP>.

check remote box
The Remote Box is not (correctly) connected or the Remote Box is connected but not activated under the <CONFIG> key.
Exit: Connect Remote Box (correctly) and set "Remote Box: ON" under <CONFIG>, >peripheral units. Switch the Titrino off/on.

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>.
DX ↑ / ↔ overload	The motor of dosing drive X has reached its current limit because the piston or the cock resp. doesn't move. Exit: <STOP> then <QUIT>. Check and clean the wet part. If everything is ok, remount it and press <CLEAR>: The dosing drive will be initialized.
data lost	The data of the memory card are lost as the battery tension was lower than 2.37 V. Exit: <CLEAR>.
data set reevaluation	Message if Titrino is reevaluating downloaded measuring point lists.
directory already exists	The directory exists already. Remedy: <QUIT> and enter a different directory name or delete the directory with the same name.
division by zero	The result could not be calculated as a divisor in the formula was equal to zero. Exit: Enter appropriate value.
EP overflow	In a DET or MET titration 9 EP's or more were found. The first 9 EP's will be listed. Remedy: Recalculation of data with higher EP criterion.
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 manually stopped.
meas out of limit	The determination has been stopped as a limit value of the measured value monitoring has been violated.
meas	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 EP	A fix 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 not corresponding	In DET or MET titrations, the number of EP's actually found does not match the set windows: Exactly 1 EP per window has not been found.
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 measuring quantity. Exit: <MEAS/HOLD> and define measured quantity.
no memory card	The memory card is not inserted (correctly). Remedy: <CLEAR> or rectify fault.

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 oven param.	The oven could not be found at the given COM. Remedy: connect the oven to the given RS-interface of the Titrino or set the following in your method under <PARAM>, >preselections, "Oven: no".
no sequence	No sequence is defined in TIP. Exit: <CLEAR> and define sequence.
no titration data	No curve can be printed as no data are available. With the curves measured value vs. time or temperature vs. time, the corresponding monitoring function must be on for the recording of measured points.
not possible	Writing functions on the card 6.6029.XXX are not possible or the function "empty" cannot be executed with a Dosimat.
not valid	A value is not available.
outside	The set fix volume, a fix EP or fix time is outside the measuring range.
overrange	The measuring 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.
prep.internal DO!	Warning that the preparation for the internal buret D0 has to be executed (the warning interval is run-off). Exit: Execute preparation with <START> or ignore warning with <CLEAR>.
prep.external DX!	Warning that the preparation for the external buret DX has to be executed (the warning interval is run-off). Exit: Execute preparation with <START> or ignore warning with <CLEAR>.
prep: manual stop	The preparation or emptying of the buret was stopped with <STOP>.
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 buret volume or change dosing 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 buret volume or change dosing 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.
result out of limits	The result lies outside the limits which were defined in the method, see page 75. Exit: Calculate result again or new start.
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).
sample size out	The sample size is outside the limits which are defined in the method, see page 19. Exit: Enter new sample size.
save lines OFF	The function "save lines" is not active although a submethod of TIP contains assignments to C24 or C25. Exit: <CLEAR> and switch on "save lines" under <SMPL DATA> key. **Warning:** The results of this line will not be saved.
second TIP call	In TIP no further TIP can be called up as a submethod. Exit: <CLEAR> and define new sequence.
service is due	The service interval has elapsed. Contact Metrohm service so that the Titrino can be serviced. This message will appear each time the Titrino is switched on. Exit: New start.
silo empty	The silo memory is switched in but empty and a titration has been started. Corrective action: At least the first 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 255 silo lines, you can create more space by deleting old methods no longer needed. 1 silo line needs 18...120 bytes. Exit: <CLEAR>.
stop EP reached	A DET or MET titration was stopped as the stop criterion "stop EP" was reached.
stop meas.val.reached	A DET or MET titration was stopped as the stop measuring value pH, U or I was reached.
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).

system error 14	No communication between the Titrino and the connected Remote Box. Possible causes: . The Remote Box was connected when the Titrino was running . Titrino has a fault. . Remote Box has a fault. Remedy: Set under <CONFIG>, >peripheral units, "Remote Box: OFF", switch off Titrino, take away Remote Box and switch on Titrino. Contact Metrohm service.
temp out of limit	The determination has been stopped as a limit value of the temperature monitoring has been violated.
temp	Message in the measuring point list: A limit value of the temperature monitoring has been violated.
time-out PC keyboard	A connected PC keyboard has been used to call up an address (e.g. <F12>) and the connection has then been interrupted. Possible causes: . Remote Box has a fault. . PC keyboard has a fault. Exit: Correct fault and switch Titrino off/on.
TIP terminated	TIP has been terminated.
transmission error	With a Remote Box connected characters are received which cannot be interpreted. Possible causes: . Wrong key combination has been pressed. . Wrong PC keyboard has been selected. . The barcode reader supplies garbled characters. . The Remote Box has a fault. Exit: Rectify fault and switch Titrino off/on.
validate instrument	Validation interval has elapsed. Exit: <CLEAR> or new start.
wrong card	The card was inserted/removed during an operation with <CARD>. Exit: <CLEAR>
wrong sample	With SET, KFT 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:

error 36 Parity
Exit: <QUIT> and set corresponding quantity the same on both instruments

error 37 Stop bit
Exit: <QUIT> and set corresponding quantity the same on both instruments

error 38 Overrun error. At least 1 character could not be read.
Exit: <QUIT>

error 39 Overflow of the receive buffer of the Titrino (> 128 characters).
Exit: <QUIT>

Send errors:

error 42 CTS=OFF
Handshake unsatisfactory for more than 1 s.
Exit: <QUIT> Is the receiver switched on and ready to receive?

error 43 The transmission of the Titrino has been interrupted with XOFF for at least 6 s.
Exit: <QUIT>.

error 45 The receive buffer of the Titrino contains an incomplete string (missing L_F). Transmission of the Titrino is thus blocked.
Exit: Send L_F or <QUIT>.

4.2 Diagnosis

4.2.1 General

The 799 GPT 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 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.

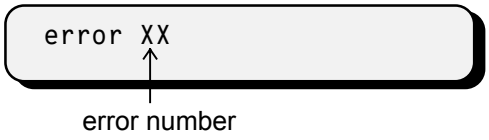
In inquiries always quote the manufacturing (page 3) and program number (see configuration, page 10) and specify possible error displays..

4.2.2 Procedure

- The diagnostic steps must be performed in sequence and compared with the reactions of the 799 GPT 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 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 <Clear>.
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 <Clear> has been pressed during the display of **'diagnose press key 0...9'**, the instrument returns to 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 page 206, point 4.4

4.2.3 Equipment required:

- *voltage calibrator, e.g. 1.773.0010 Metrohm pH Simulator*
  or 1.767.0010 Calibrated Reference for mV, pH, Ω µS, °C
- *highly insulated interconnection cable 6.2108.060*
- *resistor switch-box, class 0.1 % (or resistor 14.3 k, 0.1 %)*
- *cable 3.496.5070*
- *exchange units, if possible with different cylinder volumes (or 3.496.0070 dummy exchange unit)*
- *stop watch or watch with second hand*
- *digital or analogue voltmeter (if need be, connect a calibrated recorder)*
- *2 connecting cables with 4 mm banana plugs*
- *test plug 3.496.8550 (necessary only if plug 'Remote' should be checked)*
- *test plug 3.496.8560 (necessary only if plug 'RS 232' should be checked)*

4.2.4 Diagnosis steps

1 Prepare instruments for diagnostic test

- Power off.
- Disconnect all external connections (cables at rear, except mains cable and keyboard).
- 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>**.

Characters for a visual check of the display are generated on the eight lines.

Test sequence:

a) The display is cleared and overwritten from the top left to the bottom right with a dot pattern ( ).

b) The display is cleared and overwritten from the top left to the bottom right with a dot pattern( ).

c) The display is continuously cleared and overwritten from the top left to the bottom right with the complete character set (see page 195 / Fig. 1). At the same time with moving display the LED's „COND.", „STATISTICS" and „SILO" are swtiches on and off.

- The test sequence can be held and then continued at any time by pressing **<5>**.
- Block 2 is quit by pressing **<Clear>**.

```
diagnose press key 0...9
```

Fig. 1 Complete character set

3 Keypad test

- Press **<1>**.

```
keys test
```

- Press **<Enter>**.

```
keys test
matrix code
```

- If any key is now pressed (on the 6.2132.100 keypad or on the fron panel of the 799), the appropriate matrix code appears in the display.

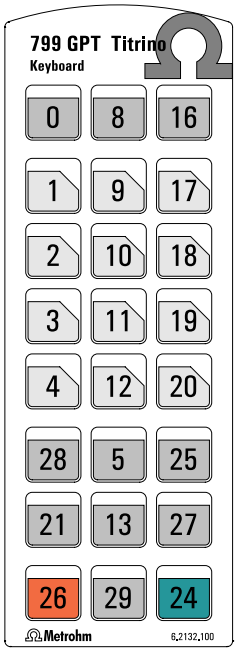


Fig. 2 Keypad 799

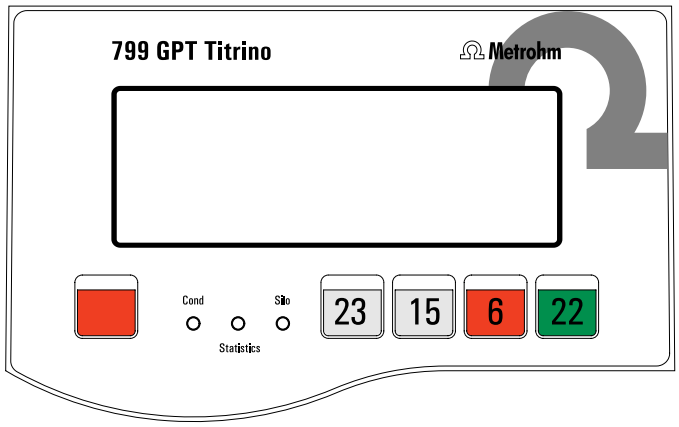


Fig. 3 Front panel 799

- Block 1 is quit by pressing the **<Clear>** key twice.

```
diagnose press key 0...9
```

4 Cylinder code, date, time

- Insert exchange unit or dummy to the internal dosing unit D0 and put the burette tip into a collecting receptacle.
- If available, connect the external dosing units D1 or D2 with the exchange units.
- Press **<0>**.

```
date/time
cylinder code
```

- Press **<Enter>**.

```
date XX-XX-XX  XX:XX:XX
code:D0   XX ml
```

activated dosing unit — *mL-code*

- Check date and time.
- Check whether the ml-code does correspond with the exchange unit placed or not.
  For the sake of completeness, different exchange units can be inserted to check their ml code. If desired, the exchange unit can be removed again. If no exchange unit is inserted display does not show the ml-code but „check exchange unit !“.
- If external dosing unit are connected, select the dosing unit in question with key <➡>.
  Check the external dosing unit in the same way as before the internal. If no dosing unit is connected display does not show the ml-code but „check drive unit !“.
- Press **<Clear>**.

```
diagnose press key 0...9
```

5 Motor timer test

- Press **<6>**.

```
motor-timer test
```

- Press **<Enter>**.

```
pot.meter dV/dt ➜ 10?
```

- Turn knob '**dV/dt**' to the right stop and press **<Enter>**.

Test sequence:

a) In a first step, the frequency of the RC oscillator (analogue rate) is tested over a period of 1 second.

b) In a second step, the frequency of the quartz oscillator (digital rate) is tested over a period of 1 second.

c) If no error is found, after about 5 s it appears

```
motor-timer test     o.k.
```

- Press **<Clear>**.

```
diagnose press key 0...9
```

6 Analogue input test

- Press **<7>**.

```
analog input test 1...5
```

6.1 Examination of highly insulated measuring inputs

- Connect 'Ind I' measuring input to a voltage calibrator (e.g. Metrohm 773 pH simulator) by means of a highly insulated cable (e.g. 6.2108.060). Set calibrator to 0 V.
- Press **<1>**.

```
Input 1          0.0 mV
```

Tolerance: ± 0.5 mV

- Set the calibrator voltage, on setting 'low ohmic' (with 773 = ~ 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 773 = 1000 MΩ).

The displayed reading may vary slightly only (with 1500 mV ≤ 1 mV)

- Press **<Clear>**.

```
analog input test 1...5
```

- Disconnect simulator from 'Ind I' input and connect to 'Ind II' input.
- Press **<2>**.

```
Input 2           XX mV
```

- Carry out the same measurements as with Input 1.
- Press **<Clear>**.

```
analog input test 1...5
```

- Short-circuit input 'Ind I' (e.g. with cable 3.496.5070).
- Press **<3>**.

```
Input 1-2         XX mV
```

The differencial voltage between inputs 'Ind I' and 'Ind II' is displayed.

Example: 0 - (+)1500 mV = -1500 mV

- Remove cables from the inputs 'Ind I' and 'Ind II'.

- Press **<Clear>**.

```
analog input test 1...5
```

6.2 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' by means of short cables.
- Press **<4>**.

```
Pt 100*           XX °C
```

(* or Pt 1000)

Tolerance: ± 0.5 °C (Note also tolerance of resistor switch-box).

The sensor allows automatic displaying of the room temperature. (The resistor values correspond to 0°C.)

- Press **<Clear>**.

```
analog input test 1...5
```

- Remove cables and resistor switch-box.

6.3 Polarizer test

- Press **<5>**.

```
polarizer test
```

- Press **<Enter>**.

```
dummy resistor 14.3kΩ ?
```

- Connect resistor switch-box (or suitable resistor 14.3 kΩ 0.1%) using 3.496.5070 cable to 'Pol' socket. Switch-box to 14.3 kΩ.
- Press **<Enter>**.

Test sequence:

1. *An asterisk flashes during the test.*
2. *In case of an error an error message appears. (If for example the switch-box is not connected,* ***error 100*** *appears).*
3. *If no error is found, after about 15 s display shows*

```
polarizer test    o.k.
```

- Press **<Clear>**.

```
analog input test 1...5
```

- Press **<Clear>.**

```
diagnose press key 0...9
```

- Remove cable and resistor switch-box.

7 External inputs and outputs

This test is meaningful only if the 799 GDP Titrino is used interconnected with other instruments via the 'Remote' connection. In addition, a 3.496.8550 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 8.

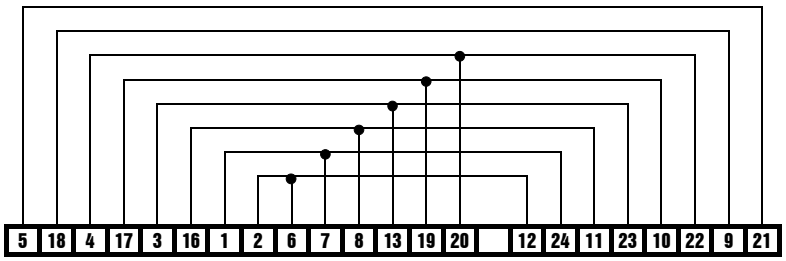


Fig. 4 Connections in the 3.496.8550 test plug

- Press **<4>**

```
extern input/output test
```

7.1 Test of the remote interface

- Press **<1>**.

```
extern input/output test
```

- Press **<ENTER>**.

```
I/O-test-connector?
```

- Insert the 3.496.8550 test plug in port B 'Remote'. (Do not switch off instrument!)
- Press **<ENTER>**.

Test sequence:

1. *In case of an error an error message is displayed. If for example no test plug is connected, error message* **error 50 01HEX** *appears).*
2. *If no error is found, after about 1 s display shows*

```
extern input/output o.k.
```

- Remove test plug.
- Press **<CLEAR>**.

```
diagnose press key 0...9
```

7.2 Test of the remote box

The remote box needs to be connected before the Titrino is switched on. Insert 3.496.8550 test plug in the remote box.

- Press **<2>**.

```
reset remote box?
```

- Press **<ENTER>**.

Test sequence:

1. *In case of an error an error message is displayed (for example* **error 490 01HEX***).*
2. *If no error is found, after about 1 s display shows*

```
remote box test o.k.
```

- Press **<CLEAR>**. The dialogue switches automatically to the "extern i/o test".

```
extern input/output test
```

- If this test should not be carried out (see 7.1), quit block 4 pressing <CLEAR> twice.
- Remove test plug.

```
diagnose press key 0...9
```

8 RS 232 test

A 3.496.8560 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 RS 232 interface is not required, continue with point 9.

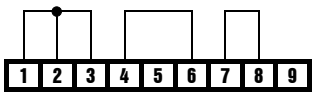


Fig. 5 Connections in the 3.496.8560 plug

- Press **<5>**.

```
RS232 test  1...2
```

8.1 RS232 test 1

- Press **<1>**.

```
RS232 test-connector? 1
```

- Insert the 3.496.8560 test plug in port 'A1'.
- Press **<Enter>**.

Test sequence:

1. *In case of an error an error message is displayed. If for example no test plug is connected, error message* ***error 68*** *appears).*
2. *If no error is found, after about 5 s display shows*

```
RS232 test 1  o.k.
```

- Remove test plug.
- Press **<Clear>**.

```
RS232 test  1...2
```

8.2 RS232 test 2

- Press **<2>**.

```
RS232 test-connector? 2
```

- Insert the 3.496.8560 test plug in port 'A2'.
- Press **<Enter>**.

Test sequence:

1. *In case of an error an error message is displayed. If for example no test plug is connected, error message* ***error 68*** *appears)*
2. *If no error is found, after about 5 s display shows*

```
RS232 test 2  o.k.
```

- Remove test plug.
- Press **<Clear>**.

```
RS232 test  1...2
```

- Press **<Clear>**.

```
diagnose press key 0...9
```

9 Memory card test

- Press **<9>**.

```
memory card test
```

- Insert memory card.
  The memory card has to be formated from a 799 GPT Titrino otherwise the test does not recognize the card and on the display appears „memory card 000 KB end“.
- Press **<Enter>**.

The test runs automatically. If no fault arises then there appears:

```
memory card 128 KB   o.k.
```

- Press **<Clear>**.

```
diagnose press key 0...9
```

10 Internal dosing unit D 0

- Insert exchange unit and put the burette tip into a collecting receptacle.
- Press **<Clear>**.

The Titrino gets out of the diagnosis menu and returns to the user program.

- The spindle drive and the cock changeover drive of the internal dispensing unit can be checked with the aid of the function **<prep>** (see page 103).
- Set the parameters of this function accord. to the following list (for setting the parameters see page 10).

```
configuration
 >prep.dosing elements
   power ON prep:       OFF
   report:              OFF
   dos.element: internal D0
   warn.interv.D0   OFF min
   volume D0         3.5 ml
   cycles D0            2
   dos.rate DX  max. ml/min
   fill rate DX max. ml/min
```

- Press **<Prep>**.

```
intern D0          prep
```

- Press **<Start>**.

  The internal dosing unit expells twice the volume of 3.5 ml.

- Remove exchange unit.
- Check spindle zero position, see Fig. 6.

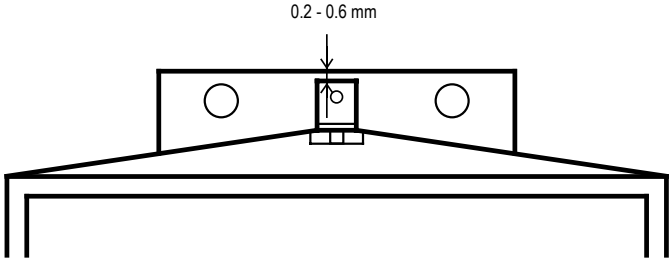


Fig. 6

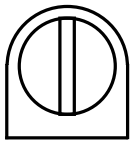


Fig. 7

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 GPT Titrino, see Fig.7.

- 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 lifting (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>** (on instrument) and simultaneously measure the time until the GPT 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>** (on instrument) 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.
- Press **<FILL>.**

11 External dosing units D 1 or D 2

This test makes sense only when the 799 GPT Titrino is operated in connection with external dosing units (685 Dosimat or 700 Dosino).

The spindle drive and the cock changeover drive of the internal dispensing unit can be checked with the aid of the function **<prep>** (see page 103).

- Connect the external dosint units D 1 or D 2 respectively.
- Insert exchange unit and put the burette tip into a collecting receptacle.
- Set the parameters of this function accord. to the following list (for setting the parameters see configuration >prep.dosing elements).

Parameters for 700 Dosino

```
configuration
 >prep.dosing elements
   power ON prep:       OFF
   report:              OFF
   dos.element: external D1 or D2
   warn.interv.DX   OFF min
   dos.drive DX:     Dosino
   outlet:              tip
   len.dos.tub.DX   40.0 cm
   diam.dos.tub.DX   2.0 mm
   len.asp.tub.DX.  25.0 cm
   diam.asp.tub.DX   2.0 mm
   dos.rate DX  max. ml/min
   fill rate DX max. ml/min
```

Parameters for 685 Dosimat

```
configuration
 >prep.dosing elements
   power ON prep:       OFF
   report:              OFF
   dos.element: external D1 or D2
   warn.interv.DX   OFF min
   dos.drive DX:    Dosimat
   volume DX         3.5 ml
   cycles DX            2
   dos.rate DX  max. ml/min
   fill rate DX max. ml/min
```

- Press **<prep>** several times, until

```
extern D1          prep
```

- or

```
extern D2          prep
```

Press **<START>**

The external dosing unit executes the following jobs:

a) To expell the total volume.
b) to fill the filling tube
c) to fill the cylinder
d) to fill the dosing tube.

12 Setting up original arrangement

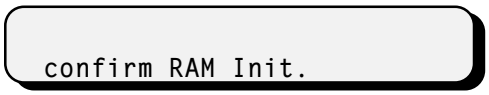
Reconnect all peripherals disconnected at the start of the diagnostic routine and perform a short function test with these.

4.3 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.

- Power OFF
- Power ON and simultaneously press keys **<DOS>** and **<STOP/FILL>**.

- Press **<START>**.



- Press **<START>**.

RAM is tested and initialised. Subsequently a warm start is executed.

The lost data of the user memory must now be reentered.

If '**system error 3**' appears in the display, **<Clear>**can be used to return 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.

4.4 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:

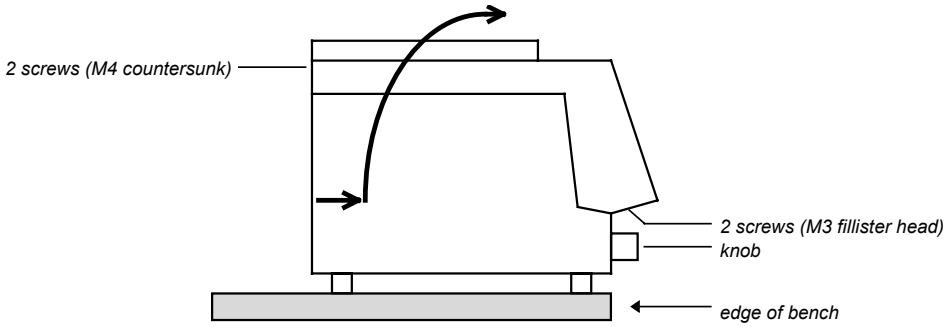


Fig. 8

- Disconnect instrument from power supply!
- Remove control knob
- Place instrument over edge of bench to allow the M3 screws to be removed (Fig. 8)
- 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!

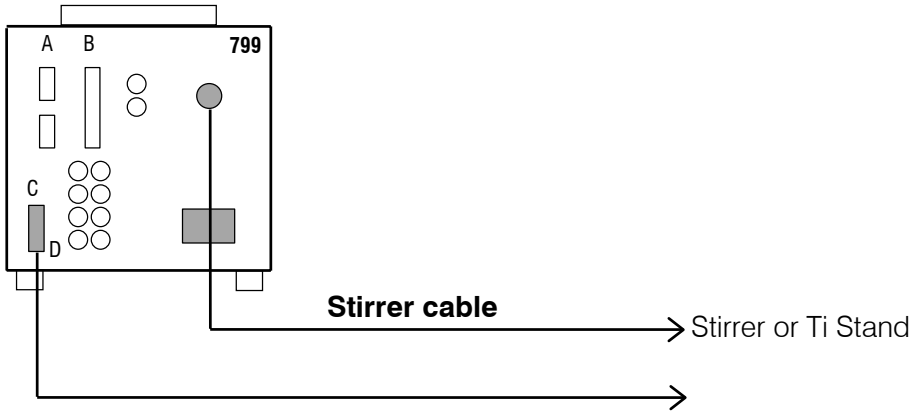
- Remove spindle from mechanical stop by turning the large gear wheel. (In case that the motor is inoperative, position spindle by hand to zero position.)

5 Preparations

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. 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

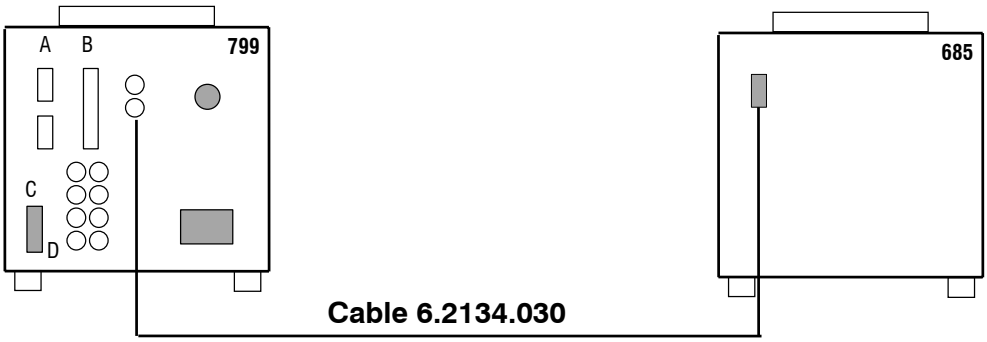
5.1.1 Titrino with Stirrer or Titration Stand



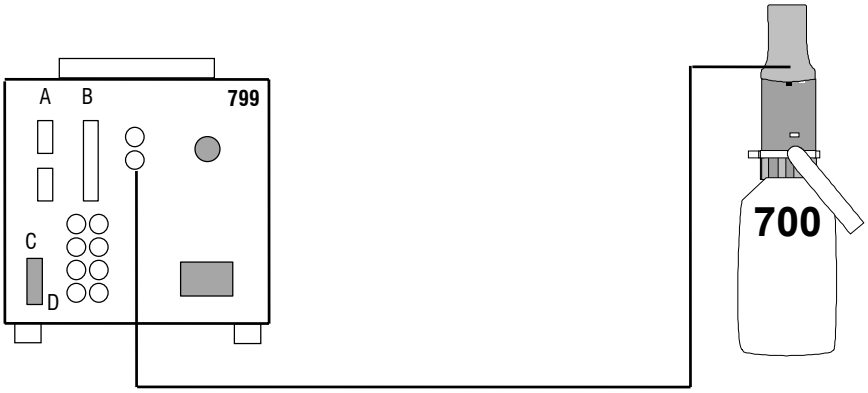
The 802 Rod Stirrer, the 727, or the 703 Ti Stand with 6.2108.100 cable can also be connected instead of the 728 Magnetic Stirrer.

5.1.2 Titrino with external burets

685 Dosimat:



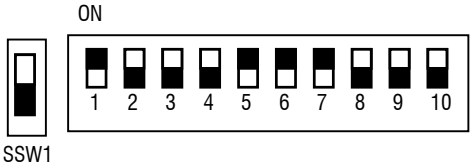
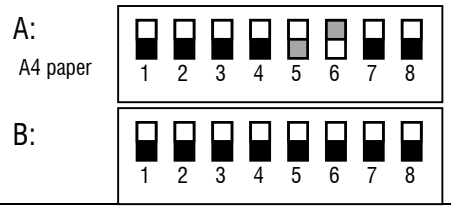
700 Dosino



The 2.700.0020 Dosino can be directly connected. If you wish to connect a 2.700.0010 Dosino, you need the 6.2134.020 adapter cable.

5.1.3 Connection of a printer

A variety of printers can be connected to the RS232 interface of the 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 COM of the Titrino as a printer, you need the 6.2125.010 + 6.2125.030 Adapters.

Printer	Cable	Settings on Titrino		Settings on Printer
Seiko DPU-414	6.2134.110	baud rate: data bit: stop bit: parity: handshake: send to:	9600 8 1 none HWs Seiko	none
Custom DP40-S4N	6.2134.110	baud rate: data bit: stop bit: parity: handshake: send to:	9600 8 1 none HWs Citizen	none, pre-set on Metrohm-version IDP-560 EMULATION FONT MAP =GERMANY PRINT=REVERSE LITTLE CR CODE=VOID CR AFTER B :FULL=VOID CR ON b. EMPTY=VALID BUFFER 1K BYTE BAUD RATE=9600 PROTOCOL=8,N,1 FLOW CONTROL CTS-RTS
Citizen iDP562 RS	6.2134.050	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs Citizen	
Epson LX-300+	6.2134.050	as above but send to:	 Epson	see printer manual
HP Desk Jet with serial interface	6.2134.050	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs HP	
HP Desk Jet with parallel interface	2.145.0330 RS232/ Parallel Converter	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs HP	see printer manual

5.1.4 Connection of a balance

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

Balance	Cable
Sartorius MP8, MC1	6.2134.060
Shimadzu BX, BW	6.2125.080+6.2125.010 Settings on Titrino: balance SARTORIUS Balance: elimiter CR+LF
Ohaus Voyager, Explorer, Analytical Plus	from Ohaus: AS017-09 (Ohaus parts number) Settings on Titrino: balance SARTORIUS Balance: SET BALANCE INTERFACE BAUD RATE 9600 DATA BITS 8 PARITY none STOP BITS 1
Mettler AB, AG (LC-RS25)	in the scope of delivery of the balance
Mettler AM, PM	6.2146.020 + 6.2125.010 additionally from Mettler: ME 47473 Adapter and ME 42500 hand switch or ME 46278 foot switch
Mettler 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 + 6.2125.010 25-pole/9-pole adapter
Mettler interface 011 or 012	6.2125.020 + 6.2125.010
Mettler AT	6.2146.020 + 6.2125.010
Mettler PG, AB-S	6.2134.110
Mettler AX, MX, UMX	6.2134.120
AND Models ER-60, 120, 180, 182 Models FR-200, 300 Models FX-200, 300, 320 with RS232 interface (OP-03)	6.2125.020 + 6.2125.010
Precisa, balances with RS232C-interface	6.2125.080 + 6.2125.010

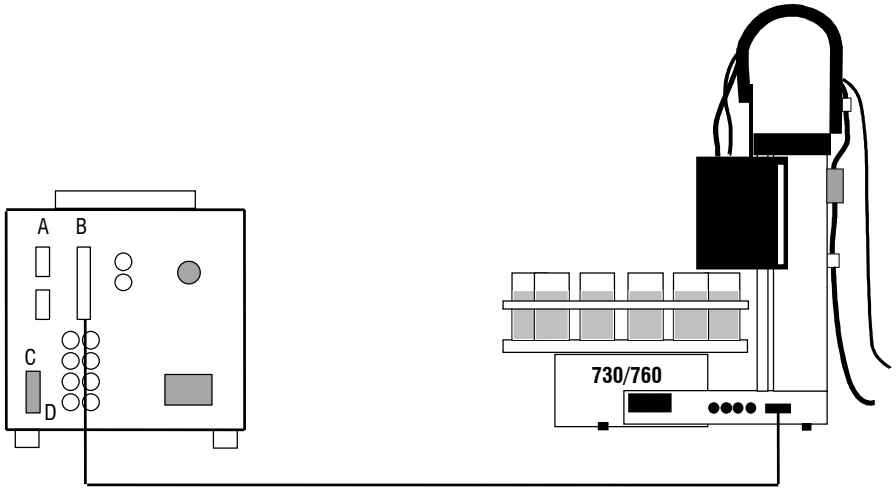
The balance type must be preselected at the Titrino with the <CONFIG> key.
The weight is transferred as a number with up to 6 digits, sign and decimal point. Units and control characters sent by the balance are not transmitted.
With the aid of a special input unit supplied by the balance manufacturer, 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	Id1	Id2	Id3
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)

If balance and printer are connected at the same Titrino COM you need the 6.2125.010 and 6.2125.030 Adapters.
If the balance works only with 7 bit and the printer with 8 bit and if hey are at the same Titrino COM, the balance has to be set to "space parity" and Titrino/printer to 8 bit, "no parity".

5.1.5 Connection of a Sample Changer

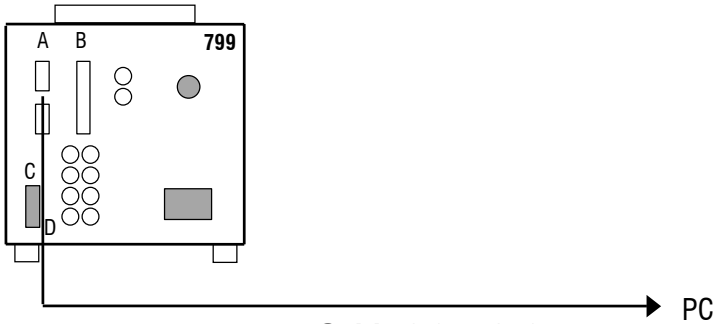


6.2141.020 Cable

With 6.2141.030 cable (instead of 6.2141.020), two Titrinos can be connected to the 730 or 760 Sample Changer at the same time.

- 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 223.
- 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 <CONFIG> key. The start command is given by the Sample Changer.

5.1.6 Connection of a computer



6.2134.040 Cable (9/9 poles)
or
6.2125.010+6.2125.060 Cables (9/25 poles

Preselections on the Titrino:

RS232 settings: ..... depend on the control program of the computer
Send to: ..... IBM
Vesuv 3.0, PC program for data acquisition and method backup
for up to 64 devices 6.6008.200
for 2 devices..... 6.6008.500

5.1.7 Connection of a Remote Box

A barcode reader and/or a PC keyboard can be connected to 6.2148.000 Remote Box. The barcode reader and PC keyboard are used as input aids.

Only plug in and unplug the Remote Box when the Titrino is switched off! The Remote Box is screwed onto the "Remote" socket of the Titrino. The remote lines of the Titrino are then accessible at the "Remote" socket of the Remote Box.

5.1.7.1 Connecting a barcode reader

Barcode readers with a 5-pole DIN plug can be connected to 6.2148.000 Remote Box. A precondition is that the barcode reader can emulate a PC keyboard. If a barcode reader and a PC keyboard are to be connected at the same time then the barcode reader must have a T-connection plug. The PC keyboard will then be plugged into this barcode reader connection.

Settings at the Titrino:

Under key <CONFIG>, >peripheral units, "Remote Box: on"

Barcode:

input The barcode string goes to the entry field in which the cursor is currently located.

method If the silo memory is switched on the barcode string always goes to the method. The cursor position has no effect.
If the silo memory is switched off the input has no meaning.

id1 The barcode string always goes to Id1. The cursor position has no effect.

id2, id3 As for id1.

smpl size The barcode string always goes to the sample size. The cursor position has no effect. If the silo memory is switched on the silo line will be concluded with the sample size and the cursor moves to the next silo line.

Settings at the barcode reader:

Plug the barcode reader into the Remote Box. The barcode reader instruction manual contains the codes which you must enter.

1. Bring the barcode reader into the programming mode.
2. Make the necessary setting for emulating a PC keyboard (may be country-specific). Select <ENTER> or "CR + LF" as termination sign.
3. Exit the programming mode.

Notes:

- If longer characters chains than are permitted by the corresponding input are transmitted then the first n characters will be accepted; the last characters will be cut off.
- If the silo memory is switched on and the settings "barcode: method" or "barcode: idX" are operative, the first silo line will be created when the string is received. Higher silo lines than 1 are only created and concluded with the sample size.

5.1.7.2 Connecting a PC keyboard

PC keyboards with a 5-pole DIN plug can be connected to 6.2148.000 Remote Box. For keyboards with a PS/2 plug an adapter PS/2→DIN is available in PC shops.

Settings at the Titrino:
Under key <CONFIG>, >peripheral units, "Remote Box: on"
Keyboard:
Select the country-specific keyboard layout of your PC keyboard.
If the Titrino does not support your keyboard you should select a keyboard which has the closest possible layout (for example check the 2nd occupancy of the numerical keys).
Country-specific special characters will probably not be converted correctly.

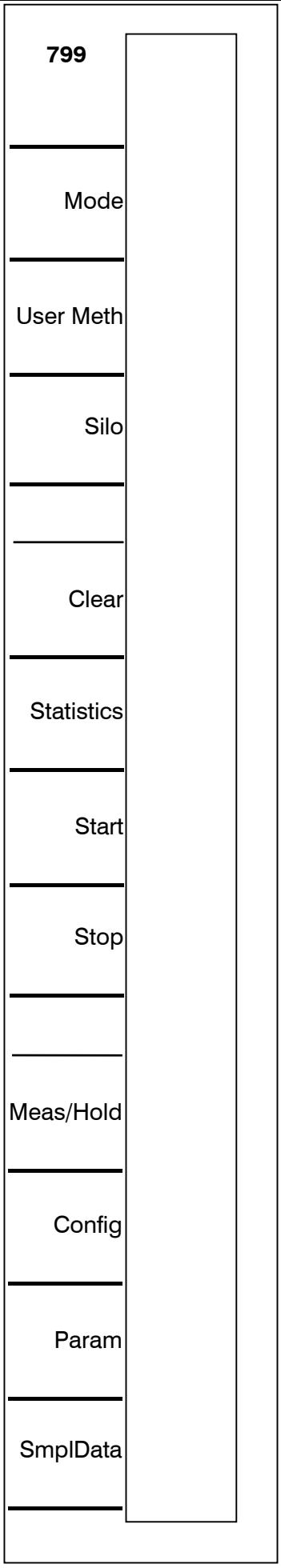
Operating via a PC keyboard:
The Titrino can be operated from the PC keyboard. The Titrino functions are called up as follows:

Titrino function	**Key combination on PC keyboard**	**Remarks**
<C-FMLA>	Alt F	
<CAL.DATA>	Alt C	
<CARD>	Alt M	
<CLEAR>	F5	
<CONFIG>	F10	
Cursor ↑ ↓	Cursor ↑ ↓	Navigation
Cursor → ←	Cursor → ←	Selection of inputs
<DEF>	Alt D	
DEF: formula input, common variable, mean value: EP RS MN C	 E R M C	Input of corresponding quantity or variable together with the numerical address, e.g. R1 gives RS1.
<ENTER>	enter	
<MEAS/HOLD>	F9	
<MODE>	F2	
<PARAM>	F11	
<PREP>	Alt E	
<PRINT>	Alt P	Report selection with → ←
<QUIT>	ESC	
<REPORTS>	Alt O	Printout reports: Alt P + Alt O
<SILO>	F4	on/off
<SMPL DATA>	F12	
<START>	F7	
<STATISTICS>	F6	on/off
<STOP>	F8	
<USER METH>	F3	
<USER>	Alt U	

The numerical block (with NumLock) and the number keys on the PC keyboard simulate the functions of the numerical keys on the Titrino. For example, entering <7> in the basic state of the Titrino switches the statistics on.

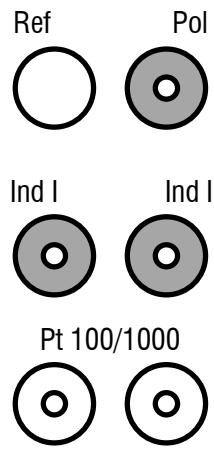
Keys which are used for setting an accent (e.g. ^, ´) are converted immediately. If you try to enter ê the Titrino will display ^e instead.

The occupancy of the PC function keys is shown to the right as an overlay. You can copy this diagram, cut out the central part and place it above the function keys of your PC keyboard.



5.2 Connection of electrodes, preparing titration vessel

Rear panel:



Ref	Connection for separate reference electrode. Input is free when a combined electrode is used.
Pol	Connection of polarized electrodes. If measured quantities Ipol or Upol are selected, this measuring input is automatically active.
Ind I Ind II	Connection of pH, redox, ISE electrodes. Combined or separate electrodes. Select measuring input 1 or 2 in the Titrino. Important: The measuring inputs 1 and 2 have a common reference. They may therefore be used as a differential measuring input see below. However, only one reference electrode can be used in the same vessel!
Pt100/ 1000	Connection of a temperature sensor Pt100 or Pt1000..

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:

Meas.input	Manual determinations	Sample Changers
Ind I	6.0133.100 pH Glass electrode	6.0130.100 pH Glass electrode
Ind II	6.0729.100 double-shielded Ag/AgCl reference electrode	6.0729.110 double-shielded Ag/AgCl reference electrode
Ref	6.0301.100 auxiliary electrode	6.0302.110 auxiliary electrode

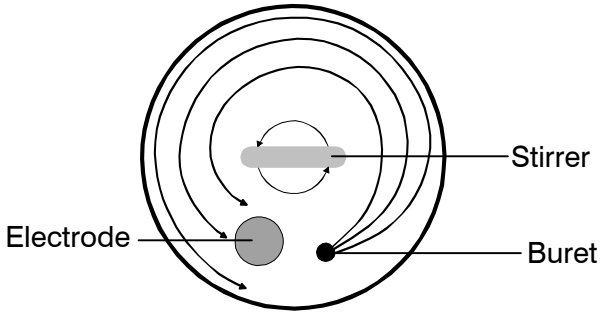
Practical tips

- 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 buret tip with earthing may be used in some cases. Use buret tips without anti-diffusion valve!

Setting up the titration vessel

The titration vessel is set up as shown in Fig. 5-6. 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.
- placing the buret tip according to the drawing below for maximum distance between the adding of the titrant and the electrode.



Pay attention on the direction of rotation of the stirrer!

6 Appendix

6.1 Technical specifications

Modes

DET: **D**ynamic **E**quivalence Point **T**itration
MET: **M**onotonic **E**quivalence Point **T**itration
SET: **S**et **E**nd point **T**itration
KFT: **K**arl **F**isher **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 inputs

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, resolution 0.01
Voltage		0...±2000 mV, resolution 1 mV, error limit 0.1 % fullscale
Current		0...±200 µA, resolution 1 µA
Temperature		–150.0...+450.0 °C, resolution 1 °C
Polarizer	Ipol	0...±127 µA, resolution 1 µA
	Upol	0...±1270 mV, in steps of 10 mV

Measuring amplifier (at 25 °C and Titrino warmed-up)

Input resistance	$>10^{13}\,\Omega$
Offset current	$<3*10^{-13}$ A
Deviation of offset voltage	15 µV/K

Dosification

Volume of buret cylinder	1, (2), 5, 10, 20 or 50 ml
Resolution	10 000 steps per buret cylinder
Titrating burets	2 external and 1 internal buret external: 685 Dosimat or 700 Dosino
Auxiliary burets	2 additional burets: 776 or 765 Dosimat

Materials

Housing	Polybutyleneterephthalate (PBTP)
Keypad cover	Polycarbonate (PC)

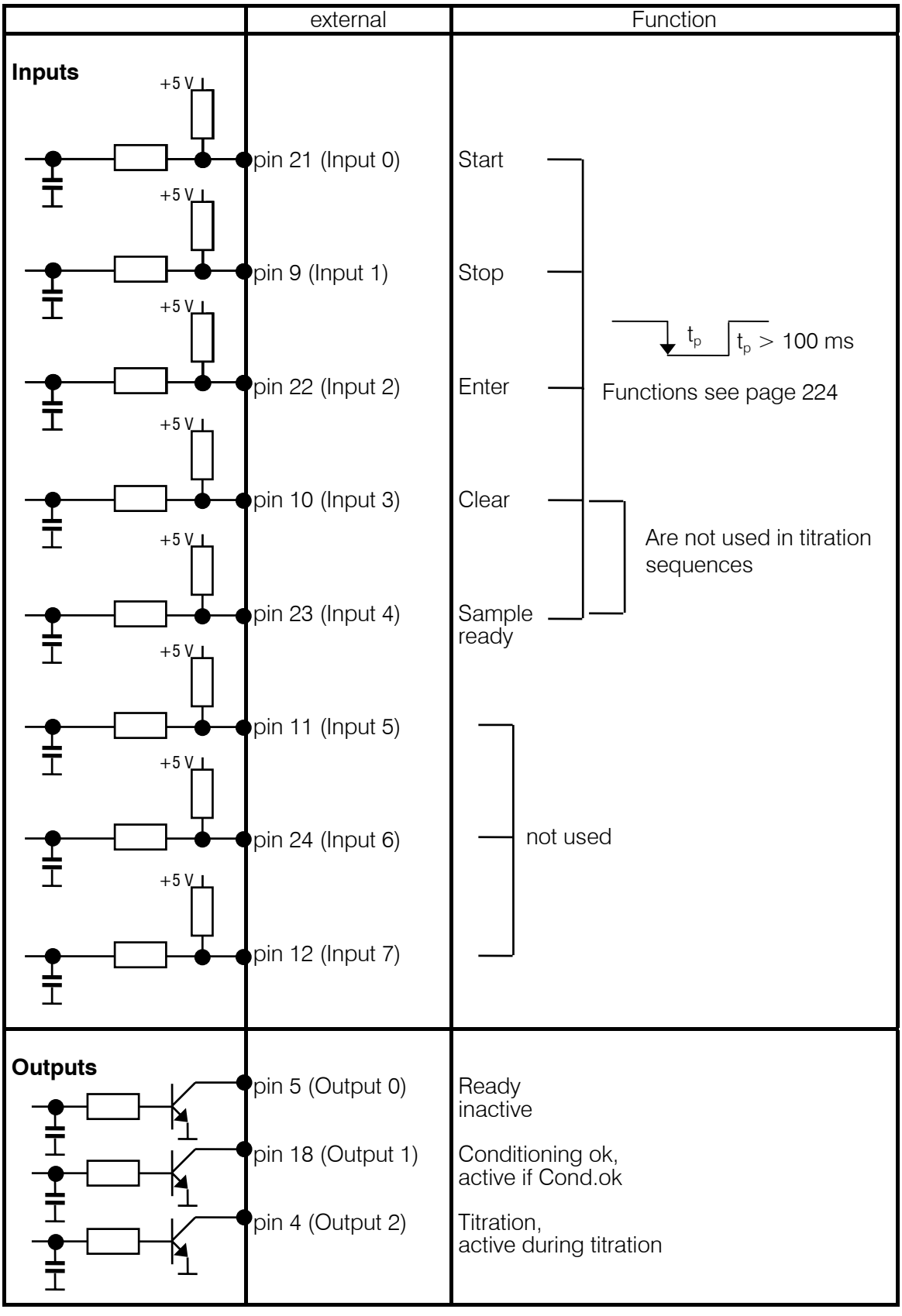
Display	Graphical LCD, 192 x 64 Dots Field: 100 x 37 mm LED back-lit
Memory card	
Standard	JEIDA ICMC 4.0 / PCMCIA (68 pins)
Data	Method memory
Storage capacity	128 KB (256 KB maximum)
SRAM card	Write and read, battery supplied
Flash	Read only with 60 Metrohm methods
Internal memory	Method memory for up to 100 methods Silo memory for sample data and results
RS232 interface	2 separate interfaces, each can be configured for printer, balance or computer connection: completely controllable from external control unit
Remote input/output lines	for Sample Changer, robot connection. With optional Remote Box: Connection of barcode reader and PC keyboard.
Stirrer control	Switch the stirrer on/off either manually or coordinated with the titration sequence
Ambient temperature	
Nom. operation range	5 ... 40 °C
Storage	– 20 ... 60 °C
Transport	– 40 ... 60 °C
Safety specifications	Designed and tested in accordance to IEC publication 1010, safety class I. This manual contains 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...240 V
Frequency	50 ... 60 Hz
Power consumption	15 W
Fuse	2 x 1 ATH (to be replaced by Metrohm Service only using the same type) Additional electronic overload protection

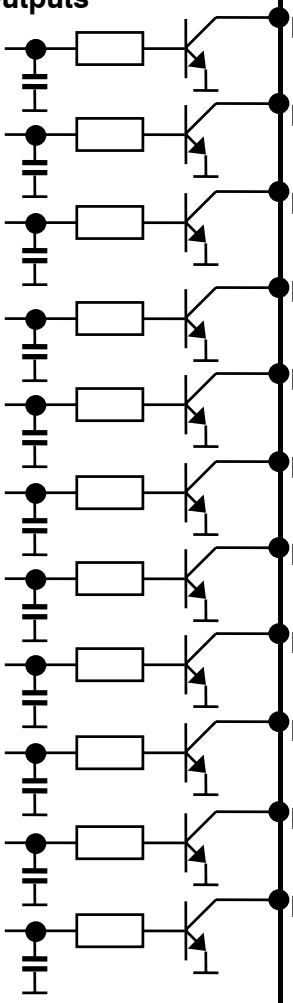
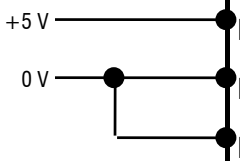
Dimensions with Exchange Unit

Width	150 mm
Height	450 mm
Depth	275 mm

Weight, incl. keypad app. 3.6 kg

6.2 Pin assignment of the "Remote" socket

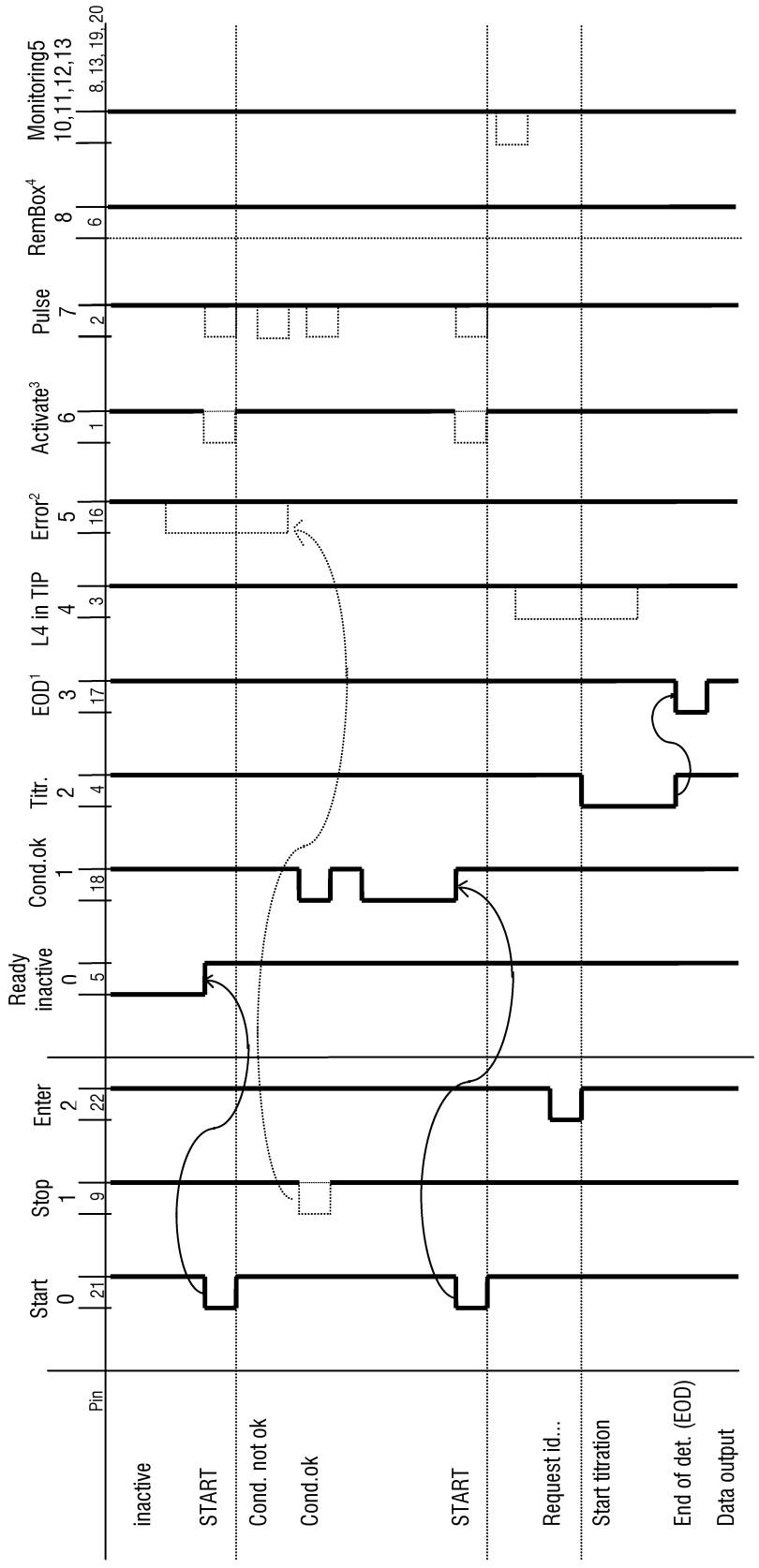


Outputs 	pin 17 (Output 3)	End of determination EOD
	pin 3 (Output 4)	L4 in TIP
	pin 16 (Output 5)	Error, active with errors
	pin 1 (Output 6)	Activate pulse, see page 224. L6 in TIP
	pin 2 (Output 7)	Pulses for recorder (t_p=150 µs) 10 000 per buret cylinder
	pin 6 (Output 8)	Remote box active
	pin 7 (Output 9)	not used
	pin 8 (Output 10)	Monitoring, L10
	pin 13 (Output 11)	Monitoring, L11
	pin 19 (Output 12)	Monitoring, L12; sample size out of limits
	pin 20 (Output 13)	Monitoring, L13; result out of limits
		For all outputs: V_{CE0} = 40 V I_C = 20 mA t_{Pulse} > 100 ms Functions see page 224
Voltage 	pin 15	I ≤ 200 mA
	pin 14	0 V: active 5 V: inactive
	pin 25	

Ordering numbers for plug:
K.210.9004 (shell) and K.210.002

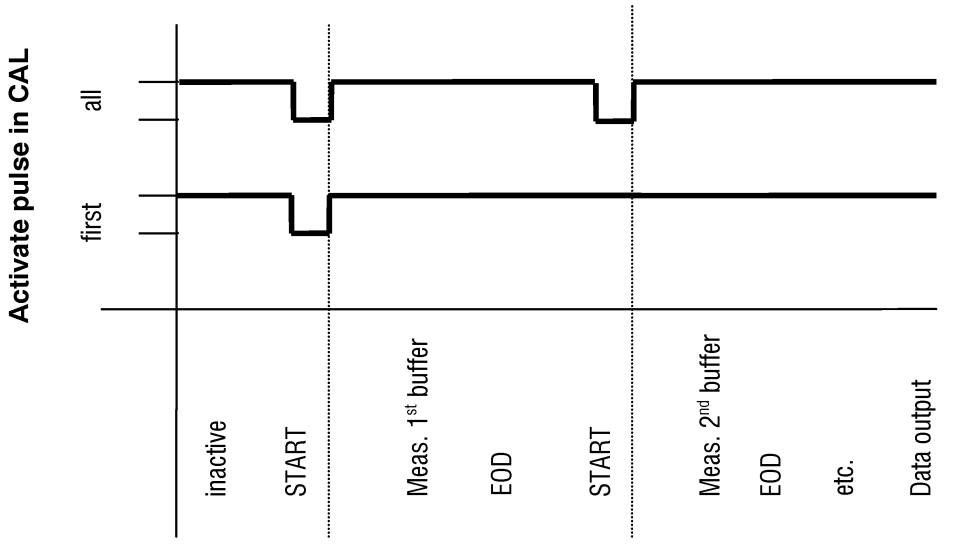
No liability whatsoever will be accepted for damage caused by improper interconnection of instruments.

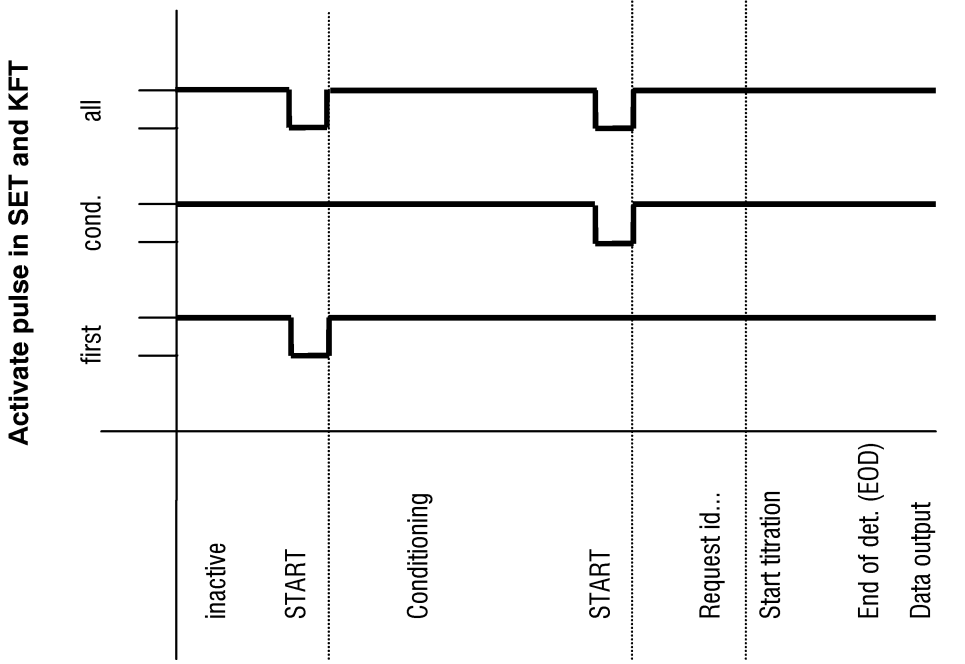
6.2.1 Lines of the "Remote" socket during the titration



1: In CAL, EOD is sent after every buffer. Automatic output of EOD can be switched off via RS232, see page 174.
2: The error line is reset when the error is rectified.
3: Line also used in TIP as L6.
4: Line is active if a remote box is registered, see page 9.
5: Lines for monitoring L10, L11, L12, L13 in modes STAT, DOS, DOC. Line L12 is active if sample size is out; L13 can be set if the result is out of limits, see page 75
The output L9 is free.

6.2.2 Possible configurations of the activate pulse in SET, KFT and CAL





6.3 Titrino validation

Checking and maintenance of the Titrino is carried out in 3 steps:
1. Testing the electronic components when the Titrino is switched on.
2. Wet-chemistry validation of the whole coulometric analysis setup
3. Maintenance and adjustment of the Titrino by Metrohm service.

6.3.1 Electronic tests

When the Titrino is switched on electronic tests are carried out. During this period **system tests** appears in the display.
The tests are documented in the system test report, which can be printed out when the Titrino is switched on (see page 8):

```
 'di
799 GPT Titrino          01102   799.0010
date  2001-09-14    time  07:24
RAM test               OK
real time clock        OK
timer                  OK
A/D converter          OK
LCD display            OK
COMPorts               OK
EPROM test             OK
          ============
```

Contact Metrohm service if one of these tests is "not OK".
If the "real time clock" test is not ok, you can try to set date and time again. If the test is OK afterwards you should check whether your stored methods have remained unchanged.

6.3.2 Wet tests

GLP (Good Laboratory Practice) requires the periodic validation of the analytical instruments. The reproducibility and accuracy of the instruments are checked.
An annual repetition of the procedure appears to be sensible. Depending on the requirements a more frequent check may be indicated, e.g. every 3 or 6 months.
Guidelines for the testing regulations (SOP, Standard Operating Procedure) are given in Metrohm Application Bulletin
No. 252: Validation of Metrohm Titrators (potentiometric) according to GLP/ISO 9001.
No. 255: Validation of Metrohm KF Titrators and KF Oven according to GLP/ISO 9001.

The validation interval can be checked by the Titrino (set under <CONFIG>, monitoring). If the interval has elapsed the Titrino displays the message **validate instrument**.

6.3.3 Maintenance and adjustment of the Titrino

The Titrino should be serviced and adjusted by Metrohm service at regular intervals.
The Titrino can check the date of the next service with the help of the monitoring function "Service" under <CONFIG>, monitoring. If this date has been passed then the Titrino will display the message **service is due**.

6.4 Warranty and conformity

6.4.1 Warranty

The warranty regarding our products is limited to rectification free of charge in our workshops of defects that can be proved to be due to material, design or manufacturing faults which appear within 12 months from the day of delivery. Transport costs are chargeable to the purchaser.

For day and night operation, the warranty is valid for 6 months.

Glass breakage in the case of electrodes or other glass parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period. For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With regard to the guarantee of accuracy, the technical specifications in the Instructions for Use are authoritative.

Concerning defects in material, construction or design as well as the absence of guaranteed features, the purchaser has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. Lack of an official damage report releases METROHM from any liability to pay compensation.

If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, buret cylinders and PTFE pistons. 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.

6.4.2 EU Declaration of conformity

CE

EU Declaration of Conformity

The METROHM AG company, Herisau, Switzerland hereby certifies, that the instrument:

799 GPT Titrino

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

Source of the specifications:

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

Description of apparatus:

All-purpose titrator with LCD graphical display. Up to three titrating burets can be controlled, titration sequences can be programmed and methods stored on a memory card.

Herisau, October 30, 2001

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

6.4.3 Certificate of Conformity and System Validation

Certificate of Conformity and System Validation

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	799 GPT Titrino
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland

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

Electromagnetic compatibility: Emission
EN50081-1, EN50081-2, EN55022 (class B)

Electromagnetic compatibility: Immunity
EN50082-1, IEC61000-6-2, Namur, IEC61000-4-2, IEC61000-4-3, ENV50204, IEC61000-4-4, IEC61000-4-5, IEC61000-4-6, IEC61000-4-11

Safety specifications
IEC61010-1, EN61010-1, UL3101-1

It has also been certified by the Swiss Electrotechnical Association (SEV), which is member of the International Certification Body (CB/IEC).

The technical specifications are documented in the instruction manual.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance. The features of the system software are documented in the instruction manual.

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, October 30, 2001

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

6.5 Scope of delivery and ordering designations

799 GPT Titrino 2.799.0010
inclusive the following accessories:

1 Titrino..... 1.799.0010
1 Keypad for GPT Titrino 799 ..... 6.2132.100
1 Memory card for methods..... 6.2245.010
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 Vesuv 3.0 light, PC program for data acquisition and method backup
for 2 devices..... 6.6008.500
1 Application card with application methods..... 6.6047.000
1 Instructions for Use for 799 GPT Titrino 8.799.1003
1 Quick References for 799 GPT Titrino..... 8.799.1013
1 Short Operating Guide for 799 GPT Titrino 8.799.1023

Options

Accessories to separate order and on payment of extra charge:

Burets

Titrating burets
685 Dosimat 2.685.0010
Cable Titrino — 685 Dosimat 6.2134.030
700 Dosino 2.700.0020
Auxiliary burets
765 Dosimat 2.765.0010
776 Dosimat 2.776.0010
Cable Titrino (activate pulse, line L6) — 765 or 776 Dosimat..... 6.2139.000
Exchange Units
V = 1 ml, ... 6.3026.110
V = 5 ml, ... 6.3026.150
V = 10 ml, ... 6.3026.210
V = 20 ml, ... 6.3026.220
V = 50 ml, ... 6.3026.250
Dosing Units for Dosino
V = 2 ml 6.3032.120
V = 5 ml 6.3032.150
V = 10 ml 6.3032.210
V = 20 ml 6.3032.220
V = 50 ml 6.3032.250

Stirrers and Titrating Stands

728 Magnetic stirrer 2.728.0040
727 Ti Stand for rinsing and addition of fresh solvent 2.727.0010
802 Rod Stirrer 2.802.0010
727 Ti Stand with built-in magnetic stirrer 2.727.0100
703 Ti Stand for KF titrations 2.703.0010

Titration equipment

Titration vessel, volumes
- 1... 50 ml 6.1415.110
- 5... 70 ml 6.1415.150
- 10... 90 ml, order 6.2036.000 holding ring separately 6.1415.210
- 20... 90 ml 6.1415.220
- 50... 150 ml 6.1415.250
- 70... 200 ml 6.1415.310

Titration vessel with thermostatic jacket, volumes
- 1... 50 ml 6.1418.110
- 5... 70 ml 6.1418.150
- 20... 90 ml 6.1418.220
- 50... 150 ml 6.1418.250

Titration vessel lid (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 and accessories

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 adapter 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

Printer Custom DP40-S4N 2.140.0200
Cable Titrino – Custom DP40-S4N (9/9 pins) 6.2134.110
Cable Titrino – Seiko DPU-414 ..... 6.2134.110
Cable Titrino – EPSON LX300+ (9/25 pins) 6.2134.050
Cable Titrino – HP Desk Jet (serial interface) (9/25 pins) 6.2134.050
Cable Titrino – HP Desk/Laser Jet (parallel IF) 2.145.0330
Adapter for connection of printer/balance at the same COM ..... 6.2125.010+6.2125.030

Balances

For Mettler cables you need an adapter 9/25 pins 6.2125.010
Cable Sartorius – balances MP8, MC1 (9/25 pins) 6.2134.060
Cable Shimadzu – balances BX, BW ..... 6.2125.080+6.2125.010
Ohaus Voyager, Explorer, Analytical Plus ..... cable from Ohaus
Mettler AB, AG balances (interface LC-RS25) ..... cable with balance
Mettler AT balance ..... 6.2146.020+6.2125.010
Mettler AM, PM balance .....6.2146.020+6.2125.010+accessories from Mettler
Mettler balances with interface 016..... cable from Mettler
Mettler balances with interface 011 or 012 ..... 6.2125.020+6.2125.010
Mettler PG, AB-S balances..... 6.2134.110
Mettler AX, MX, UMX balances 6.2134.120
AND balances (with RS232 interface OP-03)..... 6.2125.020+6.2125.010
Precisa balances..... 6.2125.080+6.2125.010
Adapter for connection of printer/balance at the same COM..... 6.2125.010+6.2125.030

Connection of PC keyboard and/or barcode reader

Remote Box..... 6.2148.000

Connection of 768 KF Oven

KF Oven 2.768.0010
Cable Titrino — Oven, control..... 6.2141.010
Cable Titrino — Oven, data..... 6.2125.110

PC connection

Cable Titrino – PC (9/9 pins) 6.2134.040
Cable Titrino – PC (9/25 pins) 6.2125.110
RS232 C extension cable (25/25 pins)..... 6.2125.020
RS232 C extension cable (9/9 pins)..... 6.2134.110
Vesuv 3.0, PC program for data acquisition and method backup
for up to 64 devices 6.6008.200

Sample Changer

730 Sample Changer, 1 working station, 1 pump and 1 valve 2.730.0010
730 Sample Changer, 1 working station, 2 pumps and 2 valves 2.730.0020
730 Sample Changer, 2 working stations, 2 pumps and 2 valves..... 2.730.0110
730 Sample Changer, 2 working stations, 4 pumps and 4 valves..... 2.730.0120
760 Sample Changer, 1 working station..... 2.760.0010
760 KFT Sample Changer, 1 working station 2.760.0020
Cable Titrino — 730, 760 Sample Changer 6.2141.020
Cable 2x Titrino — 730, 760 Sample Changer..... 6.2141.030
Cable Titrino — 730, 760 Sample Changer+665, 725, 765, 776 Dosimat 6.2141.040
Cable Titrino — 730, 760 Sample Changer+ 2x 665, 725, 765, 776 Dosimat ... 6.2141.050
Cable Titrino — Control Unit 664 for Sample Changer 673/674..... 3.980.3560

Index

Keys are marked with < >, **display texts** are in bold characters, and pages concerning the green part are *printed in italic*.

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